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

January 17, 2011

Ubiquiti Networks
91 E. Tasman
San Jose, CA 95134

Dear Robert Pera,

Enclosed is the EMC test report for compliance testing of the Ubiquiti Networks, UAP 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\EMCS82657-ETS328 Rev. 1)

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Electromagnetic Compatibility Criteria
Test Report

For the

Ubiquiti Networks
Model UAP

Tested under

ETSI EN 300 328

(Article 3.2 of R&TTE Directive)

MET Report: EMCS82657-ETS328 Rev. 1

January 17, 2011

Prepared For:

Ubiquiti Networks
91 E. Tasman
San Jose, CA 95134

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave.
Baltimore, MD 21230

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MET Report: EMCS82657-ETS328 Rev. 1

Minh Ly, 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
∅	November 22, 2010	Initial Issue.
1	January 17, 2011	Revised to reflect correct model name.

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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 (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**H**enry
µF	**micro**F**arad
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 to perform testing on a UAP.

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 model UAP.

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

Model(s) Tested:	UAP
Model(s) Number:	UAP
EUT Specifications:	Primary Power: 120VAC-230VAC
	Frequency Range: 2412MHz – 2472MHz
Lab Ambient (Normal) Test Conditions:	Temperature: 15-35º C
	Relative Humidity: 30-60%
	Atmospheric Pressure: 860-1060 mbar
Extreme Test Conditions:	Temperature: 0 to + 35º C
	Relative Humidity: 30-60%
Evaluated by:	Minh Ly
Report Date(s):	January 17, 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 UAP, Equipment Under Test (EUT), is a high performance 802.11b/g/n point to point radio specifically designed for optimized performance at 2.4GHz.

Photograph 1. Front View of EUT

Photograph 2. Rear View of EUT

E. Equipment Configuration

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Revision
A	EUT	UAP	Prototype	NA	NA
B	POE Adapter	UBI-POE-2405	NA	0912-0007220	NA

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
C	Laptop	Dell	Vostro

Table 4. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
1	POE	RJ45	1	1	Y	B
2	LAN	RJ45	1	2	Y	C

Table 5. Ports and Cabling Information

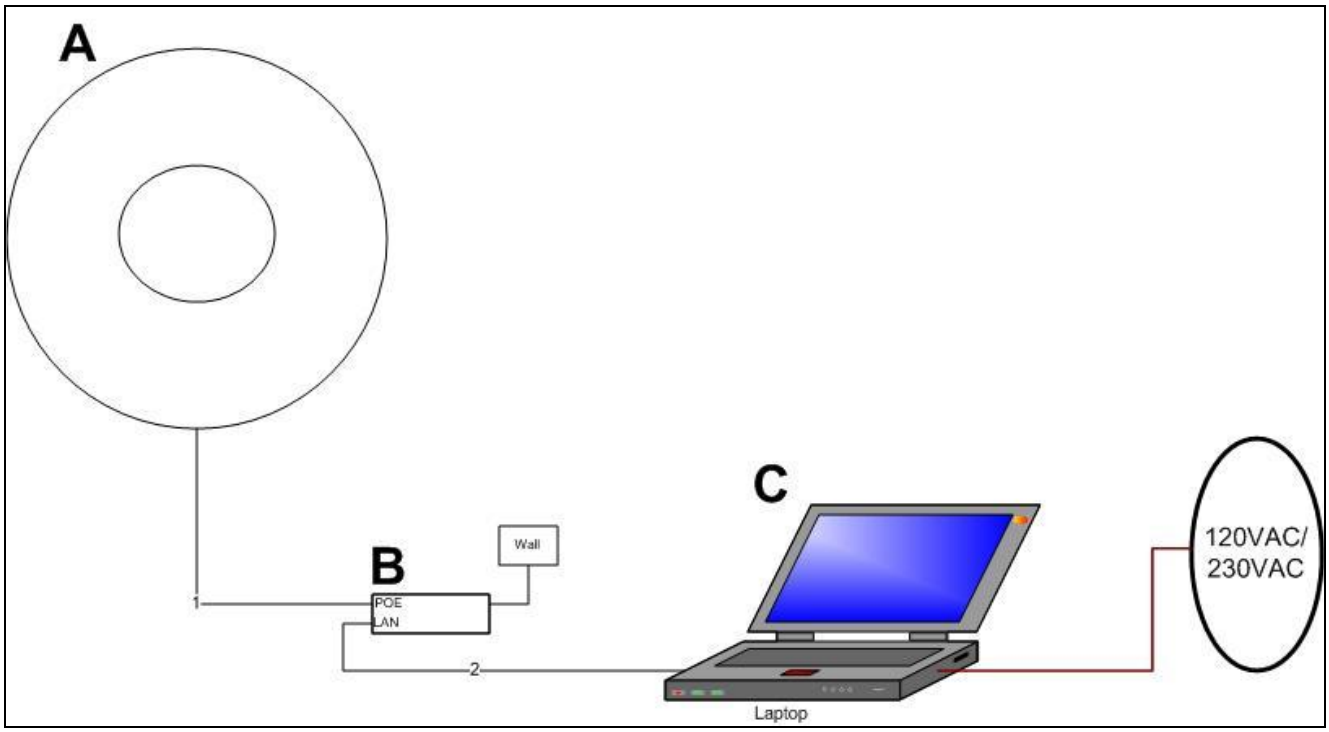


Figure 1. Block Diagram of Test Configuration

H. Mode of Operation

Using Atheros Radio Test Software.

I. Method of Monitoring EUT Operation

Ping Times out and doesn't return. Unit locks up requires power down is a fail.

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 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: The EUT was connected directly to a spectrum analyzer capable of measuring average RF power of a modulated carrier. 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. A combiner was used for MIMO operation only. The EIRP was calculated 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.

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

Test Engineer: Minh Ly

Test Date: 10/07/10

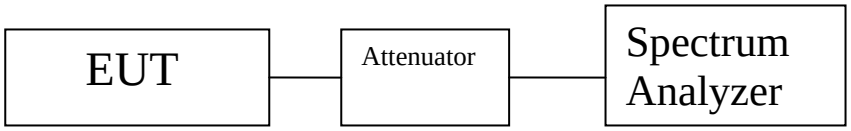


Figure 2. Maximum Transmit Power, 802.11b/g mode

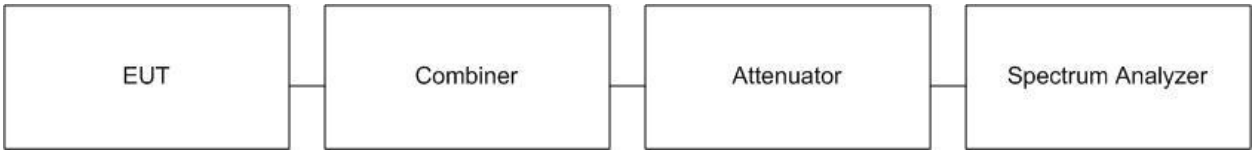


Figure 3. Maximum Transmit Power, 802.11n mode

Maximum Transmit Power (EIRP) Test Results

Maximum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
2412	20	230	13.91	5	18.91	20
2412	0	207	14.46	5	19.46	20
2412	0	253	14.32	5	19.32	20
2412	35	207	13.33	5	18.33	20
2412	35	253	13.37	5	18.37	20
2442	20	230	13.61	5	18.61	20
2442	0	207	14.56	5	19.56	20
2442	0	253	14.37	5	19.37	20
2442	35	207	13.11	5	18.11	20
2442	35	253	13.03	5	18.03	20
2472	20	230	13.44	5	18.44	20
2472	0	207	14.23	5	19.23	20
2472	0	253	13.90	5	18.90	20
2472	35	207	12.86	5	17.86	20
2472	35	253	12.86	5	17.86	20

Table 6. EIRP, Test Results, 802.11b

Maximum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
2412	20	230	14.60	5	19.60	20
2412	0	207	14.91	5	19.91	20
2412	0	253	14.89	5	19.89	20
2412	35	207	13.42	5	18.42	20
2412	35	253	13.35	5	18.35	20
2442	20	230	14.11	5	19.11	20
2442	0	207	14.64	5	19.64	20
2442	0	253	14.71	5	19.71	20
2442	35	207	13.05	5	18.05	20
2442	35	253	12.98	5	17.98	20
2472	20	230	13.99	5	18.99	20
2472	0	207	14.62	5	19.62	20
2472	0	253	14.51	5	19.51	20
2472	35	207	13.07	5	18.07	20
2472	35	253	13.13	5	18.13	20

Table 7. EIRP, Test Results, 802.11g

Maximum Transmit Power (EIRP) Test Results

Maximum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
2412	20	230	13.64	5	18.64	20
2412	0	207	14.80	5	19.80	20
2412	0	253	14.90	5	19.90	20
2412	35	207	13.33	5	18.33	20
2412	35	253	13.34	5	18.34	20
2442	20	230	13.26	5	18.26	20
2442	0	207	13.70	5	18.70	20
2442	0	253	13.61	5	18.61	20
2442	35	207	11.81	5	16.81	20
2442	35	253	11.92	5	16.92	20
2472	20	230	14.21	5	19.21	20
2472	0	207	14.91	5	19.91	20
2472	0	253	14.93	5	19.93	20
2472	35	207	13.64	5	18.64	20
2472	35	253	13.58	5	18.58	20

Table 8. EIRP, Test Results, 802.11n 20 MHz

Maximum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
2442	20	230	12.13	5	17.13	20
2442	0	207	14.70	5	19.70	20
2442	0	253	14.61	5	19.61	20
2442	35	207	13.62	5	18.62	20
2442	35	253	13.51	5	18.51	20

Table 9. EIRP, Test Results, 802.11n 40 MHz

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 then FHSS (e.g. DSSS, OFDM, etc.), the maximum EIRP spectral density is limited to 10 mW per MHz.

Test Procedure: The EUT was connected directly to a spectrum analyzer through an attenuator. The EUT was set to transmit at the highest power level in the appropriate modulation. For DTS modulations, the spectrum analyzer was set with a resolution band width of 1MHz, a positive peak detector, max hold function and a span three times the Occupied Band width. The frequency which produced the highest output across the channel bandwidth was recorded. The spectrum analyzer was then set to this frequency and the channel power/MHz was measured using the spectrum analyzer's channel power function. 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. A combiner was used for MIMO operation only.

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: Minh Ly

Test Date: 10/08/10

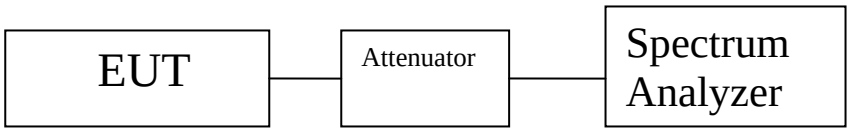


Figure 4. Maximum Spectral Density 802.11b/g

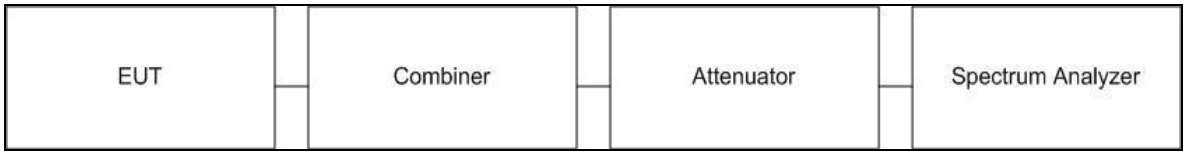
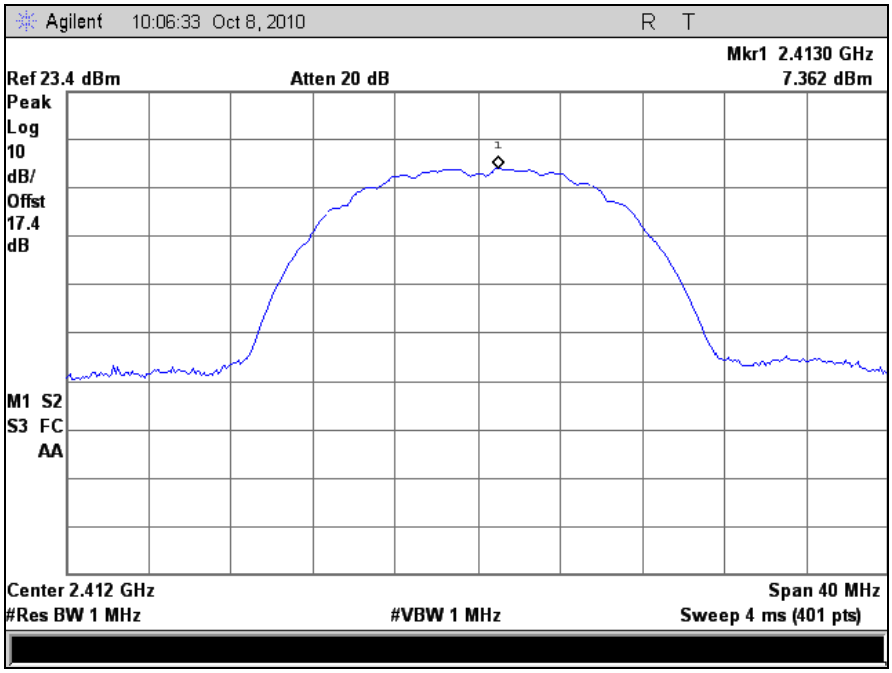


Figure 5. Maximum Spectral Density 802.11n mode

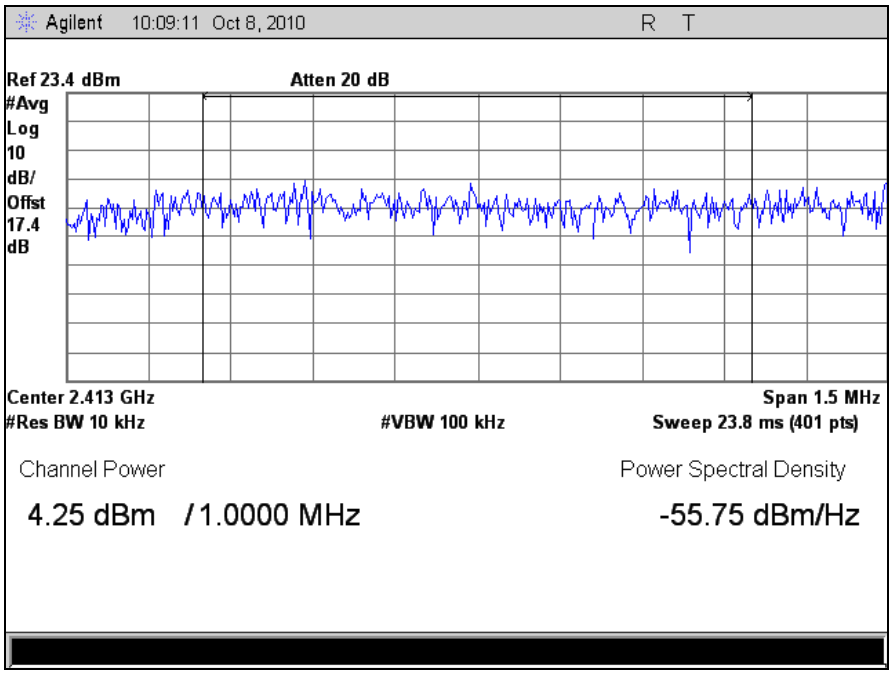
Frequency (MHz)	Mode	Measured Maximum Spectral Power Density (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Maximum SPD Limit (dBm)	Margin dB
Low	802.11b	4.25	5	9.25	10	-0.75
Mid		4.07	5	9.07	10	-0.93
High		4.70	5	9.7	10	-0.3
Low	802.11g	2.41	5	7.41	10	-2.59
Mid		2.55	5	7.55	10	-2.45
High		2.20	5	7.2	10	-2.8
Low	802.11n 20 MHz	0.18	5	5.18	10	-4.82
Mid		-1.50	5	3.5	10	-6.5
High		0.44	5	5.44	10	-4.56
Mid	802.11n 40 MHz	-5.04	5	-0.04	10	-10.04

Table 10. Peak Spectral Density, Test Results, 5 dBi Antenna

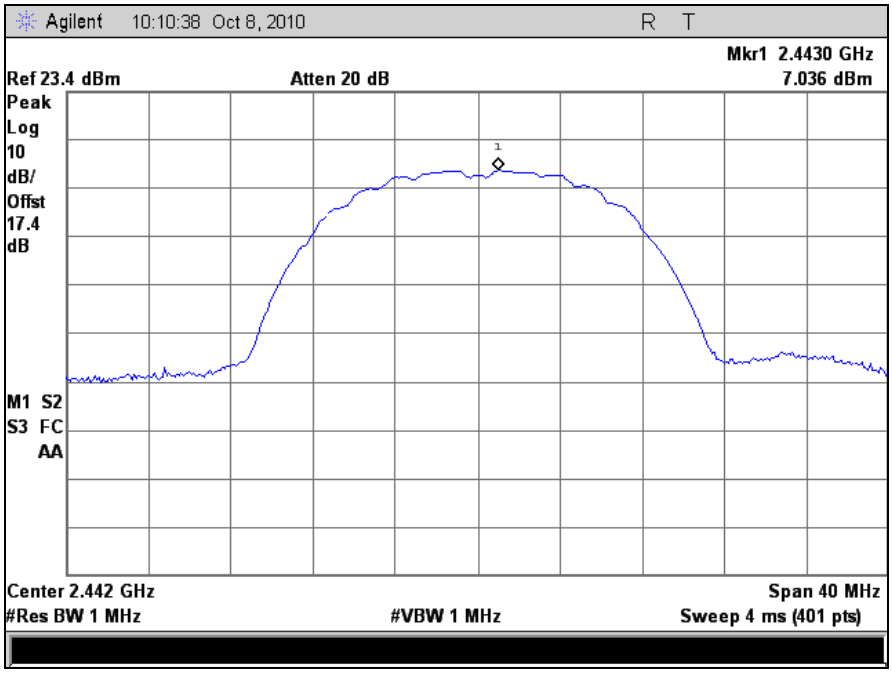
Maximum EIRP Spectral Density, Test Results, 802.11b



