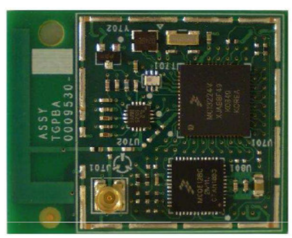
WALSHIRE LABS

Walshire Labs, LLC
8545 126th Avenue North
Largo, FL 33773
USA
Telephone: (727) 530-8637

47 C.F.R. Part 15 FCC Rules, Subpart C
&
Industry Canada RSS-GEN & RSS-210 Test Results
for the
Jabil Circuit
Universal Zigbee Interface Module



Equipment:	Universal Zigbee Interface Module
Client:	Jabil Circuit, Inc.
Address:	10800 Roosevelt Boulevard St. Petersburg, FL 33716

Test Report Number: FCCIR-JABIL-03-30-10
Date: April 12, 2010
Total Number of Pages: 65

NVLAP

NVLAP LAP Code: 200125-0
Industry Canada Site Number 7868A-1

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1 IDENTIFICATION SUMMARY

1.1 Test Report

Test Report Number: FCCIR-JABIL-03-30-10
Test Report Date: April 12, 2010

Report written and approved by:

Date	Name	Signature
April 12, 2010	Peter J. Walsh, NCE	Peter J. Walsh

1.2 Testing Laboratory

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

Telephone: (727) 530-8637
Internet: www.walshirelabs.com
Email: Peter_Walsh@walshirelabs.com

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-210e certification of the DUT.

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:	Jabil Circuit, Inc.
Street:	10800 Roosevelt Blvd.
City:	St. Petersburg
State:	FL
Zip Code	33716
Country:	USA
Phone:	(727) 803-7544
Contact Person:	Allen Fernandez
Phone:	(727) 803-3941
Email:	Allen_Fernandez@jabil.com

1.5 Dates

Date of commission:	March 30, 2010
Date of receipt of DUT:	March 31, 2010
Date of test completion:	April 12, 2010

1.6 Device Under Test (DUT)

Name:	Universal Zigbee Interface Module
Version:	Model ZIM-B-002-ER-INTA-00
Serial Number:	None (Engineering Prototype)
Antenna Type:	Inverted F PCB trace antenna
Nominal Gain:	-1.0 dBi
Modulation Type:	O-QPSK
Bit Rate:	250 kbps
Symbols:	16-ary Orthogonal

2 GENERAL INFORMATION

2.1 Product Description

The Zigbee Interface Module, or ZIM, is an IEEE 802.15.4 compliant Zigbee transceiver that operates in the 2400 to 2483.5 MHz band in accordance with 47 C.F.R. § 15.247. The ZIM features an optional real-time clock and on-board power amplifier. It utilizes an on-board inverted F PCB trace antenna. In the future, it may also be used with an external antenna cabled to an on-board MMCX connector.[1] The ZIM features a highly secure hardware based AES Coprocessor, affords frequency agility, and PAN ID conflict resolution. The ZIM will be certified as a Limited Modular Approval (LMA) radio with the restriction that the end user must provide voltage regulation to ensure that voltage to the module is 3.3 VDC ± 1%.

2.2 Interface Cable Details

There were no interface cables used in the system during testing. To enable the test modes, a USB cable was attached to the test fixture board and a PC.

2.3 Peripheral Devices

The following test support devices were used in the test set-up. Additionally a PC was used to invoke test modes. However, the PC was disconnected prior to making any measurements.

Qty	Description	Manufacturer/Model	Serial Number
1	Test fixture	Jabil Circuit / TBPBA0009530	None

2.4 Test Methodology

A radiated emission testing was performed according to ANSI C63.4-2003, the procedure referenced by Part 15, FCC Rules. Radiated emissions tests were performed at an antenna to EUT distance of 3 meters except for tests in the 18 GHz to 25 GHz band which were performed at 1m. The measurement of digital transmission systems operating under Section 15.247 was performed in accordance with KDB Publication Number 558074 issued by the FCC's OET.

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 also been registered with Industry Canada, 2146A-1.

2.6 Deviations

No deviations were exercised during the course of the testing.

[1] The qualification of an external antenna or antennas will be handled as a Type II Permissive Change.

3 SYSTEM TEST CONFIGURATION

3.1 Justification

The DUT was mounted on a test fixture board that provided a regulated 3.3 V power source and USB interface to control the radio. The test fixture board was connected to a host PC via a USB cable. The host PC ran a Hyperterminal Session to enable various test modes and properly configure the DUT's transmit power level, channel, and test mode.

Because the orientation of the end product is not known, preliminary radiated emissions tests were performed with the DUT rotated about its three orthogonal axes to determine the orientation that produced the highest emissions. Final tests were performed in the worst case orientation as shown in the test setup photographs.

Conducted measurements were performed on a second test sample that had the RF path routed to an MMCX connector. This allowed for conducted measurements to be performed using a short MMCX to SMA cable characterized for its loss over frequency.

Unless noted otherwise, the test mode used for radiated emissions was the pulse pseudo random binary sequence transmission test mode. This produced a burst of transmissions at a duty cycle slightly higher than the theoretical maximum duty cycle for an IEEE 802.15.4 device. For PSD and power measurements, a continuous modulated transmission test mode was used. The duty cycle of this test mode was 100%.

For 802.15.4 devices, the worst case duty cycle would be a full data frame or 133 bytes where the transmitter does not get an acknowledgement and retries 3 more times. In this example, the on time for one frame is 32 µs/byte * 133 bytes = 4.26 ms. Four frames are transmitted for a total on time of 17 ms and a duty cycle of 17% for 100 ms.

The measured duty cycle of the DUT in the pulse pseudo random binary sequence transmission test mode was 21.9%. Therefore this test mode could be used as it represented a slightly higher than worse case duty cycle than would occur in normal operation.

The power settings were set as shown in the table below.

Table 3.1-1 – Power Setting by Channel Number

Channel Number	Center Frequency (MHz)	Power Setting
11	2405	09
12	2410	09
13	2415	0C
14	2420	0C
15	2425	0C
16	2430	0C
17	2435	0C
18	2440	0C
19	2445	0C
20	2450	0C
21	2455	0C
22	2460	0C
23	2465	0C
24	2470	09
25	2475	09
26	2480	07

3.2 Special Accessories

A 9 VDC power adapter (Phihong Model PSA059-090) was used to power the test fixture board.

3.3 Equipment Modifications

Modifications were needed to achieve compliance.

Signature:		Date:	April 12, 2010
Typed/Printed Name:	Peter J. Walsh		
Position:	Regulatory Lab Manager		

The software controlled power level settings were according to the values shown if Table 3.1-1.

The power output of the radio was attenuated by approximately 3 dB by installing a 143-Ohm shunt resistor on the output of T701 (balun) followed by a 26.7 Ω series resistor in place of C706.

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

Signature:		Date:	April 12, 2010
Typed/Printed Name:	Allen Fernandez		
Position:	Hardware Engineer		

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.

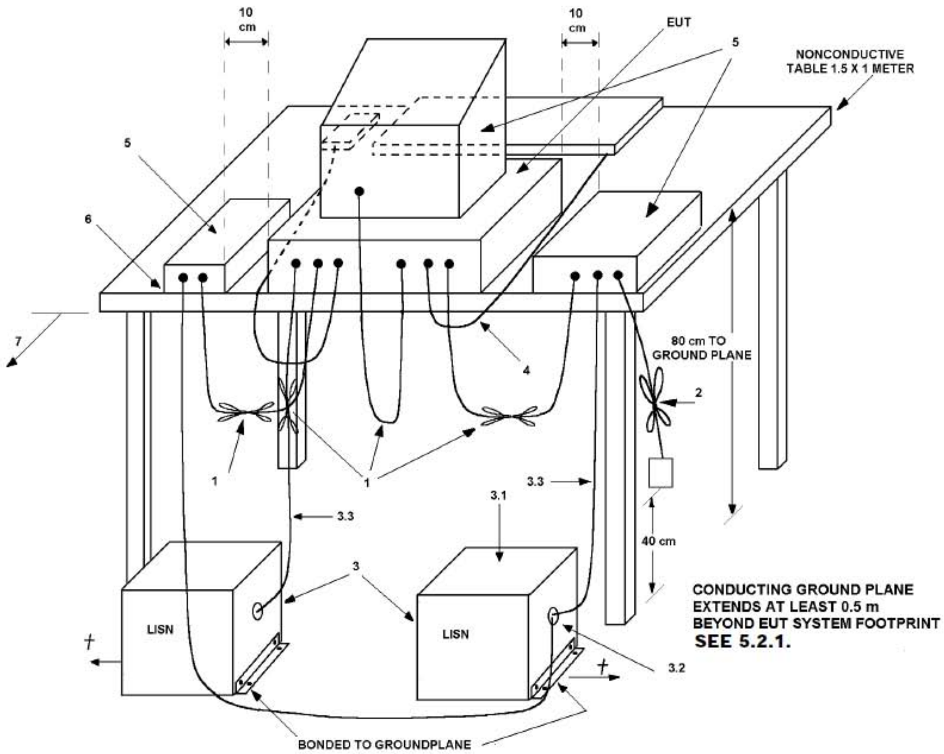
Table 4-1

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 C63.4-2003 § 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: None

As the DUT was not ac powered, the conducted emissions test was not applicable. The DUT is powered by 3.3 VDC by the host device.

4.3 Conducted Emissions Test Instrumentation

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
EMI Receiver	Rohde & Schwarz ESCS 30	825788/002	11/3/2010
LISN	Rohde & Schwarz ESH3-Z5	840730/005	08/26/2010

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

No photos were taken as the test was not performed.

5 RADIATED EMISSIONS DATA

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

(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.*

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:

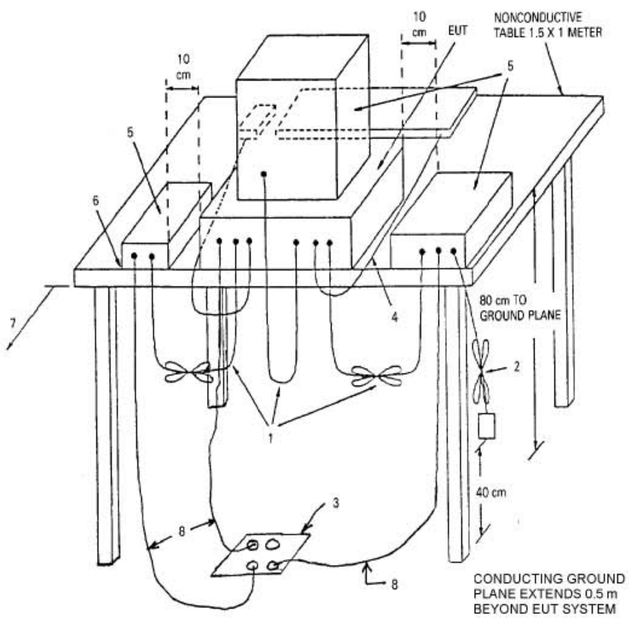
Table 5-2

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.



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 30 MHz to 25 GHz. The highest frequency to which the DUT must be measured is 24.835 GHz as this is ten times the highest operating frequency of the DUT.

5.2 Test Data

Compliance Verdict: PASS

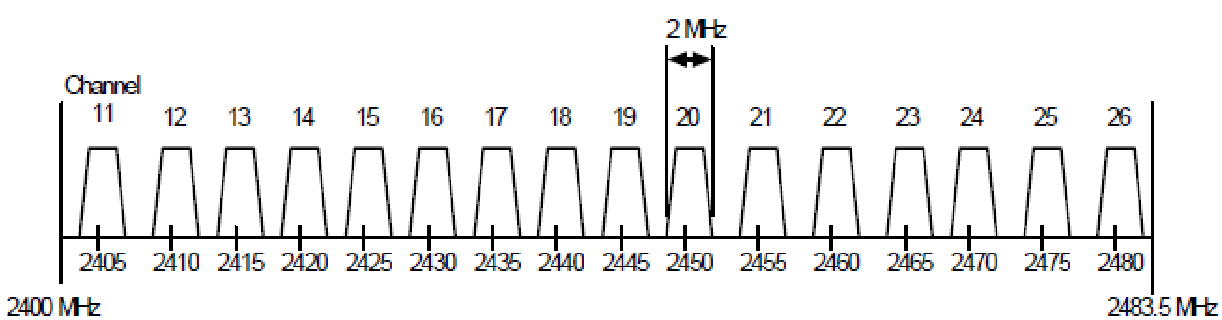
Figure 5.2-1 shows a composite preview scan graph of the radiated emissions levels from 30 to 1000 MHz measured with a peak detector in both vertical (red trace) and horizontal (blue trace) antenna polarities at turntable angles of 0, 90, 180, and 270 degrees and antenna heights of 100 cm, 250 cm and 400 cm. In the 30 to 1000 MHz frequency range, the final measurement detector was quasi-peak; the measurement bandwidth was 120 kHz. The final measurements denoted by the diamonds were taken with the turntable angle, antenna elevation and polarity set to maximize the received levels. Table 5.2-1 shows the six highest measured results within 20 dB of the limit for the 30 to 1000 MHz frequency range.

For measurements taken above 1 GHz, the final measurement detectors were peak and average. The measurement bandwidth was 1 MHz. Figures 5.2-2 through 5.2-9 show the maximum (peak hold) radiated emissions from 1 to 25 GHz. These plots include measurements at all turntable angles and an antenna heights between 100 cm and 400 cm. These measurements were made with the DUT transmitting on Channel 19 in the highest transmit power level as determined by the conducted, peak power measurements. In the 4 to 10 GHz frequency range, a 2.4 to 2.5 GHz notch filter was used at the input of the preamplifier to prevent the preamplifier from being over driven. This improved overall measurement sensitivity.

Additional radiated emissions measurements were made over a frequency range which included the 2400 MHz to 2483.5 MHz operating band as well as frequencies above and below this band to ensure compliance with the restricted band limits for operation on Channels 11, 19 and 26. The transmit power level on Channel 11 and 26 was intentionally set lower to ensure compliance with the radiated emissions limits in the restricted bands above and below the 2400 MHz to 2483.5 MHz operating band.

Though not shown as graphical plots in this test report radiated emissions were measured over the 18 GHz to 25 GHz band at a distance of 1 m. These measurements showed that there were no emissions close to the respective peak and average detector limits.

