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# TEST REPORT

**Report Number:** 101653625LEX-001  
**Project Number:** G101653625

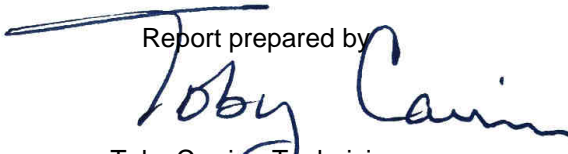
**Report Issue Date:** 7/17/2014

**Product Name:** R12 Companion Keyboard  
**Model Number:** RKB001

**FCC Standards:** Title 47 CFR Part 15 Subpart C and  
RSS-210 Issue 8

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

Client:  
Motion Computing, Inc.  
8601 Ranch Road 2222 Bldg. 2  
Austin, TX 78730

Report prepared by  
  
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**TABLE OF CONTENTS**

**1 Introduction and Conclusion ..... 3**

**2 Test Summary ..... 3**

**3 Description of Equipment Under Test ..... 4**

**4 Peak Conducted Power ..... 6**

**5 Occupied Bandwidth ..... 7**

**6 Conducted Spurious Emissions..... 12**

**7 Power Spectral Density ..... 14**

**8 Radiated Spurious Emissions (Transmitter)..... 17**

**9 Radiated Spurious Emissions (Receiver)..... 21**

**10 AC Powerline Conducted Emissions ..... 24**

**11 Antenna Requirement per FCC Part 15.203..... 26**

**12 Measurement Uncertainty..... 27**

**13 Revision History ..... 28**

## 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	IC Reference	Result
6	Peak Conducted Power	§ 15.247(b)(3)(4)	RSS-210 (A8.4)	Pass
7	Occupied Bandwidth	§ 15.247(a)(2)	RSS-210 (A8.2), RSS-GEN (4.6.1)	Pass
12	Conducted Spurious Emissions	§ 15.247(d)	RSS-210 (A8.5)	Pass
14	Power Spectral Density	§ 15.247(e)	RSS-210 (A8.2b)	Pass
17	Radiated Spurious Emissions (Transmitter)	§ 15.247(d), § 15.209, and § 15.205	RSS-210 (2.2) (A8.5)	Pass
21	Radiated Spurious Emissions (Receiver)	§ 15.109	RSS-Gen (6.1)	Pass
24	AC Powerline Conducted Emissions	§ 15.107, § 15.207	RSS-Gen (7.2.4)	Pass
26	Antenna Requirement per FCC Part 15.203	§ 15.203	RSS-Gen (7.1.2)	Pass

**3 Description of Equipment Under Test**

<b>Equipment Under Test</b>	
<b>Manufacturer</b>	Motion Computing, Inc.
<b>Model Number</b>	RKB001
<b>Serial Number</b>	Test Sample 1
<b>Receive Date</b>	6/16/2014
<b>Test Start Date</b>	6/16/2014
<b>Test End Date</b>	6/20/2014
<b>Device Received Condition</b>	Good
<b>Test Sample Type</b>	Production
<b>Frequency Band</b>	2408 – 2474MHz
<b>Mode(s) of Operation</b>	Transmitting on low, mid, or high channels (2408, 2440, 2474MHz)
<b>Modulation Type</b>	FSK
<b>Duty Cycle</b>	100%
<b>Transmission Control</b>	Test Commands
<b>Antenna Type (15.203)</b>	Internal
<b>Power Supply</b>	Battery Power

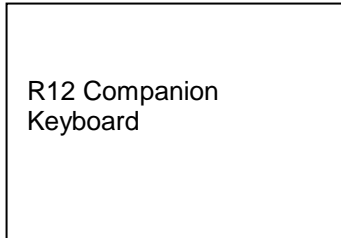
<b>Description of Equipment Under Test</b>
Wireless Keyboard for R12 tablet PC

**Operating modes of the EUT:**

<b>No.</b>	<b>Descriptions of EUT Exercising</b>
1	Transmitting 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:**

None

**3.4 Support Equipment:**

None. The test sample was tested in stand alone mode.

## 4 Peak Conducted Power

### 4.1 Test Limits

§ 15.247(b)(3): For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

§ 15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 4.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247). The peak output power was measured using the AVGSA-1 Method.

### 4.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	9/10/2013	9/10/2014

### 4.4 Results:

Mode	Frequency (MHz)	Conducted Power (dbm)
2.4G SOC	2408	3.00
	2440	2.69
	2474	2.20

Peak

Mode	Frequency (MHz)	Conducted Power (dbm)
2.4G SOC	2408	1.03
	2440	0.68
	2474	0.22

Average

## 5 Occupied Bandwidth

### 5.1 Test Limits

§ 15.247(a)(2): For digital modulation systems, the minimum 6dB bandwidth shall be at least 500kHz.

### 5.2 Test Procedure

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

### 5.3 Test Equipment Used:

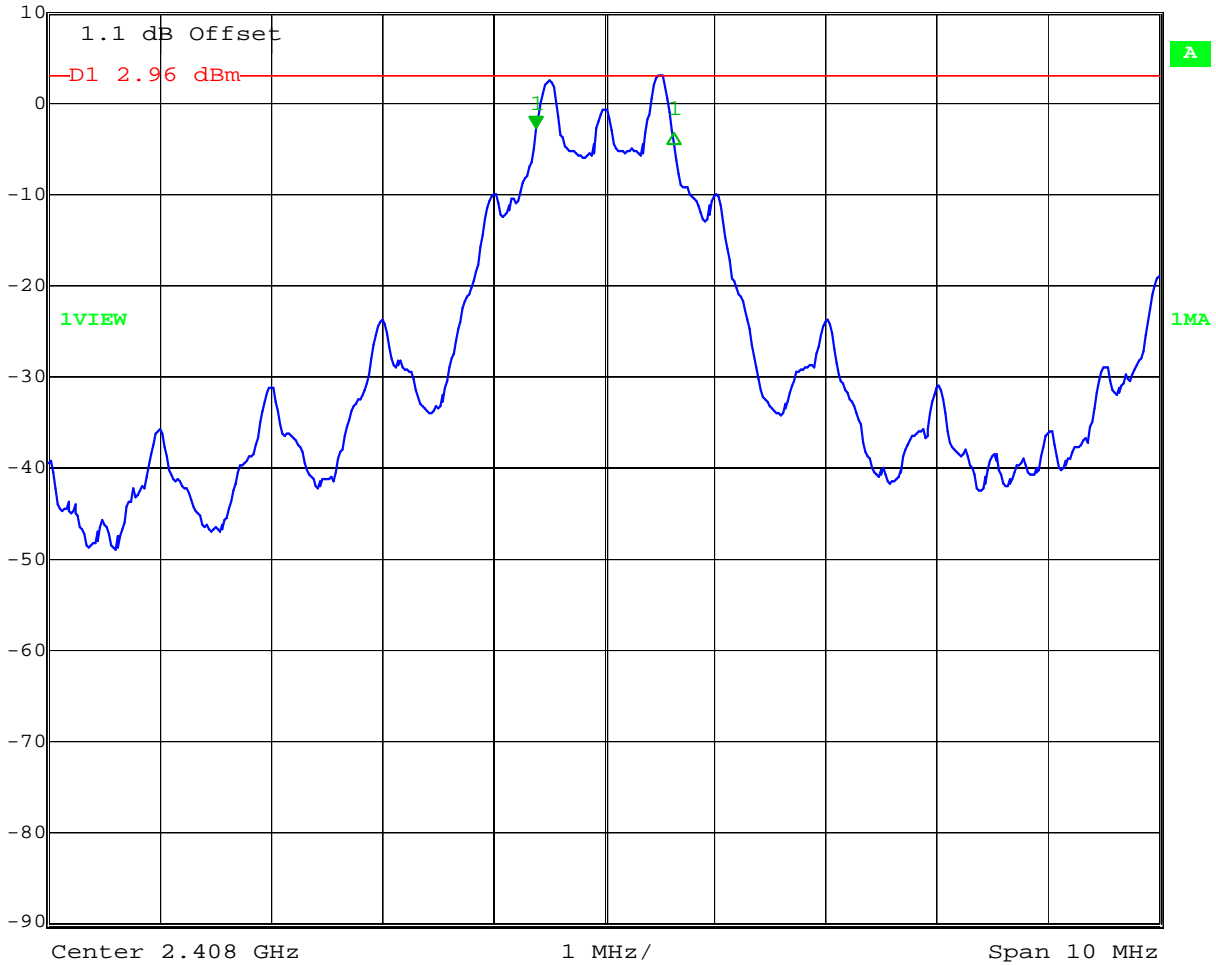
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	9/10/2013	9/10/2014