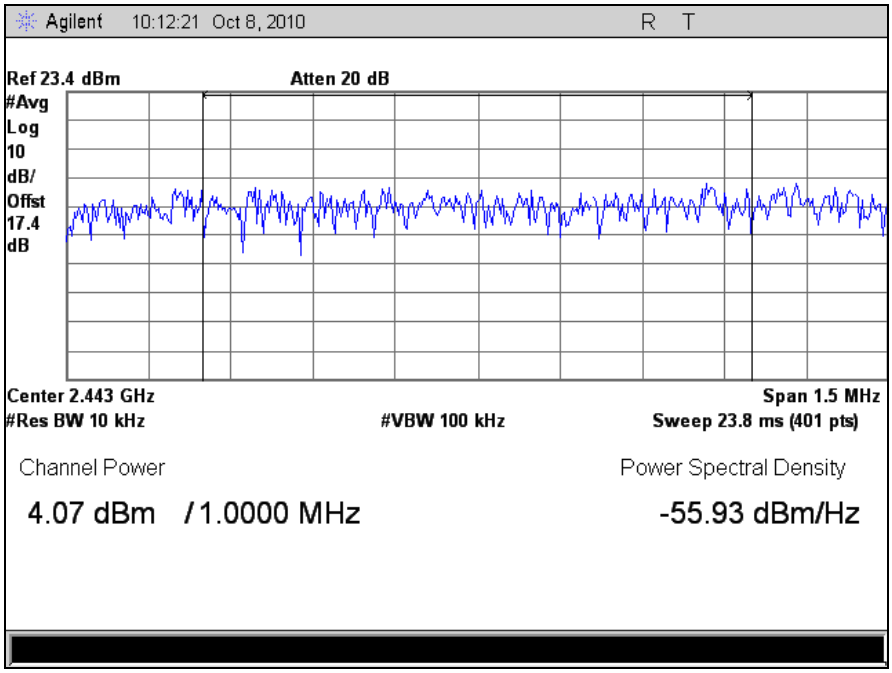
Plot 1. Peak Spectral Density, Low Channel, Peak Determination, 802.11b



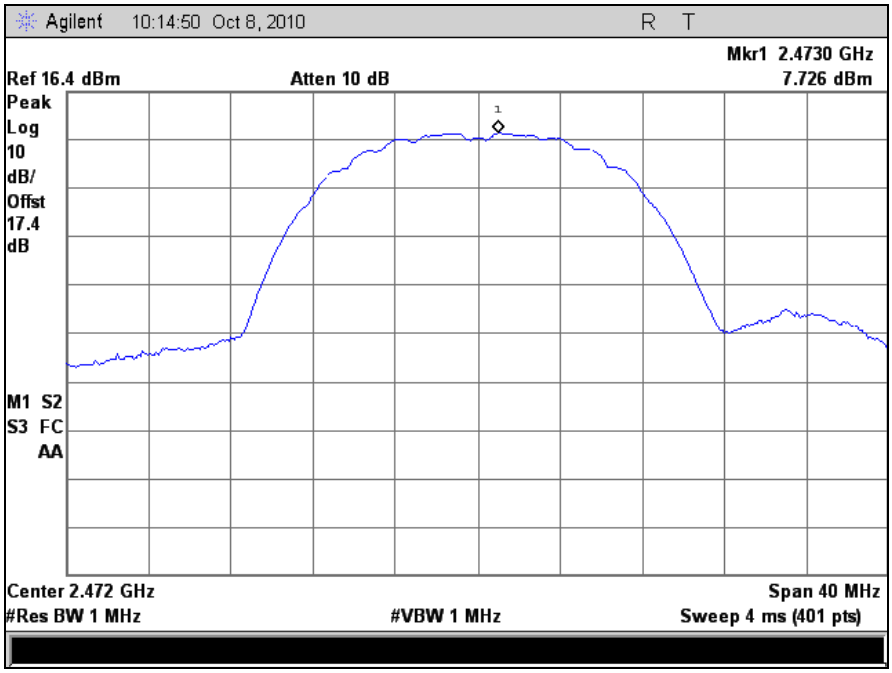
Plot 2. Peak Spectral Density, Low Channel, 802.11b



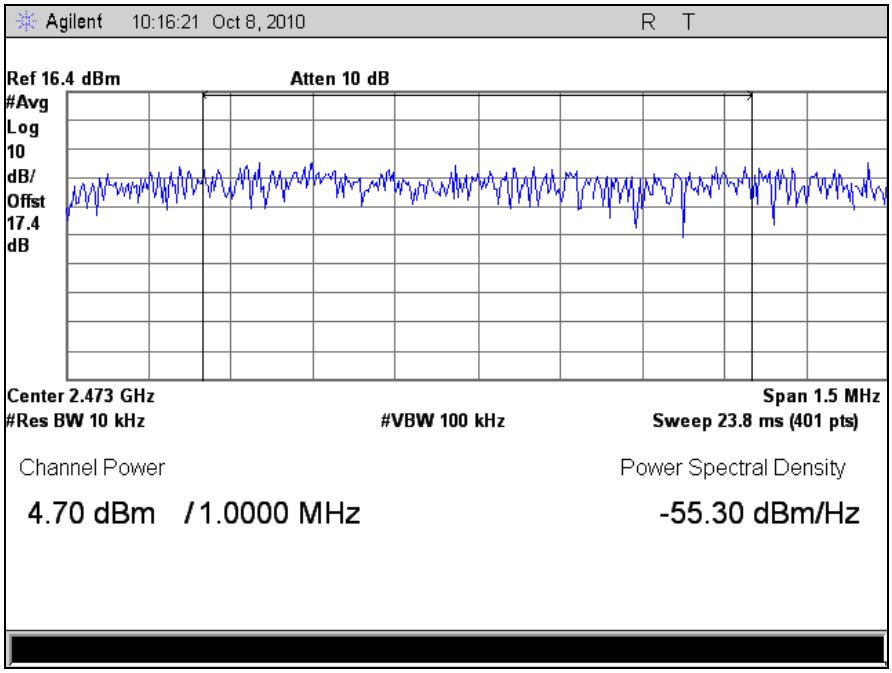
Plot 3. Peak Spectral Density, Mid Channel, Peak Determination, 802.11b



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

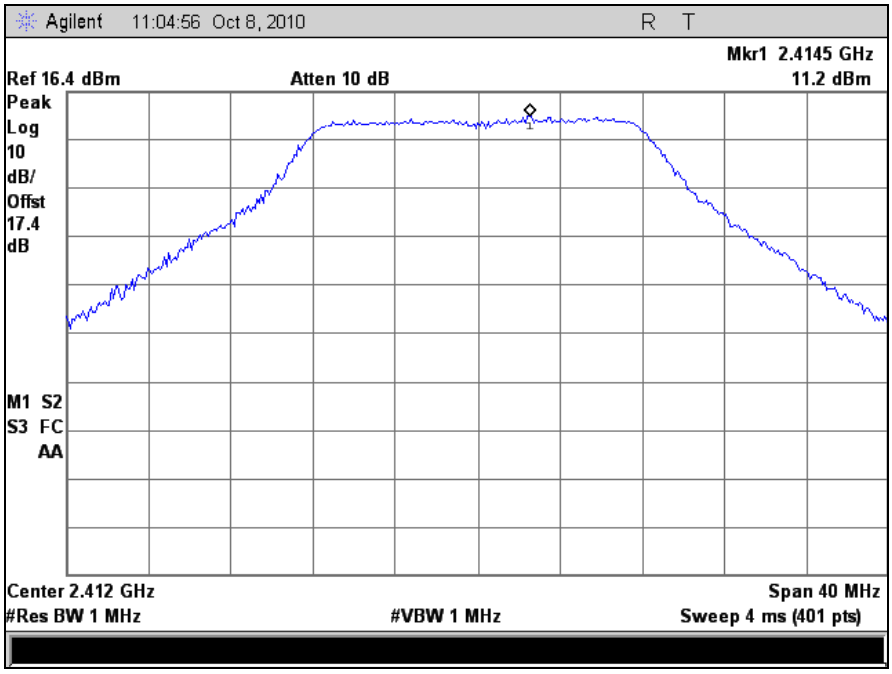


Plot 5. Peak Spectral Density, High Channel, Peak Determination, 802.11b

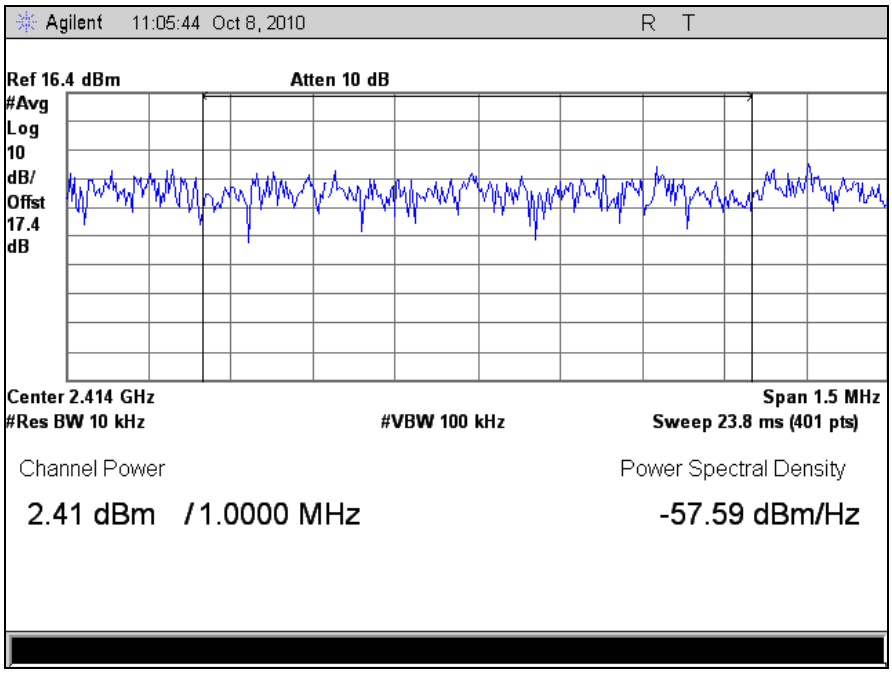


Plot 6. Peak Spectral Density, High Channel, 802.11b

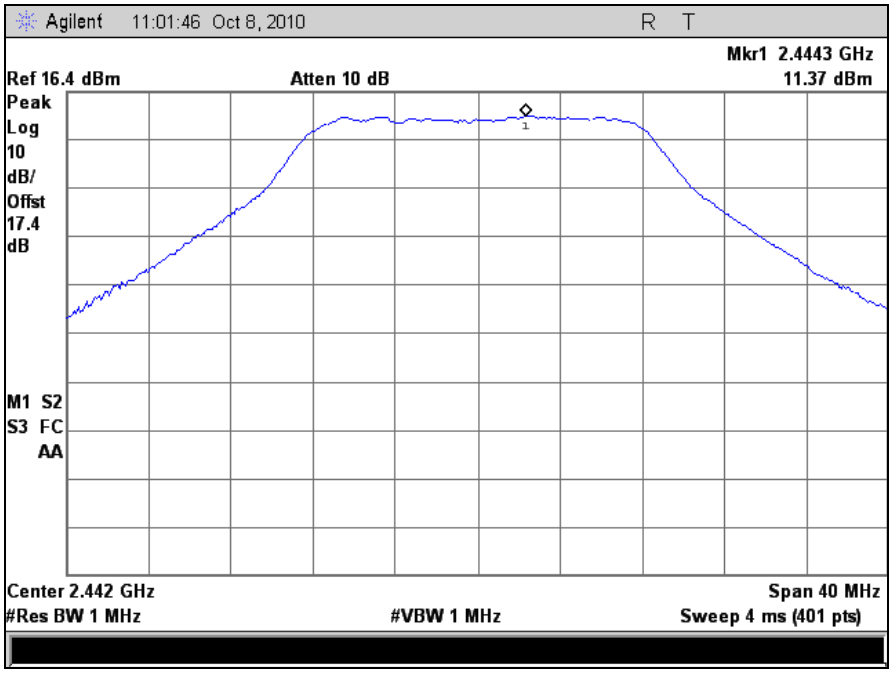
Maximum EIRP Spectral Density, Test Results, 802.11g



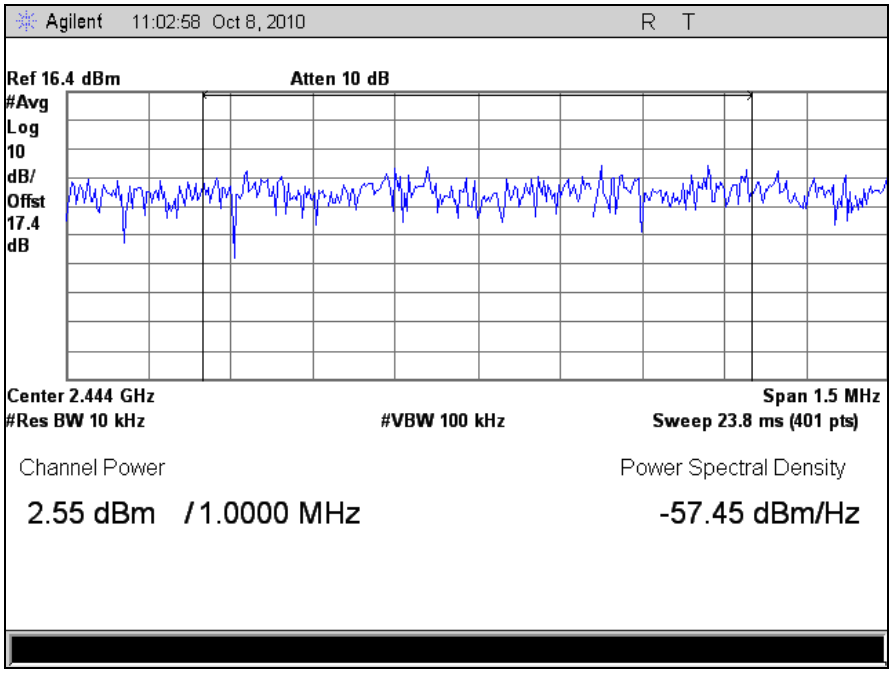
Plot 7. Peak Spectral Density, Low Channel, Peak Determination, 802.11g



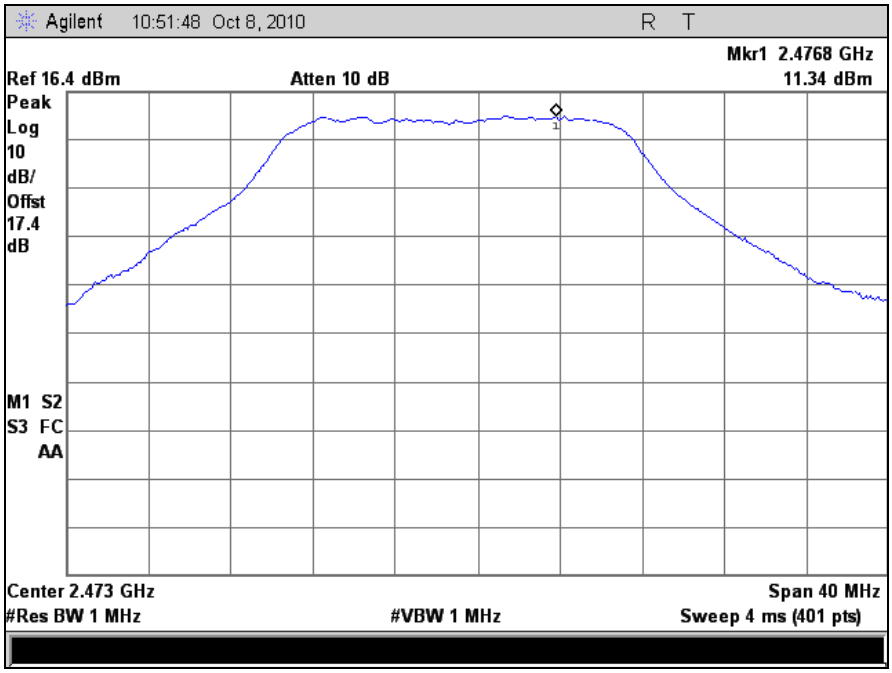
Plot 8. Peak Spectral Density, Low Channel, 802.11g



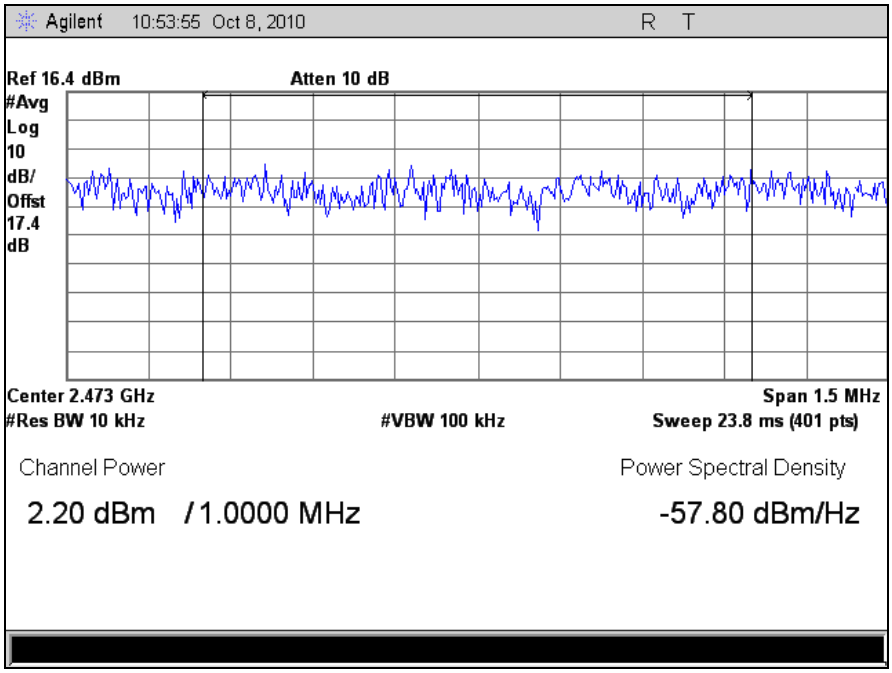
Plot 9. Peak Spectral Density, Mid Channel, Peak Determination, 802.11g



