



**F2 Labs**  
**16740 Peters Road**  
**Middlefield, Ohio 44062**  
**United States of America**  
[www.f2labs.com](http://www.f2labs.com)

## **CERTIFICATION TEST REPORT**

---

**Manufacturer:** Deister Electronic GMBH  
11 Hermann Bahlsen Str  
Barsinghausen 30890 GERMANY

**Applicant:** Deister Electronics USA, Inc.  
9817 Godwin Drive, #201  
Manassas, Virginia 20110 USA

**Product Name:** LCA500 amanTag Locator

**Product Description:** amanTag Locator for triggering and reading amanTag transponder IDs

**Operating Voltage/Frequency:** 12-24VDC from Power Adapter

**Model:** LCA500

**FCC ID:** IXLLCA500

**Testing Commenced:** Oct. 25, 2019

**Testing Ended:** Mar. 5, 2020

**Summary of Test Results:** **In Compliance**

The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications and/or manufacturer's statement. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant.



**Standards:**

- ❖ FCC Part 15 Subpart C, Section 15.209
- ❖ FCC Part 15 Subpart C, Section 15.215(c) – Additional provisions to the general radiated emission limitations
- ❖ FCC Part 15 Subpart A, Section 15.31(e) – Measurement Standards
- ❖ FCC15.207 - Conducted Limits

**Evaluation Conducted by:**

  
Julius Chiller, EMC/Wireless Engineer

**Report Reviewed by:**

  
Ken Littell, Director of EMC & Wireless Operations

F2 Labs  
26501 Ridge Road  
Damascus, MD 20872  
Ph 301.253.4500

F2 Labs  
16740 Peters Road  
Middlefield, OH 44062  
Ph 440.632.5541

F2 Labs  
8583 Zionsville Road  
Indianapolis, IN 46268  
Ph 317.610.0611

This test report may be reproduced in full; partial reproduction only may be made with the written consent of F2 Labs. The results in this report apply only to the equipment tested.



## TABLE OF CONTENTS

| Section | Title                                 | Page |
|---------|---------------------------------------|------|
| 1       | ADMINISTRATIVE INFORMATION            | 4    |
| 2       | SUMMARY OF TEST RESULTS/MODIFICATIONS | 7    |
| 3       | TABLE OF MEASURED RESULTS             | 8    |
| 4       | ENGINEERING STATEMENT                 | 9    |
| 5       | EUT INFORMATION AND DATA              | 10   |
| 6       | LIST OF MEASUREMENT INSTRUMENTATION   | 11   |
| 7       | OCCUPIED BANDWIDTH                    | 12   |
| 8       | SPURIOUS EMISSIONS                    | 14   |
| 9       | VOLTAGE VARIATIONS                    | 18   |
| 10      | CONDUCTED EMISSIONS                   | 22   |
| 11      | PHOTOGRAPHS                           | 27   |



## **1 ADMINISTRATIVE INFORMATION**

### **1.1 Measurement Location:**

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD.

### **1.2 Measurement Procedure:**

All measurements were performed according to the 2013 version of ANSI C63.10 and recommended FCC procedure of measurement of equipment operating under Section 15.209. A list of the measurement equipment can be found in Section 6.



### 1.3 Uncertainty Budget:

The uncertainty in EMC measurements arises from several factors which affect the results, some associated with environmental conditions in the measurement room, the test equipment being used, and the measurement techniques adopted.

The measurement uncertainty budgets detailed below are calculated from the test and calibration data and are expressed with a 95% confidence factor using a coverage factor of  $k=2$ . The Uncertainty for a laboratory is referred to as  $U_{lab}$ . For Radiated and Conducted Emissions, the Expanded Uncertainty is compared to the  $U_{cispr}$  values to determine if a specific margin is required to deem compliance.

#### $U_{lab}$

| Measurement Range                                   | Combined Uncertainty | Expanded Uncertainty |
|-----------------------------------------------------|----------------------|----------------------|
| Radiated Emissions <1 GHz @ 3m                      | 2.54                 | 5.07dB               |
| Radiated Emissions <1 GHz @ 10m                     | 2.55                 | 5.09dB               |
| Radiated Emissions 1 GHz to 2.7 GHz                 | 1.81                 | 3.62dB               |
| Radiated Emissions 2.7 GHz to 18 GHz                | 1.55                 | 3.10dB               |
| AC Power Line Conducted Emissions, 150kHz to 30 MHz | 1.38                 | 2.76dB               |
| AC Power Line Conducted Emissions, 9kHz to 150kHz   | 1.66                 | 3.32dB               |

#### $U_{cispr}$

| Measurement Range                                   | Expanded Uncertainty |
|-----------------------------------------------------|----------------------|
| Radiated Emissions <1 GHz @ 3m                      | 5.2dB                |
| Radiated Emissions <1 GHz @ 10m                     | 5.2dB                |
| Radiated Emissions 1 GHz to 2.7 GHz                 | Under Consideration  |
| Radiated Emissions 2.7 GHz to 18 GHz                | Under Consideration  |
| AC Power Line Conducted Emissions, 150kHz to 30 MHz | 3.6dB                |
| AC Power Line Conducted Emissions, 9kHz to 150kHz   | 4.0dB                |

If  $U_{lab}$  is less than or equal to  $U_{cispr}$ , then:

- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cispr}$  in table 1, then:

- compliance is deemed to occur if no measured disturbance, increased by ( $U_{lab} - U_{cispr}$ ), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance, increased by ( $U_{lab} - U_{cispr}$ ), exceeds the disturbance limit.

Note: Only measurements listed in the tables above that relate to tests included in this Test Report are applicable.



