




**MEASUREMENT REPORT**  
**FCC PART 15.247 900MHz ISM Band****Applicant Name:**  
Device Solutions Inc.  
3211 Moorefields Road  
Hillsborough, NC 27278  
United States**Date of Testing:**  
01/30 - 03/12/2015  
**Test Site/Location:**  
PCTEST Lab. Columbia, MD, USA  
**Test Report Serial No.:**  
0Y1501280261.OXW**FCC ID:** OXW-PA0020  
**APPLICANT:** Device Solutions Inc.**Application Type:** Certification  
**Model(s):** PA0020  
**EUT Type:** Sensor II Board Module  
**Max. RF Output Power:** 6.691 mW (8.26 dBm) Peak Conducted  
**Frequency Range:** 904.8 – 924.8MHz  
**Type of Modulation:** GFSK  
**FCC Classification:** FCC Part 15 Spread Spectrum Transmitter (DSS)  
**FCC Rule Part(s):** Part 15 Subpart C (15.247)  
**Test Procedure(s):** ANSI C63.10-2009, DA 00-705

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2009 and DA 00-705. Test results reported herein relate only to the item(s) tested.



I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

  
Randy Ortanez  
President

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# MEASUREMENT REPORT

## FCC Part 15.247

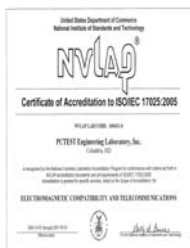


### § 2.1033 General Information



**APPLICANT:** Device Solutions Inc.  
**APPLICANT ADDRESS:** 3211 Moorefields Road  
Hillsborough, NC 27278, United States  
**TEST SITE:** PCTEST ENGINEERING LABORATORY, INC.  
**TEST SITE ADDRESS:** 7185 Oakland Mills Road, Columbia, MD 21046 USA  
**FCC RULE PART(S):** Part 15 Subpart C (15.247)  
**BASE MODEL:** PA0020  
**FCC ID:** OXW-PA0020  
**FCC CLASSIFICATION:** FCC Part 15 Spread Spectrum Transmitter (DSS)  
**Test Device Serial No.:** 03-003, 03-002, 04-016 ☐ Production ☒ Pre-Production ☐ Engineering  
**Method/System:** Frequency Hopping Spread Spectrum (FHSS)  
**DATE(S) OF TEST:** 01/30 - 03/12/2015  
**TEST REPORT S/N:** 0Y1501280261.OXW

### Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025:2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

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## 1.0 INTRODUCTION

### 1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

### 1.2 PCTEST Test Location

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Intern't'l (BWI) airport, the city of Baltimore and the Washington, DC area. (See Figure 1-1).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39° 10'23" N latitude and 76° 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on February 15, 2012.

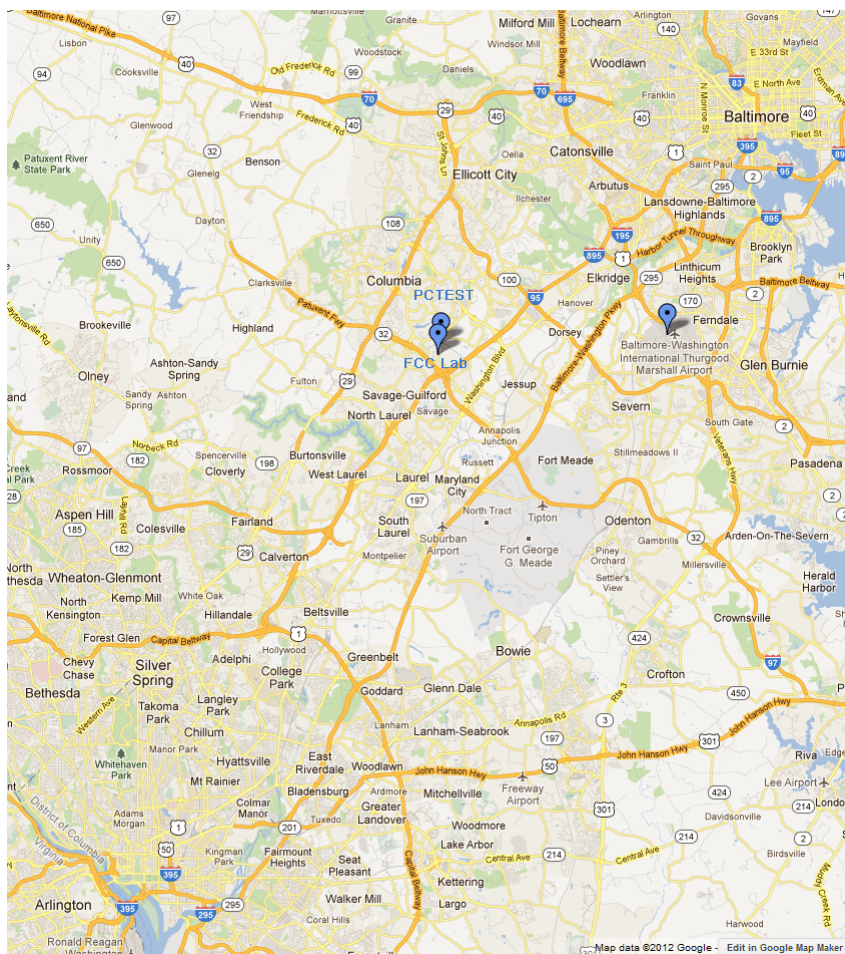


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Device Solutions Sensor II Board Module FCC ID: OXW-PA0020**. The test data contained in this report pertains only to the emissions due to the EUT's hopping transmitter.

### 2.2 Device Capabilities

This device contains the following capabilities:



900MHz ISM Band Hopping Transmitter

### 2.3 Test Configuration

The **Device Solutions Sensor II Board Module FCC ID: OXW-PA0020** was tested per the guidance of ANSI C63.10-2009 and DA 00-705. The module is being filed as a Limited Modular Approval and, thus, was tested while placed inside a representative host, as shown in the Test Setup Photographs document. ANSI C63.10-2009 was used to reference the appropriate EUT setup for radiated spurious emissions testing. See Sections 3.2, 6.9, and 6.10 for radiated emissions test setups and Sections 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, and 6.8 for antenna port conducted emissions test setups.

### 2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

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## 3.0 DESCRIPTION OF TEST

### 3.1 Evaluation Procedure

The measurement procedure described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2009) and the "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" (DA 00-705) were used in the measurement of the **Device Solutions Sensor II Board Module FCC ID: OXW-PA0020**.

Deviation from measurement procedure.....None

### 3.2 Radiated Emissions



The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Clause 5, Figure 5.7 of ANSI C63.4-2009. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. An ETS Lindgren Model 2188 raised turntable is used for radiated measurement. It is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. A 78cm high PVC support structure is placed on top of the turntable. A ¾" (~1.9cm) sheet of high density polyethylene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 0.8 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

### 3.3 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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## 4.0 ANTENNA REQUIREMENTS

### Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.”



- The antennas of the Device Solutions Sensor II Board Module are **permanently attached**.
- There are no provisions for connection to an external antenna.

### Conclusion:

The **Device Solutions Sensor II Board Module FCC ID: OXW-PA0020** unit complies with the requirement of §15.203.

Ch.	Frequency (MHz)
Low	904.8
:	:
Mid	914.8
:	:
High	924.8

**Table 4-1. Frequency/ Channel Operations**



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## 5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	10/24/2014	Annual	10/24/2015	N/A
Agilent	8447D	Broadband Amplifier	5/30/2014	Annual	5/30/2015	2443A01900
Agilent	N9020A	MXA Signal Analyzer	10/27/2014	Annual	10/27/2015	US46470561
Agilent	N5183A	MXG Analog Signal Generator	1/16/2014		3/16/2015	MY50141900
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	6/26/2013	Biennial	6/26/2015	121034
Emco	3115	Horn Antenna (1-18GHz)	1/30/2014	Biennial	1/30/2016	9704-5182
K & L	13SH10-1000/U1000	N Type High Pass Filter	12/1/2014	Annual	12/1/2015	1
Rohde & Schwarz	TS-PR18	1-18 GHz Pre-Amplifier	6/12/2014	Annual	6/12/2015	101622
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	1/28/2014	Biennial	1/28/2016	A051107
VWR	62344-734	Thermometer with Clock	2/20/2014	Biennial	2/20/2016	140140336

**Table 5-1. Annual Test Equipment Calibration Schedule**

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## 6.0 TEST RESULTS

### 6.1 Summary



Company Name: Device Solutions Inc.  
 FCC ID: OXW-PA0020  
 Method/System: Frequency Hopping Spread Spectrum (FHSS)  
 Number of Channels: 50

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
<b>TRANSMITTER MODE (Tx)</b>					
15.247(a)(1)(i)	20dB Bandwidth	< 500kHz	CONDUCTED	PASS	Section 6.2
15.247(b)(2)	Peak Transmitter Output Power	< 1 Watt if $\geq 50$ non-overlapping channels used		PASS	Section 6.3
15.247(a)(1)	Channel Separation	> 20 dB BW		PASS	Section 6.5
15.247(a)(1)(i)	Number of Channels	> 50 Channels		PASS	Section 6.7
15.247(a)(1)(i)	Time of Occupancy	< 0.4 sec in 20 sec period		PASS	Section 6.6
15.247(d)	Band Edge / Out-of-Band Emissions	Conducted > 20dBc		PASS	Section 6.4, Section 6.8
15.205, 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-210 table 3 limits)	RADIATED	PASS	Section 6.9, Section 6.10

**Table 6-1. Summary of Test Results**

#### Notes:

- 1) The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers

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## 6.2 20dB Bandwidth Measurement

### §15.247 (a.1.i)

The bandwidth at 20dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies. **The maximum permissible 20dB bandwidth is 1 MHz, unless more than 15 non-overlapping channels are employed.**

Frequency [MHz]	Channel No.	20dB Bandwidth Test Results	
		Measured Bandwidth [kHz]	Pass/Fail
904.8	Low	210.60	Pass
914.8	Mid	207.90	Pass
924.8	High	197.50	Pass

