



FCC PART 15.407



TEST AND MEASUREMENT REPORT

For

Ruckus Wireless, Inc.

350 West Java Drive, Sunnyvale, CA 94089, USA

FCC ID: S9GT504
Model: T504

| | |
|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Report Type: Original Report | Product Type: 802.11a/b/g/n/ac Access Point |
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| Report Number: <u>R1409183-407 W52</u> | |
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 * This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*" ...

TABLE OF CONTENTS

| | | |
|----------|------------------------------------------------------------------------|-----------|
| 1 | GENERAL DESCRIPTION..... | 5 |
| 1.1 | PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)..... | 5 |
| 1.2 | MECHANICAL DESCRIPTION OF EUT..... | 5 |
| 1.3 | OBJECTIVE..... | 5 |
| 1.4 | RELATED SUBMITTAL(S)/GRANT(S)..... | 5 |
| 1.5 | TEST METHODOLOGY..... | 5 |
| 1.6 | MEASUREMENT UNCERTAINTY..... | 5 |
| 1.7 | TEST FACILITY..... | 6 |
| 2 | EUT TEST CONFIGURATION..... | 7 |
| 2.1 | JUSTIFICATION..... | 7 |
| 2.2 | EUT EXERCISE SOFTWARE..... | 7 |
| 2.3 | SPECIAL EQUIPMENT..... | 7 |
| 2.4 | EQUIPMENT MODIFICATIONS..... | 7 |
| 2.5 | LOCAL SUPPORT EQUIPMENT..... | 7 |
| 2.6 | EUT INTERNAL CONFIGURATION DETAILS..... | 7 |
| 2.7 | INTERFACE PORTS AND CABLES..... | 8 |
| 2.8 | POWER SUPPLY LIST AND DETAILS..... | 8 |
| 3 | SUMMARY OF TEST RESULTS..... | 9 |
| 4 | FCC §2.1091 & §15.407(F) - RF EXPOSURE..... | 10 |
| 4.1 | APPLICABLE STANDARD..... | 10 |
| 4.2 | MPE PREDICTION..... | 10 |
| 4.3 | MPE RESULTS..... | 10 |
| 5 | FCC §15.203 – ANTENNA REQUIREMENTS..... | 12 |
| 5.3 | APPLICABLE STANDARD..... | 12 |
| 5.4 | ANTENNA DESCRIPTION..... | 12 |
| 6 | FCC §15.207 - AC POWER LINE CONDUCTED EMISSIONS..... | 13 |
| 6.1 | APPLICABLE STANDARD..... | 13 |
| 6.2 | TEST SETUP..... | 13 |
| 6.3 | TEST PROCEDURE..... | 13 |
| 6.4 | TEST SETUP BLOCK DIAGRAM..... | 14 |
| 6.5 | CORRECTED AMPLITUDE & MARGIN CALCULATION..... | 14 |
| 6.6 | TEST EQUIPMENT LIST AND DETAILS..... | 15 |
| 6.7 | TEST ENVIRONMENTAL CONDITIONS..... | 15 |
| 6.8 | SUMMARY OF TEST RESULTS..... | 15 |
| 6.9 | CONDUCTED EMISSIONS TEST PLOTS AND DATA..... | 16 |
| 7 | FCC §15.209 & §15.407(B) - SPURIOUS RADIATED EMISSIONS..... | 18 |
| 7.3 | APPLICABLE STANDARD..... | 18 |
| 7.4 | TEST SETUP..... | 19 |
| 7.5 | TEST PROCEDURE..... | 19 |
| 7.6 | CORRECTED AMPLITUDE & MARGIN CALCULATION..... | 20 |
| 7.7 | TEST EQUIPMENT LIST AND DETAILS..... | 20 |
| 7.8 | TEST ENVIRONMENTAL CONDITIONS..... | 20 |
| 7.9 | SUMMARY OF TEST RESULTS..... | 21 |
| 7.10 | RADIATED EMISSIONS TEST RESULT DATA..... | 22 |
| 8 | FCC §15.407(E) – EMISSION BANDWIDTH..... | 27 |

| | | |
|-----------|---------------------------------------------------------------|-----------|
| 8.3 | APPLICABLE STANDARDS | 27 |
| 8.4 | MEASUREMENT PROCEDURE | 27 |
| 8.5 | TEST EQUIPMENT LIST AND DETAILS | 27 |
| 8.6 | TEST ENVIRONMENTAL CONDITIONS..... | 27 |
| 8.7 | TEST RESULTS | 27 |
| 9 | FCC §407(A) – OUTPUT POWER..... | 34 |
| 9.3 | APPLICABLE STANDARDS | 34 |
| 9.4 | MEASUREMENT PROCEDURE | 34 |
| 9.5 | TEST EQUIPMENT LIST AND DETAILS | 34 |
| 9.6 | TEST ENVIRONMENTAL CONDITIONS..... | 34 |
| 9.7 | TEST RESULTS | 35 |
| 10 | FCC §15.407(B) - OUT OF BAND EMISSIONS..... | 36 |
| 10.3 | APPLICABLE STANDARD | 36 |
| 10.4 | MEASUREMENT PROCEDURE | 36 |
| 10.5 | TEST EQUIPMENT LIST AND DETAILS | 36 |
| 10.6 | TEST ENVIRONMENTAL CONDITIONS..... | 36 |
| 10.7 | TEST RESULTS | 37 |
| 11 | FCC §15.407(A) - POWER SPECTRAL DENSITY | 54 |
| 11.3 | APPLICABLE STANDARDS | 54 |
| 11.4 | MEASUREMENT PROCEDURE | 54 |
| 11.5 | TEST EQUIPMENT LIST AND DETAILS | 54 |
| 11.6 | TEST ENVIRONMENTAL CONDITIONS..... | 54 |
| 11.7 | TEST RESULTS | 55 |
| 12 | EXHIBIT A – FCC EQUIPMENT LABELLING REQUIREMENTS | 61 |
| 12.3 | FCC ID LABEL REQUIREMENTS | 61 |
| 12.4 | FCC ID LABEL CONTENTS AND LOCATION | 62 |
| 13 | EXHIBIT B - EUT SETUP PHOTOGRAPHS | 63 |
| 13.1 | RADIATED EMISSION BELOW 1 GHZ FRONT VIEW..... | 63 |
| 13.2 | RADIATED EMISSION BELOW 1 GHZ REAR VIEW | 63 |
| 13.3 | RADIATED EMISSION ABOVE 1 GHZ FRONT VIEW | 64 |
| 13.4 | RADIATED EMISSION ABOVE 1 GHZ REAR VIEW | 64 |
| 13.5 | AC LINE CONDUCTED EMISSION FRONT VIEW..... | 65 |
| 13.6 | AC LINE CONDUCTED EMISSION SIDE VIEW | 65 |
| 14 | EXHIBIT C – EUT PHOTOGRAPHS..... | 66 |
| 14.1 | EUT TOP VIEW..... | 66 |
| 14.2 | EUT REAR VIEW | 66 |
| 14.3 | EUT LEFT SIDE VIEW..... | 67 |
| 14.4 | EUT RIGHT SIDE VIEW..... | 67 |
| 14.5 | EUT FRONT SIDE VIEW | 68 |
| 14.6 | EUT BACK SIDE VIEW | 68 |
| 14.7 | EUT OPEN CASE VIEW..... | 69 |
| 14.8 | ANTENNAS TOP VIEW..... | 69 |
| 14.9 | ANTENNAS SIDE VIEW..... | 70 |
| 14.10 | PCB BOARD LOCATION VIEW..... | 70 |
| 14.11 | MAIN BOARD TOP VIEW | 71 |
| 14.12 | MAIN BOARD REAR VIEW..... | 71 |
| 14.13 | MAIN BOARD SHIELDING OFF VIEW | 72 |
| 14.14 | CABLE MODEM BOARD TOP VIEW..... | 72 |
| 14.15 | CABLE MODEM BOARD REAR VIEW | 73 |
| 14.16 | POWER SUPPLY BOARD TOP VIEW..... | 73 |
| 14.17 | POWER SUPPLY BOARD REAR VIEW | 74 |
| 14.18 | BIAS-T PCB (POWER AND RF SPLITTER) BOARD TOP VIEW | 74 |
| 14.19 | AC ADAPTER VIEW..... | 75 |

DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|-----------------|------------------|-------------------------|------------------|
| 0 | R1409183-407 W52 | Initial | 2015-02-19 |

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Ruckus Wireless, Inc.*, and their product FCC ID: S9GT504 or the “EUT” as referred to in this report. The EUT is an 802.11a/b/g/n/ac access point.

1.2 Mechanical Description of EUT

The EUT measures approximately 394 mm (L) x 216 mm (W) x 68 mm (H) and weighs approximately 2.5 kg.

The test data gathered are from typical production sample, serial number: 25140600007

1.3 Objective

This report is prepared on behalf of *Ruckus Wireless, Inc.* in accordance with FCC CFR47 §15.407.

The objective is to determine compliance with FCC Part 15.407 for Output Power, Antenna Requirements, AC Line Conducted Emissions, Bandwidth, power spectral density, Band Edges Measurement, Spurious Emissions, Conducted and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the 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 CISPR16-4-2:2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from ± 2.0 dB for Conducted Emissions tests and ± 4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BAACL Corp.

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.

1.7 Test Facility

Bay area compliance Laboratories Corp. (BACL) is:

1- An independent Commercial Test Laboratory accredited to **ISO 17025:2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminaires and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65:1996** by **A2LA** to certify:

2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.

3. Radio Communication Equipment for Singapore.

4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.

5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).

6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s), Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. 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 have 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 test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. 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 Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

<http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b>

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2009 and KDB-789033 D02 General UNII Test Procedures New Rules v01

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

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

2.2 EUT Exercise Software

The test utility used was *T504 ART* was provided by Ruckus Wireless Inc., and was verified by *Rui Zhou* to comply with the standard requirements being tested against.

2.3 Special Equipment

N/A

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

| Manufacturer | Description | Model | Serial Number |
|--------------|-------------|----------------|---------------|
| Dell | Laptop | Latitude E5420 | CHZCMQ1 |

2.6 EUT Internal Configuration Details

| Manufacturer | Description | Model | Serial Number |
|--------------|-----------------------------------------|---------------------------|---------------|
| Ruckus | Main Board (SANTORINI) | ASM 120-11266-001 rev.3.1 | RUK03828 |
| Ruckus | Cable Modem Board | 2PB-C30600B0MWR | - |
| Ruckus | BIAS-T PCB(Power and RF Splitter) Board | FAQ 100-11273-001REV 3 | - |
| Ruckus | Power Supply Board | 10007275 REV E | - |

2.7 Interface Ports and Cables

| Cable Description | Length (m) | From | To |
|-------------------|------------|--------|-----|
| Ethernet Cable | 1m | Laptop | EUT |
| RF Cable x2 | <1m | EUT | PSA |

2.8 Power Supply List and Details

| Manufacturer | Description | Model | Part Number |
|--------------|-----------------|---------------|---------------|
| Ruckus | AC Power Supply | MPBS-12020000 | 740-64129-011 |

3 Summary of Test Results

| FCC Rules | Description of Test | Result |
|-----------------------|-----------------------------------------|-----------|
| §15.407(f), §2.1091 | RF Exposure | Compliant |
| §15.203 | Antenna Requirement | Compliant |
| §15.207 | AC Power Line Conducted Emissions | Compliant |
| §15.209(a), 15.407(b) | Spurious Radiated Emissions | Compliant |
| §15.407(a) | Emission Bandwidth | Compliant |
| §407(a) | Output Power Measurement | Compliant |
| §2.1051, §15.407(b) | Band Edges | Compliant |
| §15.407(a) | Power Spectral Density | Compliant |
| §2.1051, §15.407(b) | Spurious Emissions at Antenna Terminals | Compliant |
| §15.407(h) | Dynamic Frequency Selection (DFS) | N/A |

4 FCC §2.1091 & §15.407(f) - RF Exposure

4.1 Applicable Standard

According to FCC §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.

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

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from 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

4.3 MPE Results

5 GHz Band:

| | |
|-----------------------------------------------------------------------------------------|---------------|
| <u>Maximum peak output power at antenna input terminal (dBm):</u> | <u>22.06</u> |
| <u>Maximum peak output power at antenna input terminal (mW):</u> | <u>160.69</u> |
| <u>Prediction distance (cm):</u> | <u>20</u> |
| <u>Prediction frequency (MHz):</u> | <u>5180</u> |
| <u>Maximum Antenna Gain, typical (dBi):</u> | <u>5</u> |
| <u>Maximum Antenna Gain (numeric):</u> | <u>3.162</u> |
| <u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u> | <u>0.1011</u> |
| <u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u> | <u>1.0</u> |

2.4 GHz:

| | |
|-----------------------------------------------------------------------------------------|---------------|
| <u>Maximum peak output power at antenna input terminal (dBm):</u> | <u>24.92</u> |
| <u>Maximum peak output power at antenna input terminal (mW):</u> | <u>310.46</u> |
| <u>Prediction distance (cm):</u> | <u>20</u> |
| <u>Prediction frequency (MHz):</u> | <u>2437</u> |
| <u>Maximum Antenna Gain, typical (dBi):</u> | <u>3</u> |
| <u>Maximum Antenna Gain (numeric):</u> | <u>1.995</u> |
| <u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u> | <u>0.123</u> |
| <u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u> | <u>1.0</u> |

According to KDB 447498 D01 General RF Exposure Guidance v05r02, EUT has two 2.4 GHz band antenna and two 5 GHz band antenna. The power density for 2.4 GHz band is 0.123 (refer to T504 2.4 GHz band report R1409183-247). So the sum of MPE ratio for four antennas is: $0.123 + 0.1011 = 0.2241$ mW/cm², which is smaller than 1.0. So the colocation exposure exclusion applies.

5 FCC §15.203 – Antenna Requirements

5.3 Applicable Standard

According to FCC §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.

5.4 Antenna Description

The device has 2.4/5 GHz internal antennas. The Antenna gain is 3 dBi at 2.4 GHz and 5 dBi at 5 GHz. Please refer to the internal photos.

6 FCC §15.207 - AC Power Line Conducted Emissions

6.1 Applicable Standard

As per FCC §15.207 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ 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 frequencies ranges.

| Frequency of Emission (MHz) | Conducted Limit (dBuV) | |
|--------------------------------|------------------------|-----------------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56 Note 1 | 56 to 46 Note 1 |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

Note 1 Decreases with the logarithm of the frequency.

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2009 measurement procedure. The specification used was FCC §15.207 limits.

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

The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

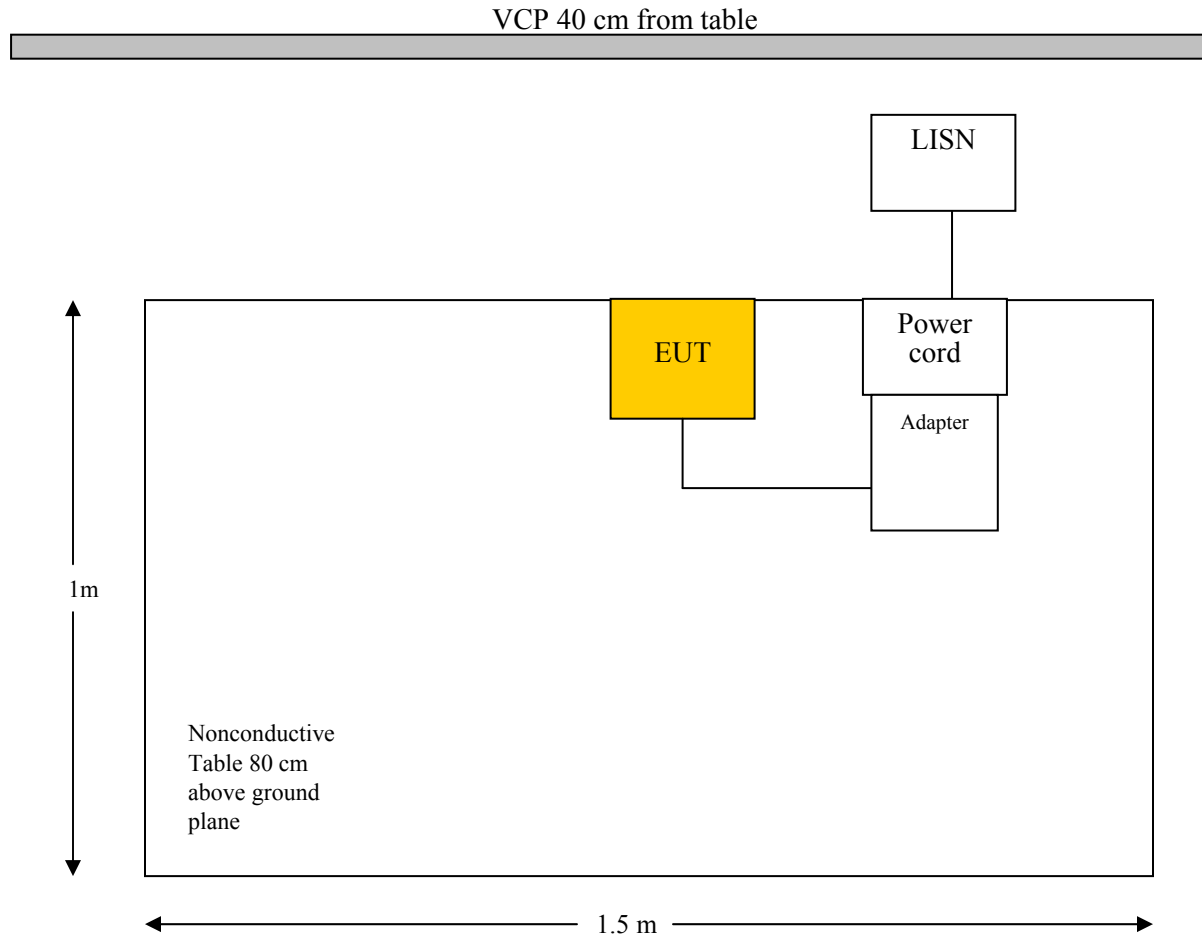
6.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cord of the support equipment was connected to LISN-2.

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

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

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL), the Attenuator Factor (Atten) to indicated Amplitude (Ai) reading. The basic equation is as follows:

$$CA = Ai + CL + Atten$$

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

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

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

6.6 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|-------------------|-------------------|-------------------|------------|------------------|----------------------|
| Rohde & Schwarz | EMI Test Receiver | ESCI 1166.5950K03 | 100337 | 2014-03-28 | 1 year |
| Solar Electronics | LISN | 9252-50-R-24-N | 511213 | 2014-07-14 | 1 year |

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

6.7 Test Environmental Conditions

| | |
|---------------------------|-----------------|
| Temperature: | 22-24 °C |
| Relative Humidity: | 40-41 % |
| ATM Pressure: | 103.1-104.1 kPa |

The testing was performed by Rui Zhou on 2014-10-15 in 5 m chamber 3.

6.8 Summary of Test Results

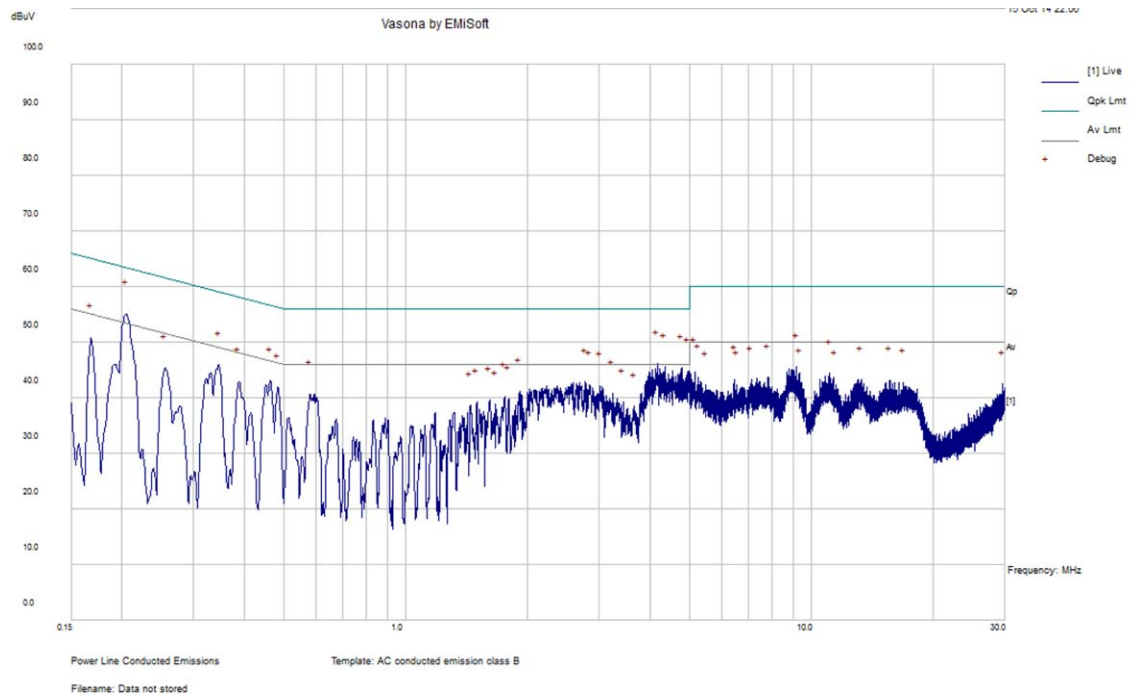
According to the recorded data in following table, the EUT complied with the FCC Part 15 standard's conducted emissions limits, with the margin reading of:

| Connection: AC/DC adapter connected to 120 V/60 Hz, AC | | | |
|--------------------------------------------------------|-----------------|-------------------------------|-------------|
| Margin (dB) | Frequency (MHz) | Conductor Mode (Line/Neutral) | Range (MHz) |
| -11.84 | 0.194769 | Line | 0.15-30 |

6.9 Conducted Emissions Test Plots and Data

Note: The EUT is transmitting at worst case: 2.4 GHz and 5 GHz colocation.

