

## COMPLIANCE WORLDWIDE INC. TEST REPORT 121-15R1

In Accordance with the Requirements of  
Federal Communications Commission Part 15.247, Subpart C  
Industry Canada RSS 210, Issue 8, Annex 8

Low Power License-Exempt Radio Communication Devices  
Intentional Radiators

Issued to

The Coca Cola Company  
1 Coca-Cola Plaza, Freestyle Products  
Atlanta, GA 30313

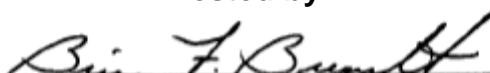
for the

RFID Reader USB  
Model PCA-1143-A03

FCC ID: 2ADIR-XQ4-FS-RFID  
IC: 8593A-XQ4FSRFID

Report Issued on March 17, 2015  
Revision R1 Issued on April 29, 2015

Tested by

  
\_\_\_\_\_  
Brian F. Breault

Reviewed by

  
\_\_\_\_\_  
Larry K. Stillings

This test report shall not be reproduced, except in full, without written permission from Compliance Worldwide, Inc.

## Table of Contents

1. Scope .....	3
2. Product Details .....	3
2.1. Manufacturer .....	3
2.2. Model Number .....	3
2.3. Serial Number.....	3
2.4. Description of EUT.....	3
2.5. Power Source .....	3
2.6. EMC Modifications .....	3
3. Product Configuration .....	4
3.1. Support Equipment .....	4
3.2. Cables .....	4
3.3. Operational Characteristics & Software .....	4
3.4. Block Diagram .....	4
4. Measurements Parameters .....	4
4.1. Measurement Equipment Used to Perform Test .....	4
4.2. Measurement & Equipment Setup .....	4
4.3. Measurement Procedure .....	5
4.4. Measurement Uncertainty .....	5
5. Choice of Equipment for Test Suits .....	6
5.1. Choice of Model.....	4
5.2. Presentation .....	4
5.3. Choice of Operating Frequencies.....	4
6. Measurement Summary .....	6
7. Measurement Data .....	7
7.1. Antenna Requirement .....	7
7.2. Frequency Hopping Requirements.....	7
7.3. Maximum Peak Conducted Output Power .....	18
7.4. Operation with directional antenna gains greater than 6 dBi .....	24
7.5. Emissions Outside of the Frequency Band .....	24
7.6. Transmitter Spurious Radiated Emissions .....	27
7.7. Spurious Radiated Emissions – Harmonic Emissions .....	31
7.8. Conducted Emissions .....	34
7.9. Public Exposure to Radio Frequency Energy Levels.....	37
8. Test Site Description .....	38

## 1. Scope

This test report certifies that The Coca Cola Company RFID Reader USB, Model PCA-1143-A03 as tested, meets the FCC Part 15, Subpart C and Industry Canada RSS 210, Issue 8 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required. Revision R1 updates the conducted output power in section 7.3 and band edge measurements in section 7.5

## 2. Product Details

- 2.1. Manufacturer:** The Coca Cola Company
- 2.2. Model Number:** PCA-1143-A03, RFID Reader USB
- 2.3. Serial Number:** 17082993
- 2.4. Description:** This device is intended for use as a radio frequency identification (RFID) component used in Coca-Cola freestyle dispenser products.
- 2.5. Power Source:** 5 VDC via USB, 120 Volts, 60 Hz
- 2.6. Hardware Revs.:** Rev 0-00
- 2.7. Software Rev.:** N/A
- 2.8. EMC Modifications:** None

### 3. Product Configuration

#### 3.1. Support Equipment

Device	Manufacturer	Model	Serial No.	Comment
Laptop	Dell	XPS L521X	DSQPVY1	
Laptop Power Supply	Dell	90W-AC-Adapter		

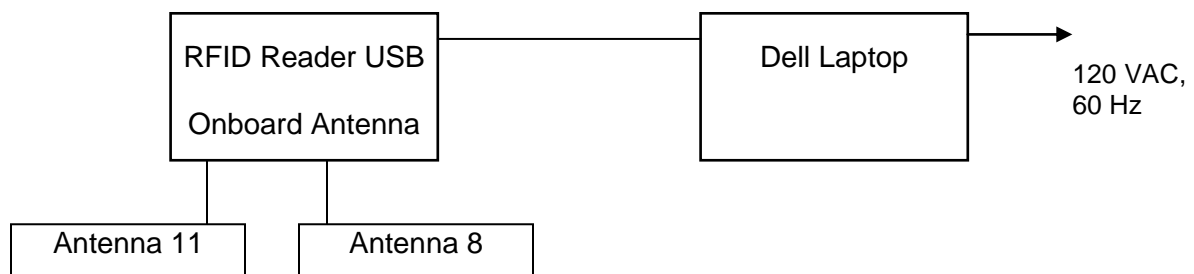
#### 3.2. Cables

Cable Type	Length	Shield	From	To
USB 3.0 Cable	2M	Yes	EUT	Laptop
Power Cable / Supply	2M + 1M	Yes	Laptop	120 VAC, 60 Hz

#### 3.3. Operational Characteristics & Software

1. After boot up on the laptop, connect the RFID Reader USB Module.
2. Using the Impinj RS500 Development Tool, connect to the module using COM5
3. To configure the device to normally hop, under the Inventory Tab click start.
4. Use the I/O Tab to write to the GPIO1 & GPIO2 registers to select the appropriate antenna.
5. To have the device "hop" on the same frequency, use the TX Control Tab, enter the desired frequency and turn PBRs to On.

#### 3.4. Block Diagram



## 4. Measurements Parameters

### 4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Test Receiver, 9kHz - 7GHz <sup>1</sup>	Rohde & Schwarz	ESR7	101156	4/4/2015	2 Years
Spectrum Analyzer 20 Hz – 40 GHz <sup>2</sup>	Rohde & Schwarz	FSV40	100899	6/5/2015	2 Years
Spectrum Analyzer, 9 kHz to 40 GHz <sup>3</sup>	Rohde & Schwarz	FSVR40	100909	5/15/2015	2 Years
EMI Receiver, 9 kHz to 6.5 GHz	Hewlett Packard	8546A	3650A00360	6/4/2016	2 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A00329	6/5/2015	2 Years
Loop Antenna, 9 kHz to 30 MHz	EMCO	6512	9309-1139	9/23/2016	2 Years
Biconilog Antenna, 30 MHz to 2 GHz	Sunol Sciences Corp	JB1	25509	5/15/2015	2 Years
Horn Antenna, 960 MHz – 18 GHz	Electro-Metrics	RGA-50 / 60	2813	7/15/2015	2 Years
LISN 50 $\Omega$ 50 $\mu$ H, 9 kHz to 30 MHz	EMCO	3825/2	9109-1860	6/2/2015	1 Year
Power Supply	Hewlett Packard	6296A	7M0599	8/26/2015	1 Year
Digital Barometer	Control Company	4195	ID236	2/25/2015	2 Years
1.8 to 9.3 GHz Band Pass Filter	Mini-Circuits	VHP-16	0341	2/25/2016	1 Year
Temperature Chamber	Associated Research	E-0029	N/A	N/A	---

<sup>1</sup> ESR7 Firmware revision: V2.26, Date installed: 8/15/2014 Previous V2.17, installed 6/11/2014.  
<sup>2</sup> FSV40 Firmware revision: V2.30 SP1 Date installed: 10/22/2014 Previous V2.30, installed 7/23/2014.  
<sup>3</sup> FSVR40 Firmware revision: V2.23, Date installed: 10/20/2014 Previous V1.63 SP1, installed 8/28/2013.

Manufacturer	Software Description	Title or Model #	Rev.	Report Sections
Compliance Worldwide	Test Report Generation Software	Test Report Generator	1.0	7.7. Conducted Emissions

### 4.2. Measurement & Equipment Setup

Test Dates:	1/29/2015, 1/30/2015, 2/3/2015, 2/5/2015, 2/18/2015, 4/29/2015
Test Engineers:	Larry Stillings, Tom Charron
Normal Site Temperature (15 - 35°C):	21.2
Relative Humidity (20 -75%RH):	33
Frequency Range:	6 MHz to 10 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	9 kHz – 9 kHz to 30 MHz 120 kHz - 30 MHz to 1 GHz 1 MHz - Above 1 GHz
EMI Receiver Avg Bandwidth:	30 kHz – 9 kHz to 30 MHz 300 kHz - 30 MHz to 1 GHz 3 MHz - Above 1 GHz
Detector Function:	Peak, Quasi-Peak & Average

#### 4. Measurements Parameters (continued)

##### 4.3. Measurement Procedure

Testing was performed in accordance with the requirements detailed in ANSI C63.10-2009, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices. In addition, FCC DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems was also referenced.

Test measurements were made in accordance with FCC Part 15.247, ANSI C63.10-2009 and IC RSS-210 Annex II: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

The test methods used to generate the data in this test report is in accordance with ANSI C63.10-2009, American National Standard for Testing Unlicensed Wireless Devices.

##### 4.4. Measurement Uncertainty

The following uncertainties are expressed for an expansion/coverage factor of K=2.

RF Frequency	$\pm 1 \times 10^{-8}$
Radiated Emission of Transmitter	$\pm 4.55$ dB
Radiated Emission of Receiver	$\pm 4.55$ dB
Temperature	$\pm 0.91^{\circ}$ C
Humidity	$\pm 5\%$

## 5. Choice of Equipment for Test Suites

### 5.1 Choice of Model

This test report is based on the test samples supplied by the manufacturer and are reported by the manufacturer to be equivalent to the production units.

### 5.2 Presentation

This test sample was tested complete with all required ancillary equipment. Refer to Section 3 of this report for product equipment configuration.

### 5.3 Choice of Operating Frequencies

The RFID Reader, USB employs 50 channels in the 902 MHz to 928 MHz frequency range. In accordance with ANSI C63.10-2009, Section 5.6, three channels are detailed in this test report:

In accordance with ANSI C63.10-2009, Section 5.6, the choice of operating frequencies selected for the testing outlined in this report was based on the lowest, middle and highest operating frequencies. The frequencies selected were:

- Low Channel – 902.750 MHz
- Middle Channel – 915.250 MHz
- High Channel – 927.250 MHz

## 6. Measurement Summary

Test Requirement	FCC Part 15.247 Reference	IC RSS-210 Reference	Test Report Section	Result	Comment
Antenna Requirement	15.203	RSS-GEN 7.1.2	7.1	Compliant	RSS GEN 7.1.4
Frequency Hopping Requirements	15.247 (a)	A.8.1(c)	7.2	Compliant	RSS GEN 4.6.1
Minimum 6 dB Bandwidth		A.8.1(c)			
Number of Hopping Channels		A.8.1(c)			
Channel Separation		A.8.1(c)			
99% Bandwidth	N/A	RSS-GEN			
Maximum Peak Conducted Output Power	15.247 (b)	A.8.4	7.3	Compliant	
Operation with directional antenna gains greater than 6 dBi	15.247 (c)	A.8.4	7.4	N/A	Antenna gain <6 dBi
Lower and Upper Band Edge	15.247 (d), 15.209	N/A	7.5	Compliant	RSS GEN 4.9
Spurious Radiated Emissions		A.8.5	7.6	Compliant	
Spurious Radiated Emissions (> GHz) - Harmonic Measurements		A.8.5	7.7	Compliant	
Power Spectral Density	15.247(e)	NR	NR	Compliant	Frequency hopping device
Conducted Emissions	FCC 15.207	N/A	7.8	Compliant	RSS GEN 7.2.2
Public Exposure to Radio Frequency Energy Levels	1.1307 (b) (1)	RSS GEN 5.5 RSS 102	7.9	Compliant	



## 7. Measurement Data

### 7.1. Antenna Requirement (Section 15.203, RSS GEN 7.1.4)

**Requirement:** 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.

**Status:** The unit under test employs an SMB connector with a color coded plastic cover to match the appropriate antenna to the port.

### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c))

**Requirements:** Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

#### 7.2.1. 20 dB Bandwidth

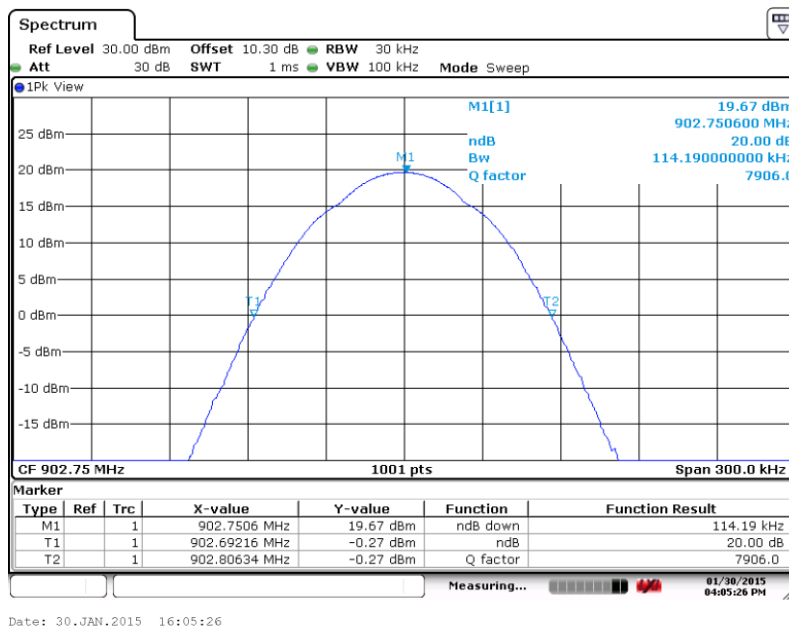
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	Maximum 20 dB Bandwidth (kHz)	Result
Low	902.750	114.19	250	Compliant
Mid	915.250	113.59	250	Compliant
High	927.250	117.18	250	Compliant

## 7. Measurement Data (continued)

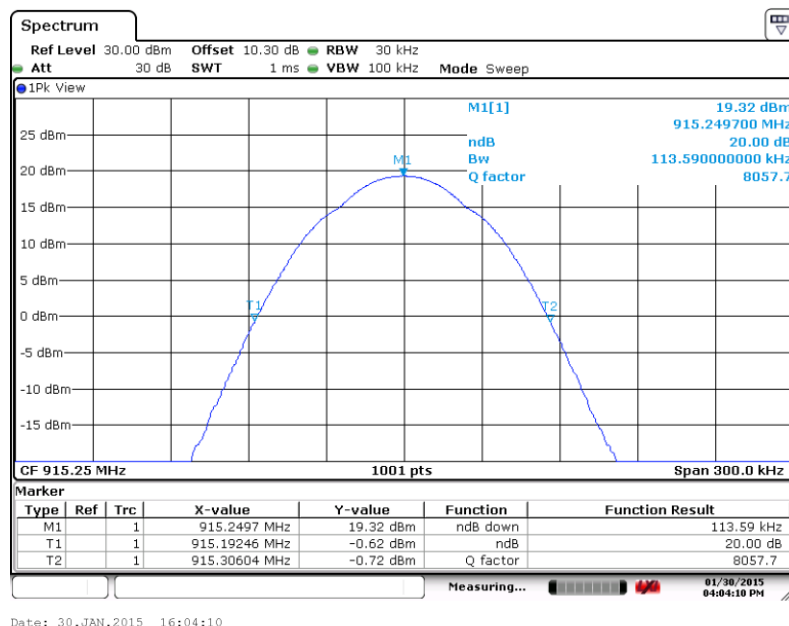
### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c)) (continued)

#### 7.2.1. 20 dB Bandwidth (continued)

##### 7.2.1.1. 20 dB Bandwidth – Low Frequency



##### 7.2.1.2. 20 dB Bandwidth – Middle Frequency

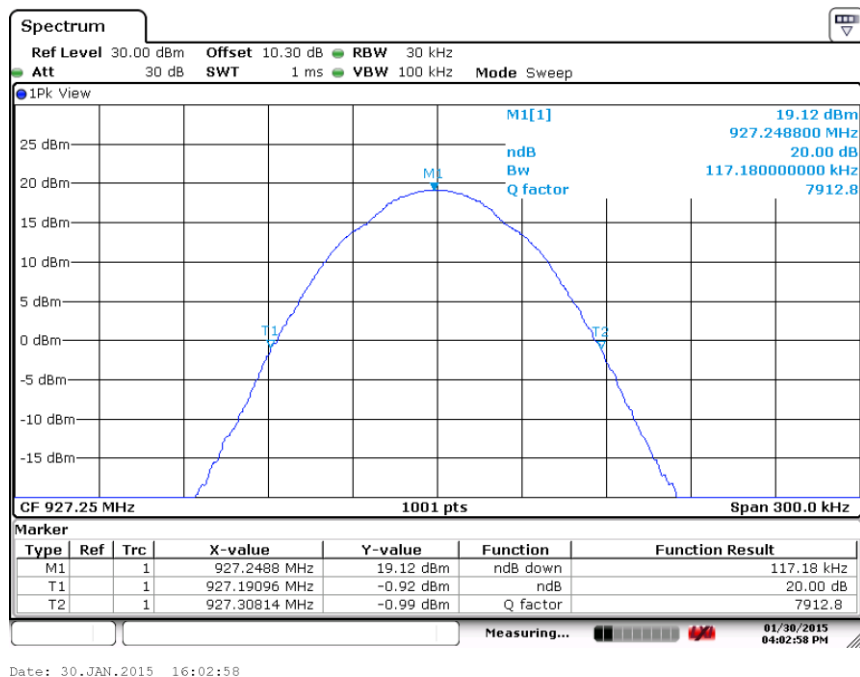


## 7. Measurement Data (continued)

### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c)) (continued)

#### 7.2.1. 20 dB Bandwidth (continued)

##### 7.2.1.3. 20 dB Bandwidth – High Frequency



#### 7.2.2. 99% Bandwidth

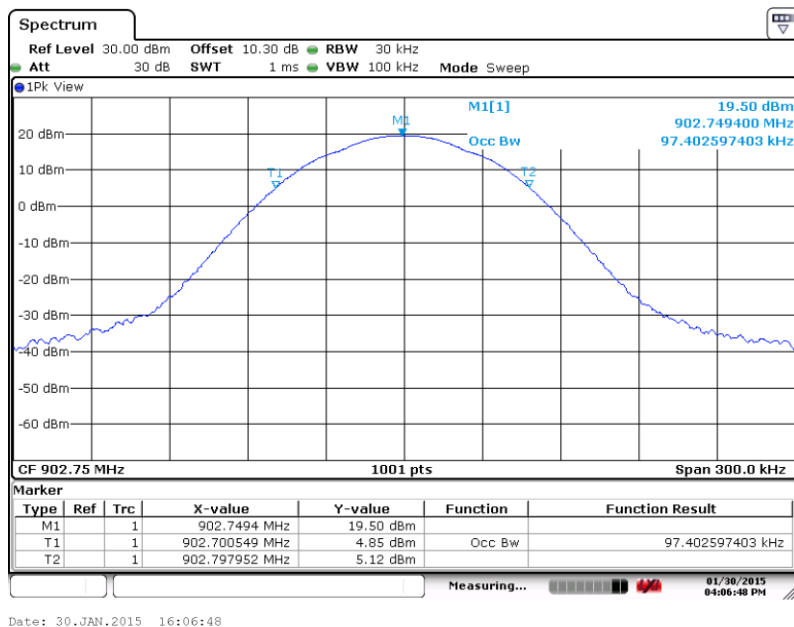
Channel	Channel Frequency (GHz)	99% Power Bandwidth (kHz)
Low	902.750	97.403
Middle	915.250	96.503
High	927.250	96.204

## 7. Measurement Data (continued)

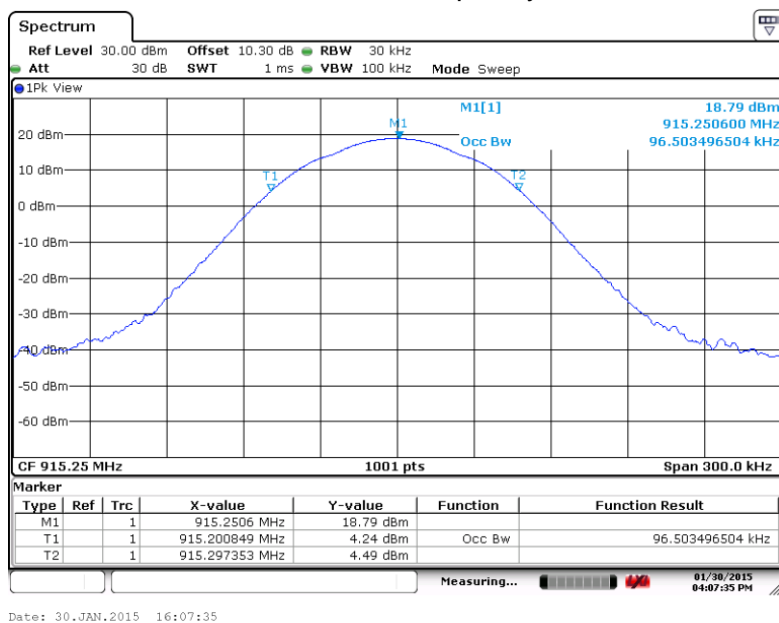
### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c)) (continued)

#### 7.2.2. 99% Bandwidth (continued)

##### 7.2.2.1. 99% Bandwidth – Low Frequency



##### 7.2.2.2. 99% Bandwidth – Middle Frequency

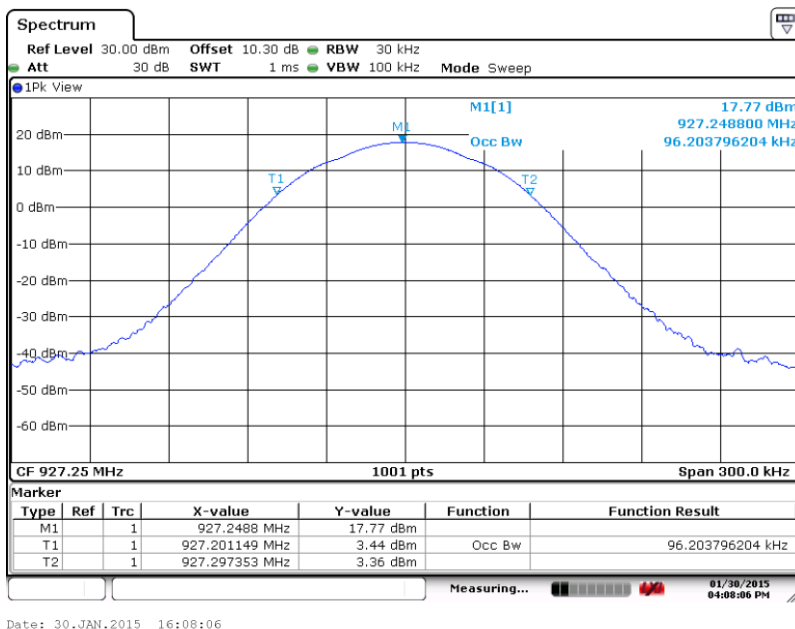


## 7. Measurement Data (continued)

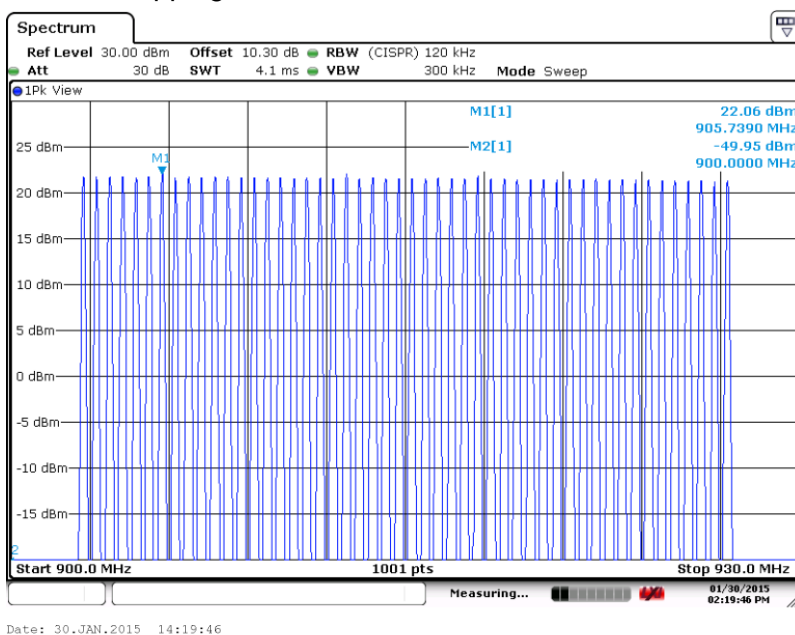
### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c)) (continued)

