Manufacturer:	**Deister Electronic GMBH** **11 Hermann Bahlsen Str** **Barsinghausen 30890 GERMANY**
Applicant:	**Deister Electronics USA, Inc.** **8576 Wellington Road** **Manassas, Virginia 20109 USA**
Product Name:	**SWH6000PCB**
Product Description:	SWH6000PCB Access Control Reader Module
Operating Voltage/Frequency:	12-24VDC
Model(s):*	**SWH6000PCB, KPD3, PRD3**
FCC ID:	**IXLSWH6000PCB**
Testing Commenced:	2021-10-05
Testing Ended:	2023-05-05
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**

**Full testing conducted on model SWH6000PCB; limited testing on KPD3 as representative between it and PRD3.*

Evaluation Conducted by:

Julius Chiller, Senior Wireless Project Engineer

Report Reviewed by:

Ken Littell, Vice President of 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 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	2.54dB	5.07dB
Radiated Emissions <1 GHz @ 10m	2.55dB	5.09dB
Radiated Emissions 1 GHz to 2.7 GHz	1.81dB	3.62dB
Radiated Emissions 2.7 GHz to 18 GHz	1.55dB	3.10dB
AC Power Line Conducted Emissions, 150kHz to 30 MHz	1.38dB	2.76dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	1.66dB	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
F2P21386A-R2-01E	First Issue	2024-10-03	K. Littell

2 SUMMARY OF TEST RESULTS

SWH6000PCB*

Test Name	Standard(s)	Results
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
Variation of the Input Power	CFR 47 Part 15.31(e)	Complies
Conducted Emissions	CFR 47 Part 15.207(a)	Complies

**Denotes model with full testing.*

PRD3**

Test Name	Standard(s)	Results
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

***Denotes additional product family model tested as worst-case representative for models PRD3 and KPD3. The KPD3 has keypad entry along with the RFID. The PRD3 is just card entry with the RFID. Same of these models contain the same PCB.*

Modifications Made to the Equipment
None

3 TABLE OF MEASURED RESULTS

Test	13.56 MHz	125kHz
SWH6000PCB		
[1] Field Strength of Fundamental at 3m	11.2 µV/m (21 dBµV/m)	56,200 µV/m (55 dBµV/m)
[1] Field Strength of Fundamental corrected for 40dB/decade 30m distance correction	-28.8 µV/m (-19 dBµV/m)	----
[1] Field Strength of Fundamental corrected for 40dB/decade 300m distance correction	----	-25 dBµV/m
Limit for Fundamental at 30m	30 µV/m	----
Limit for Fundamental at 300m	---	19.2 µV/m
-20dB Occupied Bandwidth	516kHz	1.04kHz
99% Occupied Bandwidth	580kHz	1.9kHz
[2]Variation of Input Power to 7VDC	11.2 µV/m (21 dBµV/m)	55 dBµV/m
[2]Variation of Input Power to 24VDC	11.2 µV/m (21 dBµV/m)	55 dBµV/m
PRD3 / KPD3		
[1] Field Strength of Fundamental at 3m	34.3 dBµV/m	54.7dBµV/m
[1] Field Strength of Fundamental corrected for 40dB/decade 30m distance correction	11.9 µV/m (-5.7 dBµV/m)	----
[1] Field Strength of Fundamental corrected for 40dB/decade 300m distance correction	----	54,300 µV/m (-25.3 dBµV/m)
Limit for Fundamental at 30m	30 µV/m	----
Limit for Fundamental at 300m	----	19.3 µV/m
-20dB Occupied Bandwidth	226kHz	0.80 kHz
99% Occupied Bandwidth	343kHz	12.9kHz

[1] 13.56 MHz Field Strength was measured at 3m. The dBµA/m was converted to dBµV/m by adding 51.5dB.

[2] This DC device is rated to operate at 12VDC and not to exceed 24VDC. The low voltage testing was done at 7VDC below which the unit ceased to function. Readings were recorded at 1m distance.

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 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: **Access Control Reader Module**
Model(s): **SWH6000PCB, KPD3, PRD3**
Serial No(s).: SWH6000PCB: 3246400133 (13.56); 3246400134 (125kHz)
PRD3: 3246401286 (125kHz); 3246401287 (13.56 MHz)
Firmware/Software Version(s): F27
FCC ID: **IXLSWH6000PCB**

5.2 Trade Name:

Deister Electronics USA, Inc.

5.3 Power Supply:

7-24VDC from external power supply

5.4 Applicable Rules:

CFR 47, Part 15.209

5.5 Antenna:

Inductor Antenna

5.6 Accessories:

Testing Conducted on SWH6000PCB - DC Supply: BK Precision 1685B, s/n 7611-3204-1010

Testing Conducted on PRD3 - DC Supply: BK Precision 1685B, s/n 346F17303*
**Indicates F2 Labs-supplied equipment*

5.7 Test Item Condition:

The equipment to be tested was received in good condition.

5.8 Testing Algorithm:

EUT was configured to transmit in continuous mode on 125kHz and 13.56 MHz.

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	2023-11-30
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2024-04-10
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	2022-09-14
Amplifier w/18" Loop Antenna	CL163-Loop	AH Systems, Inc.	EHA-52B	100	2023-10-23
Low Loss Cable Set	--	Pasternack	PE3C0666-252 / PE3C066-50CM	None Spec.	2023-10-12
Pre-Amplifier	CL153	Agilent	83006-69007	MY39500791	2022-04-01
Pre-Amplifier	CL285	A.H. Systems	PAM-0207	322	2023-03-30
Software:	Tile Version 3.4.B.3		Software Verified: 2021-10-05; 2022-01-17; 2022-02-21; 2022-04-28; 2023-05-05		
Software:	EMC 32, Version 8.53.0		Software Verified: 2021-10-05; 2022-01-17; 2022-02-21; 2022-04-28; 2023-05-05		
Spectrum Analyzer	0204	Hewlett Packard	HP8591A	3149A02546	2024-04-11
Software:	EMC Analyzer 85712D Rev. A.00.01			Date Verified:	2023-04-21
Transient Limiter	0202	Hewlett Packard	11947A	3107A00729	2024-04-11
Software:	Tile Version 3.4.B.3.		Software Verified: 2023-04-21		
LISN	CL181	Com-Power	LI-125A	191226	2023-12-01
LISN	CL182	Com-Power	LI-125A	191225	2023-12-01
Temp/Hum. Recorder	CL232	Extech	445814	01	2023-05-19
Temp/Hum. Recorder	CL261	Extech	445814	04	2022-03-19
Temp/Hum. Recorder	CL293	Thermpro	TP50	1	2023-04-15
Temp/Hum. Recorder	CL294	ThermPro	TP50	02	2023-04-15

7 OCCUPIED BANDWIDTH

7.1 Requirements:

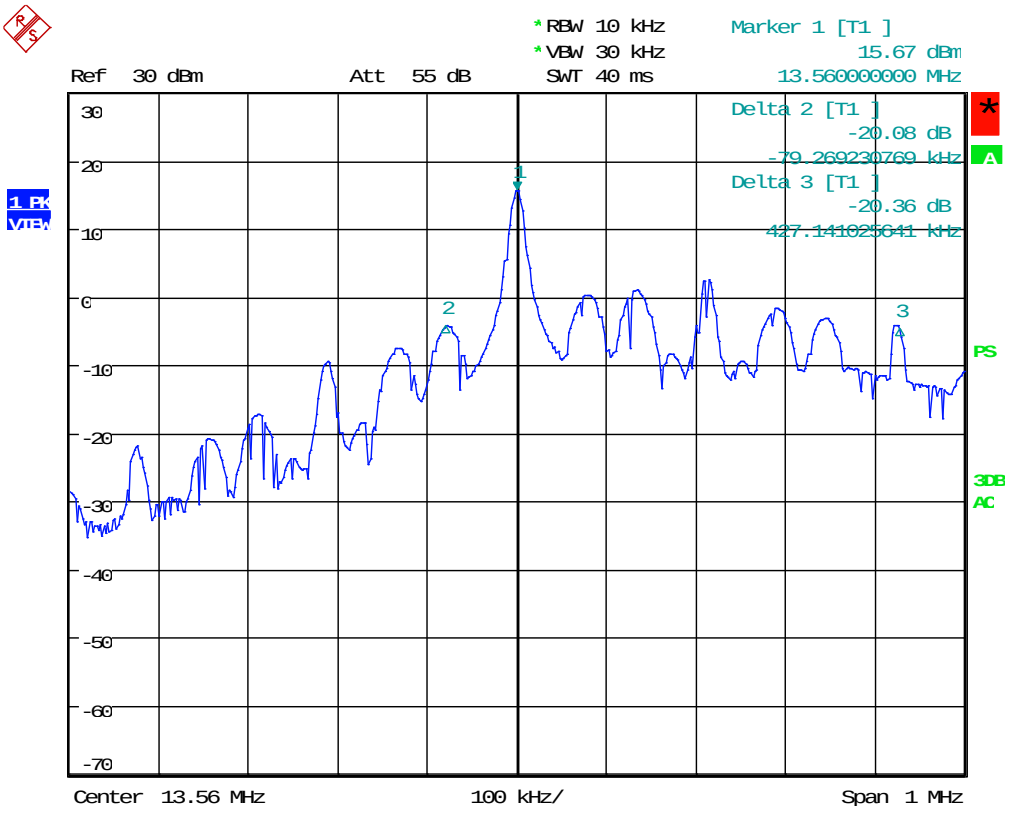
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific 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 13.56 MHz frequency. The 20dB bandwidth was measured using the Marker Delta method. The 99% bandwidth was measured using the analyzer's OBW measurement function.

