

TEST REPORT

Report Number: 3172421LEX-002
Project Number: 3172421

Evaluation of the External Reader Writer
Model Number: 8000-011-002

FCC ID: W3U800011002

Tested to the Criteria in
FCC Part 15 Subpart C (15.225),
FCC Part 15 Subpart B (15.107 and 15.109),

For

Sargent and Greenleaf Inc.

Test Performed by:
Intertek
731 Enterprise Drive
Lexington, KY 40510

Test Authorized by:
Sargent and Greenleaf Inc.
One Security Drive
Nicholasville, KY 40356

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1 JOB DESCRIPTION

1.1 Test Sample Information

The 8000-011-002 External Reader Writer (EXRW) is designed specifically for and used exclusively for retail asset tracking via an RFID reader. In a typical application the EXRW is permanently installed outside of a slide drawer installed on top of a steel safe. The EXRW is used to track details of assets as they are added to a safe compartment. A single EXRW is used in a multiple compartment safe and is controlled by a host computer via a Universal Serial Bus.

Company Information	
Manufacturer:	Sargent and Greenleaf Inc.
Address:	One Security Drive Nicholasville KY 40356
Contact Name:	Michael Clark
Telephone Number:	(859) 885-9411
Email Address:	mclark3@stanleyworks.com

Test sample	
Model Number:	8000-011-002
Serial Number:	Test Sample 1
FCC ID:	W3U800011002
FCC Classification:	Low Power Communication Device Transmitter (DXX)
Antenna Type:	PCB Antenna
Antenna Location:	On PCB
Sample Receive Date:	2/10/2009

Test Signal Mode	
Test Commands:	X
Base Station Simulator:	

1.2 System Support Equipment

A Dell laptop (Model Inspiron 1420) was used to configure the transmit mode of the External Reader Writer prior to each test. It also provided DC power to the test sample via the USB connection. The laptop was powered via an AC power adapter (Dell Model PS-1650-05D) throughout the evaluation. No other support equipment was used.

1.3 Cables associated with EUT

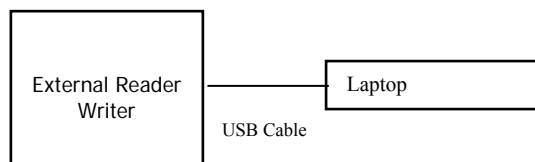
Table 1-1 contains the details of the cables associated with the EUT.

Table 1-1: Interconnecting cables between modules of EUT

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
DC Cable	6 ft.	None	Yes	Laptop	AC/DC Power Converter for Laptop
AC Power Cable	6 ft.	None	Yes	AC/DC Power Converter for Laptop	120VAC Power Source
USB Cable	3 ft.	Yes	Yes	EUT	Laptop

1.4 System Block Diagram

The diagram shown below details the interconnection of the EUT and its accessories during the testing.



1.5 Mode(s) of operation

The External Reader Writer was powered via a USB cable (5VDC) connected to a laptop computer. The laptop was powered by an AC power adapter which was connected to 120VAC / 60Hz. A control program was used to force the External Reader Writer to transmit at maximum output power during the evaluation.

1.6 Modifications required for compliance

In order to pass the conducted emission test ferrite beads had to be placed around the DC output and the AC input of the AC power adapter connected to the laptop computer (Fair-Rite part number 0431177081).

1.7 Related Submittal(s) Grants

None

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2 EXECUTIVE SUMMARY

Testing performed for: Sargent and Greenleaf Inc.

Equipment Under Test: Model 8000-011-002

Test Start Date: 2/10/2009

Test End Date: 5/6/2009

FCC Rule	Description Of Test	Result	Page
§2.1049	Measurement of 20dB Bandwidth	Compliant	8
§15.225(a), (b), and (c)	Radiated Spurious Emissions, In Band	Compliant	11
§15.225(d)	Radiated Spurious Emissions, Out Of Band	Compliant	13
§15.109	Receiver Spurious Emissions	Compliant	17
§15.107, §15.207	Power Line Conducted Emissions	Compliant	19
§15.225(e)	Frequency Stability	Compliant	24

3 TEST FACILITY

The INTERTEK-Lexington is located at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1: 1993 and ANSI C63.4: 1992. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

The test site is listed with the FCC under registration number 485103. The test site is listed with Industry Canada under site number IC 2042M-1.



3.1 Test Equipment

Description	Manufacturer	Model Number	Serial Number	Calibration due date
Environmental Chamber	Thermotron	SM-8-C	32692	1/29/2010
EMI Receiver	Rohde & Schwarz	ESI 26	1088.7490	8/28/2009
EMC Analyzer	Agilent Technologies	E7405	2142	9/5/2009
Bilog Antenna	ETS	3142C	00051864	12/24/2009
Loop Antenna	ETS	6502	3416	2/26/2010
LISN	Fischer Custom Communication	FCC-LISN-50-50-2M	1026	5/6/2009

4 MEASUREMENT OF 20DB BANDWIDTH

4.1 Test Procedure (FCC Rule: §2.1049)

The 20dB bandwidth measurement was performed with a spectrum analyzer connected to a receiving antenna. The test sample was made to transmit and the 20dB bandwidth was measured.

4.2 Test Results

The 20dB bandwidth test results are located in Table 4-1 and in Figure 4-1 through Figure 4-2.

