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June 25, 2009

Ubiquiti Networks  
495-499 Montague Expressway  
Milpitas, CA 95035

Dear Robert Pera,

Enclosed is the EMC test report for compliance testing of the Ubiquiti Networks, M5 tested to the requirements of ETSI EN 301 893 V1.4.1 (2007-07) (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\EMCS81509-ETS893)

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## **Electromagnetic Compatibility Criteria Test Report**

For the

**Ubiquiti Networks  
Model M5**

Tested under

**ETSI EN 301 893 V1.4.1 (2007-07)**  
**(Article 3.2 of R&TTE Directive)**

**MET Report: EMCS81509-ETS893**

June 25, 2009

**Prepared For:**

**Ubiquiti Networks  
495-499 Montague Expressway  
Milpitas, CA 95035**

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



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

**MET Report: EMCS81509-ETS893**

Anderson Soungpanya  
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 V1.4.1 (2007-07) of the EU Rules under normal use and maintenance.

Shawn McMillen  
Wireless Manager, Electromagnetic Compatibility Lab



## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	June 25, 2009	Initial Issue.



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## List of Terms and Abbreviations

<b>AC</b>	<b>Alternating Current</b>
<b>ACF</b>	<b>Antenna Correction Factor</b>
<b>Cal</b>	<b>Calibration</b>
<b>D</b>	<b>Measurement Distance</b>
<b>dB</b>	<b>Decibels</b>
<b>dB<math>\mu</math>A</b>	<b>Decibels above one microamp</b>
<b>dB<math>\mu</math>V</b>	<b>Decibels above one microvolt</b>
<b>dB<math>\mu</math>A/m</b>	<b>Decibels above one microamp per meter</b>
<b>dB<math>\mu</math>V/m</b>	<b>Decibels above one microvolt per meter</b>
<b>DC</b>	<b>Direct Current</b>
<b>E</b>	<b>Electric Field</b>
<b>DSL</b>	<b>Digital Subscriber Line</b>
<b>ESD</b>	<b>Electrostatic Discharge</b>
<b>EUT</b>	<b>Equipment Under Test</b>
<b><i>F<sub>c</sub></i></b>	<b>Carrier Frequency</b>
<b>CISPR</b>	<b>Comite International Special des Perturbations Radioelectriques (International Special Committee on Radio Interference)</b>
<b>GRP</b>	<b>Ground Reference Plane</b>
<b>H</b>	<b>Magnetic Field</b>
<b>HCP</b>	<b>Horizontal Coupling Plane</b>
<b>Hz</b>	<b>Hertz</b>
<b>IEC</b>	<b>International Electrotechnical Commission</b>
<b>kHz</b>	<b>kiloHertz</b>
<b>kPa</b>	<b>kiloPascal</b>
<b>kV</b>	<b>kilovolt</b>
<b>LISN</b>	<b>Line Impedance Stabilization Network</b>
<b>MHz</b>	<b>MegaHertz</b>
<b><math>\mu</math>H</b>	<b>microHenry</b>
<b><math>\mu</math>F</b>	<b>microFarad</b>
<b><math>\mu</math>s</b>	<b>microseconds</b>
<b>PRF</b>	<b>Pulse Repetition Frequency</b>
<b>RF</b>	<b>Radio Frequency</b>
<b>RMS</b>	<b>Root-Mean-Square</b>
<b>V/m</b>	<b>Volts per meter</b>
<b>VCP</b>	<b>Vertical Coupling Plane</b>



# I. Requirements Summary



## A. Requirements Summary

ETSI EN 301 893 Section Number	Descriptive Name	Compliance			Comments
		Yes	No	N/A	
Sections 4.2	Carrier Frequencies	✓			Compliant
Sections 4.3	RF Output Power, Transmit Power Control (TPC) and Power Density	✓			Compliant
Sections 4.4	Transmitter Unwanted Emissions	✓			Compliant
Sections 4.5	Receive Spurious Emissions	✓			Compliant
Sections 4.6	Dynamic Frequency Selection (DFS)	✓			Compliant
Sections 4.8	Medium Access Protocol	✓			Compliant
Sections 4.9	User Access Restrictions	✓			Compliant

**Table 1. Summary of EMC ETSI EN 301 893 V1.4.1 (2007-07) Compliance Testing**

## II. Equipment Configuration

## A. Overview

MET Laboratories, Inc. was contracted by Ubiquti Networks to perform testing on a M5.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Ubiquti Networks model M5.

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

<b>Model(s) Tested:</b>	M5
<b>Model(s) Number:</b>	M5
<b>EUT Specifications:</b>	Primary Power: 15 VDC
	Secondary Power: N/A
	Equipment Code: DSS
<b>Lab Ambient (Normal) Test Conditions:</b>	Temperature: 15-35° C
	Relative Humidity: 30-60%
	Atmospheric Pressure: 860-1060 mbar
<b>Extreme Test Conditions:</b>	Voltage: 207-253 VAC 50Hz
	Temperature: -20 to +70° C
	Relative Humidity: 30-60%
<b>Evaluated by:</b>	Anderson Soungpanya
<b>Report Date(s):</b>	June 17, 2009

## B. References

<b>ETSI EN 301.893 V1.4.1 (2007-07)</b>	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 Street, 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 Ubiquti Networks, Inc. M5, Equipment Under Test (EUT), is an outdoor radio b/g/n.

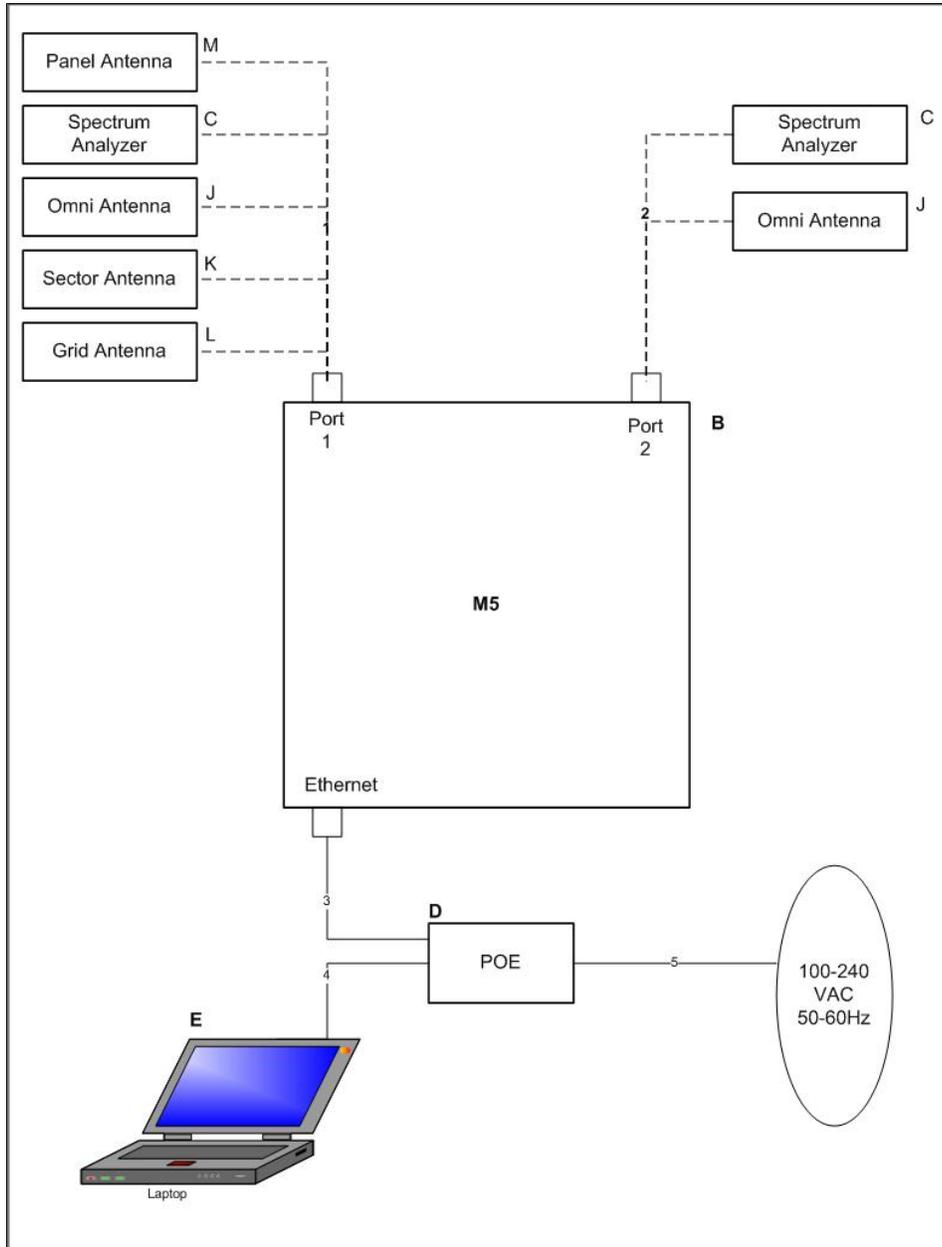


Figure 1. Block Diagram of Test Configurations

## E. Equipment Configuration

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

Ref. ID	Name / Description	Model Number	Part Number	Serial Number
B	M5	M5	M5	4-16-09
C	POWER OVER ETHERNET (UBIQUITI NETWORKS)	UB1-POE-15-8	NA	0901-0004848

**Table 3. Equipment Configuration**

## F. Support Equipment

Ubiquti Networks supplied support equipment necessary for the operation and testing of the M5. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
<b>M5</b>				
N	SPECTRUM ANALYZER	AGILENT	E4447A	N/A
E	LAPTOP	DELL	VOSTRO 1000	N/A
J	7 DBI OMNI ANTENNAS	UBIQUITI	O-5G-7	N/A
K	20 DBI SECTOR ANTENNA	UBIQUITI	AMS-5G-20	N/A
L	30 DBI GRID ANTENNA	UBIQUITI	AG-5G-30	N/A
M	24 DBI PANEL ANTENNA	UBIQUITI	RP-5G-24	N/A

**Table 4. Support Equipment**

## G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded (Y/N)	Termination Box ID & Port Name
<b>M5</b>						
1	B, ANTENNA PORT1	COAXIAL CABLE	1	3	Y	J OR K OR L OR M
2	B, ANTENNA PORT2	COAXIAL CABLE	1	3	Y	J OR K OR L OR M
3	B, ETHERNET	CAT 5	1	3	N	D
4	D, DATA	CAT 5	1	3	N	E, LAPTOP
5	D, POE	POWER CORD	1	.5	N	100-240V AC POWER

**Table 5. Ports and Cabling Information**

## H. Mode of Operation

Using Atheros Radio Test Software.

## I. Method of Monitoring EUT Operation

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

## J. Modifications

### a) Modifications to EUT

No modifications were made to the EUT.

### b) Modifications to Test Standard

No modifications were made to the EUT.

## K. Disposition of EUT

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

### **III. Conformance Requirements**

## Conformance Requirements

### 4.2. Carrier Frequencies

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

#### 4.2.1 Definition

The equipment is required to operate on the applicable specific carrier centre frequencies that correspond to the nominal carrier frequencies  $f_c$  of 5180MHz and 5350MHz for the lower Sub-Bands and 5500MHz and 5700MHz for the Higher Sub-band.

#### 4.2.2 Limits

The actual carrier centre frequency for any given channel given in table 1 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.

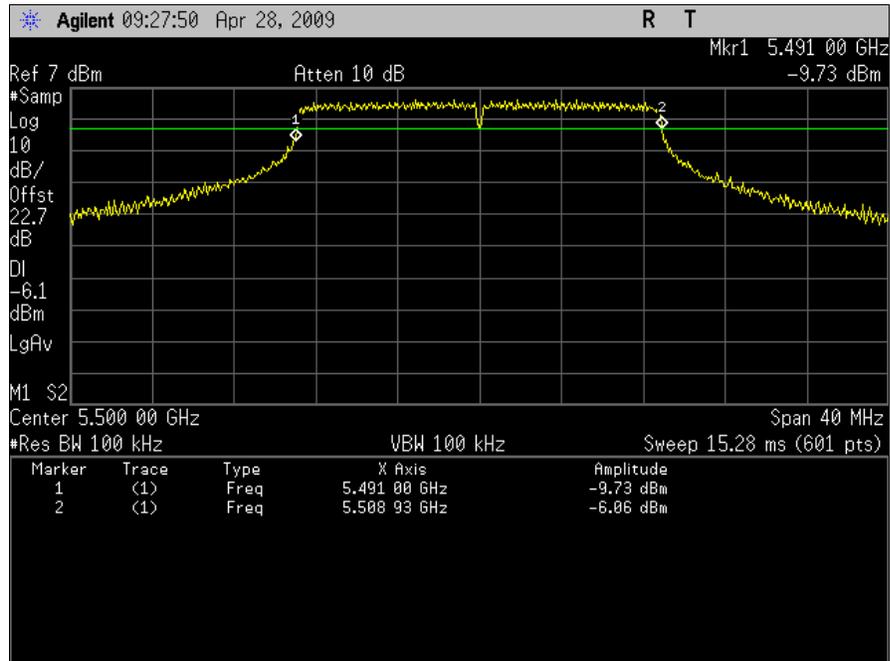
**Test Results:** The EUT was found to be compliant with the limits set forth in Clause 4.2

**Test Engineer:** Anderson Soungpanya

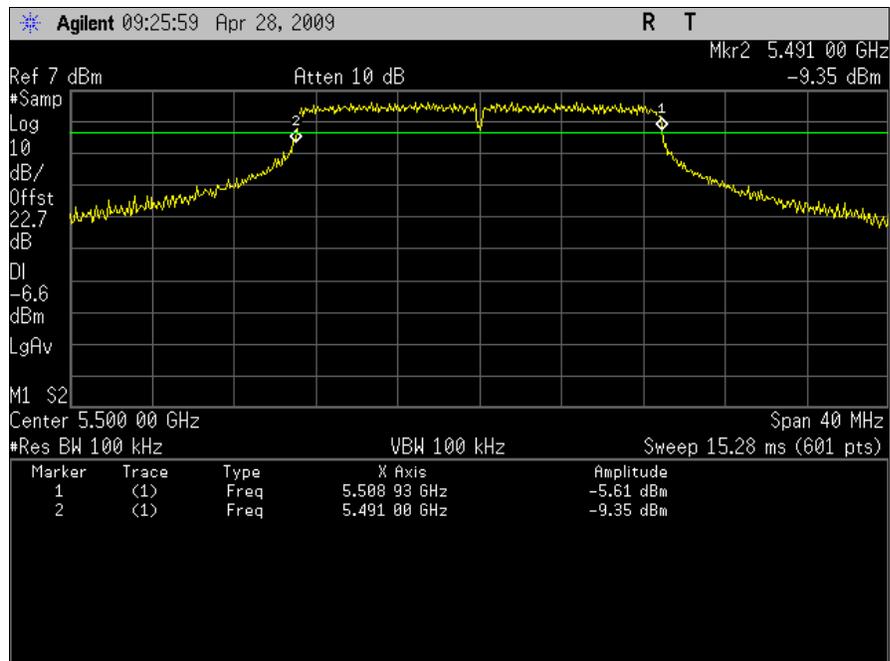
**Test Date:** April 27-28, 2009

<b>Port 1</b>						
Target Frequency (MHz)	Normal Conditions 20 °C @230V (MHz)	Extreme Conditions (MHz)				Maximum Frequency Error (ppm)
		-20 °C		+70 °C		
		207V	253V	207V	253V	
HT20						
5500	5500.070	5499.965	5499.965	5500.365	5500.365	
5700	5700.100	5700.000	5700.000	5700.400	5699.935	
HT40						
5500	5500.000	5500.063	5500.125	5500.125	5500.188	
5700	5699.875	5700.063	5700.000	5700.250	5700.188	
A Mode						
5500	5500.070	5499.965	5499.965	5500.365	5500.365	
5700	5700.100	5700.000	5700.000	5700.400	5700.435	

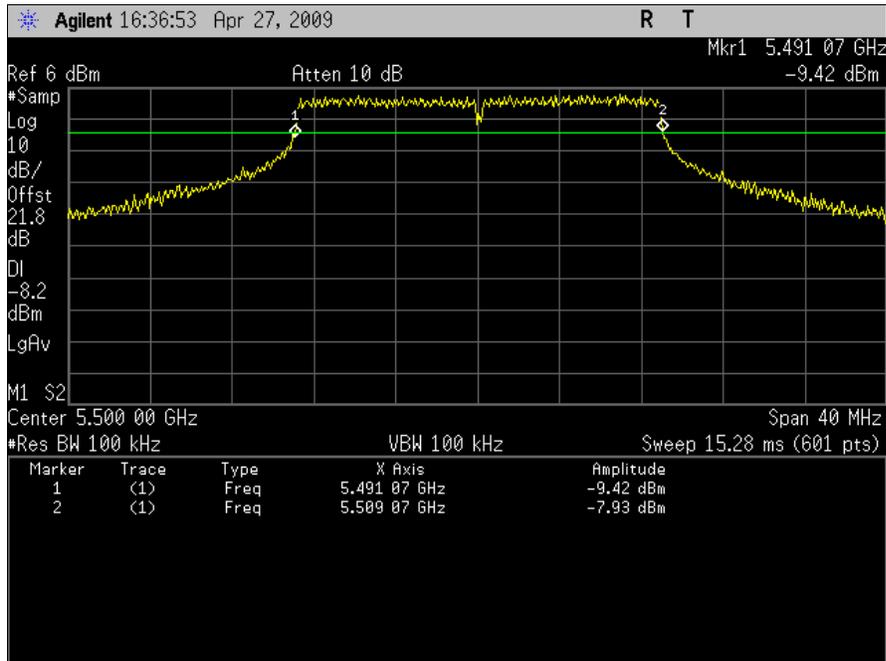
<b>Port 2</b>						
Target Frequency (MHz)	Normal Conditions 20 °C @230V (MHz)	Extreme Conditions (MHz)				Maximum Frequency Error (ppm)
		-20 °C		+70 °C		
		207V	253V	207V	253V	
HT20						
5500	5499.965	5500.000	5500.000	5500.200	5500.200	
5700	5700.035	5699.935	5700.000	5700.270	5700.270	
HT40						
5500	5500.085	5500.000	5500.063	5500.375	5500.375	
5700	5700.000	5700.000	5700.125	5700.500	5700.250	



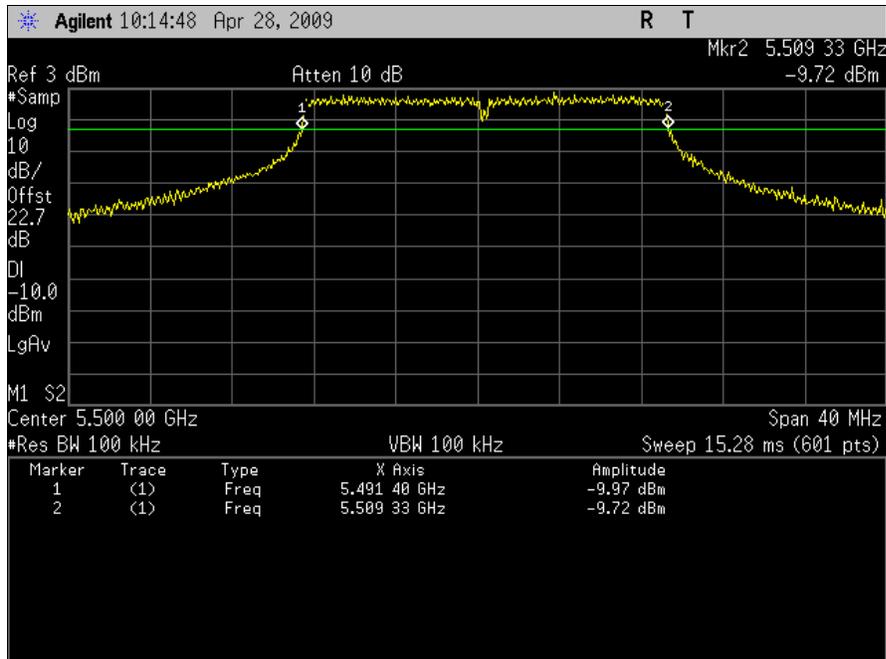
Plot 1. Carrier Frequency, 5500 Low Temperature, Low Voltage, Port 1, HT20



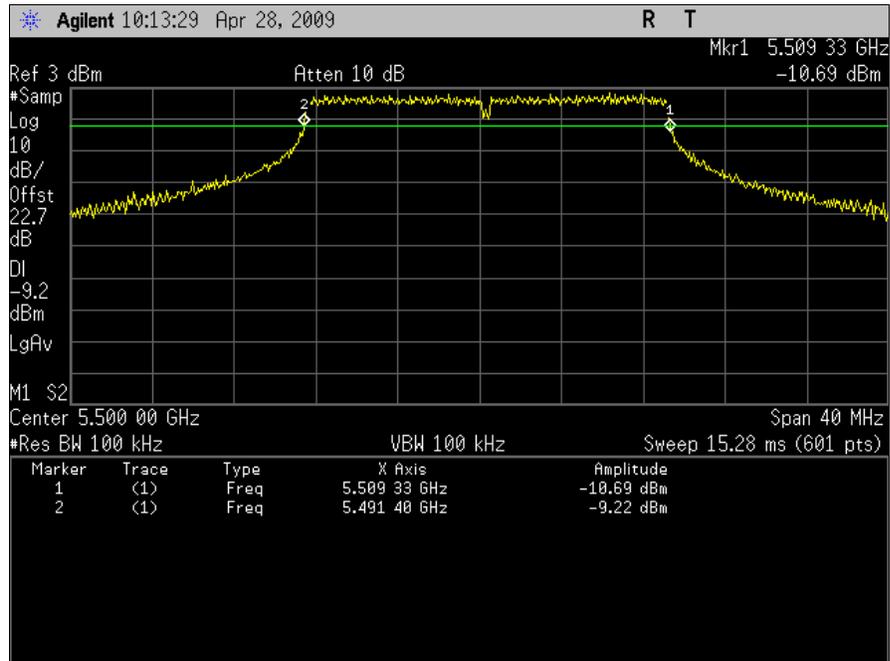
Plot 2. Carrier Frequency, 5500 Low Temperature, High Voltage, Port 1, HT20



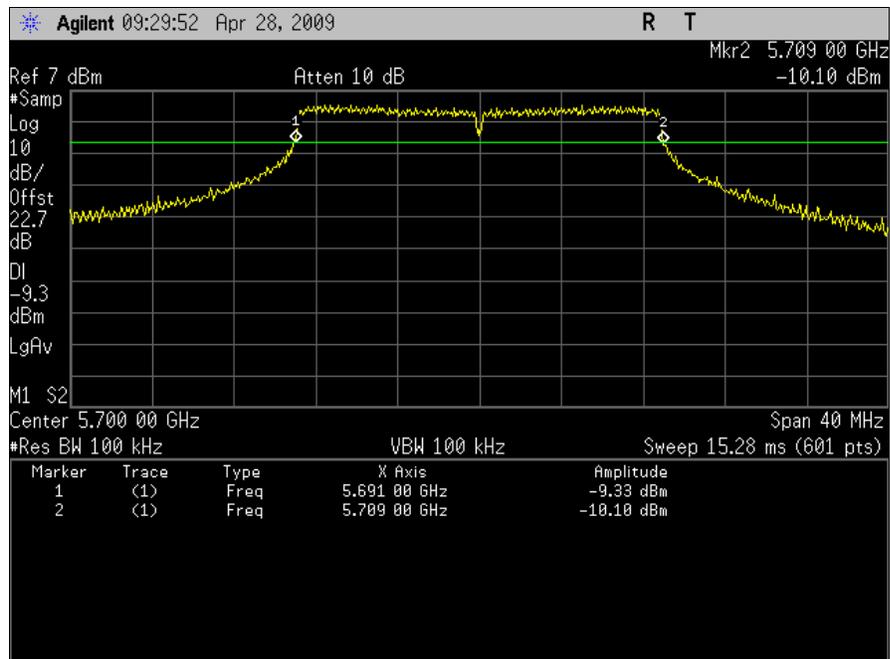
Plot 3. Carrier Frequency, 5500 Normal Temperature, Normal Voltage, Port 1, HT20



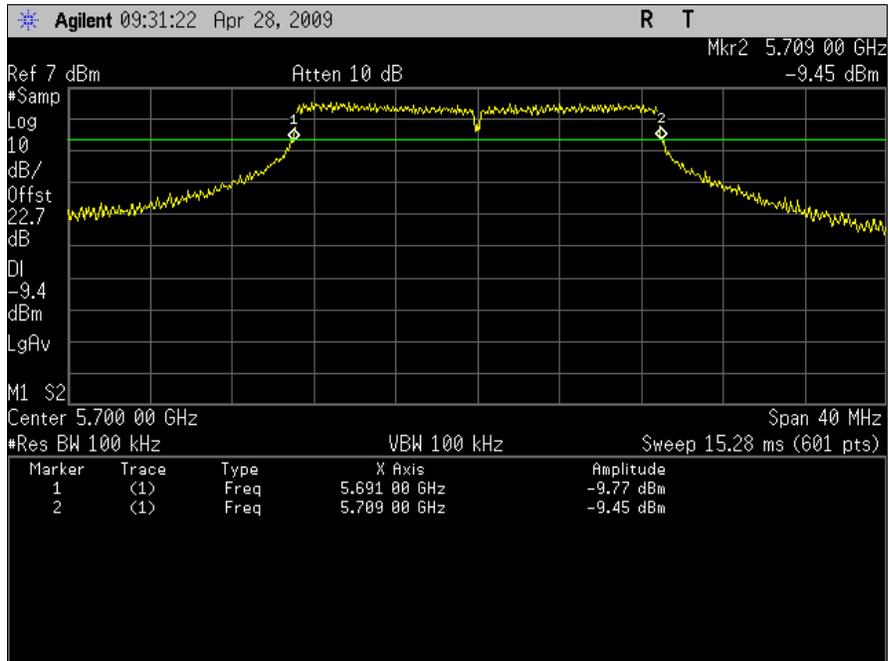
Plot 4. Carrier Frequency, 5500 High Temperature, Low Voltage, Port 1, HT20



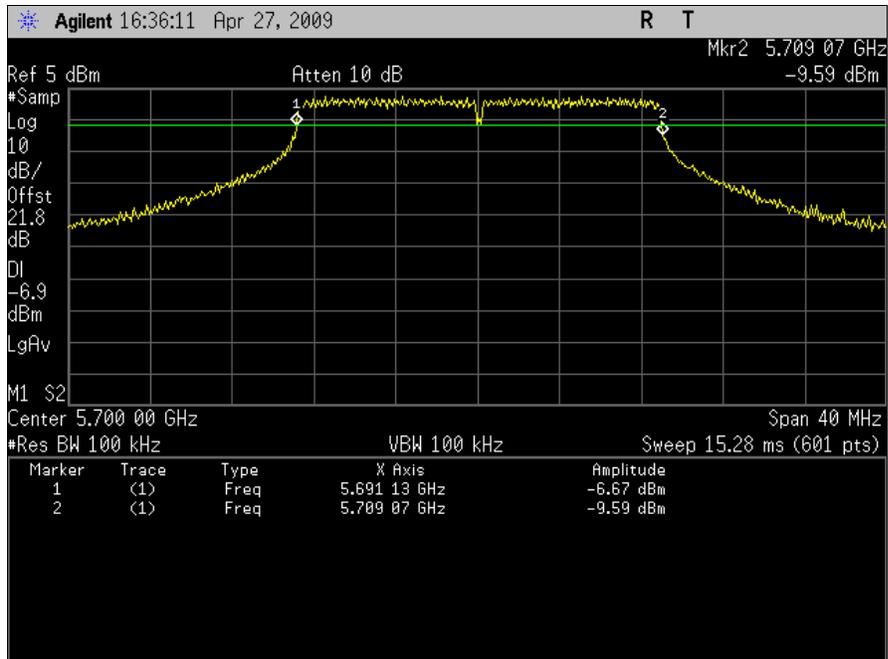
Plot 5. Carrier Frequency, 5500 High Temperature, High Voltage, Port 1, HT20



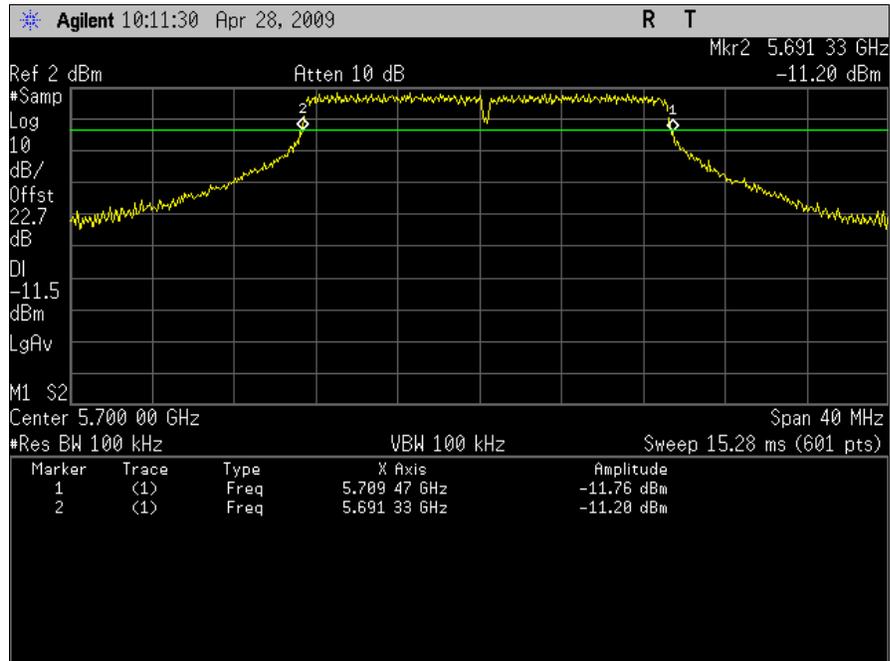
Plot 6. Carrier Frequency, 5700 Low Temperature, Low Voltage, Port 1, HT20



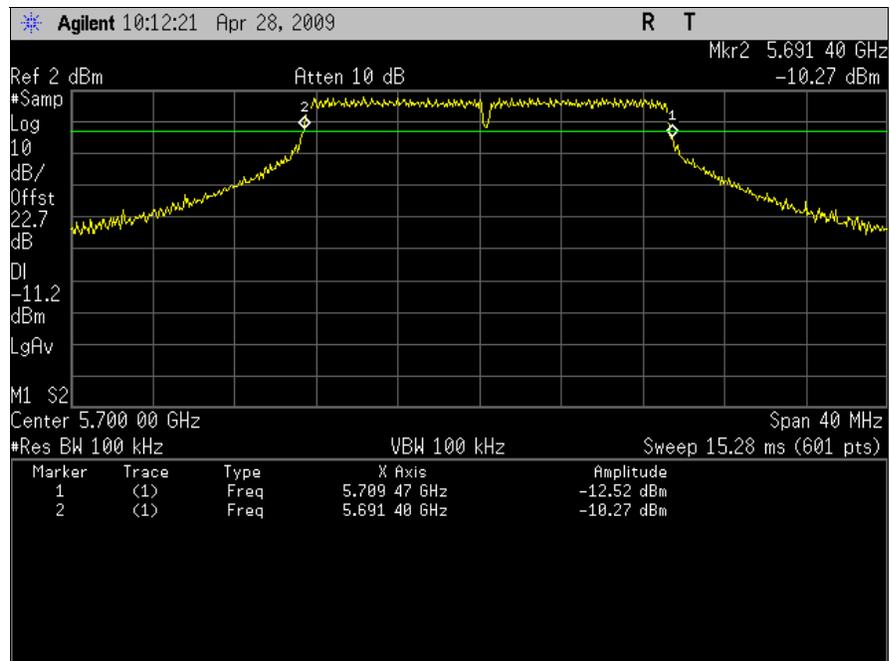
Plot 7. Carrier Frequency, 5700 Low Temperature, High Voltage, Port 1, HT20



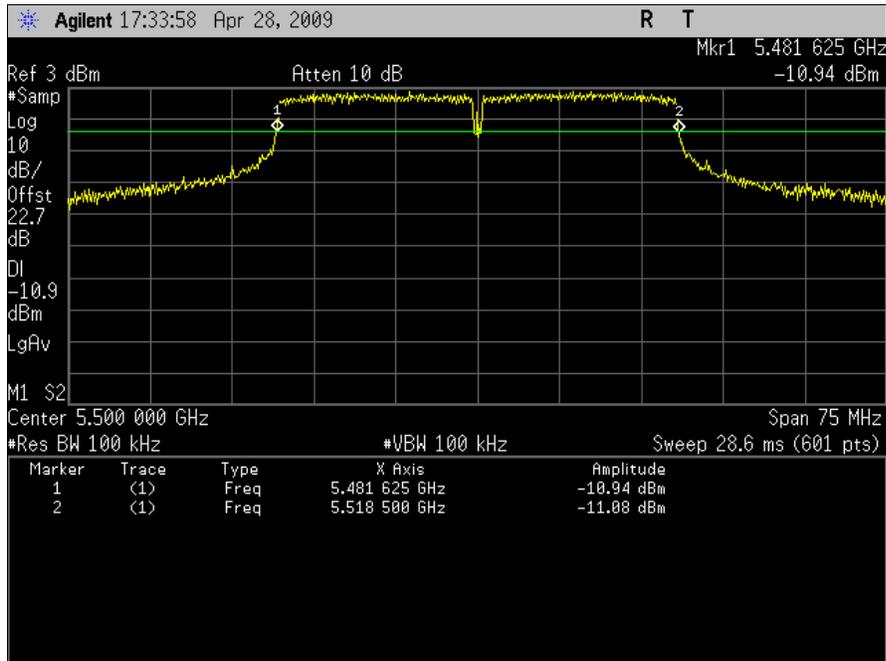
Plot 8. Carrier Frequency, 5700 Normal Temperature, Normal Voltage, Port 1, HT20



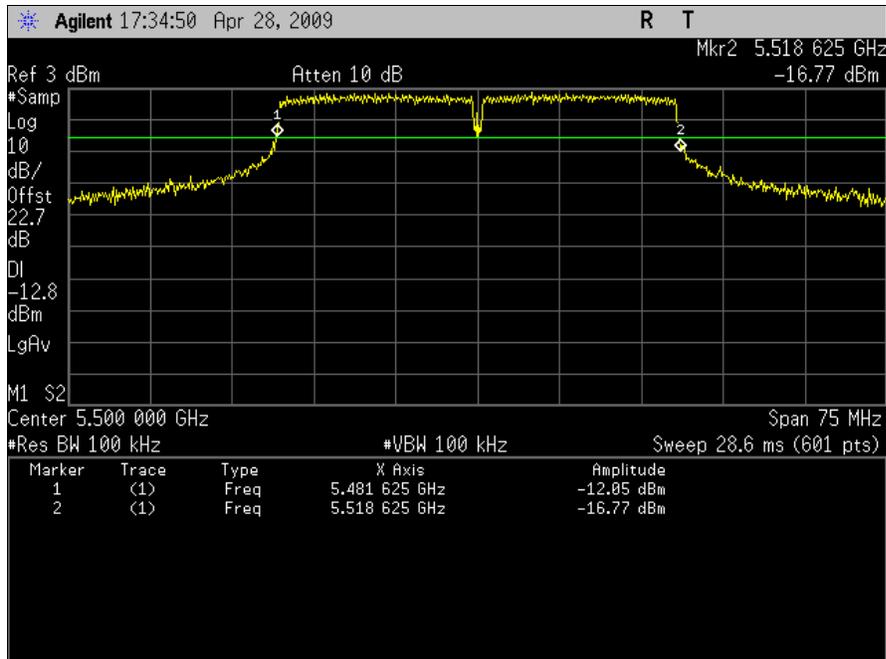
**Plot 9. Carrier Frequency, 5700 High Temperature, Low Voltage, Port 1, HT20**



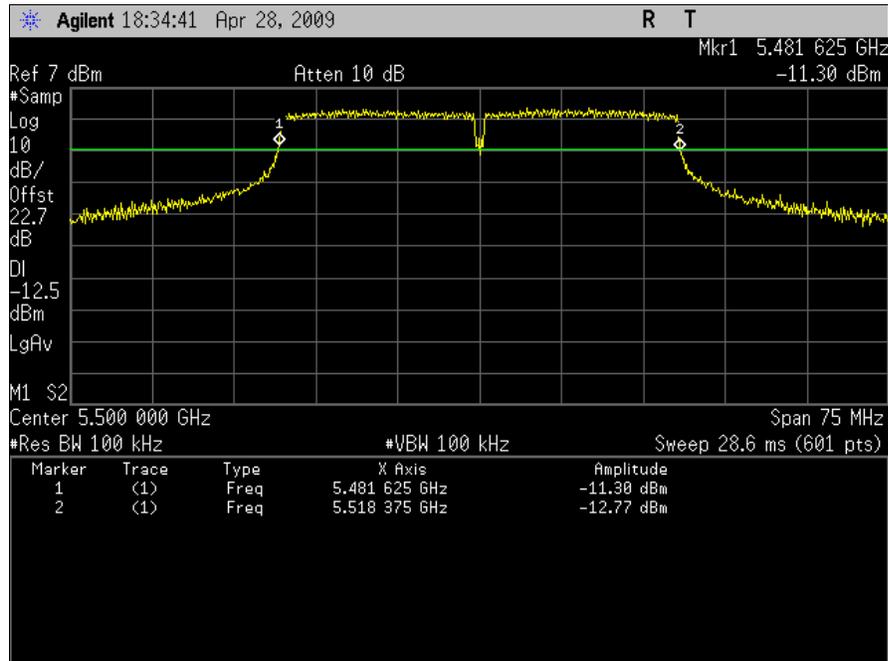
**Plot 10. Carrier Frequency, 5700 High Temperature, High Voltage, Port 1, HT20**



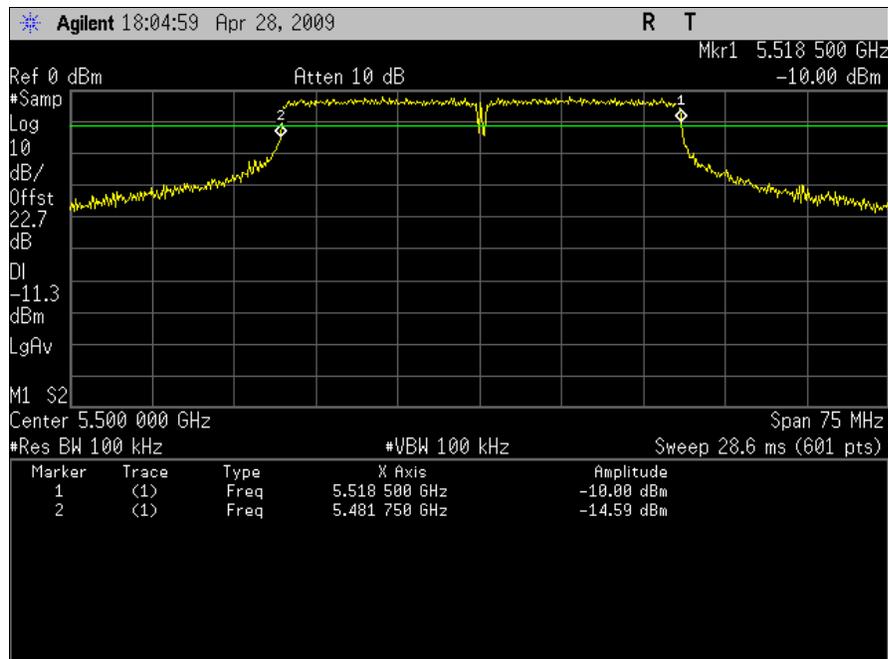
Plot 11. Carrier Frequency, 5500 Low Temperature, Low Voltage, Port 1, HT40



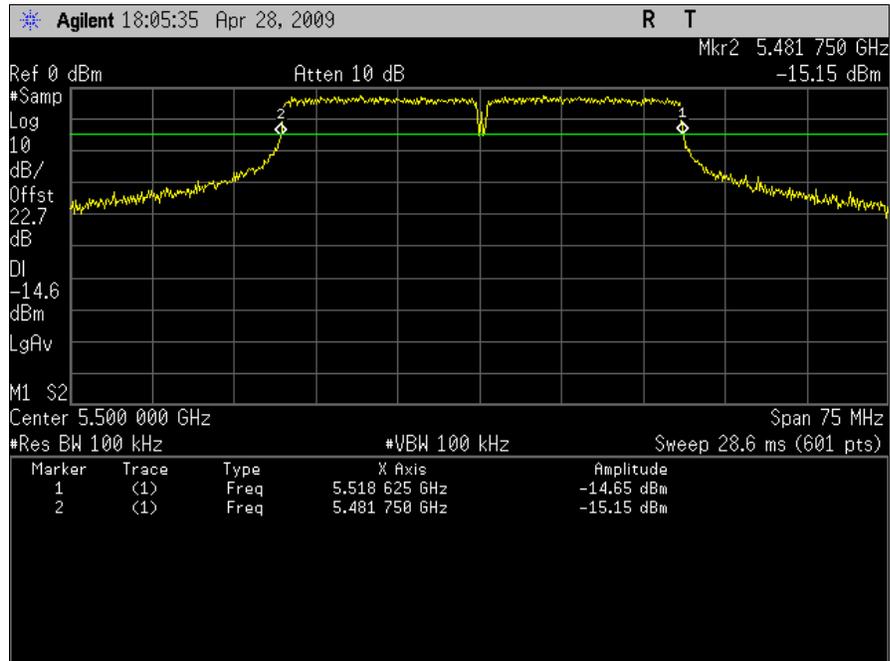
Plot 12. Carrier Frequency, 5500 Low Temperature, High Voltage, Port 1, HT40



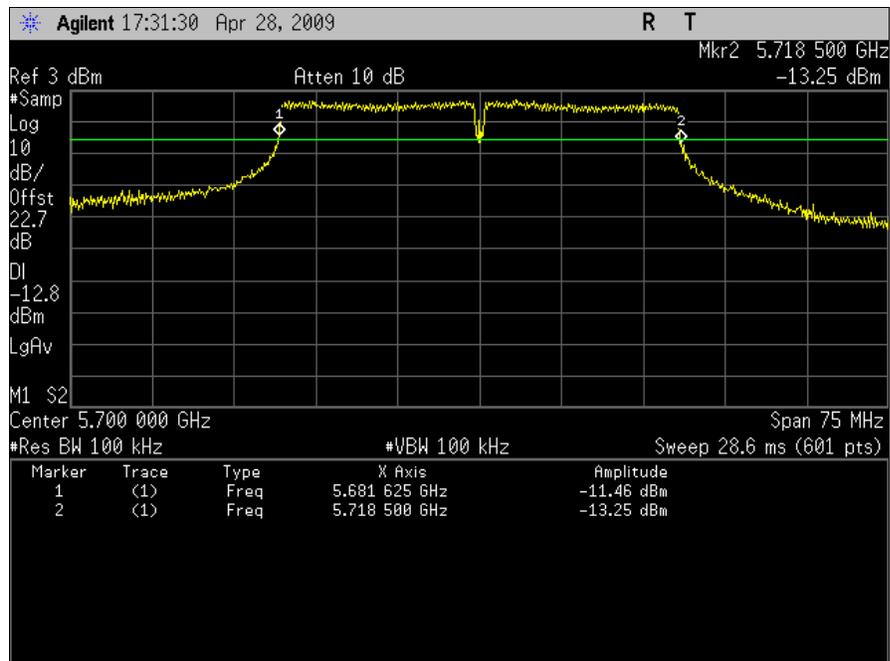
Plot 13. Carrier Frequency, 5500 Normal Temperature, Normal Voltage, Port 1, HT40



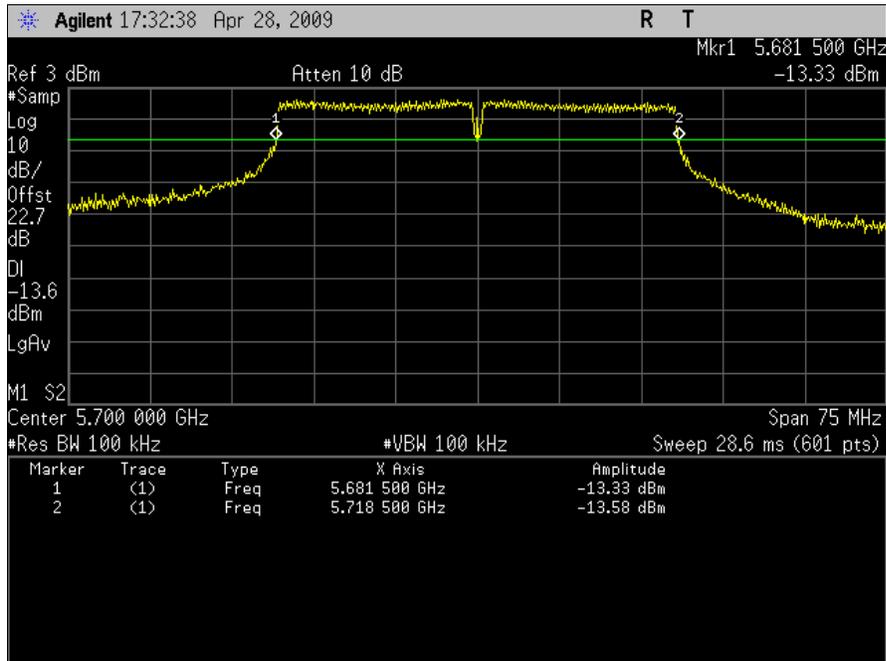
Plot 14. Carrier Frequency, 5500 High Temperature, Low Voltage, Port 1, HT40



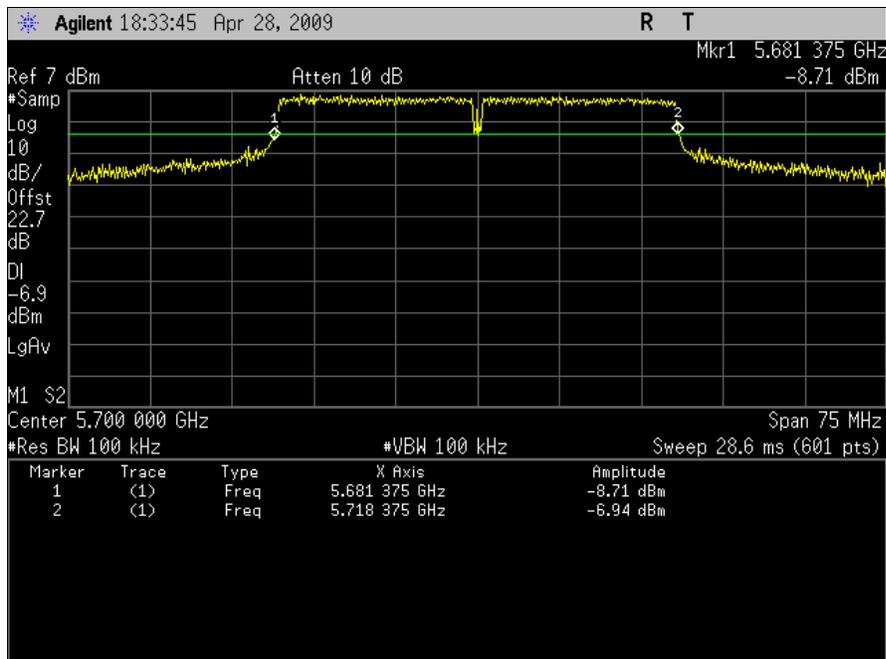
Plot 15. Carrier Frequency, 5500 High Temperature, High Voltage, Port 1, HT40



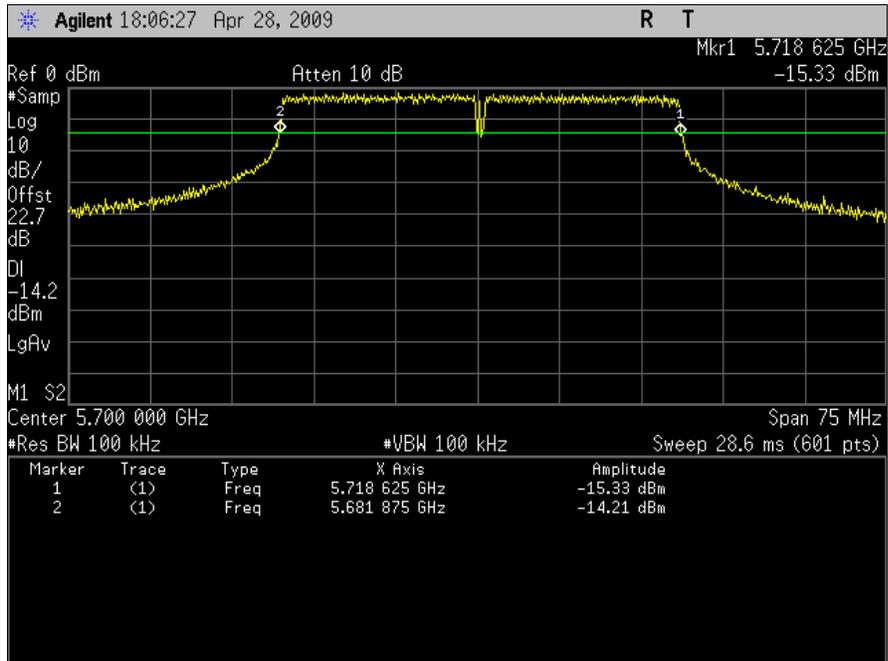
Plot 16. Carrier Frequency, 5700 Low Temperature, Low Voltage, Port 1, HT40



