MET Laboratories, Inc. *Safety Certification - EMI – Telecom Environmental Simulation*
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November 30, 2011

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, NanoStationLocoM5 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\EMCS82946-ETS893)

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Electromagnetic Compatibility Criteria Test Report

For the

Ubiquiti Networks
Model NanoStationLocoM5

Tested under

ETSI EN 301 893

(Article 3.2 of R&TTE Directive)

MET Report: EMCS82946-ETS893

November 30, 2011

Prepared For:

Ubiquiti Networks
91 E. Tasman
San Jose, CA 95134

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

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MET Report: EMCS82946-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
∅	November 30, 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	**Deci****b**els
dBµA	**Deci****b**els above one **micro**amp
dBµV	**Deci****b**els above one **micro**volt
dBµA/m	**Deci****b**els above one **micro**amp **per** **m**eter
dBµV/m	**Deci****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**Farad
µs	**micro****s**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
Sections 4.7	Dynamic Frequency Selection (DFS)	
4.7	DFS Calibration	Compliant
	DFS Bandwidth	Compliant
4.7.2.1	Channel Availability Check	Compliant
4.7.2.2	Off Channel CAC	Not Applicable – EUT doesn't employ off channel radar.
4.7.2.4	Channel Shutdown	Compliant
4.7.2.5	Non-Occupancy Period	Compliant
4.7.2.6	Uniform Spreading	Compliant
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

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Ubiquiti Networks to perform testing on a NanoStationLocoM5.

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 NanoStationLocoM5.

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

Model(s) Tested:	NanoStationLocoM5
Model(s) Number:	NanoStationLocoM5
EUT Specifications:	Primary Power: 230 VAC, 50 Hz
	Secondary Power: 24VDC
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):	November 30, 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

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 NanoStationLocoM5, Equipment Under Test (EUT), is a 5GHz Hi Power 2x2 MIMO.

Photograph 1. Ubiquiti Networks NanoStationLocoM5

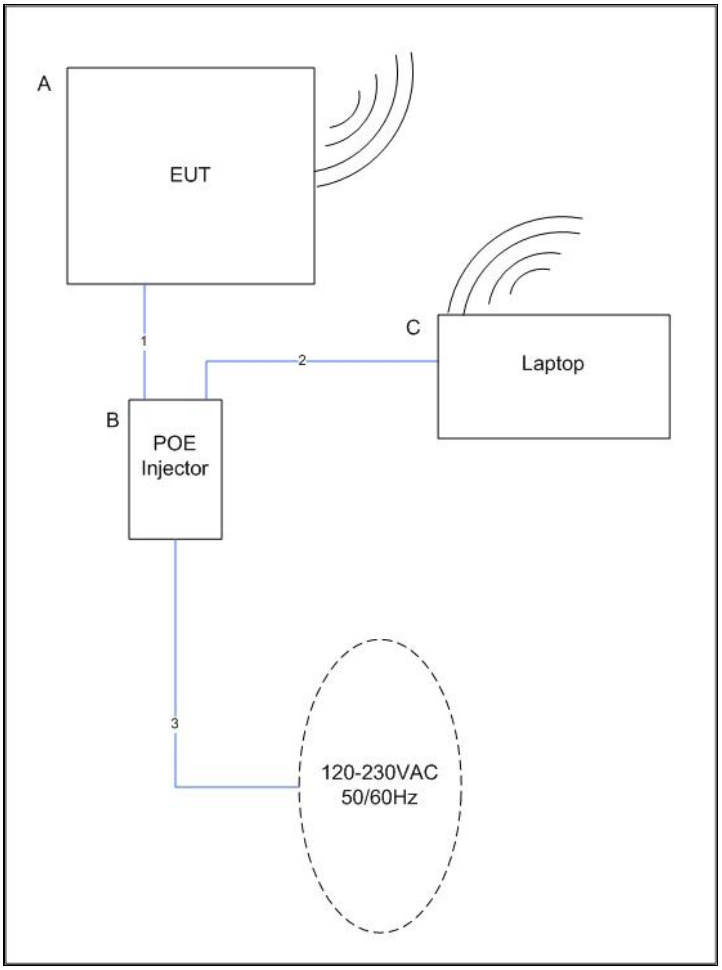


Figure 1. Block Diagram of Test Configuration

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	LocoM5 (Conducted Sample)	M5L	M0B10PSH
A	LocoM5 (Radiated Sample)	M5L	M0B408D8
B	Power Supply	UBI-POE-24-5	0912-0009854
B	Power Supply	CPWA240500US	POEZC101126181008

Table 3. Equipment Configuration

F. Support Equipment

Ubiquiti Networks supplied support equipment necessary for the operation and testing of the NanoStationLocoM5. 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	LocoM5 - Main	Ethernet	1	10	Y	PSU – POE port
1	PSU - POE	Ethernet	1	10	Y	LocoM5 - 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: 03/18/11 – 03/21/11

(5500 0MHz)				
	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
Reference @ 230VAC 20C	207	-30	5499.983844	4.074
	230	-30	5499.983384	3.990
	253	-30	5499.983512	4.013
	207	20	5499.960605	0.152
	230	20	5499.961439	0.000
5499.961439	253	20	5499.962697	0.229
	207	70	5500.041616	14.578
	230	70	5500.041075	14.479
	253	70	5500.041094	14.483
(5700 MHz)				
	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
Reference @ 230VAC 20C	207	-30	5699.986176	4.725
	230	-30	5699.985803	4.660
	253	-30	5699.985531	4.612
	207	20	5699.960515	0.223
	230	20	5699.959242	0.000
5699.959242	253	20	5699.958909	0.058
	207	70	5700.044185	14.902
	230	70	5700.043997	14.869
	253	70	5700.044418	14.943

Table 6. Carrier Frequency, Test Results, Port 1

(5500 0MHz)				
	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
Reference @ 230VAC 20C	207	-30	5499.982426	3.816
	230	-30	5499.981149	3.584
	253	-30	5499.981991	3.737
	207	20	5499.958891	0.463
	230	20	5499.959057	0.000
5499.959057	253	20	5499.959242	0.399
	207	70	5500.032237	12.872
	230	70	5500.031685	12.772
	253	70	5500.031895	12.810
(5700 MHz)				
	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
Reference @ 230VAC 20C	207	-30	5699.987172	4.900
	230	-30	5699.983045	4.176
	253	-30	5699.982725	4.120
	207	20	5699.956482	0.484
	230	20	5699.956437	0.000
5699.956437	253	20	5699.956503	0.481
	207	70	5700.033655	13.055
	230	70	5700.033459	13.021
	253	70	5700.034159	13.143

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: Lionel Gabrillo

Test Date: 03/09/11

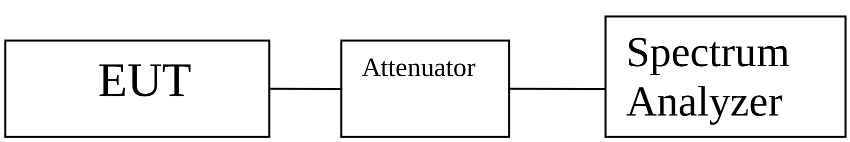


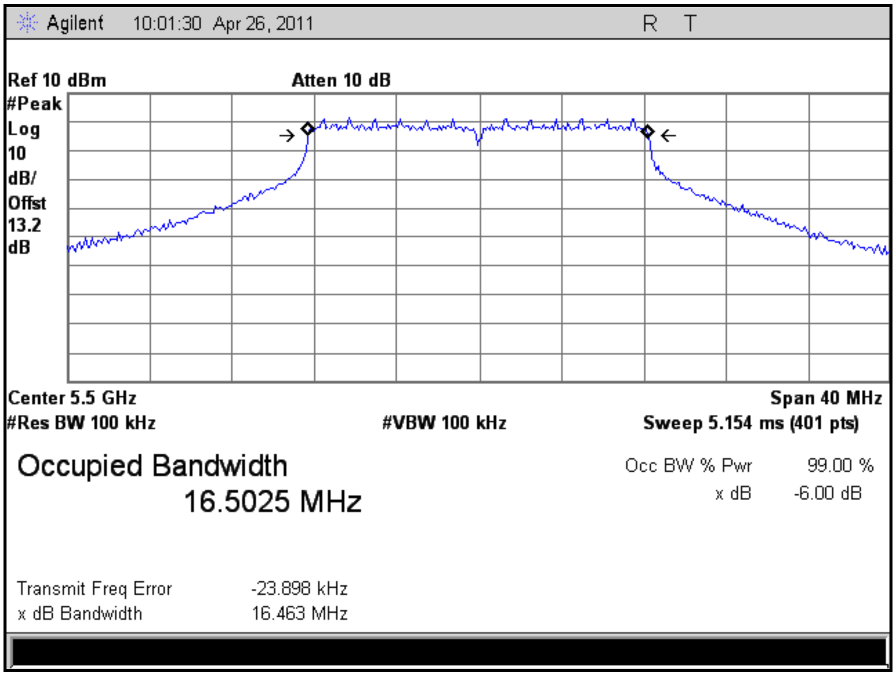
Figure 2. Occupied Bandwidth Test Setup

Occupied Bandwidth 802.11a			
Channel (MHz)		Mode OFDM	Occupied Bandwidth – Port 1 (MHz)
5500	Low	802.11a 20MHz	16.5025
5700	High	802.11a 20MHz	16.5119
5500	Low	802.11a 40MHz	36.2291
5700	High	802.11a 40MHz	36.2393

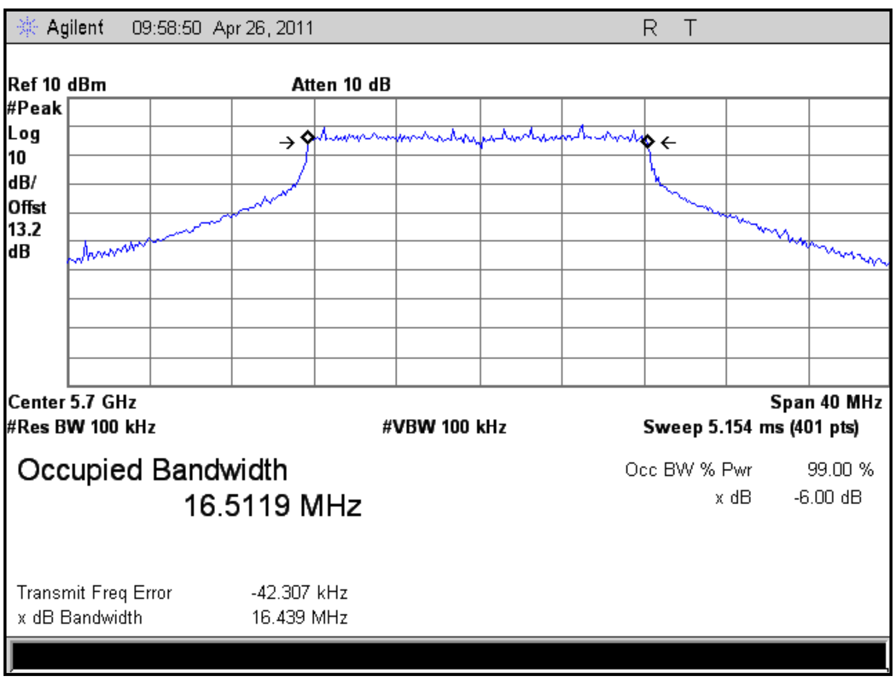
Occupied Bandwidth 802.11n				
Channel (MHz)		Mode OFDM	Occupied Bandwidth Port 1 (MHz)	Occupied Bandwidth Port 2 (MHz)
5500	Low	802.11n 20MHz	17.7706	17.7399
5700	High	802.11n 20MHz	17.7500	17.7681
5500	Low	802.11n 40MHz	36.2291	36.2401
5700	High	802.11n 40MHz	36.2393	36.2845

Table 8. Occupied Bandwidth, Test Results

Occupied Bandwidth, 802.11a 20 MHz

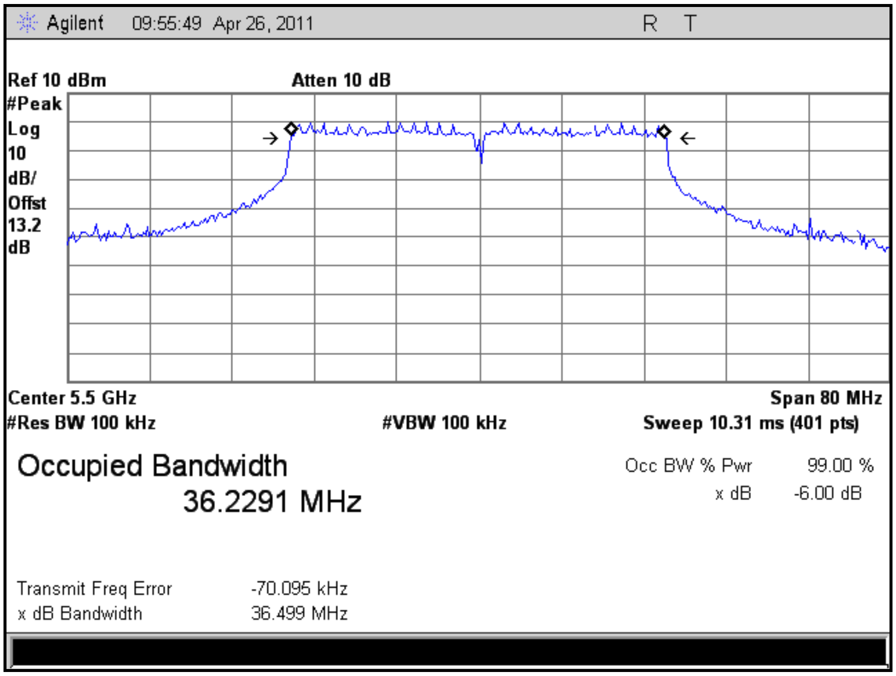


Plot 1. Occupied Bandwidth, 5500 MHz, 802.11a 20 MHz

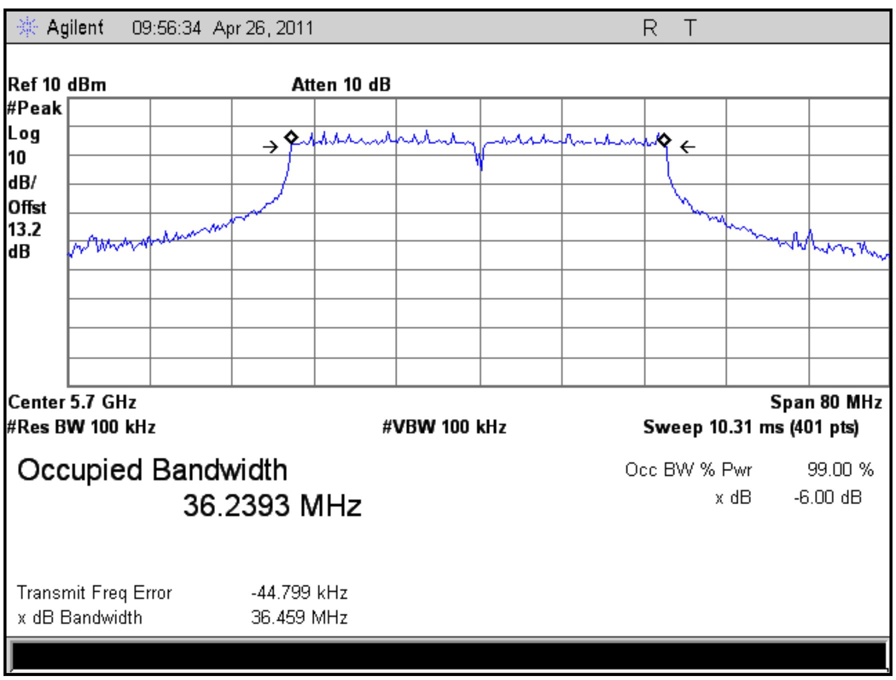


Plot 2. Occupied Bandwidth, 5700 MHz, 802.11a 20 MHz

Occupied Bandwidth, 802.11a 40 MHz

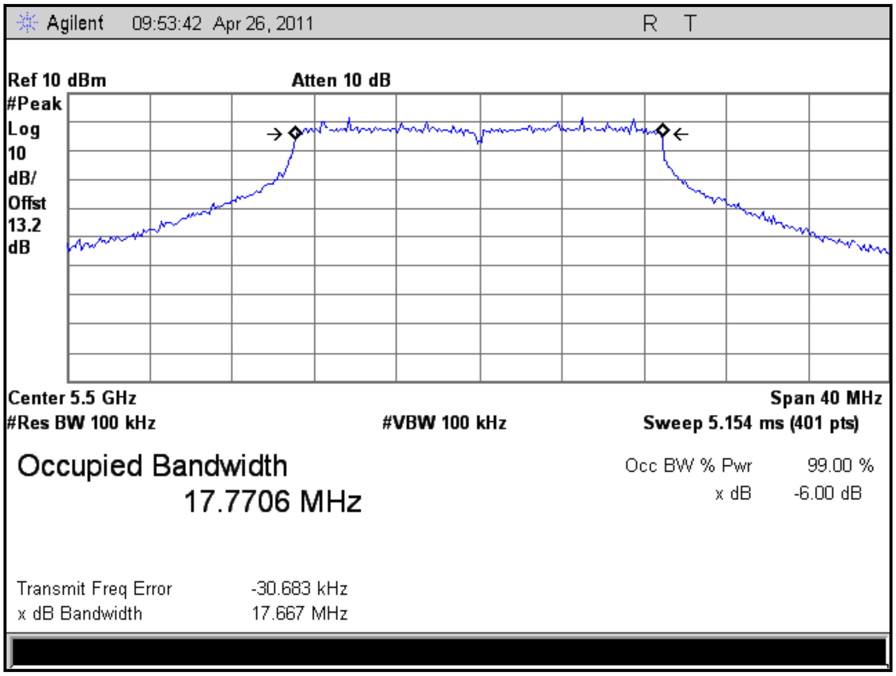


Plot 3. Occupied Bandwidth, 5500 MHz, 802.11a 40 MHz

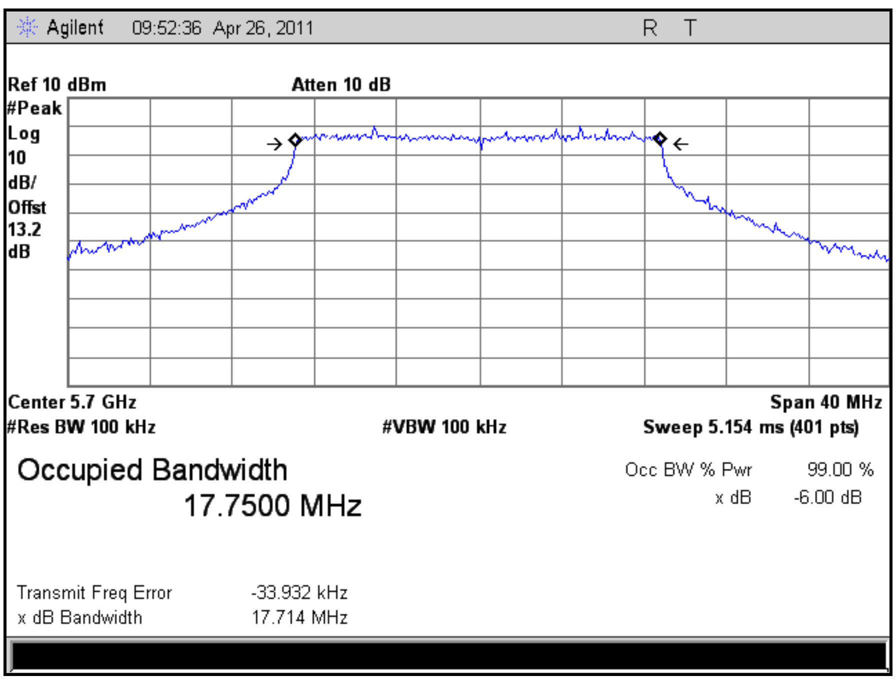


Plot 4. Occupied Bandwidth, 5700 MHz, 802.11a 40 MHz

Occupied Bandwidth, 802.11n 20 MHz, Port 1

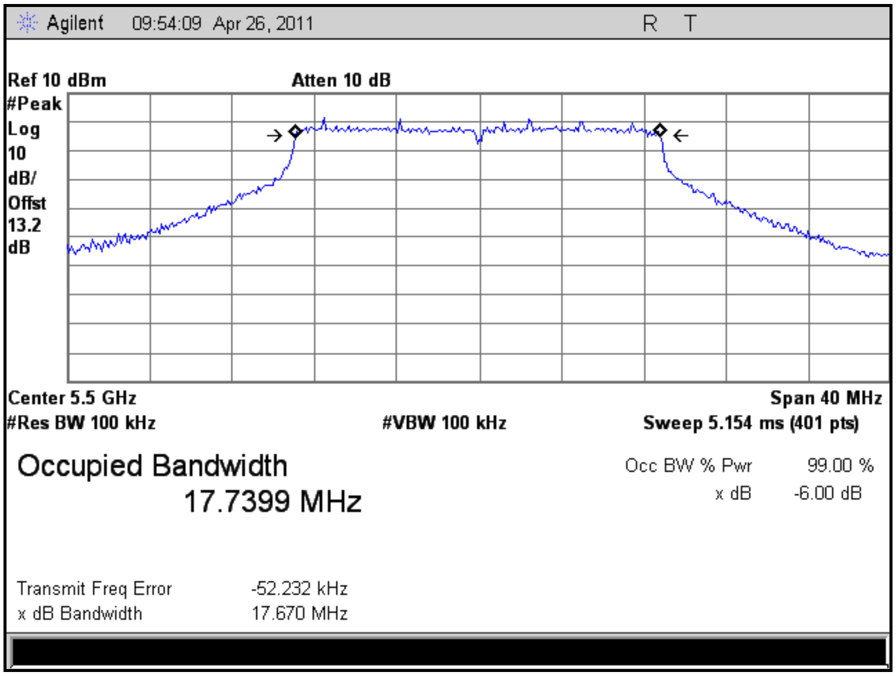


Plot 5. Occupied Bandwidth, 5500 MHz, 802.11n 20 MHz, Port 1

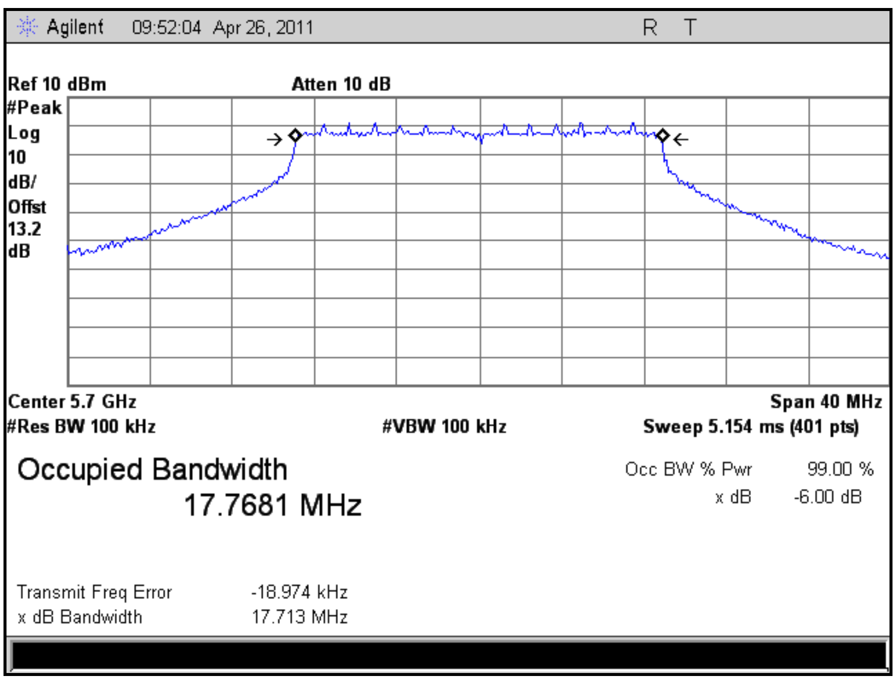


Plot 6. Occupied Bandwidth, 5700 MHz, 802.11n 20 MHz, Port 1

Occupied Bandwidth, 802.11n 20 MHz, Port 2

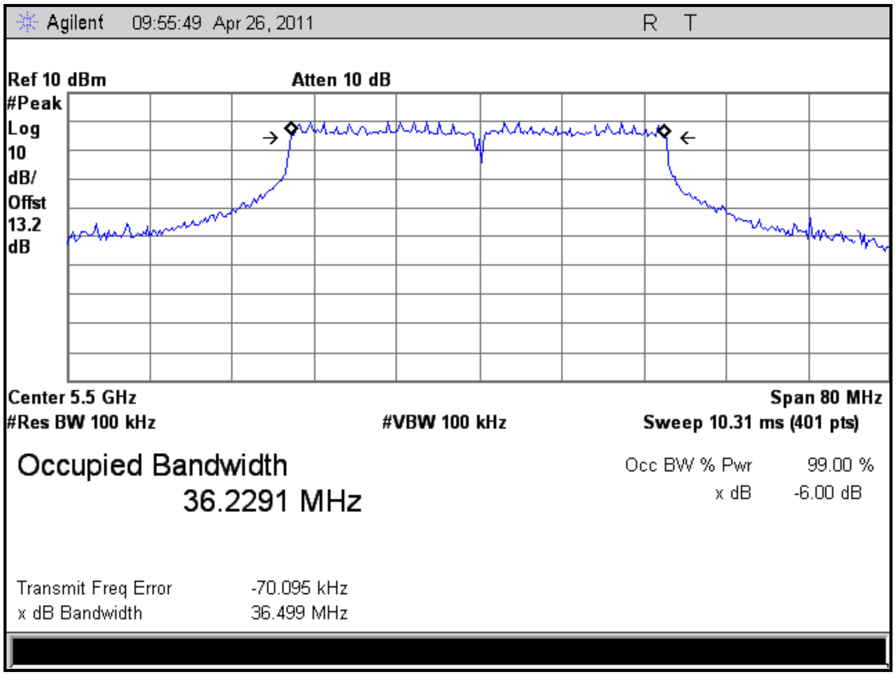


Plot 7. Occupied Bandwidth, 5500 MHz, 802.11n 20 MHz, Port 2

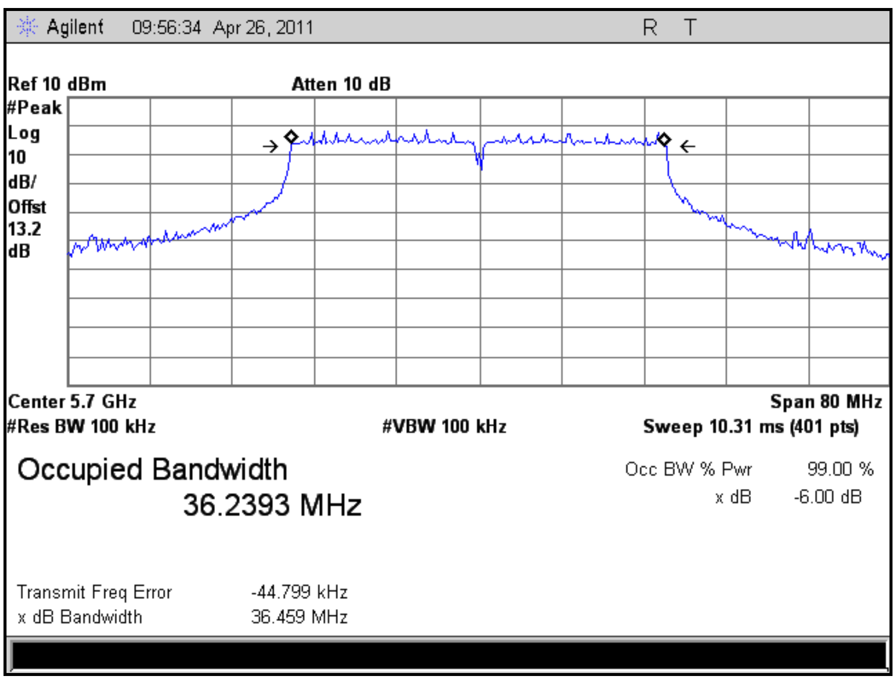


Plot 8. Occupied Bandwidth, 5700 MHz, 802.11n 20 MHz, Port 2

Occupied Bandwidth, 802.11n 40 MHz, Port 1

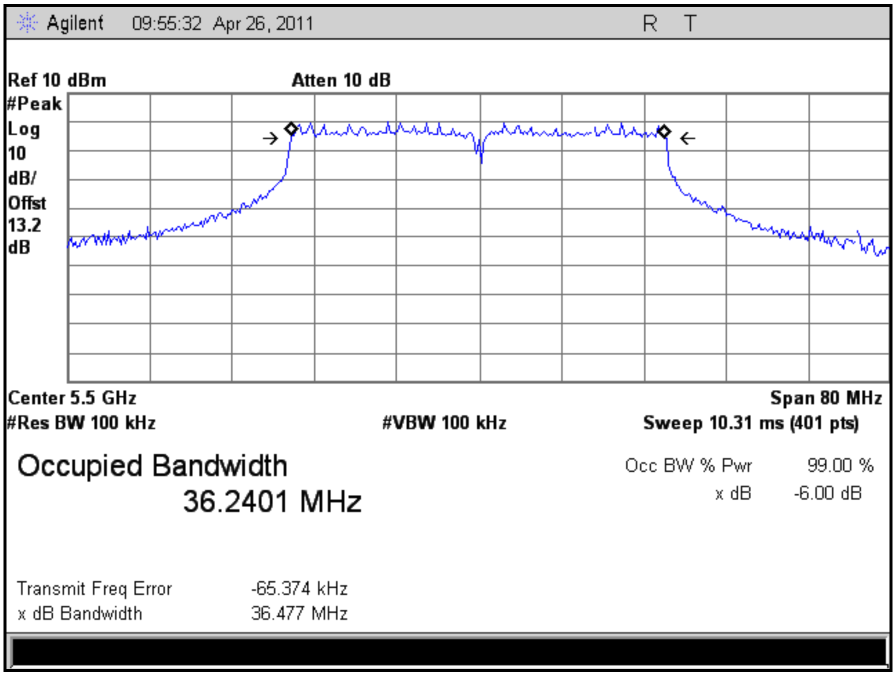


Plot 9. Occupied Bandwidth, 5500 MHz, 802.11n 40 MHz, Port 1

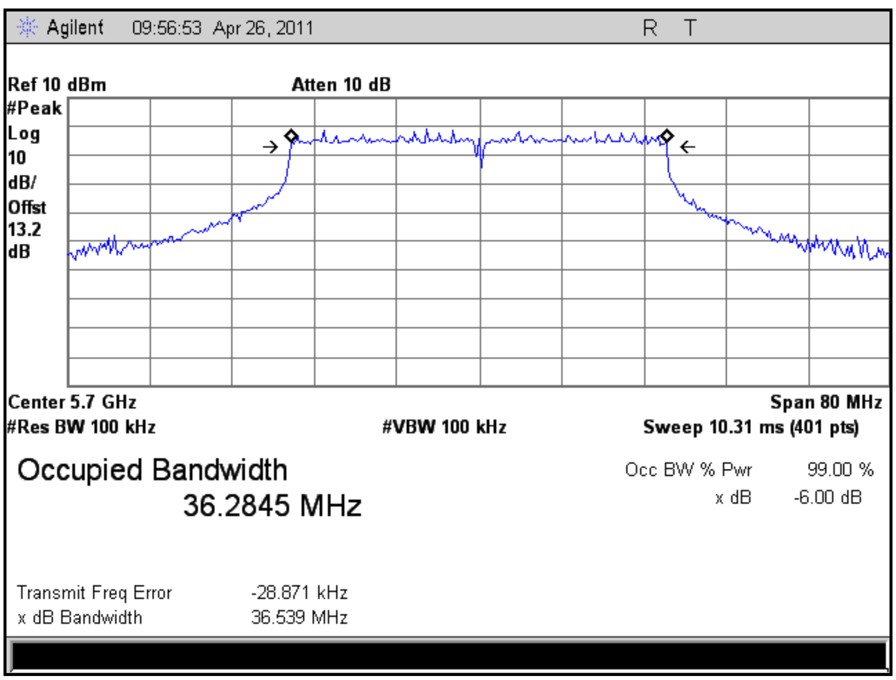


Plot 10. Occupied Bandwidth, 5700 MHz, 802.11n 40 MHz, Port 1

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: 06/16/11 – 6/17/11

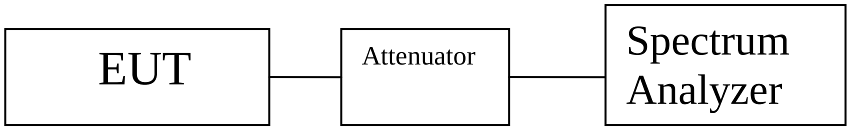


Figure 3. Output Power, TPC, and Power Density Test Setup

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	16.2	13	30	-0.80
5500	-20	207	16.9	13	30	-0.10
5500	-20	253	16.8	13	30	-0.20
5500	70	207	15.6	13	30	-1.40
5500	70	253	15.5	13	30	-1.50
5700	20	230	15.6	13	30	-1.40
5700	-20	207	16.9	13	30	-0.10
5700	-20	253	16.9	13	30	-0.10
5700	70	207	15.8	13	30	-1.20
5700	70	253	15.9	13	30	-1.10