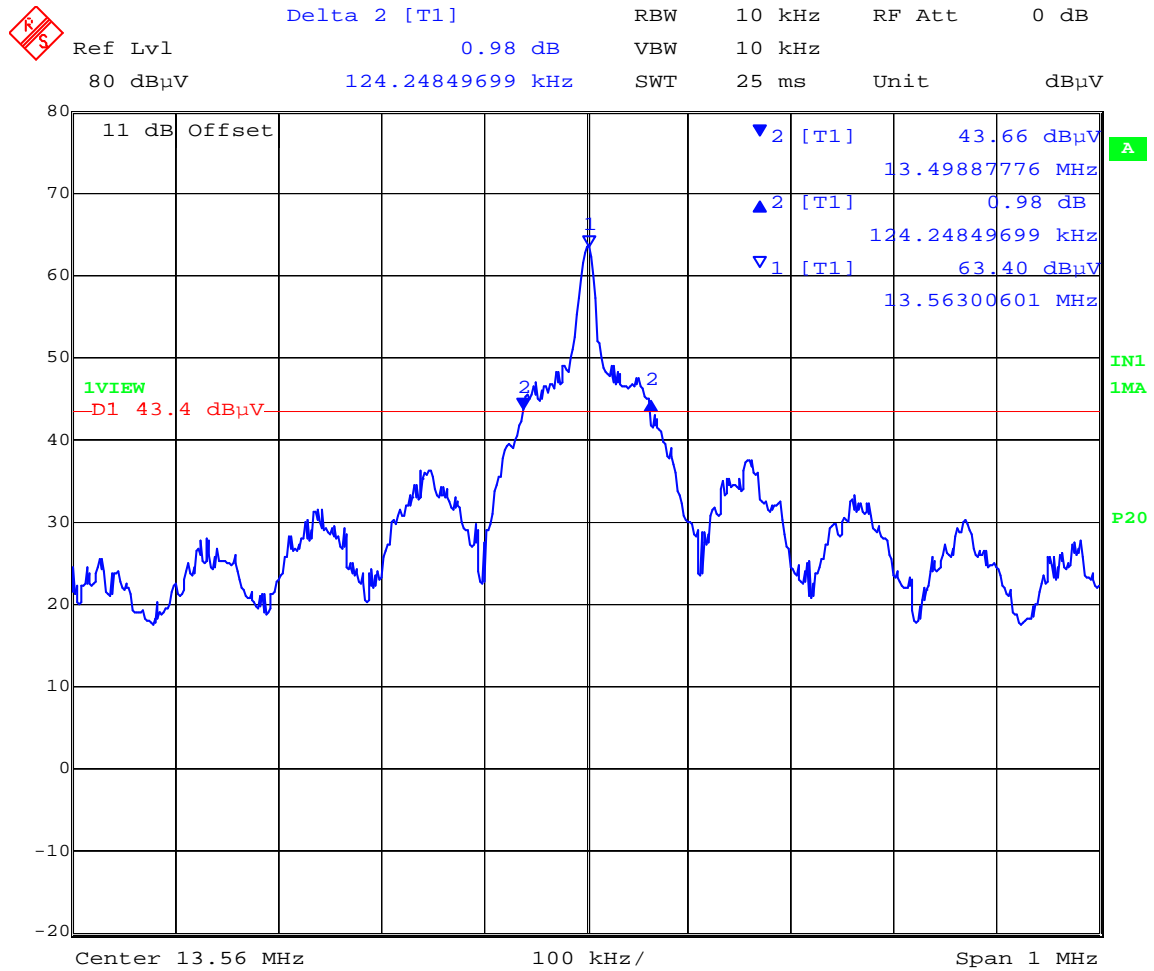
Table 4-1: 20dB Bandwidth Measurements

Mode	Frequency (MHz)	20dB Bandwidth
With Tag Present	13.56	126.25kHz
Without Tag Present	13.56	124.24kHz

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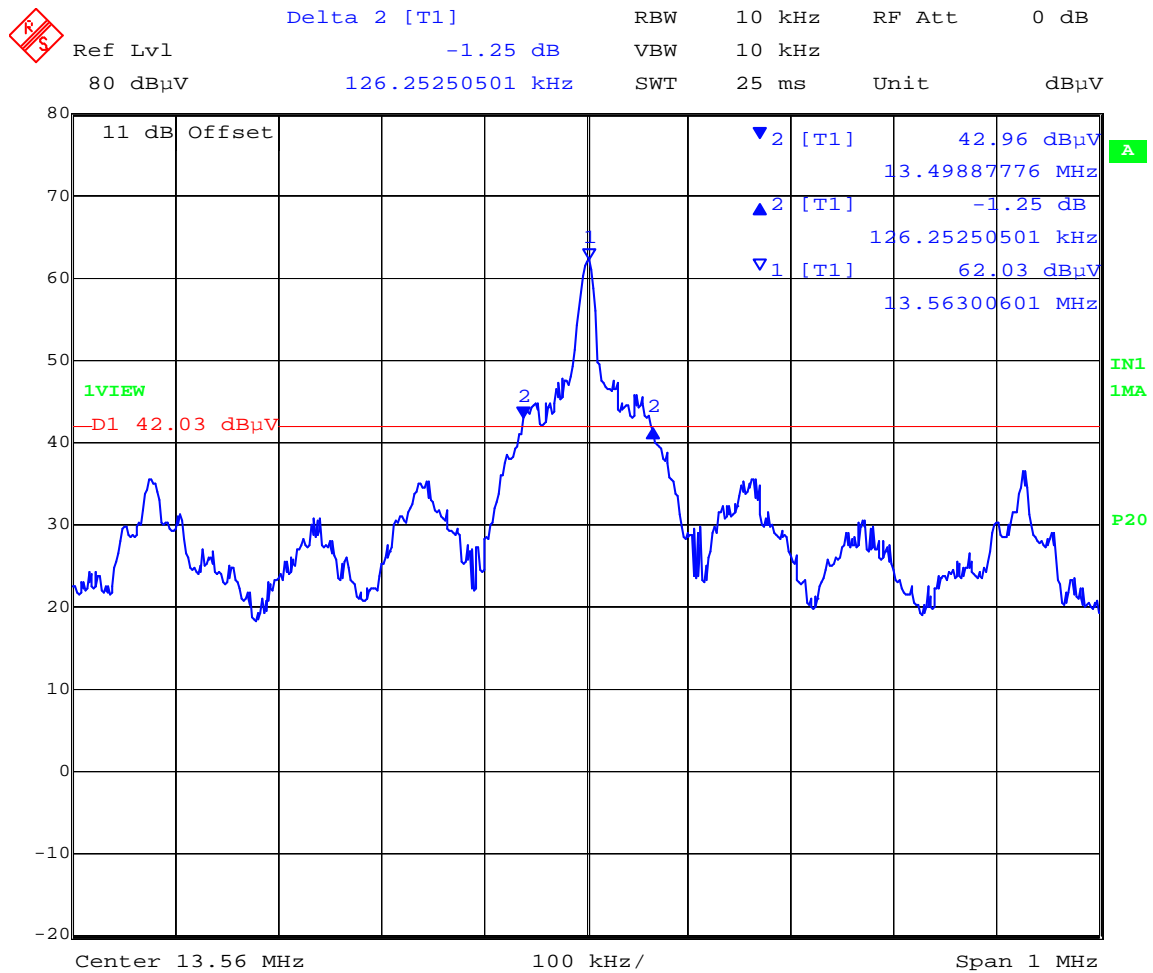
FCC ID: W3U800011002

Figure 4-1: 20dB Bandwidth, No Tag Present



Date: 1.MAY.2009 12:27:33

Figure 4-2: 20dB Bandwidth, Tag Present



Date: 1.MAY.2009 12:30:07

5 RADIATED SPURIOUS EMISSIONS, IN BAND**5.1 Test Procedure for FCC Rule §15.225(a), (b), (c)**

The External Reader Writer was placed on a non-conductive table and set to continuously transmit at its highest output power level. The spurious emission test was performed with a tag present and repeated without the tag present. The procedures from ANSI C63.4 were used for the radiated measurements from 9kHz – 1GHz as outlined below:

Procedure for Frequencies Less Than 30MHz:

The 13.11MHz – 14.01MHz range was measured with a loop antenna positioned 3 meters from the EUT with the center of the loop 1m above the reference ground plane. During the tests, the antenna and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. Final measurements were performed using CISPR quasi-peak detection.

