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47 C.F.R. Part 15 FCC Rules, Subpart C
&
Industry Canada RSS-GEN Issue 3 & RSS-210 Issue 8
Test Results for the

Augusta Irrigation Controller Unit

Equipment:	Augusta Controller Unit
Client:	Green Badge LLC D/B/A UgMO Technologies
Address:	840 First Ave., Suite 300 King of Prussia, PA 19406

Test Report Number: FCCIR-UGMO-06-05-13A
Date: August 15, 2013
Total Number of Pages: 62

NVLAP LAP Code: 200125-0
FCC Test Site Registration Number: 830450
Industry Canada Site Number 7868A-1

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1 IDENTIFICATION SUMMARY

1.1 Test Report

Test Report Number: FCCIR-UGMO-06-05-13A
Test Report Date: August 15, 2013

Report written and approved by:

August 15, 2013	Peter J. Walsh, NCE	
Date	Name	Signature

1.2 Testing Laboratory

Walshire Labs, LLC
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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 and Industry Canada RSS-210 Issue 8 certification of the DUT.

1.4 Client Information

Name:	Green Badge LLC dba UgMO Technologies
Street:	840 First Ave., Suite 300
City:	King of Prussia
State:	PA
Zip Code	19406
Country:	USA
Contact Person:	Kathy Sohrabi
Phone:	310 502 1577
Email:	KSohrabi@ugmo.com

1.5 Dates

Date of commission:	May 16, 2013
Date of receipt of DUT:	May 20, 2013
Date of test completion:	August 13, 2013

1.6 Device Under Test (DUT)

Name:	Augusta Controller
Version:	Model UG1000C-A
Unit Serial Number:	105
R Board Serial Number:	8070320002
Antenna Type:	PCB Trace
Nominal Gain:	-2.0 dBi
Modulation Type:	FSK
Bit Rate:	38.4 kBaud

2 GENERAL INFORMATION

2.1 Product Description

The Controller is a component of the UgMO Technologies Augusta advanced irrigation system that employs a radio operating in the 902-928 MHz ISM band using frequency hopping to facilitate a mesh network. The radio serves as a wireless link to other components in the system including a bridge unit and a repeater unit, certified separately. The Controller also employs a 433.92 MHz receiver to receive information from previously certified moisture sensors.

A typical Augusta system is comprised of one wireless bridge device (Bridge), which provides Internet connectivity for the system, one or more wireless irrigation controllers (Controller), each responsible for managing irrigation events for up to 24 irrigation valves, and optional wireless repeaters (Repeater) that extend the wireless range of the controller and bridge and allow covering larger areas.

The operational description exhibit provides additional information.

2.2 Interface Cable Details

Interface cables used in the system are as follows:

Qty	Length	Cable Description
1	1 m	Unshielded AC Power Cable
3	0.4 m	Unshielded Valve Control Cables

2.3 Peripheral Devices

The DUT was connected to a USB thumb drive, SanDisk Cruzer Blade 4GB.

2.4 Test Methodology

Testing was performed according to ANSI C63.4-2003, the procedure referenced by Part 15, FCC Rules along with 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). The site has been registered with the FCC under registration number 830450. The site has also been registered with Industry Canada, 2146A-1.

2.6 Deviations

No deviations were exercised during the course of the testing.

3 SYSTEM TEST CONFIGURATION

3.1 Justification

The DUT is a wall mounted device. Consistent with guidance in ANSI C63.4-2003, the DUT was tested in a table top configuration though to facilitate its proper mounting and orientation it was fastened to a small piece of plywood secured to the table. Radiated and ac mains conducted emissions tests were performed in that manner. Conducted tests were performed using a short coaxial cable attached to the DUT's external antenna port. Note that the DUT's 902 – 928 MHz band transceiver only uses an internal antenna; the external antenna connector was used strictly for FCC compliance testing.

Various test modes were used to simulate the DUT's normal modes of operation in the absence of companion equipment. A continuous 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.

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	903.053	0x04
24	915.036	0x04
49	927.492	0x04

Because the DUT's USB port is a host port intended to connect a USB thumb drive it can not be connected to a personal computer. Because of this, the DUT is ***not*** considered to be a Class B peripheral subject to DoC. *So for the device's digital circuitry it is subject to Verification and not Declaration of Conformity authorization.*

3.2 Special Accessories

None were used during the tests.

3.3 Equipment Modifications

No modifications were made by Walshire Labs to achieve compliance.

Signature:		Date:	August 13, 2013
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)
RSSGEN § 7.2.4

(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.

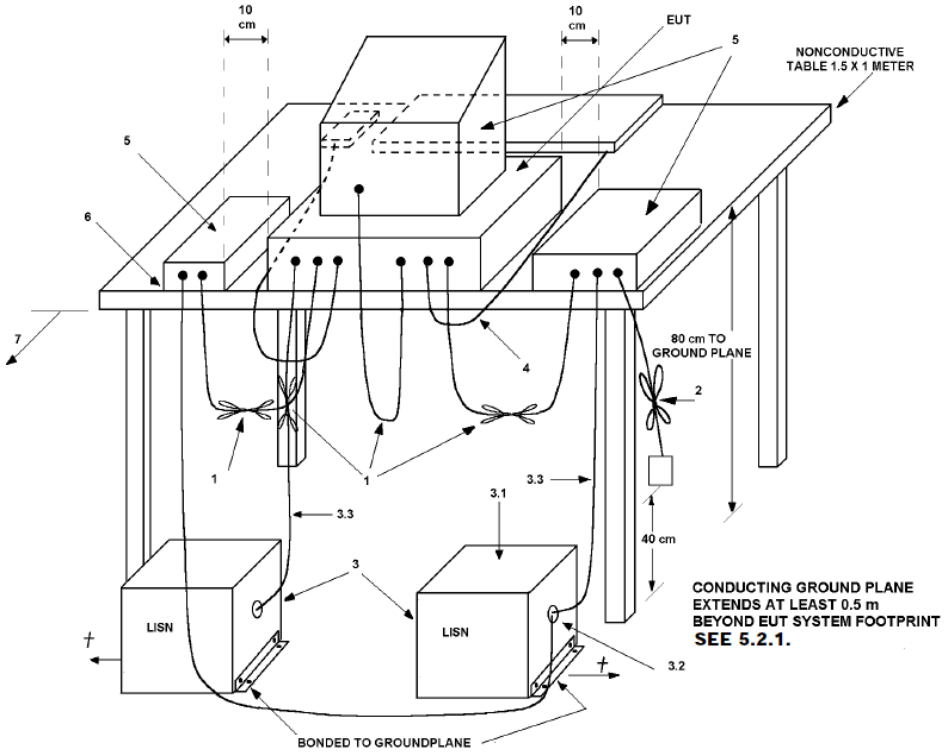
Table 4-1

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 C63.4-2003 § 7. The test setup is consistent with ANSI C63.4-2003 Figure 10a as shown below. The test is performed in a semi-anechoic chamber. As such, the optional vertical conducting plane is not used.



LEGEND:

1) Interconnecting cables that hang closer than 40 cm to the groundplane shall be folded back and forth in the center forming a bundle 30 to 40 cm long (see 6.1.4 and 11.2.4).
2) I/O cables that are not connected to a peripheral 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 6.1.4).
3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, reference groundplane (see 5.2.3 and 7.2.1).
   3.1) All other equipment powered from additional LISN(s).
   3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
   3.3) LISN at least 80 cm from nearest part of EUT chassis.
4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use (See 6.2.1.3 and 11.2.4).
5) Non-EUT components of EUT system being tested (see also Figure 13).
6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop (see 6.2.1.1 and 6.2.1.2).
7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the groundplane (see 5.2.2 for options).

Figure 10a—Test arrangement for conducted emissions

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: PASS

Figure 4.2-1 shows a composite graph of the line and neutral conducted emissions as measured with a nominal line voltage of 120 V and line frequency of 60 Hz. The figure shows the emissions levels using the peak detector (blue trace) and the average detector (green trace).

Tables 4.2-1 and 4.2-2 show the final measured results in a tabular data format using the quasi-peak and average detectors.

This test was performed with the DUT's radio placed in the continuous transmission test mode.

Voltage with 2-Line-LISN FCC Class B

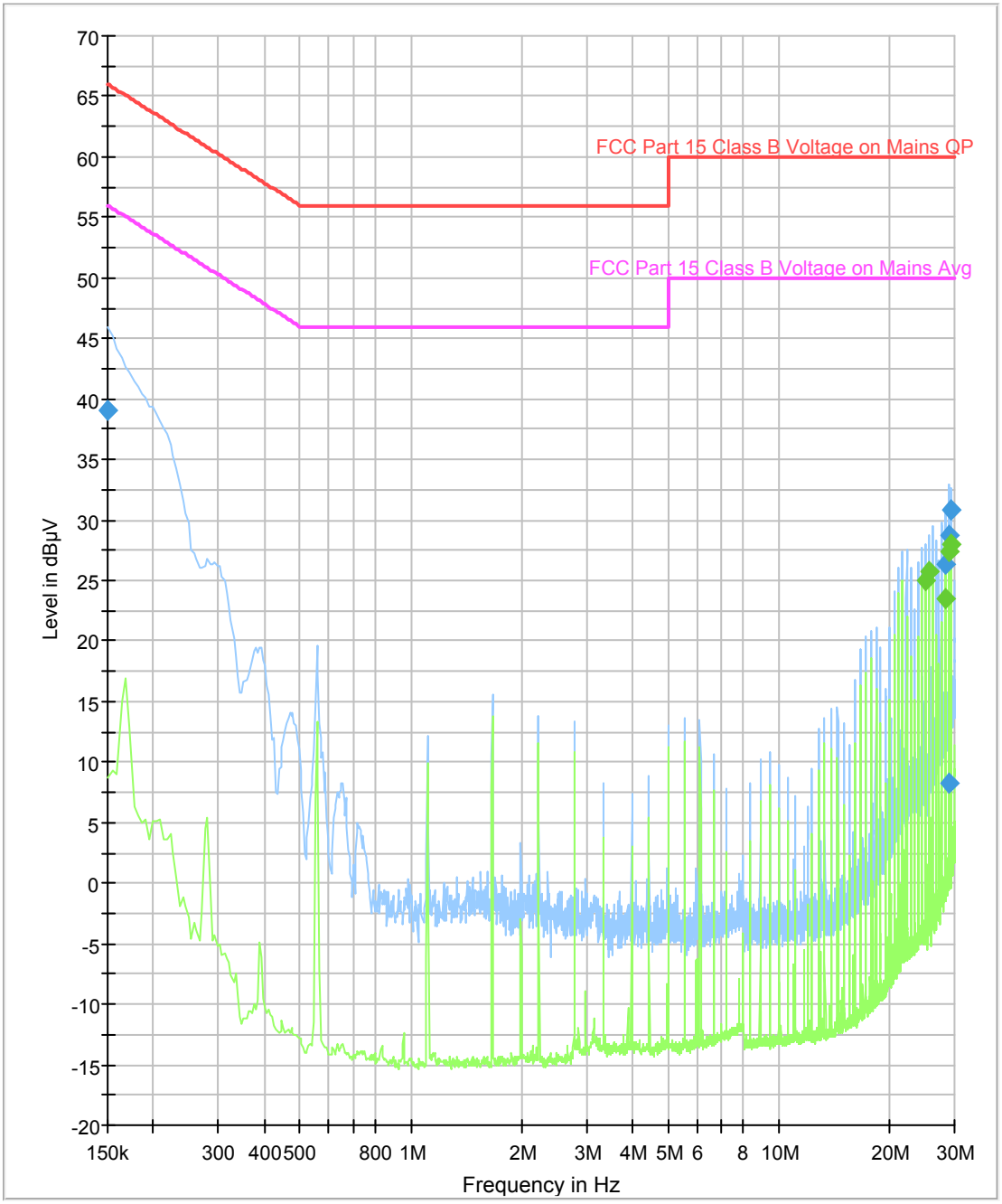


Figure 4.2-1 – FCC Part 15 Class B Conducted Emissions Plot

Table 4.2-1 - Final Quasi-peak Detector Results

Frequency (MHz)	QuasiPeak (dBµV)	Line	CF* (dB)	Margin (dB)	Limit (dBµV)
0.150000	39.1	N	0.1	26.9	66.0
28.342500	26.3	N	1.8	33.7	60.0
28.900500	28.7	L1	2.2	31.3	60.0
28.977000	8.2	L1	2.2	51.8	60.0
29.458500	30.8	L1	2.2	29.2	60.0

Table 4.2-2 - Final Average Detector Results

Frequency (MHz)	Average (dBµV)	Line	CF* (dB)	Margin (dB)	Limit (dBµV)
25.012500	24.9	N	1.7	25.1	50.0
25.570500	25.7	N	1.7	24.3	50.0
28.347000	23.5	N	1.8	26.5	50.0
28.905000	27.4	N	1.8	22.6	50.0
29.463000	28.0	L1	2.2	22.0	50.0

* CF is the LISN correction factor plus cable loss.