#### 7.2.2. 99% Bandwidth (continued)

#### 7.2.2.3. 99% Bandwidth – High Frequency



#### 7.2.3. Number of Hopping Channels = 50



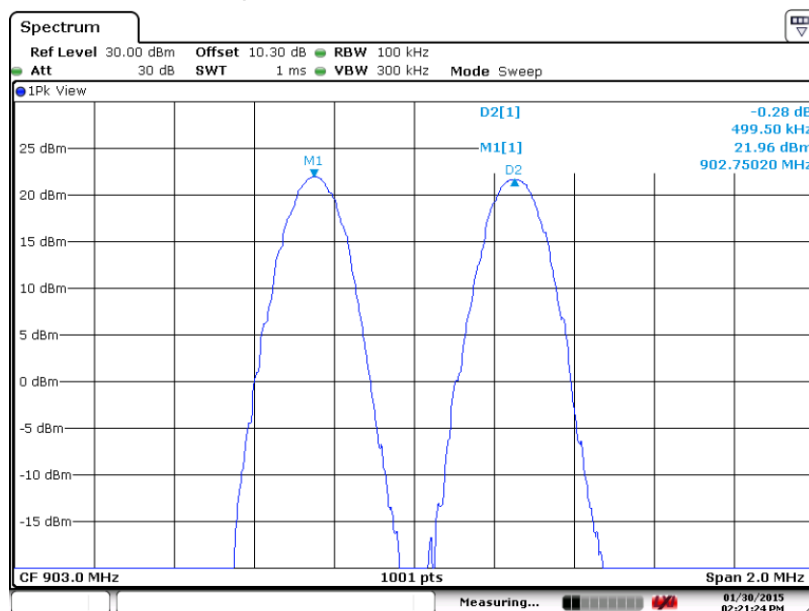
## 7. Measurement Data (continued)

### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c)) (continued)

#### 7.2.4. Channel Separation

Channel	Channel Pair	Channel Separation (kHz)	Required Channel Separation (kHz)	Result
Low	902.750	499.50	117	Compliant
	903.250			
Middle	915.250	501.50	117	Compliant
	915.750			
High	926.750	499.50	117	Compliant
	927.250			

#### 7.2.4.1. Channel Separation - Low Channels



Test Number: 121-15R1

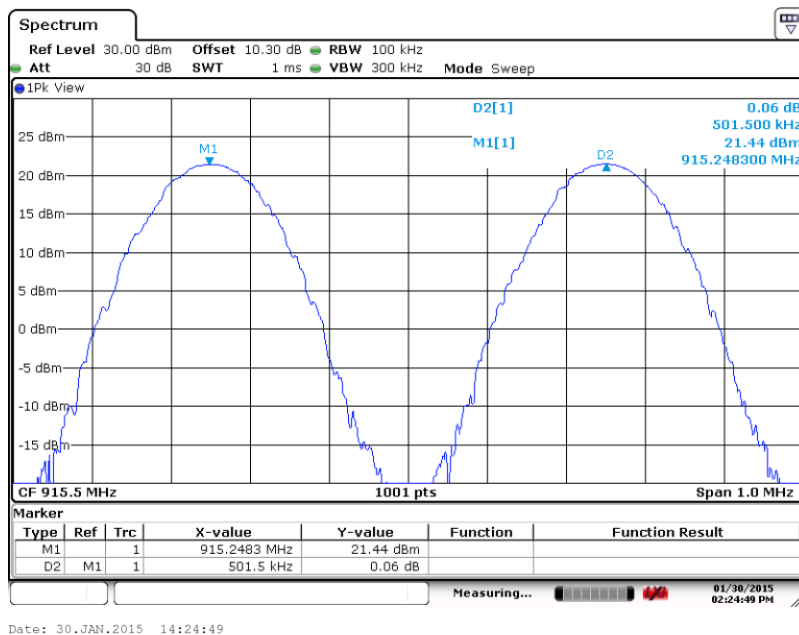
Issue Date: 4/29/2015

## 7. Measurement Data (continued)

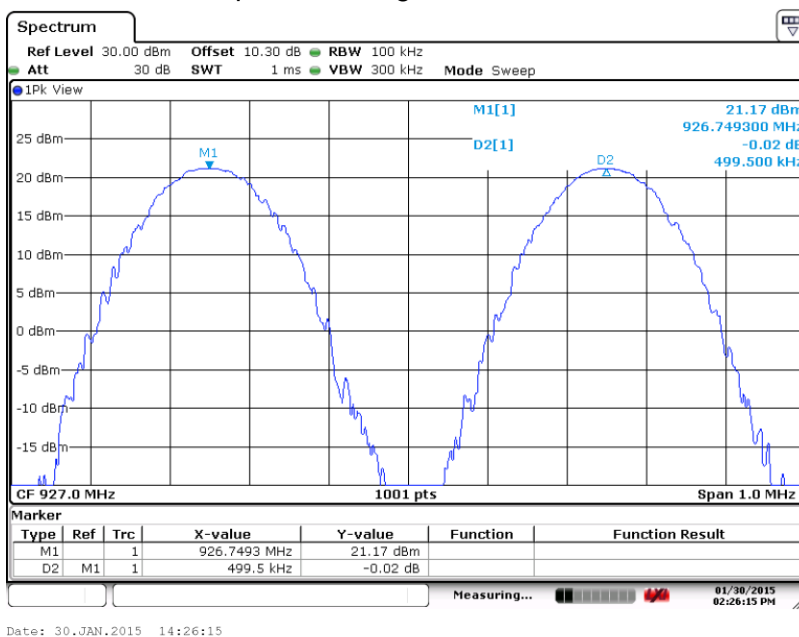
### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c)) (continued)

#### 7.2.4. Channel Separation

##### 7.2.4.2. Channel Separation - Middle Channels



##### 7.2.4.3. Channel Separation - High Channels



## 7. Measurement Data (continued)

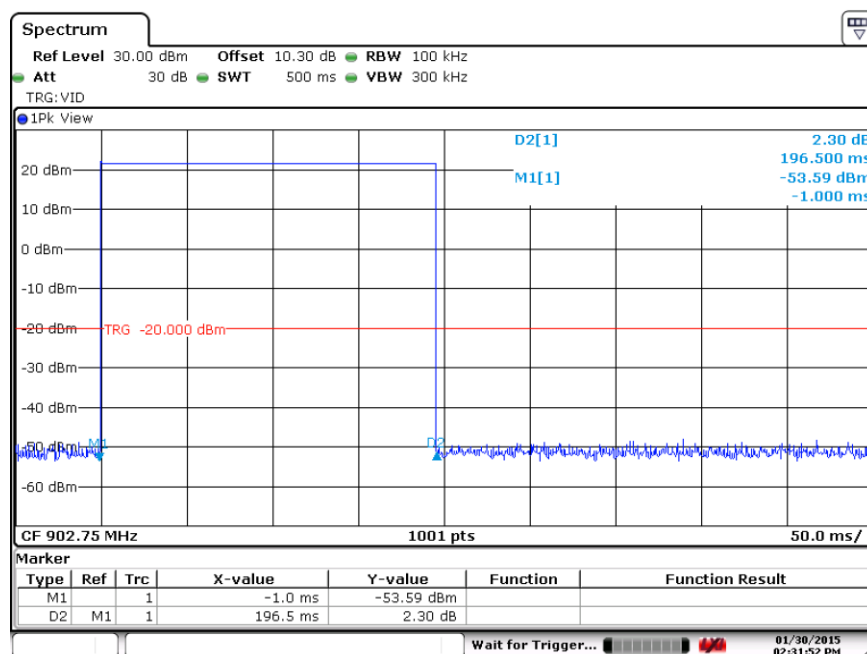
### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c)) (continued)

#### 7.2.5. Average Time of Occupancy per Period (Period = 20 Seconds)

Channel	Frequency (MHz)	Pulse Width (Sec)	Avg Time per Period (20 Seconds)	Maximum Time per Period	Result
Low	902.750	0.1965	0.3930	0.4000	Compliant
Middle	915.250	0.1965	0.3930	0.4000	Compliant
High	927.250	0.1960	0.3920	0.4000	Compliant

**Note:** Two Pulses occur every 20 seconds.

#### 7.2.5.1. Pulse Width - Low Channel



Date: 30.JAN.2015 14:31:53

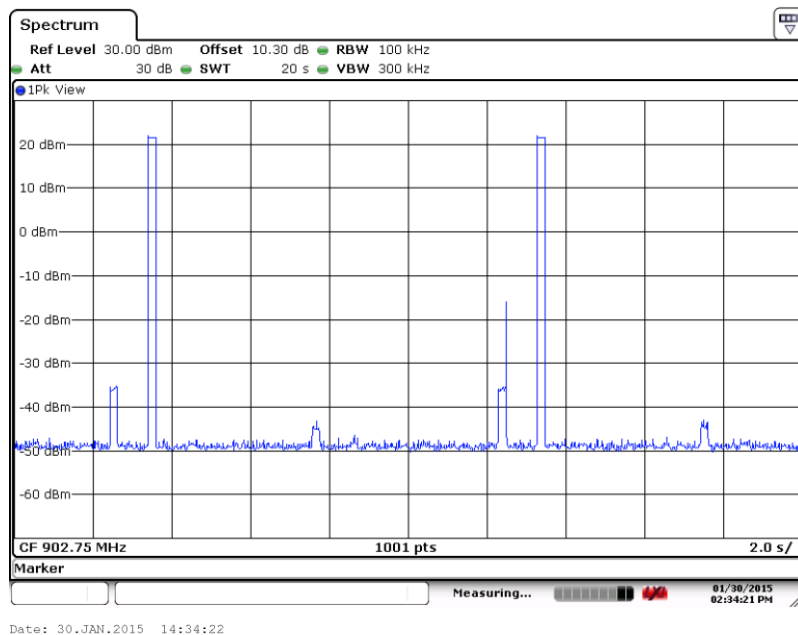


## 7. Measurement Data (continued)

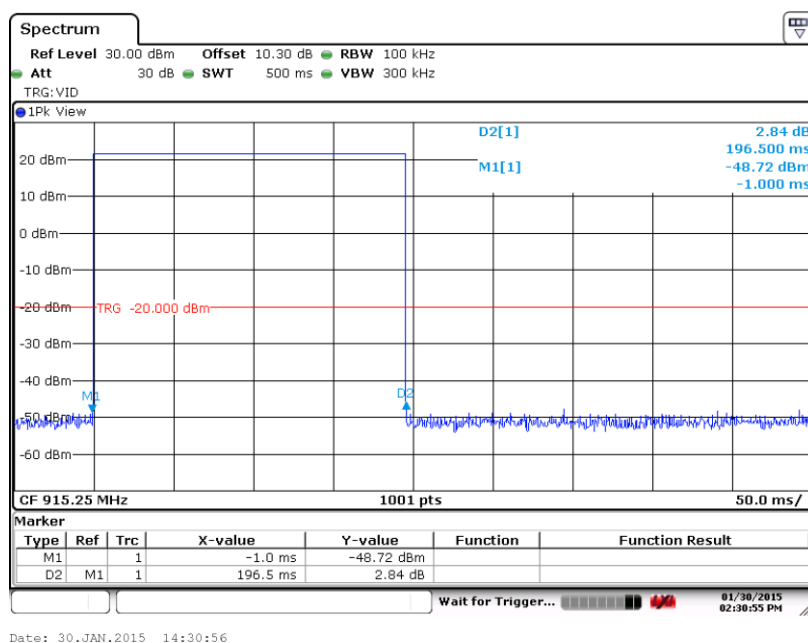
### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c)) (continued)