### 5.4 Results:

Mode	Frequency (MHz)	6dB Bandwidth	99% Power Bandwidth	Result
Normal Transmit Mode	2408	1.242MHz	--	Pass
	2440	1.242MHz	2.184MHz	Pass
	2474	1.262MHz	--	Pass



Marker 1 [T1] RBW 100 kHz RF Att 30 dB  
Ref Lvl -2.97 dBm VBW 300 kHz  
10 dBm 2.40738878 GHz SWT 5 ms Unit dBm



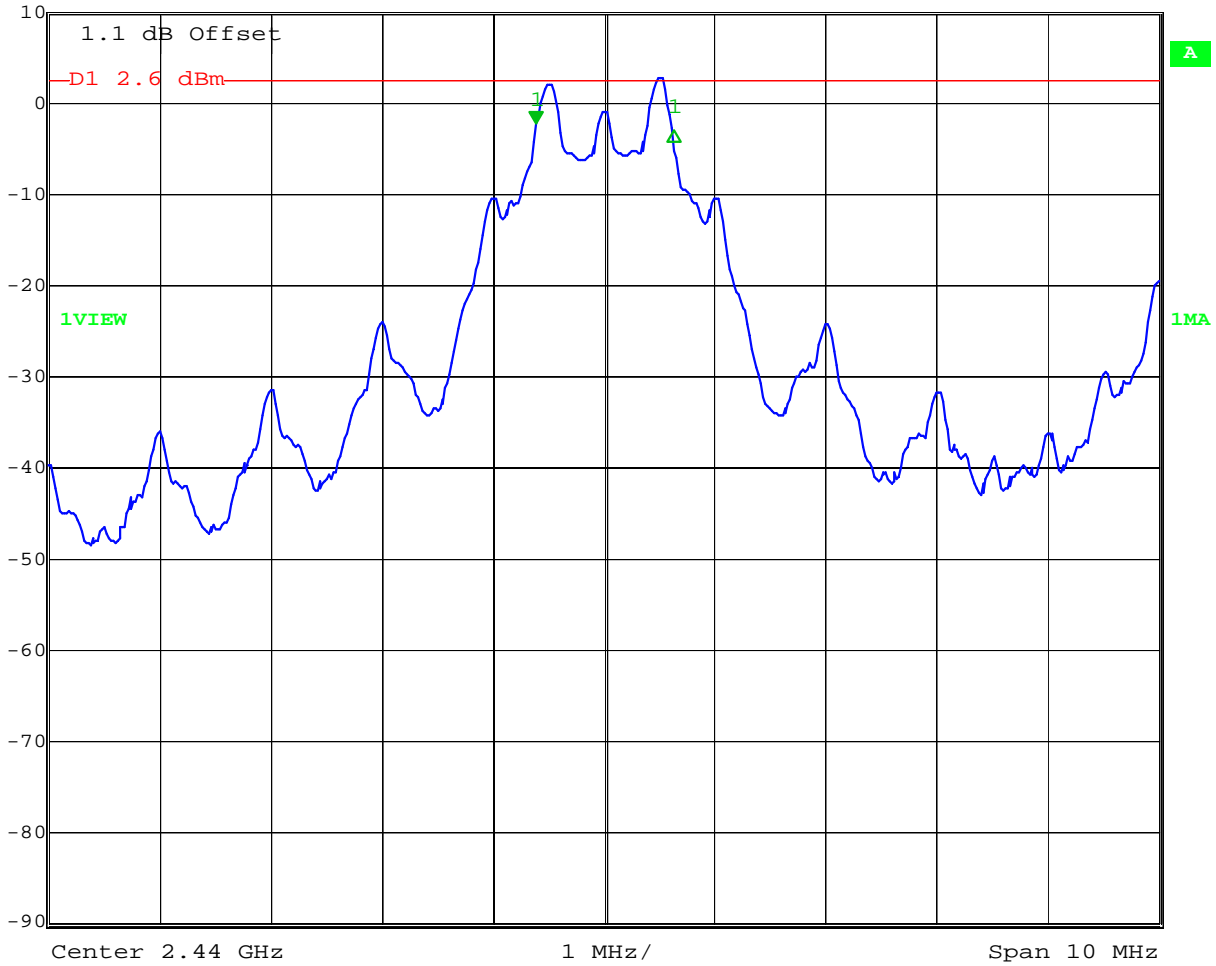
Date: 19.JUN.2014 12:54:40

6dB Bandwidth Plot (Low Channel)





Marker 1 [T1] RBW 100 kHz RF Att 30 dB  
Ref Lvl -2.46 dBm VBW 300 kHz  
10 dBm 2.43938878 GHz SWT 5 ms Unit dBm

