COMPLIANCE WORLDWIDE INC.
TEST REPORT 562-15

In Accordance with the Requirements of

FCC PART 15.247, SUBPART C
INDUSTRY CANADA RSS-247, ISSUE 1

Low Power License-Exempt Radio Communication Devices
Intentional Radiators

Issued to

Philips Medical Systems
3000 Minuteman Drive
Andover, MA 01810
978-659-2800

for the

MX40-WL3
IntelliVue Patient Worn Monitor
(New Silex SDMAN WLAN module)

FCC ID: PQC-MX40SRR
IC: 3549B- MX40SRR

Report Issued on January 25, 2016

Tested by

Brian F. Breault

Reviewed by

Larry K. Stillings

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1. Scope

This test report certifies that the Philips MX40-WL3 IntelliVue Patient Worn Monitor with the new Silex SDMAN WLAN module, as tested, meets the FCC Part 15.247, and Industry Canada RSS-247, Issue 1 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: Philips Medical Systems

2.2. Model Number: MX40-WL3

2.3. Serial Number: US035Z2978

2.4. Description of EUT: Wireless ECG/SpO2 patient monitor

2.5. Power Source: 3.7 using a custom rechargeable battery pack.

2.6. Hardware Revs.: C.01.01, WLAN Radio Rev: B.00.00, WLAN Ant 1 Rev: A.00.00

2.7. Software Rev.: Appl SW: B.05.18, WLAN SW Rev: 3.4.158.30

2.8. EMC Modifications: None

3. Product Configuration

3.1. Operational Characteristics & Software

The MX40 transmits to a Philips IntelliVue MP2 monitor which, in turn, transmits to the Philips Clinical Network located outside the field of test. Patient information will be displayed on a IntelliVue Information Center also located outside the field of test.

3.2. Operating Instructions

The MX40 will be in normal monitoring mode transmitting patient data and waveforms to a frequency corresponding wireless access point where the patient data will be transferred through the IntelliVue Telemetry infrastructure and displayed on the IntelliVue Information Center display. Patient waveforms and data are also displayed on the MX40 display for local monitoring.

For Radiated Emissions testing, fan out the ECG leads and connect them to a termination plate. Extend the SpO2 transducer across the table opposite the ECG leads. The SpO2 transducer will be connected to an SpO2 simulator. Ensure the SpO2 function is set to continuous:

Select "**PATIENT WINDOW**" for the bed being monitored on the PIIC display. From the menu button choices across the bottom of the display, select "**Telemetry Setup**". A window will open and in the "**SpO2 Equipped Devices Only**" section, select the "**Enable SpO2**" checkbox. Below that checkbox, under "**SpO2 Mode**" click the dropdown menu and select "**Continuous**". Below that, ensure the "**Pleth**", "**Pulse**" and "**SpO2 Alarm**" boxes are also checked. For all other tests, the ECG leads will be connected to an ECG simulator.

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3. Product Configuration (continued)

3.2. Operating Instructions (continued)

For FCC/ETSI Intentional Radiator testing:

To turn on SRR communication with the MP2, power on the MP2 and let it boot up. On the MP2, press the "**Main Setup**" button. Scroll to then select "**Operating Modes**". When prompted for password, enter "**4630**". Press the "Main Setup" button again. Scroll down to then select "Hardware", then scroll down to and select "SRR radio" then select "**SRR Channel**". Now select the desired channel between Channel 11 (2405 MHz) and Channel 26 (2480 MHz).

3.3. EUT Hardware

Blk Diag #	Manufactr	Model/Part # / Options	Serial Number	Input Voltage	Frq (Hz)	Description/Function
1	Philips	MX40/865352 C01 C03 J46 M02 S02	US035Z2978	3.7 V	DC	2.4 GHz Patient Worn Device

3.4. EUT Hardware/software/Firmware Revision Level

	Description	Hardware	Software	Firmware
865352 WLAN	MX40 Patient Worn Monitor	C.01.01	Not Available	A.06.40

3.5. EUT Cables/Transducers

Blk Diag Ltr	Manufacturer	Model/Part #	Length (m)	Shield Y/N	Description/Function
A	Philips	989803171841	1.5	Y	Patient ECG/SpO2 lead set
B	Philips	M1191A	2.5	Y	SpO2 transducer

3.6. Support Equipment

Blk Diag #	Manufactr	Model/Part # Options	Serial Number	Input Voltage	Input Frq.	Description/Function
2	Cisco	AIR-AP-1242AG-E-K9	FGL1518U05W	12	VDC	802.11 a/b/g/n Access Point
3	Cisco	34-1977-05	DTH1213VF5E	100-240	50-60	Power supply for Access Point
4	Proxim	7560/8600.0228	756005-22913150	100-240	50-60	Access Point Controller
5	Cisco	WS-C2950G-24-E1	FOC073221WX	100-240	50-60	10/100 Base-T LAN switch
6	HP	Rp5700/453564213931/ SL008UC#ABA	2UA1050D6X	100-240	50-60	PC/IntelliVue Information Center
7	Acer	ET BV3RP-001	ETLE10D0119340 A023FB501	100-240	50-60	IntelliVue Information Center display
8	Bio-Tek	Lionheart	203836	9	VDC	ECG simulator
9	Ox-Sim	OX-1	OX6253	9	VDC	SpO2 simulator
10	Philips	M8023A/865122	N/A	100-240	50-60	External power supply for MP2 Monitor
11	Philips	M8102A	DE03710267	48	DC	Intellivue MP2 patient monitor

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3. Product Configuration (continued)

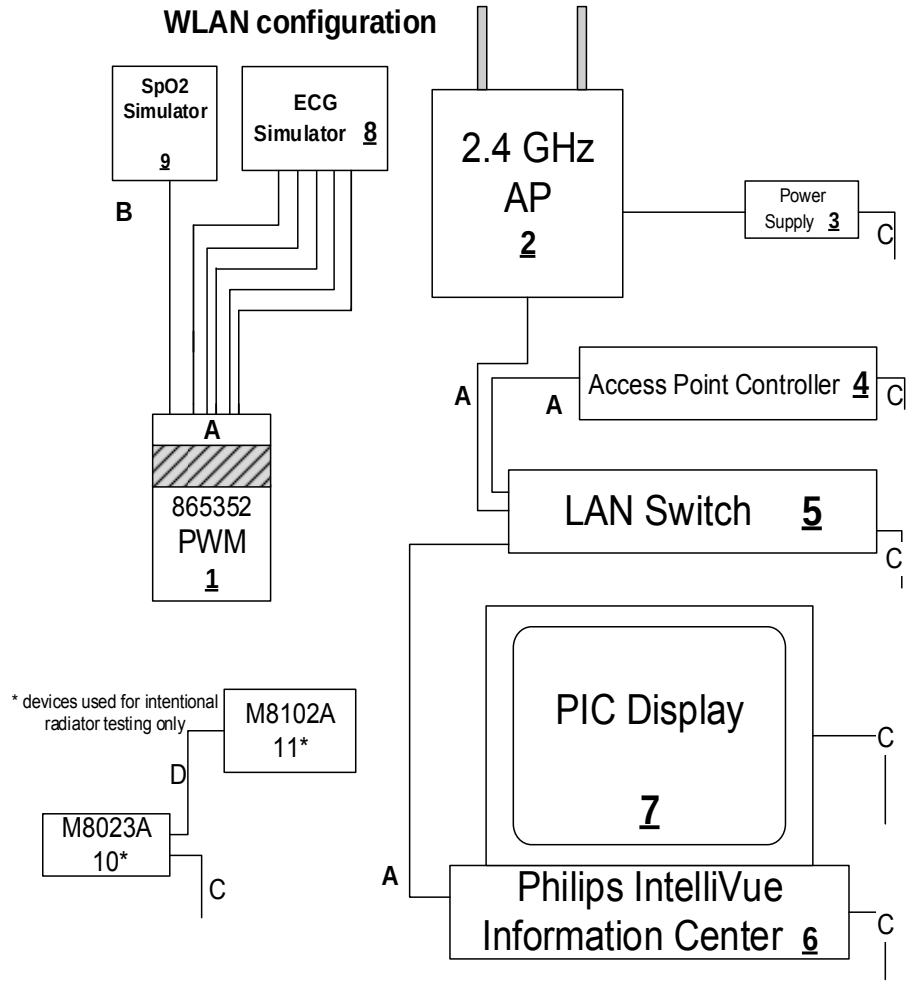
3.7. Support Equipment Cables/Transducers

Blk Diag Ltr	Manufactr	Model/Part #	Length (m)	Shield Y/N	Description/Function
C	N/A	NA	Various	N	Category 5 UTP LAN cable

3.8. Miscellaneous (e.g., consumables, test fixtures, etc.):

Blk Diag Ltr	Manufactr	Model/Part #	Qty	Description/Function
NA	Philips	453564128871	1	3.8 V rechargeable Lithium-ion battery

3.9. Block Diagram



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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 [1]	Rohde & Schwarz	ESR7	101156	7/23/2017	2 Years
Spectrum Analyzer 20 Hz – 40 GHz [2]	Rohde & Schwarz	FSV40	100899	7/23/2017	2 Years
Spectrum Analyzer, 9 kHz to 40 GHz [3]	Rohde & Schwarz	FSVR40	100909	7/23/2017	2 Years
EMI Receiver, 9 kHz to 6.5 GHz	Hewlett Packard	8546A	3650A00360	6/4/2016	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	5/15/2016	3 Years
Horn Antenna, 960 MHz – 18 GHz	Electro-Metrics	RGA-50 / 60	2813	7/15/2016	2 Years
Horn Antenna, 18 GHz – 40 GHz	Com-Power	AH-840	3075	9/24/2016	2 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A01323	7/21/2017	2 Years
LISN 50 Ω 50 µH, 9 kHz to 30 MHz	EMCO	3825/2	9109-1860	7/23/2016	1 Year
Digital Barometer	Control Company	4195	ID236	10/8/2017	2 Years
Temperature Chamber	Associated Research	E-0029	N/A	N/A	---

[1] ESR7 Firmware revision: V2.26, Date installed: 8/15/2014 Previous V2.17, installed 6/11/2014.
[2] FSV40 Firmware revision: V2.30 SP1 Date installed: 10/22/2014 Previous V2.30, installed 7/23/2014.
[3] 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:	Dec. 2rd 2015 – Dec 24th, 2015
Test Engineer:	Brian Breault
Normal Site Temperature (15 - 35°C):	21.6
Relative Humidity (20 -75%RH):	35
Frequency Range:	30 kHz to 26 GHz
Measurement Distance:	3 Meters
EMI Receiver IF/Resolution Bandwidth:	100 kHz - 30 MHz to 1 GHz
	1 MHz - Above 1 GHz
EMI Receiver Average/Video Bandwidth:	300 kHz - 30 MHz to 1 GHz
	3 MHz - Above 1 GHz
Detector Functions:	Peak, Quasi-Peak & Average

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4. Measurements Parameters

4.3. Measurement Procedure

Testing was performed in accordance with the requirements detailed in ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices. In addition, FCC OET 558074, D01: DTS Measurement Guidance v03r03 was referenced for the testing detailed in this report.

Test measurements were made in accordance with FCC Part 15.247, ANSI C63.10-2013 and IC RSS-247 Annex A: 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 C63.10-2013, American National Standard for Testing Unlicensed Wireless

The device under test is capable of utilizing 16 channels. In accordance with ANSI C63.10, section 5.6, three channel frequencies were selected for measurement:

Channel 11	2405 MHz (Low)
Channel 18	2440 MHz (Middle)
Channel 26	2480 MHz (High)

During the measurement testing, the MX40 was mounted on a polystyrene form to facilitate rotating the device through three orthogonal axes as required by ANSI C63.10-2013, section 5.10.1, for a hand held or body worn device. The three axes were defined as follows:

X-Axis	Horizontal with the top of the MX40 facing to the left. The front of MX40 was facing the antenna at 0º turntable azimuth.
Y-Axis	Vertical with the top of MX40 facing up. The front of the MX40 was facing the antenna at 0º turntable azimuth.
Z-Axis	The front of the MX40 was facing up. The bottom of the MX40 was facing the antenna at 0º turntable azimuth.

X-Axis

Y-Axis

Z-Axis

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4. Measurements Parameters

4.4. Measurement Uncertainty

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

RF Frequency	$\pm$ 1x10^{-8}
Radiated Emission of Transmitter	$\pm$ 4.55 dB
Radiated Emission of Receiver	$\pm$ 4.55 dB
Temperature	$\pm$ 0.91^{o} C
Humidity	$\pm$ 5%

5. Choice of Equipment for Test Suits

5.1 Choice of Model

This test report is based on the test sample supplied by the manufacturer and is 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 Philips MX40 IntelliVue Patient Worn Monitor, as tested, utilizes 16 channels. Refer to Section 4.3, paragraph four for the selected test frequencies.

5.4 Modes of Operation

The Philips MX40 IntelliVue Patient Worn Monitor has a single mode of operation which is determined by the system software.

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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-247 5.2 (1)	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-247 5.4 (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 8.9	7.6	Compliant
Unwanted Emissions in Non-Restricted Bands	15.247 (d)	RSS-247 5.5	7.7	Compliant
Harmonic Emissions in the Restricted Bands of Operation	15.247 (d)	N/A	7.8	Compliant
Lower and Upper Band Edge	15.247 (d)	RSS-247 5.5	7.9	Compliant
Peak Power Spectral Density	15.247(e)	RSS-247 5.2 (2)	7.10	Compliant
Conducted Emissions	15.207	RSS-GEN	NR	Battery Operated Device
Public Exposure to Radio Frequency Energy Levels	15.247(i) 1.1307 (b) (1)	RSS-GEN 5.5 RSS-102	7.11	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.

Status: The MX40 utilizes internal, inaccessible antennas. The housing of the device under test is completely sealed.

7.2. Minimum 6 dB Bandwidth (15.247 (a) (2), RSS-247 5.2(1))

Requirement: 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.

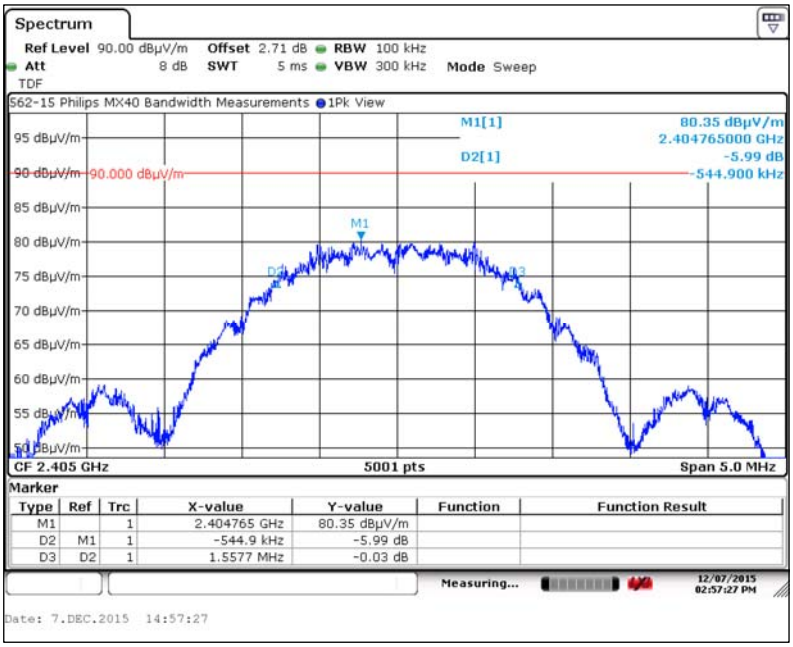
Procedure: Performed in accordance with FCC OET 558074 D01 DTS Measurement Guidance, v03r03, June 9, 2015, §8.0: DTS bandwidth.

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

Measurement Results - Minimum 6 dB Bandwidth

Channel	Frequency (MHz)	-6 dB Bandwidth (kHz)	Min. -6 dB Bandwidth (kHz)	Result
Low	2405	1557.7	>500	Compliant
Middle	2440	1554.7	>500	Compliant
High	2480	1575.7	>500	Compliant

7.2.1. -6 dB Bandwidth, Low Channel 11



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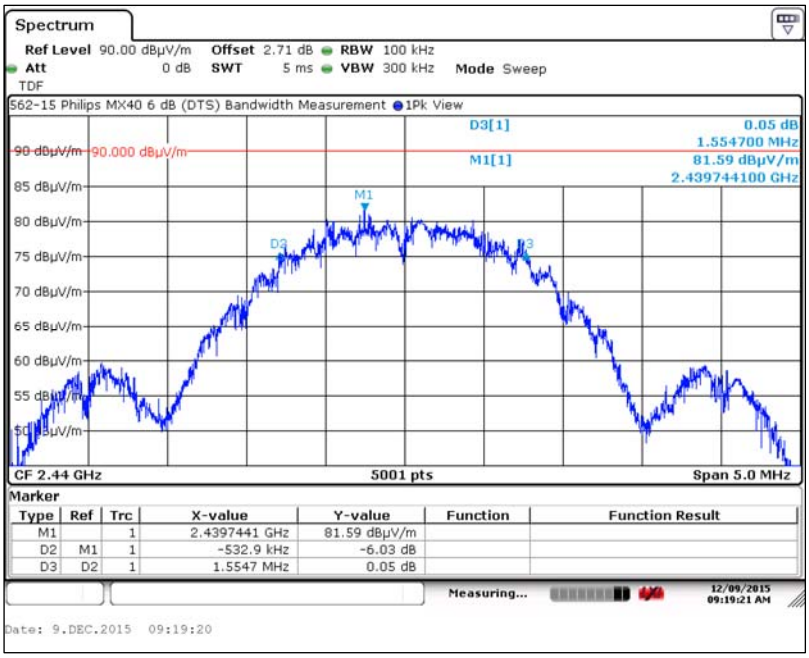
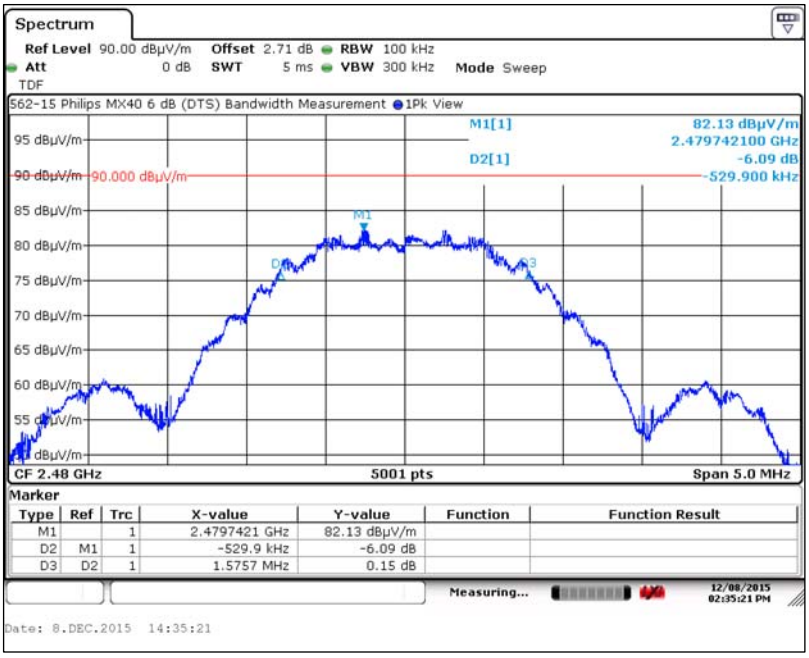
7. Measurement Data

7.2. Minimum 6 dB Bandwidth (15.247 (a) (2), RSS-247 5.2 (1)) (continued)

7.2.2. -6 dB Bandwidth, Middle Channel 18



7.2.3. -6 dB Bandwidth, High Channel 26



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7. Measurement Data (continued)

7.3. Bandwidth of Momentary Signals

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.

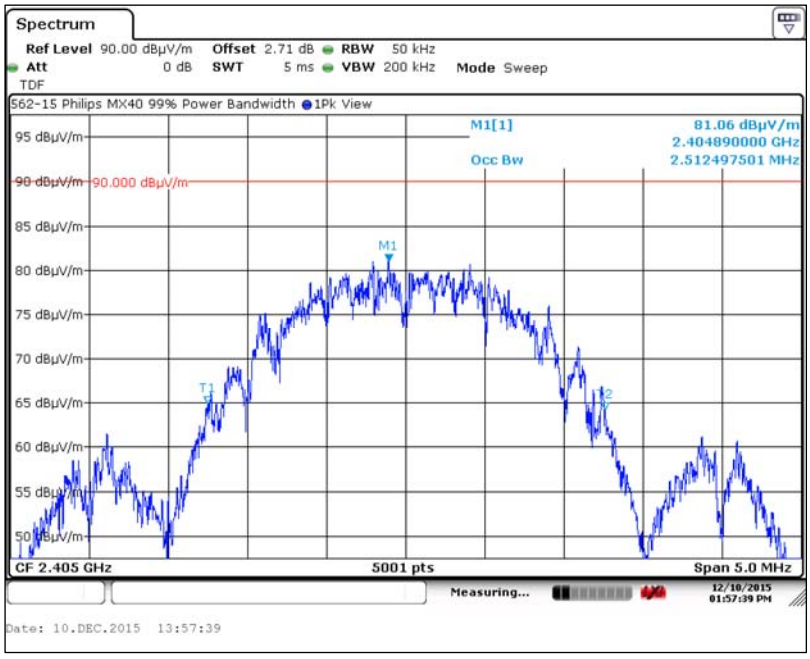
Procedure: This test was performed utilizing the automated 99% bandwidth function of the spectrum analyzer.

Conclusion: Compliant, for informational purposes.

