COMPLIANCE WORLDWIDE INC.
TEST REPORT 259-15

In Accordance with the Requirements of

Industry Canada RSS 210, Issue 8
Federal Communications Commission CFR Title 47 Part 15.231
Low Power License-Exempt Radio Communication Devices
Intentional Radiators

Issued to

Nel-Tech Labs Inc.
4 Ash Street
Derry, NH 03030

for the

Wireless FOB
433 MHz Transmitter

FCC ID: UOXNTLFOBREMOTE

Report Issued on June 12, 2015

Prepared by

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Reviewed by

Larry K. Stillings

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1. Scope

This test report certifies that the Nel-Tech Labs Inc. Wireless FOB Transmitter, as tested, meets the Subpart C, FCC Part 15.231 requirements and the RSS 210 Annex II Rules. 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

2. Product Details

2.1. Manufacturer: Nel-Tech Labs Inc.

2.2. Model Number: Wireless FOB Transmitter

2.3. Serial Number: TX1504003627

2.4. Description: 433.9 MHz Wireless FOB Transmitter.

2.5. Power Source: 3.0 VDC (CR 2032 battery x 1)

2.6. EMC Modifications: None

3. Product Configuration

3.1. Operational Characteristics & Software

Operating Instructions for Test

The Wireless FOB Transmitter employs 2 modes of operation:

- Normal mode – When the Wireless FOB Transmitter button is depressed momentarily, the device will transmit normally, emitting a signal for approximately one second.
- Custom mode - When the Wireless FOB Transmitter button is depressed for ten seconds, the device will transmit indefinitely. This mode was programmed into the device specifically for EMC testing and will not be available in the production units

3.2. EUT Hardware

Manufacturer	Model/Part # / Options	Serial Number	Volts	Frq (Hz)	Description/Function
Nel -Tech	Wireless FOB Transmitter	TX1504003627	3.0	DC	Momentary push button

3.3. Support Equipment

Manufacturer	Model/Part # / Options	Serial Number	Input Voltage	Frq (Hz)	Description/Function
None					

3.4. Support Equipment Cables

Cable Type	Length	Shield	From	To
None				

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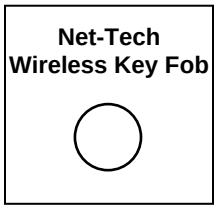
3. Product Configuration (continued)

3.5. Block Diagram



4. Measurements Parameters

4.1 Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
Spectrum Analyzer 20 Hz – 40 GHz [2]	Rohde & Schwarz	FSV40[1]	100899	6/5/2015	2 Years
EMI Receiver	Hewlett Packard	8546A	3650A00360	6/4/2016	2 Years
Loop Antenna	EMCO	6512	9309-1139	9/23/2016	2 Years
Biconilog Antenna, 30 MHz to 2 GHz	Sunol Sciences Corp	JB1	25509	5/15/2016	3 Years
Horn Antenna, 960 MHz to 18 GHz	Electro-Metrics	EM-6961	6337	10/11/2015	2 Years
Power Supply	Hewlett Packard	6296A	7M0599	8/26/2015	1 Year
Digital Barometer	Extech Instruments	SD700	Q590483	9/18/2015	2 Years
Temperature Chamber	Associated Research	E-0029	N/A	N/A	---

[1] FSV40 Firmware revision: V2.30 SP1 Date installed: 10/22/2014 Previous V2.30, installed 7/23/2014.

4.2 Measurement & Equipment Setup

Test Dates:	5/13/2015 to 6/5/2015
Test Engineers:	Cody Merry Brian Breault
Site Temperature (°C):	21.4
Relative Humidity (%RH):	32
Frequency Range:	150 kHz to 4.4 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	120 kHz (30 MHz – 1 GHz) 1 MHz (>1 GHz)
EMI Receiver Avg Bandwidth:	300 kHz (30 MHz – 1 GHz) 3 MHz (>1 GHz)
Detector Functions:	Peak, Quasi-Peak and Average
Antenna Height:	1 to 4 meters

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4. Measurements Parameters (continued)

4.3 Test Procedure

Test measurements were made in accordance FCC Part 15.231: Periodic operation within the bands 40.66 – 40.70 MHz and above 70 MHz.

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

In accordance with ANSI C63.10-2009, section 6.4.4.1c, the device under test was rotated through three orthogonal axes. The three orthogonal axes were defined as follows:

X Axis	Horizontal on left edge	Front of unit is facing the antenna at 0º
Y Axis	Upright	Front of unit is facing the antenna at 0º
Z Axis	Face Up	Bottom edge of the unit is facing the antenna at 0º

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5. Measurement Summary

Test Requirement	FCC Requirement	IC Requirement	Test Report Section	Result	Comment
Antenna Requirement	15.203	RSS210 A1.1	6.1	Compliant	The antenna is enclosed within the device under test.
Operational Requirements	15.231 (a)(1)	N/A	6.2.1	Compliant	This clause does not apply to the unit under test.
	15.231 (a)(2)	N/A	6.2.2	N/A	
	15.231 (a)(3)	N/A	6.2.3	N/A	This clause does not apply to the unit under test.
	15.231 (a)(4)	N/A	6.2.4	N/A	This clause does not apply to the unit under test.
	15.231 (a)(5)	N/A	6.2.5	N/A	This clause does not apply to the unit under test.
Radiated Field Strength of Fundamental	15.231 (b)	RSS210 A1.1.2	6.3	Compliant	
Radiated Field Strength of Harmonics	15.231 (b)(3)	N/A	6.4	Compliant	
Spurious Radiated Emissions	15.231 (b)(3), 15.209	A13.1.2 (2)	6.5	Compliant	
Emission Bandwidth	15.231 (c)	Not Required	6.6	Compliant	
Bandwidth of Momentary Signals	Not Required	IC RSS-210 A1.1.3	6.7	Compliant	
Conducted Emissions	15.207	---	---	Not Required	Unit operates on a single CR2032 battery.
Determination of Average Factor (Duty Cycle)	15.35 (c)	---	---	Not Required	
Public Exposure to Radio Frequency Energy Levels.	15.247(i) 1.1307 (b)(1)	RSS-GEN 5.5, RSS 102	6.8	Compliant	

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6. Measurement Data

6.1. Antenna Requirement (Section 15.203)

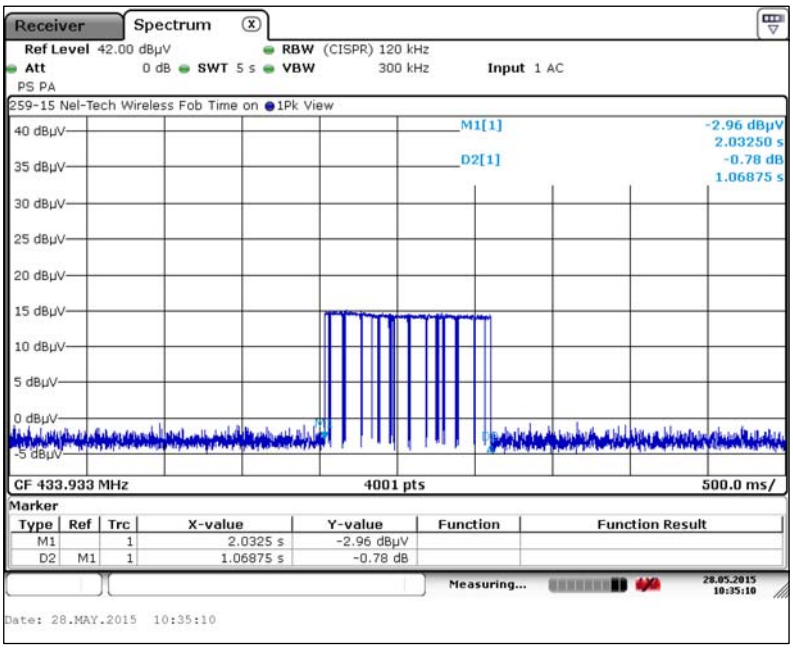
Requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section.