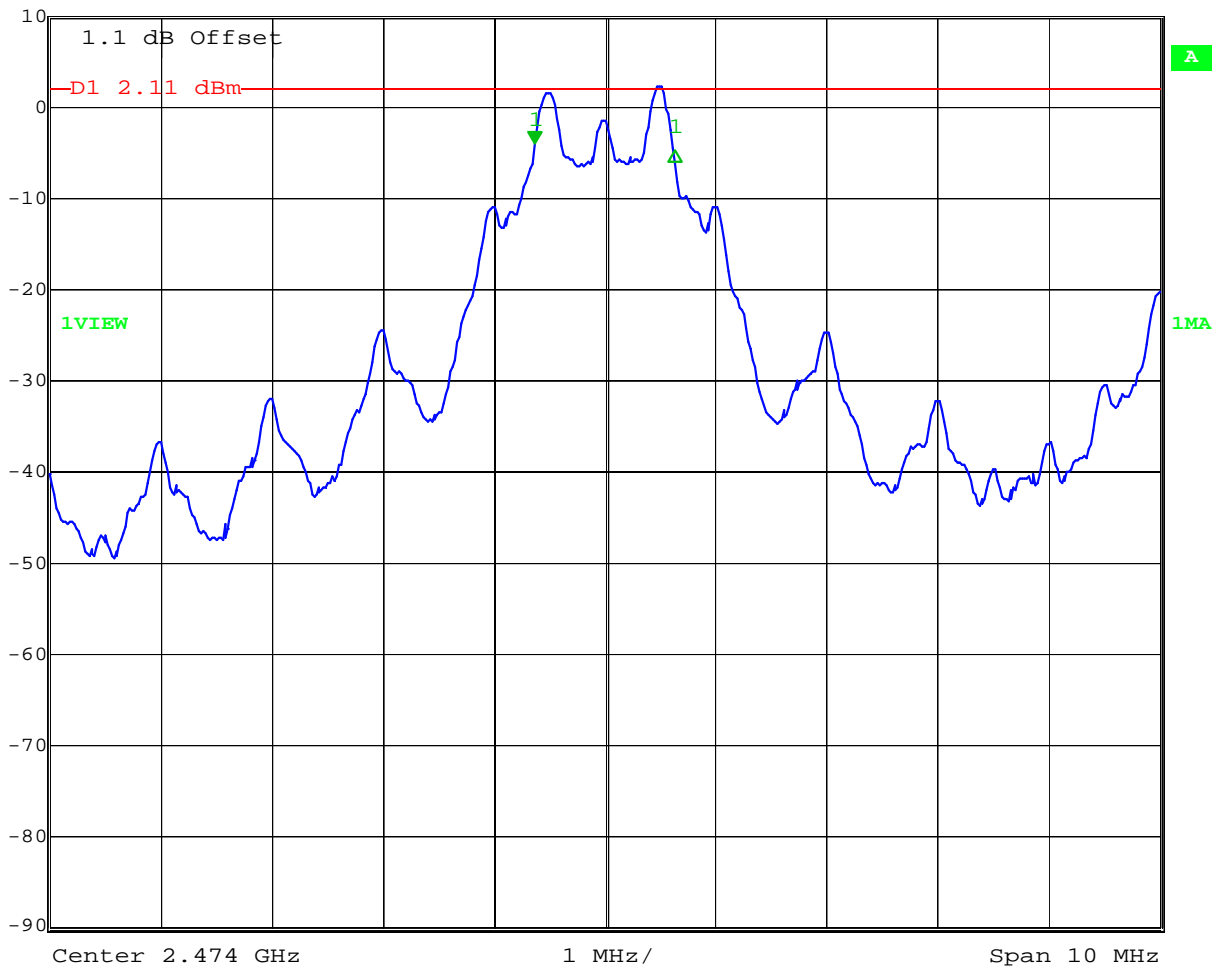


Date: 19.JUN.2014 13:00:24

6dB Bandwidth Plot (Mid Channel)



Marker 1 [T1] RBW 100 kHz RF Att 30 dB  
Ref Lvl -4.06 dBm VBW 300 kHz  
10 dBm 2.47336874 GHz SWT 17.5 ms Unit dBm

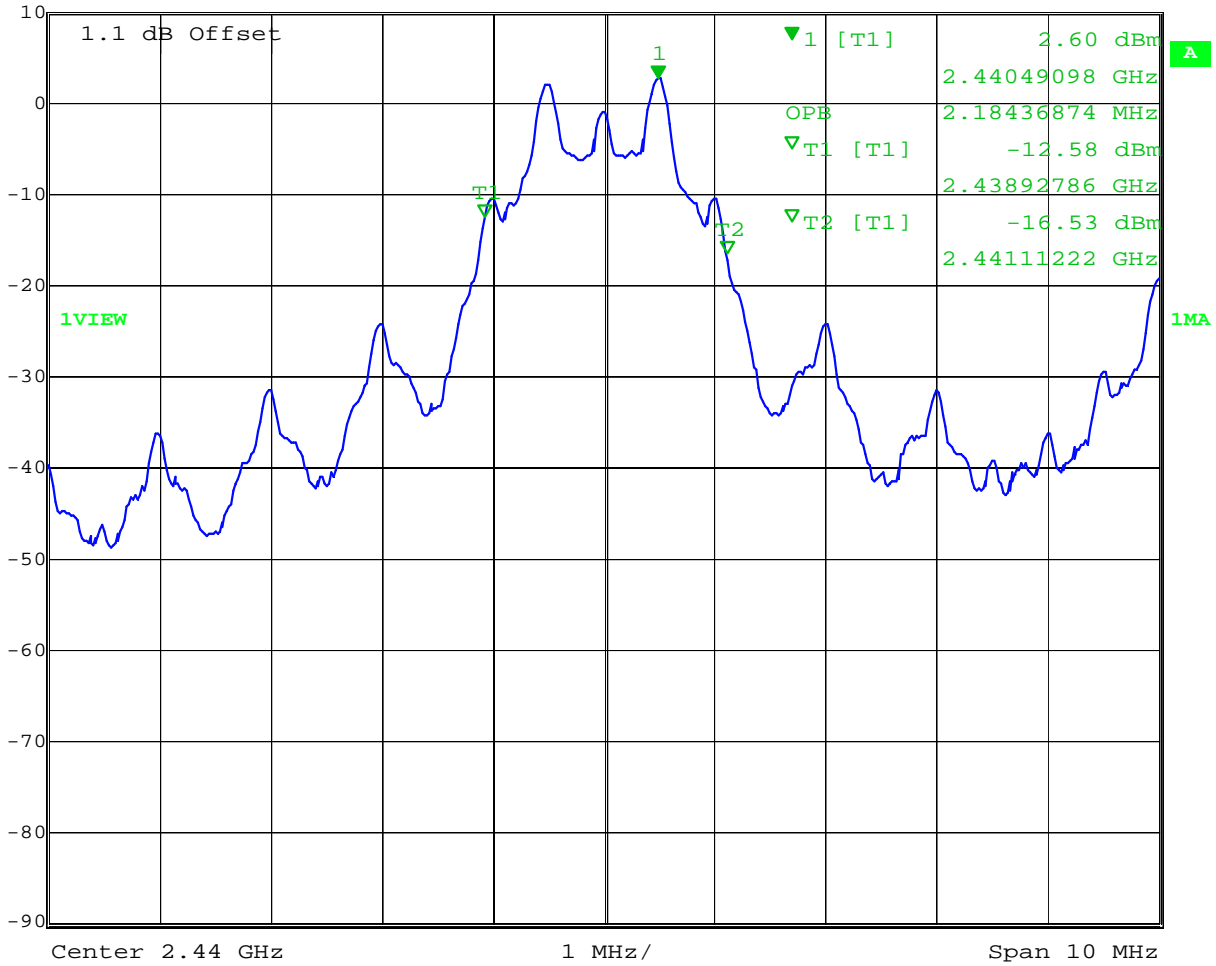


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6dB Bandwidth Plot (High Channel)



Marker 1 [T1] RBW 100 kHz RF Att 30 dB  
Ref Lvl 2.60 dBm VBW 300 kHz  
10 dBm 2.44049098 GHz SWT 17.5 ms Unit dBm



