**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372

August 15, 2011

Ubiquiti Networks, Inc.
91 E. Tasman
San Jose, CA 95134

Dear Jennifer Sanchez,

Enclosed is the EMC test report for compliance testing of the Ubiquiti Networks, Inc., NanoStationM2 tested to the requirements of ETSI EN 300 328 (Article 3.2 of R&TTE Directive).

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Ubiquiti Networks, Inc.\EMC30567-ETS328)

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# Electromagnetic Compatibility Criteria
# Test Report

For the

**Ubiquiti Networks, Inc.**
**Model NanoStationM2**

Tested under

**ETSI EN 300 328**

**(Article 3.2 of R&TTE Directive)**

**MET Report: EMC30567-ETS328**

August 15, 2011

**Prepared For:**

**Ubiquiti Networks, Inc.**
**91 E. Tasman**
**San Jose, CA 95134**

**Prepared By:**
**MET Laboratories, Inc.**
3162 Belick St.
Santa Clara, CA 95054

# Electromagnetic Compatibility Criteria
# Test Report

For the

**Ubiquiti Networks, Inc.**
**Model NanoStationM2**

Tested under

**ETSI EN 300 328**

**(Article 3.2 of R&TTE Directive)**

## MET Report: EMC30567-ETS328

Anderson Soungpanya, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

**Engineering Statement:** The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of ETSI EN 300 328 of the EU Rules under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

  

# Report Status Sheet

| Revision | Report Date | Reason for Revision |
|---|---|---|
| ∅ | August 15, 2011 | Initial Issue. |

  

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# List of Terms and Abbreviations

| | |
|---|---|
| **AC** | **A**lternating **C**urrent |
| **ACF** | **A**ntenna **C**orrection **F**actor |
| **Cal** | **Cal**ibration |
| ***d*** | **M**easurement **D**istance |
| **dB** | **D**eci**b**els |
| **dBμA** | **D**eci**b**els above one **micro**amp |
| **dBμV** | **D**eci**b**els above one **micro**volt |
| **dBμA/m** | **D**eci**b**els above one **micro**amp **per m**eter |
| **dBμV/m** | **D**eci**b**els above one **micro**volt **per m**eter |
| **DC** | **D**irect **C**urrent |
| **E** | **E**lectric Field |
| **DSL** | **D**igital **S**ubscriber **L**ine |
| **ESD** | **E**lectro**s**tatic **D**ischarge |
| **EUT** | **E**quipment **U**nder **T**est |
| ***f*** | **F**requency |
| **CISPR** | **C**omite **I**nternational **S**pecial des **P**erturbations **R**adioelectriques<br>(International Special Committee on Radio Interference) |
| **GRP** | **G**round **R**eference **P**lane |
| **H** | Magnetic Field |
| **HCP** | **H**orizontal **C**oupling **P**lane |
| **Hz** | **H**ert**z** |
| **IEC** | **I**nternational **E**lectrotechnical **C**ommission |
| **kHz** | **k**ilo**H**ert**z** |
| **kPa** | **k**ilo**Pa**scal |
| **kV** | **k**ilo**v**olt |
| **LISN** | **L**ine **I**mpedance **S**tabilization **N**etwork |
| **MHz** | **M**ega**H**ertz |
| **μH** | **micro**Henry |
| **μF** | **micro**Farad |
| **μs** | **micros**econds |
| **PRF** | **P**ulse **R**epetition **F**requency |
| **RF** | **R**adio **F**requency |
| **RMS** | **R**oot-**M**ean-**S**quare |
| **V/m** | **V**olts **per m**eter |
| **VCP** | **V**ertical **C**oupling **P**lane |

# I. Requirements Summary

# A. Requirements Summary

| ETSI EN 300 328 Section Number | Descriptive Name | Comments |
|---|---|---|
| Sections 4.3.1 | Maximum Transmit Power | Compliant |
| Sections 4.3.2 | Maximum EIRP Spectral Density | Compliant |
| Sections 4.3.3 | Frequency Range | Compliant |
| Sections 4.3.5 | Medium Access Protocol | Compliant |
| Sections 4.3.6 | Conducted Transmitter Spurious Emissions | Compliant |
| | Radiated Transmitter Spurious Emissions | Compliant |
| Sections 4.3.7 | Conducted Receiver Spurious Emissions | Compliant |
| | Radiated Receiver Spurious Emissions | Compliant |

**Table 1. Summary of EMC ETSI EN 300 328 (Article 3.2 of R&TTE Directive) Compliance Testing**

# II. Equipment Configuration

## A. Overview

MET Laboratories, Inc. was contracted by Ubiquiti Networks, Inc. to perform testing on a NanoStationM2.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Ubiquiti Networks, Inc. model NanoStationM2.

The results obtained relate only to the item(s) tested.

| | |
|---|---|
| **Model(s) Tested:** | NanoStationM2 |
| **Model(s) Number:** | NanoStationM2 |
| **EUT Specifications:** | Primary Power: 100-240 VAC |
| | Frequency Range: 2412-2472MHz |
| **Lab Ambient (Normal) Test Conditions:** | Temperature: 15-35º C |
| | Relative Humidity: 30-60% |
| | Atmospheric Pressure: 860-1060 mbar |
| **Extreme Test Conditions:** | Temperature: -20 to + 70º C |
| | Relative Humidity: 30-60% |
| **Evaluated by:** | Anderson Soungpanya |
| **Report Date(s):** | August 15, 2011 |

## B. References

| | |
|---|---|
| **ETSI EN 300 328 V1.7.1 (2006-10)** | Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems; data transmission equipment in the 2.4 GHz ISM band and using spread spectrum modulation techniques; Part1: Technical characteristics and test conditions |

**Table 2. Test References**

## C. Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick St., Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

## D. Description of Test Sample

The Ubiquiti Networks, Inc. NanoStationM2, Equipment Under Test (EUT), is a 2.4GHz Hi Power 2x2 MIMO AirMax Station.


**Photograph 1. Front View of EUT**

## E. Equipment Configuration

| Ref. ID | Name / Description | Model Number | Serial Number |
|---|---|---|---|
| A | NanoStationM2 | NS5 | N/A |
| A | NanoStationM2 | NS5 | N/A |
| A | NanoStationM2 | NS5 | 1O5OL 00156D9ED5C9 |
| B | Power Supply | CPWA240500US | POEZC101126181008 |
| B | Power Supply | UBI-POE-24-5 | 0912-0007163 |

**Table 3. Equipment Configuration**

## F. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

| Ref. ID | Name / Description | Manufacturer | Model Number | Serial Number |
|---|---|---|---|---|
| C | Laptop | Dell | Vostro 1510 | 4953929473 |

**Table 4. Support Equipment**

## G. Ports and Cabling Information

| Ref. ID | Port name on EUT | Cable Description or reason for no cable | Qty. | Length (m) | Shielded? (Y/N) | Termination Box ID & Port ID |
|---|---|---|---|---|---|---|
| 1 | NanoM2 - Main | Ethernet | 1 | 10 | Y | PSU – POE port |
| | NanoM2- Secondary | Ethernet | 1 | 10 | Y | Unterminated |
| 1 | PSU - POE | Ethernet | 1 | 10 | Y | NanoM2 - Main |
| 2 | PSU - LAN | Ethernet | 1 | 10 | Y | Laptop |
| 3 | AC port | AC Cable | 1 | 0.5 | Y | 100-240VAC Source |

**Table 5. Ports and Cabling Information**

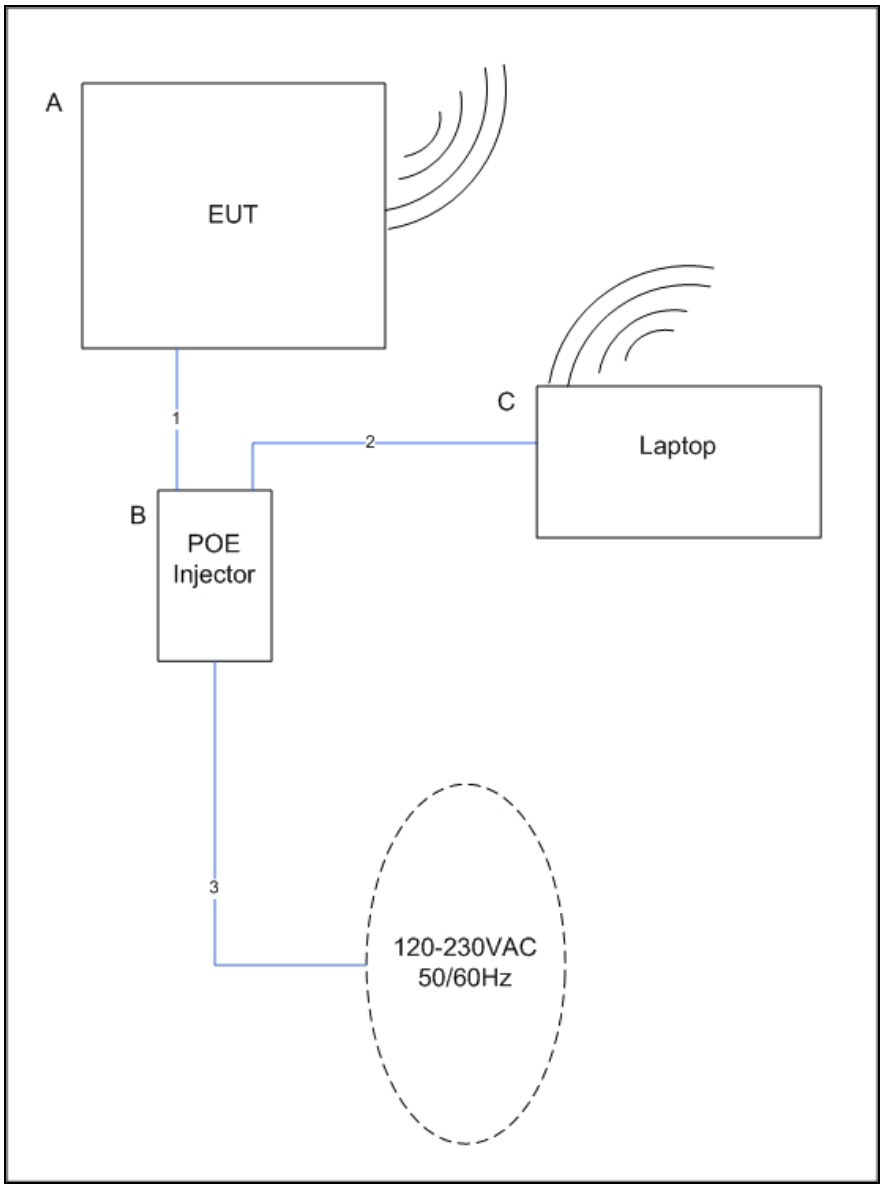



**Figure 1. Block Diagram of Test Configuration**

## H. Mode of Operation

Transmit 1-24Mbps, 36-54Mbps at 802.11b/g modes and MCS0-MCS15 at 802.11n modes @2.4GHz.

## I. Method of Monitoring EUT Operation

IP connectivity is maintained with the EUT. If IP connectivity is lost, EUT connectivity shall be re-established upon power up or re-boot.

## J. Modifications

### a) Modifications to EUT

No modifications to the EUT

### b) Modifications to Test Standard

No modifications were made to the test standard.

## K. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Ubiquiti Networks, Inc. upon completion of testing.

# III. Conformance Requirements

## Conformance Requirements

### 4.3.1 Maximum Transmit Power

**Test Requirement(s):** **ETSI EN 300 328-1, Clause 4.3.1:**

4.3.1.1 Definition

The maximum transmit power is defined as the maximum isotropic radiated power of the equipment.

4.3.1.2 Limit

The equivalent isotropic radiated power (e.i.r.p.) shall be equal to or less than -10 dBW (100 mW). This limit shall apply for any combination of power level and intended antenna assembly.

**Test Procedure:** Measurements were carried out in all modulations available and at the low, mid and high channels of the transmit band. Both normal and extreme test conditions were observed. The EIRP was calculated from the following equation:

P = A + G + 10 log (1/x); where A is the measured power, x is the duty cycle and G is the antenna assembly gain.
x = 0.99

**Test Results:** The EUT as tested was found compliant with the specified limits in clause 4.3.1.2.

**Test Engineer:** Anderson Soungpanya

**Test Date:** 07/14/11

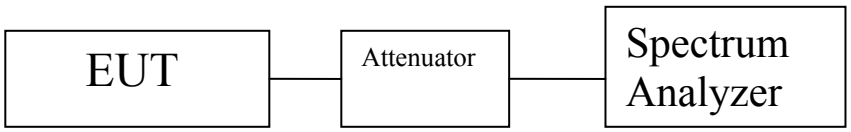



**Figure 2. Maximum Transmit Power**

## Maximum Transmit Power (EIRP) Test Results

| Maximum Average Power Under Normal and Extreme Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel (MHz) | | Temperature (C) | Voltage AC | Mode | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP dBm |
| 2412 | Low | 20 | 230 | 802.11b | 8.56 | 11 | 19.56 |
| 2442 | Mid | 20 | 230 | 802.11b | 8.65 | 11 | 19.65 |
| 2472 | High | 20 | 230 | 802.11b | 8.53 | 11 | 19.53 |
| 2412 | Low | 70 | 207 | 802.11b | 8.78 | 11 | 19.78 |
| 2412 | Low | 70 | 253 | 802.11b | 8.73 | 11 | 19.73 |
| 2442 | Mid | 70 | 207 | 802.11b | 8.44 | 11 | 19.44 |
| 2442 | Mid | 70 | 253 | 802.11b | 8.42 | 11 | 19.42 |
| 2472 | High | 70 | 207 | 802.11b | 7.38 | 11 | 18.38 |
| 2472 | High | 70 | 253 | 802.11b | 7.37 | 11 | 18.37 |
| 2412 | Low | -20 | 207 | 802.11b | 8.92 | 11 | 19.92 |
| 2412 | Low | -20 | 253 | 802.11b | 8.91 | 11 | 19.91 |
| 2442 | Mid | -20 | 207 | 802.11b | 8.98 | 11 | 19.98 |
| 2442 | Mid | -20 | 253 | 802.11b | 8.99 | 11 | 19.99 |
| 2472 | High | -20 | 207 | 802.11b | 8.87 | 11 | 19.87 |
| 2472 | High | -20 | 253 | 802.11b | 8.88 | 11 | 19.88 |

**Table 6. EIRP, Test Results, 802.11b**

| Maximum Average Power Under Normal and Extreme Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel (MHz) | | Temperature (C) | Voltage AC | Mode | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP dBm |
| 2412 | Low | 20 | 230 | 802.11g 20MHz | 8.57 | 11 | 19.57 |
| 2442 | Mid | 20 | 230 | 802.11g 20MHz | 8.42 | 11 | 19.42 |
| 2472 | High | 20 | 230 | 802.11g 20MHz | 8.11 | 11 | 19.11 |
| 2412 | Low | 70 | 207 | 802.11g 20MHz | 8.65 | 11 | 19.65 |
| 2412 | Low | 70 | 253 | 802.11g 20MHz | 8.64 | 11 | 19.64 |
| 2442 | Mid | 70 | 207 | 802.11g 20MHz | 8.12 | 11 | 19.12 |
| 2442 | Mid | 70 | 253 | 802.11g 20MHz | 8.13 | 11 | 19.13 |
| 2472 | High | 70 | 207 | 802.11g 20MHz | 7.87 | 11 | 18.87 |
| 2472 | High | 70 | 253 | 802.11g 20MHz | 7.88 | 11 | 18.88 |
| 2412 | Low | -20 | 207 | 802.11g 20MHz | 8.70 | 11 | 19.70 |
| 2412 | Low | -20 | 253 | 802.11g 20MHz | 8.71 | 11 | 19.71 |
| 2442 | Mid | -20 | 207 | 802.11g 20MHz | 8.55 | 11 | 19.55 |
| 2442 | Mid | -20 | 253 | 802.11g 20MHz | 8.56 | 11 | 19.56 |
| 2472 | High | -20 | 207 | 802.11g 20MHz | 8.37 | 11 | 19.37 |
| 2472 | High | -20 | 253 | 802.11g 20MHz | 8.38 | 11 | 19.38 |

**Table 7. EIRP, Test Results, 802.11g 20 MHz**

| Maximum Average Power Under Normal and Extreme Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel (MHz) | | Temperature (C) | Voltage AC | Mode | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP dBm |
| 2422 | Low | 20 | 230 | 802.11g 40MHz | 8.53 | 11 | 19.53 |
| 2442 | Mid | 20 | 230 | 802.11g 40MHz | 8.42 | 11 | 19.42 |
| 2462 | High | 20 | 230 | 802.11g 40MHz | 8.22 | 11 | 19.22 |
| 2422 | Low | 70 | 207 | 802.11g 40MHz | 8.36 | 11 | 19.36 |
| 2422 | Low | 70 | 253 | 802.11g 40MHz | 8.37 | 11 | 19.37 |
| 2442 | Mid | 70 | 207 | 802.11g 40MHz | 8.05 | 11 | 19.05 |
| 2442 | Mid | 70 | 253 | 802.11g 40MHz | 8.07 | 11 | 19.07 |
| 2462 | High | 70 | 207 | 802.11g 40MHz | 7.45 | 11 | 18.45 |
| 2462 | High | 70 | 253 | 802.11g 40MHz | 7.63 | 11 | 18.63 |
| 2422 | Low | -20 | 207 | 802.11g 40MHz | 8.81 | 11 | 19.81 |
| 2422 | Low | -20 | 253 | 802.11g 40MHz | 8.84 | 11 | 19.84 |
| 2442 | Mid | -20 | 207 | 802.11g 40MHz | 8.31 | 11 | 19.31 |
| 2442 | Mid | -20 | 253 | 802.11g 40MHz | 8.32 | 11 | 19.32 |
| 2462 | High | -20 | 207 | 802.11g 40MHz | 8.65 | 11 | 19.65 |
| 2462 | High | -20 | 253 | 802.11g 40MHz | 8.68 | 11 | 19.68 |

**Table 8. EIRP, Test Results, 802.11g 40 MHz**

| Maximum Average Power Under Normal and Extreme Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel (MHz) | | Temperature (C) | Voltage AC | Mode | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP dBm |
| 2412 | Low | 20 | 230 | HT5 | 3.76 | 11 | 14.76 |
| 2442 | Mid | 20 | 230 | HT5 | 3.42 | 11 | 14.42 |
| 2472 | High | 20 | 230 | HT5 | 3.13 | 11 | 14.13 |
| 2412 | Low | 70 | 207 | HT5 | 3.10 | 11 | 14.10 |
| 2412 | Low | 70 | 253 | HT5 | 3.11 | 11 | 14.11 |
| 2442 | Mid | 70 | 207 | HT5 | 2.84 | 11 | 13.84 |
| 2442 | Mid | 70 | 253 | HT5 | 2.84 | 11 | 13.84 |
| 2472 | High | 70 | 207 | HT5 | 3.00 | 11 | 14.00 |
| 2472 | High | 70 | 253 | HT5 | 2.99 | 11 | 13.99 |
| 2412 | Low | -20 | 207 | HT5 | 3.44 | 11 | 14.44 |
| 2412 | Low | -20 | 253 | HT5 | 3.45 | 11 | 14.45 |
| 2442 | Mid | -20 | 207 | HT5 | 3.17 | 11 | 14.17 |
| 2442 | Mid | -20 | 253 | HT5 | 3.17 | 11 | 14.17 |
| 2472 | High | -20 | 207 | HT5 | 3.33 | 11 | 14.33 |
| 2472 | High | -20 | 253 | HT5 | 3.32 | 11 | 14.32 |

**Table 9. EIRP, Test Results, 802.11n HT5**

| Maximum Average Power Under Normal and Extreme Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel (MHz) | | Temperature (C) | Voltage AC | Mode | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP dBm |
| 2412 | Low | 20 | 230 | HT8 | 4.22 | 11 | 15.22 |
| 2442 | Mid | 20 | 230 | HT8 | 3.93 | 11 | 14.93 |
| 2472 | High | 20 | 230 | HT8 | 3.94 | 11 | 14.94 |
| 2412 | Low | 70 | 207 | HT8 | 4.13 | 11 | 15.13 |
| 2412 | Low | 70 | 253 | HT8 | 4.12 | 11 | 15.12 |
| 2442 | Mid | 70 | 207 | HT8 | 3.40 | 11 | 14.40 |
| 2442 | Mid | 70 | 253 | HT8 | 3.40 | 11 | 14.40 |
| 2472 | High | 70 | 207 | HT8 | 3.55 | 11 | 14.55 |
| 2472 | High | 70 | 253 | HT8 | 3.55 | 11 | 14.55 |
| 2412 | Low | -20 | 207 | HT8 | 4.66 | 11 | 15.66 |
| 2412 | Low | -20 | 253 | HT8 | 4.65 | 11 | 15.65 |
| 2442 | Mid | -20 | 207 | HT8 | 3.88 | 11 | 14.88 |
| 2442 | Mid | -20 | 253 | HT8 | 3.89 | 11 | 14.89 |
| 2472 | High | -20 | 207 | HT8 | 4.04 | 11 | 15.04 |
| 2472 | High | -20 | 253 | HT8 | 4.04 | 11 | 15.04 |

**Table 10. EIRP, Test Results, 802.11n HT8**

| Maximum Average Power Under Normal and Extreme Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel (MHz) | | Temperature (C) | Voltage AC | Mode | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP dBm |
| 2412 | Low | 20 | 230 | HT10 | 4.21 | 11 | 15.21 |
| 2442 | Mid | 20 | 230 | HT10 | 4.13 | 11 | 15.13 |
| 2472 | High | 20 | 230 | HT10 | 4.23 | 11 | 15.23 |
| 2412 | Low | 70 | 207 | HT10 | 4.45 | 11 | 15.45 |
| 2412 | Low | 70 | 253 | HT10 | 4.46 | 11 | 15.46 |
| 2442 | Mid | 70 | 207 | HT10 | 4.12 | 11 | 15.12 |
| 2442 | Mid | 70 | 253 | HT10 | 4.10 | 11 | 15.10 |
| 2472 | High | 70 | 207 | HT10 | 3.89 | 11 | 14.89 |
| 2472 | High | 70 | 253 | HT10 | 3.88 | 11 | 14.88 |
| 2412 | Low | -20 | 207 | HT10 | 4.62 | 11 | 15.62 |
| 2412 | Low | -20 | 253 | HT10 | 4.63 | 11 | 15.63 |
| 2442 | Mid | -20 | 207 | HT10 | 4.29 | 11 | 15.29 |
| 2442 | Mid | -20 | 253 | HT10 | 4.27 | 11 | 15.27 |
| 2472 | High | -20 | 207 | HT10 | 4.05 | 11 | 15.05 |
| 2472 | High | -20 | 253 | HT10 | 4.04 | 11 | 15.04 |

**Table 11. EIRP, Test Results, 802.11n HT8**

| Maximum Average Power Under Normal and Extreme Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel (MHz) | | Temperature (C) | Voltage AC | Mode | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP dBm |
| 2412 | Low | 20 | 230 | HT20 | 1.32 | 11 | 12.32 |
| 2442 | Mid | 20 | 230 | HT20 | 1.22 | 11 | 12.22 |
| 2472 | High | 20 | 230 | HT20 | 0.92 | 11 | 11.92 |
| 2412 | Low | 70 | 207 | HT20 | 1.42 | 11 | 12.42 |
| 2412 | Low | 70 | 253 | HT20 | 1.41 | 11 | 12.41 |
| 2442 | Mid | 70 | 207 | HT20 | 1.76 | 11 | 12.76 |
| 2442 | Mid | 70 | 253 | HT20 | 1.77 | 11 | 12.77 |
| 2472 | High | 70 | 207 | HT20 | 0.81 | 11 | 11.81 |
| 2472 | High | 70 | 253 | HT20 | 0.81 | 11 | 11.81 |
| 2412 | Low | -20 | 207 | HT20 | 1.53 | 11 | 12.53 |
| 2412 | Low | -20 | 253 | HT20 | 1.52 | 11 | 12.52 |
| 2442 | Mid | -20 | 207 | HT20 | 1.89 | 11 | 12.89 |
| 2442 | Mid | -20 | 253 | HT20 | 1.90 | 11 | 12.90 |
| 2472 | High | -20 | 207 | HT20 | 0.87 | 11 | 11.87 |
| 2472 | High | -20 | 253 | HT20 | 0.87 | 11 | 11.87 |

**Table 12. EIRP, Test Results, 802.11n HT20**

| Maximum Average Power Under Normal and Extreme Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel (MHz) | | Temperature (C) | Voltage AC | Mode | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP dBm |
| 2422 | Low | 20 | 230 | HT30 | 8.23 | 11 | 19.23 |
| 2442 | Mid | 20 | 230 | HT30 | 8.27 | 11 | 19.27 |
| 2462 | High | 20 | 230 | HT30 | 7.99 | 11 | 18.99 |
| 2452 | Low | 70 | 207 | HT30 | 8.17 | 11 | 19.17 |
| 2422 | Low | 70 | 253 | HT30 | 8.22 | 11 | 19.22 |
| 2442 | Mid | 70 | 207 | HT30 | 7.95 | 11 | 18.95 |
| 2442 | Mid | 70 | 253 | HT30 | 7.94 | 11 | 18.94 |
| 2462 | High | 70 | 207 | HT30 | 7.74 | 11 | 18.74 |
| 2462 | High | 70 | 253 | HT30 | 7.77 | 11 | 18.77 |
| 2422 | Low | -20 | 207 | HT30 | 8.42 | 11 | 19.42 |
| 2422 | Low | -20 | 253 | HT30 | 8.47 | 11 | 19.47 |
| 2442 | Mid | -20 | 207 | HT30 | 8.20 | 11 | 19.20 |
| 2442 | Mid | -20 | 253 | HT30 | 8.19 | 11 | 19.19 |
| 2462 | High | -20 | 207 | HT30 | 7.98 | 11 | 18.98 |
| 2462 | High | -20 | 253 | HT30 | 8.01 | 11 | 19.01 |

**Table 13. EIRP, Test Results, 802.11n HT30**

| Maximum Average Power Under Normal and Extreme Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel (MHz) | | Temperature (C) | Voltage AC | Mode | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP dBm |
| 2422 | Low | 20 | 230 | HT40 | 1.43 | 11 | 12.43 |
| 2442 | Mid | 20 | 230 | HT40 | 1.32 | 11 | 12.32 |
| 2462 | High | 20 | 230 | HT40 | 1.18 | 11 | 12.18 |
| 2452 | Low | 70 | 207 | HT40 | 1.64 | 11 | 12.64 |
| 2422 | Low | 70 | 253 | HT40 | 1.55 | 11 | 12.55 |
| 2442 | Mid | 70 | 207 | HT40 | 1.38 | 11 | 12.38 |
| 2442 | Mid | 70 | 253 | HT40 | 1.39 | 11 | 12.39 |
| 2462 | High | 70 | 207 | HT40 | 1.33 | 11 | 12.33 |
| 2462 | High | 70 | 253 | HT40 | 1.31 | 11 | 12.31 |
| 2422 | Low | -20 | 207 | HT40 | 1.71 | 11 | 12.71 |
| 2422 | Low | -20 | 253 | HT40 | 1.61 | 11 | 12.61 |
| 2442 | Mid | -20 | 207 | HT40 | 1.44 | 11 | 12.44 |
| 2442 | Mid | -20 | 253 | HT40 | 1.45 | 11 | 12.45 |
| 2462 | High | -20 | 207 | HT40 | 1.39 | 11 | 12.39 |
| 2462 | High | -20 | 253 | HT40 | 1.36 | 11 | 12.36 |

**Table 14. EIRP, Test Results, 802.11n HT40**

## Conformance Requirements

## 4.3.2 Maximum EIRP Spectral Density

**Test Requirement(s):** **ETSI EN 300 328 Section 4.3.2:**

4.3.2.1 Definition
The maximum EIRP spectral density is defined as the highest EIRP level in Watts per Hertz generated by the transmitter within the power envelope.

4.3.2.2 Limit
For wide band modulations other than FHSS (e.g. DSSS, OFDM, etc.), the maximum EIRP spectral density is limited to 10 mW per MHz.

**Test Procedure:** Option 1 was used to measure the power (A). The maximum spectral power density EIRP was determined using the following equation:
P = A + G + 10 log (1/x); where A is the measured power, x is the duty cycle and G is the antenna assembly gain.
x = 0.99
Cable loss has been pre-programmed into SA.

**Test Results:** The EUT as tested was found compliant with the specified limits of Clause 4.3.2.2.

Maximum SPD <= 10mW (10 dBm) per MHz EIRP in Normal Test Condition, SPD = Spectral Power Density.

