Lab Code: 200167-0

FCC PART 15 SUBPART E

MEASUREMENT AND TEST REPORT

For

AZALEA NETWORKS

673 S. Milpitas Bld., Ste 105
Milpitas, CA 95035

FCC ID: URP-MSR1000

This Report Concerns:	Product type:
☒ Original Report	802.11a/b/g Wireless Mesh Networking Device

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Report Number:	R0702061-407
Report Date:	2007-03-21
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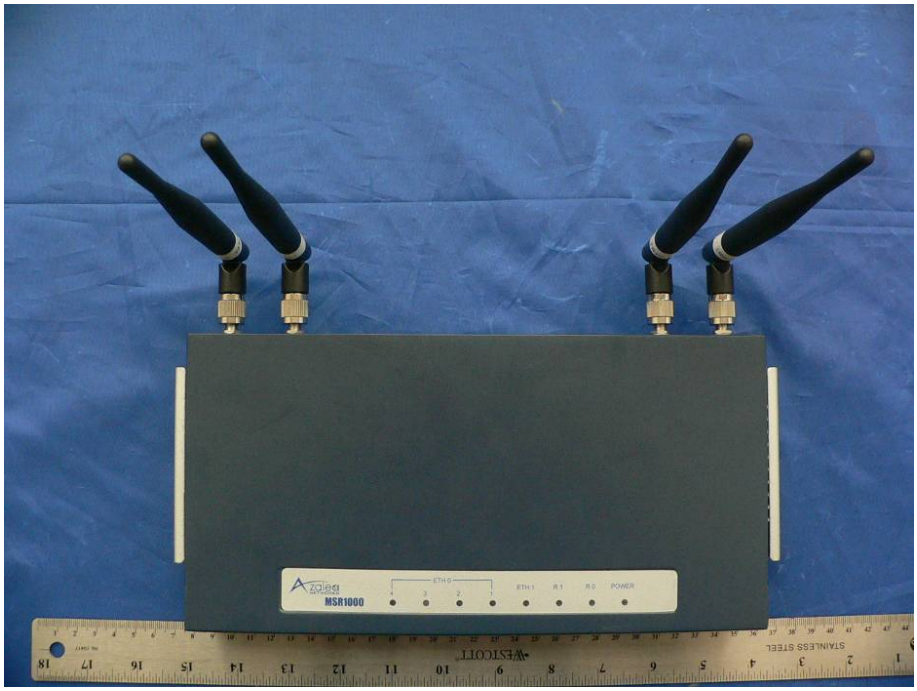
GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

This BACL measurement and test report has been compiled on behalf of *Azalea Networks* and their product *FCC ID: URP-MSR1000*, or the EUT as referred to in the rest of this report. The EUT is an 802.11 a/b/g wireless mesh networking device or router that operates on 2412-2462 MHz, 5180-5240 MHz and 5745-5805 MHz bands. It is designed to work in conjunction with neighboring routers in order to increase the efficiency of data transmissions in a high traffic environment.

** The test data gathered are from a production sample which is provided by the manufacturer with the serial number: 94V-0 0624.*

EUT Photo



Additional EUT photos in Exhibit C

Mechanical Description

The *Azalea Networks* product, measures approximately 267 mm (L) x 135 mm (W) x 35 mm (H) and weighs approximately 1280 g; it is of metallic construction.

Objective

This type approval report is prepared on behalf of *Azalea Networks.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for Maximum Output Power, Antenna Requirements, 26 dB Bandwidth, peak power spectral density, Peak excursion , Band Edges Measurement, Conducted and Radiated Spurious Emissions

Related Submittal(s)/Grant(s)

No Related Submittals.

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.

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.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by BACL Corp. to collect radiated and conducted 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

SYSTEM TEST CONFIGURATION

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.

EUT Exercise Software

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

MODE	5180MHZ	5220MHZ	5240MHZ
802.11a	9 Mbps	9 Mbps	9 Mbps

MODE	5745MHZ	5800MHZ	5805MHZ
802.11a	9 Mbps	9 Mbps	9 Mbps

Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

Equipment Modifications

No modifications were made to the EUT.

Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
IBM	Laptop	T42	23736UU

SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.407 (f) §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§ 15.207 (a)	Conducted Emissions	Compliant
§ 15.407 (b)(1) & (b)(2)	Spurious Emissions at Antenna Port	Compliant
§15.205	Restricted Band	Compliant
§15.209 (a) & §15.407(a)(1) & (a)(2)	Spurious Radiated Emissions	Compliant
§15.247 (a)(2)	99% & 26 dB Bandwidth	N/R
§15.407 (a)(1) & (a)(2)	Maximum Peak Output Power	Compliant, Please refer to FCC ID: NKRCM9
§ 15.407 (a)(6)	Peak Excursion	Compliant, Please refer to FCC ID: NKRCM9
§15.407 (a)(1) & (a)(2)	Power Spectral Density	Compliant, Please refer to FCC ID: NKRCM9
§15.407 (h)	DFS	N/R

§ 15.407 (f) and § 2.1091 - RF EXPOSURE

According to §15.407(f) 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

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
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

MPE Prediction

Predication 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

802.11a (5150 – 5250 MHz) mode:

Maximum peak output power at antenna input terminal:	16.825 (dBm)
Maximum peak output power at antenna input terminal:	48.139 (mW)
Prediction distance:	20 (cm)
Predication frequency:	5180 (MHz)
Antenna Gain (typical):	5 (dBi)
antenna gain:	3.16 (numeric)
Power density at predication frequency at 20 cm:	0.030(mW/cm^2)

MPE limit for uncontrolled exposure at prediction frequency: 1.0 (mW/cm^2)

802.11a (5725 – 5825 MHz) mode:

Maximum peak output power at antenna input terminal:	20.043 (dBm)
Maximum peak output power at antenna input terminal:	101.0 (mW)
Prediction distance:	20 (cm)
Predication frequency:	5805(MHz)
Antenna Gain (typical):	5 (dBi)
antenna gain:	3.16 (numeric)
Power density at predication frequency at 20 cm:	0.063 (mW/cm^2)

MPE limit for uncontrolled exposure at prediction frequency: 1.0 (mW/cm^2)

Test Result

The Power Density Level at 20 cm for b/g/n mode is:

For 5150 – 5250 MHz: **802.11a mode** = 0.030mW/cm^2

For 5725 – 5825 MHz: **802.11a mode** = 0.063mW/cm^2

which is below the uncontrolled exposure limit of 1.0mW/cm^2.

§15.203 - ANTENNA REQUIREMENT

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.

Result: The antennae for this device are four identical, dual band antennae with the gain of 5 dBi. Each antenna features a reverse polarity connection type to ensure that non-OEM antennae cannot be implemented by the end user:

2.4 GHz band
Antenna: 5 dBi

5.2GHz band
Antenna: 5 dBi

§15.107 - CONDUCTED EMISSIONS

Section 15.107 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	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

** Decreases with the logarithm of the frequency.*

Test Setup

The measurement was performed at shielded 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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	Artificial-Mains Network	ESH2-Z5	871884/039	2006-11-14
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2006-03-13

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

Test Procedure

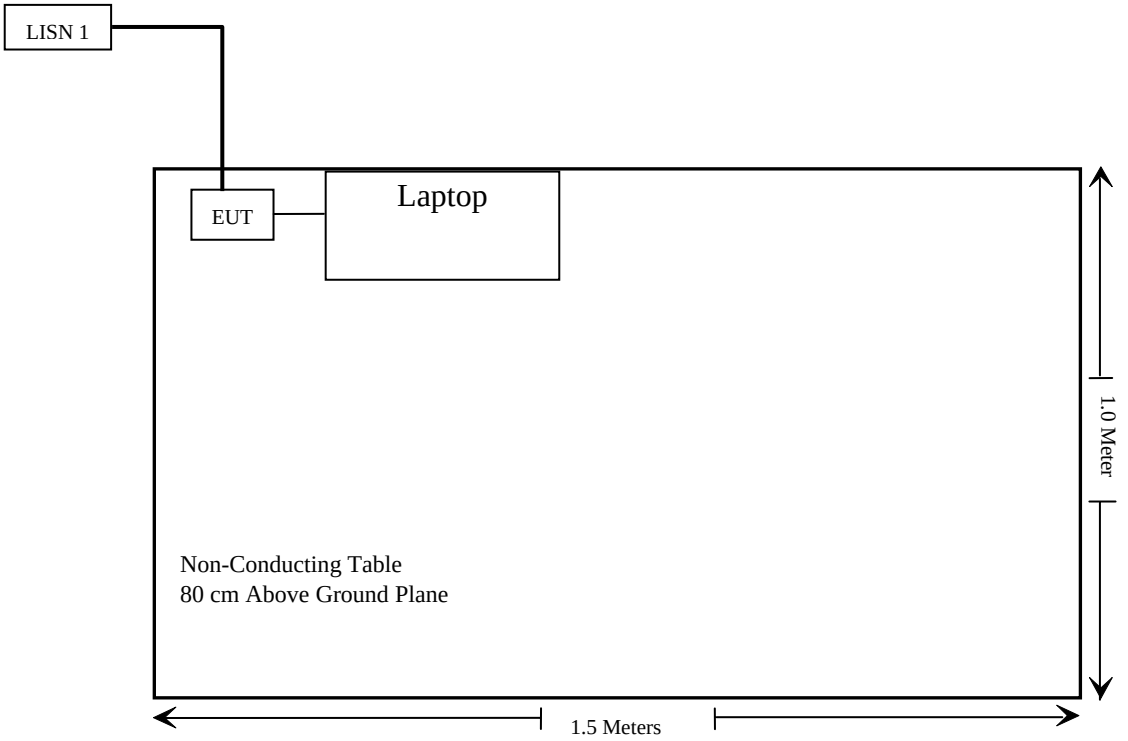
During the conducted emissions test, the power cord of the EUT was connected to the mains outlet of the LISN-1.

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".

Test Setup Diagram

Conducted Emissions



Environmental Conditions

Temperature:	20° C -23° C
Relative Humidity:	30% - 63%
ATM Pressure:	101.1 – 101.9 kPa

**The testing was performed by Dan Coronia from 2007-02-15, 22 to 03-14*

Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits for Class B devices, with the *worst* margin reading of:

AC Adaptor:

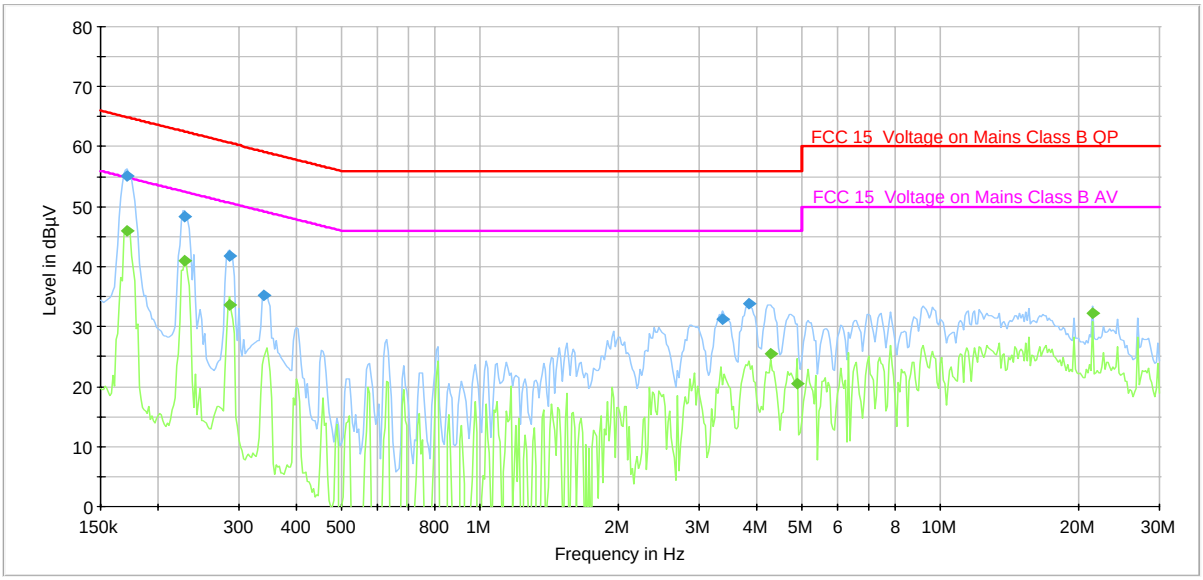
-9.0 dB at **0.171760 MHz** in the Line conductor mode

POE:

-4.3 dB at **16.777460 MHz** in the Neutral Line conductor mode

Adaptor:

120V/60 Hz Line:



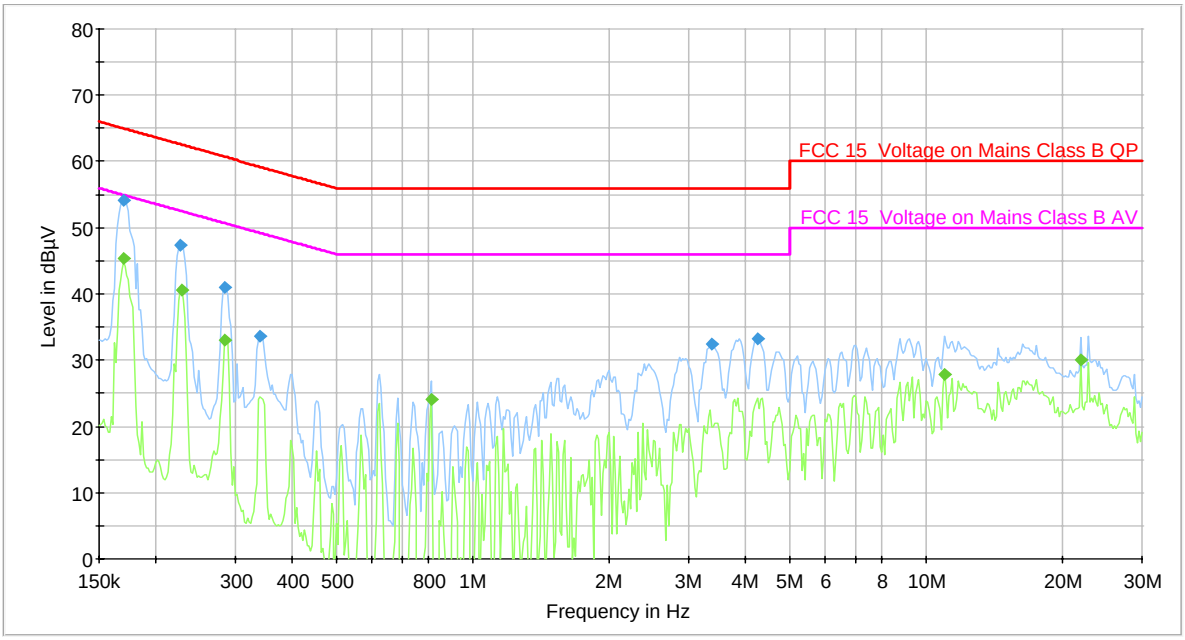
Quasi-Peak

Frequency (MHz)	Quasi Peak (dBµV)	Line	Correction Factor (dB)	Limit (dBµV)	Margin (dB)
0.171760	55.1	L1	0.1	64.9	-9.8
0.228820	48.4	L1	0.2	62.5	-14.1
0.228820	48.4	L1	0.2	62.5	-14.1
0.286020	41.8	L1	0.2	60.6	-18.8
0.340820	35.2	L1	0.3	59.2	-24.0
3.381890	31.3	L1	0.3	56.0	-24.7

