731 Enterprise Drive
Lexington, KY 40510

Telephone: 859-226-1000
Facsimile: 859-226-1040
www.intertek-etlsemko.com

TEST REPORT

Report Number:	**102774443LEX-005**
Project Number:	**G102774443**
Report Issue Date:	**1/12/2017**
Product Name:	**FUSE-001**
Standards:	**FCC Title 47 CFR Part 15.225** **RSS-210 Issue 9**
Radios Under Test:	**RFID**

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Drive
Lexington, KY 40510

Client:
Sparton Medical Systems
22740 Lunn Rd
Strongsville, OH 44149-4899

Report prepared by

Brian Lackey, Project Engineer

Report reviewed by

Bryan Taylor, Team Leader

TABLE OF CONTENTS

1 Introduction and Conclusion

The tests indicated in section 2 were performed on the product constructed as described in section 3. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test method, a list of the actual test equipment used, documentation photos, results and raw data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complied with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

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 and ANSI C63.4. 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.

2 Test Summary

Page	Test Name	FCC Reference	IC Reference	Result
6	20dB Bandwidth	§ 2.1049	RSS-GEN (4.6.1)	Pass
9	In-Band Radiated Spurious Emissions (Transmitter)	§ 15.225(a)(b)(c)	RSS-210 (A2.6)	Pass
11	Out of Band Radiated Spurious Emissions (Transmitter)	§ 15.225(d), § 15.209	RSS-210 (A2.6)	Pass
13	AC Powerline Conducted Emissions	§ 15.207	RSS-Gen (7.2.4)	Pass
15	Frequency Stability	§ 15.225(e)	RSS-210 (A2.6)	Pass
16	Antenna Requirement per FCC Part 15.203	§ 15.203	RSS-Gen (7.1.2)	Pass

3 Description of Equipment Under Test

Equipment Under Test	
Manufacturer	Sparton Medical Systems
Serial Number	Unit # 30
Receive Date	12/20/2016
Test Start Date	12/21/2016
Test End Date	1/5/2017
Device Received Condition	Good
Test Sample Type	Production
Frequency Band	13.56MHz
Mode(s) of Operation NFC	RFID Radio Transmitting
Transmission Control	Normal Operation
Antenna Type (15.203)	Internal
Power Supply	AC/DC converter

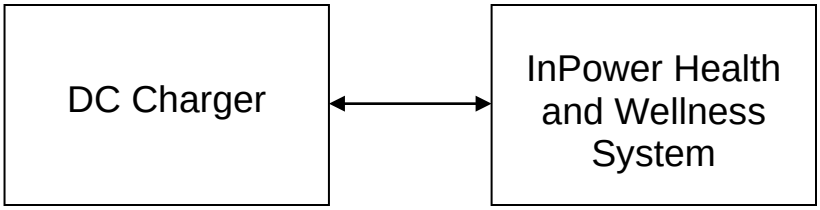
Description of Equipment Under Test
The InPower™ Wellness System consists of a solid medication dispenser (InPower™ Personal Medication Assistant), single-use medication pods, control software, and a pharmacy interface application. The medication dispenser provides audible and/or visual alerts when it is time to take a medication. The medication dispenser communicates with the pharmacy to provide information on how well you are taking your medication. The medication dispenser collects data via peripheral devices, such as glucometers, weight scales, etc.

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Test script opening and closing drawers, periodically reading RFID

3.1 System setup including cable interconnection details, support equipment and simplified block diagram

3.2 EUT Block Diagram:



3.3 Cables:

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
Power Cable	1m	No	No	DC Charger	Test Sample