**Test Engineer:** Anderson Soungpanya

**Test Date:** 07/14/11

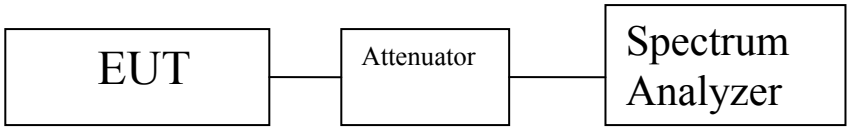


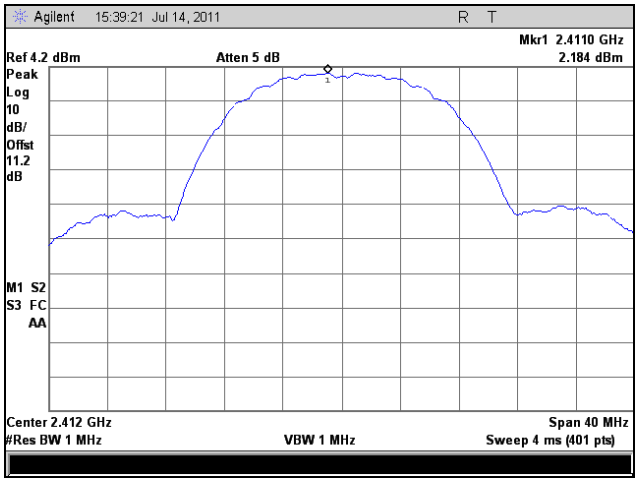

**Figure 3. Maximum Spectral Density**

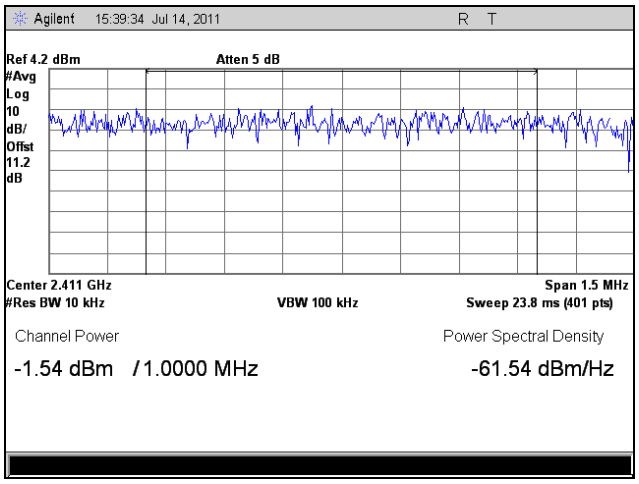
| Power Spectral Density | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel (MHz) | | Mode OFDM | Measured Power Density dBm | Antenna Gain dBi | EIRP dBm | Limit dBm | Margin dB |
| 2412 | Low | 802.11b | -1.54 | 11 | 9.46 | 10.00 | -0.54 |
| 2442 | Mid | 802.11b | -1.41 | 11 | 9.59 | 10.00 | -0.41 |
| 2472 | High | 802.11b | -2.42 | 11 | 8.58 | 10.00 | -1.42 |
| 2422 | Low | 802.11g 20MHz | -2.17 | 11 | 8.83 | 10.00 | -1.17 |
| 2442 | Mid | 802.11g 20MHz | -2.19 | 11 | 8.81 | 10.00 | -1.19 |
| 2462 | High | 802.11g 20MHz | -3.12 | 11 | 7.88 | 10.00 | -2.12 |
| 2412 | Low | 802.11g 40MHz | -6.25 | 11 | 4.75 | 10.00 | -5.25 |
| 2442 | Mid | 802.11g 40MHz | -5.3 | 11 | 5.7 | 10.00 | -4.30 |
| 2472 | High | 802.11g 40MHz | -4.37 | 11 | 6.63 | 10.00 | -3.37 |
| 2422 | Low | HT5 | -4.24 | 11 | 6.76 | 10.00 | -3.24 |
| 2442 | Mid | HT5 | -3.55 | 11 | 7.45 | 10.00 | -2.55 |
| 2462 | High | HT5 | -4.96 | 11 | 6.04 | 10.00 | -3.96 |
| 2412 | Low | HT8 | -5.45 | 11 | 5.55 | 10.00 | -4.45 |
| 2442 | Mid | HT8 | -5.54 | 11 | 5.46 | 10.00 | -4.54 |
| 2472 | High | HT8 | -5.27 | 11 | 5.73 | 10.00 | -4.27 |
| 2422 | Low | HT10 | -5.75 | 11 | 5.25 | 10.00 | -4.75 |
| 2442 | Mid | HT10 | -5.72 | 11 | 5.28 | 10.00 | -4.72 |
| 2462 | High | HT10 | -6.14 | 11 | 4.86 | 10.00 | -5.14 |
| 2412 | Low | HT20 | -10.54 | 11 | 0.46 | 10.00 | -9.54 |
| 2442 | Mid | HT20 | -10.91 | 11 | 0.09 | 10.00 | -9.91 |
| 2472 | High | HT20 | -10.13 | 11 | 0.87 | 10.00 | -9.13 |
| 2422 | Low | HT30 | -13.73 | 11 | -2.73 | 10.00 | -12.73 |
| 2442 | Mid | HT30 | -13.01 | 11 | -2.01 | 10.00 | -12.01 |
| 2462 | High | HT30 | -11.78 | 11 | -0.78 | 10.00 | -10.78 |
| 2412 | Low | HT40 | -13.51 | 11 | -2.51 | 10.00 | -12.51 |
| 2442 | Mid | HT40 | -15.98 | 11 | -4.98 | 10.00 | -14.98 |
| 2472 | High | HT40 | 12.81 | 11 | 23.81 | 10.00 | 13.81 |

**Table 15. Power Spectral Density, Test Results**

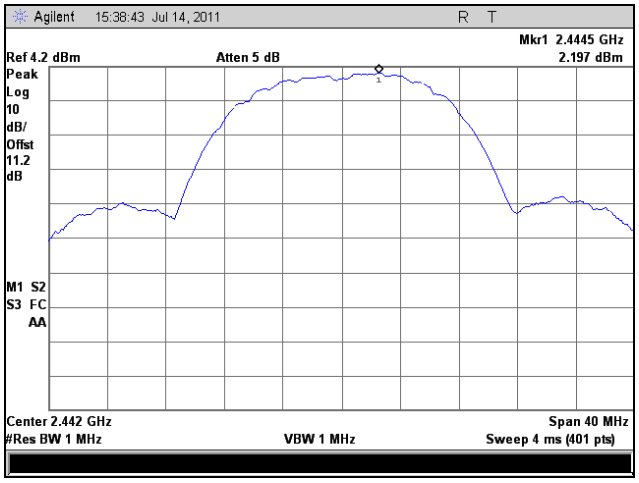
## Maximum EIRP Spectral Density, Test Results, 802.11b



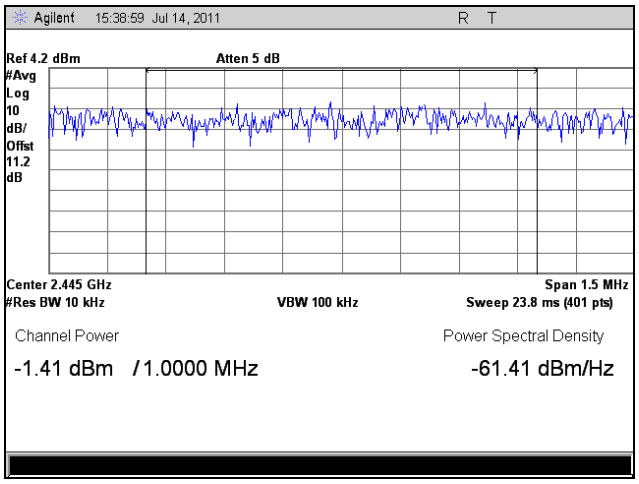

**Plot 1. Peak Spectral Density, Low Channel, Peak Determination, 802.11b**



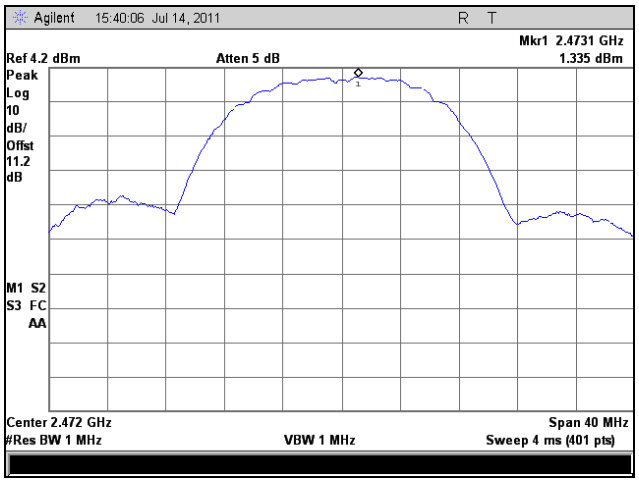

**Plot 2. Peak Spectral Density, Low Channel, 802.11b**



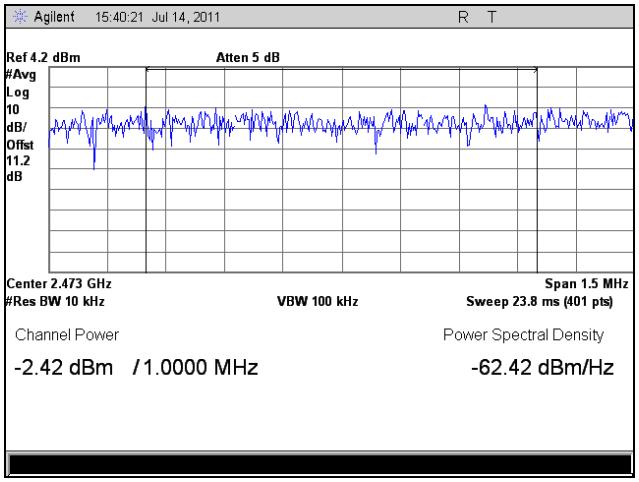

**Plot 3. Peak Spectral Density, Mid Channel, Peak Determination, 802.11b**




**Plot 4. Peak Spectral Density, Mid Channel, 802.11b**

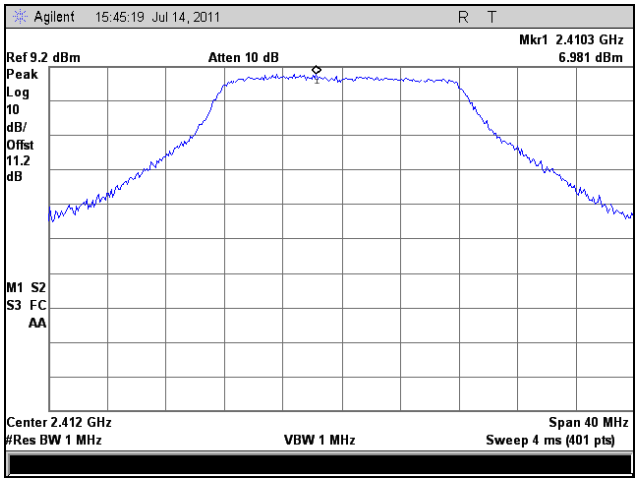



**Plot 5. Peak Spectral Density, High Channel, Peak Determination, 802.11b**

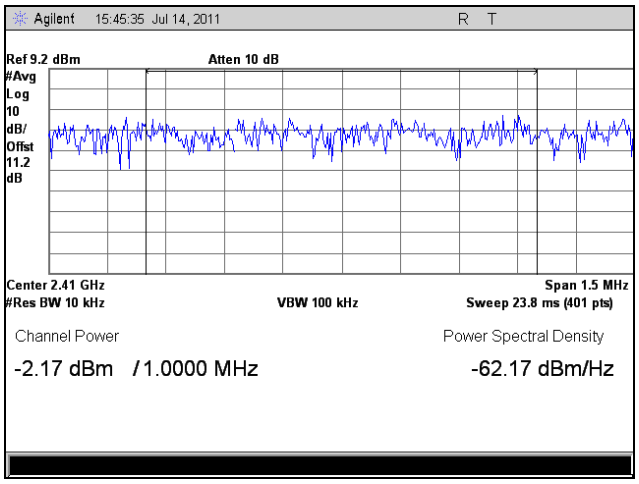



**Plot 6. Peak Spectral Density, High Channel, 802.11b**

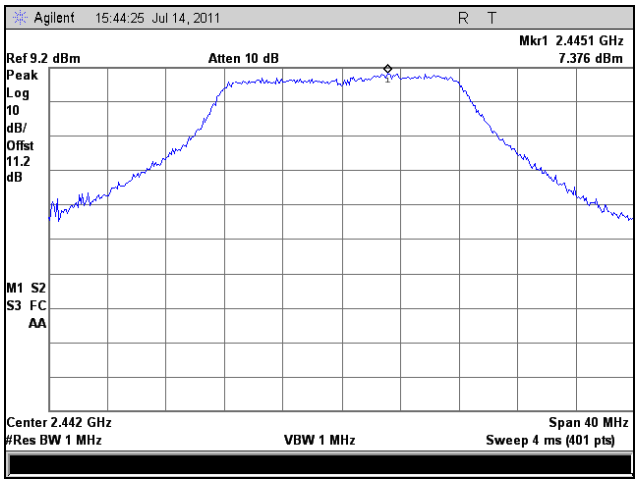
## Maximum EIRP Spectral Density, Test Results, 802.11g 20 MHz




**Plot 7. Peak Spectral Density, Low Channel, Peak Determination, 802.11g 20 MHz**

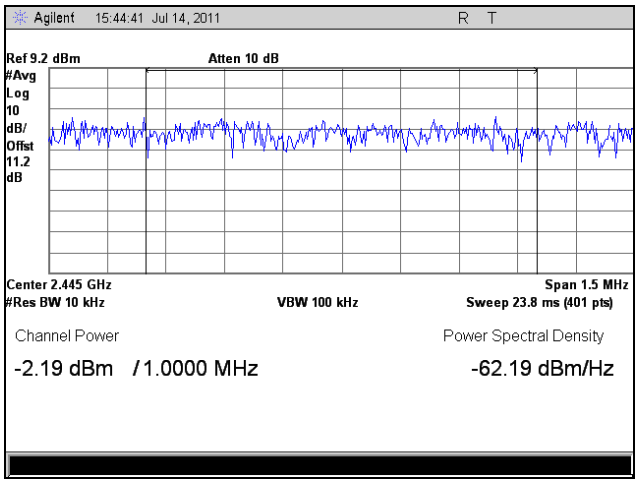



**Plot 8. Peak Spectral Density, Low Channel, 802.11g 20 MHz**

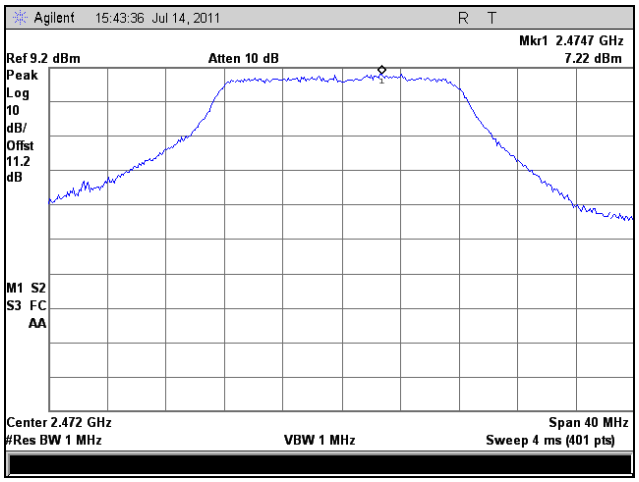



**Plot 9. Peak Spectral Density, Mid Channel, Peak Determination, 802.11g 20 MHz**

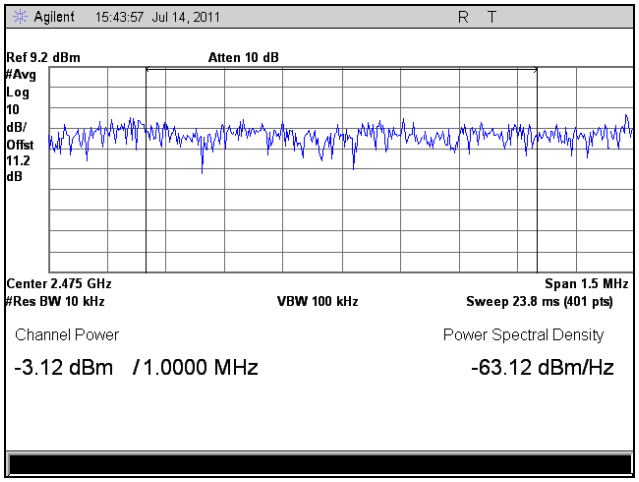
  




**Plot 10. Peak Spectral Density, Mid Channel, 802.11g 20 MHz**

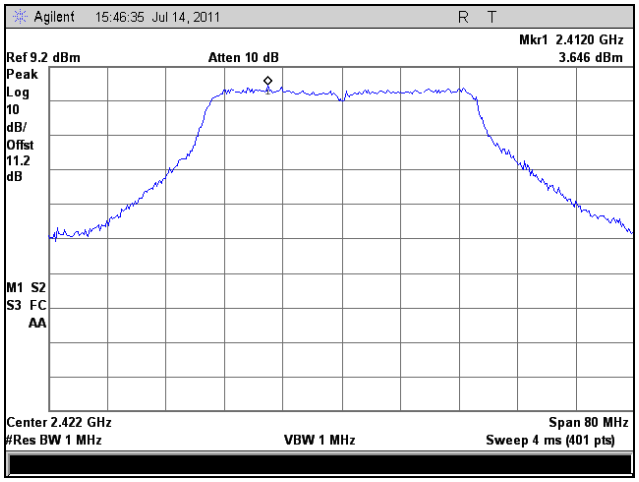



**Plot 11. Peak Spectral Density, High Channel, Peak Determination, 802.11g 20 MHz**

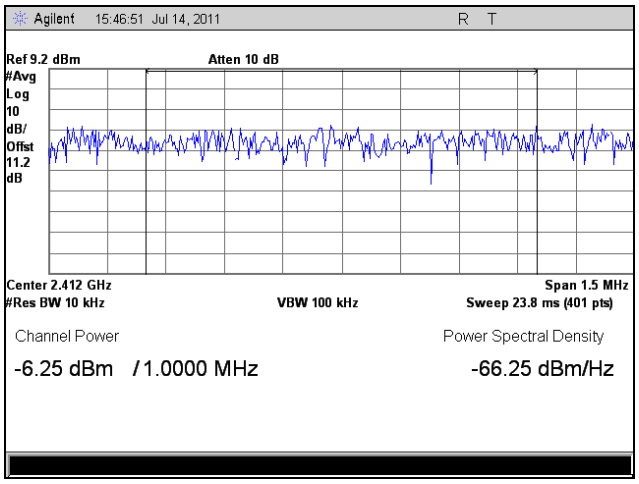



**Plot 12. Peak Spectral Density, High Channel, 802.11g 20 MHz**

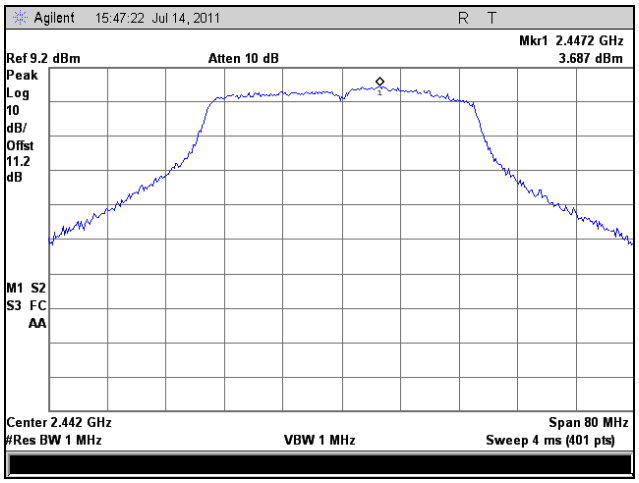
## Maximum EIRP Spectral Density, Test Results, 802.11g 40 MHz




**Plot 13. Peak Spectral Density, Low Channel, Peak Determination, 802.11g 40 MHz**

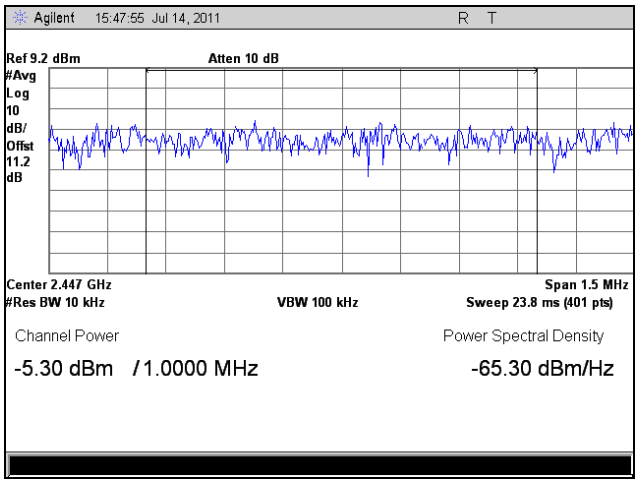



**Plot 14. Peak Spectral Density, Low Channel, 802.11g 40 MHz**

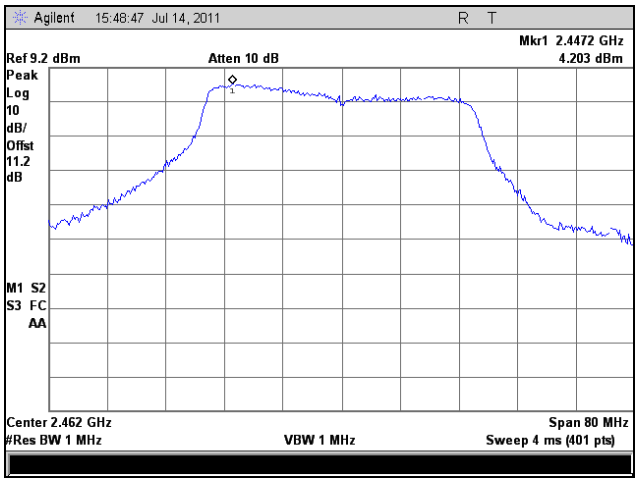



**Plot 15. Peak Spectral Density, Mid Channel, Peak Determination, 802.11g 40 MHz**

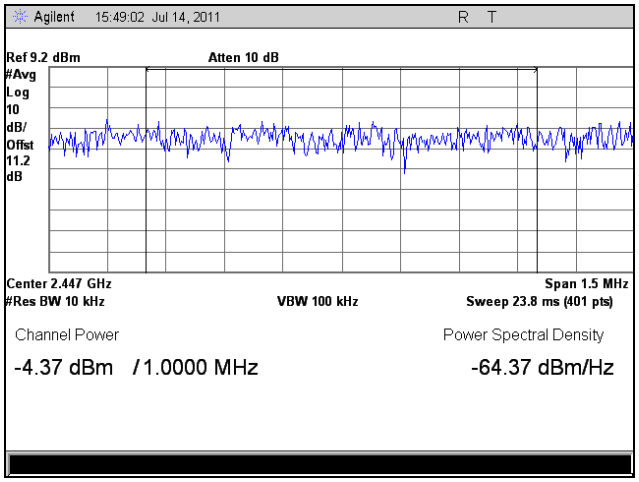
  




**Plot 16. Peak Spectral Density, Mid Channel, 802.11g 40 MHz**

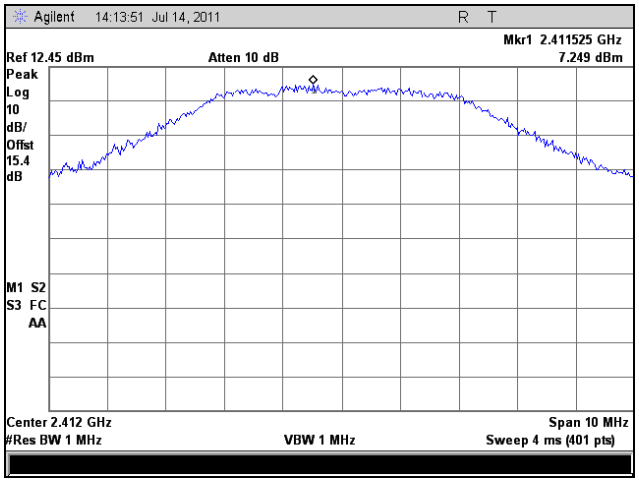



**Plot 17. Peak Spectral Density, High Channel, Peak Determination, 802.11g 40 MHz**

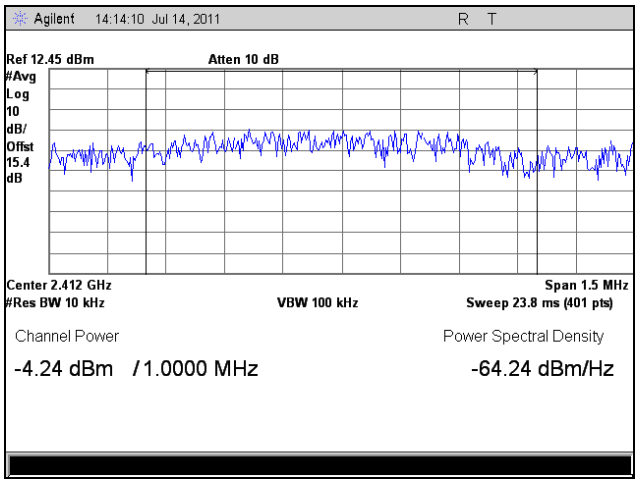



**Plot 18. Peak Spectral Density, High Channel, 802.11g 40 MHz**

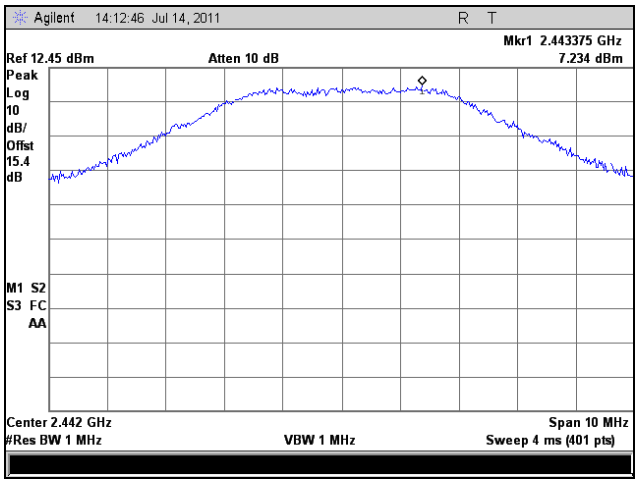
## Maximum EIRP Spectral Density, Test Results, 802.11n HT5




**Plot 19. Peak Spectral Density, Low Channel, Peak Determination, 802.11n HT5**

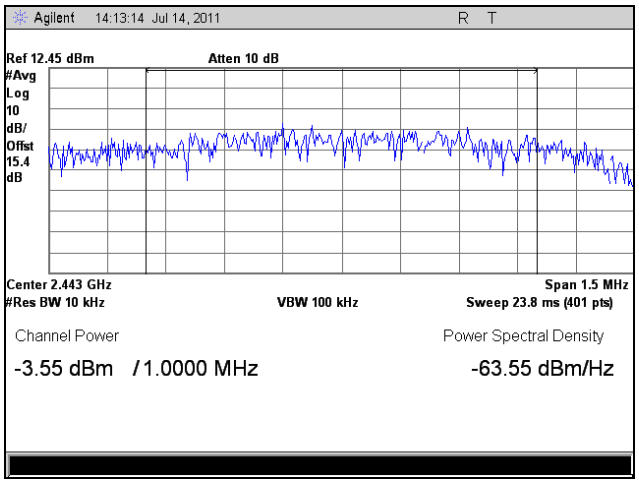



**Plot 20. Peak Spectral Density, Low Channel, 802.11n HT5**

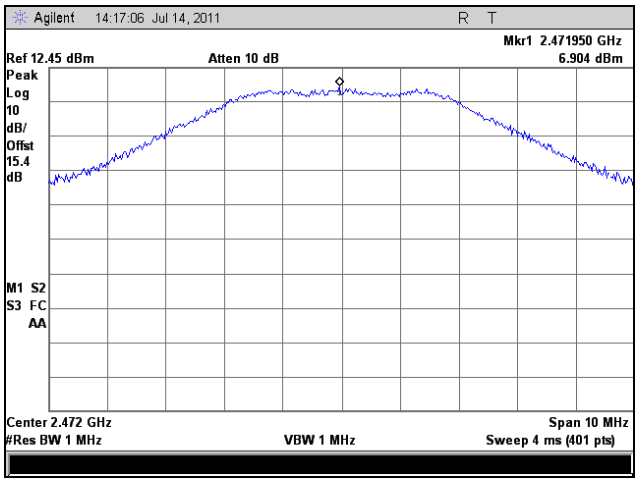



**Plot 21. Peak Spectral Density, Mid Channel, Peak Determination, 802.11n HT5**

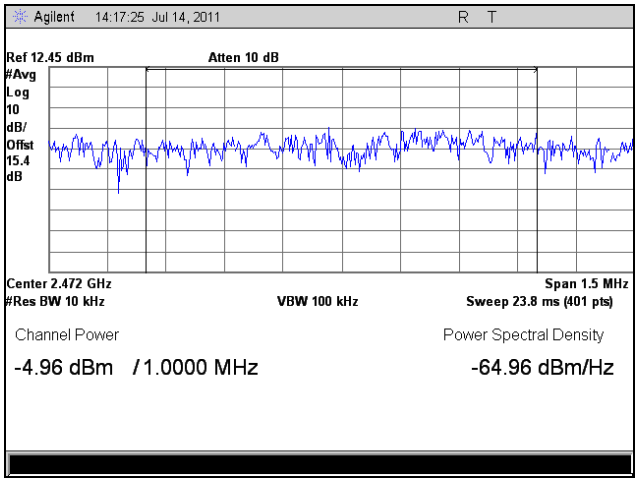
  




**Plot 22. Peak Spectral Density, Mid Channel, 802.11n HT5**

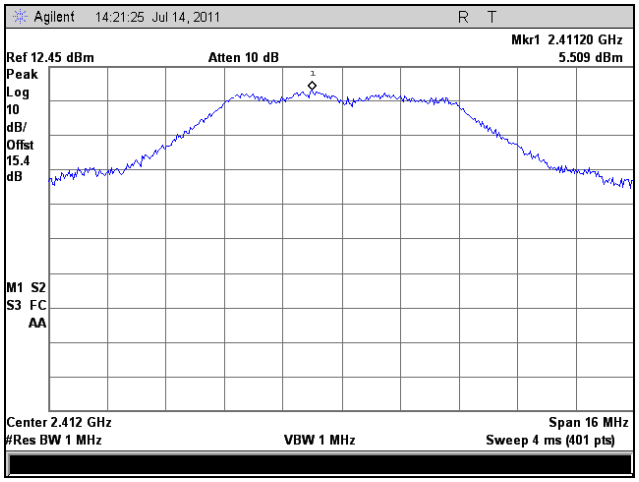



**Plot 23. Peak Spectral Density, High Channel, Peak Determination, 802.11n HT5**

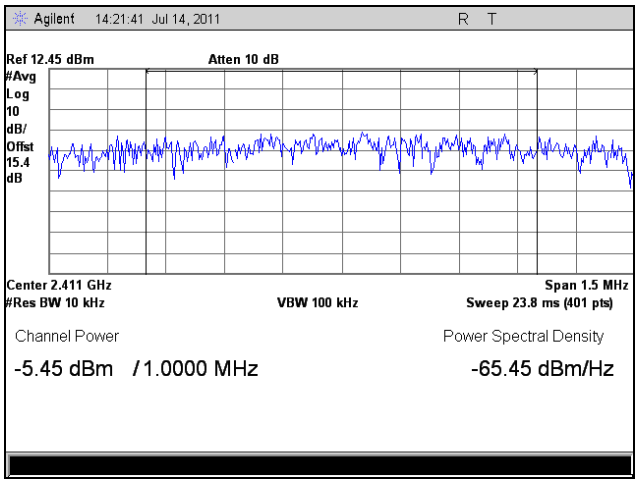



**Plot 24. Peak Spectral Density, High Channel, 802.11n HT5**

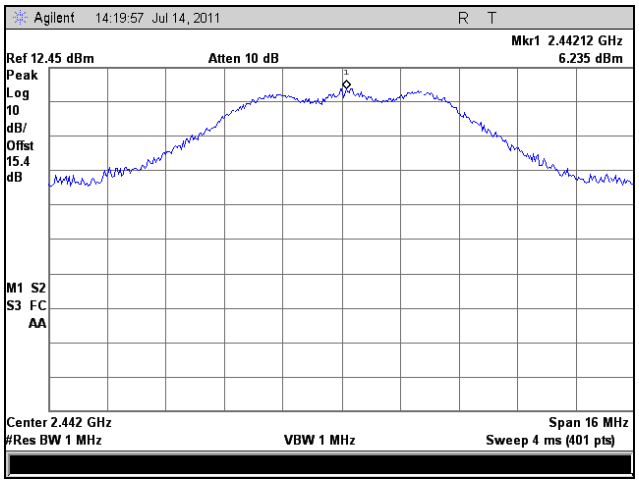
## Maximum EIRP Spectral Density, Test Results, 802.11n HT8




**Plot 25. Peak Spectral Density, Low Channel, Peak Determination, 802.11n HT8**

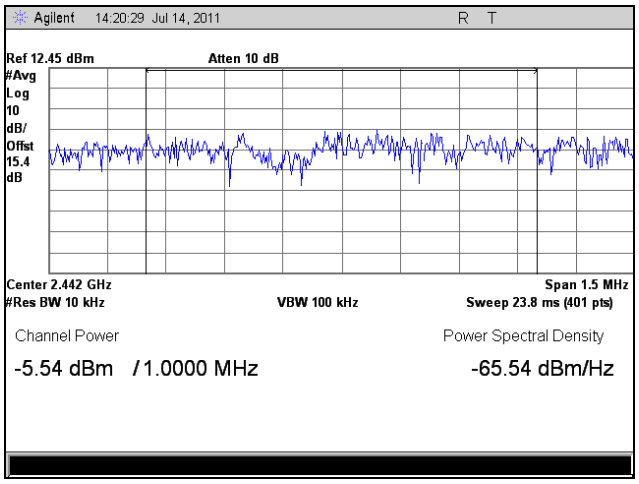



**Plot 26. Peak Spectral Density, Low Channel, 802.11n HT8**

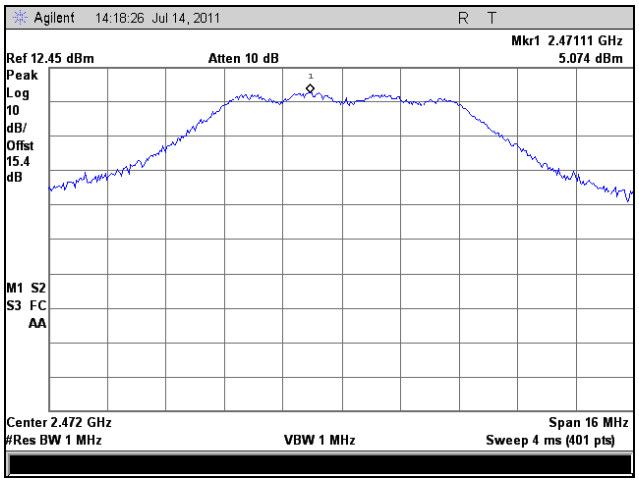



**Plot 27. Peak Spectral Density, Mid Channel, Peak Determination, 802.11n HT8**

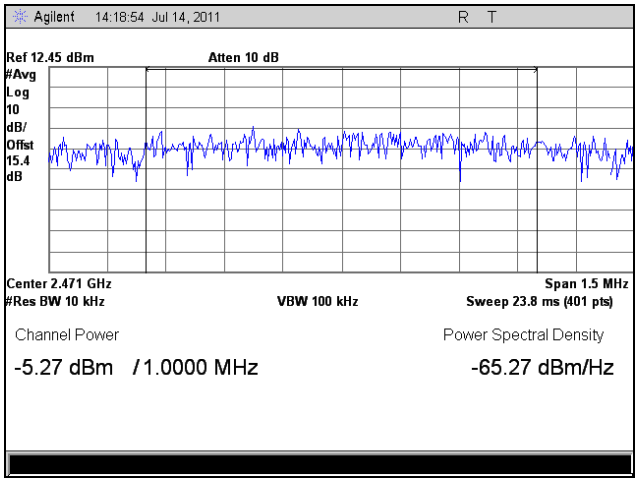
  




**Plot 28. Peak Spectral Density, Mid Channel, 802.11n HT8**

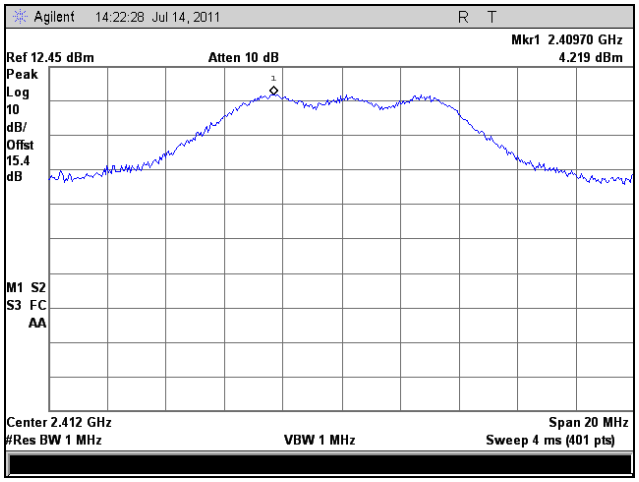



**Plot 29. Peak Spectral Density, High Channel, Peak Determination, 802.11n HT8**

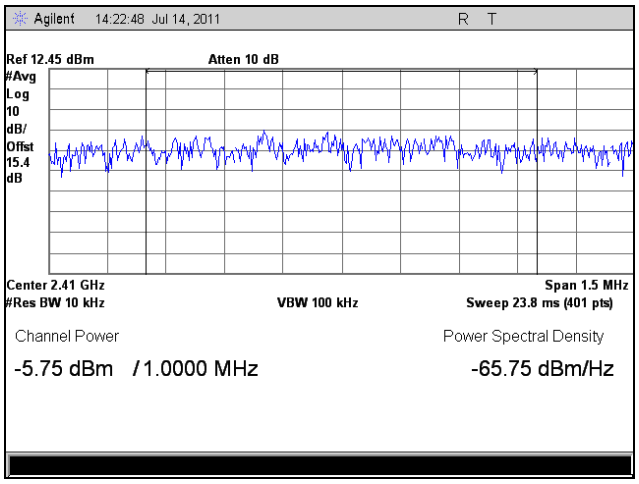



**Plot 30. Peak Spectral Density, High Channel, 802.11n HT8**

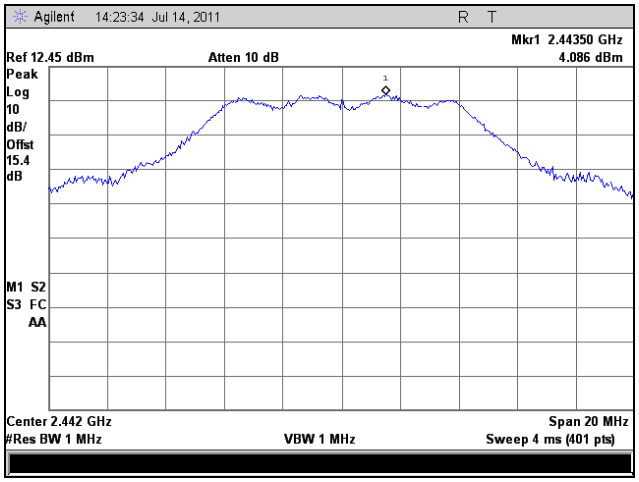
## Maximum EIRP Spectral Density, Test Results, 802.11n HT10



