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CERTIFICATION TEST REPORT

Manufacturer: **Structured Mining Systems, Inc.**
 d.b.a. Cervis Inc.
 170 Thorn Hill Road
 Warrendale, Pennsylvania 15086
 United States of America

Applicant: **Same As Above**

Product: **Module**

Model: **MRF450**

FCC ID: **LOBMRF450**

Testing Commenced: **Aug. 20, 2018**

Testing Ended: **Sept. 14, 2018**

Summary of Test Results: **In Compliance, with Modifications***

Note: This test report reflects Field Strength Emissions and Spurious Emissions results for a PCII due to changes made by the manufacturer.

Standards:

- ❖ **FEDERAL REGISTER CFR 47, PART 15 – RADIO FREQUENCY DEVICES**
 - **Part 15 Subpart C, Section 15.231 - Periodic operation in the band 40.66–40.70 MHz and above 70 MHz**
 - **Part 15 Subpart C, Section 15.209 - Radiated emissions limits; general requirements**
- ❖ **ANSI C63.10 2013 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices**



Order Number: F2LQ5719-C4A

Client: Cervis Inc.

Model: MRF450

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 ANSI C63.10:2013 and recommended FCC procedure of measurement of a Low Power <1GHz device operating under Section 15.231. A list of the measurement equipment can be found in Section 6.

1.3 Uncertainty Budget:

Radiated Emission

- Combined Uncertainty (+ or -) 2.24 dB
- Expanded Uncertainty (+ or -) 4.48 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.4 Document History

Document Number	Description	Issue Date	Approved By
F2LQ5719-07E	First Issue	Apr. 2, 2019	K. Littell



2 SUMMARY OF TEST RESULTS/MODIFICATIONS

Standard(s)	Results
CFR 47 Part 15.231(b) / Part 15.209	Complies*

Modifications Made to the Equipment
*EUT power setting was reduced to 10% to meet Field Strength requirements.



3 ENGINEERING STATEMENT

This report has been prepared on behalf of Cervis Inc. to provide documentation for the testing described herein. This equipment has been tested and found to comply with Part 15.231 of the FCC Rules using ANSI C63.10 standards. The test results found in this test report relate only to the items tested.



4 EUT INFORMATION AND DATA

4.1 Equipment Under Test:

Product: Module

Model: MRF450

Serial No.: N/A

FCC ID: LOBMRF450

4.2 Trade Name:

Structured Mining Systems, Inc. d.b.a. Cervis Inc.

4.3 Power Supply:

Battery Powered

4.4 Applicable Rules:

CFR 47, Part 15.231, subpart C

4.5 Equipment Category:

Module

4.6 Antenna:

0dBi Omni, Vertically polarized

4.7 Accessories:

N/A

4.8 Test Item Condition:

The equipment to be tested was received in good condition.

4.9 Testing Algorithm:

The EUT was configured to permit frequency changes from low-mid-upper transmission channel. Readings were taken on three frequencies, Low (450 MHz), Mid (460 MHz) and High (469.5 MHz). For all tests, the EUT was equipped with a 0dBi Omni antenna.

**5 LIST OF MEASUREMENT INSTRUMENTATION**

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166-E	AlbatrossProjects	B83117-DF435-T261	US140023	Jan. 9, 2019
Temp/Hum. Recorder	CL233	Extech	445814	02	Mar. 22, 2019
Receiver	CL204	Rohde & Schwarz	ESR7	101714	Nov. 2, 2018
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	Oct. 11, 2019
Horn Antenna	CL098	Emco	3115	9809-5580	Dec. 28, 2018
Pre-Amplifier	CL153	Agilent	83006-69007	MY39500791	Mar. 26, 2019
Pre-Amplifier	CL136	Hewlett Packard	8447E	1937A01894	Mar. 26, 2019
Software:	EMC 32, Version 8.53.0 Software Verified: Aug. 20-24, 2018				



6 FCC PART 15.231(b)

6.1 Requirements:

Field strength of emissions, fundamental and spurious using average detector and a peak limit of 20dB was added above the average limit per 15.35(b).

