RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

FCC Part 15.247 & IC RSS-210 Certification Report

Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com	Innovative Wireless Technologies, Inc. (IWT) 1047 Vista Park Dr., Suite A Tel: 434-316-5230 x14 Forest, VA 24551 Fax: 434-316-5232 Contact: Gary Raulerson, Jr.

FCC ID: **IC:**	SP8-FAP5015-050 9568A-FAP5015050	**Test Report Date:**	December 22, 2011
Platform:	N/A	**RTL Work Order Number:**	2011183
Model #:	FAP5015-050	**RTL Quote Number:**	QRTL11-249
American National Standard Institute:	ANSI C63.4-2003: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
American National Standard Institute:	ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices		
FCC Classification:	DTS – Part 15 Digital Transmission System		
FCC Rule Part(s):	FCC Rules Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System (10-01-10)		
IC Rule Part(s)	RSS-210 Issue 8: Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment		

Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
903.0 – 927.0	0.011	N/A	526KF1D

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, ANSI C63.4.

Signature: 

Date: December 22, 2011

Typed/Printed Name: Desmond A. Fraser

Position: President

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1 General Information

1.1 Scope

Applicable Standards:

- FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

1.2 Description of EUT

Equipment Under Test	Fixed Tracking Beacon (transmit only)
Model #	FAP5015-050
Power Supply	Two “C” Alkaline Batteries
Modulation Type	2-FSK
Frequency Range	903.0 – 927.0 MHz
Antenna Connector Type	Internal
Antenna Types	Internal Omni 3 dBi

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.4 Related Submittal(s)/Grant(s)

This is an original application for certification for Innovative Wireless Technologies, Inc., Model FAP5015-050, a Fixed Tracking Beacon (transmit only), FCC ID: SP8-FAP5015-050, IC: 9568A-FAP5015050.

1.5 Modifications

No modifications were required for compliance.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested:

Table 2-1: Frequencies Tested

Channel	Frequency
Low	903.0
Mid	915.0
High	927.0

2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

2.3 Test Result Summary

Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.247), IC RSS-210/RSS-Gen

FCC Reference	IC Reference	C63.10 Procedure	Test	Pass/Fail or N/A
FCC 15.207	RSS-Gen 7.2.4	6.2	AC Power Conducted Emissions	N/A
FCC 15.209	RSS-Gen 7.2.5	6.5, 6.6	Radiated Emissions	Pass
FCC 15.247(b)	RSS-210 A8.4	6.10	Maximum Peak Power Output	Pass
FCC 15.247(d)	RSS-210 A8.5	6.7	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	RSS-210 A8.5	6.9.2	Band Edge	Pass
FCC 15.247(a)(2)	RSS-210 A8.2	6.9.1	6 dB Bandwidth	Pass
FCC 15.247(e)	RSS-210 A8.2	6.11	Power Spectral Density	Pass

2.4 Test System Details

The test samples were received on December 6, 2011. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables.

Table 2-3: Equipment Under Test

Part	Manufacturer	Model #	Serial Number	FCC ID	RTL Bar Code
Tracking Beacon	Innovative Wireless Technologies, Inc.	FAP5015-050	SB00025	SP8-FAP5015-050	20252
Serial Interface PCB	Innovative Wireless Technologies, Inc.	FAP3100-005 (Bld Rev: R1A)	TBC1033017	N/A	20253