Average

Frequency (MHz)	Average (dBµV)	Line	Correction Factor (dB)	Limit (dBµV)	Margin (dB)
0.171760	45.9	L1	0.1	54.9	-9.0
0.228820	40.9	L1	0.2	52.5	-11.6
0.228820	40.9	L1	0.2	52.5	-11.6
0.286020	33.7	L1	0.2	50.6	-17.0
4.295120	25.5	L1	0.3	46.0	-20.5
4.879150	20.5	L1	0.3	46.0	-25.5

120V/60 Hz Neutral:



Quasi-Peak

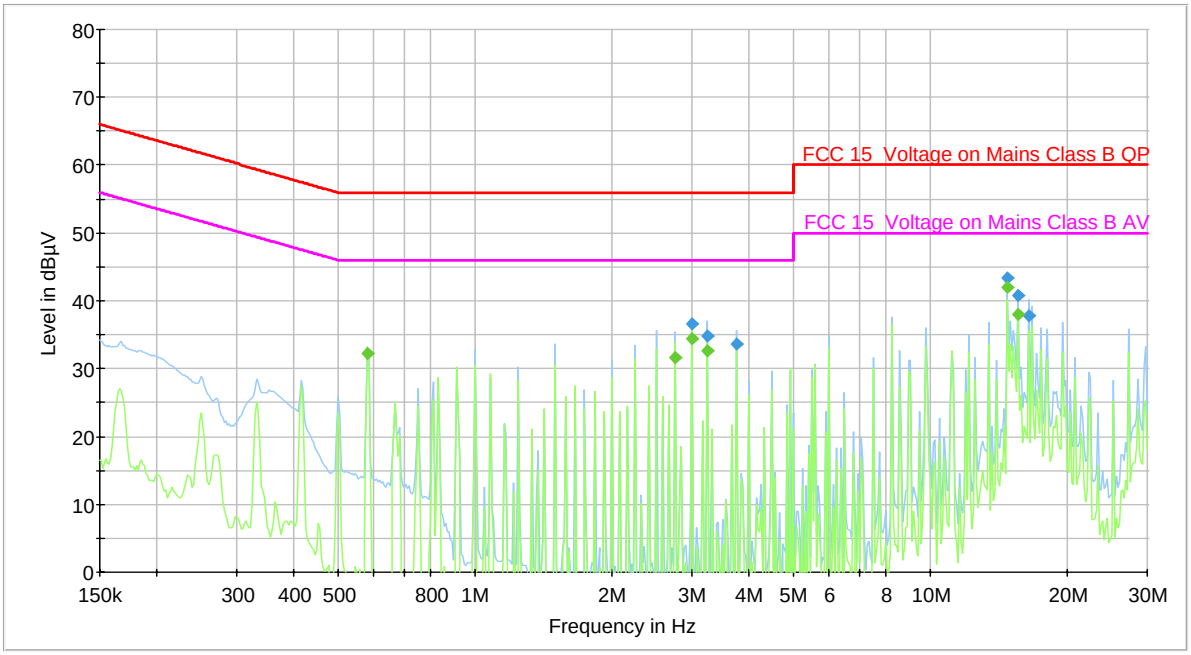
Frequency (MHz)	Quasi Peak (dBµV)	Line	Correction Factor (dB)	Limit (dBµV)	Margin (dB)
0.205000	51.4	Neutral	0.2	63.4	-12.0
0.309000	40.0	Neutral	0.2	60.0	-20.0
0.809000	27.9	Neutral	0.3	56.0	-28.1
0.409000	29.3	Neutral	0.4	57.7	-28.4
1.169000	26.7	Neutral	0.3	56.0	-29.3
1.369000	21.9	Neutral	0.2	56.0	-34.1

Average

Frequency (MHz)	Average (dBµV)	Line	Correction Factor (dB)	Limit (dBµV)	Margin (dB)
0.205000	39.3	Neutral	0.2	53.4	-14.1
0.809000	24.8	Neutral	0.3	46.0	-21.2
1.169000	24.3	Neutral	0.3	46.0	-21.7
0.309000	28.1	Neutral	0.2	50.0	-21.9
0.413000	21.2	Neutral	0.4	47.6	-26.4
0.681000	18.7	Neutral	0.3	46.0	-27.3

POE (Power over Ethernet):

120V/60 Hz Line:



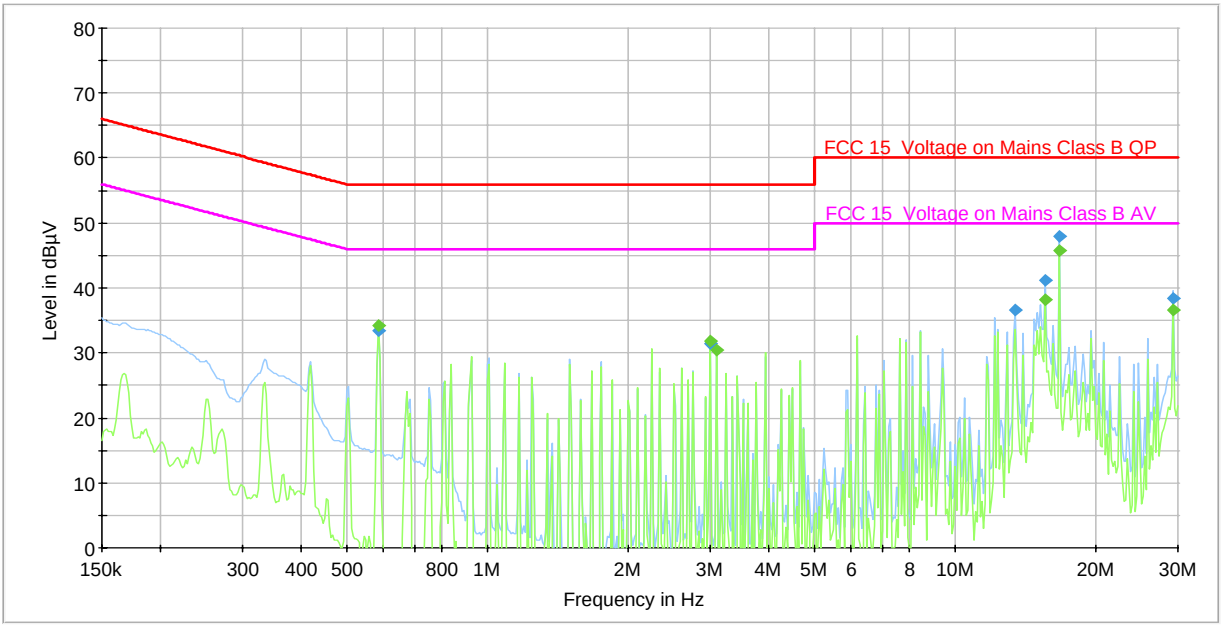
Quasi-Peak

Frequency (MHz)	Quasi Peak (dBµV)	Line	Correction Factor (dB)	Limit (dBµV)	Margin (dB)
14.769230	43.4	L1	0.5	60.0	-16.6
15.616420	40.9	L1	0.3	60.0	-19.1
3.000900	36.5	L1	0.3	56.0	-19.5
3.249800	34.8	L1	0.3	56.0	-21.3
16.512210	37.8	L1	0.4	60.0	-22.2
3.750990	33.6	L1	0.3	56.0	-22.4

Average

Frequency (MHz)	Average (dBµV)	Line	Correction Factor (dB)	Limit (dBµV)	Margin (dB)
14.769230	42.0	L1	0.5	50.0	-8.0
3.000900	34.5	L1	0.3	46.0	-11.5
15.616420	38.1	L1	0.3	50.0	-11.9
3.249800	32.7	L1	0.3	46.0	-13.3
0.581280	32.2	L1	0.3	46.0	-13.9
2.749070	31.6	L1	0.2	46.0	-14.4

120V/60 Hz Neutral:



Quasi-Peak

Frequency (MHz)	Quasi Peak (dBµV)	Line	Correction Factor (dB)	Limit (dBµV)	Margin (dB)
16.777460	48.0	Neutral	0.6	60.0	-12.0
15.616420	41.2	Neutral	0.3	60.0	-18.9
29.306470	38.3	Neutral	0.5	60.0	-21.7
0.585930	33.5	Neutral	0.3	56.0	-22.5
13.422440	36.6	Neutral	0.5	56.0	-23.4
3.000900	31.4	Neutral	0.3	56.0	-24.6

Average

Frequency (MHz)	Average (dBµV)	Line	Correction Factor (dB)	Limit (dBµV)	Margin (dB)
16.777460	45.7	Neutral	0.6	50.0	-4.3
15.616420	38.2	Neutral	0.3	50.0	-11.8
0.585930	34.1	Neutral	0.3	46.0	-11.9
29.306470	36.6	Neutral	0.5	50.0	-13.4
3.000900	31.8	Neutral	0.3	46.0	-14.2
3.098090	30.4	Neutral	0.3	46.0	-15.6

§15.205 & §15.109 & §15.407(b) - RADIATED SPURIOUS EMISSIONS

Applicable Standard

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		

As per 15.407(b): Undesirable emission limits: Except as shown in paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

(4) For transmitters operating in the 5.725–5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

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 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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Sonoma Instruments	Pre amplifier	317	260408	2006-03-02
Agilent	Pre amplifier	8449B	3008A01978	2006-08-10
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100337	2007-03-08
Sunol Science Corp	System Controller	S9V	113005-1	NR
Agilent	Spectrum Analyzer	E4440A	MY44303352	2007-02-23
A.R.A	Antenna Horn	DRG-118/A	1132	2006-08-17
Agilent	Spectrum Analyzer	8565EC	3946A00131	2007-01-24

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

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

Corrected Amplitude & Margin Calculation

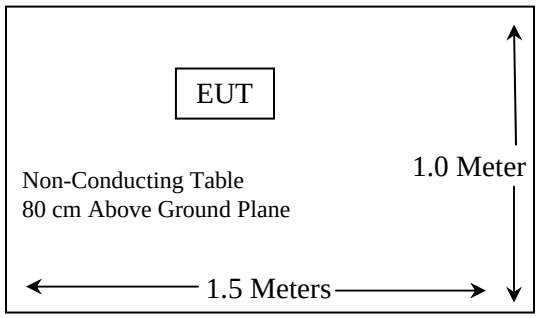
The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

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

Test Setup Diagram



Environmental Conditions

Temperature:	20° C -23° C
Relative Humidity:	30% - 63%
ATM Pressure:	101.1kPa – 101.9 kPa

**The testing was performed by Dan Coronia from 2007-02-15, 22 to 03-14*

Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart E, section 15.205, 15.209 and 15.407, and had the worst margin of:

Unintentional Emissions:

-19 dB at **669.392500 MHz** in the **Vertical** polarization for 30 MHz to 1000 MHz

For 5150 – 5250 MHz: **802.11a**

-7.8 dB at **155540.0000 MHz** in the **Vertical** polarization for Low Channel, 1GHz – 25GHz
-7.9 dB at **15660.0000 MHz** in the **Vertical** polarization for Middle Channel, 1GHz – 25GHz
-9.4 dB at **10480.0000 MHz** in the **Vertical** polarization for High Channel, 1GHz – 25GHz

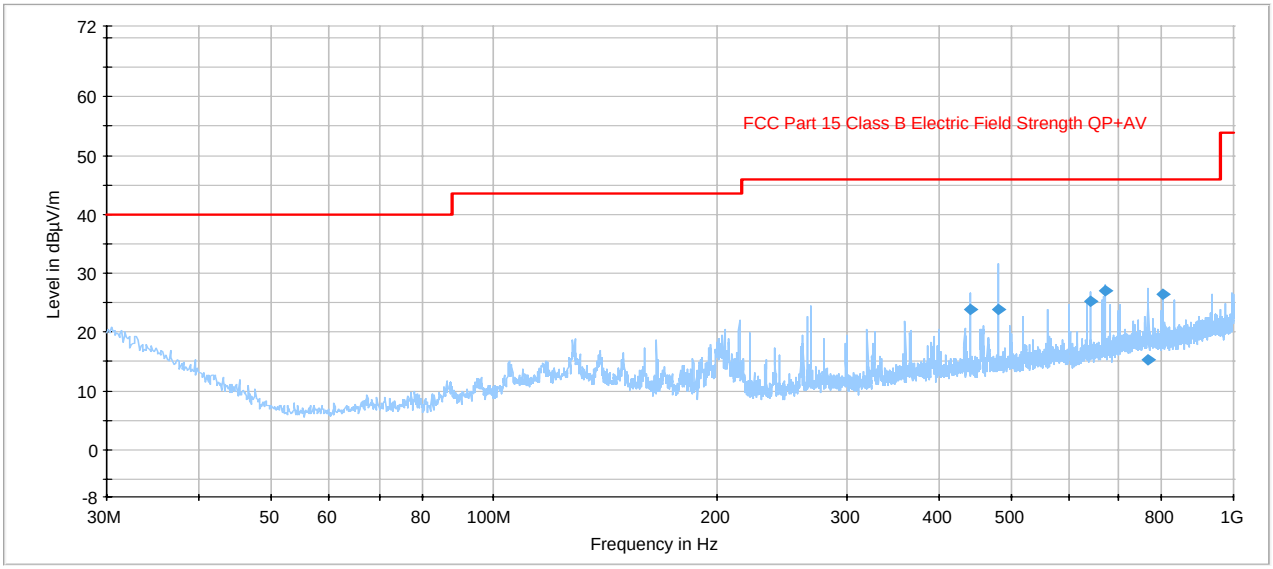
For 5745 – 5805 MHz: **802.11a**

-17.8 dB at **11490.0000 MHz** in the **Vertical** polarization for Low Channel, 1GHz – 25GHz
-3.9 dB at **11570.0000 MHz** in the **Horizontal** polarization for Middle Channel, 1GHz – 25GHz
-2.1 dB at **17415.0000 MHz** in the **Vertical** polarization for High Channel, 1GHz – 25GHz

