F2 Labs
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Middlefield, Ohio 44062
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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

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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.

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 dBµV/m
Limit for Fundamental at 300 meters	25.66 dBµV/m
Field Strength of Fundamental at 3-Meter distance	43.31 dBµV/m
Limit for Fundamental with 40dB/decade correction from 30	105.66 dBµV/m 54.2 dBµA/m
-20dB Occupied Bandwidth	.0134 MHz 13.4kHz
99% Occupied Bandwidth	0.0185 MHz 18.5kHz
Variation of Input Power @ 85%	39.29 dBµV
Variation of Input Power, Nominal	39.96 dBµV
Variation of Input Power @ 115%	40.69 dBµV

[1] 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:

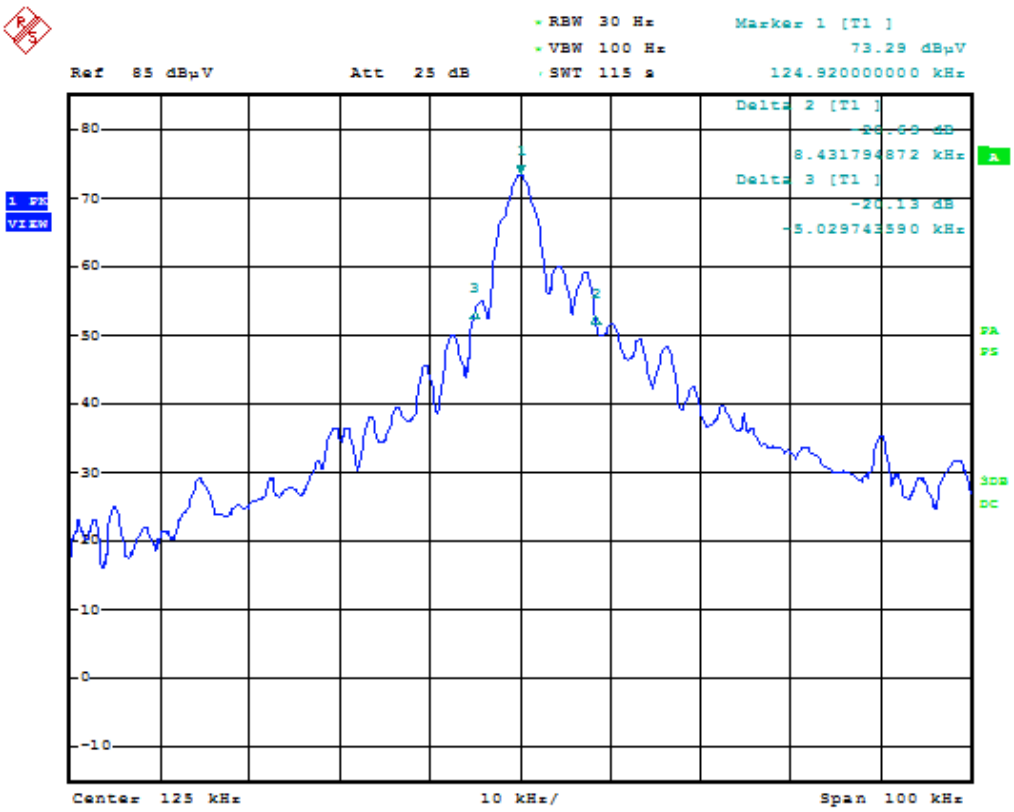
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific 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:	22.4ºC
		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.

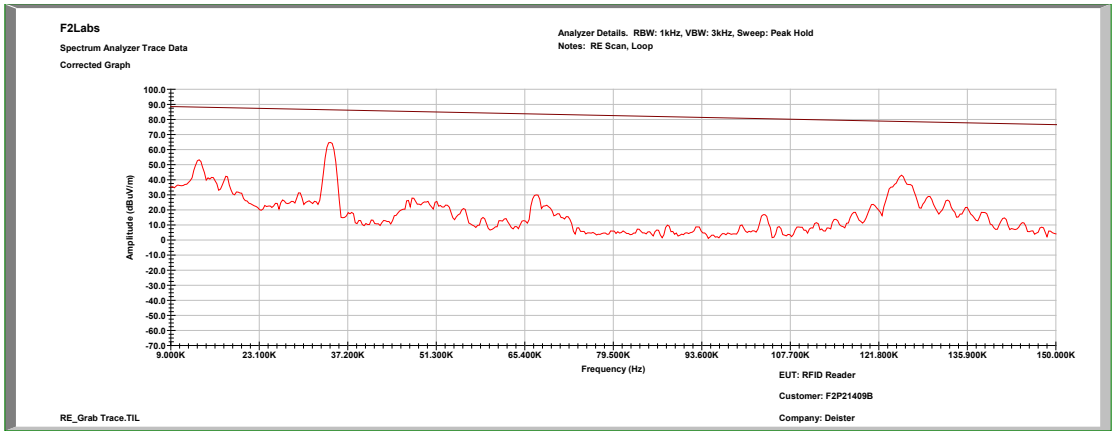
At least 6 of the highest frequencies were measured per ANSI 63.4 in a 3-meter anechoic chamber. Frequencies below 1GHz were measured using a quasi-peak detector. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. Some of the frequencies 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.