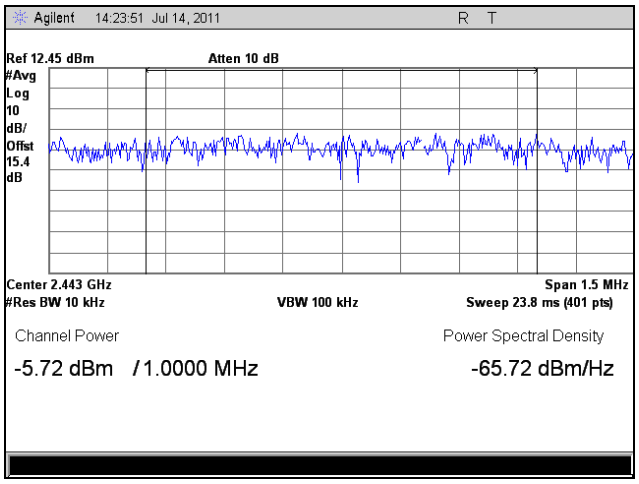

**Plot 31. Peak Spectral Density, Low Channel, Peak Determination, 802.11n HT10**



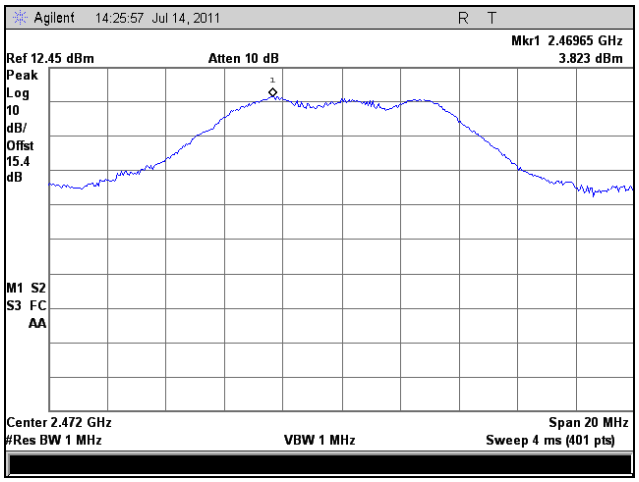

**Plot 32. Peak Spectral Density, Low Channel, 802.11n HT10**



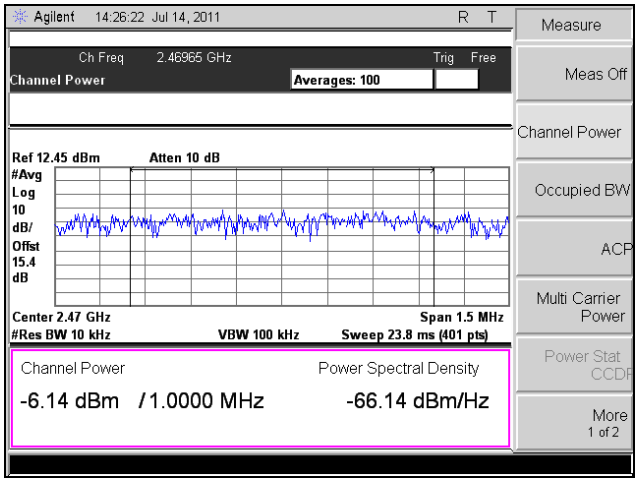

**Plot 33. Peak Spectral Density, Mid Channel, Peak Determination, 802.11n HT10**




**Plot 34. Peak Spectral Density, Mid Channel, 802.11n HT10**

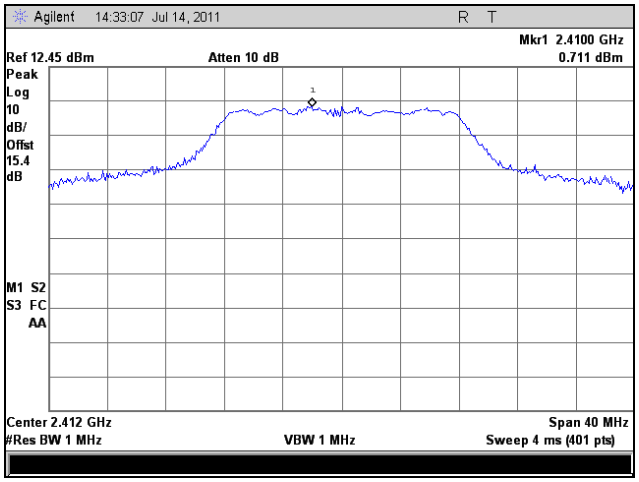



**Plot 35. Peak Spectral Density, High Channel, Peak Determination, 802.11n HT10**

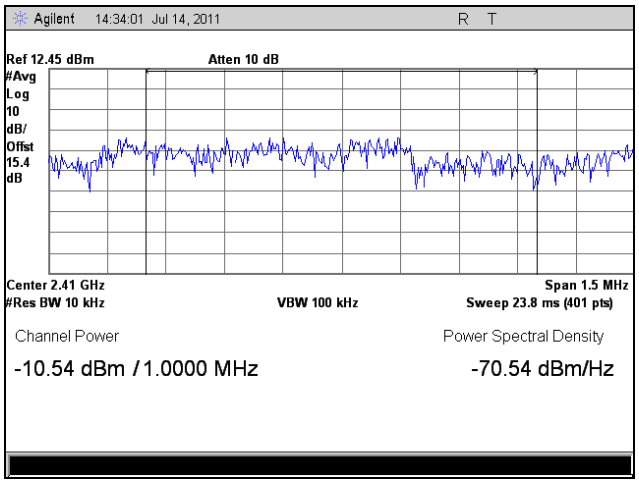



**Plot 36. Peak Spectral Density, High Channel, 802.11n HT10**

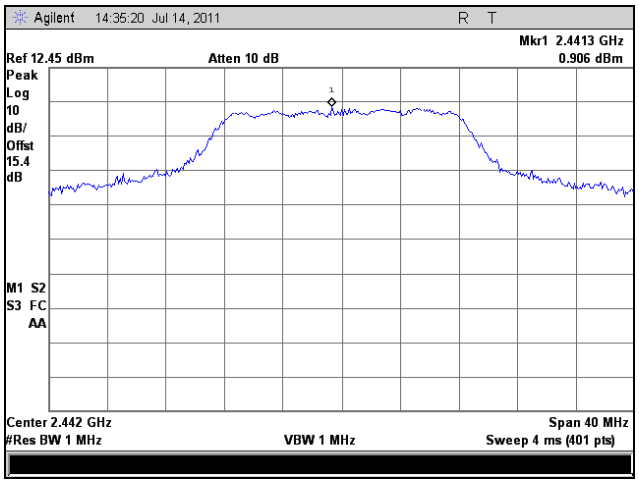
## Maximum EIRP Spectral Density, Test Results, 802.11n HT20



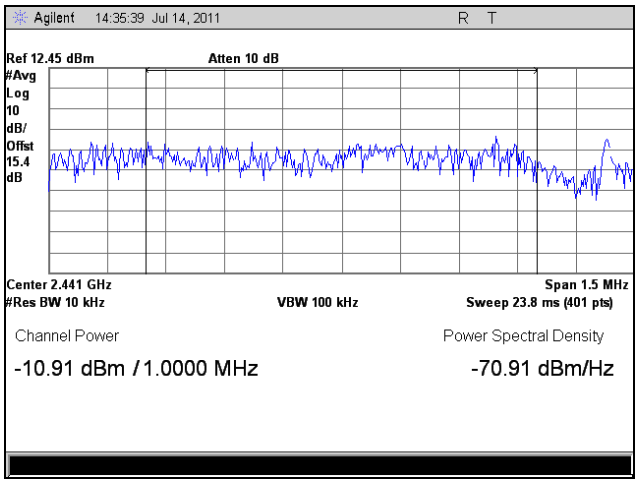

**Plot 37. Peak Spectral Density, Low Channel, Peak Determination, 802.11n HT20**



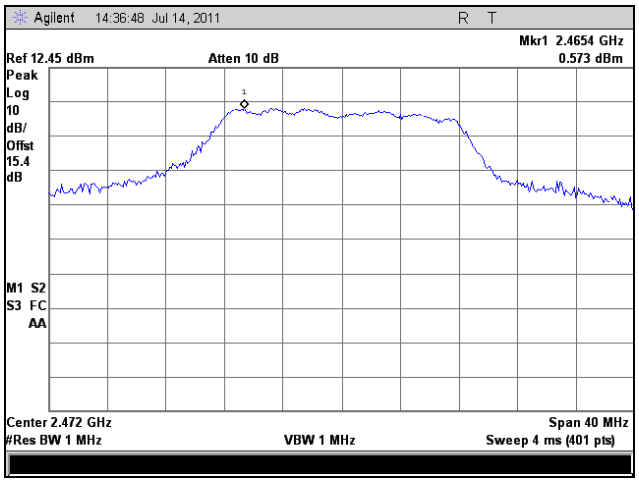

**Plot 38. Peak Spectral Density, Low Channel, 802.11n HT20**



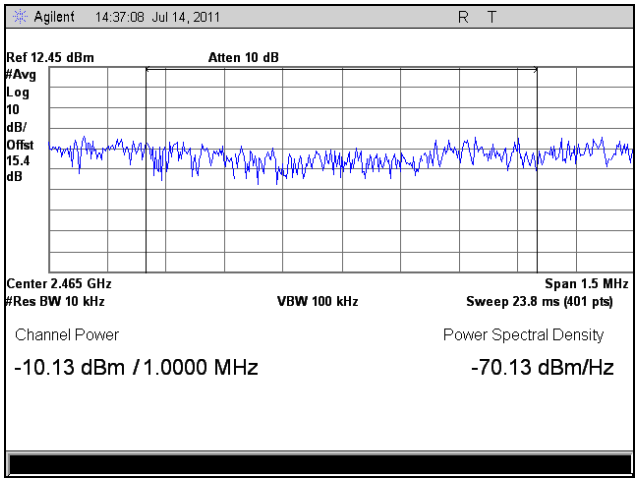

**Plot 39. Peak Spectral Density, Mid Channel, Peak Determination, 802.11n HT20**




**Plot 40. Peak Spectral Density, Mid Channel, 802.11n HT20**



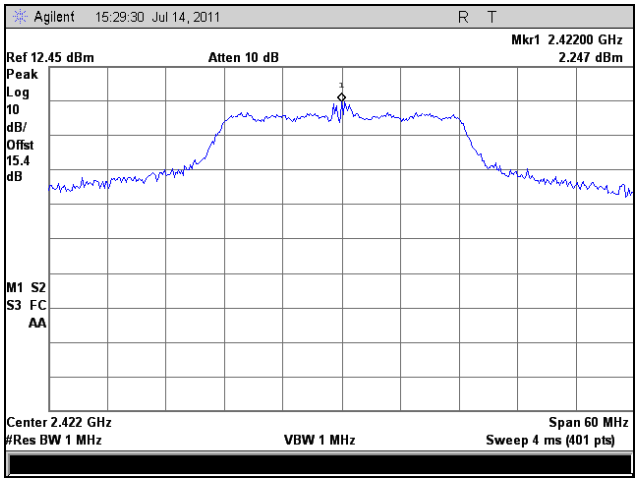

**Plot 41. Peak Spectral Density, High Channel, Peak Determination, 802.11n HT20**



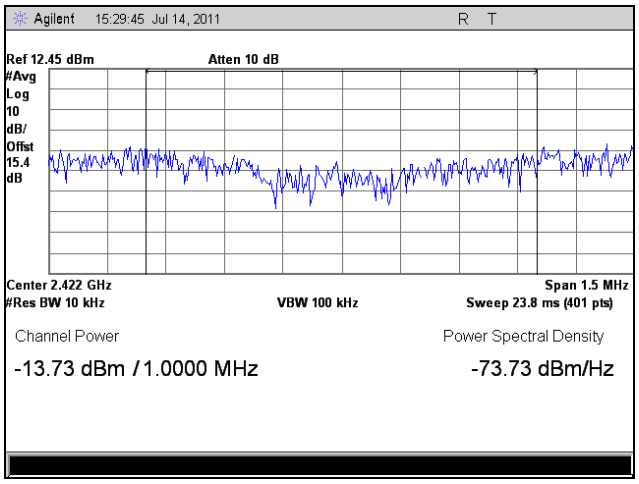

**Plot 42. Peak Spectral Density, High Channel, 802.11n HT20**

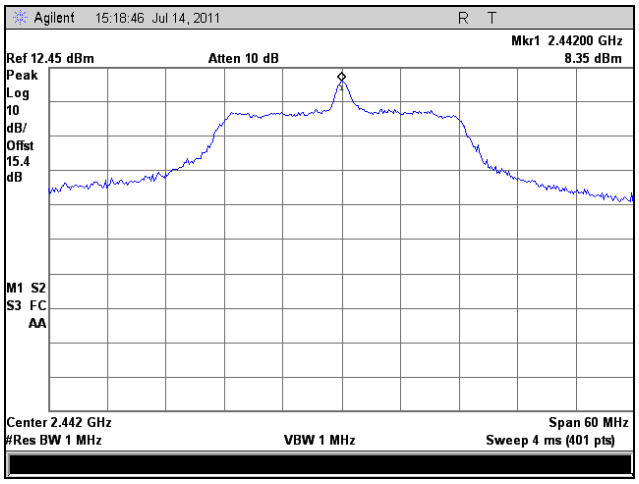
## Maximum EIRP Spectral Density, Test Results, 802.11n HT30




**Plot 43. Peak Spectral Density, Low Channel, Peak Determination, 802.11n HT30**

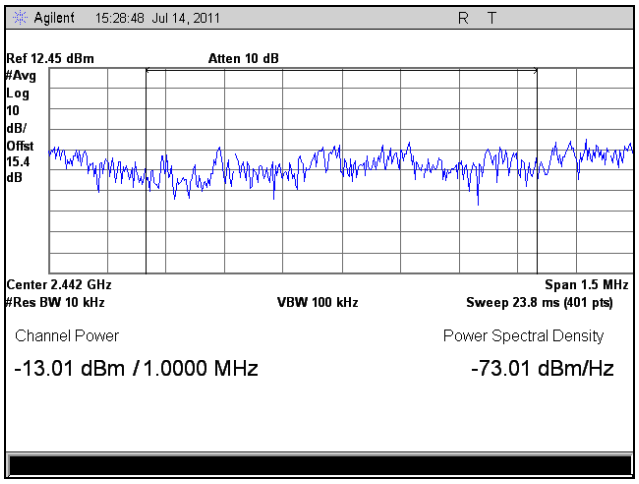



**Plot 44. Peak Spectral Density, Low Channel, 802.11n HT30**

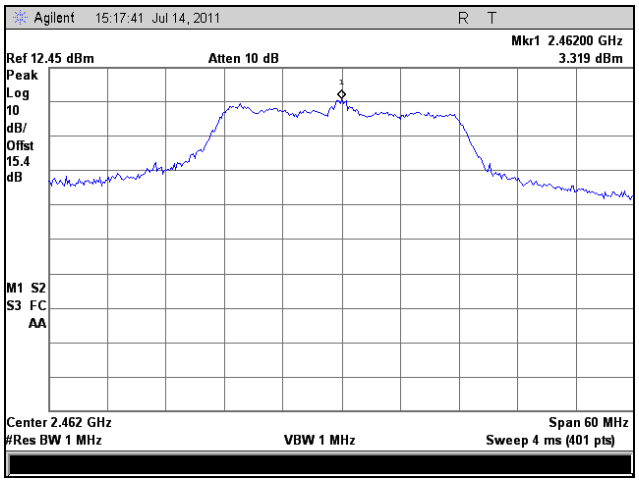



**Plot 45. Peak Spectral Density, Mid Channel, Peak Determination, 802.11n HT30**

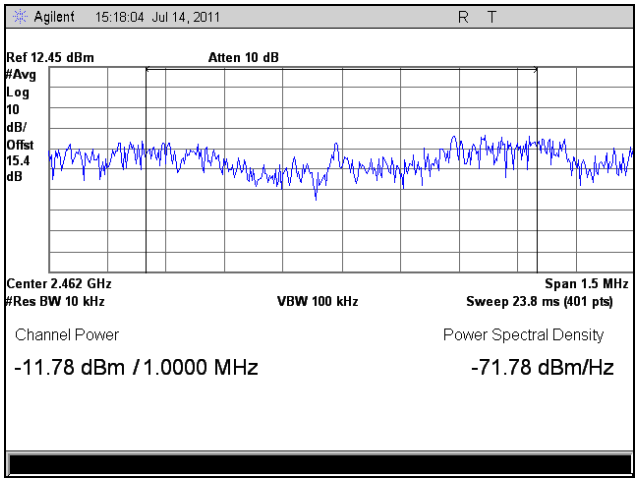
  




**Plot 46. Peak Spectral Density, Mid Channel, 802.11n HT30**

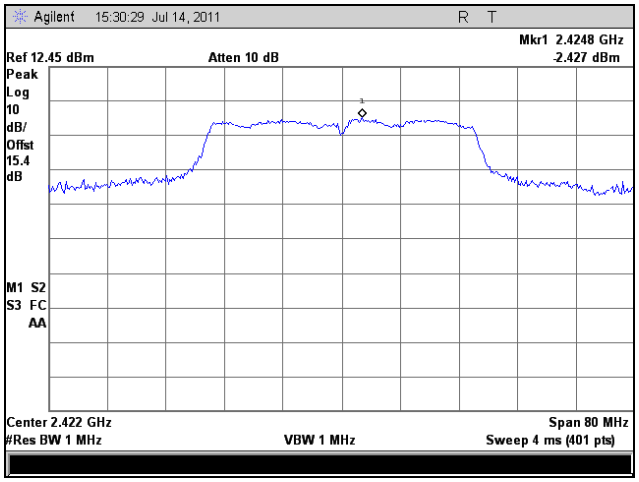



**Plot 47. Peak Spectral Density, High Channel, Peak Determination, 802.11n HT30**

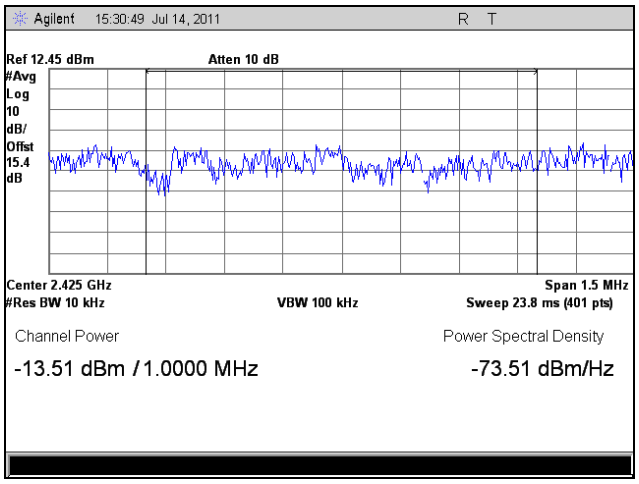



**Plot 48. Peak Spectral Density, High Channel, 802.11n HT30**

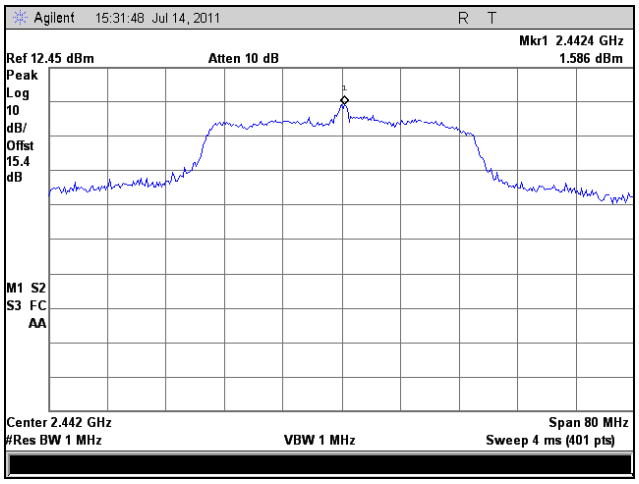
## Maximum EIRP Spectral Density, Test Results, 802.11n HT40



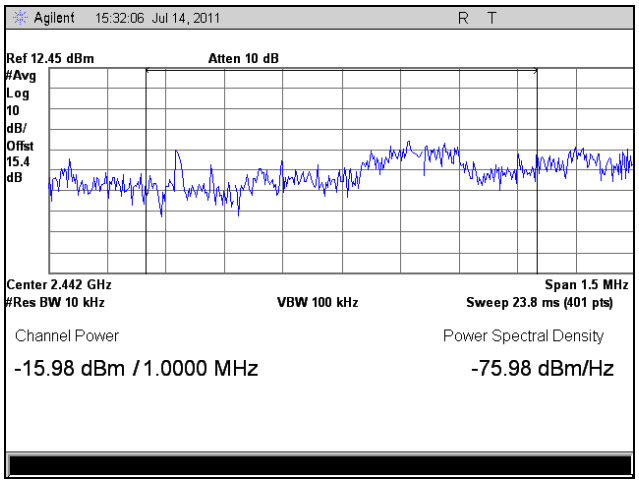

**Plot 49. Peak Spectral Density, Low Channel, Peak Determination, 802.11n HT40**



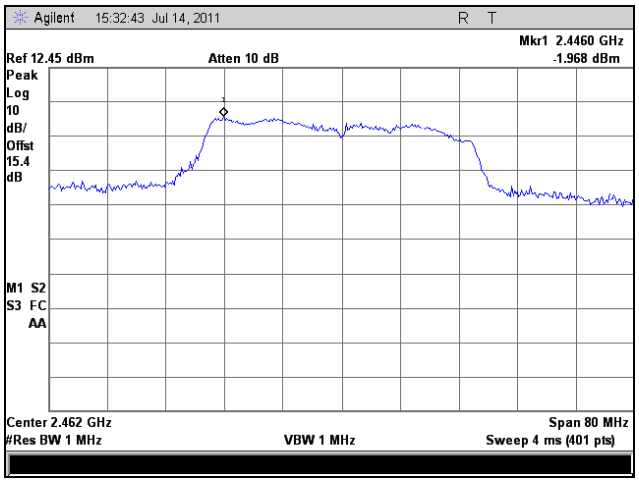

**Plot 50. Peak Spectral Density, Low Channel, 802.11n HT40**



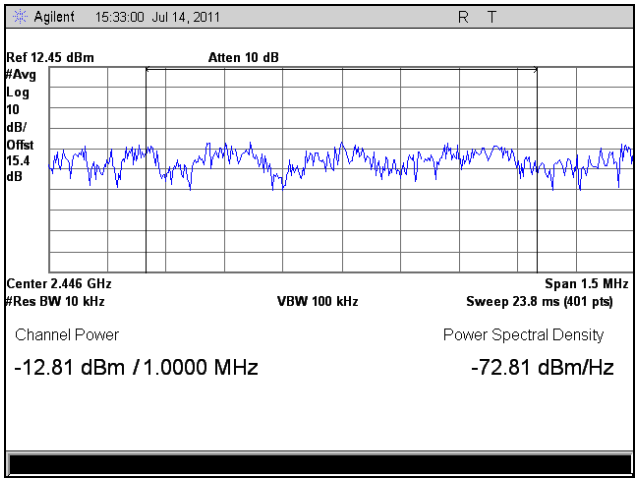

**Plot 51. Peak Spectral Density, Mid Channel, Peak Determination, 802.11n HT40**




**Plot 52. Peak Spectral Density, Mid Channel, 802.11n HT40**




**Plot 53. Peak Spectral Density, High Channel, Peak Determination, 802.11n HT40**




**Plot 54. Peak Spectral Density, High Channel, 802.11n HT40**

## Conformance Requirements

### 4.3.3 Frequency Range

**Test Requirement(s):** **EN 300 328 Clause 4.3.3:**

4.3.3.1 Definition

The frequency range of the equipment is determined by the lowest and highest frequencies occupied by the spectrum envelope.

*fH* is the highest frequency of the spectrum envelope: it is the frequency furthest above the frequency of maximum power where the EIRP spectral density drops below the level of -80 dBm/Hz (-30 dBm if measured in a 100 kHz bandwidth).

*fL* is the lowest frequency of the spectrum envelope; it is the frequency furthest below the frequency of maximum power where the EIRP spectral density drops below the level of -80 dBm/Hz (or -30 dBm if measured in a 100 kHz bandwidth).

For a given operating frequency, the width of the spectrum envelope is (*fH* - *fL*). In equipment that allows adjustment or selection of different operating frequencies, the power envelope takes up different positions in the allocated band. The frequency range is determined by the lowest value of *fL* and the highest value of *fH* resulting from the adjustment of the equipment to the lowest and highest operating frequencies.

4.3.3.2 Limit

For all equipment the frequency range shall lie within the band 2.4 GHz to 2.4835 GHz (*fL* > 2.4 GHz and *fH* < 2.4835 GHz).

**Test Procedure:** Option 1 (using a spectrum analyzer average detector) was used to perform testing. A positive 9 dB offset was programmed into SA to account for 9 dBi antenna.
Duty cycle x = 0.99 and does not add anything significant to measurement. Cable loss has been pre-programmed into SA.

**Test Results:** The EUT as tested was found compliant with the specified limits of Clause 4.3.3.2.

**Test Engineer:** Anderson Soungpanya

**Test Date:** 07/14/11

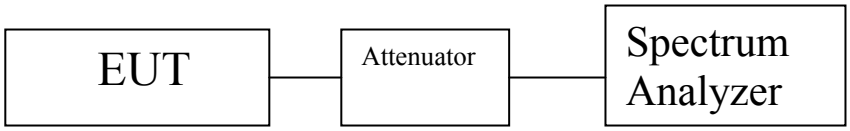



**Figure 4. Frequency Range Test Setup**

## Frequency Range, Test Results

| Frequency Range Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| Temperature (C) | Voltage AC | Mode | Frequency ($f_L$) MHz | Frequency ($f_H$) MHz | Frequency (fH-fL) MHz | Limit MHz | Margin MHz |
| 20 | 230 | 802.11b | 2402.58 | 2481.47 | 78.89 | 83.5 | -4.61 |
| 70 | 253 | 802.11b | 2402.53 | 2480.97 | 78.44 | 83.5 | -5.06 |
| 70 | 207 | 802.11b | 2402.53 | 2480.87 | 78.34 | 83.5 | -5.16 |
| -30 | 253 | 802.11b | 2402.43 | 2481.62 | 79.19 | 83.5 | -4.31 |
| -30 | 207 | 802.11b | 2402.53 | 2481.67 | 79.14 | 83.5 | -4.36 |

**Table 16. Frequency Range, Test Results, 802.11b**

| Frequency Range Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| Temperature (C) | Voltage AC | Mode | Frequency ($f_L$) MHz | Frequency ($f_H$) MHz | Frequency (fH-fL) MHz | Limit MHz | Margin MHz |
| 20 | 230 | 802.11g 20MHz | 2402.43 | 2481.52 | 79.09 | 83.5 | -4.41 |
| 70 | 253 | 802.11g 20MHz | 2402.63 | 2480.82 | 78.19 | 83.5 | -5.31 |
| 70 | 207 | 802.11g 20MHz | 2402.68 | 2480.92 | 78.24 | 83.5 | -5.26 |
| -30 | 253 | 802.11g 20MHz | 2402.33 | 2482.12 | 79.79 | 83.5 | -3.71 |
| -30 | 207 | 802.11g 20MHz | 2402.38 | 2482.07 | 79.69 | 83.5 | -3.81 |

**Table 17. Frequency Range, Test Results, 802.11g 20 MHz**

| Frequency Range Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| Temperature (C) | Voltage AC | Mode | Frequency ($f_L$) MHz | Frequency ($f_H$) MHz | Frequency (fH-fL) MHz | Limit MHz | Margin MHz |
| 20 | 230 | 802.11g 40MHz | 2403.05 | 2480.65 | 77.60 | 83.5 | -5.90 |
| 70 | 253 | 802.11g 40MHz | 2403.25 | 2480.45 | 77.20 | 83.5 | -6.30 |
| 70 | 207 | 802.11g 40MHz | 2403.25 | 2480.45 | 77.20 | 83.5 | -6.30 |
| -30 | 253 | 802.11g 40MHz | 2403.15 | 2480.95 | 77.80 | 83.5 | -5.70 |
| -30 | 207 | 802.11g 40MHz | 2403.05 | 2480.95 | 77.90 | 83.5 | -5.60 |

**Table 18. Frequency Range, Test Results, 802.11g 40 MHz**

| Frequency Range Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Temperature (C)** | **Voltage AC** | **Mode** | **Frequency ($f_L$) MHz** | **Frequency ($f_H$) MHz** | **Frequency (fH-fL) MHz** | **Limit MHz** | **Margin MHz** |
| 20 | 230 | HT20 | 2400.28 | 2481.92 | 81.64 | 83.5 | -1.86 |
| 70 | 253 | HT20 | 2400.58 | 2481.02 | 80.44 | 83.5 | -3.06 |
| 70 | 207 | HT20 | 2400.63 | 2480.87 | 80.24 | 83.5 | -3.26 |
| -30 | 253 | HT20 | 2400.23 | 2483.37 | 83.14 | 83.5 | -0.36 |
| -30 | 207 | HT20 | 2400.23 | 2483.47 | 83.24 | 83.5 | -0.26 |

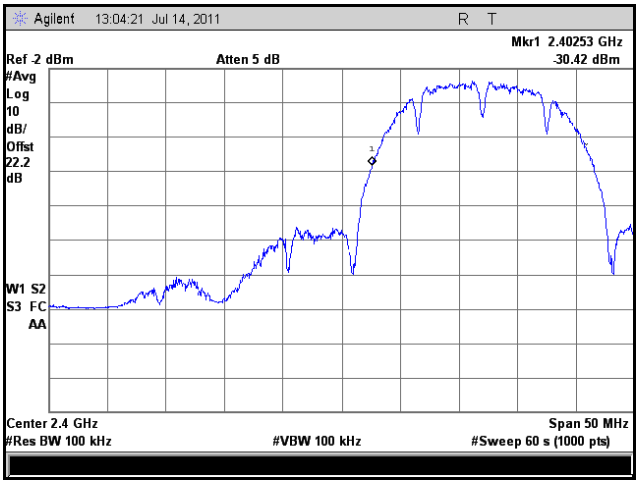
**Table 19. Frequency Range, Test Results, 802.11n HT20**

| Frequency Range Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Temperature (C)** | **Voltage AC** | **Mode** | **Frequency ($f_L$) MHz** | **Frequency ($f_H$) MHz** | **Frequency (fH-fL) MHz** | **Limit MHz** | **Margin MHz** |
| 20 | 230 | HT40 | 2401.25 | 2480.55 | 79.30 | 83.5 | -4.20 |
| 70 | 253 | HT40 | 2402.45 | 2480.45 | 78.00 | 83.5 | -5.50 |
| 70 | 207 | HT40 | 2402.15 | 2480.45 | 78.30 | 83.5 | -5.20 |
| -30 | 253 | HT40 | 2400.25 | 2481.95 | 81.70 | 83.5 | -1.80 |
| -30 | 207 | HT40 | 2400.55 | 2481.95 | 81.40 | 83.5 | -2.10 |

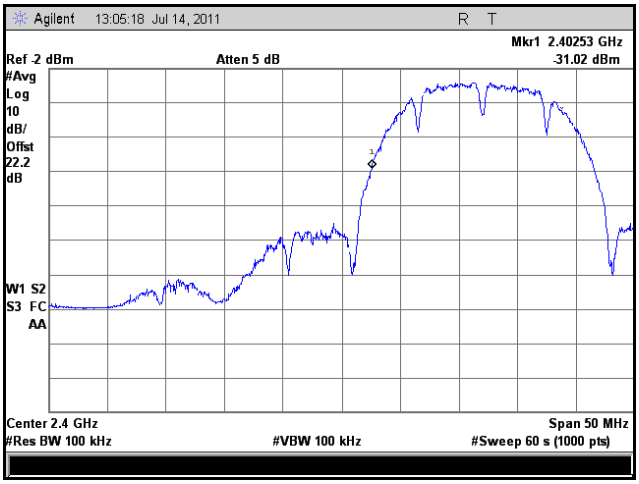
**Table 20. Frequency Range, Test Results, 802.11n HT40**