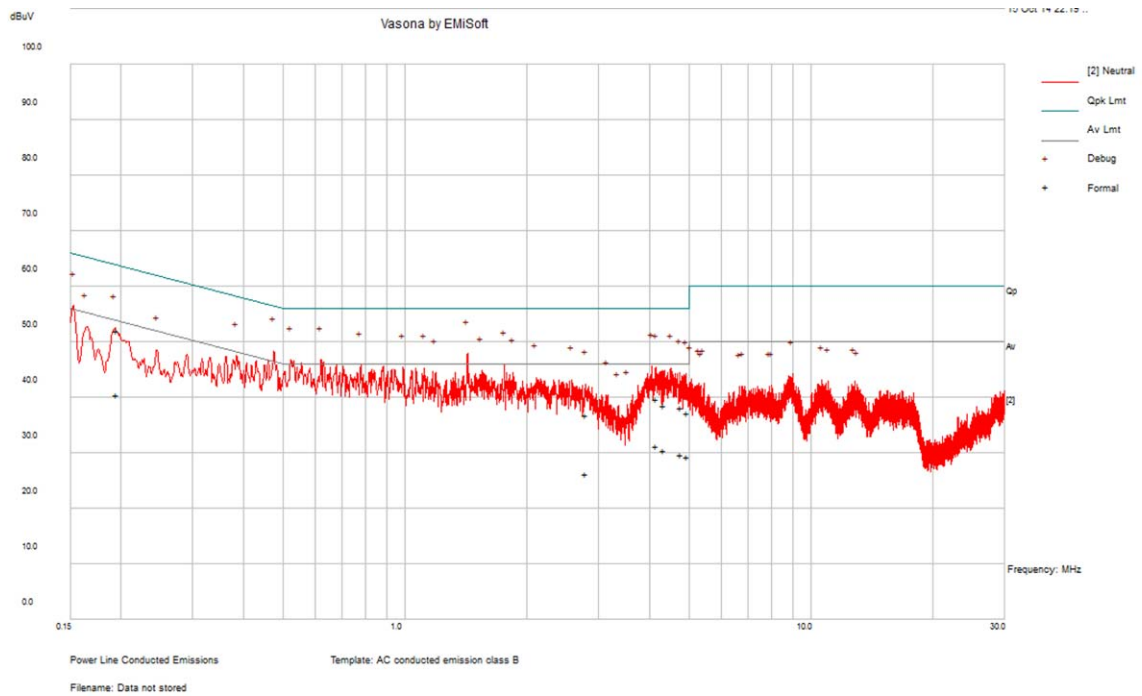
120 V, 60 Hz – Line



| Frequency (MHz) | Corrected Amplitude (dBµV) | Conductor (Line/Neutral) | Limit (dBµV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.194769 | 51.99 | Line | 63.83 | -11.84 | QP |
| 4.170098 | 39.75 | Line | 56 | -16.25 | QP |
| 4.34813 | 38.59 | Line | 56 | -17.41 | QP |
| 4.786835 | 38.25 | Line | 56 | -17.75 | QP |
| 4.972067 | 37.28 | Line | 56 | -18.72 | QP |
| 2.782478 | 36.82 | Line | 56 | -19.18 | QP |

| Frequency (MHz) | Corrected Amplitude (dBµV) | Conductor (Line/Neutral) | Limit (dBµV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.194769 | 40.56 | Line | 53.83 | -13.27 | Ave. |
| 4.170098 | 31.27 | Line | 46 | -14.73 | Ave. |
| 4.34813 | 30.44 | Line | 46 | -15.56 | Ave. |
| 4.786835 | 29.84 | Line | 46 | -16.16 | Ave. |
| 4.972067 | 29.32 | Line | 46 | -16.68 | Ave. |
| 2.782478 | 26.22 | Line | 46 | -19.78 | Ave. |

120 V, 60 Hz – Neutral



| Frequency (MHz) | Corrected Amplitude (dBμV) | Conductor (Line/Neutral) | Limit (dBμV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.469209 | 34.95 | Neutral | 56.53 | -21.57 | QP |
| 1.415133 | 35.01 | Neutral | 56 | -20.99 | QP |
| 0.637149 | 25.41 | Neutral | 56 | -30.59 | QP |
| 0.518499 | 27.96 | Neutral | 56 | -28.04 | QP |
| 0.152601 | 43.04 | Neutral | 65.86 | -22.81 | QP |
| 1.752492 | 35.42 | Neutral | 56 | -20.58 | QP |

| Frequency (MHz) | Corrected Amplitude (dBμV) | Conductor (Line/Neutral) | Limit (dBμV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.469209 | 23.65 | Neutral | 46.53 | -22.87 | Ave. |
| 1.415133 | 22.71 | Neutral | 46 | -23.29 | Ave. |
| 0.637149 | 10.16 | Neutral | 46 | -35.84 | Ave. |
| 0.518499 | 16.15 | Neutral | 46 | -29.85 | Ave. |
| 0.152601 | 17.99 | Neutral | 55.86 | -37.87 | Ave. |
| 1.752492 | 22.74 | Neutral | 46 | -23.26 | Ave. |

7 FCC §15.209 & §15.407(b) - Spurious Radiated Emissions

7.3 Applicable Standard

As per FCC §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

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

| Frequency (MHz) | Field Strength (micro volts/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 Note 1 | 3 |
| 88 - 216 | 150 Note 1 | 3 |
| 216 - 960 | 200 Note 1 | 3 |
| Above 960 | 500 | 3 |

Note 1: 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 FCC §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 FCC Part 15.407 (b)

(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 e.i.r.p. 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.

7.4 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. The specification used was the FCC 15C/15E 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.

7.5 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords were 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 meter, 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 1000 MHz:

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

Above 1000 MHz:

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

7.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

$$CA = Ai + AF + CL + Atten - Ga$$

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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

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

7.7 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|--------------------|---------------------|-------------------|------------|------------------|----------------------|
| Sunol Science Corp | System Controller | SC99V | 122303-1 | N/R | N/R |
| Sunol Science Corp | Combination Antenna | JB3 | A020106-3 | 2014-07-24 | 1 year |
| Hewlett Packard | Pre-amplifier | 8447D | 2944A06639 | 2014-04-26 | 1 year |
| Agilent | Pre-amplifier | 8449B | 3008A01978 | 2014-02-04 | 1 year |
| WiseWave | Horn Antenna | ARH-4223-02 | 10555-01 | 2012-08-09 | 3 Years |
| Agilent | Spectrum Analyzer | E4446A | US44300386 | 2013-09-29 | 1 year |
| EMCO | Horn Antenna | 3315 | 9511-4627 | 2013-10-17 | 1 year |
| Rohde & Schwarz | EMI Test Receiver | ESCI 1166.5950K03 | 100337 | 2013-10-28 | 1 year |

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

7.8 Test Environmental Conditions

| | |
|---------------------------|-----------------|
| Temperature: | 22-24 °C |
| Relative Humidity: | 40-41 % |
| ATM Pressure: | 103.1-104.1 kPa |

The testing was performed by Rui Zhou on 2014-10-15 in 5 m chamber 3.

7.9 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15.205, 15.209 and 15.407 standard's radiated emissions limits, and had the worst margin of:

30 MHz-1 GHz

| Mode: Transmitting | | | |
|--------------------|-----------------|------------------------------------|------------------------------|
| Margin (dB) | Frequency (MHz) | Polarization (Horizontal/Vertical) | Mode, Channel |
| -3.44 | 31.693 | Vertical | 2.4 GHz and 5 GHz Colocation |

Above 1 GHz

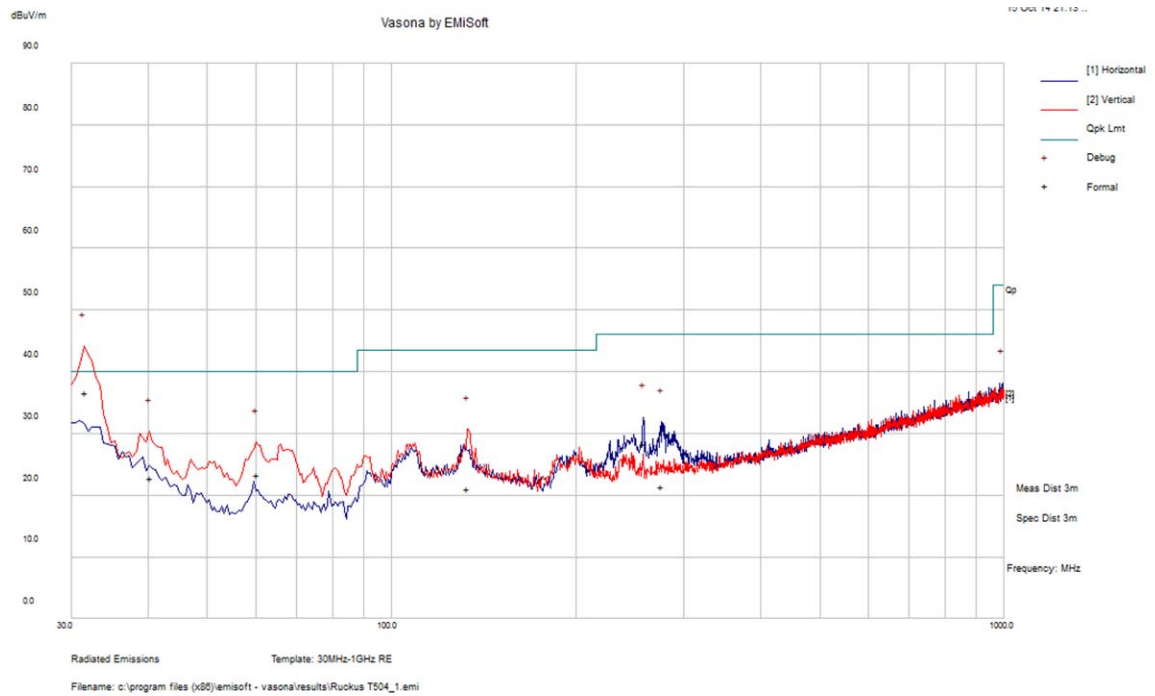
| Mode: Transmitting | | | |
|--------------------|-----------------|------------------------------------|------------|
| Margin (dB) | Frequency (MHz) | Polarization (Horizontal/Vertical) | Range |
| -8.47 | 15720 | Horizontal | 1 - 40 GHz |

Please refer to the following table and plots for specific test result details

7.10 Radiated Emissions Test Result Data

1) 30 MHz – 1 GHz

Note: The EUT is 2.4 GHz and 5 GHz Colocation.



Worst-Case:

| Frequency (MHz) | Corrected Amplitude (dBμV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBμV/m) | Margin (dB) | Comment (PK/QP/Ave) |
|-----------------|------------------------------|---------------------|------------------------|-----------------------------|----------------|-------------|---------------------|
| 31.693 | 36.56 | 124 | V | 266 | 40 | -3.44 | QP |
| 40.366 | 22.78 | 106 | V | 255 | 40 | -17.22 | QP |
| 60.27425 | 23.31 | 108 | V | 112 | 40 | -16.69 | QP |
| 133.0018 | 21.04 | 118 | V | 328 | 43.5 | -22.46 | QP |
| 257.4115 | 28.29 | 129 | H | 139 | 46 | -17.71 | QP |
| 275.671 | 21.42 | 148 | H | 140 | 46 | -24.58 | QP |

2) 1-40 GHz

W52 Band

802.11a mode

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments |
|-----------------------------------------------|---------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------|----------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 5180 MHz, measured at 3 meters | | | | | | | | | | | |
| 10360 | 49.74 | 0 | 100 | V | 38.1 | 4.08 | 33.87 | 58.05 | 74 | -15.95 | Peak |
| 10360 | 47.12 | 0 | 100 | H | 38.1 | 4.08 | 33.87 | 55.43 | 74 | -18.57 | Peak |
| 10360 | 35.11 | 0 | 100 | V | 38.1 | 4.08 | 33.87 | 43.42 | 54 | -10.58 | Ave |
| 10360 | 35.04 | 0 | 100 | H | 38.1 | 4.08 | 33.87 | 43.35 | 54 | -10.65 | Ave |
| 15540 | 48.35 | 0 | 100 | V | 38.54 | 3.93 | 33.82 | 57 | 74 | -17 | Peak |
| 15540 | 48.85 | 0 | 100 | H | 38.54 | 3.93 | 33.82 | 57.5 | 74 | -16.5 | Peak |
| 15540 | 35.96 | 0 | 100 | V | 38.54 | 3.93 | 33.82 | 44.61 | 54 | -9.39 | Ave |
| 15540 | 35.98 | 0 | 100 | H | 38.54 | 3.93 | 33.82 | 44.63 | 54 | -9.37 | Ave |
| 20720 | 47.71 | 0 | 100 | V | 34.79 | 5.72 | 34.79 | 53.43 | 74 | -20.57 | Peak |
| 20720 | 48.24 | 0 | 100 | H | 34.79 | 5.72 | 34.79 | 53.96 | 74 | -20.04 | Peak |
| 20720 | 35.17 | 0 | 100 | V | 34.79 | 5.72 | 34.79 | 40.89 | 54 | -13.11 | Ave |
| 20720 | 35.13 | 0 | 100 | H | 34.79 | 5.72 | 34.79 | 40.85 | 54 | -13.15 | Ave |
| Middle Channel 5200 MHz, measured at 3 meters | | | | | | | | | | | |
| 10400 | 49.85 | 0 | 100 | V | 38.845 | 4.07 | 33.87 | 58.90 | 74 | -15.10 | Peak |
| 10400 | 47.69 | 0 | 100 | H | 38.845 | 4.07 | 33.87 | 56.74 | 74 | -17.26 | Peak |
| 10400 | 35.79 | 0 | 100 | V | 38.845 | 4.07 | 33.87 | 44.83 | 54 | -9.17 | Ave |
| 10400 | 35.72 | 0 | 100 | H | 38.845 | 4.07 | 33.87 | 44.77 | 54 | -9.23 | Ave |
| 15600 | 48.39 | 0 | 100 | V | 38.59 | 3.94 | 33.82 | 57.10 | 74 | -16.90 | Peak |
| 15600 | 49.62 | 0 | 100 | H | 38.59 | 3.94 | 33.82 | 58.33 | 74 | -15.67 | Peak |
| 15600 | 34.98 | 0 | 100 | V | 38.59 | 3.94 | 33.82 | 43.69 | 54 | -10.31 | Ave |
| 15600 | 35.17 | 0 | 100 | H | 38.59 | 3.94 | 33.82 | 43.88 | 54 | -10.12 | Ave |
| 20800 | 46.80 | 0 | 100 | V | 34.74 | 5.78 | 34.74 | 52.58 | 74 | -21.42 | Peak |
| 20800 | 48.11 | 0 | 100 | H | 34.74 | 5.78 | 34.74 | 53.89 | 74 | -20.11 | Peak |
| 20800 | 34.90 | 0 | 100 | V | 34.74 | 5.78 | 34.74 | 40.68 | 54 | -13.32 | Ave |
| 20800 | 35.00 | 0 | 100 | H | 34.74 | 5.78 | 34.74 | 40.78 | 54 | -13.22 | Ave |
| High Channel 5240 MHz, measured at 3 meters | | | | | | | | | | | |
| 10480 | 49.36 | 0 | 100 | V | 38.55 | 4.09 | 34.71 | 57.29 | 74 | -16.71 | Peak |
| 10480 | 47.07 | 0 | 100 | H | 38.55 | 4.09 | 34.71 | 55.00 | 74 | -19.00 | Peak |
| 10480 | 34.35 | 0 | 100 | V | 38.55 | 4.09 | 34.71 | 42.28 | 54 | -11.72 | Ave |
| 10480 | 34.07 | 0 | 100 | H | 38.55 | 4.09 | 34.71 | 42.00 | 54 | -12.00 | Ave |
| 15720 | 47.36 | 0 | 100 | V | 38.61 | 5.17 | 33.78 | 57.36 | 74 | -16.64 | Peak |
| 15720 | 49.20 | 0 | 100 | H | 38.61 | 3.93 | 33.78 | 57.96 | 74 | -16.04 | Peak |
| 15720 | 36.17 | 0 | 100 | V | 38.61 | 3.93 | 33.78 | 44.93 | 54 | -9.07 | Ave |
| 15720 | 36.15 | 0 | 100 | H | 38.61 | 3.93 | 33.78 | 44.91 | 54 | -9.09 | Ave |
| 20960 | 48.66 | 0 | 100 | V | 34.71 | 5.78 | 34.71 | 54.44 | 74 | -19.56 | Peak |
| 20960 | 49.05 | 0 | 100 | H | 34.71 | 5.78 | 34.71 | 54.83 | 74 | -19.17 | Peak |
| 20960 | 35.33 | 0 | 100 | V | 34.71 | 5.78 | 34.71 | 41.11 | 54 | -12.89 | Ave |
| 20960 | 35.83 | 0 | 100 | H | 34.71 | 5.78 | 34.71 | 41.61 | 54 | -12.39 | Ave |