7.2 Test Data - Occupied Bandwidth

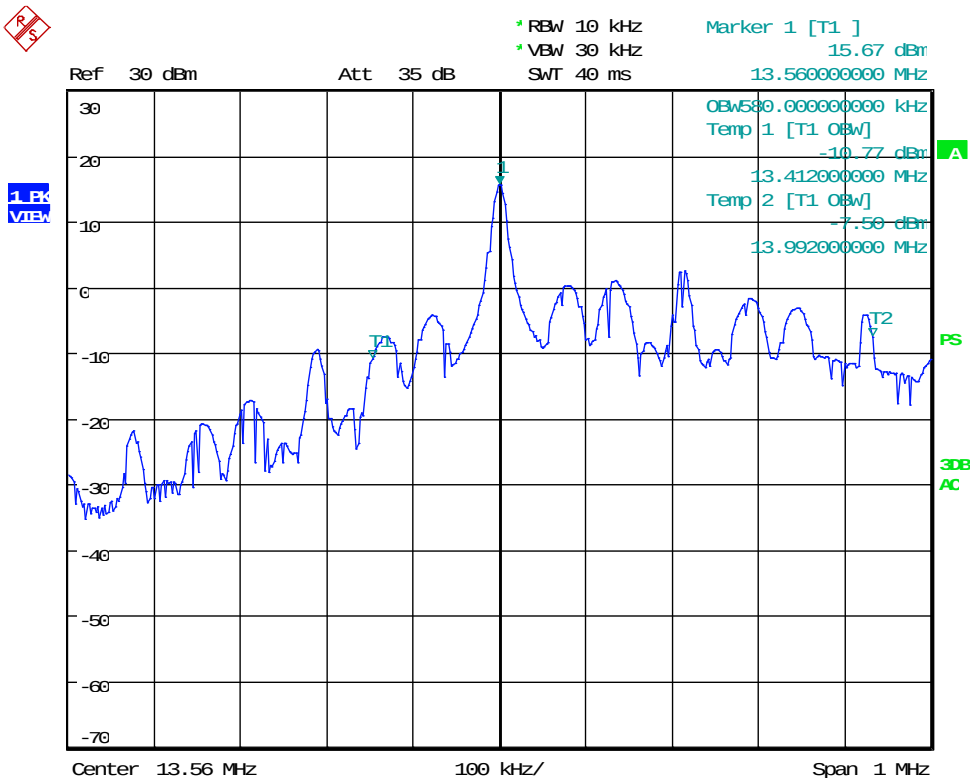
Test Date(s):	2023-04-21; 2023-05-23	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	22.6ºC
		Relative Humidity:	41%

SWH6000PCB, -20dB: 13.56 MHz



Date: 21.APR.2023 14:29:50

SWH6000PCB, 99%: 13.56 MHz



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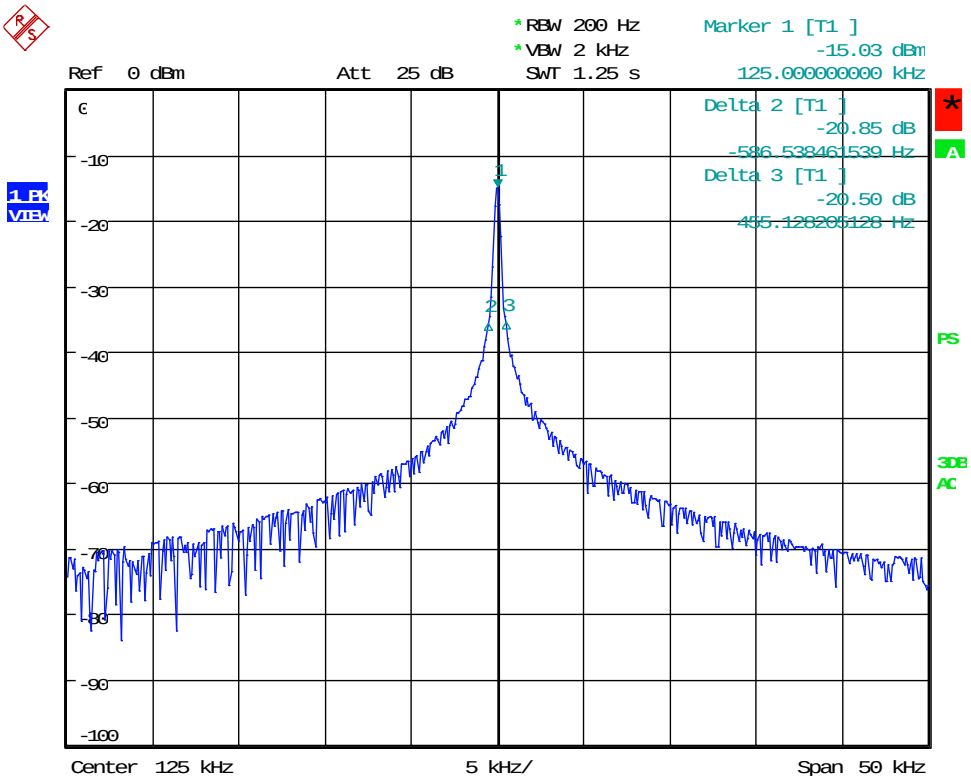
SWH6000PCB, -20dB: 125 kHz



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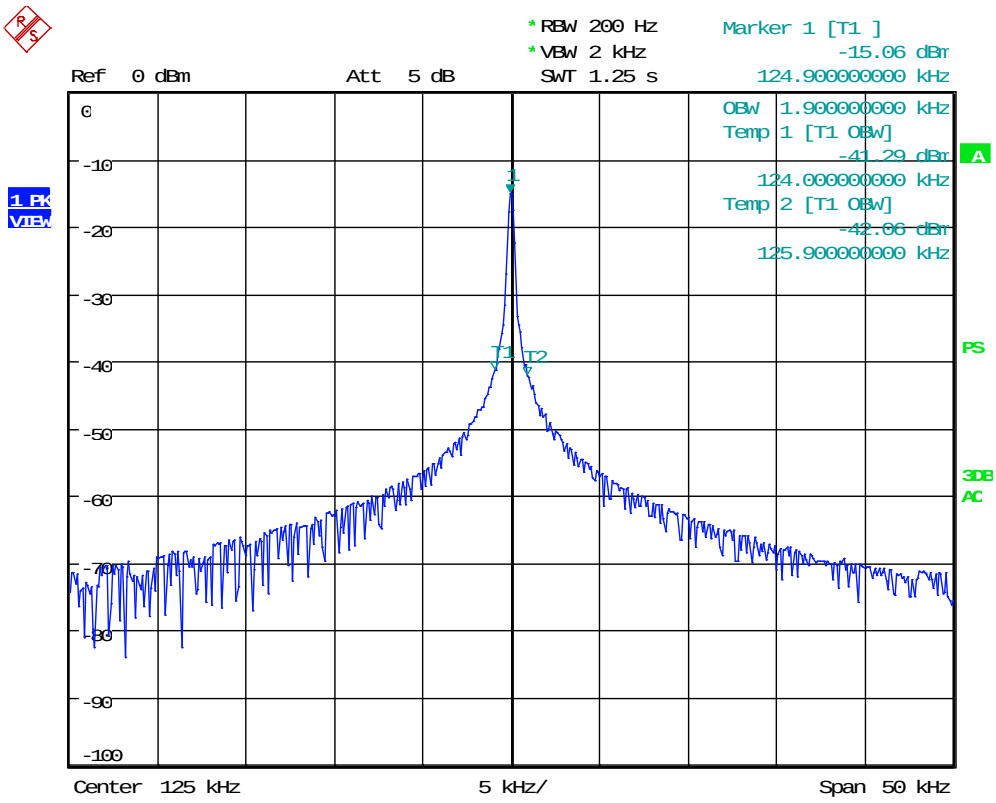
SWH6000PCB, 99%: 125 kHz



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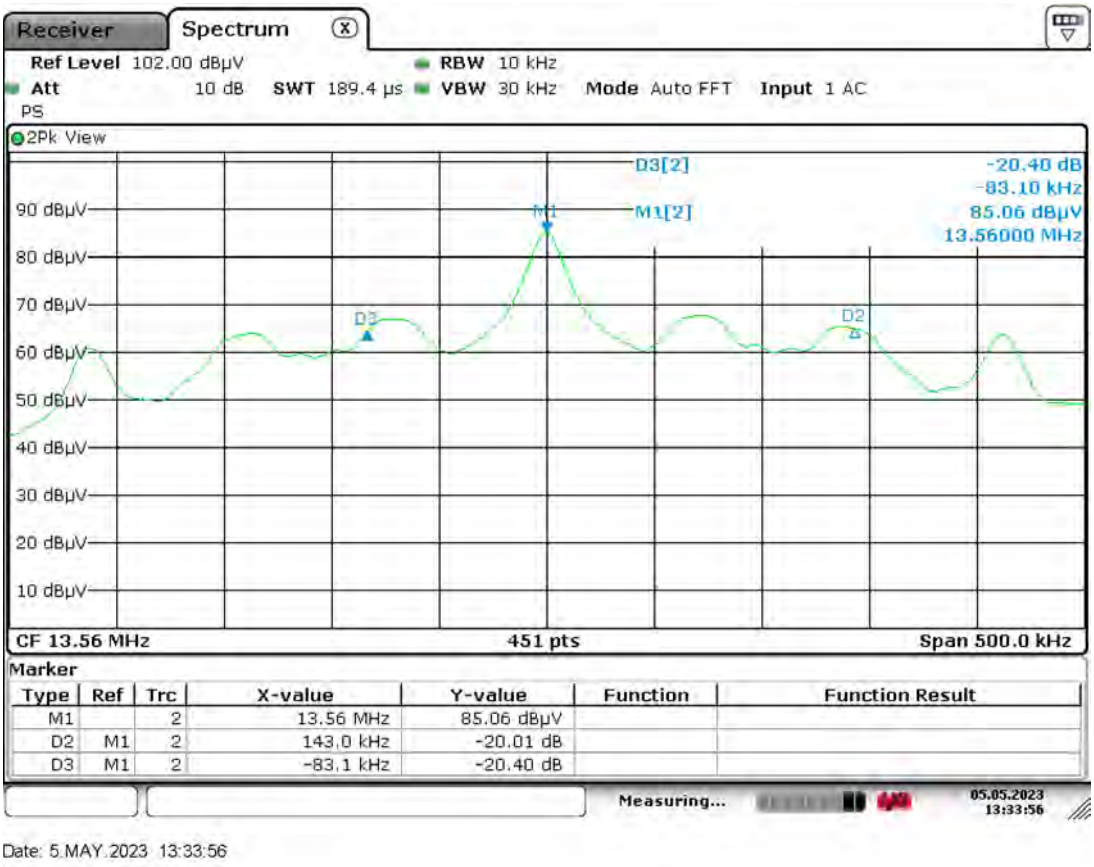
PRD3 / KPD3, -20dB: 13.56 MHz