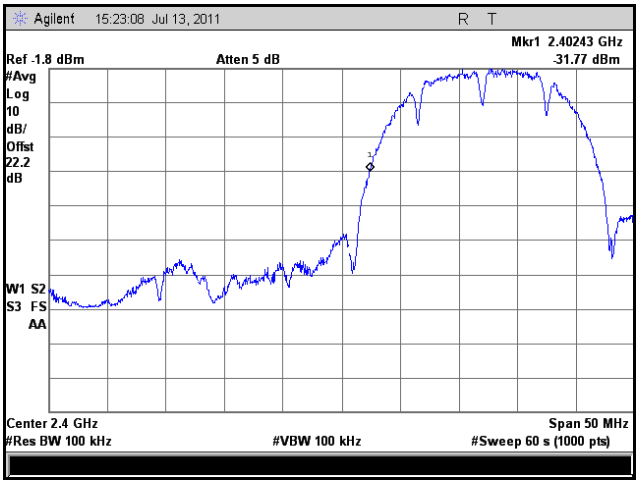
## Frequency Range, Test Results, 802.11b



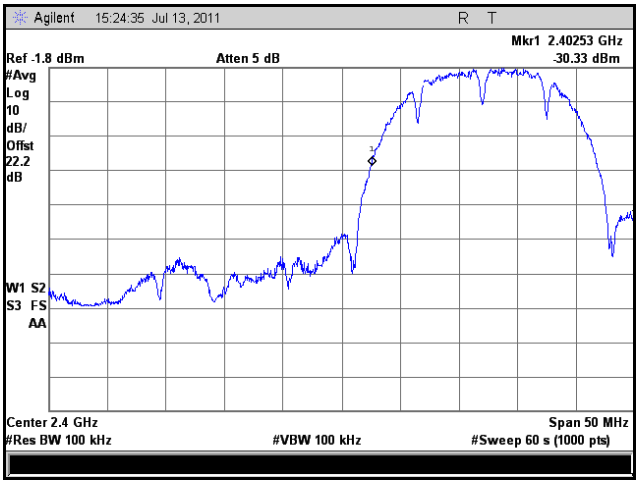

**Plot 55. Frequency Range, Low Channel, High Temperature, High Voltage, 802.11b**



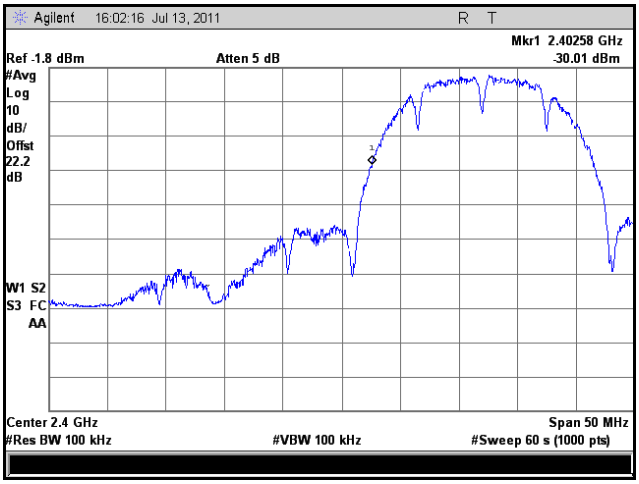

**Plot 56. Frequency Range, Low Channel, High Temperature, Low Voltage, 802.11b**



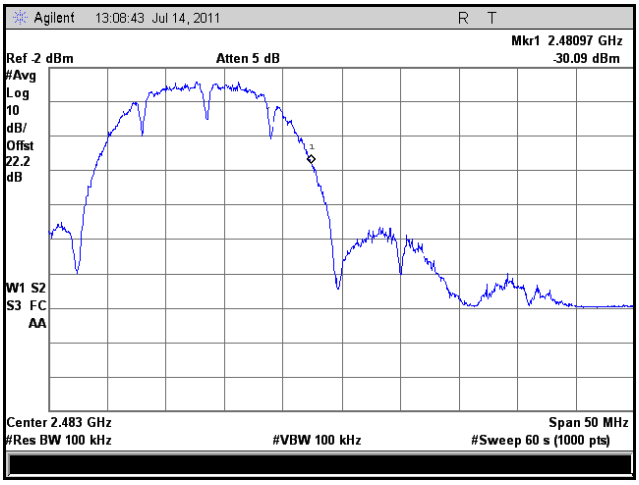

**Plot 57. Frequency Range, Low Channel, Low Temperature, High Voltage, 802.11b**



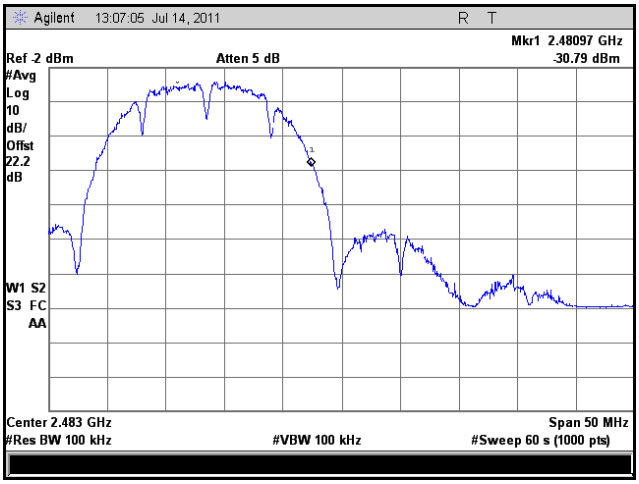

**Plot 58. Frequency Range, Low Channel, Low Temperature, Low Voltage, 802.11b**



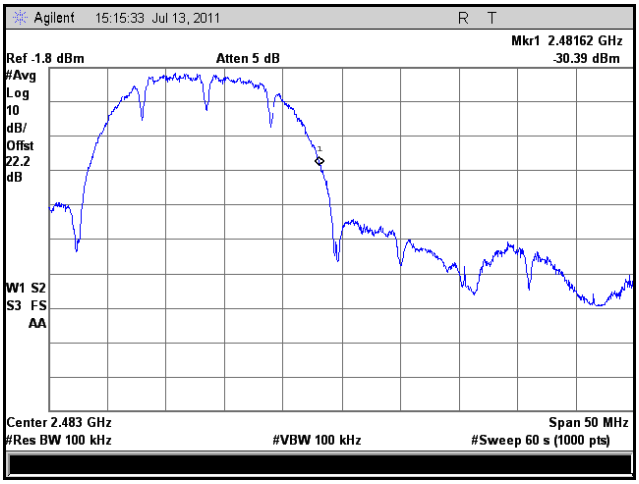

**Plot 59. Frequency Range, Low Channel, Nom. Temperature, Nom. Voltage, 802.11b**



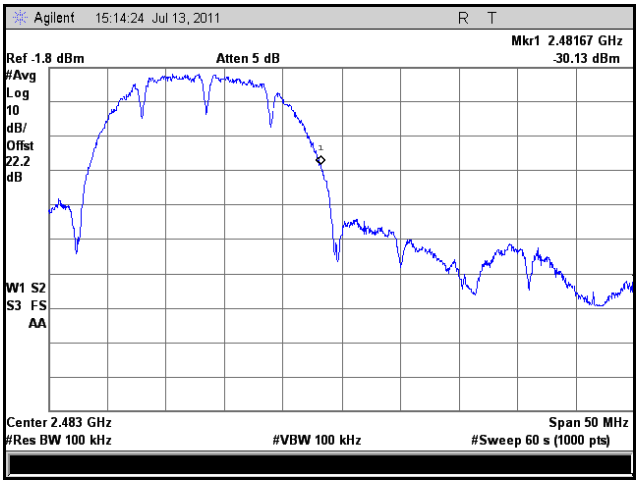

**Plot 60. Frequency Range, High Channel, High Temperature, High Voltage, 802.11b**



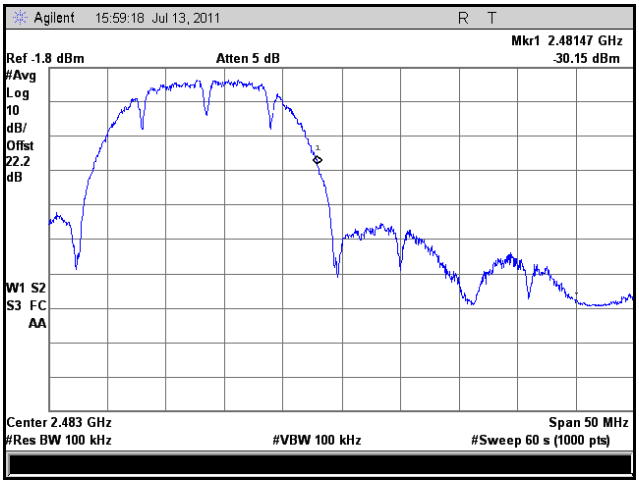

**Plot 61. Frequency Range, High Channel, High Temperature, Low Voltage, 802.11b**




**Plot 62. Frequency Range, High Channel, Low Temperature, High Voltage, 802.11b**

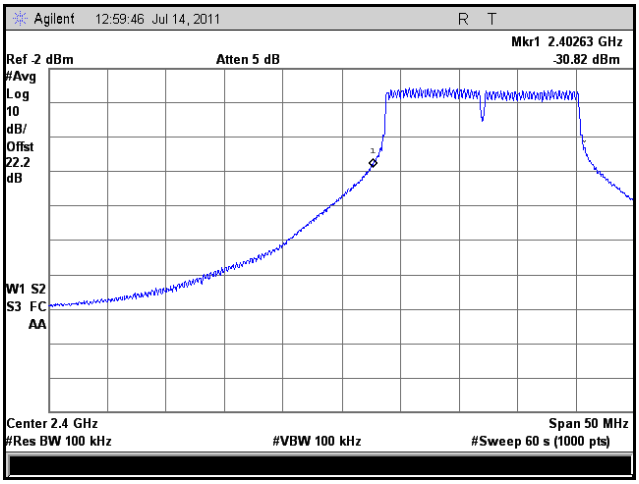



**Plot 63. Frequency Range, High Channel, Low Temperature, Low Voltage, 802.11b**

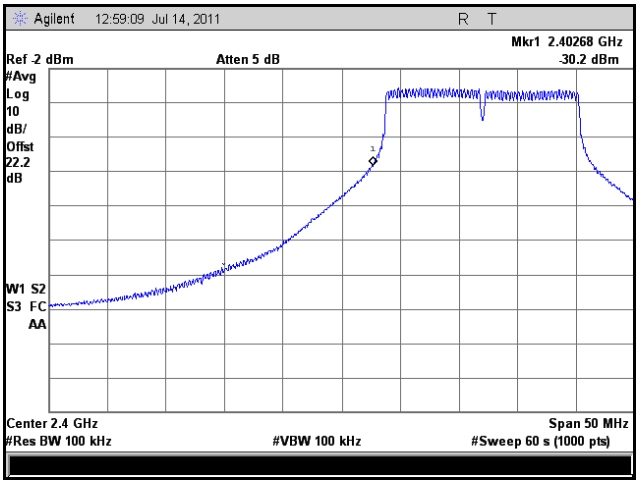



**Plot 64. Frequency Range, High Channel, Nom. Temperature, Nom. Voltage, 802.11b**

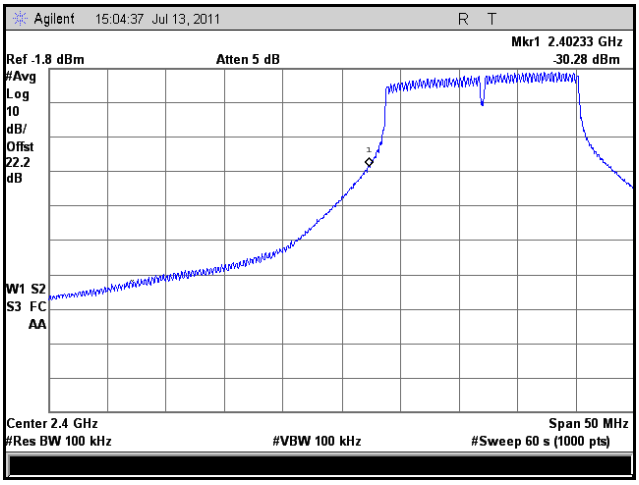
## Frequency Range, Test Results, 802.11g 20 MHz



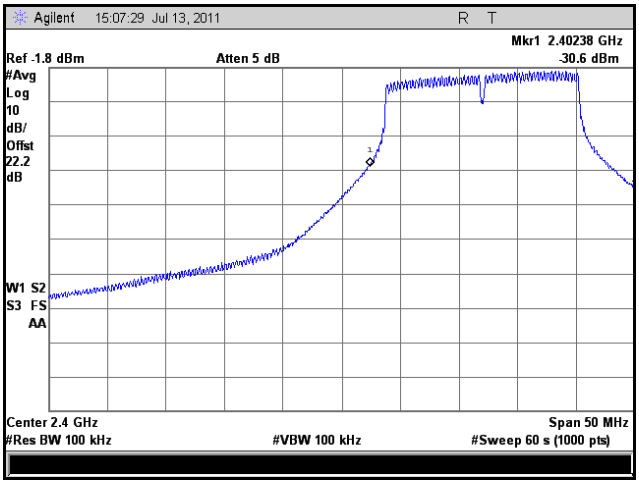

**Plot 65. Frequency Range, Low Channel, High Temperature, High Voltage, 802.11g 20 MHz**



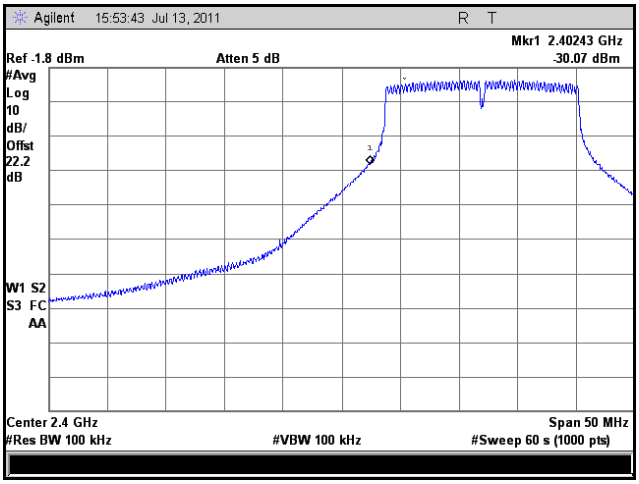

**Plot 66. Frequency Range, Low Channel, High Temperature, Low Voltage, 802.11g 20 MHz**



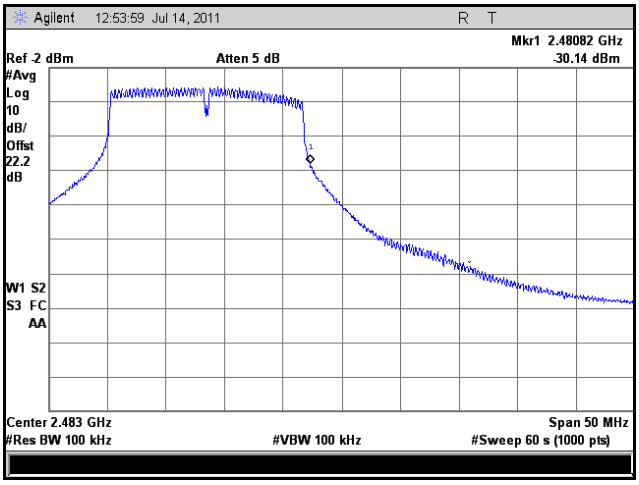

**Plot 67. Frequency Range, Low Channel, Low Temperature, High Voltage, 802.11g 20 MHz**



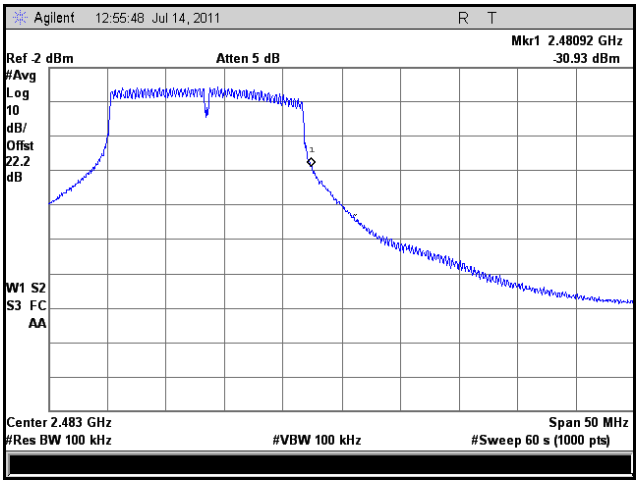

**Plot 68. Frequency Range, Low Channel, Low Temperature, Low Voltage, 802.11g 20 MHz**



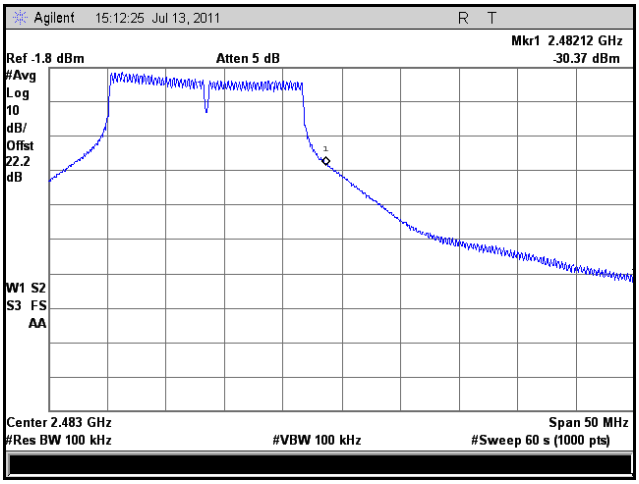

**Plot 69. Frequency Range, Low Channel, Nom. Temperature, Nom. Voltage, 802.11g 20 MHz**



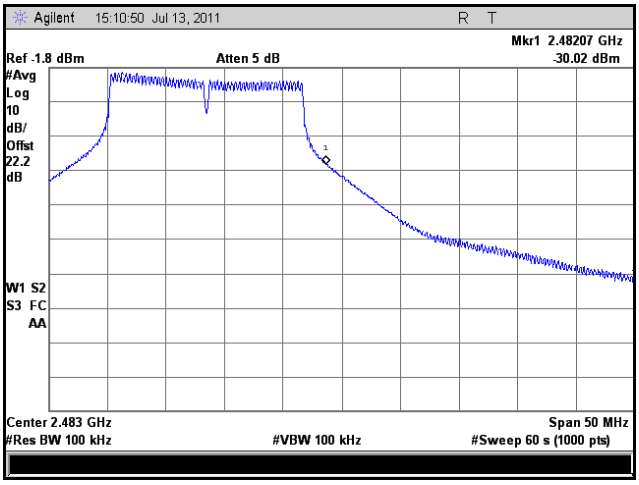

**Plot 70. Frequency Range, High Channel, High Temperature, High Voltage, 802.11g 20 MHz**



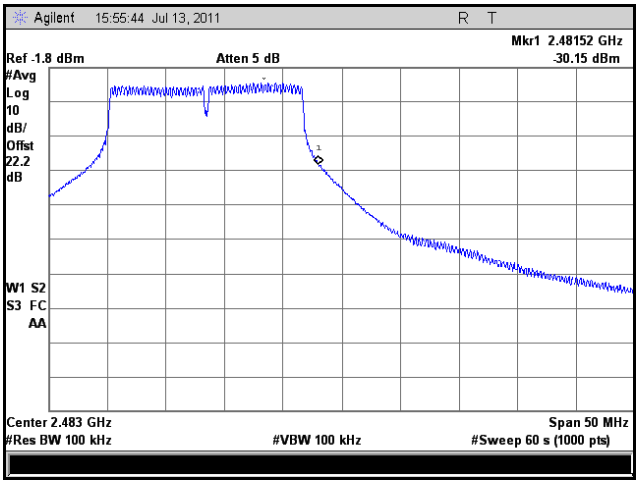

**Plot 71. Frequency Range, High Channel, High Temperature, Low Voltage, 802.11g 20 MHz**




**Plot 72. Frequency Range, High Channel, Low Temperature, High Voltage, 802.11g 20 MHz**

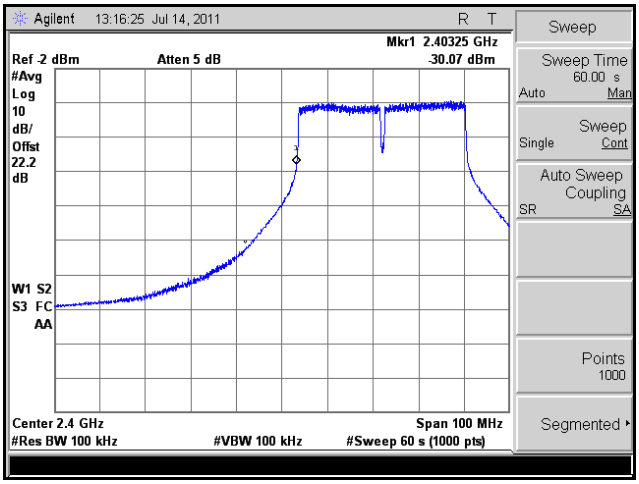



**Plot 73. Frequency Range, High Channel, Low Temperature, Low Voltage, 802.11g 20 MHz**

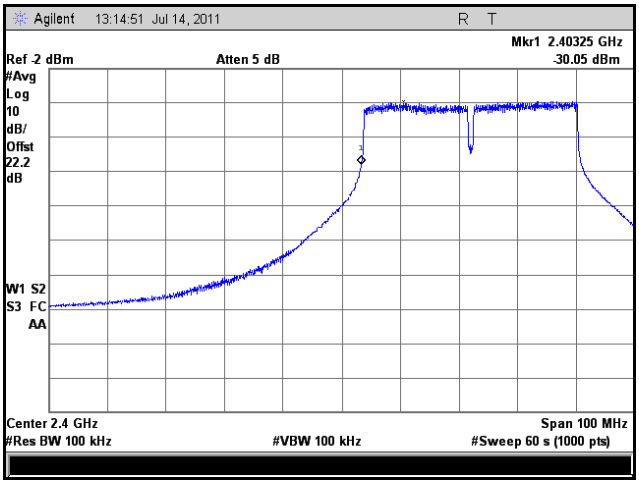



**Plot 74. Frequency Range, High Channel, Nom. Temperature, Nom. Voltage, 802.11g 20 MHz**

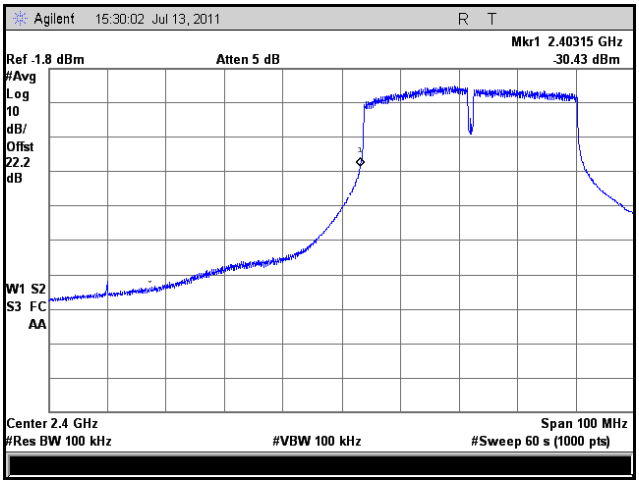
## Frequency Range, Test Results, 802.11g 40 MHz



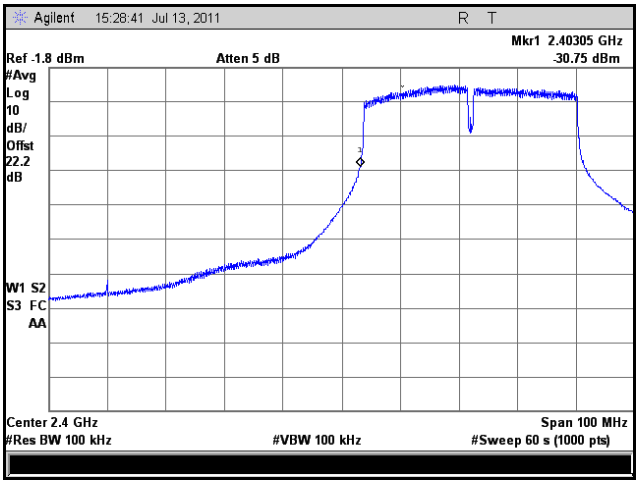

**Plot 75. Frequency Range, Low Channel, High Temperature, High Voltage, 802.11g 40 MHz**



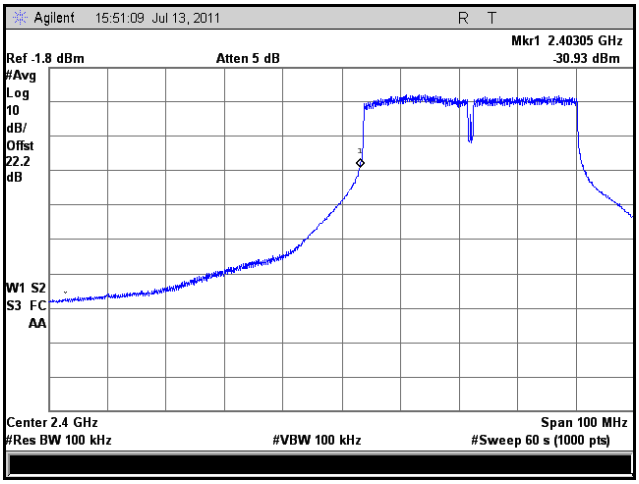

**Plot 76. Frequency Range, Low Channel, High Temperature, Low Voltage, 802.11g 40 MHz**



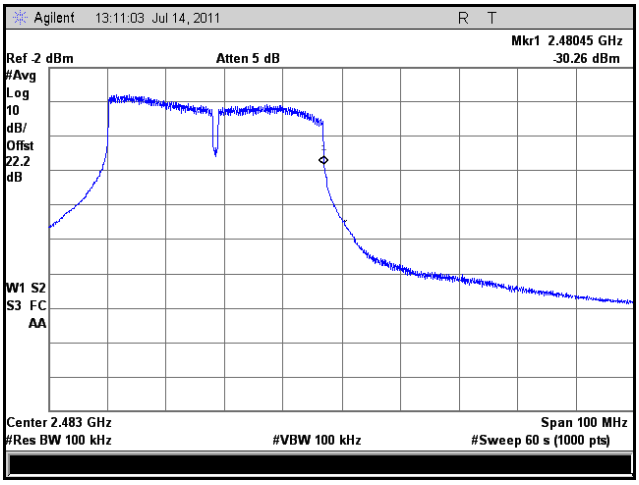

**Plot 77. Frequency Range, Low Channel, Low Temperature, High Voltage, 802.11g 40 MHz**



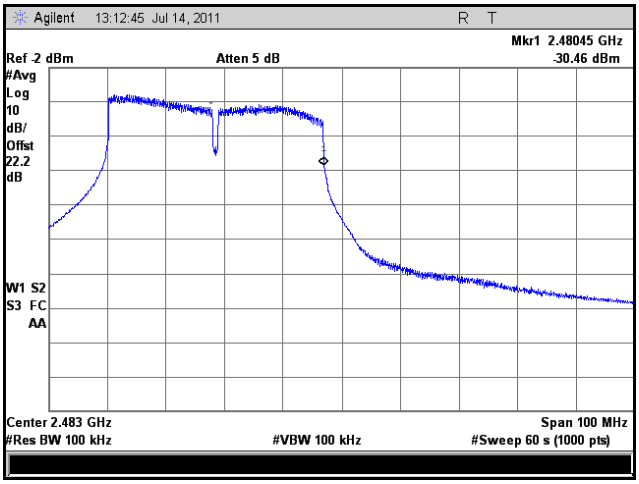

**Plot 78. Frequency Range, Low Channel, Low Temperature, Low Voltage, 802.11g 40 MHz**



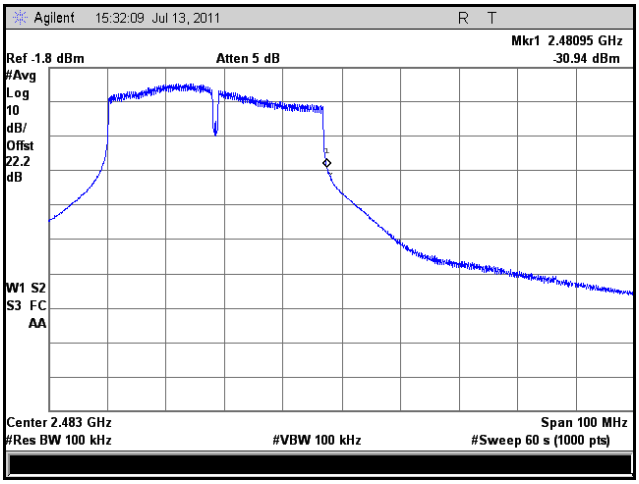

**Plot 79. Frequency Range, Low Channel, Nom. Temperature, Nom. Voltage, 802.11g 40 MHz**



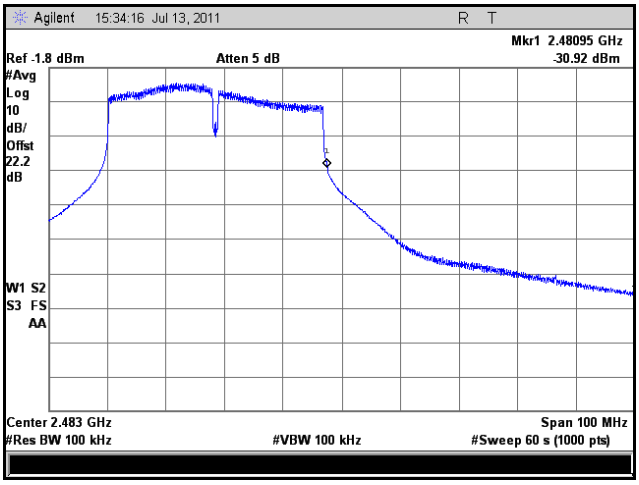

**Plot 80. Frequency Range, High Channel, High Temperature, High Voltage, 802.11g 40 MHz**



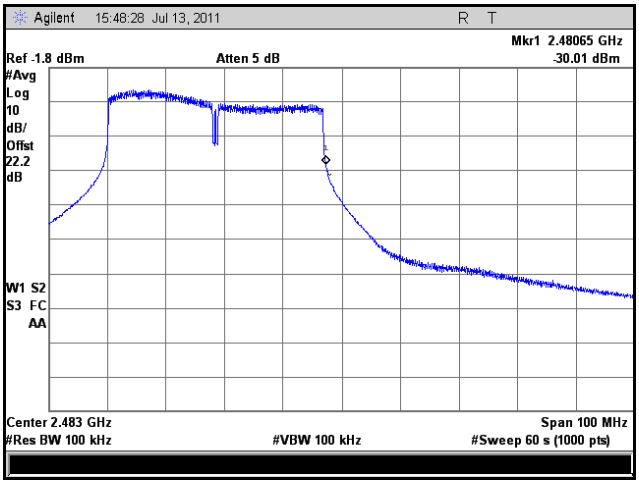

**Plot 81. Frequency Range, High Channel, High Temperature, Low Voltage, 802.11g 40 MHz**




**Plot 82. Frequency Range, High Channel, Low Temperature, High Voltage, 802.11g 40 MHz**

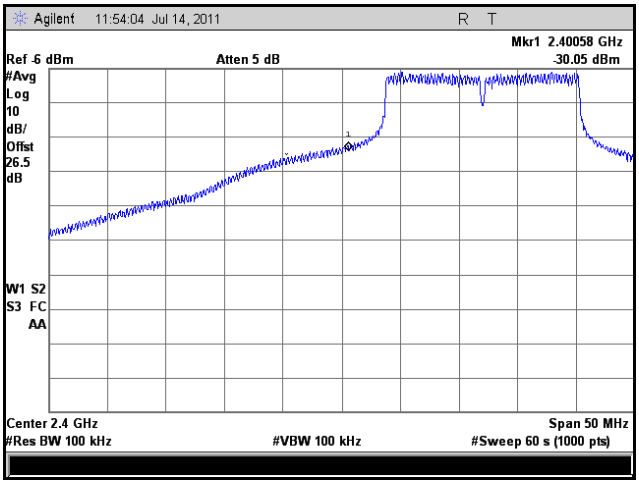



**Plot 83. Frequency Range, High Channel, Low Temperature, Low Voltage, 802.11g 40 MHz**

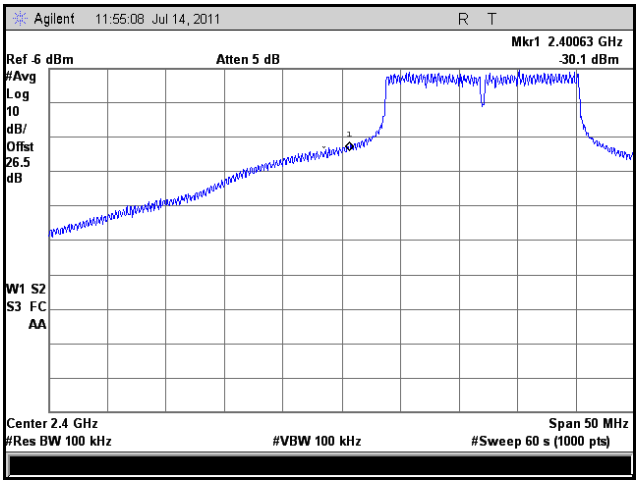



**Plot 84. Frequency Range, High Channel, Nom. Temperature, Nom. Voltage, 802.11g 40 MHz**

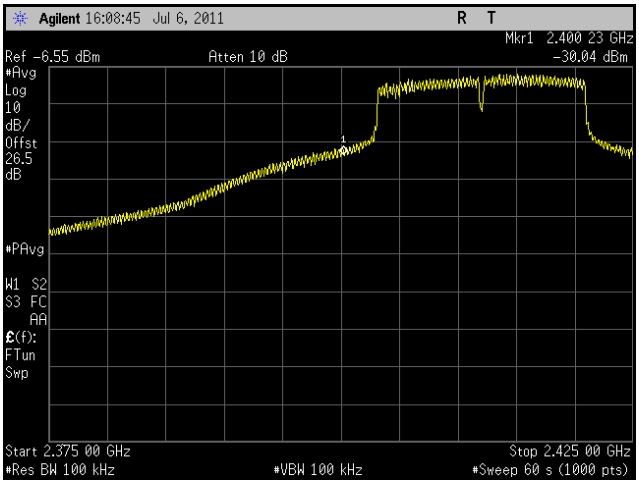
## Frequency Range, Test Results, 802.11n HT20