Plot 10. Peak Spectral Density, Mid Channel, 802.11g

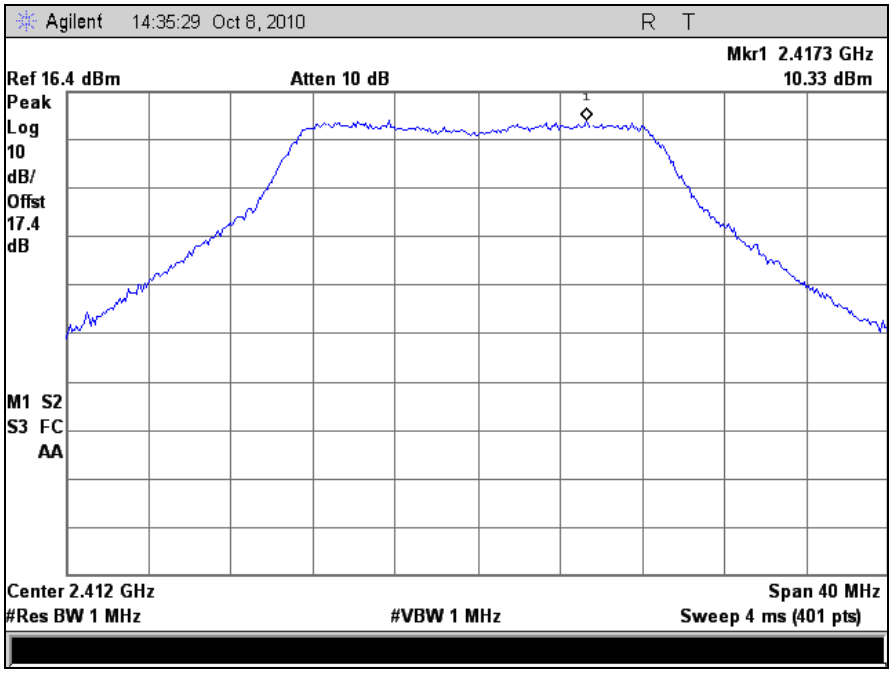


Plot 11. Peak Spectral Density, High Channel, Peak Determination, 802.11g

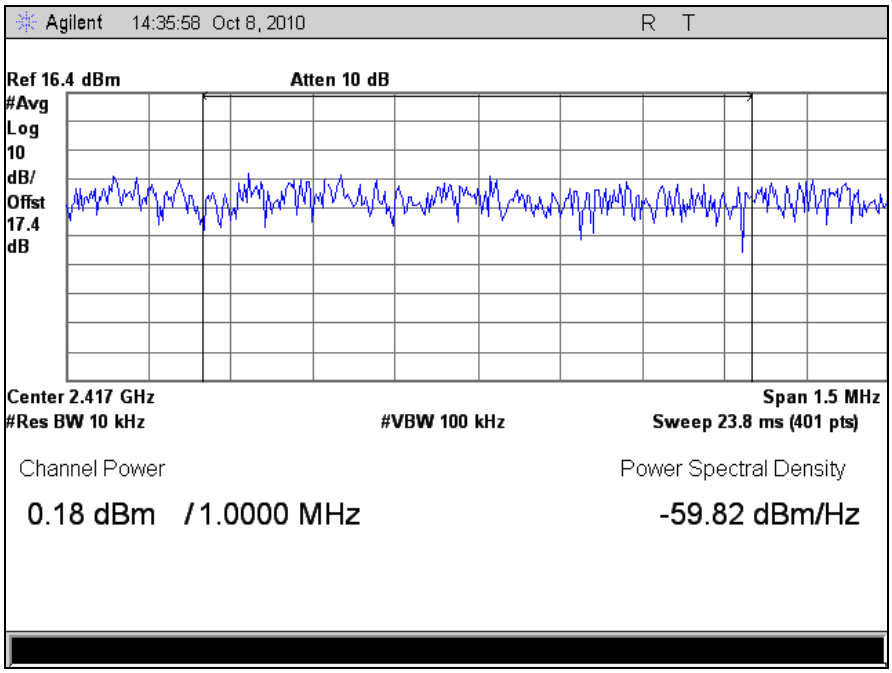


Plot 12. Peak Spectral Density, High Channel, 802.11g

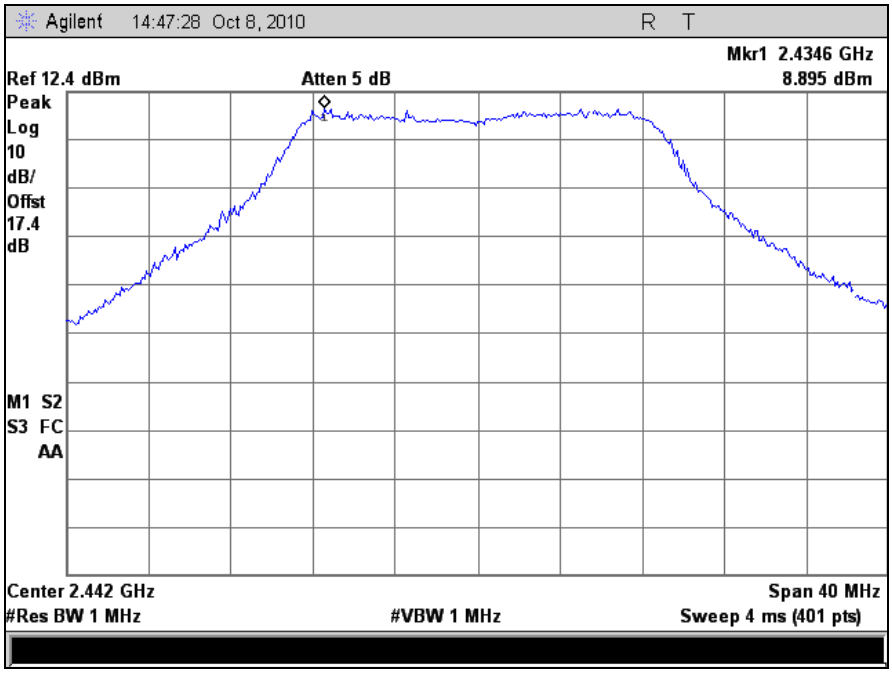
Maximum EIRP Spectral Density, Test Results, 802.11n 20 MHz



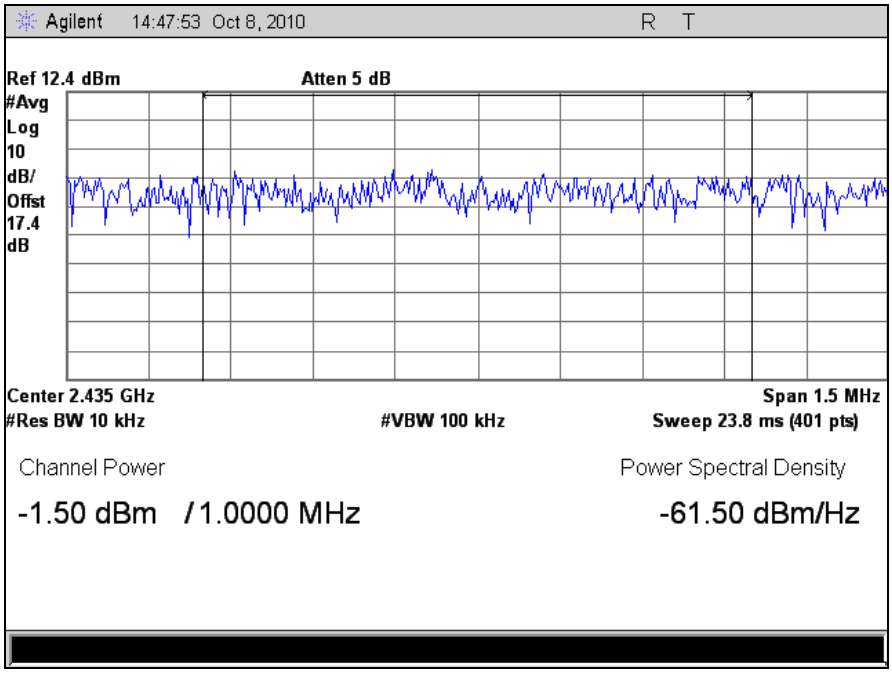
Plot 13. Peak Spectral Density, Low Channel, Peak Determination, 802.11n 20 MHz



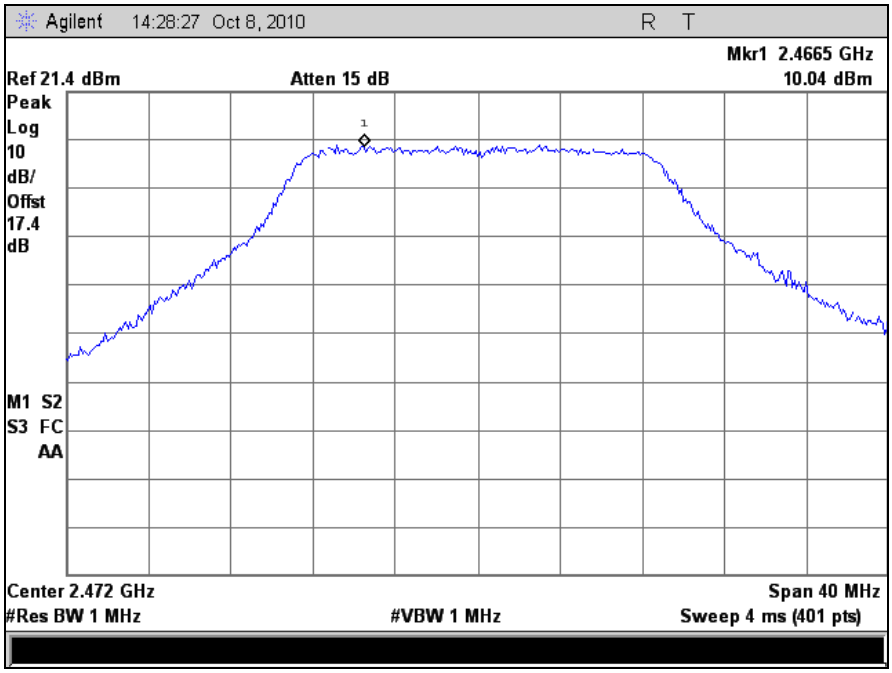
Plot 14. Peak Spectral Density, Low Channel, 802.11n 20 MHz



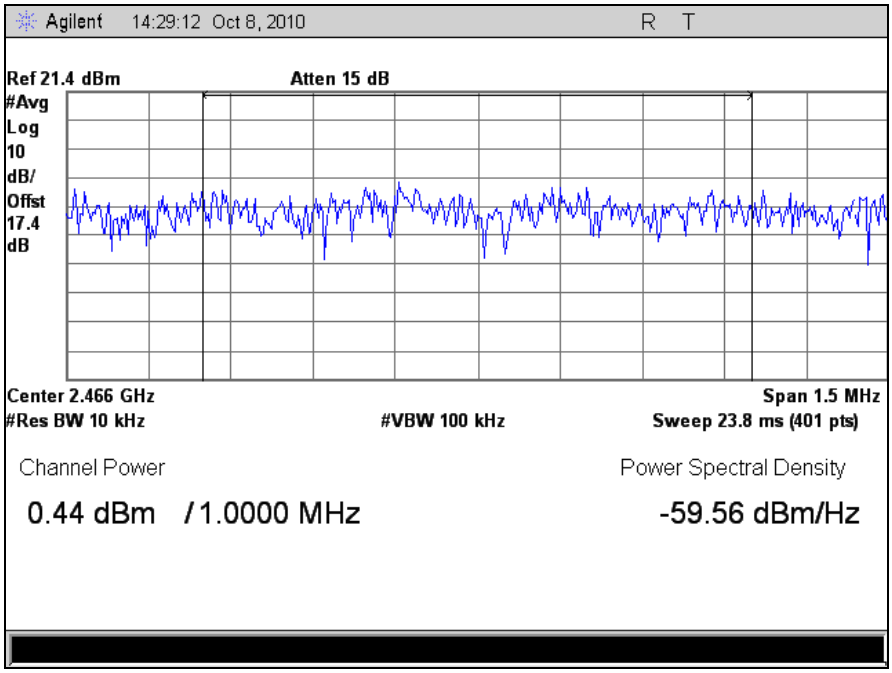
Plot 15. Peak Spectral Density, Mid Channel, Peak Determination, 802.11n 20 MHz



Plot 16. Peak Spectral Density, Mid Channel, 802.11n 20 MHz

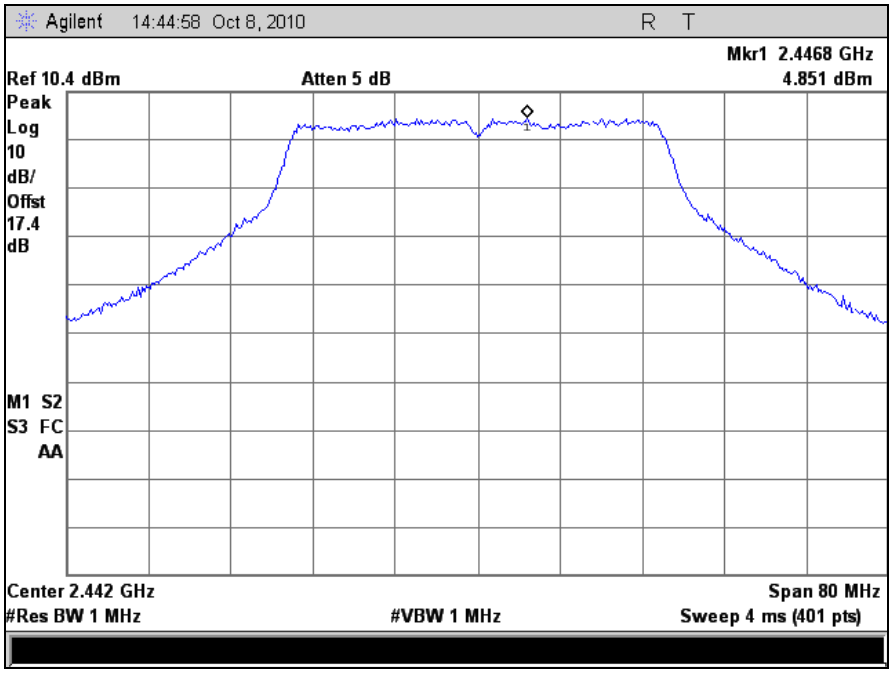


Plot 17. Peak Spectral Density, High Channel, Peak Determination, 802.11n 20 MHz

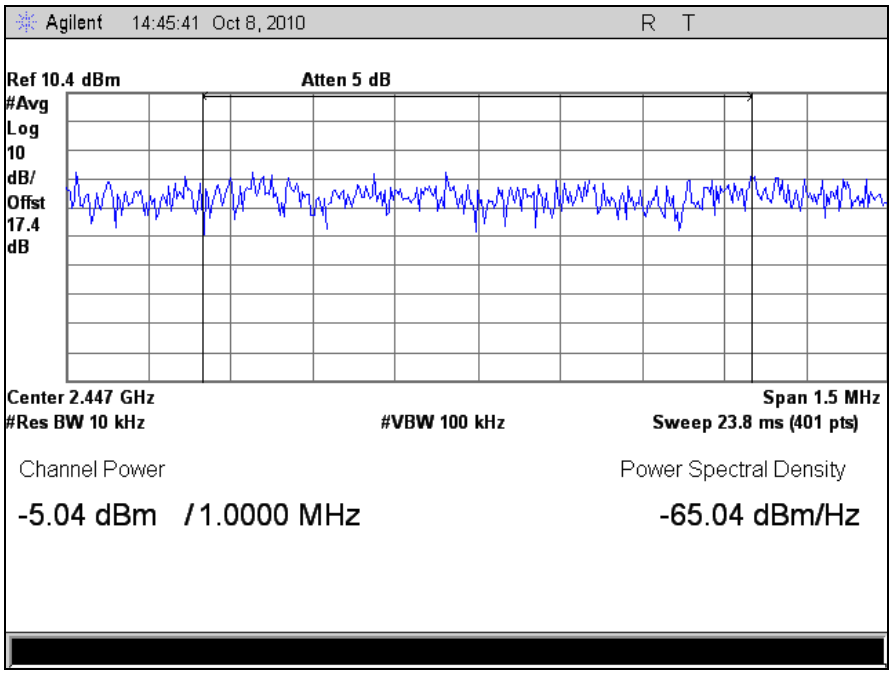


Plot 18. Peak Spectral Density, High Channel, 802.11n 20 MHz

Maximum EIRP Spectral Density, Test Results, 802.11n 40 MHz



Plot 19. Peak Spectral Density, Mid Channel, Peak Determination, 802.11n 40 MHz



Plot 20. Peak Spectral Density, Mid Channel, 802.11n 40 MHz

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: The EUT was connected directly to a spectrum analyzer through a attenuator. The resolution band width of the spectrum analyzer was set to 100 KHz with video averaging and a minimum of 50 sweeps. The lowest and highest carrier frequencies generated by all modulations was set to transmit at the highest rated power level of the EUT. The frequency at which the spectral density dropped by 30dBm from the maximum level measured was recorded for both the upper and lower frequencies of the transmit band. This procedure was carried out at both normal and extreme conditions. A positive 3 dB offset was programmed into SA to account for 3 dBi antenna. A combiner was used for MIMO operation.

