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
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February 24, 2012

Ubiquiti Networks
91 E. Tasman
San Jose, CA 95134

Dear Jennifer Sanchez,

Enclosed is the EMC test report for compliance testing of the Ubiquiti Networks, NanoStationM5 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\EMCS82947-ETS893)

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Electromagnetic Compatibility Criteria
Test Report

For the

Ubiquiti Networks
Model NanoStationM5

Tested under

ETSI EN 301 893

(Article 3.2 of R&TTE Directive)

MET Report: EMCS82947-ETS893

February 24, 2012

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: EMCS82947-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

Report Status Sheet

Revision	Draft Date	Reason for Revision
Æ	February 24, 2012	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	**C**arrier **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**Henry
µF	**micro**Farad
µs	**micros**econds
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Requirements Summary

A. Requirements Summary

ETSI EN 301 893 Section Number	Descriptive Name	Comments
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

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

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Ubiquiti Networks to perform testing on a NanoStationM5.

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 NanoStationM5.

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

Model(s) Tested:	NanoStationM5
Model(s) Number:	NanoStationM5
EUT Specifications:	Primary Power: 15V, 0.8A surge protection integrated PoE adapter
	Secondary Power: N/A
Lab Ambient (Normal) Test Conditions:	Temperature: 15-35º C
	Relative Humidity: 30-60%
	Atmospheric Pressure: 860-1060 mbar
Extreme Test Conditions:	Voltage: 230 VAC +/- 15%
	Temperature: -30 to +70º C
	Relative Humidity: 30-60%
Evaluated by:	Anderson Soungpanya
Report Date(s):	February 24, 2012

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

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 NanoStationM5, Equipment Under Test (EUT), is a 5GHz Hi Power 2x2 MIMO AirMax TDMA Station.

Photograph 1. Ubiquiti Networks NanoStationM5, Front View

Photograph 2. Ubiquiti Networks NanoStationM5, Rear View

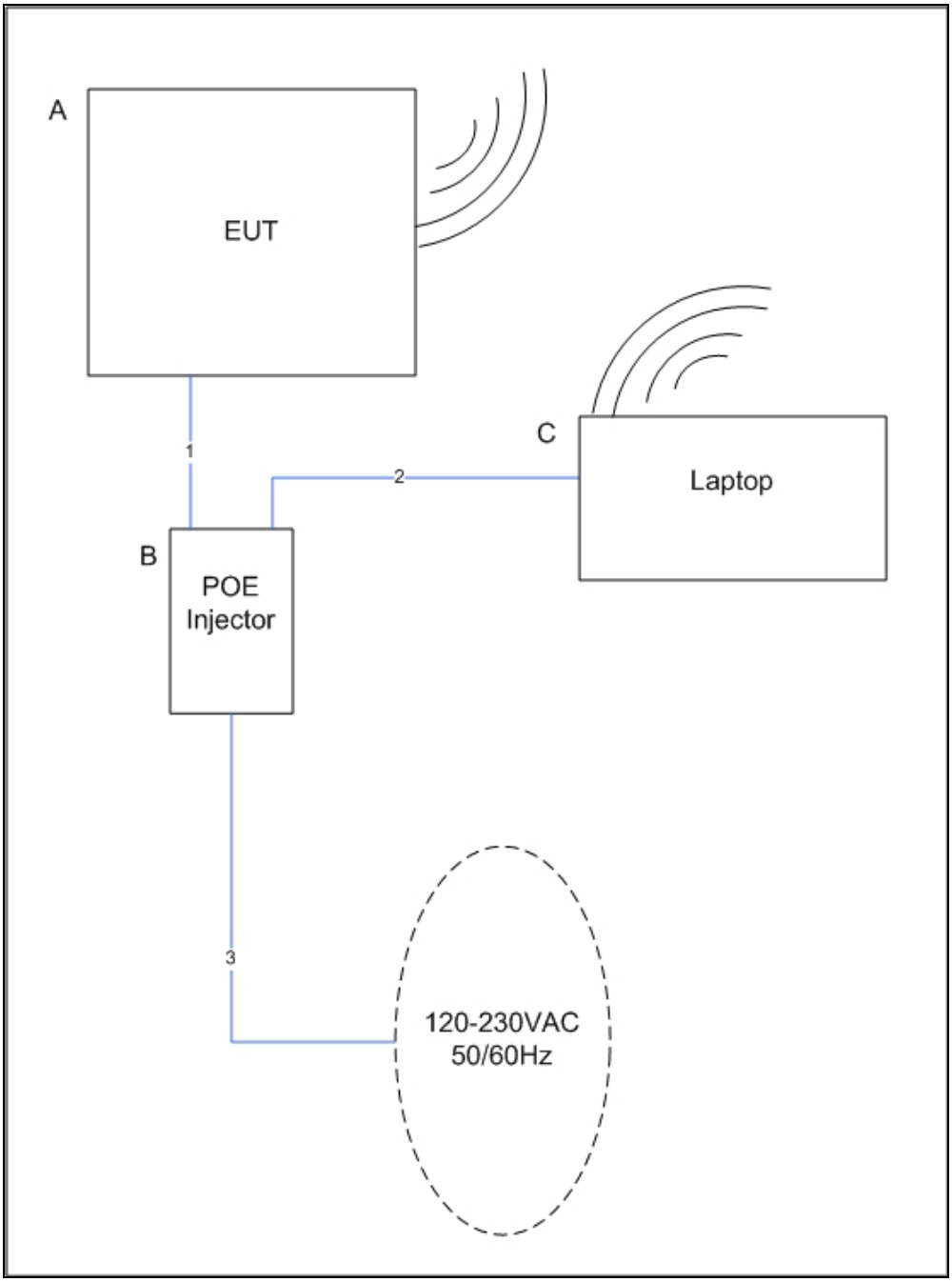


Figure 1. Block Diagram of Test Configuration

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	Serial Number
A	NanoStationM5	NS5	1040T00156D8A77BD
A	NanoStationM5	NS5	1103T002722101B00
A	NanoStationM5	NS5	1104T002722104F5D
B	Power Supply	UBI-POE-15-8	1101-0096733
B	Power Supply	UBI-POE-15-8	1101-0096734

Table 3. Equipment Configuration

F. Support Equipment

Ubiquiti Networks supplied support equipment necessary for the operation and testing of the NanoStationM5. All support equipment supplied is listed in the following Support Equipment List.

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

Table 4. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
1	NanoM5 - Main	Ethernet	1	10	Y	PSU – POE port
NA	NanoM5- Secondary	Ethernet	1	10	Y	Unterminated
1	PSU - POE	Ethernet	1	10	Y	NanoM5 - Main
2	PSU - LAN	Ethernet	1	10	Y	Laptop
3	AC port	AC Cable	1	0.5	Y	100-240VAC Source

Table 5. Ports and Cabling Information

H. Mode of Operation

Transmit 6-54Mbps at 5GHz.

I. Method of Monitoring EUT Operation

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

J. Modifications

a) Modifications to EUT

No modifications 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.

III. Conformance Requirements

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: Kenshi Chung

Test Date: 03/17/11

(5500 0MHz)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference @ 230VAC 20C	207	-30	5499.957444	7.737
	230	-30	5499.957655	7.699
	253	-30	5499.954796	8.219
	207	20	5499.975667	4.424
	230	20	5499.974661	4.607
5500.000000	253	20	5499.975503	4.454
	207	70	5500.021360	3.884
	230	70	5500.020579	3.742
	253	70	5500.019950	3.627
(5700 MHz)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference @ 230VAC 20C	207	-30	5699.953380	8.179
	230	-30	5699.953730	8.118
	253	-30	5699.953459	8.165
	207	20	5699.974726	4.434
	230	20	5699.973860	4.586
5700.000000	253	20	5699.974632	4.451
	207	70	5700.022800	4.000
	230	70	5700.023014	4.038
	253	70	5700.022116	3.880

Table 6. Carrier Frequency, Test Results, Port 1

(5500 0MHz)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference @ 230VAC 20C	207	-30	5499.954241	8.320
	230	-30	5499.954095	8.346
	253	-30	5499.954225	8.323
	207	20	5499.975295	4.492
	230	20	5499.975321	4.487
5500.000000	253	20	5499.975292	4.492
	207	70	5500.023951	4.355
	230	70	5500.024040	4.371
	253	70	5500.024306	4.419
(5700 MHz)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference @ 230VAC 20C	207	-30	5699.953628	8.135
	230	-30	5699.953498	8.158
	253	-30	5699.953861	8.095
	207	20	5699.974387	4.494
	230	20	5699.974381	4.495
5700.000000	253	20	5699.974377	4.495
	207	70	5700.024523	4.302
	230	70	5700.023957	4.203
	253	70	5700.024657	4.326

Table 7. Carrier Frequency, Test Results, Port 2

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: Kenshi Chung

Test Date: 03/17/11

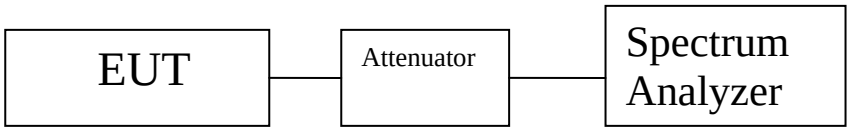


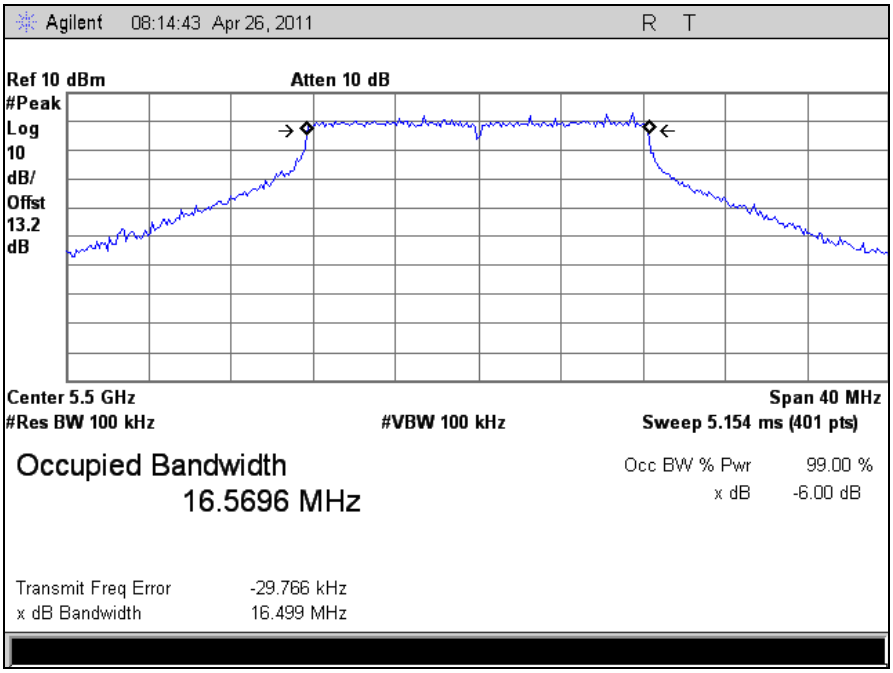
Figure 2. Occupied Bandwidth Test Setup

Occupied Bandwidth 802.11a			
Channel (MHz)		**Mode OFDM**	**Occupied Bandwidth – Port 1 (MHz)**
5500	Low	802.11a 20MHz	16.5696
5700	High	802.11a 20MHz	16.5803
5500	Low	802.11a 40MHz	36.2661
5700	High	802.11a 40MHz	36.2498

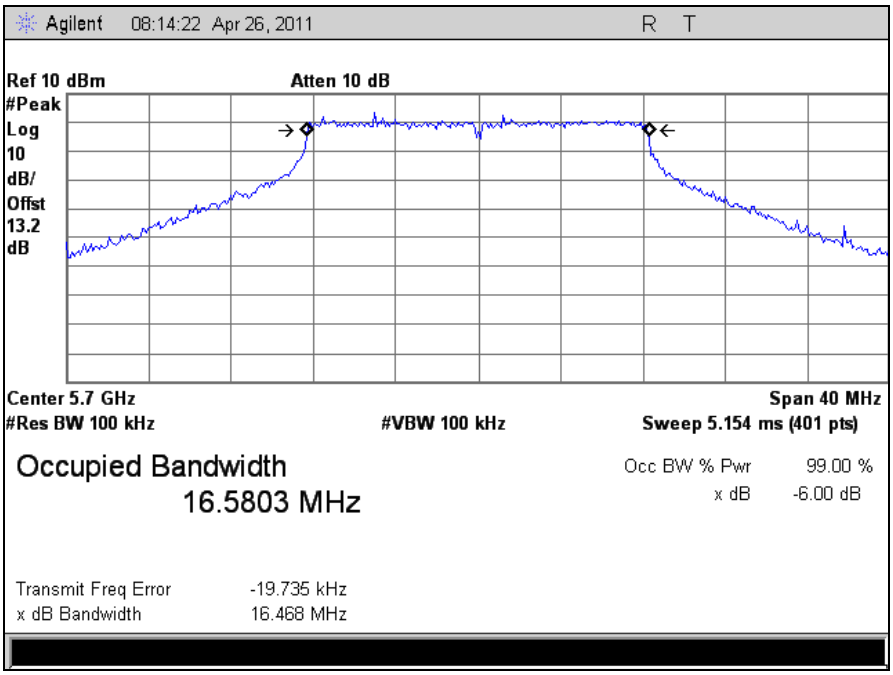
Occupied Bandwidth 802.11n				
Channel (MHz)		**Mode OFDM**	**Occupied Bandwidth Port 1 (MHz)**	**Occupied Bandwidth Port 2 (MHz)**
5500	Low	802.11n 20MHz	17.7390	17.7378
5700	High	802.11n 20MHz	17.7497	17.7595
5500	Low	802.11n 40MHz	36.2297	36.2293
5700	High	802.11n 40MHz	36.2512	36.2252

Table 8. Occupied Bandwidth, Test Results

Occupied Bandwidth, 802.11a 20 MHz

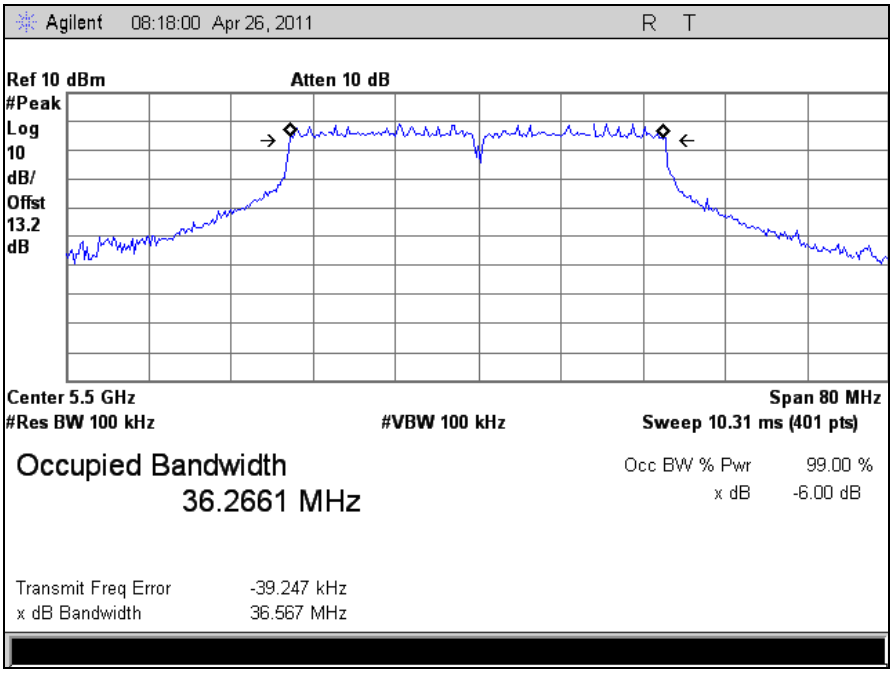


Plot 1. Occupied Bandwidth, 5500 MHz, 802.11a 20 MHz

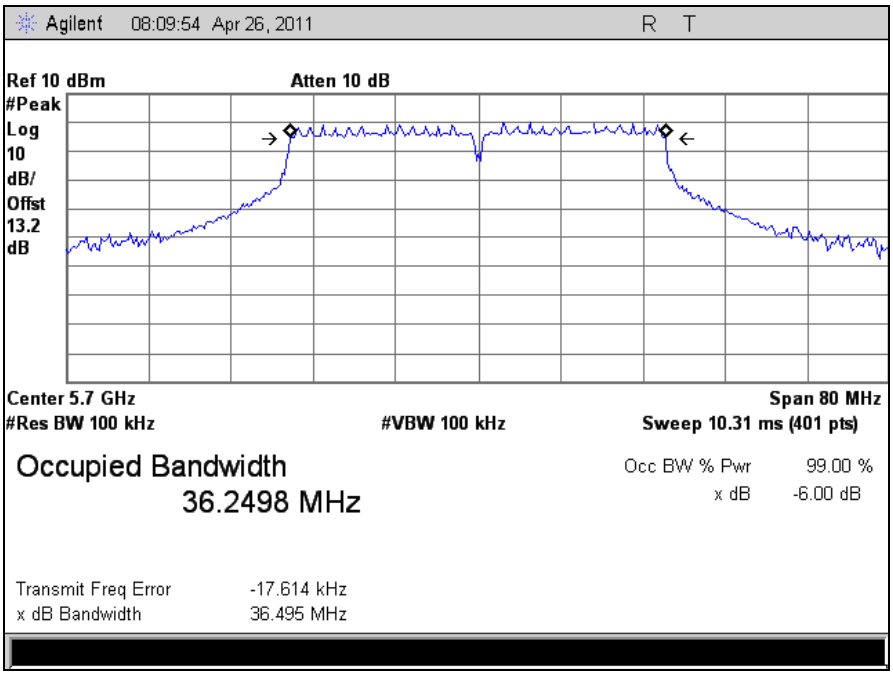


Plot 2. Occupied Bandwidth, 5700 MHz, 802.11a 20 MHz

Occupied Bandwidth, 802.11a 40 MHz

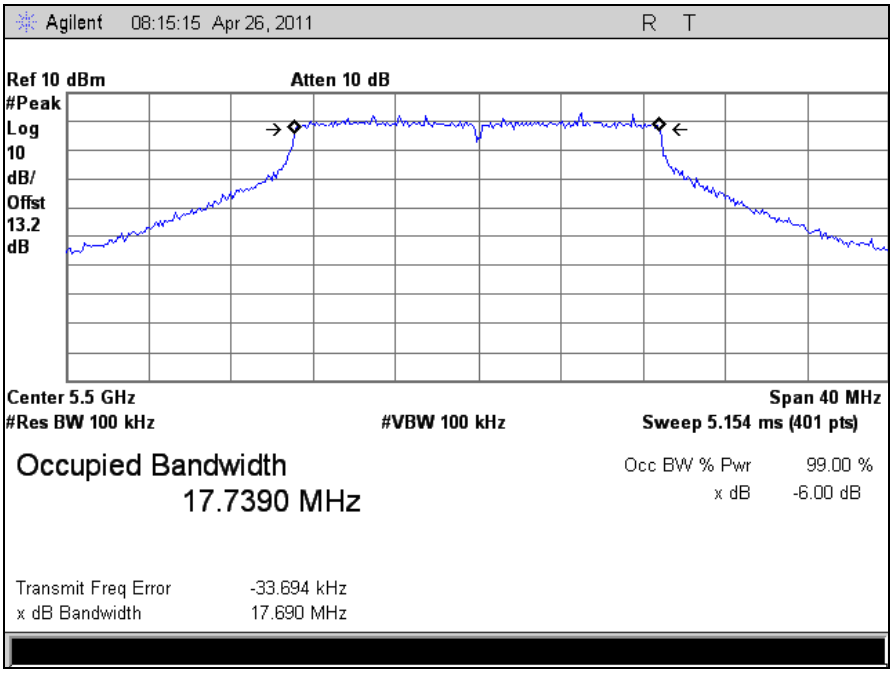


Plot 3. Occupied Bandwidth, 5500 MHz, 802.11a 40 MHz

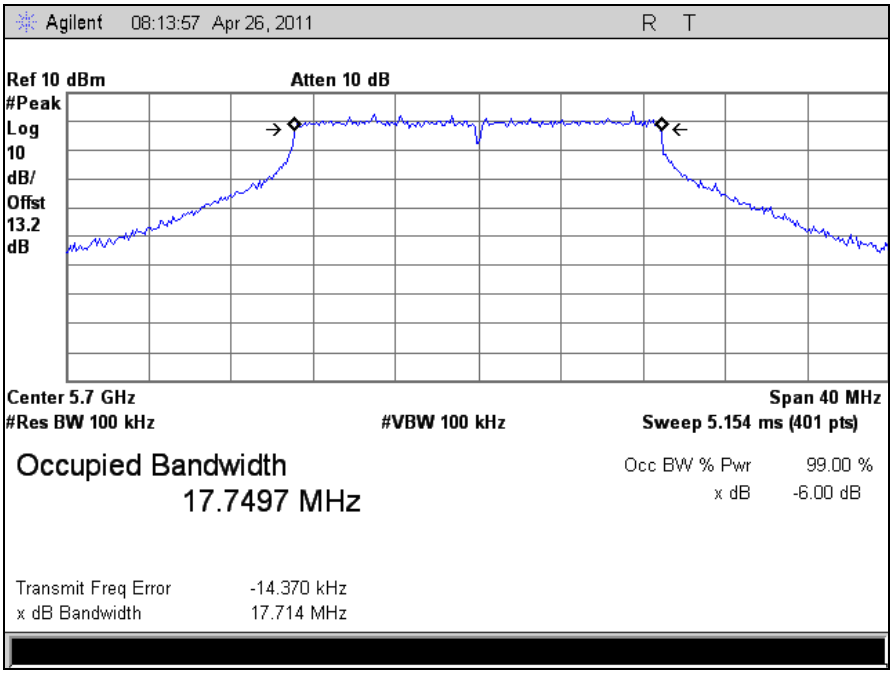


Plot 4. Occupied Bandwidth, 5700 MHz, 802.11a 40 MHz

Occupied Bandwidth, 802.11n 20 MHz, Port 1

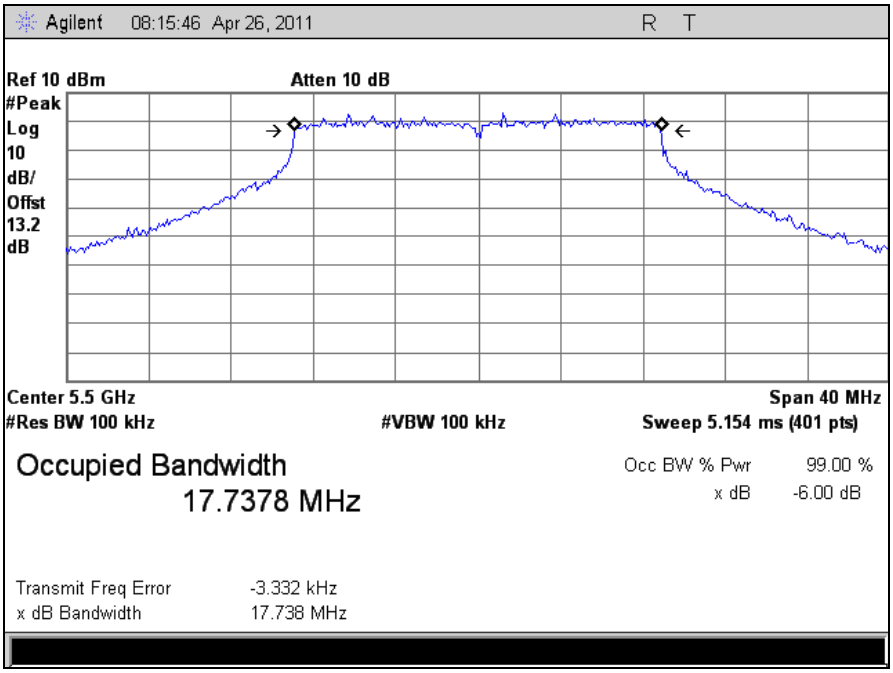


Plot 5. Occupied Bandwidth, 5500 MHz, 802.11n 20 MHz, Port 1

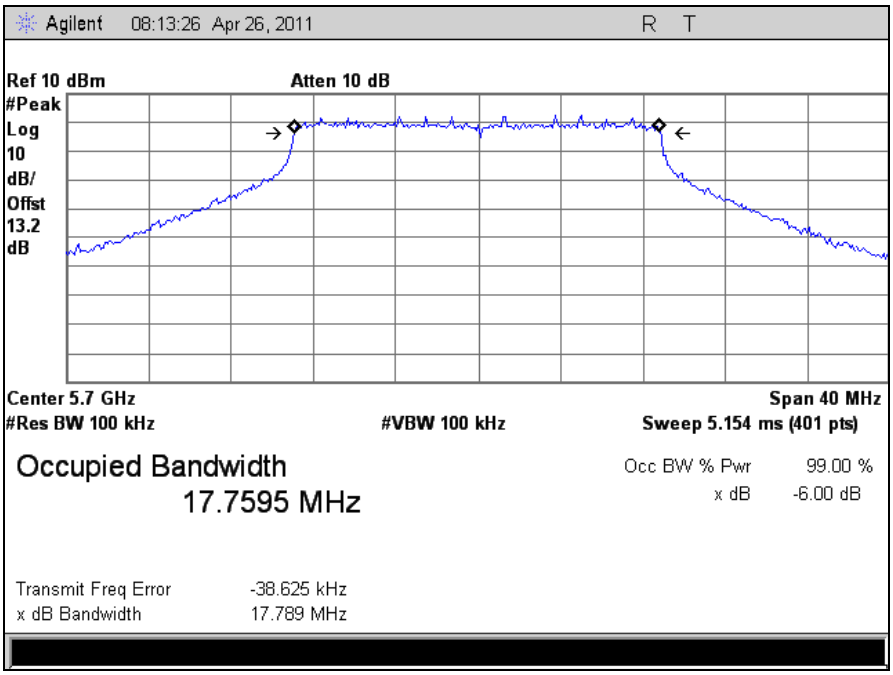


Plot 6. Occupied Bandwidth, 5700 MHz, 802.11n 20 MHz, Port 1

Occupied Bandwidth, 802.11n 20 MHz, Port 2

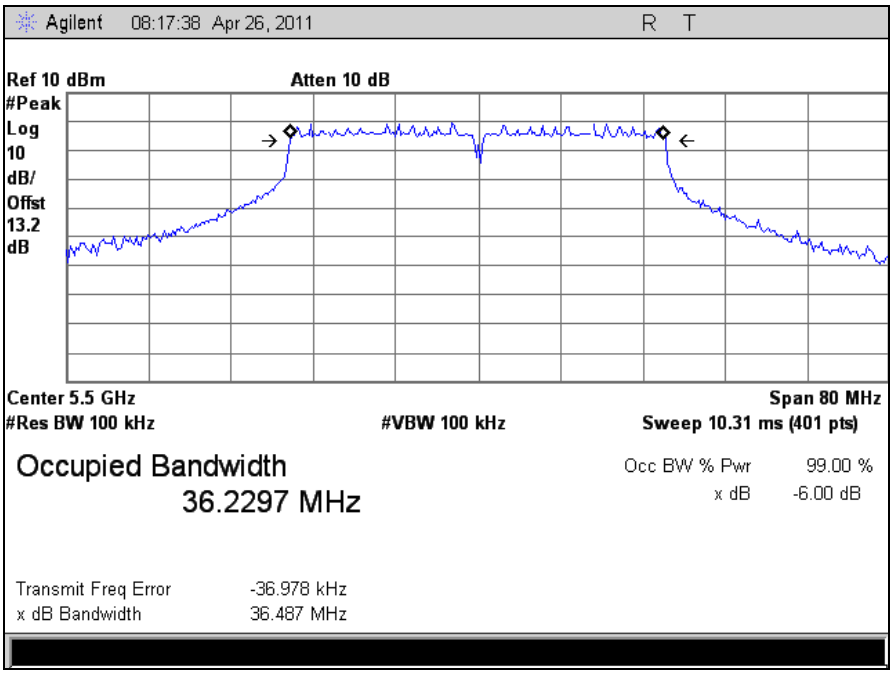


Plot 7. Occupied Bandwidth, 5500 MHz, 802.11n 20 MHz, Port 2

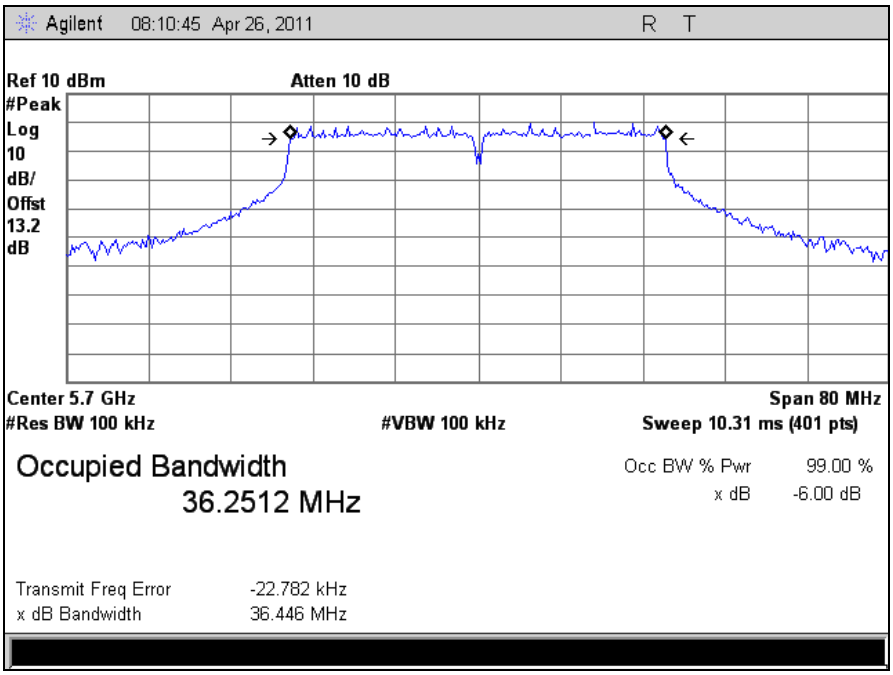


Plot 8. Occupied Bandwidth, 5700 MHz, 802.11n 20 MHz, Port 2

Occupied Bandwidth, 802.11n 40 MHz, Port 1

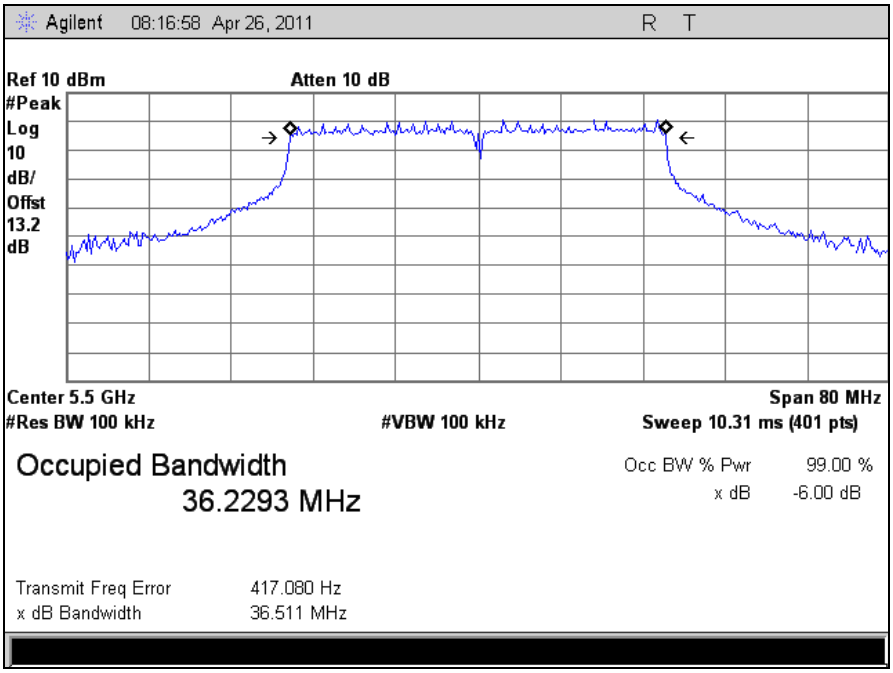


Plot 9. Occupied Bandwidth, 5500 MHz, 802.11n 40 MHz, Port 1

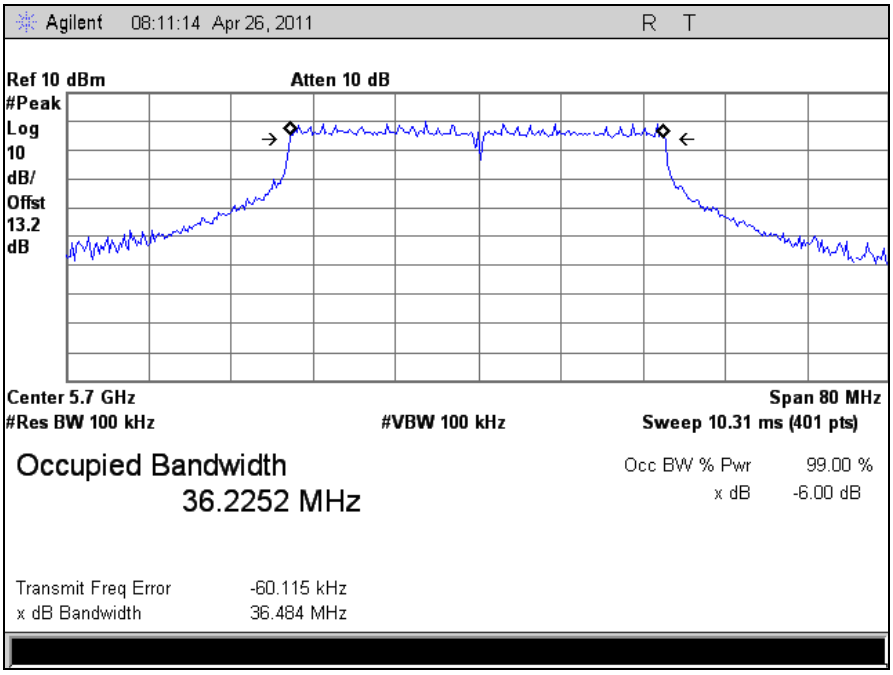


Plot 10. Occupied Bandwidth, 5700 MHz, 802.11n 40 MHz, Port 1

Occupied Bandwidth, 802.11n 40 MHz, Port 2



Plot 11. Occupied Bandwidth, 5500 MHz, 802.11n 40 MHz, Port 2



Plot 12. Occupied Bandwidth, 5700 MHz, 802.11n 40 MHz, Port 2

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 9.

