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CERTIFICATION TEST REPORT

Manufacturer: deister electronic GmbH
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Barsinghausen 30890 GERMANY

Applicant: Deister Electronics USA, Inc.
8576 Wellington Road
Manassas, Virginia 20109 USA

Product Name: RHX2 doorLoxx Read Head (Prox)

Product Description: Digital Locking System Read Head. Reads common LF (125kHz) Proximity Credentials and determines right of access.

Operating Voltage/Frequency: Battery-Operated (3VDC)

Model: RHX2

FCC ID: IXLRHX

Testing Commenced: April 9, 2020

Testing Ended: April 9, 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**



Order Number: F2P23173

Applicant: Deister Electronics USA, Inc.

Model: RHX2

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.



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Model: RHX2

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2P23173-01E	First Issue	Apr. 23, 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
Variation of the Input Power	CFR 47 Part 15.31(e)	Complies*

**Complies by using new batteries.*

Modifications Made to the Equipment
No modifications were made to the EUT.

**3 TABLE OF MEASURED RESULTS**

Test	125 kHz
Limit for Fundamental at 300 meters	25.66 dB μ V/m
Field Strength of Fundamental corrected for 40dB/decade for 300-meter distance	-25.88 dB μ V/m
Limit corrected for 40dB/decade for 3-meter distance	105.66 dB μ V/m
Limit for Fundamental @ 1 meter	125.67 dB μ V/m
Field Strength of Fundamental at 1-Meter distance	74.12 dB μ V/m
-20dB Occupied Bandwidth	1.249kHz



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Model: RHX2

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: **RHX2 doorLoxx Read Head (Prox)**

Model: RHX2

Serial No.: S01

FCC ID: IXLRHX

5.2 Trade Name:

Deister Electronics USA, Inc.

5.3 Power Supply:

Battery-Operated (3VDC)

5.4 Applicable Rules:

CFR 47, Part 15.209

5.5 Equipment Category:

Radio Transmitter – RFID Reader

5.6 Antenna:

0dBi Integral Antenna

5.7 Accessories:

Battery – Duracell CR2

5.8 Test Item Condition:

The equipment to be tested was received in good condition.

5.9 Testing Algorithm:

EUT was set up to provide a continuous modulated signal at 125kHz. Field strength was measured at 1 meter. Firmware: L83x_DLD_125kHz_920MHz_PN9.

**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	Jan. 3, 2021
Temp/Hum. Recorder	CL261	Extech	445814	04	Feb. 12, 2021
Receiver	CL204	Rohde & Schwarz	ESR7	101714	Oct. 16, 2020
Low Loss Cable Set	--	Pasternack	PE3C0666-252 / PE3C066-50CM	None Spec.	Aug. 31, 2020
Antenna, Bilog	CL211	Sunol Sciences, Inc.	JB1	A021017	Oct. 3, 2020
Preamplifier	0197	Hewlett Packard	8447D	1726A01006	Feb. 17, 2021
Amplifier w/Monopole & 18" Loop	CL163-Loop	AH Systems, Inc.	EHA-52B	100	July 24, 2020
Software:	Tile Version 3.4.B.3		Software Verified: Apr. 9, 2020		
Software:	EMC 32, Version 8.53.0		Software Verified: Apr. 9, 2020		



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.

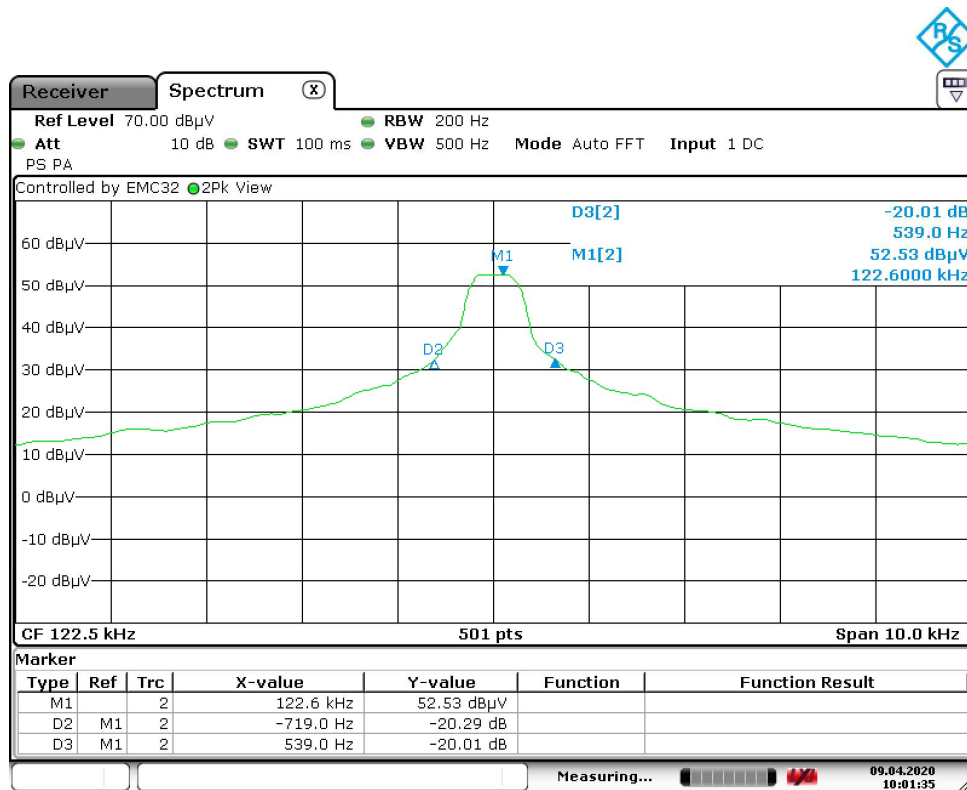
Bandwidth measurements were made at 200Hz RBW using the Marker Delta method.



