



COMPLIANCE WORLDWIDE INC.
TEST REPORT 470-13

In Accordance with the Requirements of
FCC PART 15.247, SUBPART C
INDUSTRY CANADA RSS 210, ISSUE 8

Low Power License-Exempt Radio Communication Devices
Intentional Radiators

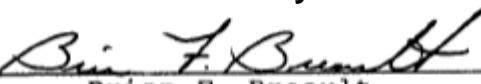
Issued to
Segway Inc.
14 Technology Drive
Bedford, NH 03110

for the
Model PT SE

FCC ID: T2Z-23444
IC: 6395A-23444

Report Issued on October 18, 2013

Tested by



Brian F. Breault

Reviewed by



Larry K. Stillings

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1. Scope

This test report certifies that the Segway Inc. Model PT SE, as tested, meets the FCC Part 15.247, 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.

2. Product Details

2.1. Manufacturer: Segway Inc.

2.2. Model Number: Model name: Segway PT SE

Item Number	Item Name
23444-00001	Model, 2013, Standard
23444-00002	Model, 2013, Standard, Patroller
23580-00001	Model, 2013, Off-Road
23580-00002	Model, 2013, Off-Road, Patroller
23580-00003	Model, 2013, Turf
23580-00004	Model, 2013, Turf, Patroller

2.3. Serial Number: 132371085781

2.4. Description: Personal Transporter

2.5. Power Source: 73.6 VDC @ 5.2 AH VDC provided by two of Lithium Ion batteries

2.6. EMC Modifications: None

3. Product Configuration

3.1. Operational Characteristics & Software

Operating Instructions for Test

- Connect the custom built USB to CAN bus cable from the laptop to the Segway PT transmitter.
- On the laptop, select a batch file from the provided list based on the desired channel frequency and modulation requirements. Run the batch file.
 - Test frequencies are as follows:
 - Channel 11: 2405 MHz
 - Channel 18: 2440 MHz
 - Channel 26: 2480 MHz
 - Disconnect the custom built USB to CAN bus cable.

3.2. EUT Hardware

Manufacturer	Model/Part # / Options	Serial Number	Input Voltage	Frq (Hz)	Description/Function
Segway	Personal Transporter (PT)	132371085781	73.6	DC	

3.3. EUT CONNECTED Hardware

Manufacturer	Model	Serial Number	Description
None	N/A	N/A	See section 3.5, Support Equipment

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3. Product Configuration continued

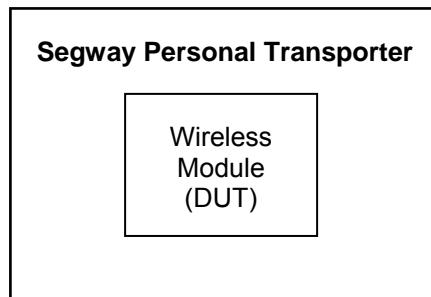
3.4. EUT Cables/Transducers

Manufacturer	Model/Part #	Len. (m)	Shield Y/N	Description/Function
Segway	N/A	~5	N	Custom built USB to CAN bus cable. For configuration purposes only. Disconnected during testing.

3.5. Support Equipment

Manufacturer	Model/Part # Options	Input Voltage	Input Freq	Description/Function
IBM	T42	120	60	Laptop PC

3.6. Block Diagram



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4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Tests

Device	Manufacturer	Model No.	Serial No.	Cal Due
EMI Test Receiver, 9kHz - 7GHz	Rohde & Schwarz	ESR7	101156	4/4/2015
Spectrum Analyzer	Rohde & Schwarz	FSV40	100899	6/6/2015
Spectrum Analyzer	Hewlett Packard	8546A	3650A00360	6/13/2014
Microwave Preamp	Hewlett Packard	8449B	3008A01323	6/5/2015
Loop Antenna, Passive, 9 kHz to 30 MHz	EMCO	6512	9309-1139	8/28/2014
Biconilog Antenna, 30 MHz to 2000 MHz	Sunol Sciences	JB1	A050913	5/15/2014
Double Ridged Antenna, 1 - 18 GHz	ETS-Lindgren	3117	00143292	1/14/2015
Horn Antenna, 18 – 40 GHz	Com-Power	AH-840	03075	8/27/2014
2.4 GHz Band Notch Filter	Micro-Tronics	BRM50702	14	5/12/2014

4.2. Measurement & Equipment Setup

Test Dates:	October 4 th to 15 th , 2013
Test Engineer:	Brian Breault
Normal Site Temperature (15 - 35°C):	21.7
Relative Humidity (20 -75%RH):	33%
Frequency Range:	10 kHz to 26.5 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	9 kHz – 150 kHz to 30 MHz 120 kHz – 30 MHz to 1 GHz 1 MHz – Above 1 GHz
EMI Receiver Avg Bandwidth:	30 kHz – 150 kHz to 30 MHz 300 kHz – 30 MHz to 1 GHz 3 MHz – Above 1 GHz
Detector Function:	Peak, QP - 150 kHz to 1 GHz Peak, Avg - Above 1 GHz Unless otherwise specified.

4.3. Measurement Procedures

Test measurements were made in accordance FCC Part 15.247, IC RSS-210 Annex II: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5850 MHz, and 24.0 - 24.25 GHz.

The test procedures used to perform the measurements for this report are detailed in the FCC Office of Engineering and Technology (OET) publication 558074 D01, DTS Measurement Guidance v03r01, dated April 9, 2013.

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4. Measurements Parameters

4.3. Measurement Procedures (continued)

The test methods used to generate the data in this test report is in accordance with ANSI C63.4:2009, 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.

4.4. Duty Cycle

The device under test was configured to run continuously at a duty cycle greater than 98%. The methodology used to determine the duty cycle is detailed in section 7.11.

4.5. 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	± 4.55 dB
Radiated Emission of Receiver	± 4.55 dB
Temperature	± 0.91 °C
Humidity	$\pm 5\%$

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5. Choice of Equipment for Test Suits

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 Segway Personal Transporter, as tested, utilizes fifteen 802.15.4 (Zigbee) channels, from channel 11 (2405 MHz) to channel 26 (2480 MHz).

In accordance with ANSI C63.4-2009, section 13.2.1, three operating frequencies were selected for testing and are detailed in the following table:

Channel	Frequency (MHz)	Status
11	2405	Tested
12	2410	Not Tested
13	2415	Not Tested
14	2420	Not Tested
15	2425	Not Tested
16	2430	Not Tested
17	2435	Not Tested
18	2440	Tested
19	2445	Not Tested
20	2450	Not Tested
21	2455	Not Tested
22	2460	Not Tested
23	2465	Not Tested
24	2470	Not Tested
25	2475	Not Tested
26	2480	Tested

5.4 Modes of Operation

The Segway PT transmitter module was configured for a single mode of operation only. This test mode configures the transmitter to operate at a duty cycle greater than 98%. Individual channel RF power output for the device under test is not configurable.

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6. Measurement Summary

Test Requirement	FCC Rule Reference	IC Rule Reference	Test Report Section	Result
Antenna Requirement	15.203	RSS-GEN 7.1.2	7.1	Compliant
Minimum 6 dB Bandwidth	15.247 (a) (2)	RSS-210 A8.2	7.2	Compliant
99% Bandwidth	N/A	RSS-GEN 4.6.1	7.3	Compliant
Maximum Peak Conducted Output Power	15.247 (b) (1)	RSS-210 A8.4 (4)	7.4	Compliant
Operation with directional antenna gains greater than 6 dBi	15.247 (b) (4)	RSS-GEN 7.1.2	7.5	Compliant
Spurious Radiated Emissions	15.247 (d)	RSS-GEN 4.9	7.6	Compliant
Unwanted Emissions into Non-Restricted Bands	15.247 (d)	RSS-210 A8.5	7.7	Compliant
Harmonic Emissions in the Restricted Bands of Operation	15.247 (d)	RSS-210 A8.9	7.8	Compliant
Lower and Upper Band Edge	15.247 (d)	RSS-210 A8.5	7.9	Compliant
Maximum Power Spectral Density	15.247(e)		7.10	Compliant
Duty Cycle			7.11	Noted
Conducted Emissions	15.207	RSS-GEN	7.12	Compliant
Public Exposure to Radio Frequency Energy Levels	1.1307 (b) (1)	RSS-GEN 5.5 RSS-102	7.13	Compliant

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7. Measurement Data

7.1. Antenna Requirement (15.203, RSS GEN 7.1.2)

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.

Conclusion: The transmitter module utilizes a PCB etched antenna.
The antenna is not user replaceable in a normal configuration.

7.2. Minimum 6 dB Bandwidth

Requirement: (15.247 (a) (2), RSS 210 A8.2(a))

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 8.1 Option 1: DTS Bandwidth.

Conclusion: The device under test meets the minimum 500 kHz 6 dB bandwidth requirement.

Test Note: In addition to the DTS bandwidth, the 20 dB occupied bandwidth was provided for informational purposes.

Measurement Results

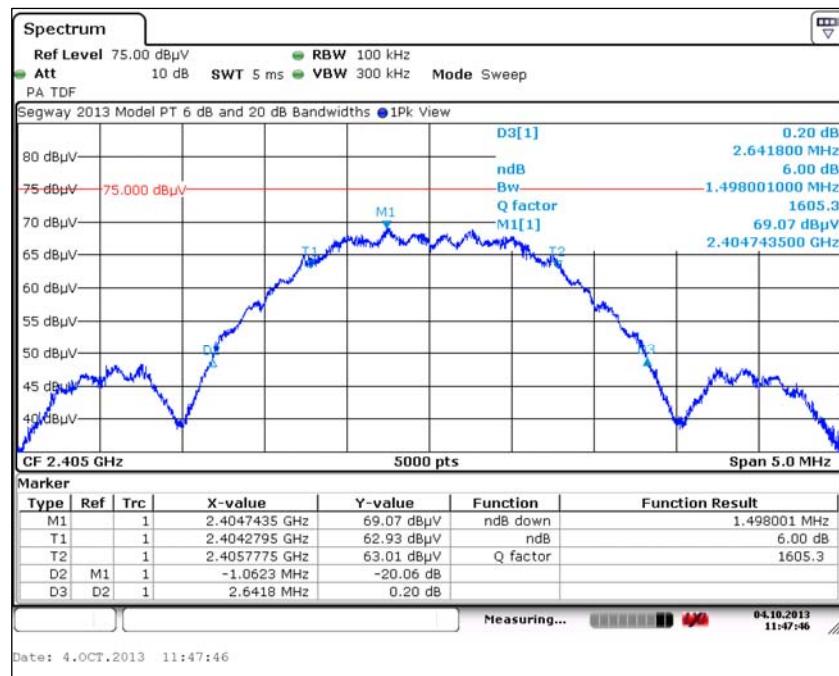
Channel	Frequency (MHz)	-6 dB Bandwidth (MHz)	Minimum -6 dB Bandwidth (kHz)	Result
Low	2405	1.498	> 500	Compliant
Middle	2440	1.572	> 500	Compliant
High	2480	1.385	> 500	Compliant

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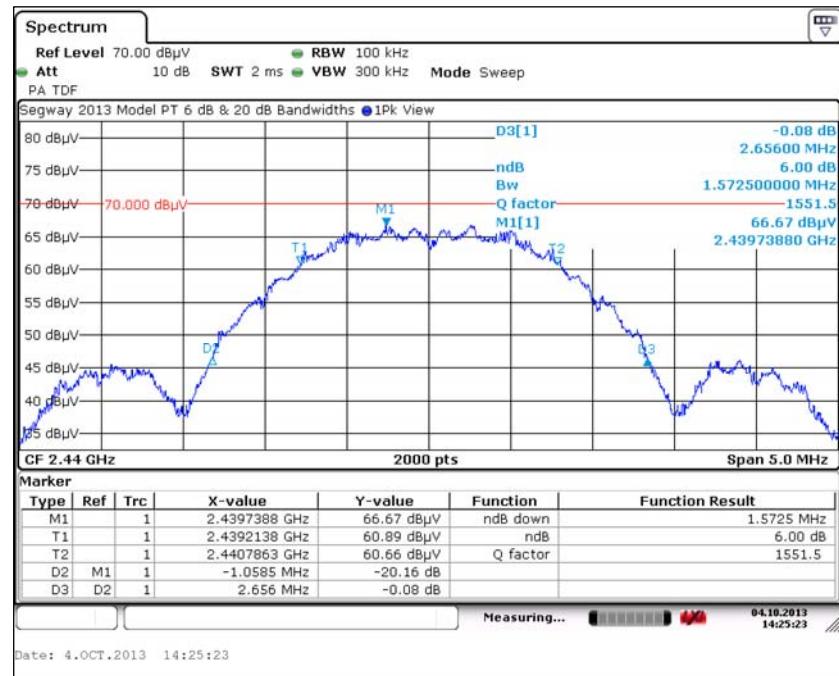
7. Measurement Data (continued)

7.2. Minimum 6 dB Bandwidth (continued)

7.2.1. Low Channel, 11



7.2.2. Middle Channel, 18



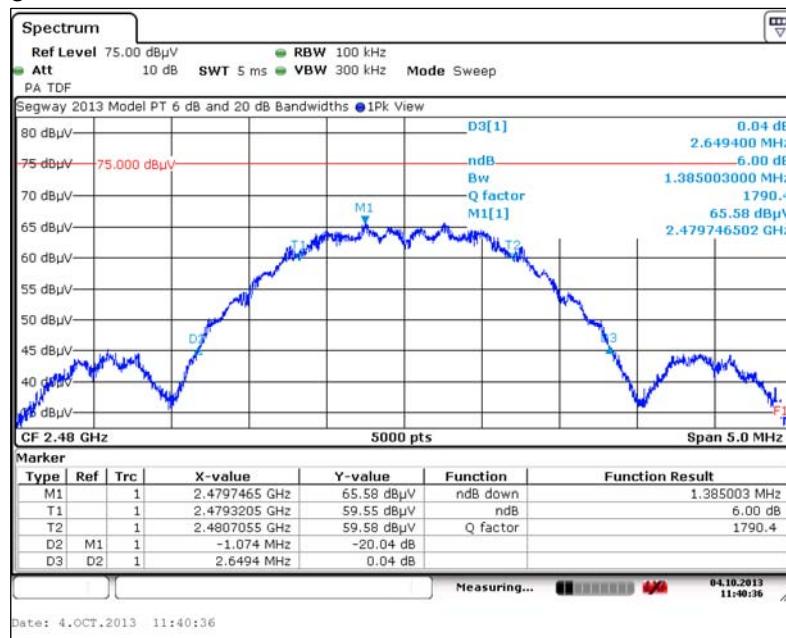
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7. Measurement Data

7.2. Minimum 6 dB Bandwidth (15.247 (a) (2)) (continued)

7.2.3. High Channel, 26



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7. Measurement Data (continued)

7.3. 99% Bandwidth (RSS 210)

Requirement: When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

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.