Status: The Wireless FOB 433 MHz Transmitter antenna is etched into the device's PC board.

6.2. Operational Requirements (Section 15.231(a))

6.2.1. Requirement: A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released (Section 15.231(a)(1)).

Status: The transmitter is automatically deactivated after a 1.07 second transmission initiated by a button push.



6.2.2. Requirement: A transmitter activated automatically shall cease transmission within 5 seconds after activation (Section 15.231(a)(2)).

Status: This transmitter is activated manually with a momentary push button switch and therefore this clause does not apply.

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6.2. Operational Requirements (Section 15.231(a)) (continued)

6.2.3. Requirement: Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour (Section 15.231(a)(3)).

Status: This clause does not apply to the unit under test.

6.2.4. Requirement: Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition. (Section 15.231(a)(4)).

Status: This clause does not apply to the unit under test.

6.2.5. Requirement: Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

Status: This clause does not apply to the unit under test.

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6. Measurement Data (continued)

6.3. Radiated Field Strength of Fundamental (15.231, Section (b))

Requirement: The 3 meter field strength of the fundamental emissions from intentional radiators operating within the 260-470 MHz frequency bands shall comply with the limits specified in FCC Part 15.231, Section (b). The limit is based on a linear interpolation of the following field strength:

Fundamental Frequency (MHz)	Field Strength of Fundamental (µV/m)
260–470	3,750 to 12,500 µV/m

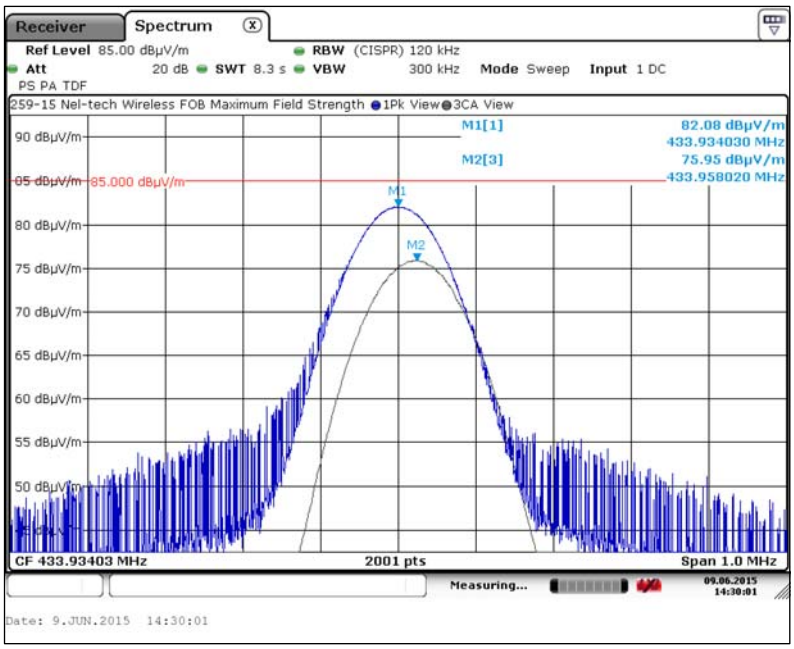
Fundamental Limit at 433.93 MHz = 10,997 µV/m = 80.83 dBµV/m

Test Note: The data detailed in this section of the test report represents the worst case product orientation (Z-Axis).

Conclusion: The radiated field strength of the device under test complies with the requirements detailed in FCC Part 15.231, Section (b).

6.3.1. Worst Case Radiated Field Strength of Fundamental

Frequency (MHz)	Amplitude[1] (dBµV/m)		Limit (dBµV/m)		Margin (dB)		Ant Polarity	Ant Height	Turntable Azimuth	Result
	Peak	Avg	Peak	Avg	Peak	Avg	H/V	cm	Deg	
433.933	82.08	75.95	100.83	80.83	-18.75	-4.88	H	100	274	Compliant



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6. Measurement Data (continued)

6.4. Radiated Field Strength of Harmonics (15.231, Section (b))

Requirement: The 3 meter field strength of the harmonic emissions from intentional radiators operating within the 260-470 MHz frequency band shall comply with the limits specified in FCC Part 15.231, Section (b). The limit is based on a linear interpolation of the following field strength:

Fundamental Frequency (MHz)	Field Strength of Spurious Emissions (µV/m)
260–470	375 to 1250

Spurious Emissions Limit = 1,099.72 µV/m = 60.83 dBµV/m

Test Notes: For emissions falling within in the restricted bands of operation (reference FCC Part 15.205), the lower FCC Part 15.209 limits take precedence. The peak field strength may not be greater than 20 dB above the average limit.

The data detailed in this section of the test report represents the worst case product orientation for each tabled emission.

Conclusion: The device under test complies with the requirements detailed in FCC 15.231, Section B.

6.4.1. Harmonics < 1 GHz

Freq. (MHz)	Amplitude[1] (dBµV/m)		Limit (dBµV/m)		Margin (dB)		Antenna Polarity	Antenna Height	Turntable Position	Result
	Peak	QP	Peak	QP	Peak	QP	H/V	cm	Deg	
867.866	57.79	50.94	80.83	60.83	-23.04	-9.89	H	110	74	Compliant

6.4.2. Harmonics > 1 GHz (Tabled data represents the worst case polarity)

Freq. (MHz)	Measured Field Strength (dBµV/m)[1]		Limit (dBµV/m)		Margin (dB)		Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Position (Deg)	Result
	Peak	Average	Peak	Average	Peak	Average				
1301.799	55.52	48.40	80.83	60.83	-23.04	-9.89	H	V	105	Compliant
1735.732	51.96	44.67	74.00	54.00	-18.48	-5.60	V	V	123	Compliant
2169.665	60.01	53.23	80.83	60.83	-28.87	-16.16	V	H	145	Compliant
2603.598	58.70	51.83	80.83	60.83	-20.82	-7.60	V	H	145	Compliant
3037.531	51.20	42.49	80.83	60.83	-22.13	-9.00	V	H	110	Compliant
3471.464	48.07	37.09	80.83	60.83	-29.63	-18.34	V	V	100	Compliant
3905.397	57.74	49.95	80.83	60.83	-32.76	-23.74	V	V	103	Compliant
4339.330	59.81	51.78	80.83	60.83	-23.09	-10.88	V	H	140	Compliant

[1] Correction factors are included in measurement values

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6. Measurement Data (continued)

6.5. Spurious Radiated Emissions, 150 kHz to 4.4 GHz (15.231, Section (b))

Requirement: The spurious radiated emissions requirements for intentional radiators shall demonstrate compliance with the field strength limits detailed in Part 15.231, Section B, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

Procedure: This test was performed in accordance with the information provided in 47CFR Part 15.231, Section (b).

