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

A2LA ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

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.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

REPRESENTATIVE: Ron Tozaki
Customer Reference Number: 5634-00

REPORT PREPARED BY:

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

Project Number: 95639

DATE OF EQUIPMENT RECEIPT: May 20, 2014
DATE(S) OF TESTING: 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

4.9-5.9GHz 11dBi Antenna
Manuf: Laird Technologies
Model: SR49120DA
Serial: None

5.8GHz 8dBi Omnidirectional Wireless LAN Antenna
Manuf: L-COM Global Connectivity
Model: HG5808U
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

Power Supply
Manuf: Dell
Model: DA130PE1-00
Serial: JU012

Laptop
Manuf: Dell
Model: Latitude E6510
Serial: 8TW92M1

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 w/ MIMO** Sequence#: 2
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.

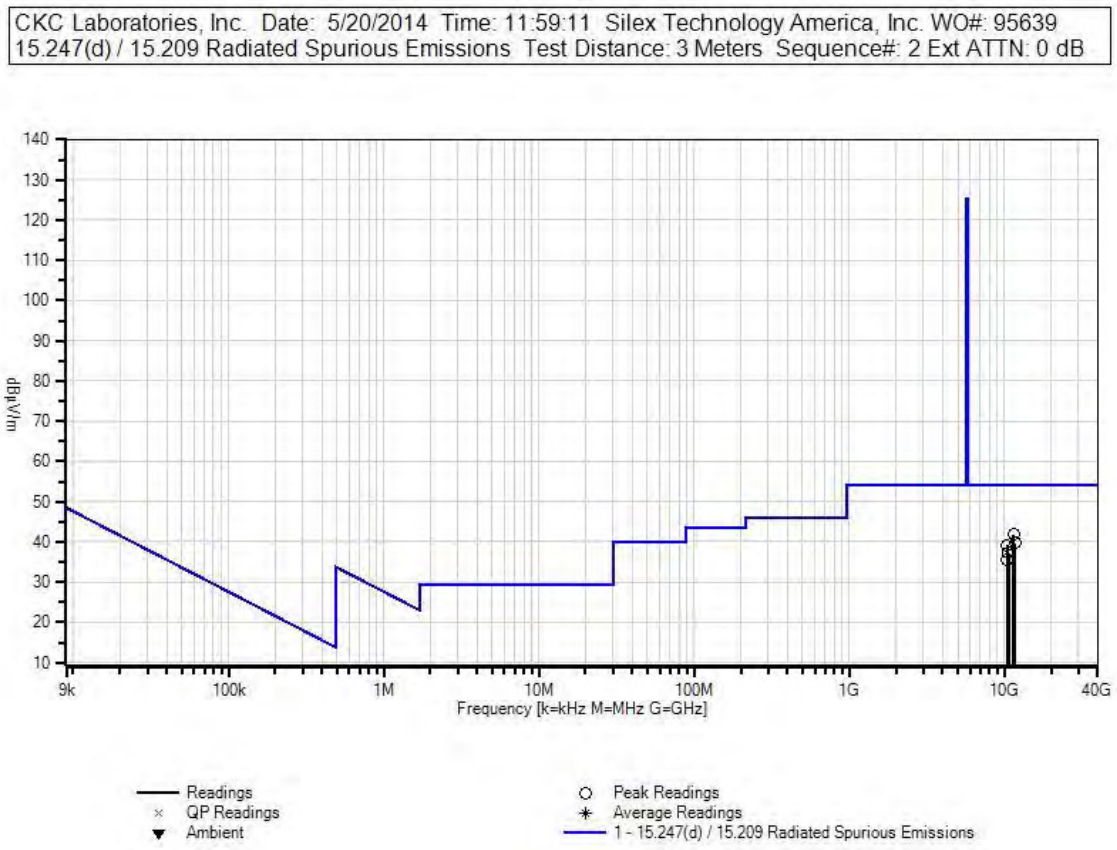
Per manufacturer, all antennas are mounted vertically in fixed position.
Any conditions under normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.
Frequency range of measurement = 9kHz-40GHz
9 kHz -150 kHz;RBW=200 Hz,VBW=200 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: 100.2kpal;
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	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	11490.000 M	17.3	-39.1 +1.5	+36.6	+16.9	+8.6	+0.0	41.8	54.0 Noise floor	-12.2	Vert
2	11650.000 M	15.2	-39.1 +1.5	+36.5	+16.9	+8.7	+0.0	39.7	54.0 Noise floor	-14.3	Vert
3	10360.000 M	19.1	-39.1 +1.4	+36.0	+13.9	+7.9	+0.0	39.2	54.0 Noise floor	-14.8	Vert
4	10640.000 M	16.4	-39.1 +1.4	+36.1	+14.4	+8.1	+0.0	37.3	54.0 Noise floor	-16.7	Vert
5	10460.000 M	15.5	-39.1 +1.4	+36.0	+13.9	+8.0	+0.0	35.7	54.0 Noise floor	-18.3	Vert