Figure E.1 from the IEEE 802.15.4 standard below shows the DUT’s channel plan.



c) IEEE 802.15.4 channel selection (2400 MHz PHY)

Figure E.1—IEEE 802.15.4 (2400 MHz PHY) and IEEE 802.11b channel selection

FCC Class B 3m 30-1000 MHz Final Test

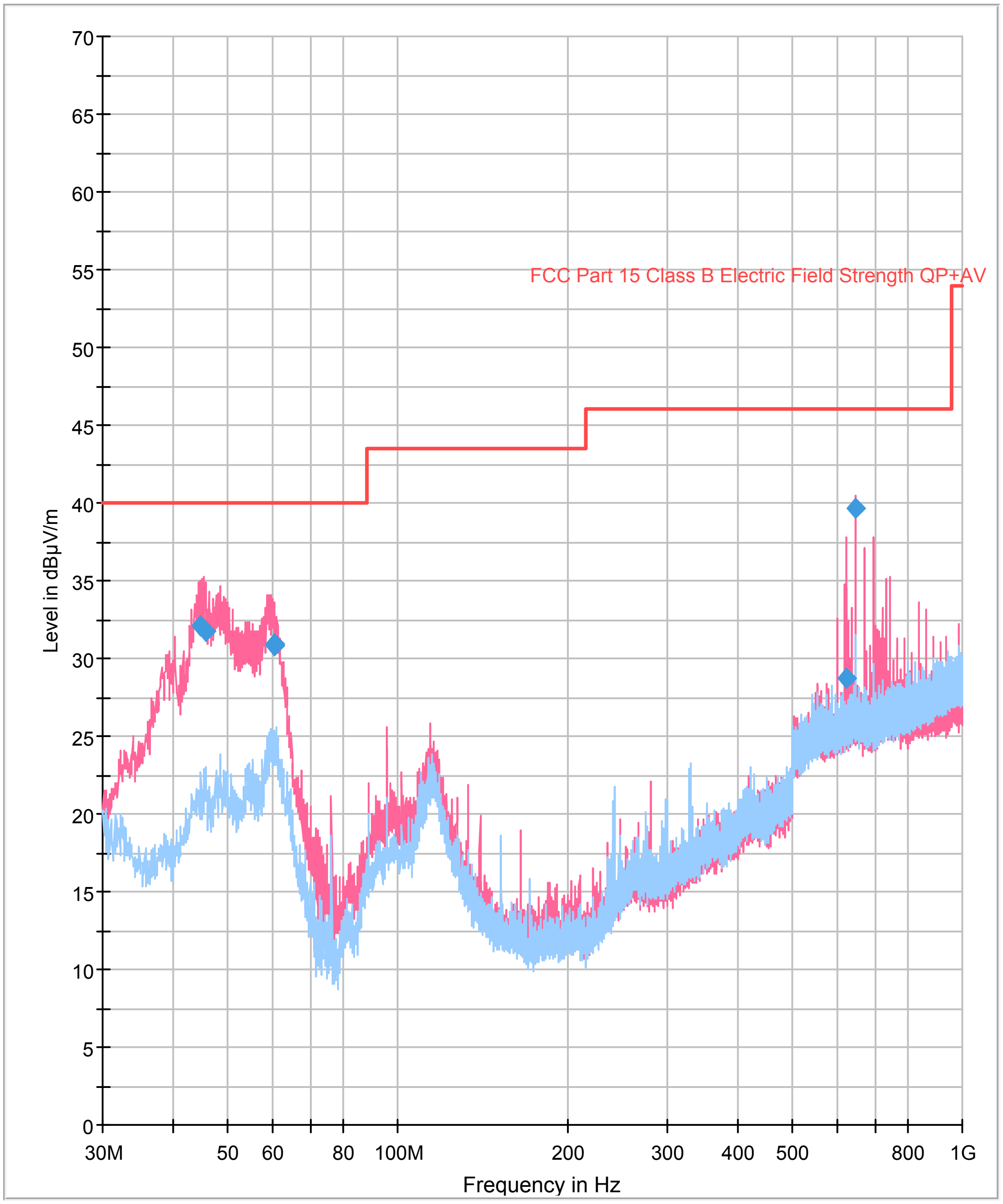


Figure 5.2-1 – Radiated Emissions Plot for the 30 – 1000 MHz Band

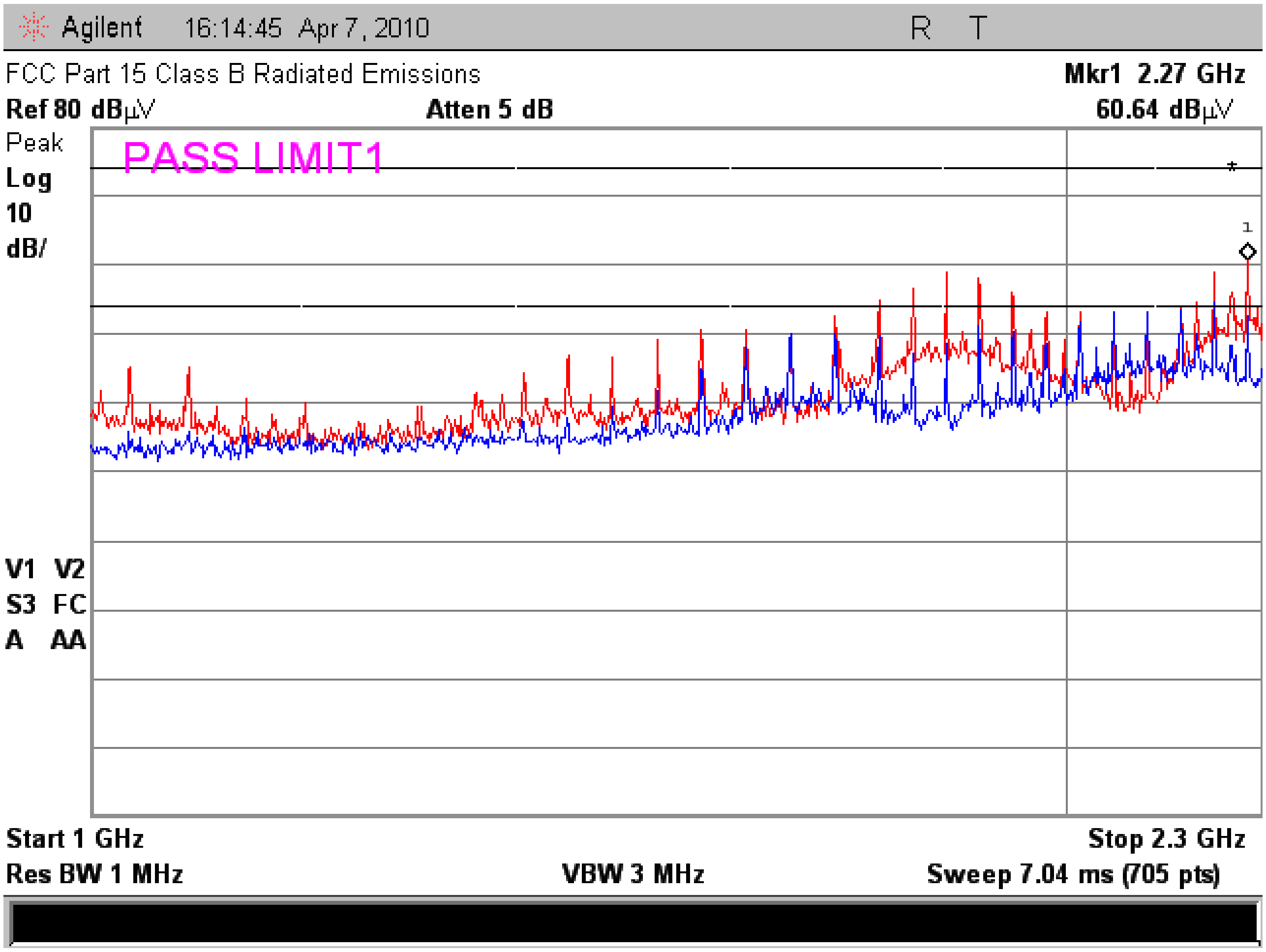


Figure 5.2-2 – Radiated Emissions 1 to 2.3 GHz for Channel 19 w/ Peak Detector

Notes:

The red trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit its pulse pseudo random binary sequence transmission test mode. The maximum level emission in this band was 13.4 dB below the peak limit.

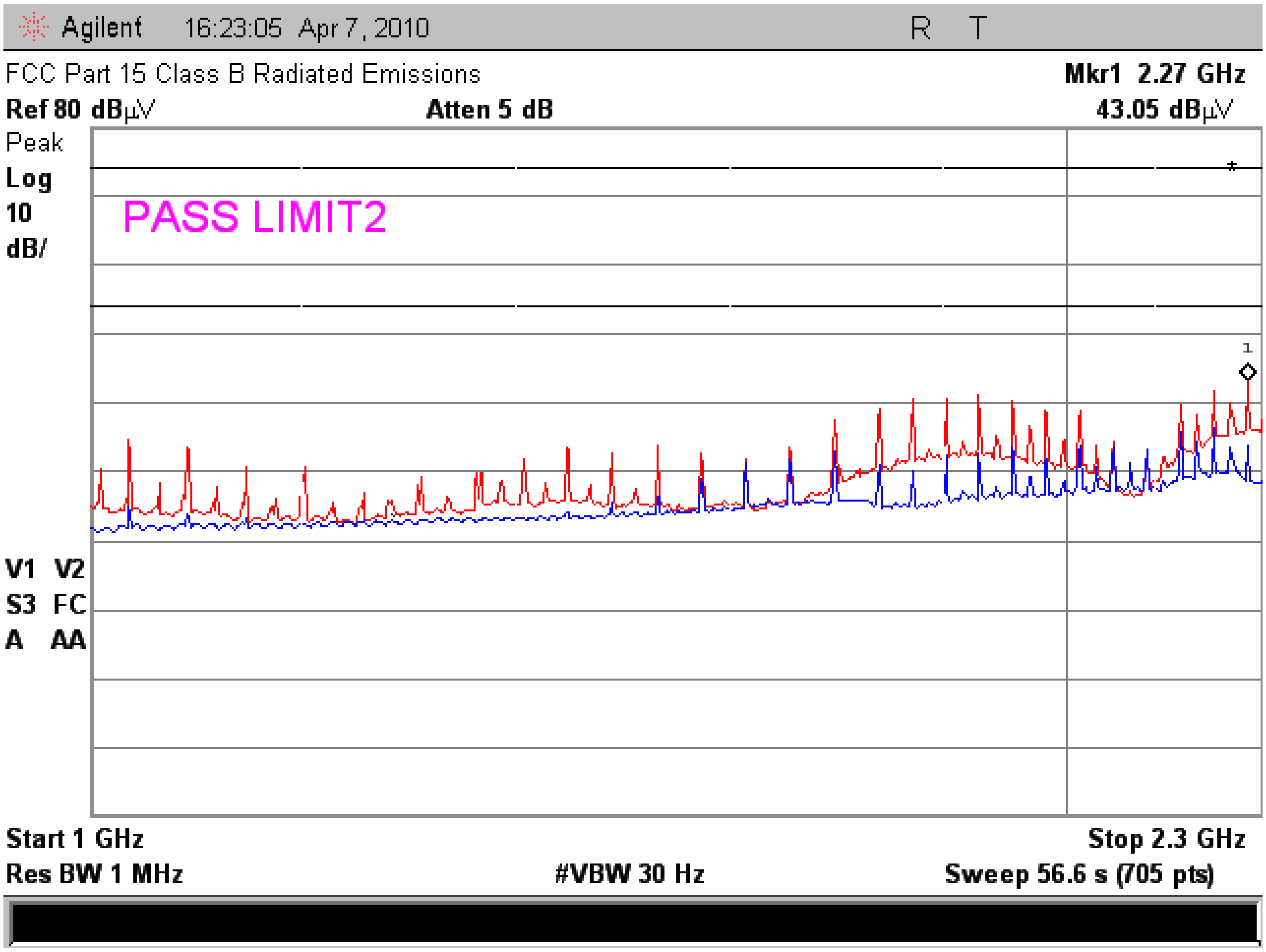


Figure 5.2-3 – Radiated Emissions 1 to 2.3 GHz for Channel 19 w/ Average Detector

Notes:

The red trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit in its pulse pseudo random binary sequence transmission test mode. The highest level of emissions occurred in vertical polarity, antenna height of 1 m, and turntable angle of 298 degrees. The maximum level emission in this band was 11 dB below the average limit.

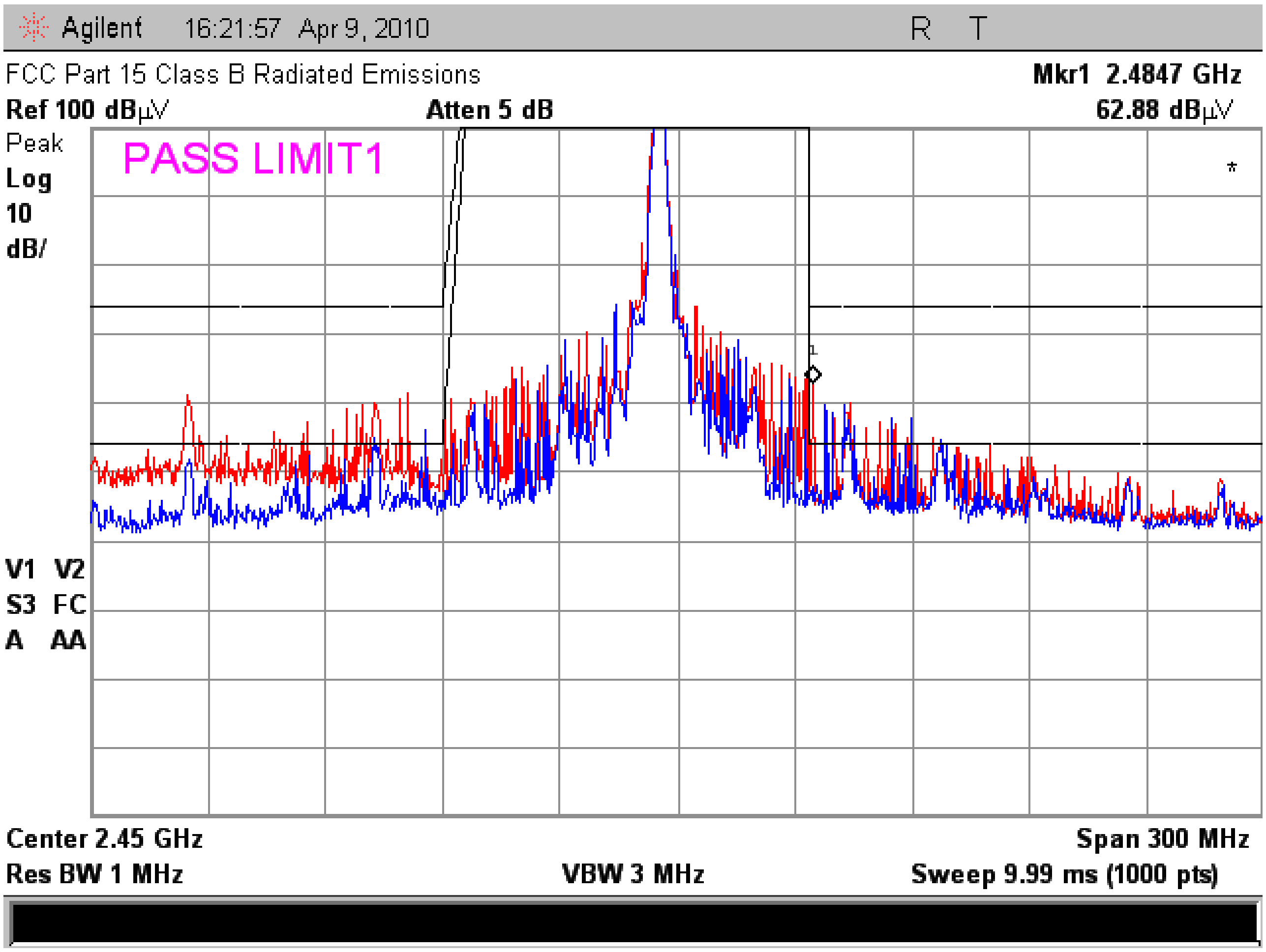


Figure 5.2-4 – Band Edge Radiated Emissions Channel 19 w/ Peak Detector

Notes:

The red trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit in its pulse pseudo random binary sequence transmission test mode. The maximum level emission in this band was 11.1 dB below the peak limit.