5.2 In-Band Radiated Spurious Emissions Criteria

§ 15.225 Operation within the band 13.110–14.010 MHz.

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The radiated emission limits from §15.225 were adjusted for a 3m test distance as shown in Table 5-1. The limits were adjusted using a 40dB/decade extrapolation factor as specified in §15.31(f)(2).

Table 5-1: Radiated Emission Limit for FCC §15.225 (a), (b), and (c)

§15.225	Frequency (MHz)	Field Strength Limits (uV/m)	Measurement Distance (Meters)	Field Strength Limits, (dB µV/m)	Field Strength Limits, (dB µV/m) @ 3m
(a)	13.553 to 13.567	15,848	30	84	124
(b)	13.410 to 13.553 13.567 to 13.710	334	30	50.47	90.47
(c)	13.110 to 13.410 13.710 to 14.010	106	30	40.5	80.5

5.3 Test Results

The 8000-011-002 External Reader Writer met the in band radiated spurious emission criteria of FCC §15.225(a), (b), and (c). The test data is shown in Table 6-1.

Table 5-2: In Band Radiated Spurious Emissions (Quasi-Peak Detection)^{1 2}

TX Mode	Frequency	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (deg)	Results
No Tag	13.559 MHz	0.37	10.72	65.09	124	-58.91	120	Compliant
Tag Present	13.559 MHz	0.37	10.72	63.59	124	-60.41	121	Compliant

The final amplitude is computed from the measured receiver amplitude by adding a correction factor associated with the Antenna and cable loss as shown in the formula below.

$$FM = RA + CF + AF \text{ where, } FM = \text{Final Measurement, } RA = \text{Receiver Amplitude, } CF = \text{Cable Factor, and } AF = \text{Antenna Factor}$$

¹ Other than the fundamental emission, there were no emissions in the 13.11MHz – 14.01MHz range within 40dB of the limit.

² These readings represent the worst case with the test sample positioned in orthogonal x, y, and z directions.

6 RADIATED SPURIOUS EMISSIONS, OUT OF BAND

6.1 Test Procedure for FCC Rule §15.225(d)

The External Reader Writer was placed on a non-conductive table and set to continuously transmit at its highest output power level. The spurious emission test was performed with a tag present and repeated without the tag present. The procedures from ANSI C63.4 were used for the radiated measurements from 9kHz – 1GHz as outlined below:

Procedure for Frequencies Less Than 30MHz:

The 9kHz - 30MHz range was measured with a loop antenna positioned 3 meters from the EUT with the center of the loop 1m above the reference ground plane. During the tests, the antenna and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. Final measurements were performed using CISPR Quasi-Peak detection.

Procedure for Frequencies Greater Than 30MHz:

The 30MHz – 1GHz range was measured with a bilog antenna positioned 3 meters from the EUT. During the tests, the antenna height, polarity, and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. Final measurements were performed using CISPR quasi-peak detection.

6.2 Out of Band Radiated Spurious Emissions Criteria

§15.225(d): The field strength of any emissions appearing outside the 13.110 – 14.010MHz band shall not exceed the general radiated emission limits in §15.209.

All testing was performed with a measurement distance of 3m. The general radiated emission limits from §15.209 were adjusted for a 3m test distance below 30MHz as shown in Table 6-1. The limits were adjusted using a 40dB/decade extrapolation factor as specified in §15.31(f)(2).

Table 6-1: Radiated Emission Limit for FCC §15.209(a)

Frequency (MHz)	Field Strength Limits (uV/m)	Measurement Distance (Meters)	Field Strength Limits, (dB µV/m)	Field Strength Limits, (dB µV/m) @ 3m
0.009 to 0.490	2400/F (kHz)	300	48.5 to 13.8	128.5 to 93.8
0.490 to 1.705	24000/F (kHz)	30	33.7 to 22.9	73.7 to 62.9
1.705 to 30	30	30	29.5	49.5
30 to 88	100	3	40.0	40.0
88 to 216	150	3	43.5	43.5
216 to 960	200	3	46.0	46.0
960 and up	500	3	54.0	54.0

6.3 Test Results

The 8000-011-002 External Reader Writer met the out of band radiated spurious emission criteria of FCC §15.209 and §15.225(d). The test data is shown in Table 6-2 and Table 6-3. The graphical scans are shown in Figure 6-1 through Figure 6-4

Table 6-2: Out of Band Radiated Spurious Emissions (Without Tag)

Frequency	Polarity (H/V)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (deg)	Tower (cm)	Results
663.9 MHz	H	3.53	20.69	35.06	46.02	-10.96	-7	136	Compliant
299.74 MHz	V	2.3	13.87	28.29	46.02	-17.73	219	125	Compliant
495.25 MHz	V	3.04	17.69	30.76	46.02	-15.26	278	180	Compliant
663.76 MHz	V	3.53	19.68	30.12	46.02	-15.9	136	179	Compliant

Table 6-3: Out of Band Radiated Spurious Emissions (With Tag)

Frequency	Polarity (H/V)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (deg)	Tower (cm)	Results
40.676 MHz	H	0.81	12.83	31.46	40	-8.54	173	248	Compliant
67.791 MHz	H	1.07	6.44	28.9	40	-11.1	214	275	Compliant
244.05 MHz	H	2.11	12.3	34	46.02	-12.02	261	116	Compliant
583.05 MHz	H	3.3	19.97	39.39	46.02	-6.63	127	122	Compliant
40.68 MHz	V	0.81	10.53	26.27	40	-13.73	178	100	Compliant
67.8 MHz	V	1.08	6.5	29.56	40	-10.44	138	180	Compliant
122.03 MHz	V	1.45	7.34	27.83	43.52	-15.69	138	180	Compliant
495.25 MHz	V	3.04	17.69	35.5	46.02	-10.52	181	192	Compliant
663.8 MHz	V	3.53	19.68	36.06	46.02	-9.96	118	206	Compliant

The final quasi peak or average amplitude is computed from the measured receiver amplitude by adding a correction factor associated with the Antenna and cable loss as shown in the formula below.

$$FM = RA + CF + AF \text{ where, } FM = \text{Final Measurement, } RA = \text{Receiver Amplitude, } CF = \text{Cable Factor, and } AF = \text{Antenna Factor}$$

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Figure 6-1: Out of Band Radiated Spurious Emissions (Below 30MHz Transmitting Without Tag)³