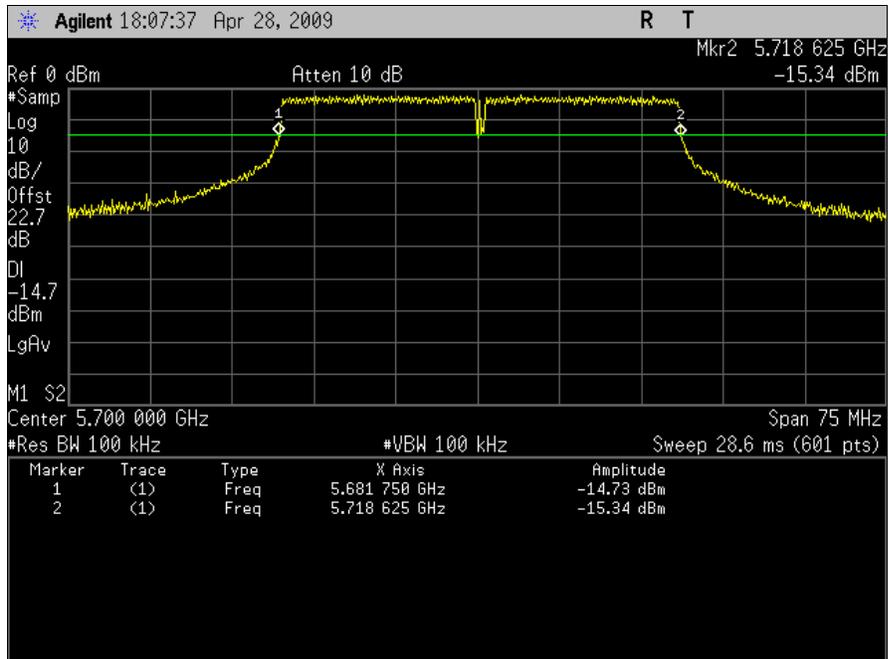
Plot 17. Carrier Frequency, 5700 Low Temperature, High Voltage, Port 1, HT40



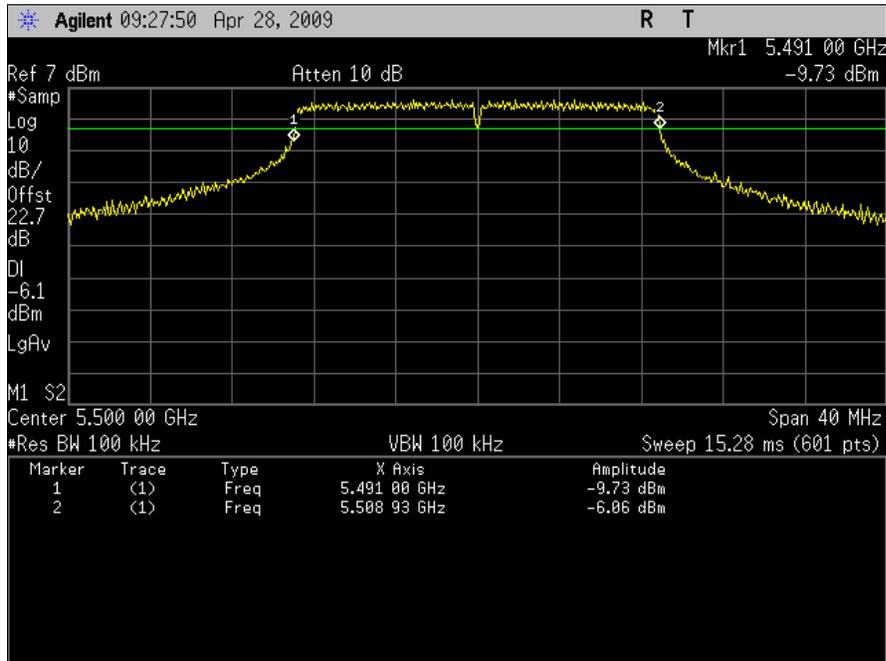
Plot 18. Carrier Frequency, 5700 Normal Temperature, Normal Voltage, Port 1, HT40



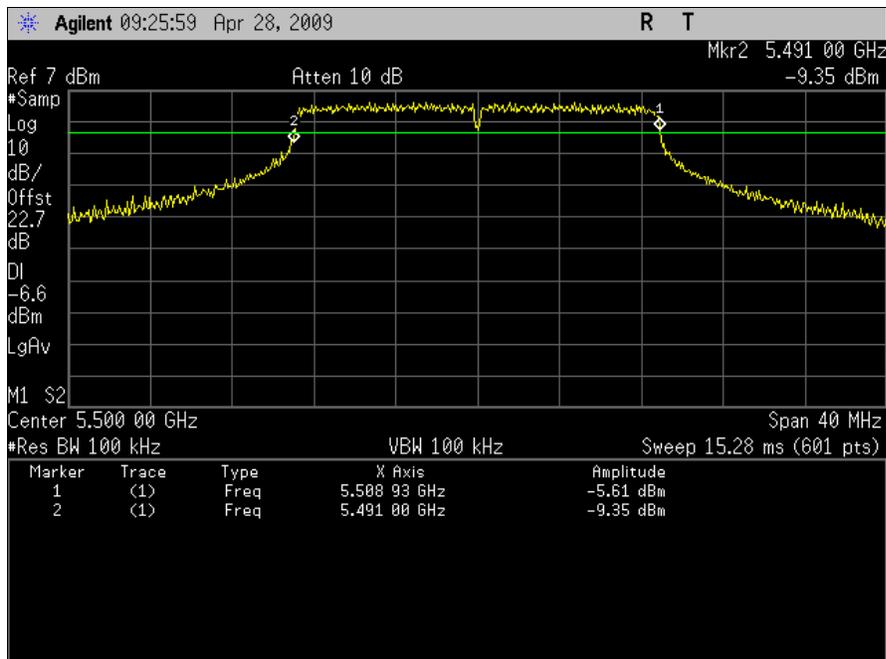
Plot 19. Carrier Frequency, 5700 High Temperature, Low Voltage, Port 1, HT40



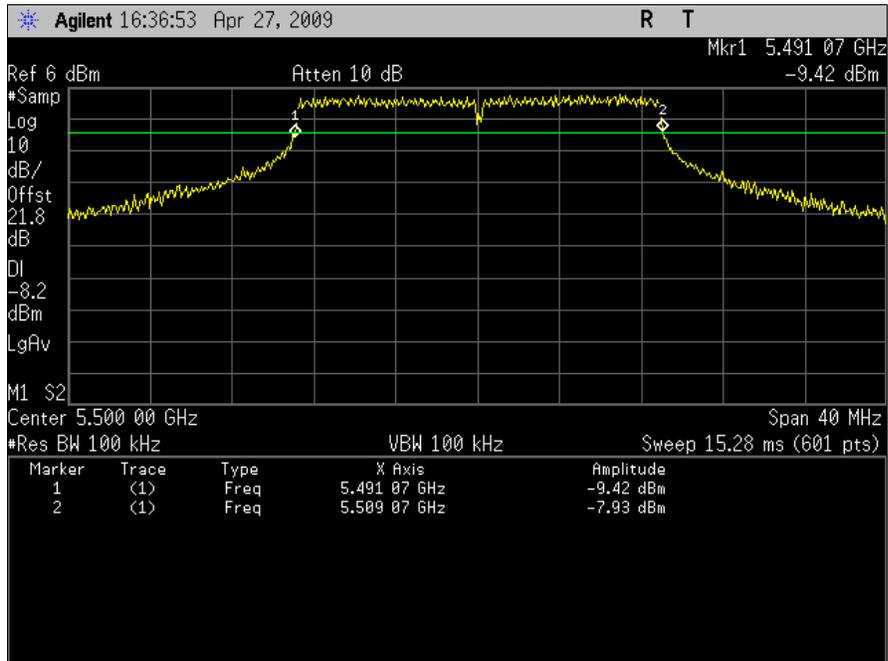
Plot 20. Carrier Frequency, 5700 High Temperature, High Voltage, Port 1, HT40



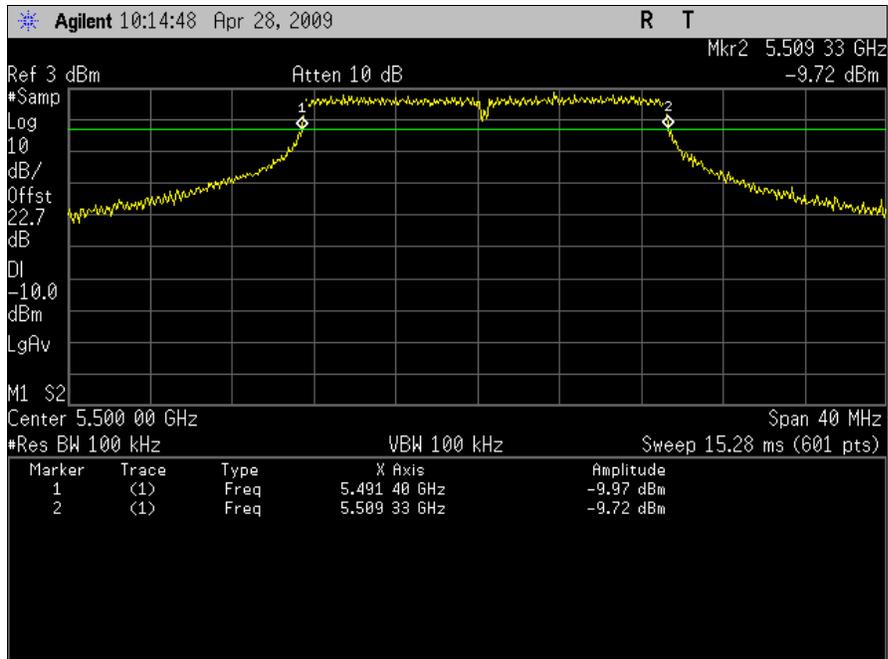
Plot 21. Carrier Frequency, 5500 Low Temperature, Low Voltage, Port 1, a



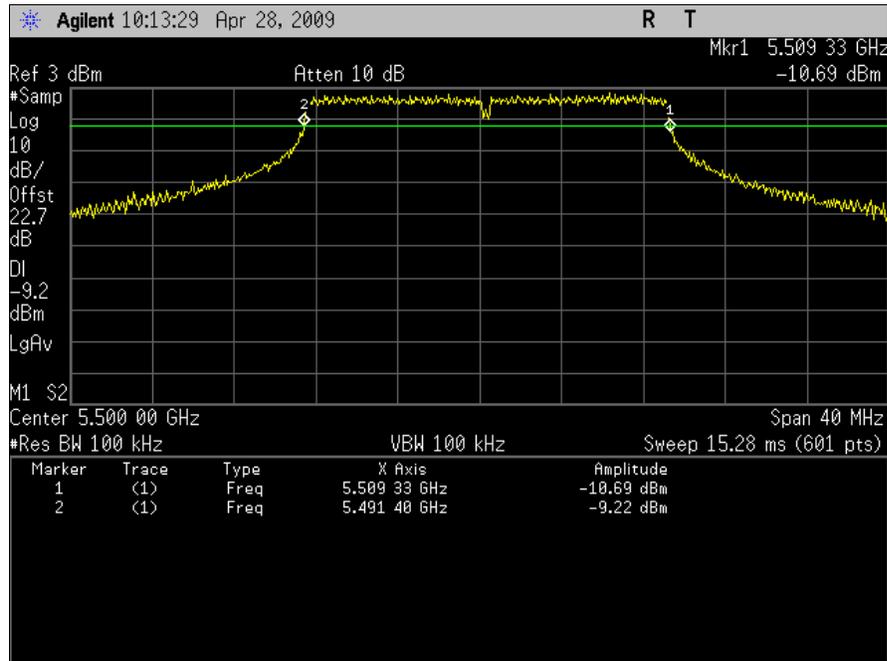
Plot 22. Carrier Frequency, 5500 Low Temperature, High Voltage, Port 1, a



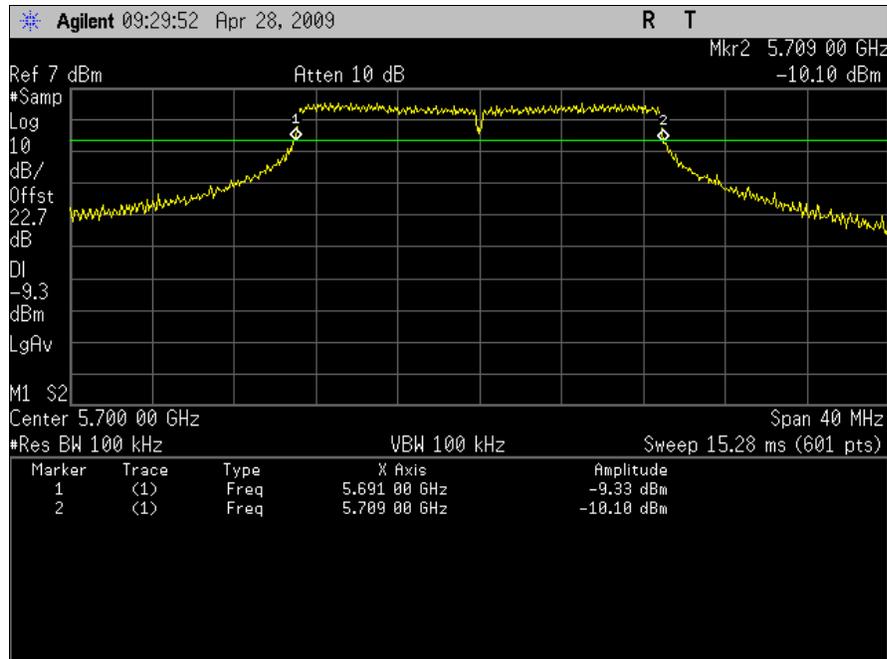
Plot 23. Carrier Frequency, 5500 Normal Temperature, Normal Voltage, Port 1, a



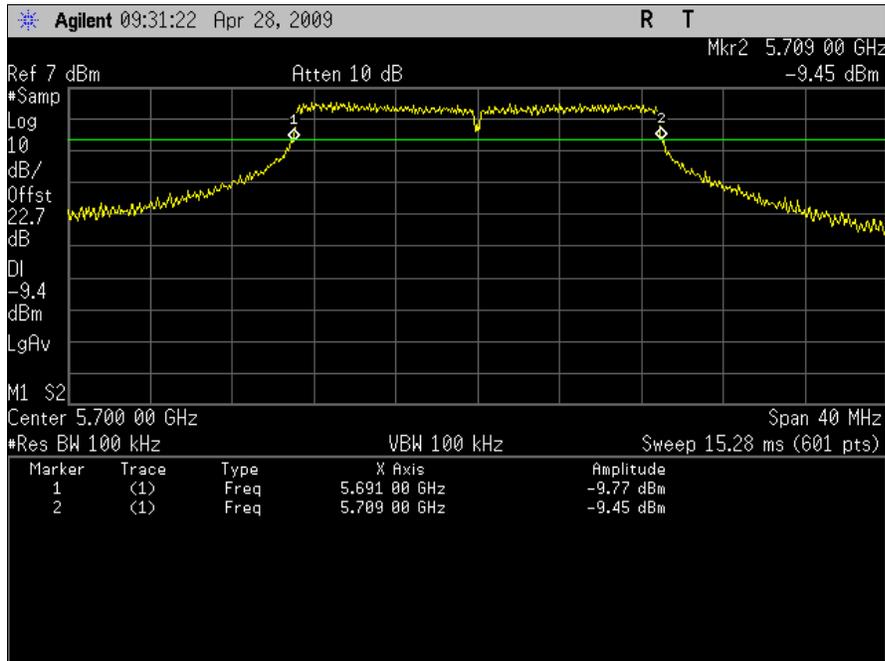
Plot 24. Carrier Frequency, 5500 High Temperature, Low Voltage, Port 1, a



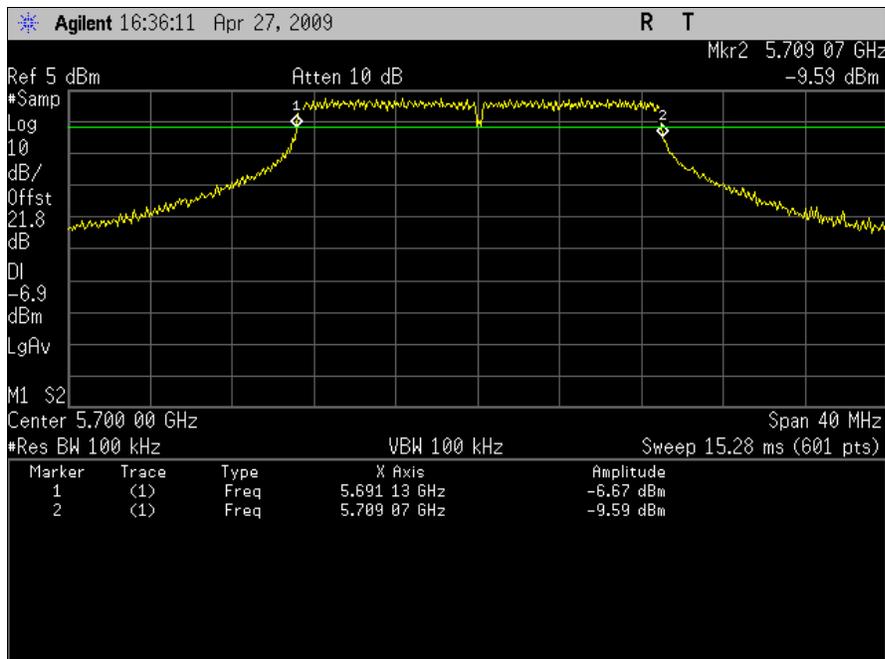
Plot 25. Carrier Frequency, 5500 High Temperature, High Voltage, Port 1, a



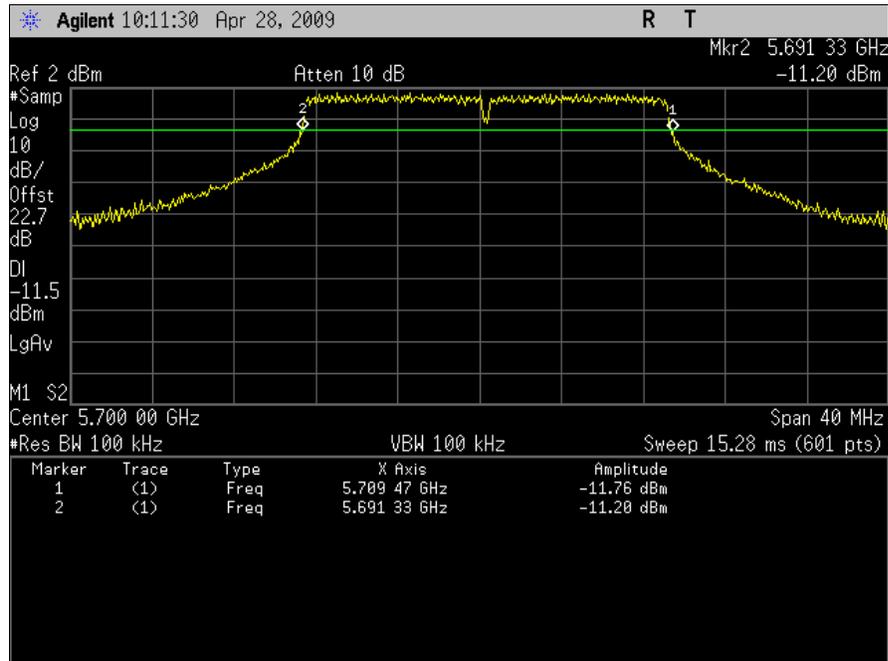
Plot 26. Carrier Frequency, 5700 Low Temperature, Low Voltage, Port 1, a



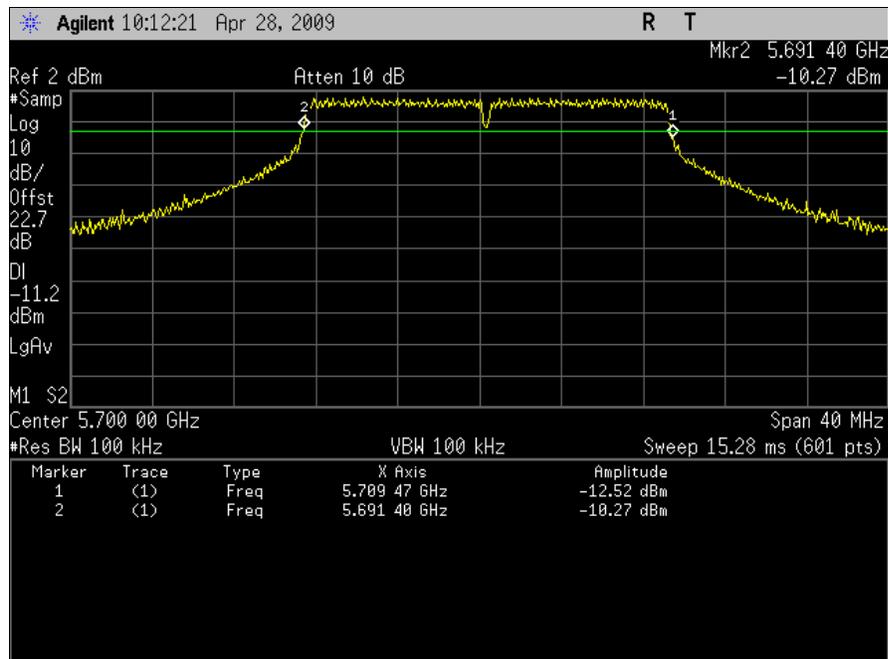
Plot 27. Carrier Frequency, 5700 Low Temperature, High Voltage, Port 1, a



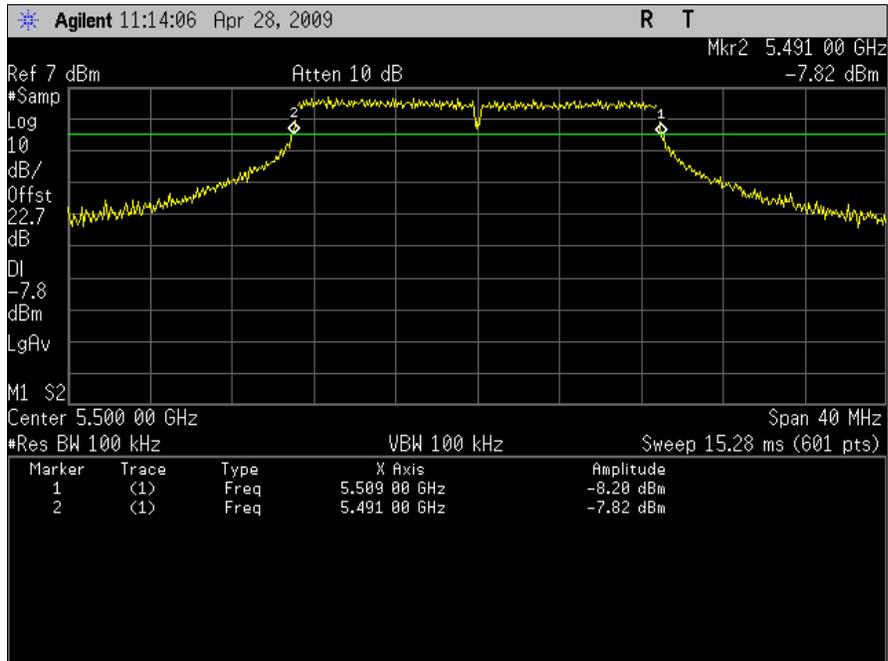
Plot 28. Carrier Frequency, 5700 Normal Temperature, Normal Voltage, Port 1, a



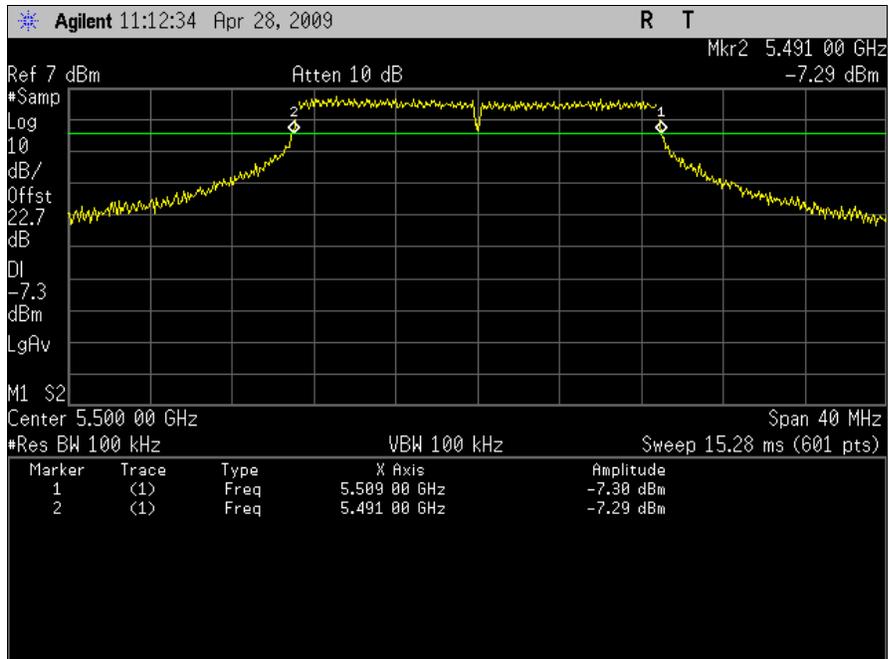
Plot 29. Carrier Frequency, 5700 High Temperature, Low Voltage, Port 1, a



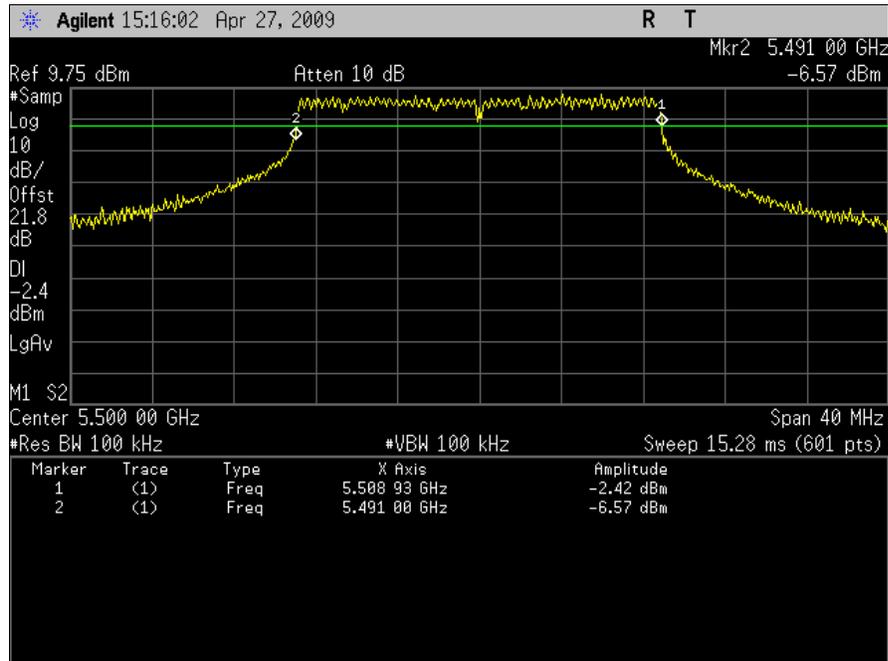
Plot 30. Carrier Frequency, 5700 High Temperature, High Voltage, Port 1, a



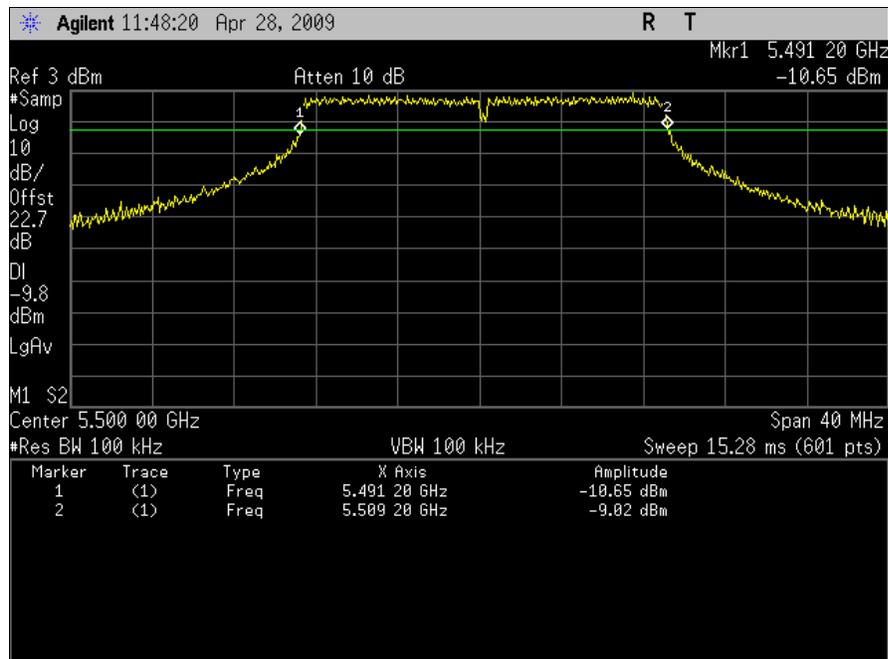
Plot 31. Carrier Frequency, 5500 Low Temperature, Low Voltage, Port 2, HT20



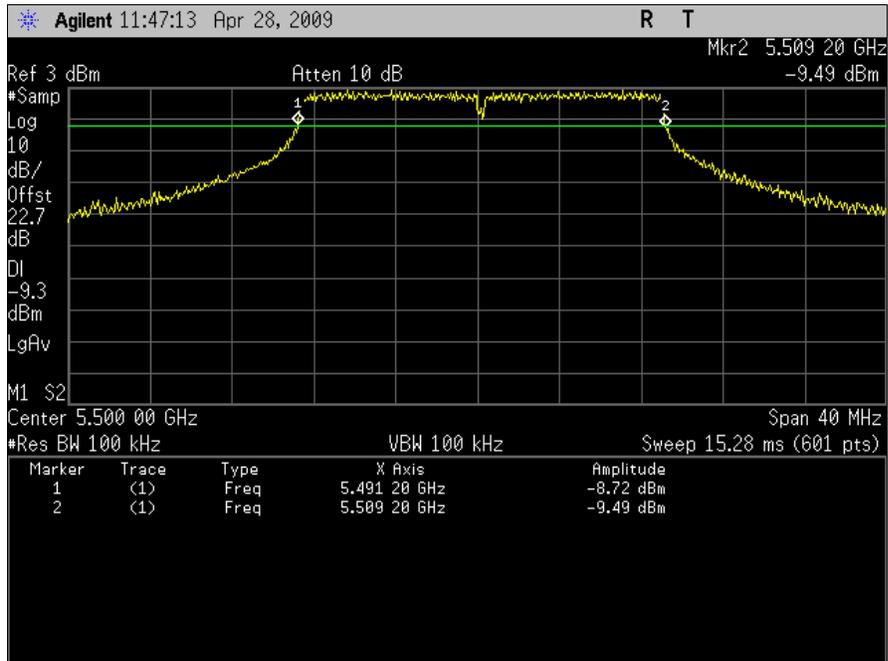
Plot 32. Carrier Frequency, 5500 Low Temperature, High Voltage, Port 2, HT20



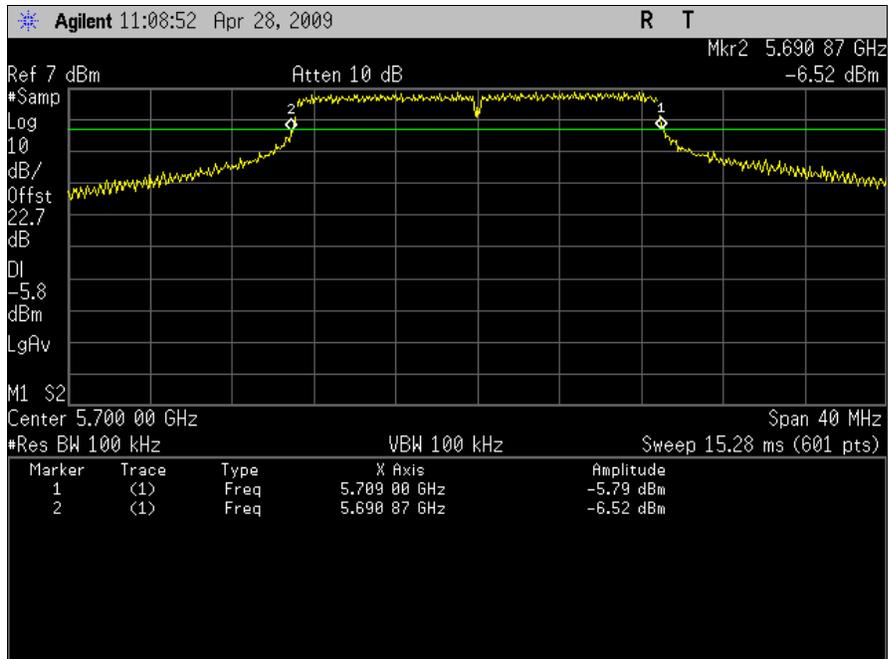
Plot 33. Carrier Frequency, 5500 Normal Temperature, Normal Voltage, Port 2, HT20



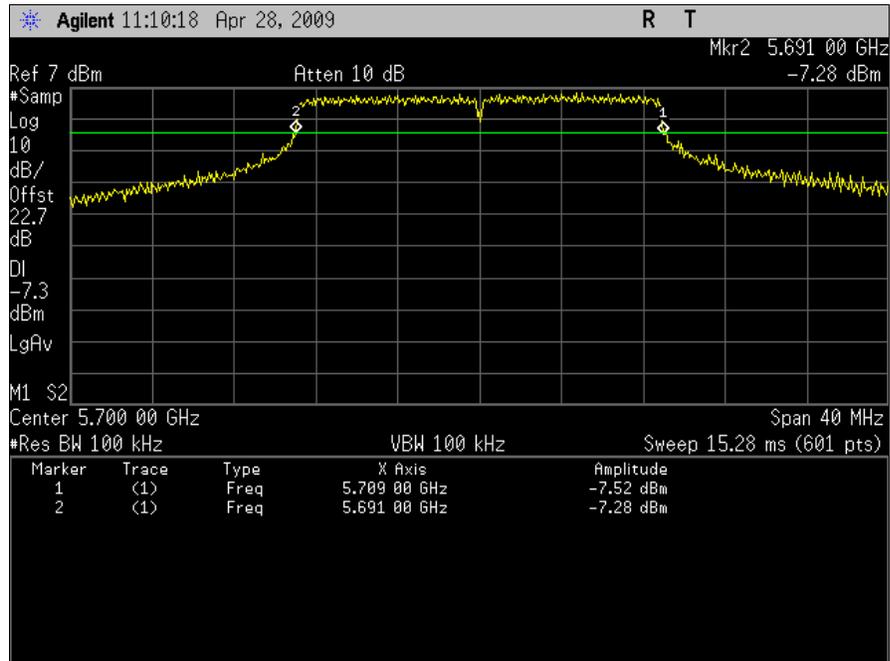
Plot 34. Carrier Frequency, 5500 High Temperature, Low Voltage, Port 2, HT20



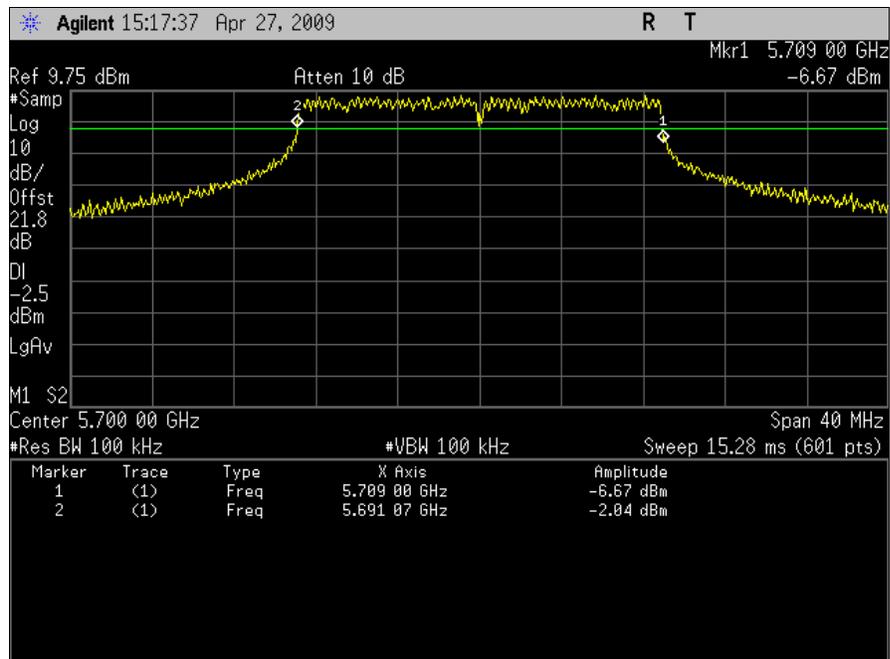
Plot 35. Carrier Frequency, 5500 High Temperature, High Voltage, Port 2, HT20



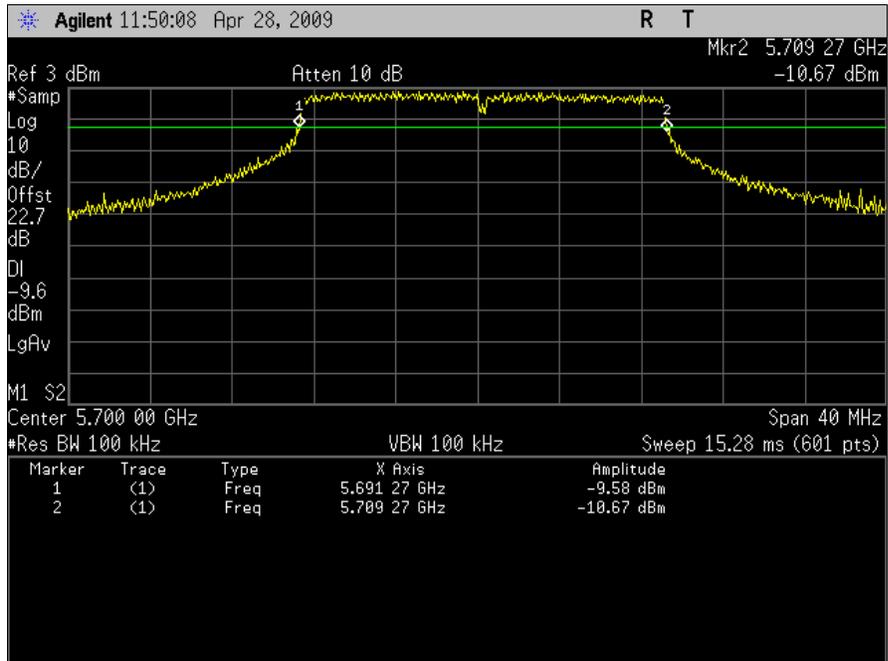
Plot 36. Carrier Frequency, 5700 Low Temperature, Low Voltage, Port 2, HT20



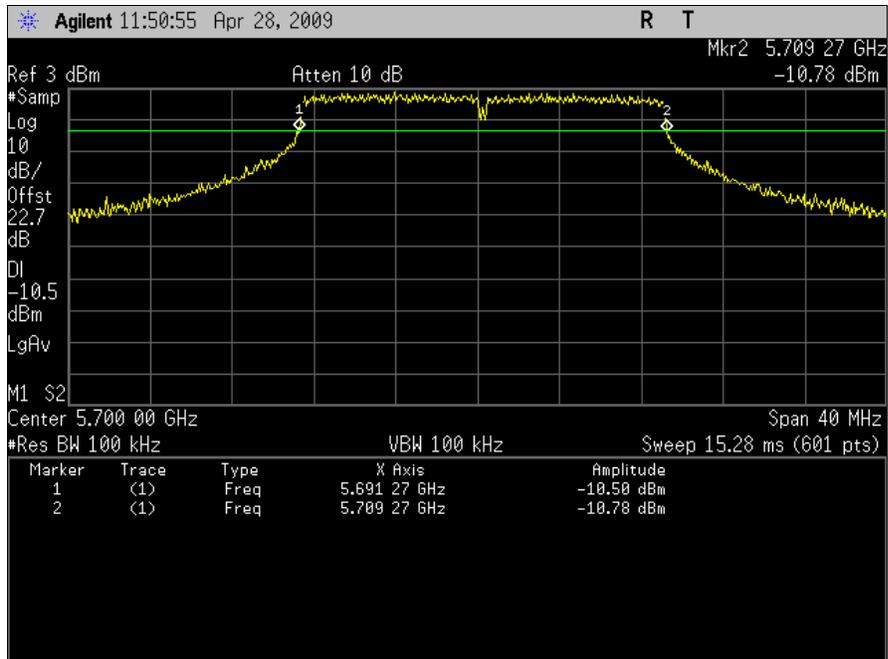
Plot 37. Carrier Frequency, 5700 Low Temperature, High Voltage, Port 2, HT20



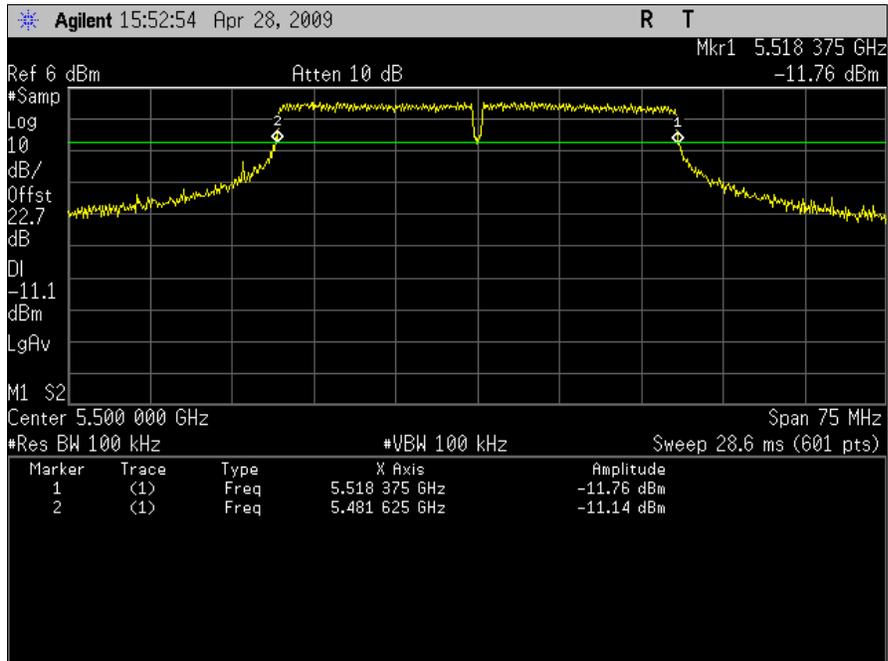
Plot 38. Carrier Frequency, 5700 Normal Temperature, Normal Voltage, Port 2, HT20



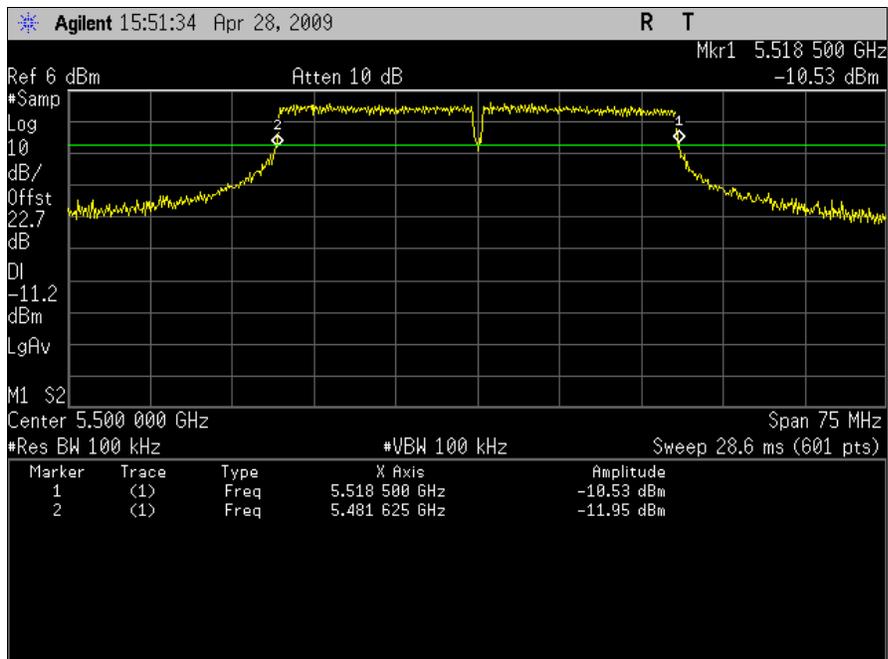
Plot 39. Carrier Frequency, 5700 High Temperature, Low Voltage, Port 2, HT20



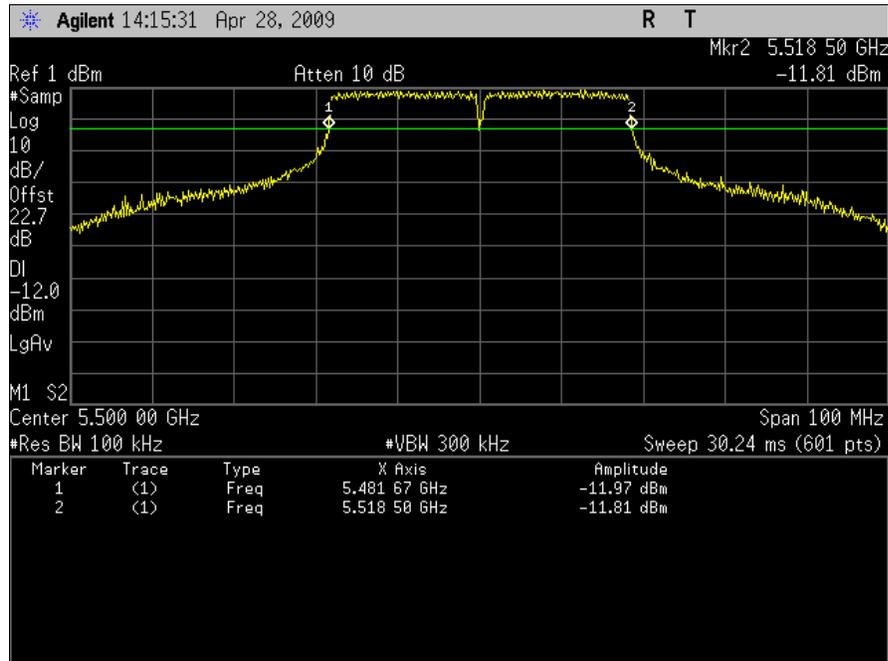
Plot 40. Carrier Frequency, 5700 High Temperature, High Voltage, Port 2, HT20



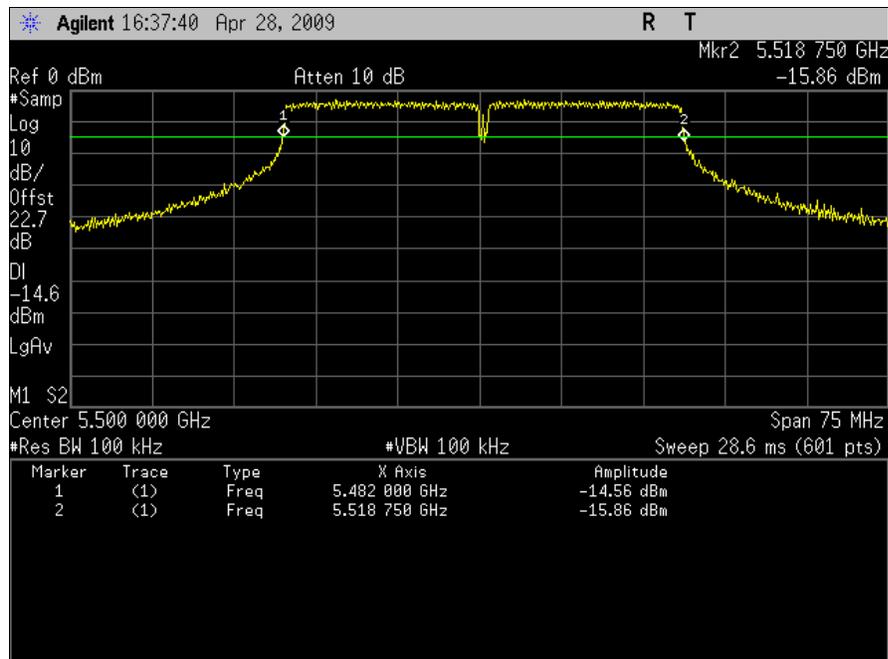
Plot 41. Carrier Frequency, 5500 Low Temperature, Low Voltage, Port 2, HT40