Minimum Margin: **22.0 dBµV**

Measurement Uncertainty: +/- 3.59 dB

Test Personnel:

August 9, 2013	Peter J. Walsh, NCE	
Date	Name	Signature

4.3 Conducted Emissions Test Instrumentation

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
EMI Receiver	Rohde & Schwarz ESCS 30	825788/002	11/23/2013
LISN	Rohde & Schwarz ESH3-Z5	840730/005	09/04/2014

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

4.4 Conducted Emissions Photographs

Photo 4.4-1 - Front View of the Conducted Emissions Test Set-up

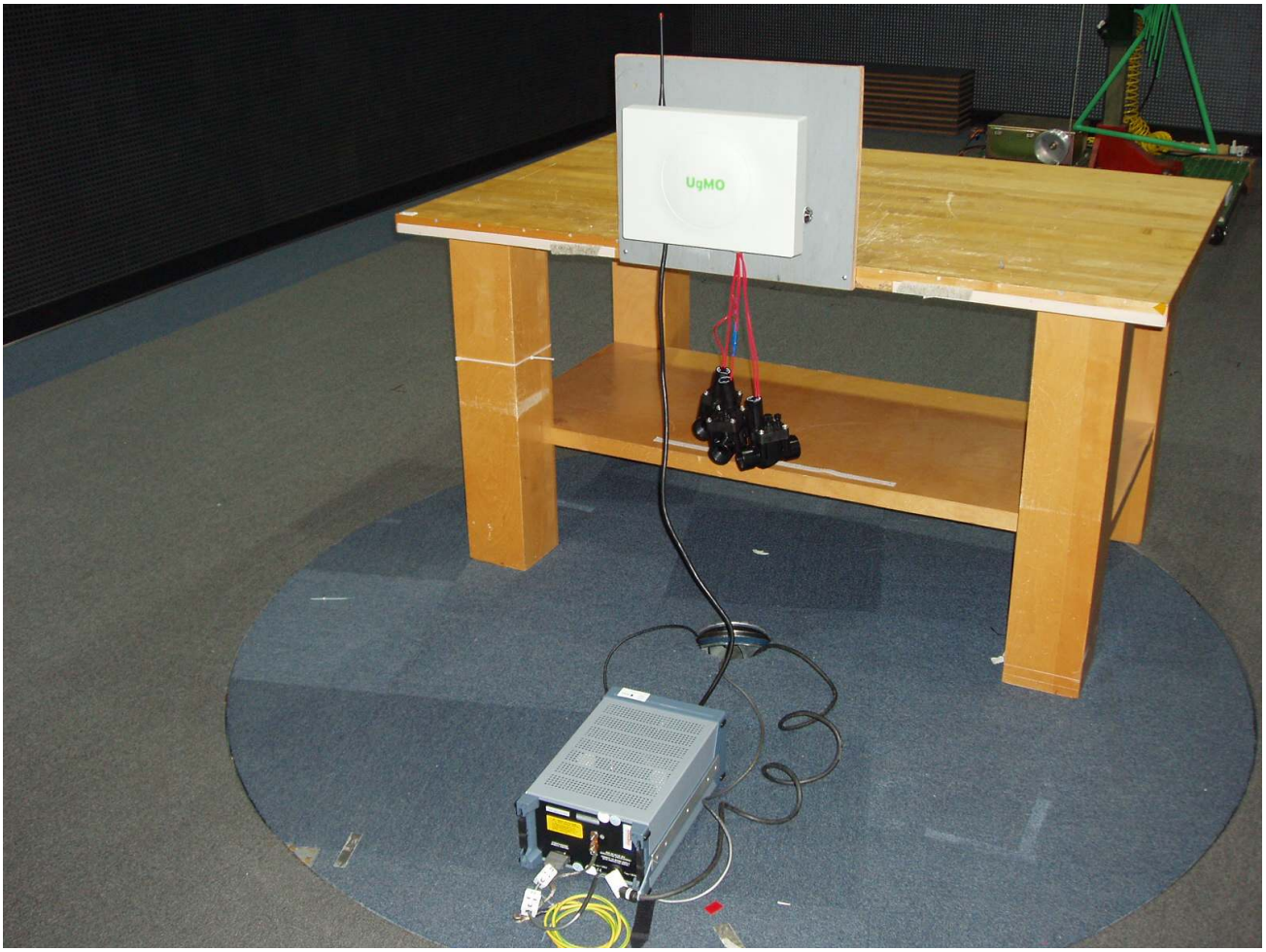


Photo 4.4-2 - Rear View of the Conducted Emissions Test Set-up

5 RADIATED EMISSIONS DATA

References: 47 C.F.R. § 15.209
RSS-210 § 2.2
RSSGEN § 6.1

(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.

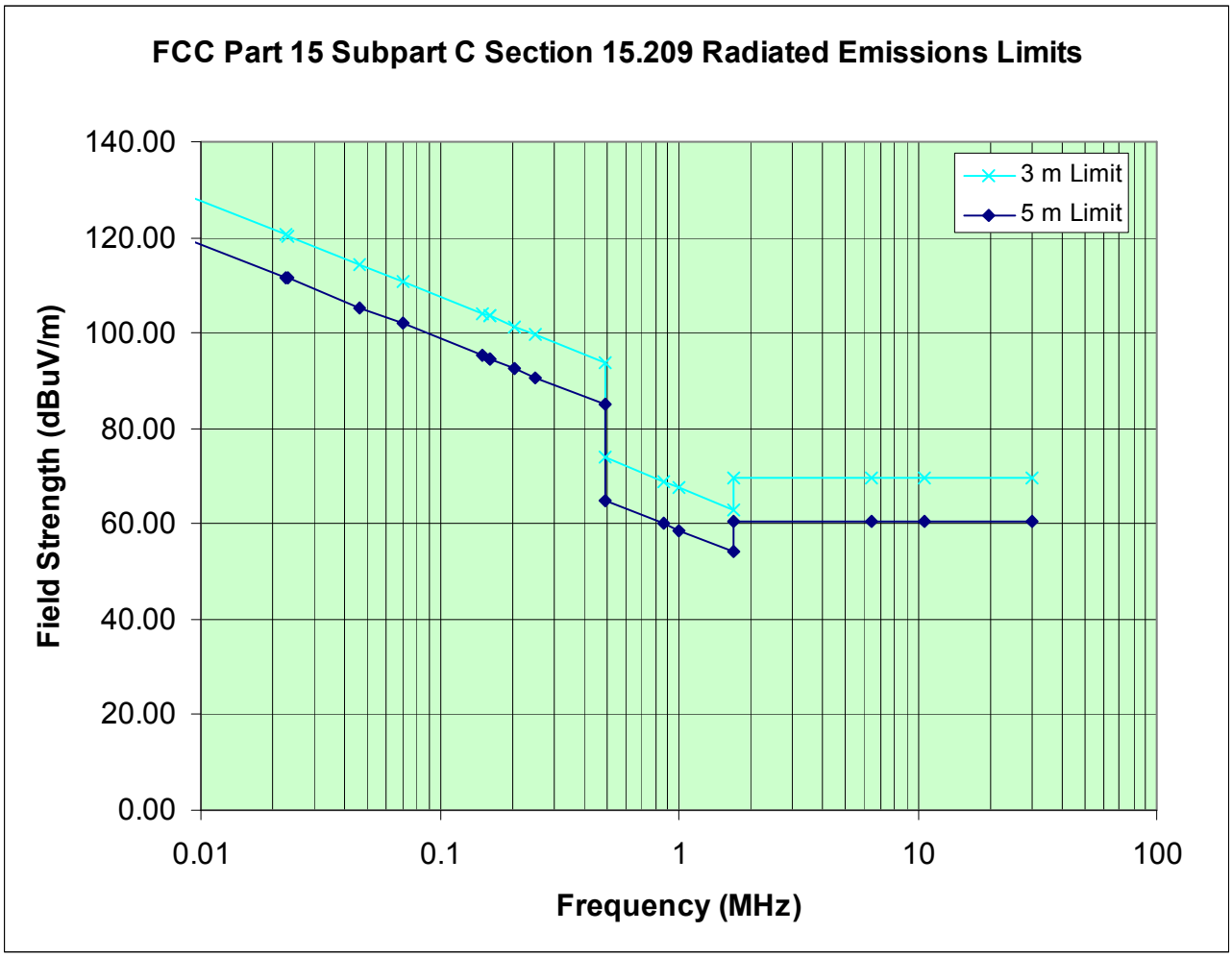


Figure 5-1 – Adjusted Field Strength Limits

References: 47 C.F.R. § 15.205
RSS-210 § 2.2

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

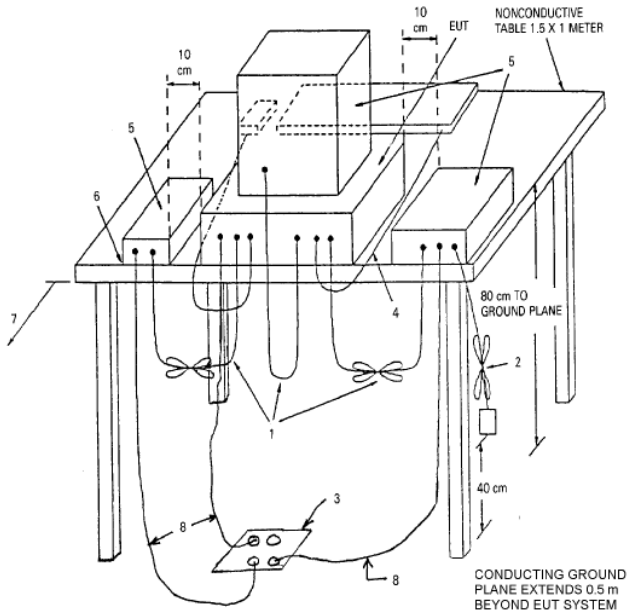
Table 5-2

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 C63.4-2003 § 8. The test setup is consistent with ANSI C63.4-2003 Figure 11a below. The test is performed in a semi-anechoic chamber. For frequencies between 14.74 MHz and 30 MHz, a shielded magnetic loop antenna was used. As a guidance document FCC/OET MP-5 was used.



LEGEND:

1) Interconnecting cables that hang closer than 40 cm to the groundplane shall be folded back and forth in the center, forming a bundle 30 to 40 cm long (see 6.1.4 and 11.2.4).
2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using the correct terminating impedance. The total length shall not exceed 1 m (see 6.1.4).
3) If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the groundplane with the receptacle flush with the groundplane (see 6.1.4).
4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use (see 6.2.1.3 and 11.2.4).
5) Non-EUT components of EUT system being tested (see also Figure 13).
6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop (see 6.2.1.1 and 6.2.1.2).
7) No vertical conducting plane used (see 5.2.2).
8) Power cords drape to the floor and are routed over to receptacle (see 6.1.4).

Figure 11a—Test arrangement for radiated emissions tabletop equipment

The following data lists the significant emission frequencies, amplitude levels (including cable correction and antenna factors), plus the limit. The frequency range investigated was 14.74 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 (14.74 MHz) was determined by a crystal frequency of 14.74 MHz used in the transceiver. The highest frequency to which the DUT had to be tested for its digital circuitry in accordance with FCC Part 15 Subpart B was 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 20 dB of the FCC Part 15 and RSS-GEN limits over the frequency range of 14.74 – 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 in accordance with RSSGEN Clause 6.1 as well as the emissions associated with the DUT's digital circuitry in accordance with FCC Part 15 Subpart B, for Class B equipment. This data has been provided voluntarily and is not required for the FCC application for certification. The preview scan was taken with the peak detector in both vertical (red trace) and horizontal (blue trace) antenna polarities at turntable angles of 0, 90, 180, and 270 degrees and antenna heights of 1, 2.5, and 4 meters. Rotating the turntable and adjusting the antenna elevation and polarity maximized the final quasi-peak measurements, denoted by the diamonds. Table 5.2-1 shows the highest measured results in a tabular data format.

With the transmitter enabled by selecting the continuous 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 with an EMI receiver. Measurements were made with the transmitter set on channel 0, 24, and 49 respectively. The highest measured emissions have been shown in Table 5.2-2.

For measurements taken above 1 GHz, the final measurement detectors were peak and average. The measurement bandwidth was 1 MHz. Exploratory tests were performed with the transmitter set on channel 0, 24, and 49 respectively. The highest measured emissions have been shown in Tables 5.2-3 and 5.2.4 for the peak and average detectors respectively.