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

Test Engineer: Minh Ly

Test Date: 10/07/10

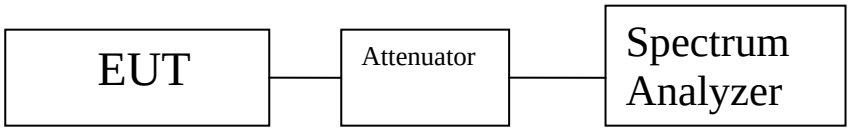


Figure 6. Frequency Range Test Setup 802.11b/g

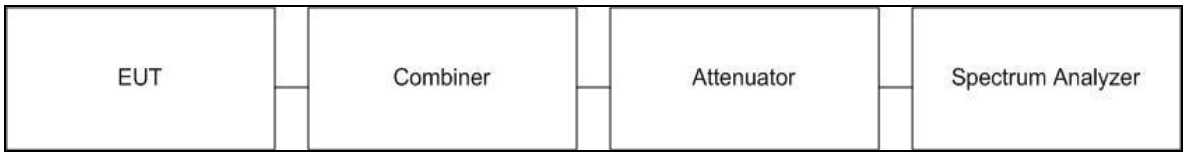


Figure 7. Frequency Range Test Setup 802.11n mode

Frequency Range, Test Results

Temperature	Voltage	Mode	Lowest Frequency (f_L) MHz	Highest Frequency (f_H) MHz	Difference (f_H - f_L) MHz	Limit MHz	Margin MHz
Nominal	Nominal	802.11b	2402.4	2481.5	79.1	83.5	4.4
Maximum	Maximum	802.11b	2402.5	2481.5	79	83.5	4.5
Maximum	Minimum	802.11b	2402.5	2481.5	79.1	83.5	4.4
Minimum	Maximum	802.11b	2402.4	2481.6	79.2	83.5	4.3
Minimum	Minimum	802.11b	2402	2482	80	83.5	3.5

Table 11. Frequency Range, Test Results, 802.11b

Temperature	Voltage	Mode	Lowest Frequency (f_L) MHz	Highest Frequency (f_H) MHz	Difference (f_H - f_L) MHz	Limit MHz	Margin MHz
Nominal	Nominal	802.11g	2402.1	2481.8	79.7	83.5	3.8
Maximum	Maximum	802.11g	2402.4	2481.6	79.2	83.5	4.3
Maximum	Minimum	802.11g	2402.4	2481.7	79.2	83.5	4.3
Minimum	Maximum	802.11g	2402.1	2482	79.9	83.5	3.6
Minimum	Minimum	802.11g	2402	2482	80	83.5	3.5

Table 12. Frequency Range, Test Results, 802.11g

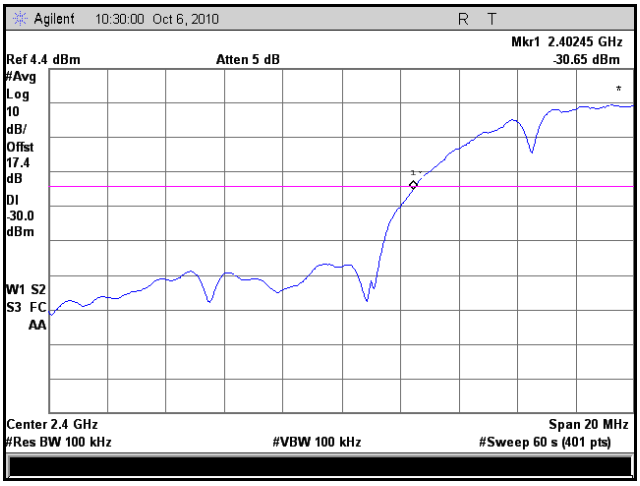
Temperature	Voltage	Mode	Lowest Frequency (f_L) MHz	Highest Frequency (f_H) MHz	Difference (f_H - f_L) MHz	Limit MHz	Margin MHz
Nominal	Nominal	HT 20	2401.6	2482.5	80.9	83.5	2.6
Maximum	Maximum	HT 20	2401.8	2482.2	80.4	83.5	3.1
Maximum	Minimum	HT 20	2401.6	2482.2	80.6	83.5	2.9
Minimum	Maximum	HT 20	2401.5	2482.7	81.2	83.5	2.3
Minimum	Minimum	HT 20	2401.4	2482.7	81.3	83.5	2.2

Table 13. Frequency Range, Test Results, 802.11n 20 MHz

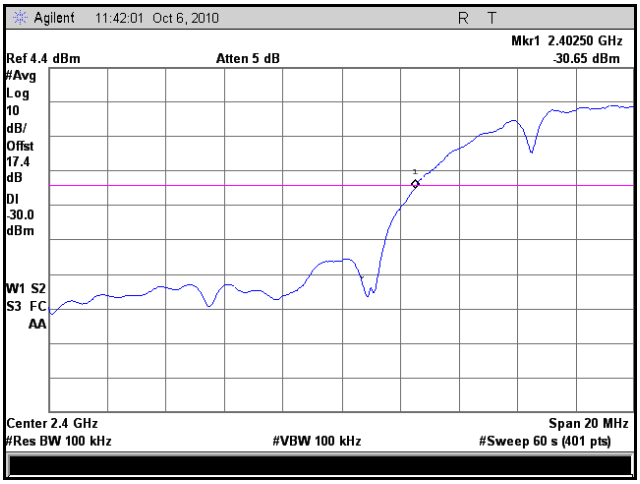
Temperature	Voltage	Mode	Lowest Frequency (f_L) MHz	Highest Frequency (f_H) MHz	Difference (f_H - f_L) MHz	Limit MHz	Margin MHz
Nominal	Nominal	HT 40	2423.2	2460.7	37.5	83.5	46
Maximum	Maximum	HT 40	2423	2461	38	83.5	45.5
Maximum	Minimum	HT 40	2423	2461.2	38.2	83.5	45.3
Minimum	Maximum	HT 40	2423	2461.2	38.2	83.5	45.3
Minimum	Minimum	HT 40	2423	2461.2	38.2	83.5	45.3

Table 14. Frequency Range, Test Results, 802.11n 40 MHz

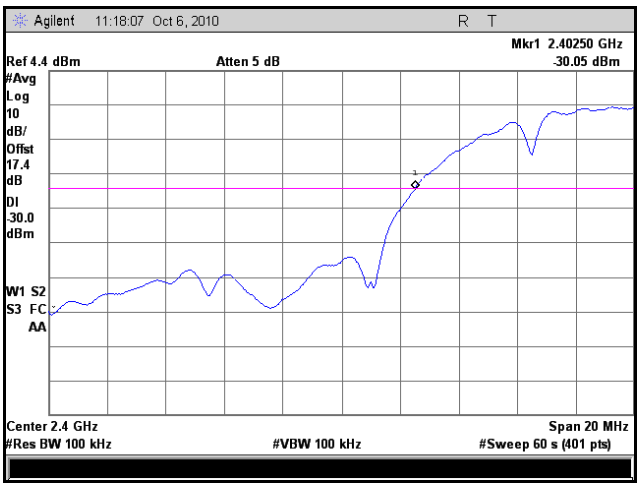
Frequency Range, 802.11b



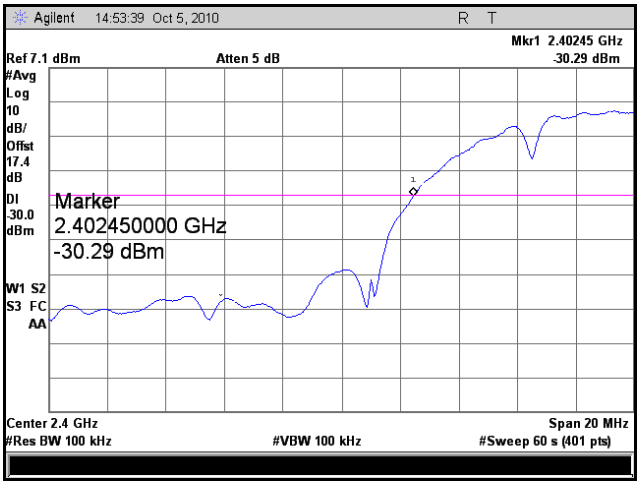
Plot 21. Frequency Range, Low Channel, 802.11b, Normal Temperature, Normal Voltage



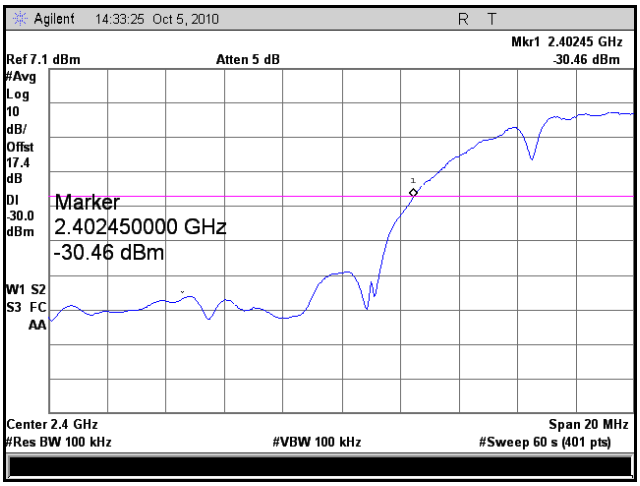
Plot 22. Frequency Range, Low Channel, 802.11b, Maximum Temperature, Maximum Voltage



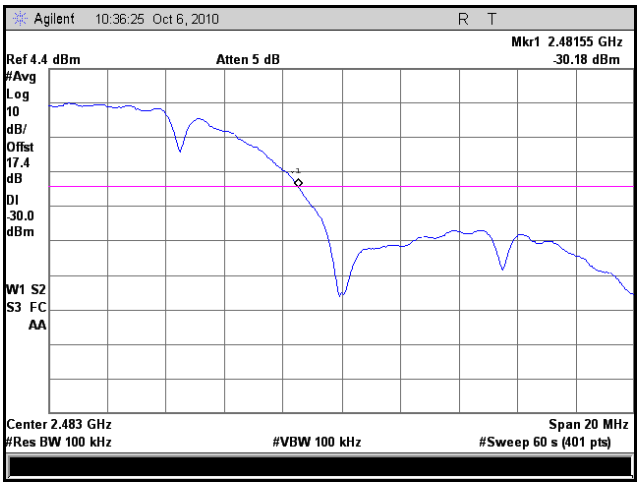
Plot 23. Frequency Range, Low Channel, 802.11b, Maximum Temperature, Minimum Voltage



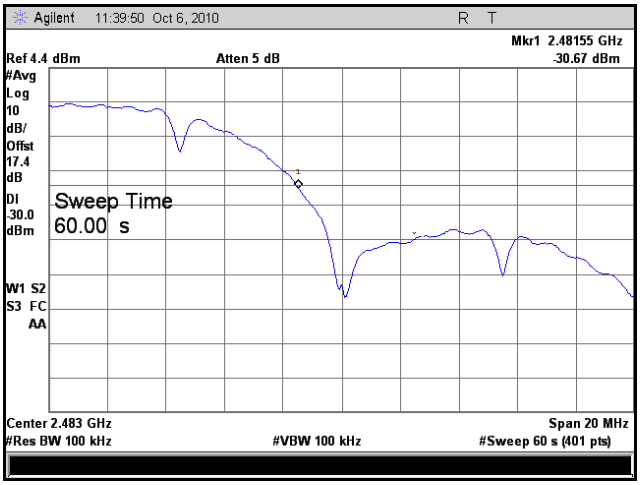
Plot 24. Frequency Range, Low Channel, 802.11b, Minimum Temperature, Maximum Voltage



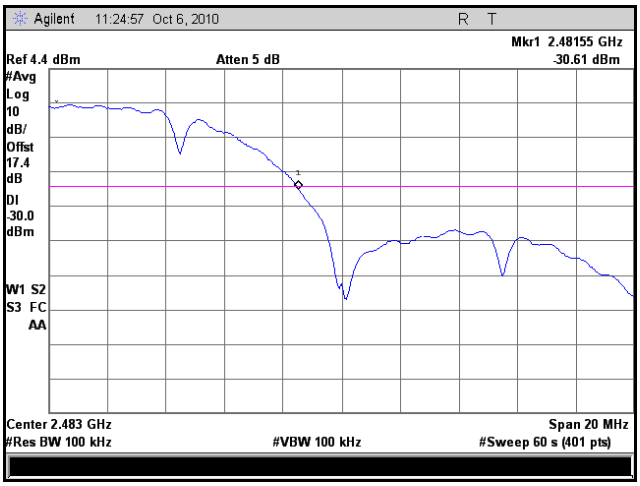
Plot 25. Frequency Range, Low Channel, 802.11b, Minimum Temperature, Minimum Voltage



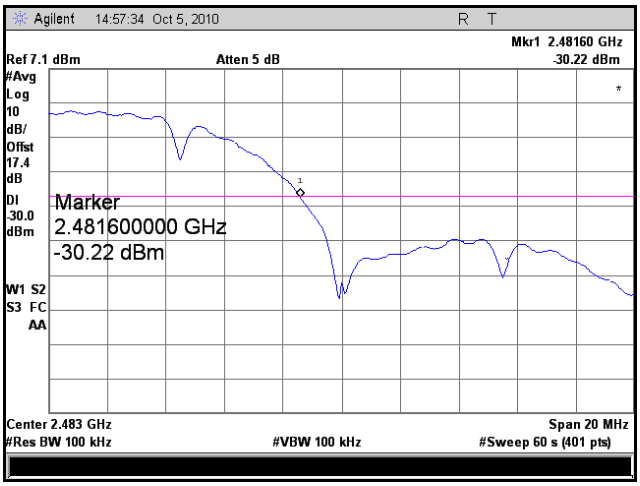
Plot 26. Frequency Range, High Channel, 802.11b, Normal Temperature, Normal Voltage



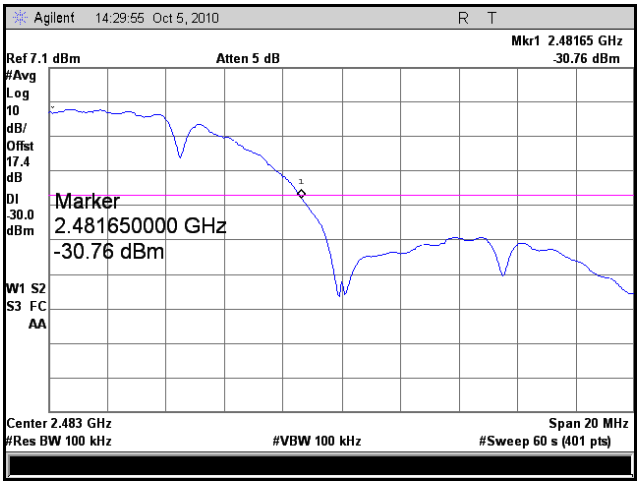
Plot 27. Frequency Range, High Channel, 802.11b, Maximum Temperature, Maximum Voltage



Plot 28. Frequency Range, High Channel, 802.11b, Maximum Temperature, Minimum Voltage

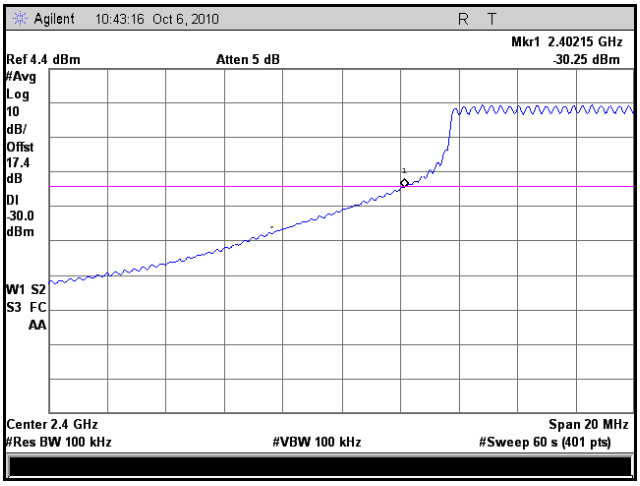


Plot 29. Frequency Range, High Channel, 802.11b, Minimum Temperature, Maximum Voltage

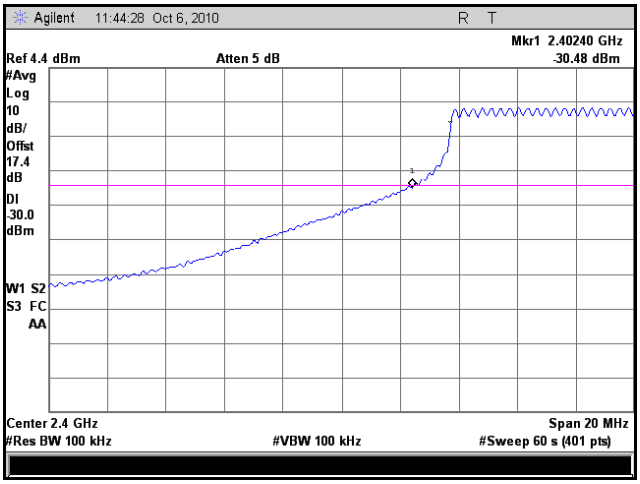


Plot 30. Frequency Range, High Channel, 802.11b, Minimum Temperature, Minimum Voltage

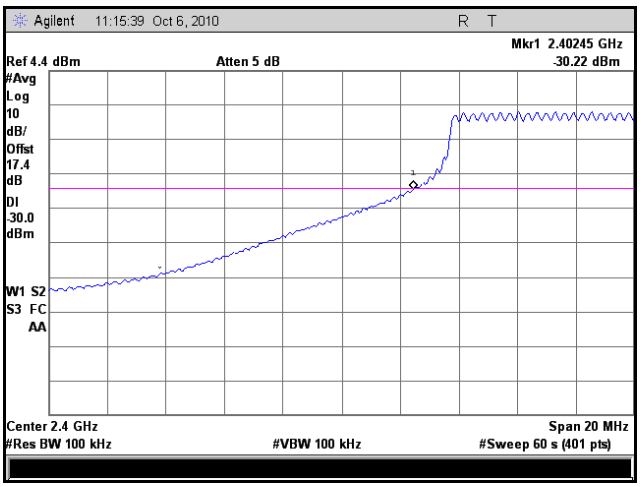
Frequency Range, 802.11g



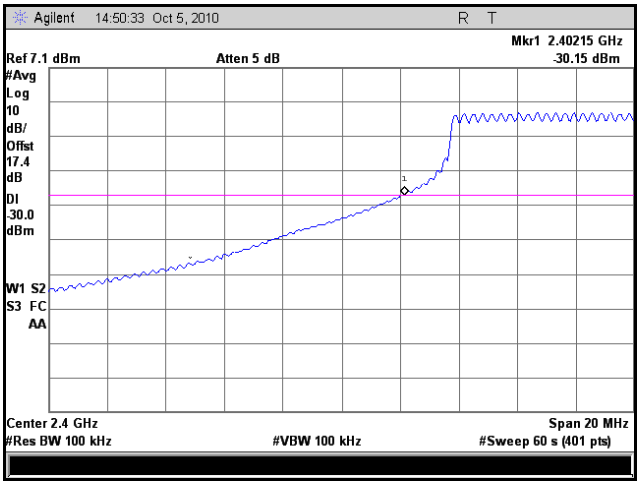
Plot 31. Frequency Range, Low Channel, 802.11g, Normal Temperature, Normal Voltage



