Lab Code: 200167-0

FCC PART 15 SUBPART C
INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007

MEASUREMENT AND TEST REPORT

For

Ruckus Wireless, Inc.

880 West Maude Ave., Suite 101
Sunnyvale, CA 94085, USA

Model: VF7811 & VF7111
FCC ID: S9GVF7XX1
IC: 5912A-VF7XX1

This Report Concerns:	**Product type:**
☒ Original Report	Wi-Fi Access Point

Test Engineer:	Xiao Ming Hu
Report No.:	R0803191-DTS
Report Date:	2008-06-20
Reviewed By:	Boni Baniqued, Sr. RF Test Engineer
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1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The Ruckus Wireless, Inc. product, VF7811 & VF7111, the "EUT" as referred to in this report is the Access Point and Ethernet to Wireless Adapter which operates in 5725-5850 MHz (802.11 a/n mode, W58).

The EUT was measured approximately 140 mm (L) x 120 mm (W) x 80 mm (H).

** The test data gathered are from typical production sample, serial number: 605 provided by the manufacturer.*

1.2 EUT Photo

EUT External Photos required confidentiality

Additional photos please refer to Appendix C

1.3 Objective

This type approval report is prepared on behalf of *Ruckus Wireless Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, C of the Federal Communication Commissions rules and Industry Canada RSS-210 Issue 7, June 2007 standard.

The objective is to determine compliance with FCC/IC rules for Maximum Output Power, Antenna Requirements, 6 dB Bandwidth, and peak power spectral density, Band Edges Measurement, Conducted and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

FCC ID: S9GVF7XX1 IC ID: 5912A-VFXX1 as NII equipment class.

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from $\pm$2.0 for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

1.7 Test Facility

The Test site used by BACL Corp. to collect emissions measurement data is located at it's facility in Sunnyvale, California, USA.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and is listed under FCC registration number: 90464 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.
Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The host system was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the testing mode to represent *worst*-case results during the final qualification test.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

The EUT is programmed with the following data rate settings that were used during testing:

For 5725 – 5850 MHz (W58)

Radio Mode	5745 MHz	5785 MHz	5825 MHz
802.11a 20MHz	6Mbps	6Mbps	6Mbps
802.11n 20MHz	6.5Mbps MCS0	6.5Mbps MCS0	6.5Mbps MCS0
Power Level setting	21dBm	21dBm	21dBm

Radio Mode	5755 MHz	5795 MHz
802.11n 40MHz	13Mbps MCS0	13Mbps MCS0
Power Level setting	21dBm	21dBm

2.3 Special Accessories

The unit was tested with OEM supplied cabling and accessories as would be normally supplied by the manufacturer to the customer; no special accessories were used.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

Manufacturer / Product Type	Model	Serial Number
Dell Laptop	Inspiron 2650	-

2.6 Interface Ports and Cabling

Cable Description	Length (m)	From	To
CAT6 Cable	1.5	EUT	Laptop

2.7 Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number
Ruckus Wireless, Inc.	AC/DC Power Adapter	DSA-12R-12AUS	-
Ruckus Wireless, Inc.	AC/DC Power Adapter	MPB-1201250	-

3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC/IC Rules	Description of Test	Result
§15.247(i),§2.1091, IC RSS-Gen 5.5 & RSS-102	RF Exposure	Compliant
FCC §15.203, IC RSS-Gen §7.1.4	Antenna Requirement	Compliant
FCC §15.207, IC RSS-Gen §7.2.2	Conducted Emissions	Compliant
FCC § 15.247(d) IC RSS210 A8.5	Spurious Emissions at Antenna Port	Compliant
FCC§15.205; §15.209 §15.247(d) IC RSS210 A8.5	Spurious Radiated Emissions	Compliant
FCC §15.247 (a) IC RSS210 A9.2	6 dB & 99% Bandwidth	Compliant
FCC §15.247(a)(2) IC RSS210 A8.4	Maximum Peak Output Power	Compliant
FCC §15.247(e) IC RSS210 A8.2(b)	Power Spectral Density	Compliant

4 FCC§15.247 (i), §2.1091 & IC RSS-Gen 5.5, RSS-102 - RF Exposure

4.1 Applicable Standard

According to §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	$*(180/f^2)$	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

According to RSS-102 Issue 2, November 2005 §2.5.2 exception from Routine Evaluation Limits- RF Exposure Evaluation:

RF exposure evaluation is required if the separation distance between the user and the device is greater than 20 cm, except when the device operates:

1) below 1.5 GHz and its e.i.r.p. is equal to or less than 2.5 W;
2) at or above 1.5 GHz and the e.i.r.p. of the device is equal to or less than 5 W.

4.2 MPE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

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

W58 Band:

Maximum peak output power at antenna input terminal (dBm):	23.31
Maximum peak output power at antenna input terminal (mW):	214.42
Prediction distance (cm):	20
Prediction frequency (MHz):	5785
Maximum Antenna Gain, typical (dBi):	4.98
Maximum Antenna Gain (numeric):	3.15
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.134
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

4.3 Results:

FCC§15.247(i) and §2.1091:

For W58, the power density level at 20 cm is 0.134 mW/cm², which is below the uncontrolled exposure limit of 1.0mW/cm² at 5785 MHz.

RSS-102 Issue 2:

For W58, the power density level at 20 cm is 1.34 W/m², which is below the uncontrolled exposure limit of 10W/m² at 5785 MHz.

5 FCC §15.203 & IC RSS-Gen §7.1.4 - Antenna Requirement

5.1 Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to § 15.407 (a)(1) and (a)(2), if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

As per IC RSS-Gen §7.1.4: Transmitter Antenna, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

5.2 Result:

Antenna Photos is required confidentiality

Antenna Pattern is required

Confidentiality

The antenna is capable of 64 different element combinations with the peak gain of each individual pattern of 4.98dBi, the lowest peak gain is -2.3dBi. It is not possible for both chains to point in the same direction. The highest gain for which both antennas point in the same direction is 1.5dBi.

6 FCC §15.207 (a) &IC RSS-Gen §7.2.2 - Conducted Emissions

6.1 Section 15.207 Conducted limits:

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.

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

** Decreases with the logarithm of the frequency.*

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was connected with LISN-1.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	Artificial-Mains Network	ESH2-Z5	871884/039	2007-11-14
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2008-03-31

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

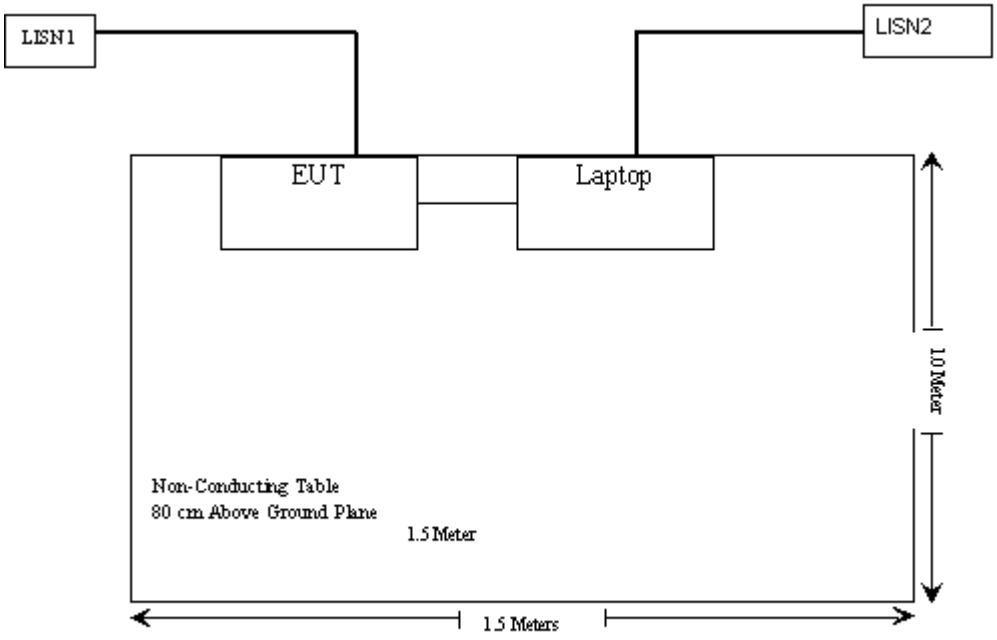
6.4 Test Procedure

During the conducted emissions test, the power cord of the EUT was connected to the mains outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a "QP". Average readings are distinguished with an "Ave".

6.5 Test Setup Diagram



6.6 Environmental Conditions

Temperature:	20° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

**The testing was performed by Xiao Ming Hu from 2008-05-08 to 2008-05-14*

6.7 Summary of Test Results

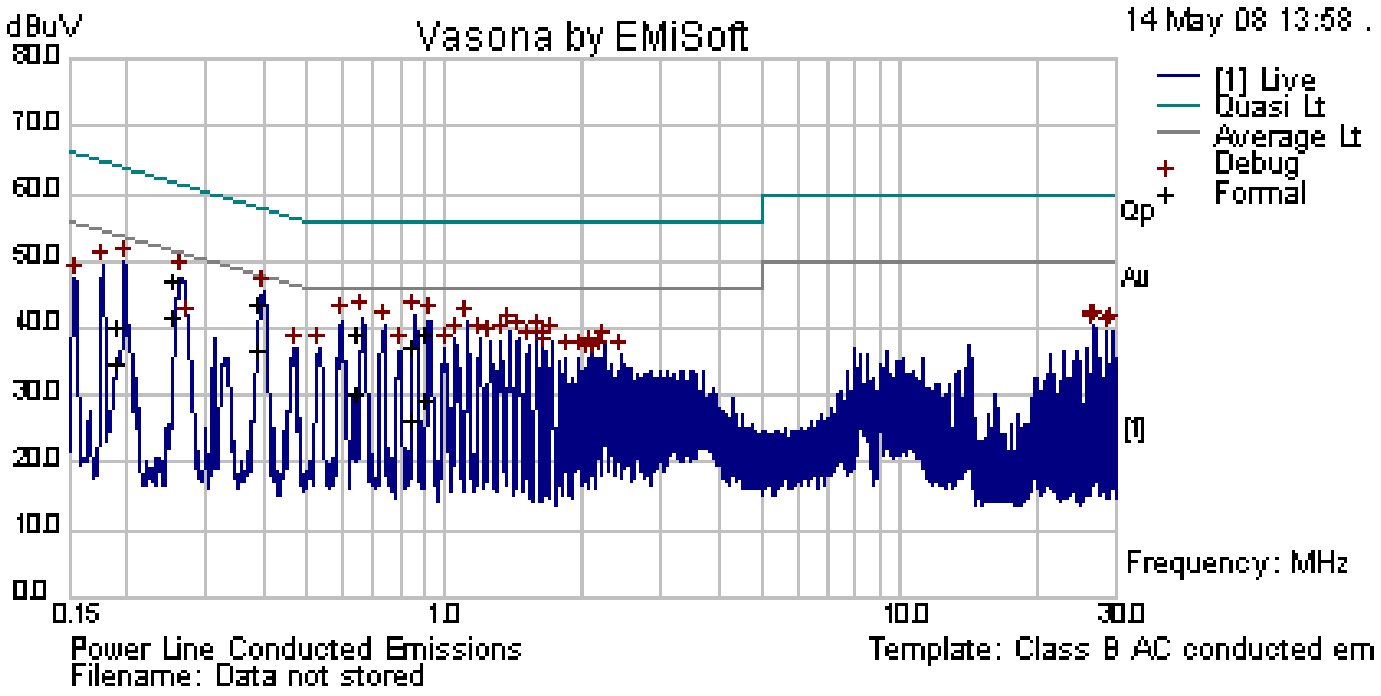
According to the recorded data in following table, the EUT complied with the FCC 15.207 and IC RSS-Gen with the *worst* margin reading of:

-9.96 dB at **0.258 MHz** in the **Neutral** conductor mode for **Power Supply DSA-12R-12AUS**
-2.4 dB at **0.683 MHz** in the **Live** conductor mode for **Power Supply MPB-1201250**

6.8 Test Plot and Data

For Power Supply DSA-12R-12AUS

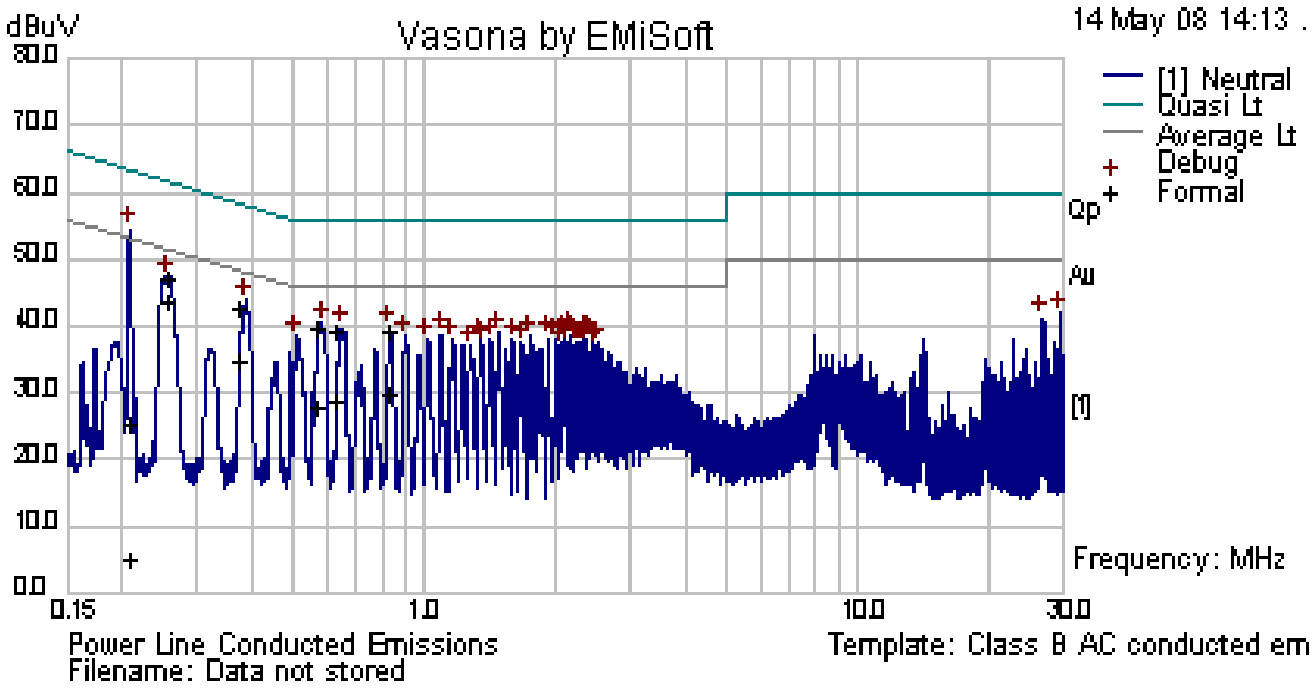
120V/60 Hz Line:



Quasi-Peak and Average Measurements:

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	Corrected Reading (dBuV)	Measurement Type	Line (N/L)	Limit (dBuV)	Margin (dB)
0.257	27.38	12.2	39.58	Average	Live	51.53	-11.95
0.396	21.83	12.39	34.22	Average	Live	47.94	-13.72
0.396	28.72	12.39	41.11	Quasi Peak	Live	57.94	-16.83
0.257	32.49	12.2	44.69	Quasi Peak	Live	61.53	-16.84
0.644	15.89	12.3	28.19	Average	Live	46	-17.81
0.912	14.82	12.3	27.12	Average	Live	46	-18.88
0.644	24.64	12.3	36.94	Quasi Peak	Live	56	-19.06
0.912	24.36	12.3	36.66	Quasi Peak	Live	56	-19.34
0.854	22.84	12.3	35.14	Quasi Peak	Live	56	-20.86
0.194	20.27	12.09	32.36	Average	Live	53.86	-21.50
0.854	11.84	12.3	24.14	Average	Live	46	-21.86
0.194	25.58	12.09	37.66	Quasi Peak	Live	63.86	-26.19

120V/60 Hz Neutral:

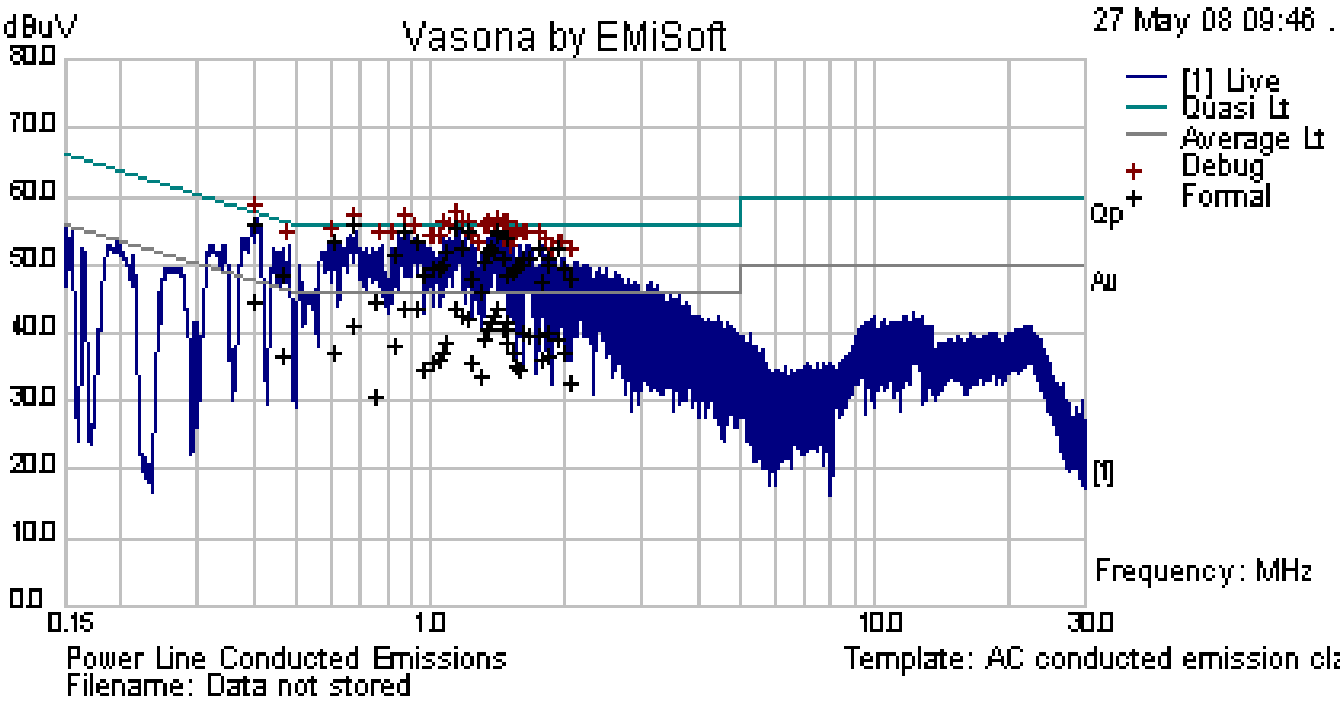


Quasi-Peak and Average Measurements:

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	Corrected Reading (dBuV)	Measurement Type	Line (L/N)	Limit (dBuV)	Margin (dB)
0.258	29.34	12.2	41.54	Average	Neutral	51.5	-9.96
0.383	20.15	12.37	32.52	Average	Neutral	48.21	-15.68
0.258	32.68	12.2	44.88	Quasi Peak	Neutral	61.5	-16.62
0.383	28.15	12.37	40.52	Quasi Peak	Neutral	58.21	-17.69
0.838	15.35	12.3	27.65	Average	Neutral	46	-18.35
0.575	25.28	12.3	37.58	Quasi Peak	Neutral	56	-18.42
0.641	24.82	12.3	37.12	Quasi Peak	Neutral	56	-18.88
0.838	24.63	12.3	36.93	Quasi Peak	Neutral	56	-19.07
0.641	14.28	12.3	26.58	Average	Neutral	46	-19.42
0.575	13.32	12.3	25.62	Average	Neutral	46	-20.38
0.215	10.97	12.2	23.17	Quasi Peak	Neutral	63.03	-39.85
0.215	-9.41	12.2	2.79	Average	Neutral	53.03	-50.23