Test measurements were made in accordance with ANSI C63.10-2009, American National Standard for Testing Unlicensed Wireless Devices.

Test Notes: Table 6.4.2 of the previous section details the marked emissions above 1 GHz located in the screen captures in this section.

Conclusion: Compliant. The Emissions from the DUT did not exceed the field strength levels specified in Part 15.231, Section B.

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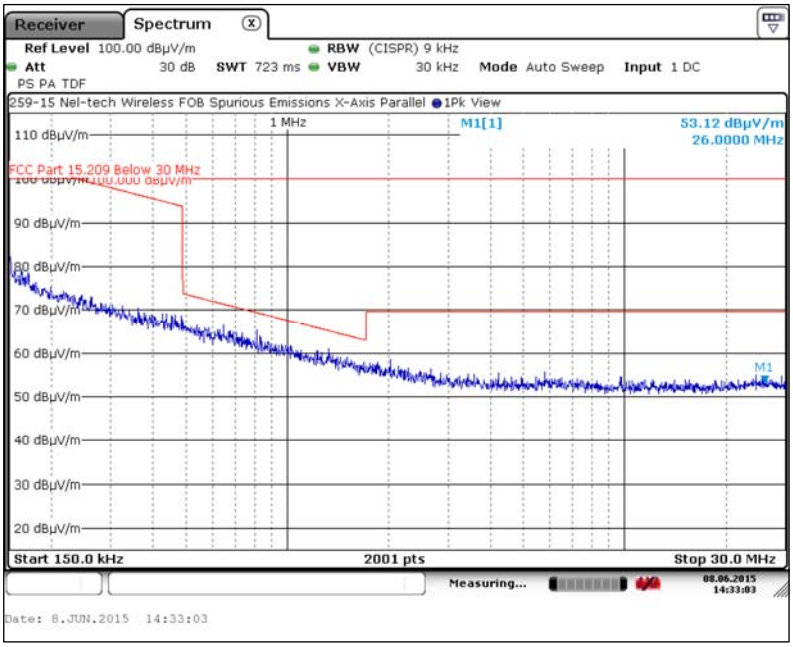
6. Measurement Data (continued)

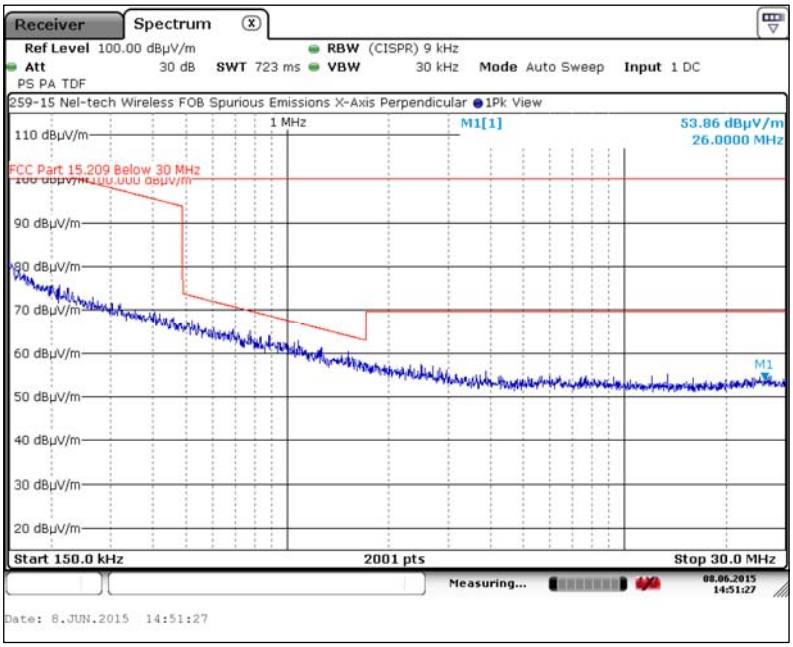
6.5. Spurious Radiated Emissions, 150 kHz to 4.4 GHz (15.231, Section (b)) (cont'd)

6.5.1. Spurious Radiated Emissions, 150 kHz to 30 MHz Test Results

6.5.1.1. X-Axis, Parallel Antenna



6.5.1.2. X-Axis, Perpendicular Antenna



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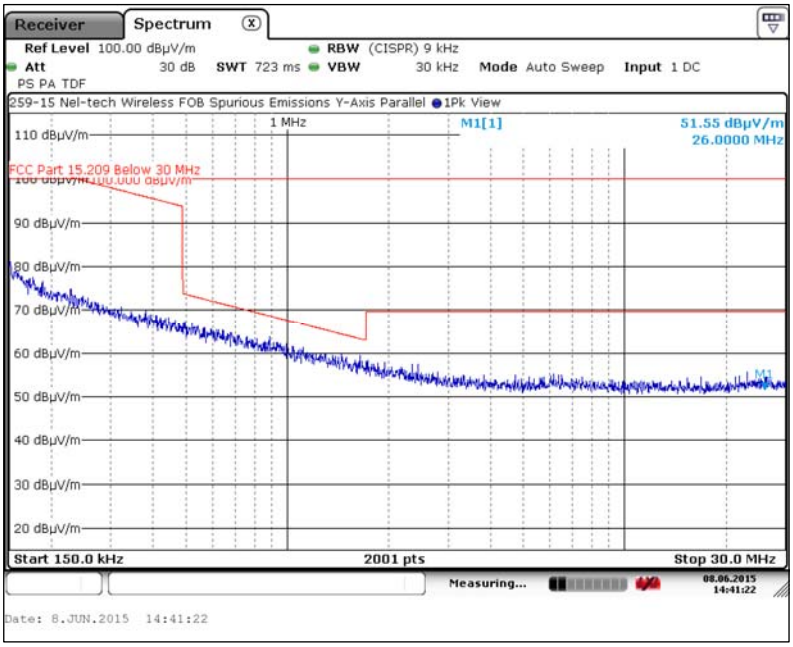
6. Measurement Data (continued)