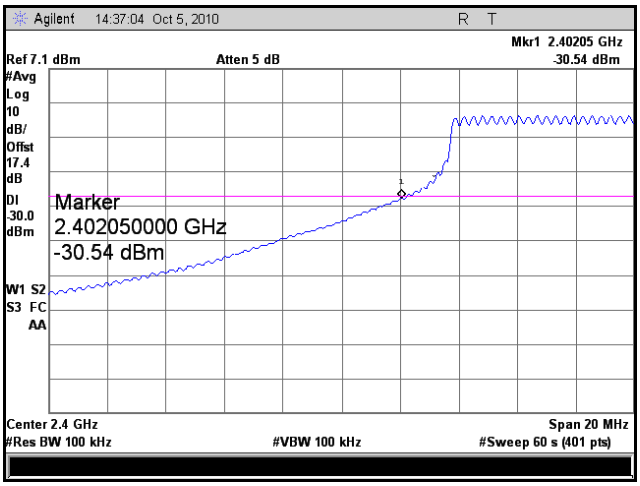
Plot 32. Frequency Range, Low Channel, 802.11g, Maximum Temperature, Maximum Voltage



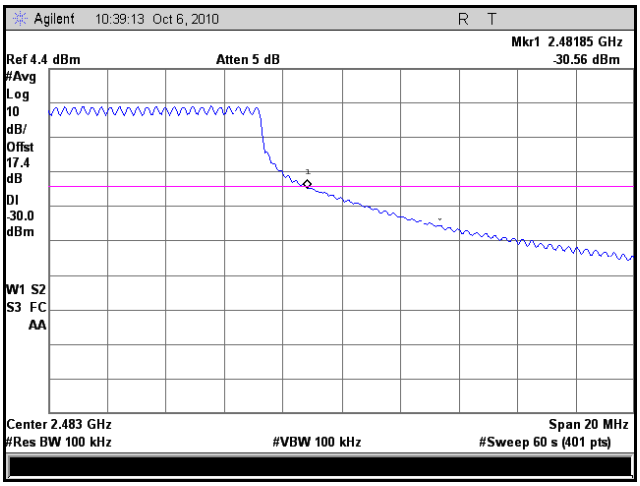
Plot 33. Frequency Range, Low Channel, 802.11g, Maximum Temperature, Minimum Voltage



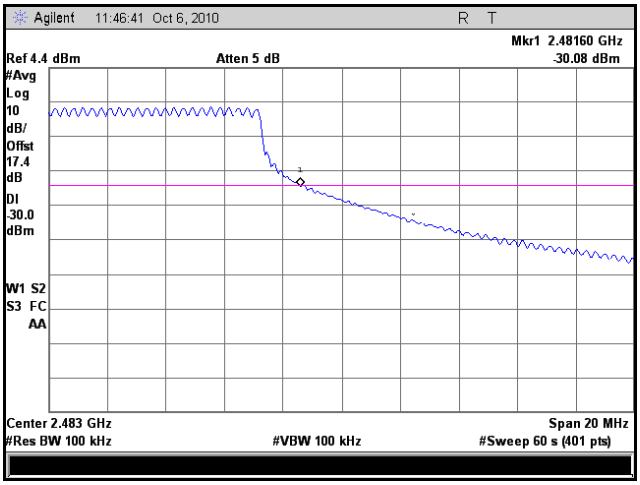
Plot 34. Frequency Range, Low Channel, 802.11g, Minimum Temperature, Maximum Voltage



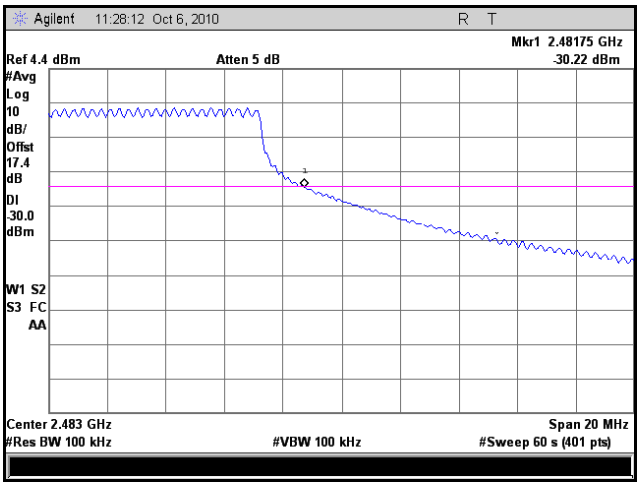
Plot 35. Frequency Range, Low Channel, 802.11g, Minimum Temperature, Minimum Voltage



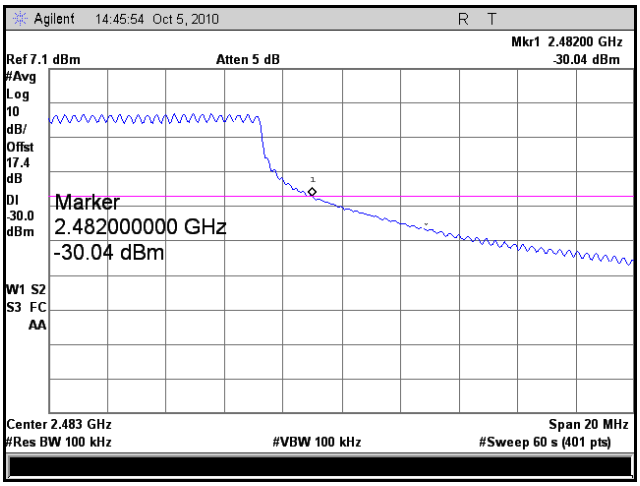
Plot 36. Frequency Range, High Channel, 802.11g, Normal Temperature, Normal Voltage



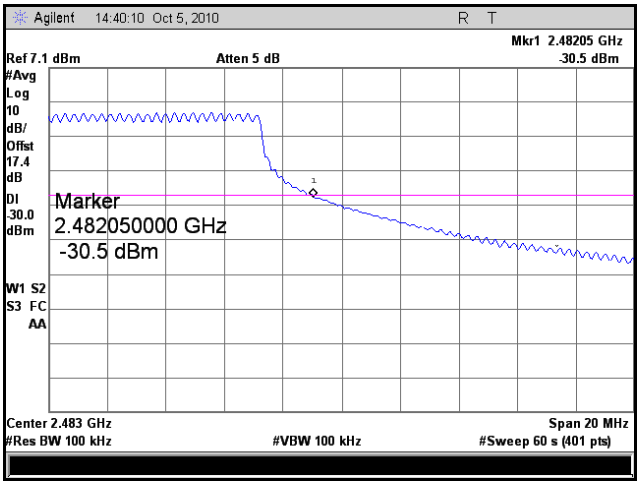
Plot 37. Frequency Range, High Channel, 802.11g, Maximum Temperature, Maximum Voltage



Plot 38. Frequency Range, High Channel, 802.11g, Maximum Temperature, Minimum Voltage

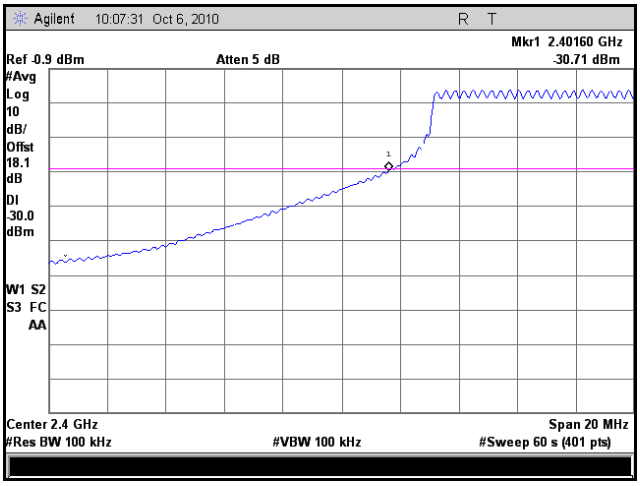


Plot 39. Frequency Range, High Channel, 802.11g, Minimum Temperature, Maximum Voltage

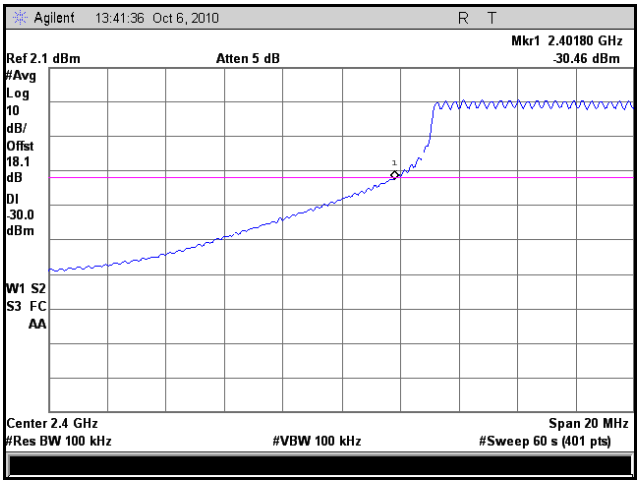


Plot 40. Frequency Range, High Channel, 802.11g, Minimum Temperature, Minimum Voltage

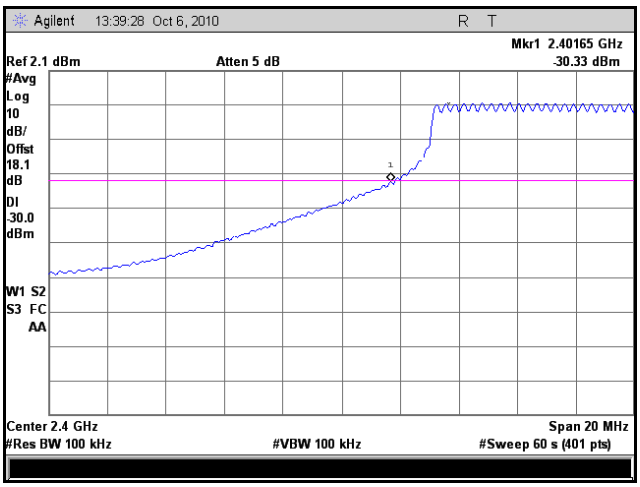
Frequency Range, 802.11n 20 MHz



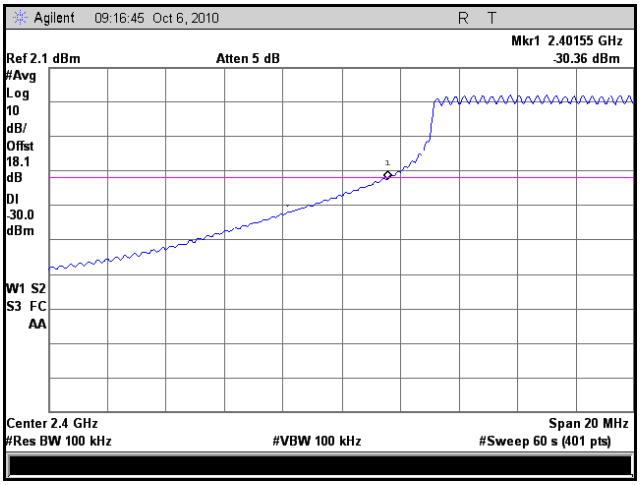
Plot 41. Frequency Range, Low Channel, 802.11n 20 MHz, Normal Temperature, Normal Voltage



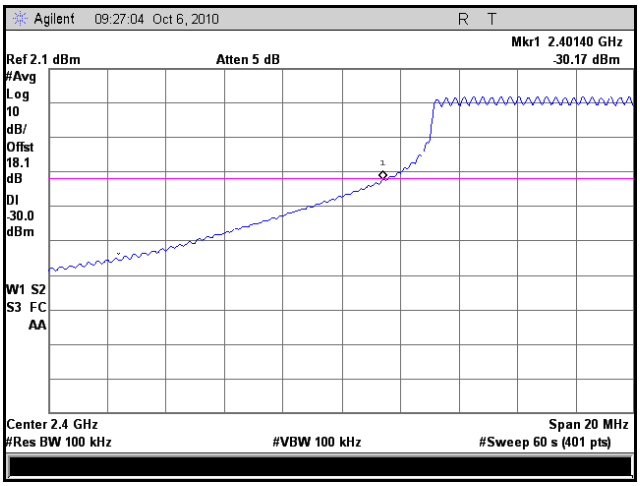
Plot 42. Frequency Range, Low Channel, 802.11n 20 MHz, Maximum Temperature, Maximum Voltage



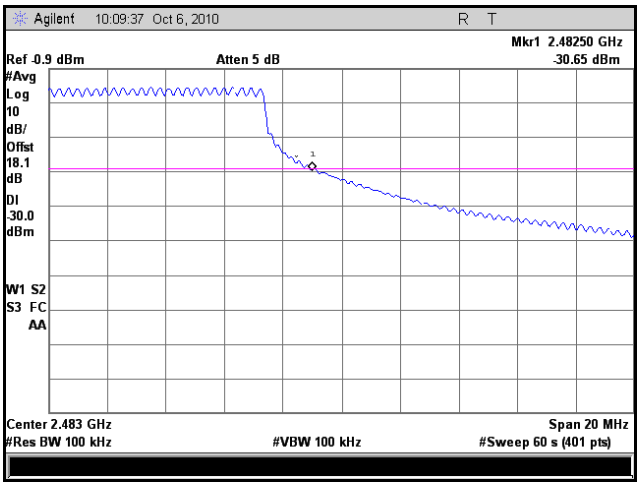
Plot 43. Frequency Range, Low Channel, 802.11n 20 MHz, Maximum Temperature, Minimum Voltage



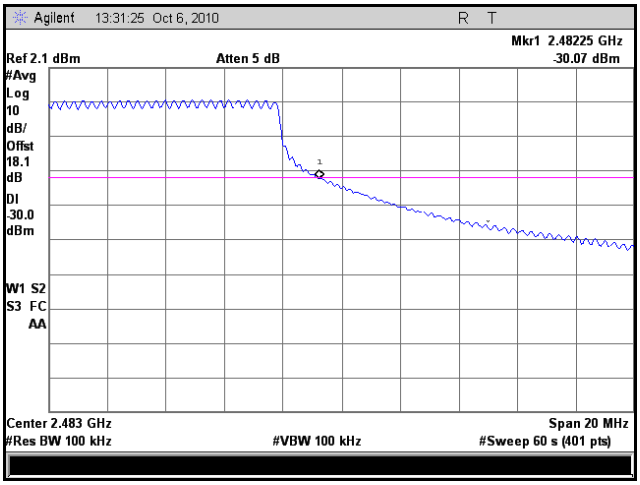
Plot 44. Frequency Range, Low Channel, 802.11n 20 MHz, Minimum Temperature, Maximum Voltage



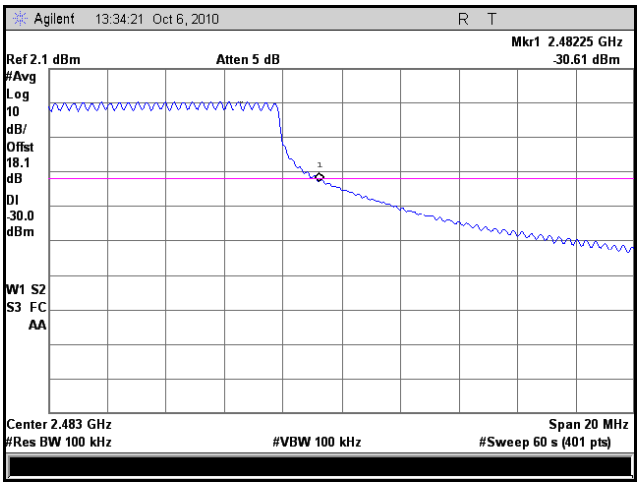
Plot 45. Frequency Range, Low Channel, 802.11n 20 MHz, Minimum Temperature, Minimum Voltage



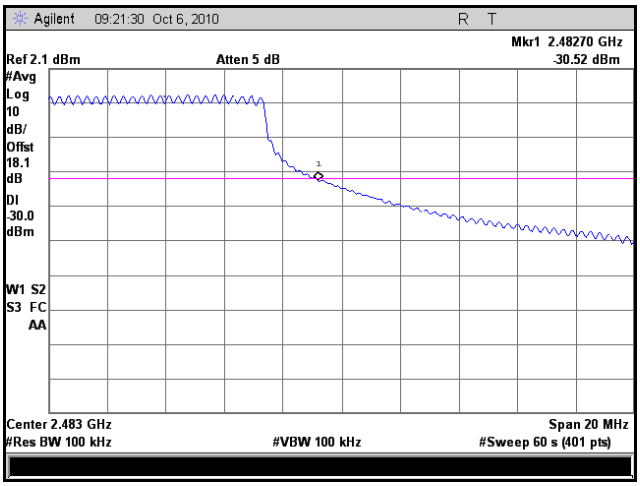
Plot 46. Frequency Range, High Channel, 802.11n 20 MHz, Normal Temperature, Normal Voltage



