

## TEST REPORT 223-11

In Accordance with the Requirements of  
Industry Canada RSS 210, Issue 8, Annex II  
Federal Communications Commission CFR Title 47 Part 15.231, Subpart C  
Low Power License-Exempt Radio Communication Devices  
Intentional Radiators

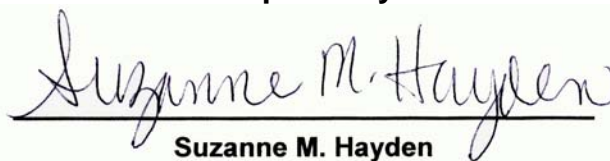
Issued to  
The Schawbel Corporation  
26 Crosby Drive  
Bedford, MA 01730

for the  
433 MHz Key-Fob Device

FCC ID: ZAM-THS02  
IC: 9559A-TXTHS02

Report Issued on May 13, 2011

Prepared by

  
Suzanne M. Hayden

Reviewed By

  
Larry K. Stillings

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### 1. Scope

This test report certifies that the Schawbel 433 MHz Key-Fob Device, as tested, meets the RSS 210 Annex II Rules and FCC Part 15.231, Subpart C 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.

### 2. Product Details

- 2.1. **Manufacturer:** Schawbel Corporation
- 2.2. **Model Number:** THSRC-02; 433 MHz Key-Fob Device
- 2.3. **Serial Number:** N/A
- 2.4. **Description:** Transmitter for the Thermacell Innersoles
- 2.5. **Power Source:** One 3 volt CR2032 Lithium battery.
- 2.6. **EMC Modifications:** None

### 3. Product Configuration

#### 3.1. Cables

Cable Type	Length	Shield	From	To
No Cables				

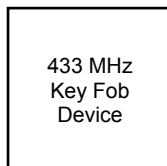
#### 3.2. Support Equipment

Device	Manufacturer	Model	Serial No.
No Support Equipment			

#### 3.3. Operational Characteristics

The firmware in the unit under test was programmed to put the unit into a continuous transmit state when the “High” button was depressed in order to facilitate testing. The unit could also be powered off by pressing the “Medium” button. This retrofit was implemented to maintain maximum continuous transmitter output level and save the battery when testing was suspended.

#### 3.4. Block Diagram



#### 4. Measurements Parameters

##### 4.1 Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due
EMI Receiver	Hewlett Packard	8546A	3330A00115	10/28/2011
Bilog Antenna	Com-Power	AC-220	25509	8/30/2011
Horn Antenna	Electro-Metrics	EM-6961	6337	10/19/2011

##### 4.2 Measurement & Equipment Setup

Test Date:	4/27/2011 to 5/4/2011
Test Engineer:	Cody Merry
Site Temperature (°C):	20.6
Relative Humidity (%RH):	30
Frequency Range:	30 MHz 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

##### 4.3 Test Procedure

Test measurements were made in accordance FCC Part 15.231: 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 C63.4: 2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

The Schawbel 433 MHz Key-Fob Device is a hand-held device and therefore subject to the requirements detailed in ANSI C63.4-2003, section 13.1.4.1 c. The three orthogonal axes are defined as follows:

- X Axis - Horizontal on left edge, front of unit is facing the antenna at 0°
- Y Axis - Upright, front of unit is facing the antenna at 0°
- Z Axis - Face up, bottom of unit is facing the antenna at 0°

