Testing Tomorrow's Technology

Application for Certification

Per
Title 47 USC Part 2, Subpart J, Equipment Authorization Procedures, Paragraph 2.907, Certification and Part 15, Subpart C, Intentional Radiators, Paragraph 15.225, Operation within the band 13.110 to 14.010 MHz
And
Innovation, Science, and Economic Development Canada
Certification Per
ICRSS-Gen General Requirements for Radio Apparatus
And
RSS-210 License-Exempt Radio Apparatus: Category I Equipment, Annex B (B.6), Devices Operating in Frequency Bands for any Application (Band 13.110-14.010 MHz)

For the

Radio Systems

ScoopFree Crystal Plus Self-Cleaning Litter Box
Model: 300-3449

UST Project: 24-0208
Issue Date: 11/4/2024

Number of Pages in this report: 16

3505 Francis Circle Alpharetta, GA 30004
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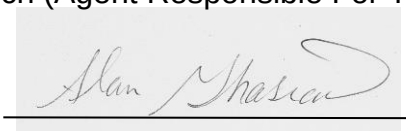
Testing Tomorrow's Technology

I certify that I am authorized to sign for the test facility and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US Tech (Agent Responsible For Test):

By: 

Name: Alan Ghasiani

Title: President – Consulting Engineer

Date: 11/04/2024

NVLAP TESTING

NVLAP LAB CODE 200162-0

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MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: Radio Systems Corporation
PRODUCT: ScoopFree Crystal Plus Self-Cleaning Litter Box
FCC ID: KE3-3003449
DATE: 11/04/2024

This report concerns (check one): ☒Original grant □Class II change

Equipment type: 13.56 MHz transmitter

Technical:
13.56 MHz
Type of modulation:
ASK
Software used to program EUT: N/A
EUT firmware number: version: N/A
Power setting: default setting

Report prepared by:
US Tech
3505 Francis Circle
Alpharetta, GA30004

Table of Contents

Paragraph Title Page

List of Figures

Figure **Title** **Page**

List of Tables

Tables **Title** **Page**

1. General Information

This report is prepared as a means of presenting test data to be used by a Telecom Certification Body in determination of whether this product is permitted for unlicensed dissemination to the general public according to the Innovation, Science, and Economic Development Canada and FCC Rules and Regulations for RF Devices Intentional Radiators.

1.1 Product Description

The Equipment under Test (EUT) is the Radio Systems Model 300-3449 ScoopFree Crystal Plus Self-Cleaning Litter Box a Self-Cleaning Litter Box With RFID.

This model litter box is identical to the model 300-3450 and 300-3450-1 except it does not contain the LCD display otherwise all electronic circuits are the same including the NFC transmitter circuit and antenna.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on 8/16/2024 in good operating condition.

1.3 Related Submittal(s)/Grant(s)

The EUT is subject to the following FCC Equipment Authorizations:

a) Certification of the transmitter.
b) Verification as a Class B digital device.

2. Tests and Measurements

2.1 Configuration of Tested System

The Test sample was tested per *ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices* to show compliance to CFR 47, Part 15.225 & RSS-210, B.6.

All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was set to 3 times the resolution bandwidth or off throughout the evaluation process. There were no interconnecting cables to manipulate in an attempt to maximize emissions; however, the physical position of the EUT was varied through the three mutually exclusive orthogonal planes in an attempt to maximize the emissions. The worst case position is the position used for final measurements and is gathered in this test report. A block diagram of the tested system is shown in Figure 1.

2.2 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and registered with the FCC, under site registration number US5301. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1 and is also a NVLAP accredited test lab; lab code 200162-0.