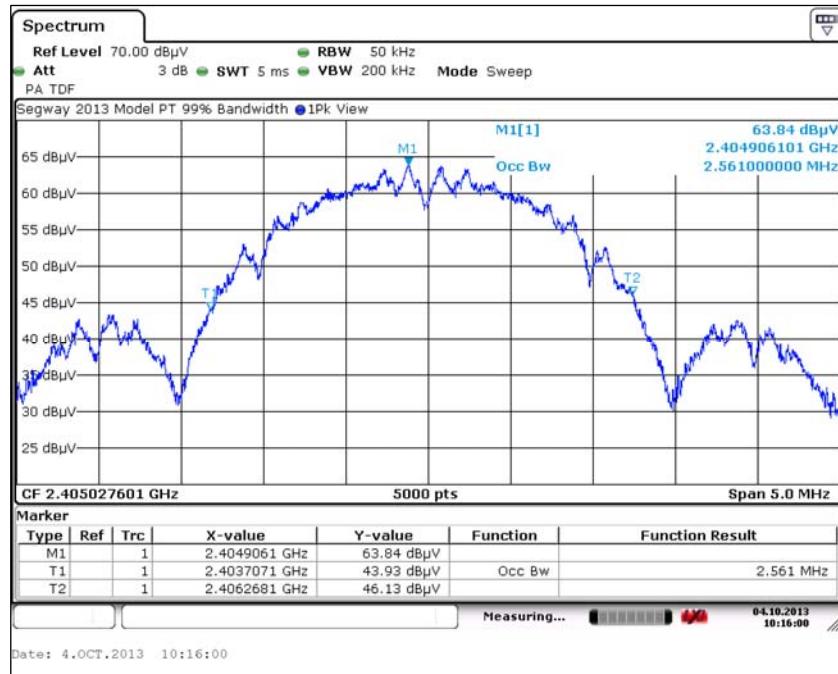
Procedure: This test was performed utilizing the automated 99% bandwidth function of the spectrum analyzer.

Conclusion: Compliant, for informational purposes only.

Measured results

Channel	Channel Frequency (MHz)	99% Power Bandwidth (MHz)
Low	2405	2.561
Middle	2440	2.545
High	2480	2.557

7.3.1. Low Channel, 11

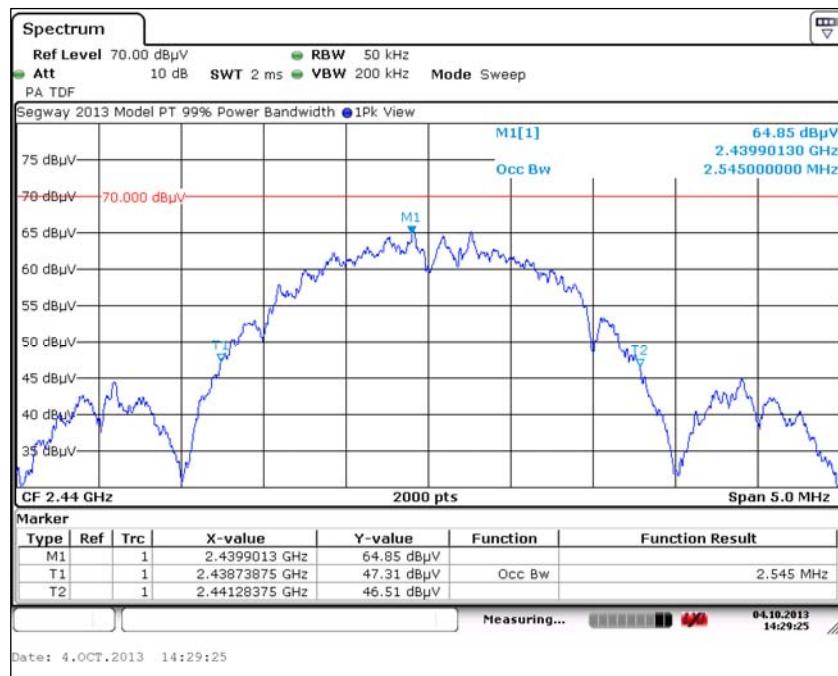


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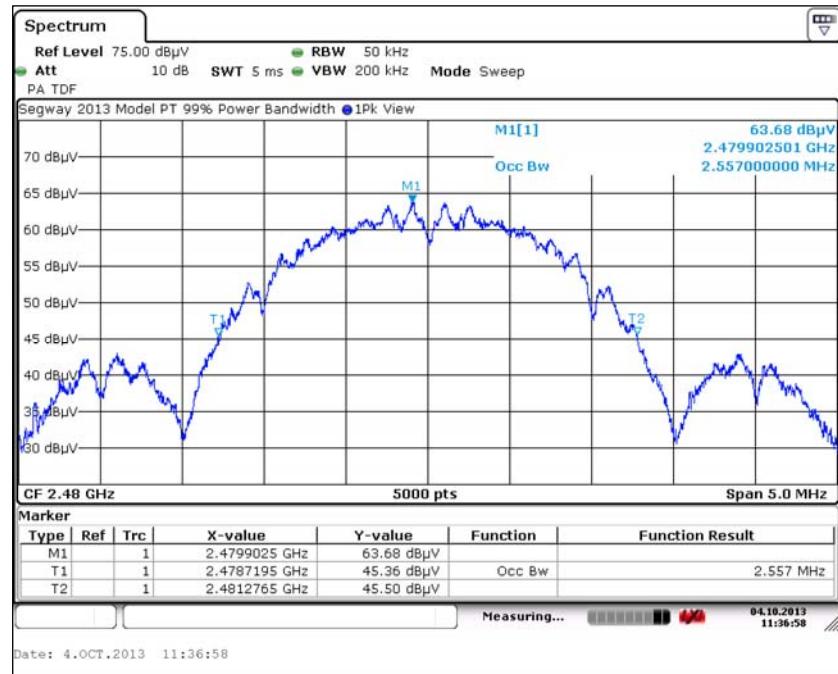
7. Measurement Data (continued)

7.3. 99% Bandwidth (RSS 210) (continued)

7.3.2. Middle Channel, 18



7.3.3. High Channel, 26



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7. Measurement Data (continued)

7.4. Maximum Peak Conducted Output Power

Requirement: (15.247 (b) (3))

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 9.1.2 integrated band power method.

Using the Rohde & Schwarz FSV40 band power function the integrated peak power was measured. The band power function span is determined by using the 6 dB Emission Bandwidth (EBW) measured in Section 7.2 of this report.

Test Note¹: The device under test does not facilitate conducted power measurements. Integrated peak measurements were made according to the procedure outlined above and converted to field strength values. The results were then converted to units of power using the following formula:

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

P = the power in Watts (power has been converted to milliwatts in the table).

E = the measured maximum field in V/m

G = the numeric gain of the transmitting antenna over an isotropic radiator.

d = the distance in meters of the field strength measurement.

¹ Reference FCC OET 412172: Determining ERP and EIRP

Conclusion: The device under test meets the required maximum peak conducted output power level of 1 Watt.

Channel	Freq.	Peak Field Strength	Distance	Antenna Gain ¹		Measured Output Power	Output Power Limit	Result
	(MHz)	(dB μ V/m)	(m)	(dBi)	(numeric)	(mW)	(mW)	
Low	2402	83.95	3.0	1.00	1.259	0.06	1000	Compliant
Middle	2440	82.31	3.0	1.00	1.259	0.04	1000	Compliant
High	2480	83.13	3.0	1.00	1.259	0.05	1000	Compliant

¹ Provided by the product manufacturer.

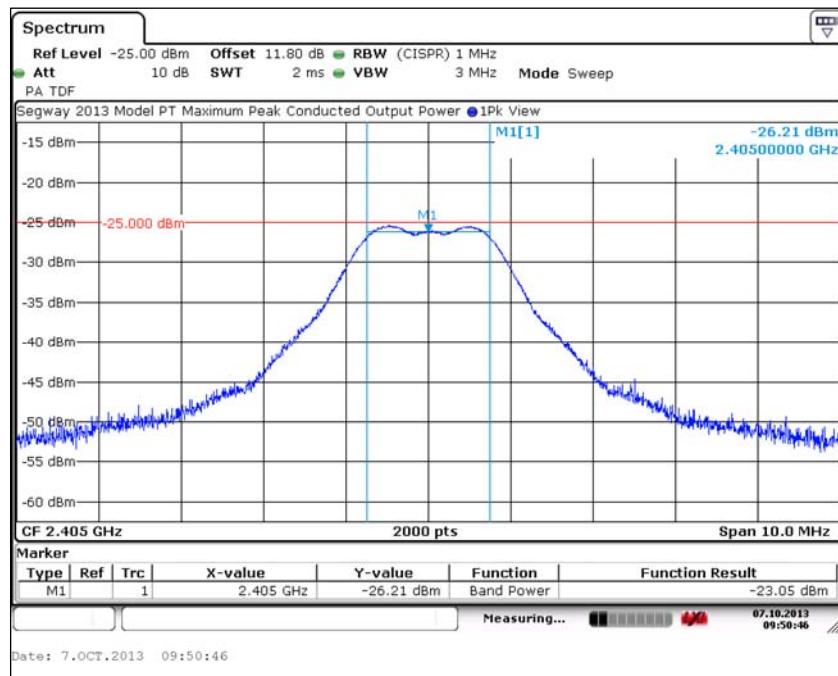
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7. Measurement Data (continued)

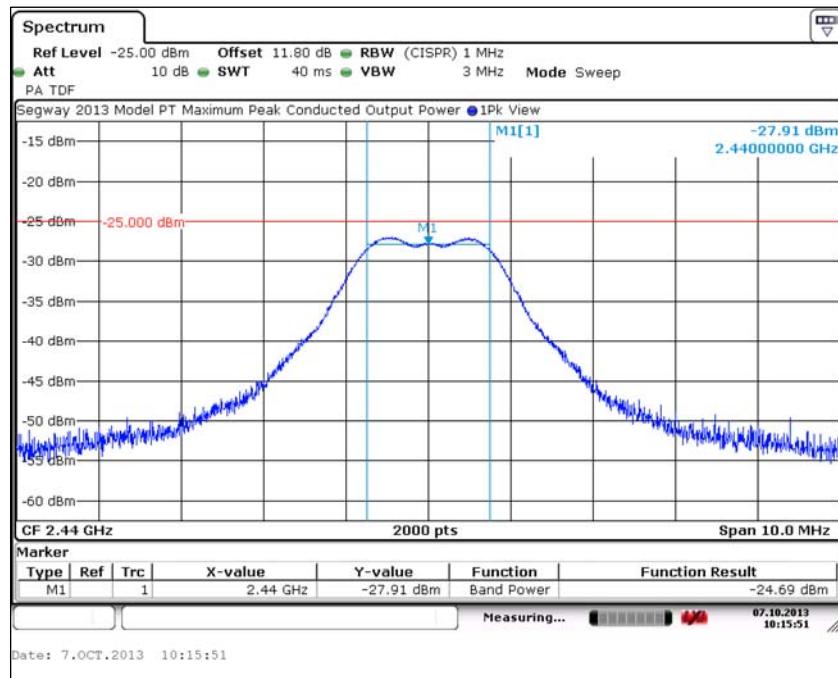
7.4. Maximum Peak Conducted Output Power (continued)