802.11n-HT 20 mode

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments |
|-----------------------------------------------|---------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------|----------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 5180 MHz, measured at 3 meters | | | | | | | | | | | |
| 10360 | 50.57 | 0 | 100 | V | 38.1 | 4.08 | 33.87 | 58.88 | 74 | -15.12 | Peak |
| 10360 | 47.16 | 0 | 100 | H | 38.1 | 4.08 | 33.87 | 55.47 | 74 | -18.53 | Peak |
| 10360 | 35.76 | 0 | 100 | V | 38.1 | 4.08 | 33.87 | 44.07 | 54 | -9.93 | Ave |
| 10360 | 35.18 | 0 | 100 | H | 38.1 | 4.08 | 33.87 | 43.49 | 54 | -10.51 | Ave |
| 15540 | 49.05 | 0 | 100 | V | 38.54 | 3.93 | 33.82 | 57.70 | 74 | -16.30 | Peak |
| 15540 | 48.11 | 0 | 100 | H | 38.54 | 3.93 | 33.82 | 56.76 | 74 | -17.24 | Peak |
| 15540 | 35.19 | 0 | 100 | V | 38.54 | 3.93 | 33.82 | 43.84 | 54 | -10.16 | Ave |
| 15540 | 35.00 | 0 | 100 | H | 38.54 | 3.93 | 33.82 | 43.65 | 54 | -10.35 | Ave |
| 20720 | 46.77 | 0 | 100 | V | 34.79 | 5.72 | 34.79 | 52.49 | 74 | -21.51 | Peak |
| 20720 | 47.52 | 0 | 100 | H | 34.79 | 5.72 | 34.79 | 53.24 | 74 | -20.76 | Peak |
| 20720 | 34.61 | 0 | 100 | V | 34.79 | 5.72 | 34.79 | 40.33 | 54 | -13.67 | Ave |
| 20720 | 34.72 | 0 | 100 | H | 34.79 | 5.72 | 34.79 | 40.44 | 54 | -13.56 | Ave |
| Middle Channel 5200 MHz, measured at 3 meters | | | | | | | | | | | |
| 10400 | 49.23 | 0 | 100 | V | 38.845 | 4.07 | 33.87 | 58.28 | 74 | -15.72 | Peak |
| 10400 | 46.37 | 0 | 100 | H | 38.845 | 4.07 | 33.87 | 55.42 | 74 | -18.58 | Peak |
| 10400 | 34.28 | 0 | 100 | V | 38.845 | 4.07 | 33.87 | 43.32 | 54 | -10.68 | Ave |
| 10400 | 34.11 | 0 | 100 | H | 38.845 | 4.07 | 33.87 | 43.16 | 54 | -10.84 | Ave |
| 15600 | 47.63 | 0 | 100 | V | 38.59 | 3.94 | 33.82 | 56.34 | 74 | -17.66 | Peak |
| 15600 | 48.66 | 0 | 100 | H | 38.59 | 3.94 | 33.82 | 57.37 | 74 | -16.63 | Peak |
| 15600 | 36.75 | 0 | 100 | V | 38.59 | 3.94 | 33.82 | 45.46 | 54 | -8.54 | Ave |
| 15600 | 36.10 | 0 | 100 | H | 38.59 | 3.94 | 33.82 | 44.81 | 54 | -9.19 | Ave |
| 20800 | 48.14 | 0 | 100 | V | 34.74 | 5.78 | 34.74 | 53.92 | 74 | -20.08 | Peak |
| 20800 | 48.46 | 0 | 100 | H | 34.74 | 5.78 | 34.74 | 54.24 | 74 | -19.76 | Peak |
| 20800 | 35.66 | 0 | 100 | V | 34.74 | 5.78 | 34.74 | 41.44 | 54 | -12.56 | Ave |
| 20800 | 35.99 | 0 | 100 | H | 34.74 | 5.78 | 34.74 | 41.77 | 54 | -12.23 | Ave |
| High Channel 5240 MHz, measured at 3 meters | | | | | | | | | | | |
| 10480 | 48.94 | 0 | 100 | V | 38.55 | 4.09 | 34.71 | 56.87 | 74 | -17.13 | Peak |
| 10480 | 46.56 | 0 | 100 | H | 38.55 | 4.09 | 34.71 | 54.49 | 74 | -19.51 | Peak |
| 10480 | 35.05 | 0 | 100 | V | 38.55 | 4.09 | 34.71 | 42.98 | 54 | -11.02 | Ave |
| 10480 | 34.56 | 0 | 100 | H | 38.55 | 4.09 | 34.71 | 42.49 | 54 | -11.51 | Ave |
| 15720 | 47.88 | 0 | 100 | V | 38.61 | 5.17 | 33.78 | 57.88 | 74 | -16.12 | Peak |
| 15720 | 48.32 | 0 | 100 | H | 38.61 | 3.93 | 33.78 | 57.08 | 74 | -16.92 | Peak |
| 15720 | 35.32 | 0 | 100 | V | 38.61 | 3.93 | 33.78 | 44.08 | 54 | -9.92 | Ave |
| 15720 | 36.77 | 0 | 100 | H | 38.61 | 3.93 | 33.78 | 45.53 | 54 | -8.47 | Ave |
| 20960 | 48.23 | 0 | 100 | V | 34.71 | 5.78 | 34.71 | 54.01 | 74 | -19.99 | Peak |
| 20960 | 48.59 | 0 | 100 | H | 34.71 | 5.78 | 34.71 | 54.37 | 74 | -19.63 | Peak |
| 20960 | 36.11 | 0 | 100 | V | 34.71 | 5.78 | 34.71 | 41.89 | 54 | -12.11 | Ave |
| 20960 | 35.23 | 0 | 100 | H | 34.71 | 5.78 | 34.71 | 41.01 | 54 | -12.99 | Ave |

802.11n-HT40 mode

| Frequency (MHz) | S.A. Reading (dBμV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBμV/m) | FCC | | Comments |
|---------------------------------------------|---------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------|----------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBμV/m) | Margin (dB) | |
| Low Channel 5190 MHz, measured at 3 meters | | | | | | | | | | | |
| 10380 | 50.51 | 0 | 100 | V | 38.1 | 4.09 | 33.87 | 58.83 | 74 | -15.17 | Peak |
| 10380 | 47.53 | 0 | 100 | H | 38.1 | 4.09 | 33.87 | 55.85 | 74 | -18.15 | Peak |
| 10380 | 35.65 | 0 | 100 | V | 38.1 | 4.09 | 33.87 | 43.97 | 54 | -10.03 | Ave |
| 10380 | 35.73 | 0 | 100 | H | 38.1 | 4.09 | 33.87 | 44.05 | 54 | -9.95 | Ave |
| 15570 | 49.10 | 0 | 100 | V | 38.54 | 3.95 | 33.82 | 57.77 | 74 | -16.23 | Peak |
| 15570 | 49.24 | 0 | 100 | H | 38.54 | 3.95 | 33.82 | 57.91 | 74 | -16.09 | Peak |
| 15570 | 36.42 | 0 | 100 | V | 38.54 | 3.95 | 33.82 | 45.09 | 54 | -8.91 | Ave |
| 15570 | 36.29 | 0 | 100 | H | 38.54 | 3.95 | 33.82 | 44.96 | 54 | -9.04 | Ave |
| 20760 | 48.57 | 0 | 100 | V | 34.79 | 5.72 | 34.79 | 54.29 | 74 | -19.71 | Peak |
| 20760 | 47.49 | 0 | 100 | H | 34.79 | 5.72 | 34.79 | 53.21 | 74 | -20.79 | Peak |
| 20760 | 34.31 | 0 | 100 | V | 34.79 | 5.72 | 34.79 | 40.03 | 54 | -13.97 | Ave |
| 20760 | 34.15 | 0 | 100 | H | 34.79 | 5.72 | 34.79 | 39.87 | 54 | -14.13 | Ave |
| High Channel 5230 MHz, measured at 3 meters | | | | | | | | | | | |
| 10460 | 49.54 | 0 | 100 | V | 38.55 | 4.11 | 34.71 | 57.49 | 74 | -16.51 | Peak |
| 10460 | 46.24 | 0 | 100 | H | 38.55 | 4.11 | 34.71 | 54.19 | 74 | -19.81 | Peak |
| 10460 | 34.74 | 0 | 100 | V | 38.55 | 4.11 | 34.71 | 42.69 | 54 | -11.31 | Ave |
| 10460 | 34.91 | 0 | 100 | H | 38.55 | 4.11 | 34.71 | 42.86 | 54 | -11.14 | Ave |
| 15690 | 47.95 | 0 | 100 | V | 38.61 | 3.96 | 33.78 | 56.74 | 74 | -17.26 | Peak |
| 15690 | 47.93 | 0 | 100 | H | 38.61 | 3.96 | 33.78 | 56.72 | 74 | -17.28 | Peak |
| 15690 | 35.22 | 0 | 100 | V | 38.61 | 3.96 | 33.78 | 44.01 | 54 | -9.99 | Ave |
| 15690 | 35.89 | 0 | 100 | H | 38.61 | 3.96 | 33.78 | 44.68 | 54 | -9.32 | Ave |
| 20920 | 48.35 | 0 | 100 | V | 34.71 | 5.78 | 34.71 | 54.13 | 74 | -19.87 | Peak |
| 20920 | 48.50 | 0 | 100 | H | 34.71 | 5.78 | 34.71 | 54.28 | 74 | -19.72 | Peak |
| 20920 | 35.59 | 0 | 100 | V | 34.71 | 5.78 | 34.71 | 41.37 | 54 | -12.63 | Ave |
| 20920 | 35.66 | 0 | 100 | H | 34.71 | 5.78 | 34.71 | 41.44 | 54 | -12.56 | Ave |

802.11ac-VHT80 mode

| Frequency (MHz) | S.A. Reading (dBμV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBμV/m) | FCC | | Comments |
|--------------------------------------------|---------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------|----------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBμV/m) | Margin (dB) | |
| Low Channel 5190 MHz, measured at 3 meters | | | | | | | | | | | |
| 10380 | 49.51 | 0 | 100 | V | 38.55 | 4.11 | 34.71 | 57.46 | 74 | -16.54 | Peak |
| 10380 | 46.65 | 0 | 100 | H | 38.55 | 4.11 | 34.71 | 54.60 | 74 | -19.40 | Peak |
| 10380 | 34.21 | 0 | 100 | V | 38.55 | 4.11 | 34.71 | 42.16 | 54 | -11.84 | Ave |
| 10380 | 34.64 | 0 | 100 | H | 38.55 | 4.11 | 34.71 | 42.59 | 54 | -11.41 | Ave |
| 15570 | 47.96 | 0 | 100 | V | 38.61 | 3.96 | 33.78 | 56.75 | 74 | -17.25 | Peak |
| 15570 | 48.71 | 0 | 100 | H | 38.61 | 3.96 | 33.78 | 57.50 | 74 | -16.50 | Peak |
| 15570 | 36.34 | 0 | 100 | V | 38.61 | 3.96 | 33.78 | 45.13 | 54 | -8.87 | Ave |
| 15570 | 36.47 | 0 | 100 | H | 38.61 | 3.96 | 33.78 | 45.26 | 54 | -8.74 | Ave |
| 20760 | 47.75 | 0 | 100 | V | 34.61 | 5.78 | 34.71 | 53.43 | 74 | -20.57 | Peak |
| 20760 | 48.87 | 0 | 100 | H | 34.61 | 5.78 | 34.71 | 54.55 | 74 | -19.45 | Peak |
| 20760 | 36.14 | 0 | 100 | V | 34.61 | 5.78 | 34.71 | 41.82 | 54 | -12.18 | Ave |
| 20760 | 35.60 | 0 | 100 | H | 34.61 | 5.78 | 34.71 | 41.28 | 54 | -12.72 | Ave |

8 FCC §15.407(e) – Emission Bandwidth

8.3 Applicable Standards

FCC §15.407(a)

8.4 Measurement Procedure

The measurements are base on FCC KDB 789033 D01 General UNII Test Procedures v01r03: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices section C: Emission bandwidth and section D: 99 Percent Occupied Bandwidth

8.5 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|--------------|-------------------|-----------|------------|------------------|----------------------|
| Agilent | Spectrum Analyzer | E4440A | MY44303352 | 2013-11-07 | 1 year |

Statement of Traceability: BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

8.6 Test Environmental Conditions

| | |
|--------------------|-----------------|
| Temperature: | 22-24 °C |
| Relative Humidity: | 40-41 % |
| ATM Pressure: | 103.1-104.1 kPa |

The testing was performed by Rui Zhou from 2014-10-15 at RF site.

8.7 Test Results

Please refer to the following tables and plots.

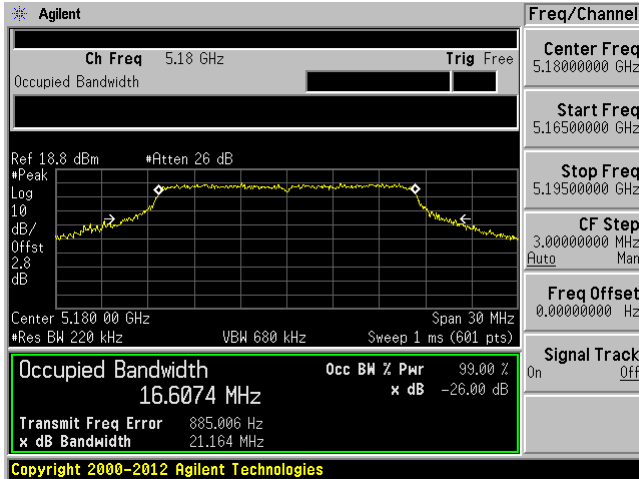
W52 Band

| Channel | Frequency (MHz) | 26 dB Emission Bandwidth (MHz) | | 99% Emission Bandwidth (MHz) | |
|---------------------|-----------------|--------------------------------|--------|------------------------------|---------|
| | | J0 | J1 | J0 | J1 |
| 802.11a mode | | | | | |
| Low | 5180 | 21.164 | 20.831 | 16.6074 | 16.5569 |
| Middle | 5200 | 20.881 | 21.377 | 16.5662 | 16.5886 |
| High | 5240 | 21.467 | 21.127 | 16.5559 | 16.5624 |
| 802.11n-HT20 mode | | | | | |
| Low | 5180 | 22.048 | 22.426 | 17.7818 | 17.4355 |
| Middle | 5200 | 22.392 | 23.128 | 17.7235 | 17.4314 |
| High | 5240 | 21.43 | 22.285 | 17.7014 | 17.4406 |
| 802.11n-HT40 mode | | | | | |
| Low | 5190 | 42.726 | 42.19 | 36.3118 | 36.2423 |
| High | 5230 | 42.825 | 41.677 | 36.3276 | 32.2453 |
| 802.11ac-VHT80 mode | | | | | |
| - | 5210 | 86.146 | 84.984 | 75.9131 | 75.6702 |

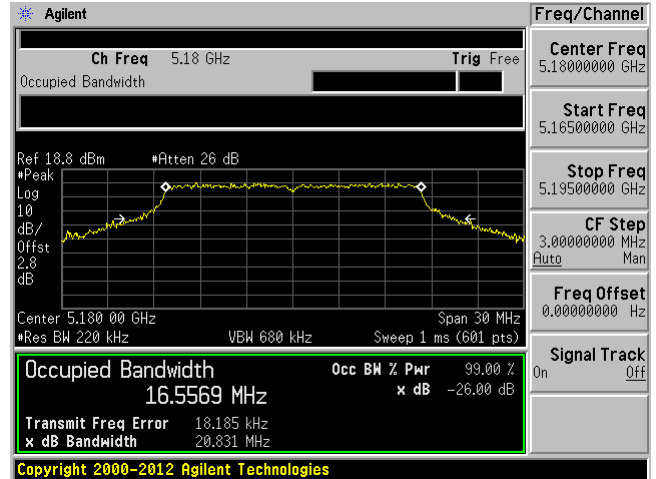
5.2 GHz Band

802.11a mode

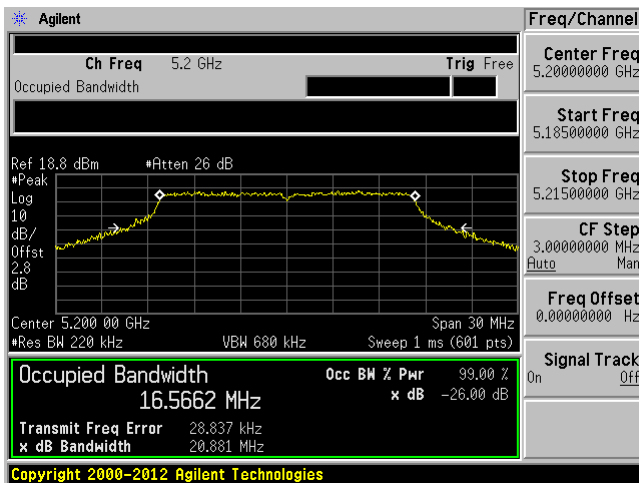
Low channel: 5180 MHz Chain 0



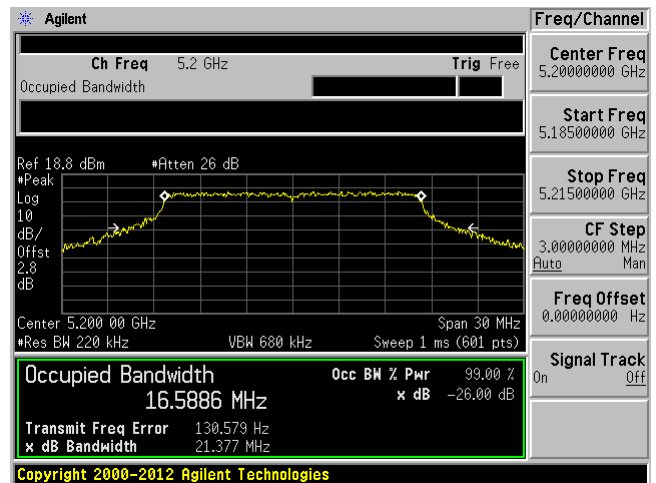
Low channel: 5180 MHz Chain 1



Middle channel: 5200 MHz Chain 0

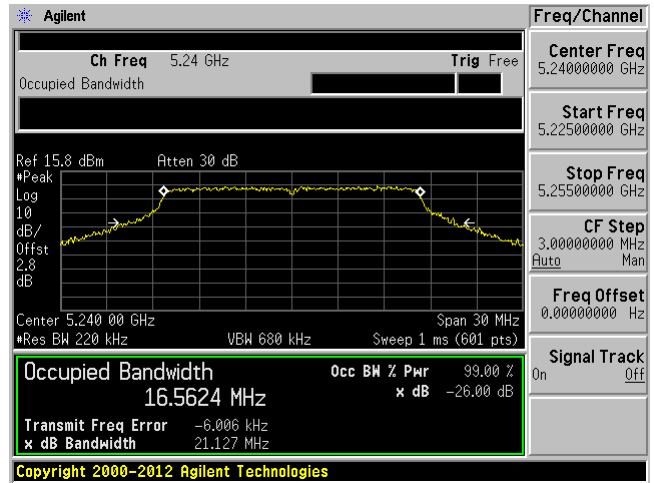
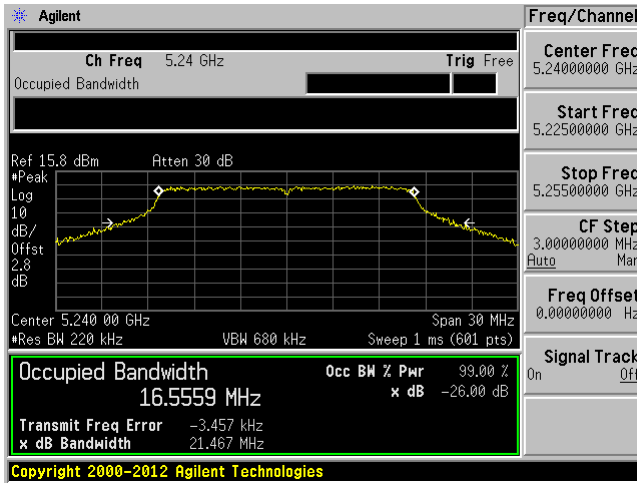


Middle channel: 5200 MHz Chain 1



High channel: 5240 MHz Chain 0

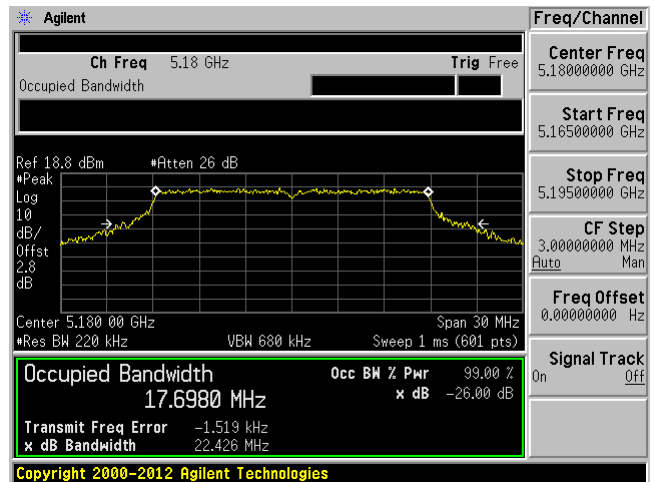
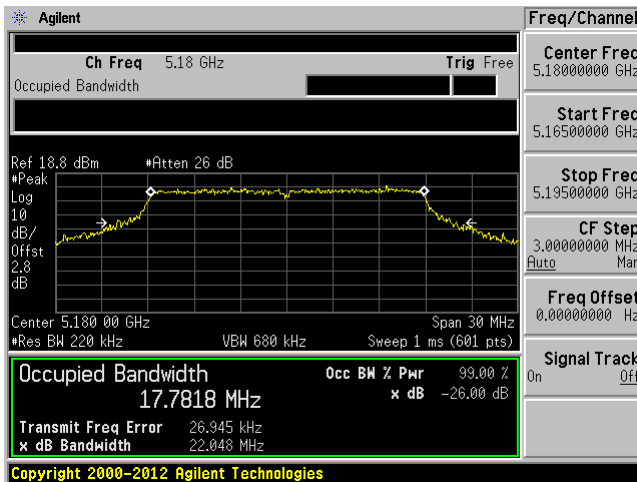
High channel: 5240 MHz Chain 1