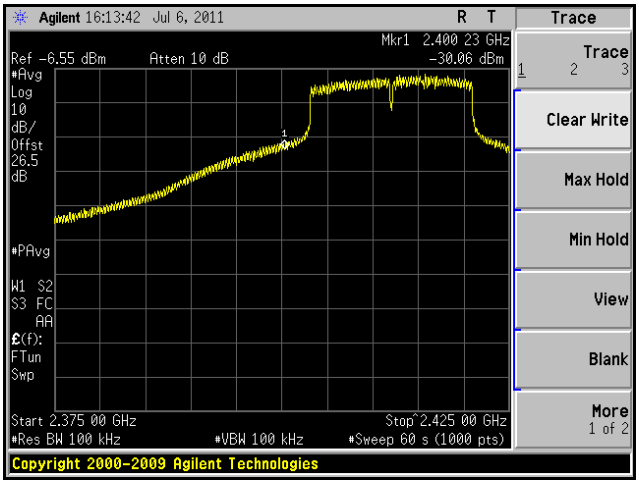

**Plot 85. Frequency Range, Low Channel, High Temperature, High Voltage, 802.11n HT20**



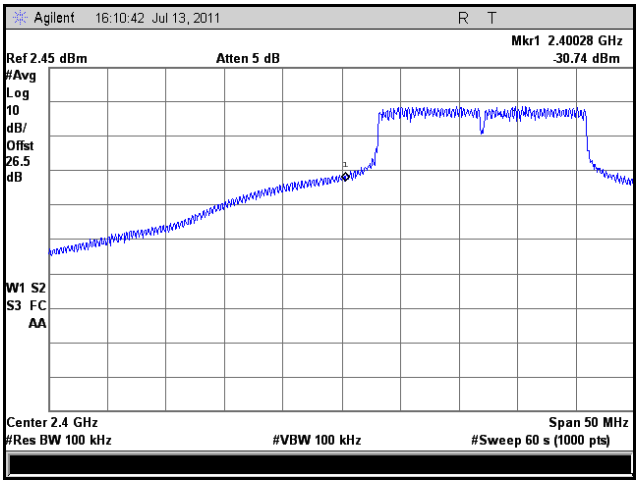

**Plot 86. Frequency Range, Low Channel, High Temperature, Low Voltage, 802.11n HT20**



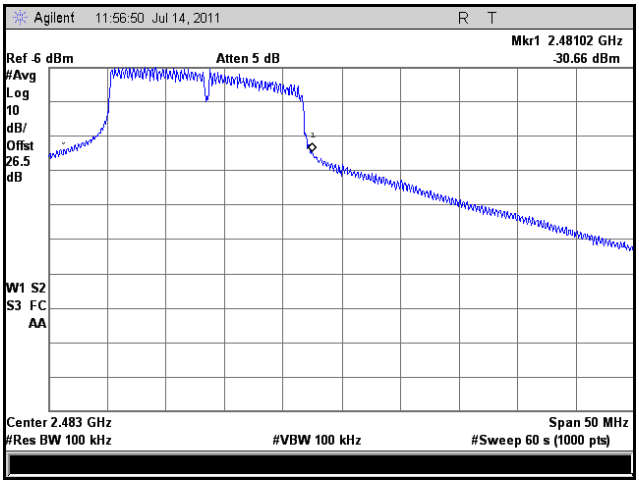

**Plot 87. Frequency Range, Low Channel, Low Temperature, High Voltage, 802.11n HT20**



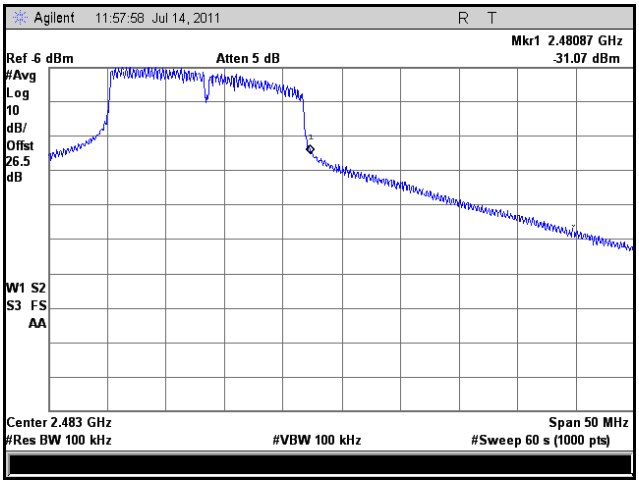

**Plot 88. Frequency Range, Low Channel, Low Temperature, Low Voltage, 802.11n HT20**



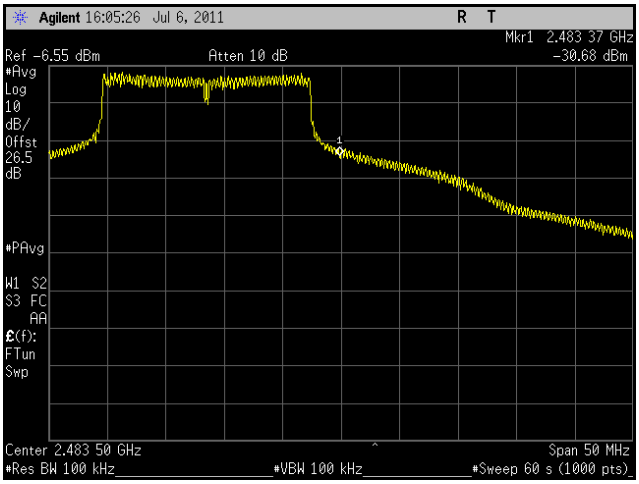

**Plot 89. Frequency Range, Low Channel, Nom. Temperature, Nom. Voltage, 802.11n HT20**



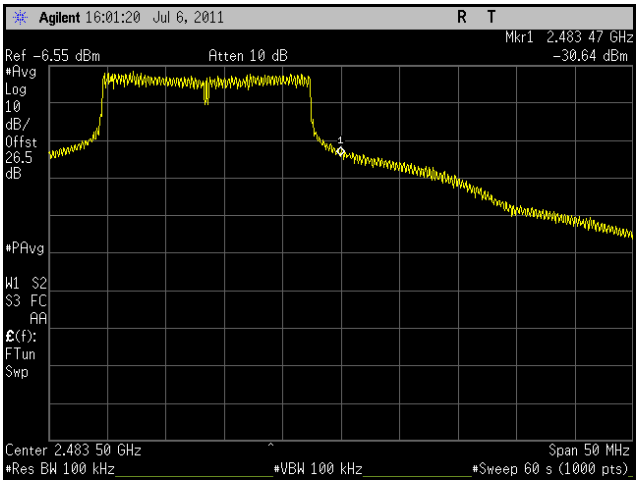

**Plot 90. Frequency Range, High Channel, High Temperature, High Voltage, 802.11n HT20**




**Plot 91. Frequency Range, High Channel, High Temperature, Low Voltage, 802.11n HT20**

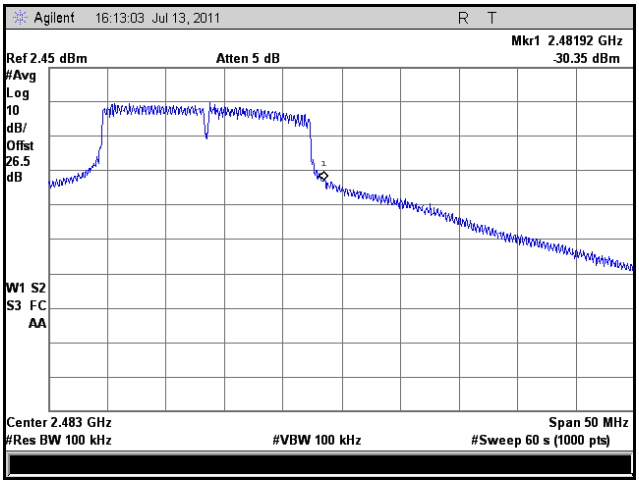



**Plot 92. Frequency Range, High Channel, Low Temperature, High Voltage, 802.11n HT20**



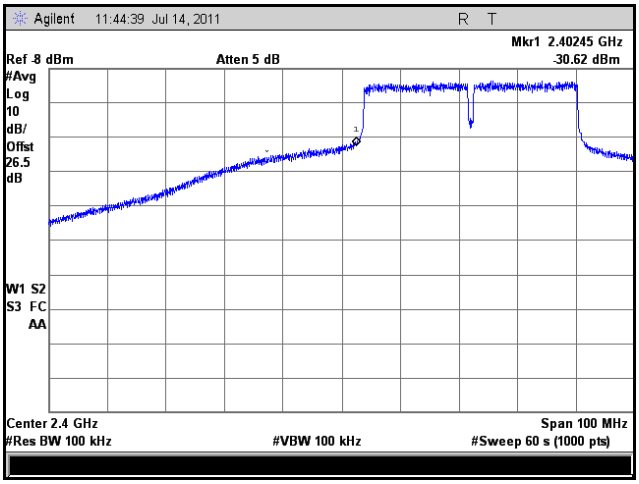

**Plot 93. Frequency Range, High Channel, Low Temperature, Low Voltage, 802.11n HT20**

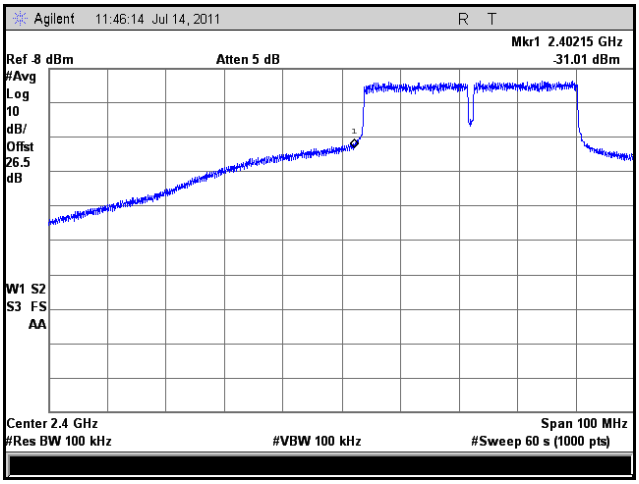



**Plot 94. Frequency Range, High Channel, Nom. Temperature, Nom. Voltage, 802.11n HT20**

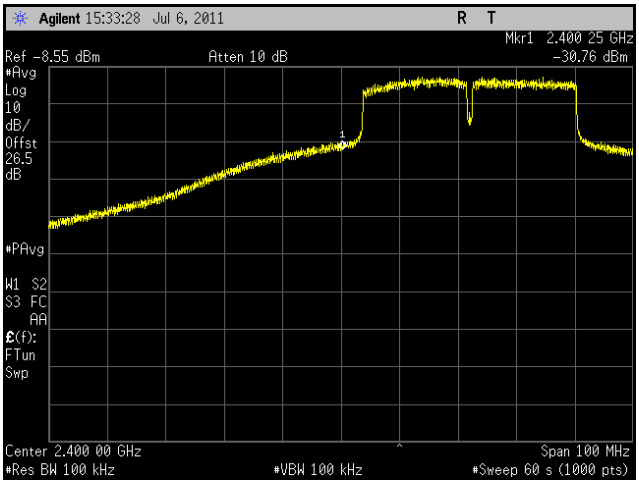
## Frequency Range, Test Results, 802.11n HT40



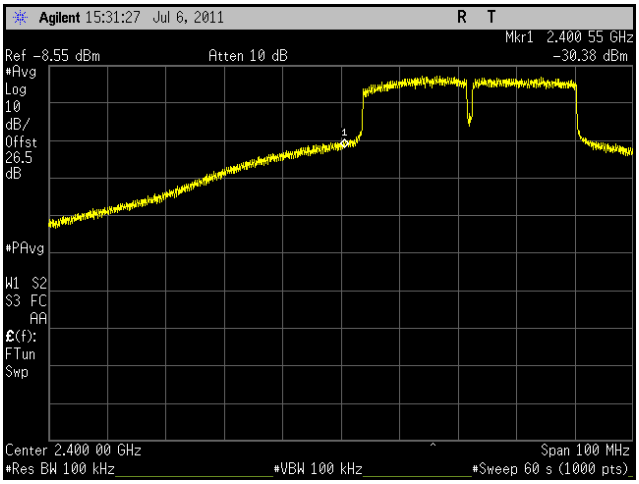

**Plot 95. Frequency Range, Low Channel, High Temperature, High Voltage, 802.11n HT40**



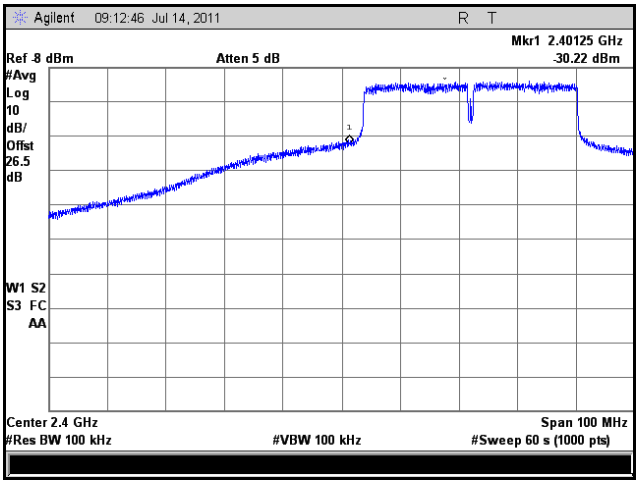

**Plot 96. Frequency Range, Low Channel, High Temperature, Low Voltage, 802.11n HT40**



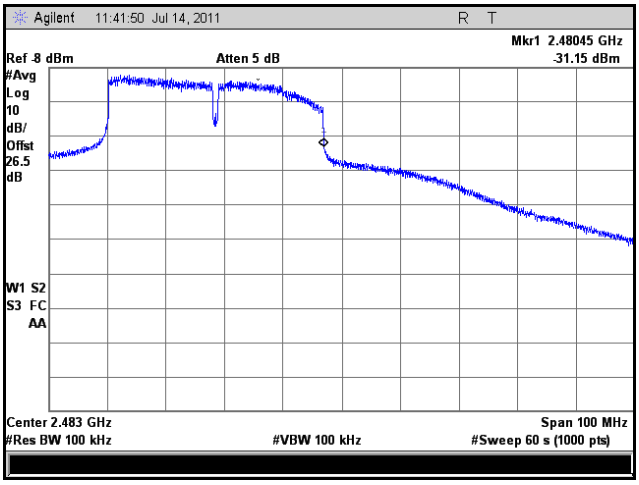

**Plot 97. Frequency Range, Low Channel, Low Temperature, High Voltage, 802.11n HT40**



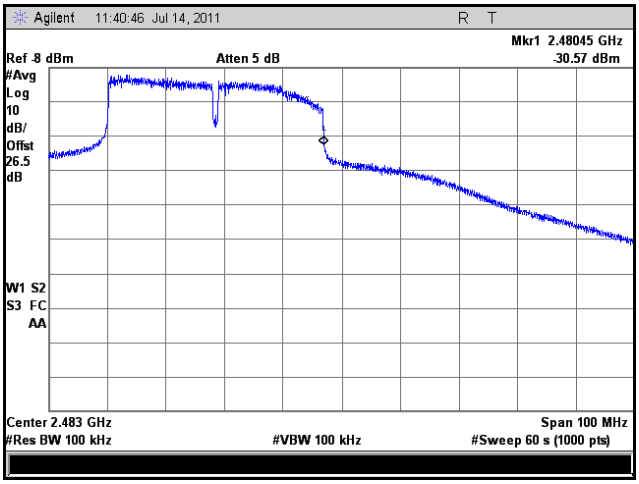

**Plot 98. Frequency Range, Low Channel, Low Temperature, Low Voltage, 802.11n HT40**



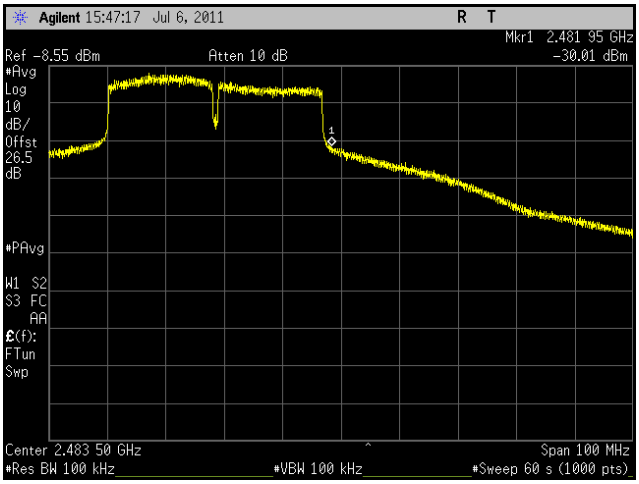

**Plot 99. Frequency Range, Low Channel, Nom. Temperature, Nom. Voltage, 802.11n HT40**



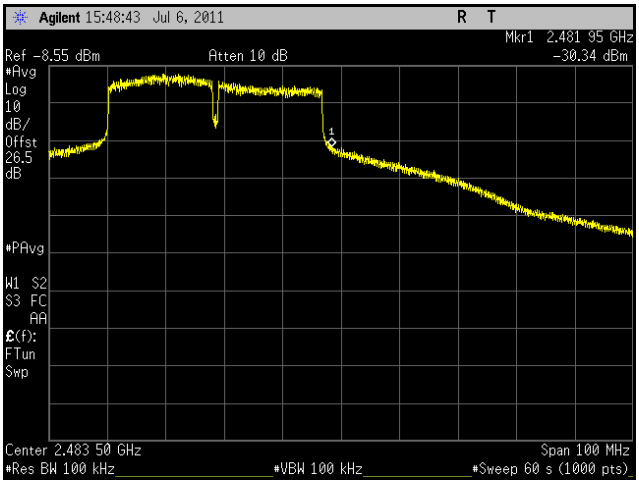

**Plot 100. Frequency Range, High Channel, High Temperature, High Voltage, 802.11n HT40**




**Plot 101. Frequency Range, High Channel, High Temperature, Low Voltage, 802.11n HT40**

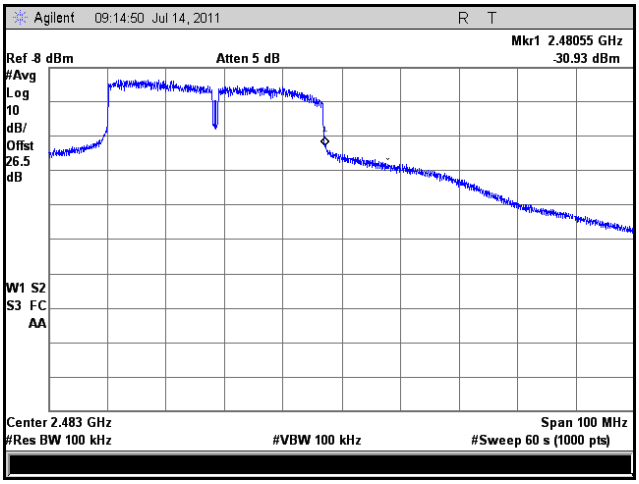



**Plot 102. Frequency Range, High Channel, Low Temperature, High Voltage, 802.11n HT40**




**Plot 103. Frequency Range, High Channel, Low Temperature, Low Voltage, 802.11n HT40**




**Plot 104. Frequency Range, High Channel, Nom. Temperature, Nom. Voltage, 802.11n HT40**

## 4.3.5 Medium Access Protocol

**Test Requirement(s):** **EN 300 328, Clause 4.3.5:**

4.3.5.1 Definition

A medium access protocol is a mechanism designed to facilitate spectrum sharing with other devices in a wireless network.

4.3.5.2 Limit

A medium access protocol shall be implemented by the equipment.

**Test Results:** The EUT facilitates medium access protocol and therefore is compliant with the requirements of Clause 4.3.5.2.

**Test Engineer:** Anderson Soungpanya

**Test Date:** 07/14/11

## 4.3.6 Transmitter Spurious Emissions - Conducted

**Test Requirement(s):** **EN 300 328, Clause 4.3.6:**

4.3.6.1 Definition

Transmitter spurious emissions are emissions outside the frequency range(s) of the equipment as defined in *Clause 4.3.3.1* when the equipment is in Transmit mode and/or in Standby mode.

4.3.6.2 Limit

The spurious emissions of the transmitter shall not exceed the values in Table 21 and Table 22 and in the indicated bands.

| Frequency Range | Limit when operating | Limit when in standby |
|---|---|---|
| 30 MHz to 1 GHz | -36 dBm | -57 dBm |
| above 1 GHz to 12,75 GHz | -30 dBm | -47 dBm |
| 1,8 GHz to 1,9 GHz<br>5,15 GHz to 5,3 GHz | -47 dBm | -47 dBm |

**Table 21. Transmitter limits for narrowband spurious emissions**

The above limit values apply to narrowband emissions, e.g. as caused by local oscillator leakage. The measurement bandwidth for such emissions may be as small as necessary to achieve a reliable measurement result.

Wideband emissions shall not exceed the values given in Table 22.

| Frequency Range | Limit when operating | Limit when in standby |
|---|---|---|
| 30 MHz to 1 GHz | -86 dBm | -107 dBm/Hz |
| above 1 GHz to 12,75 GHz | -80 dBm | -97 dBm/Hz |
| 1,8 GHz to 1,9 GHz 5,15 GHz to 5,3 GHz | -97 dBm | -97 dBm/Hz |

**Table 22. Transmitter limits for wideband spurious emissions**

## 4.3.6 Transmitter Spurious Emissions - Conducted

**Test Procedure:** The EUT was connected directly to a spectrum analyzer through an attenuator. The resolution band width of the spectrum analyzer was set to 100 KHz and the video band width set to 30 KHz. A positive peak detector was used along with peak hold function. The measurement was performed using normal operation of the equipment. Cable loss has been pre-programmed into SA.

**Test Results:** The EUT as tested was found compliant with the specified requirements of Clause 4.3.6.2.

**Test Engineer:** Anderson Soungpanya

**Test Date:** 07/15/11

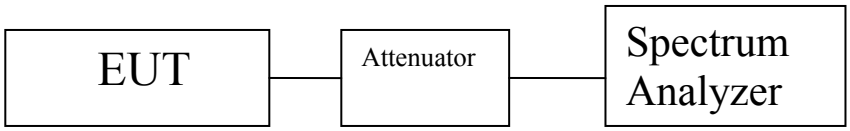
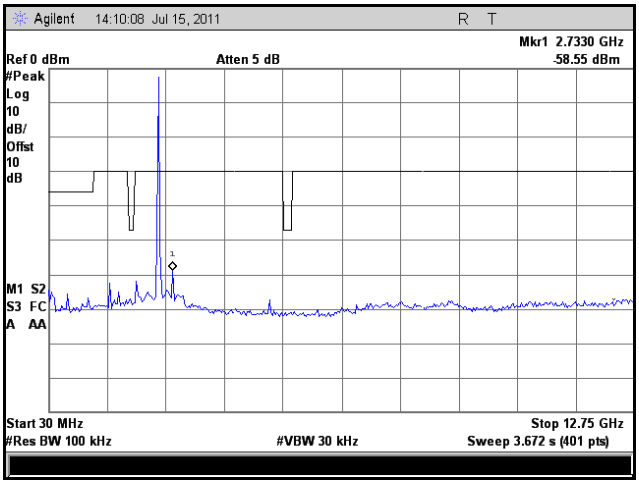


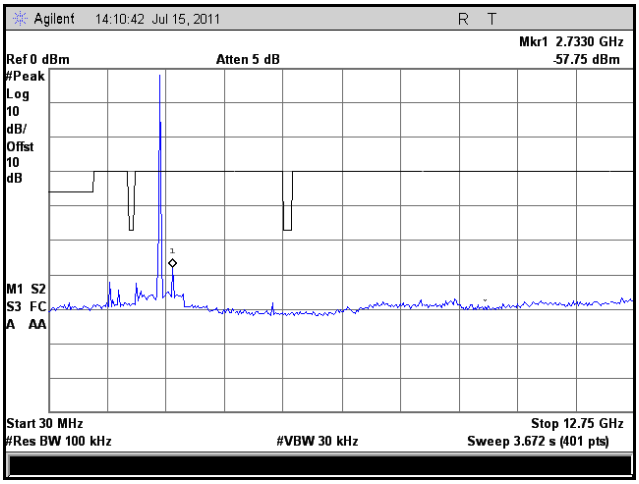

**Figure 5. Transmitter Spurious Emissions - Conducted Test Setup**

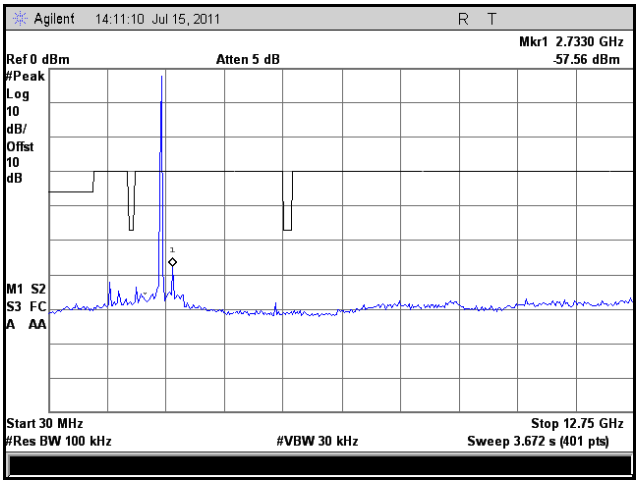
## Transmitter Spurious Emissions – Conducted, Test Results, 802.11b




**Plot 105. Conducted Spurious Emission, Low Channel, 30 MHz – 12.75 GHz, 802.11b**

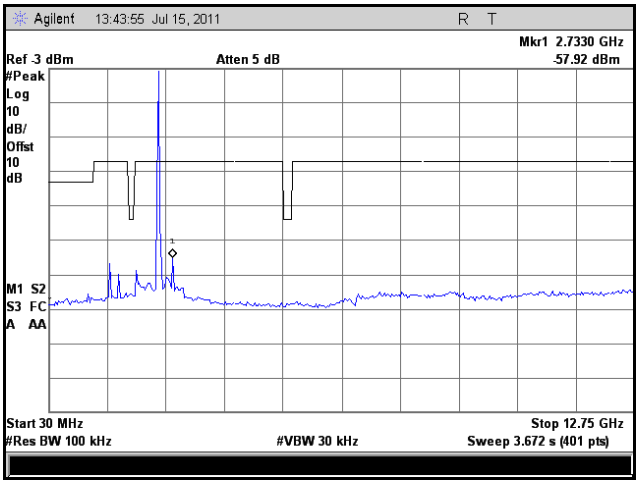



**Plot 106. Conducted Spurious Emission, Mid Channel, 30 MHz - 12.75 GHz, 802.11b**

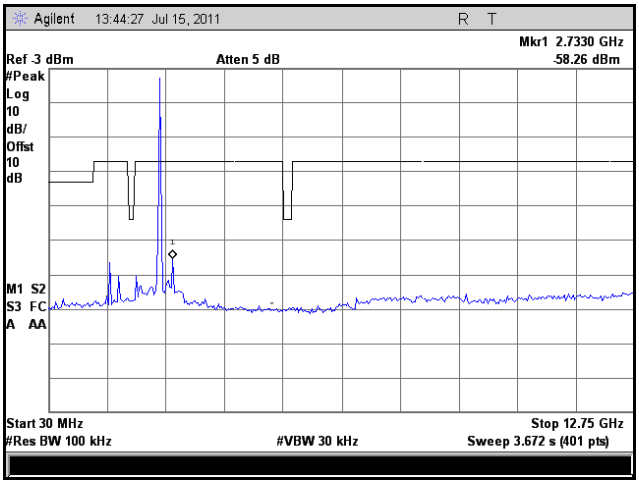



**Plot 107. Conducted Spurious Emission, High Channel, 30 MHz – 12.75 GHz, 802.11b**

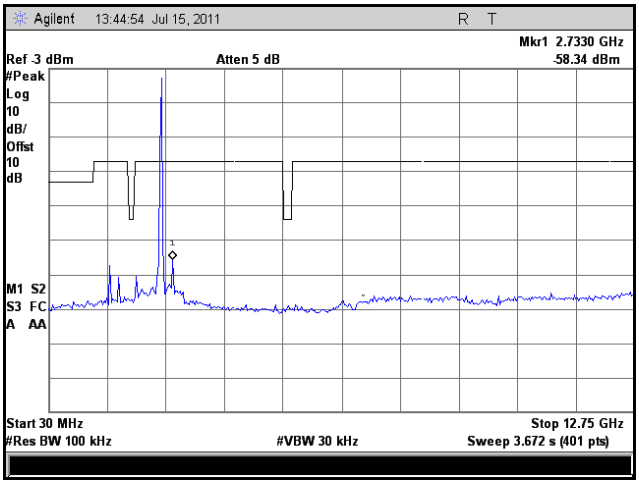
## Transmitter Spurious Emissions – Conducted, Test Results, 802.11g 20 MHz




**Plot 108. Conducted Spurious Emission, Low Channel, 30 MHz – 12.75 GHz, 802.11g 20 MHz**

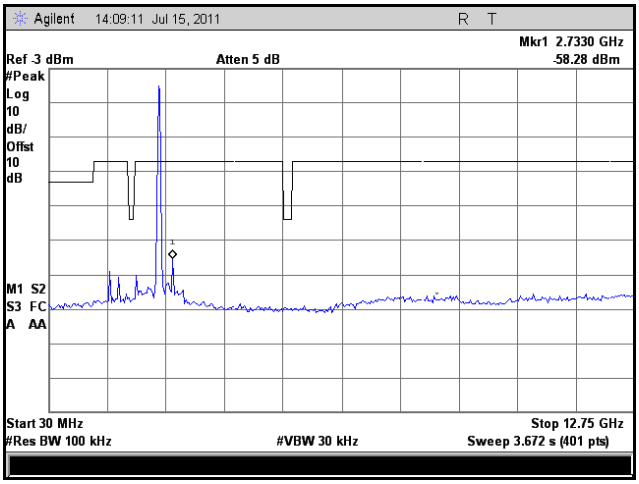



**Plot 109. Conducted Spurious Emission, Mid Channel, 30 MHz - 12.75 GHz, 802.11g 20 MHz**

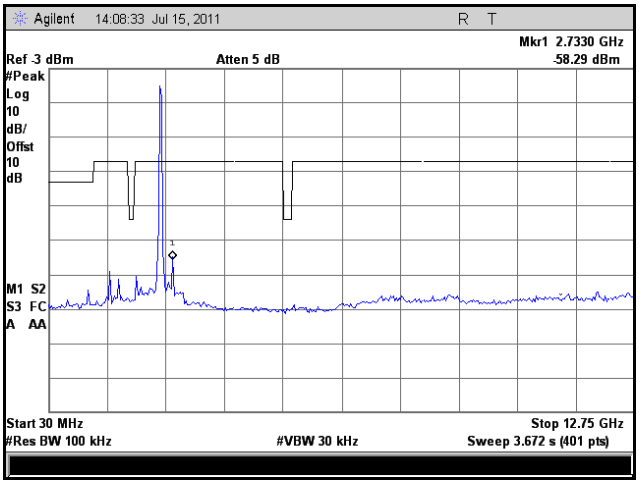



**Plot 110. Conducted Spurious Emission, High Channel, 30 MHz – 12.75 GHz, 802.11g 20 MHz**

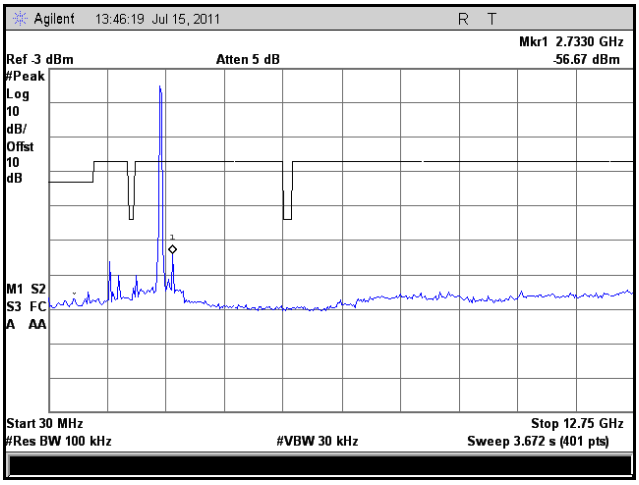
## Transmitter Spurious Emissions – Conducted, Test Results, 802.11g 40 MHz