2.5 Configuration of Tested System

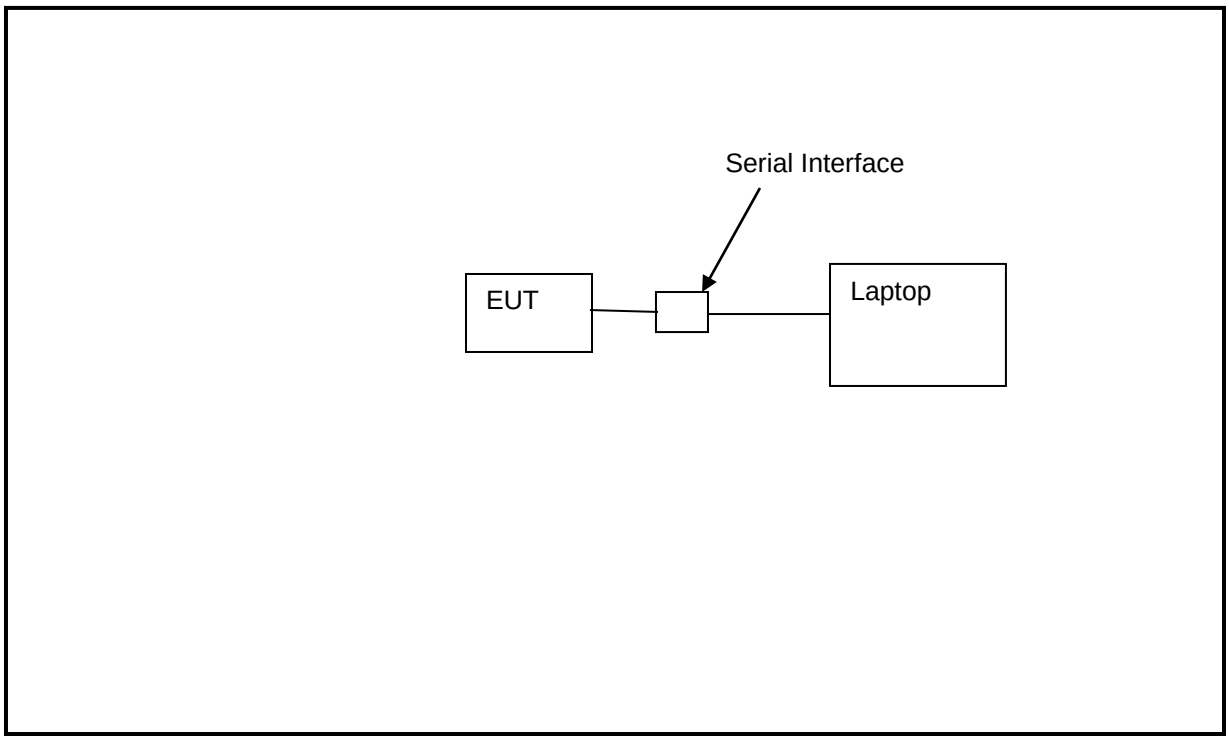


Figure 2-1: Configuration of System Under Test

3 Peak Output Power – FCC 15.247(b)(3); IC RSS-Gen

3.1 Power Output Test Procedure

A conducted power measurement of the EUT was taken using an Agilent power meter and sensor.

Procedure: C63.10-2009 6.10

Table 3-1: Power Output Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	1/20/12
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	1/20/12

3.2 Power Output Test Data

Table 3-2: Power Output Test Data

Frequency (MHz)	Peak Conducted Power (dBm)
903.0	10.2
915.0	9.7
927.0	9.2

Test Personnel:

Richard B. McMurray, P.E.	Richard B. McMurray	December 7, 2011
Test Engineer	Signature	Date of Test

4 Band Edge Compliance of RF Conducted Emissions – FCC 15.247(d); IC RSS-Gen

4.1 Band Edge Test Procedure

Procedure: C63.10-2009 6.9.2, 6.9.3

The EUT was connected to the spectrum analyzer through suitable attenuation. The span was set wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The spectrum analyzer was set to the following:

RBW > = 1% of the span
VBW > = RBW
Sweep = auto
Detector function = peak
Trace = max hold