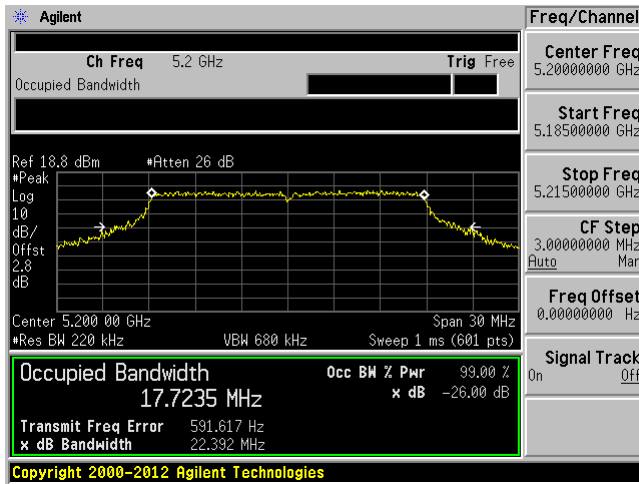
802.11n-HT20 mode

Low channel: 5180 MHz Chain 0

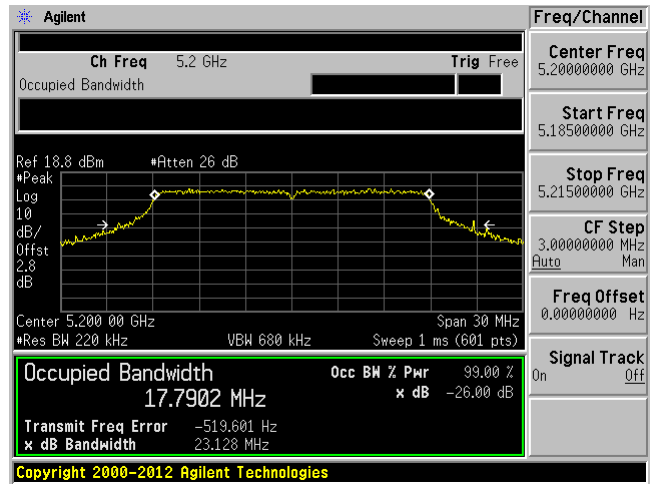
Low channel: 5180 MHz Chain 1



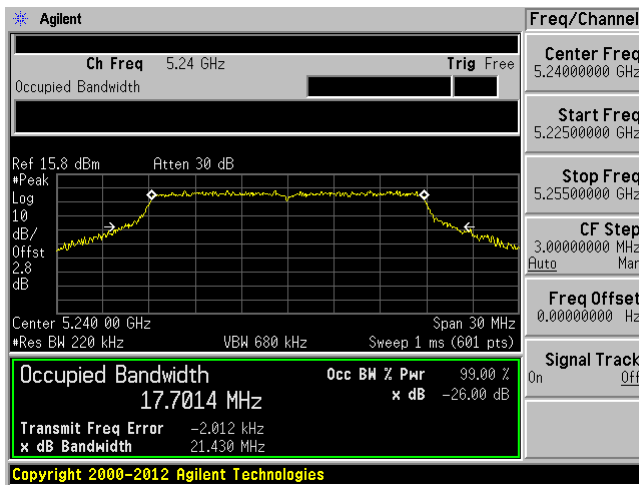
Middle channel: 5200 MHz Chain 0



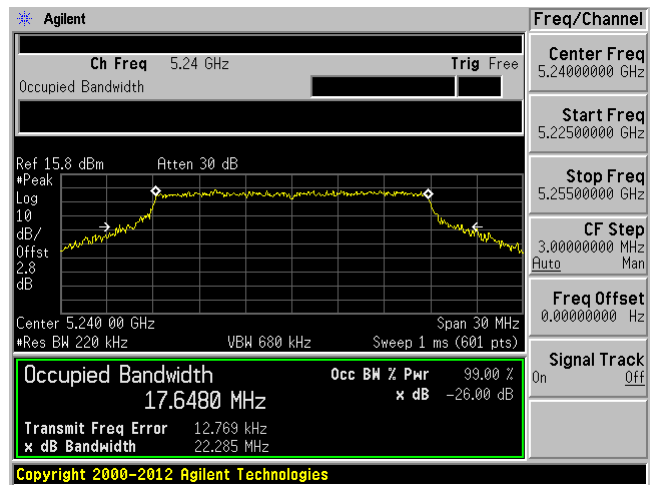
Middle channel: 5200 MHz Chain 1



High channel: 5240 MHz Chain 0



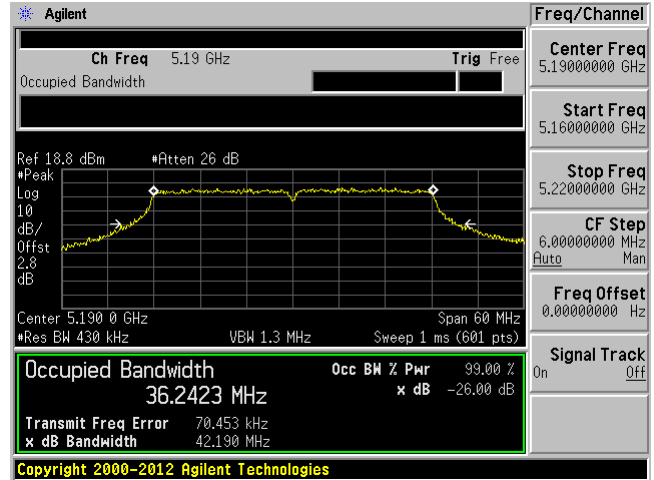
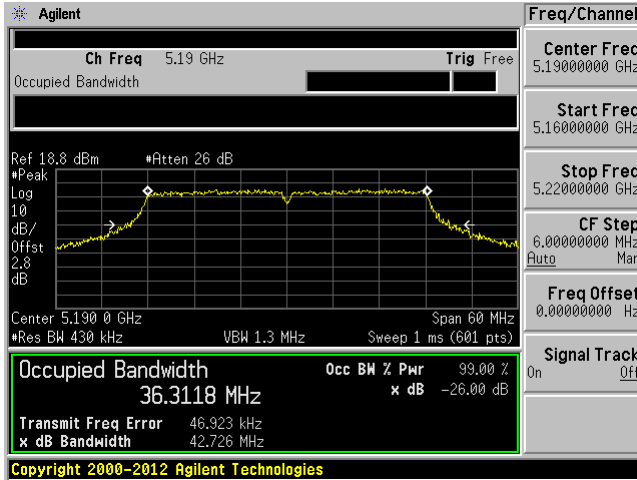
High channel: 5240 MHz Chain 1



802.11n-HT40 mode

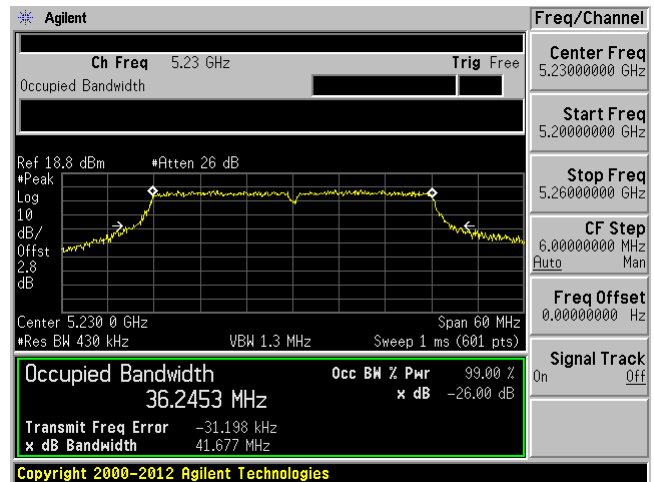
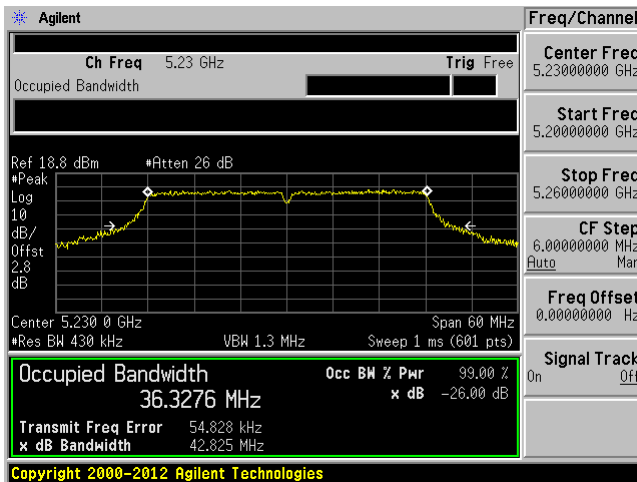
Low channel: 5190 MHz Chain 0

Low channel: 5190 MHz Chain 1



High channel: 5230 MHz Chain 0

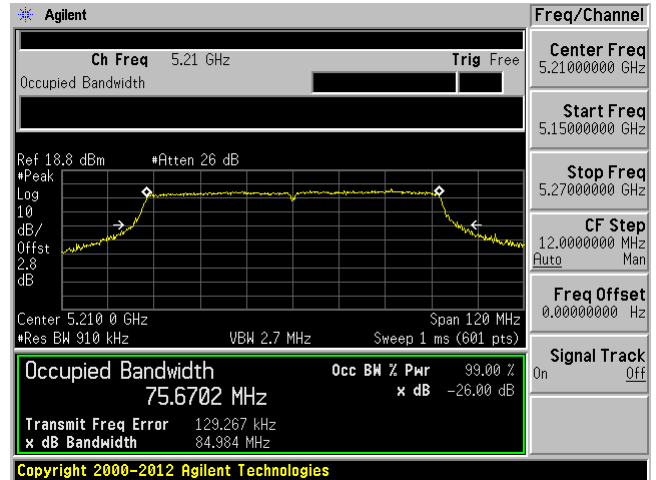
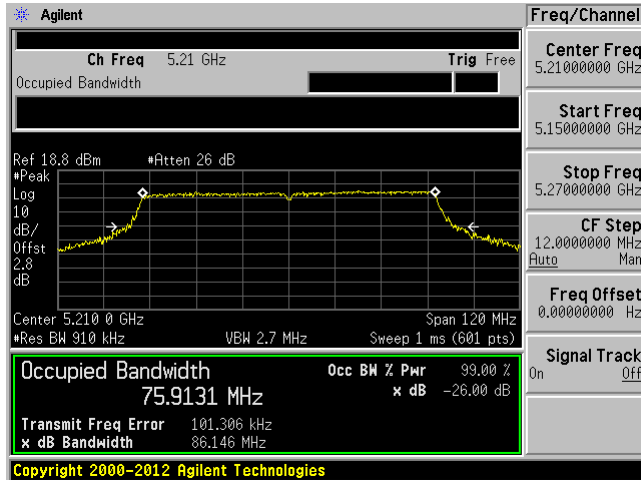
High channel: 5230 MHz Chain 1



802.11ac-VHT80 mode 5775 MHz

Chain 0

Chain 1



9 FCC §407(a) – Output Power

9.3 Applicable Standards

According to FCC §15.407(a)

(1) (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 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 maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

9.4 Measurement Procedure

Test measurements are base on FCC KDB 789033 D02 General UNII Test Procedures New Rules v01, GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL INFORAMTION INFRASTRUCTURE (U-NII) DEVICES PART 15, SUBPART E

9.5 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|--------------|-------------------|-----------|------------|------------------|----------------------|
| Agilent | Spectrum Analyzer | E4440A | MY44303352 | 2013-11-07 | 1 year |

Statement of Traceability: BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

9.6 Test Environmental Conditions

| | |
|---------------------------|-----------------|
| Temperature: | 22-24 °C |
| Relative Humidity: | 40-41 % |
| ATM Pressure: | 103.1-104.1 kPa |

The testing was performed by Rui Zhou from 2014-10-15 at RF site.

9.7 Test Results**W52 Band**

| Channel | Frequency (MHz) | Conducted Output Power (dBm) | | Total Output Power (dBm) | Limit (dBm) | Result | Power Setting |
|---------------------|-----------------|------------------------------|----------|--------------------------|-------------|--------|---------------|
| | | Chain J0 | Chain J1 | | | | |
| 802.11a mode | | | | | | | |
| Low | 5180 | 19.01 | 19.08 | 22.06 | 30 | Pass | 18 |
| Middle | 5200 | 16.7 | 17.41 | 20.08 | 30 | Pass | 16 |
| High | 5240 | 15.22 | 15.53 | 18.39 | 30 | Pass | 14.5 |
| 802.11n-HT20 mode | | | | | | | |
| Low | 5180 | 18.97 | 19.13 | 22.06 | 30 | Pass | 18 |
| Middle | 5200 | 16.73 | 17.37 | 20.07 | 30 | Pass | 16 |
| High | 5240 | 15.12 | 15.53 | 18.34 | 30 | Pass | 14.5 |
| 802.11n-HT40 mode | | | | | | | |
| Low | 5190 | 15.18 | 15.39 | 18.30 | 30 | Pass | 15 |
| High | 5230 | 17.45 | 17.57 | 20.52 | 30 | Pass | 17 |
| 802.11ac-VHT80 mode | | | | | | | |
| - | 5210 | 13.59 | 13.66 | 16.64 | 30 | Pass | 13.5 |

10 FCC §15.407(b) - Out of Band Emissions

10.3 Applicable Standard

According to FCC §15.407(b)

(b)(1)Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits: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 e.i.r.p. of -27 dBm/MHz. For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

10.4 Measurement Procedure

The measurements are base on FCC KDB 789033 D02 General UNII Test Procedures New Rules v01: GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL INFORAMTION INFRASTRUCTURE (U-NII) DEVICES PART 15, SUBPART E

10.5 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|--------------|-------------------|-----------|------------|------------------|----------------------|
| Agilent | Spectrum Analyzer | E4440A | MY44303352 | 2013-11-07 | 1 year |

Statement of Traceability: BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

10.6 Test Environmental Conditions

| | |
|---------------------------|-------------|
| Temperature: | 21 °C |
| Relative Humidity: | 43 % |
| ATM Pressure: | 101-102 kPa |

The testing was performed by Rui Zhou from 2014-10-15 at RF site.

10.7 Test Results

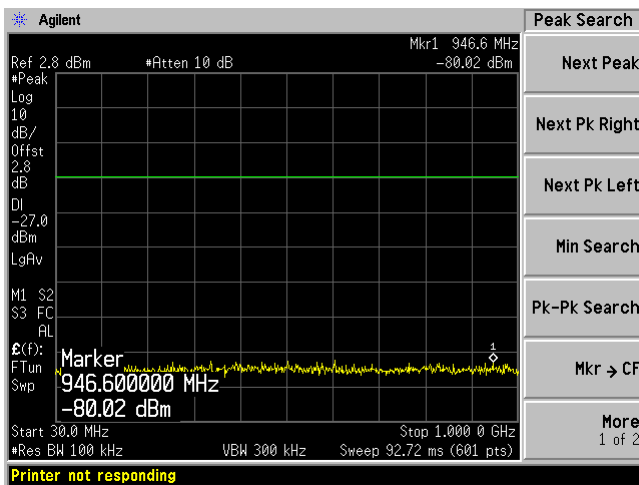
Please refer to the following plots.

Note: the offset include the attenuation, cable loss and the margin between limit line and the emission covers antenna gain and other requirements in the KDB 789033.

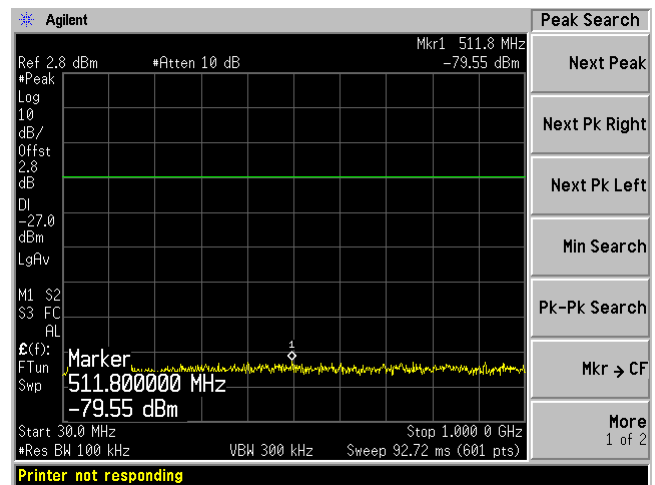
(1)Conducted Spurious Emission from 30 MHz - 40 GHz, 5.2 GHz Band