Order Number: F2P21409B

Applicant: Deister Electronics USA, Inc.  
Model: LCA500

#### 1.4 Document History:

| Document Number | Description | Issue Date   | Approved By |
|-----------------|-------------|--------------|-------------|
| F2P21409B-01E   | First Issue | Mar. 9, 2020 | K. Littell  |
|                 |             |              |             |
|                 |             |              |             |

**2 SUMMARY OF TEST RESULTS**

| Test Name                    | Standard(s)           | Results  |
|------------------------------|-----------------------|----------|
| -20dB Occupied Bandwidth     | CFR 47 Part 15.215(c) | Complies |
| Field Strength of Emissions  | CFR 47 Part 15.209    | Complies |
| Radiated Spurious Emissions  | CFR 47 Part 15.209    | Complies |
| Conducted Emissions          | CFR 47 Part 15.207(a) | Complies |
| Variation of the Input Power | CFR 47 Part 15.31(e)  | Complies |

| Modifications Made to the Equipment |
|-------------------------------------|
| None                                |



### 3 TABLE OF MEASURED RESULTS

| Test                                                      | 125 kHz                                  |
|-----------------------------------------------------------|------------------------------------------|
| Field Strength of Fundamental corrected for 40dB/decade   | -36.69 dB $\mu$ V/m                      |
| Limit for Fundamental at 300 meters                       | 25.66 dB $\mu$ V/m                       |
| Field Strength of Fundamental at 3-Meter distance         | 43.31 dB $\mu$ V/m                       |
| Limit for Fundamental with 40dB/decade correction from 30 | 105.66 dB $\mu$ V/m<br>54.2 dB $\mu$ A/m |
| -20dB Occupied Bandwidth                                  | .0134 MHz<br>13.4kHz                     |
| 99% Occupied Bandwidth                                    | 0.0185 MHz<br>18.5kHz                    |
| Variation of Input Power @ 85%                            | 39.29 dB $\mu$ V                         |
| Variation of Input Power, Nominal                         | 39.96 dB $\mu$ V                         |
| Variation of Input Power @ 115%                           | 40.69 dB $\mu$ V                         |

- <sup>1</sup> 125 kHz Field Strength was measured at 3m and measured in dBuV/m. The limit is 19.2 expressed in microvolts/meter at 300 meters. When converted to dBuV/m, the limit becomes 25.67 dBuV/m at 300 meters.



#### **4 ENGINEERING STATEMENT**

This report has been prepared on behalf of Deister Electronics USA, Inc., to provide documentation for the testing described herein. This equipment has been tested and found to comply with part 15.209 of the FCC Rules using ANSI C63.10 2013 and Part 15 standards. The test results found in this test report relate only to the items tested.



## **5 EUT INFORMATION AND DATA**

### **5.1 Equipment Under Test:**

Product: LCA500 amanTag Locator

Model: LCA500

Serial No.: None Specified

FCC ID: **IXLLCA500**

### **5.2 Trade Name:**

Deister Electronics USA, Inc.

### **5.3 Power Supply:**

12-24VDC from Power Adapter

### **5.4 Applicable Rules:**

CFR 47, Part 15.209

### **5.5 Equipment Category:**

Radio Transmitter

### **5.6 Antenna:**

0 dBi Inductor Antenna

### **5.7 Accessories:**

Power Adapter: TRIWO model FW7530/24

### **5.8 Test Item Condition:**

The equipment to be tested was received in good condition.

### **5.9 Testing Algorithm:**

EUT was configured to transmit in the continuous mode on 125kHz.

**6 LIST OF MEASUREMENT INSTRUMENTATION**

| Equipment Type                  | Asset Number           | Manufacturer       | Model                               | Serial Number | Calibration Due Date |
|---------------------------------|------------------------|--------------------|-------------------------------------|---------------|----------------------|
| Shielded Chamber                | CL166-E                | Albatross Projects | B83117-DF435-T261                   | US140023      | Dec. 31, 2019        |
| Receiver                        | CL151                  | Rohde & Schwarz    | ESU40                               | 100319        | Oct. 21, 2020        |
| Antenna, JB3 Combination        | CL211                  | Sunol Sciences     | JB1                                 | A021017       | Oct. 3, 2021         |
| Amplifier w/Monopole & 18" Loop | CL163-Loop             | AH Systems, Inc.   | EHA-52B                             | 100           | July 24, 2020        |
| Pre-Amplifier                   | CL153                  | Agilent            | 83006-69007                         | MY39500791    | Aug. 5, 2020         |
| Temp/Hum. Recorder              | CL261                  | Extech             | 445814                              | 04            | Mar. 6, 2020         |
| Temp/Hum. Recorder              | CL263                  | Extech             | 445814                              | 06            | Mar. 6, 2020         |
| Transient Limiter               | CL102                  | Hewlett Packard    | 11947A                              | 3107A03325    | Feb. 7, 2020         |
| Software:                       | Tile Version 3.4.B.3.  |                    | Software Verified: Oct. 25-28, 2019 |               |                      |
| Spectrum Analyzer               | CL147                  | Agilent            | E7402A                              | MY45101241    | Jan. 25, 2020        |
| LISN                            | CL181                  | Com-Power          | LI-125A                             | 191226        | Sept. 6, 2020        |
| LISN                            | CL182                  | Com-Power          | LI-125A                             | 191225        | Sept. 6, 2020        |
| Software:                       | EMC 32, Version 8.53.0 |                    | Software Verified: Oct. 25-28, 2019 |               |                      |



## **7 OCCUPIED BANDWIDTH**

### **7.1 Requirements:**

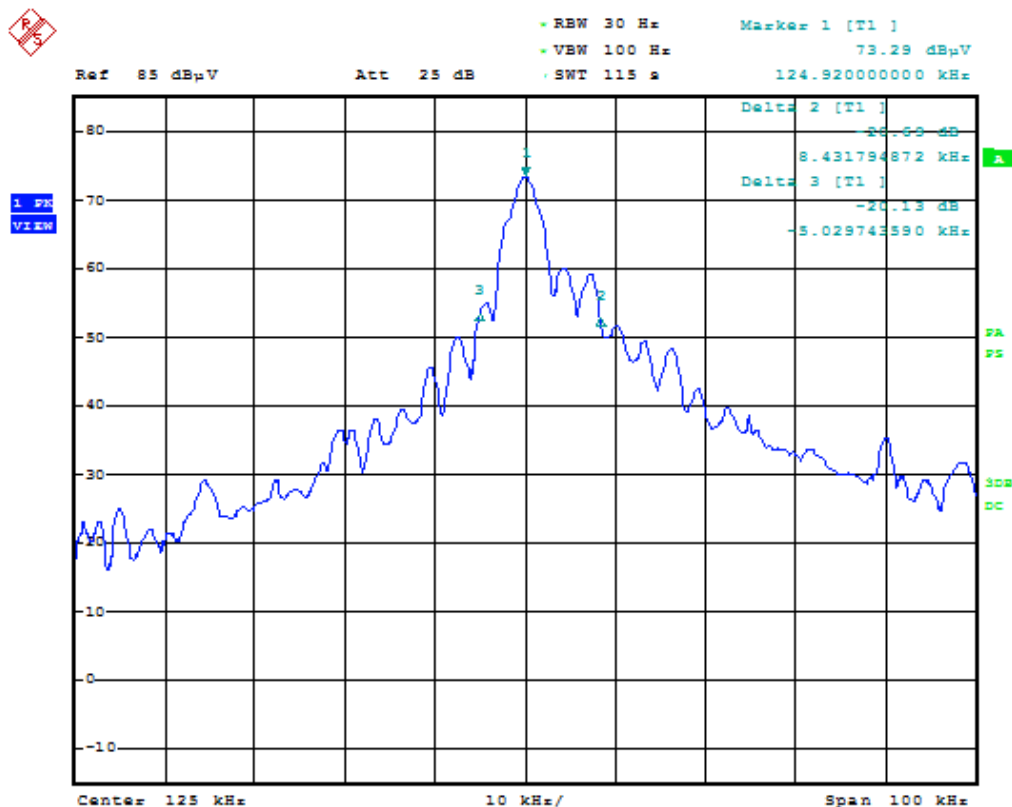
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific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

Bandwidth measurements were made at the 125kHz frequency. The bandwidth was measured using the Marker Delta method.