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99% Power Bandwidth Plot (Mid Channel)

## 6 Conducted Spurious Emissions

### 6.1 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.

### 6.2 Test Procedure

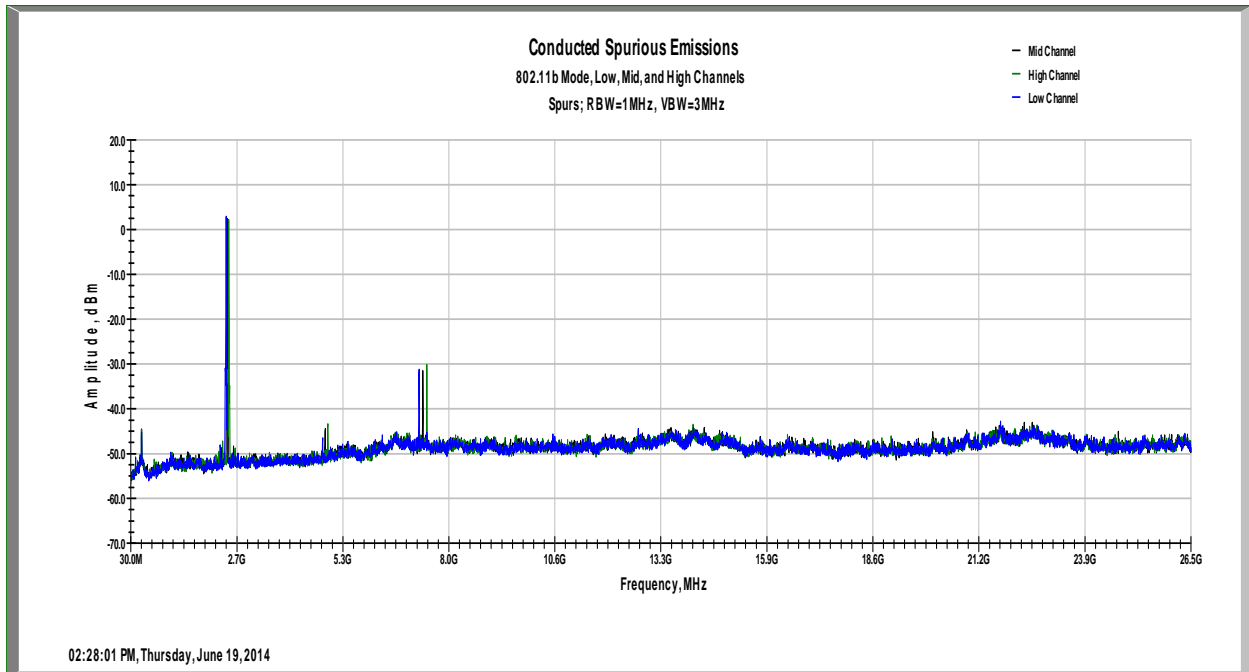
ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

### 6.3 Test Equipment Used:

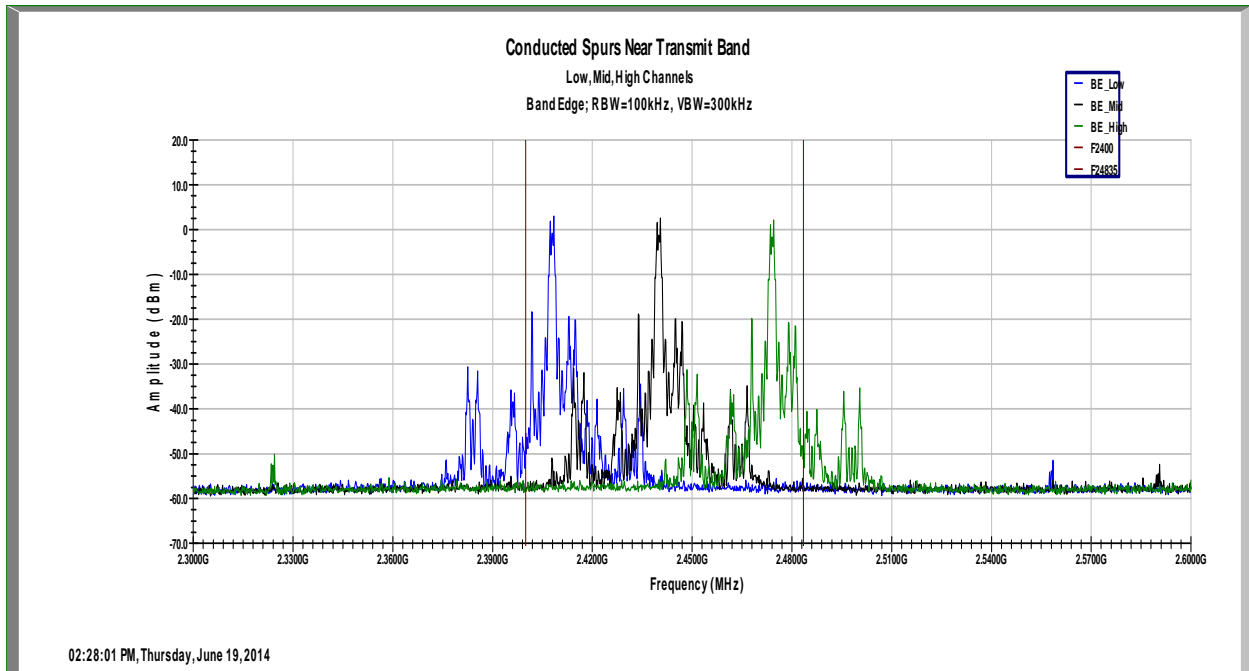
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	9/10/2013	9/10/2014

### 6.4 Results:

The following plots show that there are no conducted spurious emissions exceeding the 20dB down criteria.



Conducted Spurious Emissions - Low, Mid, High Channels



Emissions Close to Band Edge - Low, Mid, and High Channel

## 7 Power Spectral Density

### 7.1 Test Limits

§ 15.247(e): For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### 7.2 Test Procedure