802.11a, Low Channel, 5180 MHz

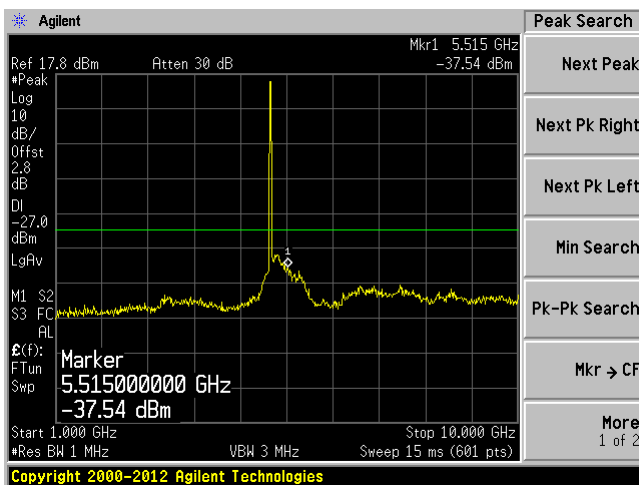
Chain 0, Plot: 30 MHz – 1 GHz



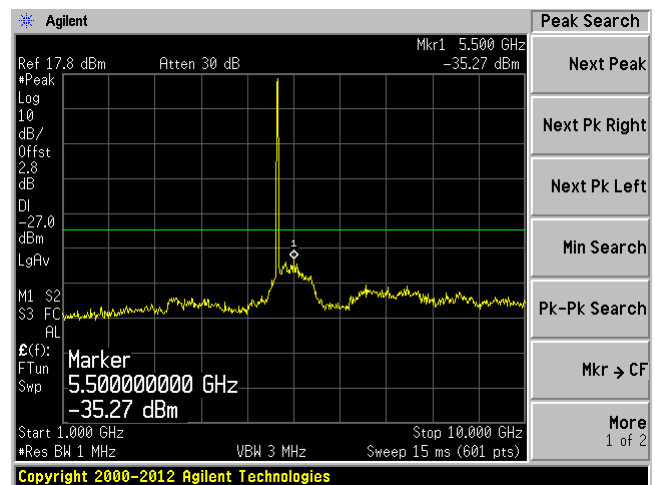
Chain 1, Plot: 30 MHz – 1 GHz



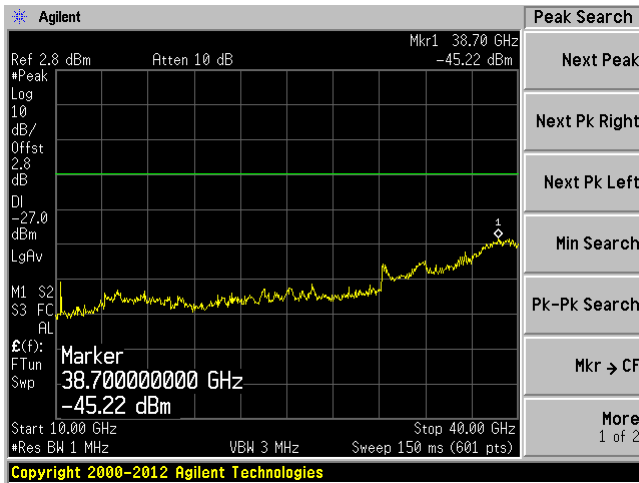
Chain 0, Plot: 1 GHz –26 GHz



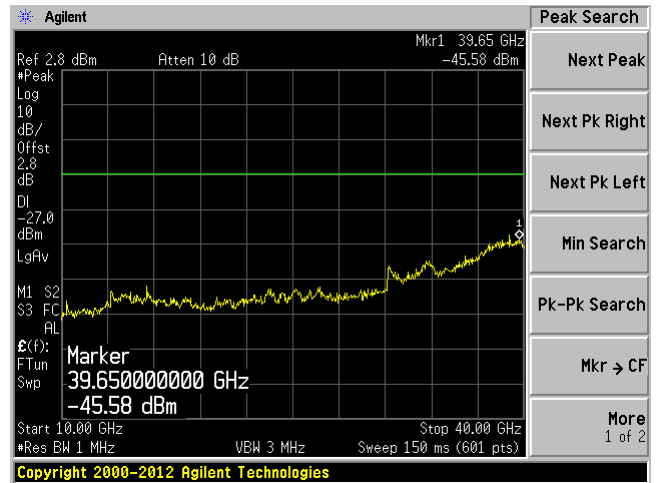
Chain 1, Plot: 1 GHz – 26 GHz



Chain 0, Plot: 26 GHz – 40 GHz

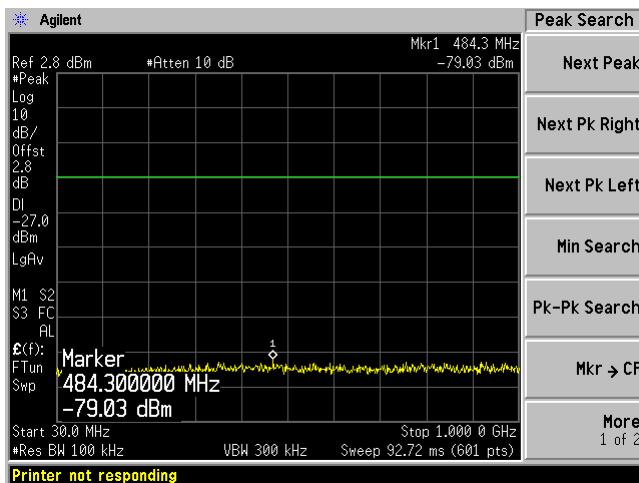


Chain 1, Plot: 26 GHz – 40 GHz

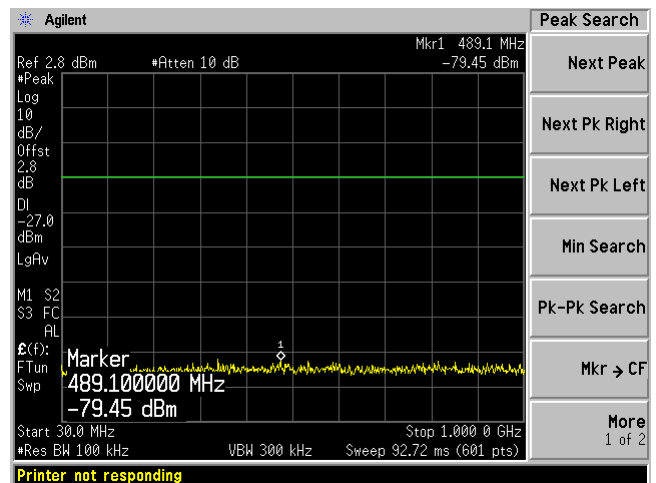


802.11a, Middle Channel, 5200 MHz

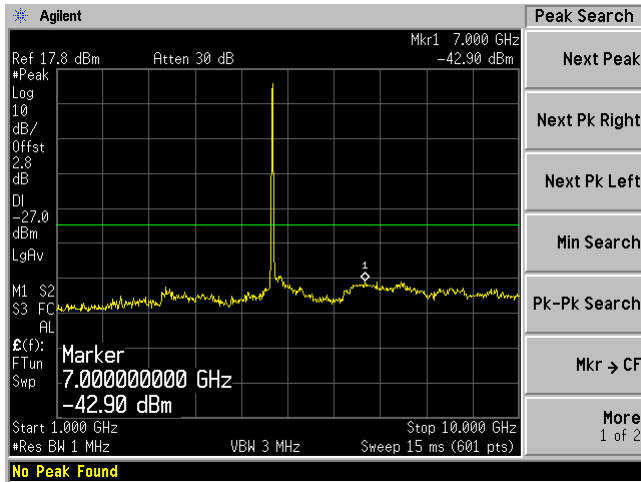
Chain 0, Plot: 30 MHz – 1 GHz



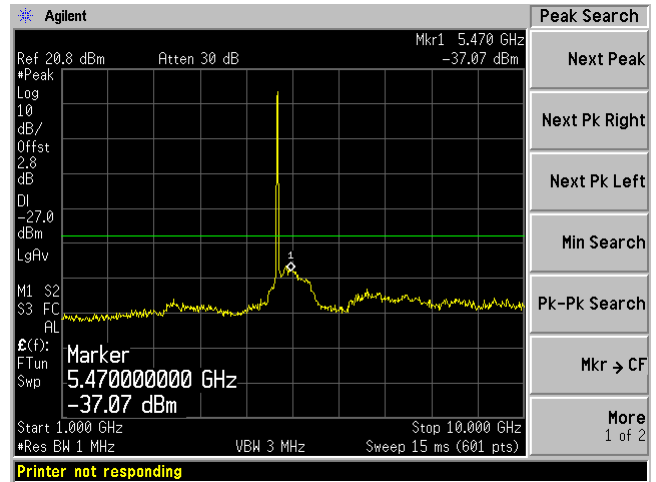
Chain 1, Plot: 30 MHz – 1 GHz



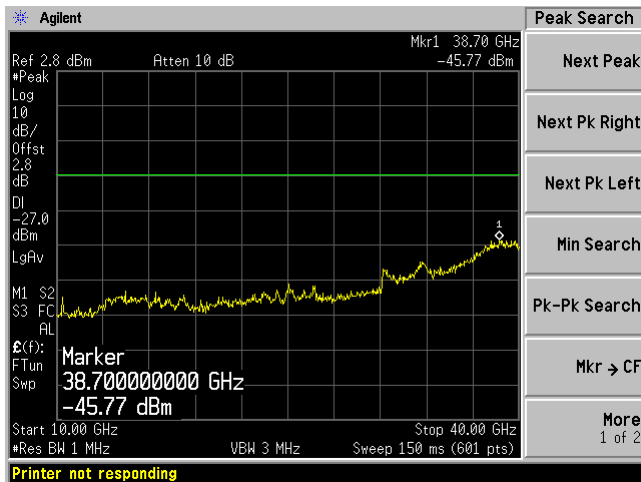
Chain 0, Plot: 1 GHz –26 GHz



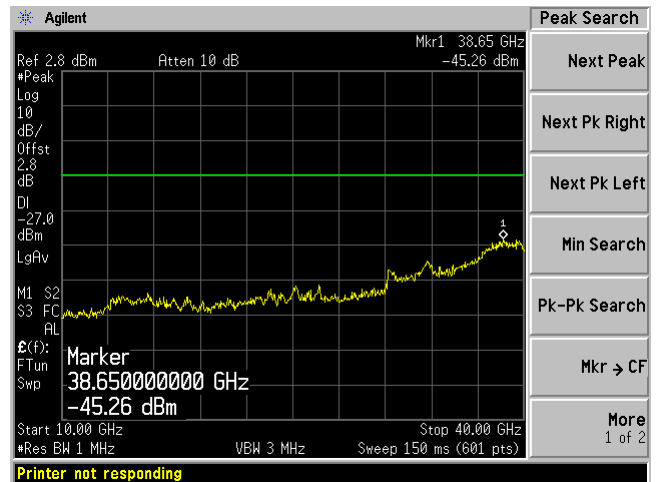
Chain 1, Plot: 1 GHz – 26 GHz



Chain 0, Plot: 26 GHz –40 GHz

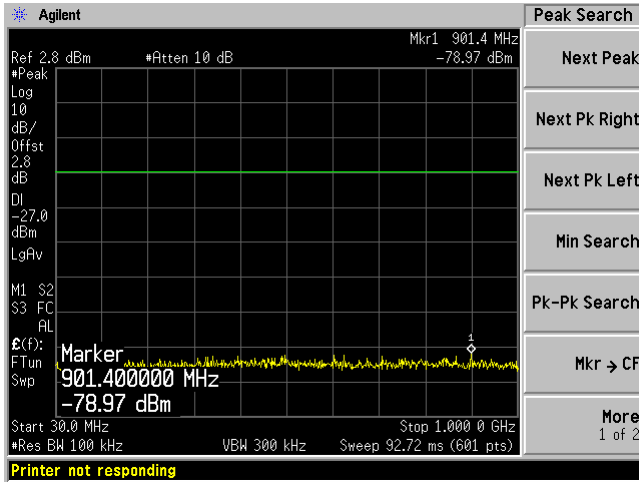


Chain 1, Plot: 26 GHz – 40 GHz

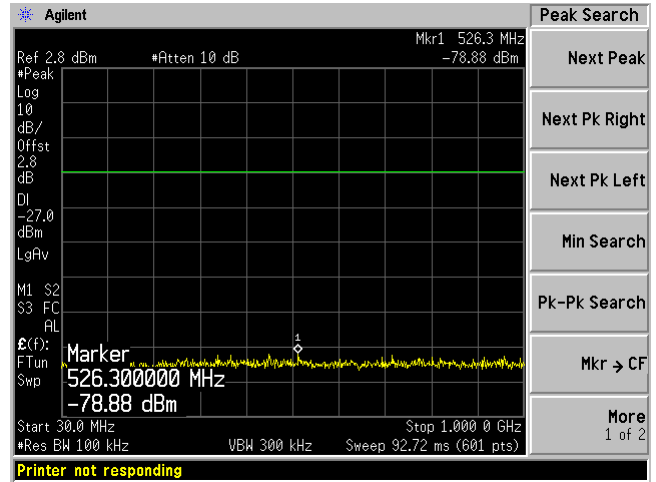


802.11a, High Channel, 5240 MHz

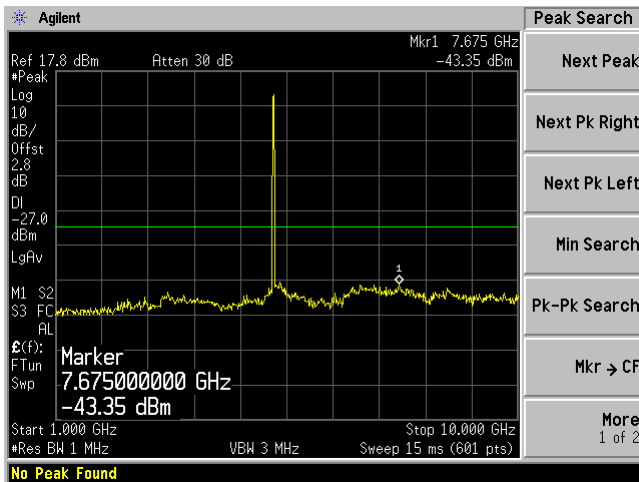
Chain 0, Plot: 30 MHz – 1 GHz



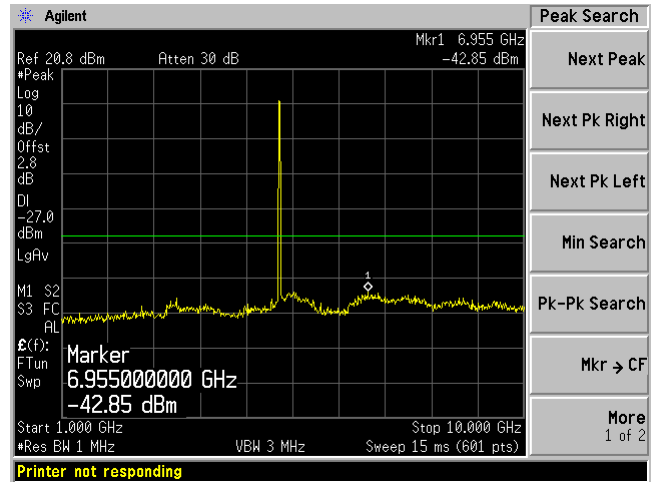
Chain 1, Plot: 30 MHz – 1 GHz



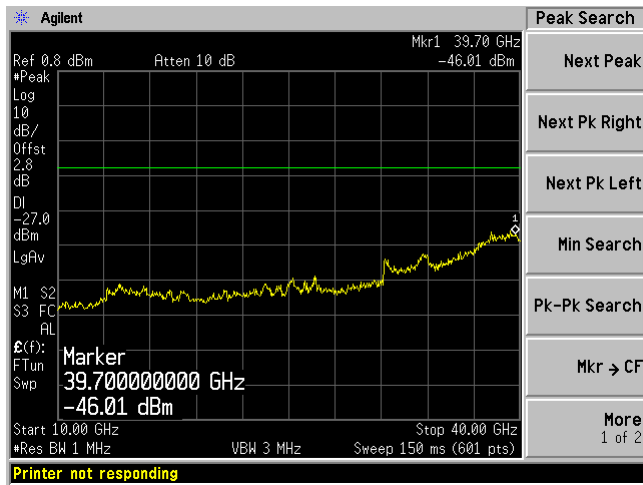
Chain 0, Plot: 1 GHz – 26 GHz



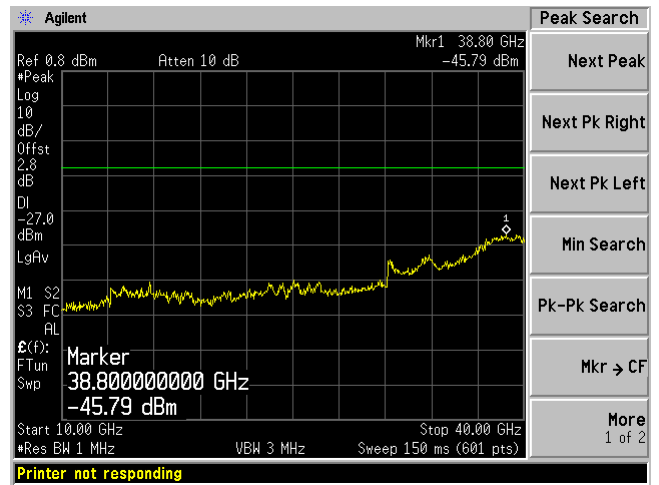
Chain 1, Plot: 1 GHz – 26 GHz



Chain 0, Plot: 26 GHz –40 GHz

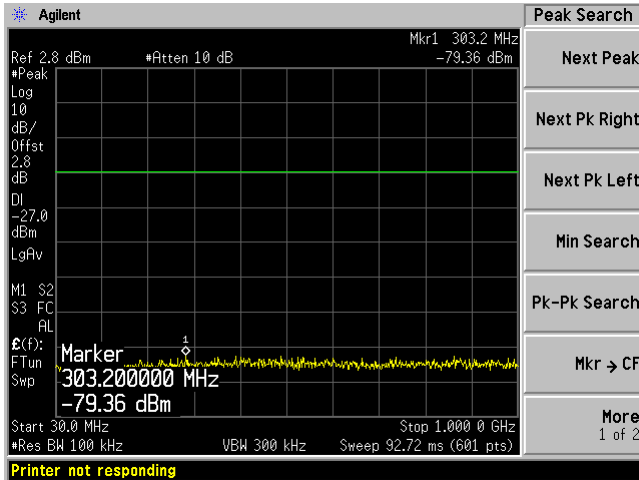


Chain 1, Plot: 26 GHz – 40 GHz

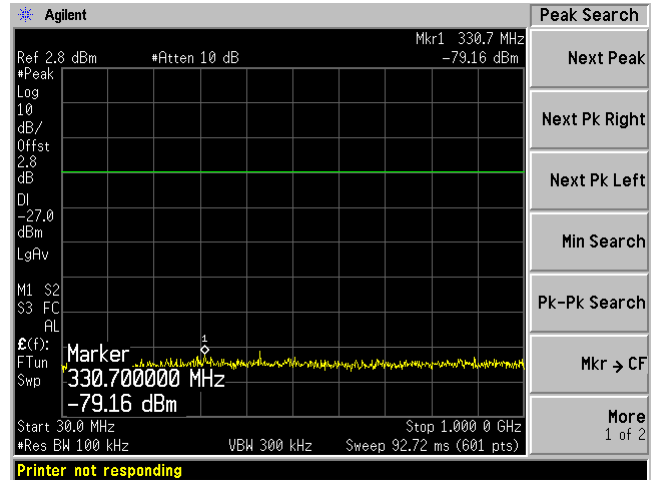


802.11n-HT20, Low Channel 5180 MHz

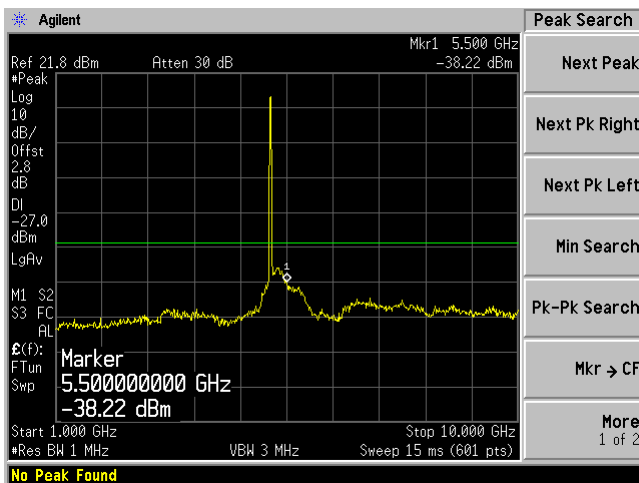
Chain 0, Plot: 30 MHz – 1 GHz



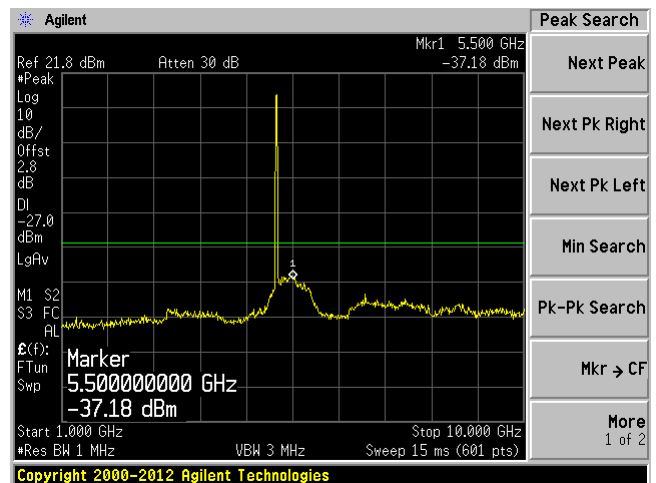
Chain 1, Plot: 30 MHz – 1 GHz



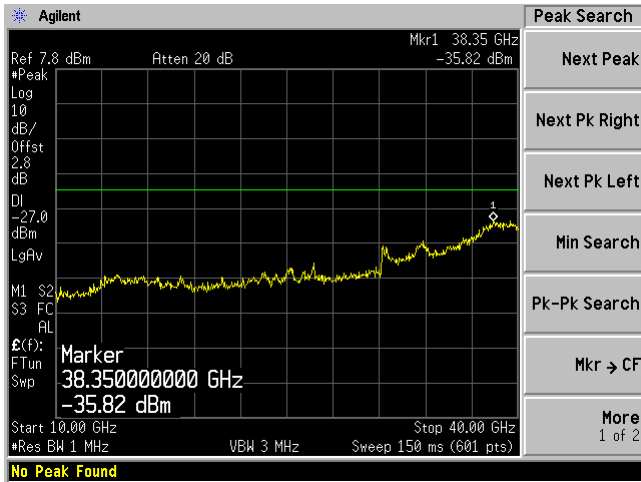
Chain 0, Plot: 1 GHz – 26 GHz



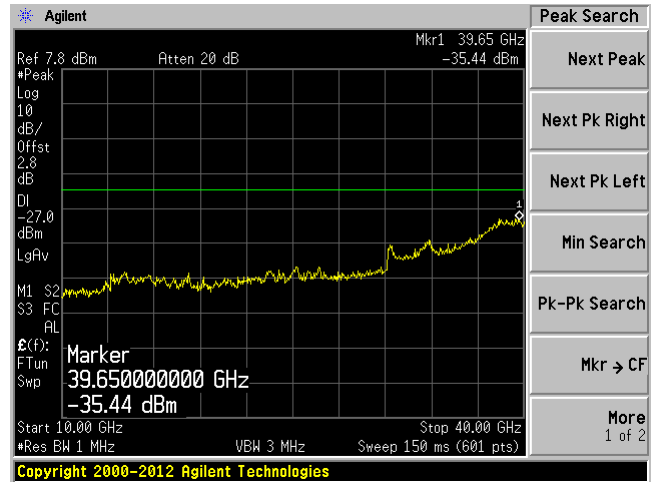
Chain 1, Plot: 1 GHz – 26 GHz



Chain 0, Plot: 26 GHz – 40 GHz

