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July 12, 2011

Ubiquiti Networks
91 East Tasman Drive
San Jose, CA 95134

Dear Jennifer Sanchez,

Enclosed is the EMC test report for compliance testing of the Ubiquiti Networks, NanoBridgeM5 tested to the requirements of ETSI EN 301 893 (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\EMCS31986-ETS893)

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Electromagnetic Compatibility Criteria Test Report

For the

Ubiquiti Networks
Model NanoBridgeM5

Tested under

ETSI EN 301 893

(Article 3.2 of R&TTE Directive)

MET Report: EMCS31986-ETS893

July 12, 2011

Prepared For:

Ubiquiti Networks
91 East Tasman Drive
San Jose, CA 95134

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

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Electromagnetic Compatibility Criteria
Test Report

For the

Ubiquiti Networks
Model NanoBridgeM5

Tested under

ETSI EN 301 893

(Article 3.2 of R&TTE Directive)

MET Report: EMCS31986-ETS893

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 301 893 of the EU Rules under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

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Report Status Sheet

Revision	Report Date	Reason for Revision
∅	July 12, 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
fc	Carrier **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

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I. Requirements Summary

A. Requirements Summary

ETSI EN 301 893 Section Number	Descriptive Name	Compliance			Comments
		Yes	No	N/A	
Sections 4.2	Carrier Frequencies	✓			Compliant
Sections 4.3	Nominal Channel Bandwidth and Occupied Channel Bandwidth	✓			Compliant
Sections 4.4	RF Output Power	✓			Compliant
	Transmit Power Control (TPC)	✓			Compliant
	Power Density	✓			Compliant
Sections 4.5	Transmitter Unwanted Emissions				
4.5.1	Out of Band Unwanted Emissions – Conducted	✓			Compliant
	Out of Band Unwanted Emissions – Radiated	✓			Compliant
4.5.2	In Band Unwanted Emissions – Conducted	✓			Compliant
	In Band Unwanted Emissions – Radiated	✓			Compliant
Sections 4.6	Receiver Spurious Emissions – Conducted	✓			Compliant
	Receiver Spurious Emissions – Conducted	✓			Compliant
Sections 4.7	Dynamic Frequency Selection (DFS)				
4.7	DFS Calibration			✓	Not Tested/Evaluated at MET Laboratories.
	DFS Bandwidth			✓	Not Tested/Evaluated at MET Laboratories.
4.7.2.1	Channel Availability Check			✓	Not Tested/Evaluated at MET Laboratories.
4.7.2.2	Off Channel CAC			✓	Not Tested/Evaluated at MET Laboratories.
Sections 4.8	Medium Access Protocol	✓			Compliant
Sections 4.9	User Access Restrictions	✓			Compliant

Table 1. Summary of EMC ETSI EN 301 893 Compliance Testing

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II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Ubiquiti Networks to perform testing on a NanoBridgeM5.

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 NanoBridgeM5.

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

Model(s) Tested:	NanoBridgeM5
Model(s) Number:	NanoBridgeM5
EUT Specifications:	Primary Power: 203VAC 50Hz
	Secondary Power: None
	Frequency Range: 5500 – 5700 MHz
Lab Ambient (Normal) Test Conditions:	Temperature: 15-35º C
	Relative Humidity: 30-60%
	Atmospheric Pressure: 860-1060 mbar
Extreme Test Conditions:	Voltage: 230 VAC +/- 10%
	Temperature: -30 to +70º C
	Relative Humidity: 30-60%
Evaluated by:	Anderson Soungpanya
Report Date(s):	July 12, 2011

B. References

ETSI EN 301.893 V1.5.1 (2008-12)	Broadband Radio Access Networks (BRAN); 5GHz high performance RLAN; Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive.

Table 2. Test References

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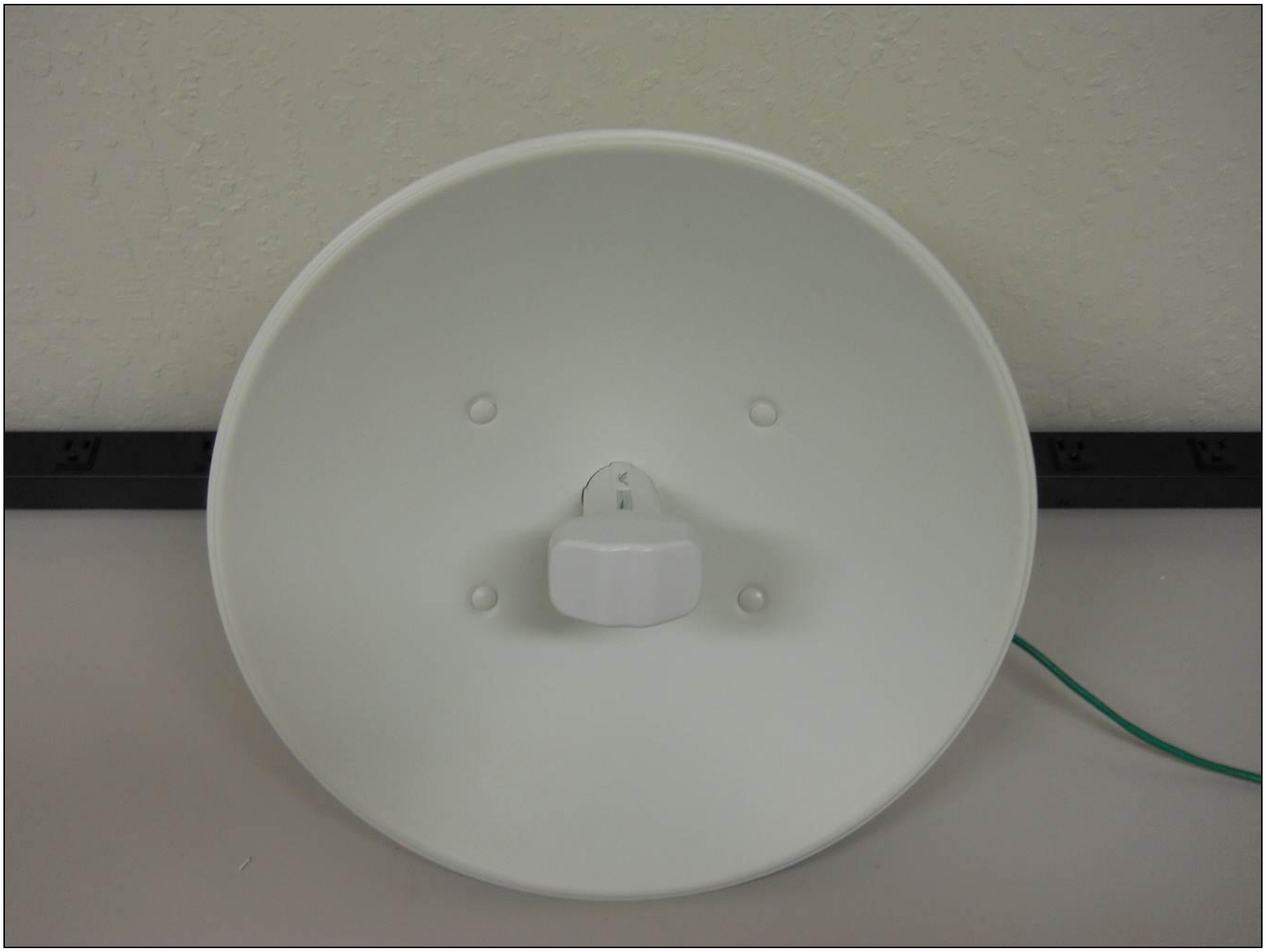
C. Test Site

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 NanoBridgeM5, Equipment Under Test (EUT), is a 802.11b/g/n high-performance, long range completely integrated CPE in the feed of a 25 dBi dish antenna.



Photograph 1. Ubiquiti Networks NanoBridgeM5

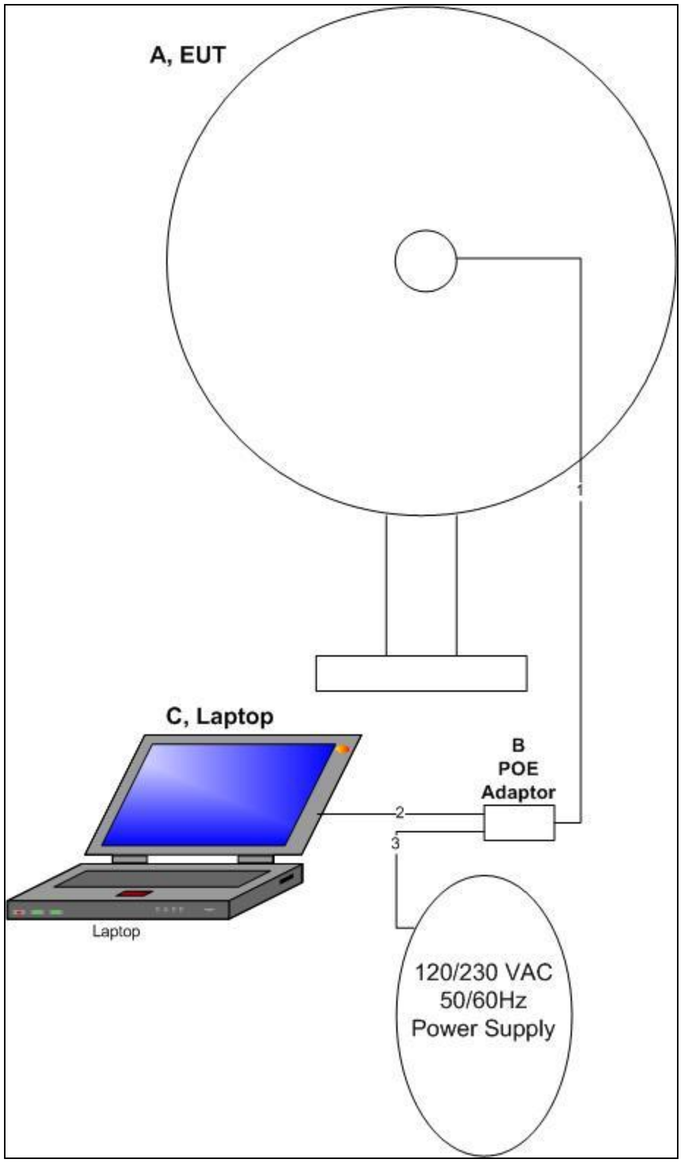


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Part Number	Serial Number
A	NanoBridgeM2	NanoBridgeM2	N/A	00272230AFFF
B	Power Supply (POE)	UBI-POE-24-5	N/A	0912-0007220

Table 3. Equipment Configuration

F. Support Equipment

Ubiquiti Networks supplied support equipment necessary for the operation and testing of the NanoBridgeM5. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number
C	Laptop	Dell	Vostro 1510

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 Name
1	A,EUT	CAT 5E	1	8	Y	B, POE
2	B	CAT 5E	1	8	Y	C, Laptop
3	B	Power Cable	1	.5	N	230VAC Power Supply

Table 5. Ports and Cabling Information

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H. Mode of Operation

Using Atheros Radio Test Software.

I. Method of Monitoring EUT Operation

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

J. Modifications

a) Modifications to EUT

No modifications were made 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.

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III. Conformance Requirements

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4.2 Centre Frequencies

Test Requirement(s): **ETSI EN 301 893, Clause 5.3.2:**

4.2.1 Definition
The centre frequency is the centre of the channel declared by the manufacturer as part of the declared channel plan(s).

4.2.2 Limits
The actual centre frequency for any given channel declared by the manufacturer shall be maintained within the range $f_c \pm 20$ ppm.

Test Procedure: The EUT was placed in an environmental chamber and the RF port was connected directly to a spectrum analyzer through an attenuator. Depending on which band was being investigated, the EUT was set to transmit at the f_c indicated above at a normal power level. If the EUT was capable of transmitting a CW carrier then the spectrum analyzer's frequency counting function was used to measure the actual frequency. If only a modulated carrier was available then the frequency relative to -10dBc above and below the carrier was measured and the carrier frequency was determined using (f1+f2)/2. The frequency of the carrier was measured at normal and extreme conditions. The resulting carrier frequencies were tabulated below and the frequency error determined.

Test Results: The EUT was found to be compliant with the limits set forth in Clause 5.3.2.

Test Engineer: Anderson Soungpanya

Test Date: 06/23/11

(5500MHz)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference @ 230VAC 20C	207	60	5500.085480	15.542
	230	60	5500.085630	15.569
	253	60	5500.085840	15.607
	207	20	5500.032830	5.969
	230	20	5500.032660	5.938
5500.000000	253	20	5500.032690	5.944
	207	-40	5500.003320	0.604
	230	-40	5500.002920	0.531
	253	-40	5500.002910	0.529
(5700MHz)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference @ 230VAC 20C	207	60	5700.092320	16.196
	230	60	5700.092840	16.288
	253	60	5700.092430	16.216
	207	20	5700.033930	5.953
	230	20	5700.033970	5.960
5700.000000	253	20	5700.033920	5.951
	207	-40	5700.004720	0.828
	230	-40	5700.004380	0.768
	253	-40	5700.004480	0.786

Table 6. Carrier Frequencies, Test Results

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4.3 Nominal Channel Bandwidth and Occupied Channel Bandwidth

Test Requirement(s): **ETSI EN 301 893, Clause 5.3.3:**

4.3.1 Definition
The nominal channel bandwidth is the widest band of frequencies, inclusive of guard bands, assigned to a single channel.

The occupied channel bandwidth is the frequency bandwidth of the signal power at the -6 dBc points when measured with a 100 kHz resolution bandwidth.

NOTE: dBc is the spectral density relative to the maximum spectral power density of the transmitted signal.

4.3.2 Limit
The nominal bandwidth shall be in the range from 5 MHz to 40 MHz.

The occupied channel bandwidth shall be between 80 % and 100 % of the declared nominal channel bandwidth. In case of smart antenna systems (devices with multiple transmit chains) each of the transmit chains shall meet this requirement.

NOTE: The limit for occupied bandwidth is not applicable for devices with a nominal bandwidth of 40 MHz when temporarily operating in a mode in which they transmit only in the upper or lower 20 MHz part of a 40 MHz channel (e.g. to transmit a packet in the upper or lower 20 MHz part of a 40 MHz channel).