## 7.2 Test Data - Occupied Bandwidth

|               |                       |                    |            |
|---------------|-----------------------|--------------------|------------|
| Test Date(s): | Oct. 28, 2019         | Test Engineer(s):  | J. Chiller |
| Standards:    | CFR 47 Part 15.215(c) | Air Temperature:   | 22.4°C     |
|               |                       | Relative Humidity: | 35%        |

**-20dB**



## 8.0 SPURIOUS EMISSIONS

Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions and three orthogonal positions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some frequencies, no emissions from the EUT were measurable over the ambient noise floor. The readings did not change with EUT on and EUT off.

At least 6 of the highest frequencies were measured per ANSI 63.4 in a 3-meter anechoic chamber. Frequencies below 1GHz were measured using a quasi-peak detector. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. Some of the frequencies did not change with the EUT on or off. At those frequencies, the test distance was shortened to 1 meter and still no emissions from the EUT were visible or over the ambient or limit. Frequencies were scanned from 9kHz to 1000 MHz and the highest emissions are listed below.

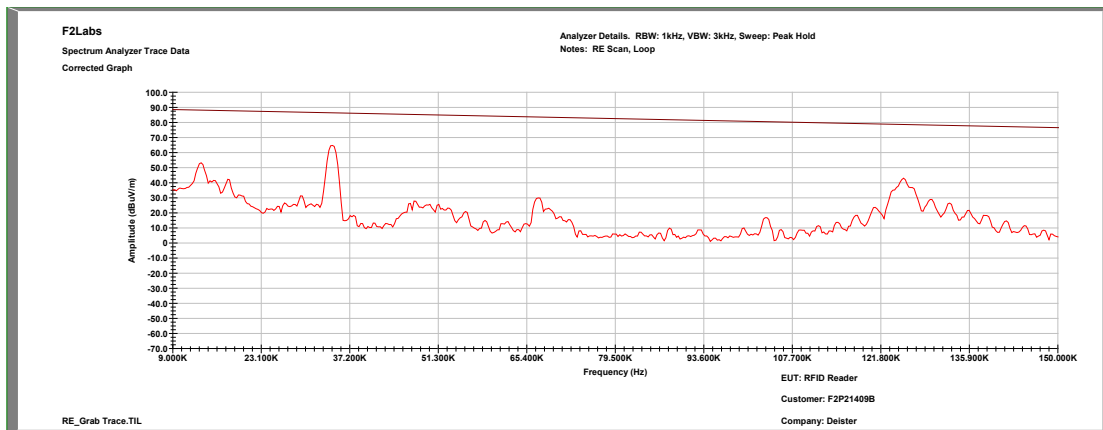
In the following plots, the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables below.



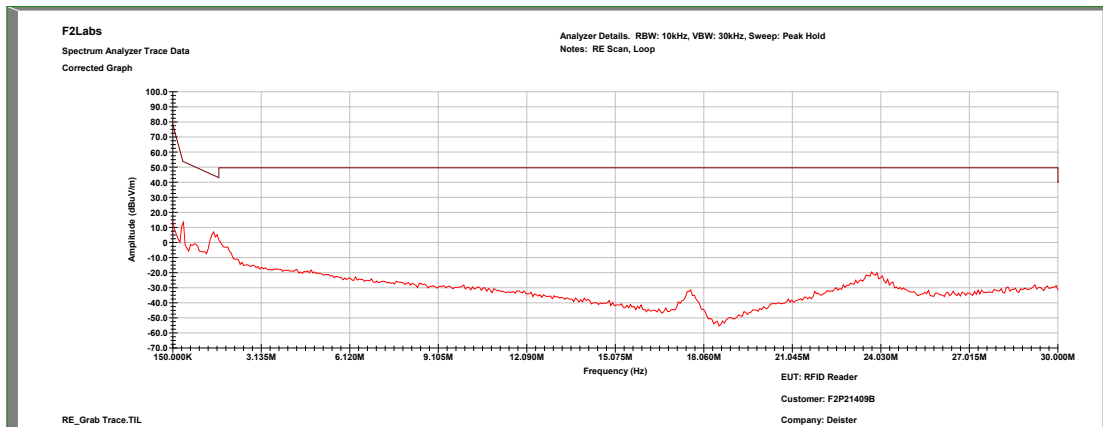
## 8.1 Test Data

|               |                    |                    |            |
|---------------|--------------------|--------------------|------------|
| Test Date(s): | Oct. 25, 2019      | Test Engineer(s):  | J. Chiller |
| Standards:    | CFR 47 Part 15.209 | Air Temperature:   | 22.8°C     |
| Results:      | Complies           | Relative Humidity: | 35%        |