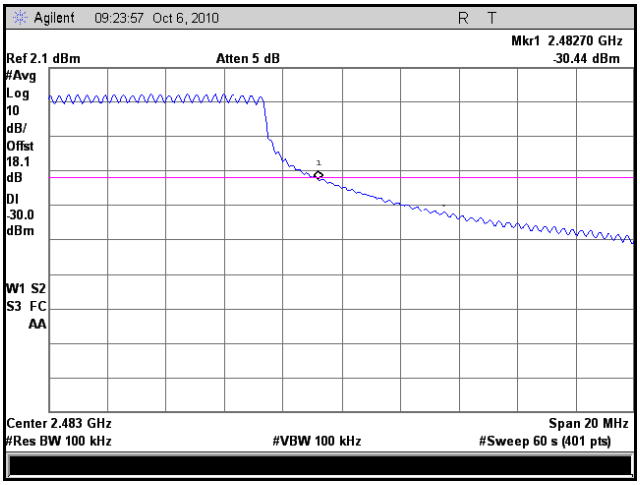
Plot 47. Frequency Range, High Channel, 802.11n 20 MHz, Maximum Temperature, Maximum Voltage



Plot 48. Frequency Range, High Channel, 802.11n 20 MHz, Maximum Temperature, Minimum Voltage

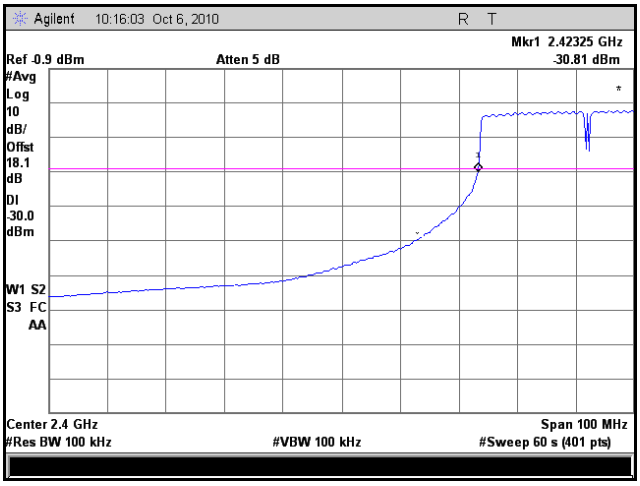


Plot 49. Frequency Range, High Channel, 802.11n 20 MHz, Minimum Temperature, Maximum Voltage

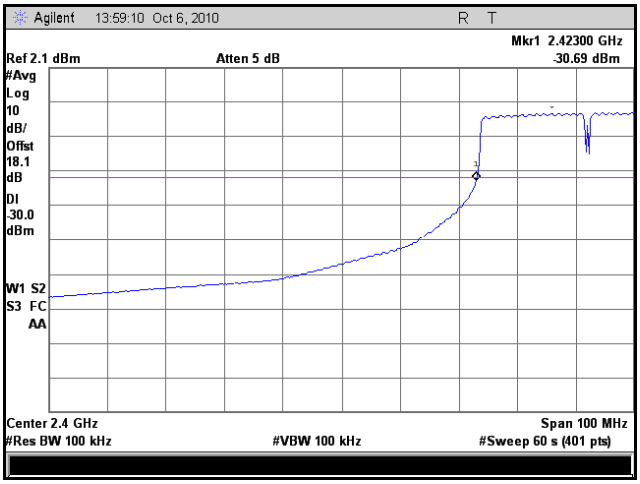


Plot 50. Frequency Range, High Channel, 802.11n 20 MHz, Minimum Temperature, Minimum Voltage

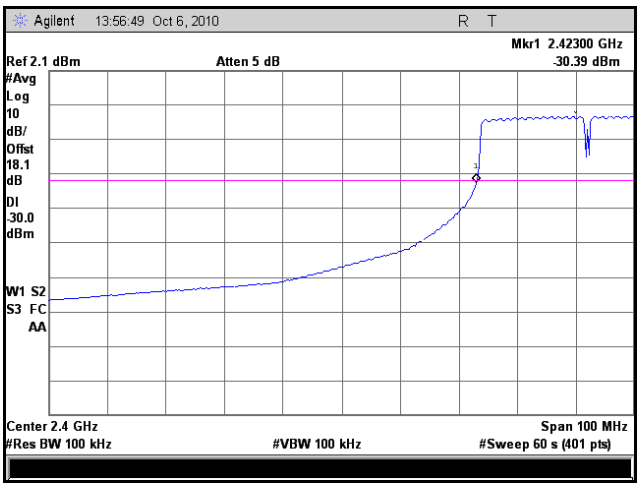
Frequency Range, 802.11n 40 MHz



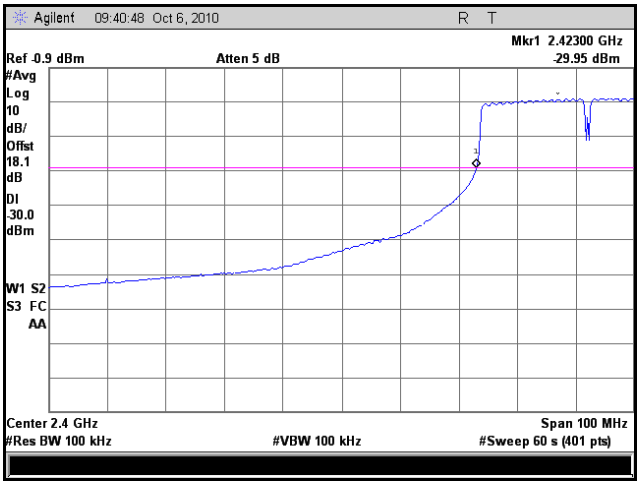
Plot 51. Frequency Range, Low Channel, 802.11n 40 MHz, Normal Temperature, Normal Voltage



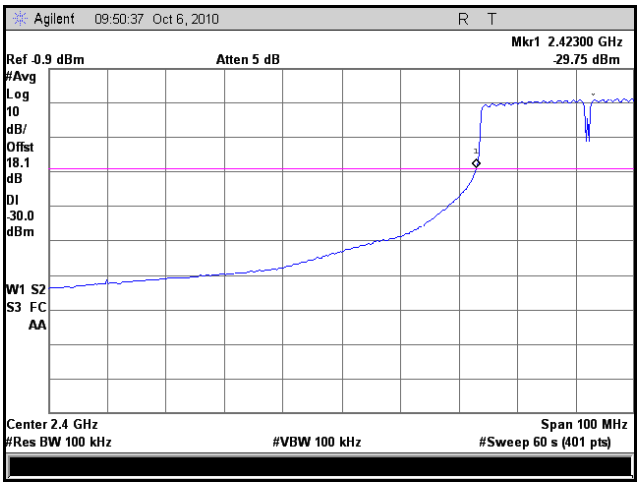
Plot 52. Frequency Range, Low Channel, 802.11n 40 MHz, Maximum Temperature, Maximum Voltage



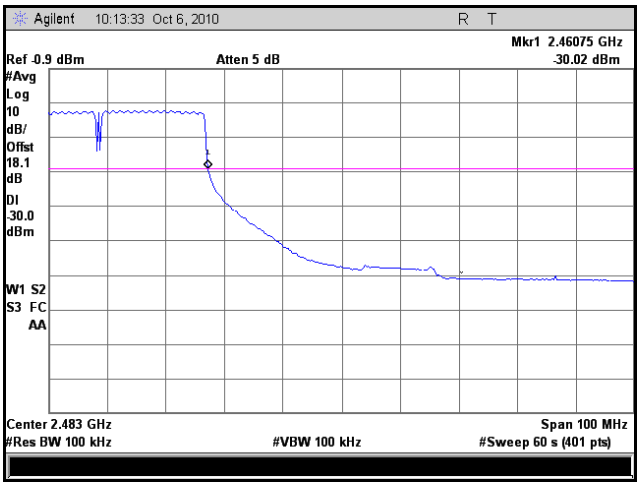
Plot 53. Frequency Range, Low Channel, 802.11n 40 MHz, Maximum Temperature, Minimum Voltage



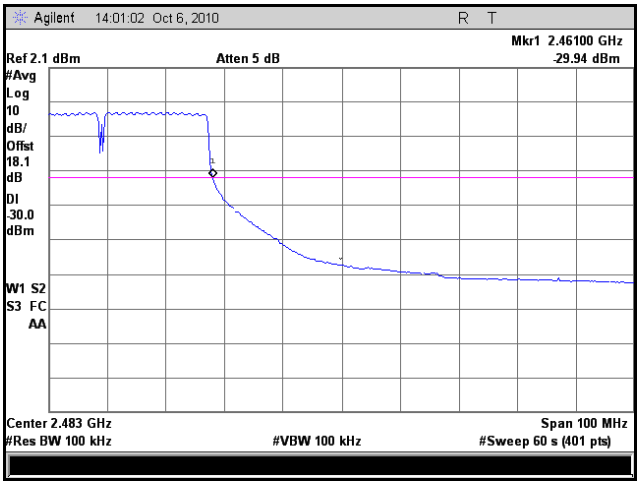
Plot 54. Frequency Range, Low Channel, 802.11n 40 MHz, Minimum Temperature, Maximum Voltage



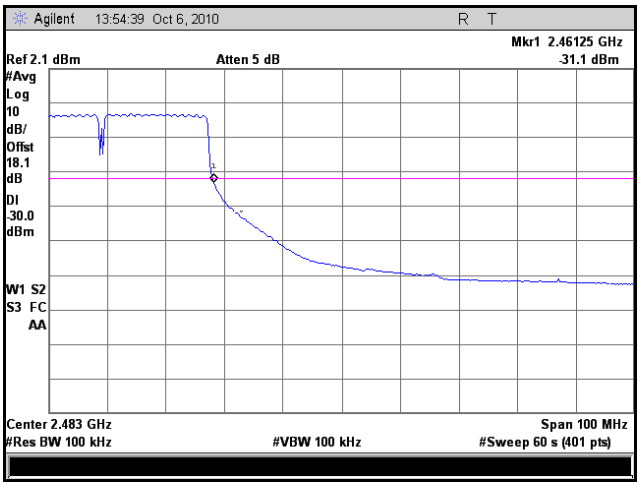
Plot 55. Frequency Range, Low Channel, 802.11n 40 MHz, Minimum Temperature, Minimum Voltage



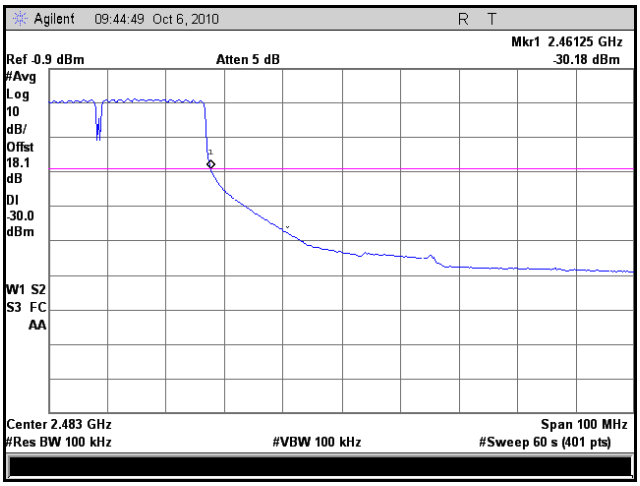
Plot 56. Frequency Range, High Channel, 802.11n 40 MHz, Normal Temperature, Normal Voltage



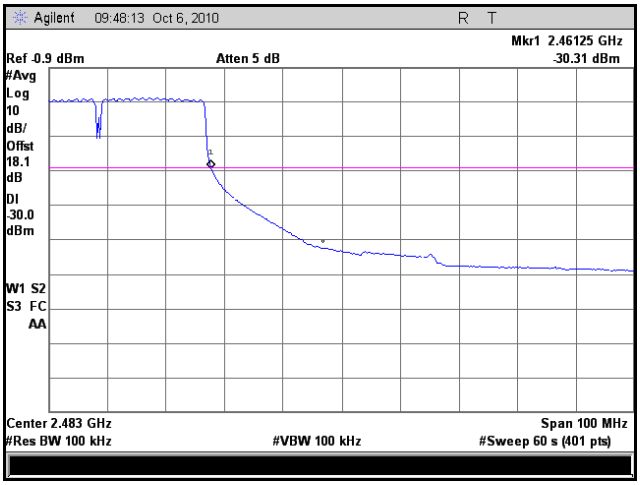
Plot 57. Frequency Range, High Channel, 802.11n 40 MHz, Maximum Temperature, Maximum Voltage



Plot 58. Frequency Range, High Channel, 802.11n 40 MHz, Maximum Temperature, Minimum Voltage



Plot 59. Frequency Range, High Channel, 802.11n 40 MHz, Minimum Temperature, Maximum Voltage



Plot 60. Frequency Range, High Channel, 802.11n 40 MHz, Minimum Temperature, Minimum Voltage

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: Minh Ly

Test Date: 09/29/10

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 15 and Table 16 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 5,15 GHz to 5,3 GHz	-47 dBm	-47 dBm

Table 15. 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 16.

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 16. Transmitter limits for wideband spurious emissions

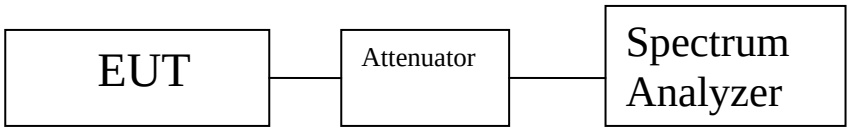
4.3.6 Transmitter Spurious Emissions - Conducted

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: Minh Ly

Test Date: 10/20/10



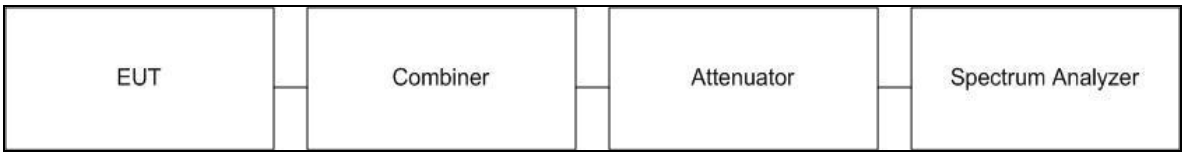
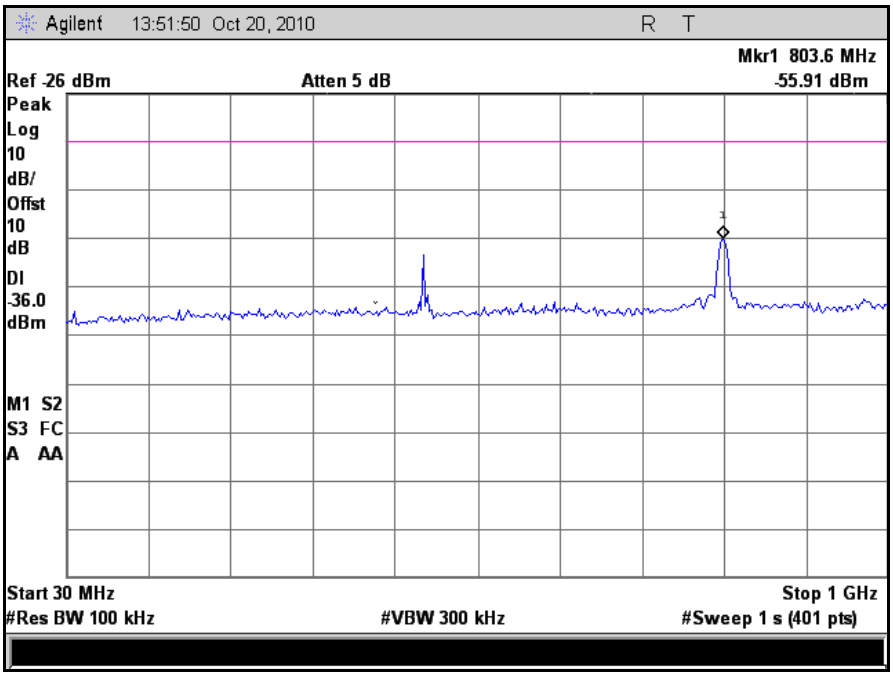
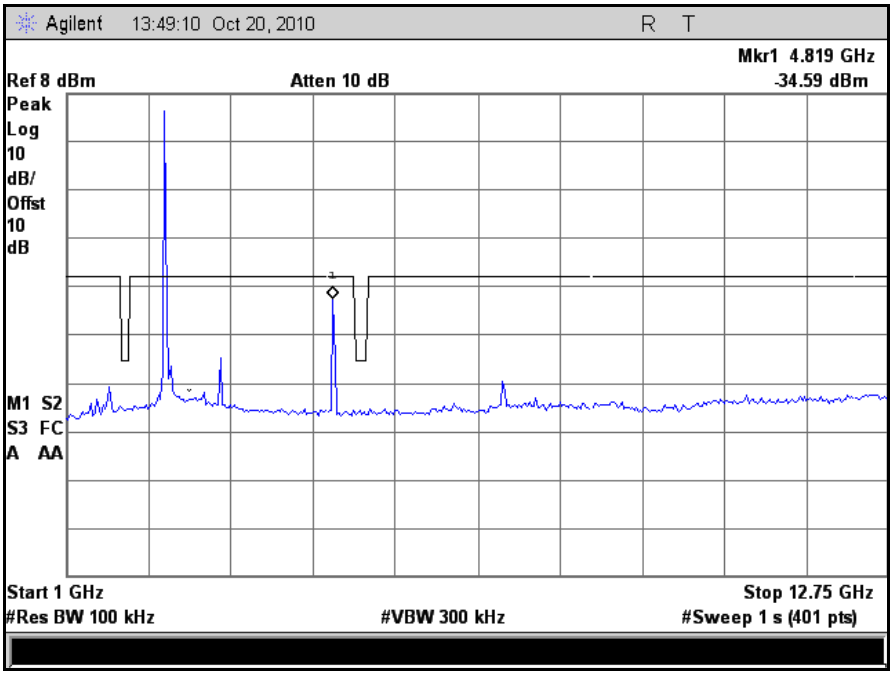