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 9.

For devices without TPC, the limits in Table 9 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 9. 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 10.

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 10. 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 10 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. 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. 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. 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: 06/24/11

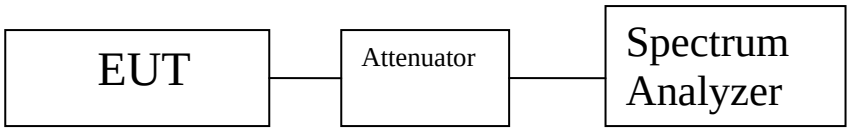


Figure 3. Output Power, TPC, and Power Density Test Setup

Effective Isotropic Radiated Power Results

Maximum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	**Temperature (C)**	**Voltage (V)**	**Port 1 dBm**	**Antenna Gain dBi**	**Limit dBm**	**Margin dBm**
5500	20	230	12.701	16	30	-1.30
5500	-30	207	13.25	16	30	-0.75
5500	-30	253	13.171	16	30	-0.83
5500	70	207	12.23	16	30	-1.77
5500	70	253	12.152	16	30	-1.85
5700	20	230	12.23	16	30	-1.77
5700	-30	207	13.25	16	30	-0.75
5700	-30	253	13.25	16	30	-0.75
5700	70	207	12.387	16	30	-1.61
5700	70	253	12.466	16	30	-1.53

Table 11. Maximum Transmit Power Control, Test Results, 802.11a 20 MHz

Minimum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	**Temperature (C)**	**Voltage (V)**	**Port 1 dBm**	**Antenna Gain dBi**	**Limit dBm**	**Margin dBm**
5500	20	230	5.14	16	24	-2.87
5500	-30	207	5.59	16	24	-2.41
5500	-30	253	5.59	16	24	-2.41
5500	70	207	4.68	16	24	-3.32
5500	70	253	4.75	16	24	-3.26
5700	20	230	5.14	16	24	-2.87
5700	-30	207	5.72	16	24	-2.28
5700	-30	253	5.66	16	24	-2.35
5700	70	207	4.68	16	24	-3.32
5700	70	253	4.75	16	24	-3.26

Table 12. Minimum Transmit Power Control, Test Results, 802.11a 20 MHz

Maximum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Port 1 dBm	Antenna Gain dBi	Limit dBm	Margin dBm
5500	20	230	13.17	16	30	-0.83
5500	-30	207	13.41	16	30	-0.59
5500	-30	253	13.41	16	30	-0.59
5500	70	207	12.83	16	30	-1.17
5500	70	253	12.75	16	30	-1.25
5700	20	230	12.83	16	30	-1.17
5700	-30	207	13.41	16	30	-0.59
5700	-30	253	13.41	16	30	-0.59
5700	70	207	13.00	16	30	-1.00
5700	70	253	13.08	16	30	-0.92

Table 13. Maximum Transmit Power Control, Test Results, 802.11a 40 MHz

Minimum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Port 1 dBm	Antenna Gain dBi	Limit dBm	Margin dBm
5500	20	230	4.97	16	24	-3.03
5500	-30	207	5.67	16	24	-2.33
5500	-30	253	5.67	16	24	-2.33
5500	70	207	4.48	16	24	-3.52
5500	70	253	4.62	16	24	-3.38
5700	20	230	5.25	16	24	-2.75
5700	-30	207	5.53	16	24	-2.47
5700	-30	253	5.46	16	24	-2.54
5700	70	207	4.83	16	24	-3.17
5700	70	253	4.76	16	24	-3.24

Table 14. Minimum Transmit Power Control, Test Results, 802.11a 40 MHz

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	8.52	8.04	13.48	11.30	16	30	-2.70
5500	-30	207	9.49	8.94	16.73	12.24	16	30	-1.76
5500	-30	253	9.42	9.01	16.72	12.23	16	30	-1.77
5500	70	207	8.11	7.76	12.44	10.95	16	30	-3.05
5500	70	253	8.04	7.76	12.34	10.91	16	30	-3.09
5700	20	230	8.73	8.39	14.36	11.57	16	30	-2.43
5700	-30	207	9.22	8.87	16.06	12.06	16	30	-1.94
5700	-30	253	9.42	8.87	16.47	12.17	16	30	-1.83
5700	70	207	7.76	7.21	11.23	10.50	16	30	-3.50
5700	70	253	7.76	7.28	11.31	10.54	16	30	-3.46

Plot 13. Maximum Transmit Power Control, Test Results, 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	3.94	5.04	5.67	7.53	16	24	-0.47
5500	-30	207	3.87	4.96	5.57	7.46	16	24	-0.54
5500	-30	253	3.87	4.89	5.52	7.42	16	24	-0.58
5500	70	207	3.87	4.89	5.52	7.42	16	24	-0.58
5500	70	253	3.80	4.82	5.43	7.35	16	24	-0.65
5700	20	230	3.94	4.96	5.61	7.49	16	24	-0.51
5700	-30	207	3.07	4.31	4.72	6.74	16	24	-1.26
5700	-30	253	3.14	4.31	4.76	6.77	16	24	-1.23
5700	70	207	4.02	4.67	5.45	7.37	16	24	-0.63
5700	70	253	4.09	4.75	5.55	7.44	16	24	-0.56

Plot 14. Minimum Transmit Power Control, Test Results, 802.11n 20 MHz

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	8.86	8.57	14.88	11.72	16	30	-2.28
5500	-30	207	9.94	9.00	17.80	12.50	16	30	-1.50
5500	-30	253	9.79	9.22	17.88	12.52	16	30	-1.48
5500	70	207	7.42	7.13	10.68	10.28	16	30	-3.72
5500	70	253	7.49	7.20	10.86	10.36	16	30	-3.64
5700	20	230	8.50	7.99	13.37	11.26	16	30	-2.74
5700	-30	207	9.94	9.22	18.22	12.61	16	30	-1.39
5700	-30	253	9.96	9.21	18.25	12.61	16	30	-1.39
5700	70	207	7.85	7.34	11.52	10.61	16	30	-3.39
5700	70	253	7.85	7.42	11.61	10.65	16	30	-3.35

Plot 15. Maximum Transmit Power Control, Test Results, 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	3.02	2.81	3.91	5.93	16	24	-2.07
5500	-30	207	3.42	3.28	4.33	6.36	16	24	-1.64
5500	-30	253	3.48	3.22	4.33	6.36	16	24	-1.64
5500	70	207	2.21	2.01	3.25	5.12	16	24	-2.88
5500	70	253	2.14	1.94	3.20	5.05	16	24	-2.95
5700	20	230	2.81	2.75	3.79	5.79	16	24	-2.21
5700	-30	207	3.02	2.95	3.97	5.99	16	24	-2.01
5700	-30	253	3.02	2.95	3.97	5.99	16	24	-2.01
5700	70	207	2.35	2.28	3.41	5.32	16	24	-2.68
5700	70	253	2.21	2.28	3.35	5.25	16	24	-2.75

Plot 16. Minimum Transmit Power Control, Test Results, 802.11n 40 MHz

Power Density

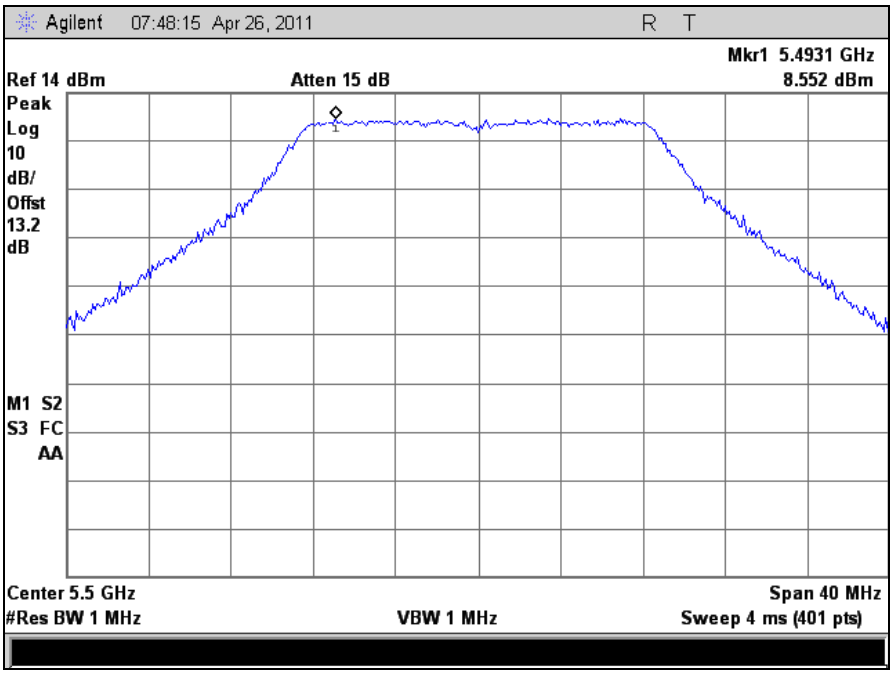
Power Spectral Density 802.11a							
Channel (MHz)		Mode OFDM	Measured Power Density Port 1 dBm	Antenna Gain dBi	EIRP dBm	Limit dBm	Margin dB
5500	Low	HT20	-0.35	16	15.65	17	-1.35
5700	High	HT20	0.92	16	16.92	17	-0.08
5500	Low	HT40	-1.91	16	14.09	17	-2.91
5700	High	HT40	-2.60	16	13.40	17	-3.60

Table 15. Power Density, Test Results, 802.11a

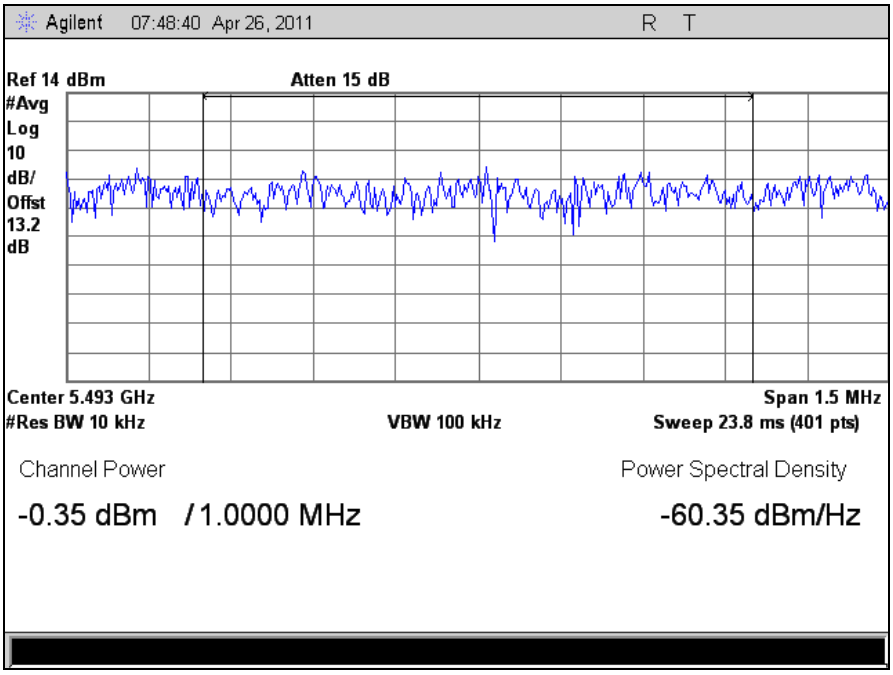
Power Spectral Density 802.11n									
Channel (MHz)		Mode OFDM	Measured Power Density Port 1 dBm	Measured Power Density Port 2 dBm	Summed Ports dBm	Antenna Gain dBi	EIRP dBm	Limit dBm	Margin dB
5500	Low	HT20	-3.69	-2.74	-0.18	16	15.82	17	-1.18
5700	High	HT20	-3.81	-4.07	-0.93	16	15.07	17	-1.93
5500	Low	HT40	-4.15	-3.61	-0.86	16	15.14	17	-1.86
5700	High	HT40	-3.71	-3.62	-0.65	16	15.35	17	-1.65

