WALSHIRE LABS

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47 C.F.R. Part 15 FCC Rules, Subpart C
Test Results for the

APS Asset Positioning Sensor

Equipment:	APS
Client:	Stay Secure Systems, LLC
Address:	18900 Serenoa CT
	Alva, FL 33920

Test Report Number: FCCIR-STAYSECURE-09-07-15B
Date: August 31, 2015
Total Number of Pages: 63

NVLAP LAP Code: 200125-0

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1 IDENTIFICATION SUMMARY

1.1 Test Report

Test Report Number: FCCIR-STAYSECURE-08-07-15B
Test Report Date: August 31, 2015

Report written and approved by:

Date	Name	Signature
August 31, 2015	Peter J. Walsh, NCE	Peter J. Walsh

1.2 Testing Laboratory

Walshire Labs, LLC
8545 126th Avenue North
Largo, FL 33773
USA

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1.3 Limits and Reservations

The test results in this report apply only to the particular Device Under Test (DUT) and component Implementations Under Test (IUTs) declared in this test report. The results and associated conclusions apply only to the DUT while operating in the configuration and modes described herein. The test data contained herein is intended to be used by a TCB for the purpose of achieving FCC Part 15 certification of the DUT. This test report has been updated to address observations made during the TCB review.

This test report shall not be reproduced except in full without the written permission of Walshire Labs or its assigns.

The test report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

1.4 Client Information

Name:	Stay Secure Systems, LLC
Street:	18900 Serenoa CT
City:	Alva
State:	FL
Zip Code	33920
Country:	USA
Contact Person:	Darryl J. Klein
Phone:	239-694-8080
Email:	darryljklein@gmail.com

1.5 Dates

Date of commission:	August 10, 2015
Date of receipt of DUT:	August 11, 2015
Date of test completion:	August 31, 2015

1.6 Device Under Test (DUT)

Name:	APS
Version:	Model M113PB
Unit Serial Number:	20720489
Antenna Type:	External ¼ wave Wire Vertical
Nominal Gain:	5.19 dBi
Modulation Type:	GFSK
Deviation:	11.25 KHz
Data Rate:	10777 Hz
Power:	12 VDC through Vehicle OBDII Interface

2 GENERAL INFORMATION

2.1 Product Description

The DOG is a revolutionary new wireless system designed exclusively for the automotive industry. It includes a secure, power-efficient Asset Positioning Sensor (APS) that is capable of reporting valuable vehicle information critical to dealer management, such as vehicle status, battery-supply voltage, fuel level, distance traveled, and more. This vehicle mounted device called the APS connects to car's OBDII port. The data is transmitted to a Master Radio that connects to a PC running a software program to present the data to the user as shown in Photo 2.1-1 below. The APS is the subject of this application for certification.[1] The Master Radio will be certified separately.

Photo 2.1-1 – DOG User Interface

The operational description exhibit provides additional information.

2.2 Interface Cable Details

A 1m long unshielded DC power cable connected the DUT to a 12 VDC power source.

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[1] The APS meets the conditions for exempted devices under Part 15, Subpart B, FCC Rules by virtue of its exclusive use onboard a transportation vehicle.

2.3 Peripheral Devices

No peripheral devices were directly used in the test set-up.

2.4 Test Methodology

Testing was performed according to ANSI C63.10-2013, the procedure referenced by Part 15, FCC Rules. Additional test guidance was given in DA 00-705, “Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. Radiated emissions tests were performed at an antenna to EUT distance of 3 meters.

2.5 Test Facility

The 3-meter semi-anechoic test chamber and measurement facility used to collect the radiated and conducted data is located at 8545 126th Avenue N., Largo FL 33773. This site is NVLAP Accredited (200125-0).

2.6 Deviations

No deviations were exercised during the course of the testing.

3 SYSTEM TEST CONFIGURATION

3.1 Justification

The DUT was tested in a table top configuration. The effective height of the table was 80 cm for radiated emissions tests up to 1000 MHz and 1.5 meter for tests above 1 GHz. Although it is not a handheld device its orientation in the vehicle may vary depending upon the location of the vehicle's OBDII connector. As such, exploratory tests were conducted with the DUT lying flat and with one side elevated relative to the horizontal plane and it was determined that the spurious emissions were maximized by operating the DUT in a position that was 60 degrees relative to the horizontal plane of the table. Final radiated emissions tests were performed in that manner. As the DUT was 12 VDC powered by the vehicle's battery, the ac power line emissions test was not applicable. Antenna port conducted tests were performed using a direct connection to the antenna port using a very short coaxial cable.

Various test modes were used to simulate the DUT's normal modes of operation in the absence of companion equipment. A continuous random data transmission test mode was used for most of the tests. This test mode modulated the carrier frequency using a pseudo random binary sequence. A frequency hopping test mode was used for those tests which represented a frequency hopping sequence used in normal operation. A receiver test mode was used to measure the DUT's receiver spurious emissions as well as emissions from the DUT's digital circuitry.

Unless noted otherwise, tests were performed on three channels. The channels, frequencies, and power settings were as shown in the table below.

Table 3.1-1 – Power Setting by Channel Number

Channel Number	Center Frequency (MHz)	Power Setting
0	902.35	17 dBm
24	914.83	17 dBm
49	927.83	17 dBm

The DUT was also tested in the receive mode and found to be in compliance.

3.2 Special Accessories

None.

3.3 Equipment Modifications

No modifications were made by Walshire Labs during this test effort.

Signature:	Peter J. Walsh	Date:	August 31, 2015
Typed/Printed Name:	Peter J. Walsh		
Position:	Regulatory Lab Manager		

If modifications were needed to achieve compliance, the client shall acknowledge these by signing below.

Signature:		Date:	
Typed/Printed Name:			
Position:			

4 CONDUCTED EMISSIONS DATA

References: 47 C.F.R. § 15.207 (a)

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

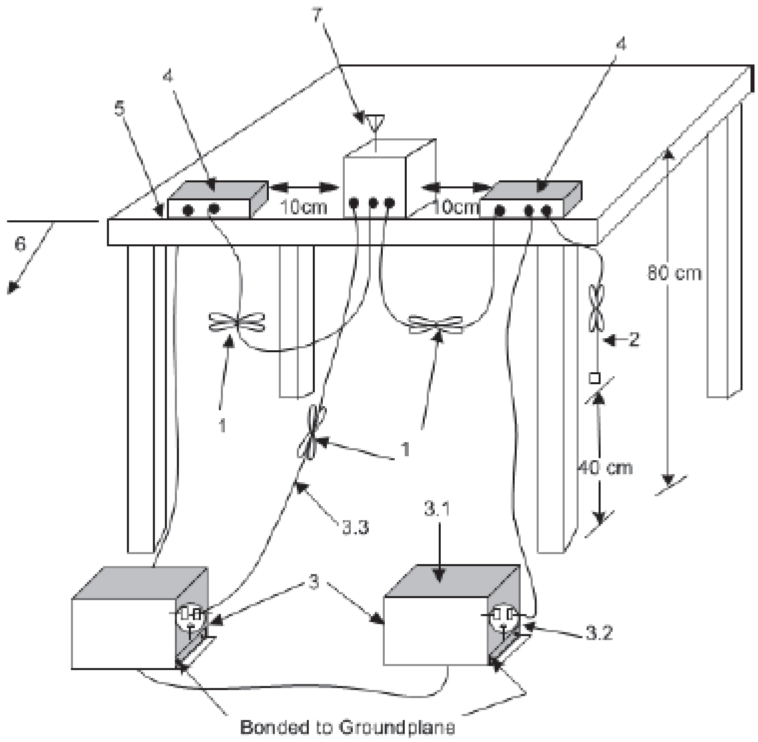
Table 4-1

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

4.1 Test Procedure

The test is performed in accordance with ANSI C63.10-2013 § 6.2. The test setup is consistent with Figure 5 as shown below. The test is performed in a semi-anechoic chamber. As the use of the vertical conducting plane is optional, it was not used.



1—Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long see (see 6.2.3.2).
2—The I/O cables that are not connected to an accessory shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m (see 6.2.2).
3—EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω loads. LISN may be placed on top of, or immediately beneath, reference ground plane (see 6.2.2 and 6.2.3).
3.1—All other equipment powered from additional LISN(s).
3.2—A multiple-outlet strip may be used for multiple power cords of non-EUT equipment.
3.3—LISN at least 80 cm from nearest part of EUT chassis.
4—Non-EUT components of EUT system being tested.
5—Rear of EUT, including peripherals, shall all be aligned and flush with edge of tabletop (see 6.2.3.2).
6—Edge of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane (see 6.2.2 for options).
7—Antenna can be integral or detachable. If detachable, then the antenna shall be attached for this test.

Figure 5—Test arrangement for power-line conducted emissions (product with accessories)

Conducted emissions measurements are first made using a peak detector and average detector simultaneously. The receiver then performs the final measurements using a quasi-peak detector for comparison with the quasi-peak limit and an average detector for comparison with the average limit.

4.2 Measured Data

Compliance Verdict: None

As the DUT was DC powered (12 VDC) by the vehicle's battery, the ac power line conducted emissions test was not applicable.

4.3 Conducted Emissions Test Instrumentation

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
EMI Receiver	Rohde & Schwarz ESCS 30	825788/002	12/14/2015
LISN	Rohde & Schwarz ESH3-Z5	840730/005	09/05/2016

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods with a calibration interval of 24 months.

4.4 Conducted Emissions Photographs

No photographs were taken as the test was not applicable.

5 RADIATED EMISSIONS DATA

References: 47 C.F.R. § 15.209

(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Table 5-1

Frequency of Emission (MHz)	Field Strength (3 m) (microvolts/meter)	Field Strength (3 m) (dBμV/m)
0.009 – 0.490	2400/F (kHz) @ 300 m	300
0.490 – 1.705	24000/F (kHz) @ 30 m	30
1.705 – 30.0	30 @ 30 m	30
30 - 88	100**	40.0
88 - 216	150**	43.5
216 - 960	200**	46.0
Above 960	500	54.0

*** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

The field strength limits for frequencies below 30 MHz were calculated for a measurement distance of 3 m using the prescribed 40 dB/decade correction factor as shown in Figure 5-1.

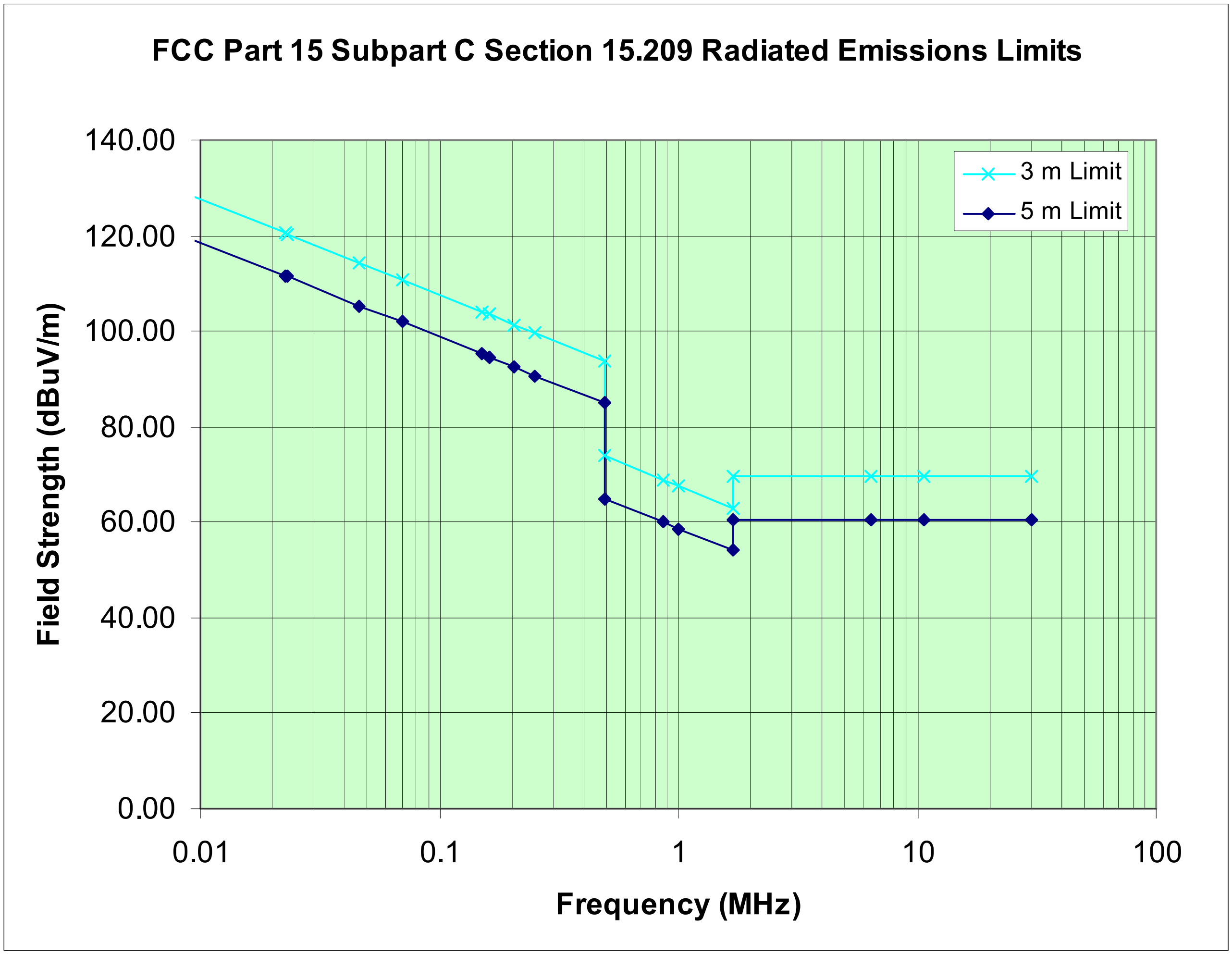


Figure 5-1 – Adjusted Field Strength Limits

References: 47 C.F.R. § 15.205

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

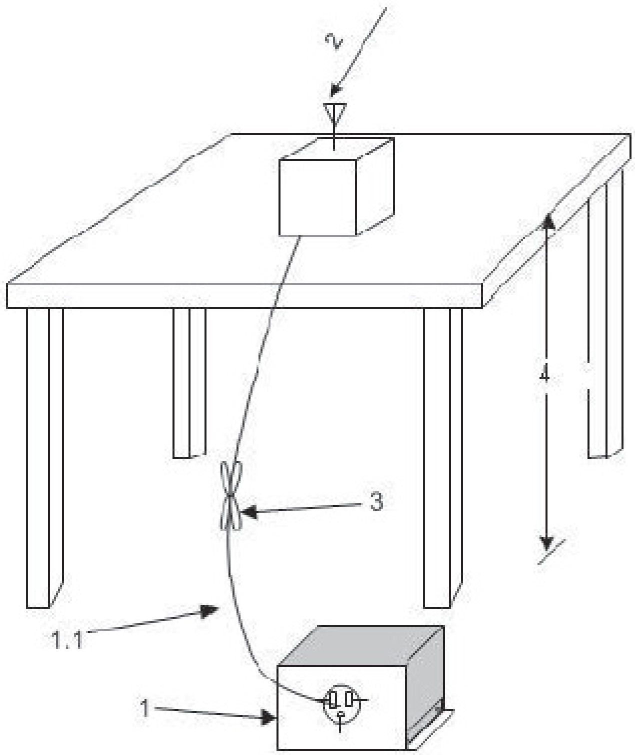
Table 5-2

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

5.1 Test Procedure

The test is performed in accordance with ANSI C63.10-2013 § 6.38. The test setup is consistent with ANSI C63.10-2013 Figure 4 below.



1—A LISN is optional for radiated measurements between 30 MHz and 1000 MHz but not allowed for measurements below 30 MHz and above 1000 MHz (see 6.3.1). If used, then connect EUT to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω loads. The LISN may be placed on top of, or immediately beneath, the reference ground plane (see 6.2.2 and 6.2.3.2).
1.1—LISN spaced at least 80 cm from the nearest part of the EUT chassis.
2—Antenna can be integral or detachable, depending on the EUT (see 6.3.1).
3—Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long (see 6.3.1).
4—For emission measurements at or below 1 GHz, the table height shall be 80 cm. For emission measurements above 1 GHz, the table height shall be 1.5 m for measurements, except as otherwise specified (see 6.3.1 and 6.6.3.1).

Figure 4—Test arrangement for radiated emissions (tabletop product)

The following data lists the significant emission frequencies, amplitude levels (including cable correction and antenna factors), plus the limit. The frequency range investigated was 20 MHz to 10 GHz. The highest frequency to which the DUT must be measured is 9.28 GHz as this is ten times the highest operating frequency of the DUT. The lowest frequency tested was determined by a crystal frequency of 20 MHz used in the transceiver's digital circuitry. The highest frequency to which the DUT would normally have to be tested for its digital circuitry in accordance with FCC Part 15 Subpart B would be 1000 MHz since the highest speed of any digital signal was less than 108 MHz.

5.2 Test Data

Compliance Verdict: PASS

There were no emissions within 30 dB of the FCC Part 15 limit over the frequency range of 20 – 30 MHz.