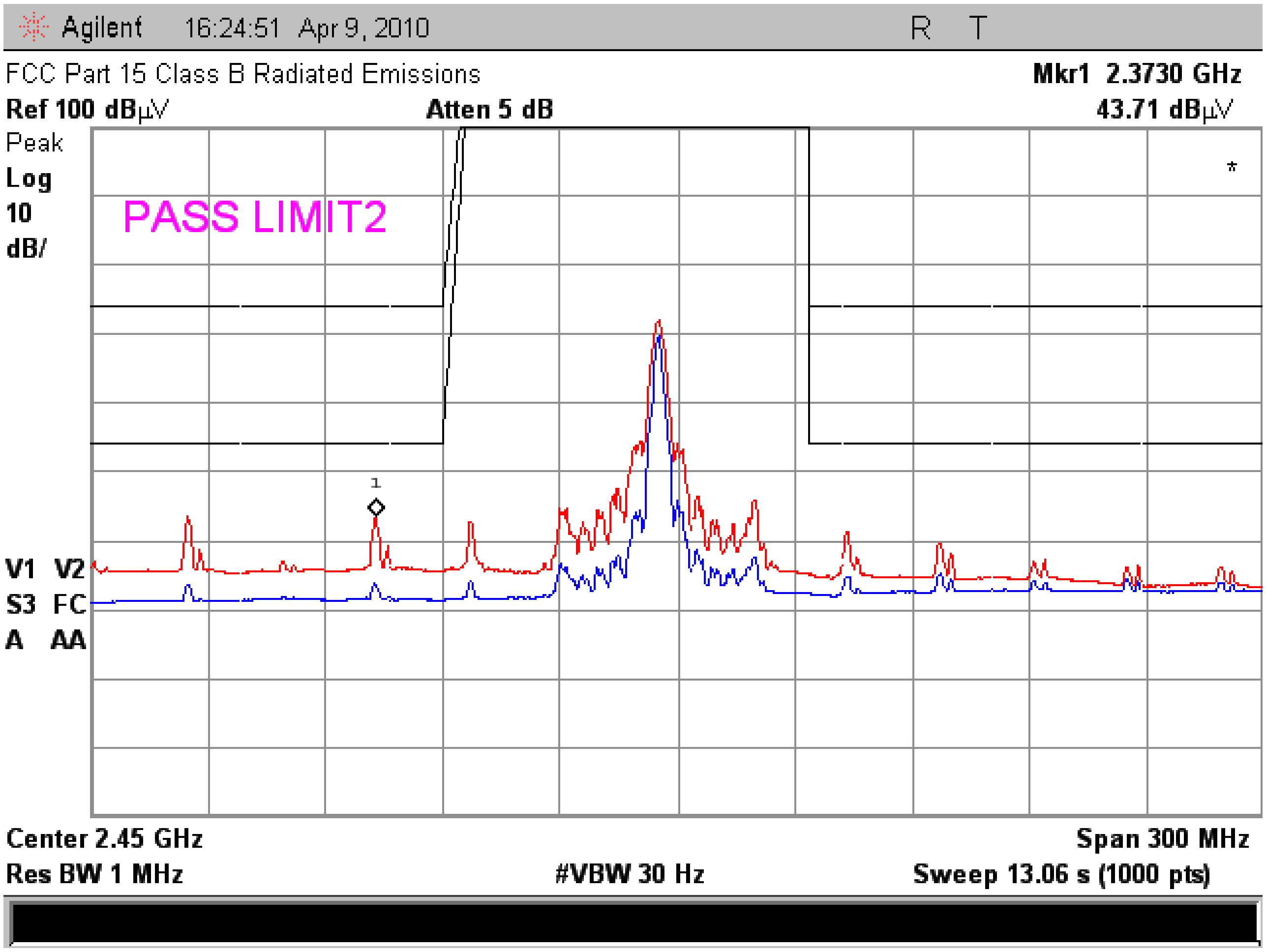


Figure 5.2-5 – Band Edge Radiated Emissions Channel 19 w/ Average Detector

Notes:

The red trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit in its pulse pseudo random binary sequence transmission test mode. The maximum level emission in this band was 11.3 dB below the average limit. The turntable angle, polarity, and antenna elevation were set to maximize emissions. This occurred at 277 degrees, vertical, 110 cm respectively.

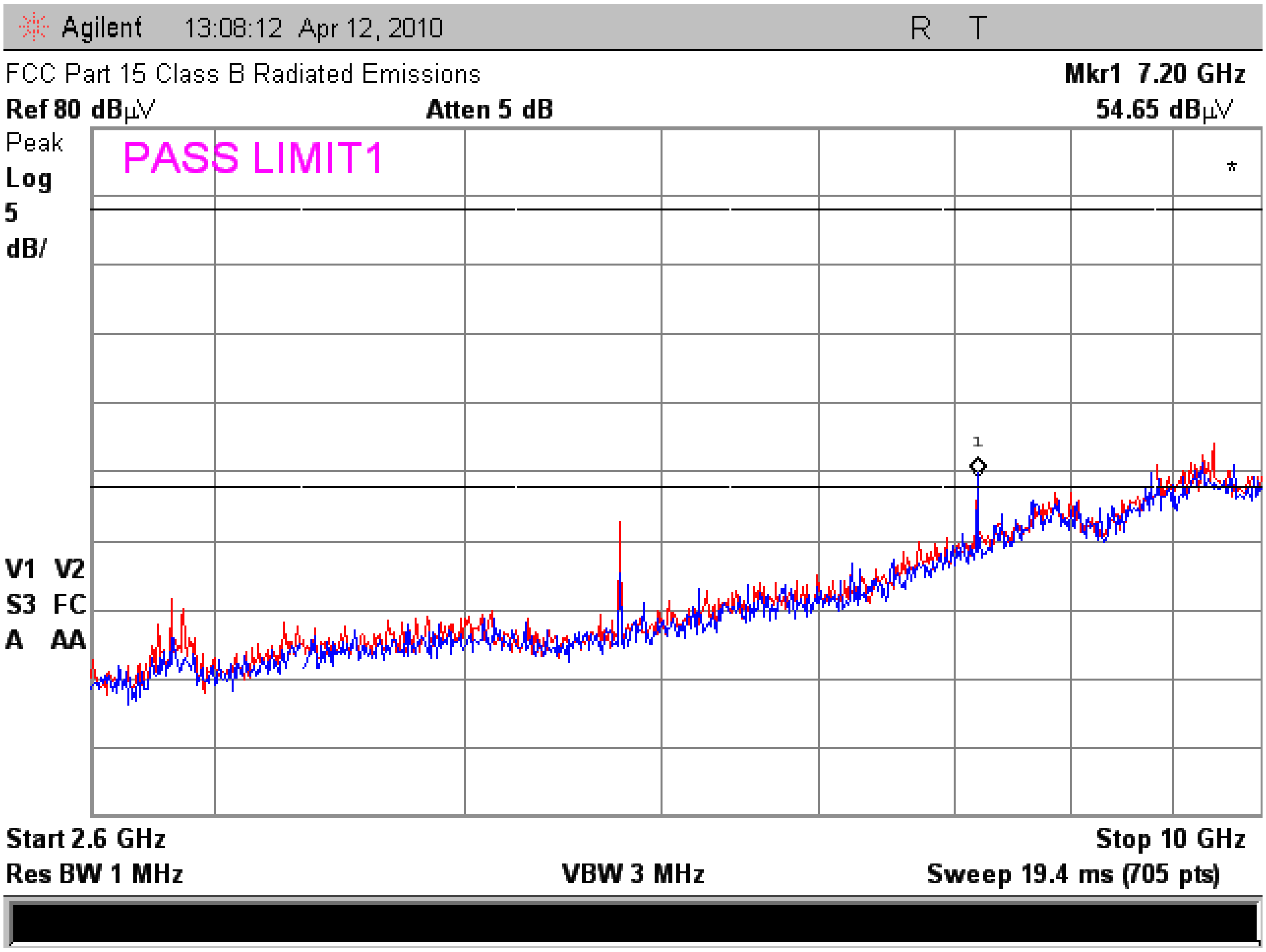


Figure 5.2-6 – Radiated Emissions 2.6 to 10 GHz for Channel 19 w/ Peak Detector

Notes:

The red trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit its pulse pseudo random binary sequence transmission test mode. The maximum level emission in this band was 19.3 dB below the peak limit.

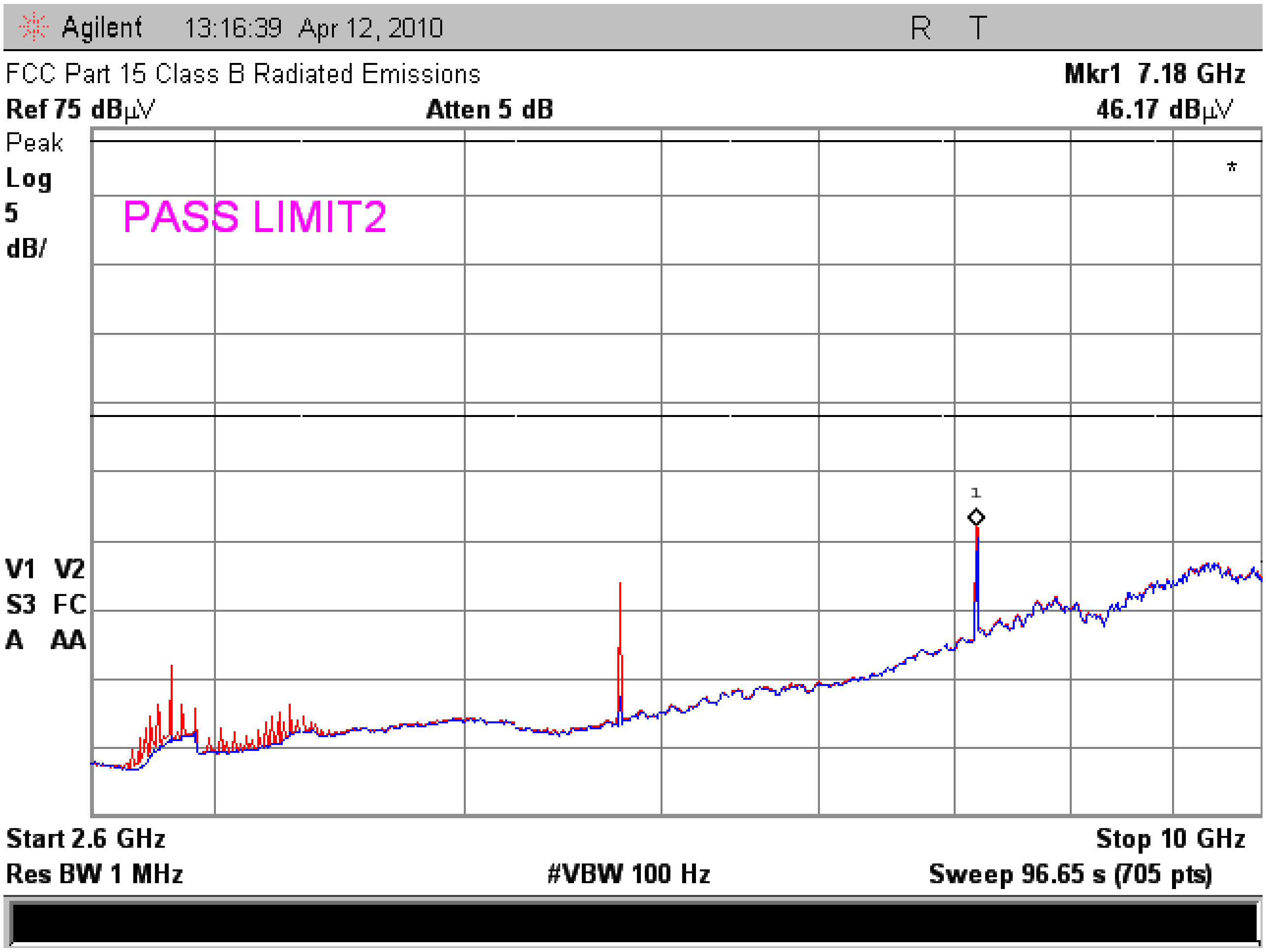


Figure 5.2-7 – Radiated Emissions 2.6 to 10 GHz for Channel 19 w/ Average Detector

Notes:

The red trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit its pulse pseudo random binary sequence transmission test mode. The average level at the marker frequency was re-measured with a 30 Hz VBW and this resulted in a reading of 42.8 dBµV/m. The maximum level of this emission (the third harmonic of the operating band) was 11.2 dB below the average limit.

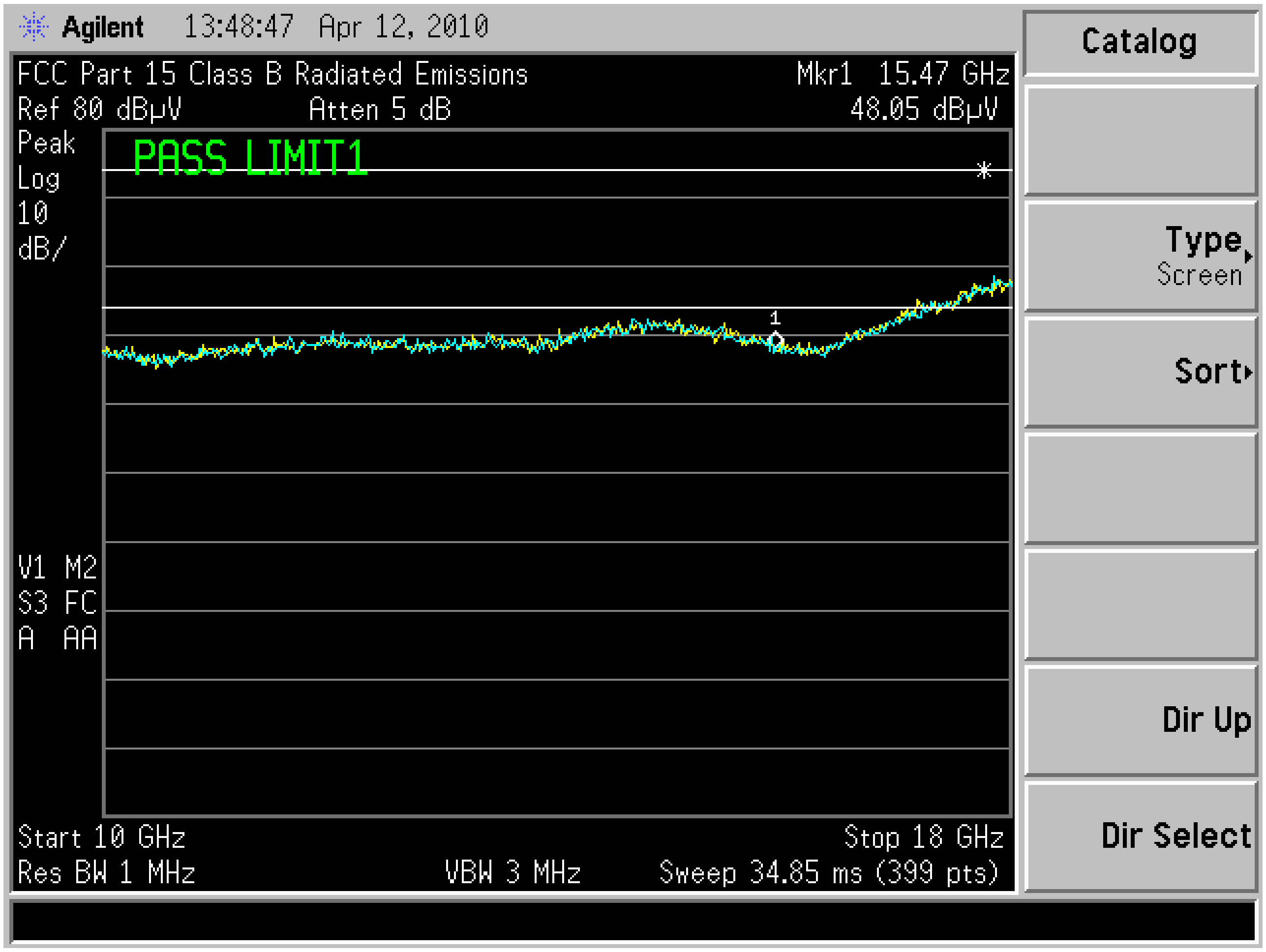


Figure 5.2-8 – Radiated Emissions 10 to 18 GHz for Channel 19 w/ Peak Detector

Notes:

The yellow trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit its pulse pseudo random binary sequence transmission test mode. There were no emissions that could be detected above the noise floor of the measurement system.