Limits for fundamental frequency 260 MHz to 470 MHz is : 3750 to 12,500 $\mu\text{V/m}$.

Limits for spurious emissions were those specified in 15.209.

While the equipment was energized, the receiving antenna was scanned from 1.0 meter to 4.0 meters in both vertical and horizontal polarities while the turntable was adjusted 360 degrees to determine the maximum field strength.

The equipment was fully exercised with all cabling attached to the EUT and was positioned for maximum emissions. The EUT antenna was positioned flat against the plastic tabletop and it was verified, by placing a foam support between the table and the antenna, that the table had no effect on the emissions at these frequency ranges.

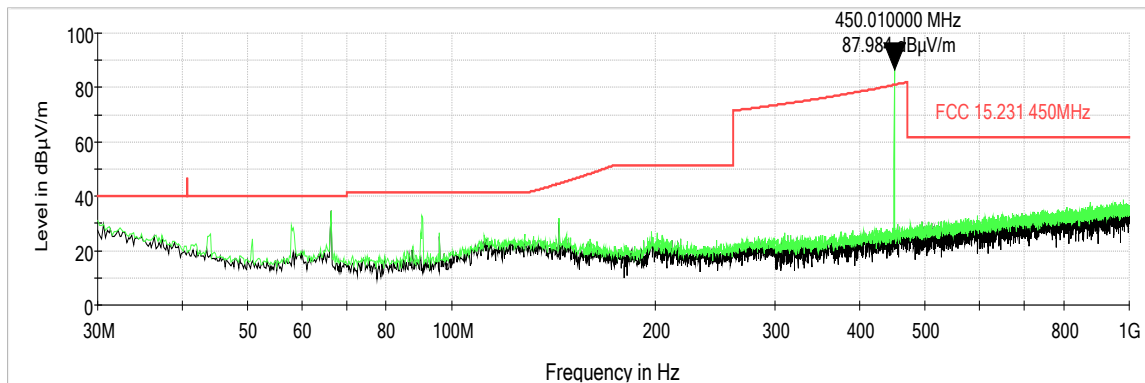
Spurious emissions were scanned on the Low, Mid, and High channels, and then measured and recorded on the low channel which was determined the worst-case Spurious Emissions between the Low, Mid, and High channels.



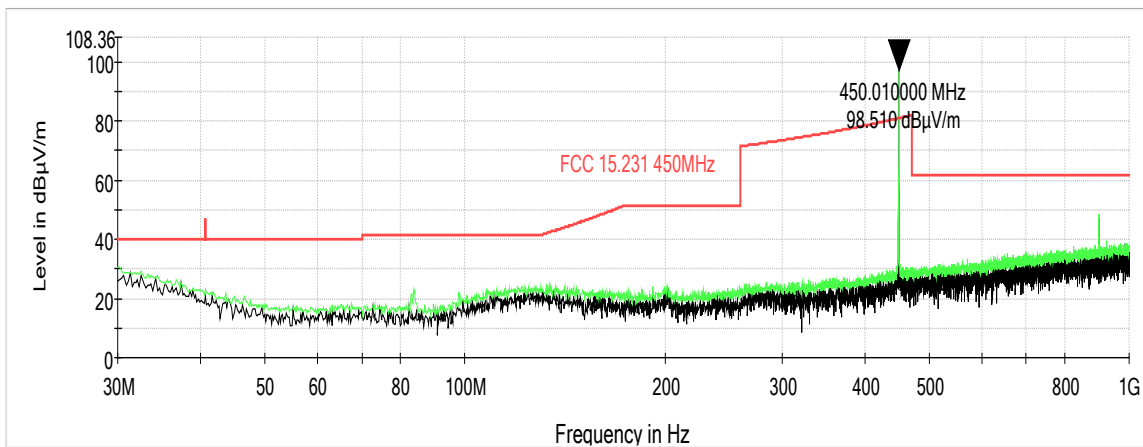
6.2 Test Data

Test Date:	Aug. 20, 2018	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.231(b); 15.209	Air Temperature:	23.2°C
		Relative Humidity:	41%

