

## FCC PART 15.407

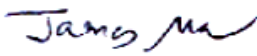
# MEASUREMENT AND TEST REPORT

For

**IXIA**

26601 W. Agoura Road  
Calabasas, CA 91302

**FCC ID: RCXEE11ABG5**

|                                                                            |                                                                                                                                                  |
|----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Report Type:</b><br><input checked="" type="checkbox"/> Original Report | <b>Product Type:</b><br>802.11 a/b/g Multi AP Emulator (client device)                                                                           |
| <b>Test Engineer:</b>                                                      | Dan Corona                                                  |
| <b>Report Number:</b>                                                      | R0710244-407 Rev. 1                                                                                                                              |
| <b>Report Date:</b>                                                        | 2007-11-06                                                                                                                                       |
| <b>Reviewed By:</b>                                                        | James Ma, Test Engineer                                     |
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**Note:** This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government

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## GENERAL INFORMATION

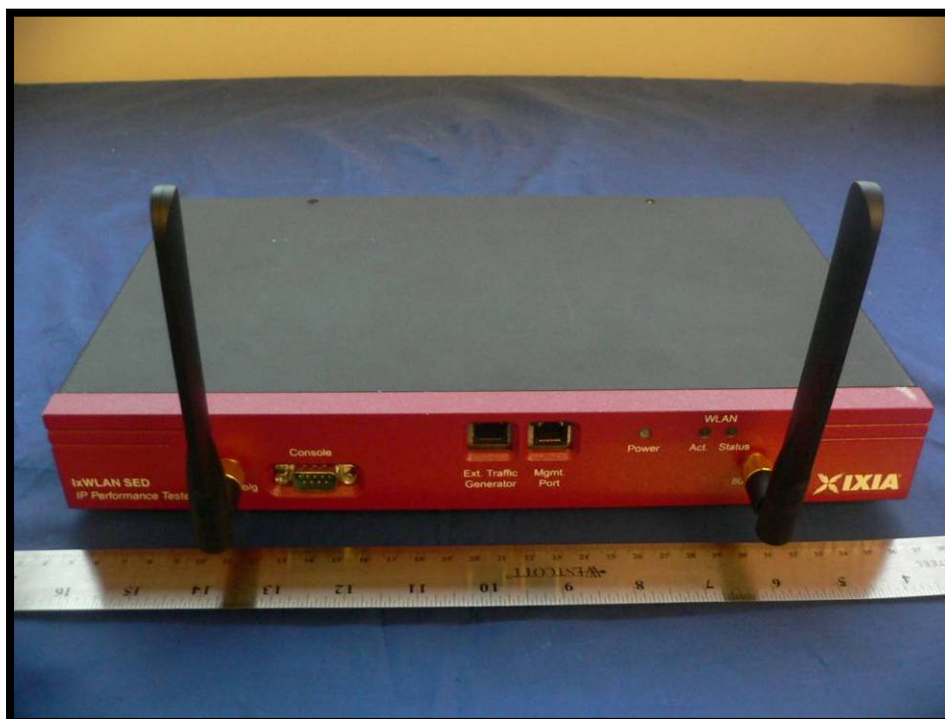
### Product Description for Equipment under Test (EUT)

This BACL measurement and test report has been compiled on behalf of *Ixia* and their product *FCC ID: RCXEE11ABG5*, or the EUT as referred to in the rest of this report which is an AP device station emulator (client device) platform designed for testing Wi-Fi devices and networks. The model *IxWLAN SED*, capable of simulating multiple, concurrent virtual stations, also features roaming and multiple SSID testing capabilities. The EUT is an 802.11 a/b/g wireless AP device that operates on 2412-2462 MHz, 5150-5350 MHz, 5470-5725 MHz and 5725-5825 MHz bands. The EUT is programmed at the point of manufacture for client device operation only and does not have autonomous transmitting ability.

**Antenna Information:** The two identical antennae, *Nearson* model: Swivel Antenna 614 utilized by this device are external antennae with SMA (reverse polarity plug, female) connectors and maximum gain of 4.0 dBi (2.4~2.5 GHz), 5dBi (5.15~5.35 GHz) and 4.5dBi (5.75~5.85 GHz).

| Swivel Multi-band Wireless LAN Antennae |                         |              |           |
|-----------------------------------------|-------------------------|--------------|-----------|
| Frequency (MHz)                         | Main Antenna Gain (dBi) | Polarization | Radiation |
| 2450                                    | 4.0                     | Vertical     | Omni      |
| 5250                                    | 5.0                     | Vertical     | Omni      |
| 5750                                    | 4.5                     | Vertical     | Omni      |

### EUT Photo



*Additional EUT photos in Exhibit C*

## Mechanical Description

The EUT is of metallic construction and measures approximately 203 mm (L) x 330 mm (W) x 53 mm (H) and weighs approximately 2.24 kg.

*The physical measurement data are gathered from a typical production sample provided by the manufacturer, Serial Number: IxWLAN-066236.*

## Objective

This type approval report is prepared on behalf of *Ixia* 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 intentional radiators using test data and test setup photographs from BACL Project # R0706045, report number: R0706045-407, and R0706045-DFS.

As declared by *Ixia* the EUT is electrically identical to the model: IxWLAN SED-MR+, FCC ID: RCXGC617644 with the only differences being that the EUT only employs one radio transmitter module (FCC ID: NKRCM9, Model CM9) and utilize two Nearson swivel antennae, while the IxWLAN SED-MR+ model employ three radio modules and utilize three antennae.

## Related Submittal(s)/Grant(s)

This Submittal is related to, *Ixia*'s Model: IxWLAN SED-MR+, FCC ID: RCXGC617644, BACL Project # R0706045, due to the EUT's established similarity with this product model, all relevant test data and test setup photographs from the R0706045 project, report number: R0706045-407, and R0706045-DFS are applied to this test report.

## 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/Standards/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:

| Channel | Mode    | Frequency (MHz) | Date Rate (Mbps) |
|---------|---------|-----------------|------------------|
| 36      | 802.11a | 5180            | 6 - 54           |
| 52      | 802.11a | 5260            | 6 - 54           |
| 64      | 802.11a | 5320            | 6 - 54           |
| 100     | 802.11a | 5500            | 6 - 54           |
| 120     | 802.11a | 5600            | 6 - 54           |
| 140     | 802.11a | 5700            | 6 - 54           |

### 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 |
|--------------|-------------|-------|---------------|
| Dell         | Laptop PC   | PP04S | OF926A02      |

### Power Supply Information

| Manufacturer | Description | Model    | Serial Number | FCC ID |
|--------------|-------------|----------|---------------|--------|
| CUI Inc.     | AC Adapter  | A1-15S05 | R00042200434  | None   |



**External I/O Cabling List and Details**

| Cable Description | Length (M) | Cable Type | From | To        |
|-------------------|------------|------------|------|-----------|
| RJ45              | 2          | Shielded   | EUT  | Laptop PC |
| Serial Cable      | 1.7        | Shielded   | EUT  | Laptop PC |

## SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

| FCC Rules                               | Description of Test                | Result    | Notes                                     |
|-----------------------------------------|------------------------------------|-----------|-------------------------------------------|
| §15.407 (f)<br>§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 | Please refer to FCC ID: NKRCM9            |
| §15.205                                 | Restricted Band                    | Compliant | /                                         |
| §15.209 (a) &<br>§15.407(a)(1) & (a)(2) | Spurious Radiated Emissions        | Compliant | /                                         |
| §15.247 (a)(5)                          | 99% & 26 dB Bandwidth              | NA        | /                                         |
| §15.407 (a)(1) & (a)(2)                 | Maximum Peak Output Power          | Compliant | Please refer to                           |
| § 15.407 (a)(6)                         | Peak Excursion                     | Compliant | Please refer to ISL Report: ISL-04LR018FC |
| §15.407 (a)(1) & (a)(2)                 | Power Spectral Density             | Compliant | Please refer to ISL Report: ISL-04LR018FC |
| §15.407 (h)                             | DFS                                | Compliant | /                                         |

§15.407 (h): DFS

The following result table represents the list of measurements required under the CFR47 §47 Part15.407 (h) and FCC 06-96.

| Items                          | Description of Test                           | Result   |
|--------------------------------|-----------------------------------------------|----------|
| Detection Bandwidth            | UNII Detection Bandwidth                      | NR       |
| Performance Requirements Check | Initial Channel Availability Check Time (CAC) | NR       |
|                                | Radar Burst at the Beginning of the CAC       | NR       |
|                                | Radar Burst at the End of the CAC             | NR       |
| In-Service Monitoring          | Channel Move Time                             | Complies |
|                                | Channel Closing Transmission Time             | Complies |
|                                | Non-Occupancy Period                          | NR       |
| Radar Detection                | Statistical Performance Check                 | NR       |

## § 15.407(f) and § 2.1091 - RF EXPOSURE

According to §15.407(f) and §1.1307(b)(1), §2.1091 and §2.1093, 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 <sup>2</sup> ) | Averaging Time (minutes) |
|------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34                                                   | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34-30                                                    | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 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

For 5150 – 5350 MHz: 802.11a

Maximum peak output power at antenna input terminal: 18.387 (dBm)

Maximum peak output power at antenna input terminal: 68.976 (mW)

Prediction distance: 20 (cm)

Predication frequency: 5260(MHz)

Antenna Gain (typical): 5 (dBi)

antenna gain: 3.16 (numeric)

Power density at predication frequency at 20 cm: 0.043 (mW/cm<sup>2</sup>)

**MPE limit for uncontrolled exposure at prediction frequency: 1.0 (mW/cm<sup>2</sup>)**

**For 5470 – 5725 MHz: 802.11a**

|                                                      |                                  |
|------------------------------------------------------|----------------------------------|
| Maximum peak output power at antenna input terminal: | <u>23.40 (dBm)</u>               |
| Maximum peak output power at antenna input terminal: | <u>218.78 (mW)</u>               |
| Prediction distance:                                 | <u>20 (cm)</u>                   |
| Predication frequency:                               | <u>5600(MHz)</u>                 |
| Antenna Gain (typical):                              | <u>4.5 (dBi)</u>                 |
| antenna gain:                                        | <u>2.82 (numeric)</u>            |
| Power density at predication frequency at 20 cm:     | <u>0.123 (mW/cm<sup>2</sup>)</u> |

**MPE limit for uncontrolled exposure at prediction frequency: 1.0 (mW/cm<sup>2</sup>)**

**Result:** Compliant.

## §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:** Compliant, the two identical antennae, *Nearson* model: Swivel Antenna 614 utilized by this device are external antenna with SMA (reverse polarity plug, female) connectors and a maximum gain of 4.0 dBi (2.4~2.5 GHz), 5dBi (5.15~5.35 GHz) and 4.5dBi (5.75~5.85 GHz).

| Swivel Multi-band Wireless LAN Antennae |                         |              |           |
|-----------------------------------------|-------------------------|--------------|-----------|
| Frequency (MHz)                         | Main Antenna Gain (dBi) | Polarization | Radiation |
| 2450                                    | 4.0                     | Vertical     | Omni      |
| 5250                                    | 5.0                     | Vertical     | Omni      |
| 5750                                    | 4.5                     | Vertical     | Omni      |



## §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  $\mu$ H/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<br>(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 plugged into LISN 1 which provided 120V/ 60 Hz AC

### Test Equipment List and Details

| Manufacturer      | Description       | Model             | Serial Number | Calibration Date |
|-------------------|-------------------|-------------------|---------------|------------------|
| Rohde & Schwarz   | EMI Test Receiver | ESCI 1166.5950K03 | 100337        | 2007-03-08       |
| Solar Electronics | LISN              | 9252-R-24-BNC     | 511205        | 2006-07-07       |

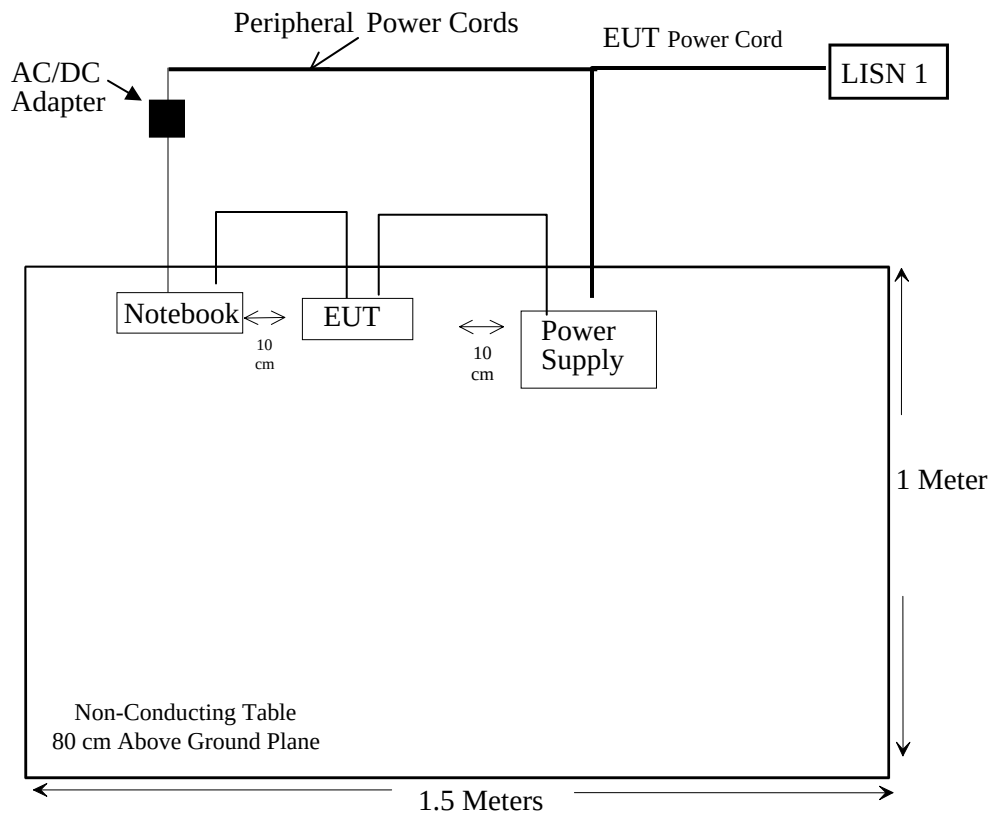
\* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

### 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 Block Diagram****Conducted Emissions**

**Environmental Conditions**

|                           |                   |
|---------------------------|-------------------|
| <b>Temperature:</b>       | 20° C -23° C      |
| <b>Relative Humidity:</b> | 30% - 63%         |
| <b>ATM Pressure:</b>      | 101.1 – 101.9 kPa |

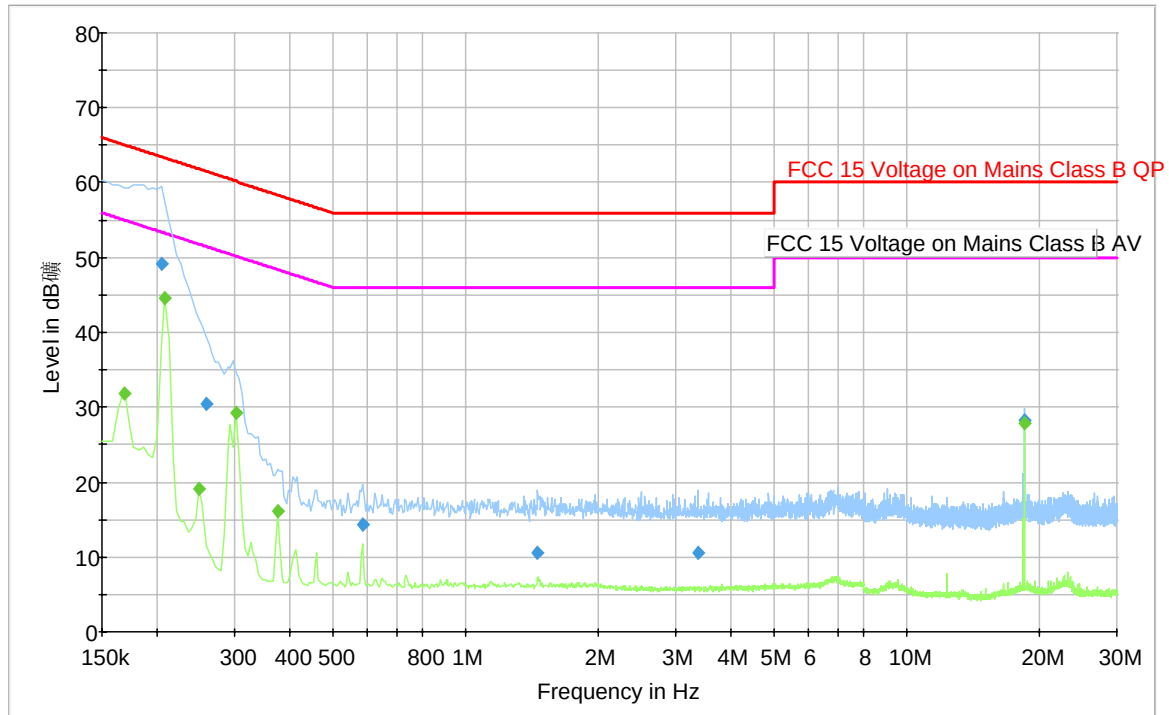
*\* The testing was performed by Dan Corona from 2007-06-11 to 2007-06-15*

**Summary of Test Results**

According to the recorded data in following table, the EUT complied with the FCC rules for conducted emissions for Class B devices, with the following margin reading closest to the limit:

| <b>Connection: 120 V/60 Hz AC</b> |                        |                                         |                     |
|-----------------------------------|------------------------|-----------------------------------------|---------------------|
| <b>Margin (dB)</b>                | <b>Frequency (MHz)</b> | <b>Conductor Mode<br/>(Hot/Neutral)</b> | <b>Range (MHz)</b>  |
| -8.8                              | 0.208500               | Hot                                     | 0.150 MHz to 30 MHz |

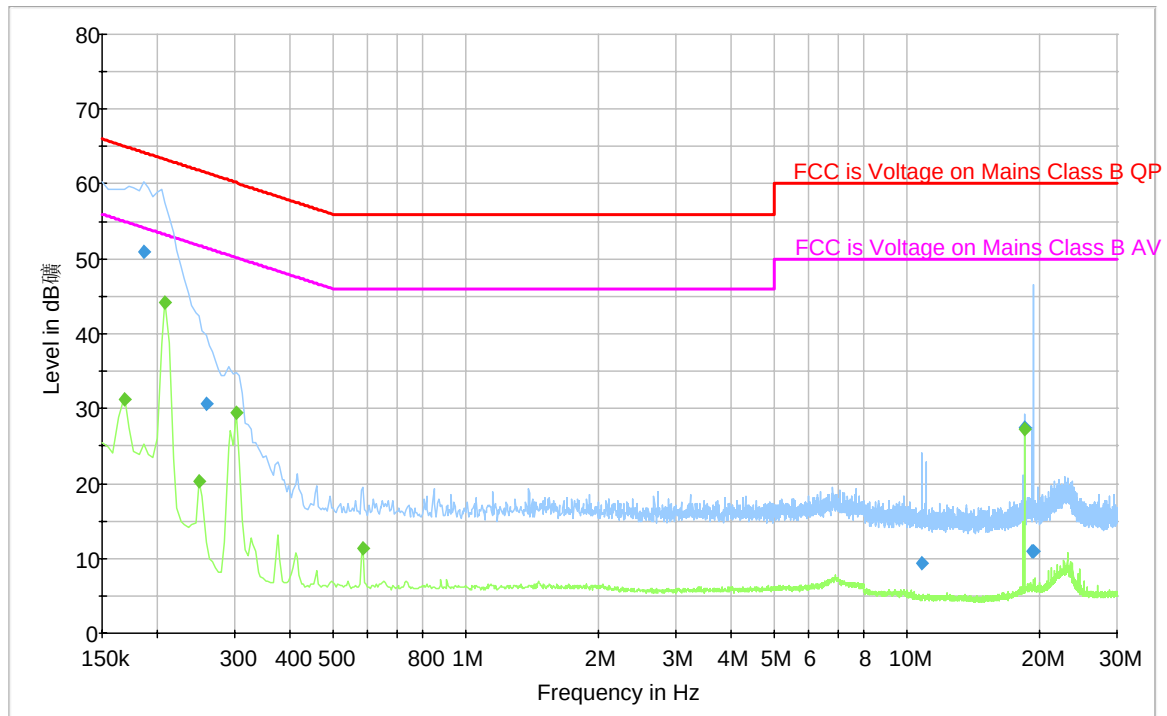


**120 V/ 60 Hz Hot:****Quasi-Peak**

| Frequency (MHz) | Quasi -Peak (dBµV) | Hot/Neutral | Correction Factor (dB) | Limit (dBµV) | Margin (dB) |
|-----------------|--------------------|-------------|------------------------|--------------|-------------|
| 0.204000        | 49.2               | Hot         | 12.1                   | 63.4         | -14.2       |
| 0.258000        | 30.5               | Hot         | 12.3                   | 61.5         | -31.0       |
| 18.487500       | 28.2               | Hot         | 12.5                   | 60.0         | -31.8       |
| 0.586500        | 14.4               | Hot         | 12.5                   | 56.0         | -41.6       |
| 1.459500        | 10.5               | Hot         | 12.5                   | 56.0         | -45.5       |
| 3.372000        | 10.5               | Hot         | 12.4                   | 56.0         | -45.5       |

**Average**

| Frequency (MHz) | Average (dBµV) | Hot/Neutral | Correction Factor (dB) | Limit (dBµV) | Margin (dB) |
|-----------------|----------------|-------------|------------------------|--------------|-------------|
| 0.208500        | 44.5           | Hot         | 12.2                   | 53.3         | -8.8        |
| 0.303000        | 29.2           | Hot         | 12.3                   | 50.2         | -20.9       |
| 18.487500       | 27.9           | Hot         | 12.3                   | 50.0         | -22.1       |
| 0.168000        | 31.9           | Hot         | 12.3                   | 55.1         | -23.1       |
| 0.375000        | 16.1           | Hot         | 12.3                   | 48.4         | -32.3       |
| 0.249000        | 19.1           | Hot         | 12.3                   | 51.8         | -32.7       |

**120 V/ 60 Hz Neutral:****Quasi-Peak**

| Frequency (MHz) | Quasi-Peak (dBμV) | Hot/Neutral | Correction Factor (dB) | Limit (dBμV) | Margin (dB) |
|-----------------|-------------------|-------------|------------------------|--------------|-------------|
| 0.186000        | 50.8              | Neutral     | 12.3                   | 64.2         | -13.4       |
| 0.258000        | 30.6              | Neutral     | 12.3                   | 61.5         | -30.9       |
| 18.487500       | 27.5              | Neutral     | 12.3                   | 60.0         | -32.5       |
| 19.297500       | 11.0              | Neutral     | 12.3                   | 60.0         | -49.0       |
| 19.356000       | 10.9              | Neutral     | 12.3                   | 60.0         | -49.1       |
| 10.828500       | 9.4               | Neutral     | 12.3                   | 60.0         | -50.6       |

**Average**

| Frequency (MHz) | Average (dBμV) | Hot/Neutral | Correction Factor (dB) | Limit (dBμV) | Margin (dB) |
|-----------------|----------------|-------------|------------------------|--------------|-------------|
| 0.208500        | 44.2           | Neutral     | 12.4                   | 53.3         | -9.1        |
| 0.303000        | 29.4           | Neutral     | 12.5                   | 50.2         | -20.8       |
| 0.168000        | 31.3           | Neutral     | 12.1                   | 55.1         | -23.8       |
| 18.487500       | 27.4           | Neutral     | 12.6                   | 50.0         | -22.6       |
| 0.249000        | 20.3           | Neutral     | 12.5                   | 51.8         | -31.5       |
| 0.586500        | 11.3           | Neutral     | 12.3                   | 46.0         | -34.7       |

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## **§2.1051 & §15.407(b) (1) & (b) (2) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS**

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### **Applicable Standard**

For §15.407 (b)(1), (b)(2) & (b)(3), transmitters operating in the 5.15-5.35 GHz band: all emissions outside 5.15 – 5.35 and 5.47 – 5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz

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

*For 5150 – 5350 MHz: 802.11a*

### **Measurement Procedure**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### **Test Equipment**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### **Test Setup Diagram**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### **Environmental Conditions**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### **Measurement Results**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

*For 5470 – 5725 MHz: 802.11a*

### Measurement Procedure

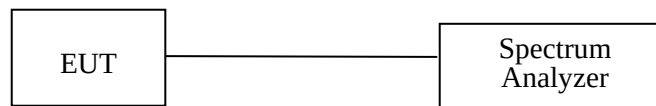
1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.