### 5. Measurement Summary

Test Requirement	FCC Requirement	Test Report Section	Result	Comment
Antenna Requirement	15.203	6.1	Compliant	Unit has a permanently mounted internal antenna.
Operational Requirements	15.231 (a)(1)	6.2.1	Compliant	
	15.231 (a)(2)	6.2.2	N/A	This clause does not apply to the unit under test.
	15.231 (a)(3)	6.2.3	N/A	
	15.231 (a)(4)	6.2.4	N/A	This clause does not apply to the unit under test.
	15.231 (a)(5)	6.2.5	N/A	This clause does not apply to the unit under test.
Radiated Field Strength of Fundamental	15.231 (b)	6.3	Compliant	
Radiated Field Strength of Harmonics	15.231 (b)(3)	6.4	Compliant	
Spurious Radiated Emissions	15.231 (b)(3), 15.209	6.5	Compliant	
Emission Bandwidth	15.231 (c)	6.6	Compliant	
Bandwidth of Momentary Signals	IC RSS-210 A1.1.3	6.7	Compliant	
Conducted Emissions	15.207	---	Not Required	Unit is battery operated
Determination of Average Factor (Duty Cycle)	15.35 (c)	---	Not Required	

**6. Measurement Data**

**6.1. Antenna Requirement (Section 15.203)**

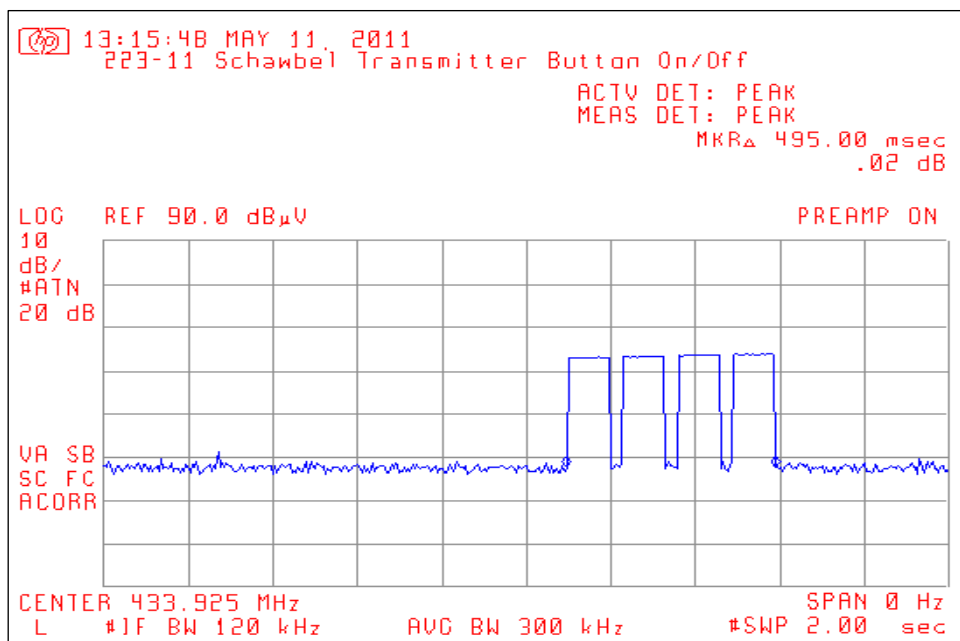
Requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient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

Status: The unit under test employs a permanent, internally mounted antenna.

**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 DUT transmits for a 495 millisecond interval when any one of the three buttons is depressed and released.



**6. Measurement Data (continued)****6.2. Operational Requirements (Section 15.231(a)) (continued)**

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

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

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.