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	7.9	13	24	-3.10
5500	-20	207	8.6	13	24	-2.40
5500	-20	253	8.6	13	24	-2.40
5500	70	207	7.2	13	24	-3.80
5500	70	253	7.3	13	24	-3.70
5700	20	230	7.9	13	24	-3.10
5700	-20	207	8.8	13	24	-2.20
5700	-20	253	8.7	13	24	-2.30
5700	70	207	7.2	13	24	-3.80
5700	70	253	7.3	13	24	-3.70

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	15.9	13	30	-1.10
5500	-20	207	16.2	13	30	-0.80
5500	-20	253	16.2	13	30	-0.80
5500	70	207	15.5	13	30	-1.50
5500	70	253	15.4	13	30	-1.60
5700	20	230	15.5	13	30	-1.50
5700	-20	207	16.2	13	30	-0.80
5700	-20	253	16.2	13	30	-0.80
5700	70	207	15.7	13	30	-1.30
5700	70	253	15.8	13	30	-1.20

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	7.1	13	24	-3.90
5500	-20	207	8.1	13	24	-2.90
5500	-20	253	8.1	13	24	-2.90
5500	70	207	6.4	13	24	-4.60
5500	70	253	6.6	13	24	-4.40
5700	20	230	7.5	13	24	-3.50
5700	-20	207	7.9	13	24	-3.10
5700	-20	253	7.8	13	24	-3.20
5700	70	207	6.9	13	24	-4.10
5700	70	253	6.8	13	24	-4.20

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	12.3	11.6	31.44	14.97	13	30	-2.03
5500	-20	207	13.7	12.9	42.94	16.33	13	30	-0.67
5500	-20	253	13.6	13	42.86	16.32	13	30	-0.68
5500	70	207	11.7	11.2	27.97	14.47	13	30	-2.53
5500	70	253	11.6	11.2	27.64	14.41	13	30	-2.59
5700	20	230	12.6	12.1	34.42	15.37	13	30	-1.63
5700	-20	207	13.3	12.8	40.43	16.07	13	30	-0.93
5700	-20	253	13.6	12.8	41.96	16.23	13	30	-0.77
5700	70	207	11.2	10.4	24.15	13.83	13	30	-3.17
5700	70	253	11.2	10.5	24.40	13.87	13	30	-3.13

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	5.4	6.9	8.37	9.22	13	24	-1.78
5500	-20	207	5.3	6.8	8.17	9.12	13	24	-1.88
5500	-20	253	5.3	6.7	8.07	9.07	13	24	-1.93
5500	70	207	5.3	6.7	8.07	9.07	13	24	-1.93
5500	70	253	5.2	6.6	7.88	8.97	13	24	-2.03
5700	20	230	5.4	6.8	8.25	9.17	13	24	-1.83
5700	-20	207	4.2	5.9	6.52	8.14	13	24	-2.86
5700	-20	253	4.3	5.9	6.58	8.18	13	24	-2.82
5700	70	207	5.5	6.4	7.91	8.98	13	24	-2.02
5700	70	253	5.6	6.5	8.10	9.08	13	24	-1.92

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	12.3	11.9	32.47	15.11	13	30	-1.89
5500	-20	207	13.8	12.5	41.77	16.21	13	30	-0.79
5500	-20	253	13.6	12.8	41.96	16.23	13	30	-0.77
5500	70	207	10.3	9.9	20.49	13.11	13	30	-3.89
5500	70	253	10.4	10.0	20.96	13.21	13	30	-3.79
5700	20	230	11.8	11.1	28.02	14.47	13	30	-2.53
5700	-20	207	13.8	12.5	41.77	16.21	13	30	-0.79
5700	-20	253	13.8	12.5	41.77	16.21	13	30	-0.79
5700	70	207	10.9	10.2	22.77	13.57	13	30	-3.43
5700	70	253	10.9	10.3	23.02	13.62	13	30	-3.38

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	4.5	4.2	5.45	7.36	13	24	-3.64
5500	-20	207	5.1	4.9	6.33	8.01	13	24	-2.99
5500	-20	253	5.2	4.8	6.33	8.01	13	24	-2.99
5500	70	207	3.3	3.0	4.13	6.16	13	24	-4.84
5500	70	253	3.2	2.9	4.04	6.06	13	24	-4.94
5700	20	230	4.2	4.1	5.20	7.16	13	24	-3.84
5700	-20	207	4.5	4.4	5.57	7.46	13	24	-3.54
5700	-20	253	4.5	4.4	5.57	7.46	13	24	-3.54
5700	70	207	3.5	3.4	4.43	6.46	13	24	-4.54
5700	70	253	3.3	3.4	4.33	6.36	13	24	-4.64

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

Power Density

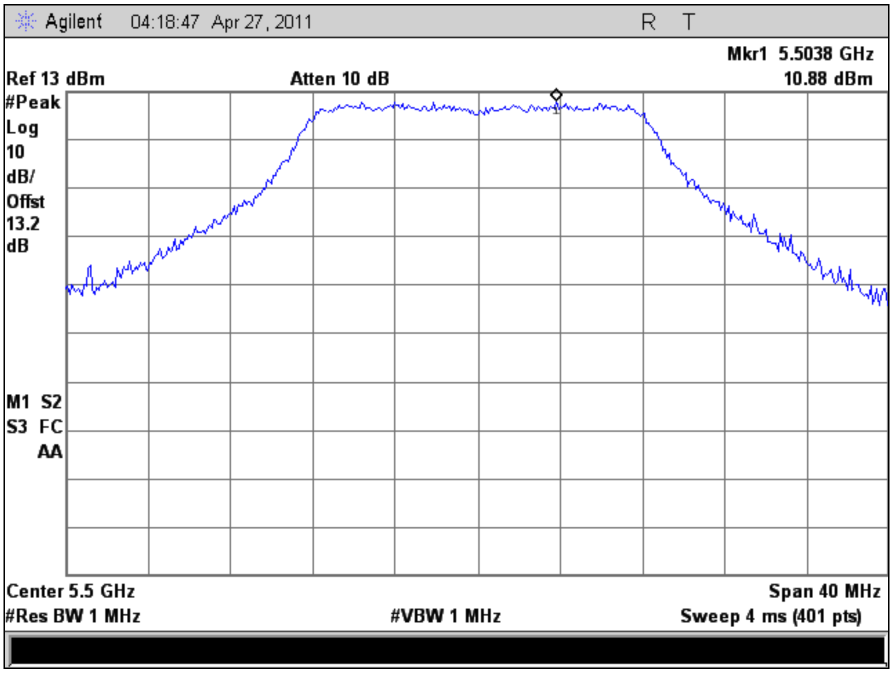
Power Spectral Density 802.11a							
Channel (MHz)		Mode OFDM	Measured Power Density Port 1 dBm	Antenna Gain dBi	EIRP dBm	Limit dBm	Margin dB
5500	Low	HT20	1.59	13	14.59	17	-2.41
5700	High	HT20	1.04	13	14.04	17	-2.96
5500	Low	HT40	-0.43	13	12.57	17	-4.43
5700	High	HT40	-1.08	13	11.92	17	-5.08

Table 15. Power Density, Test Results, 802.11a

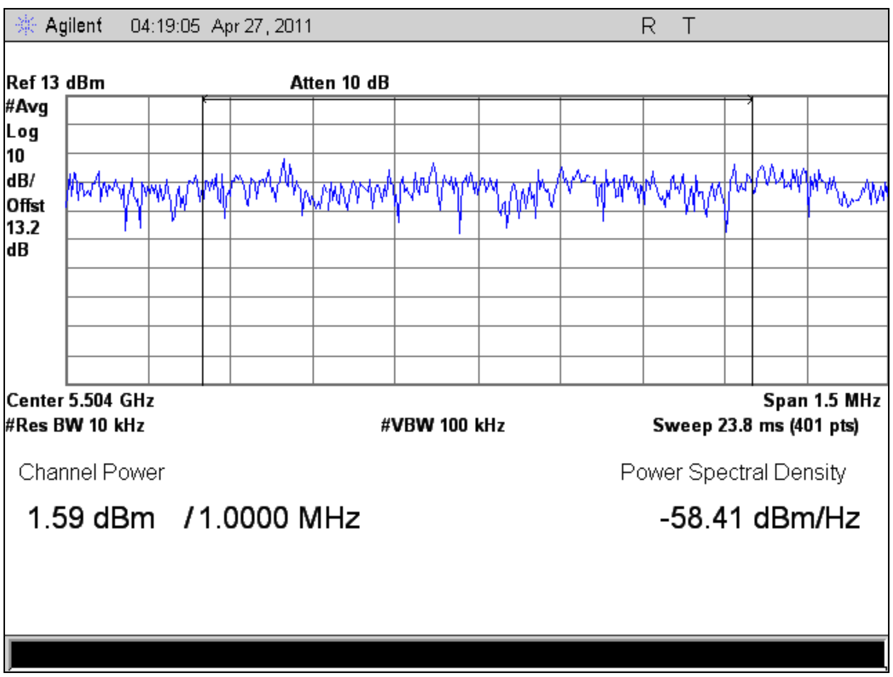
Power Spectral Density 802.11n									
Channel (MHz)		Mode OFDM	Measured Power Density Port 1 dBm	Measured Power Density Port 2 dBm	Summed Ports dBm	Antenna Gain dBi	EIRP dBm	Limit dBm	Margin dB
5500	Low	HT20	0.30	-0.26	3.04	13	16.04	17	-0.96
5700	High	HT20	-1.60	-1.17	1.63	13	14.63	17	-2.37
5500	Low	HT40	-3.76	-3.68	-0.71	13	12.29	17	-4.71
5700	High	HT40	-3.66	-2.73	-0.16	13	12.84	17	-4.16