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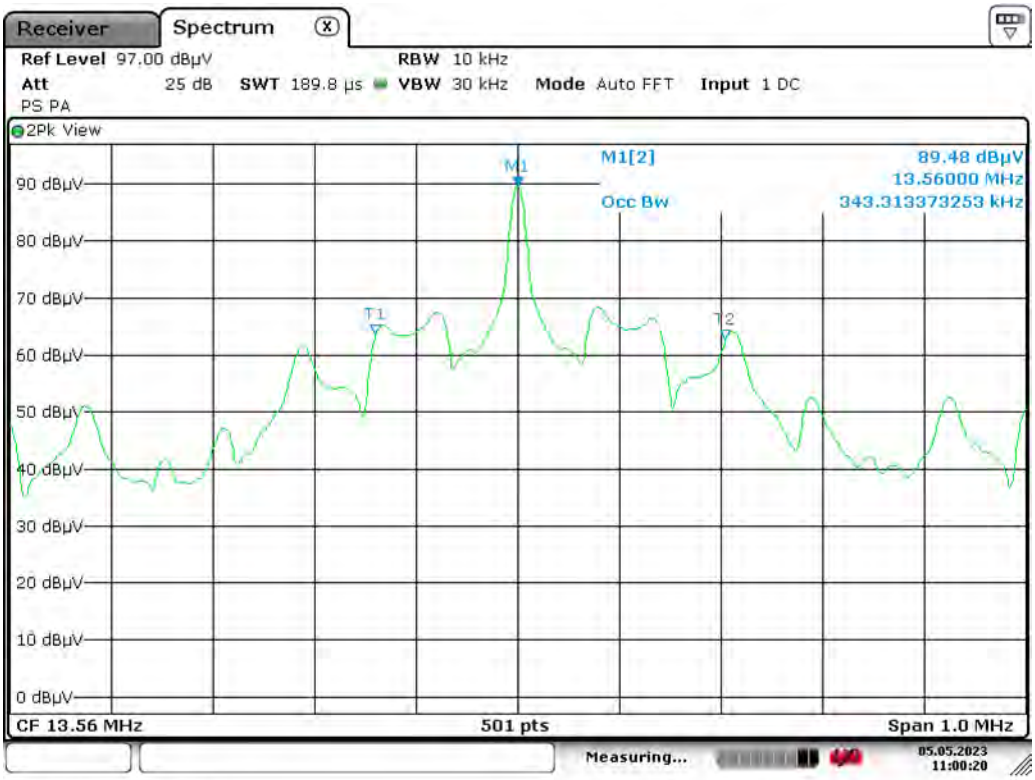
PRD3 / KPD3, 99%: 13.56 MHz



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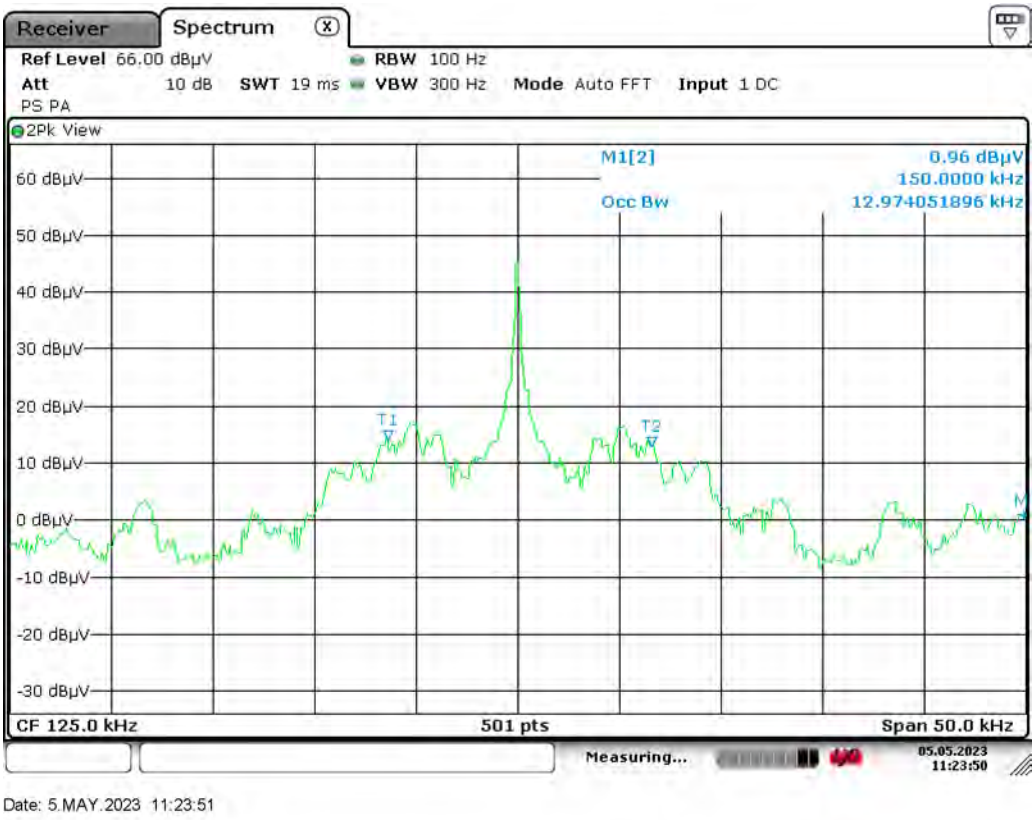
PRD3 / KPD3, -20dB: 125 kHz

PRD3 / KPD3, 99%: 125 kHz



8 FIELD STRENGTH OF EMISSIONS/RADIATED SPURIOUS EMISSONS

At least 6 of the highest frequencies were measured per ANSI 63.4 in a 3-meter anechoic chamber. Frequencies below 1 GHz 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.

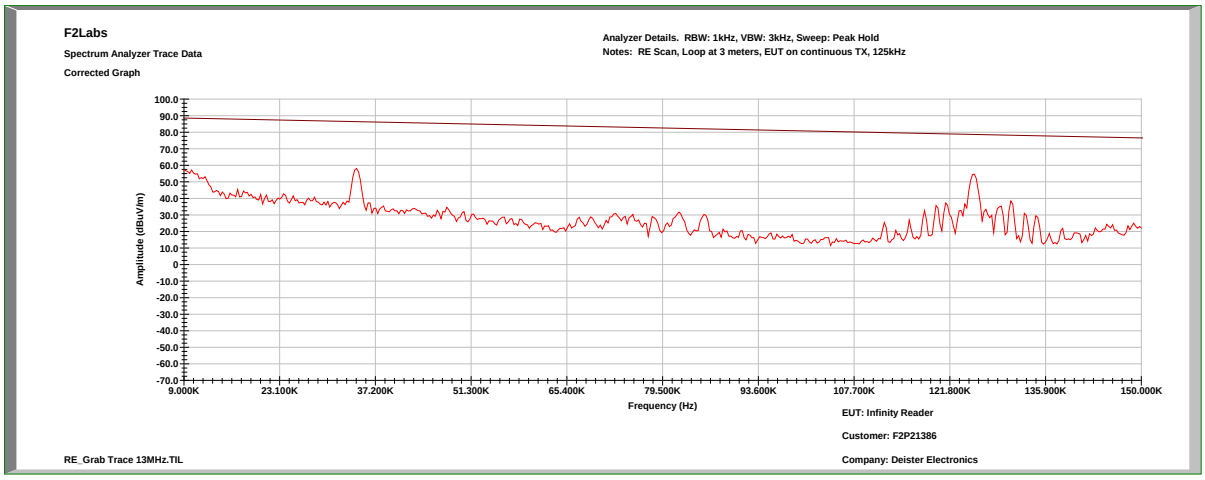
Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions and three orthogonal positions to find the maximum emissions. The orthogonal position that showed the highest 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.

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 the tables that follow.

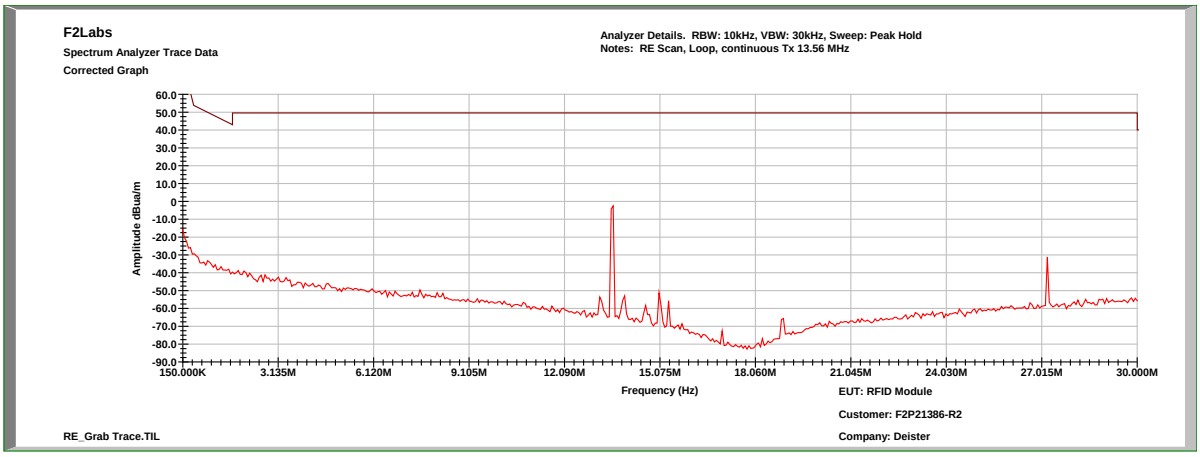
The emissions on the PRD3 and KPD3 showed no difference. If one had to be chosen as worst-case, it was the PRD3 and therefore the following results are of the worst-case between the PRD3 and KPD3 enclosures.