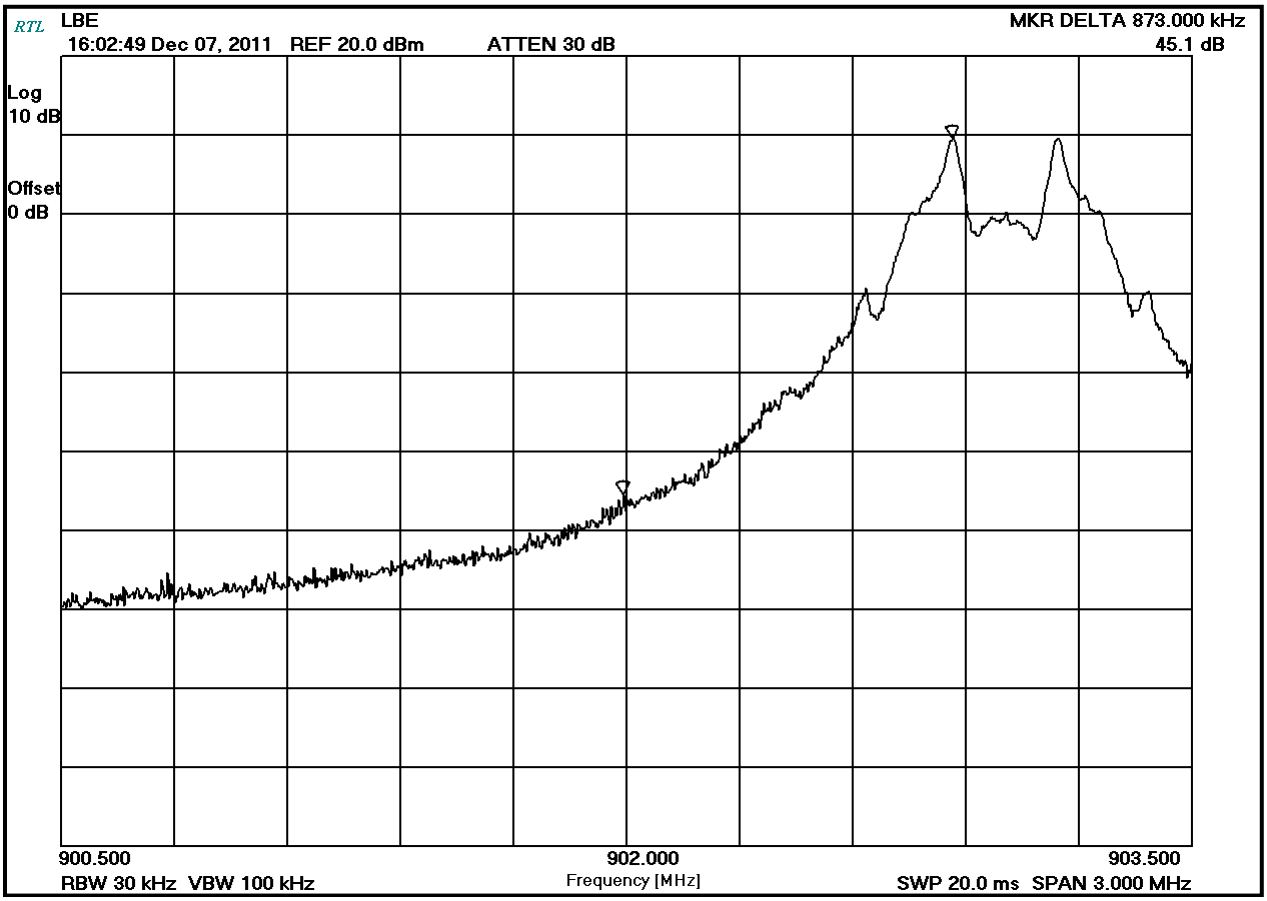
The trace was allowed to stabilize. The marker was set on the emission at the band edge. The marker-delta was used to show the delta between the maximum in-band emission and the emission at the band edge, and was compared to the 20 dBc requirement of 15.247(d) (when using peak emissions).

Table 4-1: Test Equipment

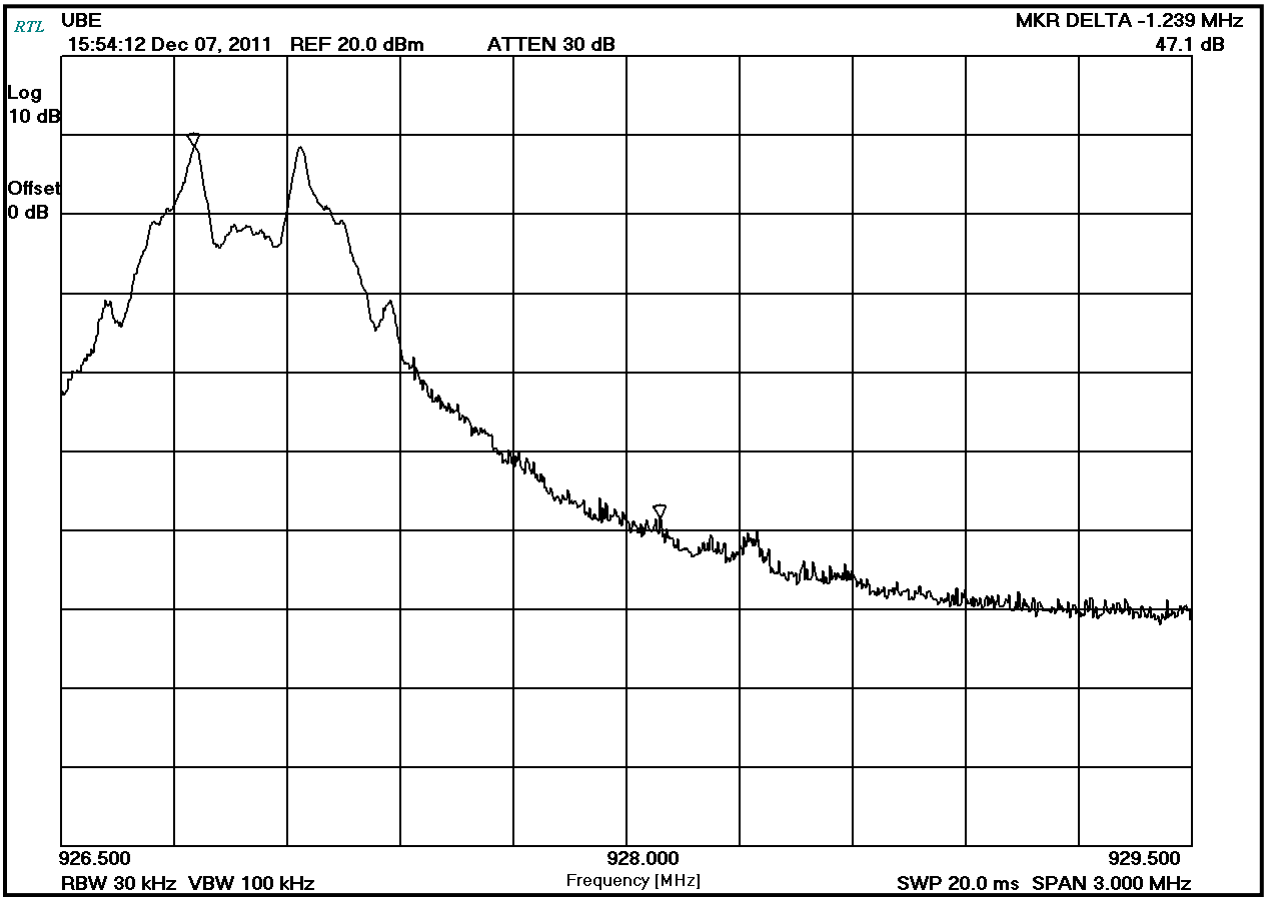
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	9/13/12
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	9/13/12