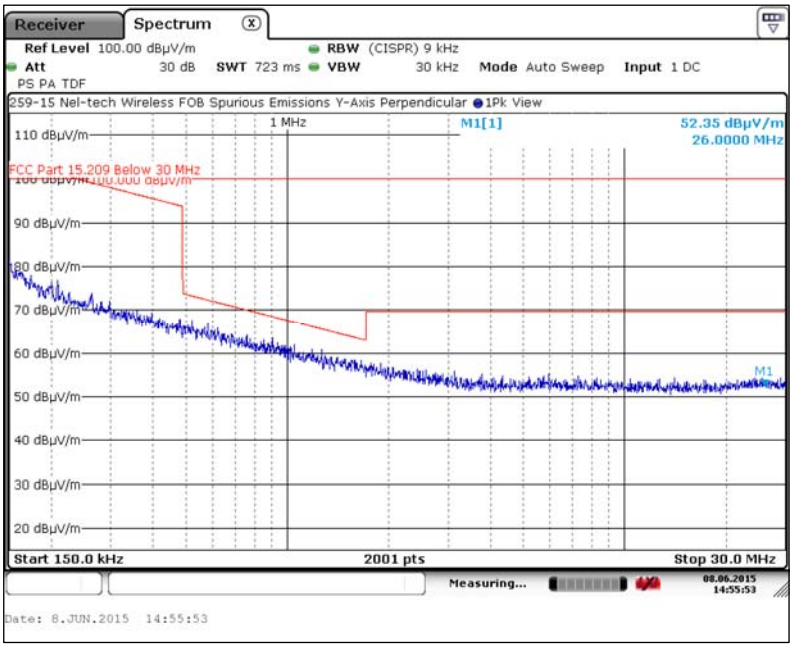
6.5. Spurious Radiated Emissions, 150 kHz to 4.4 GHz (15.231, Section (b)) (cont'd)

6.5.1. Spurious Radiated Emissions, 150 kHz to 30 MHz Test Results

6.5.1.3. Y-Axis, Parallel Antenna



6.5.1.4. Y-Axis, Perpendicular Antenna



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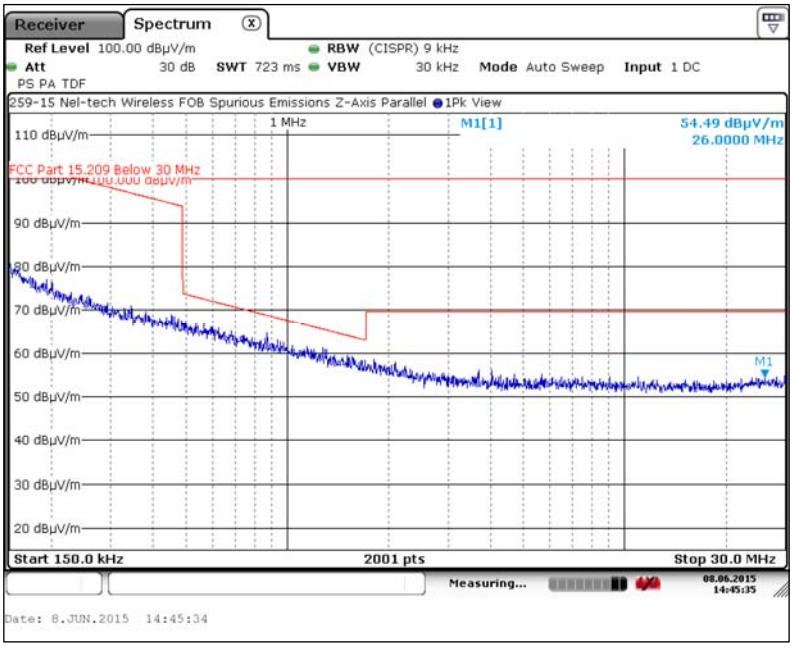
6. Measurement Data (continued)

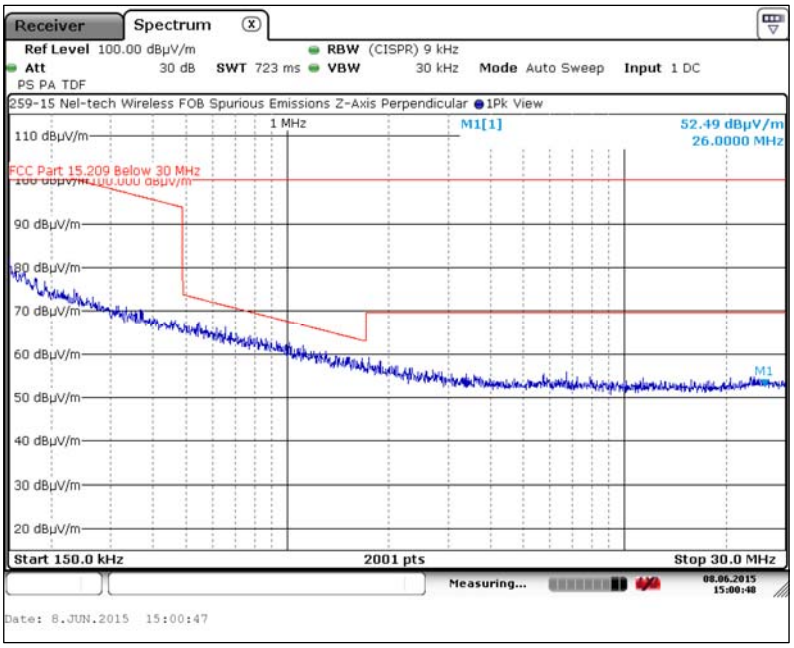
6.5. Spurious Radiated Emissions, 150 kHz to 4.4 GHz (15.231, Section (b)) (cont'd)

6.5.1. Spurious Radiated Emissions, 150 kHz to 30 MHz Test Results

6.5.1.5. Z-Axis, Parallel Antenna



6.5.1.6. Z-Axis, Perpendicular Antenna



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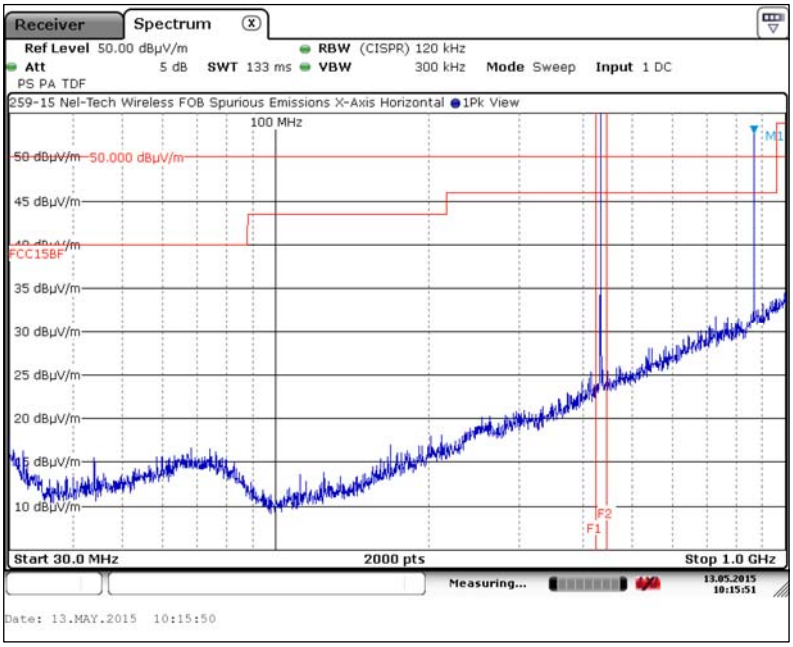
6. Measurement Data (continued)