Test Date(s):	2021-10-05; 2022-01-17; 2022-02-21; 2023-05-05	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.209	**Air Temperature:**	23.2ºC
		Relative Humidity:	35%
Results:	Complies		

SWH6000PCB, 125kHz: Characterization Scan, 0.009 MHz to 0.15 MHz (Loop Antenna)

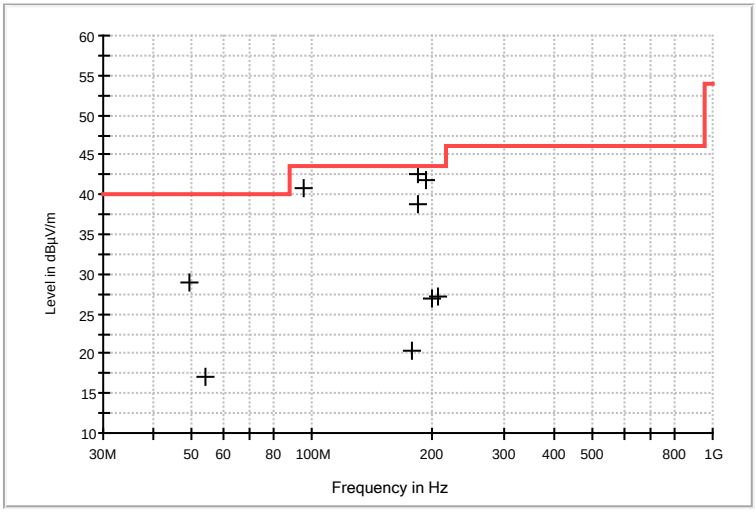


SWH6000PCB, 13.56 MHz: Characterization Scan, 0.15 MHz to 30 MHz (Loop Antenna)

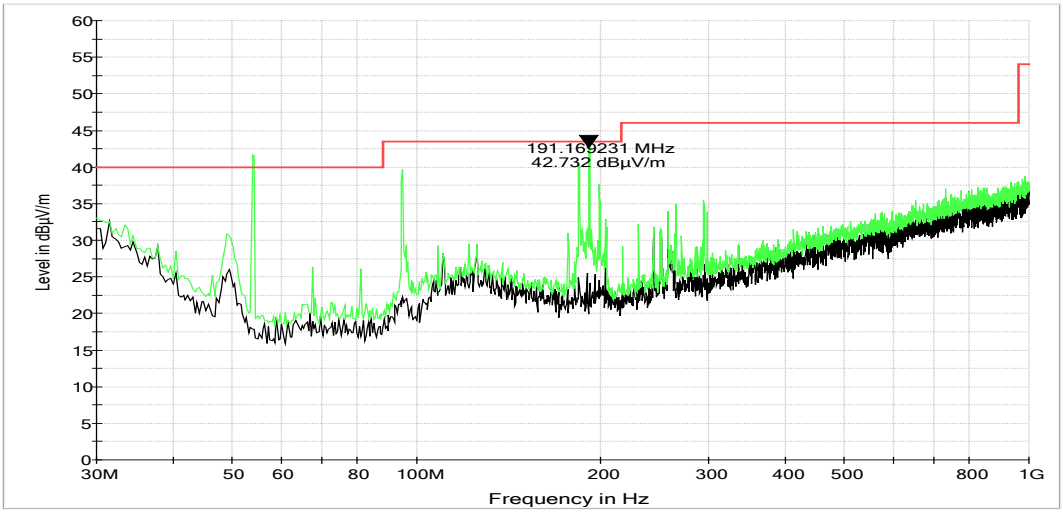


SWH6000PCB, Measurements, 30 MHz to 1000 MHz

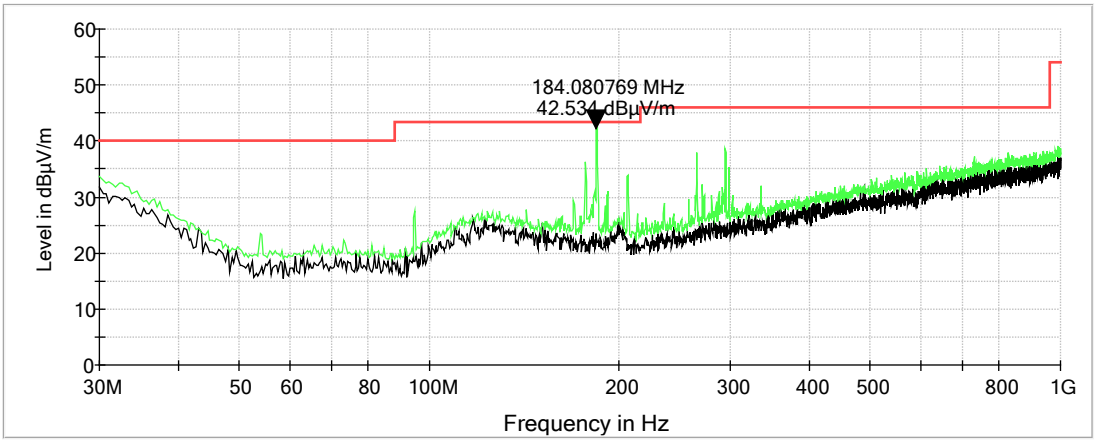
Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Azimuth (degrees)	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
49.400000	V	100.00	241.00	39.7	-10.7	29.00	40.0	-11.0
53.880000	V	100.00	6.00	28.8	-11.7	17.10	40.0	-22.9
94.920000	V	100.00	257.00	51.2	-10.3	40.90	43.5	-2.6
177.000000	H	100.00	0.00	27.4	-7.0	20.40	43.5	-23.1
184.080000	H	100.00	343.00	45.8	-6.9	38.90	43.5	-4.6
184.080000	V	100.00	222.00	49.4	-6.9	42.50	43.5	-1.0
191.920000	V	100.00	116.00	48.3	-6.4	41.90	43.5	-1.6



SWH6000PCB, Characterization Scan, 30 MHz to 1000 MHz, Vertical



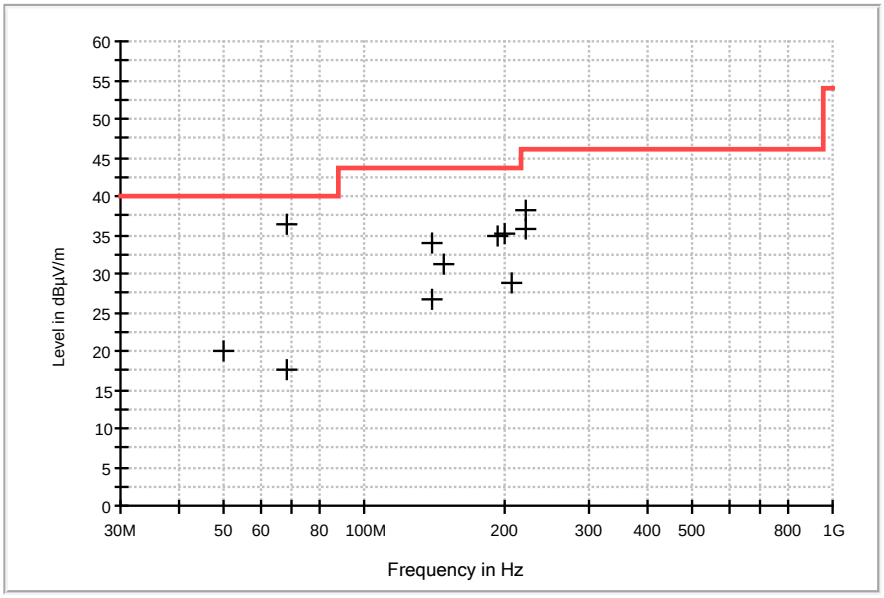
SWH6000PCB, Characterization Scan, 30 MHz to 1000 MHz, Horizontal



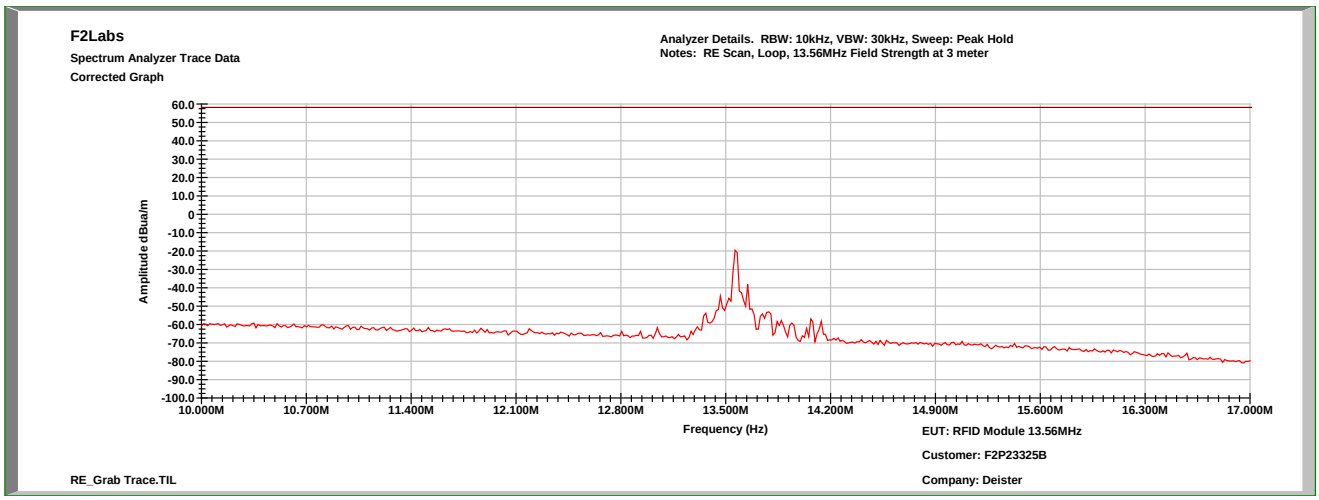
Test Date(s):	2022-04-28	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.209	**Air Temperature:**	21.1ºC
		Relative Humidity:	33%
Results:	Complies		