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

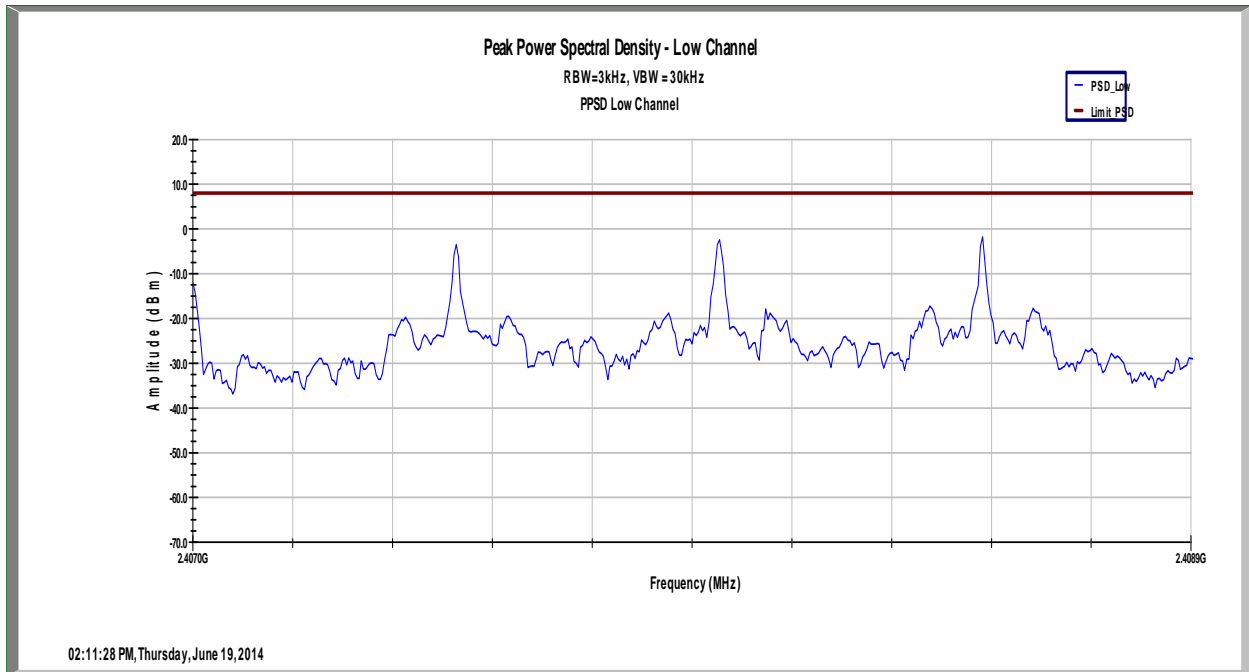
### 7.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	9/10/2013	9/10/2014

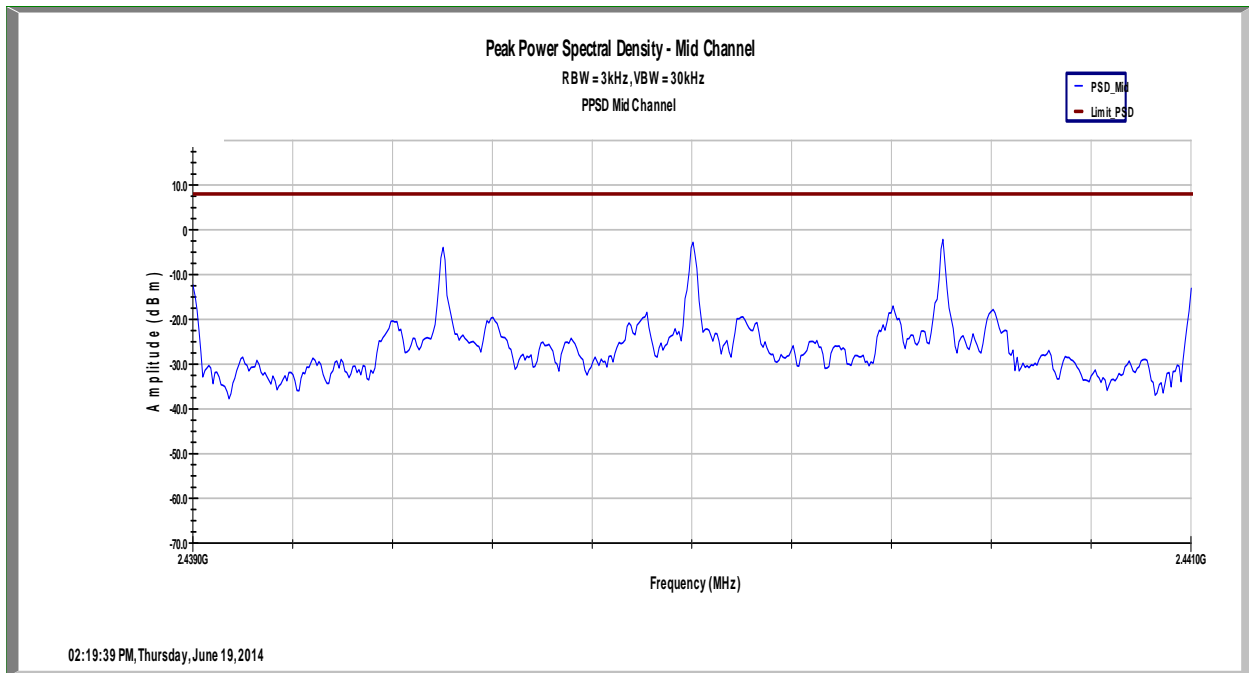
### 7.4 Results:

\*PSD Option 1 Method

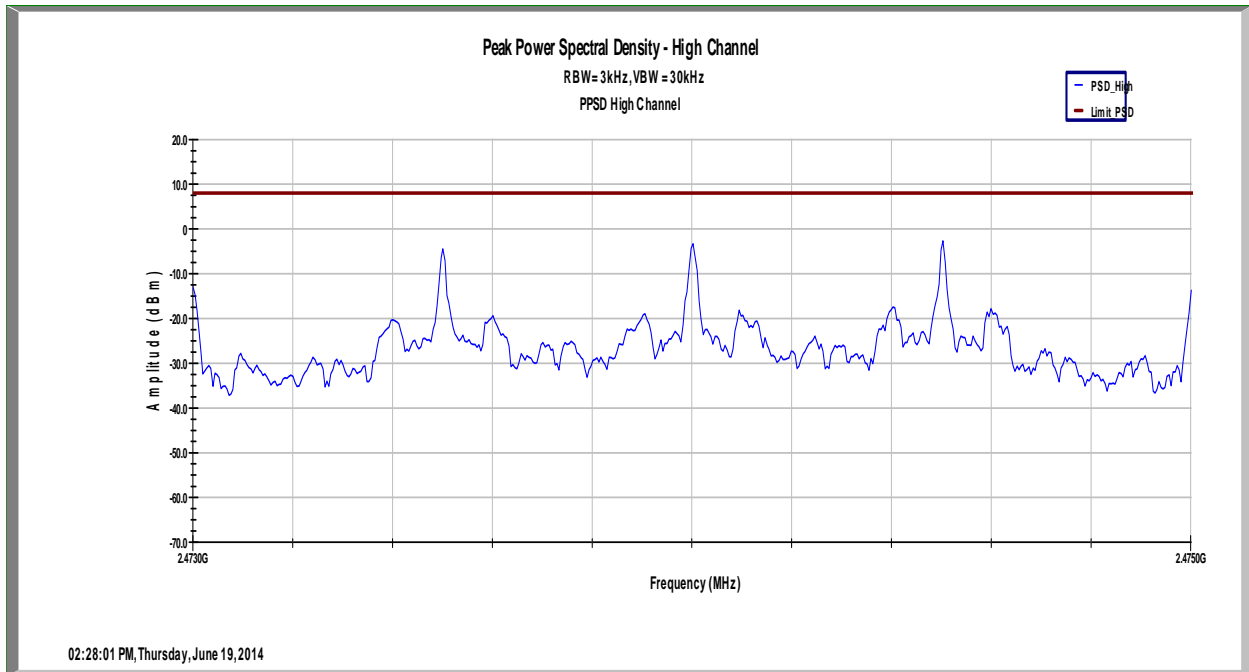
Mode	Frequency (MHz)	PSD in 3kHz BW (dBm)	Limit (dBm)	Result
Normal Transmit Mode	2408	-1.79	8.0	Pass
	2440	-2.16	8.0	Pass
	2474	-2.63	8.0	Pass