Figure 5.2-1 shows the DUT's radiated emissions with the transmitter off and therefore is a measure of receiver spurious emissions. The scan was taken with the peak detector in both vertical (red trace) and horizontal (blue trace) antenna polarities at turntable angles between 0 and 360 degrees and antenna heights between 1 and 4 meters. There were no emissions within 20 dB of the limit. Figure 5.2-2 shows the radiated emissions test results with the transmitter off from 1 to 10 GHz.

With the transmitter enabled by selecting the continuous random test data transmission test mode, the quasipeak detector levels of the fundamental and any spurious emissions that fell in restricted bands between 30 MHz and 1000 MHz were measured. In band measurements were made with the transmitter set on channels 0, 24, and 49 respectively. The highest measured emissions in the 30 MHz to 1000 MHz frequency range have been shown in Table 5.2-1a. Table 5.2-1b shows the effect of varied input voltage. The emissions of note in this frequency range were limited to the fundamental signals associated with each channel. Exploratory tests showed no significant emissions in the restricted bands between 30 MHz and 1000 MHz. This observation was also confirmed by the antenna port conducted emissions tests which showed that the levels of any spurious emissions (both band edge and harmonics) were well below the level of the fundamental.

Figure 5.2-3 shows the radiated emissions test results from 1 to 10 GHz with the radio in the continuous transmission test mode with the channel set to 24. For measurements taken above 1 GHz, the final measurement detectors were peak and average. The measurement bandwidth was 1 MHz. The highest measured emissions have been shown in Tables 5.2-2 and 5.2.3 for the peak and average detectors respectively.

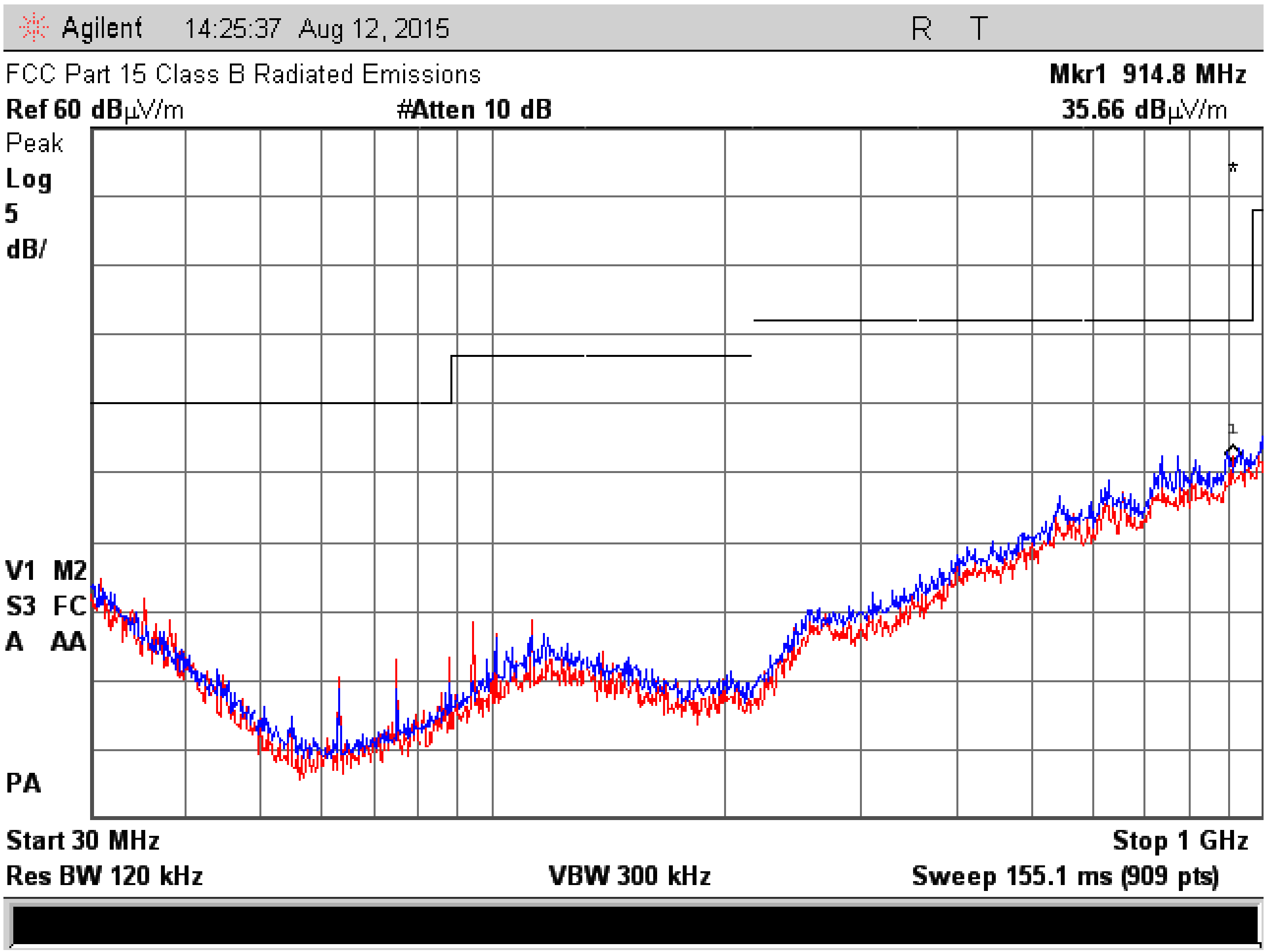


Figure 5.2-1 – FCC Part 15 Receiver Spurious Radiated Emissions Informative Plot

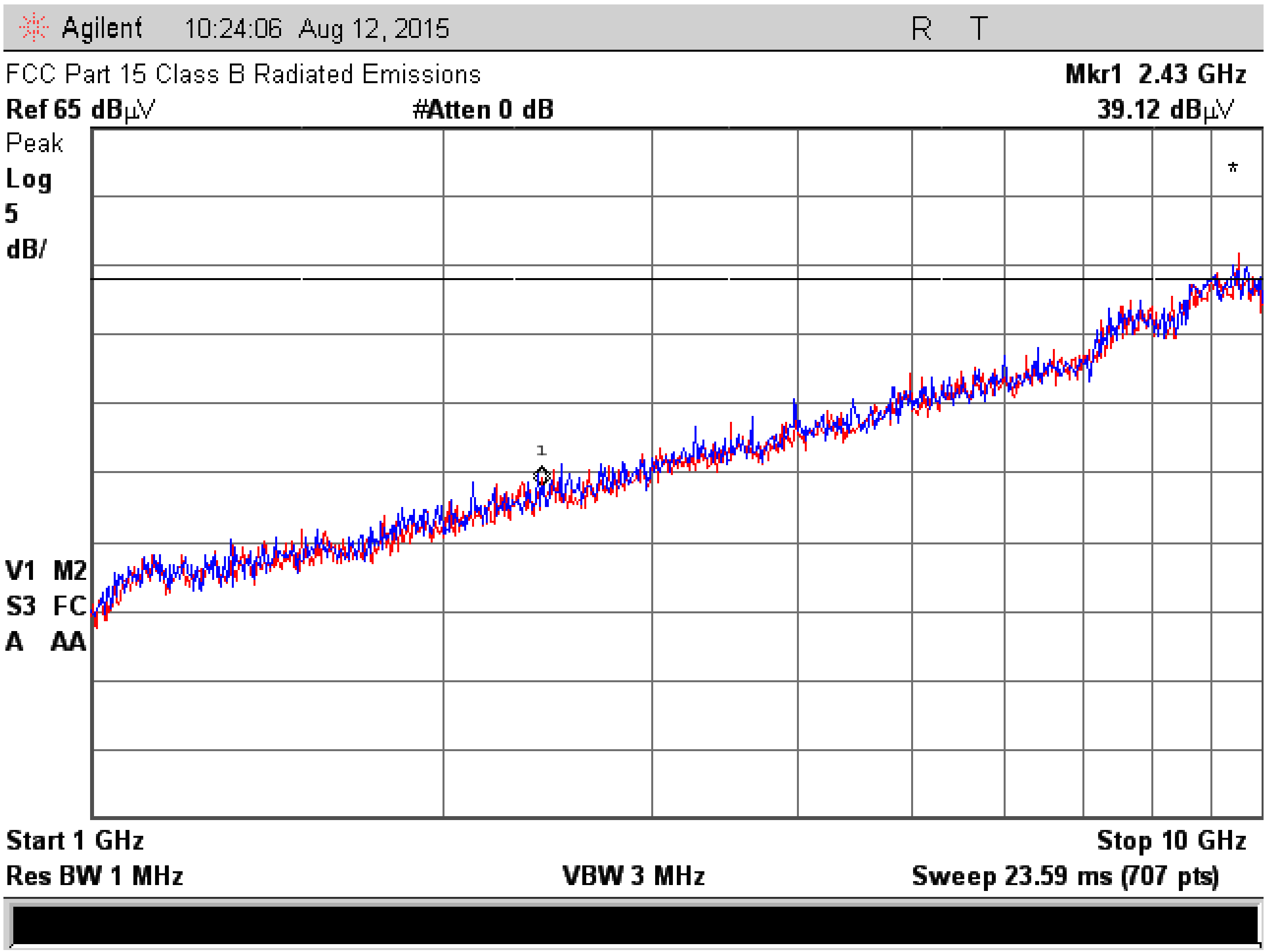


Figure 5.2-2 – Radiated Emissions 1 to 10 GHz Receive Test Mode– Peak Detector Plot

Notes:

The red trace was with vertical polarity. The blue trace was with horizontal polarity.

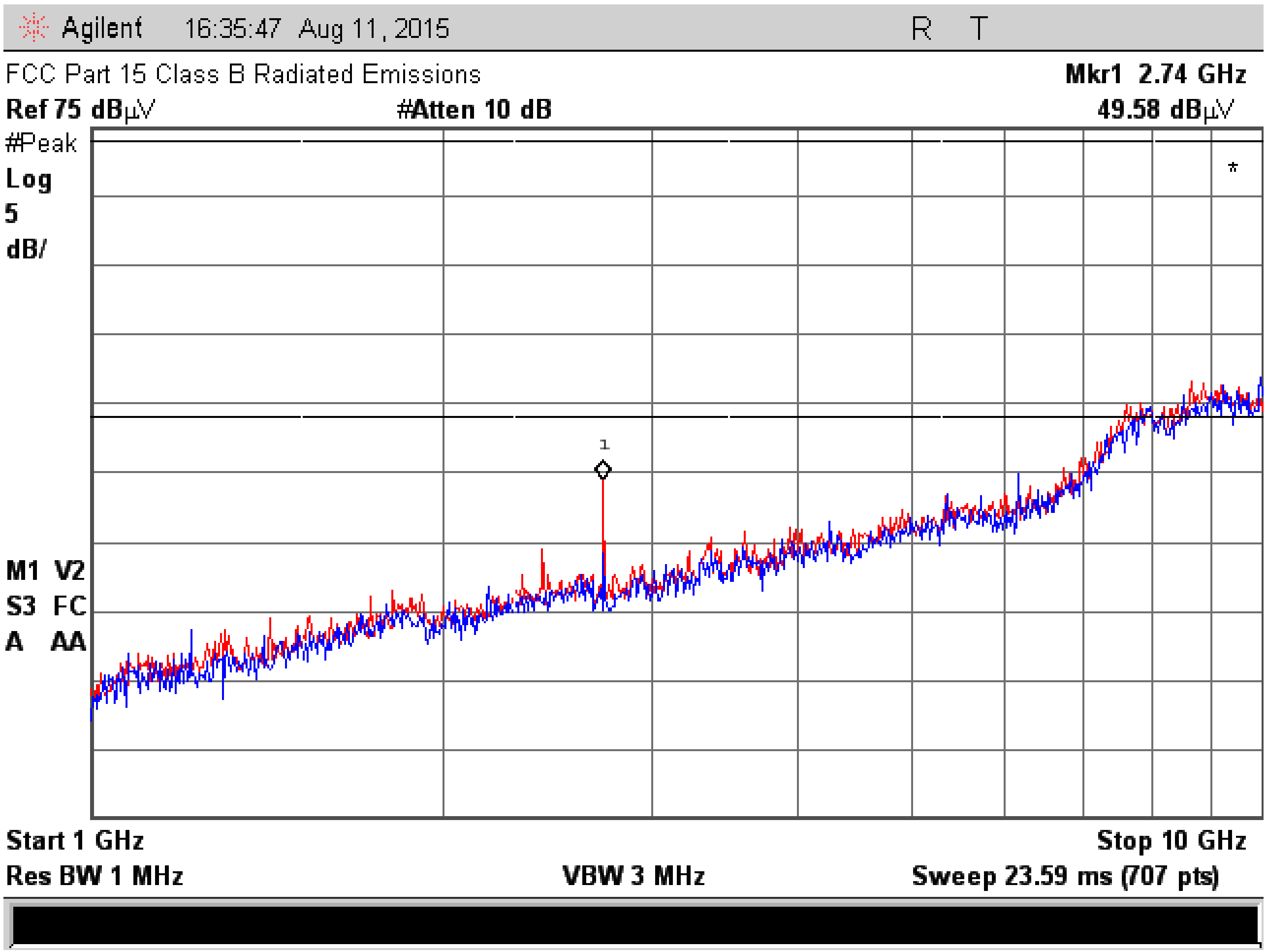


Figure 5.2-3 – Radiated Emissions 1 to 10 GHz Transmitter On – Peak Detector Plot

Notes:

The red trace was with vertical polarity. The blue trace was with horizontal polarity.

For this scan the channel was set to 24 and the test mode set to the continuous transmission test mode.

Refer to Table 5.2.3 and 5.2.4 for the field strength data on the highest level emissions. This data includes operation on channels 0, 24, and 49.

Table 5.2-1a – Radiated Emissions QuasiPeak Levels 30 – 1000 MHz Transmitter On

Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	CF* (dB)	Margin (dB)	DeFacto Limit (dBµV/m)	Notes
902.35	112.1	100	V	171	26.1	19.1	131.2	Channel 0 with DUT ant vert
914.83	112.0	100	V	180	26.2	19.2	131.2	Channel 24 with DUT ant vert
927.83	112.2	100	V	180	26.3	19.0	131.2	Channel 49 with DUT ant vert

The results shown in Table 5.2-1b below show the effect of ± 15% variation in the 12.0 VDC input voltage.

Table 5.2-1b – Radiated Emissions QuasiPeak Levels on Channel 24 with Varied Input Voltage

Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	CF* (dB)	Margin (dB)	DeFacto Limit (dBµV/m)	Voltage (V)
914.83	112.0	100	V	180	26.2	19.2	131.2	10.2
914.83	112.0	100	V	180	26.2	19.2	131.2	12.0
914.83	112.0	100	V	180	26.2	19.2	131.2	13.8

Notes:

* CF is the antenna correction factor plus cable loss.

The unit has onboard voltage regulation so the transmit power was not affected by variations in the supply voltage or ± 15%.

Table 5.2-3 – Radiated Emissions Peak Detector Levels 1 – 10 GHz

Frequency (MHz)	Peak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	CF* (dB)	Margin (dB)	Limit (dBµV/m)	Harmonic	Channel
2705.05	50.4	134	V	170	-2.2	23.6	74	3	0
3609.40	38.7	160	V	0	1.7	35.3	74	4	0
2744.49	49.0	140	V	180	-2.2	45.0	74	3	24
3659.32	39.8	160	V	360	1.7	34.2	74	4	24
2783.49	49.0	164	V	360	-2.2	25.0	74	3	49
3711.32	45.8	160	V	360	1.7	25.2	74	4	49

Table 5.2-4 – Radiated Emissions Average Detector Levels 1 – 10 GHz

Frequency (MHz)	Average (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	CF* (dB)	Margin (dB)	Limit (dBµV/m)	Harmonic	Channel
2705.05	49.6	134	V	170	-2.2	4.4	54	3	0
3609.40	35.4	160	V	0	1.7	18.6	54	4	0
2744.49	48.8	140	V	180	-2.2	5.2	54	3	24
3659.32	36.4	160	V	360	1.7	17.6	54	4	24
2783.49	48.1	164	V	360	-2.2	5.9	54	3	49
3711.32	40.0	160	V	360	1.7	14.0	54	4	49

Notes:

* CF is the antenna correction factor, amplifier gain, HPF loss, and cable loss.

The above table doesn't include measurements of the second harmonic because for all channels the harmonic didn't fall in a restricted band and was much more than 20 dB below the level of the fundamental. Above the 4th harmonic no spurious emissions were detected.

Minimum Margin: **4.4 dBµV/m**

Measurement Uncertainty: +4.8 dB, -5.2 dB

Test Personnel:

Date	Name	Signature
August 31, 2015	Peter J. Walsh, NCE	Peter J. Walsh

5.3 Test Instrumentation Used, Radiated Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
EMI Receiver	Rohde & Schwarz ESCS 30	825788/002	12/4/2015
Spectrum Analyzer	Agilent E7405A	MY42000055	4/10/2017
Preamplifier	Com-Power PA-122	181925	5/31/2016
1.2 GHz HPF	Micro-tronics HPM50108-01	014	6/17/2016
Antenna	Chase EMCCBL6112B	2579	1/9/2016
Antenna	EMCO Horn Model 3115	9002-3393	3/19/2017
Antenna	Schwarzbeck Mess - Electronik Model BBHA 9170 Horn Antenna	BBHA9170398	4/15/2017

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods with a calibration interval of 24 months.