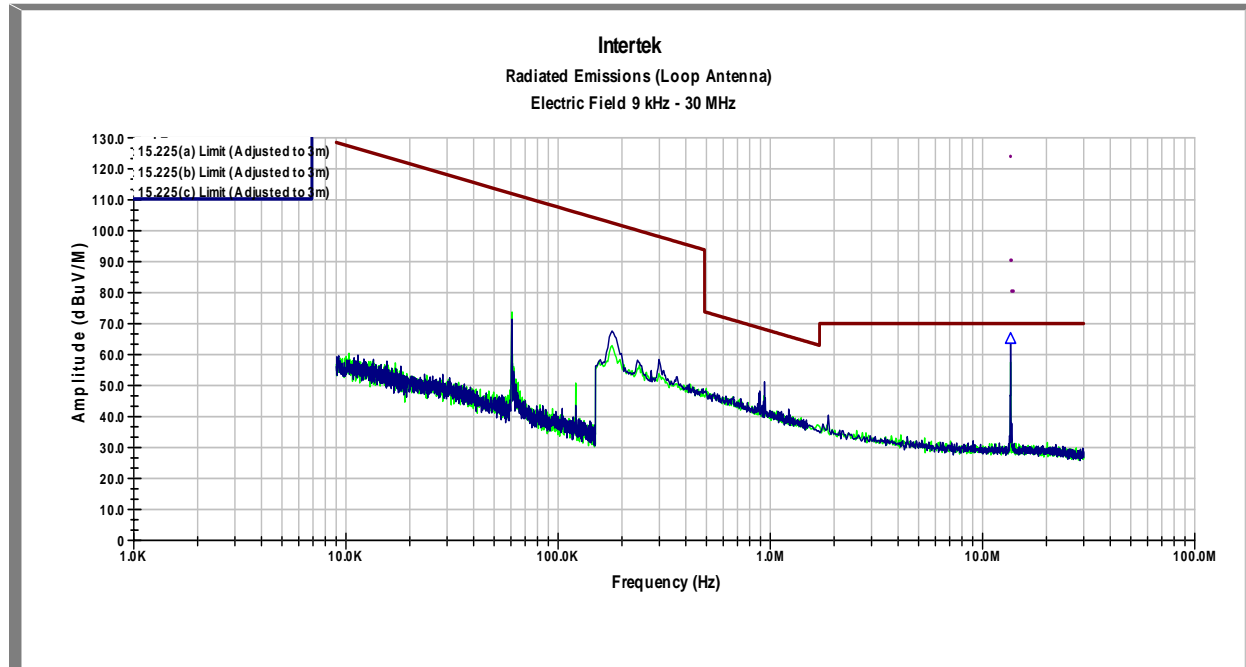
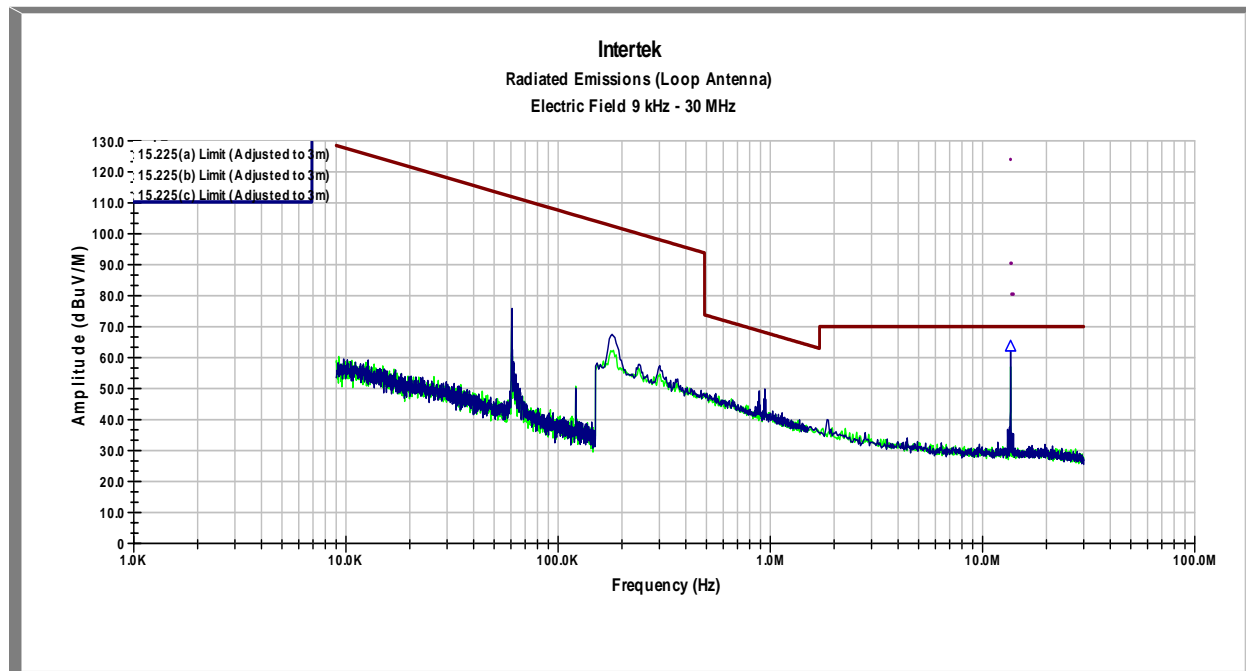


Figure 6-2: Out of Band Radiated Spurious Emissions (Below 30MHz Transmitting With Tag)³



³ The emission appearing at 13.56MHz in these graphs is the wanted fundamental signal coming from the test sample. It is not a spurious emission.

Figure 6-3: Out of Band Radiated Spurious Emissions (Above 30MHz Transmitting Without Tag)