Table 16. Power Density, Test Results, 802.11n

Power Density, 802.11a 20 MHz

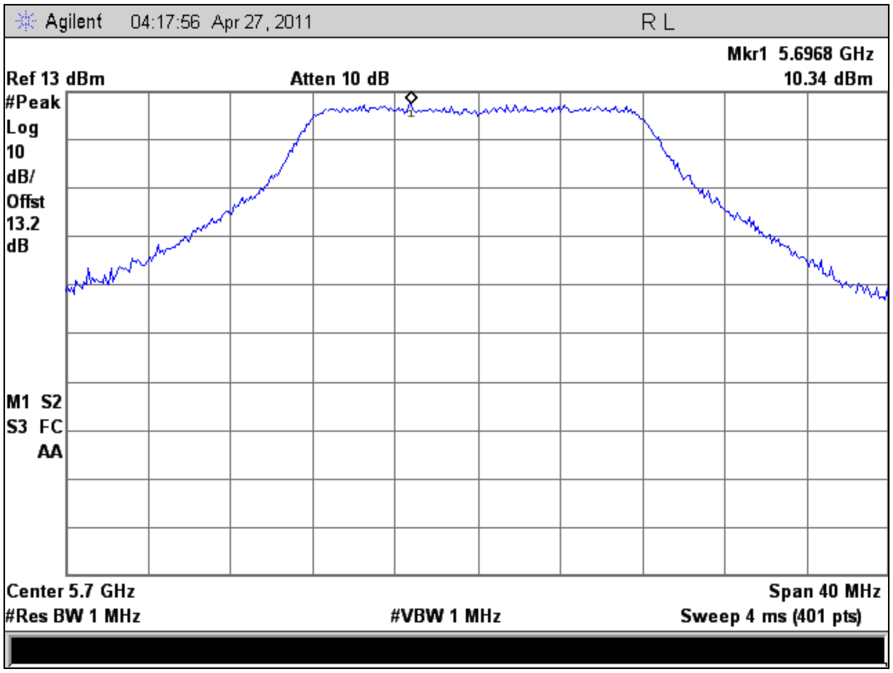


Plot 17. Power Density, Determination, 5500 MHz, 802.11a 20 MHz

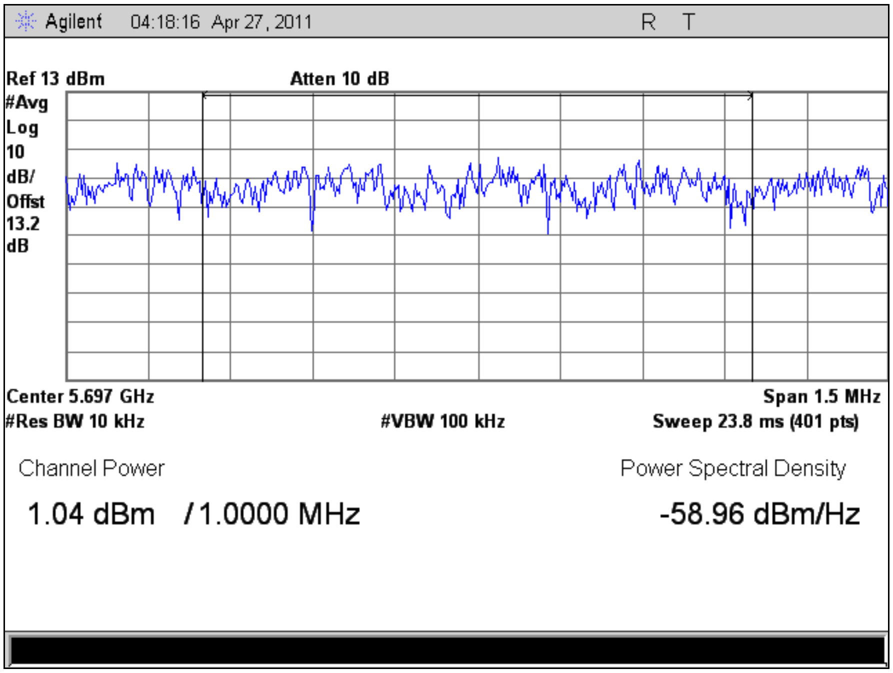


Plot 18. Power Density, 5500 MHz, 802.11a 20 MHz

Power Density, 802.11a 20 MHz

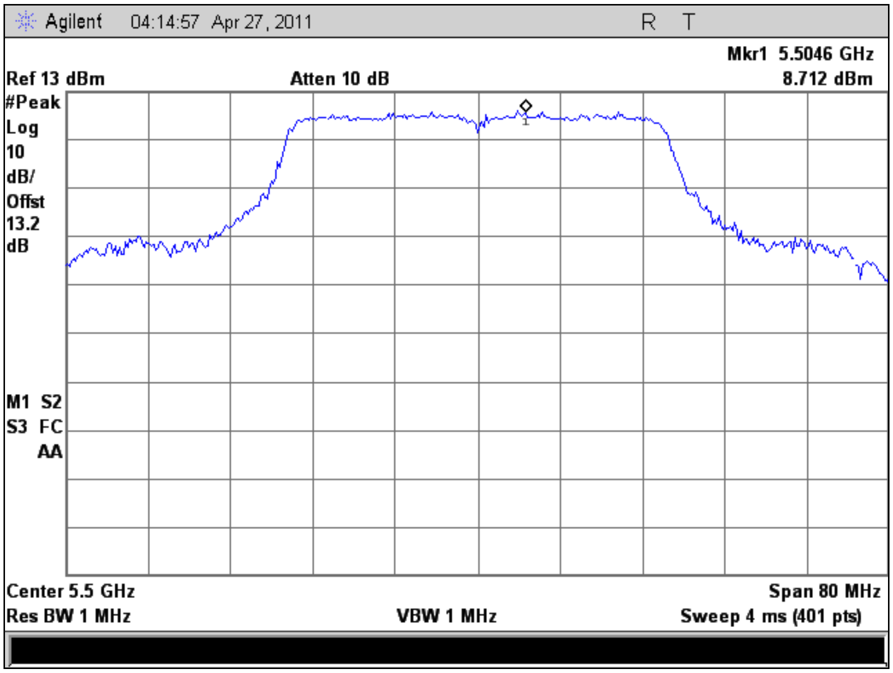


Plot 19. Power Density, Determination, 5700 MHz, 802.11a 20 MHz

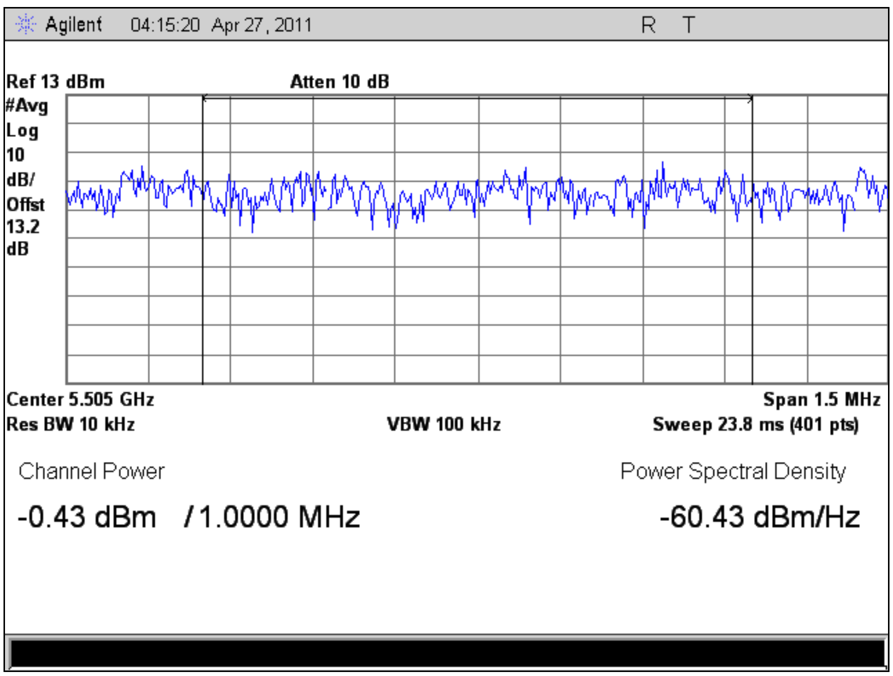


Plot 20. Power Density, 5700 MHz, 802.11a 20 MHz

Power Density, 802.11a 40 MHz

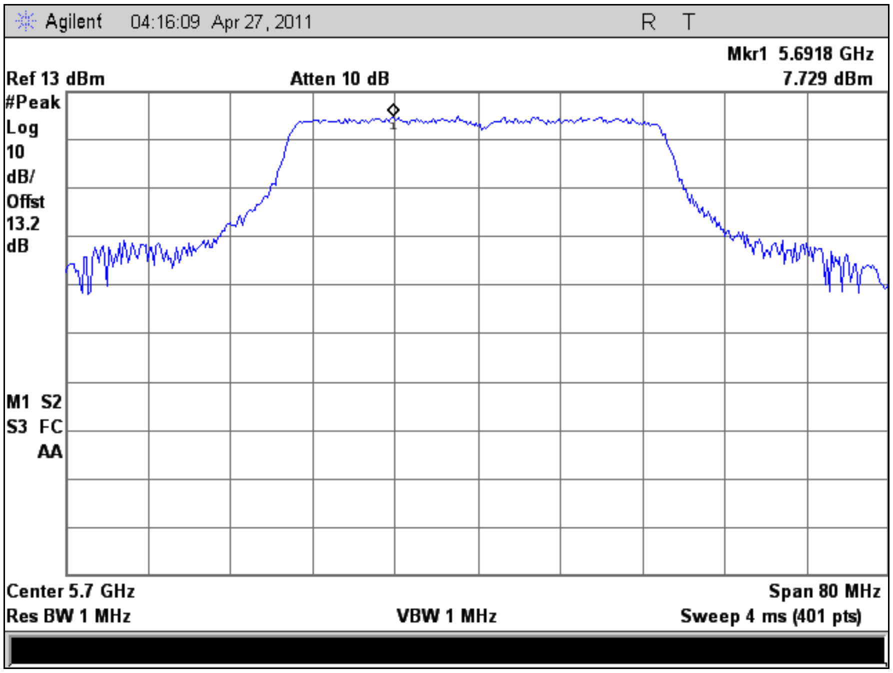


Plot 21. Power Density, Determination, 5500 MHz, 802.11a 40 MHz

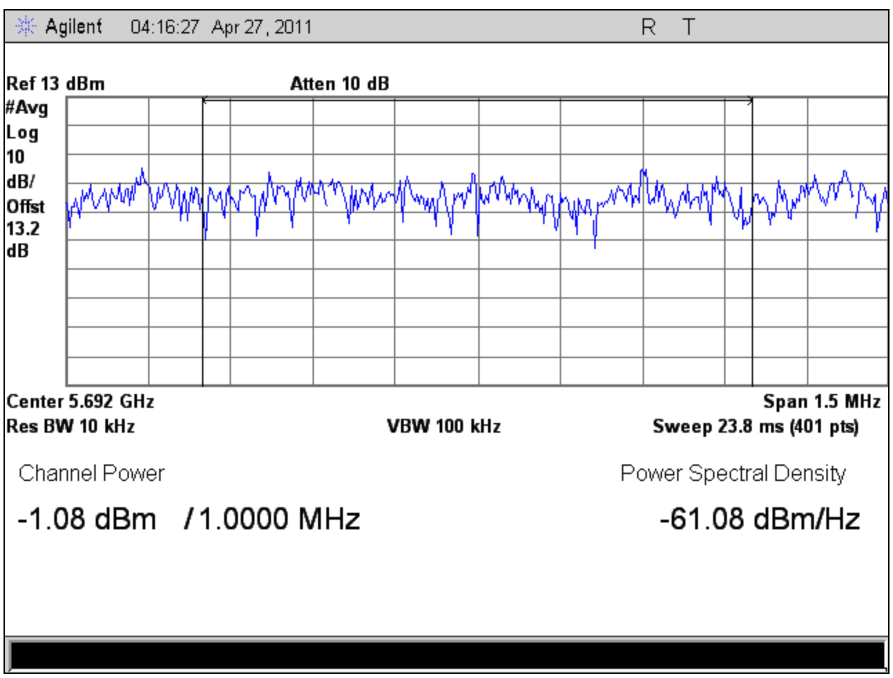


Plot 22. Power Density, 5500 MHz, 802.11a 40 MHz

Power Density, 802.11a 40 MHz

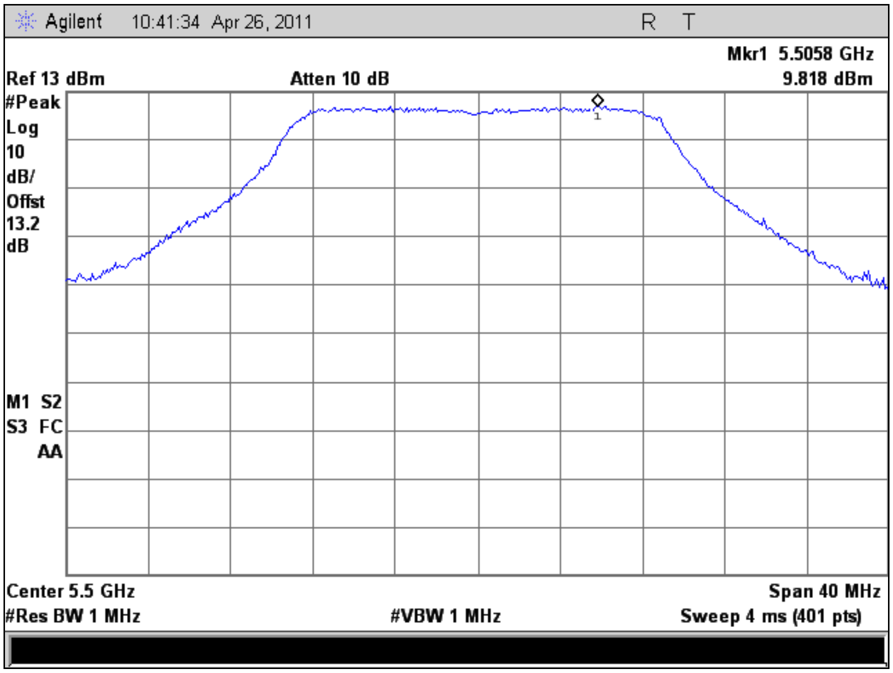


Plot 23. Power Density, Determination, 5700 MHz, 802.11a 40 MHz

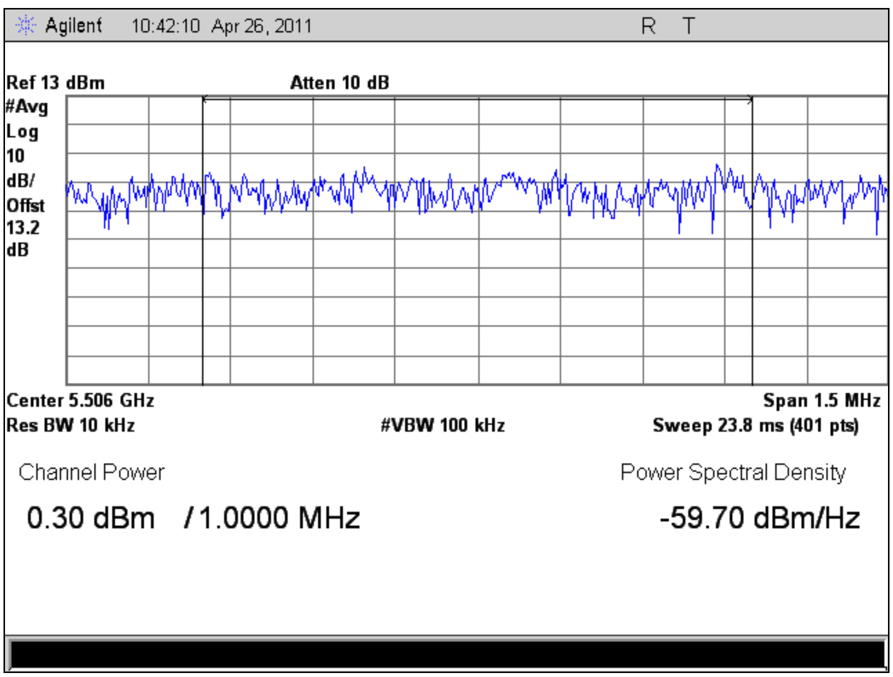


Plot 24. Power Density, 5700 MHz, 802.11a 40 MHz

Power Density, 802.11n 20 MHz, Port 1

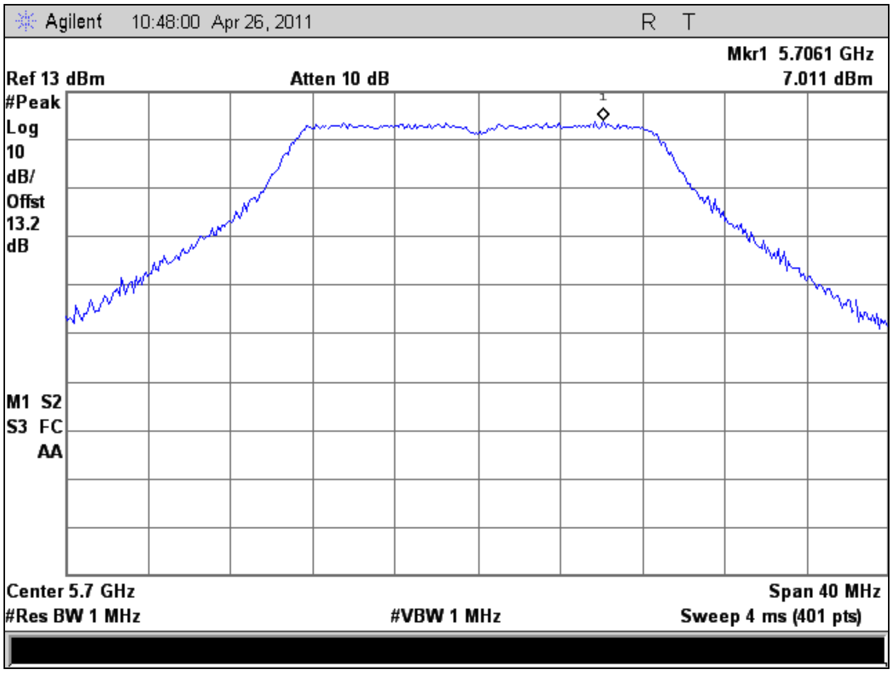


Plot 25. Power Density, Determination, 5500 MHz, 802.11n 20 MHz, Port 1

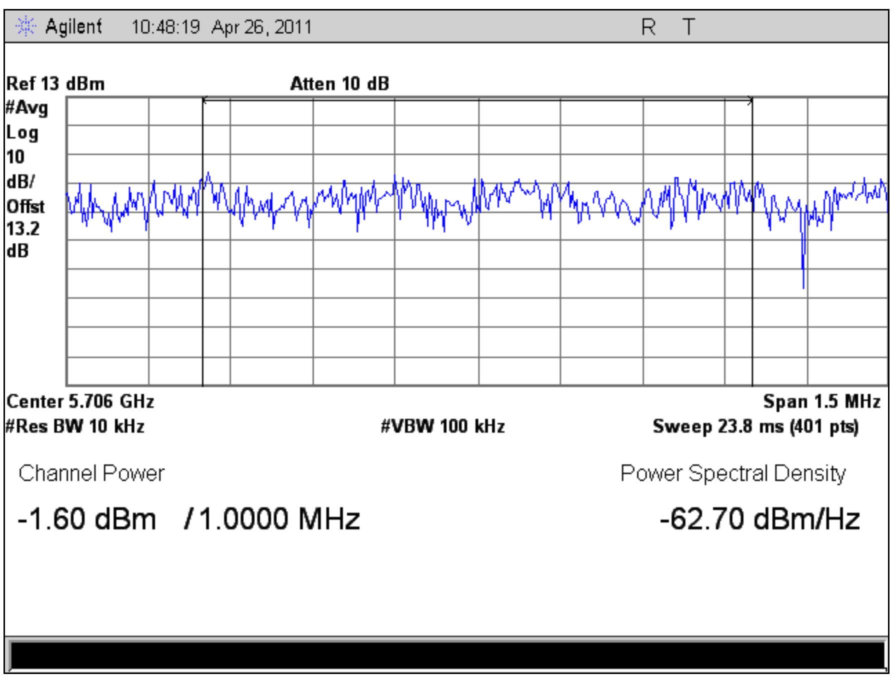


Plot 26. Power Density, 5500 MHz, 802.11n 20 MHz, Port 1

Power Density, 802.11n 20 MHz, Port 1

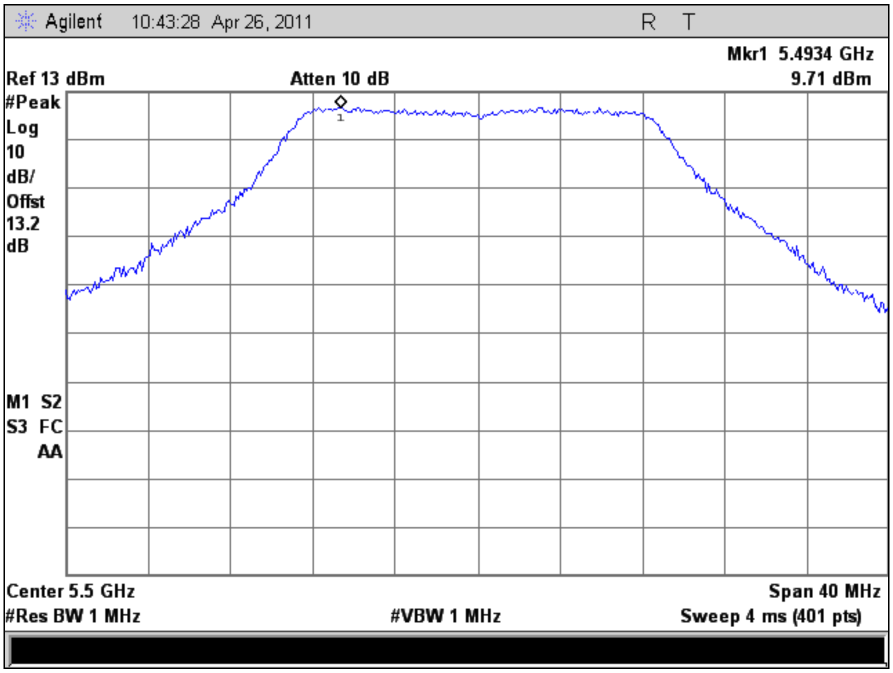


Plot 27. Power Density, Determination, 5700 MHz, 802.11n 20 MHz, Port 1

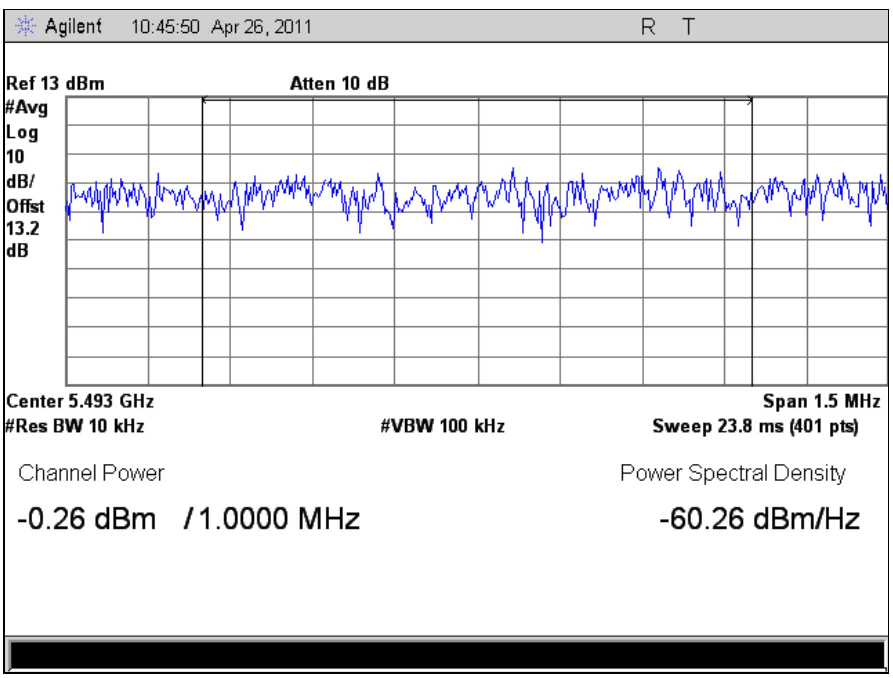


Plot 28. Power Density, 5700 MHz, 802.11n 20 MHz, Port 1

Power Density, 802.11n 20 MHz, Port 2

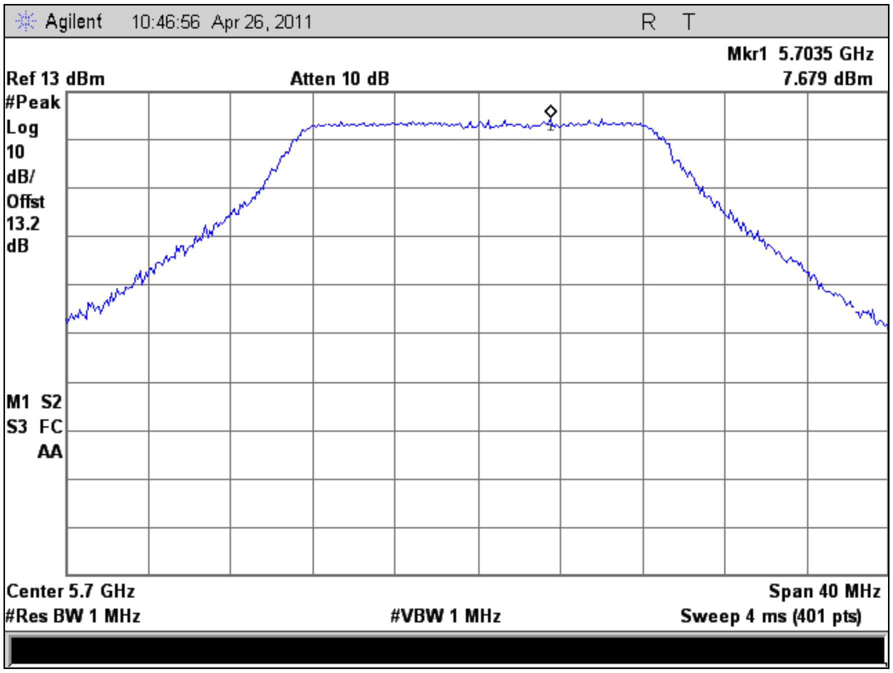


Plot 29. Power Density, Determination, 5500 MHz, 802.11n 20 MHz, Port 2

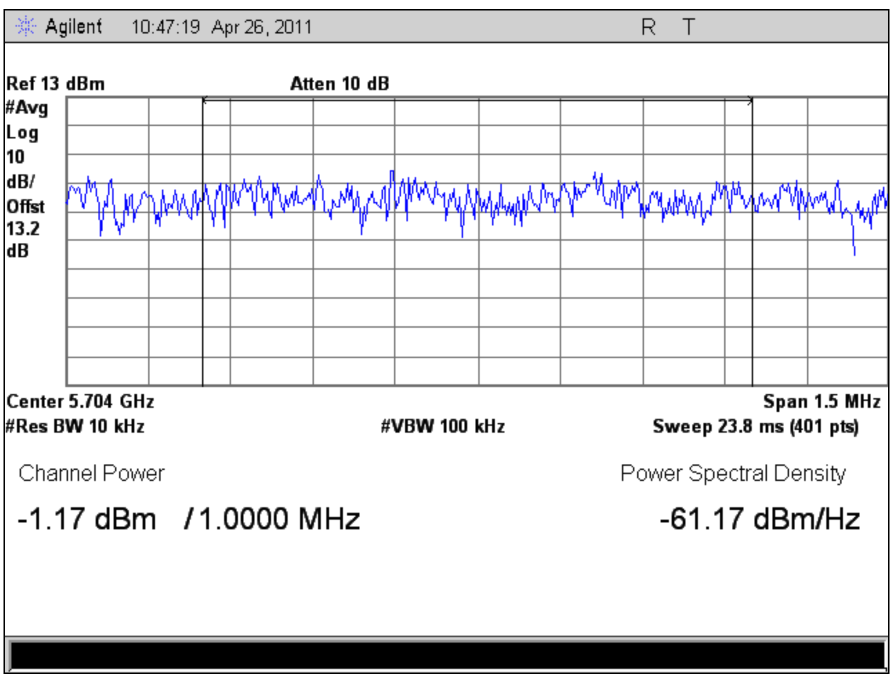


Plot 30. Power Density, 5500 MHz, 802.11n 20 MHz, Port 2

Power Density, 802.11n 20 MHz, Port 2

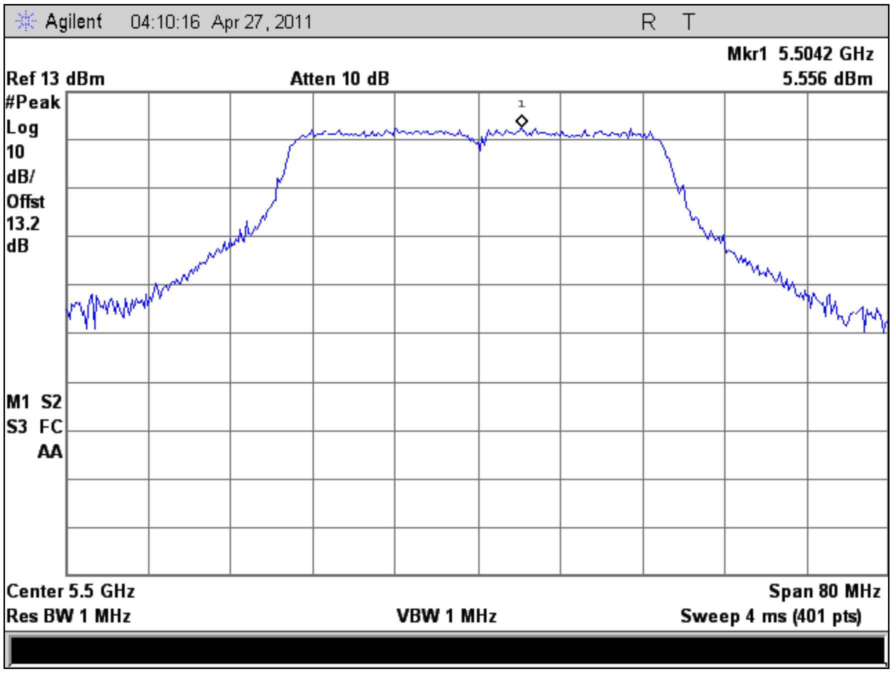


Plot 31. Power Density, Determination, 5700 MHz, 802.11n 20 MHz, Port 2

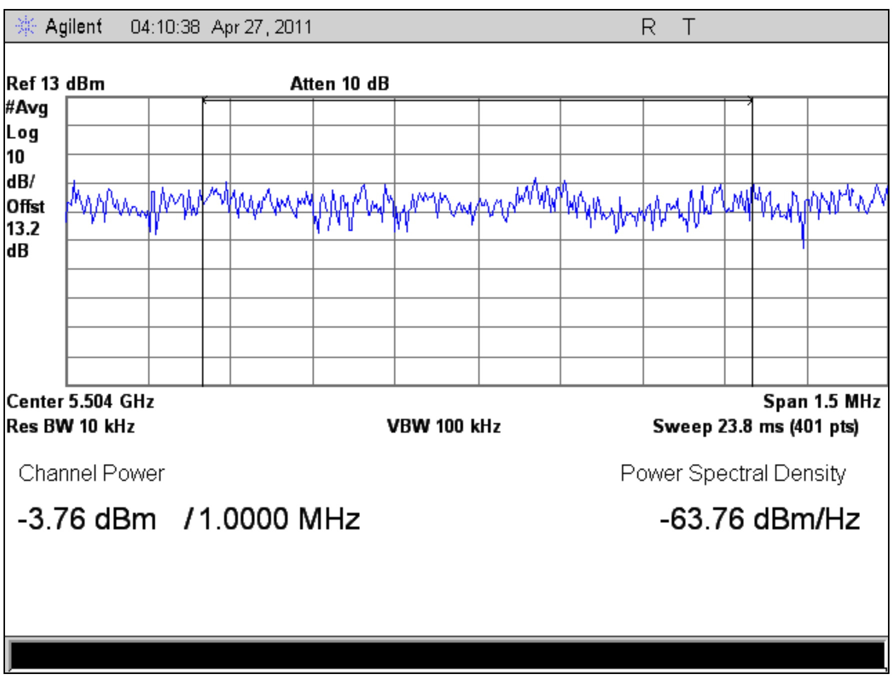


Plot 32. Power Density, 5700 MHz, 802.11n 20 MHz, Port 2

Power Density, 802.11n 40 MHz, Port 1

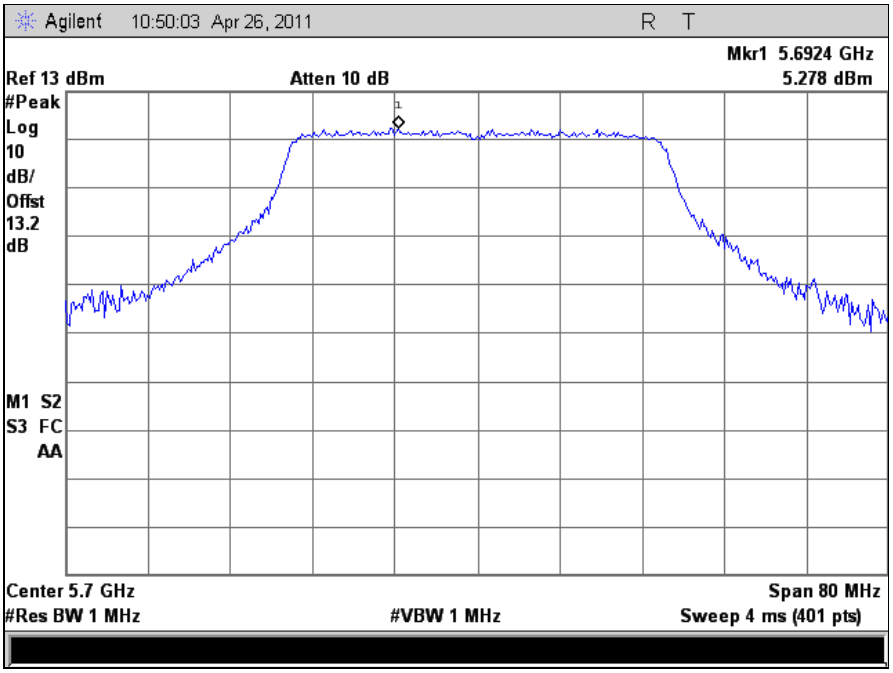


Plot 33. Power Density, Determination, 5500 MHz, 802.11n 40 MHz, Port 1

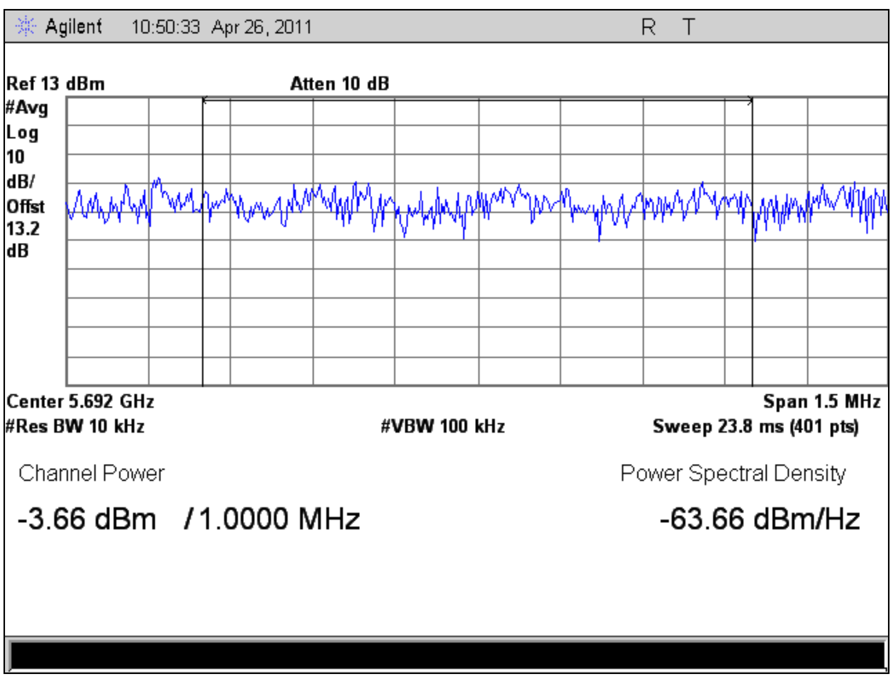


Plot 34. Power Density, 5500 MHz, 802.11n 40 MHz, Port 1

Power Density, 802.11n 40 MHz, Port 1

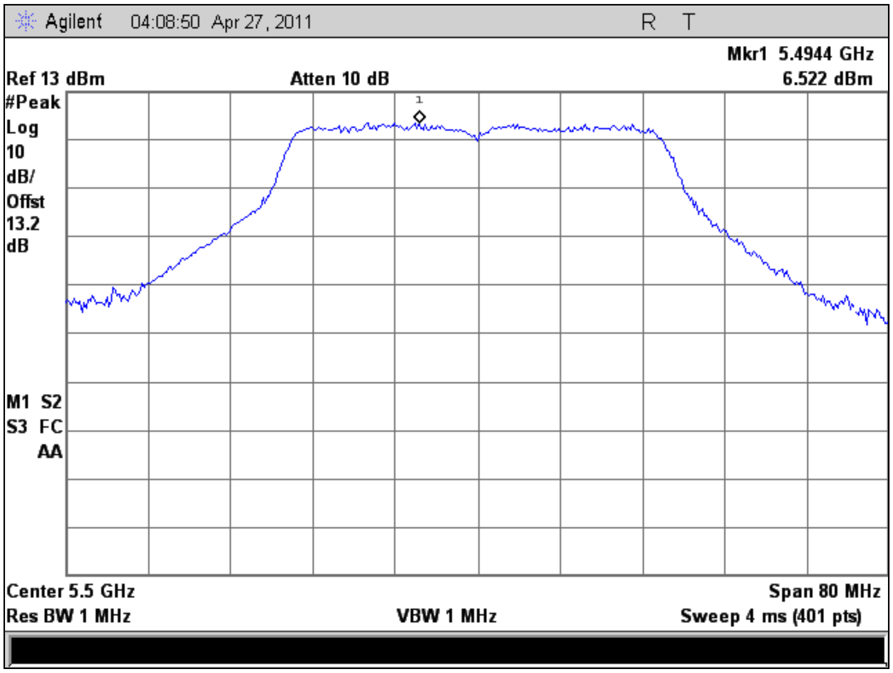


Plot 35. Power Density, Determination, 5700 MHz, 802.11n 40 MHz, Port 1

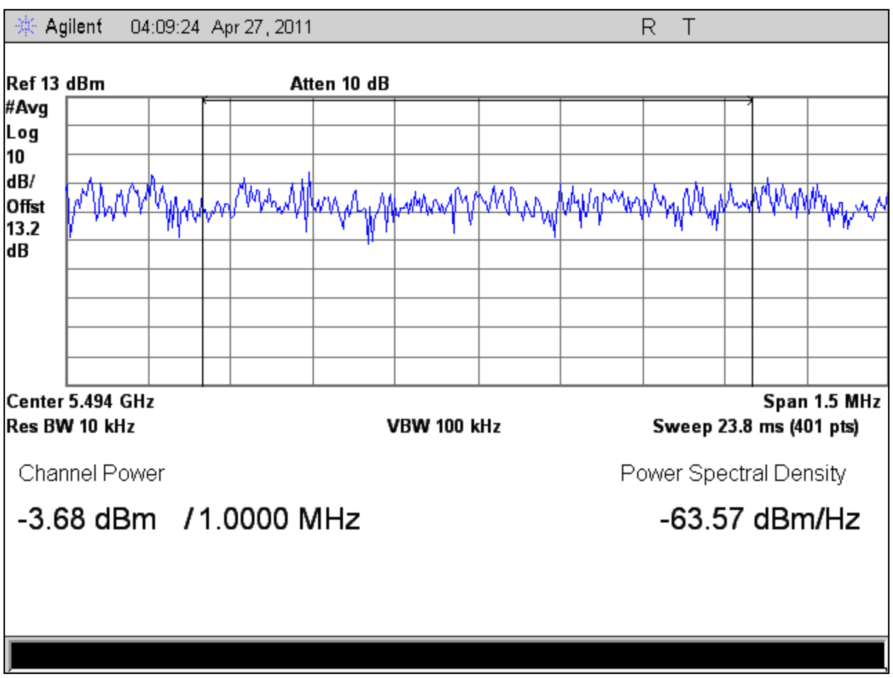


Plot 36. Power Density, 5700 MHz, 802.11n 40 MHz, Port 1

Power Density, 802.11n 40 MHz, Port 2

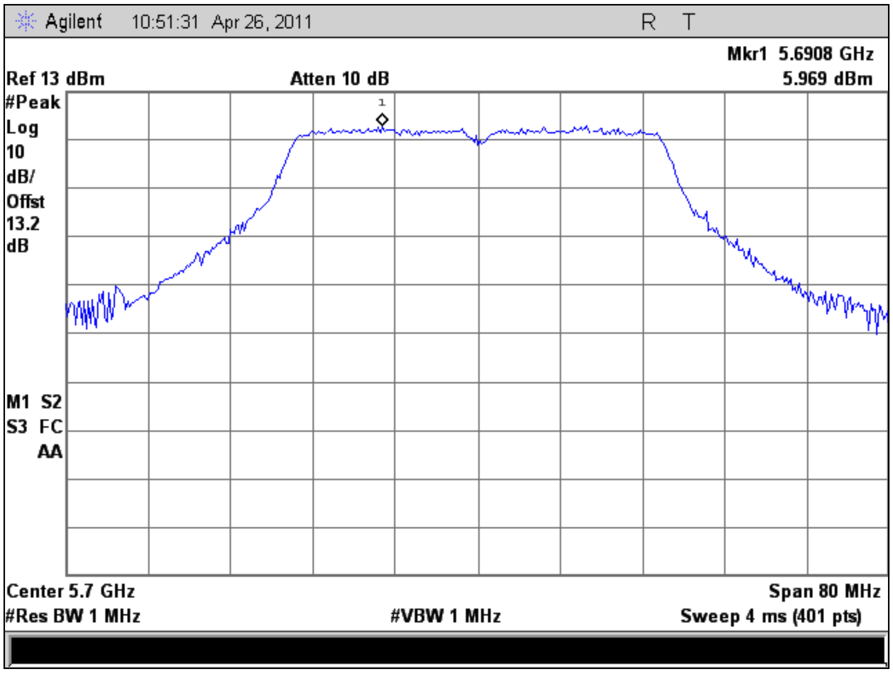


Plot 37. Power Density, Determination, 5500 MHz, 802.11n 40 MHz, Port 2

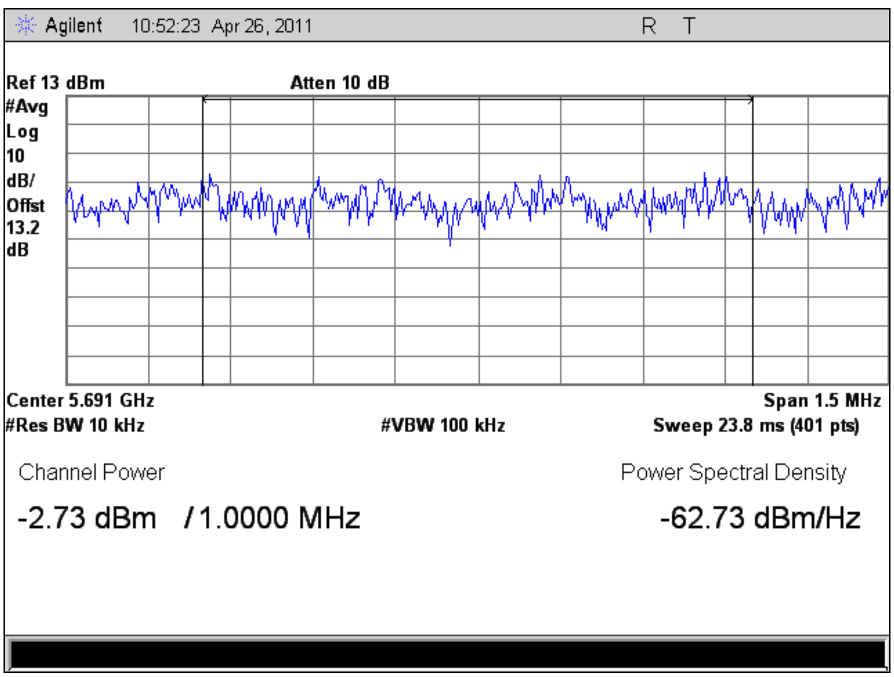


Plot 38. Power Density, 5500 MHz, 802.11n 40 MHz, Port 2

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: 06/24/11 – 06/28/11

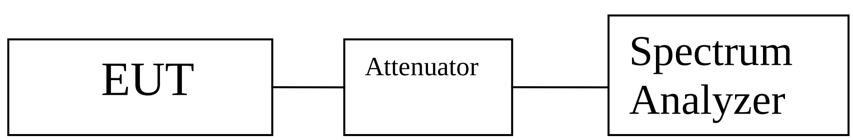
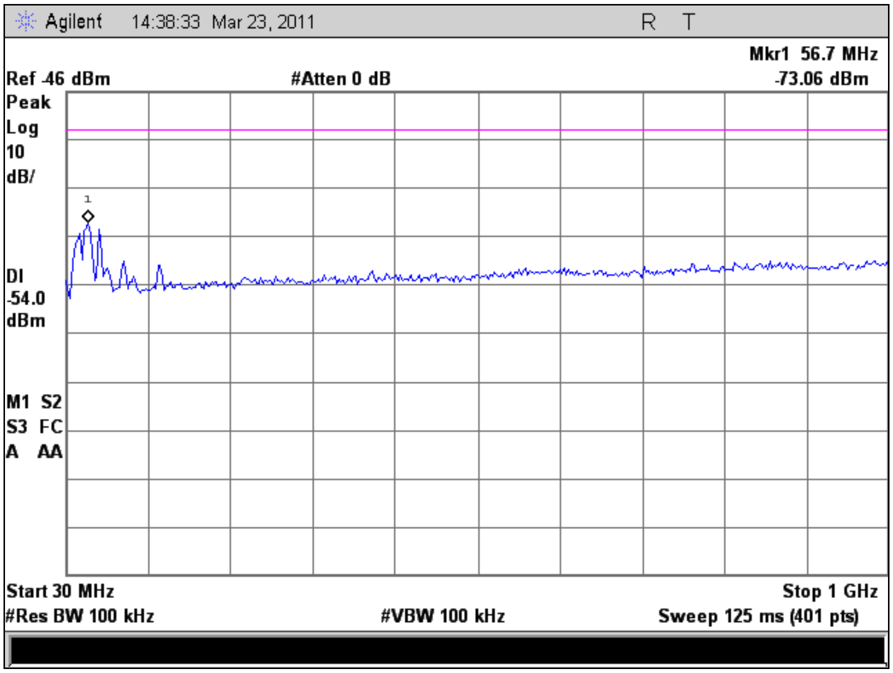
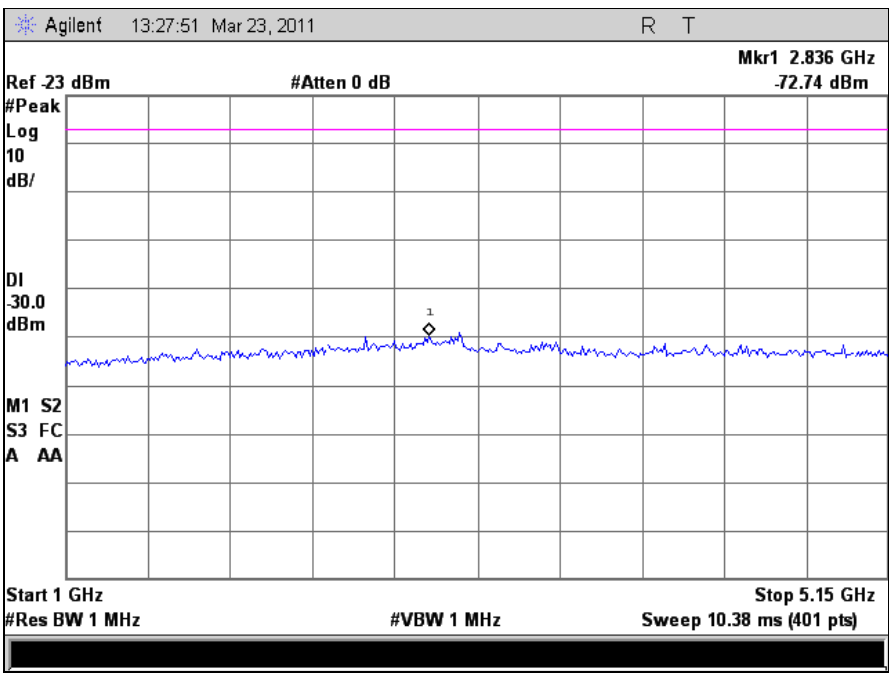


