

Silex Technology America, Inc.

TEST REPORT FOR

**802.11 abgn PCI Express Card Module w/ MIMO
Model: SX-PCEAN
Using 8dbi and 11dbi Antennas**

Tested To The Following Standards:

**FCC Part 15 Subpart C Section(s)
15.247**

Report No.: 95639-21

Date of issue: June 20, 2014



This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

TABLE OF CONTENTS

| | |
|--|----|
| Administrative Information | 3 |
| Test Report Information | 3 |
| Report Authorization | 3 |
| Test Facility Information | 4 |
| Software Versions..... | 4 |
| Site Registration & Accreditation Information | 4 |
| Summary of Results | 5 |
| Conditions During Testing..... | 5 |
| Equipment Under Test..... | 6 |
| Peripheral Devices | 6 |
| FCC Part 15 Subpart C | 7 |
| 15.247(d) Field Strength of Spurious Emissions and Band Edge | 7 |
| Supplemental Information..... | 18 |
| Measurement Uncertainty | 18 |
| Emissions Test Details..... | 18 |

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Silex Technology America, Inc.
201 E. Sandpointe Avenue
Santa Ana, CA 92707

REPORT PREPARED BY:

Morgan Tramontin
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

REPRESENTATIVE: Ron Tozaki
Customer Reference Number: 5634-00

Project Number: 95639

DATE OF EQUIPMENT RECEIPT:
DATE(S) OF TESTING:

May 20, 2014
May 20, 2014

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

Software Versions

| CKC Laboratories Proprietary Software | Version |
|---------------------------------------|---------|
| EMITest Emissions | 5.00.14 |
| Immunity | 5.00.07 |

Site Registration & Accreditation Information

| Location | CB # | TAIWAN | CANADA | FCC | JAPAN |
|----------|--------|----------------|---------|--------|--------|
| Brea D | US0060 | SL2-IN-E-1146R | 3082D-2 | 100638 | A-0147 |

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C

| Test Procedure/Method | Description | Modifications* | Results |
|--|---|----------------|---------|
| 15.247(d) / DO1 DTS Measurement Guidance v03r01 | Field Strength of Spurious Emissions and Band Edge | NA | Pass |
| | | | |

Modifications*/Conditions During Testing

This list is a summary of the conditions noted for or modifications made to the equipment during testing.

| Summary of Conditions |
|--|
| A new antenna was added to the EUT requiring a permissive change report. Only radiated spurious emissions and band edge were required to be tested. |
| |

*Modifications listed above must be incorporated into all production units.

EQUIPMENT UNDER TEST (EUT)

EQUIPMENT UNDER TEST

802.11 abgn PCI Express Card Module w/ MIMO

Manuf: Silex Technology America, Inc.

Model: SX-PCEAN

Serial: 0080925668AB

5.8GHz 8dBi Omnidirectional Wireless LAN

Antenna

Manuf: L-COM Global Connectivity

Model: HG5808U

Serial: None

4.9-5.9GHz 11dBi Antenna

Manuf: Laird Technologies

Model: SR49120DA

Serial: None

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

ExpressCard Adapter

Manuf: Silex Technology America, Inc.

Model: Silex 1

Serial: 600004428

Laptop

Manuf: Dell

Model: Latitude E6510

Serial: 8TW92M1

Power Supply

Manuf: Dell

Model: DA130PE1-00

Serial: JU012

FCC PART 15 SUBPART C

This report contains EMC emissions test results under United States Federal Communications Commission (FCC) CFR 47 Section 15 Subpart C requirements for Intentional Radiators.

15.247(d) Field Strength of Spurious Emissions and Band Edge

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 110 North Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **Silex Technology America, Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **95639** Date: **5/20/2014**
 Test Type: **Maximized Emissions** Time: **11:59:11**
 Equipment: **802.11 abgn PCI Express Card Module** Sequence#: **2**
w/ MIMO
 Manufacturer: Silex Technology America, Inc. Tested By: Don Nguyen
 Model: SX-PCEAN
 S/N: 0080925668AB

Test Equipment:

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|----|----------|--------------------------------|--------------------------|------------------|--------------|
| T1 | AN00787 | Preamp | 83017A | 5/31/2013 | 5/31/2015 |
| T2 | AN01646 | Horn Antenna | 3115 | 3/18/2014 | 3/18/2016 |
| T3 | ANP04382 | Cable | LDF-50 | 8/30/2012 | 8/30/2014 |
| T4 | ANP06360 | Cable | L1-PNMNM-48 | 8/29/2012 | 8/29/2014 |
| T5 | ANP06544 | Cable | 32026-29094K-29094K-36TC | 11/20/2013 | 11/20/2015 |
| | AN02672 | Spectrum Analyzer | E4446A | 9/4/2012 | 9/4/2014 |
| | AN02755 | High Pass Filter | 11SH10-6000/T18000-O/O | 5/1/2014 | 5/1/2016 |
| | AN02946 | Cable | 32022-2-2909K-36TC | 7/31/2013 | 7/31/2015 |
| | AN01413 | Horn Antenna-ANSI C63.5 (dB/m) | 84125-80008 | 11/9/2012 | 11/9/2014 |
| | AN03158 | Active Horn Antenna | AMFW-5F-26004000-33-8P | 12/18/2012 | 12/18/2014 |
| | AN00314 | Loop Antenna | 6502 | 6/29/2012 | 6/29/2014 |
| | AN00010 | Preamp | 8447D | 3/12/2014 | 3/12/2016 |
| | AN00851 | Biconilog Antenna | CBL6111C | 4/30/2014 | 4/30/2016 |
| | ANP05555 | Cable | RG223/U | 5/7/2014 | 5/7/2016 |
| | ANP05569 | Cable | RG-214/U | 5/7/2014 | 5/7/2016 |

Equipment Under Test (* = EUT):

| Function | Manufacturer | Model # | S/N |
|-------------------------|---------------------------|----------|--------------|
| 802.11 abgn PCI Express | Silex Technology America, | SX-PCEAN | 0080925668AB |

| | | | |
|--|---------------------------|-----------|----|
| Card Module w/ MIMO* | Inc. | | |
| 5.8GHz 8dBi Omnidirectional Wireless LAN Antenna | L-com Global Connectivity | HG5808U | NA |
| 5.8GHz 8dBi Omnidirectional Wireless LAN Antenna | L-com Global Connectivity | HG5808U | NA |
| 4.9-5.9GHz 11dBi Antenna | Laird Technologies | SR49120DA | NA |
| 4.9-5.9GHz 11dBi Antenna | Laird Technologies | SR49120DA | NA |

Support Devices:

| Function | Manufacturer | Model # | S/N |
|---------------------|--------------------------------|----------------|-----------|
| ExpressCard Adapter | Silex Technology America, Inc. | Silex 1 | 600004428 |
| Laptop | Dell | Latitude E6510 | 8TW92M1 |
| Power Supply | Dell | DA130PE1-00 | JU012 |

Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness.

The EUT is connected to a support laptop via Expresscard to a mini PCIE adapter.

Laptop is running DOS program to control TX setting.

The EUT is powered from Expresscard slot of support laptop.

Input voltage=3.3VDC.

Transmitting duty cycle was set close to 100%.

Two antenna ports (0 and 1) are connected to two external antennas.

Two external antennas are transmitting one at a time.

EUT software:

Atheros Radio Test (ART), rev 0.9 BUILD #27 ART_11n, Customer Version (ANWI BUILD)

Power settings:

11a(6Mbps): 15dbm (5745 to 5825MHz)

11n-20 5GHz (MCS8): 13.5dBm (5745 to 5825MHz)

11n-40 5GHz (MCS8): 11.0dBm(5755 and 5795MHz)

Permissive change with new antennas.

Per manufacturer, all antennas are mounted vertically in fixed position.

Any conditions under normal use do not exceed the condition of setting.

In addition, end users cannot change the settings of the output power of the product.

Frequency range of measurement = 9kHz-40GHz

9 kHz -150 kHz;RBW=200 Hz,VBW=200 Hz;

150 kHz-30 MHz;RBW=9 kHz,VBW=9 kHz;