FCC Class B 3m 30-1000 MHz Final Test

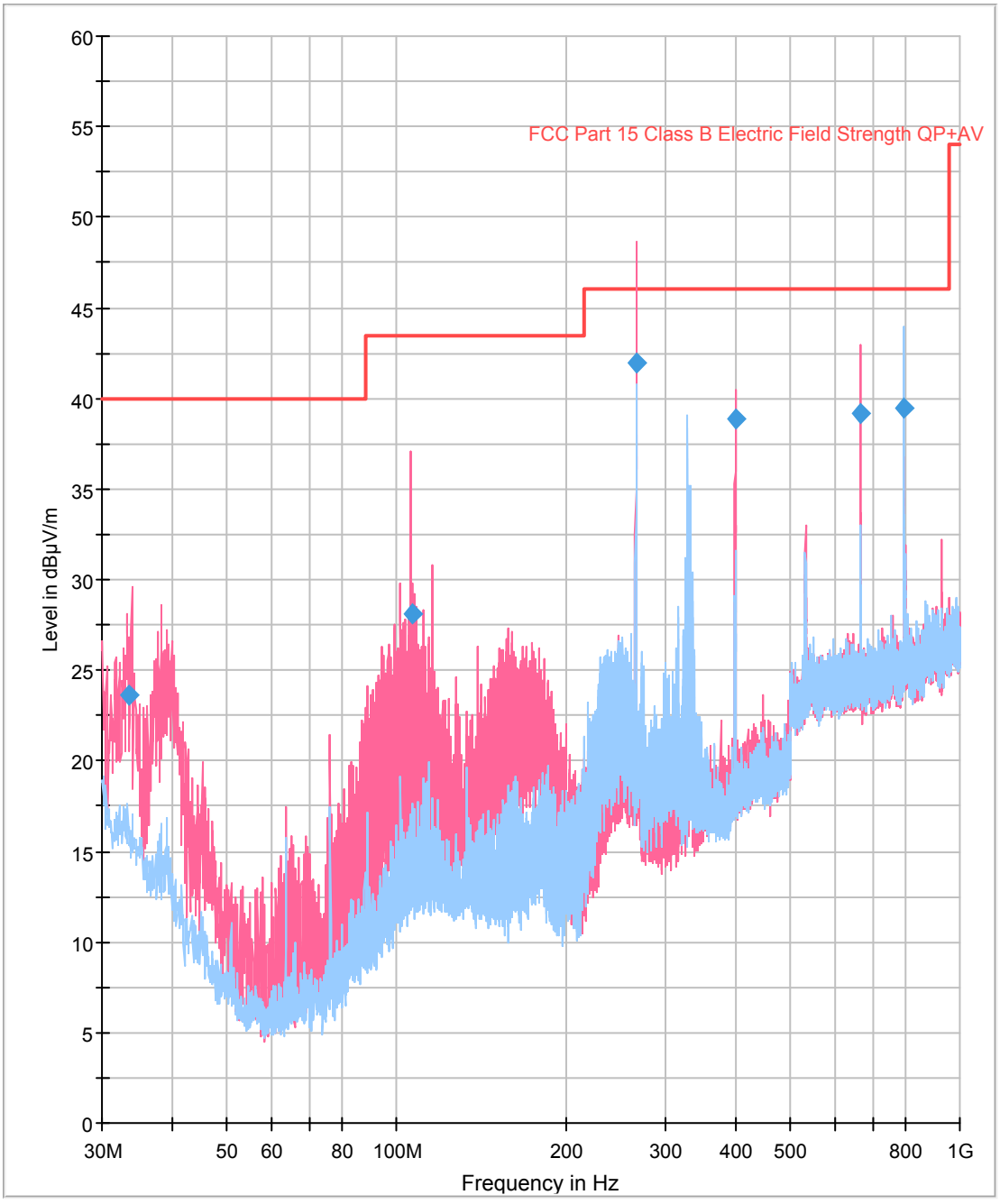


Figure 5.2-1 – FCC Part 15 Class B Radiated Emissions Plot

Table 5.2-1 – Radiated Emissions QuasiPeak Levels 30 – 1000 MHz with Transmitter Off

Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	CF* (dB)	Margin (dB)	Limit (dBµV/m)
33.420000	23.6	100.0	V	104.0	16.8	16.4	40.0
106.740000	28.1	100.0	V	180.0	12.4	15.4	43.5
266.000000	42.0	100.0	V	180.0	15.3	4.0	46.0
399.000000	38.9	147.0	V	224.0	18.2	7.1	46.0
665.040000	39.2	100.0	V	194.0	22.2	6.8	46.0
798.000000	39.4	148.0	H	148.0	24.3	6.6	46.0

Notes:

* CF is the antenna correction factor plus cable loss.

Table 5.2-2 – 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)	Limit (dBµV/m)	Notes
903.05	114.4	100	V	163	26.1	N/A	N/A	Channel 0
915.03	113.0	100	V	160	26.2	N/A	N/A	Channel 24
927.50	113.0	100	V	149	26.3	N/A	N/A	Channel 49
967.10	48.4	100	V	151	26.0	5.6	54.0	Channel 24 spur
970.94	52.9	100	V	160	26.0	1.1	54.0	Channel 49 spur
978.30	53.2	100	V	159	26.0	0.8	54.0	Channel 49 spur

* CF is the antenna correction factor plus cable loss.

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
2709	53.29	100	H	160	-2.2	20.71	74	3	0
2783	53.32	119	V	166	-2.2	20.68	74	3	49
4638	55.83	120	V	174	4.0	18.17	74	5	49
8127	57.24	109	V	160	24.2	16.76	74	9	0
9030	58.12	110	H	194	24.2	15.88	74	10	0

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
2709	51.12	100	H	160	-2.2	2.88	54	3	0
2783	50.99	119	V	166	-2.2	3.01	54	3	49
4638	52.68	120	V	174	4.0	1.32	54	5	49
8127	48.74	109	V	160	24.2	5.26	54	9	0
9030	49.54	110	H	194	24.2	4.46	54	10	0

* CF is the antenna correction factor and cable loss

Minimum Margin: 0.8 dBµV/m

Measurement Uncertainty: +4.8 dB, -5.2 dB

Test Personnel:

August 13, 2013	Peter J. Walsh, NCE	Peter J. Walsh
Date	Name	Signature

5.3 Test Instrumentation Used, Radiated Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
EMI Receiver	Rohde & Schwarz ESCS 30	825788/002	11/2/2013
Spectrum Analyzer	Agilent E7405A	MY42000055	3/29/2015
Preamplifier	Com-Power PA-122	181925	5/31/2015
1000 MHz HPF	TTE HC11-1000M-50-1554A	L9157	5/31/2015
Antenna	Chase EMCCBL6112B	2579	1/20/2014
Antenna	EMCO Horn Model 3115	9002-3393	3/7/2015
Antenna	Com-Power AL-130	121033	4/17/2014

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

5.4 Field Strength Calculation

The field strength (FS) is calculated by adding the antenna correction factor (ACF) and cable loss (CL) 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) – AG (dB)

FS = 25 + 12.1 + 0.7 + 0 = 37.8 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 Radiated Emissions Test Set-up

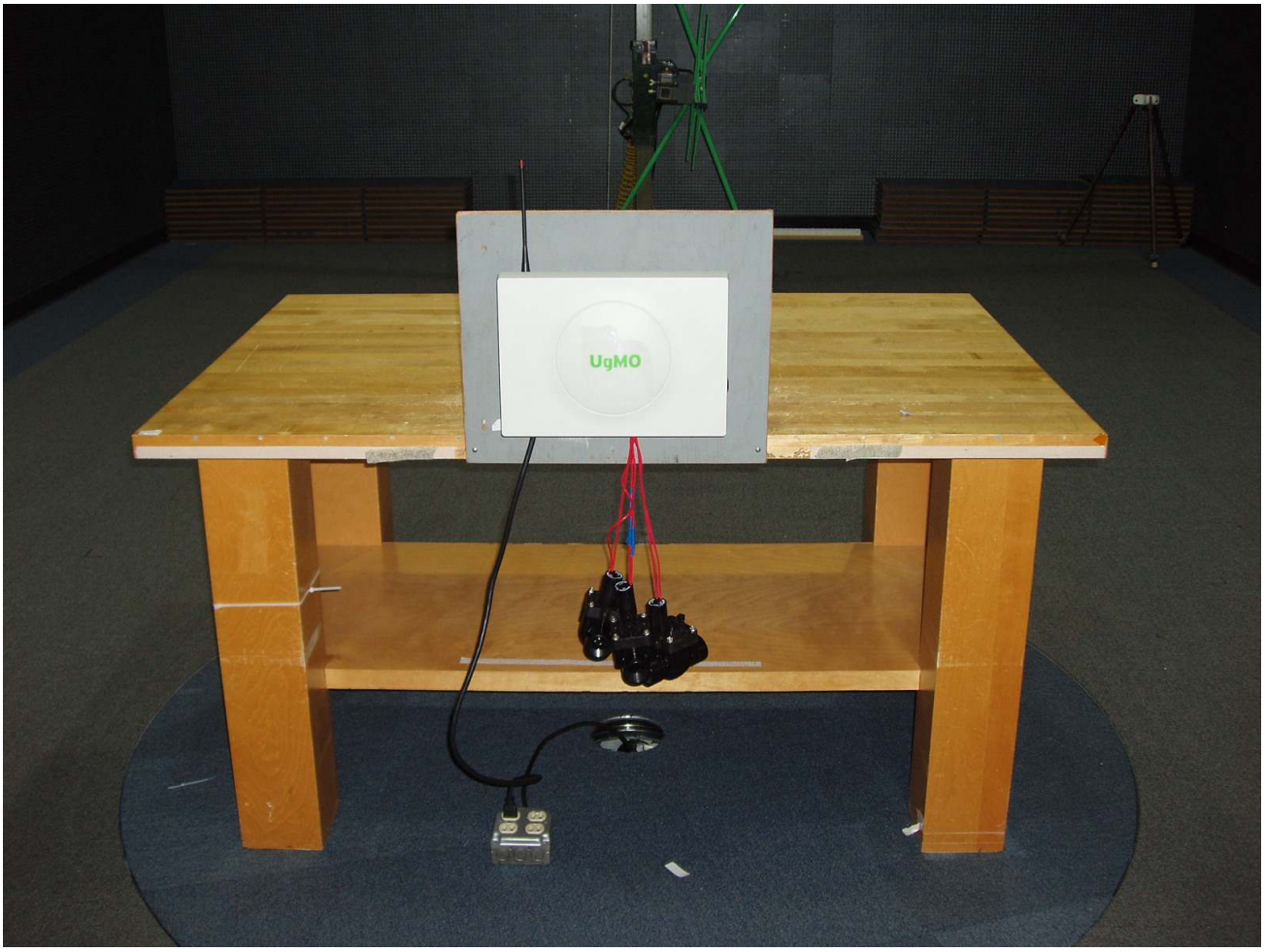


Photo 5.5-2 - Rear View of the Radiated Emissions Test Set-up 30 – 1000 MHz

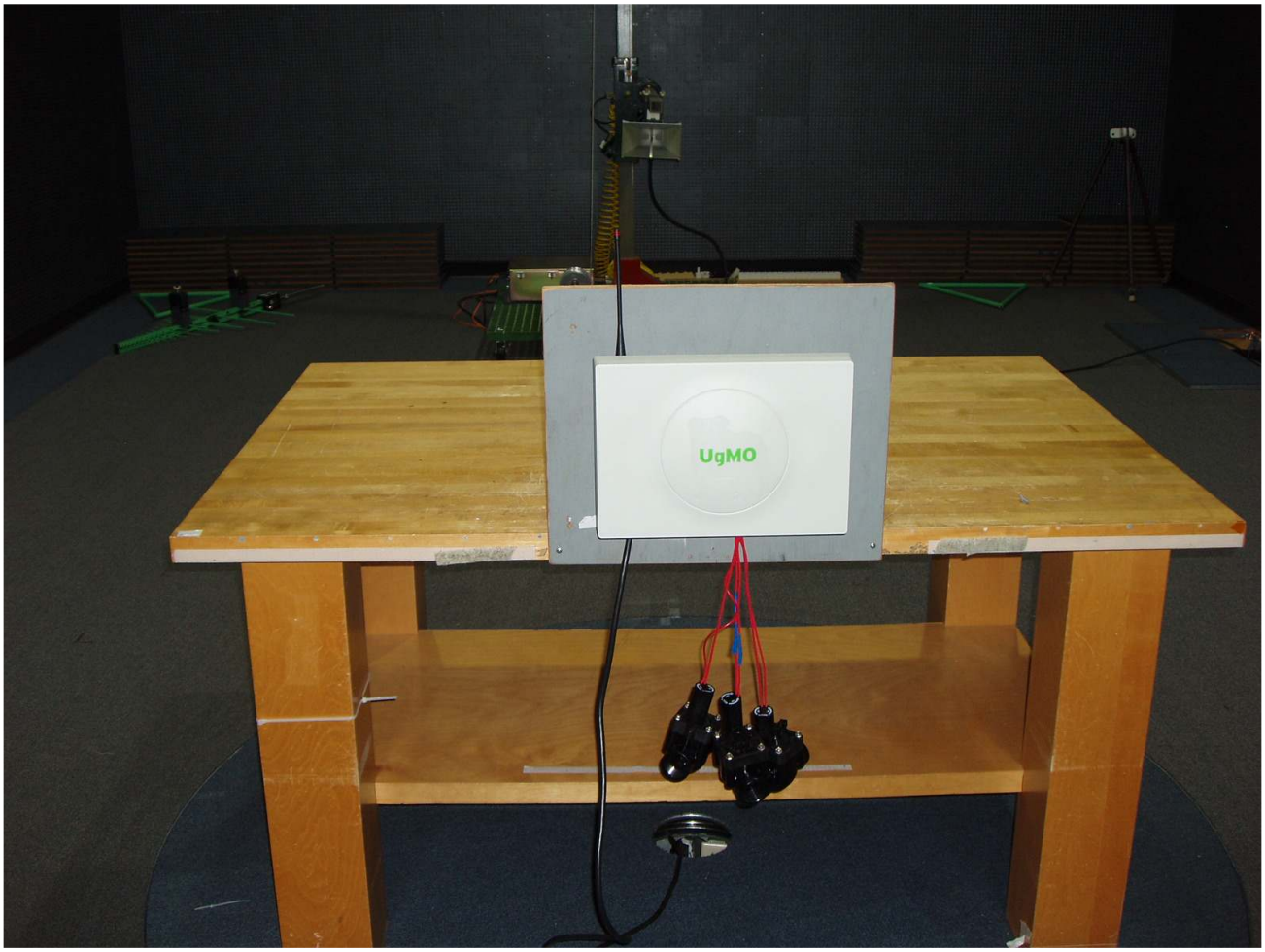


Photo 5.5-3 - Rear View of the Radiated Emissions Test Set-up above 1 GHz

Photo 5.5-4 - Rear View of the Radiated Emissions Test Set-up with the Loop Antenna

6 ANTENNA REQUIREMENT

References: 47 C.F.R. § 15.203
RSS-GEN § 7.1.2

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 an internal PCB trace antenna is used.