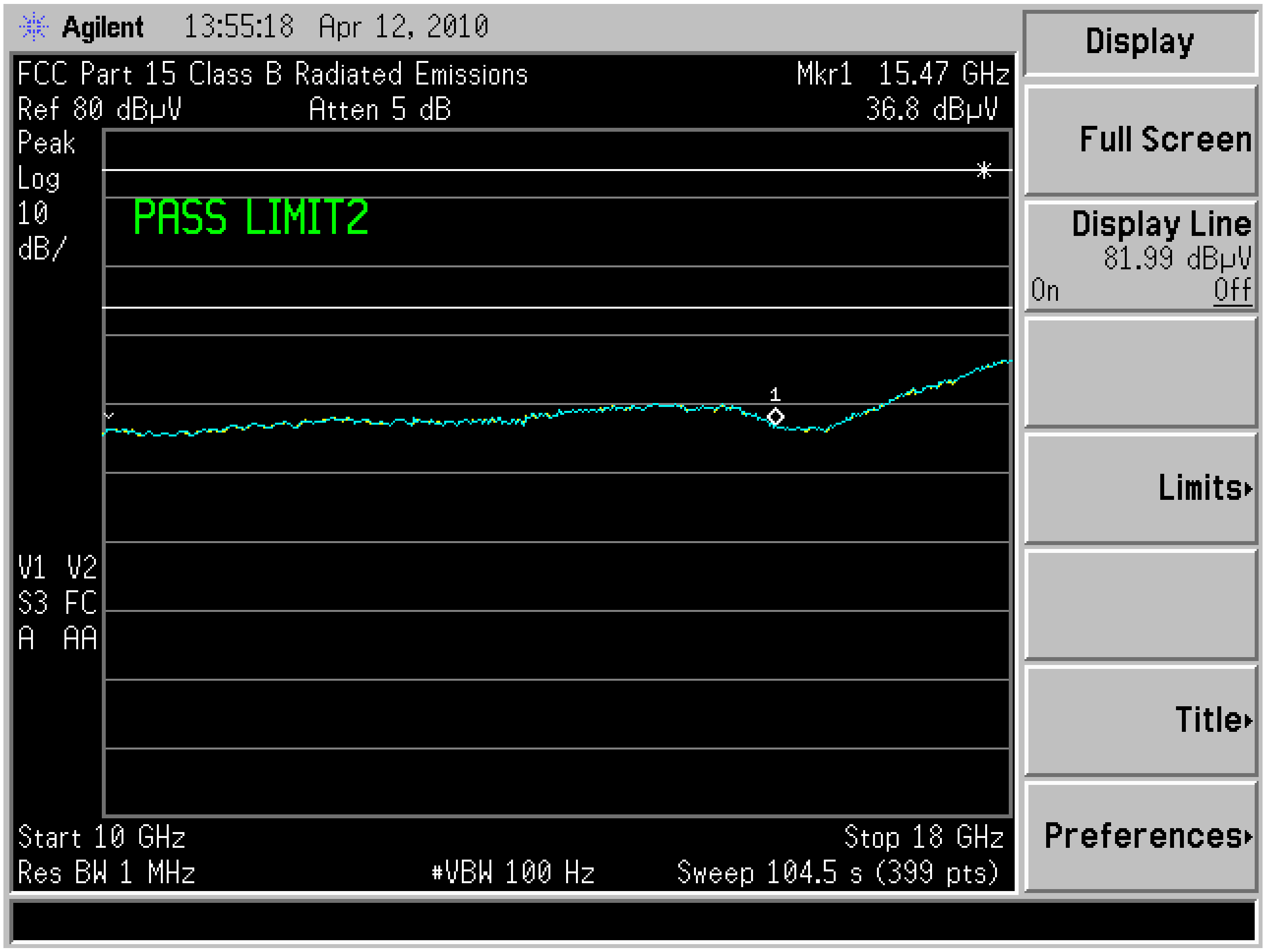


Figure 5.2-9 – Radiated Emissions 10 to 18 GHz for Channel 19 w/ Average Detector

Notes:

The yellow trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit its pulse pseudo random binary sequence transmission test mode. There were no emissions that could be detected above the noise floor of the measurement system.

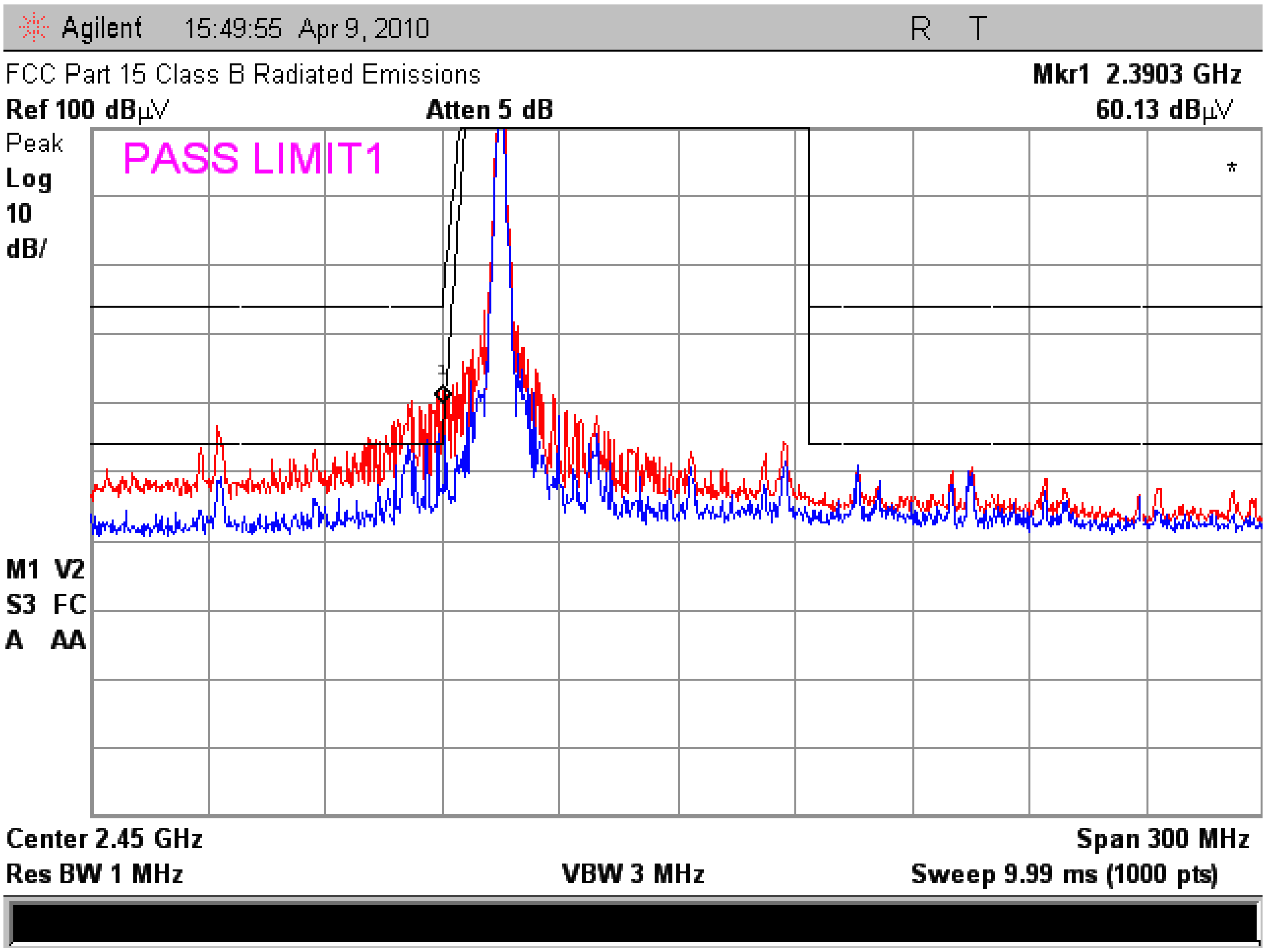


Figure 5.2-10 – Band Edge Radiated Emissions Channel 11 w/ Peak Detector

Notes:

The red trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit in its pulse pseudo random binary sequence transmission test mode. The maximum level emission in this band was 13.9 dB below the peak limit.

The power level was set to 09 as the initial setting of 0C produced levels over the peak limit when measured with the peak detector.

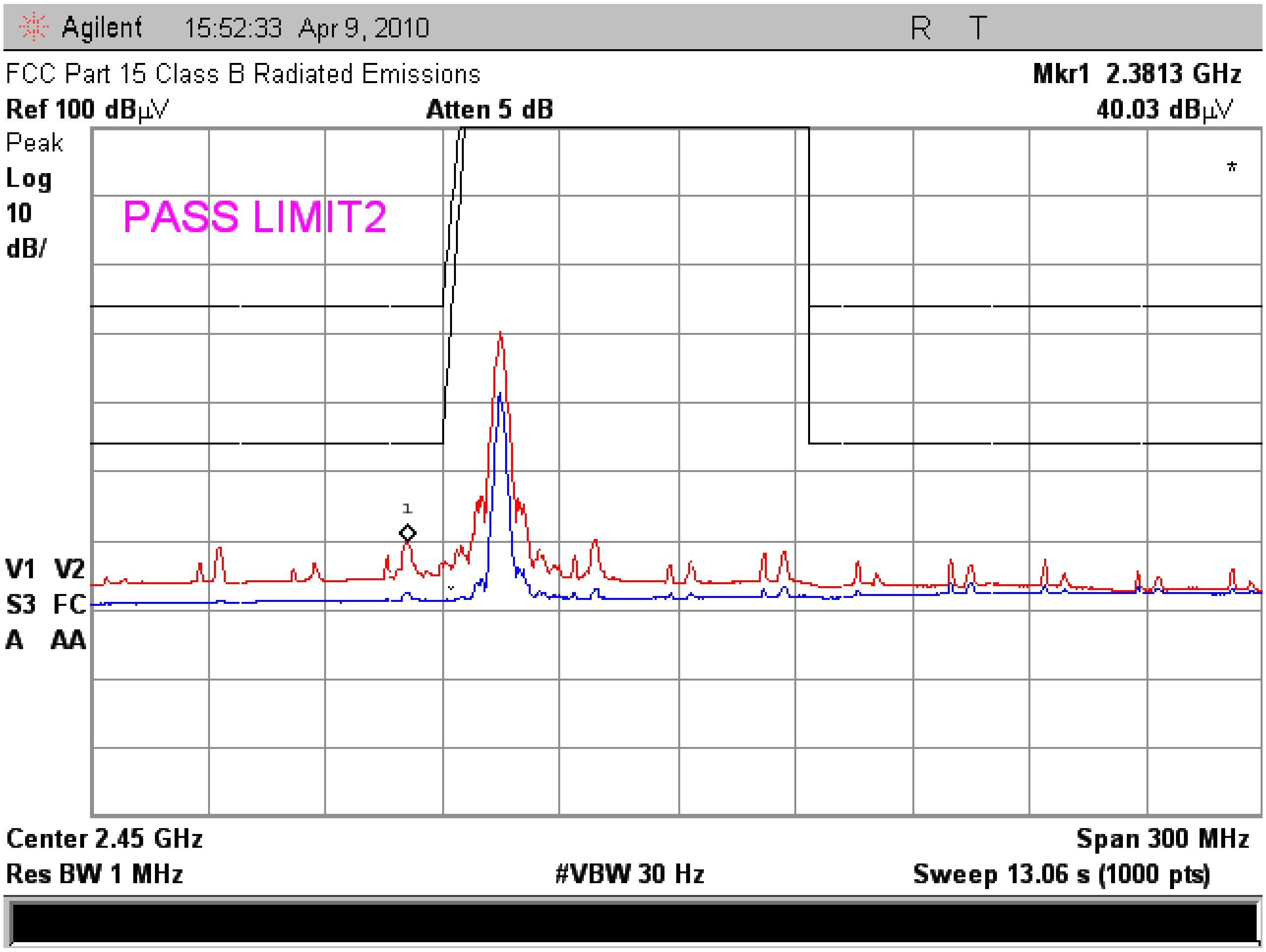


Figure 5.2-11 – Band Edge Radiated Emissions Channel 11 w/ Average Detector

Notes:

The red trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit in its pulse pseudo random binary sequence transmission test mode. The maximum level emission in this band was 14.0 dB below the average limit. The turntable angle, polarity, and antenna elevation were set to maximize emissions. This occurred at 269 degrees, vertical, 110 cm respectively.

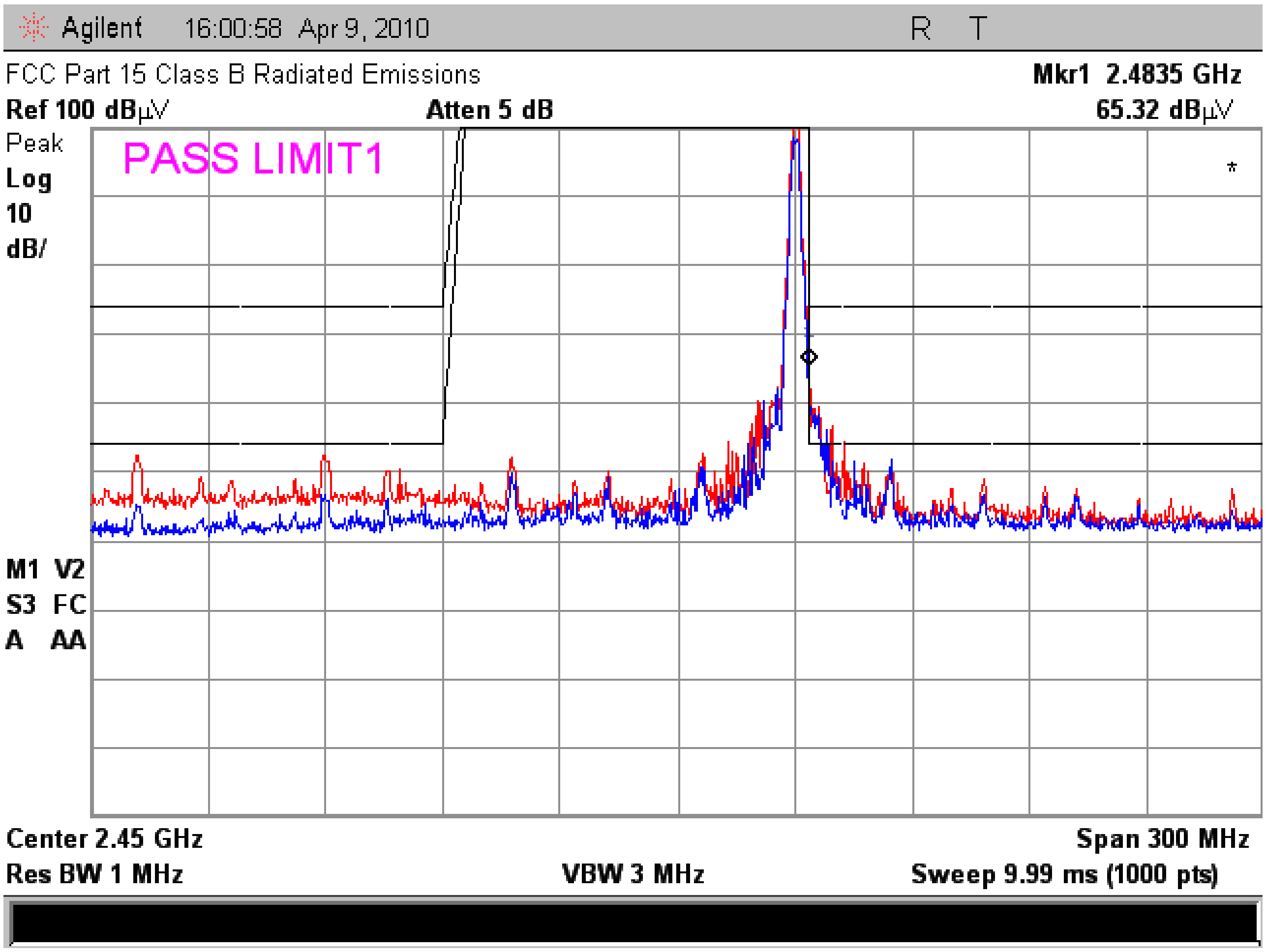


Figure 5.2-12 – Band Edge Radiated Emissions Channel 26 w/ Peak Detector

The red trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit in its pulse pseudo random binary sequence transmission test mode. As shown by the marker 1, the maximum level emission in restricted band above the 2400 MHz to 2483.5 MHz operating band was 8.7dB below the peak limit.

The power level was set to 07 as the initial setting of 0C produced levels over the peak limit when measured with the peak detector.