6. Measurement Data (continued)

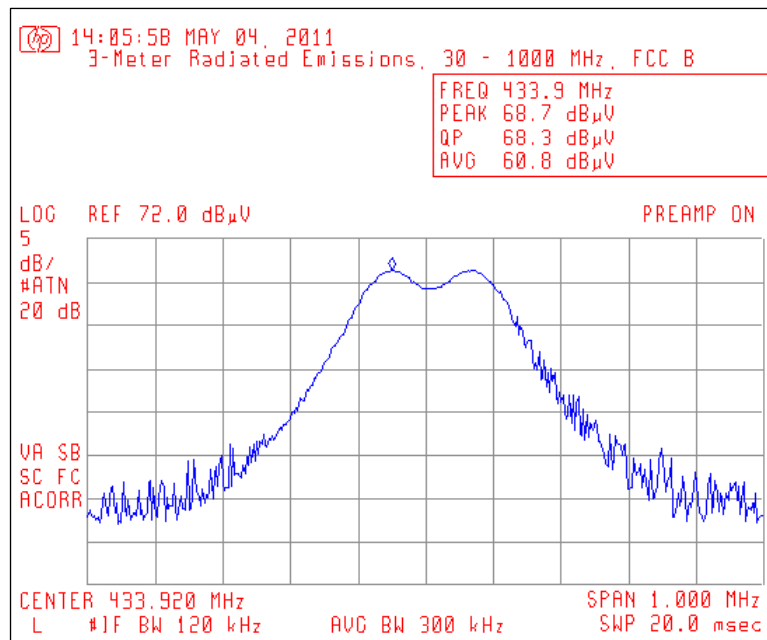
6.3. Radiated Field Strength of Fundamental (15.231, Section (b))

Requirement: The 3 meter field strength of the fundamental emissions from intentional radiators operated within the 260-470 MHz frequency bands shall comply with the limits specified in FCC Part 15.231, Section (b).

Site Temperature: 22.4°C Site Humidity: 31% RH

Freq.	Amplitude <sup>1</sup> (dBμV/m)		Limit (dBμV/m)		Margin (dB)		Ant Polarity	Ant Height	Turntable Azimuth	Result
	Peak	QP	Peak	QP	Peak	QP	H/V	cm	Deg	
433.920	68.70	68.30	100.83	80.83	-32.1	-12.5	V	121	85	Compliant

6.3.1. Worst Case Radiated Field Strength of Fundamental





## 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 operated within the 260-470 MHz frequency band shall comply with the limits specified in FCC Part 15.231, Section (b). Peak field strength may not be greater than 20 dB above the average limit.

#### 6.4.1. Harmonics < 1 GHz

Freq.	Amplitude <sup>1</sup> (dBµV/m)		Limit (dBµV/m)		Margin (dB)		Ant Polarity	Ant Height	Turntable Azimuth	Result
	Peak	QP	Peak	QP	Peak	QP	H/V	cm	Deg	
867.84	37.50	32.00	80.83	60.83	-43.33	-28.83	V	184	0	Compliant

#### 6.4.2. Harmonics > 1 GHz

Freq.	Amplitude <sup>1</sup> (dBµV/m)		Limit (dBµV/m)		Margin (dB)		Ant Polarity	Ant Height	Turntable Azimuth	Result
	Peak	Average	Peak	Average	Peak	Average	H/V	cm	Deg	
1301.76 <sup>1</sup>	44.10	34.10	74.00	54.00	-29.90	-19.90	V	151	269	Compliant
1735.68	45.90	35.60	80.83	60.83	-34.93	-25.23	V	171	280	Compliant
2169.60	47.20	33.70	80.83	60.83	-33.63	-27.13	H	230	63	Compliant
2603.52	49.70	36.20	80.83	60.83	-31.13	-24.63	H	263	249	Compliant
3037.44	44.50	31.00	80.83	60.83	-36.33	-29.83	H	100	0	Compliant
3471.36	45.70	31.80	80.83	60.83	-35.13	-29.03	H	100	0	Compliant
3905.28 <sup>1</sup>	48.20	34.40	74.00	54.00	-25.80	-19.60	H	100	0	Compliant
4339.20 <sup>1</sup>	47.20	33.50	74.00	54.00	-26.80	-20.50	H	100	0	Compliant

<sup>1</sup> Frequency falls within the Restricted Bands of Operation. See FCC Part 15, Section 15.205 for additional information.