5.4 Field Strength Calculation

The field strength (FS) is calculated by adding the antenna correction factor (ACF), cable loss (CL), filter loss (FL) and subtracting the amplifier gain (AG) if any to the measured reading. The formula and a sample calculation are:

FS = Reading (dBµV/m) + ACF (dB) + CL (dB) FL (dB) – AG (dB)

FS = 25 + 12.1 + 0.7 + 0.3 + 0 = 38.1 dBµV/m

The Rohde & Schwarz Model ESCS 30 receiver and Agilent E7405A spectrum analyzer have the capability of automatically performing the field strength calculations. The amplitude level displayed on the receiver or analyzer represents the total measured field strength. This level is directly compared to the appropriate FCC limit to determine the actual margin of the DUT.

5.5 Radiated Emissions Photographs

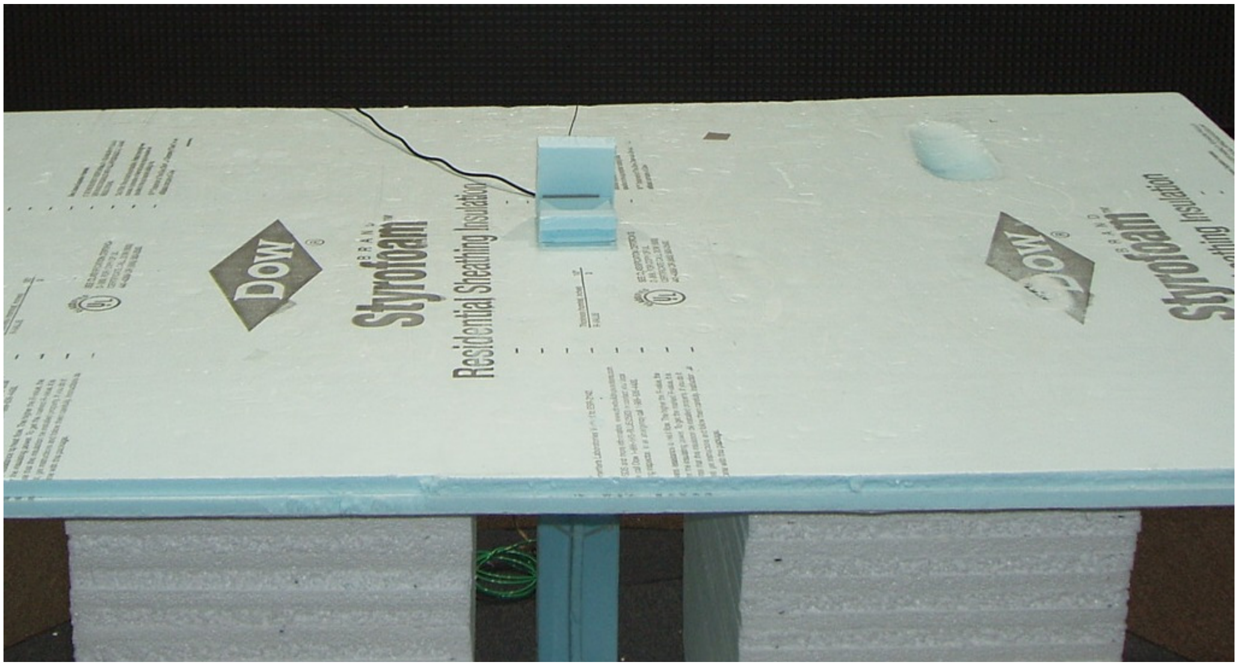


Photo 5.5-1 - Front View of the 30 – 1000 MHz Radiated Emissions Test Set-up

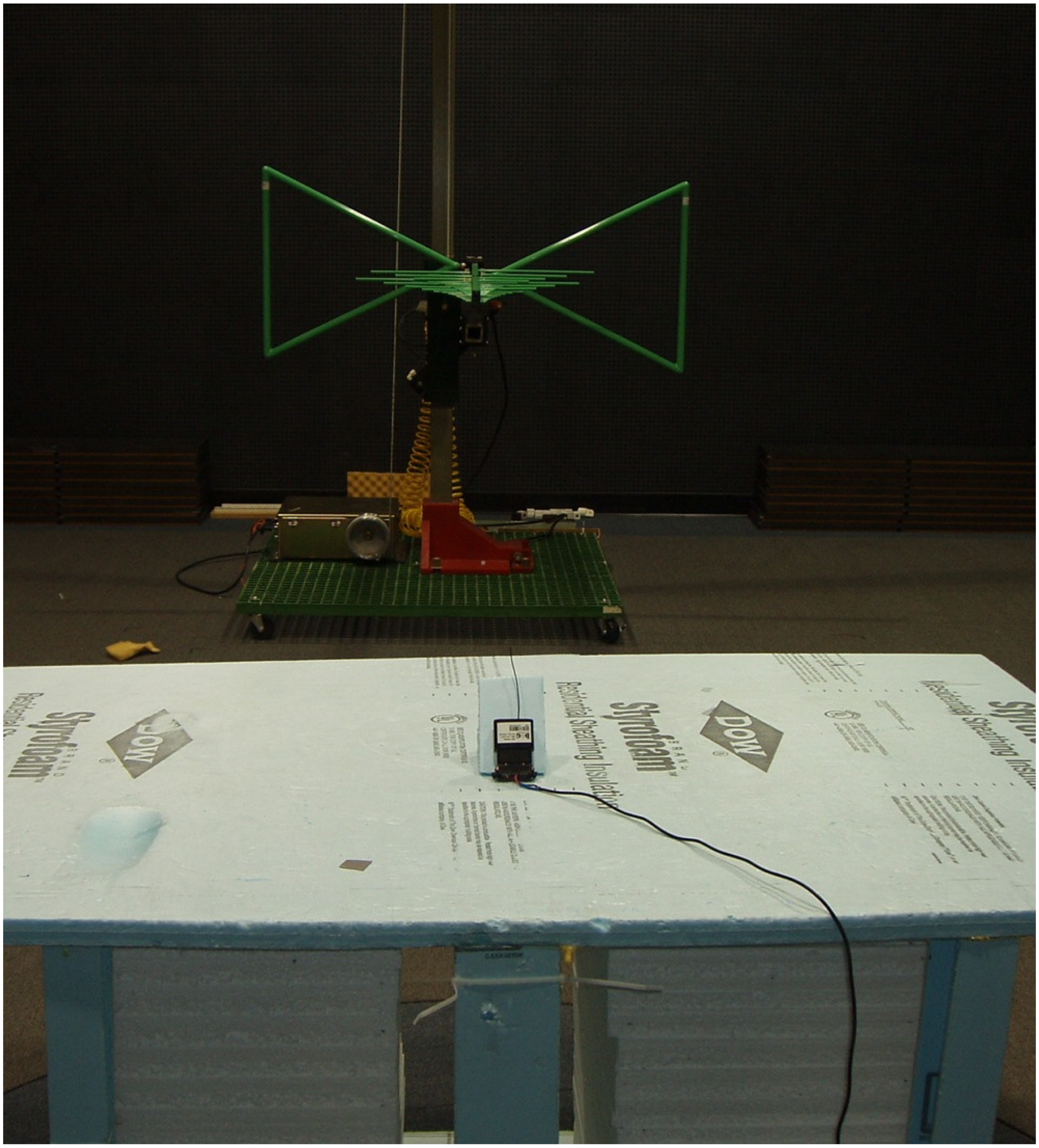


Photo 5.5-2 - Rear View of the Radiated Emissions Test Set-up 30 – 1000 MHz

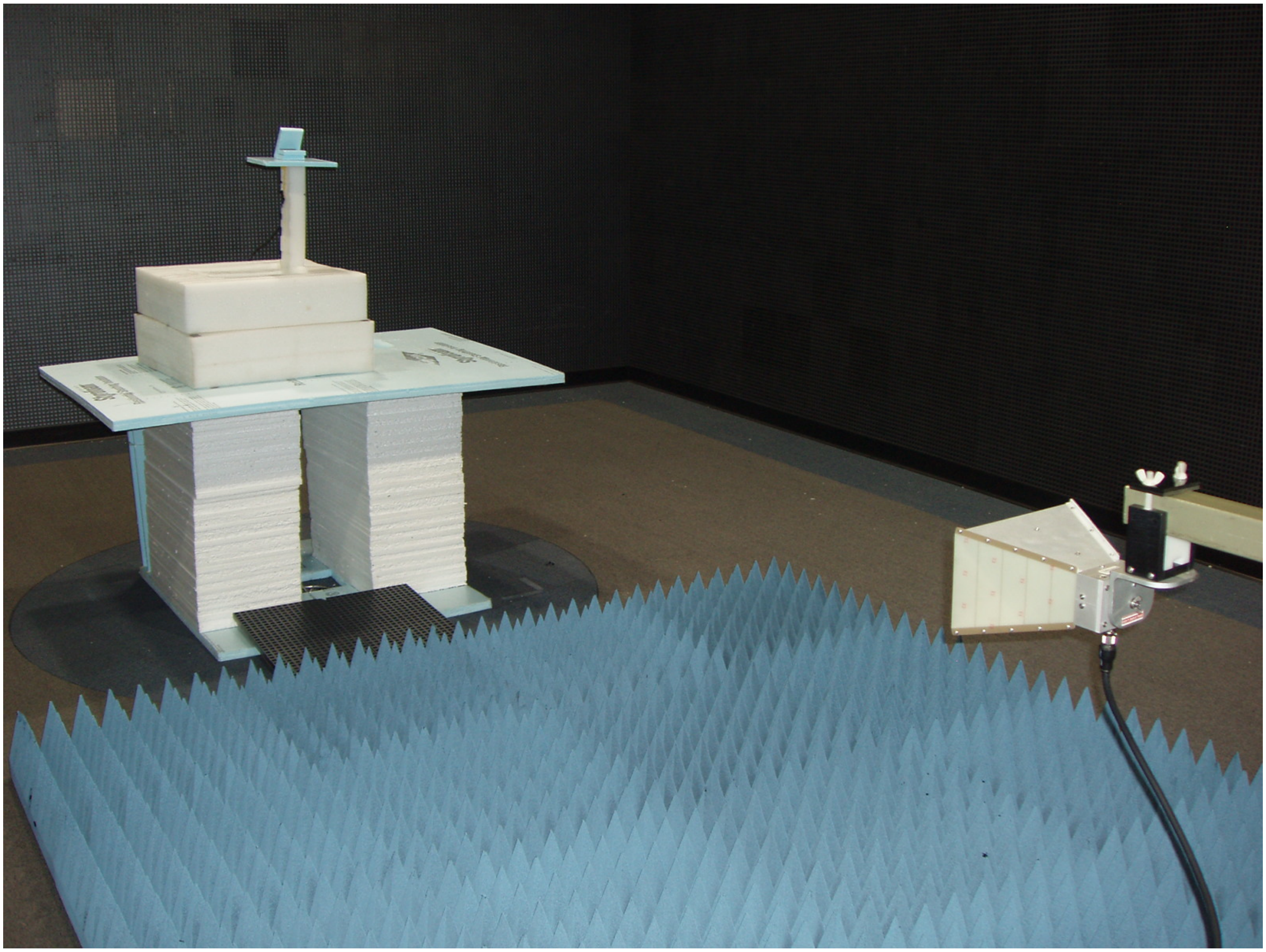


Photo 5.5-3 – Front View of the Radiated Emissions Test Set-up above 1 GHz

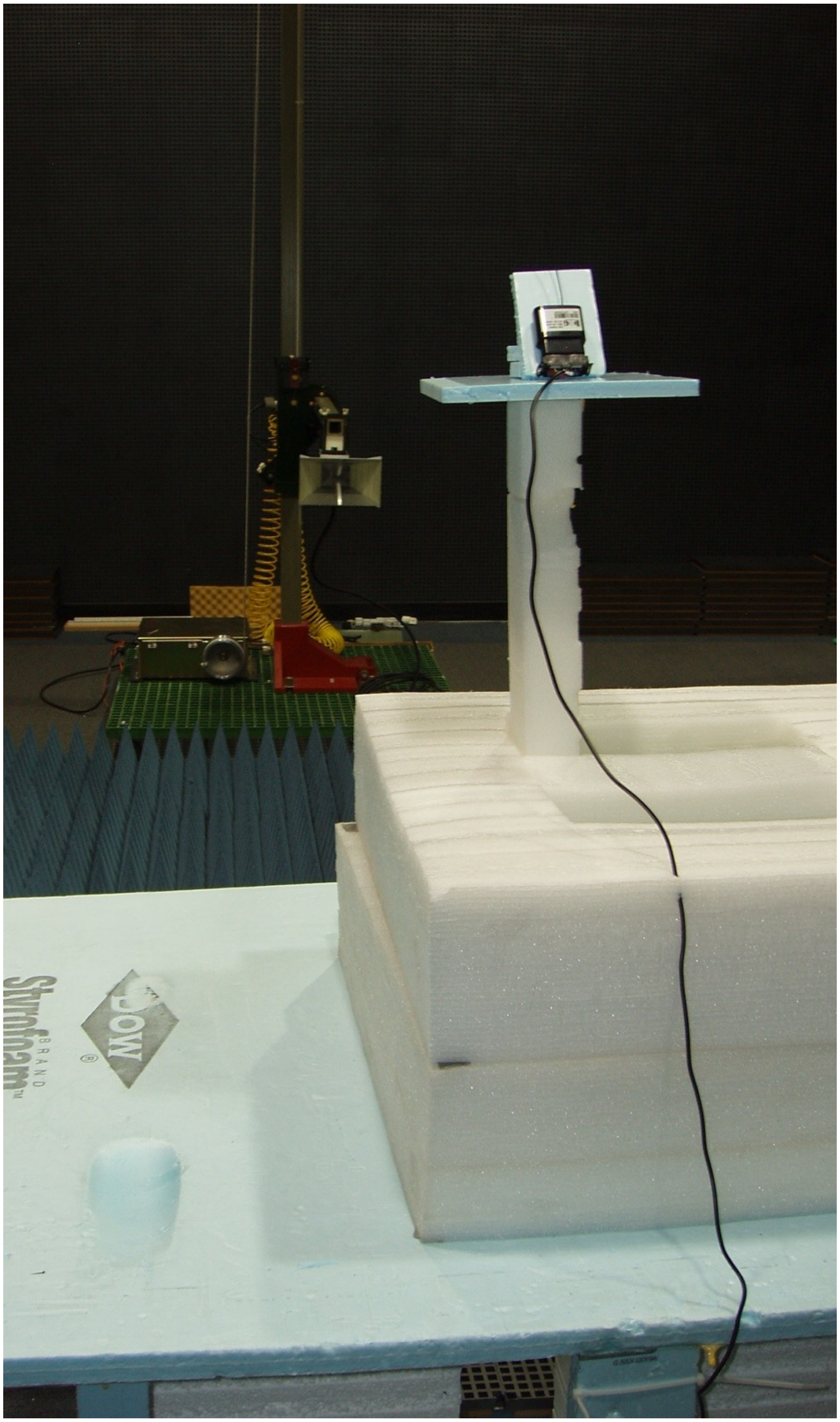


Photo 5.5-4 – Rear View of the Radiated Emissions Test Set-up above 1 GHz

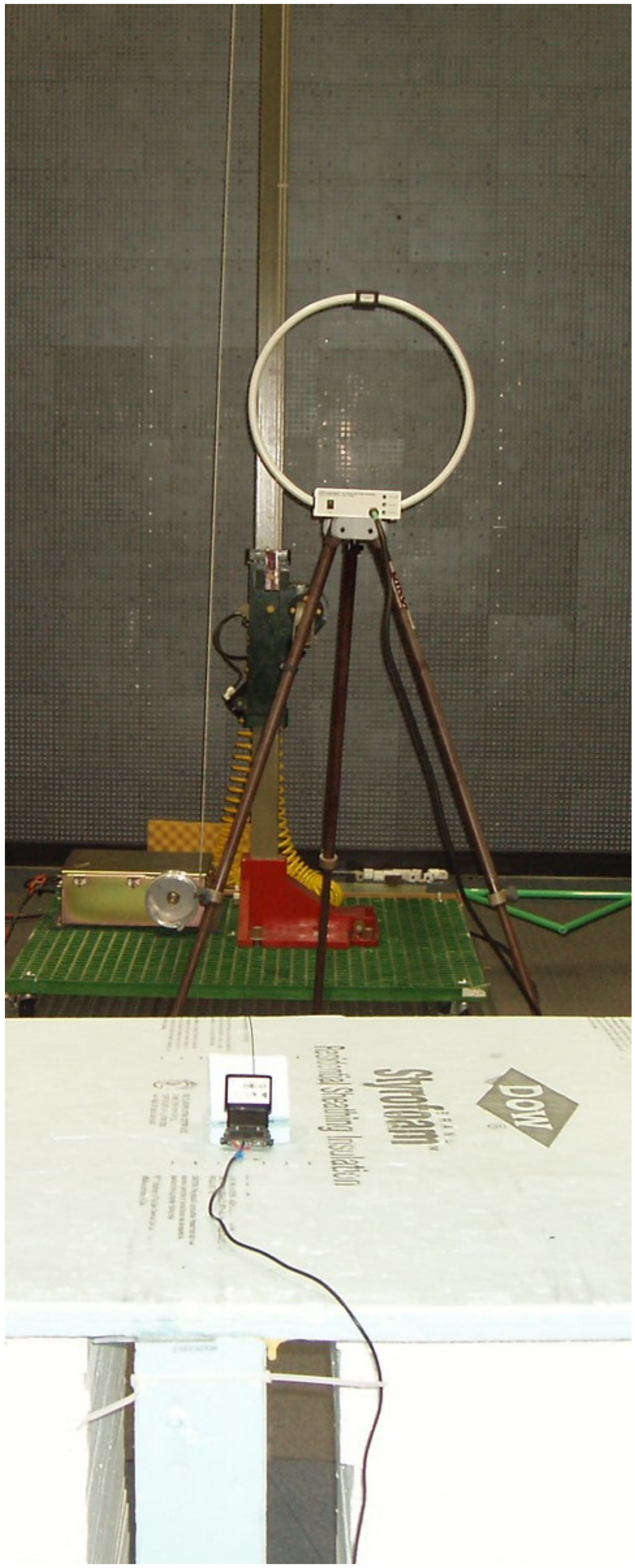


Photo 5.5-5 - Rear View of the Radiated Emissions Test Set-up 20 - 30 MHz

6 ANTENNA REQUIREMENT

References: 47 C.F.R. § 15.203

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

6.1 Test Procedure

Inspect the DUT.