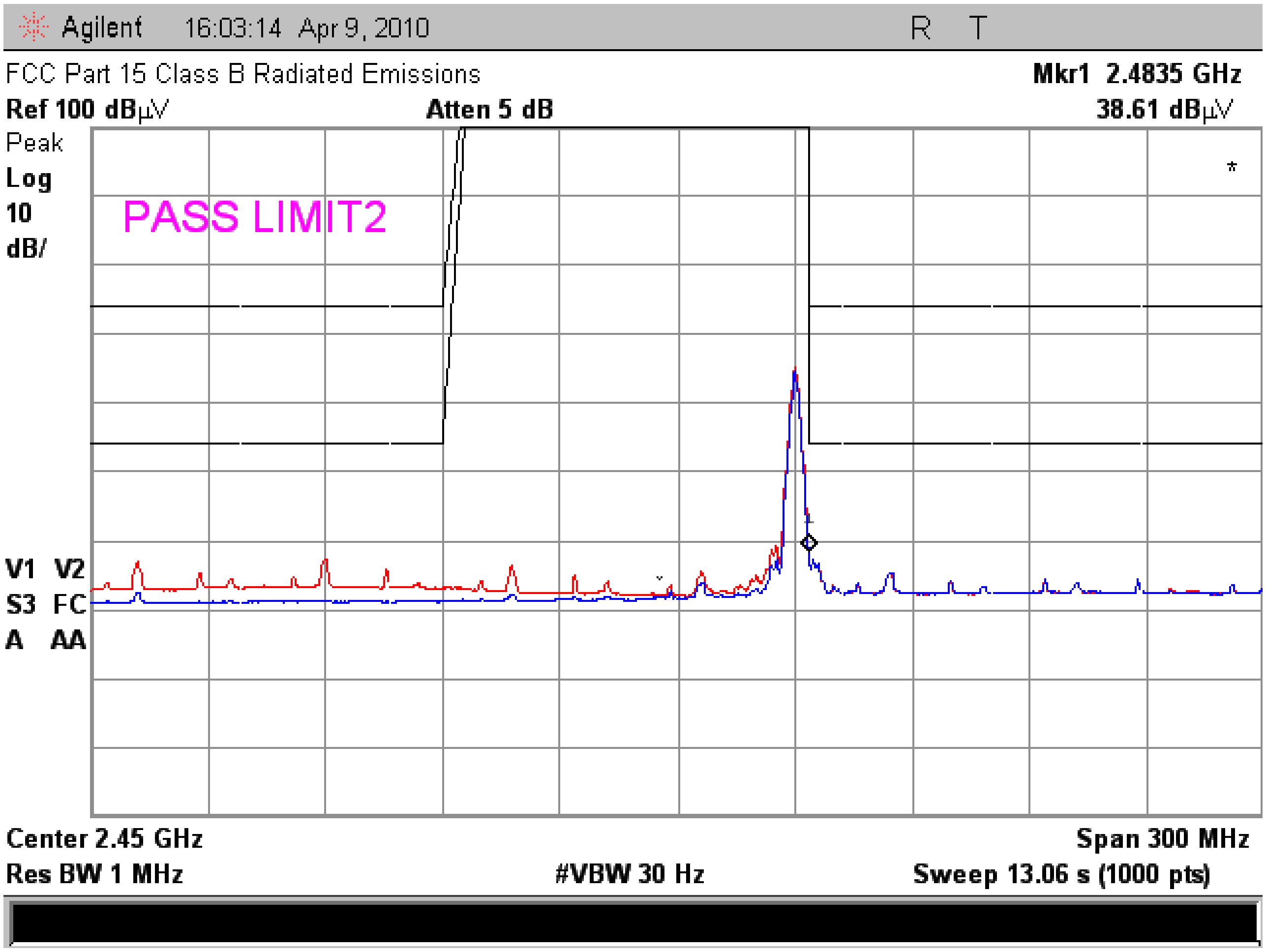


Figure 5.2-13 – Band Edge Radiated Emissions Channel 26 w/ Average Detector

The red trace was with vertical polarity. The blue trace was with horizontal polarity. The DUT was set to transmit in its pulse pseudo random binary sequence transmission test mode. As shown by the marker 1, the maximum level emission in restricted band above the 2400 MHz to 2483.5 MHz operating band was 15.4 dB below the average limit.

The turntable angle, polarity, and antenna elevation were set to maximize emissions. This occurred at 241degrees, vertical, 110 cm respectively.

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

Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	CF* (dB)	Margin (dB)	Limit (dBµV/m)
44.760000	32.0	100.0	V	29.0	10.0	8.0	40.0
45.600000	31.7	100.0	V	0.0	9.6	8.3	40.0
60.360000	30.9	149.0	V	209.0	7.2	9.1	40.0
60.540000	30.8	148.0	V	225.0	7.2	9.2	40.0
624.060000	28.7	100.0	V	255.0	22.8	17.3	46.0
648.000000	39.7	149.0	V	300.0	23.2	6.3	46.0

Table 5.2-2 – Radiated Emissions Peak Levels 1 – 25 GHz

Frequency (MHz)	Peak (dBµV/m)	Antenna height (cm)	Polarity	Limit (dBµV/m)	Margin (dB)
2270.0	60.6	100	V	74	13.4
2483.5	65.3	100	V	74	8.7
7335.0	54.7	100	V	74	11.3

Table 5.2-3 – Radiated Emissions Average Levels 1 – 25 GHz

Frequency (MHz)	Average (dBµV/m)	Antenna height (cm)	Polarity	Limit (dBµV/m)	Margin (dB)
2270	43.1	100	V	54	10.0
2483.5	38.6	100	V	54	15.4
7335.0	42.4	100	V	54	11.6

* CF is the antenna correction factor and cable loss

Minimum Margin: **6.3 dBµV/m**

Measurement Uncertainty: +4.8 dB, -5.2 dB

Test Personnel:

April 12, 2010	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	11/3/2010
Spectrum Analyzer	Agilent E7405A	MY42000055	3/16/2011
Preamplifier	Com-Power PA-122	181925	3/22/2011
Notch Filter	Micro-tronics BRM50702-01	023	3/22/2011
Antenna	Chase EMCCBL6112B	2579	11/19/2011
Antenna	EMCO Horn Model 3115	9002-3393	3/27/2011
Antenna	Schwarzbeck Mess - Electronik	SBA 9119	12/14/2010

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 is calculated by adding the antenna correction factor and cable loss and subtracting the amplifier gain (if any) from the measured reading.

The Rohde & Schwarz Model ESCS30 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

6 ANTENNA REQUIREMENT

References: 47 C.F.R. § 15.203
RSS-GEN § 7.1.4

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 as of the date of this report, only the internal PCB trace inverted F antenna may be used. In the future, external antennas may be authorized and these will connect to a non-standard type MMCX connector.

6.3 Antenna Photograph

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

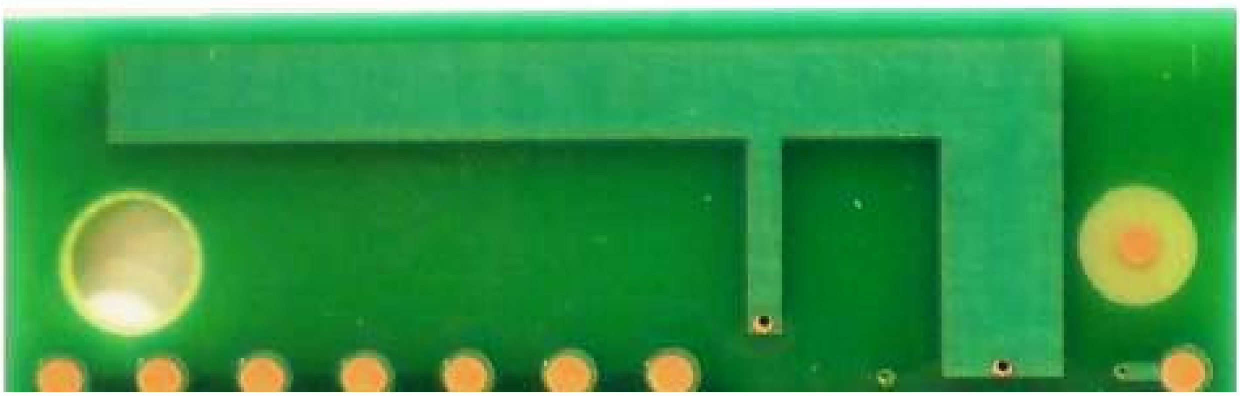


Photo 6.3-1

7 BANDWIDTH DATA

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

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

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

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 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.

7.2 Test Data

Compliance Verdict: PASS

Figures 7.2-1 through 7.2-3 show the 6 dB bandwidth of the DUT operating on Channels 11, 19, and 26 respectively. The IEEE 802.15.4 standard assures that the 6 dB bandwidth will be much greater than the required 500 kHz.