For Power SupplyMPB-1201250

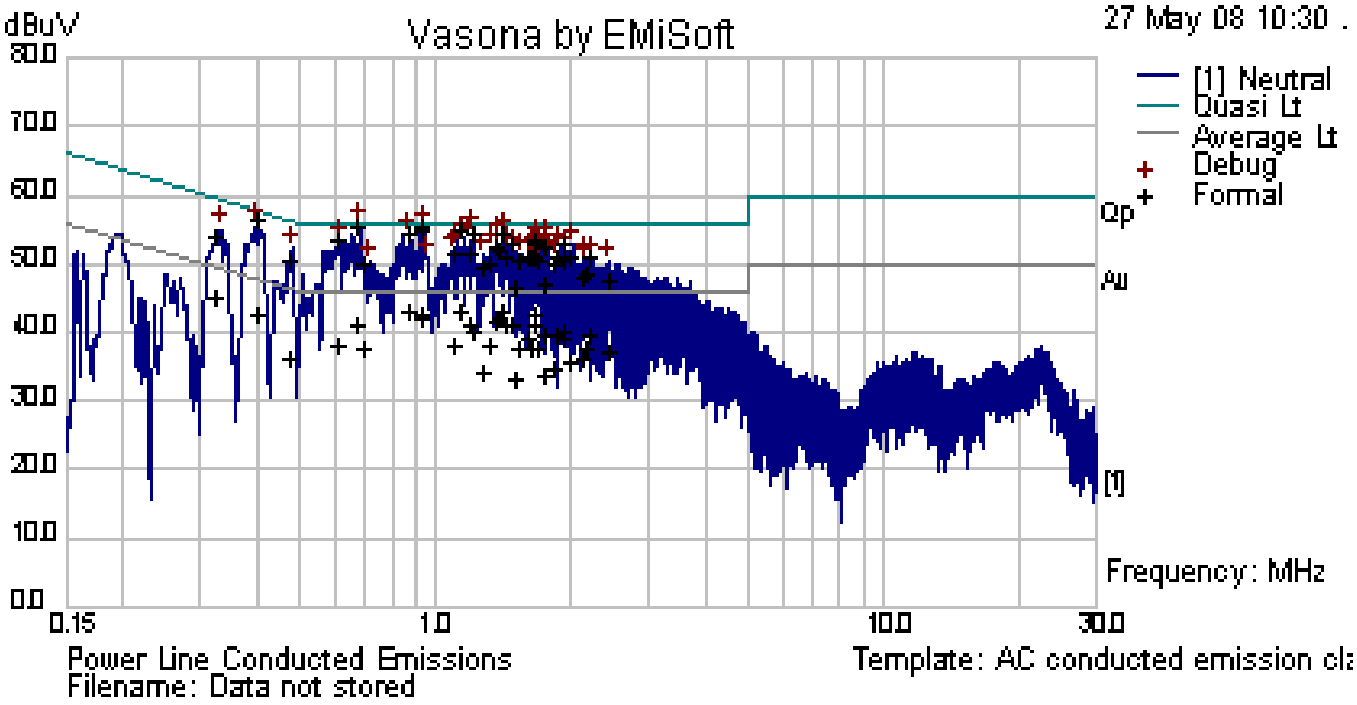
120V/60 Hz Line:



Quasi-Peak and Average Measurements:

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	Corrected Reading (dBuV)	Measurement Type	Line (L/N)	Limit (dBuV)	Margin (dB)
0.683	43.3	10.3	53.6	Quasi Peak	Live	56	-2.40
1.164	42.68	10.3	52.98	Quasi Peak	Live	56	-3.02
1.229	42.65	10.3	52.95	Quasi Peak	Live	56	-3.05
0.888	42.41	10.3	52.71	Quasi Peak	Live	56	-3.29
1.435	42.27	10.24	52.51	Quasi Peak	Live	56	-3.49
1.436	42.12	10.24	52.35	Quasi Peak	Live	56	-3.65
0.888	31.27	10.3	41.57	Average	Live	46	-4.43
1.435	31.08	10.24	41.32	Average	Live	46	-4.68
1.164	31.01	10.3	41.31	Average	Live	46	-4.69
0.944	30.9	10.3	41.2	Average	Live	46	-4.80
1.436	30.92	10.24	41.15	Average	Live	46	-4.85
0.408	32.05	10.39	42.44	Average	Live	47.69	-5.25

120V/60 Hz Neutral:



Quasi-Peak and Average Measurements:

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	Corrected Reading (dBuV)	Measurement Type	Line (L/N)	Limit (dBuV)	Margin (dB)
0.681	42.94	10.3	53.24	Quasi Peak	Neutral	56	-2.76
0.954	42.67	10.3	52.97	Quasi Peak	Neutral	56	-3.03
0.955	42.62	10.3	52.92	Quasi Peak	Neutral	56	-3.08
1.159	42.49	10.3	52.79	Quasi Peak	Neutral	56	-3.21
0.409	43.72	10.23	54.11	Quasi Peak	Neutral	57.66	-3.55
0.886	42.14	10.3	52.44	Quasi Peak	Neutral	56	-3.56
1.159	30.63	10.28	40.93	Average	Neutral	46	-5.07
0.886	30.49	10.25	40.79	Average	Neutral	46	-5.21
1.432	30.53	10.25	40.76	Average	Neutral	46	-5.24
1.705	30.16	10.3	40.46	Average	Neutral	46	-5.54
1.705	30.08	10.3	40.38	Average	Neutral	46	-5.62
0.955	29.98	10.3	40.28	Average	Neutral	46	-5.72

7 FCC §15.247(d) & RSS-210 § A8.5 - Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

FCC §15.247 (d)

IC RSS-210 A8.5

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1057.

7.2 Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1 MHz. sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

7.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2008-03-19

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

7.4 Test Setup Diagram

7.5 Environmental Conditions

Temperature:	20° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

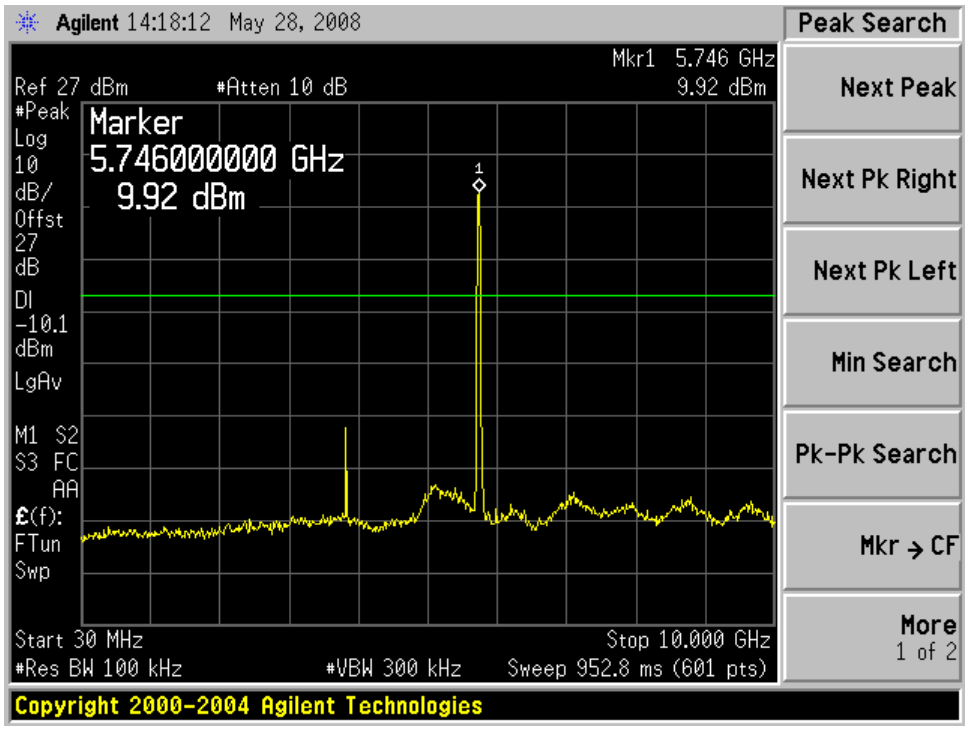
**The testing was performed by Xiao Ming Hu from 2008-05-28.*

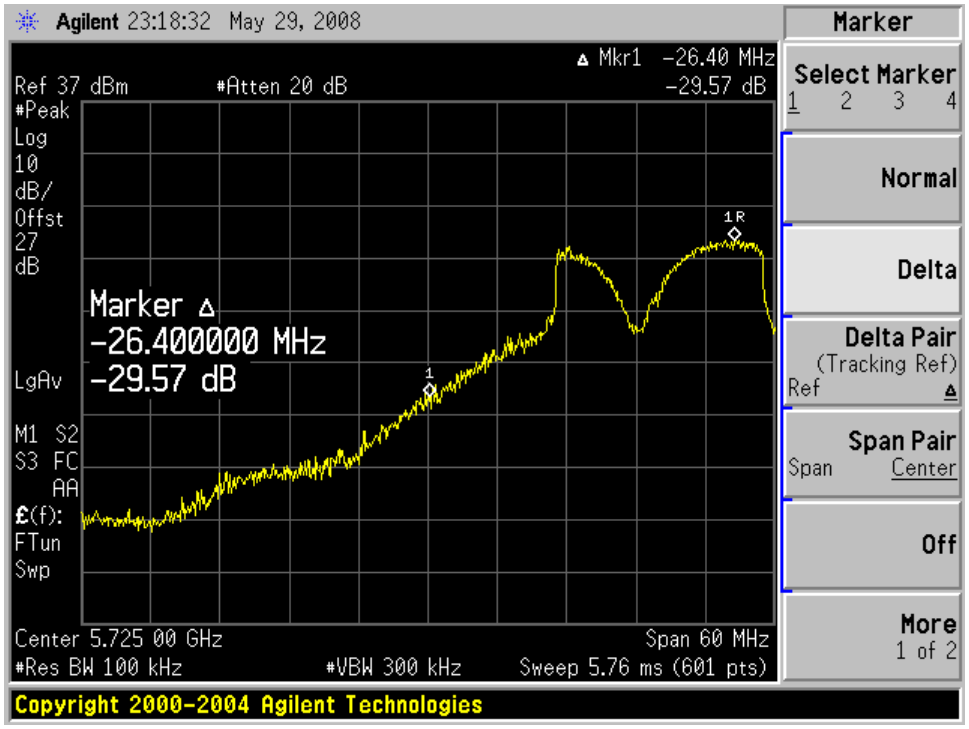
7.6 Measurement Result

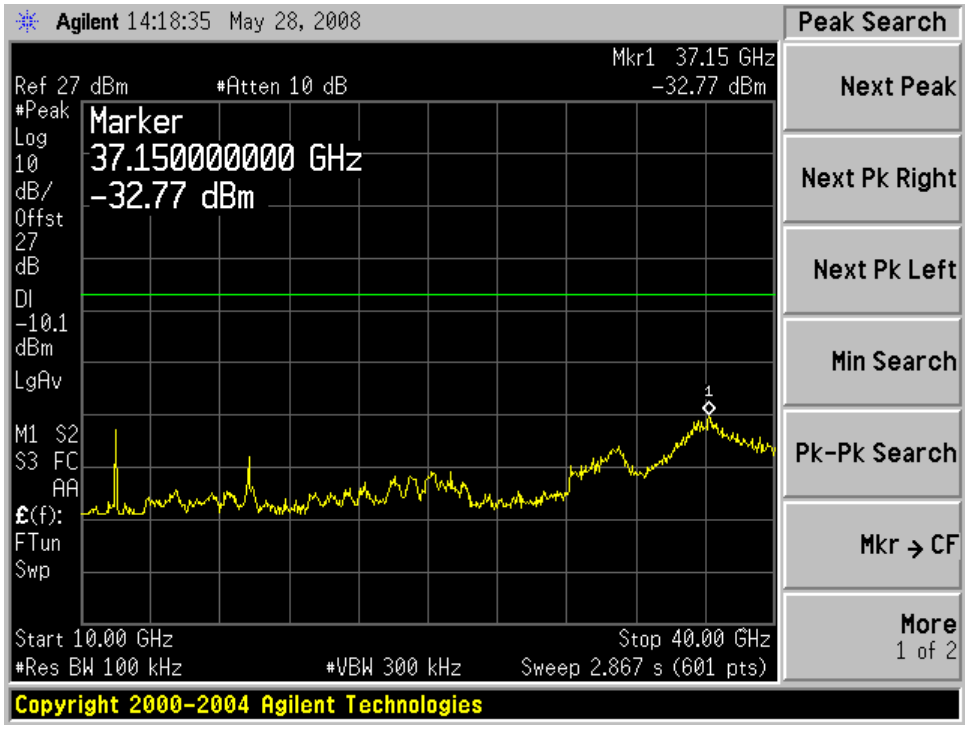
Please refer to following pages for plots of spurious emissions.

802.11n 20MHz

Low Channel







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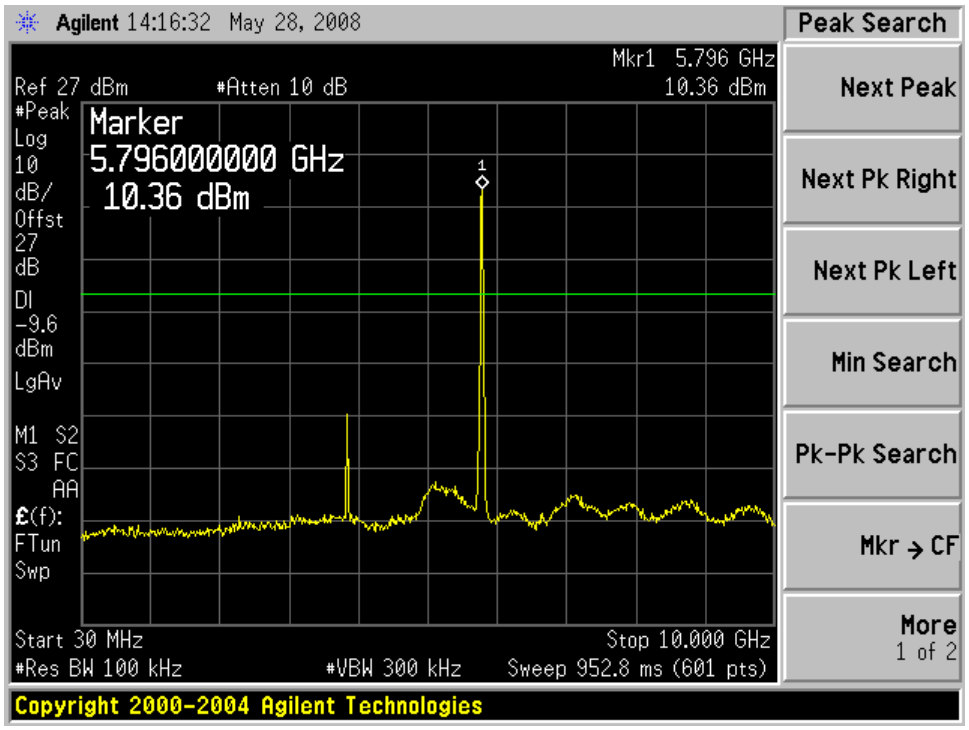

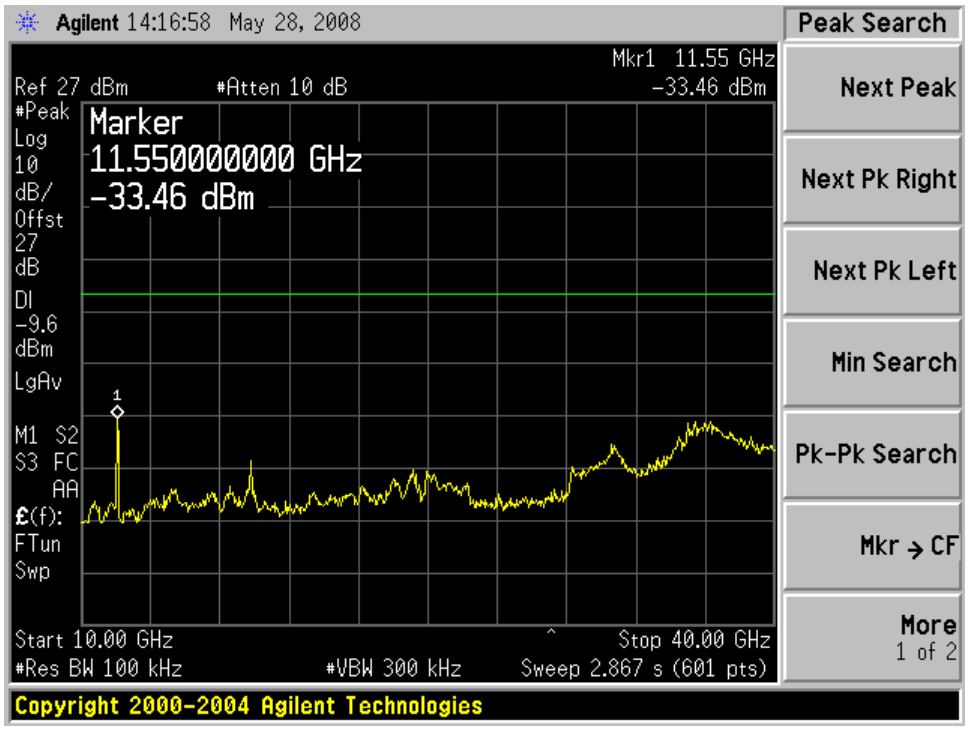

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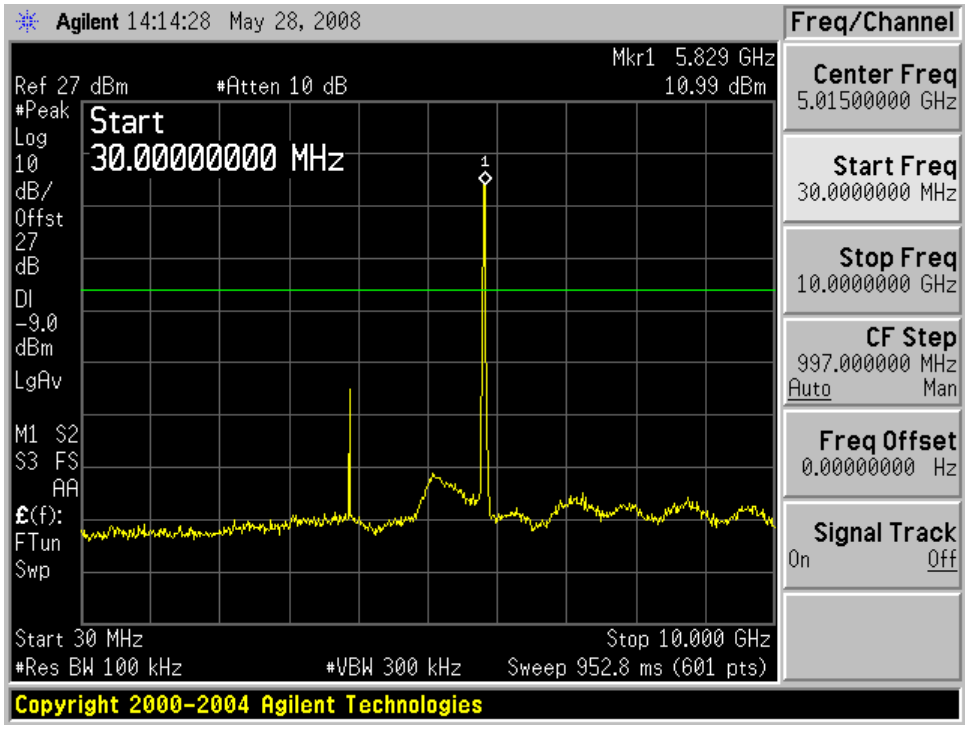