7.4.1. Fixed Antenna Version

7.4.1.1. Low Channel, 11



7.4.1.2. Middle Channel, 18



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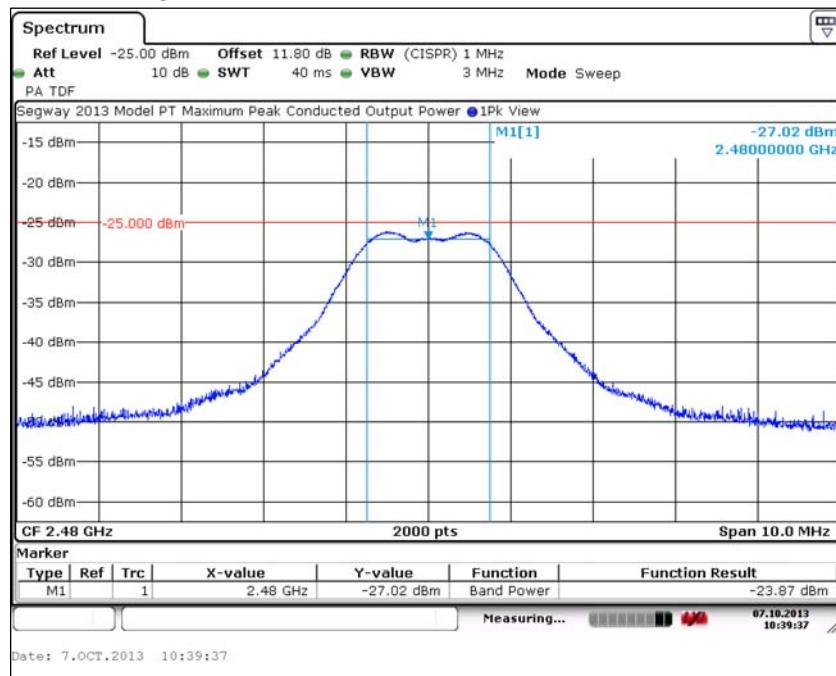
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7. Measurement Data (continued)

7.4. Maximum Peak Conducted Output Power (15.247 (b) (1)) (continued)

7.4.1. Fixed Antenna Version

7.4.1.3. High Channel, 26



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7. Measurement Data (continued)

7.5. Operation with directional antenna gains greater than 6 dBi (15.247 (b)(4))

Requirement: 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 FCC Part 15.247, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Conclusion: The fixed antenna has a gain of 1.0 dBi. An adjustment in the peak power output of the DUT related to antenna gain was not necessary.

7.6. Transmitter Spurious Radiated Emissions (150 kHz to 26 GHz)

Requirement: (15.209) The Emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency Range (MHz)	Distance (Meters)	Limit (dB μ V/m) ¹
0.009 to 0.490	3	128.5 to 93.8
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

¹ Measurements in the 9 to 90 kHz, 110 to 490 kHz and above 1000 MHz ranges employ an average detector. Otherwise a quasi-peak detector is used.

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 10.0: Maximum Unwanted Emissions Levels and FCC 47 CFR Part 15.209: Radiated Emission Limits; General Requirements.

Test measurements were made in accordance with ANSI C63.4-2009, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

Conclusion: The Emissions from the DUT did not exceed the field strength levels specified in the above table.

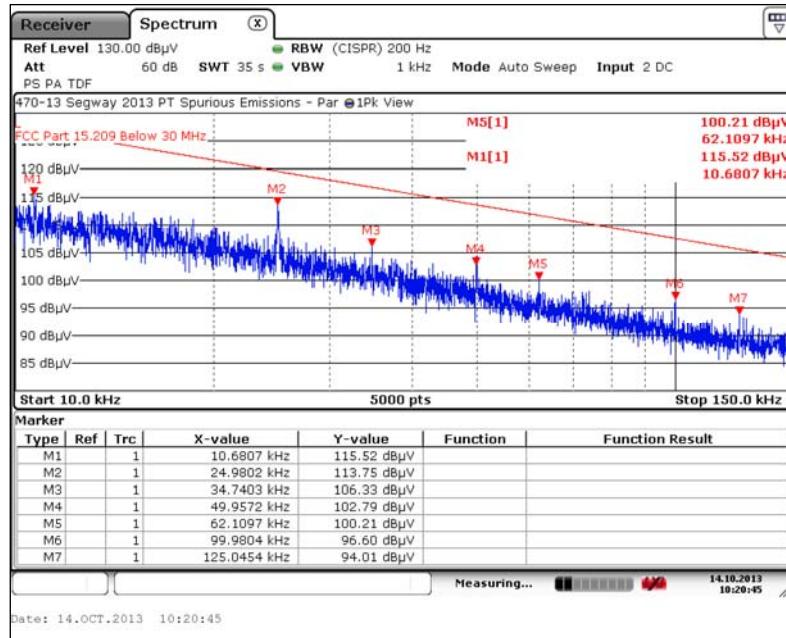
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7. Measurement Data (continued)

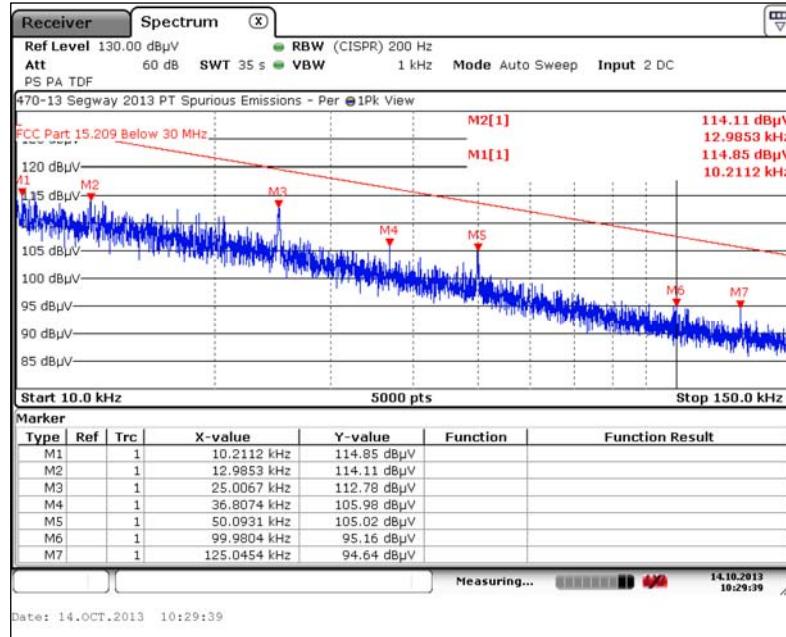
7.6. Transmitter Spurious Radiated Emissions (150 kHz to 26 GHz)

7.6.1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

Measurement Results – Parallel Antenna



Measurement Results – Perpendicular Antenna



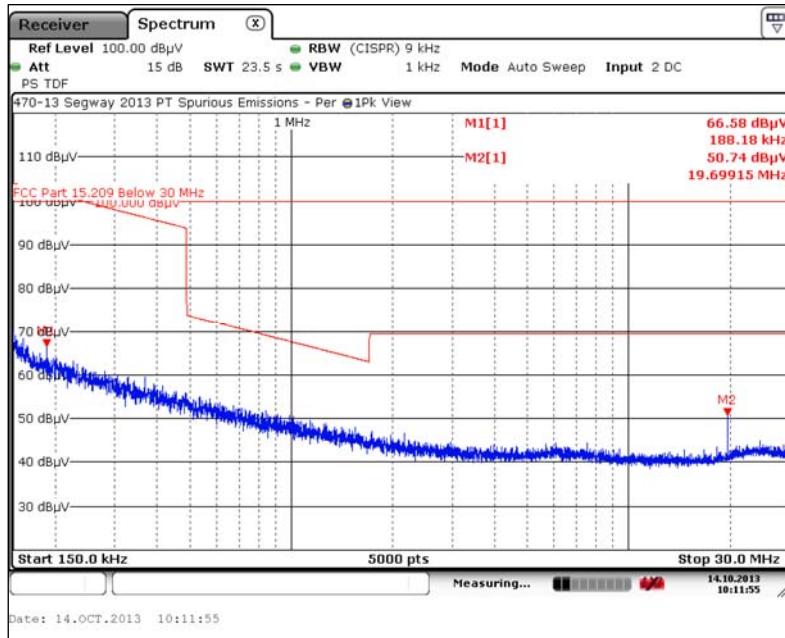
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7. Measurement Data (continued)

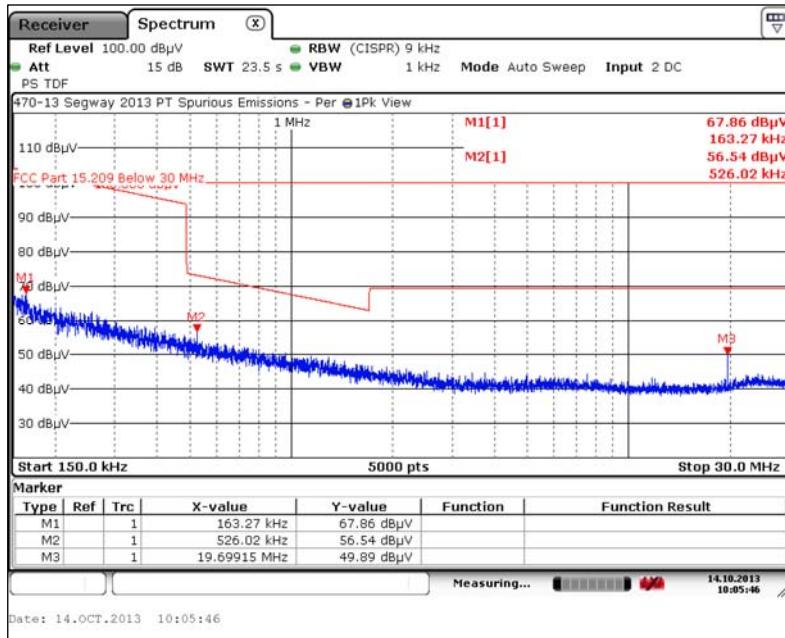
7.6. Transmitter Spurious Radiated Emissions (150 kHz to 26 GHz)

7.6.2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

Measurement Results – Parallel Antenna



Measurement Results – Perpendicular Antenna



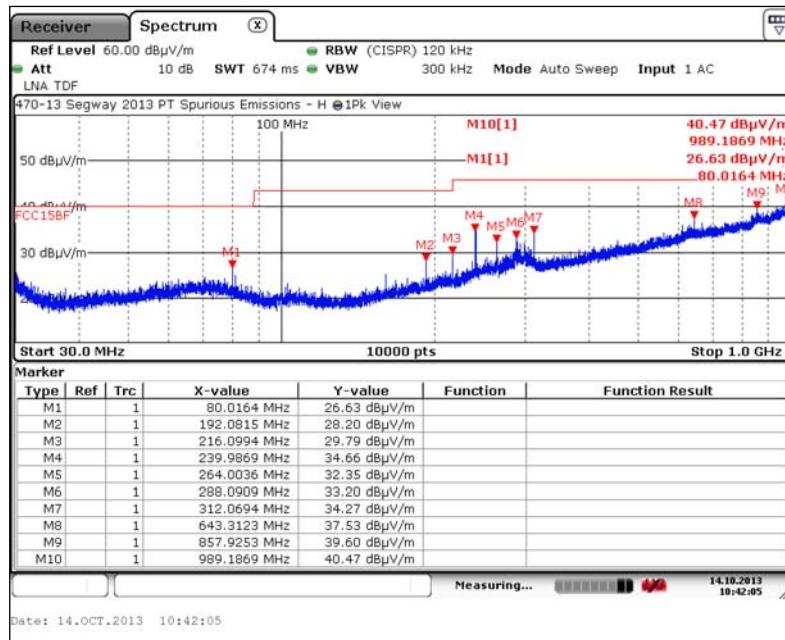
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7. Measurement Data (continued)

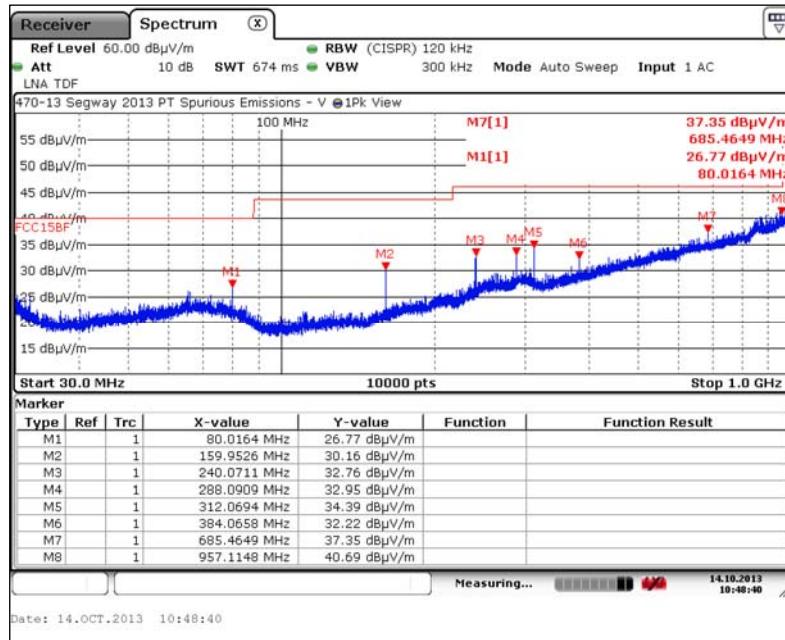
7.6. Transmitter Spurious Radiated Emissions (150 kHz to 26 GHz)