2.3 Test Equipment

Table 1. EUT and Peripherals

EUT MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID	CABLES P/D
ScoopFree Crystal Plus Self-Cleaning Litter Box Radio Systems (EUT)	300-3449	Various	Pending: FCC ID: KE3-3003449	N/A
PERIPHERAL MANUFACTURER	**MODEL NUMBER**	**SERIAL NUMBER**	**FCC/IC ID:**	**CABLES P/D**
ScoopFree AC/DC Adapter/ ShenZhen SOY Technology Coo., Ltd	SOY-1800083	N/A	None	P

S= Shielded, U=Unshielded, P= Power line, D= Data line

Table 2. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	CALIBRATION DUE DATE
Spectrum Analyzer	E4407B	Agilent	US41442935	9/21/2024 2 Years
Spectrum Analyzer	E4440A	Agilent	MY45304803	7/21/2025 2 Years
Loop Antenna	6502	EMCO	9810-3246	12/7/2024 2 Years
Biconical Antenna	3110B	EMCO	9307-1431	1/13/2025 2 Years
Log Periodic	3146	EMC	9305-3600	3/13/2026 2 Years
Horn Antenna	3115	EMCO	9107-3723	3/13/2025 2 Years
Preamp	8449B	Hewlett Packard	3008A00914	3/4/2025
Preamp	8447D	Hewlett-Packard	2944A07519	1/5/2025
LISN	9247-50-TS-50-N	Solar Electronics	955824	4/28/2025
LISN	9247-50-TS-50-N	Solar Electronics	955825	4/28/2025
RF Cable	ConCable	US Tech	ConCable	6/21/2025
RF Cable	HF Cable	US Tech	CA403	3/05/2025
RF Cable	HF Cable	US Tech	CA407	3/05/2025
RF Cable	Preamp	US Tech	CA191	7/23/2025

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.4 EUT Antenna Description (FCC Sec. 15.203, RSS-Gen 6.8)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The Radio Systems, Model 300-3449 incorporates the antennas detailed in Table 3.

Table 3. Antenna Description

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	TYPE OF CONNECTOR
Antenna	Radio Systems	PCB coil	NFC	Solder

2.5 Modifications to Equipment

No modifications were needed to bring the EUT into compliance with the FCC Part or IC RSS requirements.

2.6 Test Procedure

The EUT was configured as shown in the following block diagram(s) and photograph(s). The sample was tested per ANSI C63.10:2013. Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz depending on the frequency range of testing, 150 kHz-30 MHz or 30 MHz to 1000 MHz, respectively. All measurements are peak unless stated otherwise. The video filter on the spectrum analyzer was set to 3x the RBW throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. The EUT was rotated 360 degrees with the turntable to maximize emissions. The physical position of the EUT was varied through the three mutually exclusive orthogonal planes in an attempt to maximize the emissions. The worst case data is presented in the test report.

Figure 1. Block Diagram of Test Configuration

2.7 Transmitter Output Power (RSS Gen, 6.12)

Transmit output power measurements shall be carried out before the unwanted emissions test. The transmitter output power value, obtained from this test serves as the reference level used to determine the unwanted emissions. For comparative purposes the measurements of emission power and unwanted emissions can be in peak or average provided that the same parameter is used when measuring both.

The following formula may be used to convert field strength (FS) in volts/meter to transmitter output power (TP) in watts:

$TP= (FS \times D)^2 / (30 \times G)$

D= distance in meters between the two antennas and G= antenna gain numeric

2.8 Intentional Radiator, Power Line Conducted Emissions (47 CFR 15.207) (RSS Gen, 8.8)

Power line conducted emissions testing for license exempt devices was performed according to ANSI C63.10:2013. The test data is presented in the sections below.

2.9 Field Strength of Fundamental (47 CFR 15.225, RSS-210, B.6)

The results of the measurements for peak fundamental emissions are given in Table 4. The EUT emissions measurement was started by setting up the Antenna in the vertical orientation at a distance of 3 meters from the EUT and at a height of 1.0 meters above the ground. The EUT's major axis was set normal to the direction of the measuring antenna.

The Spectrum Analyzer (SA) displays were set to: Channel 2 free-running, Channel 1 to Max-Hold. Choose a frequency or frequency range and scan it at a coupled rate. When a signal is detected, raise and lower the antenna to maximize the signal.