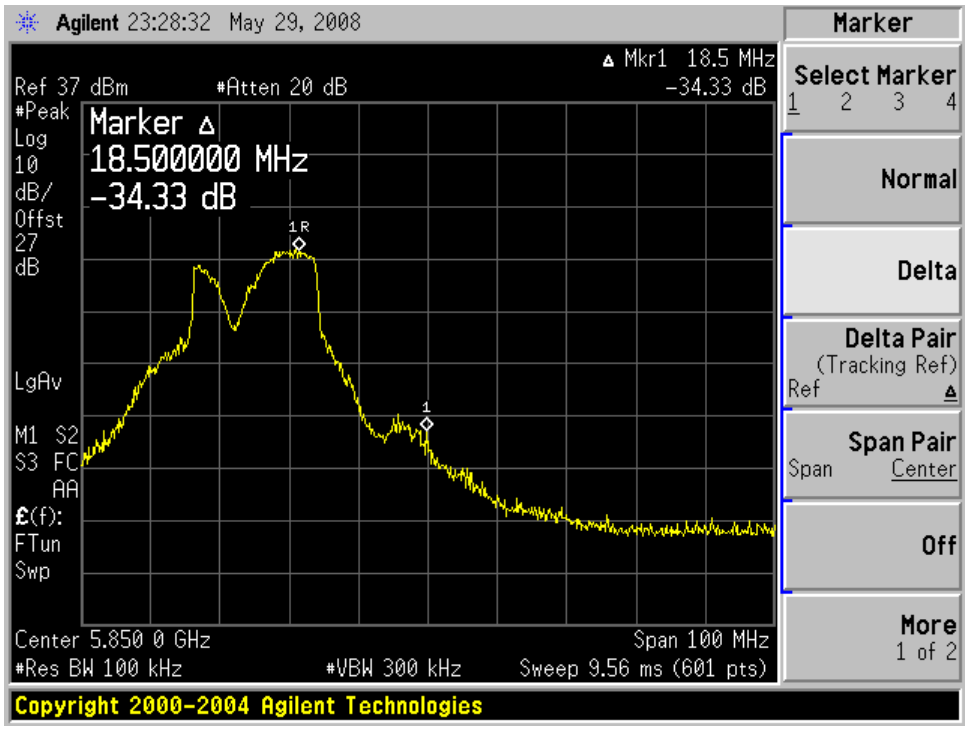
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Ref 37 dBm
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Log
10
dB/
Offst
27
dB
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-34.33 dB
1R
1
LgAv
M1 S2
S3 FC
AA
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FTun
Swp
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#VBW 300 kHz
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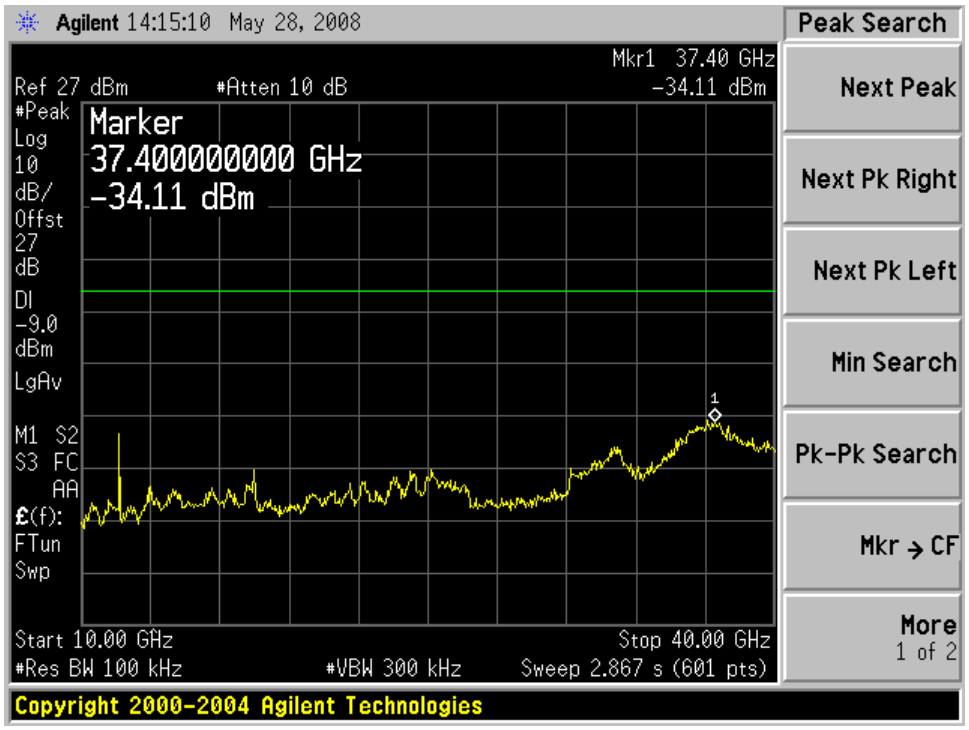
Copyright 2000-2004 Agilent Technologies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Ref 27 dBm
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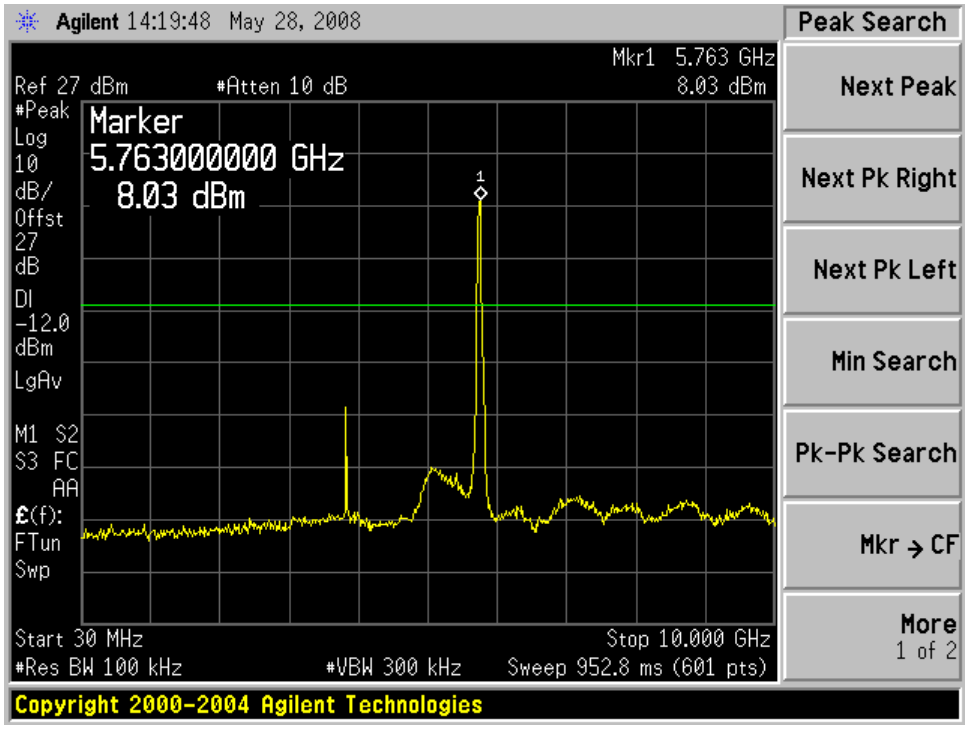
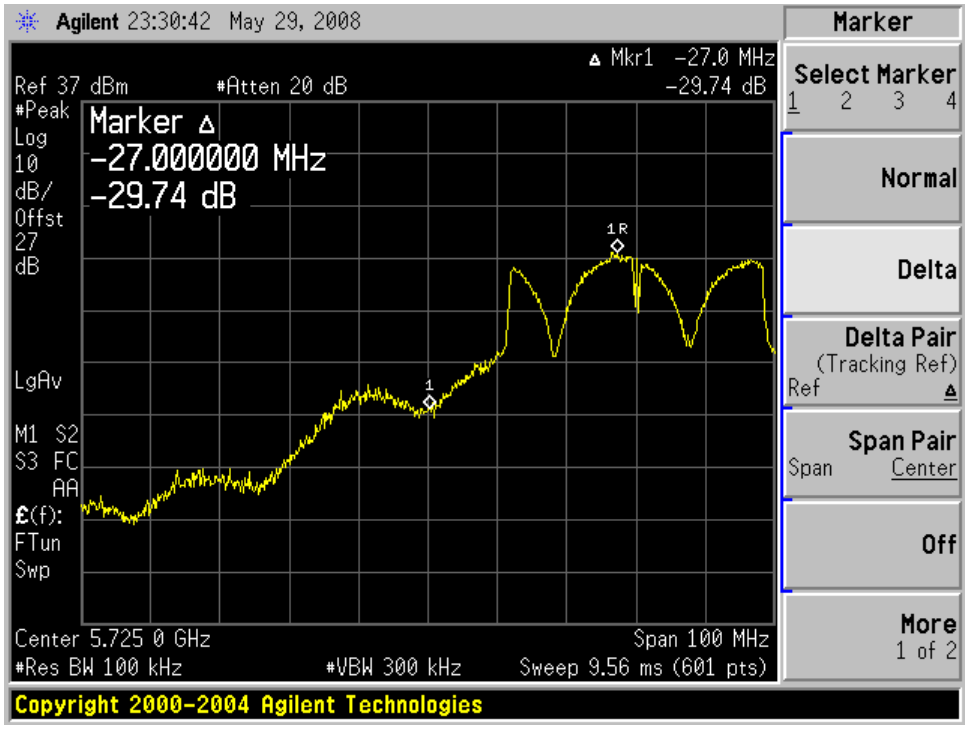
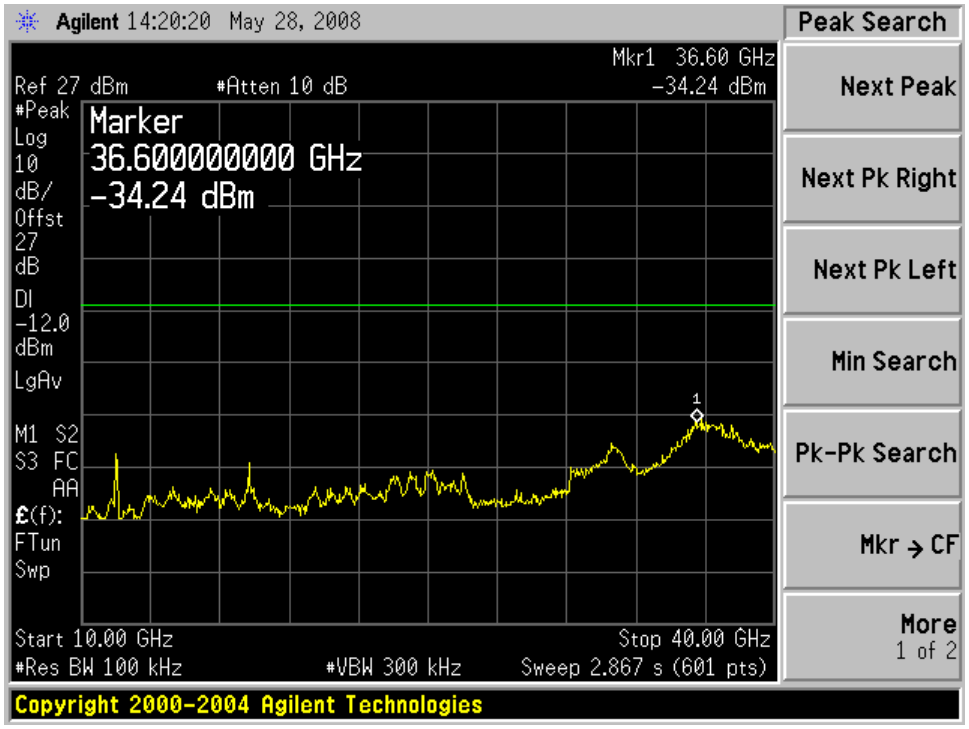
#Peak
Log
10
dB/
Offst
27
dB
Marker
37.400000000 GHz
-34.11 dBm
Dl
-9.0
dBm
1
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 10.00 GHz
Stop 40.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.867 s (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Copyright 2000-2004 Agilent Technologies

802.11n 40MHz

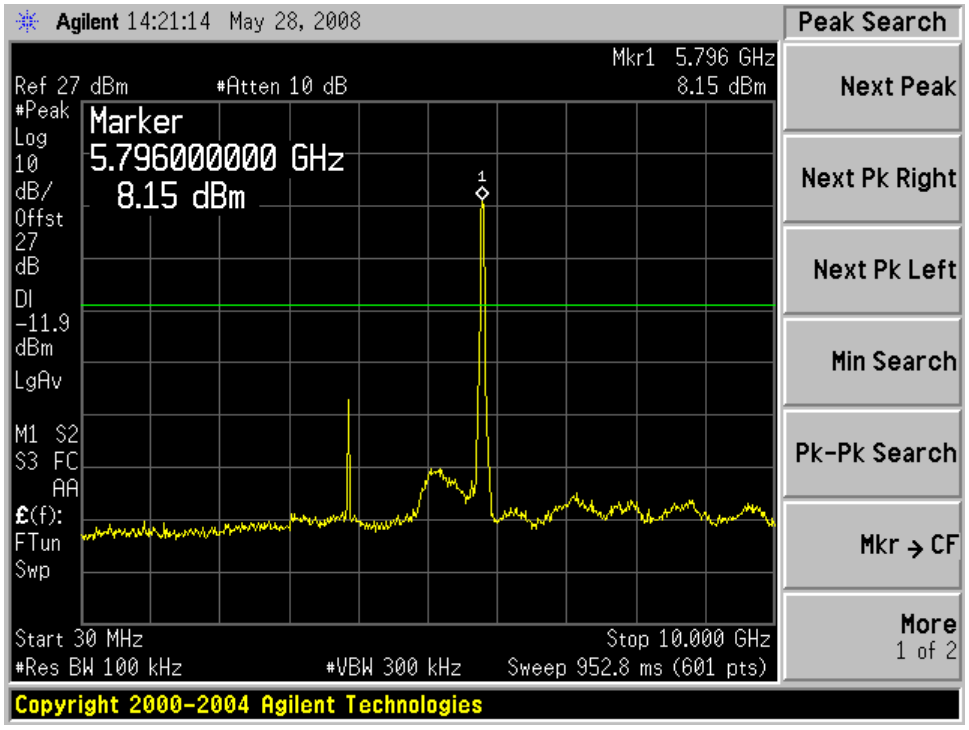
Low Channel

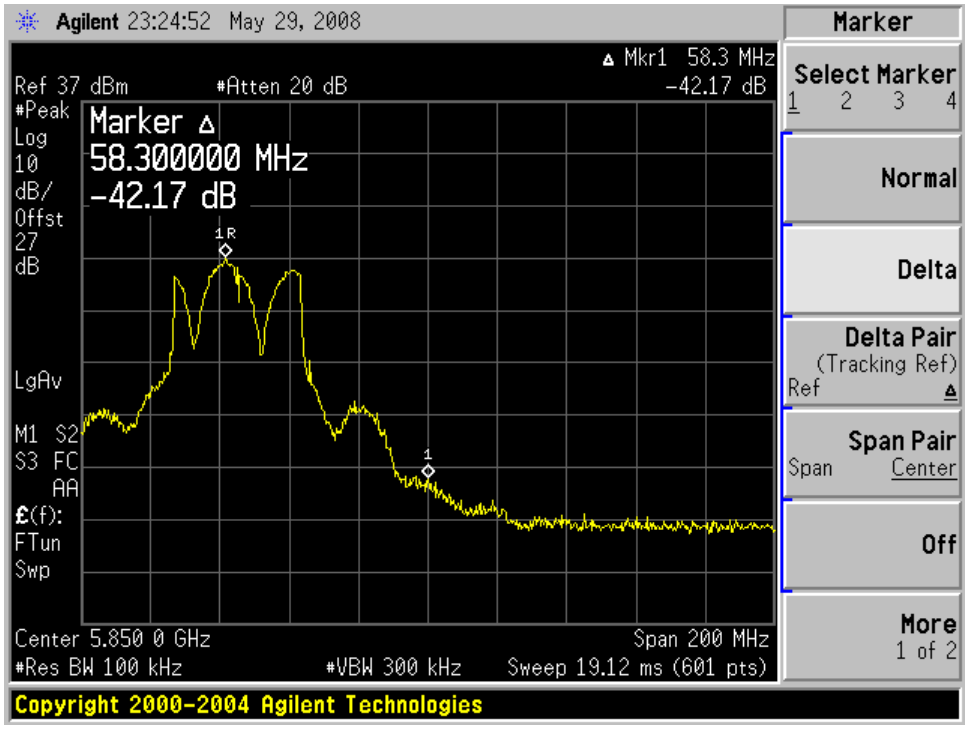






High Channel




Agilent 23:24:52 May 29, 2008
Marker
Ref 37 dBm
#Atten 20 dB
Mkr1 58.3 MHz
-42.17 dB
#Peak
Log
10
dB/
Offst
27
dB
Marker Δ
58.300000 MHz
-42.17 dB
1R
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Center 5.850 0 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 200 MHz
Sweep 19.12 ms (601 pts)
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref
Span Pair
Span Center
Off
More
1 of 2
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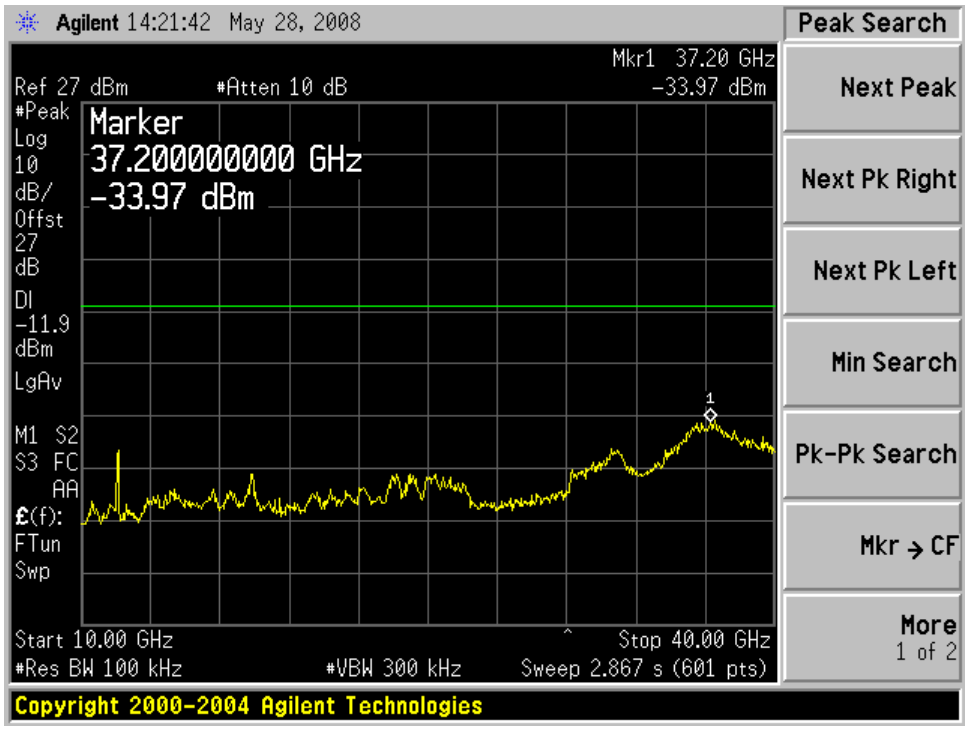
Agilent 14:21:42 May 28, 2008
Peak Search
Ref 27 dBm
#Atten 10 dB
Mkr1 37.20 GHz
-33.97 dBm
#Peak
Log
10
dB/
Offst
27
dB
Marker
37.200000000 GHz
-33.97 dBm
Dl
-11.9
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 10.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 40.00 GHz
Sweep 2.867 s (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
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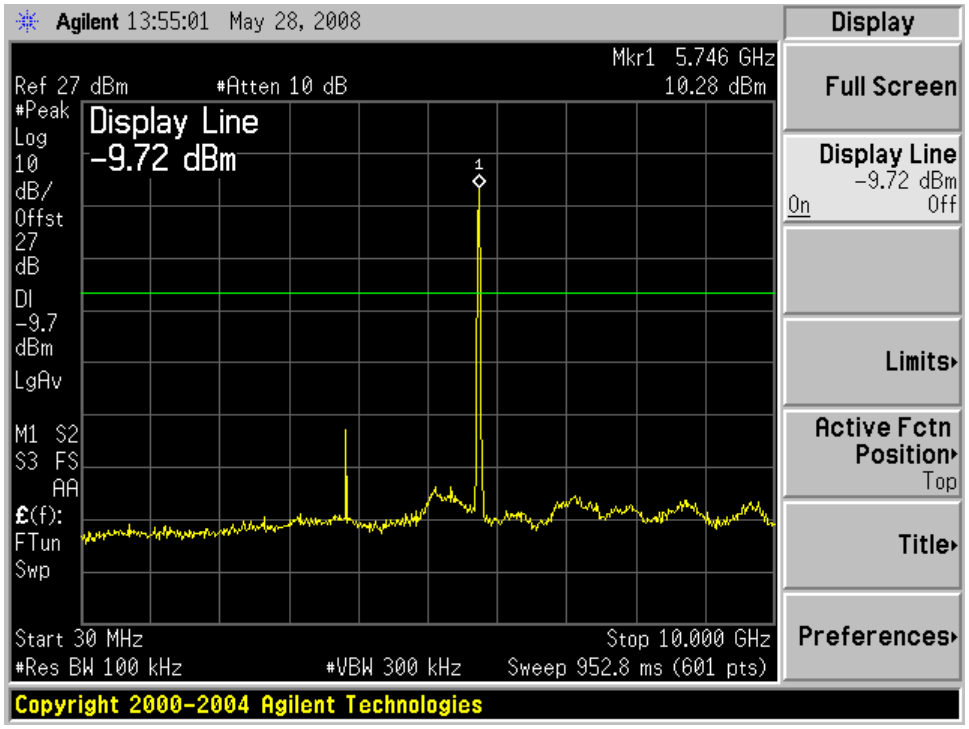
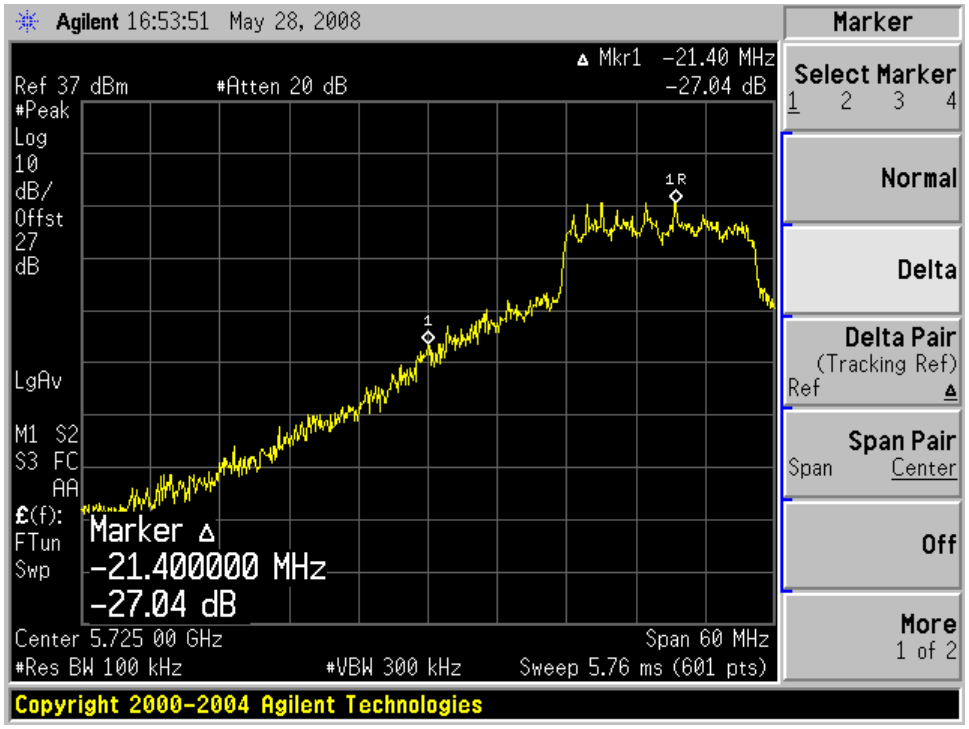
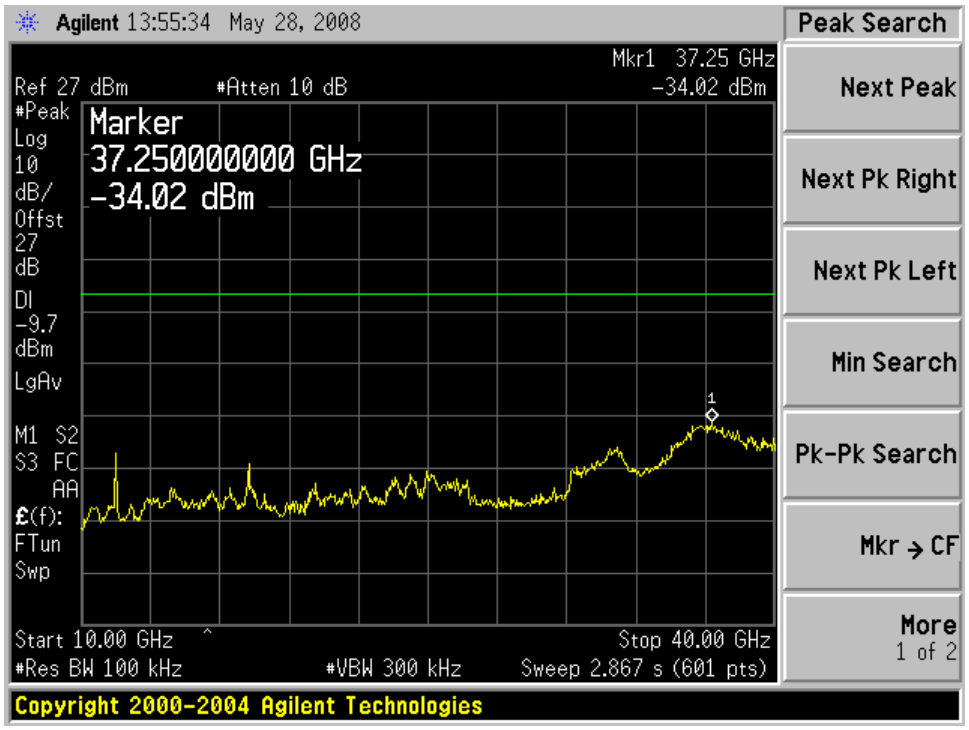
802.11a 20MHz