### Equipment Lists

| Manufacturer | Description       | Model  | Serial Number | Cal. Date  |
|--------------|-------------------|--------|---------------|------------|
| Agilent      | Spectrum Analyzer | E4440A | MY44303352    | 2007-02-23 |

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

### Test Setup Diagram



### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 22 °C     |
| Relative Humidity: | 56 %      |
| ATM Pressure:      | 104.1 kPa |

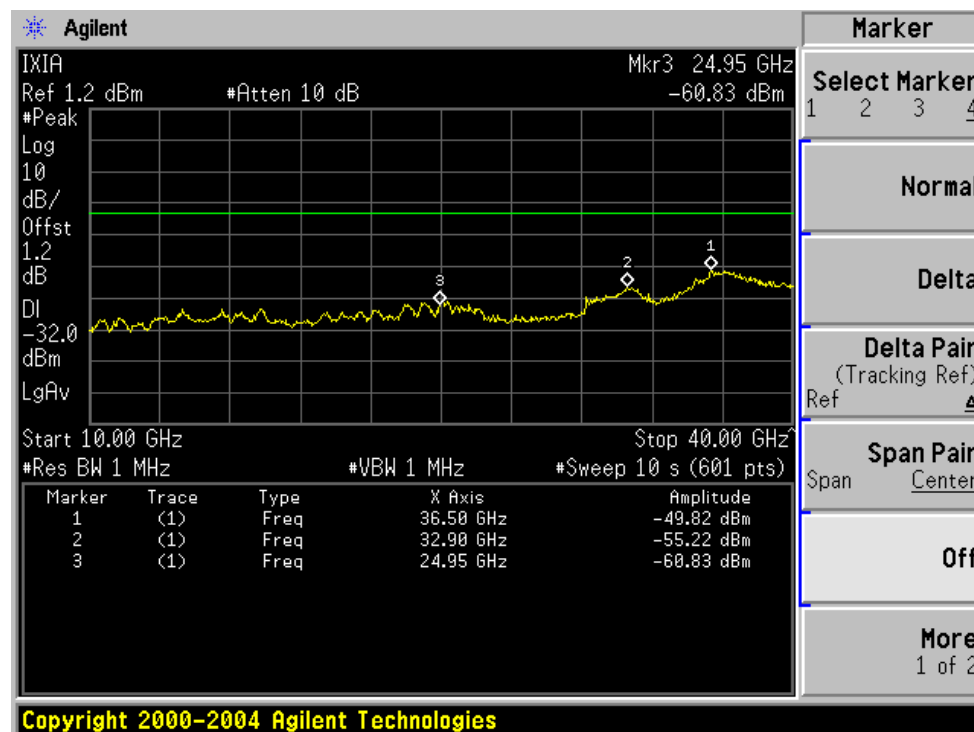
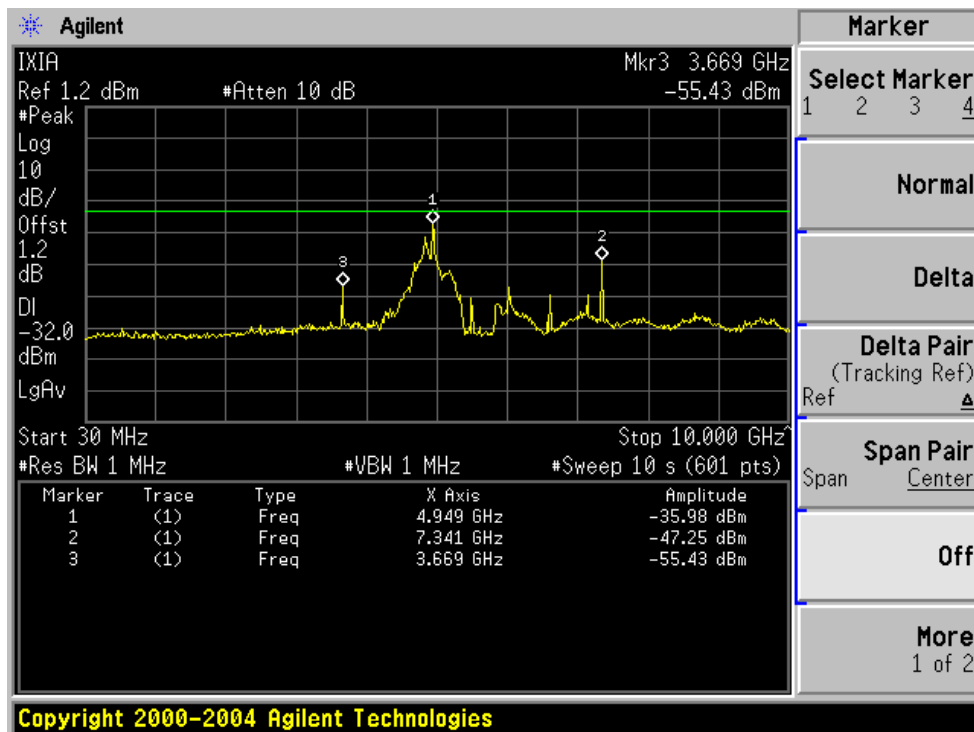
\* The testing was performed by Dan Corona from 2007-06-11 to 2007-06-15

**Test Result**

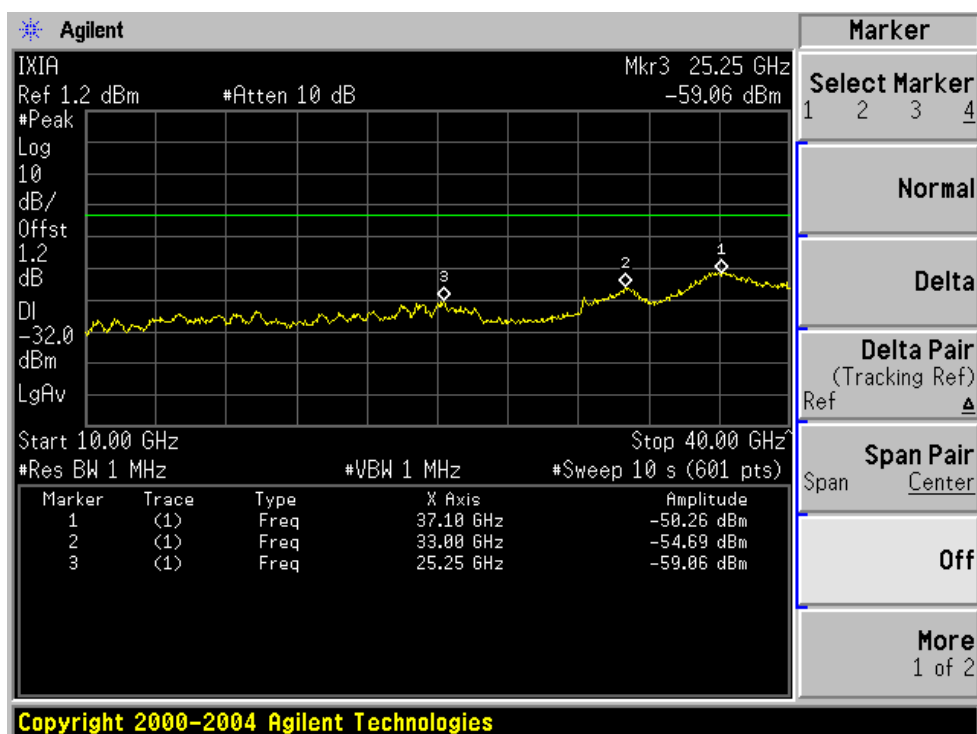
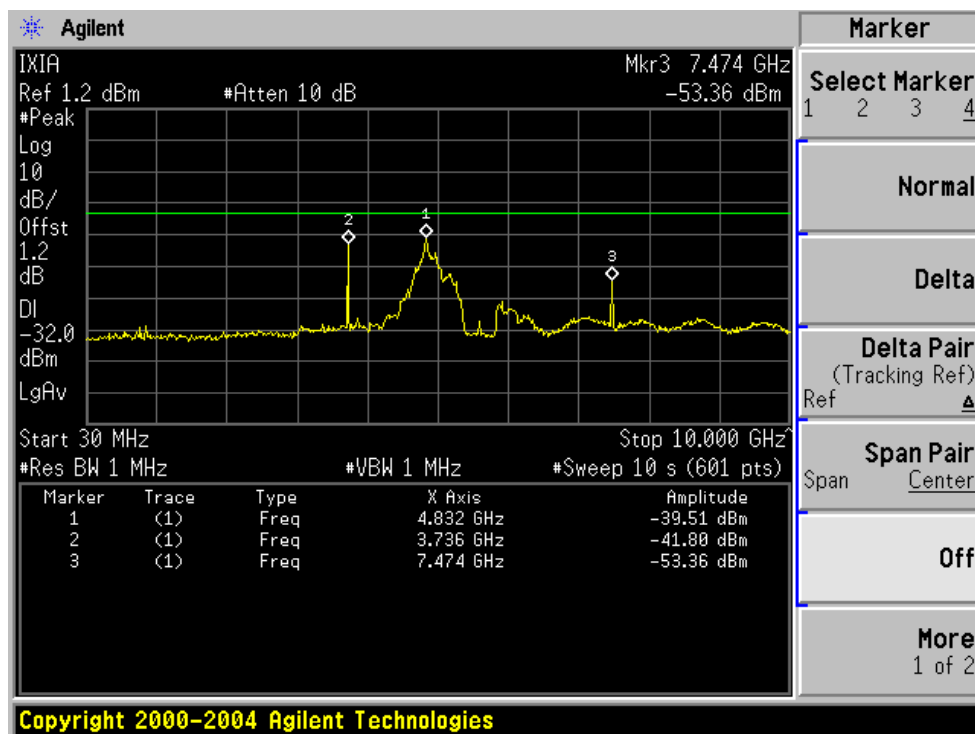
Please refer to following pages for plots of spurious emissions.

For 5470 – 5725 MHz: 802.11a

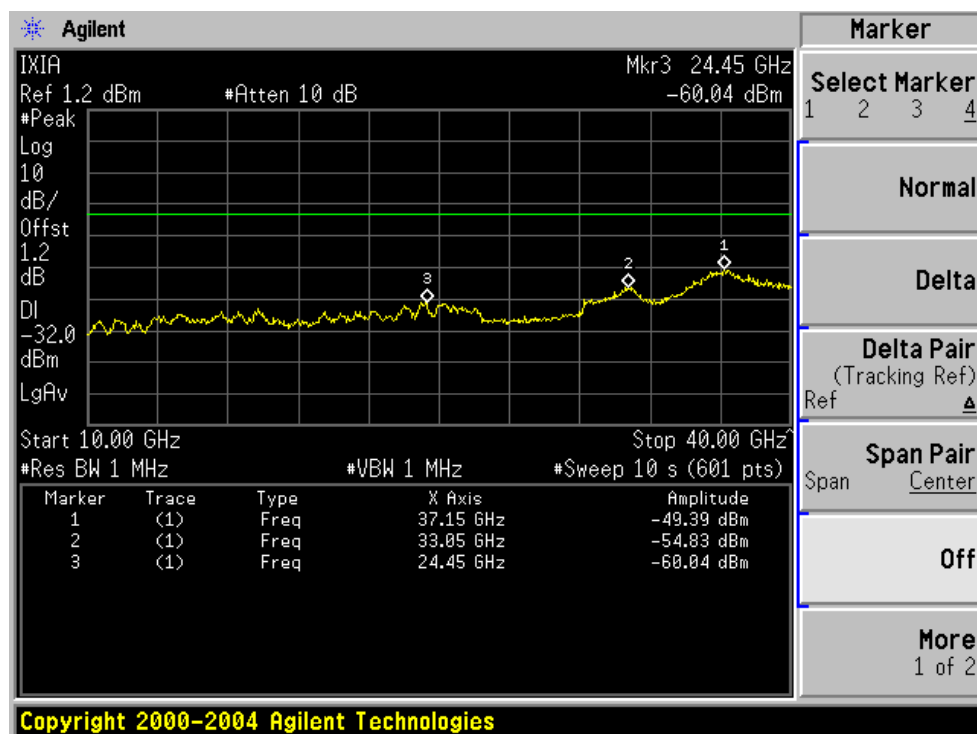
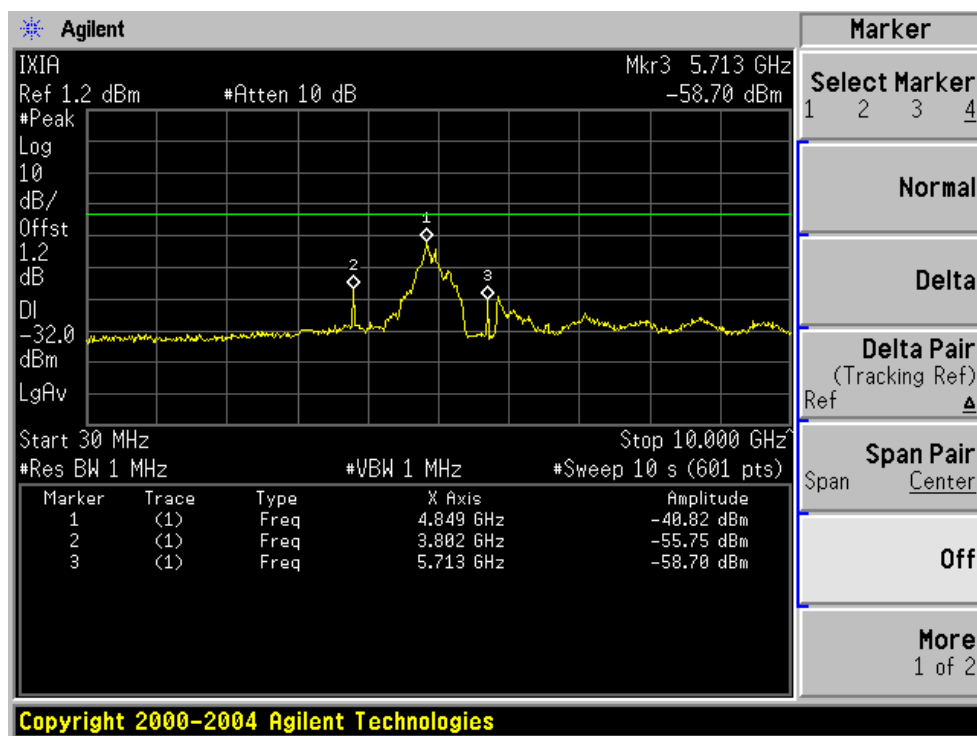
Channel: 100 (5500MHz)



Channel: 120 (5600MHz)



Channel: 140 (5700MHz)



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**§15.407 – 26 dB & 99% BANDWIDTH**

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**Applicable Standard**

No limit, for reporting purpose only.

For 5150 – 5350 MHz: 802.11a

**Measurement Procedure**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

**Test Equipment**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

**Test Setup Diagram**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

**Environmental Conditions**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

**Measurement Results**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**



*For 5470 – 5725 MHz: 802.11a*

### Measurement Procedure

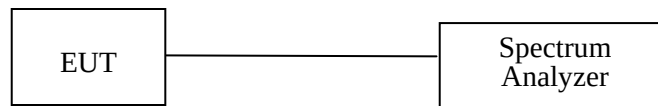
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency 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 26 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

### Equipment Lists

| Manufacturer | Description       | Model  | Serial Number | Cal. Date  |
|--------------|-------------------|--------|---------------|------------|
| Agilent      | Spectrum Analyzer | E4440A | MY44303352    | 2007-02-23 |

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

### Test Setup Diagram



### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 22 °C     |
| Relative Humidity: | 56 %      |
| ATM Pressure:      | 104.1 kPa |

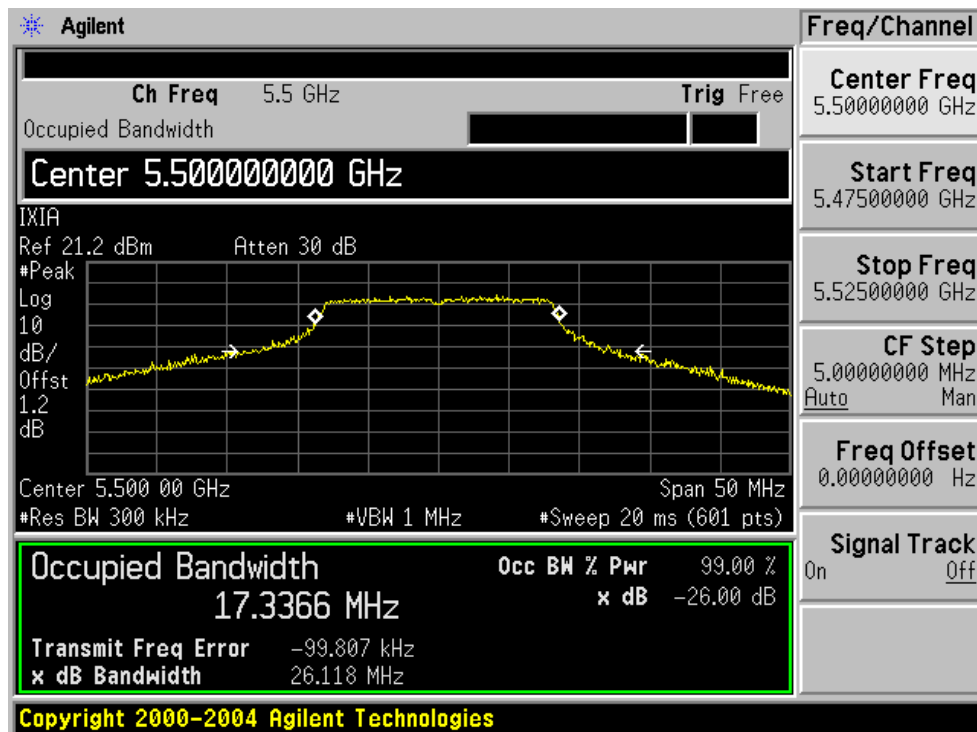
*\* The testing was performed by Dan Corona from 2007-06-11 to 2007-06-15*

**Test Result**

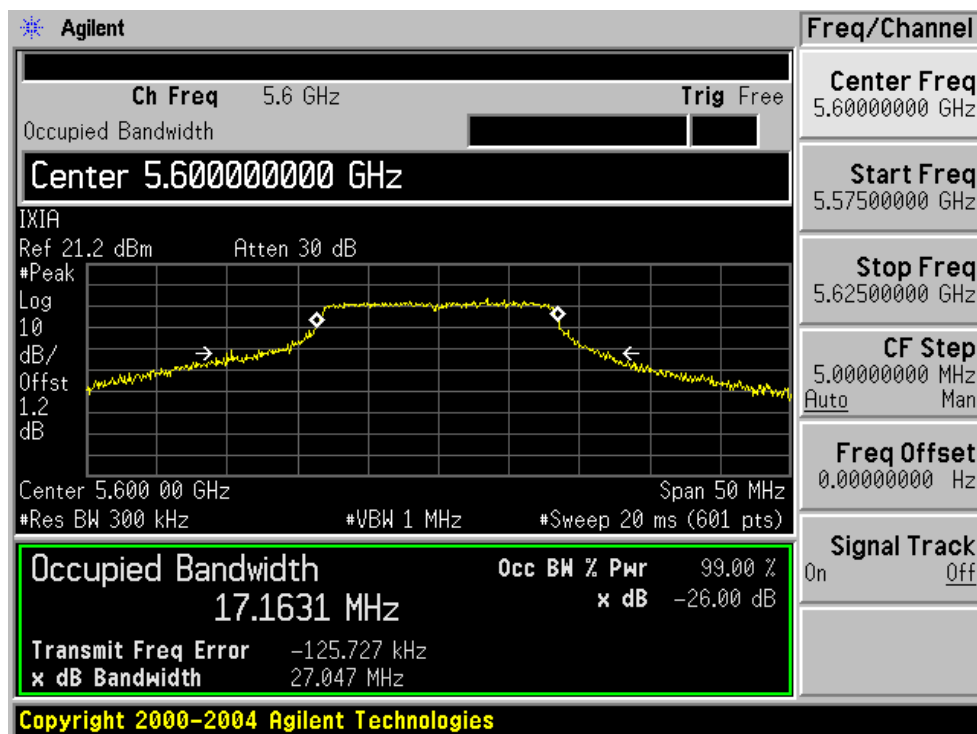
Please refer to following pages for plots of spurious emissions.