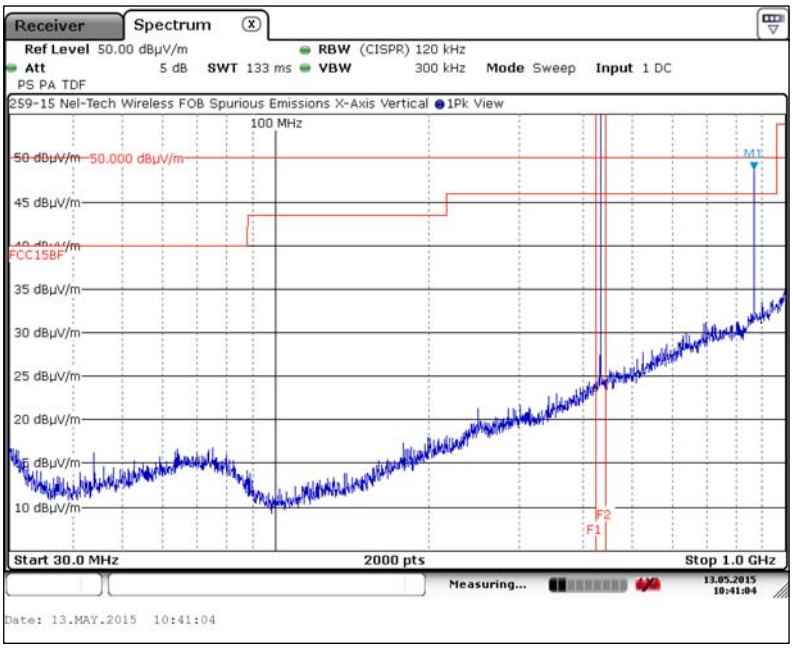
6.5. Spurious Radiated Emissions, 150 kHz to 4.4 GHz (15.231, Section (b)) (cont'd)

6.5.2. Spurious Radiated Emissions, 30 MHz to 1 GHz Test Results

6.5.2.1. X-Axis, Horizontal Polarity (Marker M1 is detailed in Table 6.4.1)



6.5.2.2. X-Axis, Vertical Polarity (Marker M1 is detailed in Table 6.4.1)



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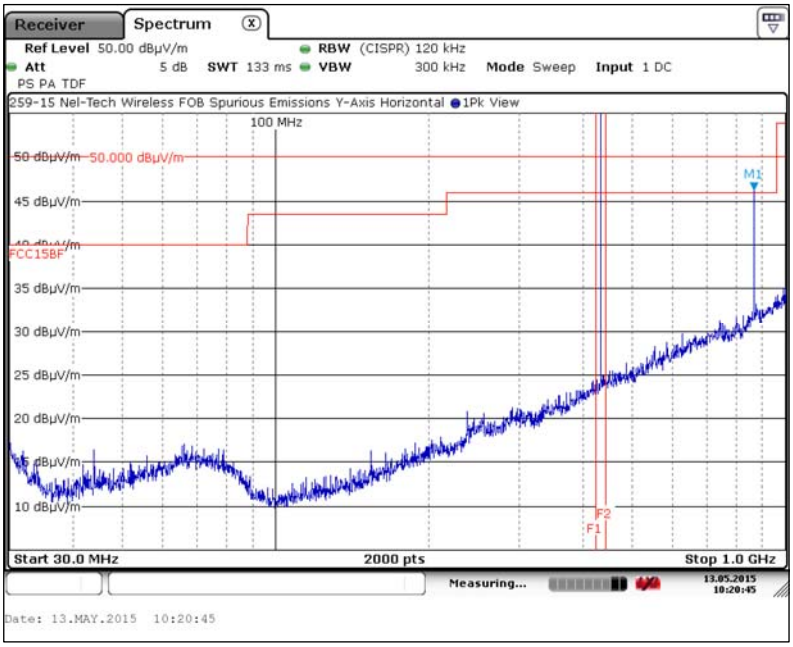
6. Measurement Data (continued)

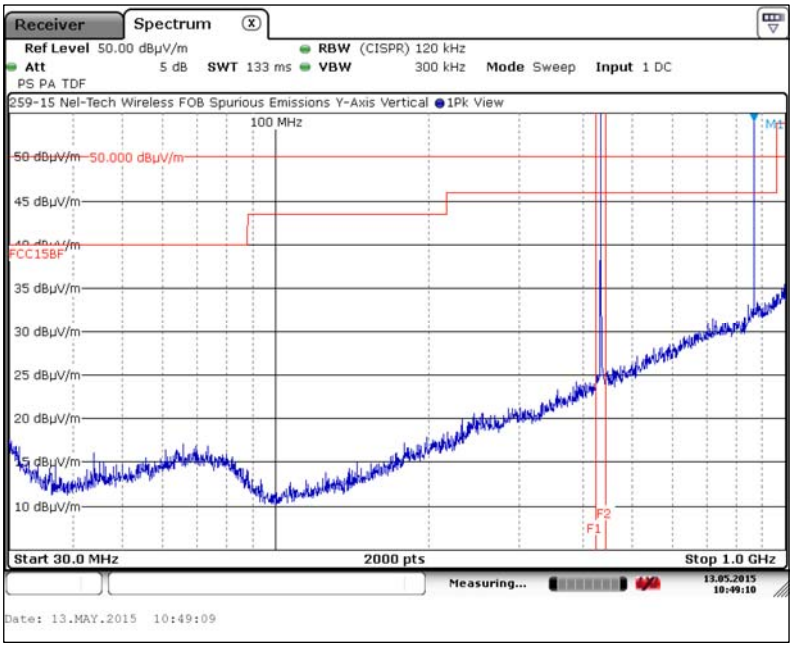
6.5. Spurious Radiated Emissions, 150 kHz to 4.4 GHz (15.231, Section (b)) (cont'd)

6.5.2. Spurious Radiated Emissions, 30 MHz to 1 GHz Test Results

6.5.2.3. Y-Axis, Horizontal Polarity (Marker M1 is detailed in Table 6.4.1)



6.5.2.4. Y-Axis, Vertical Polarity (Marker M1 is detailed in Table 6.4.1)



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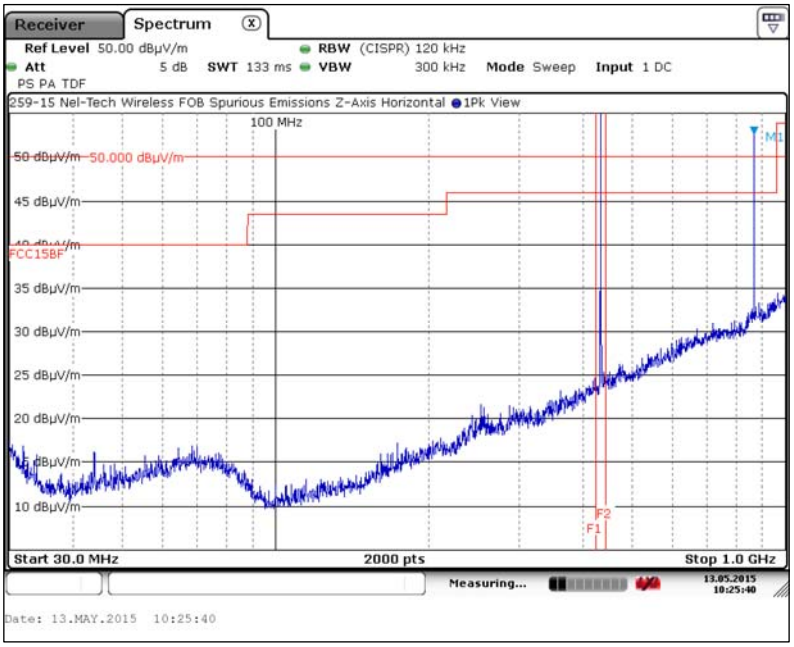
6. Measurement Data (continued)