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth, VBW > RBW. The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels.

In case of conducted measurements on smart antenna systems (devices with multiple transmit chains) measurements need only to be performed on one of the active transmit chains (antenna outputs).

Test Results: The EUT as tested was found compliant with the specified limits in clause 5.3.3.

Test Engineer: Anderson Soungpanya

Test Date: 06/22/11

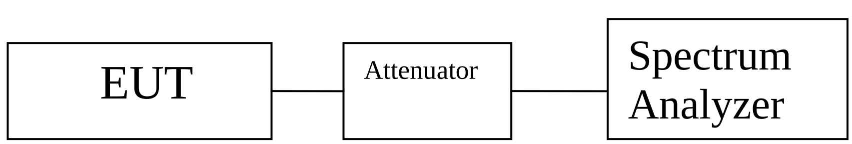

Figure 2. Occupied Bandwidth Test Setup

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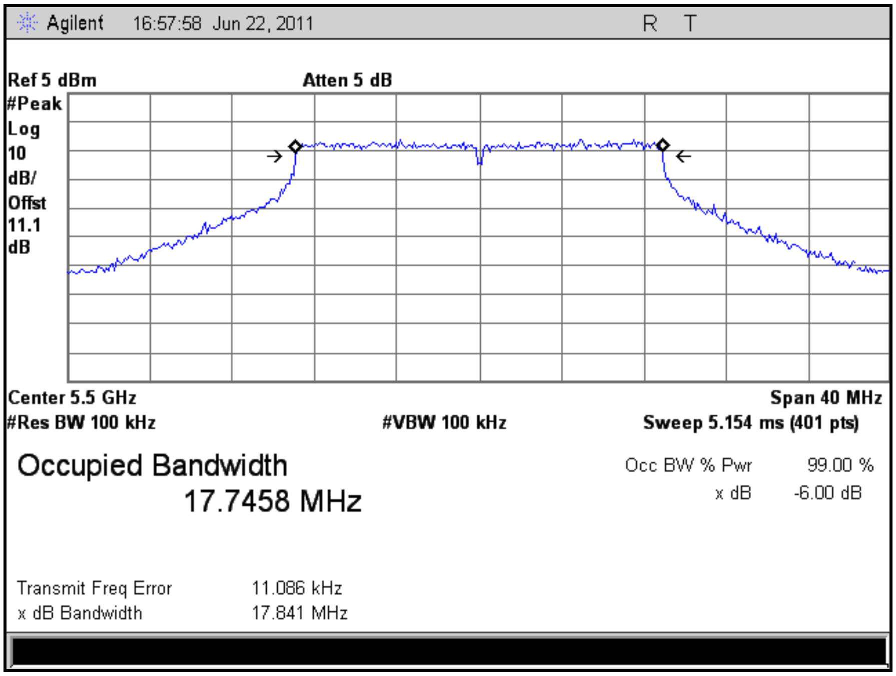
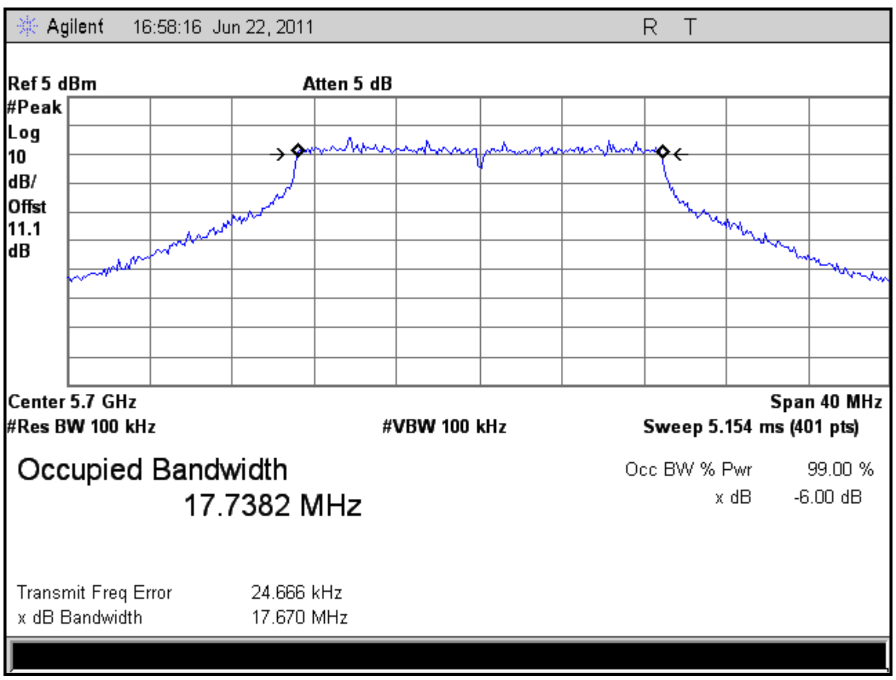


Plot 1. Occupied Bandwidth, 5500 MHz, 802.11n 20 MHz, Port 1



Plot 2. Occupied Bandwidth, 5700 MHz, 802.11n 20 MHz, Port 1

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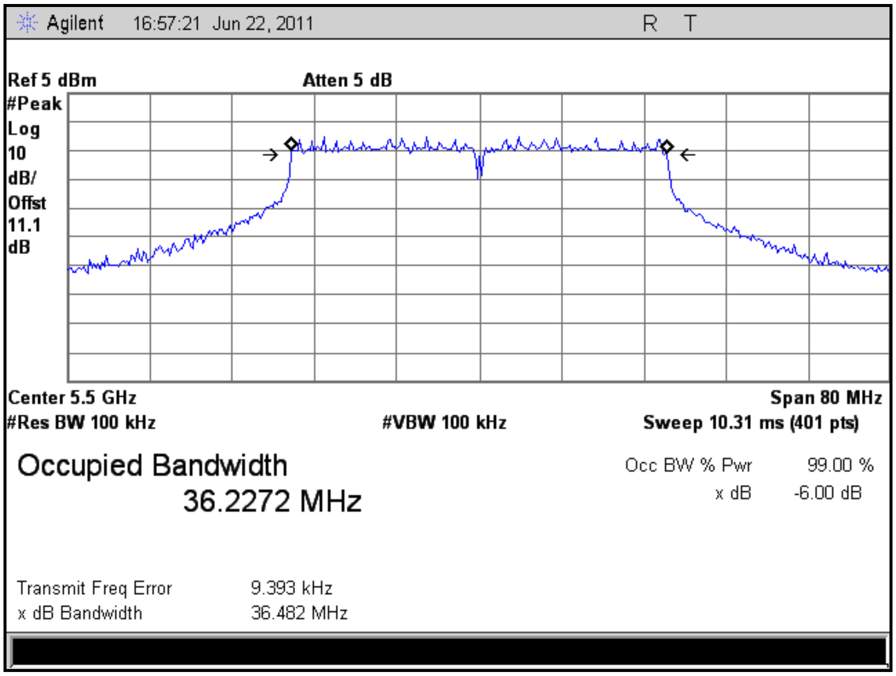
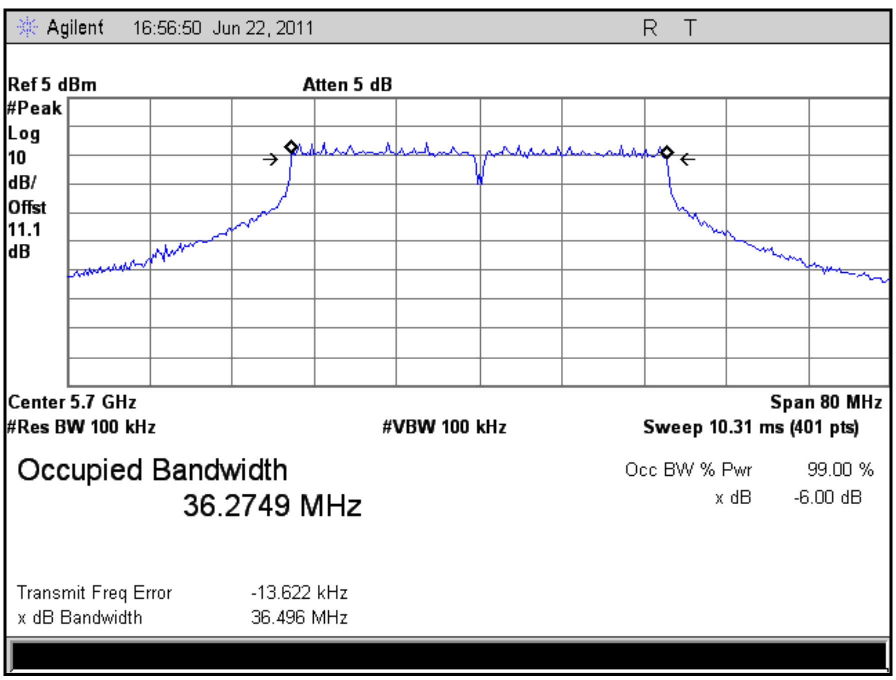


Plot 3. Occupied Bandwidth, 5500 MHz, 802.11n 40 MHz, Port 1



Plot 4. Occupied Bandwidth, 5700 MHz, 802.11n 40 MHz, Port 1

4.4 RF Output Power, Transmit Power Control (TPC), and Power Density

Test Requirement(s): **ETSI EN 301 893, Clause 5.3.4:**

4.4.1 Definitions

4.4.1.1 – RF Power
The RF output power is the mean equivalent isotropically radiated power (EIRP) during a transmission burst.

4.4.1.2 – Transmit Power Control (TPC)
Transmit Power Control (TPC) is a mechanism to be used by the RLAN device to ensure a mitigation factor of at least 3 dB on the aggregate power from a large number of devices. This requires the RLAN device to have a TPC range from which the lowest value is at least 6 dB below the values for mean EIRP given in Table 7.

TPC is not required for channels whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz.

4.4.1.3 – Power Density
The power density is the mean Equivalent Isotropically Radiated Power (EIRP) density during a transmission burst.

4.4.2 Limits

The limits below are applicable to the system as a whole and in any possible configuration. This includes smart antenna systems (devices with multiple transmit chains).

4.4.2.1 Limit: RF Output Power and Power Density at the Highest Power Level
For devices with TPC, the RF output power and the power density when configured to operate at the highest stated power level of the TPC range shall not exceed the levels given in Table 7.

For devices without TPC, the limits in Table 7 shall be reduced by 3 dB, except when operating on channels whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz.

Frequency range	Mean EIRP limit	Mean EIRP Density limit
5 150 MHz to 5 350 MHz	23 dBm	10 dBm/MHz
5 470 MHz to 5 725 MHz	30 dBm (see Note)	17 dBm/MHz (see note)

Table 7. Mean EIRP Limits for RF Output Power and Power Density at the Highest Power Level

Note: For Slave devices without a Radar Interference Detection function the mean EIRP shall be less than 23 dBm and the mean EIRP density shall be less than 10 dBm/MHz.

4.4.2.2 Limit: RF Output Power at the Lowest Power Level of the TPC Range
For devices using TPC, the RF output power during a transmission burst when configured to operate at the lowest stated power level of the TPC range shall not exceed the levels given in Table 8.

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Frequency range	Mean EIRP limit
5 250 MHz to 5 350 MHz	17 dBm
5 470 MHz to 5 725 MHz	24 dBm (see Note)

Table 8. Mean EIRP Limits for RF Output Power at the Lowest Power Level of the TPC Range

Note: For Slave devices without a Radar Interference Detection function the mean EIRP shall be less than 17 dBm.

The limits in Table 8 do not apply for devices without TPC or when operating on channels whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz.

Test Procedures:

RF Output Power
The EUT was connected directly to a spectrum analyzer capable of measuring the average RF power of a modulated carrier. Measurements were carried out in all modulations available. . 20MHz BW frequency were at f_c of 5700MHz for the Higher Sub-band. 40MHz BW frequency were at f_c of 5510MHz and 5670MHz for the Higher Sub-band. Both normal and extreme test conditions were observed.
The EIRP was determined from the 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.

Transmit Power Control (TPC)
The EUT was connected directly to a spectrum analyzer capable of measuring the average RF power of a modulated carrier. Measurements were carried out in all modulations available. 20MHz BW frequency were at f_c of 5700MHz for the Higher Sub-band. 40MHz BW frequency were at f_c of 5510MHz and 5670MHz for the Higher Sub-band. Both normal and extreme test conditions were observed.

Power Density
The EUT was connected directly to a spectrum analyzer capable of measuring the average RF power of a modulated carrier. Measurements were carried out in all modulations available. 20MHz BW frequency were at f_c of 5700MHz for the Higher Sub-band. 40MHz BW frequency were at f_c of 5510MHz and 5670MHz for the Higher Sub-band. The spectrum analyzer was initially set with a RBW and VBW of 1MHz and a span 3 times that of the carrier width. The max hold function was used to determine the frequency which gave the maximum value across the occupied band of the carrier. The spectrum analyzer was reset to use the power density function at the frequency found previously. The power density was then measured over 1MHz resolution.

In case of conducted measurements on smart antenna systems operating in a mode with multiple transmit chains active simultaneously, the output power of each transmit chain shall be measured separately to calculate the total power for the UUT.

Test Results: The EUT as tested was found compliant with the specified limits in clause 5.3.4.