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

Measurement Results – Horizontal Antenna



Measurement Results – Vertical Antenna



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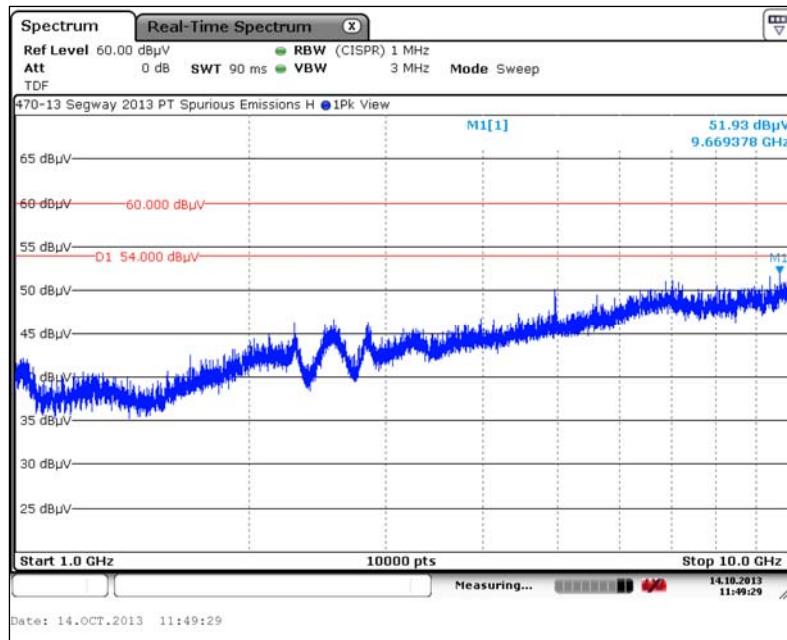
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7. Measurement Data (continued)

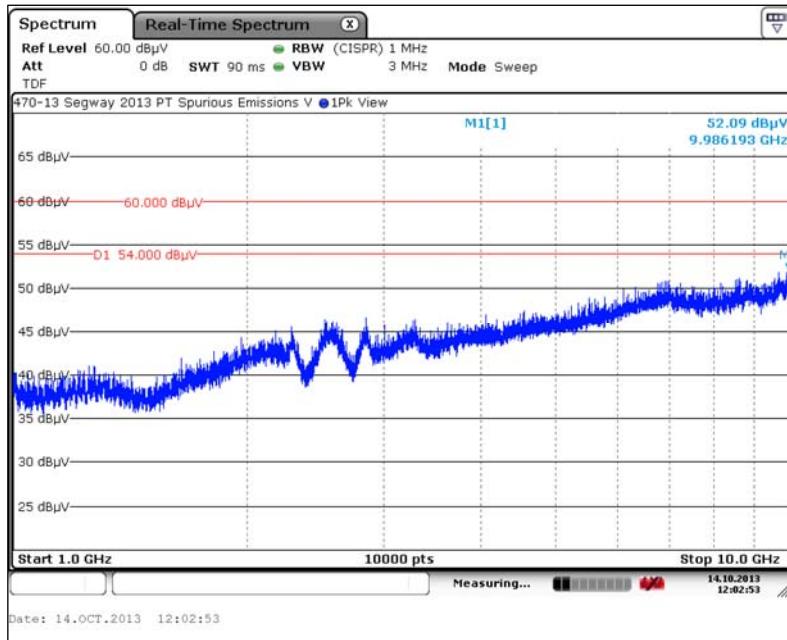
7.6. Transmitter Spurious Radiated Emissions (150 kHz to 26 GHz)

7.6.4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

Measurement Results – Horizontal Antenna



Measurement Results – Vertical Antenna



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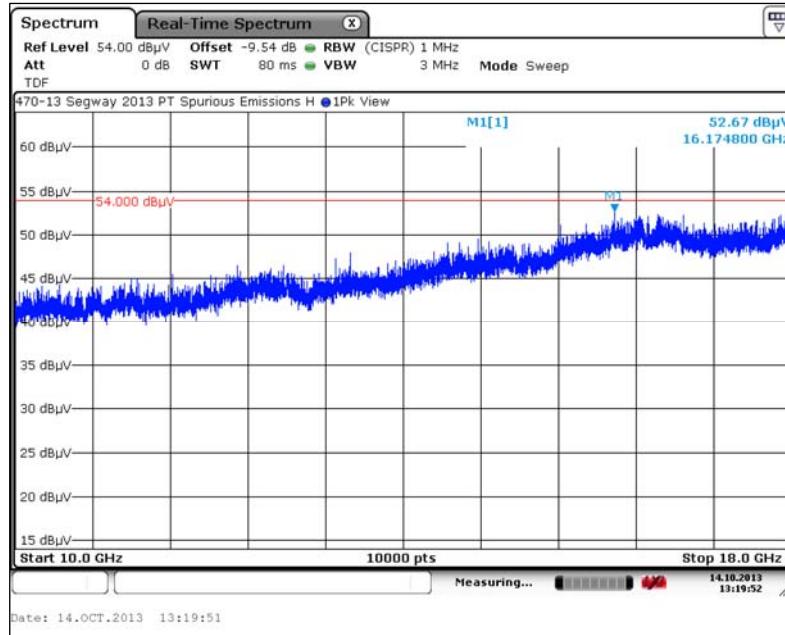
Issue Date: 10/18/2013

7. Measurement Data (continued)

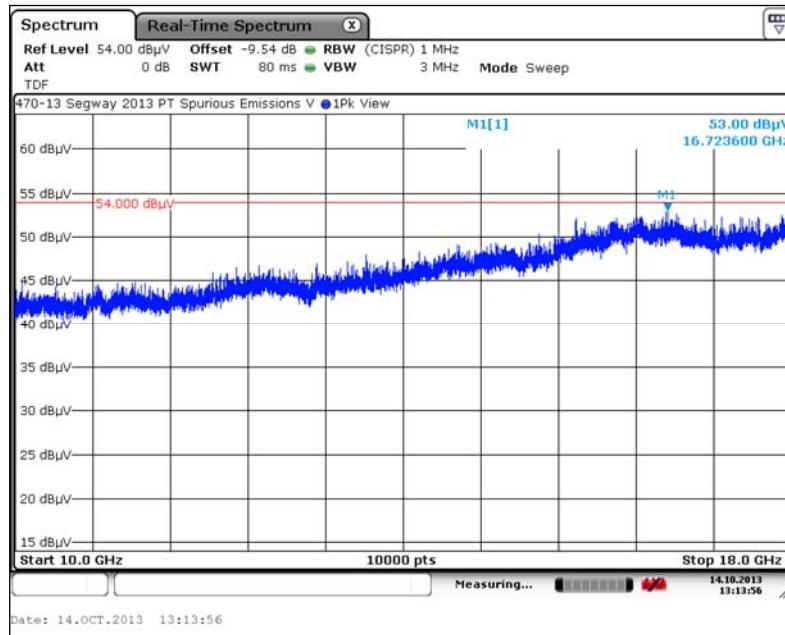
7.6. Transmitter Spurious Radiated Emissions (150 kHz to 26 GHz)

7.6.5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

Measurement Results – Horizontal Antenna



Measurement Results – Vertical Antenna



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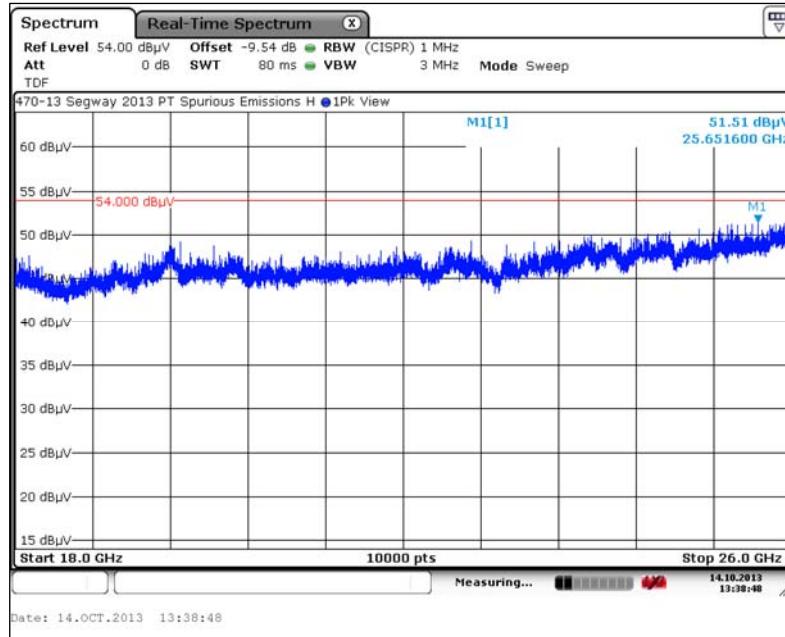
Issue Date: 10/18/2013

7. Measurement Data (continued)

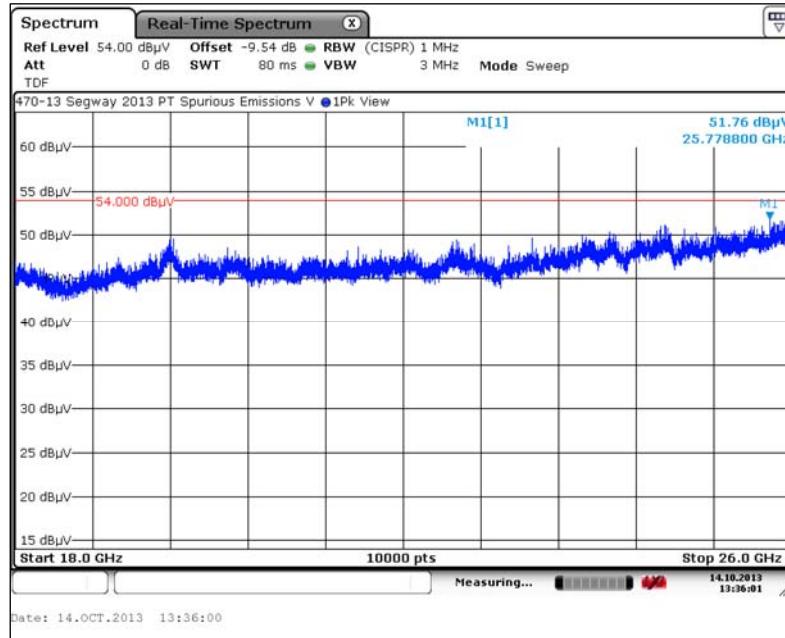
7.6. Transmitter Spurious Radiated Emissions (150 kHz to 26 GHz)

7.6.6. Spurious Radiated Emissions (18 GHz – 26 GHz) Test Results

Measurement Results – Horizontal Antenna



Measurement Results – Vertical Antenna



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7. Measurement Data (continued)

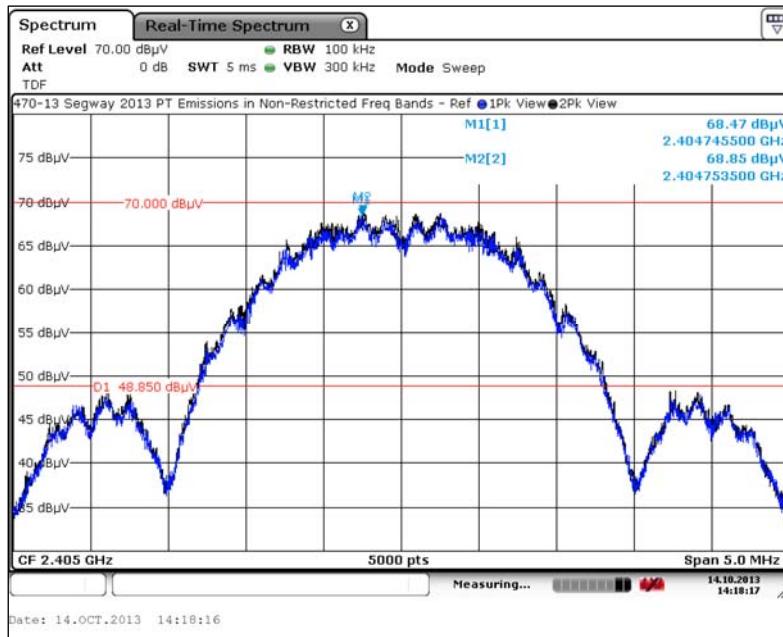
7.7. Emissions in Non-Restricted Frequency Bands (15.247(d))

Requirement: 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Procedure: For the lower band edge, this test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 11, Emissions in Non-Restricted Frequency.

Test Note: For the following reference plots: M1 = Vertical polarity, M2 = Horizontal polarity.