Power Spectral Density – Low Channel



Power Spectral Density – Mid Channel



Power Spectral Density – High Channel



## 8 Radiated Spurious Emissions (Transmitter)

### 8.1 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	( <sup>2</sup> )
13.36–13.41			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

<sup>2</sup> 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

## 8.2 Test Procedure

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

### 8.3 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 $\mu$ V/m

RA = Receiver Amplitude in dB $\mu$ V

AF = Antenna Factor in dB

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

Example Calculation:

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

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

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

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

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

### 8.4 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
Bilog Antenna	00051864	ETS	3142C	12/17/2013	12/17/2014
Horn Antenna	00154521	ETS	3117	10/10/2013	10/10/2014
Horn Antenna (18 – 26.5GHz)	LM8621	ETS	3160-09	10/9/2013	10/9/2014
Preamplifier	122005	Rohde&Schwarz	TS-PR18	9/19/2013	9/19/2014
Preamplifier	100050	Rohde&Schwarz	TS-PR26	9/19/2013	9/19/2014
System Controller	3957	Sunol Sciences	SC110V	Time of Use	Time of Use

**8.5 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. The frequency spectrum was investigated up to 10 times the fundamental frequency. Emissions not reported here were at or below the measurement noise floor.

Radiated Emissions										
<b>Test Engineer:</b>	Toby Carrier		<b>Start Date:</b>	6/13/2014		<b>End Date:</b>	6/13/2014			
<b>Temperature:</b>	23.5C		<b>Humidity:</b>	46.70%		<b>Pressure:</b>	988.7mBar			
<b>Specification:</b>	FCC Part 15B		<b>Test Limit:</b>	15.247						
<b>Notes:</b>	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
4.816 GHz	H	36.84	-29.605	34.7	41.935	74	-32.065	1MHz/Pk	3m	Compliant
4.816 GHz	H	35.78	-29.605	34.7	40.875	54	-13.125	1MHz/Avg	3m	Compliant
7.224 GHz	H	35.33	-22.542	35.921	48.708	74	-25.292	1MHz/Pk	3m	Compliant
7.224 GHz	H	31.43	-22.542	35.921	44.808	54	-9.192	1MHz/Avg	3m	Compliant
9.632 GHz	H	26.86	-16.467	37.311	47.704	74	-26.296	1MHz/Pk	3m	Compliant
9.632 GHz	H	18.71	-16.467	37.311	39.554	54	-14.446	1MHz/Avg	3m	Compliant
4.816 GHz	V	36.26	-29.605	34.7	41.355	74	-32.645	1MHz/Pk	3m	Compliant
4.816 GHz	V	35.15	-29.605	34.7	40.245	54	-13.755	1MHz/Avg	3m	Compliant
7.224 GHz	V	33.85	-22.542	35.921	47.228	74	-26.772	1MHz/Pk	3m	Compliant
7.224 GHz	V	33.21	-22.542	35.921	46.588	54	-7.412	1MHz/Avg	3m	Compliant
9.632 GHz	V	28.16	-16.467	37.311	49.004	74	-24.996	1MHz/Pk	3m	Compliant
9.632 GHz	V	18.72	-16.467	37.311	39.564	54	-14.436	1MHz/Avg	3m	Compliant
Band Edge Measurements										
2.39 GHz	H	40.42	-34.335	32.944	39.029	74	-34.971	1MHz/Pk	3m	Compliant
2.39 GHz	H	38.06	-34.335	32.944	36.669	54	-17.331	1MHz/Avg	3m	Compliant
2.39 GHz	V	38.75	-34.335	32.944	37.359	74	-36.641	1MHz/Pk	3m	Compliant
2.39 GHz	V	37.01	-34.335	32.944	35.619	54	-18.381	1MHz/Avg	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

**Worst Case Spurious Measurements (Low Channel)**

Radiated Emissions										
<b>Test Engineer:</b>	Toby Carrier		<b>Start Date:</b>	6/16/2014		<b>End Date:</b>	6/16/2014			
<b>Temperature:</b>	23.5C		<b>Humidity:</b>	46.70%		<b>Pressure:</b>	988.7mBar			
<b>Specification:</b>	FCC Part 15B		<b>Test Limit:</b>	15.247						
<b>Notes:</b>	Mid Channel (2440MHz)									
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
4.88 GHz	H	38.3	-29.512	34.7	43.488	74	-30.512	1MHz/Pk	3m	Compliant
4.88 GHz	H	34.52	-29.512	34.7	39.708	54	-14.292	1MHz/Avg	3m	Compliant
7.32 GHz	H	34.39	-22.164	35.9	48.126	74	-25.874	1MHz/Pk	3m	Compliant
7.32 GHz	H	31.96	-22.164	35.9	45.696	54	-8.304	1MHz/Avg	3m	Compliant
9.76 GHz	H	27.76	-16.473	37.516	48.803	74	-25.197	1MHz/Pk	3m	Compliant
9.76 GHz	H	18.1	-16.473	37.516	39.143	54	-14.857	1MHz/Avg	3m	Compliant
4.88 GHz	V	33.53	-29.512	34.7	38.718	74	-35.282	1MHz/Pk	3m	Compliant
4.88 GHz	V	34.96	-29.512	34.7	40.148	54	-13.852	1MHz/Avg	3m	Compliant
7.32 GHz	V	32.96	-22.164	35.9	46.696	74	-27.304	1MHz/Pk	3m	Compliant
7.32 GHz	V	33.7	-22.164	35.9	47.436	54	-6.564	1MHz/Avg	3m	Compliant
9.76 GHz	V	27.94	-16.473	37.516	48.983	74	-25.017	1MHz/Pk	3m	Compliant
9.76 GHz	V	18.53	-16.473	37.516	39.573	54	-14.427	1MHz/Avg	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