Test Engineer: Anderson Soungpanya

Test Date: 06/22/11 – 06/23/11

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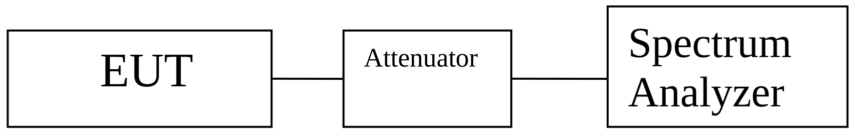

Figure 3. Output Power, TPC, and Power Density Test Setup

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Effective Isotropic Radiated Power Results

Maximum Average Power Under Normal and Extreme Conditions									
Frequency (MHz)	Temperature (C)	Voltage (V)	Port 1 dBm	Port 2 dBm	Sum of Ports mW	Sum of Ports dBm	Antenna Gain dBi	Limit dBm	Margin dBm
5500	20	230	1.55	1.72	2.91	4.65	25	30	-0.35
5500	-30	207	1.78	1.98	3.08	4.89	25	30	-0.11
5500	-30	253	1.76	1.97	3.07	4.88	25	30	-0.12
5500	70	207	1.44	1.66	2.86	4.56	25	30	-0.44
5500	70	253	1.42	1.65	2.85	4.55	25	30	-0.45
5700	20	230	1.76	1.88	3.04	4.83	25	30	-0.17
5700	-30	207	1.89	1.99	3.13	4.95	25	30	-0.05
5700	-30	253	1.88	1.97	3.12	4.94	25	30	-0.06
5700	70	207	1.56	1.66	2.90	4.62	25	30	-0.38
5700	70	253	1.57	1.63	2.89	4.61	25	30	-0.39

Table 9. RF Output Power, Test Results, Maximum Average Power, 802.11n 20 MHz

Minimum Average Power Under Normal and Extreme Conditions									
Frequency (MHz)	Temperature (C)	Voltage (V)	Port 1 dBm	Port 2 dBm	Sum of Ports mW	Sum of Ports dBm	Antenna Gain dBi	Limit dBm	Margin dBm
5500	20	230	-10.11	-9.99	0.20	-7.04	25	24	-6.04
5500	-30	207	-9.81	-9.52	0.22	-6.65	25	24	-5.65
5500	-30	253	-9.82	-9.54	0.22	-6.67	25	24	-5.67
5500	70	207	-10.50	-10.21	0.18	-7.34	25	24	-6.34
5500	70	253	-10.54	-10.19	0.18	-7.35	25	24	-6.35
5700	20	230	-10.02	-9.66	0.21	-6.83	25	24	-5.83
5700	-30	207	-9.84	-9.40	0.22	-6.60	25	24	-5.60
5700	-30	253	-9.84	-9.41	0.22	-6.61	25	24	-5.61
5700	70	207	-10.45	-10.22	0.19	-7.32	25	24	-6.32
5700	70	253	-10.46	-10.24	0.18	-7.34	25	24	-6.34

Table 10. RF Output Power, Test Results, Minimum Average Power, 802.11n 20 MHz

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Maximum Average Power Under Normal and Extreme Conditions									
Frequency (MHz)	**Temperature (C)**	**Voltage (V)**	**Port 1 dBm**	**Port 2 dBm**	**Sum of Ports mW**	**Sum of Ports dBm**	**Antenna Gain dBi**	**Limit dBm**	**Margin dBm**
5500	20	230	1.33	1.65	2.82	4.50	25	30	-0.50
5500	-30	207	1.47	1.74	2.90	4.62	25	30	-0.38
5500	-30	253	1.49	1.78	2.92	4.65	25	30	-0.35
5500	70	207	1.22	1.66	2.79	4.46	25	30	-0.54
5500	70	253	1.24	1.69	2.81	4.48	25	30	-0.52
5700	20	230	1.44	1.56	2.83	4.51	25	30	-0.49
5700	-30	207	1.56	1.88	2.97	4.73	25	30	-0.27
5700	-30	253	1.57	1.87	2.97	4.73	25	30	-0.27
5700	70	207	1.32	1.45	2.75	4.40	25	30	-0.60
5700	70	253	1.32	1.45	2.75	4.40	25	30	-0.60

Table 11. RF Output Power, Test Results, Maximum Average Power, 802.11n 40 MHz

Minimum Average Power Under Normal and Extreme Conditions									
Frequency (MHz)	**Temperature (C)**	**Voltage (V)**	**Port 1 dBm**	**Port 2 dBm**	**Sum of Ports mW**	**Sum of Ports dBm**	**Antenna Gain dBi**	**Limit dBm**	**Margin dBm**
5500	20	230	-10.42	-10.74	0.18	-7.57	25	24	-6.57
5500	-30	207	-10.11	-10.24	0.19	-7.16	25	24	-6.16
5500	-30	253	-10.12	-10.26	0.19	-7.18	25	24	-6.18
5500	70	207	-10.82	-10.98	0.16	-7.89	25	24	-6.89
5500	70	253	-10.87	-10.96	0.16	-7.90	25	24	-6.90
5700	20	230	-10.33	-10.39	0.18	-7.35	25	24	-6.35
5700	-30	207	-10.14	-10.11	0.19	-7.11	25	24	-6.11
5700	-30	253	-10.14	-10.12	0.19	-7.12	25	24	-6.12
5700	70	207	-10.77	-10.99	0.16	-7.87	25	24	-6.87
5700	70	253	-10.78	-11.01	0.16	-7.88	25	24	-6.88

Table 12. RF Output Power, Test Results, Minimum Average Power, 802.11n 40 MHz

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Power Spectral Density									
Channel (MHz)		Mode OFDM	Measured Power Density Port 1 dBm	Measured Power Density Port 2 dBm	Summed Ports dBm	Antenna Gain dBi	EIRP dBm	Limit dBm	Margin dB
5500	Low	HT20	-12.43	-11.36	-8.85	25	12.57	17	-4.43
5700	High	HT20	-11.57	-12.02	-8.78	25	13.43	17	-3.57
5500	Low	HT40	-13.50	-13.70	-10.59	25	11.50	17	-5.50
5700	High	HT40	-13.31	-12.64	-9.95	25	11.69	17	-5.31

Table 13. Power Spectral Density, Test Results

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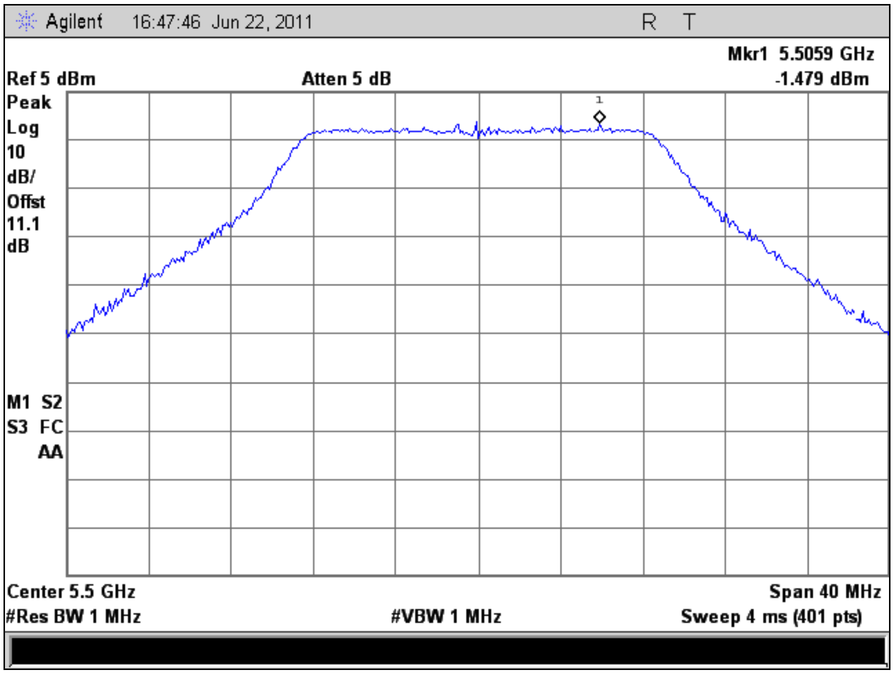
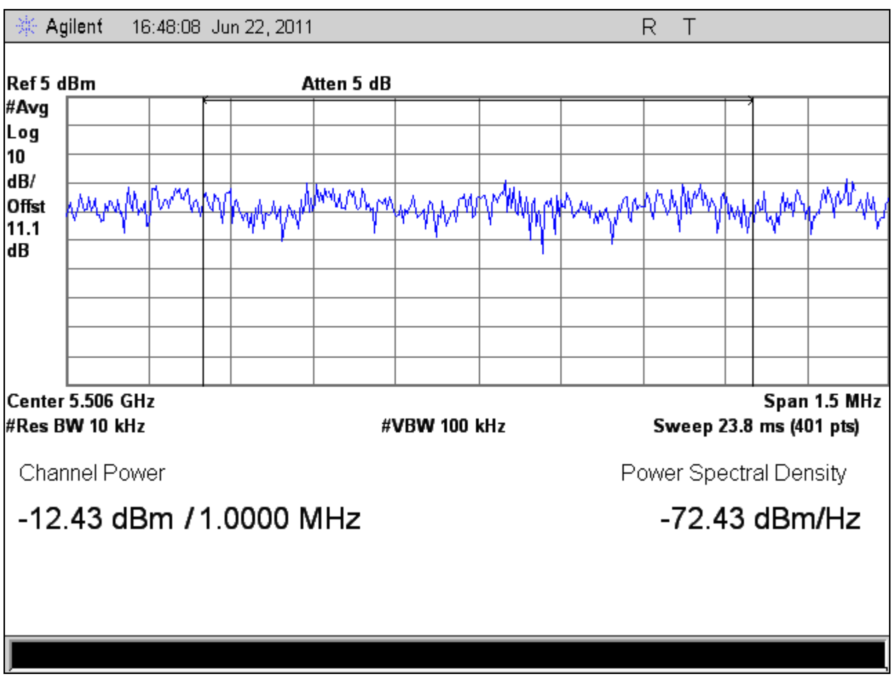
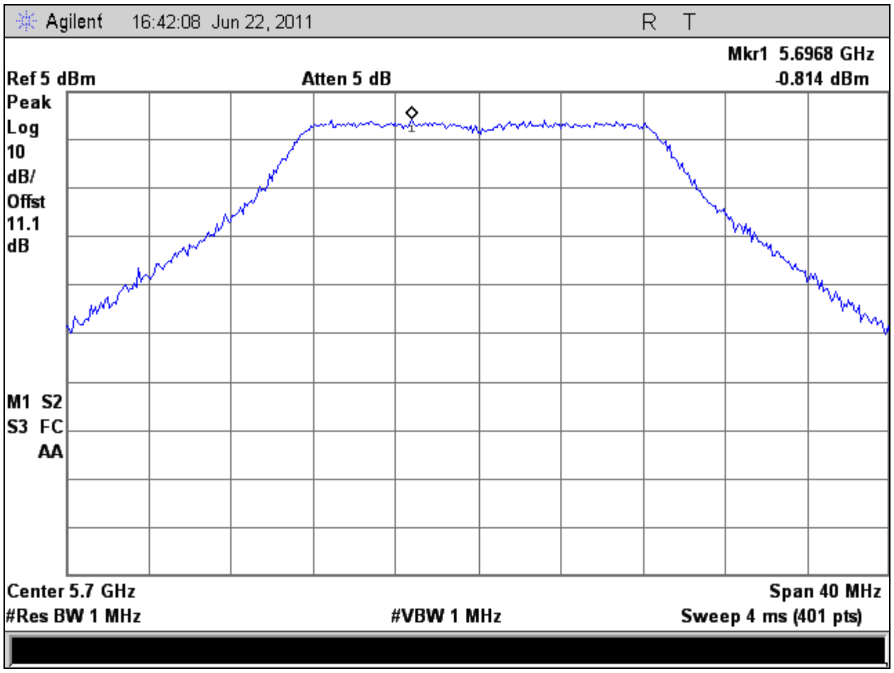
Power Density



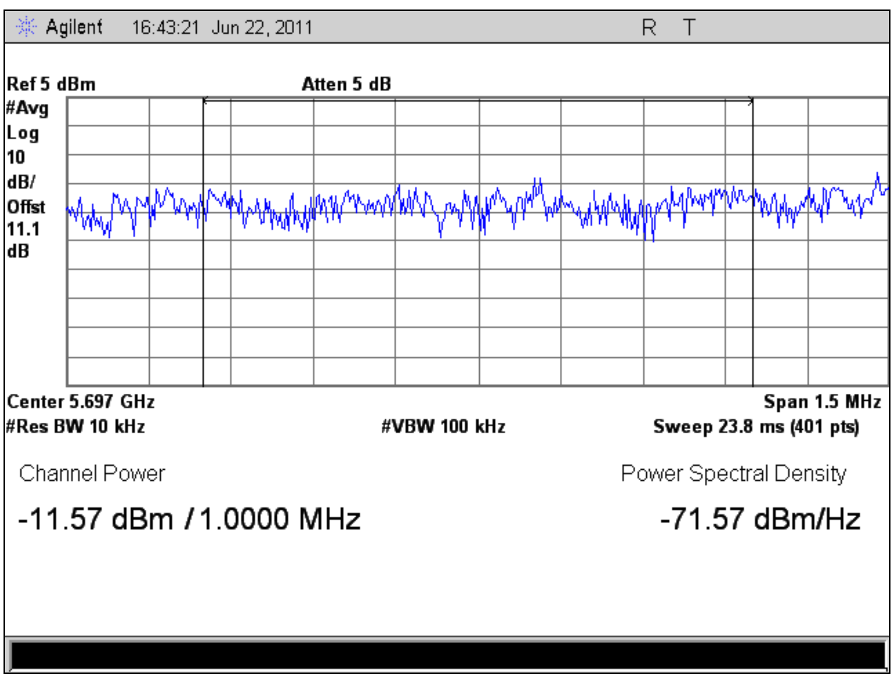
Plot 5. Power Spectral Density, 5500 MHz, 802.11n 20 MHz, Port 1, Determination