For 5470 – 5725 MHz: 802.11a

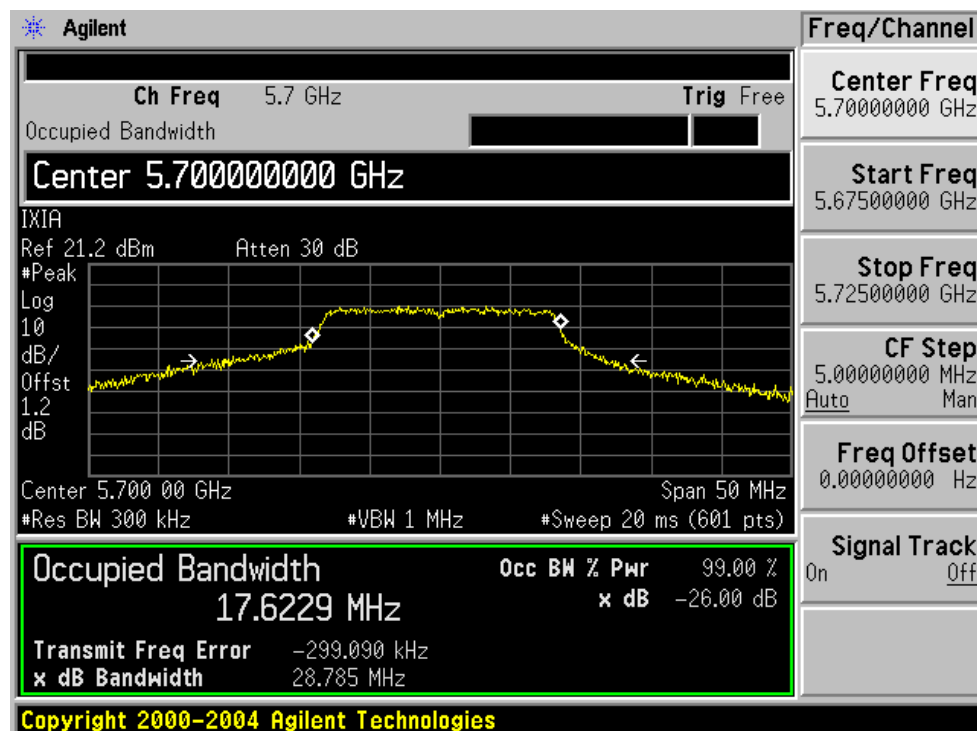
Channel: 100 (5500MHz)



Channel: 120 (5600MHz)



Channel: 140 (5700MHz)



## §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:

| Frequency (MHz)     | Frequency (MHz)       | Frequency (MHz) | Frequency (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     | 3332 – 3339     | 22.01 – 23.12   |
| 8.41425 – 8.41475   | 167.72 – 173.2        | 3345.8 – 3358   | 23.6 – 24.0     |
| 12.29 – 12.293      | 240 – 285             | 3600 – 4400     | 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.
- (3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47 – 5.725 GHz band shall 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             | Amplifier, Pre      | 317                | 260406        | 2007-04-30 |
| 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:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000MHz:

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

## Corrected Amplitude & Margin Calculation

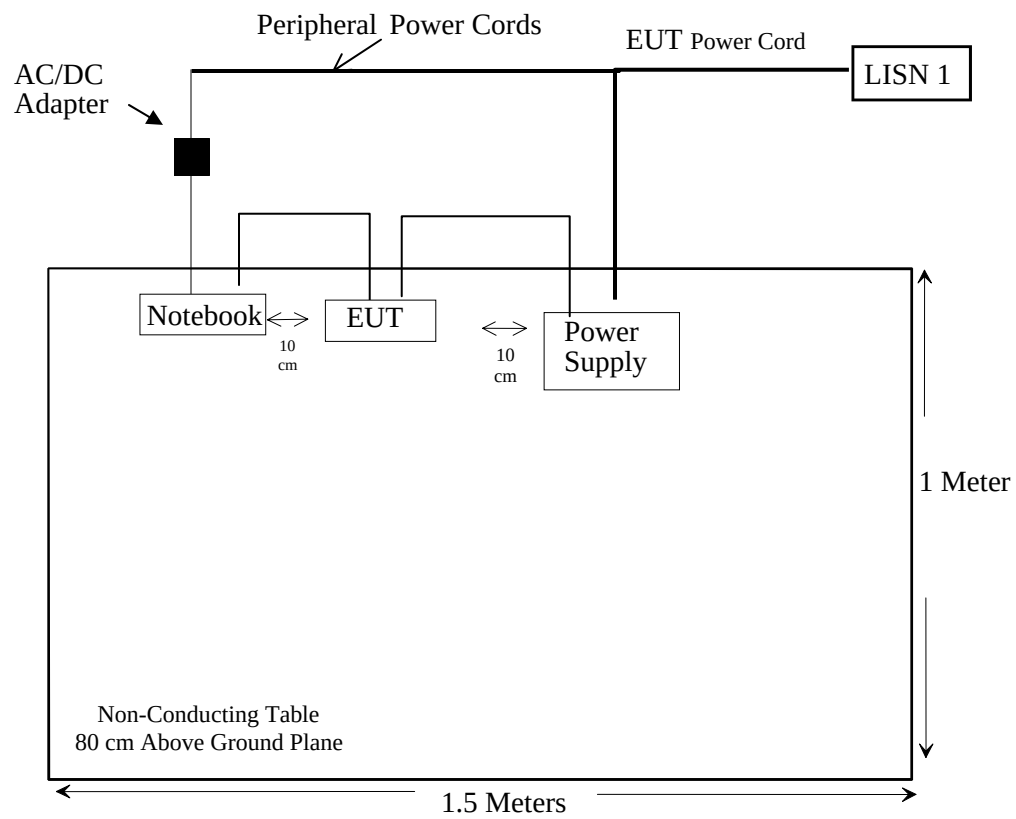
The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Corrected Amplitude} - \text{FCC Limit}$$

**Test Setup Block Diagram**

**Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 22° C     |
| <b>Relative Humidity:</b> | 56 %      |
| <b>ATM Pressure:</b>      | 104.1 kPa |

\* The testing was performed by Dan Corona from 2007-06-11 to 2007-06-15

**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:

| <b>Mode: Receiver</b> |                        |                                               |                        |
|-----------------------|------------------------|-----------------------------------------------|------------------------|
| <b>Margin (dB)</b>    | <b>Frequency (MHz)</b> | <b>Polarization<br/>(Horizontal/Vertical)</b> | <b>Channel</b>         |
| -4.1                  | 666.643750             | Horizontal                                    | NA, 30 MHz to 1000 MHz |

Intentional Emissions:

| <b>Mode: 802.11 a (5150 – 5250)</b> |                        |                                               |                       |
|-------------------------------------|------------------------|-----------------------------------------------|-----------------------|
| <b>Margin (dB)</b>                  | <b>Frequency (MHz)</b> | <b>Polarization<br/>(Horizontal/Vertical)</b> | <b>Channel</b>        |
| -4.19                               | 15540.00               | Vertical                                      | Low, 1 GHz – 40GHz    |
| -3.43                               | 15780.00               | Vertical                                      | Middle, 1 GHz – 40GHz |
| -2.45                               | 15960.00               | Vertical                                      | High, 1 GHz – 40GHz   |

Intentional Emissions:

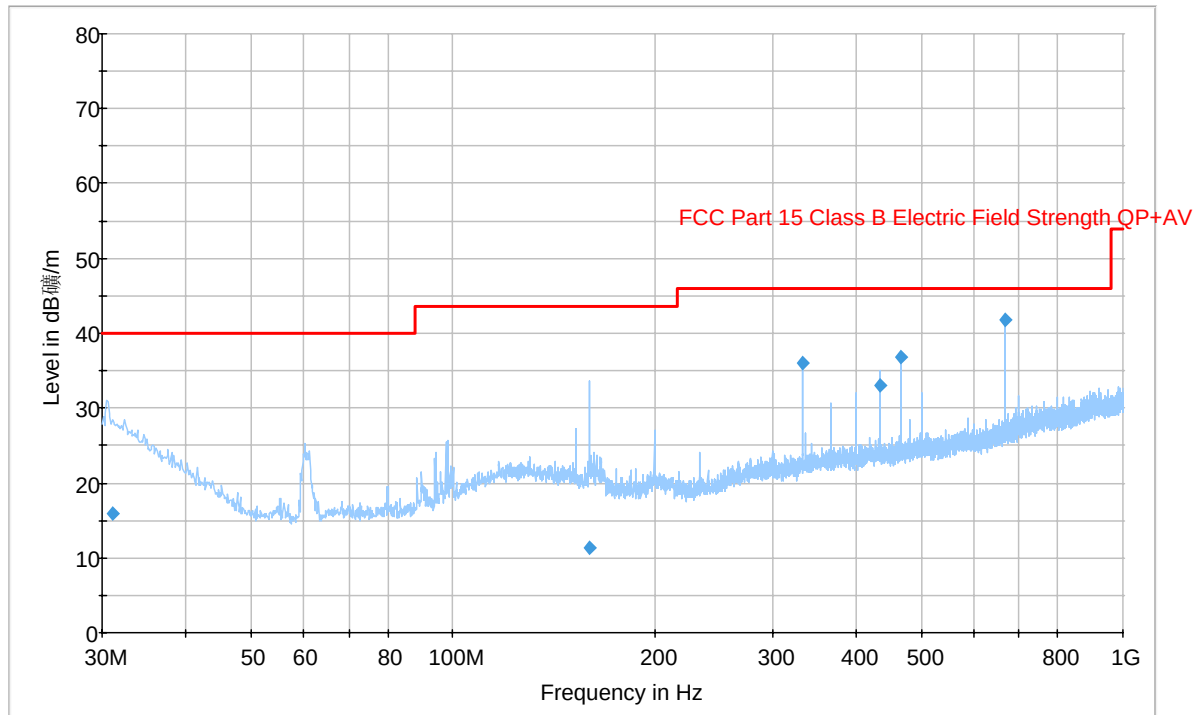
| <b>Mode: 802.11 a (5470 – 5725)</b> |                        |                                               |                       |
|-------------------------------------|------------------------|-----------------------------------------------|-----------------------|
| <b>Margin (dB)</b>                  | <b>Frequency (MHz)</b> | <b>Polarization<br/>(Horizontal/Vertical)</b> | <b>Channel</b>        |
| -3.66                               | 16500.00               | Vertical                                      | Low, 1 GHz – 40GHz    |
| -4.72                               | 16800.00               | Vertical                                      | Middle, 1 GHz – 40GHz |
| -3.9                                | 17100.00               | Vertical                                      | High, 1 GHz – 40GHz   |

Please see the following plots and tables for full test result details



**Radiated Emissions Test plot & data:**

Primary scan 30MHz -1GHz



| Frequency (MHz) | Quasi-Peak (dBμV/m) | Antenna Height (cm) | Polarity (H/V) | Turntable Position (degrees) | Limit (dBμV/m) | Margin (dB) |
|-----------------|---------------------|---------------------|----------------|------------------------------|----------------|-------------|
| 666.643750      | 41.9                | 99.0                | H              | 141.0                        | 46.0           | -4.1        |
| 466.662500      | 36.9                | 99.0                | V              | 6.0                          | 46.0           | -9.1        |
| 333.327500      | 36.1                | 99.0                | H              | 124.0                        | 46.0           | -9.9        |
| 433.318750      | 33.0                | 99.0                | V              | 149.0                        | 46.0           | -13.0       |
| 31.085000       | 16.0                | 383.0               | V              | 152.0                        | 40.0           | -24.0       |
| 160.300000      | 11.4                | 325.0               | H              | 263.0                        | 43.5           | -32.1       |

**802.11a** 5150 – 5350 MHz band:

Channel: 36 (5180)

| Frequency (MHz) | Reading (dBuV) | Direction Degrees | Height (m) | Polar. H / V | Antenna Factor (dB/m) | Cable Loss (dB) | Pre-Amplifier (dB) | Corrected Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments  |
|-----------------|----------------|-------------------|------------|--------------|-----------------------|-----------------|--------------------|-------------------------|----------------|-------------|-----------|
| 5180.0000       | 99.2           | 256               | 1.0        | V            | 34.0                  | 3.9             | 34.9               | 102.2                   |                |             | Fund/Peak |
| 5180.0000       | 89.0           | 274               | 1.1        | H            | 34.0                  | 3.9             | 34.9               | 92.0                    |                |             | Fund/Peak |
| 5180.0000       | 90.5           | 256               | 1.0        | V            | 34.0                  | 3.9             | 34.9               | 93.5                    |                |             | Ave       |
| 5180.0000       | 80.2           | 274               | 1.1        | H            | 34.0                  | 3.9             | 34.9               | 83.2                    |                |             | Ave       |
| 15540.0000      | 35.4           | 294               | 1.4        | V            | 40.4                  | 7.3             | 33.2               | 49.8                    | 54             | -4.19       | Ave       |
| 15540.0000      | 34.6           | 278               | 1.6        | H            | 40.4                  | 7.3             | 33.2               | 49.0                    | 54             | -4.99       | Ave       |
| 10360.0000      | 32.8           | 290               | 1.1        | V            | 38.0                  | 5.7             | 36.8               | 39.7                    | 54             | -14.27      | Ave       |
| 10360.0000      | 30.1           | 251               | 1.4        | H            | 38.0                  | 5.7             | 36.8               | 37.0                    | 54             | -16.97      | Ave       |
| 15540.0000      | 48.3           | 294               | 1.4        | V            | 40.4                  | 7.3             | 33.2               | 62.7                    | 74             | -11.26      | Peak      |
| 15540.0000      | 47.5           | 278               | 1.6        | H            | 40.4                  | 7.3             | 33.2               | 61.9                    | 74             | -12.09      | Peak      |
| 10360.0000      | 43.3           | 290               | 1.1        | V            | 38.0                  | 5.7             | 36.8               | 50.2                    | 74             | -23.82      | Peak      |
| 10360.0000      | 41.5           | 251               | 1.4        | H            | 38.0                  | 5.7             | 36.8               | 48.4                    | 74             | -25.57      | Peak      |

Channel: 52 (5260)

| Frequency (MHz) | Reading (dBuV) | Direction Degrees | Height (m) | Polar. H / V | Antenna Factor (dB/m) | Cable Loss (dB) | Pre-Amplifier (dB) | Corrected Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments  |
|-----------------|----------------|-------------------|------------|--------------|-----------------------|-----------------|--------------------|-------------------------|----------------|-------------|-----------|
| 5260.0000       | 102.5          | 310               | 1.0        | V            | 34.0                  | 4.0             | 34.4               | 106.1                   |                |             | Fund/Peak |
| 5260.0000       | 89.8           | 301               | 1.8        | H            | 34.0                  | 4.0             | 34.4               | 93.4                    |                |             | Fund/Peak |
| 5260.0000       | 93.5           | 310               | 1.0        | V            | 34.0                  | 4.0             | 34.4               | 97.1                    |                |             | Ave       |
| 5260.0000       | 80.5           | 301               | 1.8        | H            | 34.0                  | 4.0             | 34.4               | 84.1                    |                |             | Ave       |
| 15780.0000      | 36.2           | 247               | 1.1        | V            | 40.4                  | 7.3             | 33.2               | 50.6                    | 54             | -3.43       | Ave       |
| 15780.0000      | 36.0           | 292               | 1.3        | H            | 40.4                  | 7.3             | 33.2               | 50.4                    | 54             | -3.60       | Ave       |
| 10520.0000      | 34.6           | 274               | 1.0        | V            | 38.7                  | 5.8             | 39.0               | 40.2                    | 54             | -13.81      | Ave       |
| 10520.0000      | 34.5           | 317               | 1.6        | H            | 38.7                  | 5.8             | 39.0               | 40.1                    | 54             | -13.91      | Ave       |
| 15780.0000      | 46.7           | 247               | 1.1        | V            | 40.4                  | 7.3             | 33.2               | 61.1                    | 74             | -12.93      | Peak      |
| 15780.0000      | 46.5           | 292               | 1.3        | H            | 40.4                  | 7.3             | 33.2               | 60.9                    | 74             | -13.10      | Peak      |
| 10520.0000      | 45.3           | 274               | 1.0        | V            | 38.7                  | 5.8             | 39.0               | 50.9                    | 74             | -23.08      | Peak      |
| 10520.0000      | 44.7           | 317               | 1.6        | H            | 38.7                  | 5.8             | 39.0               | 50.3                    | 74             | -23.74      | Peak      |

Channel: 64 (5320)

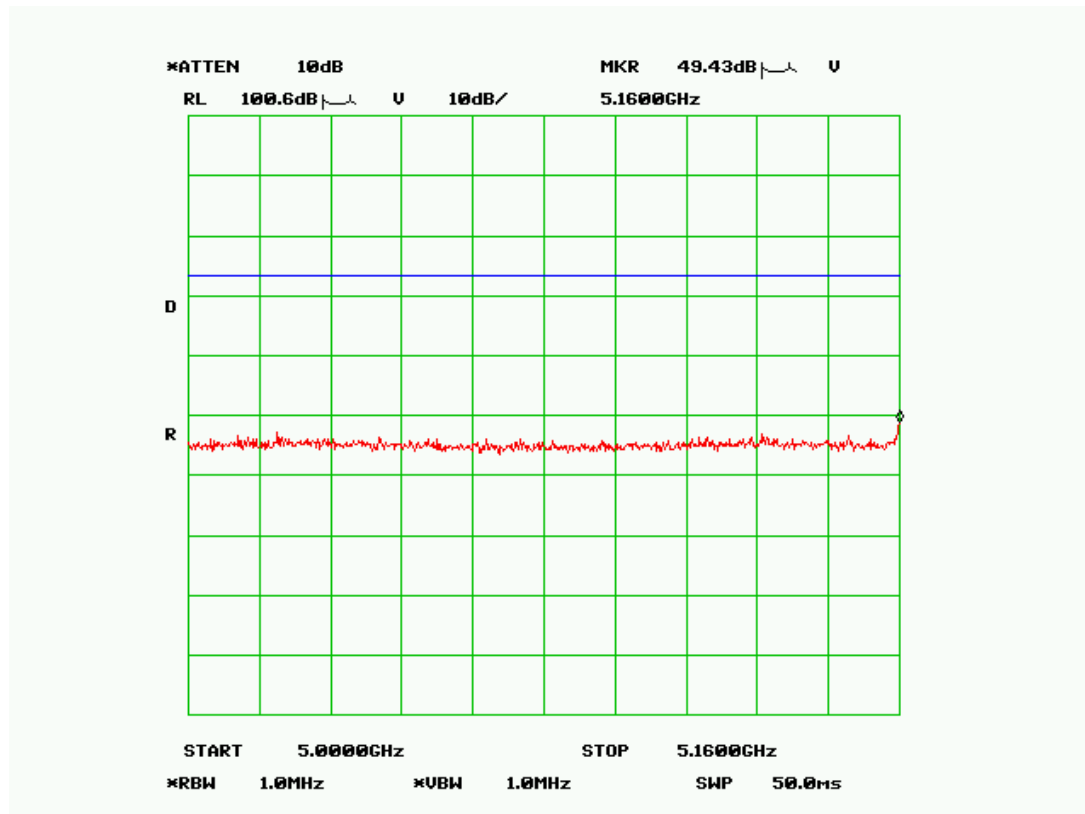
| Frequency (MHz) | Reading (dBuV) | Direction Degrees | Height (m) | Polar. H / V | Antenna Factor (dB/m) | Cable Loss (dB) | Pre-Amplifier (dB) | Corrected Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments  |
|-----------------|----------------|-------------------|------------|--------------|-----------------------|-----------------|--------------------|-------------------------|----------------|-------------|-----------|
| 5320.0000       | 104.7          | 290               | 1.0        | V            | 34.0                  | 4.0             | 33.9               | 108.7                   |                |             | Fund/Peak |
| 5320.0000       | 92.0           | 254               | 1.2        | H            | 34.0                  | 4.0             | 33.9               | 96.1                    |                |             | Fund/Peak |
| 5320.0000       | 95.0           | 290               | 1.0        | V            | 34.0                  | 4.0             | 33.9               | 99.1                    |                |             | Ave       |
| 5320.0000       | 81.8           | 254               | 1.2        | H            | 34.0                  | 4.0             | 33.9               | 85.9                    |                |             | Ave       |
| 15960.0000      | 36.8           | 215               | 1.2        | V            | 40.4                  | 7.6             | 33.2               | 51.5                    | 54             | -2.45       | Ave       |
| 15960.0000      | 36.5           | 325               | 1.6        | H            | 40.4                  | 7.6             | 33.2               | 51.2                    | 54             | -2.75       | Ave       |
| 10640.0000      | 32.5           | 312               | 1.1        | V            | 38.7                  | 5.9             | 39.0               | 38.2                    | 54             | -15.90      | Ave       |
| 10640.0000      | 32.3           | 294               | 1.5        | H            | 38.7                  | 5.9             | 39.0               | 38.0                    | 54             | -16.10      | Ave       |
| 15960.0000      | 48.2           | 215               | 1.2        | V            | 40.4                  | 7.6             | 33.2               | 62.9                    | 74             | -11.05      | Peak      |
| 15960.0000      | 47.1           | 325               | 1.6        | H            | 40.4                  | 7.6             | 33.2               | 61.8                    | 74             | -12.15      | Peak      |
| 10640.0000      | 43.3           | 312               | 1.1        | V            | 38.7                  | 5.9             | 39.0               | 49.0                    | 74             | -25.10      | Peak      |
| 10640.0000      | 42.5           | 294               | 1.5        | H            | 38.7                  | 5.9             | 39.0               | 48.2                    | 74             | -25.90      | Peak      |

**\*Note:** All frequencies from 1GHz to 40 GHz have been investigated.  
The restricted band limit is 54 dB $\mu$ V/m, the out of band limit is 68.3 dB $\mu$ V/m.