**Worst Case Spurious Measurements (Mid Channel)**

Radiated Emissions										
<b>Test Engineer:</b>	Toby Carrier		<b>Start Date:</b>	6/16/2014		<b>End Date:</b>	6/16/2014			
<b>Temperature:</b>	23.5C		<b>Humidity:</b>	46.70%		<b>Pressure:</b>	988.7mBar			
<b>Specification:</b>	FCC Part 15B		<b>Test Limit:</b>	15.247						
<b>Notes:</b>	High Channel (2474MHz)									
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
4.948 GHz	H	41.82	-29.414	34.7	47.106	74	-26.894	1MHz/Pk	3m	Compliant
4.948 GHz	H	40.8	-29.414	34.7	46.086	54	-7.914	1MHz/Avg	3m	Compliant
7.422 GHz	H	39.46	-21.763	35.9	53.597	74	-20.403	1MHz/Pk	3m	Compliant
7.422 GHz	H	32.17	-21.763	35.9	46.307	54	-7.693	1MHz/Avg	3m	Compliant
9.896 GHz	H	27.78	-16.479	37.734	49.034	74	-24.966	1MHz/Pk	3m	Compliant
9.896 GHz	H	18	-16.479	37.734	39.254	54	-14.746	1MHz/Avg	3m	Compliant
4.948 GHz	V	34.68	-29.414	34.7	39.966	74	-34.034	1MHz/Pk	3m	Compliant
4.948 GHz	V	39.06	-29.414	34.7	44.346	54	-9.654	1MHz/Avg	3m	Compliant
7.422 GHz	V	33.33	-21.763	35.9	47.467	74	-26.533	1MHz/Pk	3m	Compliant
7.422 GHz	V	32.97	-21.763	35.9	47.107	54	-6.893	1MHz/Avg	3m	Compliant
9.896 GHz	V	27.66	-16.479	37.734	48.914	74	-25.086	1MHz/Pk	3m	Compliant
9.896 GHz	V	18.21	-16.479	37.734	39.464	54	-14.536	1MHz/Avg	3m	Compliant
Band Edge Measurements										
2.4835 GHz	H	47.21	-34.085	32.907	46.032	74	-27.968	1MHz/Pk	3m	Compliant
2.4835 GHz	H	42.61	-34.085	32.907	41.432	54	-12.568	1MHz/Avg	3m	Compliant
2.4835 GHz	V	41.73	-34.085	32.907	40.552	74	-33.448	1MHz/Pk	3m	Compliant
2.4835 GHz	V	42.82	-34.085	32.907	41.642	54	-12.358	1MHz/Avg	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

**Worst Case Spurious Measurements (High Channel)**

## 9 Radiated Spurious Emissions (Receiver)

### 9.1 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

### 9.2 Test Procedure

ANSI C63.4: 2009

### 9.3 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 $\mu$ V/m

RA = Receiver Amplitude in dB $\mu$ V

AF = Antenna Factor in dB

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

Example Calculation:

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

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

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

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

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

### 9.4 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
Bilog Antenna	00051864	ETS	3142C	12/17/2013	12/17/2014
Horn Antenna	00154521	ETS	3117	10/10/2013	10/10/2014
Preamplifier	122005	Rohde&Schwarz	TS-PR18	9/19/2013	9/19/2014
System Controller	3957	Sunol Sciences	SC110V	Time of Use	Time of Use

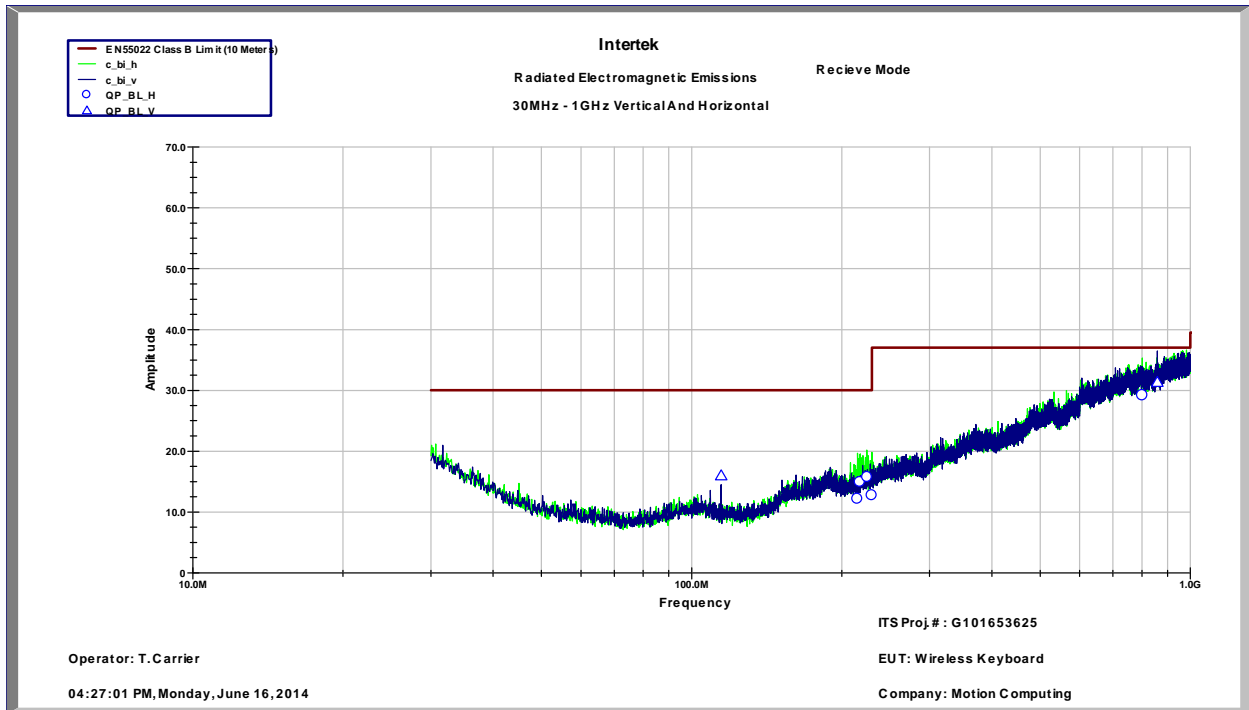
**9.5 Results:**

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.