Plot 6. Power Spectral Density, 5500 MHz, 802.11n 20 MHz, Port 1



Plot 7. Power Spectral Density, 5700 MHz, 802.11n 20 MHz, Port 1, Determination



Plot 8. Power Spectral Density, 5700 MHz, 802.11n 20 MHz, Port 1

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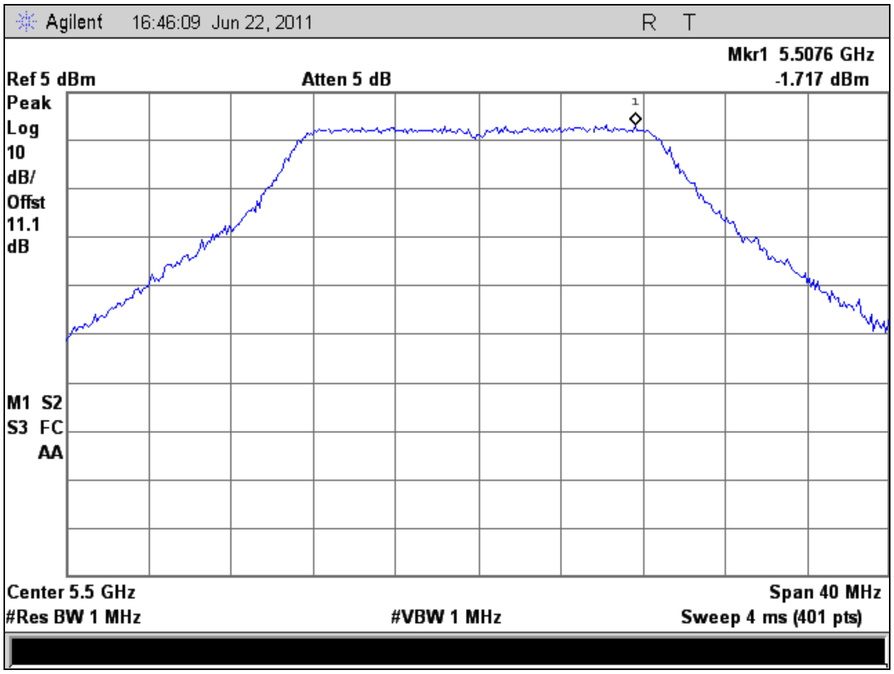
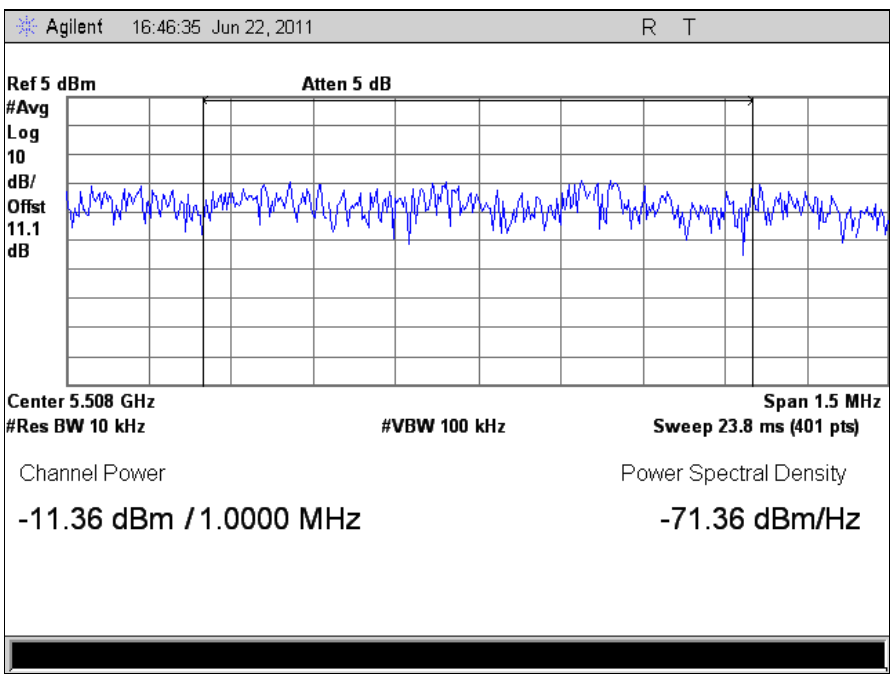
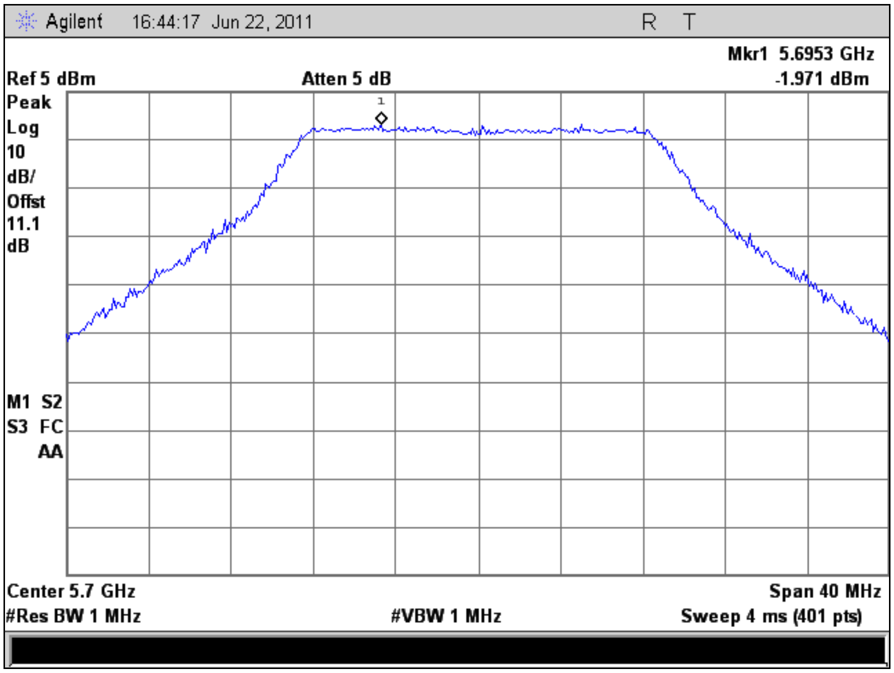


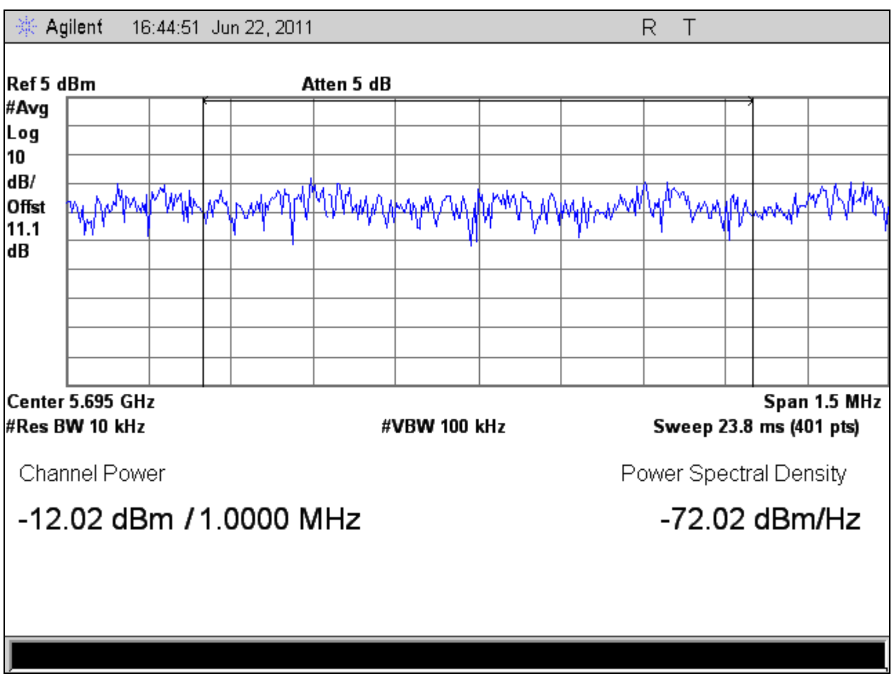
Plot 9. Power Spectral Density, 5500 MHz, 802.11n 20 MHz, Port 2, Determination



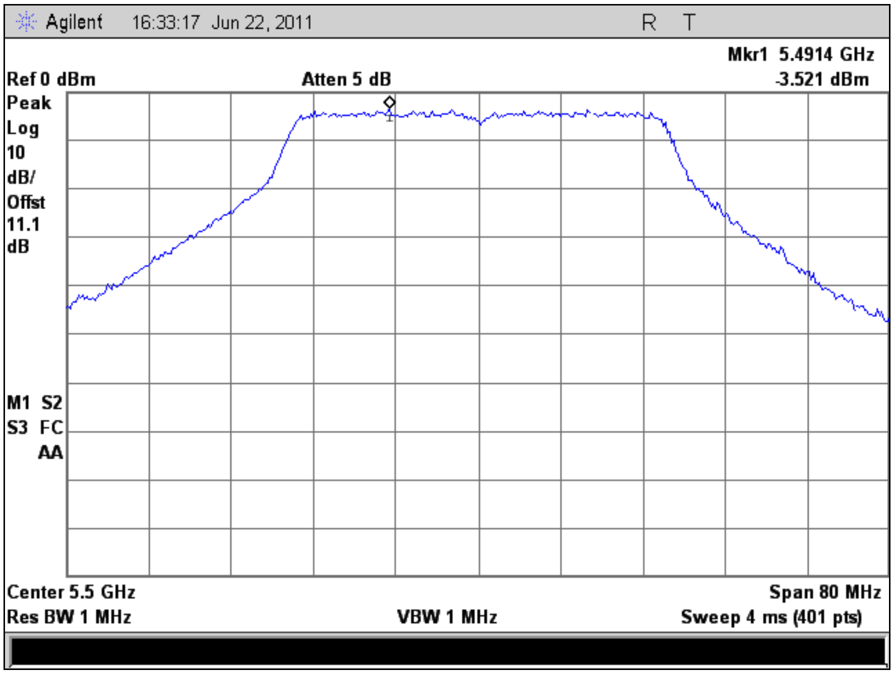
Plot 10. Power Spectral Density, 5500 MHz, 802.11n 20 MHz, Port 2



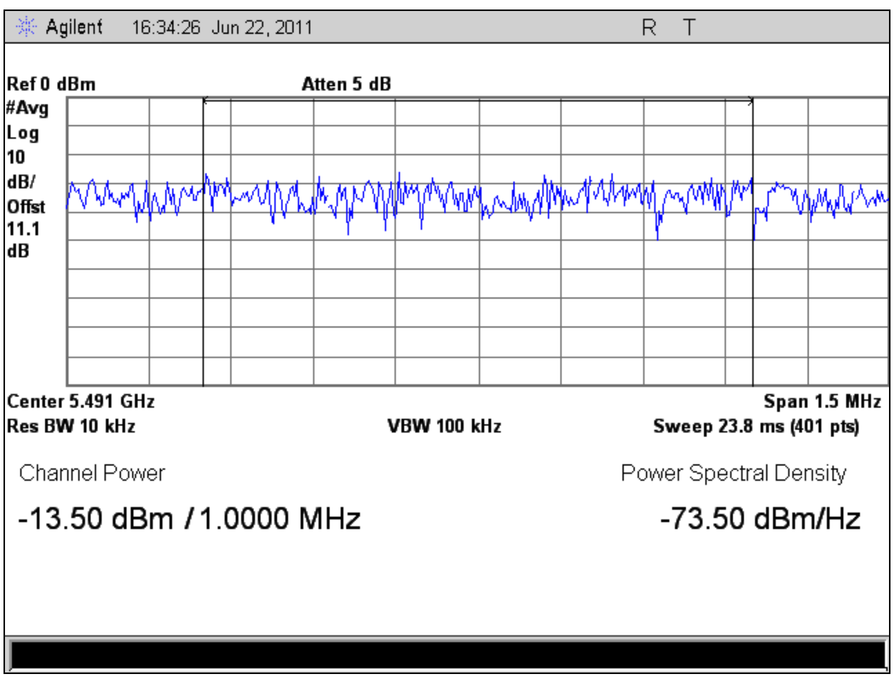
Plot 11. Power Spectral Density, 5700 MHz, 802.11n 20 MHz, Port 2, Determination



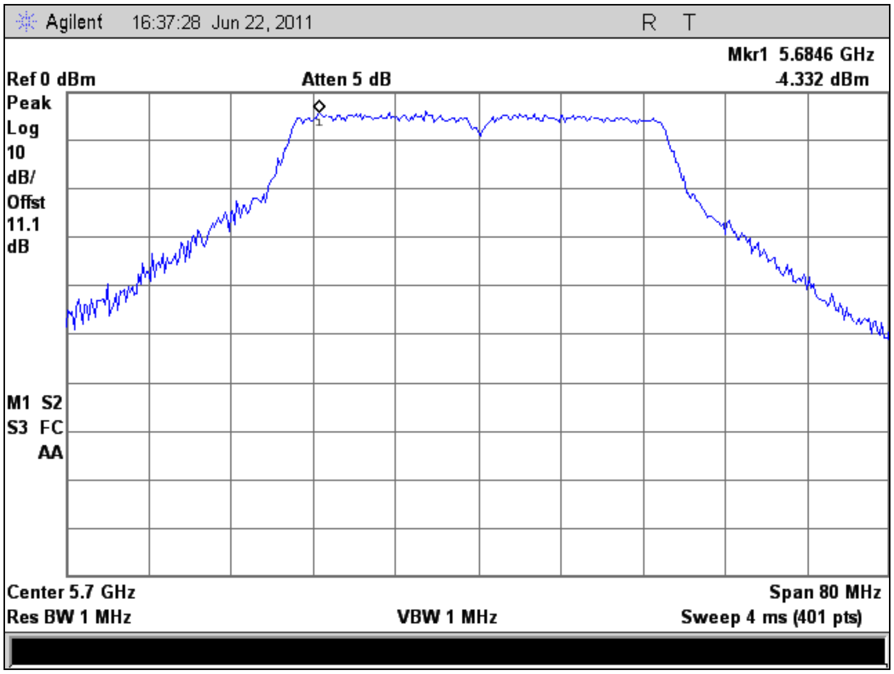
Plot 12. Power Spectral Density, 5700 MHz, 802.11n 20 MHz, Port 2