When the signal has been maximized, the antenna height is fixed the turn-table is rotated through 360 degrees to further maximize the signal.

When all signals have been maximized for antenna height and direction, the EUT case is carefully maneuvered in each of the three mutually exclusive orthogonal planes while observing the same Max-hold/free-running SA display indication. When the EUT position is found that further maximizes the signal, record the antenna height, rotation orientation, EUT orthogonal position and signal strength on the data sheet for that particular frequency.

Next, the measurement antenna is re-oriented to a Horizontal polarization at 1 meter height and the process described above is repeated. All signals within 6 dB of the limit are recorded.

Finally, the collected data is input into the calculation spread sheet. The spread sheet is designed to calculate for the true value that is collected. The spread sheet takes into account the SA reading, the antenna correction factor, cable losses and duty cycle factors. See the data tables herein.

2.10 Limits for Operation within the Band 13.110-14.010 MHz (CFR15.225, RSS-210, B.6)

This limit versus frequency table is as follows (test distance = 3.0 meters):

Frequency (MHz)	Field Strength @ 30m (uV/m)	Field Strength @ 30m (dBuV/m)	Field Strength @ 3m (dBuV/m)
13.553-13.567	15848	84	124
13.410-13.553	334	50.5	90.5
13.567-13.710	334	50.5	90.5
13.110-13.410	106	40.5	80.5
13.710-14.010	106	40.5	80.5
Any emissions outside of the band 13.110-14.010 MHz shall not exceed the limits in 15.209			

Note: formula 1: dBuV/m= 20 log (uV/m)
2: 3m distance = (dBuV/m@30m) + 40 log (30/3)

The frequency spectrum above the fundamental to its 10th harmonic shall be examined and measured for signals falling into the restricted bands of 15.205. If average emissions measurements are employed, the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Spurious and harmonics shall meet the requirements of the above table or the requirements of 15.209, whichever requirement permits a higher field strength.

Table 4. Intentional Radiated Emissions Fundamental

Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	PK Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detection Method
13.56	52.25	11.04	63.29	124.0	3 meter	60.71	**PK**

No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 13.56:

Magnitude of Measured Frequency	52.25	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	11.04	dB/m
Corrected Result	63.29	dBuV/m

Test Date: 8/22/2024
Tested By

Signature: Ian Charboneau Name: Ian Charboneau

2.11 Radiated Spurious Emissions other than Fundamental (CFR 15.209, 15.225, RSS-Gen 8.8, 8.9)

The EUT was placed in a state representative of how the device will function under normal operation. The radiated spurious emissions were measured over the frequency range of 9 KHz to 30MHz and 30 MHz to the 10th harmonic of the fundamental frequency of the intentional transmitter or 1000 MHz whichever is higher. The test results are shown below.

Table 5. Spurious Radiated Emissions, 9 kHz - 30 MHz

9 kHz to 30 MHz, 15.209 limits							
Frequency (MHz)	**Test Data (dBuV)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
No signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic.							