30 MHz-1000 MHz;RBW=120 kHz,VBW=120 kHz,

1000 MHz-40000 MHz;RBW=1 MHz,VBW=1 MHz.

Temperature: 23°C

Relative Humidity: 38%

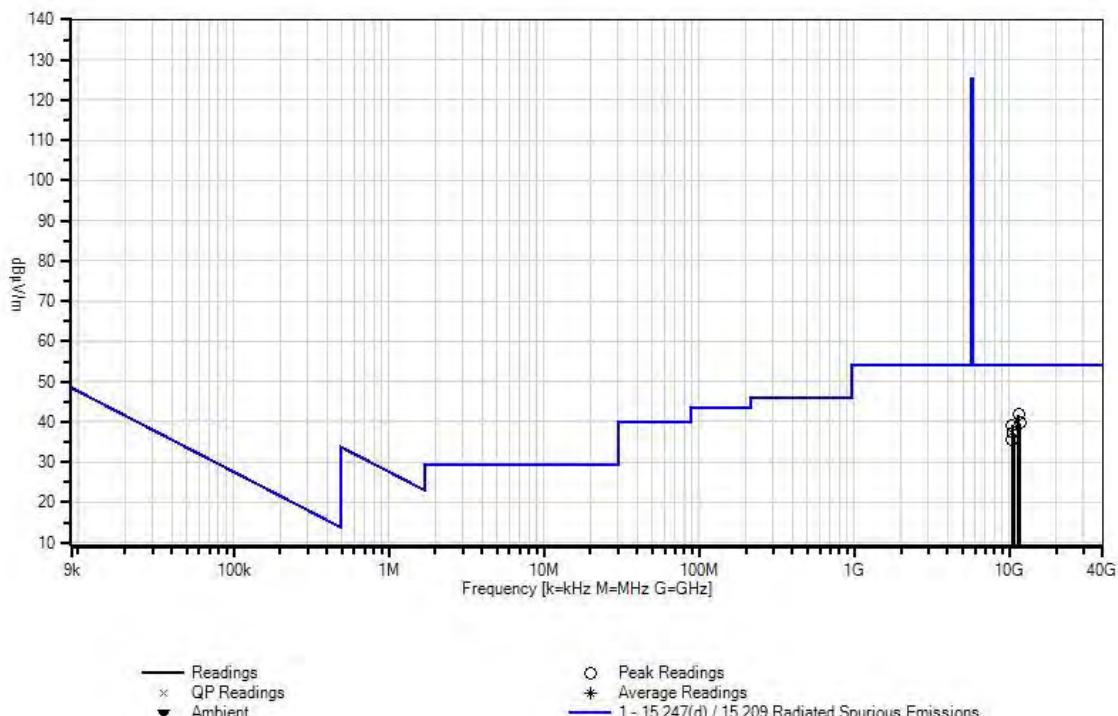
Pressure: 100.2kpa;

Site D

No emission found. Noise floor emissions were recorded for reference.

Ext Attn: 0 dB

| Measurement Data: | | | Reading listed by margin. | | | | Test Distance: 3 Meters | | | | |
|-------------------|-----------|------------|---------------------------|-------|-------|------|-------------------------|--------------|--------------|--------|-------------|
| # | Freq | Rdng | T1 T5 | T2 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
| | MHz | dB μ V | dB | dB | dB | dB | Table | dB μ V/m | dB μ V/m | dB | Ant |
| 1 | 11490.000 | 17.3 | -39.1 M | +36.6 | +16.9 | +8.6 | +0.0 | 41.8 | 54.0 | -12.2 | Vert |
| | | | +1.5 | | | | | | | | Noise floor |
| 2 | 11650.000 | 15.2 | -39.1 M | +36.5 | +16.9 | +8.7 | +0.0 | 39.7 | 54.0 | -14.3 | Vert |
| | | | +1.5 | | | | | | | | Noise floor |
| 3 | 10360.000 | 19.1 | -39.1 M | +36.0 | +13.9 | +7.9 | +0.0 | 39.2 | 54.0 | -14.8 | Vert |
| | | | +1.4 | | | | | | | | Noise floor |
| 4 | 10640.000 | 16.4 | -39.1 M | +36.1 | +14.4 | +8.1 | +0.0 | 37.3 | 54.0 | -16.7 | Vert |
| | | | +1.4 | | | | | | | | Noise floor |
| 5 | 10460.000 | 15.5 | -39.1 M | +36.0 | +13.9 | +8.0 | +0.0 | 35.7 | 54.0 | -18.3 | Vert |
| | | | +1.4 | | | | | | | | Noise floor |

 CKC Laboratories, Inc. Date: 5/20/2014 Time: 11:59:11 Silex Technology America, Inc. WO#: 95639
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Sequence#: 2 Ext ATTN: 0 dB


Band Edge Test Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **Silex Technology America, Inc.**
 Specification: **15.247(d) Band Edge Compliance**
 Work Order #: **95639** Date: **5/20/2014**
 Test Type: **Maximized Emissions** Time: **11:59:11**
 Equipment: **802.11 abgn PCI Express Card Module** Sequence#: **2**
 w/ **MIMO**
 Manufacturer: Silex Technology America, Inc. Tested By: Don Nguyen
 Model: SX-PCEAN
 S/N: 0080925668AB

Test Equipment:

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|----|----------|-------------------|--------------------------|------------------|--------------|
| T1 | AN00787 | Preamp | 83017A | 5/31/2013 | 5/31/2015 |
| T2 | AN01646 | Horn Antenna | 3115 | 3/18/2014 | 3/18/2016 |
| | ANP04382 | Cable | LDF-50 | 8/30/2012 | 8/30/2014 |
| | ANP06360 | Cable | L1-PNMNM-48 | 8/29/2012 | 8/29/2014 |
| T3 | ANP06544 | Cable | 32026-29094K-29094K-36TC | 11/20/2013 | 11/20/2015 |
| | AN02672 | Spectrum Analyzer | E4446A | 9/4/2012 | 9/4/2014 |
| T4 | AN02946 | Cable | 32022-2-2909K-36TC | 7/31/2013 | 7/31/2015 |

Equipment Under Test (* = EUT):

| Function | Manufacturer | Model # | S/N |
|--|--------------------------------|-----------|--------------|
| 802.11 abgn PCI Express Card Module w/ MIMO* | Silex Technology America, Inc. | SX-PCEAN | 0080925668AB |
| 5.8GHz 8dBi Omnidirectional Wireless LAN Antenna | L-com Global Connectivity | HG5808U | NA |
| 5.8GHz 8dBi Omnidirectional Wireless LAN Antenna | L-com Global Connectivity | HG5808U | NA |
| 4.9-5.9GHz 11dBi Antenna | Laird Technologies | SR49120DA | NA |
| 4.9-5.9GHz 11dBi Antenna | Laird Technologies | SR49120DA | NA |

Support Devices:

| Function | Manufacturer | Model # | S/N |
|---------------------|--------------------------------|----------------|-----------|
| ExpressCard Adapter | Silex Technology America, Inc. | Silex 1 | 600004428 |
| Laptop | Dell | Latitude E6510 | 8TW92M1 |
| Power Supply | Dell | DA130PE1-00 | JU012 |

Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10cm thickness.
The EUT is connected to a support laptop via Expresscard to a mini PCIE adapter.
Laptop is running DOS program to control TX setting.
The EUT is powered from Expresscard slot of support laptop.

Input voltage=3.3VDC.
Transmitting duty cycle was set close to 100%.
Two antenna ports (0 and 1) are connected to two external antennas.
Two external antennas are transmitting one at a time.

EUT software:

Atheros Radio Test (ART), rev 0.9 BUILD #27 ART_11n, Customer Version (ANWI BUILD)

Power settings:

11a(6Mbps): 15dbm (5745 to 5825MHz)
11n-20 5GHz (MCS8): 13.5dBm (5745 to 5825MHz)
11n-40 5GHz (MCS8): 11.0dBm(5755 and 5795MHz)

Permissive change with new antennas.

Per manufacturer, all antennas are mounted vertically in fixed position.
Any conditions under normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

Frequency range of measurement = Fundamental
RBW=VBW=1MHz;

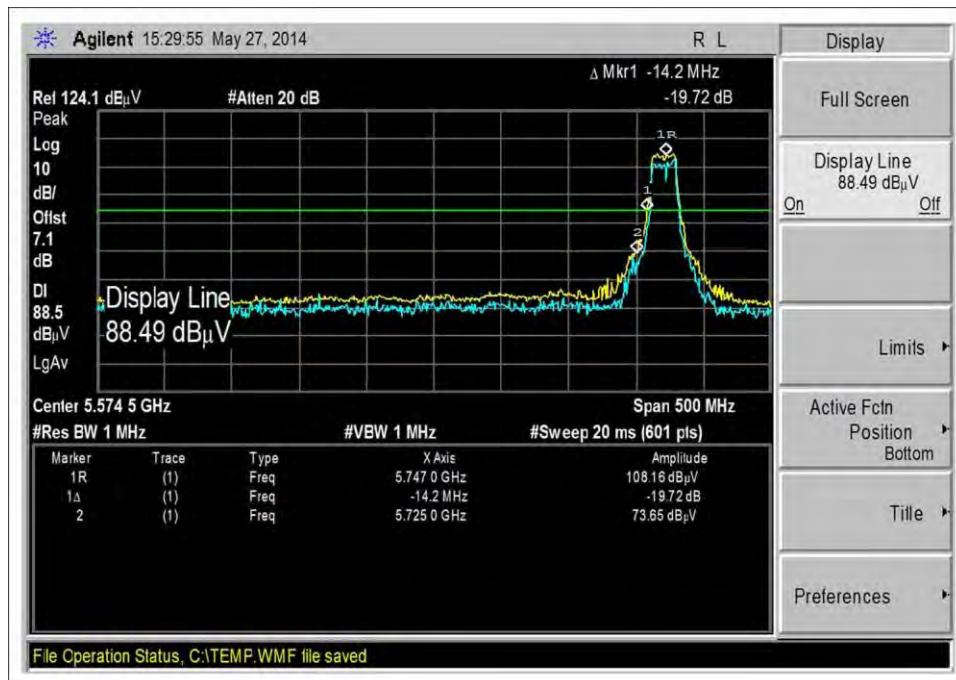
Temperature: 23°C
Relative Humidity: 38%
Pressure: 100.2kpal;