**Plot 111. Conducted Spurious Emission, Low Channel, 30 MHz – 12.75 GHz, 802.11g 40 MHz**

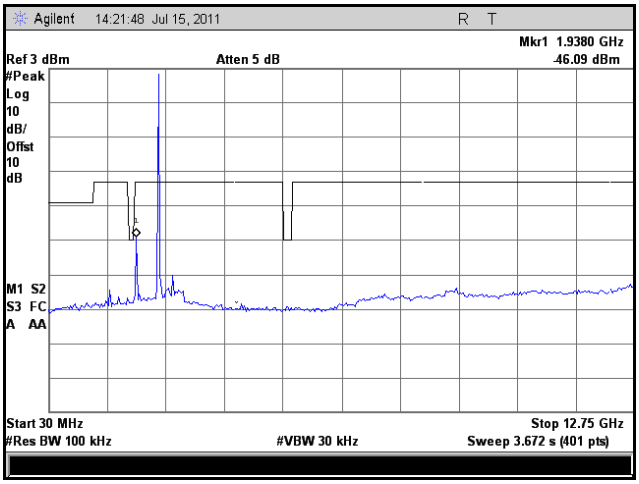



**Plot 112. Conducted Spurious Emission, Mid Channel, 30 MHz - 12.75 GHz, 802.11g 40 MHz**

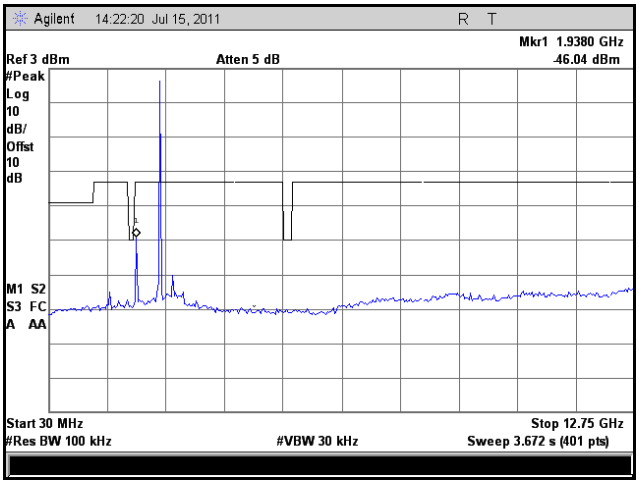



**Plot 113. Conducted Spurious Emission, High Channel, 30 MHz – 12.75 GHz, 802.11g 40 MHz**

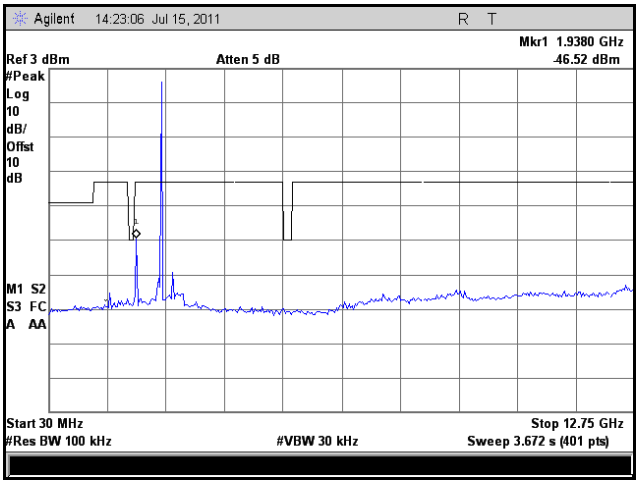
## Transmitter Spurious Emissions – Conducted, Test Results, 802.11n HT5




**Plot 114. Conducted Spurious Emission, Low Channel, 30 MHz – 12.75 GHz, 802.11n HT5**

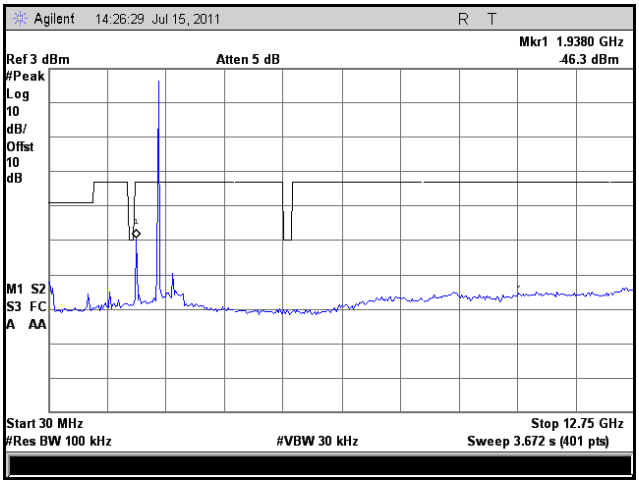



**Plot 115. Conducted Spurious Emission, Mid Channel, 30 MHz - 12.75 GHz, 802.11n HT5**

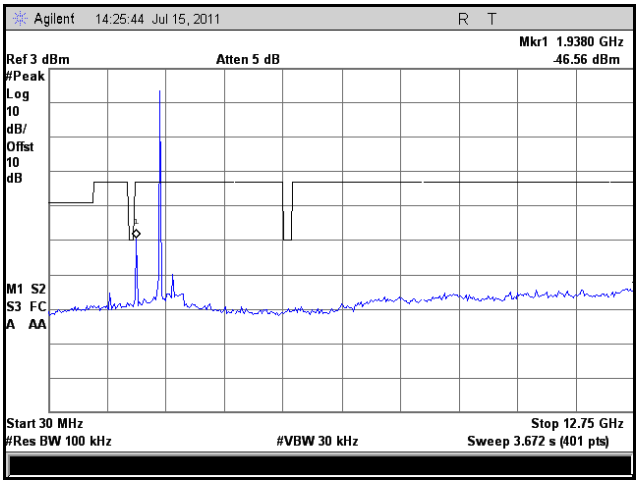



**Plot 116. Conducted Spurious Emission, High Channel, 30 MHz – 12.75 GHz, 802.11n HT5**

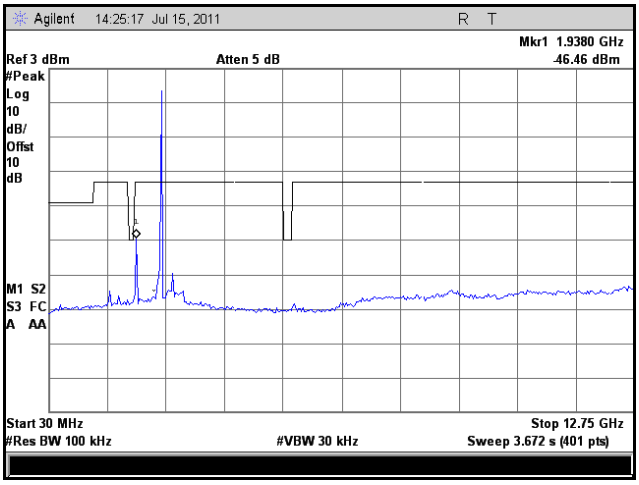
## Transmitter Spurious Emissions – Conducted, Test Results, 802.11n HT8




**Plot 117. Conducted Spurious Emission, Low Channel, 30 MHz – 12.75 GHz, 802.11n HT8**

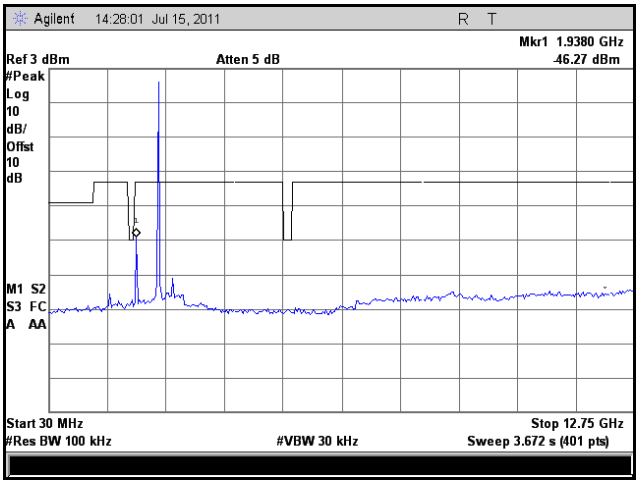



**Plot 118. Conducted Spurious Emission, Mid Channel, 30 MHz - 12.75 GHz, 802.11n HT8**

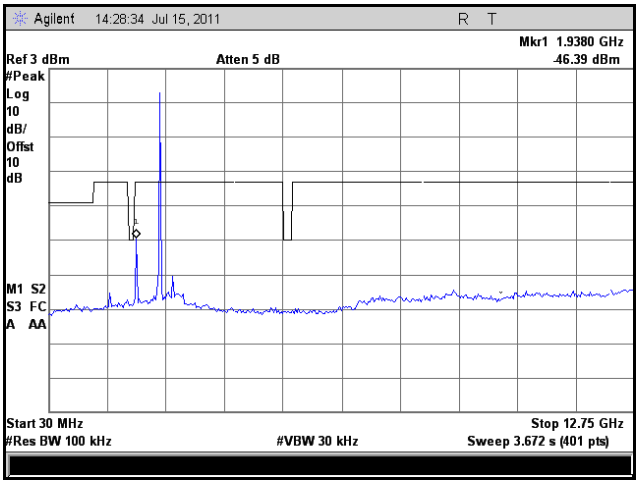



**Plot 119. Conducted Spurious Emission, High Channel, 30 MHz – 12.75 GHz, 802.11n HT8**

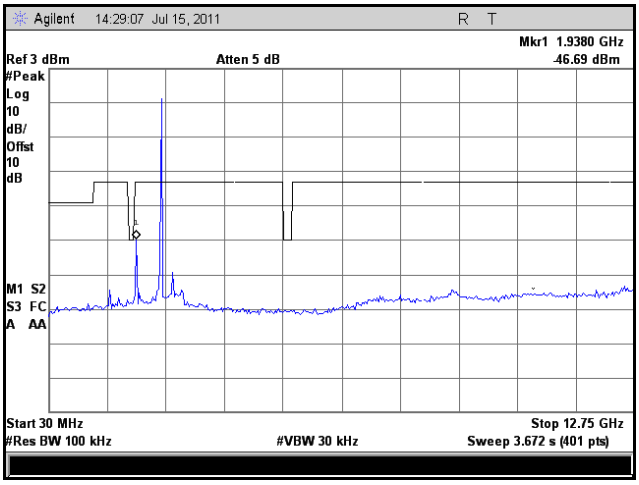
## Transmitter Spurious Emissions – Conducted, Test Results, 802.11n HT10




**Plot 120. Conducted Spurious Emission, Low Channel, 30 MHz – 12.75 GHz, 802.11n HT10**

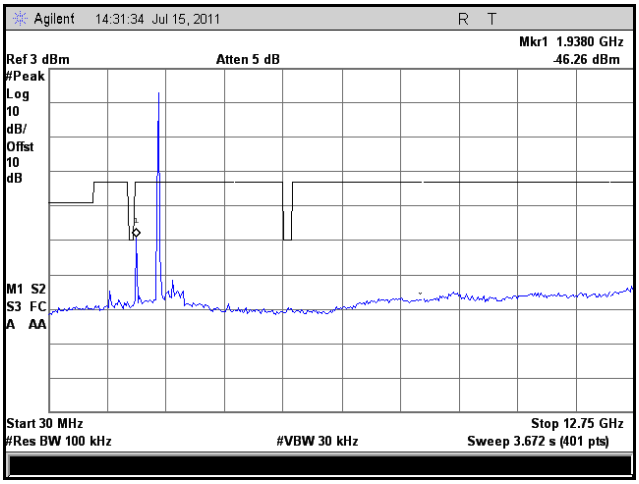



**Plot 121. Conducted Spurious Emission, Mid Channel, 30 MHz - 12.75 GHz, 802.11n HT10**

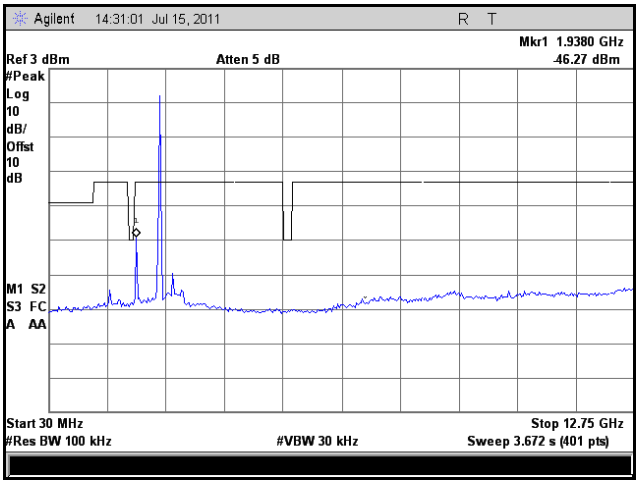



**Plot 122. Conducted Spurious Emission, High Channel, 30 MHz – 12.75 GHz, 802.11n HT10**

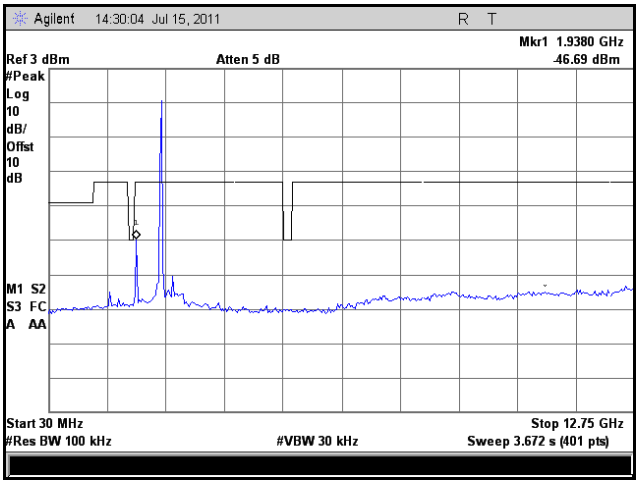
## Transmitter Spurious Emissions – Conducted, Test Results, 802.11n HT20




**Plot 123. Conducted Spurious Emission, Low Channel, 30 MHz – 12.75 GHz, 802.11n HT20**



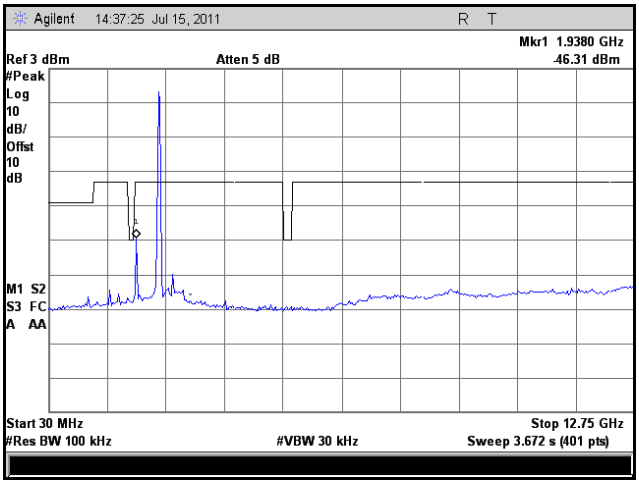

**Plot 124. Conducted Spurious Emission, Mid Channel, 30 MHz - 12.75 GHz, 802.11n HT20**



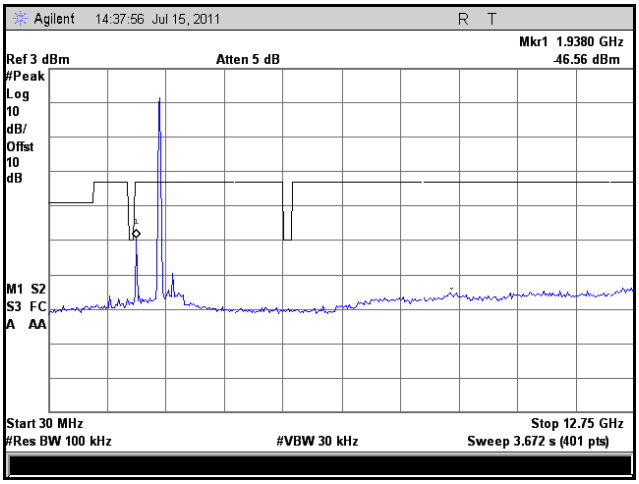

**Plot 125. Conducted Spurious Emission, High Channel, 30 MHz – 12.75 GHz, 802.11n HT20**

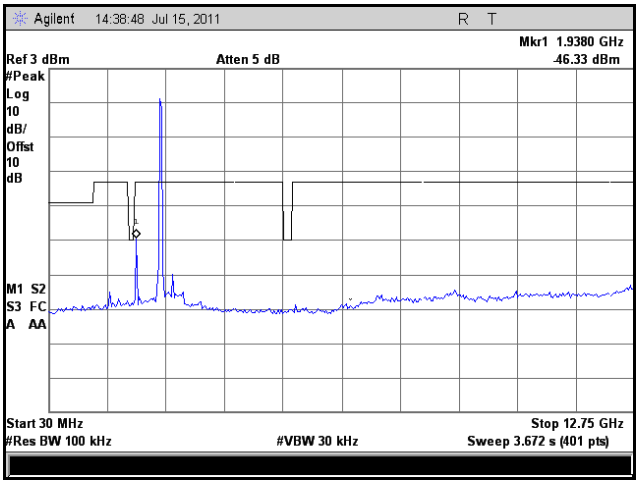
## Transmitter Spurious Emissions – Conducted, Test Results, 802.11n HT30




**Plot 126. Conducted Spurious Emission, Low Channel, 30 MHz – 12.75 GHz, 802.11n HT30**

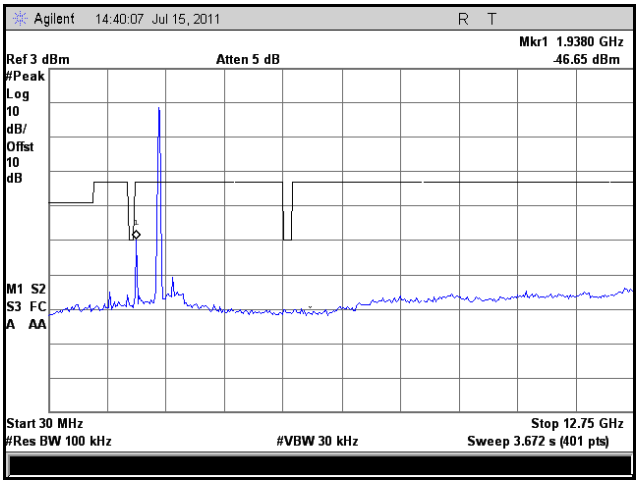



**Plot 127. Conducted Spurious Emission, Mid Channel, 30 MHz - 12.75 GHz, 802.11n HT30**

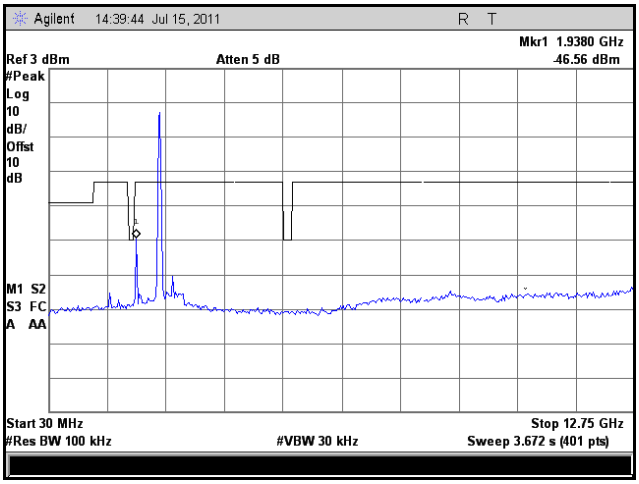



**Plot 128. Conducted Spurious Emission, High Channel, 30 MHz – 12.75 GHz, 802.11n HT30**

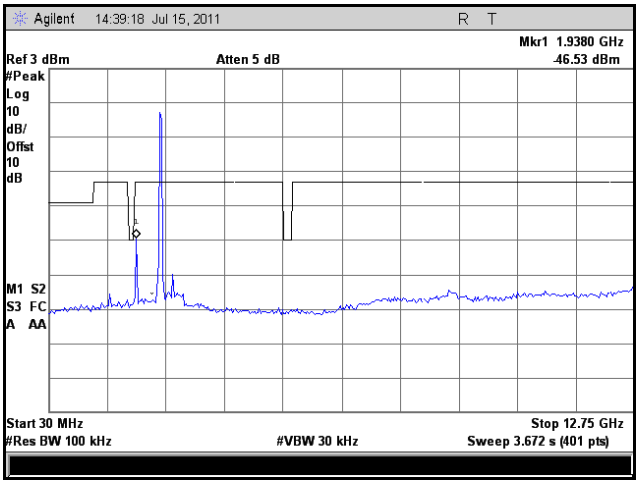
## Transmitter Spurious Emissions – Conducted, Test Results, 802.11n HT40




**Plot 129. Conducted Spurious Emission, Low Channel, 30 MHz – 12.75 GHz, 802.11n HT40**




**Plot 130. Conducted Spurious Emission, Mid Channel, 30 MHz - 12.75 GHz, 802.11n HT40**




**Plot 131. Conducted Spurious Emission, High Channel, 30 MHz – 12.75 GHz, 802.11n HT40**

## 4.3.6 Transmitter Spurious Emissions - Radiated

**Test Requirement(s):** **EN 300 328, Clause 4.3.6:**

4.3.6.1 Definition

Transmitter spurious emissions are emissions outside the frequency range(s) of the equipment as defined in *Clause 4.3.3.1* when the equipment is in Transmit mode and/or in Standby mode.

4.3.6.2 Limit

The spurious emissions of the transmitter shall not exceed the values in Table 21 and Table 22 and in the indicated bands.

| Frequency Range | Limit when operating | Limit when in standby |
|---|---|---|
| 30 MHz to 1 GHz | -36 dBm | -57 dBm |
| above 1 GHz to 12,75 GHz | -30 dBm | -47 dBm |
| 1,8 GHz to 1,9 GHz<br>5,15 GHz to 5,3 GHz | -47 dBm | -47 dBm |

**Table 23. Transmitter limits for narrowband spurious emissions**

The above limit values apply to narrowband emissions, e.g. as caused by local oscillator leakage. The measurement bandwidth for such emissions may be as small as necessary to achieve a reliable measurement result.

Wideband emissions shall not exceed the values given in Table 22.

| Frequency Range | Limit when operating | Limit when in standby |
|---|---|---|
| 30 MHz to 1 GHz | -86 dBm | -107 dBm/Hz |
| above 1 GHz to 12,75 GHz | -80 dBm | -97 dBm/Hz |
| 1,8 GHz to 1,9 GHz 5,15 GHz to 5,3 GHz | -97 dBm | -97 dBm/Hz |

**Table 24. Transmitter limits for wideband spurious emissions**

**Test Procedure:** The EUT was placed on a 1.5m high wooden table inside a semi-anechoic chamber. The measurements were performed using normal operation of the equipment. The method of testing, test conditions, and test procedures of *Annex B* were used. The frequencies and amplitudes of field strengths were recorded for reference during final measurements.

The EUT was set to transmit at its highest output power at both the low and high channels of the transmit band as well as all applicable modulations. The receive antenna was adjusted in order to find the maximum emission. The table was also rotated about $360^0$. Both vertical and horizontal polarizations were used to determine the maximum emission.

**Test Results:** The EUT as tested was found compliant with the specified limits of Clause 4.3.6.2. There were no emissions within 6 dB of the limit.

**Test Engineer:** Anderson Soungpanya

**Test Date:** 07/15/11

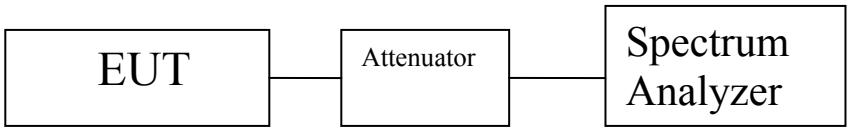
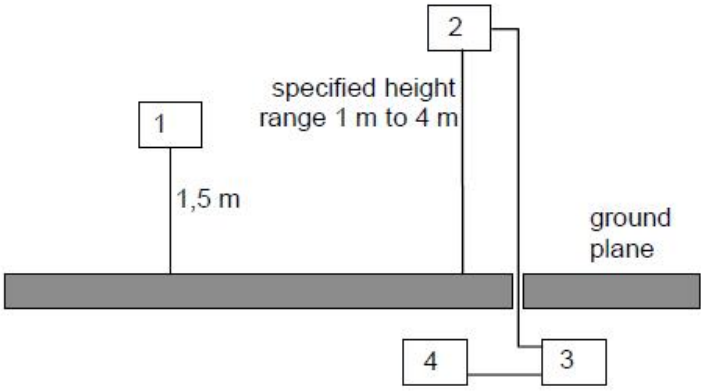


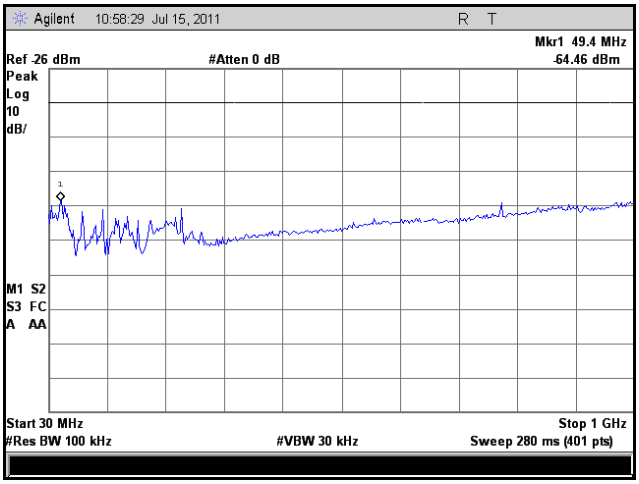

**Figure 6. Transmitter Spurious Emissions - Radiated Test Setup**



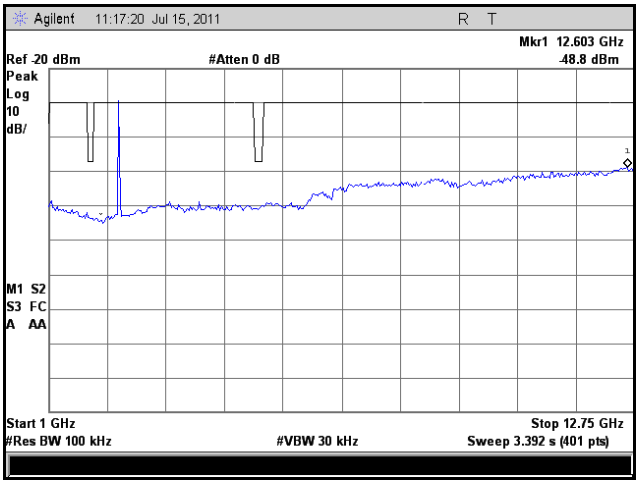

1) Equipment under test.
2) Test antenna.
3) High pass filter (as required).
4) Spectrum analyser or measuring receiver.

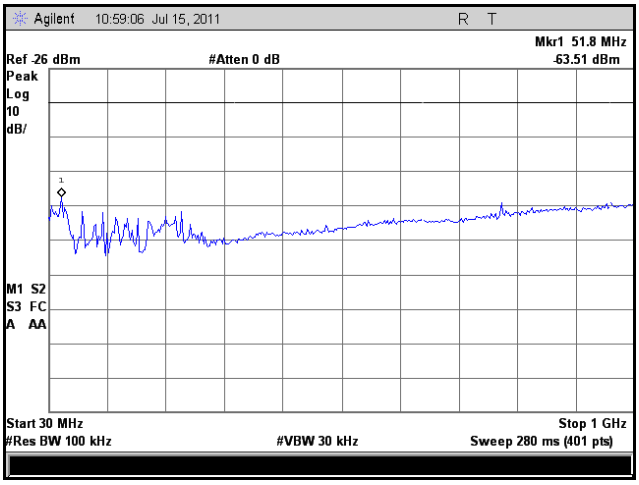
## Transmitter Spurious Emissions – Radiated, Test Results, 802.11b



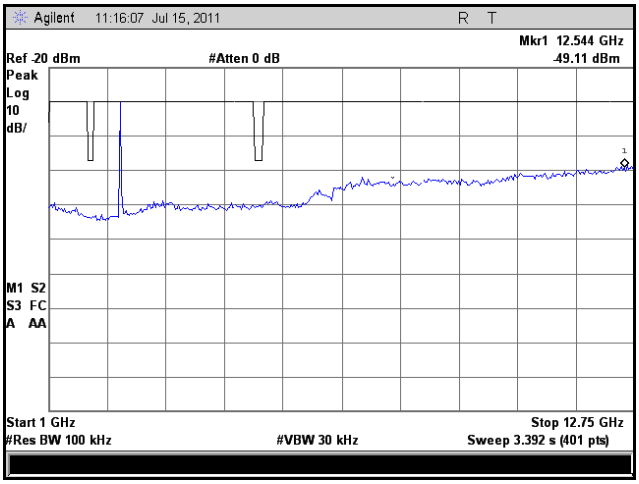

**Plot 132. Radiated Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11b**



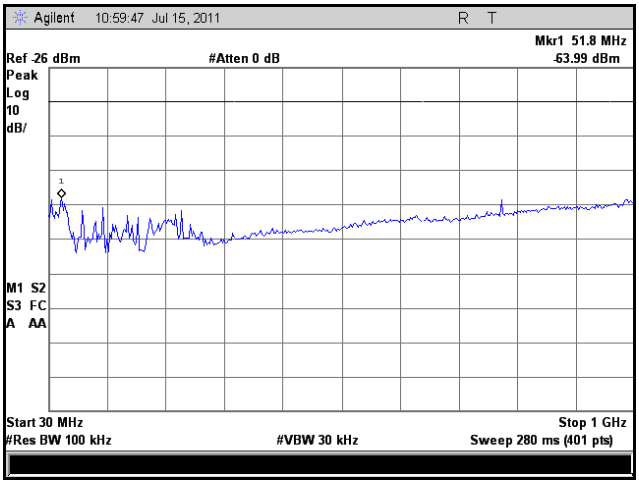

**Plot 133. Radiated Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11b**



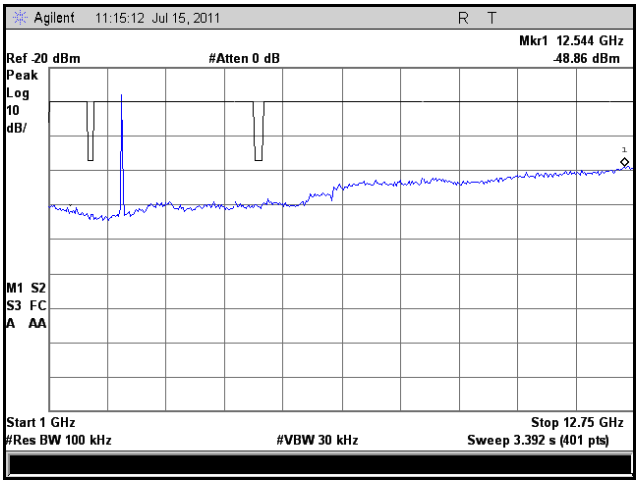

**Plot 134. Radiated Spurious Emission, Mid Channel, 30 MHz – 1 GHz, 802.11b**




**Plot 135. Radiated Spurious Emission, Mid Channel, 1 GHz - 12.75 GHz, 802.11b**

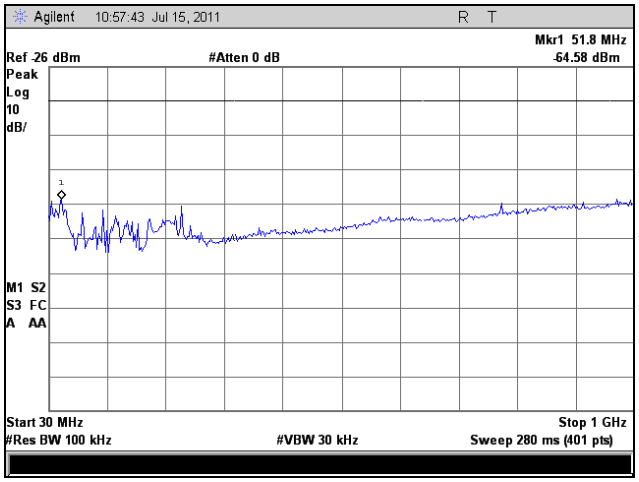



**Plot 136. Radiated Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11b**

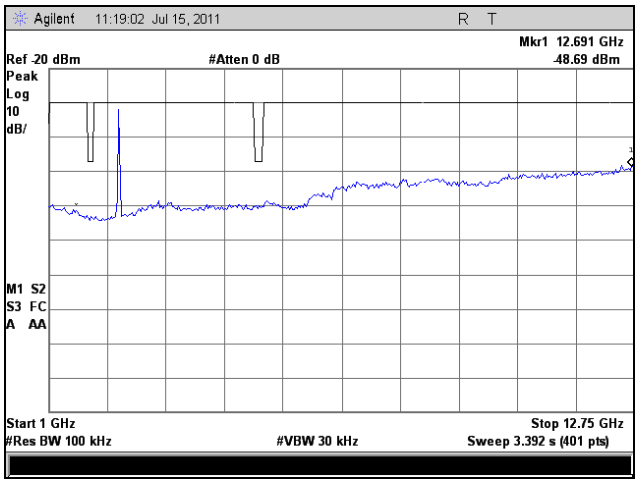



**Plot 137. Radiated Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11b**

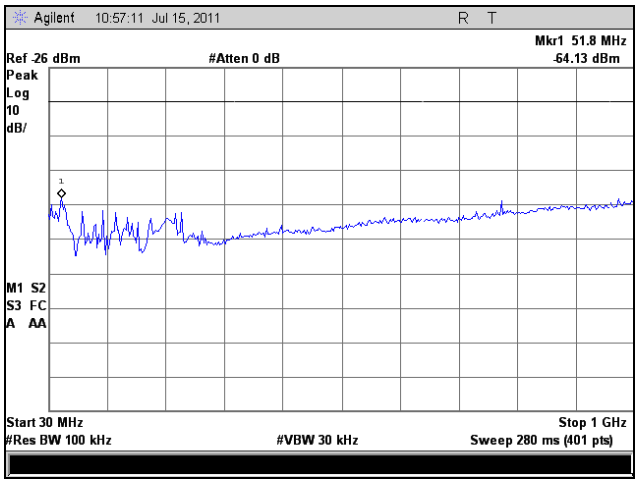
## Transmitter Spurious Emissions – Radiated, Test Results, 802.11g 20 MHz