PRD3: 30 MHz to 1000 MHz

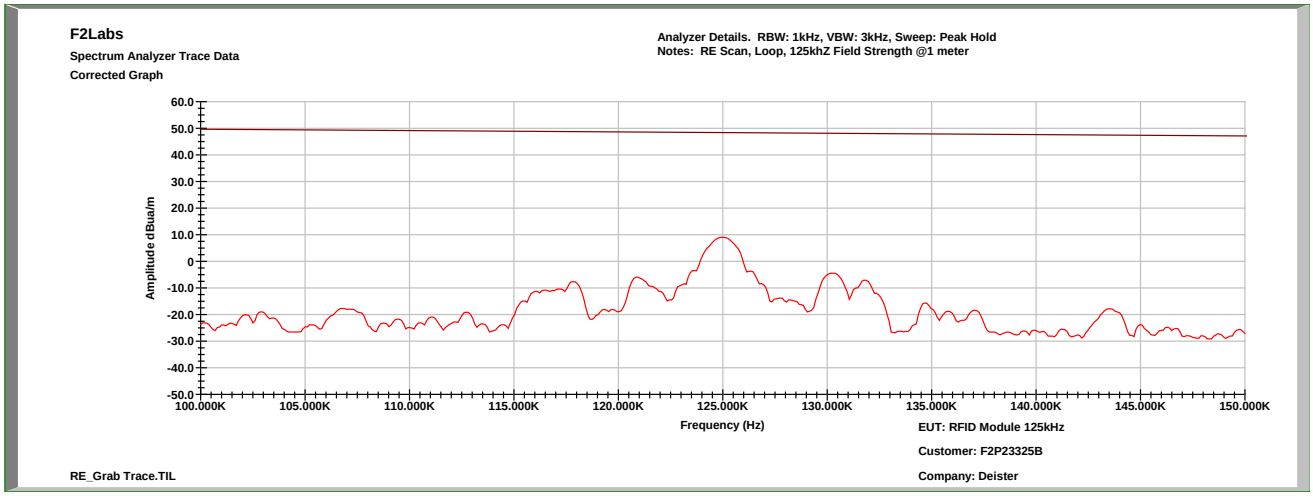
Frequency (MHz)	Antenna Polarization	Azimuth (degrees)	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
49.600000	V	224.00	34.1	-14.1	20.00	40.0	-20.0
67.840000	H	300.00	32.1	-14.6	17.50	40.0	-22.5
67.840000	V	0.00	50.9	-14.6	36.30	40.0	-3.7
139.800000	H	23.00	35.6	-8.8	26.80	43.5	-16.7
139.800000	V	0.00	42.9	-8.8	34.10	43.5	-9.4
147.560000	V	233.00	40.4	-9.3	31.10	43.5	-12.4
191.400000	V	0.00	44.8	-10.0	34.80	43.5	-8.7
198.800000	V	179.00	44.0	-8.7	35.30	43.5	-8.2
206.720000	H	131.00	39.2	-10.5	28.70	43.5	-14.8
220.880000	V	84.00	48.3	-10.3	38.00	46.0	-8.0
221.520000	H	141.00	46.1	-10.3	35.80	46.0	-10.2



PRD3: 13.56 MHz (Loop Antenna)

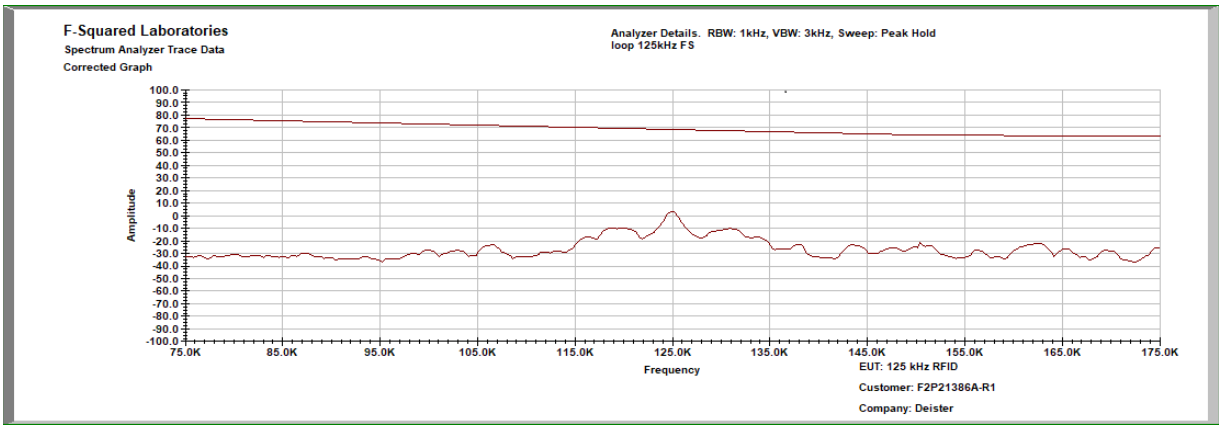


PRD3: 125 kHz (Loop Antenna)

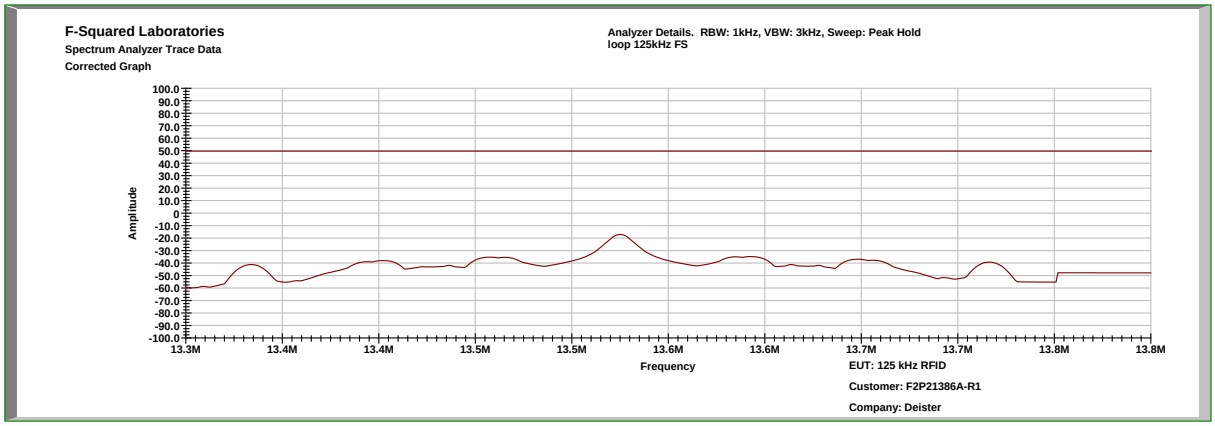


Test Date(s):	2023-05-05	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.209	Air Temperature:	21.2ºC
Results:	Complies	Relative Humidity:	33%

PRD3 / KPD3, 125kHz: Characterization Scan, 0.009 MHz to 0.15 MHz (Loop Antenna)



PRD3 / KPD3, 13.56 MHz: Characterization Scan, 0.15 MHz to 30 MHz (Loop Antenna)



9 VARIATION OF THE INPUT POWER, 15.31(e)

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.

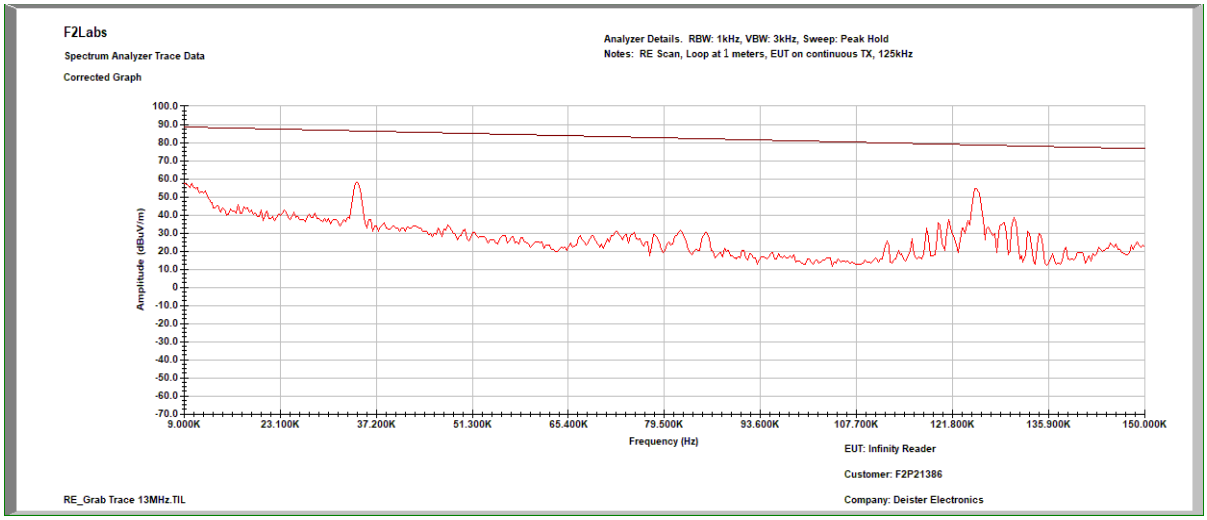
This DC device is rated to operate at 12VDC and not to exceed 24VDC. The low voltage testing was done at 7VDC below which the unit ceased to function.