Site D

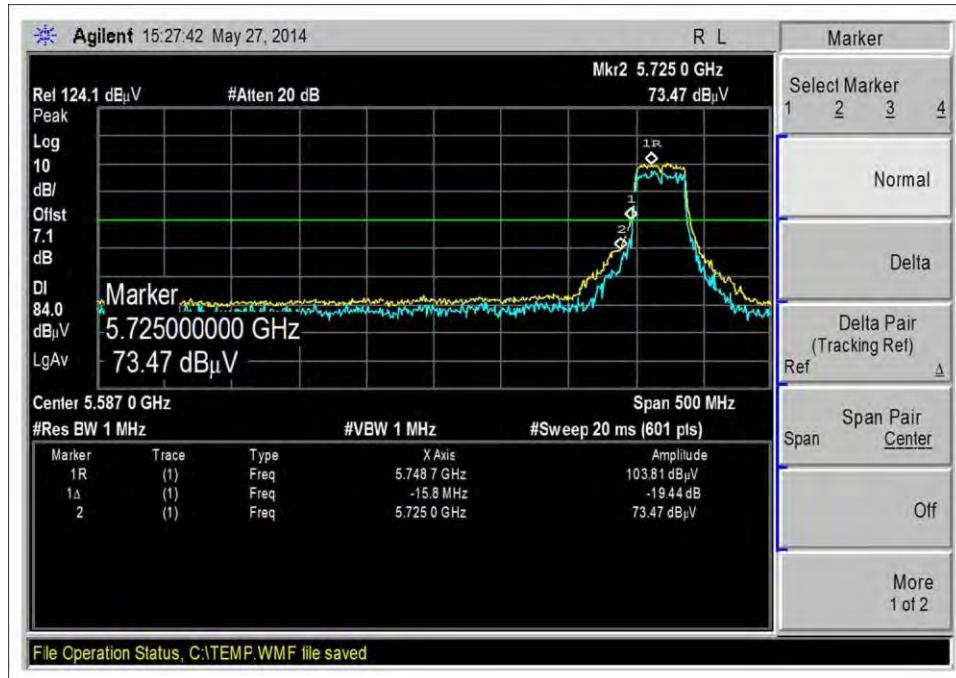
15.247(d) In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains 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.

**Limit was drawn at -20dbc from marker 1 using delta marker function.
Marker 2 indicates band edge frequencies 5725MHz and 5850MHz**