Measurement Results - 99% Bandwidth

Channel	Channel Frequency (MHz)	99% Power Bandwidth (MHz)
Low	2405	2.5125
Middle	2440	2.5425
High	2480	2.4945

7.3.1. 99% Bandwidth, Low Channel 11



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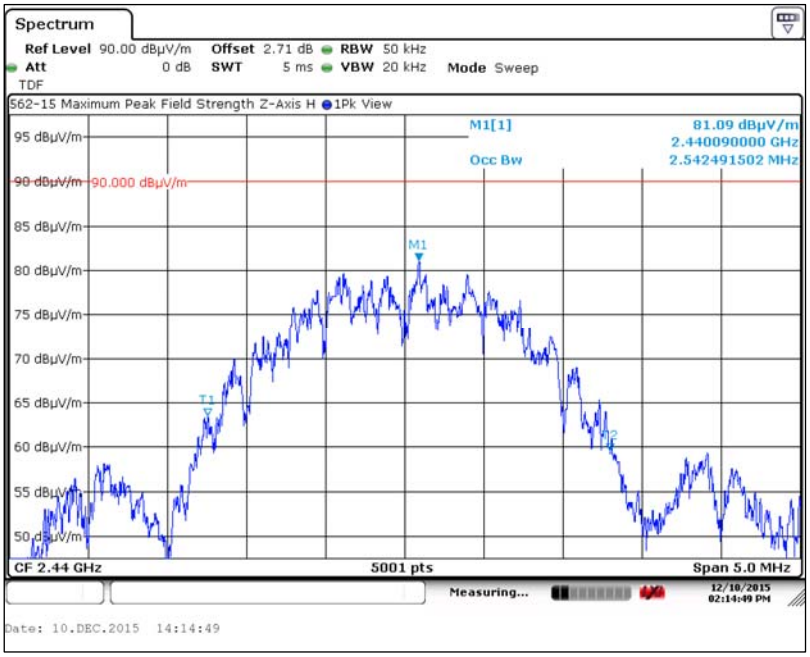
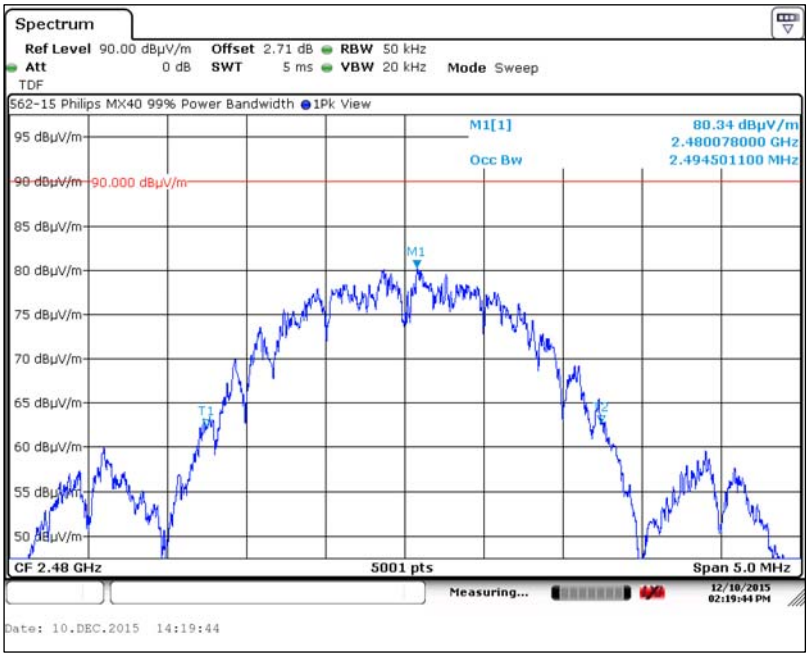
7. Measurement Data (continued)

7.3. Bandwidth of Momentary Signals

7.3.2. 99% Bandwidth, Middle Channel 18



7.3.3. 99% Bandwidth, High Channel 26



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7. Measurement Data (continued)

7.4. Maximum Peak Conducted Output Power (15.247 (b) (1), RSS-247 5.4 (4))

Requirement: 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: FCC OET 558074 D01, DTS Measurement Guidance v03r03, Section 9.9.1: Maximum peak conducted output power, RBW ≥ DTS bandwidth, was referenced for the maximum peak conducted output power measurements detailed in this section of this report.

Test Notes: The device under test does not have an accessible antenna port and therefore does not facilitate conducted power measurements. Radiated field strength measurements were made and converted to units of power using the following formula[1]:

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.7$$

EIRP = the equivalent isotropically radiated power in dBm.
E_{Meas} = the measured maximum field strength in dBµV/m.
d_{Meas} = the field strength measurement distance, in meters.

[1] Reference ANSI C63.10-2013, Section 9.5.: Equations to calculate EIRP

EIRP Measurement Results

Frequency	Peak Field Strength (E_{Meas})	Distance (d_{Meas})	Equivalent Isotropic Radiated Power (EIRP)		Output Power Limit	Result
(MHz)	(dBµV/m)	(Meters)	(dBm)	(mW)	(mW)	
2405	88.28	3.0	-6.88	0.205	1000.0	Compliant
2440	89.37	3.0	-5.79	0.264	1000.0	Compliant
2480	89.10	3.0	-6.06	0.248	1000.0	Compliant

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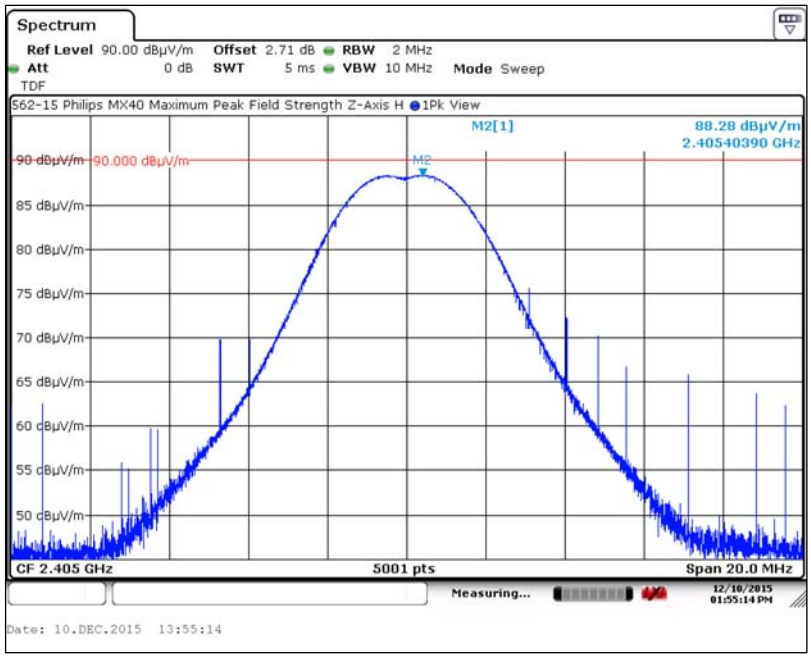
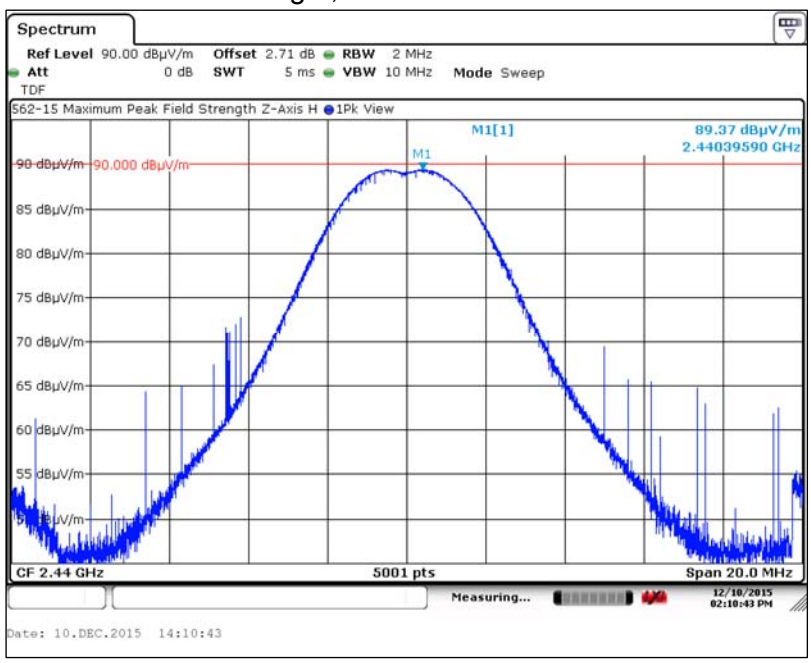
7. Measurement Data (continued)

7.4. Maximum Peak Conducted Output Power (15.247 (b) (3), RSS-247 5.4 (4)) (cont.)

7.4.1. Maximum Peak Field Strength, Low Channel 11



7.4.2. Maximum Peak Field Strength, Middle Channel 18



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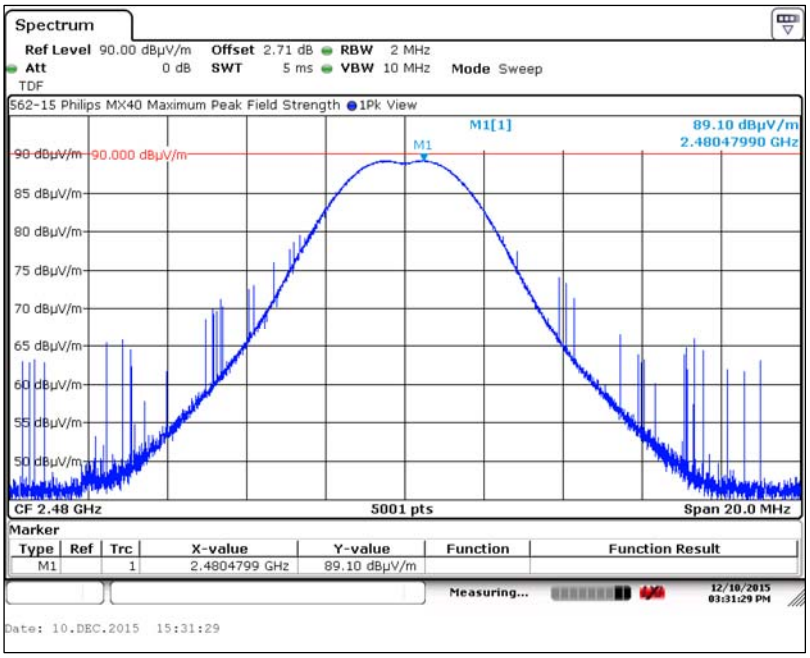
7. Measurement Data (continued)

7.4. Maximum Peak Conducted Output Power (15.247 (b) (3), RSS-247 5.4 (4)) (cont.)

7.4.3. Maximum Peak Field Strength, 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 antennas used with the DUT have a gain of approximately 3.2 dBi. Therefore Part 15.247, section (b)(4)) does not apply.

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7. Measurement Data (continued)

7.6. Transmitter Spurious Radiated Emissions (30 kHz to 10 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 (dBµV/m)
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

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Procedure: This test was performed in accordance with the procedure detailed in ANSI C63.10:2013, section 6.3: Radiated emissions testing—general requirements and FCC 47 CFR Part 15.209: Radiated Emission Limits; General Requirements.

Test measurements were made in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

Test Note: The measurements were performed with the device in three orthogonal positions in accordance with ANSI C63.10-2013, sections 5.10.1. Reference section 4.3 of this report for additional information.

Conclusion: The Emissions from the DUT did not exceed the FCC Part 15,209 field strength levels specified in the above table. Reference Appendix A for the transmitter spurious emission data.

Worst Case Measurements

Range	Frequency	Peak Field Strength	FCC 15.209 Limit	Margin	Result	Appendix A Reference
(MHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)		
0.03 to 0.15	0.03007	94.90	118.027	-23.13	Compliant	1.1
0.15 to 30.0	1.16150	54.36	66.325	-11.96	Compliant	2.6
30 to 1000	30.21100	32.63	40.000	-7.37	Compliant	3.1
1000 to 2400	2397.55000	47.38	54.000	-6.62	Compliant	4.4
2483.5 to 10000	9731.70000	46.16	54.000	-7.84	Compliant	5.5
10000 to 18000	17949.60000	46.09	54.000	-7.91	Compliant	6.3
18000 to 25000	24938.80000	47.92	54.000	-6.08	Compliant	7.2

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7. Measurement Data (continued)

7.7. Emissions in Non-Restricted Frequency Bands (15.247(d), RSS-247 5.4 (5))

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: The procedure detailed in publication 558074 D01 - DTS Measurement Guidance v03r03, June 9, 2015, Section 11: *Emissions in non-restricted frequency bands* was used to perform the following measurements.

Test Notes: Reference Section 7.2, Screen Capture 7.2.3 for the in-band reference used to set the -20 dB limit for the measurements taken in this section. The Channel 26 100 kHz measurement level of 82.13 dBµV/m was used as the reference for the out of band measurements.

Reference Appendix B for the emissions in non-restricted frequency bands screen captures.

Worst Case Measurements

Range	Frequency	Peak Field Strength	W/C In-Band -20 dB	Margin	Result	Appendix B Reference
(MHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)		
30 to 1000	30.11	34.08	62.130	-28.05	Compliant	1.3
1000 to 2400	2398.25	40.77	62.130	-21.36	Compliant	2.2
2483.5 to 10000	9575.40	45.94	62.130	-16.19	Compliant	3.2
10000 to 18000	17847.20	56.04	62.130	-6.09	Compliant	4.6
18000 to 25000	24707.90	54.88	62.130	-7.25	Compliant	5.5

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7. Measurement Data (continued)

7.8. Harmonic Emissions in the Restricted Bands of Operation (15.247 (d))

Measurement Results – Worst Case Harmonic Emissions

Freq. (MHz)	Field Strength (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)		Antenna Polarity (H/V)	Result
	Peak	Average	Peak	Average	Peak	Average		
4810.000	48.56	34.05	74.00	54.00	-25.44	-19.95	H	Compliant
4880.000	52.54	37.25	74.00	54.00	-21.46	-16.75	H	Compliant
4960.000	51.88	35.61	74.00	54.00	-22.12	-18.39	V	Compliant
7320.000	53.48	39.22	74.00	54.00	-20.52	-14.78	H	Compliant
7440.000	53.30	39.50	74.00	54.00	-20.70	-14.50	V	Compliant
12025.000	59.00	45.58	74.00	54.00	-15.00	-8.42	H	Compliant
12200.000	58.51	45.43	74.00	54.00	-15.49	-8.57	V	Compliant
12400.000	60.66	46.74	74.00	54.00	-13.34	-7.26	V	Compliant
19240.000	61.46	48.18	74.00	54.00	-12.54	-5.82	H	Compliant
19520.000	62.80	48.30	74.00	54.00	-11.20	-5.70	H	Compliant
19840.000	60.59	47.26	74.00	54.00	-13.41	-6.74	H	Compliant
22320.000	63.92	49.95	74.00	54.00	-10.08	-4.05	H	Compliant

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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).

Procedures: Lower Band Edge - ANSI C63.10:2013, section 6.10.4: Authorized-band band-edge measurements (-20 dB delta relative method).

Upper Band Edge – ANSI C63.10:2013, section 6.10.5: Restricted-band band-edge measurements.

Conclusion: The DUT meets the band edge requirements

Measurement Results

Lower Band Edge

Lowest Channel (MHz)	In-Band Peak Measurement (dBµV/m)		Band Edge Frequency (MHz)	Band Edge Measurement (dBµV/m)		Required Offset (dB)	Actual Offset (dB)	Result
	Peak	Average		Peak	Average			
2405	80.94	---	2400	39.88	---	>20	41.06	Compliant

Upper Band Edge

Highest Channel Frequency (MHz)	Field Strength (dBµV/m)		Band Edge Frequency (MHz)	Field Strength (dBµV/m)		FCC Part 15.209 Limit (dBµV/m)		Margin (dB)		Result
	Peak	Avg		Peak	Avg	Peak	Avg	Peak	Avg	
2480	88.78	58.42	2483.500	66.96	34.42	74.00	54.00	-7.04	-19.58	Compliant

Lower Restricted Band

Frequency (MHz)	Field Strength (dBµV/m)		FCC Part 15.209 Limit (dBµV/m)		Margin (dB)		Result
	Peak	Average	Peak	Average	Peak	Average	
2388.7440	47.63	---	74.00	54.00	-26.37	Note 1	Compliant

Note 1: The peak field strength meets the average limit.

Upper Restricted Band

Frequency (MHz)	Field Strength (dBµV/m)		FCC Part 15.209 Limit (dBµV/m)		Margin (dB)		Result
	Peak	Average	Peak	Average	Peak	Average	
2483.5095	67.26	34.16	74.00	54.00	-6.74	-19.84	Compliant

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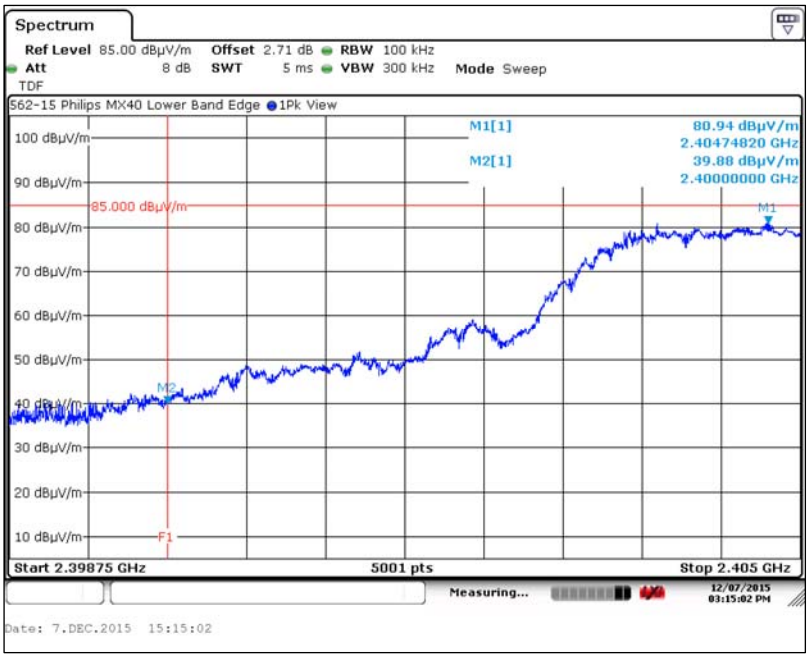
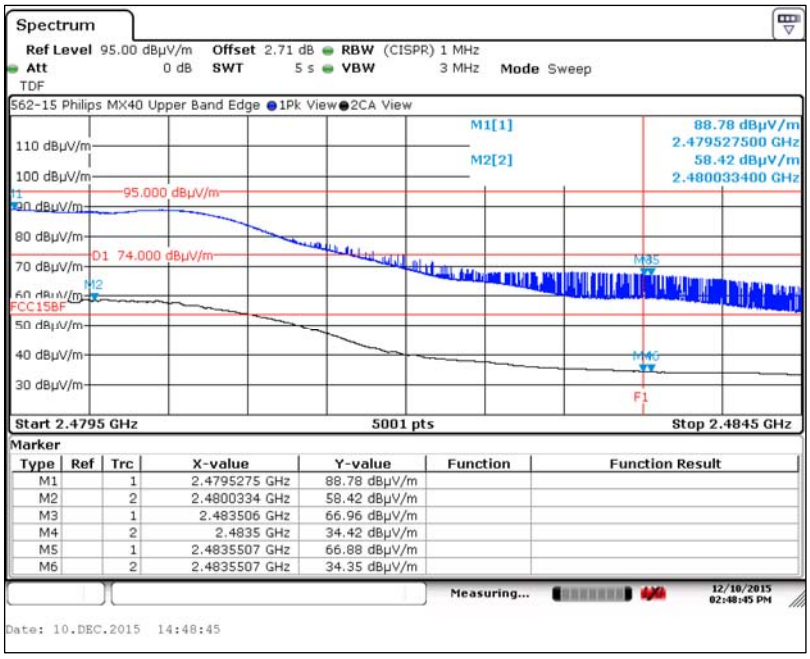
7. Measurement Data (continued)

7.9. Band Edge Measurements (15.247 d))

7.9.1. Lower Band Edge



7.9.2. Upper Band Edge



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4795275 GHz	88.78 dBµV/m		
M2		2	2.4800334 GHz	58.42 dBµV/m		
M3		1	2.483506 GHz	66.96 dBµV/m		
M4		2	2.4835 GHz	34.42 dBµV/m		
M5		1	2.4835507 GHz	66.88 dBµV/m		
M6		2	2.4835507 GHz	34.35 dBµV/m		

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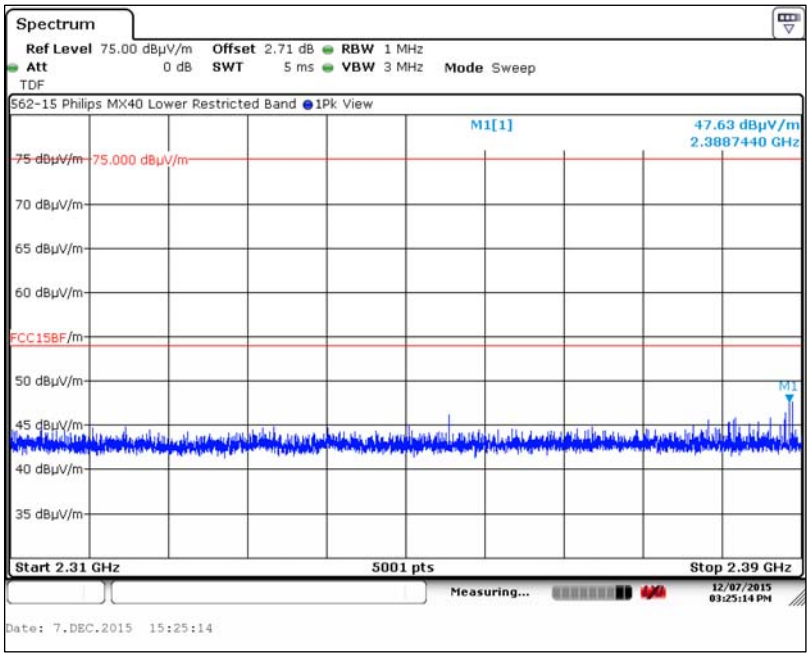
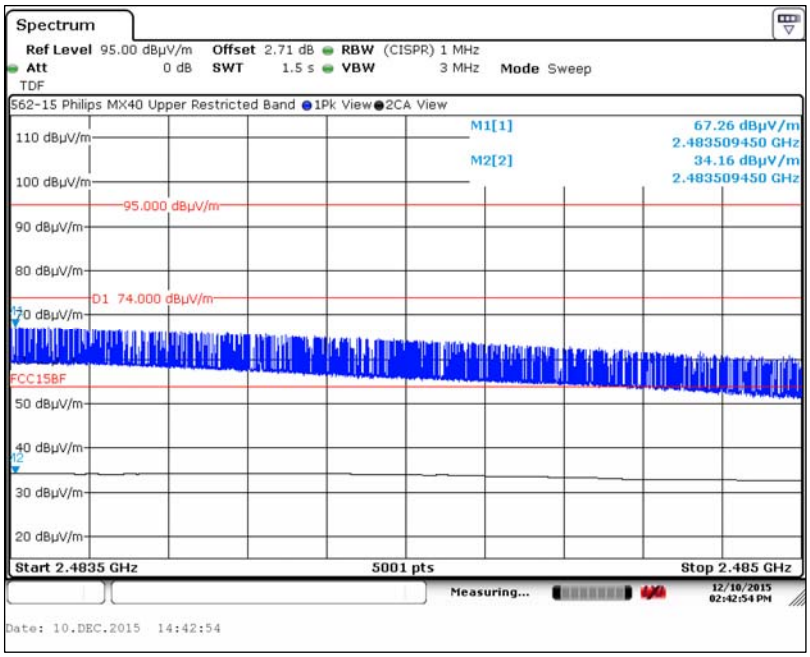
7. Measurement Data (continued)

7.9. Band Edge Measurements (15.247 d))

7.9.3. Lower Restricted Band



7.9.4. Upper Restricted Band



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7. Measurement Data (continued)

7.10. Peak Power Spectral Density (15.247(e), RSS-247 5.2 (2))

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: This measurement was performed in accordance with FCC OET 558074 D01 DTS Measurement Guidance, v03r03, dated June 9, 2015, section 10.2: Method PKPSD (peak PSD).

Test Notes: The data presented in this test report represents the worst case receive antenna polarity and elevation and turntable position.