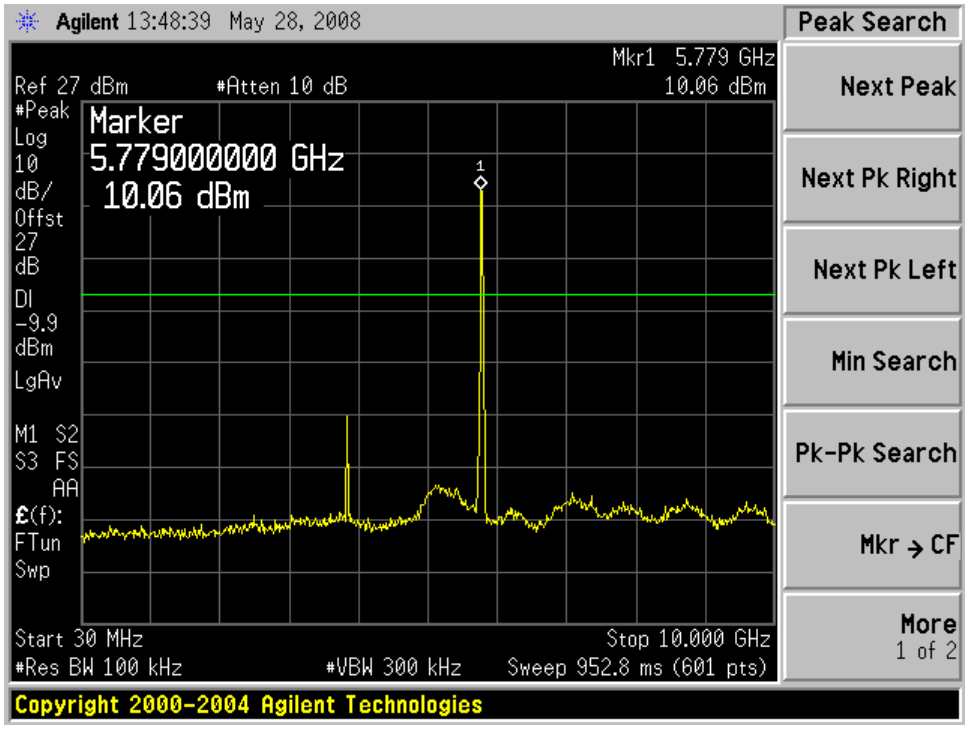
Low Channel

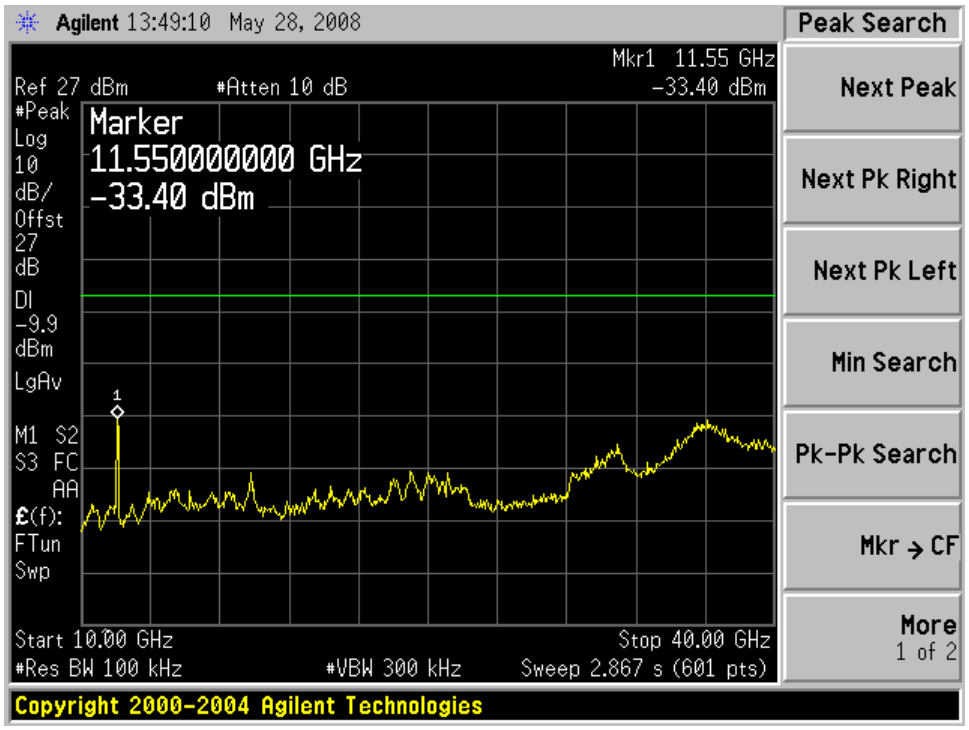




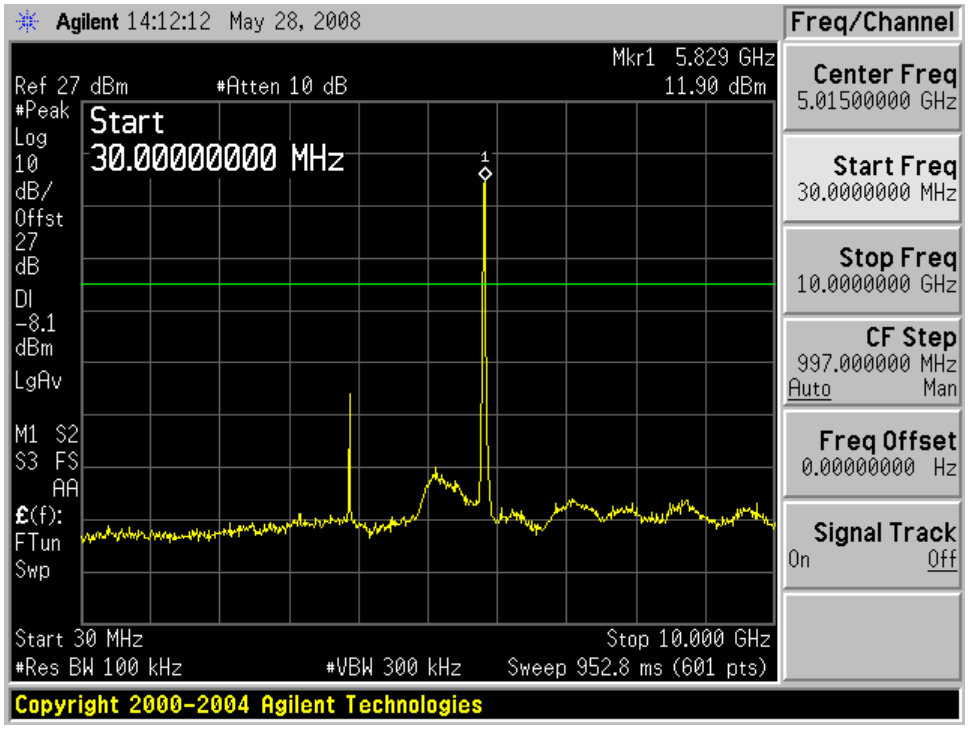


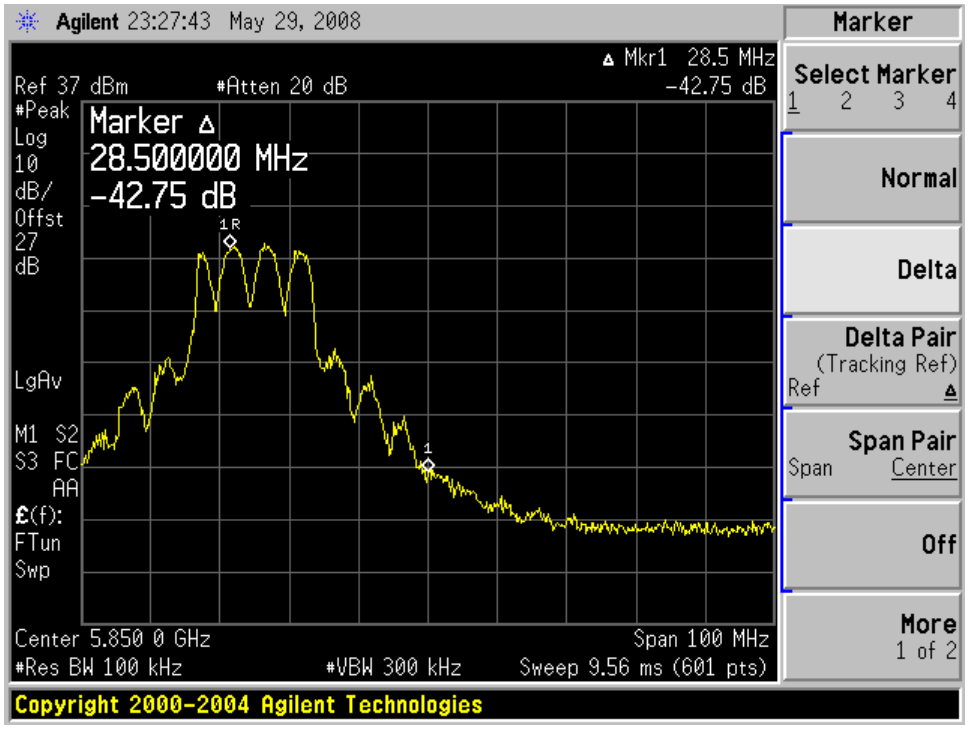
Middle Channel





High Channel




Agilent 23:27:43 May 29, 2008
Marker
Ref 37 dBm
#Atten 20 dB
Mkr1 28.5 MHz
-42.75 dB
#Peak
Log
10
dB/
Offst
27
dB
Marker Δ
28.500000 MHz
-42.75 dB
1R
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Center 5.850 0 GHz
Span 100 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 9.56 ms (601 pts)
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref
Span Pair
Span Center
Off
More
1 of 2
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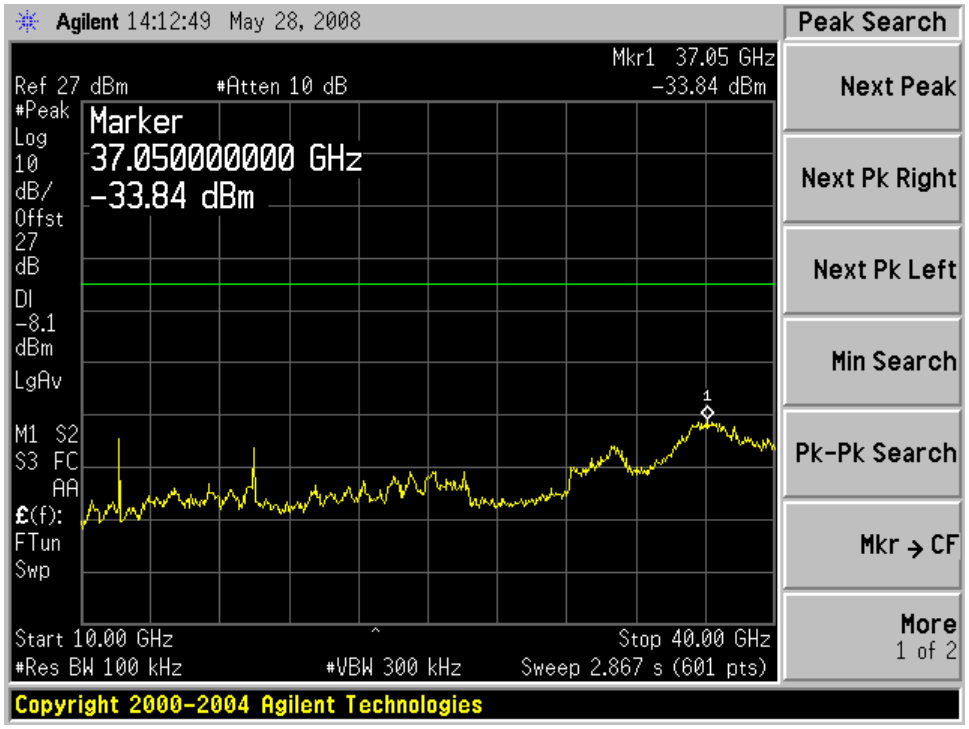

Agilent 14:12:49 May 28, 2008
Peak Search
Ref 27 dBm
#Atten 10 dB
Mkr1 37.05 GHz
-33.84 dBm
#Peak
Log
10
dB/
Offst
27
dB
Marker
37.050000000 GHz
-33.84 dBm
Dl
-8.1
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 10.00 GHz
Stop 40.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.867 s (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Copyright 2000-2004 Agilent Technologies

8 FCC §15.205, §15.209, §15.247(d) & IC RSS-210 §2.6, §A8.5 - Spurious Radiated Emissions

8.1 Applicable Standard

FCC §15.247(d) & IC RSS-210 §2.6, §A8.5

As per 15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per 15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** 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.

As Per 15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

IC RSS-210 §2.6 General Field Strength Limits

Tables 2 and 3 show the general field strength limits of unwanted emissions, where applicable, for transmitters and receivers operating in accordance with the provisions specified in this RSS. Transmitters whose wanted emissions are also within the limits shown in Tables 2 and 3 may operate in any of the frequency bands of Tables 2 and 3, other than the restricted bands of Table 1 and the TV bands, and shall be certified under RSS-210. (**Note:** Devices operating below 490 kHz all of whose emissions are at least 40 dB below the limit given in Table 3 are Category II devices subject to RSS-310.) Unwanted emissions of transmitters and receivers are permitted to fall into Table 1 and TV frequencies but intentional emissions are prohibited. See the note of Table 2 for further details.

8.2 Test Setup

The radiated emissions tests were performed in the 3-meter open area test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C and E limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal Date
HP	Pre amplifier	8447D	2944A07030	2007-11-12
Agilent	Pre amplifier	8449B	3008A01978	2007-11-02
Sunol Science	Combination Antenna	JB1 Antenna	A013105-3	2008-03-25
Antenna Research Associates, Inc.	Horn Antenna	DRG-118/A	1132	2007-06-18
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	1000337	2008-04-21
Sunol Science	System Controller	SC99V	122303-1	NR
Agilent	Spectrum analyzer	E4440A	MY44303352	2008-04-28

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

8.4 Test Procedure

For the radiated emissions test, the EUT, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 mete, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto

Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

8.5 Corrected Amplitude & Margin Calculation

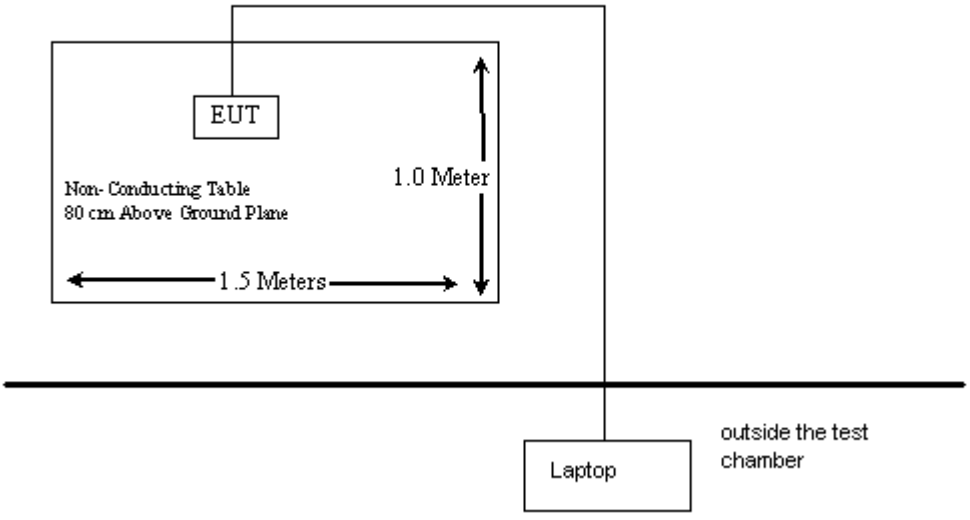
The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit.
The equation for margin calculation is as follows:

Margin = Corrected Amplitude - FCC Limit

8.6 Test Setup Diagram



8.7 Environmental Conditions

Temperature:	20° C -23° C
Relative Humidity:	30% - 63%
ATM Pressure:	1011mbar - 1019 mbar

**The testing was performed by Xiao Ming Hu from 2008-05-14 to 2008-05-22*

8.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15.205, 15.209, 15.247 and IC RSS-210 §2.6, A8.5, had the worst margin of:

5725-5850 MHz Band (W58)

802.11n 20MHz:

-0.20 dB at 11489.94 MHz in the Vertical polarization for Low Channel, 1GHz – 40 GHz
-4.60 dB at 11570.0 MHz in the Vertical polarization for Middle Channel, 1GHz – 40 GHz
-0.58 dB at 17472.34 MHz in the Vertical polarization for High Channel, 1GHz – 40 GHz

802.11n 40MHz:

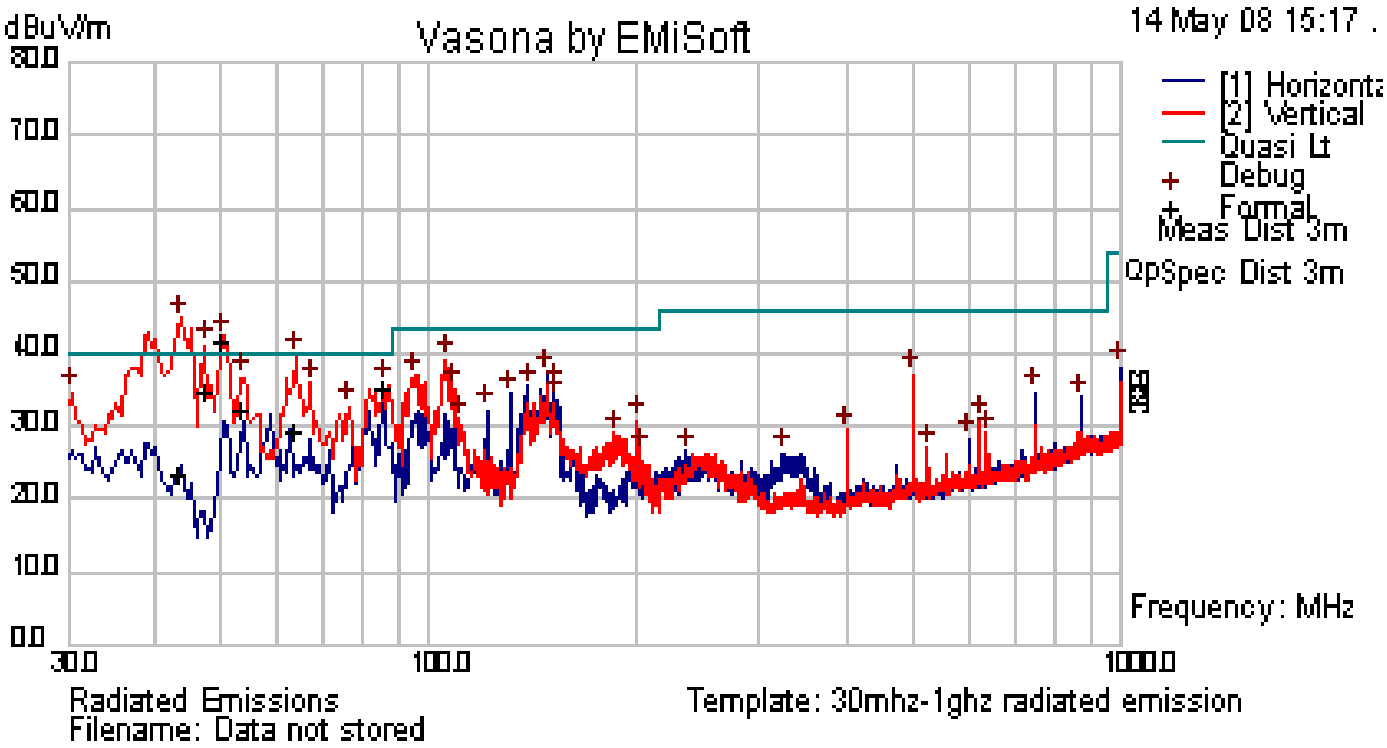
-1.99 dB at 3836.722 MHz in the Horizontal polarization for Low Channel, 1GHz – 40 GHz
-0.10 dB at 3863.32 MHz in the Horizontal polarization for High Channel, 1GHz – 40 GHz