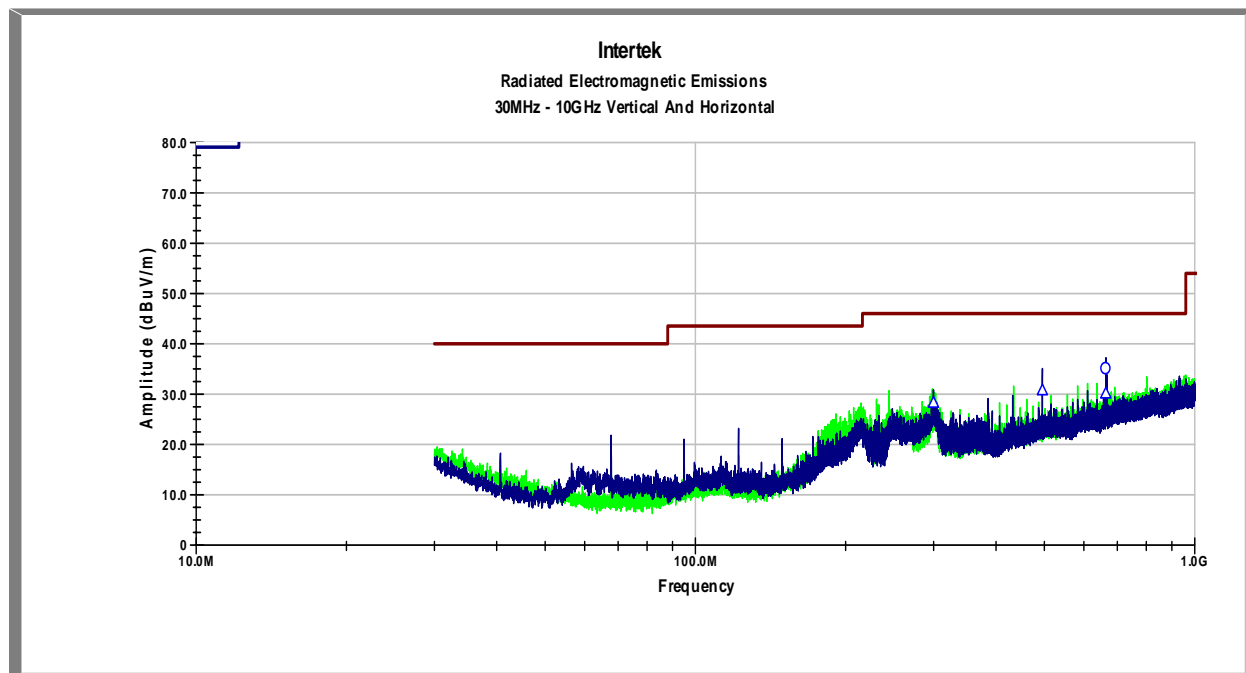
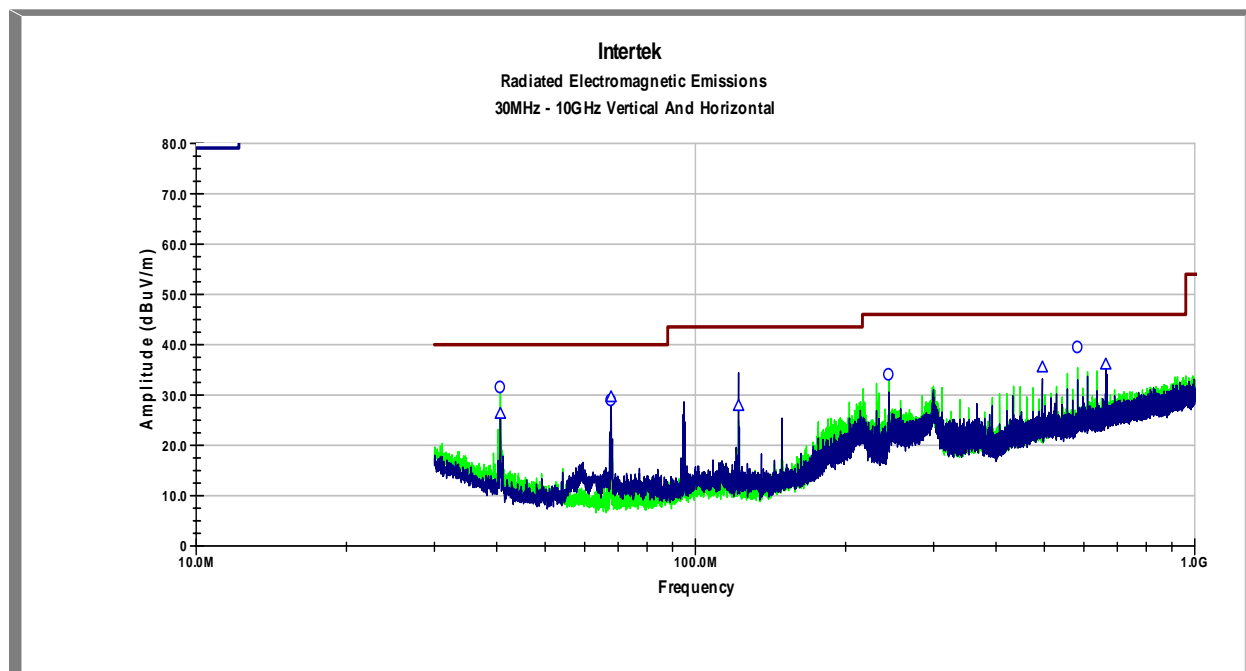


Figure 6-4: Out of Band Radiated Spurious Emissions (Above 30MHz Transmitting With Tag)



7 RECEIVER SPURIOUS EMISSIONS

7.1 Test Procedure (FCC §15.109)

Measurements are made over the frequency range of 30 MHz to five times the highest frequency operating within the device. The measuring receiver meets the requirements of CISPR 16 and the measuring antenna correlates to a balanced dipole. From 30 to 1000 MHz, a quasi-peak detector was used for measurement. Above 1000 MHz average measurements were performed.

Measurements of the radiated field are made with the antenna located at a distance of 3 meters from the EUT. If the field-strength measurements at 3m cannot be made because of high ambient noise level or for other reasons, measurements may be made at a closer distance, for example 1m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4.

7.2 Receiver Spurious Emissions Criteria

All testing was performed with a measurement distance of 3m and are shown in Table 7-1.

Table 7-1 Radiated Emission Limit for FCC §15.109(a)

Frequency (MHz)	Field Strength Limits (uV/m)	Measurement Distance (Meters)	Field Strength Limits, (dB µV/m)
30 to 88	100	3	40.0
88 to 216	150	3	43.5
216 to 960	200	3	46.0
960 and up	500	3	54.0

7.3 Test Results

The 8000-011-002 External Reader Writer is **compliant** with the radiated disturbance requirements of FCC §15.109 for a class B device. The table in Figure 7-1 and the graph in Figure 7-2 show that there are no emissions above the limits specified in §15.109.