#### 7.2.5. Average Time of Occupancy per Period (Period = 20 Seconds)

##### 7.2.5.2. Pulses per 20 Second Period - Low Channel



##### 7.2.5.3. Pulse Width - Middle Channel

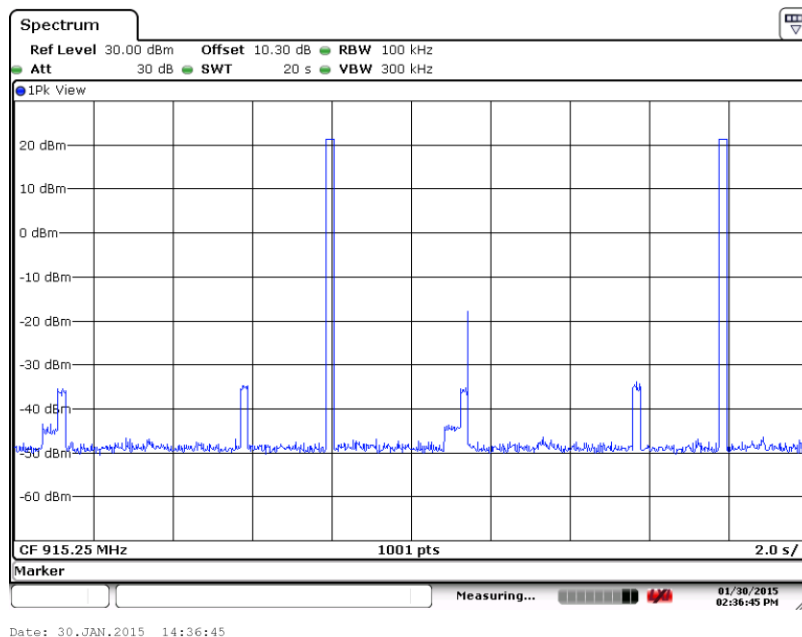


## 7. Measurement Data (continued)

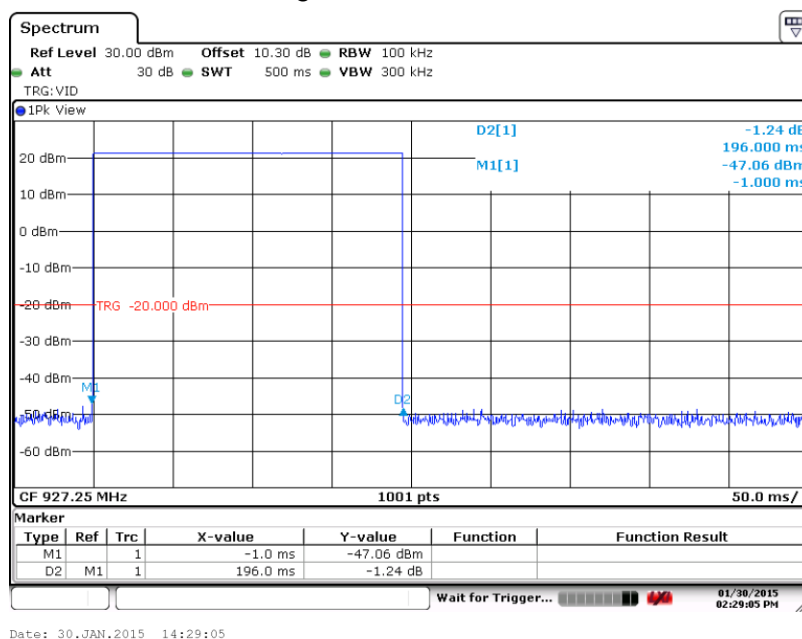
### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c)) (continued)

#### 7.2.5. Average Time of Occupancy per Period (Period = 20 Seconds)

##### 7.2.5.4. Pulses per 20 Second Period - Middle Channel



##### 7.2.5.5. Pulse Width - High Channel



Test Number: 121-15R1

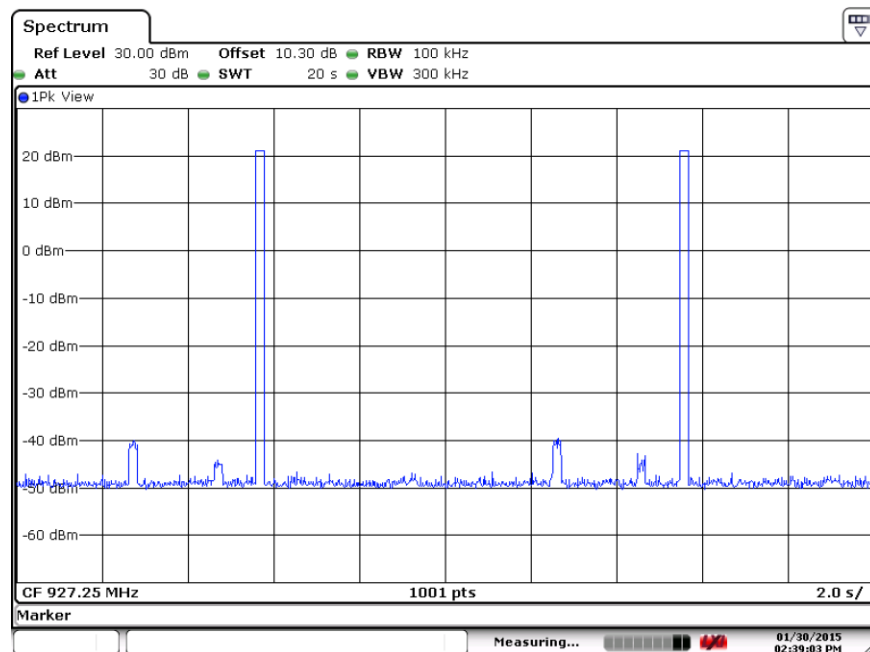
Issue Date: 4/29/2015

## 7. Measurement Data (continued)

### 7.2. Frequency Hopping Requirements (Section 15.247 (a), A.8.1(c)) (continued)

#### 7.2.5. Average Time of Occupancy per Period (Period = 20 Seconds)

#### 7.2.5.6. Pulses per 20 Second Period - High Channel



Date: 30.JAN.2015 14:39:03

## 7. Measurement Data (continued)

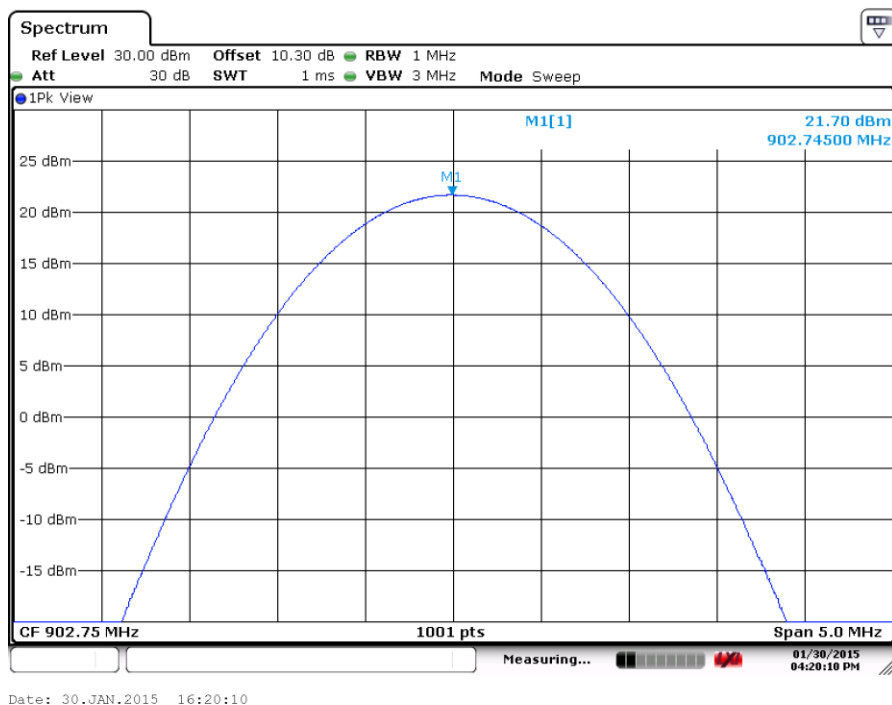
### 7.3. Maximum Peak Conducted Output Power (Section 15.247 (b), A.8.4)

Requirements: The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Channel	Frequency (MHz)	Max Conducted Output Power (dBm)	Max Peak Conducted Output Power (Watts)	Limit (Watts)	Result
Low – Antenna 11	902.750	21.70	0.148	1	Compliant
Middle – Antenna 11	915.250	21.20	0.132	1	Compliant
High – Antenna 11	927.250	20.33	0.108	1	Compliant

**Note:** Port Ant1 for Antenna 11 is worse case, as this port has the shortest trace length from the output of the RF switch on the board.