Table 6-2. Conducted 20dB Bandwidth Measurements

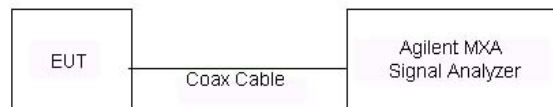
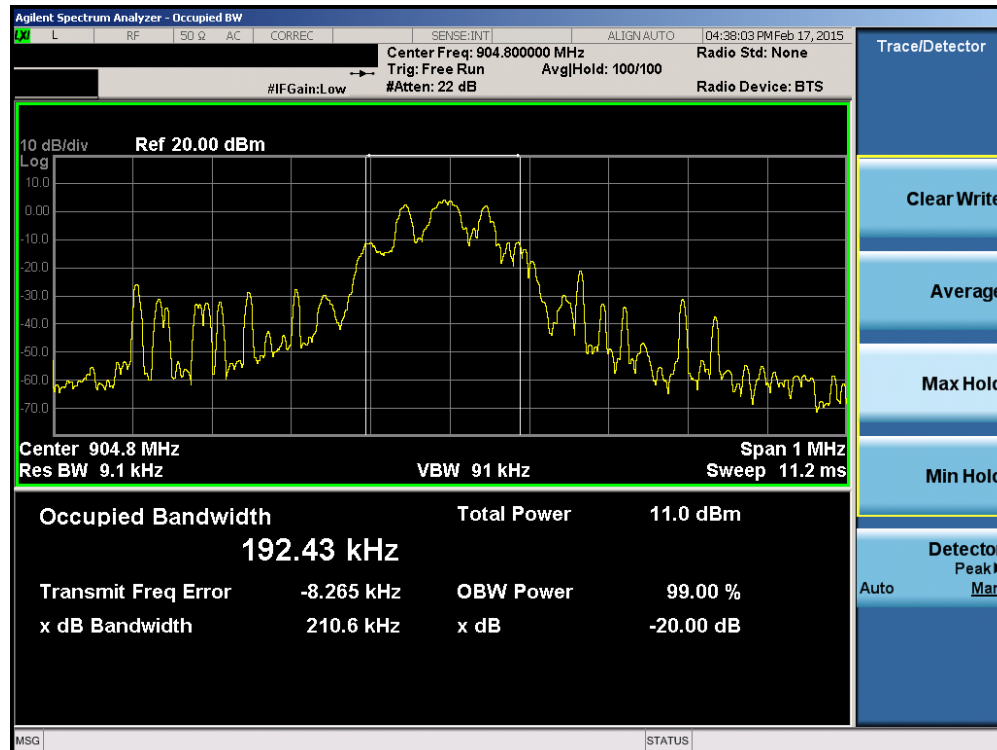
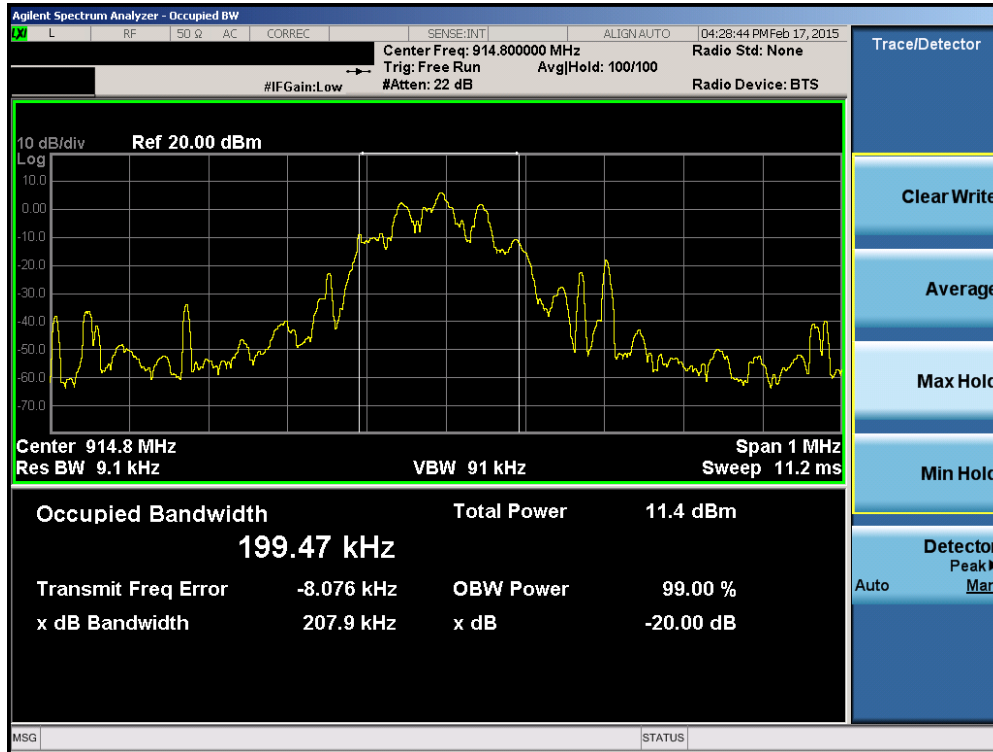


Figure 6-1. Test Instrument & Measurement Setup

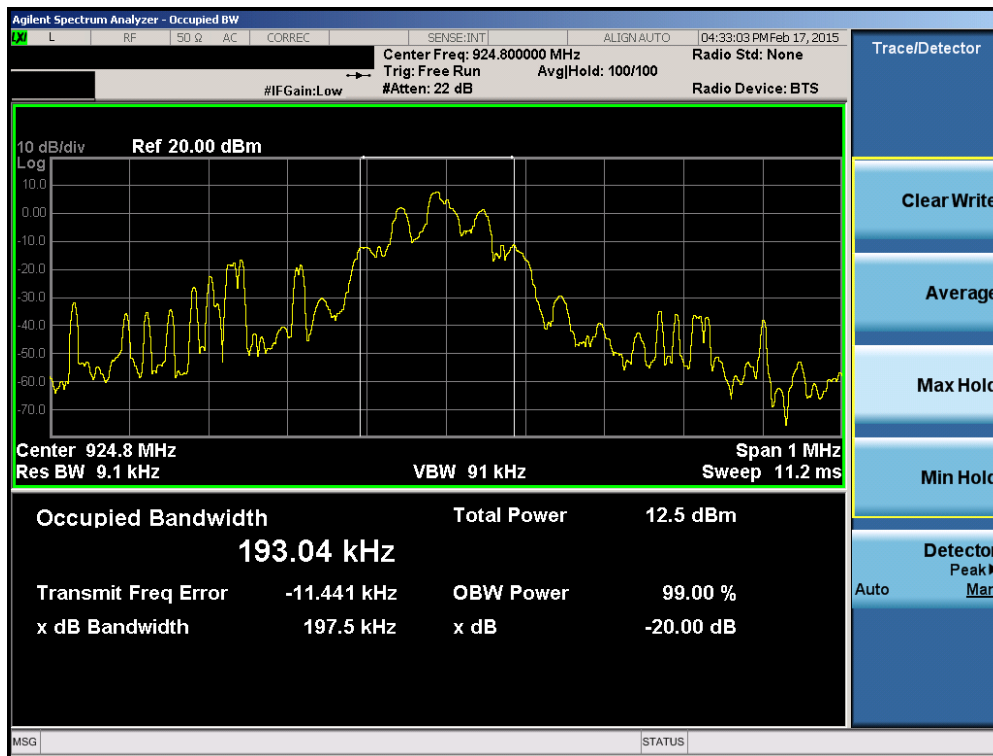


Plot 6-1. 20dB Bandwidth Plot (Low Channel)

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**Plot 6-2. 20dB Bandwidth Plot (Mid Channel)**



**Plot 6-3. 20dB Bandwidth Plot (High Channel)**

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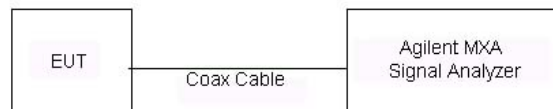
## 6.3 Output Power Measurement

### §15.247 (b.2)

Measurement is made while the EUT is operating in non-hopping transmission mode. The powers shown below were measured using a spectrum analyzer. Peak power measurements are performed in the analyzers' swept spectrum mode using a peak detector with RBW = VBW = 3MHz. **Since at least 50 hopping channels are used, the maximum permissible output power is 1 Watt.**

Frequency [MHz]	Channel No.	Peak Conducted Power	
		[dBm]	[mW]
904.8	Low	8.26	6.691
914.8	Mid	8.00	6.310
924.8	High	7.80	6.026

**Table 6-3. Conducted Output Power Measurements**





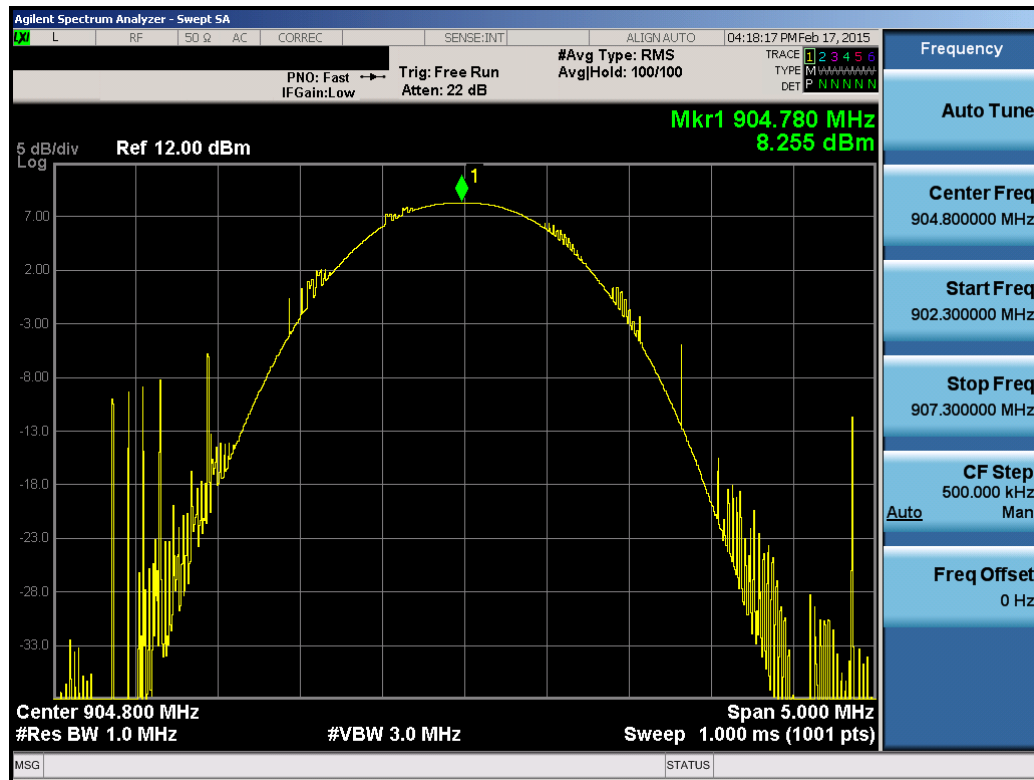
**Figure 6-2. Test Instrument & Measurement Setup**

#### Note

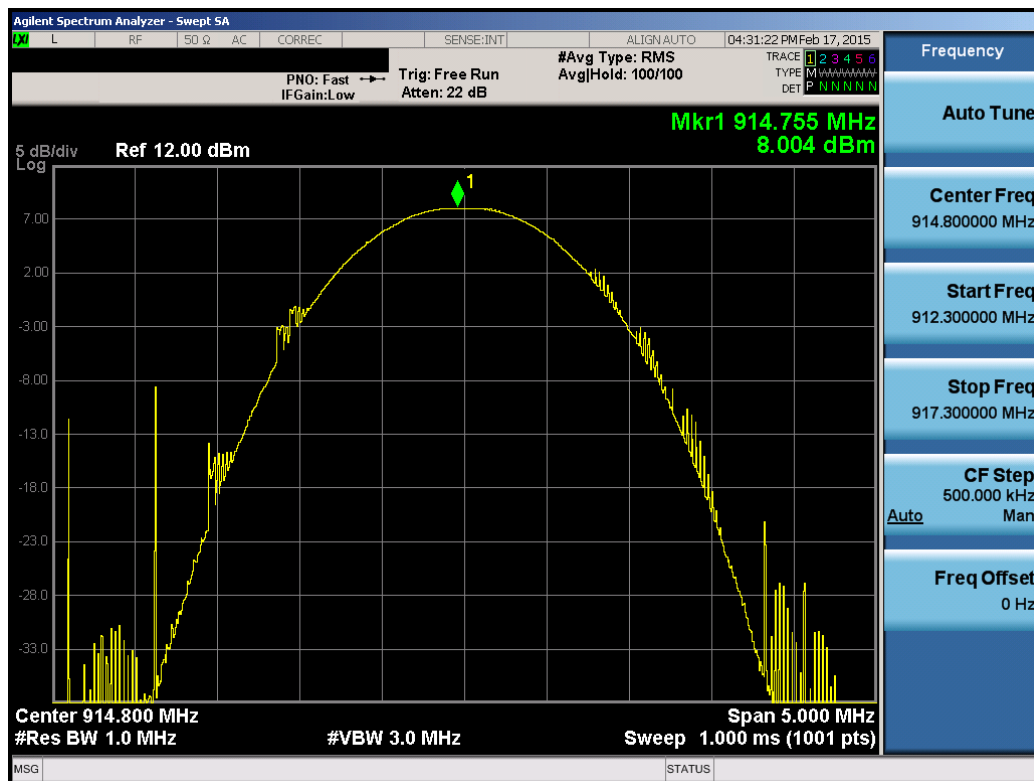
Final results were obtained using calibrated couplers, attenuators and cables. The following formula was used:

$$\text{Output Power (dBm)} = \text{Raw Analyzer Level (dBm)} + \text{Cable Loss (dB)} + \text{Attenuator Loss (dB)}$$