### 125kHz: Characterization Scan, 0.009 MHz to 0.15 MHz (Loop Antenna)

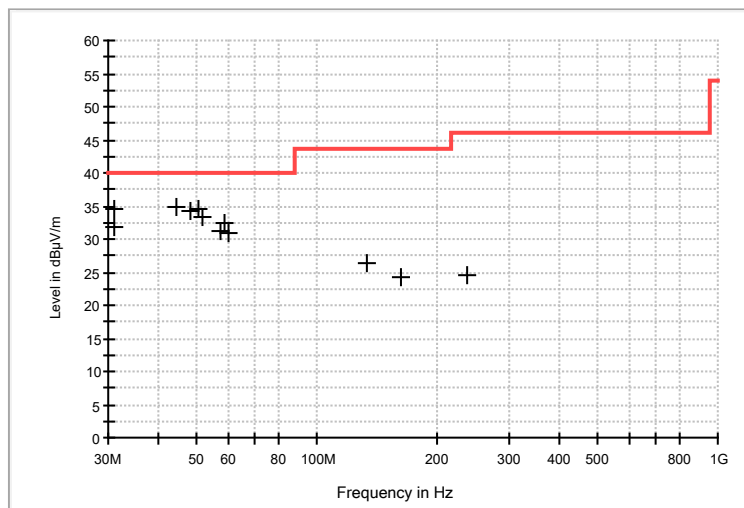


### 125kHz: Characterization Scan, 0.15 MHz to 30 MHz (Loop Antenna)



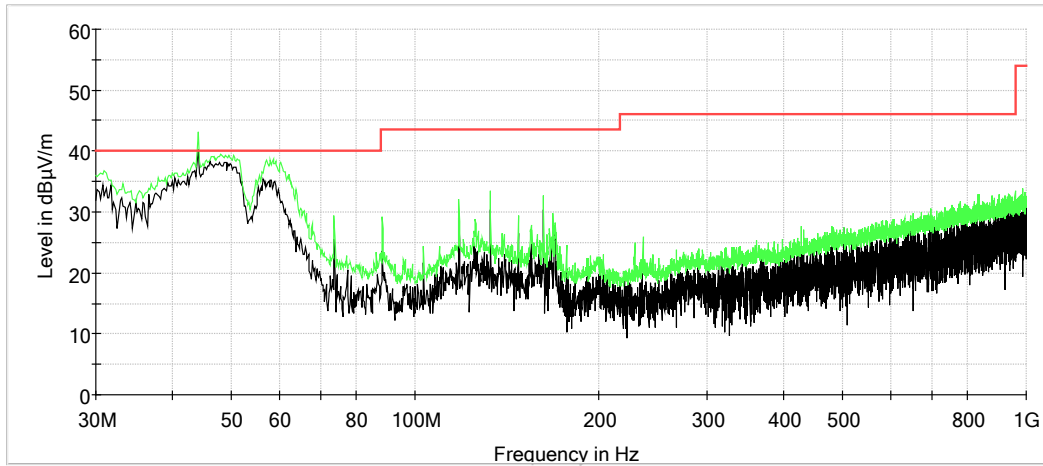


| Frequency (MHz) | Antenna Polarization | Antenna Height (cm) | Azimuth (degrees) | Reading (dB $\mu$ V) | Cable Loss & Antenna Factor (dB) | Emission (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|----------------------|---------------------|-------------------|----------------------|----------------------------------|-------------------------|----------------------|-------------|
| 0.125000        | Loop                 | 200.00              | 0.00              | -8.0                 | 51.3                             | 43.31                   | 105.7                | -62.4       |
| 30.960000       | V                    | 100.00              | 0.00              | 26.1                 | 5.9                              | 32.00                   | 40.0                 | -8.0        |
| 31.160000       | H                    | 100.00              | 0.00              | 28.7                 | 5.8                              | 34.50                   | 40.0                 | -5.5        |
| 44.160000       | V                    | 100.00              | 0.00              | 38.4                 | -3.7                             | 34.70                   | 40.0                 | -5.3        |
| 48.040000       | V                    | 100.00              | 0.00              | 40.2                 | -5.8                             | 34.40                   | 40.0                 | -5.6        |
| 50.360000       | V                    | 100.00              | 346.00            | 41.3                 | -6.6                             | 34.70                   | 40.0                 | -5.3        |
| 51.520000       | V                    | 100.00              | 0.00              | 40.4                 | -7.0                             | 33.40                   | 40.0                 | -6.6        |
| 57.160000       | V                    | 100.00              | 346.00            | 38.8                 | -7.5                             | 31.30                   | 40.0                 | -8.7        |
| 58.520000       | V                    | 100.00              | 200.00            | 40.0                 | -7.5                             | 32.50                   | 40.0                 | -7.5        |
| 60.280000       | V                    | 100.00              | 212.00            | 38.5                 | -7.5                             | 31.00                   | 40.0                 | -9.0        |
| 132.640000      | H                    | 100.00              | 208.00            | 28.1                 | -1.7                             | 26.40                   | 43.5                 | -17.1       |
| 162.120000      | H                    | 100.00              | 280.00            | 27.5                 | -3.3                             | 24.20                   | 43.5                 | -19.3       |
| 235.840000      | H                    | 100.00              | 92.00             | 28.3                 | -3.7                             | 24.60                   | 46.0                 | -21.4       |

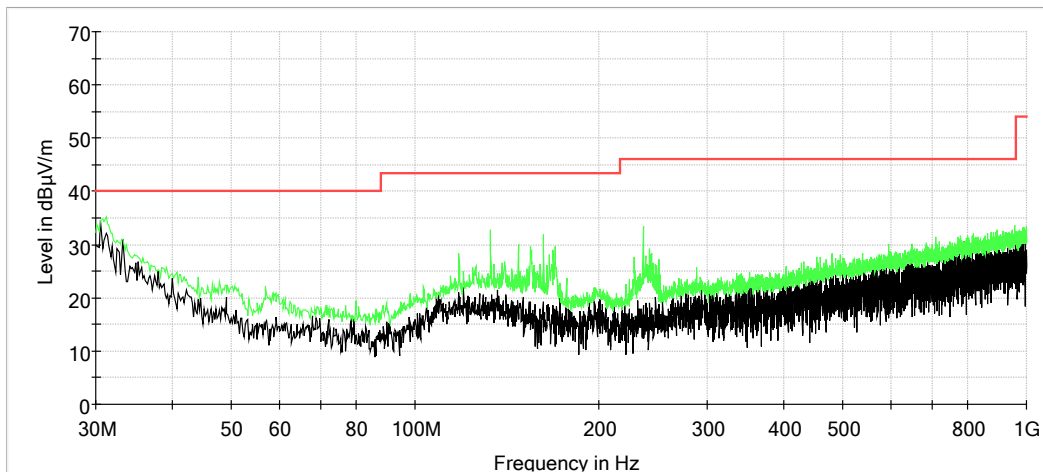




### Characterization Scan, 30 MHz to 1000 MHz, Vertical



### Characterization Scan, 30 MHz to 1000 MHz, Horizontal





## **9 VOLTAGE VARIATIONS**

### **9.1 Requirements**

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.