6.3 Antenna Photographs

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

Photo 6.3-1 – Internal Antenna

7 BANDWIDTH DATA

References: 47 C.F.R. § 15.247 (a) (2)
RSS-210 § A8.1

(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.

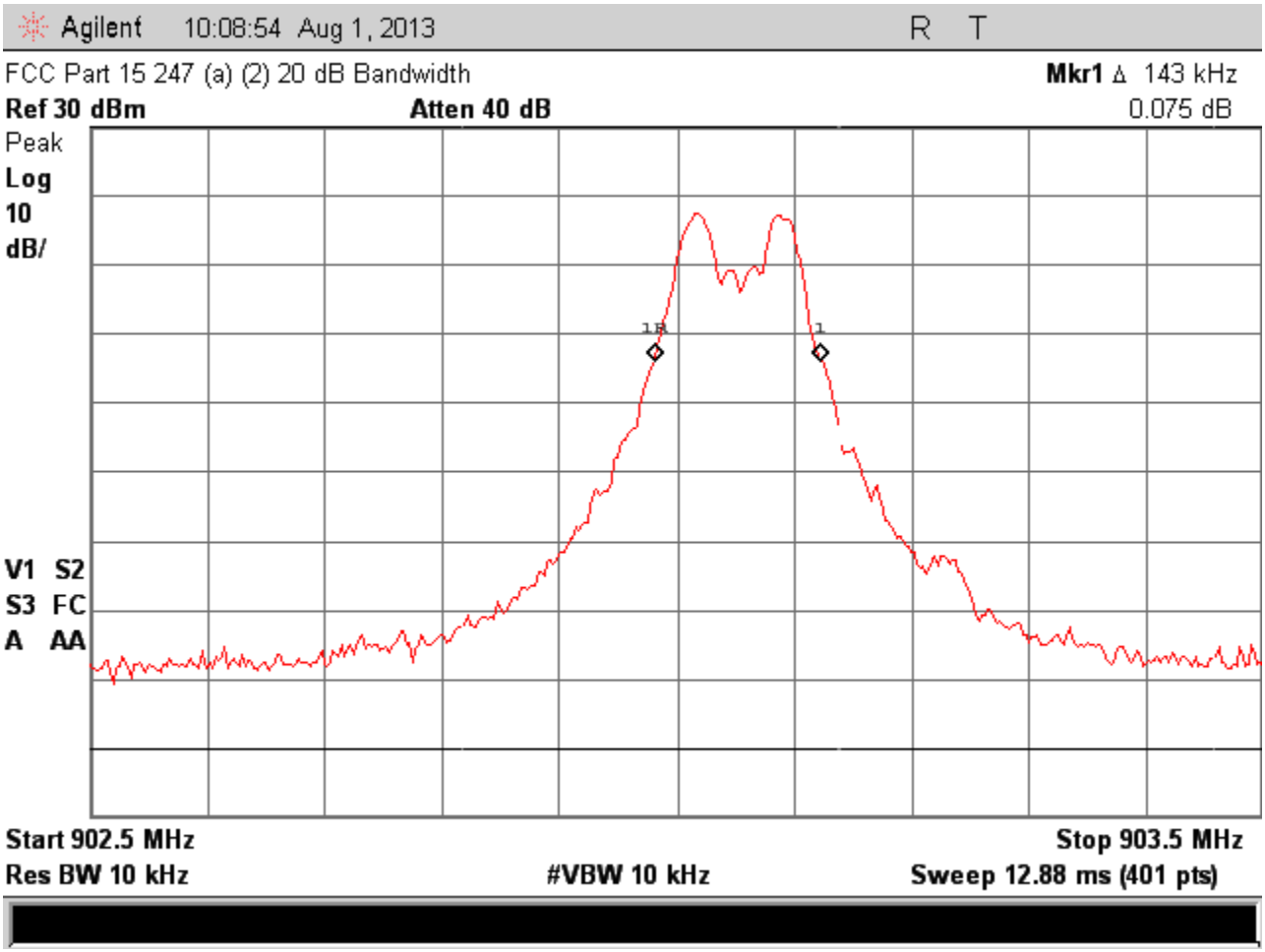


Figure 7.2-1 – Channel 0 Bandwidth

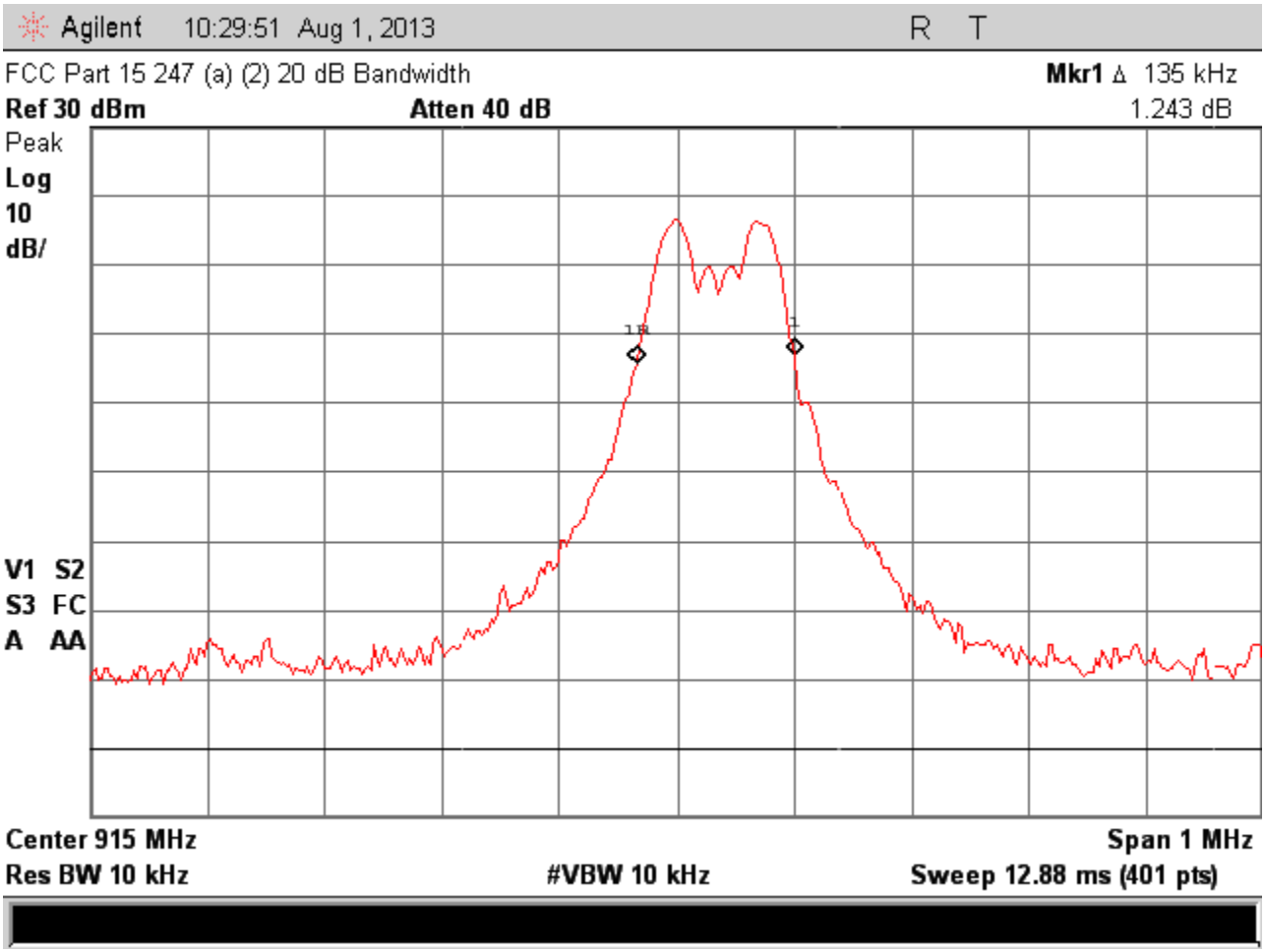


Figure 7.2-2 – Channel 24 Bandwidth

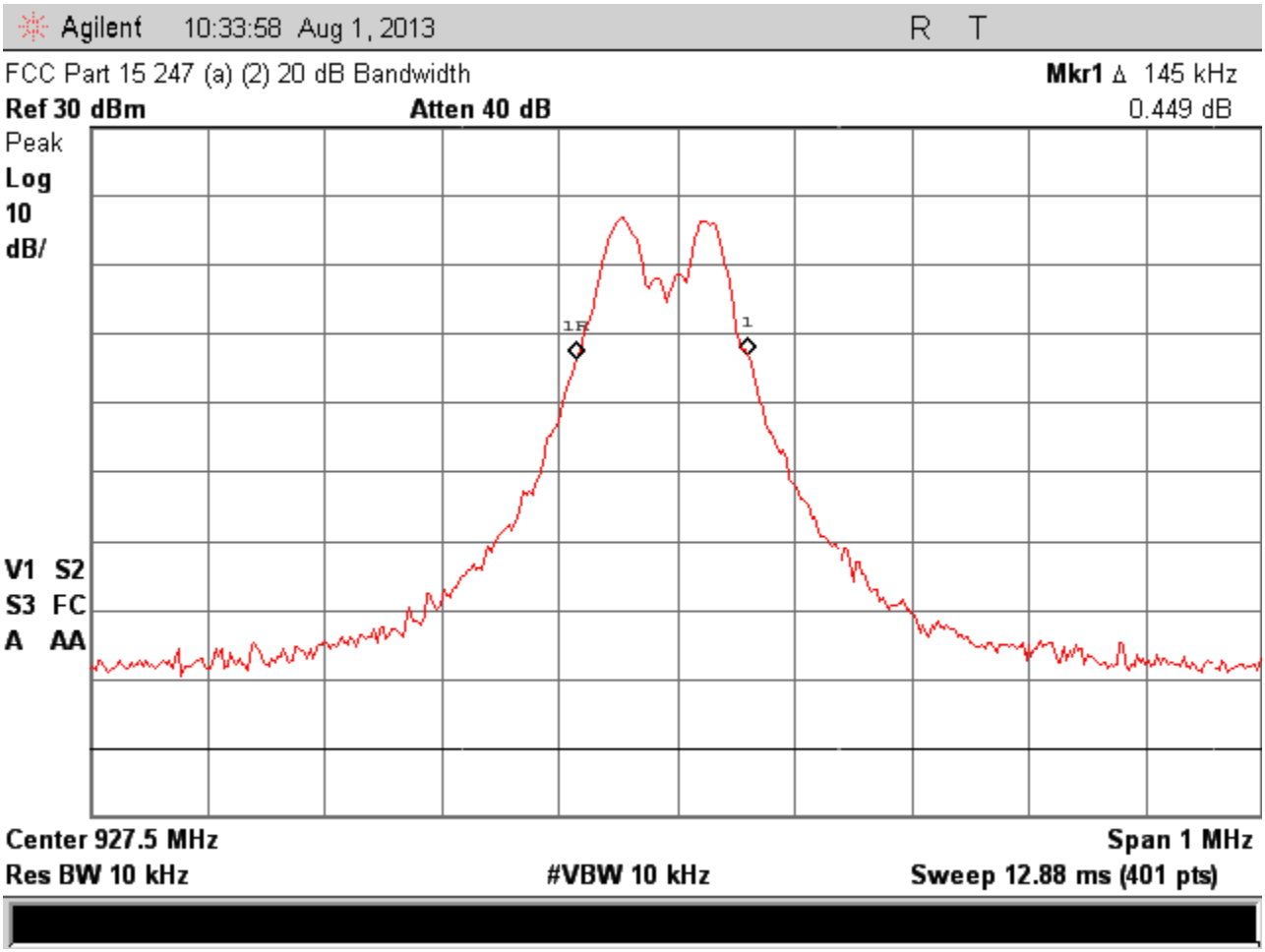


Figure 7.2-3 – Channel 49 Bandwidth

7.3 Test Instrumentation Used, Bandwidth Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	3/29/2015

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

7.4 Photograph of the Setup for Conducted Measurements

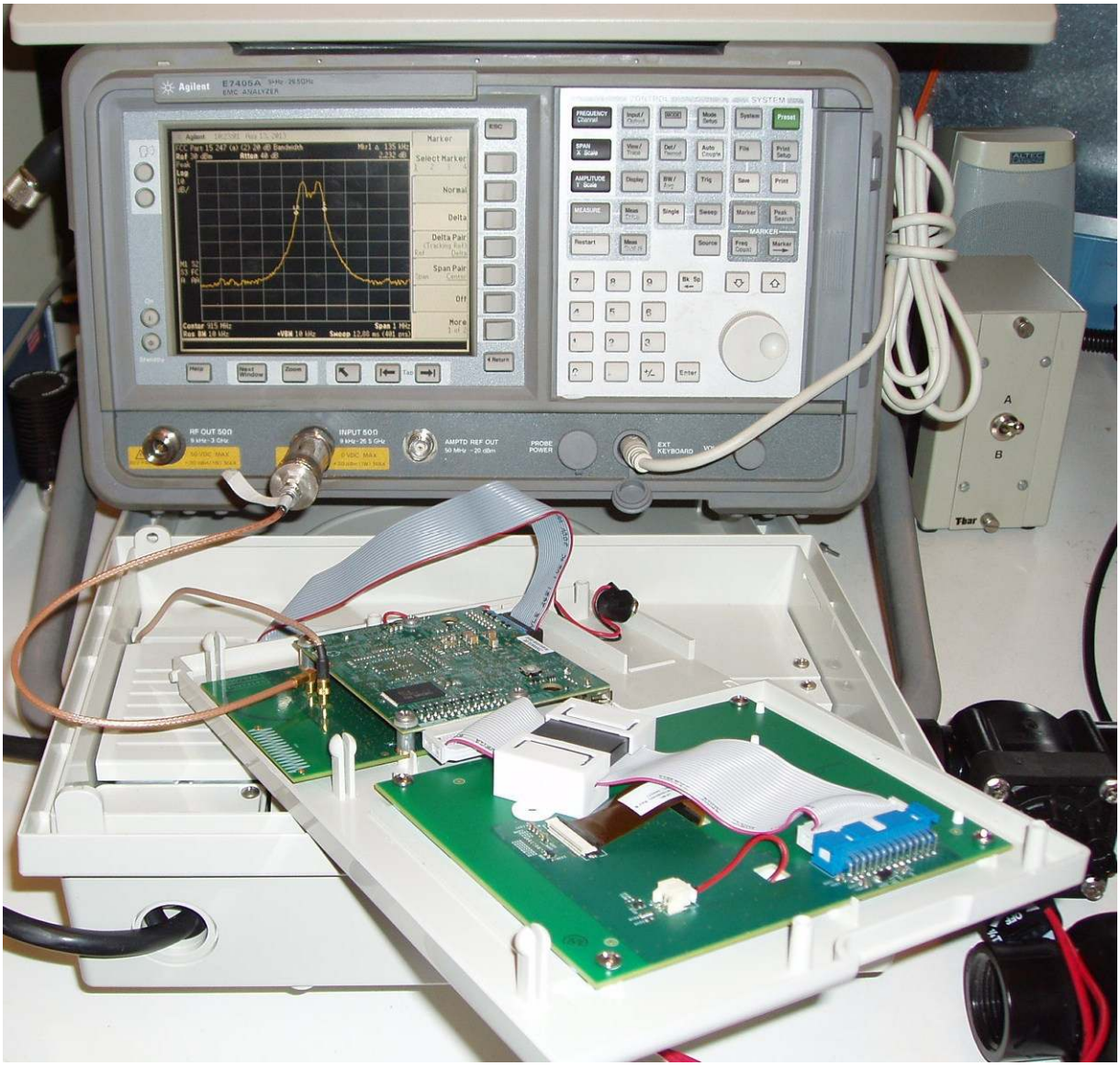


Photo 7.4-1 – Antenna Port Conducted Measurement Test -Setup

8 PEAK POWER DATA

References: 47 C.F.R. § 15.247 (b)
RSS-210 § A8.4 (1)

(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)
RSS-GEN § 7.1.2

(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 transmit 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 declared by the manufacturer to be -2.0 dBi. Because the gain did not exceed 6.0 dBi by more than 3 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
903.053	20.53	0.113	0	0x04
915.036	20.15	0.104	24	0x04
927.492	19.85	0.097	49	0x04

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.