Table 16. Power Density, Test Results, 802.11n

Power Density, 802.11a 20 MHz

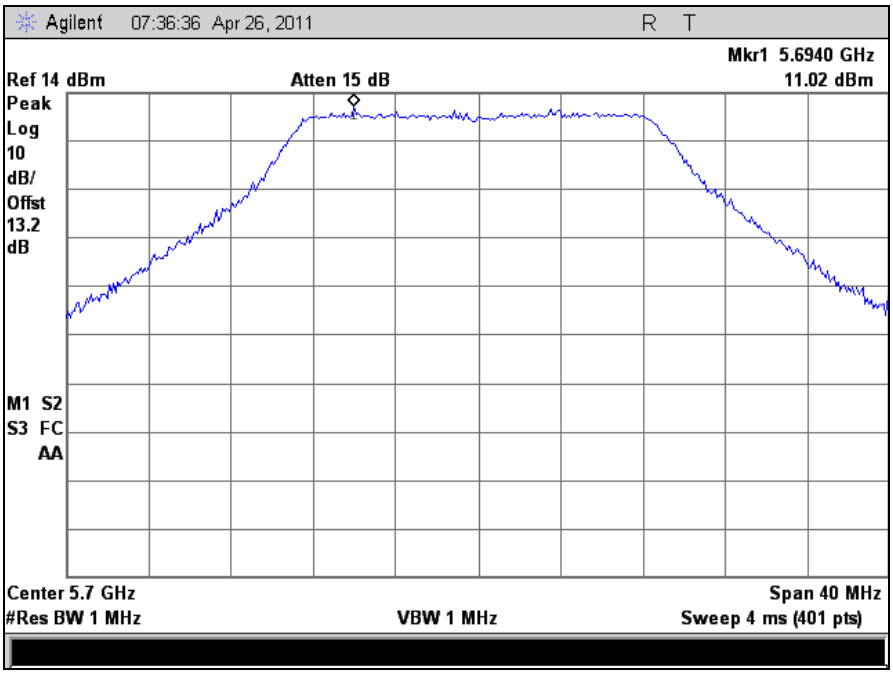


Plot 17. Power Density, Determination, 5500 MHz, 802.11a 20 MHz

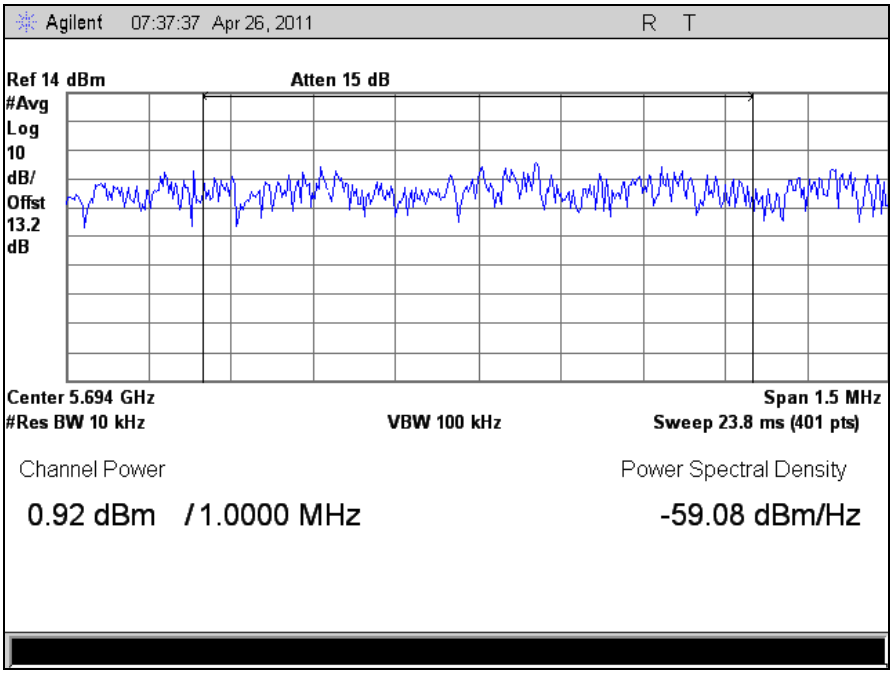


Plot 18. Power Density, 5500 MHz, 802.11a 20 MHz

Power Density, 802.11a 20 MHz

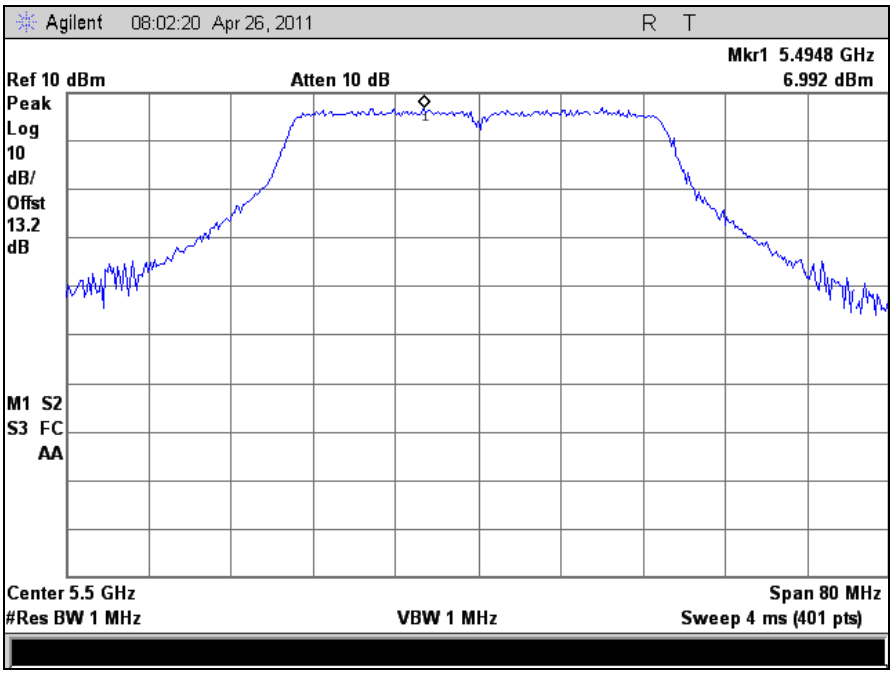


Plot 19. Power Density, Determination, 5700 MHz, 802.11a 20 MHz

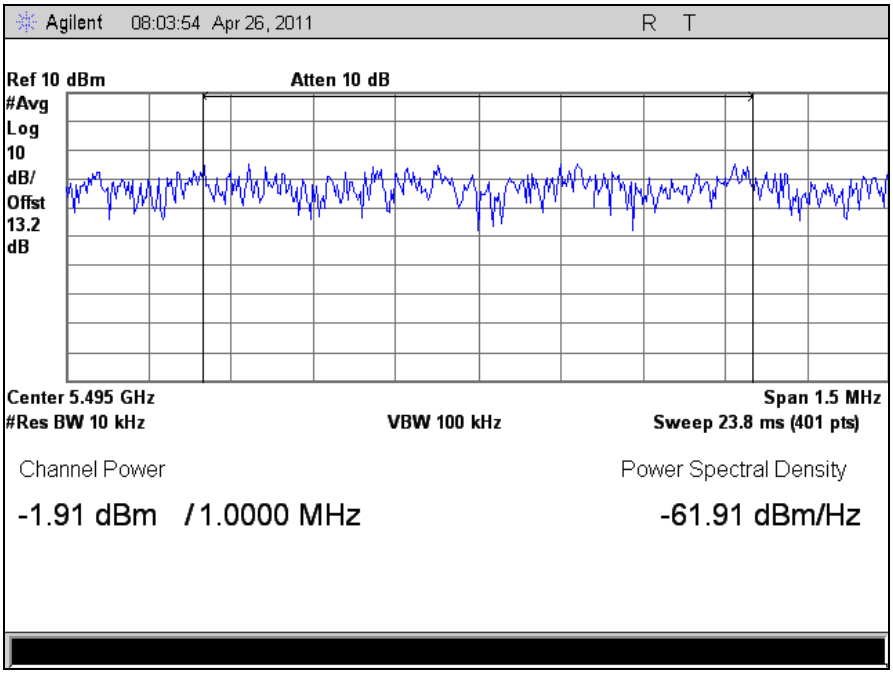


Plot 20. Power Density, 5700 MHz, 802.11a 20 MHz

Power Density, 802.11a 40 MHz

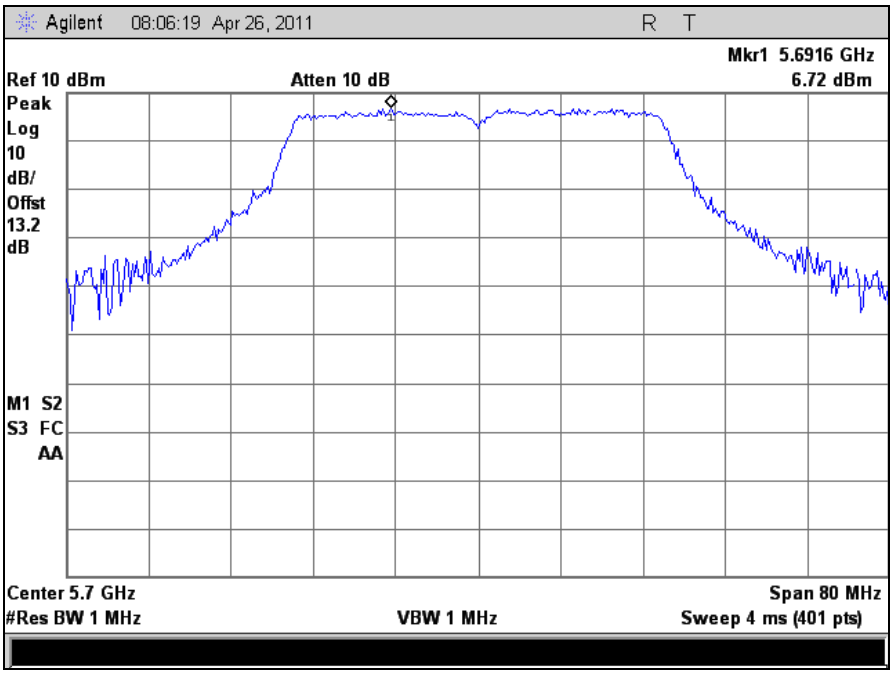


Plot 21. Power Density, Determination, 5500 MHz, 802.11a 40 MHz

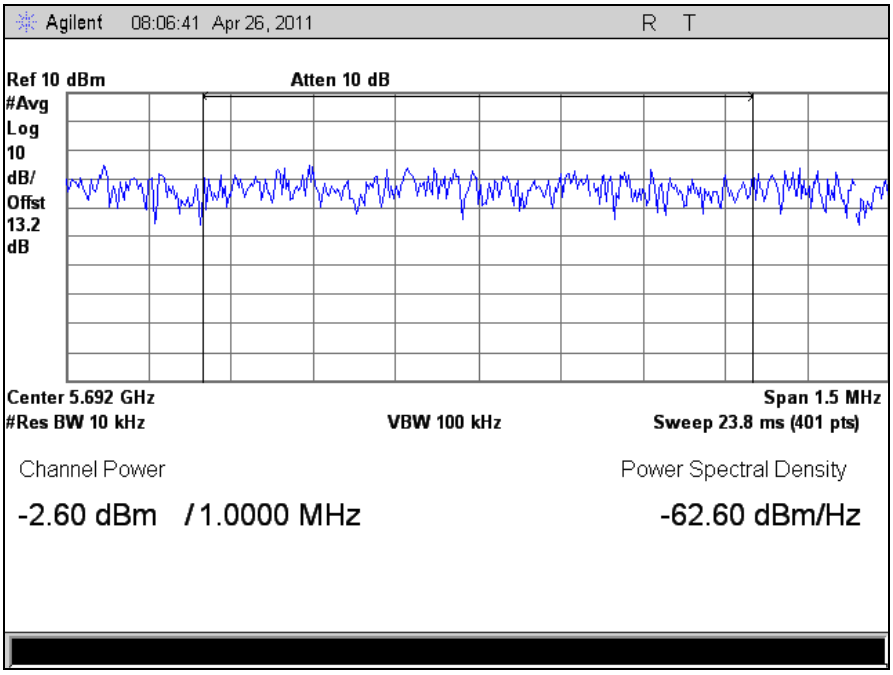


Plot 22. Power Density, 5500 MHz, 802.11a 40 MHz

Power Density, 802.11a 40 MHz

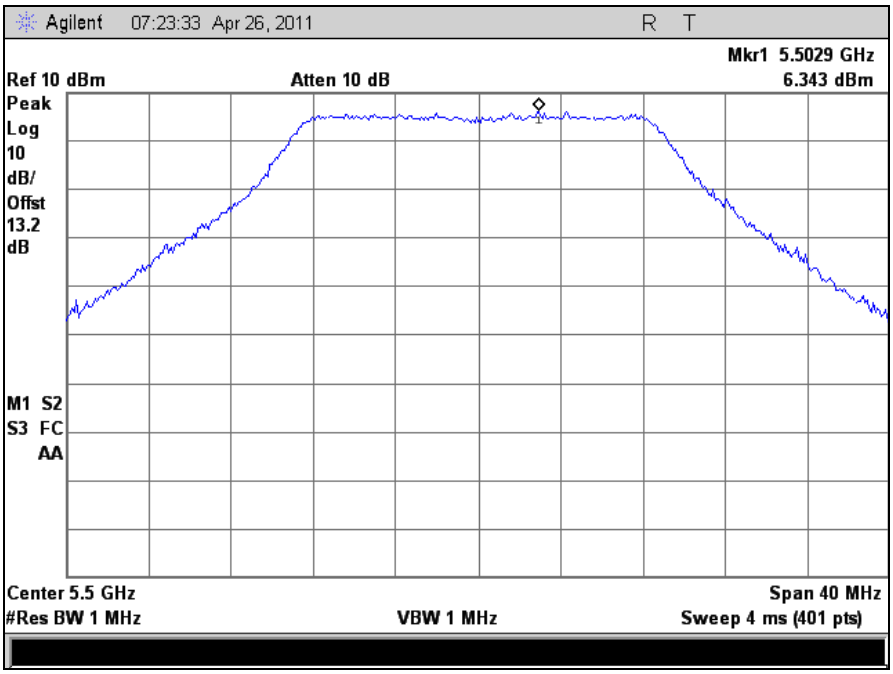


Plot 23. Power Density, Determination, 5700 MHz, 802.11a 40 MHz

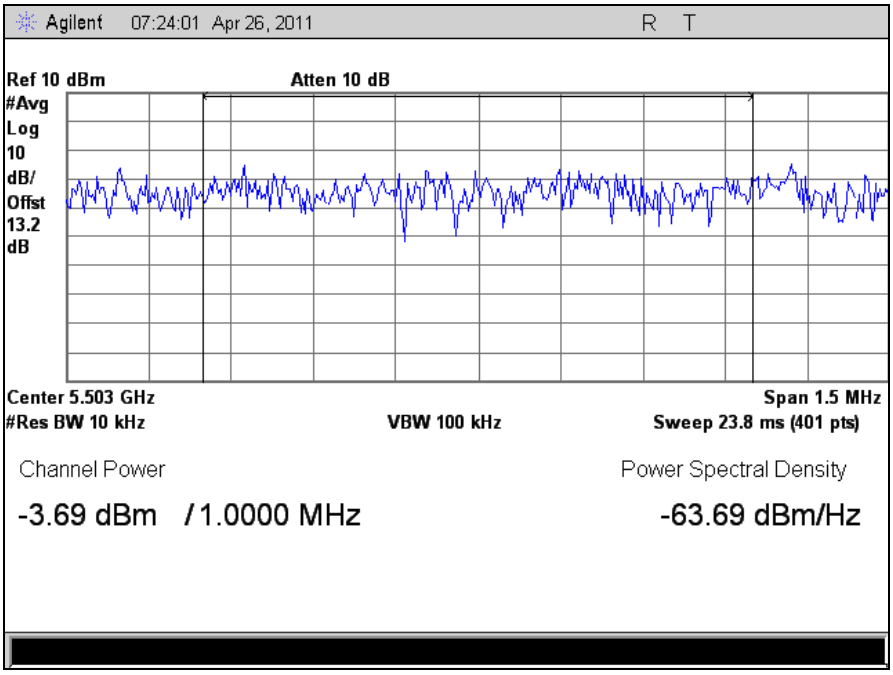


Plot 24. Power Density, 5700 MHz, 802.11a 40 MHz

Power Density, 802.11n 20 MHz, Port 1

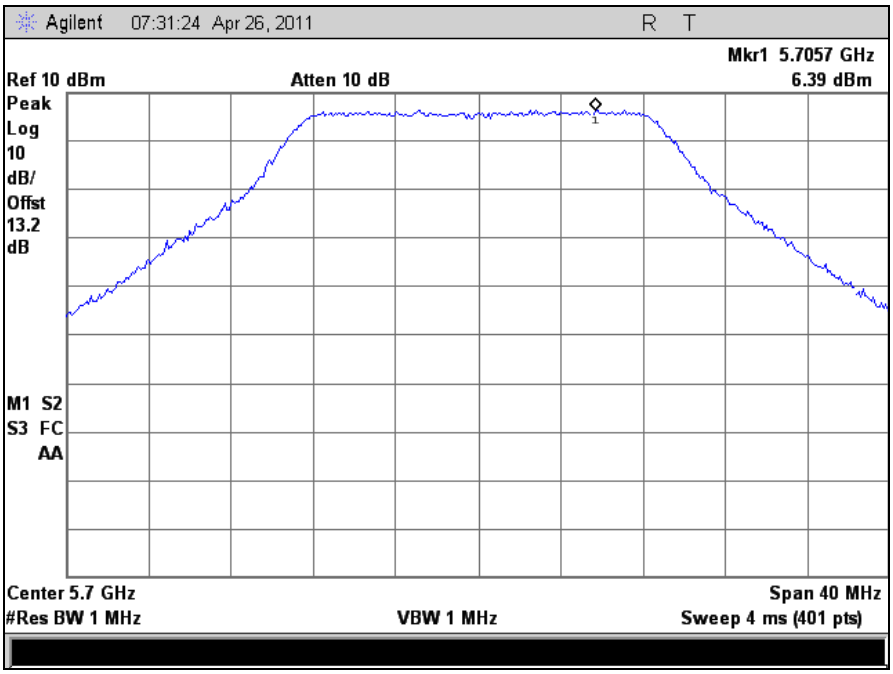


Plot 25. Power Density, Determination, 5500 MHz, 802.11n 20 MHz, Port 1

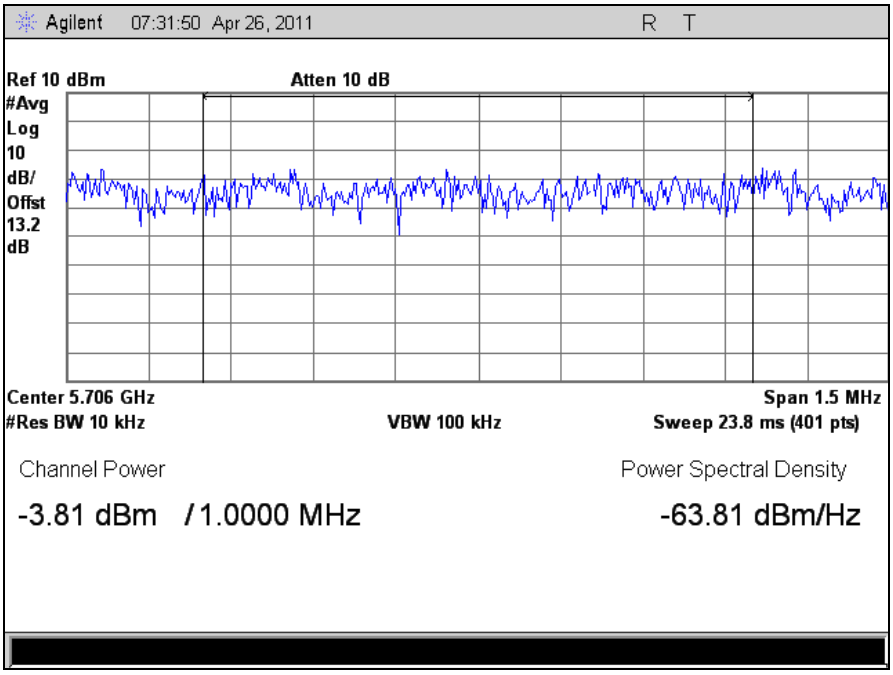


Plot 26. Power Density, 5500 MHz, 802.11n 20 MHz, Port 1

Power Density, 802.11n 20 MHz, Port 1

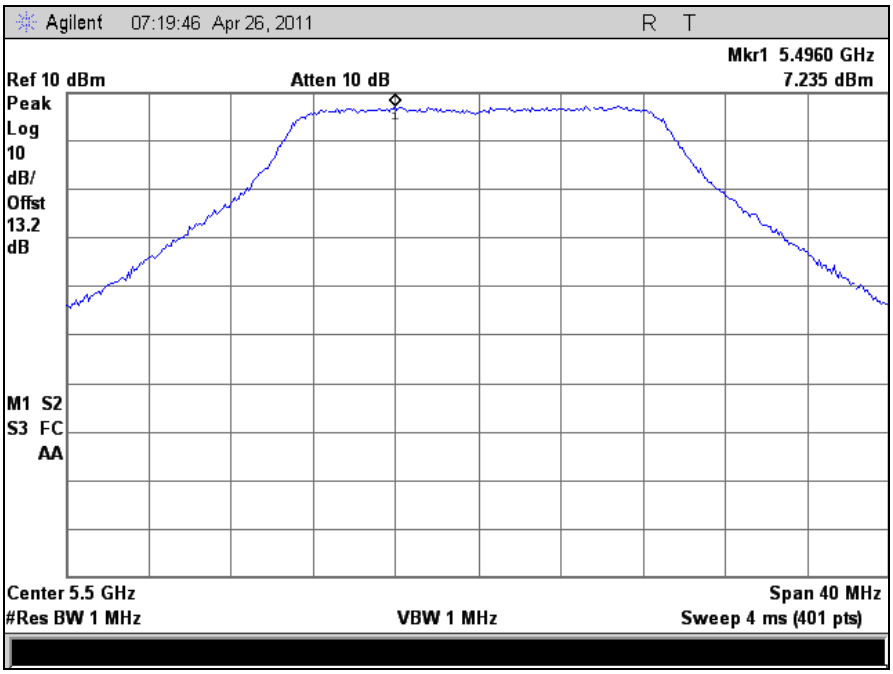


Plot 27. Power Density, Determination, 5700 MHz, 802.11n 20 MHz, Port 1

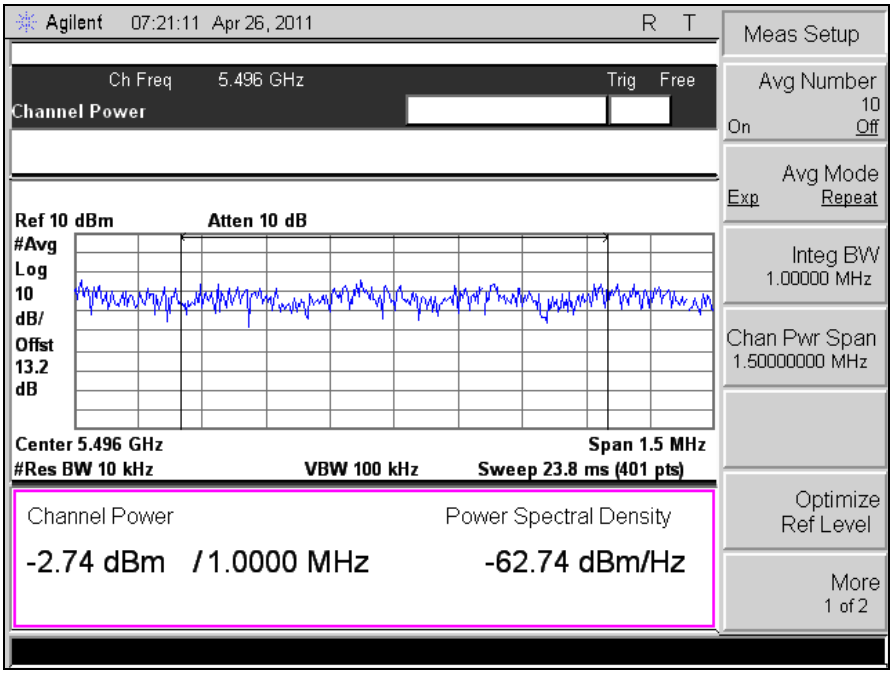


Plot 28. Power Density, 5700 MHz, 802.11n 20 MHz, Port 1

Power Density, 802.11n 20 MHz, Port 2

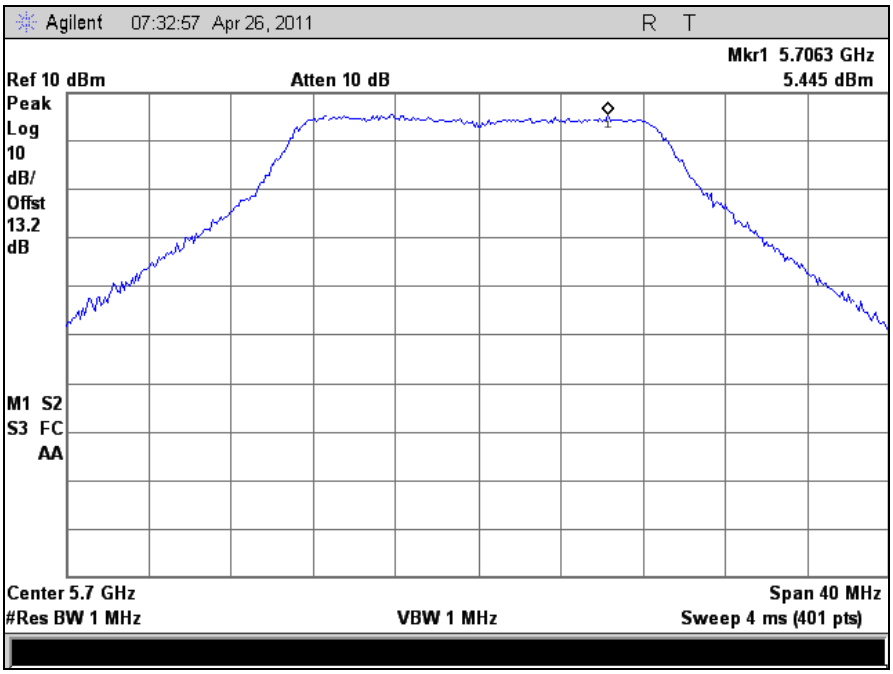


Plot 29. Power Density, Determination, 5500 MHz, 802.11n 20 MHz, Port 2

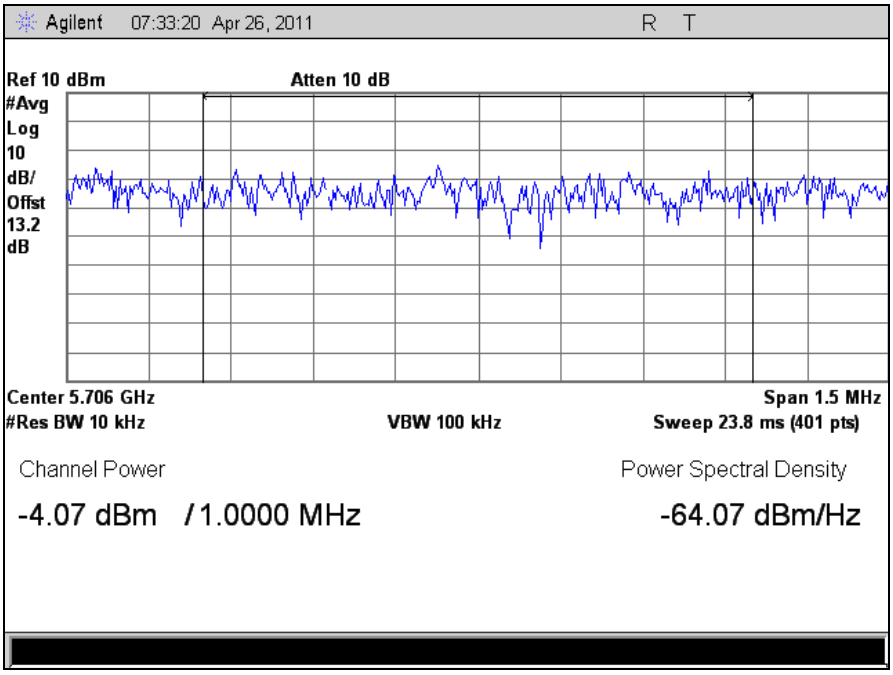


Plot 30. Power Density, 5500 MHz, 802.11n 20 MHz, Port 2

Power Density, 802.11n 20 MHz, Port 2

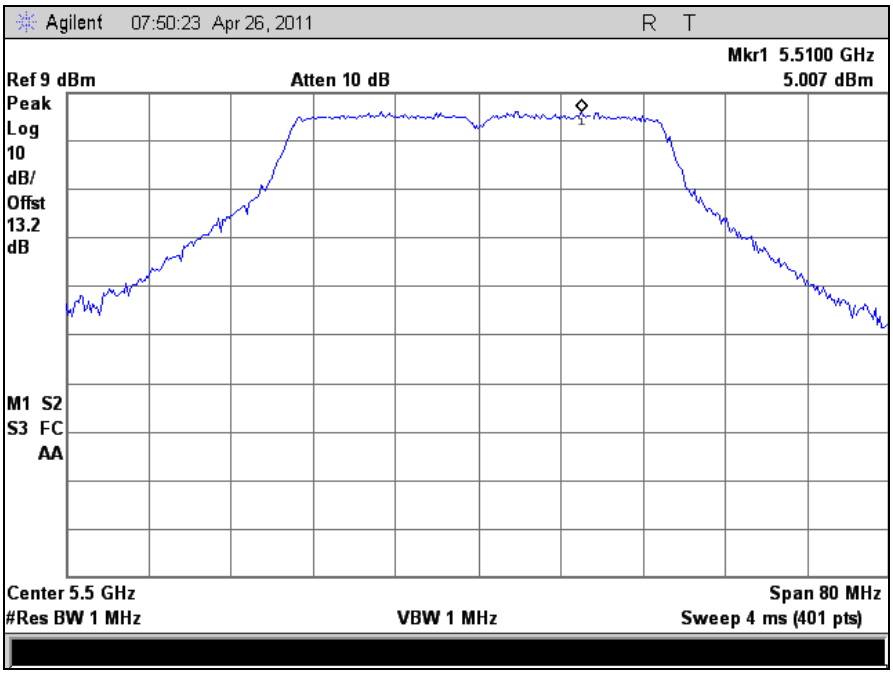


Plot 31. Power Density, Determination, 5700 MHz, 802.11n 20 MHz, Port 2

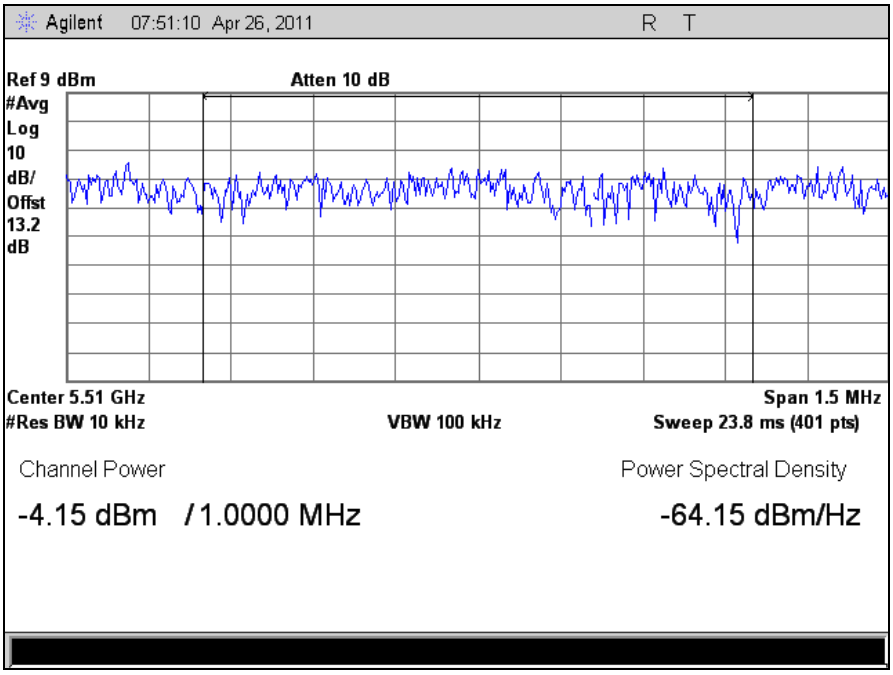


Plot 32. Power Density, 5700 MHz, 802.11n 20 MHz, Port 2

Power Density, 802.11n 40 MHz, Port 1

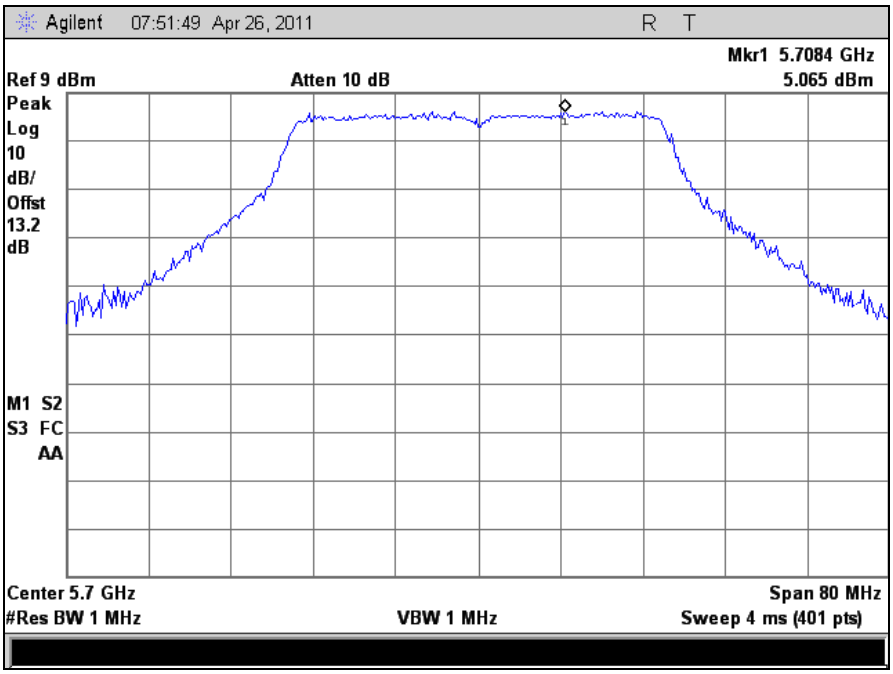


Plot 33. Power Density, Determination, 5500 MHz, 802.11n 40 MHz, Port 1

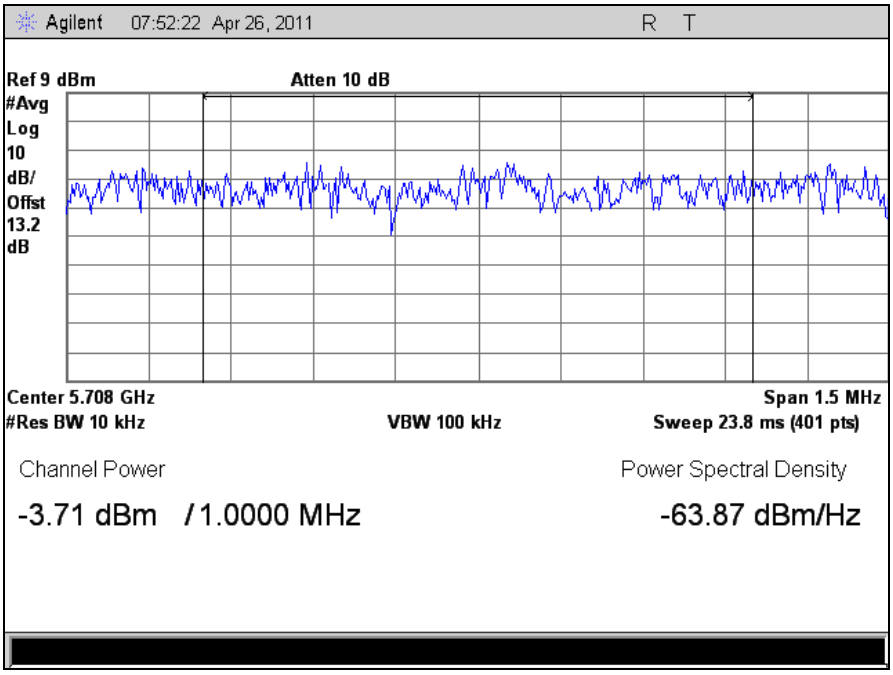


Plot 34. Power Density, 5500 MHz, 802.11n 40 MHz, Port 1

Power Density, 802.11n 40 MHz, Port 1

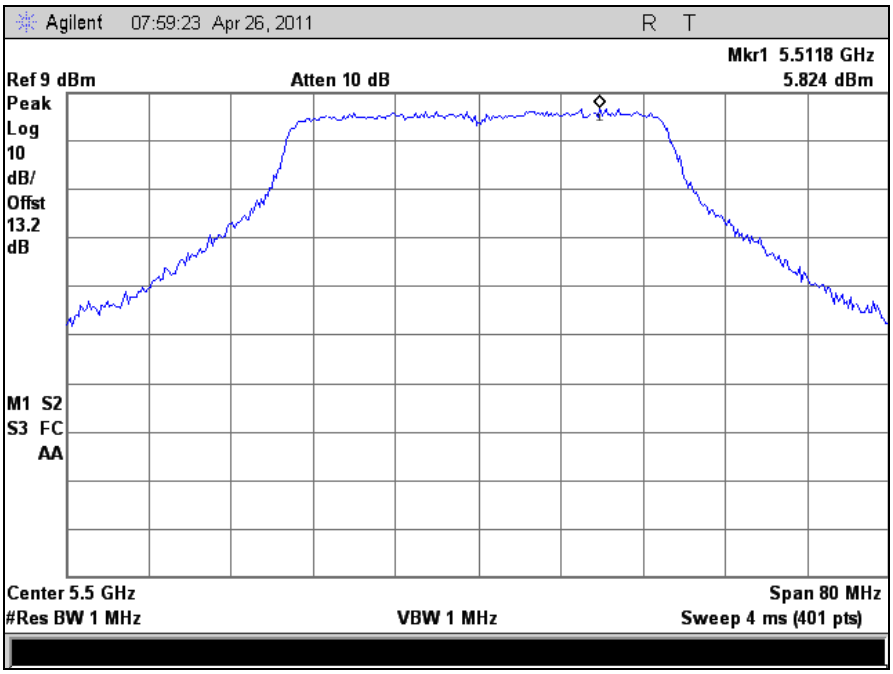


Plot 35. Power Density, Determination, 5700 MHz, 802.11n 40 MHz, Port 1

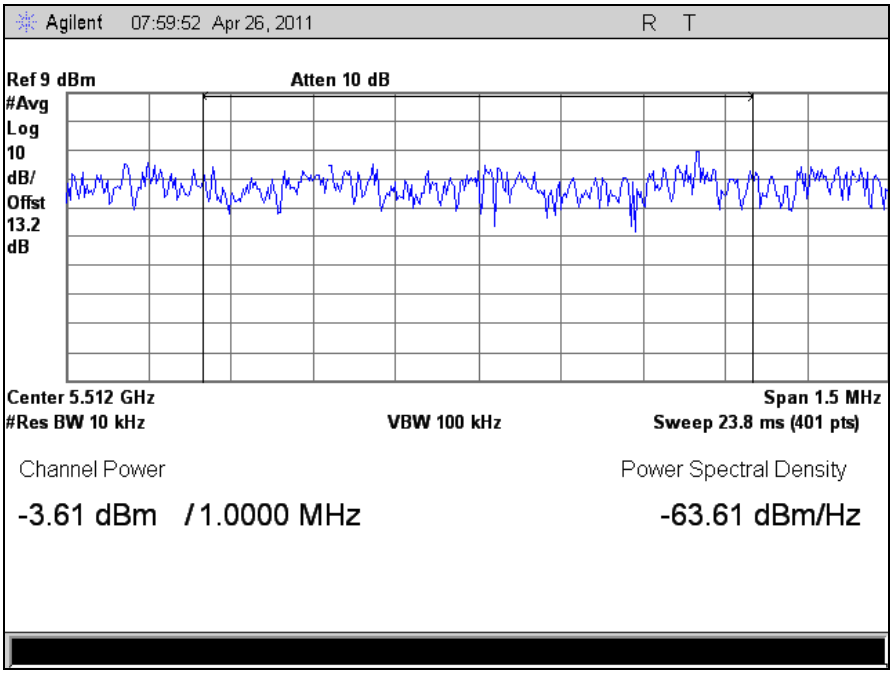


Plot 36. Power Density, 5700 MHz, 802.11n 40 MHz, Port 1

Power Density, 802.11n 40 MHz, Port 2

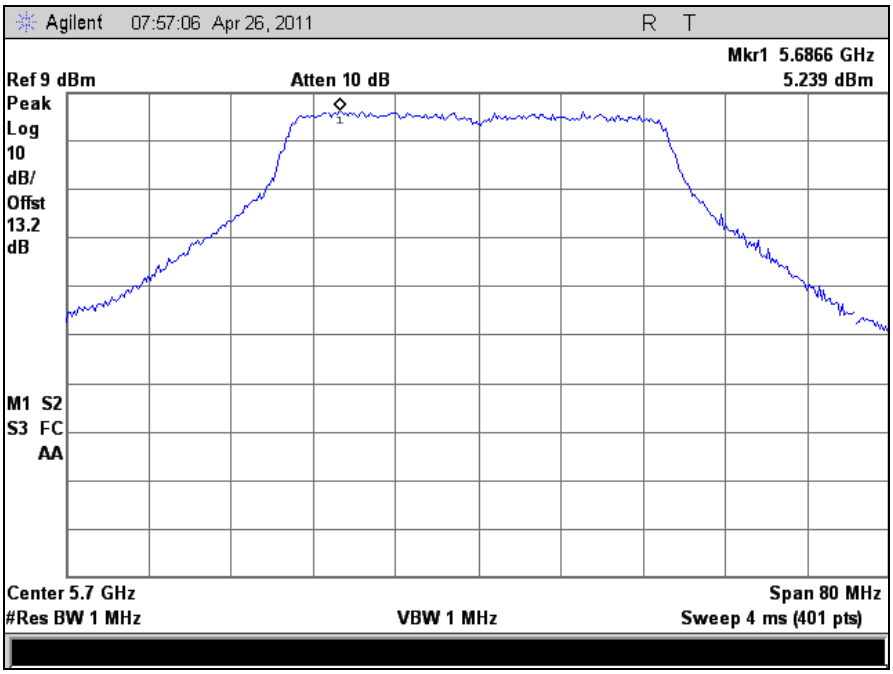


Plot 37. Power Density, Determination, 5500 MHz, 802.11n 40 MHz, Port 2

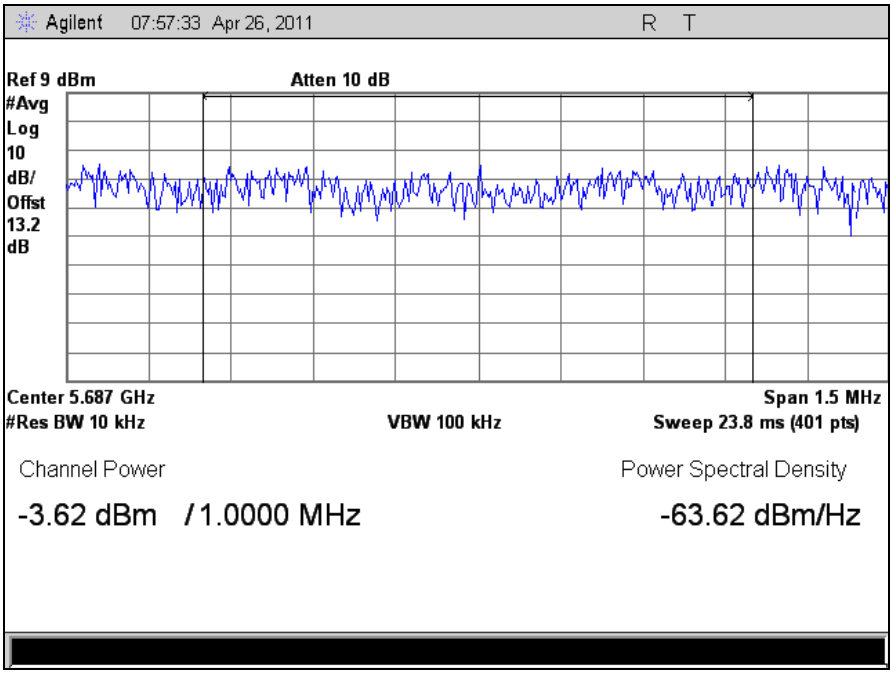


Plot 38. Power Density, 5500 MHz, 802.11n 40 MHz, Port 2

Power Density, 802.11n 40 MHz, Port 2



Plot 39. Power Density, Determination, 5700 MHz, 802.11n 40 MHz, Port 2



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

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

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

4.5.1.1 Definition
These are conducted 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 below.

Frequency range	Maximum power ERP	Resolution 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 connected directly to a spectrum analyzer through an attenuator. The spectrum analyzer was initially set to the peak hold function or video averaging. Emissions were investigated from 30MHz up to 26.5GHz. 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. Measurements were carried out in all modulations available.

Please see radiated spurious section for MIMO operation.

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

Test Engineer: Anderson Soungpanya

Test Date: 06/28/11

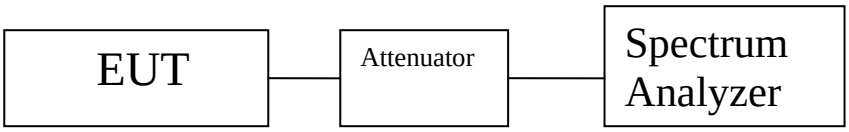
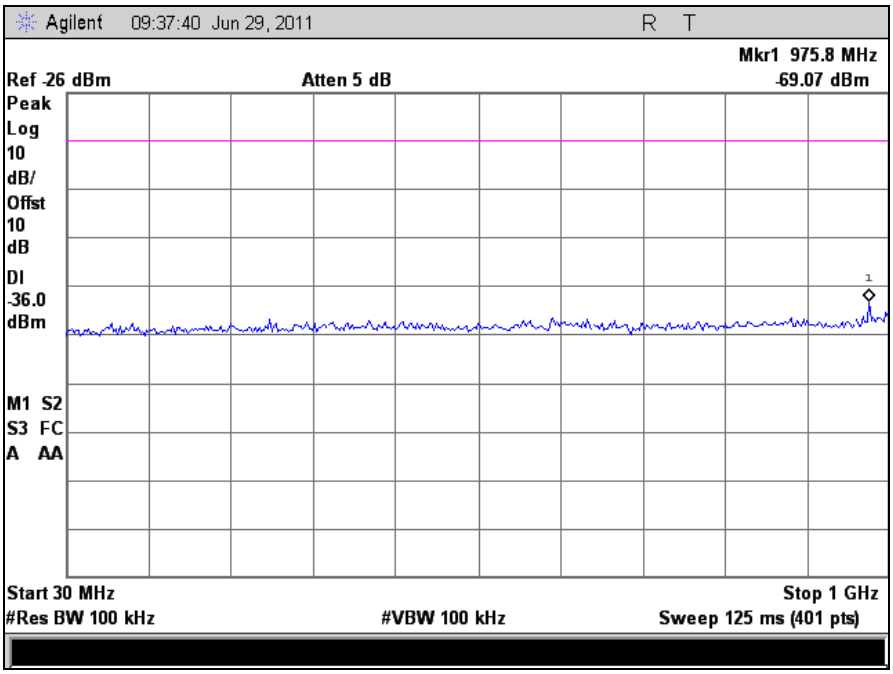
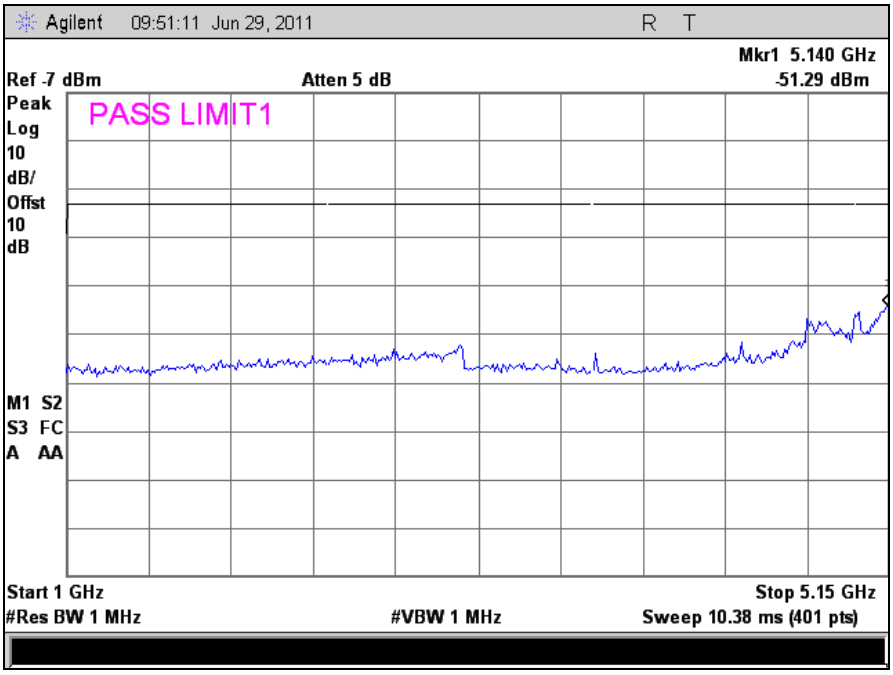


Figure 4. Unwanted Conducted Emissions Outside Test Setup

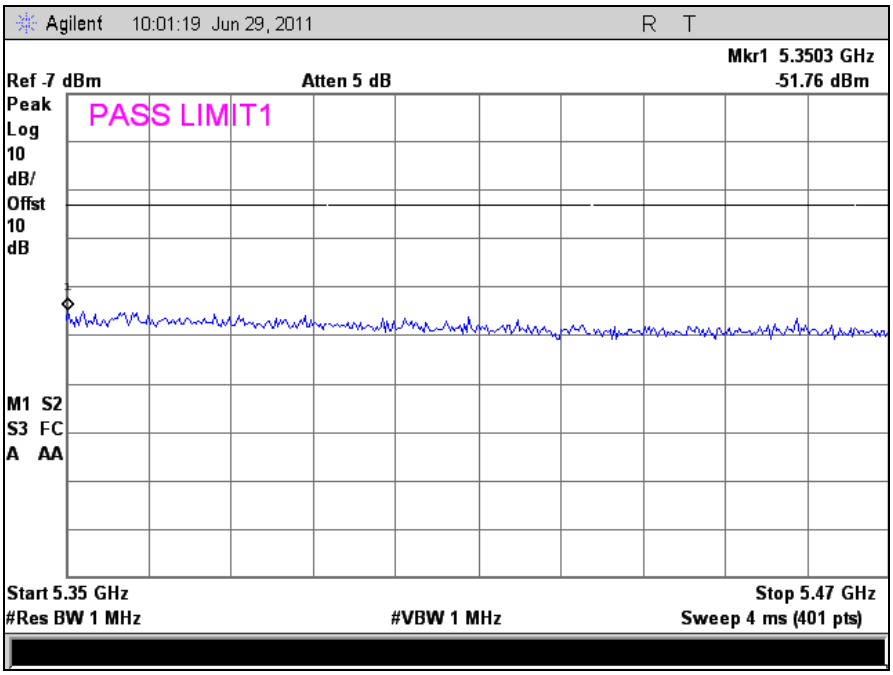
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 20 MHz, Port 1



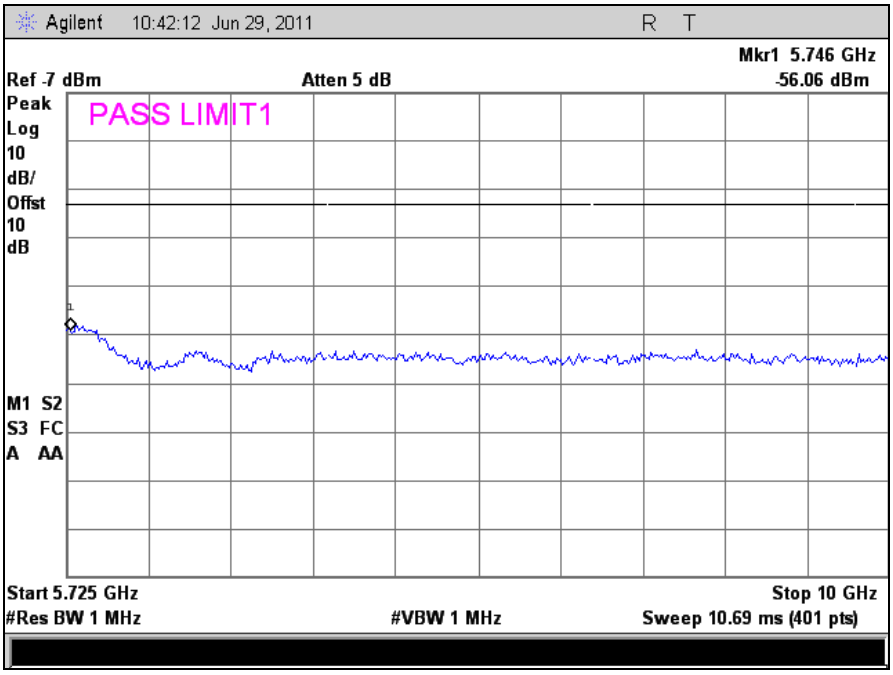
Plot 41. Conducted Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11a 20 MHz, Port 1



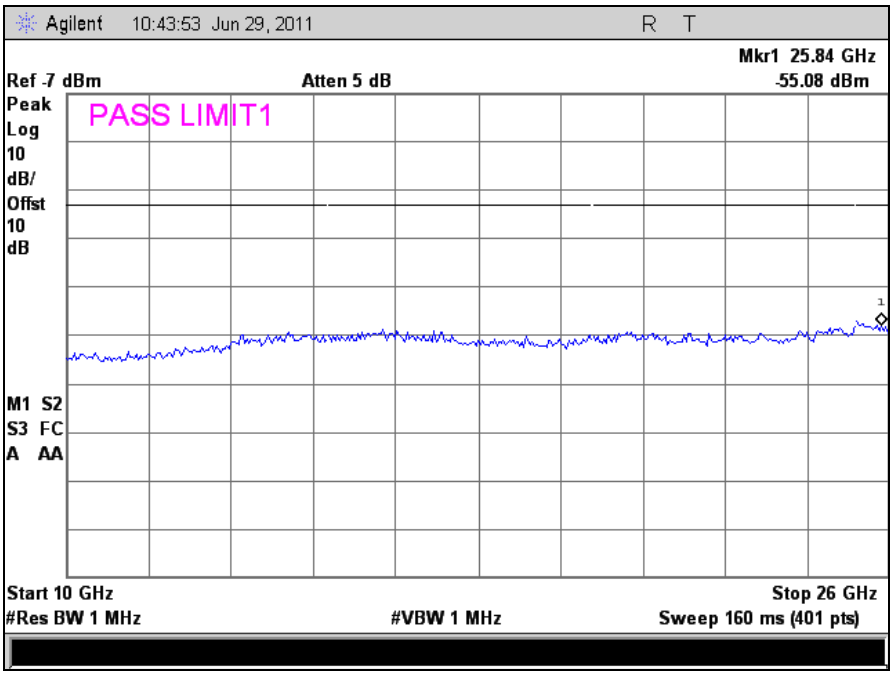
Plot 42. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5500 MHz, 802.11a 20 MHz, Port 1



Plot 43. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5500 MHz, 802.11a 20 MHz, Port 1

