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WLAN TEST REPORT

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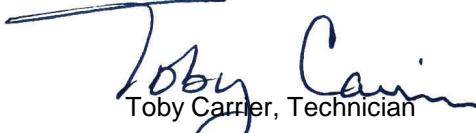
Report Issue Date: 6/3/2014

Product Name: rCell – Intelligent Wireless Router
FCCID: AU792U13A16855
Standards: Title 47 CFR Part 15 Subpart C

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

Client:
MultiTech Systems, Inc.
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Mounds View, MN 55112

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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 full name	FCC Reference	Result
6	Radiated Spurious Emissions (Transmitter)	§ 15.247(d), § 15.209, and § 15.205	Pass
17	Radiated Spurious Emissions (Receiver)	§ 15.109	Pass
21	AC Powerline Conducted Emissions	§ 15.107, § 15.207	Pass
23	Antenna Requirement per FCC Part 15.203	§ 15.203	Pass

3 Description of Equipment Under Test

Equipment Under Test	
Manufacturer	MultiTech Systems, Inc.
Model Number	MTR-EV3-B10
Serial Number	5227149K
FCC Identifier	AU792U13A16855
Receive Date	4/29/2014
Test Start Date	4/29/2014
Test End Date	5/28/2014
Device Received Condition	Good
Test Sample Type	Production
Frequency Band	2412MHz – 2462MHz
Mode(s) of Operation	802.11b/g/n
Modulation Type	BPSK, QPSK, CCK, OFDM
Duty Cycle	100%
Transmission Control	Test Commands
Test Channels	1, 6, 11
Antenna Type (15.203)	External antenna with 1.8dbi Gain
Operating Voltage	115VAC/60Hz (Via AC /DC Power Adapter)

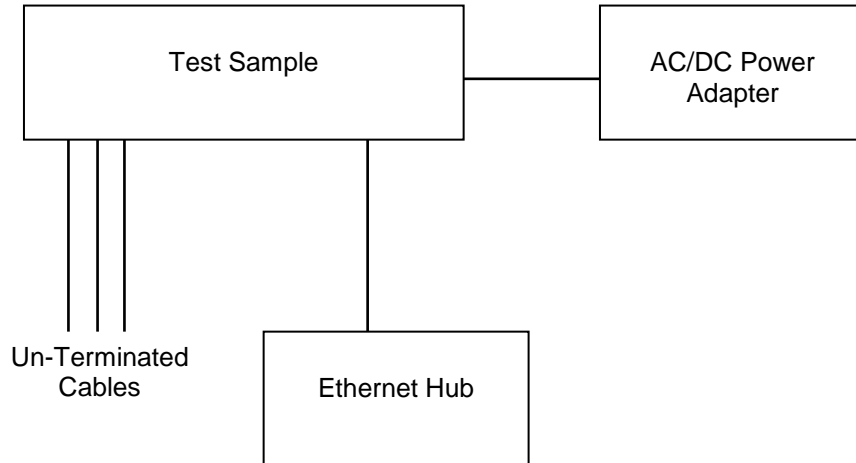
Description of Equipment Under Test
M2M Cellular Modem

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmitting 802.11 b, g, n (HT-20) on low, mid or high channels
2	Receive / Idle Mode

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
DB9 Serial Cable	1m	Yes	No	Serial Port	Unterminated
Ethernet	3m	None	None	Ethernet Port	Ethernet Hub
GPS Antenna Cable	1m	Yes	No	GPS Port	GPS Antenna
DC Power Cable	1m	No	No	DC Input	AC/DC Power Adapter

4 Radiated Spurious Emissions (Transmitter)

4.1 Test Limits

§ 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Part 15.205(a): Restricted Bands of Operations

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
10.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(²)
13.36–13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

² Above 38.6

Part 15.209(a): Field 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

4.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

4.3 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 dB μ V/m

RA = Receiver Amplitude in dB μ V

AF = Antenna Factor in dB

CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

$$RA = 19.48 \text{ dB}\mu\text{V}$$

$$AF = 18.52 \text{ dB}$$

$$CF = 0.78 \text{ dB}$$

$$FS = 19.48 + 18.52 + 0.78 = 38.78 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(38.78 \text{ dB}\mu\text{V/m})/20] = 86.89 \mu\text{V/m}$$