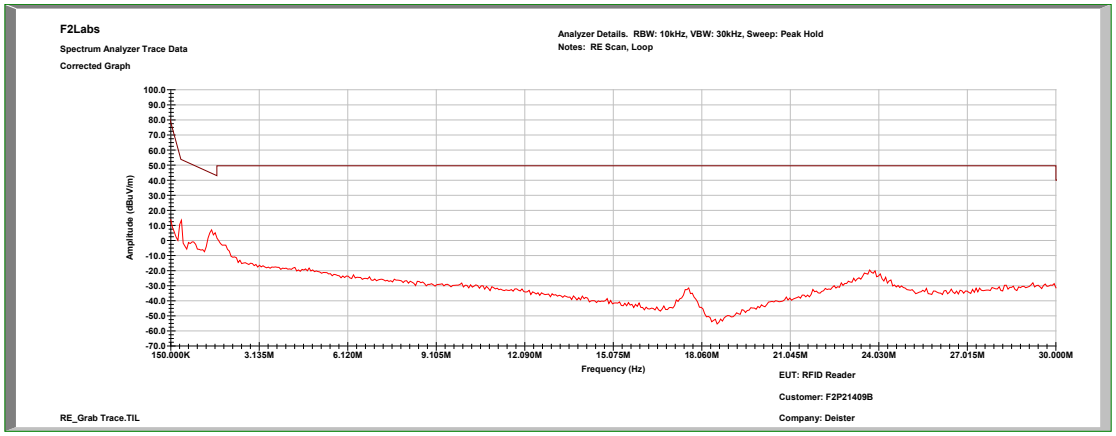
8.1 Test Data

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

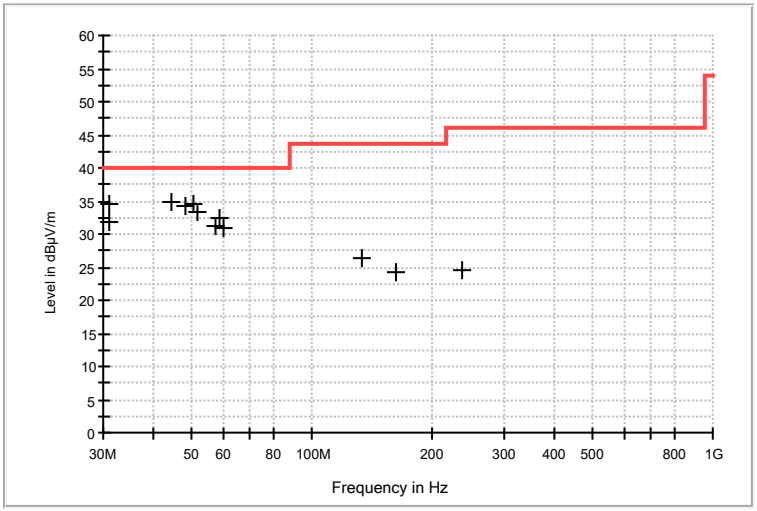
125kHz: Characterization Scan, 0.009 MHz to 0.15 MHz (Loop Antenna)