## 6. Measurement Data (continued)

### 6.5. Spurious Radiated Emissions, 30 MHz to 4.4 GHz (15.231, Section (b))

Requirement: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

#### 6.5.1. Spurious Radiated Emissions Test Setup

##### 6.5.1.1. Regulatory Limit: FCC Part 209, Quasi-Peak

Frequency Range (MHz)	Distance (Meters)	Limit (dB $\mu$ V/m)
30 to 88	3	40.0
88 to 216	3	43.5
216 to 960	3	46.0
Above 960	3	54.0

##### 6.5.1.2. Test Procedure

Test measurements were made in accordance with ANSI C63.4-2003, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

#### Test Notes:

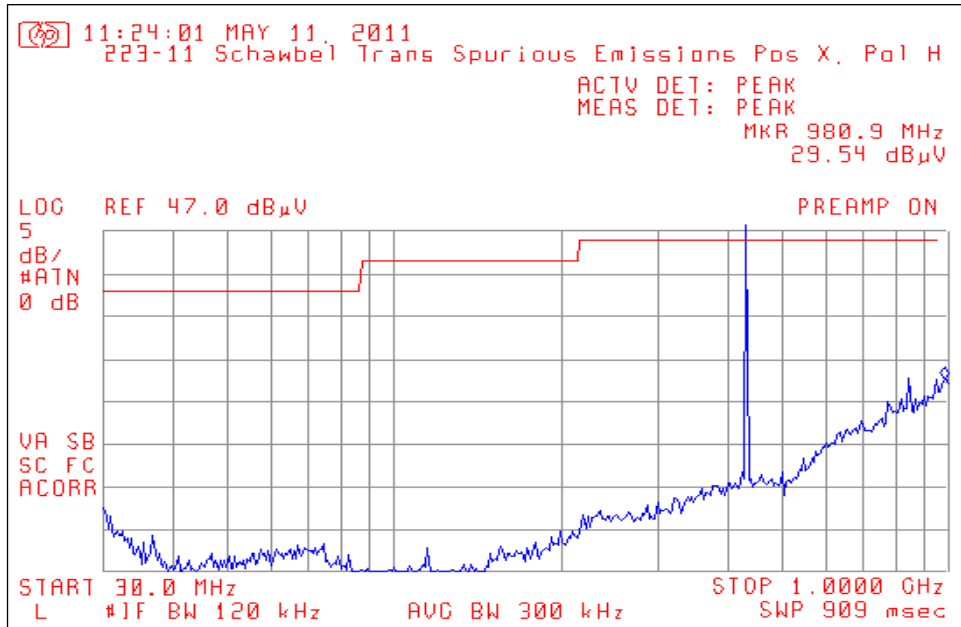
1. The emission at approximately 432 MHz in the following spectrum analyzer screen captures is the fundamental transmit frequency of the device under test.
2. There were no measureable emissions above 1 GHz other than the harmonic emissions detailed in section 6.4.2.
3. The marked emission in each of the scans is the transmitter's fundamental output.

6. Measurement Data (continued)

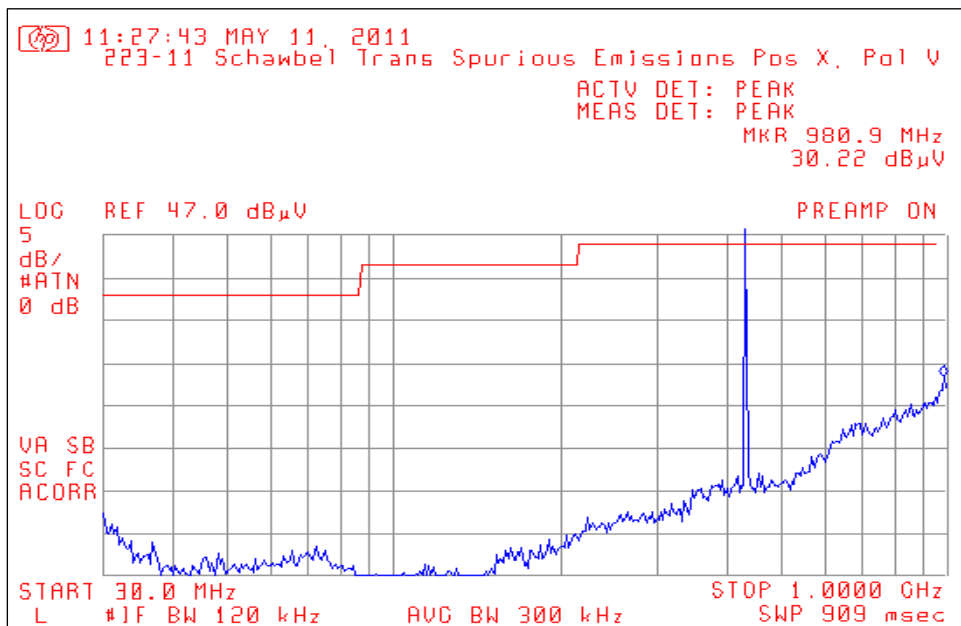
6.5. Spurious Radiated Emissions, 30 MHz to 4.4 GHz (15.231, Section (b))