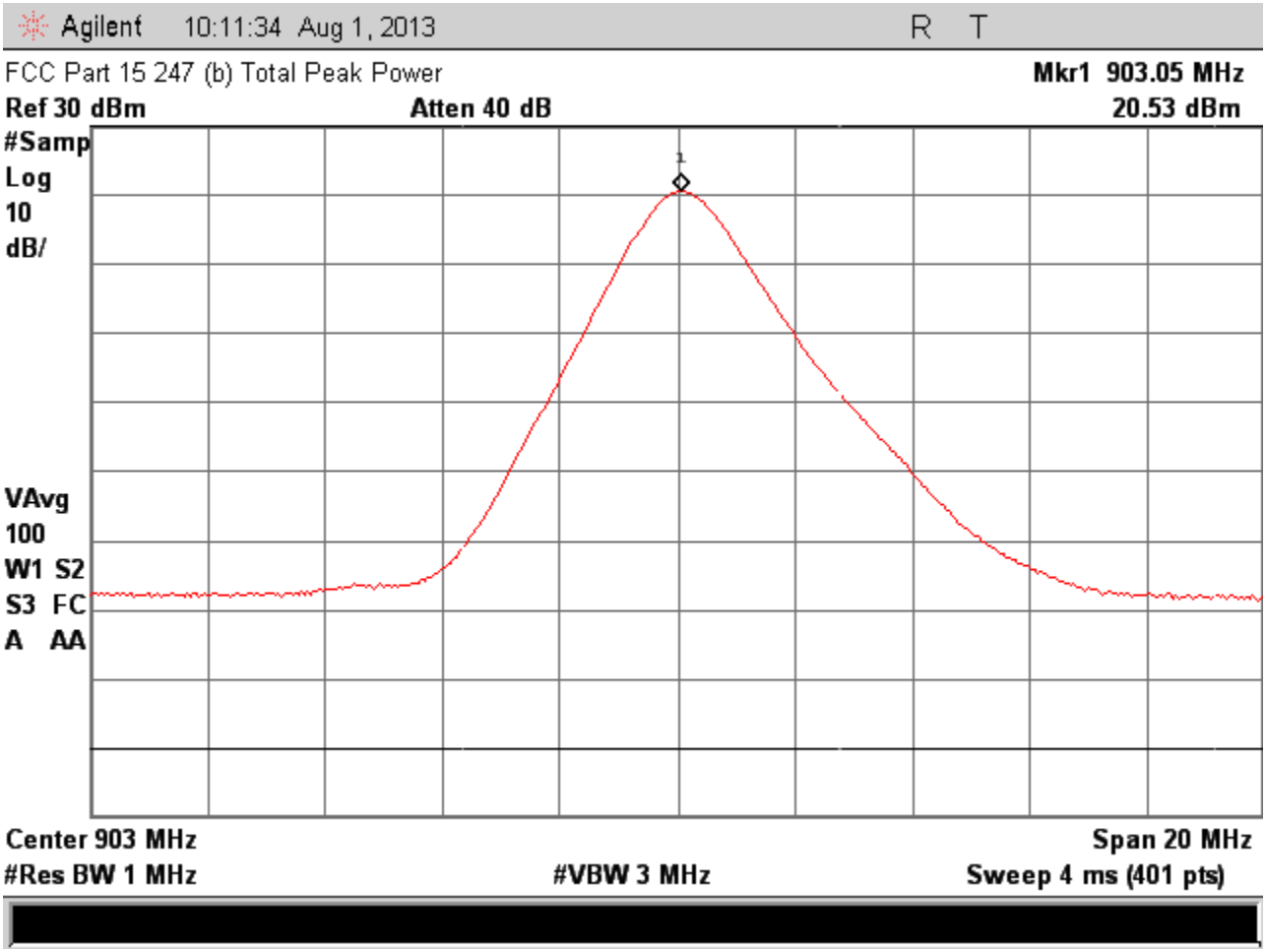


Figure 8.2-1 – Channel 0 Signal Power

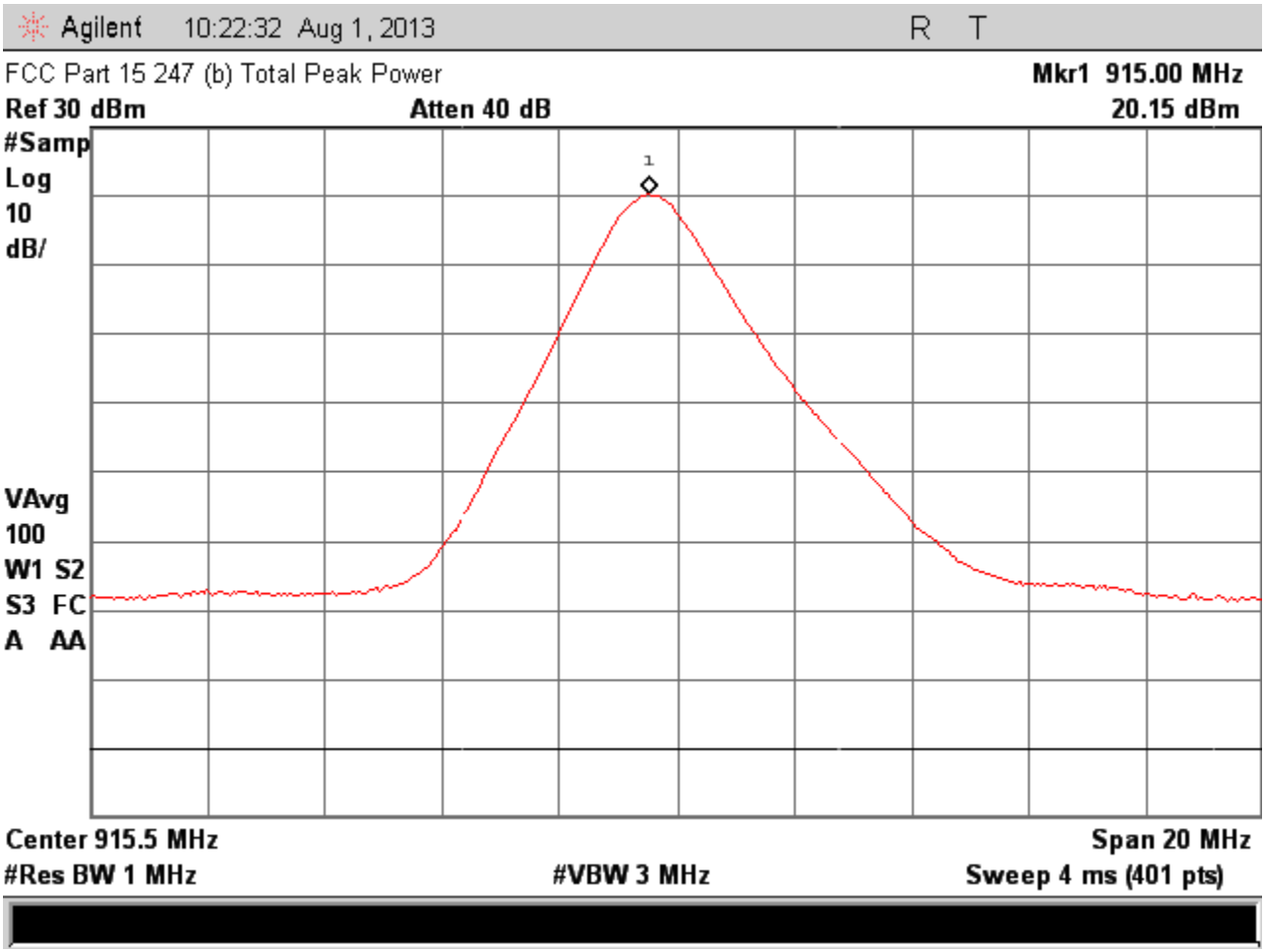


Figure 8.2-2 – Channel 24 Signal Power

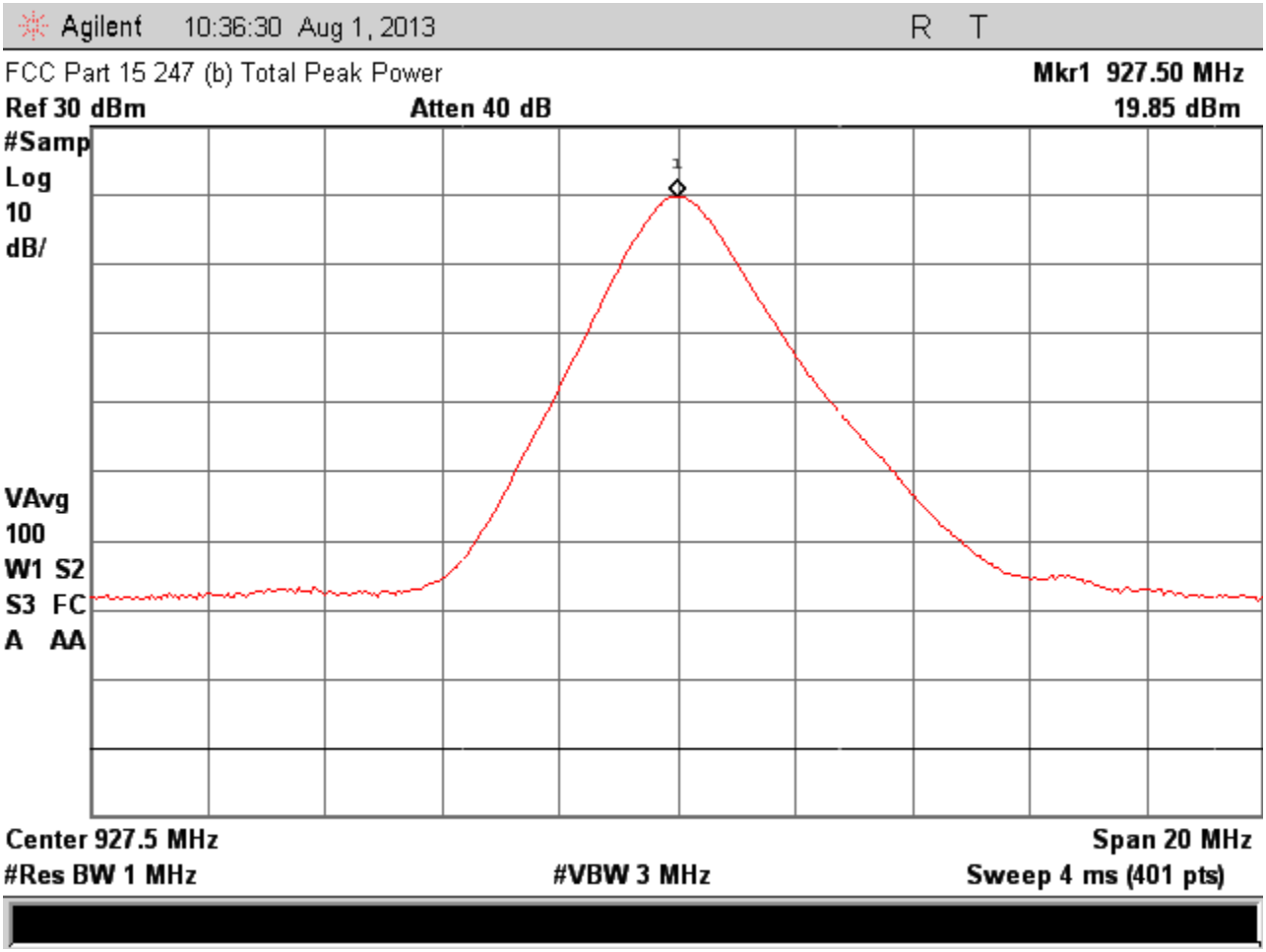


Figure 8.2-3 – Channel 49 Signal Power

8.3 Test Instrumentation Used, Peak Power Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	3/29/2015

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

9 OUT OF BAND POWER DATA

References: 47 C.F.R. § 15.247 (d)
RSS-210 § A8.5

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 9.2-1 shows the out of band conducted data relative to the peak conducted level for the radio operating on channel 0. Figures 9.2-2 and 9.2-3 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. Figure 9.2-4 shows the results with the DUT operating in the frequency hopping test mode.[1] The harmonics and other spurious emissions were attenuated by at least 20 dB in all cases.