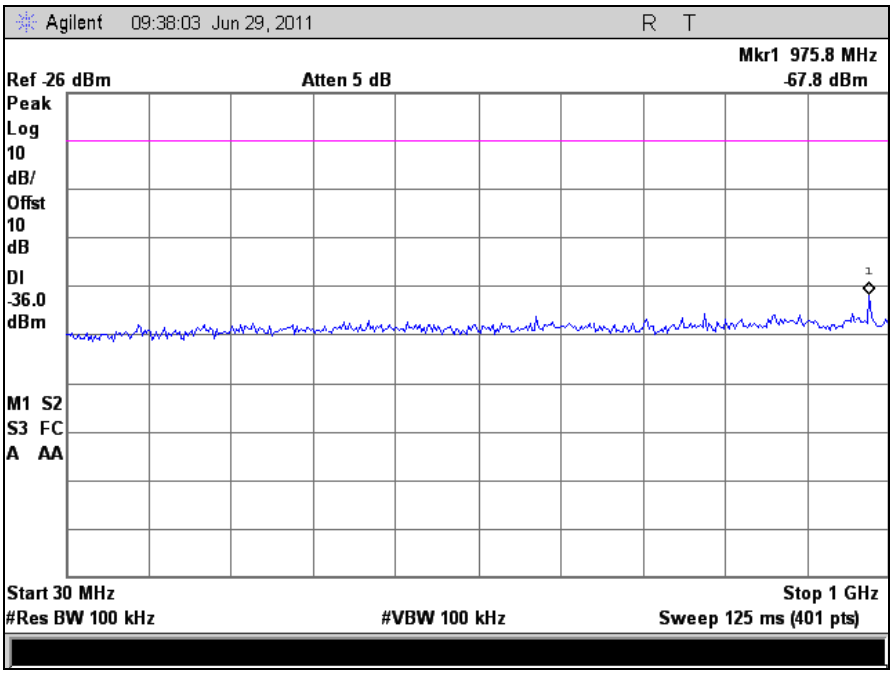


Plot 44. Conducted Spurious Emission, 5.725 GHz – 10 GHz, 5500 MHz, 802.11a 20 MHz, Port 1

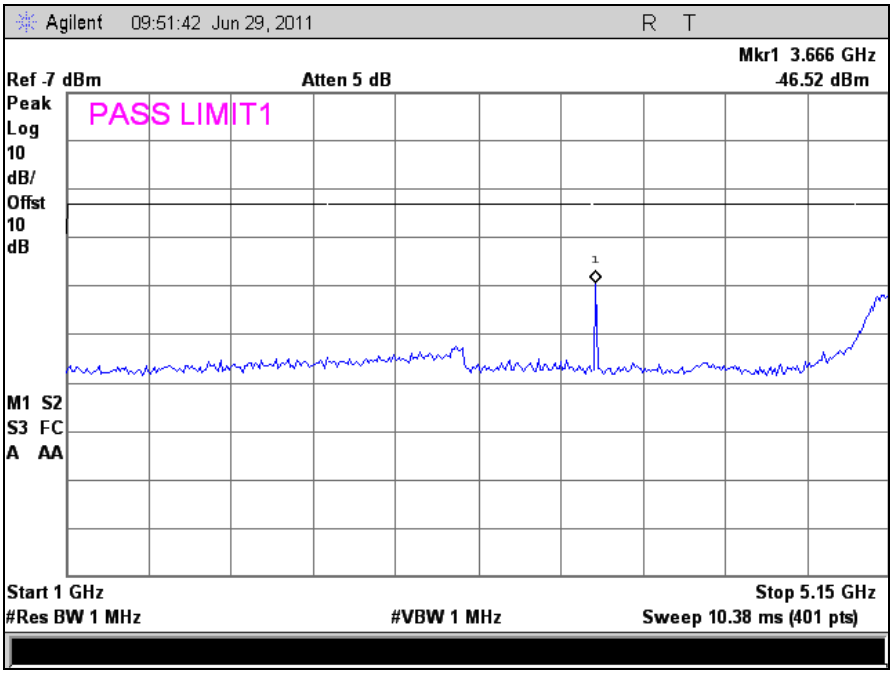


Plot 45. Conducted Spurious Emission, 10 GHz – 26 GHz, 5500 MHz, 802.11a 20 MHz, Port 1

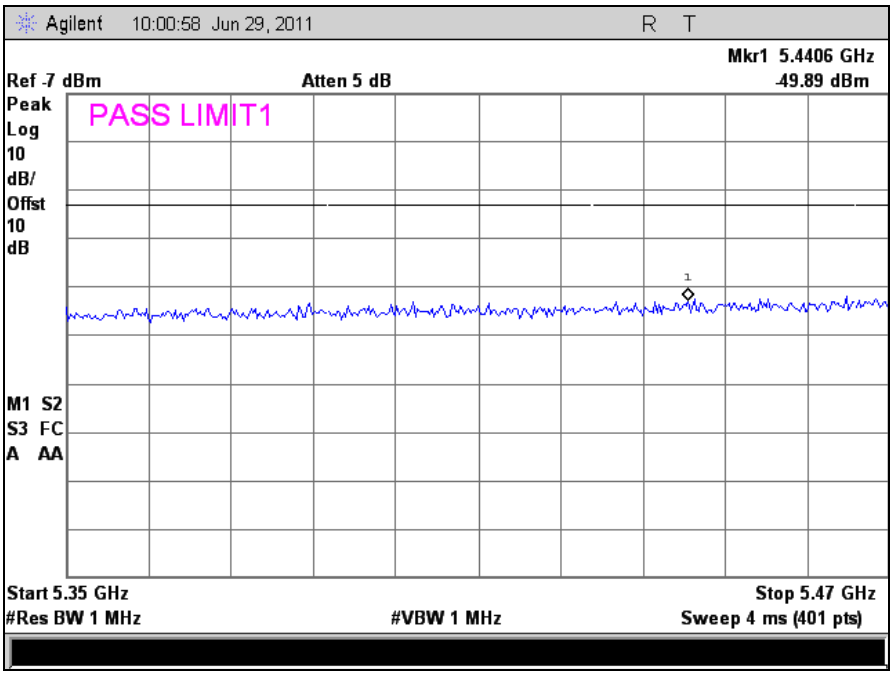
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 20 MHz, Port 2



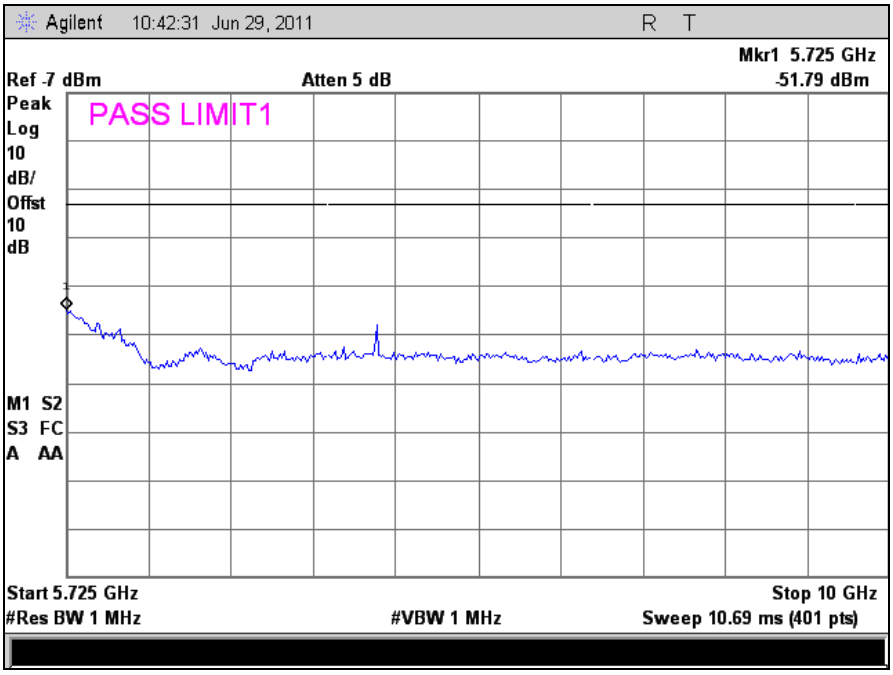
Plot 46. Conducted Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11a 20 MHz, Port 2



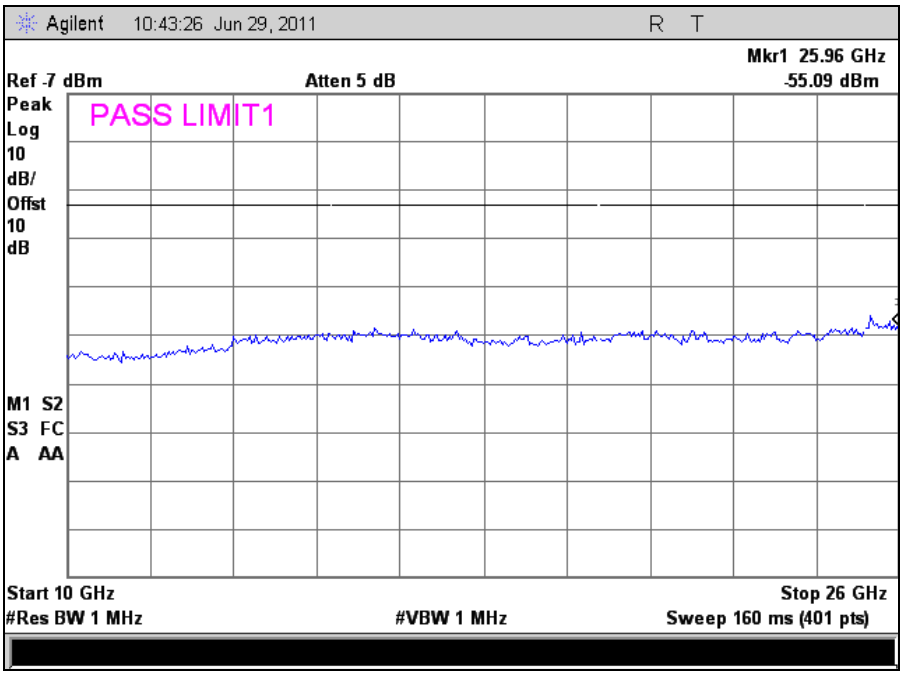
Plot 47. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5500 MHz, 802.11a 20 MHz, Port 2



Plot 48. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5500 MHz, 802.11a 20 MHz, Port 2

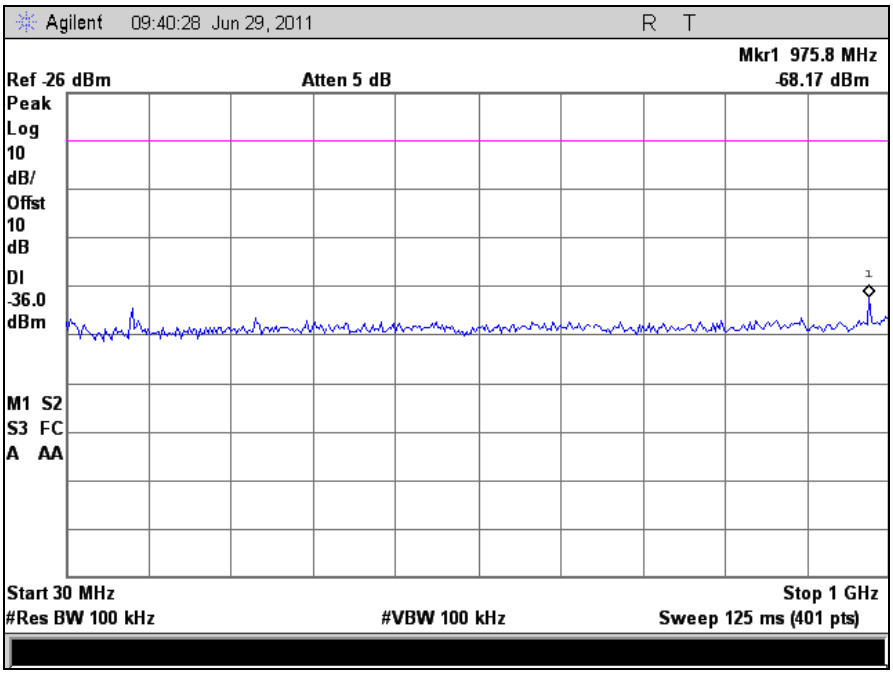


Plot 49. Conducted Spurious Emission, 5.725 GHz – 10 GHz, 5500 MHz, 802.11a 20 MHz, Port 2

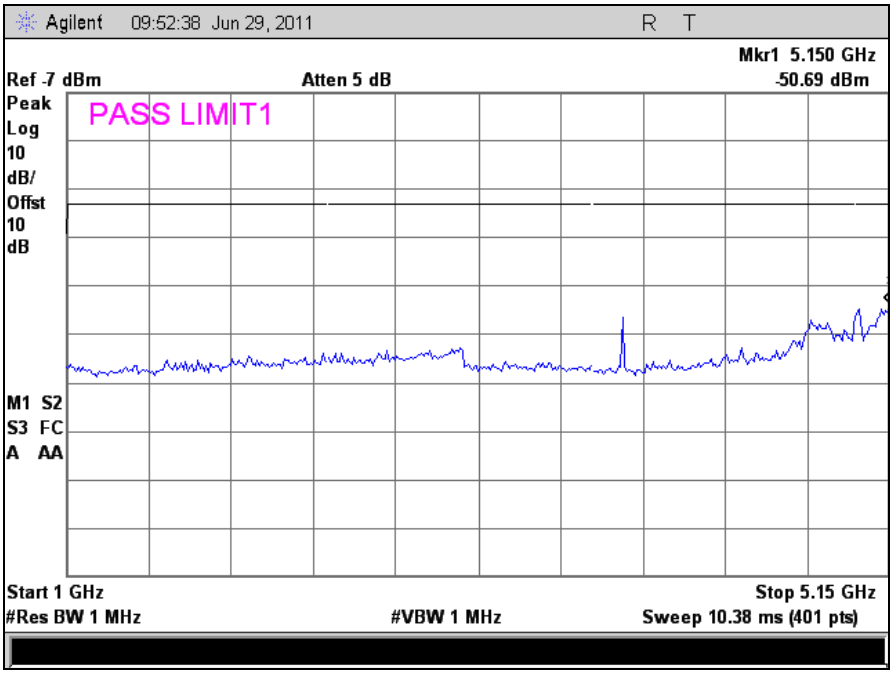


Plot 50. Conducted Spurious Emission, 10 GHz – 26 GHz, 5500 MHz, 802.11a 20 MHz, Port 2

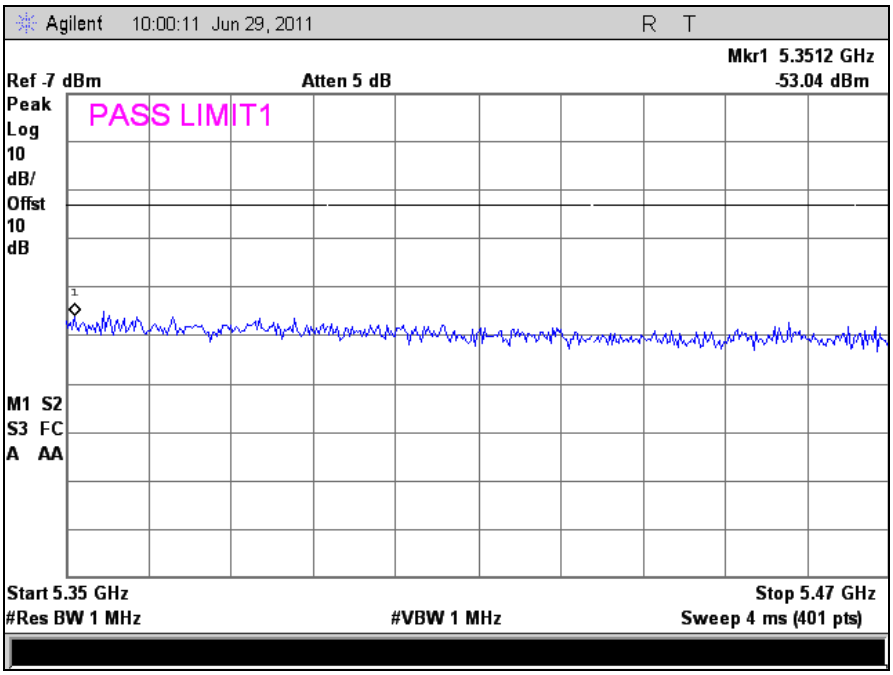
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 20 MHz, Port 1



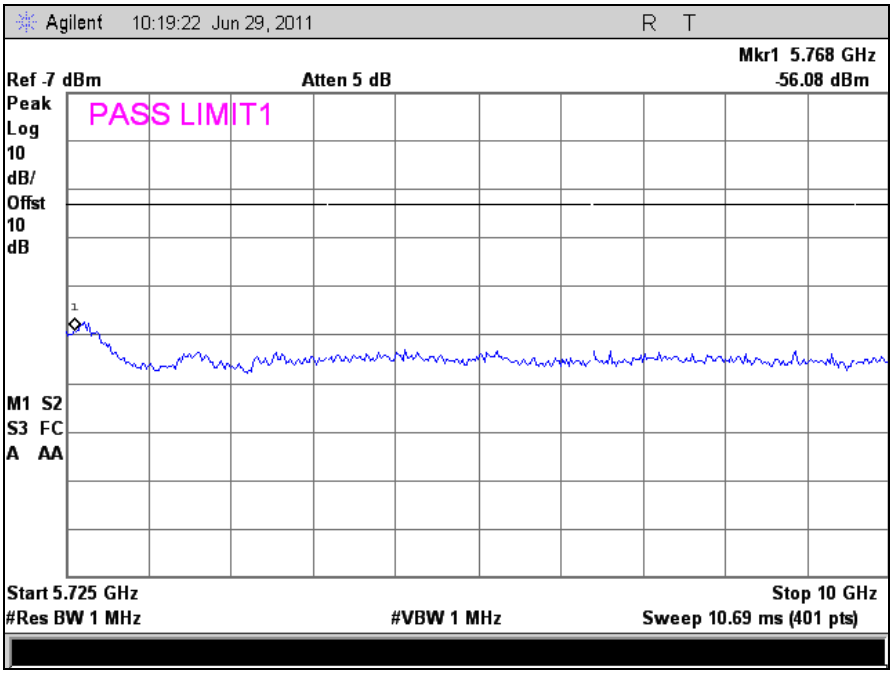
Plot 51. Conducted Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11a 20 MHz, Port 1



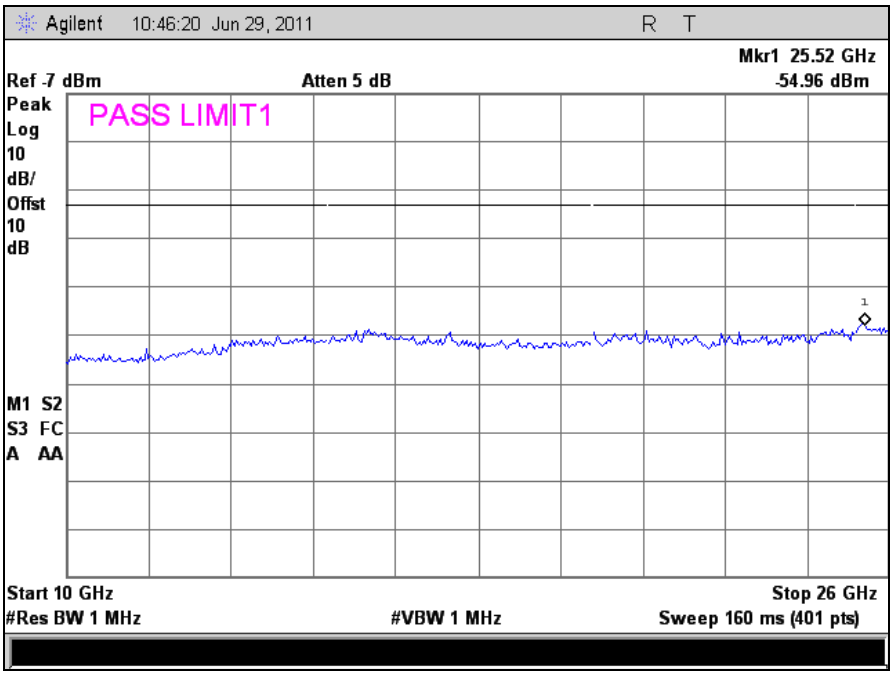
Plot 52. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5700 MHz, 802.11a 20 MHz, Port 1



Plot 53. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5700 MHz, 802.11a 20 MHz, Port 1

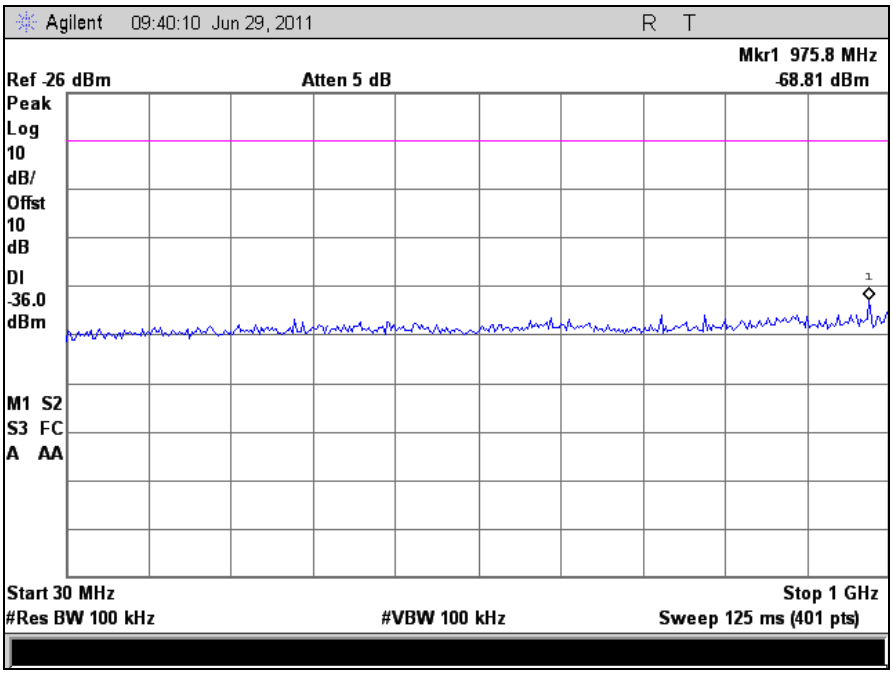


Plot 54. Conducted Spurious Emission, 5.725 GHz – 10 GHz, 5700 MHz, 802.11a 20 MHz, Port 1

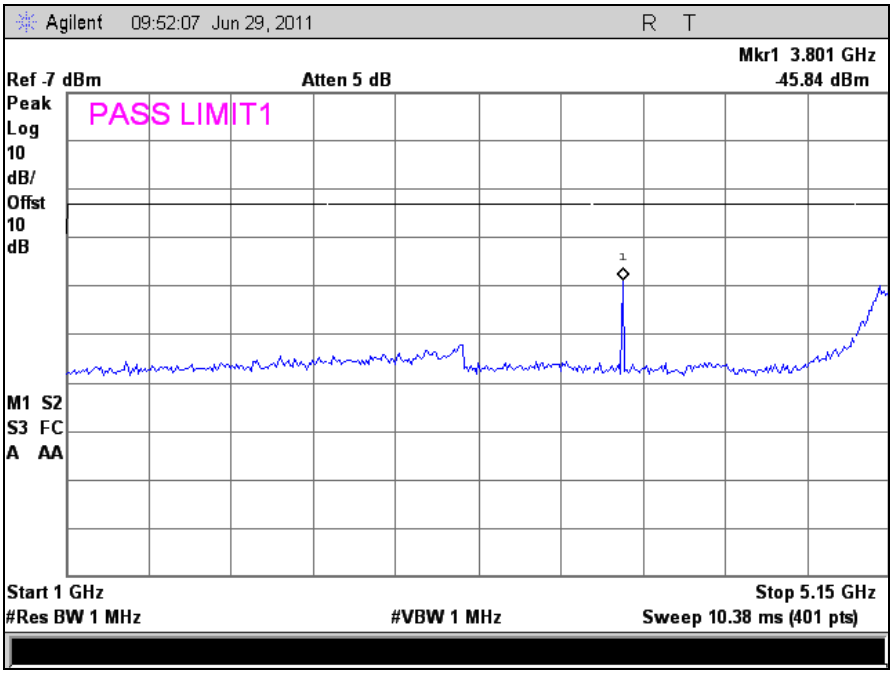


Plot 55. Conducted Spurious Emission, 10 GHz – 26 GHz, 5700 MHz, 802.11a 20 MHz, Port 1

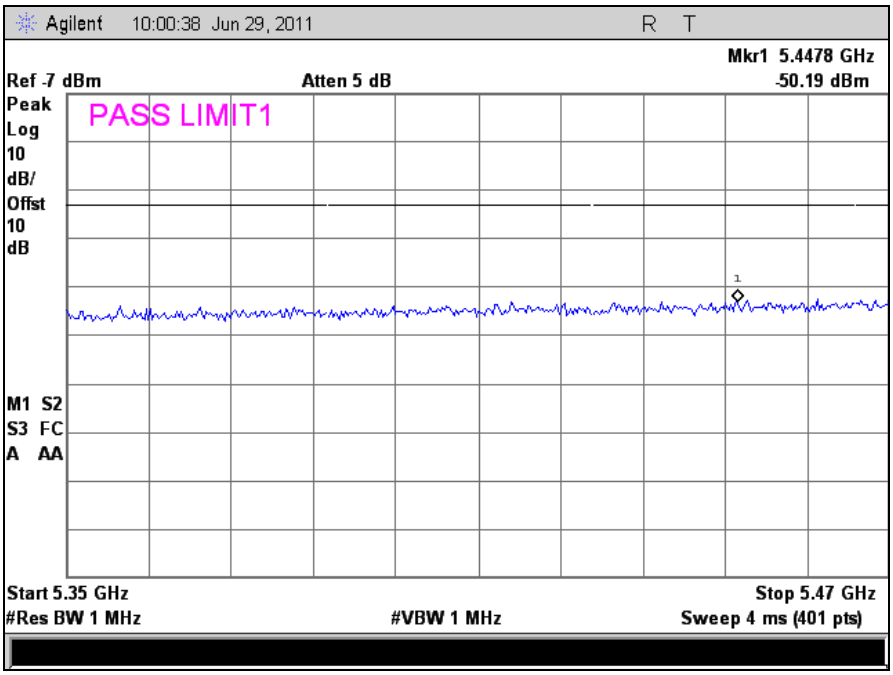
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 20 MHz, Port 2



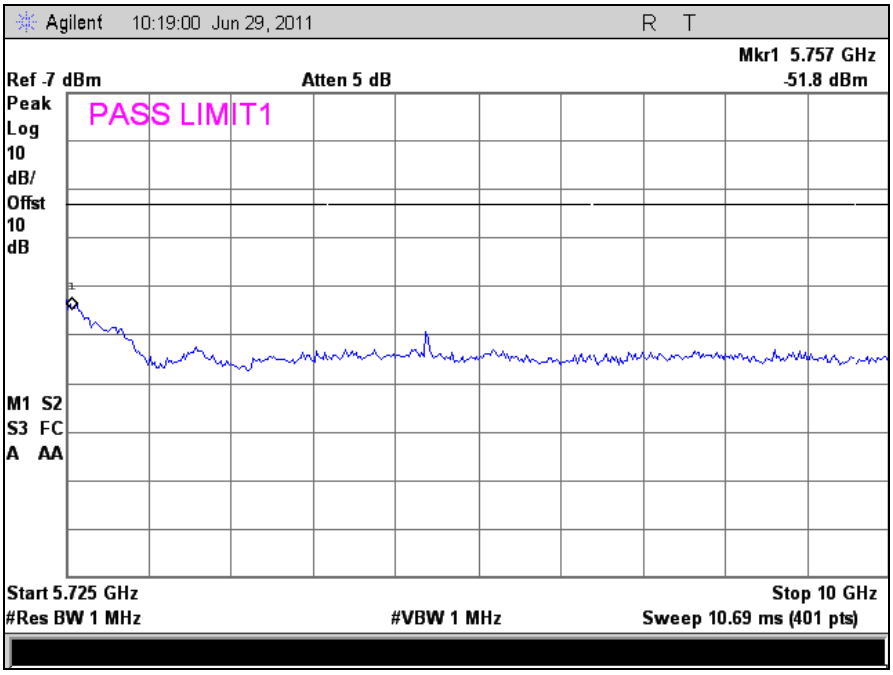
Plot 56. Conducted Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11a 20 MHz, Port 2



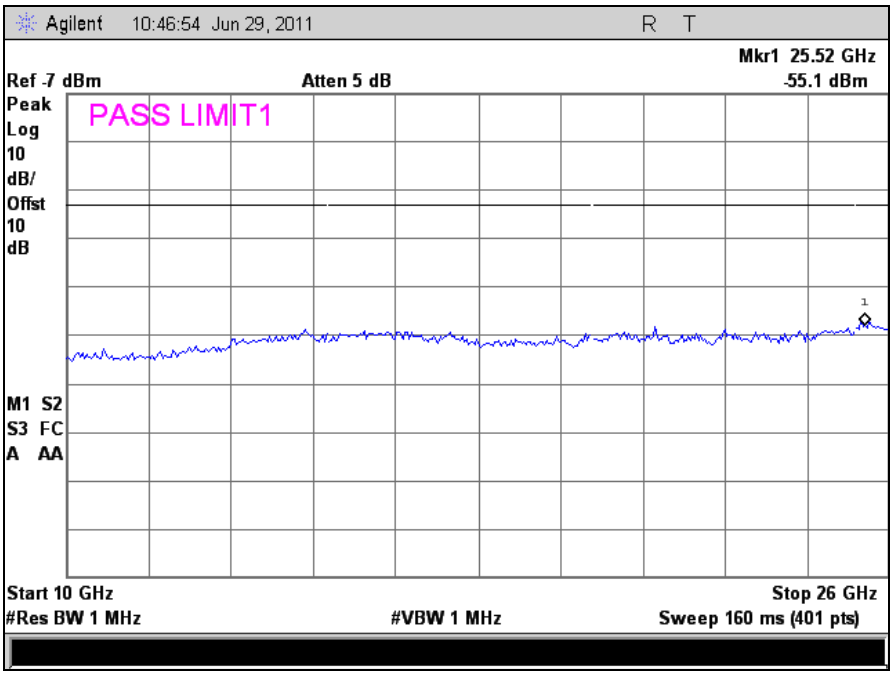
Plot 57. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5700 MHz, 802.11a 20 MHz, Port 2



Plot 58. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5700 MHz, 802.11a 20 MHz, Port 2

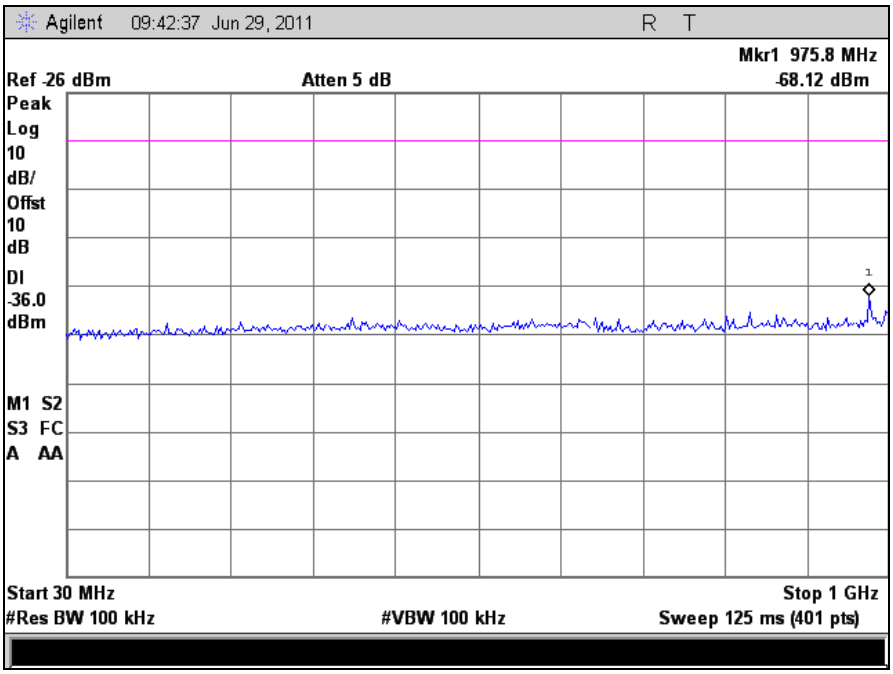


Plot 59. Conducted Spurious Emission, 5.725 GHz – 10 GHz, 5700 MHz, 802.11a 20 MHz, Port 2

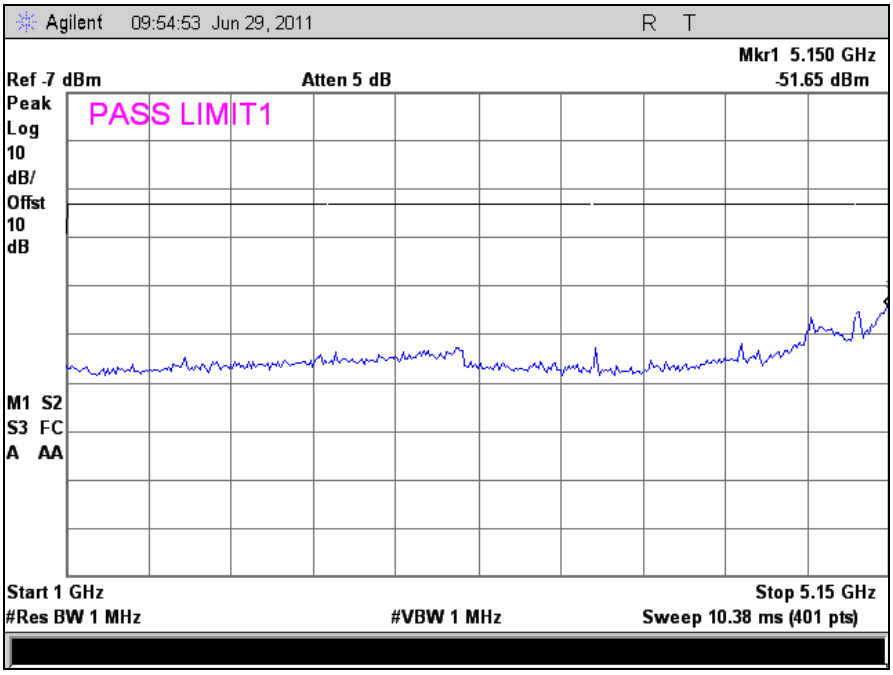


Plot 60. Conducted Spurious Emission, 10 GHz – 26 GHz, 5700 MHz, 802.11a 20 MHz, Port 2