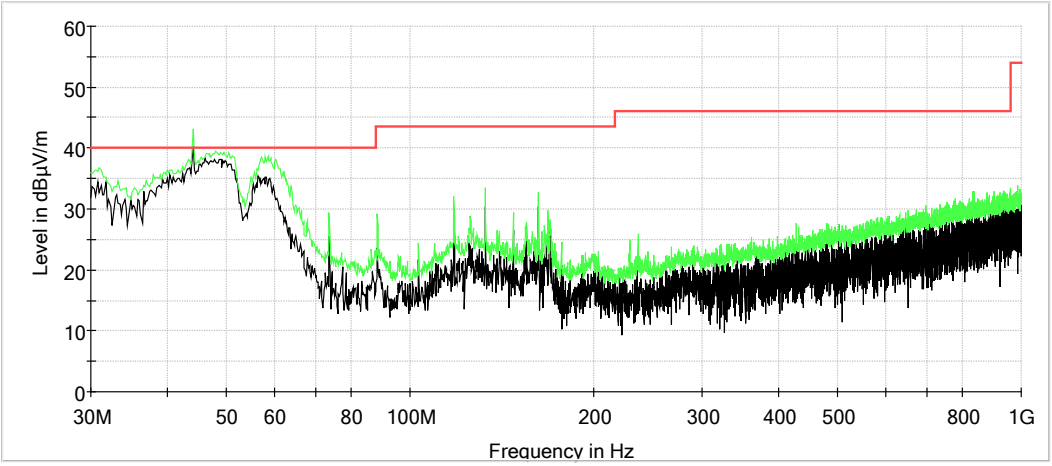
125kHz: Characterization Scan, 0.15 MHz to 30 MHz (Loop Antenna)



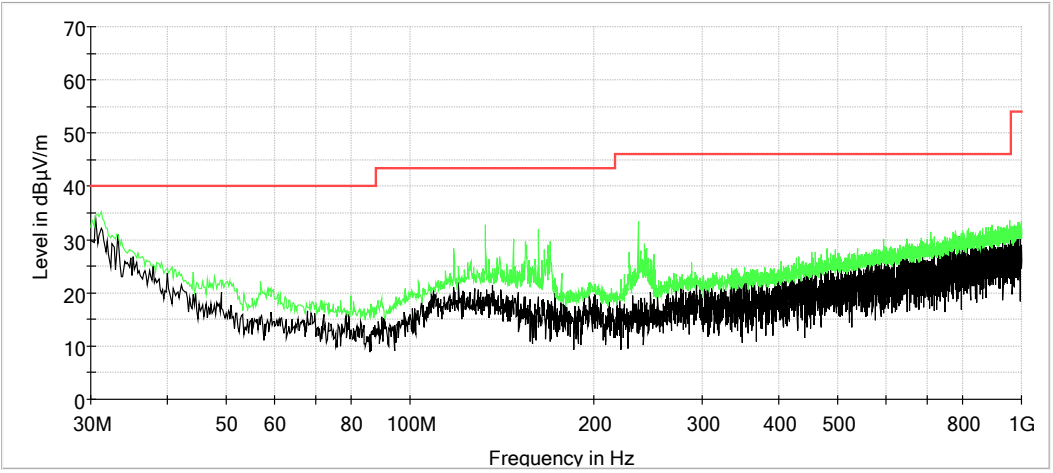
Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Azimuth (degrees)	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
0.125000	Loop	200.00	0.00	-8.0	51.3	43.31	105.7	-62.4
30.960000	V	100.00	0.00	26.1	5.9	32.00	40.0	-8.0
31.160000	H	100.00	0.00	28.7	5.8	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