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

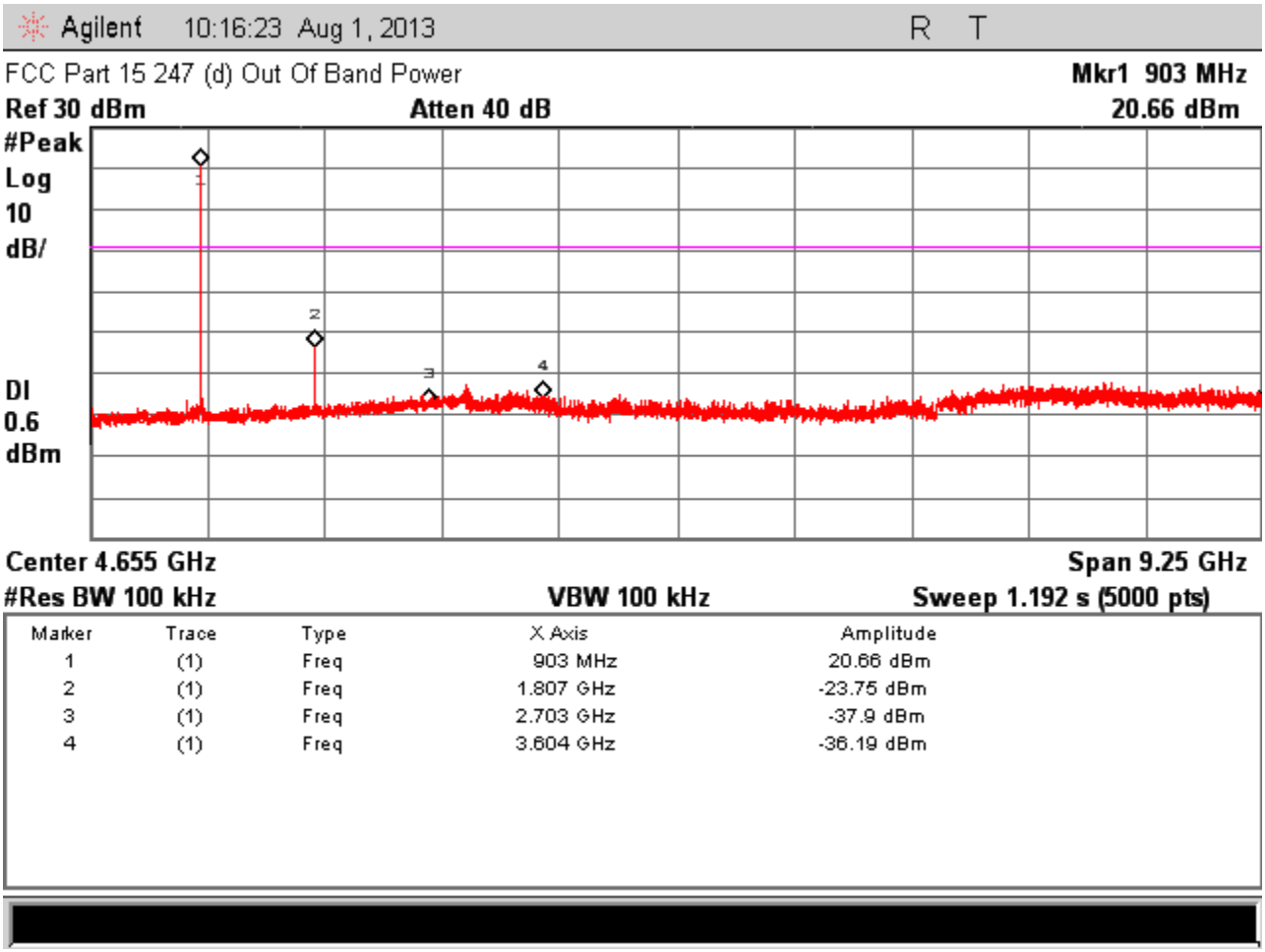


Figure 9.2-1 – Out of Band Conducted Data for Channel 0

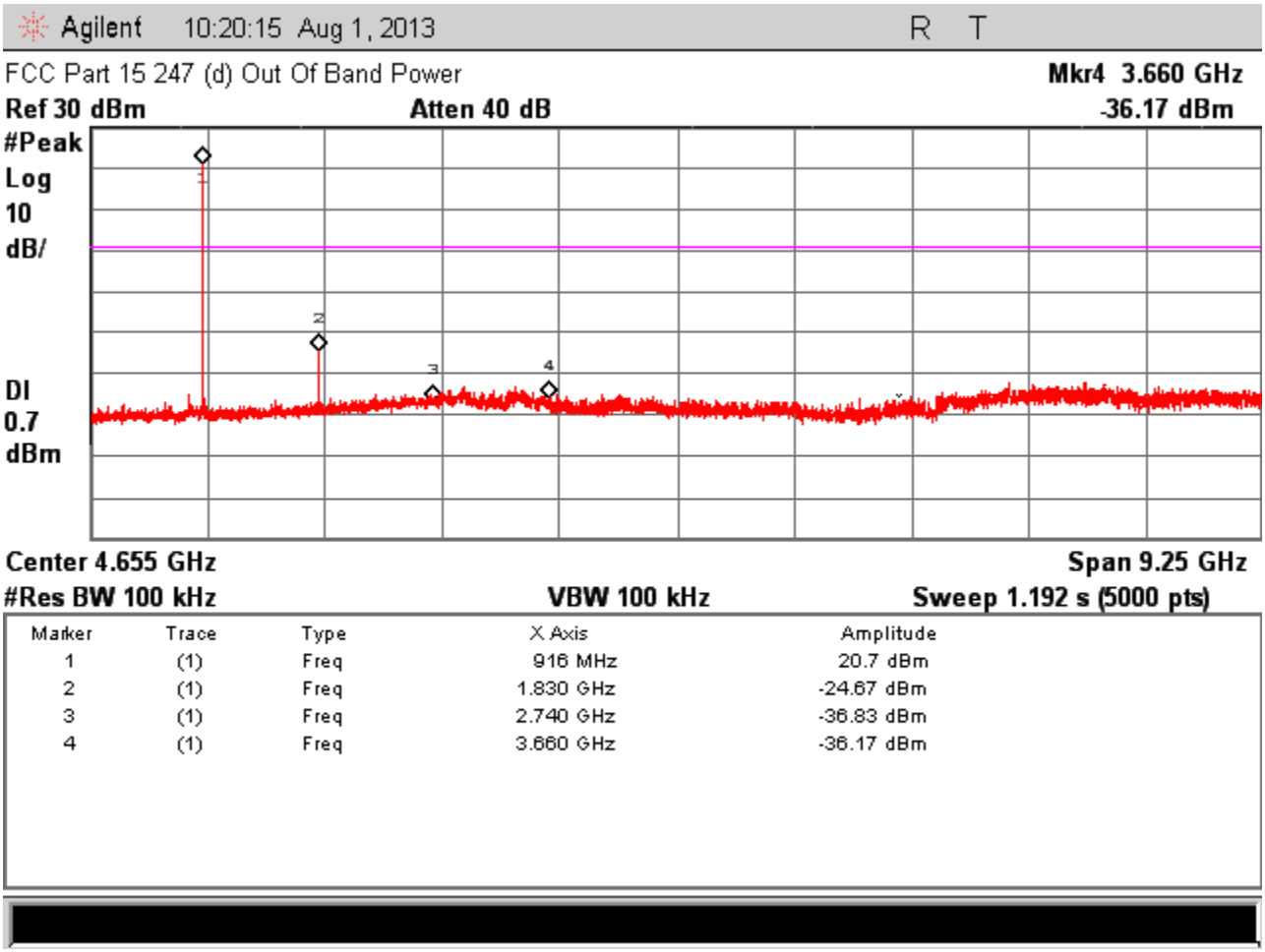


Figure 9.2-2 – Out of Band Conducted Data for Channel 24

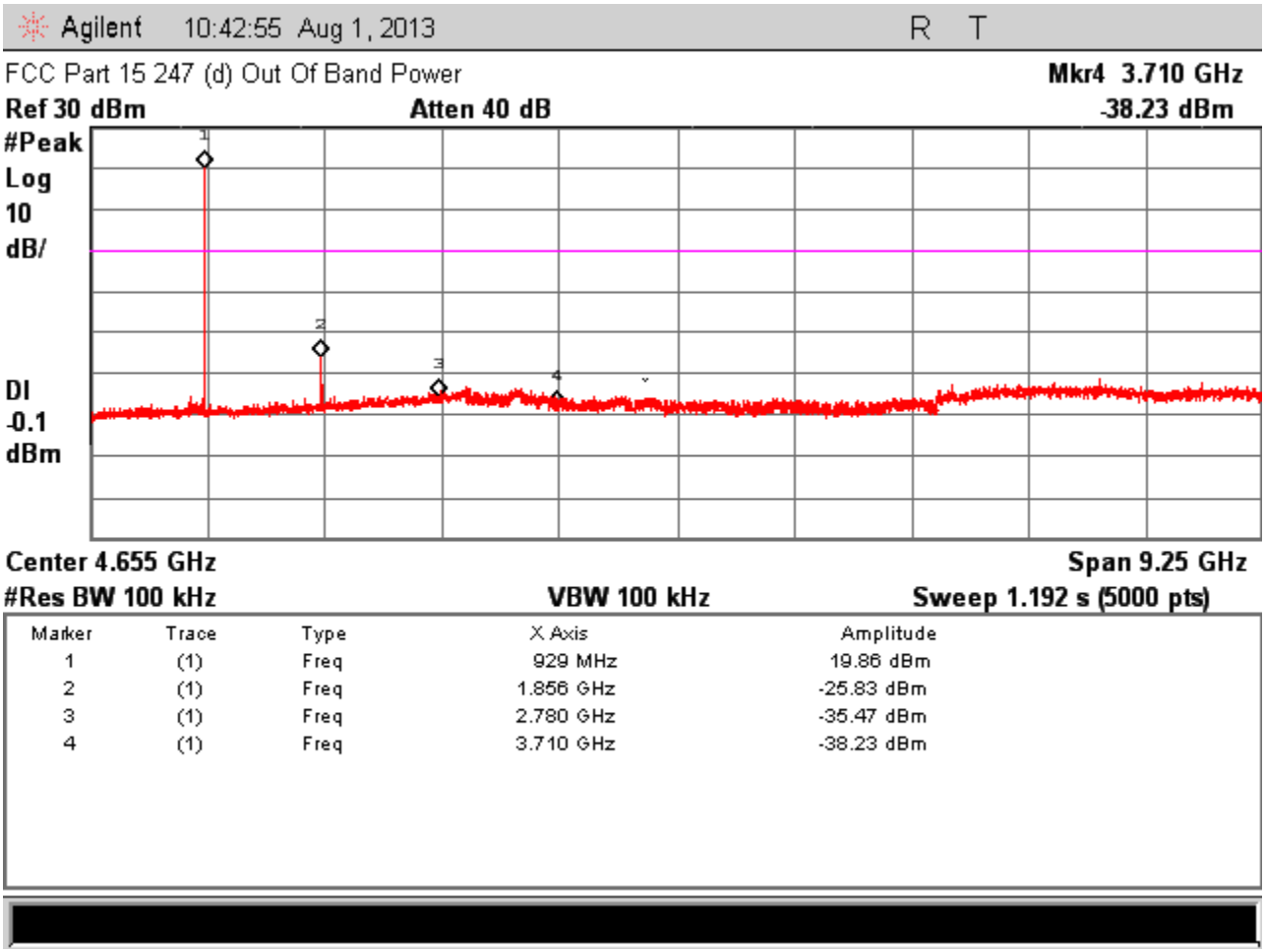


Figure 9.2-3 – Out of Band Conducted Data for Channel 49

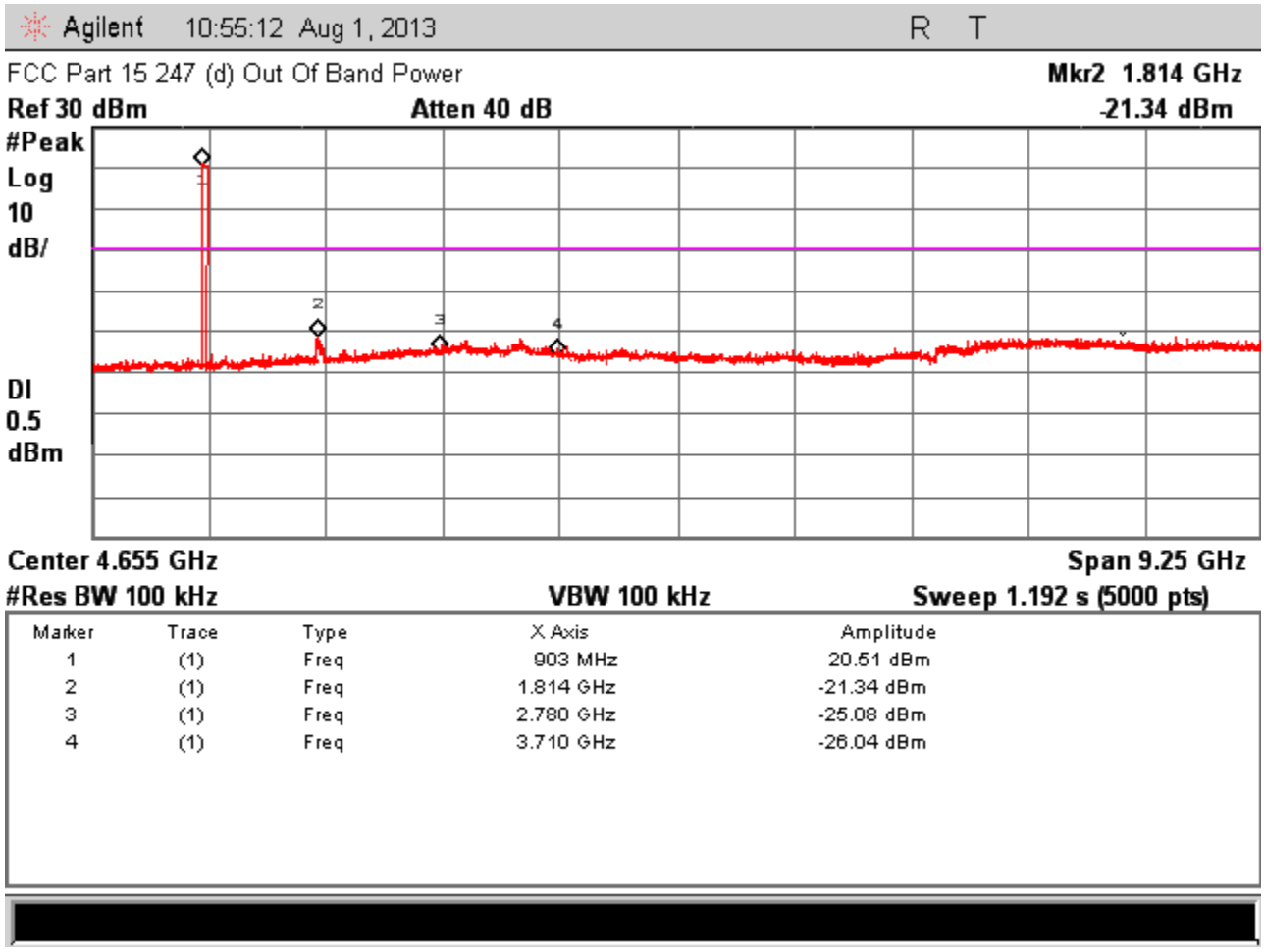


Figure 9.2-4 – Out of Band Conducted Data for Radio in the Frequency Hopping Mode

9.3 Test Instrumentation Used, Out of band Power Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	3/29/2015