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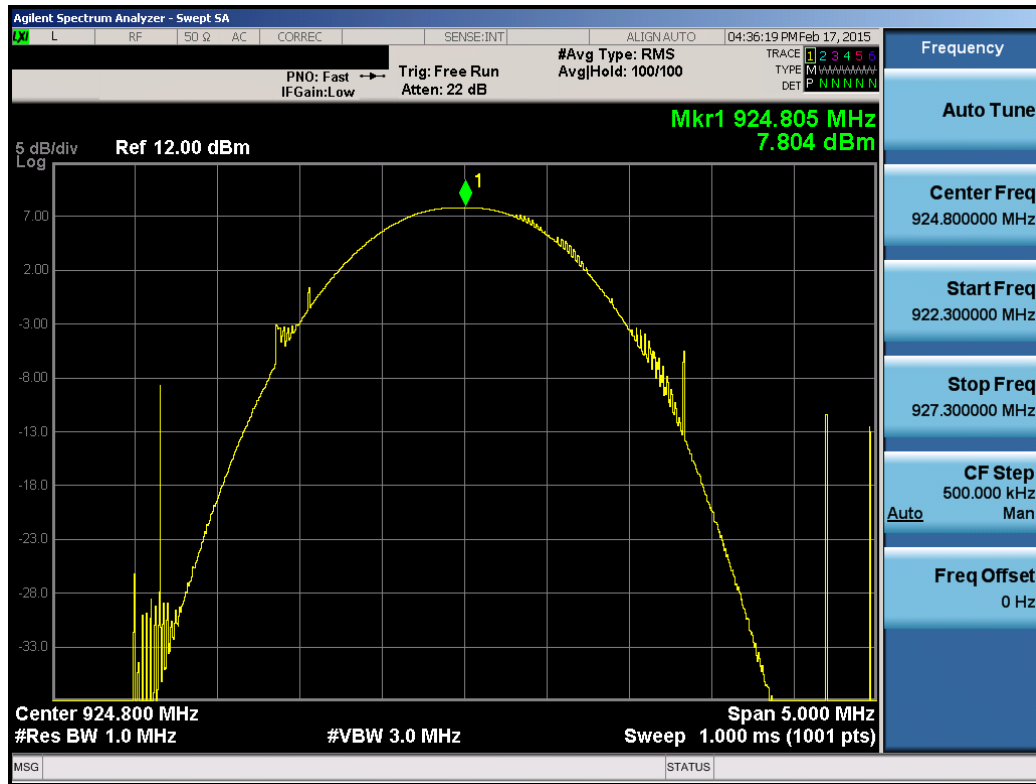


Plot 6-4. Peak Conducted Power (Low Channel)



Plot 6-5. Peak Conducted Power (Mid Channel)

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Plot 6-6. Peak Conducted Power (High Channel)

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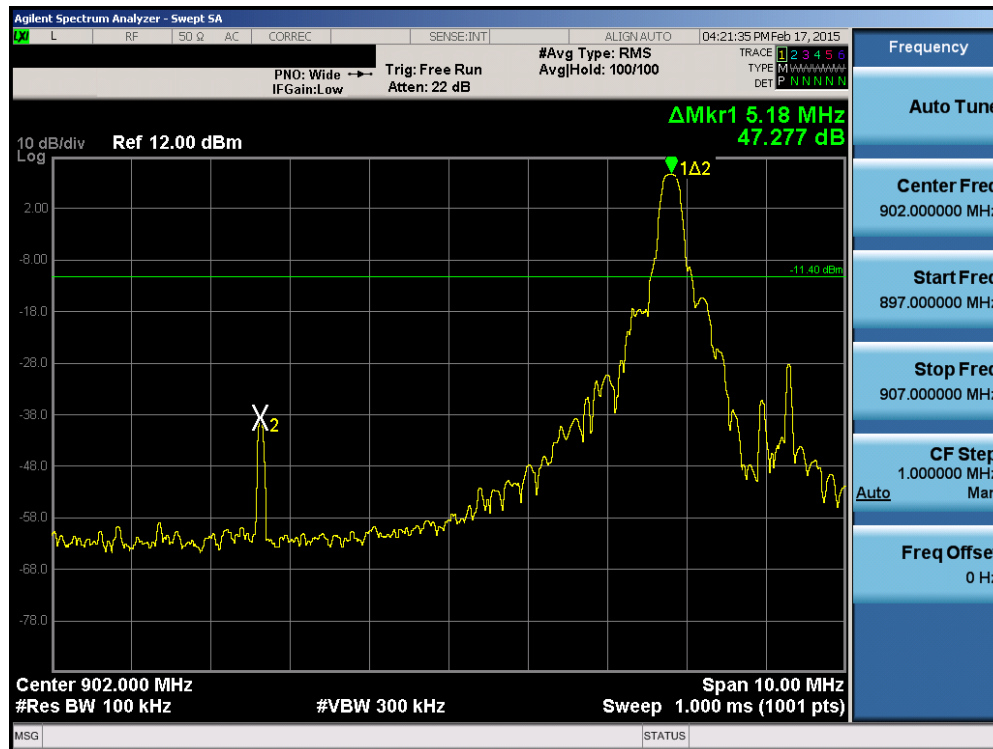


## 6.4 Band Edge Compliance

### \$15.247 (d)

Measurement is taken at the highest point located outside of the emission bandwidth. **The maximum permissible emission level is 20 dBc. Any emission lying outside of the emission bandwidth and in a restricted band is subject to a field strength limit specified in Section 15.209 of the Title 47 CFR.**

Out of band conducted spurious emissions at the band edge were investigated with the EUT transmitting at its maximum power in hopping and non-hopping modes. Plots of the worst case emissions are shown below.

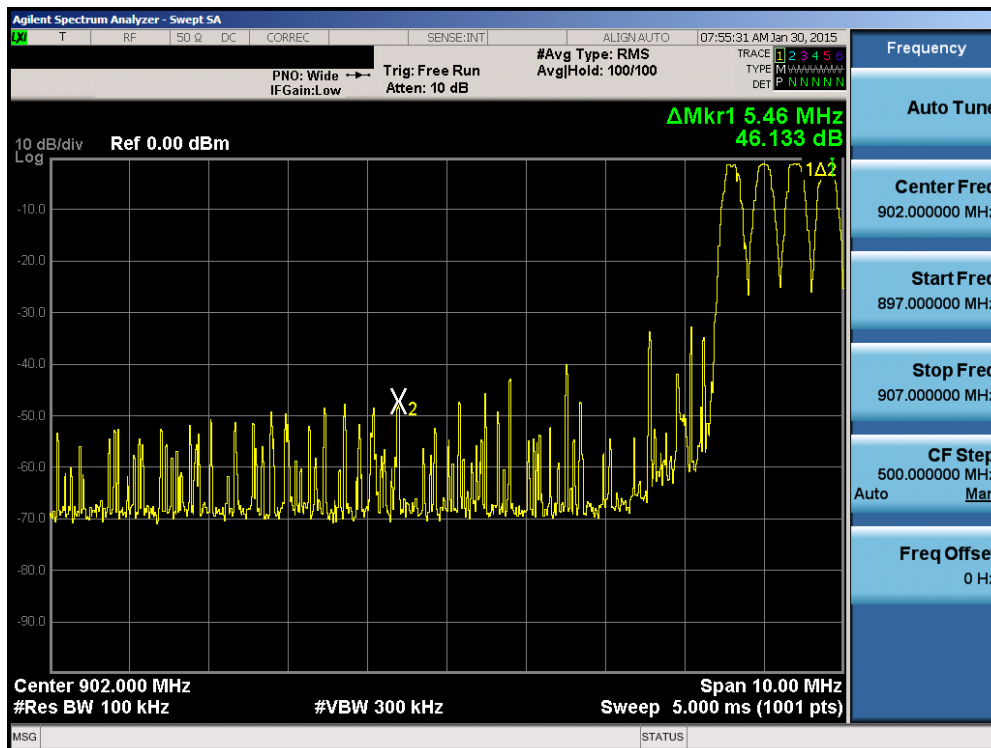


Plot 6-7. Lower Band Edge Plot (Hopping Disabled)

FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
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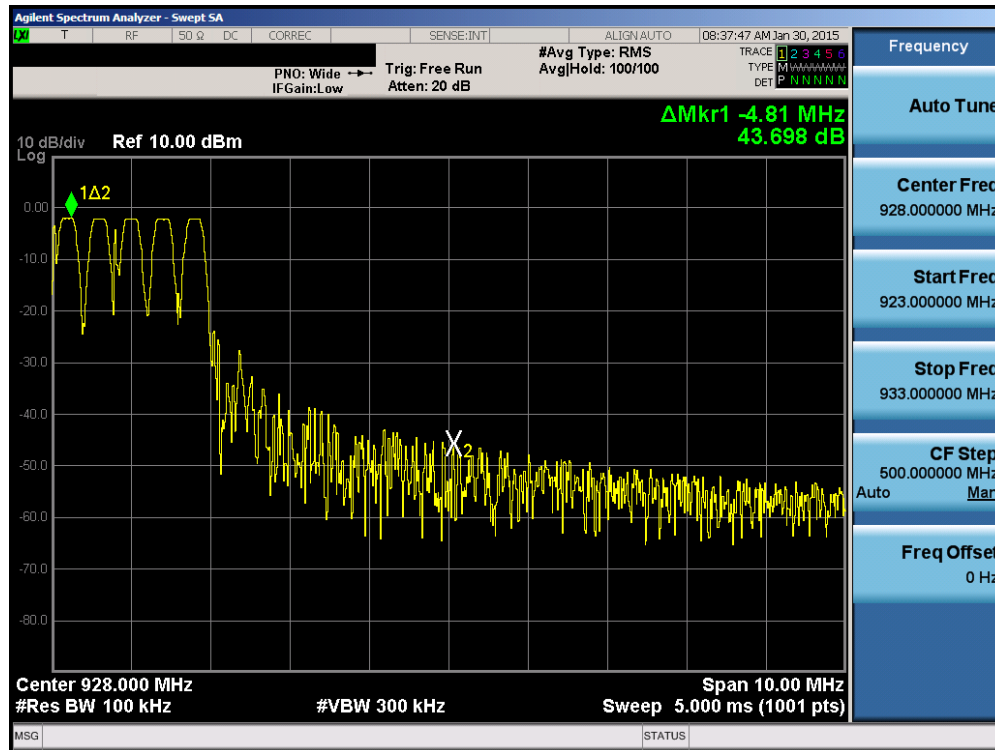