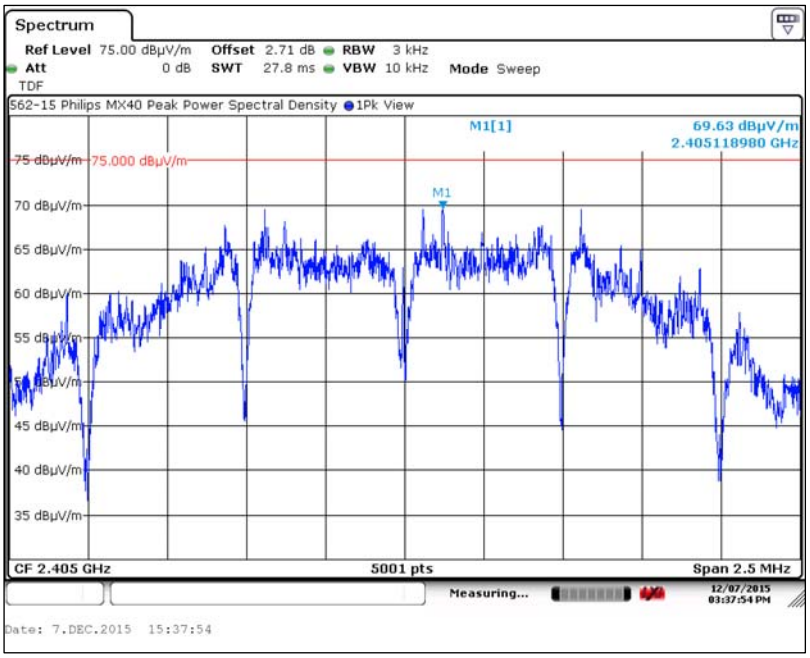
The method used to convert the field strength to power is detailed in the test notes in section 7.4 of this test report.

Conclusion: The DUT meets the Part 15.247(e) power spectral density requirement.

Measurement Results – Power Spectral Density

Channel Frequency	Measured Frequency	Peak Power Spectral Density	Distance	Peak Power Spectral Density		Output Power Limit	Result
(MHz)	(MHz)	(dBµV/m)	(Meters)	(dBm)	(mW)	(dBm)	
2405	2405.1189	69.63	3.0	-25.53	0.003	8.0	Compliant
2440	2440.4274	71.69	3.0	-23.47	0.005	8.0	Compliant
2480	2479.5581	71.14	3.0	-24.02	0.004	8.0	Compliant

7.10.1. Peak Power Spectral Density, Low Channel 0



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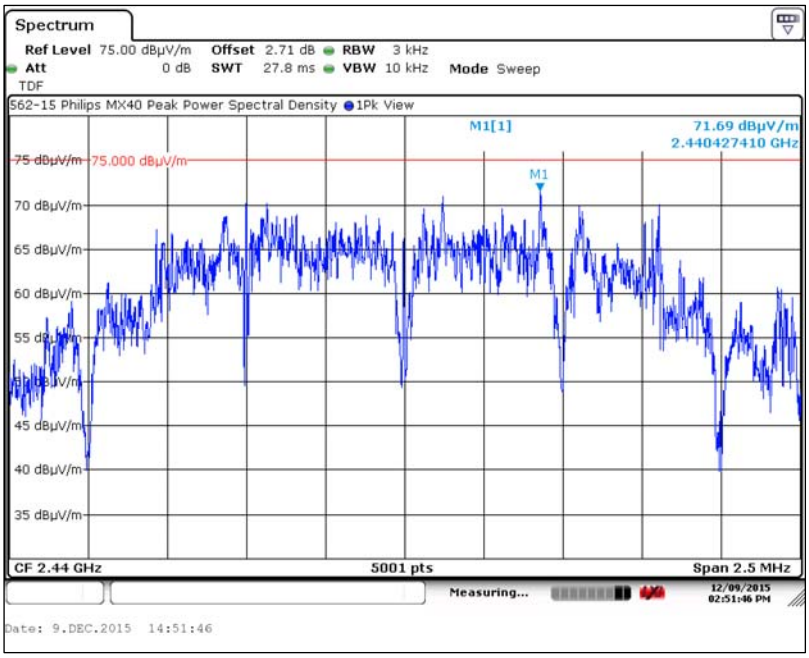
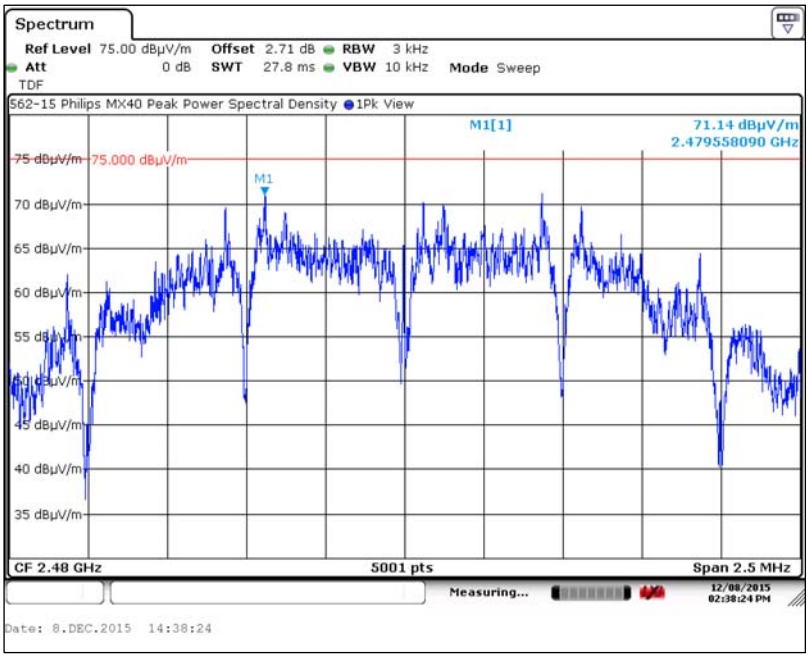
7. Measurement Data (continued)

7.10. Peak Power Spectral Density (15.247(e), RSS-247 5.2 (2)) (continued)

7.10.2. Peak Power Spectral Density, Middle Channel 24



7.10.2. Peak Power Spectral Density, High Channel 47



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7. Measurement Data (continued)

7.11. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1)) RSS-GEN, ISSUE 4 5.5, RSS 102)

7.11.1. 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:

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

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.

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

Input:	P_{MAX}[1]	(mW)	0.21	0.26	0.25
	d_{MIN}	(mm)	5.00	5.00	5.00
	$f_{(GHz)}$		2.405	2.440	2.480
Test Exclusion:			**0.37**	**0.09**	**0.17**
Limit Exemption:			**3.00**	**3.00**	**3.00**

[1] Taken from column 5 of the table in Section 7.4 of this test report.

7.11.2. 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
2405	≤5	0.21	4.25	Compliant
2440	≤5	0.26	4.05	Compliant
2480	≤5	0.25	3.94	Compliant

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8. Test Setup Images

8.1. Radiated Emissions – Front View

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8. Test Setup Images

8.2. Radiated Emissions – Rear View Below 30 MHz

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8. Test Setup Images

8.3. Radiated Emissions – Rear View 30 MHz to 1 GHz

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8. Test Setup Images

8.4. Microwave Emissions – Front View

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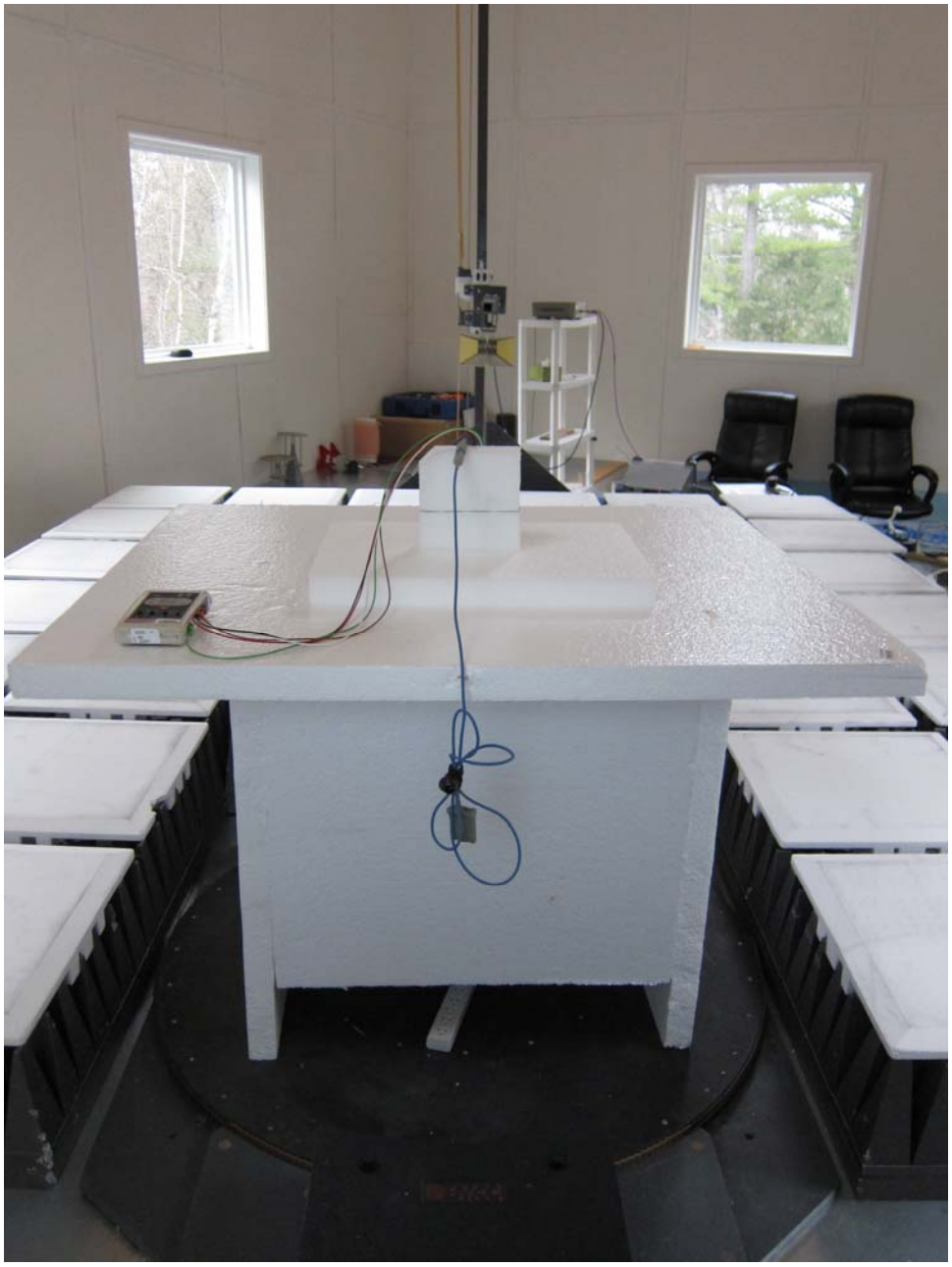
8. Test Setup Images

8.5. Microwave Emissions – Rear View 1GHz to 18 GHz



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8. Test Setup Images

8.6. Microwave Emissions – Rear View Above 18 GHz

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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 US1091), 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.

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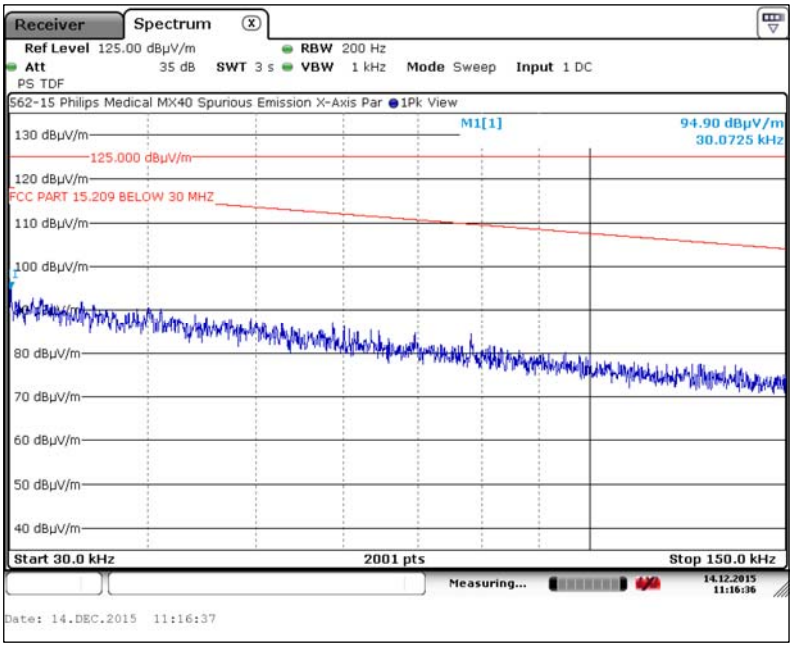
Appendix A

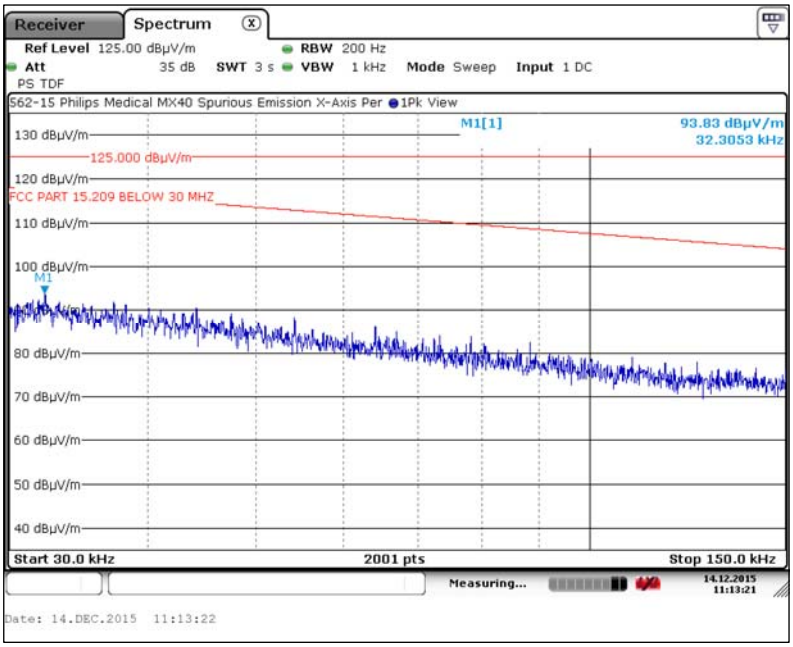
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

1. Measurement Results – 30 kHz to 150 kHz

1.1. X-Axis, Parallel Antenna



1.2. X-Axis, Perpendicular Antenna



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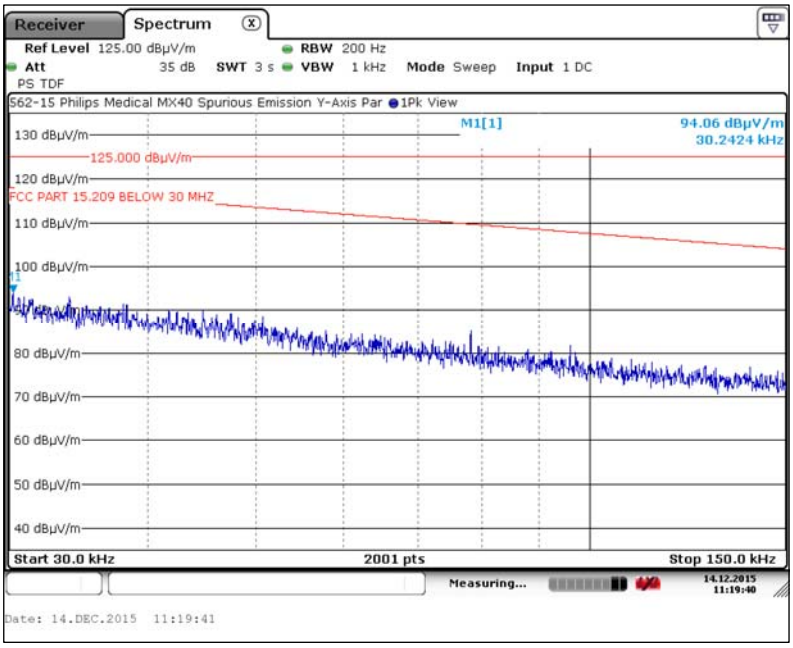
Appendix A (continued)

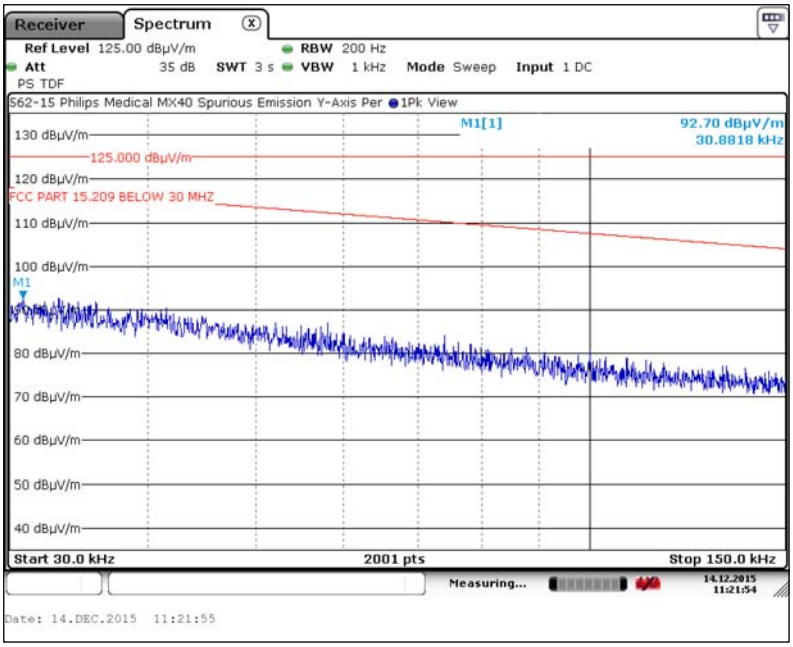
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

1. Measurement Results – 30 kHz to 150 kHz (continued)

1.3. Y-Axis, Parallel Antenna



1.4. Y-Axis, Perpendicular Antenna



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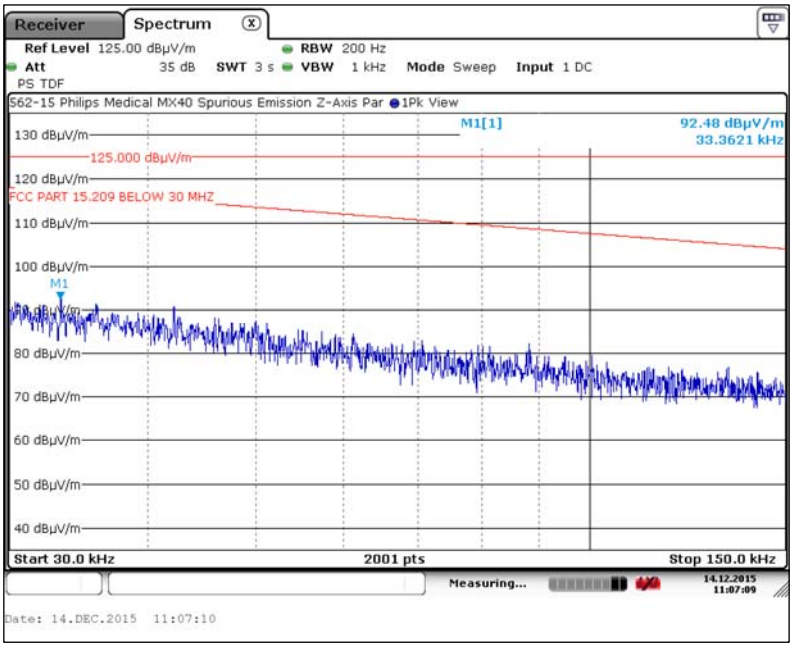
Appendix A (continued)

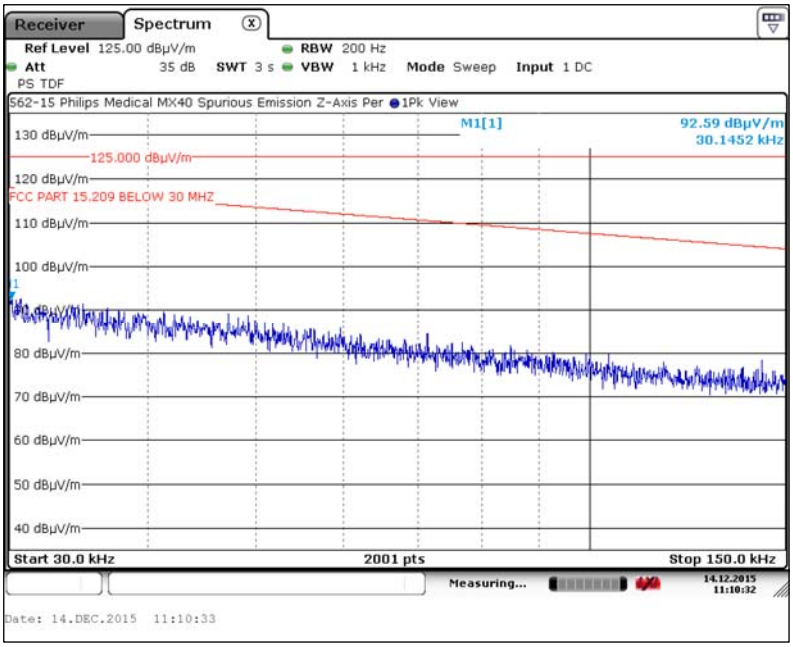
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

1. Measurement Results – 30 kHz to 150 kHz (continued)

1.5. Z-Axis, Parallel Antenna



1.6. Z-Axis, Perpendicular Antenna



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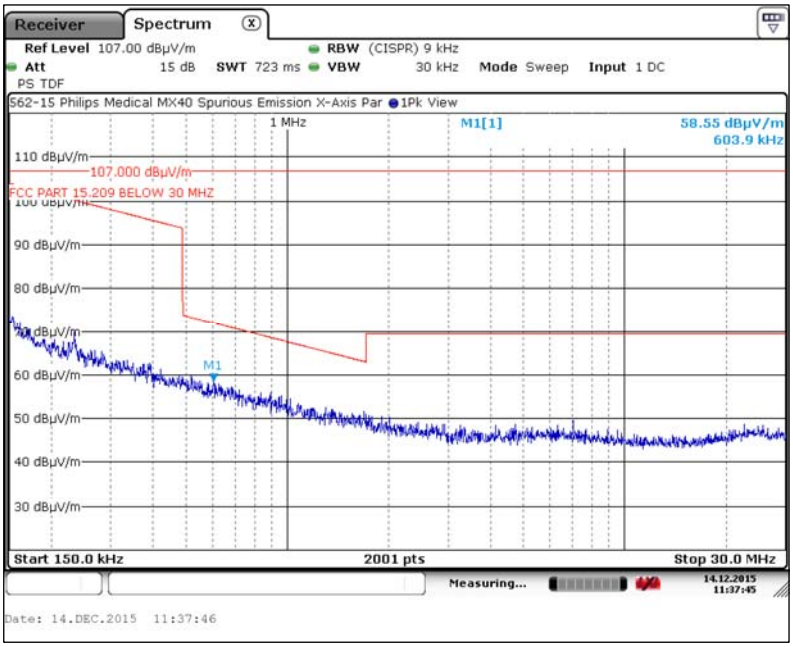
Appendix A (continued)