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

10 FREQUENCY HOPPING REQUIREMETNS

References: 47 C.F.R. § 15.247 (a)
RSS-210 § A8.1

(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 145 kHz, the channel separation was measured relative to that constraint.

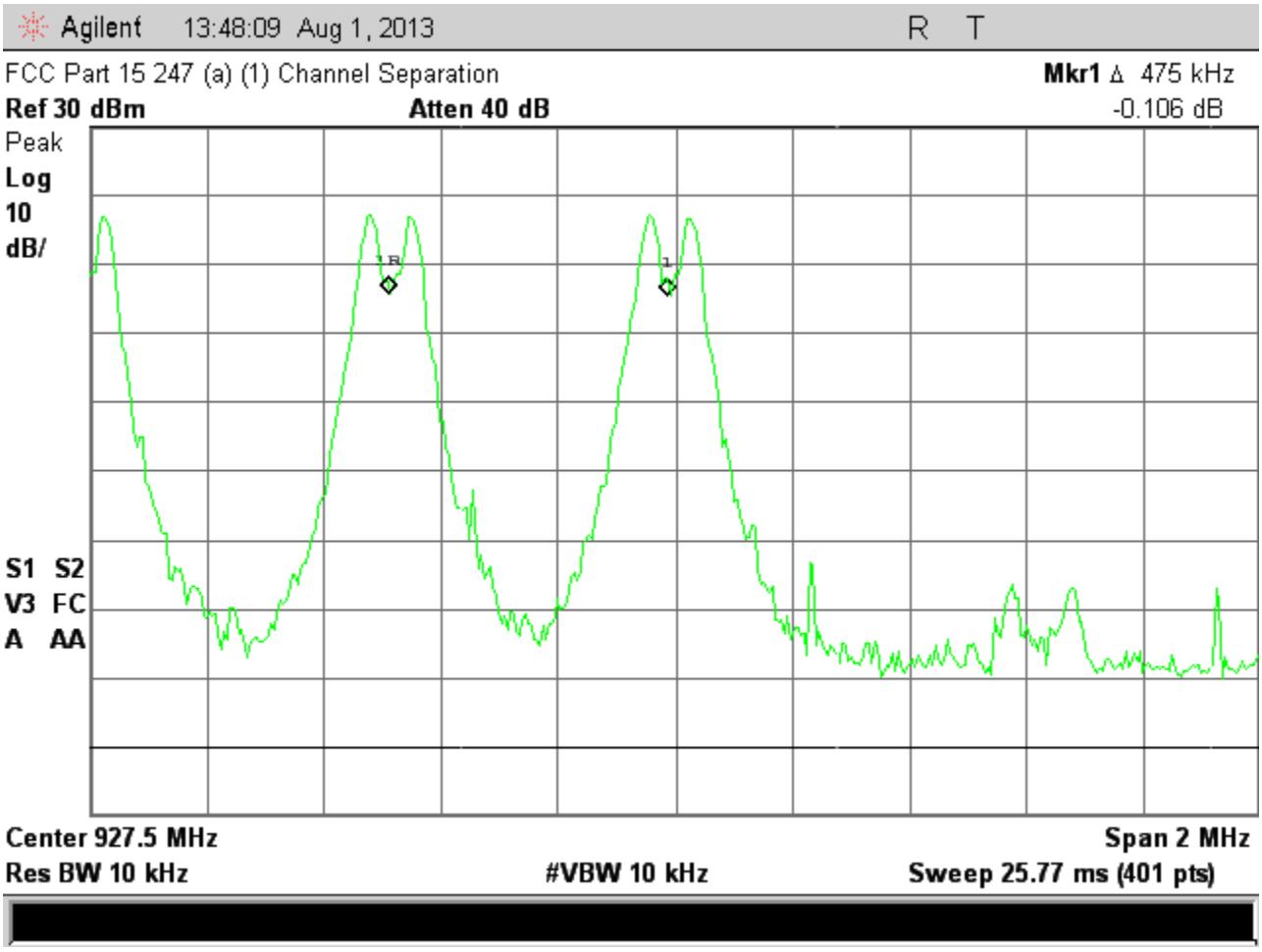


Figure 10.2-1 – Carrier Frequency Separation

The radio's specified minimum channel separation is 370 kHz. The measured separation between channels 48 and 49 was 475 kHz. Based upon this data, the DUT passes this requirement.