802.11a 20MHz:

-0.50 dB at 3830.009 MHz in the Horizontal polarization for Low Channel, 1GHz – 40 GHz
-0.10 dB at 3856.793 MHz in the Horizontal polarization for Middle Channel, 1GHz – 40GHz
-0.30 dB at 3883.38 MHz in the Horizontal l polarization for High Channel, 1GHz – 40 GHz

8.9 Test Plot and Data

Radiated Spurious Emissions Worst-case scan below 1 GHz



Quasi-Peak Measurements:

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV/m)	Measurement Type	Ant. Pol. (H/V)	Hgt (cm)	Azt Deg	Limit (dBuV/m)	Margin (dB)
50.432	48.84	10.4	-19.83	39.41	Quasi -Peak	V	110	313	40	-0.59
86.014	42.32	10.56	-20.14	32.74	Quasi -Peak	V	266	22	40	-7.26
47.582	40.88	10.4	-18.69	32.59	Quasi -Peak	V	109	287	40	-7.41
53.976	39.85	10.4	-20.46	29.8	Quasi -Peak	V	151	177	40	-10.2
64.137	36.6	10.44	-20.19	26.86	Quasi -Peak	V	138	-5	40	-13.14
43.785	27.13	10.4	-16.65	20.87	Quasi -Peak	V	317	253	40	-19.13

8.9.1 5725-5850 MHz Band (W58)

802.11n 20MHz:

Low channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
11489.94	44.25	3.95	5.6	53.8	Average	V	111	222	54	-0.2
3829.963	53.48	2.03	-8.72	46.79	Average	H	138	0	54	-7.21
5221.491	46.65	2.44	-3.89	45.2	Average	H	155	18	54	-8.8
17235.55	30.95	5.38	8.4	44.73	Average	V	96	186	54	-9.27
17523.6	26.01	5.44	10.08	41.53	Average	V	191	13	54	-12.47
5289.062	40.58	2.46	-3.67	39.37	Average	H	112	146	54	-14.63

Mid channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
11570	39.92	3.99	5.49	49.4	Average	V	136	281	54	-4.6
3856.683	54.9	2	-8.7	48.3	Average	H	129	238	54	-5.7
5164.207	46.39	2.43	-4.08	44.75	Average	H	139	360	54	-9.25
17358.02	29.36	5.41	9.22	44	Average	V	144	327	54	-10
17517.73	26.13	5.44	10.1	41.67	Average	H	136	360	54	-12.33

High channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
17472.34	38.01	5.44	9.98	53.42	Average	V	124	283	54	-0.58
3883.321	58.7	2.1	-8.6	52.1	Average	H	169	300	54	-1.9
5146.524	48.5	2.42	-4.13	46.8	Average	H	116	268	54	-7.2
5295.435	45.96	2.46	-3.64	44.77	Average	H	135	328	54	-9.23
11650	35.35	4.01	5.36	44.72	Average	V	136	281	54	-9.28
17506.32	26.45	5.44	10.14	42.03	Average	V	99	311	54	-11.97

802.11n 40MHz:

Low channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
3836.722	58.69	2.03	-8.71	52.01	Average	H	164	189	54	-1.99
17259.61	34.3	5.38	8.56	48.24	Average	V	101	102	54	-5.76
5161.286	48.64	2.43	-4.09	46.98	Average	H	99	100	54	-7.02
11503.53	36.98	3.95	5.61	46.54	Average	V	129	141	54	-7.46
11532.39	33.81	3.97	5.56	43.34	Average	H	109	0	54	-10.66
17505.36	26.38	5.44	10.14	41.96	Average	H	118	18	54	-12.04
5314.351	41.78	2.47	-3.58	40.67	Average	H	101	138	54	-13.33
1890.185	38.85	1.26	-10.1	30.01	Average	V	99	66	54	-23.99

High channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
3863.32	60.51	2.05	-8.66	53.9	Average	H	156	360	54	-0.10
5161.95	49.2	2.43	-4.08	47.55	Average	H	143	360	54	-6.45
11596.17	36.49	4	5.44	45.93	Average	H	148	240	54	-8.07
17367.43	30.58	5.42	9.29	45.28	Average	V	99	232	54	-8.72
5781.659	44.85	2.64	-2.47	45.02	Average	V	145	189	54	-8.98
5319.217	45.89	2.47	-3.56	44.79	Average	H	136	360	54	-9.21
17567.51	26.18	5.45	9.93	41.55	Average	H	183	360	54	-12.45
11619.45	28.64	4	5.41	38.06	Average	V	140	132	54	-15.94

802.11a 20MHz:

Low channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
3830.009	60.19	2.03	-8.72	53.5	Average	H	158	360	54	-0.5
17238.42	36.84	5.38	8.42	50.64	Average	V	99	124	54	-3.36
5240.293	45.45	2.45	-3.83	44.06	Average	H	127	150	54	-9.94
11490.87	33.86	3.95	5.6	43.41	Average	V	173	130	54	-10.59
17487.49	26.22	5.44	10.08	41.74	Average	V	133	341	54	-12.26
5333.493	40.93	2.48	-3.51	39.9	Average	H	107	333	54	-14.1

Mid channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
3856.793	60.53	2.04	-8.67	53.9	Average	H	109	241	54	-0.1
11568.99	41.91	3.98	5.49	51.38	Average	H	106	250	54	-2.62
17355.03	34.15	5.41	9.2	48.77	Average	V	135	258	54	-5.23
17983.14	26.45	5.61	8.51	40.58	Average	V	171	86	54	-13.42

High channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
3883.38	60.3	2.1	-8.6	53.7	Average	H	142	45	54	-0.3
5150.196	49.95	2.43	-4.12	48.25	Average	H	134	173	54	-5.75
11646.66	35.97	4.01	5.37	45.35	Average	V	185	0	54	-8.65
17479.16	29.74	5.44	10.02	45.2	Average	V	99	0	54	-8.8
17500.45	26.53	5.44	10.16	42.13	Average	V	128	74	54	-11.87
5324.165	42.88	2.47	-3.54	41.8	Average	H	105	254	54	-12.2
11671.91	29.44	4.01	5.34	38.79	Average	H	103	242	54	-15.21

9 FCC §15.247(a) (2) & RSS 210 A8.2 (a) – 6 dB & 99% Emission Bandwidth

9.1 Applicable Standard

FCC §15.247 (a) (2); IC RSS-210 A8.2 (a)

9.2 Measurement Procedure

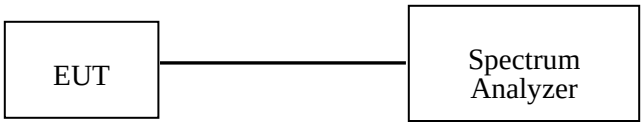
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

9.3 Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum analyzer	E4440A	MY44303352	2008-04-28

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

9.4 Test Setup Diagram



`

9.5 Environmental Conditions

Temperature:	20° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

**The testing was performed by Xiao Ming Hu from 2008-05-15.*

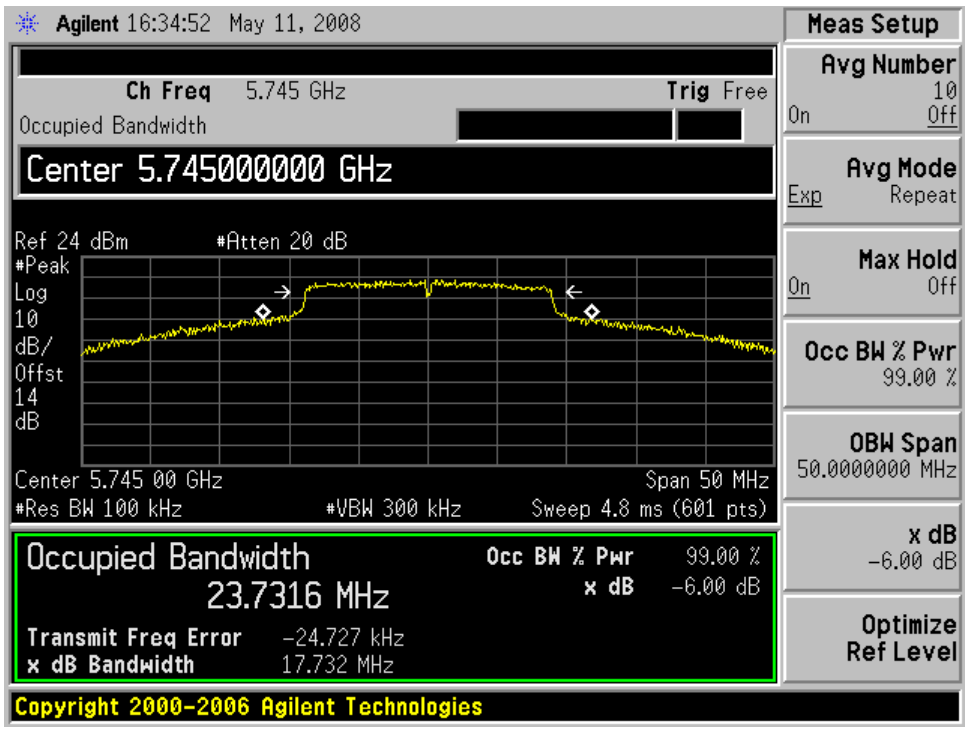
9.6 Test Results:

5725-5850 MHz Band (W58)

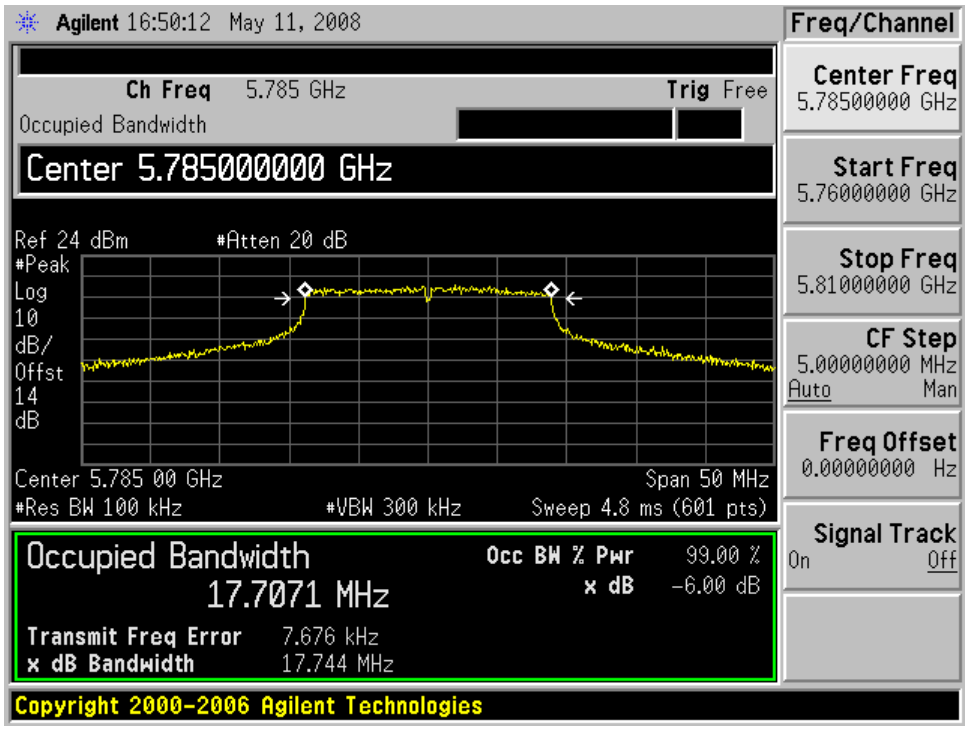
Channel	Frequency (MHz)	6 dB BW (MHz)	99% BW (MHz)
802.11 n 20MHz			
Low	5745	17.732	23.7316
Middle	5785	17.744	17.7071
High	5825	17.774	22.5741
802.11 n 40MHz			
Low	5755	36.631	36.4104
High	5795	36.635	36.4514
802.11 a 20 MHz			
Low	5745	15.526	25.4912
Middle	5785	16.232	17.1406
High	5825	16.258	17.5042

802.11n 20MHz:

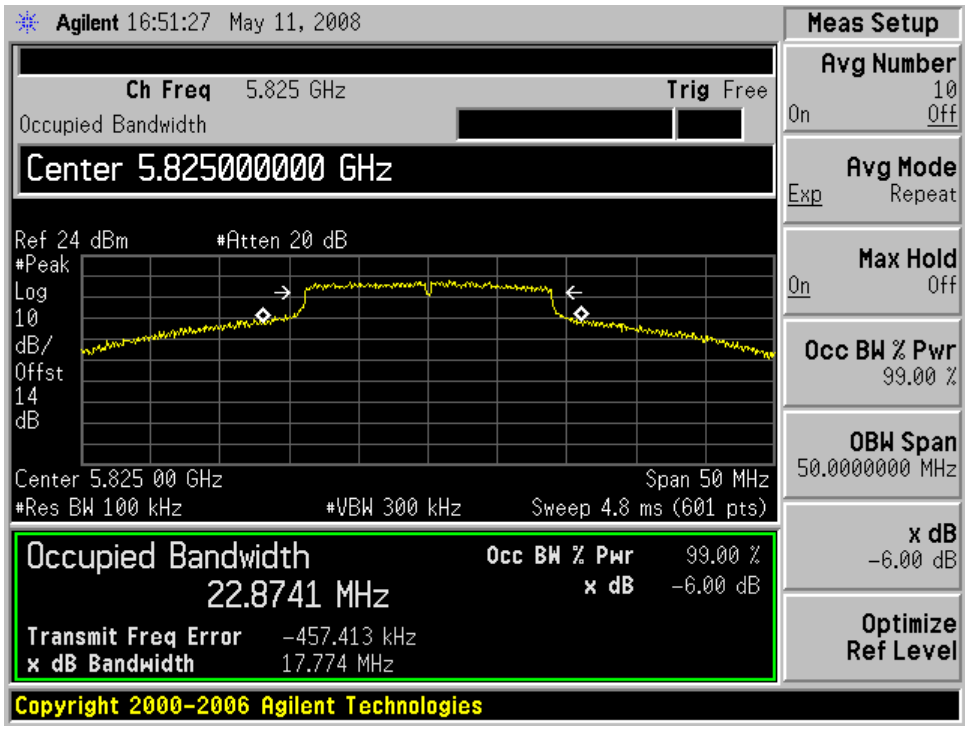
Low Channel



Middle Channel

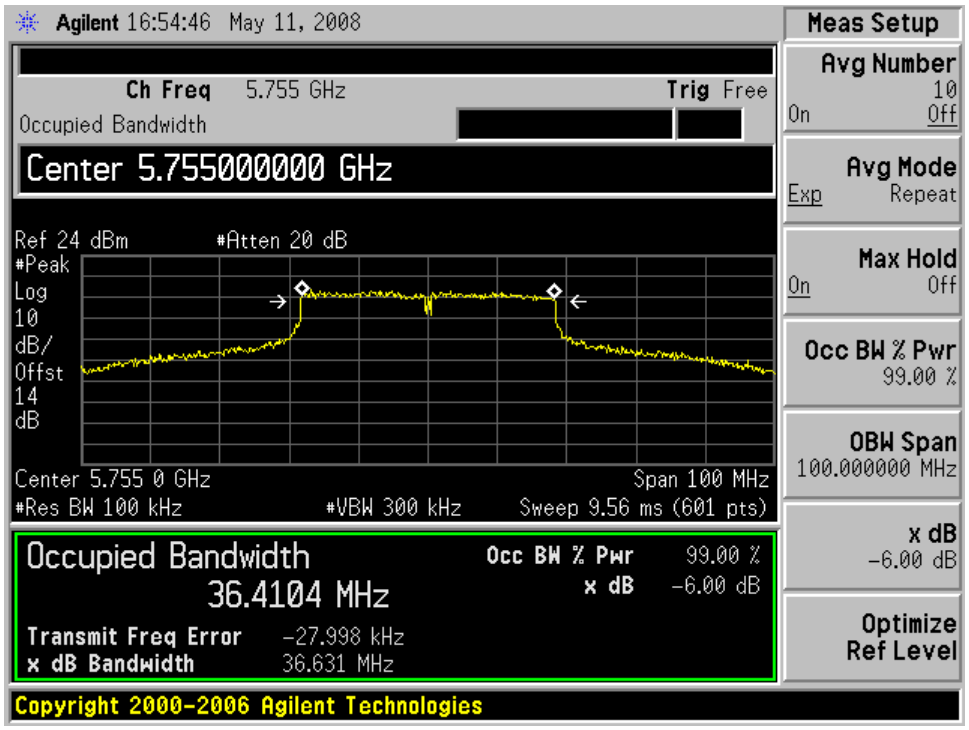


High Channel

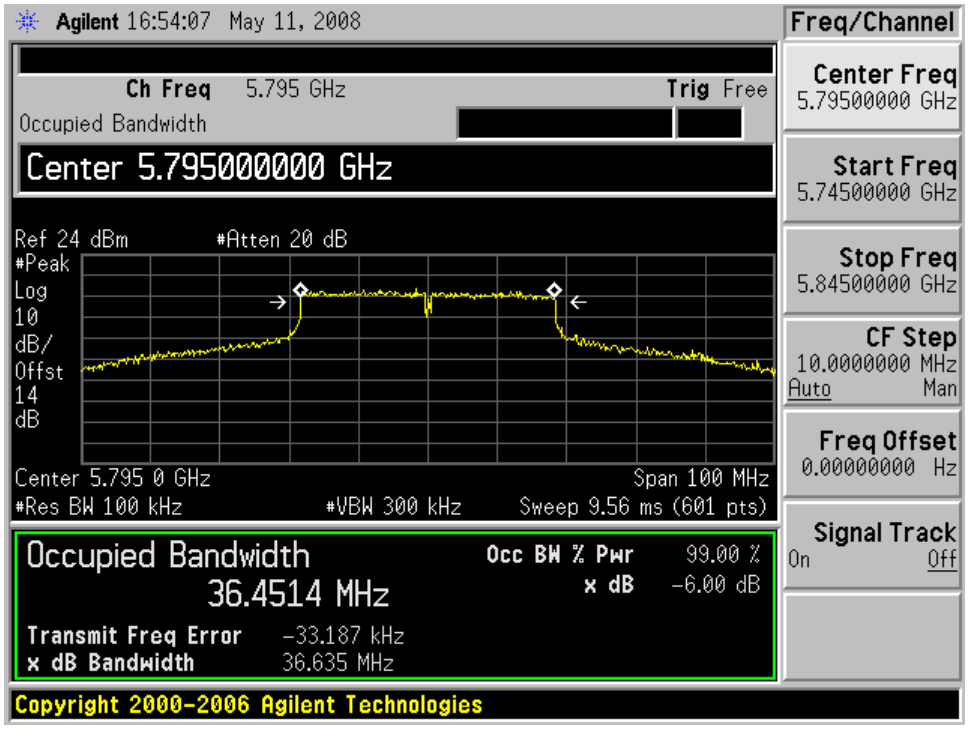


802.11n 40MHz:

Low Channel

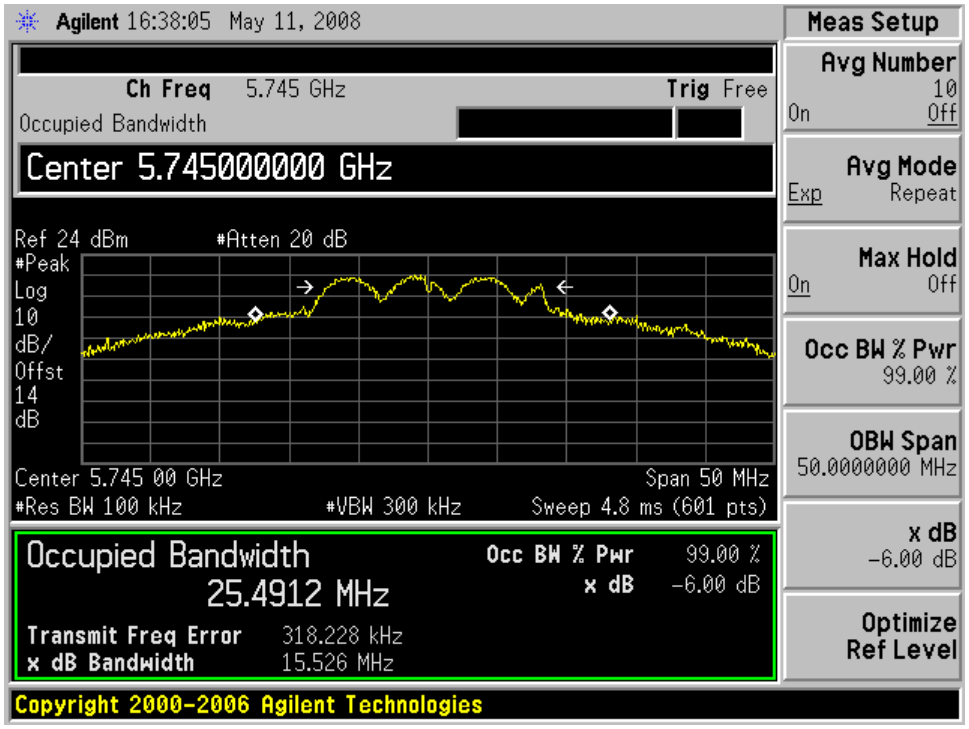


High Channel

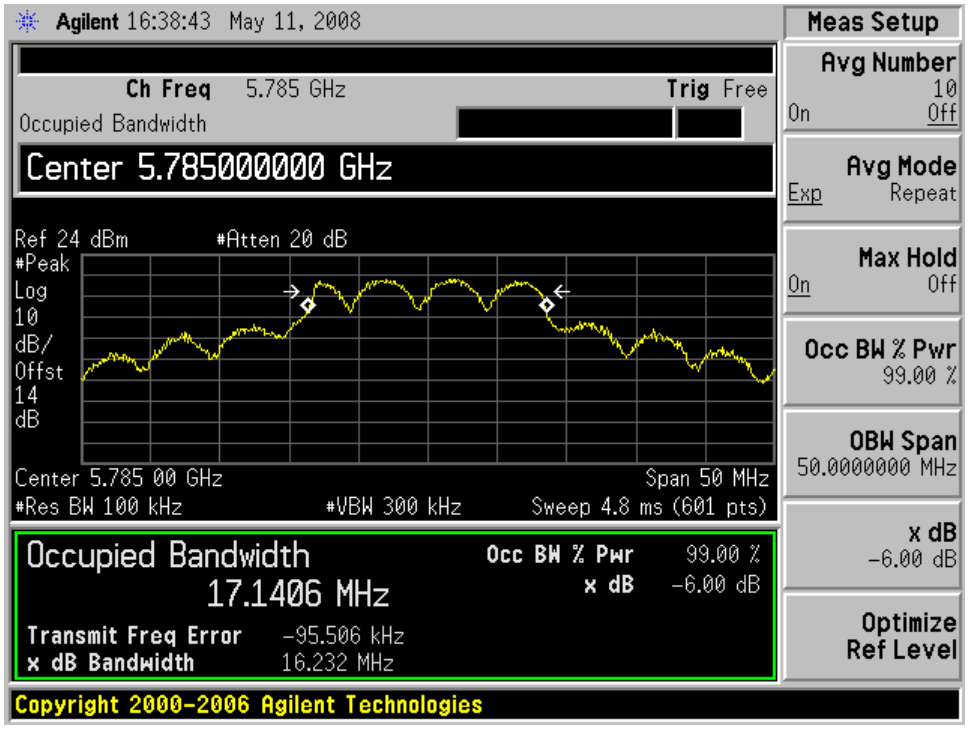


802.11a 20MHz:

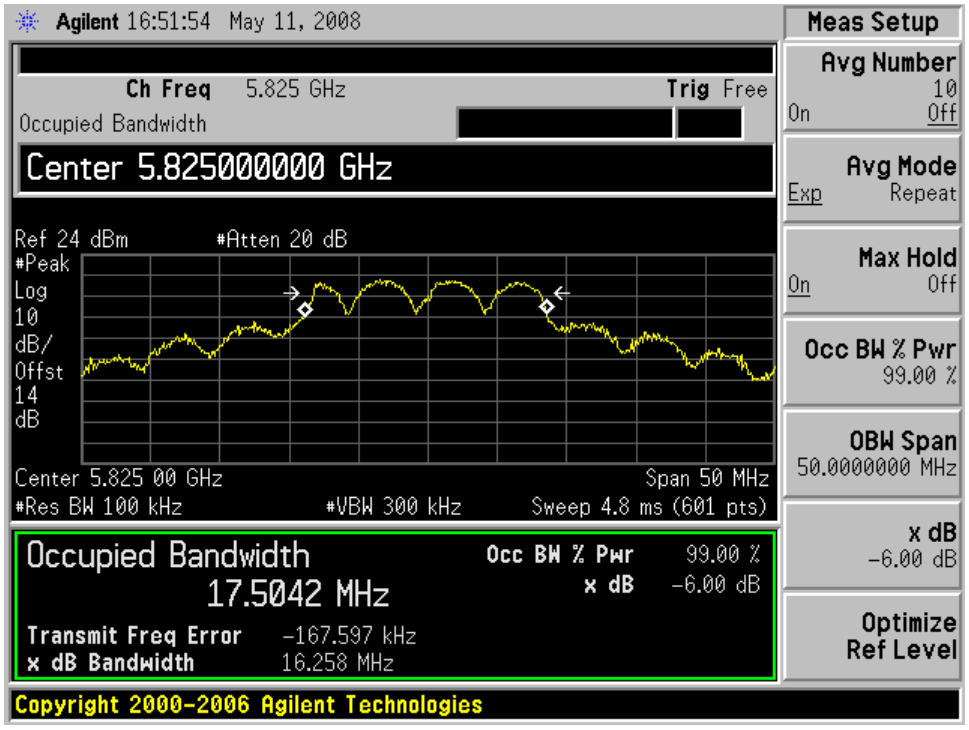
Low Channel



Middle Channel



High Channel



10 FCC §15.247(b) & RSS 210 A8.4 - Maximum Output Power

10.1 Applicable Standard

FCC §15.247 (b); IC RSS-210 A8.4

10.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.

Each chain is measured separately and the total power is calculated using the following formula:

Total Power = 10 log (10^ (Chain A Power / 10) + 10 ^ (Chain B Power / 10))

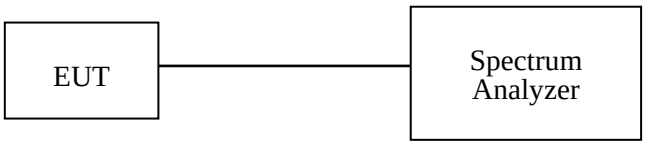
Effective Antenna Gain = Antenna Gain + 10 log (Number Tx Chains)

10.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum analyzer	E4440A	MY44303352	2008-04-28

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

10.4 Test Setup Diagram



10.5 Environmental Conditions

Temperature:	20° C -23° C
Relative Humidity:	30% - 63%
ATM Pressure:	1011mbar - 1019 mbar

**The testing was performed by Xiao Ming Hu from 2008-05-16 to 2008-05-19.*

10.6 Test Result

5725 - 5850 MHz Band (W58)

802.11n 20MHz

Frequency (MHz)/BW	J4 (dBm)	J5 (dBm)	J4 (mW)	J5 (mW)	Total Power (mW)	Total Power (dBm)	Limit (dBm)	Margin (dB)
5745/20	19.22	20.10	83.56	102.33	185.89	22.69	30	-7.31
5785/20	19.74	20.80	94.19	120.23	214.42	23.31	30	-6.69
5825/20	19.03	20.70	79.98	117.49	197.47	22.96	30	-7.04

802.11n 40MHz

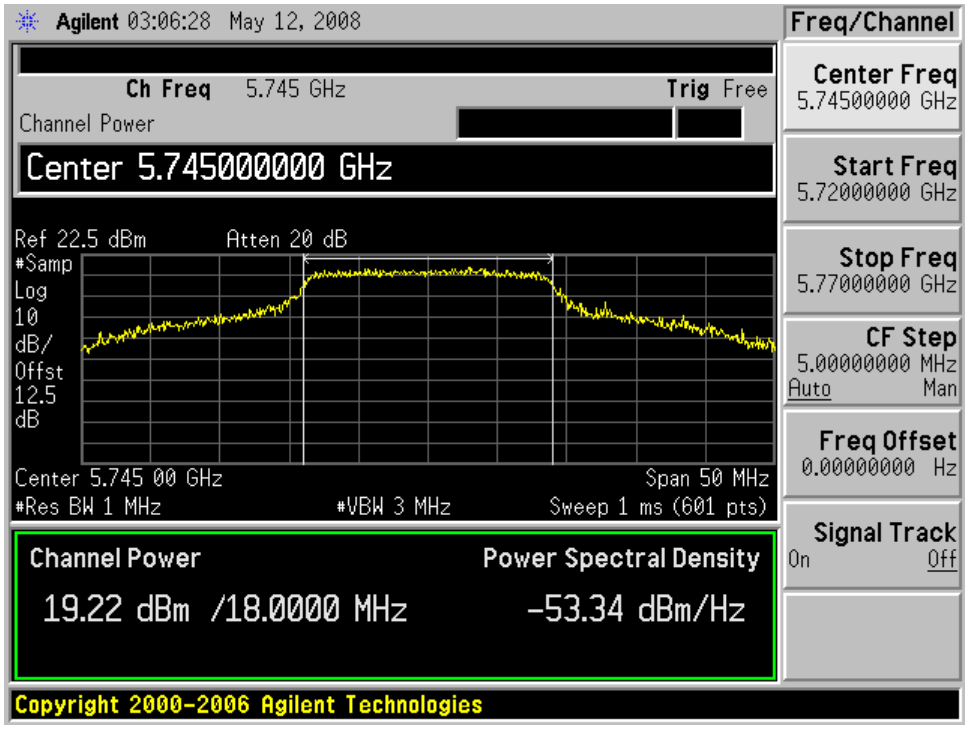
Frequency (MHz)/BW	J4 (dBm)	J5 (dBm)	J4 (mW)	J5 (mW)	Total Power (mW)	Total Power (dBm)	Limit (dBm)	Margin (dB)
5755/40	19.12	19.72	81.66	93.76	175.41	22.44	30	-7.56
5795/40	18.94	20.52	78.34	112.72	191.06	22.81	30	-7.19

802.11a 20MHz

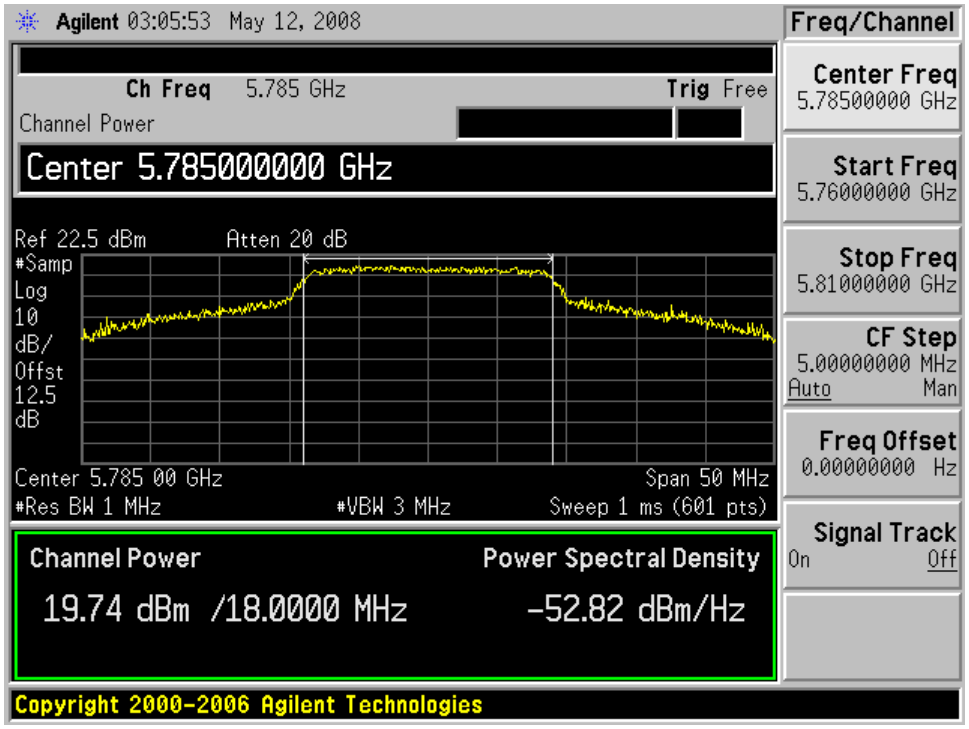
Frequency (MHz)/BW	J4 (dBm)	J5 (dBm)	J4 (mW)	J5 (mW)	Total Power (mW)	Total Power (dBm)	Limit (dBm)	Margin (dB)
5745/20	19.30	20.21	85.11	104.95	190.07	22.79	30	-7.21
5785/20	18.78	18.70	75.51	74.13	149.64	21.75	30	-8.25
5825/20	16.76	18.81	47.42	76.03	123.46	20.92	30	-9.08