4.2 Test Results

Plot 4-1: Lower Band Edge (902 MHz Band Edge, 903.0 MHz Carrier)



Plot 4-2: Upper Band Edge (928 MHz Band Edge, 927.0 MHz Carrier)



Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	December 7, 2011
EMC Test Engineer	Signature	Date of Test

5 Antenna Conducted Spurious Emissions – FCC 15.247(d); IC RSS-Gen

5.1 Antenna Conducted Spurious Emissions Test Procedures

Procedure: C63.10-2009 6.7

Antenna spurious emissions per FCC 15.247(d) were measured from the EUT antenna port using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 100 kHz. The modulated carrier was identified at the following frequencies: 903.0 MHz, 915 MHz and 927.0 MHz. The carrier to the 10th harmonic of the carrier frequency was investigated.

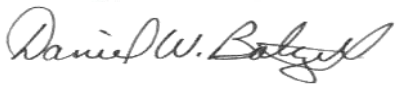
5.2 Antenna Conducted Spurious Emissions Test Results

All spurious emissions were greater than 20 dB below the limit (note that we are reporting power as peak). Per FCC 15.31(o), no data is being reported.

Table 5-1: Antenna Conducted Spurious Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	9/13/12
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	9/13/12

Test Personnel:

Daniel W. Baltzell		December 7, 2011
EMC Test Engineer	Signature	Date of Test

6 6 dB Bandwidth – FCC 15.247(a)(2); IC RSS-210 A8.2(a)

6.1 6 dB Bandwidth Test Procedure – Minimum 6 dB Bandwidth

Procedure: C63.10-2009 6.9

The minimum 6 dB bandwidths per FCC 15.247(a)(2) were measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The device was modulated. The minimum 6 dB bandwidths are presented below.

Table 6-1: 6 dB Bandwidth Test Equipment

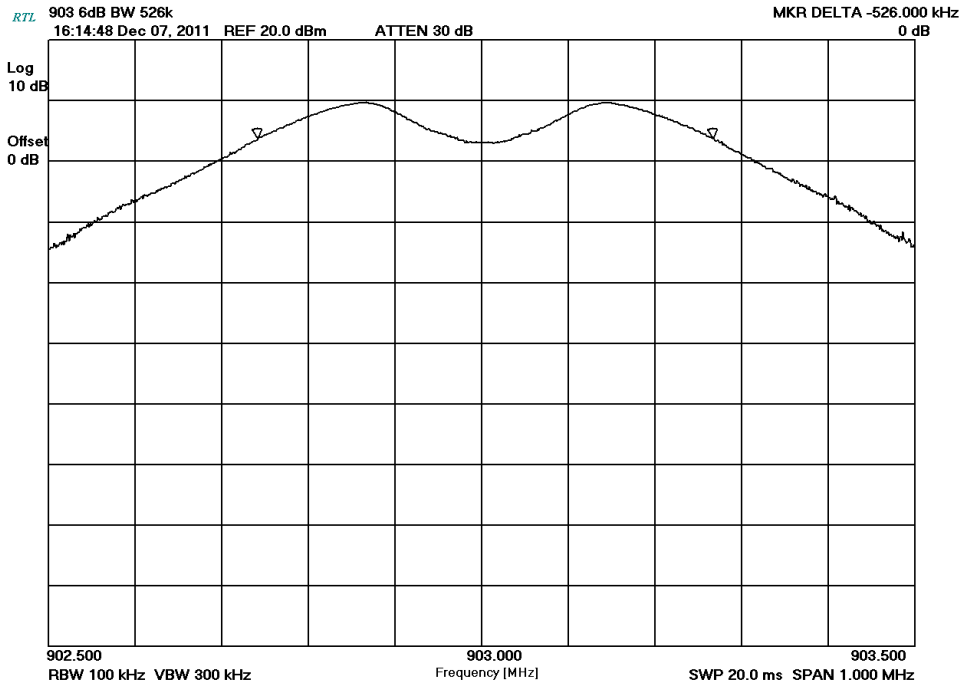
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	9/13/12
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	9/13/12