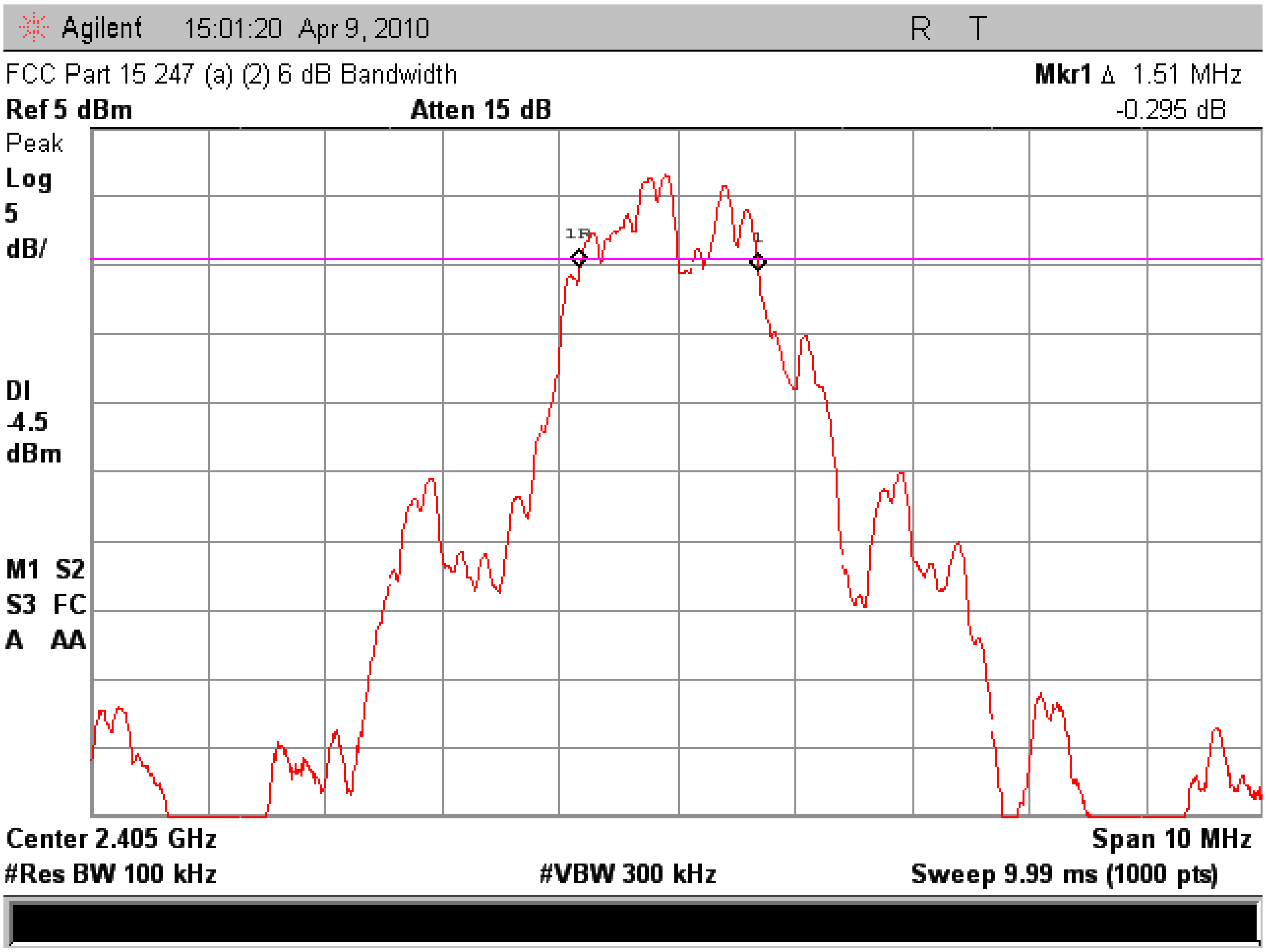


Figure 7.2-1 – Channel 11 Bandwidth

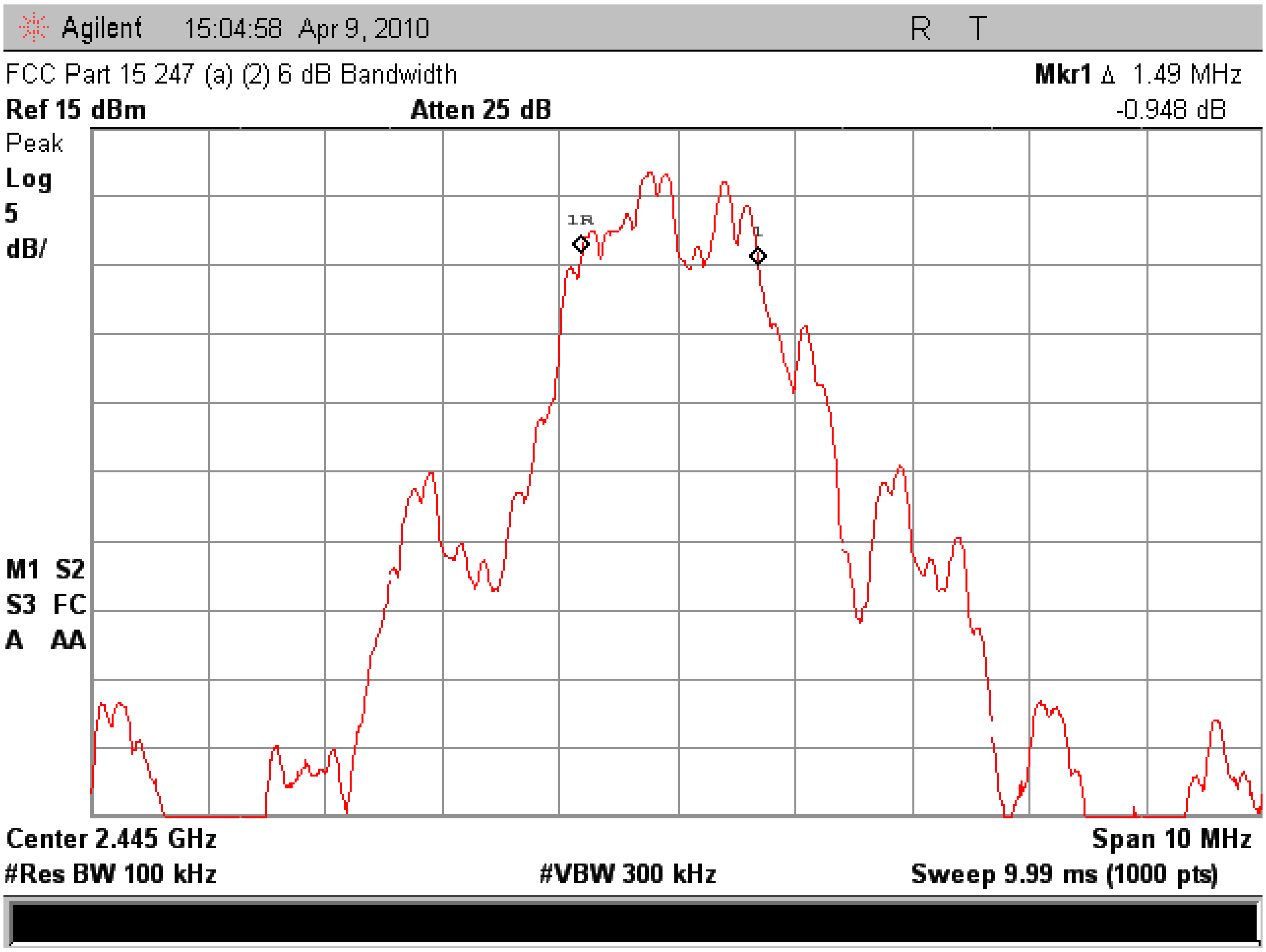


Figure 7.2-2 – Channel 19 Bandwidth

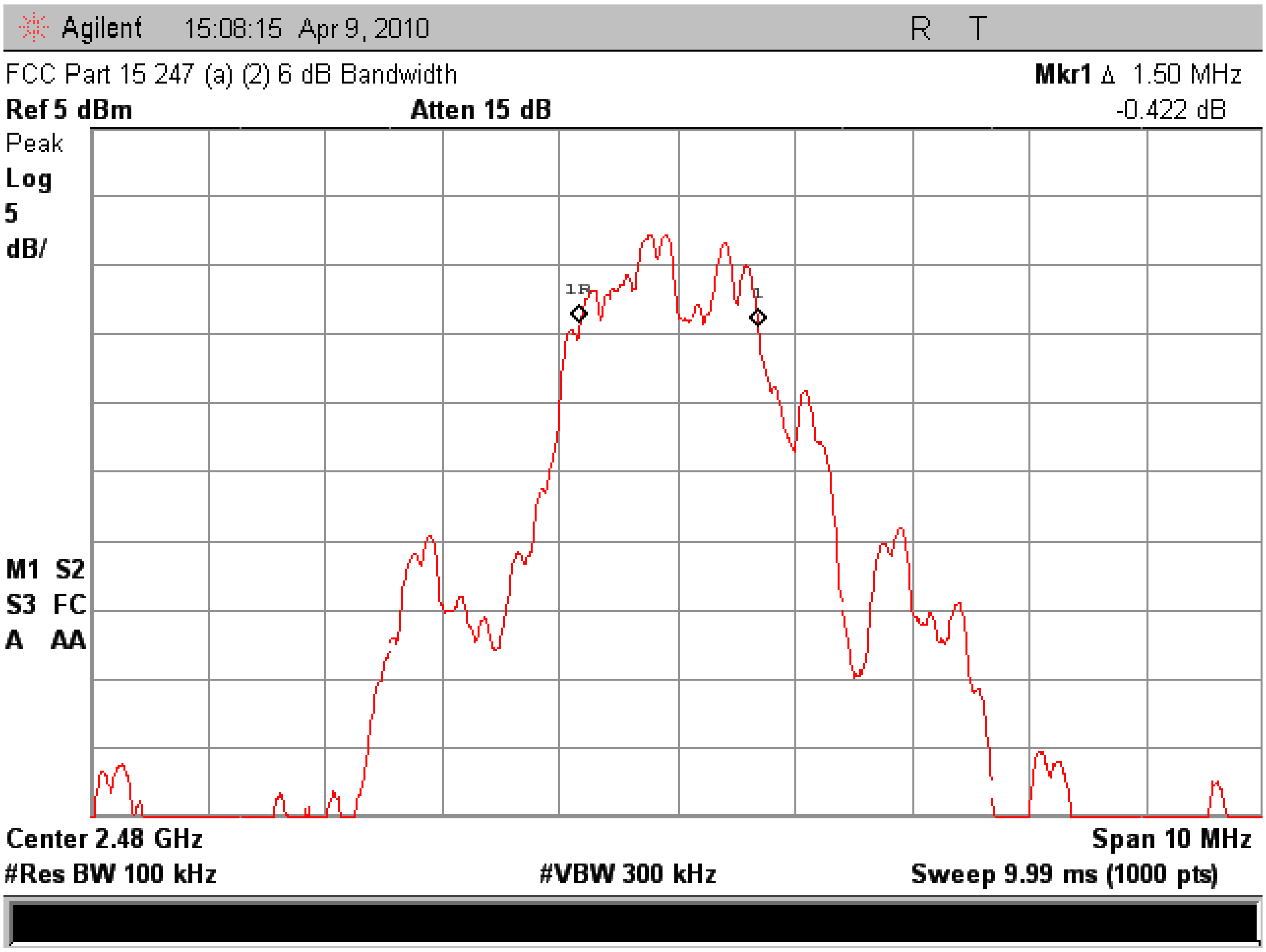


Figure 7.2-3 – Channel 26 Bandwidth

7.3 Test Instrumentation Used, Bandwidth Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	3/16/2011

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

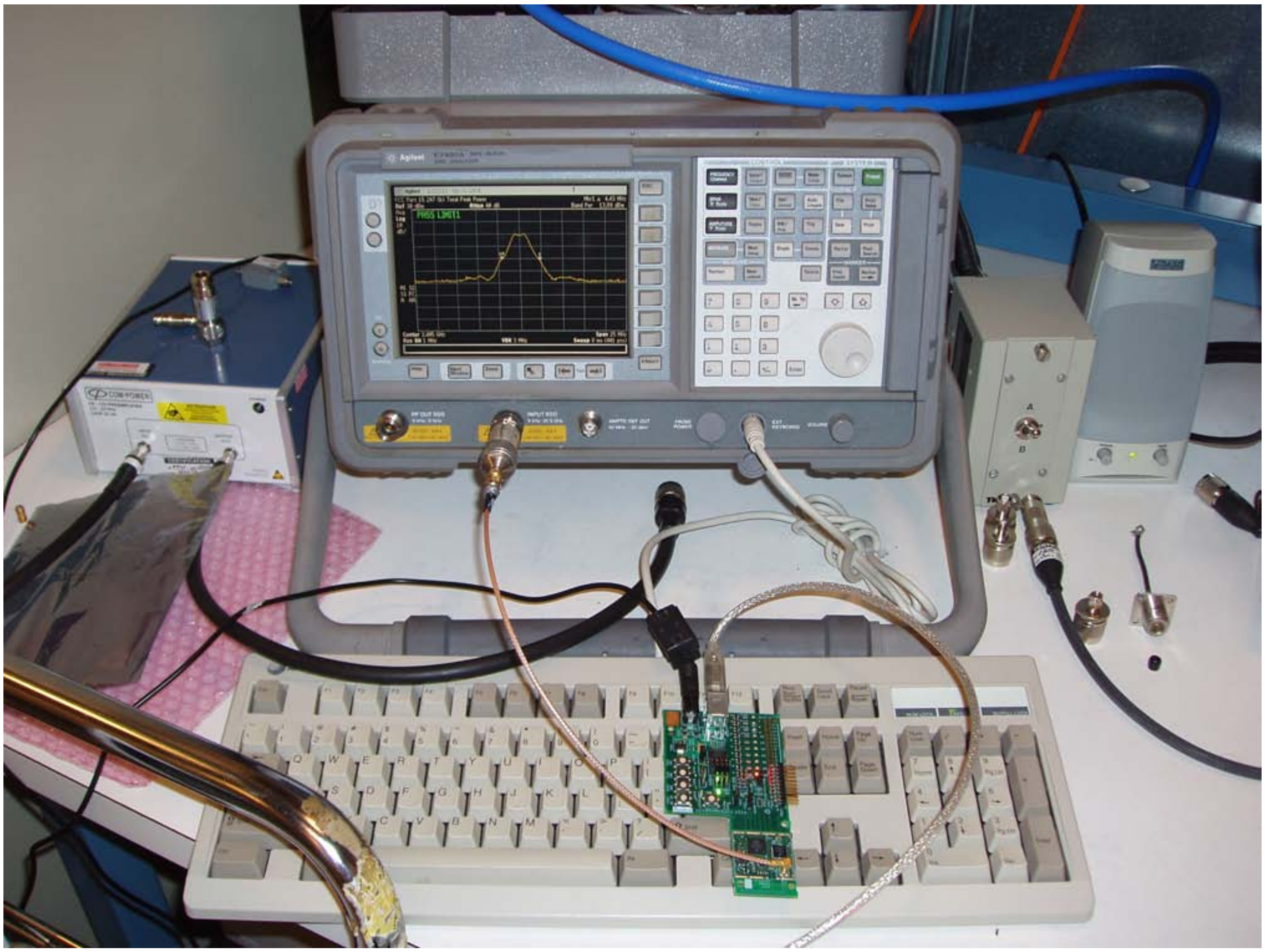


Photo 7.4-1 – Conducted Measurement Test -Setup

8 PEAK POWER DATA

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

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

(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 § 7.1.4

(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, video bandwidth set to 10 kHz 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 modulated transmission test mode. The trace should be set to max hold. Markers are placed at the lower and upper 20 dB points relative to the peak level. The spectrum analyzer's bandpower function is used to integrate the total power. The test method used was set out in KDB Publication No. 558074, Power Output Option 2, Method # 3.

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 -1.0 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 11, 19, and 26

Total Power (dBm)	Total Power (watts)	Channel	Power Setting
10.22	0.010519619	11	09
20.53	0.112979591	19	0C
6.22	0.004187936	26	07

Figures 8.2-1 through 8.2-3 show the in-band spectral characteristics and the bandpower calculation performed by the spectrum analyzer.