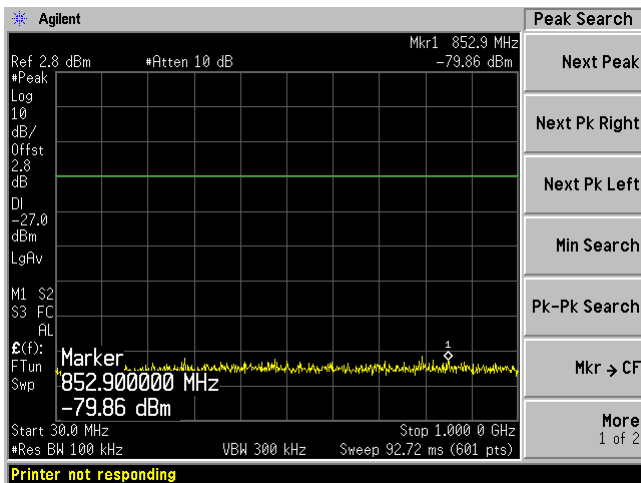


Chain 1, Plot: 26 GHz – 40 GHz

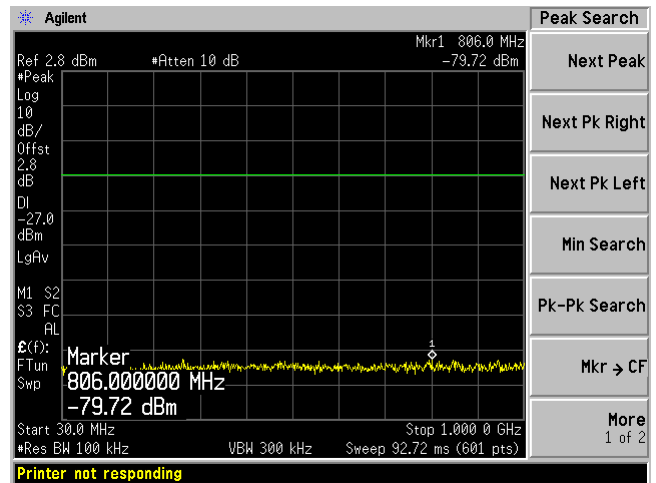


802.11n-HT20, Middle Channel 5200 MHz

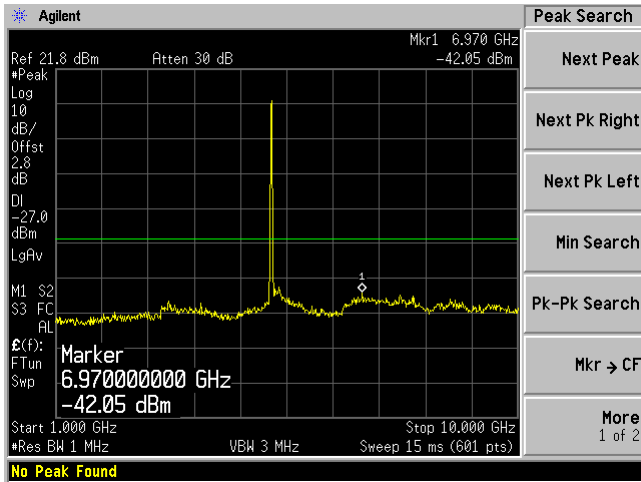
Chain 0, Plot: 30 MHz – 1 GHz



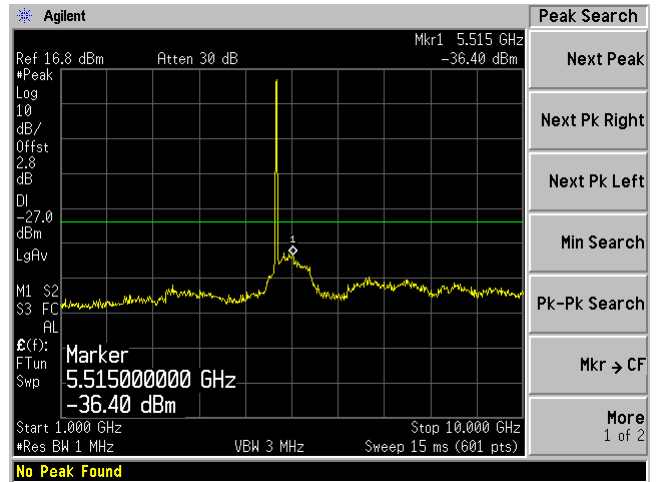
Chain 1, Plot: 30 MHz – 1 GHz



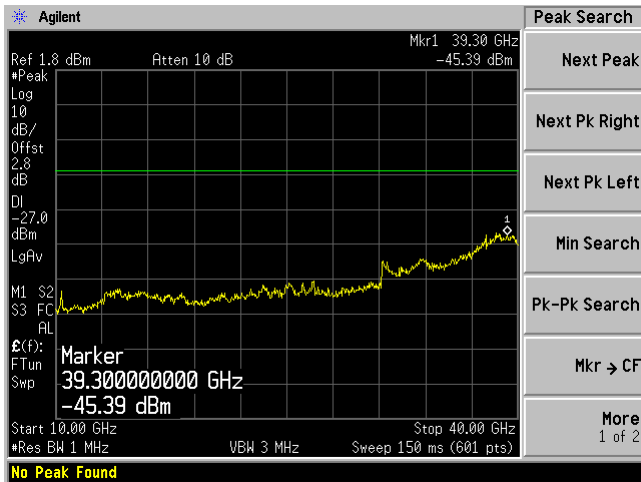
Chain 0, Plot: 1 GHz –26 GHz



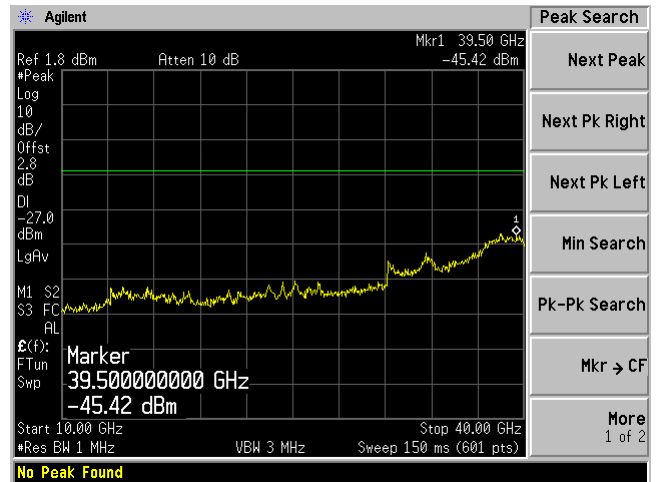
Chain 1, Plot: 1 GHz – 26 GHz



Chain 0, Plot: 26 GHz –40 GHz

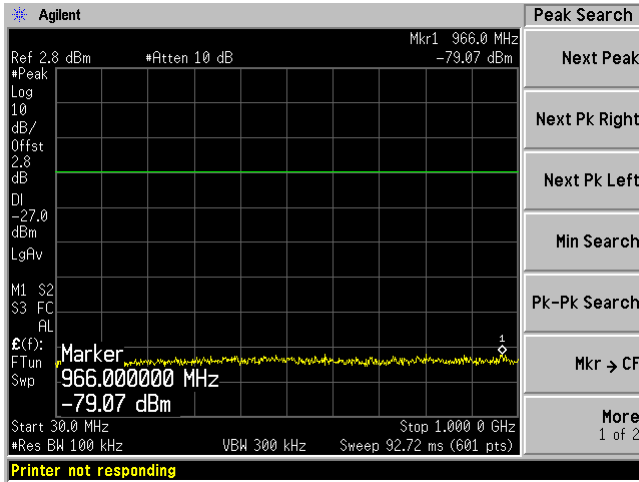


Chain 1, Plot: 26 GHz – 40 GHz

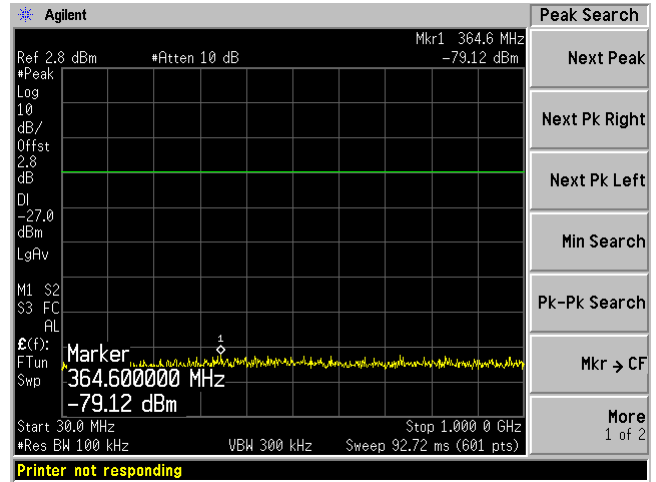


802.11n-HT20, High Channel 5240 MHz

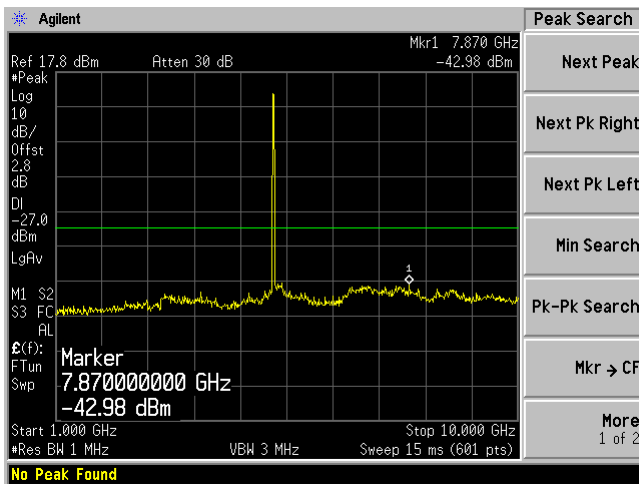
Chain 0, Plot: 30 MHz – 1 GHz



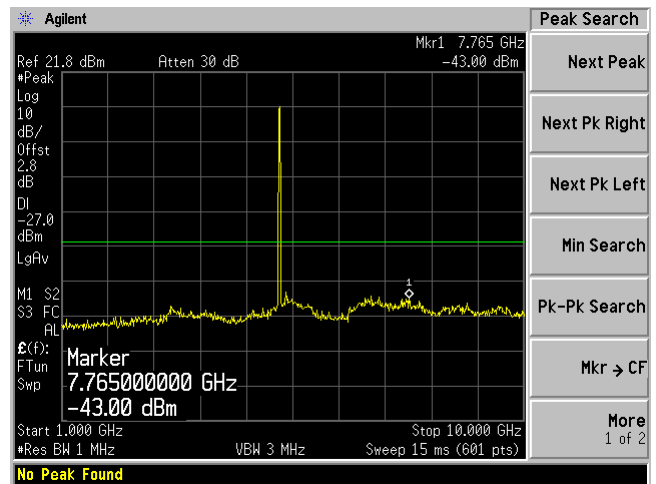
Chain 1, Plot: 30 MHz – 1 GHz



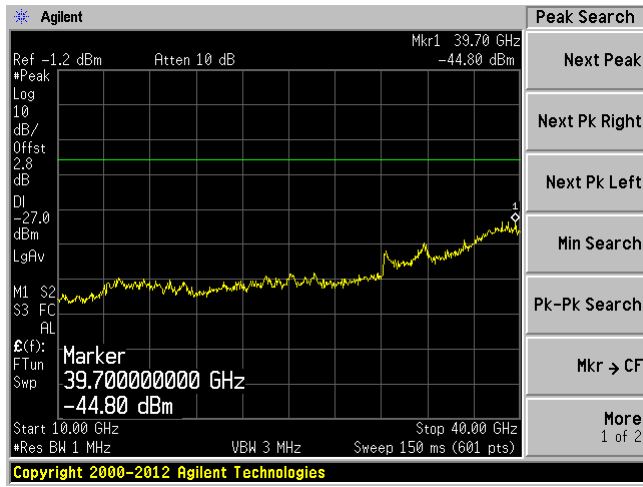
Chain 0, Plot: 1 GHz – 26 GHz



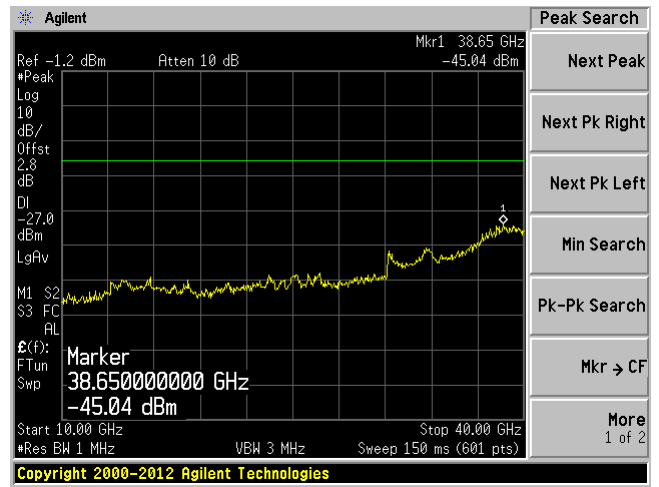
Chain 1, Plot: 1 GHz – 26 GHz



Chain 0, Plot: 26 GHz –40 GHz

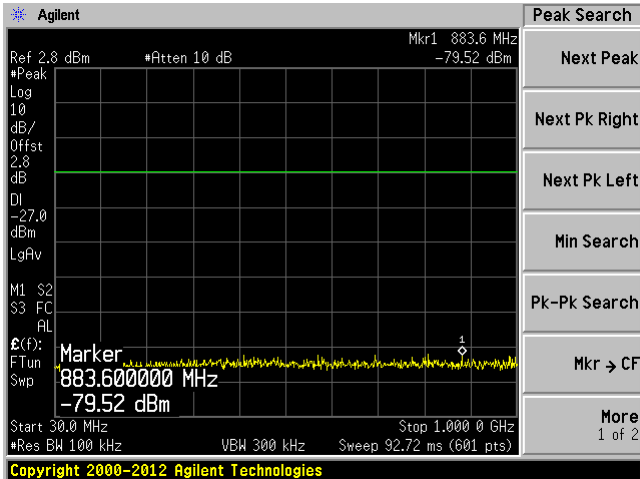


Chain 1, Plot: 26 GHz – 40 GHz

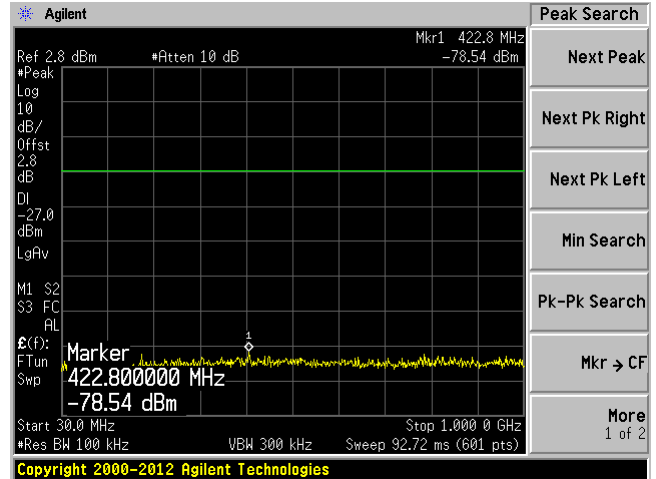


802.11n-HT40, Low Channel 5190 MHz

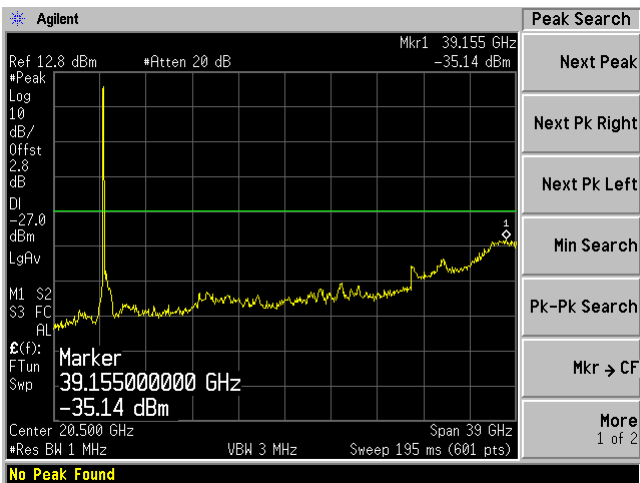
Chain 0, Plot: 30 MHz – 1 GHz



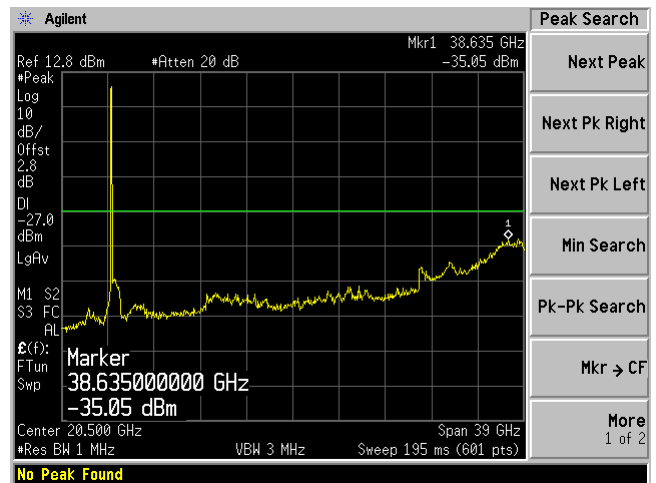
Chain 1, Plot: 30 MHz – 1 GHz



Chain 0, Plot: 1 GHz – 40 GHz

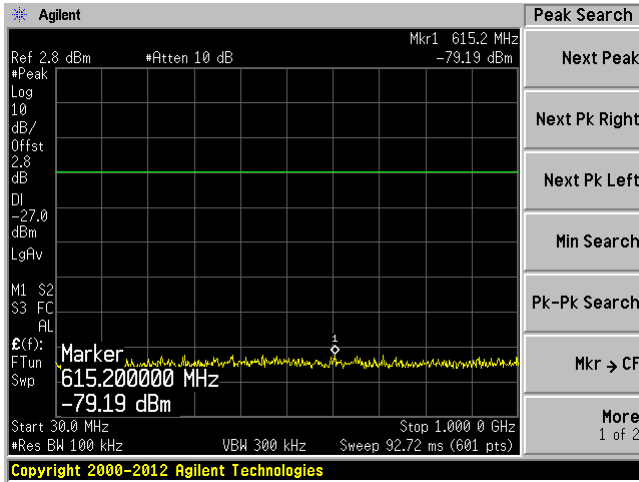


Chain 1, Plot: 1 GHz – 40 GHz

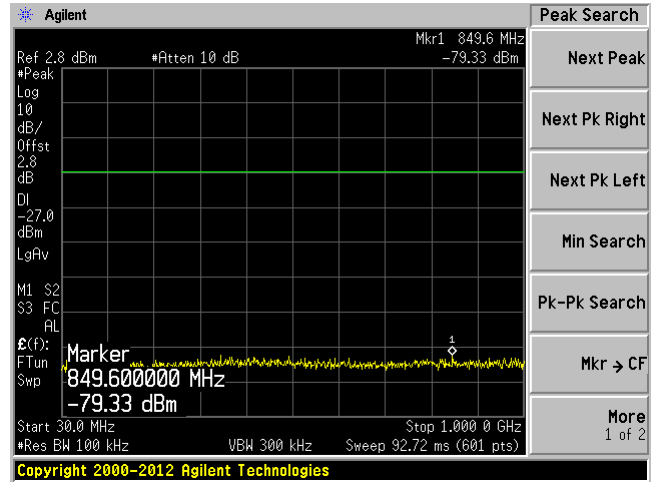


802.11n-HT40, High Channel 5230 MHz

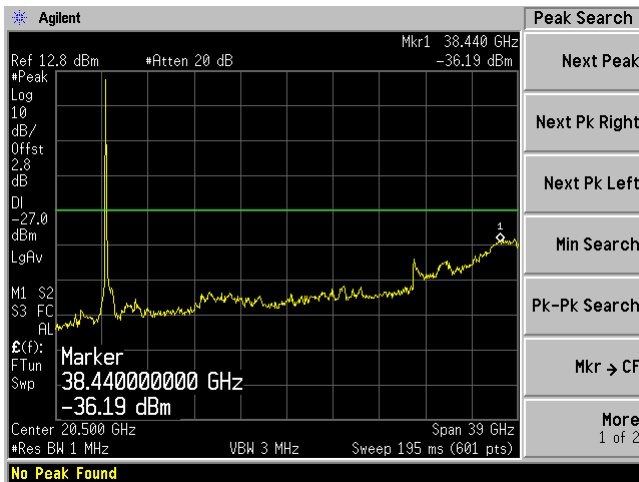
Chain 0, Plot: 30 MHz – 1 GHz



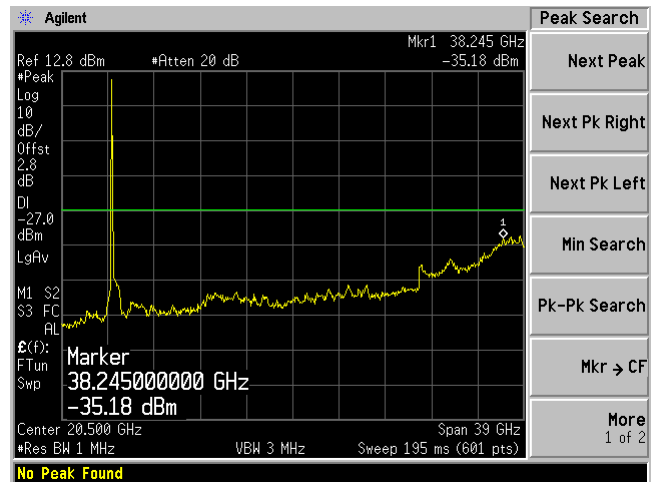
Chain 1, Plot: 30 MHz – 1 GHz



Chain 0, Plot: 1 GHz – 40 GHz

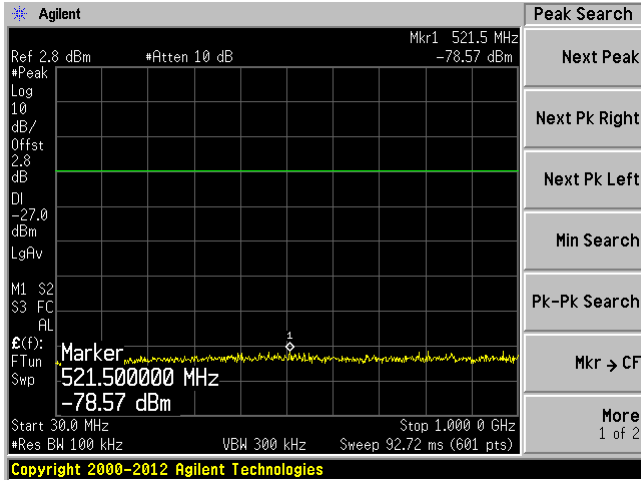


Chain 1, Plot: 1 GHz – 40 GHz

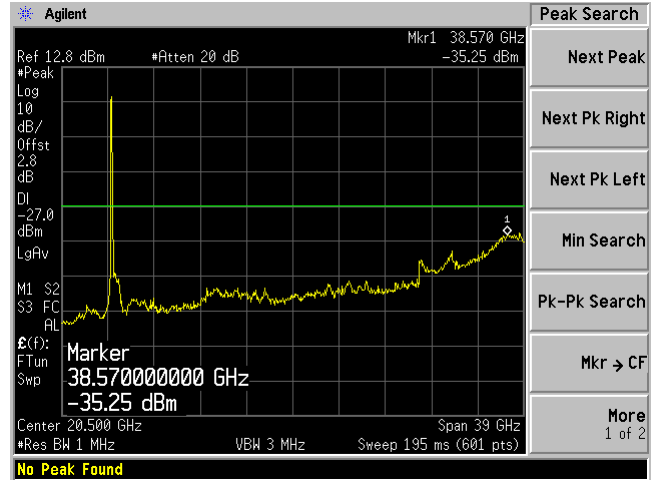


802.11ac- VHT80, 5210 MHz