Radiated Emissions Test plot & data:

Primary scan 30MHz -1GHz

Frequency (MHz)	Quasi Peak (dBµV/m)	Antenna Height (cm)	Polarity	Turntable Position (deg)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
669.392500	27.0	100.0	V	115.0	-15.7	46.0	-19.0
803.252500	26.5	102.0	V	248.0	-14.0	46.0	-19.5
640.008750	25.2	101.0	H	347.0	-16.1	46.0	-20.8
439.987500	23.9	156.0	V	137.0	-19.1	46.0	-22.1
480.000000	23.9	116.0	V	122.0	-18.3	46.0	-22.1
767.297500	15.2	101.0	H	10.0	-13.9	46.0	-30.8



For 5150 – 5250 MHz: **802.11a**

Low channel

Frequency (MHz)	Reading (dBµV)	Azimuth Degree	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amp. dB	Correction Factor (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5180.0000	101.3	289	2.0	V	34.0	3.9	34.9	104.3			Fund/Peak
5180.0000	93.2	48	1.0	H	34.0	3.9	34.9	96.3			Fund/Peak
5180.0000	91.5	289	2.0	V	34.0	3.9	34.9	94.6			Ave
5180.0000	83.5	48	1.0	H	34.0	3.9	34.9	86.6			Ave
15540.0000	31.8	156	1.5	V	40.4	7.3	33.2	46.2	54	-7.8	Ave
15540.0000	31.8	217	1.0	H	40.4	7.3	33.2	46.2	54	-7.8	Ave
10360.0000	38.0	252	1.5	H	38.0	5.7	36.8	44.9	54	-9.1	Ave
10360.0000	37.0	301	1.7	V	38.0	5.7	36.8	43.9	54	-10.1	Ave
10360.0000	51.4	252	1.5	H	38.0	5.7	36.8	58.3	74	-15.7	Peak
15540.0000	43.6	156	1.7	V	40.4	7.3	33.2	58.0	74	-16.0	Peak
10360.0000	50.3	301	1.7	V	38.0	5.7	36.8	57.2	74	-16.8	Peak
15540.0000	42.5	217	1.0	H	40.4	7.3	33.2	56.9	74	-17.1	Peak

Middle channel

Frequency (MHz)	Reading (dBµV)	Azimuth Degree	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amp. dB	Correction Factor (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5220.0000	104.1	205	1.2	V	34.0	4.0	34.4	107.7			Fund/Peak
5220.0000	96.0	327	1.1	H	34.0	4.0	34.4	99.5			Fund/Peak
5220.0000	94.3	205	1.2	V	34.0	4.0	34.4	97.9			Ave
5220.0000	86.2	327	1.1	H	34.0	4.0	34.4	89.7			Ave
15660.0000	31.7	213	1.3	V	40.4	7.2	33.2	46.1	54	-7.9	Ave
15660.0000	31.7	315	1.4	H	40.4	7.2	33.2	46.1	54	-7.9	Ave
10440.0000	38.0	290	1.5	H	38.0	5.8	36.8	45.0	54	-9.0	Ave
10440.0000	38.0	227	1.8	V	38.0	5.8	36.8	44.9	54	-9.1	Ave
15660.0000	43.8	315	1.4	H	40.4	7.2	33.2	58.2	74	-15.8	Peak
15660.0000	43.4	213	1.3	V	40.4	7.2	33.2	57.8	74	-16.2	Peak
10440.0000	50.7	227	1.8	V	38.0	5.8	36.8	57.6	74	-16.4	Peak
10440.0000	50.4	290	1.5	H	38.0	5.8	36.8	57.4	74	-16.6	Peak

High channel

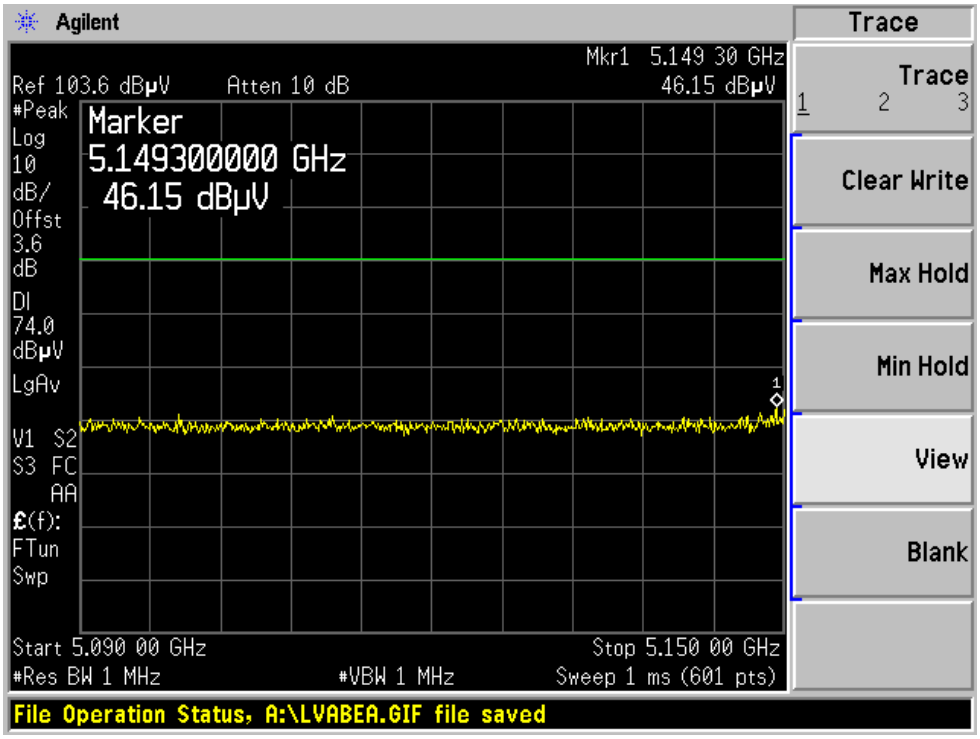
Frequency (MHz)	Reading (dBµV)	Azimuth Degree	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amp. dB	Correction Factor (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5240.0000	104.3	177	1.6	V	34.0	4.0	34.4	107.8			Fund/Peak
5240.0000	92.6	232	1.6	H	34.0	4.0	34.4	96.2			Fund/Peak
5240.0000	94.8	177	1.6	V	34.0	4.0	34.4	98.4			Ave
5240.0000	84.0	232	1.6	H	34.0	4.0	34.4	87.6			Ave
10480.0000	37.6	239	1.5	V	38.0	5.8	36.8	44.6	54	-9.4	Ave
10480.0000	37.6	277	1.3	H	38.0	5.8	36.8	44.6	54	-9.4	Ave
15720.0000	30.1	325	1.3	V	40.4	7.3	33.2	44.5	54	-9.5	Ave
15720.0000	30.1	273	1.1	H	40.4	7.3	33.2	44.5	54	-9.5	Ave
10480.0000	50.5	239	1.5	V	38.0	5.8	36.8	57.4	74	-16.6	Peak
10480.0000	49.5	277	1.3	H	38.0	5.8	36.8	56.4	74	-17.6	Peak
15720.0000	41.8	325	1.3	V	40.4	7.3	33.2	56.2	74	-17.8	Peak
15720.0000	41.6	273	1.1	H	40.4	7.3	33.2	56.1	74	-17.9	Peak

Note: All frequencies from 1GHz to 40 GHz have been investigated.
The restricted band limit is 54 dBµV/m, the out of band limit is 68.3 dBµV/m.

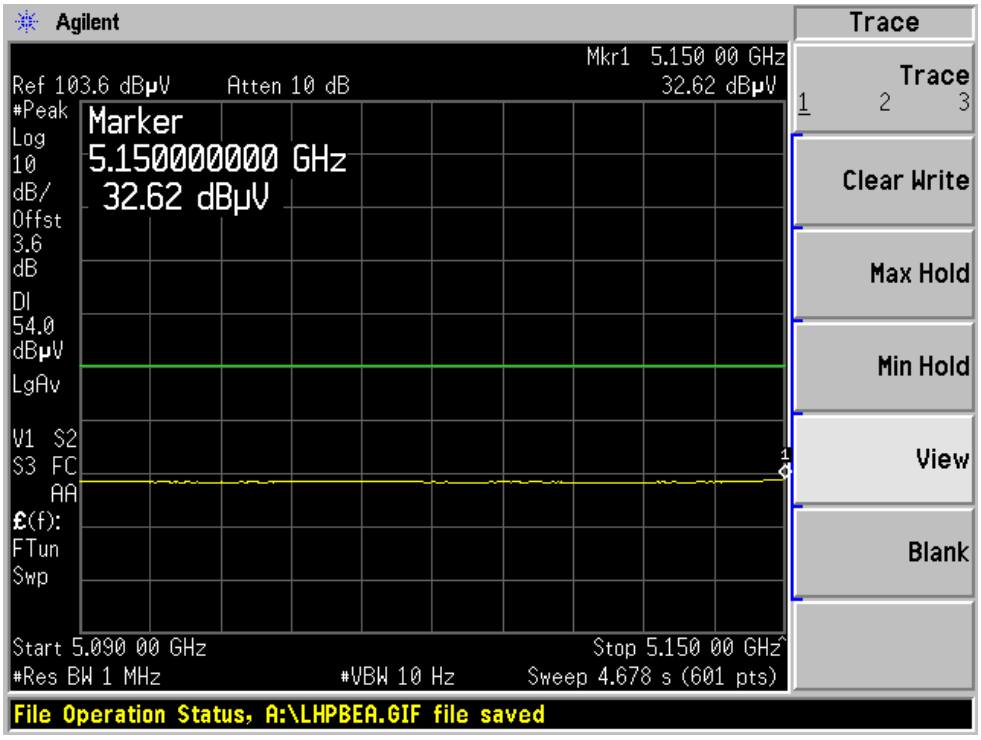
Restricted band edge

Low channel

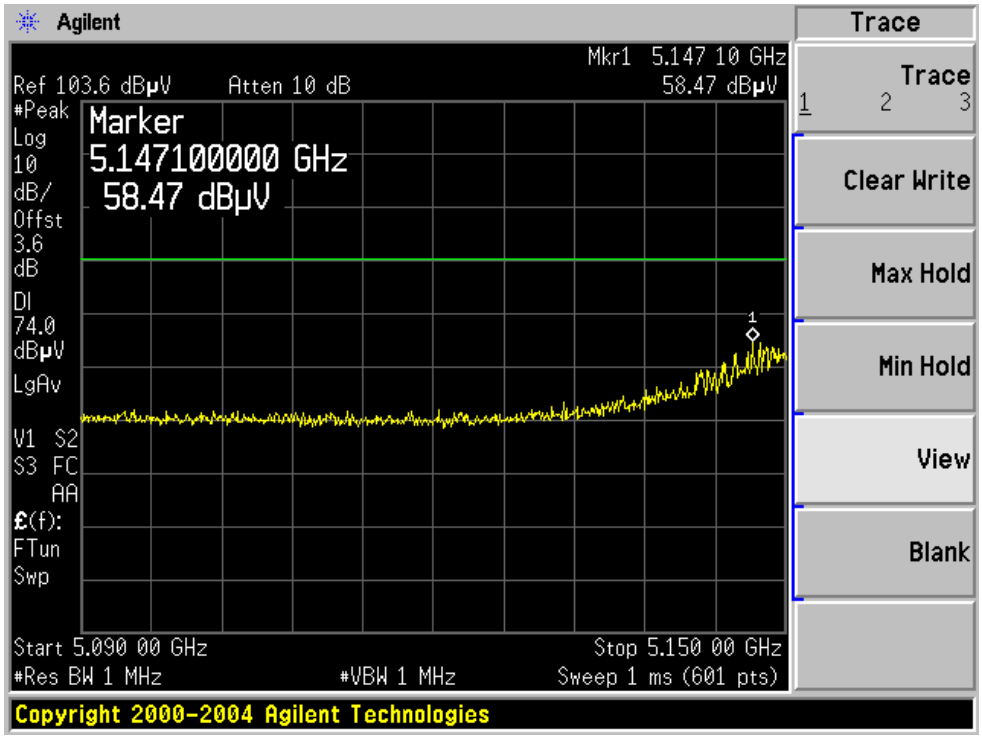
Peak, Horizontal



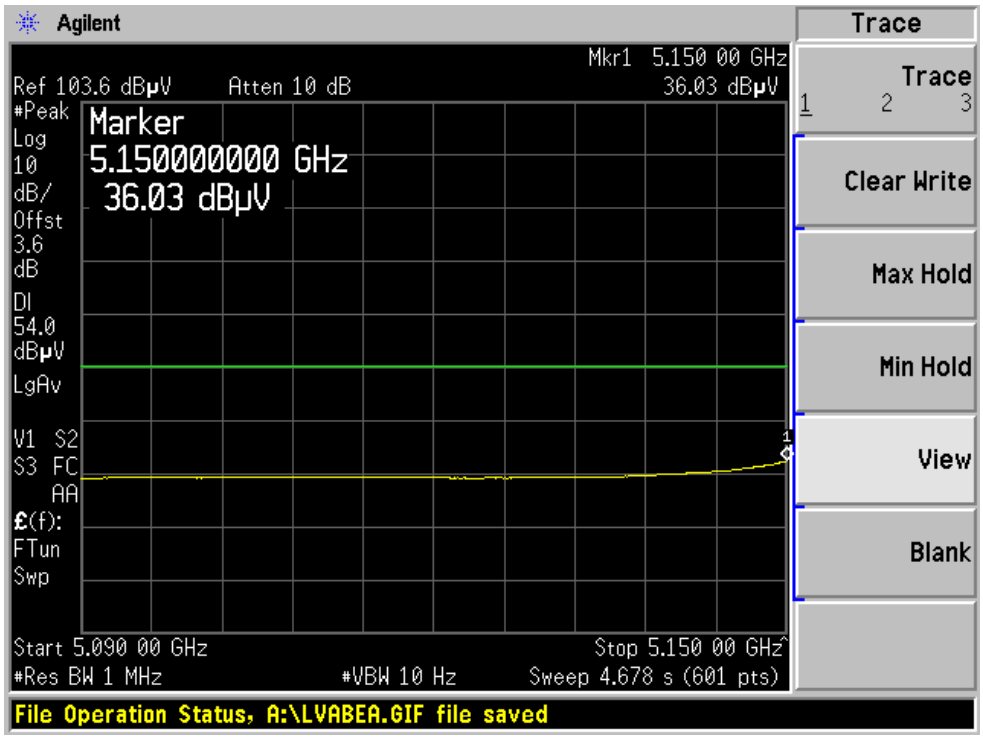
Average, Horizontal



Peak, Vertical



Average, Vertical



For 5745 – 5850 MHz: **802.11a**

Low channel

Frequency (MHz)	Reading (dBµV)	Azimuth Degree	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amp. dB	Correction Factor (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5745.0000	108.7	290	1.0	V	34.1	4.2	34.4	112.5			Fund/Peak
5745.0000	93.0	100	1.0	H	34.1	4.2	34.4	96.8			Fund/Peak
5745.0000	98.4	290	1.0	V	34.1	4.2	34.4	102.2			Ave
5745.0000	83.5	100	1.0	H	34.1	4.2	34.4	87.3			Ave
11490.0000	30.3	210	1.6	V	39.3	6.1	39.5	36.2	54	-17.8	Ave
11490.0000	30.3	252	1.5	H	39.3	6.1	39.5	36.2	54	-17.8	Ave
11490.0000	44.1	210	1.6	V	39.3	6.1	39.5	50.0	74	-24.0	Peak
11490.0000	43.9	236	1.7	H	39.3	6.1	39.5	49.8	74	-24.2	Peak