6.2 Test Data

Compliance Verdict: PASS

This requirement is met because the antenna is permanently attached. It is soldered to the board and the housing can not be opened by the customer.

6.3 Antenna Photograph

Photo 6.3-1 below shows the DUT's antenna.

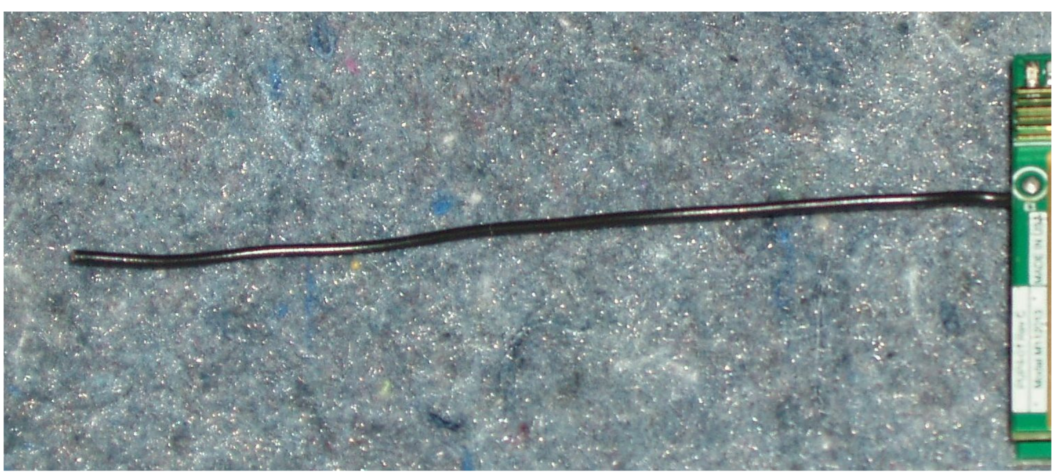


Photo 6.3-1 – Antenna

7 BANDWIDTH DATA

References: 47 C.F.R. § 15.247 (a) (2)

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

7.1 Test Procedure

The measurement is made using a direct connection between the DUT's antenna connection and the spectrum analyzer. The spectrum analyzer's resolution bandwidth (RBW) is set to 10 kHz (> 1% of the emission bandwidth) and its span set to encompass the full bandwidth of the emission. The DUT is conditioned to transmit at its maximum duty cycle.

7.2 Test Data

Compliance Verdict: PASS

Figures 7.2-1 through 7.2-3 show the 20 dB bandwidth of the DUT operating on Channels 0, 24, and 49 respectively. Because the bandwidth was less than 250 kHz, the radio supported 50 hopping frequencies. The measured 20 dB bandwidth was 60 kHz.

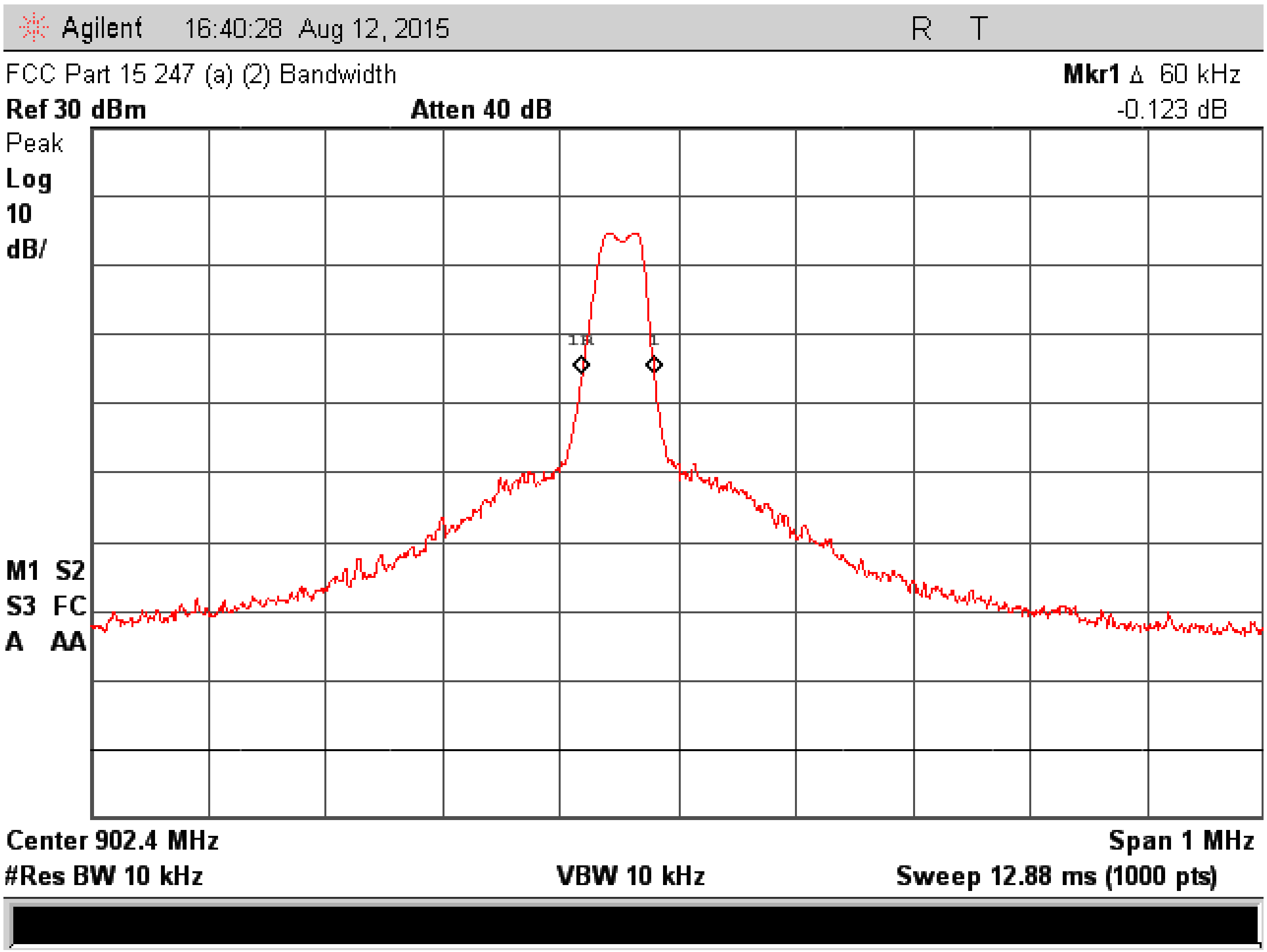


Figure 7.2-1 – Channel 0 Bandwidth

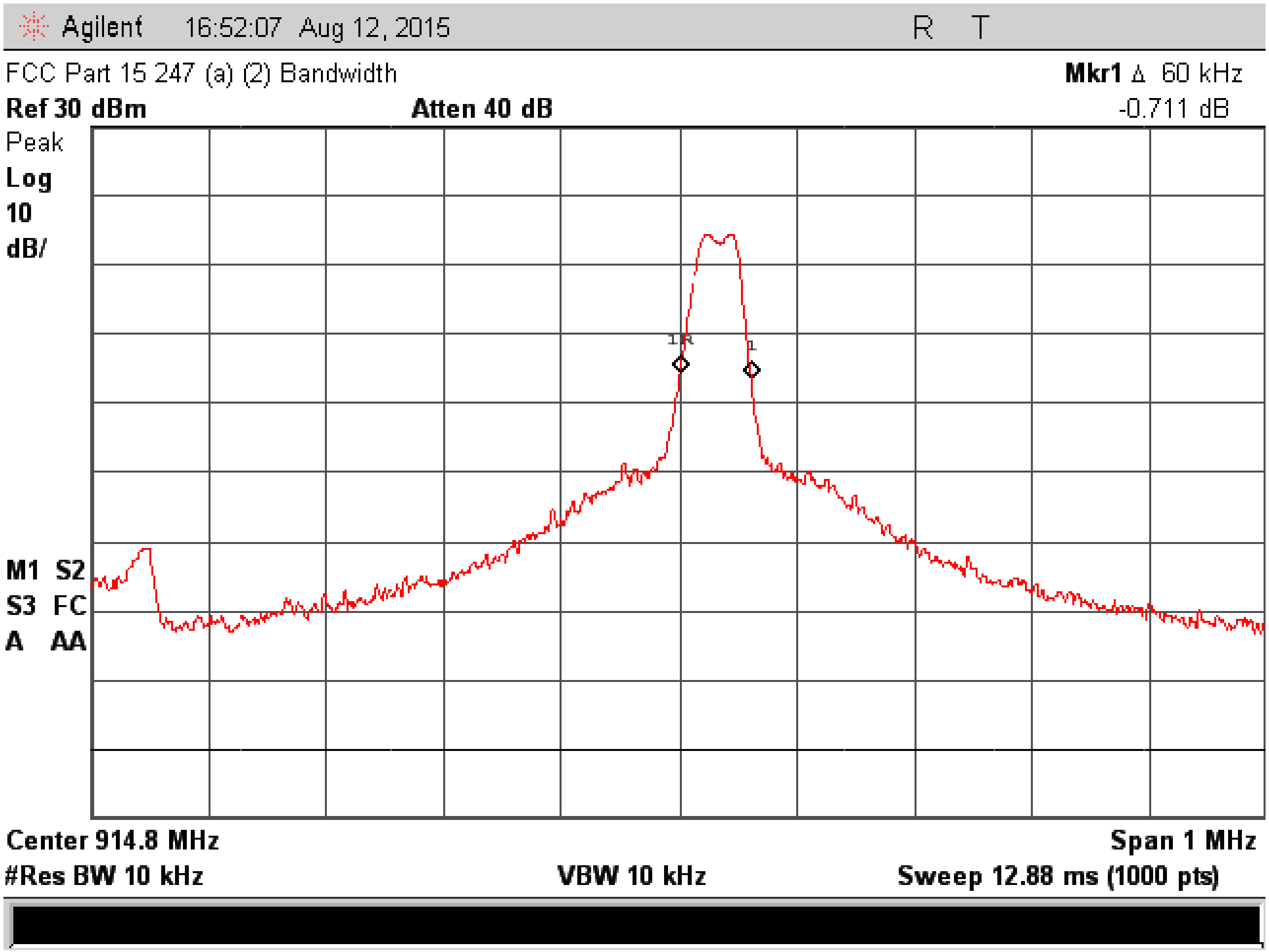


Figure 7.2-2 – Channel 24 Bandwidth

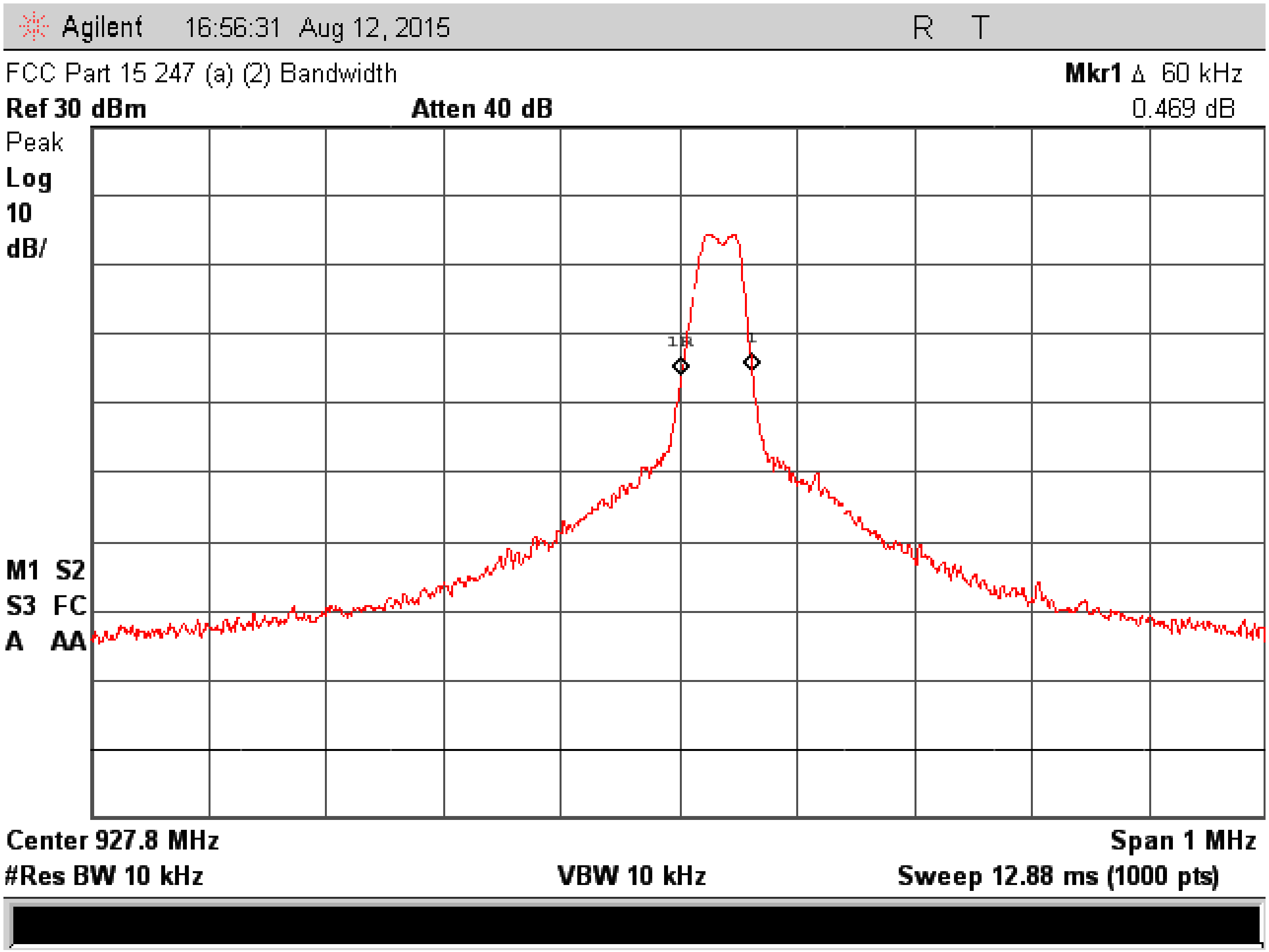


Figure 7.2-3 – Channel 49 Bandwidth

7.3 Test Instrumentation Used, Bandwidth Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	4/10/2017

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods with a calibration interval of 24 months.