4.4 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	9/11/2013	9/11/2014
Preamplifier	987410	Miteq	AFS44-00102000-30-10P-44	9/11/2013	9/11/2014
Preamplifier	SF456200904	Mini-Circuits	ZX60-3018G-S+	9/11/2013	9/11/2014
Bilog Antenna	00051864	ETS	3142C	12/17/2013	12/17/2014
Horn Antenna	00154521	ETS	3117	10/10/2013	10/10/2014
Horn Antenna	00156319	ETS	3780	5/2/2014	5/2/2015
System Controller	121701-1	Sunol Sciences	SC99V	Calibration Not Required	Calibration Not Required
High Pass Filter	3986-01 DC0408	Microwave Circuits, Inc.	H3G020G2	Calibrate at Time Of Use	Calibrate at Time Of Use
Band Reject filter	155	Micro-Tronics	BRM50702	Calibrate at Time Of Use	Calibrate at Time Of Use

4.5 Results:

All spurious emissions were attenuated by at least 20dB below the level of the fundamental as required by Part 15.247(d). Additionally, all emissions falling within restricted bands of operation and at the band edges were found to be below the limit specified in Part 15.209(a). The spurious emissions listed in the following tables are the worst case emissions.

Worst Case Spurious Measurements (802.11b Mode, Low Channel)

Radiated Emissions										
Test Engineer: Toby Carrier		Start Date: 4/29/2014			End Date: 4/29/2014					
Temperature: 23.3C		Humidity: 43.50%			Pressure: 988.9mBar					
Specification: FCC Part 15B		Test Limit: Class B								
Notes: 802.11 B Mode. Low Channel										
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.824 GHz	H	34.98	-29.594	34.7	40.086	74	-33.914	1MHz/Pk	3m	Compliant
4.824 GHz	V	36.25	-29.594	34.7	41.356	74	-32.644	1MHz/Pk	3m	Compliant
4.824 GHz	H	24.78	-29.594	34.7	29.886	54	-24.114	1MHz/Av	3m	Compliant
4.824 GHz	V	25.15	-29.594	34.7	30.256	54	-23.744	1MHz/Av	3m	Compliant
Band Edge Measurements										
2.39 GHz	H	21.58	4.673	32.944	59.197	74	-14.803	1MHz / Pk	3m	Compliant
2.39 GHz	H	13.08	4.673	32.944	50.697	54	-3.303	1MHz / Av	3m	Compliant
2.39 GHz	V	23.79	4.673	32.944	61.407	74	-12.593	1MHz / Pk	3m	Compliant
2.39 GHz	V	13.08	4.673	32.944	50.697	54	-3.303	1MHz / Av	3m	Compliant
Calculations:					$F = C + D + E$		$H = F - G$			

*Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

Worst Case Spurious Measurements (802.11b Mode, Middle Channel)

Radiated Emissions										
Test Engineer: Toby Carrier		Start Date: 4/29/2014			End Date: 4/29/2014					
Temperature: 23.3C		Humidity: 43.50%			Pressure: 988.9mBar					
Specification: FCC Part 15B		Test Limit: Class B								
Notes: 802.11 B Mode. Middle Channel										
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.875 GHz	H	33.89	-29.52	34.7	39.07	74	-34.93	1MHz/Pk	3m	Compliant
4.874 GHz	V	33.07	-29.521	34.7	38.249	74	-35.751	1MHz/Pk	3m	Compliant
4.875 GHz	H	24.98	-29.52	34.7	30.16	54	-23.84	1MHz/Av	3m	Compliant
4.874 GHz	V	25	-29.521	34.7	30.179	54	-23.821	1MHz/Av	3m	Compliant
Calculations:				F = C + D + E			H = F - G			

*Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

Worst Case Spurious Measurements (802.11b Mode, High Channel)

Radiated Emissions										
Test Engineer: Toby Carrier		Start Date: 4/29/2014		End Date: 4/29/2014						
Temperature: 23.3C		Humidity: 43.50%		Pressure: 988.9mBar						
Specification: FCC Part 15B		Test Limit: Class B								
Notes: 802.11 B Mode. High Channel										
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.924 GHz	H	33.1	-29.449	34.7	38.351	74	-35.649	1MHz/Pk	3m	Compliant
4.924 GHz	V	32.54	-29.449	34.7	37.791	74	-36.209	1MHz/Pk	3m	Compliant
4.924 GHz	H	23.63	-29.449	34.7	28.881	54	-25.119	1MHz/Av	3m	Compliant
4.924 GHz	V	23.91	-29.449	34.7	29.161	54	-24.839	1MHz/Av	3m	Compliant
Band Edge Measurements										
2.4835 GHz	H	22.83	4.773	32.907	60.51	74	-13.49	1MHz / Pk	3m	Compliant
2.4835 GHz	H	13.75	4.773	32.907	51.43	54	-2.57	1MHz / Av	3m	Compliant
2.4835 GHz	V	23.07	4.773	32.907	60.75	74	-13.25	1MHz / Pk	3m	Compliant
2.4835 GHz	V	13.79	4.773	32.907	51.47	54	-2.53	1MHz / Av	3m	Compliant
Calculations:				$F = C + D + E$			$H = F - G$			

*Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

Worst Case Spurious Measurements (802.11g Mode, Low Channel)

Radiated Emissions										
Test Engineer: Toby Carrier		Start Date: 4/29/2014		End Date: 4/29/2014						
Temperature: 23.3C		Humidity: 43.50%		Pressure: 988.9mBar						
Specification: FCC Part 15B		Test Limit: Class B								
Notes: 802.11 G Mode. Low Channel										
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.824 GHz	H	36.12	-29.594	34.7	41.226	74	-32.774	1MHz/Pk	3m	Compliant
4.824 GHz	V	34.77	-29.594	34.7	39.876	74	-34.124	1MHz/Pk	3m	Compliant
4.824 GHz	H	25.22	-29.594	34.7	30.326	54	-23.674	1MHz/Av	3m	Compliant
4.824 GHz	V	25.7	-29.594	34.7	30.806	54	-23.194	1MHz/Av	3m	Compliant
Band Edge Measurements										
2.39 GHz	H	23.33	4.673	32.944	60.947	74	-13.053	1MHz / Pk	3m	Compliant
2.39 GHz	H	13.08	4.673	32.944	50.697	54	-3.303	1MHz / Av	3m	Compliant
2.39 GHz	V	21.32	4.673	32.944	58.937	74	-15.063	1MHz / Pk	3m	Compliant
2.39 GHz	V	13.07	4.673	32.944	50.687	54	-3.313	1MHz / Av	3m	Compliant
Calculations:				$F = C + D + E$			$H = F - G$			

*Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

Worst Case Spurious Measurements (802.11g Mode, Middle Channel)

Radiated Emissions										
Test Engineer: Toby Carrier		Start Date: 4/29/2014			End Date: 4/29/2014					
Temperature: 23.3C		Humidity: 43.50%			Pressure: 988.9mBar					
Specification: FCC Part 15B		Test Limit: Class B								
Notes: 802.11 G Mode. Middle Channel										
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.874 GHz	H	33.3	-29.521	34.7	38.479	74	-35.521	1MHz/Pk	3m	Compliant
4.874 GHz	V	35.26	-29.521	34.7	40.439	74	-33.561	1MHz/Pk	3m	Compliant
4.874 GHz	H	24.45	-29.521	34.7	29.629	54	-24.371	1 MHz/Av	3m	Compliant
4.874 GHz	V	24.35	-29.521	34.7	29.529	54	-24.471	1 MHz/Av	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

*Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

Worst Case Spurious Measurements (802.11g Mode, High Channel Channel)

Radiated Emissions										
Test Engineer: Toby Carrier		Start Date: 4/29/2014		End Date: 4/29/2014						
Temperature: 23.3C		Humidity: 43.50%		Pressure: 988.9mBar						
Specification: FCC Part 15B		Test Limit: Class B								
Notes: 802.11 G Mode. High Channel										
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.924 GHz	H	33.18	-29.449	34.7	38.431	74	-35.569	1MHz / Pk	3m	Compliant
4.924 GHz	V	33.26	-29.449	34.7	38.511	74	-35.489	1MHz / Pk	3m	Compliant
4.924 GHz	H	24.82	-29.449	34.7	30.071	54	-23.929	1MHz / Av	3m	Compliant
4.924 GHz	V	24.12	-29.449	34.7	29.371	54	-24.629	1MHz / Av	3m	Compliant
Band Edge Measurements										
2.4835 GHz	H	22.55	4.774	32.907	60.23	74	-13.77	1MHz / Pk	3m	Compliant
2.4835 GHz	H	13.74	4.774	32.907	51.42	54	-2.58	1MHz / Av	3m	Compliant
2.4835 GHz	V	22	4.773	32.907	59.68	74	-14.32	1MHz / Pk	3m	Compliant
2.4835 GHz	V	13.75	4.773	32.907	51.43	54	-2.57	1MHz / Av	3m	Compliant
Calculations:				F = C + D + E			H = F - G			

*Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

Worst Case Spurious Measurements (802.11n Mode, Low Channel)

Radiated Emissions										
Test Engineer: Toby Carrier		Start Date: 4/29/2014		End Date: 4/29/2014						
Temperature: 23.3C		Humidity: 43.50%		Pressure: 988.9mBar						
Specification: FCC Part 15B		Test Limit: Class B								
Notes: 802.11 N (20MHz), Low Channel										
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.824 GHz	H	36.38	-29.594	34.7	41.486	74	-32.514	1MHz/Pk	3m	Compliant
4.824 GHz	V	34.78	-29.594	34.7	39.886	74	-34.114	1MHz/Pk	3m	Compliant
4.824 GHz	H	25.87	-29.594	34.7	30.976	54	-23.024	1MHz/Av	3m	Compliant
4.824 GHz	V	25.91	-29.594	34.7	31.016	54	-22.984	1MHz/Av	3m	Compliant
Band Edge Measurements										
2.39 GHz	H	22.82	4.673	32.944	60.437	74	-13.563	1MHz / Pk	3m	Compliant
2.39 GHz	H	13.11	4.673	32.944	50.727	54	-3.273	1MHz / Av	3m	Compliant
2.39 GHz	V	23.66	4.673	32.944	61.277	74	-12.723	1MHz / Pk	3m	Compliant
2.39 GHz	V	13.25	4.673	32.944	50.867	54	-3.133	1MHz / Av	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

*Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

Worst Case Spurious Measurements (802.11n Mode, Middle Channel)

Radiated Emissions										
Test Engineer: Toby Carrier		Start Date: 4/29/2014			End Date: 4/29/2014					
Temperature: 23.3C		Humidity: 43.50%			Pressure: 988.9mBar					
Specification: FCC Part 15B		Test Limit: Class B								
Notes: 802.11 N (20MHz) Mode. Middle Channel										
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.874 GHz	H	34.83	-29.521	34.7	40.009	74	-33.991	1MHz/Pk	3m	Compliant
4.874 GHz	V	35.12	-29.521	34.7	40.299	74	-33.701	1MHz/Pk	3m	Compliant
4.874 GHz	H	25.51	-29.521	34.7	30.689	54	-23.311	1MHz/Av	3m	Compliant
4.874 GHz	V	25.7	-29.521	34.7	30.879	54	-23.121	1MHz/Av	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

*Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

Worst Case Spurious Measurements (802.11n Mode, High Channel)

Radiated Emissions										
Test Engineer: Toby Carrier		Start Date: 4/29/2014		End Date: 4/29/2014						
Temperature: 23.3C		Humidity: 43.50%		Pressure: 988.9mBar						
Specification: FCC Part 15B		Test Limit: Class B								
Notes: 802.11 N (20MHz). High Channel										
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.924 GHz	H	33.23	-29.449	34.7	38.481	74	-35.519	1MHz / Pk	3m	Compliant
4.924 GHz	V	33.61	-29.449	34.7	38.861	74	-35.139	1MHz / Pk	3m	Compliant
4.924 GHz	H	24.53	-29.449	34.7	29.781	54	-24.219	1MHz / Av	3m	Compliant
4.924 GHz	V	24.51	-29.449	34.7	29.761	54	-24.239	1MHz / Av	3m	Compliant
Band Edge Measurements										
2.4836 GHz	H	23.07	4.774	32.907	60.751	74	-13.249	1MHz / Pk	3m	Compliant
2.4836 GHz	H	13.73	4.774	32.907	51.411	54	-2.589	1MHz / Av	3m	Compliant
2.4835 GHz	V	23.75	4.774	32.907	61.43	74	-12.57	1MHz / Pk	3m	Compliant
2.4835 GHz	V	13.75	4.774	32.907	51.43	54	-2.57	1MHz / Av	3m	Compliant
Calculations:					F = C + D + E			H = F - G		

*Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

5 Radiated Spurious Emissions (Receiver)

5.1 Test Limits

§ 15.109: Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength (microvolts/meter)	Field strength (dBuV/m)
30–88	100	40
88–216	150	43.5
216–960	200	46
Above 960	500	54