Figure 4. Unwanted Conducted Emissions Outside Test Setup

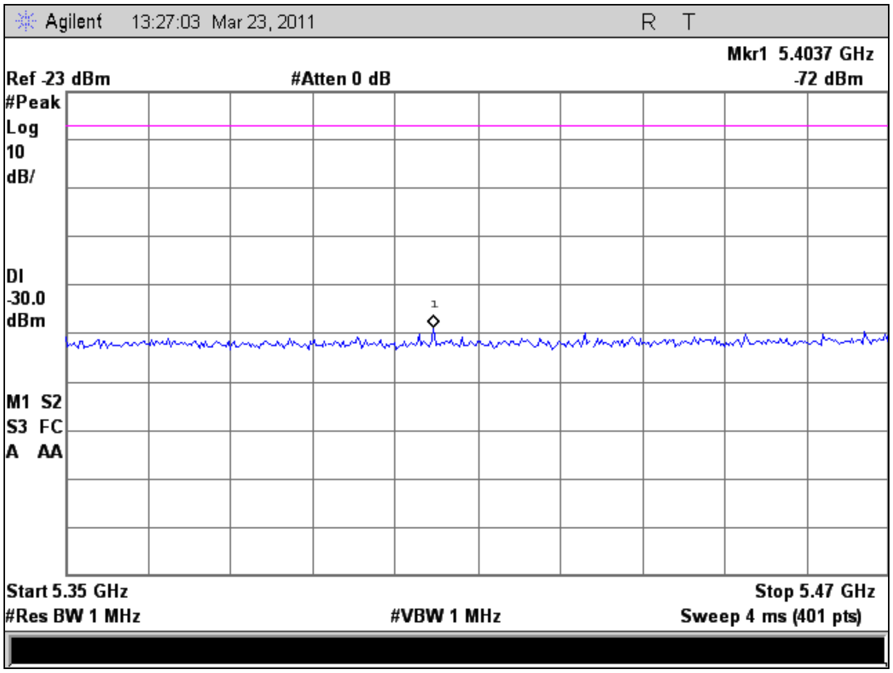
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 20 MHz



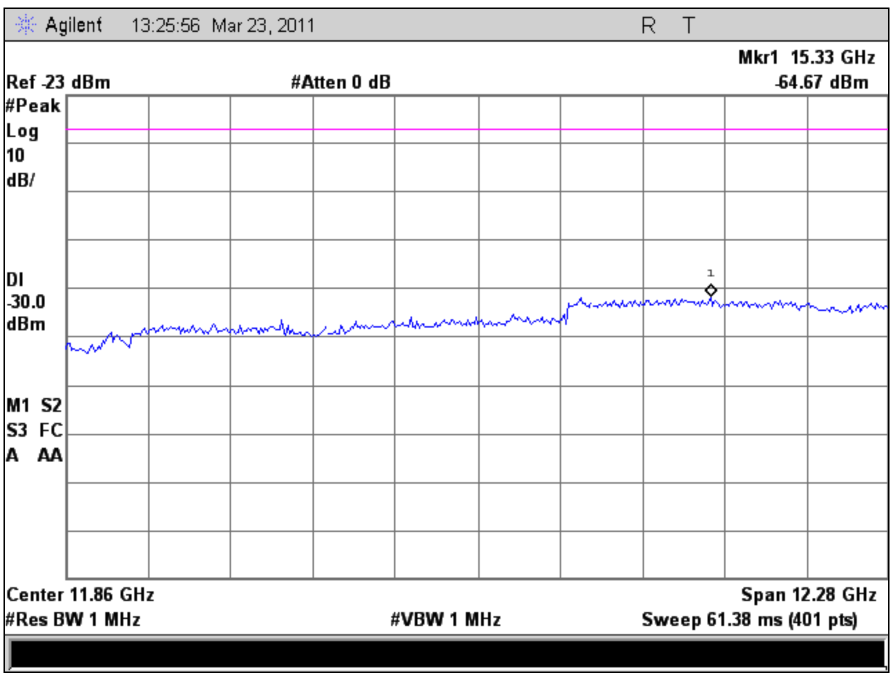
Plot 41. Conducted Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11a 20 MHz



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

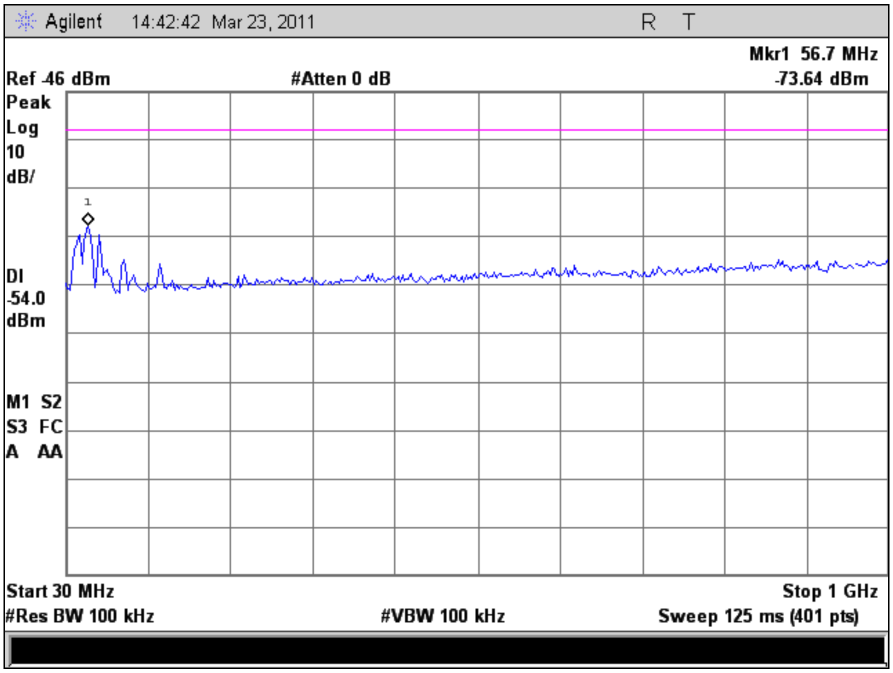


Plot 43. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5500 MHz, 802.11a 20 MHz

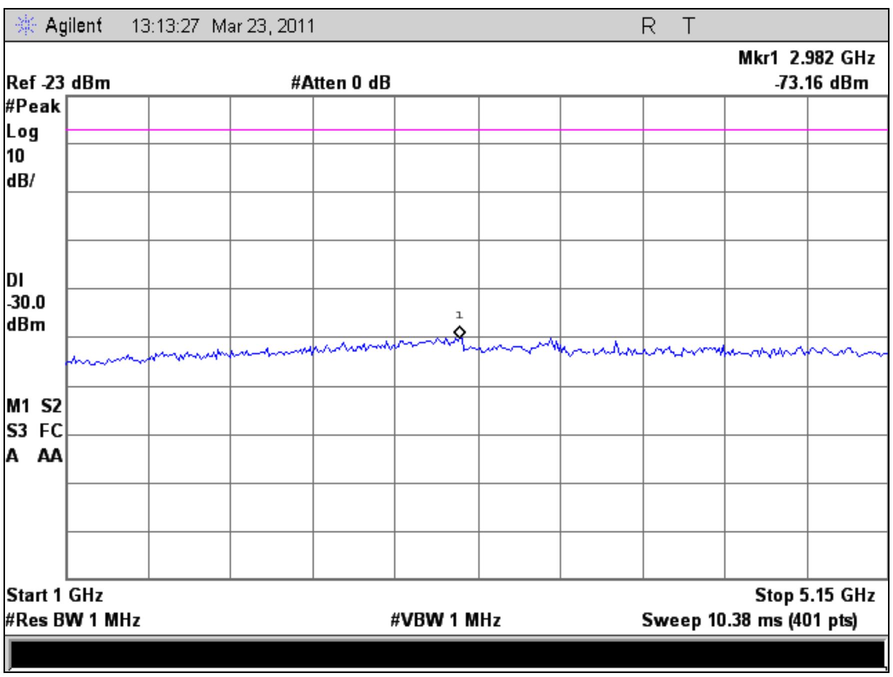


Plot 44. Conducted Spurious Emission, 5.725 GHz – 18 GHz, 5500 MHz, 802.11a 20 MHz

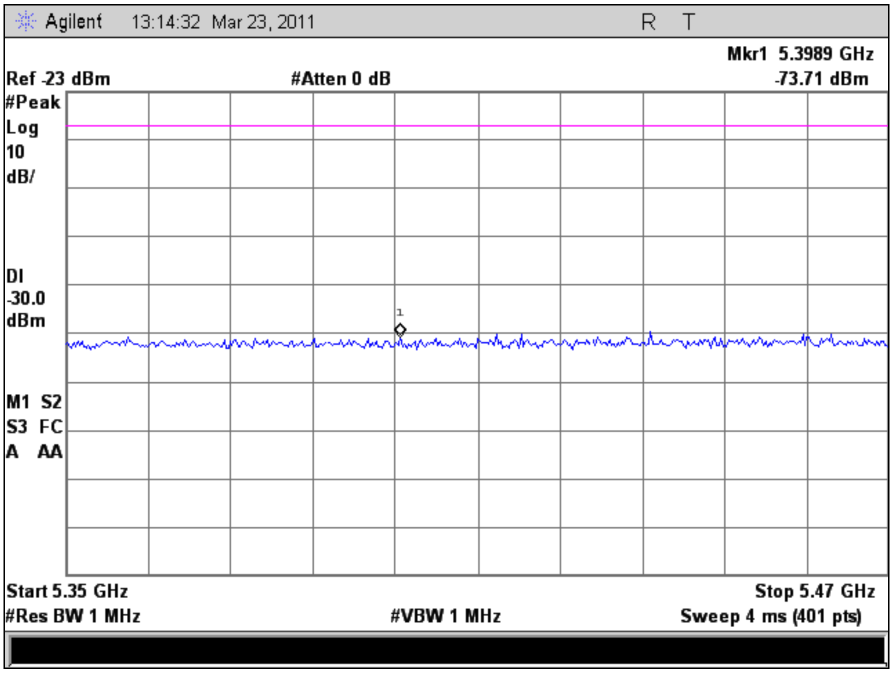
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 20 MHz



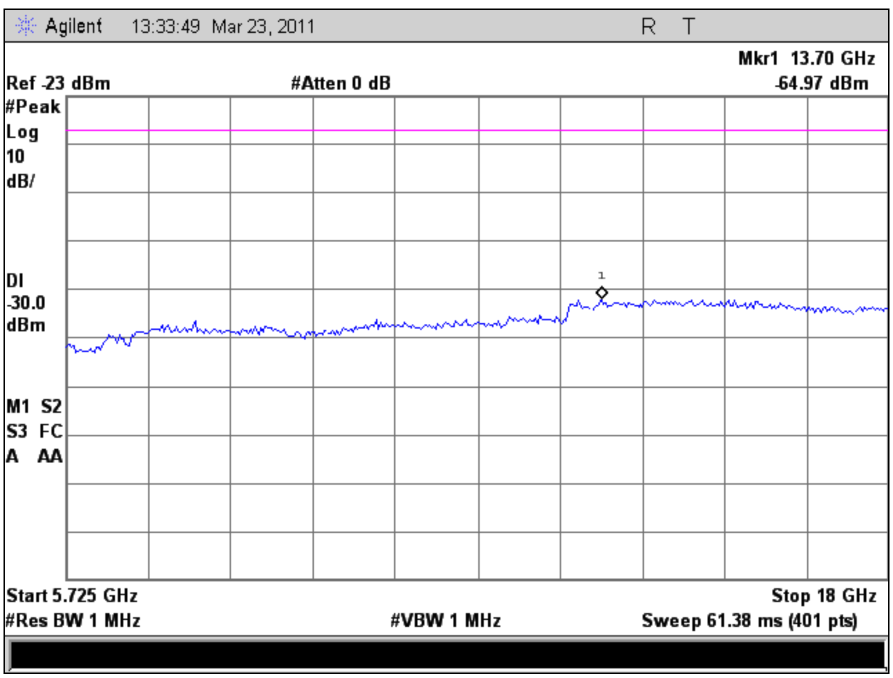
Plot 45. Conducted Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11a 20 MHz



Plot 46. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5700 MHz, 802.11a 20 MHz

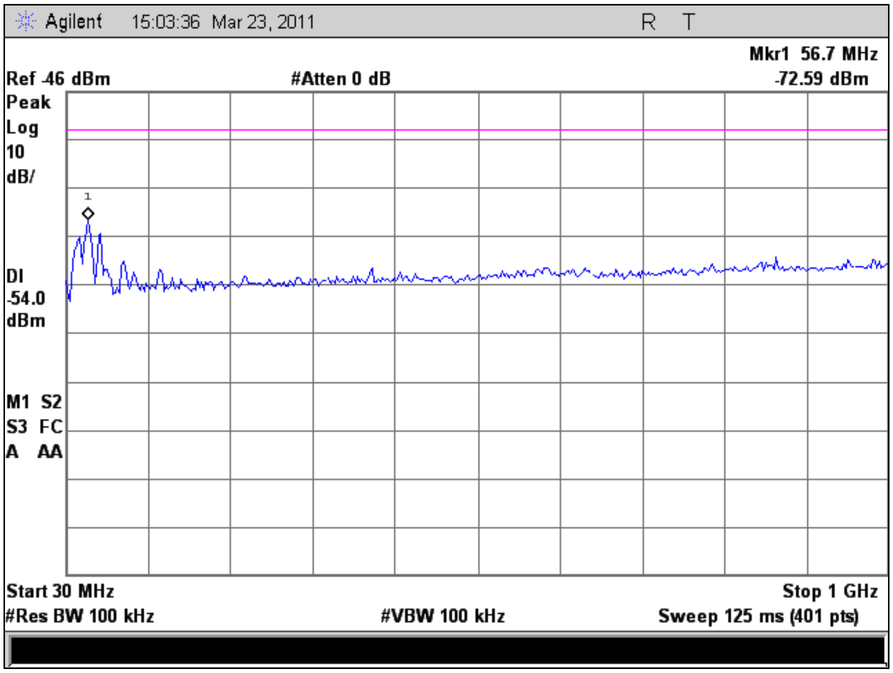


Plot 47. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5700 MHz, 802.11a 20 MHz

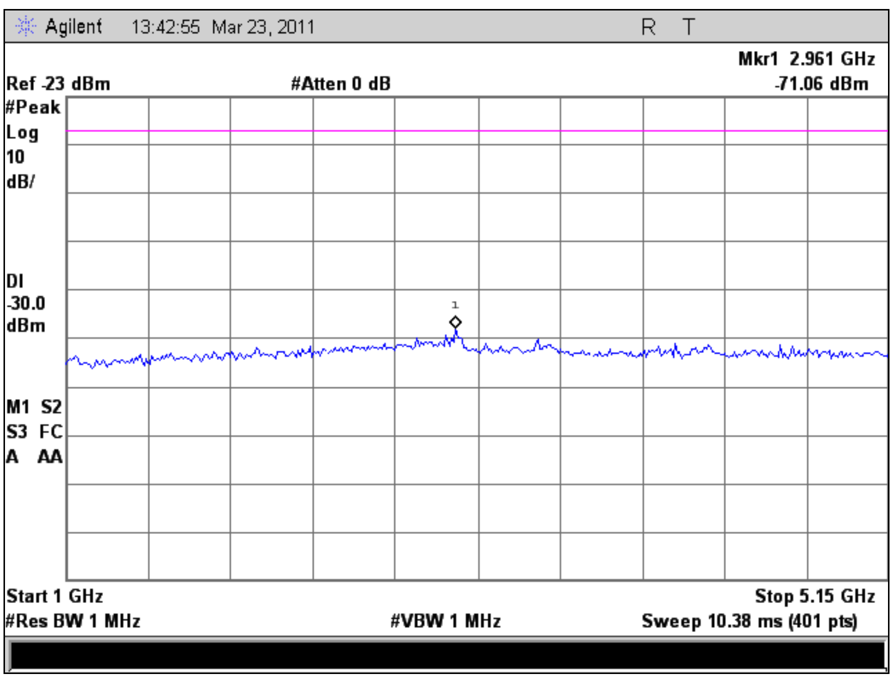


Plot 48. Conducted Spurious Emission, 5.725 GHz – 18 GHz, 5700 MHz, 802.11a 20 MHz

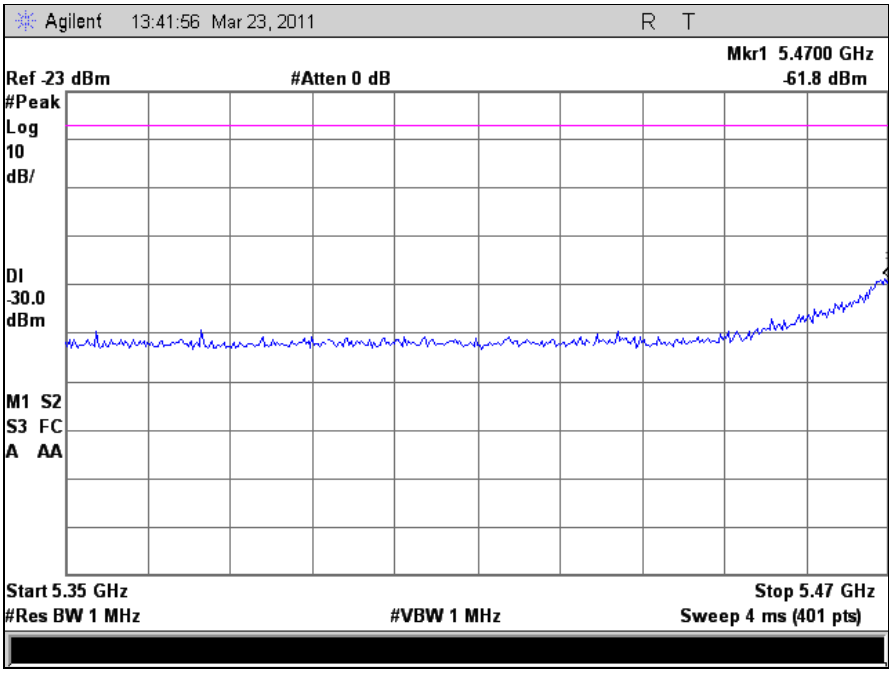
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 40 MHz



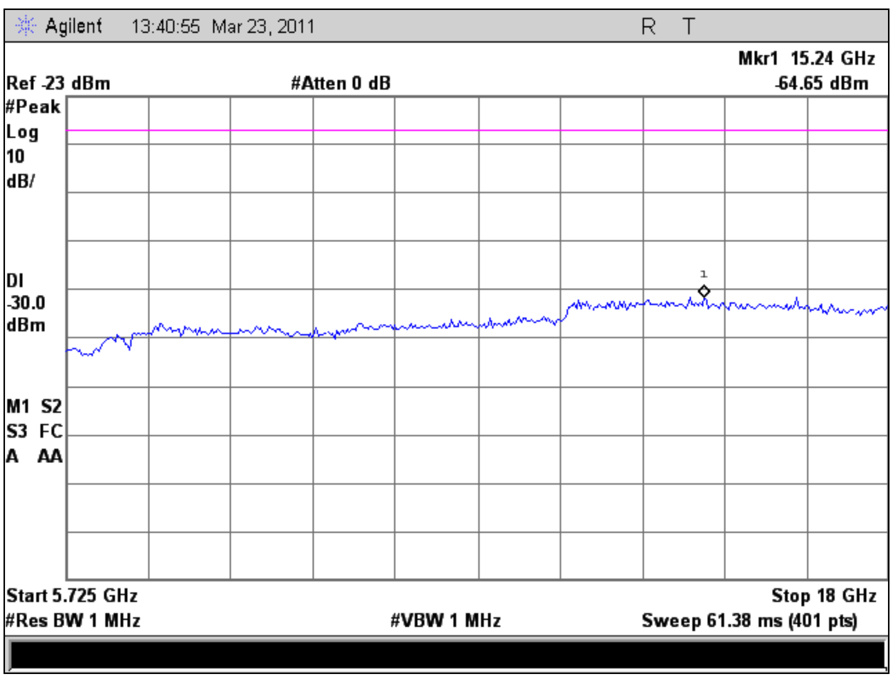
Plot 49. Conducted Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11a 40 MHz



Plot 50. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5500 MHz, 802.11a 40 MHz

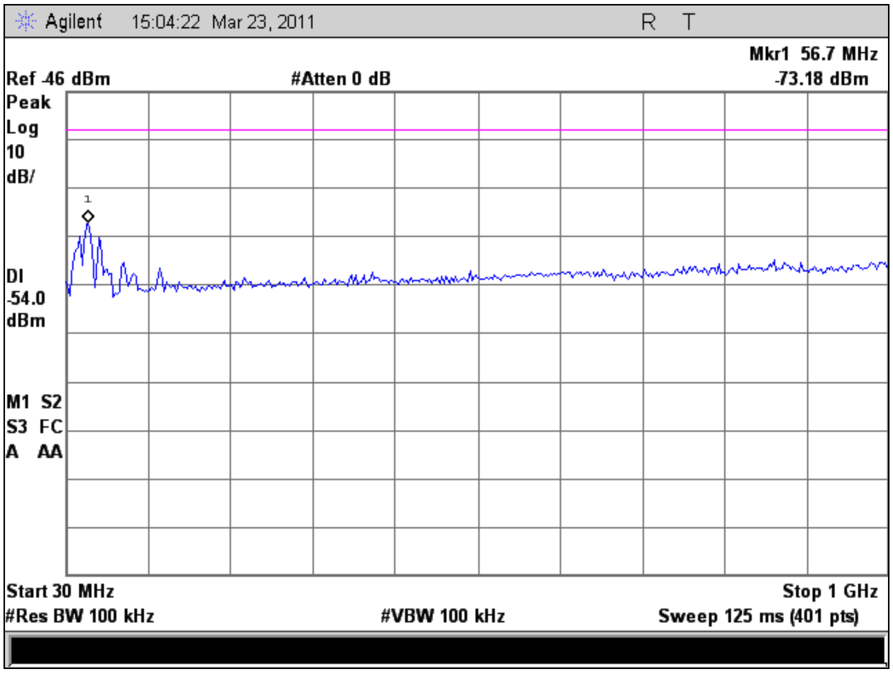


Plot 51. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5500 MHz, 802.11a 40 MHz

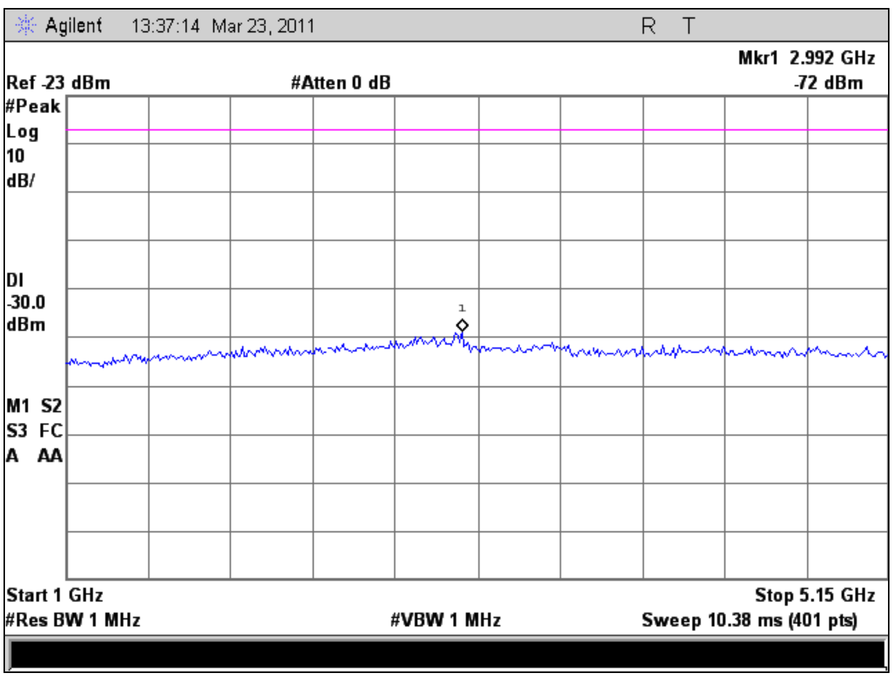


Plot 52. Conducted Spurious Emission, 5.725 GHz – 18 GHz, 5500 MHz, 802.11a 40 MHz

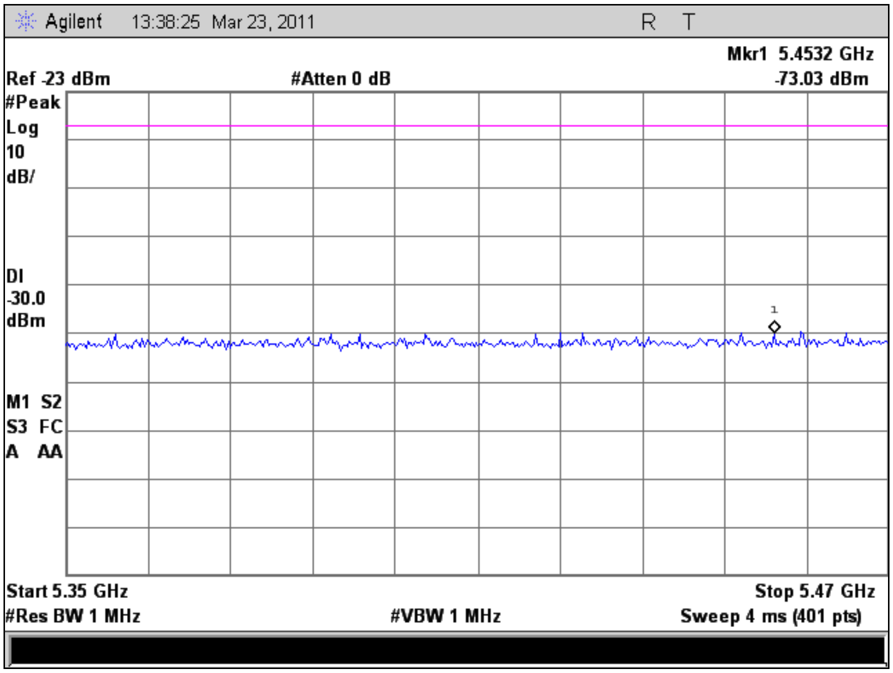
Conducted Spurious Emissions Outside the 5GHz RLAN Bands, 802.11a 40 MHz



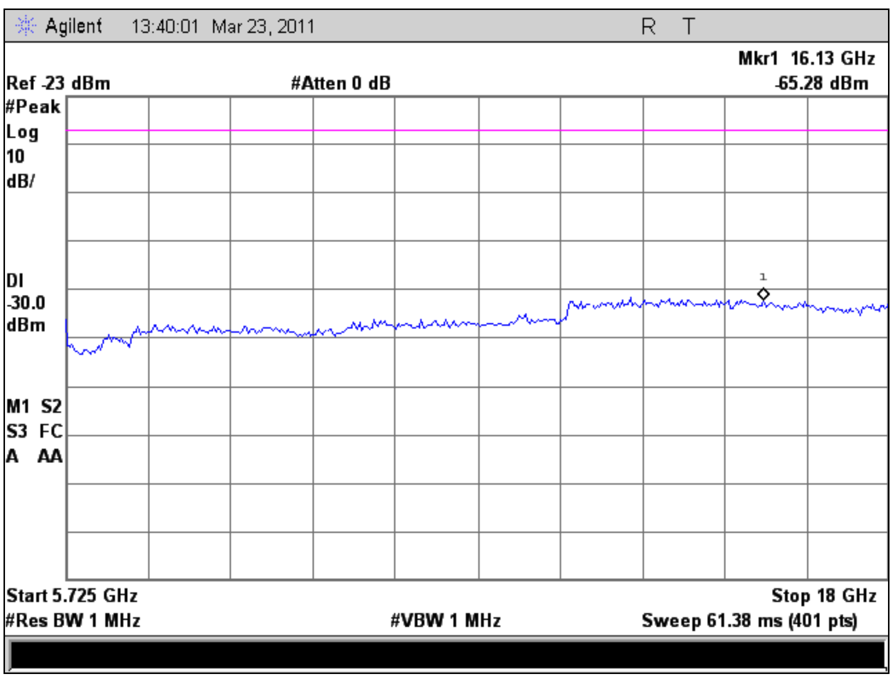
Plot 53. Conducted Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11a 40 MHz



Plot 54. Conducted Spurious Emission, 1 GHz – 5.15 GHz, 5700 MHz, 802.11a 40 MHz



Plot 55. Conducted Spurious Emission, Port 1, 5.35 GHz – 5.47 GHz, 5700 MHz, 802.11a 40 MHz



Plot 56. Conducted Spurious Emission, 5.725 GHz – 18 GHz, 5700 MHz, 802.11a 40 MHz

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

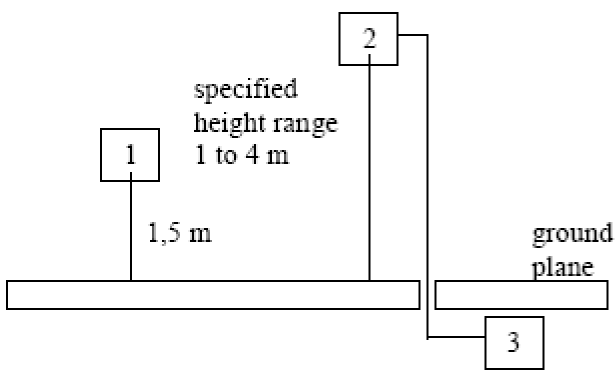
Test Requirement(s): **EN 301 893, Clause 5.3.5**

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

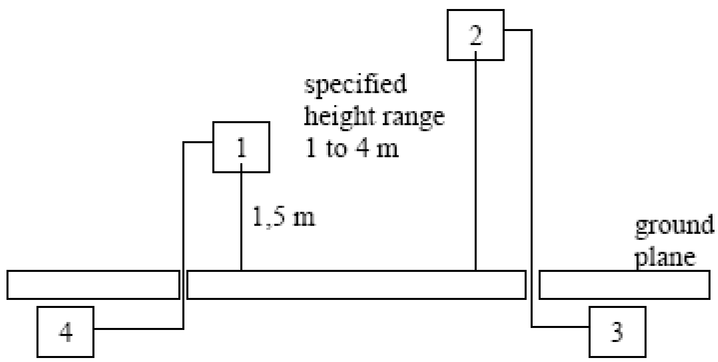
Test Procedure: The EUT was setup as per the specifications set out in Annex B of 301 893 and is shown below.