6.2 6 dB Bandwidth Test Results

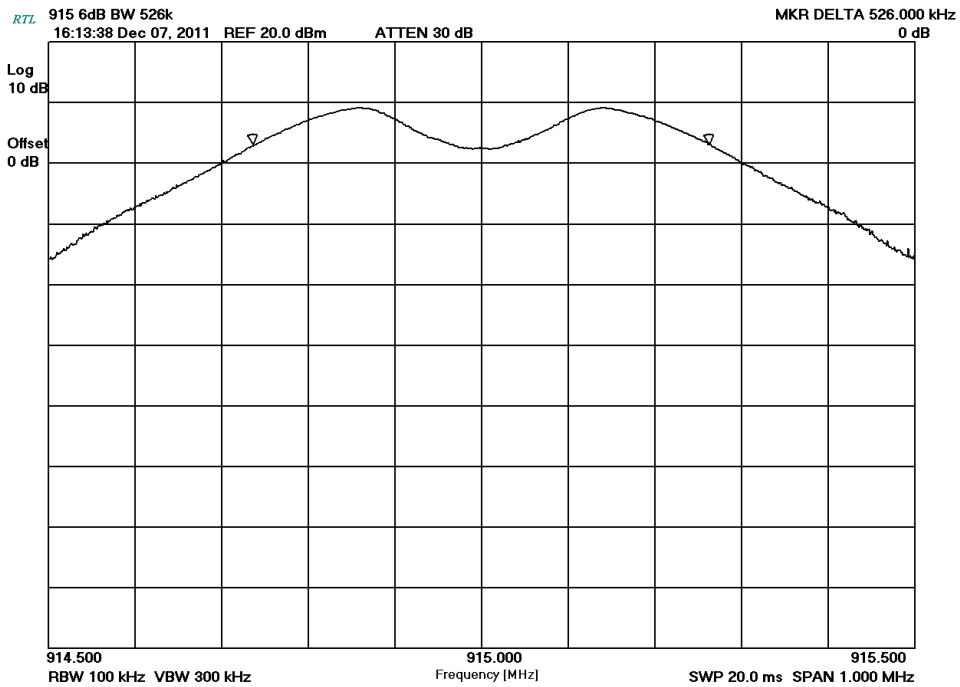
Table 6-2: 6 dB Bandwidth Test Data

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
903.0	0.526	0.500	Pass
915.0	0.526	0.500	Pass
927.0	0.517	0.500	Pass

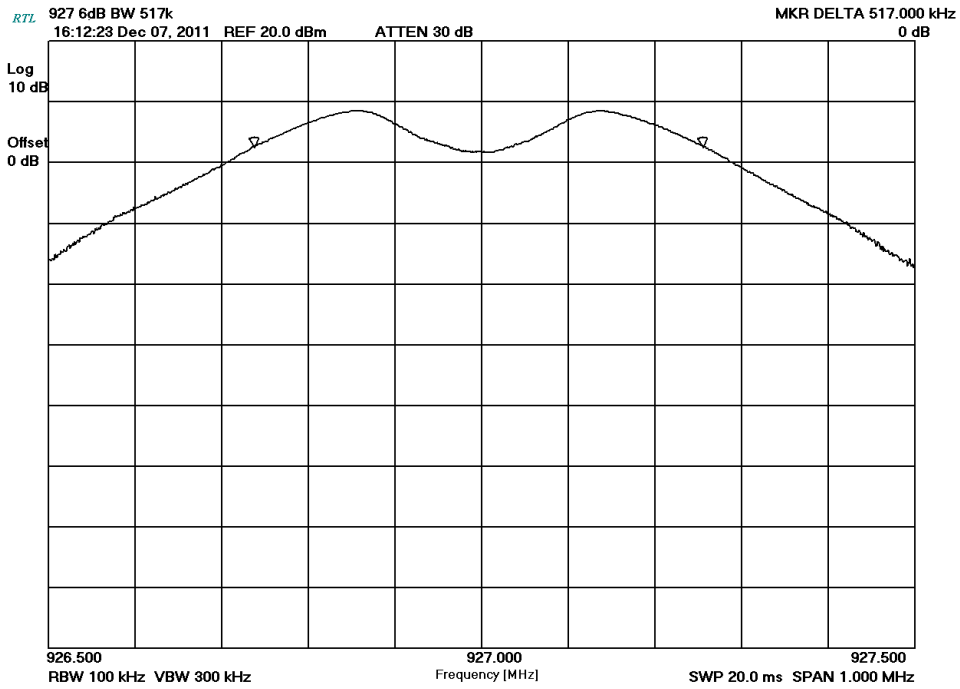
Plot 6-1: 6 dB Bandwidth; 903 MHz; 526 kHz