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 w/ MIMO**	Sequence#:	2
Manufacturer:	Silex Technology America, Inc.	Tested By:	Don Nguyen
Model:	SX-PCEAN		
S/N:	0080925668AB		

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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
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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;

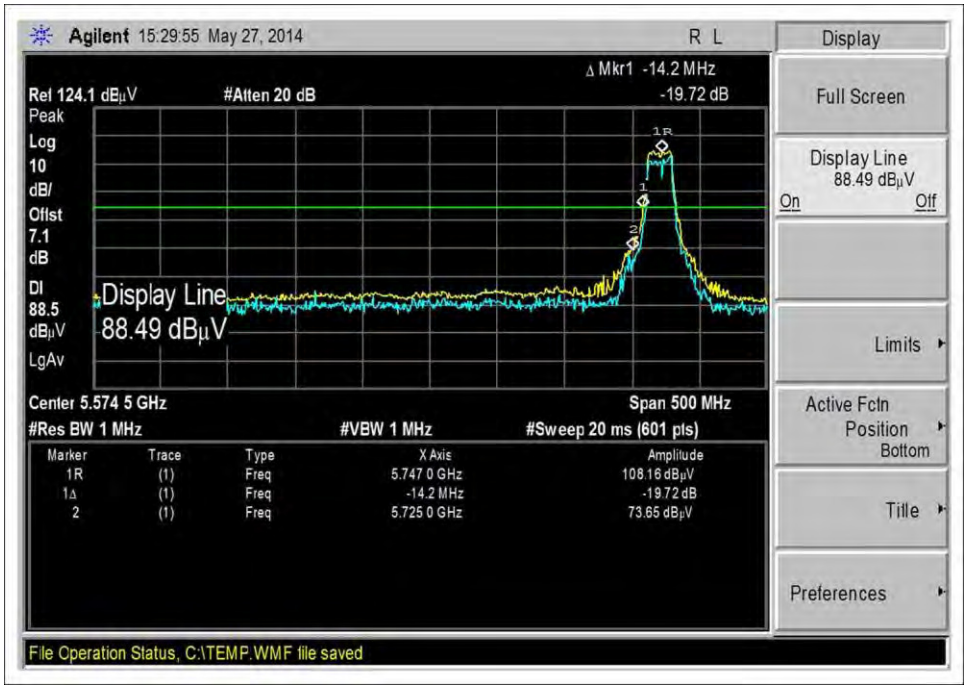
Temperature: 23°C
Relative Humidity: 38%
Pressure: 100.2kpal;