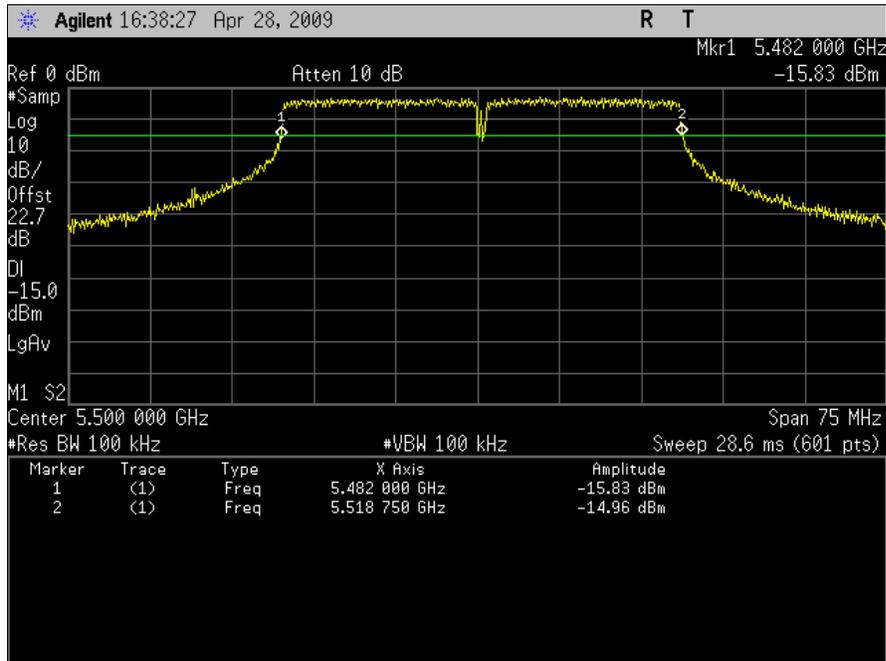
Plot 42. Carrier Frequency, 5500 Low Temperature, High Voltage, Port 2, HT40



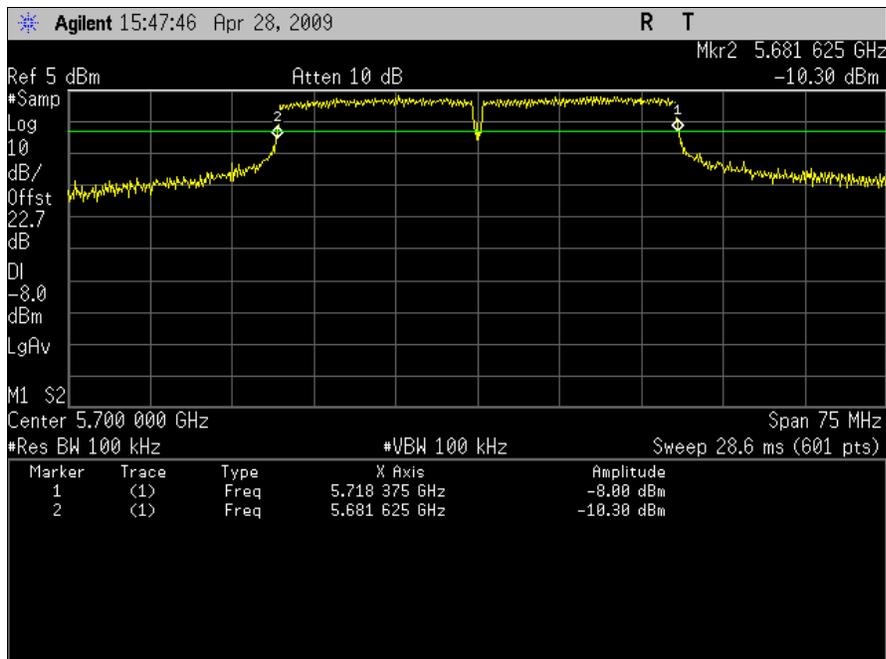
Plot 43. Carrier Frequency, 5500 Normal Temperature, Normal Voltage, Port 2, HT40



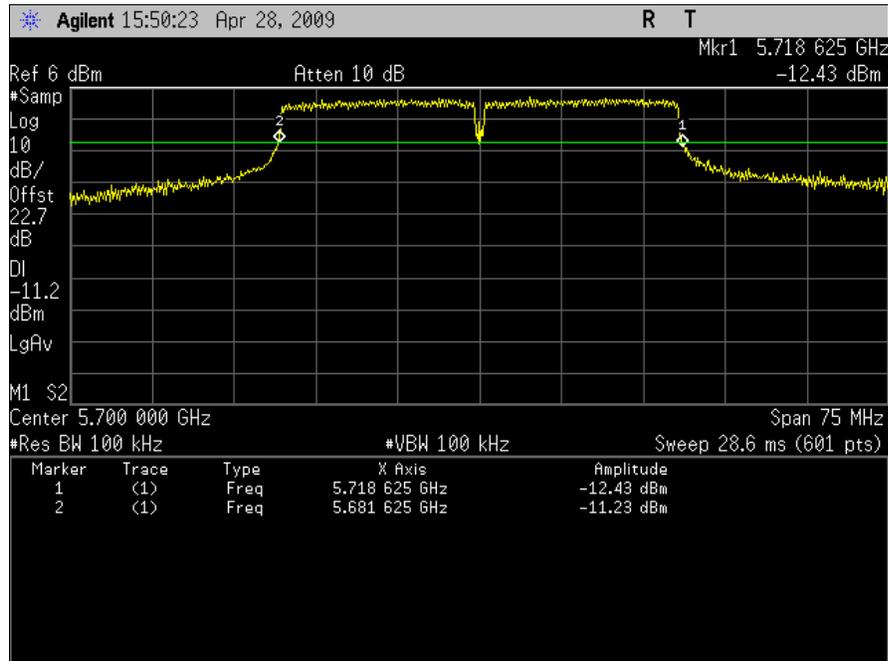
Plot 44. Carrier Frequency, 5500 High Temperature, Low Voltage, Port 2, HT40



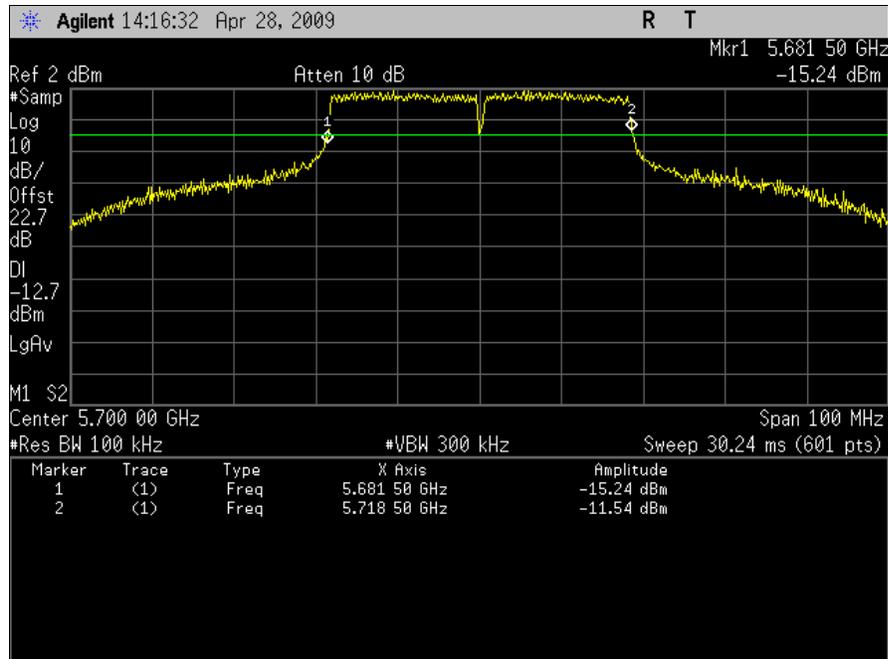
Plot 45. Carrier Frequency, 5500 High Temperature, High Voltage, Port 2, HT40



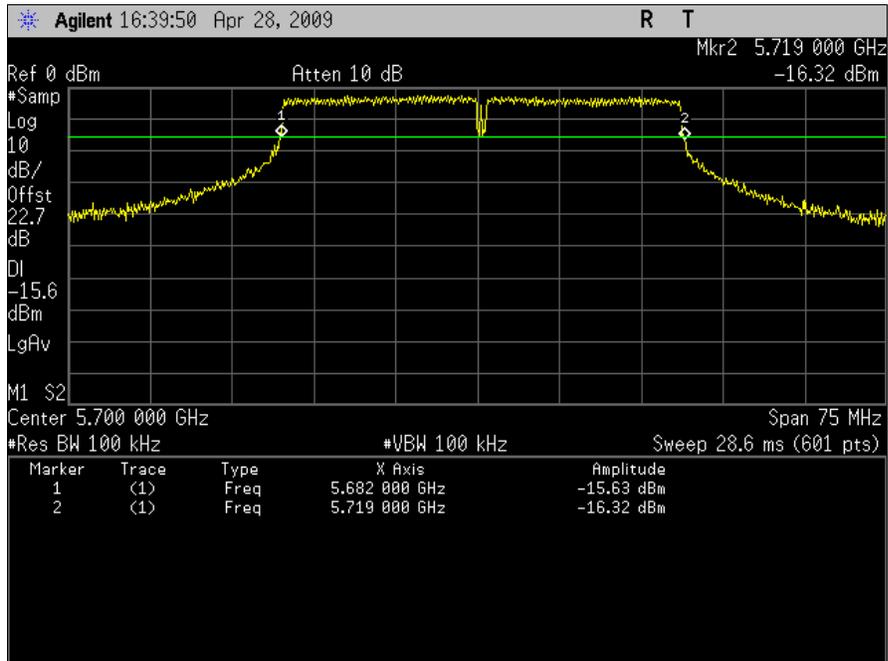
Plot 46. Carrier Frequency, 5700 Low Temperature, Low Voltage, Port 2, HT40



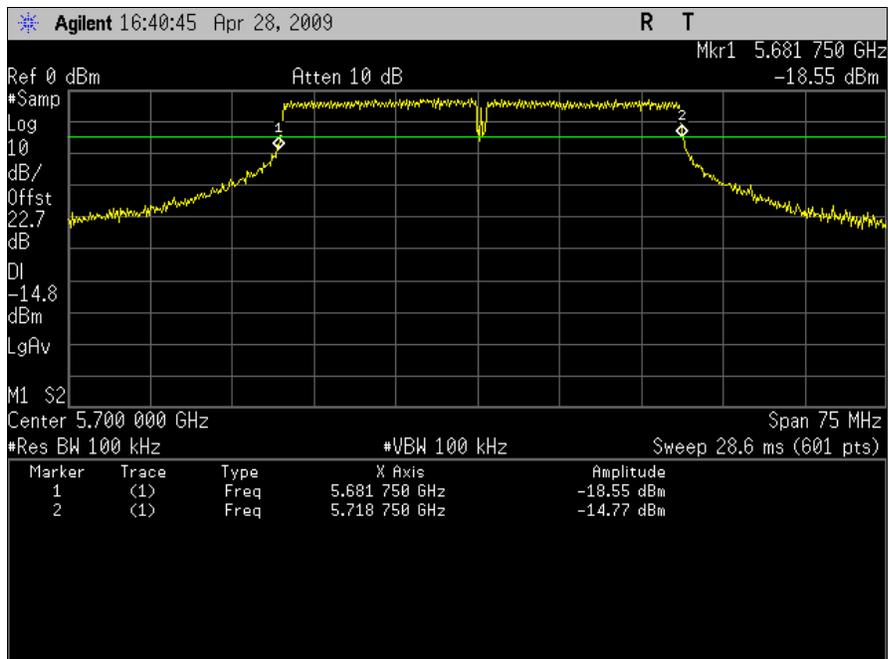
Plot 47. Carrier Frequency, 5700 Low Temperature, High Voltage, Port 2, HT40



Plot 48. Carrier Frequency, 5700 Normal Temperature, Normal Voltage, Port 2, HT40



Plot 49. Carrier Frequency, 5700 High Temperature, Low Voltage, Port 2, HT40



Plot 50. Carrier Frequency, 5700 High Temperature, High Voltage, Port 2, HT40

## Conformance Requirements

### 4.3 RF Output Power

**Test Requirement(s):** ETSI EN 301 893, Clause 5.3.3.2:

#### 4.3.1.1 Definition

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

#### 4.3.2.1 Limit

Frequency range	Mean EIRP limit
5 150 MHz to 5 350 MHz	23 dBm
5 470 MHz to 5 725 MHz	30 dBm

This limit shall apply for any combination of power level and intended antenna assembly.

**Test Procedure:** The EUT was connected directly to a Spectrum Analyzer capable of measuring the average RF power of a modulated carrier. Measurements were carried out in all modulations available and at  $f_c$  of 5500MHz and 5700MHz for the Higher Sub-band. Both normal and extreme test conditions were observed.

The EIRP was determined from the equation  $P = A + G + 10 \log (1/x)$ ; where A is the measured power, x is the duty cycle and G is the antenna assembly gain.

**Test Results:** The EUT as tested was found compliant with the specified limits in clause 4.3.

**Test Engineer:** Anderson Soungpanya

**Test Date:** 04/28/09

## Conformance Requirements

### Effective Isotropic Radiated Power Results

Maximum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
5500	22	230	18.05	7	25.05	30
5500	-20	207	18.14	7	25.14	30
5500	-20	253	18.64	7	25.64	30
5500	55	207	16.53	7	23.53	30
5500	55	253	16.44	7	23.44	30
5700	22	230	17.44	7	24.44	30
5700	-20	207	17.63	7	24.63	30
5700	-20	253	17.81	7	24.81	30
5700	55	207	16.2	7	23.2	30
5700	55	253	16.13	7	23.13	30

Table 6. Maximum Average – RF Output Power Test Results, Port 1, HT20

Maximum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
5500	22	230	19.71	7	26.71	30
5500	-20	207	19.03	7	26.03	30
5500	-20	253	19.07	7	26.07	30
5500	55	207	15.86	7	22.86	30
5500	55	253	15.79	7	22.79	30
5700	22	230	18.21	7	25.21	30
5700	-20	207	18.81	7	25.81	30
5700	-20	253	18.75	7	25.75	30
5700	55	207	16.72	7	23.72	30
5700	55	253	16.64	7	23.64	30

Table 7. Maximum Average – RF Output Power Test Results, Port 1, HT40

Maximum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
5500	22	230	18.05	7	25.05	30
5500	-20	207	18.14	7	25.14	30
5500	-20	253	18.64	7	25.64	30
5500	55	207	16.53	7	23.53	30
5500	55	253	16.44	7	23.44	30
5700	22	230	17.44	7	24.44	30
5700	-20	207	17.63	7	24.63	30
5700	-20	253	17.81	7	24.81	30
5700	55	207	16.2	7	23.2	30
5700	55	253	16.13	7	23.13	30

**Table 8. Maximum Average – RF Output Power Test Results, Port 1, a**

Maximum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
5500	22	230	18.35	7	25.35	30
5500	-20	207	19.27	7	26.27	30
5500	-20	253	19.22	7	26.22	30
5500	55	207	17.96	7	24.96	30
5500	55	253	18.12	7	25.12	30
5700	22	230	19.69	7	26.69	30
5700	-20	207	19.87	7	26.87	30
5700	-20	253	19.91	7	26.91	30
5700	55	207	18.88	7	25.88	30
5700	55	253	18.82	7	25.82	30

**Table 9. Maximum Average – RF Output Power Test Results, Port 2, HT20**

<b>Maximum Average Power Under Normal and Extreme Conditions</b>						
<b>Frequency (MHz)</b>	<b>Temperature (C)</b>	<b>Voltage (V)</b>	<b>Conducted Power (dBm)</b>	<b>Antenna Gain (dBi)</b>	<b>EIRP</b>	<b>Limit</b>
5500	22	230	18.36	7	25.36	30
5500	-20	207	19.4	7	26.4	30
5500	-20	253	19.46	7	26.46	30
5500	55	207	15.89	7	22.89	30
5500	55	253	15.78	7	22.78	30
5700	22	230	19.15	7	26.15	30
5700	-20	207	19.55	7	26.55	30
5700	-20	253	19.51	7	26.51	30
5700	55	207	16.45	7	23.45	30
5700	55	253	16.39	7	23.39	30

**Table 10. Maximum Average – RF Output Power Test Results, Port 2, HT40**

## Conformance Requirements

### 4.3 Transmit Power Control

**Test Requirement(s):** ETSI EN 301 893 Section 5.3.3.2.1.2:

#### 4.3.1.2 Definition

The Transmit Power Control (TPC) is a mechanism to be used by the EUT to ensure a mitigation factor of at least 3dB on the aggregate power from a large number of devices. This requires the EUT to have a TPC range from which the lowest value is at least 6 dB below the values for the mean EIRP given in the table below. TPC is not required in the band 5150MHz- 5250MHz.

#### 4.3.2.2 Limit

Frequency range	Mean EIRP limit
5 250 MHz to 5 350 MHz	17 dBm
5 470 MHz to 5 725 MHz	24 dBm

Mean EIRP for RF Output Power at the Lowest TPC level

**Test Procedure:** 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 and at  $f_c$  of 5500MHz and 5700MHz for the Higher Sub-band. Both normal and extreme test conditions were observed.

**Test Results:** The EUT was found to be compliant with the limits set forth in Clause 4.3

**Test Engineer:** Anderson Soungpanya

**Test Date:** 04/28/09

## Conformance Requirements

### Effective Isotropic Radiated Power Results

Minimum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
5500	22	230	11.21	7	18.21	24
5500	-20	207	12.76	7	19.76	24
5500	-20	253	12.81	7	19.81	24
5500	55	207	10.23	7	17.23	24
5500	55	253	10.42	7	17.42	24
5700	22	230	11.51	7	18.51	24
5700	-20	207	11.98	7	18.98	24
5700	-20	253	11.76	7	18.76	24
5700	55	207	9.31	7	16.31	24
5700	55	253	9.55	7	16.55	24

**Table 11. Minimum Average – RF Output Power Test Results, Port 1, HT20**

Minimum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
5500	22	230	11.25	7	18.25	24
5500	-20	207	13.35	7	20.35	24
5500	-20	253	13.32	7	20.32	24
5500	55	207	11.32	7	18.32	24
5500	55	253	11.14	7	18.14	24
5700	22	230	11.38	7	18.38	24
5700	-20	207	12.02	7	19.02	24
5700	-20	253	12.08	7	19.08	24
5700	55	207	10.69	7	17.69	24
5700	55	253	10.51	7	17.51	24

**Table 12. Minimum Average – RF Output Power Test Results, Port 1, HT40**

Minimum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
5500	22	230	11.21	7	18.21	24
5500	-20	207	12.76	7	19.76	24
5500	-20	253	12.81	7	19.81	24
5500	55	207	10.23	7	17.23	24
5500	55	253	10.42	7	17.42	24
5700	22	230	11.51	7	18.51	24
5700	-20	207	11.98	7	18.98	24
5700	-20	253	11.76	7	18.76	24
5700	55	207	9.31	7	16.31	24
5700	55	253	9.55	7	16.55	24

**Table 13. Minimum Average – RF Output Power Test Results, Port 1, a**

Minimum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
5500	22	230	13.15	7	20.15	24
5500	-20	207	13.22	7	20.22	24
5500	-20	253	13.7	7	20.7	24
5500	55	207	11.98	7	18.98	24
5500	55	253	12.18	7	19.18	24
5700	22	230	13.09	7	20.09	24
5700	-20	207	13.46	7	20.46	24
5700	-20	253	13.66	7	20.66	24
5700	55	207	12.54	7	19.54	24
5700	55	253	12.31	7	19.31	24

**Table 14. Minimum Average – RF Output Power Test Results, Port 2, HT20**

Minimum Average Power Under Normal and Extreme Conditions						
Frequency (MHz)	Temperature (C)	Voltage (V)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP	Limit
5500	22	230	13.41	7	20.41	24
5500	-20	207	13.76	7	20.76	24
5500	-20	253	13.78	7	20.78	24
5500	55	207	12.15	7	19.15	24
5500	55	253	12.28	7	19.28	24
5700	22	230	13.01	7	20.01	24
5700	-20	207	13.75	7	20.75	24
5700	-20	253	13.83	7	20.83	24
5700	55	207	12.59	7	19.59	24
5700	55	253	12.65	7	19.65	24

**Table 15. Minimum Average – RF Output Power Test Results, Port 2, HT40**

## Conformance Requirements

### 4.3 Power Density

**Test Requirement(s):** ETSI EN 301 893 Section 5.3.3.2.1.3:

4.3.1.3 Definition

The Power Density is the mean equivalent isotropically radiated power (EIRP) during a transmission burst

4.3.2.1 Limit

For Devices with TPC, the Power Density when configured to operate at the highest stated power level shall not exceed the levels below.

Frequency range	Mean EIRP Density limit
5 250 MHz to 5 350 MHz	10 dBm/MHz
5 470 MHz to 5 725 MHz	17 dBm/MHz

**Test Procedure:** The EUT was connected directly to a Spectrum Analyzer through an attenuator. Measurements were carried out in all modulations available and at  $f_c$  of 5150MHz and 5350MHz for the lower Sub-Bands and 5500MHz and 5700MHz for the Higher Sub-band. The spectrum analyzer was initially set with a RBW and VBW of 1MHz and a span 3 times that of the carrier width. The max hold function was used to determine the frequency which gave the maximum value across the occupied band of the carrier. The spectrum analyzer was reset to use the power density function at the frequency found previously. The power density was then measured over 1MHz resolution.

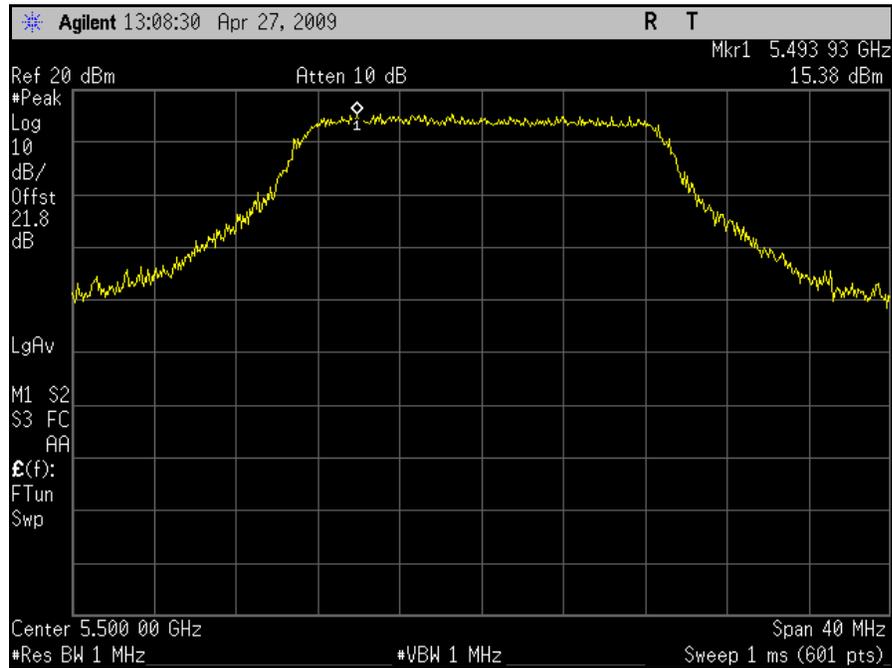
**Test Results:** The EUT as tested was found compliant with the specified limits of Clause 4.3.

**Test Engineer:** Anderson Soungpanya

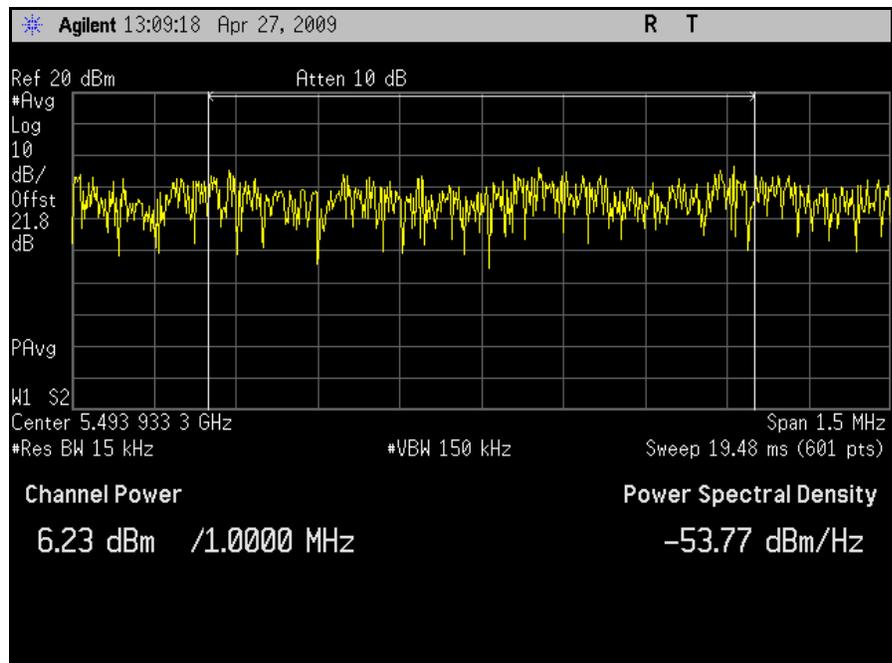
**Test Date:** 04/27/09

Port 1 HT20						
Frequency (MHz)	Mode	Measured Maximum Spectral Power Density (dBm)	Antenna Gain	Maximum Spectral Power Density (dBm)	Maximum SPD Limit (dBm)	Margin dB
5500	OFDM	6.23	7	13.23	17	-3.77
5700	OFDM	5.76	7	12.76	17	-4.24
Port 1 HT20						
Frequency (MHz)	Mode	Measured Maximum Spectral Power Density (dBm)	Antenna Gain	Maximum Spectral Power Density (dBm)	Maximum SPD Limit (dBm)	Margin dB
5500	OFDM	4.09	7	11.09	17	-5.11
5700	OFDM	3.19	7	10.19	17	-6.81
Port 1 A Mode						
Frequency (MHz)	Mode	Measured Maximum Spectral Power Density (dBm)	Antenna Gain	Maximum Spectral Power Density (dBm)	Maximum SPD Limit (dBm)	Margin dB
5500	OFDM	6.23	7	13.23	17	-3.77
5700	OFDM	5.76	7	12.76	17	-4.24
Port 2 HT20						
Frequency (MHz)	Mode	Measured Maximum Spectral Power Density (dBm)	Antenna Gain	Maximum Spectral Power Density (dBm)	Maximum SPD Limit (dBm)	Margin dB
5500	OFDM	7.60	7	14.60	17	-2.40
5700	OFDM	7.64	7	14.64	17	-2.36
Port 2 HT40						
Frequency (MHz)	Mode	Measured Maximum Spectral Power Density (dBm)	Antenna Gain	Maximum Spectral Power Density (dBm)	Maximum SPD Limit (dBm)	Margin dB
5500	OFDM	4.59	7	11.59	17	-5.41
5700	OFDM	6.21	7	13.21	17	-3.79

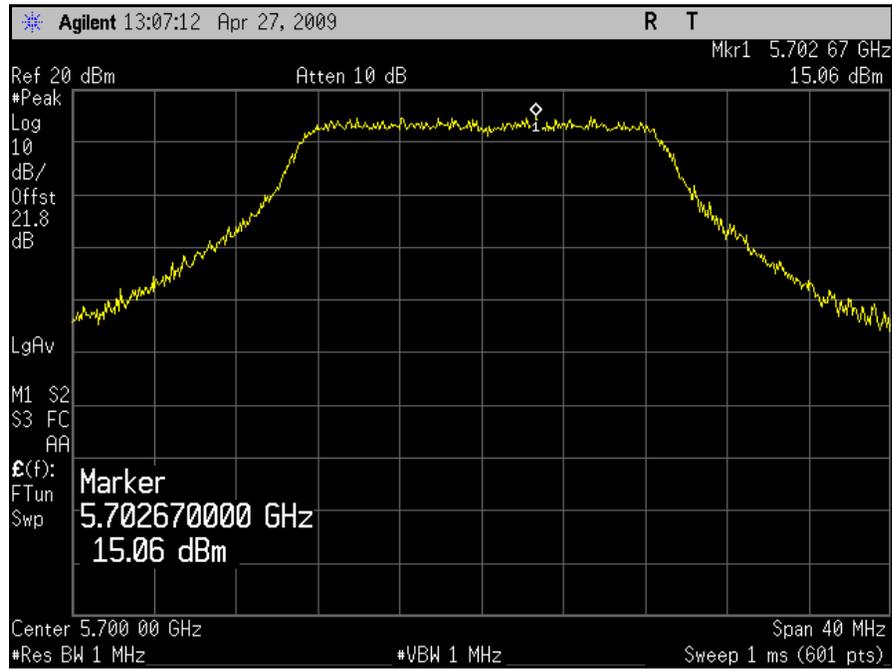
Table 16. Power Density, Test Results



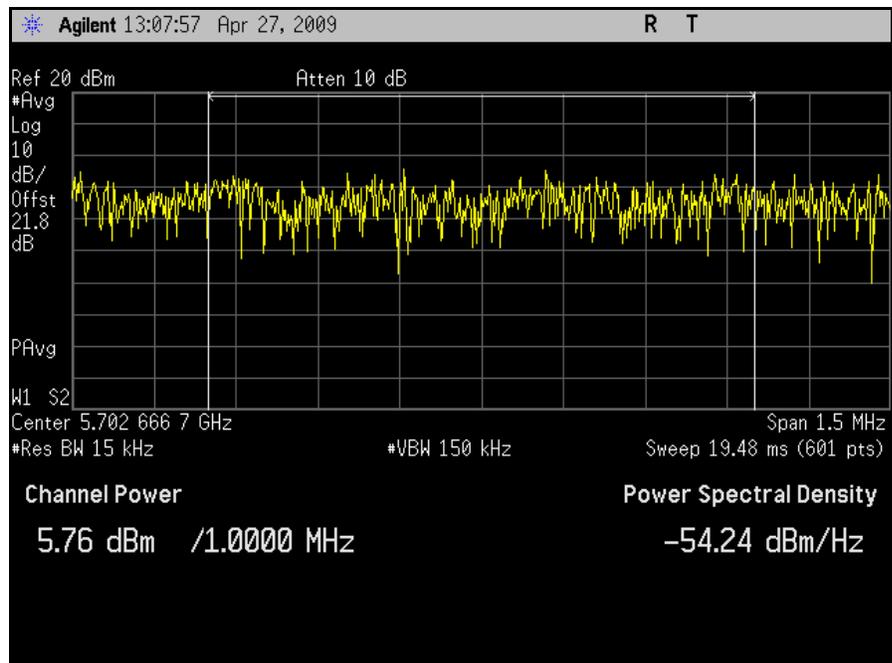
Plot 51. 5500 Power Spectral Density Determination, Port 1, HT20



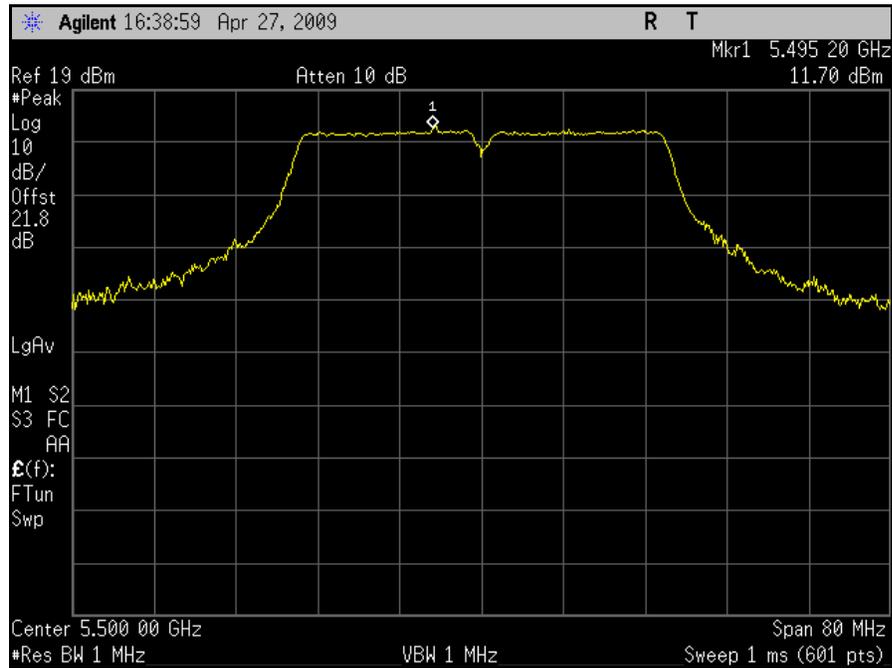
Plot 52. 5500 Power Spectral Density, Port 1, HT20



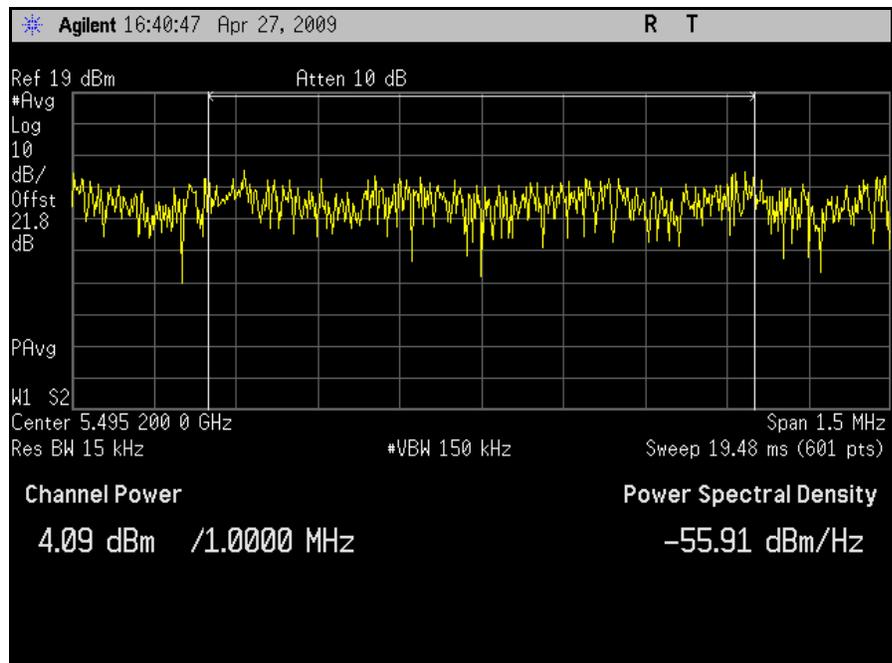
Plot 53. 5700 Power Spectral Density Determination, Port 1, HT20



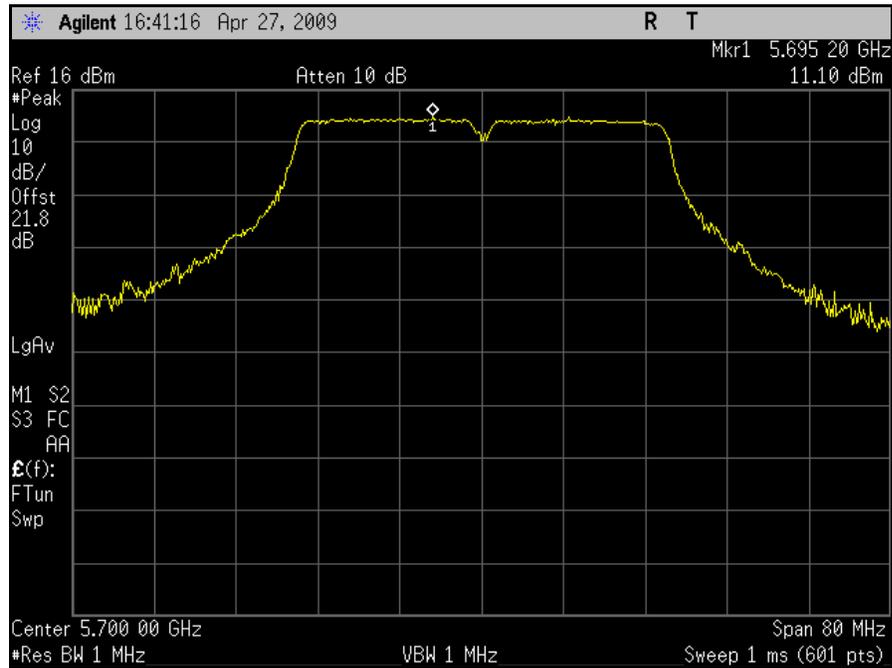
Plot 54. 5700 Power Spectral Density, Port 1, HT20



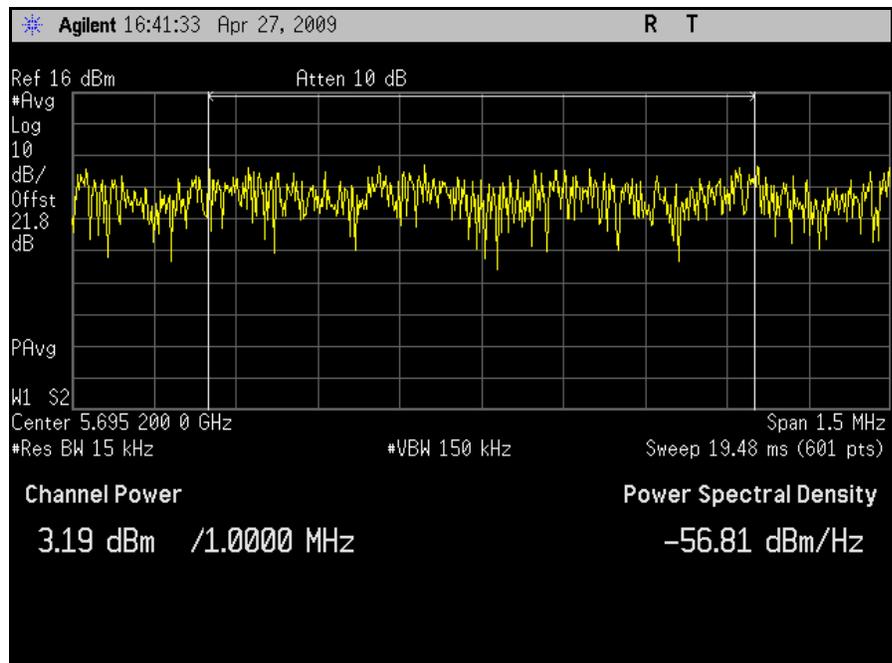
Plot 55. 5500 Power Spectral Density Determination, Port 1, HT40



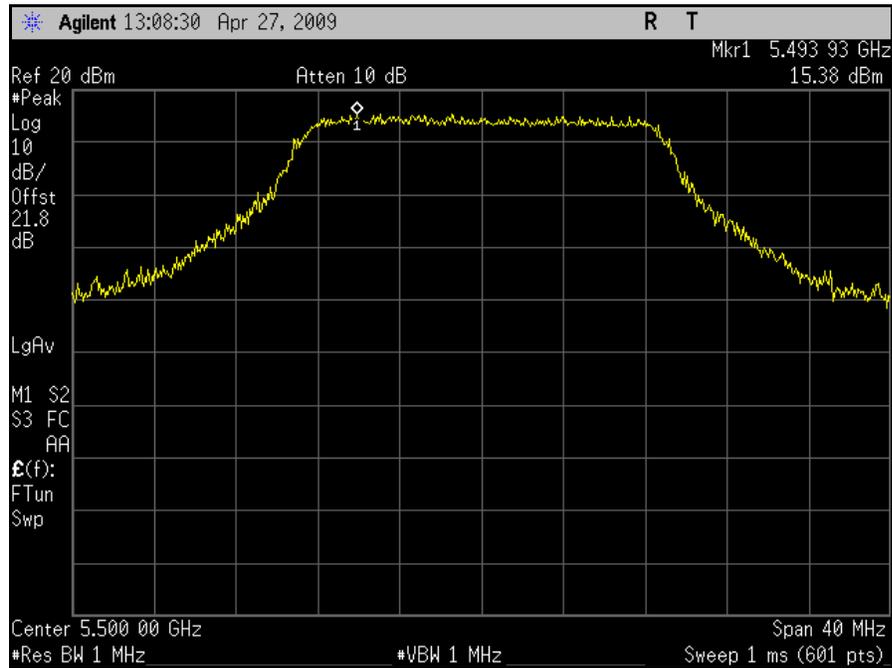
Plot 56. 5500 Power Spectral Density, Port 1, HT40



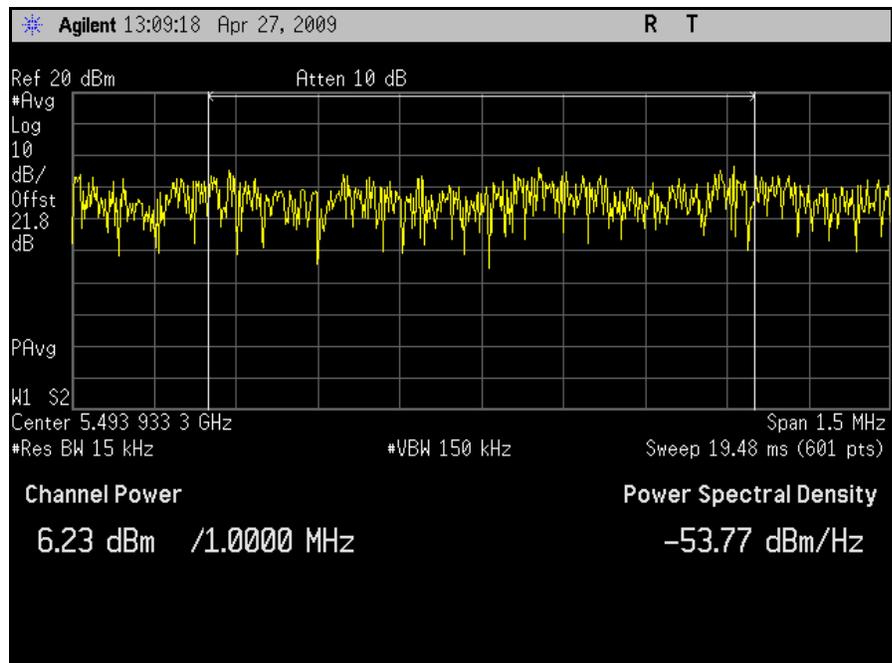
Plot 57. 5700 Power Spectral Density Determination, Port 1, HT40



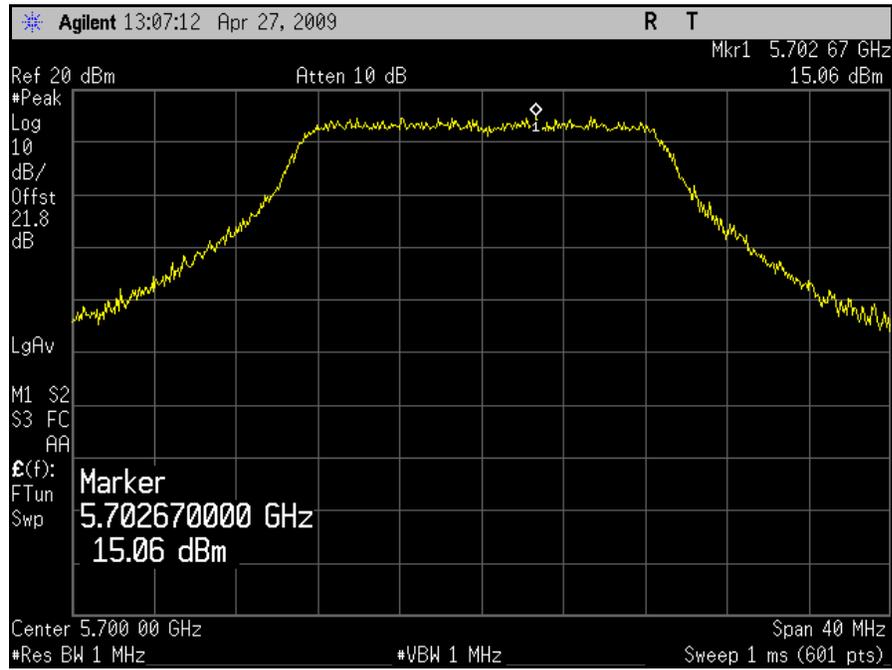
Plot 58. 5700 Power Spectral Density, Port 1, HT40



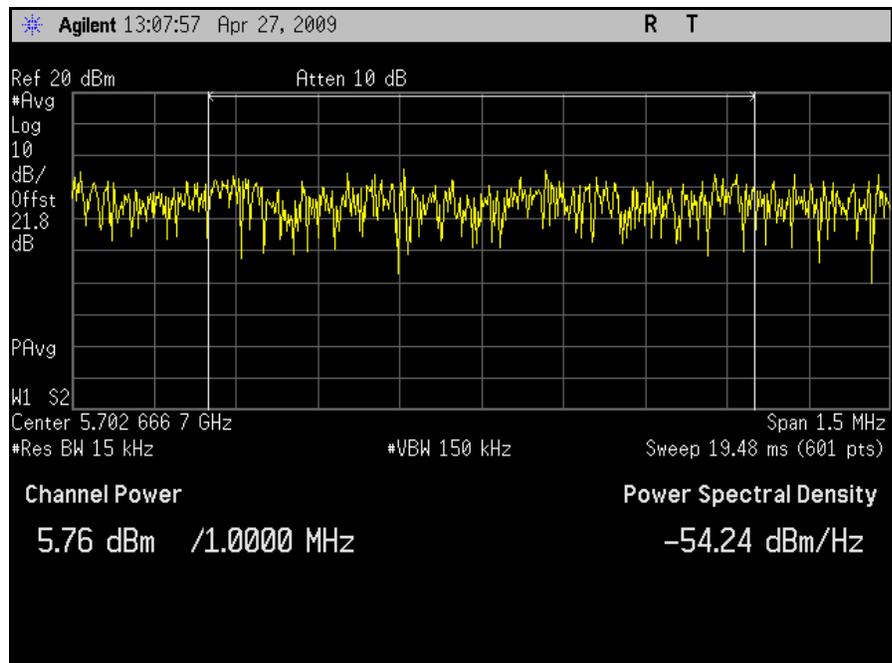
Plot 59. 5500 Power Spectral Density Determination, Port 1, a



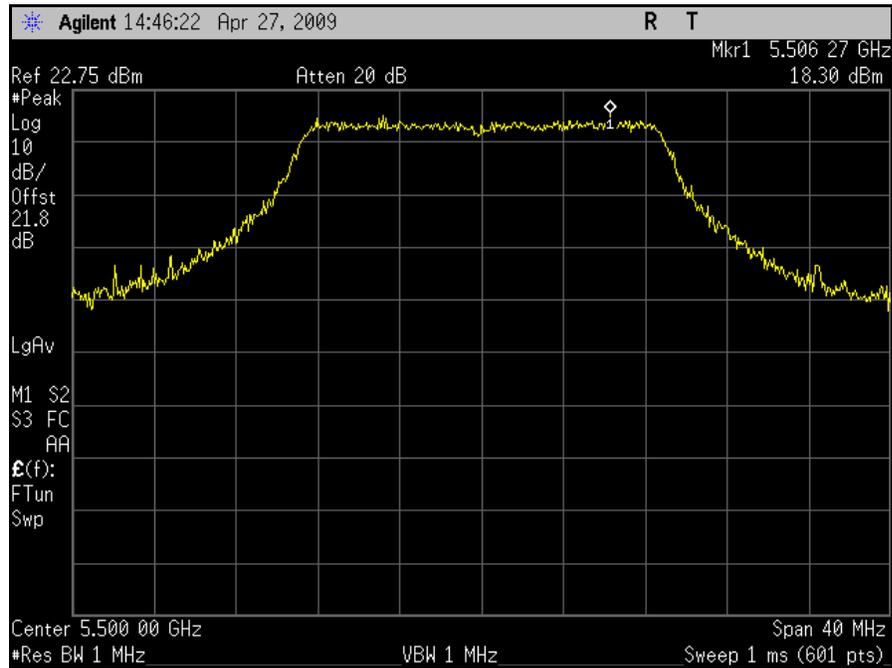
Plot 60. 5500 Power Spectral Density, Port 1, a