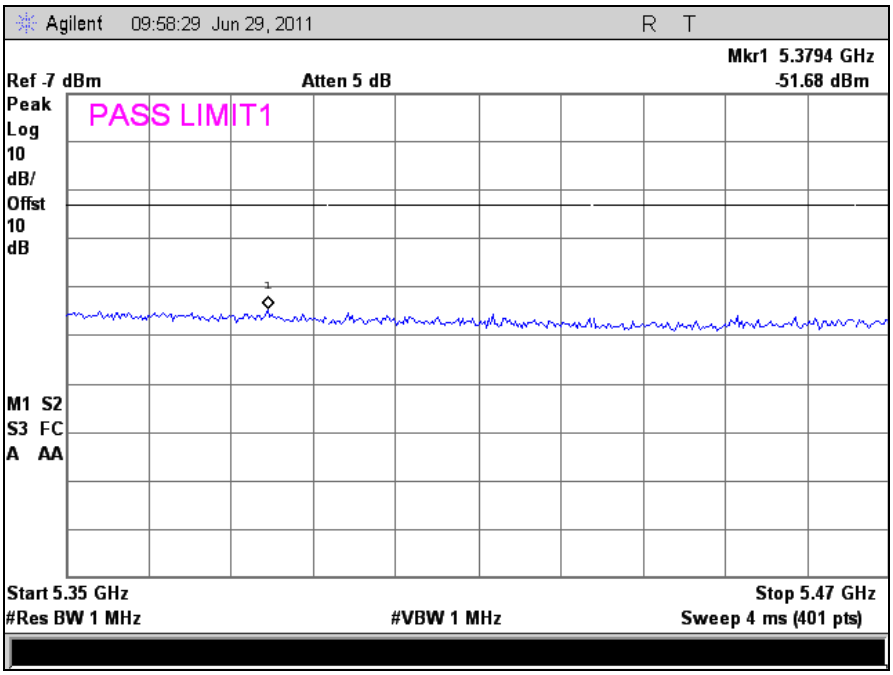
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 40 MHz, Port 1



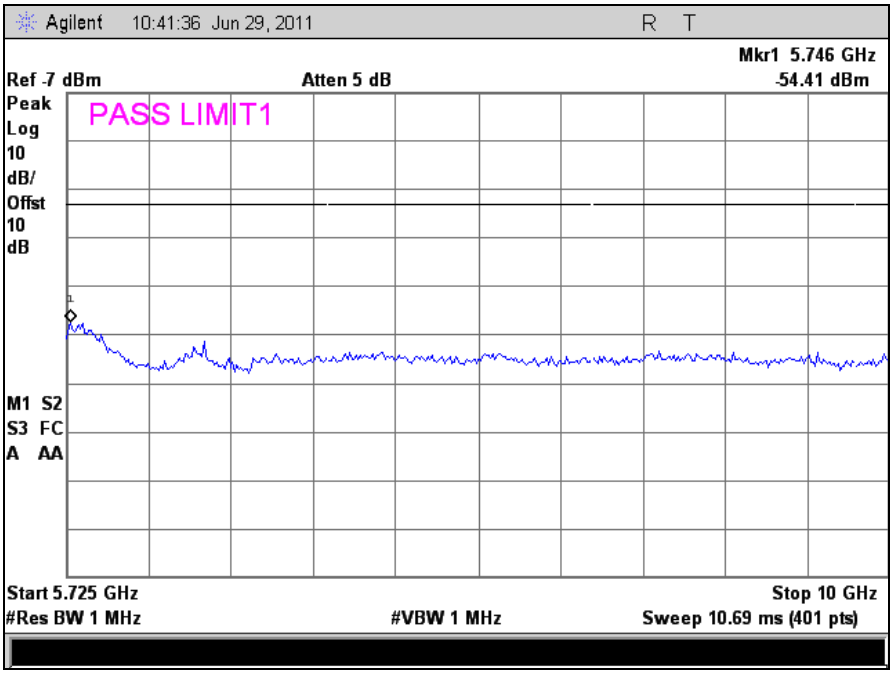
Plot 61. Conducted Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11a 40 MHz, Port 1



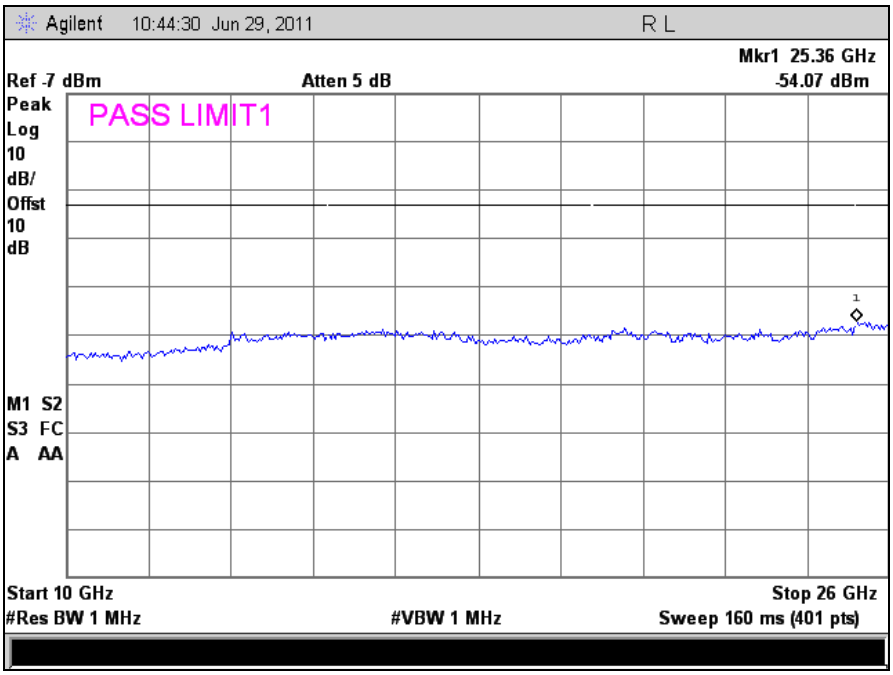
Plot 62. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5500 MHz, 802.11a 40 MHz, Port 1



Plot 63. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5500 MHz, 802.11a 40 MHz, Port 1

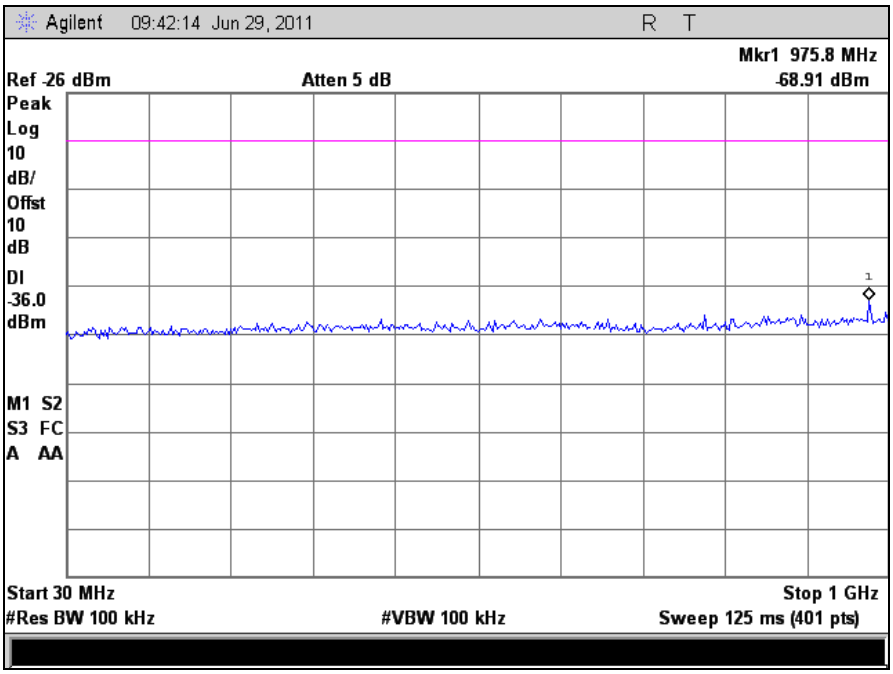


Plot 64. Conducted Spurious Emission, 5.725 GHz – 10 GHz, 5500 MHz, 802.11a 40 MHz, Port 1

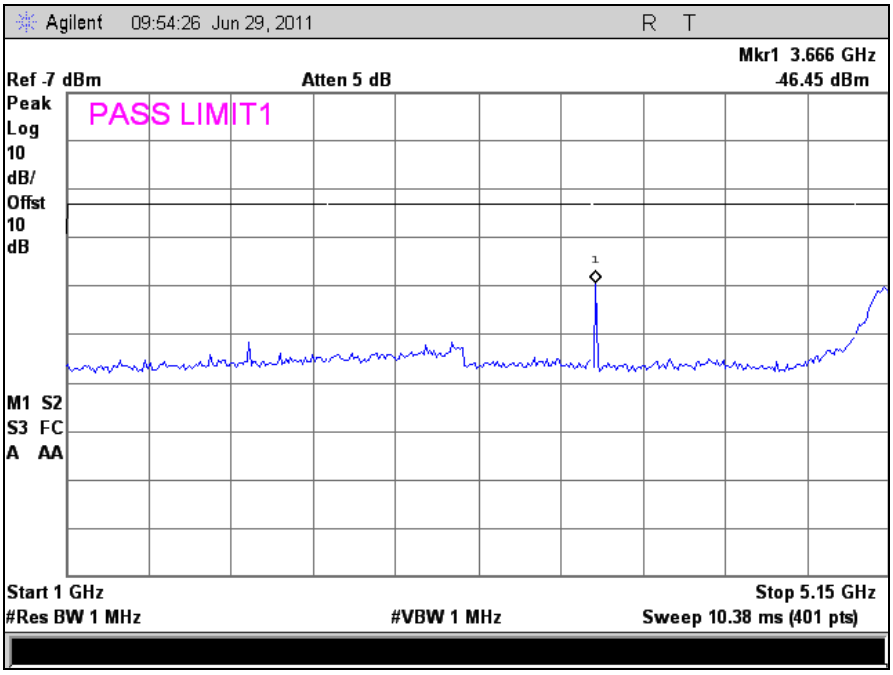


Plot 65. Conducted Spurious Emission, 10 GHz – 26 GHz, 5500 MHz, 802.11a 40 MHz, Port 1

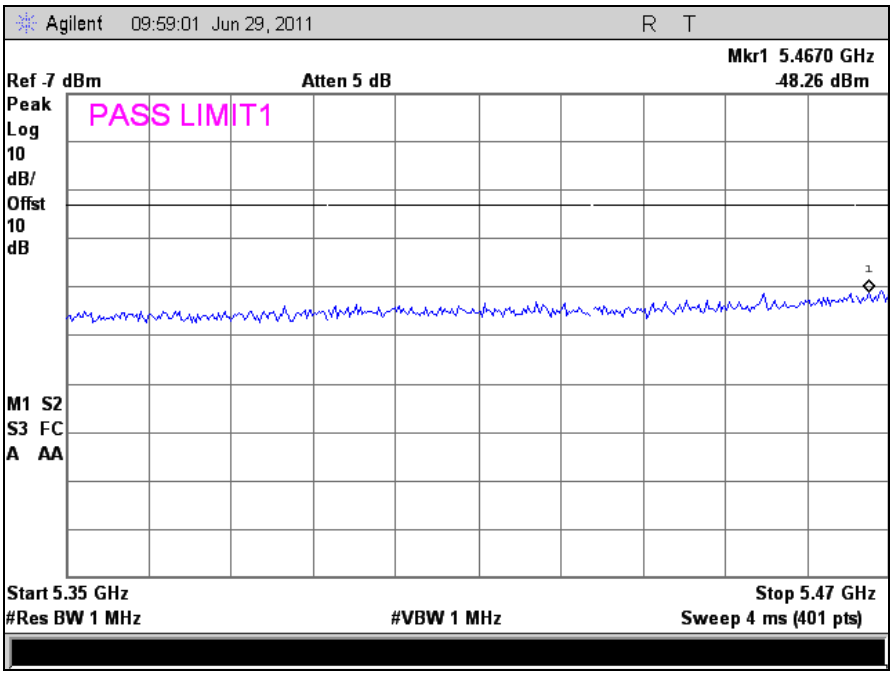
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 40 MHz, Port 2



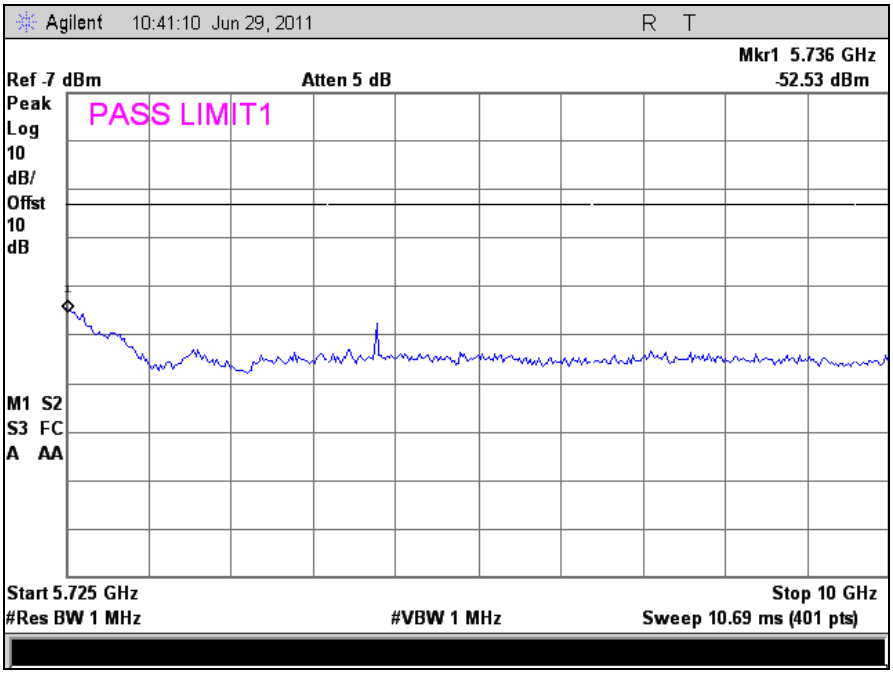
Plot 66. Conducted Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11a 40 MHz, Port 2



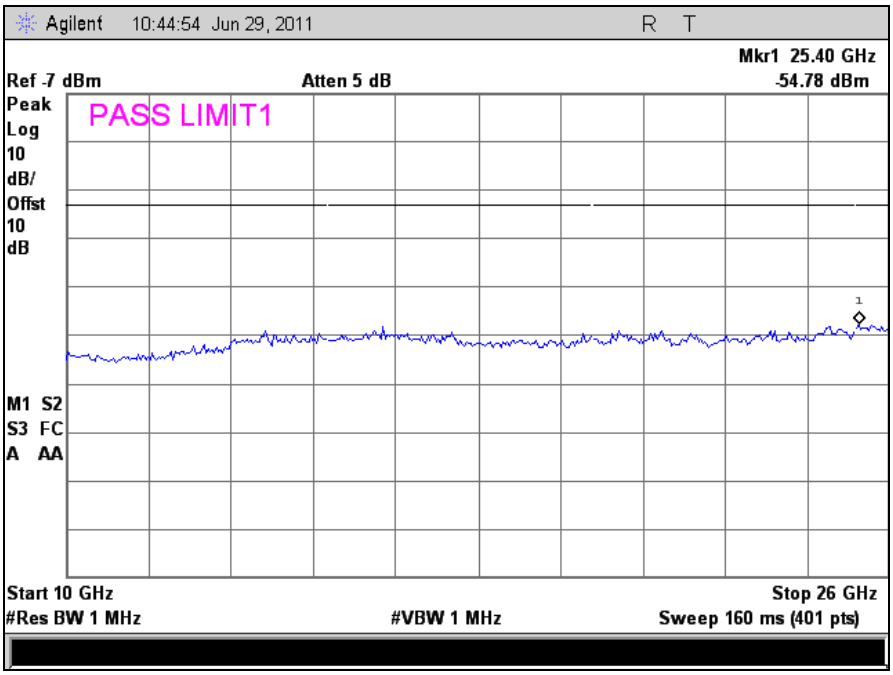
Plot 67. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5500 MHz, 802.11a 40 MHz, Port 2



Plot 68. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5500 MHz, 802.11a 40 MHz, Port 2

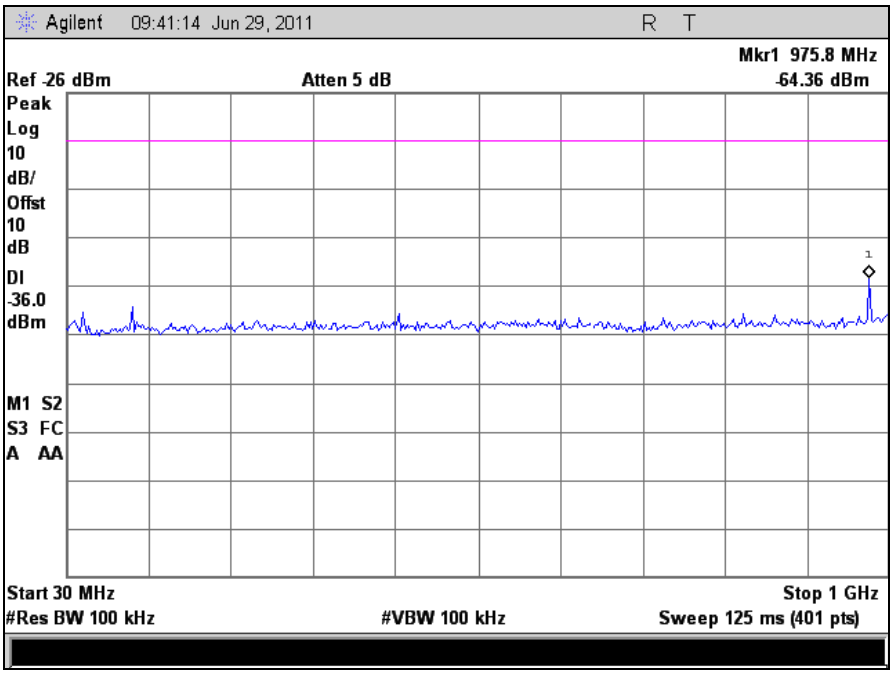


Plot 69. Conducted Spurious Emission, 5.725 GHz – 10 GHz, 5500 MHz, 802.11a 40 MHz, Port 2

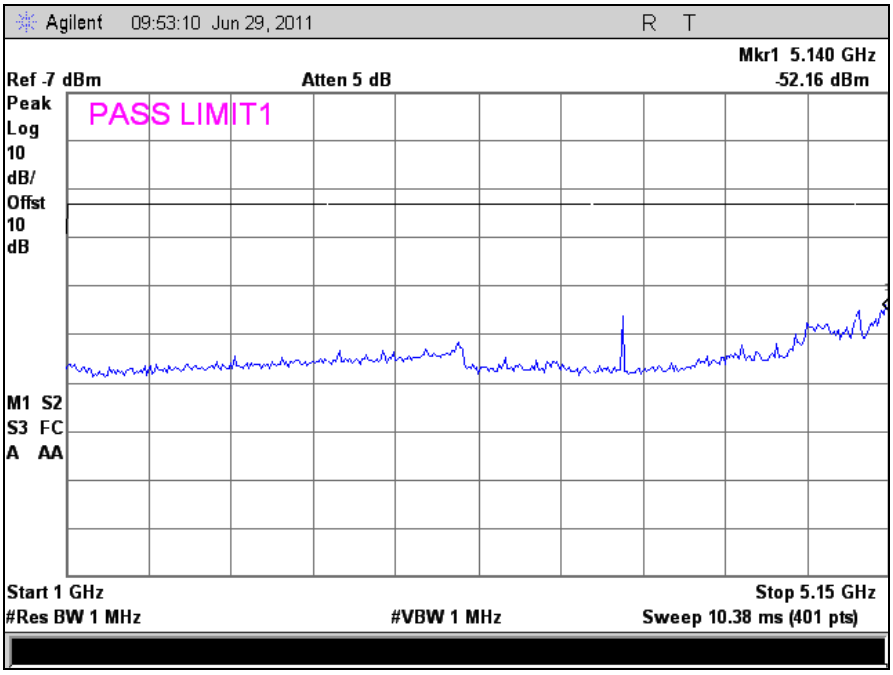


Plot 70. Conducted Spurious Emission, 10 GHz – 26 GHz, 5500 MHz, 802.11a 40 MHz, Port 2

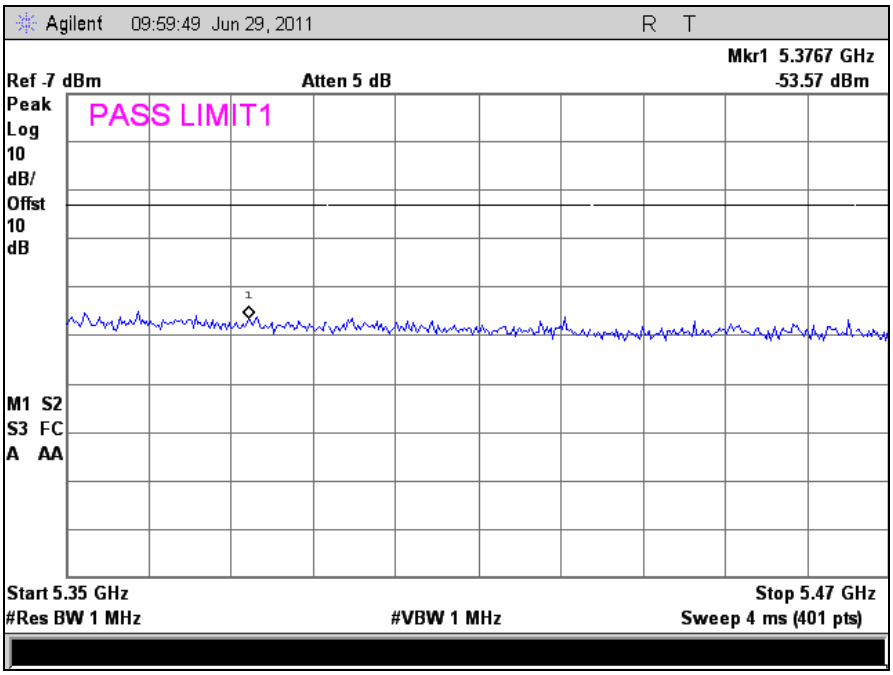
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 40 MHz, Port 1



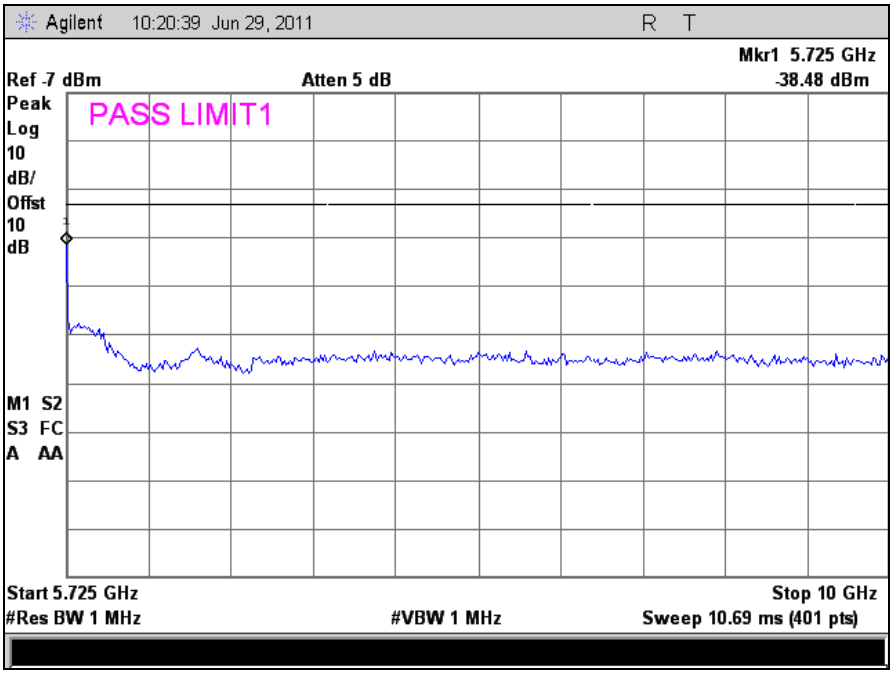
Plot 71. Conducted Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11a 40 MHz, Port 1



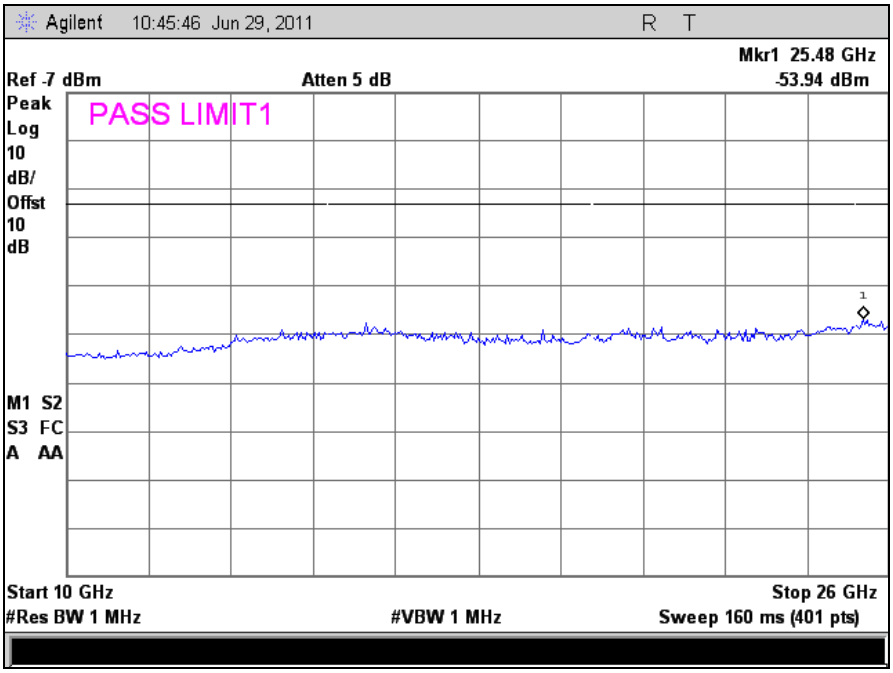
Plot 72. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5700 MHz, 802.11a 40 MHz, Port 1



Plot 73. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5700 MHz, 802.11a 40 MHz, Port 1

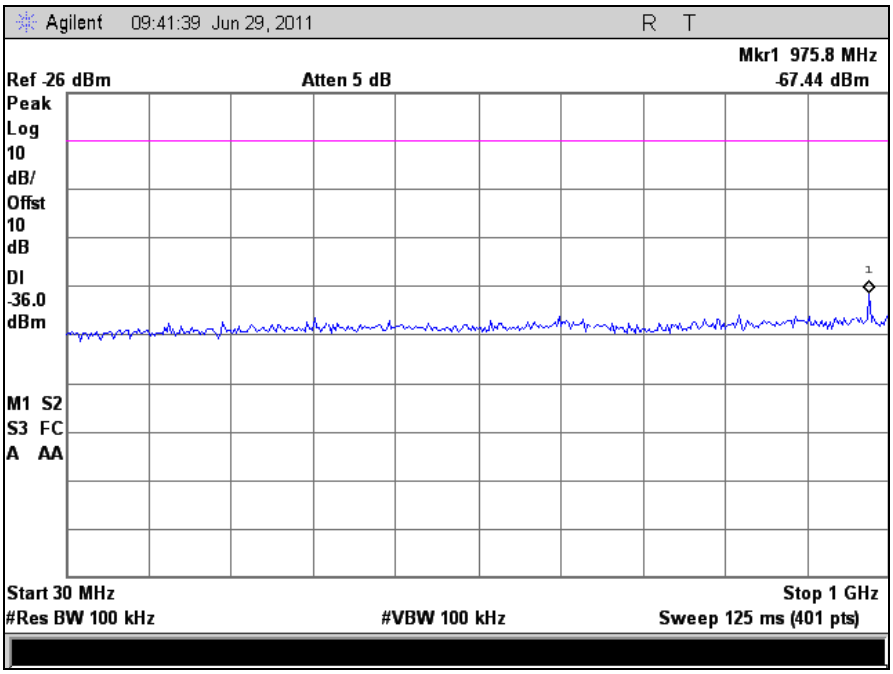


Plot 74. Conducted Spurious Emission, 5.725 GHz – 10 GHz, 5700 MHz, 802.11a 40 MHz, Port 1

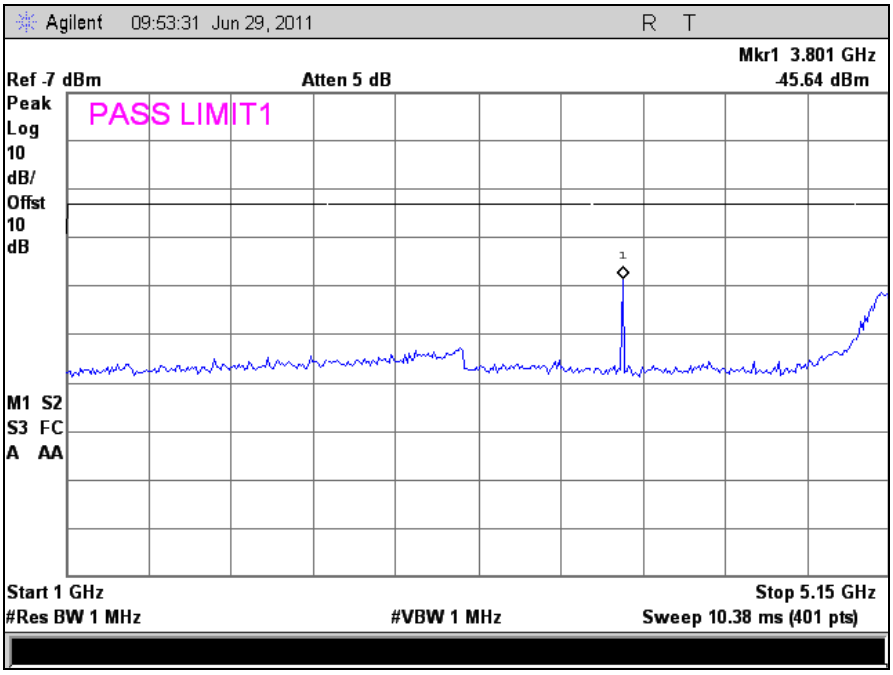


Plot 75. Conducted Spurious Emission, 10 GHz – 26 GHz, 5700 MHz, 802.11a 40 MHz, Port 1

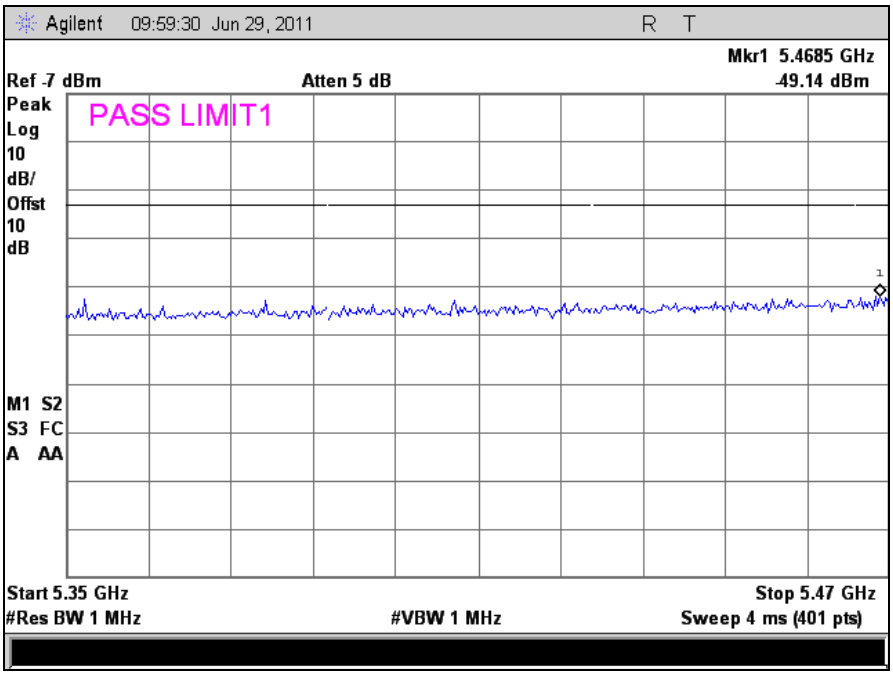
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 40 MHz, Port 2



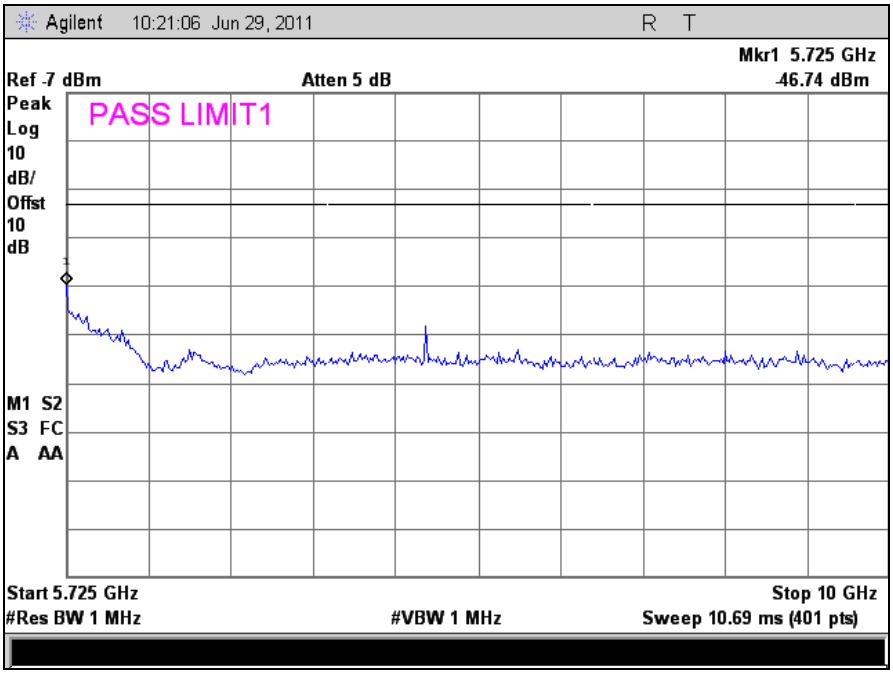
Plot 76. Conducted Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11a 40 MHz, Port 2



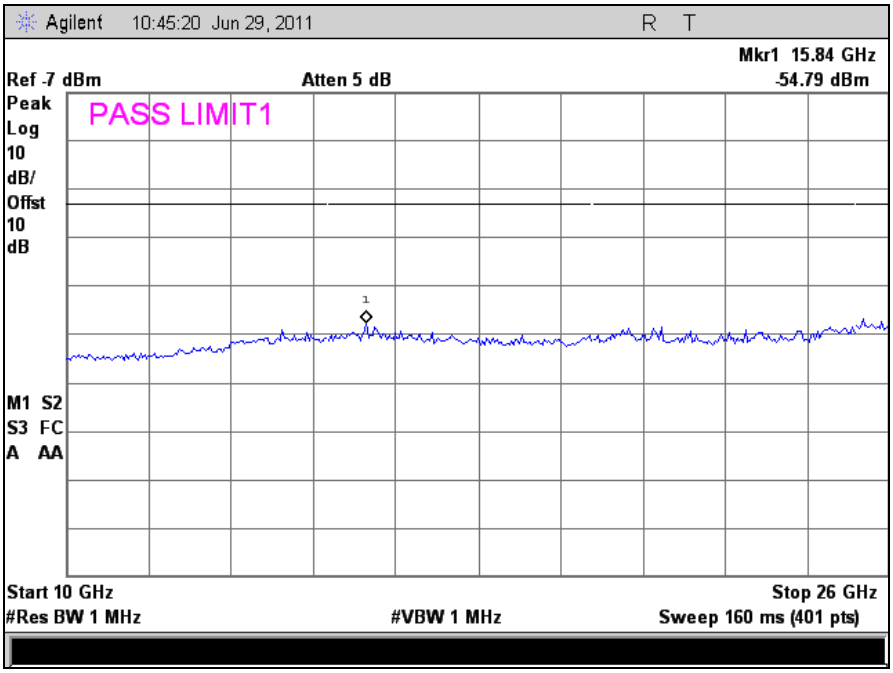
Plot 77. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5700 MHz, 802.11a 40 MHz, Port 2



Plot 78. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5700 MHz, 802.11a 40 MHz, Port 2



Plot 79. Conducted Spurious Emission, 5.725 GHz – 10 GHz, 5700 MHz, 802.11a 40 MHz, Port 2



Plot 80. Conducted Spurious Emission, 10 GHz – 26 GHz, 5700 MHz, 802.11a 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

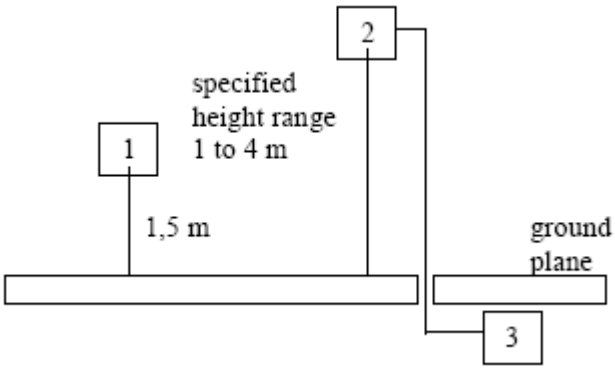
These are radiated radio frequency emissions outside the 5GHz RLAN bands when the RF output port is connected to a spectrum analyzer.