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



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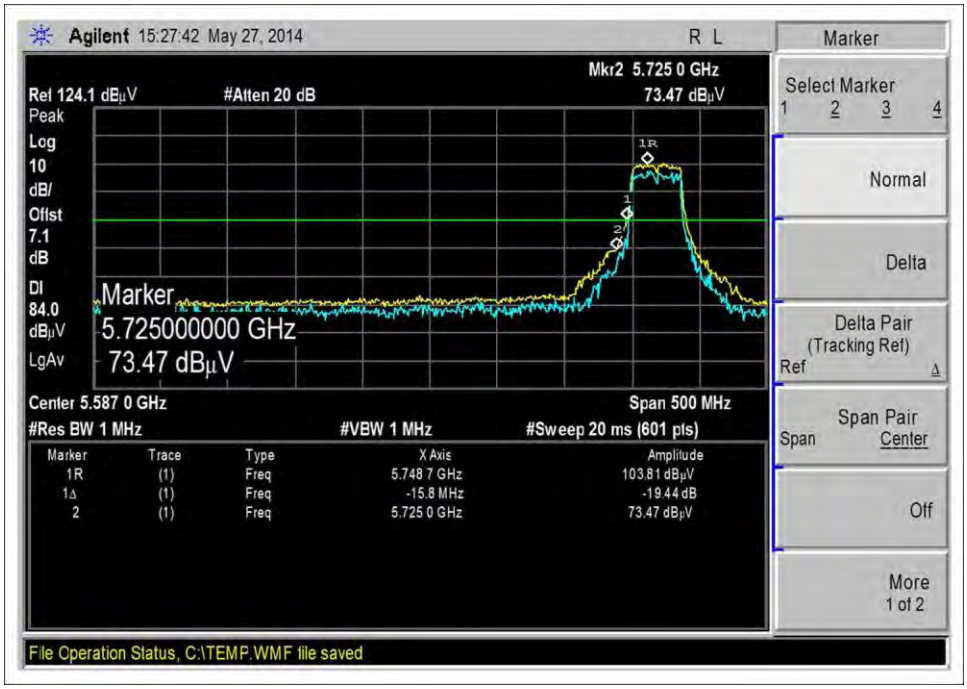
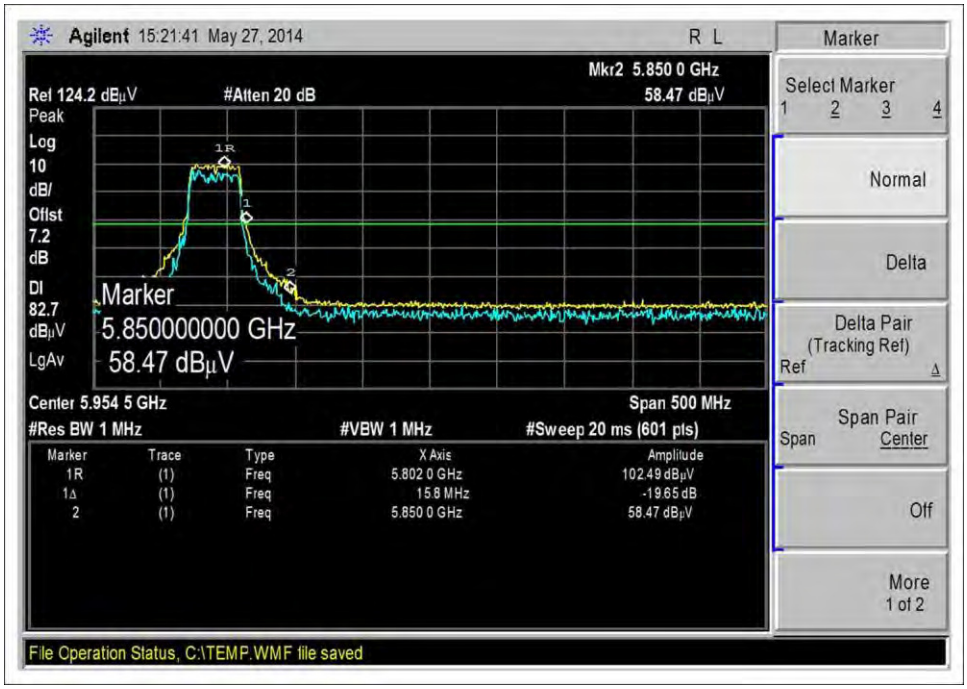
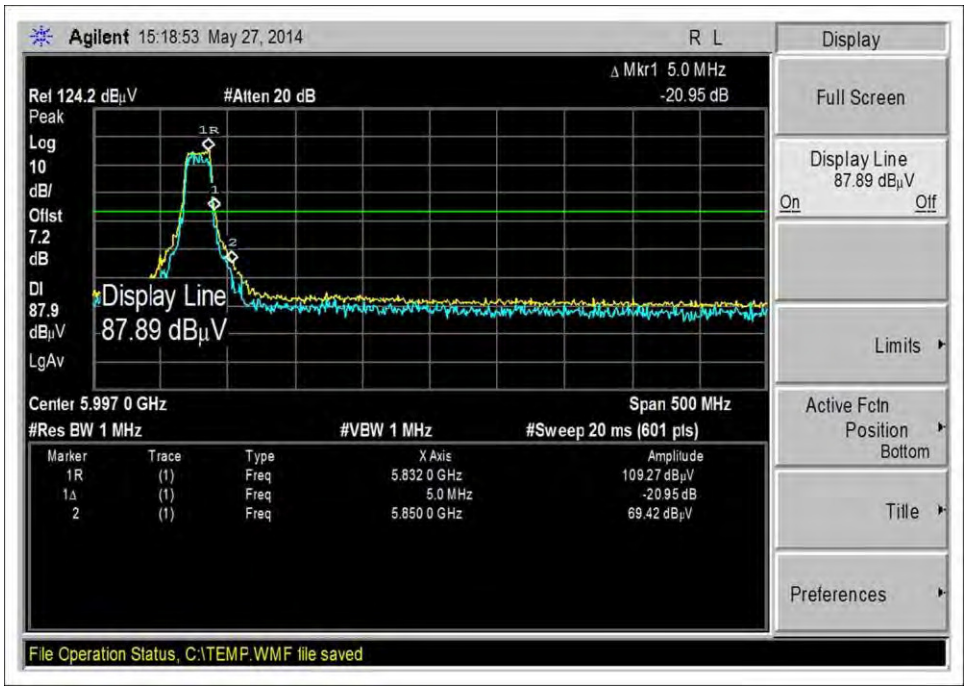