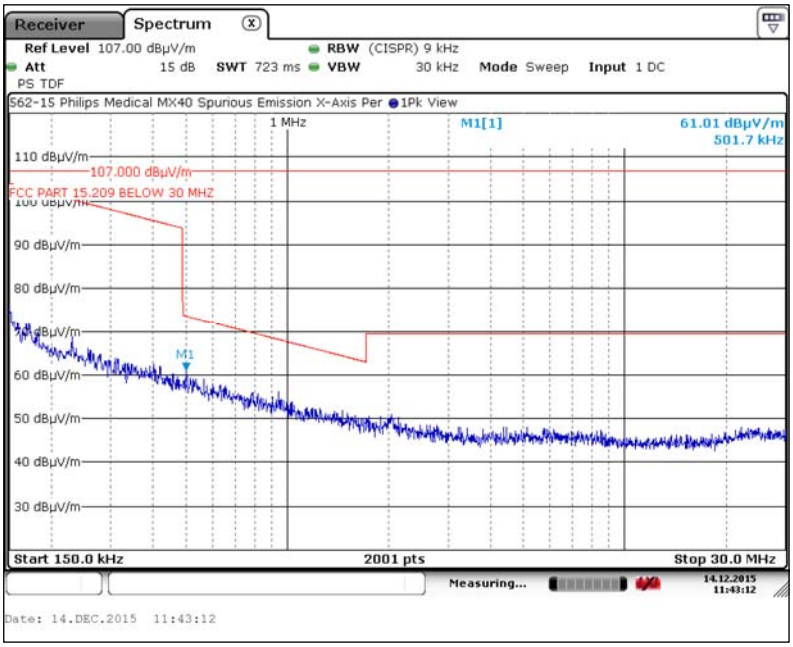
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

2. Measurement Results – 150 kHz to 30 MHz

2.1. X-Axis, Parallel Antenna



2.2. X-Axis, Perpendicular Antenna



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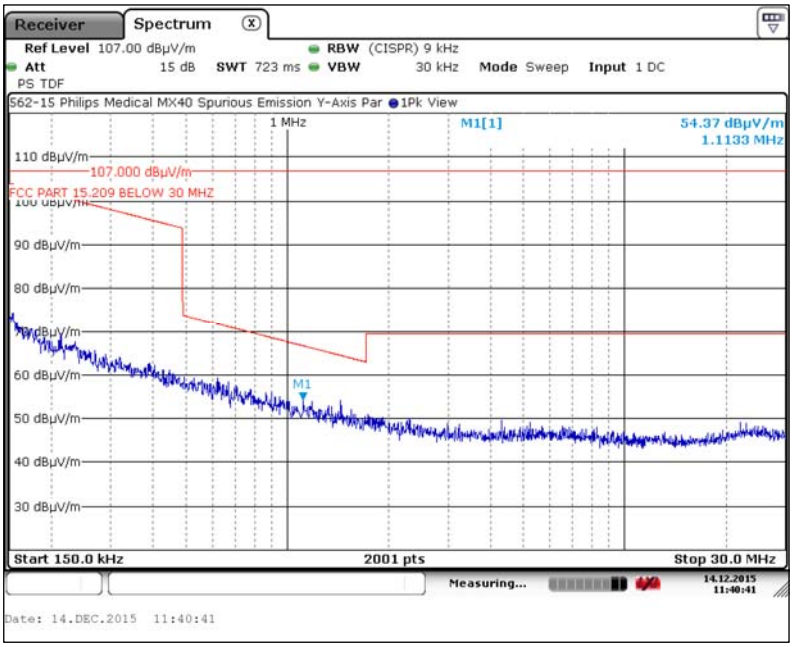
Appendix A (continued)

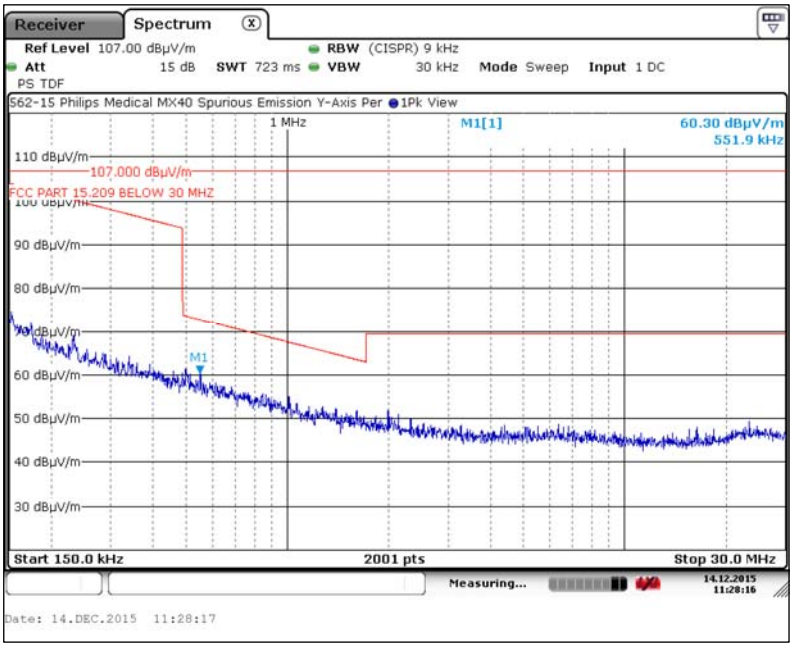
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

2. Measurement Results – 150 kHz to 30 MHz (continued)

2.3. Y-Axis, Parallel Antenna



2.4 Y-Axis, Perpendicular Antenna



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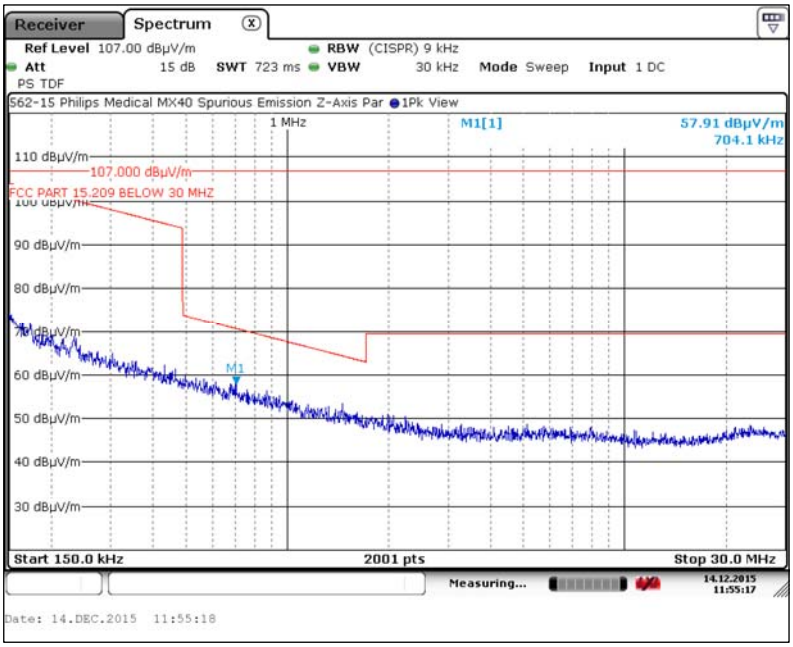
Appendix A (continued)

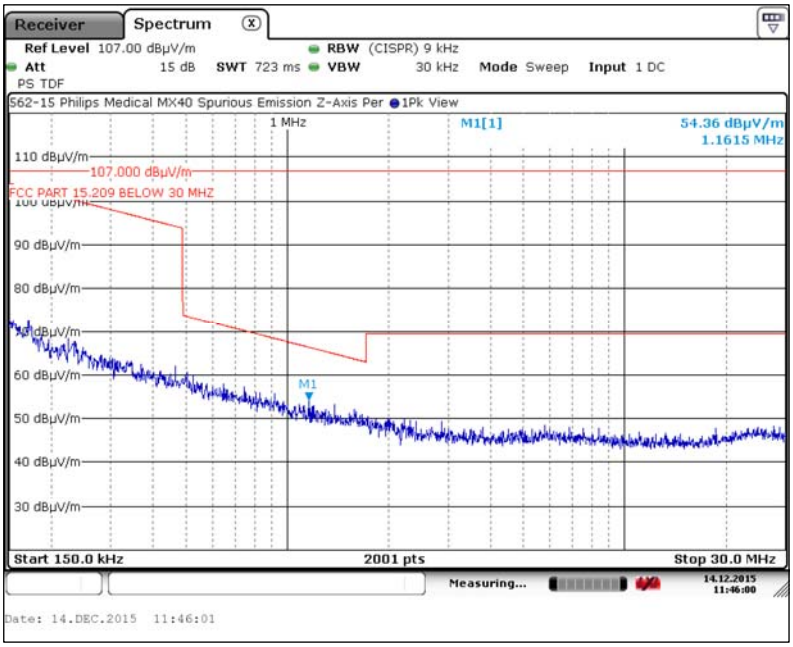
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

2. Measurement Results – 150 kHz to 30 MHz (continued)

2.5. Z-Axis, Parallel Antenna



2.6. Z-Axis, Perpendicular Antenna



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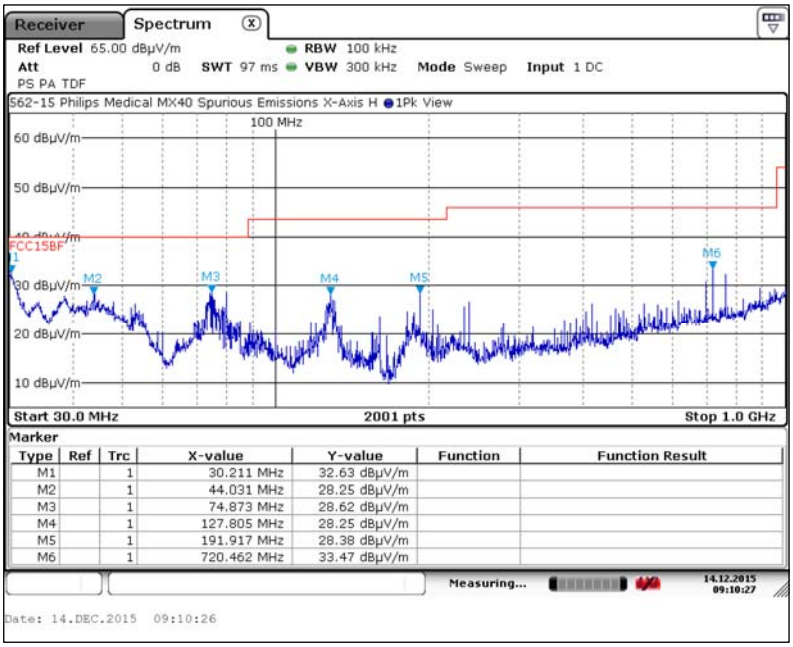
Appendix A (continued)

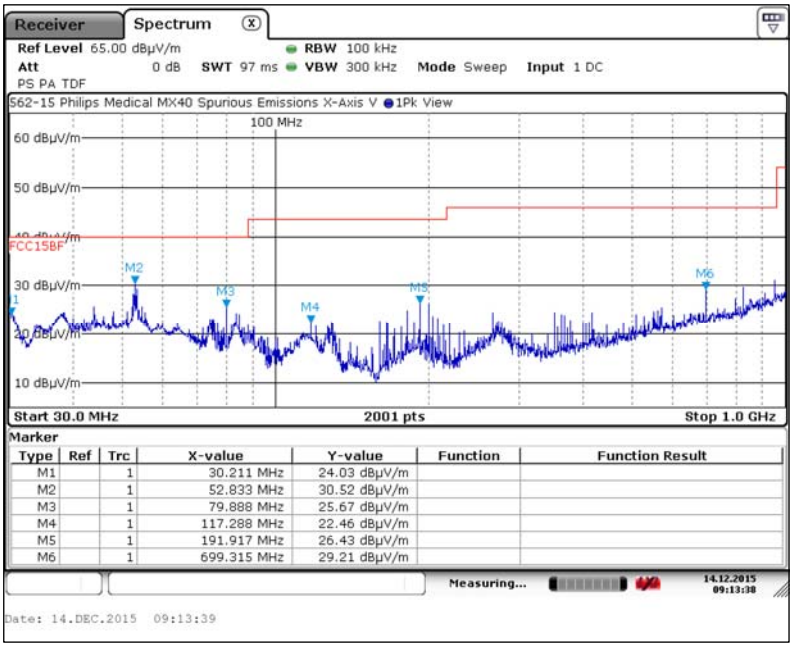
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

3. Measurement Results – 30 MHz to 1 GHz

3.1. X-Axis, Horizontal Antenna



3.2. X-Axis, Vertical Antenna



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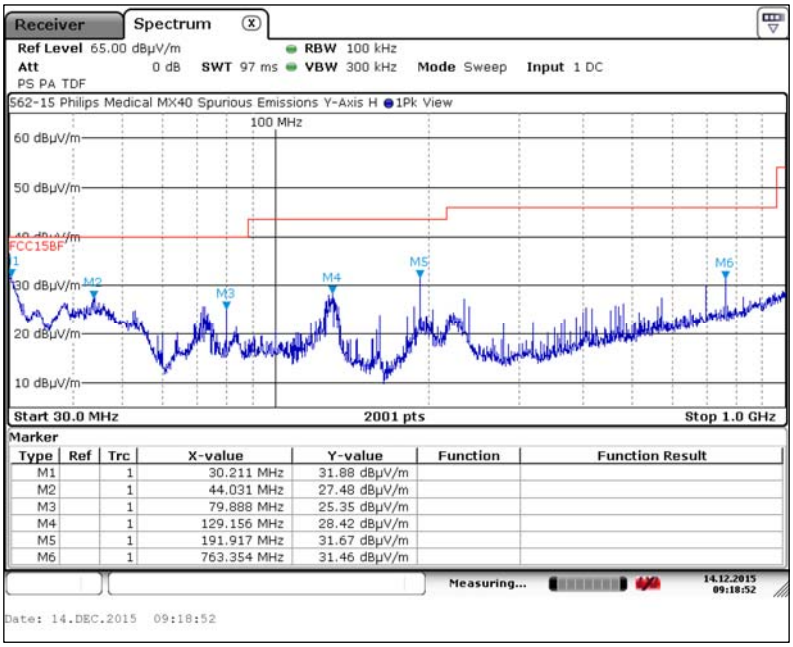
Appendix A (continued)

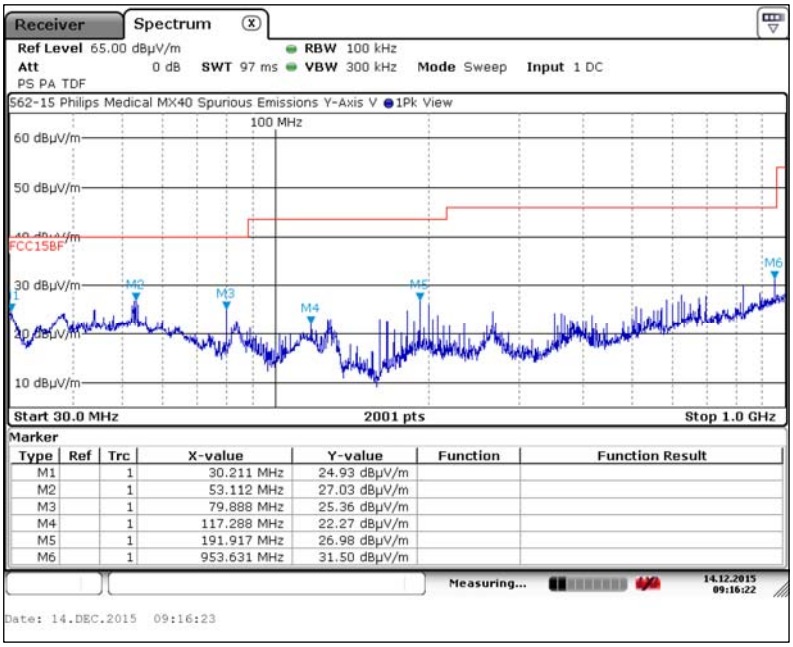
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

3. Measurement Results – 30 MHz to 1 GHz (continued)

3.3. Y-Axis, Horizontal Antenna



3.4. Y-Axis, Vertical Antenna



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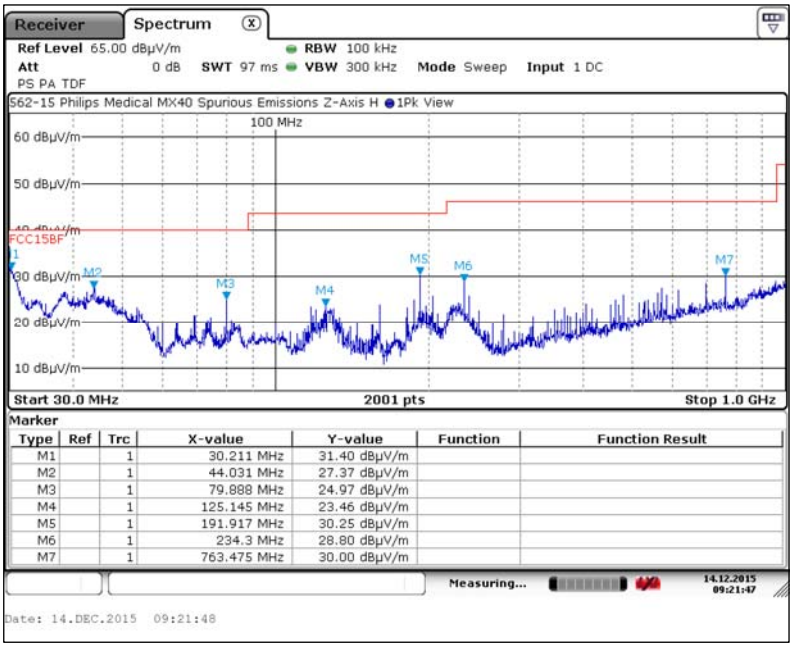
Appendix A (continued)

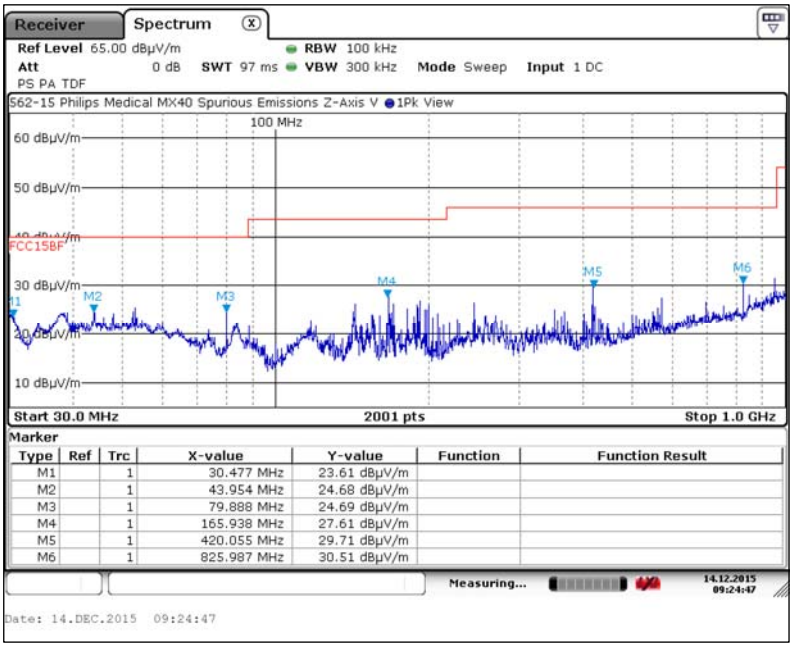
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

3. Measurement Results – 30 MHz to 1 GHz (continued)

3.5. Z-Axis, Horizontal Antenna



3.6. Z-Axis, Vertical Antenna



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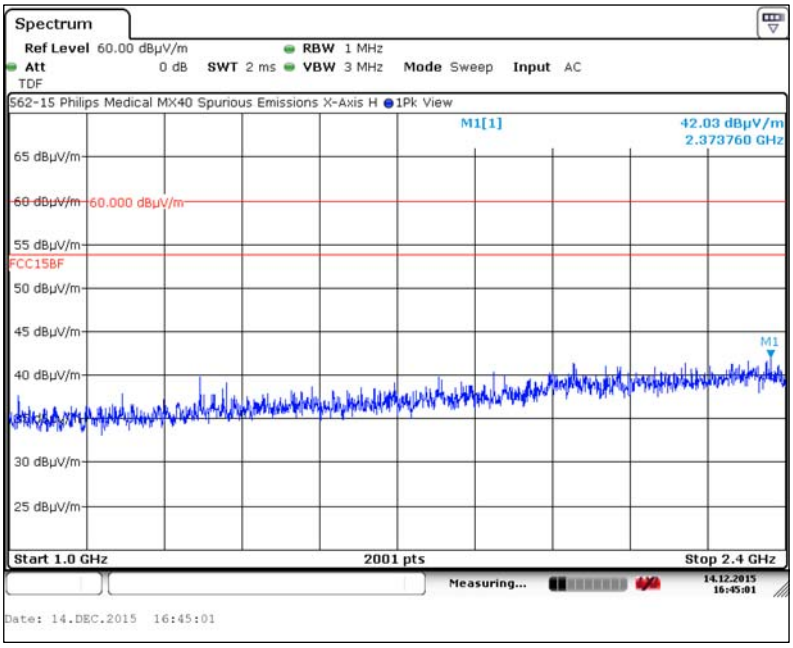
Appendix A (continued)

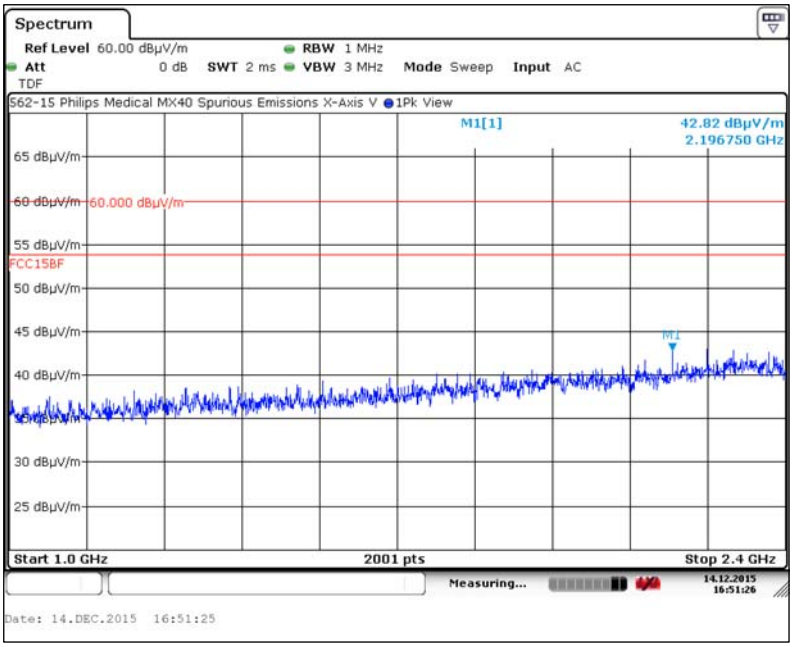
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