**Applicant: Deister Electronics USA, Inc.**

## 9.2 Voltage Variations Test Data

## Nominal



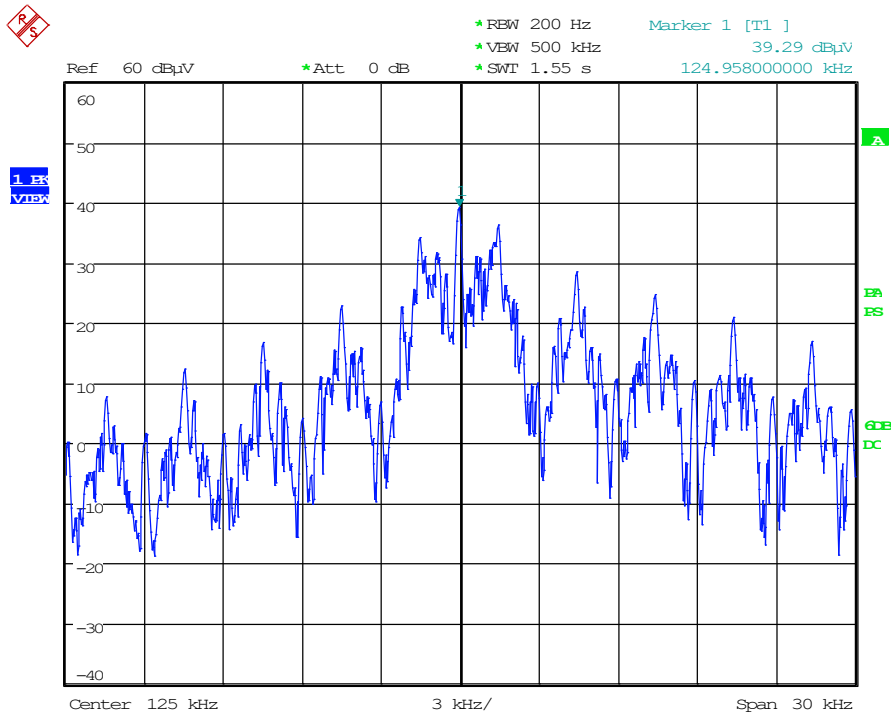


Order Number: F2P21409B

Applicant: Deister Electronics USA, Inc.

Model: LCA500

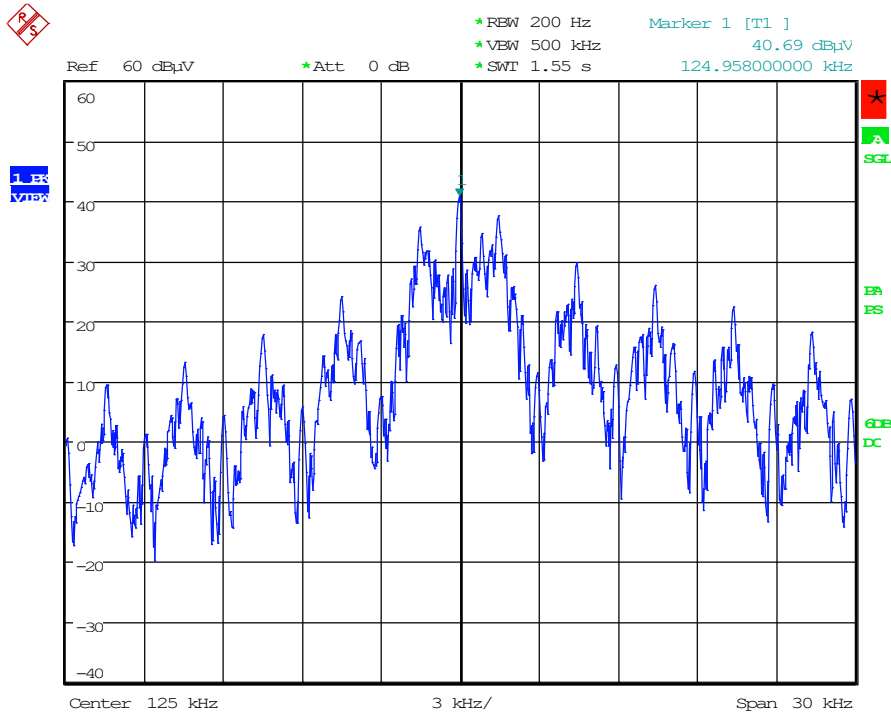
-15% (10.2VDC)



Date: 5.MAR.2020 16:12:49



**+15% (27.6VDC)**



Date: 5.MAR.2020 16:11:07



## 10 CONDUCTED EMISSIONS

### 10.1 Requirements

In accordance with FCC CFR 47 Part 15.207(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  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of Emission (MHz) | Conducted Limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15-0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5-5                       | 56                           | 46        |
| 5-30                        | 60                           | 50        |

\*Decreases with the logarithm of the frequency.

### 10.2 Procedure

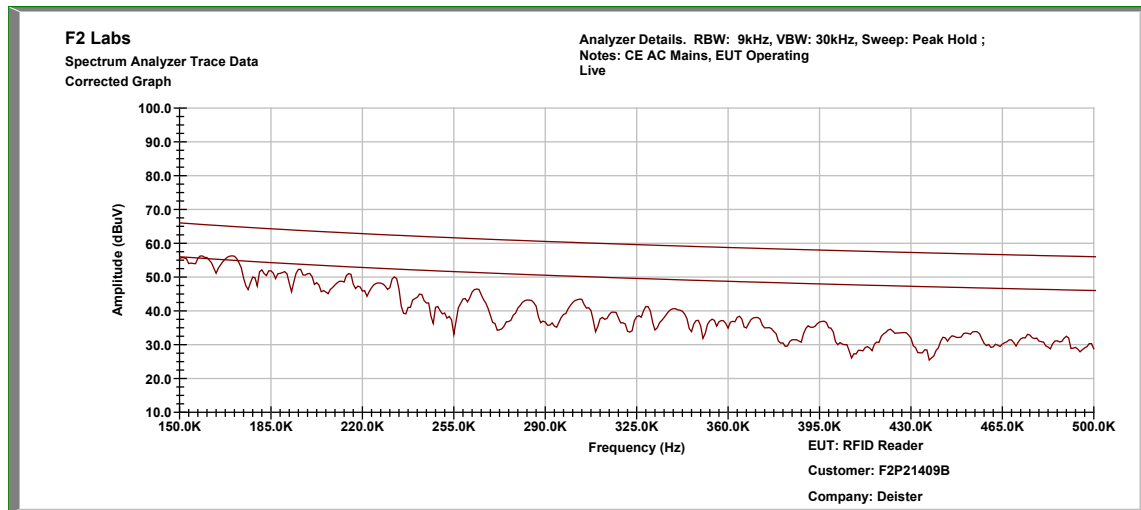
The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power source. The output of the LISN was connected to the input of the receiver via a transient limiter, and emissions in the range 150 kHz to 30 MHz were measured. The measurements were recorded using the quasi-peak and average detectors as directed by the standard, and the resolution bandwidth during testing was 9 kHz. The raw measurements were corrected to allow for attenuation from the LISN, transient limiter and cables.