7.4 Photograph of the Setup for Conducted Measurements

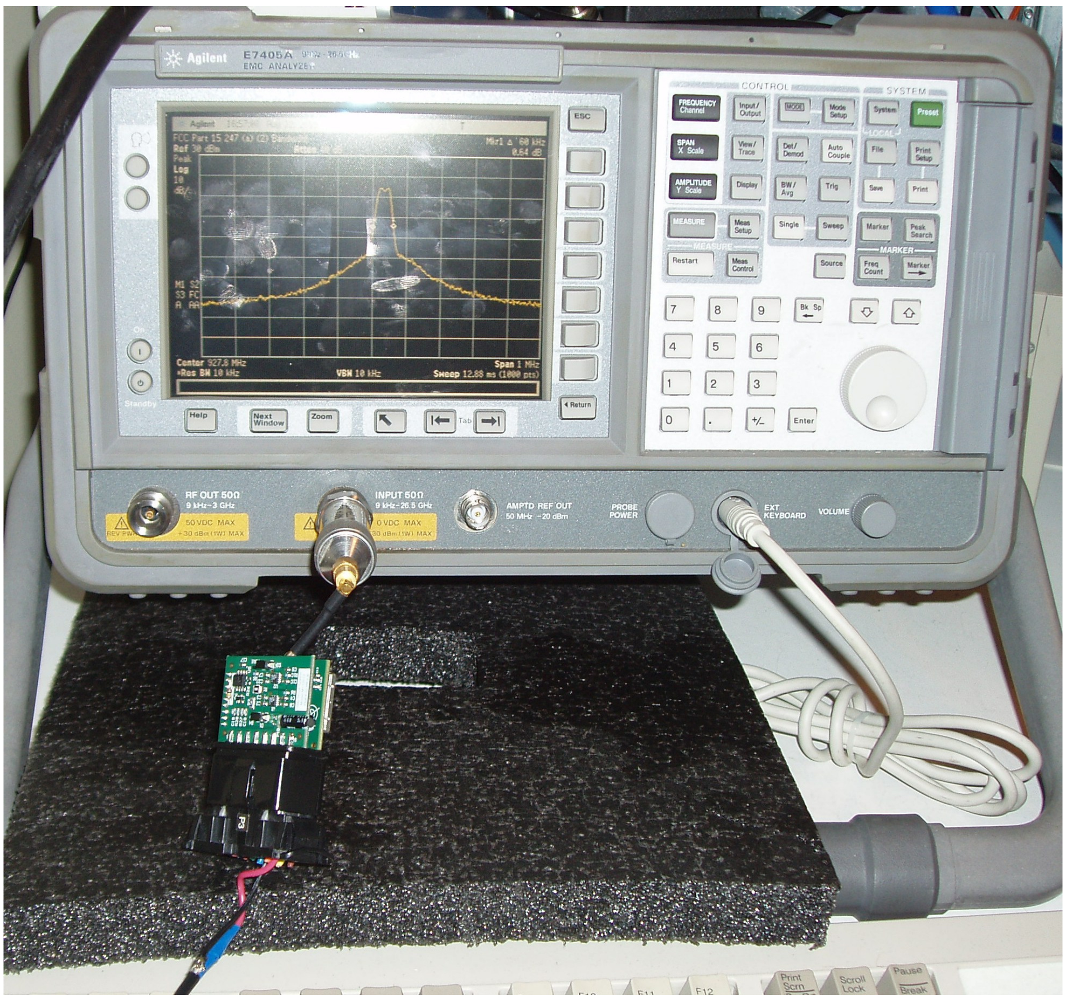


Photo 7.4-1 – Conducted Measurement Test -Setup

8 PEAK POWER DATA

References: 47 C.F.R. § 15.247 (b)

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(2) For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, 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 this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

References: 47 C.F.R. § 15.247 (c)

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(i)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 conducted 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.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (c)(1)(i) and (c)(1)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log(number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beam forming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

(iv) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.

8.1 Test Procedure

The measurement is made using a direct connection between the DUT's antenna connection and the spectrum analyzer. The spectrum analyzer's resolution bandwidth (RBW) is set to 1 MHz, and its span set to encompass the full bandwidth of the emission, approximately 5 times the 20 dB bandwidth of the channel. The DUT is conditioned to transmit continuously by selecting the continuous random data test mode. The trace is set to max hold. Since the radio's bandwidth is less than the 1 MHz resolution bandwidth, the total power is displayed directly.

8.2 Test Data

Compliance Verdict: PASS

First the total power limit must be determined. The system employed a single antenna with a gain of 5.19 dBi. Because the gain did not exceed 6.0 dBi, it was not necessary to further reduce the DUT's output power. The 1 watt peak limit was applicable.

Table 8.2-1 below shows the measured power at the DUT's antenna terminal.

Table 8.2-1 – Measured Power on Channels 0, 24, and 49

Frequency (MHz)	Total Power (dBm)	Total Power (watts)	Channel	Power Setting
902.35	14.61	0.029	0	17 dBm
914.83	14.36	0.027	24	17 dBm
927.83	14.07	0.026	49	17 dBm

Figures 8.2-1 through 8.2-3 show the power measured by the spectrum analyzer as the 1 MHz resolution bandwidth was greater than the radio's bandwidth.

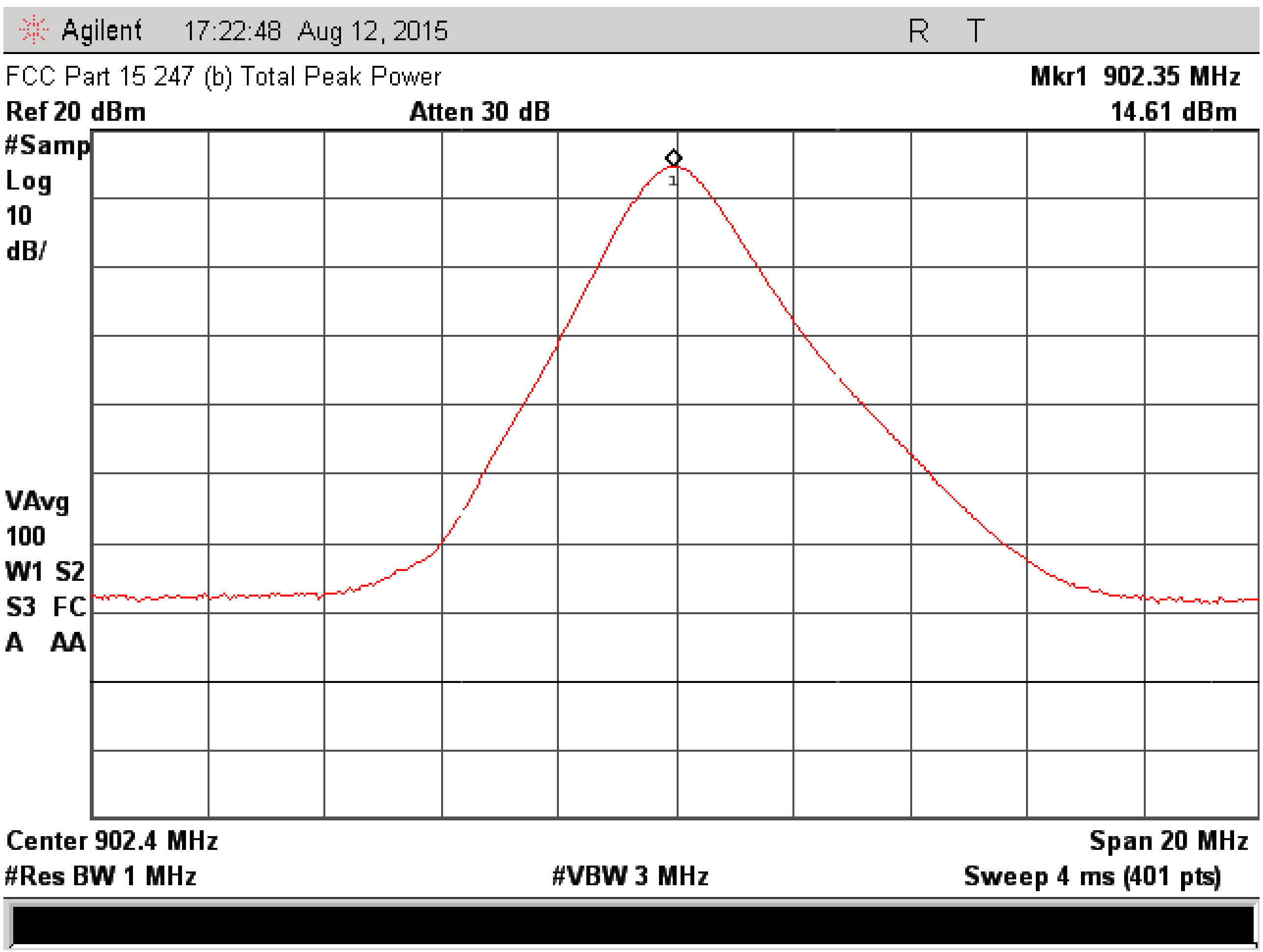


Figure 8.2-1 – Channel 0 Signal Power

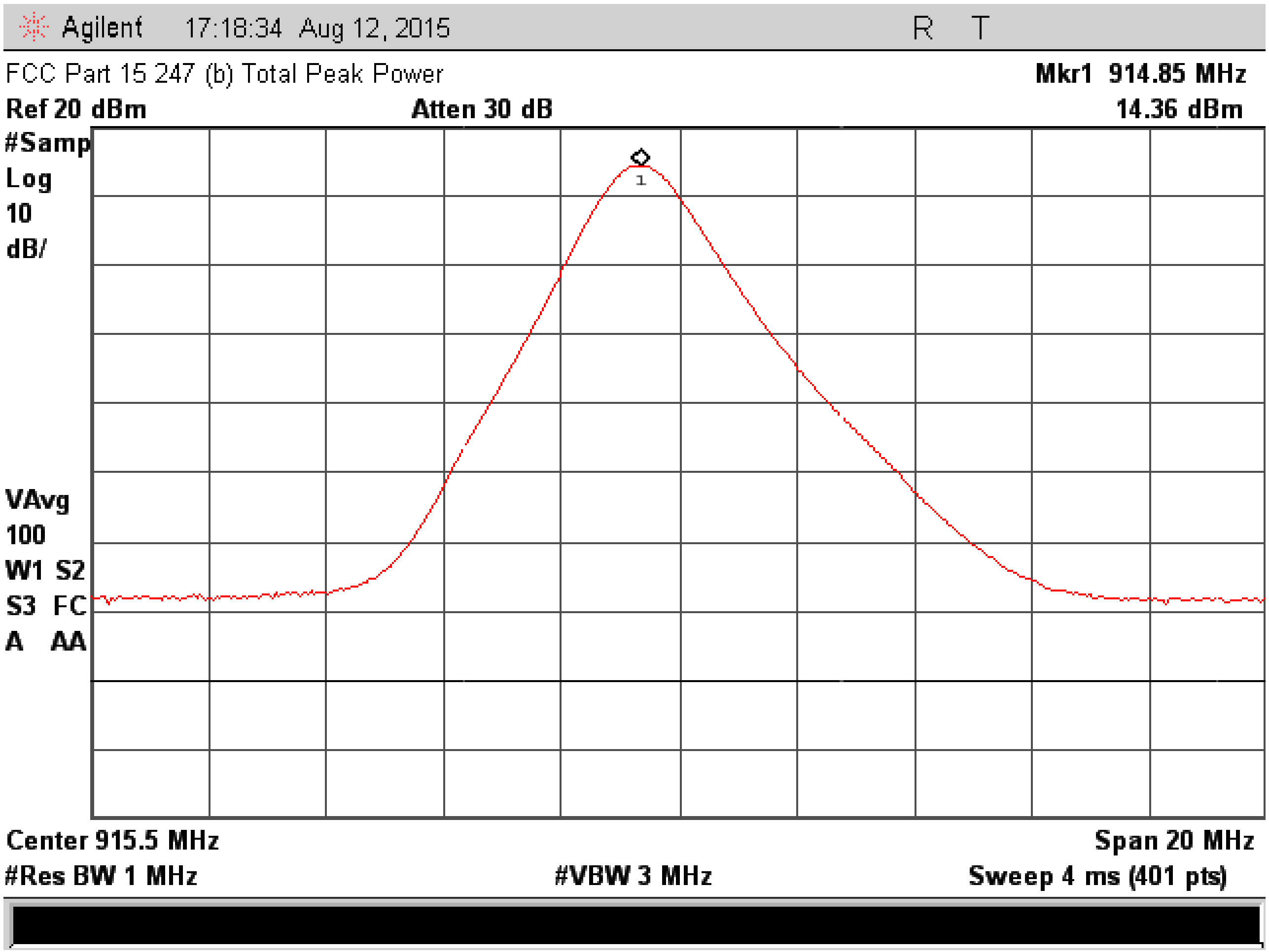


Figure 8.2-2 – Channel 24 Signal Power

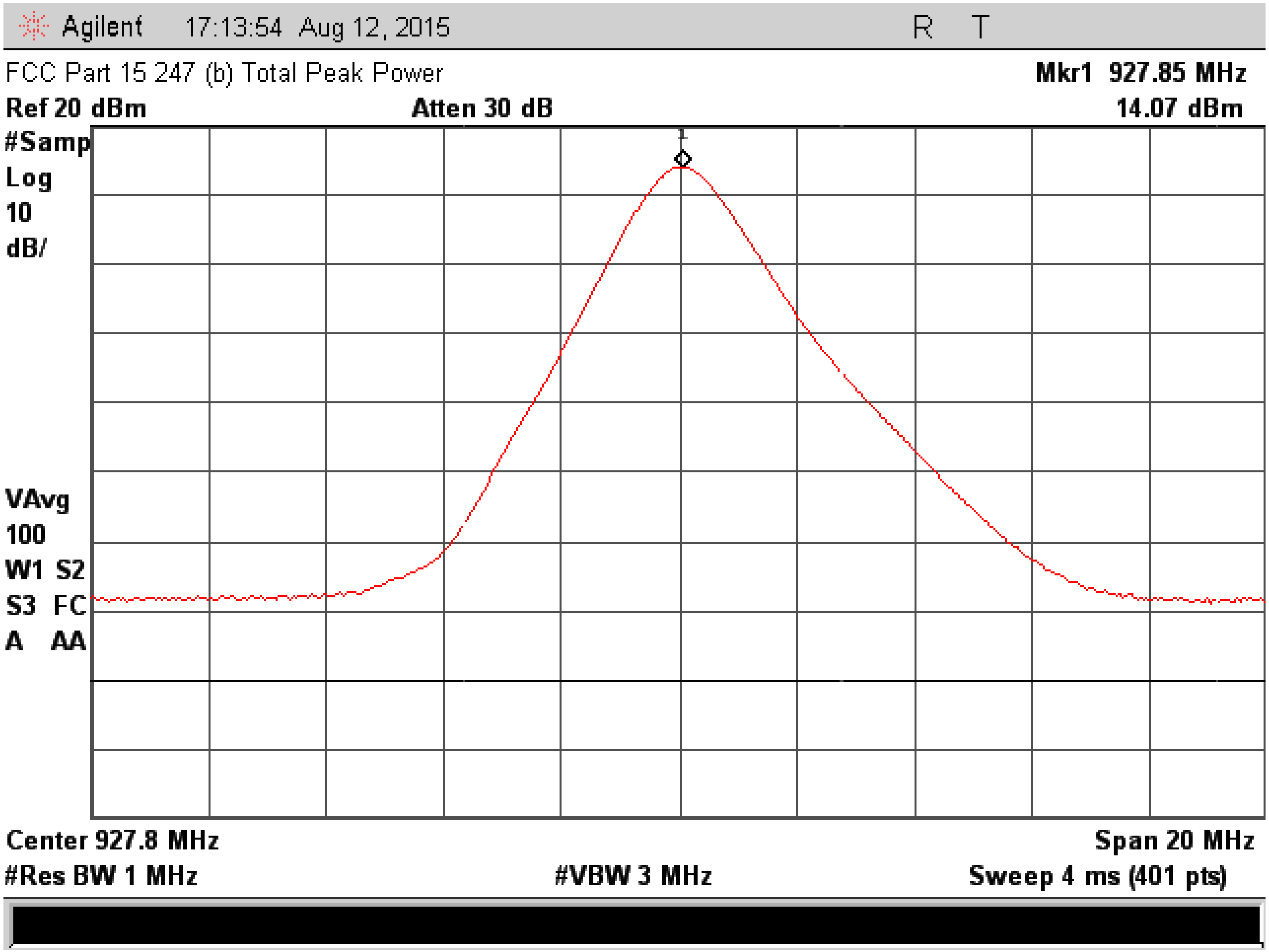


Figure 8.2-3 – Channel 49 Signal Power

8.3 Test Instrumentation Used, Peak Power Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	4/10/2017

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods with a calibration interval of 24 months.

9 OUT OF BAND POWER DATA

References: 47 C.F.R. § 15.247 (d)

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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)).

9.1 Test Procedure

The measurement is made using a direct connection between the DUT's antenna connection and the spectrum analyzer. The spectrum analyzer's resolution bandwidth (RBW) is set to 100 kHz and its span set to encompass the full bandwidth of the emission. The DUT is conditioned to transmit at its maximum duty cycle. The maximum peak power level of the emission is measured first. Next, a limit line is programmed at a level 20 dB below the measured maximum peak power level outside the operating band. Spurious emissions are measured relative to that limit.

Radiated emissions in the restricted bands are measured using the test method referenced in Section 5.1.

9.2 Test Data

Compliance Verdict: PASS

Figure 9.2-1a and 9.2-1b show the out of band conducted and band-edge data relative to the peak conducted level for the radio operating on channel 0. Figures 9.2-2a through 9.2-3b show the results for the radio operating on channels 24 and 49 respectively. These measurements were made with the DUT set in the continuous transmit test mode. The display line was set 20 dB lower than the peak level of the desired power. Figures 9.2-4a and 9.2-4b shows the results with the DUT operating in the frequency hopping test mode.[2] The harmonics and other spurious emissions were attenuated by at least 20 dB in all cases.

The results in this section of the report also satisfy the band-edge measurements as detailed in ANSI C63.10-2013. The preferred method by that standard is to make antenna port conducted measurements. For the 902 – 928 MHz band there are no restricted bands close to the operating band however the band-edge measurements were nonetheless performed using a 9 kHz RBW as a 100 kHz RBW would encompass the in-band signals.

[2] This test was performed to ensure that the gating of transmitter did not give rise to unwanted, additional spurious emissions.