**Plot 138. Radiated Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11g 20 MHz**

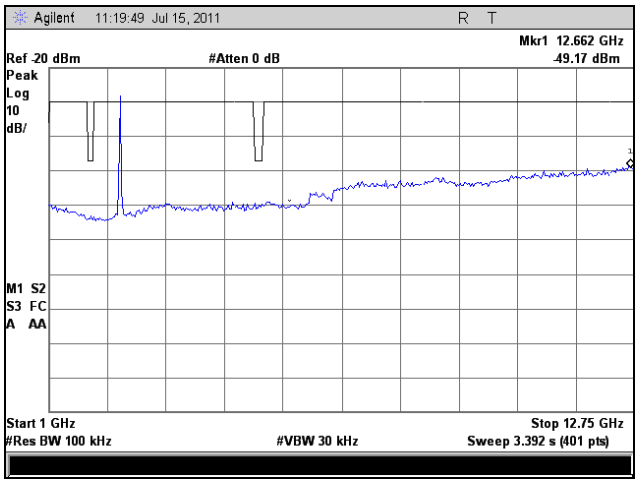



**Plot 139. Radiated Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11g 20 MHz**

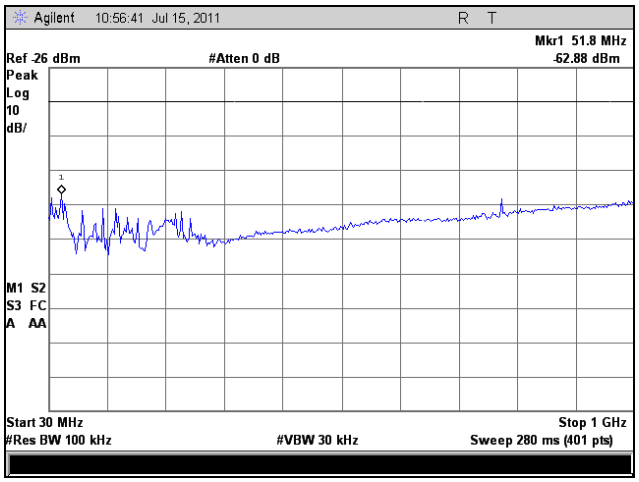



**Plot 140. Radiated Spurious Emission, Mid Channel, 30 MHz – 1 GHz, 802.11g 20 MHz**

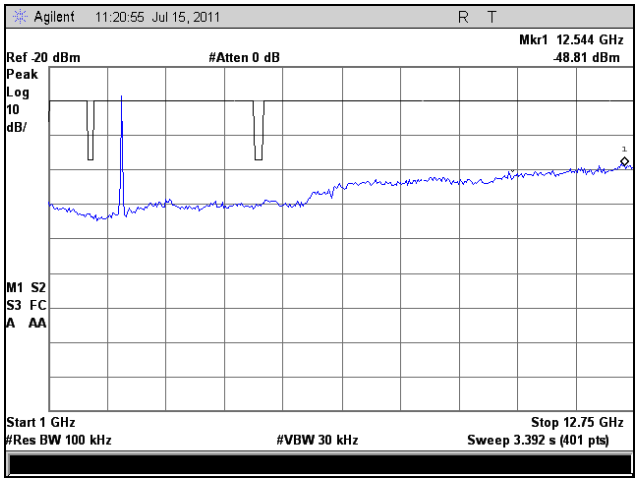
  




**Plot 141. Radiated Spurious Emission, Mid Channel, 1 GHz - 12.75 GHz, 802.11g 20 MHz**

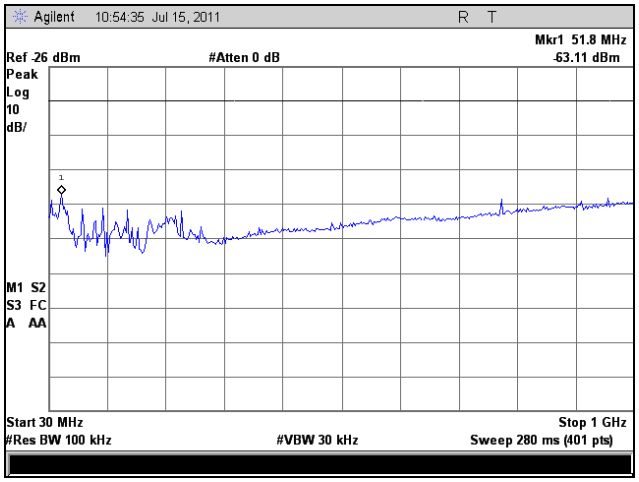



**Plot 142. Radiated Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11g 20 MHz**

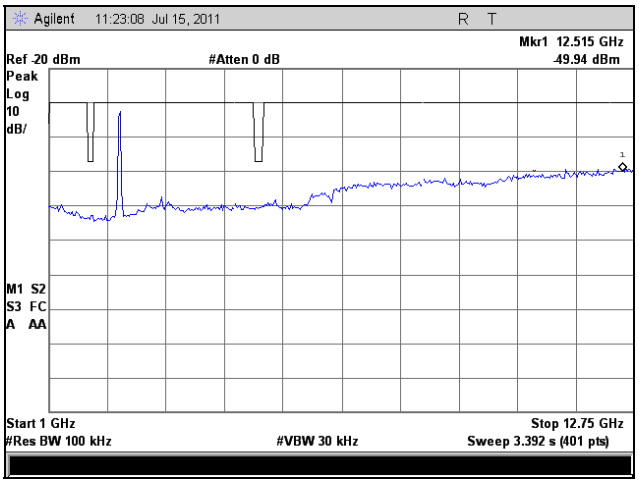



**Plot 143. Radiated Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11g 20 MHz**

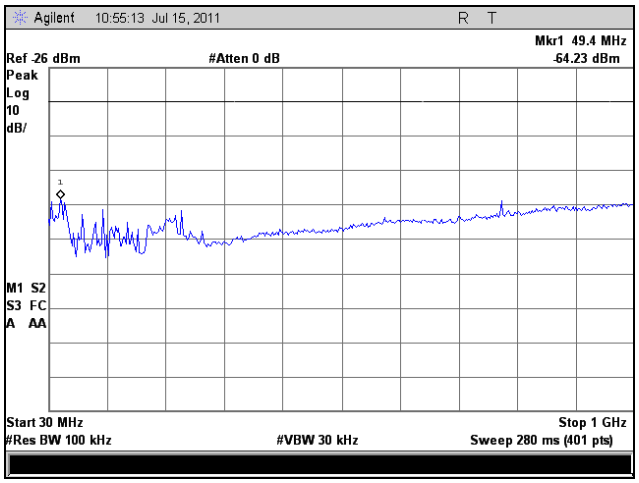
## Transmitter Spurious Emissions – Radiated, Test Results, 802.11g 40 MHz




**Plot 144. Radiated Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11g 40 MHz**

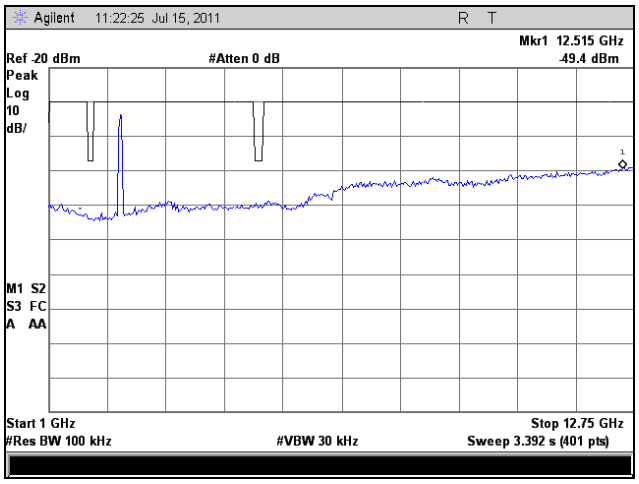



**Plot 145. Radiated Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11g 40 MHz**

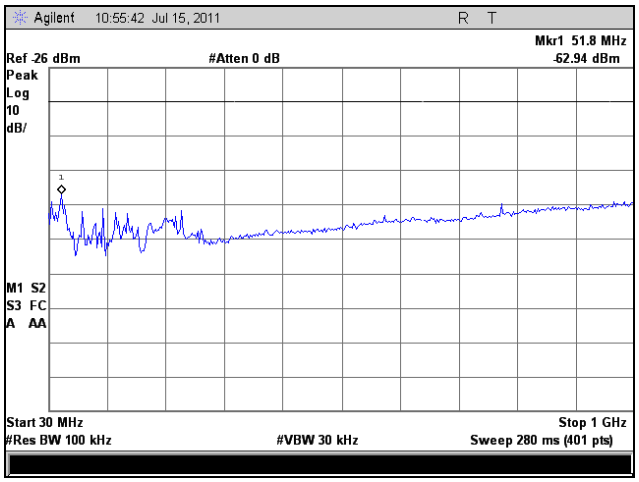



**Plot 146. Radiated Spurious Emission, Mid Channel, 30 MHz – 1 GHz, 802.11g 40 MHz**

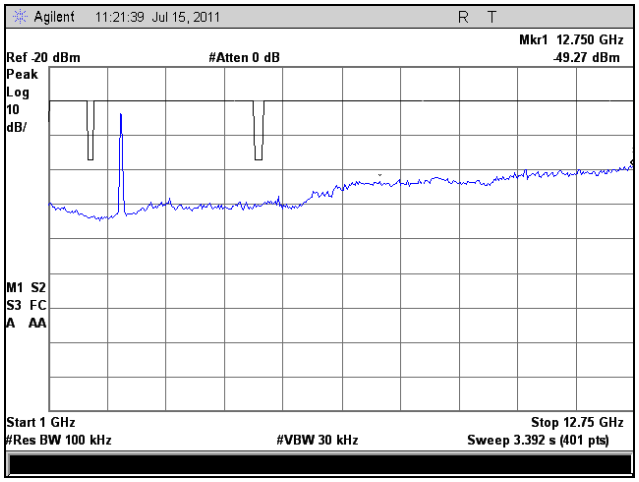
  




**Plot 147. Radiated Spurious Emission, Mid Channel, 1 GHz - 12.75 GHz, 802.11g 40 MHz**

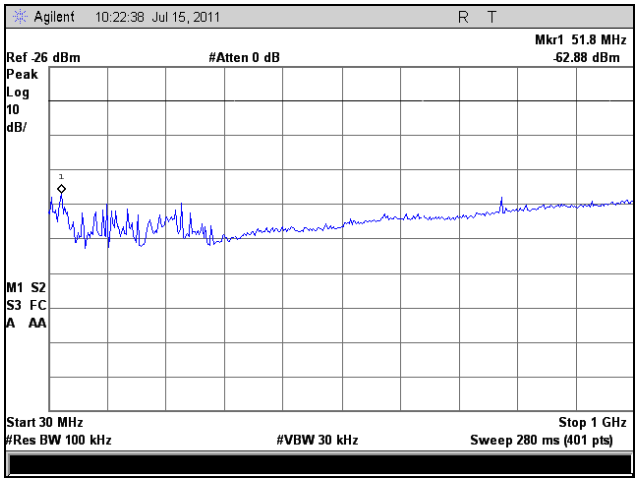



**Plot 148. Radiated Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11g 40 MHz**

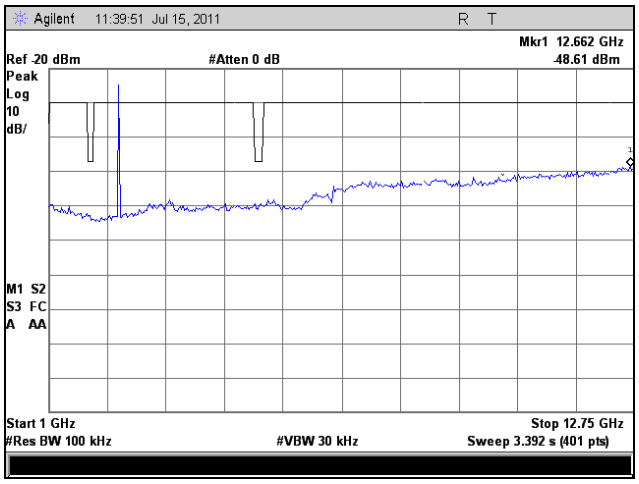



**Plot 149. Radiated Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11g 40 MHz**

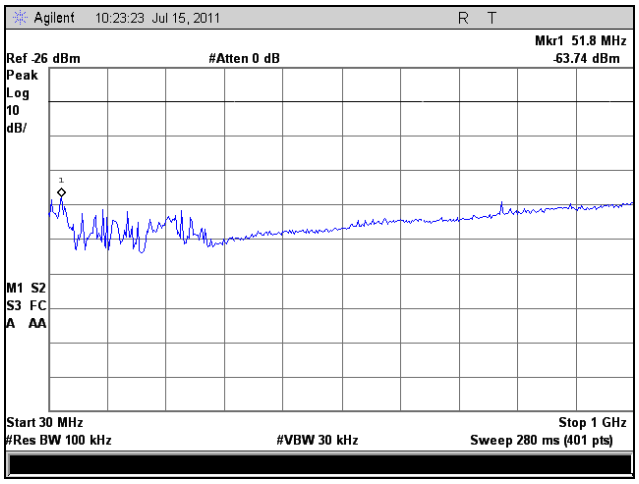
## Transmitter Spurious Emissions – Radiated, Test Results, 802.11n HT5



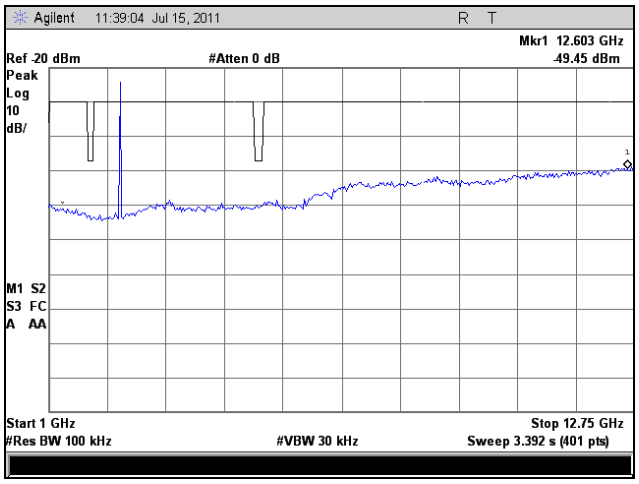

**Plot 150. Radiated Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11n HT5**



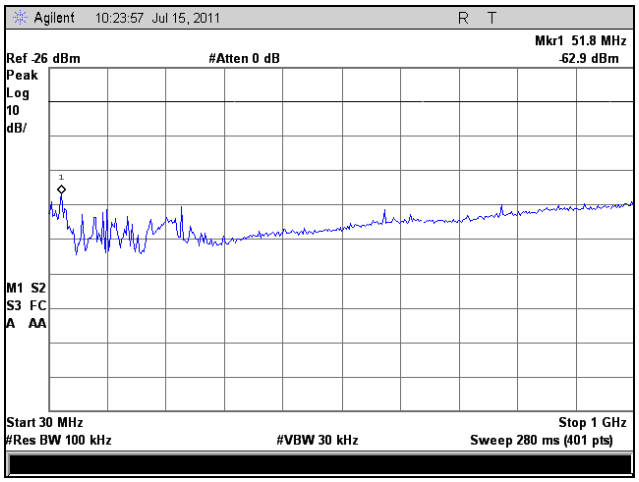

**Plot 151. Radiated Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11n HT5**



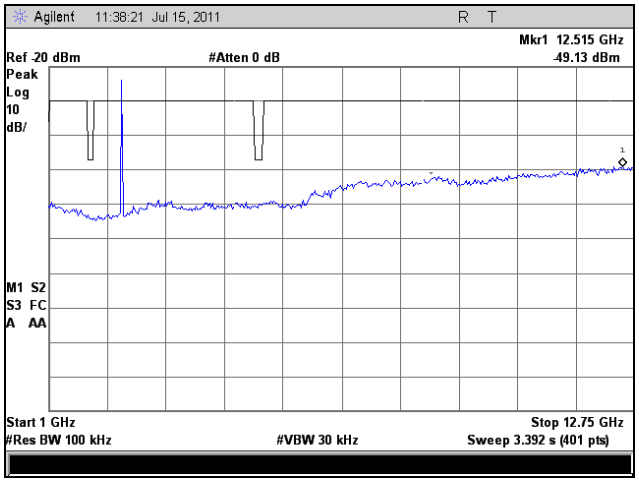

**Plot 152. Radiated Spurious Emission, Mid Channel, 30 MHz – 1 GHz, 802.11n HT5**




**Plot 153. Radiated Spurious Emission, Mid Channel, 1 GHz - 12.75 GHz, 802.11n HT5**

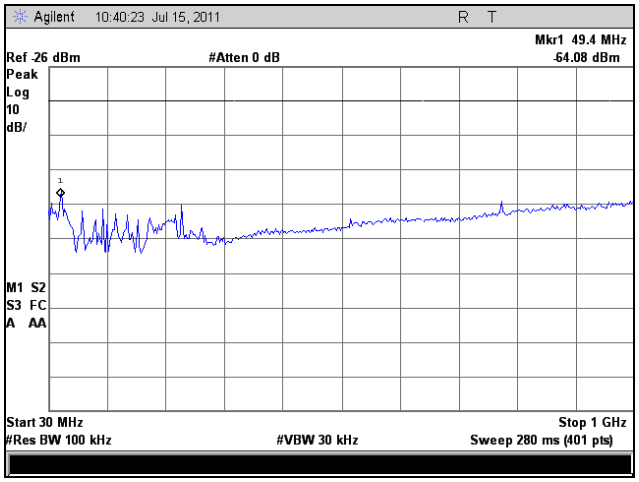



**Plot 154. Radiated Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11n HT5**

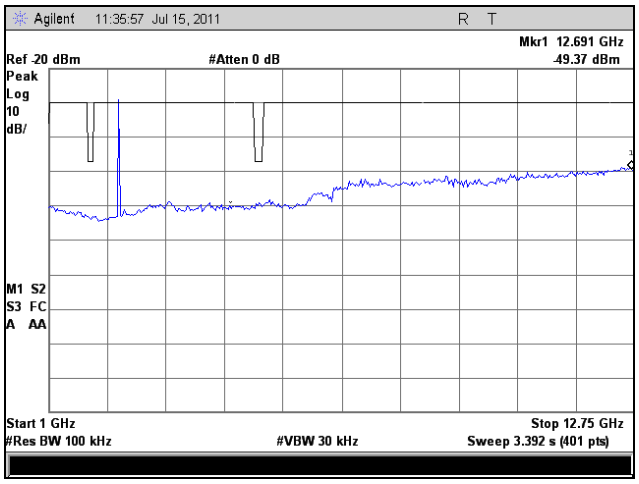



**Plot 155. Radiated Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11n HT5**

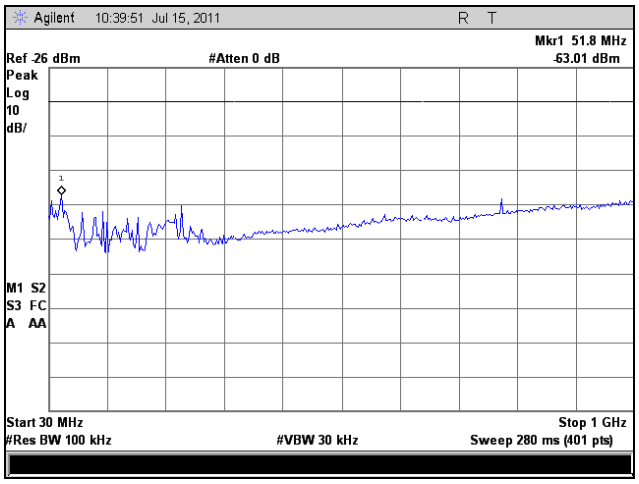
## Transmitter Spurious Emissions – Radiated, Test Results, 802.11n HT8




**Plot 156. Radiated Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11n HT8**

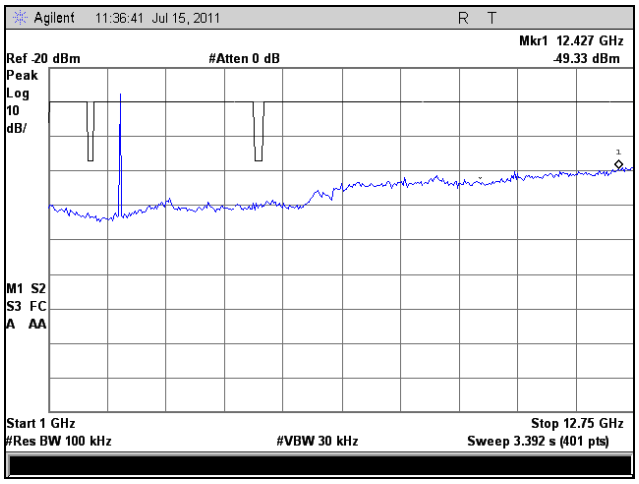



**Plot 157. Radiated Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11n HT8**

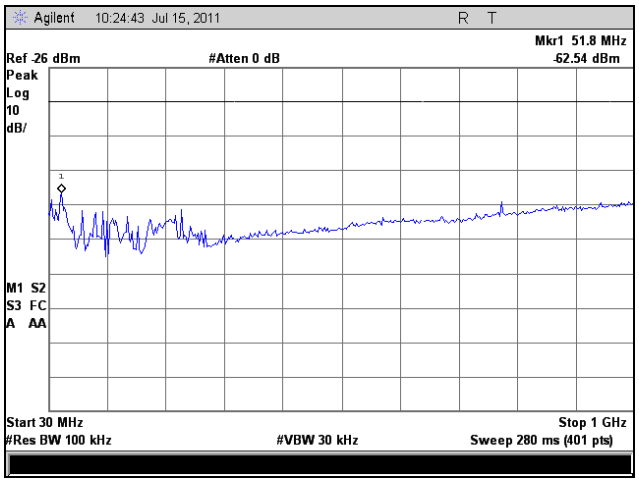



**Plot 158. Radiated Spurious Emission, Mid Channel, 30 MHz – 1 GHz, 802.11n HT8**

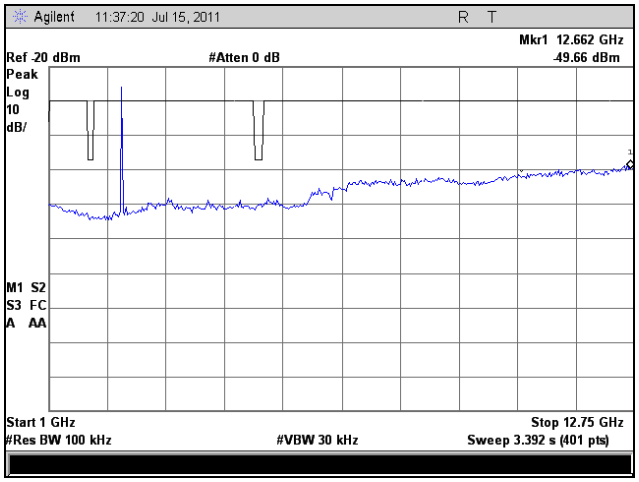
  




**Plot 159. Radiated Spurious Emission, Mid Channel, 1 GHz - 12.75 GHz, 802.11n HT8**

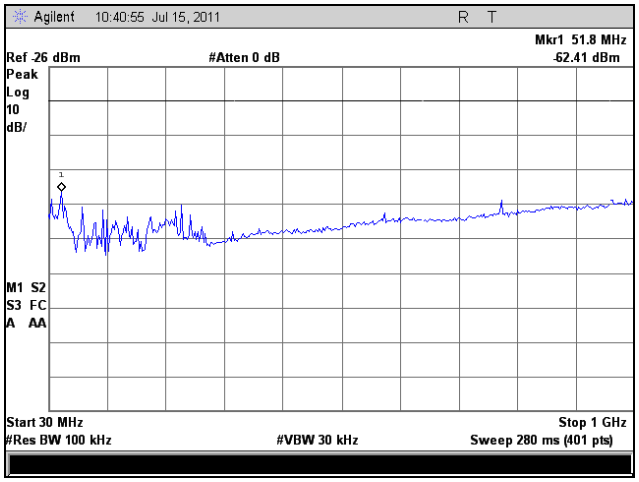



**Plot 160. Radiated Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11n HT8**

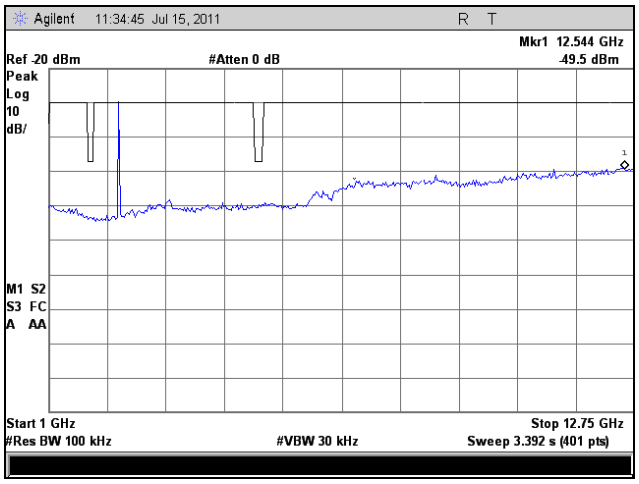



**Plot 161. Radiated Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11n HT8**

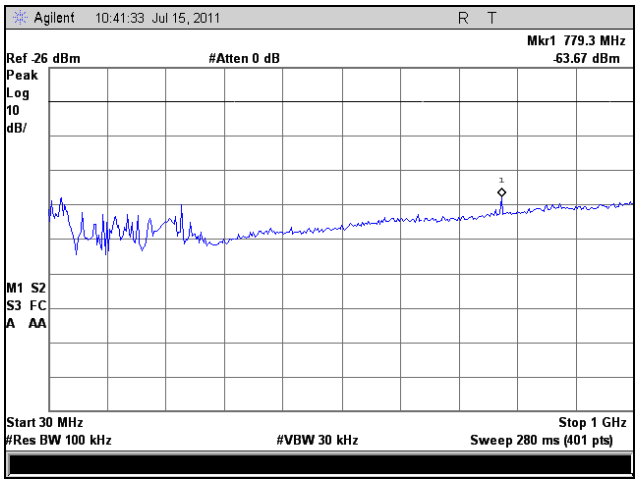
## Transmitter Spurious Emissions – Radiated, Test Results, 802.11n HT10



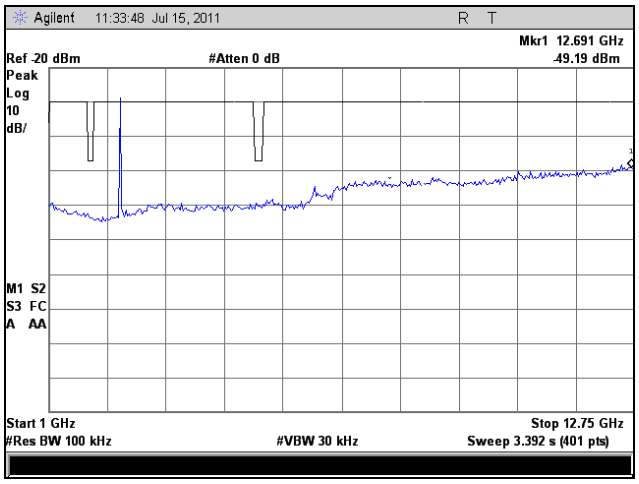

**Plot 162. Radiated Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11n HT10**



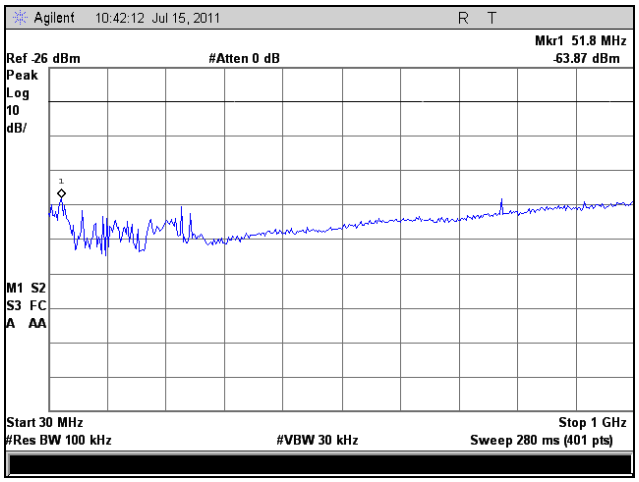

**Plot 163. Radiated Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11n HT10**



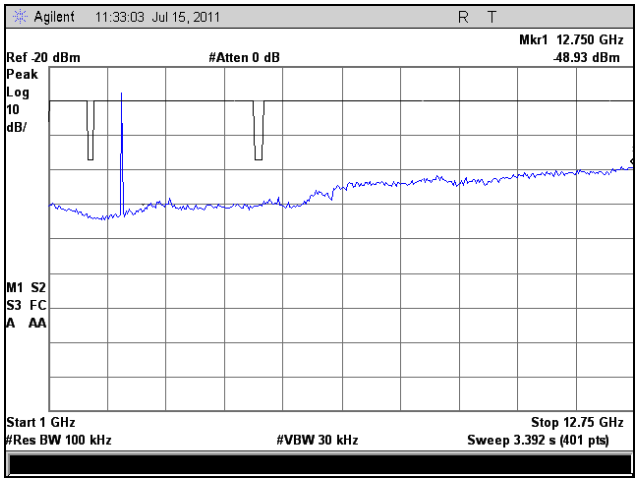

**Plot 164. Radiated Spurious Emission, Mid Channel, 30 MHz – 1 GHz, 802.11n HT10**




**Plot 165. Radiated Spurious Emission, Mid Channel, 1 GHz - 12.75 GHz, 802.11n HT10**

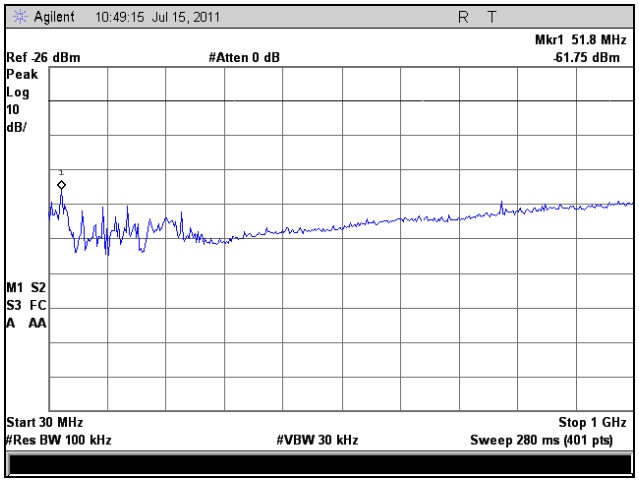



**Plot 166. Radiated Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11n HT10**

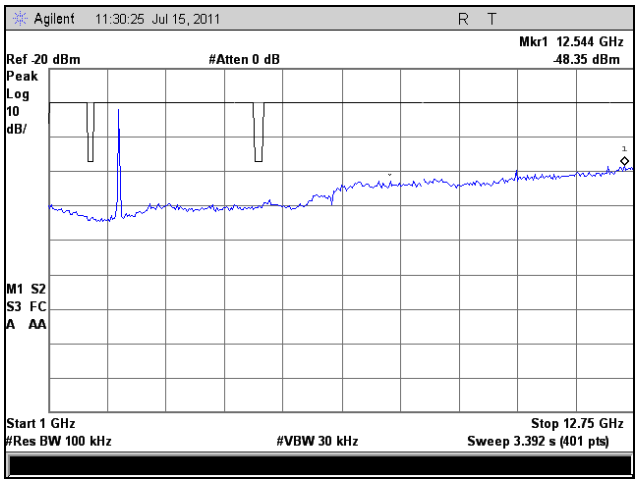



**Plot 167. Radiated Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11n HT10**

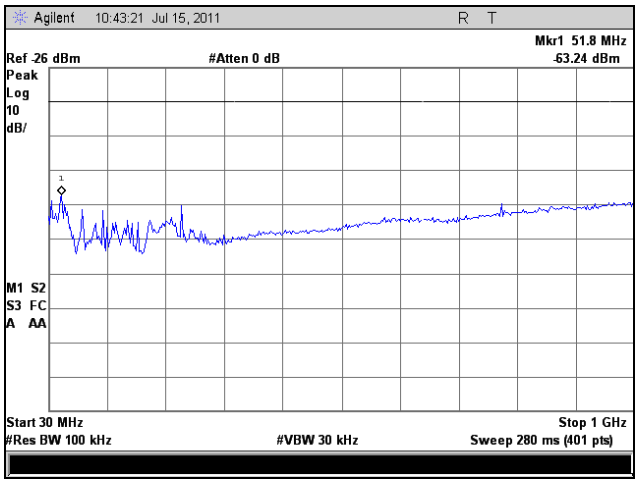
## Transmitter Spurious Emissions – Radiated, Test Results, 802.11n HT20