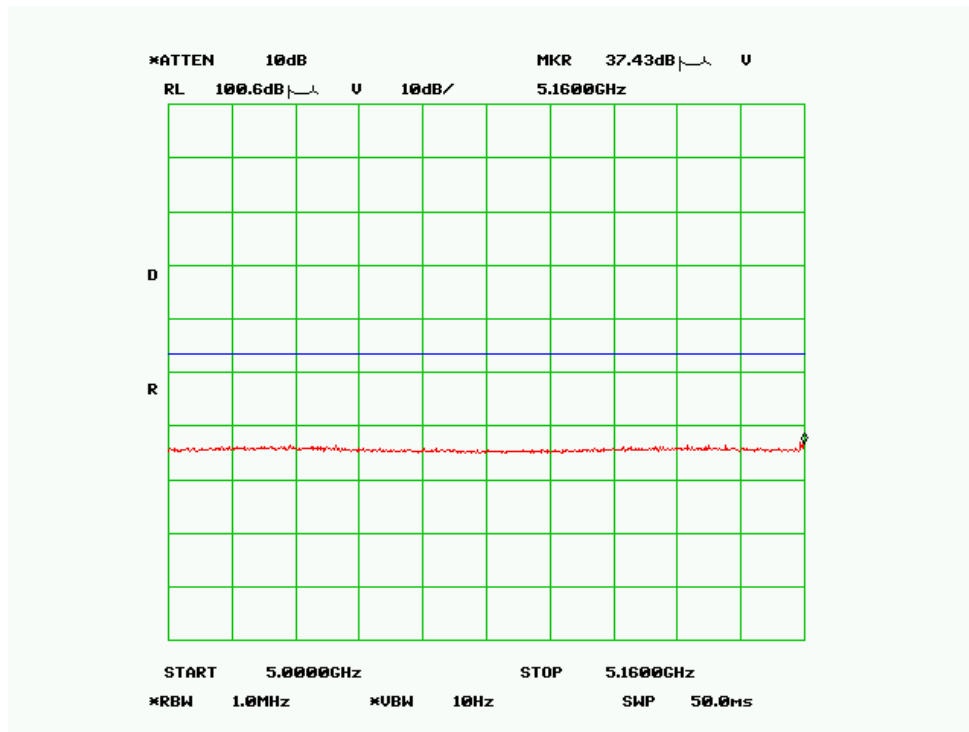
### Restricted band edge

Low channel

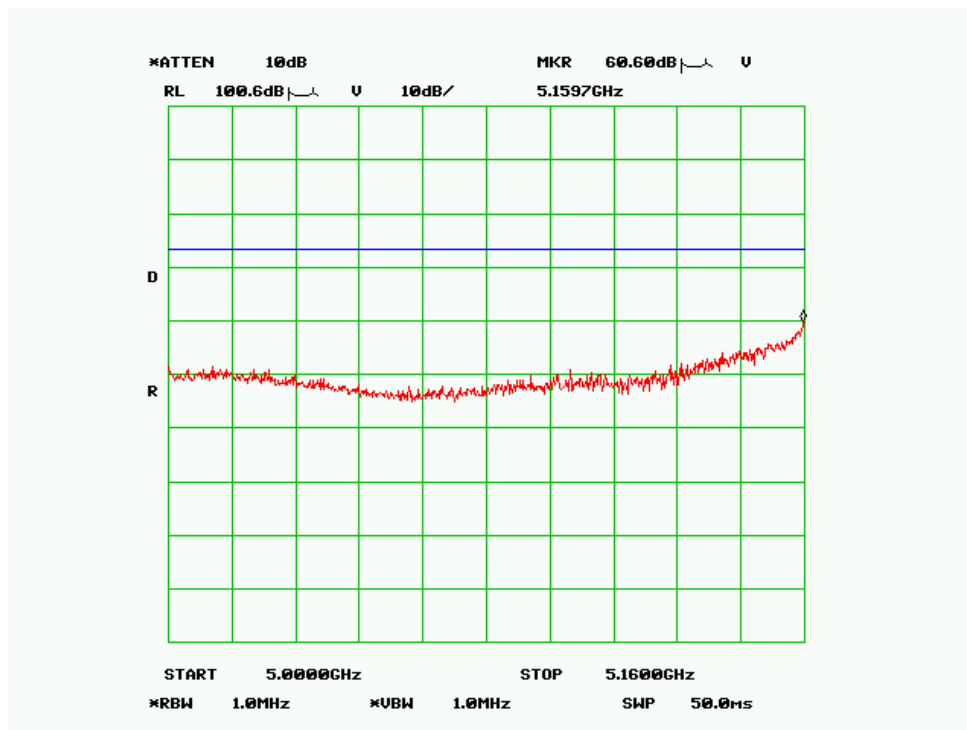
Peak, Horizontal



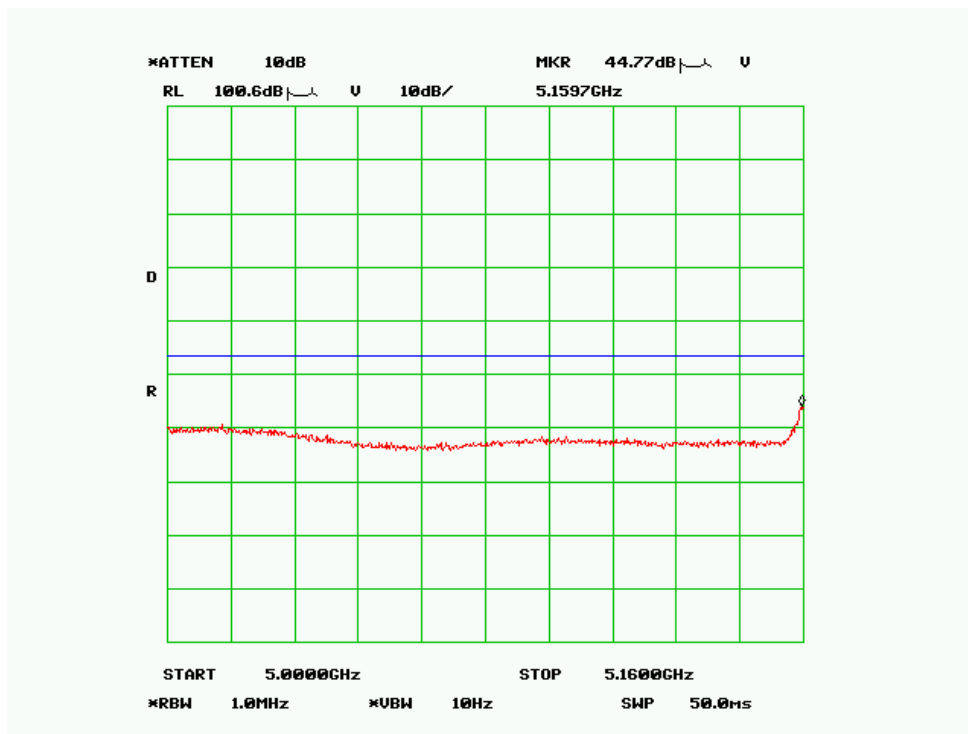
## Average, Horizontal



## Peak, Vertical

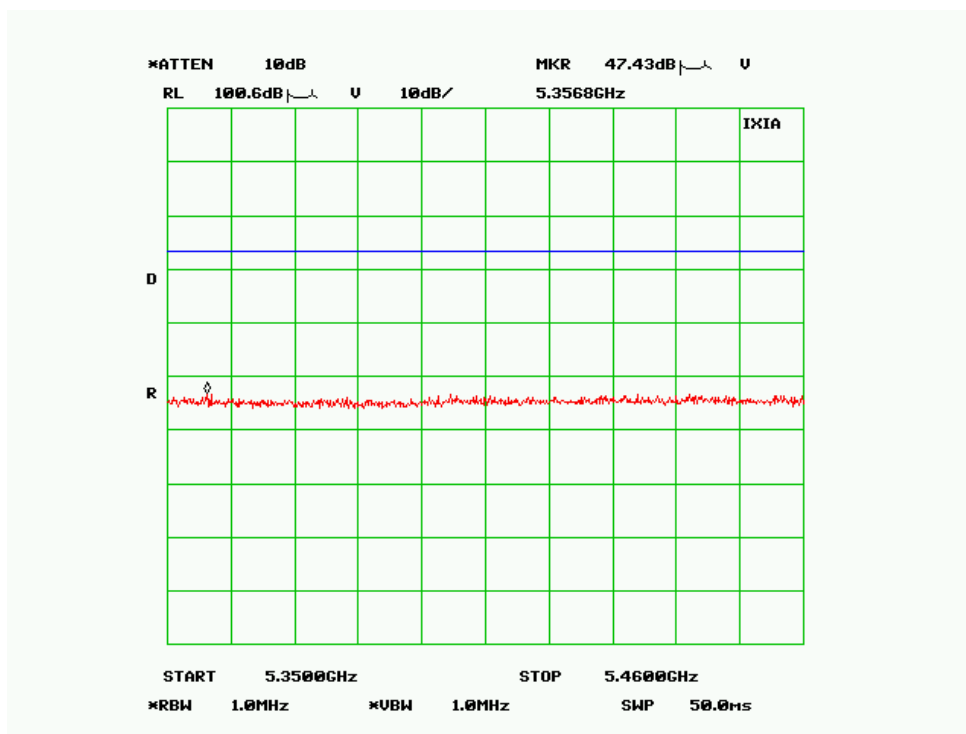


Average, Vertical

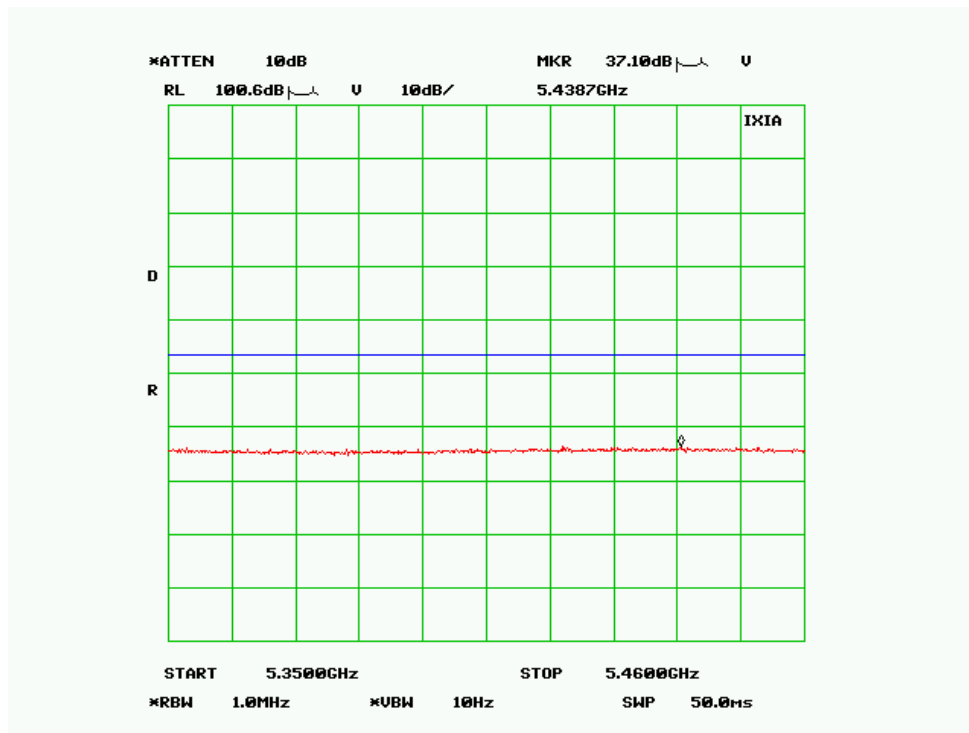


High channel

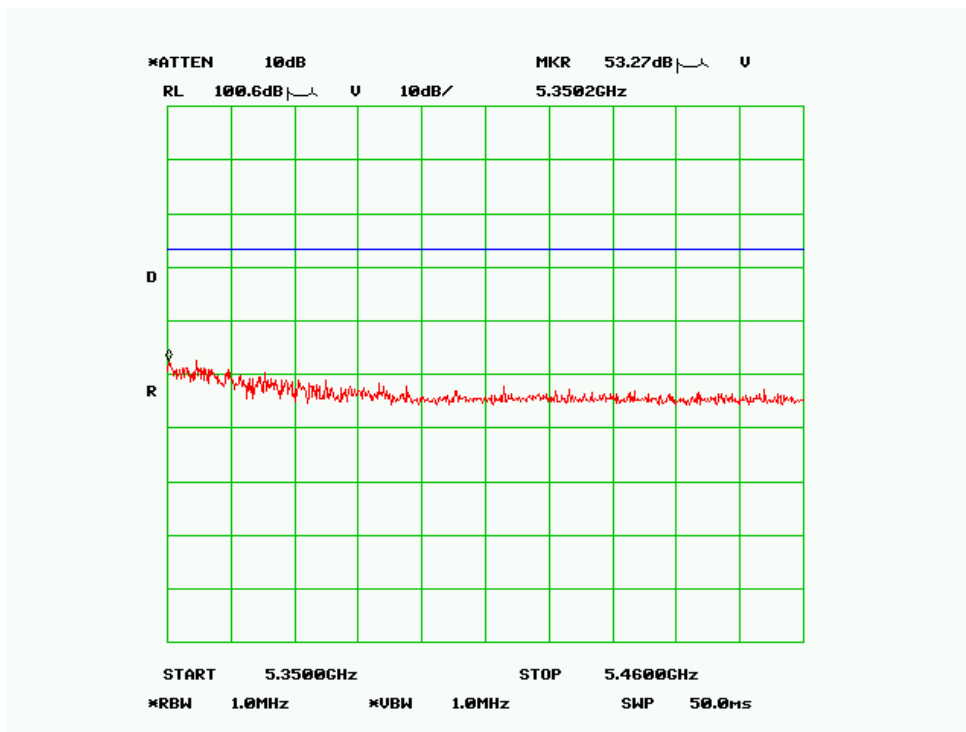
Peak, Horizontal



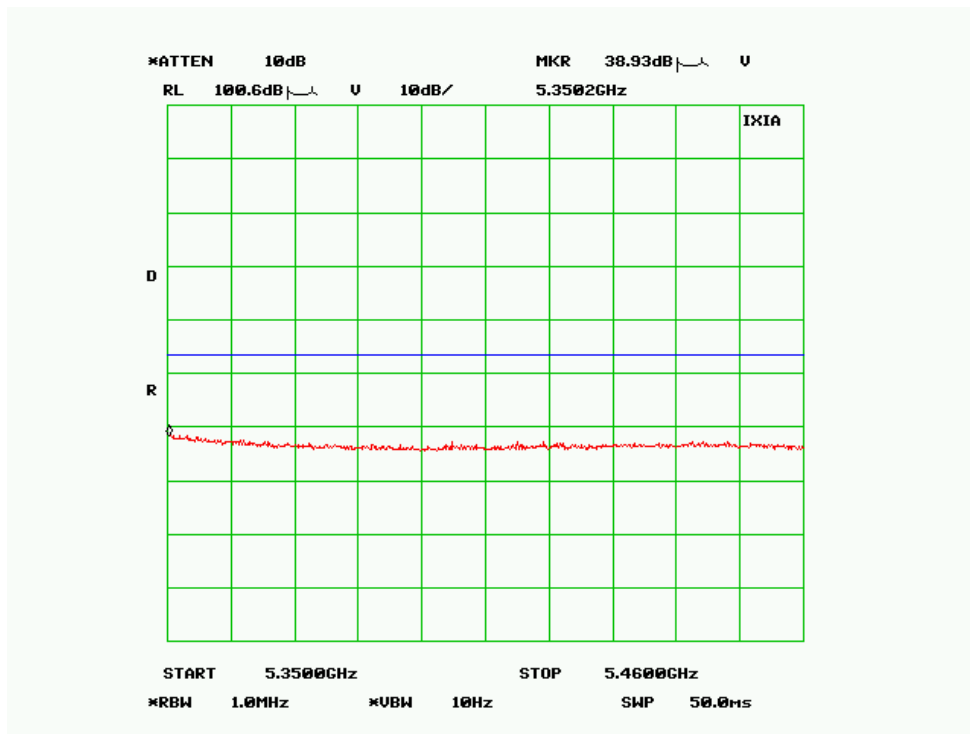
## Average, Horizontal



## Peak, Vertical



## Average, Vertical



**802.11a** 5470 – 5725 MHz band:

Channel: 100 (5500)

| Frequency (MHz) | Reading (dBuV) | Direction Degrees | Height (m) | Polar. H / V | Antenna Factor (dB/m) | Cable Loss (dB) | Pre-Amplifier (dB) | Corrected Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments  |
|-----------------|----------------|-------------------|------------|--------------|-----------------------|-----------------|--------------------|-------------------------|----------------|-------------|-----------|
| 5500.0000       | 102.7          | 248               | 1.1        | V            | 34.1                  | 4.1             | 34.1               | 106.8                   |                |             | Fund/Peak |
| 5500.0000       | 92.8           | 329               | 1.5        | H            | 34.1                  | 4.1             | 34.1               | 96.9                    |                |             | Fund/Peak |
| 5500.0000       | 93.5           | 248               | 1.1        | V            | 34.1                  | 4.1             | 34.1               | 97.6                    |                |             | Ave       |
| 5500.0000       | 83.3           | 329               | 1.5        | H            | 34.1                  | 4.1             | 34.1               | 87.4                    |                |             | Ave       |
| 16500.0000      | 31.8           | 322               | 1.1        | V            | 42.6                  | 7.5             | 31.6               | 50.3                    | 54             | -3.66       | Ave       |
| 16500.0000      | 30.5           | 269               | 1.3        | H            | 42.6                  | 7.5             | 31.6               | 49.0                    | 54             | -4.96       | Ave       |
| 11000.0000      | 36.3           | 277               | 1.0        | V            | 39.3                  | 6.0             | 39.5               | 42.2                    | 54             | -11.84      | Ave       |
| 11000.0000      | 35.7           | 287               | 1.5        | H            | 39.3                  | 6.0             | 39.5               | 41.5                    | 54             | -12.50      | Ave       |
| 16500.0000      | 45.5           | 322               | 1.1        | V            | 42.6                  | 7.5             | 31.6               | 64.0                    | 74             | -9.96       | Peak      |
| 16500.0000      | 44.8           | 269               | 1.3        | H            | 42.6                  | 7.5             | 31.6               | 63.3                    | 74             | -10.66      | Peak      |
| 11000.0000      | 45.8           | 277               | 1.0        | V            | 39.3                  | 6.0             | 39.5               | 51.6                    | 74             | -22.37      | Peak      |
| 11000.0000      | 44.5           | 287               | 1.5        | H            | 39.3                  | 6.0             | 39.5               | 50.3                    | 74             | -23.67      | Peak      |

Channel: 120 (5600)

| Frequency (MHz) | Reading (dBuV) | Direction Degrees | Height (m) | Polar. H / V | Antenna Factor (dB/m) | Cable Loss (dB) | Pre-Amplifier (dB) | Corrected Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments  |
|-----------------|----------------|-------------------|------------|--------------|-----------------------|-----------------|--------------------|-------------------------|----------------|-------------|-----------|
| 5600.0000       | 104.3          | 308               | 1.1        | V            | 34.1                  | 4.2             | 34.3               | 108.3                   |                |             | Fund/Peak |
| 5600.0000       | 95.7           | 292               | 1.7        | H            | 34.1                  | 4.2             | 34.3               | 99.6                    |                |             | Fund/Peak |
| 5600.0000       | 93.8           | 308               | 1.1        | V            | 34.1                  | 4.2             | 34.3               | 97.8                    |                |             | Ave       |
| 5600.0000       | 85.2           | 292               | 1.7        | H            | 34.1                  | 4.2             | 34.3               | 89.1                    |                |             | Ave       |
| 16800.0000      | 30.8           | 301               | 1.0        | V            | 42.6                  | 7.5             | 31.6               | 49.3                    | 54             | -4.72       | Ave       |
| 16800.0000      | 30.1           | 320               | 1.2        | H            | 42.6                  | 7.5             | 31.6               | 48.6                    | 54             | -5.40       | Ave       |
| 11200.0000      | 34.7           | 323               | 1.0        | V            | 39.3                  | 6.0             | 39.5               | 40.5                    | 54             | -13.49      | Ave       |
| 11200.0000      | 34.7           | 308               | 1.3        | H            | 39.3                  | 6.0             | 39.5               | 40.5                    | 54             | -13.49      | Ave       |
| 16800.0000      | 45.2           | 301               | 1.0        | V            | 42.6                  | 7.5             | 31.6               | 63.6                    | 74             | -10.35      | Peak      |
| 16800.0000      | 44.8           | 320               | 1.2        | H            | 42.6                  | 7.5             | 31.6               | 63.3                    | 74             | -10.72      | Peak      |
| 11200.0000      | 46.7           | 323               | 1.0        | V            | 39.3                  | 6.0             | 39.5               | 52.5                    | 74             | -21.49      | Peak      |
| 11200.0000      | 45.3           | 308               | 1.3        | H            | 39.3                  | 6.0             | 39.5               | 51.2                    | 74             | -22.83      | Peak      |



Channel: 140 (5700)