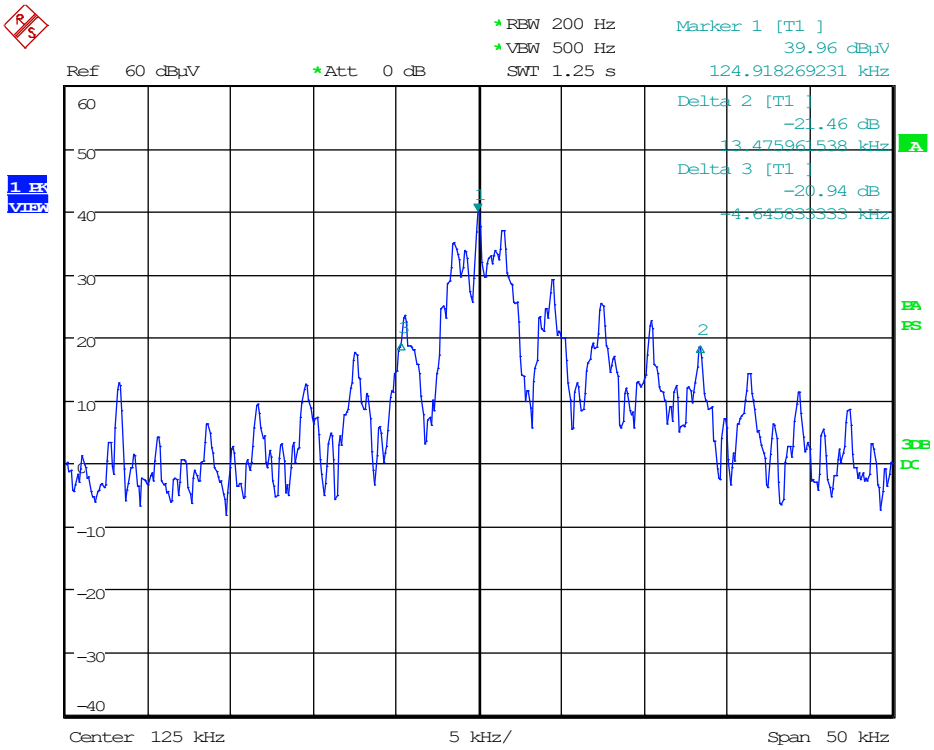
9.1 Requirements

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.

9.2 Voltage Variations Test Data

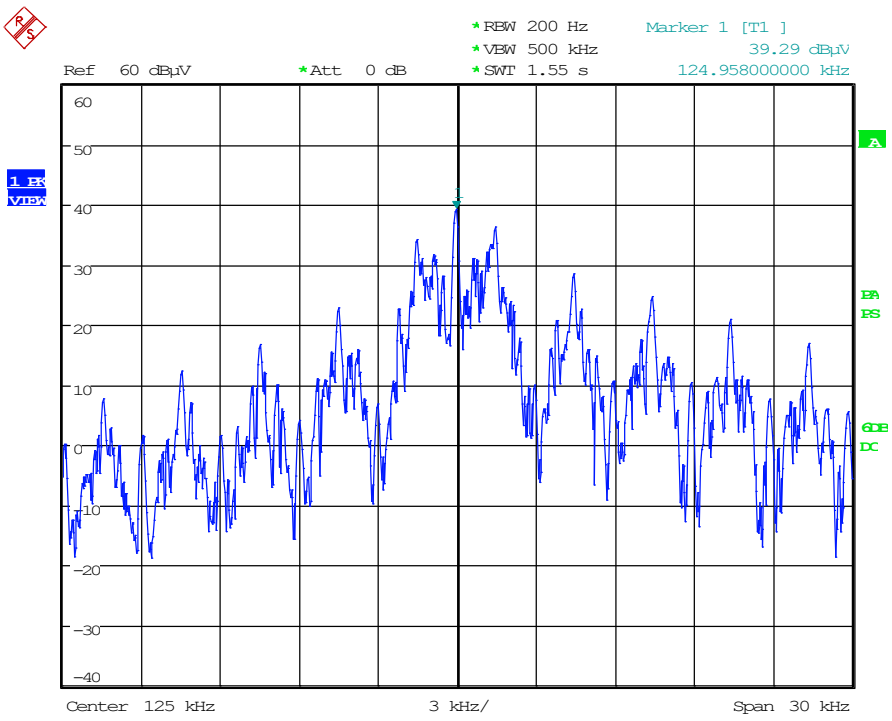
Test Date(s):	Mar. 5, 2020	**Test Engineer:**	J. Chiller
Rule:	15.31(e)	**Air Temperature:**	21.2º C
Test Results:	Complies	**Relative Humidity:**	27%