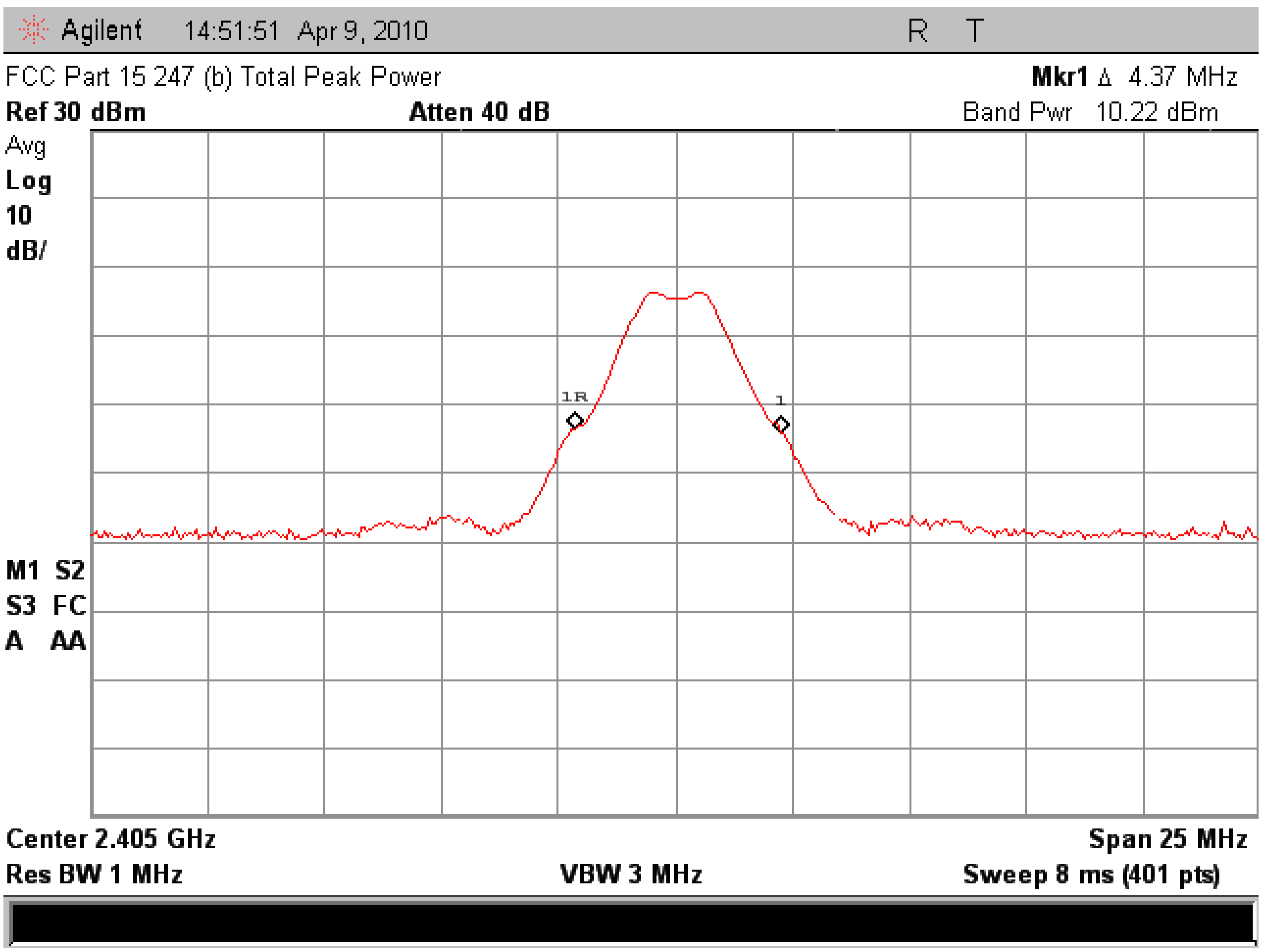


Figure 8.2-1 – Channel 11 Signal Power

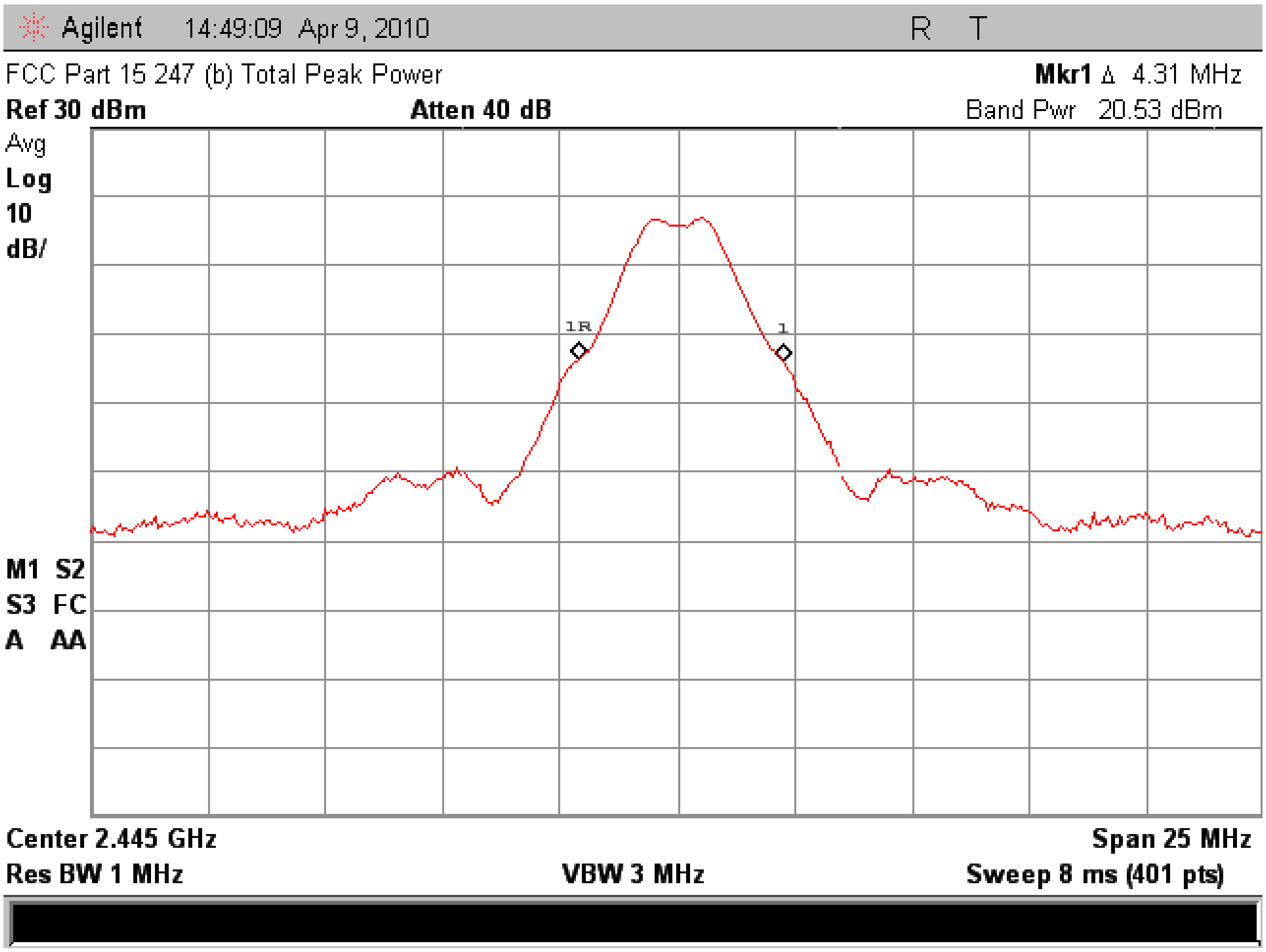


Figure 8.2-2 – Channel 19 Signal Power

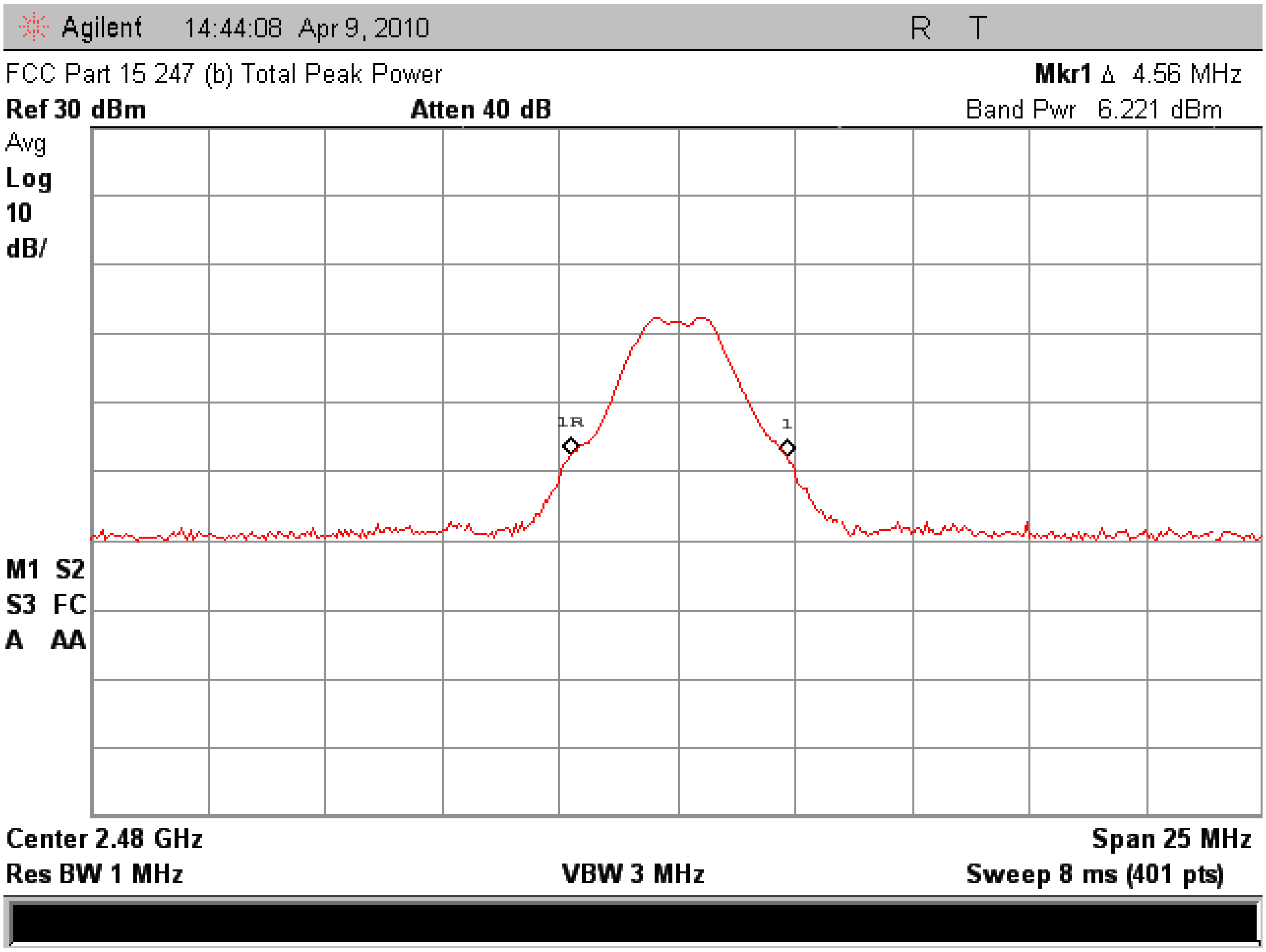


Figure 8.2-3 – Channel 26 Signal Power

8.3 Test Instrumentation Used, Peak Power Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	3/16/2011

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. This measurement was made with the DUT set in the continuous modulated mode. The display line was set 20 dB lower than the peak level of the desired power. There were no spurious emissions close to the limit. Though not shown, the conducted levels in the 30 MHz to 1000 MHz band were well below the limit. Also, spurious emissions with the S test mode did not result in levels that were notably different from the continuous modulated test mode.

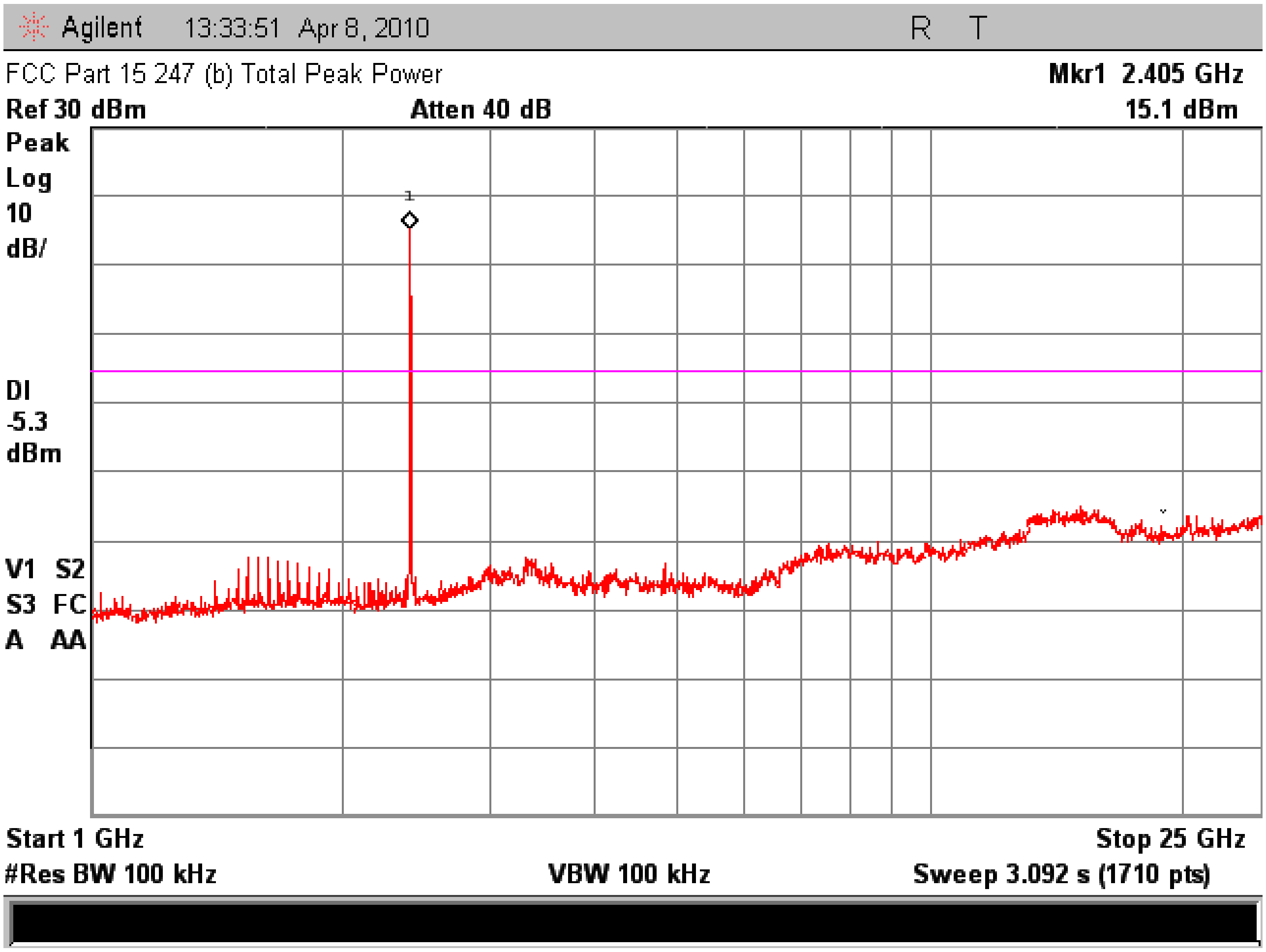


Figure 9.2-1 – Out of Band Conducted Data

9.3 Test Instrumentation Used, Out of band Power Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	3/16/2011

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 POWER SPECTRAL DENSITY DATA

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

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

10.1 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 3 kHz and its span set to encompass the full bandwidth of the emission. The DUT was conditioned to transmit continuously by selecting the modulated transmission test mode. The maximum peak power level of the emission measured.

10.2 Test Data

Compliance Verdict: PASS

Figures 10.2-1 through 10.2-3 show the conducted power in a 3 kHz bandwidth (PSD) of the DUT on Channels 11, 19, and 26 respectively.