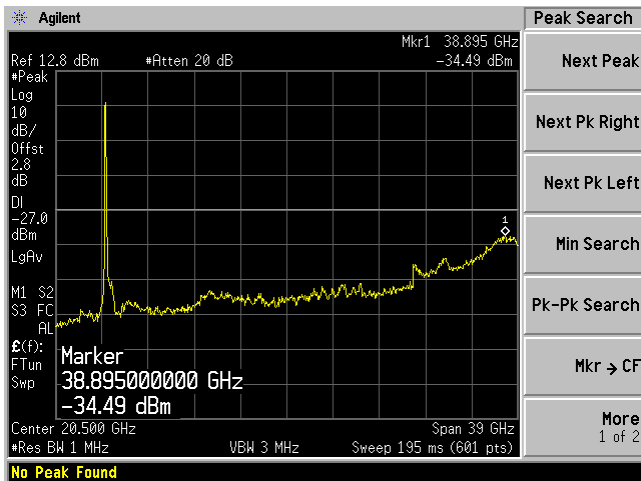
Chain 0, Plot: 30 MHz – 1 GHz



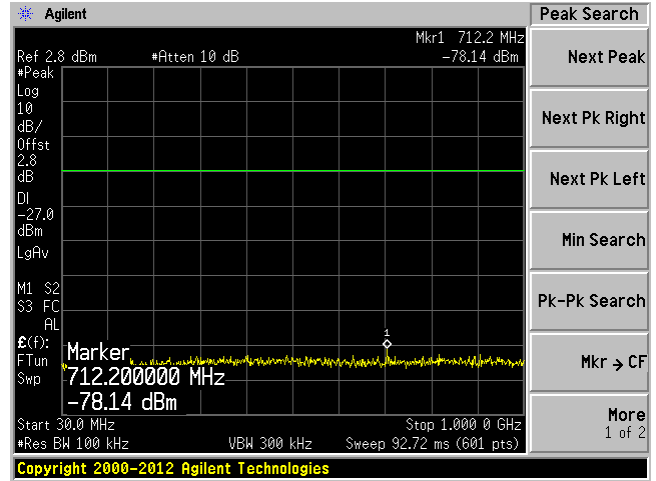
Chain 1, Plot: 30 MHz – 1 GHz



Chain 0, Plot: 1 GHz – 40 GHz



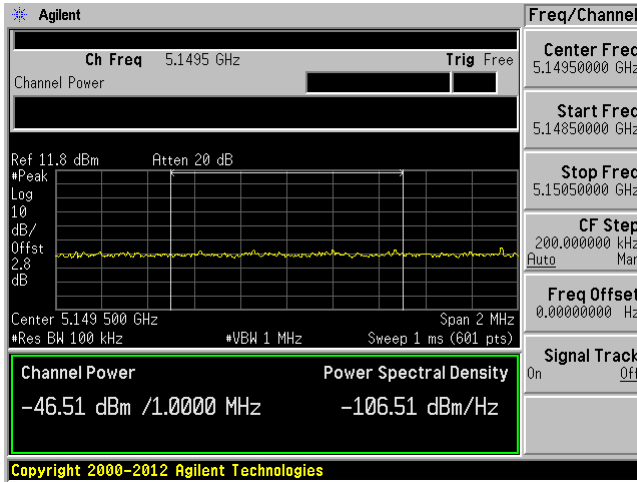
Chain 1, Plot: 1 GHz – 40 GHz



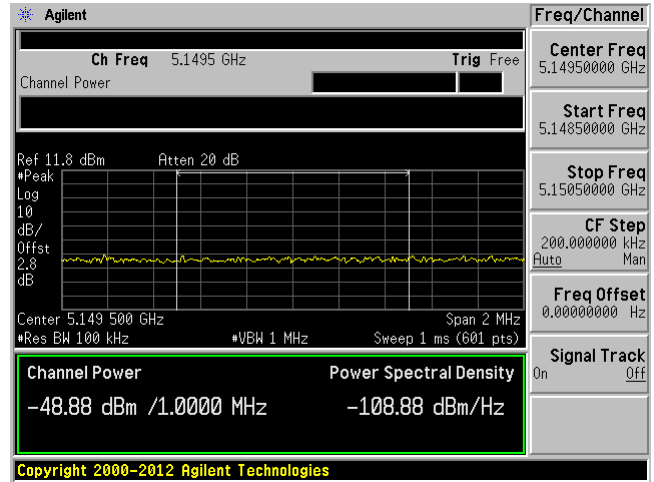
(2) W52 Band, Band Edge Measurement:

802.11a mode

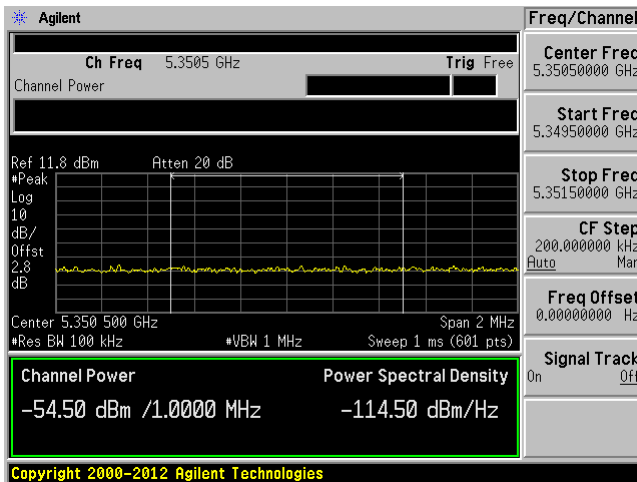
Low channel: 5180 MHz Chain 0



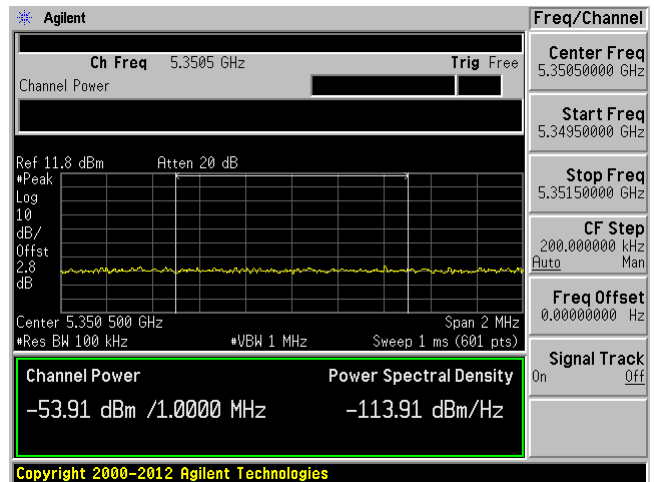
Low channel: 5180 MHz Chain 1



High channel: 5240 MHz Chain 0

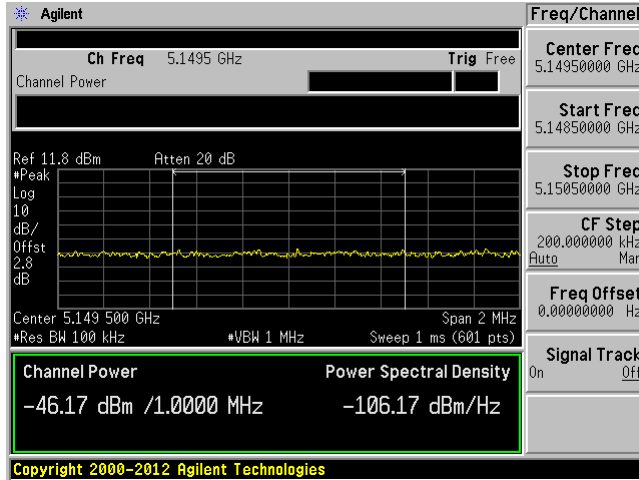


High channel: 5240 MHz Chain 1

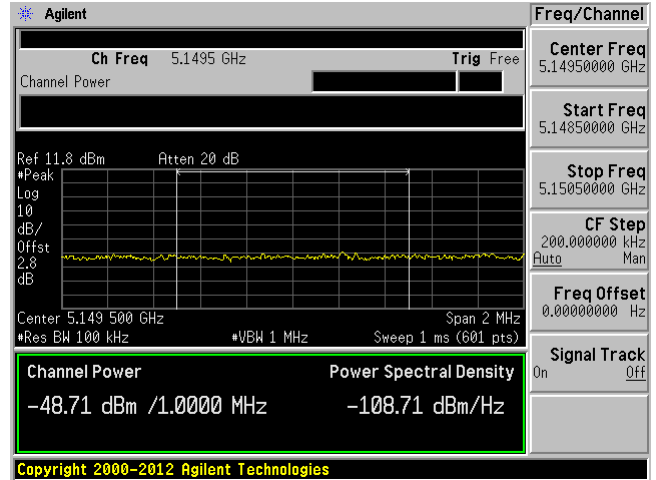


802.11n-HT20 mode

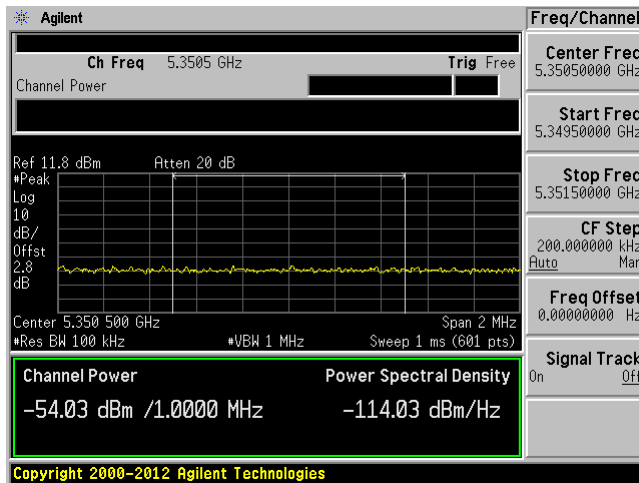
Low channel: 5180 MHz Chain 0



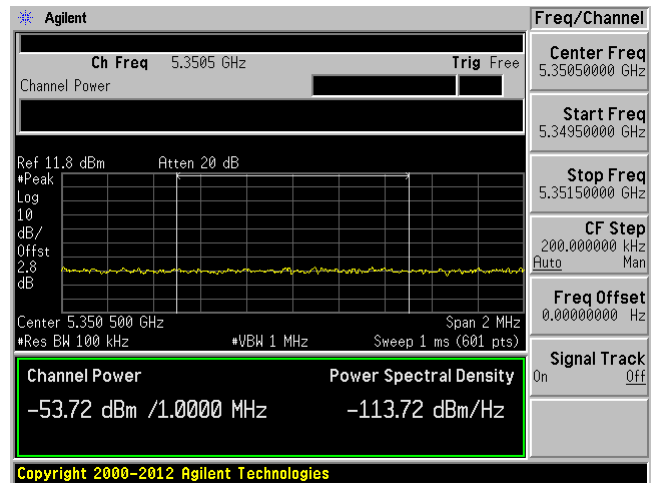
Low channel: 5180 MHz Chain 1



High channel: 5240 MHz Chain 0

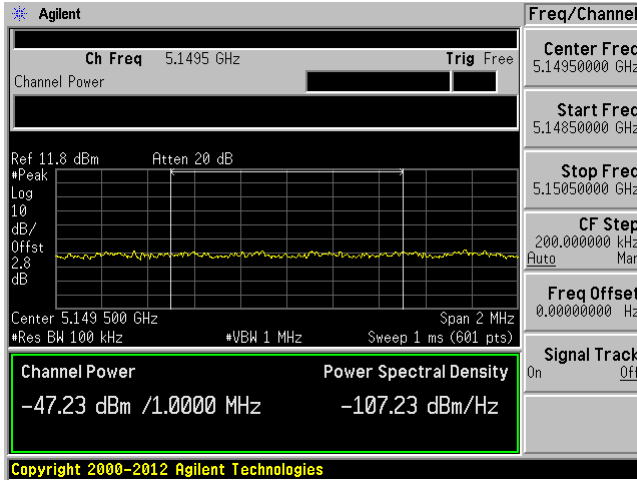


High channel: 5240 MHz Chain 1

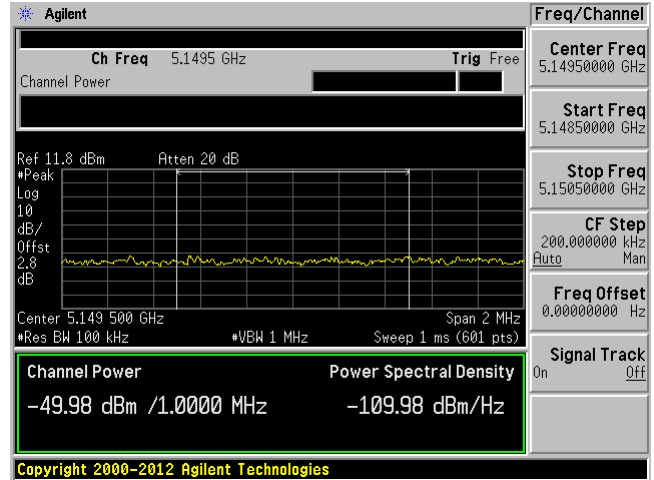


802.11n-HT40 mode

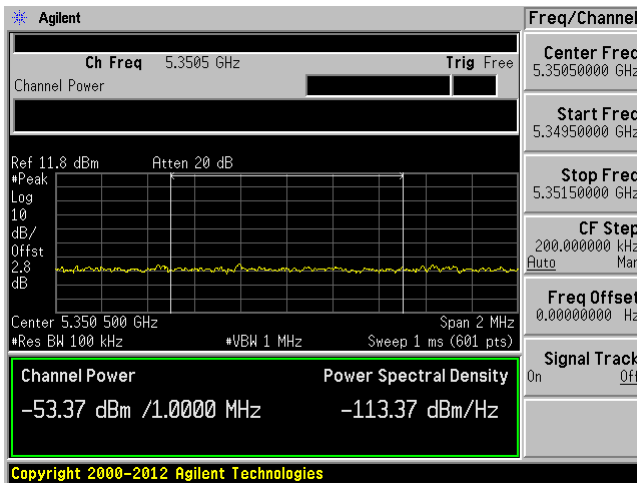
Low channel: 5190 MHz Chain 0



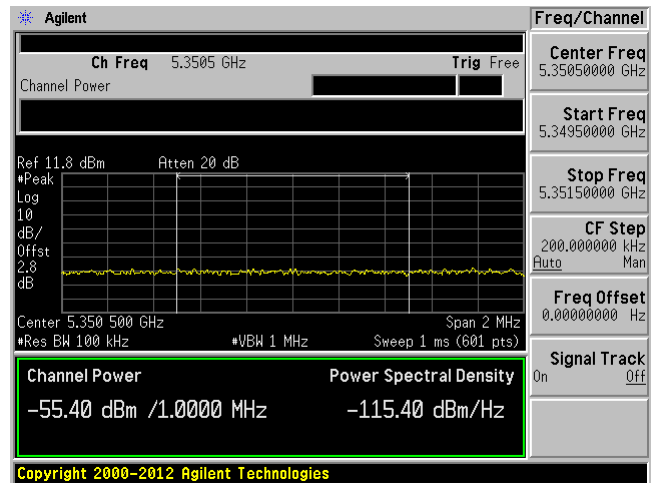
Low channel: 5190 MHz Chain 1



High channel: 5230 MHz Chain 0

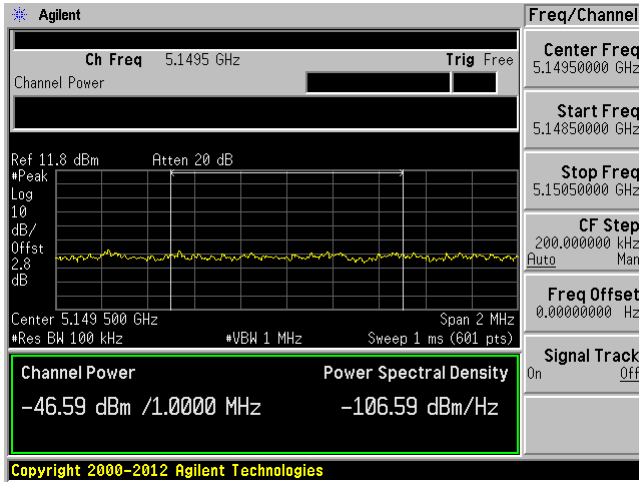


High channel: 5230 MHz Chain 1

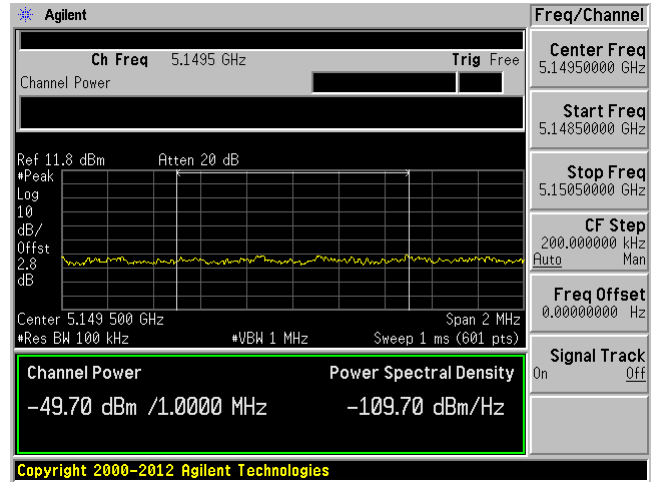


802.11ac-VHT80 mode 5210 MHz

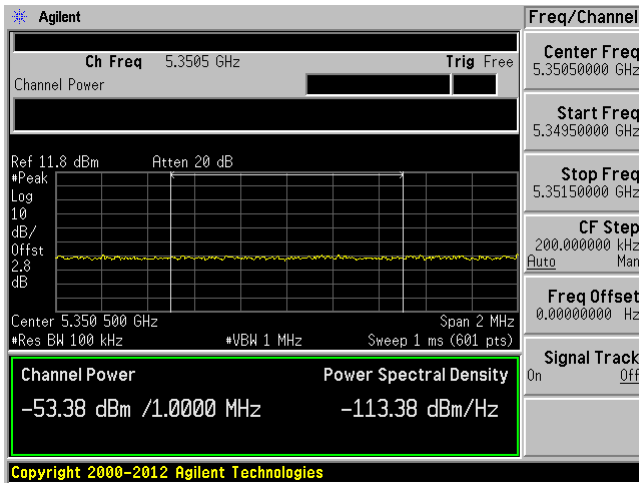
Low Edge Chain 0



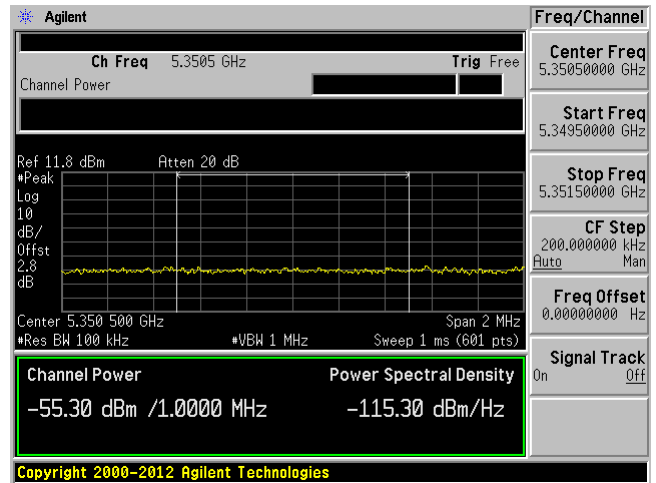
Low Edge Chain 1



High Edge Chain 0



High Edge Chain 1



11 FCC §15.407(a) - Power Spectral Density

11.3 Applicable Standards

According to FCC §15.407(a)

(1)(i) 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 $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. In addition, 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, 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.