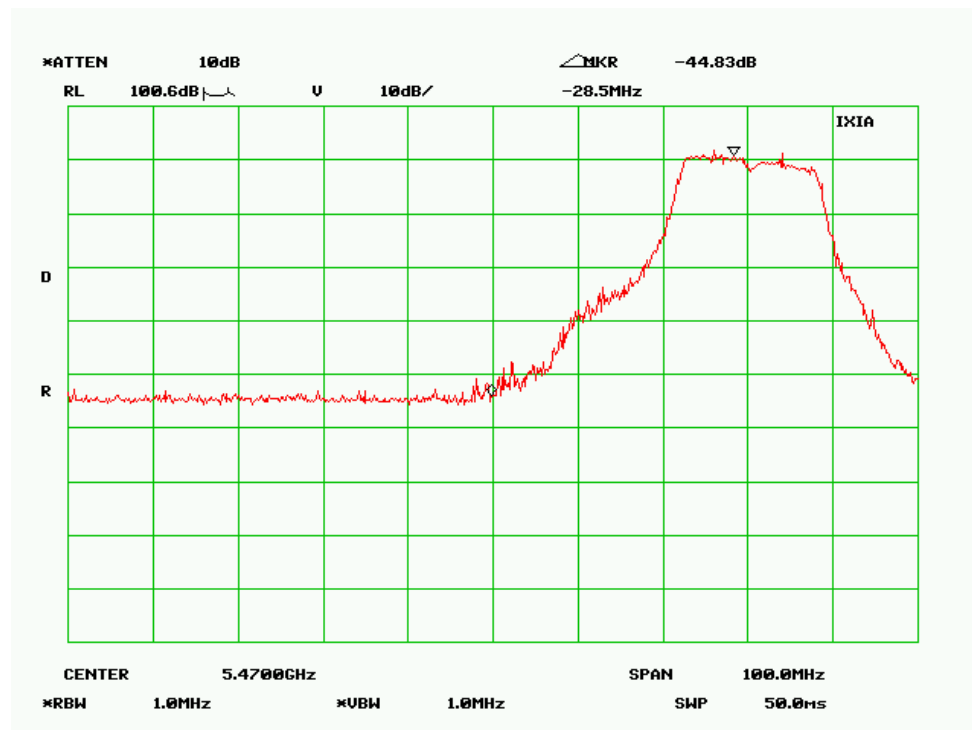
| Frequency (MHz) | Reading (dBuV) | Direction Degrees | Height (m) | Polar. H / V | Antenna Factor (dB/m) | Cable Loss (dB) | Pre-Amplifier (dB) | Corrected Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments  |
|-----------------|----------------|-------------------|------------|--------------|-----------------------|-----------------|--------------------|-------------------------|----------------|-------------|-----------|
| 5700.0000       | 101.2          | 300               | 1.2        | V            | 34.1                  | 4.2             | 34.4               | 105.0                   |                |             | Fund/Peak |
| 5700.0000       | 95.2           | 329               | 1.4        | H            | 34.1                  | 4.2             | 34.4               | 99.0                    |                |             | Fund/Peak |
| 5700.0000       | 91.8           | 300               | 1.2        | V            | 34.1                  | 4.2             | 34.4               | 95.7                    |                |             | Ave       |
| 5700.0000       | 86.7           | 329               | 1.4        | H            | 34.1                  | 4.2             | 34.4               | 90.5                    |                |             | Ave       |
| 17100.0000      | 30.5           | 300               | 1.3        | V            | 43.6                  | 7.6             | 31.6               | 50.1                    | 54             | -3.9        | Ave       |
| 17100.0000      | 30.3           | 320               | 1.2        | H            | 43.6                  | 7.6             | 31.6               | 49.9                    | 54             | -4.1        | Ave       |
| 11400.0000      | 35.6           | 245               | 1.1        | V            | 39.3                  | 6.1             | 39.5               | 41.5                    | 54             | -12.5       | Ave       |
| 11400.0000      | 34.8           | 230               | 1.4        | H            | 39.3                  | 6.1             | 39.5               | 40.7                    | 54             | -13.3       | Ave       |
| 17100.0000      | 43.7           | 300               | 1.3        | V            | 43.6                  | 7.6             | 31.6               | 63.3                    | 74             | -10.7       | Peak      |
| 17100.0000      | 43.2           | 320               | 1.2        | H            | 43.6                  | 7.6             | 31.6               | 62.8                    | 74             | -11.2       | Peak      |
| 11400.0000      | 44.7           | 245               | 1.1        | V            | 39.3                  | 6.1             | 39.5               | 50.6                    | 74             | -23.4       | Peak      |
| 11400.0000      | 43.9           | 230               | 1.3        | H            | 39.3                  | 6.1             | 39.5               | 49.8                    | 74             | -24.2       | Peak      |

**\*Note:** All frequencies from 1GHz to 40 GHz have been investigated.  
The restricted band limit is 54 dB $\mu$ V/m, the out of band limit is 68.3 dB $\mu$ V/m.

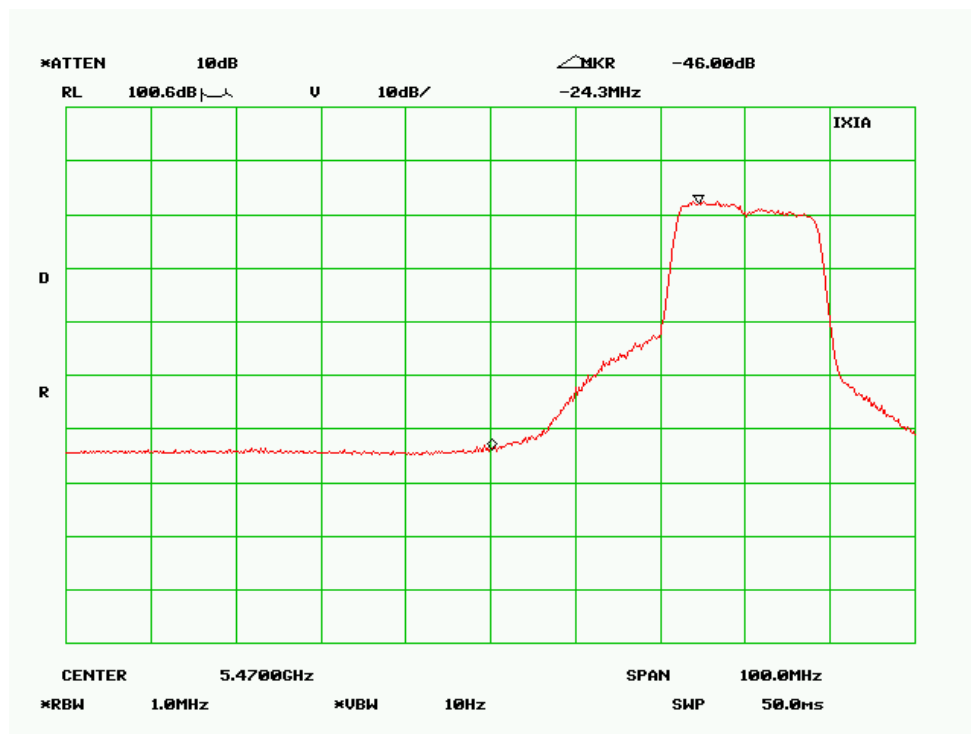
### Restricted band edge

Low channel

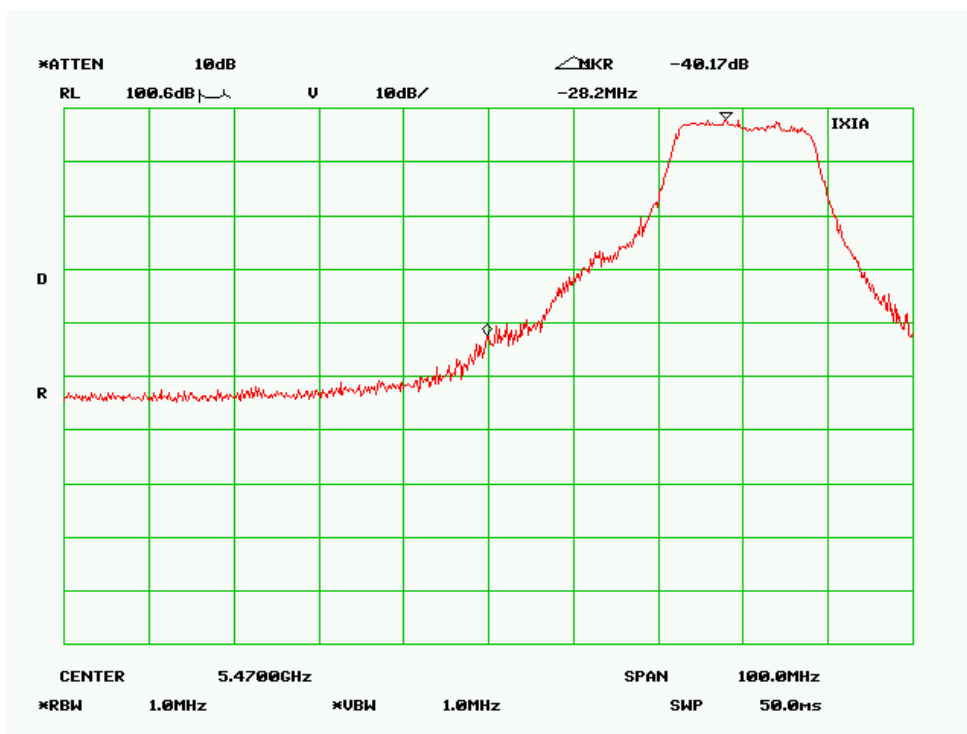
Peak, Horizontal



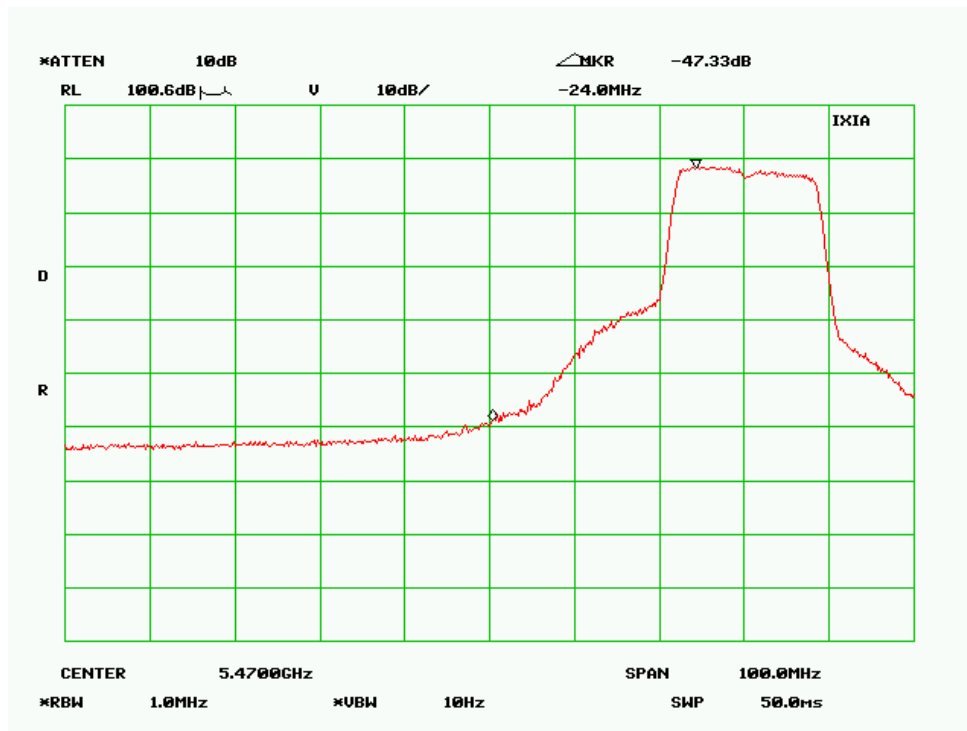
## Average, Horizontal



## Peak, Vertical

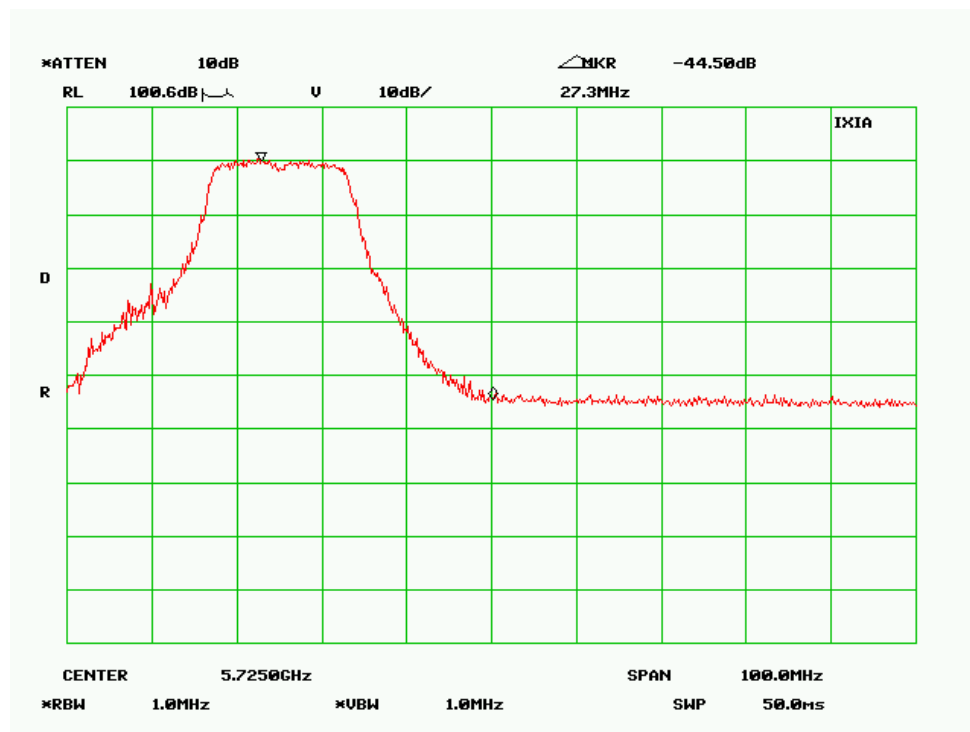


Average, Vertical

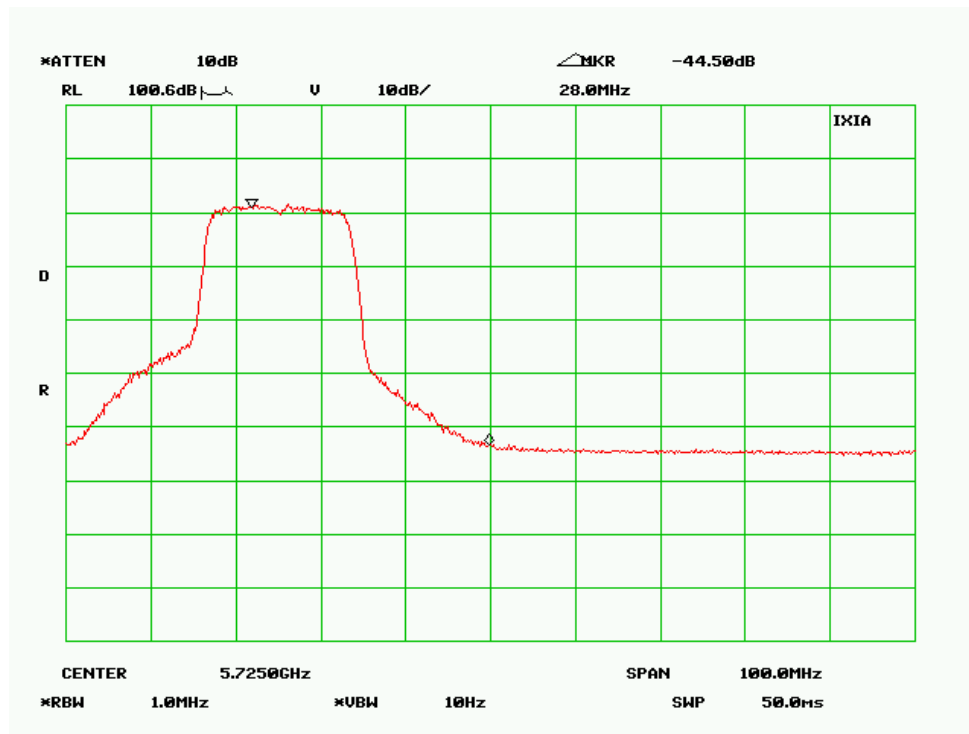


High channel

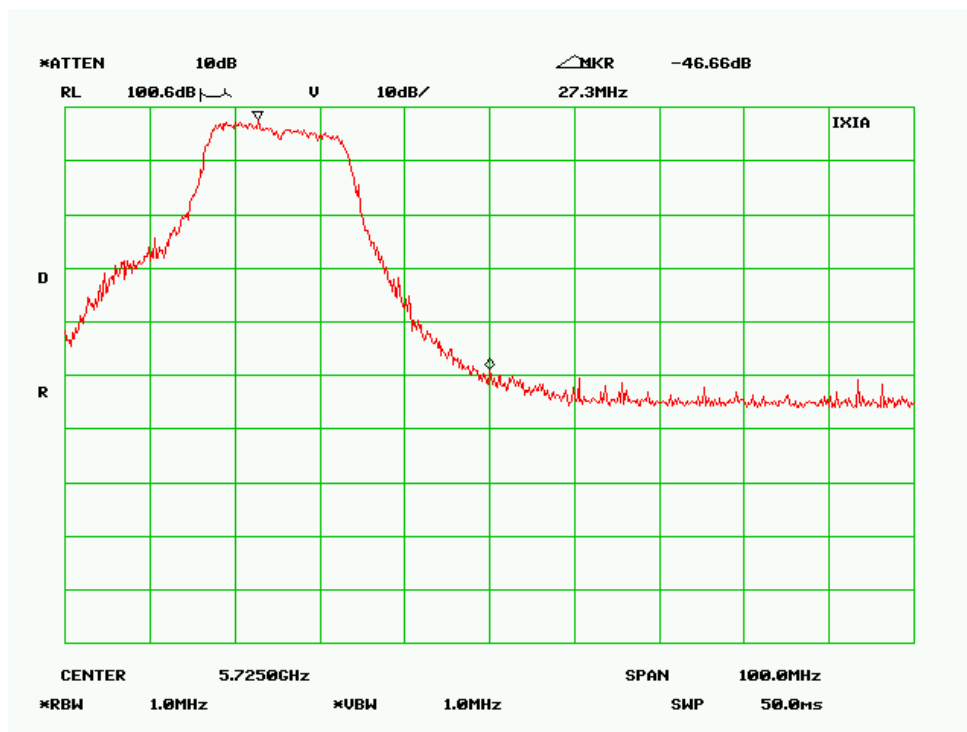
Peak, Horizontal



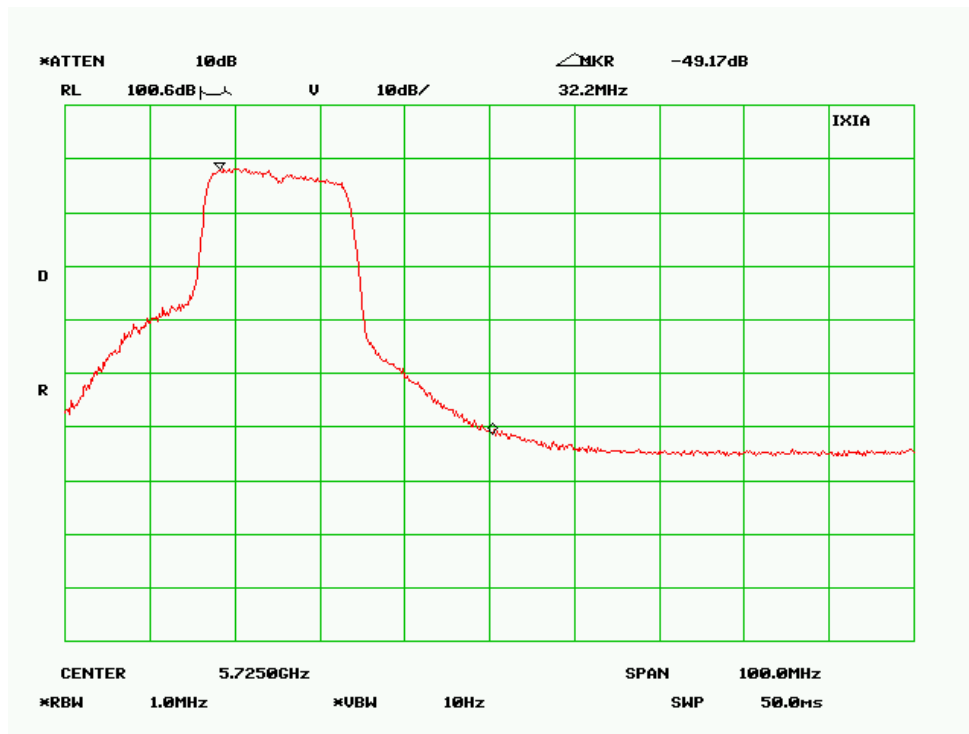
## Average, Horizontal



## Peak, Vertical



Average, Vertical



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

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### 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.

§15.407 (a)(2) For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz 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.

For 5150 – 5350 MHz: 802.11a

### Measurement Procedure

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### Test Equipment

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### Test Setup Diagram

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### Environmental Conditions

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### Measurement Results

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

For 5470 – 5725 MHz: 802.11a

### Measurement Procedure

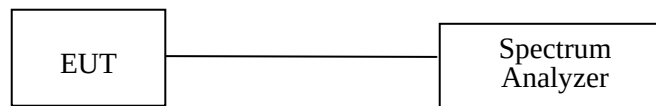
4. Place the EUT on a bench and set it in transmitting mode.
5. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
6. Add a correction factor to the display.