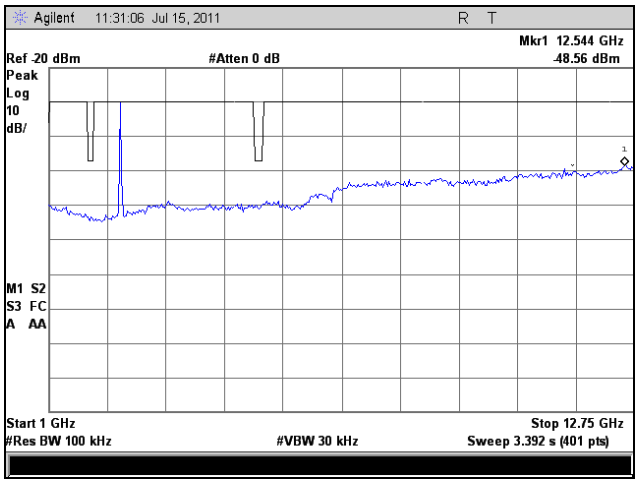

**Plot 168. Radiated Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11n HT20**



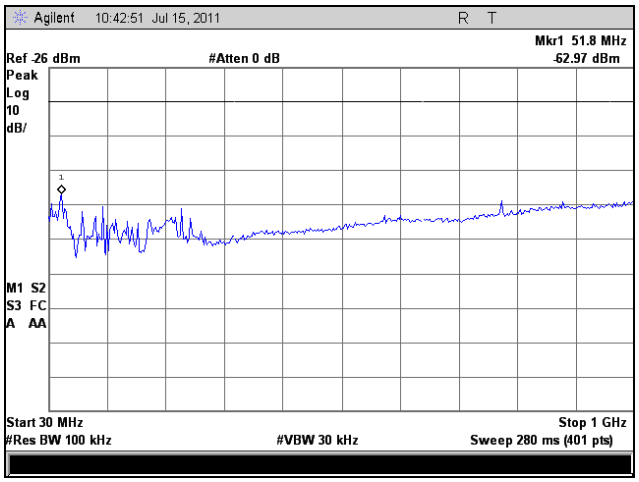

**Plot 169. Radiated Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11n HT20**



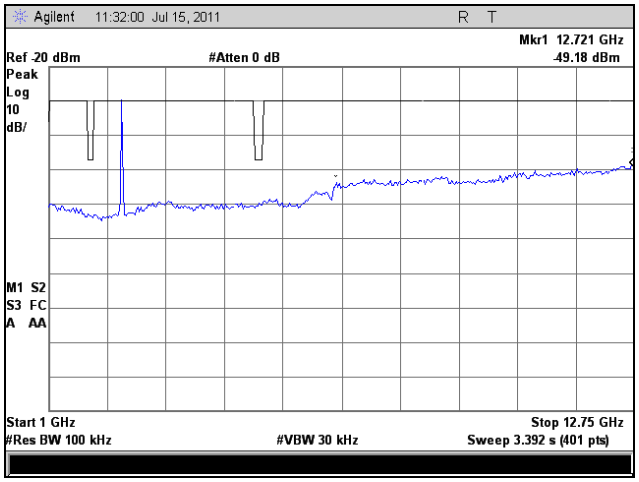

**Plot 170. Radiated Spurious Emission, Mid Channel, 30 MHz – 1 GHz, 802.11n HT20**




**Plot 171. Radiated Spurious Emission, Mid Channel, 1 GHz - 12.75 GHz, 802.11n HT20**

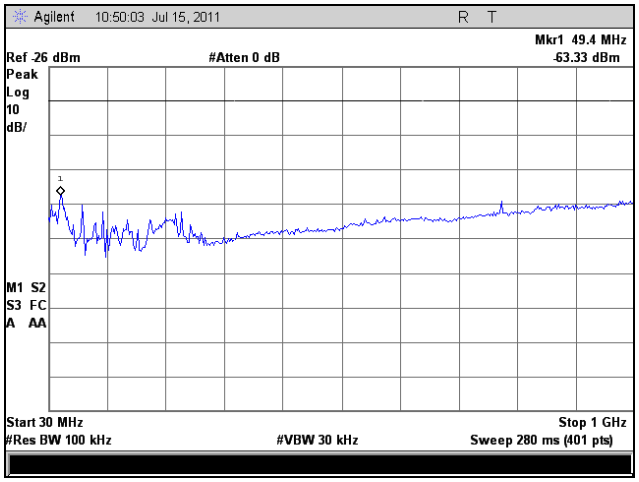



**Plot 172. Radiated Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11n HT20**

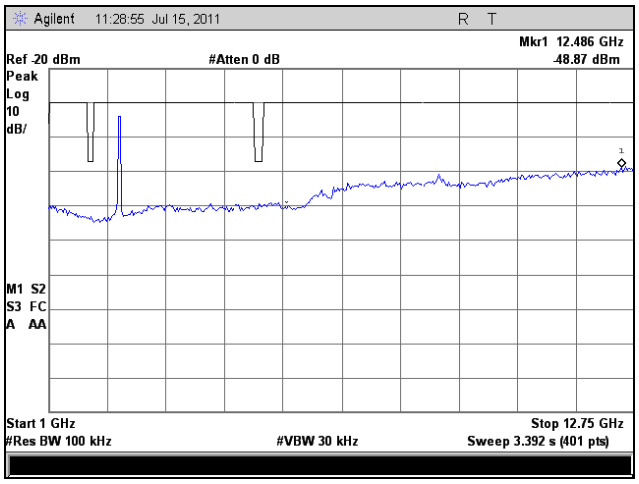



**Plot 173. Radiated Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11n HT20**

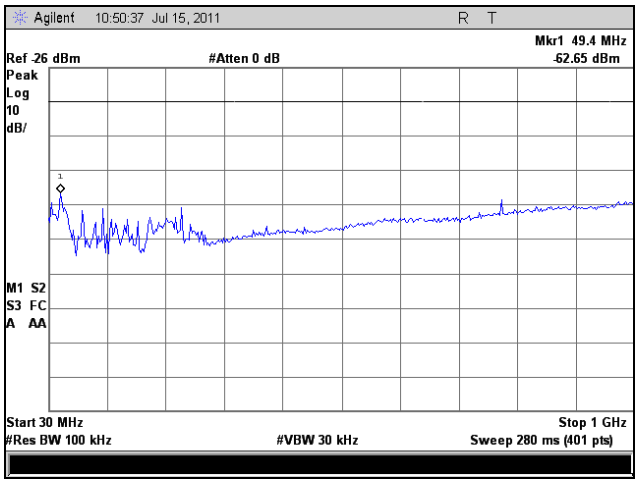
## Transmitter Spurious Emissions – Radiated, Test Results, 802.11n HT30



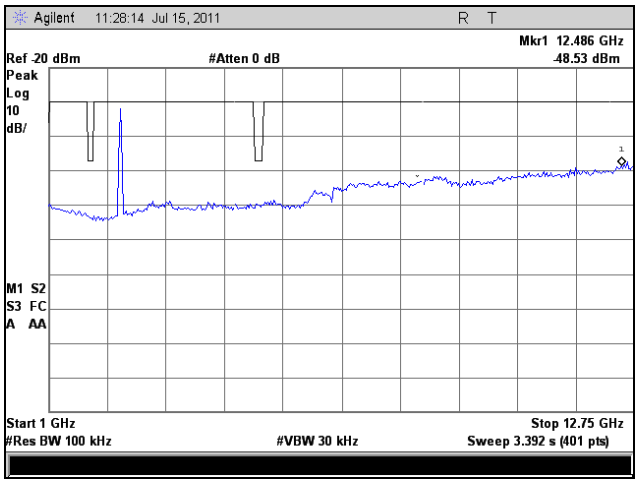

**Plot 174. Radiated Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11n HT30**



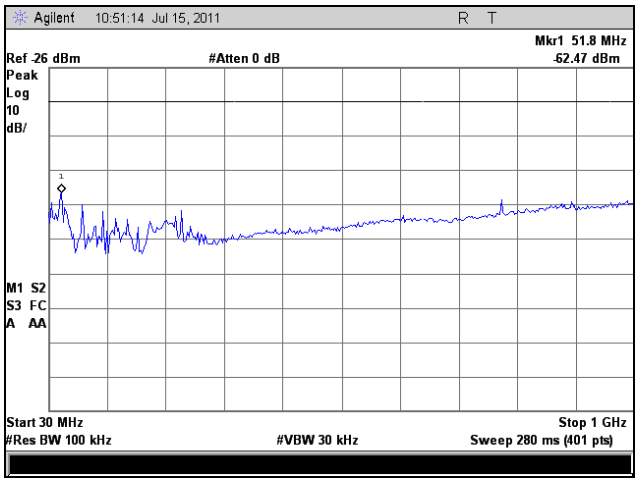

**Plot 175. Radiated Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11n HT30**



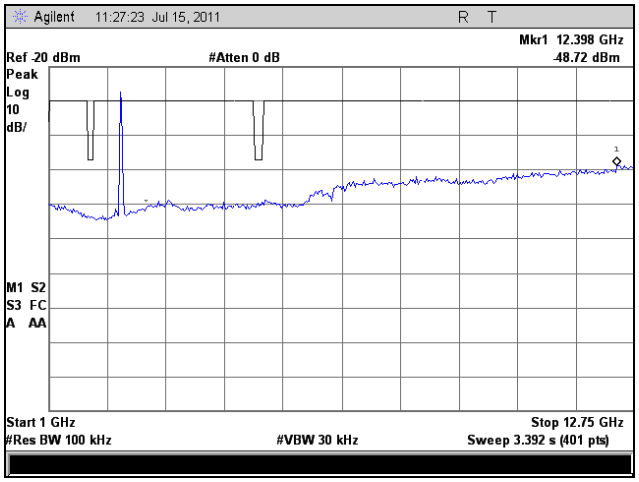

**Plot 176. Radiated Spurious Emission, Mid Channel, 30 MHz – 1 GHz, 802.11n HT30**




**Plot 177. Radiated Spurious Emission, Mid Channel, 1 GHz - 12.75 GHz, 802.11n HT30**

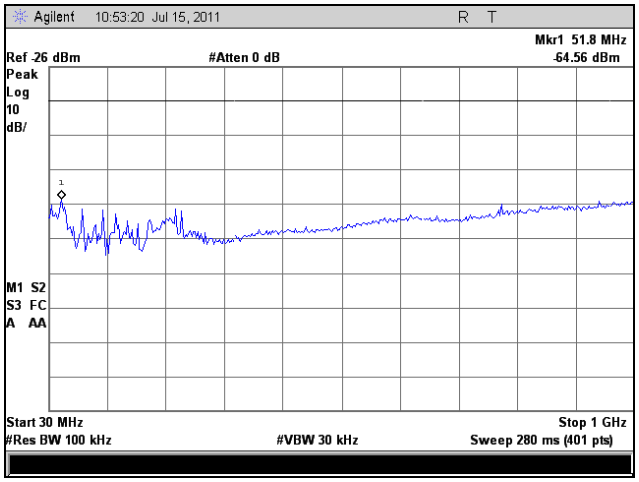



**Plot 178. Radiated Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11n HT30**

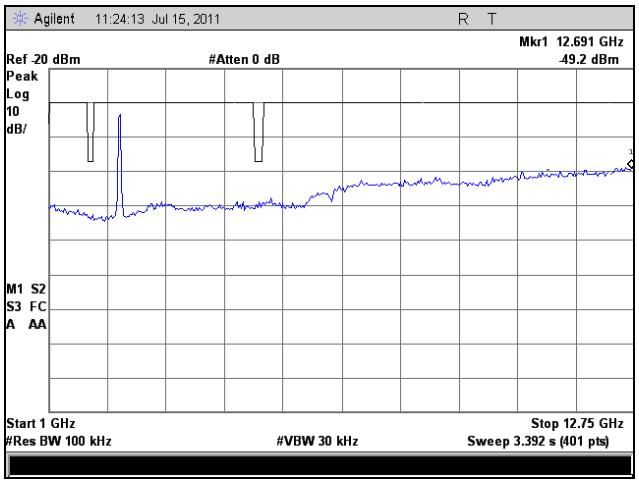



**Plot 179. Radiated Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11n HT30**

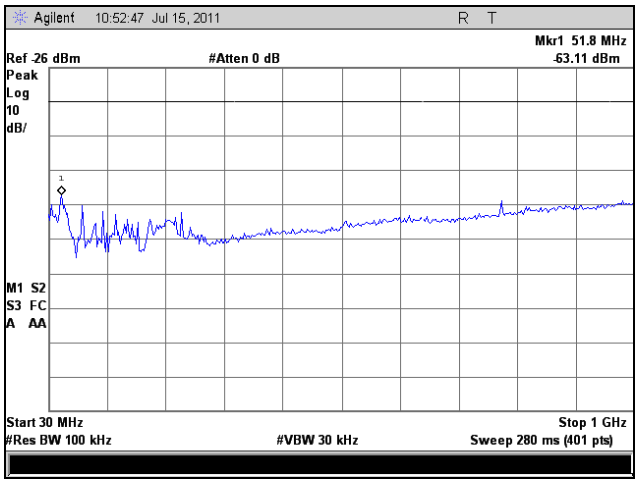
## Transmitter Spurious Emissions – Radiated, Test Results, 802.11n HT40



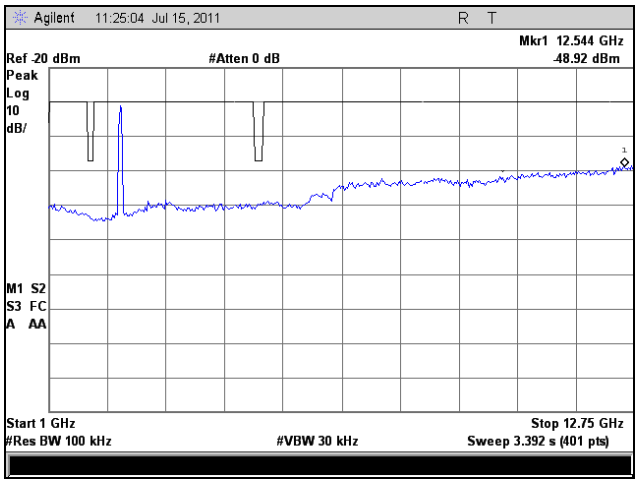

**Plot 180. Radiated Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11n HT40**



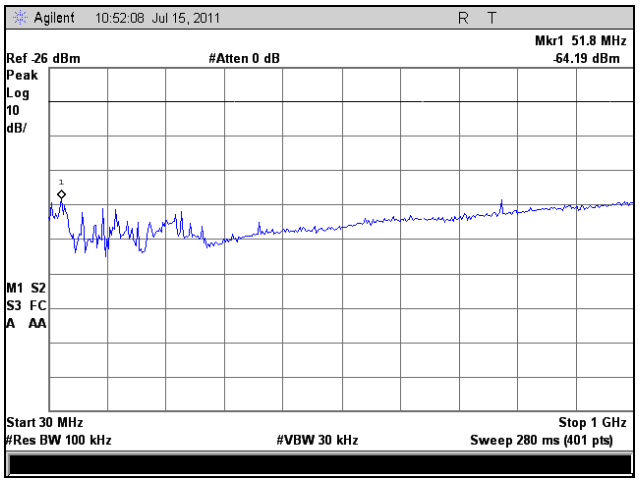

**Plot 181. Radiated Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11n HT40**



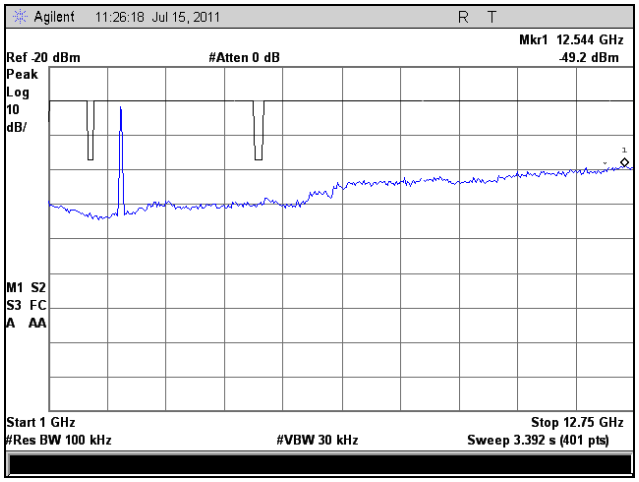

**Plot 182. Radiated Spurious Emission, Mid Channel, 30 MHz – 1 GHz, 802.11n HT40**




**Plot 183. Radiated Spurious Emission, Mid Channel, 1 GHz - 12.75 GHz, 802.11n HT40**

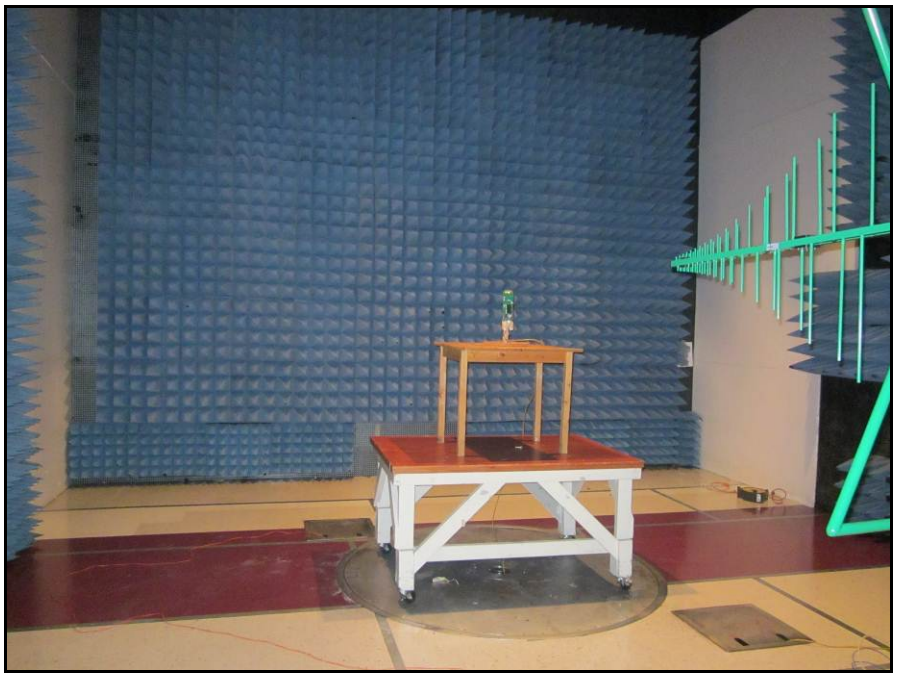



**Plot 184. Radiated Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11n HT40**

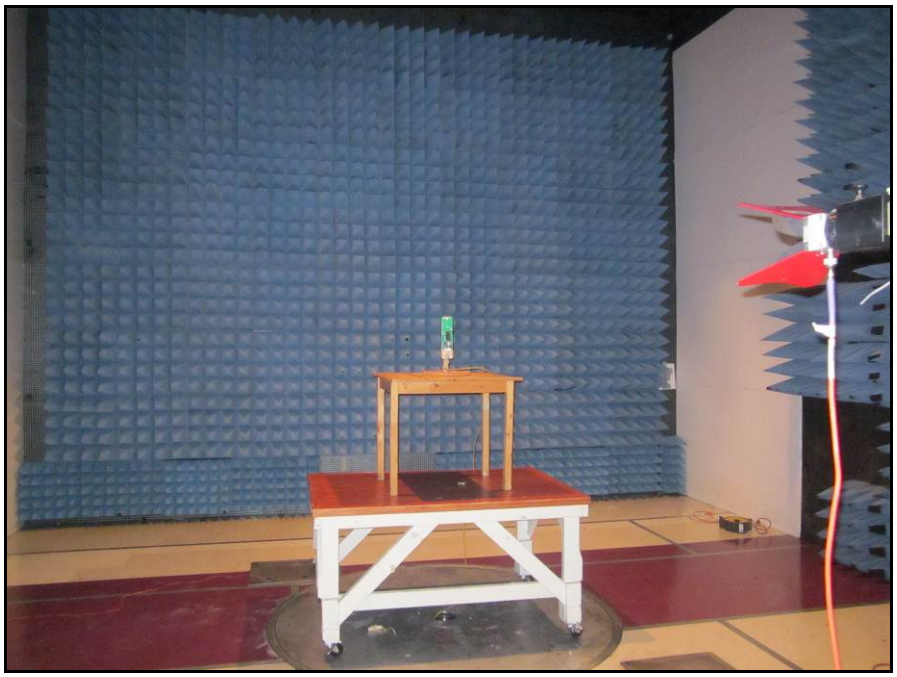



**Plot 185. Radiated Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11n HT40**

## Transmitter Spurious Emissions – Radiated, Test Setup



**Photograph 2. Radiated Emissions, Test Setup, 30 MHz – 1 GHz**



**Photograph 3. Radiated Emissions, Test Setup, 1 GHz – 12.75 GHz**

**Photograph 4. Radiated Emissions, Test Setup**

## Conformance Requirements

### 4.3.7 Receiver Spurious Emissions - Conducted

**Test Requirement(s):** 4.3.7.1 Definition

Receiver spurious emissions are emissions at any frequency when the equipment is in received mode.

4.3.7.2 Limit

The spurious emissions of the receiver shall not exceed the values in tables Table 25 and Table 26 and in the indicated bands.

| Frequency Range | Limit |
|---|---|
| 30 MHz to 1 GHz | -57 dBm |
| above 1 GHz to 12,75 GHz | -47 dBm |

**Table 25. Narrowband spurious emission limits for receivers**

The above limit values apply to narrowband emissions, e.g. as caused by local oscillator leakage. The measurement bandwidth for such emissions may be as small as necessary to get a reliable measurement result.

Wideband emissions shall not exceed the values given in Table 26.

| Frequency Range | Limit |
|---|---|
| 30 MHz to 1 GHz | -107dBm/Hz |
| above 1 GHz to 12,75 GHz | -97 dBm/Hz |

**Table 26. Wideband spurious emission limits for receivers**

**Test Procedure:** The EUT was directly connected to a SA.

**Test Results:** The EUT as tested was found compliant with the specified limits of Clause 4.3.7.2.

**Test Engineer:** Anderson Soungpanya

**Test Date:** 07/15/11

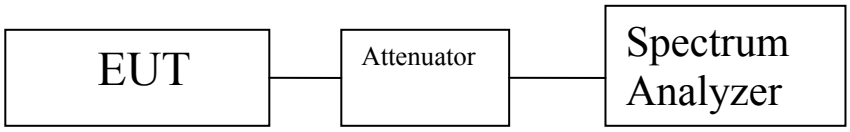
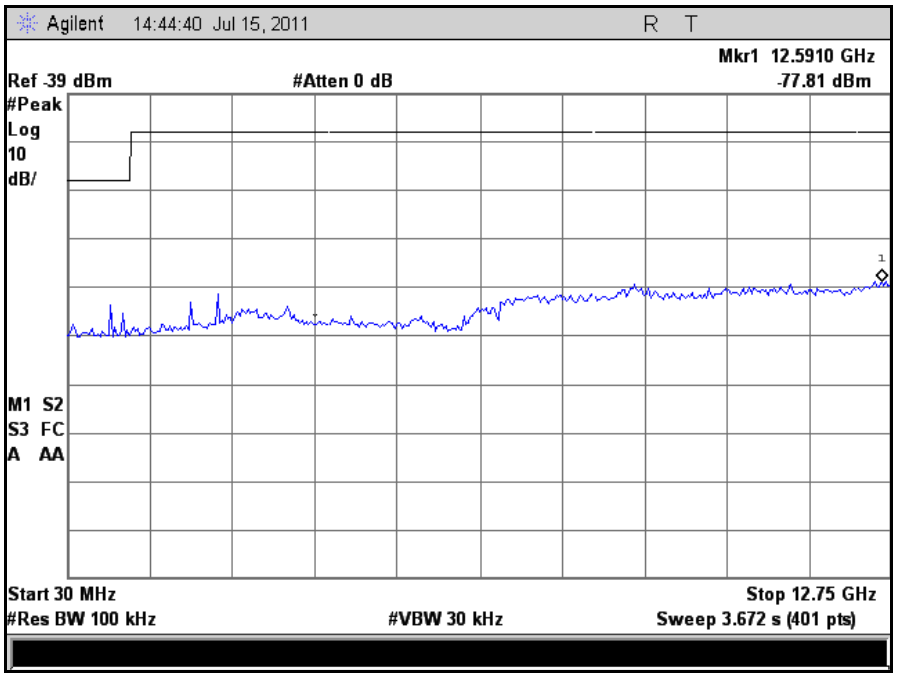



**Figure 7. Receiver Spurious Emissions**

## Conducted Receiver Spurious Emissions, Test Results




**Plot 186. Conducted Spurious Emission, 30 MHz – 12.75 GHz**

# Conformance Requirements

## 4.3.7 Receiver Spurious Emissions – Radiated

**Test Requirement(s):** 4.3.7.1 Definition

Receiver spurious emissions are emissions at any frequency when the equipment is in received mode.

4.3.7.2 Limit

The spurious emissions of the receiver shall not exceed the values in tables Table 25 and Table 26 and in the indicated bands.

| Frequency Range | Limit |
|---|---|
| 30 MHz to 1 GHz | -57 dBm |
| above 1 GHz to 12,75 GHz | -47 dBm |

**Table 27. Narrowband spurious emission limits for receivers**

The above limit values apply to narrowband emissions, e.g. as caused by local oscillator leakage. The measurement bandwidth for such emissions may be as small as necessary to get a reliable measurement result.

Wideband emissions shall not exceed the values given in Table 26.

| Frequency Range | Limit |
|---|---|
| 30 MHz to 1 GHz | -107dBm/Hz |
| above 1 GHz to 12,75 GHz | -97 dBm/Hz |

**Table 28. Wideband spurious emission limits for receivers**

**Test Procedure:** The EUT was placed on a 1.5m high wooden table inside a semi-anechoic chamber. The measurements were performed using normal operation of the equipment. The method of testing, test conditions, and test procedures of *Annex B* were used. The frequencies and amplitudes of field strengths were recorded for reference during final measurements.

The EUT was set to transmit at its highest output power at both the low and high channels of the transmit band as well as all applicable modulations. The receive antenna was adjusted in order to find the maximum emission. The table was also rotated about $360^0$. Both vertical and horizontal polarizations were used to determine the maximum emission.

**Test Results:** The EUT as tested was found compliant with the specified limits of Clause 4.3.7.2.

**Test Engineer:** Anderson Soungpanya

**Test Date:** 07/15/11

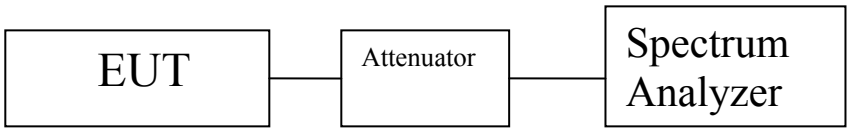
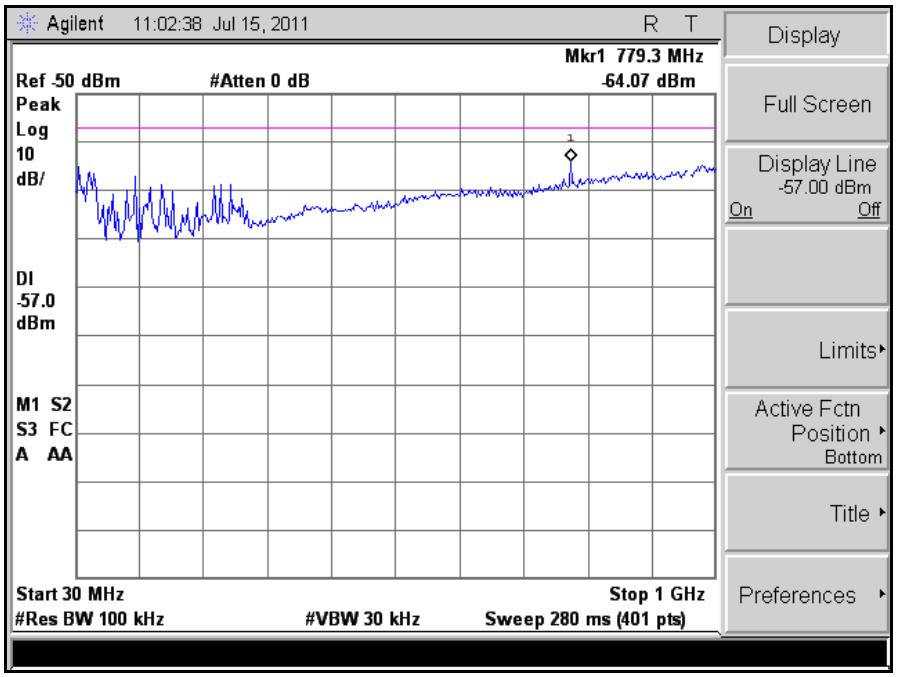


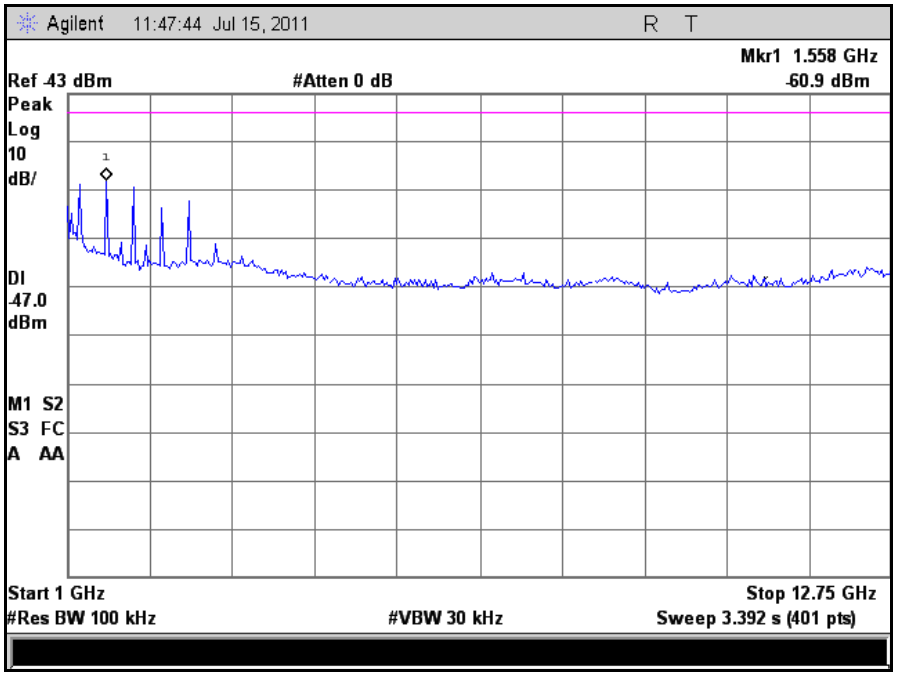

**Figure 8. Receiver Spurious Emissions**

## Receiver Spurious Emissions – Radiated, Test Results




**Plot 187. Radiated Spurious Emission, 30 MHz – 1 GHz**




**Plot 188. Radiated Spurious Emission, 1 GHz – 12.75 GHz**

# IV. Test Equipment

## Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

| MET Asset # | EQUIPMENT | Manufacturer | Model | Last Cal Date | Cal Due Date |
|---|---|---|---|---|---|
| 1S2603 | HORN ANTENNA | ETS-LINDGREN | 3117 | 5/9/2011 | 5/9/2012 |
| 1S2202 | HORN ANTENNA | EMCO | 3116 | 4/23/2010 | 4/23/2013 |
| 1S2583 | ANALYZER, SPECTRUM | AGILENT | E4447A | 03/18/2011 | 03/18/2012 |
| 1S2460 | ANALYZER, SPECTRUM | AGILENT | E4407B | 07/13/2010 | 07/13/2011 |
| 1S2482 | CHAMBER, 5 METER | PANASHIELD | 641431 | 11/13/2010 | 11/13/2011 |
| 1S2399 | TURNTABLE CONTROLLER | SUNOL SCIENCE | SC99V | SEE NOTE | |
| 1S2498 | VARIABLE POWER SUPPLY | ISE., INC | 5021CT-DVAM | SEE NOTE | |
| 1S2229 | TEMPERATURE CHAMBER | TENNY | T6 | 02/18/2011 | 02/18/2012 |
| 1S2484 | BILOG ANTENNA | TESEQ | CBL6112D | 2/27/2011 | 2/27/2012 |

Note: Functionally verified test equipment is verified using calibrated instrumentation at the time of testing.

# End of Report