Nominal



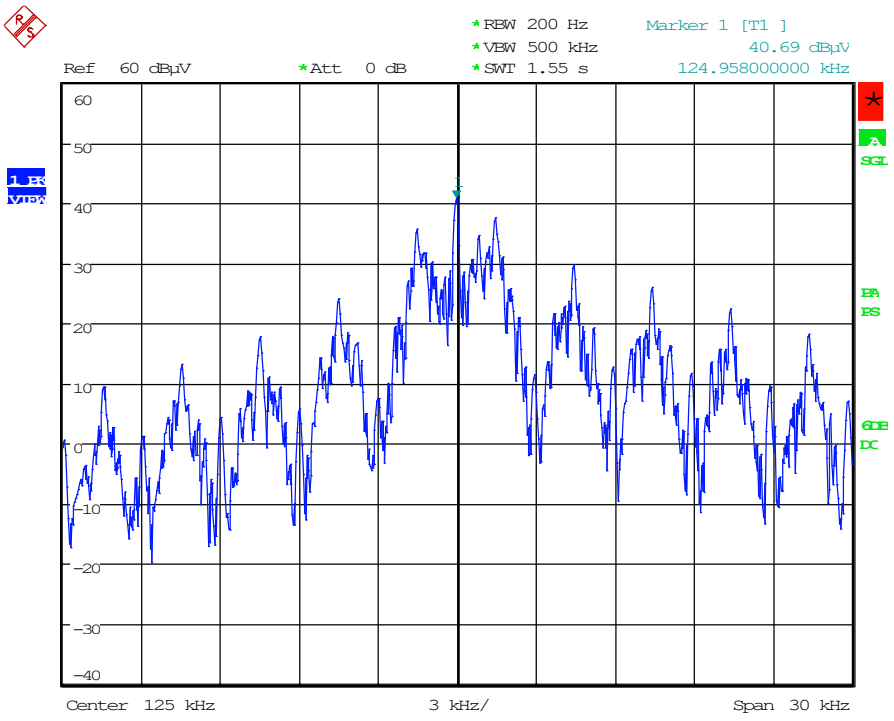
Date: 28.OCT.2019 10:45:52

-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 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 of Emission (MHz)	Conducted Limit (dBμV)	
	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.

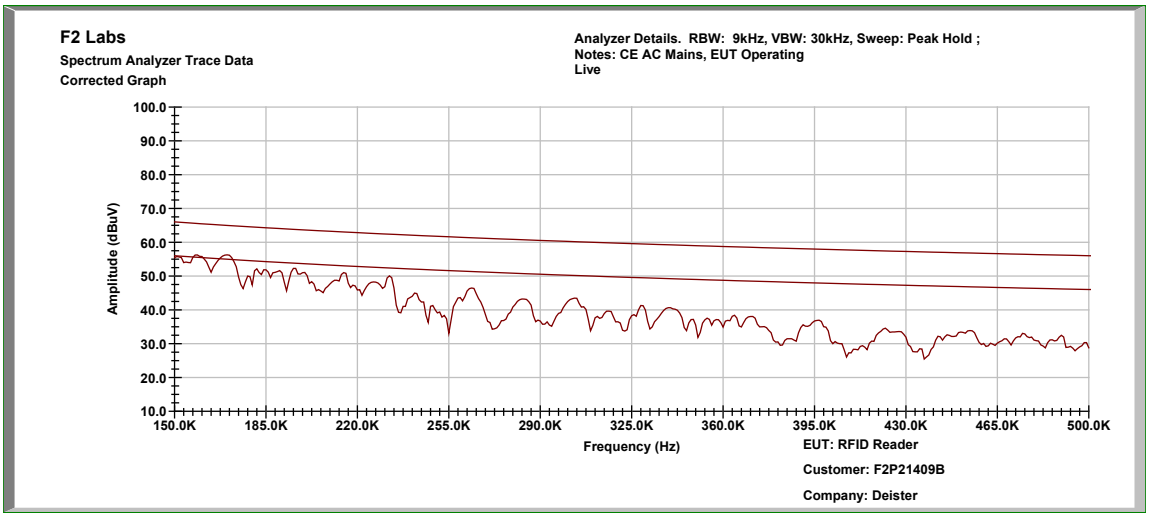
10.2 Procedure

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.