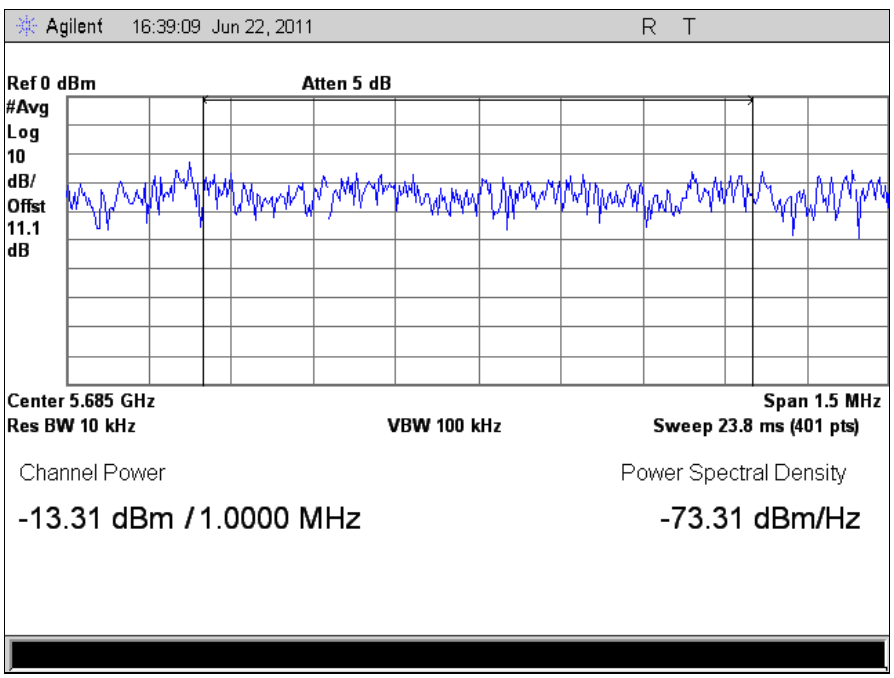
Plot 13. Power Spectral Density, 5500 MHz, 802.11n 40 MHz, Port 1, Determination



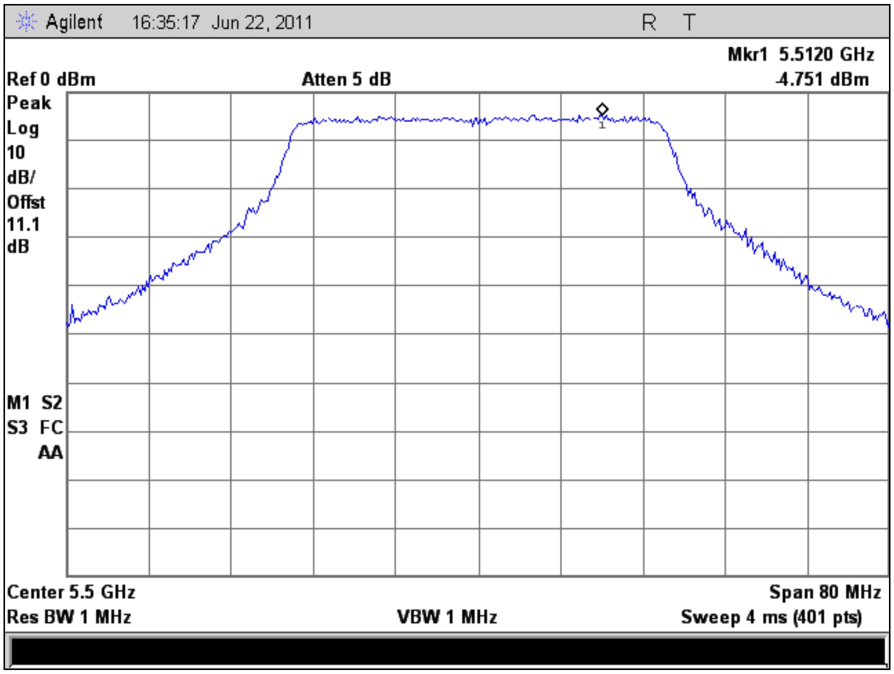
Plot 14. Power Spectral Density, 5500 MHz, 802.11n 40 MHz, Port 1



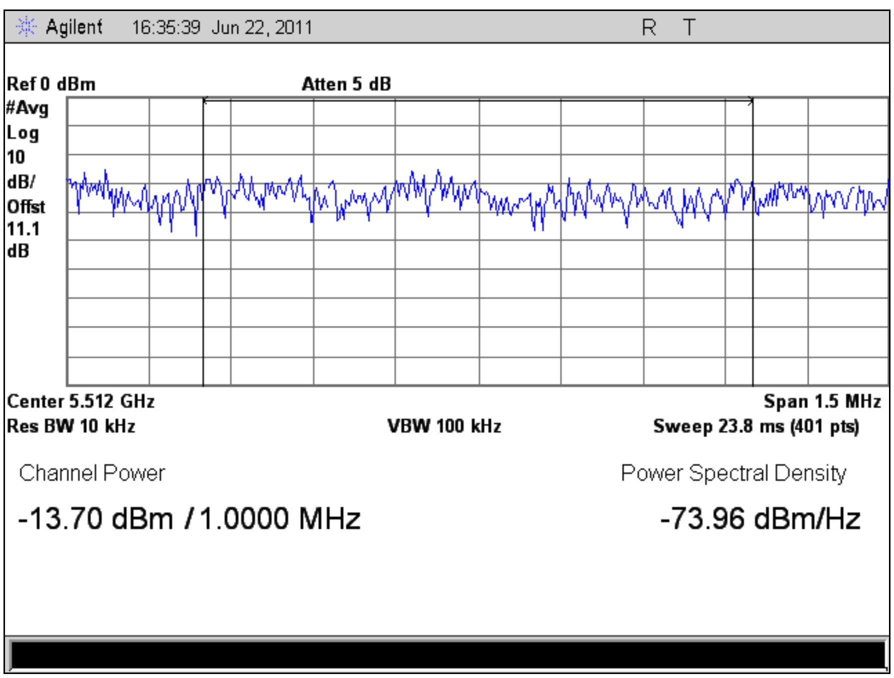
Plot 15. Power Spectral Density, 5700 MHz, 802.11n 40 MHz, Port 1, Determination



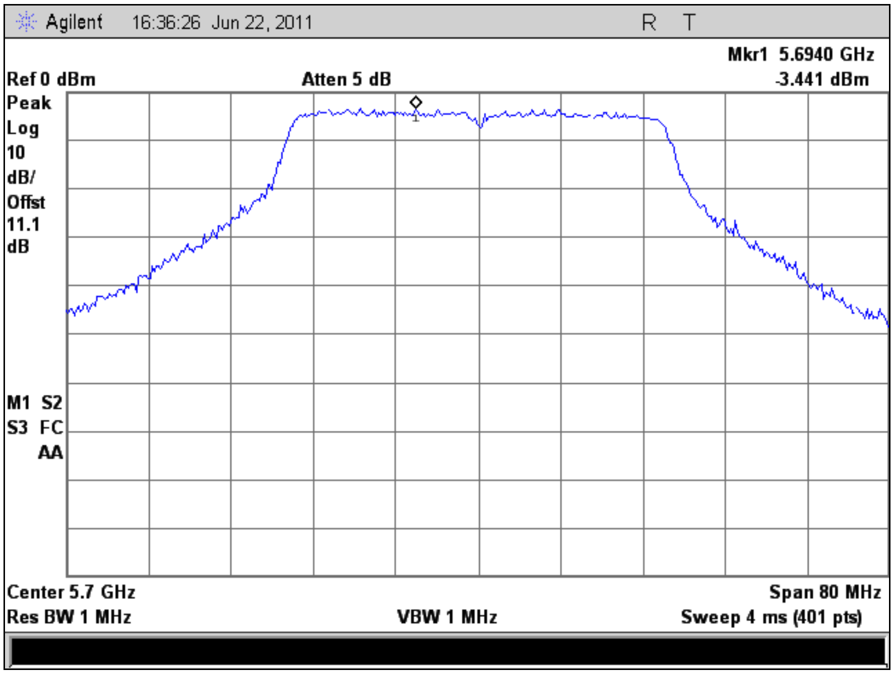
Plot 16. Power Spectral Density, 5700 MHz, 802.11n 40 MHz, Port 1



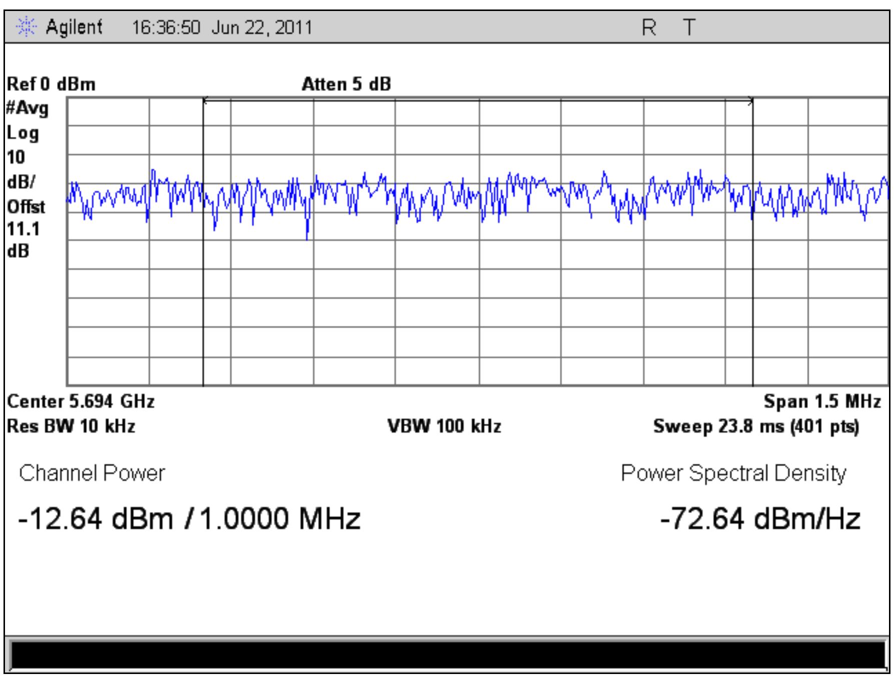
Plot 17. Power Spectral Density, 5500 MHz, 802.11n 40 MHz, Port 2, Determination



Plot 18. Power Spectral Density, 5500 MHz, 802.11n 40 MHz, Port 2



Plot 19. Power Spectral Density, 5700 MHz, 802.11n 40 MHz, Port 2, Determination



Plot 20. Power Spectral Density, 5700 MHz, 802.11n 40 MHz, Port 2

4.5.1 Transmitter Unwanted Emissions Outside the 5GHz RLAN Bands (Radiated)

Test Requirement(s): **EN 301 893, Clause 5.3.5**

4.5.1.1 Definition

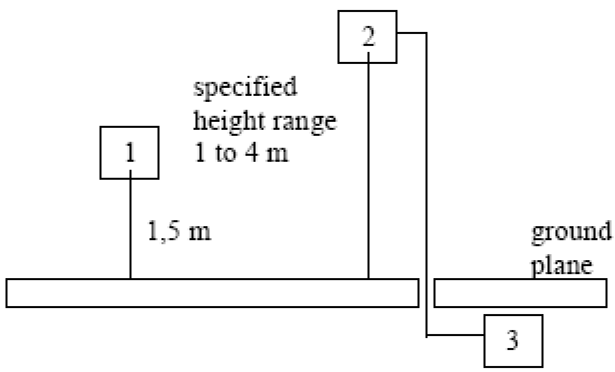
These are radiated radio frequency emissions outside the 5GHz RLAN bands when the RF output port is connected to a spectrum analyzer.

4.5.1.2 Limit

The level of unwanted emissions shall not exceed the limits given

Frequency range	Maximum power ERP	Bandwidth
30 MHz to 47 MHz	-36dBm	100KHz
47 MHz to 74 MHz	-54dBm	100KHz
74 MHz to 87,5 MHz	-36dBm	100KHz
87,5 MHz to 118 MHz	-54dBm	100KHz
118 MHz to 174 MHz	-36dBm	100KHz
174 MHz to 230 MHz	-54dBm	100KHz
230 MHz to 470 MHz	-36dBm	100KHz
470 MHz to 862 MHz	-54dBm	100KHz
862 MHz to 1 GHz	-36dBm	100KHz
1 GHz to 5,15 GHz	-30dBm	1MHz
5,35 GHz to 5,47 GHz	-30dBm	1MHz
5,725 GHz to 26,5 GHz	-30dBm	1MHz

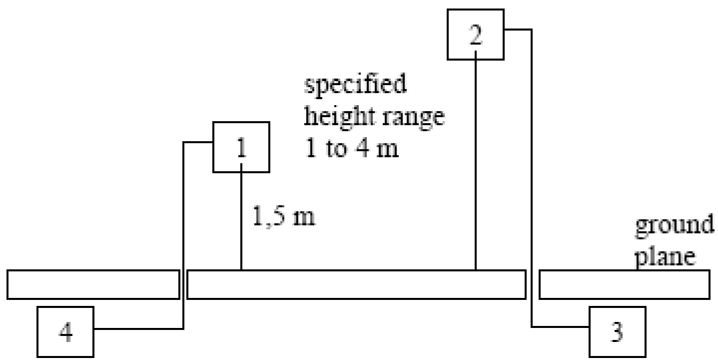
Test Procedure: The EUT was setup as per the specifications set out in Annex B of 301 893 and is shown below.



1. Equipment Under Test
2. Test Antenna
3. Spectrum Analyzer

The receiving antenna was connected directly to a spectrum analyzer through an RF pre-amplifier. The spectrum analyzer were initially set to the peak hold function or video averaging. Emissions were investigated from. If any emission exceeded the limits in the table above then the spectrum analyzer was reset with a resolution of 100KHz, zero span, and the spectrum investigate at 11 frequencies spaced 100KHz in a band ± 0.5MHz centered on the failing frequency. The spectrum also was investigated from 1GHz to 5.15GHz, 5.35GHz to 5.47GHz and 5.725GHz to 26.5GHz using a resolution of 1MHz and a peak hold function or video averaging. The turntable was rotated about 360^0 and the receiving antenna raised and lowered 1-4m in order to determine the maximum emissions. Measurements were carried out in all modulations available.

The levels of emissions were then determined using a signal substitution method and the setup is shown below.



1. Substitution Antenna
2. Test Antenna
3. Spectrum Analyzer
4. Signal Generator

Test Results: The EUT as tested was found compliant with the specified requirements of Clause 5.3.5.