Plot 6-2: 6 dB Bandwidth; 915 MHz; 526 kHz



Plot 6-3: 6 dB Bandwidth; 927 MHz; 517 kHz



Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	December 7, 2011
EMC Test Engineer	Signature	Date of Test

7 Power Spectral Density – FCC 15.247(e); IC RSS-210 A8.2(b)

7.1 Power Spectral Density Test Procedure

Procedure: C63.10-2009 6.11.2

The power spectral density per FCC 15.247(d) was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 3 kHz, the video bandwidth set at 10 kHz, and the sweep time set at 100 seconds. The spectral lines were resolved for the modulated carriers at 903.0, 915.0 and 927.0 MHz. These levels are below the +8 dBm limit. See the power spectral density table and plots.

Table 7-1: Power Spectral Density Test Equipment

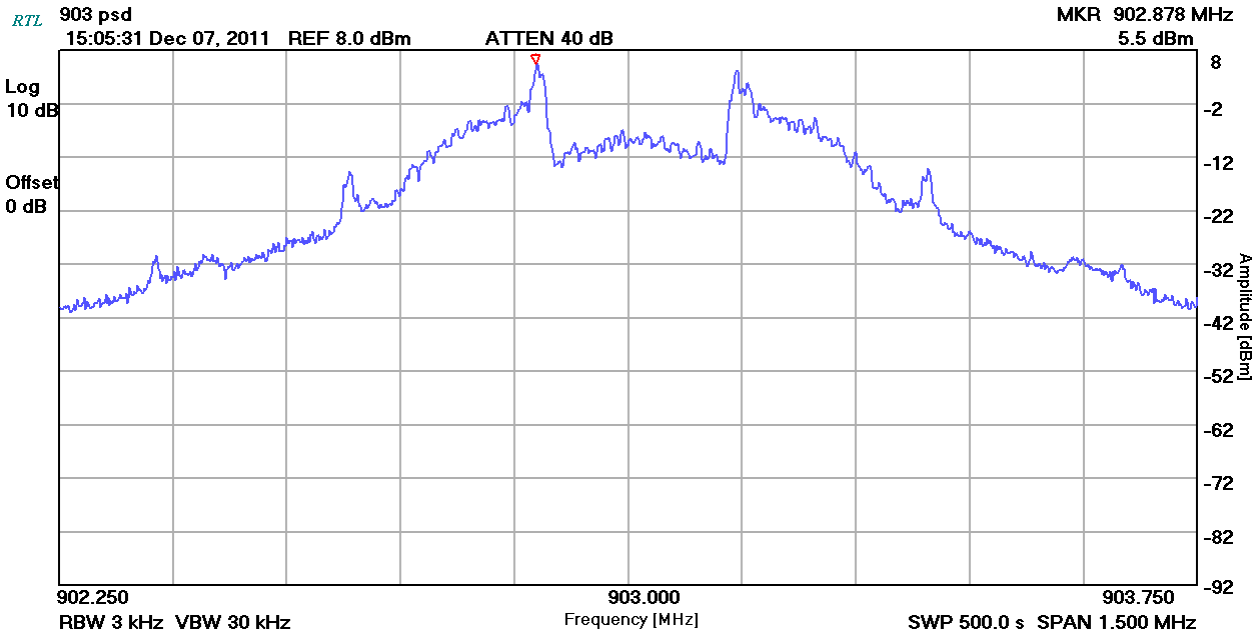
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900970	Hewlett Packard	8567A	Spectrum Analyzer	2542A11239	11/17/12