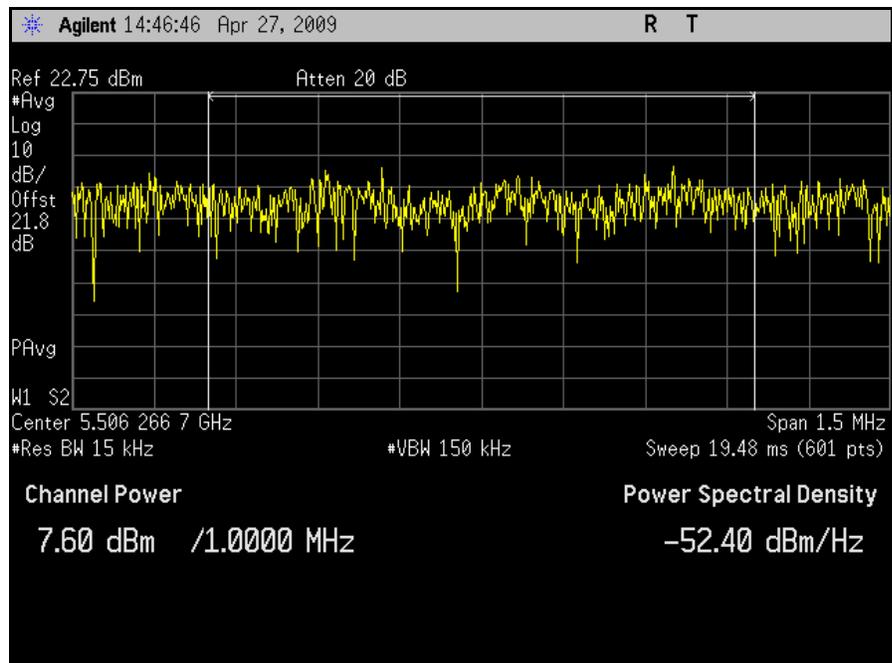
Plot 61. 5700 Power Spectral Density Determination, Port 1, a



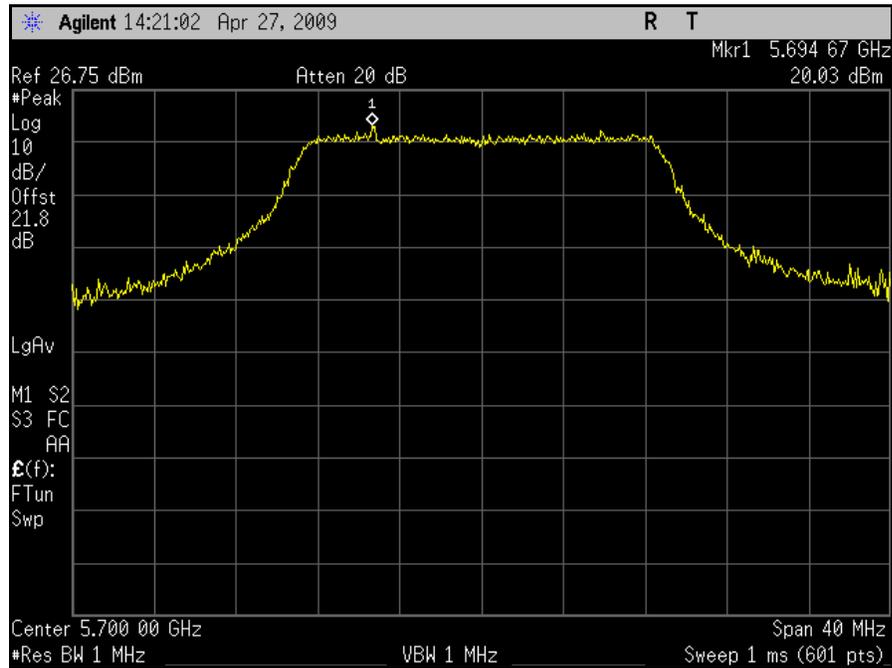
Plot 62. 5700 Power Spectral Density, Port 1, a



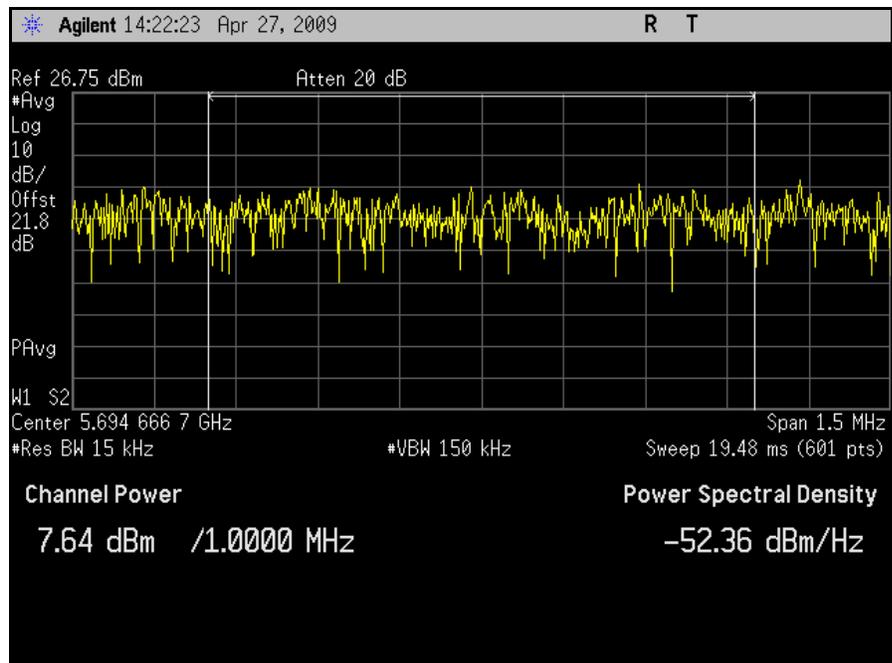
**Plot 63. 5500 Power Spectral Density Determination, Port 2, HT20**



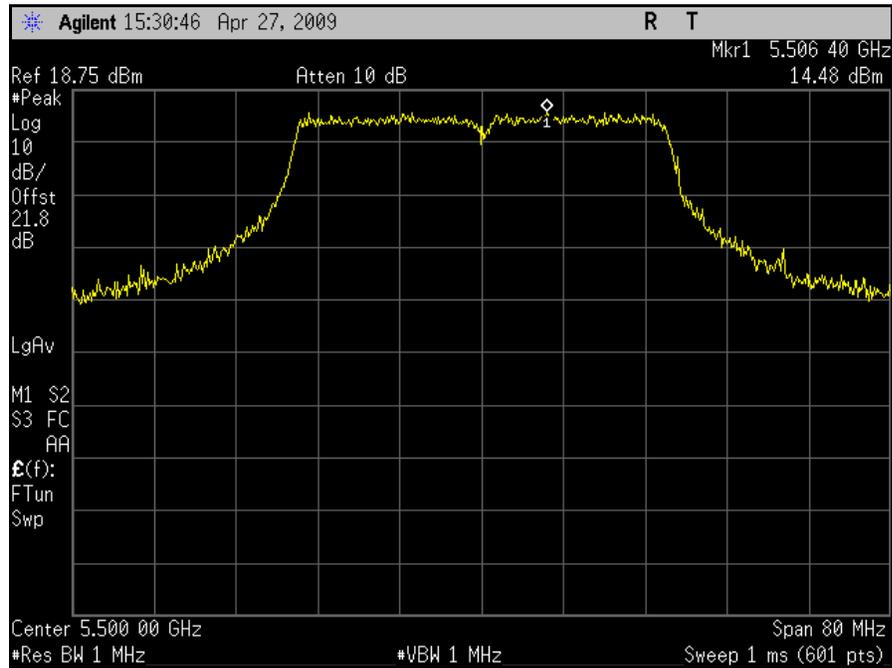
**Plot 64. 5500 Power Spectral Density, Port 2, HT20**



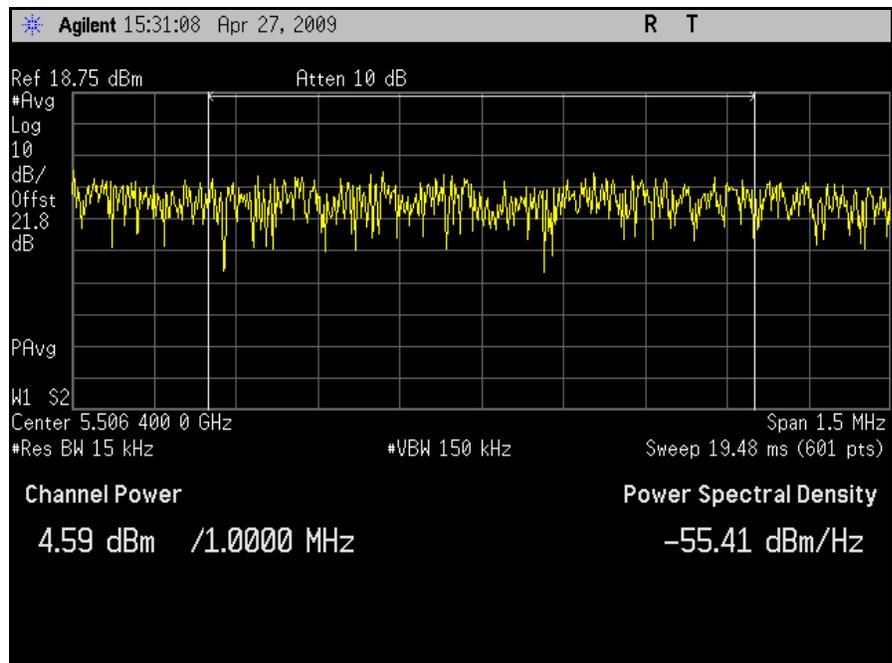
Plot 65. 5700 Power Spectral Density Determination, Port 2, HT20



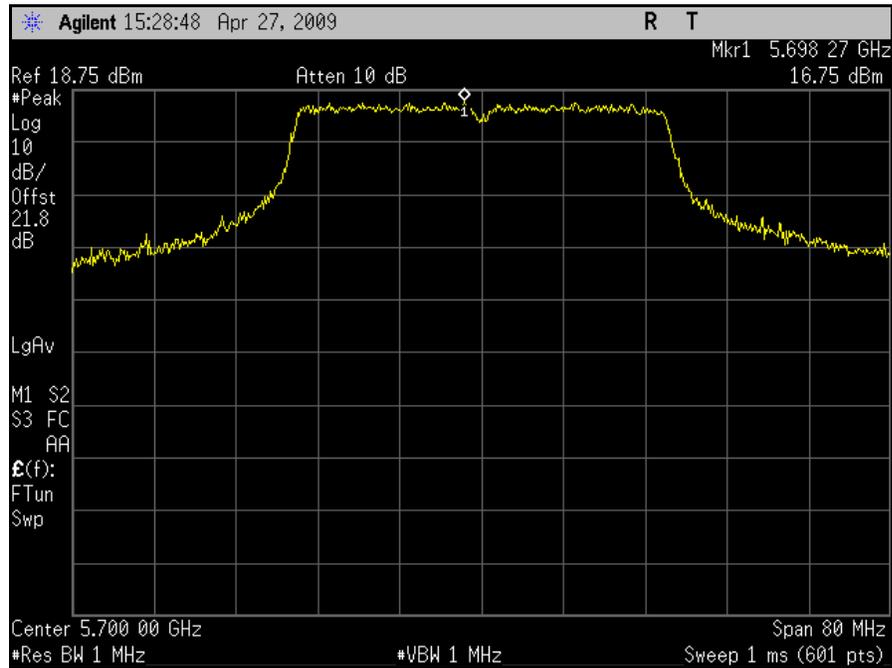
Plot 66. 5700 Power Spectral Density, Port 2, HT20



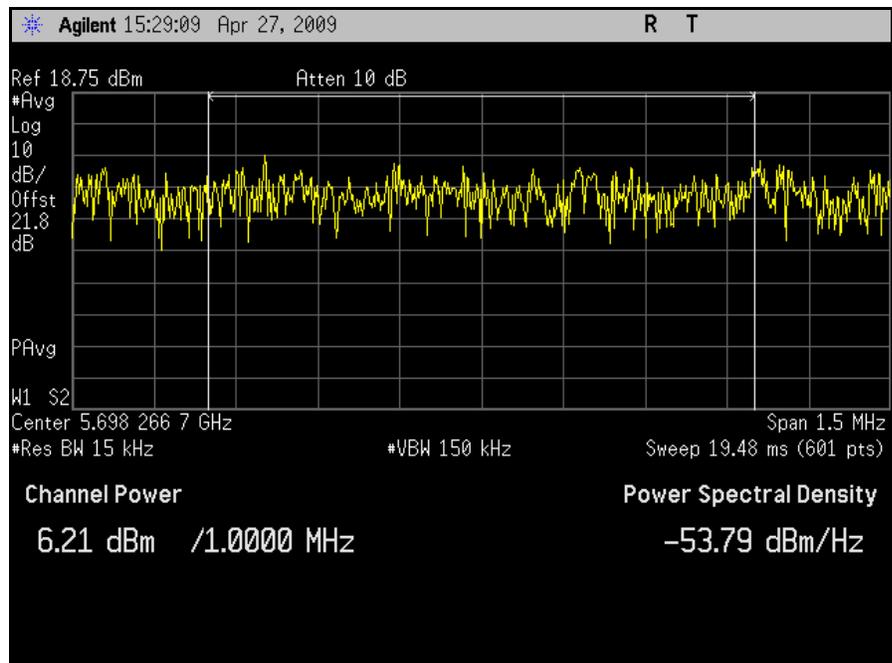
Plot 67. 5500 Power Spectral Density Determination, Port 2, HT40



Plot 68. 5500 Power Spectral Density, Port 2, HT40



Plot 69. 5700 Power Spectral Density Determination, Port 2, HT40



Plot 70. 5700 Power Spectral Density, Port 2, HT40

#### 4.4 Transmitter Unwanted Emissions Outside the 5GHz RLAN Bands (conducted)

**Test Requirement(s):** EN 301 893, Clause 5.3.4.2:

##### 4.4.1.1 Definition

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

##### 4.3.4.2 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 RBW and VBW of the spectrum analyzer were initially set to 1MHz using the peak hold function or video averaging. Emissions were investigated from 25MHz up to 1GHz. 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  $\pm 0.5$ MHz 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 and at  $f_c$  of 5150MHz and 5350MHz for the lower Sub-Bands and 5500MHz and 5700MHz for the Higher Sub-band.

**Test Results:**

The EUT as tested was found compliant with the specified requirements of Clause 4.4.

**Test Engineer:**

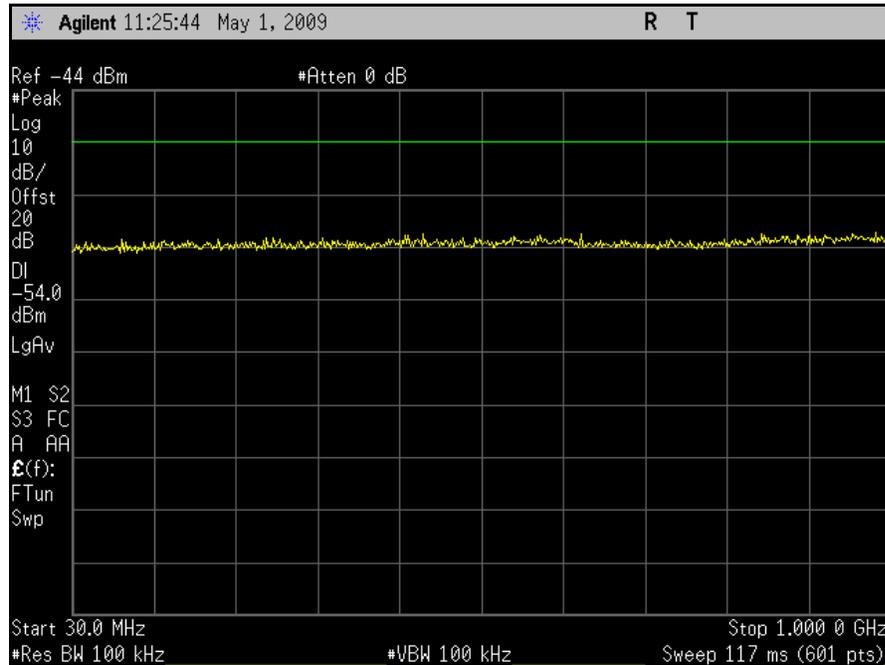
Anderson Soungpanya

**Test Date:**

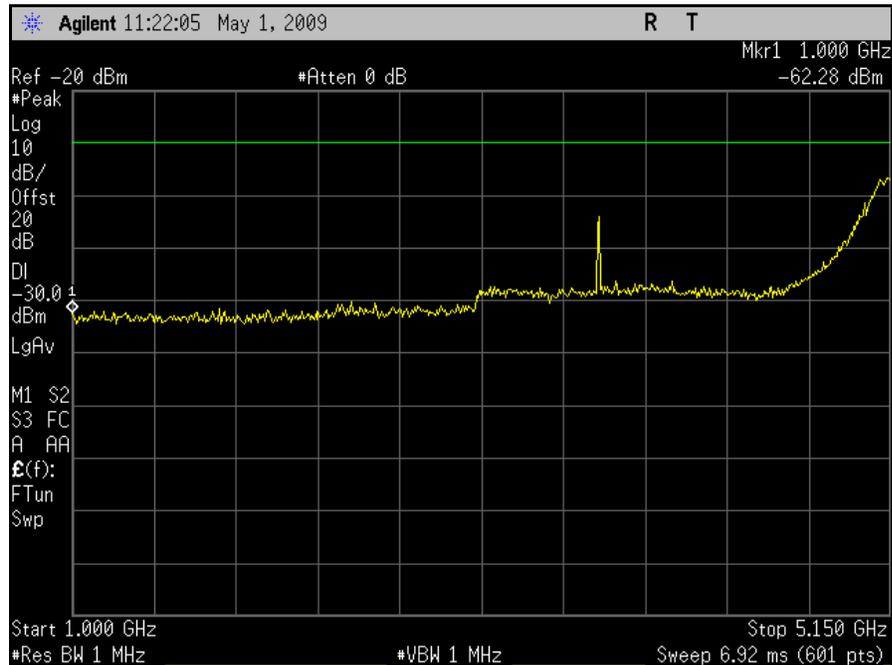
05/13/09

## Conformance Requirements

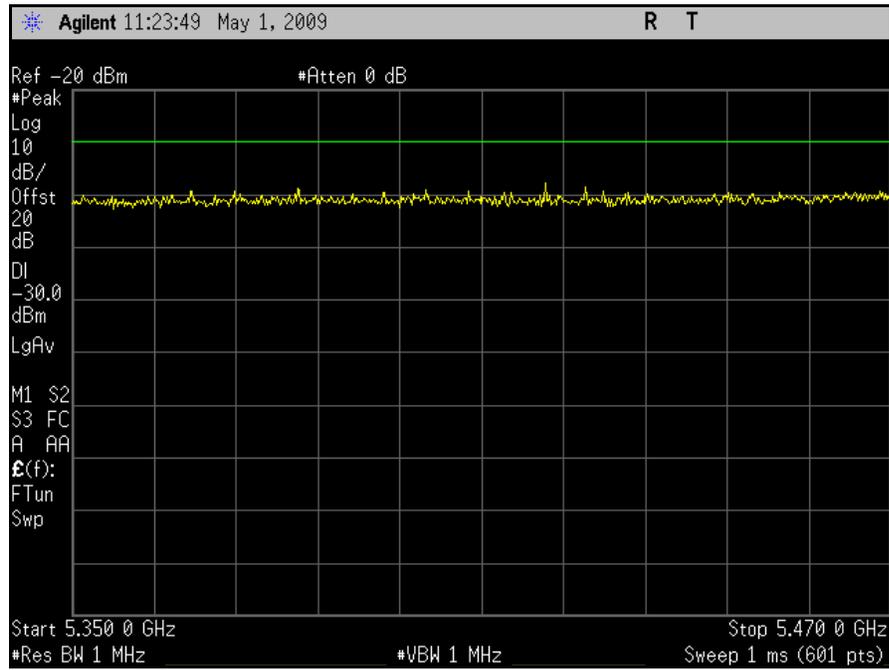
### 4.4.1 Transmitter Unwanted Emissions Outside the 5GHz RLAN Bands (conducted)



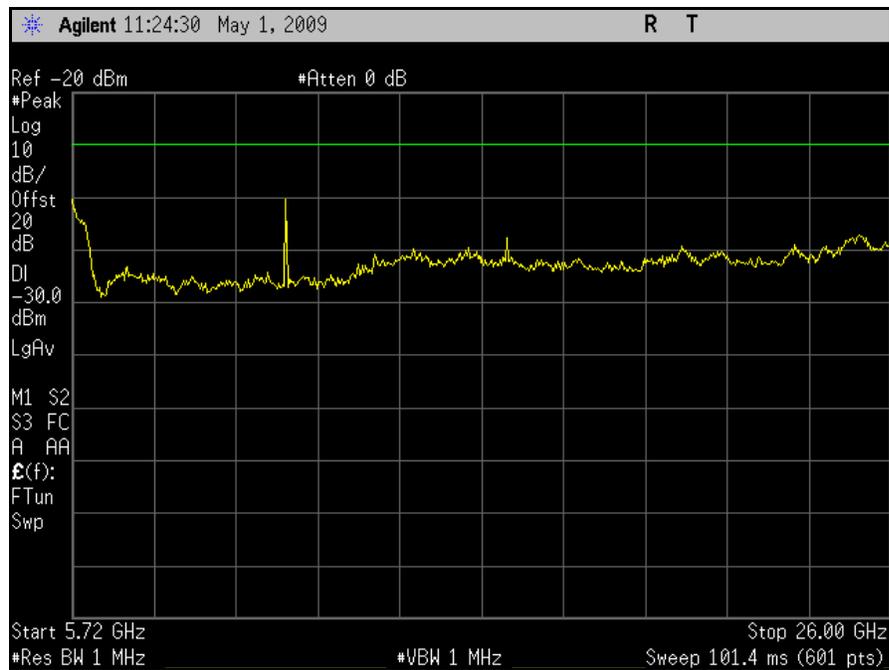
Plot 71. Low Channel (5500 MHz) Spurious Emission 30 MHz – 1 GHz, Port 1, HT20



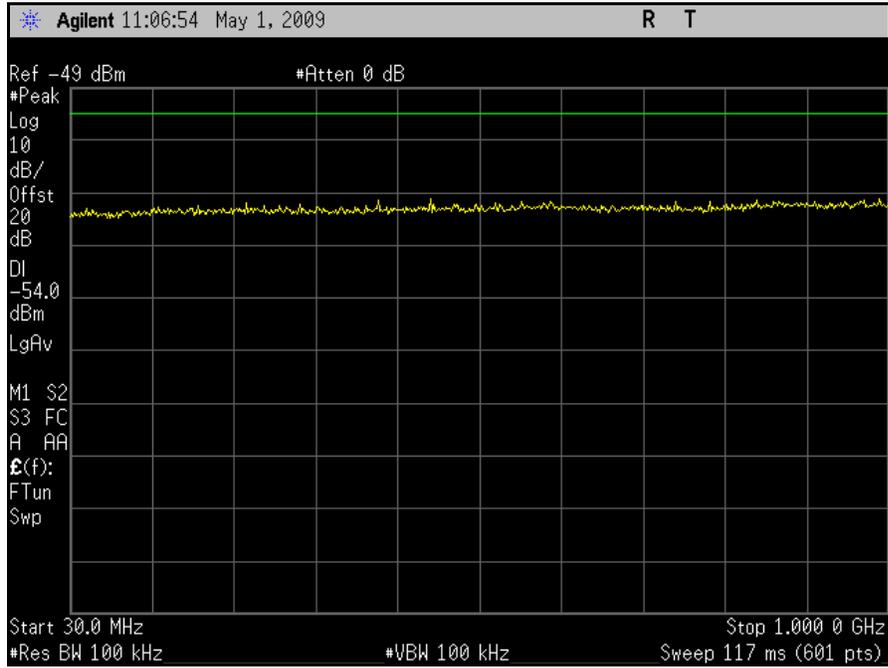
Plot 72. Low Channel (5500 MHz) Spurious Emission 1 GHz – 5.15 GHz Port 1, HT20



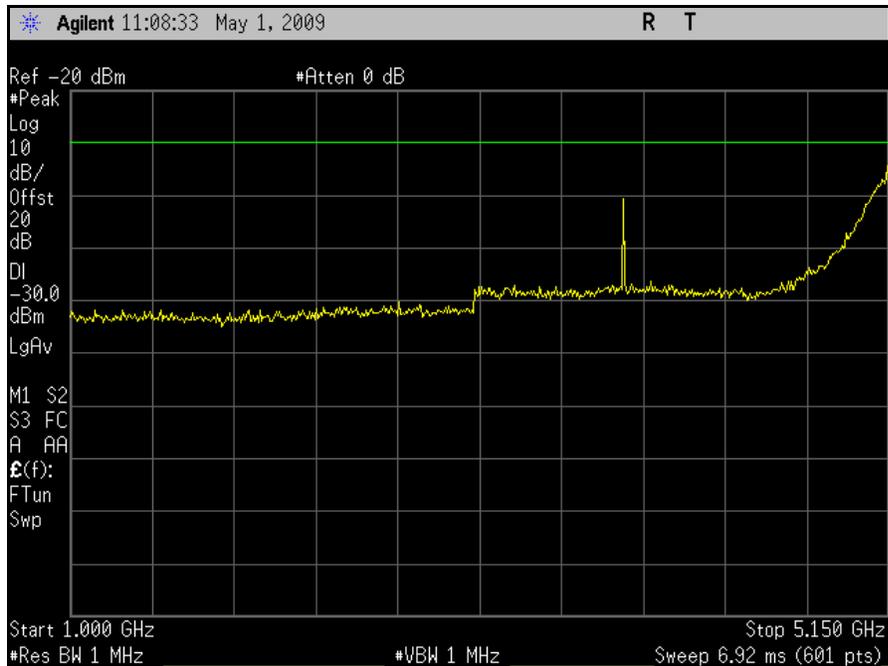
Plot 73. Low Channel (5500 MHz) Spurious Emission 5.35 GHz – 5.47 GHz Port 1, HT20



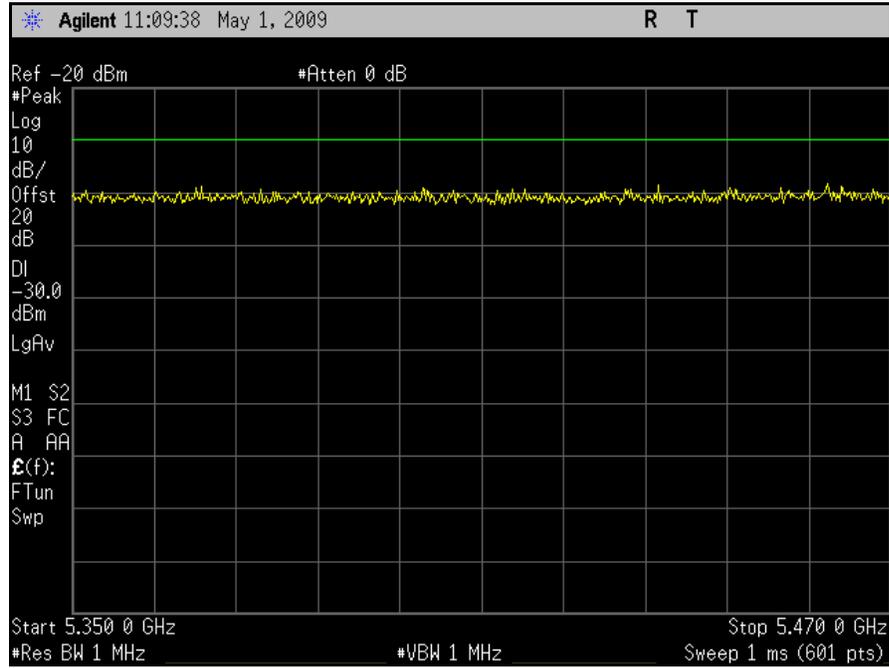
Plot 74. Low Channel (5500 MHz) Spurious Emission 5.725 GHz - 26 GHz, Port 1, HT20



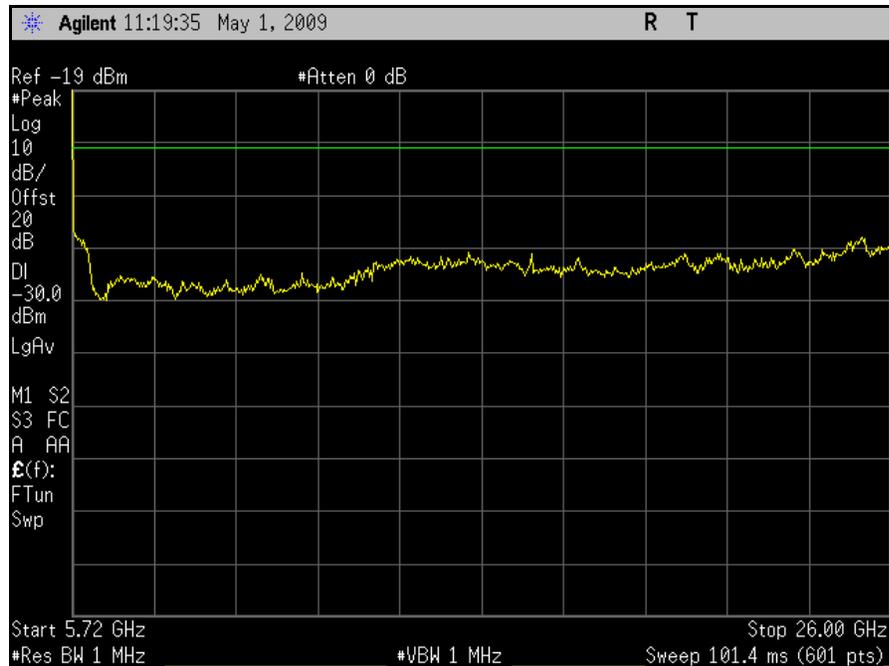
Plot 75. High Channel (5700 MHz) Spurious Emission 30 MHz - 1GHz, Port 1, HT20



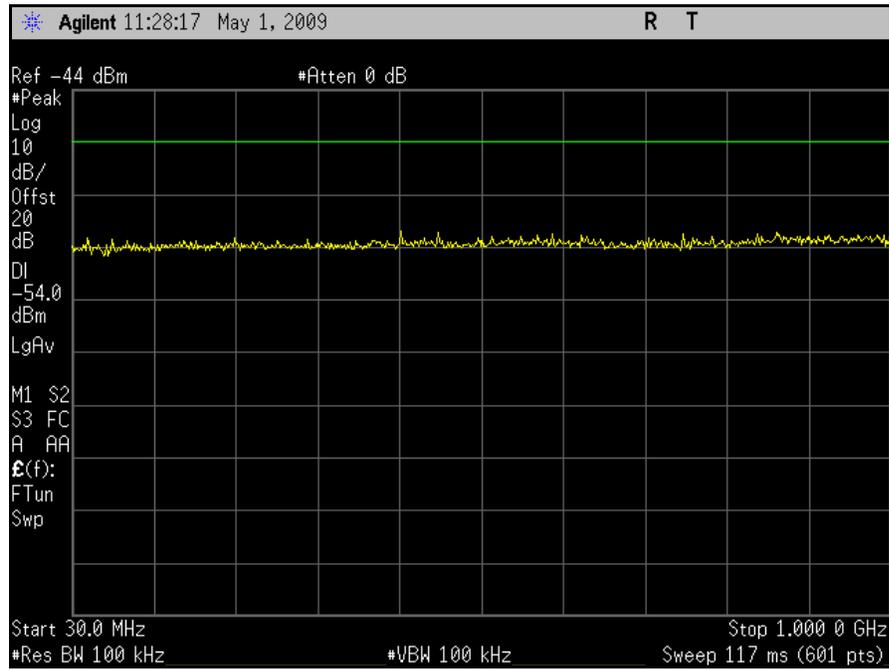
Plot 76. High Channel (5700 MHz) Spurious Emission 1 GHz – 5.15 GHz, Port 1, HT20



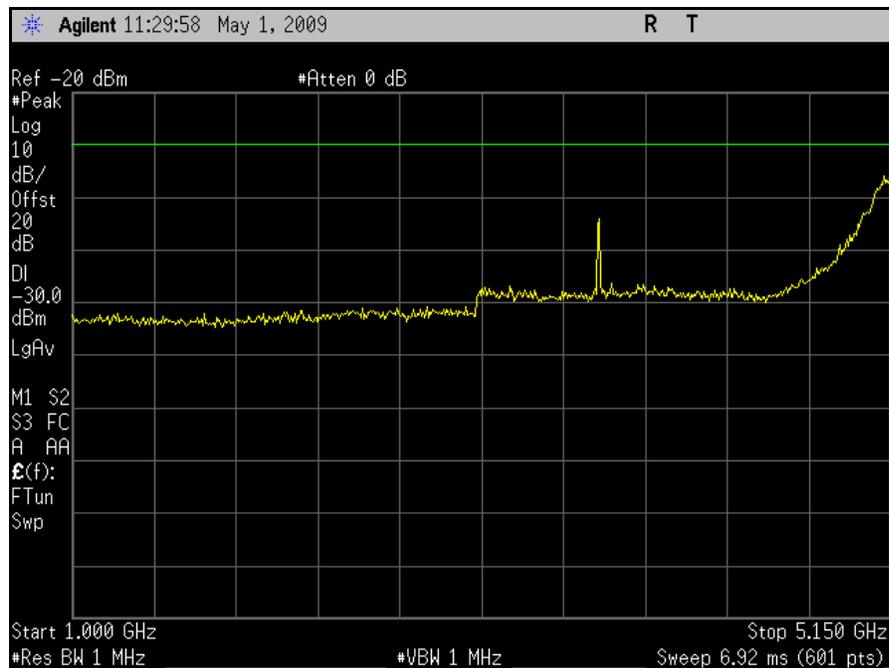
Plot 77. High Channel (5700 MHz) Spurious Emission 5.35 GHz – 5.47 GHz, Port 1, HT20



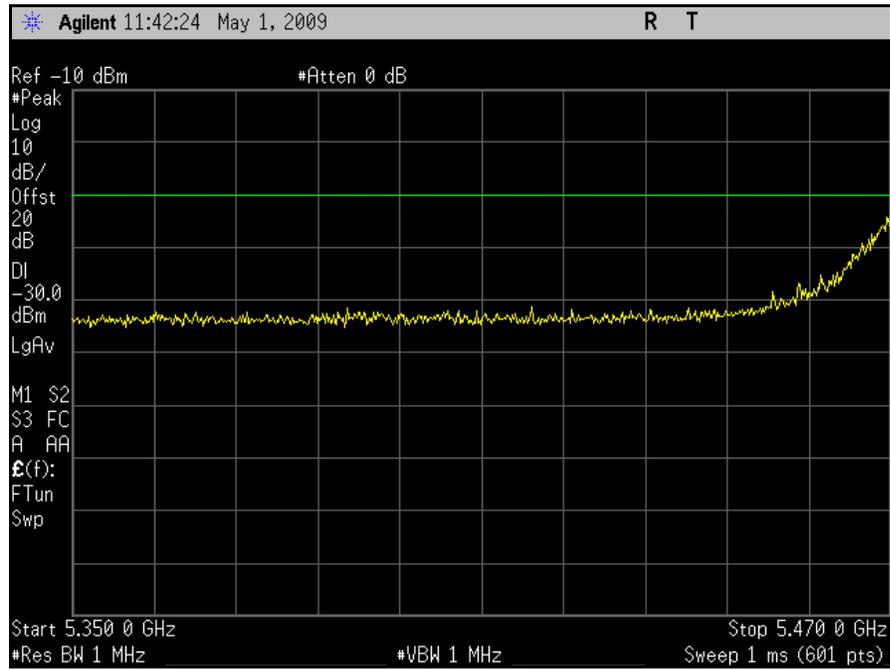
Plot 78. High Channel (5700 MHz) Spurious Emission 5.725 GHz – 26 GHz, Port 1, HT20



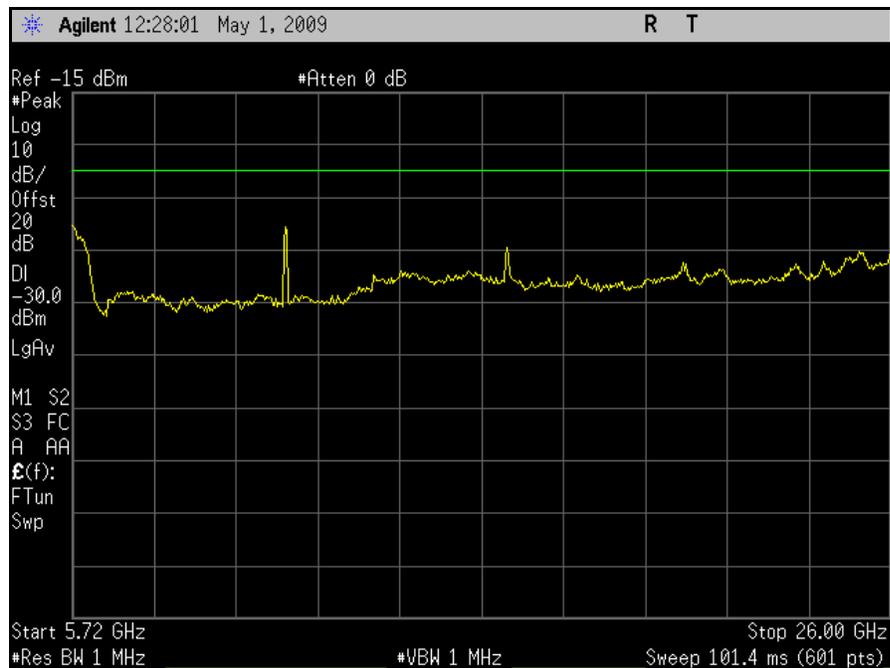
Plot 79. Low Channel (5500 MHz) Spurious Emission 30 MHz – 1 GHz, Port 1, HT40



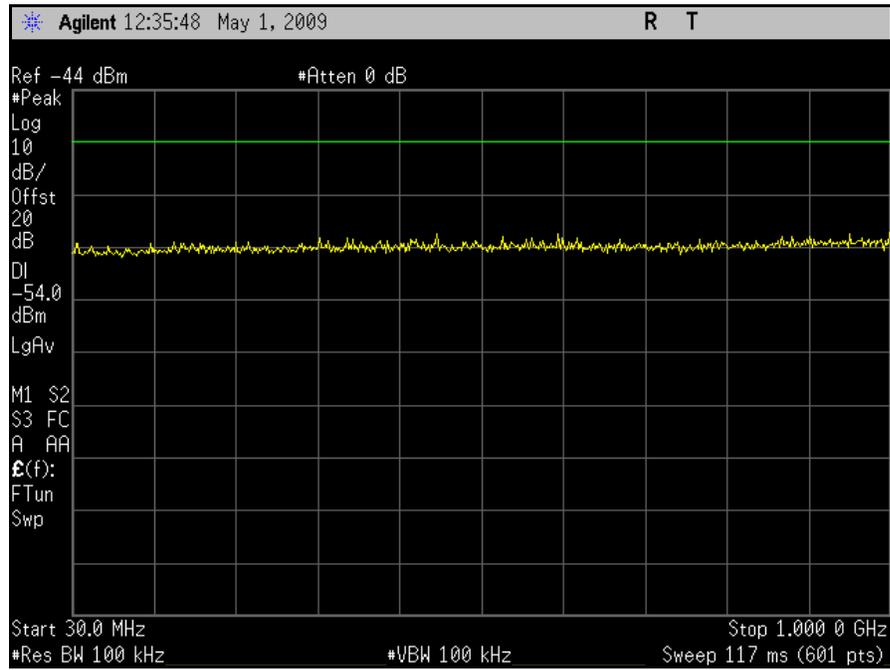
Plot 80. Low Channel (5500 MHz) Spurious Emission 1 GHz – 5.15 GHz Port 1, HT40



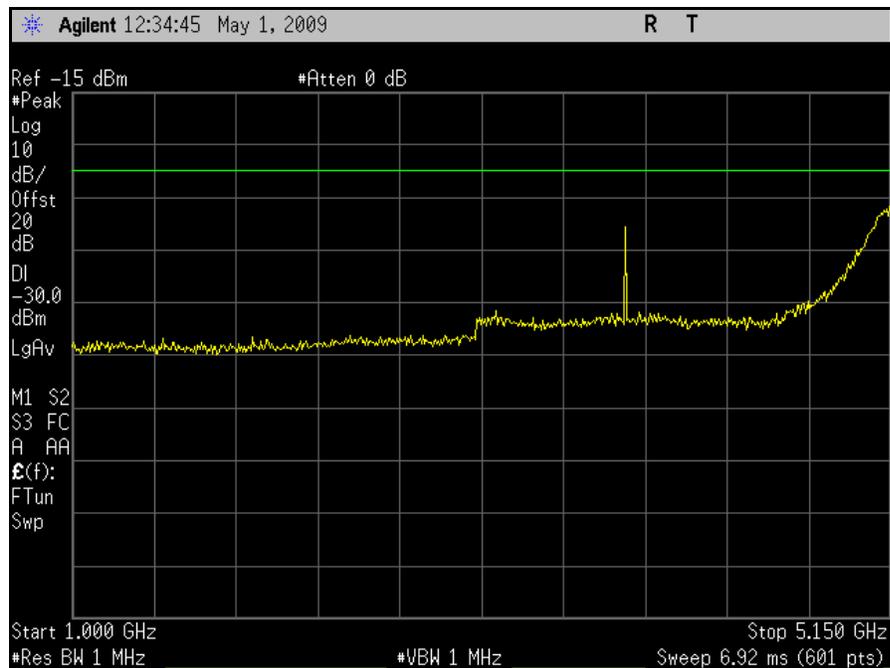
Plot 81. Low Channel (5500 MHz) Spurious Emission 5.35 GHz – 5.47 GHz Port 1, HT40



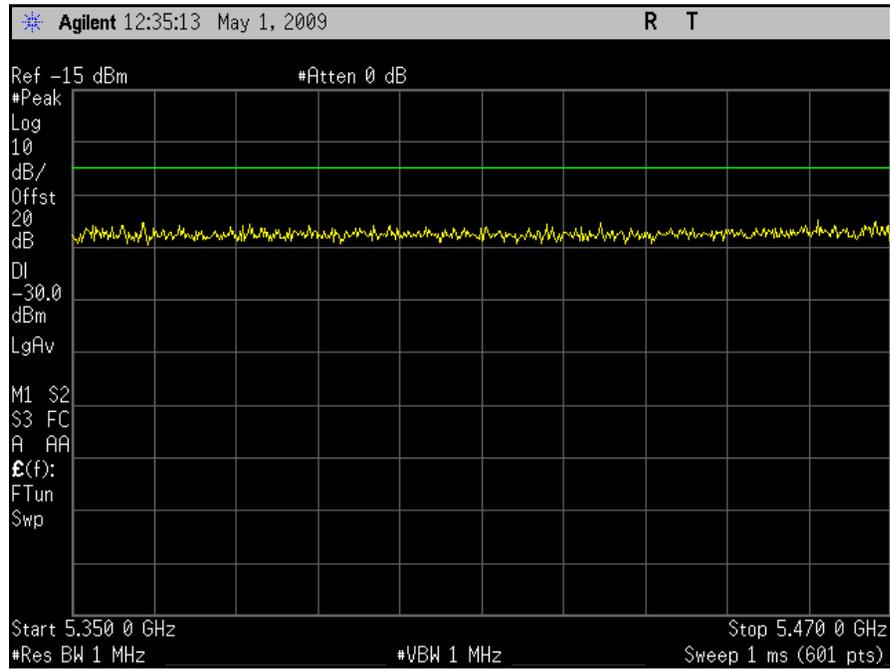
Plot 82. Low Channel (5500 MHz) Spurious Emission 5.725 GHz - 26 GHz, Port 1, HT40



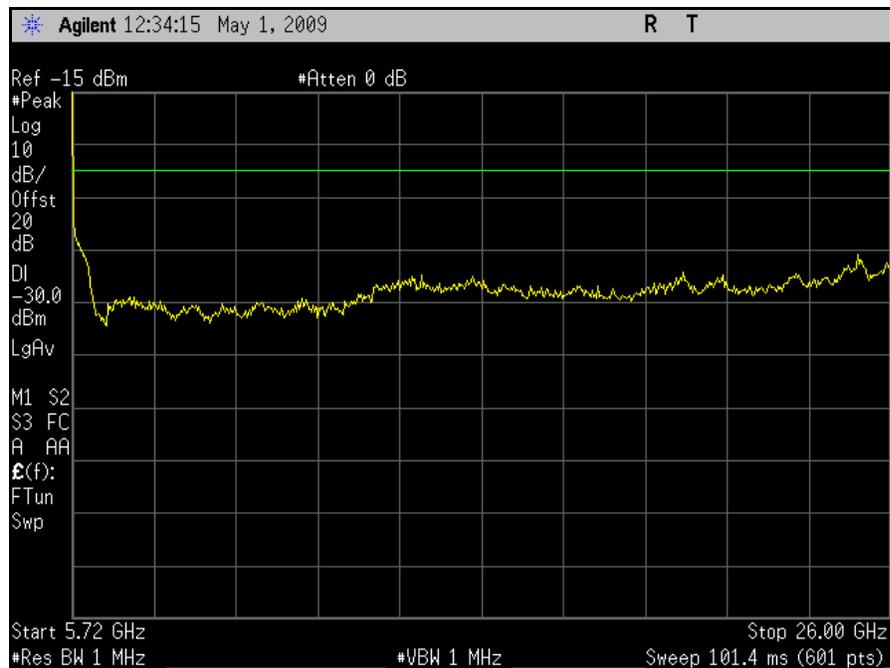
Plot 83. High Channel (5700 MHz) Spurious Emission 30 MHz - 1GHz, Port 1, HT40



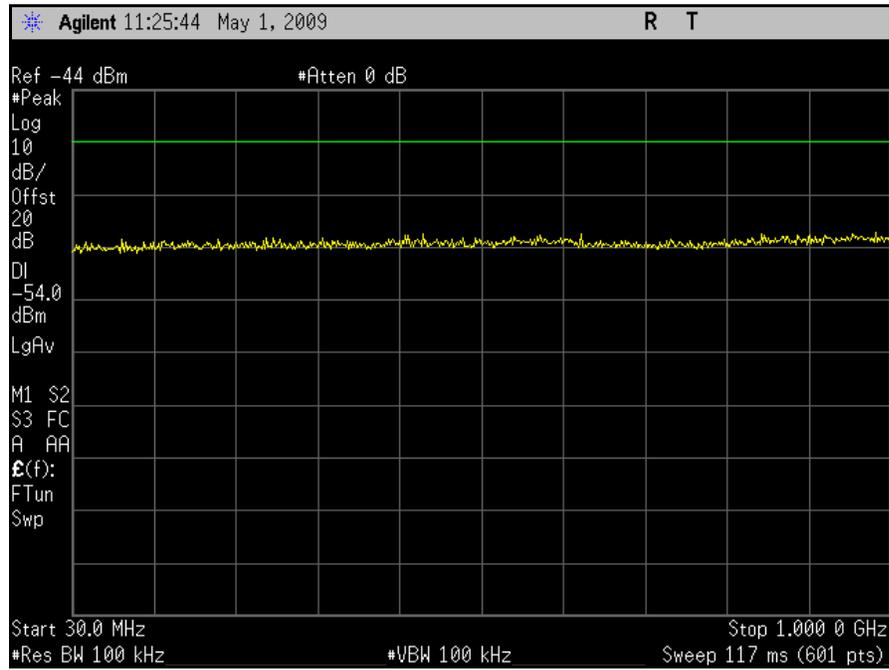
Plot 84. High Channel (5700 MHz) Spurious Emission 1 GHz – 5.15 GHz, Port 1, HT40



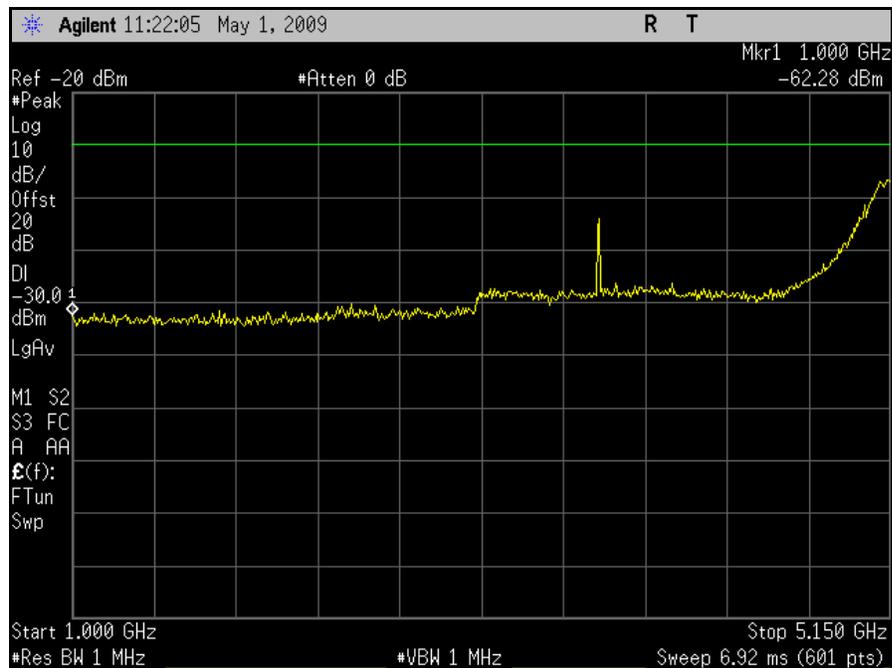
Plot 85. High Channel (5700 MHz) Spurious Emission 5.35 GHz – 5.47 GHz, Port 1, HT40