802.11n 20MHz, Chain j4

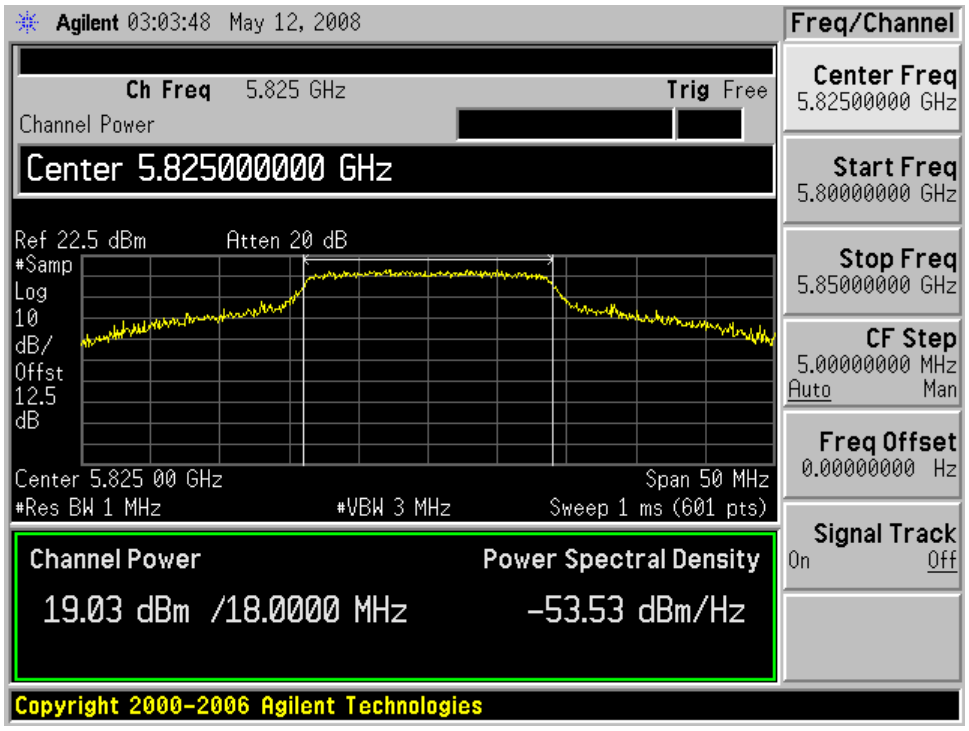
Low Channel



Middle Channel

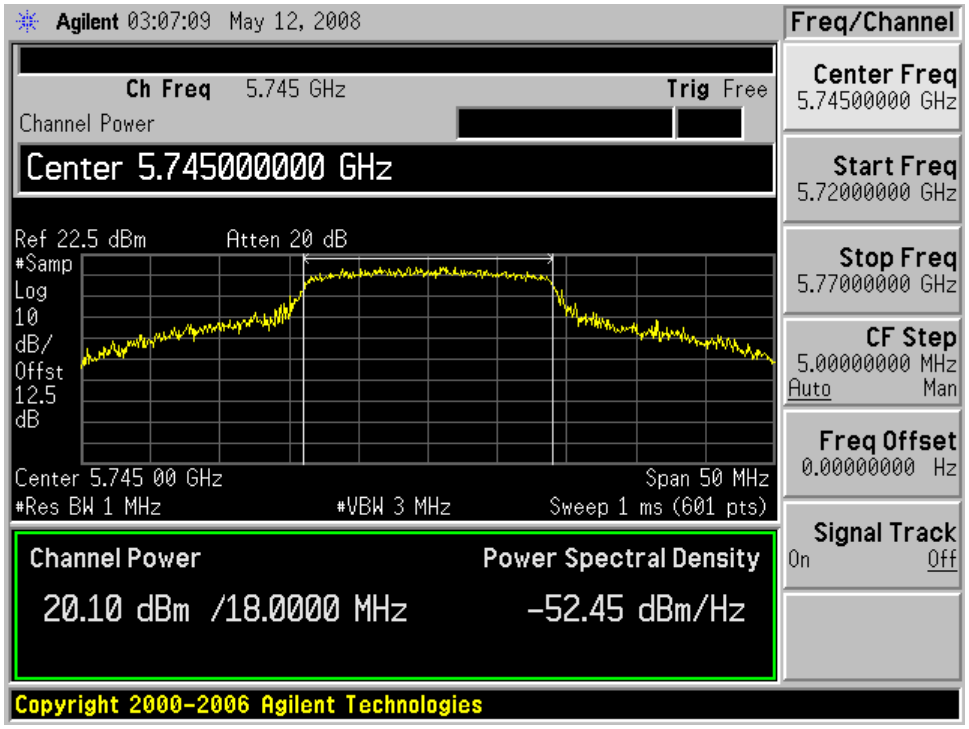


High Channel

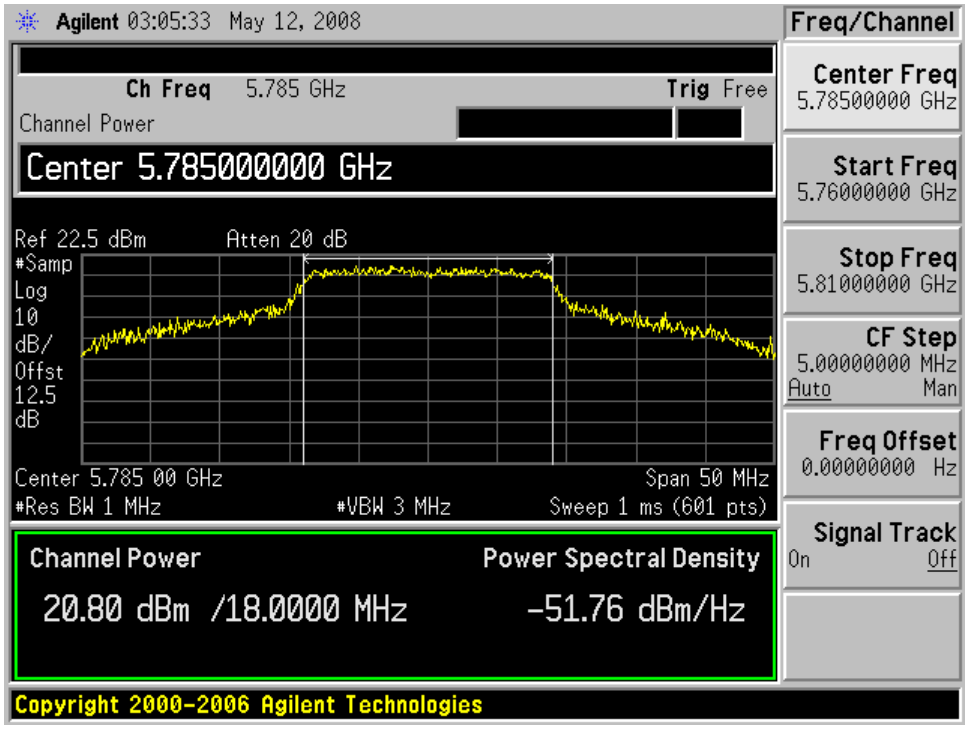


802.11n 20MHz, Chain j5

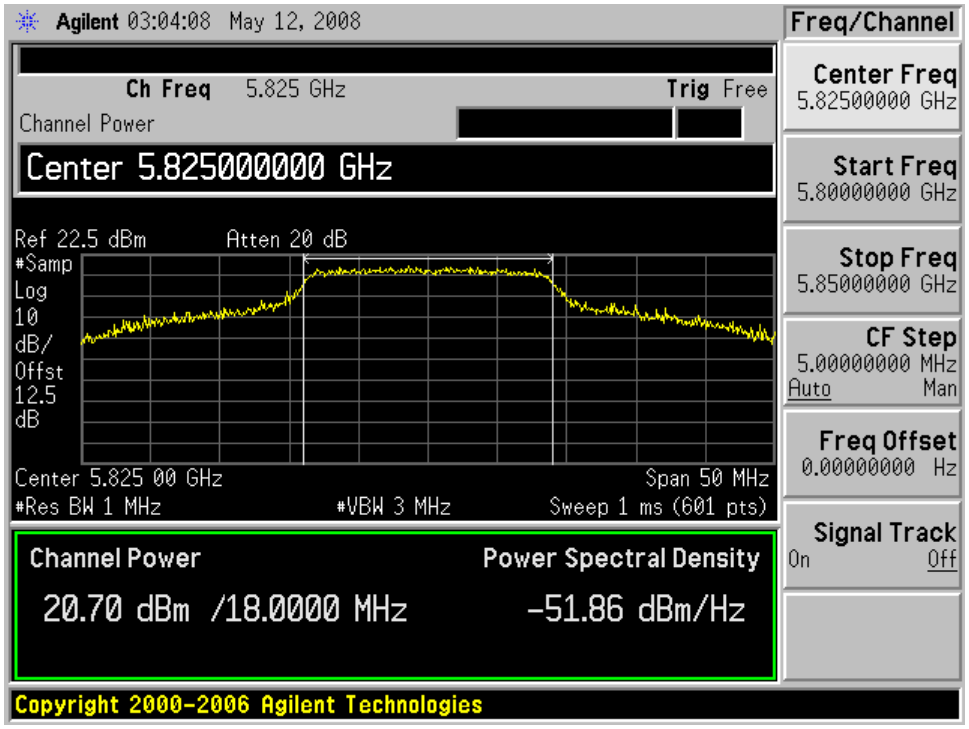
Low Channel



Middle Channel

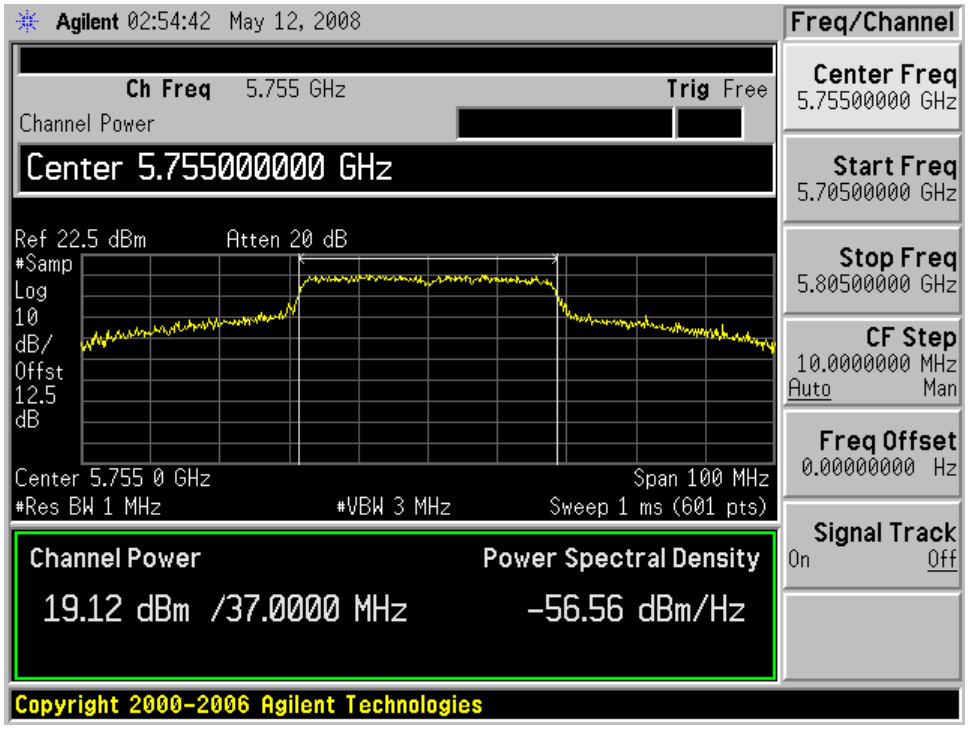


High Channel

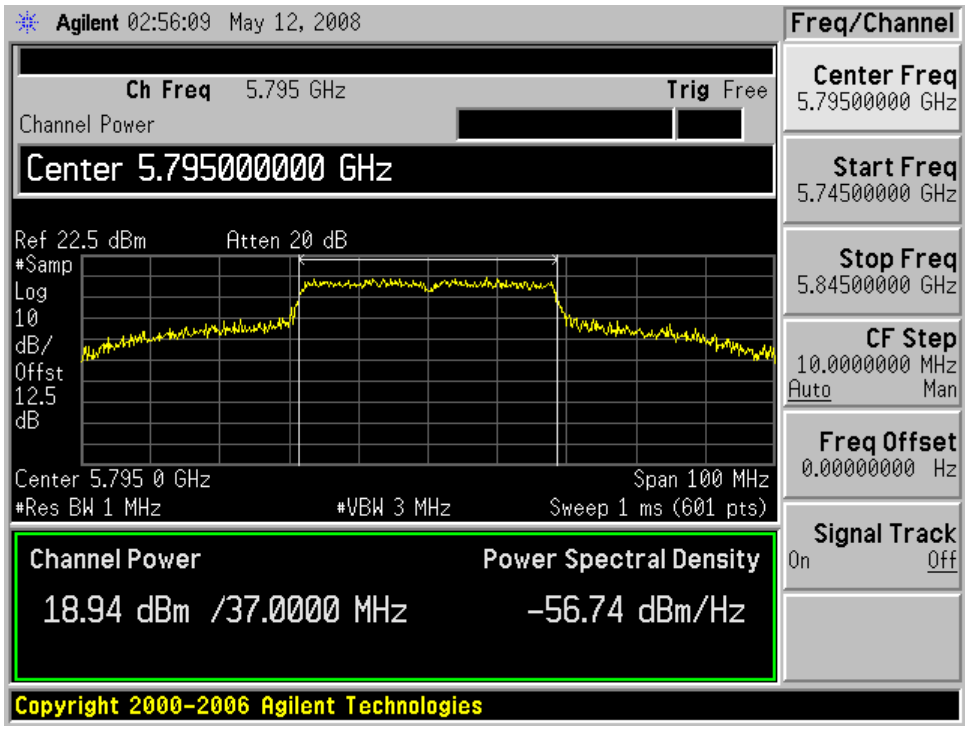


802.11n 40MHz, Chain j4

Low Channel

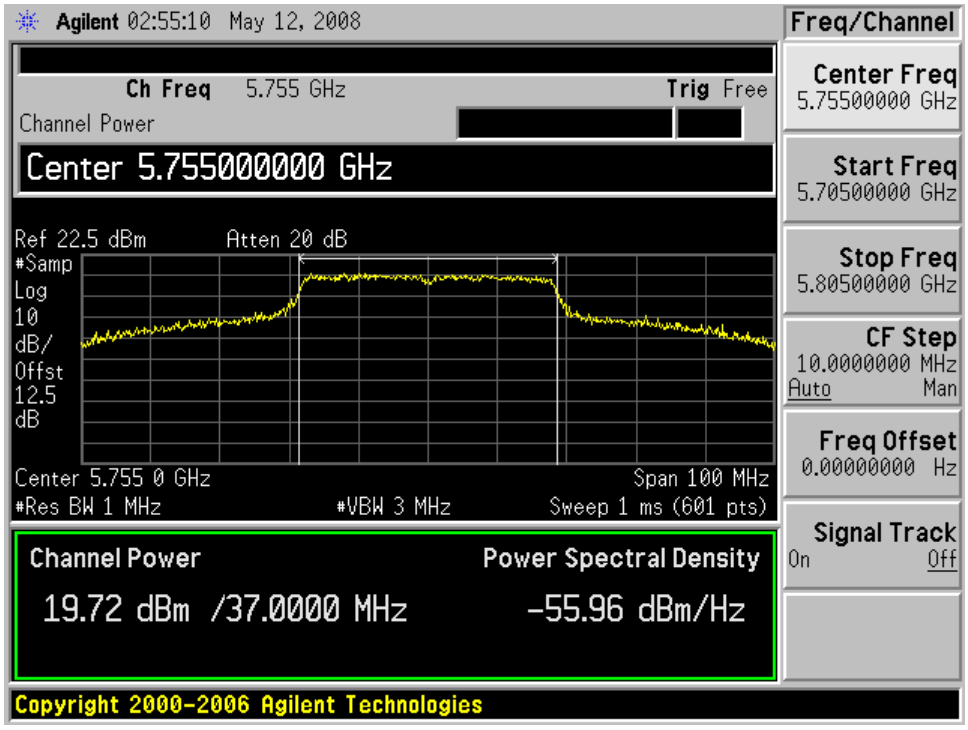


High Channel

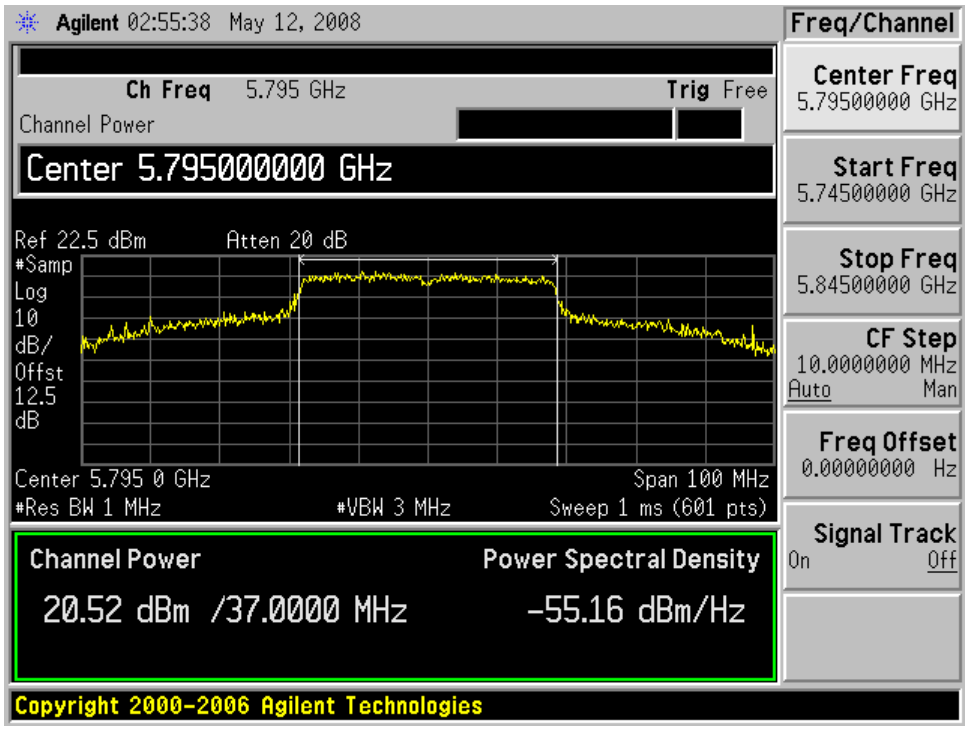


802.11n 40MHz, Chain j5

Low Channel

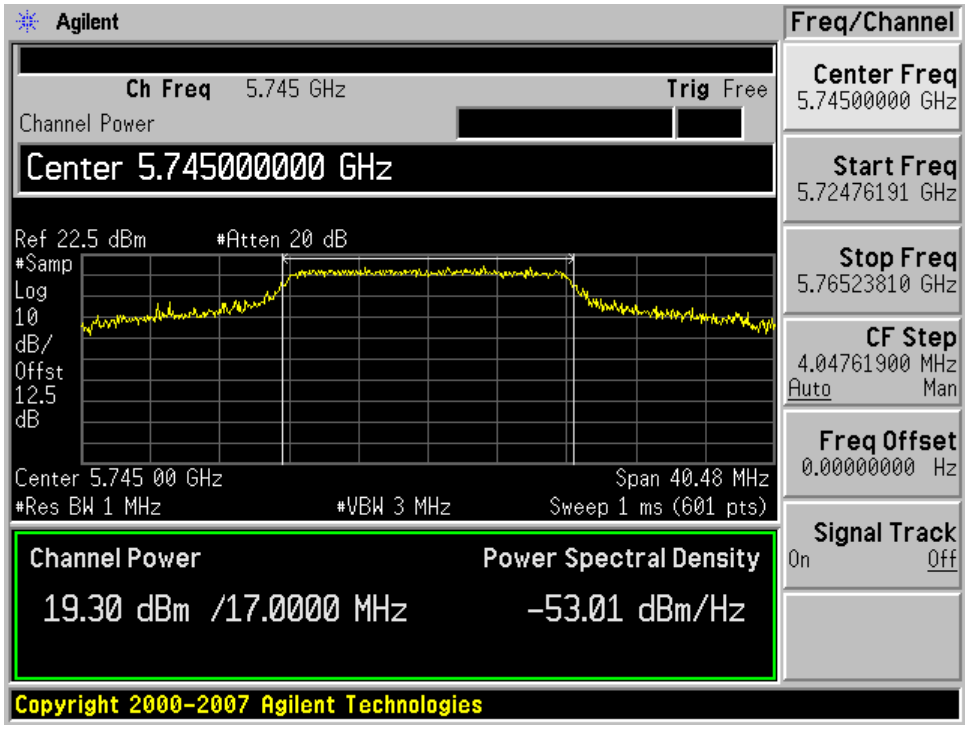


High Channel

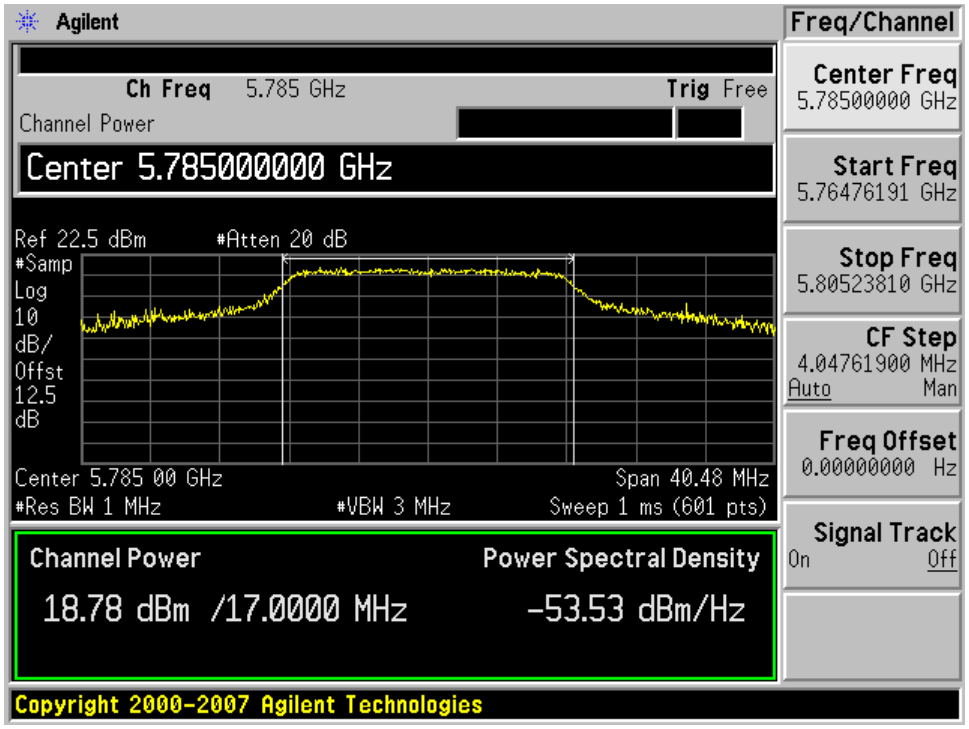


802.11a 20MHz, Chain j4

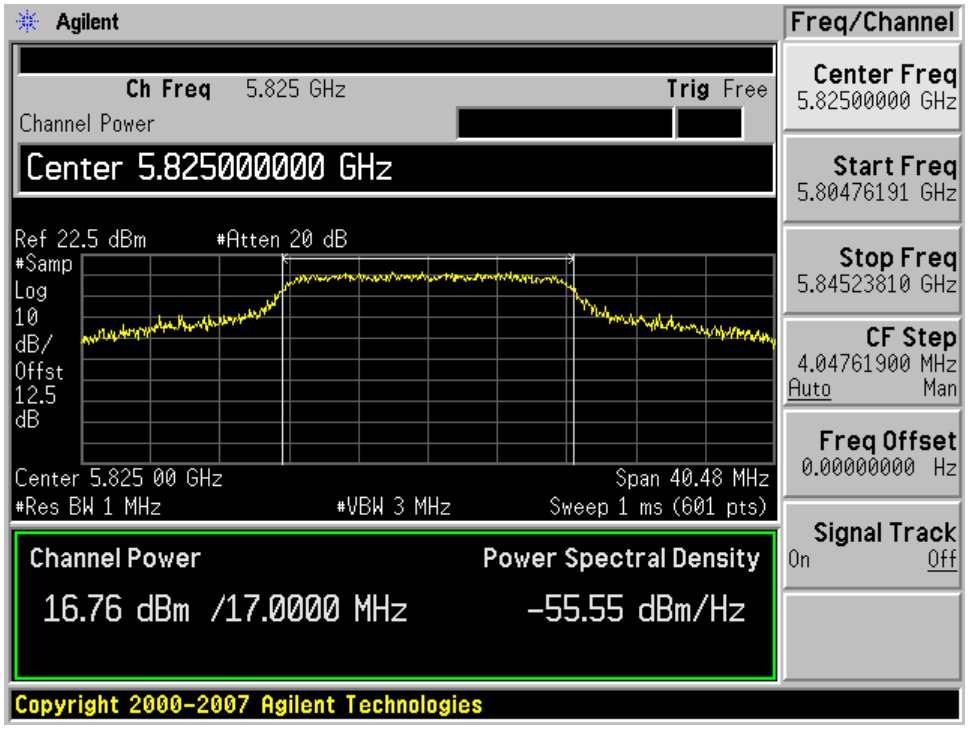
Low Channel



Middle Channel

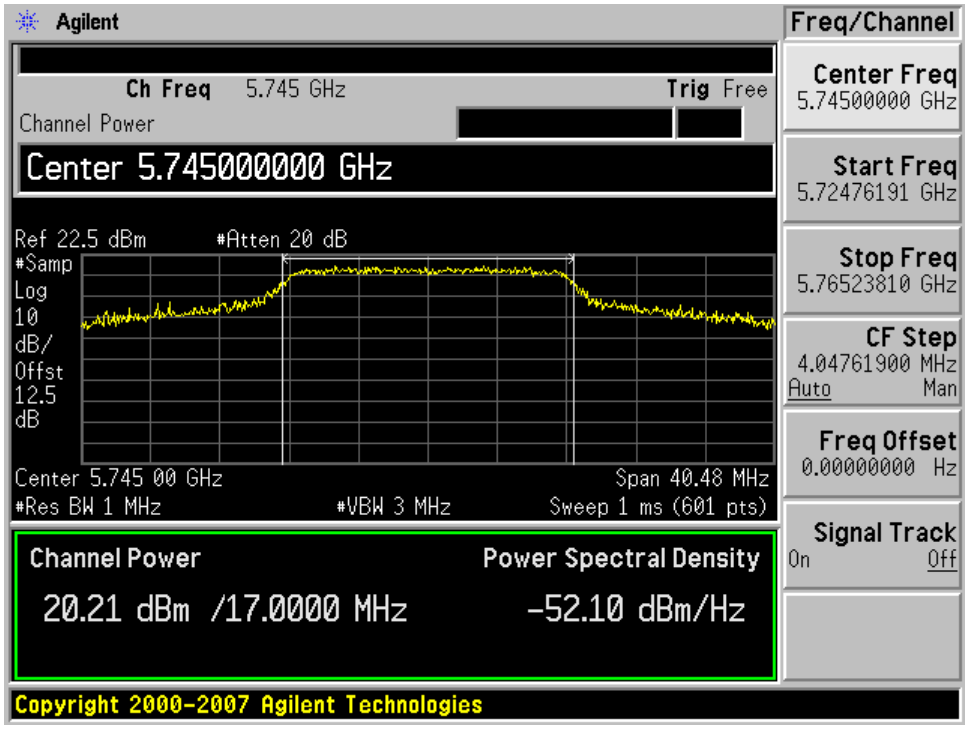


High Channel

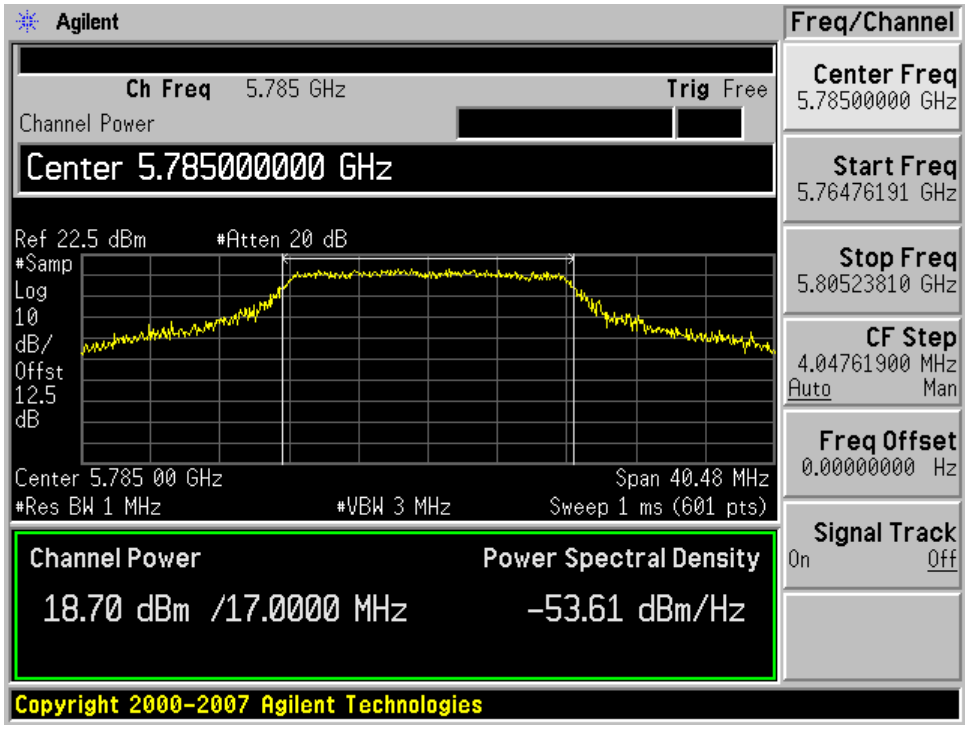


802.11a 20MHz, Chain j5

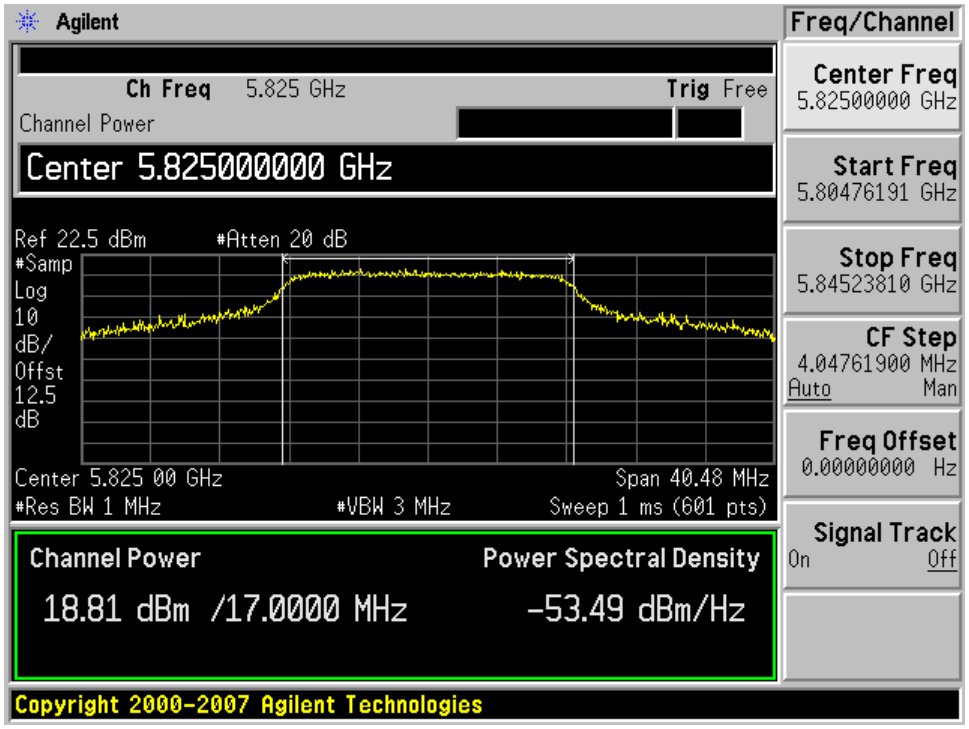
Low Channel



Middle Channel



High Channel



11 FCC 247(e) & RSS 210 A8.2 (b) - PEAK POWER SPECTRAL DENSITY

11.1 Applicable Standard

FCC §15.247(e); IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter antenna port shall not be greater than 8 dBm in any 3 kHz band during any time interval of continues transmission.

11.2 Measurement Procedure

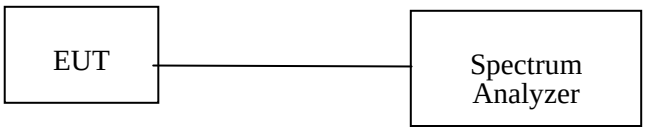
Output power was measured based on the use a peak measurement, therefore the power spectral density was measured using PDS Option 1in accordance with FCC document "Measurement of Digital Transmission System Operating under section 15.247, March 2005"