Middle channel

Frequency (MHz)	Reading (dBµV)	Azimuth Degree	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amp. dB	Correction Factor (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5785.0000	111.8	306	1.0	V	34.1	4.3	34.4	115.7			Fund/Peak
5785.0000	98.3	119	1.5	H	34.1	4.3	34.4	102.2			Fund/Peak
5785.0000	101.7	306	1.0	V	34.1	4.3	34.4	105.6			Ave
5785.0000	88.3	119	1.5	H	34.1	4.3	34.4	92.2			Ave
11570.0000	36.4	165	1.2	H	39.5	6.1	32.0	50.1	54	-3.9	Ave
11570.0000	32.4	155	1.1	V	39.5	6.1	32.0	46.1	54	-7.9	Ave
11570.0000	47.9	165	1.2	H	39.5	6.1	32.0	61.6	74	-12.4	Peak
11570.0000	44.6	155	1.1	V	39.5	6.1	32.0	58.3	74	-15.7	Peak

High channel

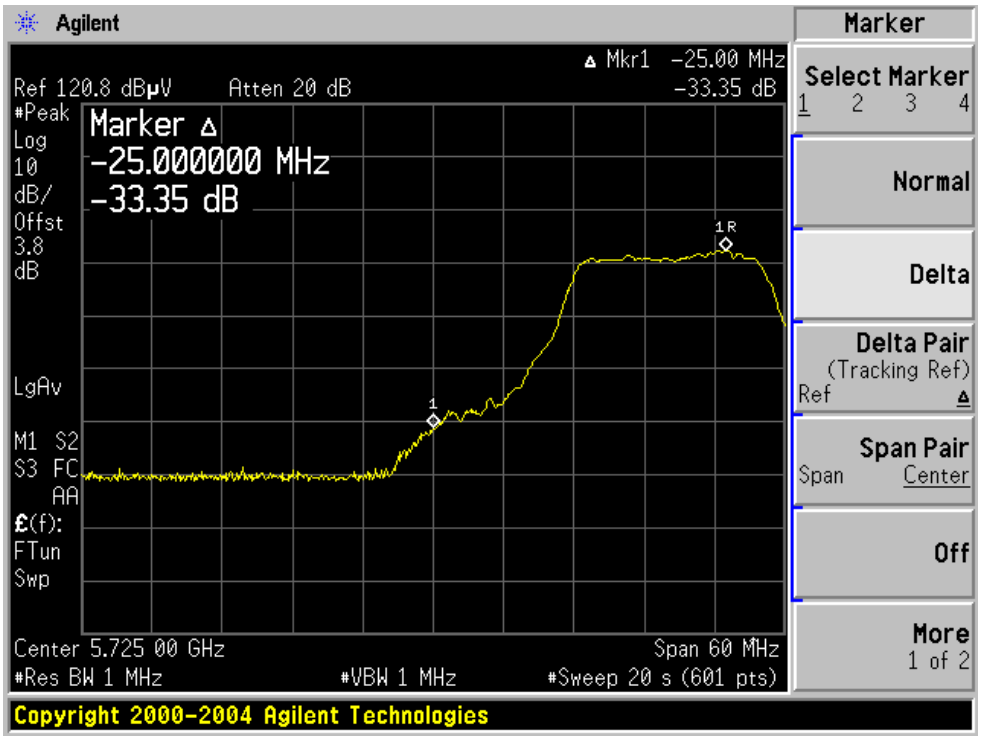
Frequency (MHz)	Reading (dBµV)	Azimuth Degree	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amp. dB	Correction Factor (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5805.0000	109.1	217	1.2	V	34.1	4.2	34.3	113.1			Fund/Peak
5805.0000	96.7	124	1.3	H	34.1	4.2	34.3	100.8			Fund/Peak
5805.0000	98.5	217	1.2	V	34.1	4.2	34.3	102.6			Ave
5805.0000	86.4	124	1.3	H	34.1	4.2	34.3	90.4			Ave
17415.0000	32.3	222	1.3	V	43.6	7.6	31.6	51.9	54	-2.1	Ave
17415.0000	32.3	311	1.6	H	43.6	7.6	31.6	51.9	54	-2.1	Ave
11610.0000	37.5	183	1.3	V	39.5	6.2	32.0	51.2	54	-2.8	Ave
11610.0000	31.5	222	1.3	H	39.5	6.2	32.0	45.2	54	-8.8	Ave
17415.0000	44.4	311	1.6	H	43.6	7.6	31.6	64.1	74	-9.9	Peak
17415.0000	44.3	238	1.3	V	43.6	7.6	31.6	64.0	74	-10.0	Peak
11610.0000	46.0	183	1.3	V	39.5	6.2	32.0	59.7	74	-14.3	Peak
11610.0000	41.6	222	1.3	H	39.5	6.2	32.0	55.3	74	-18.7	Peak

Note: All frequencies from 1GHz to 40 GHz have been investigated.
The restricted band limit is 54 dBµV/m, the out of band limit is 68.3 dBµV/m.