4. Measurement Results – 1 GHz to 2.4 GHz

4.1. X-Axis, Horizontal Antenna



4.2. X-Axis, Vertical Antenna



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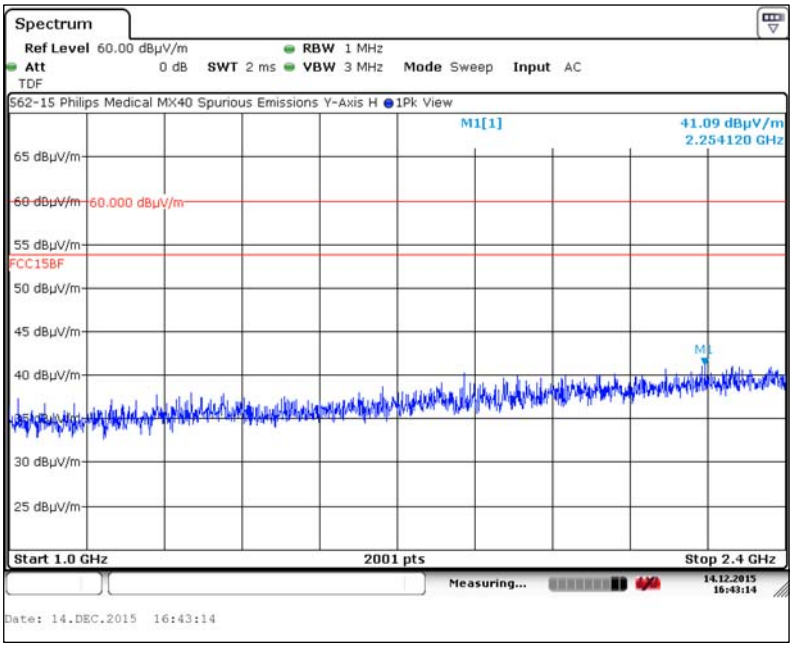
Appendix A (continued)

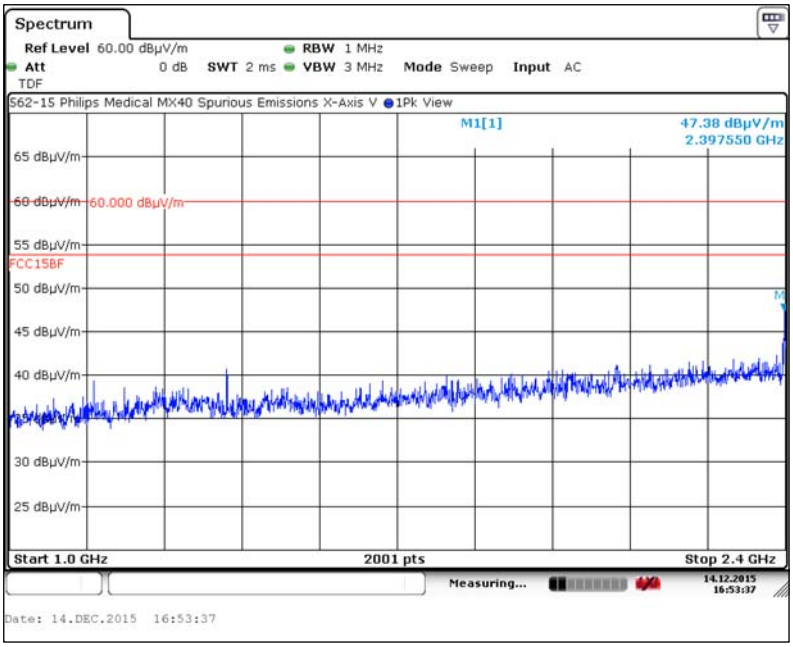
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

4. Measurement Results – 1 GHz to 2.4 GHz (continued)

4.3. Y-Axis, Horizontal Antenna



4.4. Y-Axis, Vertical Antenna



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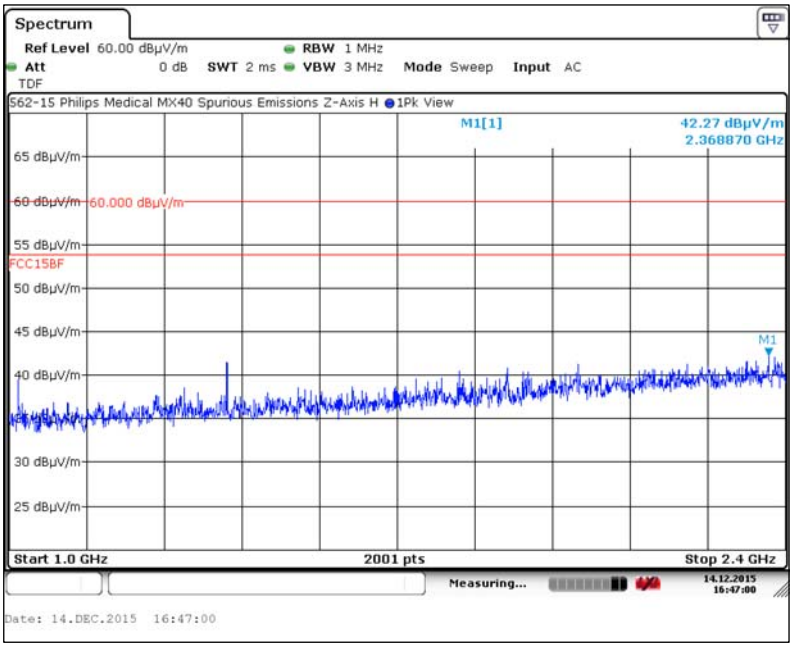
Appendix A (continued)

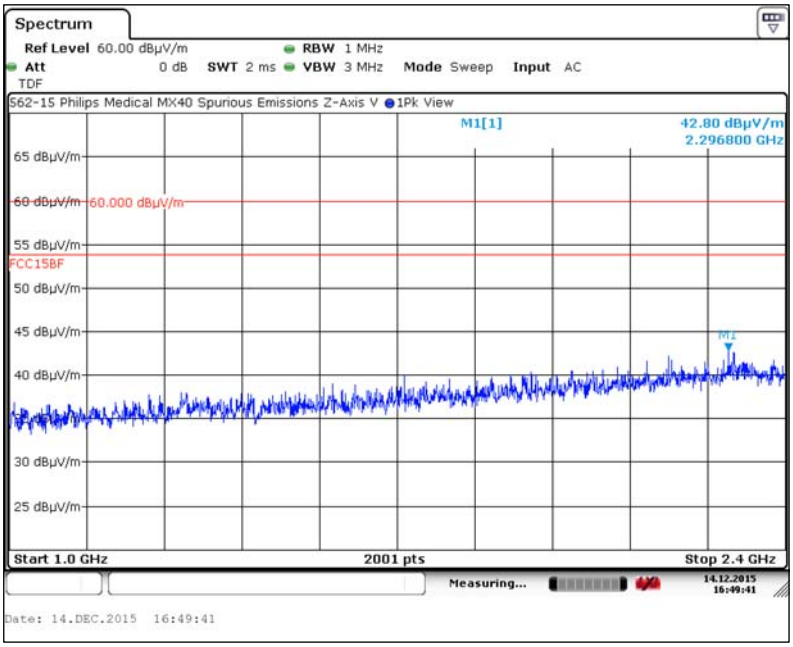
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

4. Measurement Results – 1 GHz to 2.4 GHz (continued)

4.5. Z-Axis, Horizontal Antenna



4.6. Z-Axis, Vertical Antenna



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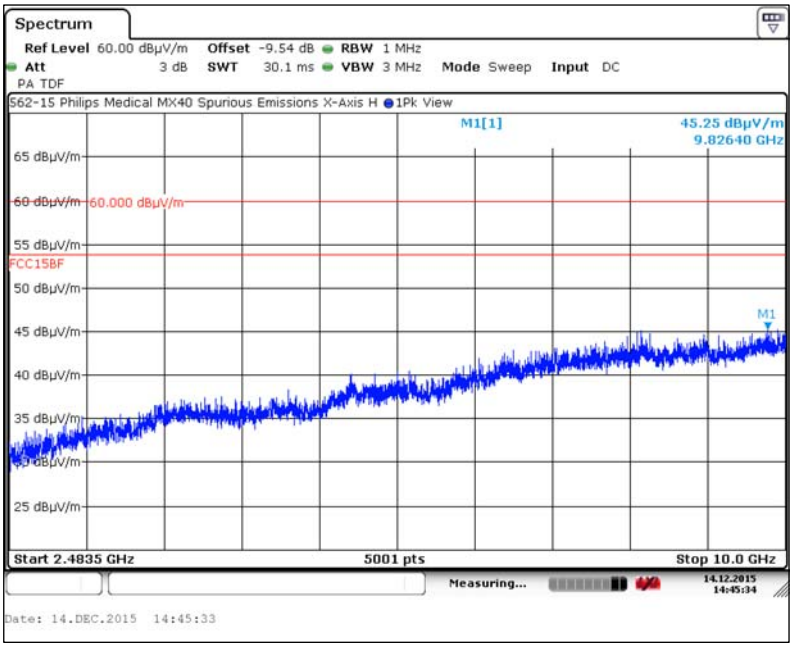
Appendix A (continued)

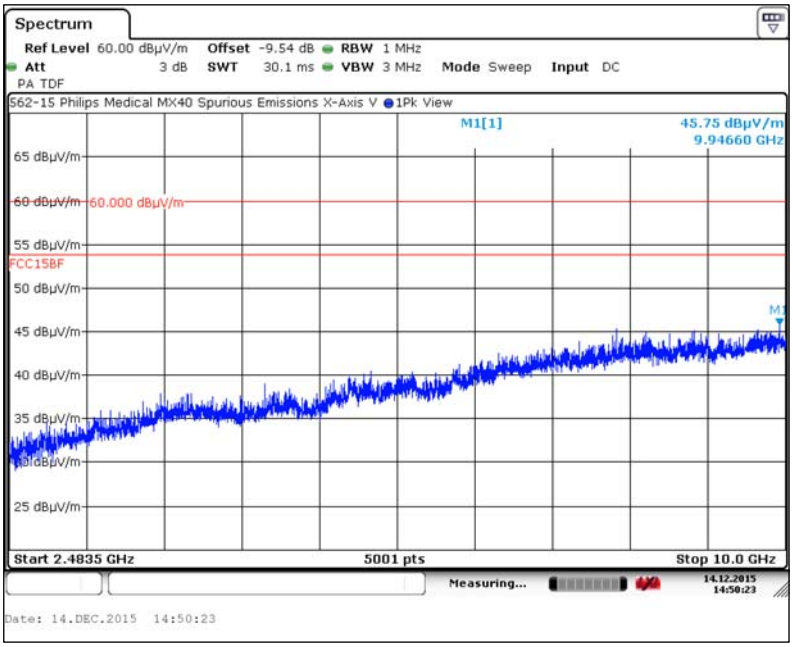
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

5. Measurement Results – 2.4835 GHz to 10 GHz

5.1. X-Axis, Horizontal Antenna



5.2. X-Axis, Vertical Antenna



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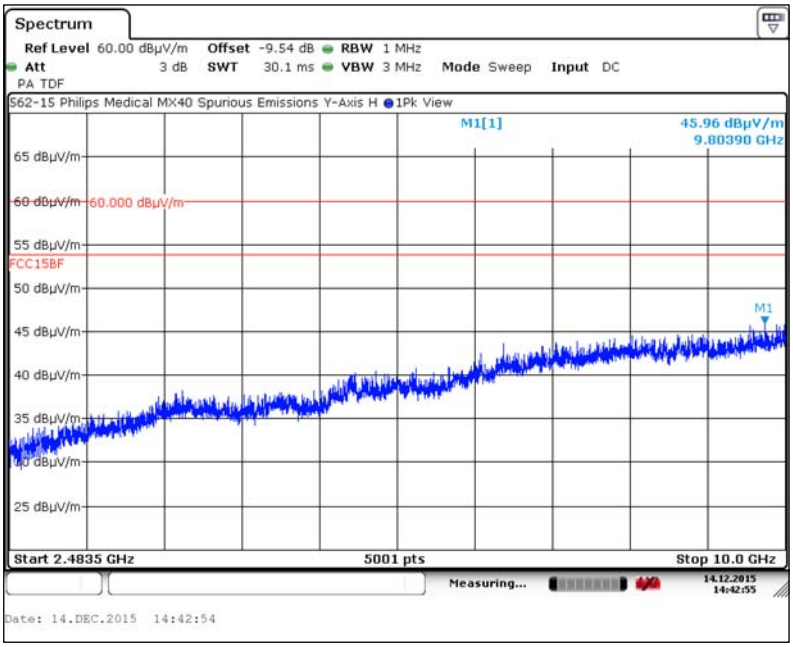
Appendix A (continued)

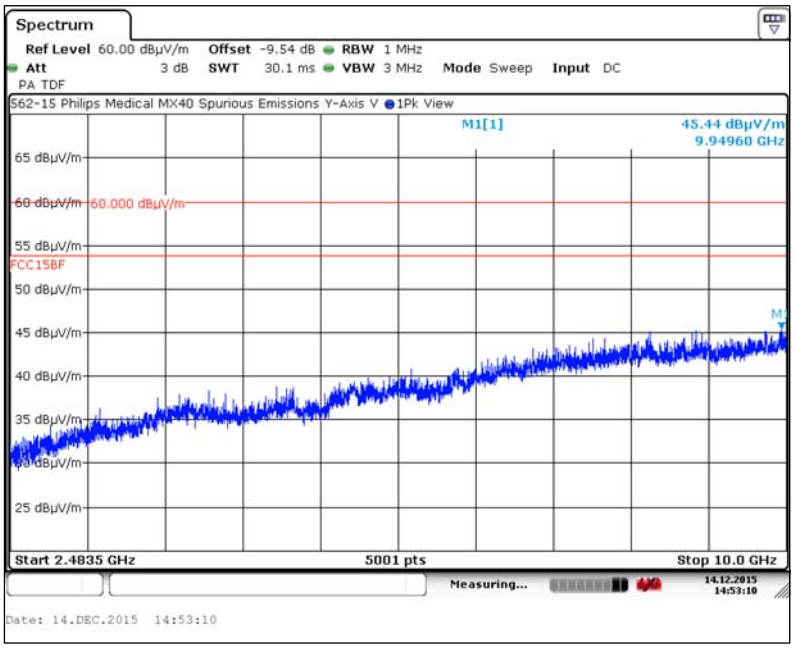
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

5. Measurement Results – 2.4835 GHz to 10 GHz (continued)

5.3. Y-Axis, Horizontal Antenna



5.4. Y-Axis, Vertical Antenna



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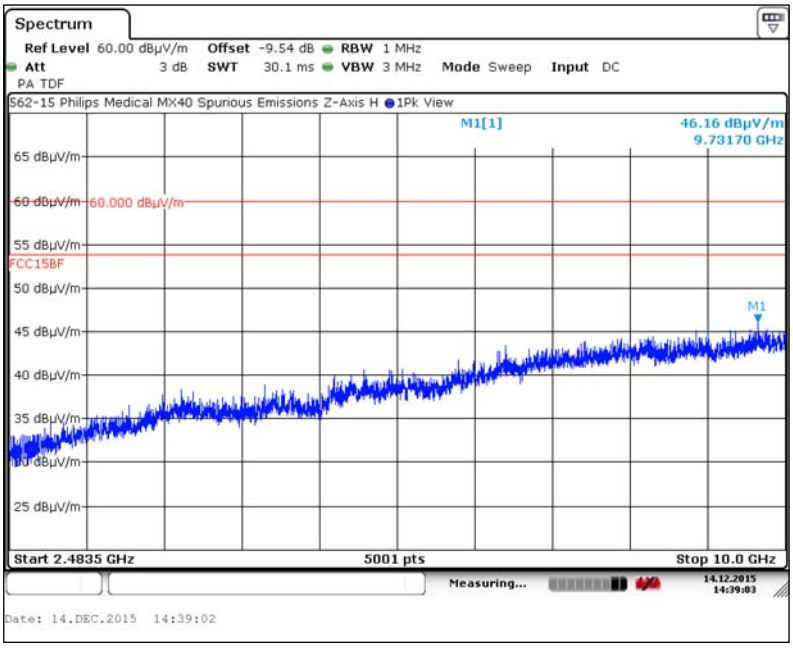
Appendix A (continued)

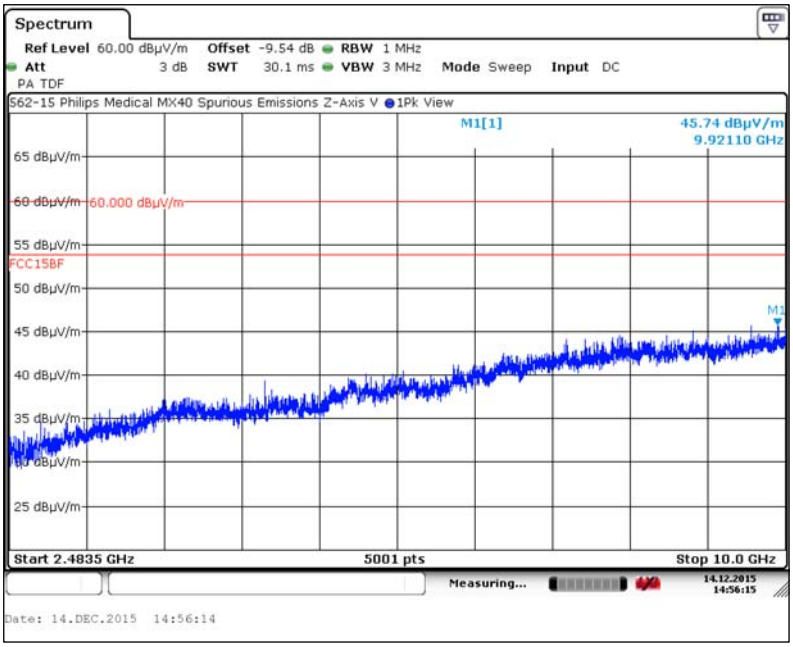
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

5. Measurement Results – 2.483.5 GHz to 10 GHz (continued)

5.5. Z-Axis, Horizontal Antenna



5.6. Z-Axis, Vertical Antenna



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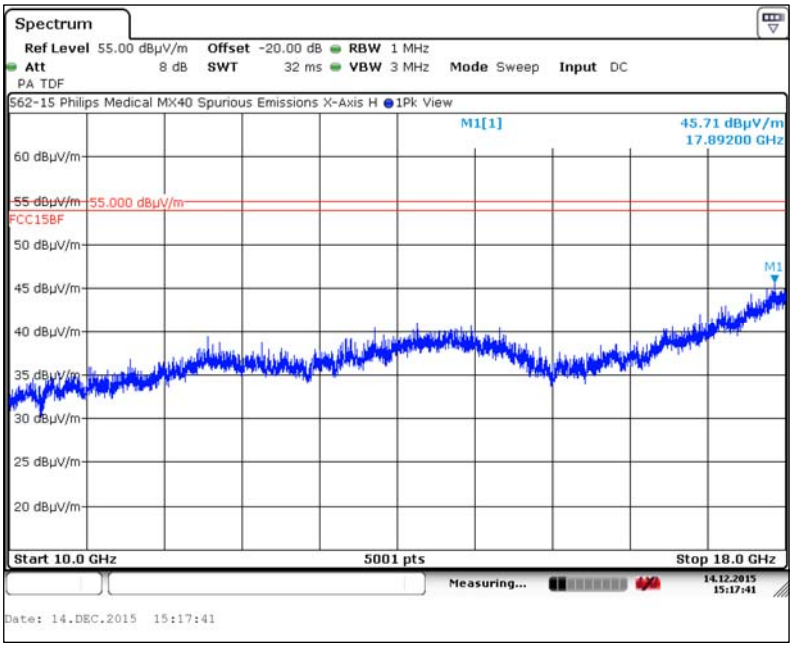
Appendix A (continued)

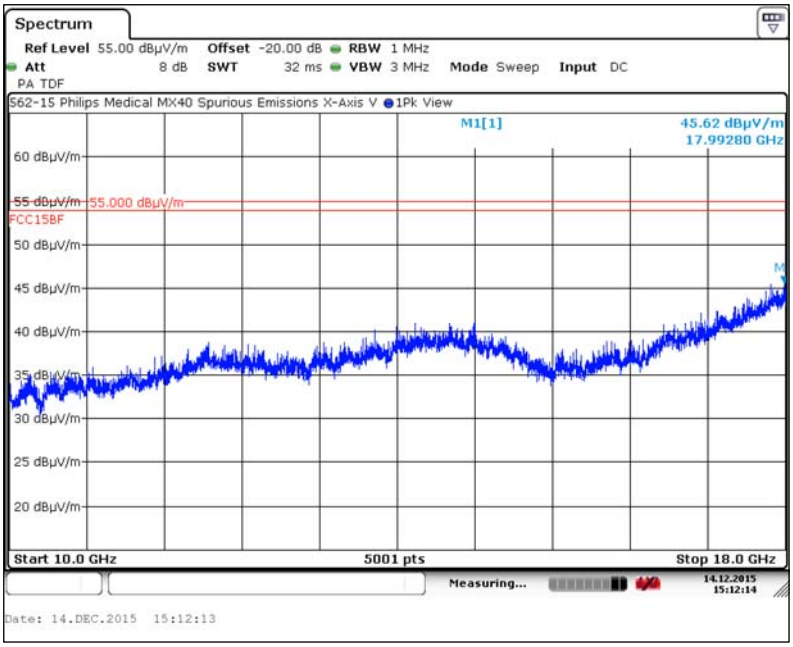
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

6. Measurement Results – 10 GHz to 18 GHz (continued)

6.1. X-Axis, Horizontal Antenna



6.2. X-Axis, Vertical Antenna



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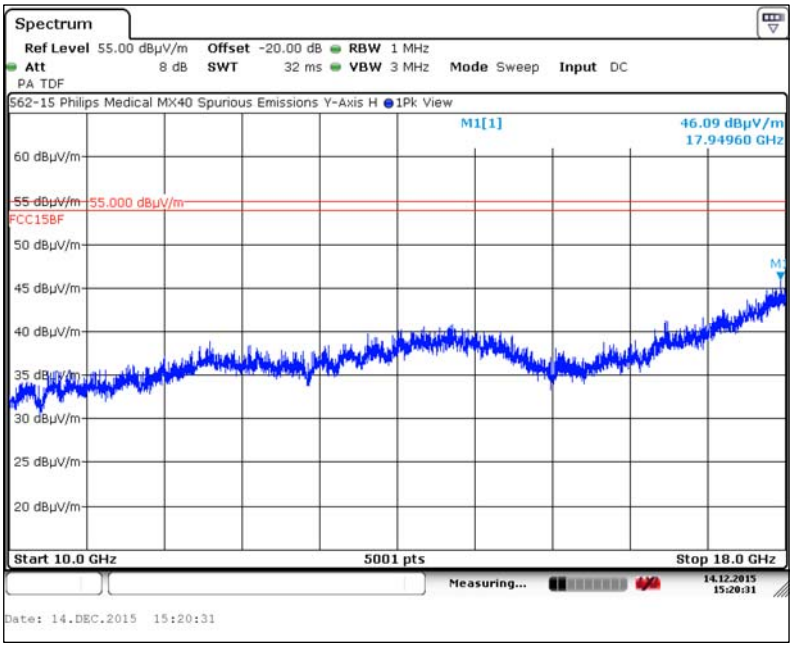
Appendix A (continued)