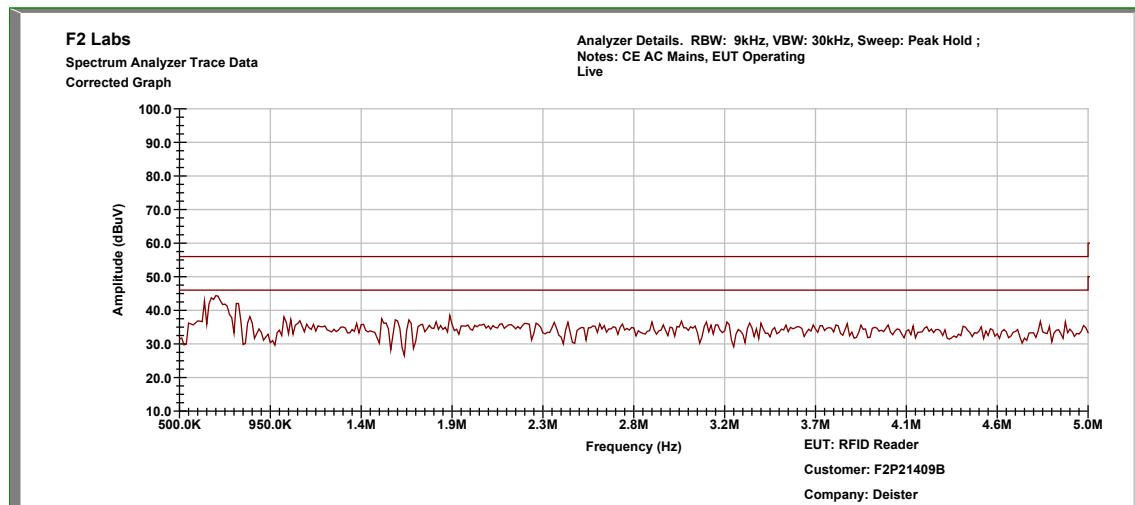
### 10.3 Conducted Emissions Test Data

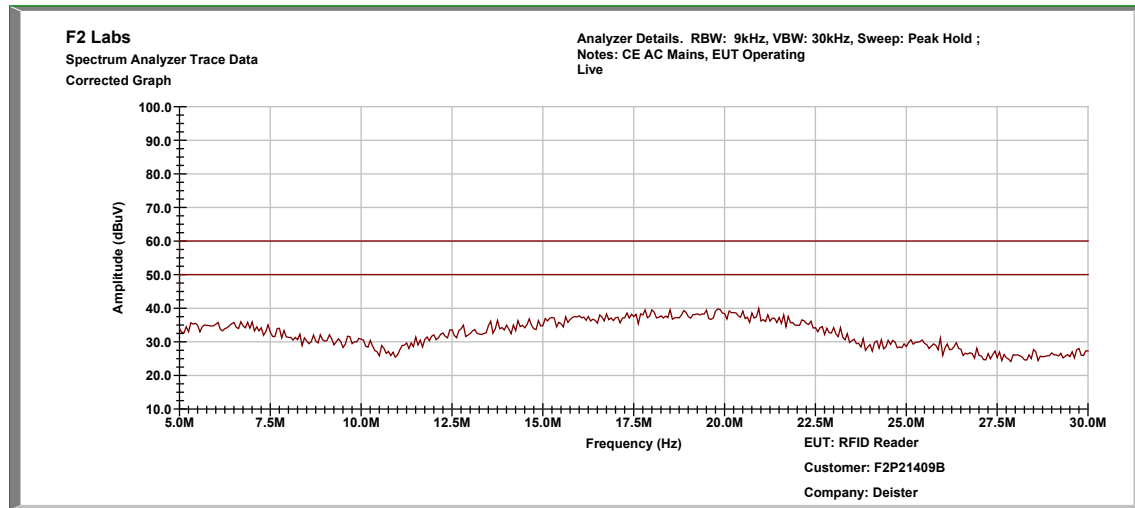
|               |               |                    |            |
|---------------|---------------|--------------------|------------|
| Test Date:    | Oct. 28, 2019 | Test Engineer:     | J. Chiller |
| Rule:         | 15.207        | Air Temperature:   | 23.0° C    |
| Test Results: | Complies      | Relative Humidity: | 40%        |