Figure 8. Transmitter Spurious Emissions - Conducted Test Setup

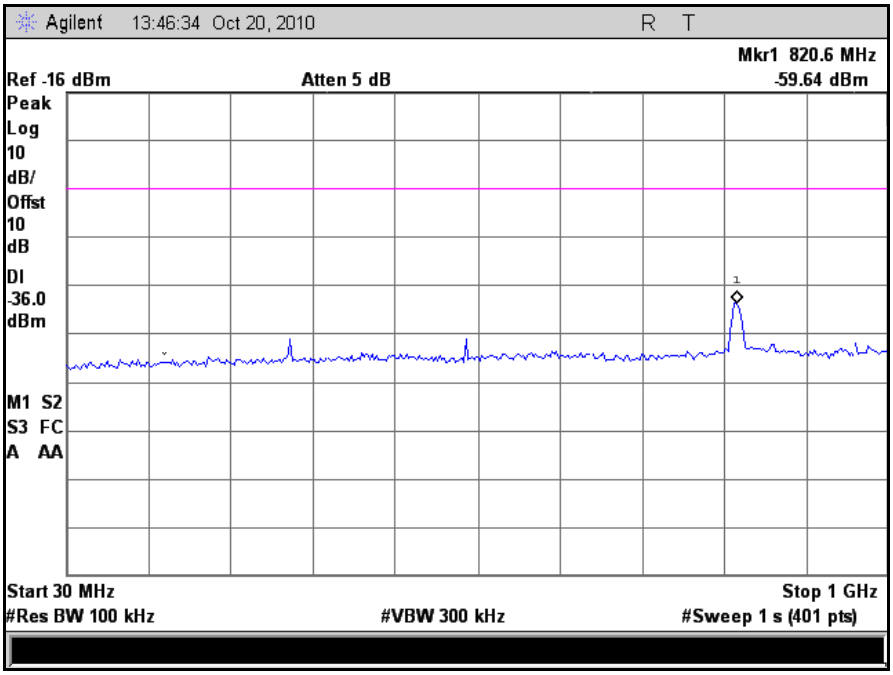
Transmitter Spurious Emissions – Conducted, Test Results, 802.11b



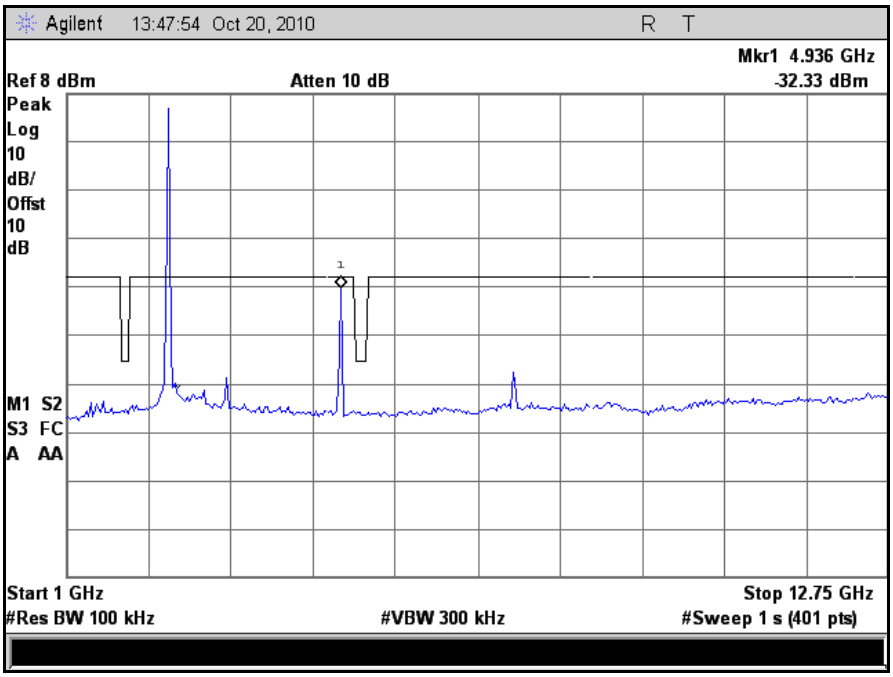
Plot 61. Conducted Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11b



Plot 62. Conducted Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11b

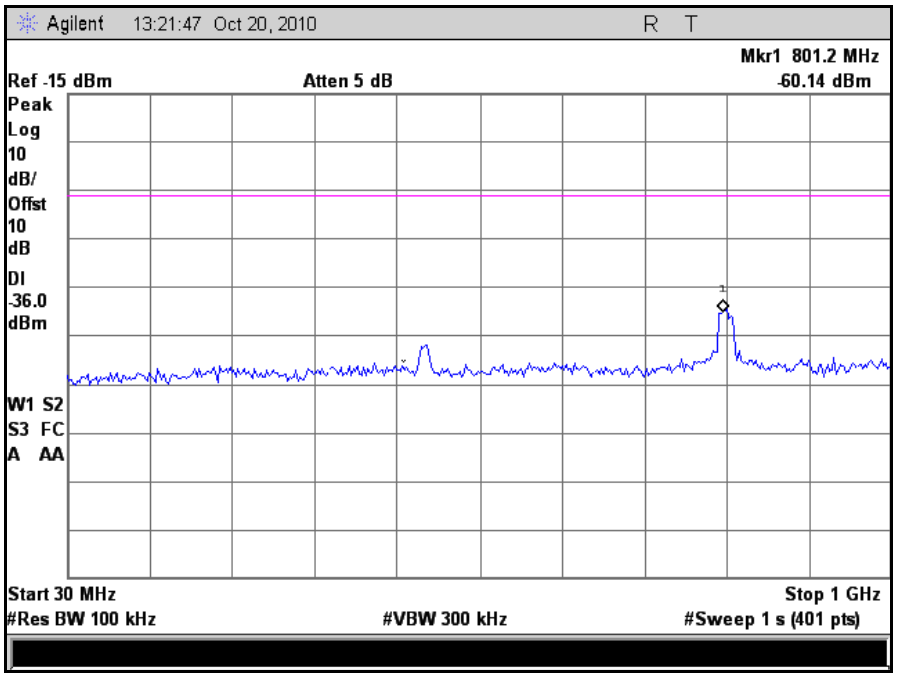


Plot 63. Conducted Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11b

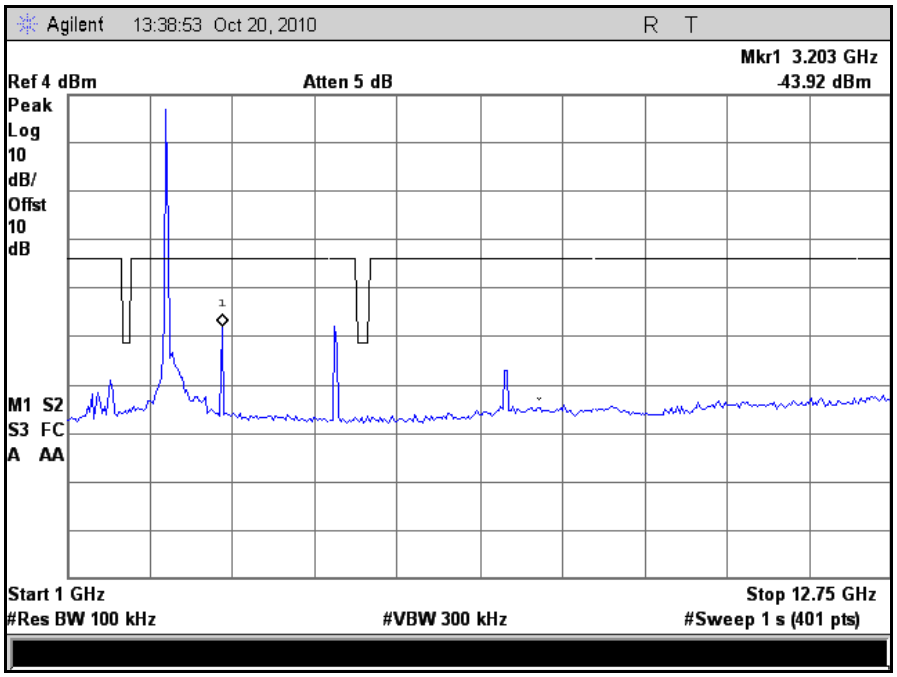


Plot 64. Conducted Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11b

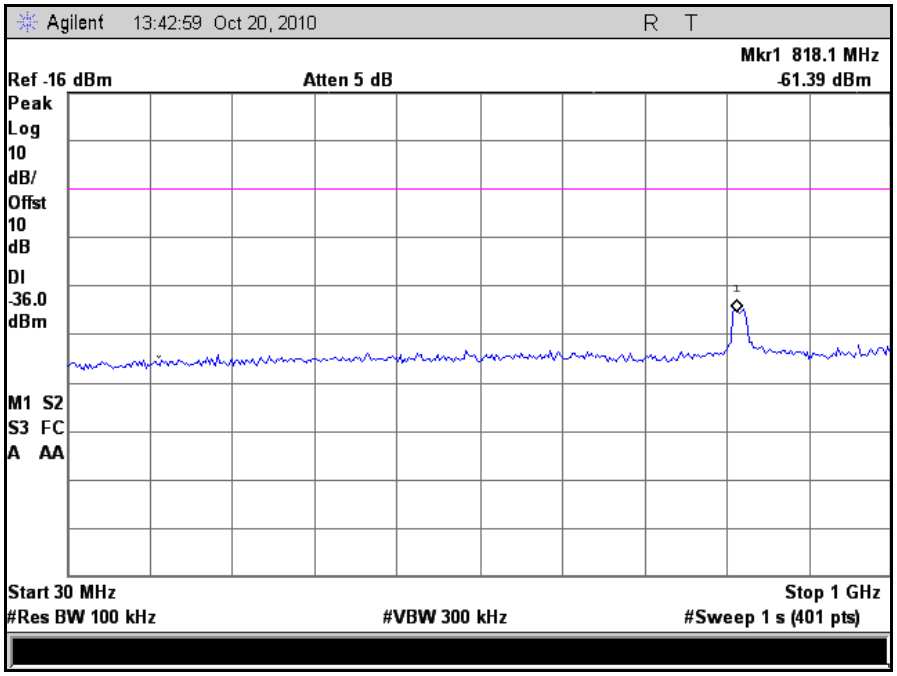
Transmitter Spurious Emissions – Conducted, Test Results, 802.11g



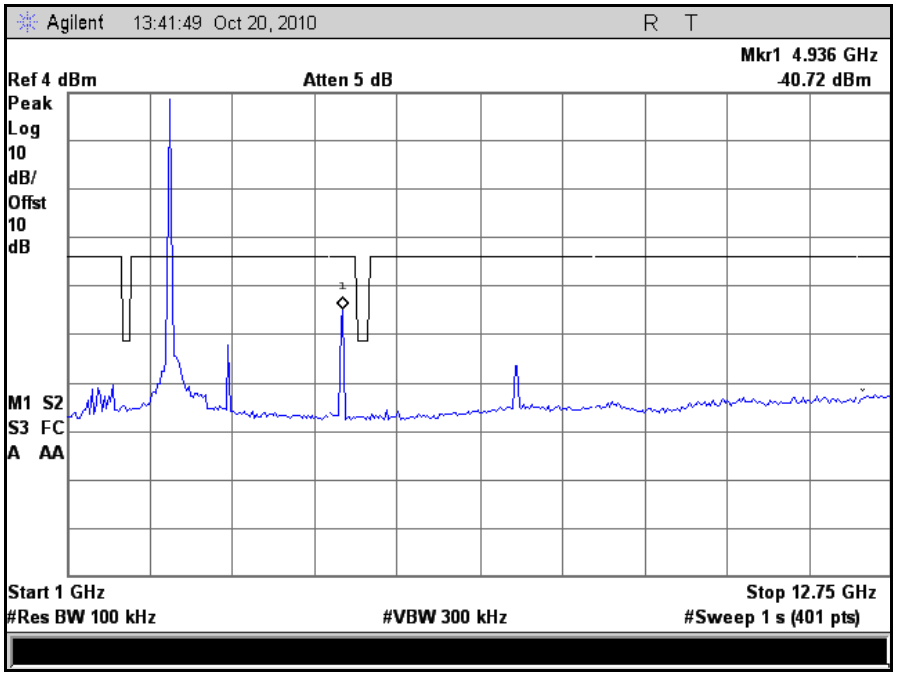
Plot 65. Conducted Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11g



Plot 66. Conducted Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11g

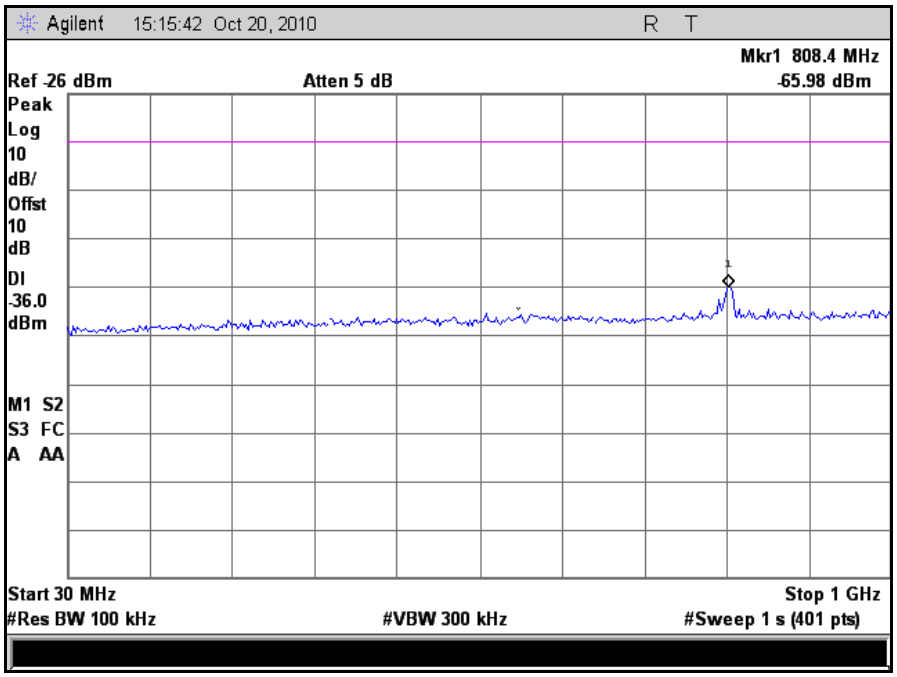


Plot 67. Conducted Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11g

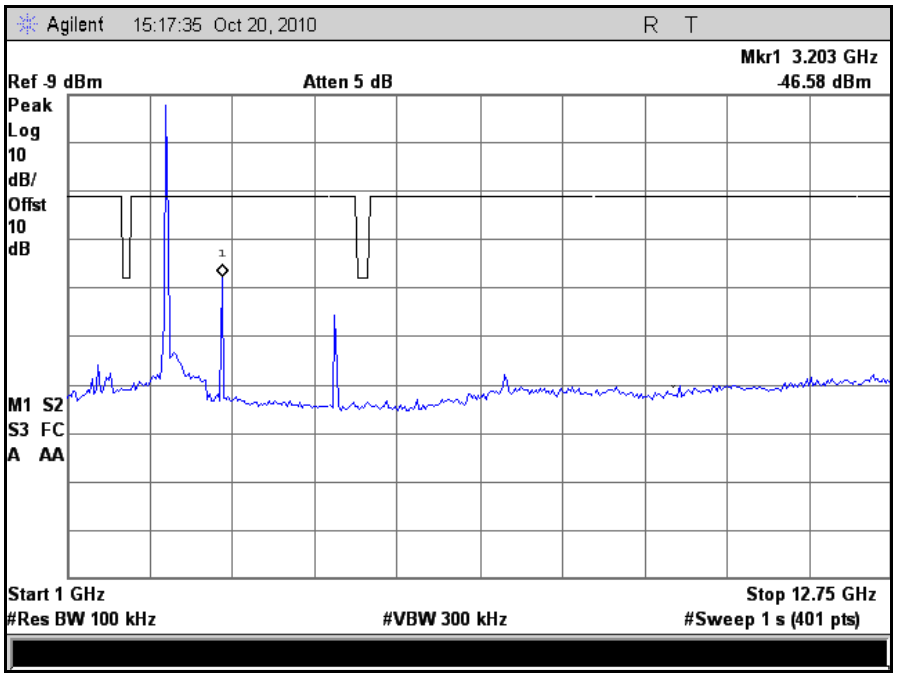


Plot 68. Conducted Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11g

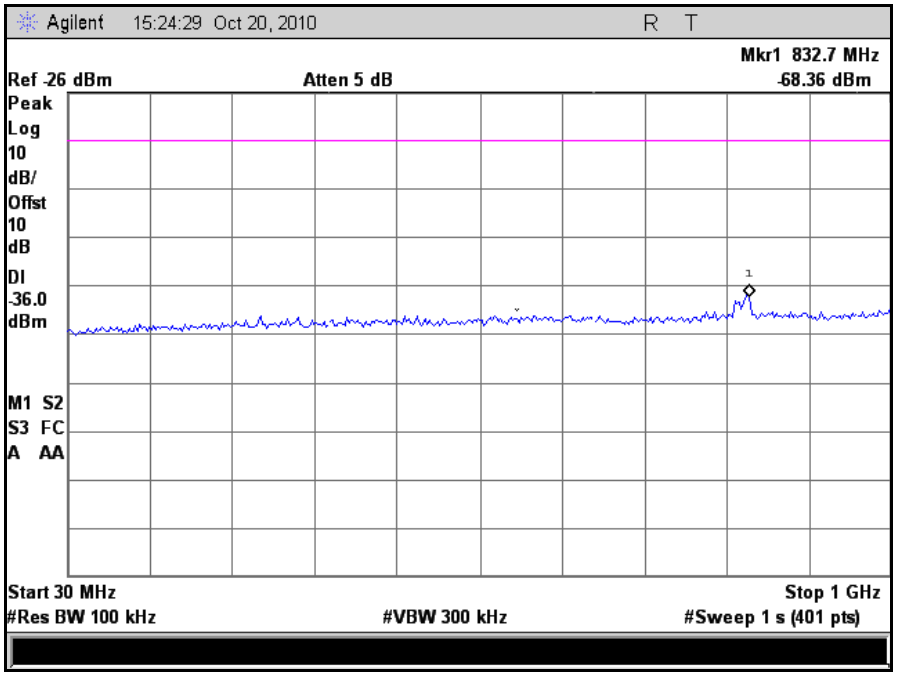
Transmitter Spurious Emissions – Conducted, Test Results, 802.11n 20 MHz