Plot 6-8. Upper Band Edge Plot (Hopping Disabled)



Plot 6-9. Lower Band Edge Plot (Hopping Enabled)

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Plot 6-10. Upper Band Edge Plot (Hopping Enabled)

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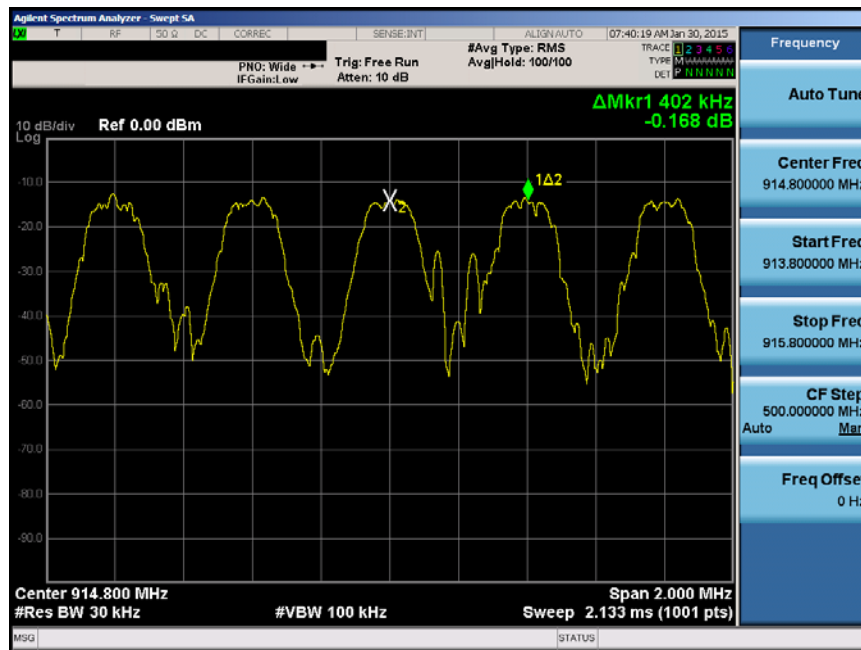
## 6.5 Carrier Frequency Separation

### §15.247 (a.1)

Measurement is made with EUT operating in hopping mode. **The minimum permissible channel separation for this system is equal to the value of the 20dB BW.**

Frequency [MHz]	Channel No.	Min. Channel Separation [kHz]
904.8	Low	210.6
914.8	Mid	207.9
924.8	High	197.5

Table 6-4. Minimum Channel Separation



Plot 6-11. Channel Spacing Plot (Bluetooth)

FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
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## 6.6 Time of Occupancy

**\$15.247 (a.1.i)**

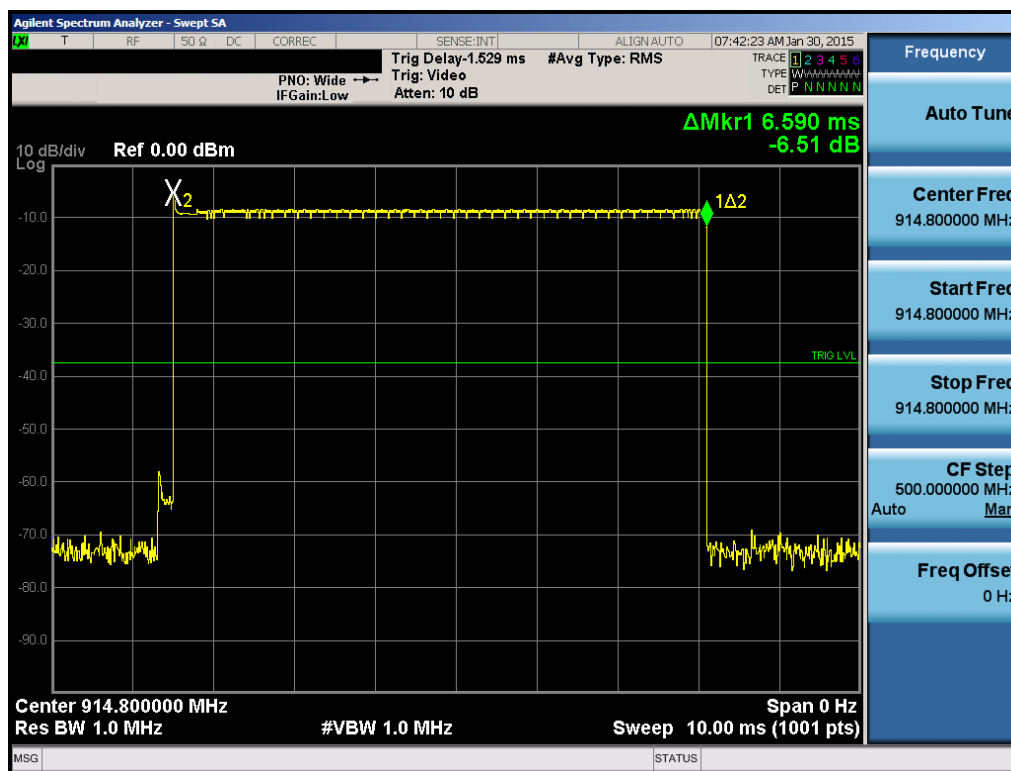
Measurement is made while EUT is operating in hopping mode with the spectrum analyzer set to zero span. **The maximum permissible time of occupancy is 400 ms within a period of 20 seconds.**

This device operates by sending bursts comprised of 60 pulses (Plot 6-13) each having a pulse width of 6.59ms (Plot 6-12). As the device pseudo-randomly hops through its hop table, it takes roughly 90 seconds before the device returns to the original transmitting channel. Thus, the worst case dwell time over any 20 second window (Plot 6-14) only includes one 60-pulse burst.

### Time of Occupancy Calculation

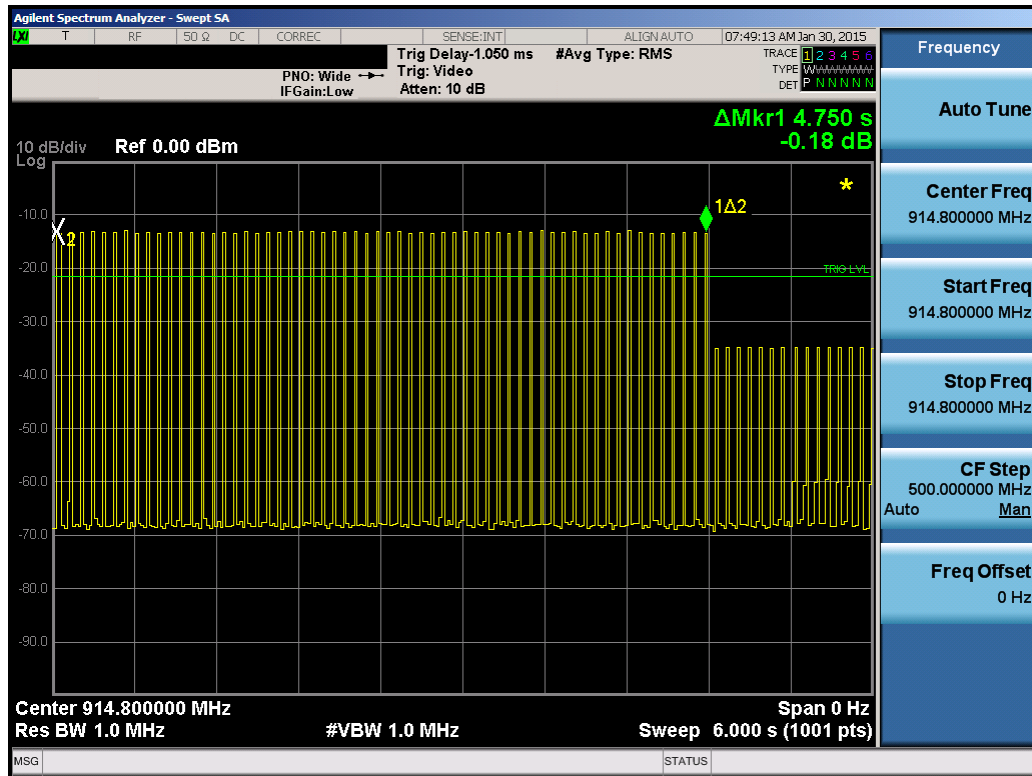
The maximum allowed time of occupancy is 400 ms within any 20 second period.

- Worst case 20 second period includes only one occurrence of a 60-pulse burst
- $6.59\text{ms} \times 60 \text{ pulses/burst} = 395.4\text{ms}$  (worst case dwell time for one channel)

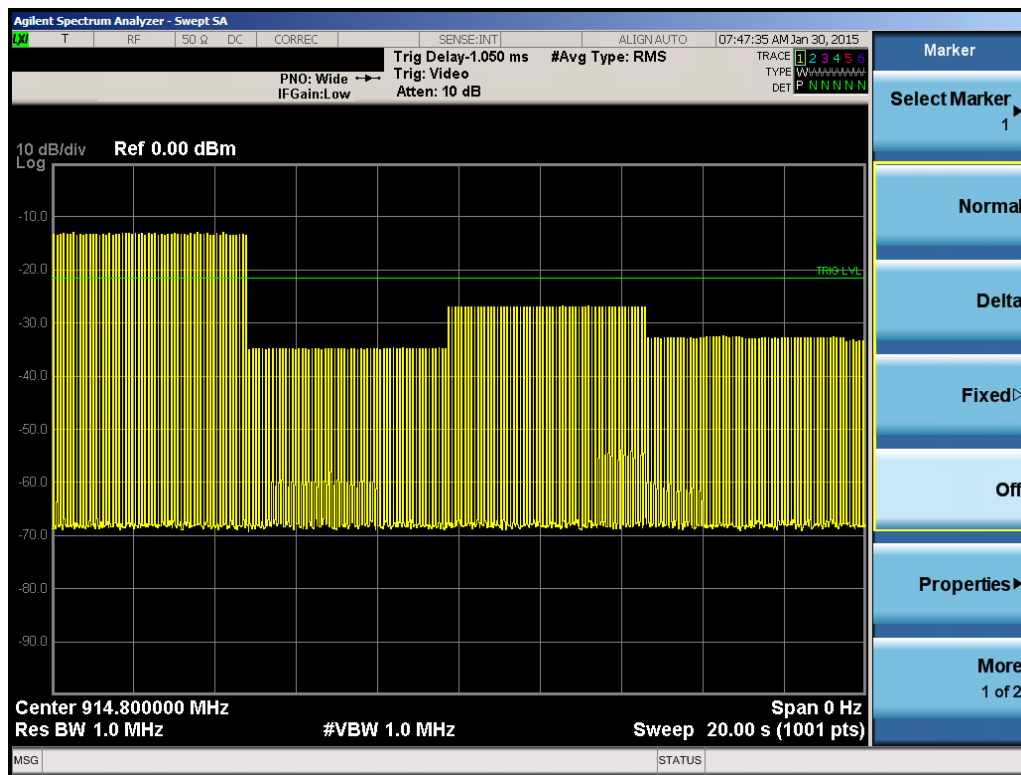


Plot 6-12. Time of Occupancy Plot (Bluetooth)

FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
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Plot 6-13. Burst Length Plot