Low Channel - Pre-scan, Vertical

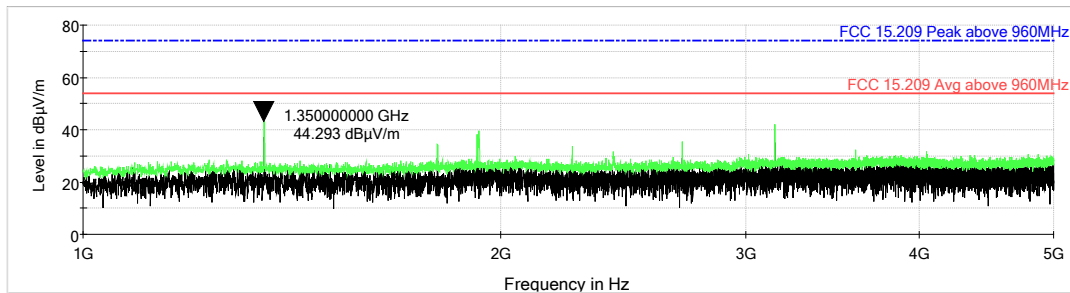


Low Channel - Pre-scan, Horizontal

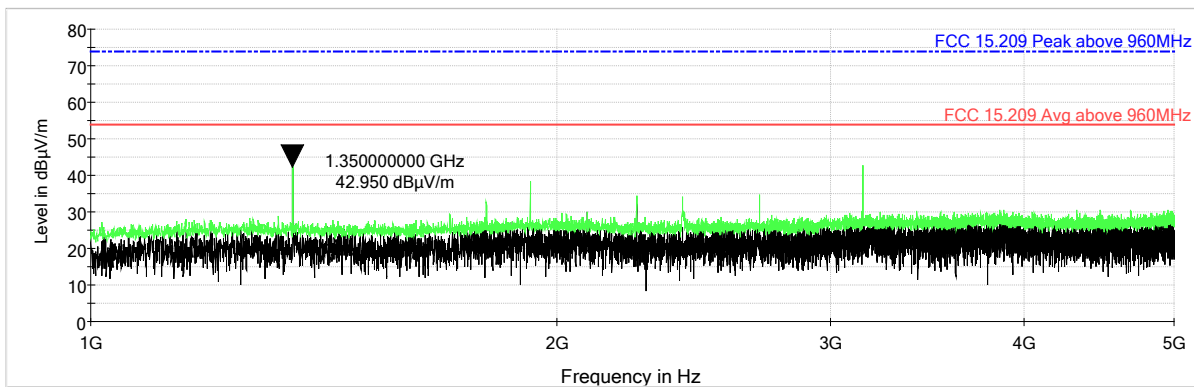




Low Channel - PCB, Characterization Scan: 1 GHz to 5 GHz, Vertical



Low Channel - PCB, Characterization Scan: 1 GHz to 5 GHz, Horizontal

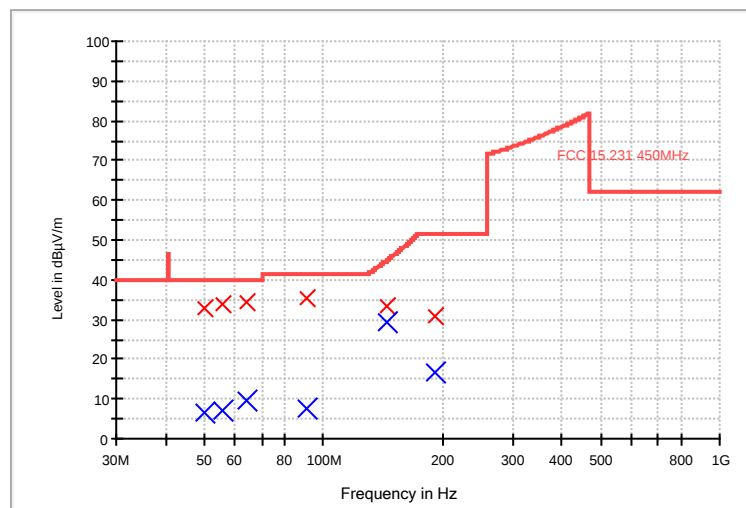




Test Date:	Aug. 20, 2018	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.231(b); 15.209	Air Temperature:	23.1°C
		Humidity:	42%