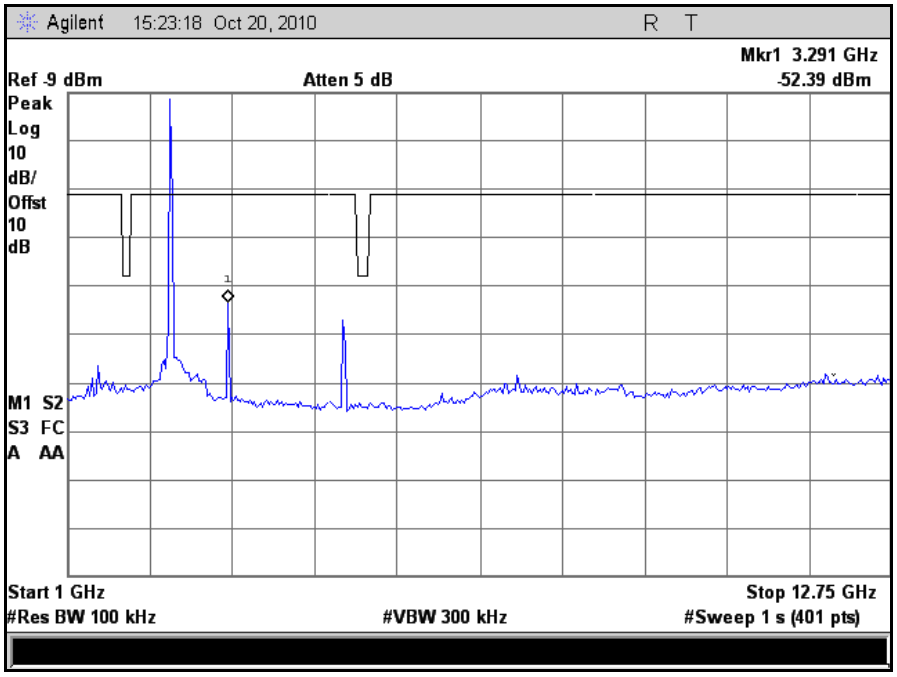
Plot 69. Conducted Spurious Emission, Low Channel, 30 MHz – 1 GHz, 802.11n 20 MHz



Plot 70. Conducted Spurious Emission, Low Channel, 1 GHz - 12.75 GHz, 802.11n 20 MHz

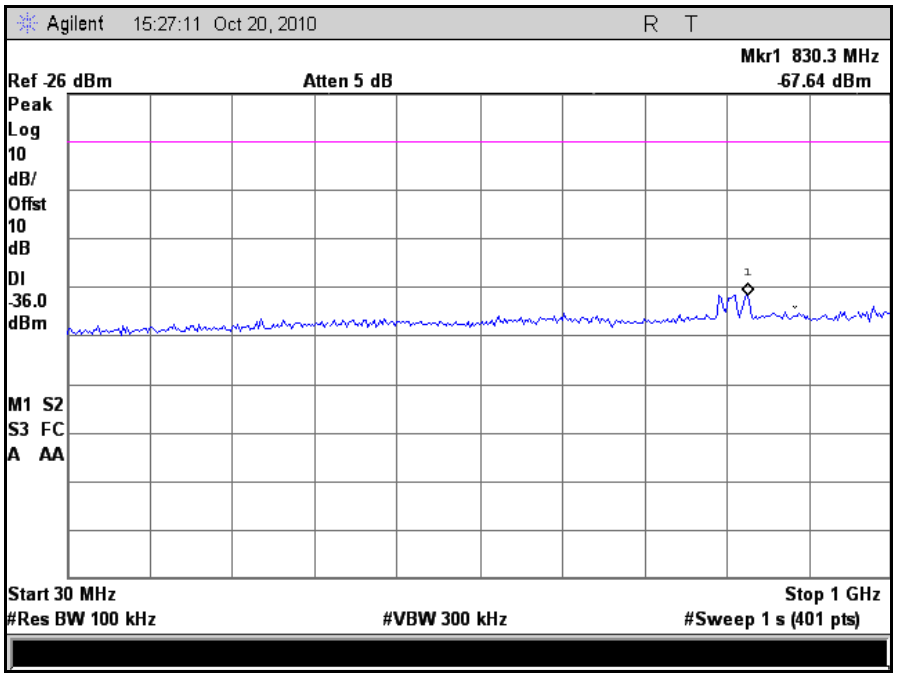


Plot 71. Conducted Spurious Emission, High Channel, 30 MHz – 1 GHz, 802.11n 20 MHz

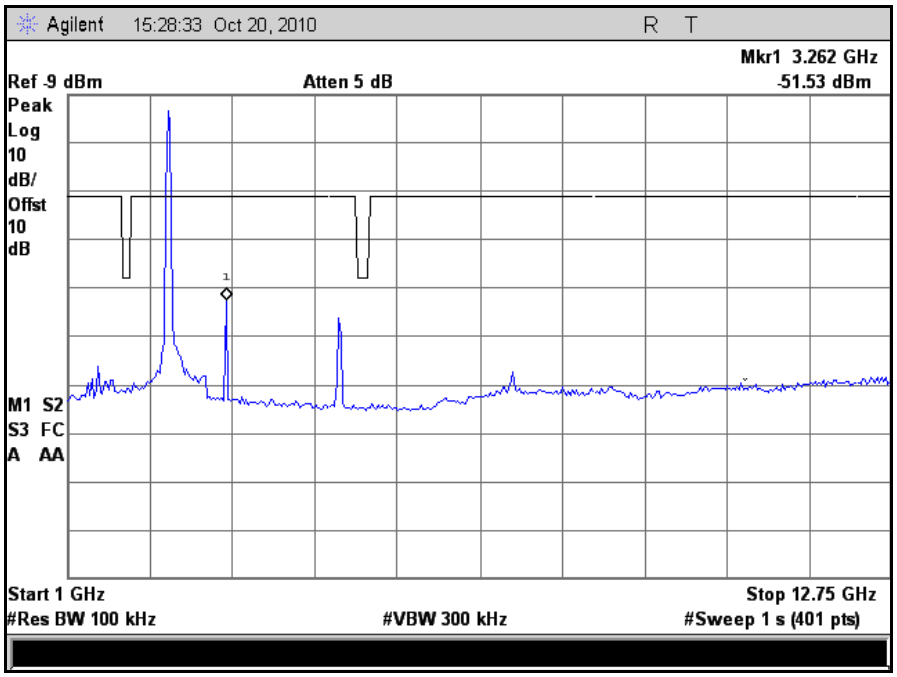


Plot 72. Conducted Spurious Emission, High Channel, 1 GHz - 12.75 GHz, 802.11n 20 MHz

Transmitter Spurious Emissions – Conducted, Test Results, 802.11n 40 MHz



Plot 73. Conducted Spurious Emission, Mid Channel, 30 MHz – 1 GHz, 802.11n 40 MHz



Plot 74. Conducted Spurious Emission, Mid Channel, 1 GHz - 12.75 GHz, 802.11n 40 MHz

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 17 and Table 18 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 17. 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 18.

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

Table 18. Wideband spurious emission limits for receivers

Test Procedure: The EUT was directly connected to a SA through an anttenuater.

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

Test Engineer: Minh Ly

Test Date: 10/20/10

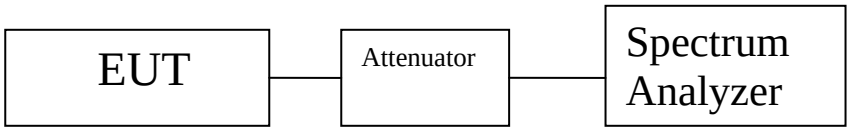
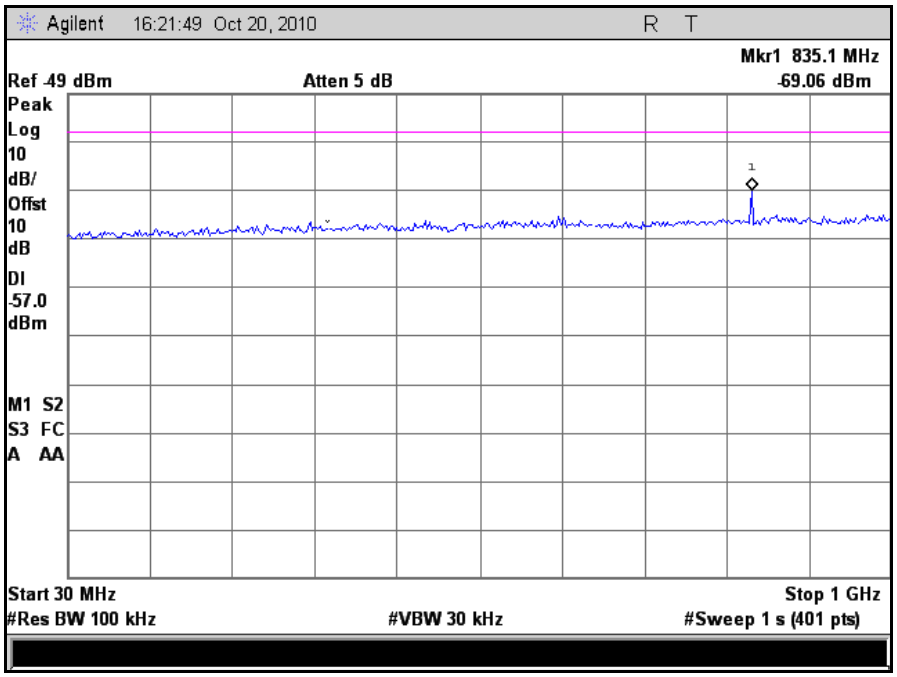
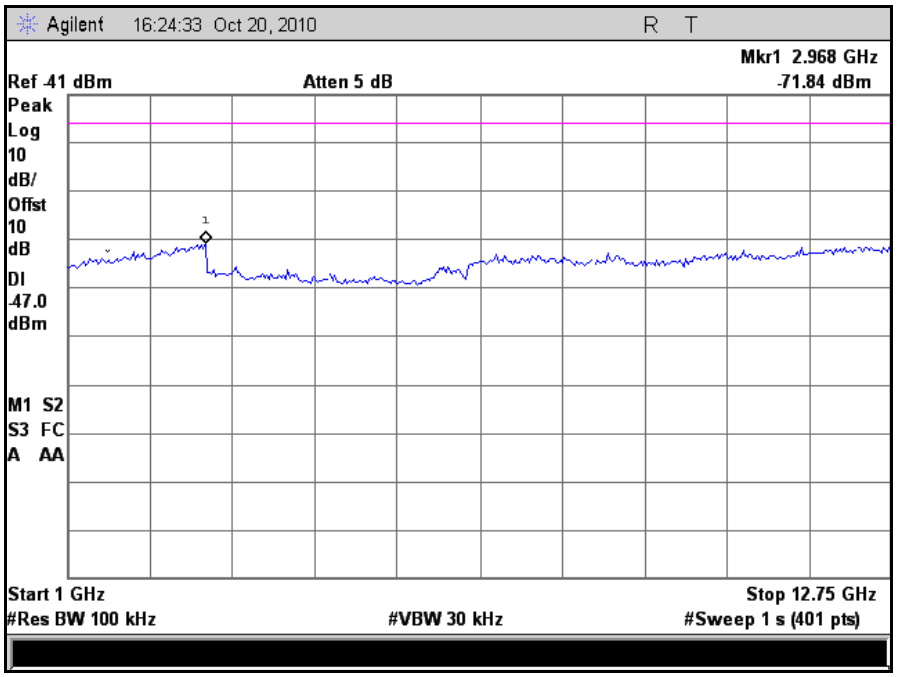


Figure 9. Receiver Spurious Emissions

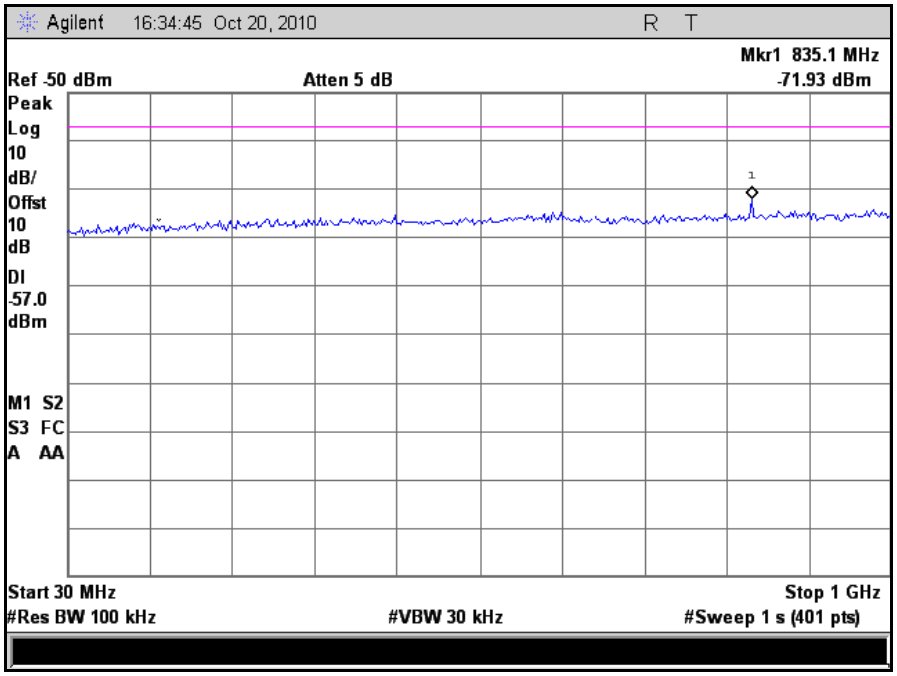
Conducted Receiver Spurious Emissions, Test Results



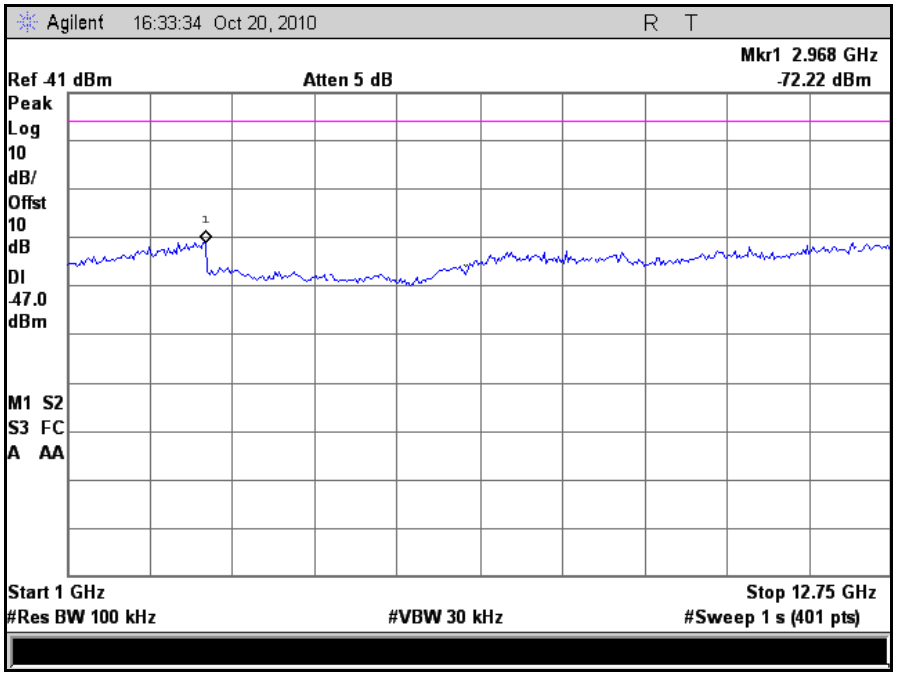
Plot 75. Conducted Spurious Emission, 30 MHz – 1 GHz, Low Channel



Plot 76. Conducted Spurious Emission, 1 GHz – 12.75 GHz, Low Channel



Plot 77. Conducted Spurious Emission, 30 MHz – 1 GHz, High Channel



Plot 78. Conducted Spurious Emission, 1 GHz – 12.75 GHz, High Channel

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
1S2501	EMI RECEIVER	ROHDE&SCHWARZ	ESU40	06/03/2010	06/03/2011
1S2484	BILOG ANTENNA	TESEQ	CBL6112D	SEE NOTE	
1S2399	TURNNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	NOT REQUIRED	
1S2522	DIGITAL THERMO/HYGROMETER	CONTROL COMPANY	11-661-7D	11/11/2009	11/11/2010
1S2482	5M CHAMBER	PANASHIELD	N/A	10/16/2009	11/16/2010
1S2603	DOUBLE RIDGED WAVEGUIDE HORN	ETS-LINGREN	3117	04/09/2009	04/09/2011
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	SEE NOTE	
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2430	WIDEBAND POWER METER	ANRITSU COMPANY	ML2488A	07/26/2010	07/26/2011
1S2432	WIDEBAND POWER SENSOR	ANRITSU COMPANY	MA2491A	07/26/2010	07/26/2011
1S2034	COUPLER, DIRECTIONAL 1-20 GHZ	KRYTAR	101020020	SEE NOTE	
1S2583	SPECTRUM ANALYZER	AGILENT	E4447A	01/26/2010	01/26/2011
1S2460	ANALYZER, SPECTRUM 9 KHZ-40GHZ	AGILENT	E4407B	07/13/2010	07/213/2011
1S2229	TEMPERATURE CHAMBER	TENNY ENGINEERING	T63C	02/19/2010	02/19/2011
1S2128	HARMONIC MIXER	HEWLETT PACKARD	11970A	11/22/2008	11/22/2010
1S2129	HARMONIC MIXER	HEWLETT PACKARD	11970K	11/22/2008	11/22/2010

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

End of Report