### Equipment Lists

| Manufacturer | Description       | Model  | Serial Number | Cal. Date  |
|--------------|-------------------|--------|---------------|------------|
| Agilent      | Spectrum Analyzer | E4440A | MY44303352    | 2007-02-23 |

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

### Test Setup Diagram



### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 22 °C     |
| Relative Humidity: | 56 %      |
| ATM Pressure:      | 104.1 kPa |

\* The testing was performed by Dan Corona from 2007-06-11 to 2007-06-15

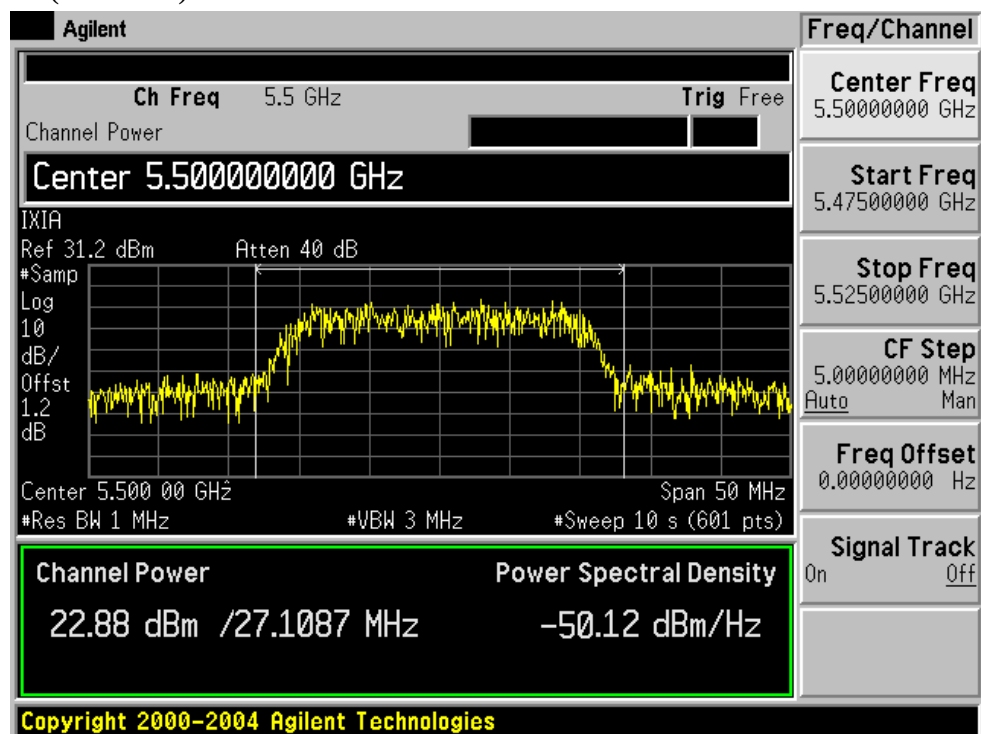
### Test Result

For 5470 – 5725 MHz: 802.11a

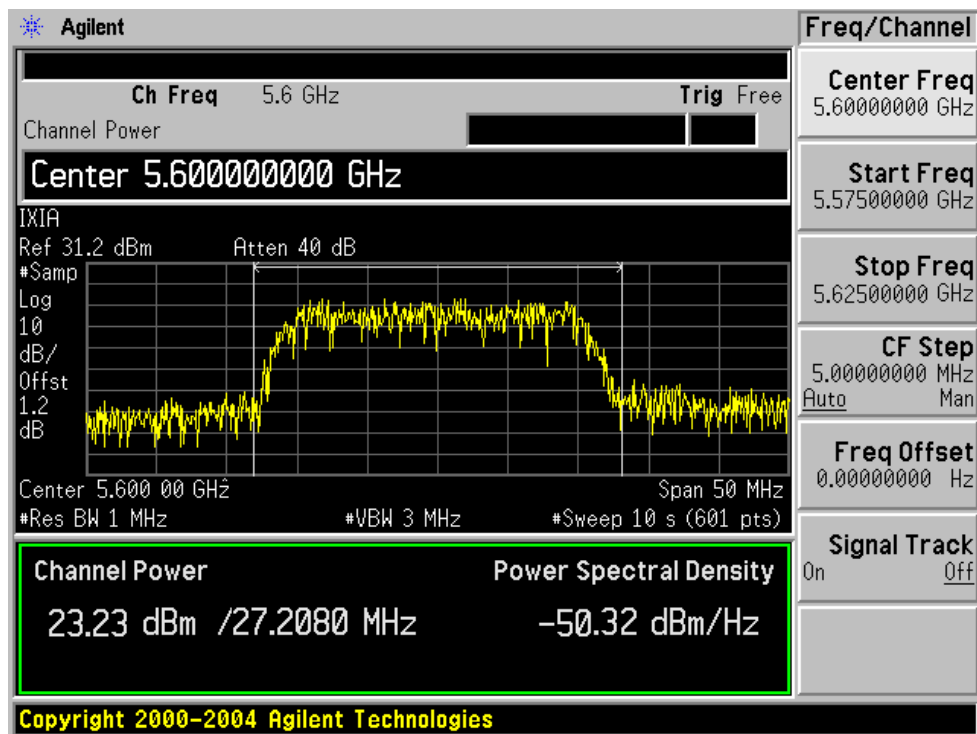
| Channel | Frequency (MHz ) | Peak Power Output (dBm) | Lesser Limit (dBm) | 11 + 10 Log B Limit (dBm) | Margin (dB) | Result    |
|---------|------------------|-------------------------|--------------------|---------------------------|-------------|-----------|
| 100     | 5500             | 22.88                   | 24                 | 25.17                     | -1.12       | Compliant |
| 120     | 5600             | 23.23                   | 24                 | 25.32                     | -0.77       | Compliant |
| 140     | 5700             | 22.09                   | 24                 | 25.59                     | -1.91       | Compliant |

*For 5470 – 5725 MHz: 802.11a*

Channel: 100 (5500MHz)

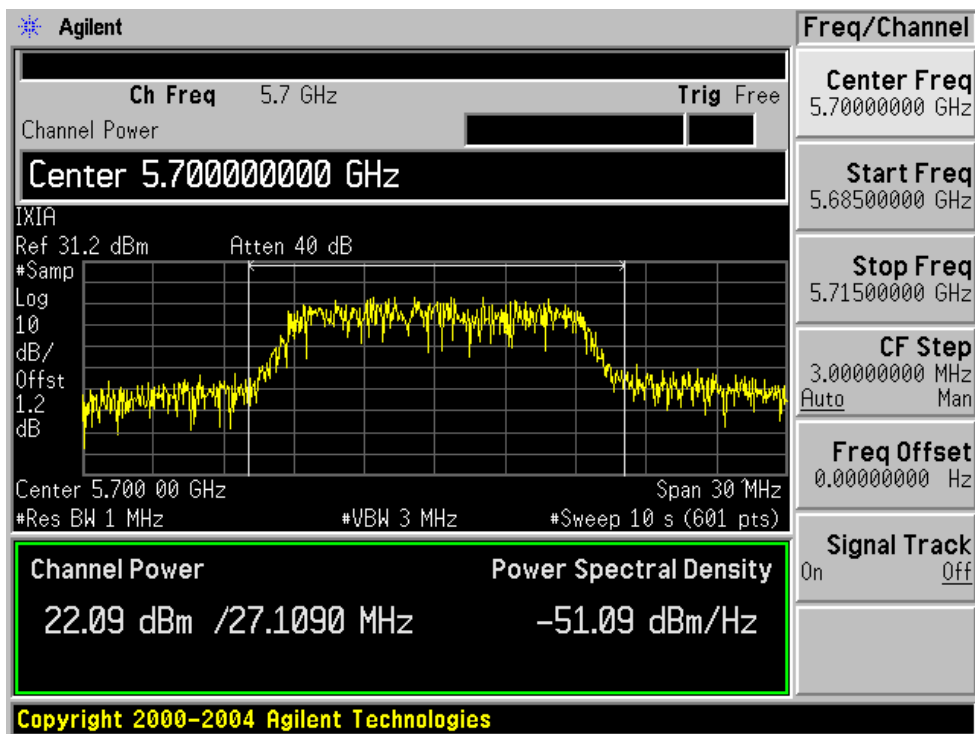


Channel: 120 (5600MHz)





Channel: 140 (5700MHz)



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

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**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)(2) For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz 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.

*For 5150 – 5350 MHz: 802.11a*

**Measurement Procedure**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

**Test Equipment**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

**Test Setup Diagram**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

**Environmental Conditions**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

**Measurement Results**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

*For 5470 – 5725 MHz: 802.11a*

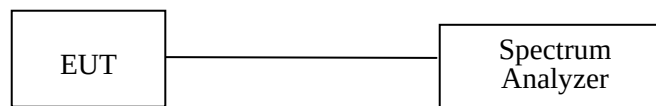
**Measurement Procedure**

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

**Equipment Lists**

| Manufacturer | Description       | Model  | Serial Number | Cal. Date  |
|--------------|-------------------|--------|---------------|------------|
| Agilent      | Spectrum Analyzer | E4440A | MY44303352    | 2007-02-23 |

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

**Test Setup Diagram****Environmental Conditions**

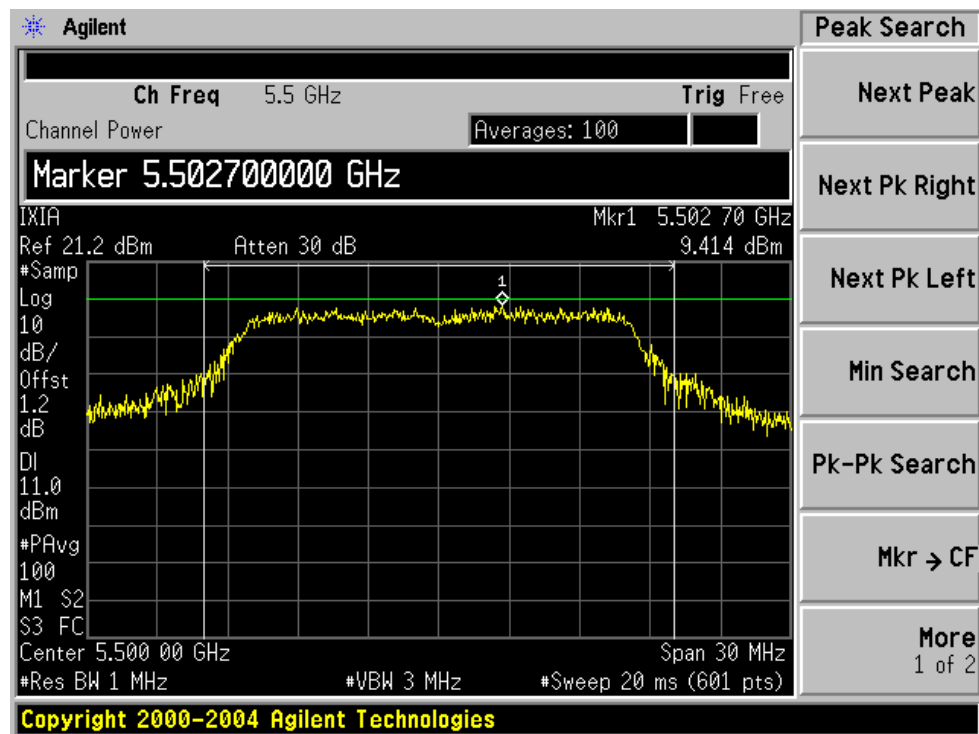
|                    |           |
|--------------------|-----------|
| Temperature:       | 22° C     |
| Relative Humidity: | 56 %      |
| ATM Pressure:      | 104.1 kPa |

\* The testing was performed by Dan Corona from 2007-06-11 to 2007-06-15

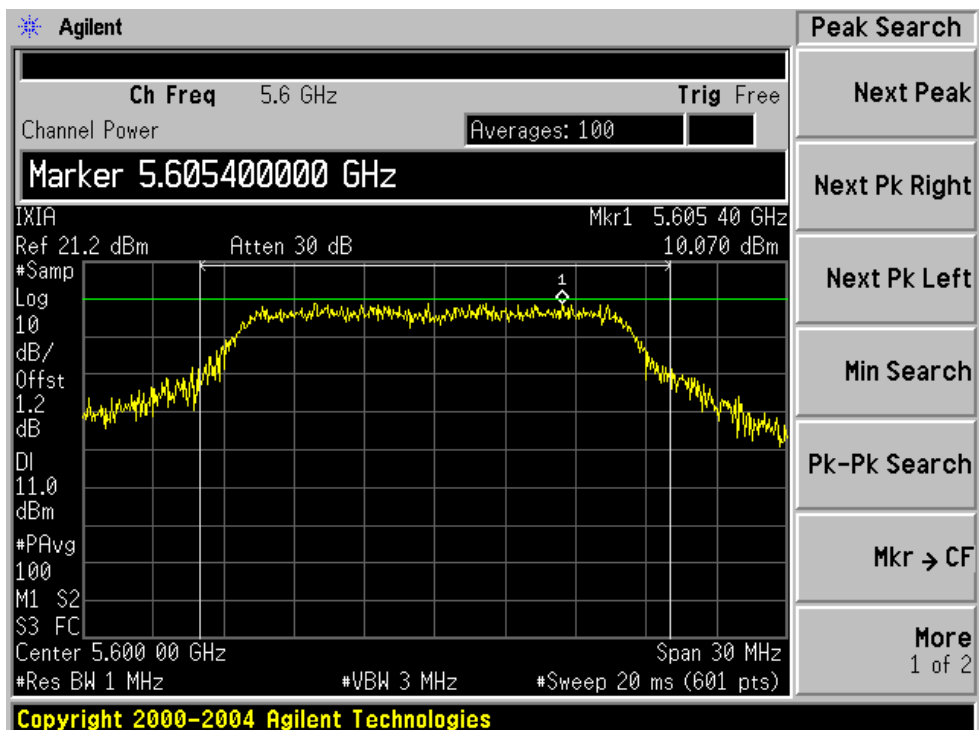
**Test Result**

For 5470 – 5725 MHz: 802.11a

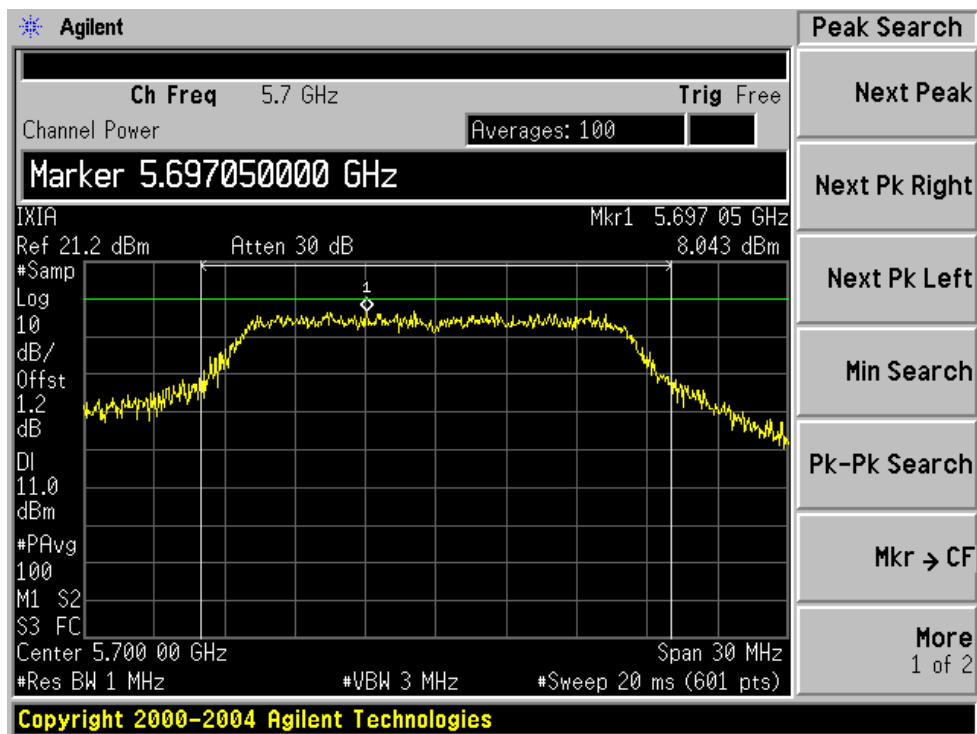
Channel: 100 (5500MHz)



Channel: 120 (5600MHz)



Channel: 140 (5700MHz)



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## **§15.407(a) (6) – Peak Excursion**

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### **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.

*For 5150 – 5350 MHz: 802.11a*

### **Measurement Procedure**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### **Test Equipment**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### **Test Setup Diagram**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### **Environmental Conditions**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

### **Measurement Results**

Please refer to the following test report:

**(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).**

*For 5470 – 5725 MHz: 802.11a*

### Measurement Procedure

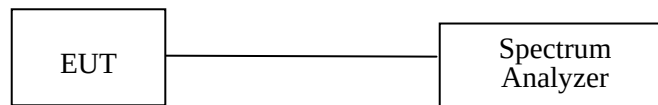
10. Place the EUT on a bench and set it in transmitting mode.
11. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
12. Add a correction factor to the display.

### Equipment Lists

| Manufacturer | Description       | Model  | Serial Number | Cal. Date  |
|--------------|-------------------|--------|---------------|------------|
| Agilent      | Spectrum Analyzer | E4440A | MY44303352    | 2007-02-23 |

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

### Test Setup Diagram



### Environmental Conditions

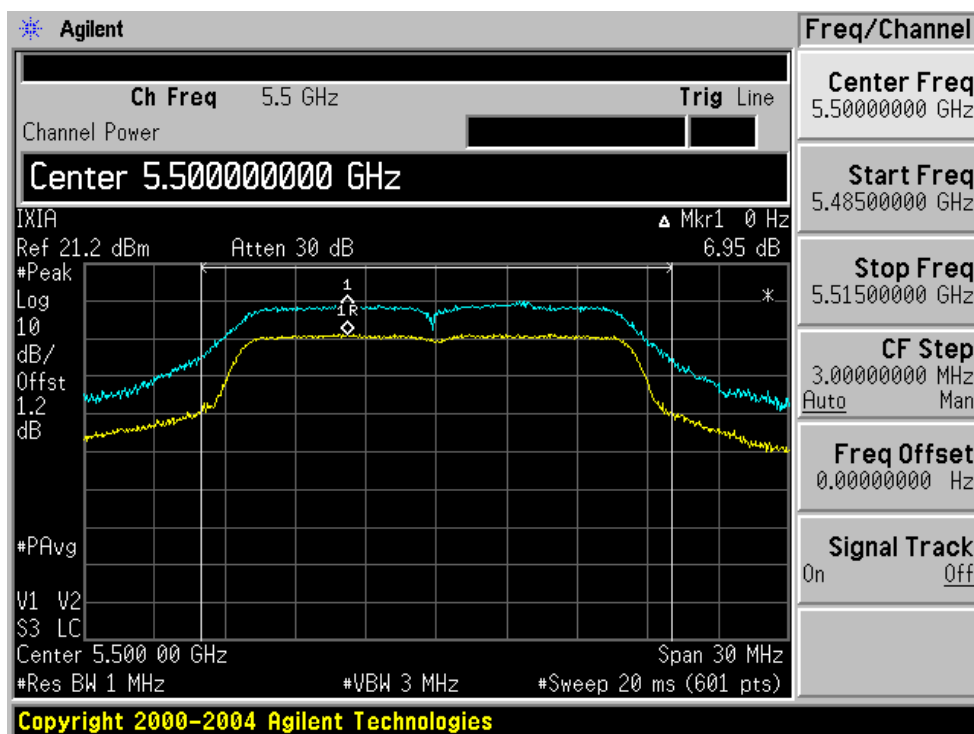
|                    |           |
|--------------------|-----------|
| Temperature:       | 22 °C     |
| Relative Humidity: | 56 %      |
| ATM Pressure:      | 104.1 kPa |

*\* The testing was performed by Dan Corona from 2007-06-11 to 2007-06-15*

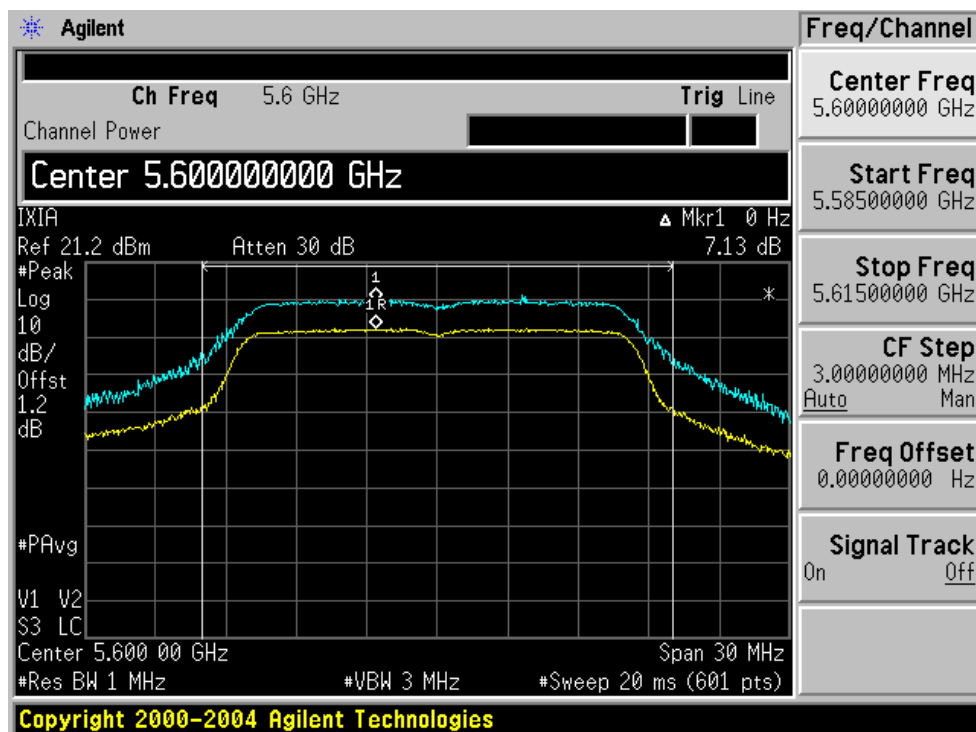
**Test Result**

For 5470 – 5725 MHz: 802.11a

Channel: 100 (5500MHz)

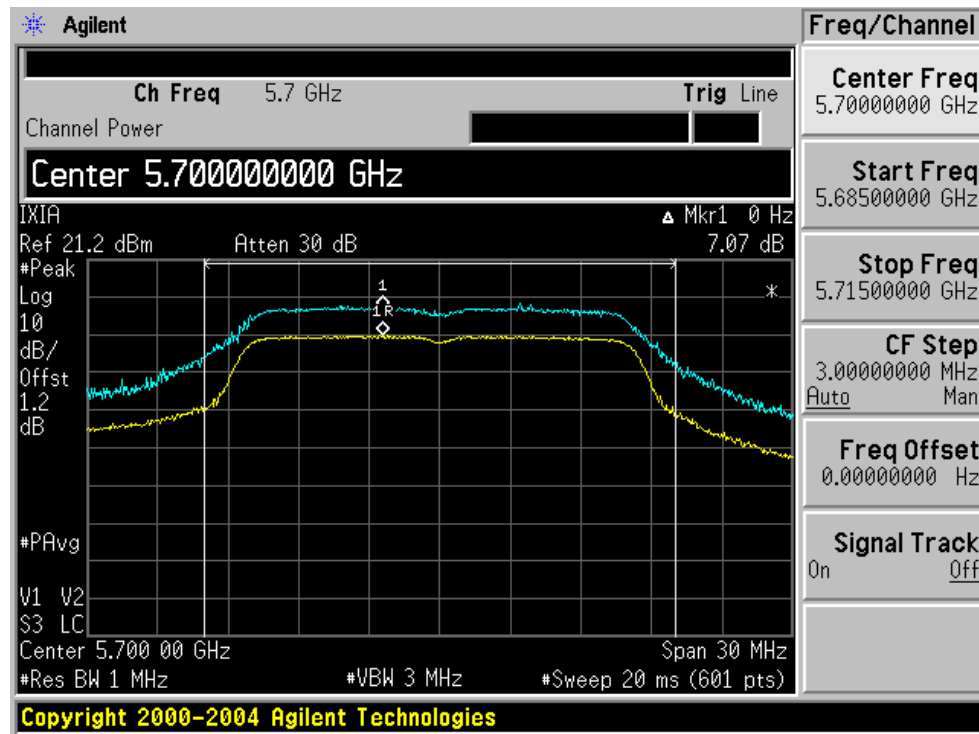


Channel: 120 (5500MHz)





Channel: 140 (5700MHz)



## §15.407(h) – Dynamic Frequency Selection

### TEST RESULTS

#### Description of EUT

The EUT operates in 5230-5350 MHz and 5470-5725 MHz range.