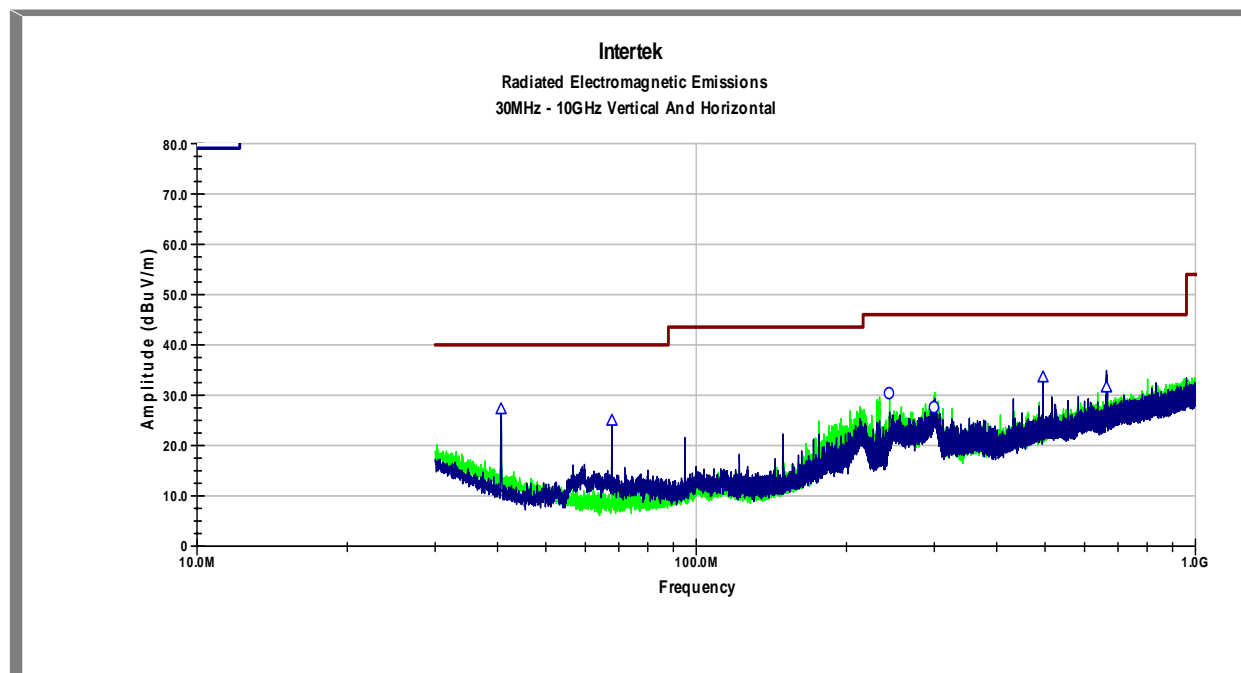
Figure 7-1: FCC §15.109 Receiver Spurious Emission (Quasi-Peak Readings)

Frequency	Polarity (H/V)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (deg)	Tower (cm)	Results
244.05 MHz	H	2.11	12.3	30.3	46.02	-15.72	265	121	Compliant
300.0 MHz	H	2.3	14	27.47	46.02	-18.55	161	100	Compliant
40.68 MHz	V	0.81	10.53	27.23	40	-12.77	35	99	Compliant
67.795 MHz	V	1.07	6.5	24.94	40	-15.06	147	109	Compliant
495.25 MHz	V	3.04	17.69	33.54	46.02	-12.48	256	206	Compliant
663.83 MHz	V	3.53	19.68	31.56	46.02	-14.46	119	188	Compliant

The final quasi peak amplitude is computed from the measured receiver amplitude by adding a correction factor associated with the Antenna and cable loss as shown in the formula below.

FM = RA + CF + AF where, FM = Final Measurement, RA = Receiver Amplitude, CF = Cable Factor, and AF = Antenna Factor

Figure 7-2: FCC §15.109 Receiver Spurious Emission (Vertical and Horizontal)



8 POWER LINE CONDUCTED EMISSIONS

8.1 Test Procedure (FCC §15.207 and §15.107)

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

8.2 Power Line Conducted Emissions Criteria

The RF energy radiated back onto the public utility (AC Power Lines) shall not exceed the values in the following table when measured with the corresponding detector function.

Table 8-1 Conducted Emission Limit for FCC §15.207(a) and §15.107(a)

Frequency Range (MHz)	FCC Part 15.207(a) Quasi Peak Limit (dBuV)	FCC Part 15.207(a) Average Limit (dBuV)
0.15 – 0.5 MHz	66 to 56	56 to 46
0.5 – 5.0 MHz	56	46
5.0 - 30 MHz	60	50

8.3 Test Results

The 8000-011-002 External Reader Writer met the power line conducted emission requirements of §15.207 and §15.107. See Figure 8-1 for tabular data with the device in transmit and receive modes. See Figure 8-1 through Figure 8-5 for the test results with the device in transmit and receive modes. The test was performed on the AC input to the laptop computer providing the DC voltage to the 8000-011-002 External Reader Writer.

In order to obtain these passing results, the power cables (both DC and AC) connecting to the AC power adapter for the laptop had to be fitted with ferrite beads (Fair-Rite part number 0431177081). The test results presented in the following exhibits were obtained with the ferrite beads in place.