Plot 6-14. Worst Case Dwell Time in a 20 second Period

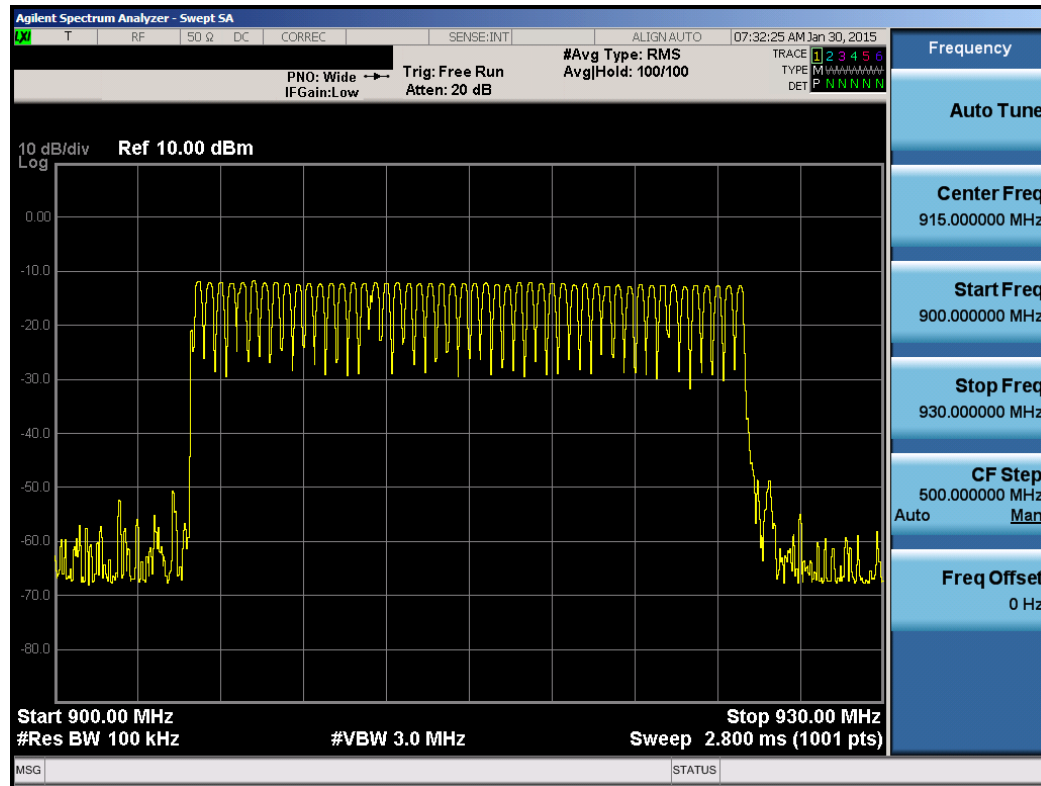
FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
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## 6.7 Number of Hopping Channels

### §15.247 (a.1.i)

Measurement is made while EUT is operating in hopping mode. ***This frequency hopping system must employ a minimum of 50 hopping channels since the 20dB BW is less than the required 250 kHz.***



Plot 6-15. Low End Spectrum Channel Hopping Plot (Bluetooth)

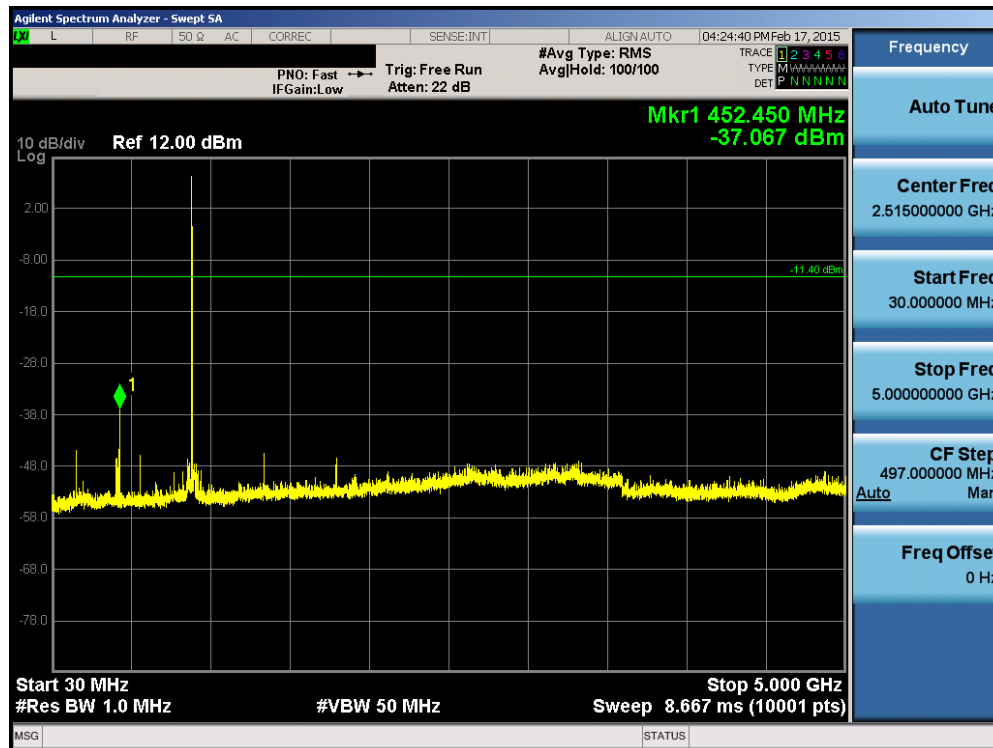
FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
Test Report S/N: 0Y1501280261.OXW	Test Dates: 01/30 - 03/12/2015	EUT Type: Sensor II Board Module		Page 21 of 36

## 6.8 Conducted Spurious Emissions

### \$15.247 (d)

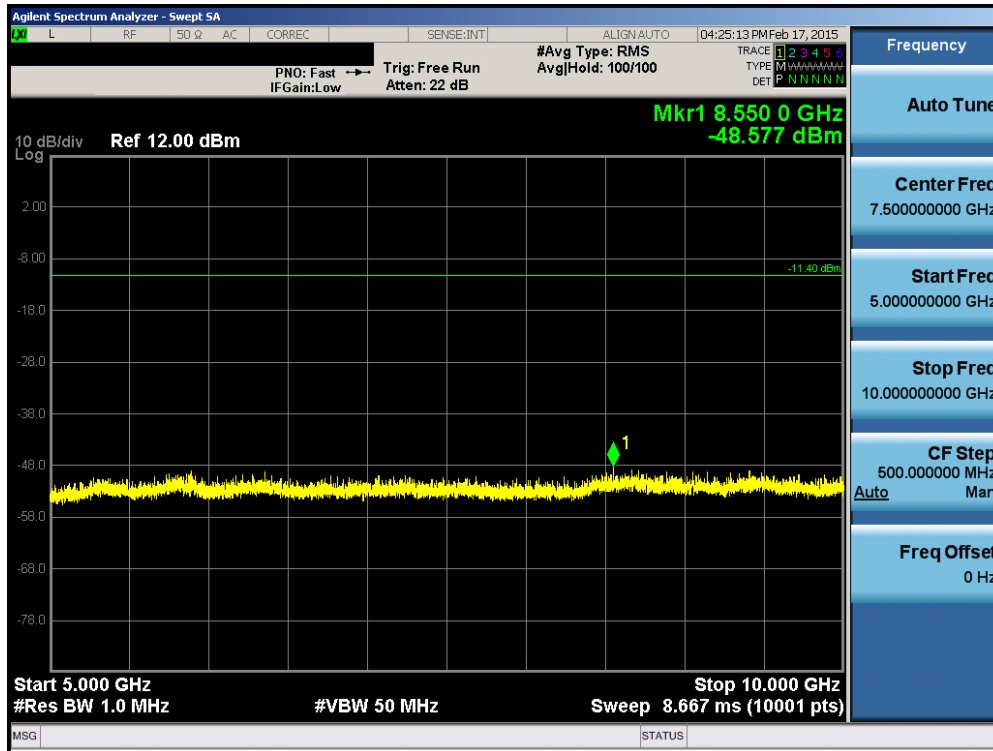
Out of band conducted spurious emissions were performed with the EUT in non-hopping mode. Plots of the worst case emissions are shown below.

The display line shown in the following plots denotes the limit at 20dB below the fundamental emission level measured in a 100kHz bandwidth. However, since the traces in the following plots are measured with a 1MHz RBW, the display line may not necessarily appear to be 20dB below the level of the fundamental in a 1MHz bandwidth.

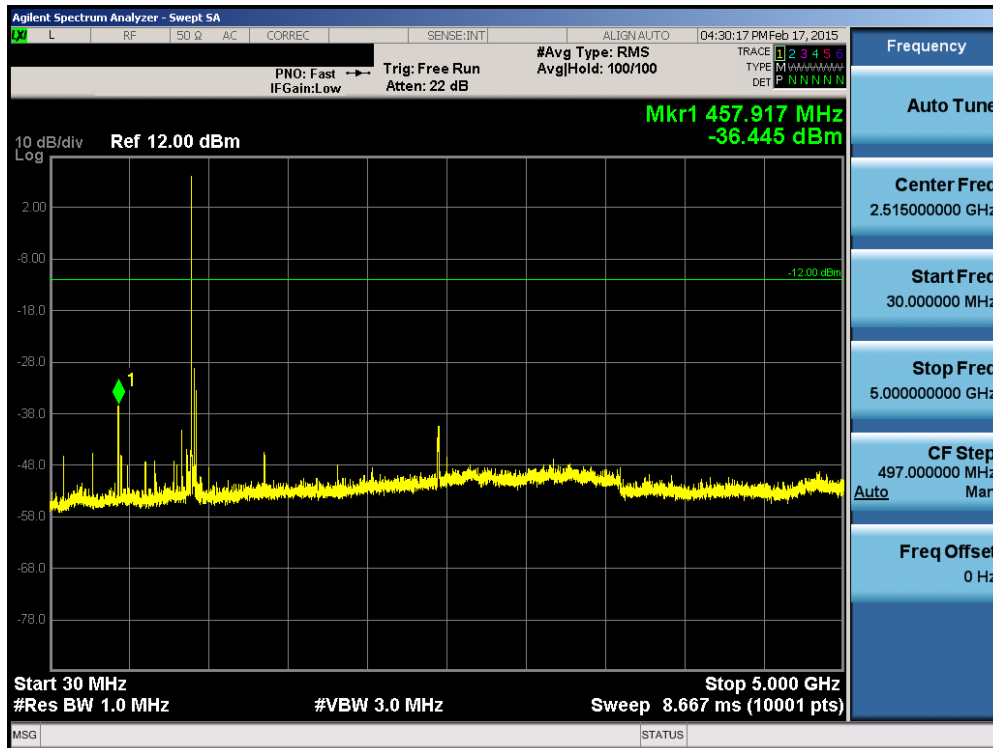


**Plot 6-16. Conducted Spurious Plot (Low Channel)**

FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
Test Report S/N: 0Y1501280261.OXW	Test Dates: 01/30 - 03/12/2015	EUT Type: Sensor II Board Module		Page 22 of 36