Test Date: 8/22/2024
Tested By

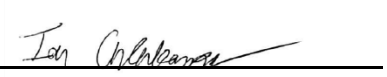
Signature:  Name: Ian Charboneau

Table 6. Spurious Radiated Emissions

>30 MHz 15.209 Limits							
Frequency (MHz)	**Test Data (dBuV)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
67.80	47.98	-14.35	33.63	40.0	3m./HORZ	6.4	**PK**
94.90	53.06	-14.45	38.62	43.5	3m./HORZ	4.9	**PK**
122.05	46.89	-12.57	34.32	43.5	3m./HORZ	9.2	**PK**
138.90	45.59	-11.59	33.99	43.5	3m./HORZ	9.5	**PK**
149.15	51.65	-11.39	40.26	43.5	3m./HORZ	3.2	**PK**
158.75	47.99	-11.24	36.75	43.5	3m./HORZ	6.8	**PK**
176.30	44.22	-10.45	33.77	43.5	3m./HORZ	9.7	**PK**
189.85	44.20	-9.23	34.97	43.5	3m./HORZ	8.5	**PK**
203.40	45.88	-11.28	34.60	43.5	3m./HORZ	8.9	**PK**
230.50	47.13	-11.43	35.70	46.0	3m./HORZ	10.3	**PK**
271.15	41.50	-9.67	31.83	46.0	3m./HORZ	14.2	**PK**
325.44	44.42	-8.09	36.33	46.0	3m./HORZ	9.7	**PK**
379.64	40.93	-7.17	33.76	46.0	3m./HORZ	12.2	**PK**
406.79	40.71	-6.49	34.23	46.0	3m./HORZ	11.8	**PK**
596.63	39.00	-2.46	36.54	46.0	3m./HORZ	9.5	**PK**
623.77	33.66	-1.92	31.73	46.0	3m./HORZ	14.3	**PK**
30.1	42.86	-9.46	33.41	40.0	3m./VERT	6.6	**PK**
32.55	46.07	-9.95	36.13	40.0	3m./VERT	3.9	**PK**
34.7	41.27	-10.43	30.84	40.0	3m./VERT	9.2	**PK**
40.65	46.27	-11.76	34.51	40.0	3m./VERT	5.5	**PK**
67.8	50.37	-14.95	35.41	40.0	3m./VERT	4.6	**PK**
94.95	46.93	-13.55	33.39	43.5	3m./VERT	10.1	**PK**
108.45	42.63	-12.93	29.70	43.5	3m./VERT	13.8	**PK**
122.05	42.64	-12.07	30.57	43.5	3m./VERT	12.9	**PK**
149.15	42.85	-10.59	32.26	43.5	3m./VERT	11.2	**PK**
158.8	39.31	-10.24	29.07	43.5	3m./VERT	14.4	**PK**
325.39	36.24	-8.69	27.55	46.0	3m./VERT	18.5	**PK**
352.49	37.48	-8.32	29.16	46.0	3m./VERT	16.8	**PK**
379.64	38.73	-7.87	30.86	46.0	3m./VERT	15.1	**PK**
406.73	39.32	-7.29	32.04	46.0	3m./VERT	14.0	**PK**
461.03	37.83	-6.17	31.66	46.0	3m./VERT	14.3	**PK**
596.58	37.95	-3.46	34.49	46.0	3m./VERT	11.5	**PK**
All other emissions greater than 20 dB below the applicable limit.							

Sample Calculation at 67.80 MHz:

Magnitude of Measured Frequency	47.98	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	-14.35	dB/m
Corrected Result	33.63	dBuV/m