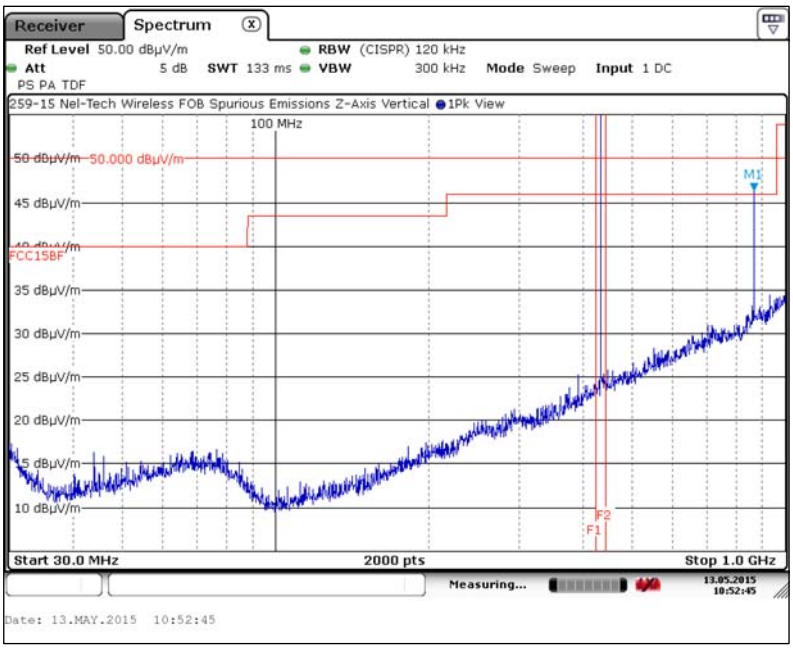
6.5. Spurious Radiated Emissions, 150 kHz to 4.4 GHz (15.231, Section (b)) (cont'd)

6.5.2. Spurious Radiated Emissions, 30 MHz to 1 GHz Test Results

6.5.2.5. Z-Axis, Horizontal Polarity (Marker M1 is detailed in Table 6.4.1)



6.5.2.6. Z-Axis, Vertical Polarity (Marker M1 is detailed in Table 6.4.1)



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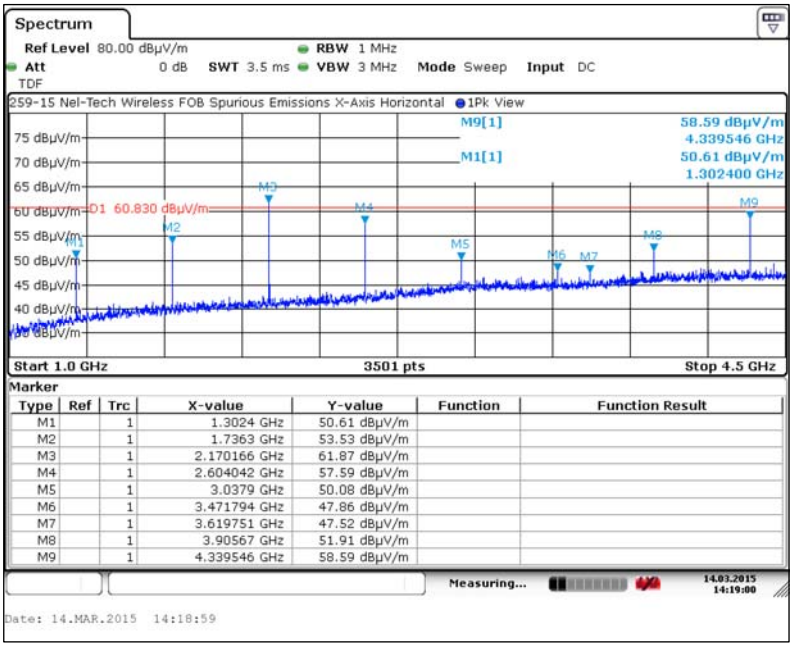
6. Measurement Data (continued)

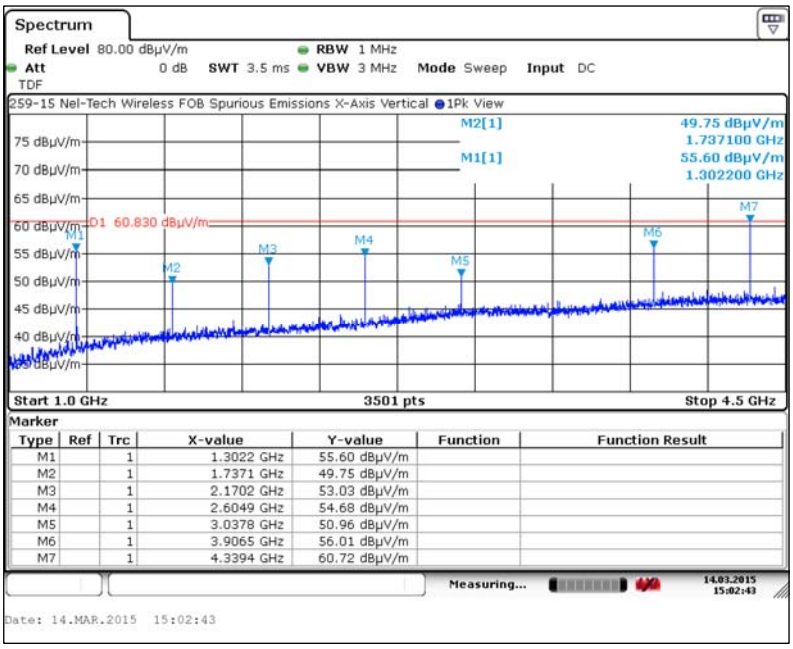
6.5. Spurious Radiated Emissions, 150 kHz to 4.4 GHz (15.231, Section (b)) (cont'd)