#### Conducted Test – Line 1: 0.15 MHz to 0.5 MHz



#### Conducted Test – Line 1: 0.5 MHz to 5.0 MHz

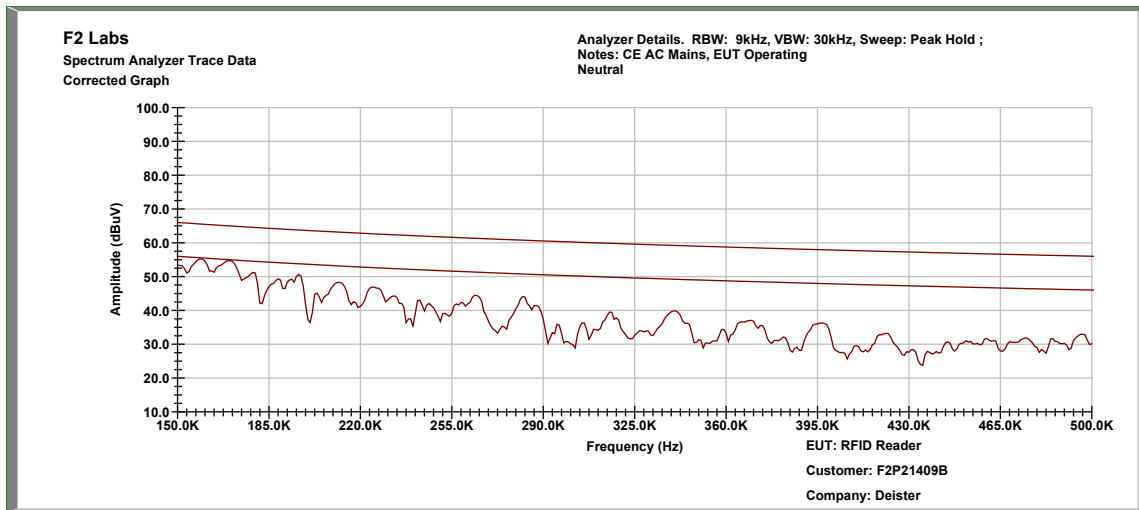


**Conducted Test – Line 1: 5.0 MHz to 30.0 MHz**

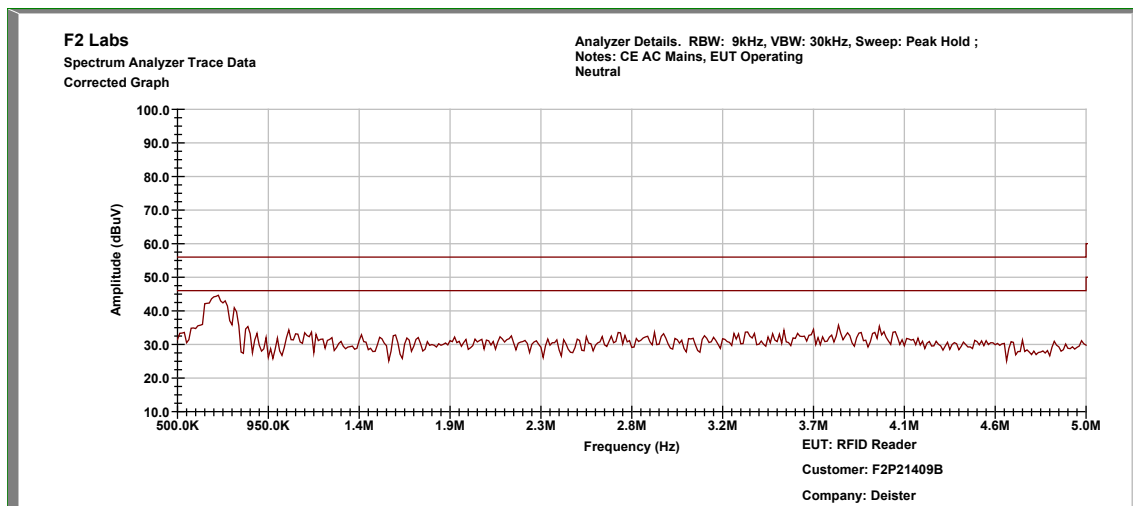
| Top Discrete Measurements |           |                 |            |              |                 |                |              |             |
|---------------------------|-----------|-----------------|------------|--------------|-----------------|----------------|--------------|-------------|
| No.                       | Conductor | Frequency (MHz) | Detector   | Level (dBμV) | Adjustment (dB) | Results (dBμV) | Limit (dBμV) | Margin (dB) |
| 1                         | Live      | 0.152           | Quasi-Peak | 39.78        | 11.544          | 51.32          | 65.857       | -14.5       |
|                           |           |                 | Average    | 21.57        | 11.544          | 33.11          | 55.857       | -22.7       |
| 2                         | Live      | 0.158           | Quasi-Peak | 37.79        | 11.484          | 49.27          | 65.530       | -16.3       |
|                           |           |                 | Average    | 20.43        | 11.484          | 31.91          | 55.530       | -23.6       |
| 3                         | Live      | 0.170           | Quasi-Peak | 46.65        | 11.374          | 58.02          | 64.961       | -6.9        |
|                           |           |                 | Average    | 23.66        | 11.374          | 35.03          | 54.961       | -19.9       |
| 4                         | Live      | 0.196           | Quasi-Peak | 35.1         | 11.116          | 46.22          | 63.763       | -17.5       |
|                           |           |                 | Average    | 15.91        | 11.116          | 27.03          | 53.763       | -26.7       |
| 5                         | Live      | 0.215           | Quasi-Peak | 35.96        | 10.954          | 46.91          | 63.01        | -16.1       |
|                           |           |                 | Average    | 19.6         | 10.954          | 30.55          | 53.01        | -22.5       |
| 6                         | Live      | 0.233           | Quasi-Peak | 34.46        | 10.802          | 45.26          | 62.338       | -17.1       |
|                           |           |                 | Average    | 19.58        | 10.802          | 30.38          | 52.338       | -22.0       |
| 7                         | Live      | 0.691           | Quasi-Peak | 31.29        | 10.409          | 41.70          | 56.0         | -14.3       |
|                           |           |                 | Average    | 21.75        | 10.409          | 32.16          | 46.0         | -13.8       |
| 8                         | Live      | 0.623           | Quasi-Peak | 29.9         | 10.476          | 40.38          | 56.0         | -15.6       |
|                           |           |                 | Average    | 13.84        | 10.476          | 24.32          | 46.0         | -21.7       |