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.



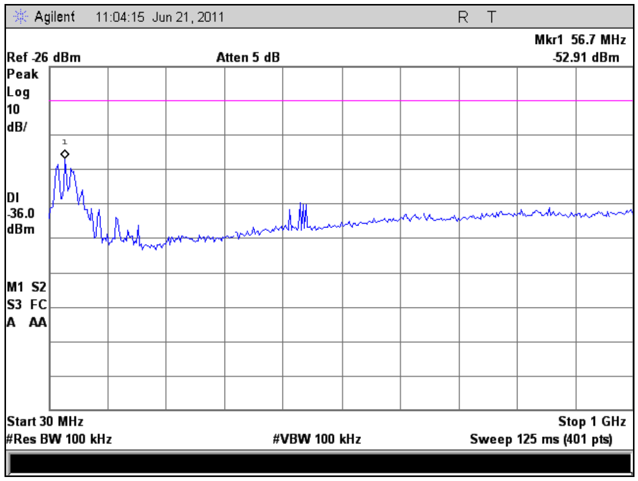
1. Substitution Antenna
2. Test Antenna
3. Spectrum Analyzer
4. Signal Generator

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

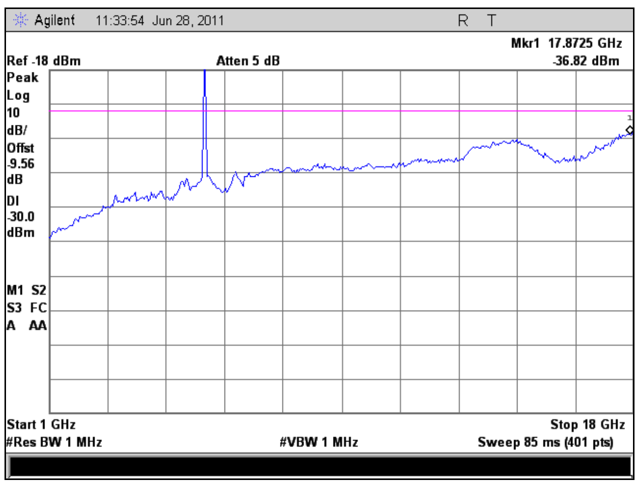
Test Engineer: Anderson Soungpanya

Test Date: 06/24/11 – 06/28/11

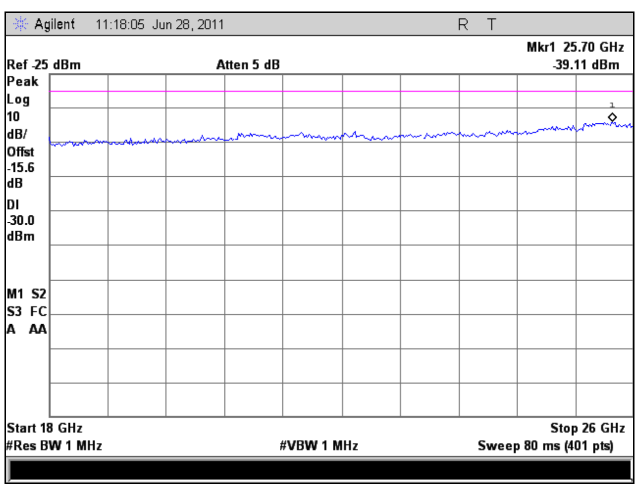
Radiated Spurious Emissions, 802.11a 20 MHz



Plot 57. Radiated Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11a 20 MHz

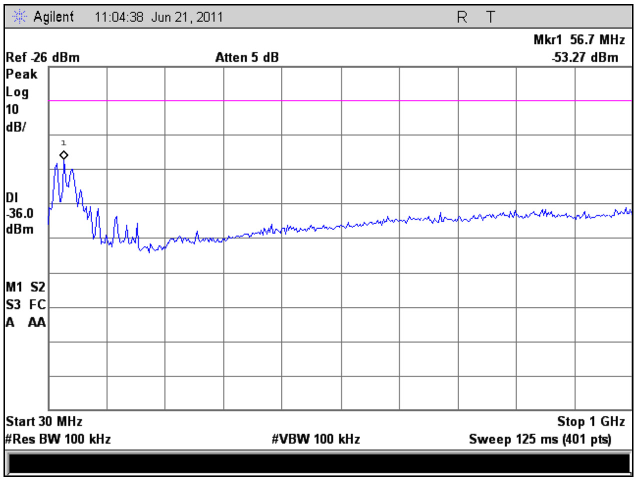


Plot 58. Radiated Spurious Emission, 1 GHz – 18 GHz, 5500 MHz, 802.11a 20 MHz

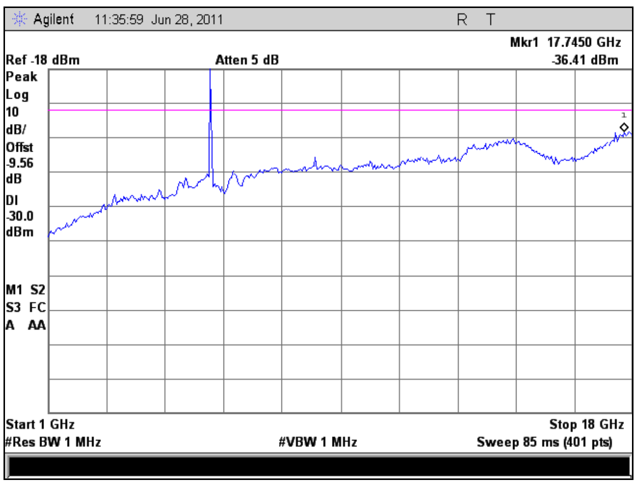


Plot 59. Radiated Spurious Emission, 18 GHz – 26 GHz, 5500 MHz, 802.11a 20 MHz

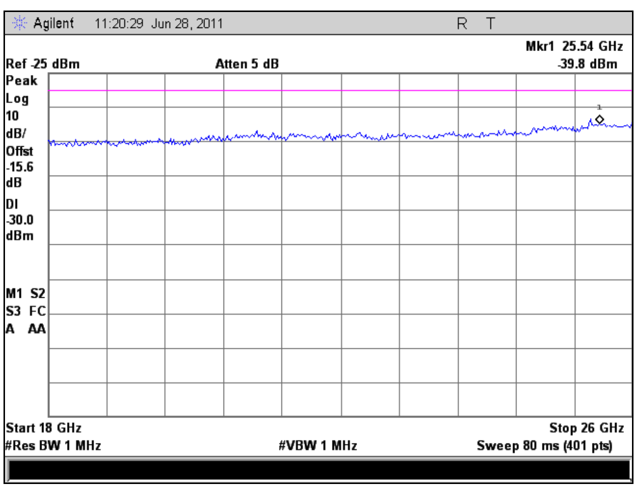
Radiated Spurious Emissions, 802.11a 20 MHz



Plot 60. Radiated Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11a 20 MHz

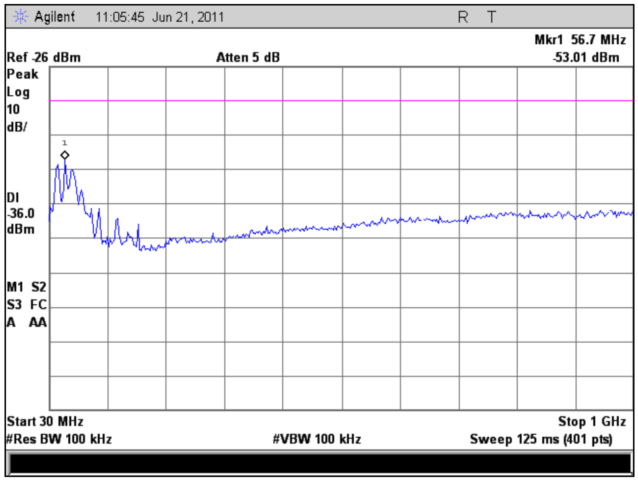


Plot 61. Radiated Spurious Emission, 1 GHz – 18 GHz, 5700 MHz, 802.11a 20 MHz

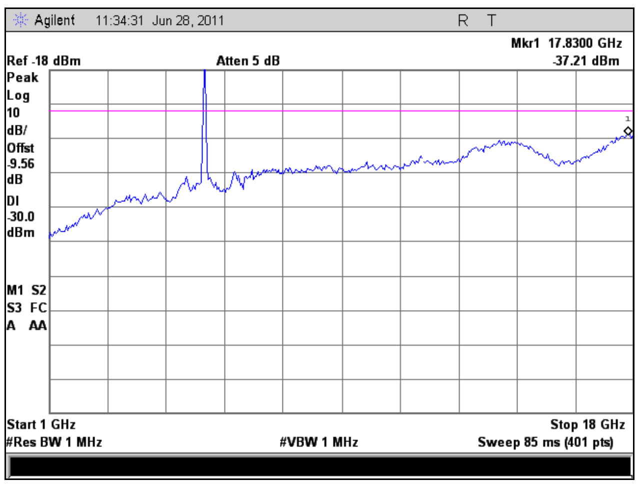


Plot 62. Radiated Spurious Emission, 18 GHz – 26 GHz, 5700 MHz, 802.11a 20 MHz

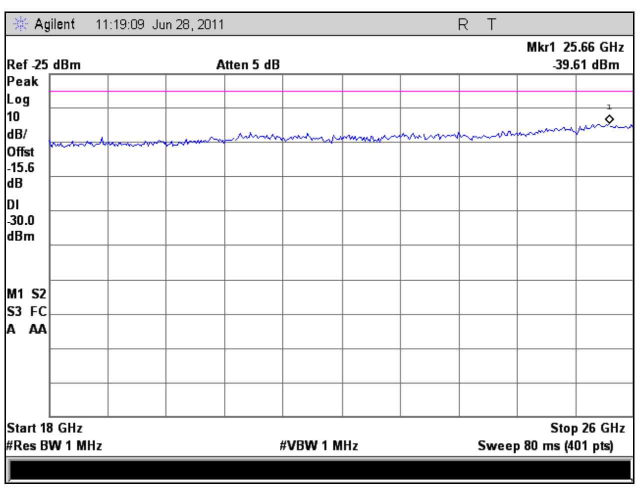
Radiated Spurious Emissions, 802.11a 40 MHz



Plot 63. Radiated Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11a 40 MHz

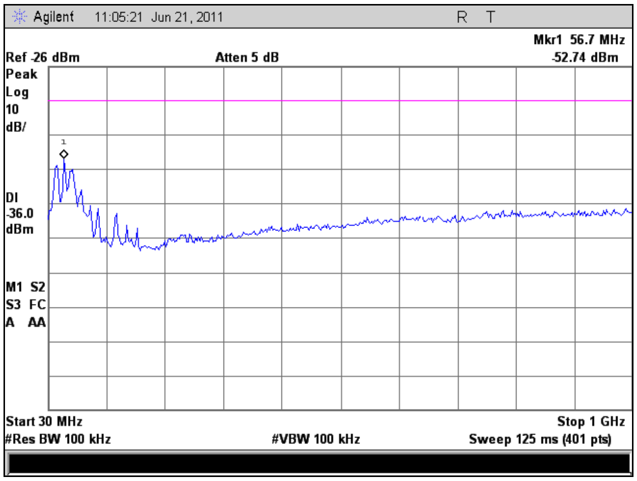


Plot 64. Radiated Spurious Emission, 1 GHz – 18 GHz, 5500 MHz, 802.11a 40 MHz

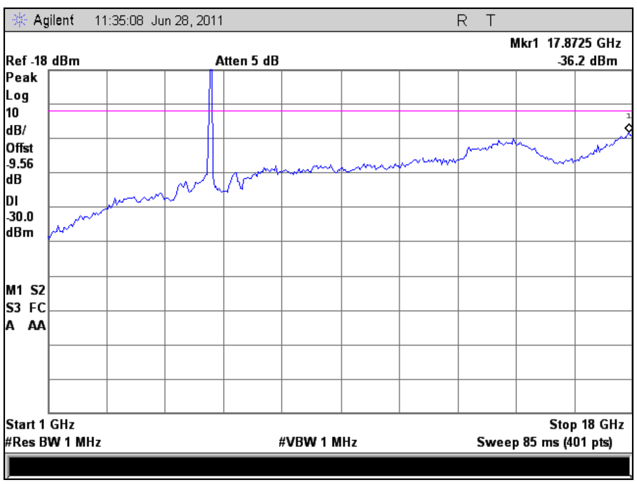


Plot 65. Radiated Spurious Emission, 18 GHz – 26 GHz, 5500 MHz, 802.11a 40 MHz

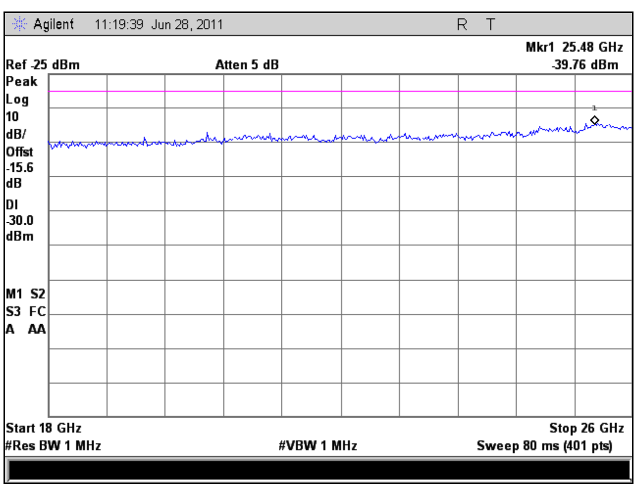
Radiated Spurious Emissions, 802.11a 40 MHz



Plot 66. Radiated Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11a 40 MHz

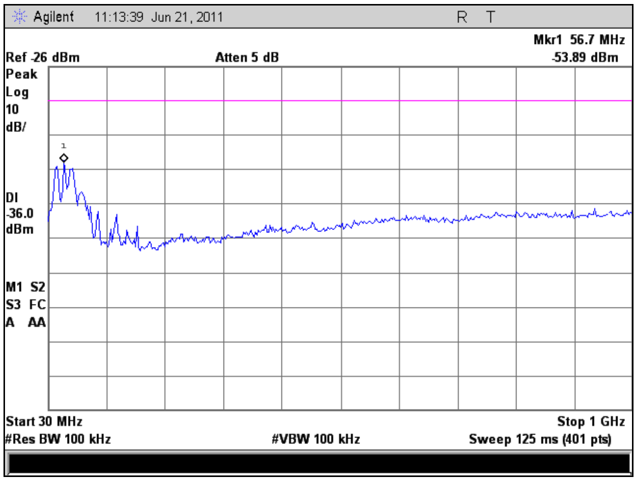


Plot 67. Radiated Spurious Emission, 1 GHz – 18 GHz, 5700 MHz, 802.11a 40 MHz

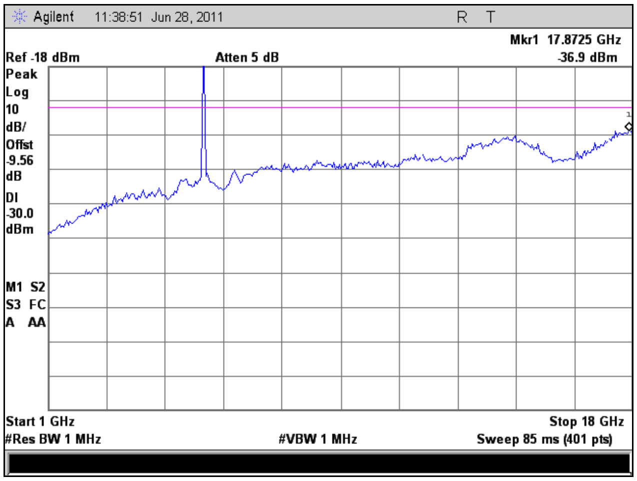


Plot 68. Radiated Spurious Emission, 18 GHz – 26 GHz, 5700 MHz, 802.11a 40 MHz

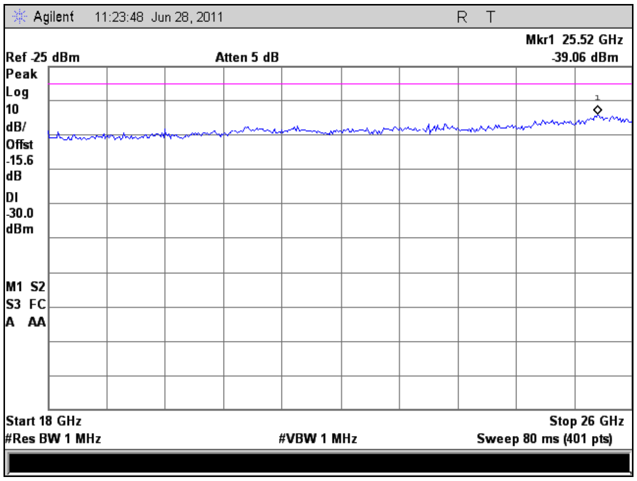
Radiated Spurious Emissions, 802.11n 20 MHz



Plot 69. Radiated Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11n 20 MHz

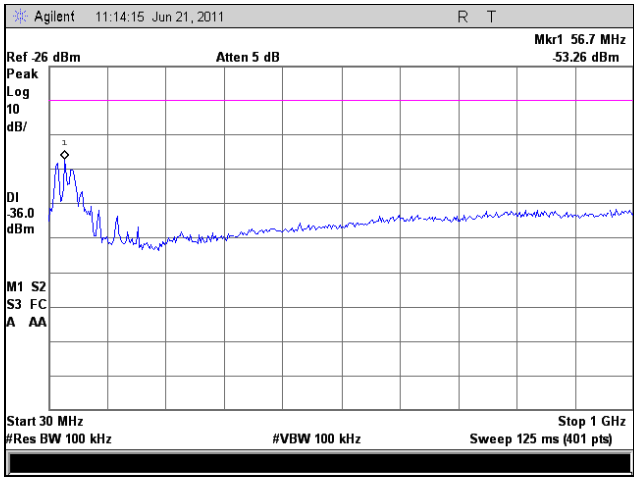


Plot 70. Radiated Spurious Emission, 1 GHz – 18 GHz, 5500 MHz, 802.11n 20 MHz

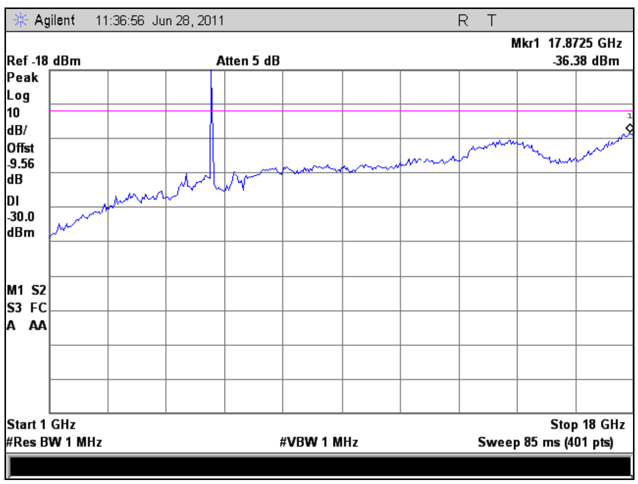


Plot 71. Radiated Spurious Emission, 18 GHz – 26 GHz, 5500 MHz, 802.11n 20 MHz

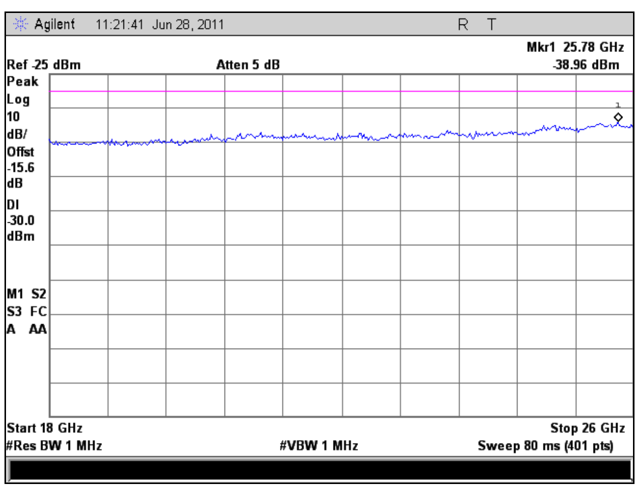
Radiated Spurious Emissions, 802.11n 20 MHz



Plot 72. Radiated Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11n 20 MHz

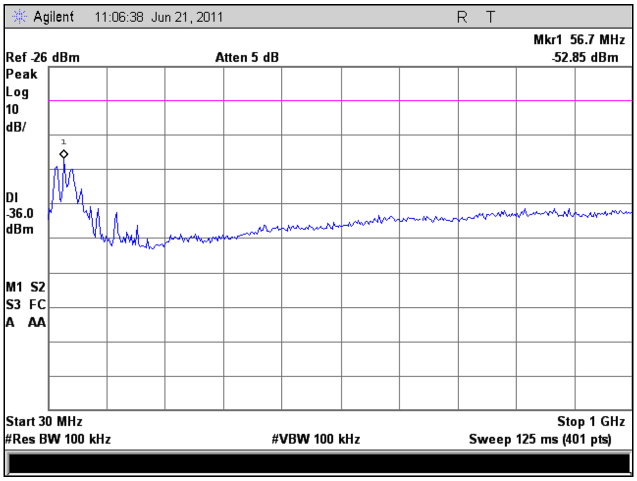


Plot 73. Radiated Spurious Emission, 1 GHz – 18 GHz, 5700 MHz, 802.11n 20 MHz

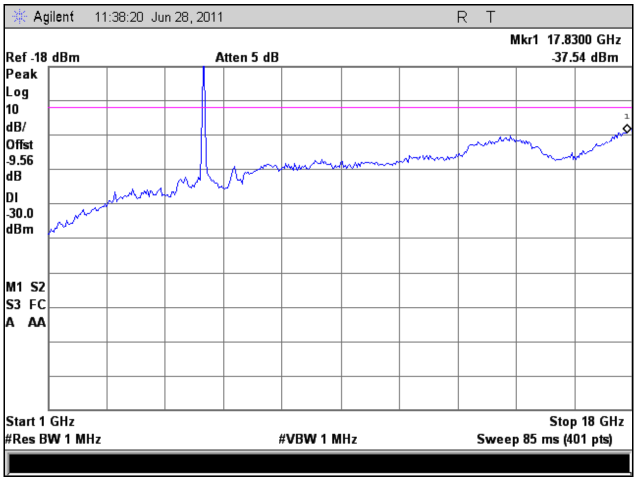


Plot 74. Radiated Spurious Emission, 18 GHz – 26 GHz, 5700 MHz, 802.11n 20 MHz

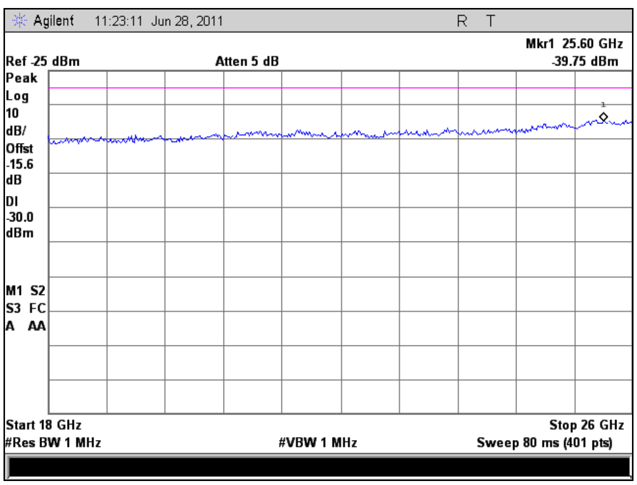
Radiated Spurious Emissions, 802.11n 40 MHz



Plot 75. Radiated Spurious Emission, 30 MHz – 1 GHz, 5500 MHz, 802.11n 40 MHz

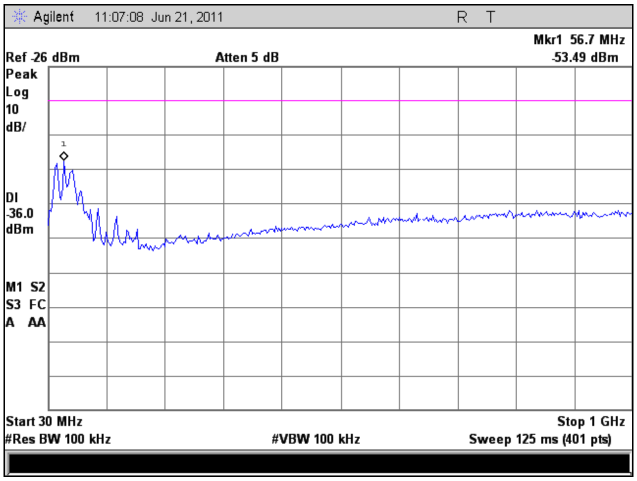


Plot 76. Radiated Spurious Emission, 1 GHz – 18 GHz, 5500 MHz, 802.11n 40 MHz

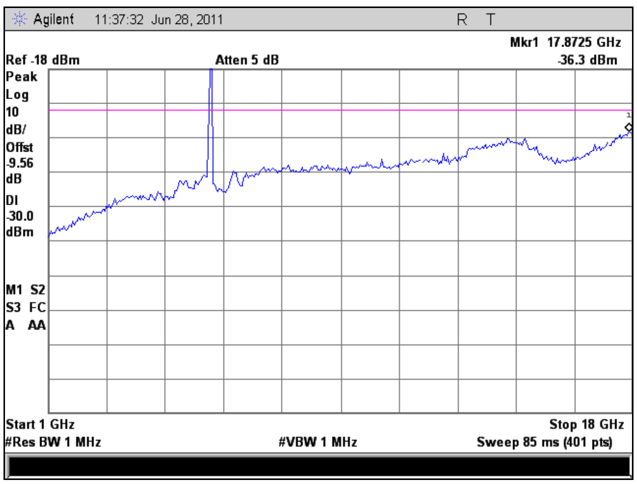


Plot 77. Radiated Spurious Emission, 18 GHz – 26 GHz, 5500 MHz, 802.11n 40 MHz

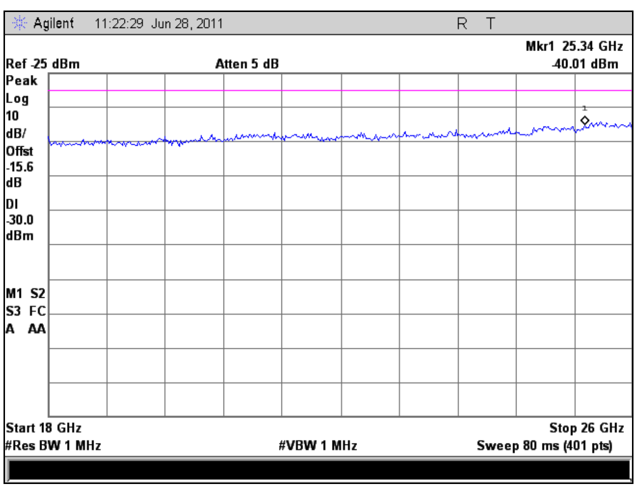
Radiated Spurious Emissions, 802.11n 40 MHz