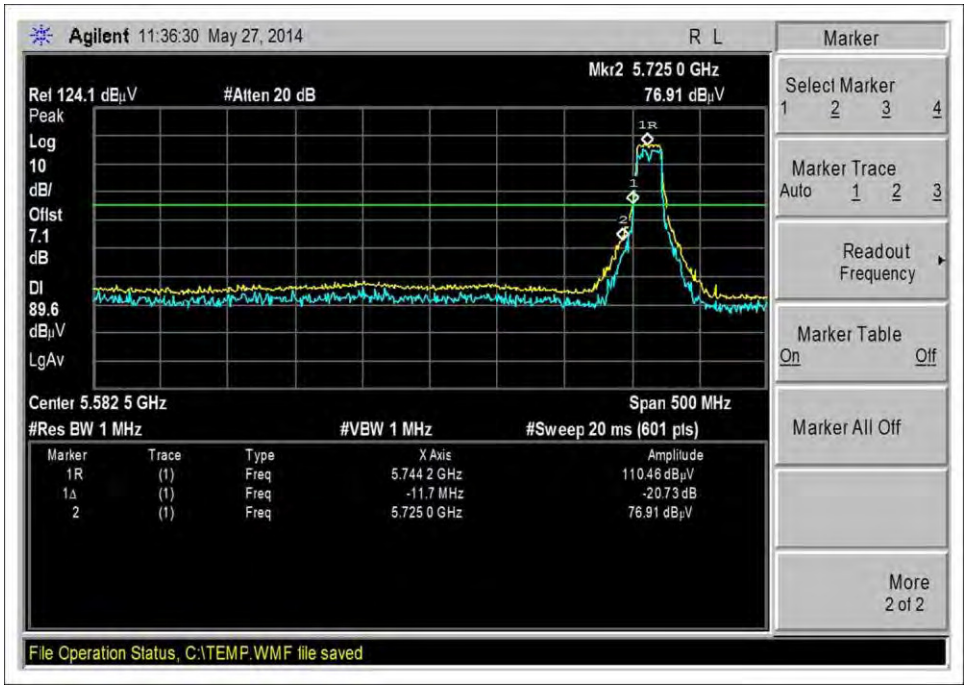
8dbi ant_11n-40_11dbm_5755MHz



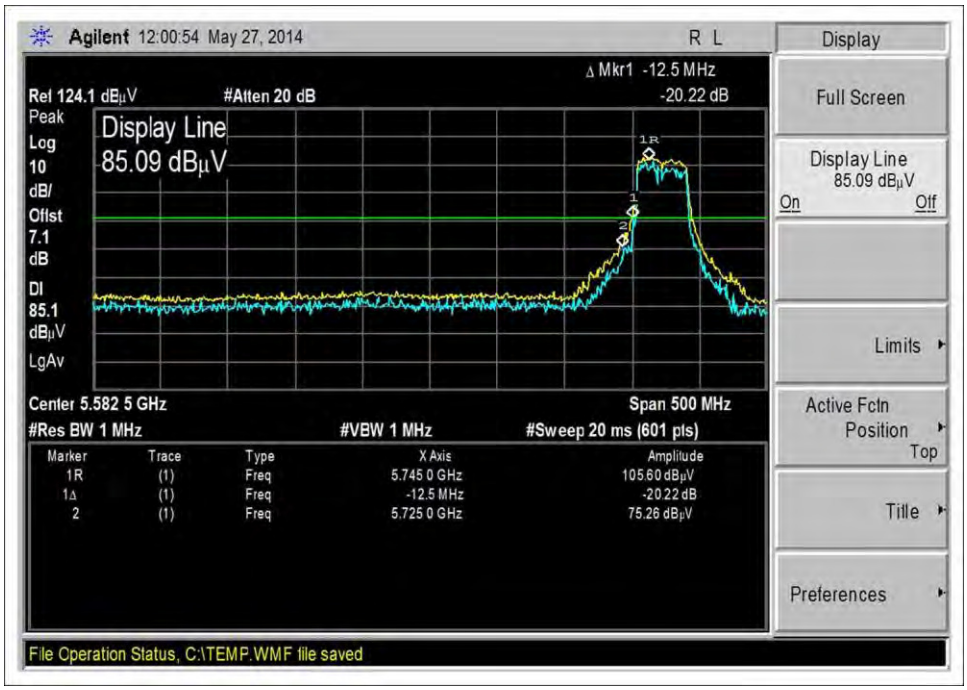
8dbi ant_11n-40_11dbm_5795MHz



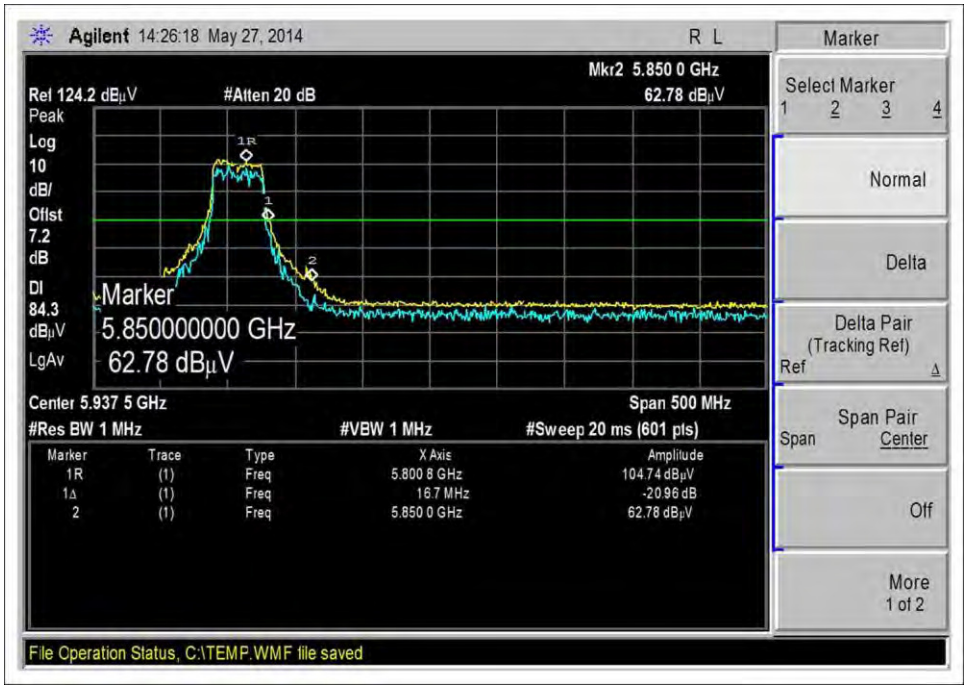
8dbi ant_11n-20_13.5dbm_5825MHz



11dbi ant_11n-20_13.5dbm_5745MHz



11dbi ant_11n-40_11dbm_5755MHz