7.7.1. Reference Level Measurement - LF



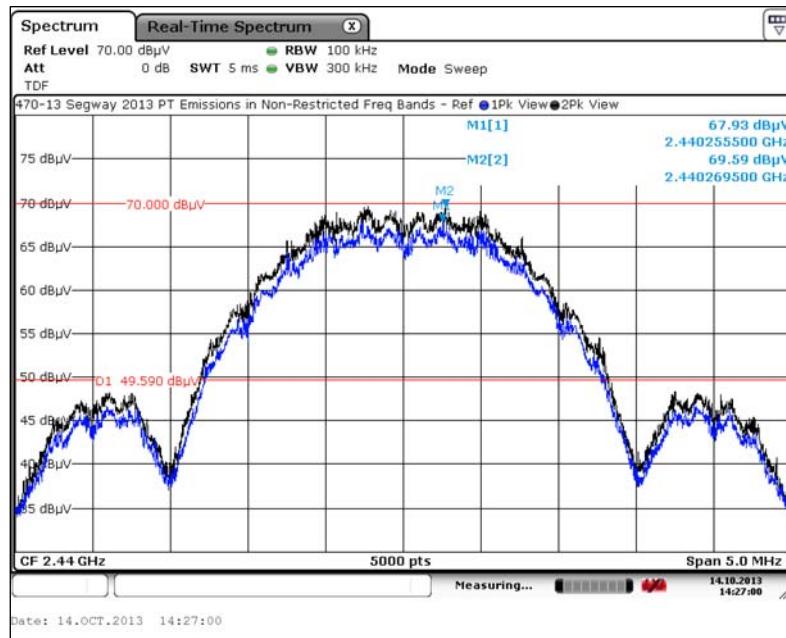
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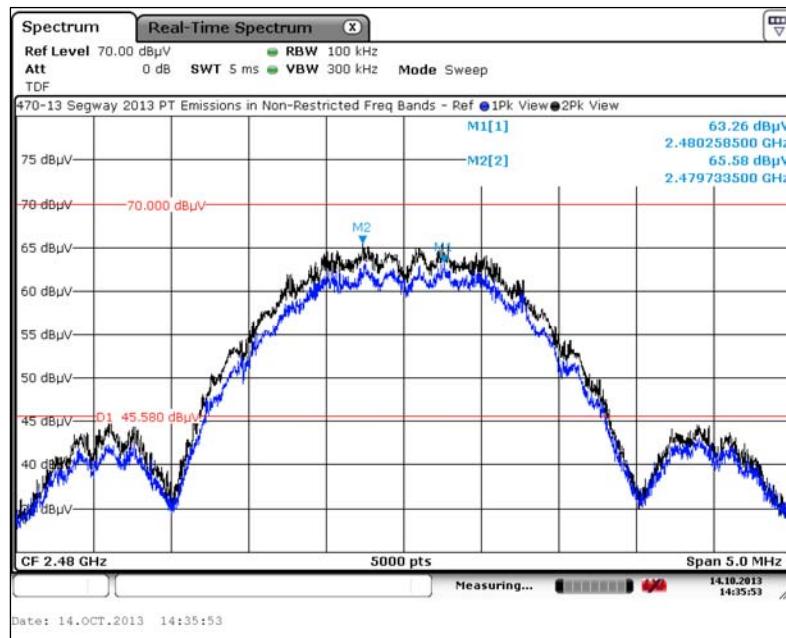
7. Measurement Data (continued)

7.7. Emissions in Non-Restricted Frequency Bands (15.247(d))

7.7.2. Reference Level Measurement - MF



7.7.3. Reference Level Measurement - HF



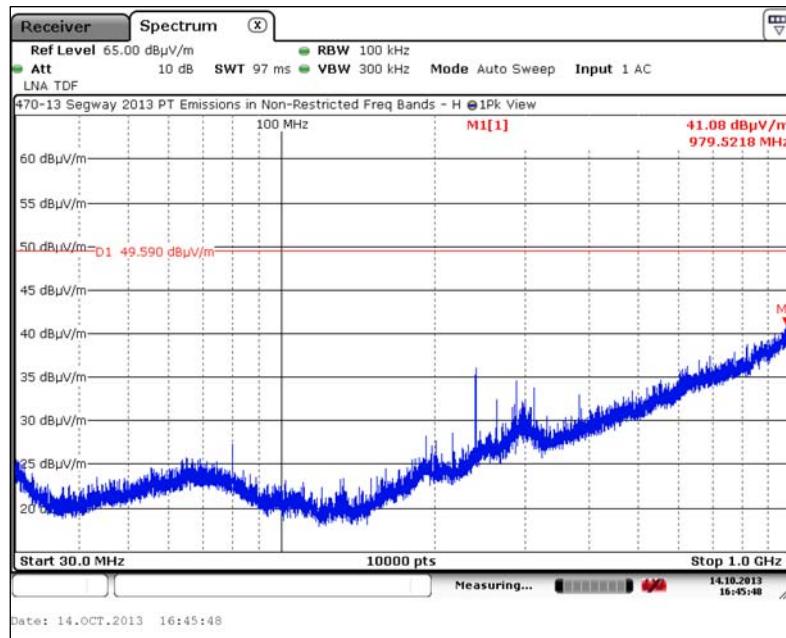
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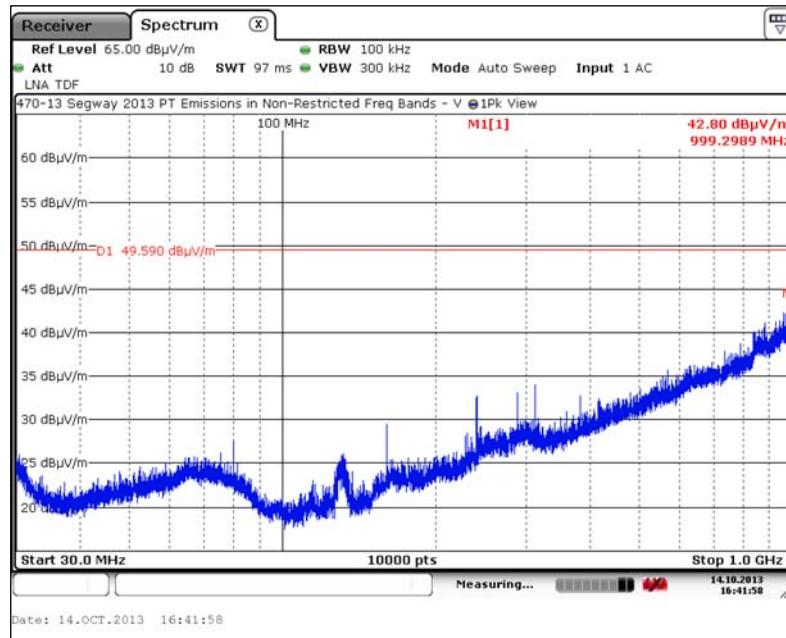
7. Measurement Data (continued)

7.7. Emissions in Non-Restricted Frequency Bands (15.247(d))

7.7.4. 30 MHz to 1000 MHz - Horizontal



7.7.5. 30 MHz to 1000 MHz - Vertical



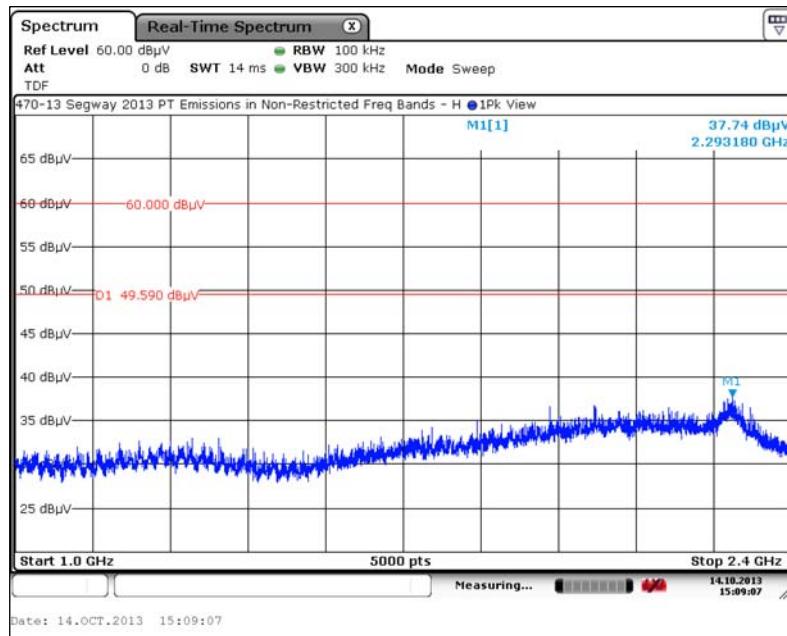
Test Number: 470-13

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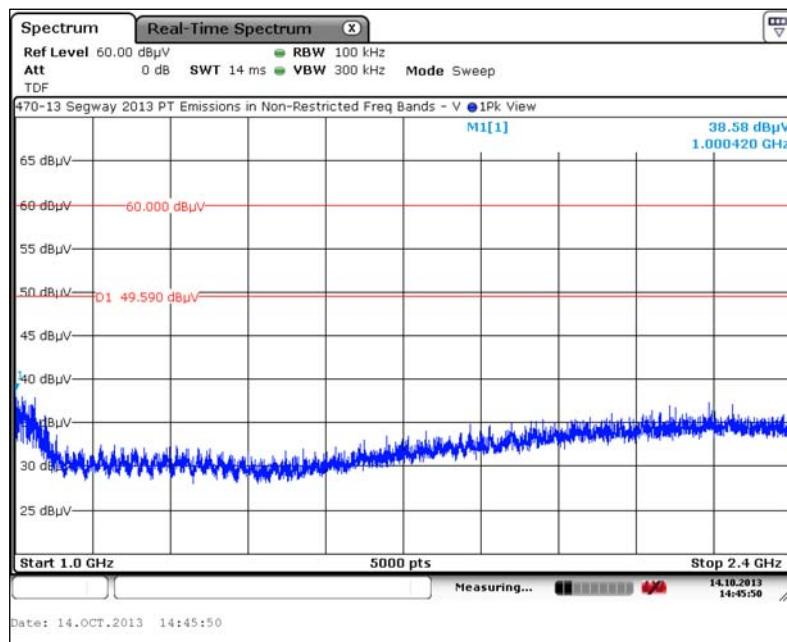
7. Measurement Data (continued)

7.7. Emissions in Non-Restricted Frequency Bands (15.247(d))

7.7.6. 1 GHz to 2.4 GHz - Horizontal



7.7.7. 1 GHz to 2.4 GHz - Vertical



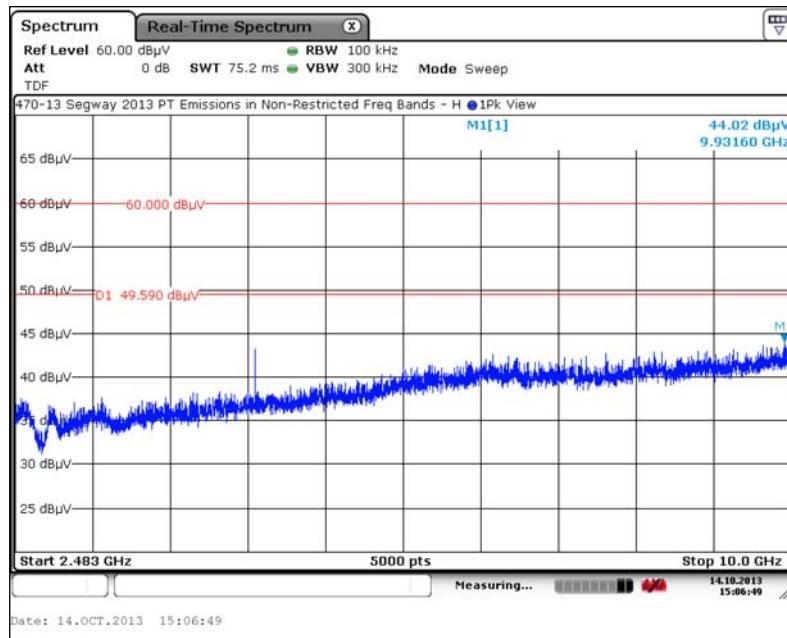
Test Number: 470-13

Issue Date: 10/18/2013

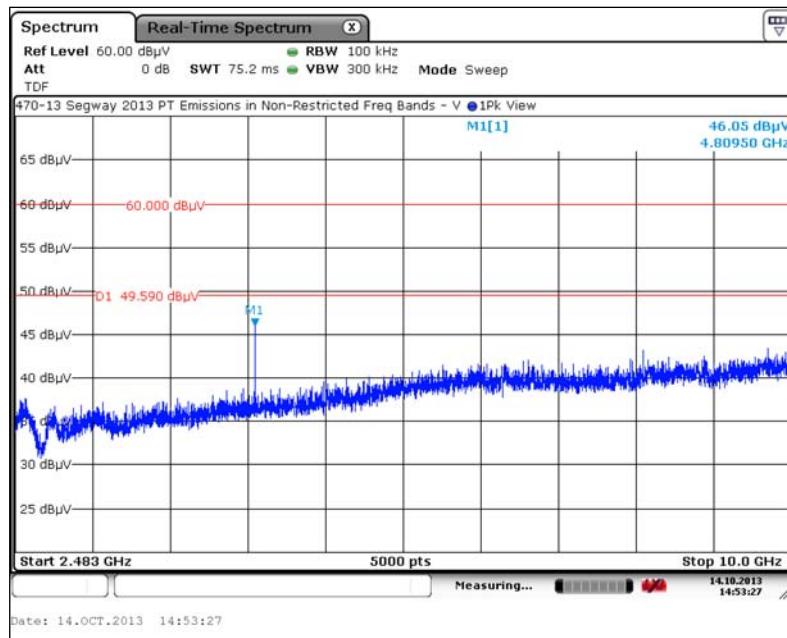
7. Measurement Data (continued)