Test Date: 8/22/2024
Tested By
Signature: Ian Charboneau Name: Ian Charboneau

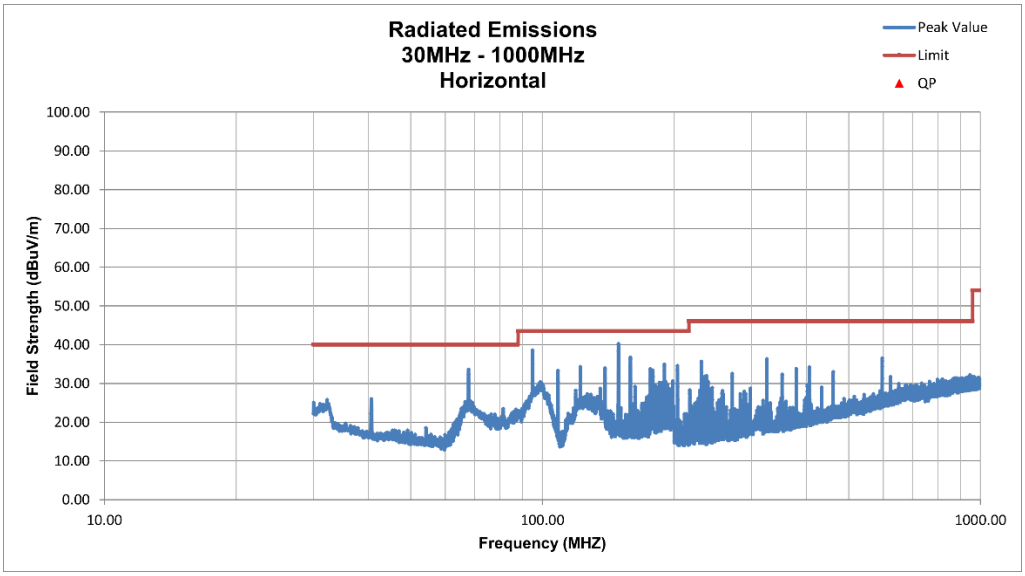


Figure 2. Radiated Emissions 30 - 1000 MHz Horizontal

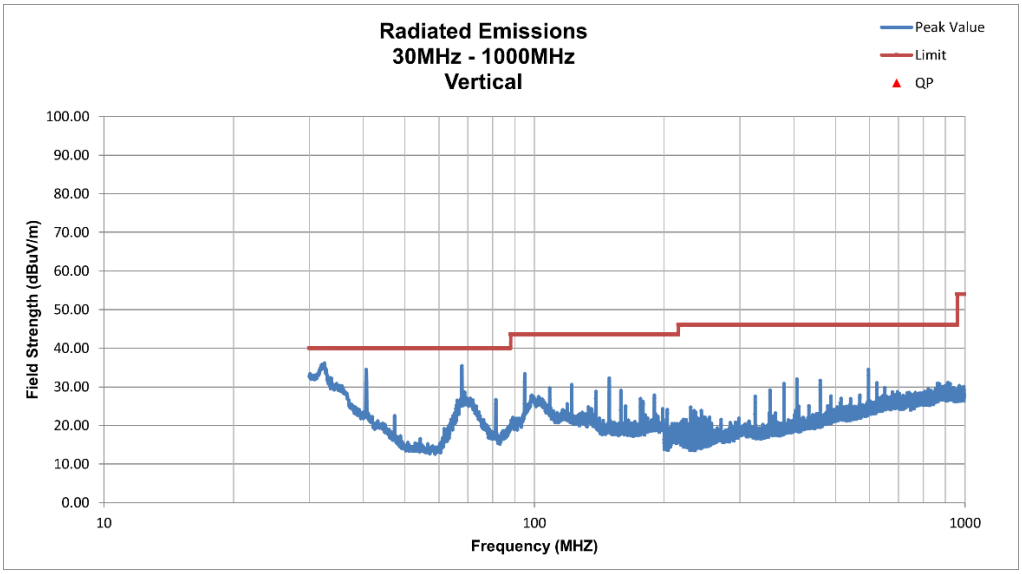


Figure 3. Radiated Emissions 30 - 1000 MHz Vertical

2.12 Power Line Conducted Emissions (CFR 15.207, RSS-Gen 8.8, 8.9)

Table 7. Power Line Conducted Emissions

150 KHz to 30 MHz						
Frequency (MHz)	**Test Data (dBuv)**	**LISN+CL-PA (dB)**	**Results (dBuV)**	**AVG Limits (dBuV)**	**Margin (dB)**	**Detector PK, QP, or AVG**
Phase						
0.151	44.86	0.27	45.13	55.8	10.67	**PK**
0.875	33.01	0.79	33.8	46	12.2	**PK**
1.200	32.24	1.06	33.3	46	12.7	**PK**
7.750	32.97	0.39	33.36	50	16.64	**PK**
13.550	30.53	0.89	31.42	60.0*	28.58	**QP**
13.550	17.4	0.89	18.29	50	31.71	**AVG**
20.100	28.6	1.08	29.68	50	20.32	**PK**
Neutral						
0.386	41.44	0.29	41.73	48	6.31	**PK**
0.638	29.76	0.73	30.49	46	15.51	**PK**
1.140	29.17	0.7	29.87	46	16.13	**PK**
8.250	27.99	0.57	28.56	50	21.44	**PK**
19.280	28.71	1.38	30.09	50	19.91	**PK**
20.470	29.39	1.52	30.91	50	19.09	**PK**

(*) indicates Quasi – Peak (QP) limits used.