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

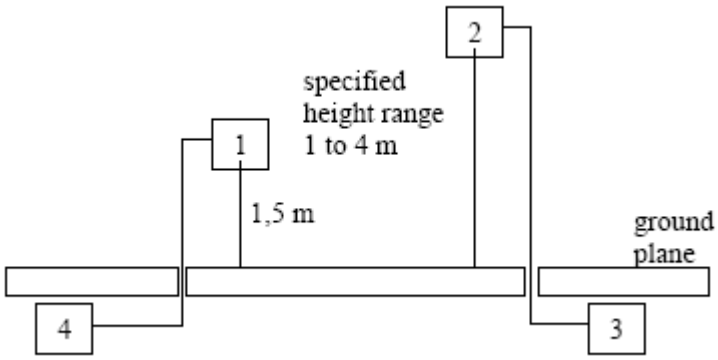
Test Procedure: The EUT was setup as per the specifications set out in Annex B of 301 893 and is shown below.



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

The antenna ports were terminated into a 50Ω load. 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.



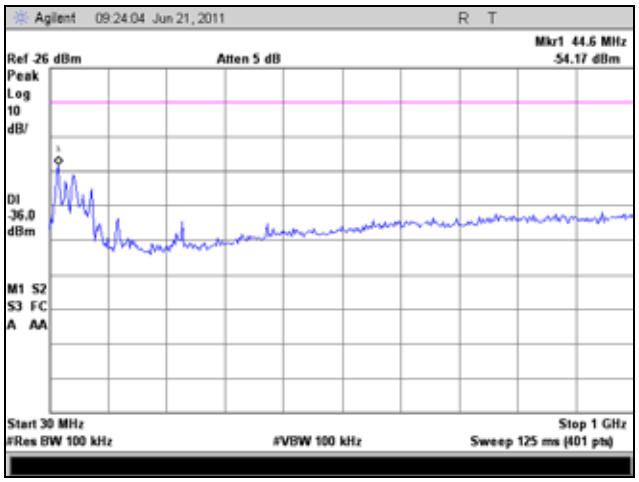
1. Substitution Antenna
2. Test Antenna
3. Spectrum Analyzer
4. Signal Generator

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

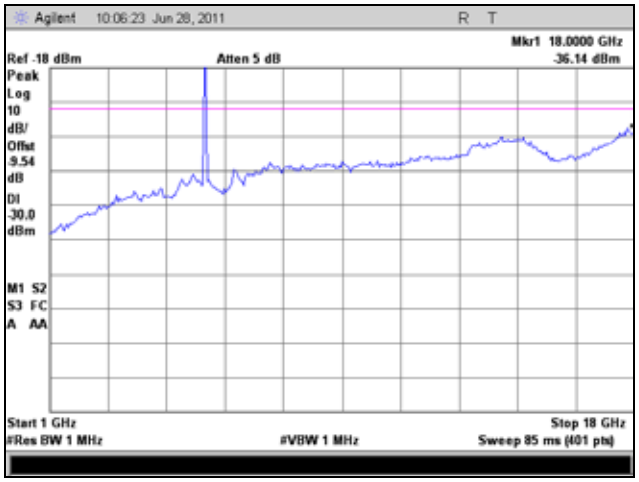
Test Engineer: Anderson Soungpanya

Test Date: 06/28/11

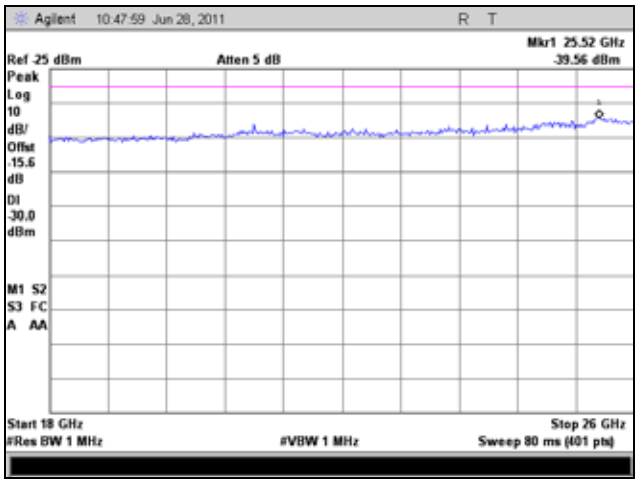
Radiated Spurious Emissions, 802.11a 20 MHz



Plot 81. Radiated Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11a 20 MHz

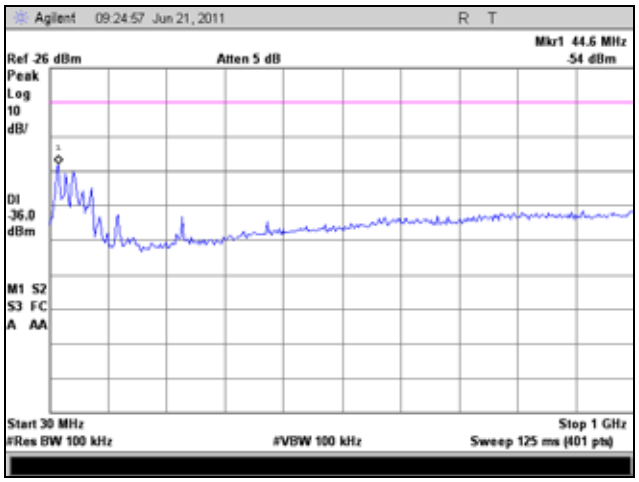


Plot 82. Radiated Spurious Emission, 1 GHz – 18 GHz, 5500 MHz, 802.11a 20 MHz

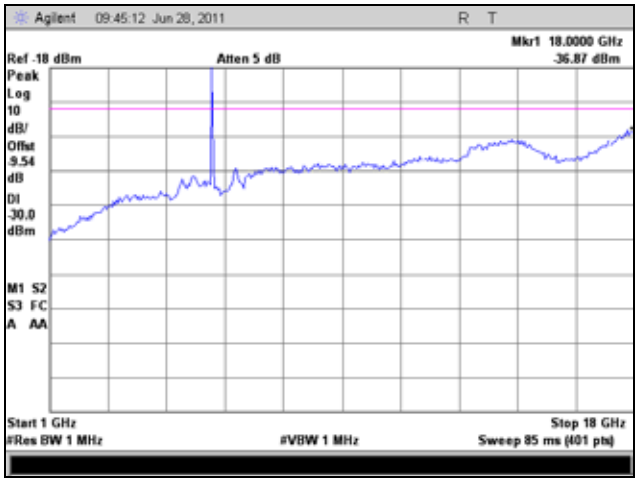


Plot 83. Radiated Spurious Emission, 18 GHz – 26 GHz, 5500 MHz, 802.11a 20 MHz

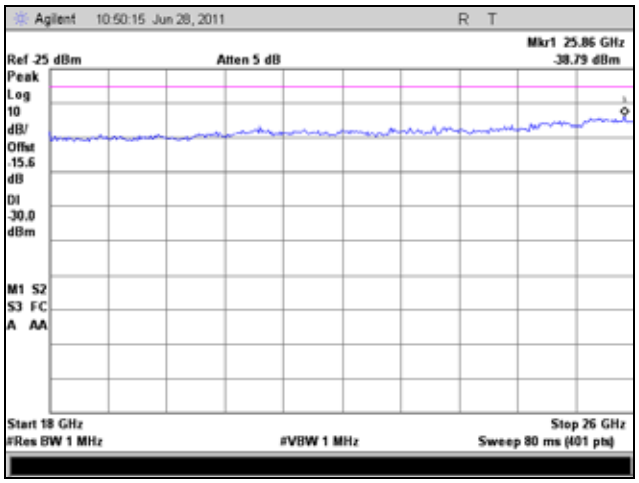
Radiated Spurious Emissions, 802.11a 20 MHz



Plot 84. Radiated Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11a 20 MHz

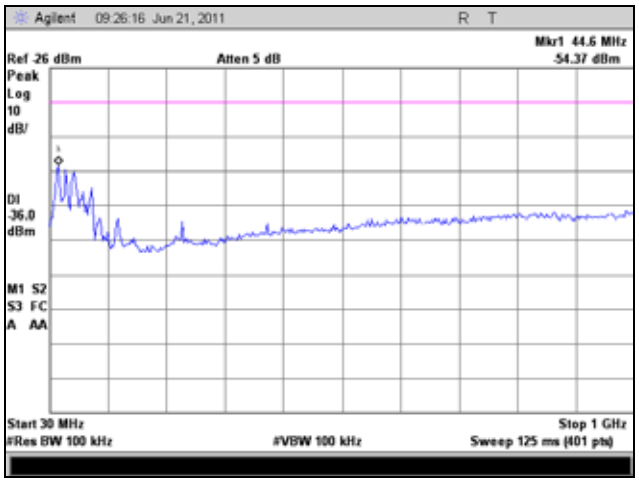


Plot 85. Radiated Spurious Emission, 1 GHz – 18 GHz, 5700 MHz, 802.11a 20 MHz

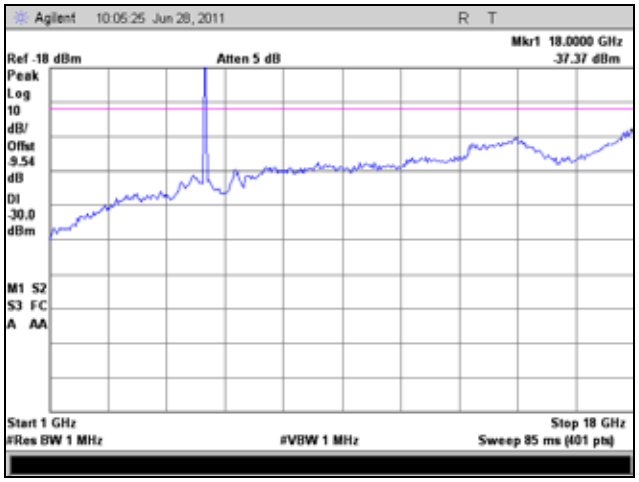


Plot 86. Radiated Spurious Emission, 18 GHz – 26 GHz, 5700 MHz, 802.11a 20 MHz

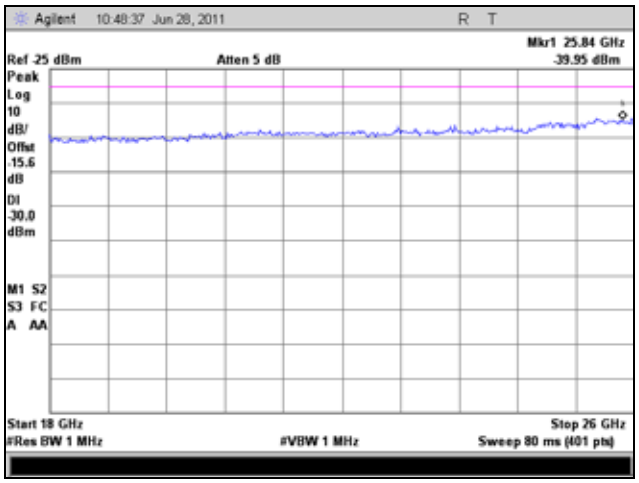
Radiated Spurious Emissions, 802.11a 40 MHz



Plot 87. Radiated Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11a 40 MHz

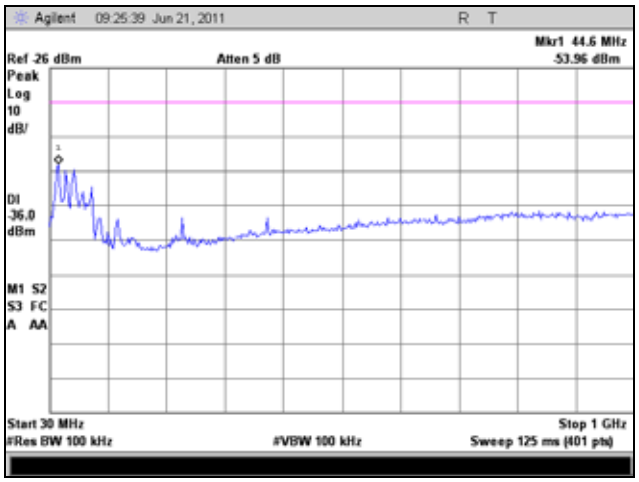


Plot 88. Radiated Spurious Emission, 1 GHz – 18 GHz, 5500 MHz, 802.11a 40 MHz

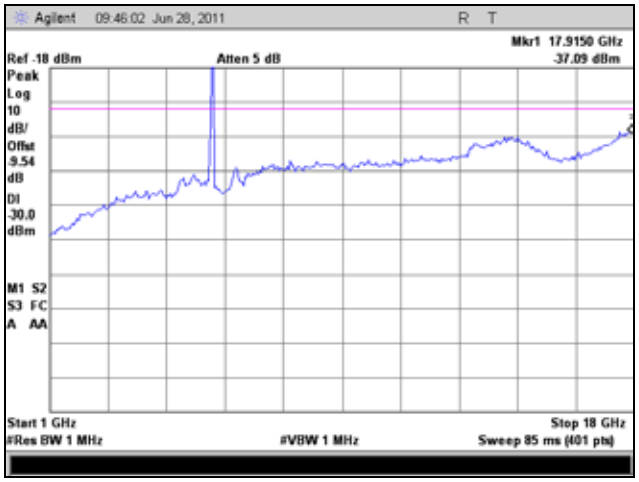


Plot 89. Radiated Spurious Emission, 18 GHz – 26 GHz, 5500 MHz, 802.11a 40 MHz

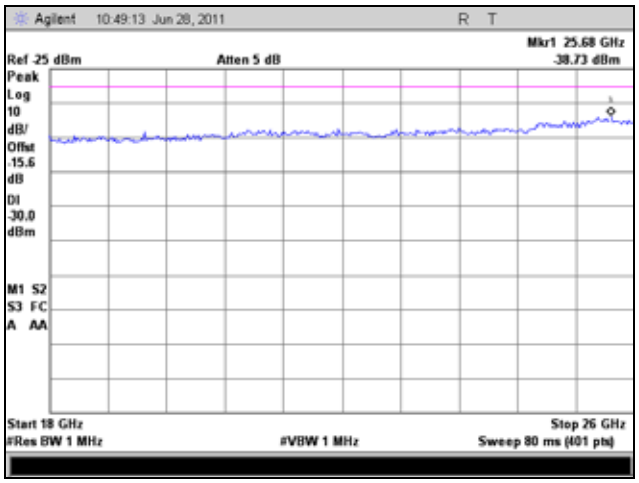
Radiated Spurious Emissions, 802.11a 40 MHz



Plot 90. Radiated Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11a 40 MHz

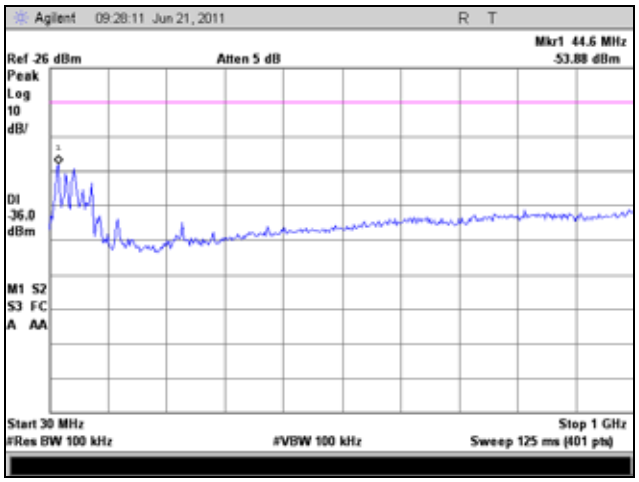


Plot 91. Radiated Spurious Emission, 1 GHz – 18 GHz, 5700 MHz, 802.11a 40 MHz

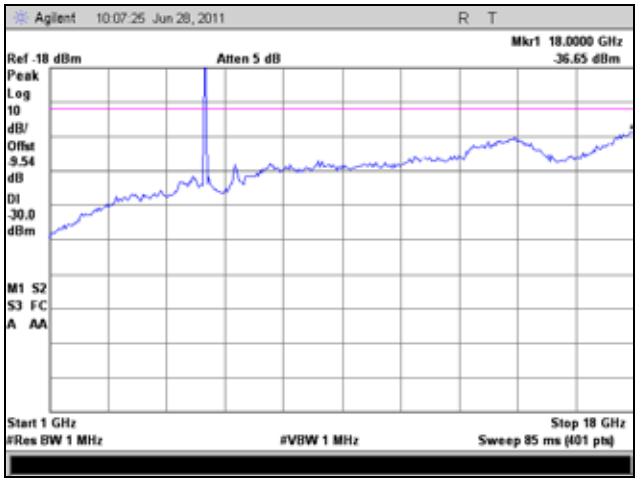


Plot 92. Radiated Spurious Emission, 18 GHz – 26 GHz, 5700 MHz, 802.11a 40 MHz

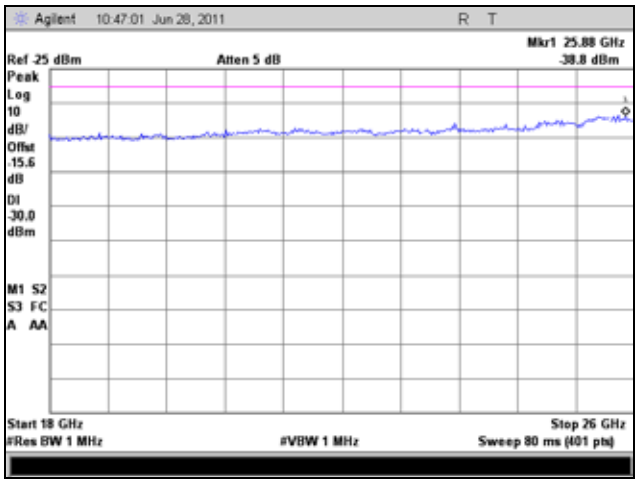
Radiated Spurious Emissions, 802.11n 20 MHz



Plot 93. Radiated Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11n 20 MHz

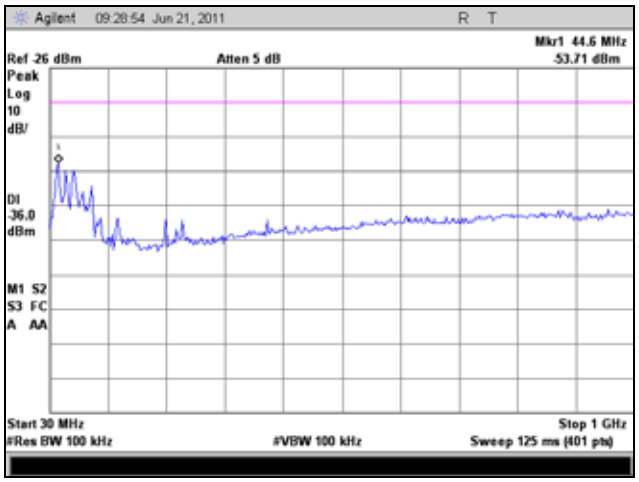


Plot 94. Radiated Spurious Emission, 1 GHz – 18 GHz, 5500 MHz, 802.11n 20 MHz

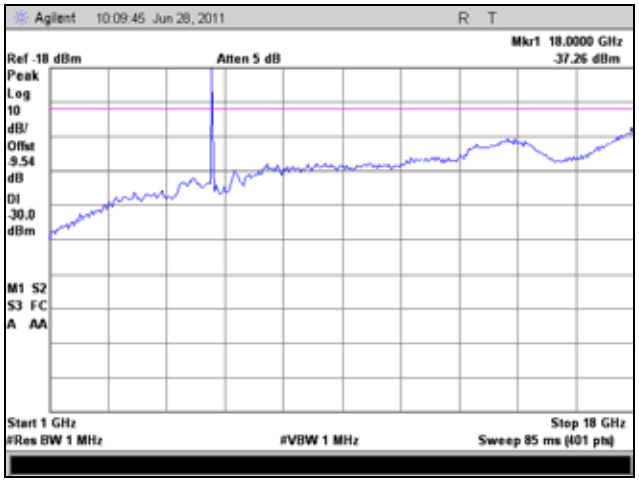


Plot 95. Radiated Spurious Emission, 18 GHz – 26 GHz, 5500 MHz, 802.11n 20 MHz

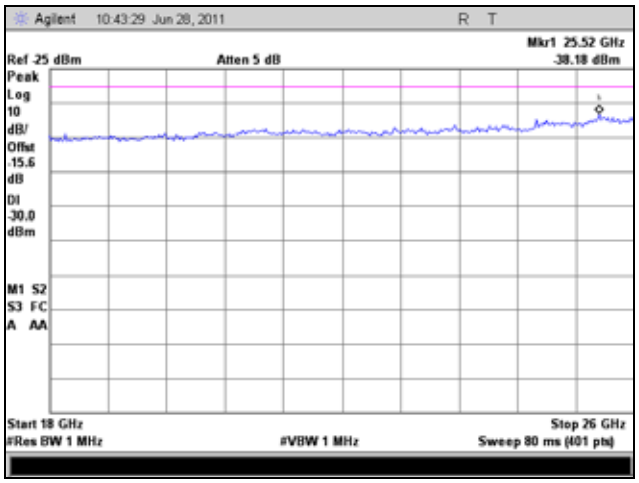
Radiated Spurious Emissions, 802.11n 20 MHz



Plot 96. Radiated Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11n 20 MHz

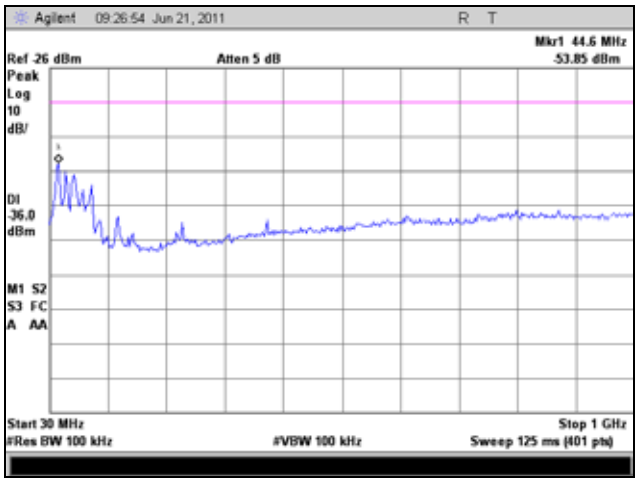


Plot 97. Radiated Spurious Emission, 1 GHz – 18 GHz, 5700 MHz, 802.11n 20 MHz

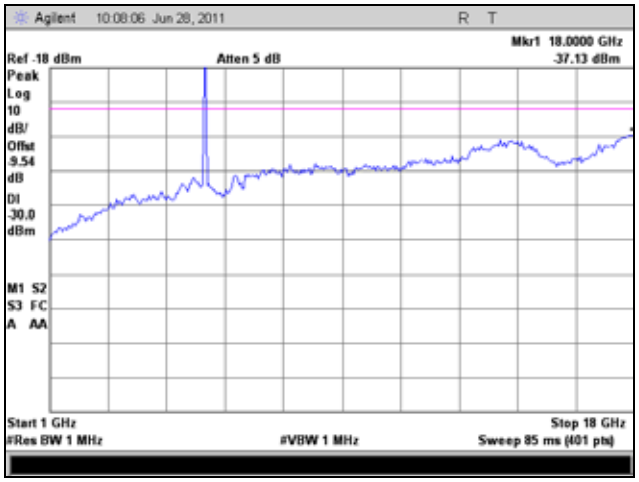


Plot 98. Radiated Spurious Emission, 18 GHz – 26 GHz, 5700 MHz, 802.11n 20 MHz

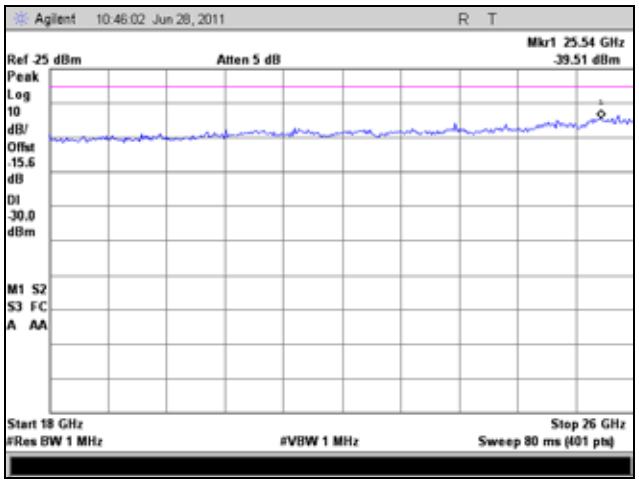
Radiated Spurious Emissions, 802.11n 40 MHz



Plot 99. Radiated Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11n 40 MHz

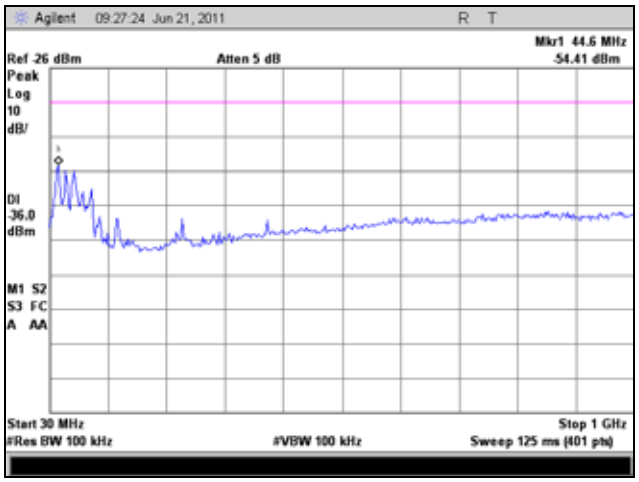


Plot 100. Radiated Spurious Emission, 1 GHz – 18 GHz, 5500 MHz, 802.11n 40 MHz

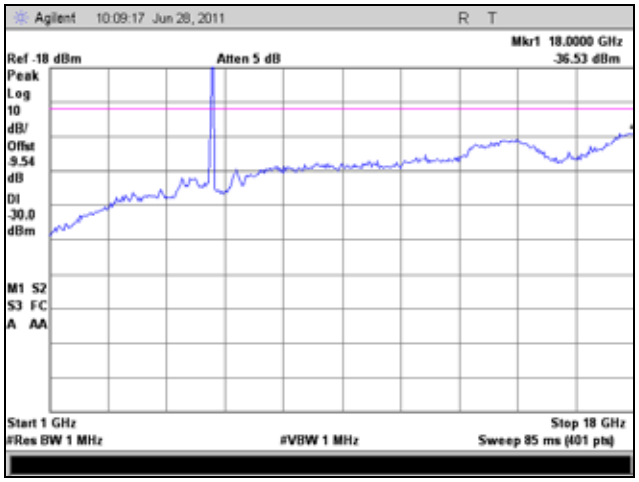


Plot 101. Radiated Spurious Emission, 18 GHz – 26 GHz, 5500 MHz, 802.11n 40 MHz

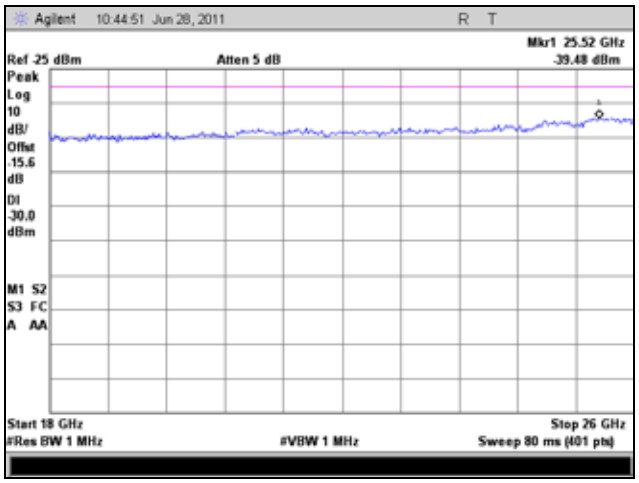
Radiated Spurious Emissions, 802.11n 40 MHz



Plot 102. Radiated Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11n 40 MHz

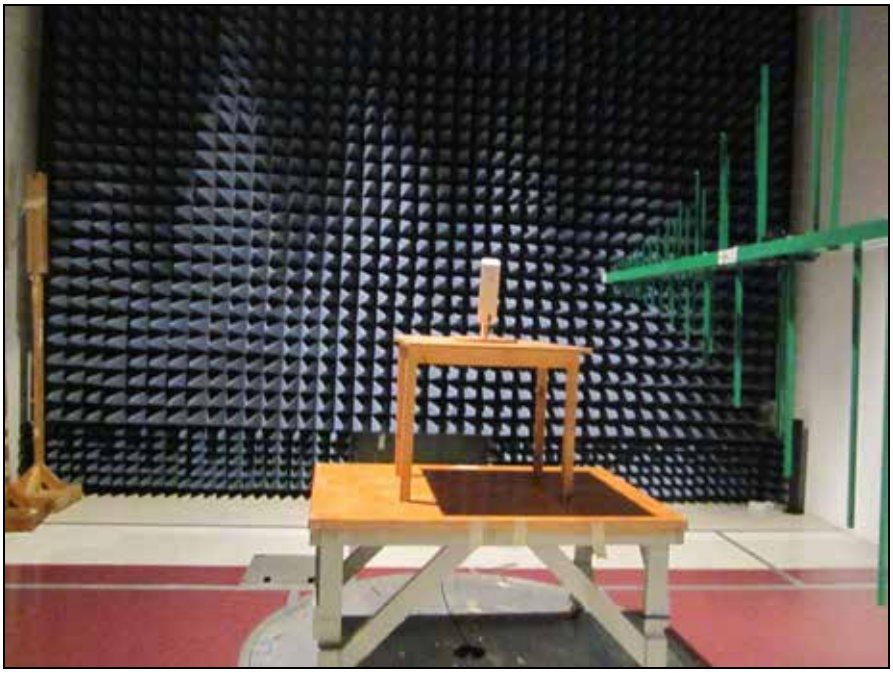


Plot 103. Radiated Spurious Emission, 1 GHz – 18 GHz, 5700 MHz, 802.11n 40 MHz

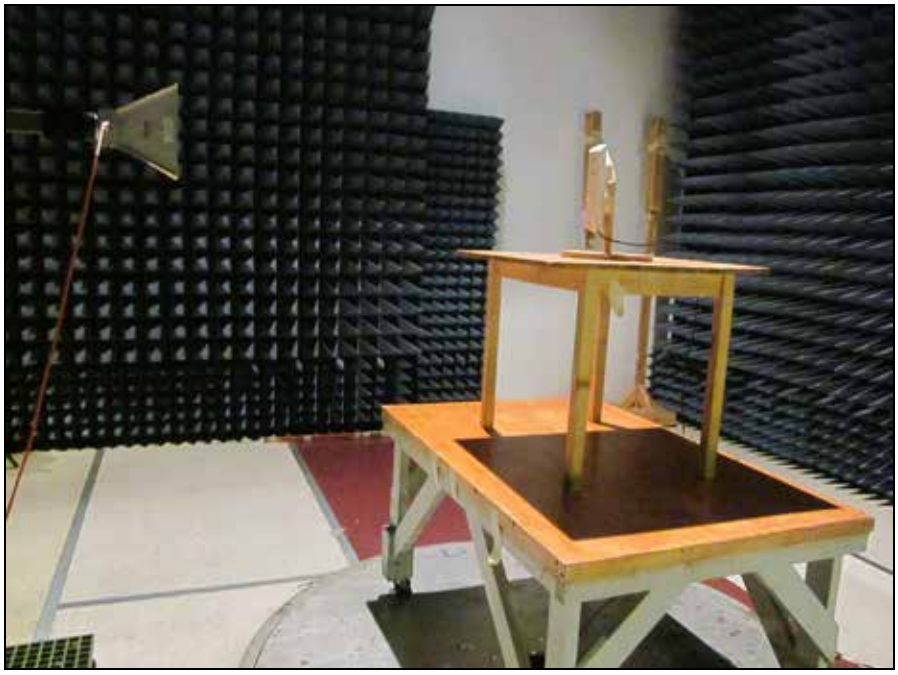


Plot 104. Radiated Spurious Emission, 18 GHz – 26 GHz, 5700 MHz, 802.11n 40 MHz

Radiated Emissions Test Setup Photographs



Photograph 3. Radiated Emissions, Test Setup, 30 MHz – 1 GHz



Photograph 4. Radiated Emissions, Test Setup, 1 GHz – 18 GHz

Photograph 5. Radiated Emissions, Test Setup, 1 GHz – 26.5 GHz

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

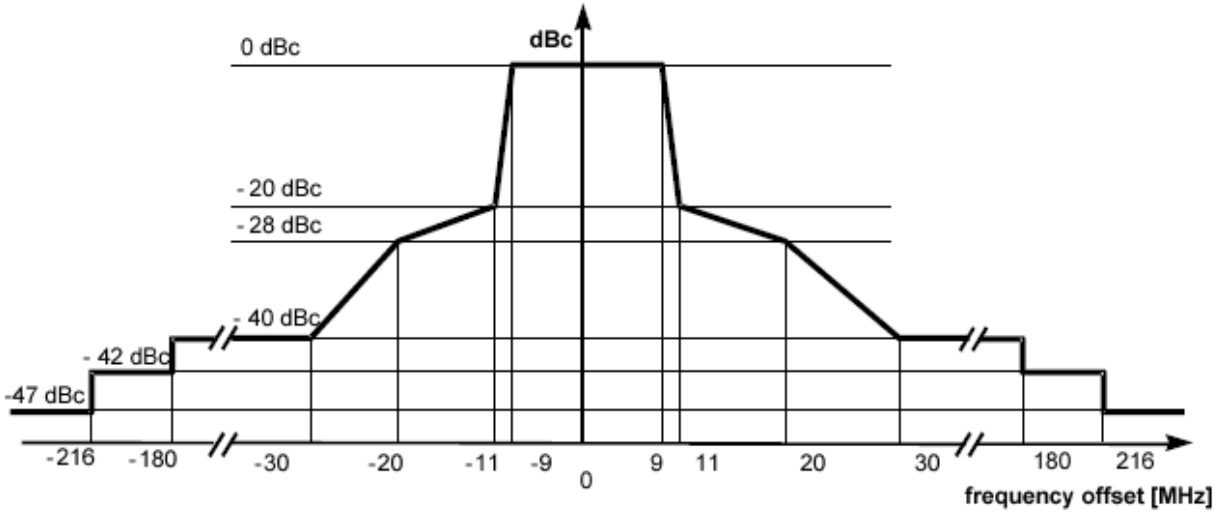
Test Requirement(s): **EN 301 893, Clause 5.3.6:**

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.