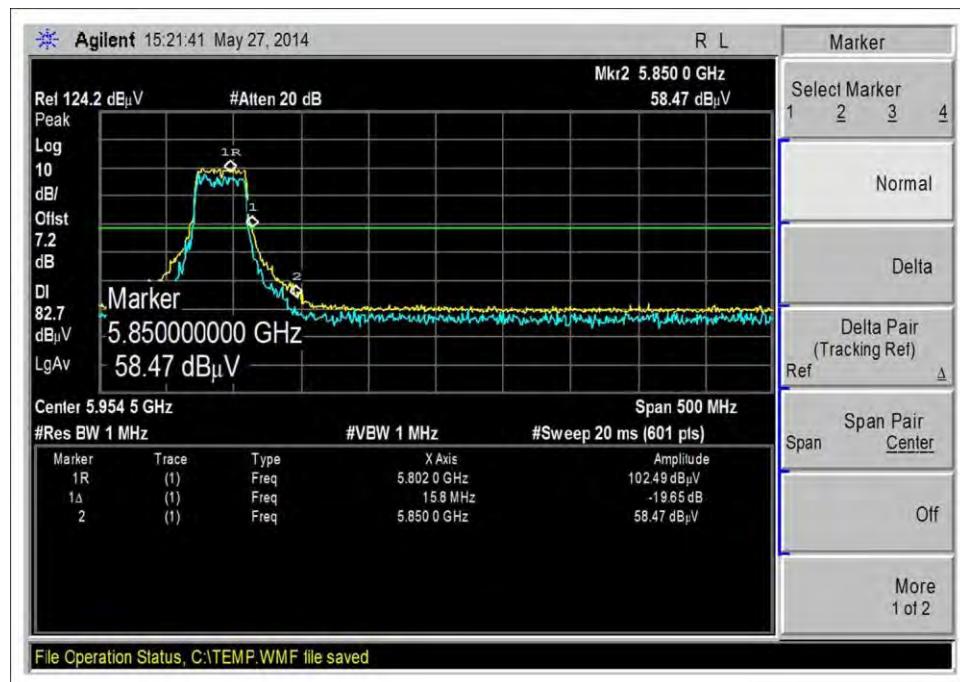
Band Edge Test Plots



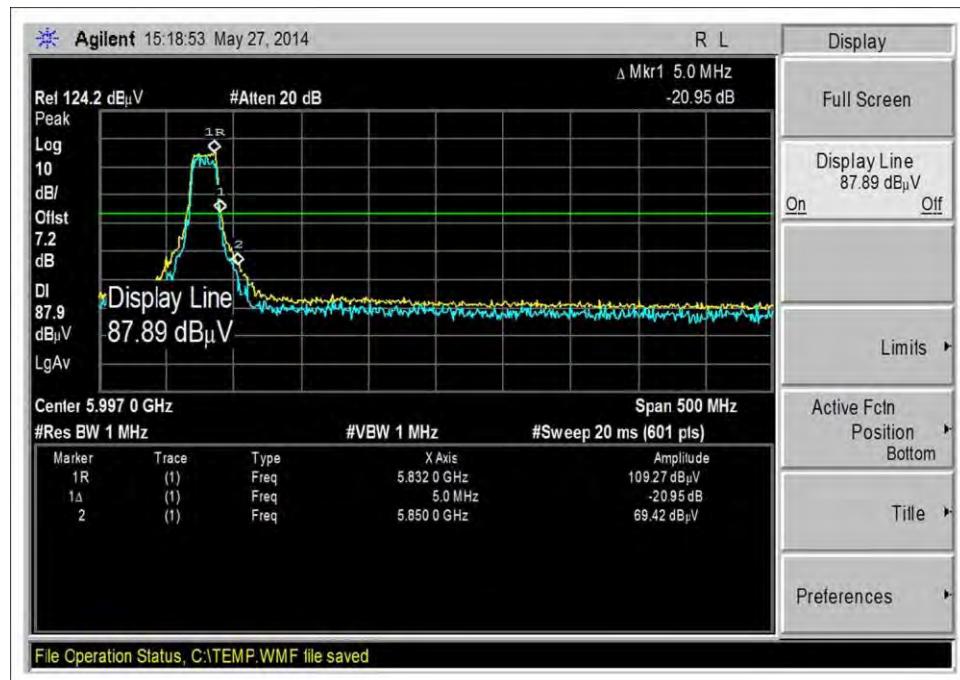
8dbi ant_11n-20_13.5dbm_5745MHz



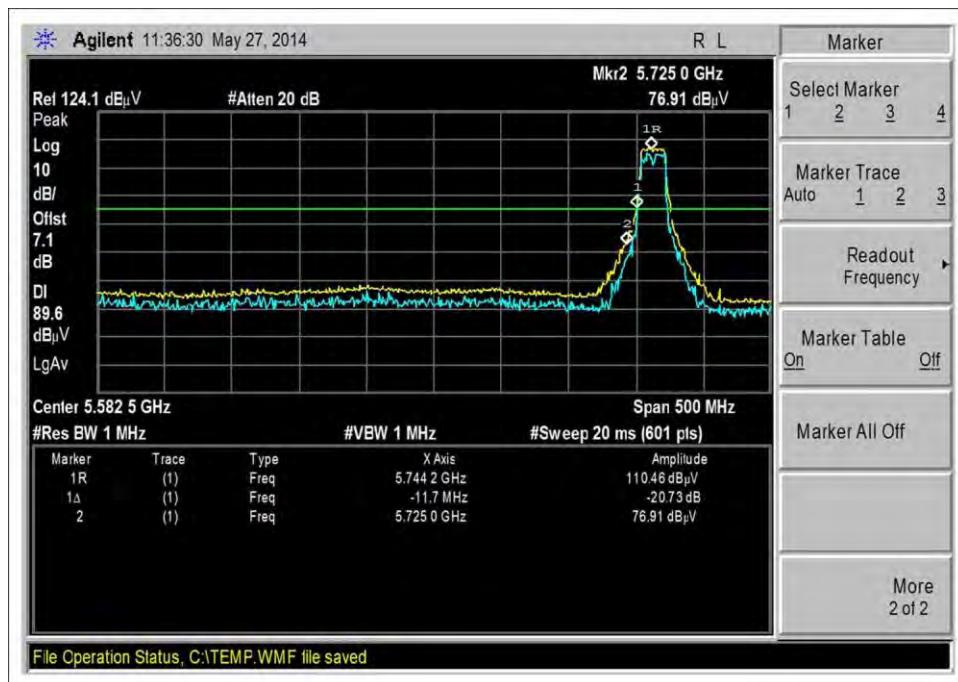
8dbi ant_11n-40_11dbm_5755MHz



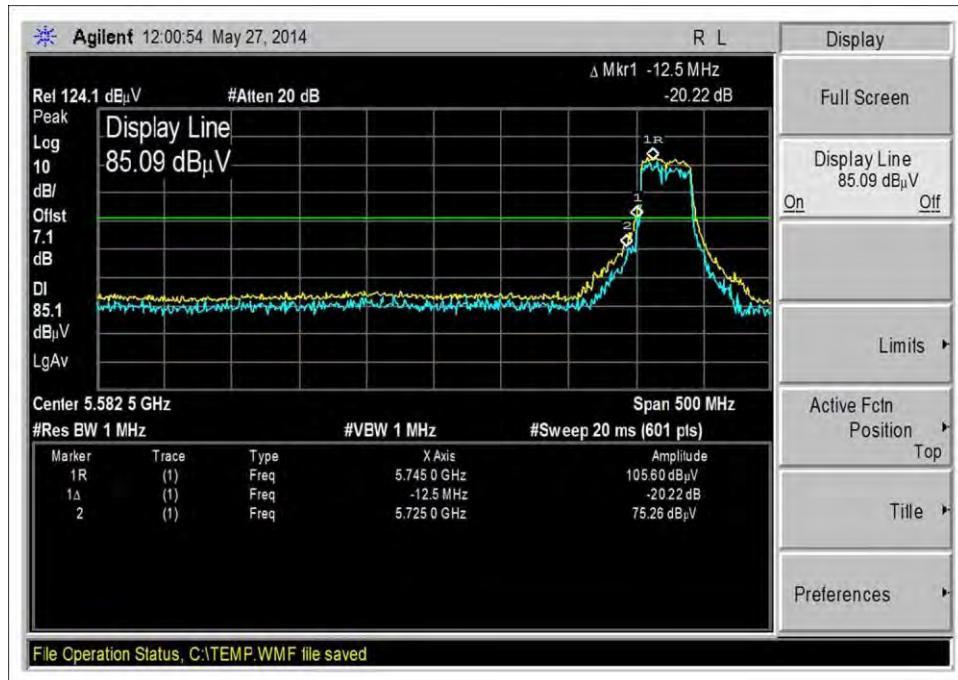
8dbi ant_11n-40_11dbm_5795MHz



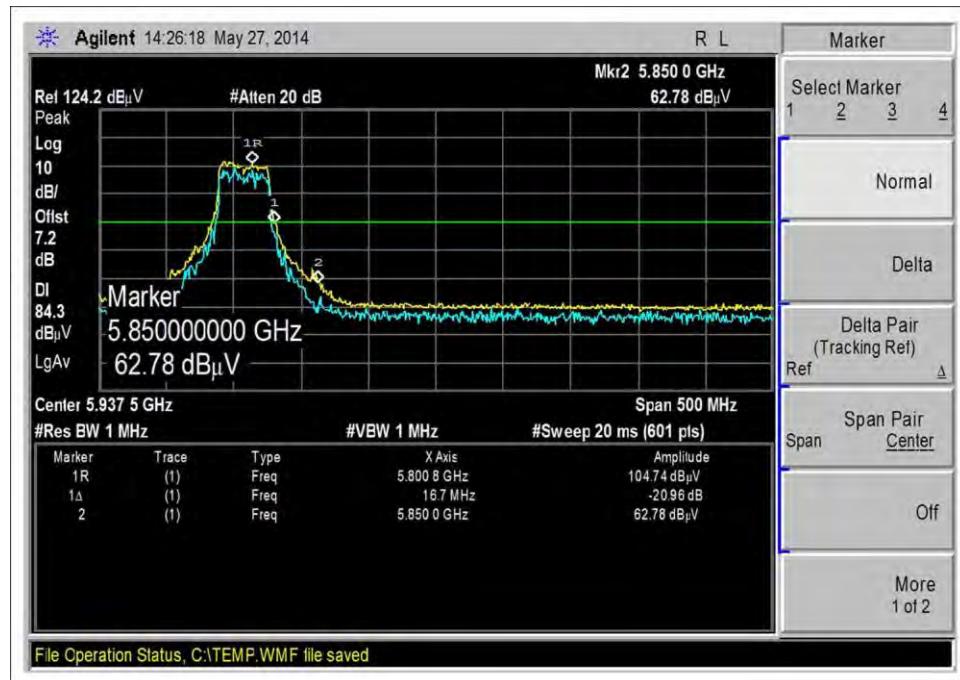
8dbi ant_11n-20_13.5dbm_5825MHz



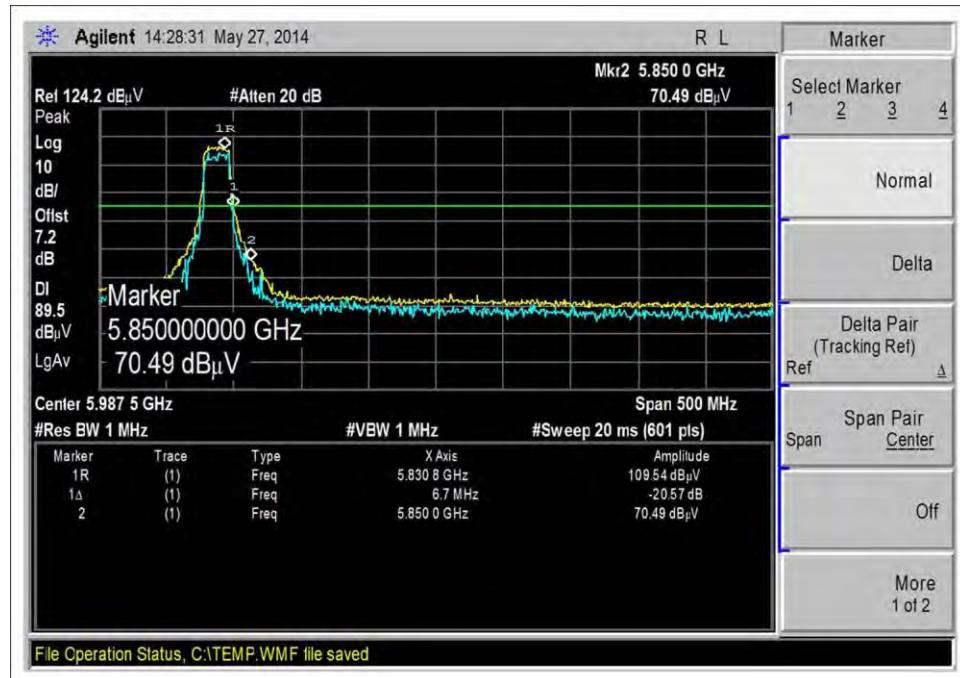
11dbi ant_11n-20_13.5dbm_5745MHz



11dbi ant_11n-40_11dbm_5755MHz



11dbi ant_11n-40_11dbm_5795MHz



11dbi ant_11n-20_13.5dbm_5825MHz

Test Setup Photos



8dbi Antenna



8dbi Antenna



11dbi Antenna



11dbi Antenna

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

| Uncertainty Value | Parameter |
|-------------------|---------------------------|
| 4.73 dB | Radiated Emissions |