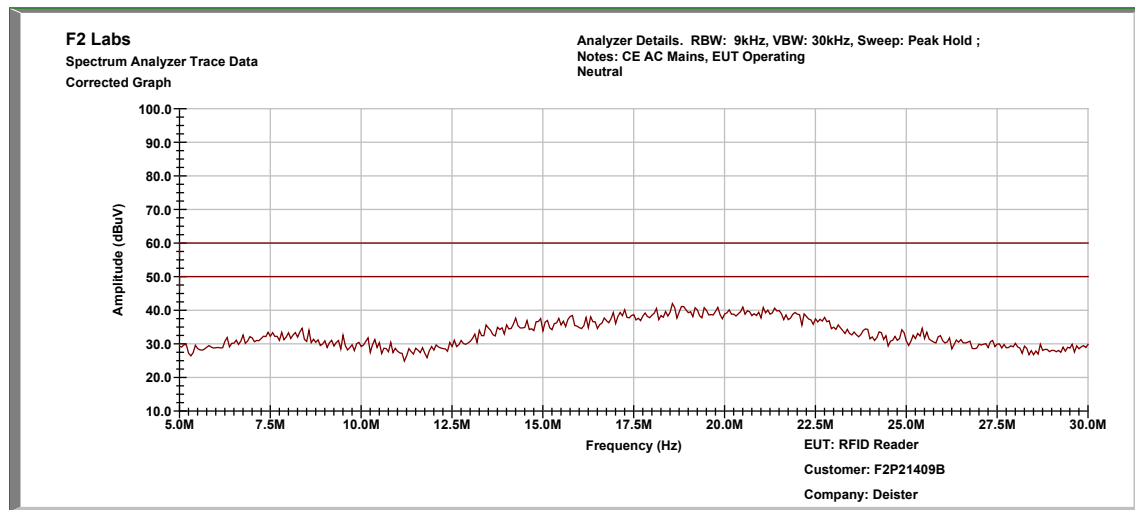


### Conducted Test – Line 2: 0.15 MHz to 0.5 MHz



### Conducted Test – Line 2: 0.5 MHz to 5.0 MHz



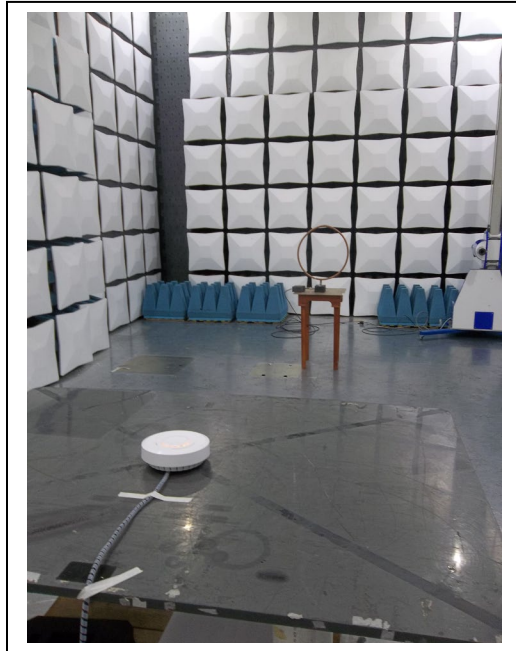
**Conducted Test – Line 2: 5.0 MHz to 30.0 MHz**

| Top Discrete Measurements |           |                 |            |              |                 |                |              |             |
|---------------------------|-----------|-----------------|------------|--------------|-----------------|----------------|--------------|-------------|
| No.                       | Conductor | Frequency (MHz) | Detector   | Level (dBμV) | Adjustment (dB) | Results (dBμV) | Limit (dBμV) | Margin (dB) |
| 1                         | Neutral   | 0.160           | Quasi-Peak | 39.06        | 11.534          | 50.59          | 65.5         | -14.9       |
|                           |           |                 | Average    | 21.9         | 11.534          | 33.43          | 55.5         | -22.0       |
| 2                         | Neutral   | 0.170           | Quasi-Peak | 40.27        | 11.427          | 51.70          | 65.0         | -13.3       |
|                           |           |                 | Average    | 21.86        | 11.427          | 33.29          | 55.0         | -21.7       |
| 3                         | Neutral   | 0.179           | Quasi-Peak | 38.84        | 11.325          | 50.17          | 64.5         | -14.3       |
|                           |           |                 | Average    | 20.98        | 11.325          | 32.31          | 54.5         | -22.2       |
| 4                         | Neutral   | 0.657           | Quasi-Peak | 32.23        | 10.443          | 42.67          | 56.0         | -13.3       |
|                           |           |                 | Average    | 24.16        | 10.443          | 34.60          | 46.0         | -11.4       |
| 5                         | Neutral   | 0.702           | Quasi-Peak | 32.27        | 10.428          | 42.70          | 56.0         | -13.3       |
|                           |           |                 | Average    | 24.17        | 10.428          | 34.60          | 46.0         | -11.4       |
| 6                         | Neutral   | 0.736           | Quasi-Peak | 30.5         | 10.405          | 40.91          | 56.0         | -15.1       |
|                           |           |                 | Average    | 15.3         | 10.405          | 25.71          | 46.0         | -20.3       |

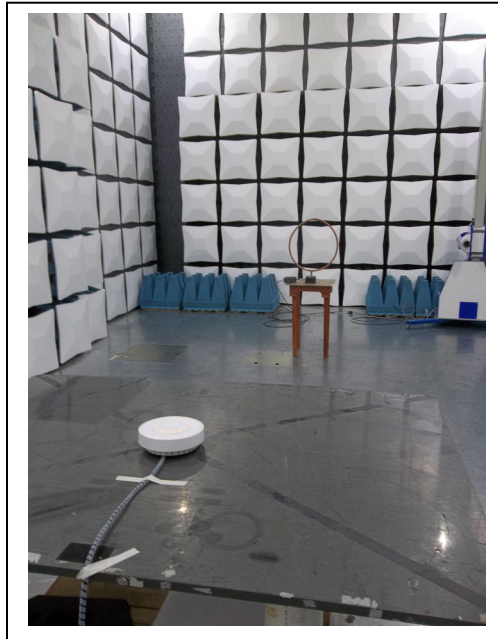


## 11 PHOTOGRAPHS

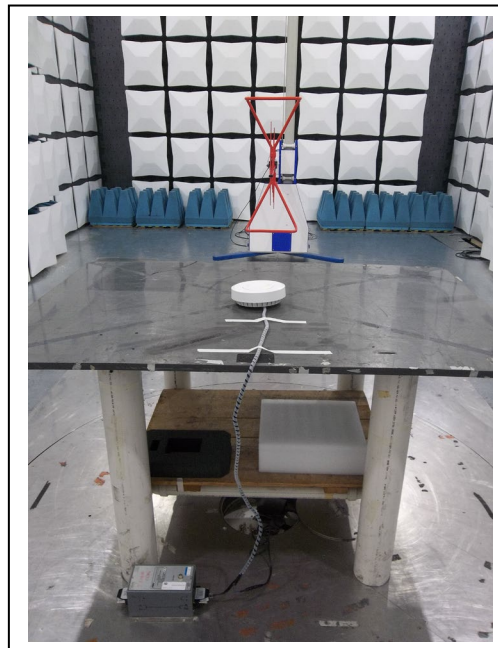
### Occupied Bandwidth



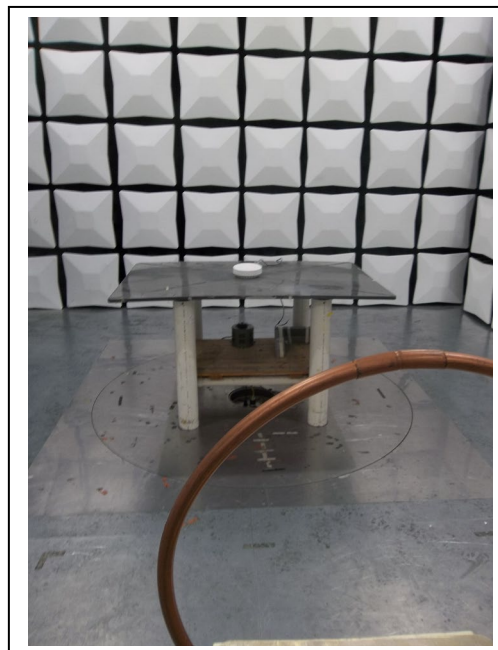
**Radiated Spurious Emissions: Less than 30MHz**



**Radiated Spurious Emissions: 30 to 1000 MHz**



### Voltage Variations





### Conducted Emissions