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

6.5.2.1. X-Axis, Horizontal Polarity



6.5.2.2. X-Axis, Vertical Polarity

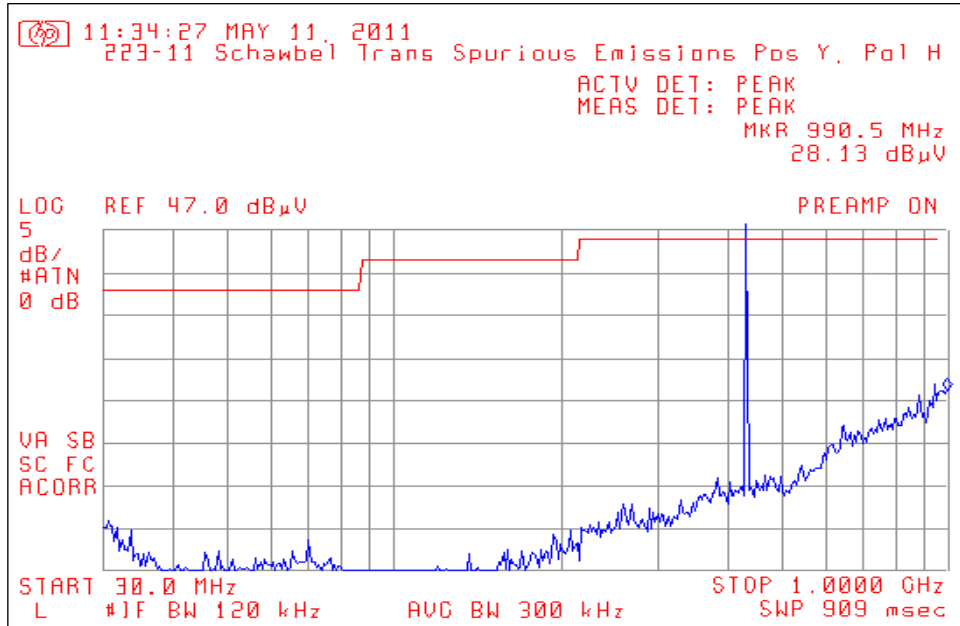


6. Measurement Data (continued)

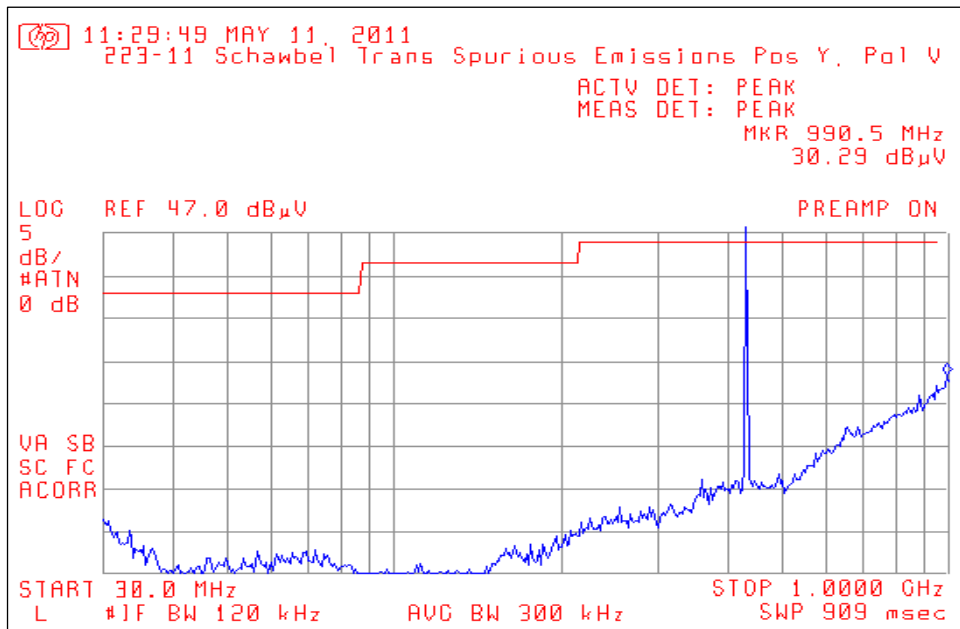
6.5. Spurious Radiated Emissions, 30 MHz to 4.4 GHz (15.231, Section (b))