| 3.34 dB | Mains Conducted Emissions |
| 3.30 dB | Disturbance Power |

The reported measurement uncertainties are calculated based on the worst case of all laboratory environments from CKC Laboratories, Inc. test sites. Only those parameters which require estimation of measurement uncertainty are reported. The reported worst case measurement uncertainty is less than the maximum values derived in CISPR 16-4-2. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k=2$. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in $\text{dB}\mu\text{V}/\text{m}$, the spectrum analyzer reading in $\text{dB}\mu\text{V}$ was corrected by using the following formula. This reading was then compared to the applicable specification limit.

| SAMPLE CALCULATIONS | |
|----------------------------|----------------|
| Meter reading | (dB μ V) |
| + Antenna Factor | (dB) |
| + Cable Loss | (dB) |
| - Distance Correction | (dB) |
| - Preamplifier Gain | (dB) |
| = Corrected Reading | (dB μ V/m) |

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

| MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE | | | |
|---|---------------------|------------------|-------------------|
| TEST | BEGINNING FREQUENCY | ENDING FREQUENCY | BANDWIDTH SETTING |
| CONDUCTED EMISSIONS | 150 kHz | 30 MHz | 9 kHz |
| RADIATED EMISSIONS | 9 kHz | 150 kHz | 200 Hz |
| RADIATED EMISSIONS | 150 kHz | 30 MHz | 9 kHz |
| RADIATED EMISSIONS | 30 MHz | 1000 MHz | 120 kHz |
| RADIATED EMISSIONS | 1000 MHz | >1 GHz | 1 MHz |

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or carrot ("") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.