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. 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: 01/30/12

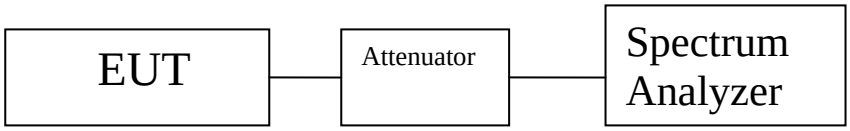
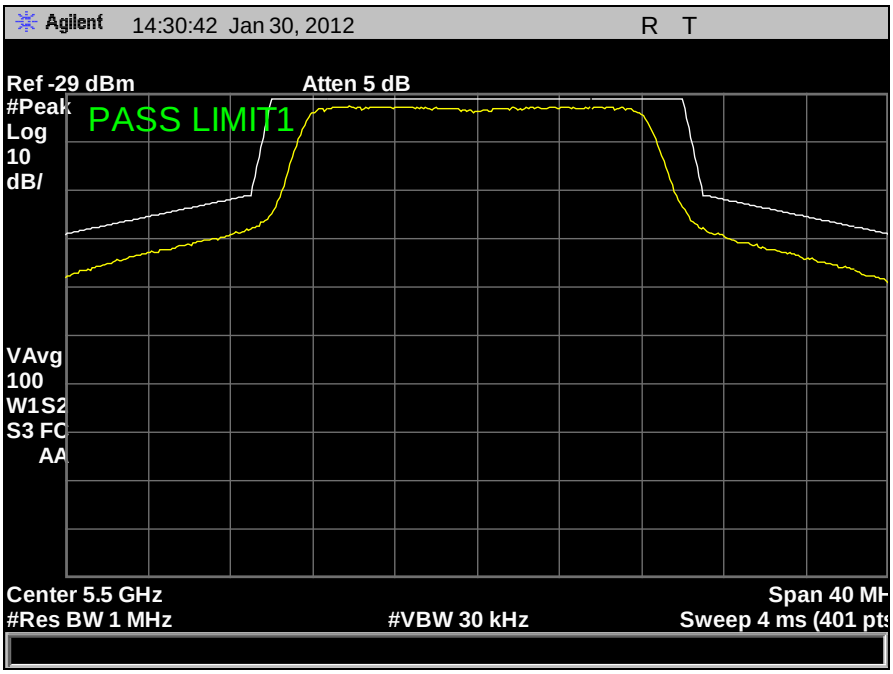
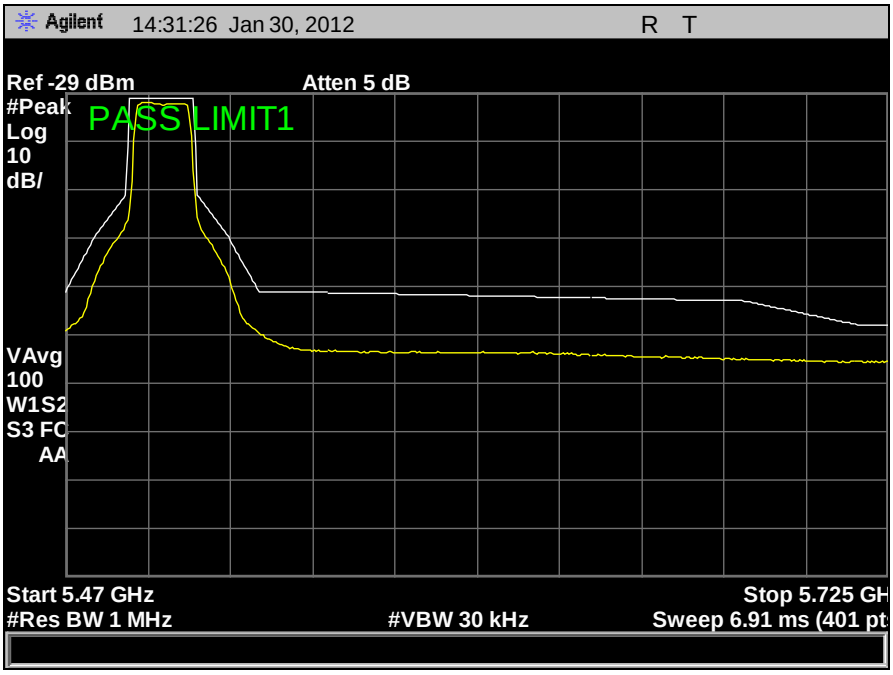


Figure 5. Unwanted Conducted Emissions Within Test Setup

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted), 802.11a 20 MHz

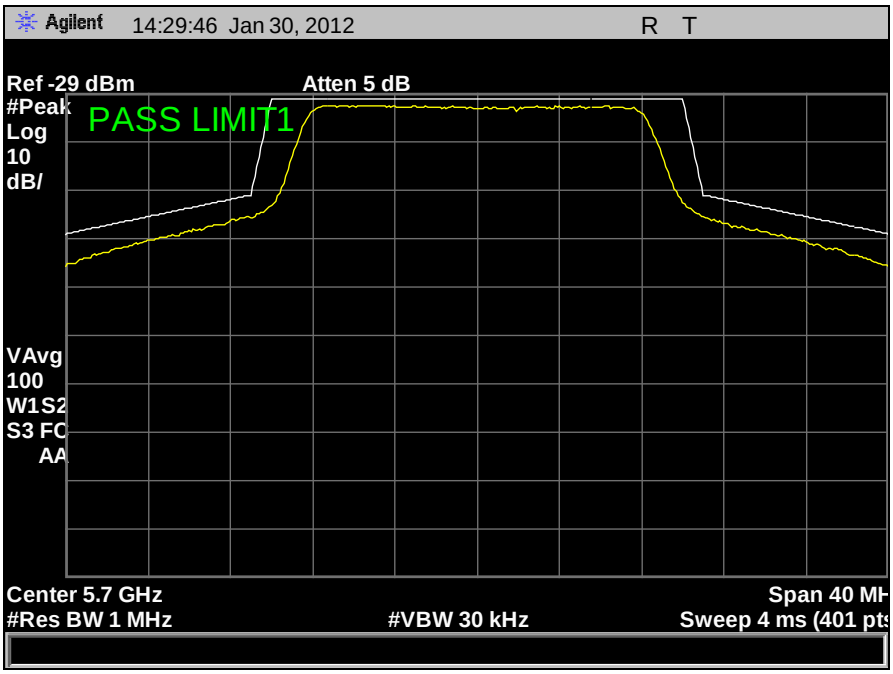


Plot 105. Conducted In Band Spurious Emission, 40 MHz Span, 5500 MHz, 802.11a 20 MHz

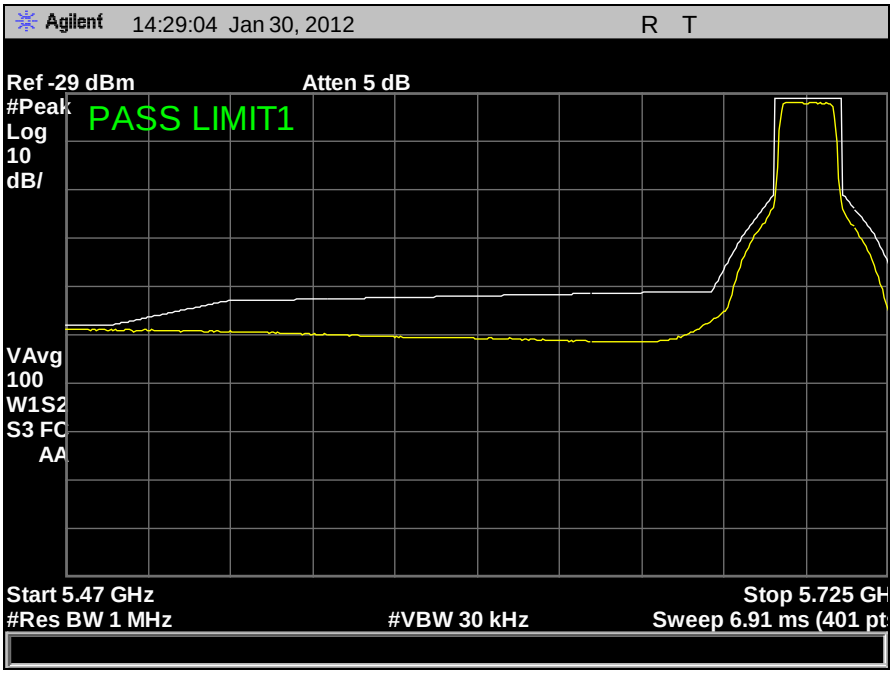


Plot 106. Conducted In Band Spurious Emission, Wide Span, 5500 MHz, 802.11a 20 MHz

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted), 802.11a 20 MHz

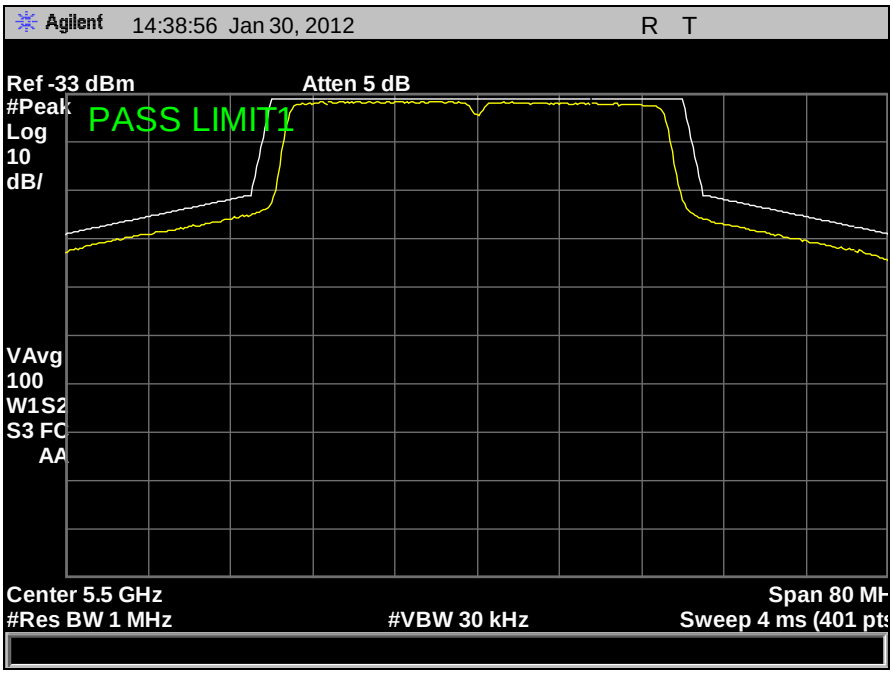


Plot 107. Conducted In Band Spurious Emission, 40 MHz Span, 5700 MHz, 802.11a 20 MHz

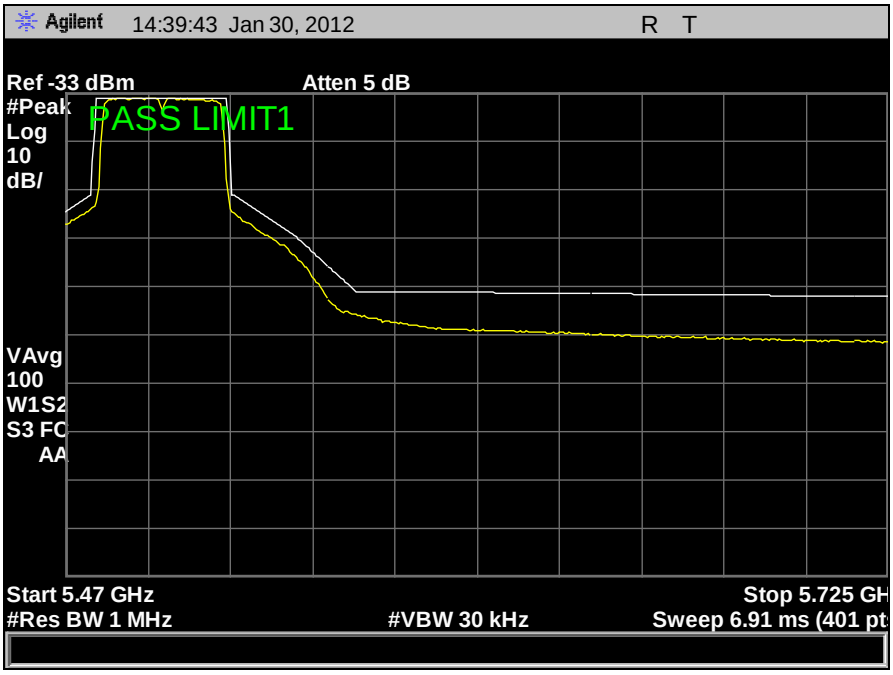


Plot 108. Conducted In Band Spurious Emission, Wide Span, 5700 MHz, 802.11a 20 MHz

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted), 802.11a 40 MHz

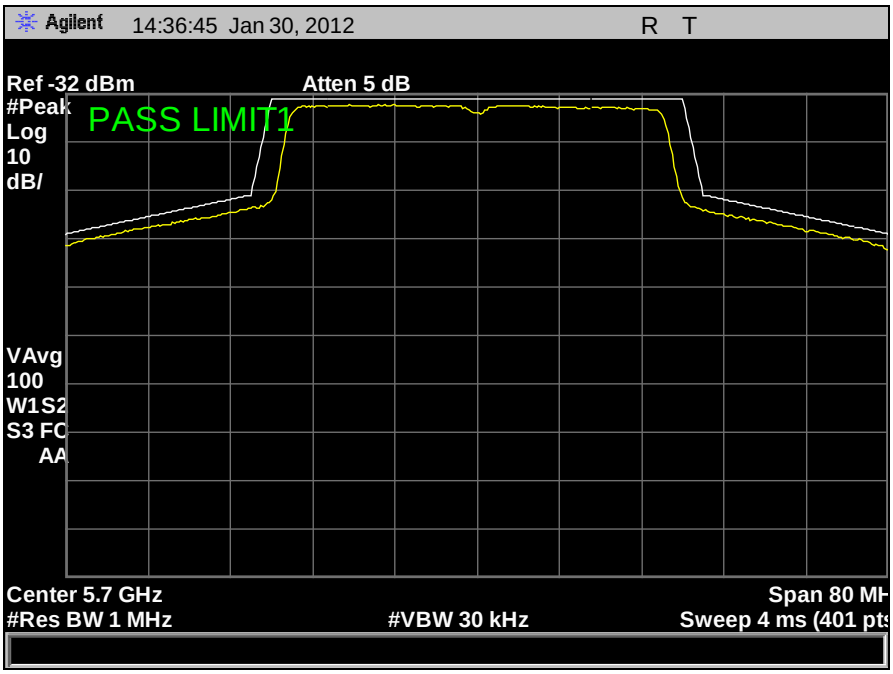


Plot 109. Conducted In Band Spurious Emission, 80 GHz Span, 5500 MHz, 802.11a 40 MHz

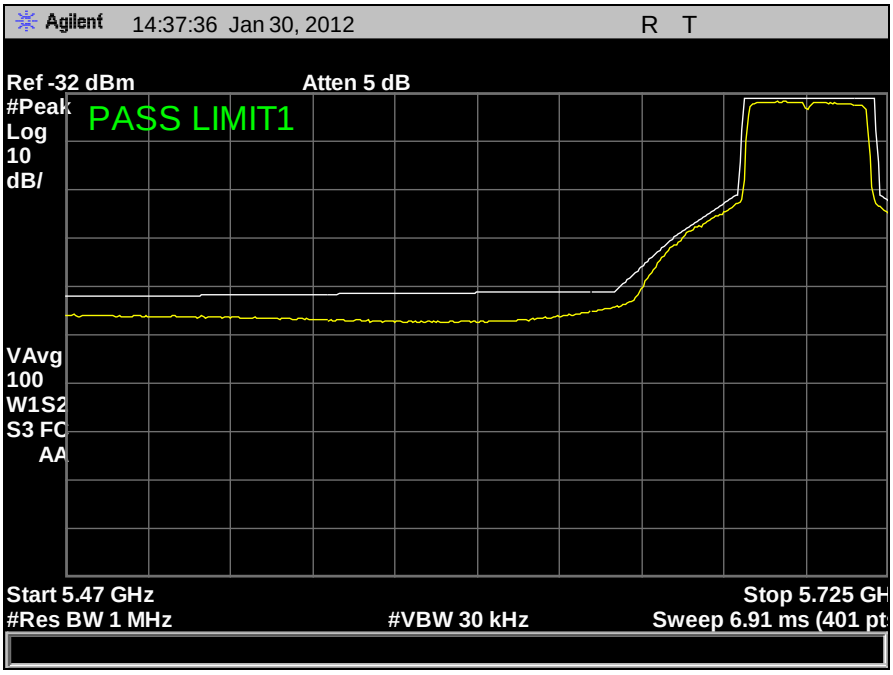


Plot 110. Conducted In Band Spurious Emission, Wide Span, 5500 MHz, 802.11a 40 MHz

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted), 802.11a 40 MHz

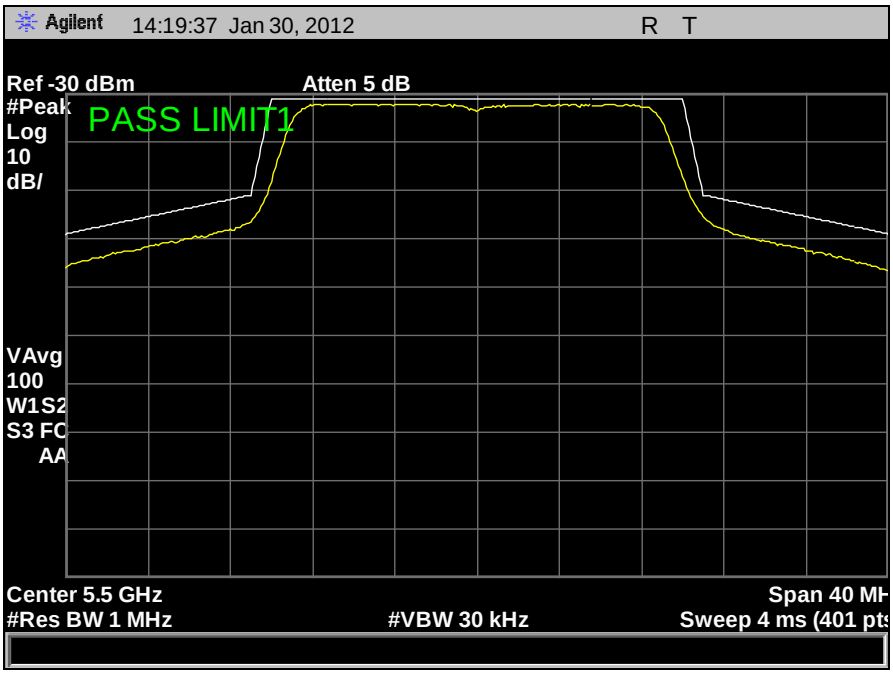


Plot 111. Conducted In Band Spurious Emission, 80 MHz Span, 5700 MHz, 802.11a 40 MHz

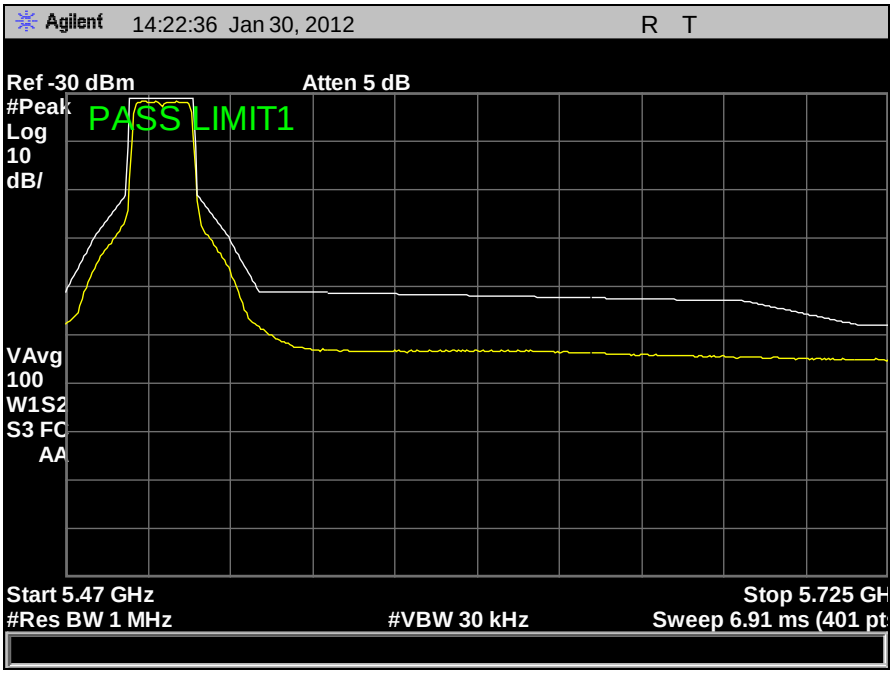


Plot 112. Conducted In Band Spurious Emission, Wide Span, 5700 MHz, 802.11a 40 MHz

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted), 802.11n 20 MHz

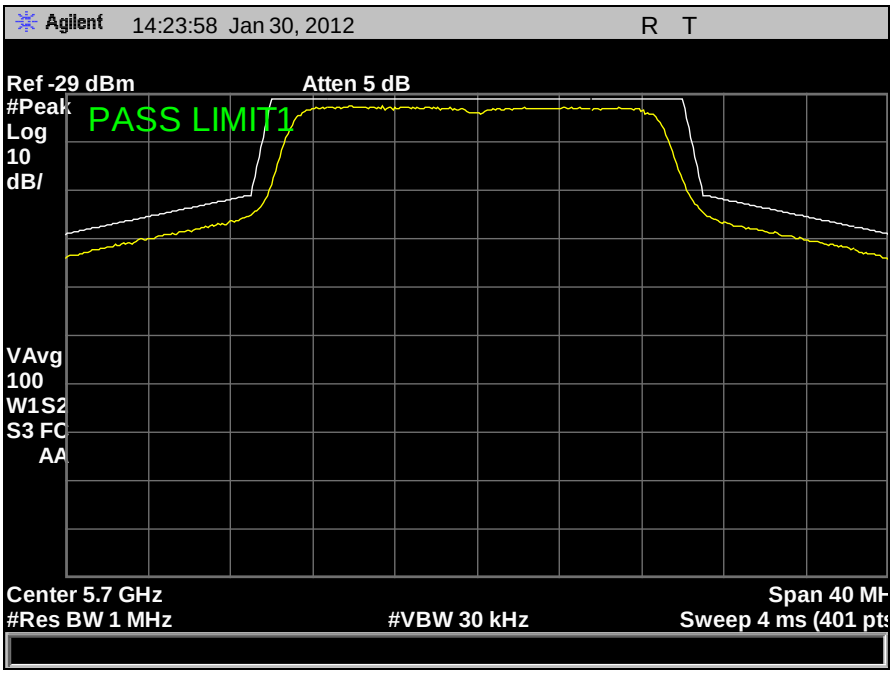


Plot 113. Conducted In Band Spurious Emission, 40 MHz Span, 5500 MHz, 802.11n 20 MHz

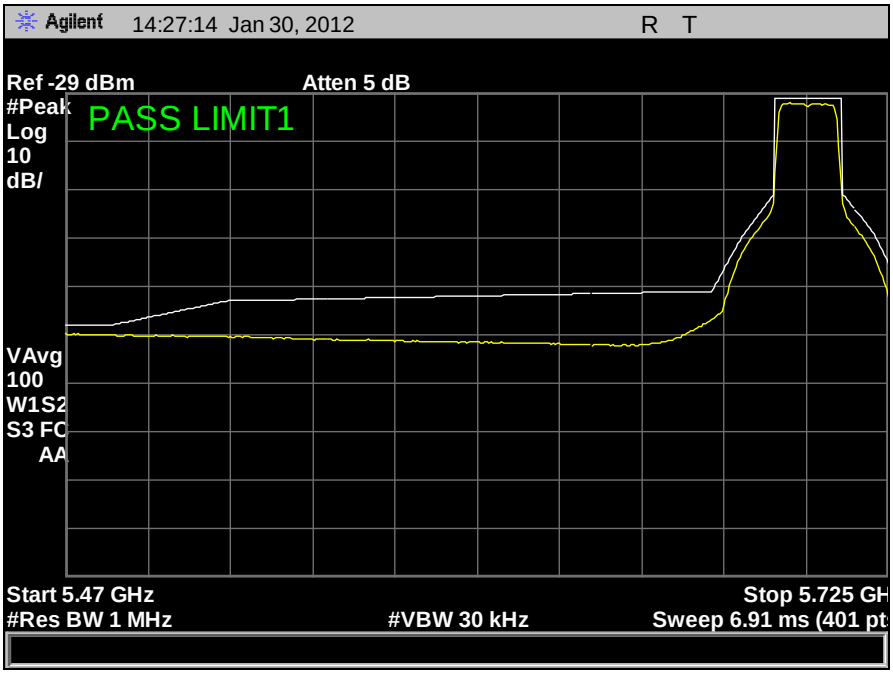


Plot 114. Conducted In Band Spurious Emission, Wide Span, 5500 MHz, 802.11n 20 MHz

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted), 802.11n 20 MHz

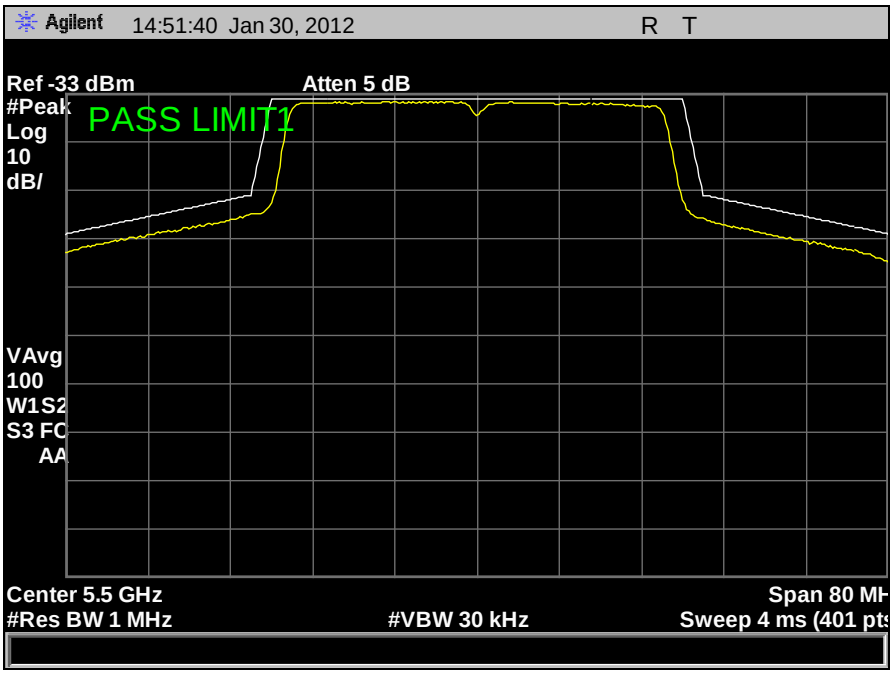


Plot 115. Conducted In Band Spurious Emission, 40 MHz Span, 5700 MHz, 802.11n 20 MHz

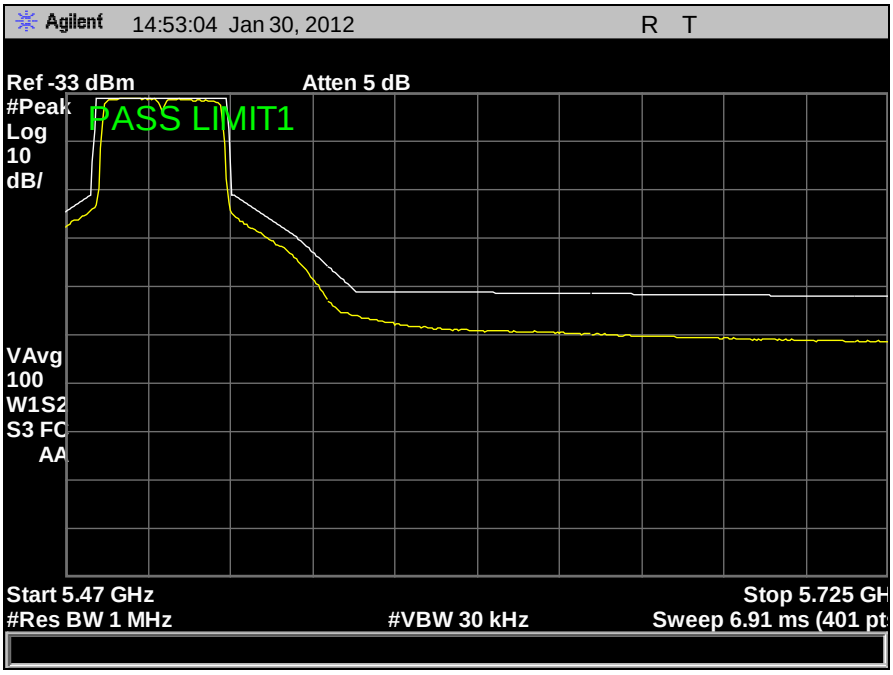


Plot 116. Conducted In Band Spurious Emission, Wide Span, 5700 MHz, 802.11n 20 MHz

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted), 802.11n 40 MHz

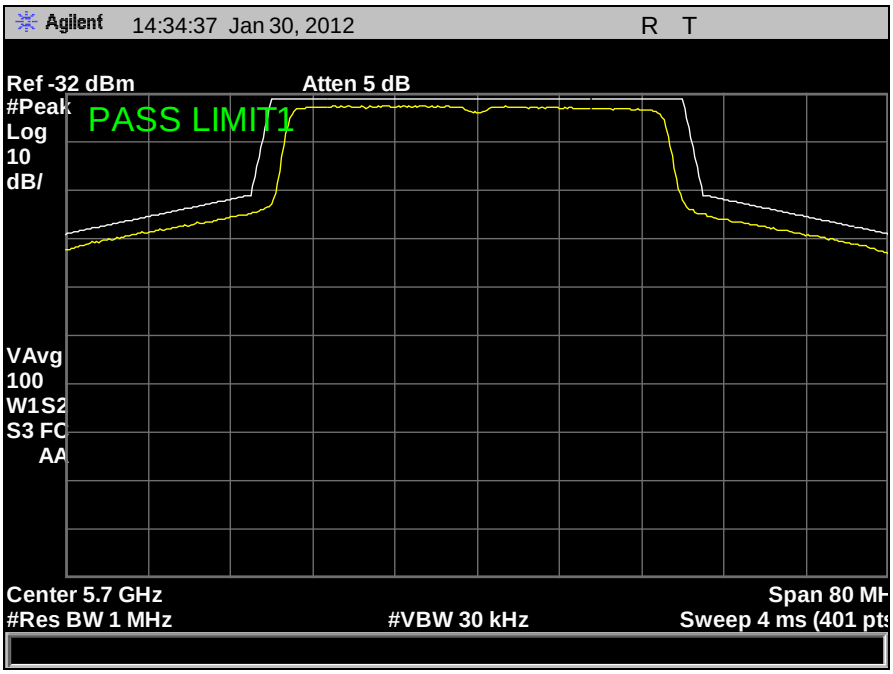


Plot 117. Conducted In Band Spurious Emission, 80 MHz Span, 5500 MHz, 802.11n 40 MHz

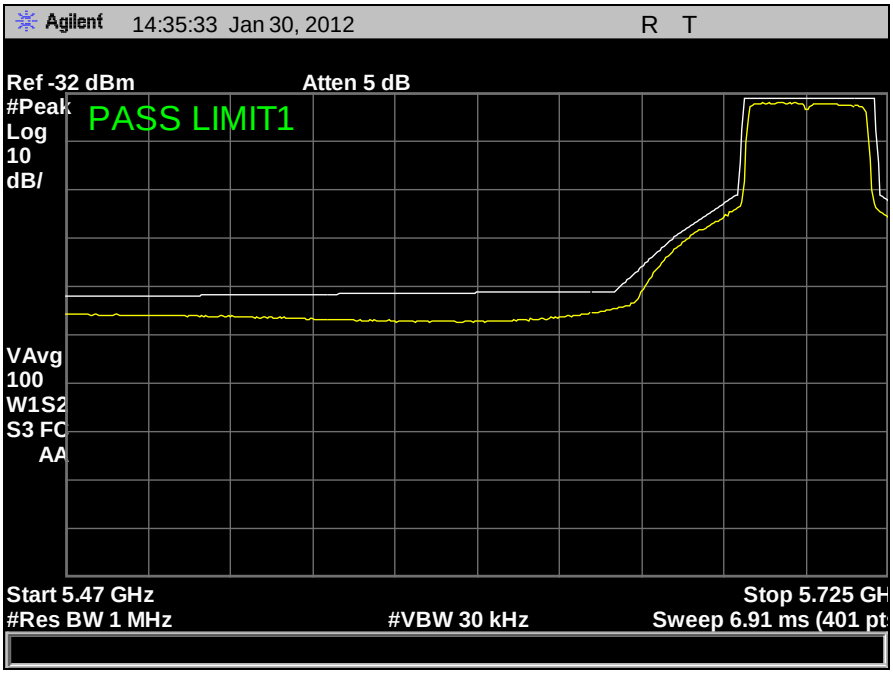


Plot 118. Conducted In Band Spurious Emission, Wide Span, 5500 MHz, 802.11n 40 MHz

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted), 802.11n 40 MHz



Plot 119. Conducted In Band Spurious Emission, 80 MHz Span, 5700 MHz, 802.11n 40 MHz



Plot 120. Conducted In Band Spurious Emission, Wide Span, 5700 MHz, 802.11n 40 MHz

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

Test Requirement(s): **EN 301 893, Clause 3.5.6:**

4.5.2.1 Definition

These are radiated radio frequency emissions within the 5GHz RLAN bands from the cabinet or structure when the EUT is in receive mode.