6.5.3. Spurious Radiated Emissions, 1 GHz to 4.4 GHz Test Results

6.5.3.1. X-Axis, Horizontal Polarity



6.5.3.2. X-Axis, Vertical Polarity



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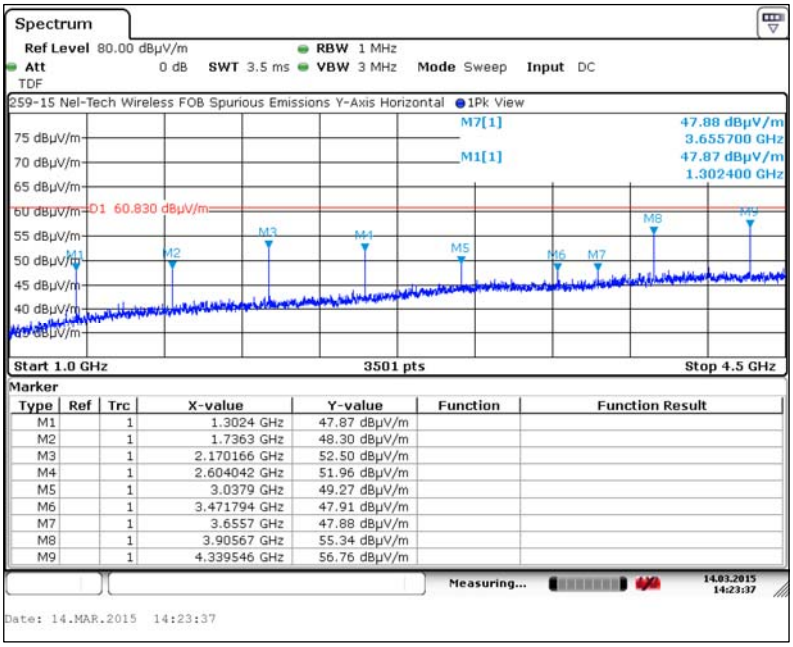
6. Measurement Data (continued)

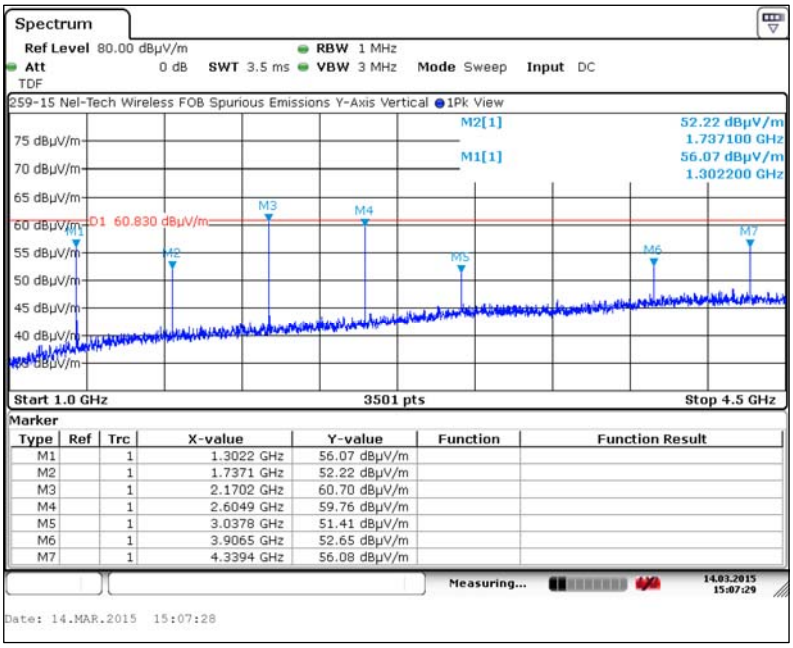
6.5. Spurious Radiated Emissions, 150 kHz to 4.4 GHz (15.231, Section (b)) (cont'd)

6.5.3. Spurious Radiated Emissions, 1 GHz to 4.4 GHz Test Results

6.5.3.3. Y-Axis, Horizontal Polarity



6.5.3.4. Y-Axis, Vertical Polarity



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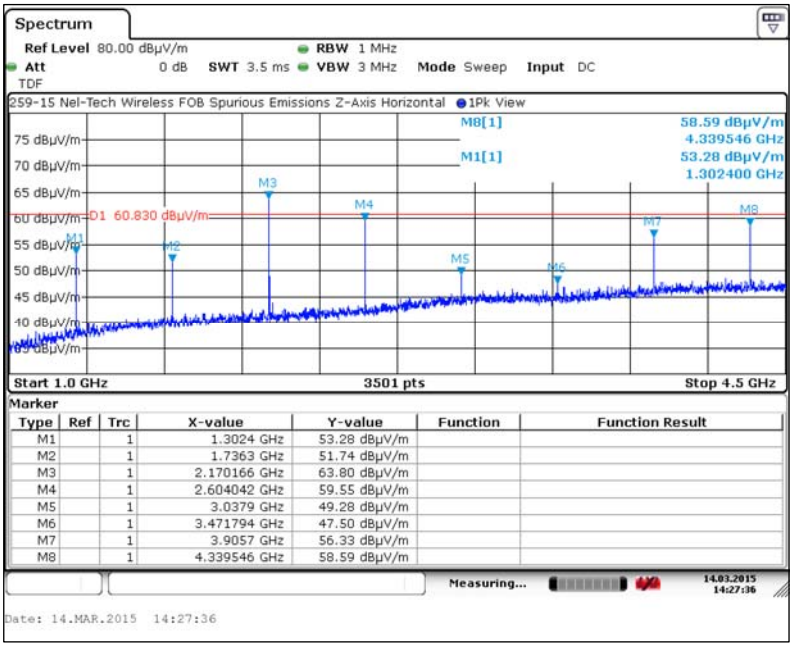
6. Measurement Data (continued)

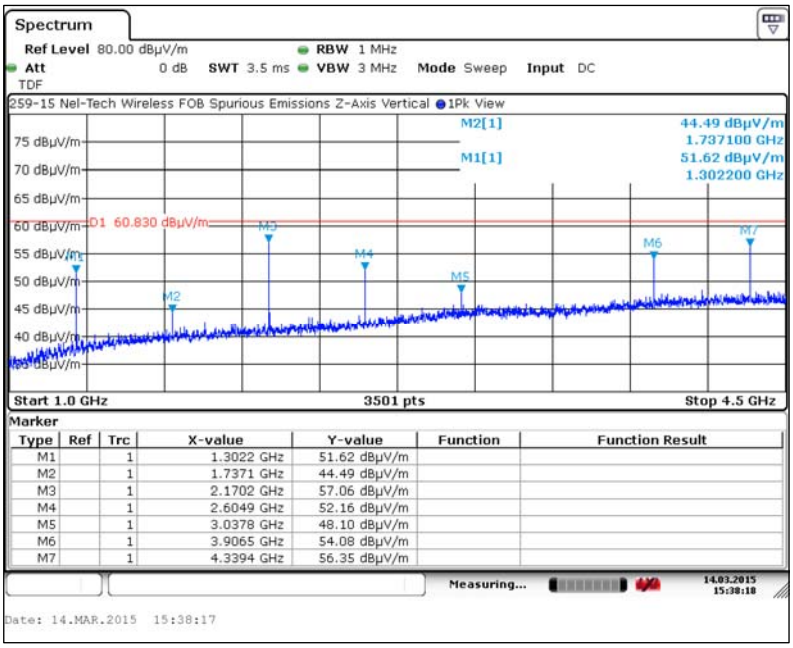
6.5. Spurious Radiated Emissions, 150 kHz to 4.4 GHz (15.231, Section (b)) (cont'd)

6.5.3. Spurious Radiated Emissions, 1 GHz to 4.4 GHz Test Results

6.5.3.5. Z-Axis, Horizontal Polarity



6.5.3.6. Z-Axis, Vertical Polarity



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6. Measurement Data (continued)