Low Channel, Spurious Emissions 30 MHz to 1000 MHz – Average

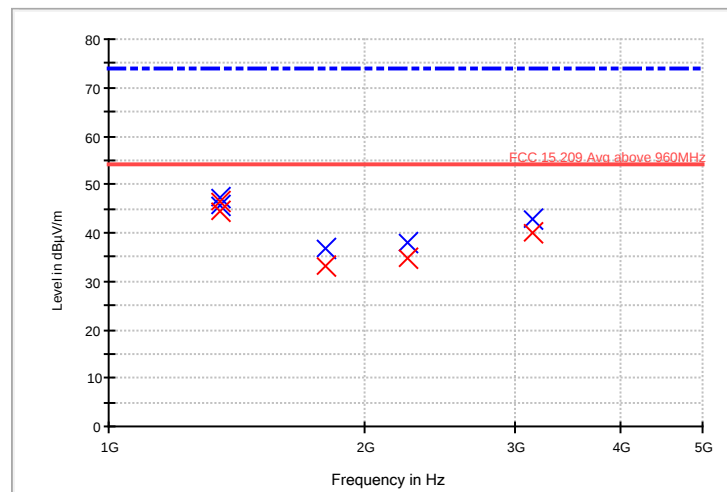
Frequency (MHz)	Antenna Polarization	Average (dBμV/m)	Correction Factors (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
49.950000	V	14.3	-7.6	6.70	40.0	-33.3
55.440000	H	15.4	-8.5	6.90	40.0	-33.1
64.180000	H	17.9	-8.1	9.80	40.0	-30.2
90.330000	V	15.2	-7.8	7.40	41.5	-34.1
143.970000	V	31.2	-2.1	29.10	44.7	-15.6
190.140000	H	-3.2	19.9	16.70	51.5	-34.8





Low Channel, 1 GHz to 5 GHz - Average

Frequency (MHz)	Antenna Polarization	Average (dB μ V/m)	Correction Factors (dB)	Emission (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1350.000000	V	50.5	-6.1	44.40	54.0	-9.6
1350.000000	H	52.4	-6.1	46.30	54.0	-7.7
1800.000000	H	38.3	-5.2	33.10	54.0	-20.9
2250.000000	H	39.7	-4.8	34.90	54.0	-19.1
3150.000000	H	43.1	-3.3	39.80	54.0	-14.2

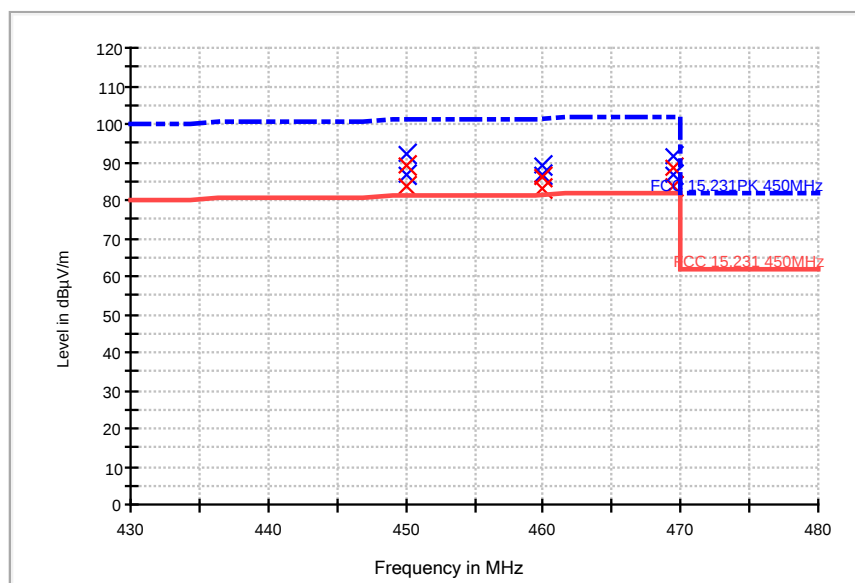




Test Date(s):	Aug. 24, 2018; Sept. 14, 2019	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.231(b); 15.209	Air Temperature:	21.5°C
		Relative Humidity:	49%