4.5.2.2 Limit

Frequency Range	Maximum Power, ERP	Measurement Bandwidth
5.470GHz to 5.725GHz	-47 dBm	1MHz

Test Procedure: The EUT was setup as per section 4.4 above for measuring out of band radiated emissions. The spectrum within the 5GHz RLAN band was investigated for spurious emissions. Measurements were carried out in all modulations available.

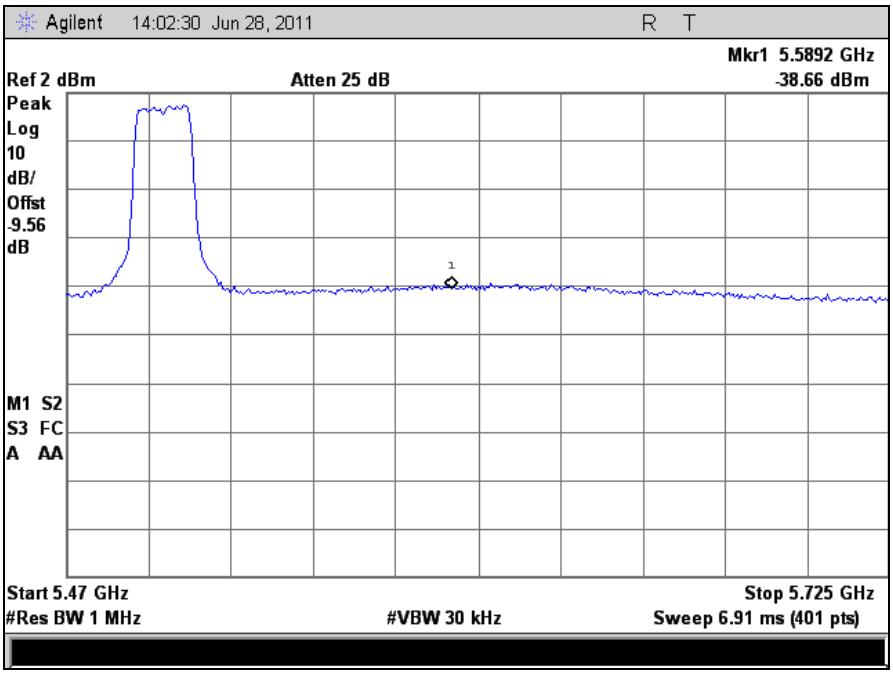
In case of measurements on smart antenna systems (devices with multiple transmit chains) measurements need only to be performed on one of the active transmit chains (antenna outputs).

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

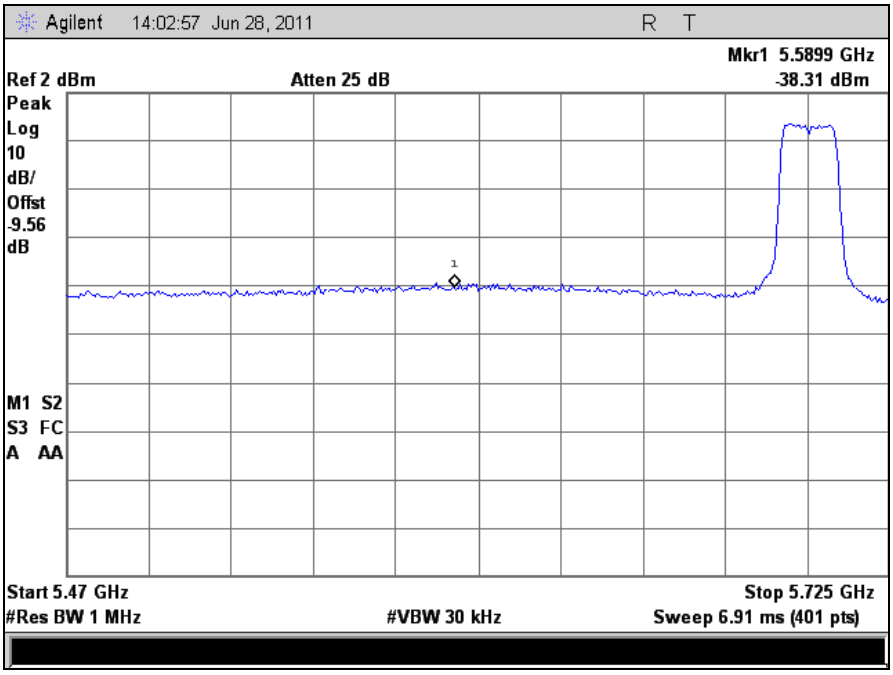
Test Engineer: Anderson Soungpanya

Test Date: 01/30/12

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Radiated), 802.11a 20 MHz

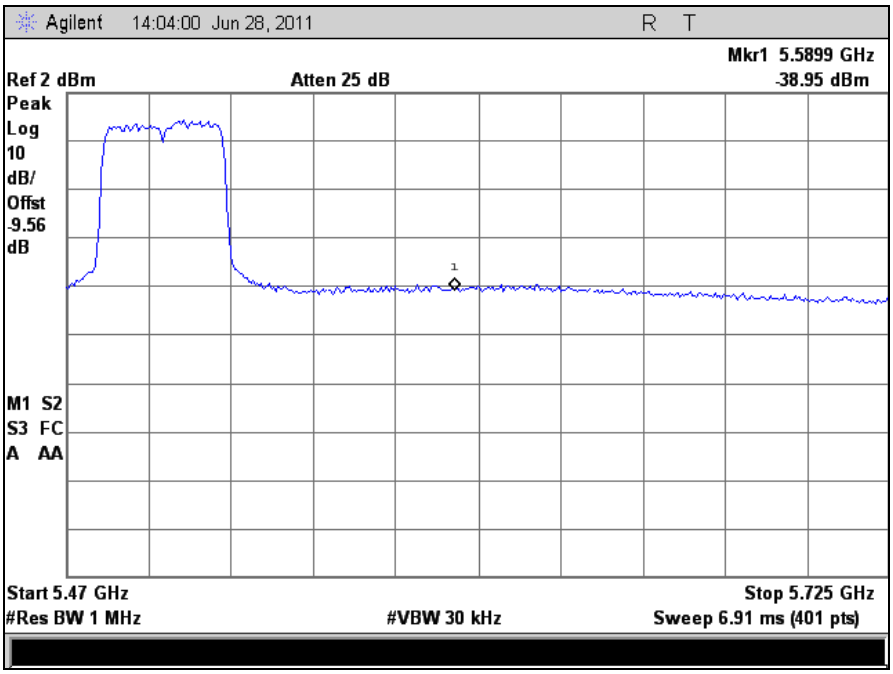


Plot 121. Radiated In Band Spurious Emission, 5500 MHz, 802.11a 20 MHz

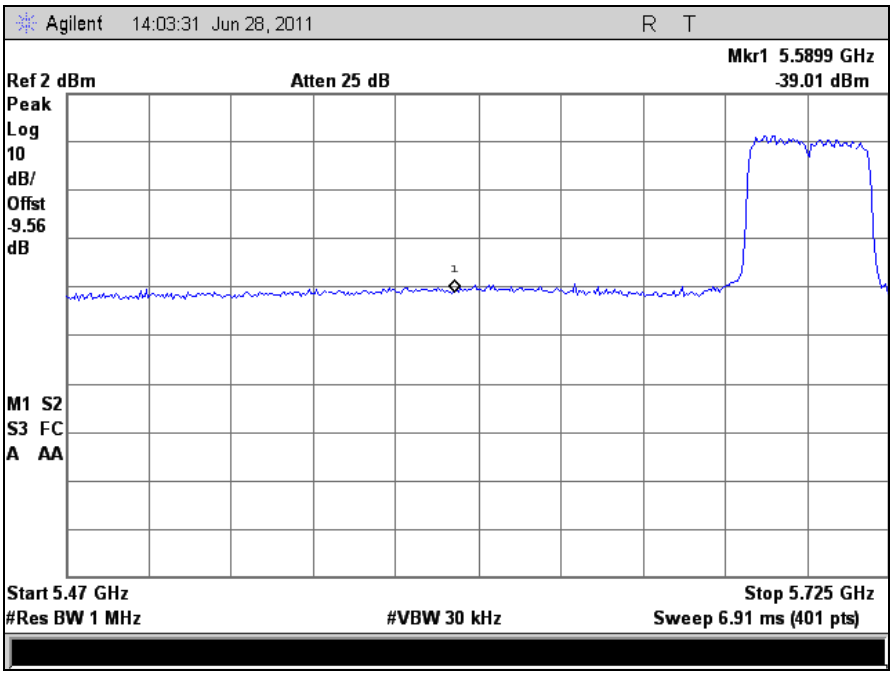


Plot 122. Radiated In Band Spurious Emission, 5700 MHz, 802.11a 20 MHz

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Radiated), 802.11a 40 MHz

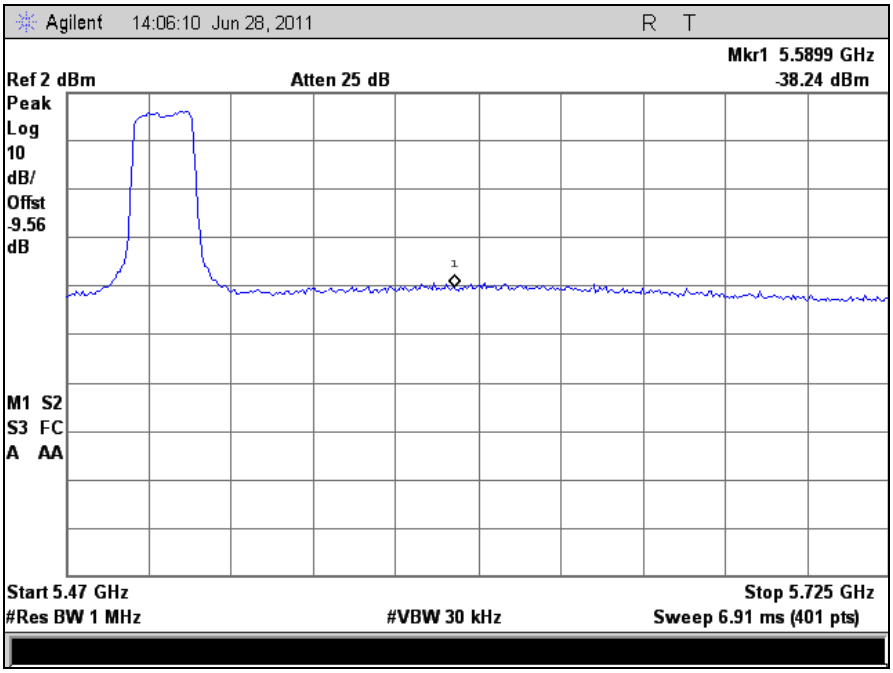


Plot 123. Radiated In Band Spurious Emission, 5500 MHz, 802.11a 40 MHz

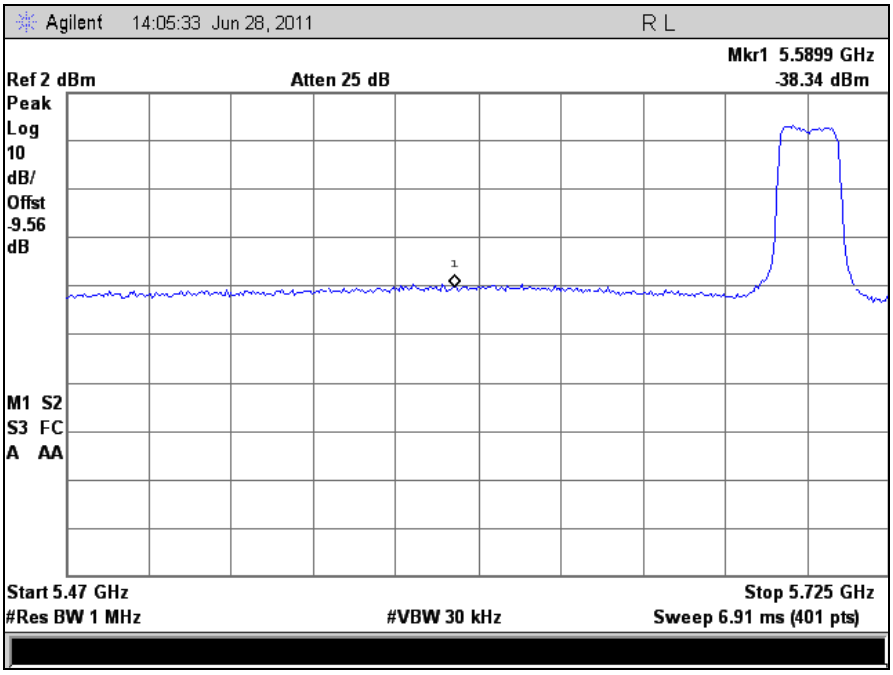


Plot 124. Radiated In Band Spurious Emission, 5700 MHz, 802.11a 40 MHz

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Radiated), 802.11n 20 MHz

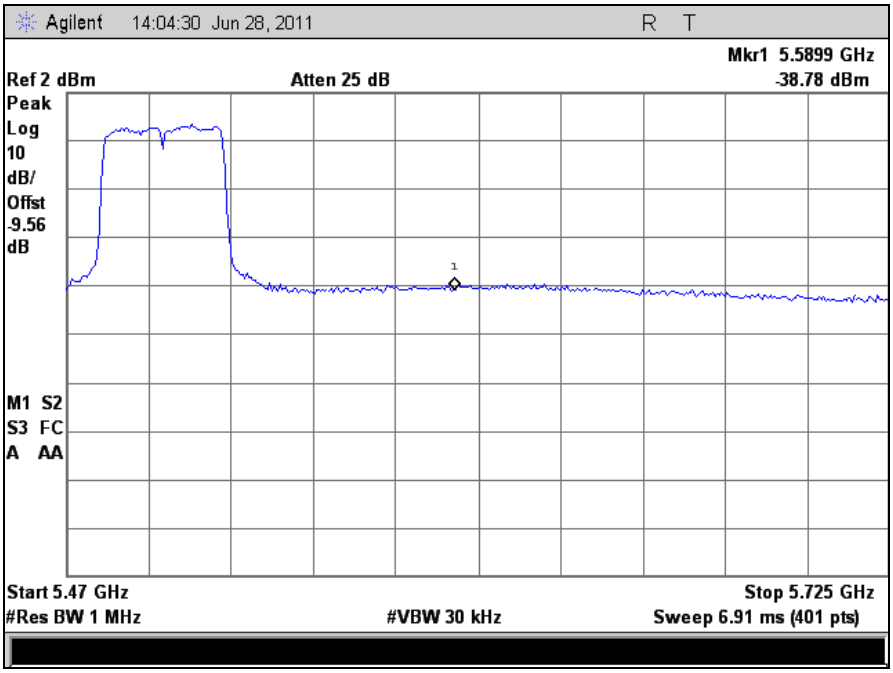


Plot 125. Radiated In Band Spurious Emission, 5500 MHz, 802.11n 20 MHz

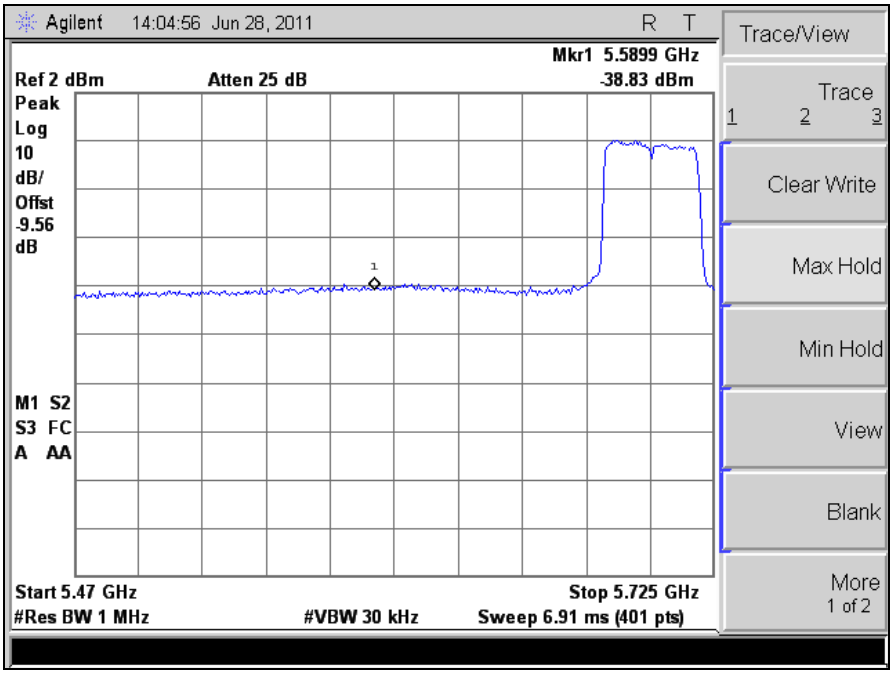


Plot 126. Radiated In Band Spurious Emission, 5700 MHz, 802.11n 20 MHz

Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Radiated), 802.11n 40 MHz



Plot 127. Radiated In Band Spurious Emission, 5500 MHz, 802.11n 40 MHz



Plot 128. Radiated In Band Spurious Emission, 5700 MHz, 802.11n 40 MHz

4.6 Receiver Spurious Emissions (Conducted)

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: Two EUTs were setup to communicate with each other. A test transmission sequence as shown below was used to send data between the two units. A directional coupler was used to isolate the emission measurements from the test data signal while the EUT received test data. The spectrum analyzer was initially set with a RBW of 1MHz or 100 kHz and a VBW of 1MHZ using video averaging or peak hold. The Frequency was scanned from 30 MHz to 26.5 GHz.

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

Test Engineer: Anderson Soungpanya

Test Date: 6/28/11

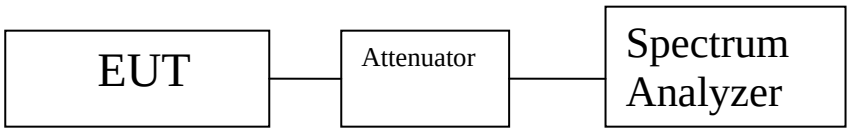
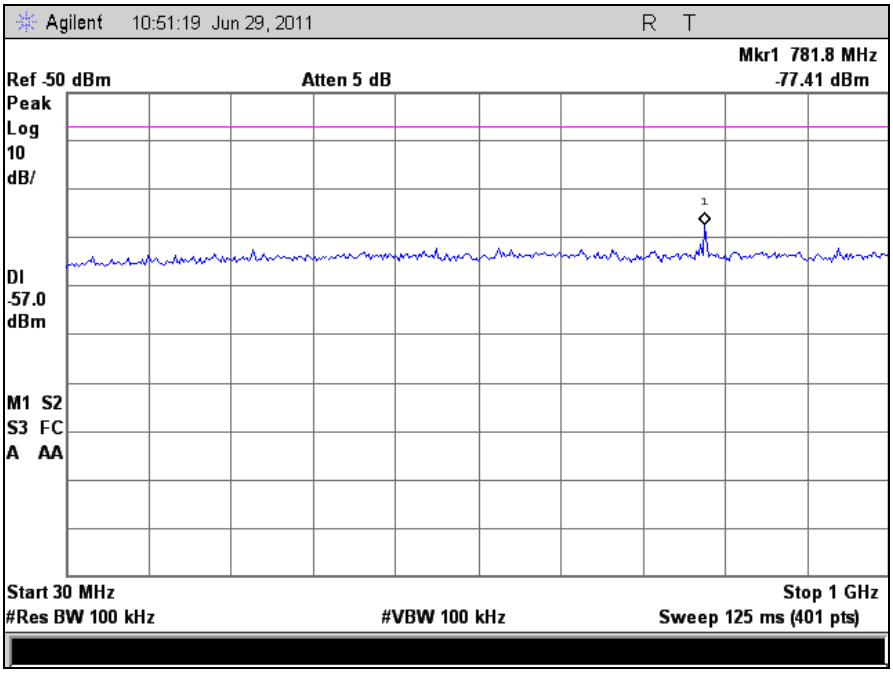
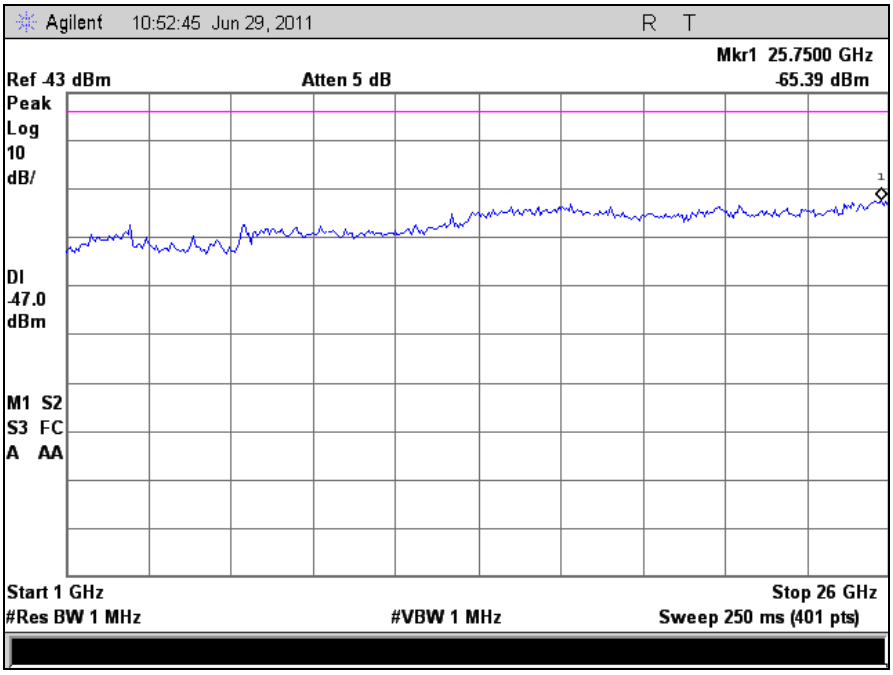


Figure 6. Receiver Spurious Emissions Test Setup

Receiver Spurious Emissions (Conducted), Port 1

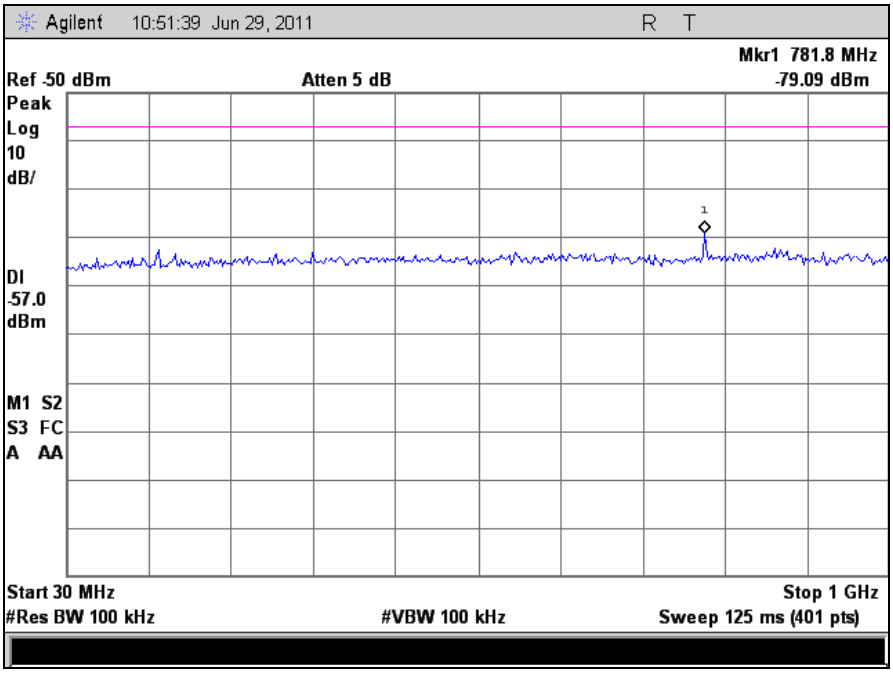


Plot 129. Conducted Receiver Spurious Emission, 30 MHz – 1 GHz, Port 1

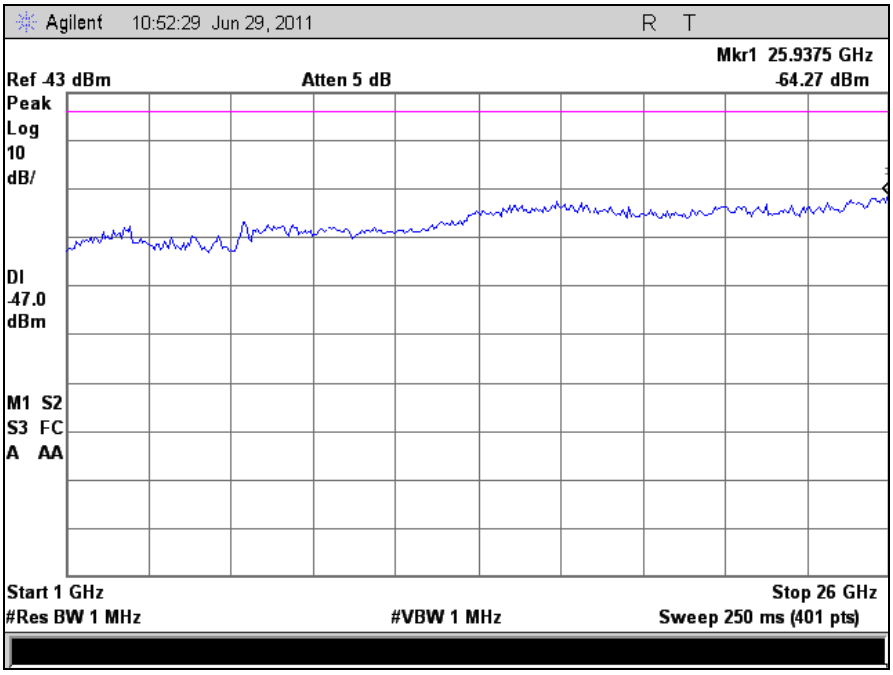


Plot 130. Conducted Receiver Spurious Emission, 1 GHz – 26 GHz, Port 1

Receiver Spurious Emissions (Conducted), Port 2



Plot 131. Conducted Receiver Spurious Emission, 30 MHz – 1 GHz, Port 2



Plot 132. Conducted Receiver Spurious Emission, 1 GHz – 26 GHz, Port 2

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.

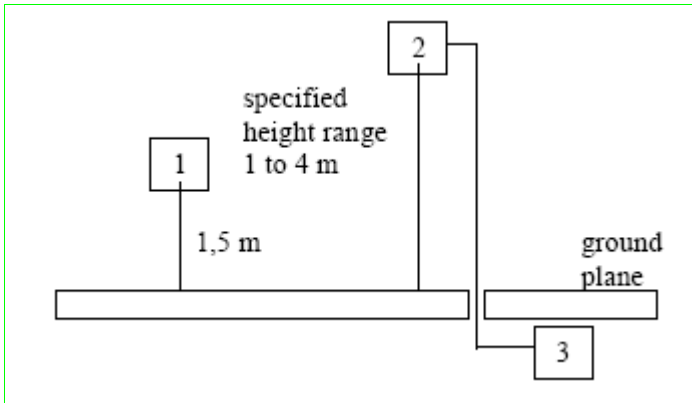
Frequency Range	Maximum Power, ERP	Measurement Bandwidth
30 MHz to 1 GHz	-57 dBm	100KHz
above 1 GHz to 26.5 GHz	-47 dBm	1MHz

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

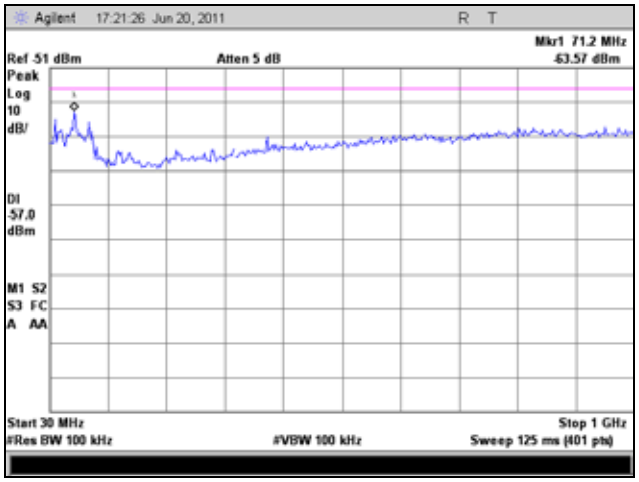
Test Date: 6/28/11



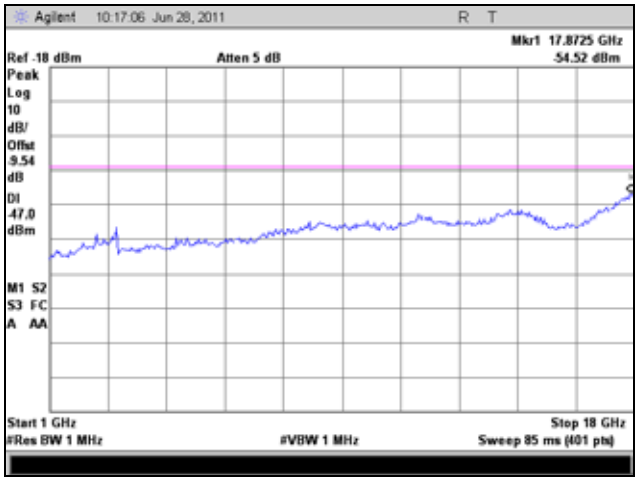
1. Equipment Under Test
2. Test Antenna
3. Spectrum Analyzer

Figure 7. Receiver Spurious Emissions Test Setup

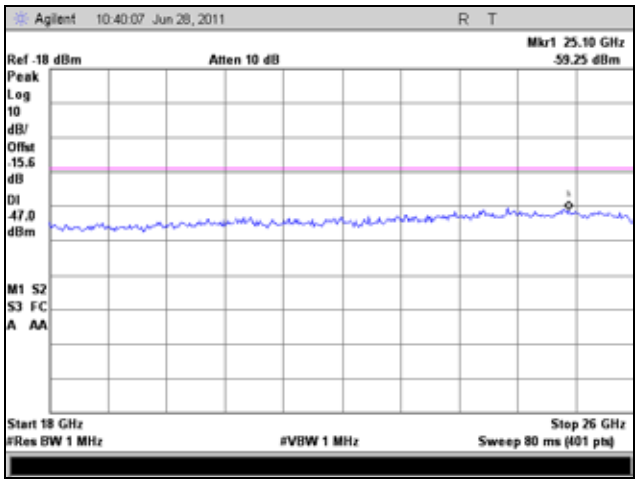
Receiver Spurious Emissions (Radiated)



Plot 133 Radiated Receiver Spurious Emission, 30 MHz - 1 GHz



Plot 134. Radiated Receiver Spurious Emission, 1 GHz - 18 GHz



Plot 135. Radiated Receiver Spurious Emission, 18 GHz – 26 GHz

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: 03/23/11

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: 03/23/11

IV. Test Equipment

Test Equipment

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

MET Asset #	EQUIPMENT	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2603	HORN ANTENNA	ETS-LINDGREN	3117	5/9/2011	5/9/2012
1S2202	HORN ANTENNA	EMCO	3116	4/23/2010	4/23/2013
1S2583	ANALYZER, SPECTRUM	AGILENT	E4447A	03/18/2011	03/18/2012
1S2460	ANALYZER, SPECTRUM	AGILENT	E4407B	07/12/2011	07/12/2012
1S2482	CHAMBER, 5 METER	PANASHIELD	641431	11/22/2011	11/22/2012
1S2399	TURNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	SEE NOTE	
1S2498	VARIABLE POWER SUPPLY	ISE., INC	5021CT-DVAM	SEE NOTE	
1S2229	TEMPERATURE CHAMBER	TENNY	T6	02/18/2011	02/18/2012
1S2484	BILOG ANTENNA	TESEQ	CBL6112D	2/27/2011	2/27/2012

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

End of Report