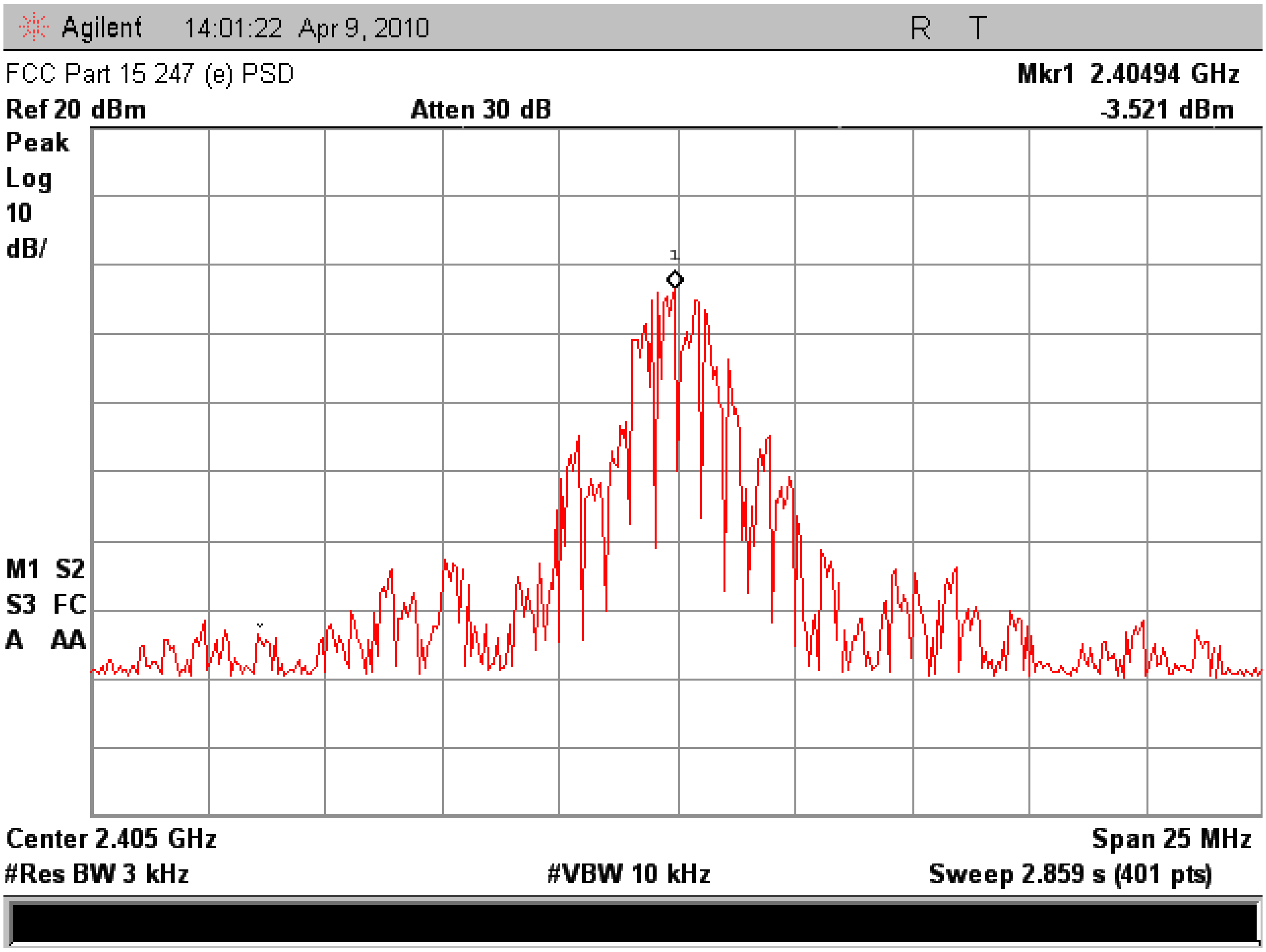


Figure 10.2-1 – Channel 11 PSD

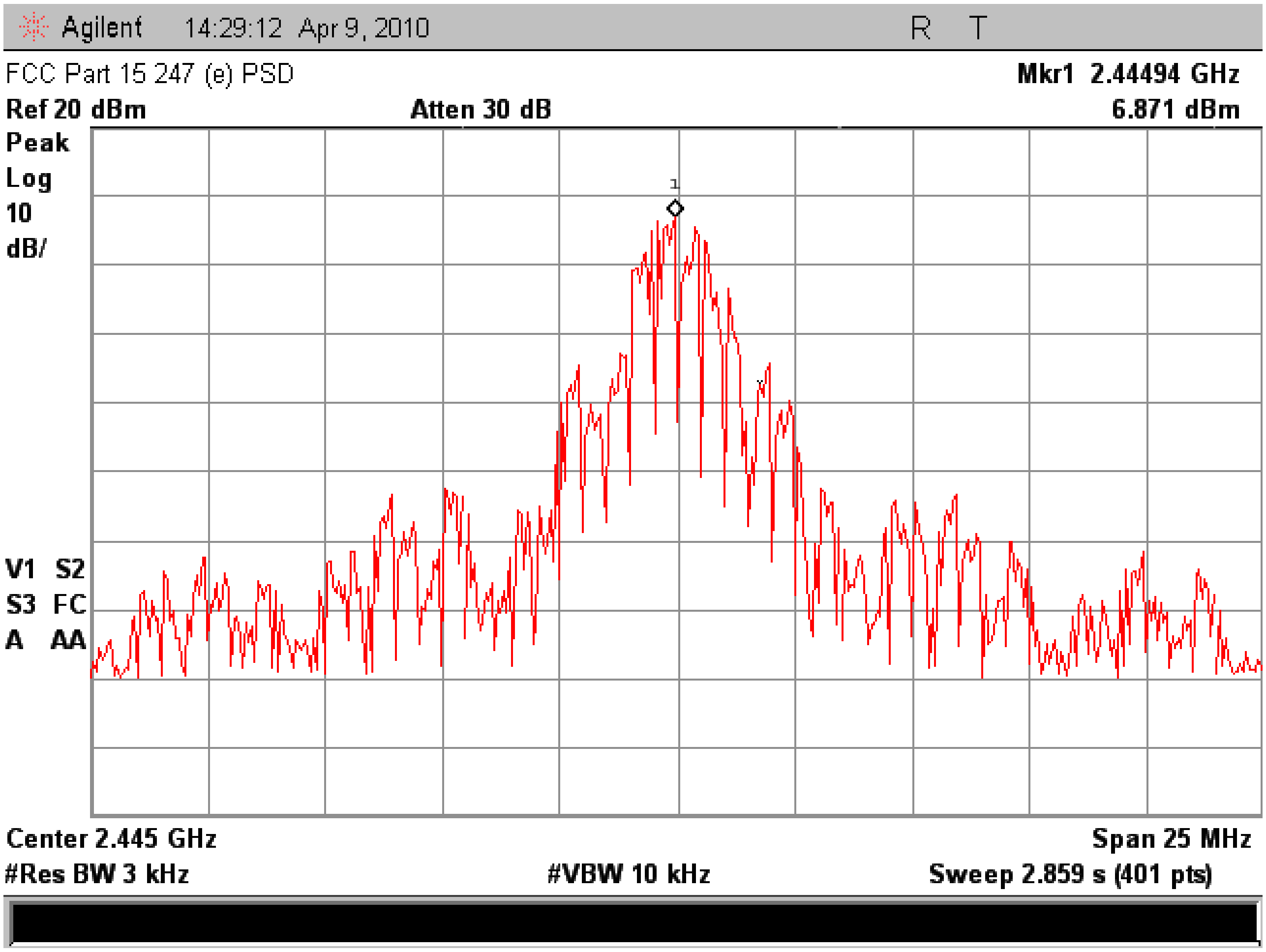


Figure 10.2-2 – Channel 19 PSD

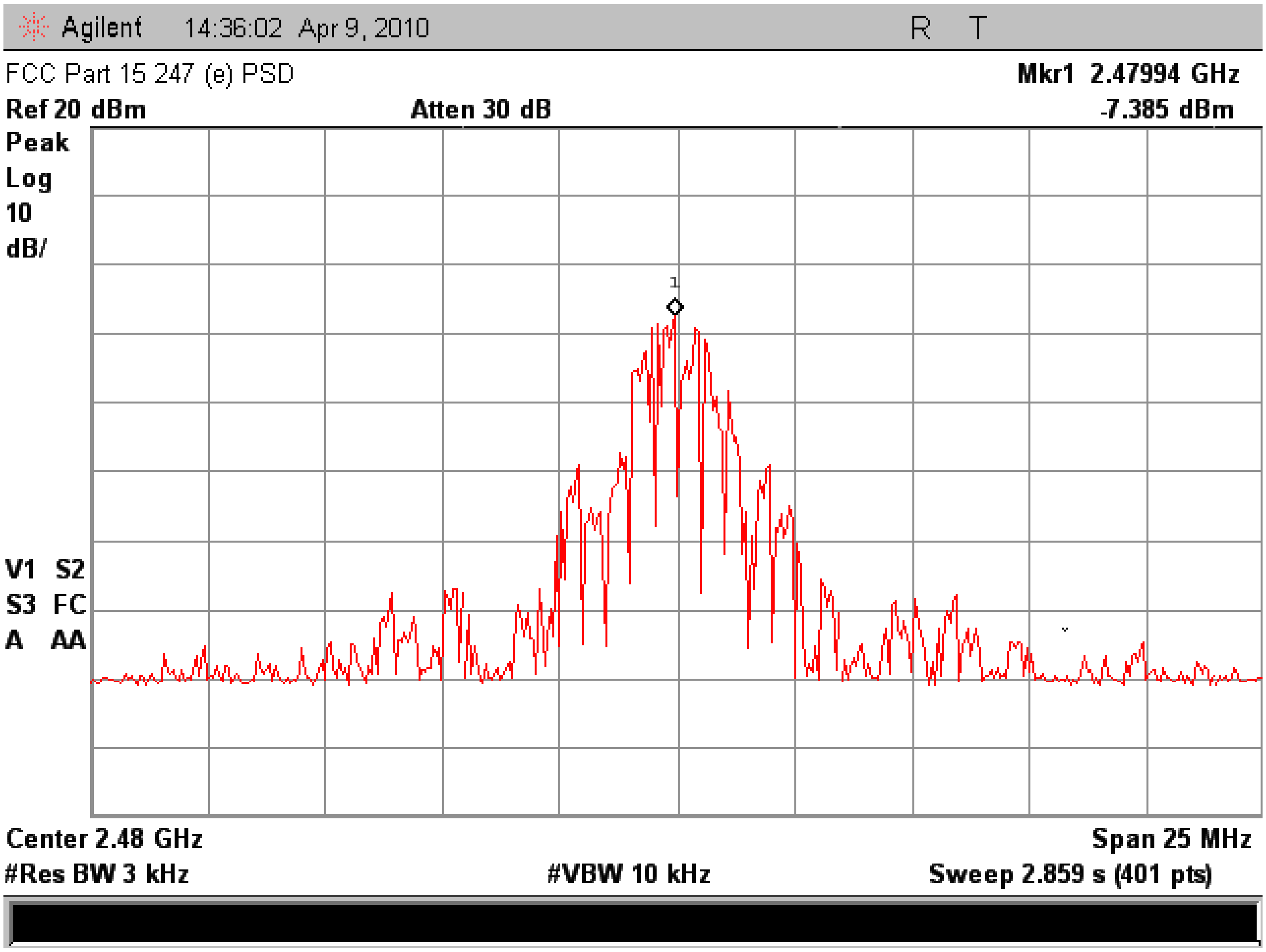


Figure 10.2-3 – Channel 26 PSD

10.3 Test Instrumentation Used, PSD Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	3/16/2011

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

Figures 11.2-1 and 11.2-3 show the results. The purpose of this test was to assess whether the test mode produced a duty cycle sufficiently high enough to facilitate accurate field strength measurements. Because the duty cycle of the test mode was slightly higher than can be expected in normal operation, it was judged to be suitable. The average field strength was measured by using this test mode and a video bandwidth setting on the spectrum analyzer of 30 Hz.

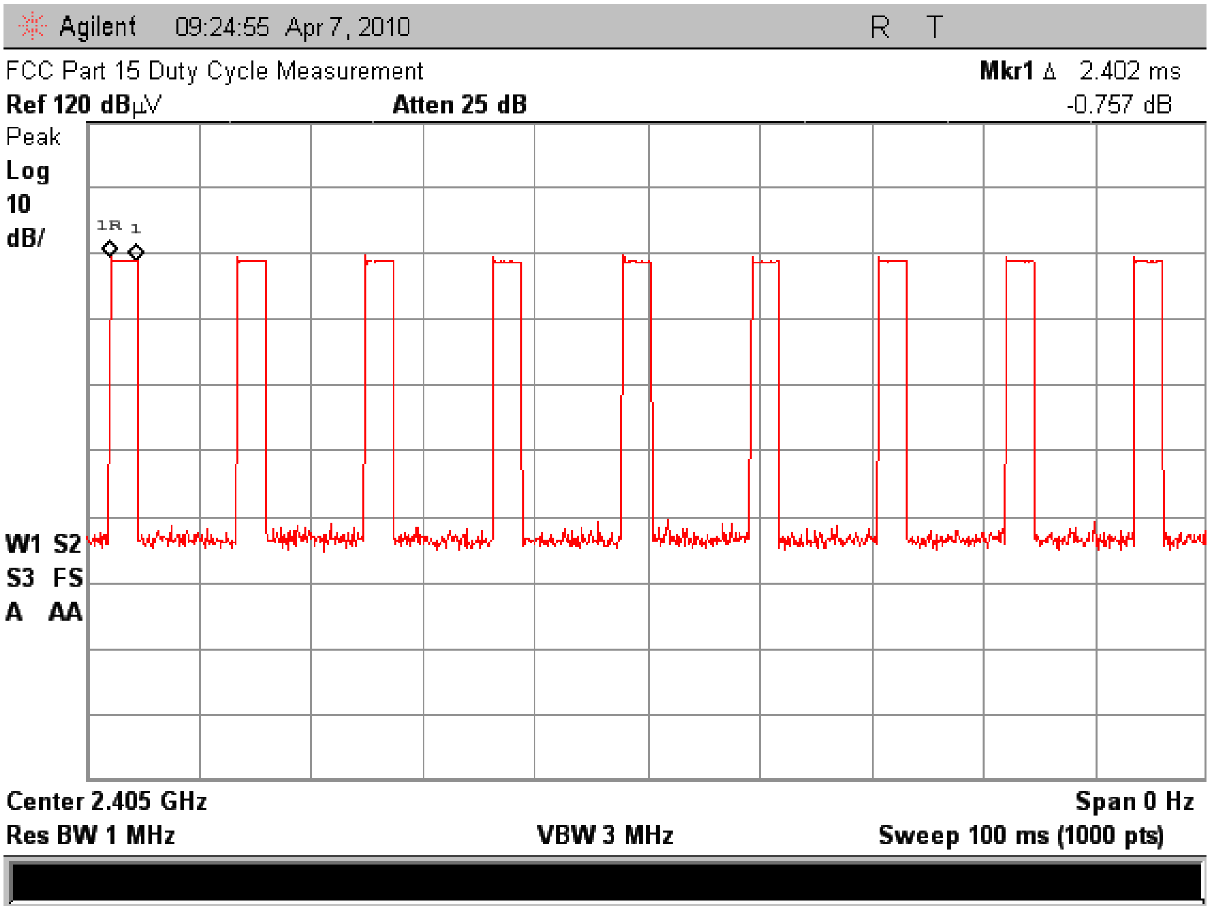


Figure 11.2-1 – Time Domain Measurement with the Radio in the S Test Mode

Notes:

In the above figure, the S test mode produces 9 bursts within a 100 msec window.

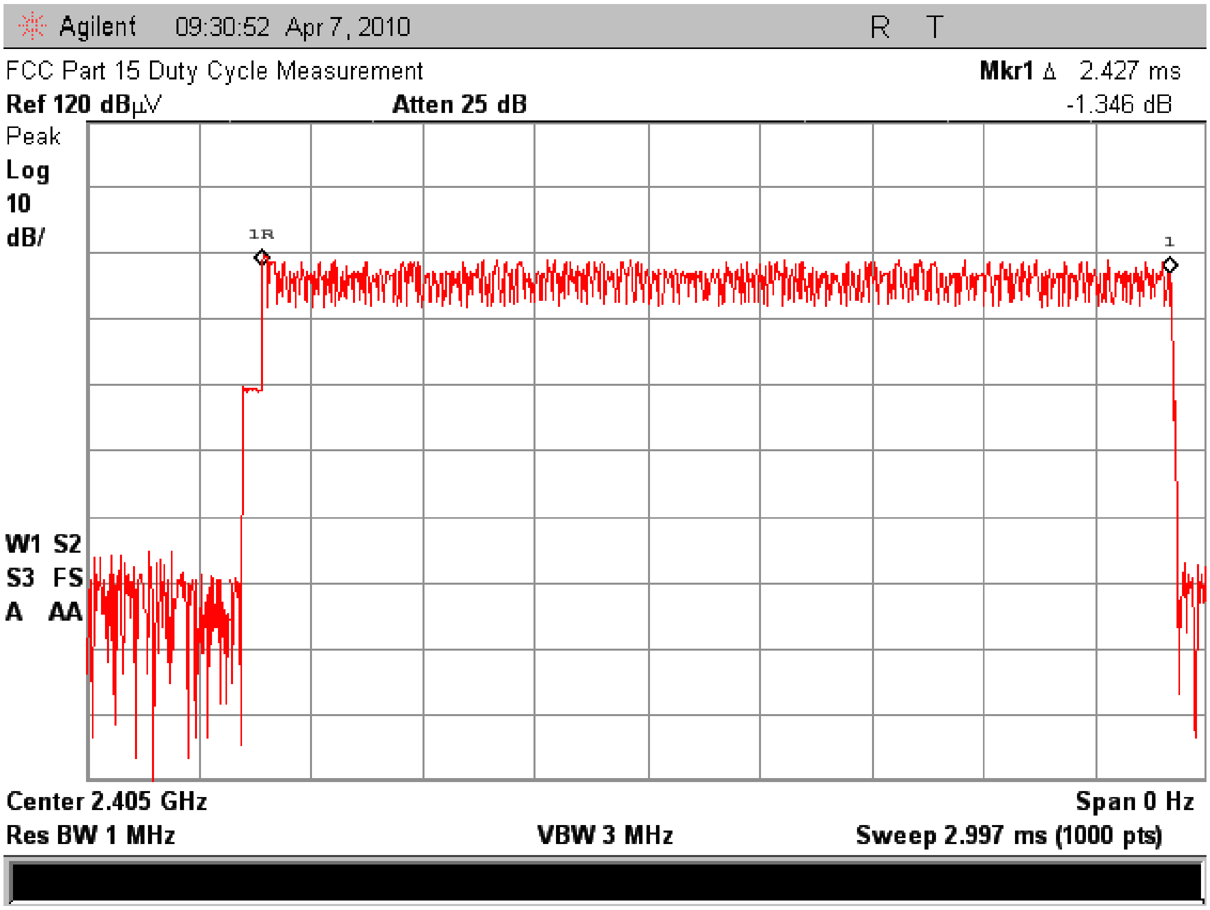


Figure 11.2-2 – Zoomed Time Domain Measurement with the Radio in the S Test Mode

Notes:

In the above figure, the duration of a single burst is measured.

The duty cycle is then calculated as follows:

Duty Cycle = (9 X 2.427)/100 = 21.8 %

Though not used in this evaluation, the duty cycle correction factor was calculated as follows:

Duty Cycle Correction Factor = 20LOG(Duty Cycle) = 20LOG(0.218) = -13.2 dB

11.3 Test Instrumentation Used, PSD Measurement

Type	Manufacturer/ Model No.	Serial Number	Calibration Due Date
Spectrum Analyzer	Agilent E7405A	MY42000055	3/16/2011

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: K4U-ZIM-B

The Industry Canada id number will be: IC:2146A-ZIM-B

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

MODEL: ZIM-B-002-ER-INTA-00	
FCC ID: K4U-ZIM-B	
IC: 2146A-ZIM-B	
Lot: 00001	S/N: 000001

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 approved antennas that are 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 inverted F antenna. The use of an external antenna 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.

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).

2010-04-01 through 2011-03-31
Effective dates

DEPARTMENT OF COMMERCE ★ UNITED STATES OF AMERICA ★

Sally S. Bruce
For the National Institute of Standards and Technology

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

ANNEX B NVLAP SCOPE of ACCREDITATION

National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Walshire Labs, LLC
8545 126th Ave N.
Largo, FL 33773
Mr. Peter Walsh, NCE
Phone: 727-530-8637   Fax:
E-Mail: peter_walsh@walshirelabs.com
URL: http://www.walshirelabs.com

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS — **NVLAP LAB CODE 200125-0**

NVLAP Code	*Designation / Description*
Emissions Test Methods	
12/CIS22	IEC/CISPR 22 (1997) & EN 55022 (1998) + A1(2000): Limits and methods of measurement of radio disturbance characteristics of information technology equipment
12/CIS22L	EN 55022 (2006) + A1 (2007): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
12/CIS22a	IEC/CISPR 22 (1993) and EN 55022 (1994): Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1 (1995) and Amendment 2 (1996)
12/CIS22b	CNS 13438 (1997): Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment
12/CIS22c1	IEC/CISPR 22, Edition 5 (2005) and EN 55022 (1998): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
12/CIS22c3	IEC/CISPR 22, Edition 5 (2005) + A1(2005): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
12/CIS22c4	EN 55022 (1998) + A1(2000) + A2(2003): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement

2010-04-01 through 2011-03-31
Effective dates

Sally S. Bruce
For the National Institute of Standards and Technology

Page 1 of 4

NVLAP-01S (REV. 2005-05-19)

NVLAP® National Voluntary Laboratory Accreditation Program

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS **NVLAP LAB CODE 200125-0**

NVLAP Code	*Designation / Description*
12/CIS22j	EN 55022 (2006): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
12/F18a	FCC OST/MP-5: 1986 (excludes RE below 30 MHz): FCC Methods of Measurement of Radio Noise Emissions for ISM Equipment (cited in FCC Method 47 CFR Part 18 - Industrial, Scientific, and Medical Equipment)
12/FCC15b	ANSI C63.4 (2003) with FCC Method 47 CFR Part 15, Subpart B: Unintentional Radiators
12/FCC15c	ANSI C63.4 (2003) with FCC Method 47 CFR Part 15, Subpart C: Intentional Radiators
12/T51a	AS/NZS CISPR 22 (2004): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
12/VCCId	Agreement of VCCI V-3 (2008.04): Agreement of Voluntary Control Council for Interference by Information Technology Equipment - Technical Requirements: V-3/2008.04
12/VCCIe	Agreement of VCCI V-3 (2009.04): Agreement of Voluntary Control Council for Interference by Information Technology Equipment - Technical Requirements: V-3/2009.04 (Above 1GHz)

Radio Test Methods

12/BETS7a	Document AT-34-04-RT: Testing Procedures for Type Approval testing per BETS-7, Issue 1 (November 1, 1996)

Telecommunications Test Methods

12/CS03a	Industry Canada CS-03, Issue 9, Amendment 1 (2005): Compliance Specification for Terminal Equipment, Terminal Systems, Network Protection Devices, Connection Arrangements and Hearing Aids Compatibility (Sections I, II, V only)
12/CS03b	Industry Canada CS-03, Issue 9, +A2, +A3: Compliance Specification for Terminal Equipment, Terminal Systems, Network Protection Devices, Connection Arrangements and Hearing Aids Compatibility

2010-04-01 through 2011-03-31
Effective dates

Sally S. Bruce
For the National Institute of Standards and Technology

NVLAP® **National Voluntary Laboratory Accreditation Program**

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 200125-0

NVLAP Code	*Designation / Description*
12/CS03c	Industry Canada CS-03, Issue 9 Amendment 3 (2007): Compliance Specification for Terminal Equipment, Terminal Systems, Network Protection Devices, Connection Arrangements and Hearing Aids Compatibility
12/CS03d	Industry Canada CS-03, Issue 9 Amendment 4 (2009): Compliance Specification for Terminal Equipment, Terminal Systems, Network Protection Devices, Connection Arrangements and Hearing Aids Compatibility
12/T01	Terminal Equipment Network Protection Standards, FCC/ACTA Method - 47 CFR Part 68 - Analog and Digital
12/T01a	68.302 (Par. c,d,e,f) Environmental simulation; 68.304 Leakage current limit.; 68.306 Hazardous voltage limit.; 68.308 Signal power limit.; 68.310 Longitudinal balance limit.; 68.312 On-hook impedance limit.; 68.314 Billing protection
12/T01b	68.316 and 68.317 Hearing Aid Compatibility: technical standards
12/T01c	68.302 Environmental simulation (Par. a,b)
12/TIA1096	ANSI/TIA-1096 (2006-08): Telephone Terminal Equipment Connector Requirements for Connection of Terminal Equipment to the Telephone Network
12/TIA968	ANSI/TIA-968-A (2003): Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network
12/TIA968a	ANSI/TIA-968-A-1 (2003): Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network - Addendum 1
12/TIA968b	ANSI/TIA-968-A-2 (2004): Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network - Addendum 2
12/TIA968c	ANSI/TIA-968-A-3 (2005): Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network - Addendum 3
12/TIA968d	ANSI/TIA-968-A-4 (2006-11): Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network - Addendum 4

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NVLAP-01S (REV. 2005-05-19)

National Voluntary Laboratory Accreditation Program

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 200125-0

NVLAP Code	*Designation / Description*
12/TIA968e	ANSI/TIA-968-A-5 (2007-07): Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network - Addendum 5

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For the National Institute of Standards and Technology

NVLAP-018 (REV. 2006-05-19)

ANNEX C 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.