7.2 Power Spectral Density Test Data

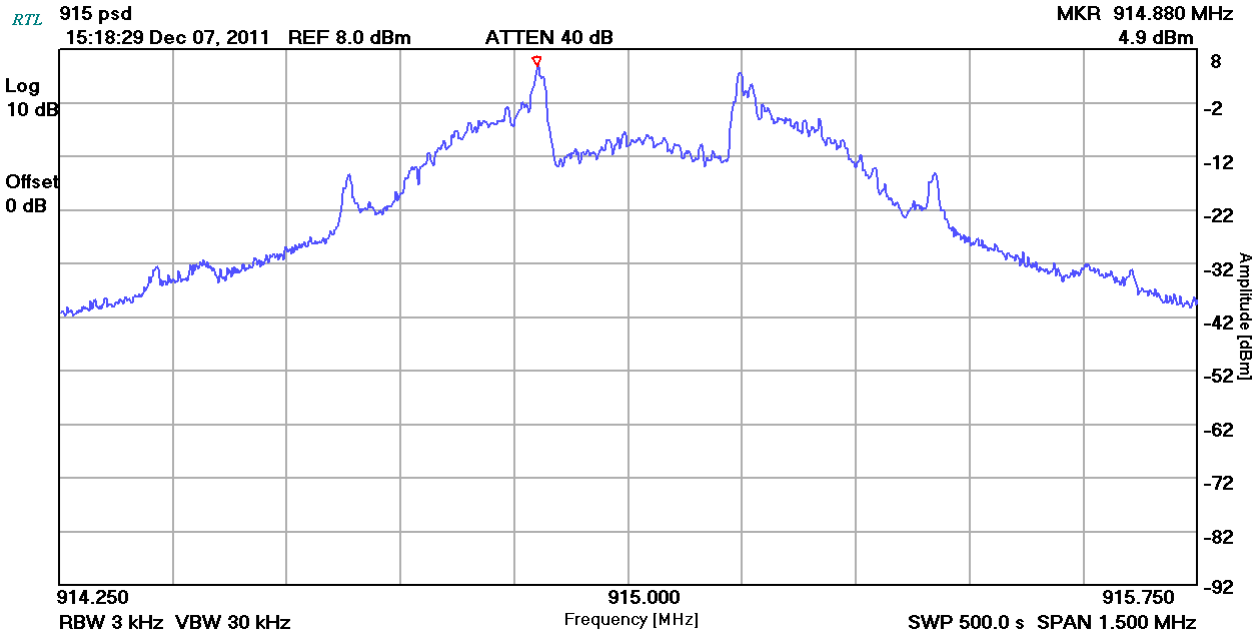
Table 7-2: Power Spectral Density Test Data

Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8 dBm	Pass/Fail
903.0	5.5	-2.5	Pass
915.0	4.9	-3.1	Pass
927.0	4.6	-3.4	Pass

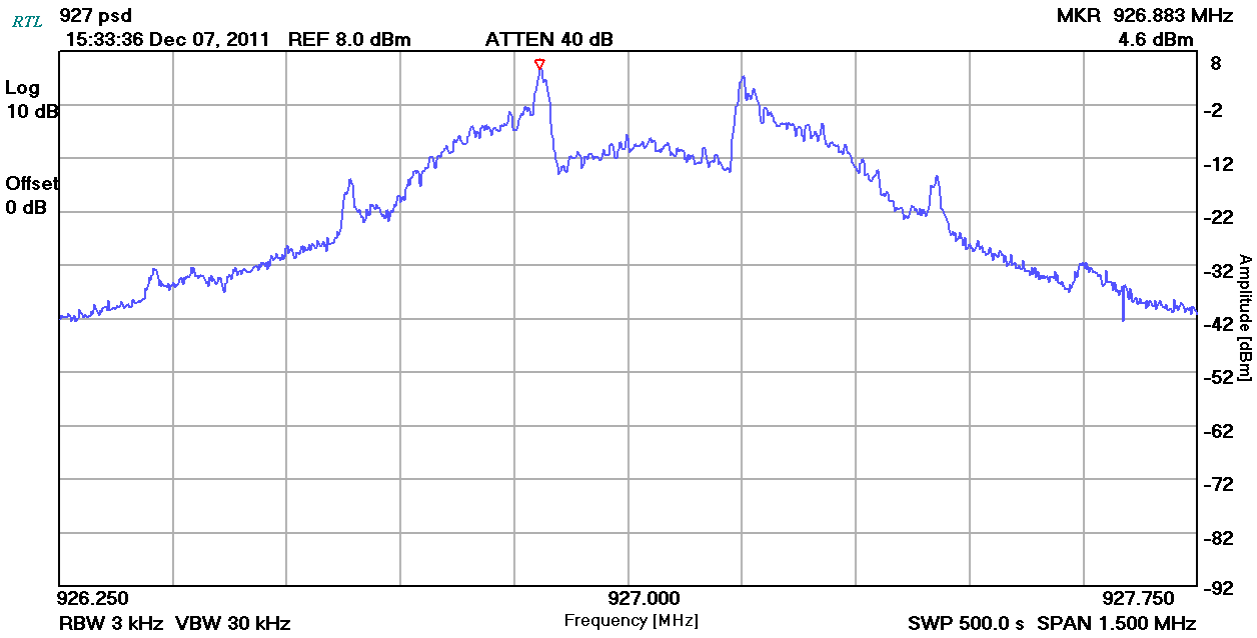
Plot 7-1: Power Spectral Density; 903 MHz; 5.5 dBm