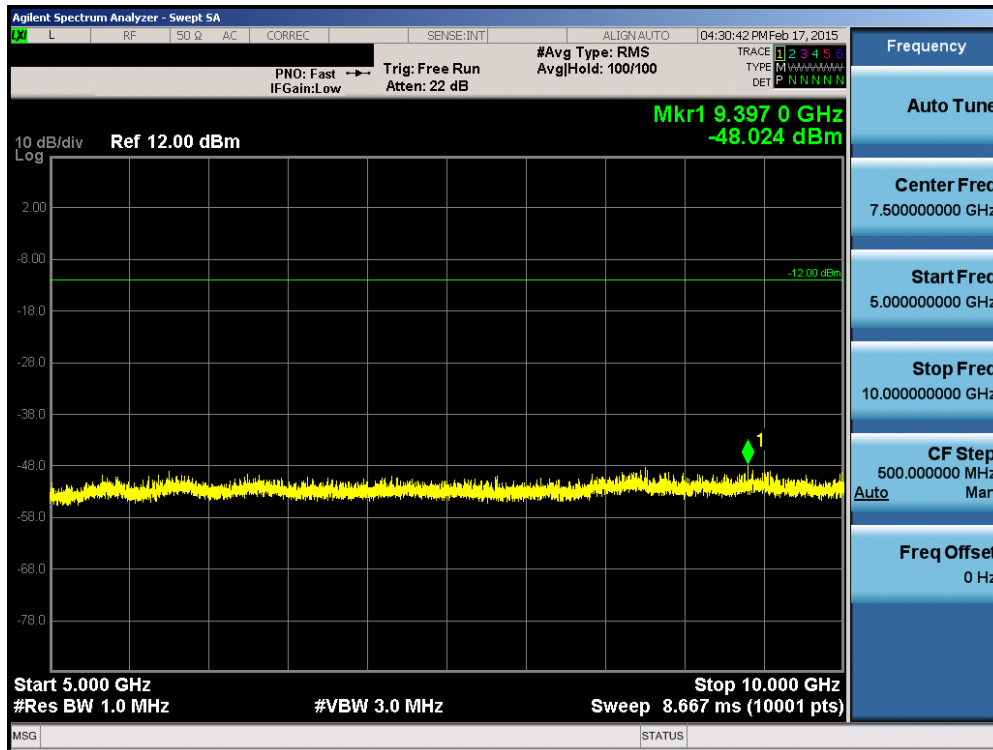


Plot 6-17. Conducted Spurious Plot (Low Channel)

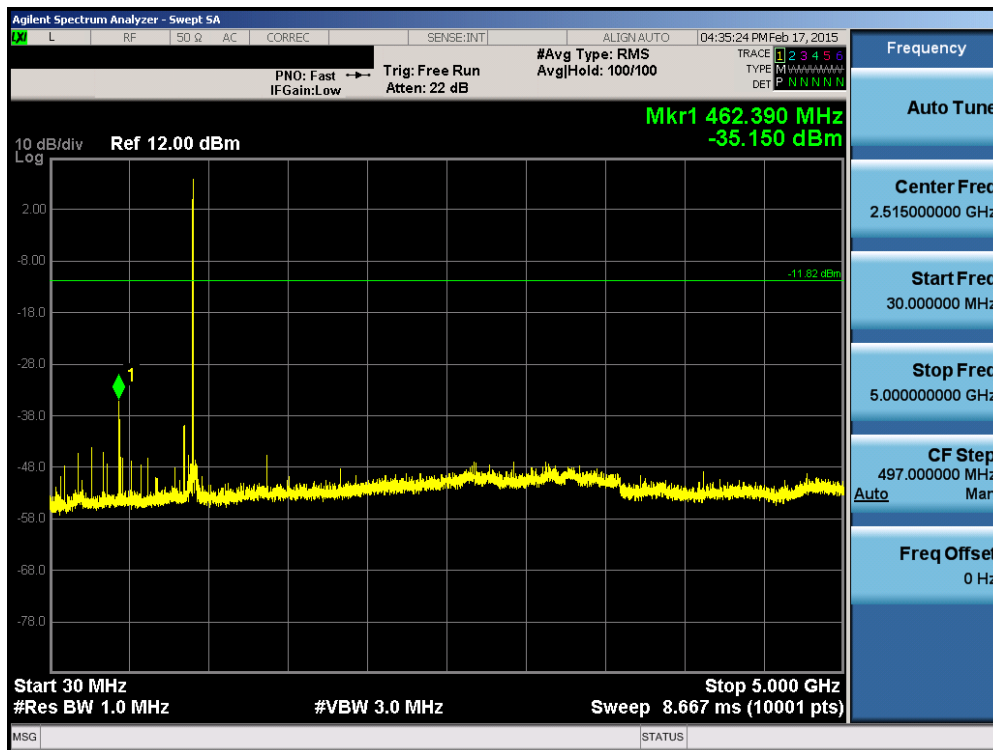


Plot 6-18. Conducted Spurious Plot (Mid Channel)

FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
Test Report S/N: 0Y1501280261.OXW	Test Dates: 01/30 - 03/12/2015	EUT Type: Sensor II Board Module		Page 23 of 36

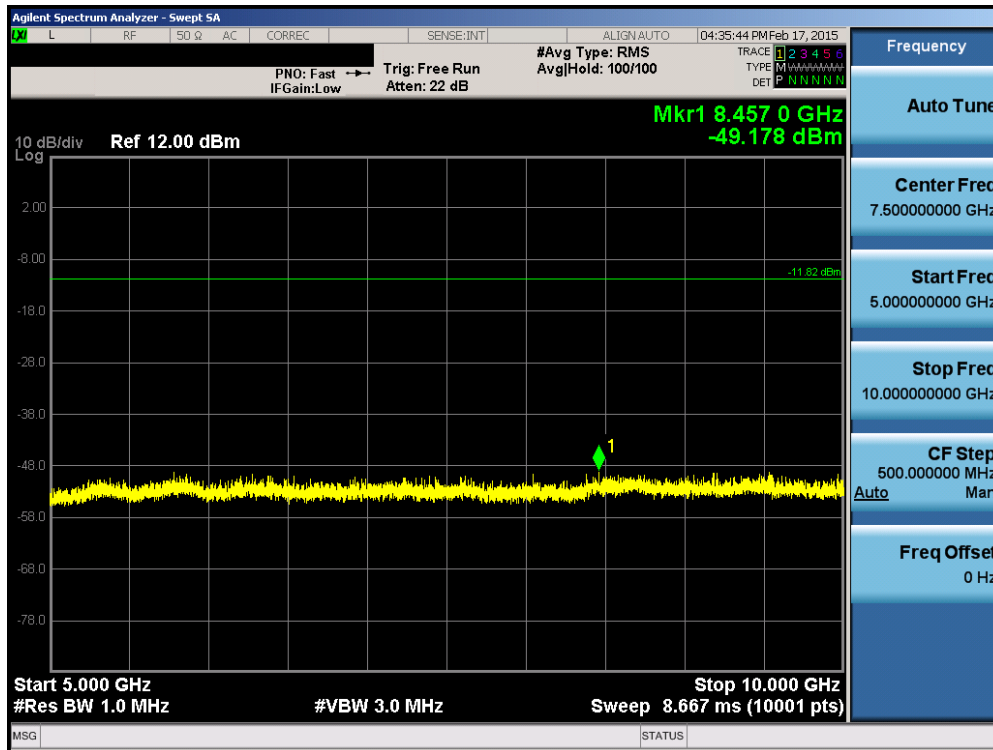


Plot 6-19. Conducted Spurious Plot (Mid Channel)



Plot 6-20. Conducted Spurious Plot (High Channel)

FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
Test Report S/N: 0Y1501280261.OXW	Test Dates: 01/30 - 03/12/2015	EUT Type: Sensor II Board Module		Page 24 of 36



Plot 6-21. Conducted Spurious Plot (High Channel)

FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
Test Report S/N: 0Y1501280261.OXW	Test Dates: 01/30 - 03/12/2015	EUT Type: Sensor II Board Module		Page 25 of 36

## 6.9 Radiated Spurious Emission Measurements – Above 1GHz

§15.205 §15.209 §15.247 (d)

Frequency	Field Strength [ $\mu\text{V/m}$ ]	Measured Distance [Meters]
Above 960.0 MHz	500	3

**Table 6-5. Radiated Limits**

### Sample Calculation



- Field Strength Level [ $\text{dB}\mu\text{V/m}$ ] = Analyzer Level [ $\text{dBm}$ ] + 107 + AFCL [ $\text{dB/m}$ ] + Duty Cycle Correction [ $\text{dB}$ ]
- AFCL [ $\text{dB/m}$ ] = Antenna Factor [ $\text{dB/m}$ ] + Cable Loss [ $\text{dB}$ ]
- Margin [ $\text{dB}$ ] = Field Strength Level [ $\text{dB}\mu\text{V/m}$ ] – Limit [ $\text{dB}\mu\text{V/m}$ ]

### Duty Cycle Correction Factor Calculation

- Pulse Repetition Interval = 30ms (PRI)
- Pulse Width = 6.59ms
- In the worst case 100ms window, there will be 4 pulse widths, based on a PRI of 30ms
- Worst Case Dwell Time = 6.59ms x 4 = 26.36ms
- Duty Cycle Correction =  $20\log(\text{Worst Case Dwell Time}/100\text{ms})$  [ $\text{dB}$ ] = -11.58dB

### Test Notes

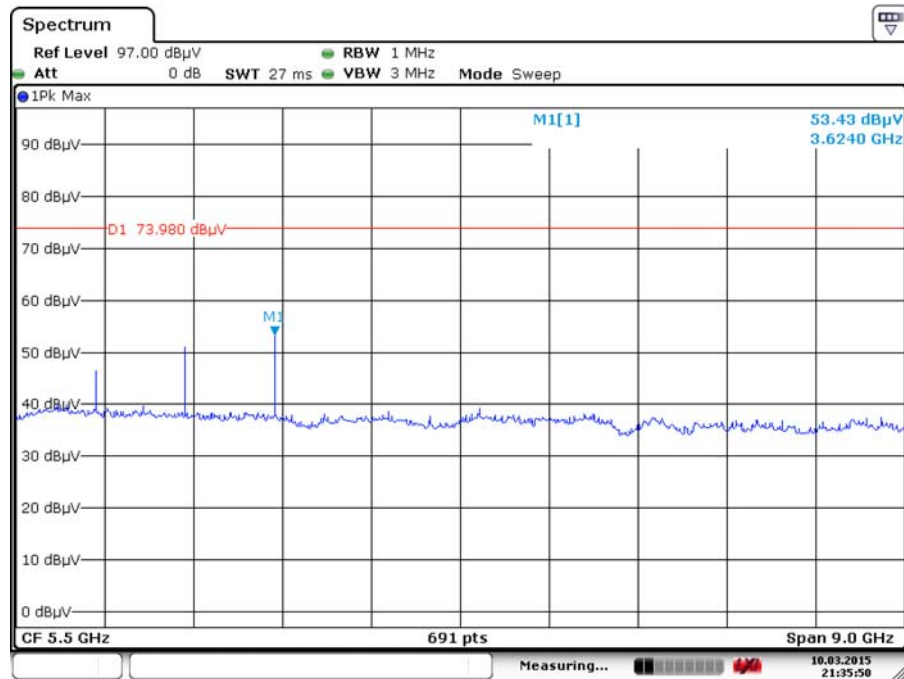
- All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 6-5.
- No significant radiated emissions were found in the 2310 - 2390MHz restricted band.
- Average measurements > 1GHz using RBW = 1MHz and VBW = 1kHz  $\geq 1/\tau$  Hz, where  $\tau$  = pulse width in seconds. Peak measurements > 1GHz using RBW = 1MHz and VBW = 3MHz. Both average and peak measurements were made using a peak detector.
- The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
- This unit was tested while powered by a 9V battery.
- The spectrum is measured from 9kHz to the 10<sup>th</sup> harmonic and the worst-case emissions are reported.
- The duty cycle correction factor was not applied to noise floor measurements.