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

6.5.2.3. Y-Axis, Horizontal Polarity



6.5.2.4. Y-Axis, Vertical Polarity

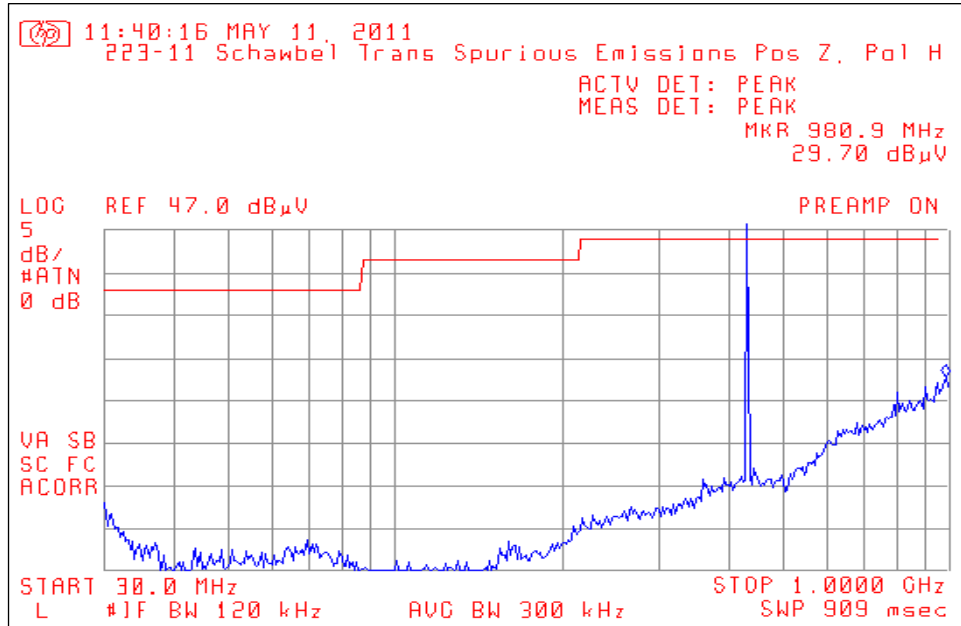


6. Measurement Data (continued)

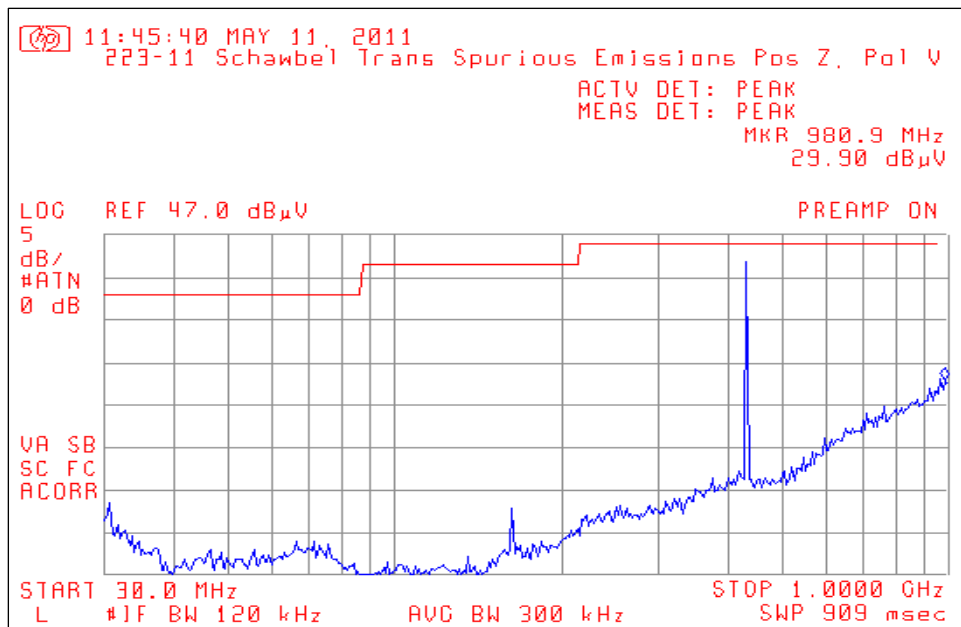
6.5. Spurious Radiated Emissions, 30 MHz to 4.4 GHz (15.231, Section (b))

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

6.5.2.5. Z-Axis, Horizontal Polarity



6.5.2.6. Z-Axis, Vertical Polarity



**6. Measurement Data (continued)**

**6.6. Occupied Bandwidth**

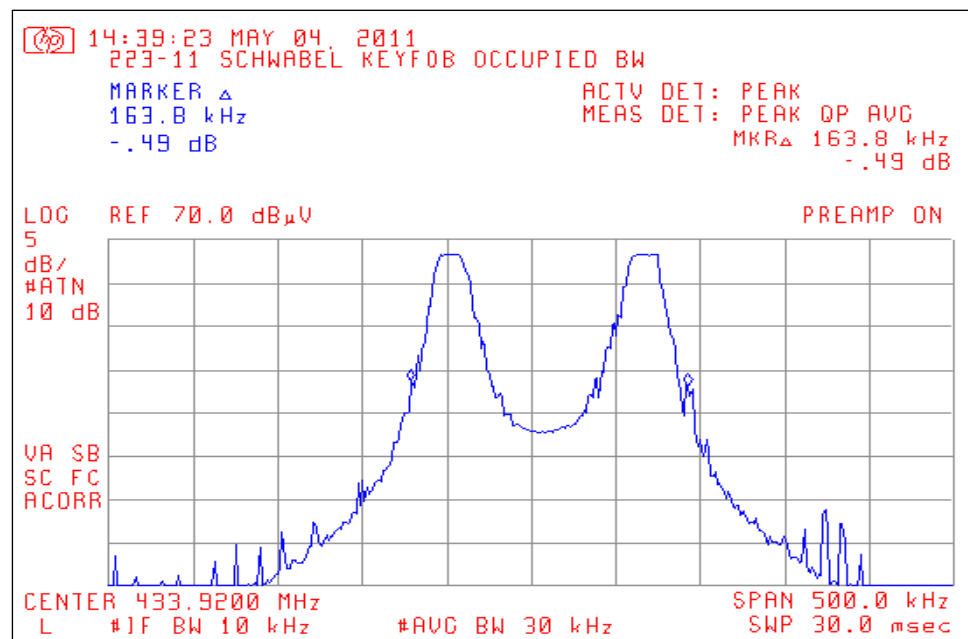
Requirement: The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Note: In order to measure the modulated signal properly, a resolution bandwidth that is small compared with the bandwidth required by the procuring or regulatory agency shall be used on the measuring instrument. However, the resolution bandwidth of the measuring instrument shall be set to a value within 1% to 5% of the signal bandwidth requirements. When no bandwidth requirements are specified, the minimum resolution bandwidth of the measuring instrument is given in following table.