7.2 Test Data - Occupied Bandwidth

Test Date(s):	Apr. 9, 2020	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	23.0°C
		Relative Humidity:	30%

125kHz: -20dB



Date: 9.APR.2020 10:01:35



8 FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	$2400/F(\text{kHz})$	300
0.490-1.705	$24000/F(\text{kHz})$	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

Notes:

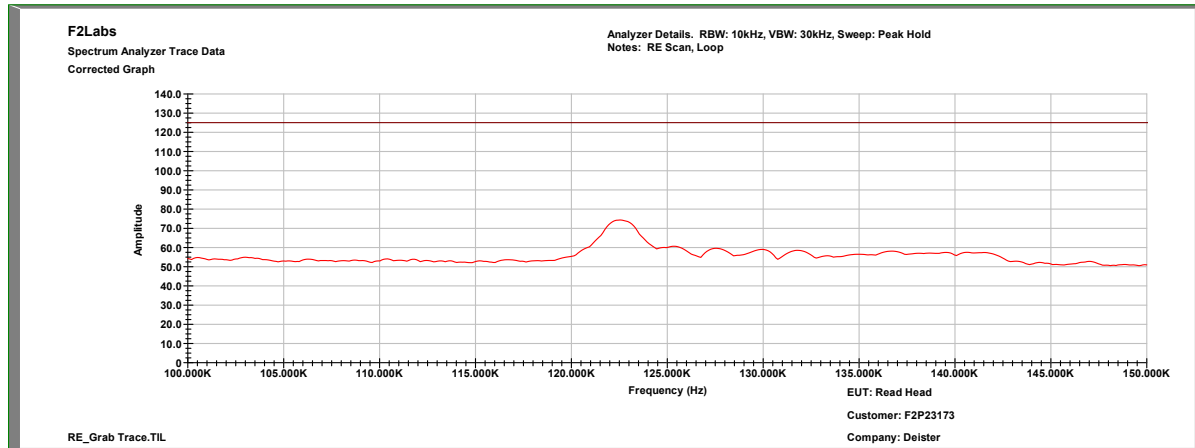
During the pre-scan evaluation, the EUT was rotated in all possible directions and all three orthogonal positions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions.

125 kHz Field Strength was measured at 1m distance, as the emission could not be seen from 3m away.



8.1 Test Data - Field Strength of Emissions from Intentional Radiators

Test Date(s):	Apr. 9, 2020	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.209	Air Temperature:	23.0°C
Results:	Complies	Relative Humidity:	30%



Frequency (MHz)	Antenna Height (m)	Azimuth (degrees)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Corrected Emission	Limit (dBμV/m)	Margin (dB)
0.125000	1.00	0.00	51.5	22.65	74.12	125.7	51.6



8.2 Test Data – 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 presented.

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.