7.7. Emissions in Non-Restricted Frequency Bands (15.247(d))

7.7.8. 2.483 GHz to 10 GHz - Horizontal



7.7.9. 2.483 GHz to 10 GHz - Vertical



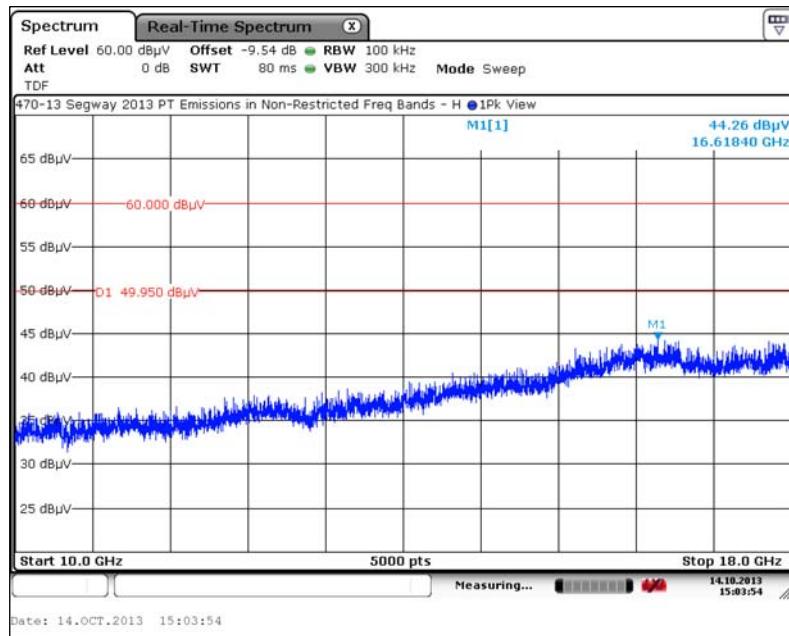
Test Number: 470-13

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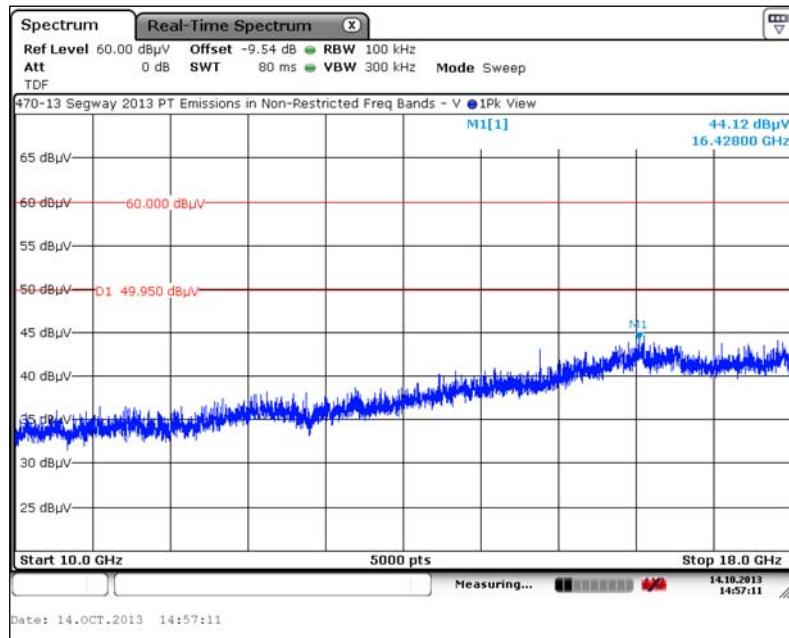
7. Measurement Data (continued)

7.7. Emissions in Non-Restricted Frequency Bands (15.247(d))

7.7.10. 10 GHz to 18 GHz - Horizontal



7.7.11. 10 GHz to 18 GHz - Vertical



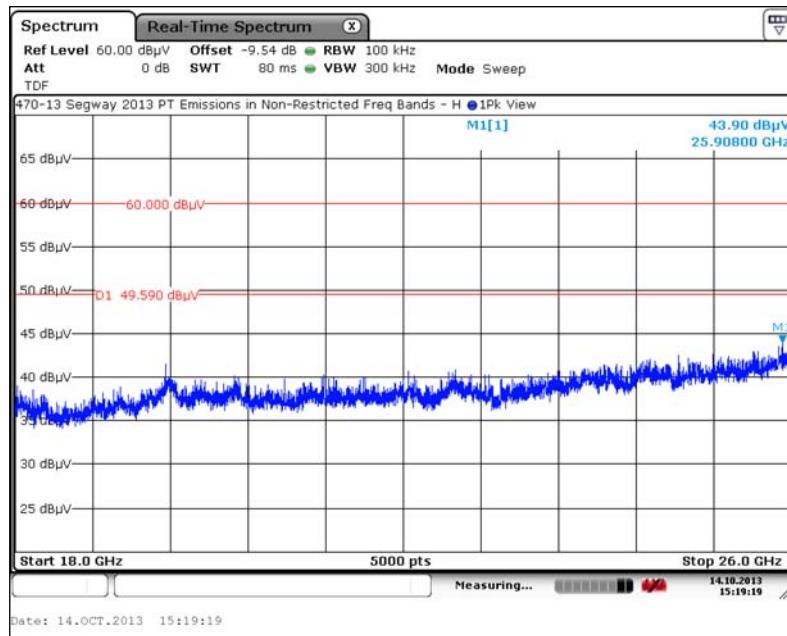
Test Number: 470-13

Issue Date: 10/18/2013

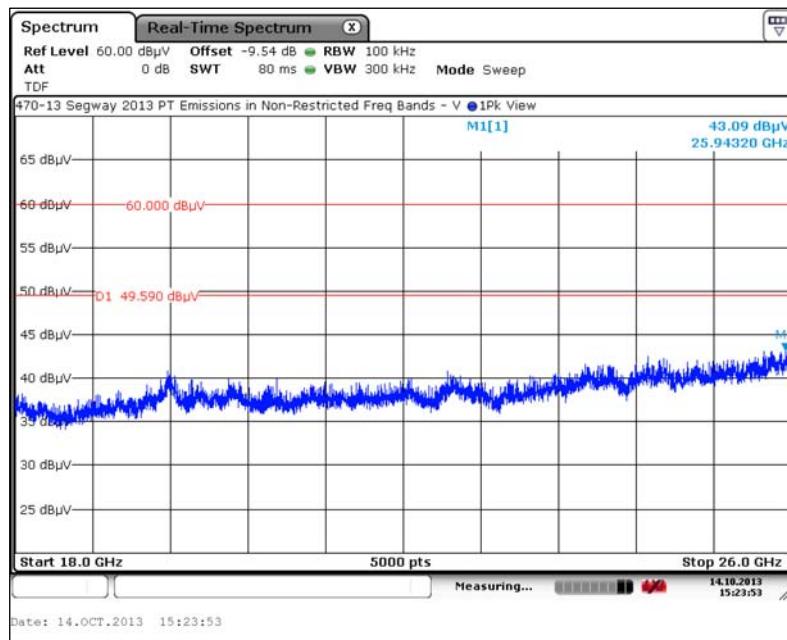
7. Measurement Data (continued)

7.7. Emissions in Non-Restricted Frequency Bands (15.247(d))

7.7.12. 18 GHz to 26 GHz - Horizontal



7.7.13. 18 GHz to 26 GHz - Vertical



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7. Measurement Data (continued)

7.8. Harmonic Emissions in the Restricted Bands of Operation

7.8.1. Measurement Results

Freq. (MHz)	Measured Field Strength (dB μ V/m)		Duty Cycle CF (dB) ¹	Adjusted Average Field Strength (dB μ V/m) ¹	Limit (dB μ V/m)		Margin (dB μ V/m) ²		Antenna Polarity (H/V)	Result
	Peak	Average			Peak	Average	Peak	Average		
4810	51.47	43.53	0	43.53	74.00	54.00	-15.64	-14.46	V	Compliant
4880	52.25	45.32	0	45.32	74.00	54.00	-13.93	-12.52	V	Compliant
4960	52.86	46.83	0	46.83	74.00	54.00	-11.41	-10.41	V	Compliant
7320	51.19	37.98	0	37.98	74.00	54.00	-9.32	-7.91	V	Compliant
7440	51.75	38.00	0	38.00	74.00	54.00	-2.39	-1.39	H	Compliant
12025	56.90	42.97	0	42.97	74.00	54.00	-15.44	-14.26	V	Compliant
12200	57.02	43.72	0	43.72	74.00	54.00	-14.96	-13.55	V	Compliant
12400	58.12	43.89	0	43.89	74.00	54.00	-14.15	-13.15	V	Compliant
19240	57.10	43.00	0	43.00	74.00	54.00	-18.66	-17.48	H	Compliant
19520	57.19	43.64	0	43.64	74.00	54.00	-17.05	-15.64	H	Compliant
19840	55.85	52.69	0	52.69	74.00	54.00	-16.98	-15.98	V	Compliant
22320	57.02	43.99	0	43.99	74.00	54.00	-15.51	-14.51	V	Compliant

¹ Duty cycle correction factors were not used because the duty cycle is 100%.

² Average margin was factored from the adjusted average field strength.

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7. Measurement Data (continued)

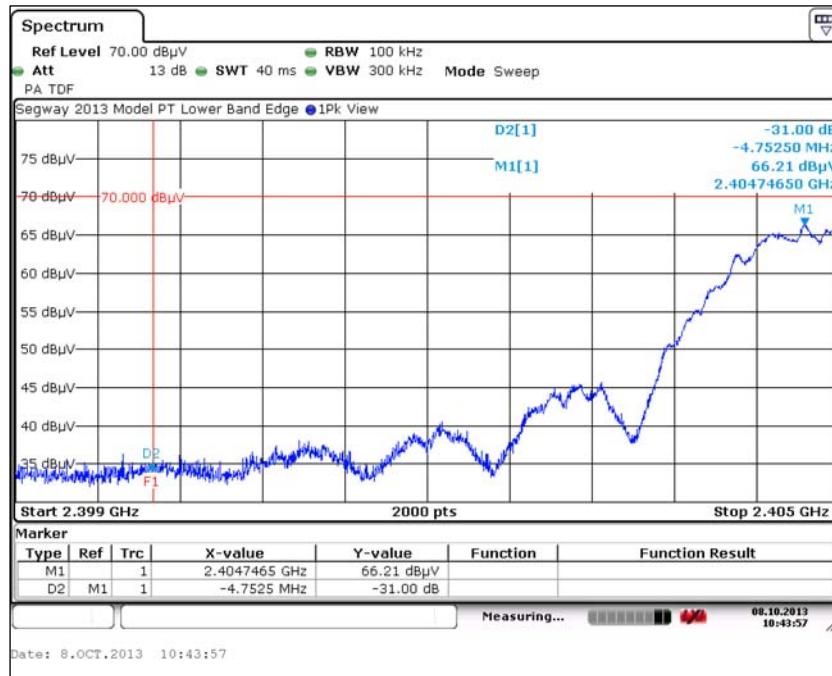
7.9. Band Edge Measurements (15.247 d))

Requirement: 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Procedure: For the lower band edge, this test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 13, Band-Edge Measurements and KDB 913591, band edge measurements of a Part 15 intentional radiator.

7.9.1. Measurement Results - Lower Band Edge

Lowest Channel (MHz)	Reference Level (dB μ V/m)		Band Edge Frequency (MHz)	Field Strength (dB μ V/m)	Required Attenuation	Actual Attenuation	Result
	Freq.	Peak					
2405	2404.7465	66.21	2400	35.21	≥ 20 dB	31.00	Compliant



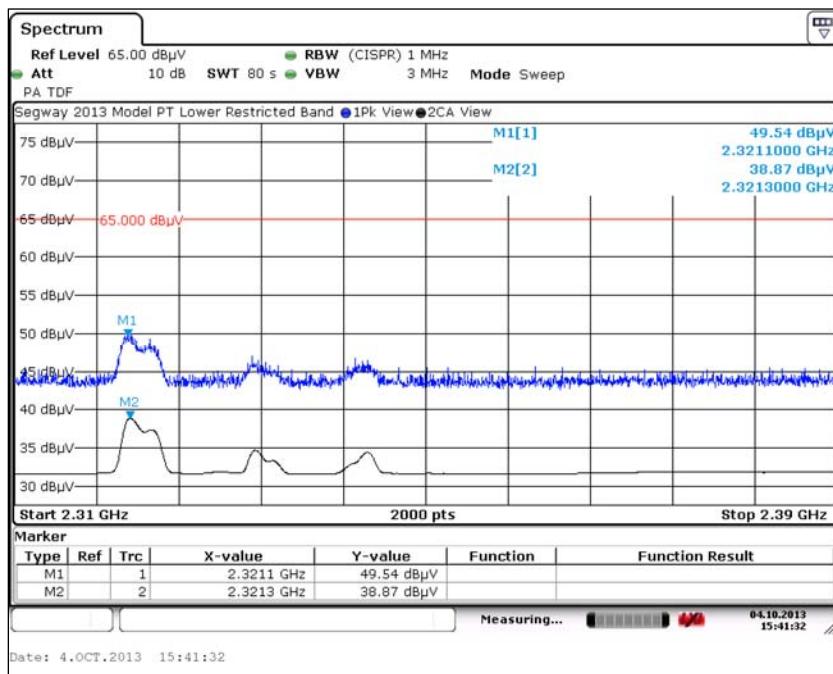
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7. Measurement Data (continued)