11.4 Measurement Procedure

The measurements are based on FCC KDB 789033 D01 General UNII Test Procedures v01r03: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices section F:

Peak power spectral density (PPSD)

11.5 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|--------------|-------------------|-----------|------------|------------------|----------------------|
| Agilent | Spectrum Analyzer | E4440A | MY44303352 | 2013-11-07 | 1 year |

Statement of Traceability: BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

11.6 Test Environmental Conditions

| | |
|---------------------------|-----------------|
| Temperature: | 22-24 °C |
| Relative Humidity: | 40-41 % |
| ATM Pressure: | 103.1-104.1 kPa |

The testing was performed by Rui Zhou from 2014-10-15 at RF site.

Note: The PSA's RBW=100 kHz and a $10 \cdot \log(5)$ factor is added to compare the limit as 30dBm/500kHz for W58 Band.

11.7 Test Results

Please refer to the following tables and plots.

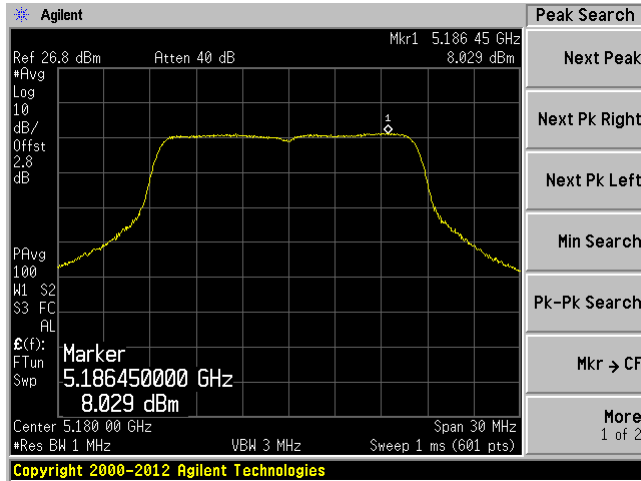
5.2 GHz Band

| Channel | Frequency (MHz) | TX Chain J0 Power (dBm) | TX Chain J1 Power (dBm) | Total PSD (dBm) | Limit (dBm) |
|---------------------|-----------------|-------------------------|-------------------------|-----------------|-------------|
| 802.11a mode | | | | | |
| Low | 5180 | 8.029 | 8.041 | 11.05 | 17 |
| Middle | 5200 | 5.784 | 6.223 | 9.02 | 17 |
| High | 5240 | 4.19 | 4.439 | 7.33 | 17 |
| 802.11n-HT20 mode | | | | | |
| Low | 5180 | 7.172 | 7.682 | 10.44 | 17 |
| Middle | 5200 | 5.446 | 5.637 | 8.55 | 17 |
| High | 5240 | 3.583 | 4.348 | 6.99 | 17 |
| 802.11n-HT40 mode | | | | | |
| Low | 5190 | 0.996 | 1.174 | 4.10 | 17 |
| High | 5230 | 3.129 | 3.25 | 6.20 | 17 |
| 802.11ac-VHT80 mode | | | | | |
| - | 5210 | -3.536 | -3.738 | -0.63 | 17 |

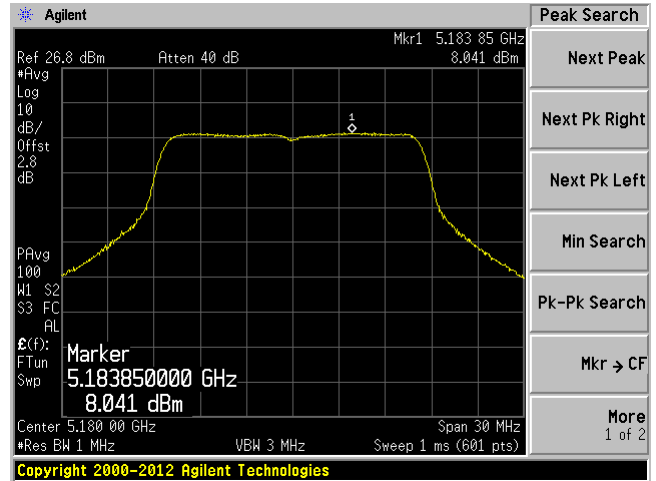
5.2 GHz Band

802.11a mode

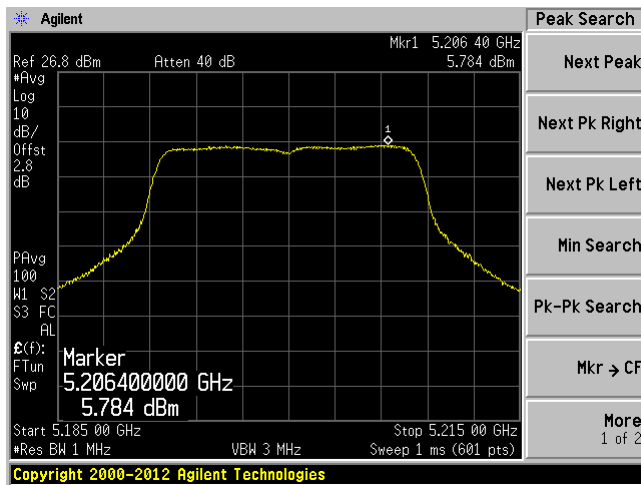
Low channel: 5180 MHz Chain 0



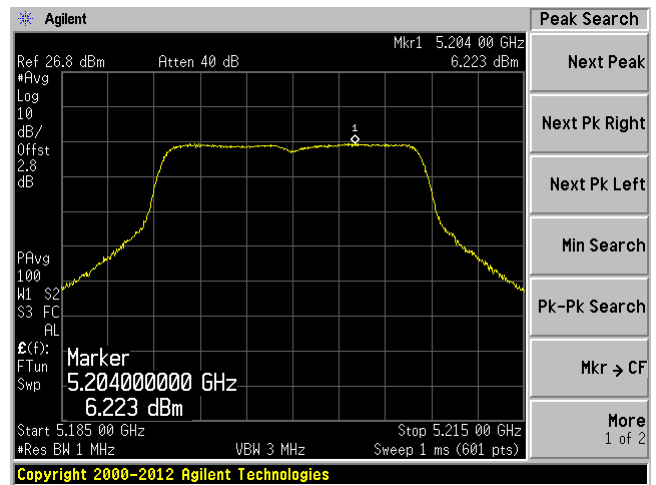
Low channel: 5180 MHz Chain 1



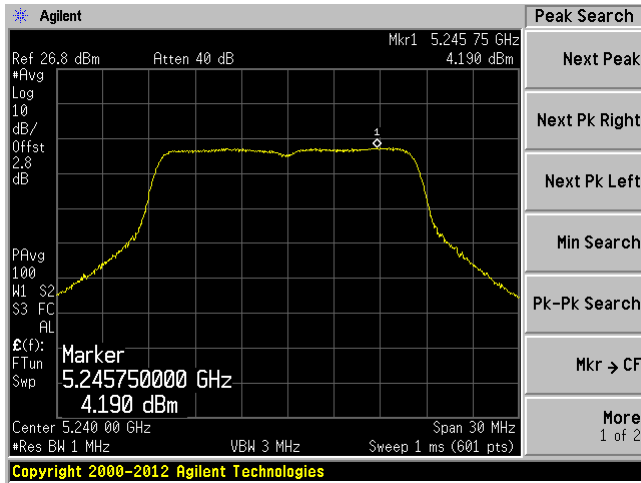
Middle channel: 5200 MHz Chain 0



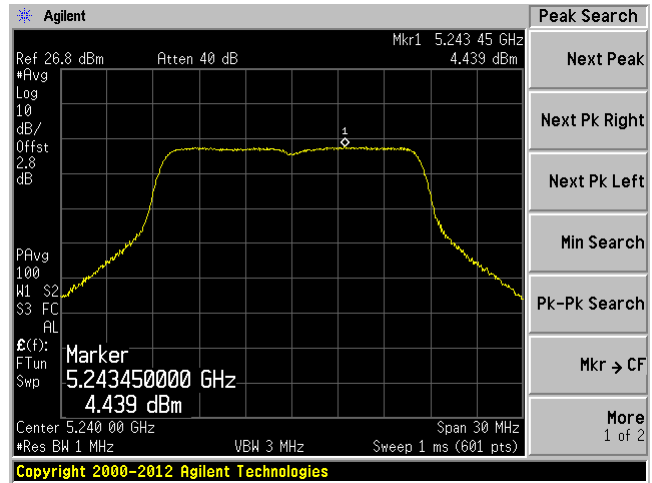
Middle channel: 5200 MHz Chain 1



High channel: 5240 MHz Chain 0

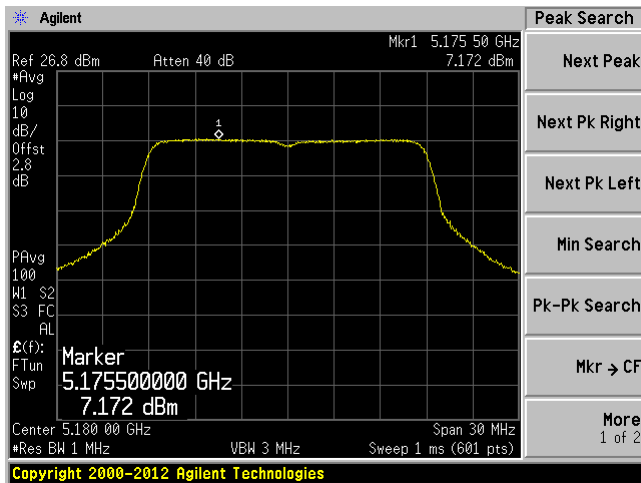


High channel: 5240 MHz Chain 1

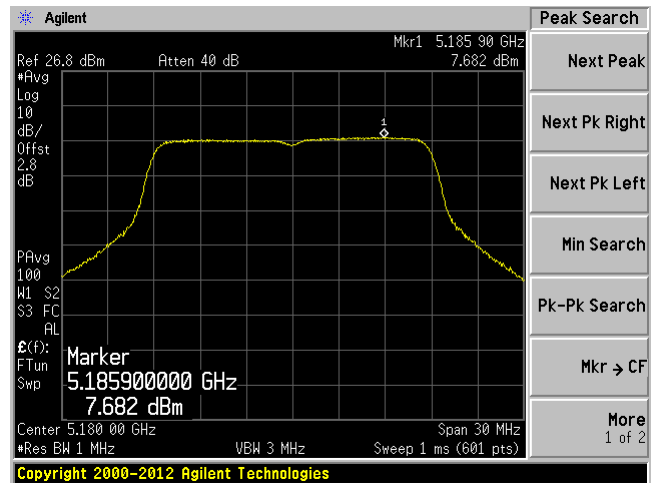


802.11n-HT20 mode

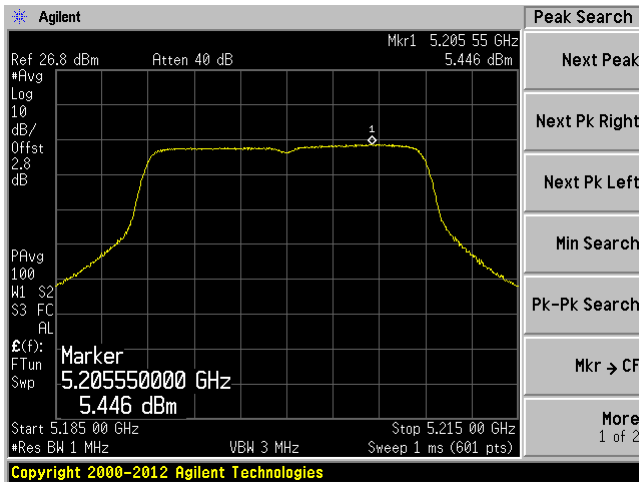
Low channel: 5180 MHz Chain 0



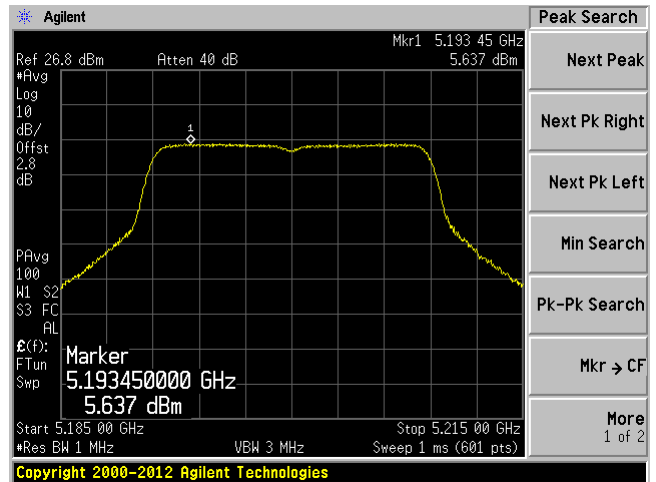
Low channel: 5180 MHz Chain 1



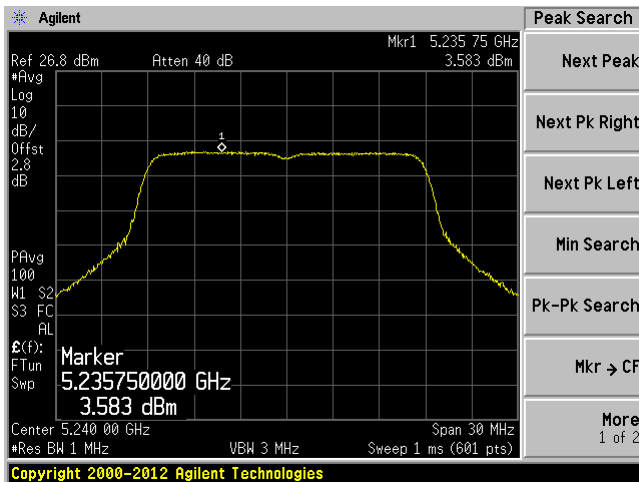
Middle channel: 5200 MHz Chain 0



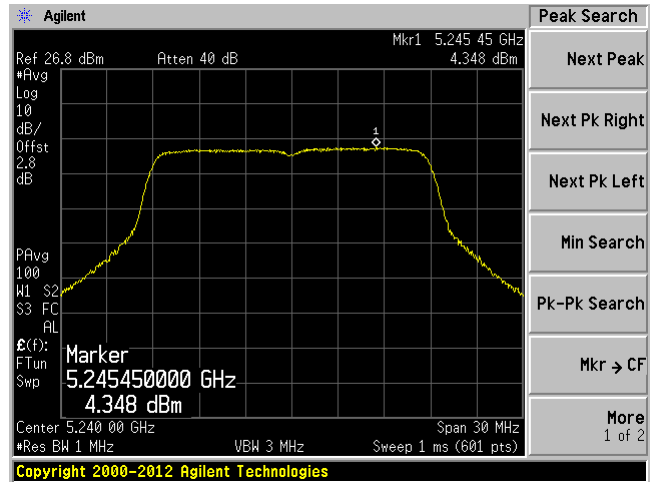
Middle channel: 5200 MHz Chain 1



High channel: 5240 MHz Chain 0

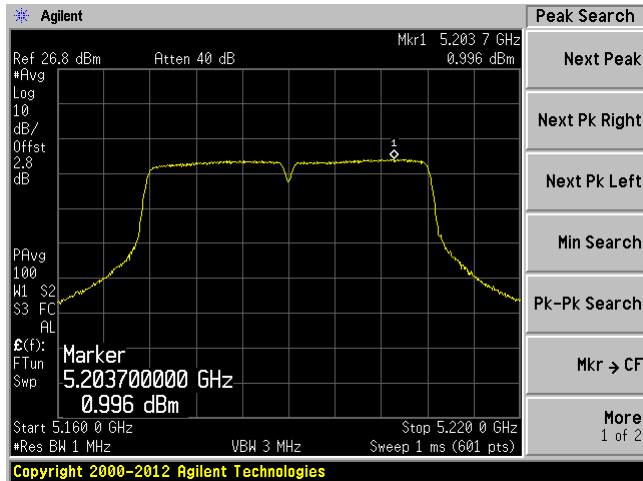


High channel: 5240 MHz Chain 1

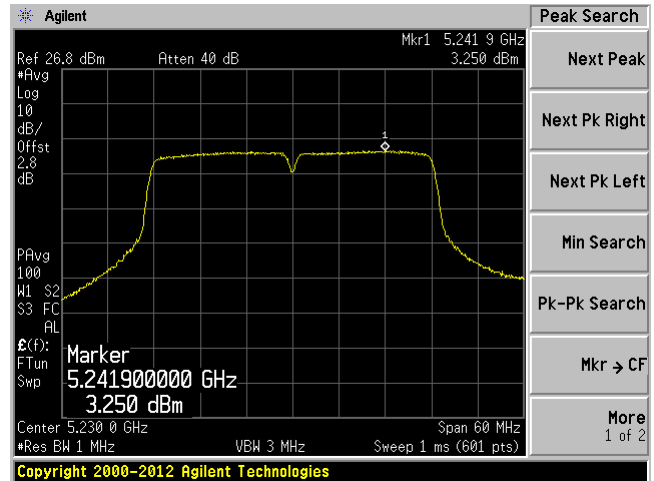


802.11n-HT40 mode

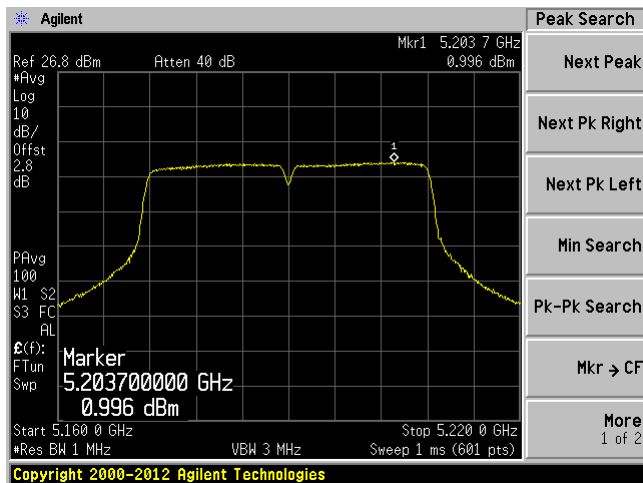
Low channel: 5190 MHz Chain 0



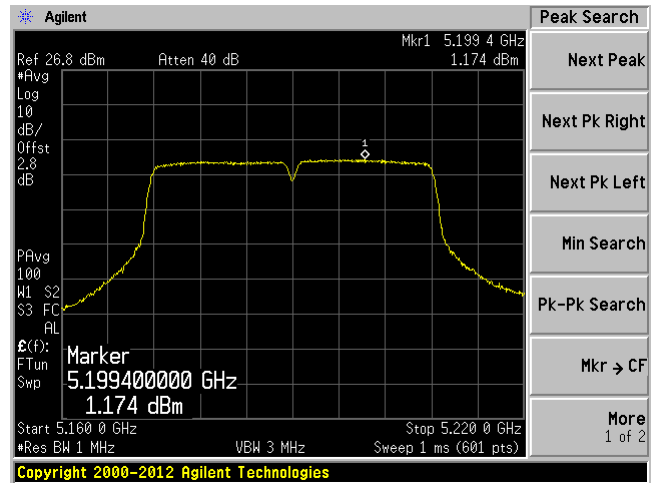
Low channel: 5190 MHz Chain 1



High channel: 5230 MHz Chain 0



High channel: 5230 MHz Chain 1



802.11ac-VHT80 mode 5210MHz

Chain 0

Chain 1