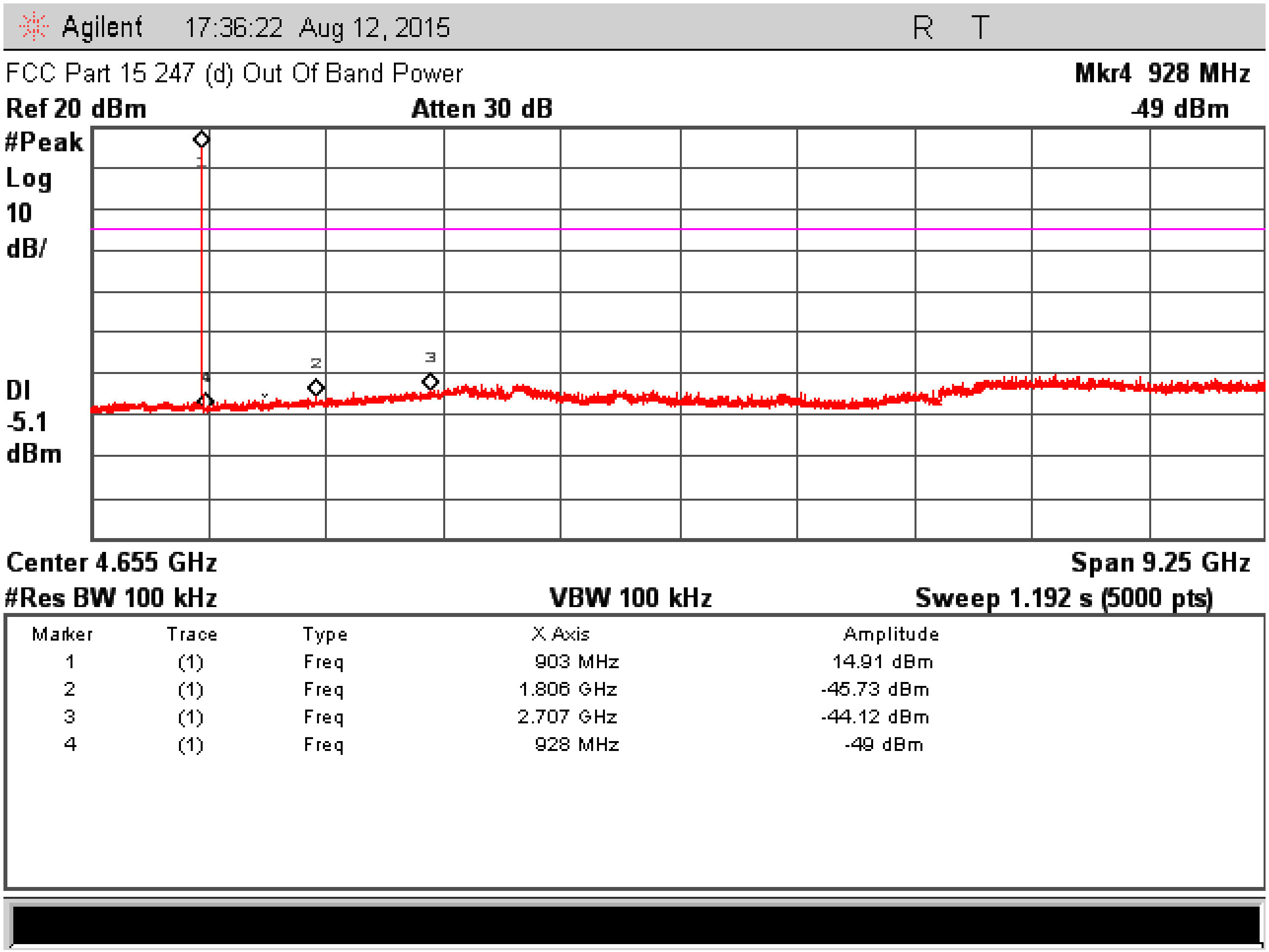


Figure 9.2-1a – Out of Band Conducted Data for Channel 0

Notes:

Marker 1 was placed on the fundamental. The magenta line was 20 dB down from the fundamental. Marker 2 was on the second harmonic. Marker 3 was on the third harmonic. Marker 4 was placed at the upper band edge.

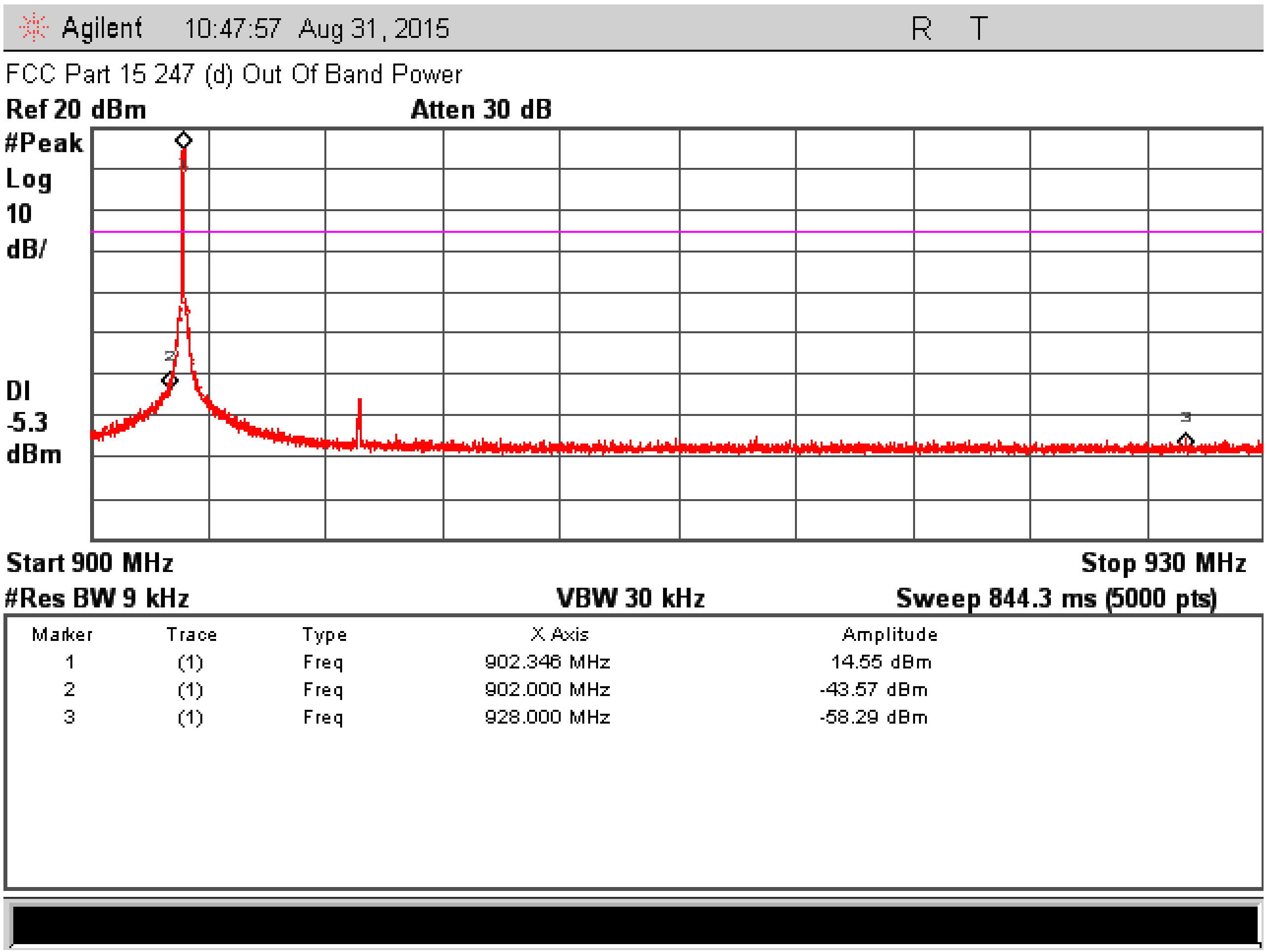


Figure 9.2-1b – Band-edge Conducted Data for Channel 0

Notes:

Marker 1 was placed on the fundamental. Marker 2 was placed at the lower band-edge frequency. Marker 3 was placed at the upper band-edge frequency.

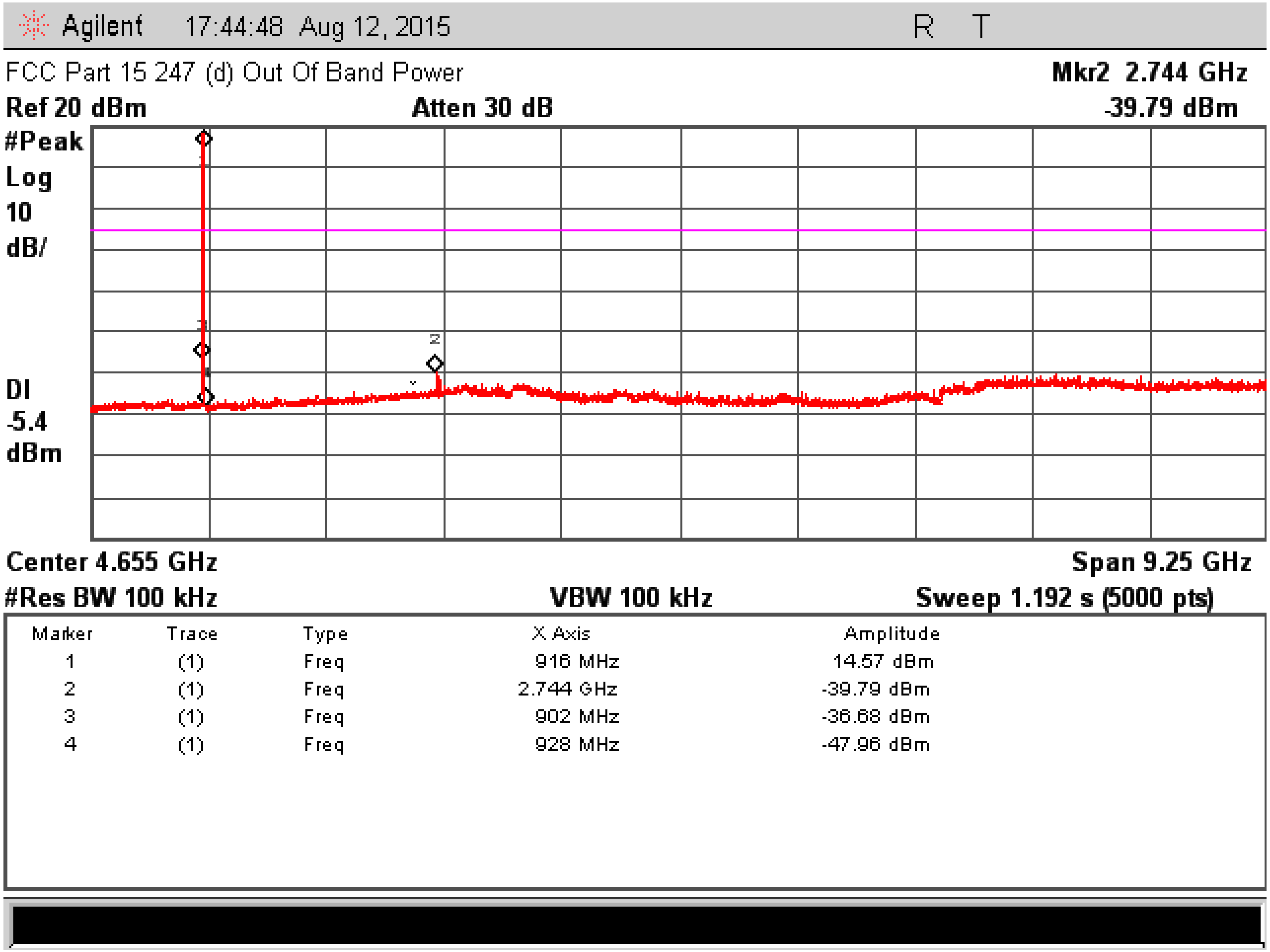


Figure 9.2-2 – Out of Band Conducted Data for Channel 24

Notes:

Marker 1 was placed on the fundamental. The magenta line was 20 dB down from the fundamental. Marker 2 was on the third harmonic. Marker 3 was on the lower band edge. Marker 4 was placed at the upper band edge.

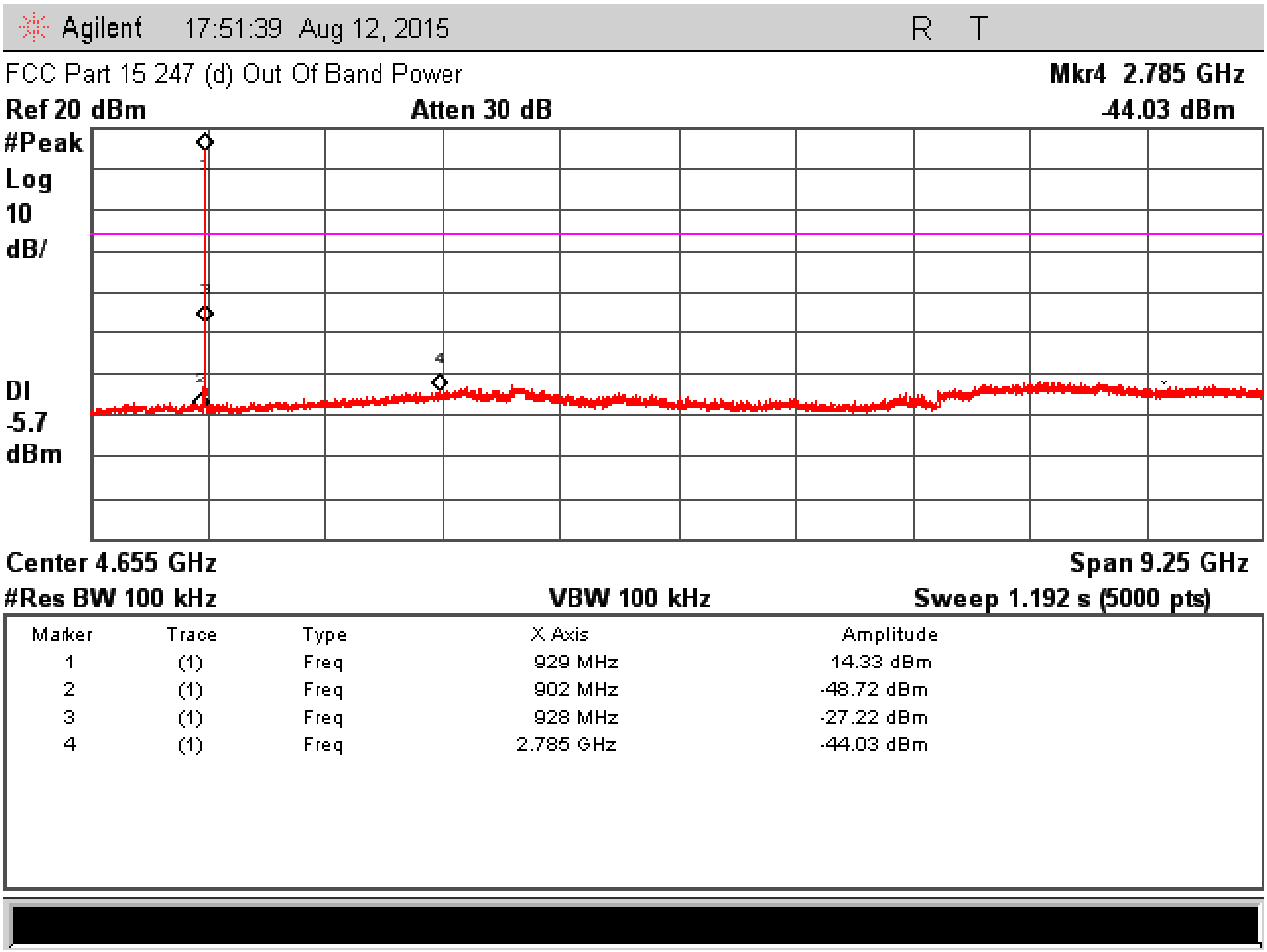


Figure 9.2-3a – Out of Band Conducted Data for Channel 49

Notes:

Marker 1 was placed on the fundamental. The magenta line was 20 dB down from the fundamental. Marker 2 was on the lower band edge. Marker 3 was on the upper band edge. Marker 4 was placed at the third harmonic.