These limits are identical to those in RSS-GEN

5.2 Test Procedure

ANSI C63.4: 2003

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 dB μ V/m

RA = Receiver Amplitude in dB μ V

AF = Antenna Factor in dB

CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

$$RA = 19.48 \text{ dB}\mu\text{V}$$

$$AF = 18.52 \text{ dB}$$

$$CF = 0.78 \text{ dB}$$

$$FS = 19.48 + 18.52 + 0.78 = 38.78 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(38.78 \text{ dB}\mu\text{V/m})/20] = 86.89 \mu\text{V/m}$$

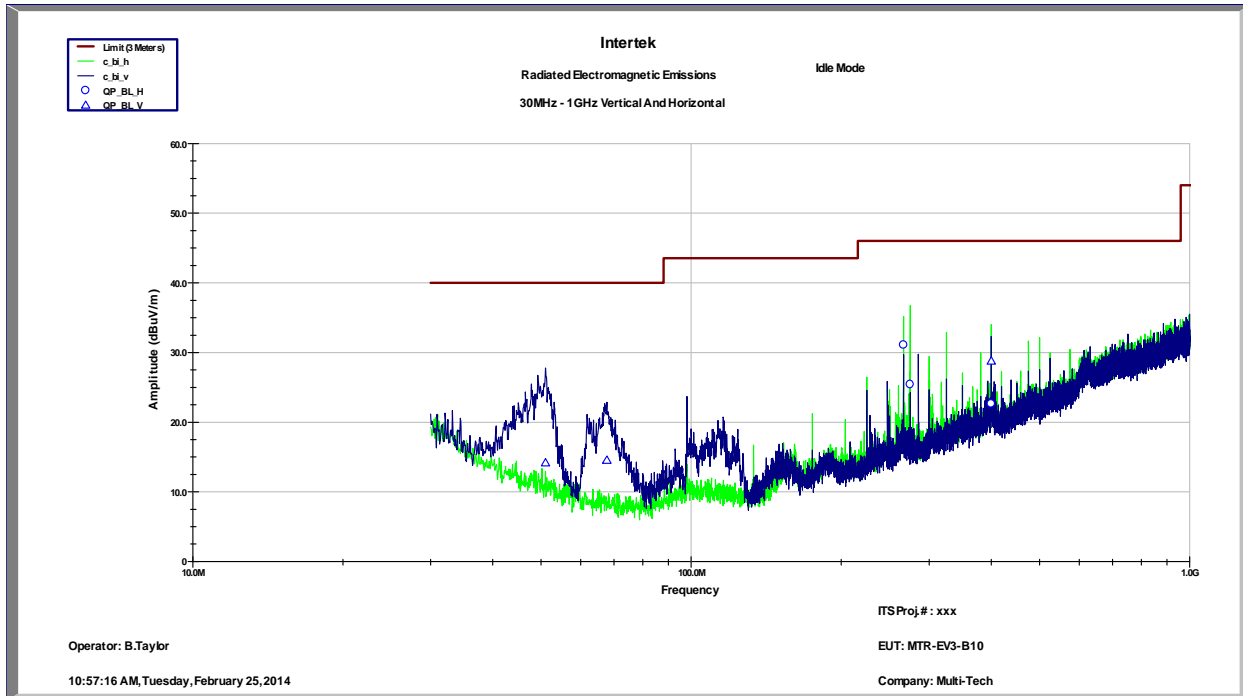
5.4 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	9/11/2013	9/11/2014
Preamplifier	987410	Miteq	AFS44-00102000-30-10P-44	9/4/2013	9/4/2014
Bilog Antenna	00051864	ETS	3142C	12/17/2013	12/17/2014
Horn Antenna	00156319	ETS	3780	5/2/2014	5/2/2015
System Controller	121701-1	Sunol Sciences	SC99V	Calibration Not Required	Calibration Not Required