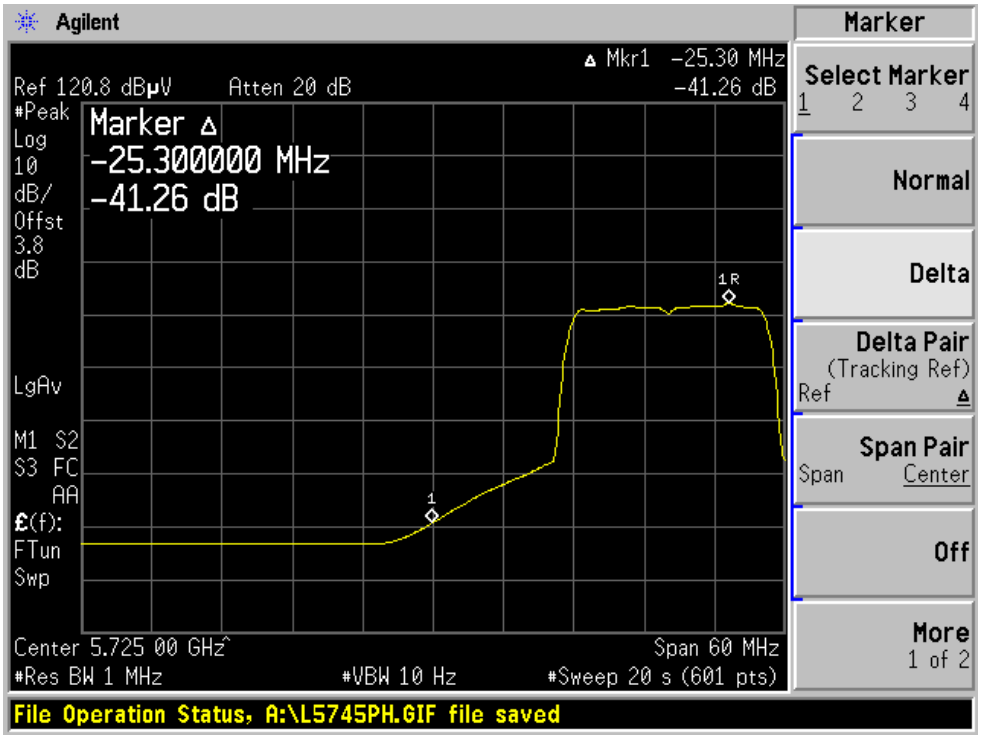
Restricted band edge

Low channel

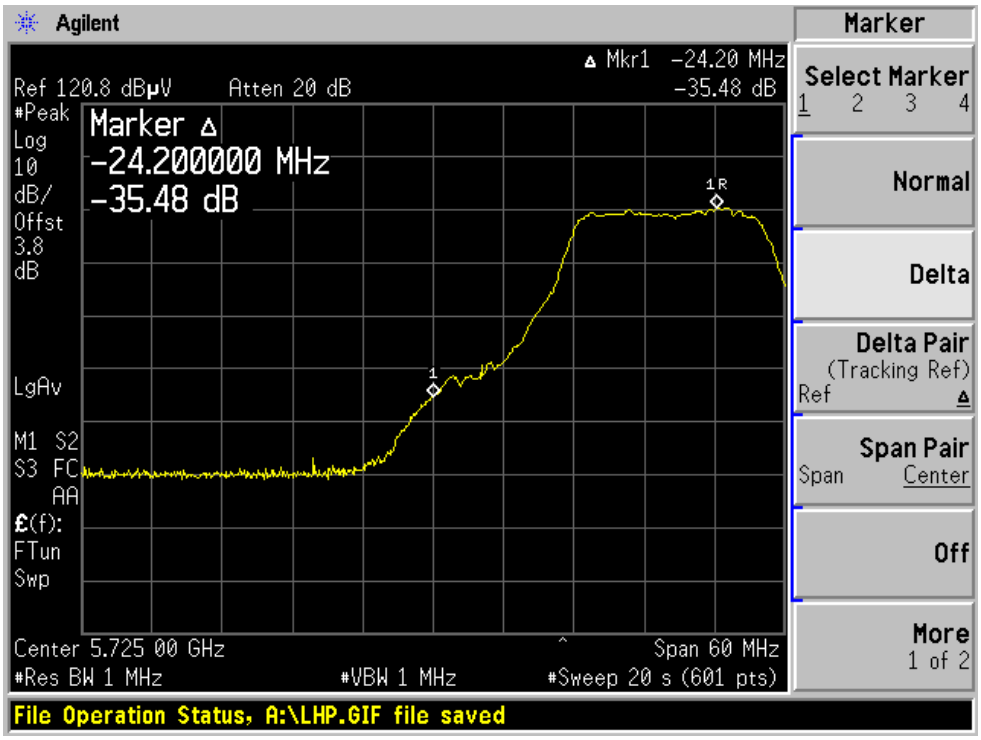
Peak, Horizontal



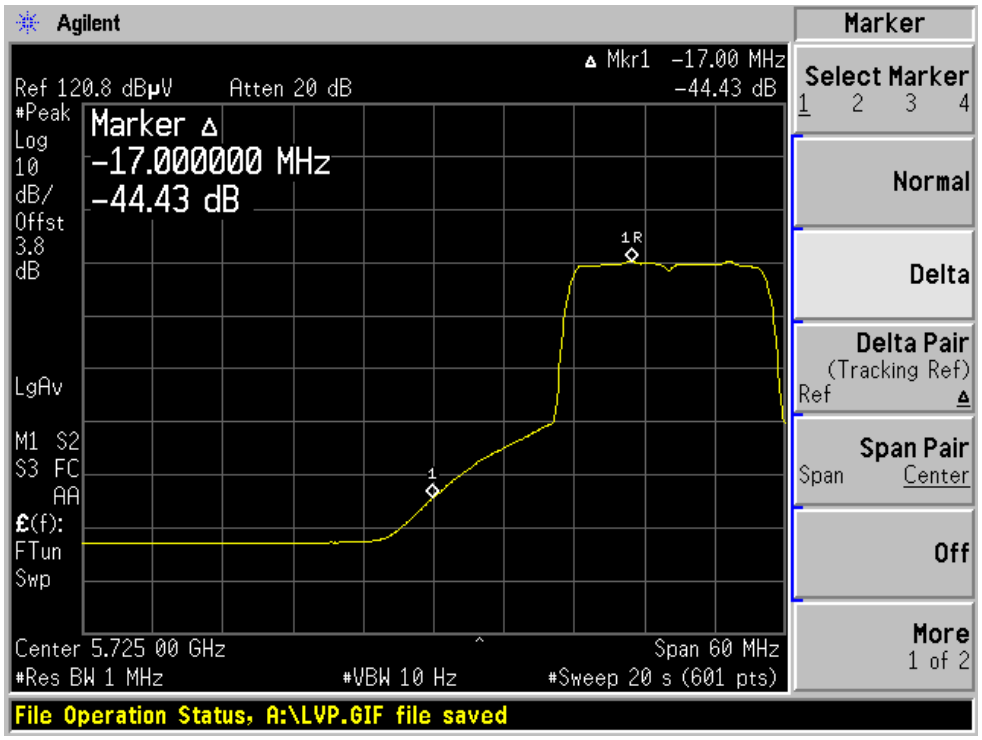
Average, Horizontal



Peak, Vertical

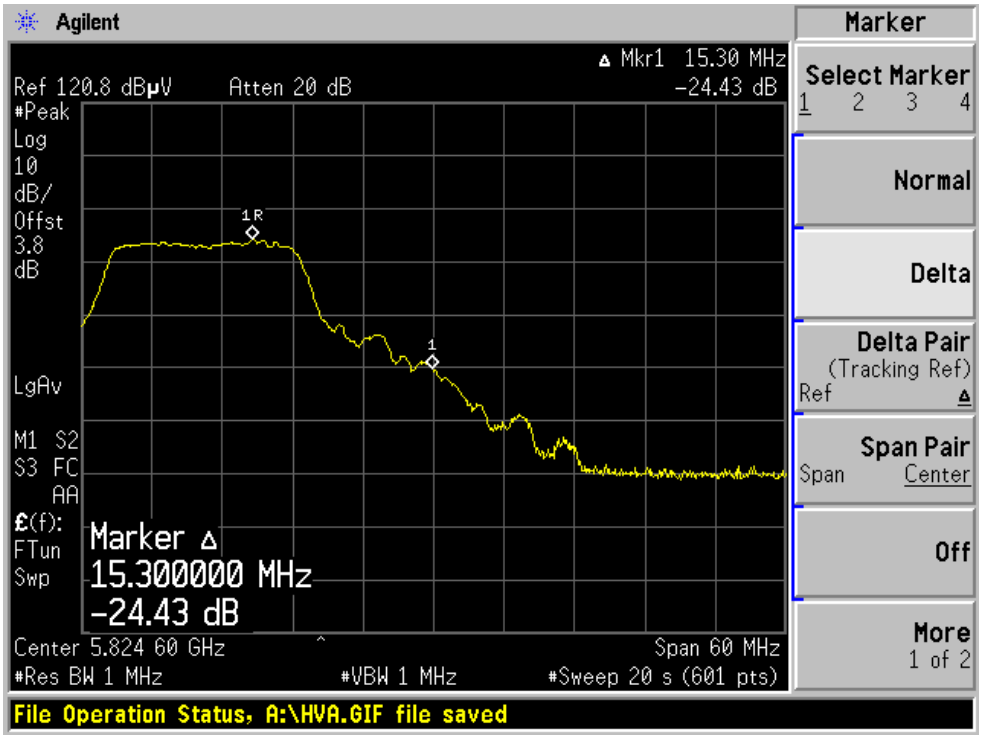


Average, Vertical

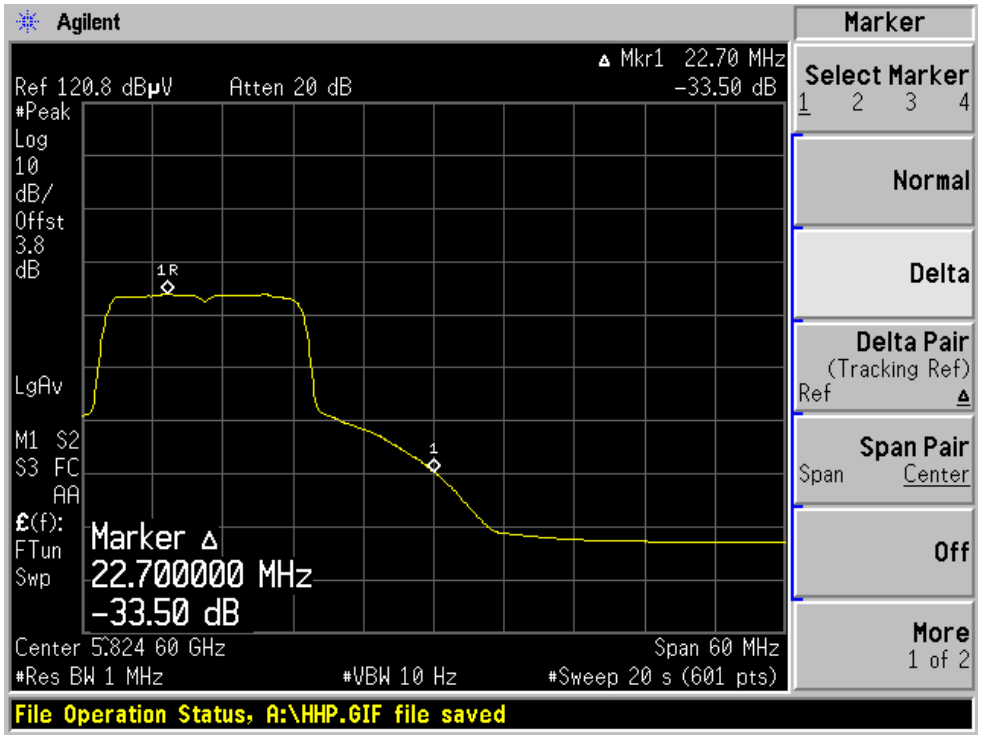


High channel

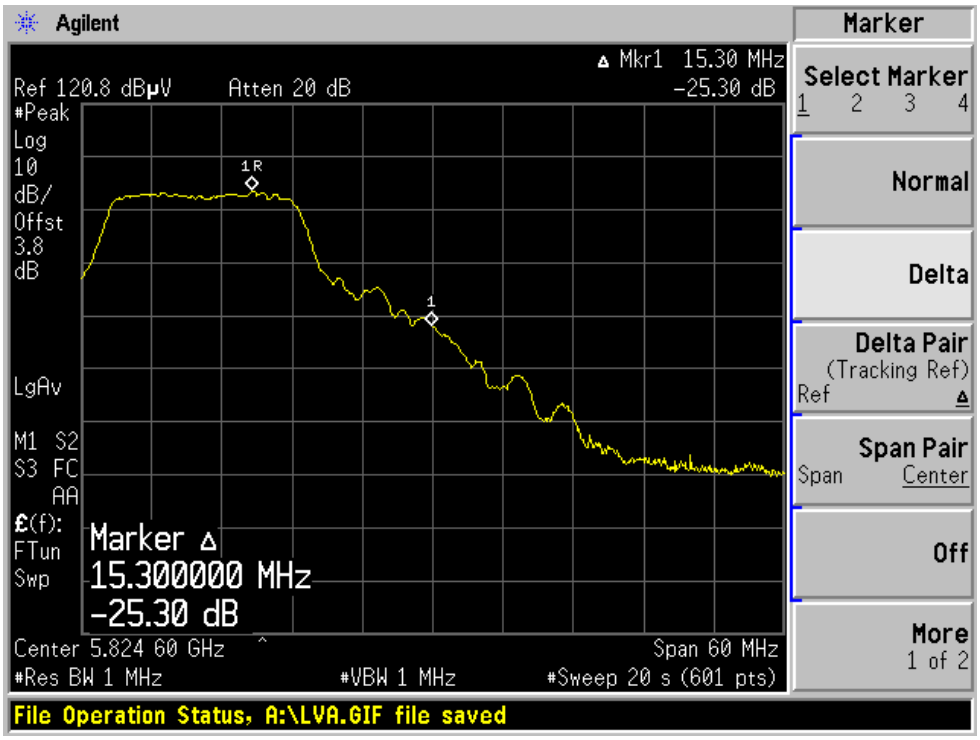
Peak, Horizontal



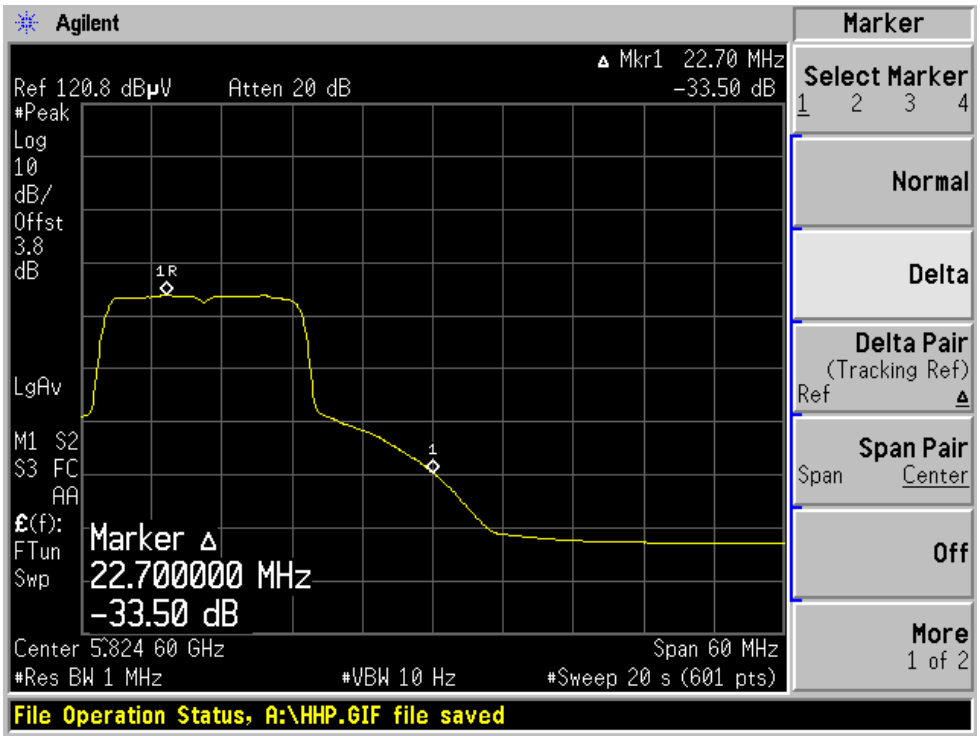
Average, Horizontal



Peak, Vertical



Average, Vertical



§15.407 (a) (1) & (a) (2) - MAXIMUM POWER

Applicable Standard

§15.407 (a)(1) For the band 5.15 – 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. 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.

(3) For the band 5.725–5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum 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.

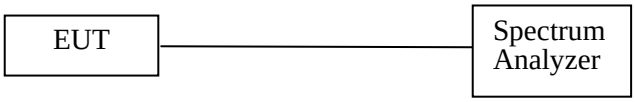
Measurement Procedure

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.

Equipment List

Please refer to International Standard Laboratory report number **04LR018FC** (**FCC ID: NKRCM9**).

Test Setup Diagram



Environmental Conditions

Please refer to International Standard Laboratory report number **04LR018FC** (**FCC ID: NKRCM9**).

**The testing was performed by International Standard Laboratory*

Test Result

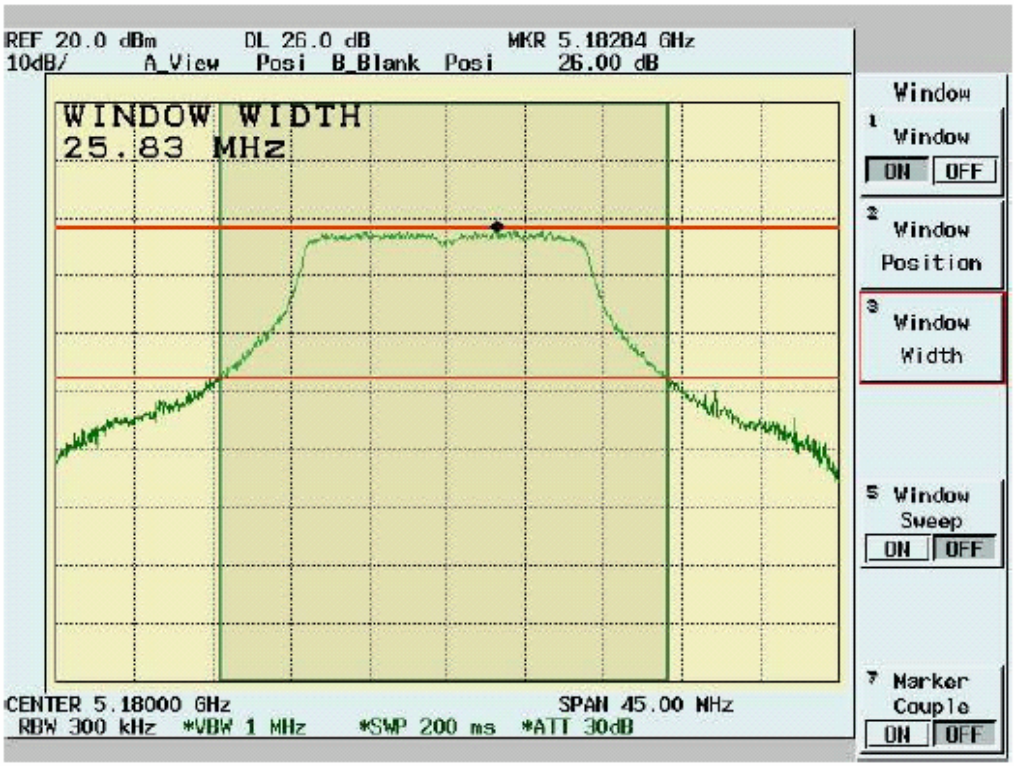
For 5150 – 5250 MHz: **802.11a**

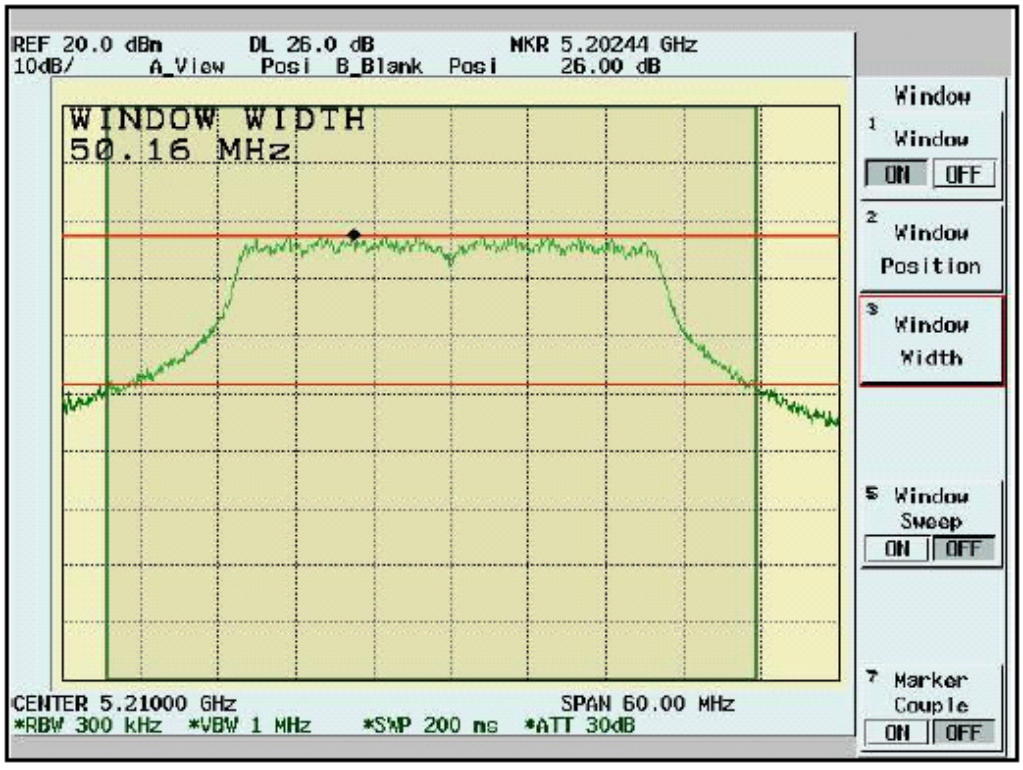
Frequency (MHz)	Peak Power Output (dBm)	26 dBc BW/Limit MHz/dBm	The lesser Limit (dBm)	Pass/Fail
5180	14.481	25.83 / 18.12	17.00	Pass
5210	16.825	50.16 / 21.00	17.00	Pass
5240	13.918	26.28 / 18.20	17.00	Pass