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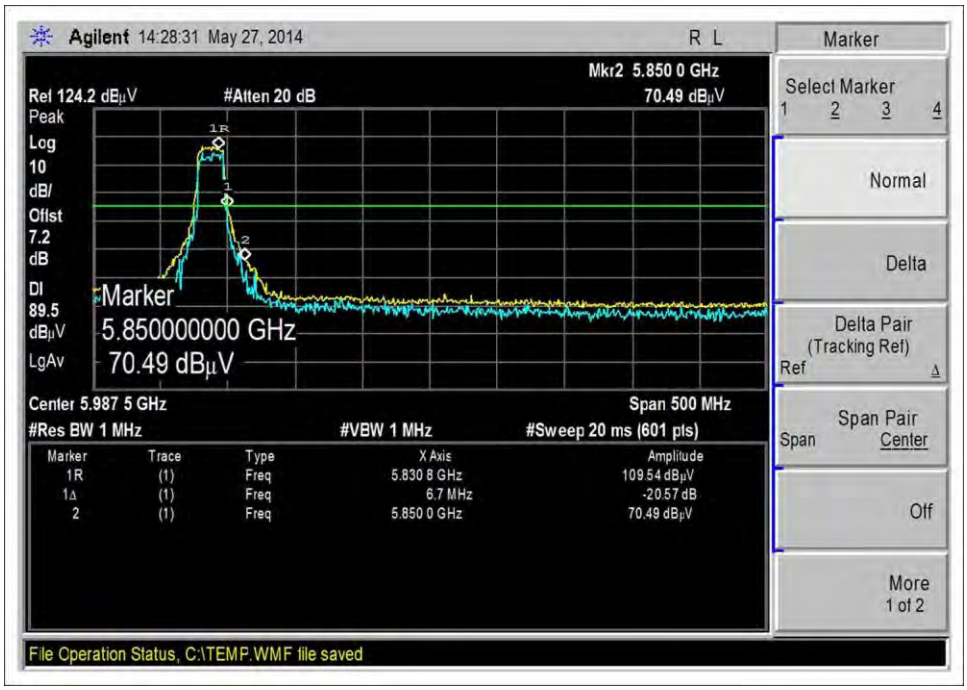
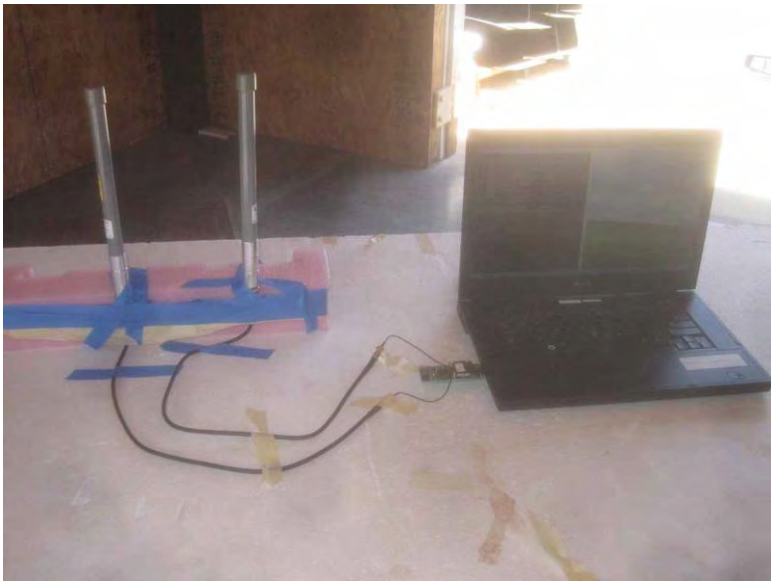


11dbi ant_11n-20_13.5dbm_5825MHz

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 dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/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.