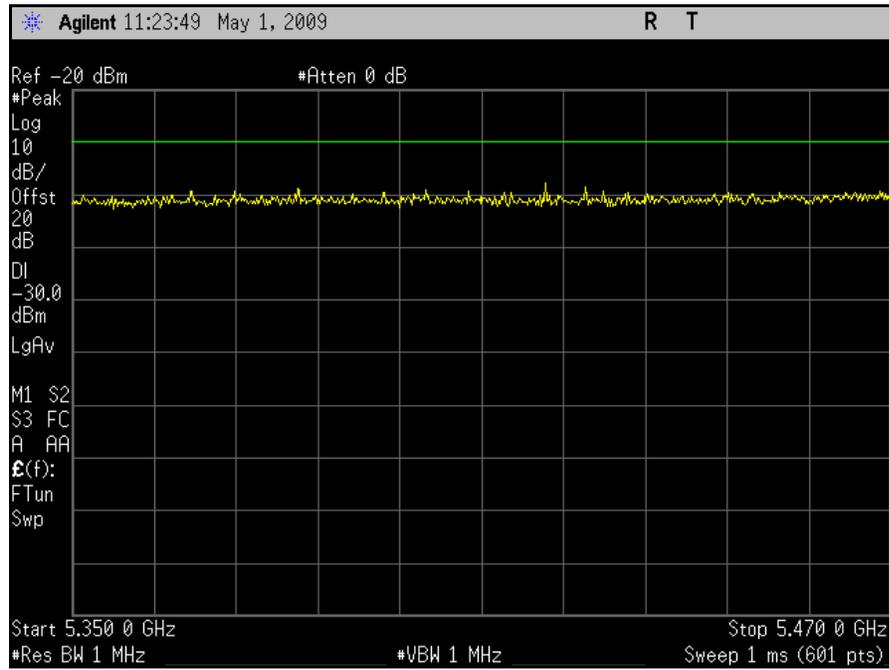
Plot 86. High Channel (5700 MHz) Spurious Emission 5.725 GHz – 26 GHz, Port 1, HT40



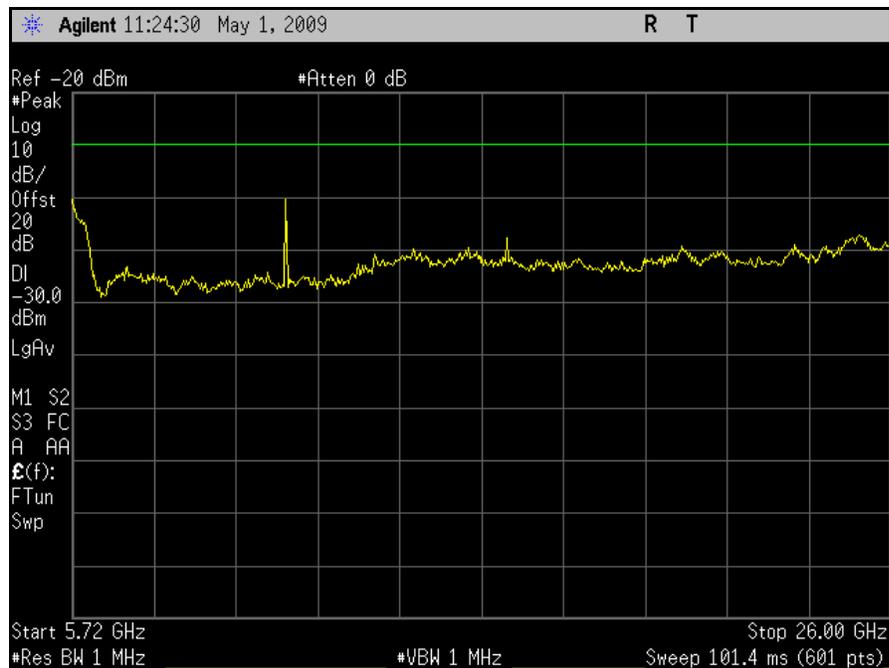
Plot 87. Low Channel (5500 MHz) Spurious Emission 30 MHz – 1 GHz, Port 1, a



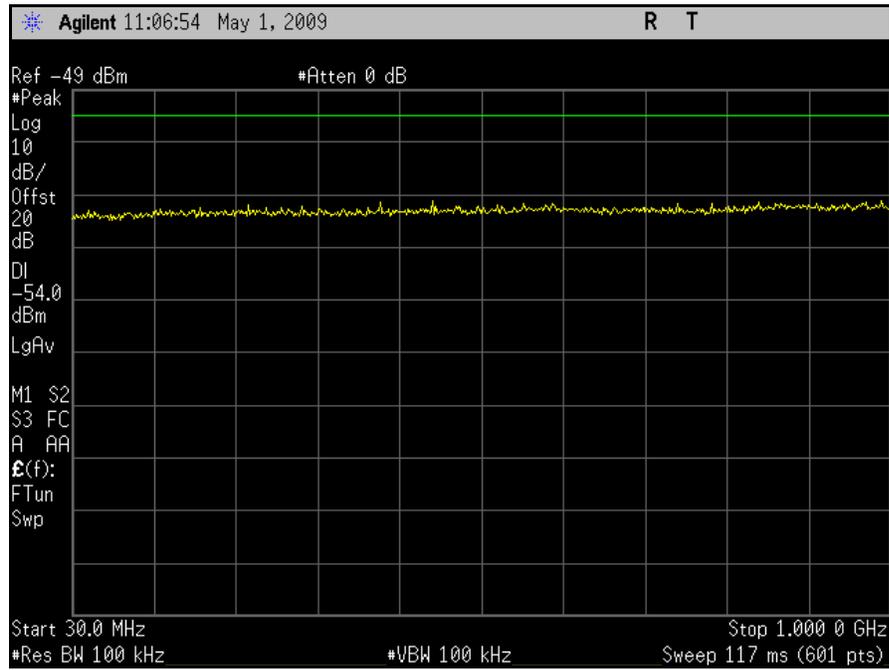
Plot 88. Low Channel (5500 MHz) Spurious Emission 1 GHz – 5.15 GHz Port 1, a



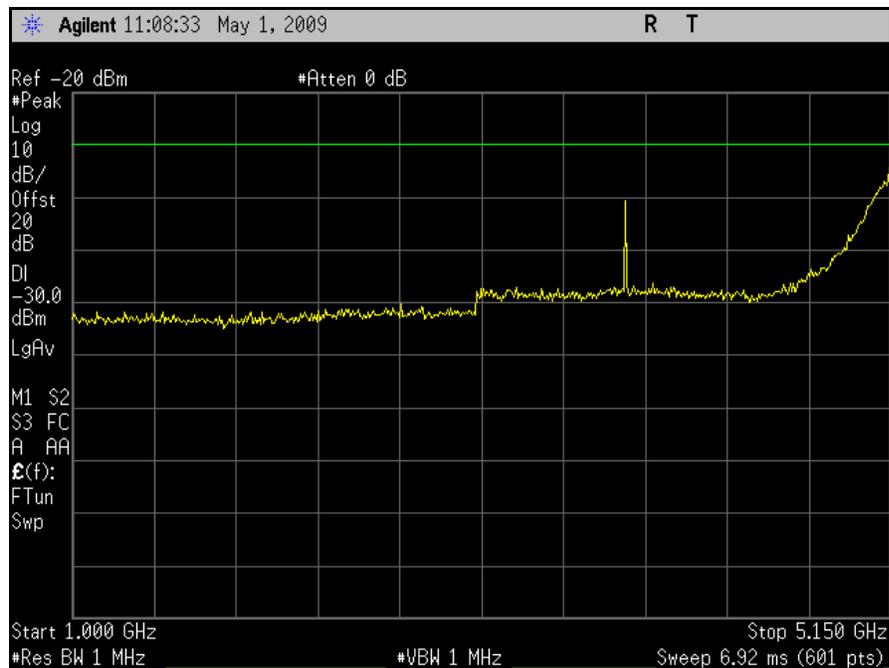
Plot 89. Low Channel (5500 MHz) Spurious Emission 5.35 GHz – 5.47 GHz Port 1, a



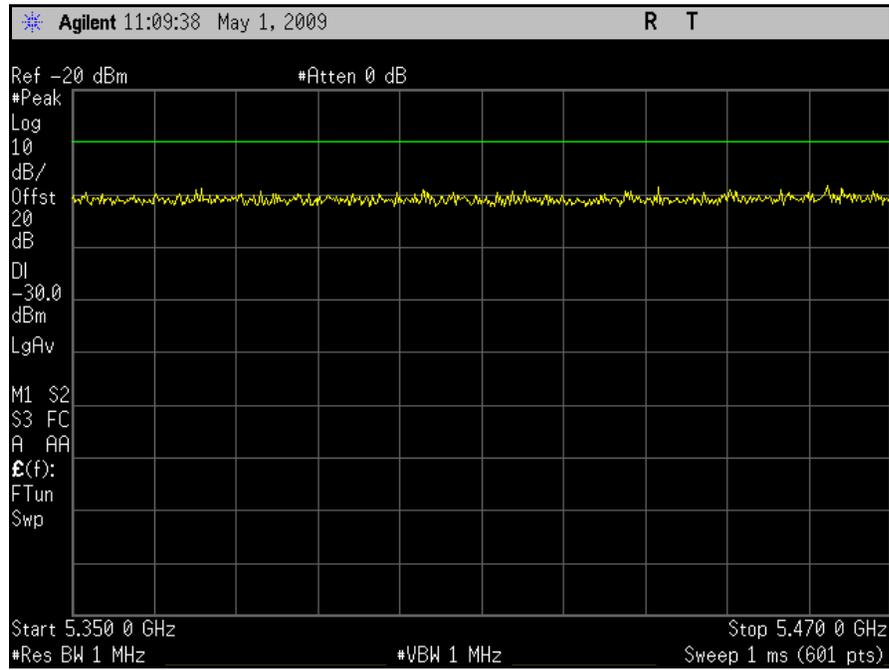
Plot 90. Low Channel (5500 MHz) Spurious Emission 5.725 GHz - 26 GHz, Port 1, a



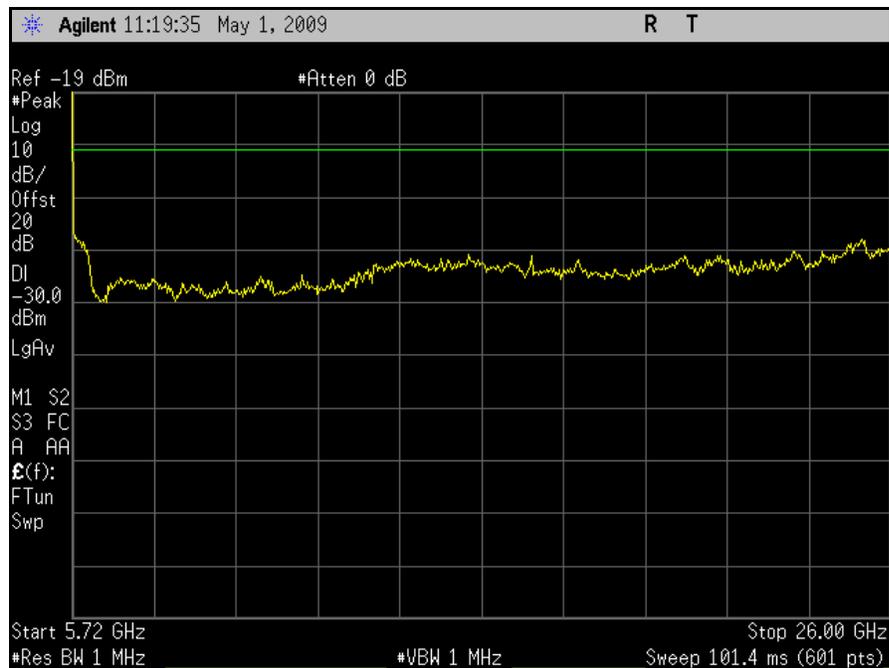
Plot 91. High Channel (5700 MHz) Spurious Emission 30 MHz - 1GHz, Port 1, a



Plot 92. High Channel (5700 MHz) Spurious Emission 1 GHz – 5.15 GHz, Port 1, a



Plot 93. High Channel (5700 MHz) Spurious Emission 5.35 GHz – 5.47 GHz, Port 1, a



Plot 94. High Channel (5700 MHz) Spurious Emission 5.725 GHz – 26 GHz, Port 1, a

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

**Test Requirement(s):** EN 301 893, Clause 5.3.4.2.2:

### 4.4.1.1 Definition

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

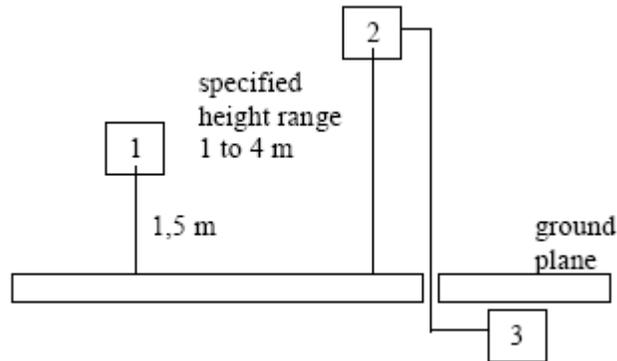
### 4.3.4.2 Limit

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:**

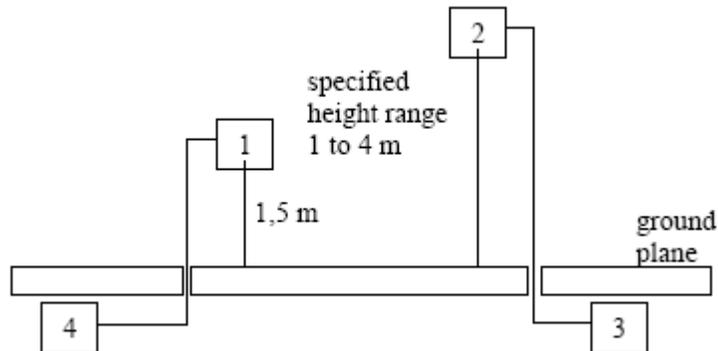
The EUT was setup as per the specifications set out in Annex B of 301 893 and is shown below.



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

The antenna ports were terminated into a  $50\Omega$  load. The receiving antenna was connected directly to a spectrum analyzer through an RF pre-amplifier. The RBW and VBW of the spectrum analyzer were initially set to 1MHz using the peak hold function or video averaging. Emissions were investigated from 25MHz up to 1GHz. 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  $\pm 0.5$ MHz 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  $360^{\circ}$  and the receiving antenna raised and lowered 1-4m in order to determine the maximum emissions. Measurements were carried out in all modulations available and at  $f_c$  of 5150MHz and 5350MHz for the lower Sub-Bands and 5500MHz and 5700MHz for the Higher Sub-band.

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

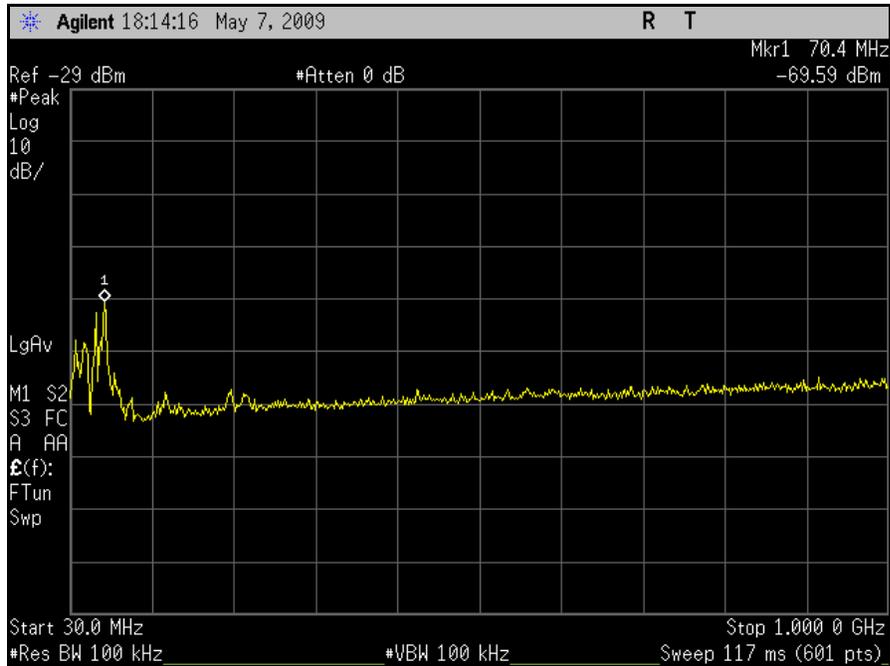
**Test Results:** The EUT as tested was found compliant with the specified requirements of Clause 4.4

**Test Engineer:** Anderson Soungpanya

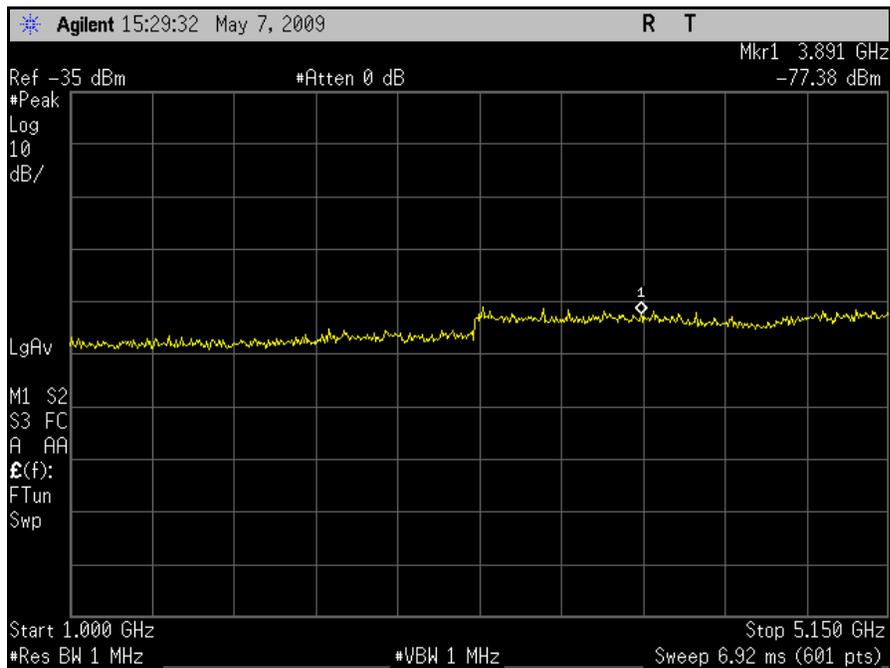
**Test Date:** 05/13/09

## Conformance Requirements

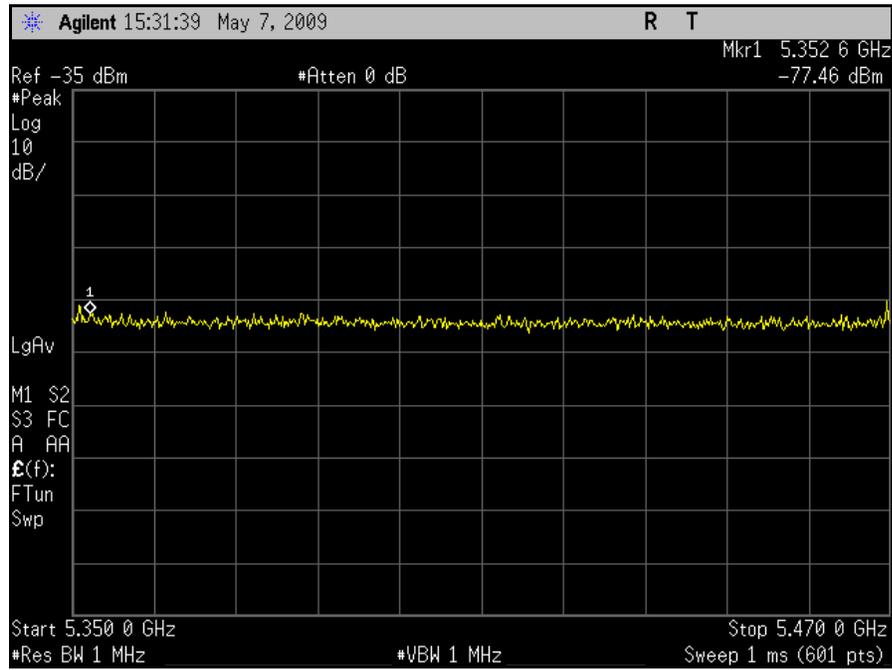
### 4.4 Transmitter Unwanted Emissions Outside the 5GHz WLAN Bands (Radiated)



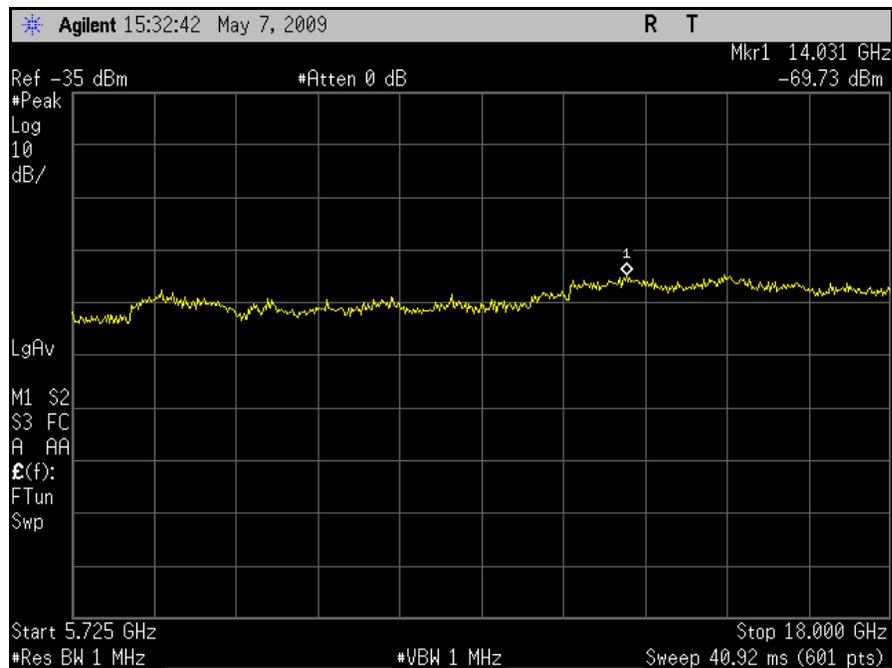
Plot 95. Low Channel (5500 MHz) Spurious Emission, 30 MHz – 1 GHz, All Ports, HT20



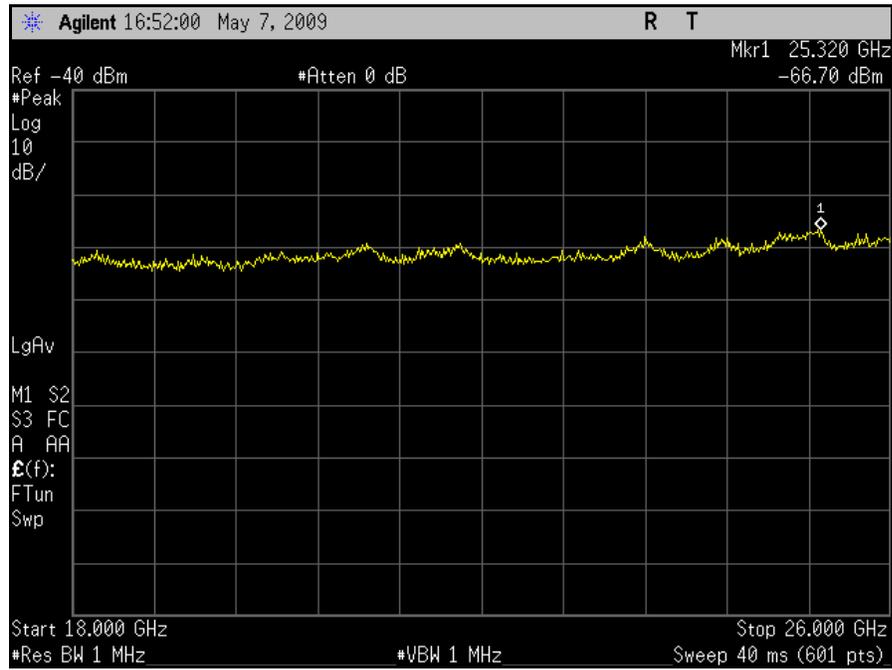
Plot 96. Low Channel (5500 MHz) Spurious Emission, 1 GHz – 5.15 GHz, All Ports, HT20



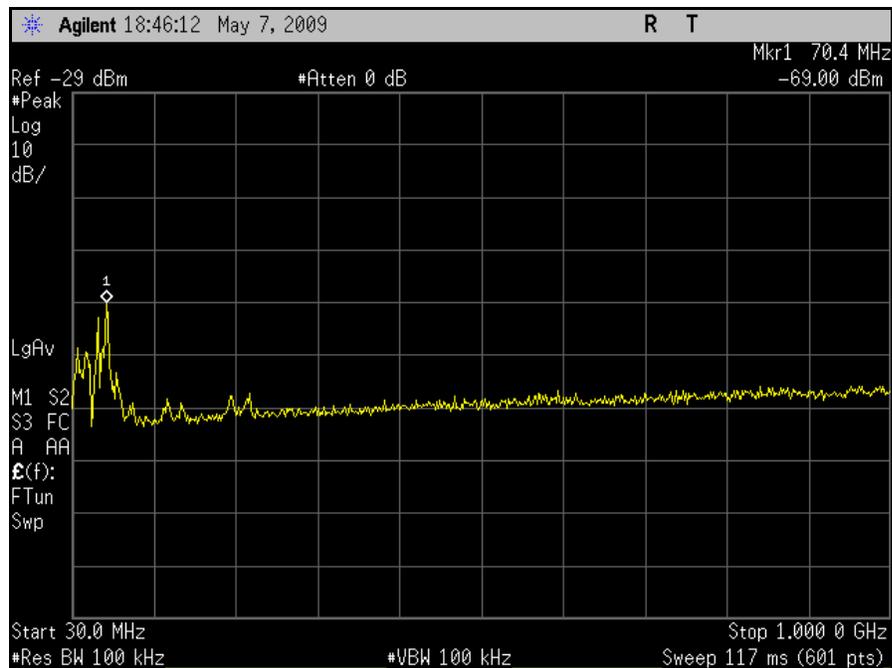
Plot 97. Low Channel (5500 MHz) Spurious Emission, 5.35 GHz – 5.47 GHz, All Ports, HT20



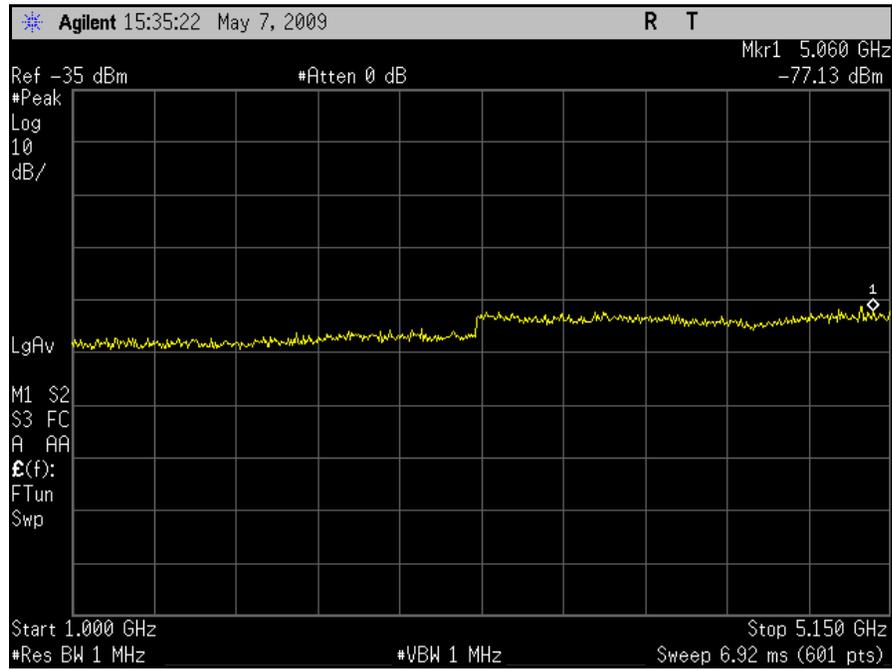
Plot 98. Low Channel (5500 MHz) Spurious Emission, 5.725 GHz - 18 GHz, All Ports, HT20



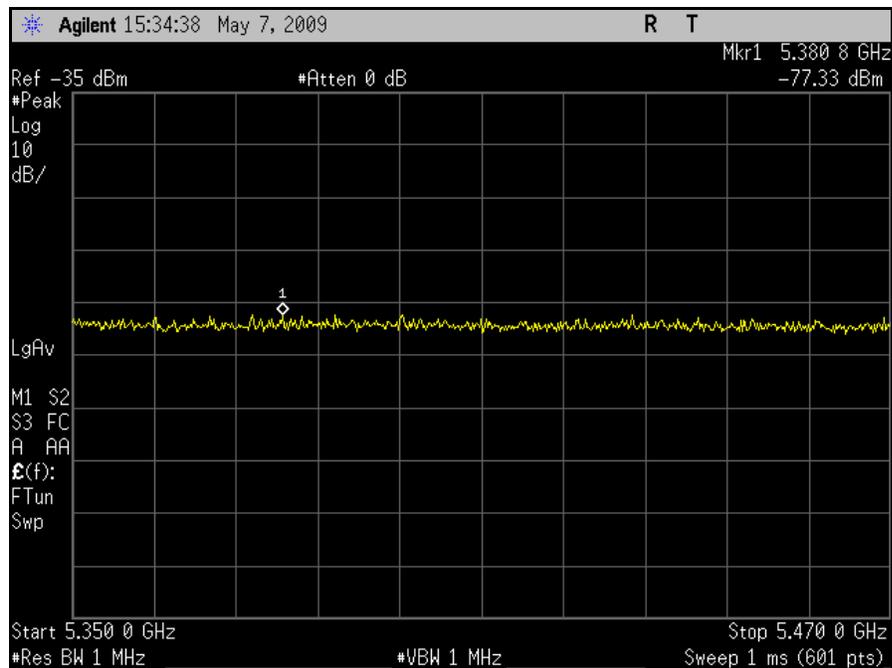
Plot 99. Low Channel (5500 MHz) Spurious Emission, 18 GHz – 26 GHz, All Ports, HT20



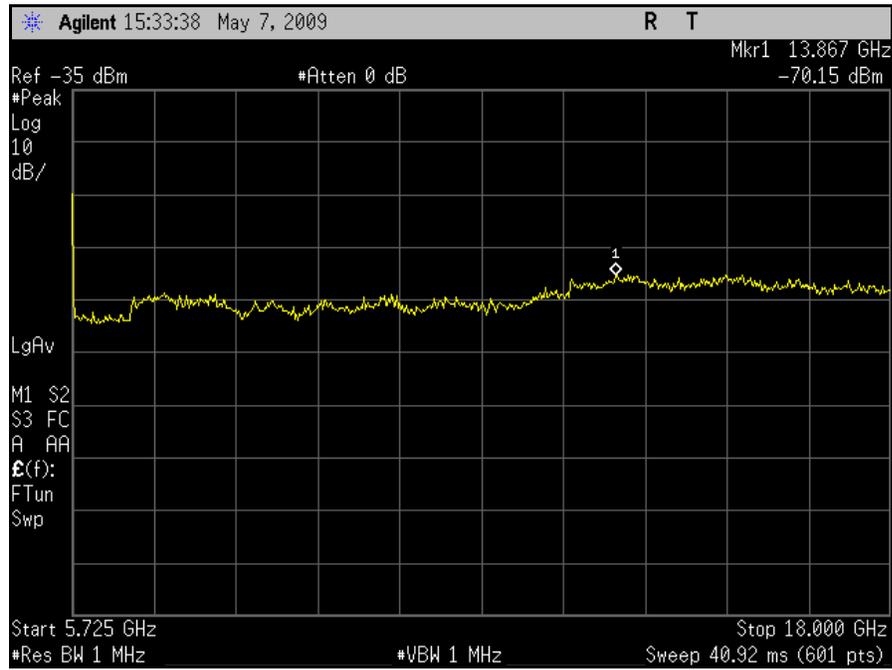
Plot 100. High Channel (5700 MHz) Spurious Emission, 30 MHz – 1 GHz, All Ports, HT20



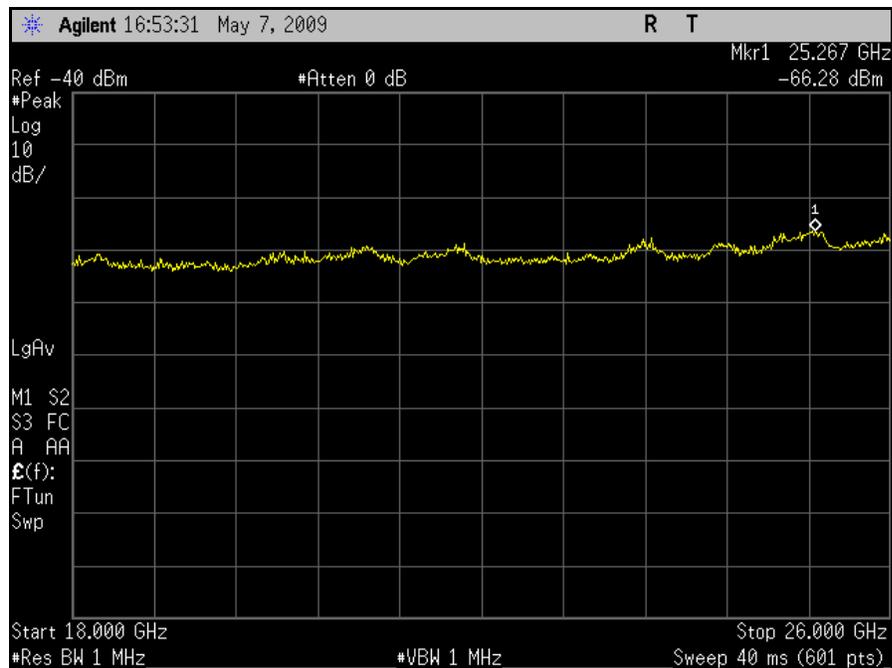
**Plot 101. High Channel (5700 MHz) Spurious Emission, 1 GHz – 5.15 GHz, All Ports, HT20**



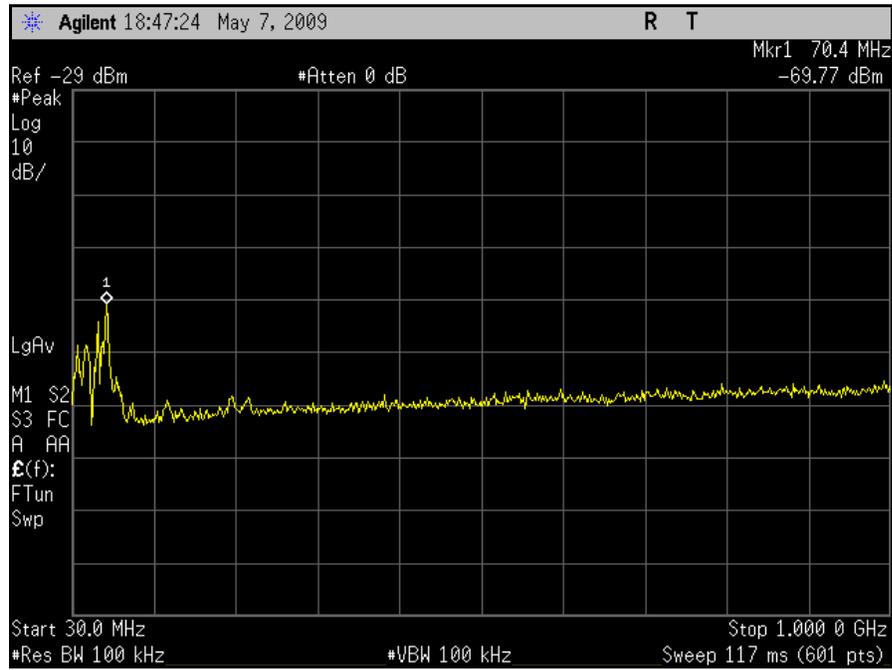
**Plot 102. High Channel (5700 MHz) Spurious Emission, 5.35 GHz – 5.47 GHz, All Ports, HT20**



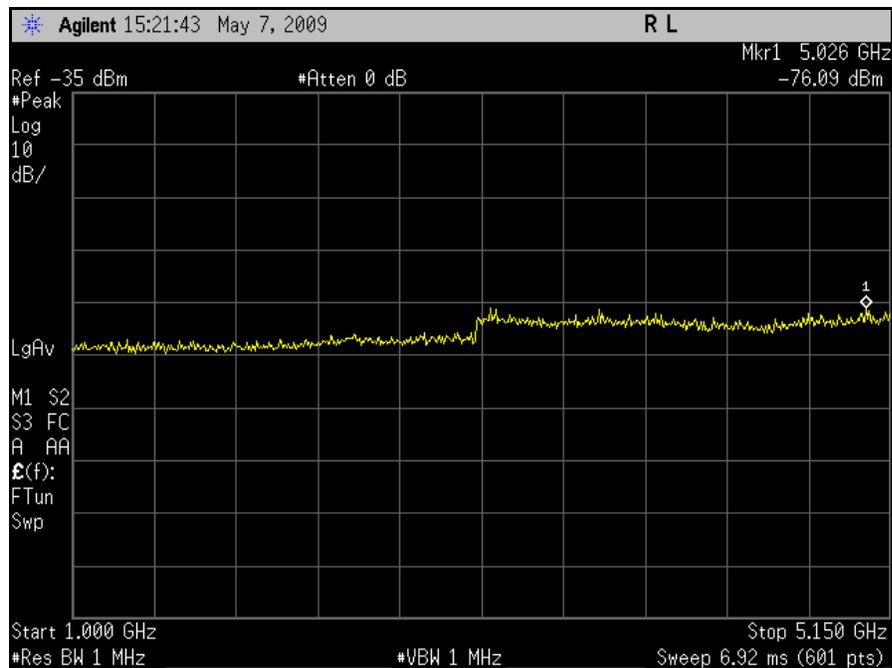
**Plot 103. High Channel (5700 MHz) Spurious Emission, 5.725 GHz – 18 GHz, All Ports, HT20**



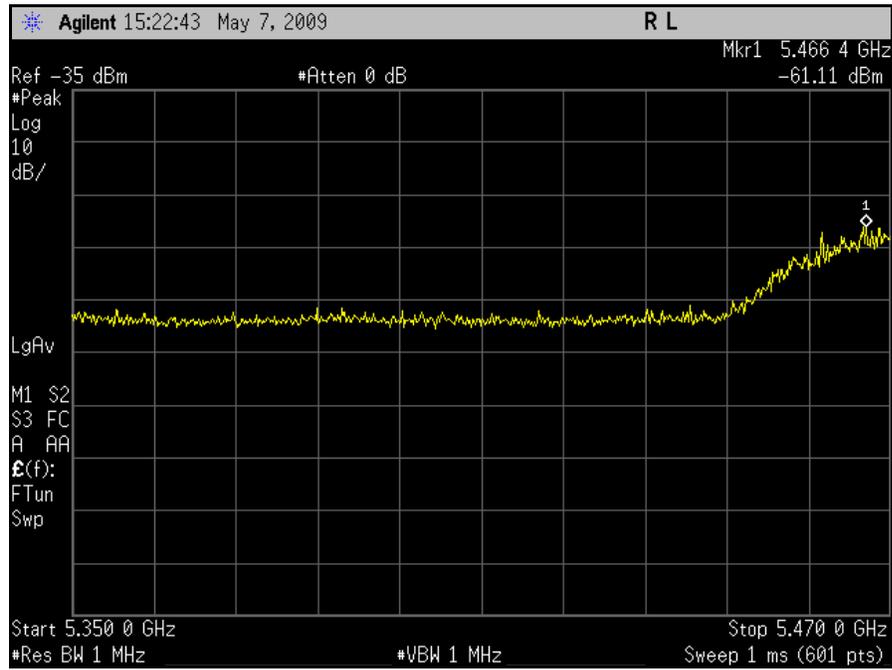
**Plot 104. High Channel (5700 MHz) Spurious Emission, 18 GHz – 26 GHz, All Ports, HT20**



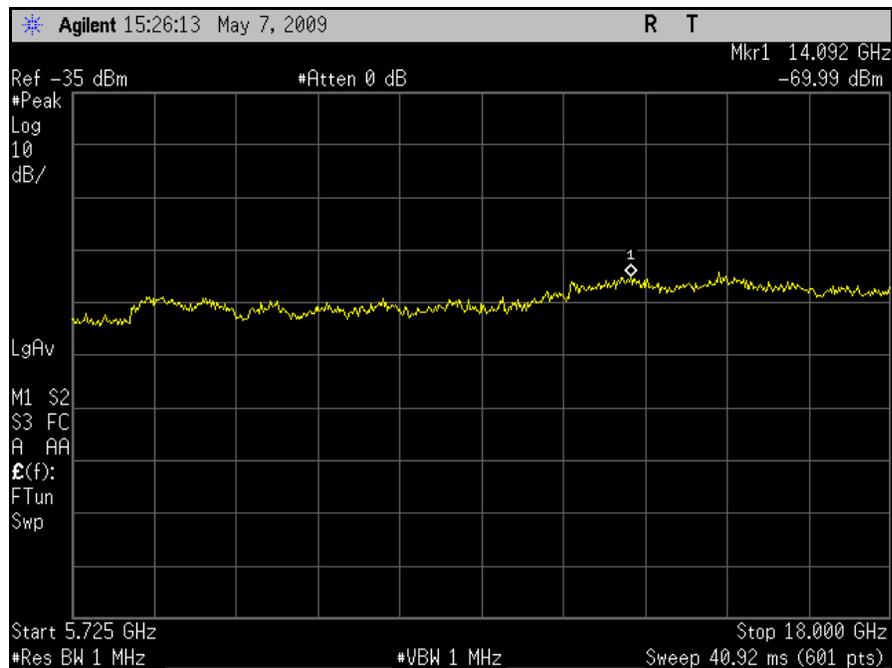
Plot 105. Low Channel (5500 MHz) Spurious Emission, 30 MHz – 1 GHz, All Ports, HT40



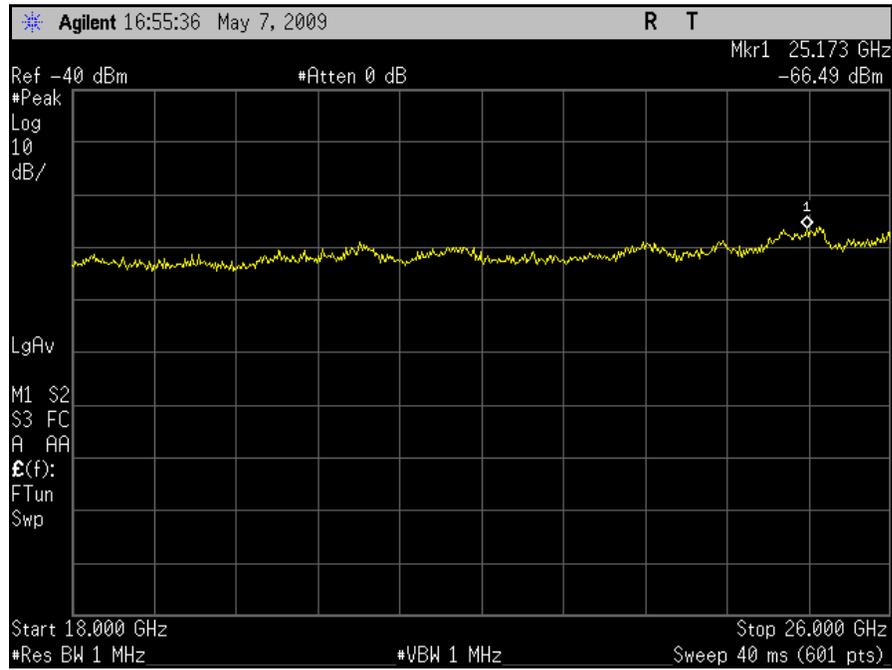
Plot 106. Low channel (5500 MHz) Spurious Emission, 1 GHz – 5.15 GHz, All Ports, HT40



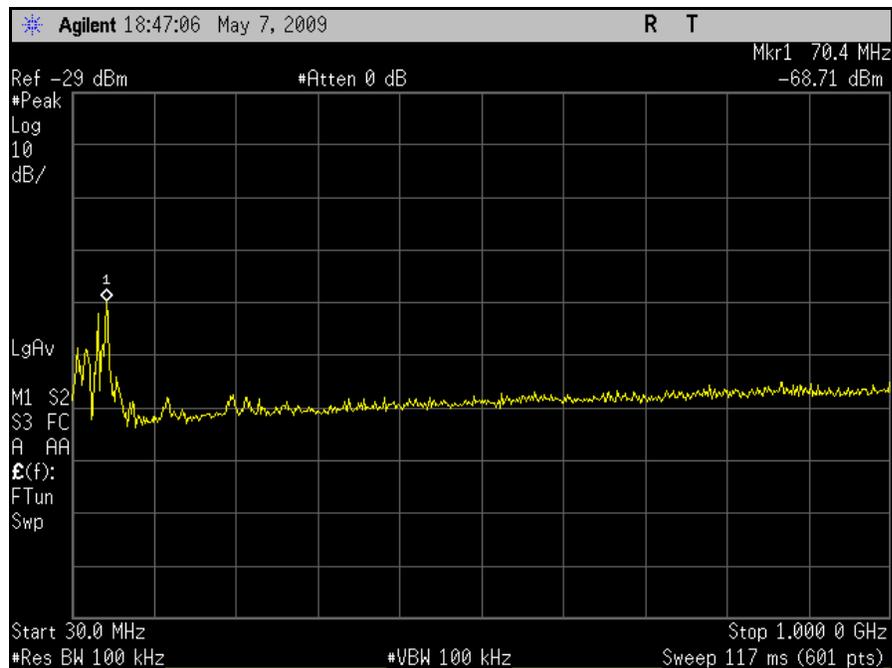
Plot 107. Low Channel (5500 MHz) Spurious Emission, 5.35 GHz – 5.47 GHz, All Ports, HT40



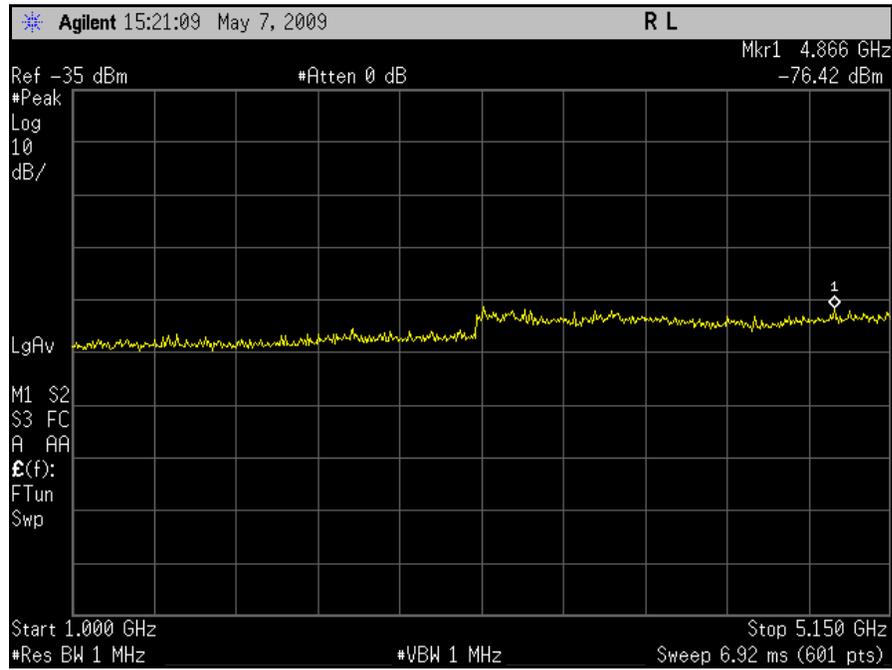
Plot 108. Low Channel (5500 MHz) Spurious Emission, 5.725 GHz - 18 GHz, All Ports, HT40



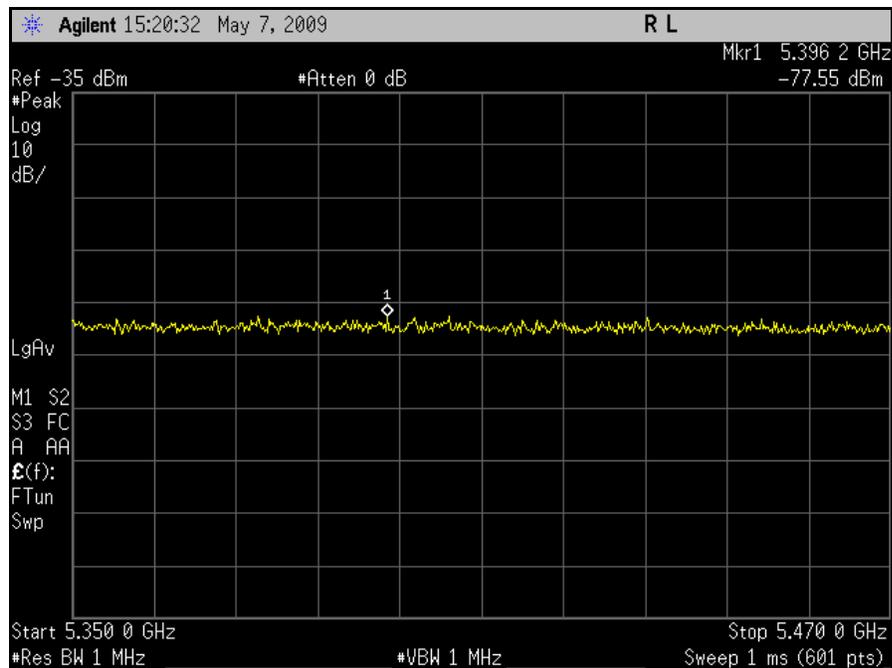
Plot 109. Low Channel (5500 MHz) Spurious Emission, 18 GHz – 26 GHz, All Ports, HT40