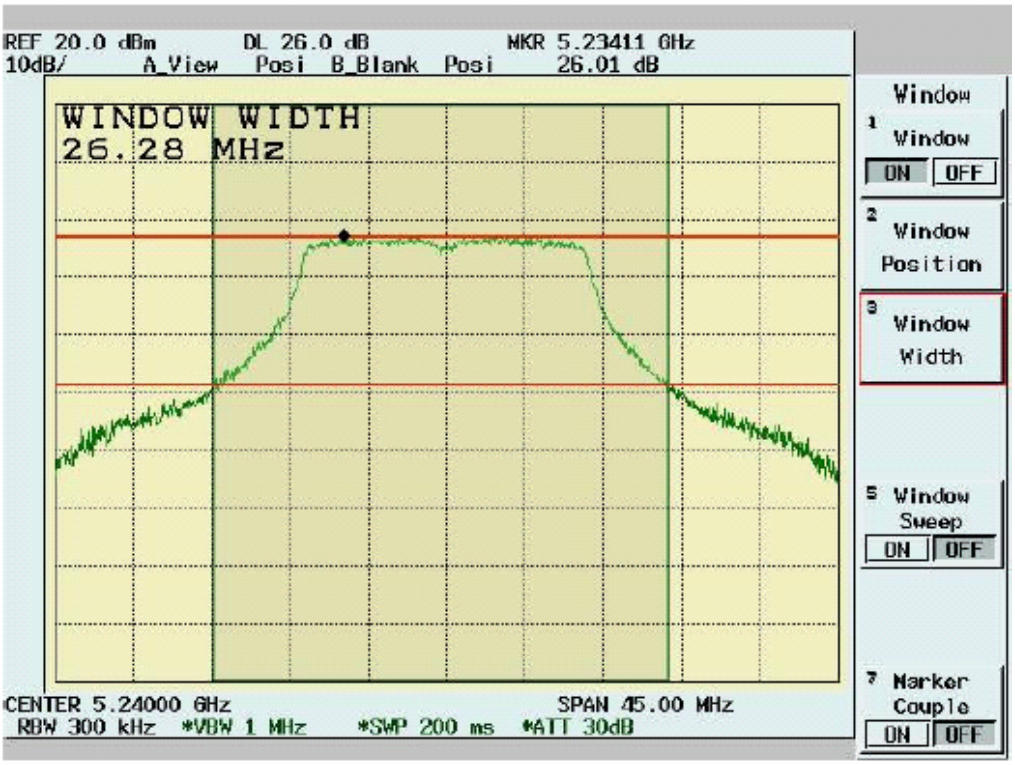
For 5725 – 5825 MHz: **802.11a**

Frequency (MHz)	Peak Power Output (dBm)	26 dBc BW/Limit MHz/dBm	The lesser Limit (dBm)	Pass/Fail
5745	20.012	26.28 / 31.20	30.00	Pass
5760	19.293	53.04 / 34.25	30.00	Pass
5805	20.043	29.34 / 31.67	30.00	Pass

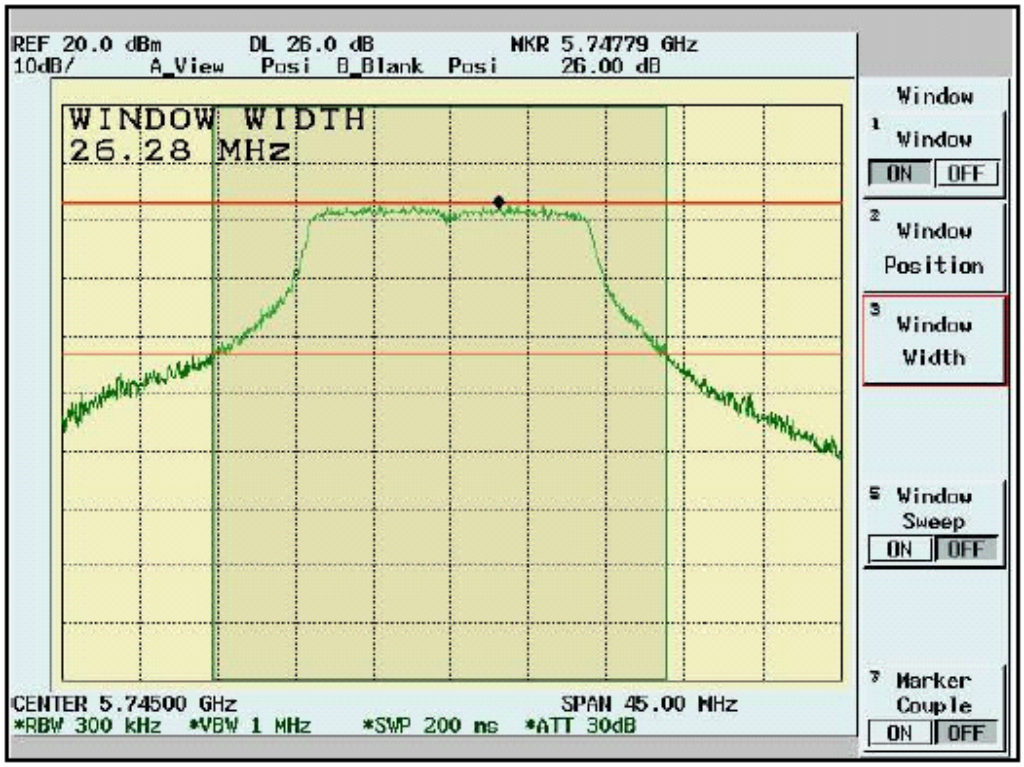
For 5150 – 5250 MHz: **802.11a**

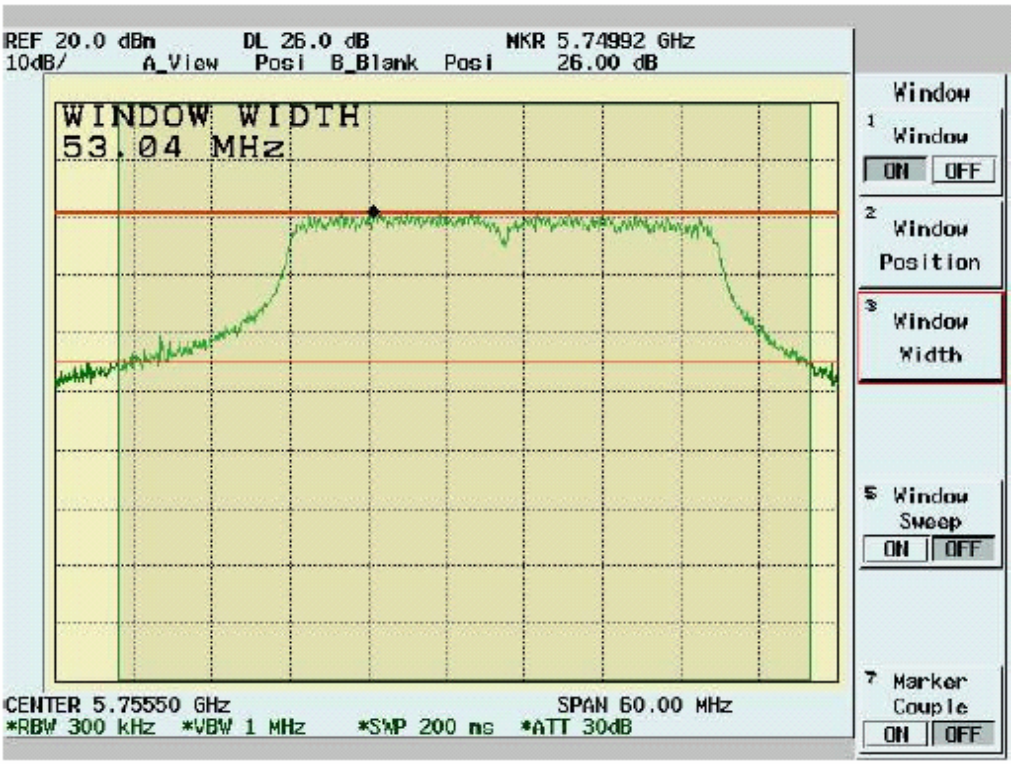


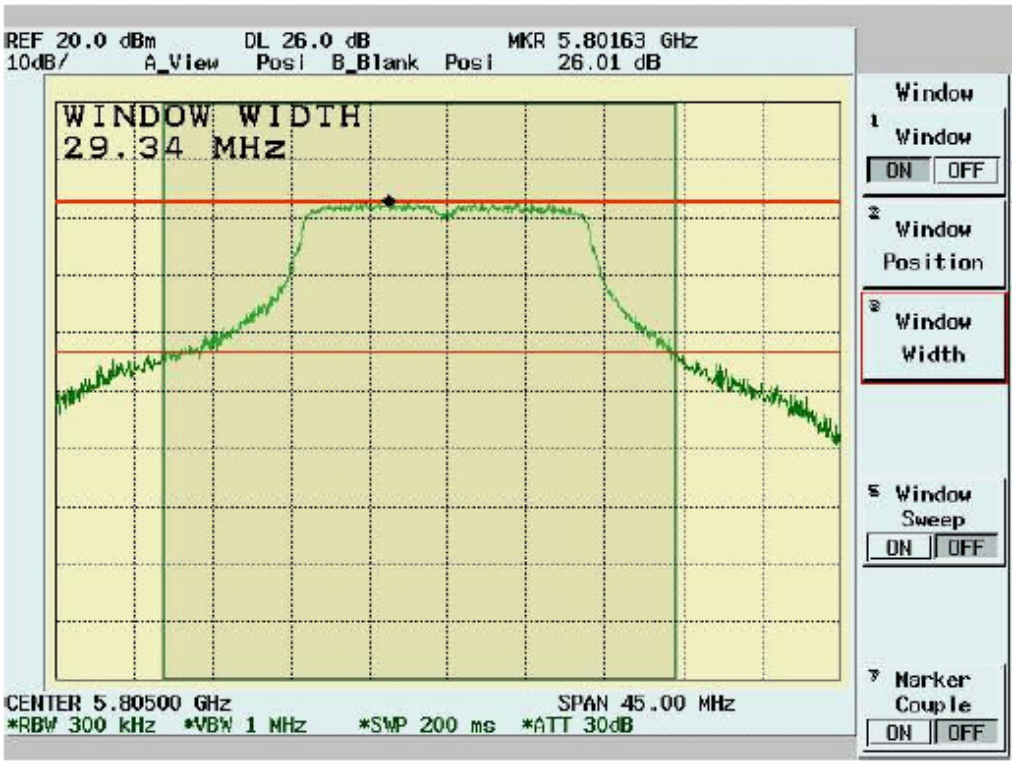




For 5725 – 5825 MHz: **802.11a**




REF 20.0 dBm
DL 26.0 dB
MKR 5.74992 GHz
10dB/
A_View
Posi
B_Blank
Posi
26.00 dB
WINDOW WIDTH
53.04 MHz
Window
1 Window
ON OFF
2 Window Position
3 Window Width
5 Window Sweep
ON OFF
7 Marker Couple
ON OFF
CENTER 5.75550 GHz
SPAN 60.00 MHz
*RBW 300 kHz
*VBW 1 MHz
*SWP 200 ms
*ATT 30dB


REF 20.0 dBm
DL 26.0 dB
MKR 5.80163 GHz
10dB/
A_View
Posi
B_Blank
Posi
26.01 dB
WINDOW WIDTH
29.34 MHz
Window
1 Window
ON OFF
2 Window Position
3 Window Width
5 Window Sweep
ON OFF
7 Marker Couple
ON OFF
CENTER 5.80500 GHz
SPAN 45.00 MHz
*RBW 300 kHz
*VBW 1 MHz
*SWP 200 ms
*ATT 30dB

§15.407 (a) (1) & (a)(3)(5) – PEAK POWER SPECTRAL DENSITY

Applicable Standard

§15.407 (a)(1) For the band 5.15 – 5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. 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.

§15.407 (a)(2) For the band 5.25 – 5.35 GHz, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. 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.

§15.407 (a)(3) For the band 5.725–5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum 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

§15.407 (a)(5) The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

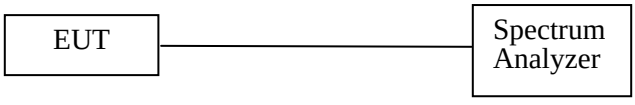
Measurement Procedure

1. Using sample detector and power averaging mode, set RBW=1 MHz and VBW > 1 MHz.
2. PSD is the highest level found across the emission in any 1-MHz band after 100 sweeps of averaging.
3. When the emission bandwidth is less than 1 MHz, a measurement bandwidth equal to the emission bandwidth is used in accordance with section 15.407(a) (5).

Equipment List

Please refer to International Standard Laboratory report number **04LR018FC** (**FCC ID: NKRCM9**).

Test Setup Diagram



Environmental Conditions

Please refer to International Standard Laboratory report number **04LR018FC** (**FCC ID: NKRCM9**).