9.2 Test Data – Variation of the Input Power

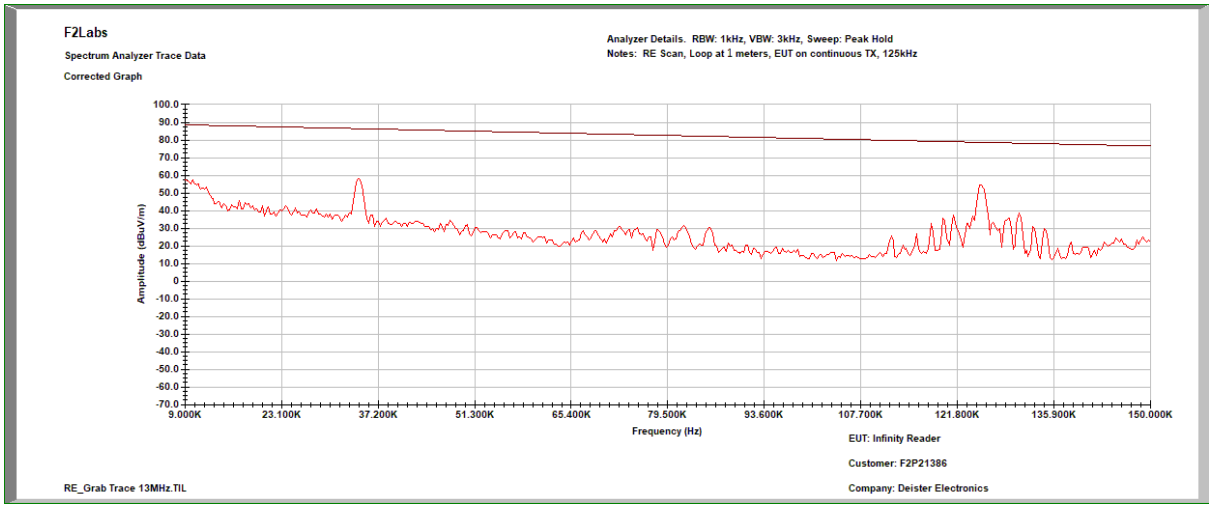
Test Date(s):	Verified 2023-05-03	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.31(e)	**Air Temperature:**	23.2ºC
		Relative Humidity:	35%
Results:	Complies*		

**The results showed that the fundamental frequency did not move outside the frequency band and the field strength did not increase above the limit during the variations.*

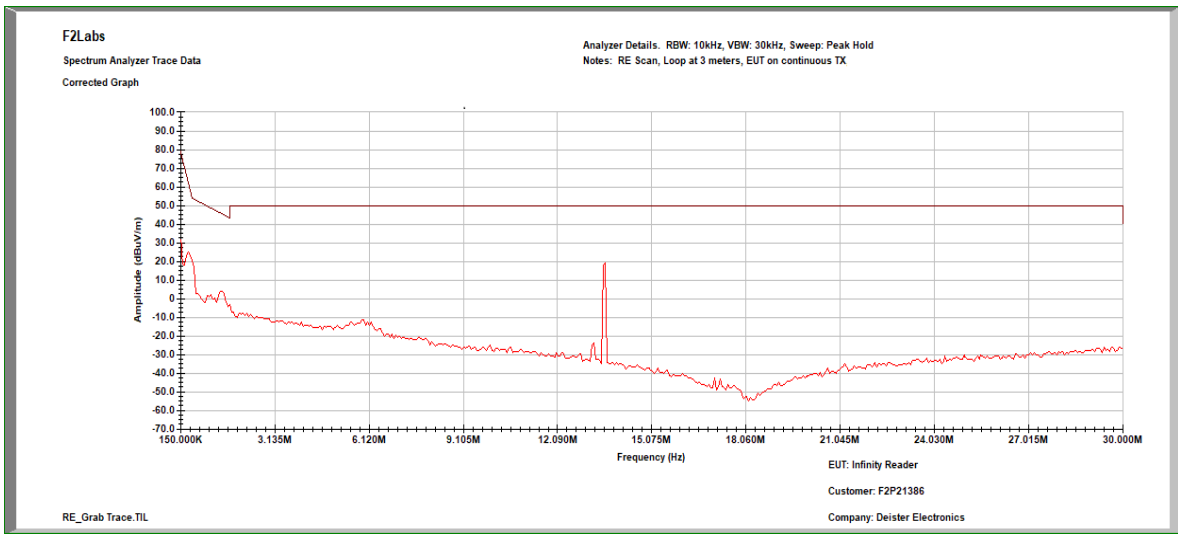
SWH6000PCB, 125kHz: Characterization Scan, 7VDC



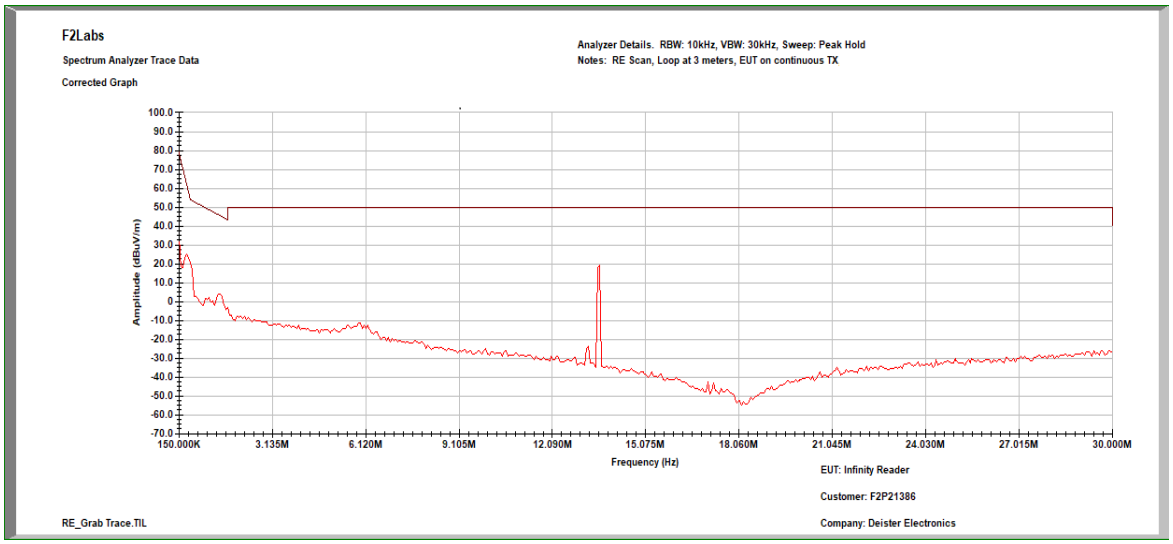
SWH6000PCB, 125kHz: Characterization Scan, 24VDC



SWH6000PCB, 13.56 MHz: Characterization Scan, 7VDC



SWH6000PCB, 13.56 MHz: Characterization Scan, 24VDC



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.

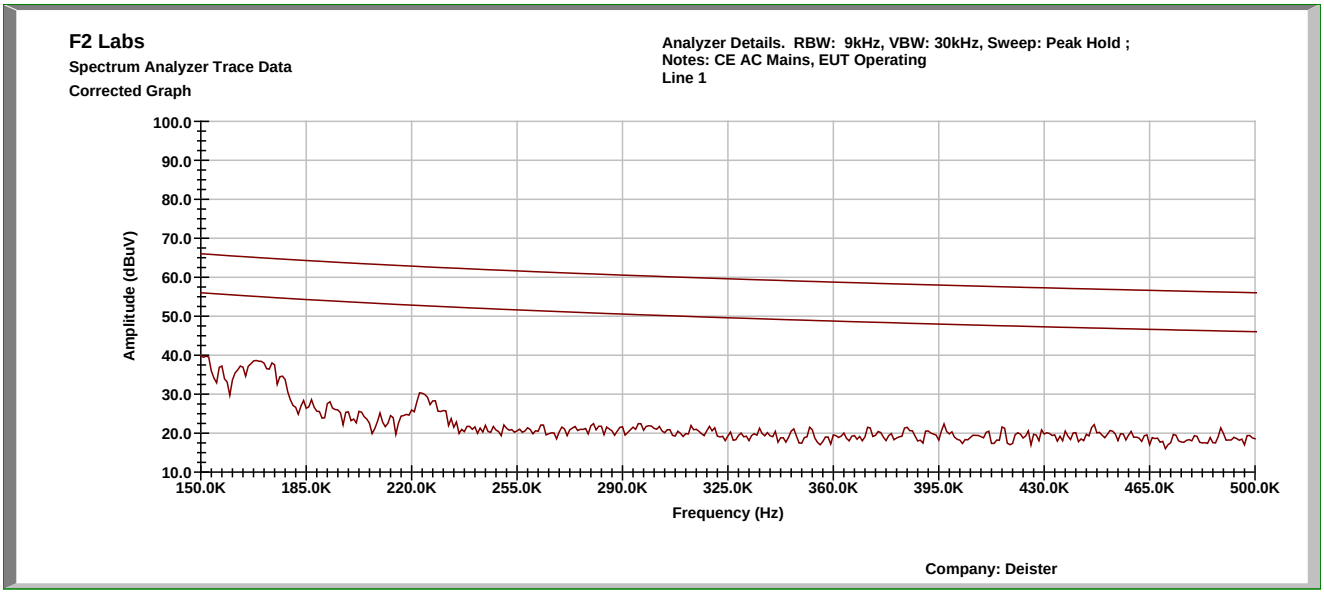
10.2 Procedure

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.