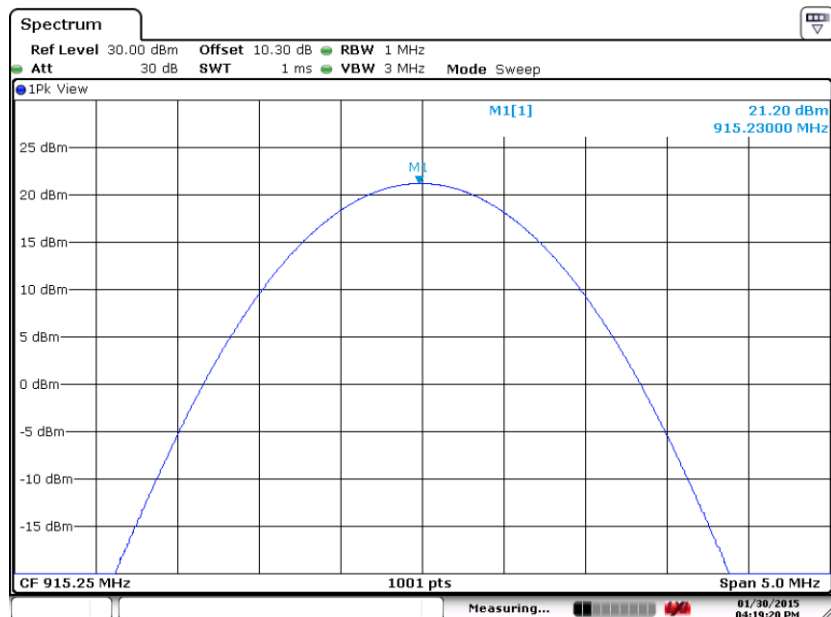
#### 7.3.1. Maximum Peak Conducted Output Power – Low Channel – Antenna 11



## 7. Measurement Data (continued)

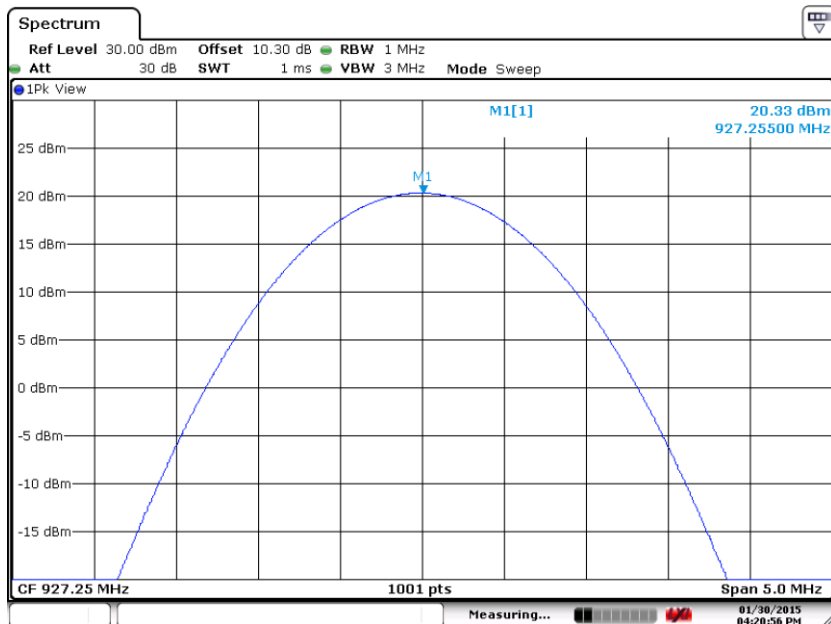
### 7.3. Maximum Peak Conducted Output Power (Section 15.247 (b), A.8.4) (continued)

#### 7.3.2. Maximum Peak Conducted Output Power – Middle Channel – Antenna 11



Date: 30.JAN.2015 16:19:20

#### 7.3.3. Maximum Peak Conducted Output Power – High Channel – Antenna 11

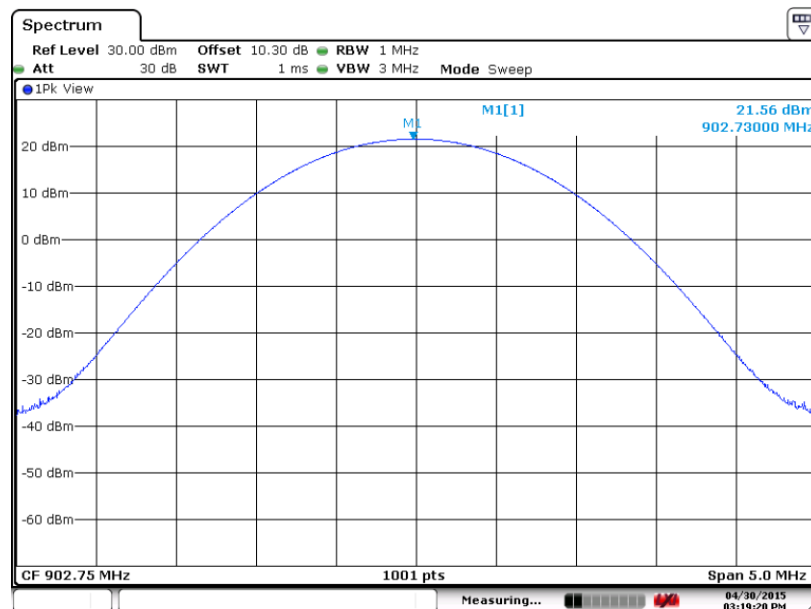


Date: 30.JAN.2015 16:20:56

## 7. Measurement Data (continued)

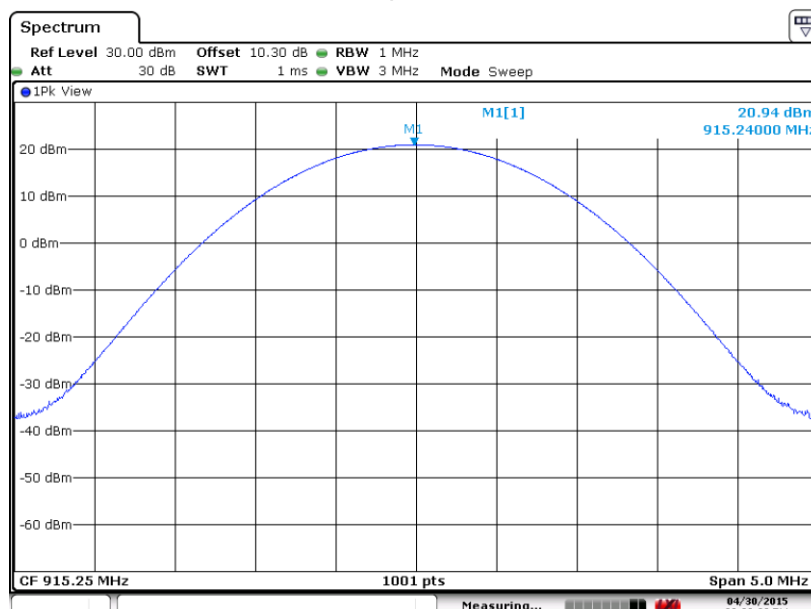
### 7.3. Maximum Peak Conducted Output Power (Section 15.247 (b), A.8.4) (continued)

#### 7.3.4. Maximum Peak Conducted Output Power – Low Channel – Antenna 8



Date: 30.APR.2015 15:19:20

#### 7.3.5. Maximum Peak Conducted Output Power – Middle Channel – Antenna 8

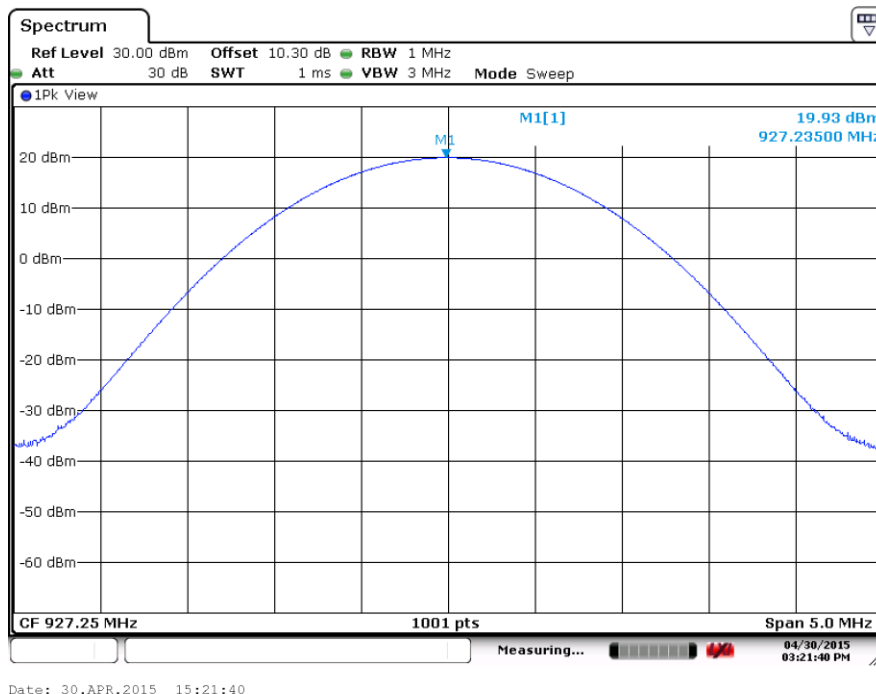


Date: 30.APR.2015 15:20:36

## 7. Measurement Data (continued)

### 7.3. Maximum Peak Conducted Output Power (Section 15.247 (b), A.8.4) (continued)

#### 7.3.6. Maximum Peak Conducted Output Power – High Channel – Antenna 8



#### 7.3.7 Maximum Peak Power Radiated Measurements at 3 meters

Frequency (MHz)	Antenna	Peak Field Strength (dBμV/m)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Position (deg)
Maximum Peak Level of all channels	Antenna 11	82.15	V	111	224
		-13.05 dBm			
	Antenna 8	114.30	V	116	40
		19.1 dBm			
	Onboard Ant	110.95	V	110	184
		15.75 dBm			

**Note:** dBm levels were determined by subtracting 95.2 from the 3 meter field strength levels. Antennas for the EUT are designed to measure / activate tags at very short distances.

**7. Measurement Data (continued)**
**7.4. Operation with Directional Antenna Gains Greater than 6 dBi (Section 15.247 (c))**

Status: Section 15.247 (c)) does not apply to the product under test.

**7.5. Emissions Outside the Frequency Band (Section 15.247 (d), RSS GEN 4.9)**

Requirements: 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.

Test Note: The measurement methodology detailed in FCC Office of Engineering and Technology Publication Number: 913591 is used to determine the band edge values.

**7.5.1. Band Edge Measurements**
**Lower Band Edge**

Lowest Channel (MHz)	Measured Power (dBm)	Band Edge Frequency (MHz)	Measured Power (dBm)	Requirement (-20 dB from Peak)	Margin (dB)	Result
	Peak		Peak	Peak		
902.750	21.56	902	-41	1.56	-42.56	Compliant

**Upper Band Edge**

Highest Channel (MHz)	Measured Power (dBm)	Band Edge Frequency (MHz)	Measured Power (dBm)	Requirement (-20 dB from Peak)	Margin (dB)	Result
	Peak		Peak	Peak		
927.250	20.15	928	-46	0.15	-46.15	Compliant



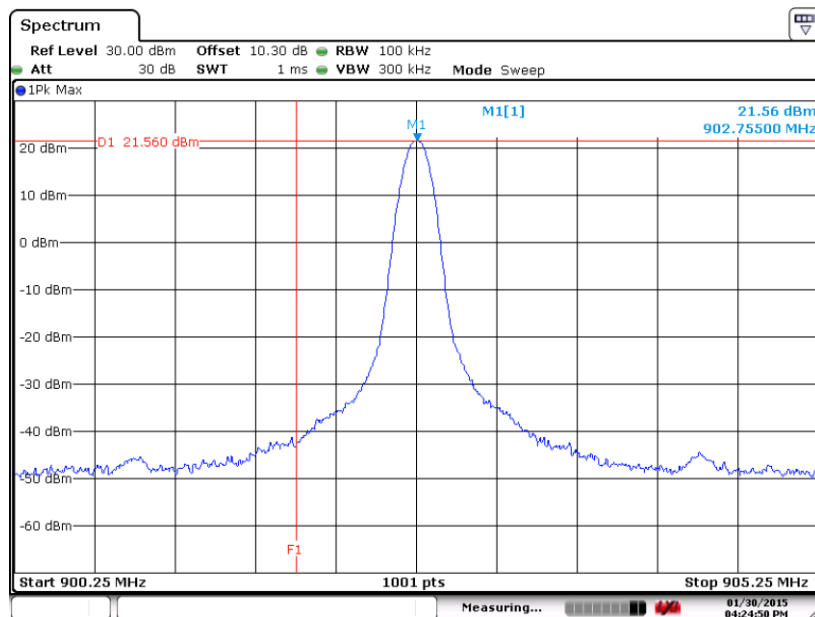
Test Number: 121-15R1

Issue Date: 4/29/2015

## 7. Measurement Data (continued)

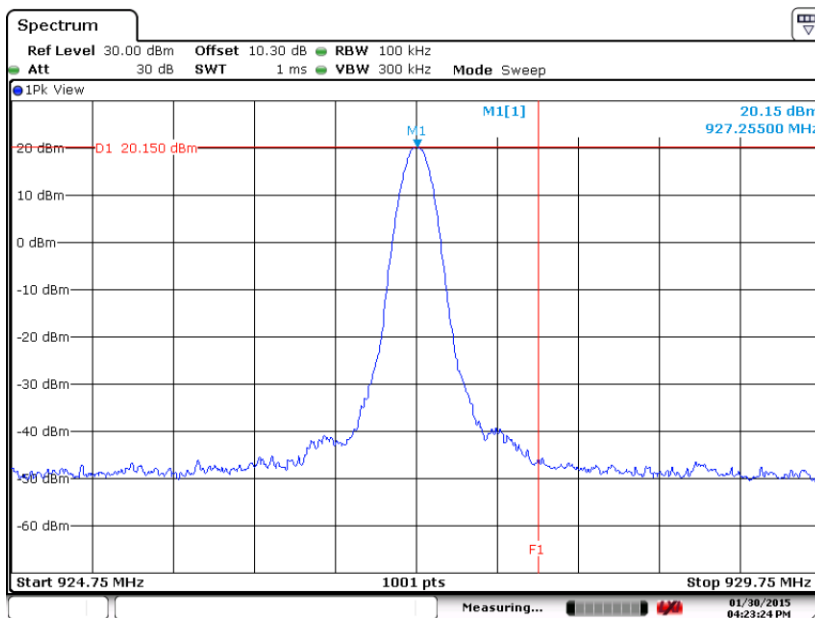
### 7.5. Emissions outside the Frequency Band (15.247 (d), RSS GEN 4.9) (continued)