Figure 8-1: FCC §15.207 Power Line Conducted Emissions

Operating Mode	Line	Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta (dB)	Average (dBuV)	Average Limit (dBuV)	Average Delta (dB)	Results
With Tag Present	Line 1	159.0 KHz	45.82	65.52	-19.7	35.97	55.52	-19.55	Compliant
	Line 1	303.0 KHz	48.01	60.16	-12.15	36.04	50.16	-14.12	Compliant
	Line 1	474.0 KHz	46.37	56.44	-10.07	43.76	46.44	-2.68	Compliant
	Line 1	744.0 KHz	47.08	56	-8.92	43.6	46	-2.4	Compliant
	Line 1	1.014	45.99	56	-10.01	40.84	46	-5.16	Compliant
	Line 1	1.12 MHz	45.83	56	-10.17	42.16	46	-3.84	Compliant
	Line 1	1.2234	44.44	56	-11.56	41.65	46	-4.35	Compliant
	Line 1	1.49 MHz	45.78	56	-10.22	41.24	46	-4.76	Compliant
	Line 1	1.86 MHz	44.7	56	-11.3	38.7	46	-7.3	Compliant
	Line 1	13.56	39.83	60	-20.17	37.45	50	-12.55	Compliant
	Line 2	303.0 KHz	47.89	60.16	-12.27	36.02	50.16	-14.14	Compliant
	Line 2	385.7 KHz	48.79	58.16	-9.36	34.69	48.16	-13.46	Compliant
	Line 2	476.7 KHz	46.28	56.4	-10.11	44.65	46.4	-1.74	Compliant
	Line 2	744.0 KHz	46.84	56	-9.16	43.63	46	-2.37	Compliant
	Line 2	1.014	45.6	56	-10.4	41.21	46	-4.79	Compliant
	Line 2	1.122	45.9	56	-10.1	40.32	46	-5.68	Compliant
	Line 2	1.49 MHz	46.59	56	-9.41	41.82	46	-4.18	Compliant
	Line 2	1.5983	46.14	56	-9.86	42.07	46	-3.93	Compliant
	Line 2	1.869	46.06	56	-9.94	40.78	46	-5.22	Compliant
	Line 2	1.9759	45.79	56	-10.21	38.4	46	-7.6	Compliant
	Line 2	2.1121	34.67	56	-21.33	27.79	46	-18.21	Compliant
No Tag	Line 1	150.0 KHz	45.82	66	-20.18	34.15	56	-21.85	Compliant
	Line 1	375.0 KHz	48.12	58.39	-10.27	46.13	48.39	-2.26	Compliant
	Line 1	749.4 KHz	47.69	56	-8.31	44.82	46	-1.18	Compliant
	Line 1	1.023	45.82	56	-10.18	39.88	46	-6.12	Compliant
	Line 1	1.5001	45.62	56	-10.38	39.39	46	-6.61	Compliant
	Line 1	13.56	41.08	60	-18.92	39.19	50	-10.81	Compliant
	Line 2	150.0 KHz	44.74	66	-21.26	31.01	56	-24.99	Compliant
	Line 2	374.8 KHz	46.24	58.39	-12.16	43.98	48.39	-4.42	Compliant
	Line 2	475.0 KHz	45.83	56.43	-10.59	43.89	46.43	-2.53	Compliant
	Line 2	749.4 KHz	47.16	56	-8.84	43.92	46	-2.08	Compliant
	Line 2	1.023	44.61	56	-11.39	38.34	46	-7.66	Compliant
	Line 2	1.3294	41.01	56	-14.99	37.86	46	-8.14	Compliant
	Line 2	1.5001	45.96	56	-10.04	38.6	46	-7.4	Compliant
	Line 2	1.602	45.85	56	-10.15	39.77	46	-6.23	Compliant
	Line 2	1.8673	45.92	56	-10.08	40.65	46	-5.35	Compliant
	Line 2	1.9742	45.79	56	-10.21	39.78	46	-6.22	Compliant
	Line 2	13.56	42.25	60	-17.75	40.24	50	-9.76	Compliant

The final quasi peak or average amplitude is computed from the measured receiver amplitude by adding a correction factor associated with the LISN and cable loss as shown in the formula below.

$$FM = RA + CF + LF \text{ where, } FM = \text{Final Measurement, } RA = \text{Receiver Amplitude, } CF = \text{Cable Factor, and } LF = \text{LISN Factor}$$

Evaluation For: Sargent and Greenleaf Inc.
Model Number: 8000-011-002

FCC ID: W3U800011002

Figure 8-2: FCC §15.207 Power Line Conducted Emissions (Tag Present)

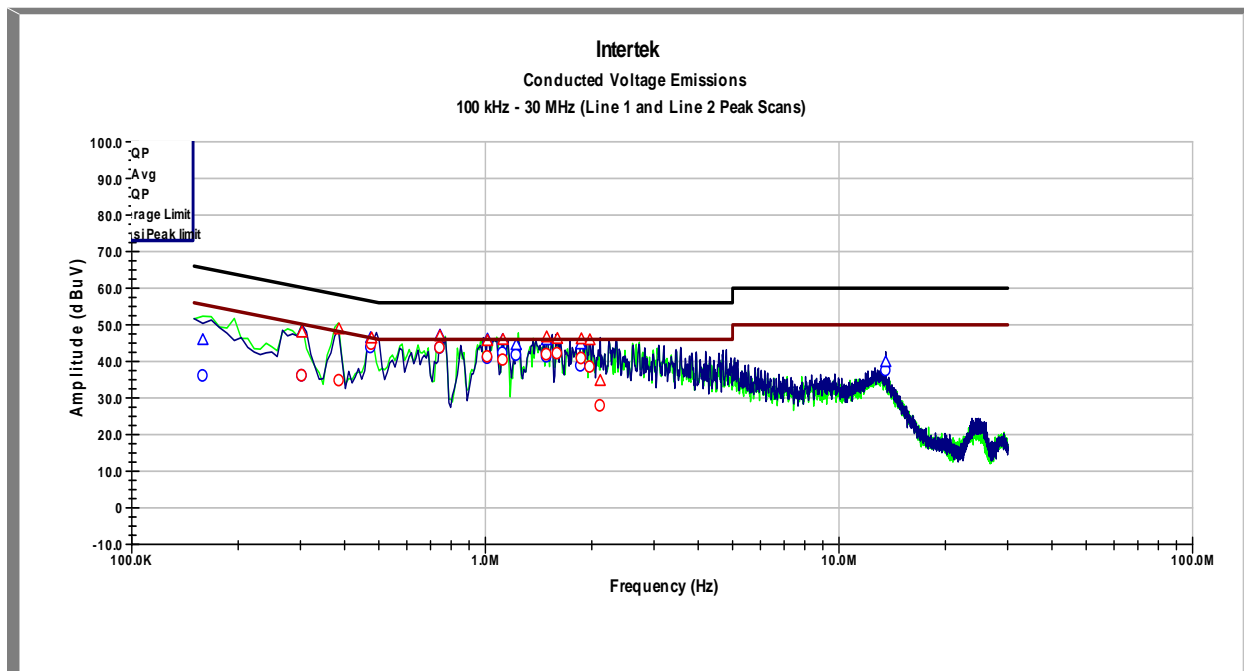


Figure 8-3: FCC §15.207 Power Line Conducted Emissions (No Tag)