Plot 78. Radiated Spurious Emission, 30 MHz – 1 GHz, 5700 MHz, 802.11n 40 MHz

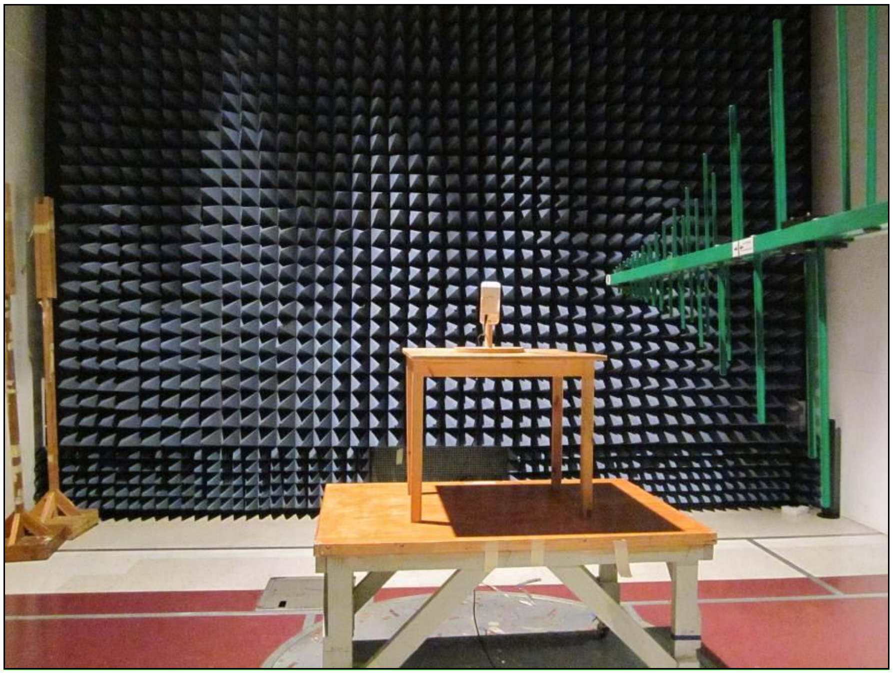


Plot 79. Radiated Spurious Emission, 1 GHz – 18 GHz, 5700 MHz, 802.11n 40 MHz



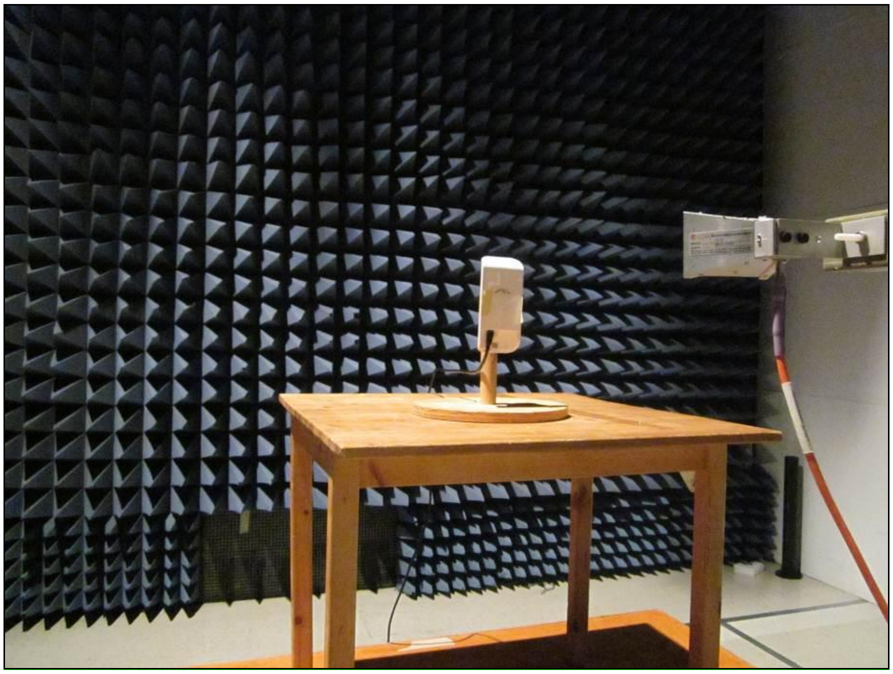
Plot 80. Radiated Spurious Emission, 18 GHz – 26 GHz, 5700 MHz, 802.11n 40 MHz

Radiated Emissions Test Setup Photographs



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

Photograph 3. Radiated Emissions, Test Setup, 1 GHz – 18 GHz



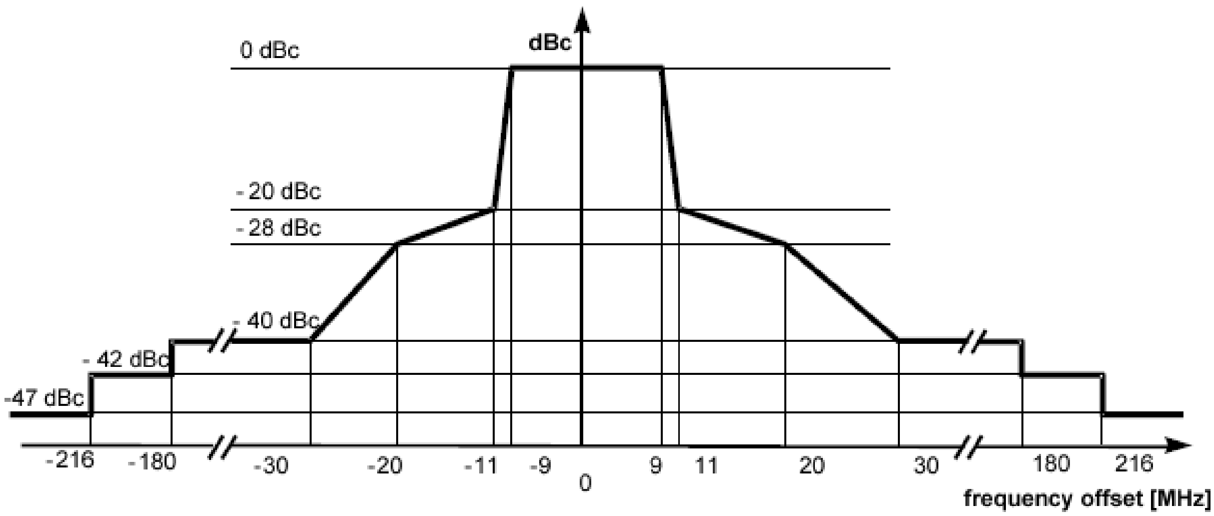
Photograph 4. Radiated Emissions, Test Setup, 1 GHz – 26.5 GHz

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: 06/24/11 – 06/28/11

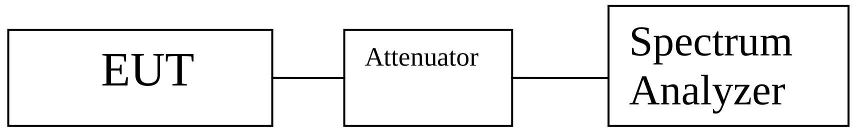
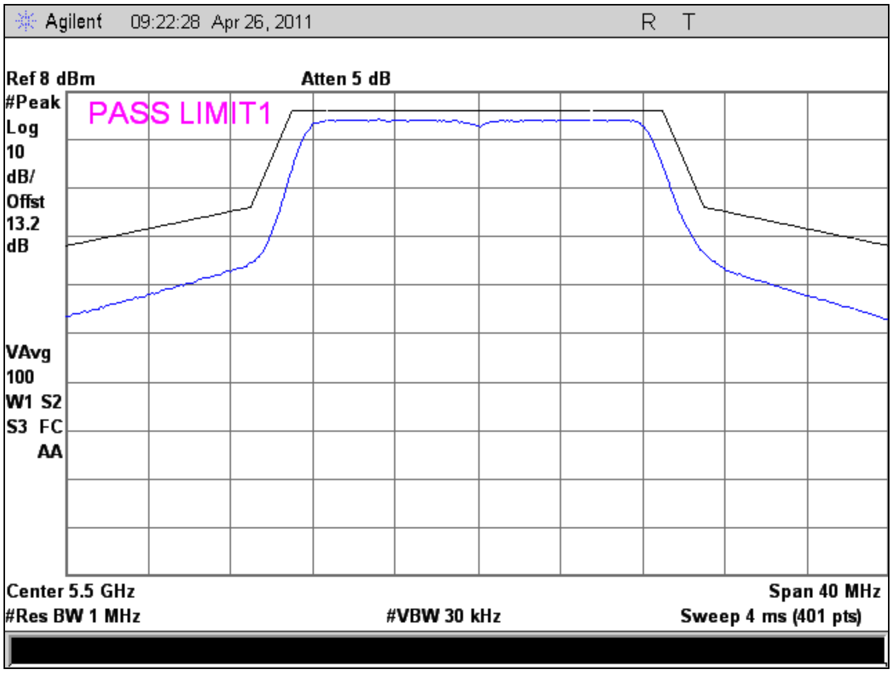
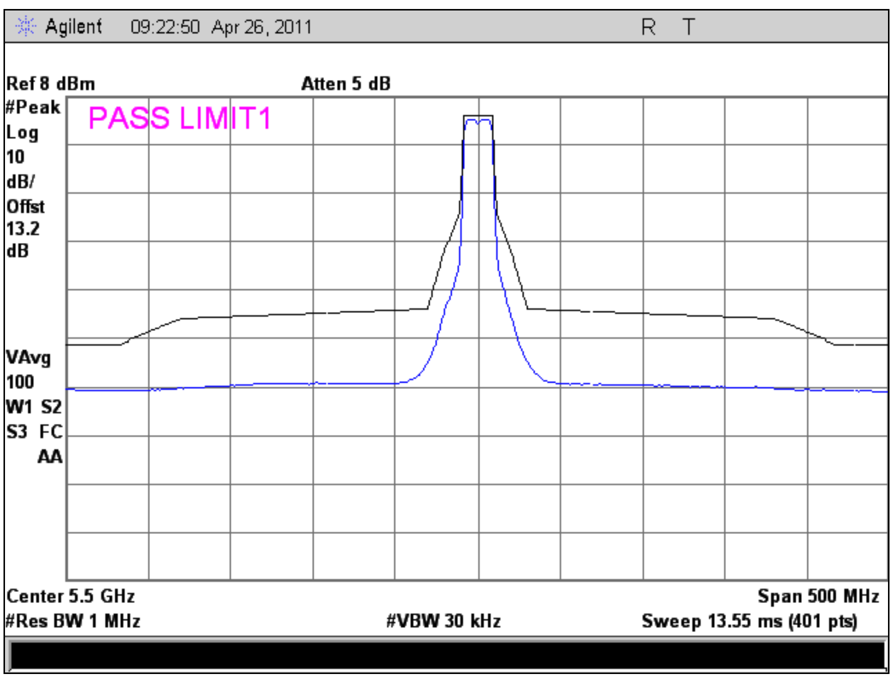


Figure 5. Unwanted Conducted Emissions Within Test Setup

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

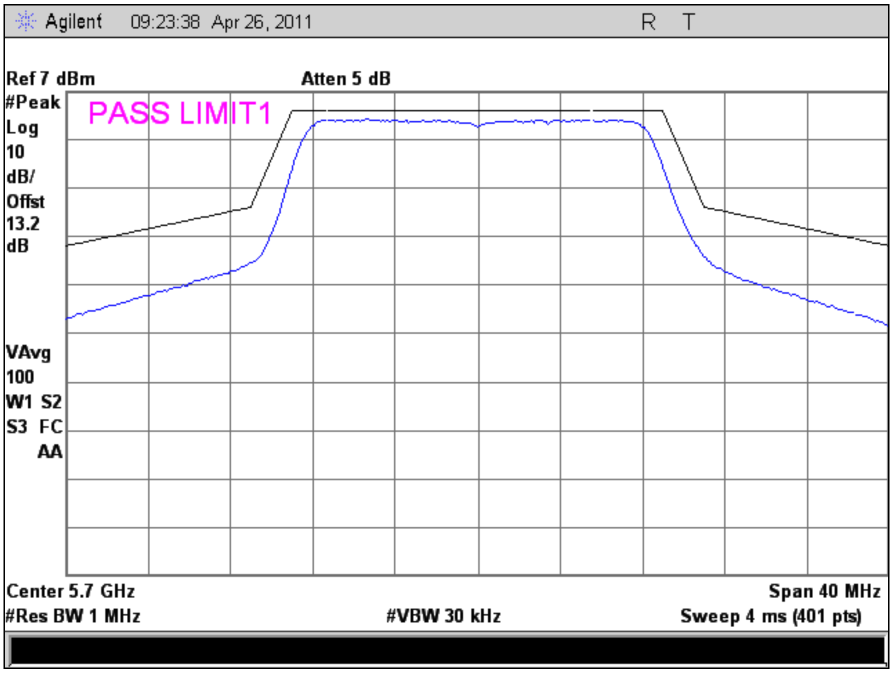


Plot 81. Conducted In Band Spurious Emission, 40 MHz Span, 5500 MHz, 802.11a 20 MHz

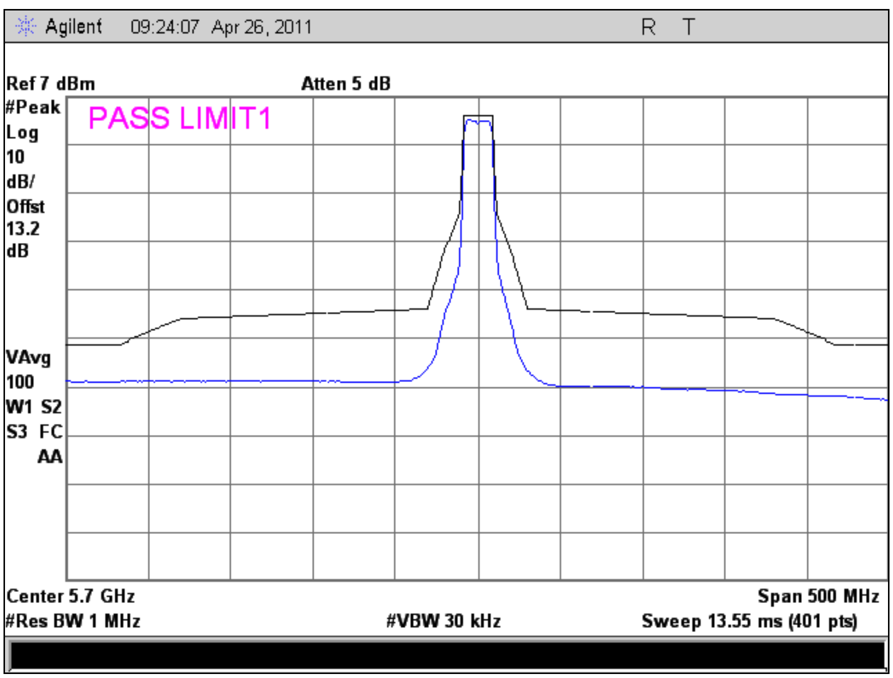


Plot 82. Conducted In Band Spurious Emission, 500 MHz Span, 5500 MHz, 802.11a 20 MHz

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

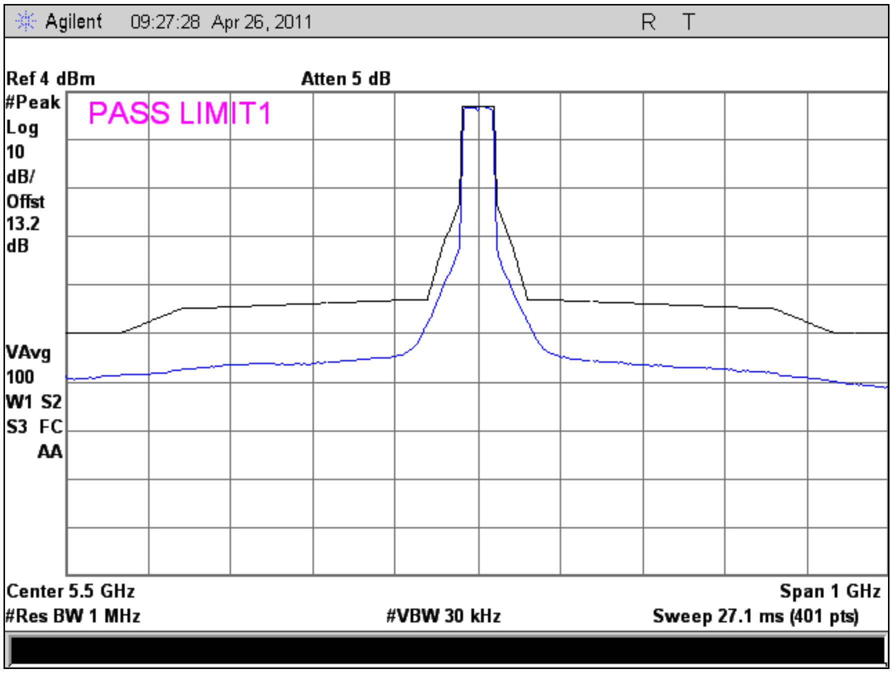


Plot 83. Conducted In Band Spurious Emission, 40 MHz Span, 5700 MHz, 802.11a 20 MHz

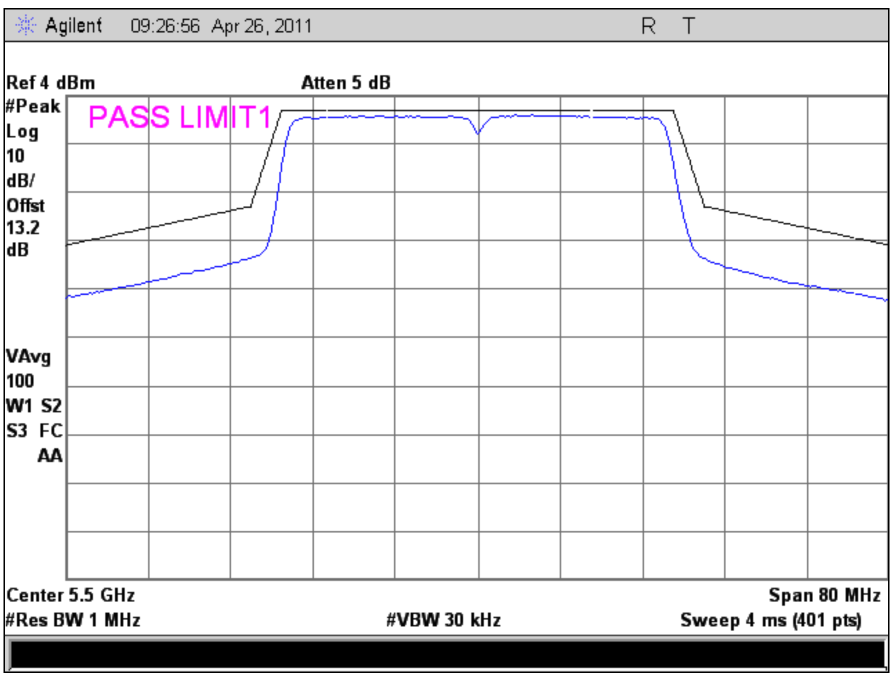


Plot 84. Conducted In Band Spurious Emission, 500 MHz Span, 5700 MHz, 802.11a 20 MHz

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

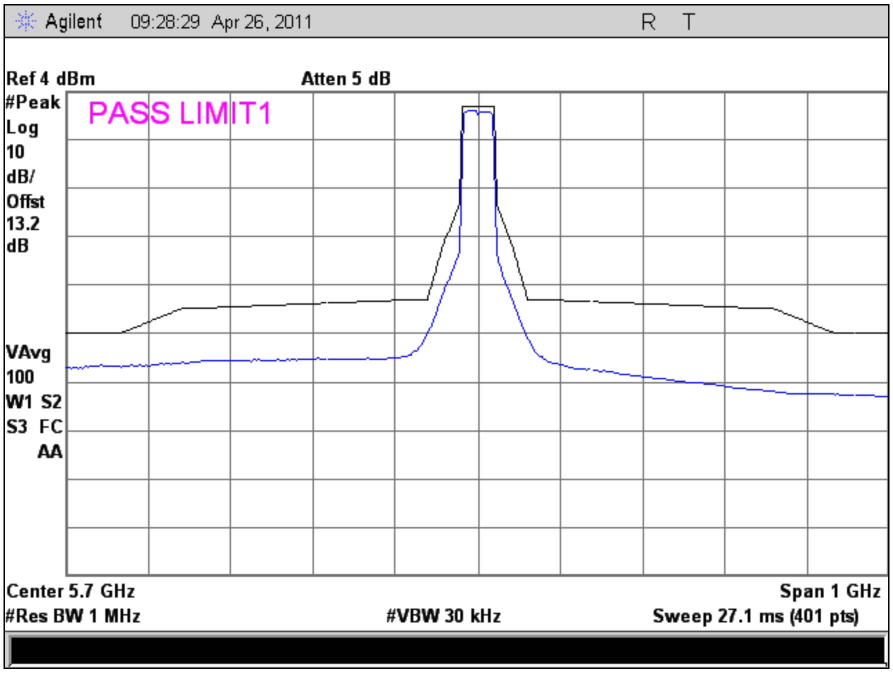


Plot 85. Conducted In Band Spurious Emission, 1 GHz Span, 5500 MHz, 802.11a 40 MHz

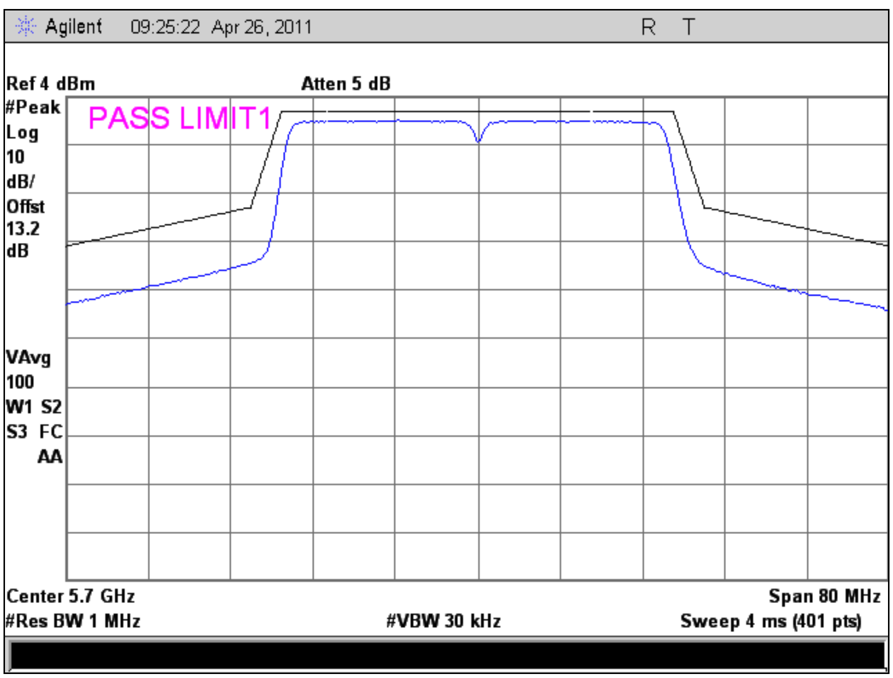


Plot 86. Conducted In Band Spurious Emission, 80 MHz Span, 5500 MHz, 802.11a 40 MHz

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



Plot 87. Conducted In Band Spurious Emission, 1 GHz Span, 5700 MHz, 802.11a 40 MHz



Plot 88. Conducted In Band Spurious Emission, 80 MHz Span, 5700 MHz, 802.11a 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.

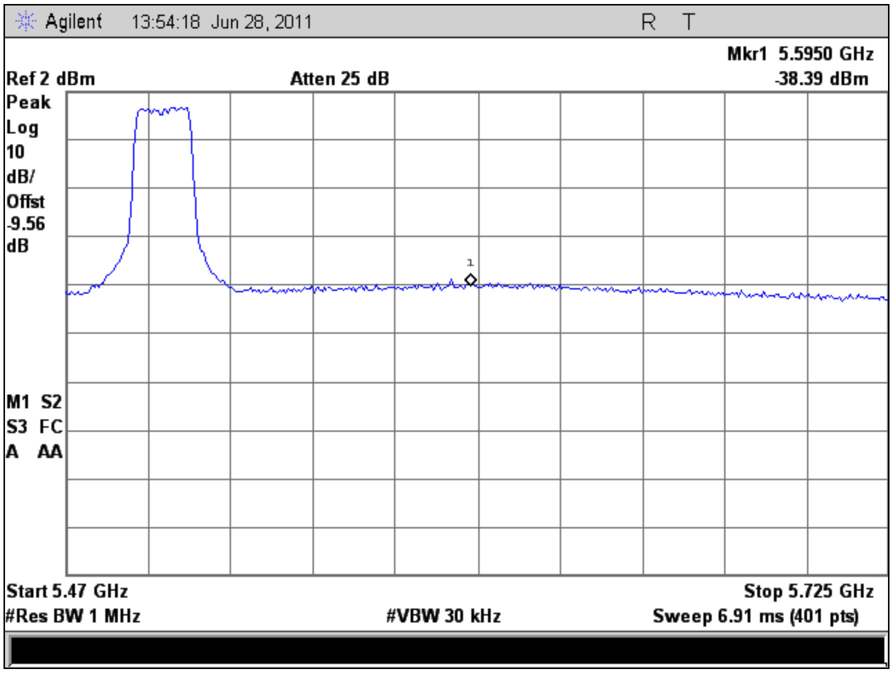
In case of measurements on smart antenna systems (devices with multiple transmit chains) measurements need only to be performed on one of the active transmit chains (antenna outputs).