#### 7.5.1.1. Lower Band Edge



Date: 30.JAN.2015 16:24:50

#### 7.5.1.2. Upper Band Edge

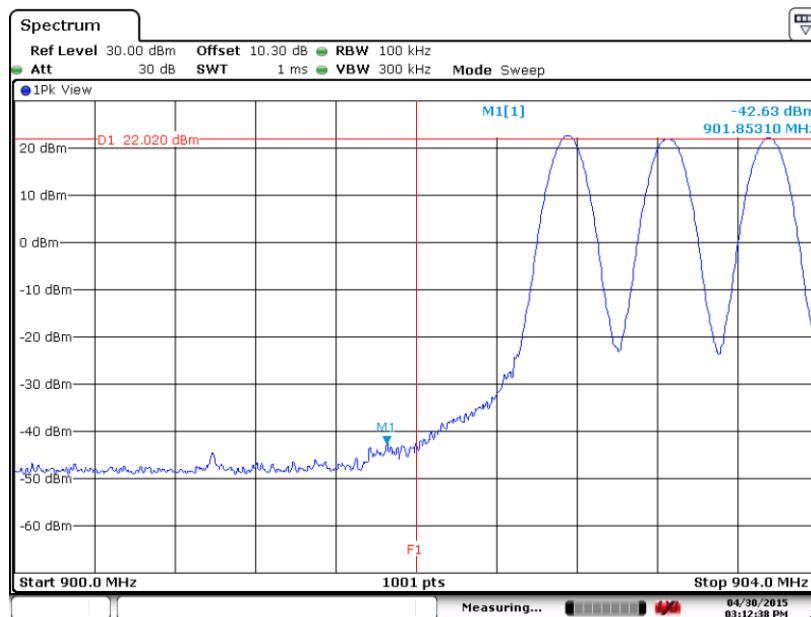


Date: 30.JAN.2015 16:23:24

## 7. Measurement Data (continued)

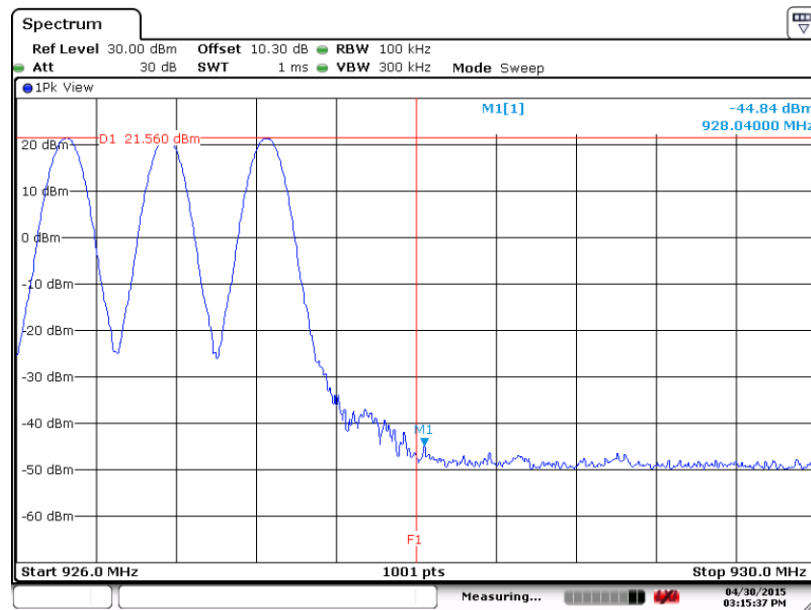
### 7.5. Emissions outside the Frequency Band (15.247 (d), RSS GEN 4.9) (continued)

#### 7.5.1.3. Lower Band Edge (Hopping Mode)



Date: 30.APR.2015 15:12:38

#### 7.5.1.4. Upper Band Edge (Hopping Mode)



Date: 30.APR.2015 15:15:37

## 7. Measurement Data (continued)

### 7.6. Transmitter Spurious Radiated Emissions (1 MHz to 10 GHz)

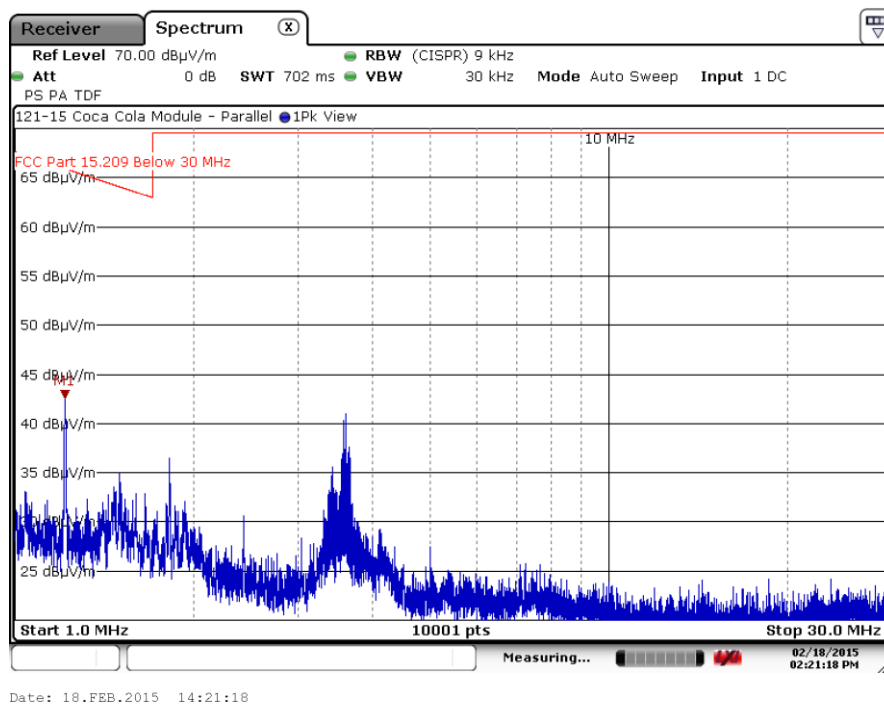
Note: The spurious emissions detailed in this section represent the combined worst case emissions of the low, middle and high operating frequencies.

#### 7.6.1. Regulatory Limit: FCC Part 209, A.8.5 Quasi-Peak

Frequency Range (MHz)	Distance (Meters)	Limit (dB $\mu$ V/m)
0.490 to 1.705	3	73.8 to 63.0
1.705 to 30	3	69.5
30 to 88	3	40.0
88 to 216	3	43.5
216 to 960	3	46.0
>960	3	54.0