4 20dB Bandwidth

4.1 Test Limits

None

4.2 Test Procedure

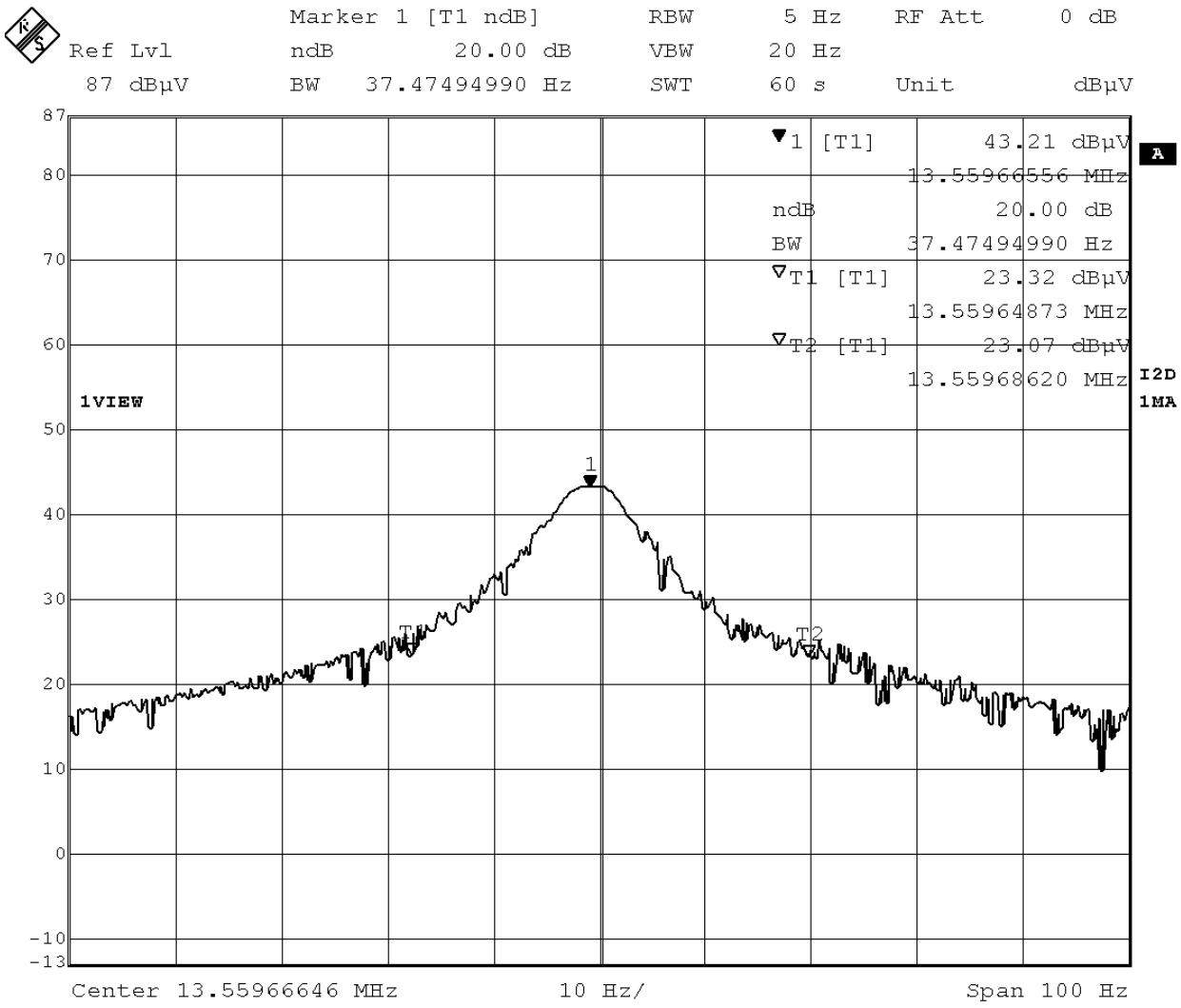
The 20dB bandwidth was measured by a spectrum analyzer connected to a receive antenna placed near the test sample while it is transmitting. The “N dB Down” function of the analyzer was used to mark the bandwidth.