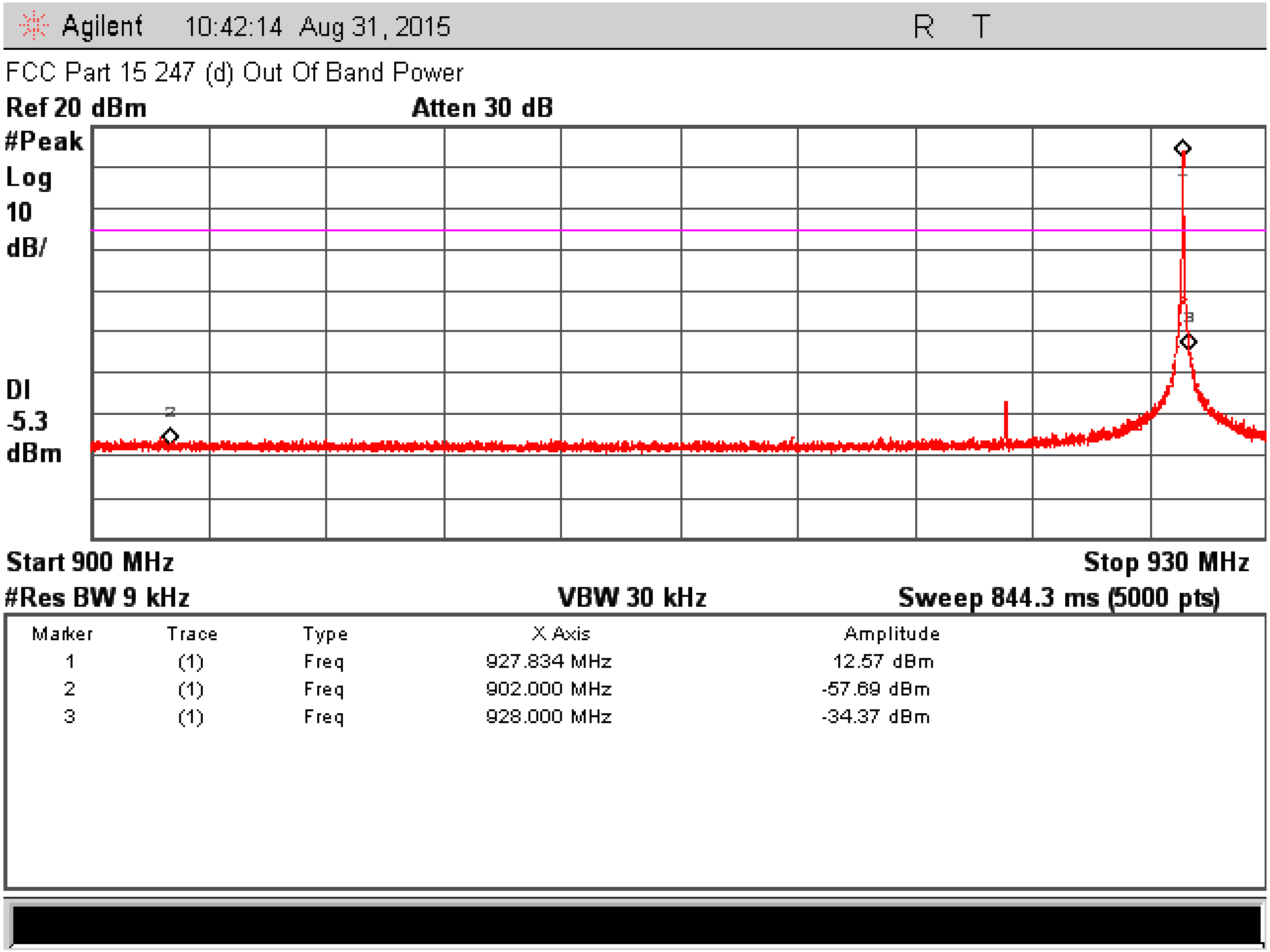


Figure 9.2-3b – Band-edge Conducted Data for Channel 49

Notes:

Marker 1 was placed on the fundamental. Marker 2 was placed at the lower band-edge frequency. Marker 3 was placed at the upper band-edge frequency.

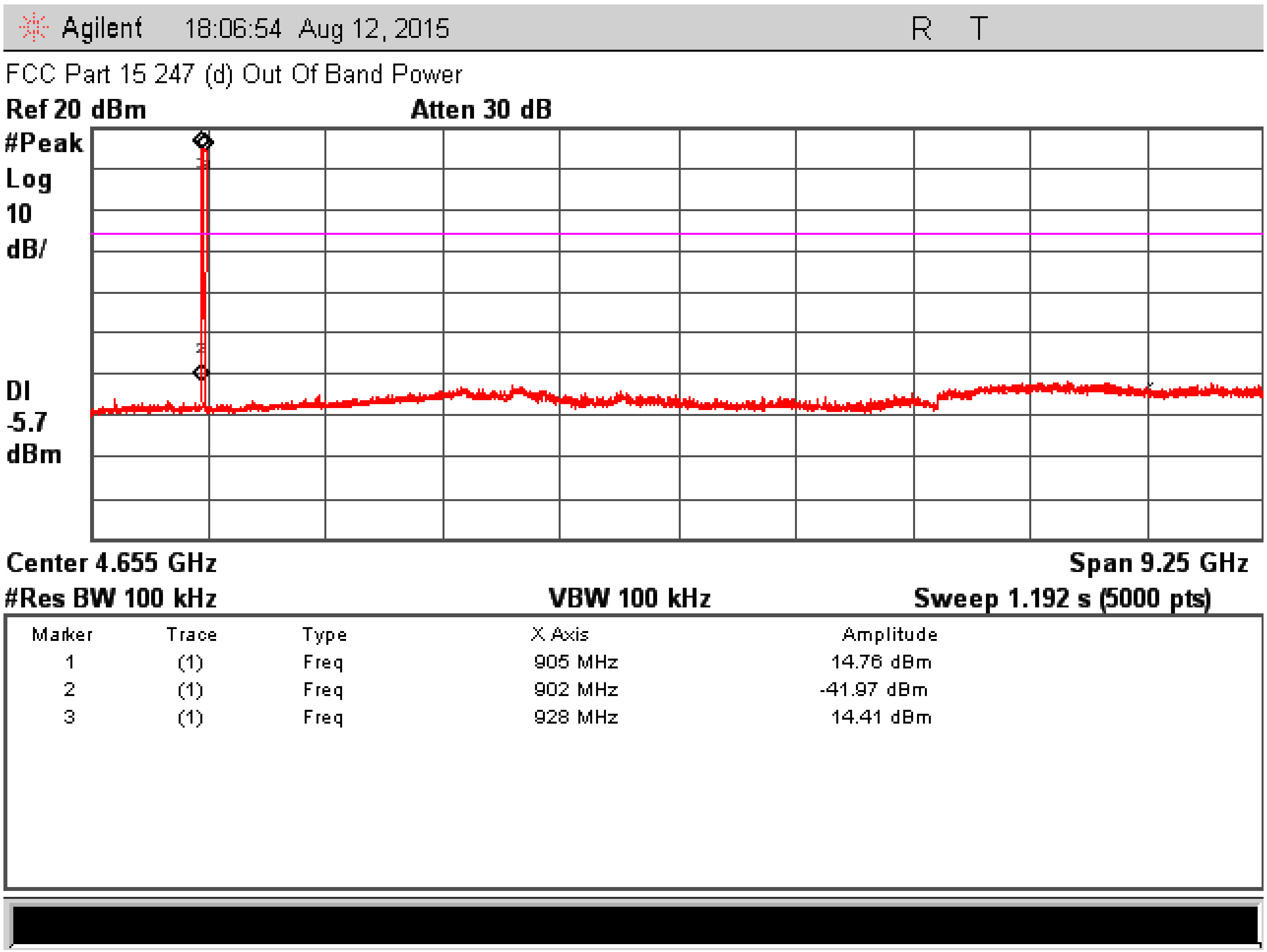
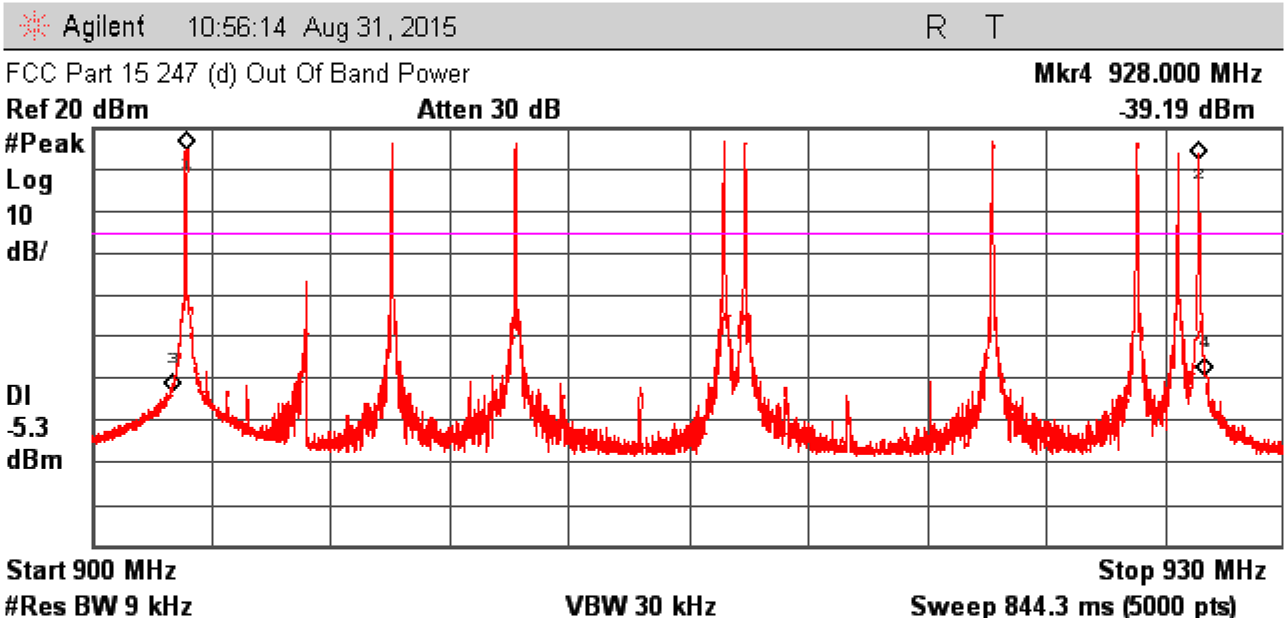


Figure 9.2-4a – Out of Band Conducted Data for Radio in the Frequency Hopping Mode

Notes:

Marker 1 was placed on the fundamental. The magenta line was 20 dB down from the fundamental. Marker 2 was on the lower band edge. Marker 3 was on the upper band edge.



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	902.346 MHz	14.55 dBm
2	(1)	Freq	927.834 MHz	12.24 dBm
3	(1)	Freq	902.000 MHz	-43.16 dBm
4	(1)	Freq	928.000 MHz	-39.19 dBm

Figure 9.2-4b – Band-edge Conducted Data in the Frequency Hopping Mode

Notes:

Markers 1 and 2 were placed on the fundamental signals for channels 0 and 49 respectively. Marker 3 was placed at the lower band-edge frequency. Marker 4 was placed at the upper band-edge frequency.

9.3 Test Instrumentation Used, Out of band Power Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	4/10/2017

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods with a calibration interval of 24 months.

10 FREQUENCY HOPPING REQUIREMETNS

References: 47 C.F.R. § 15.247 (a)

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

10.1 Test Procedure

Carrier Frequency Separation

The measurement is made using a direct connection between the DUT's antenna connection and the spectrum analyzer. The spectrum analyzer's resolution bandwidth (RBW) is set to 10 kHz and its span set to encompass the full bandwidth (1 MHz) of the emission. The DUT is conditioned to transmit at its maximum duty cycle. The center frequency is measured with the DUT transmitting on Channel 48 and then again with it transmitting on Channel 49. The difference between the two carrier frequencies was the separation.

Number of Hopping Channels

The method is similar to measuring the carrier frequency separation except that the span is set to occupy the full bandwidth of the 902 MHz to 928 MHz operating band. The DUT is conditioned to operate on all channels using the frequency hopping test mode and the number of channels is counted.

Time of Occupancy

The measurement is made using a direct connection between the DUT's antenna connection and the spectrum analyzer. The spectrum analyzer's resolution bandwidth (RBW) is set to 1 MHz and its span set to 0 Hz. The DUT is conditioned to transmit at its maximum duty cycle as represented by the frequency hopping test mode. The dwell time or maximum time the transmitter is on is then measured.

10.2 Test Data

Compliance Verdict: PASS

Based upon the measured 20 dB bandwidth of 60 kHz, the channel separation was measured relative to that constraint.

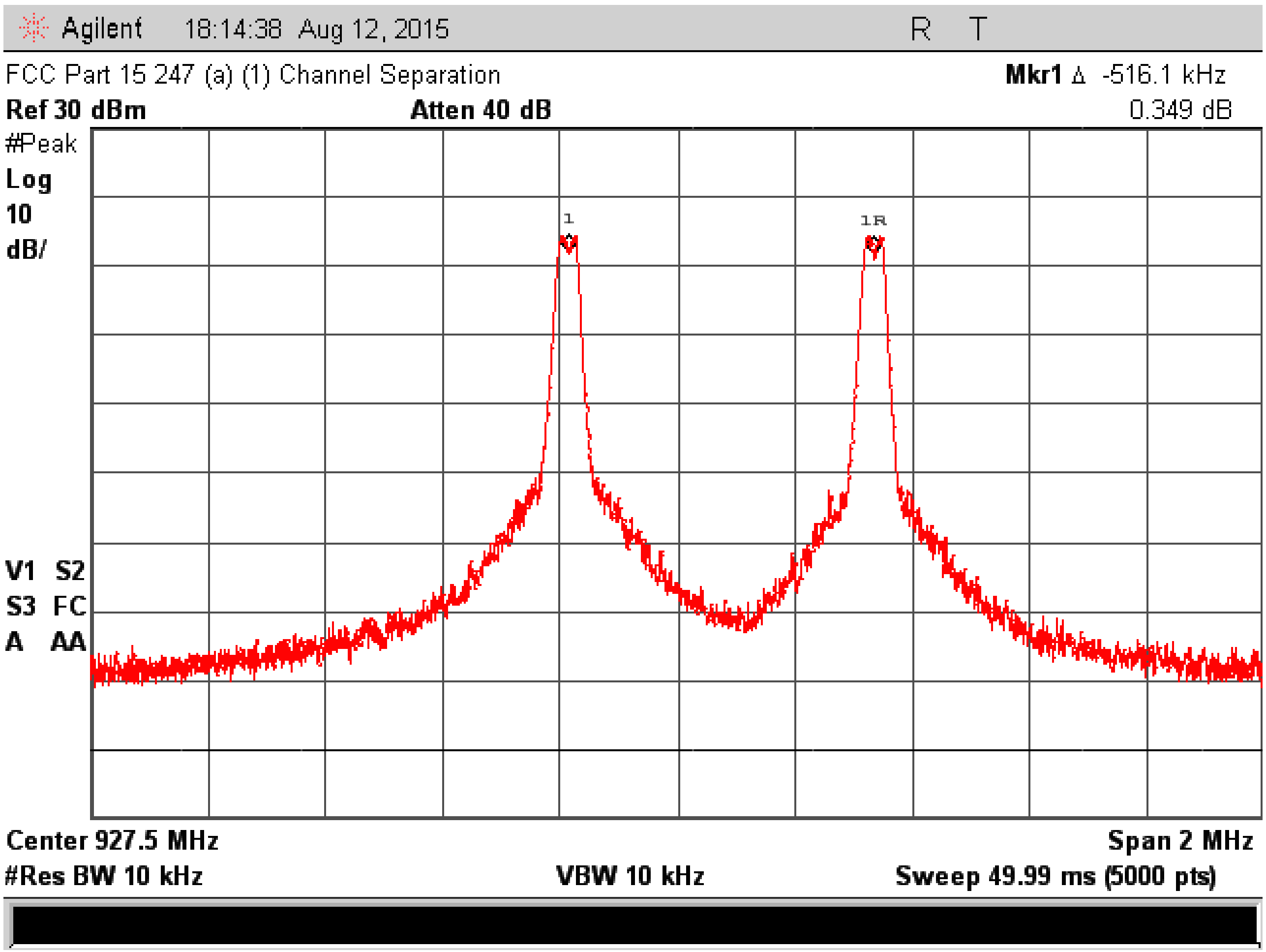


Figure 10.2-1 – Carrier Frequency Separation

The radio's specified nominal channel separation is 520 kHz. The measured separation between channels 48 and 49 was 516 kHz. This channel separation was much greater than the 20 dB bandwidth of 60 kHz.