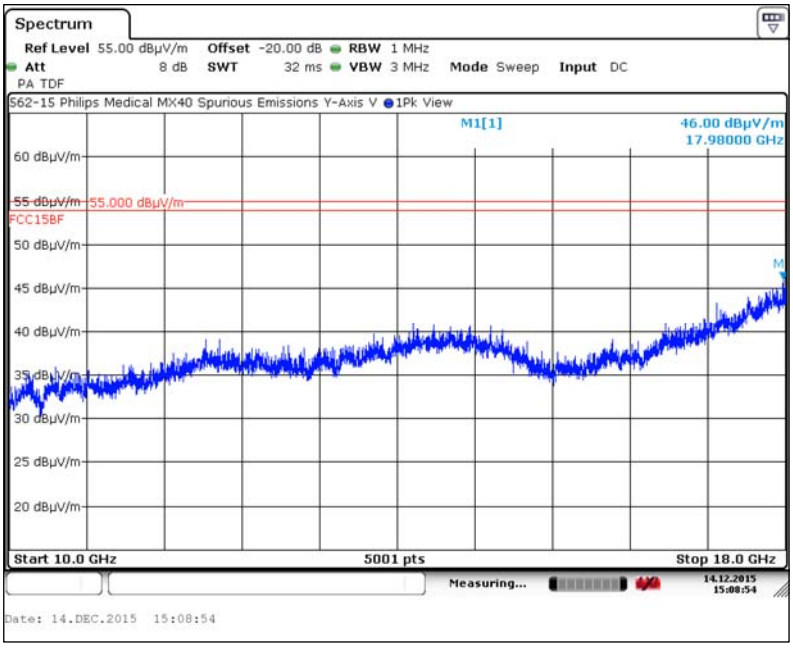
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

6. Measurement Results – 10 GHz to 18 GHz (continued)

6.3. Y-Axis, Horizontal Antenna



6.4. Y-Axis, Vertical Antenna



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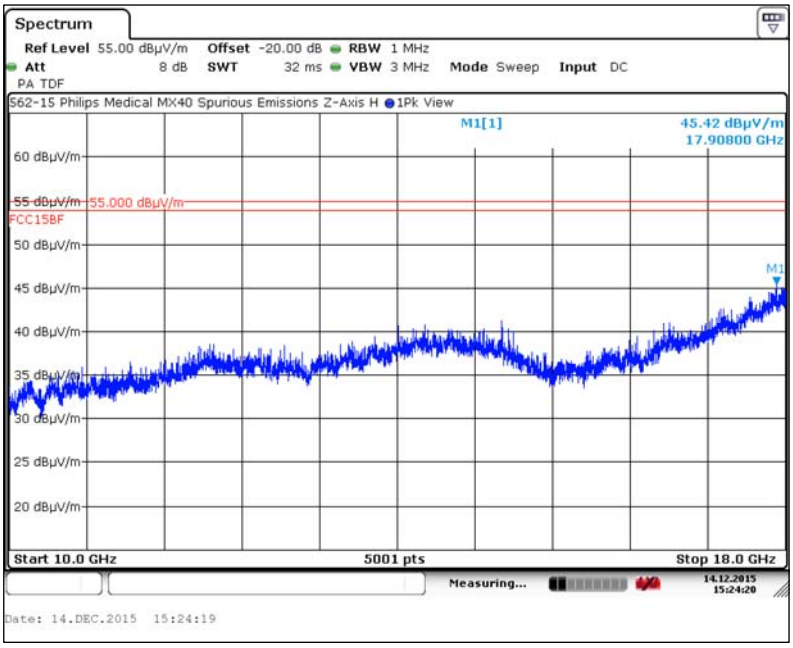
Appendix A (continued)

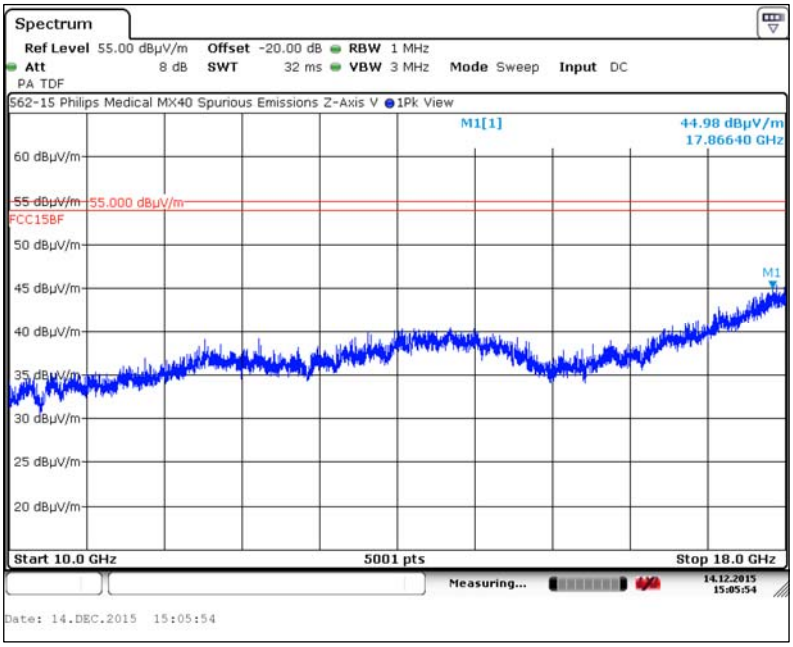
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

6. Measurement Results – 10 GHz to 18 GHz (continued)

6.5. Z-Axis, Horizontal Antenna



6.6. Z-Axis, Vertical Antenna



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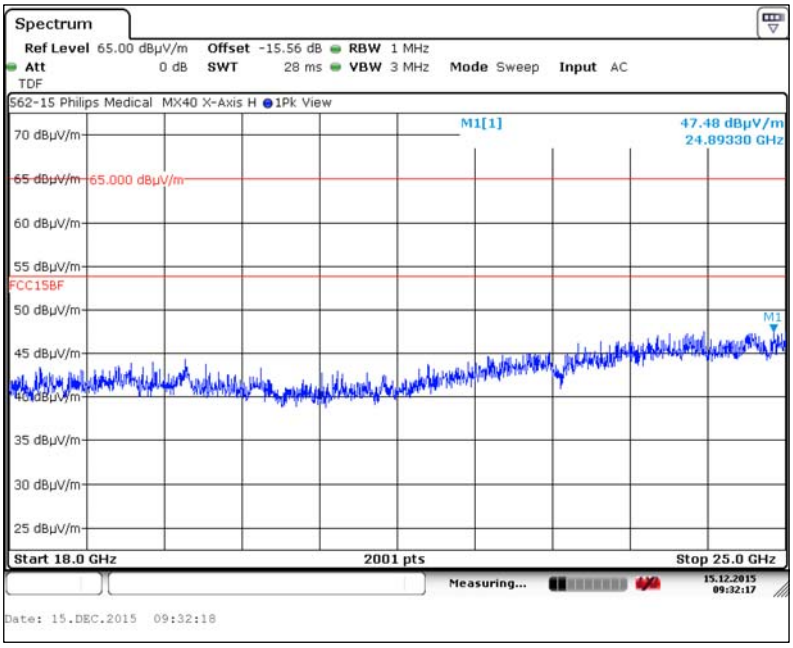
Appendix A (continued)

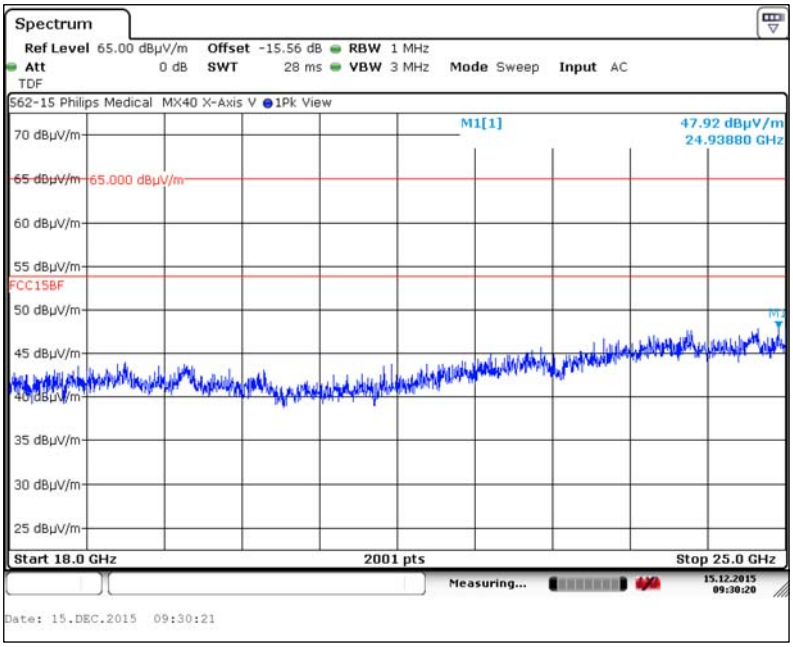
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

7. Measurement Results – 18 GHz to 25 GHz

7.1. X-Axis, Horizontal Antenna



7.2. X-Axis, Vertical Antenna



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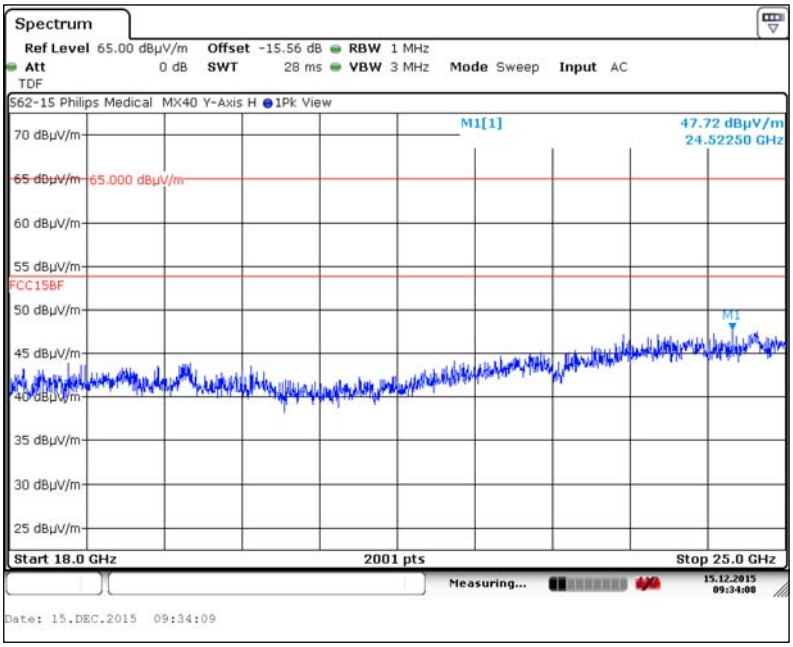
Appendix A (continued)

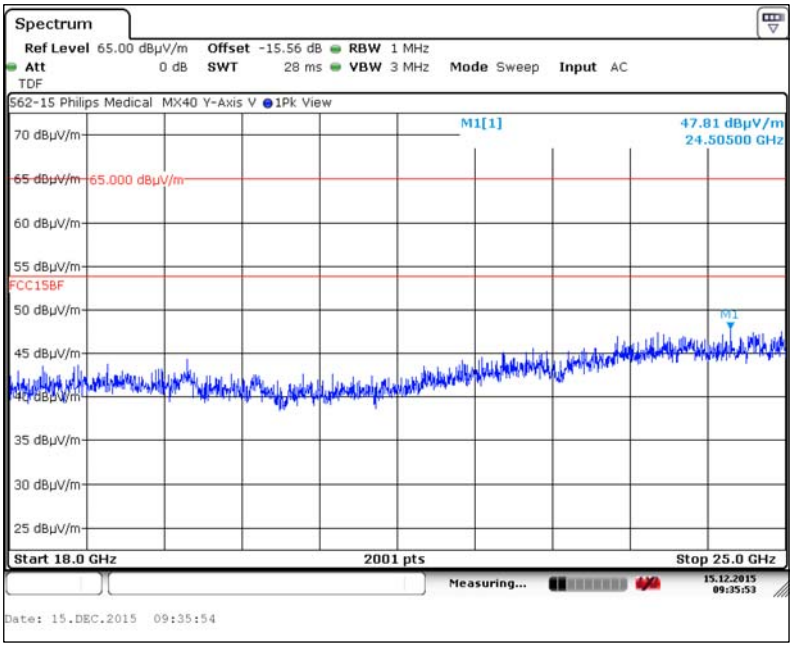
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

7. Measurement Results – 18 GHz to 25 GHz (continued)

7.3. Y-Axis, Horizontal Antenna



7.4. Y-Axis, Vertical Antenna



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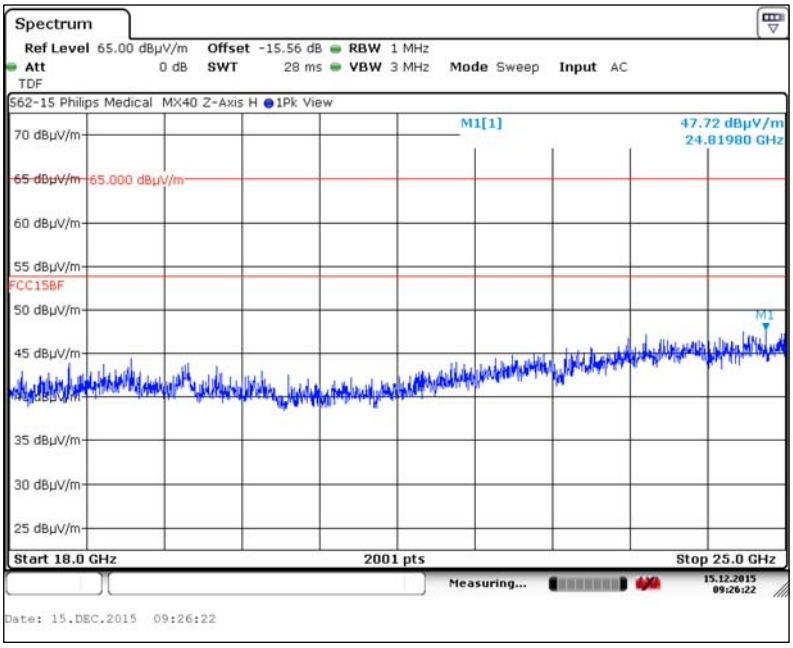
Appendix A (continued)

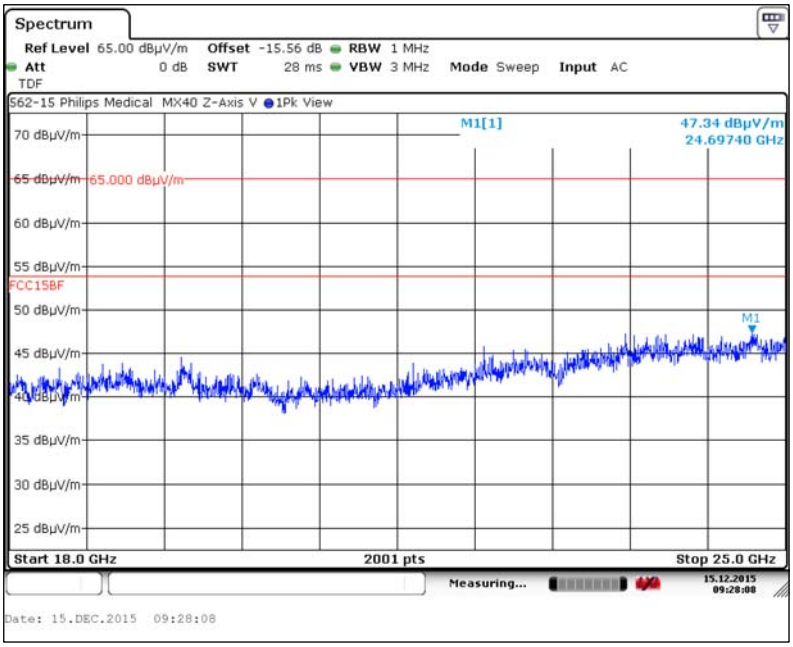
Spurious Radiated Emissions Test Results (15.209), IC RSS-GEN, ISSUE 4

7. Measurement Results – 18 GHz to 25 GHz (continued)

7.5. Z-Axis, Horizontal Antenna



7.6. Z-Axis, Vertical Antenna



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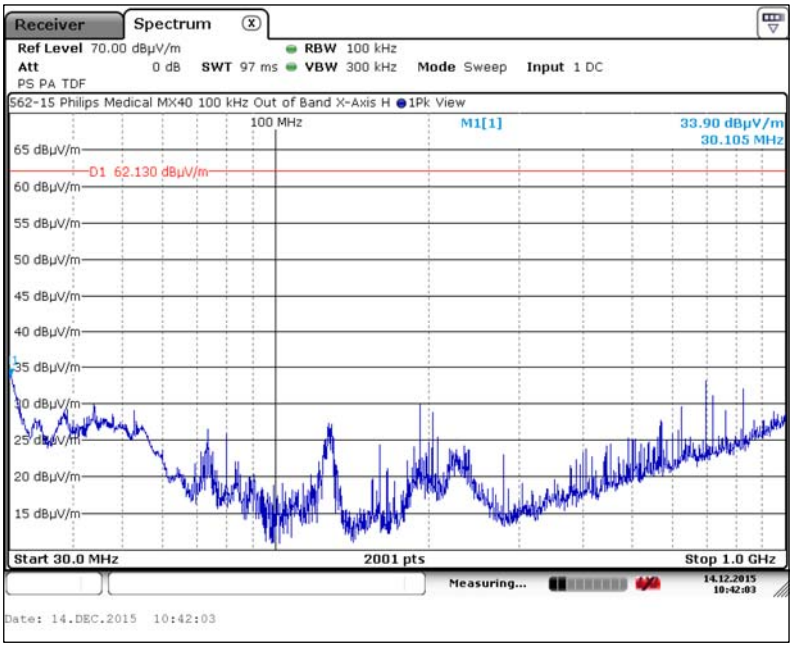
Appendix B

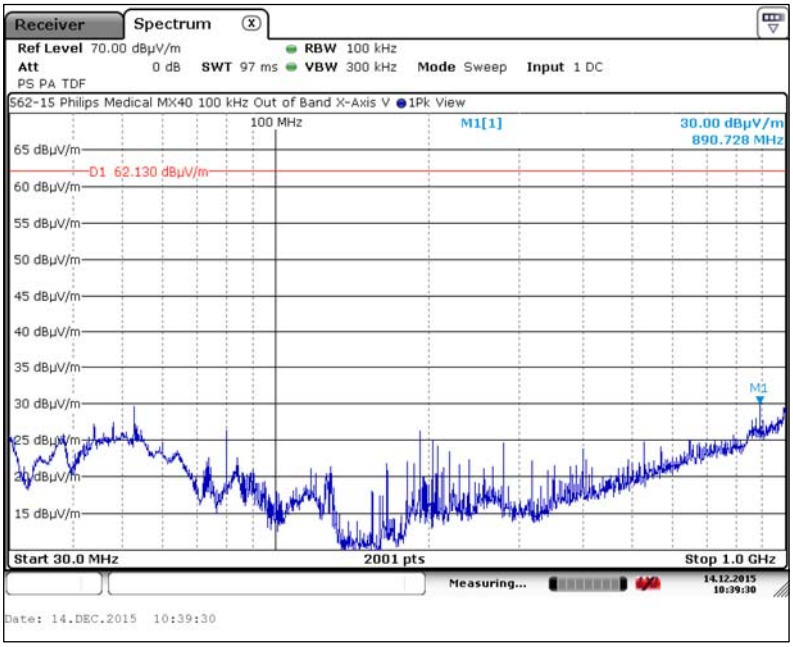
Emissions in Non-Restricted Frequency Bands (15.247(d))

1. Measurement Results – 30 MHz to 1 GHz

1.1. Horizontal Antenna, X-Axis



1.2. Vertical Antenna, X-Axis



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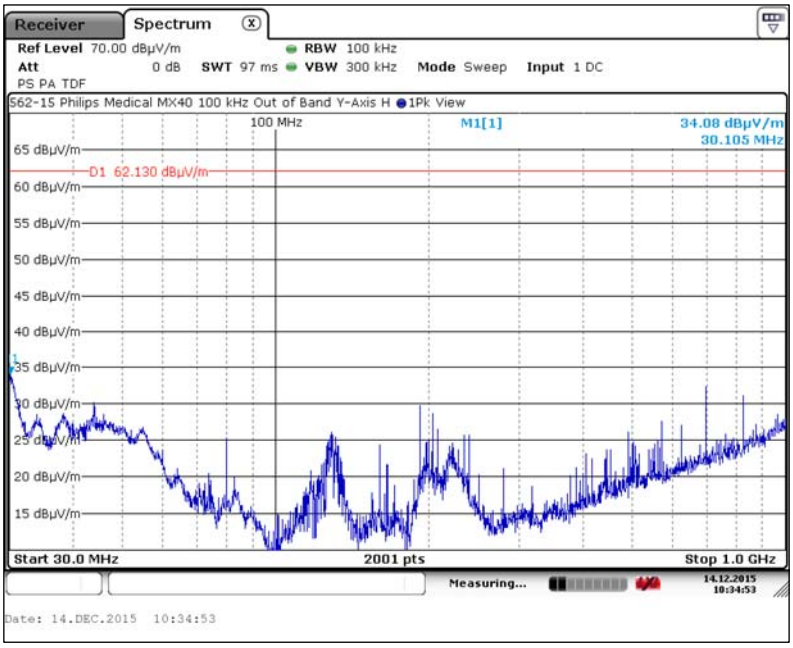
Appendix B (continued)

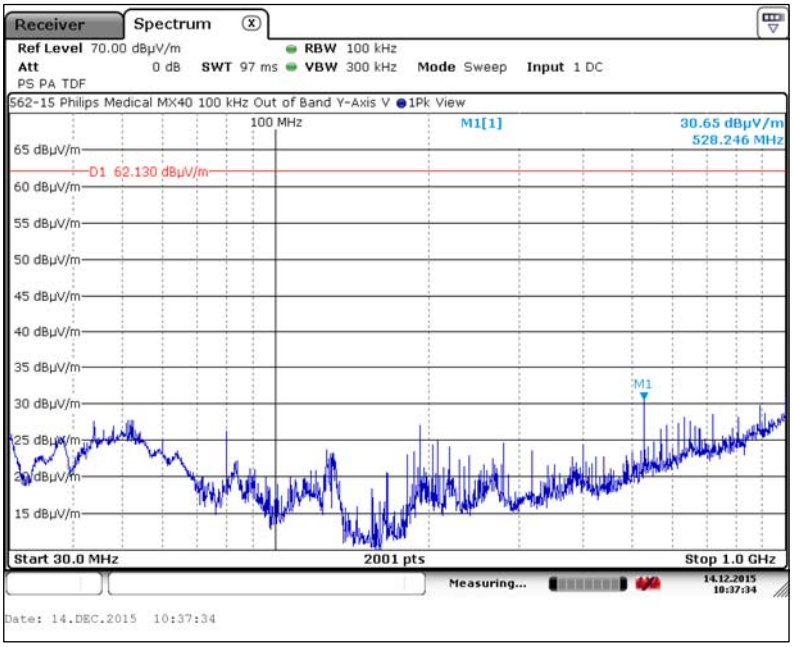
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