Test Engineer: Anderson Soungpanya

Test Date: 06/23/11

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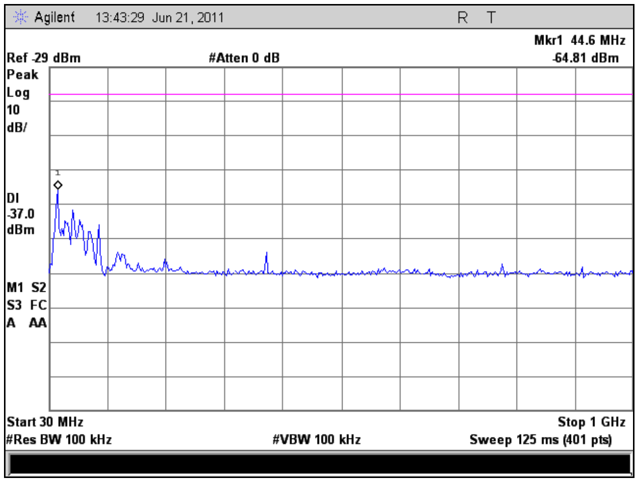
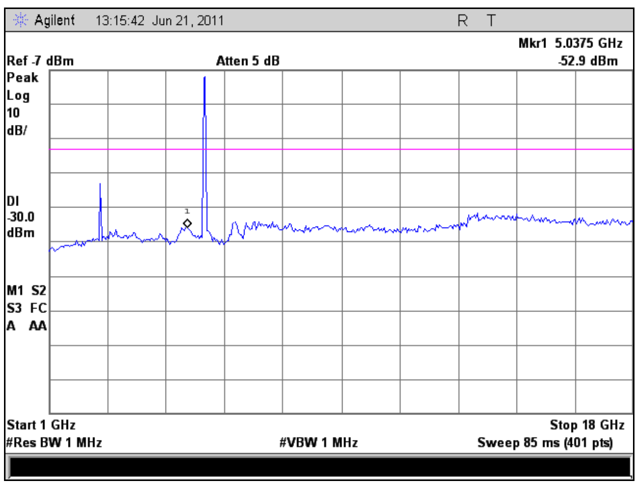
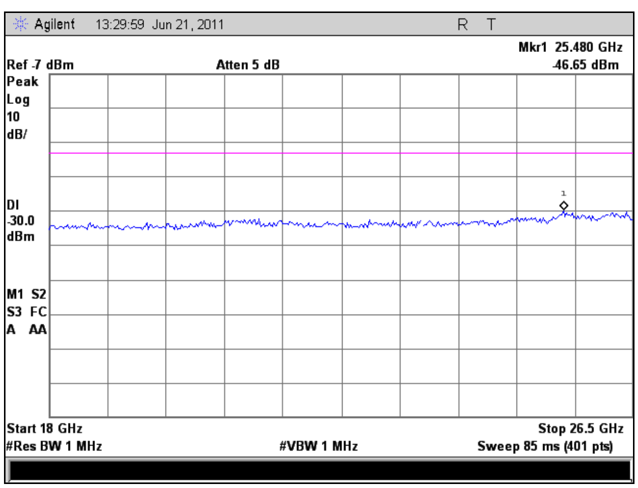
Radiated Spurious Emissions



Plot 21. Transmitter Radiated Spurious Emission, 5500 MHz, 802.11n 20 MHz, 30 MHz – 1 GHz



Plot 22. Transmitter Radiated Spurious Emission, 5500 MHz, 802.11n 20 MHz, 1 GHz – 18 GHz



Plot 23. Transmitter Radiated Spurious Emission, 5500 MHz, 802.11n 20 MHz, 18 GHz – 26.5 GHz

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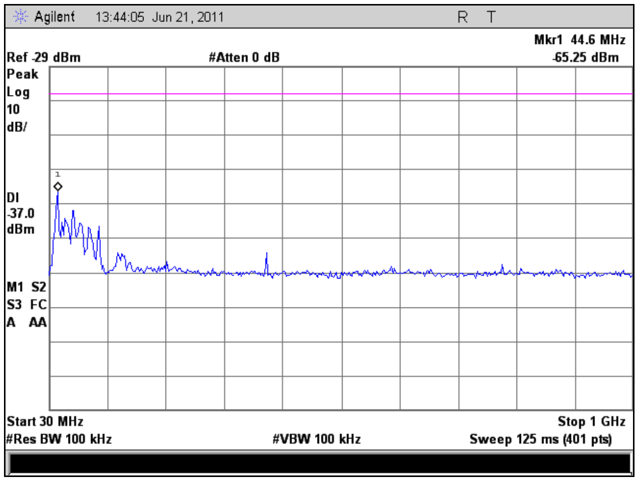
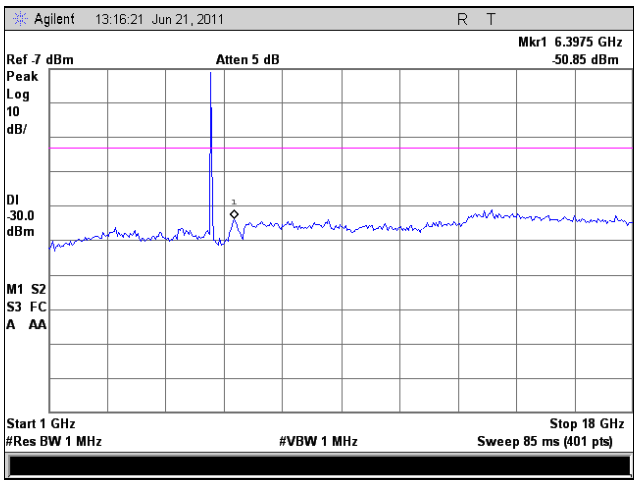
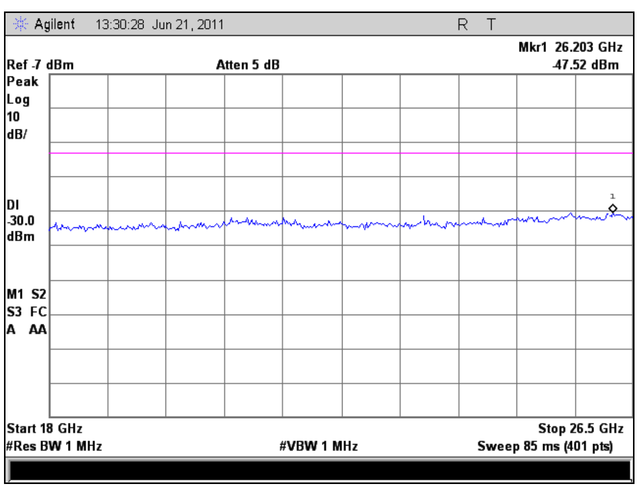


Plot 24. Transmitter Radiated Spurious Emission, 5700 MHz, 802.11n 20 MHz, 30 MHz – 1 GHz



Plot 25. Transmitter Radiated Spurious Emission, 5700 MHz, 802.11n 20 MHz, 1 GHz – 18 GHz



Plot 26. Transmitter Radiated Spurious Emission, 5700 MHz, 802.11n 20 MHz, 18 GHz – 26.5 GHz

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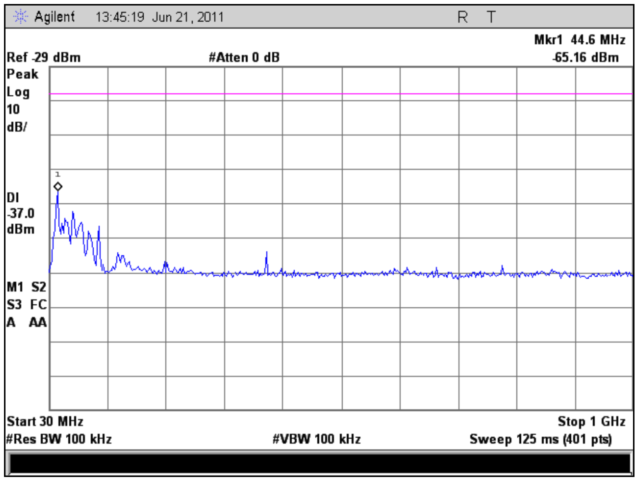
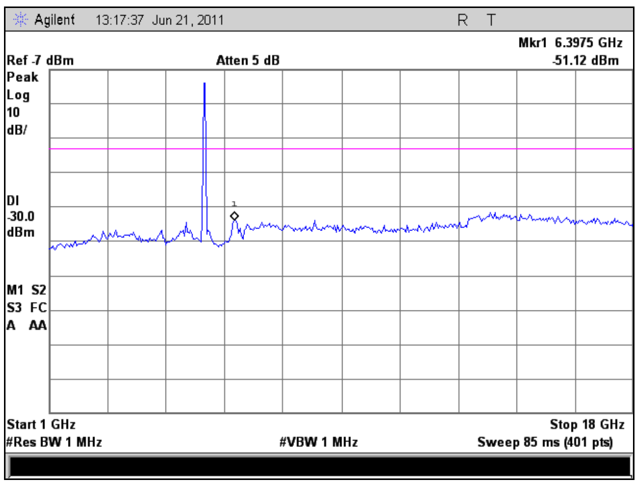
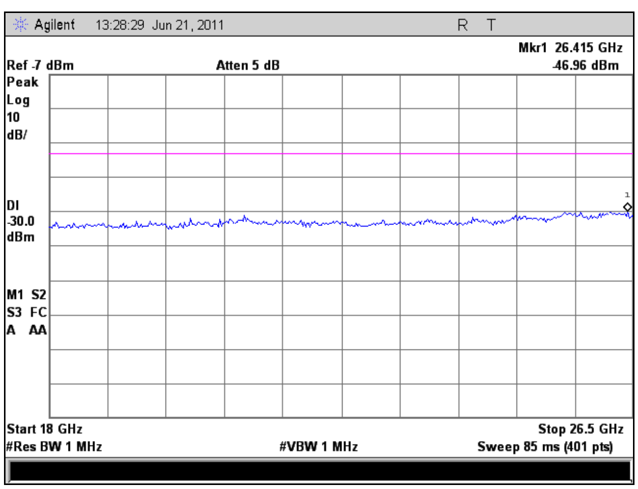


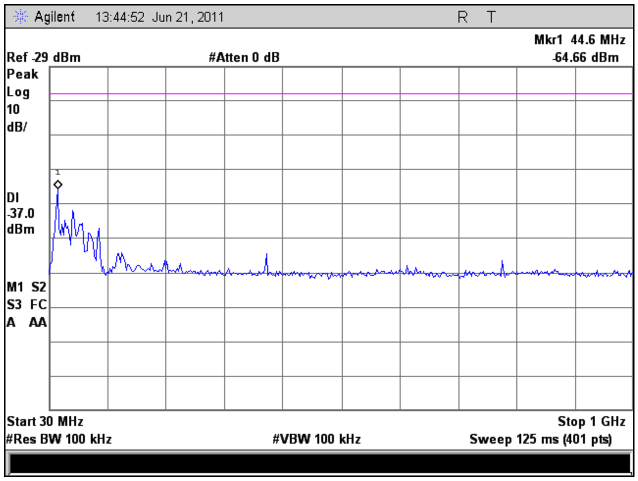
Plot 27. Transmitter Radiated Spurious Emission, 5500 MHz, 802.11n 40 MHz, 30 MHz – 1 GHz



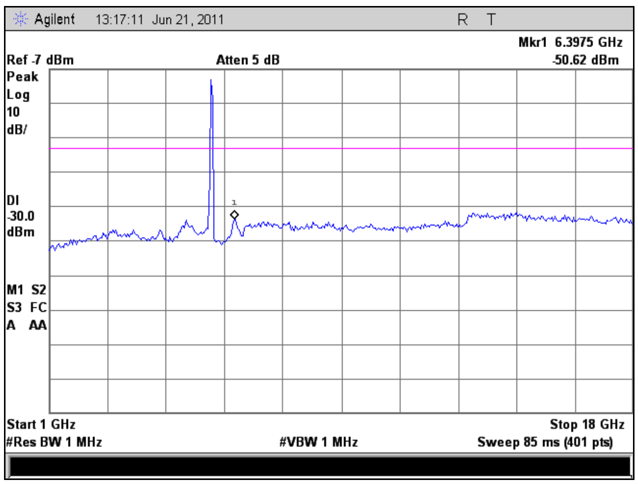
Plot 28. Transmitter Radiated Spurious Emission, 5500 MHz, 802.11n 40 MHz, 1 GHz – 18 GHz



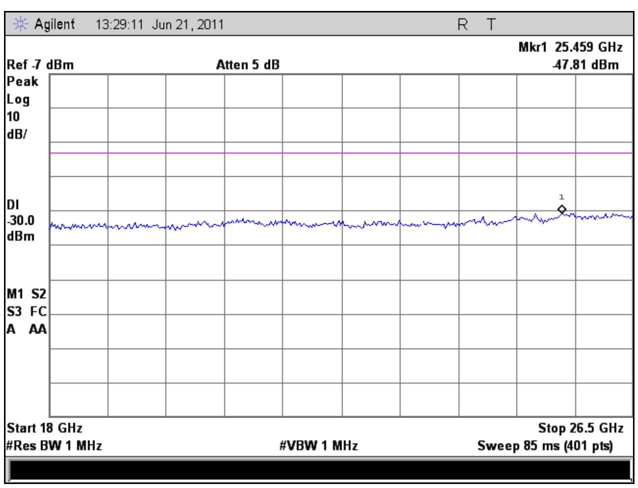
Plot 29. Transmitter Radiated Spurious Emission, 5500 MHz, 802.11n 40 MHz, 18 GHz – 26.5 GHz



Plot 30. Transmitter Radiated Spurious Emission, 5700 MHz, 802.11n 40 MHz, 30 MHz – 1 GHz



Plot 31. Transmitter Radiated Spurious Emission, 5700 MHz, 802.11n 40 MHz, 1 GHz – 18 GHz



Plot 32. Transmitter Radiated Spurious Emission, 5700 MHz, 802.11n 40 MHz, 18 GHz – 26.5 GHz

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Radiated Emissions Test Setup Photographs