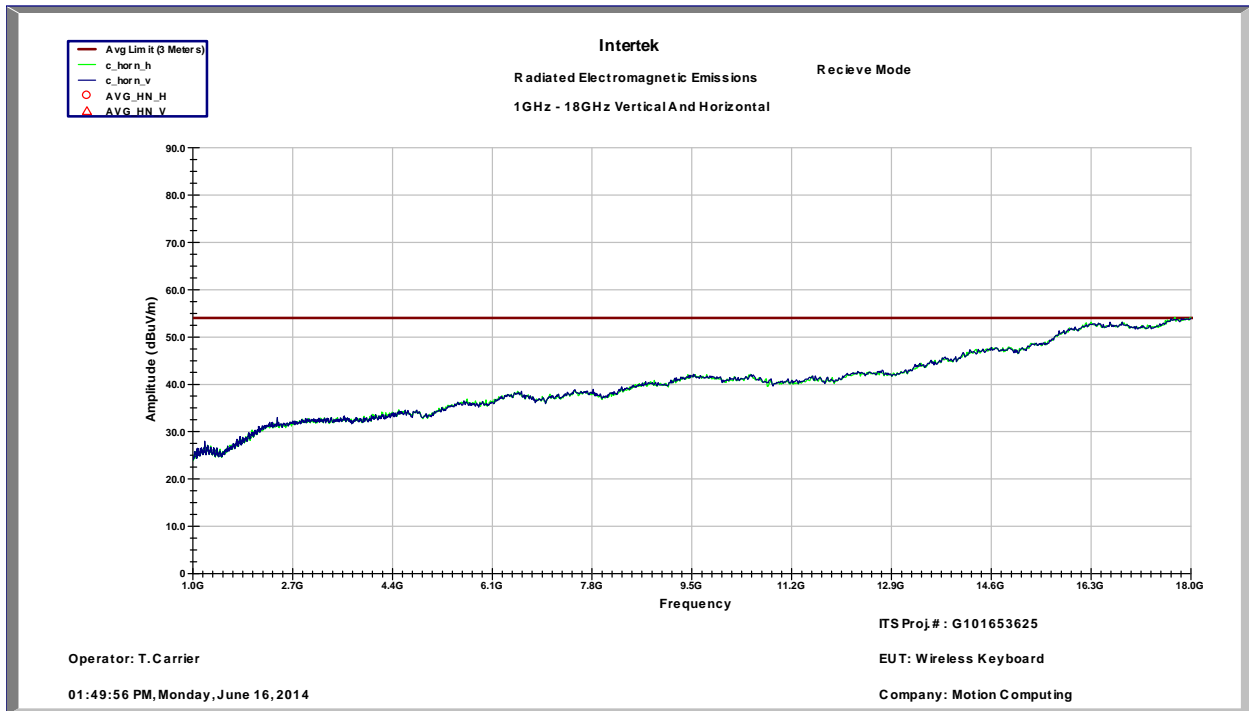
**9.6 Test Data:**

Radiated Emissions										
<b>Test Engineer:</b>	Toby Carrier		<b>Start Date:</b>	6/16/2014		<b>End Date:</b>	6/16/2014			
<b>Temperature:</b>	28.3°C		<b>Humidity:</b>	40.10%		<b>Pressure:</b>	985.1 mbar			
<b>Specification:</b>	EN55022		<b>Test Limit:</b>	Class B						
<b>Notes:</b>	Receive Mode									
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
215.19 MHz	H	-1.1	2.7	10.51	12.11	30	-17.89	120kHz/QP	10m	Compliant
217.78 MHz	H	1.56	2.72	10.61	14.89	30	-15.11	120kHz/QP	10m	Compliant
225.16 MHz	H	1.84	2.77	11.11	15.71	30	-14.29	120kHz/QP	10m	Compliant
230.09 MHz	H	-1.41	2.8	11.31	12.69	37	-24.31	120kHz/QP	10m	Compliant
801.91 MHz	H	1.35	5.41	22.39	29.14	37	-7.86	120kHz/QP	10m	Compliant
114.56 MHz	V	6.9	1.94	7.1	15.94	30	-14.06	120kHz/QP	10m	Compliant
859.13 MHz	V	2.34	5.58	23.41	31.33	37	-5.67	120kHz/QP	10m	Compliant
<b>Calculations:</b>					F = C + D + E		H = F - G			

Deviations, Additions, or Exclusions: None



Bilog Prescan



Horn Prescan

## 10 AC Powerline Conducted Emissions

### 10.1 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  $\mu$ 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 $\mu$ 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.

### 10.2 Test Procedure

ANSI C63.4: 2009

### 10.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ES126	9/11/2013	9/11/2014
LISN	3333	Teseq	NNB52	3/12/2014	3/12/2015

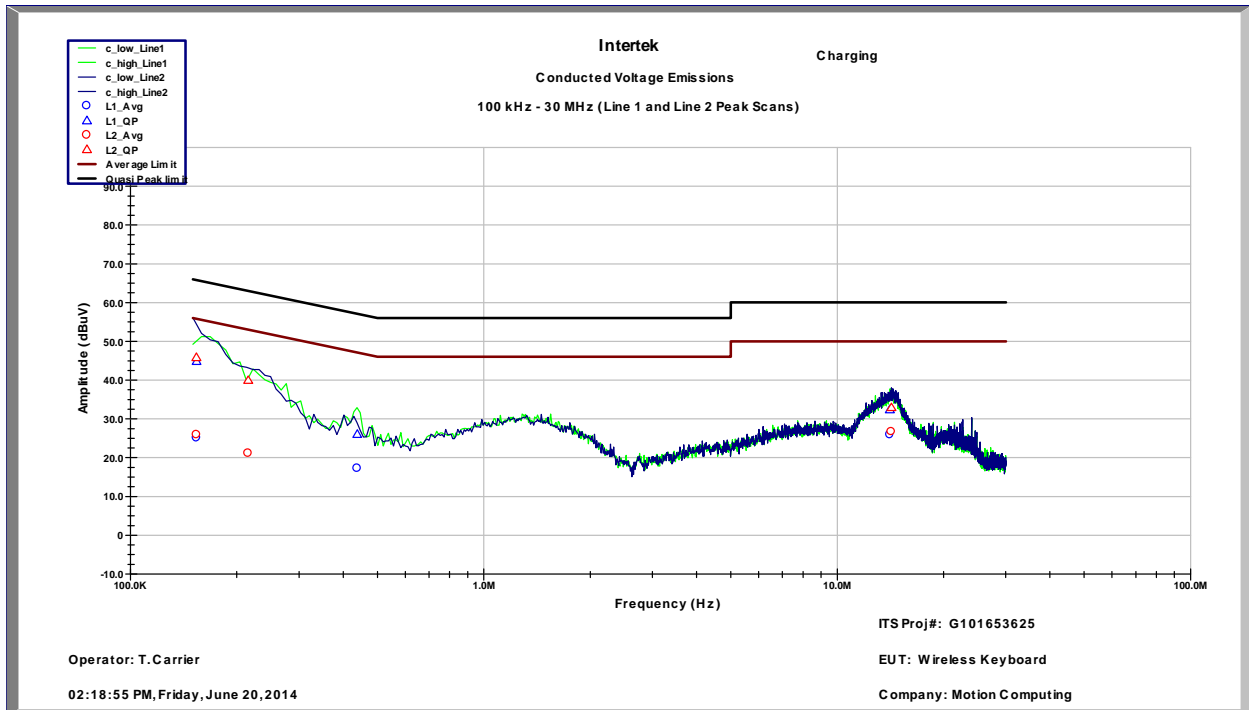
### 10.4 Results:

The sample tested was found to Comply.



10.5 Data (Charging):

Conducted Voltage Emissions on Power Lines								
<b>Test Engineer:</b>	Toby Carrier	<b>Start Date:</b>	6/20/2014	<b>End Date:</b>	6/20/2014			
<b>Temperature:</b>	27.3°C	<b>Humidity:</b>	41.20%	<b>Pressure:</b>	982 mbar			
<b>Specification:</b>	EN 55022	<b>Test Limit:</b>	Class B	<b>RBW:</b>	9kHz			
<b>Notes:</b>	Charging							
Line	Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta (dB)	Average (dBuV)	Average Limit (dBuV)	Average Delta (dB)	Results
L1	153.8 KHz	44.88	65.79	-20.91	25.09	55.79	-30.7	Compliant
	438.1 KHz	26.02	57.1	-31.08	17.2	47.1	-29.9	Compliant
	14.09 MHz	32.41	60	-27.59	25.94	50	-24.06	Compliant
L2	153.7 KHz	45.87	65.8	-19.93	25.94	55.8	-29.86	Compliant
	215.4 KHz	39.96	62.99	-23.04	21.1	52.99	-31.9	Compliant
	14.239 MHz	32.95	60	-27.05	26.7	50	-23.3	Compliant



Deviations, Additions, or Exclusions: None

**11 Antenna Requirement per FCC Part 15.203****11.1 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.

**11.2 Results:**

The sample tested met the antenna requirement. The antenna used was permanently attached and integral to the PCB.

## 12 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	

**13 Revision History**

Revision Level	Date	Report Number	Notes
0	7/17/2014	101653625LEX-001	Original Issue