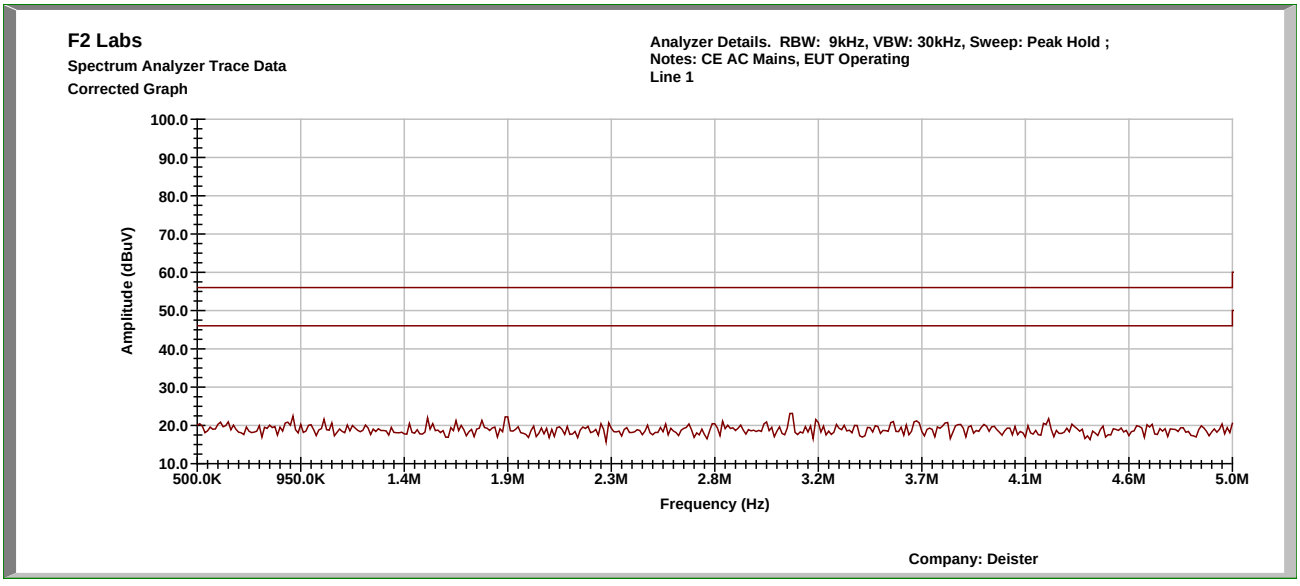
10.3 Conducted Emissions Test Data

Test Date:	2023-04-21	**Test Engineer:**	J. Chiller
Rule:	15.207	**Air Temperature:**	22.6º C
Test Results:	Complies	**Relative Humidity:**	41%

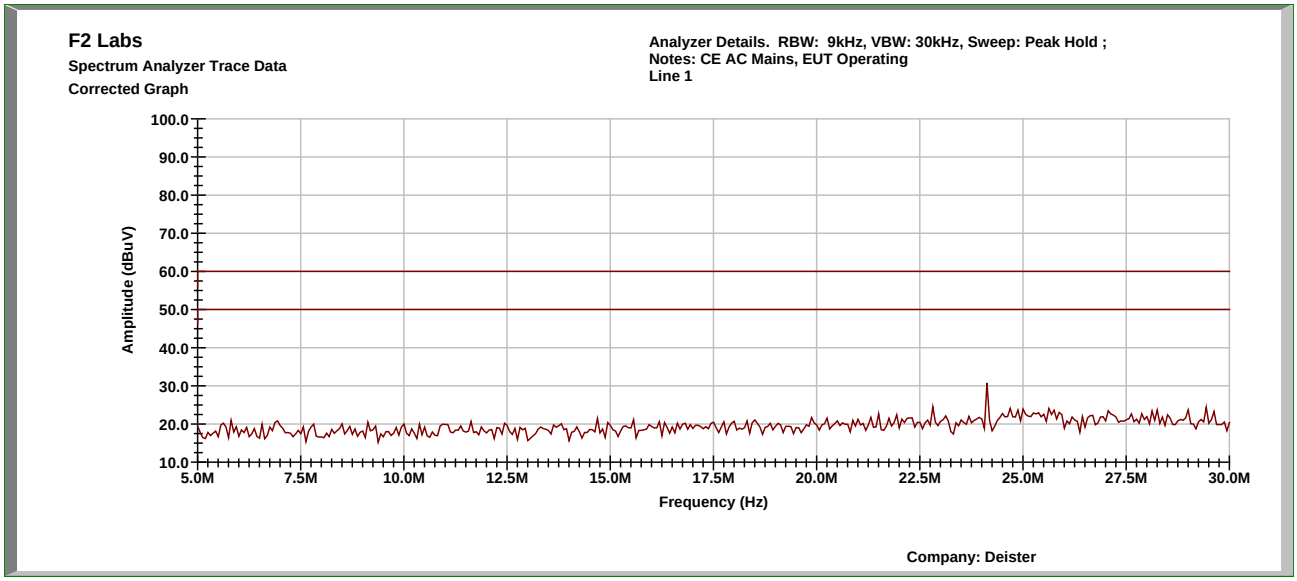
SWH6000PCB, Conducted Test – Live: 0.15 MHz to 0.5 MHz



SWH6000PCB, Conducted Test – Live: 0.5 MHz to 5.0 MHz

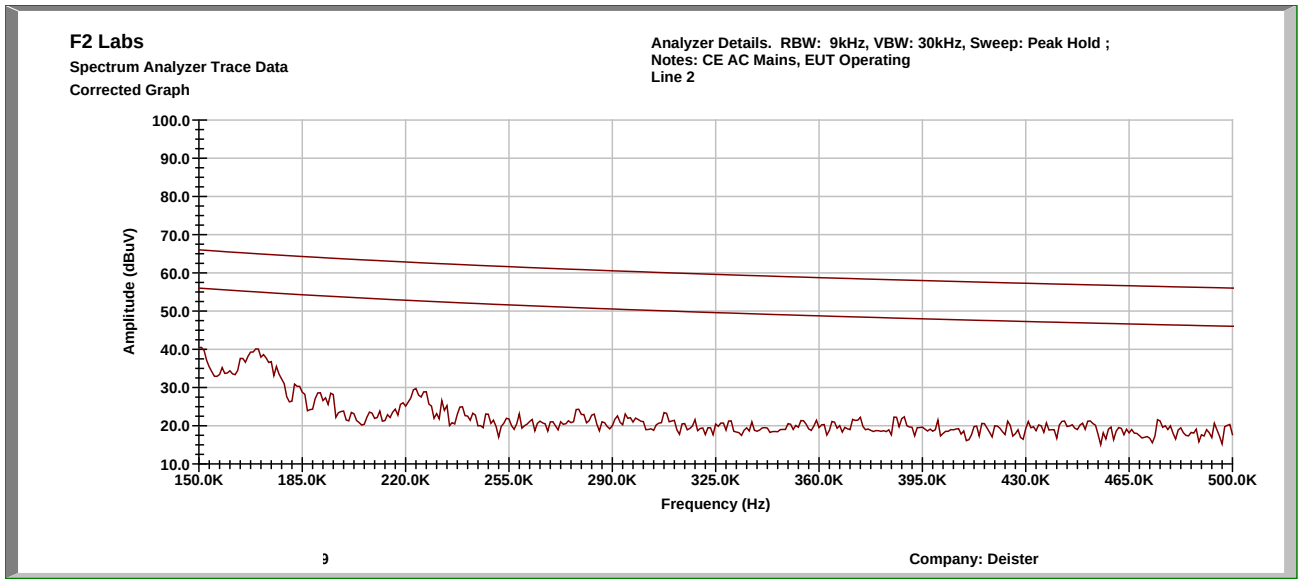


SWH6000PCB, Conducted Test – Live: 5.0 MHz to 30.0 MHz

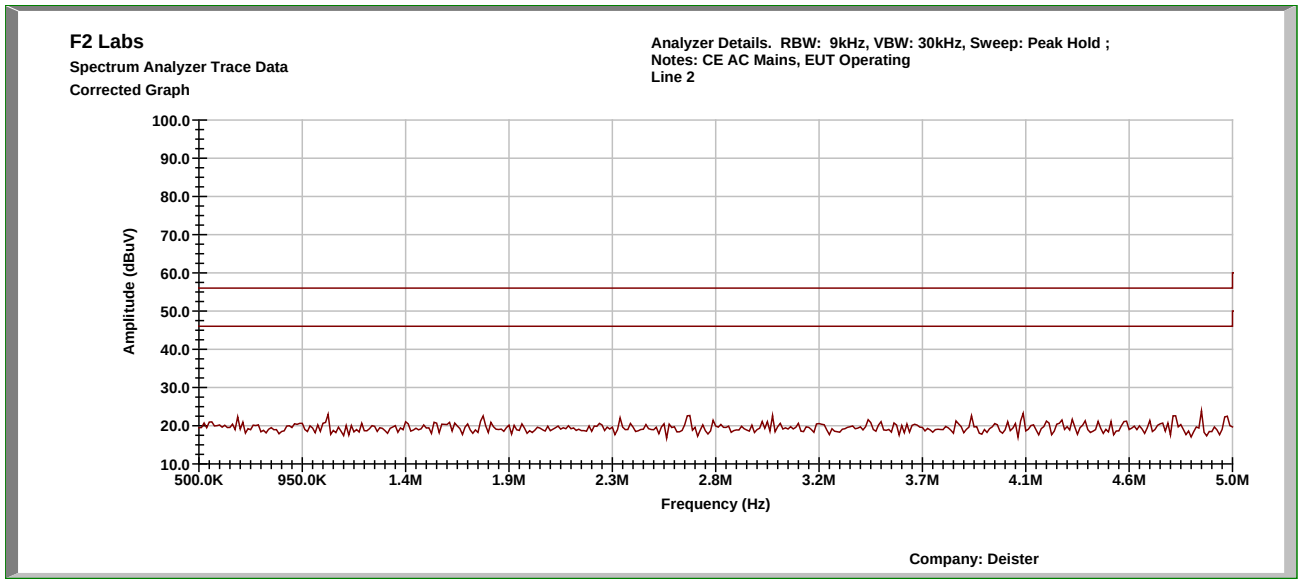


Note: Peak scans below AVG limit.