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

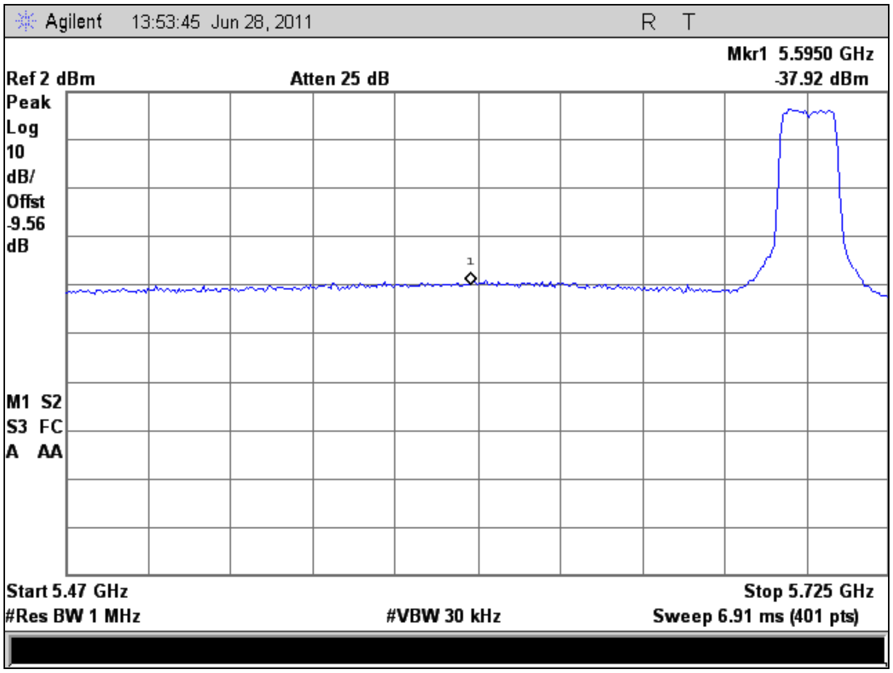
Test Engineer: Anderson Soungpanya

Test Date: 06/24/11 – 06/28/11

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

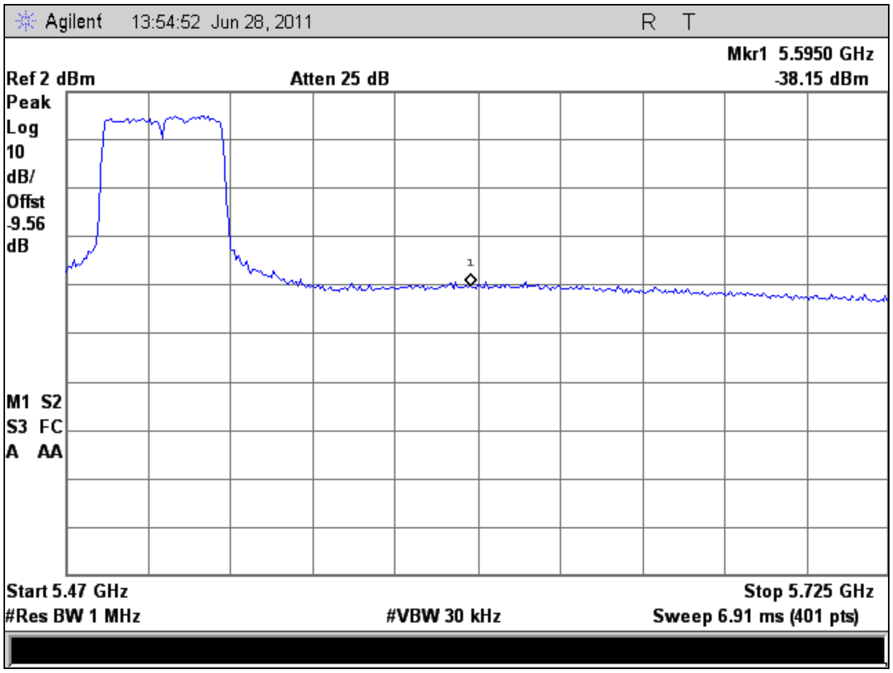


Plot 89. Radiated In Band Spurious Emission, 5500 MHz, 802.11a 20 MHz

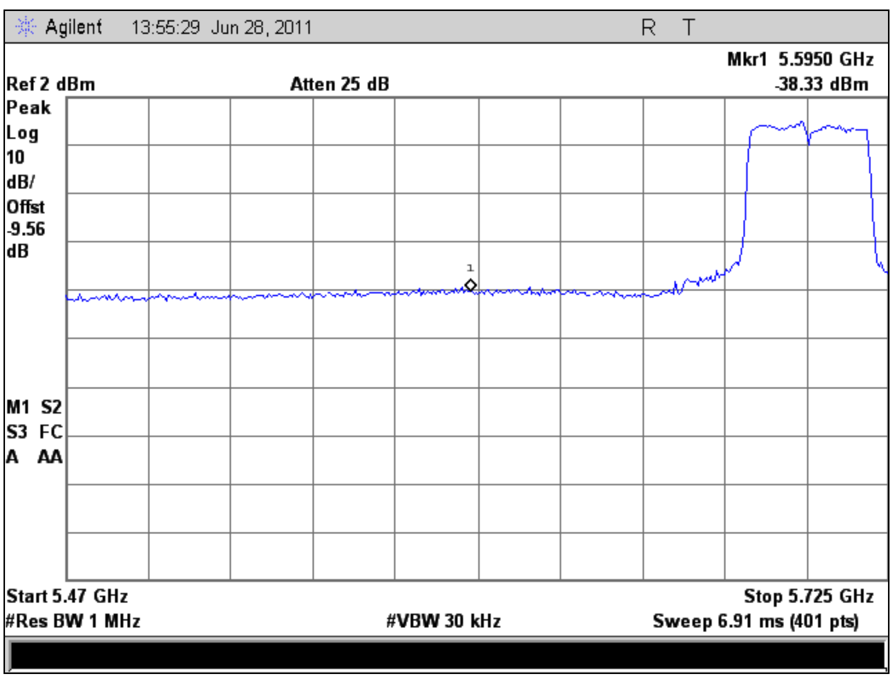


Plot 90. Radiated In Band Spurious Emission, 5700 MHz, 802.11a 20 MHz

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

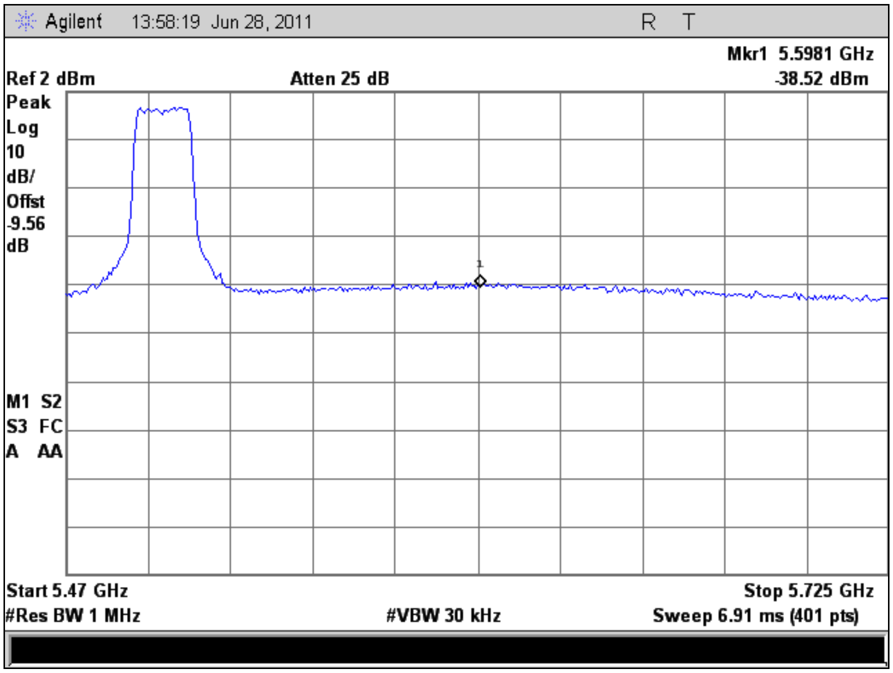


Plot 91. Radiated In Band Spurious Emission, 5500 MHz, 802.11a 40 MHz

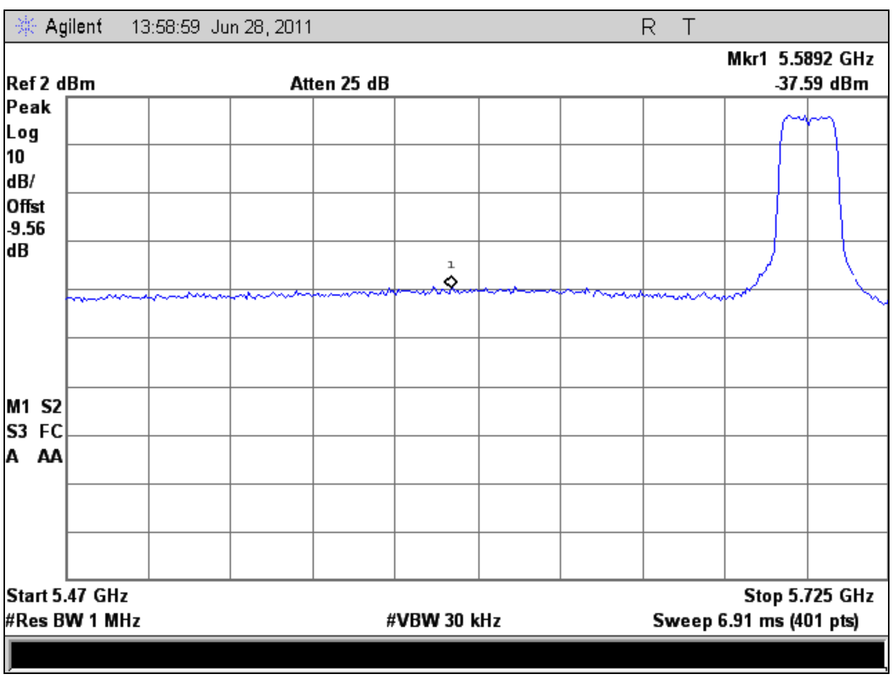


Plot 92. Radiated In Band Spurious Emission, 5700 MHz, 802.11a 40 MHz

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

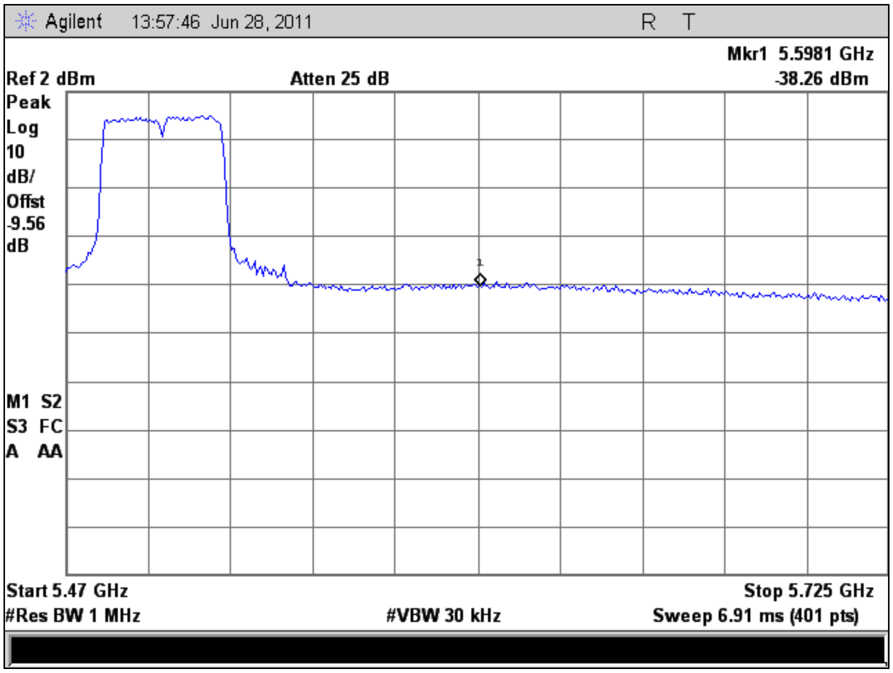


Plot 93. Radiated In Band Spurious Emission, 5500 MHz, 802.11n 20 MHz

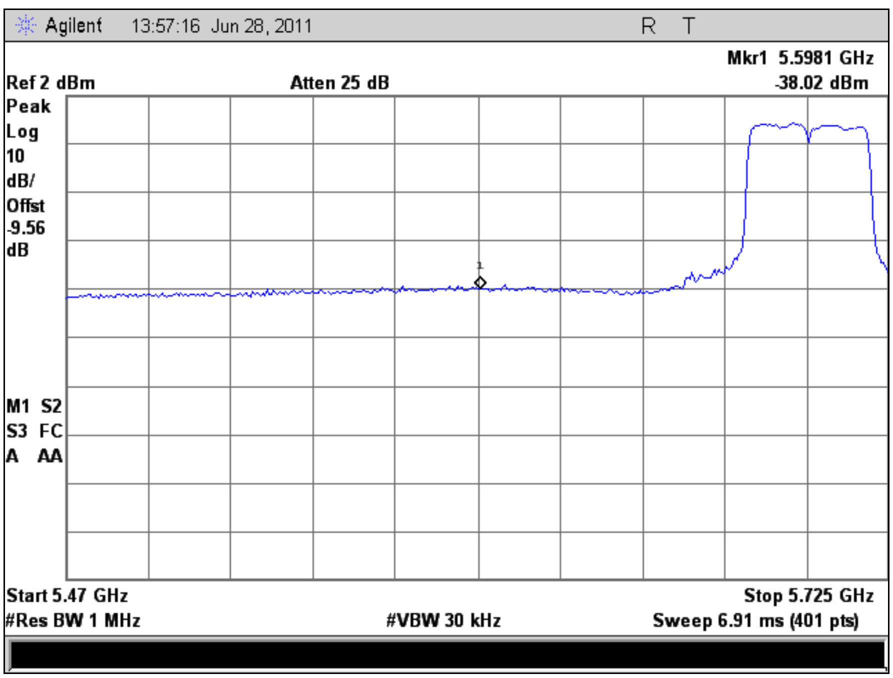


Plot 94. Radiated In Band Spurious Emission, 5700 MHz, 802.11n 20 MHz

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



Plot 95. Radiated In Band Spurious Emission, 5500 MHz, 802.11n 40 MHz



Plot 96. 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: Lionel Gabrillo and Anderson Soungpanya

Test Date: 03/23/11 – 6/28/11

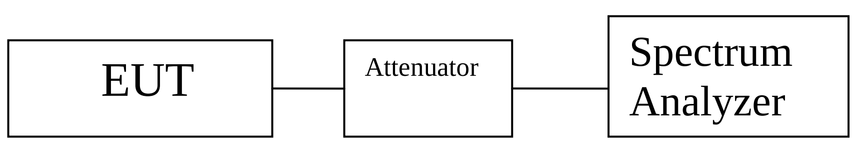
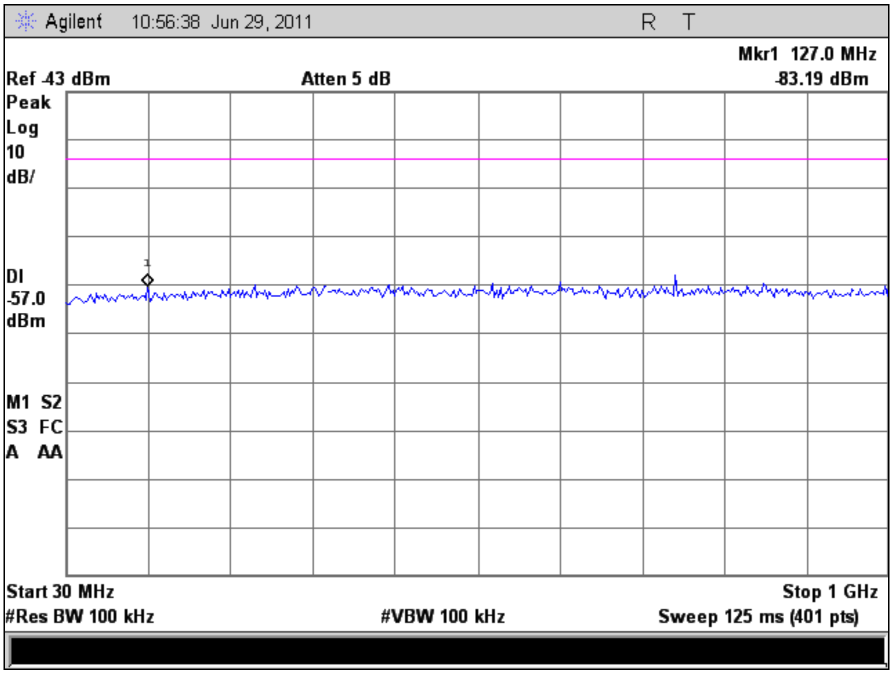
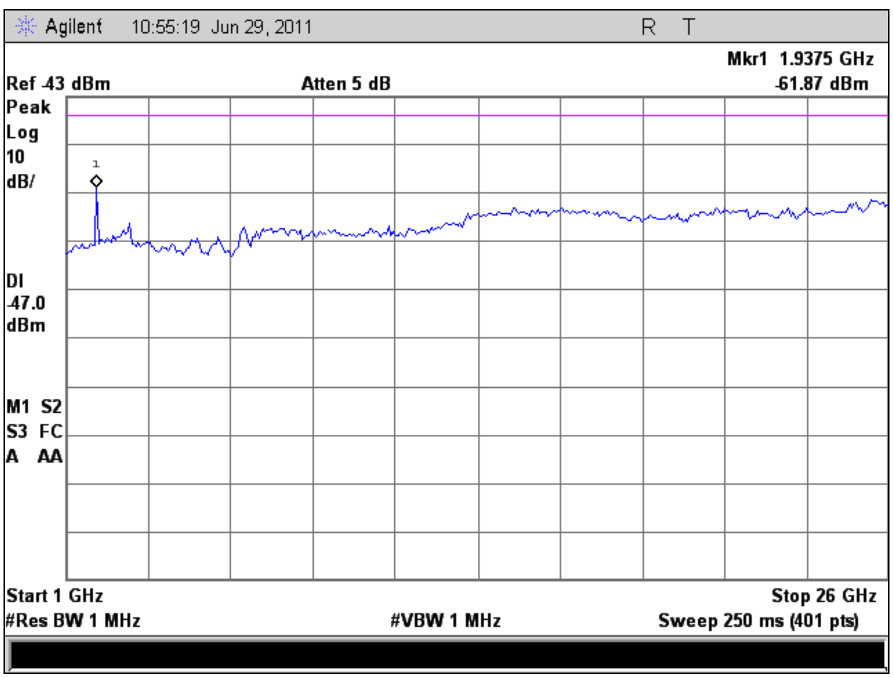


Figure 6. Receiver Spurious Emissions Test Setup

Receiver Spurious Emissions (Conducted), Port 1

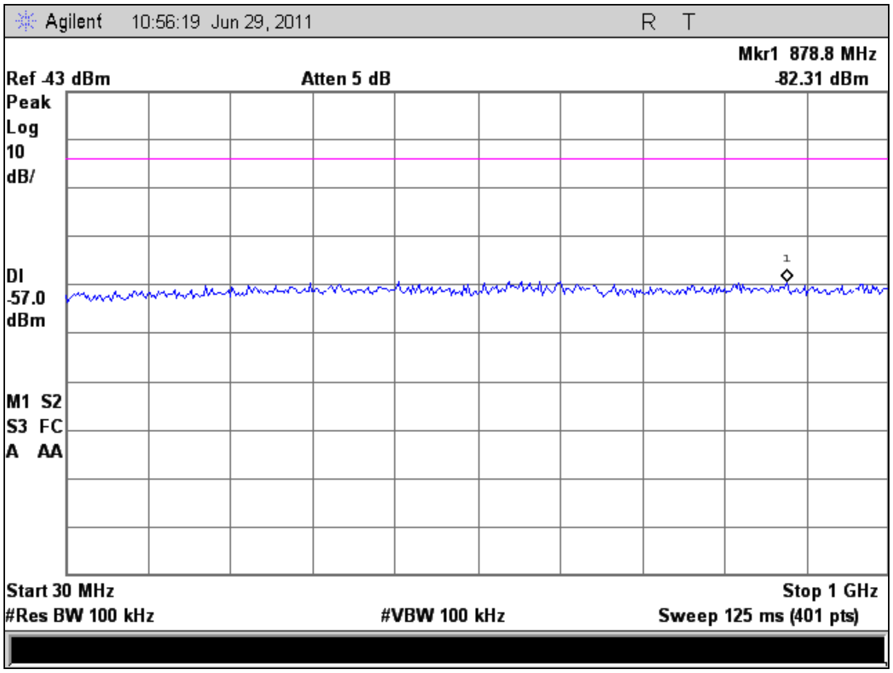


Plot 97. Conducted Receiver Spurious Emission, 30 MHz – 1 GHz, Port 1

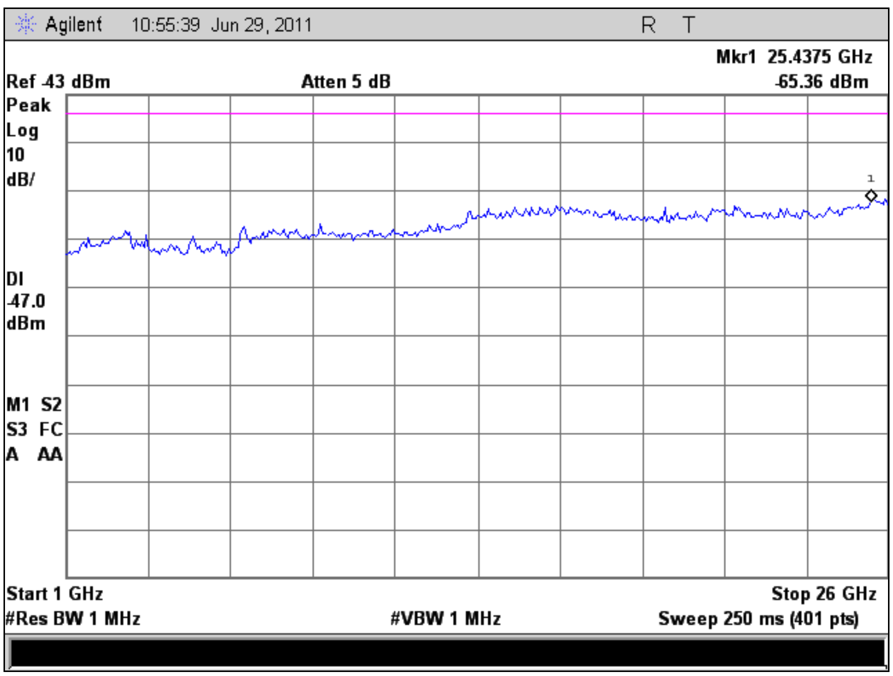


Plot 98. Conducted Receiver Spurious Emission, 1 GHz – 26 GHz, Port 1

Receiver Spurious Emissions (Conducted), Port 2



Plot 99. Conducted Receiver Spurious Emission, 30 MHz – 1 GHz, Port 2



Plot 100. 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.

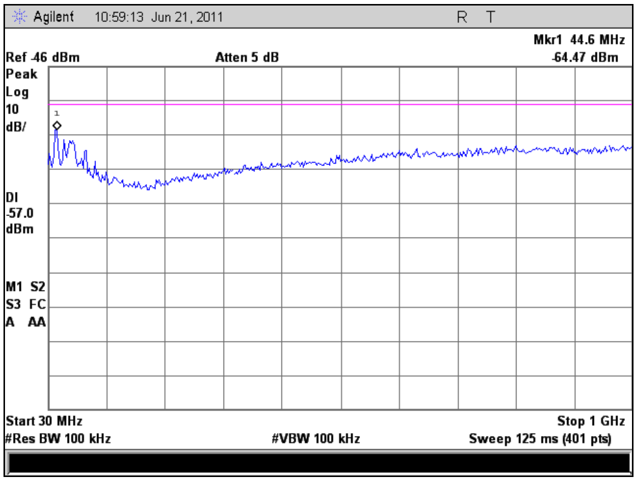
Test Results: The EUT as tested was found compliant with the specified limits of Clause 5.3.7.

Test Engineer: Lionel Gabrillo and Anderson Soungpanya

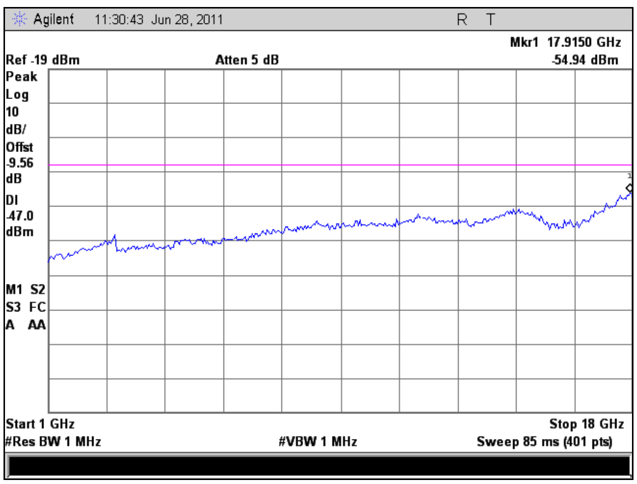
Test Date: 03/23/11 – 6/28/11

Figure 7. Receiver Spurious Emissions Test Setup

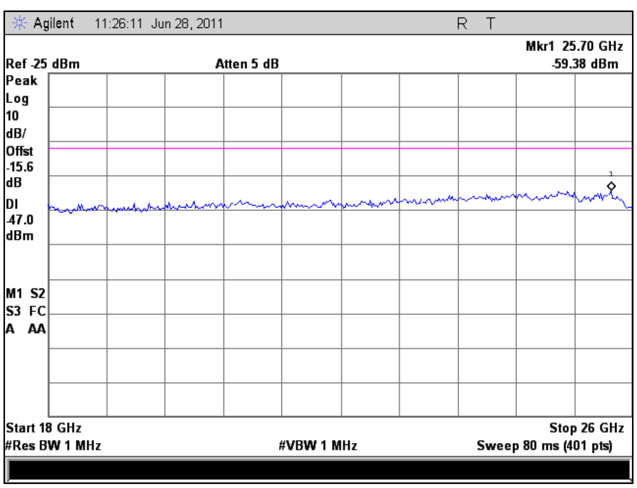
Receiver Spurious Emissions (Radiated)



Plot 101 Radiated Receiver Spurious Emission, 30 MHz - 1 GHz



Plot 102. Radiated Receiver Spurious Emission, 1 GHz - 18 GHz



Plot 103. 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. DFS Requirements

4.7 Dynamic Frequency Selection (DFS)

4.7.1 Introduction

An RLAN shall employ a Dynamic Frequency Selection (DFS) function to:

- detect interference from other systems and to avoid co-channel operation with these systems, notably radar systems (radar detection);
- provide on aggregate a uniform loading of the spectrum across all devices.

Radar detection is required when operating on channels whose nominal bandwidth falls partly or completely within the frequency ranges 5 250 MHz to 5 350 MHz or 5 470 MHz to 5 725 MHz. This requirement applies to all types of RLAN devices and to any type of communication between these devices.

In addition, equipment transmitting in the band 5600 - 5650MHz must also be able to detect meteorological radars employing non-constant pulse interval times. These are often referred to as staggered or interleaved PRFs (Pulse Repetition Frequencies) by which up to 3 different PRF values are used. The staggered radar bins from 301 893 v 1.5.1 were used to demonstrate compliance.

The DFS function as described in the present document is not tested for its ability to detect frequency hopping radar signals.

4.7.1.1 DFS operational modes

Within the context of the operation of the DFS function, an RLAN device shall operate in either master mode or slave mode. RLAN devices operating in slave mode (slave device) shall only operate in a network controlled by a RLAN device operating in master mode (master device).

Some RLAN devices are capable of communicating in ad-hoc manner without being attached to a network. Devices operating in this manner on channels whose nominal bandwidth falls partly or completely within the range 5 250 MHz to 5 350 MHz or 5 470 MHz to 5 725 MHz shall employ DFS and should be tested against the requirements applicable to a master.

4.7.1.2 DFS operation

The operational behaviour and individual DFS requirements that are associated with master and slave devices are as follows:

Master devices:
a) The master device shall use a Radar Interference Detection function in order to detect radar signals. b) Before initiating a network on a channel, which has not been identified as an Available Channel, the master device shall perform a Channel Availability Check to ensure that there is no radar operating on the channel. c) During normal operation, the master device shall monitor the Operating Channel (In-Service Monitoring) to ensure that there is no radar operating on the channel. d) If the master device has detected a radar signal during In-Service Monitoring, the Operating Channel is made unavailable. The master device shall instruct all its associated slave devices to stop transmitting on this (to become unavailable) channel. e) The master device shall not resume any transmissions on this Unavailable Channel during a period of time after a radar signal was detected. This period is referred as the Non-Occupancy Period.

Slave devices:
f) A slave device shall not transmit before receiving an appropriate enabling signal from a master device. g) A slave device shall stop all its transmissions whenever instructed by a master device to which it is associated. The device shall not resume any transmissions until it has again received an appropriate enabling signal from a master device. h) A slave device which is required to perform radar detection (see table D.3), shall stop its own transmissions if it has detected a radar. The Operating Channel is made unavailable for the slave device. It shall not resume any transmissions on this Unavailable Channel for a period of time equal to the Non-Occupancy Period.

See Table 17 for the applicability of DFS requirements for each of the above mentioned operational modes. The master device may implement the Radar Interference Detection function referred to under a) using another device associated with the master. In such a case, the combination shall be tested against the requirements applicable to the master. The maximum power level of a slave device will define whether or not the device needs to have a Radar Interference Detection function (see table D.3).

4.7.2 DFS technical requirements specifications

Table 17 lists the DFS related technical requirements and their applicability for each of the operational modes described in clause 4.7.1. If the RLAN device is capable of operating in more than one operational mode described in clause 4.7.1 then each operating mode shall be assessed separately.

Requirement	DFS Operational mode		
	Master	**Slave without radar detection**	**Slave with radar detection**
Channel Availability Check	✓	Not required	Not required (see Note 2)
Off-Channel CAC (see Note 1)	✓	Not required	✓ (see Note 2)
In-Service Monitoring	✓	Not required	✓
Channel Shutdown	✓	✓	✓
Non-Occupancy Period	✓	Not required	✓
Uniform Spreading	✓	Not required	Not required
Note 1: Where implemented by the manufacturer. **Note 2:** Slave A slave with radar detection is not required to perform a CAC or Off-Channel CAC at initial use of the channel but only after the slave has detected a radar signal on the Operating Channel by In-Service Monitoring.			

Table 17. Applicability of DFS requirements

DFS Detection Thresholds

EIRP Spectral Density	Value (see Notes 1 and 2)
10 dBm/MHz	-62 dBm
Note 1: This is the level at the input of the receiver with a maximum EIRP density of 10 dBm/MHz and assuming a 0 dBi receive antenna. For devices employing different EIRP spectral density and/or a different receive antenna gain G (dBi) the DFS threshold level at the receiver input follows the following relationship: DFS Detection Threshold (dBm) = -62 + 10 – EIRP Spectral Density (dBm/MHz) + G (dBi), however the DFS threshold level shall not be lower than -64 dBm assuming a 0 dBi receive antenna gain. **Note 2:** Slave devices with a maximum EIRP of less than 23 dBm do not have to implement radar detection.	

Table 18. Interference Threshold values, Master or Client incorporating In-Service Monitoring

Parameter	Value
Channel Availability Check Time	60 seconds (see Note 1)
Maximum Off-Channel CAC Time	4 hours (see Note 2)
Non-occupancy period	Minimum 30 minutes
Channel Move Time	10 seconds
Channel Closing Transmission Time	1 s
Note 1: For channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz, the CAC Time shall be 10 minutes. **Note 2:** For channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz, the Maximum Off-Channel cAC Time shall be 24 hours.	

Table 19. DFS Requirement values

Pulse width W [µs]	Pulse repetition frequency PRF (PPS)	Pulses per burst (PPB)
1	700	18

Table 20. Parameters of the reference DFS test signal

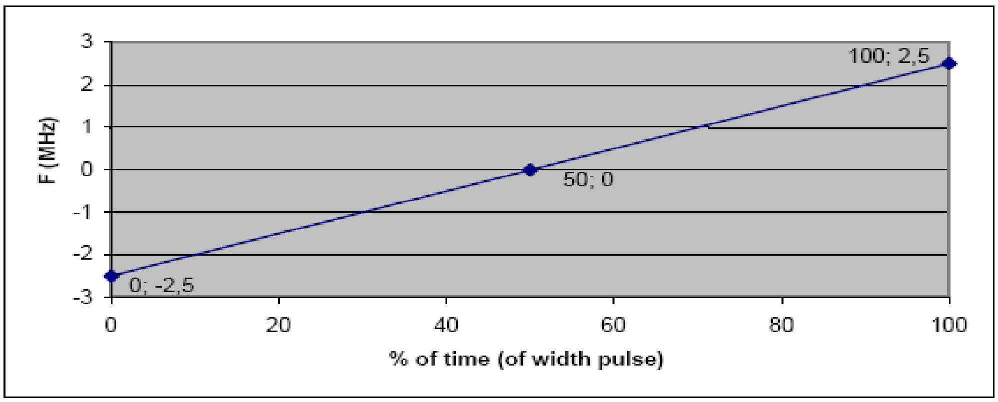
Parameter	Detection Probability (P_d)	
	Channels whose nominal bandwidth falls partly or completely within the 5 600 MHz to 5 650 MHz band	Other channels
CAC, Off-Channel CAC	99,99 %	60 %
In-Service Monitoring	60 %	60 %
NOTE: P_d gives the probability of detection per simulated radar burst and represents a minimum level of detection performance under defined conditions. Therefore P_d does not represent the overall detection probability for any particular radar under real life conditions.		

Table 21. Detection Probability

Required Radar Test Waveforms

Radar test Signal # (see Notes 1 to 3)	Pulse width W [µs]		Pulse repetition frequency PRF (PPS)		Number of different PRFs	Pulses per burst for each PRF (PPB) (see Note 5)
	Min	Max	Min	Max		
1	0,8	5	200	1 000	1	10 (see Note 6)
2	0,8	15	200	1 600	1	15 (see Note 6)
3	0,8	15	2 300	4 000	1	25
4	20	30	2 000	4 000	1	20
5	0,8	2	300	4000	2/3	10 (see Note 6)
6	0,8	2	400	1 200	2/3	15 (see Note 6)

NOTE 1: Radar test signals 1 to 4 are constant PRF based signals. These radar test signals are intended to simulate also radars using a packet based Staggered PRF.
NOTE 2: The modulation to be used for the radar test signal 4 is a chirp modulation with a ±2,5MHz frequency deviation which is described below.