In Band Levels

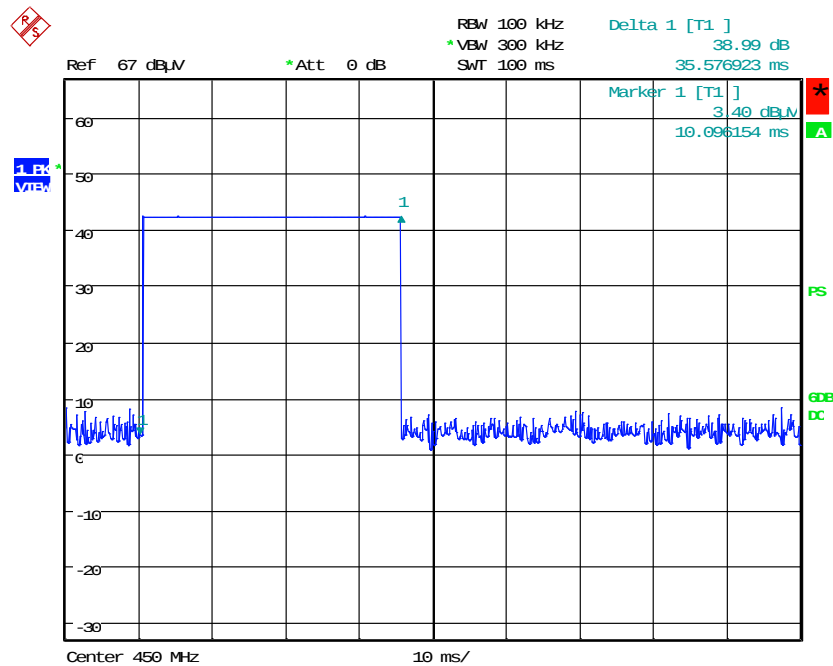
Frequency (MHz)	Antenna Polarization	Bandwidth (kHz)	MaxPeak (dBμV/m)	Limit MaxPeak (dBμV/m)	Corr. Factors (dB)	Average (dBμV/m)	Average w/DCCF (dBμV/m)	Limit (AVG) (dBμV/m)	Margin AVG (dBμV/m)
450.000000	V	120.00	91.9	101.3	3.5	88.8	79.93	81.3	-1.4
	H	120.00	86.6	101.3	3.5	83.4	74.53	81.3	-6.8
460.000000	V	120.00	89.2	101.6	3.8	86.1	77.23	81.6	-4.4
	H	120.00	86.4	101.6	3.8	83.2	74.33	81.6	-7.3
470.000000	V	120.00	91.8	101.9	4.2	88.7	79.83	81.9	-2.1
	H	120.00	86.7	101.9	4.2	83.4	74.53	81.9	-7.4





A duty cycle correction of -8.87dB was added to the field strength measured because the EUT has a 36% duty cycle. Transmission was on for 36mS out of a 100mS time. The formula used was: $DCCF = 20\log \frac{36mS}{100mS} = -8.87$

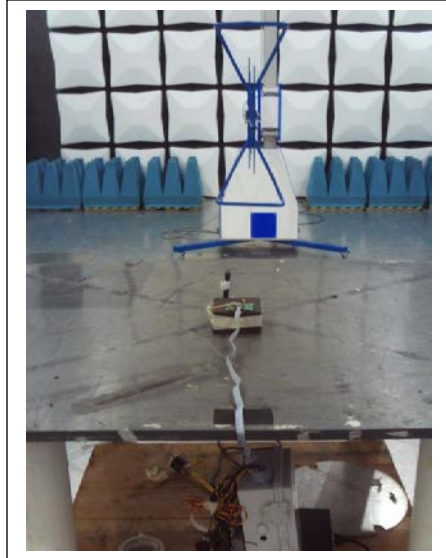
100mS



Date: 14.SEP.2018 17:54:04

7 PHOTOGRAPHS

Radiated Spurious Emissions, Less than 1 GHz; Field Strength



Radiated Spurious Emissions, Greater than 1 GHz