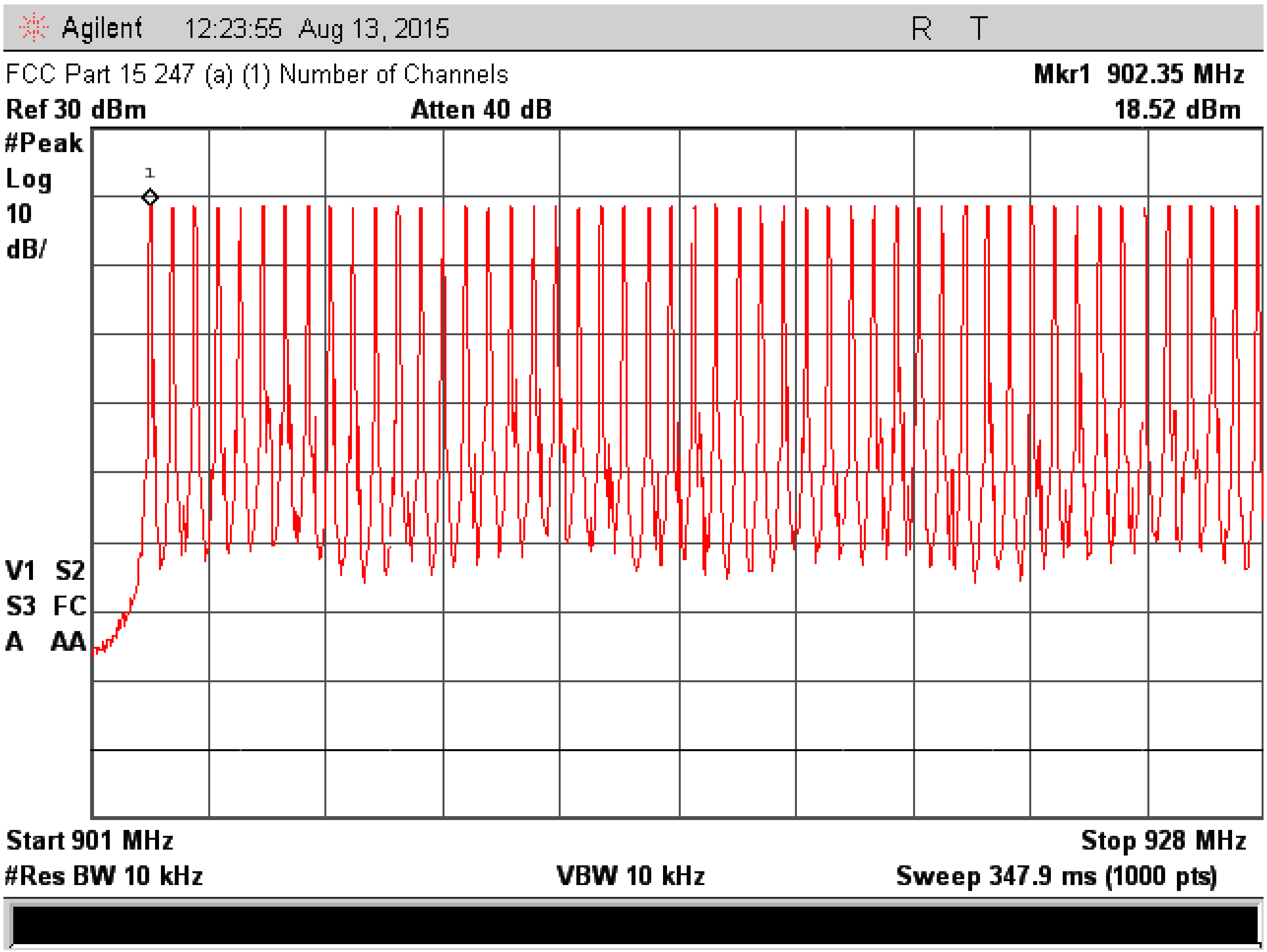


Figure 10.2-2 – Number of Hopping Channels

Notes:

The DUT operates on 50 channels as per FCC Part 15 requirements. The above plot was captured using the spectrum analyzer's max hold function as the radio cycled through its hopping sequence.

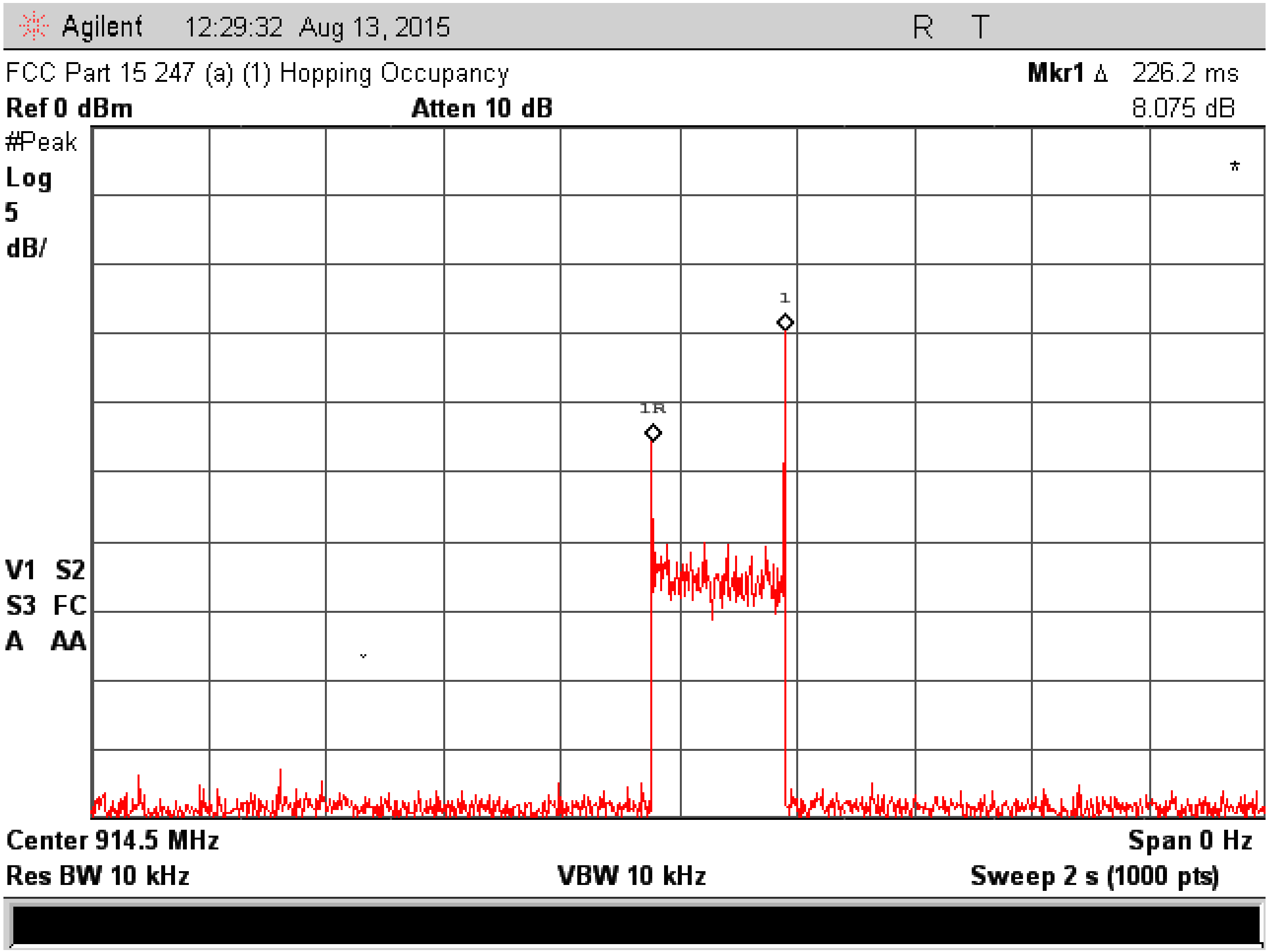


Figure 10.2-3 – Time of Channel Occupancy

Notes:

The DUT operates on a channel for 226 msec then hops to another channel. The above plot was taken monitoring the frequency used by channel 24.

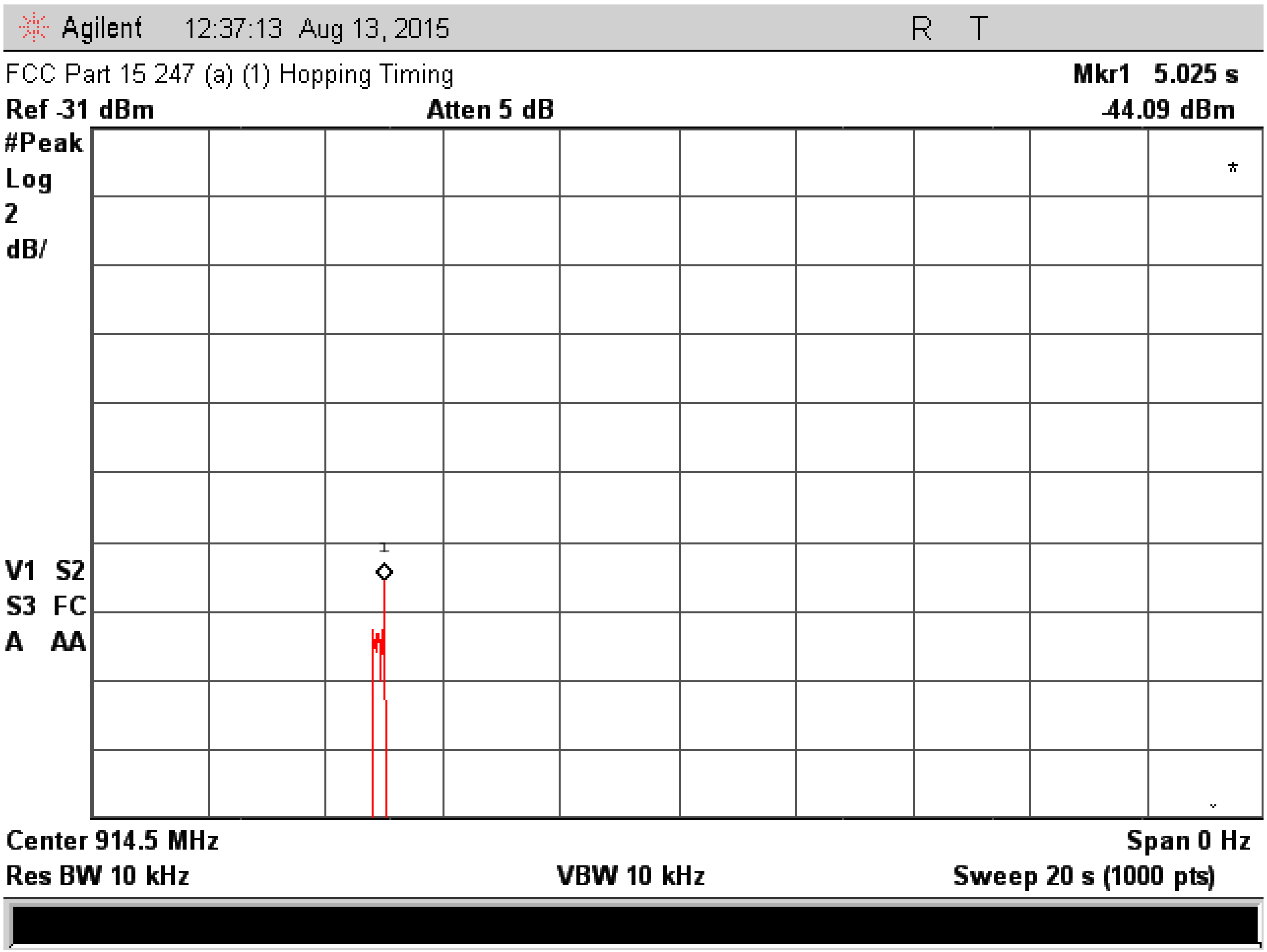


Figure 10.2-4 – Time of Channel Occupancy in a 20 Second Interval

Notes:

The DUT only transmits on a given channel once over a 20 second time internal.

10.3 Test Instrumentation Used, Frequency Hopping Measurements

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	4/10/2017

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods with a calibration interval of 24 months.

11 DUTY CYCLE

References: 47 C.F.R. § 15.35 (c)

Unless otherwise specified, e.g. §15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

11.1 Test Procedure

The measurement is made as a field strength measurement except that the spectrum analyzer's frequency span is set to 0 Hz to facilitate a time domain measurement. The sweep time is set to 100 msec. The DUT is conditioned to transmit at its maximum duty cycle. The duty cycle is calculated by summing the on times and dividing by 100 msec.

11.2 Test Data

Compliance Verdict: None

The test mode used for radiated emissions measurements was the continuous transmission test mode. This was a 100 % duty cycle transmission. A reduction in the field strength measurements based upon duty cycle was not appropriate because the transmitter was on for greater than 100 msec. In normal operation the transmitter may be on for greater than 100 msec so the application of a duty cycle correction factor to peak detector readings is not appropriate.

Refer to section 10 for time domain measurements with the DUT operating in the frequency hopping test mode.

11.3 Test Instrumentation Used, Duty Cycle Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	4/10/2017

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods with a calibration interval of 24 months.

12 LABELING AND USER'S GUIDE REQUIREMENTS

12.1 FCC Label Statement

Due to the small size of the device the following statement has been included in the user guide.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The FCC identifier or the unique identifier, as appropriate, will be displayed on the device.

The FCC ID number will be: 2ADCCM113PB

Figure 12.1-1 below shows a sample of the FCC label.

Figure 12.1-1 - Sample Label

12.2 Instruction Manual Statements

The instruction manual must contain the following statements:

Pup Model: M112PB FCC ID: 2ADCCM112PB

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

- This device may only be used with the approved antenna that is shipped with the unit and installed per the installation instructions. The use of any other antennas will invalidate the units' FCC Part 15 certifications.
- To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication. Operating the device with the supplied antenna will ensure that this requirement is met.

This equipment generates and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. A separation distance of 20 cm should be observed to maintain compliance with the FCC's RF exposure guidelines set out in OET Bulletin 65.

13 MPE CONSIDERATIONS

References: 47 C.F.R. § 1.1310

Radiofrequency radiation exposure limits.

The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation."

Table 13-1

Table 1—Limits for Maximum Permissible Exposure (MPE) **Frequency range (MHz)**	**Electric field strength (V/m)**	**Magnetic field strength (A/m)**	**Power density (mW/cm2)**	**Averaging time (minutes)**
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f2)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100.000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f2)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100.000			1.0	30
f = frequency in MHz				
* = Plane-wave equivalent power density				

2.5.2 Exemption from Routine Evaluation Limits – RF Exposure Evaluation
RF exposure evaluation is required if the separation distance between the user and the device's radiating element is greater than 20 cm, except when the device operates as follows:

below 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 2.5 W;

at or above 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 5 W.

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

Prediction of MPE Limit for a Specified Distance

Reference: OET Bulletin 65, Edition 97-01

The power density formula is as follows:

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Table 13-2 – MPE Calculation for OET Bulletin 65 Compliance

Maximum peak output power at antenna terminal:	14.61	(dBm)
Maximum peak output power at antenna terminal:	28.91	(mW)
Antenna Gain (typical):	5.19	(dBi)
Maximum Antenna Gain:	3.30	(numeric)
Prediction Distance:	20.00	(cm)
Prediction Frequency:	902.35	(MHz)
MPE Limit for Uncontrolled Exposure at Prediction Frequency:	0.60	(mW/cm^2)
Power Density at the Prediction Frequency:	0.0190	(mW/cm^2)
Maximum Allowable Antenna Gain:	20.20	(dBi)
Margin of Compliance at 20 cm:	15.01	(dB)

ANNEX A NVLAP CERTIFICATE of ACCREDITATION

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200125-0

Walshire Labs, LLC
Largo, FL

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2015-04-01 through 2016-03-31
Effective dates

DEPARTMENT OF COMMERCE • UNITED STATES OF AMERICA •

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

ANNEX B DISCLOSURE STATEMENT

Walshire Labs, LLC represents to the client that testing was done in accordance with standard procedures as applicable and that reported test results are accurate within generally accepted commercial ranges of accuracy. Walshire Labs Inc. test reports only apply to the specific sample(s) tested. This report is the property of the client. This report shall not be reproduced except in full without the expressed written approval of Walshire Labs, LLC.

TERMS and CONDITIONS

ARTICLE 1 *- Services, Walshire Labs will:*

1.1 Act for Client in a professional manner, using the degree of care and skill ordinarily exercised by and consistent with the standards of the profession.

1.2 Provide only those services that lie within the technical and professional area of expertise and capability of the Lab.

1.3 Perform all technical services in accordance with accepted laboratory test principles and practices.

1.4 Use test equipment which has been calibrated within a period not exceeding the manufacturer's recommendation and which is traceable to the NIST.

1.6 Consider all reports to be the confidential property of the client, and distribute reports only to those persons designated by the client.

ARTICLE 2 *- Client's Responsibilities, The Client will:*

2.1 Provide all information necessary for proper performance of technical services.

2.2 Designate a person who is authorized to transmit instructions, receive information and test data reports, interpret and define Client's policies, and make decisions regarding technical services, as may be required at Clients expense.

2.3 Deliver without cost, representative samples of product for technical evaluation, together with any relevant data.

2.4 Furnish such labor and equipment necessary to handle sample product and to facilitate the technical evaluation.

2.5 The Client shall provide prior to the start of evaluation testing a signed Purchase Order for the amount agreed to by both parties.

ARTICLE 3 *- General Requirements.*

3.1 The only warranty made by Walshire Labs, in connection with services performed thereunder is that it will use that degree of care and skill as stated in Article 1.1 and 1.3 above. No other warranty, expressed or implied, is made or intended for services provided thereunder.

3.2 Walshire Labs shall supply technical services and prepare reports based solely on product samples submitted. The Client understands that application of the data to other devices is highly speculative and should be applied with extreme caution.

3.3 Walshire Labs agrees to exercise ordinary care in receiving, preserving, and shipping any test sample to be tested, but assumes no responsibility for damages, either direct or consequential, which arise or are alleged to arise from loss, damage or destruction of the sample due to the act of examination, modification or testing, or technical analysis, or circumstances beyond our control.

3.4 The Client recognizes that generally accepted error variances apply and agrees to consider such error variances in its use of test data.

3.5 It is agreed between Walshire Labs and Client that no distribution of any test reports, etc. shall be made to any third party without the prior written consent of both parties.

3.6 Test Reports may not be used by the Client to claim product endorsement by NVLAP or any agency of the U.S. Government.

ARTICLE 4 *- Payment.*

4.1 The Client agrees to pay for services and expenses as covered in the Purchase Order or modified by Article 2.2. Walshire Labs will present an invoice at the completion of work and will be paid within 15 days of receipt by Client.