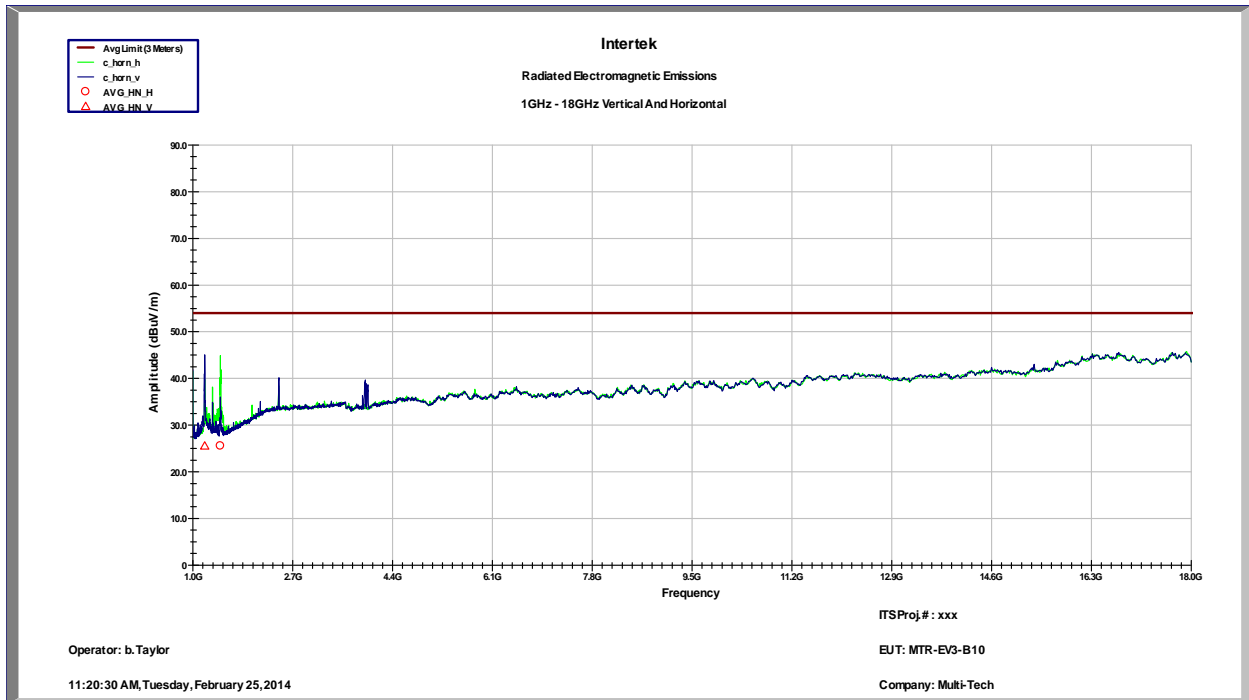
5.5 Results:

All spurious emissions with the test sample in receive mode were below the limits specified in Part 15.109 for a class B digital device and RSS-GEN Section 6.1. All peak detected emissions were at least 15dB below the limit.

Radiated Emissions										
Test Engineer:		Bryan Taylor		Start Date:		2/25/2014		End Date:		2/25/2014
Temperature:		23.4C		Humidity:		34.20%		Pressure:		998.2mBar
Specification:		FCC Part 15B		Test Limit:		Class B				
Notes:		Powered by 120VAC / 60Hz								
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
50.999 MHz	V	3.87	1.1	9.2	14.17	40	-25.83	120kHz / QP	10m	Compliant
67.699 MHz	V	6.66	1.25	6.63	14.54	40	-25.46	120kHz / QP	10m	Compliant
400.01 MHz	V	8.66	3.2	16.9	28.76	46	-17.24	120kHz / QP	10m	Compliant
266.69 MHz	H	15.44	2.6	13.03	31.07	46	-14.93	120kHz / QP	10m	Compliant
275.02 MHz	H	9.71	2.6	13.1	25.41	46	-20.59	120kHz / QP	10m	Compliant
400.05 MHz	H	2.5	3.2	16.9	22.6	46	-23.4	120kHz / QP	10m	Compliant
1.201 GHz	V	23.85	-27.3	29.01	25.56	54	-28.44	1MHz / AV	10m	Compliant
1.467 GHz	H	24.45	-27	28.08	25.53	54	-28.47	1MHz / AV	10m	Compliant
Calculations:					F = C + D + E		H = F - G			



Frequencies Below 1GHz



Frequencies Above 1GHz

Peak Scan (Receive Mode)

6 AC Powerline Conducted Emissions

6.1 Test Limits

§ 15.107(e): 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 μ H/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 (dB μ V)	
	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.