FCC ID: OXW-PA0020		FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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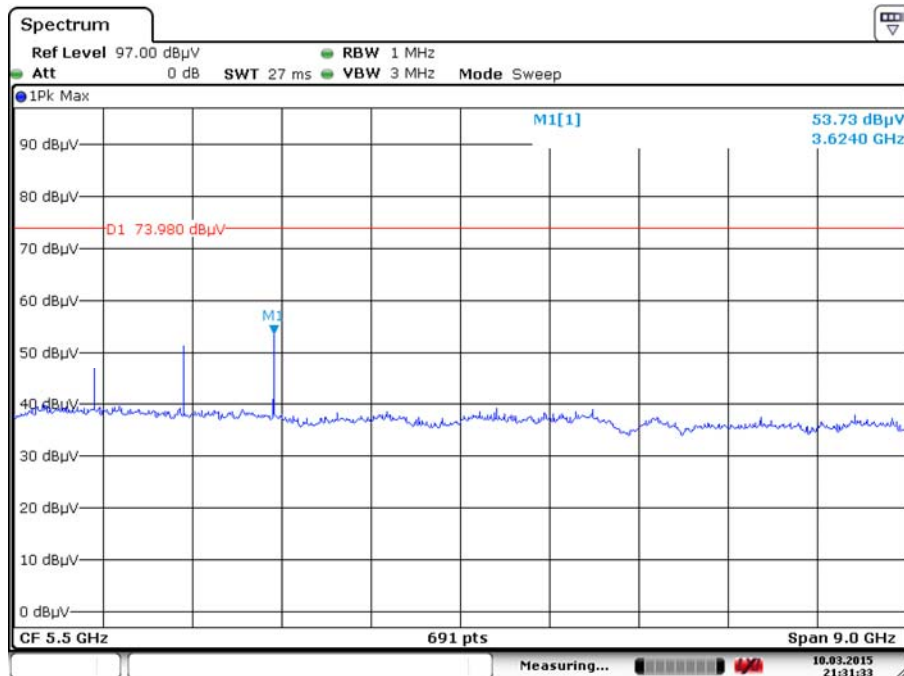
## Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247 (d)



Date: 10.MAR.2015 21:35:50

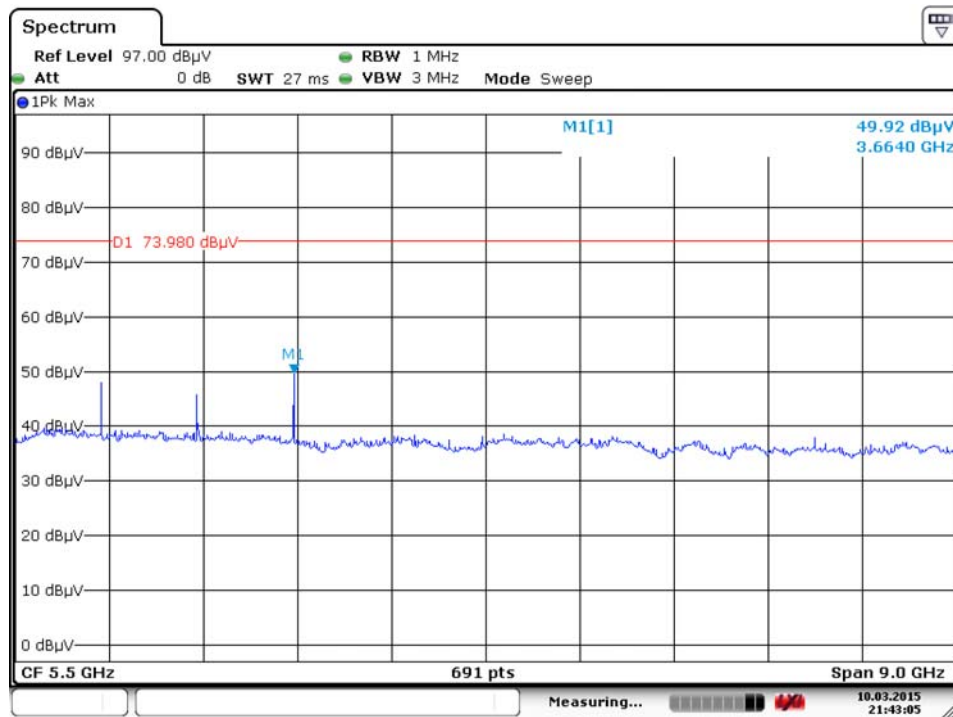
**Plot 6-22. Radiated Spurious Plot above 1GHz (Low Channel) (Pol. H)**



Date: 10.MAR.2015 21:31:34

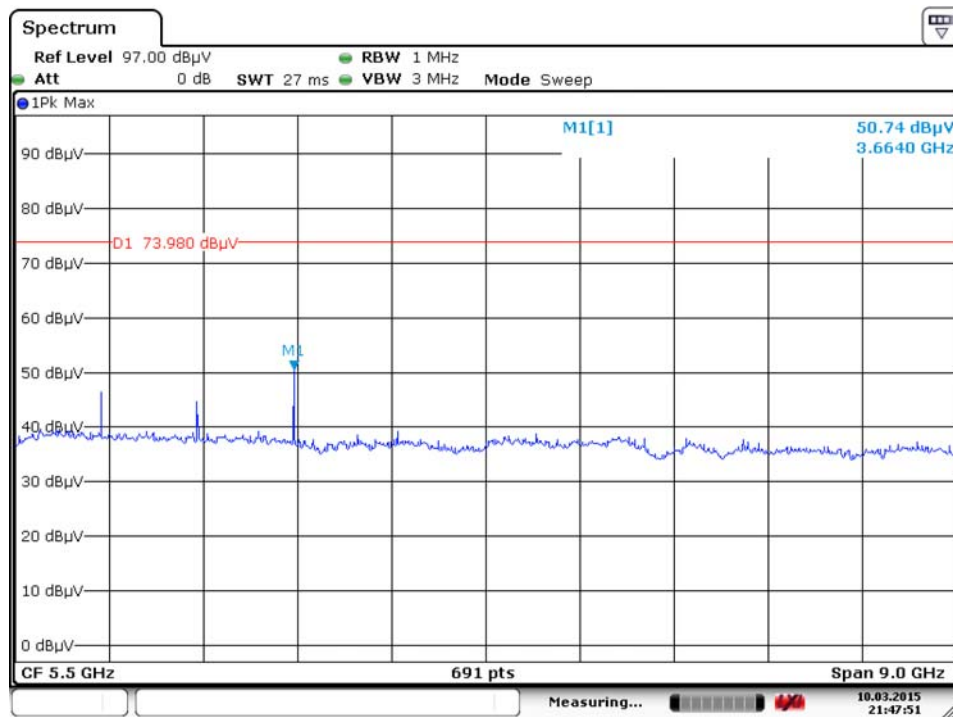
**Plot 6-23. Radiated Spurious Plot above 1GHz (Low Channel) (Pol. V)**

FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
Test Report S/N: 0Y1501280261.OXW	Test Dates: 01/30 - 03/12/2015	EUT Type: Sensor II Board Module		Page 27 of 36



Date: 10. MAR 2015 21:43:05

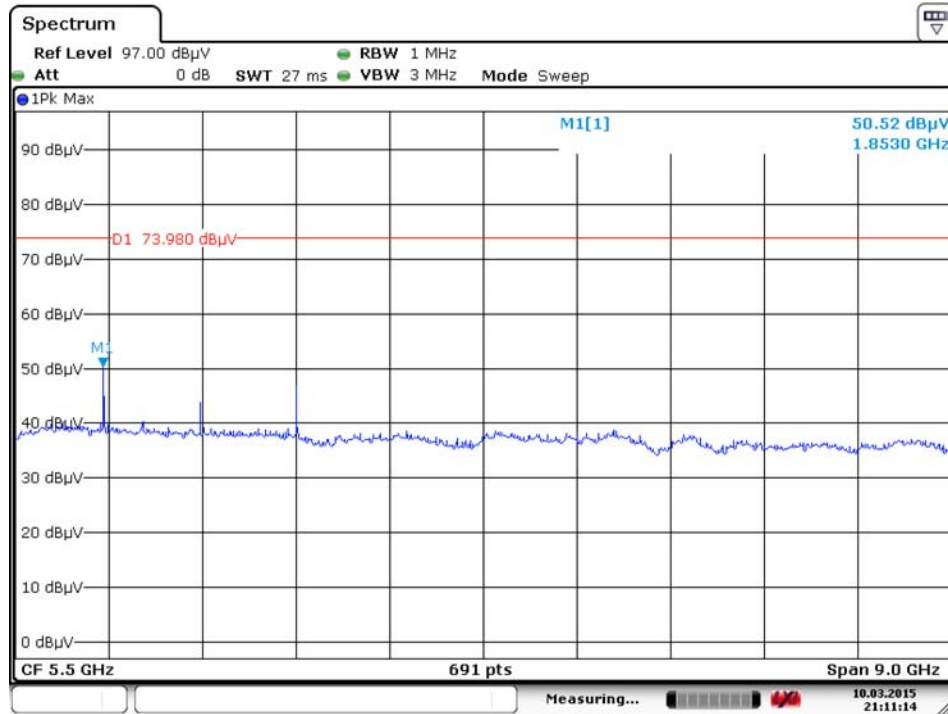
**Plot 6-24. Radiated Spurious Plot above 1GHz (Mid Channel) (Pol. H)**



Date: 10. MAR 2015 21:47:51

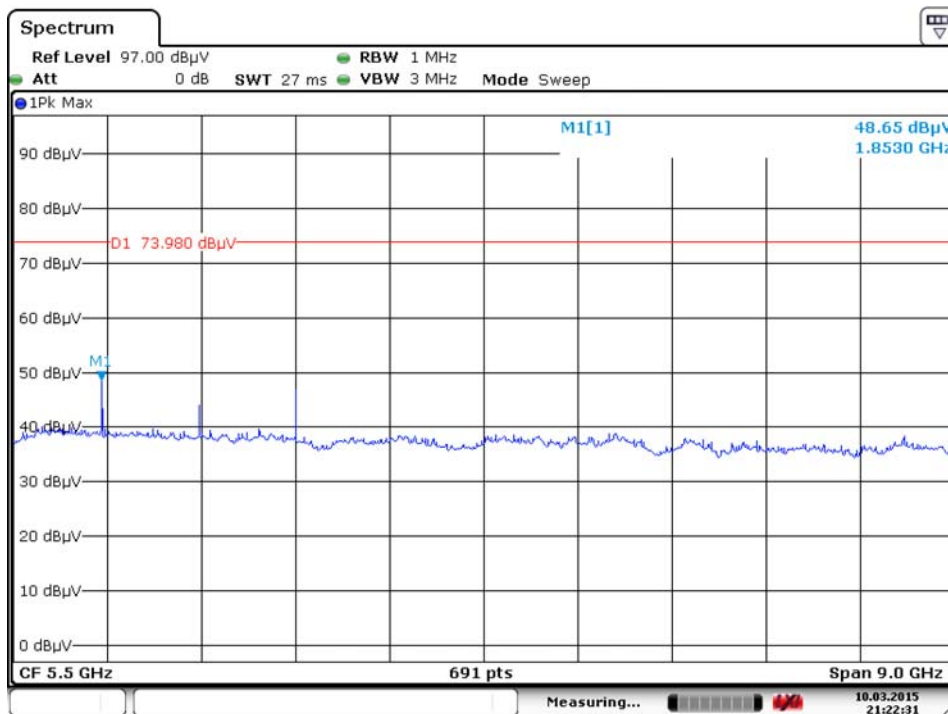
**Plot 6-25. Radiated Spurious Plot above 1GHz (Mid Channel) (Pol. V)**

FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DeviceSolutions</b> Integration. Redefined.	Reviewed by: Quality Manager
Test Report S/N: 0Y1501280261.OXW	Test Dates: 01/30 - 03/12/2015	EUT Type: Sensor II Board Module		Page 28 of 36



Date: 10.MAR.2015 21:11:14

**Plot 6-26. Radiated Spurious Plot above 1GHz (High Channel) (Pol. H)**



Date: 10.MAR.2015 21:22:31

**Plot 6-27. Radiated Spurious Plot above 1GHz (High Channel) (Pol. V)**

FCC ID: OXW-PA0020	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)	<b>DS</b> DeviceSolutions Integration. Redefined.	Reviewed by: Quality Manager
Test Report S/N: 0Y1501280261.OXW	Test Dates: 01/30 - 03/12/2015	EUT Type: Sensor II Board Module		Page 29 of 36

## Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247 (d)

Measurement Distance: 3 Meters  
 Operating Frequency: 904.8MHz



Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB]	Duty Cycle Correction [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
2714.40	-88.53	Avg	H	32.96	-11.58	39.85	53.98	-14.13
2714.40	-86.93	Peak	H	32.96	0.00	53.03	73.98	-20.95
3619.20	-84.31	Avg	H	36.39	-11.58	47.50	53.98	-6.48
3619.20	-83.42	Peak	H	36.39	0.00	59.97	73.98	-14.01
4524.00	-112.79	Avg	H	38.94	-11.58	21.57	53.98	-32.41
4524.00	-99.20	Peak	H	38.94	0.00	46.74	73.98	-27.24
5428.80	-114.52	Avg	H	42.42	0.00	34.90	53.98	-19.08
5428.80	-101.02	Peak	H	42.42	0.00	48.40	73.98	-25.58

**Table 6-6. Radiated Measurements**

Measurement Distance: 3 Meters  
 Operating Frequency: 914.8MHz

Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB]	Duty Cycle Correction [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
2744.40	-92.24	Avg	H	33.01	-11.58	36.19	53.98	-17.79
2744.40	-90.26	Peak	H	33.01	0.00	49.75	73.98	-24.23
3659.20	-87.56	Avg	H	36.70	-11.58	44.55	53.98	-9.43
3659.20	-86.10	Peak	H	36.70	0.00	57.59	73.98	-16.39
4574.00	-113.30	Avg	H	39.09	0.00	32.79	53.98	-21.19
4574.00	-99.98	Peak	H	39.09	0.00	46.11	73.98	-27.87

**Table 6-7. Radiated Measurements**

FCC ID: OXW-PA0020		FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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## Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247 (d)

Measurement Distance:	3 Meters
Operating Frequency:	924.8MHz

Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB]	Duty Cycle Correction [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
2774.40	-94.37	Avg	H	33.07	-11.58	34.13	53.98	-19.85
2774.40	-91.81	Peak	H	33.07	0.00	48.27	73.98	-25.71
3699.20	-91.12	Avg	H	37.08	-11.58	41.38	53.98	-12.60
3699.20	-89.42	Peak	H	37.08	0.00	54.66	73.98	-19.32
4624.00	-113.26	Avg	H	38.00	0.00	31.73	53.98	-22.24
4624.00	-99.48	Peak	H	38.00	0.00	45.51	73.98	-28.47

**Table 6-8. Radiated Measurements**

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## 6.10 Radiated Spurious Emissions Measurements – Below 1GHz

### §15.209

#### Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

***All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 6-9 per Section 15.209.***

Frequency	Field Strength [ $\mu\text{V/m}$ ]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

**Table 6-9. Radiated Limits**



#### Test Procedures Used

ANSI C63.4-2009

#### Test Settings

##### Quasi-Peak Field Strength Measurements

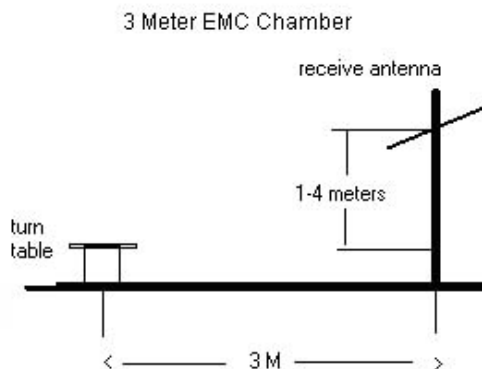
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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## Test Setup



The EUT and measurement equipment were set up as shown in the diagram below.



**Figure 6-3. Test Instrument & Measurement Setup**

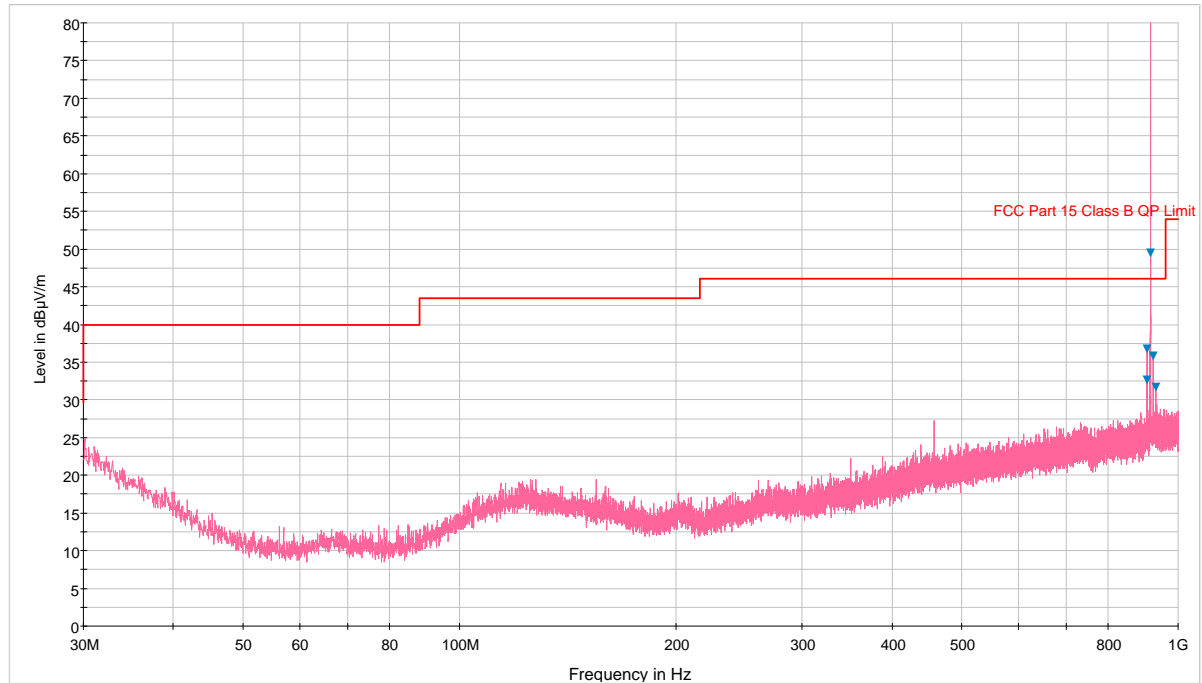
## Test Notes

1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 6-9.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested while powered by a 9V battery.
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
5. Emissions were measured at a 3 meter test distance.
6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
7. No spurious emissions were detected within 20dB of the limit below 30MHz.
8. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.

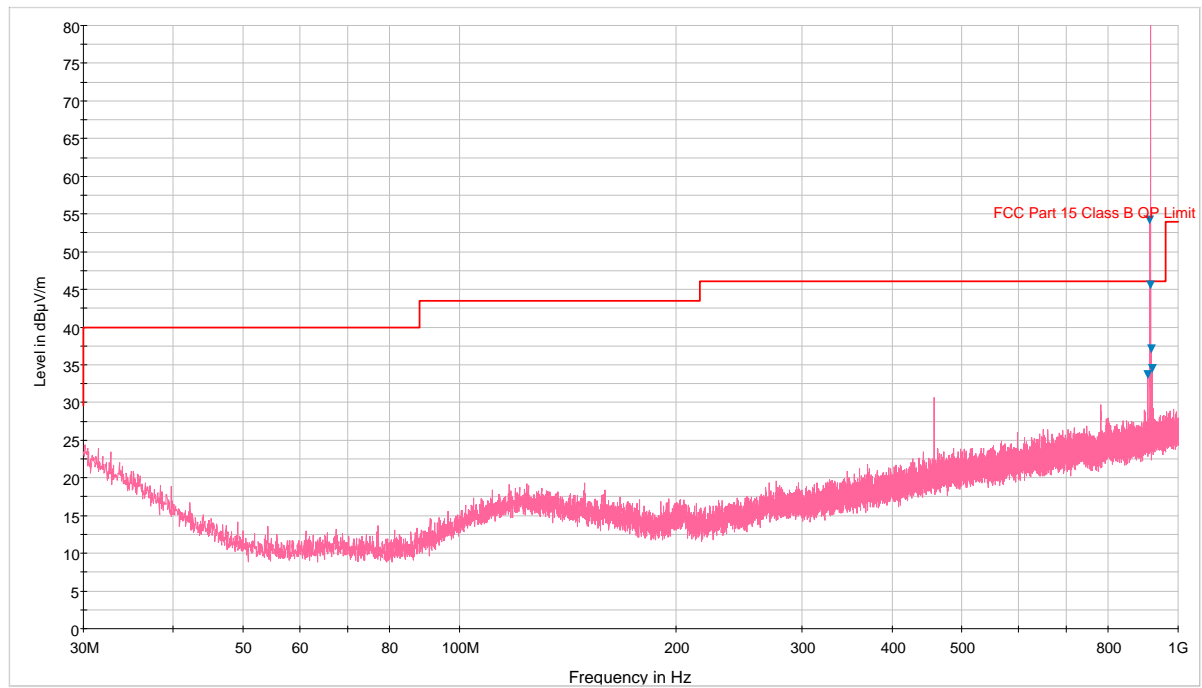
<b>FCC ID:</b> OXW-PA0020		<b>FCC Pt. 15.247 900MHz ISM BAND TEST REPORT (CERTIFICATION)</b>		<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0Y1501280261.OXW	<b>Test Dates:</b> 01/30 - 03/12/2015	<b>EUT Type:</b> Sensor II Board Module		Page 33 of 36

## Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209



**Plot 6-28. Radiated Spurious Plot below 1GHz (Pol. H)**



**Plot 6-29. Radiated Spurious Plot below 1GHz (Pol. V)**



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## Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209



Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
66.89	-103.19	Quasi-Peak	V	8.76	12.57	40.00	-27.43
154.55	-103.56	Quasi-Peak	V	13.70	17.14	43.52	-26.39
225.71	-103.64	Quasi-Peak	V	12.74	16.11	46.02	-29.92
430.53	-104.65	Quasi-Peak	V	18.34	20.69	46.02	-25.33
457.42	-102.66	Quasi-Peak	V	18.92	23.26	46.02	-22.76
515.64	-104.32	Quasi-Peak	V	19.96	22.65	46.02	-23.37

**Table 6-10. Radiated Spurious Emissions Below 1GHz**

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## 7.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Device Solutions Sensor II Board Module FCC ID: OXW-PA0020** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules.

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