7.9. Band Edge Measurements (continued)

7.9.2. Measurement Results – Lower Restricted Band 2310 to 2390 MHz

Freq. (MHz)	Field Strength (dB μ V/m)		Limit (dB μ V/m)		Margin (dB μ V/m)		Result
	Peak	Average	Peak	Average	Peak	Average	
2321.130	49.54	38.87	74	54	-24.46	-15.13	Compliant



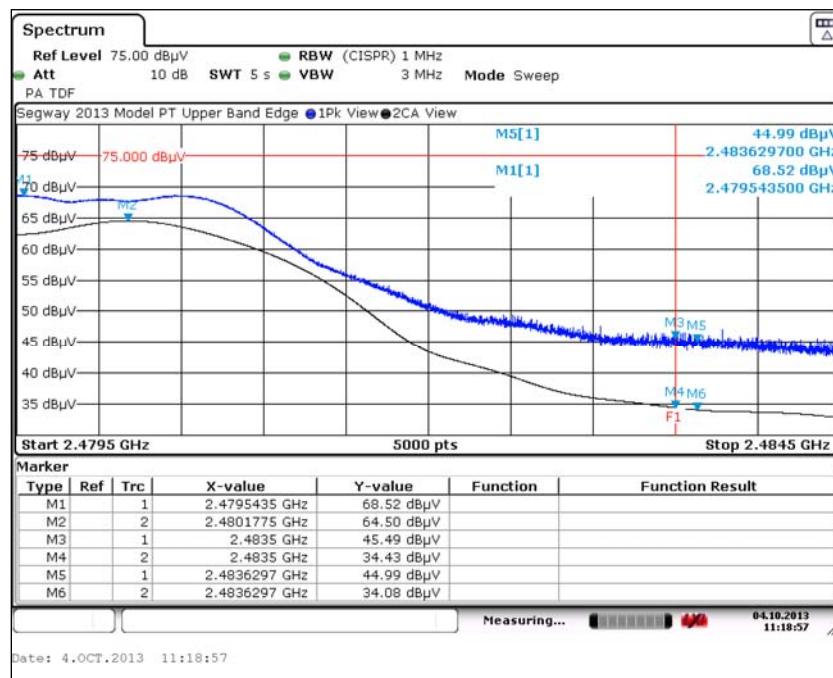
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7. Measurement Data (continued)

7.9. Band Edge Measurements (continued)

7.9.3. Upper Band Edge and Worst Case Out of Band

Highest Channel Frequency (MHz)	Fundamental Field Strength (dB μ V/m)		Band Edge & Worst Case Out of Band ¹		Limit		Result	
	Peak	Average	Freq. (MHz)	Amplitude (dB μ V/m)		(dB μ V/m)		
				Peak	Average	Peak	Average	
2480.000	68.52	44.99	2483.500	45.49	34.43	74	54	Compliant
			2483.893	44.99	34.08	74	54	Compliant



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7. Measurement Data (continued)

7.10. Maximum Power Spectral Density (15.247(e))

Requirement: 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.

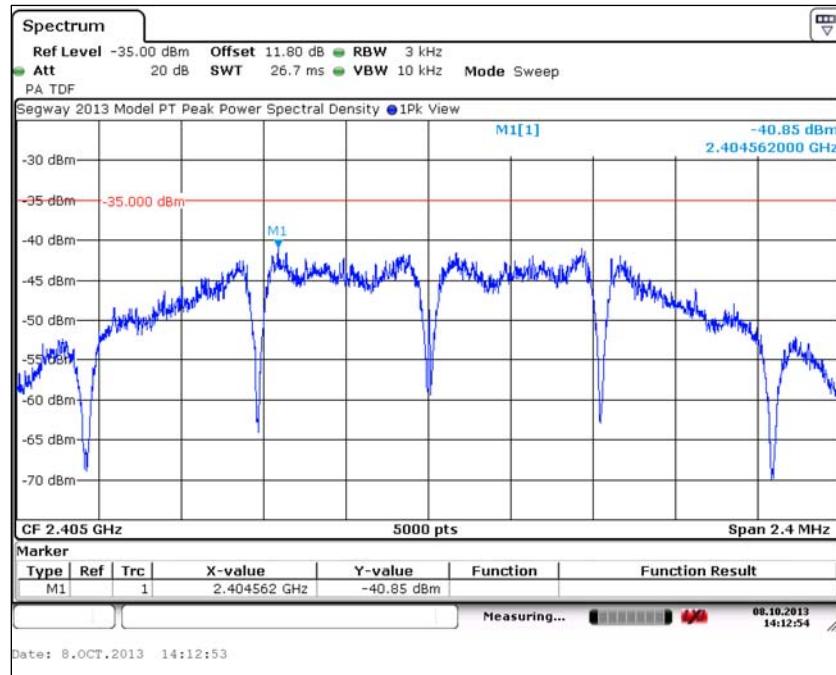
Procedure: FCC OET publication number 558074, Section 9.0: Maximum Power Spectral Density Level in the Fundamental Emission, Option 10.2.

Conclusion: The DUT meets the required power spectral density limit at the tested frequencies.

7.10.1. Measurement Results for the Fixed Antenna Version

Channel	Channel Frequency	DUT Channel Output Power Setting	Measured Frequency	Power Spectral Density	Limit	Margin	Result
	(MHz)		(MHz)	(dBm)	(dBm)	(dB)	
Low	2405	N/A	2404.5620	-40.85	8	-48.85	Compliant
Middle	2440	N/A	2440.4495	-41.78	8	-49.78	Compliant
High	2480	N/A	2480.5685	-43.58	8	-51.58	Compliant

7.10.1.1. Low Channel, 11



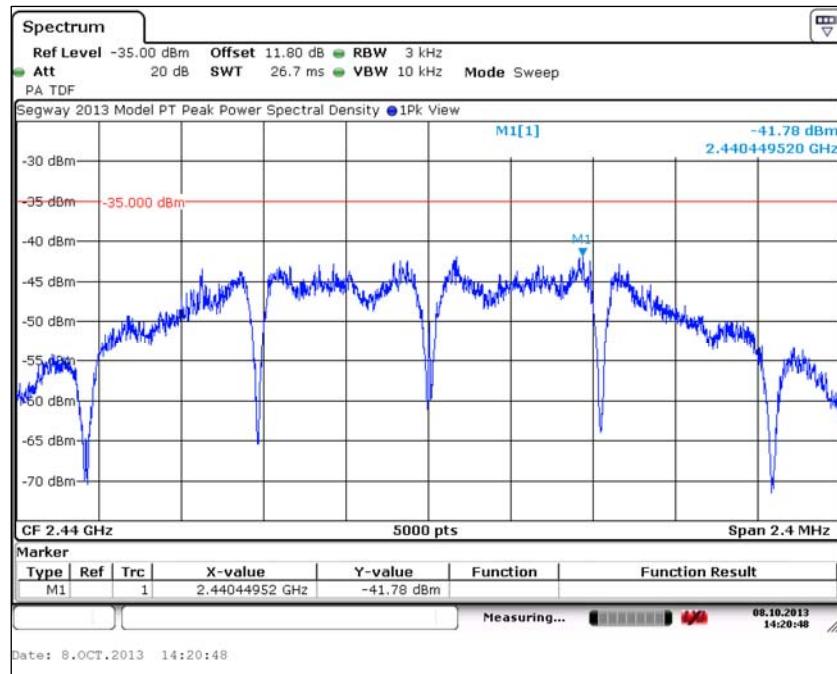
Test Number: 470-13
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7. Measurement Data (continued)

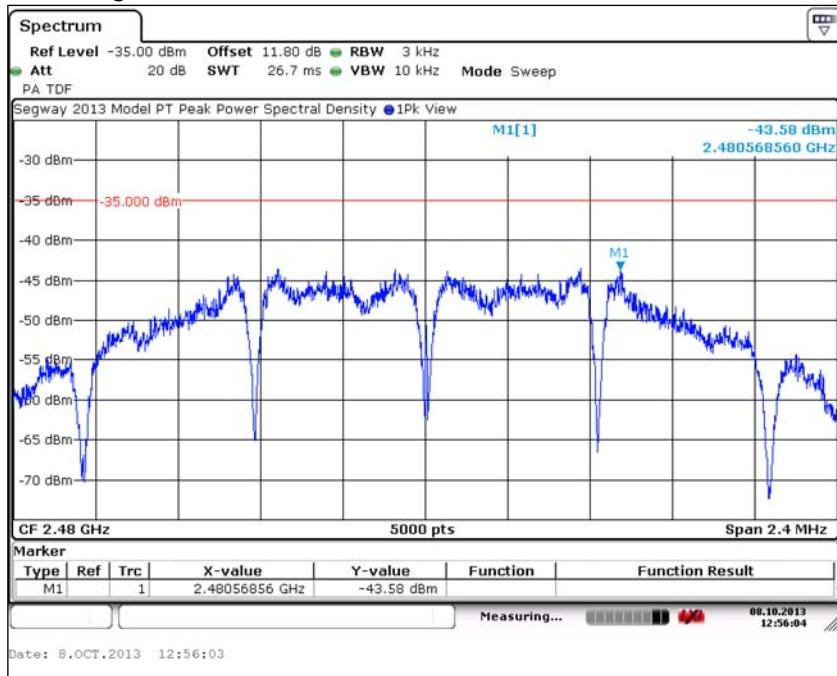
7.10. Power Spectral Density (15.247(e)) (continued)

7.10.1. Fixed Antenna Version

7.10.1.2. Middle Channel, 18



7.10.1.3. High Channel, 25



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7. Measurement Data (continued)

7.11. Duty Cycle Calculations (ANSI C63.10-2009, Section 7.5)

Requirement: When the average value of the pulsed emissions from a DUT must be determined, the average can be found by measuring the peak pulse amplitude and determining the duty cycle correction factor of the pulse modulation. The duty cycle correction factor δ may be expressed in dB as in the following equation:

$$\delta \text{ (dB)} = 20 \log_{10} (\delta)$$

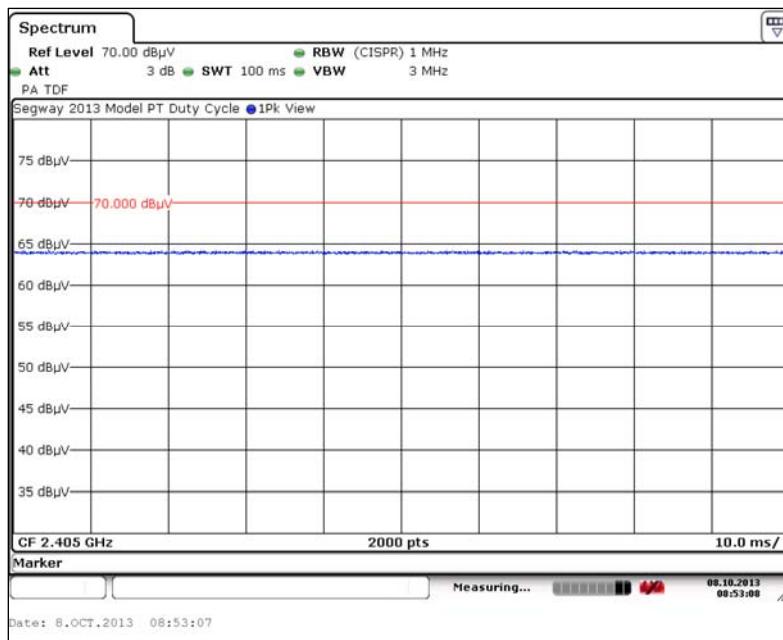
This correction factor can then be applied to the peak pulse amplitude to find the average emission. This correction is applied for all emissions including the fundamental and harmonics.

Note: The DUT was operated at its maximum transmission rate under normal operations to produce the following duty cycle.