4.3 Test Equipment Used:

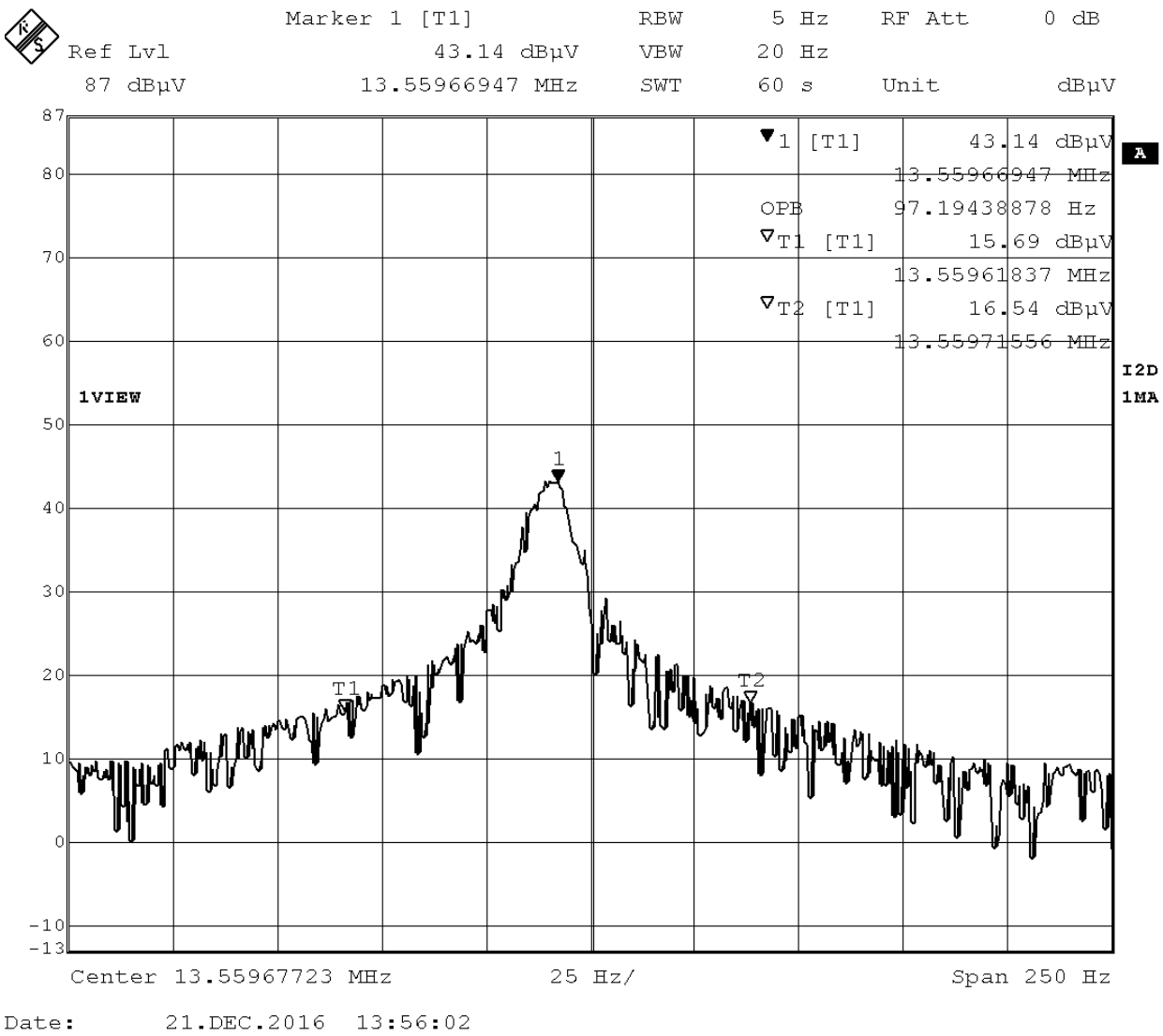
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/20/2016	9/20/2017
Near Field Probe	2179	Com-Power	PS-400	Calibration Not Required	

4.4 Results:

The 20dB bandwidth was measured to be 37.5 Hz as shown in the plot below.



20dB bandwidth of RFID transmitter



99% power bandwidth of RFID transmitter

5 In-Band Radiated Spurious Emissions (Transmitter)

5.1 Test Limits

§ 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.

5.2 Test Procedure

ANSI C63.10: 2014

5.3 Example of Field Strength Calculation Method:

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculations are listed below:

Formula:
FS = RA + AF + CF

FS = Field Strength in dBμV/m
RA = Receiver Amplitude in dBμV
AF = Antenna Factor in dB
CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dBμV
AF = 18.52 dB
CF = 0.78 dB

FS = 19.48 + 18.52 + 0.78 = 38.78 dBμV/m
Level in μV/m = Common Antilogarithm [(38.78 dBμV/m)/20] = 86.89 μV/m

5.4 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	9/20/2016	9/20/2017
Active Loop Antenna	3416	ETS	6502	6/2/2016	6/2/2017
3m Cable System				11/17/2016	11/17/2017
System Controller	121701-1	Sunol Sciences	SC99V	Calibration Not Required	Calibration Not Required

5.5 Results:

The spurious emissions listed in the following tables are the worst case emissions. Emissions not reported were at or below the measurement noise floor.