#### 7.6.2. Spurious Radiated Emissions (1 to 30 MHz) Test Results

##### 7.6.2.1. Measurement Results – Parallel



Test Number: 121-15R1

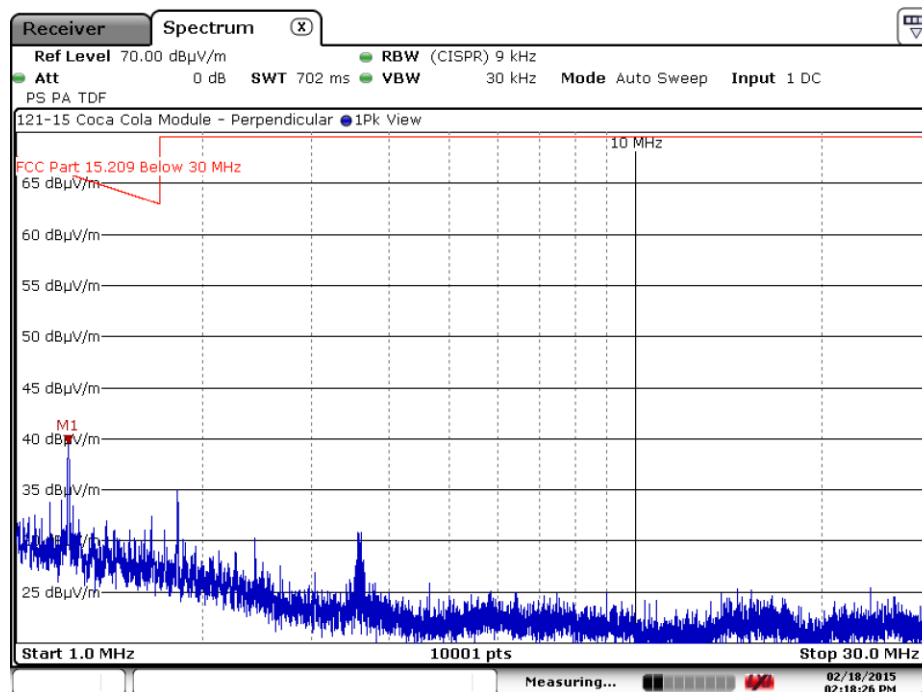
Issue Date: 4/29/2015

## 7. Measurement Data (continued)

### 7.6. Spurious Radiated Emissions (1 MHz to 10 GHz) (continued)

#### 7.6.2. Spurious Radiated Emissions (1 MHz to 30 MHz) Test Results

##### 7.6.2.2. Measurement Results – Perpendicular



Date: 18.FEB.2015 14:18:26

Test Number: 121-15R1

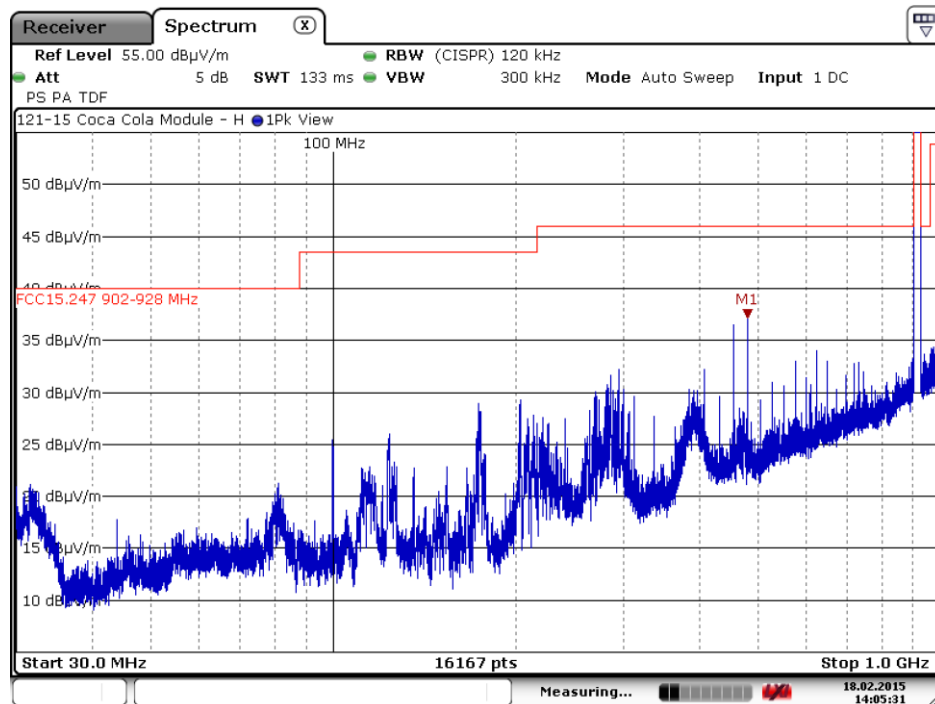
Issue Date: 4/29/2015

## 7. Measurement Data (continued)

### 7.6. Spurious Radiated Emissions (6 MHz to 10 GHz) (continued)

#### 7.6.3. Spurious Radiated Emissions (30 MHz to 1 GHz) Test Results

##### 7.6.3.1. Measurement Results – Horizontal



Date: 18.FEB.2015 14:05:31

Test Number: 121-15R1

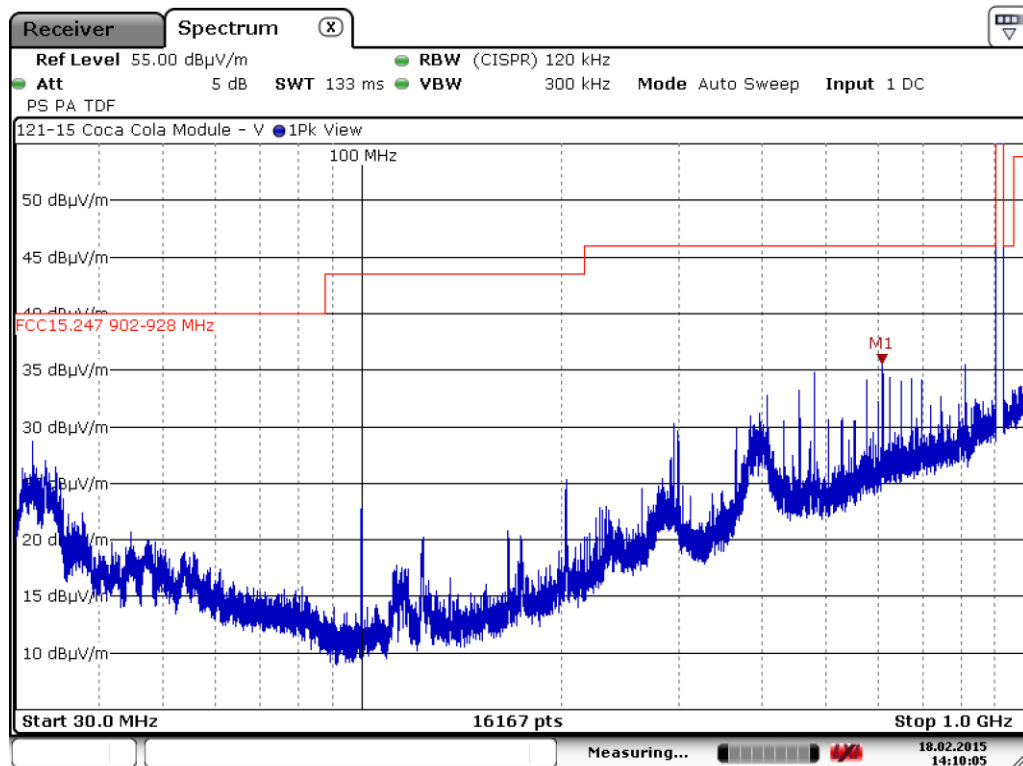
Issue Date: 4/29/2015

## 7. Measurement Data (continued)

### 7.6. Spurious Radiated Emissions (1 MHz to 10 GHz) (continued)

#### 7.6.3. Spurious Radiated Emissions (30 MHz to 1 GHz) Test Results

##### 7.6.3.2. Measurement Results – Vertical



Date: 18.FEB.2015 14:10:06

**7. Measurement Data (continued)**
**7.7. Spurious Radiated Emissions – Harmonic Emissions**

Note: The harmonic emissions detailed in this section represent the combined worst case emissions of the low, middle and high operating frequencies.

**7.7.1. Spurious Radiated Emissions (Harmonic Measurements) Test Results**

Antenna 8

Freq. (MHz)	Field Strength (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)		Antenna Polarity (H/V)	Result
	Peak	Average	Peak	Average	Peak	Average		
1805.500	50.55	46.26	74.00	54.00	-23.45	-7.74	H	Compliant
1830.500	46.47	36.57	74.00	54.00	-27.53	-17.43	H	Compliant
1854.500	47.10	38.20	74.00	54.00	-26.90	-15.80	H	Compliant
2708.250	51.56	45.97	74.00	54.00	-22.44	-8.03	H	Compliant
2745.750	44.72	31.27	74.00	54.00	-29.28	-22.73	H	Compliant
2781.750	46.90	31.60	74.00	54.00	-27.10	-22.40	H	Compliant
3611.000	50.40	41.35	74.00	54.00	-23.60	-12.65	H	Compliant
3661.000	47.82	34.56	74.00	54.00	-26.18	-19.44	H	Compliant
3709.000	48.60	35.30	74.00	54.00	-25.40	-18.70	H	Compliant
4513.750	51.75	40.44	74.00	54.00	-22.25	-13.56	H	Compliant
4576.250	49.94	36.30	74.00	54.00	-24.06	-17.70	V	Compliant
4636.250	50.00	36.00	74.00	54.00	-24.00	-18.00	V	Compliant
5416.500	51.36	37.15	74.00	54.00	-22.64	-16.85	V	Compliant
5491.500	51.06	37.50	74.00	54.00	-22.94	-16.50	H	Compliant
5563.500	51.40	37.70	74.00	54.00	-22.60	-16.30	V	Compliant
6319.250	51.87	38.33	74.00	54.00	-22.13	-15.67	H	Compliant
6406.750	52.30	39.10	74.00	54.00	-21.70	-14.90	V	Compliant
6490.750	53.10	39.60	74.00	54.00	-20.90	-14.40	H	Compliant
7222.000	56.30	43.04	74.00	54.00	-17.70	-10.96	H	Compliant
7322.000	56.90	43.20	74.00	54.00	-17.10	-10.80	V	Compliant
7418.000	57.30	43.50	74.00	54.00	-16.70	-10.50	H	Compliant
8124.750	59.64	45.80	74.00	54.00	-14.36	-8.20	V	Compliant
8237.250	58.00	44.40	74.00	54.00	-16.00	-9.60	H	Compliant
8345.250	58.10	44.20	74.00	54.00	-15.90	-9.80	V	Compliant
9027.500	58.46	45.04	74.00	54.00	-15.54	-8.96	H	Compliant
9152.500	58.20	44.80	74.00	54.00	-15.80	-9.20	V	Compliant
9272.500	57.80	44.20	74.00	54.00	-16.20	-9.80	H	Compliant

<sup>1</sup> All correction factors are stored in the spectrum analyzer and applied to this column entry.

**7. Measurement Data (continued)**
**7.7. Spurious Radiated Emissions – Harmonic Emissions (cont.)**

Note: The harmonic emissions detailed in this section represent the combined worst case emissions of the low, middle and high operating frequencies.

**7.7.2. Spurious Radiated Emissions (Harmonic Measurements) Test Results**

Antenna 11

Freq. (MHz)	Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dBμV/m)		Antenna Polarity (H/V)	Result
	Peak	Average	Peak	Average	Peak	Average		
1805.500	46.00	36.30	74.00	54.00	-28.00	-17.70	H	Compliant
1830.500	46.20	36.60	74.00	54.00	-27.80	-17.40	H	Compliant
1854.500	43.80	32.60	74.00	54.00	-30.20	-21.40	H	Compliant
2708.250	48.70	39.50	74.00	54.00	-25.30	-14.50	H	Compliant
2745.750	45.00	32.90	74.00	54.00	-29.00	-21.10	H	Compliant
2781.750	44.50	30.60	74.00	54.00	-29.50	-23.40	H	Compliant
3611.000	49.70	37.90	74.00	54.00	-24.30	-16.10	H	Compliant
3661.000	47.80	34.80	74.00	54.00	-26.20	-19.20	H	Compliant
3709.000	48.00	34.60	74.00	54.00	-26.00	-19.40	H	Compliant
4513.750	51.20	38.70	74.00	54.00	-22.80	-15.30	H	Compliant
4576.250	49.70	36.20	74.00	54.00	-24.30	-17.80	V	Compliant
4636.250	49.80	36.10	74.00	54.00	-24.20	-17.90	V	Compliant
5416.500	51.00	37.30	74.00	54.00	-23.00	-16.70	V	Compliant
5491.500	51.30	37.50	74.00	54.00	-22.70	-16.50	H	Compliant
5563.500	51.10	37.70	74.00	54.00	-22.90	-16.30	V	Compliant
6319.250	52.30	38.20	74.00	54.00	-21.70	-15.80	H	Compliant
6406.750	52.70	39.10	74.00	54.00	-21.30	-14.90	V	Compliant
6490.750	53.00	39.10	74.00	54.00	-21.00	-14.90	H	Compliant
7222.000	56.40	42.60	74.00	54.00	-17.60	-11.40	H	Compliant
7322.000	57.30	43.10	74.00	54.00	-16.70	-10.90	V	Compliant
7418.000	56.90	43.40	74.00	54.00	-17.10	-10.60	H	Compliant
8124.750	59.50	45.70	74.00	54.00	-14.50	-8.30	V	Compliant
8237.250	57.80	44.30	74.00	54.00	-16.20	-9.70	H	Compliant
8345.250	58.10	44.30	74.00	54.00	-15.90	-9.70	V	Compliant
9027.500	59.40	44.98	74.00	54.00	-14.60	-9.02	H	Compliant
9152.500	58.30	44.80	74.00	54.00	-15.70	-9.20	V	Compliant
9272.500	57.70	44.30	74.00	54.00	-16.30	-9.70	V	Compliant

<sup>1</sup> All correction factors are stored in the spectrum analyzer and applied to this column entry.



**7. Measurement Data (continued)**
**7.7. Spurious Radiated Emissions – Harmonic Emissions (cont.)**

Note: The harmonic emissions detailed in this section represent the combined worst case emissions of the low, middle and high operating frequencies.