NOTE 3: Radar test signals 5 and 6 are single pulse based Staggered PRF radar test signals using 2 or 3 different PRF values. For radar test signal 5, the difference between the PRF values chosen shall be between 20 pps and 50 pps. For radar test signal 6, the difference between the PRF values chosen shall be between 80 pps and 400 pps.
NOTE 4: Apart for the Off-Channel CAC testing, the radar test signals above shall only contain a single burst of pulses.
NOTE 5: The total number of pulses in a burst is equal to the number of pulses for a single PRF multiplied by the number of different PRFs used.
NOTE 6: For the CAC and Off-Channel CAC requirements, the minimum number of pulses (for each PRF) for any of the radar test signals to be detected in the band 5 600 MHz to 5 650 MHz shall be 18.

Table 22. EN 301 893 1.5.1 Radar Test Waveforms

Radar Waveform Calibration

The following equipment setup was used to calibrate the conducted Radar Waveform See Figure 8. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero span (Time Domain) mode at the frequency of the Radar Waveform generator. Peak detection was utilized. The spectrum analyzer's resolution bandwidth (RBW) was set to 1MHz and the video bandwidth (VBW) was set to MHz. A 30dB preamplifier was used in during the calibration procedure

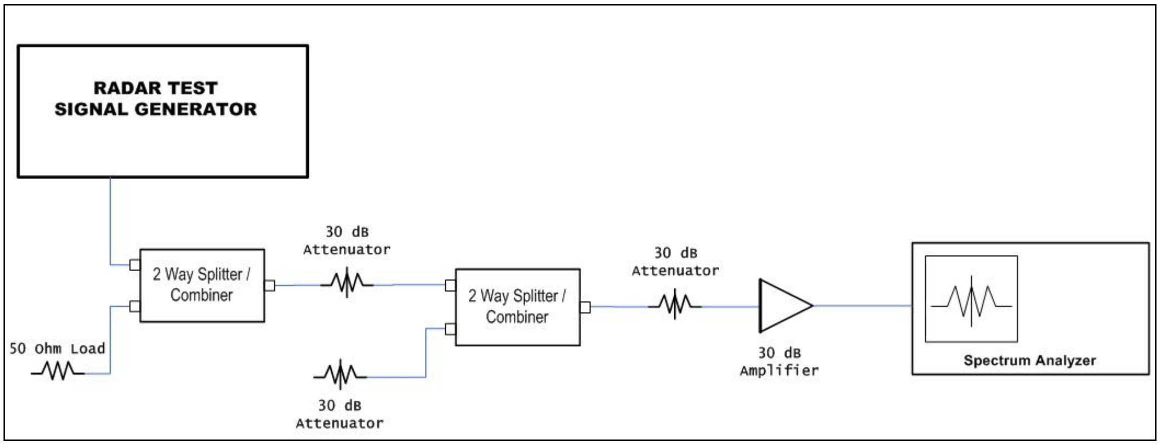
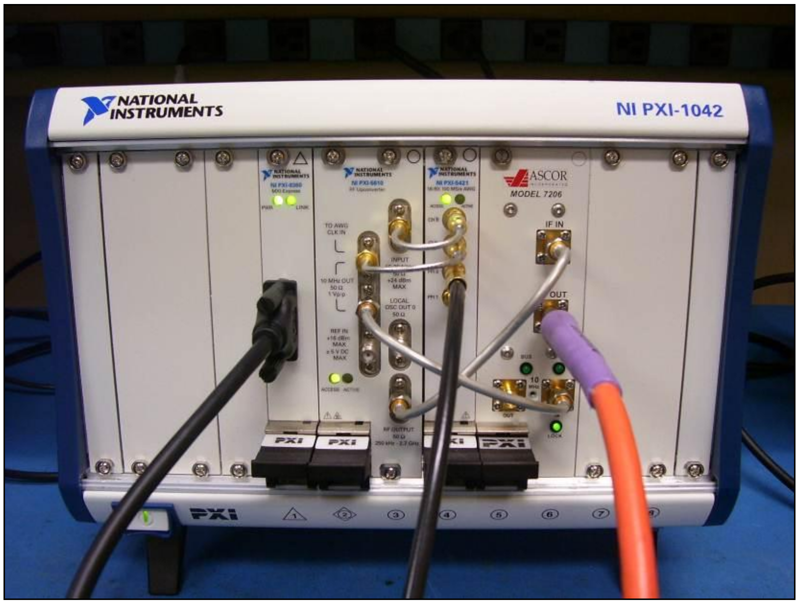
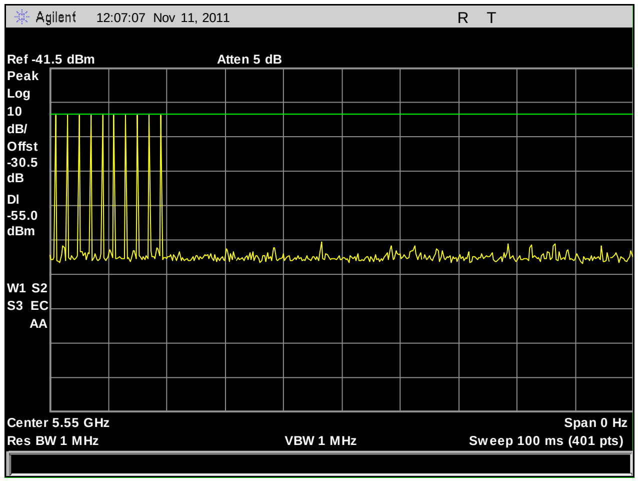


Figure 8. Radar Waveform Calibration Setup

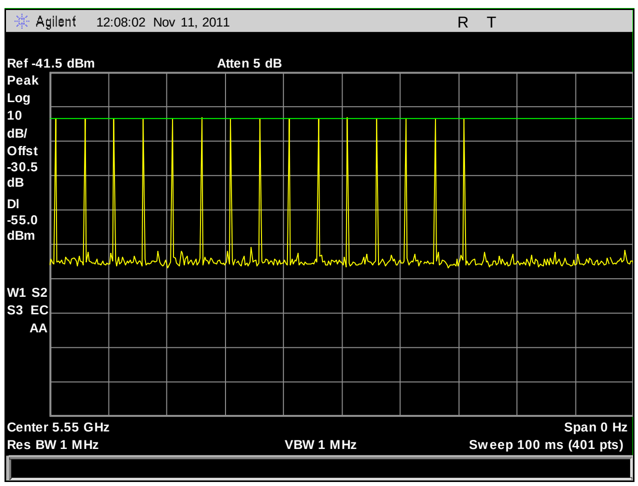


Photograph 5. Radar Test Signal Generator

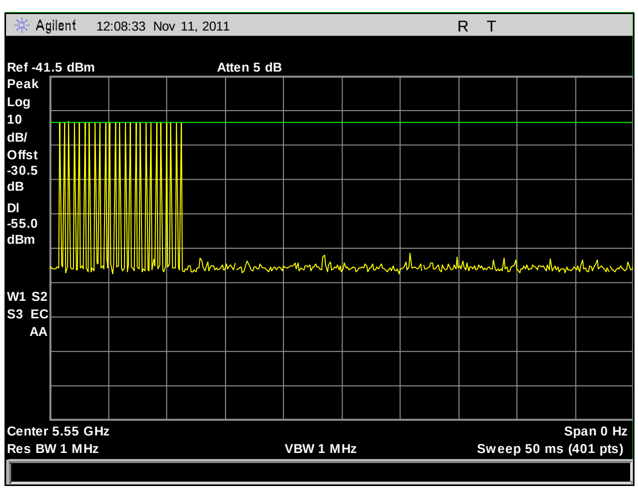
Calibration Plots



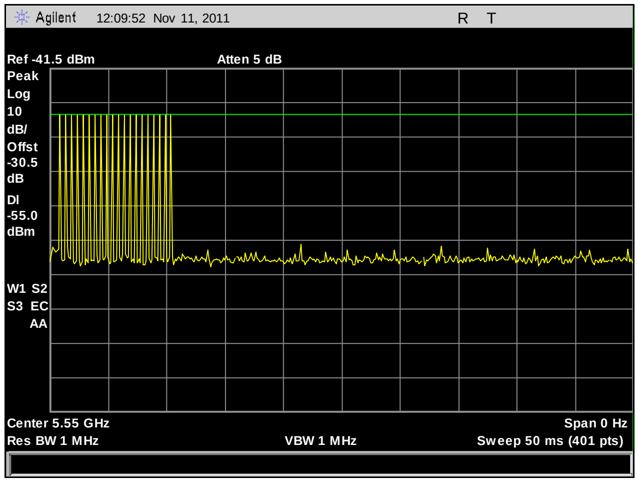
Plot 104. Calibration Plot, Bin 1



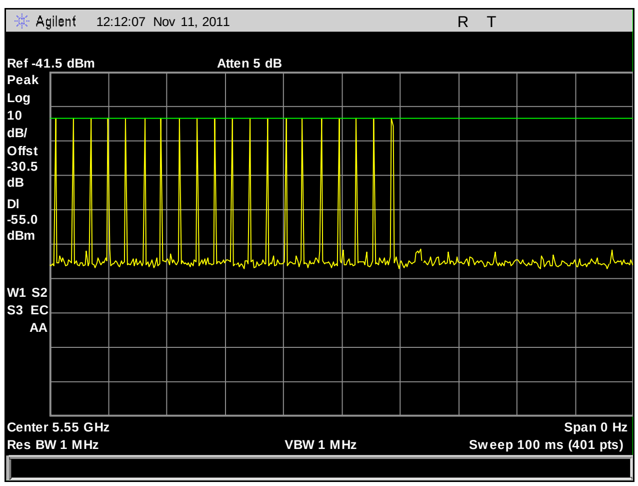
Plot 105. Calibration Plot, Bin 2



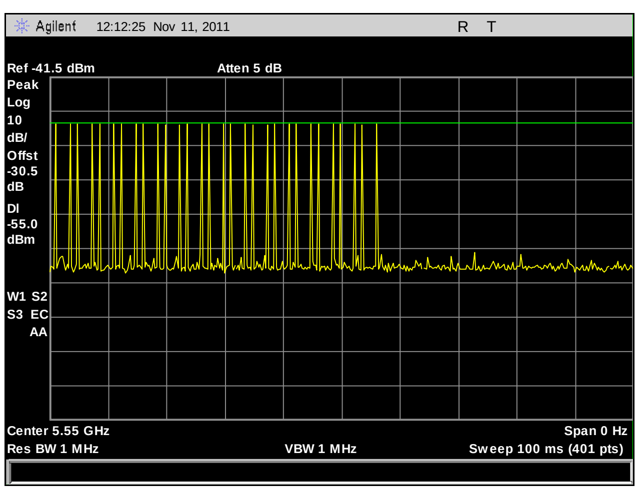
Plot 106. Calibration Plot, Bin 3



Plot 107. Calibration Plot, Bin 4



Plot 108. Calibration Plot, Bin 5



Plot 109. Calibration Plot, Bin 6

Test Setup for EUT

1. A spectrum analyzer is used as a monitor to verify that the UUT has vacated the Channel within the (Channel Closing Transmission Time and Channel Move Time, and does not transmit on a Channel during the Non-Occupancy Period after the detection and Channel move. It is also used to monitor UUT transmissions during the Channel Availability Check Time.
2. Figure 9 shows the test setup used for injection of radar waveforms in to a master device.

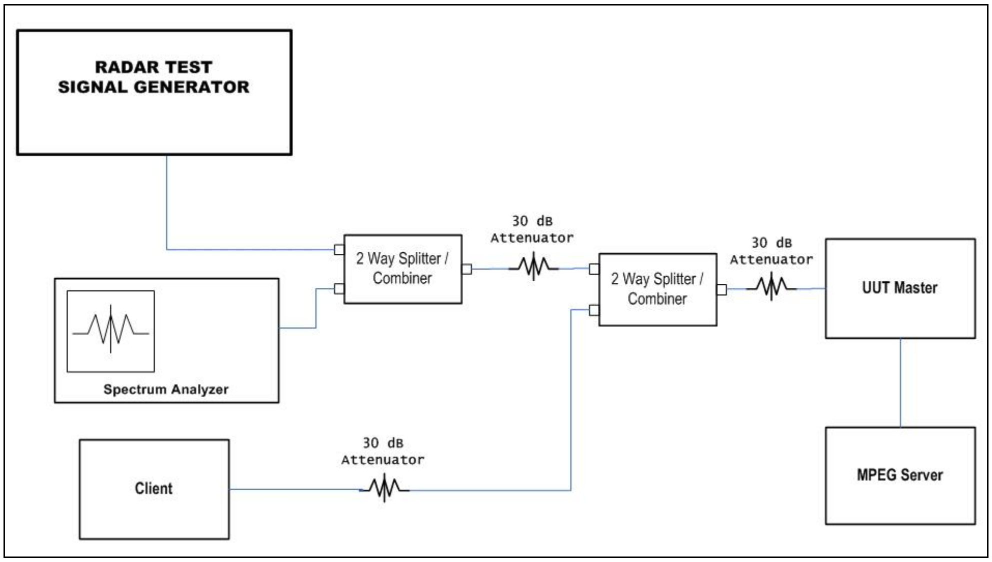


Figure 9. Test Setup for Master Device

Channel Availability Check

Test Requirement(s): **ETSI EN 301 893, Section 4.7.2.1, Clause 5.3.8**

Definition: **4.7.2.1.1**
The Channel Availability Check is defined as the mechanism by which an RLAN device checks a channel for the presence of radar signals.

Limit(s): **4.7.2.1.2**

Parameter	Value
Channel Availability Check Time (CACT)	60s

Test Procedure: The EUT was connected as in Figure #9. The measurement was performed using normal operation of the equipment. The EUT was switched on at time T_o. Once the EUT has completed its power up routine, that time is marked as T_1. A simulated radar burst consisting of the reference bin and at a conducted level 10dB greater than conducted power + antenna gain of the EUT, was injected into the master within 2 seconds after time T_1. This test was repeated with the injection of the simulated radar signal at the end of the Channel Availability Check time less 2 seconds.

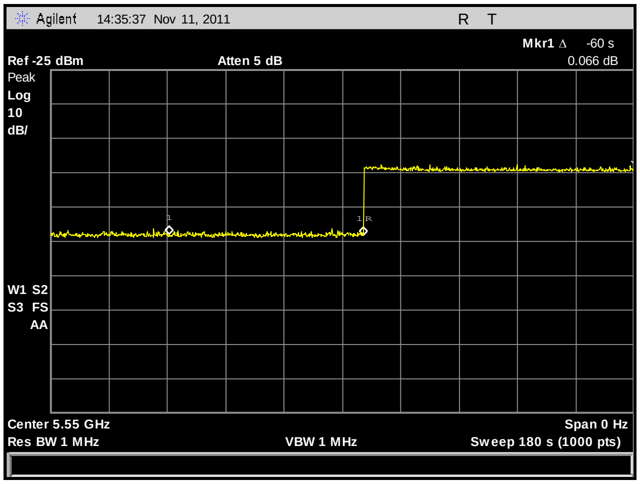
Test Results: The master EUT did detect the presence of the Radar Signals at the beginning and end of the CACT and did not establish communication with a client at the end of the CACT and is therefore compliant with the specified requirements.

Test Engineer: Anderson Soungpanya

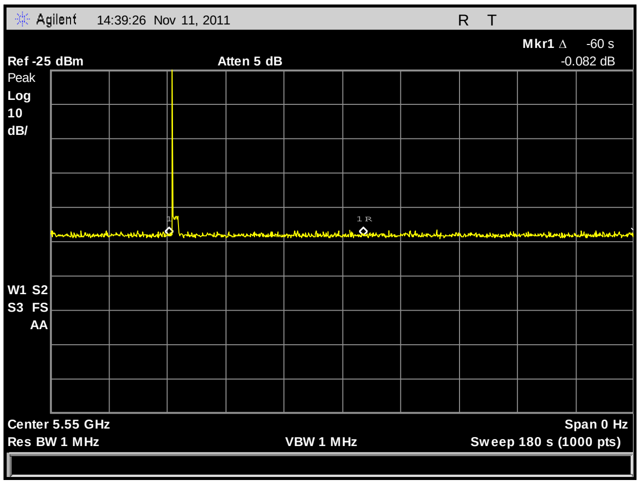
Test Date: 11/11/11

EUT Frequency - 5550 MHz using Bin # 1			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
Trial	**Detection**	**Trial**	**Detection**
1	1	11	1
2	1	12	1
3	1	13	1
4	1	14	1
5	1	15	1
6	1	16	1
7	1	17	1
8	1	18	1
9	1	19	1
10	1	20	1
Detection Probability			100%

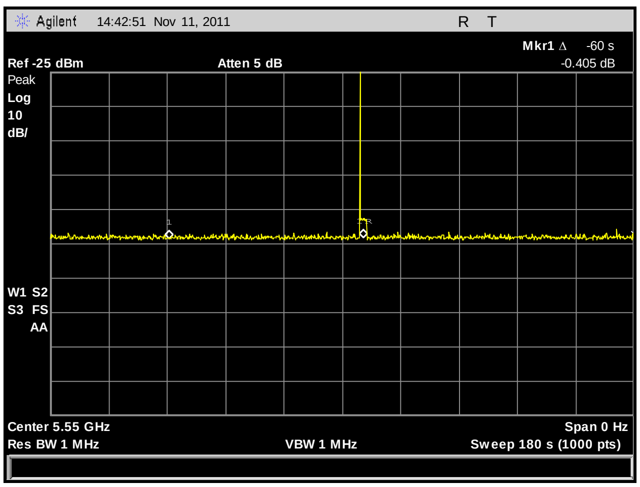
Table 23. CACT Probability, Test Results, 5500 MHz



Plot 110. Channel Availability Check Time (CACT)



Plot 111. Burst at beginning of CACT



Plot 112. Burst at end of CACT

4.7.2.2 Off Channel CAC

Test Requirement(s): **ETSI EN 301 893, Section 4.7.2.2, Clause 5.3.8**

Definition: **4.7.2.2.1**
Off-Channel CAC is defined as an optional mechanism by which a RLAN monitors channel(s), different from the Operating Channel, for the presence of radar signals. The Off-Channel CAC may be used in addition to the Channel Availability Check defined in clause 4.7.3.1, for identifying Available Channels.

Limit: **4.7.2.2.2**
Where implemented, the Off-Channel CAC Time shall be declared by the manufacturer. However, the declared Off-Channel CAC Time shall not be greater than the values specified in Table 19. During the Off-Channel CAC, the RLAN shall be capable of detecting any of the radar test signals that fall within the ranges given by Table 22 with a level above the Radar Detection Threshold defined in Table 18.

Test Results: The master EUT was not applicable with the specified requirements. This feature is not supported by the EUT.

4.7.2.3 In-Service Monitoring Interference Detection Threshold

Test Requirement(s): **ETSI EN 301 893, Section 4.7.2.3, Clause 5.3.8**

Definition: **4.7.2.3.1**
The *In-Service Monitoring* is defined as the process by which an RLAN monitors the *Operating Channel* for the presence of radar signals.

Limit(s): **4.7.2.3.2**
The In-Service Monitoring shall be used to monitor an Operating Channel. The In-Service-Monitoring shall start immediately after the RLAN has started transmissions on a channel. During the In-Service Monitoring, the RLAN shall be capable of detecting any of the radar test signals that fall within the ranges given by Table 22 with a level above the Radar Detection Threshold defined in Table 18. The minimum required detection probability associated to a given radar test signal is defined in Table 21.

Antenna Gain	Value
5 dBi	58 dBm

Test Procedure: The EUT was setup as in Figure #2. The measurement was performed using normal operation of the equipment. Simulated radar bursts from bins 1-6 and the reference bin were injected into the master during the In-service operation. This procedure was repeated 20 times in order to determine the detection probability for each selected radar test signal in the table below.

Test Results: The master EUT did detect the presence of the Radar Signals during in-service monitoring to within the allowable limits and is therefore compliant with the specified requirements.

Test Engineer: Anderson Sougnpanya

Test Date: 11/11/11

EUT Frequency - 5550 MHz using Bin # 1			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
Trial	**Detection**	**Trial**	**Detection**
1	1	11	1
2	1	12	1
3	1	13	1
4	1	14	1
5	1	15	1
6	1	16	1
7	1	17	1
8	1	18	1
9	1	19	1
10	1	20	1
Detection Probability			100%

Table 24. In Service Monitoring, Bin 1, Results

EUT Frequency - 5550 MHz using Bin # 2			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
Trial	**Detection**	**Trial**	**Detection**
1	1	11	1
2	1	12	1
3	1	13	1
4	1	14	1
5	1	15	1
6	1	16	1
7	1	17	1
8	1	18	1
9	1	19	1
10	1	20	1
Detection Probability			100%

Table 25. In Service Monitoring, Bin 2, Results

EUT Frequency - 5550 MHz using Bin # 3			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
Trial	**Detection**	**Trial**	**Detection**
1	1	11	1
2	1	12	1
3	1	13	1
4	1	14	1
5	1	15	1
6	1	16	1
7	1	17	1
8	1	18	1
9	1	19	1
10	1	20	1
Detection Probability			100%

Table 26. In Service Monitoring, Bin 3, Results

EUT Frequency - 5550 MHz using Bin # 4			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
Trial	**Detection**	**Trial**	**Detection**
1	1	11	1
2	1	12	1
3	1	13	1
4	1	14	1
5	1	15	1
6	1	16	1
7	1	17	1
8	1	18	1
9	1	19	1
10	1	20	1
Detection Probability			100%

Table 27. In Service Monitoring, Bin 4, Results

EUT Frequency - 5550 MHz using Bin # 5			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
Trial	**Detection**	**Trial**	**Detection**
1	1	11	1
2	1	12	1
3	1	13	1
4	1	14	1
5	1	15	1
6	1	16	1
7	1	17	1
8	1	18	1
9	1	19	1
10	1	20	1
Detection Probability			100%

Table 28. In Service Monitoring, Bin 5, Results

EUT Frequency - 5550 MHz using Bin # 6			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
Trial	**Detection**	**Trial**	**Detection**
1	1	11	1
2	1	12	1
3	1	13	1
4	1	14	1
5	1	15	1
6	1	16	1
7	1	17	1
8	1	18	1
9	1	19	1
10	1	20	1
Detection Probability			100%

Table 29. In Service Monitoring, Bin 6, Results

4.7.2.4 Channel Shutdown and 4.7.2.5 Non-Occupancy Period

Test Requirement(s): **ETSI EN 301 893, Sections 4.7.2.4 & 4.7.2.5, Clause 5.3.8**

Definition:

4.7.2.4.1
The *Channel Shutdown* is defined as the process initiated by the RLAN device immediately after a radar signal has been detected on an *Operating Channel*.

The master device shall instruct all associated slave devices to stop transmitting on this channel, which they shall do within the Channel Move Time.

Slave devices with a Radar Interference Detection function, shall stop their own transmissions within the Channel Move Time upon detecting a radar signal.

The aggregate duration of all transmissions of the RLAN device on this channel during the Channel Move Time shall be limited to the Channel Closing Transmission Time. The aggregate duration of all transmissions shall not include quiet periods in between transmissions.

4.7.2.5.1
The *Non-Occupancy Period* is defined as the time during which the RLAN device shall not make any transmissions on a channel after a radar signal was detected on that channel by either the *Channel Availability Check* or the *In-Service Monitoring*.

Limit(s): **4.7.2.4.2 & 4.7.2.5.2**

Parameter	Limit
Channel Move Time	10 s
Channel Closing Transmission Time	1 s
Non-Occupancy Period	30 min

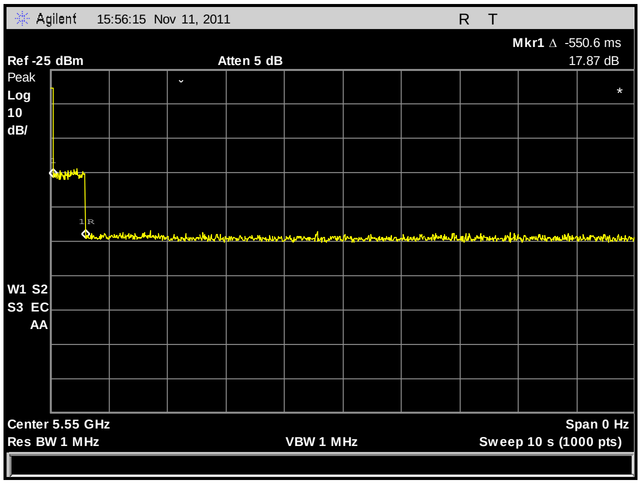
Test Procedure: The EUT was connected as in Figure #2. The channel selection mechanism for the Uniform Spreading requirement is disabled on the master .

The measurement was performed using normal operation of the equipment. The reference bin at a level above 10 dB above the level of the EUT, was injected into the EUT at time T_o. The time T_1 - T_o was recorded as the duration of the radar burst. At the end of time T_1 the EUT was monitored for a period ≥ 10s and the aggregate duration of all transmissions from the EUT were recorded. The difference between T_2, indicating the EUT had ceased all transmission, and T_1 was recorded. If the EUT was a Master then the selected channel was observed for a period of 30 min to insure no transmissions reoccurred on that channel.

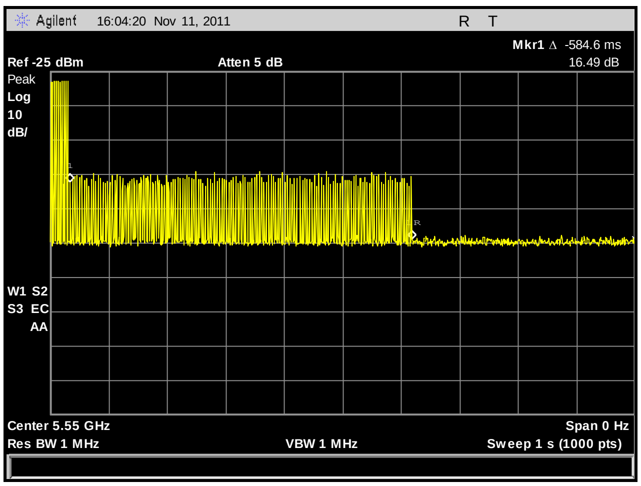
Test Results: The master EUT did detect the presence of the Radar Signal and did close the channel in the appropriate time allowed and did not resume communication on that channel until 30 minutes had transpired.

Test Engineer: Anderson Sougnpanya

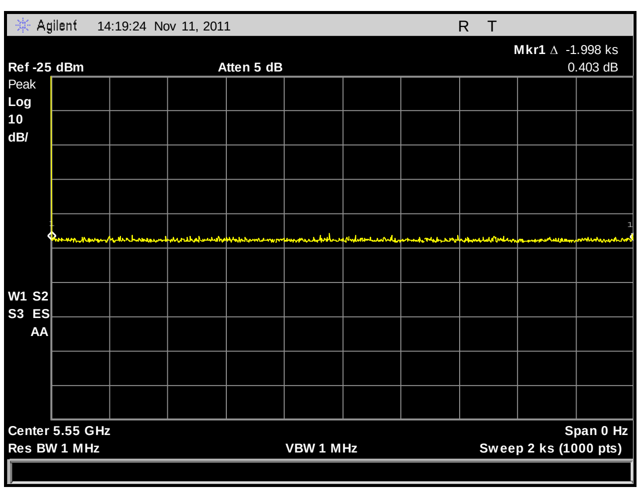
Test Date(s): 11/11/11



Plot 113. Channel Closing and Move Time in a 10 sec Frame



Plot 114. Channel Closing Time in a 1 sec Frame



Plot 115. 30 Minute Non-Occupancy

4.7.2.6 Uniform Spreading

Test Requirement(s): **ETSI EN 301 893, Section 4.7.2.1, Clause 5.3.8**

Definition: **4.7.2.1.1**
The Interference Detection Threshold is the probability of the Master EUT to detect Radar Bursts with 30% channel load. This is carried out during the Channel Availability Check.

Test Procedure: **4.7.2.1.2**
The EUT was connected as in Figure #2. The measurement was performed using normal operation of the equipment. The EUT was switched on at time T_o. Once the EUT has completed it's powered up routine, that time is marked as T_1. A simulated radar burst consisting of 15 pulses, 1μs in width, at a pulse repetition frequency of 750, and at a conducted level indicated above + the antenna gain of the EUT, was injected into the master at approximately 10 seconds after time T_1. This procedure was repeated 20 times in order to determine the detection probability for each selected radar test signal in the table below.

Test Results: The master EUT did detect the presence of the Radar Signals during the CACT within the allowable limits and is therefore compliant with the specified requirements.

Test Engineer: Anderson Soungpanya

Test Date: 11/11/11

V. 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	11/13/2010	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.

MET Asset	Equipment	Manufacturer	Last Cal Date	Cal Due Date
1S2243	NI PXI-1042 8-SLOT 3U CHASSIS	NATIONAL INSTRUMENTS	SEE NOTE	
1S2602	NI PXI-5421 16-BIT 100MS/S ARBITRARY WAVEFORM GENERATOR	NATIONAL INSTRUMENTS	SEE NOTE	
1S2278	NI PXI-5610 2.7GHZ RF UPCONVERTER	NATIONAL INSTRUMENTS	SEE NOTE	
1S2069	UPCONVERTER, 7206 PXI 4.9 TO 6GHZ	ASCOR	SEE NOTE	
N/A	SPLITTER/COMBINER, ZFSC-2-9G (QTY 2)	MINI-CIRCUITS	SEE NOTE	
N/A	30DB ATTENUATOR, BW-S30W2 (QTY 2)	PASTERNAK	SEE NOTE	
N/A	10DB ATTENUATOR, BW-S10W2 (QTY 2)	PASTERNAK	SEE NOTE	
1S2523	PRE-AMPLIFIER, 8449B	AGILENT	SEE NOTE	
1S2583	SPECTRUM ANALYZER, E447A	AGILENT	03/18/2011	03/18/2012
1S2460	SPECTRUM ANALYZER, E4407B	AGILENT	07/12/2011	07/12/2012

Table 30. DFS Equipment List

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

End of Report