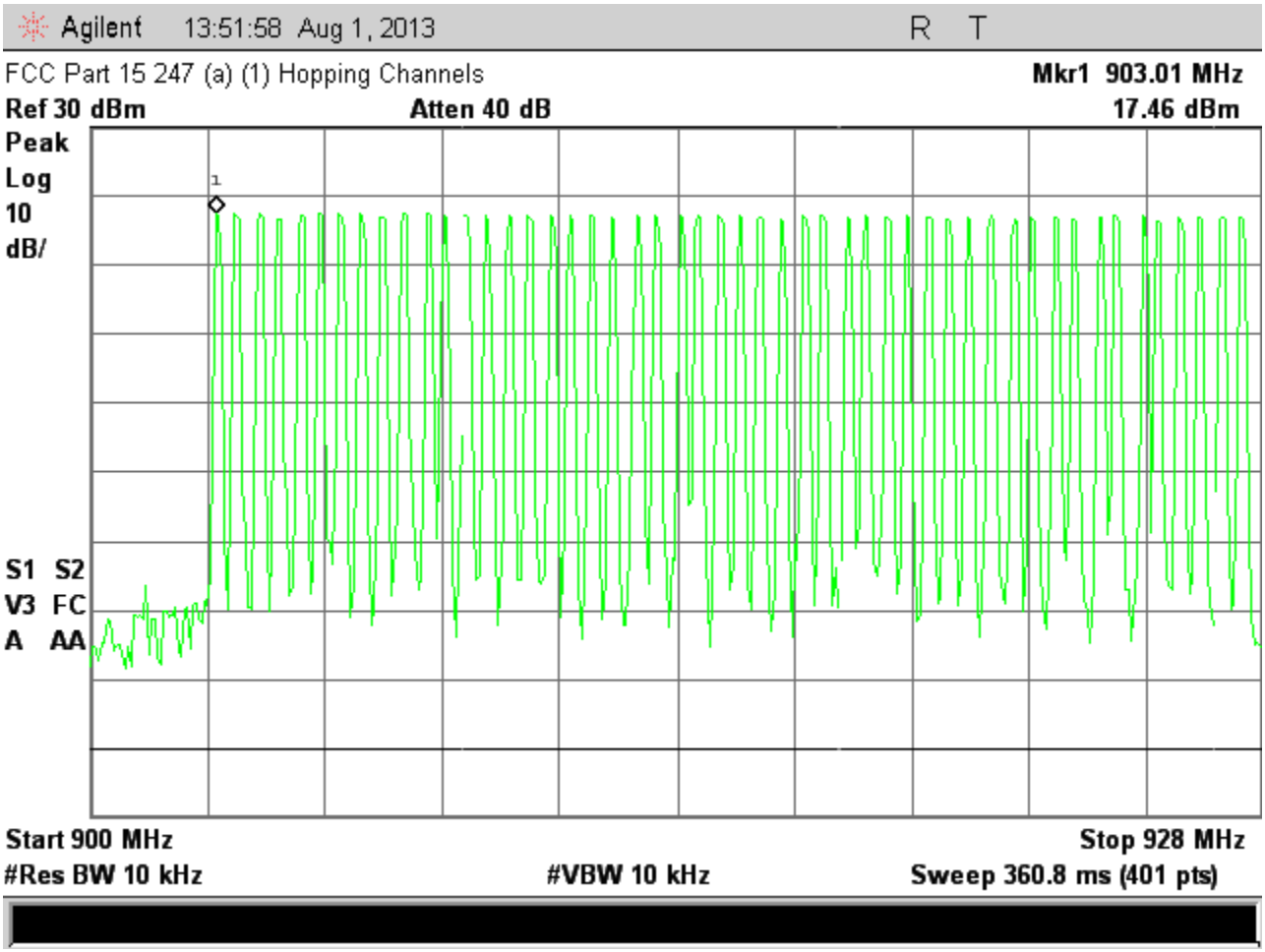


Figure 10.2-2 – Number of Hopping Channels

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.

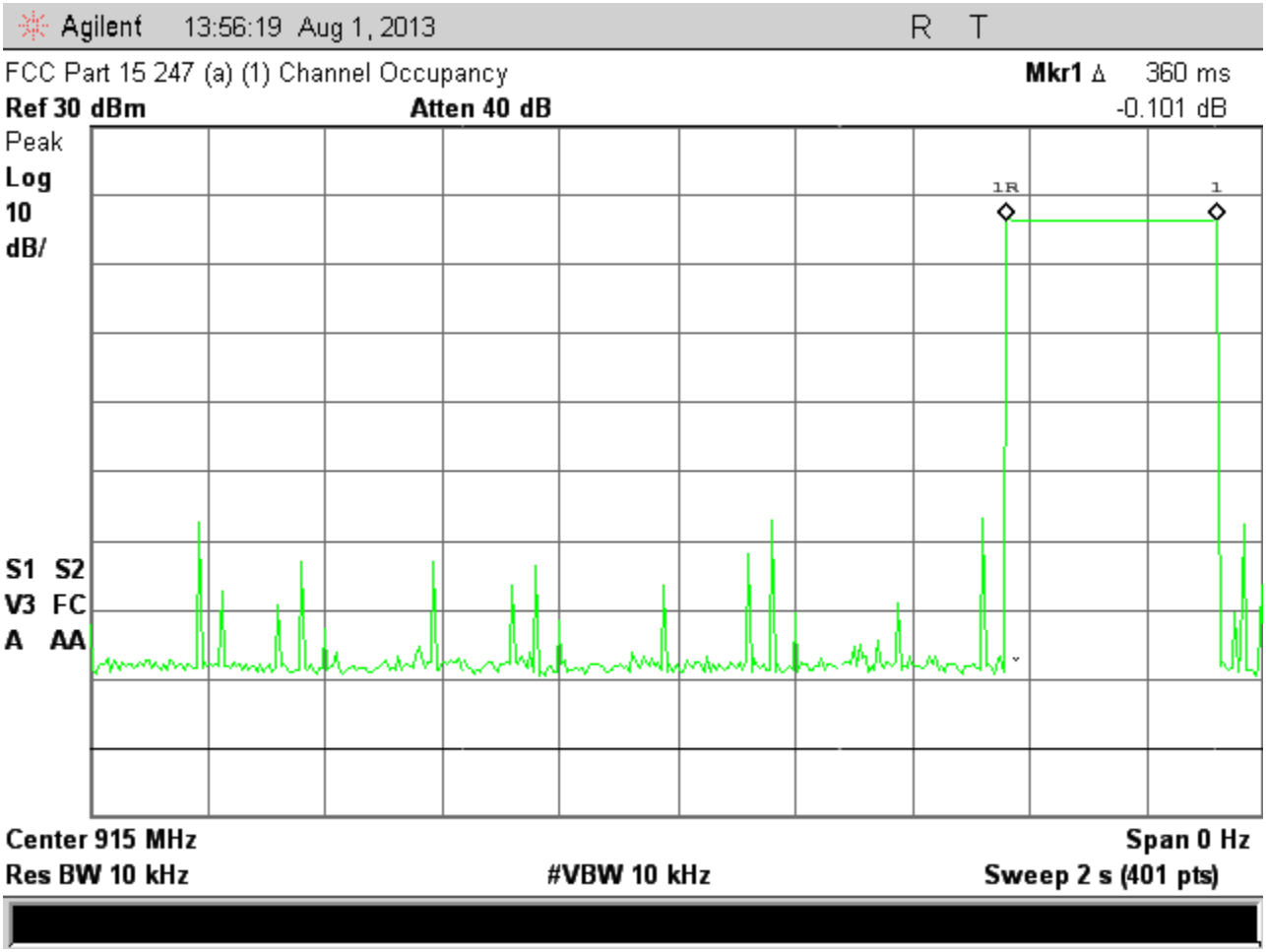


Figure 10.2-3 – Time of Channel Occupancy

Notes:

The DUT operates on a channel for 360 msec then hops to another channel. The above plot was taken monitoring the frequency used by channel 24.

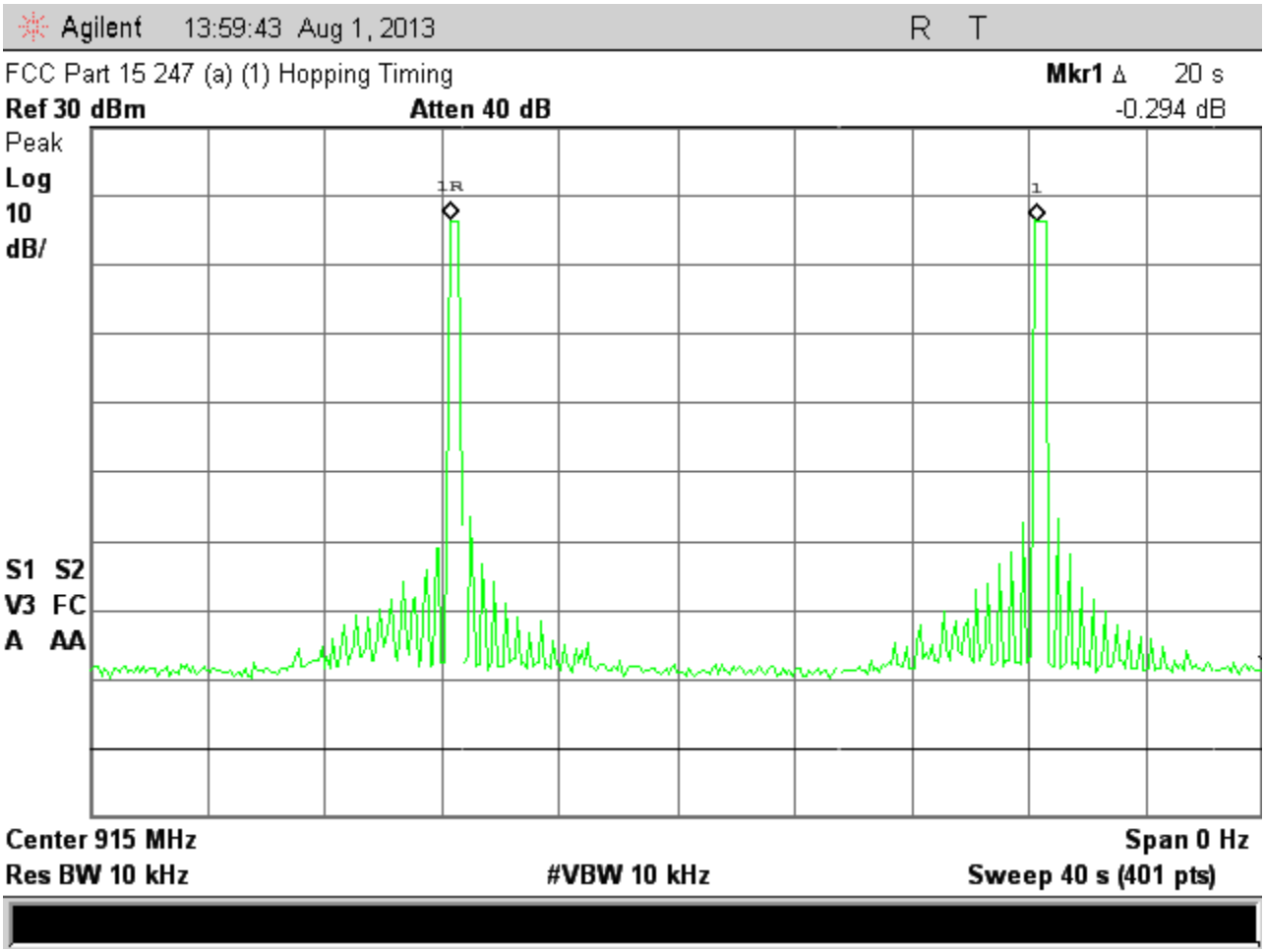


Figure 10.2-4 – Time of Channel Occupancy in a 20 Second Interval

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	3/29/2015

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

11 DUTY CYCLE

References: 47 C.F.R. § 15.35 (c)
RSS-GEN § 4.5

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.

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	3/29/2015

Calibration and Traceability: All measuring and test equipment are calibrated and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

12 LABELING AND USER'S GUIDE REQUIREMENTS

12.1 FCC Label Statement

The FCC compliance label shall include the following information:

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, must be displayed on the device.

The FCC ID number will be: YVAUG1000CA

The Industry Canada ID number will be: IC: 10216A-UG1000CA

Figure 12.1-1 below shows a drawing of the label.

Figure 12.1-1 - Sample Label

12.2 Instruction Manual Statements

The instruction manual must contain the following statements:

- Changes or modifications not expressly approved by the responsible party could void the user's authority to operate the equipment.
- This device may only be used with the approved internal antenna that is shipped with the unit and installed per installation instructions. The use of any other antennas will invalidate the unit's FCC Part 15 certification.
- This device has been designed to operate with the on-board PCB antenna. The use of an external antenna for transmission will require authorization. Contact the responsible party for details.
- 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.
- Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
- 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:	20.53	(dBm)
Maximum peak output power at antenna terminal:	112.98	(mW)
Antenna Gain (typical):	-2.00	(dBi)
Maximum Antenna Gain:	0.63	(numeric)
Prediction Distance:	20.00	(cm)
Prediction Frequency:	903.05	(MHz)
MPE Limit for Uncontrolled Exposure at Prediction Frequency:	0.60	(mW/cm^2)
Power Density at the Prediction Frequency:	0.0142	(mW/cm^2)
Maximum Allowable Antenna Gain:	14.28	(dBi)
Margin of Compliance at 20 cm:	16.28	(dB)

Table 13-3 – RSS-102 Duty Cycle Correction Calculation

Total Frequency Hopping Period:	20	seconds
Channel Occupancy Period:	0.3604	seconds
Number of Channels:	50	seconds
Cumulative On Time for Transmission:	18.02	seconds
Duty Cycle:	0.901	
Duty Cycle Correction Factor:	-0.9	dB

Table 13-4 – MPE Calculation for RSS-102 Compliance

Maximum peak output power at antenna terminal:	20.53	(dBm)
Maximum peak output power at antenna terminal:	112.98	(mW)
Antenna Gain (typical):	-2.90	(dBi)
Maximum Antenna Gain:	0.51	(numeric)
Prediction Distance:	20.00	(cm)
Prediction Frequency:	903.05	(MHz)
MPE Limit for Uncontrolled Exposure at Prediction Frequency:	0.60	(mW/cm^2)
Power Density at the Prediction Frequency:	0.0115	(mW/cm^2)
Maximum Allowable Antenna Gain:	14.28	(dBi)
Margin of Compliance at 20 cm:	17.18	(dB)

The device meets the condition for an Industry Canada exemption from the routine evaluation limits because the time-averaged output power is less than the 200 mW limit for general public use.

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).

2013-04-01 through 2014-03-31
Effective dates

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.