The EUT is a Slave device without radar detection function.

The antenna of the EUT is tri-band Omni antenna, the gain is 5 dBi (5.3 GHz) and 4.5 dBi (5.75 GHz).

The rated output power of EUT is >23 dBm (EIRP).

WLAN traffic is generated by streaming the video file TestFile.mpg, this file is used by IP and Frame based systems for loading the test channel during the In-service compliance testing of the U-NII device. The file is streamed from the Access Point to the Client in full motion video mode using the media player with the V2.61 Codec package.

The Master device supported for testing is a Cisco Aironet 1130AG Series IEEE 802.11 a/b/g Access Point  
 FCC ID: LDK102054E  
 Model No.: AIR-AP1131AG-A-K9  
 S/N: FTX1109T0X8  
 Manufacturer: Cisco Systems, Inc.

#### Test Equipment

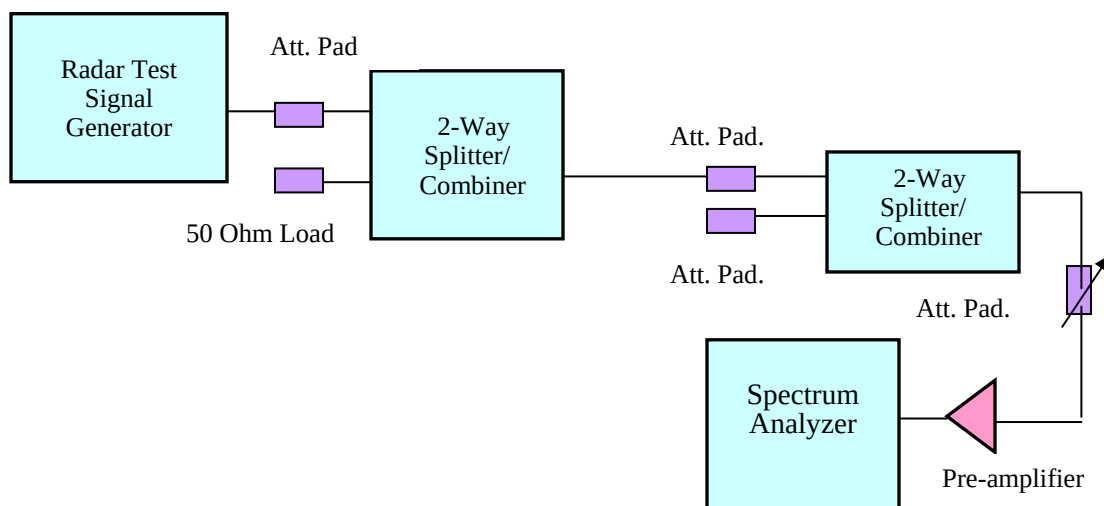
| Equipment Description        | Manufacturer          | Model Number    | S/N        |
|------------------------------|-----------------------|-----------------|------------|
| NI PXI-1042 8-Slot chassis   | National Instruments  | PXI-1042        | V08X01EE1  |
| Arbitrary Waveform Generator | National Instruments  | PXI-5421        | N/A        |
| RF Upconverter               | National Instruments  | PXI-5610        | N/A        |
| Upconverter                  | Ascor                 | AS-7206         | n/A        |
| Spectrum Analyzer            | Agilent               | E4440A          | MY44303352 |
| Pre-Amplifier                | Avantek               | 2-8 GHz Lab AMP | 218        |
| Pre-Amplifier                | Ducommun Technologies | ALN-09173030-01 | 990297-02  |
| Splitter/Combiner            | Mini-Circuits         | 2FSC-2-10G      | 0349       |
| Splitter/Combiner            | Narada                | 4326B-2         | 03514      |
| Attenuator                   | MIDWest               | 290-30          | N/A        |
| Attenuator                   | Mini-Circuits         | BW-S30W2        | N/A        |

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

**Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 23 °C     |
| <b>Relative Humidity:</b> | 55 %      |
| <b>ATM Pressure:</b>      | 101.1 kPa |

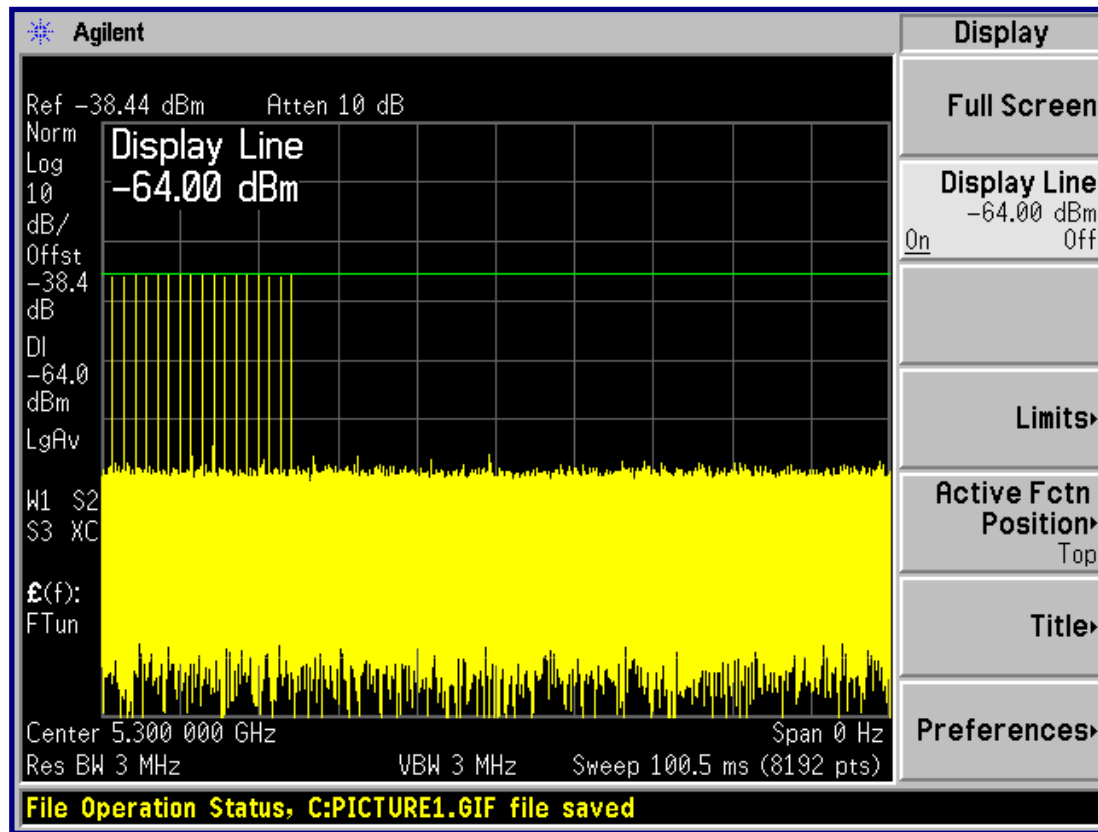
*Testing performed by Dan Corona on 2007-07-10.*

**Radar Waveform Calibration**

**Conducted Calibration Setup Block Diagram**

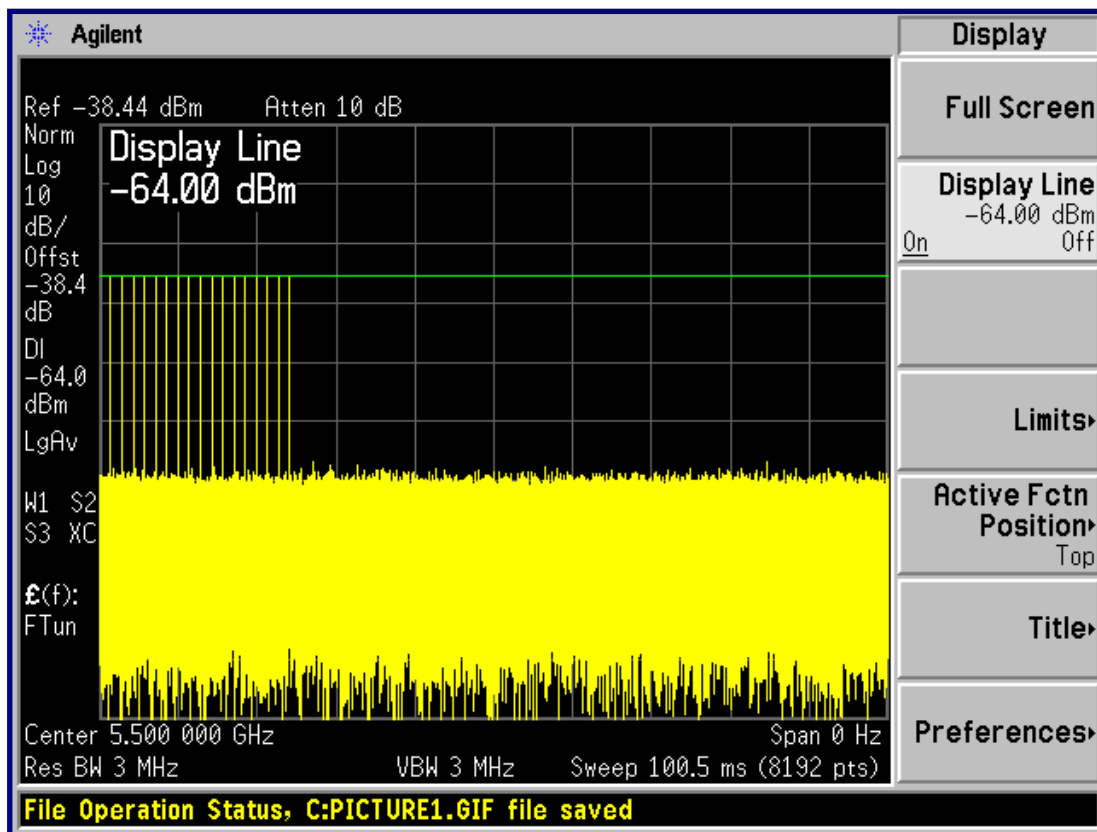
**Plots of Radar Waveforms**

5300 MHz

**Radar Type 1**

5500 MHz

## Radar Type 1



**Channel Availability Check Time (CAC)****Test Procedure**

- 1) Measure the initial power-up time of EUT.
- 2) With link established on channel, apply a radar signal within 0~6 seconds after the initial power-up period, monitor the transmissions on channel from the spectrum analyzer.
- 3) Reboot EUT, with a link established on channel, apply a radar signal within 54~60 seconds after the initial power-up period, monitor the transmission on channel from the spectrum analyzer.

**EUT Initial power-up Cycle Time**

| EUT initial Power-up cycle (Second) |
|-------------------------------------|
| /                                   |

**Results:** Not Required.

| Timing of Radar Burst                | Spectrum Analyzer Display |
|--------------------------------------|---------------------------|
| No Radar Triggered                   | /                         |
| Within 6 seconds of the CAC starting | /                         |
| Within the last 6 seconds of the CAC | /                         |

## Channel Move time and channel closing transmission time

### Test Procedure:

Perform one of the type1 to type 4 short pulse radar waveform, BACL use type 1 radar signal, repeat using a long pulse radar type5 waveform.

The aggregate channel closing transmission time is calculated as follows:

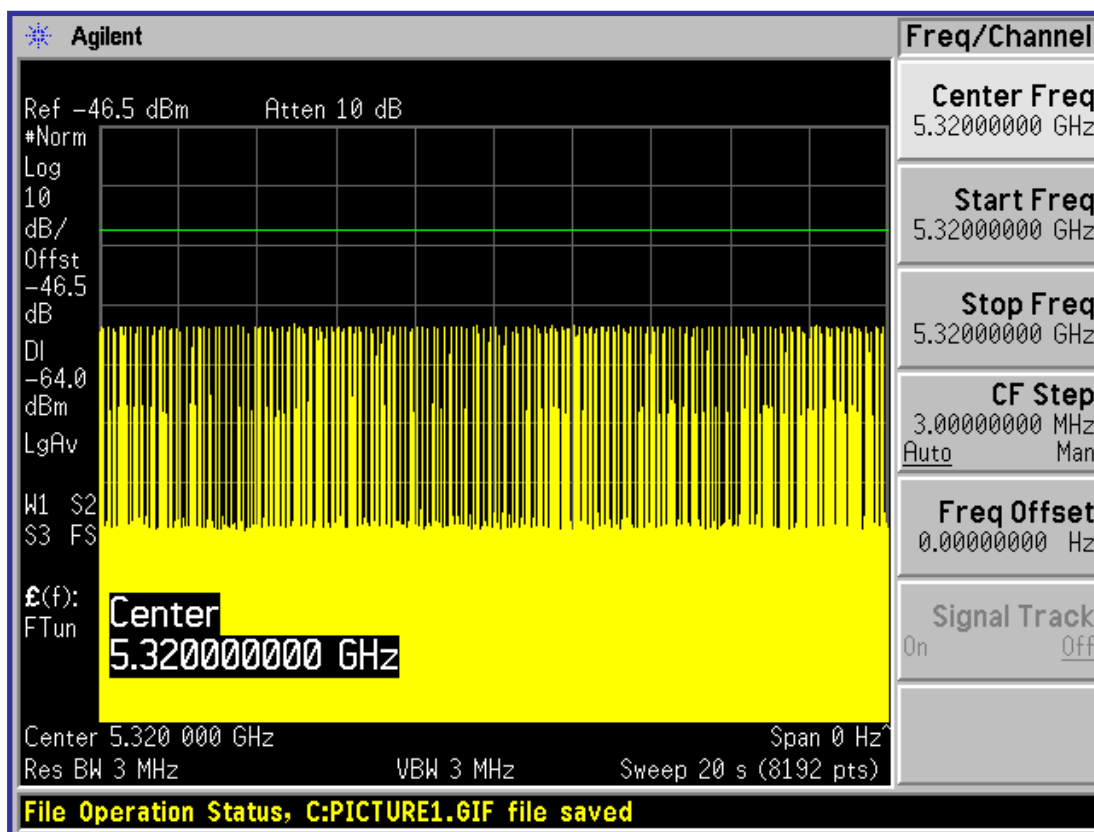
$$\text{Aggregate Transmission Time} = N * \text{Dwell Time}$$

N is the number of spectrum analyzer bins showing a device transmission

Dwell Time is the dwell time per bin (i.e.  $\text{Dwell Time} = S/B$ , S is the sweep time and B is the number of bin, i.e. 8192)

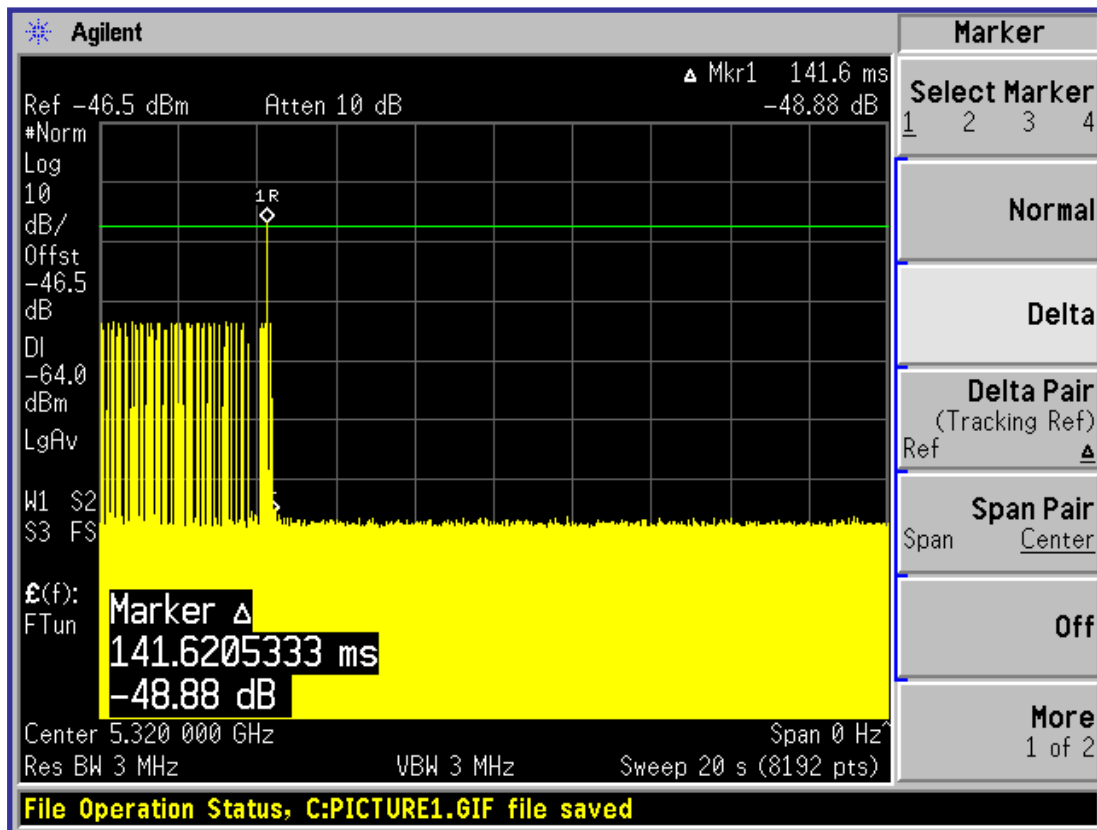
**5320 MHz**

### WLAN Traffic:



Type 1 radar channel move time result:

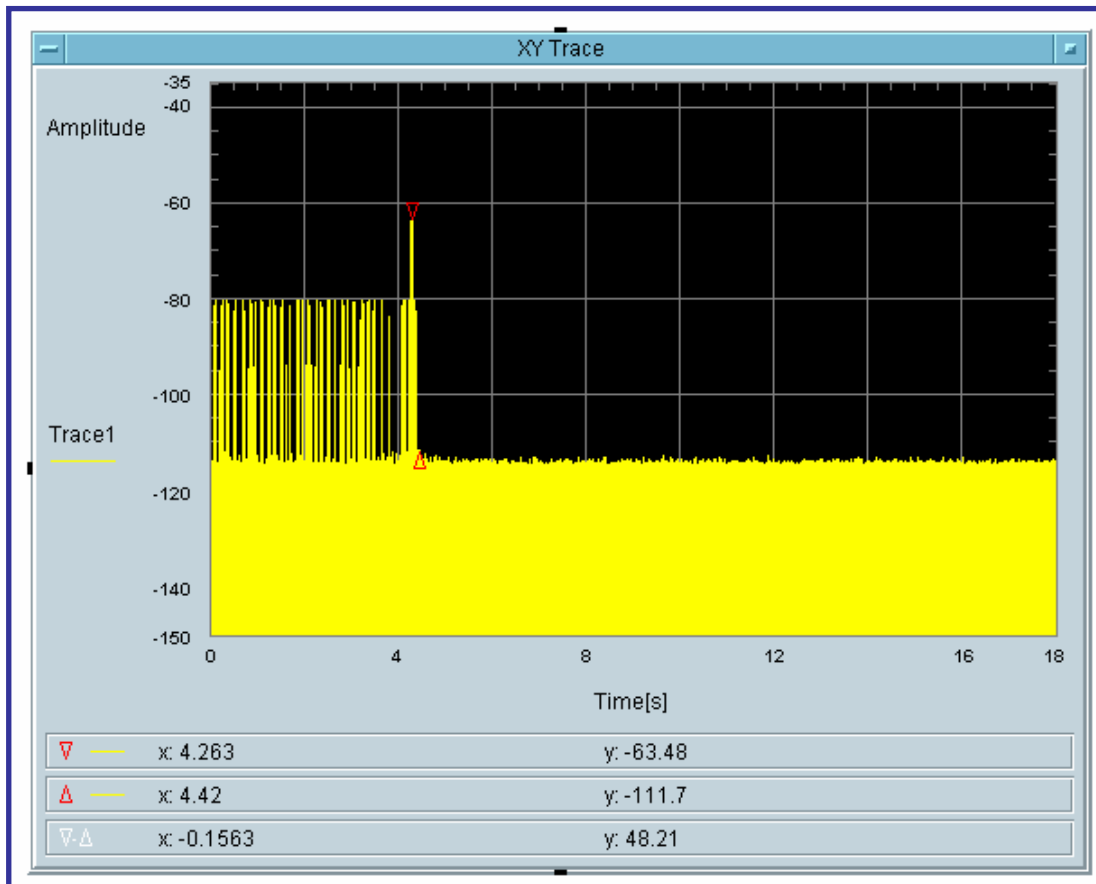
| Channel Move Time (sec.) | Limit (sec.) |
|--------------------------|--------------|
| 0.1416                   | 10           |