Plot 7-2: Power Spectral Density; 915 MHz; 4.9 dBm



Plot 7-3: Power Spectral Density; 927 MHz; 4.6 dBm



Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	December 7, 2011
EMC Test Engineer	Signature	Date of Test

8 Conducted Emissions Measurement Limits – FCC 15.207; IC RSS-Gen

8.1 Limits of Conducted Emissions Measurement

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

8.2 Conducted Emissions Measurement Test Procedure

Procedure: C63.10-2009 6.2

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm / 50 micro Henry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

8.3 Conducted Line Emissions Test Data

N/A – EUT is battery operated.

9 Radiated Emissions – FCC 15.209; IC RSS-210

9.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/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

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any circumstances of modulation.

9.2 Radiated Emissions Measurement Test Procedure

Procedure: C63.10-2009 6.5, 6.6

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10^{th} harmonic of the highest fundamental transmitter frequency.

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1,000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 9-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900932	Hewlett Packard	8449B OPT H02	Preamplifier 1-26.5 GHz	3008A00505	2/22/12
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901516	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	10/14/12
901517	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/14/12
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	6/14/12
900321	EMCO	3161-03	Horn Antennas (4 - 8,2GHz)	9508-1020	6/14/12
900323	EMCO	3160-7	Horn Antennas (8,2 - 12,4 GHz)	9605-1054	6/14/12
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 KHz - 12.8 GHz)	3826A00144	1/13/12
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	9/13/12
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	9/13/12

9.3 Radiated Emissions Test Results

9.3.1 Radiated Emissions Digital

Table 9-2: Radiated Emissions Digital

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/ Fail
35.000	Qp	H	0	1.0	34.4	-13.4	21.0	40.0	-19.0	Pass
85.000	Qp	H	0	1.0	34.4	-20.6	13.8	40.0	-26.2	Pass
150.000	Qp	H	0	1.0	34.4	-18.5	15.9	43.5	-27.6	Pass
325.000	Qp	H	0	1.0	32.9	-13.6	19.3	46.0	-26.7	Pass
450.000	Qp	V	0	1.0	36.1	-9.3	26.8	46.0	-19.2	Pass
575.000	Qp	V	0	1.0	32.8	-6.5	26.3	46.0	-19.7	Pass
800.000	Qp	V	0	1.0	32.6	-4.2	28.4	46.0	-17.6	Pass
950.000	Qp	V	0	1.0	32.2	-2.0	30.2	46.0	-15.8	Pass

9.3.2 Radiated Emissions Harmonics/Spurious

Table 9-3: Radiated Emissions Harmonics/Spurious TX Frequency – 903.0 MHz

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
2709.000	40.9	29.0	10.0	39.0	54.0	-15.0
3612.000	32.6	21.3	9.4	30.7	54.0	-23.3
4515.000	28.3	19.9	13.0	32.9	54.0	-21.1
5418.000	27.3	18.9	12.1	31.0	54.0	-23.0
8127.000	36.5	25.8	18.0	43.8	54.0	-10.2
9030.000	36.1	24.6	18.3	42.9	54.0	-11.1

Table 9-4: Radiated Emissions Harmonics/Spurious TX Frequency – 915.0 MHz

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
2745.000	40.2	27.7	9.9	37.6	54.0	-16.4
3660.000	30.9	19.6	9.5	29.1	54.0	-24.9
4575.000	29.3	20.3	12.9	33.2	54.0	-20.8
7320.000	34.0	24.1	12.9	37.0	54.0	-17.0
8235.000	36.2	26.1	18.0	44.1	54.0	-9.9
9150.000	35.2	25.1	18.4	43.5	54.0	-10.5

Table 9-5: Radiated Emissions Harmonics/Spurious TX Frequency – 927.0 MHz

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
2781.000	40.4	27.8	9.8	37.6	54.0	-16.4
3708.000	31.6	20.8	9.6	30.4	54.0	-23.6
4635.000	30.4	19.5	12.9	32.4	54.0	-21.6
7416.000	35.3	23.9	12.8	36.7	54.0	-17.3
8343.000	35.5	25.1	18.0	43.1	54.0	-10.9
9270.000	34.4	23.9	18.5	42.4	54.0	-11.6

Test Personnel:

Daniel W. Baltzell		December 8, 2011
EMC Test Engineer	Signature	Date of Test

10 Conclusion

The data in this measurement report shows that the Innovative Wireless Technologies, Inc. (IWT), Model FAP5015-050, a Fixed Tracking Beacon, FCC ID: SP8-FAP5015-050, IC: 9568A-FAP5015050, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations and Industry Canada RSS-210.