6.2 Test Procedure

ANSI C63.4: 2003

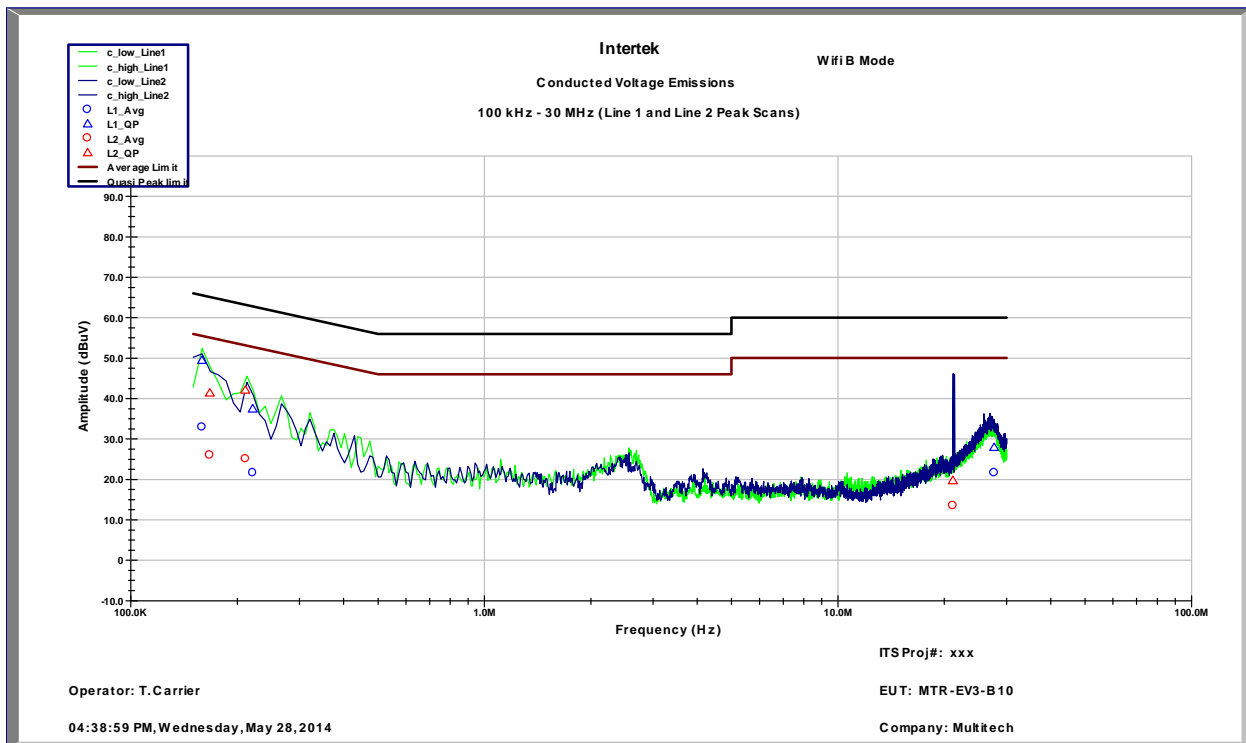
6.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/11/2013	9/11/2014
LISN	3333	Teseq	NNB52	3/12/2014	3/12/2015

6.4 Results:

Conducted Voltage Emissions on Power Lines								
Test Engineer: Toby Carrier			Start Date: 5/28/2014			End Date: 5/28/2014		
Temperature: 25.1°C			Humidity: 52.70%			Pressure: 984.2 mbar		
Specification: FCC Part 15			Test Limit: Class B			RBW: 9kHz		
Notes: Wifi B Mode								
Line	Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta (dB)	Average (dBuV)	Average Limit (dBuV)	Average Delta (dB)	Results
L1	158.9 KHz	49.43	65.52	-16.09	32.93	55.52	-22.59	Compliant
	221.1 KHz	37.44	62.78	-25.34	21.59	52.78	-31.19	Compliant
	27.654 MHz	27.9	60	-32.1	21.61	50	-28.39	Compliant
L2	167.1 KHz	41.36	65.1	-23.75	26.02	55.1	-29.09	Compliant
	210.7 KHz	42.09	63.18	-21.09	25.06	53.18	-28.12	Compliant
	21.145 MHz	19.73	60	-40.27	13.52	50	-36.48	Compliant

Quasi-Peak and Average Measurements (802.11b Mode)



Peak Scan (Line 1 and 2) – 802.11b Mode

7 Antenna Requirement per FCC Part 15.203**7.1 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.

7.2 Results:

The sample tested met the antenna requirement. The unit utilized a non-standard reverse polarity SMA connector.

8 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	

9 Revision History

Revision Level	Date	Report Number	Notes
0	6/3/2014	101549076LEX-002	Original Issue