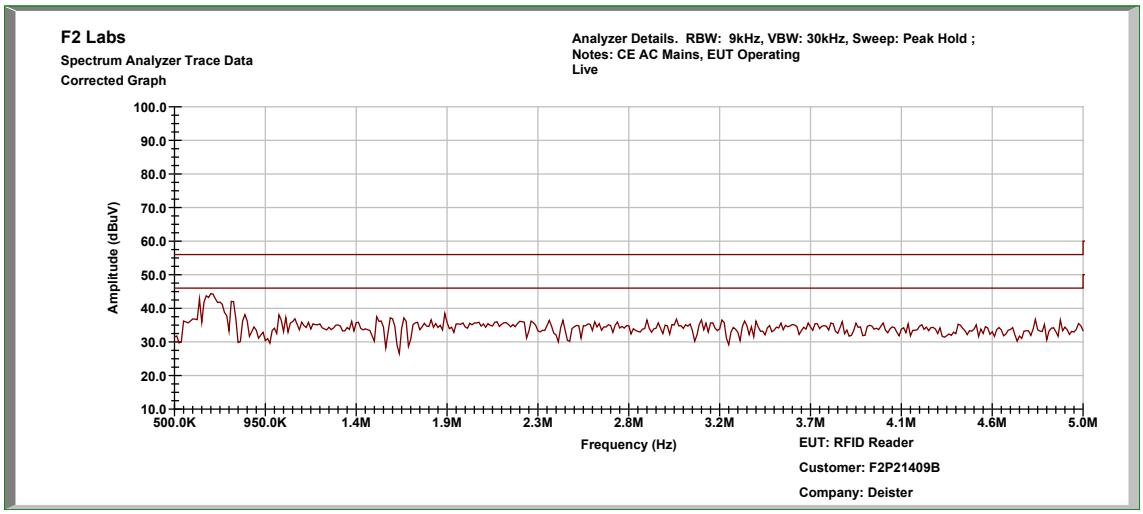
10.3 Conducted Emissions Test Data

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

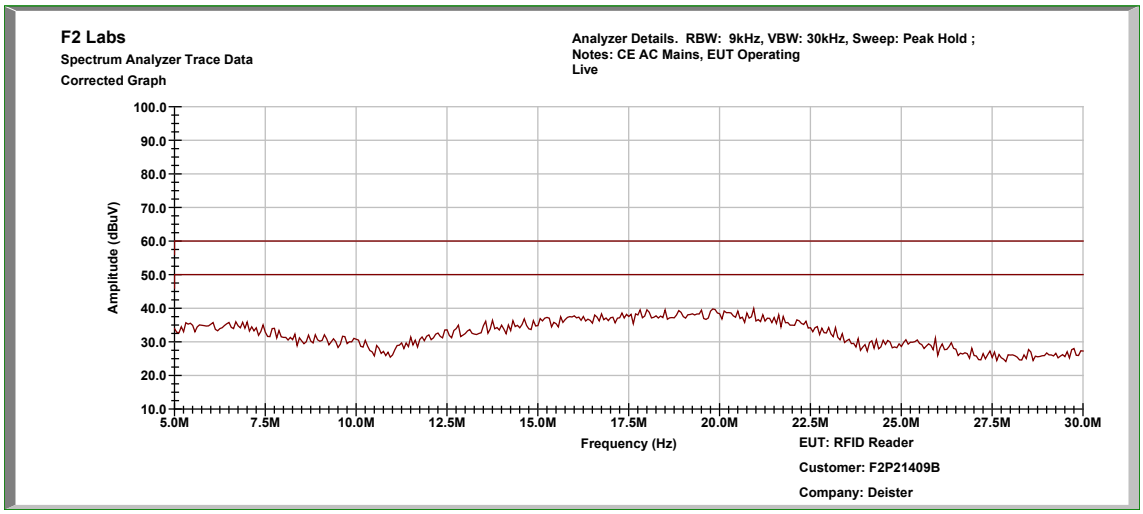
Conducted Test – Line 1: 0.15 MHz to 0.5 MHz