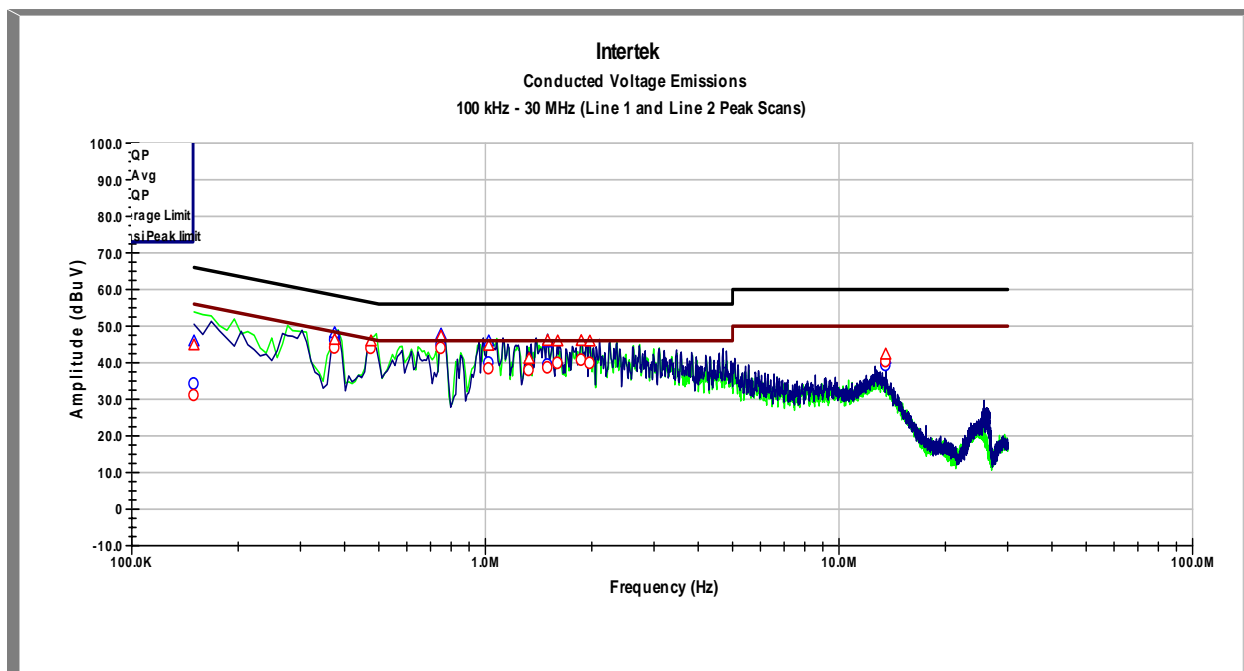


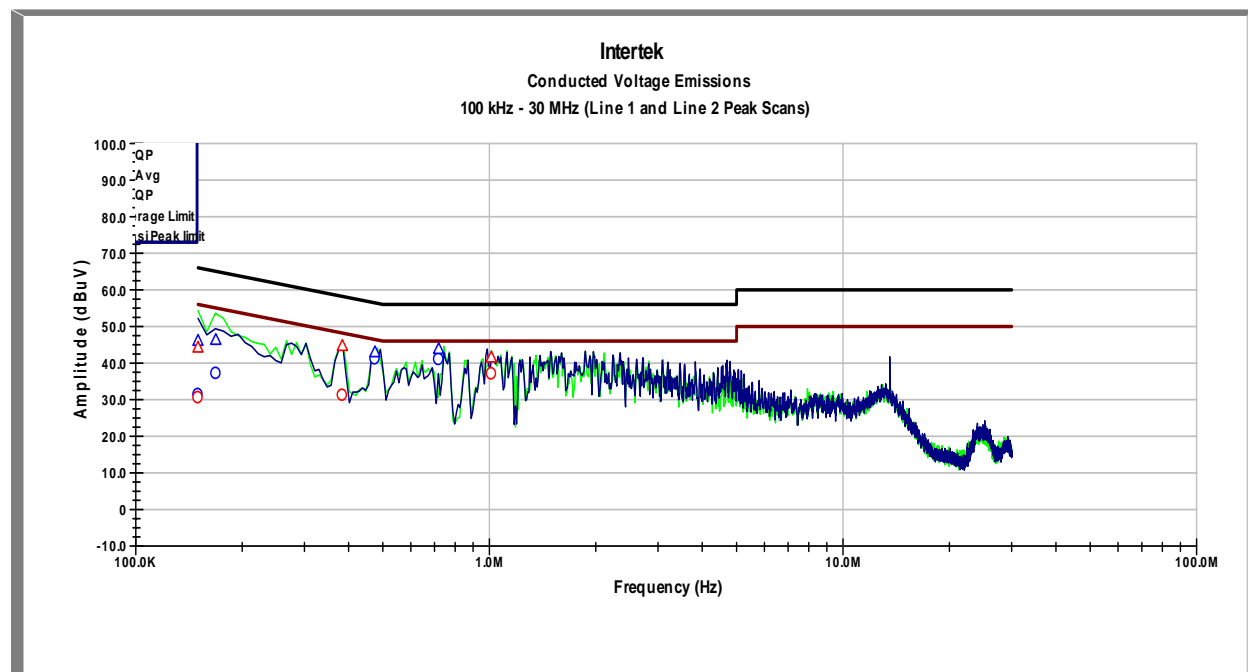
Figure 8-4: FCC §15.107 Power Line Conducted Emissions

Operating Mode	Line	Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta (dB)	Average (dBuV)	Average Limit (dBuV)	Average Delta (dB)	Results
Receive Mode	Line 1	150.0 KHz	46.08	66	-19.92	31.36	56	-24.64	Compliant
	Line 1	168.5 KHz	46.33	65.03	-18.7	37.14	55.03	-17.89	Compliant
	Line 1	474.7 KHz	42.97	56.43	-13.46	41.13	46.43	-5.3	Compliant
	Line 1	719.0 KHz	43.83	56	-12.17	41	46	-5	Compliant
	Line 2	150.0 KHz	44.23	66	-21.77	30.51	56	-25.49	Compliant
	Line 2	384.0 KHz	44.67	58.19	-13.52	31.17	48.19	-17.02	Compliant

The final quasi peak or average amplitude is computed from the measured receiver amplitude by adding a correction factor associated with the LISN and cable loss as shown in the formula below.

$$FM = RA + CF + LF \text{ where, } FM = \text{Final Measurement, } RA = \text{Receiver Amplitude, } CF = \text{Cable Factor, and } LF = \text{LISN Factor}$$

Figure 8-5: FCC §15.107 Power Line Conducted Emissions (Receive Mode)



9 FREQUENCY STABILITY

9.1 Test Procedure for FCC Rule §15.225(e)

The External Reader Writer was placed inside an environmental chamber and connected to the laptop computer. A near field probe, also located inside the environmental chamber was used to measure the wanted signal from the External Reader Writer. The probe was connected to a spectrum analyzer with an onboard frequency counter. The frequency was recorded at 10 degree intervals from +50C to -20C and at 85% and 115% power supply voltage.

9.2 Frequency Stability Criteria

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

9.3 Test Results

The 8000-011-002 External Reader Writer met the frequency stability criteria of FCC §15.225(e). The test data is shown in Table 9-1.

Table 9-1: Frequency Stability Measurements

Operating Frequency:		13,560,000 Hz	
Reference Voltage:		5.00 Vdc	
Deviation Limit ($\pm 0.01\%$):		1,356 Hz	
Voltage (%)	Temp (Centigrade)	Freq. (Hz)	Freq. Dev. (Hz)
100	-20	13,559,312.0	-688
100	-10	13,559,306.0	-694
100	0	13,559,316.0	-684
100	10	13,559,308.0	-692
100	20	13,559,290.0	-710
85	20	13,559,292.0	-708
115	20	13,559,295.0	-705
100	25	13,559,281.0	-719
100	30	13,559,270.0	-730
100	40	13,559,250.0	-750
100	50	13,559,236.0	-764