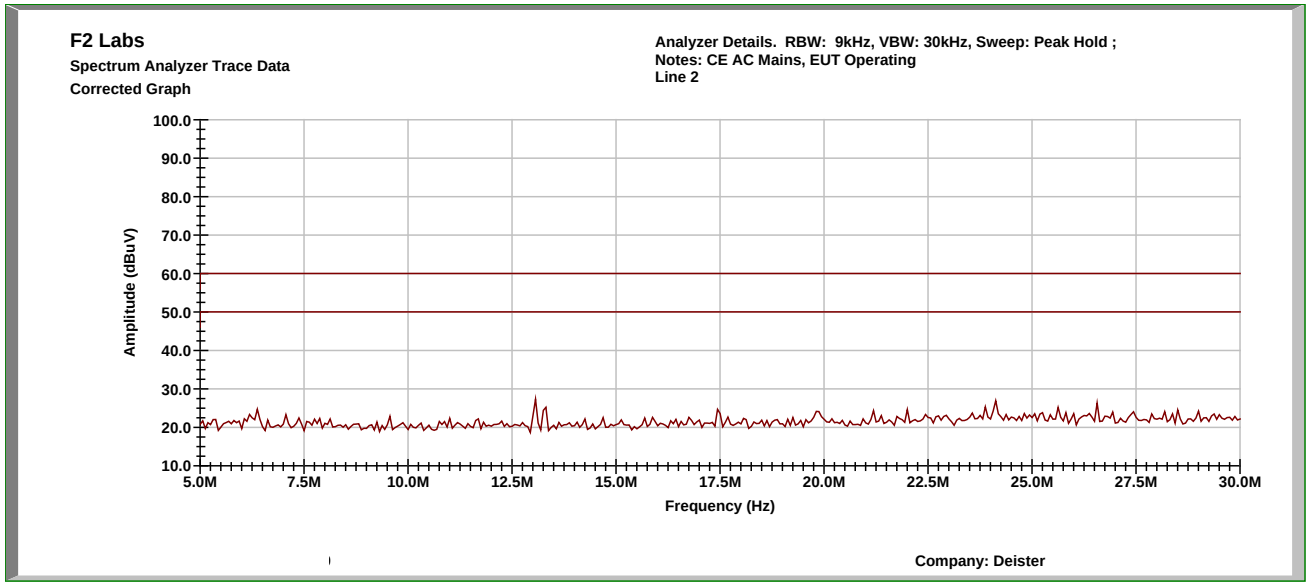
SWH6000PCB, Conducted Test – Neutral: 0.15 MHz to 0.5 MHz



SWH6000PCB, Conducted Test – Neutral: 0.5 MHz to 5.0 MHz



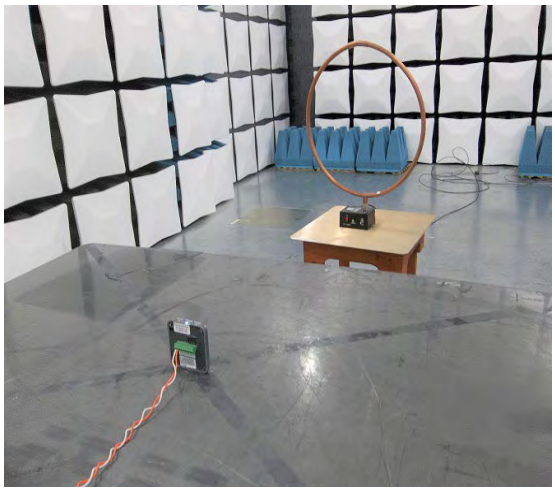
SWH6000PCB, Conducted Test – Neutral: 5.0 MHz to 30.0 MHz



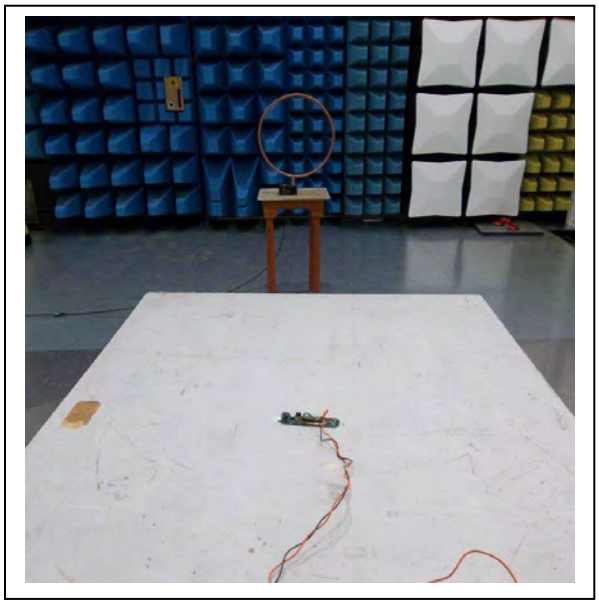
Note: Peak scans below AVG limit.

11 TEST SETUP PHOTOGRAPH(S)

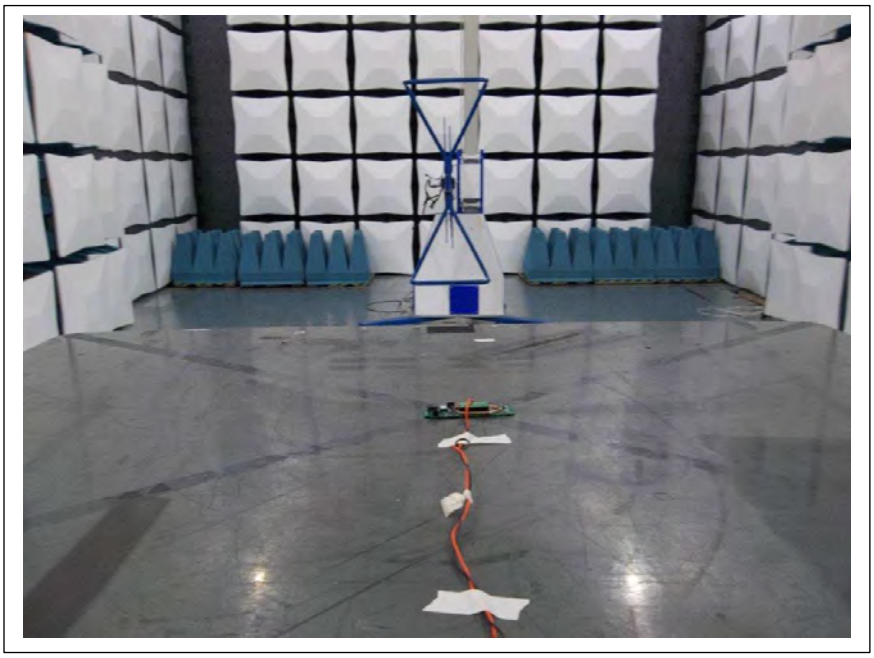
SWH6000PCB, Occupied Bandwidth



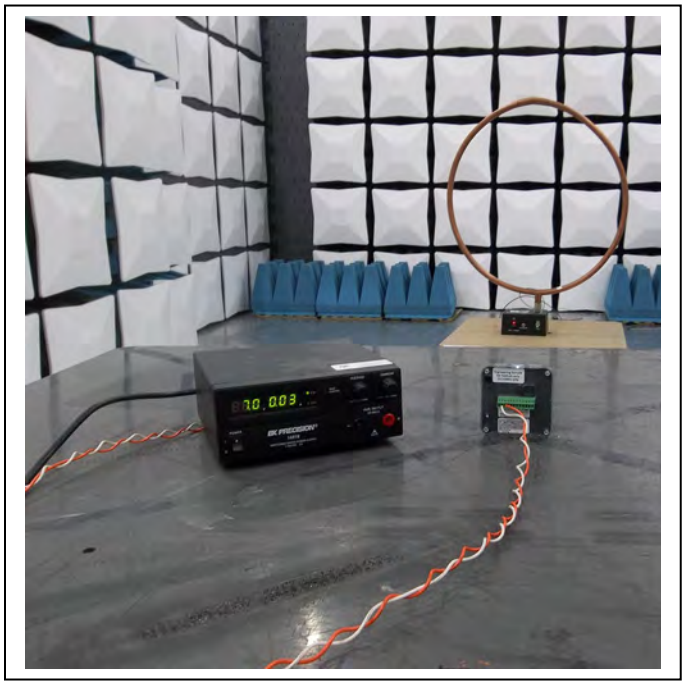
SWH6000PCB, Radiated Spurious Emissions: Less than 30 MHz



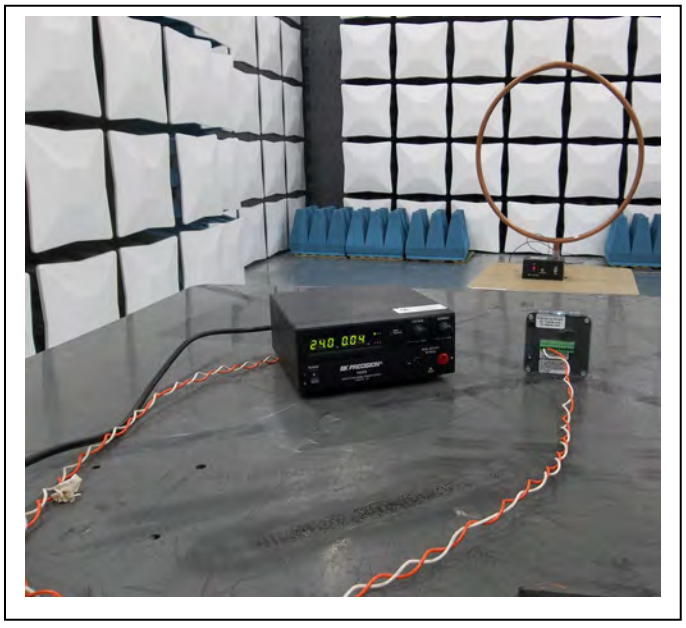
SWH6000PCB, Radiated Spurious Emissions: 30 MHz to 1000 MHz



SWH6000PCB, Voltage Variations, Low



SWH6000PCB, Voltage Variations, High



SWH6000PCB, Conducted Emissions

PRD3, Radiated Spurious Emissions: Less than 30 MHz

PRD3, Radiated Spurious Emissions: 30 MHz to 1000 MHz