**The testing was performed by International Standard Laboratory*

Test Result

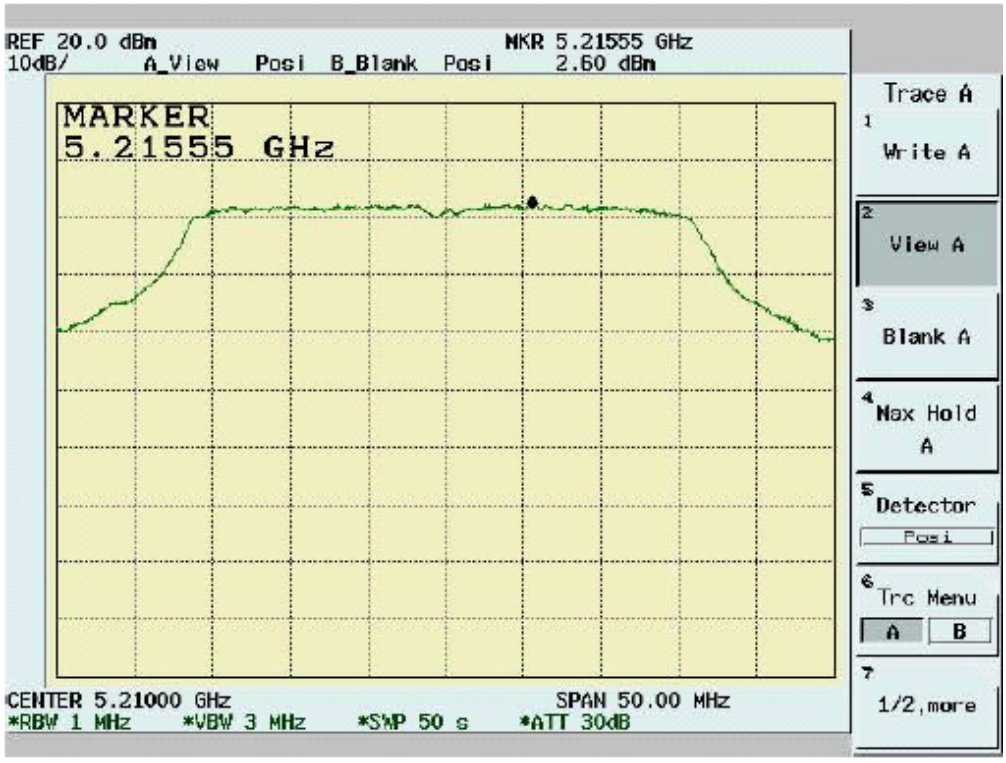
For 5150 – 5250 MHz: **802.11a**

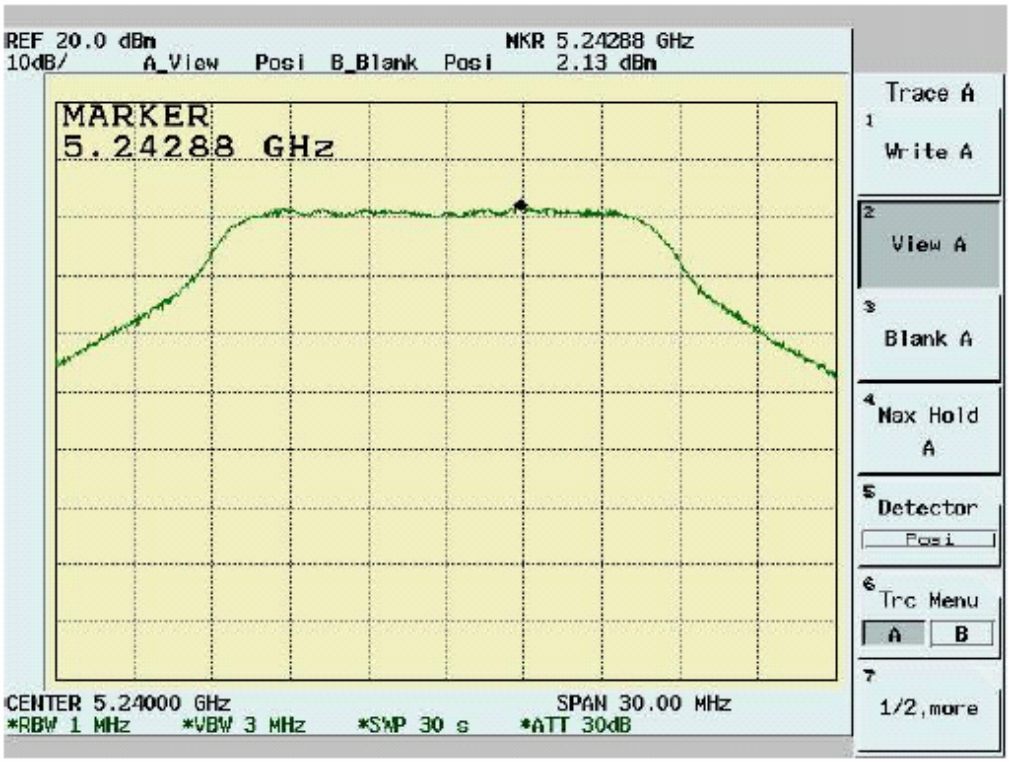
Frequency (MHz)	Spectrum Reading (dBm)	Cable Loss (dB)	Peak Power Output MHz/dBm	Limit (dBm/MHz)	Pass/Fail
5180	2.68	1.20	3.88	4.00	Pass
5210	2.60	1.20	3.80	4.00	Pass
5240	2.13	1.20	3.33	4.00	Pass

For 5725 – 5825 MHz: **802.11a**

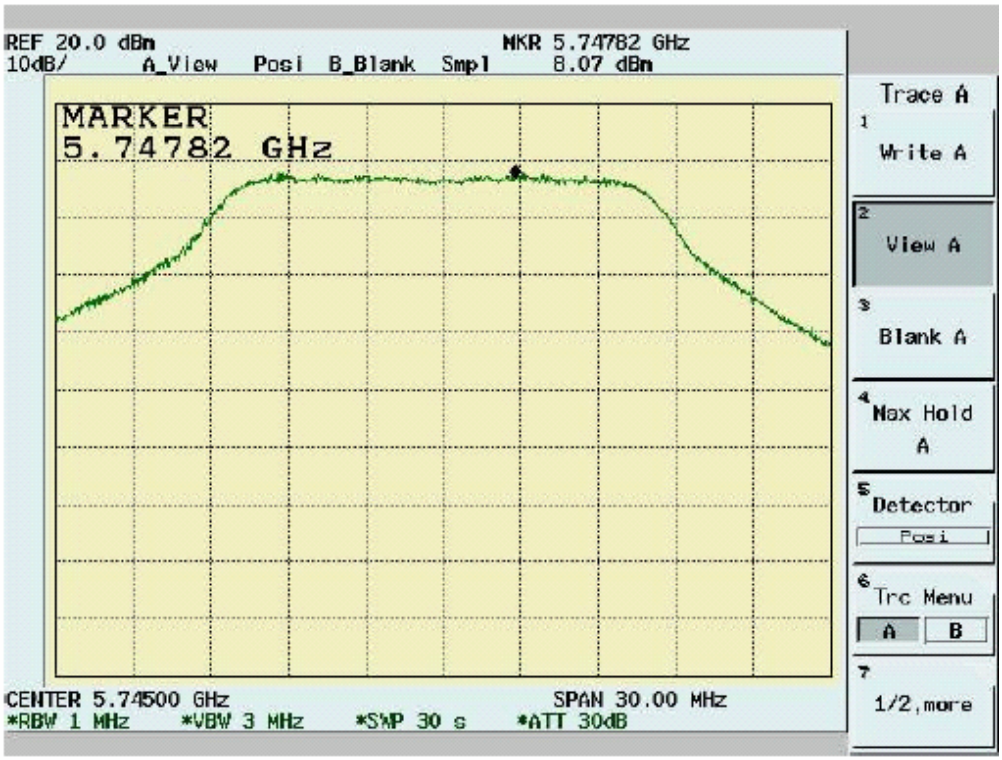
Frequency (MHz)	Spectrum Reading (dBm)	Cable Loss (dB)	Peak Power Output MHz/dBm	Limit (dBm/MHz)	Pass/Fail
5745	8.07	1.20	9.27	17	Pass
5760	3.76	1.20	4.99	17	Pass
5805	8.34	1.20	9.54	17	Pass

For 5150 – 5250 MHz: **802.11a**

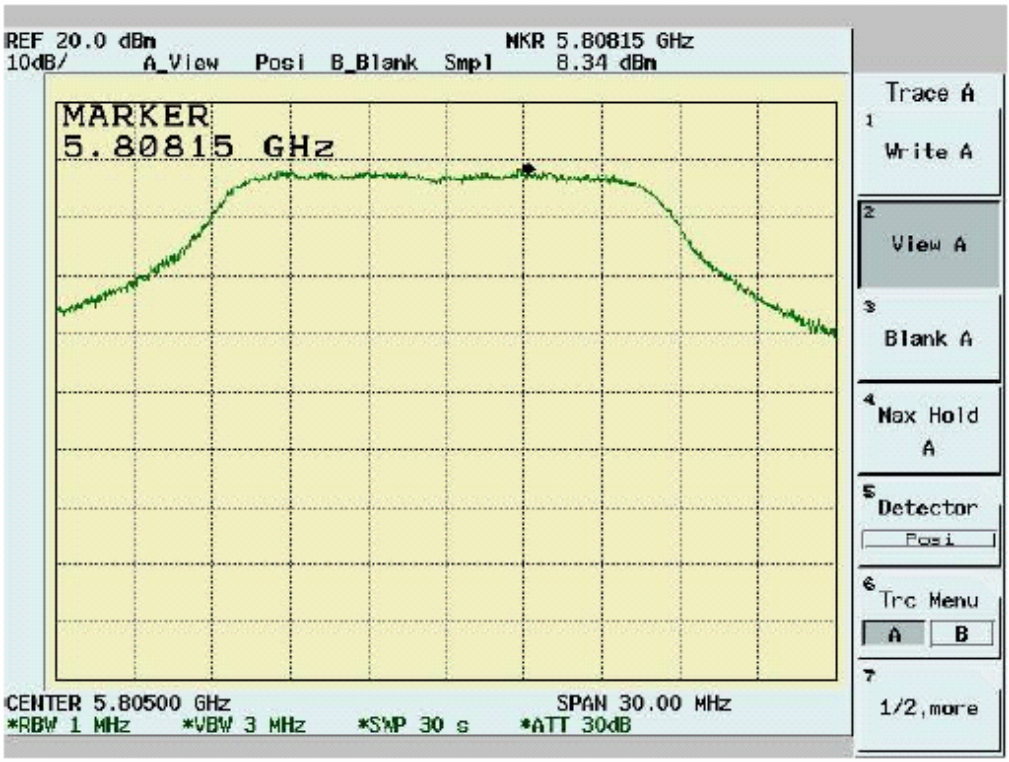




For 5725 – 5825 MHz: **802.11a**




REF 20.0 dBm
10dB/ A_View Posi B_Blank Smpl
MKR 5.76560 GHz
3.79 dBm
MARKER
5.76560 GHz
CENTER 5.76000 GHz
SPAN 50.00 MHz
*RBW 1 MHz *VBW 3 MHz *SWP 50 s *ATT 30dB
Trace A
1 Write A
2 View A
3 Blank A
4 Max Hold A
5 Detector Posi
6 Trc Menu A B
7 1/2,more


REF 20.0 dBm
10dB/ A_View Posi B_Blank Smpl
MKR 5.80815 GHz
8.34 dBm
MARKER
5.80815 GHz
CENTER 5.80500 GHz
SPAN 30.00 MHz
*RBW 1 MHz *VBW 3 MHz *SWP 30 s *ATT 30dB
Trace A
1 Write A
2 View A
3 Blank A
4 Max Hold A
5 Detector Posi
6 Trc Menu A B
7 1/2,more

§15.407(a) (6) – Peak Excursion

Applicable Standard

According to §15.407 (a)(6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

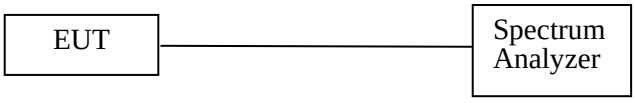
Measurement Procedure

1. Set the SA span to view the entire emission bandwidth. The largest difference between the following two traces must be less than or equal to 13 dB for all frequencies across the emission bandwidth.
2. For the first trace, set RBW = 1MHz and VBW greater or equal to 3MHz utilizing the peak detector and max-hold function. Second trace is created using the setting as described in method # 3 as used in measuring conducted peak output power under FCC Public Notice for U-NII devices August 30, 2002.

Equipment List

Please refer to International Standard Laboratory report number **04LR018FC** (**FCC ID: NKRCM9**).

Test Setup Diagram



Environmental Conditions

Please refer to International Standard Laboratory report number **04LR018FC** (**FCC ID: NKRCM9**).