Conducted Test – Line 1: 0.5 MHz to 5.0 MHz

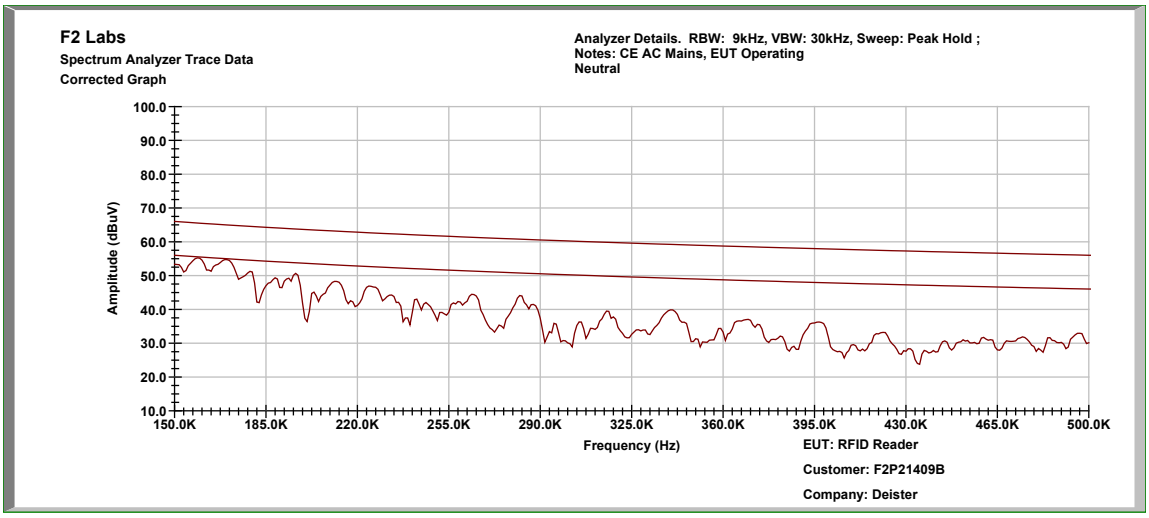


Conducted Test – Line 1: 5.0 MHz to 30.0 MHz

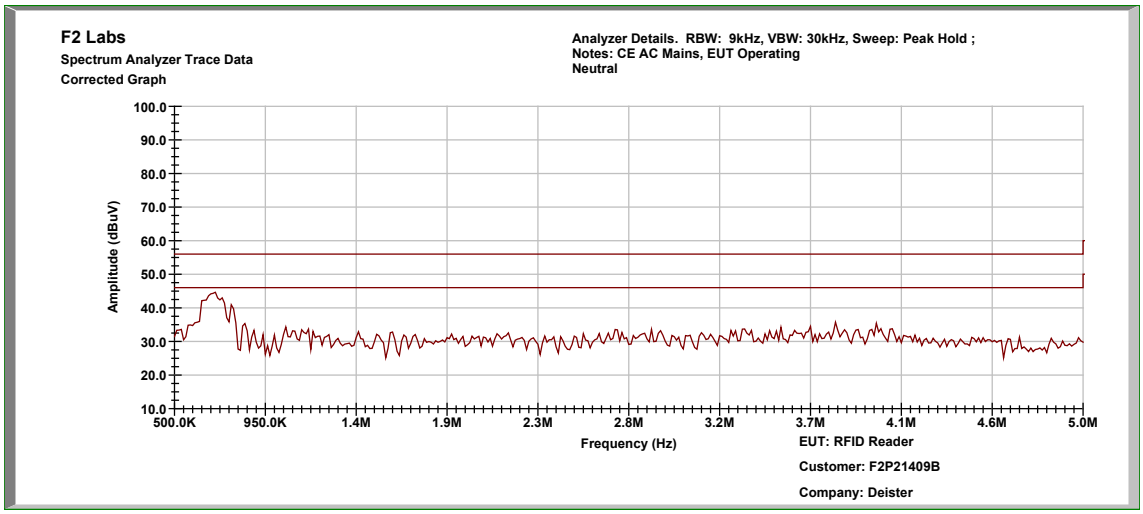


Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBµV)	Adjustment (dB)	Results (dBµV)	Limit (dBµV)	Margin (dB)
1	Live	0.152	Quasi-Peak	39.78	11.544	51.32	65.857	-14.5
			Average	21.57	11.544	33.11	55.857	-22.7
2	Live	0.158	Quasi-Peak	37.79	11.484	49.27	65.530	-16.3
			Average	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

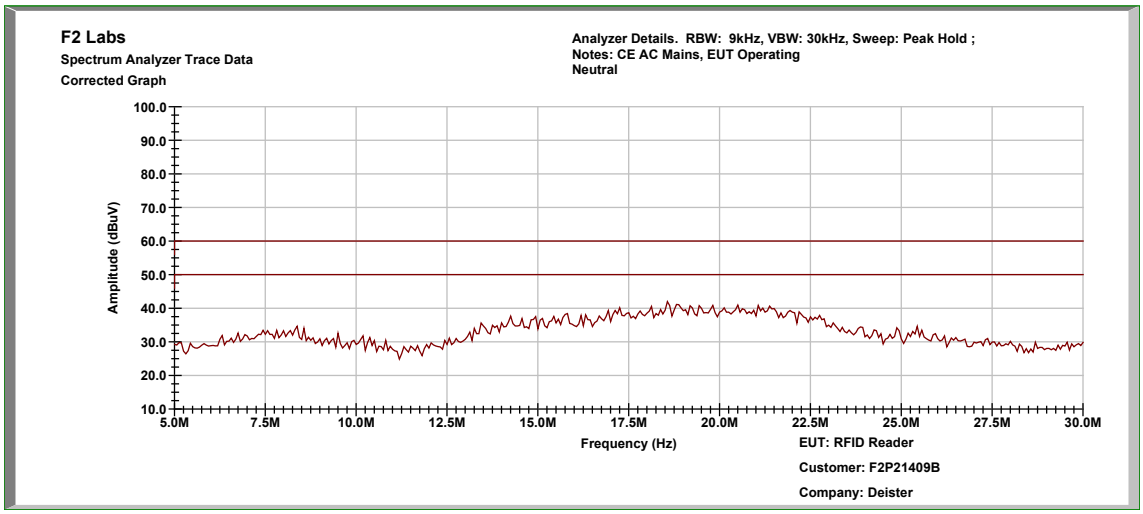
Conducted Test – Line 2: 0.15 MHz to 0.5 MHz