Sample Calculation at 0.151 MHz:

Magnitude of Measured Frequency	44.86	dBuV
+ (LISN+CL-PA)	0.27	dB
Corrected Result	45.13	dBuV

Test Date: 8/28/2024
Tested By

Signature: Ian Charboneau Name: Ian Charboneau

2.13 Bandwidth of Fundamental (CFR15.215)

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 20 dB 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.

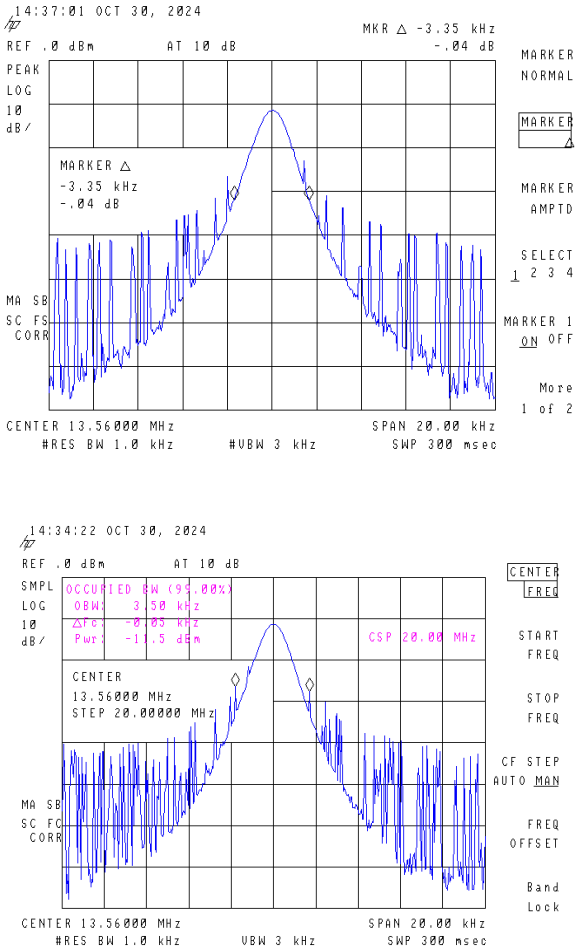


Figure 4. EUT Bandwidth Measurements (20 dB & 99% BW)

2.14 Frequency Stability

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -30 degrees to +50 degrees C

< 0.01% = 100 PPM = 0.0001

Table 8. Frequency Deviation/Stability

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (ppm)
-30	13.560000	-0.0
-20	13.560000	-0.0
-10	13.560000	-0.0
0	13.560000	-0.0
10	13.560000	-0.0
20	13.560000	-0.0
30	13.560000	-0.0
40	13.560000	-0.0
50	13.560000	-0.0

Test date: 8/21/2024

Tested By
Signature:  Name: Ian Charboneau

2.15 Measurement Uncertainty

2.15.1 Conducted Emissions Measurement Uncertainty

Measurement uncertainty (within a 95% confidence level) for this test is ± 2.85 dB.

2.15.2 Radiated Emissions Measurement Uncertainty

For the measurement distance of 3 m, the measurement uncertainty (with a 95% confidence level) for this test using a Biconnical Antenna (30 MHz to 200 MHz) is ± 5.40 dB.

For a measurement distance of 3 m, the measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ± 5.19 dB.

For a measurement distance of 3 m, the measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna (1000 MHz to 6000 MHz) is ± 5.08 dB.

END TEST REPORT