7.11.1 Duty Cycle for the Device as Tested

Channel	Channel Frequency (MHz)	Total Time On per 100 ms Period (ms)	Percentage of Time On per 100 ms Period (Fraction)	Duty Cycle Correction Factor (dB)	Maximum Allowed Duty Cycle Correction Factor (dB)	Applied Duty Cycle
Low	2405	100.000	1	0.000	-20	0.000
Middle	2440	100.000	1	0.000	-20	0.000
High	2480	100.000	1	0.000	-20	0.000

Low Channel, 11



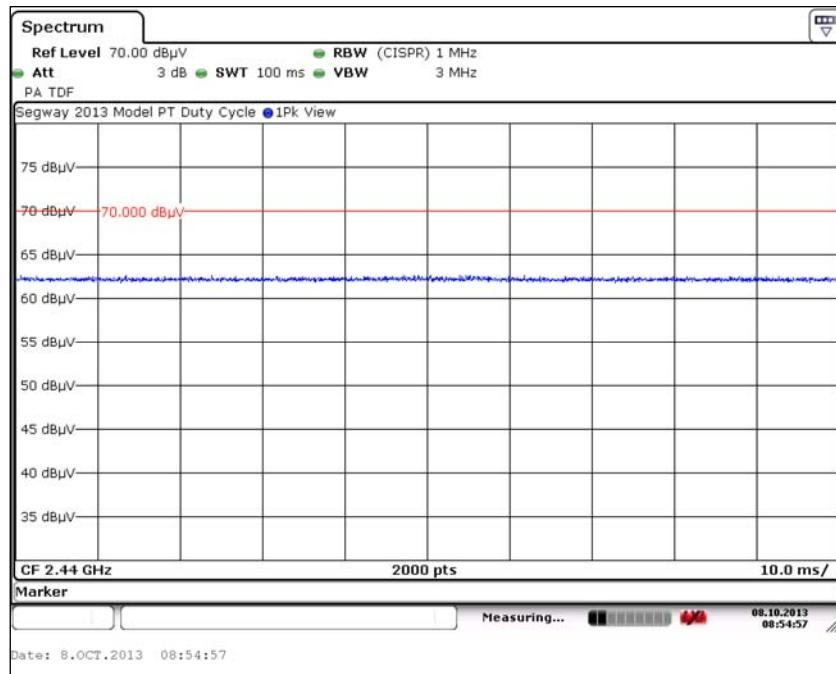
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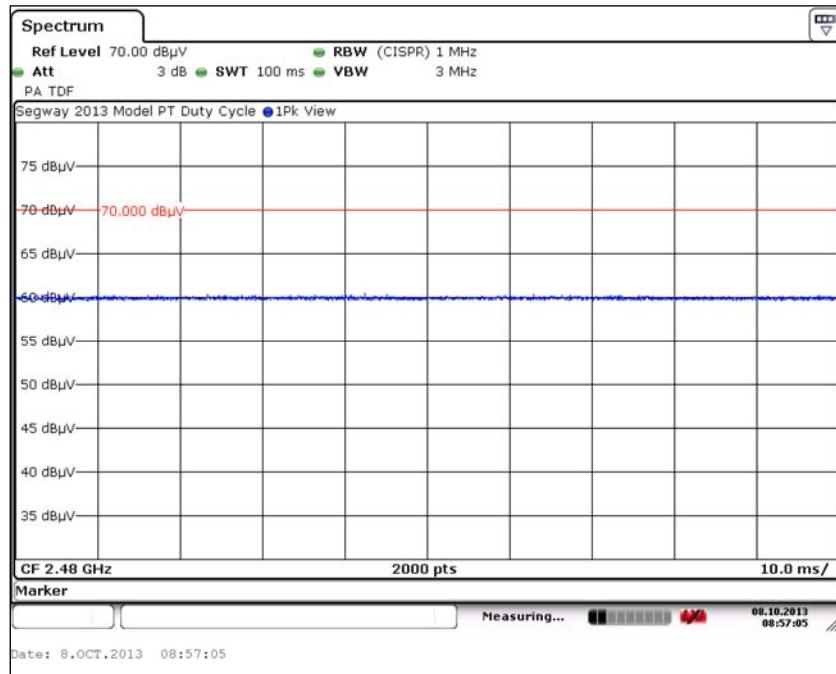
7. Measurement Data (continued)

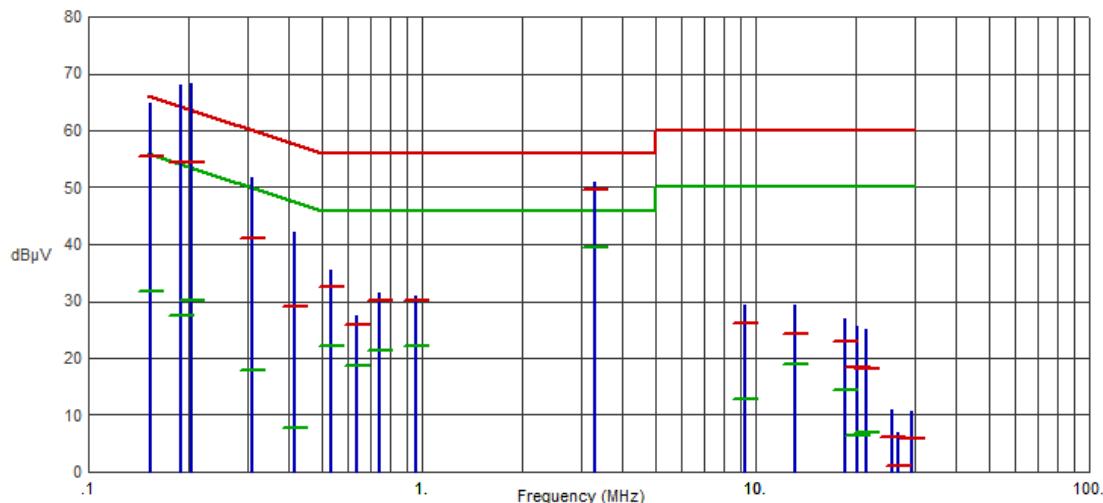
7.11. Duty Cycle Calculations (ANSI C63.10-2009, Section 7.5) (continue)

Middle Channel, 18

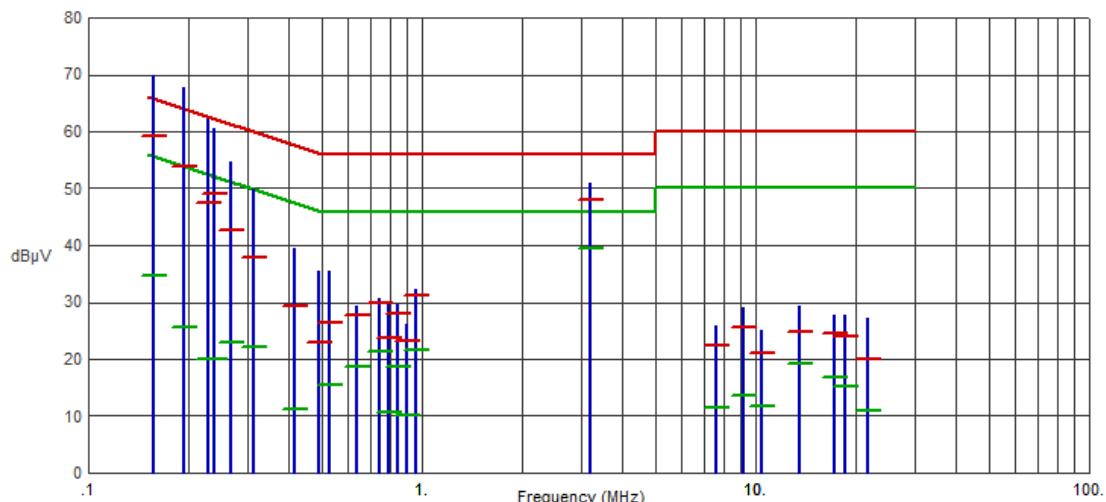


High Channel, 26



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7. Measurement Data (continued)
7.12. Conducted Emissions
7.12.1. 120 Volts, 60 Hz Phase
Test No.: 470-13, 120 Volts, 60 Hz Phase
FCC, Class B


Frequency (MHz)	Pk Amp (dB μ V)	QP Amp (dB μ V)	QP Limit (dB μ V)	QP Margin (dB)	Avg Amp (dB μ V)	Avg Limit (dB μ V)	Avg Margin (dB)	Comments
.1535	64.87	55.36	65.81	-10.45	31.69	55.81	-24.12	
.1892	68.00	54.38	64.07	-9.69	27.58	54.07	-26.49	
.2044	68.24	54.41	63.43	-9.02	30.06	53.43	-23.37	
.3095	51.79	41.06	59.98	-18.92	17.74	49.98	-32.24	
.4155	42.12	29.07	57.54	-28.47	7.84	47.54	-39.70	
.5314	35.36	32.64	56.00	-23.36	22.03	46.00	-23.97	
.6386	27.45	25.96	56.00	-30.04	18.70	46.00	-27.30	
.7433	31.44	30.25	56.00	-25.75	21.22	46.00	-24.78	
.9559	30.98	30.16	56.00	-25.84	22.23	46.00	-23.77	
3.2946	50.86	49.47	56.00	-6.53	39.51	46.00	-6.49	
9.2454	29.45	26.06	60.00	-33.94	12.80	50.00	-37.20	
13.1426	29.38	24.24	60.00	-35.76	19.01	50.00	-30.99	
18.4905	27.05	22.83	60.00	-37.17	14.32	50.00	-35.68	
20.1687	25.48	18.28	60.00	-41.72	6.43	50.00	-43.57	
21.4690	25.09	18.26	60.00	-41.74	6.82	50.00	-43.18	
25.7163	10.86	6.16	60.00	-53.84	-2.77	50.00	-52.77	
26.6983	6.96	1.06	60.00	-58.94	-5.52	50.00	-55.52	
29.2737	10.74	5.76	60.00	-54.24	-4.50	50.00	-54.50	

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7. Measurement Data (continued)
7.12. Conducted Emissions (continued)
7.12.2. 120 Volts, 60 Hz Neutral
Test No.: 470-13, 120 Volts, 60 Hz Neutral
FCC, Class B


Frequency (MHz)	Pk Amp (dB μ V)	QP Amp (dB μ V)	QP Limit (dB μ V)	QP Margin (dB)	Avg Amp (dB μ V)	Avg Limit (dB μ V)	Avg Margin (dB)	Comments
.1562	69.97	59.07	65.66	-6.59	34.76	55.66	-20.90	
.1933	67.82	53.88	63.89	-10.01	25.62	53.89	-28.27	
.2286	62.26	47.58	62.50	-14.92	20.03	52.50	-32.47	
.2377	60.64	49.18	62.18	-13.00	20.10	52.18	-32.08	
.2661	54.67	42.66	61.24	-18.58	22.83	51.24	-28.41	
.3124	49.92	37.77	59.91	-22.14	22.19	49.91	-27.72	
.4161	39.41	29.24	57.53	-28.29	11.19	47.53	-36.34	
.4896	35.52	22.91	56.17	-33.26	-0.03	46.17	-46.20	
.5256	35.44	26.41	56.00	-29.59	15.36	46.00	-30.64	
.6376	29.22	27.78	56.00	-28.22	18.75	46.00	-27.25	
.7436	30.75	29.82	56.00	-26.18	21.33	46.00	-24.67	
.7952	29.82	23.74	56.00	-32.26	10.65	46.00	-35.35	
.8487	29.55	27.91	56.00	-28.09	18.74	46.00	-27.26	
.9034	26.04	23.19	56.00	-32.81	10.11	46.00	-35.89	
.9550	32.37	31.25	56.00	-24.75	21.67	46.00	-24.33	
3.1845	51.04	47.91	56.00	-8.09	39.38	46.00	-6.62	
7.6483	25.75	22.36	60.00	-37.64	11.47	50.00	-38.53	
9.2402	28.99	25.60	60.00	-34.40	13.50	50.00	-36.50	
10.4057	25.19	21.04	60.00	-38.96	11.75	50.00	-38.25	
13.4914	29.25	24.72	60.00	-35.28	19.11	50.00	-30.89	
17.2061	27.78	24.56	60.00	-35.44	16.72	50.00	-33.28	
18.5876	27.72	23.87	60.00	-36.13	15.20	50.00	-34.80	
21.6658	27.10	19.94	60.00	-40.06	11.00	50.00	-39.00	

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7. Measurement Data (continued)

7.13. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1))

RSS-GEN 5.5, RSS 102

Requirement: (15.247(i))

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. Devices are subject to the radio frequency radiation exposure requirements specified in 47CFR 1.1307(b), FCC 47 CFR 2.1091 and 47 CFR 2.1093, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment.

Procedure: The power density is calculated from the maximum peak output power of the device under test using the following formula:

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

- **PD** = Power Density (mW/cm²)
- **OP** = DUT Output Power (dBm)
- **AG** = DUT Antenna Gain (dBi)
- **d** = MPE Distance (cm)

Conclusion: The device under test is meets radio frequency radiation exposure requirements specified in 47CFR 1.1307(b), § 2.1091 and § 2.1093.

Channel Frequency	MPE Distance (cm)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	Power Density		Limit (mW/cm ²)	Result
				(mW/cm ²)	(W/m ²)		
				(1)	(2)	(3)	(4)
2405	2.5	-12.28	1.0	0.000000005	0.000000048	1	Compliant
2440	2.5	-13.92	1.0	0.000000003	0.000000033	1	Compliant
2480	2.5	-13.10	1.0	0.000000004	0.000000040	1	Compliant

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. Power density is calculated from the maximum peak output power of the device under test.
5. Reference CFR 1.1310, Table 1: Limits for Maximum Permissible Exposure (MPE), Section (B): Limits for General Population/Uncontrolled Exposure.

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8. Test Setup Photographs

8.1. Radiated Emissions - Front:



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8. Test Setup Photographs

8.2. Radiated Emissions Rear - Below 30 MHz



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8. Test Setup Photographs

8.3. Radiated Emissions Rear – 30 MHz to 1 GHz



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8. Test Setup Photographs

8.4. Radiated Emissions Front - Above 1 GHz



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8. Test Setup Photographs

8.4. Radiated Emissions Rear - Above 1 GHz



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8. Test Setup Photographs

8.5. Conducted Emissions Front



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8. Test Setup Photographs

8.6. Conducted Emissions Rear





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9. 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), Industry Canada, and Voluntary Control Council Interference (VCCI) standards. A description of the test sites is on file with the FCC (registration number 96392), Industry Canada (file number IC 3023A-1), and VCCI (Member number 3168), Registration numbers C-3673, G-167, R-3305 & T-1809.

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 22, Chinese-Taipei (Taiwan) BSMI CNS 13438 and Korea (RRA) KN 22.

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.