11.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum analyzer	E4440A	MY44303352	2008-04-28

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

11.4 Test Setup Diagram



11.5 Environmental Conditions

Temperature:	20° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

**The testing was performed by Xiao Ming Hu from 2008-06-02.*

11.6 Test Result

5725 - 5850 MHz Band (W58)

802.11n 20MHz

Frequency (MHz)/BW	PSD with Combiner (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
5745/20	4.01	8	3.99
5785/20	4.42	8	3.58
5825/20	2.87	8	5.13

802.11n 40MHz

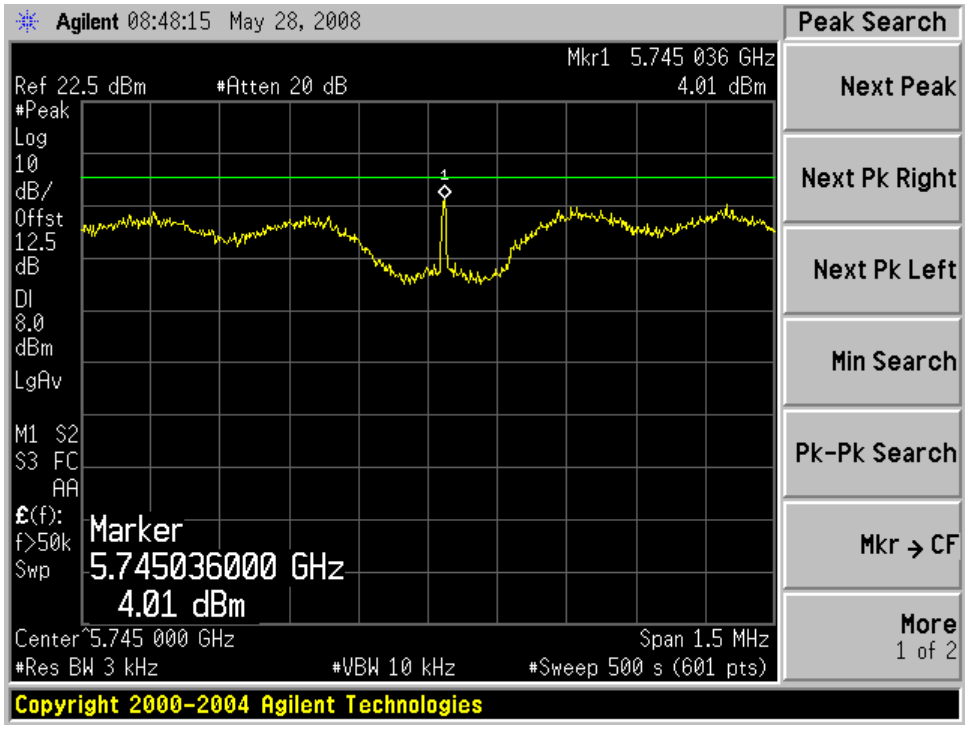
Frequency (MHz)/BW	PSD with Combiner (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
5755/40	5.20	8	2.80
5795/40	3.57	8	4.43

802.11a 20MHz

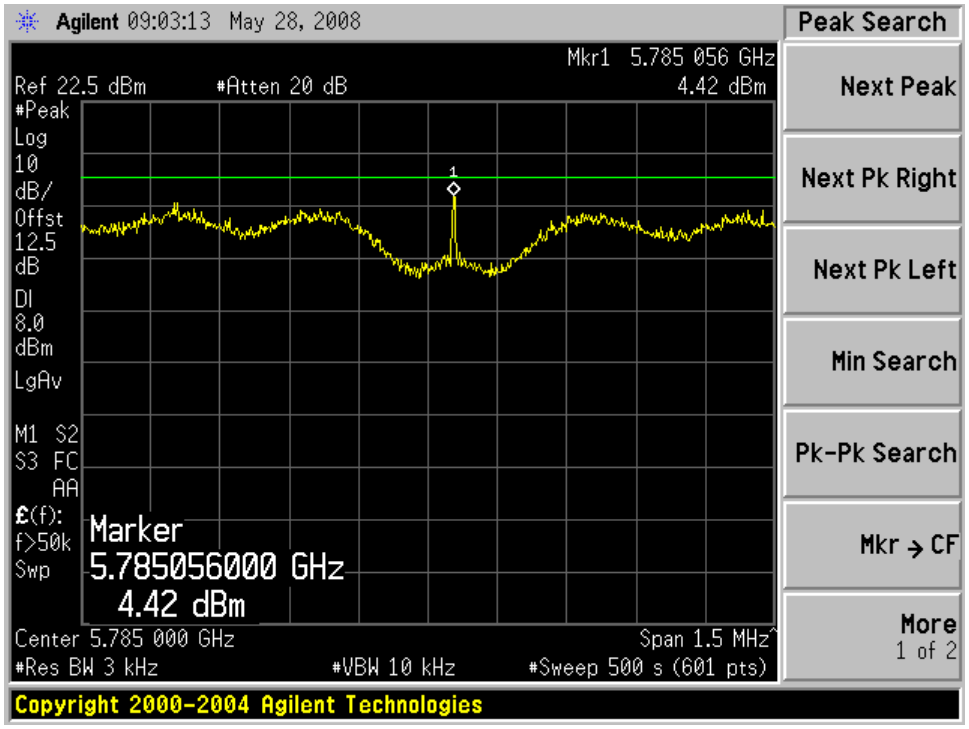
Frequency (MHz)/BW	PSD with Combiner (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
5745/20	0.60	8	7.40
5785/20	2.00	8	6.00
5825/20	-0.32	8	8.32

802.11n 20MHz

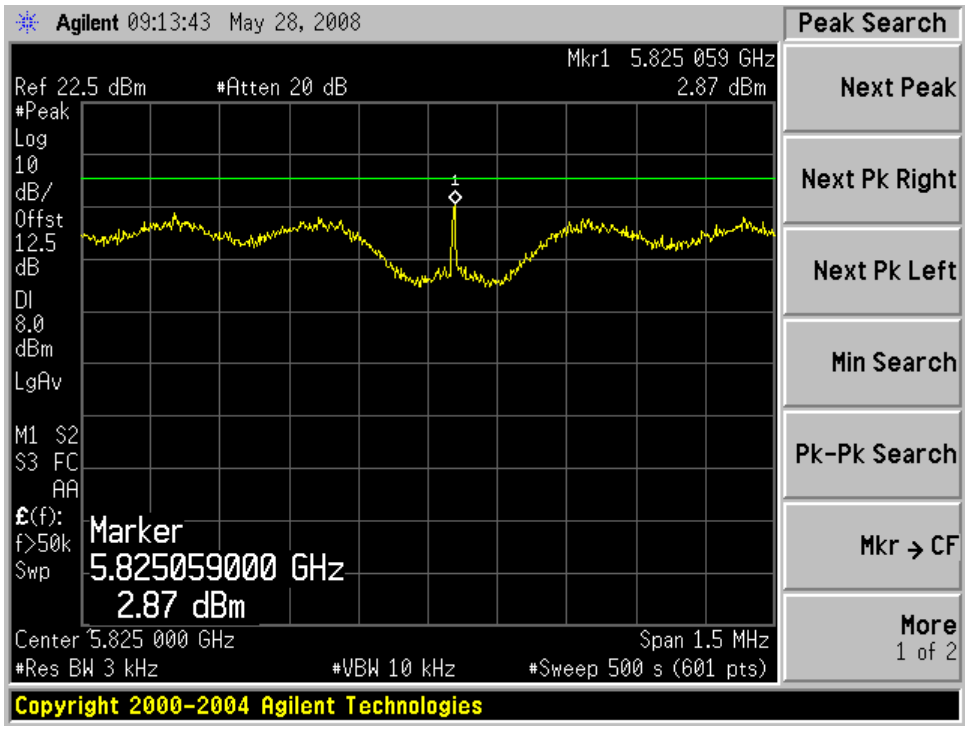
Low Channel



Middle Channel

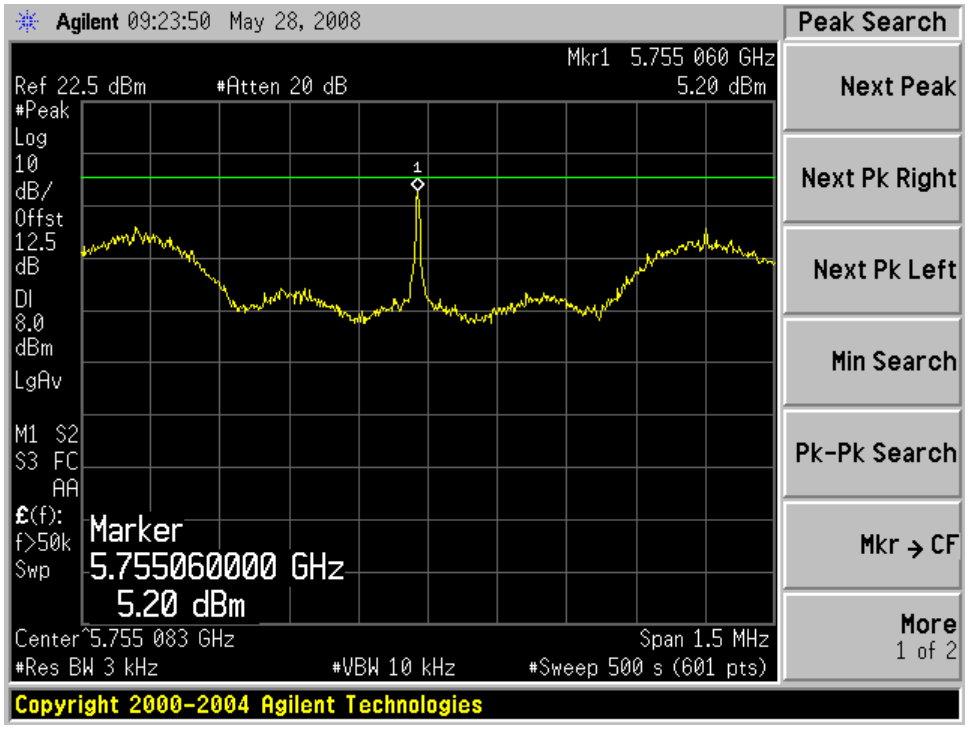


High Channel

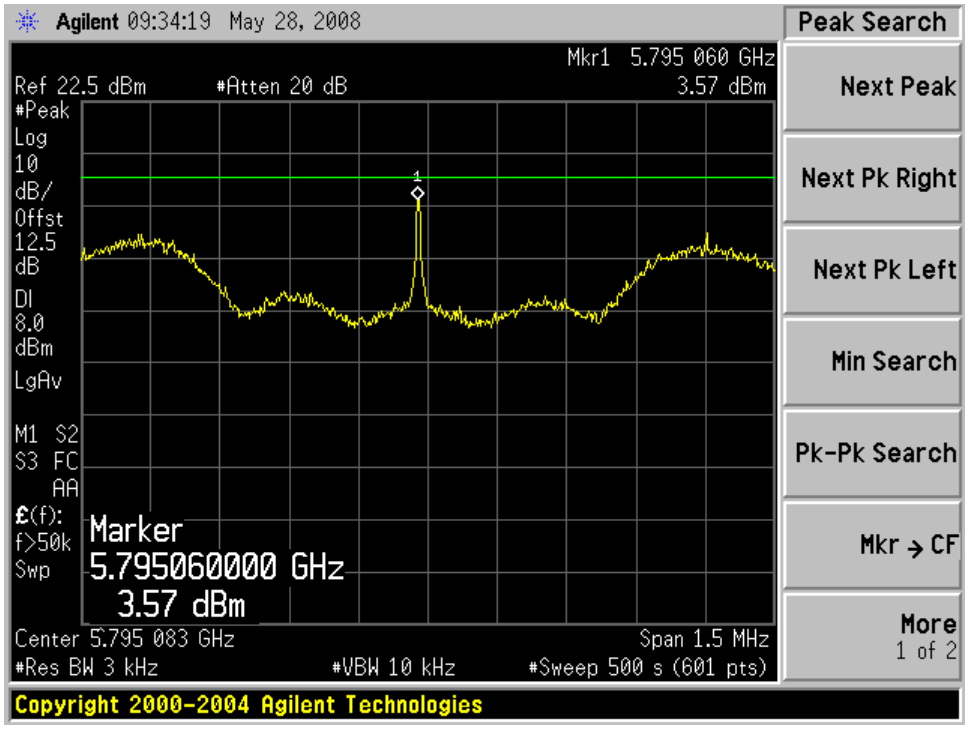


802.11n 40MHz

Low Channel

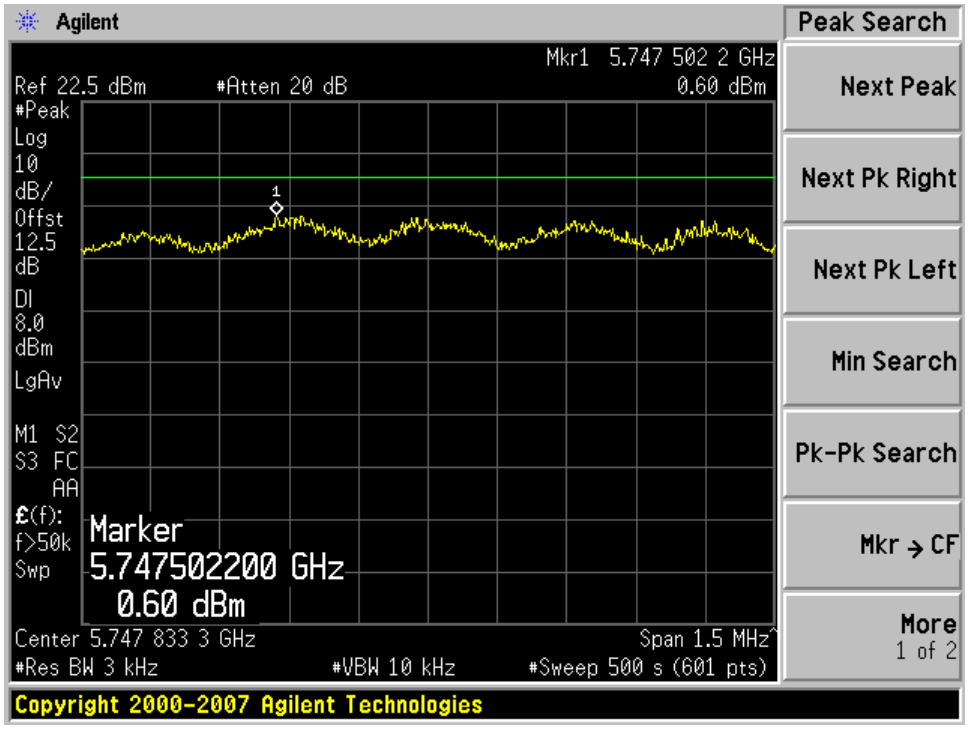


High Channel

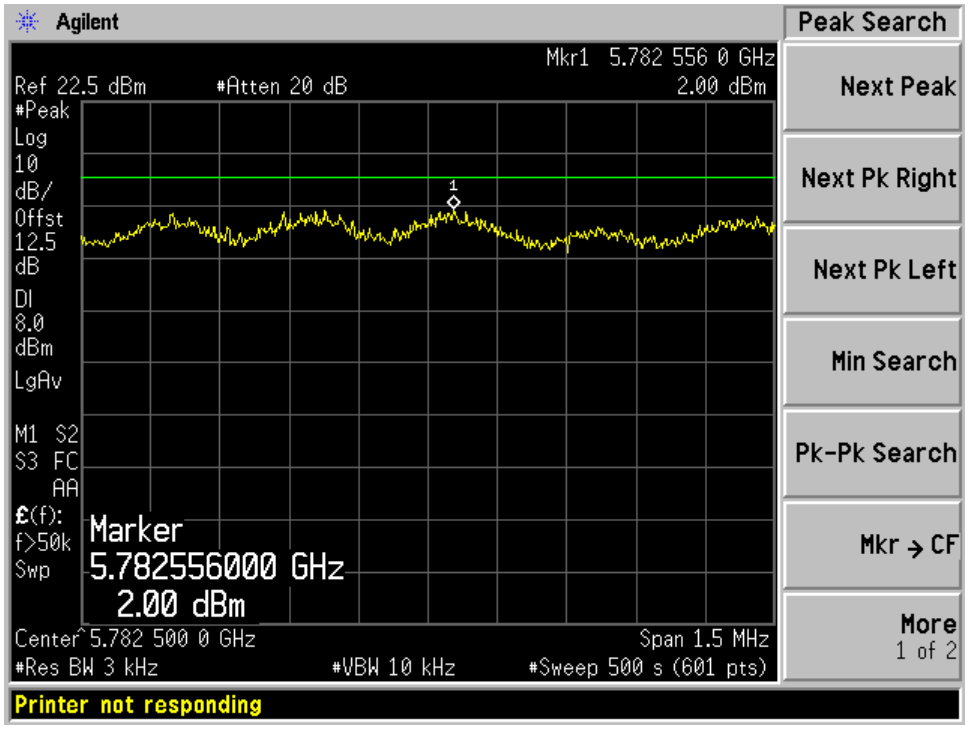


802.11a 20MHz

Low Channel



Middle Channel



High Channel