**The testing was performed by International Standard Laboratory*

Test Result

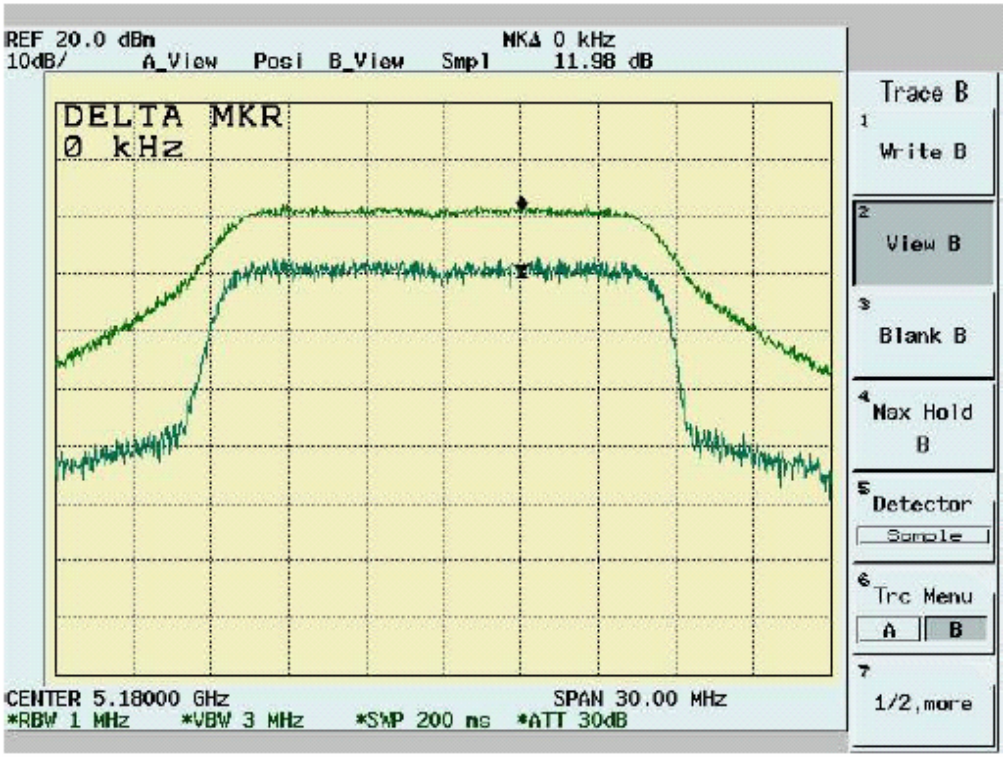
For 5150 – 5250 MHz: **802.11a**

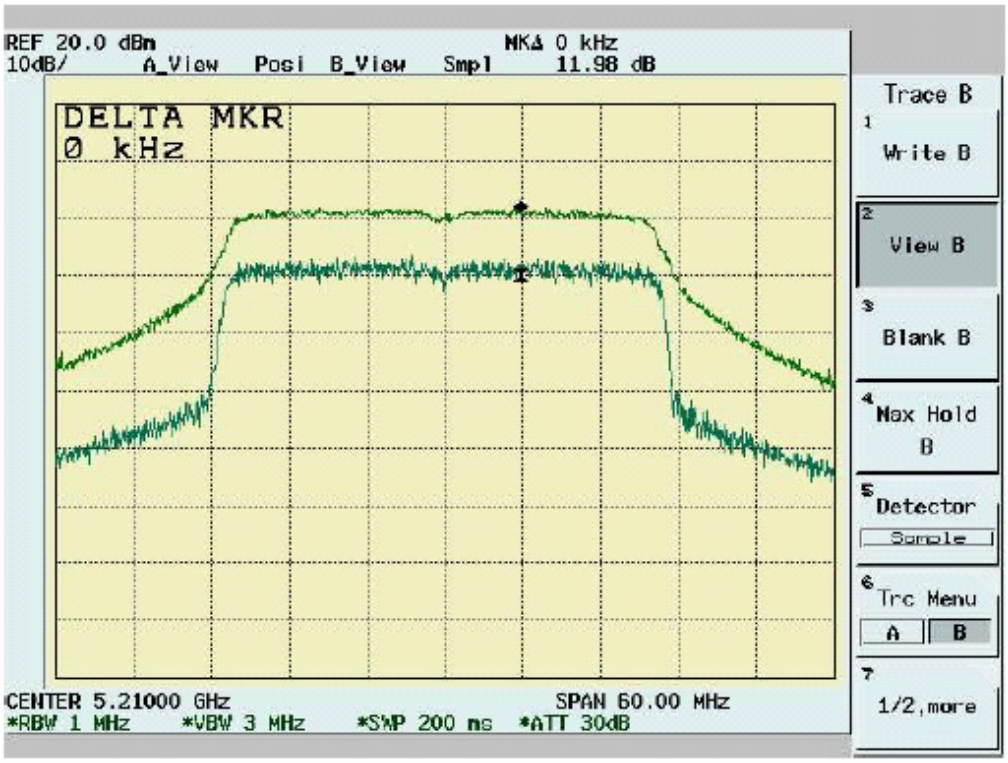
Frequency (MHz)	Peak Power Excursion (dBm)	Limit (dBm)	Pass/Fail
5180	11.98	13	Pass
5210	11.98	13	Pass
5240	11.73	13	Pass

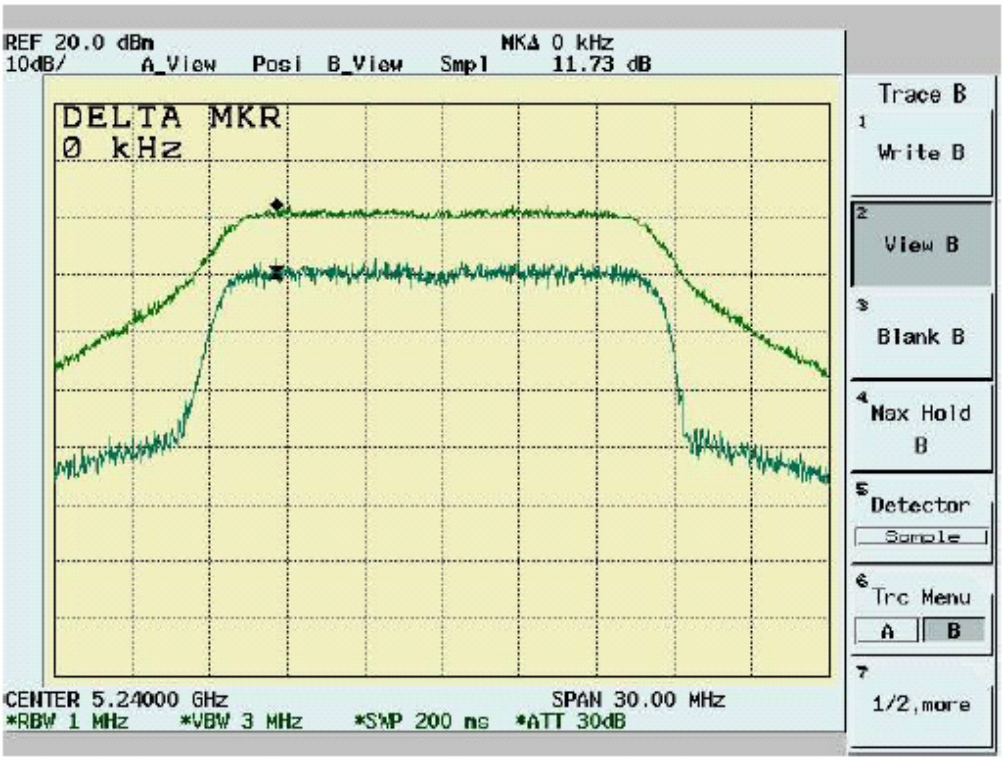
For 5725 – 5825 MHz: **802.11a**

Frequency (MHz)	Peak Power Excursion (dBm)	Limit (dBm)	Pass/Fail
5745	11.98	13	Pass
5760	10.63	13	Pass
5805	11.04	13	Pass

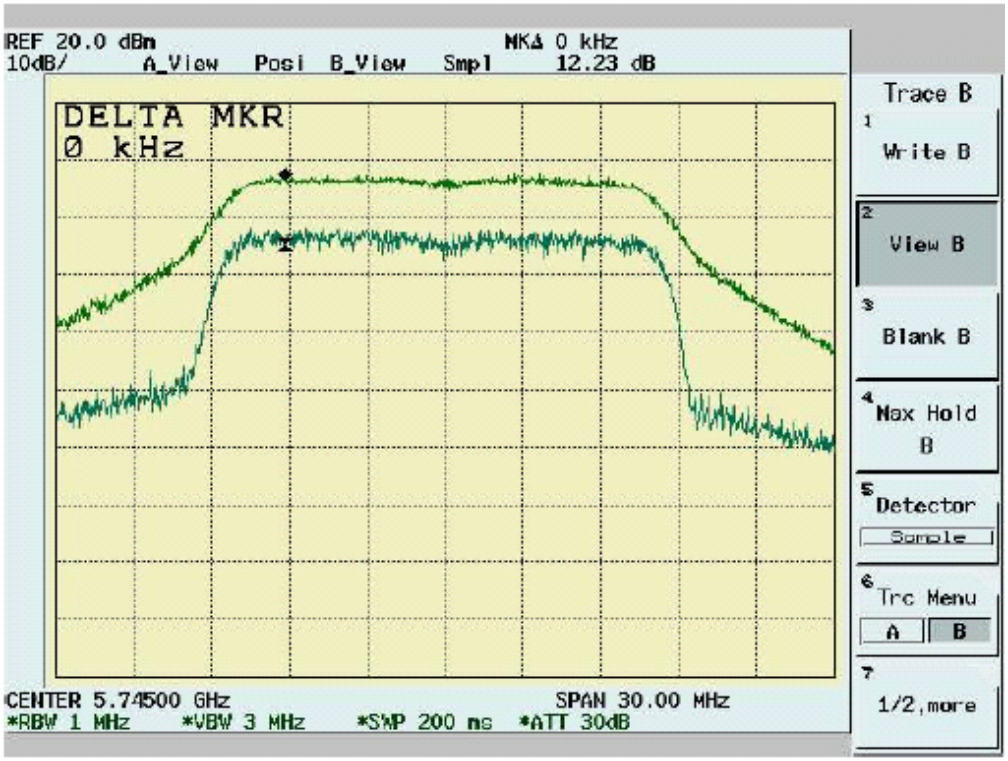
For 5150 – 5250 MHz: **802.11a**

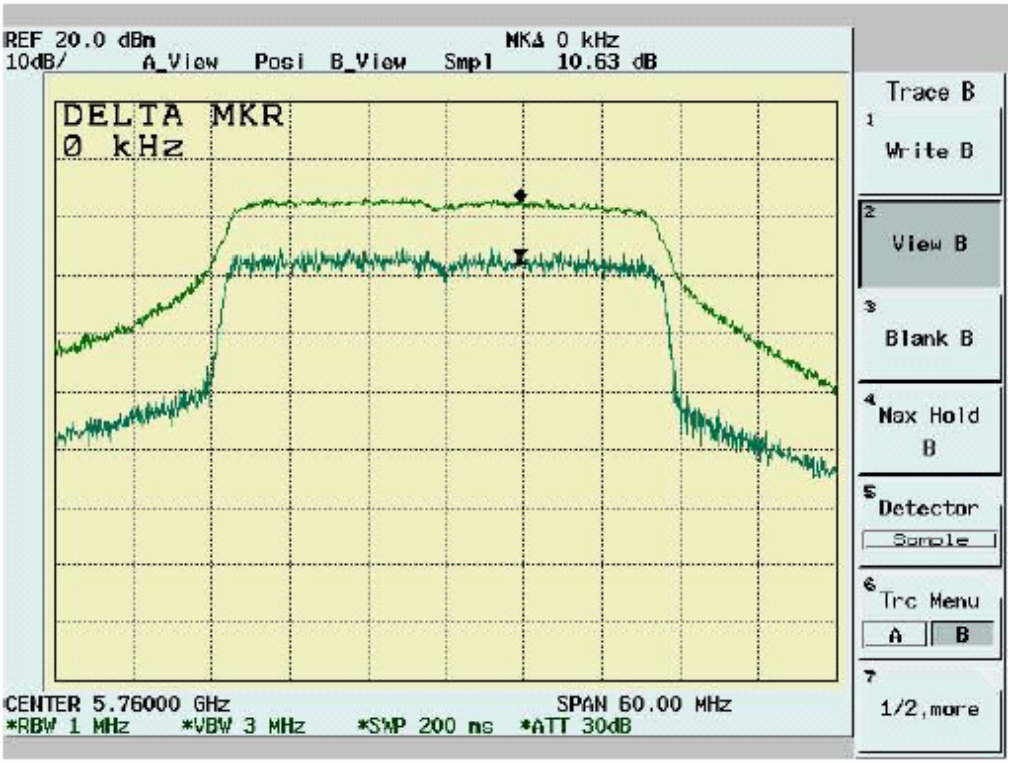


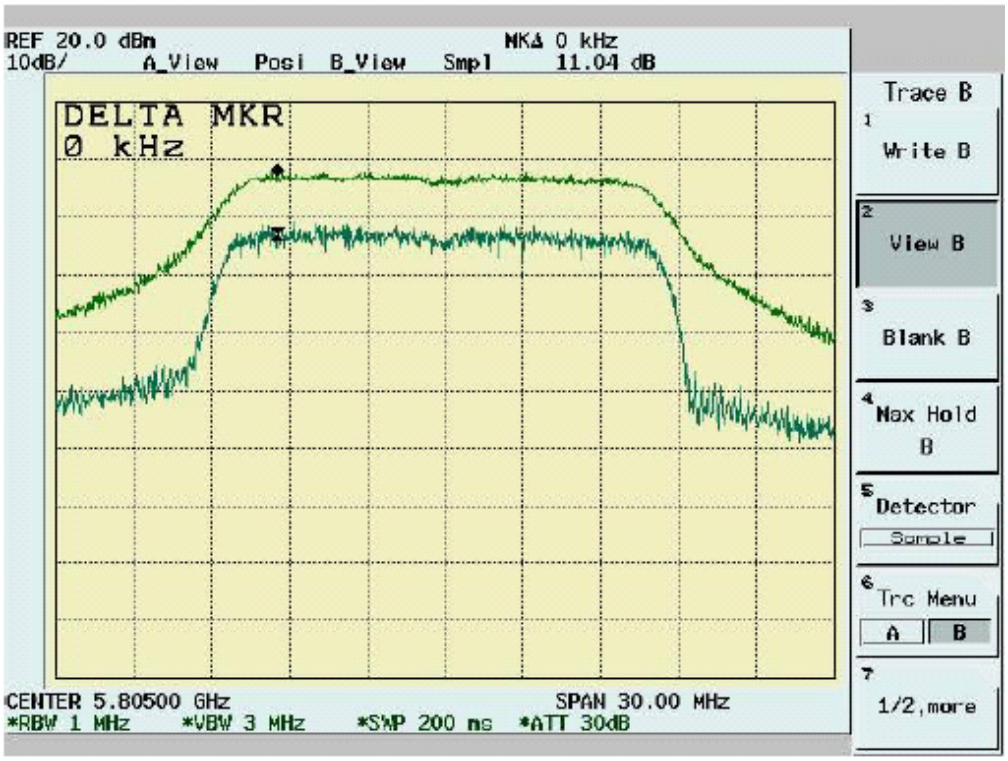




For 5725 – 5825 MHz: **802.11a**




REF 20.0 dBm
MKΔ 0 kHz
10dB/ A_View Posi B_View Smpl 10.63 dB
DELTA MKR
0 kHz
Trace B
1 Write B
2 View B
3 Blank B
4 Max Hold B
5 Detector
Sample
6 Trc Menu
A B
7 1/2,more
CENTER 5.76000 GHz
SPAN 60.00 MHz
*RBW 1 MHz *VBW 3 MHz *SWP 200 ms *ATT 30dB


REF 20.0 dBm
MKΔ 0 kHz
10dB/ A_View Posi B_View Smpl 11.04 dB
DELTA MKR
0 kHz
Trace B
1 Write B
2 View B
3 Blank B
4 Max Hold B
5 Detector
Sample
6 Trc Menu
A B
7 1/2,more
CENTER 5.80500 GHz
SPAN 30.00 MHz
*RBW 1 MHz *VBW 3 MHz *SWP 200 ms *ATT 30dB