Worst Case Spurious Emissions (RFID Radio Transmitting)

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB)	Comment
13.434108	37.26	90.5	53.24	9kHz	0.0	11.7	
13.454632	39.42	90.5	51.08	9kHz	0.0	11.7	
13.559280	62.62	124.0	61.38	9kHz	0.0	11.7	
13.687184	38.60	90.5	51.90	9kHz	0.0	11.7	
13.771576	44.61	80.5	35.89	9kHz	0.0	11.7	
13.981137	35.56	80.5	44.94	9kHz	0.0	11.6	

Notes:

(1) Peak detection was used.

(2) All measurements were performed with a loop antenna positioned in three orthogonal axis with the level at the highest position being recorded.

(3) Measurements were performed at 3m distance and the level extrapolated to the specified measurement distance of 30m. An inverse linear distance extrapolation factor of 40dB/decade (from part 15.31(f)) was used to facilitate this. Extrapolation Factor = $20\log(30/3)^2$ = 40dB.

Manufacturer:	Sparton Medical Systems
Test Engineer:	Brian Lackey
Date:	12/22/2016
Temp/Humidity/Pressure:	21.7C/23.7%/992.2mbar
Comment:	Continuous RFID Operation

6 Out of Band Radiated Spurious Emissions (Transmitter)

6.1 Test Limits

6.2 § 15.225 Operation within the band 13.110-14.010 MHz.

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

Part 15.209(a): Field General Strength Limits for Restricted Bands of Operation

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / F (kHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

6.3 Test Procedure

ANSI C63.4: 2014

6.4 Example of Field Strength Calculation Method:

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculations are listed below:

Formula:
FS = RA + AF + CF

FS = Field Strength in dBμV/m
RA = Receiver Amplitude in dBμV
AF = Antenna Factor in dB
CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dBμV
AF = 18.52 dB
CF = 0.78 dB

FS = 19.48 + 18.52 + 0.78 = 38.78 dBμV/m
Level in μV/m = Common Antilogarithm [(38.78 dBμV/m)/20] = 86.89 μV/m

6.5 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	9/26/2016	9/26/2017
Preamplifier	SF456200904	Mini-Circuits	ZX60-3018G-S+	11/17/2016	11/17/2017
Biconnilog Antenna	00051864	ETS	3142C	3/23/2016	3/23/2017
Active Loop Antenna	3416	ETS	6502	6/2/2016	6/2/2017
3m Cable System				11/17/2016	11/17/2017
System Controller	121701-1	Sunol Sciences	SC99V	Time of Use	Time of Use

6.6 Results:

All out of band emissions were below the general limits from Part 15.209. The sample was tested from 9kHz – 1GHz excluding the in band 13.110 – 14.010 MHz range. The spurious emissions listed in the following tables are the worst case emissions.

Worst Case Out of Band Spurious Emissions (NFC Radio Transmitting)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
26.725064	31.28	69.5	38.22	9.000	100	V	87.0	9.9
36.263000	30.40	40.00	9.60	120.000	109.7	V	145.0	21.1
49.989000	22.95	40.00	17.05	120.000	104.8	V	311.0	15.5
64.032000	37.26	40.00	2.74	120.000	104.9	V	55.0	14.2
79.966000	29.96	40.00	10.04	120.000	213.6	H	118.0	15.4
96.003000	40.98	43.52	2.54	120.000	110.0	V	7.0	16.7
108.480000	31.00	43.50	12.50	120.000	177.3	H	265.0	16.7
122.260000	23.32	43.50	20.18	120.000	287.5	H	82.0	16.4
140.400000	23.30	43.50	20.20	120.000	263.8	H	302.0	16.8

Notes:

(1) Quasi-Peak detection was used.

(2) All measurements below 30MHz were performed with a loop antenna positioned in three orthogonal axis with the level at the highest position being recorded.

(3) All measurements above 30MHz were performed with a bilog antenna maximized from 1-4m in height and in vertical and horizontal polarities.

(4) Measurements were performed at 3m distance.

Manufacturer:	Sparton Medical Systems
Test Engineer:	Brian Lackey
Date:	12/22/2016
Temp/Humidity/Pressure:	21.7C/23.7%/992.2mbar
Comment:	Continuous RFID Operation

7 AC Powerline Conducted Emissions

7.1 Test Limits

§ 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.