Type1 radar channel closing transmission time result:

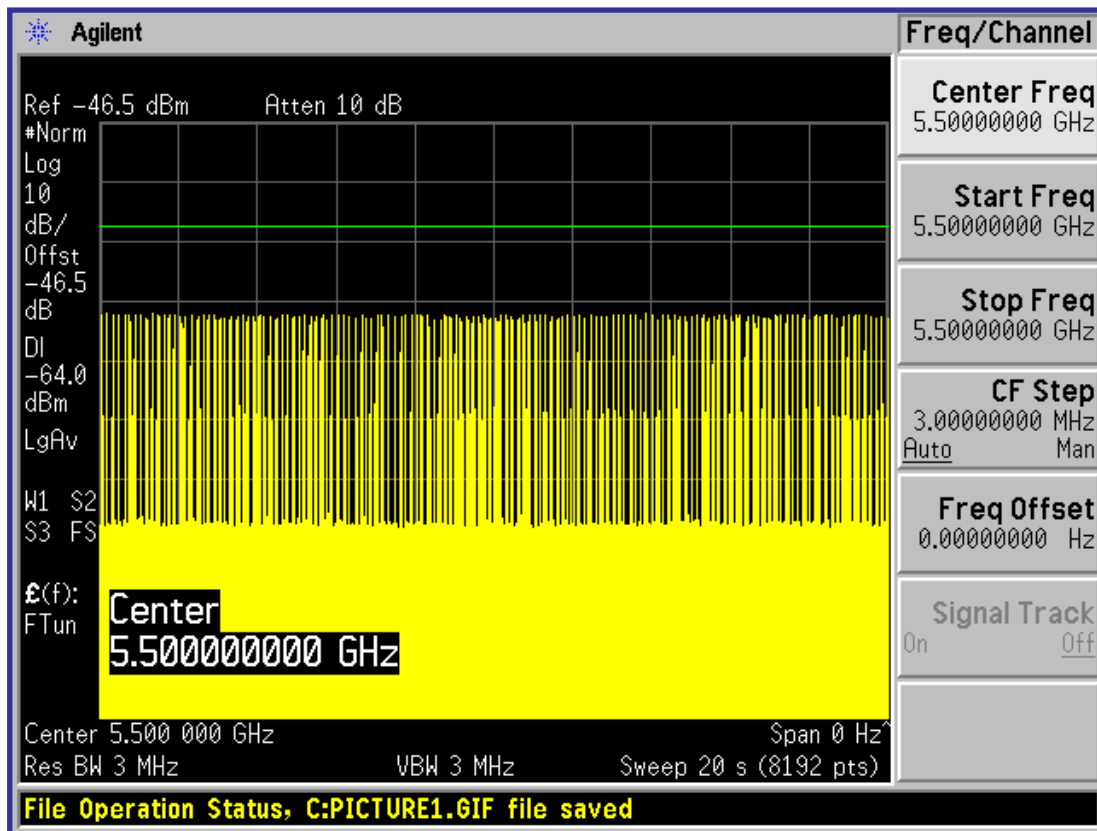
| Aggregate Transmission Time (ms) | Limit (ms) | Margin (ms) |
|----------------------------------|------------|-------------|
| 0                                | 60         | 60          |



Total On Time [s]  
10.99m

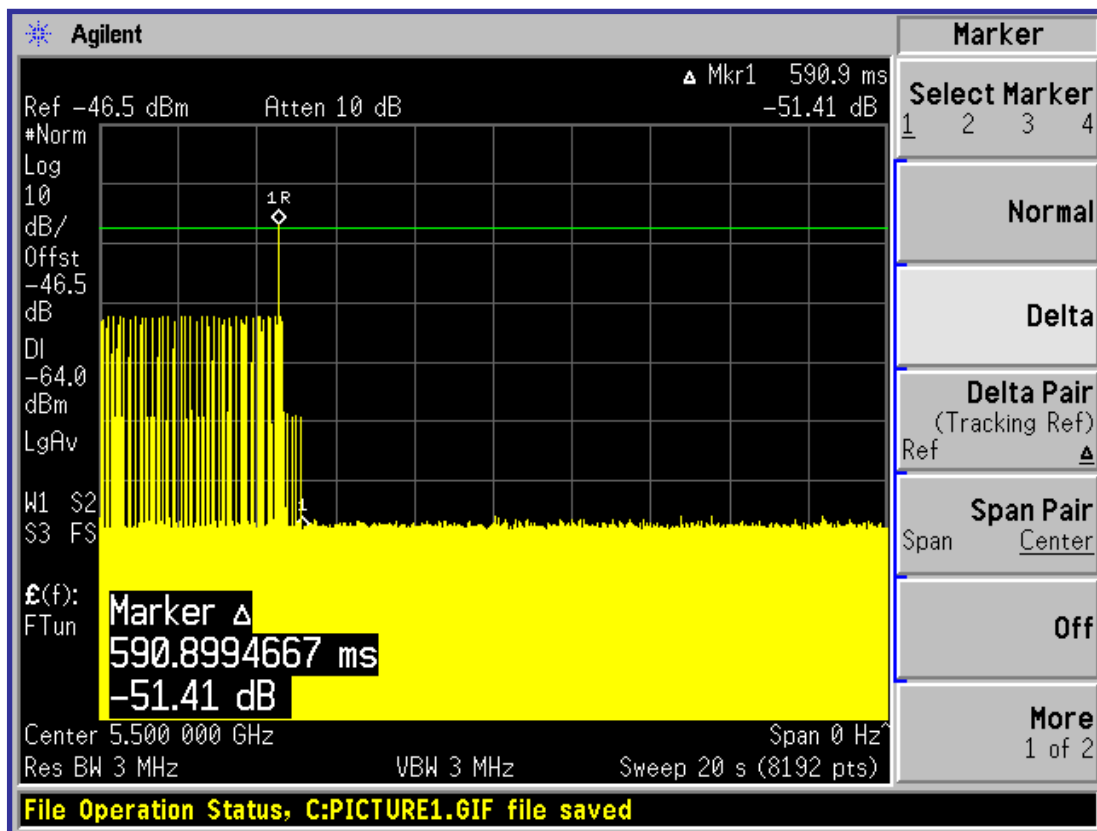
Total On Time After Delay [s]

5500 MHz

WLAN Traffic:

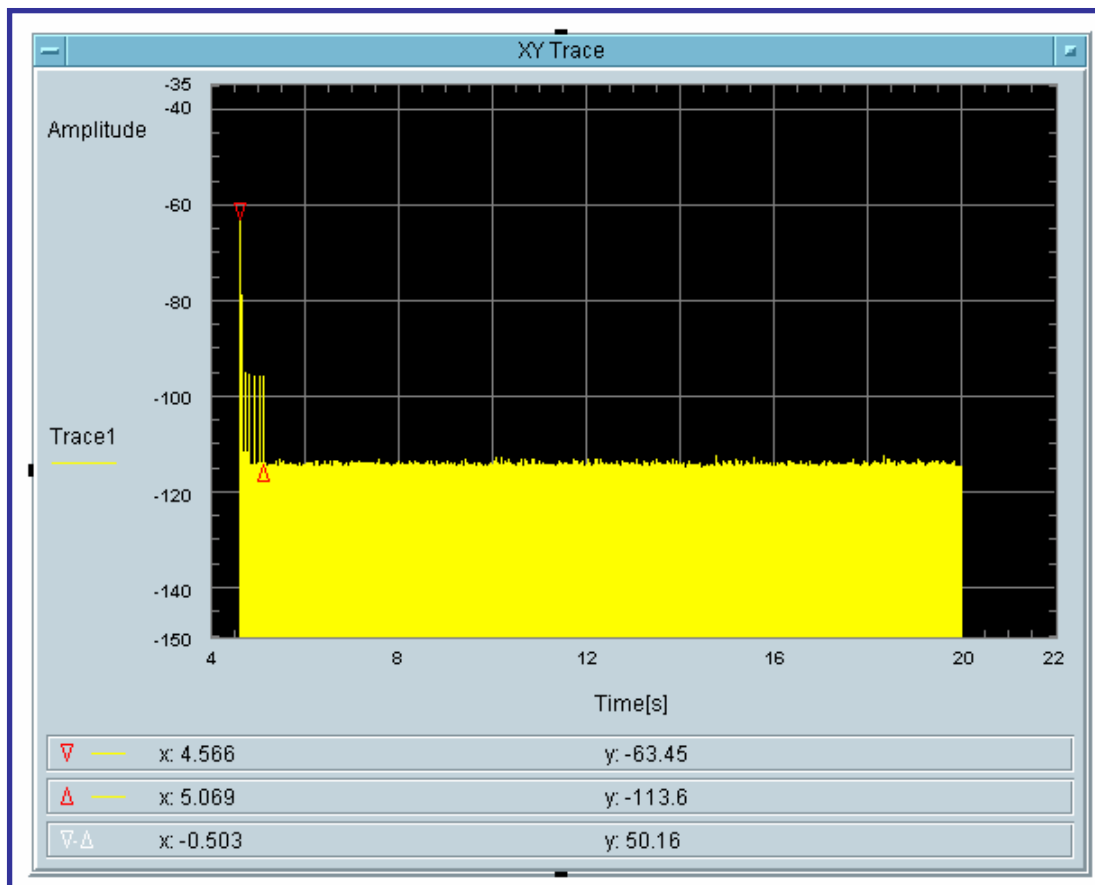
Type 1 radar channel move time result:

| Channel Move Time (sec.) | Limit (sec.) |
|--------------------------|--------------|
| 0.591                    | 10           |



Type1 radar channel closing transmission time result:

| Aggregate Transmission Time<br>(ms) | Limit<br>(ms) | Margin<br>(ms) |
|-------------------------------------|---------------|----------------|
| 0                                   | 60            | 60             |



Total On Time [s]  
14.65m

Total On Time After Delay [s]

## Non-Occupancy Period

### Test Procedure

Client device is not permitted to transmit beacons on DFS frequencies.

- 1) Non-associated test: The master has been off, monitor the analyzer on the test mode frequency that have been selected for testing, power up the client for 30 minutes to make sure no beacons have been transmitted.
- 2) Associated test: Associate the master and client and stream the movie as specified for non-occupancy test. Transmit Radar type 1, monitor the test frequency to make sure no beacons have been transmitted for 30 minutes.

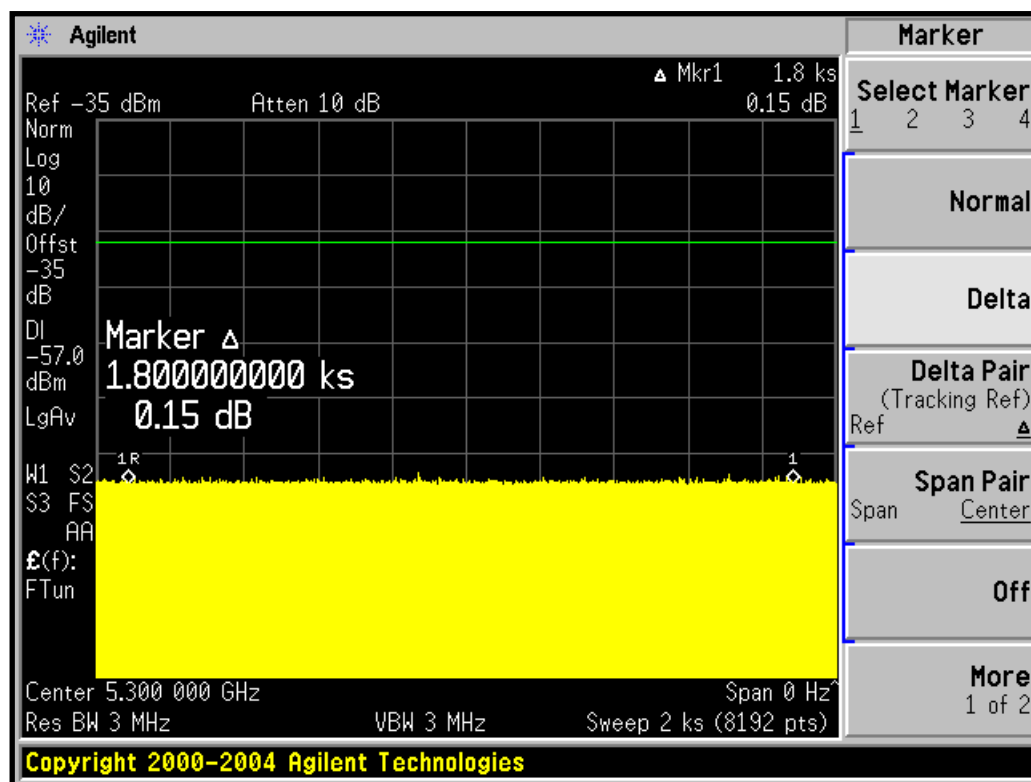
**Result:** Pass.

| Mode           | Results             |
|----------------|---------------------|
| Non-Associated | No Beacons transmit |
| Associated     | No transmissions    |

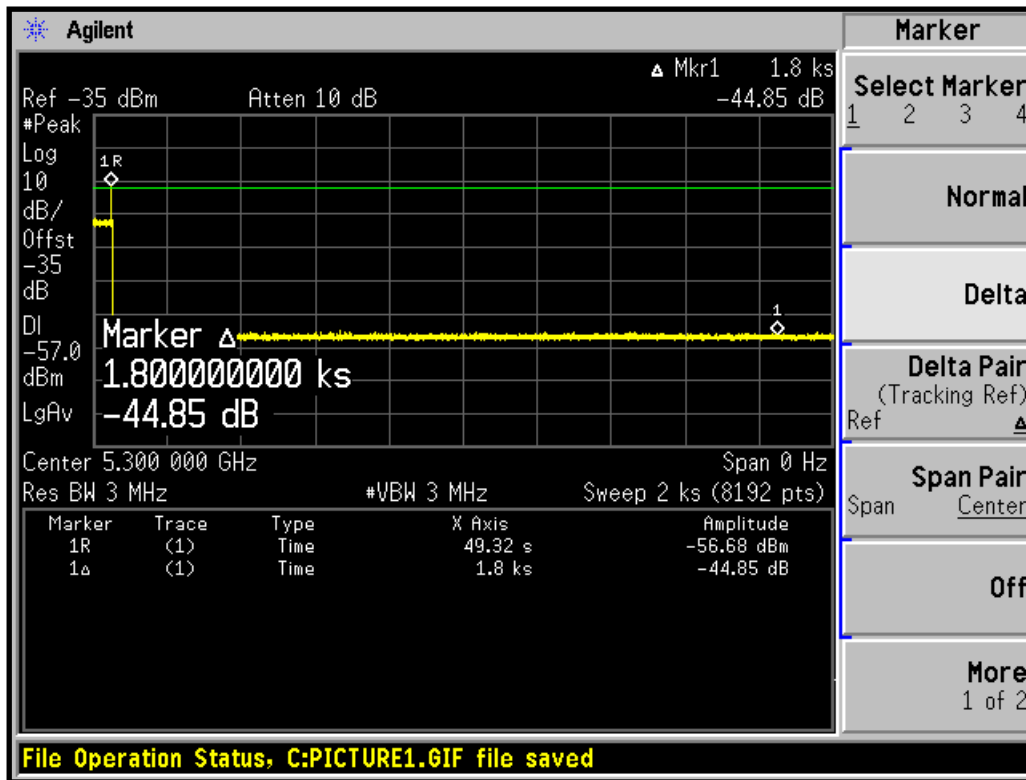
Please refer to the following plots.

### 5300 MHz:

- 1) Non-associated:

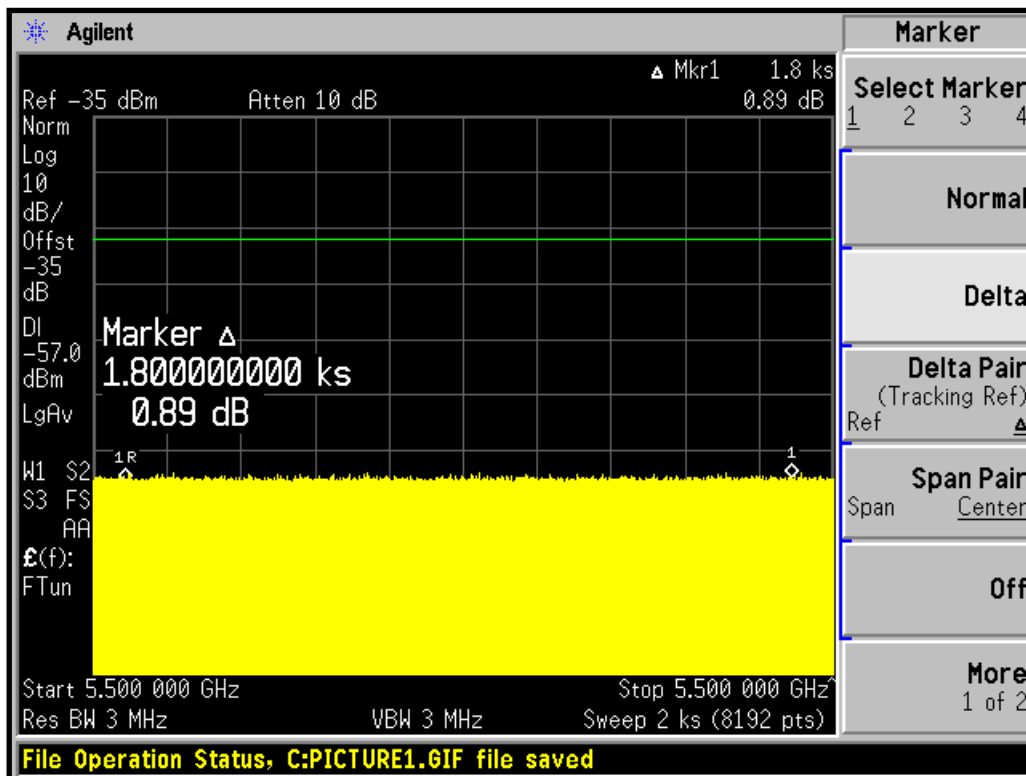


## 2) Associated:

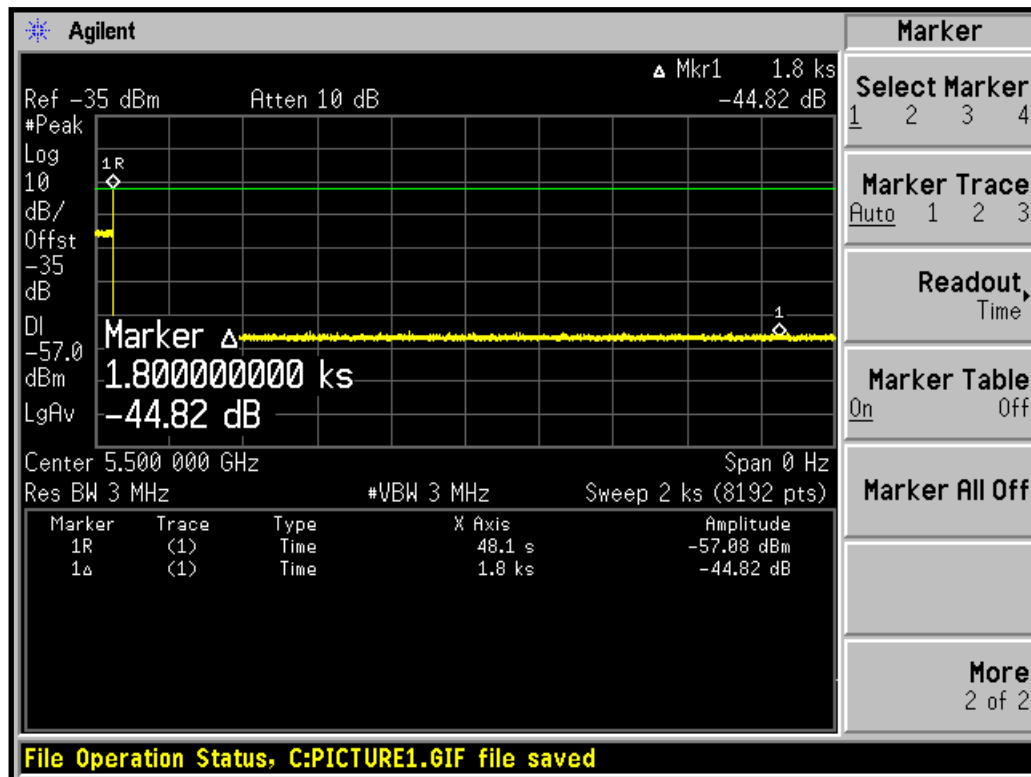


## 5500 MHz:

## 1) Non-associated:



2) Associated:



**Detection Bandwidth****Procedure:**

Performed with any one of the short pulse radar waveforms (type 1, 2, 3 or 4)

Start with radar generator frequency set to the center of the channel ( $F_c$ )

Perform at least 10 trials and confirm at least 90% detected

Increment radar generator frequency by 1 MHz and repeat

Perform at least 10 trials and confirm at least 90% detected

Continue incrementing the radar frequency until detection rate falls below 90%

Starting at  $F_c - 1$  MHz, repeat the process, this time decrementing the radar frequency by 1 MHz

$F_L$  is the lowest frequency at which detection was 80% or better

$F_H$  is the highest frequency at which detection was 80% or better

UNII Detection Bandwidth =  $F_H - F_L$

**Result:** Not Required.



**-Service Monitoring**

## Procedure:

Stream MPEG file from master to slave

Generate radar waveform

Record whether or not the waveform was detected

At least 30 trials are applied for each radar type

For radar types with randomized parameters, each trial uses a unique waveform

Perform with each of the radar types 1-6

Confirm that the detection rate for each radar type meets the minimum requirement

Type 1, 2, 3, 4: 60% each

Type 5: 80%

Type 6: 70%

Confirm that the mean of the rates for radar types 1 through 4 meets the requirement of 80%

$$\text{Detection Ratio} = \frac{\text{Total Waveform Detections}}{\text{Total Waveform Trails}} \times 100$$

**Result:** Not Required.