Photograph 2. Transmitter Radiated Emissions, Test Setup 1

Photograph 3. Transmitter Radiated Emissions, Test Setup 2

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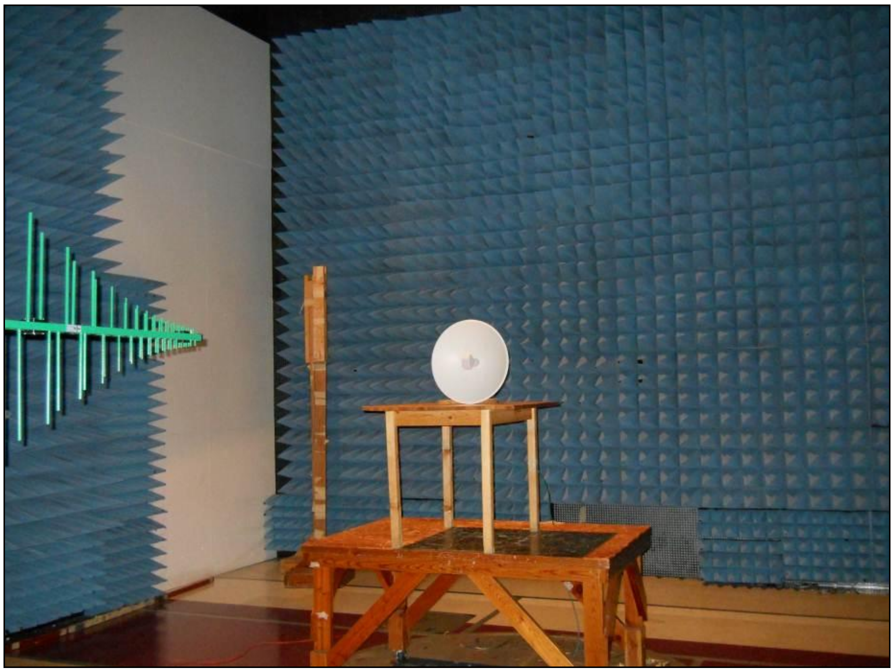
Photograph 4. Transmitter Radiated Emissions, Test Setup 3



Photograph 5. Transmitter Radiated Emissions, Test Setup 4

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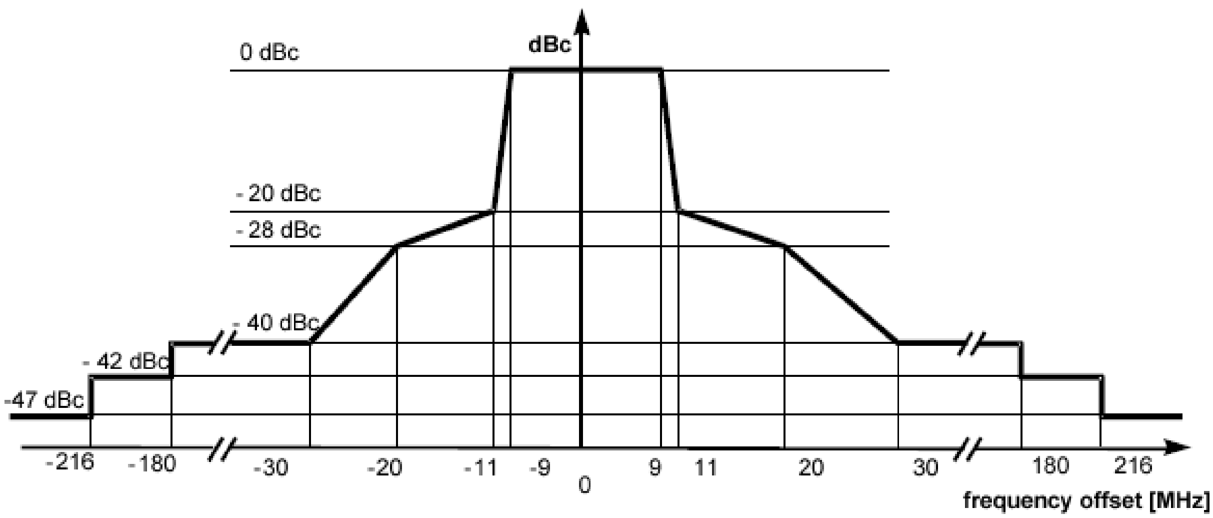
4.5.2 Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted)

Test Requirement(s): **EN 301 893, Clause 5.3.6:**

4.5.2.1 Definition
These are conducted radio frequency emissions within the 5GHz RLAN bands when the RF output port is connected to a spectrum analyzer.

4.5.2.2 Limit
The average level of the transmitted spectrum within the 5GHz RLAN bands shall not exceed the limits given below.



Note: dBc is the spectral density relative to the maximum spectral power density of the transmitted signal**.**

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Test Procedure: The maximum spectral power density of the EUT's transmitted signal was determined using a broadband power meter capable of measuring the average power of a modulated carrier. The EUT was then connected to a spectrum analyzer with a RBW of 1MHz, a VBW of 30 KHz and with video averaging on. The level of the power density measured previously was then used to set the emission mask relative to the 0 dB reference level of the modulated carrier. Measurements were carried out in all modulations available. Frequency was at f_c of 5500MHz and 5700MHz for the Higher Sub-band. The spectrum under the mask was examined both in a relatively narrow span and a broader span in order to determine compliance.

In case of conducted measurements on smart antenna systems (devices with multiple transmit chains) measurements need only to be performed on one of the active transmit chains (antenna outputs).

Test Results: The EUT as tested was found compliant with the specified requirements of Clause 5.3.6.

Test Engineer: Anderson Soungpanya

Test Date: 07/05/11

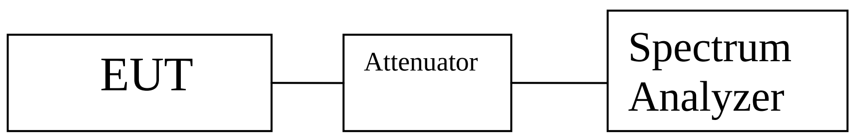
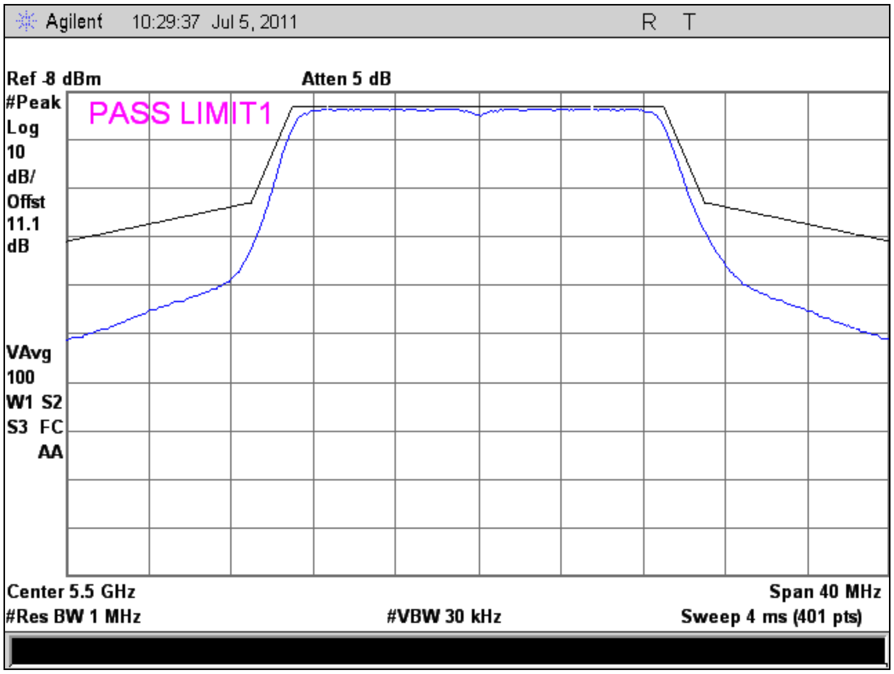
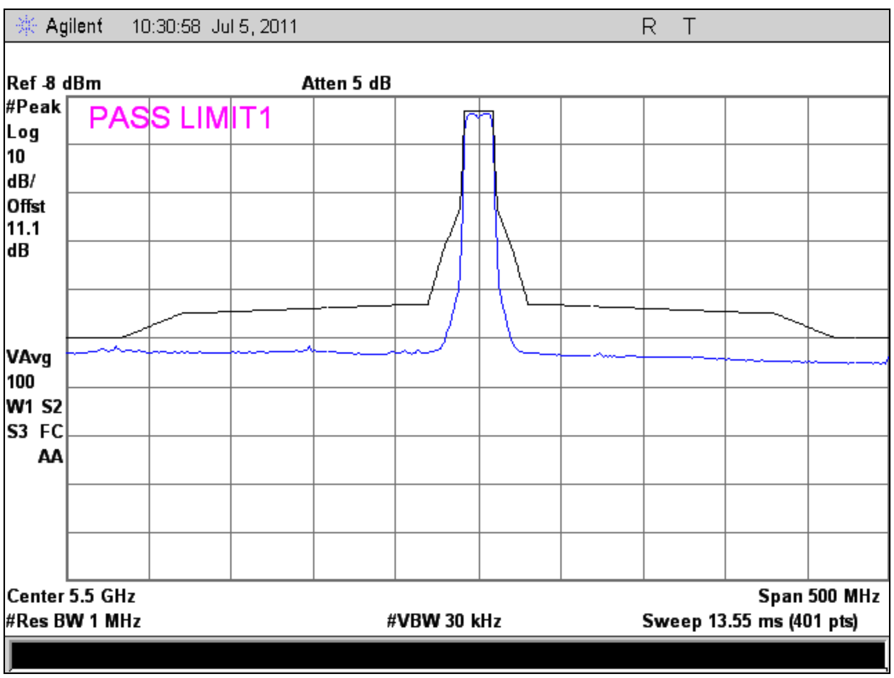


Figure 4. Unwanted Conducted Emissions Within Test Setup

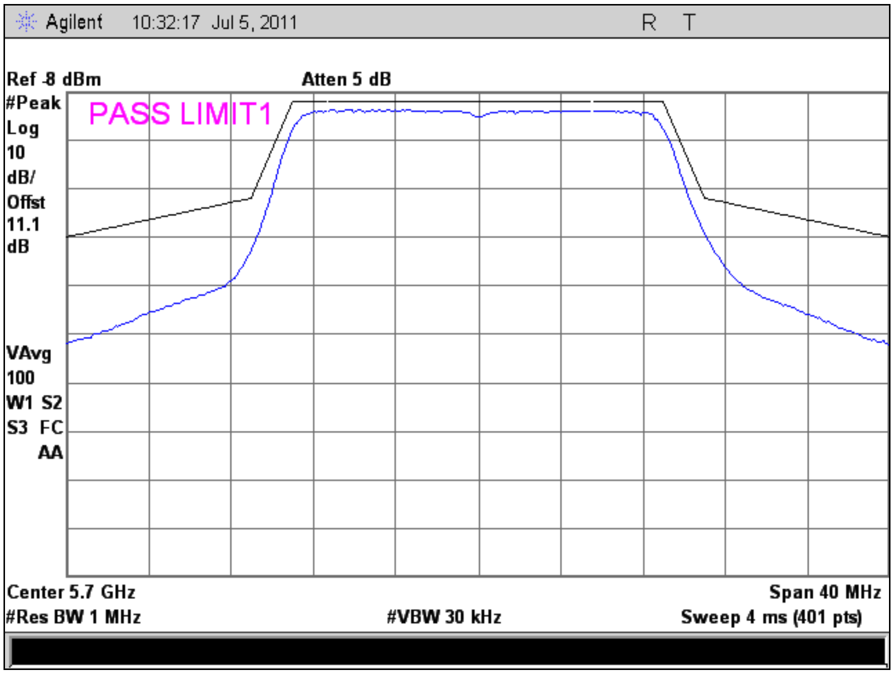
Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted)



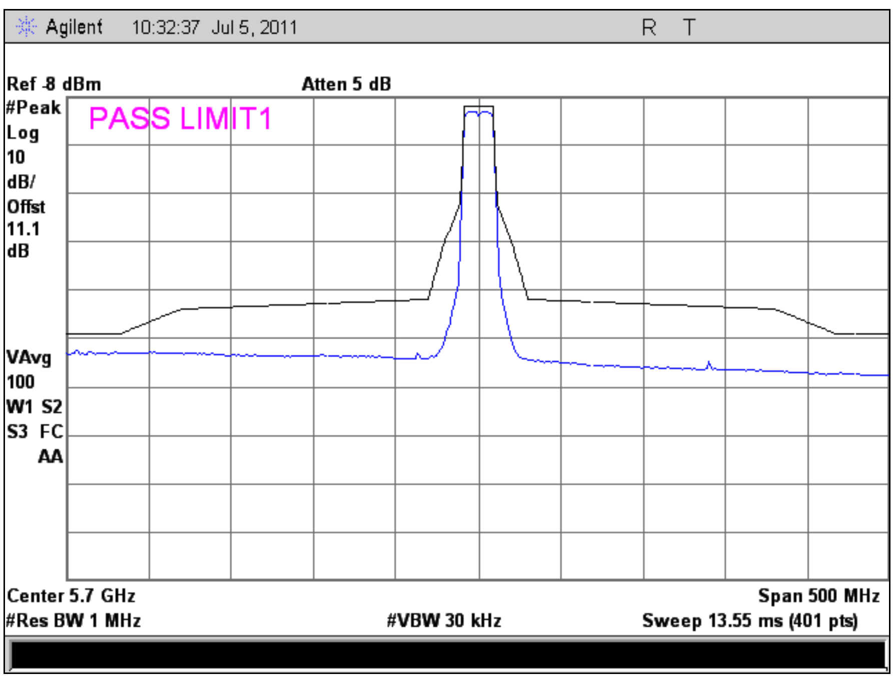
Plot 33. Conducted In-Band Spurious Emissions, 5500 MHz, 802.11n 20 MHz, 40 MHz Span



Plot 34. Conducted In-Band Spurious Emissions, 5500 MHz, 802.11n 20 MHz, 500 MHz Span



Plot 35. Conducted In-Band Spurious Emissions, 5700 MHz, 802.11n 20 MHz, 40 MHz Span