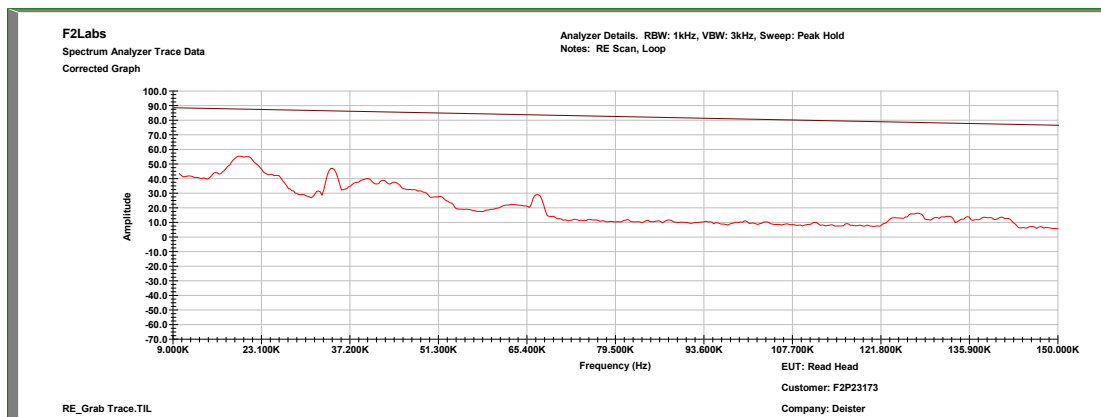
Order Number: F2P23173

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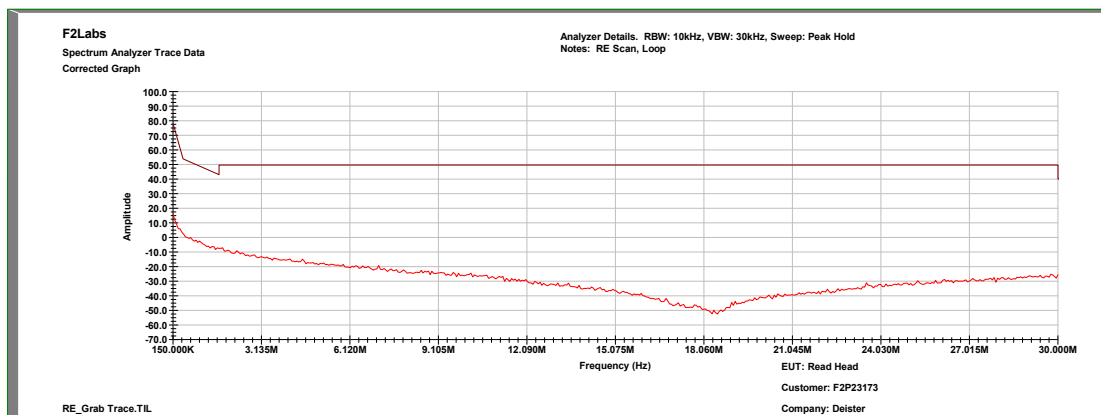
Model: RHX2

Test Date(s):	Apr. 9, 2020	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.209	Air Temperature:	23.1°C
Results:	Complies	Relative Humidity:	30%

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



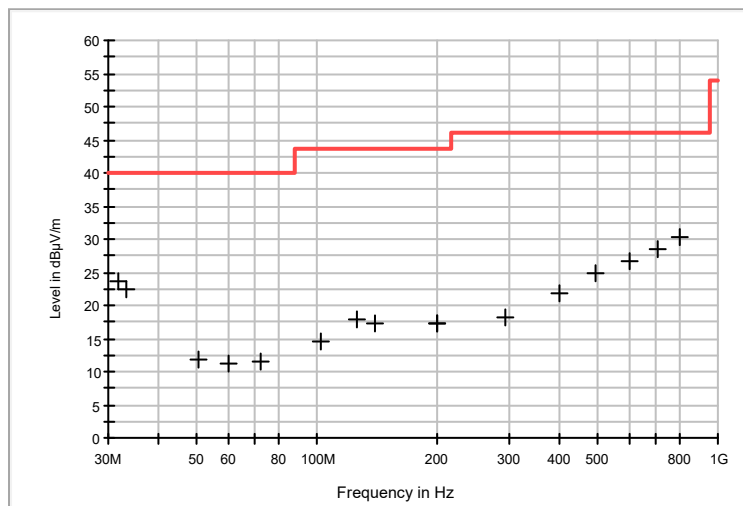
125kHz: Characterization Scan, 0.15 MHz to 30 MHz (Loop Antenna)





125kHz: 30 MHz to 1000 MHz

Frequency (MHz)	Antenna Polarization	Azimuth (degrees)	Reading (dB μ V)	Cable Loss & Antenna Factor (dB)	Emission (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
31.880000	V	1.00	20.0	3.6	23.60	40.0	-16.4
33.360000	H	359.00	19.8	2.6	22.40	40.0	-17.6
50.160000	V	1.00	20.0	-8.1	11.90	40.0	-28.1
60.200000	H	359.00	19.9	-8.7	11.20	40.0	-28.8
72.160000	V	1.00	19.7	-8.0	11.70	40.0	-28.3
102.000000	H	359.00	19.6	-5.0	14.60	43.5	-28.9
125.120000	V	1.00	19.5	-1.5	18.00	43.5	-25.5
139.680000	H	359.00	19.4	-2.1	17.30	43.5	-26.2
199.360000	H	359.00	19.0	-1.8	17.20	43.5	-26.3
199.760000	V	1.00	19.1	-1.8	17.30	43.5	-26.2
294.120000	V	1.00	18.8	-0.5	18.30	46.0	-27.7
403.080000	H	359.00	19.7	2.3	22.00	46.0	-24.0
495.960000	V	1.00	20.4	4.6	25.00	46.0	-21.0
602.320000	H	359.00	20.3	6.4	26.70	46.0	-19.3
704.520000	V	1.00	20.5	8.1	28.60	46.0	-17.4
806.000000	H	359.00	20.4	10.0	30.40	46.0	-15.6





9 PHOTOGRAPHS

Occupied Bandwidth & Field Strength





Radiated Spurious Emissions: Less than 30 MHz



Radiated Spurious Emissions: 30 MHz to 1000 MHz