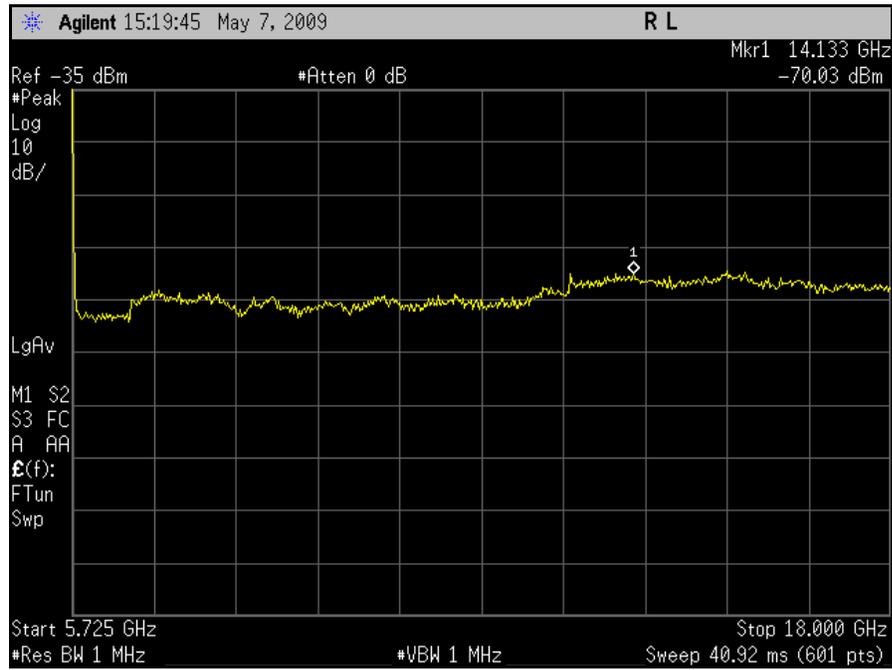
Plot 110. High Channel (5700 MHz) Spurious Emission, 30 MHz – 1 GHz, All Ports, HT40



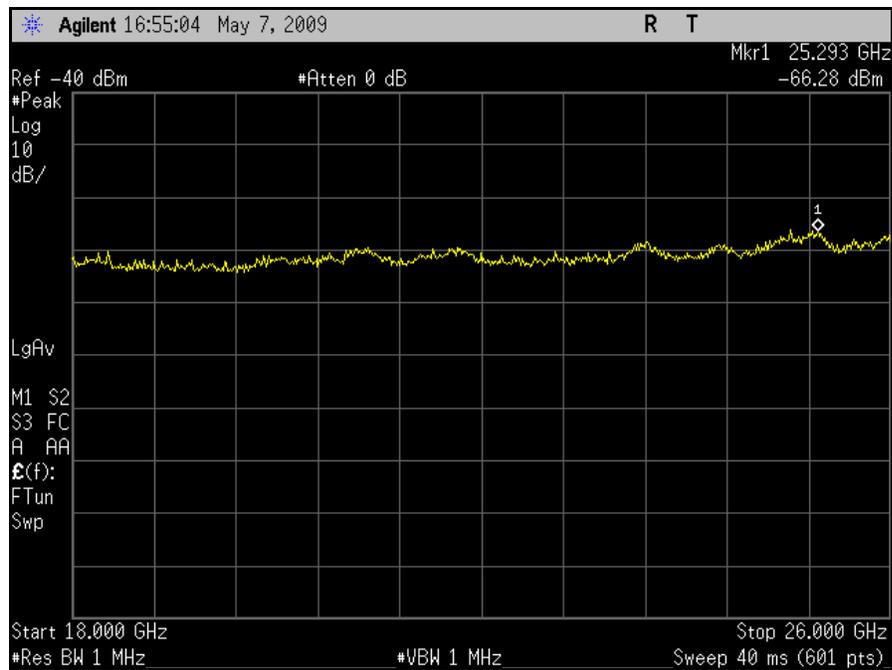
Plot 111. High Channel (5700 MHz) Spurious Emission, 1 GHz – 5.15 GHz, All Ports, HT40



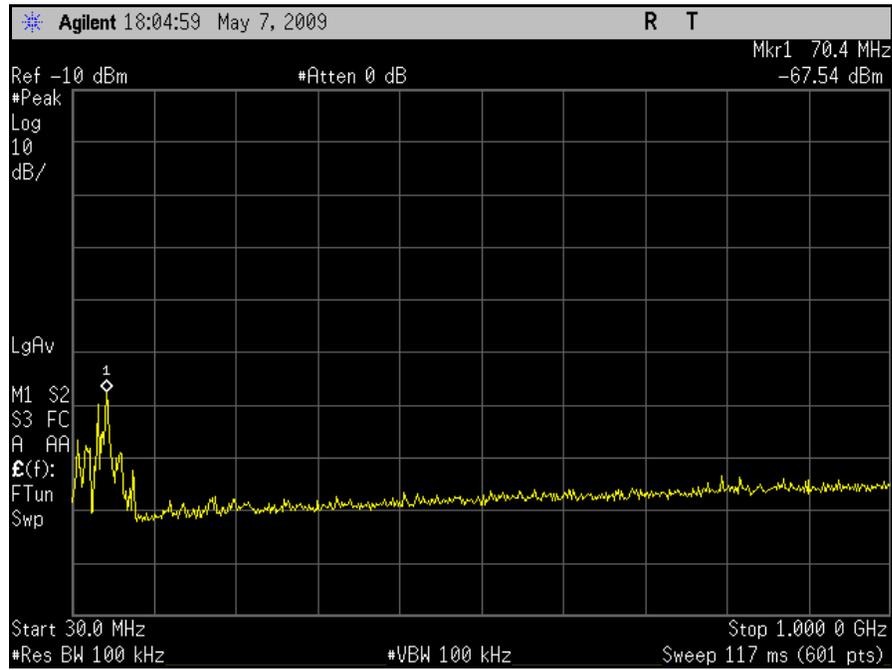
Plot 112. High Channel (5700 MHz) Spurious Emission, 5.35 GHz – 5.47 GHz, All Ports, HT40



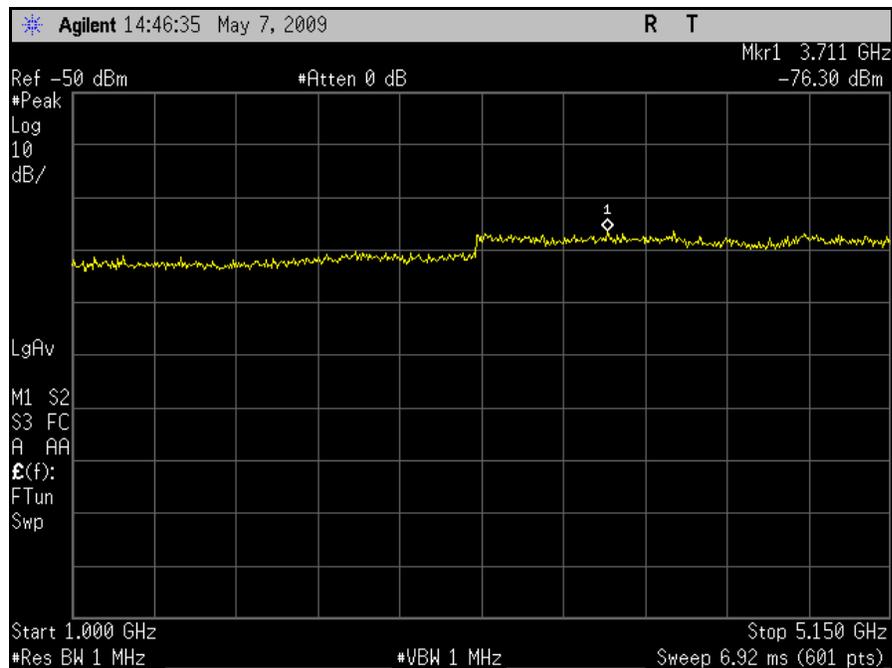
Plot 113. High Channel (5700 MHz) Spurious Emission, 5.725 GHz – 18 GHz, All Ports, HT40



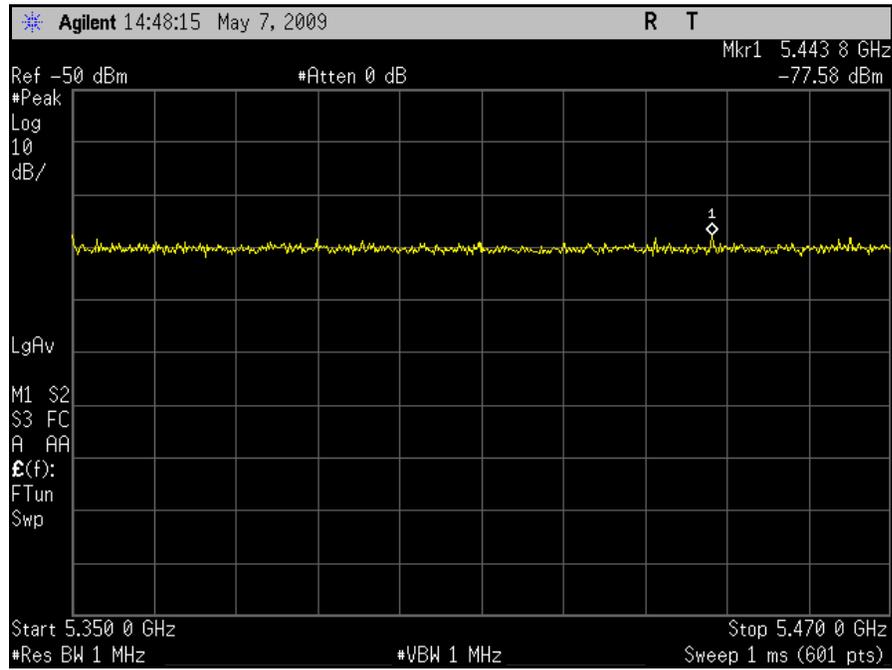
Plot 114. High Channel (5700 MHz) Spurious Emission, 18 GHz – 26 GHz, All Ports, HT40



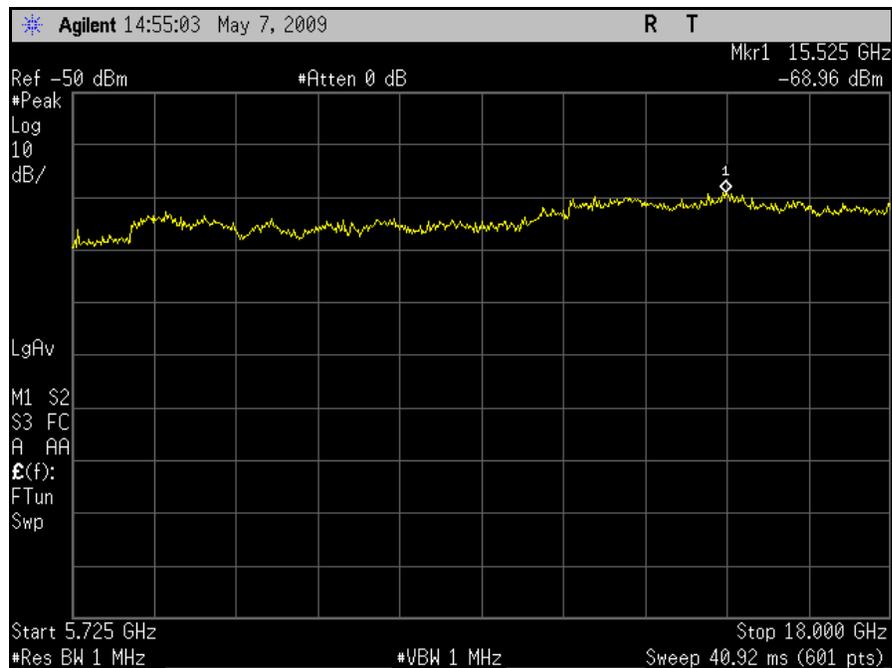
Plot 115. Low Channel (5500 MHz) Spurious Emission, 30 MHz – 1 GHz, Port 1, a



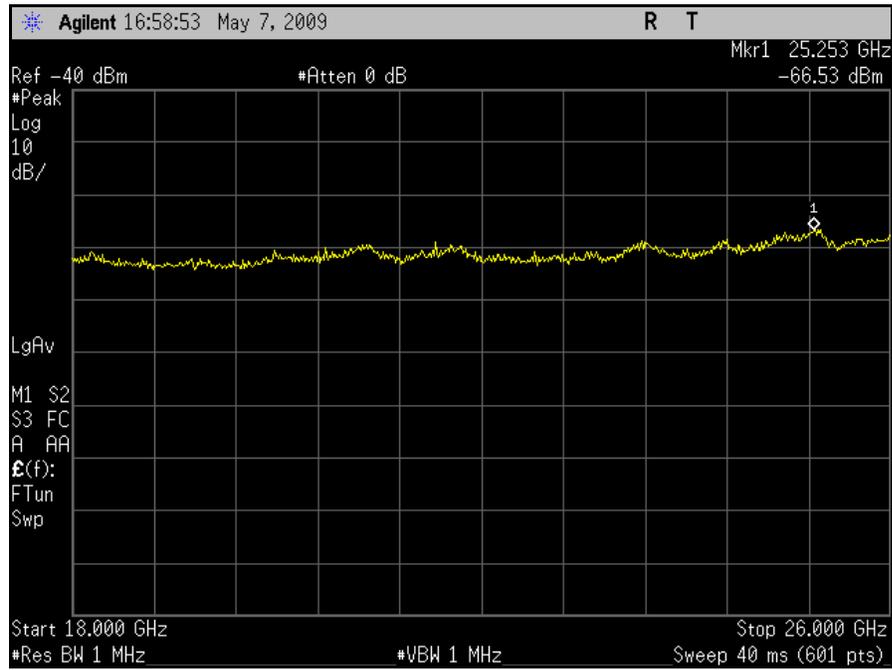
Plot 116. Low channel (5500 MHz) Spurious Emission, 1 GHz – 5.15 GHz, Port 1, a



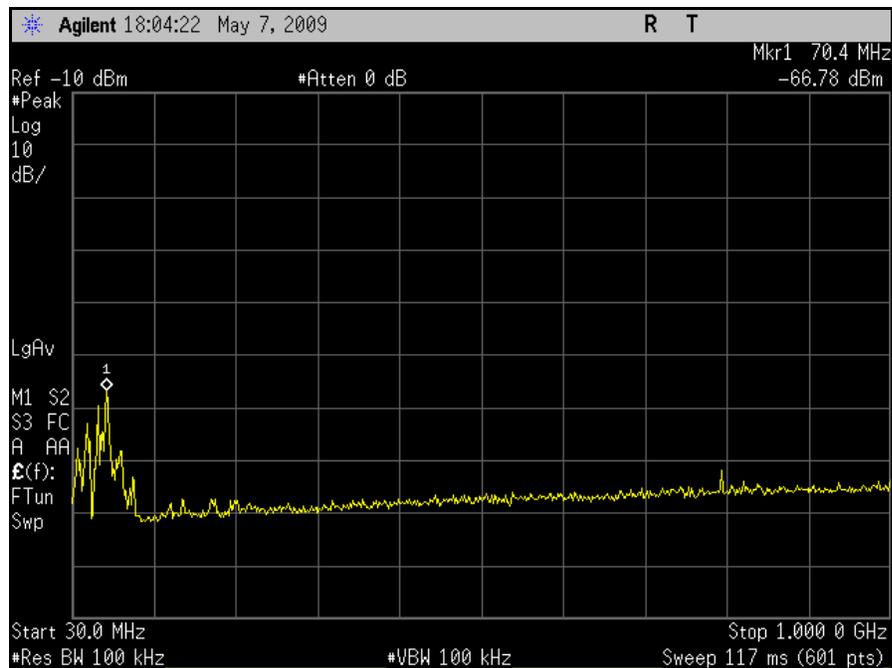
Plot 117. Low Channel (5500 MHz) Spurious Emission, 5.35 GHz – 5.47 GHz, Port 1, a



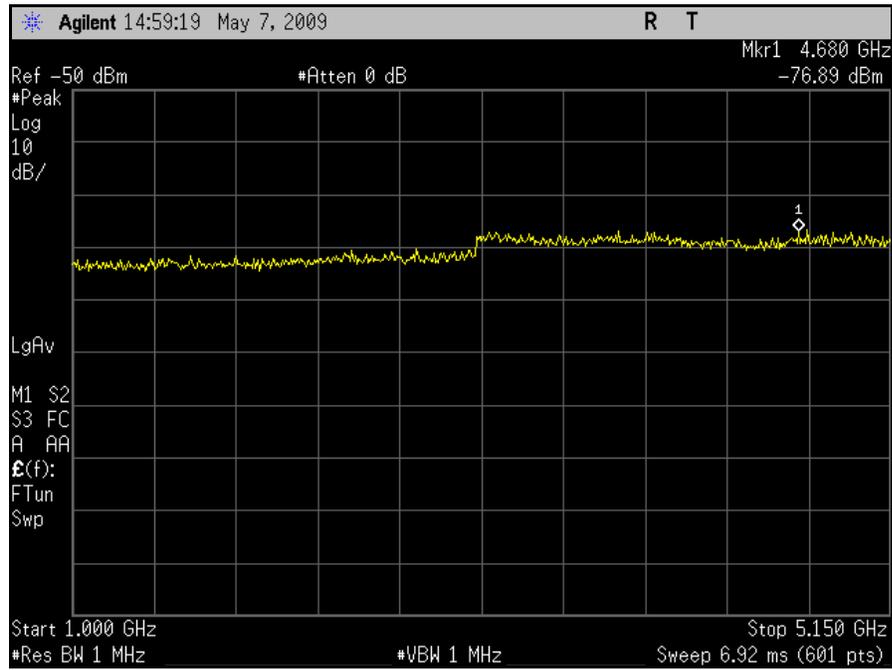
Plot 118. Low Channel (5500 MHz) Spurious Emission, 5.725 GHz - 18 GHz, Port 1, a



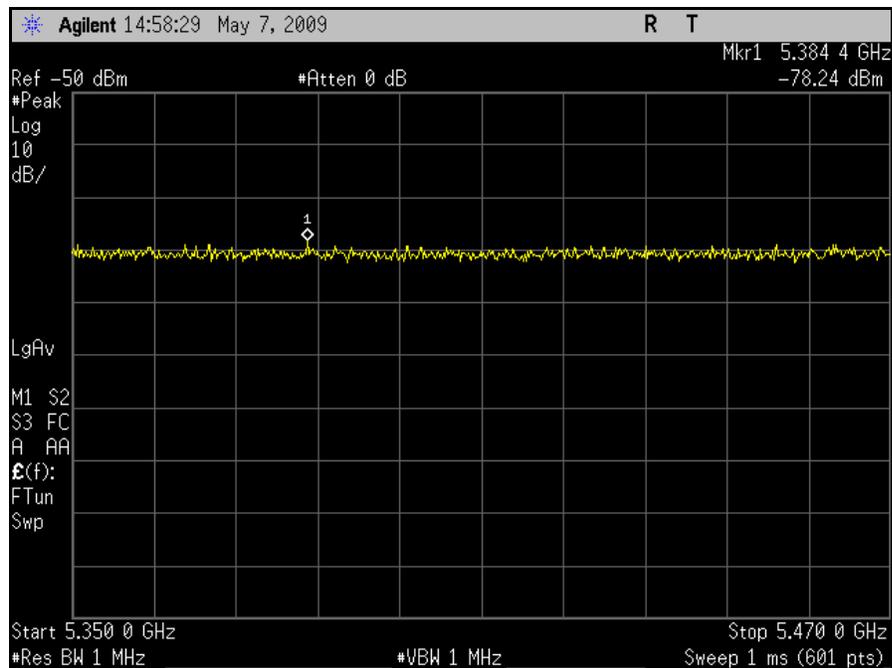
Plot 119. Low Channel (5500 MHz) Spurious Emission, 18 GHz – 26 GHz, Port 1, a



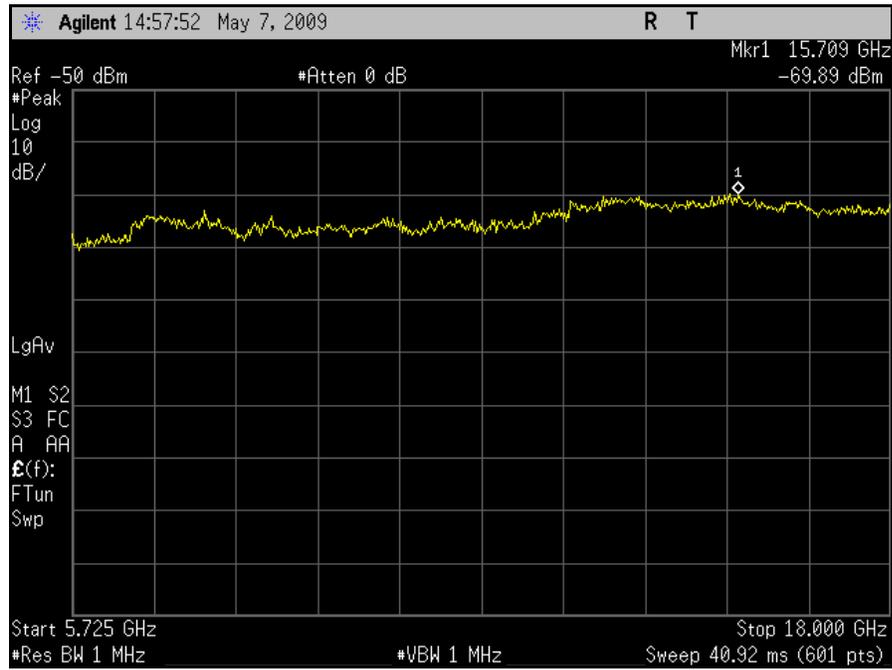
Plot 120. High Channel (5700 MHz) Spurious Emission, 30 MHz – 1 GHz, Port 1, a



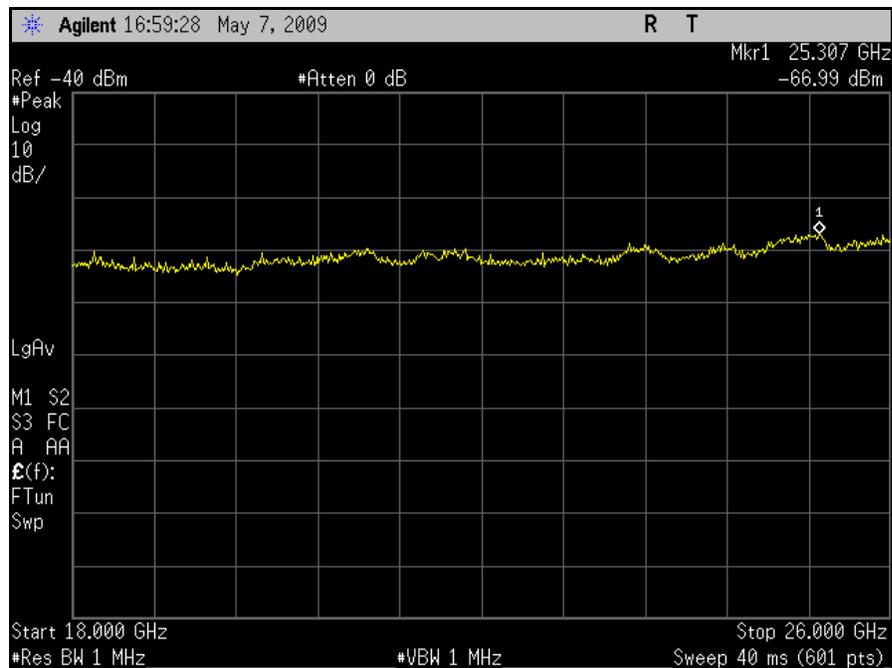
Plot 121. High Channel (5700 MHz) Spurious Emission, 1 GHz – 5.15 GHz, Port 1, a



Plot 122. High Channel (5700 MHz) Spurious Emission, 5.35 GHz – 5.47 GHz, Port 1, a



Plot 123. High Channel (5700 MHz) Spurious Emission, 5.725 GHz – 18 GHz, Port 1, a



Plot 124. High Channel (5700 MHz) Spurious Emission, 18 GHz – 26 GHz, Port 1, a

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

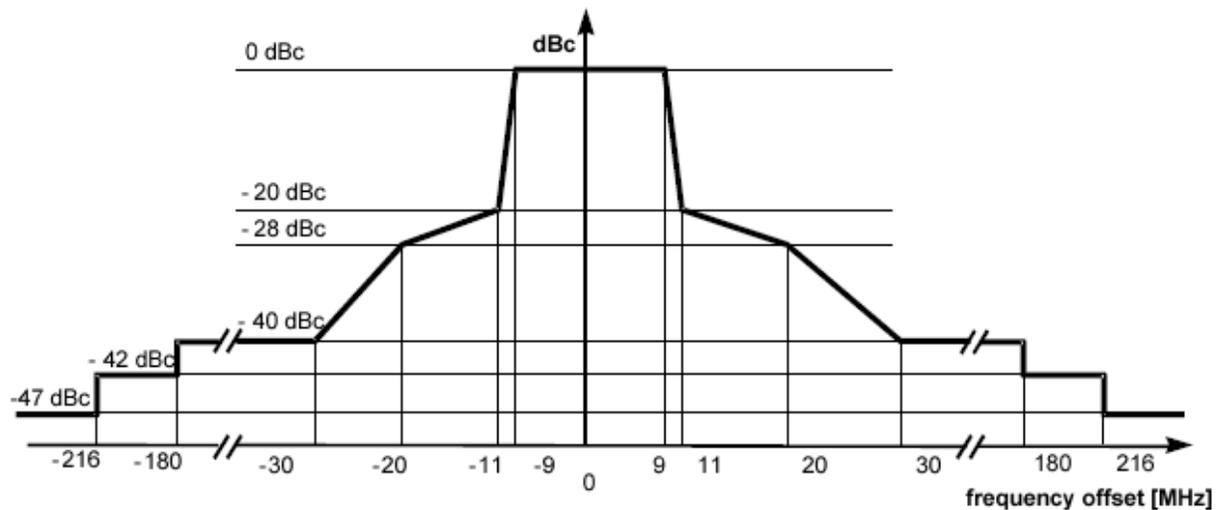
Test Requirement(s): EN 301 893, Clause 5.3.5.2.1:

##### 4.4.1.2 Definition

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

##### 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 and at  $f_c$  of 5500MHz and 5700MHz for the Higher Sub-band. The spectrum under the mask was examined both in a relatively narrow span and a broader span in order to determine compliance.

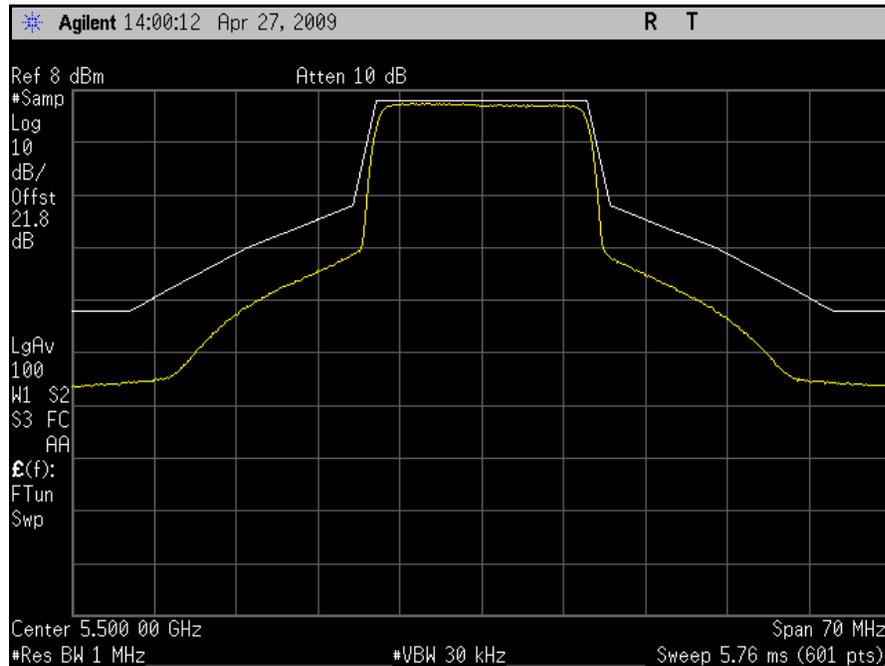
**Test Results:** The EUT as tested was found compliant with the specified requirements of Clause 4.4.

**Test Engineer:** Anderson Soungpanya

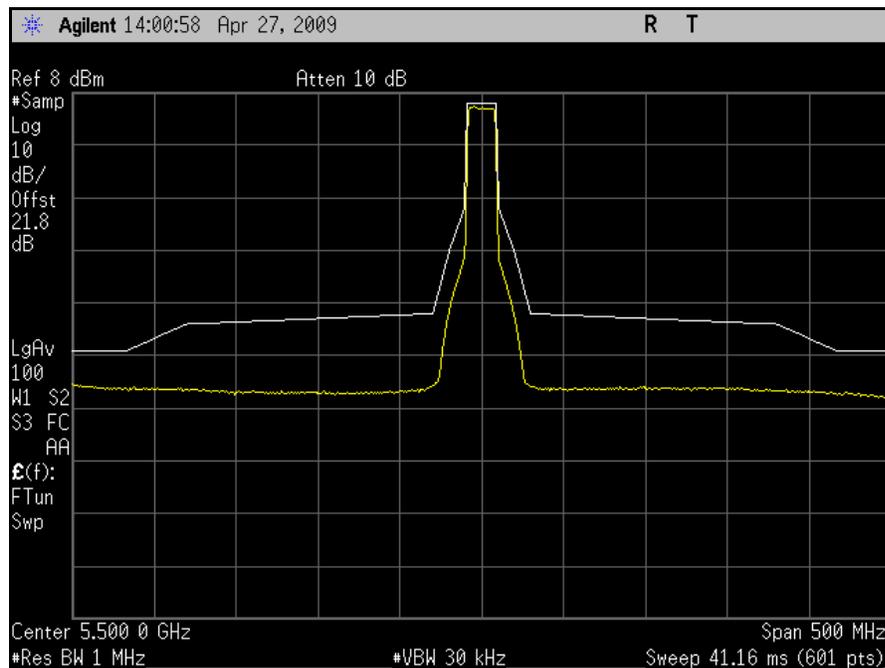
**Test Date:** 05/13/09

## Conformance Requirements

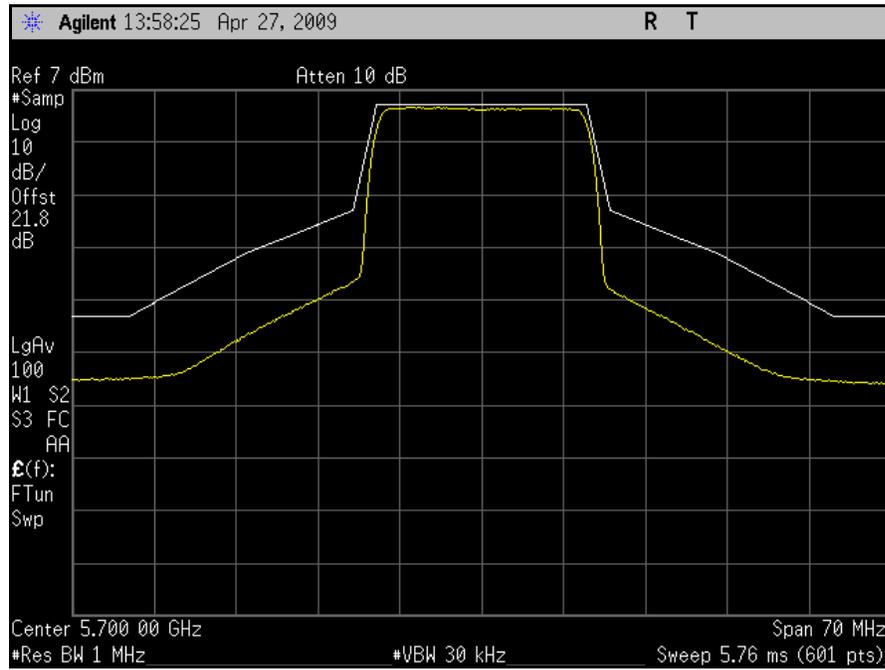
### 4.3.4 Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Conducted)



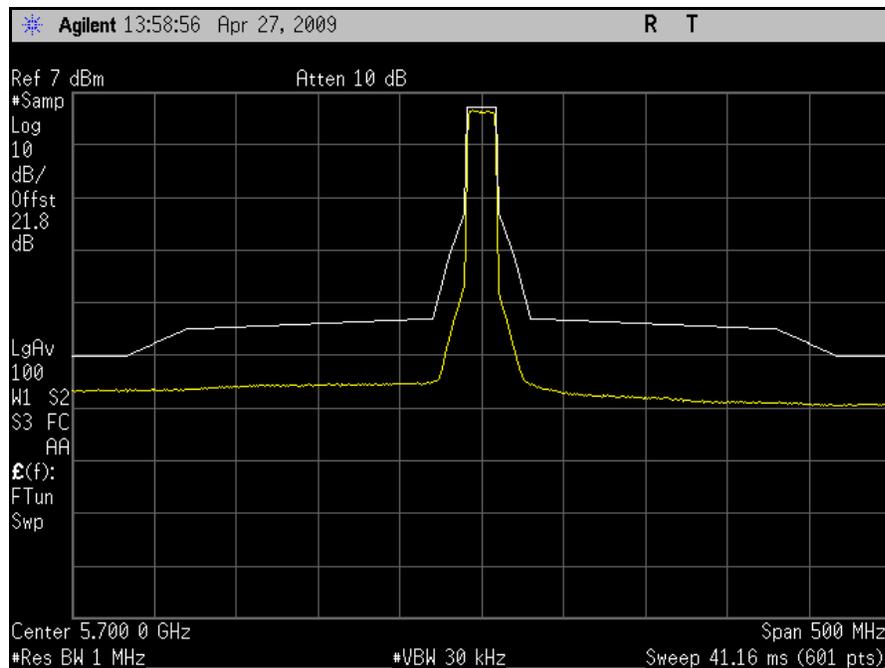
Plot 125. Low Channel (5500 MHz) In Band Spurious Emission, 70 MHz Span, Port 1, HT20



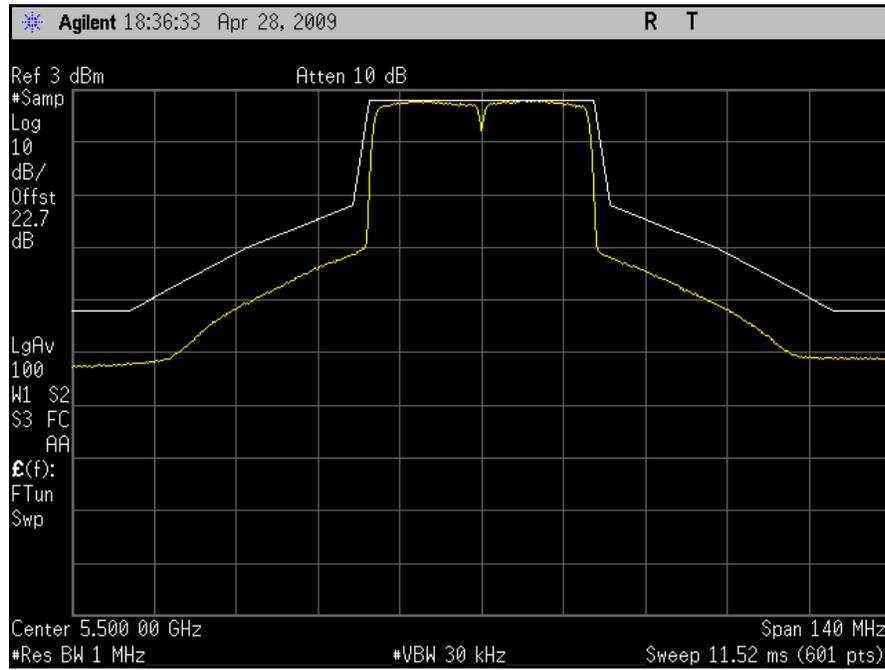
Plot 126. Low Channel (5500 MHz) In Band Spurious Emission, 500 MHz Span, Port 1, HT20



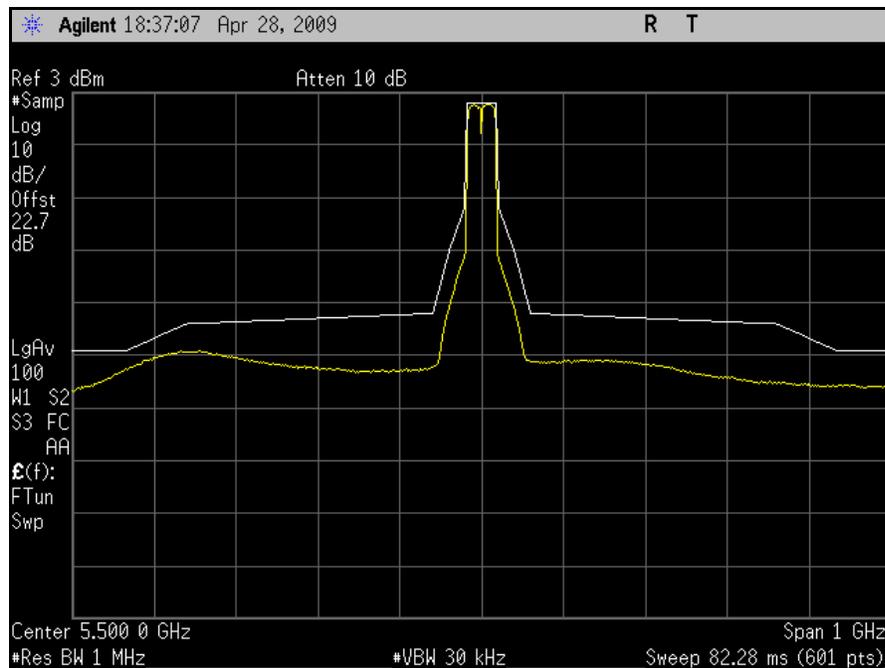
Plot 127. High Channel (5700 MHz) In Band Spurious Emission, 70 MHz Span, Port 1, HT20



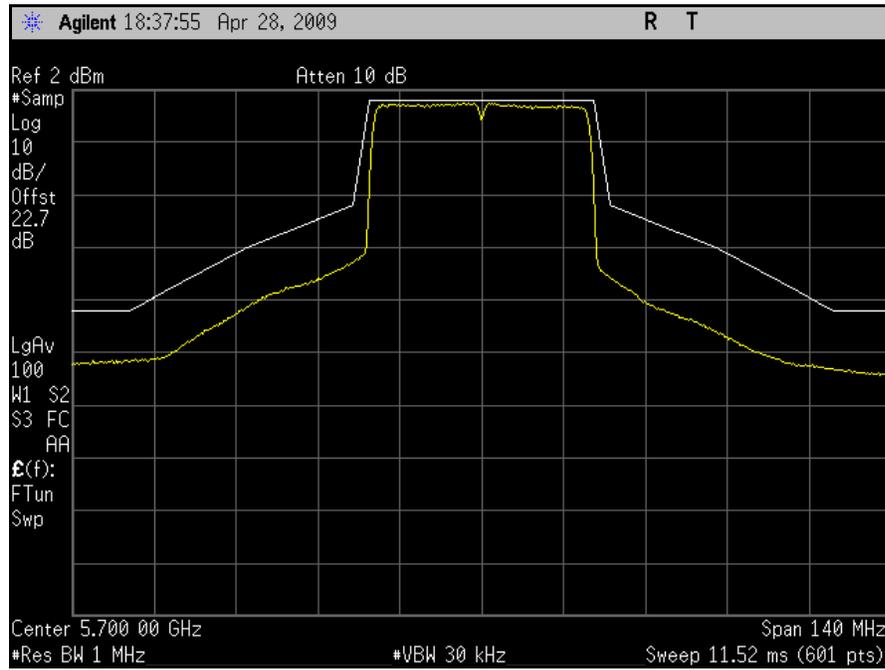
Plot 128. High Channel (5700 MHz) In Band Spurious Emission, 500 MHz Span, Port 1, HT20



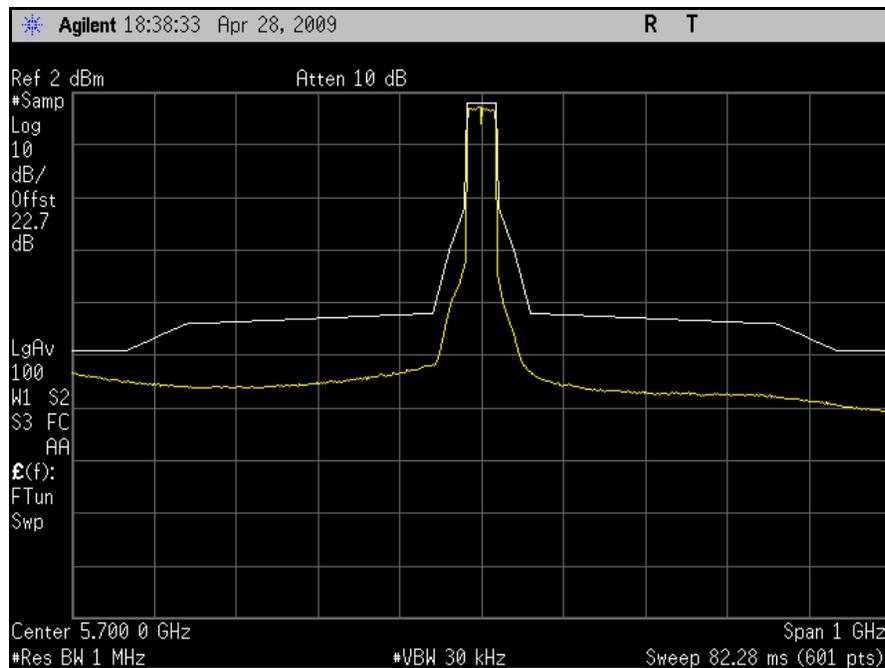
Plot 129. Low Channel (5500 MHz) In Band Spurious Emission, 140 MHz Span, Port 1, HT40



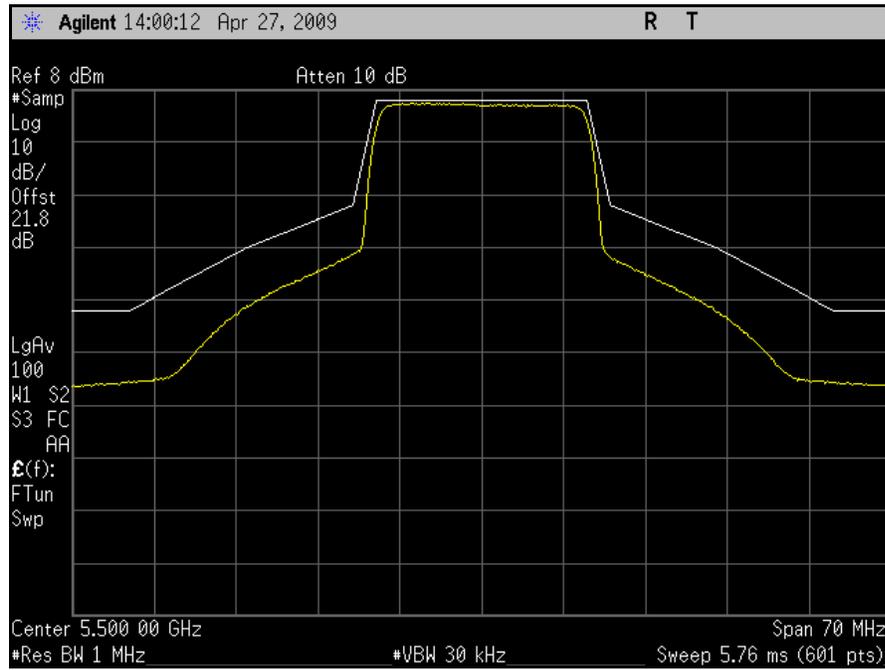
Plot 130. Low Channel (5500 MHz) In Band Spurious Emission, 1 GHz Span, Port 1, HT40



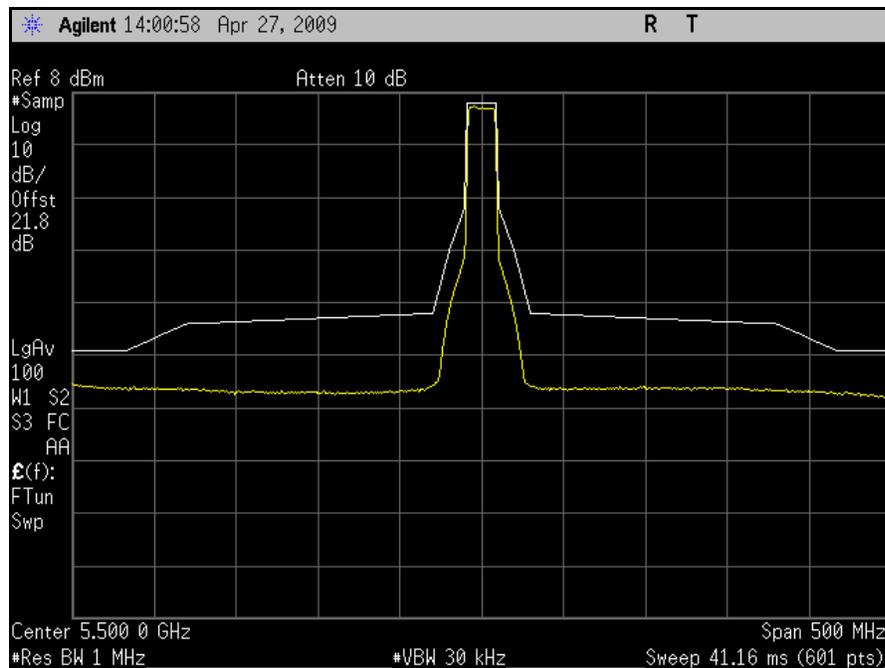
**Plot 131. High Channel (5700 MHz) In Band Spurious Emission, 140 MHz Span, Port 1, HT40**



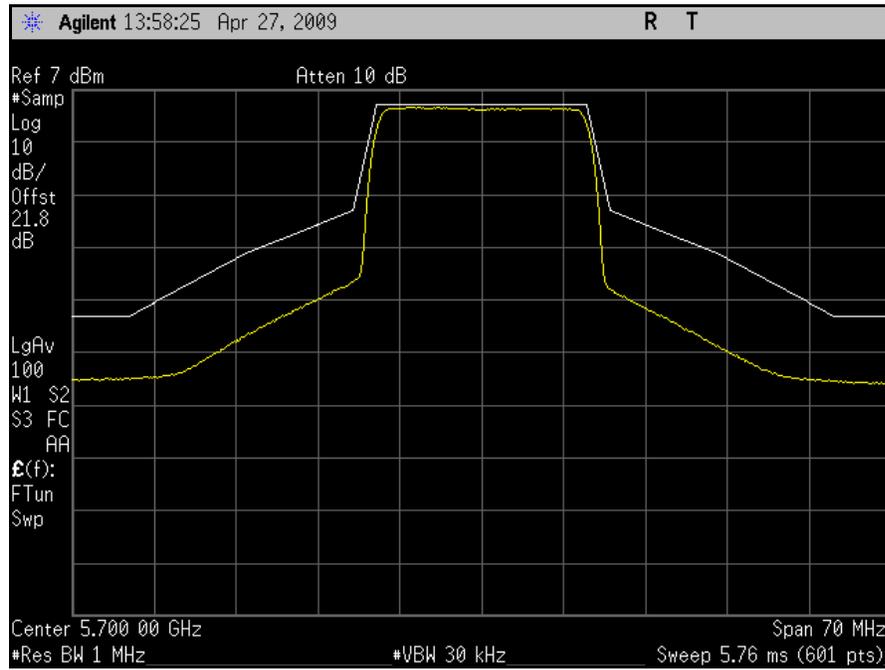
**Plot 132. High Channel (5700 MHz) In Band Spurious Emission, 1 GHz Span, Port 1, HT40**