Conducted Test – Line 2: 0.5 MHz to 5.0 MHz



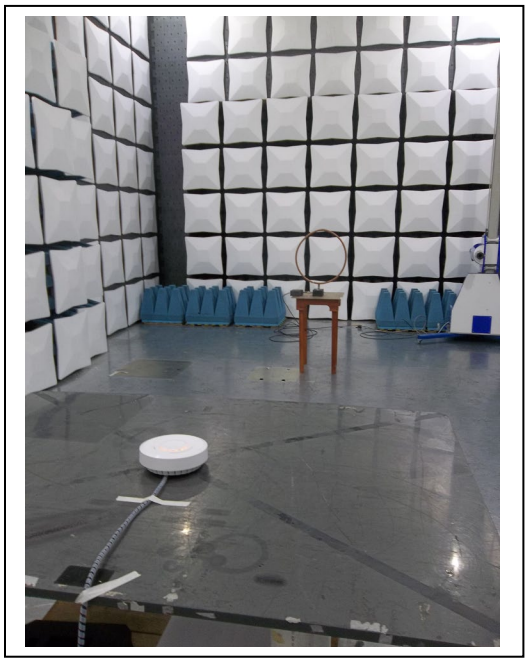
Conducted Test – Line 2: 5.0 MHz to 30.0 MHz



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

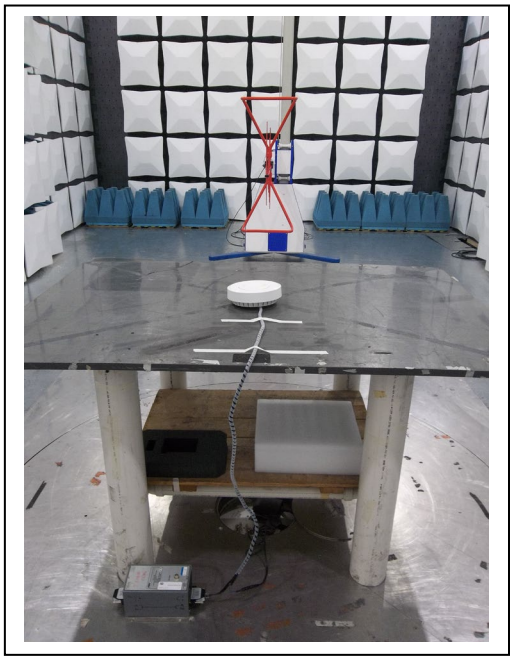
11 PHOTOGRAPHS

Occupied Bandwidth

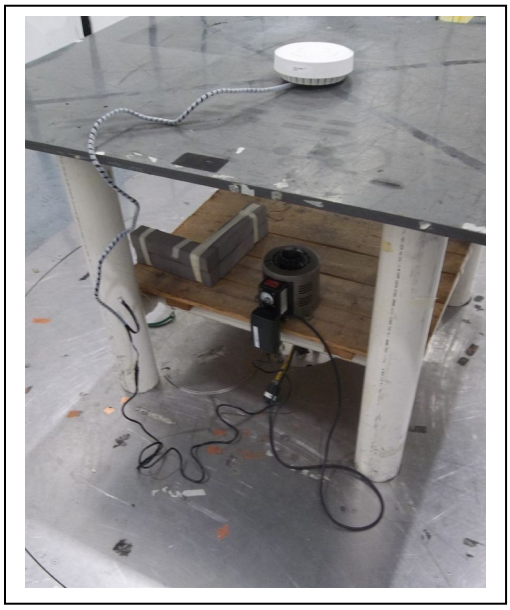


Radiated Spurious Emissions: Less than 30MHz

Radiated Spurious Emissions: 30 to 1000 MHz



Voltage Variations



Conducted Emissions