Fundamental Frequency	Minimum Resolution Bandwidth
9 kHz to 30	1 kHz
30 MHz to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

Site Temperature: 22.4°C Site Humidity: 31% RH

Fundamental Frequency (MHz)	-20 dB Bandwidth (MHz)	Limit (MHz)	Result
433.920	0.163	1.085	Compliant



6. Measurement Data (continued)

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

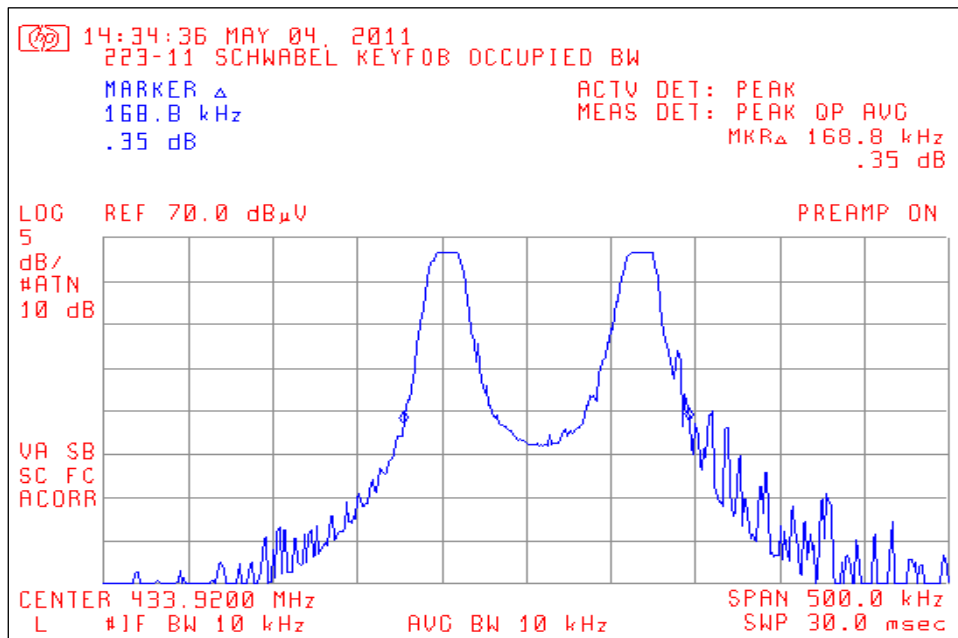
Requirement: The 99% bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz - 900 MHz.

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.

Site Temperature: 22.4°C

Site Humidity: 31% RH

Fundamental Frequency	99% Bandwidth	Limit	Result
(MHz)	(MHz)	(MHz)	
433.920	0.1688	1.085	Compliant



**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**

Channel Frequency	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)	
433.92	2.5	-27.03	-20.00	0.0000003	0.0000025	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 6.3 of this test report. The output power was determined from the measured field strength:
3. Data supplied by the client. Antenna specification data of worst case antenna used by the DUT.
4. Power density is calculated from field strength measurement and antenna gain.
5. Reference CFR 1.1310, Table 1: Limits for Maximum Permissible Exposure (MPE), Section (B): Limits for General Population/Uncontrolled Exposure.



## **7. 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 3023**).

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 meters W x 1.5 meters L x 2.0 meters H, floor standing or table top.