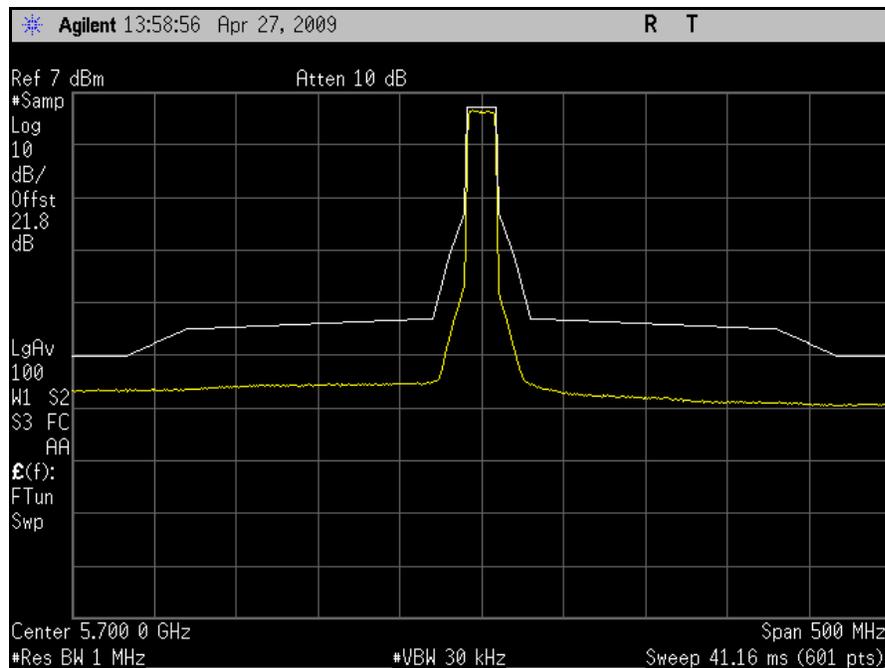
Plot 133. Low Channel (5500 MHz) In Band Spurious Emission, 70 MHz Span, Port 1, a



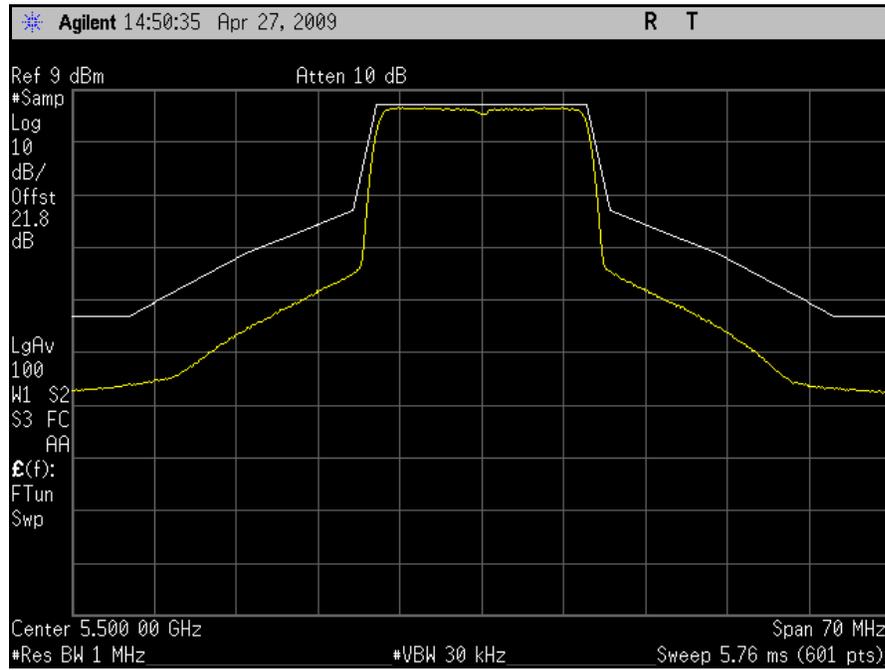
Plot 134. Low Channel (5500 MHz) In Band Spurious Emission, 500 MHz Span, Port 1, a



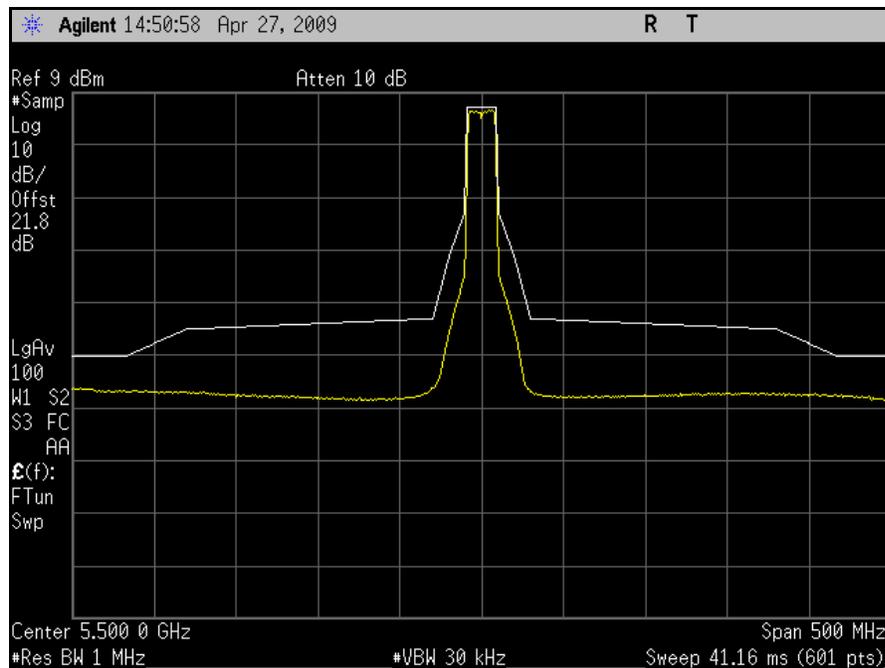
Plot 135. High Channel (5700 MHz) In Band Spurious Emission, 70 MHz Span, Port 1, a



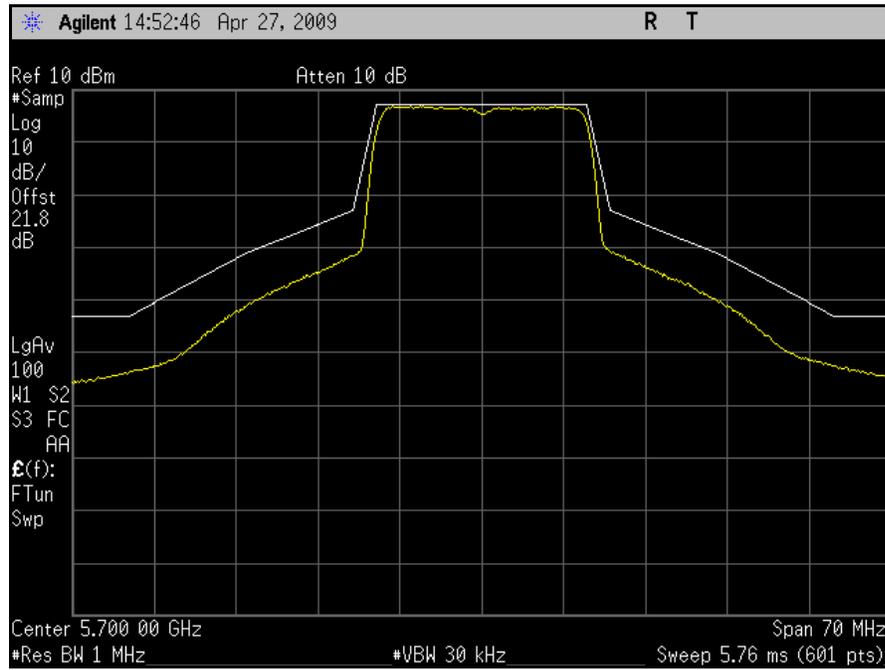
Plot 136. High Channel (5700 MHz) In Band Spurious Emission, 500 MHz Span, Port 1, a



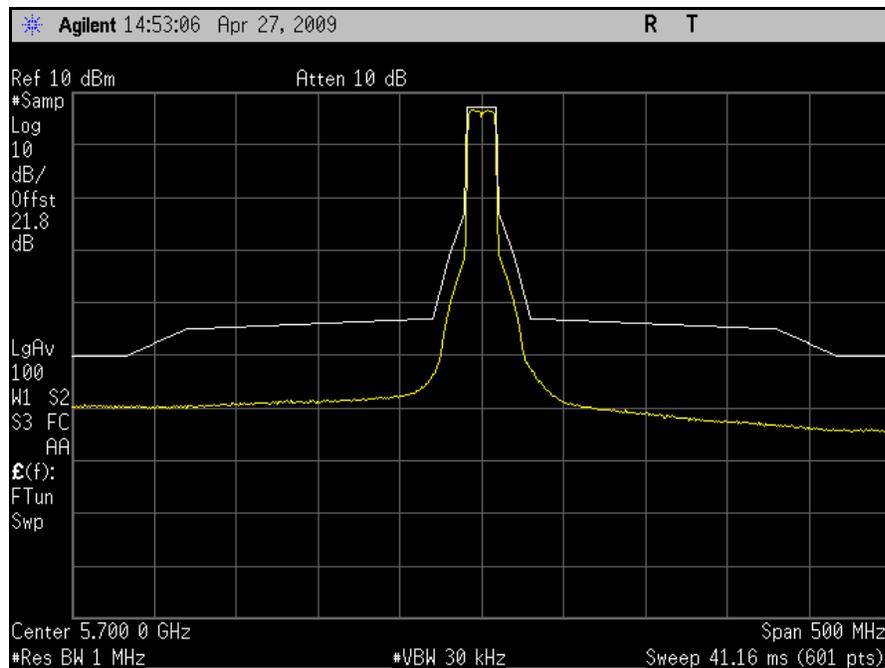
Plot 137. Low Channel (5500 MHz) In Band Spurious Emission, 70 MHz Span, Port 2, HT20



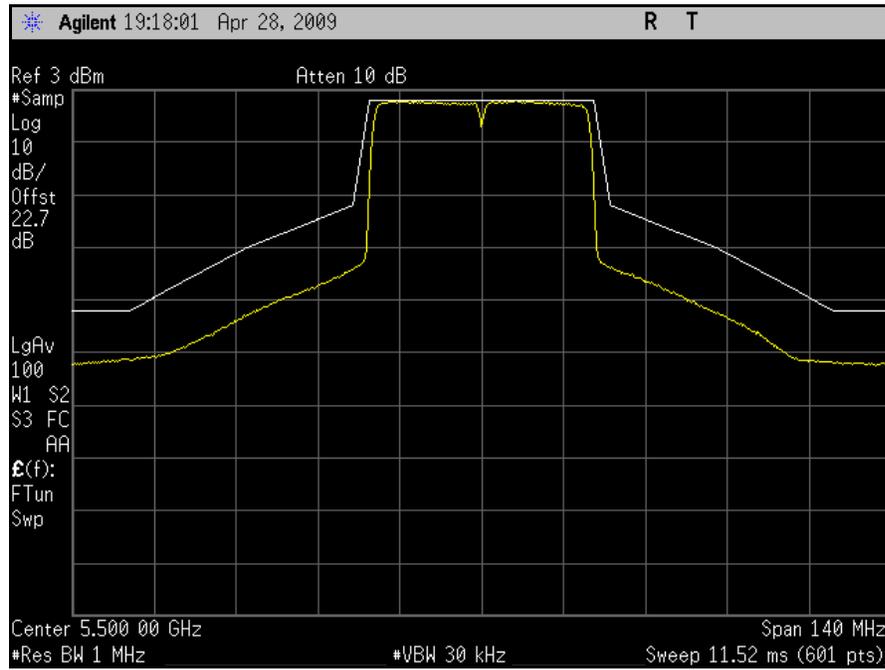
Plot 138. Low Channel (5500 MHz) In Band Spurious Emission, 500 MHz Span, Port 2, HT20



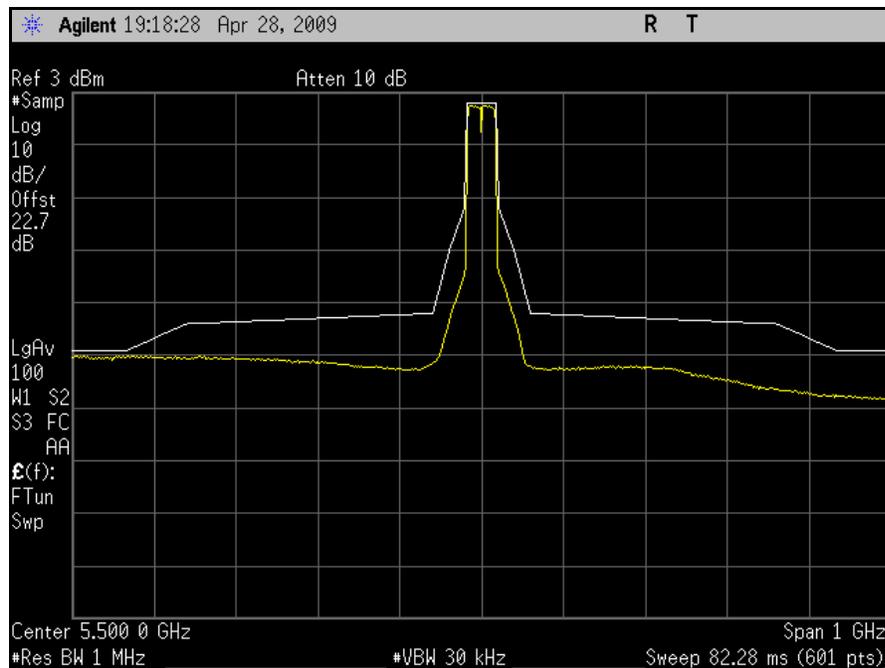
Plot 139. High Channel (5700 MHz) In Band Spurious Emission, 70 MHz Span, Port 2, HT20



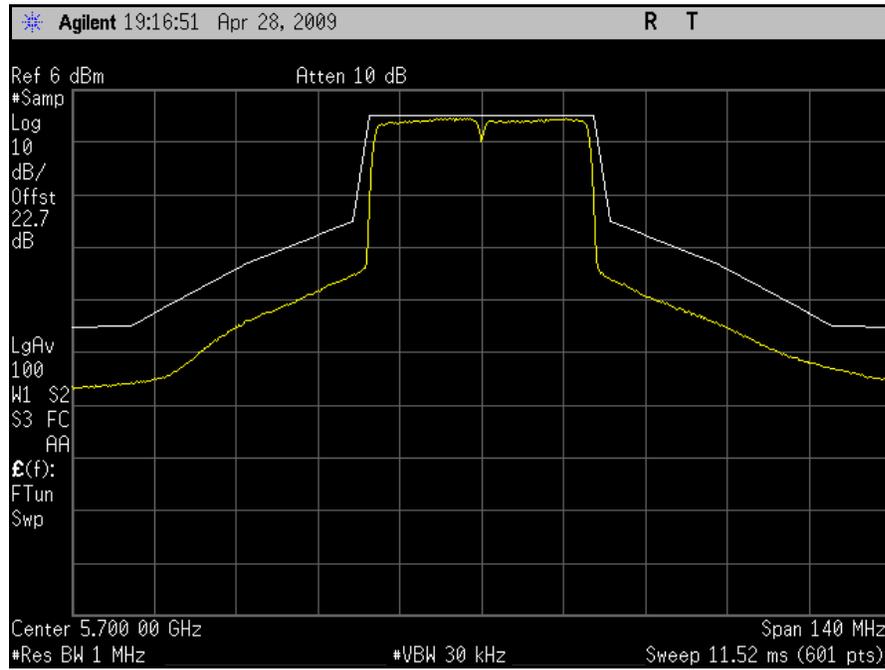
Plot 140. High Channel (5700 MHz) In Band Spurious Emission, 500 MHz Span, Port 2, HT20



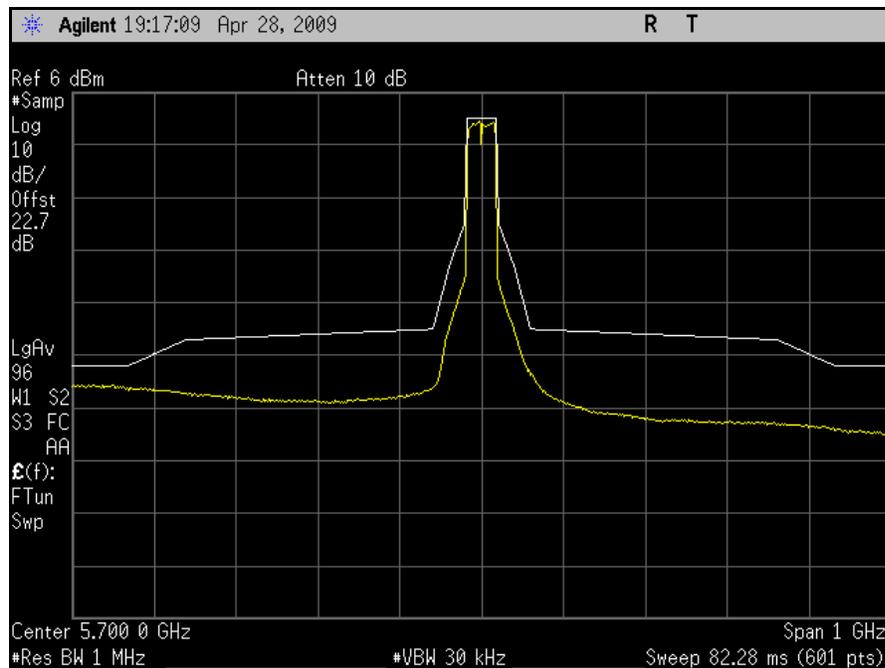
Plot 141. Low Channel (5500 MHz) In Band Spurious Emission, 140 MHz Span, Port 2, HT40



Plot 142. Low Channel (5500 MHz) In Band Spurious Emission, 1 GHz Span, Port 2, HT40



**Plot 143. High Channel (5700 MHz) In Band Spurious Emission, 140 MHz Span, Port 2, HT40**



**Plot 144. High Channel (5700 MHz) In Band Spurious Emission, 1 GHz Span, Port 2, HT40**

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

**Test Requirement(s):** EN 301 893, Clause 5.3.6.2.2:

4.5.1 Definition

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

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 and at  $f_c$  of 5150MHz and 5350MHz for the lower Sub-Bands and 5500MHz and 5700MHz for the Higher Sub-band.

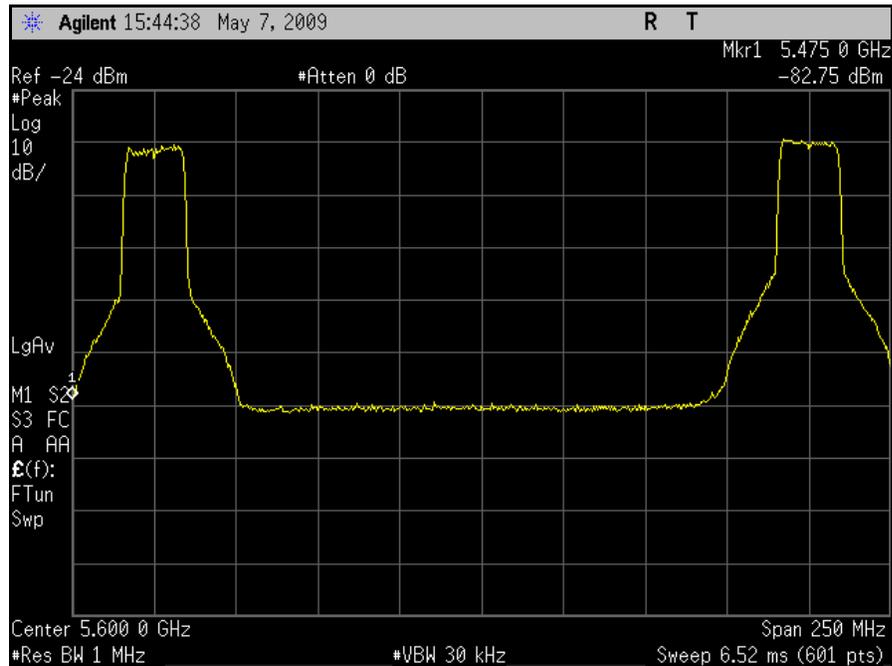
**Test Results:** The EUT as tested was found compliant with the specified requirements of Clause 5.3.6.2.2.

**Test Engineer:** Anderson Soungpanya

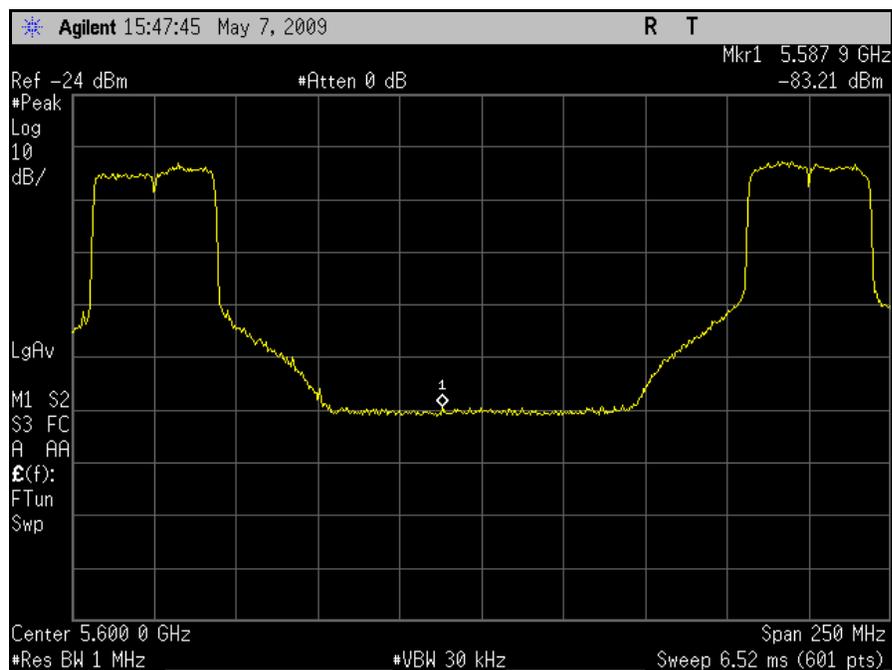
**Test Date:** 05/13/09

## Conformance Requirements

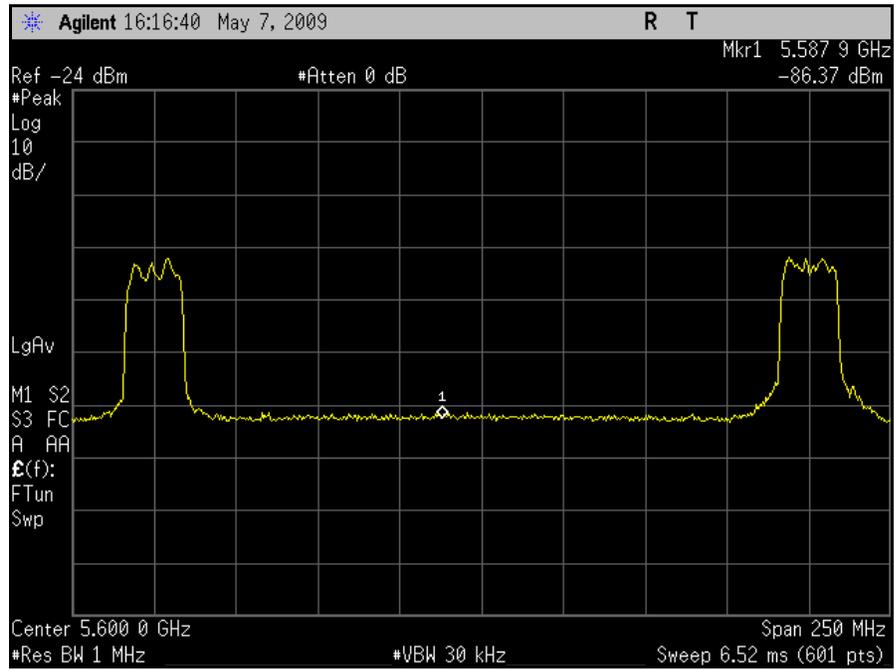
### 4.3.4 Transmitter Unwanted Emissions Within the 5GHz RLAN Bands (Radiated)



Plot 145. In Band Radiated Spurious Emission, All Ports, HT20



Plot 146. In Band Radiated Spurious Emission, All Ports, HT40



**Plot 147. In Band Radiated Spurious Emission, Port 1, a**

## Conformance Requirements

### 4.5 Receiver Spurious Emissions (Conducted)

**Test Requirement(s):** 4.5.1 Definition

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

4.5.2 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 100KHz and a VBW of 1MHz using video averaging or peak hold. The Frequency was scanned from 30MHz to 26.5GHz. Measurements were carried out in all modulations available and at  $f_c$  of 5250MHz and 5350MHz for the lower Sub-Bands and 5500MHz and 5700MHz for the Higher Sub-band.

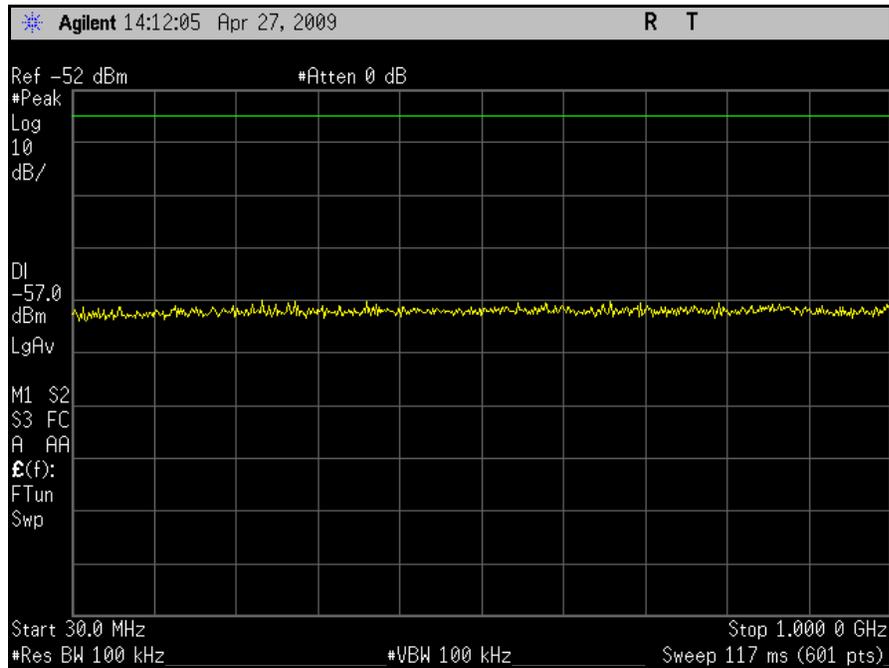
**Test Results:** The EUT as tested was found compliant with the specified limits of Clause 4.5.

**Test Engineer:** Anderson Soungpanya

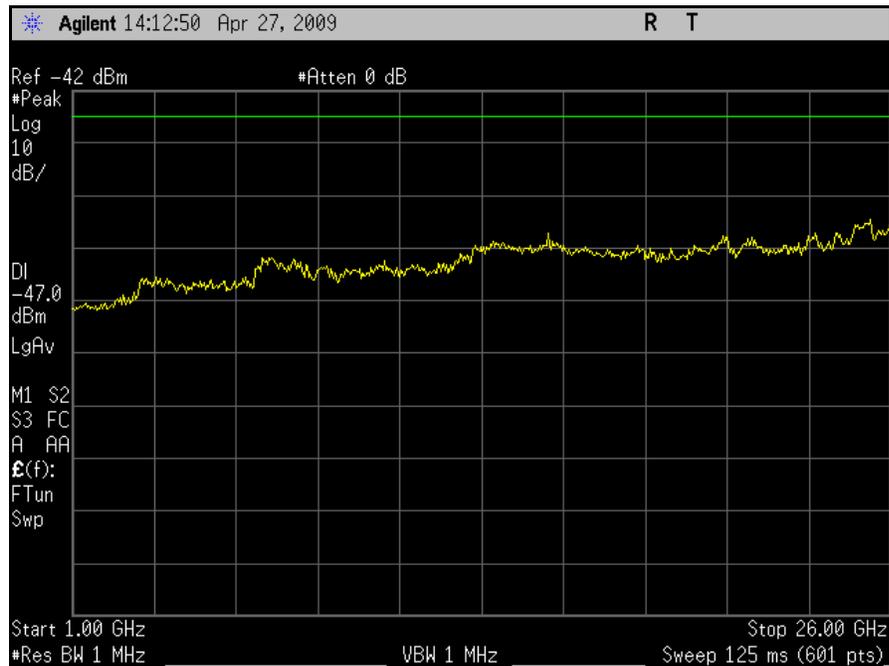
**Test Date:** 05/13/09

## Conformance Requirements

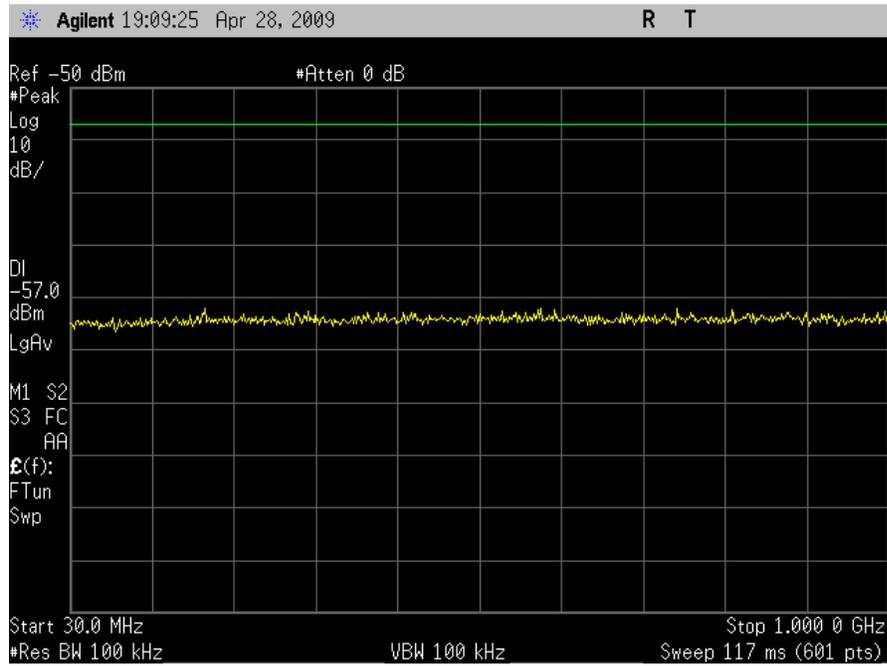
### 4.3.5 Receiver Spurious Emissions (Conducted)



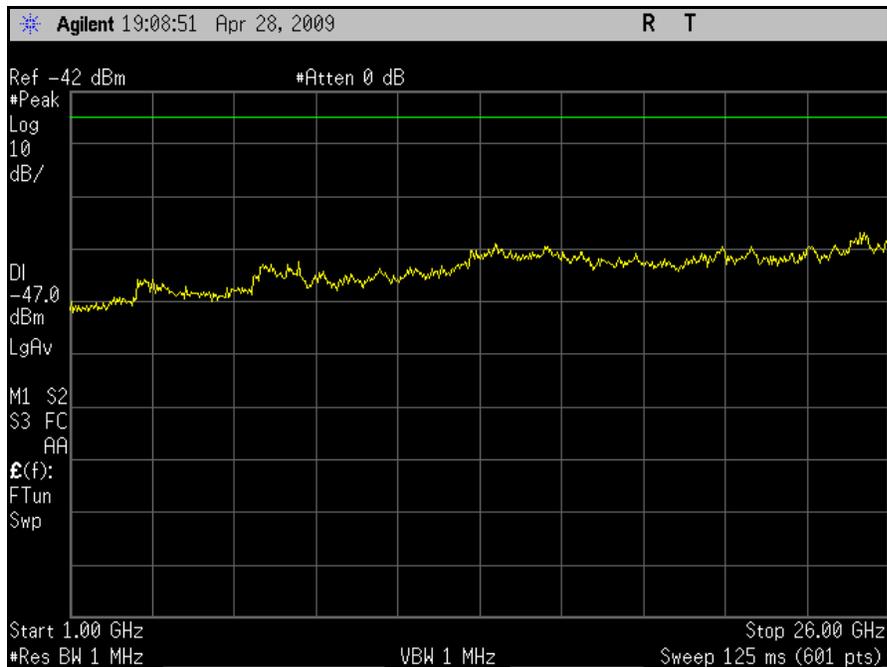
Plot 148. Receiver Spurious Emission, 30 MHz – 1 GHz, Port 1, HT20



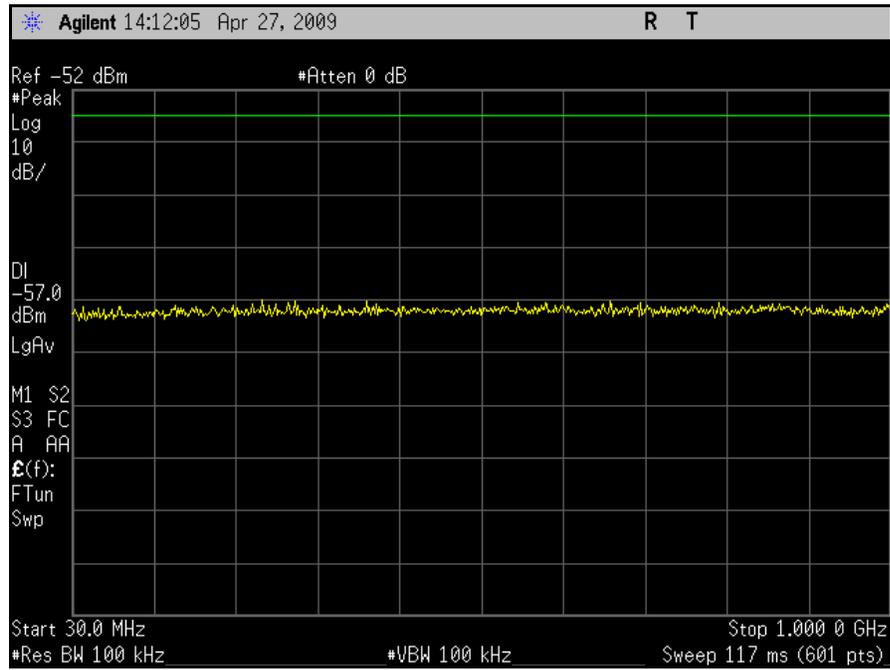
Plot 149. Receiver Mode Spurious Emission 1 GHz - 26.5 GHz, Port 1, HT20



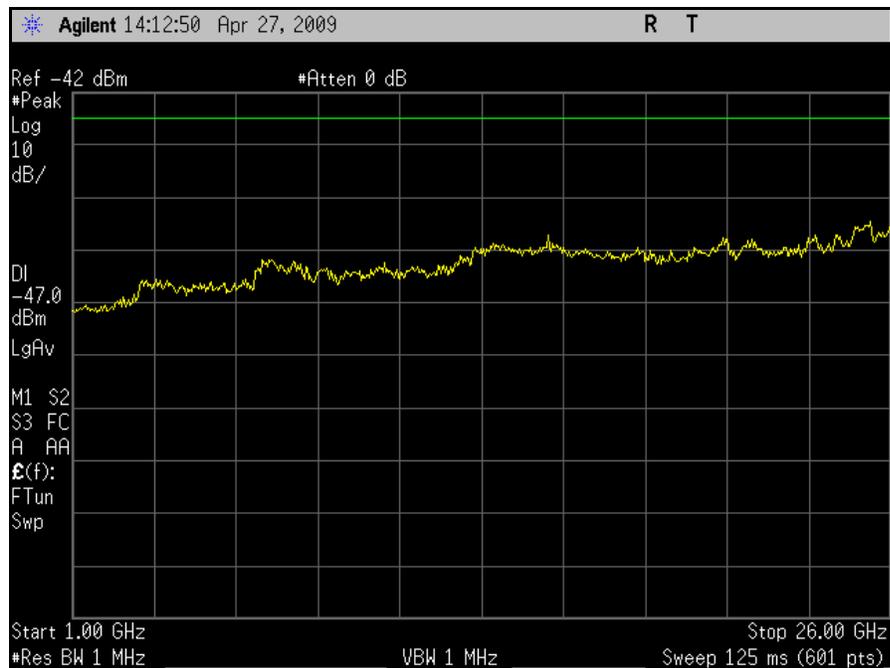
**Plot 150. Receiver Spurious Emission, 30 MHz – 1 GHz, Port 1, HT40**



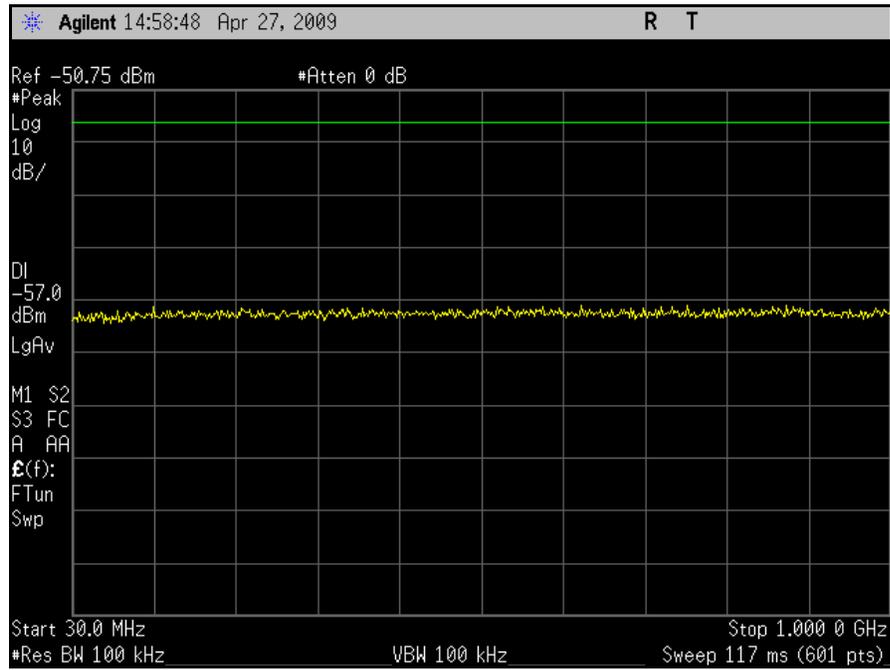
**Plot 151. Receiver Mode Spurious Emission 1 GHz - 26.5 GHz, Port 1, HT40**



**Plot 152. Receiver Spurious Emission, 30 MHz – 1 GHz, Port 1, a**



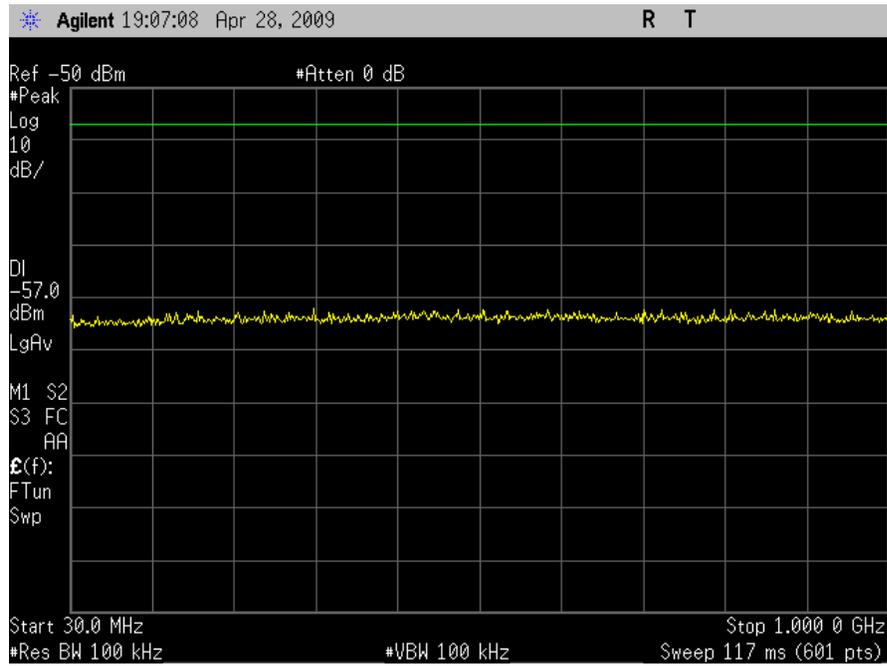
**Plot 153. Receiver Mode Spurious Emission 1 GHz - 26.5 GHz, Port 1, a**



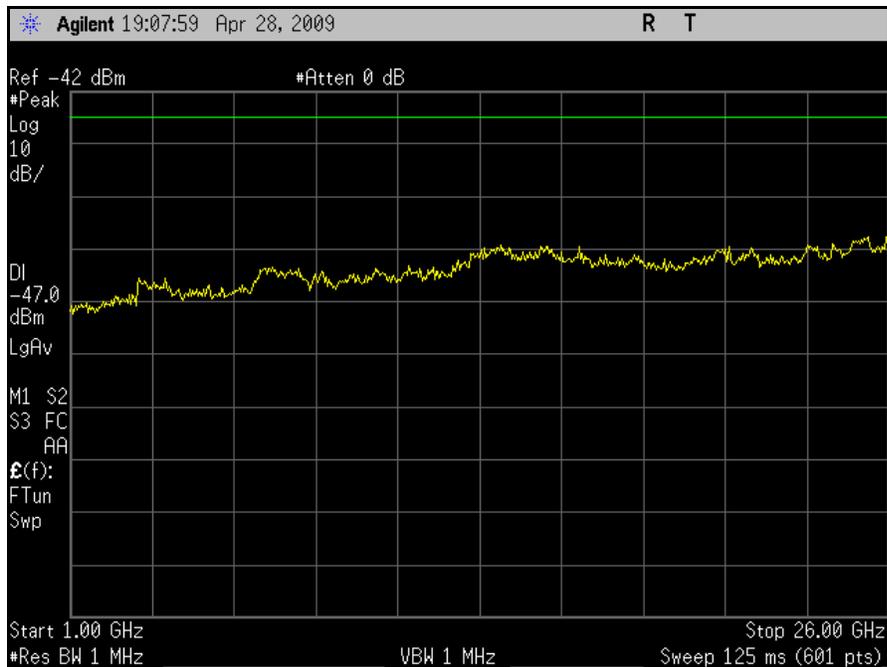
**Plot 154. Receiver Spurious Emission, 30 MHz – 1 GHz, Port 2, HT20**



**Plot 155. Receiver Mode Spurious Emission 1 GHz - 26.5 GHz, Port 2, HT20**



Plot 156. Receiver Spurious Emission, 30 MHz – 2 GHz, Port 1, HT40



Plot 157. Receiver Mode Spurious Emission 1 GHz - 26.5 GHz, Port 2, HT40

## Conformance Requirements

### 4.5 Receiver Spurious Emissions (Radiated)

**Test Requirement(s):** 4.5.1 Definition

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

4.5.2 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.

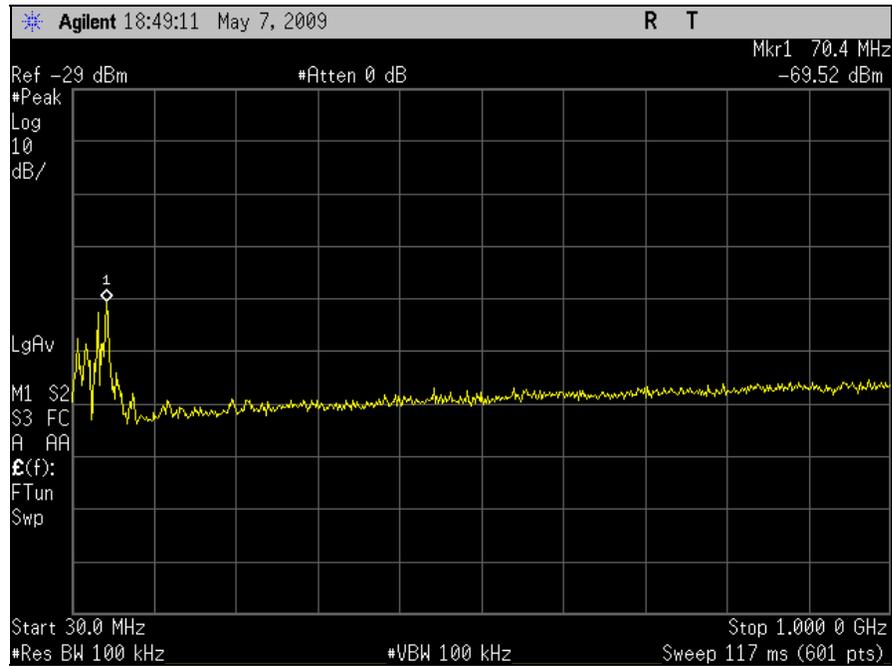
**Test Results:** The EUT as tested was found compliant with the specified limits of Clause 5.3.6.