6.6. Emission Bandwidth

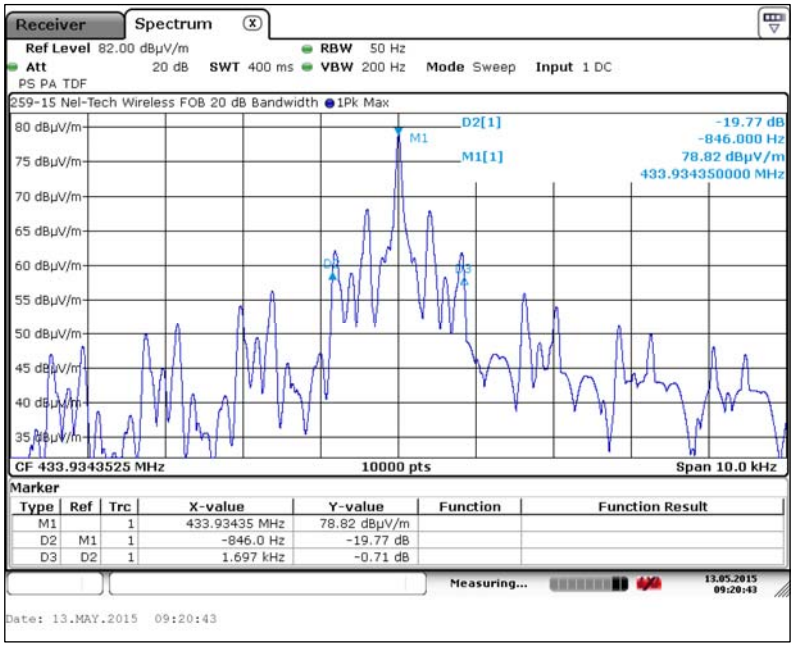
Requirement: The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Note: Reference ANSI C63.10, Section 6.9.1. The span range for the SA display shall be between two times and five times the OBW. The nominal IF filter bandwidth (3 dB RBW) should be approximately 1% to 5% of the OBW, unless otherwise specified, depending on the applicable requirement. The dynamic range of the SA at the selected RBW shall be more than 10 dB below the target "dB down" (attenuation) requirement.

Conclusion: The Emissions from the DUT meets the above requirement.

Site Temperature: 22.4ºC Site Humidity: 31% RH

Fundamental Frequency	-20 dB Bandwidth	Limit	Result
(MHz)	(kHz)	(MHz)	
433.934	0.846	1.0850	Compliant



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6. Measurement Data (continued)

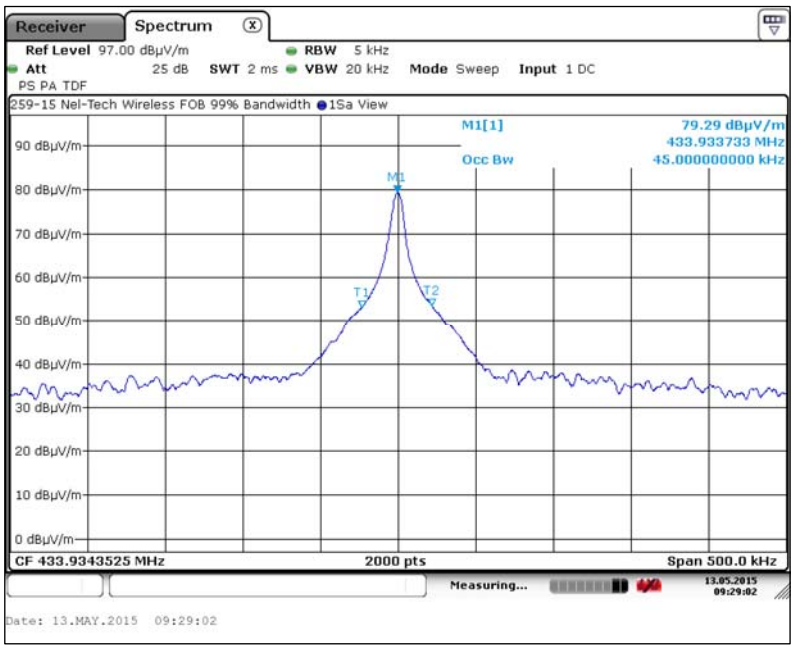
6.7. Bandwidth of Momentary Signals (IC RSS-210 A1.1.3)

Requirement: The 99% bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz - 900 MHz.

Test Note: Reference RSS-Gen, Section 4.6.1. The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

Conclusion: The Emissions from the DUT meets the above requirement.

Fundamental Frequency	99% Bandwidth	Limit	Result
(MHz)	(MHz)	(MHz)	
434.050	0.4325	1.0850	Compliant



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6. Measurement Data (continued)

6.8. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1)) RSS-GEN 5.5, RSS 102)

6.8.1. 15.247(i) (1.1307 (b)(1) Requirements

Requirement: Portable devices are subject to radio frequency radiation exposure requirements.

For a 1-g SAR, the test exclusion result must be ≤ 3.0.

Test Notes: The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by the following formula:

$$\text{SAR Test Exclusion} = \frac{P_{MAX}}{d_{MIN}} \times \sqrt{f_{(GHz)}} \qquad (1)$$

P_{MAX}	mW	Maximum power of channel, including tune-up tolerance
d_{MIN}	mm	Minimum test separation distance, mm (≤ 50 mm)
$f_{(GHz)}$	GHz	$f_{(GHz)}$ is the RF channel transmit frequency in GHz (>100 MHz and <6 GHz)

(1) FCC OET 447498 - Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

The following equation was used to determine the peak output power from the measured field strength:

$$P = \frac{(E \times d)^2}{(30 \times G)}$$

P = the power in Watts.
E = the measured maximum field in V/m.
From section 6.3 of this test report.
G = the numeric gain of the transmitting antenna over an isotropic radiator.
d = the distance in meters of the field strength measurement.

Result: The device under test meets the exclusion requirement detailed in FCC OET 447498.

Input:	P_{MAX}[1]	(mW)	0.04
	d_{MIN}	(mm)	5.00
	$f_{(GHz)}$		0.434
Test Exclusion:			**0.005**
Limit Exemption:			**3.000**

[1] Calculated from the above equation.

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6. Measurement Data (continued)

6.8. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1)) RSS-GEN 5.5, RSS 102) (continued)

6.8.2. RSS-102 Issue 5 Requirements

Requirement: SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1. Portable devices are subject to radio frequency radiation exposure requirements.

Test Notes: The limit was taken from Table 1 of RSS-102 Issue 5.

Frequency (MHz)	Separation Distance (mm)	Maximum Power (mW)	RSS-102 Limit (mW)	Result
433.93	≤5	0.04	54.04	Compliant

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7. Test Setup Photographs

7.1. Radiated Emissions Front View

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7. Test Setup Photographs

7.2. Radiated Emissions Rear View < 30 MHz

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7. Test Setup Photographs

7.3. Radiated Emissions Rear View 30 MHz – 1 GHz

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7. Test Setup Photographs

7.5. Radiated Emissions Front View > 1 GHz

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7. Test Setup Photographs

7.5. Radiated Emissions Rear View > 1 GHz

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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.

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