**7.7.3. Spurious Radiated Emissions (Harmonic Measurements) Test Results**

Onboard Antenna

Freq. (MHz)	Field Strength (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)		Antenna Polarity (H/V)	Result
	Peak	Average	Peak	Average	Peak	Average		
1805.500	44.70	34.10	74.00	54.00	-29.30	-19.90	H	Compliant
1830.500	43.70	31.50	74.00	54.00	-30.30	-22.50	H	Compliant
1854.500	43.70	32.10	74.00	54.00	-30.30	-21.90	H	Compliant
2708.250	45.70	34.80	74.00	54.00	-28.30	-19.20	H	Compliant
2745.750	44.30	30.70	74.00	54.00	-29.70	-23.30	H	Compliant
2781.750	44.10	30.50	74.00	54.00	-29.90	-23.50	H	Compliant
3611.000	49.10	37.30	74.00	54.00	-24.90	-16.70	H	Compliant
3661.000	46.95	33.80	74.00	54.00	-27.05	-20.20	H	Compliant
3709.000	47.70	34.20	74.00	54.00	-26.30	-19.80	H	Compliant
4513.750	49.90	36.80	74.00	54.00	-24.10	-17.20	H	Compliant
4576.250	49.70	36.02	74.00	54.00	-24.30	-17.98	V	Compliant
4636.250	49.00	35.80	74.00	54.00	-25.00	-18.20	V	Compliant
5416.500	51.00	37.00	74.00	54.00	-23.00	-17.00	V	Compliant
5491.500	51.00	37.20	74.00	54.00	-23.00	-16.80	H	Compliant
5563.500	51.70	37.50	74.00	54.00	-22.30	-16.50	V	Compliant
6319.250	51.90	38.00	74.00	54.00	-22.10	-16.00	H	Compliant
6406.750	52.50	38.70	74.00	54.00	-21.50	-15.30	V	Compliant
6490.750	52.60	38.90	74.00	54.00	-21.40	-15.10	H	Compliant
7222.000	56.70	42.60	74.00	54.00	-17.30	-11.40	H	Compliant
7322.000	56.70	43.20	74.00	54.00	-17.30	-10.80	V	Compliant
7418.000	57.70	43.40	74.00	54.00	-16.30	-10.60	H	Compliant
8124.750	59.80	45.50	74.00	54.00	-14.20	-8.50	V	Compliant
8237.250	57.40	43.80	74.00	54.00	-16.60	-10.20	H	Compliant
8345.250	58.10	44.00	74.00	54.00	-15.90	-10.00	V	Compliant
9027.500	58.70	44.90	74.00	54.00	-15.30	-9.10	H	Compliant
9152.500	57.70	44.40	74.00	54.00	-16.30	-9.60	V	Compliant
9272.500	57.90	44.10	74.00	54.00	-16.10	-9.90	V	Compliant

<sup>1</sup> All correction factors are stored in the spectrum analyzer and applied to this column entry.

## 7. Measurement Data (continued)

### 7.8. Conducted Emissions

#### 7.8.1. Regulatory Limit: FCC Part 15, Class B

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-Peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5.0	56	46
5.0 to 30.0	60	50
* Decreases with the logarithm of the frequency.		

#### 7.8.2. Measurement & Equipment Setup

Test Date:	02/03/2015
Test Engineer:	Thomas Charron
Site Temperature (°C):	21.5
Relative Humidity (%RH):	25
Frequency Range:	0.15 MHz to 30 MHz
EMI Receiver IF Bandwidth:	9 kHz
EMI Receiver Avg Bandwidth:	30 kHz
Detector Functions:	Peak, Quasi-Peak. & Average

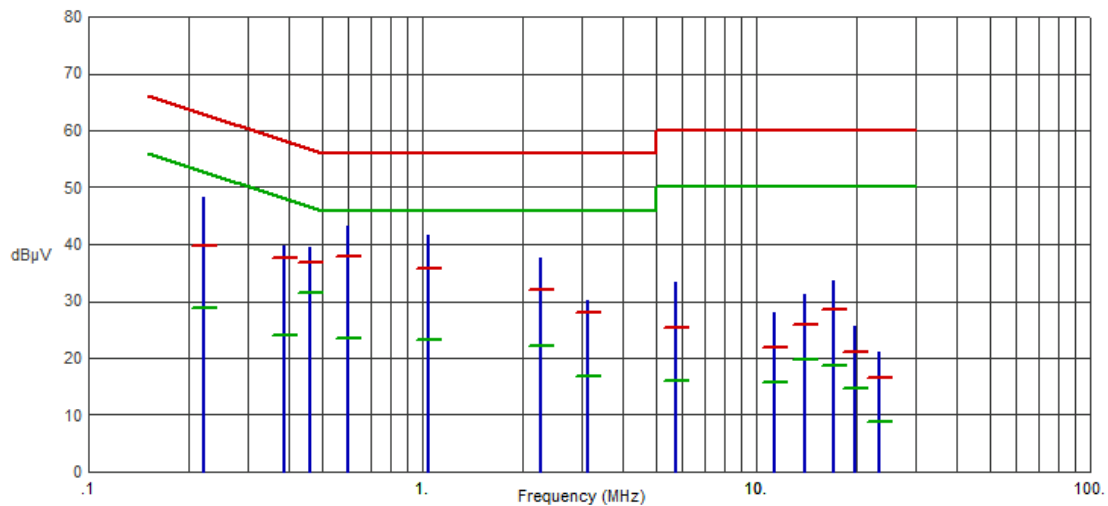
## 7. Measurement Data (continued)

### 7.8. Conducted Emissions

#### 7.8.3. 120 Volts, 60 Hz Phase

Test No.: 121-15, 120 Volts, 60 Hz Phase

FCC, Class B



Frequency (MHz)	Pk Amp (dBμV)	QP Amp (dBμV)	QP Limit (dBμV)	QP Margin (dB)	Avg Amp (dBμV)	Avg Limit (dBμV)	Avg Margin (dB)	Comments
.2219	48.38	39.83	62.75	-22.92	28.91	52.75	-23.84	
.3842	39.80	37.56	58.19	-20.63	24.03	48.19	-24.16	
.4624	39.60	36.88	56.65	-19.77	31.59	46.65	-15.06	
.6018	43.21	37.81	56.00	-18.19	23.35	46.00	-22.65	
1.0393	41.65	35.61	56.00	-20.39	23.22	46.00	-22.78	
2.2643	37.71	32.13	56.00	-23.87	22.10	46.00	-23.90	
3.1138	30.23	27.88	56.00	-28.12	16.91	46.00	-29.09	
5.7325	33.36	25.41	60.00	-34.59	15.87	50.00	-34.13	
11.3642	27.87	21.90	60.00	-38.10	15.68	50.00	-34.32	
14.0191	31.10	25.75	60.00	-34.25	19.76	50.00	-30.24	
17.1247	33.61	28.54	60.00	-31.46	18.65	50.00	-31.35	
19.7825	25.60	21.10	60.00	-38.90	14.64	50.00	-35.36	
23.4569	21.08	16.47	60.00	-43.53	8.91	50.00	-41.09	

Test Number: 121-15R1

Issue Date: 4/29/2015

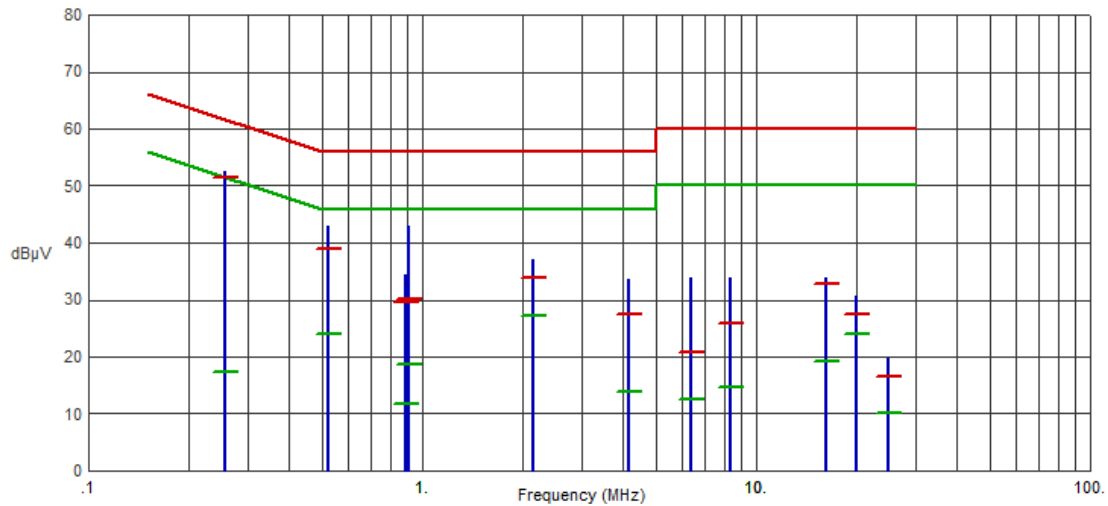
## 7. Measurement Data (continued)

### 7.8. Conducted Emissions

#### 7.8.4. 120 Volts, 60 Hz Neutral

Test No.: 121-15, 120 Volts, 60 Hz Neutral

FCC, Class B



Frequency (MHz)	Pk Amp (dBμV)	QP Amp (dBμV)	QP Limit (dBμV)	QP Margin (dB)	Avg Amp (dBμV)	Avg Limit (dBμV)	Avg Margin (dB)	Comments
.2569	52.44	51.44	61.53	-10.09	17.33	51.53	-34.20	
.5253	42.88	38.93	56.00	-17.07	23.97	46.00	-22.03	
.8873	34.52	29.71	56.00	-26.29	11.77	46.00	-34.23	
.9060	42.89	30.13	56.00	-25.87	18.80	46.00	-27.20	
2.1496	37.03	33.96	56.00	-22.04	27.23	46.00	-18.77	
4.1602	33.62	27.48	56.00	-28.52	13.84	46.00	-32.16	
6.3608	33.99	20.86	60.00	-39.14	12.43	50.00	-37.57	
8.3888	33.76	25.86	60.00	-34.14	14.66	50.00	-35.34	
16.2277	33.78	32.78	60.00	-27.22	19.24	50.00	-30.76	
20.0000	30.67	27.41	60.00	-32.59	24.06	50.00	-25.94	
24.8348	19.76	16.61	60.00	-43.39	10.03	50.00	-39.97	

**7. Measurement Data (continued)**
**7.9. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1))  
RSS-GEN 5.5, RSS 102**
**Antenna 8**

Frequency (MHz)	MPE Distance (cm)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	Power Density		Limit (mW/cm <sup>2</sup> )	Result
				(mW/cm <sup>2</sup> )	(W/m <sup>2</sup> )		
	(1)	(2)	(3)	(4)		(5)	
902.750	20.0	21.70	0.1600	0.0305302	0.3053023	1	Compliant
915.250	20.0	21.20	0.1600	0.0272101	0.2721010	1	Compliant
927.250	20.0	20.33	0.1600	0.0222705	0.2227051	1	Compliant

**Antenna 11**

Frequency (MHz)	MPE Distance (cm)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	Power Density		Limit (mW/cm <sup>2</sup> )	Result
				(mW/cm <sup>2</sup> )	(W/m <sup>2</sup> )		
	(1)	(2)	(3)	(4)		(5)	
902.750	20.0	21.70	-20.0000	0.0002943	0.0029426	1	Compliant
915.250	20.0	21.20	-20.0000	0.0002623	0.0026226	1	Compliant
927.250	20.0	20.33	-20.0000	0.0002146	0.0021465	1	Compliant

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

- PD = Power Density (mW/cm<sup>2</sup>)
- OP = DUT Output Power (dBm)
- AG = DUT Antenna Gain (dBi)
- d = MPE Distance (cm)

1. Reference CFR 2.1093(b): For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.
2. Section 7.4 of this test report.
3. Data supplied by the client. Antenna specification data of worst case antenna used by the DUT.
4. Time Averaging Duty Cycle Correction Factor.
5. Power density is calculated from field strength measurement and antenna gain.
6. Reference CFR 1.1310, Table 1: Limits for Maximum Permissible Exposure (MPE), Section (B): Limits for General Population/Uncontrolled Exposure.

---

**8. Test Site Description**

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with Federal Communications Commission (FCC) and Industry Canada standards. A description of the test sites is on file with the FCC (registration number **96392**) and Industry Canada (file number **IC 3023A-1**).

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane required by EN 55022.

Both sites are designed to test products or systems 1.5 meter W x 1.5 meter L x 2.0 meter H, floor standing or table top.