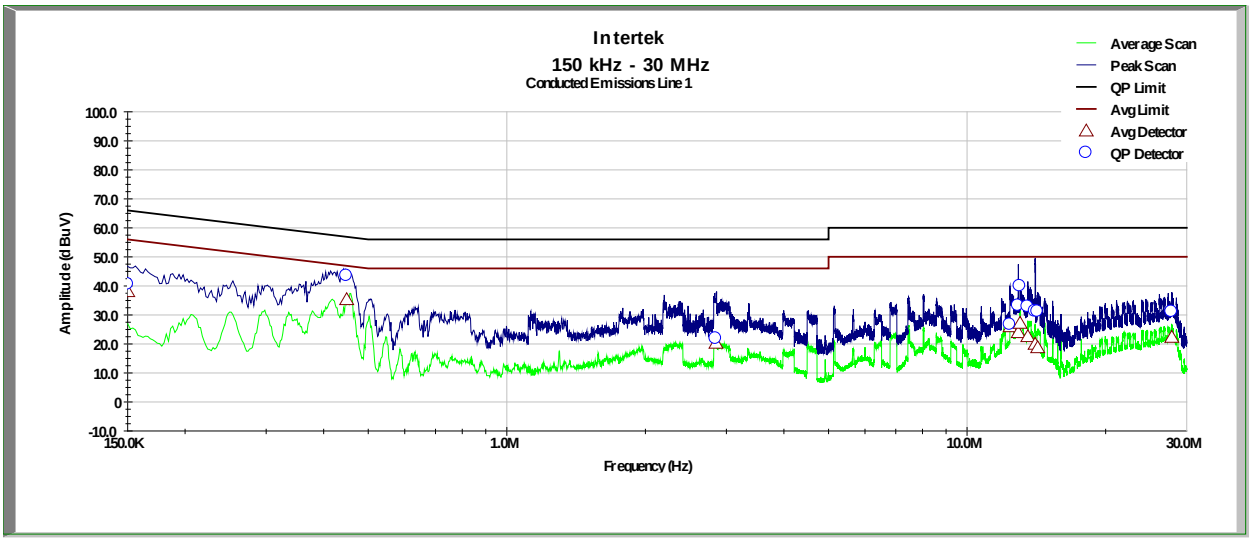
7.2 Test Procedure

ANSI C63.4: 2014

7.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/20/2016	9/20/2017
LISN	3333	Teseq	NNB52	6/3/2016	6/3/2017
Cable	COND2			11/17/2016	11/17/2017

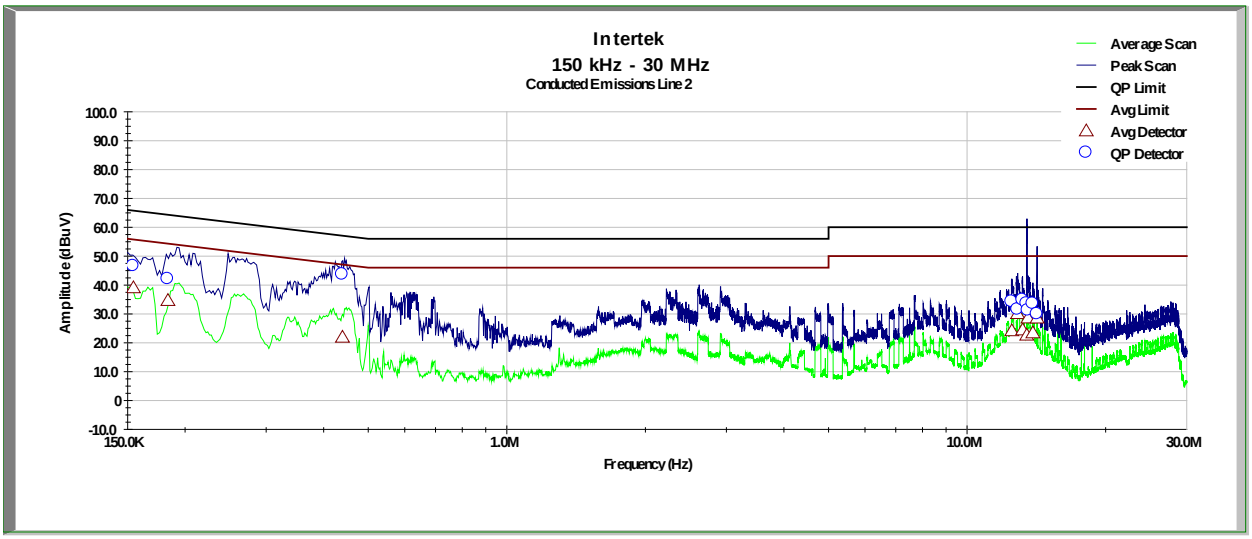
7.4 Results:



Line 1

Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
150.100 KHz	40.491	65.997	25.506	38.013	55.997	17.984
448.700 KHz	43.403	57.466	14.063	35.259	47.466	12.207
2.847 MHz	21.758	56.000	34.242	20.234	46.000	25.766
12.398 MHz	26.585	60.000	33.415	25.923	50.000	24.077
12.919 MHz	33.144	60.000	26.856	23.889	50.000	26.111
13.036 MHz	39.866	60.000	20.134	27.103	50.000	22.897
13.552 MHz	32.748	60.000	27.252	22.499	50.000	27.501
14.055 MHz	31.194	60.000	28.806	19.867	50.000	30.133
14.234 MHz	31.071	60.000	28.929	18.680	50.000	31.320
27.847 MHz	31.015	60.000	28.985	22.268	50.000	27.732

Line 1



Line 2

Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
154.400 KHz	46.537	65.874	19.337	39.019	55.874	16.855
183.500 KHz	42.026	65.043	23.017	34.636	55.043	20.407
439.500 KHz	43.599	57.729	14.129	21.900	47.729	25.828
12.508 MHz	34.160	60.000	25.840	24.128	50.000	25.872
12.871 MHz	31.479	60.000	28.521	30.082	50.000	19.918
13.204 MHz	34.776	60.000	25.224	24.438	50.000	25.562
13.481 MHz	33.567	60.000	26.433	22.628	50.000	27.372
13.567 MHz	31.161	60.000	28.839	28.585	50.000	21.415
13.903 MHz	33.507	60.000	26.493	23.410	50.000	26.590
14.194 MHz	29.846	60.000	30.154	28.561	50.000	21.439

Line 2

8 Frequency Stability

8.1 Test Limits

8.2 § 15.225 Operation within the band 13.110-14.010 MHz.

(e) The frequency tolerance of the carrier signal shall be maintained within ±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.

8.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3099	Rohde & Schwarz	FSP	9/20/2016	9/20/2017
Near Field Probe	2179	Com-Power	PS-400	Calibration Not Required	
Environmental Chamber	2149	Thermotron	SE-1000-5-5	3/28/2016	3/28/2017

8.4 Results:

The data below shows that the test sample meets the frequency stability requirements from Part 15.225.

Frequency Stability Test Data

Operating Freqeuncy:		13,560,000	Hz		
Channel:		RFID			
Reference Voltage:		120	VAC		
Deviation Limit:		0.01	% =	135600	Hz
Notes:					

Voltage (%)	Voltage (AC)	Temp (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)
100%	120.0	-30	13559730	-270	-0.0019882
100%	120.0	-20	13559671	-329	-0.0024277
100%	120.0	-10	13559678	-322	-0.0023717
100%	120.0	0	13559689	-311	-0.0022920
100%	120.0	10	13559656	-344	-0.0025383
100%	120.0	20	13559700	-300	-0.0022124
100%	120.0	30	13559648	-352	-0.0025973
100%	120.0	40	13559636	-364	-0.0026844
100%	120.0	50	13559620	-380	-0.0028009
100%	120.0	60	13559610	-390	-0.0028776
115%	138.0	20	13559707	-293	-0.0021578
85%	102.0	20	13559699	-301	-0.0022168

9 Antenna Requirement per FCC Part 15.203

9.1 Test Limits

§ 15.203: 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 manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

9.2 Results:

The sample tested met the antenna requirement. The device utilized an integral antenna.

10 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of k = 2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

Parameter	Uncertainty	Notes
Radiated emissions, 30 to 1000 MHz	±3.9dB	
Radiated emissions, 1 to 18 GHz	±4.2dB	
Radiated emissions, 18 to 40 GHz	±4.3dB	
Power Port Conducted emissions, 150kHz to 30 MHz	±2.8dB	

11 Revision History

Revision Level	Date	Report Number	Notes
0	1/12/2017	102774443LEX-005	Original Issue