1. Measurement Results – 30 MHz to 1 GHz (continued)

1.3. Horizontal Antenna, Y-Axis



1.4. Vertical Antenna, Y-Axis



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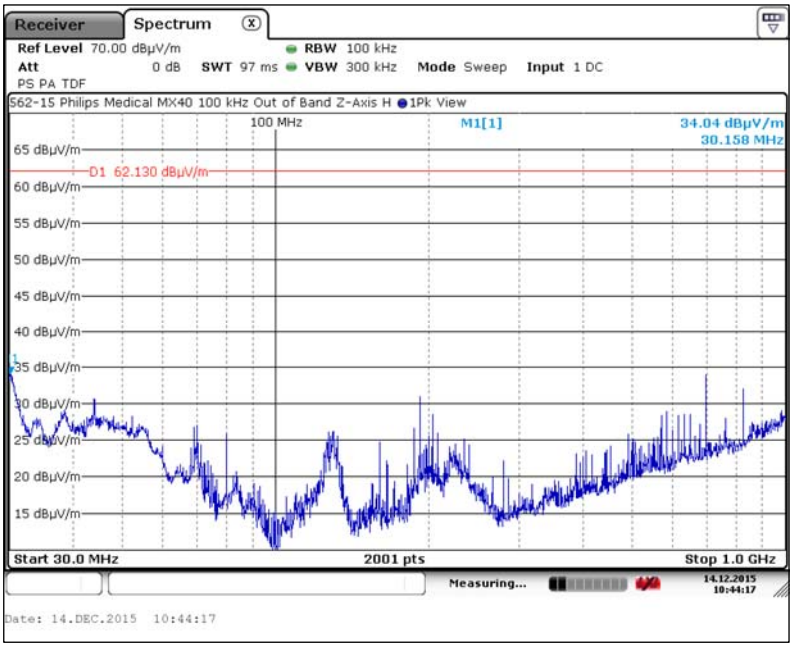
Appendix B (continued)

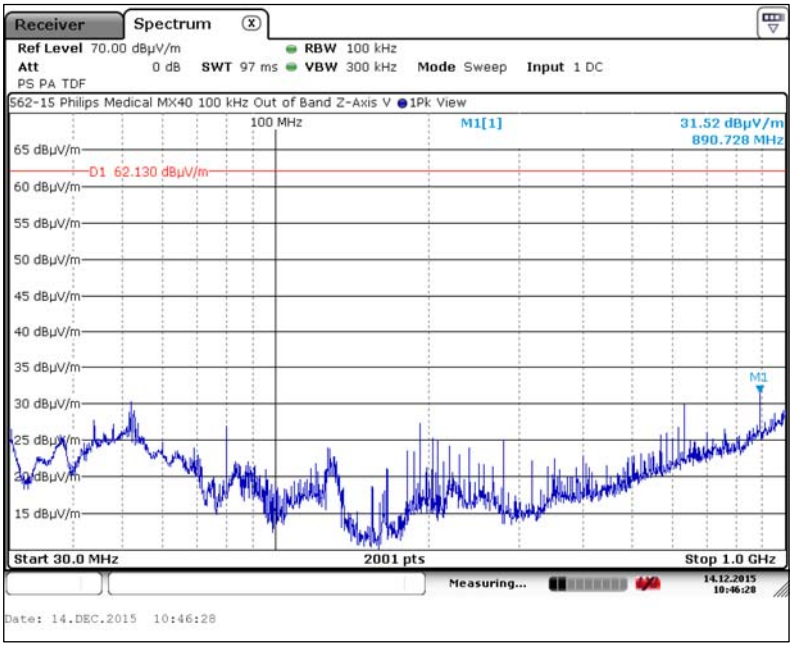
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

1. Measurement Results – 30 MHz to 1 GHz (continued)

1.5. Horizontal Antenna, Z-Axis



1.6. Vertical Antenna, Z-Axis



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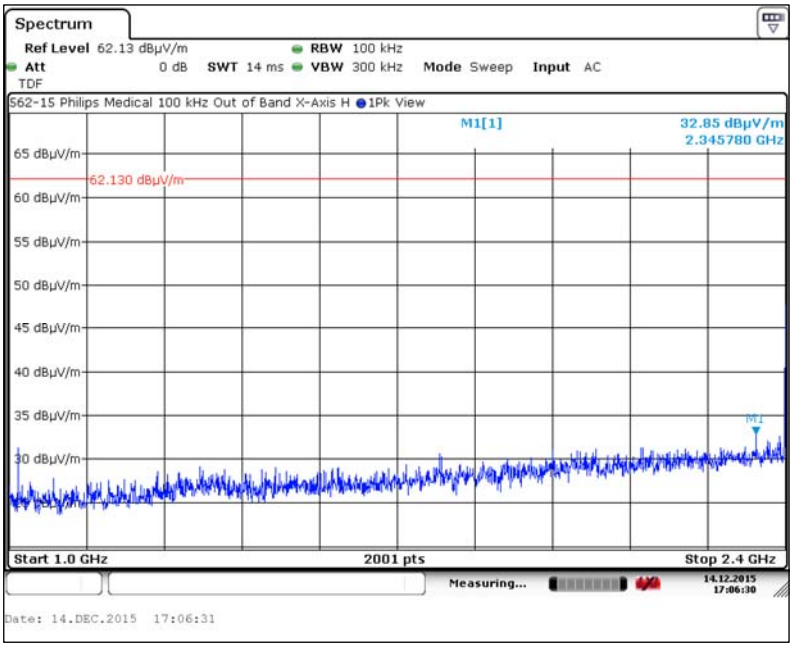
Appendix B (continued)

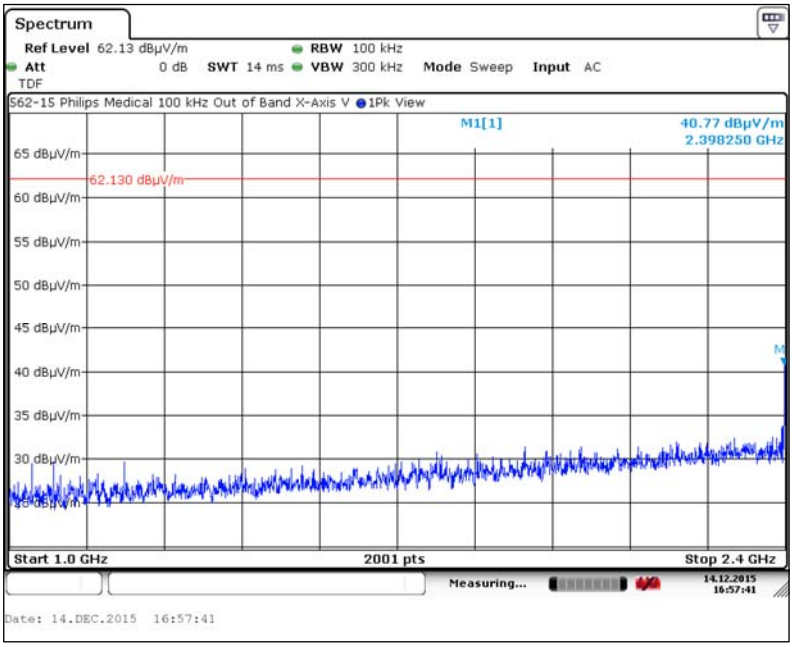
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

2. Measurement Results – 1 GHz to 2.4 GHz

2.1. Horizontal Antenna, X-Axis



2.2. Vertical Antenna, X-Axis



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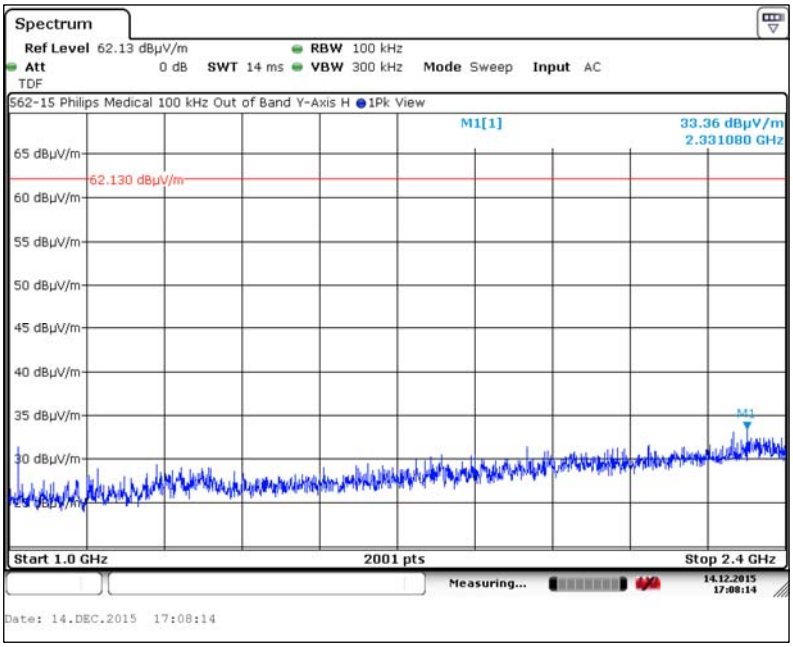
Appendix B (continued)

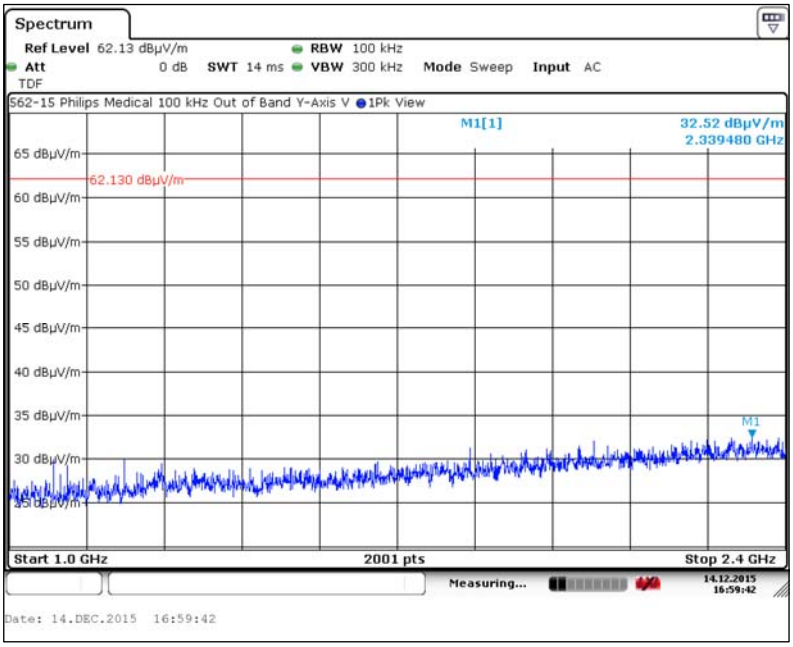
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

2. Measurement Results – 1 GHz to 2.4 GHz (continued)

2.3. Horizontal Antenna, Y-Axis



2.4. Vertical Antenna, Y-Axis



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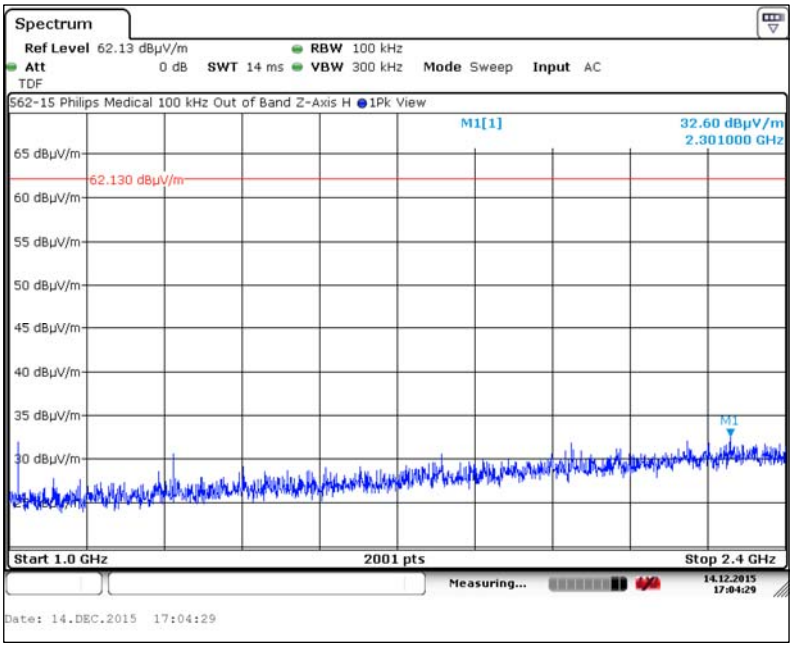
Appendix B (continued)

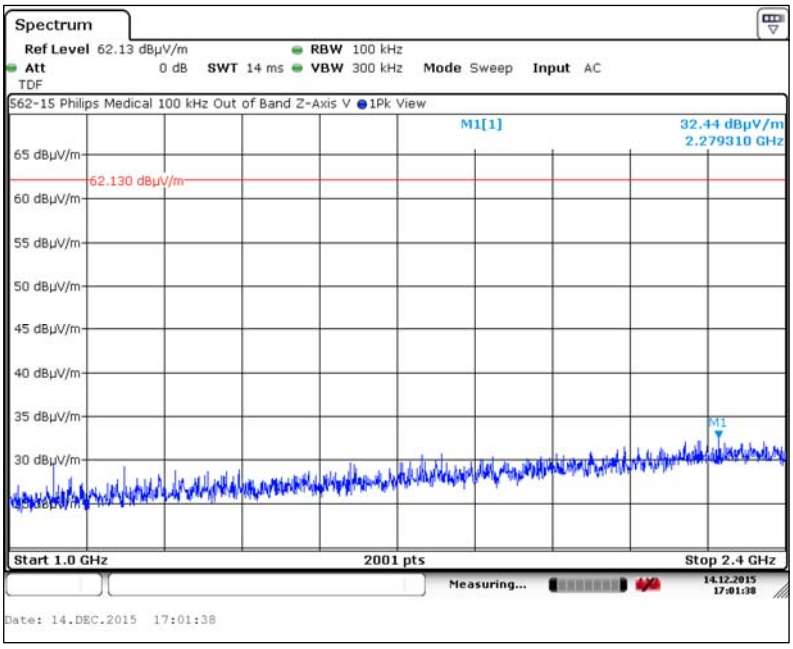
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

2. Measurement Results – 1 GHz to 2.4 GHz (continued)

2.5. Horizontal Antenna, Z-Axis



2.6. Vertical Antenna, Z-Axis



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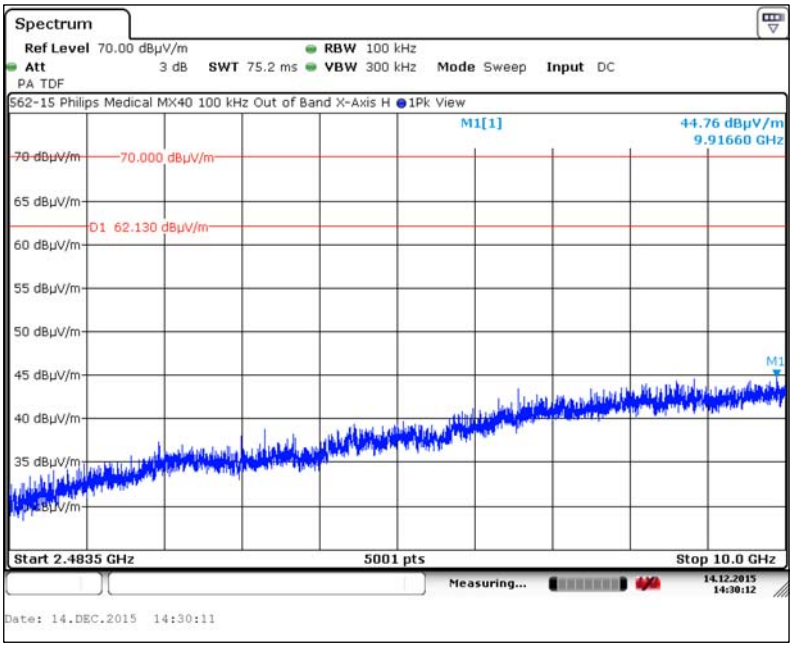
Appendix B (continued)

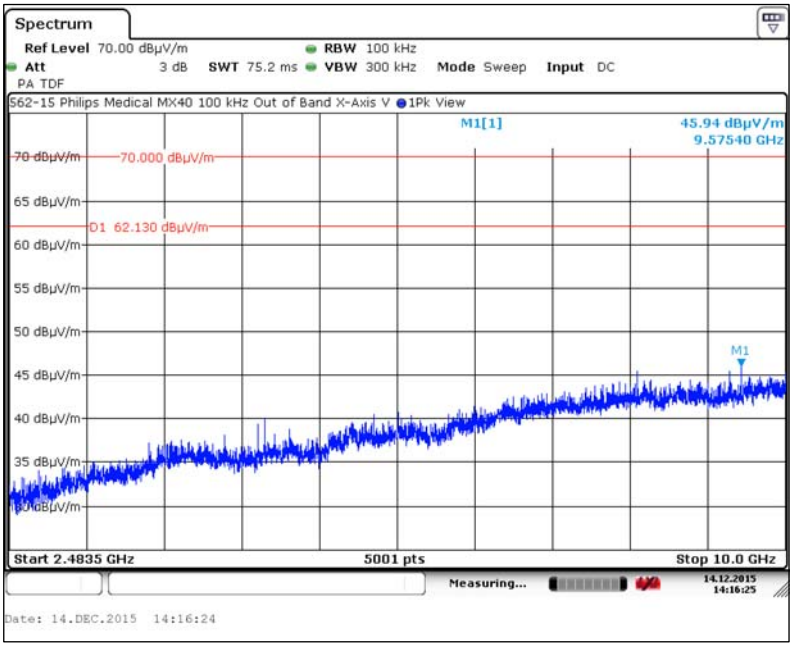
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

3. Measurement Results – 2.4835 GHz to 10 GHz

3.1. Horizontal Antenna, X-Axis



3.2. Vertical Antenna, X-Axis



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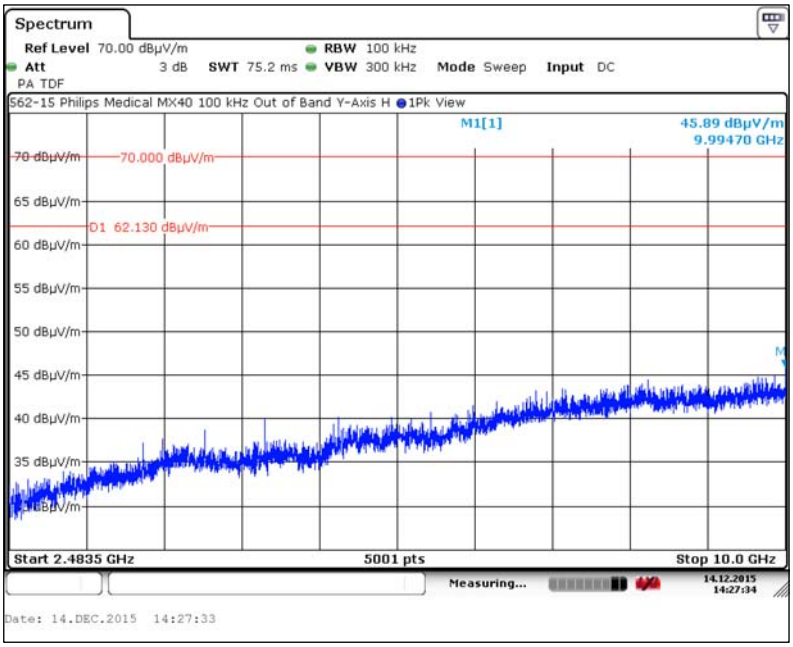
Appendix B (continued)

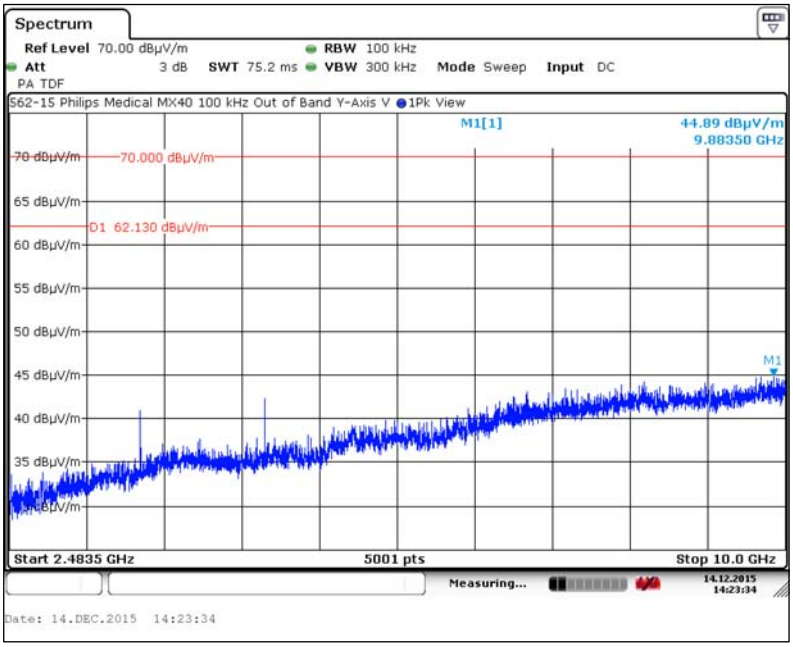
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

3. Measurement Results – 2.4835 GHz to 10 GHz (continued)

3.3. Horizontal Antenna, Y-Axis



3.4. Vertical Antenna, Y-Axis



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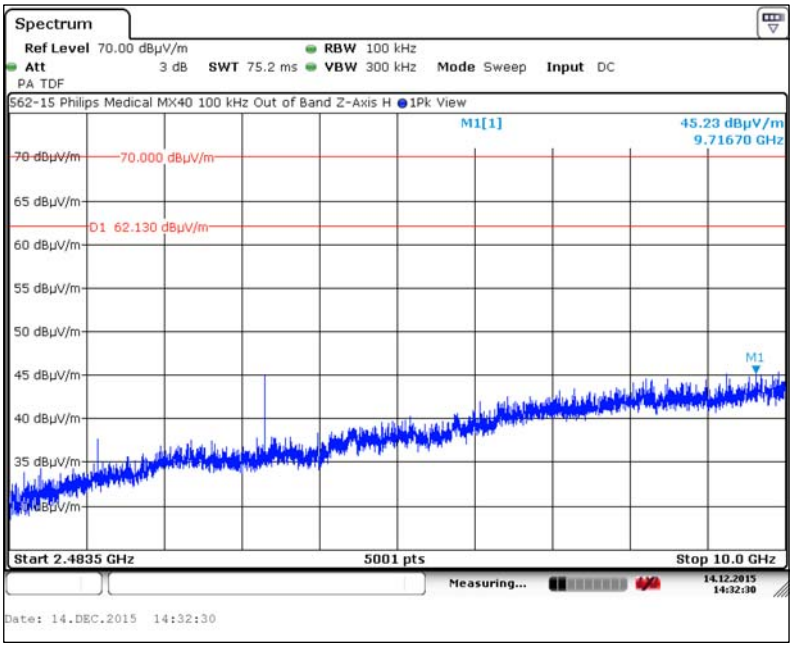
Appendix B (continued)