Plot 36. Conducted In-Band Spurious Emissions, 5700 MHz, 802.11n 20 MHz, 500 MHz Span

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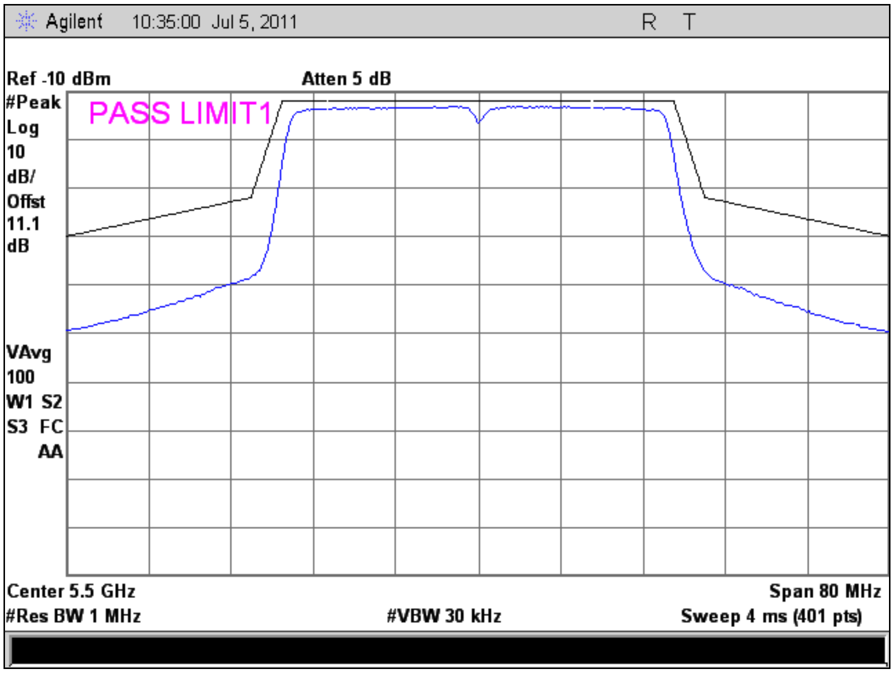
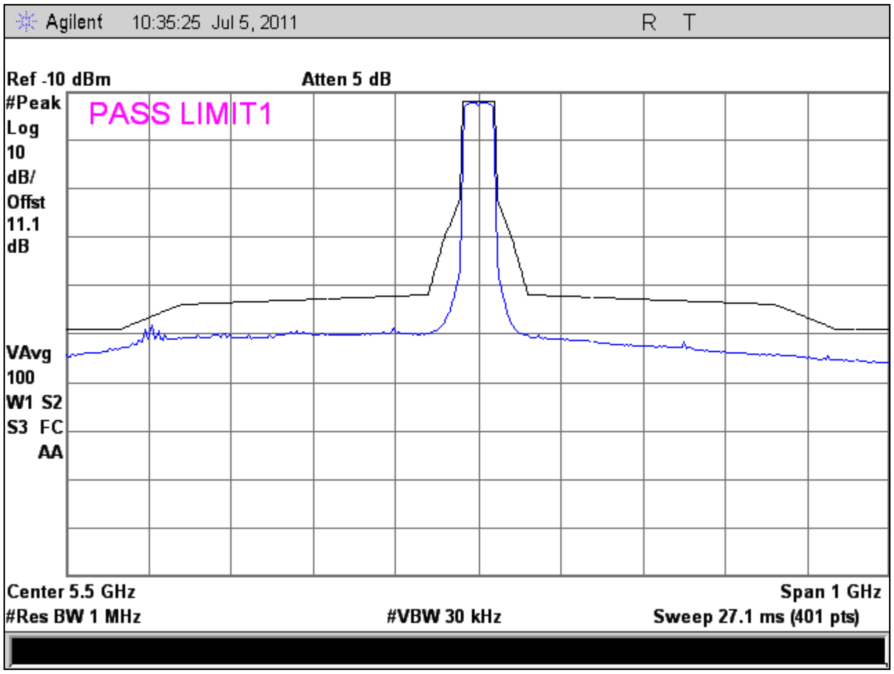


Plot 37. Conducted In-Band Spurious Emissions, 5500 MHz, 802.11n 40 MHz, 80 MHz Span



Plot 38. Conducted In-Band Spurious Emissions, 5500 MHz, 802.11n 40 MHz, 1 GHz Span

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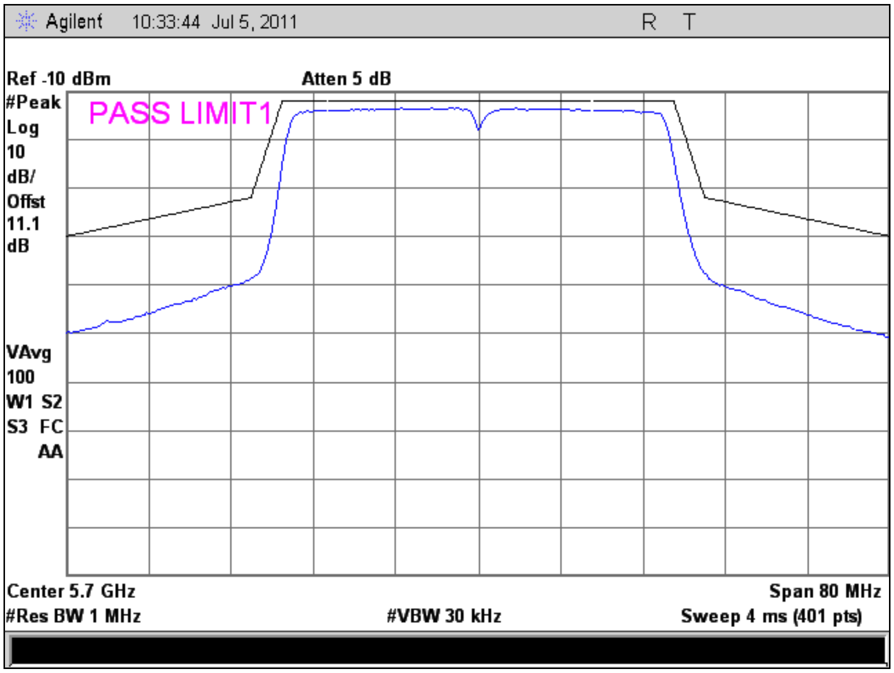
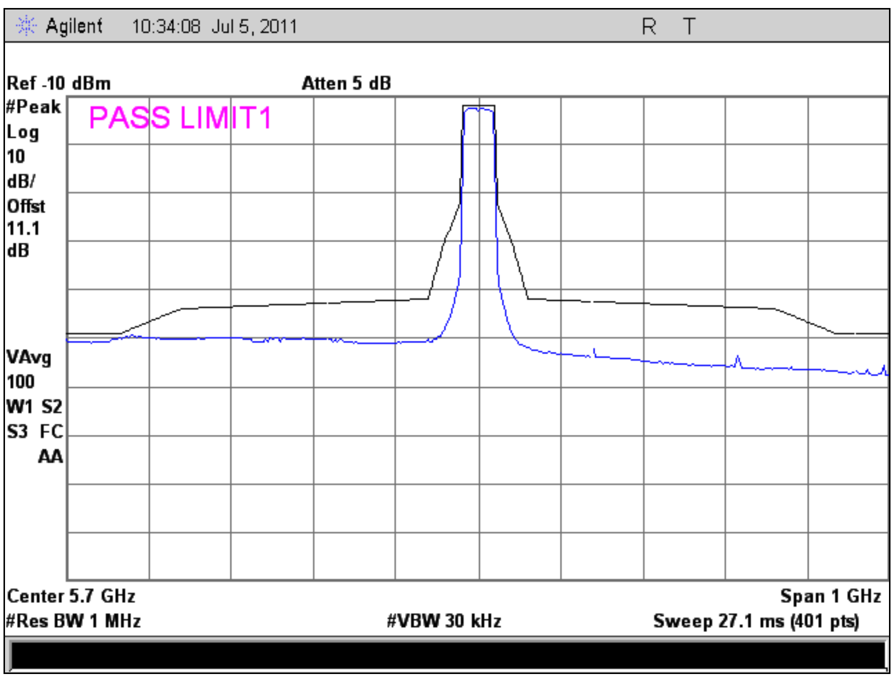


Plot 39. Conducted In-Band Spurious Emissions, 5700 MHz, 802.11n 40 MHz, 80 MHz Span



Plot 40. Conducted In-Band Spurious Emissions, 5700 MHz, 802.11n 40 MHz, 1 GHz Span

4.6 Receiver Spurious Emissions (Radiated)

Test Requirement(s): **EN 301 893V1.4.1, Clause 5.3.7**

4.6.1 Definition

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

4.6.2 Limit

The spurious emissions of the receiver shall not exceed the values in table below.

Frequency Range	Maximum Power, ERP	Measurement Bandwidth
30 MHz to 1 GHz	-57 dBm	100KHz
above 1 GHz to 26.5 GHz	-47 dBm	1MHz

Test Procedure: The EUT was setup as per section 4.4 above for measuring out of band radiated emissions. The EUT was set up to receive data. The spectrum within the 5GHz RLAN band was investigated for spurious emissions.

Test Results: The EUT as tested was found compliant with the specified limits of Clause 5.3.7.

Test Engineer: Anderson Soungpanya

Test Date: 06/23/11

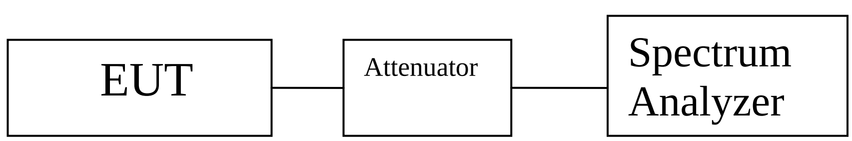


Figure 5. Receiver Spurious Emissions Test Setup

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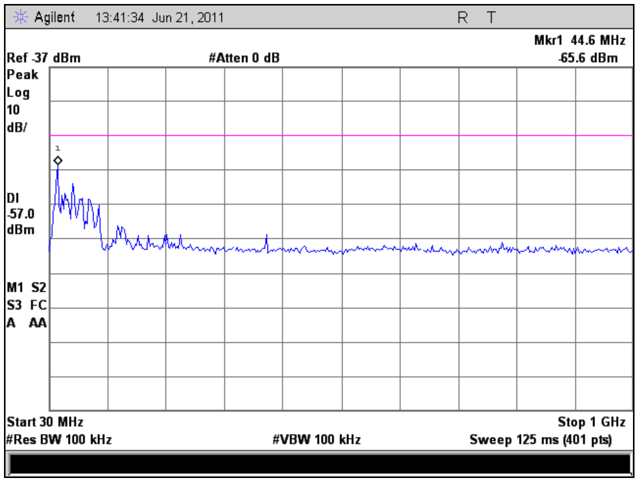
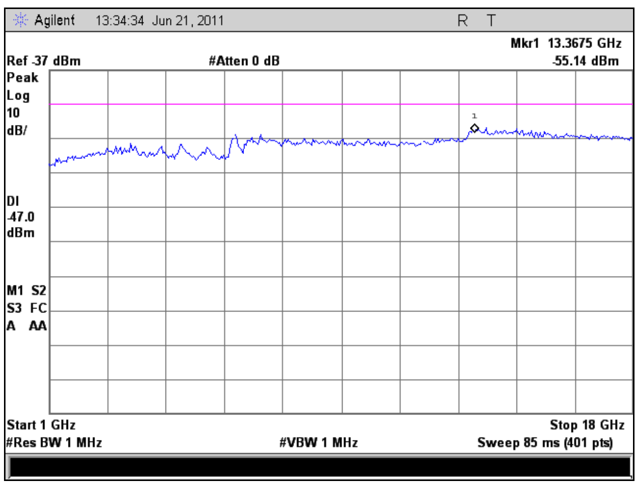
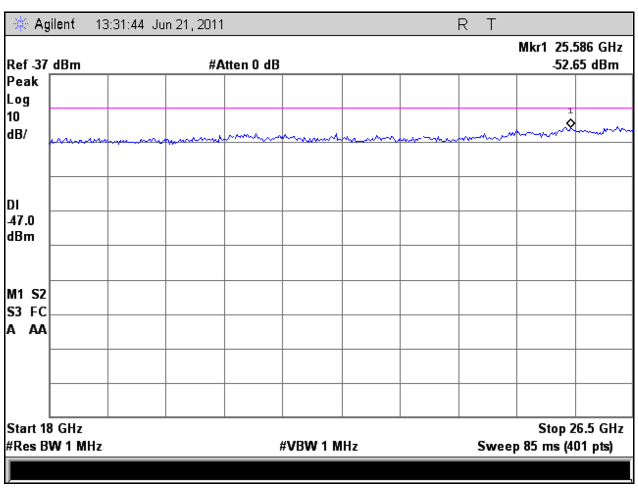
Receiver Spurious Emissions (Radiated)



Plot 41 Radiated Receiver Spurious Emission, 30 MHz - 1 GHz



Plot 42. Radiated Receiver Spurious Emission, 1 GHz - 18 GHz



Plot 43. Radiated Receiver Spurious Emission, 18 GHz – 26.5 GHz

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4.8 Medium Access Protocol

Test Requirement(s): **EN 301 893, Section 4.8**

4.8.1 Definition

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

4.8.2 Requirement

A medium access protocol shall be implemented by the equipment and shall be active under all circumstances.

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

Test Engineer: Anderson Soungpanya

Test Date: 06/22/11

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Conformance Requirements

4.9 User Access Restrictions

Test Requirement(s): **EN 301 893, Section 4.9**

4.9.1 Definition

User Access Restrictions are restraints implemented in the RLAN to restrict access for the user to certain hardware and/or software settings of the equipment.

4.9.2 Requirement
DFS controls (hardware or software) related to radar detection shall not be accessible to the user so that the DFS requirements described in clauses 4.7.2.1 to 4.7.2.4 can neither be disabled nor altered.

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

Test Engineer: Anderson Soungpanya

Test Date: 06/22/11

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IV. Test Equipment

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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.

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End of Report

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