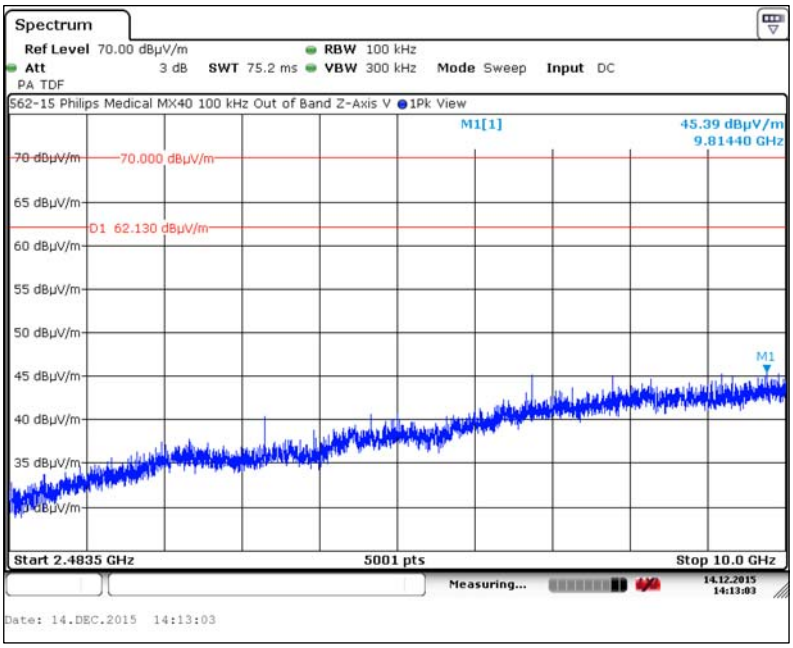
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

3. Measurement Results – 2.4835 GHz to 10 GHz (continued)

3.5. Horizontal Antenna, Z-Axis



3.6. Vertical Antenna, Z-Axis



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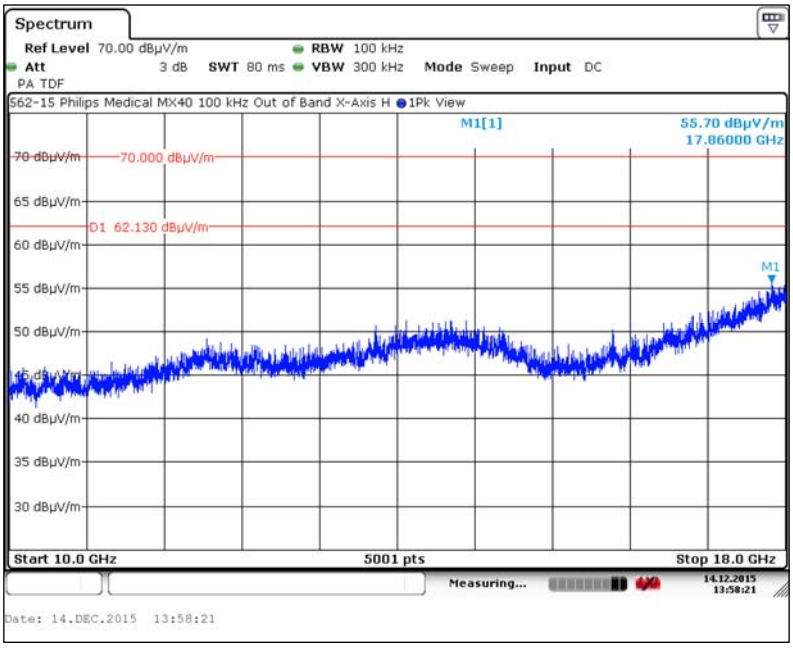
Appendix B (continued)

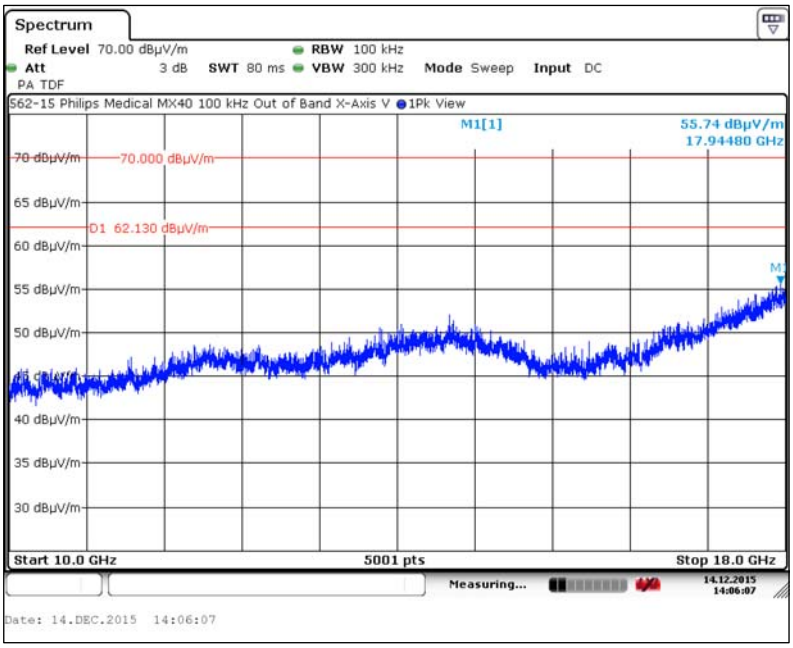
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

4. Measurement Results – 10 GHz to 18 GHz

4.1. Horizontal Antenna, X-Axis



4.2. Vertical Antenna, X-Axis



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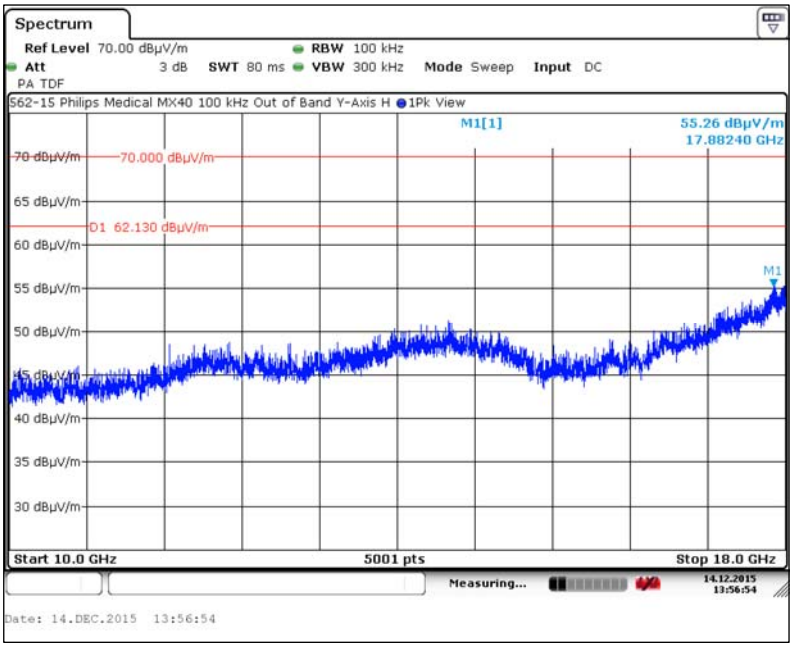
Appendix B (continued)

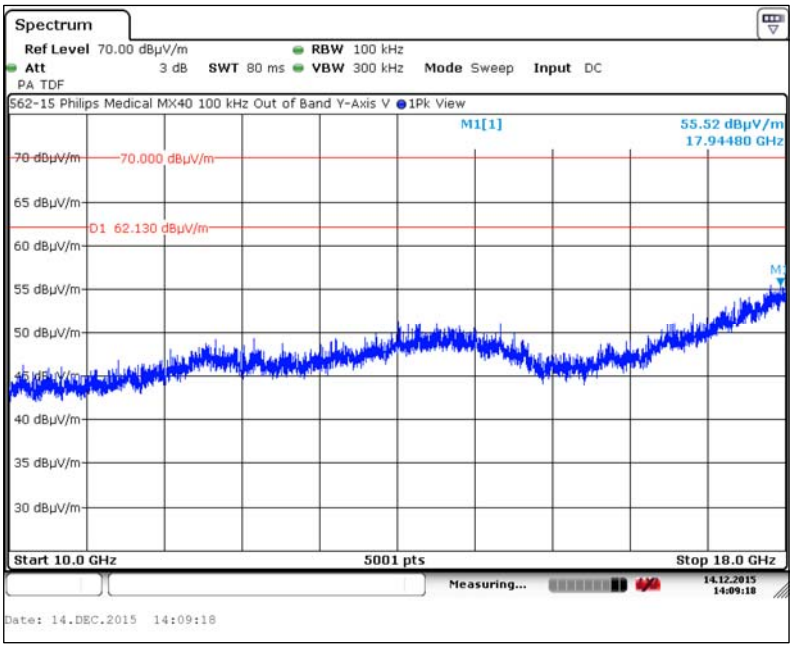
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

4. Measurement Results – 10 GHz to 18 GHz (continued)

4.3. Horizontal Antenna, Y-Axis



4.4. Vertical Antenna, Y-Axis



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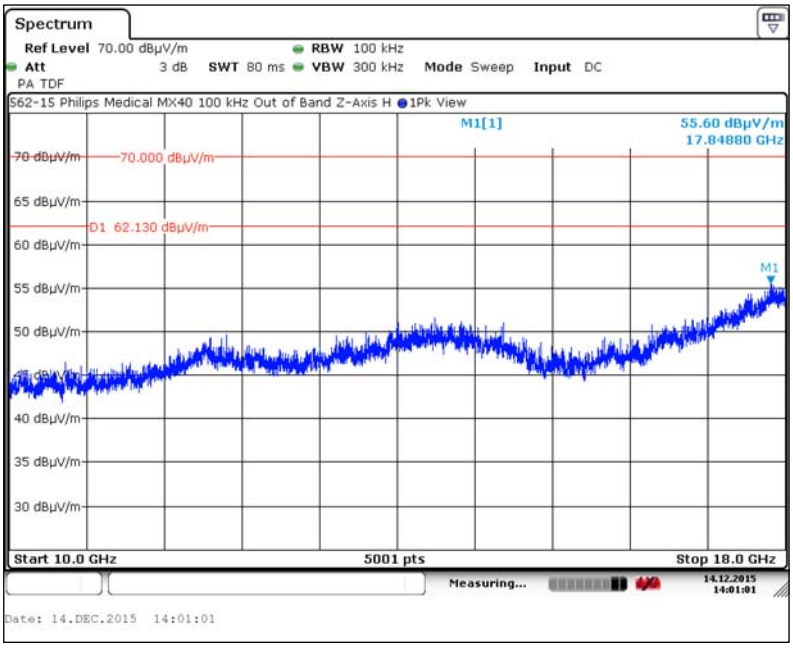
Appendix B (continued)

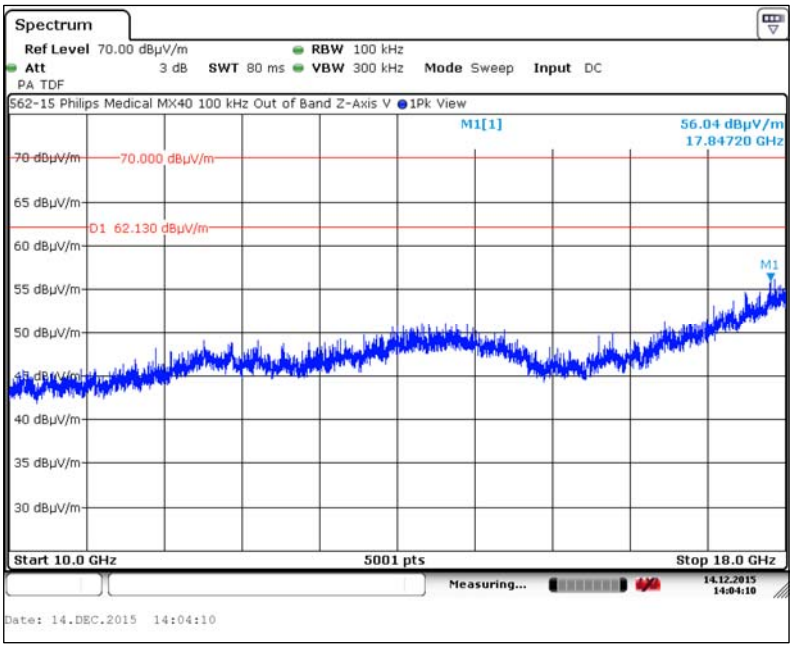
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

4. Measurement Results – 10 GHz to 18 GHz (continued)

4.5. Horizontal Antenna, Z-Axis



4.6. Vertical Antenna, Z-Axis



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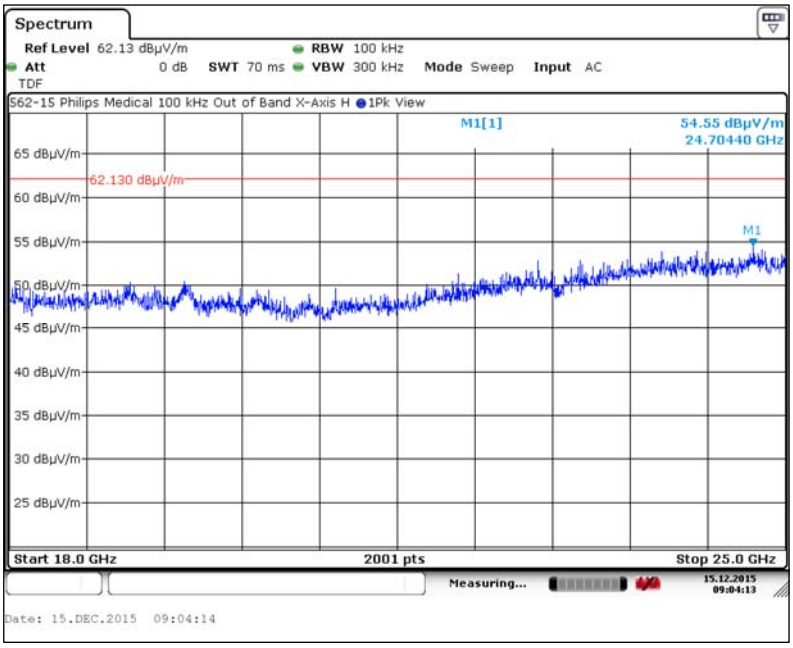
Appendix B (continued)

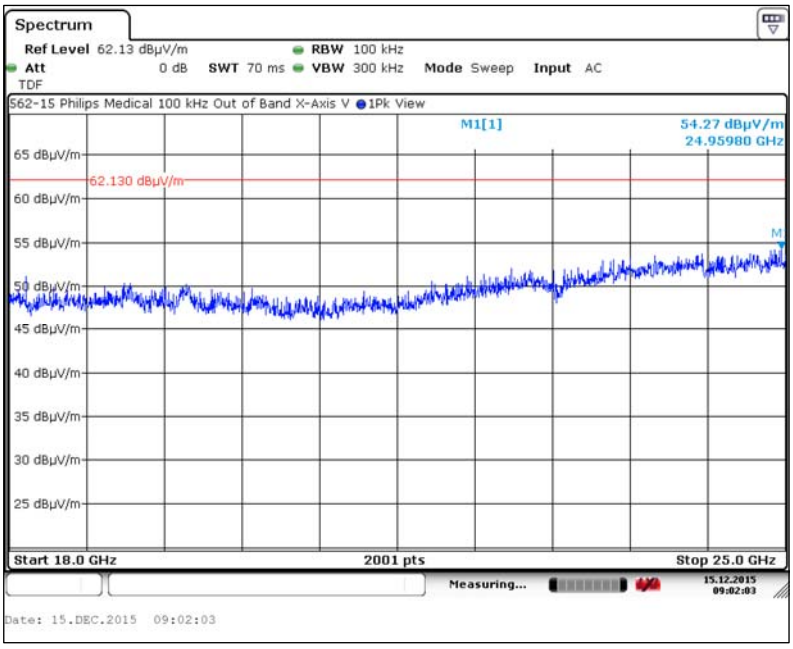
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

5. Measurement Results – 18 GHz to 25 GHz

5.1. Horizontal Antenna, X-Axis



5.2. Vertical Antenna, X-Axis



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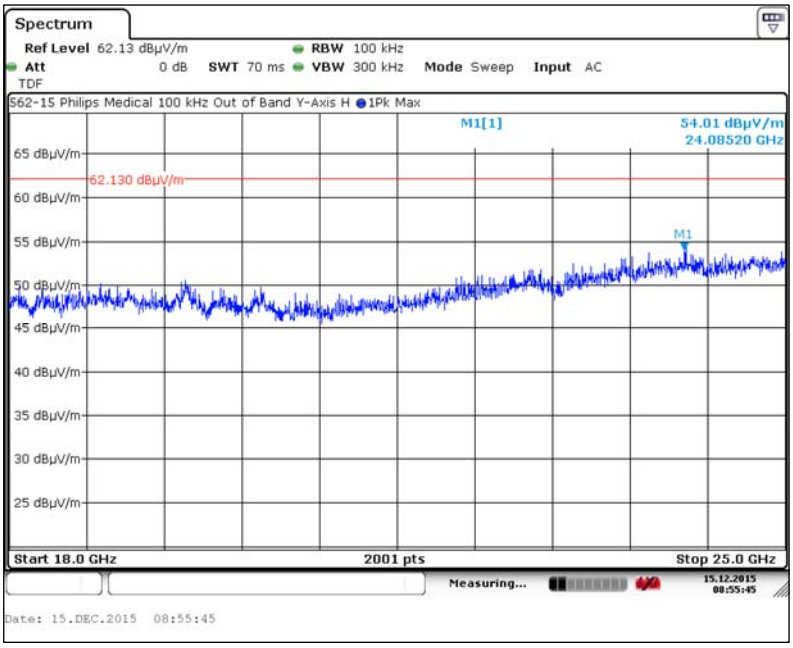
Appendix B (continued)

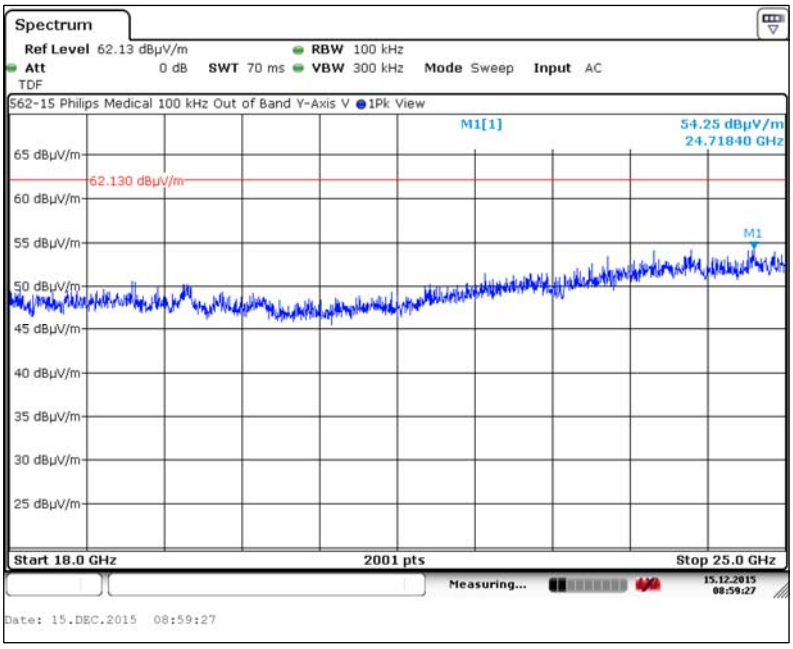
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

5. Measurement Results – 18 GHz to 25 GHz (continued)

5.3. Horizontal Antenna, Y-Axis



5.4. Vertical Antenna, Y-Axis



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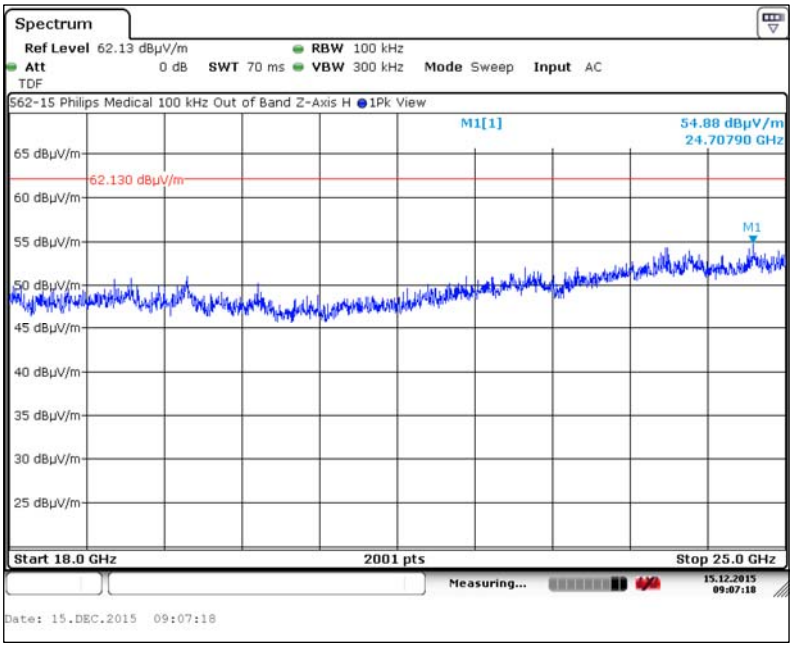
Appendix B (continued)

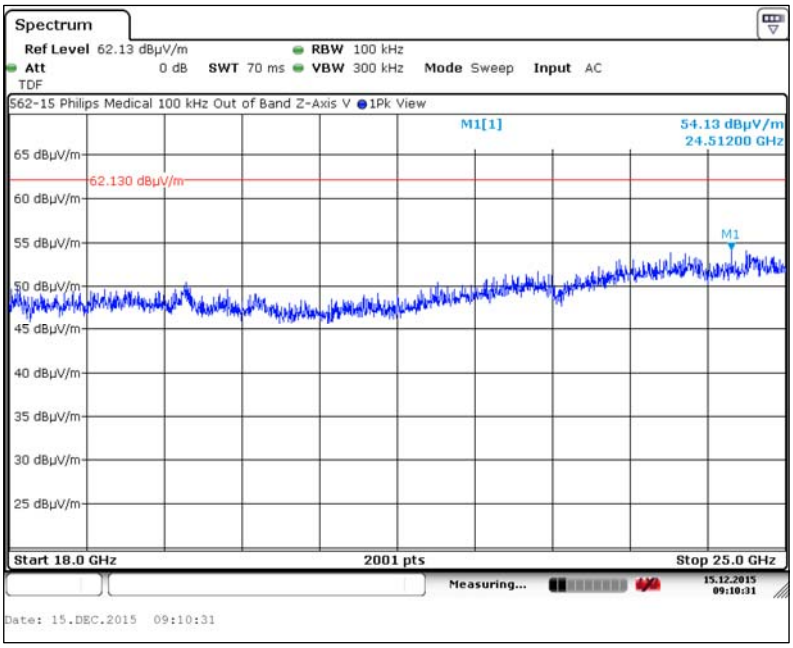
Emissions in Non-Restricted Frequency Bands (15.247(d)) (continued)

5. Measurement Results – 18 GHz to 25 GHz (continued)

5.5. Horizontal Antenna, Z-Axis



5.6. Vertical Antenna, Z-Axis



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