**Test Engineer:** Anderson Soungpanya

**Test Date:** 05/13/09

## Conformance Requirements

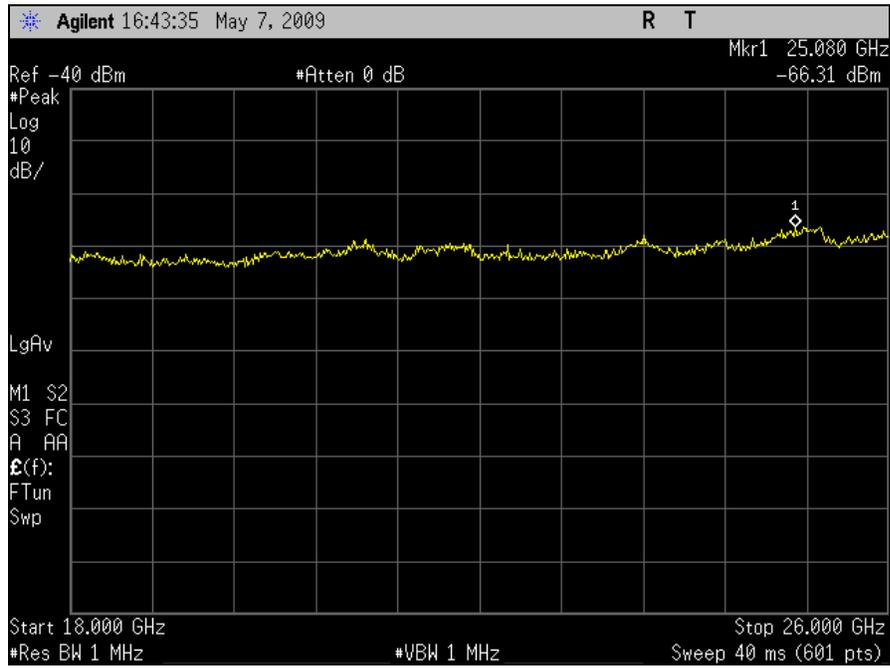
### 4.3.5 Receiver Spurious Emissions (Radiated)



Plot 158. Receiver Spurious Emission, 30 MHz – 1 GHz, All Ports



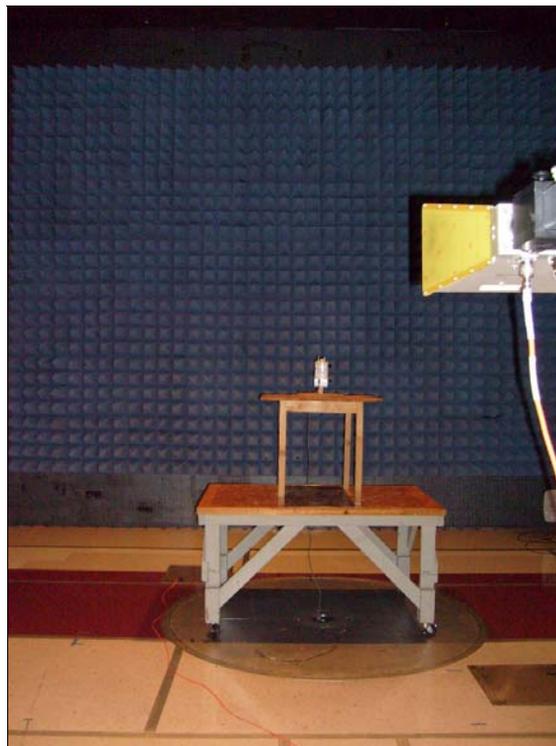
Plot 159. Receiver Mode Spurious Emission, 1 GHz - 18 GHz, , All Ports



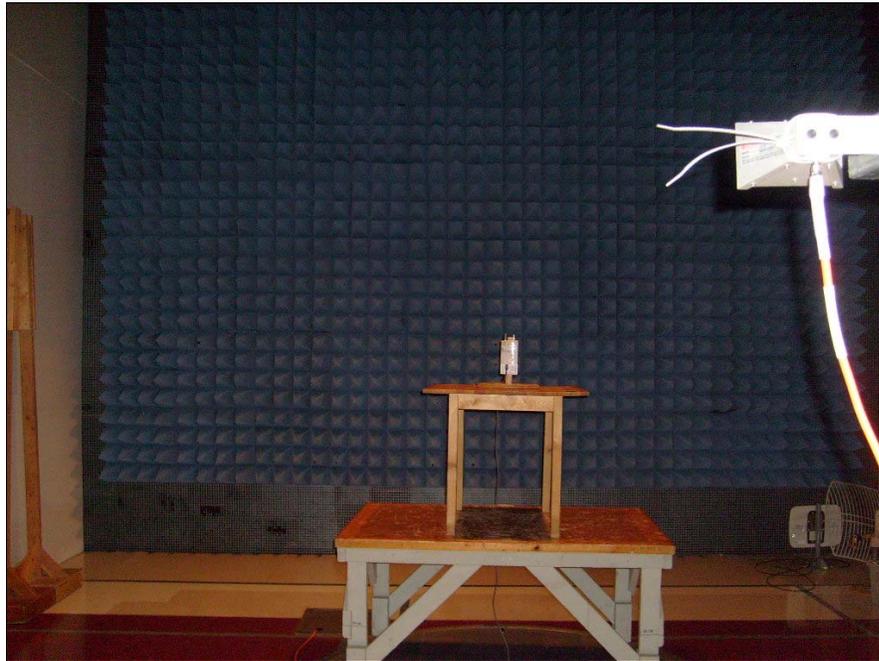
**Plot 160. Receiver Spurious Emission, 18 GHz – 26.5 GHz, All Ports**



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



**Photograph 2. Radiated Emissions, Test Setup, 1 GHz – 18 GHz**



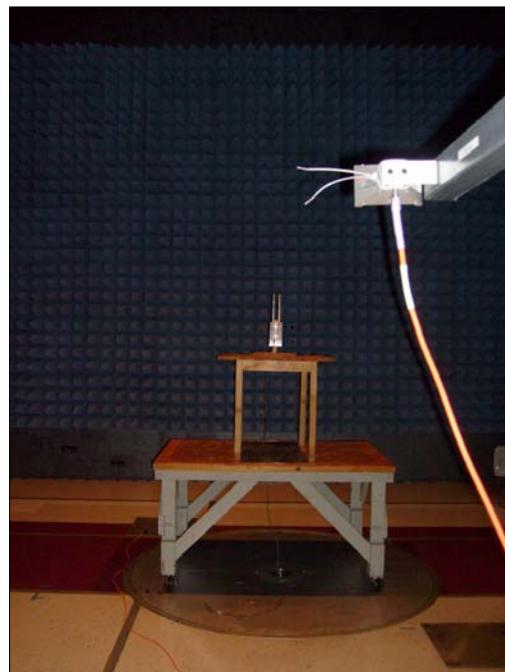
**Photograph 3. Radiated Emissions, Test Setup, 18 GHz – 26 GHz**



**Photograph 4. Radiated Emissions, Test Setup, 30 MHz – 1 GHz, n**



**Photograph 5. Radiated Emissions, Test Setup, 1 GHz – 18 GHz, n**



**Photograph 6. Radiated Emissions, Test Setup, 18 GHz – 26 GHz, n**

## **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.

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 behavior 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

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
<b>Note 1:</b> Where implemented by the manufacturer.			
<b>Note 2:</b> 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 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

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
<b>Note 1:</b> Where implemented by the manufacturer.			
<b>Note 2:</b> 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 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
<b>Note 1:</b> Where implemented by the manufacturer.			
<b>Note 2:</b> 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

### Interference Threshold values, Master or Client incorporating In-Service Monitoring

EIRP Spectral Density	Value (see Notes 1 and 2)
10 dBm/MHz	-62 dBm
<p><b>Note 1:</b> 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.</p> <p><b>Note 2:</b> Slave devices with a maximum EIRP of less than 23 dBm do not have to implement radar detection.</p>	

### DFS Response requirement values

Parameter	Value
<i>Channel Availability Check Time</i>	60 seconds (see Note 1)
<i>Maximum Off-Channel CAC Time</i>	4 hours (see Note 2)
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Move Time</i>	10 seconds
<i>Channel Closing Transmission Time</i>	1 s
<p><b>Note 1:</b> 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.</p> <p><b>Note 2:</b> 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.</p>	

## Parameters of the reference DFS test signal

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

## Detection Probability

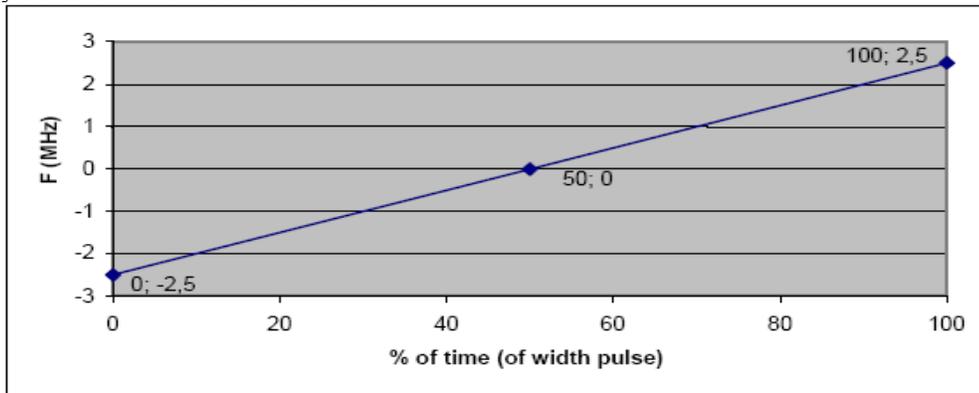
Parameter	Detection Probability ( $P_d$ )	
	Channels whose nominal bandwidth falls partly or completely within the 5 600 MHz to 5 650 MHz band	Other channels
CAC, Off-Channel CAC	99,99 %	60 %
In-Service Monitoring	60 %	60 %
<p>NOTE: <math>P_d</math> gives the probability of detection per simulated radar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

## Parameters of the Radar Test Signals

Radar test Signal # (see Notes 1 to 3)	Pulse width W [ $\mu$ s]		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  $\pm 2,5$  MHz 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.

## Radar Waveform Calibration

The following equipment setup was used to calibrate the conducted Radar Waveform See Figure 2. 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

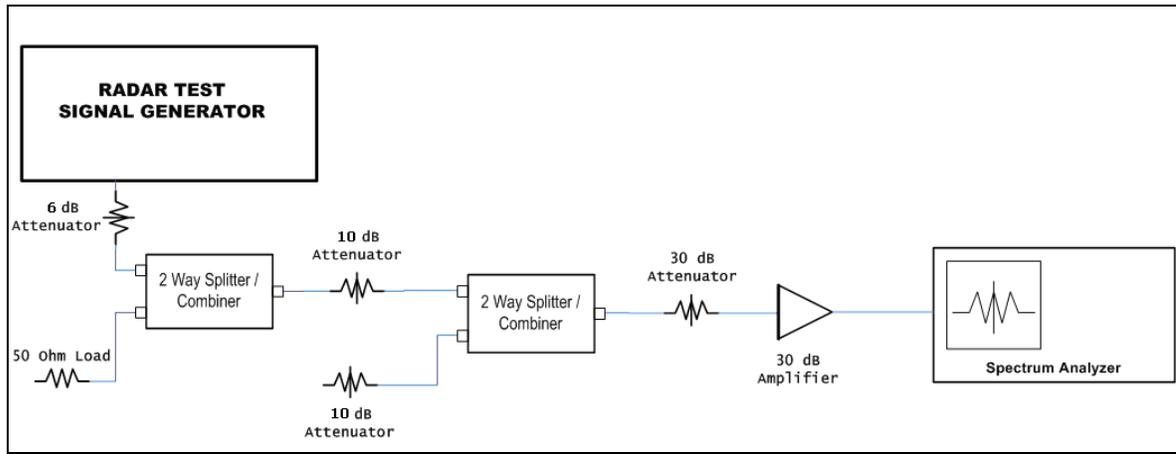
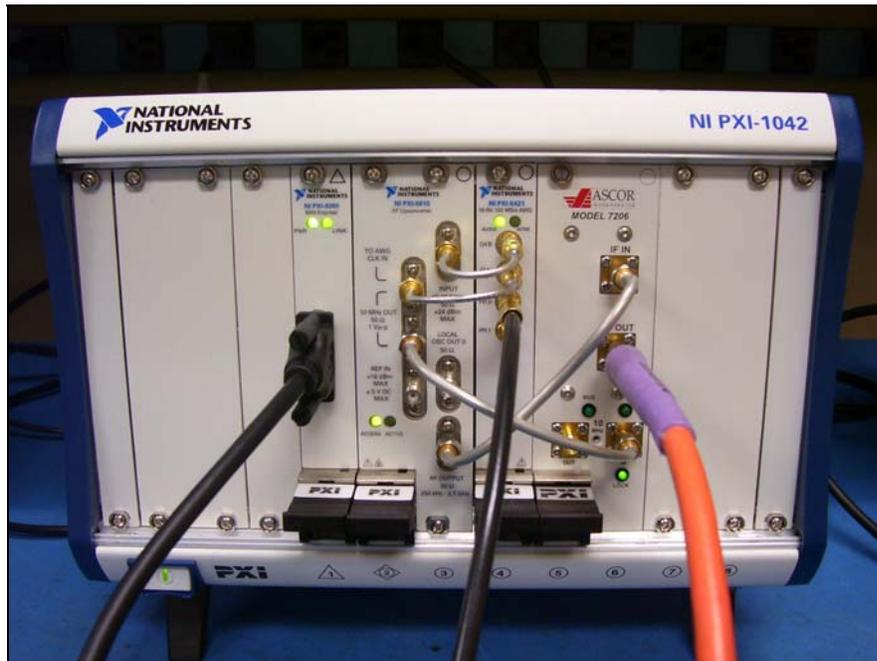
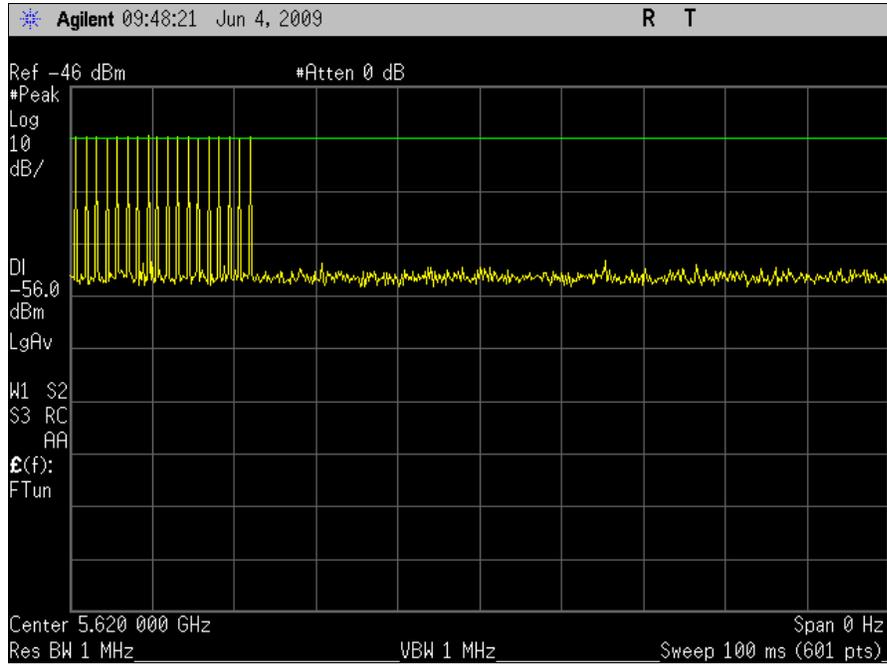


Figure 2. Radar Waveform Calibration Setup

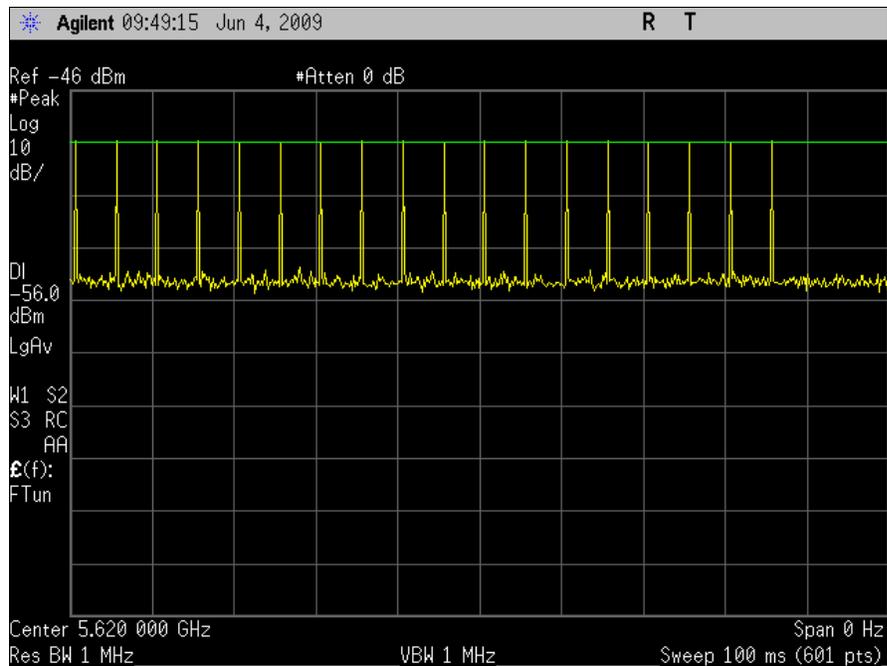


Photograph 7. Radar Test Signal Generator

### Radar Calibration, 5620MHz

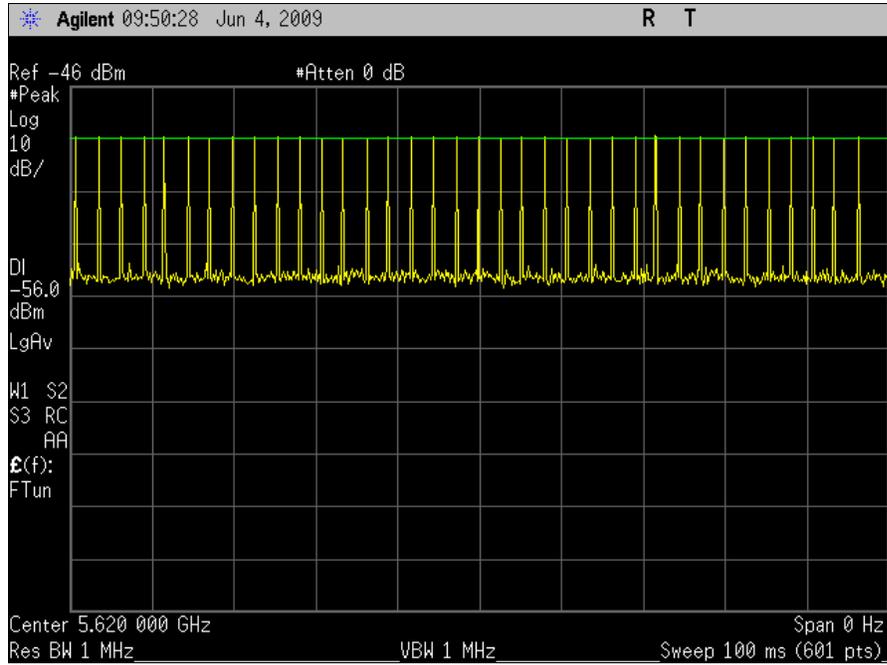


**Plot 161. Bin 1, Weather Radar Calibration**

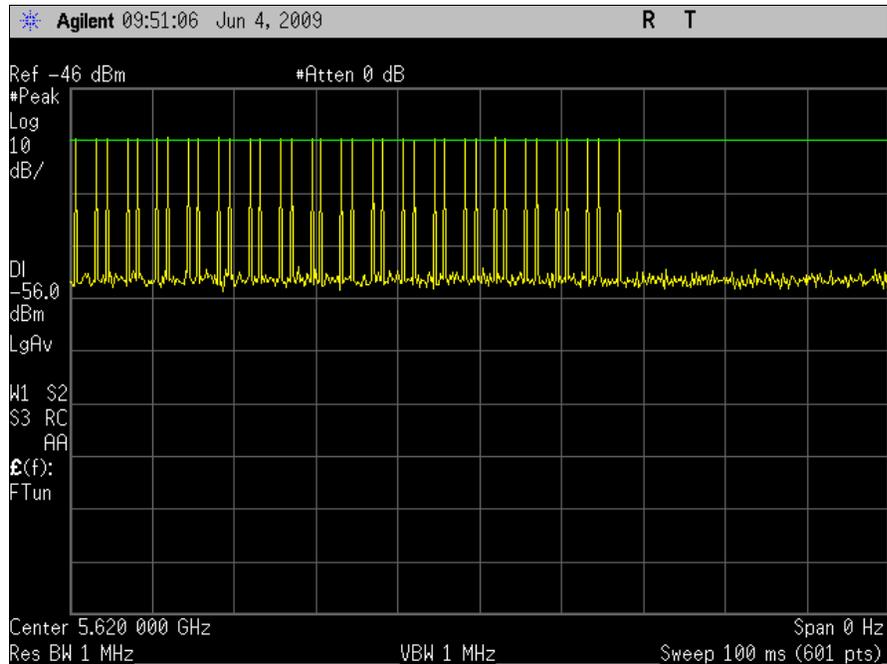


**Plot 162. Bin 2, Weather Radar Calibration**

### Radar Calibration, 5620MHz

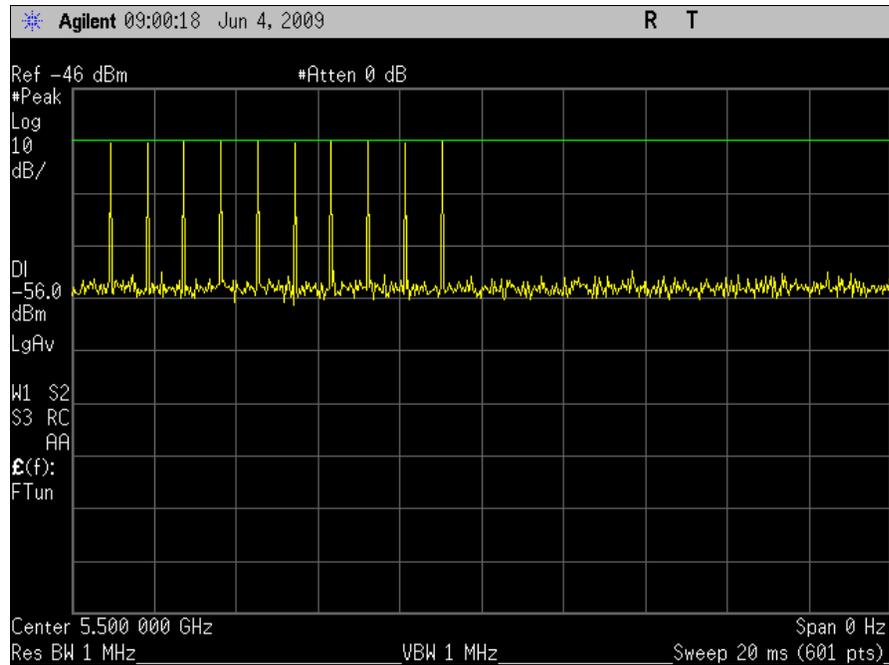


**Plot 163. Bin 5, Weather Radar Calibration**

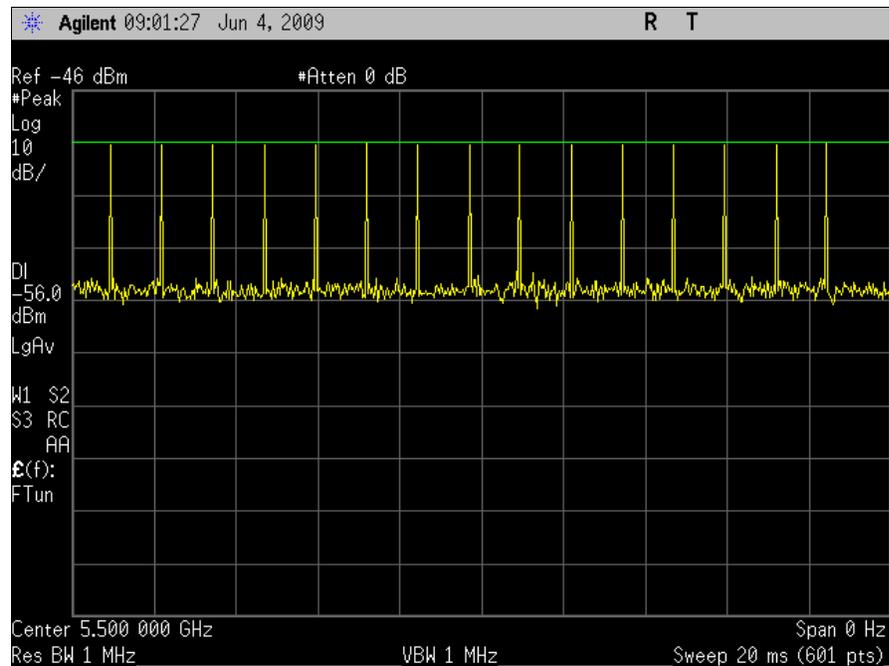


**Plot 164. Bin 6, Weather Radar Calibration**

## Radar Calibration, 5500MHz

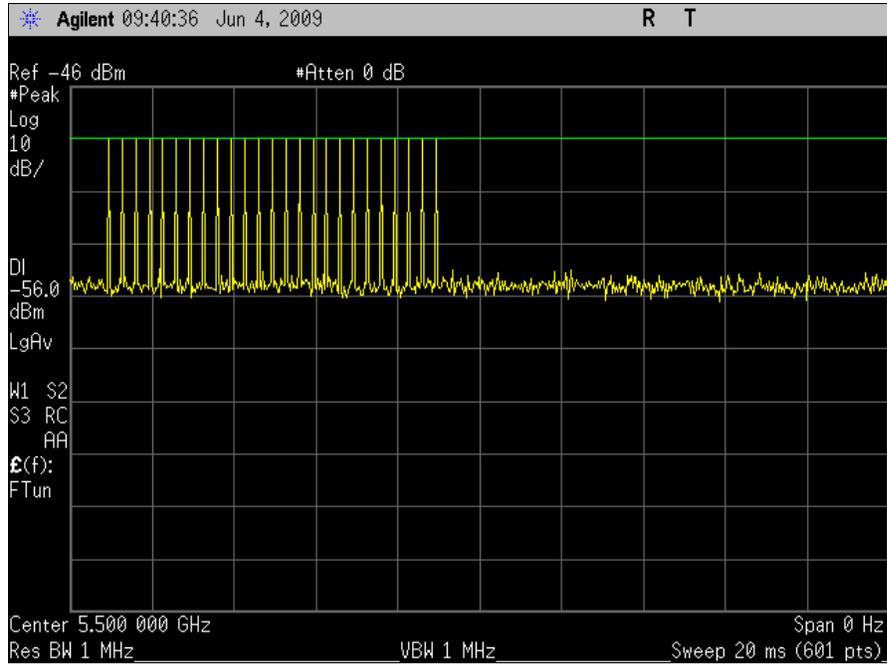


Plot 165. Bin 1, Radar Calibration

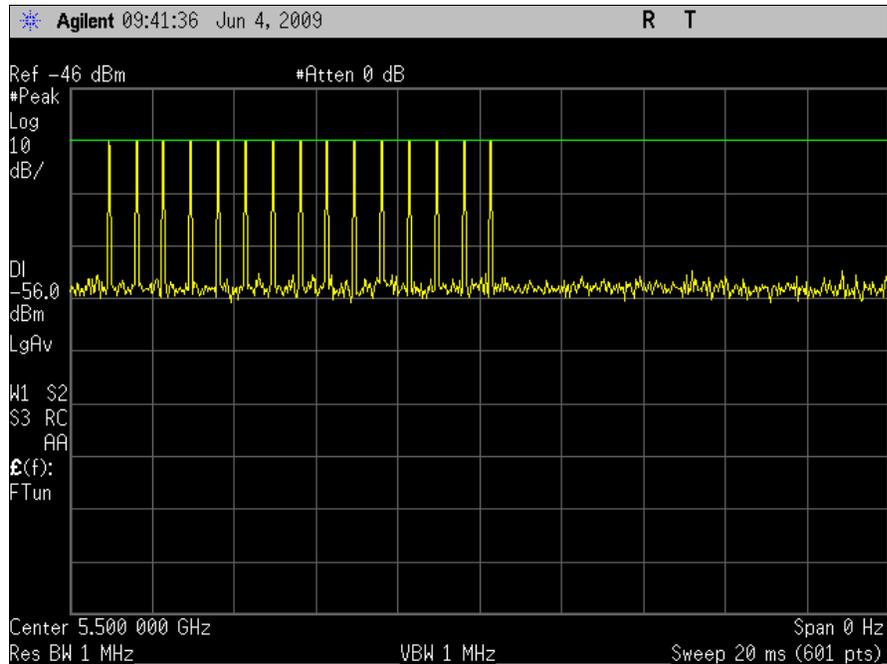


Plot 166. Bin 2, Radar Calibration

## Radar Calibration, 5500MHz

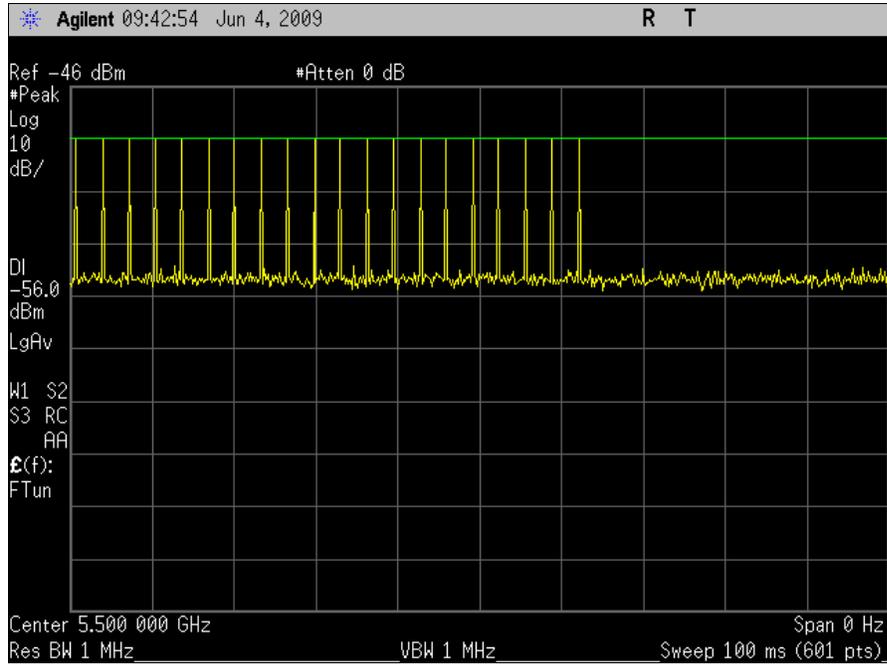


Plot 167. Bin 3, Radar Calibration

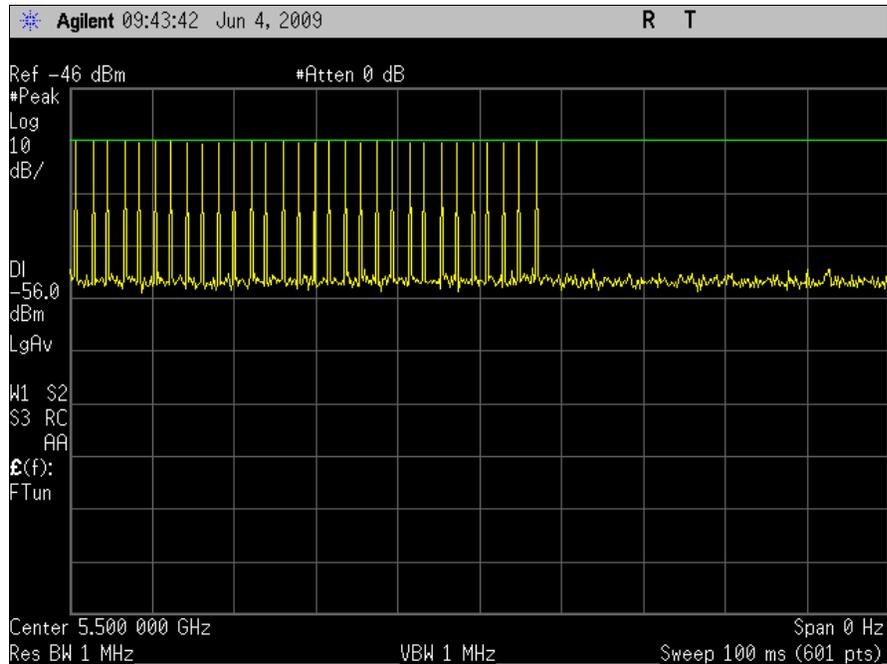


Plot 168. Bin 4, Radar Calibration

## Radar Calibration, 5500MHz



Plot 169. Bin 5, Radar Calibration



Plot 170. Bin 6, Radar Calibration

## 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 3 shows the test setup used for injection of radar waveforms in to a master device.

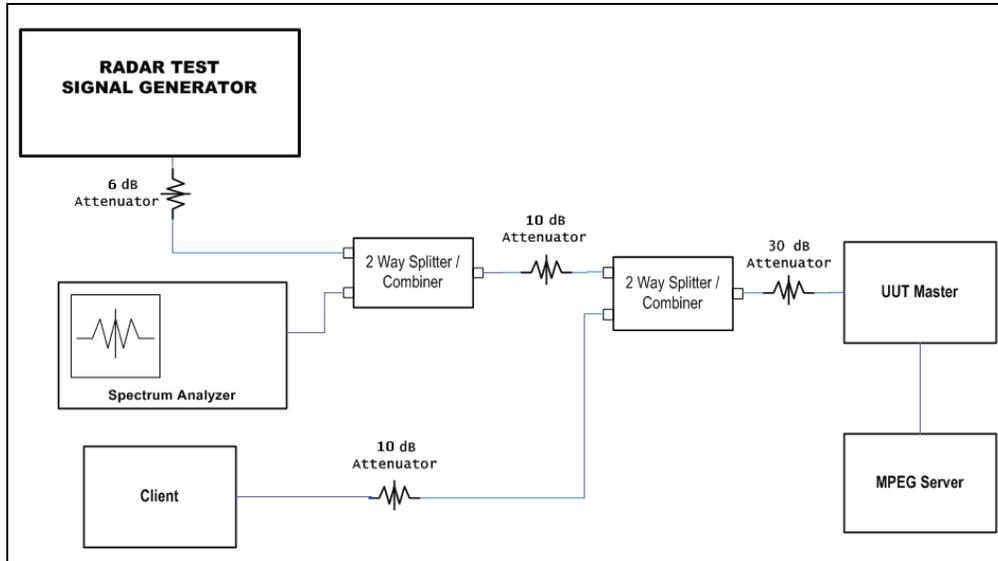
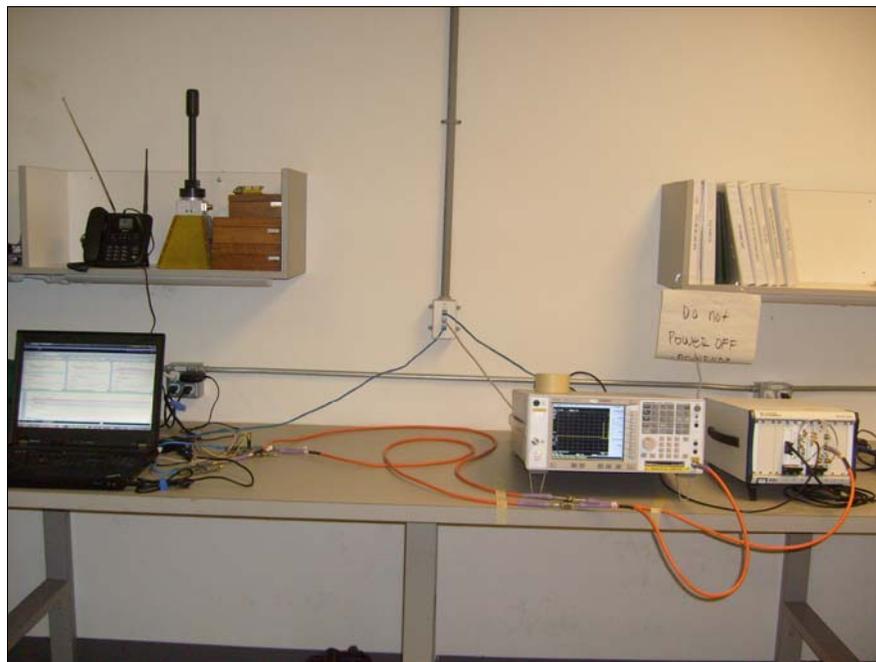


Figure 3. Test Setup for Master Device



Photograph 8. EUT Test Setup Photograph

### 4.7.2.1 Channel Availability Check

**Test Requirement(s):** ETSI EN 301 893 V1.5.1, 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. This mechanism is used for identify Available Channels.

**Limit(s):** **4.7.2.1.2**

Parameter	Value
Channel Availability Check Time (CACT)	60s

**Test Procedure:** 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  $T_0$ . 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:** 06/05/09

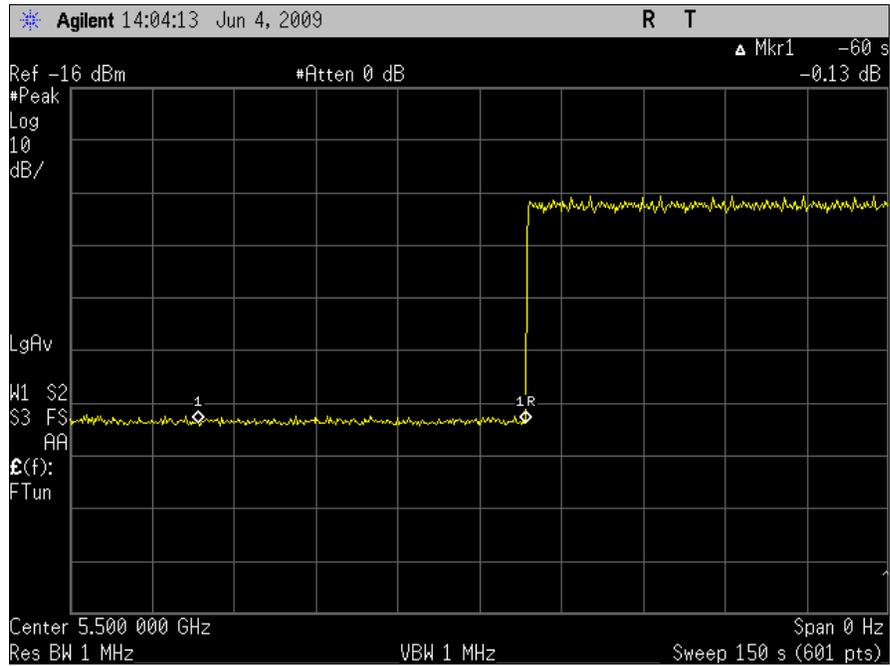
EUT Frequency - 5500 MHz using Bin # 1			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
Trial	Detection	Trial	Detection
1	1	11	1
2	1	12	1
3	1	13	1
4	1	14	1
5	1	15	1
6	1	16	1
7	1	17	1
8	1	18	1
9	1	19	1
10	1	20	1
Detection Probability			100%

**Table 18. CACT Results**

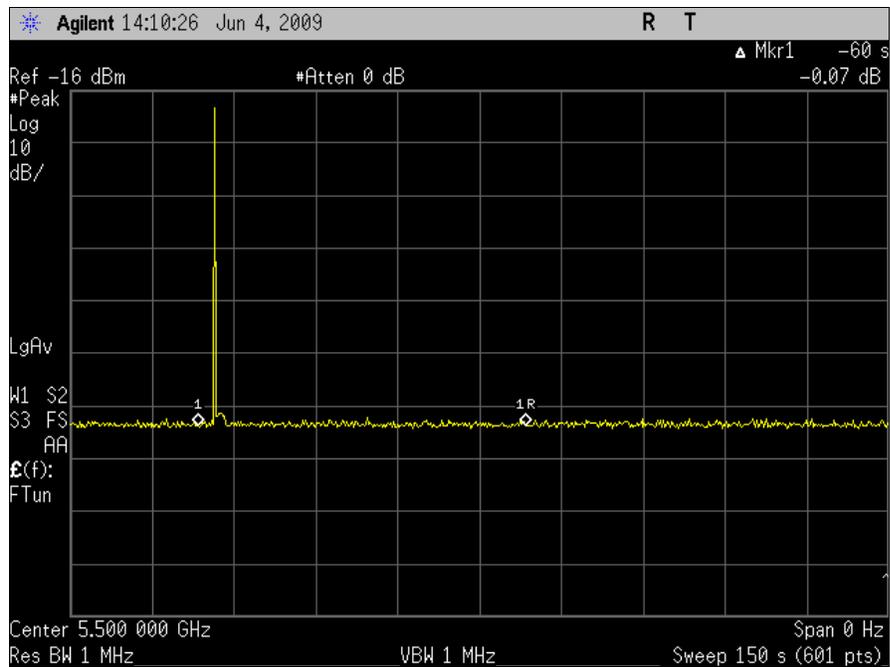
Radar Type	Trial	Pulse Width	PRF	PRF	PRF	Detection
	#	(usec)	(pps)	(pps)	(pps)	1 = Yes, 0 = No
1	1	0.8	200			1
2	2	0.8	1500			1
5	3	2.0	360	380	400	1
6	4	1.0	640	880		1
1	5	0.8	300			1
2	6	15.0	1600			1
5	7	1.0	300	330	375	1
6	8	0.8	720	960	1200	1
1	9	5.0	300			1
2	10	2.0	300			1
5	11	2.0	360	380		1
6	12	0.8	400	640		1
1	13	1.0	1000			1
2	14	2.0	1000			1
5	15	1.0	300	320	340	1
6	16	1.0	720	800		1
1	17	0.8	100			1
2	18	10.0	1600			1
5	19	2.0	330	380	400	1
6	20	2.0	800	1040		1
Detection Probability						100%

**Table 19. Weather CACT Results**

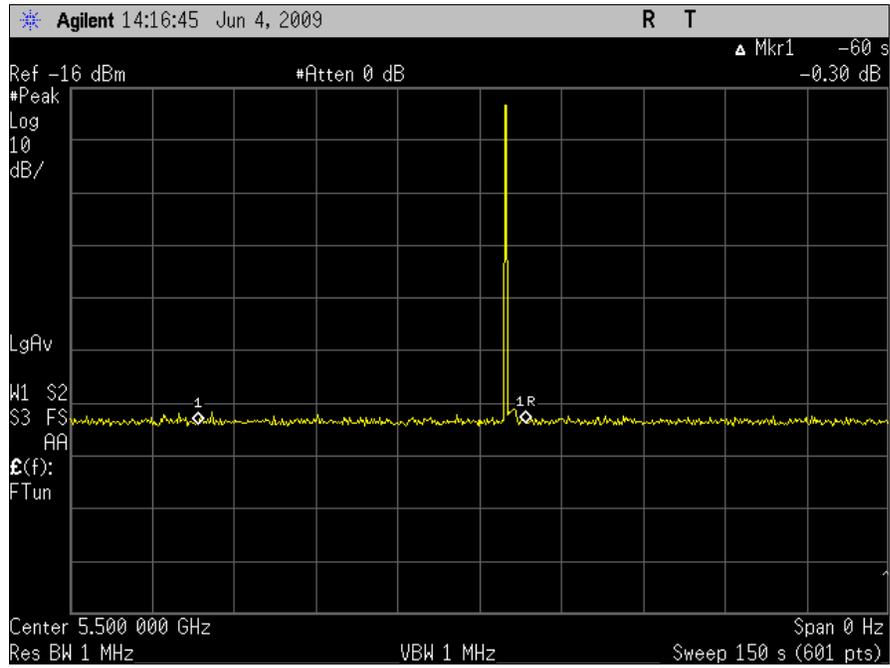
Note: CAC probability test for Ubiquiti M5, tested at 5620 MHz on 6/4/09.



**Plot 171. Channel Availability Check Time (CACT), Boot-Up**



**Plot 172. Burst at Beginning of CACT**



**Plot 173. Burst at End of CACT**

### **4.7.2.2 Off Channel CAC**

**Test Requirement(s):** ETSI EN 301 893 V1.5.1, 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.

**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 V1.5.1, 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 limits used for this section are the **Interference Threshold Values and the Detection Probability tables** in section 4.7.2 of this report

Antenna Gain	Value
10 dBi	-64 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 Soungpanya

**Test Date:** 06/05/09

<b>EUT Frequency - 5500 MHz using Bin # 1</b>			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
<b>Trial</b>	<b>Detection</b>	<b>Trial</b>	<b>Detection</b>
1	1	11	1
2	1	12	1
3	1	13	1
4	1	14	1
5	1	15	1
6	1	16	0
7	1	17	1
8	1	18	0
9	1	19	0
10	1	20	1
Detection Probability			85%

**Table 20. In Service Monitoring Bin 1 Results, 5500 MHz**

<b>EUT Frequency - 5500 MHz using Bin # 2</b>			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
<b>Trial</b>	<b>Detection</b>	<b>Trial</b>	<b>Detection</b>
1	1	11	0
2	1	12	1
3	0	13	1
4	0	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			85%

**Table 21. In Service Monitoring Bin 2 Results, 5500 MHz**

<b>EUT Frequency - 5500 MHz using Bin # 3</b>			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
<b>Trial</b>	<b>Trial</b>	<b>Trial</b>	<b>Trial</b>
1	1	11	0
2	1	12	0
3	1	13	1
4	0	14	0
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			80%

**Table 22. In Service Monitoring Bin 3 Results, 5500 MHz**

<b>EUT Frequency - 5500 MHz using Bin # 4</b>			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
<b>Trial</b>	<b>Trial</b>	<b>Trial</b>	<b>Trial</b>
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	0	19	1
10	1	20	1
Detection Probability			95%

**Table 23. In Service Monitoring Bin 4 Results, 5500 MHz**

<b>EUT Frequency - 5500 MHz using Bin # 5</b>			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
<b>Trial</b>	<b>Trial</b>	<b>Trial</b>	<b>Trial</b>
1	1	11	1
2	1	12	1
3	1	13	1
4	1	14	1
5	0	15	1
6	0	16	1
7	1	17	1
8	1	18	0
9	0	19	1
10	1	20	0
Detection Probability			75%

**Table 24. In Service Monitoring Bin 5 Results, 5500 MHz**

<b>EUT Frequency - 5500 MHz using Bin # 6</b>			
DFS Detection Trials (1 = Detection, 0 = No Detection)			
<b>Trial</b>	<b>Trial</b>	<b>Trial</b>	<b>Trial</b>
1	1	11	1
2	1	12	1
3	0	13	1
4	1	14	1
5	1	15	0
6	1	16	1
7	1	17	0
8	1	18	1
9	1	19	1
10	0	20	1
Detection Probability			80%

**Table 25. In Service Monitoring Bin 6 Results, 5500 MHz**

### **4.7.2.4 Channel Shutdown and 4.7.2.5 Non-Occupancy Period**

**Test Requirement(s):** ETSI EN 301 893 V1.5.1, 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*.

**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

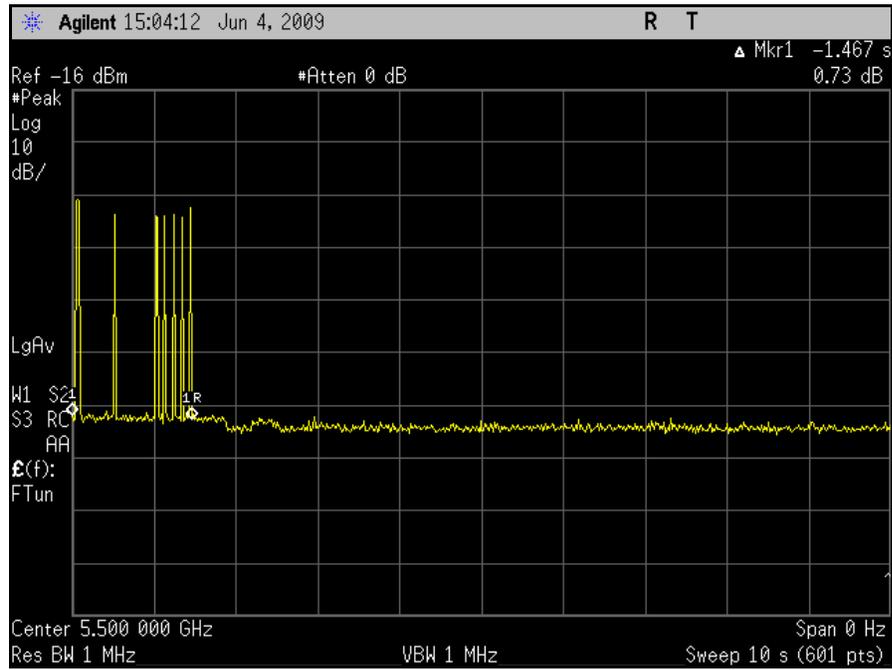
**Test Procedure:** The EUT was connected as in Figure #2. The channel selection mechanism for the Uniform Spreading requirement is disabled on the master.

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  $T_0$ . The time  $T_1 - T_0$  was recorded as the duration of the radar burst. At the end of time  $T_1$  the EUT was monitored for a period  $\geq 10$ s 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.

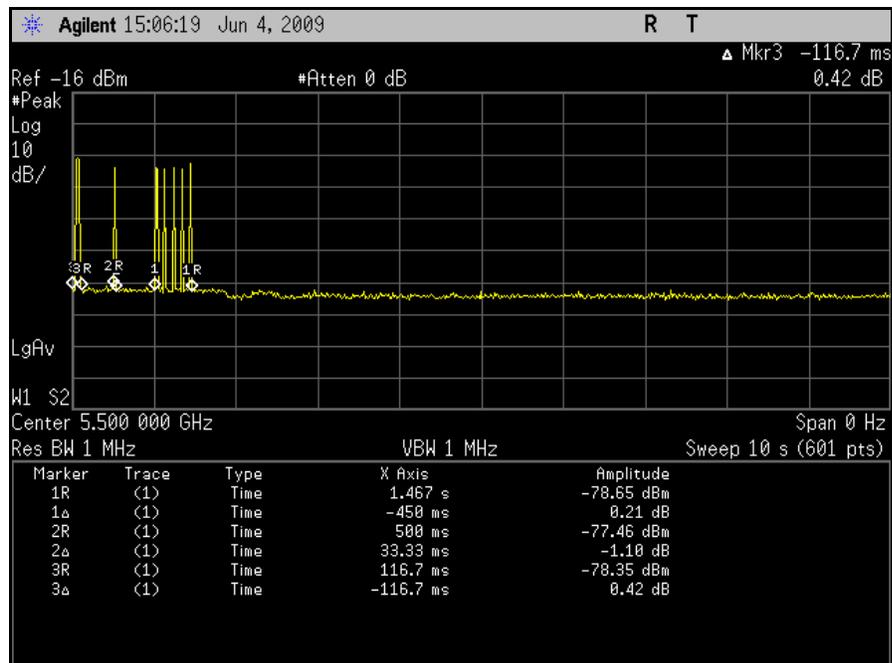
**Test Results:** The master EUT did detect the presence of the Radar Signal and did close the channel in the appropriate time allowed and did not resume communication on that channel until 30 minutes had transpired.

**Test Engineer:** Anderson Soungpanya

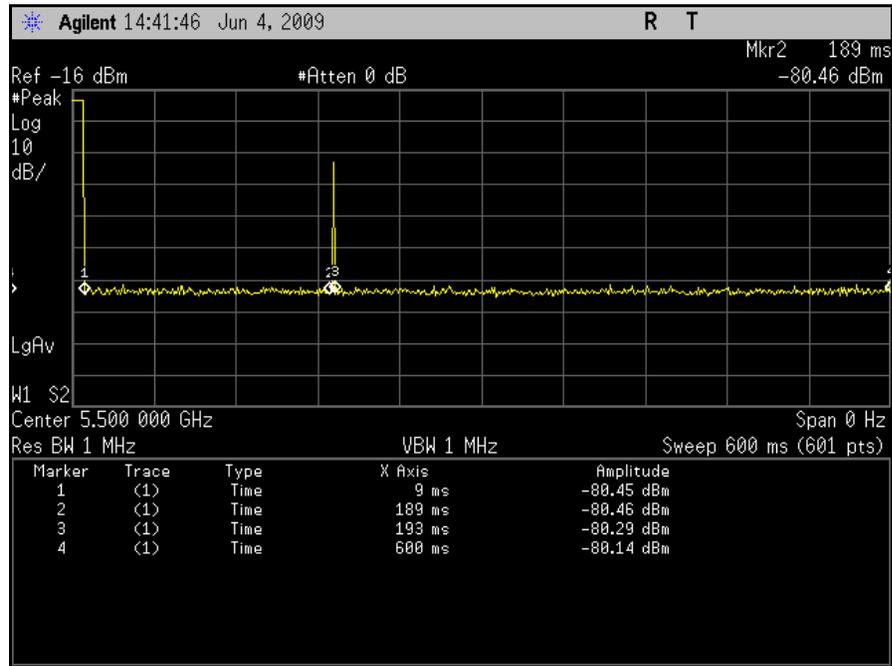
**Test Date(s):** 06/05/09



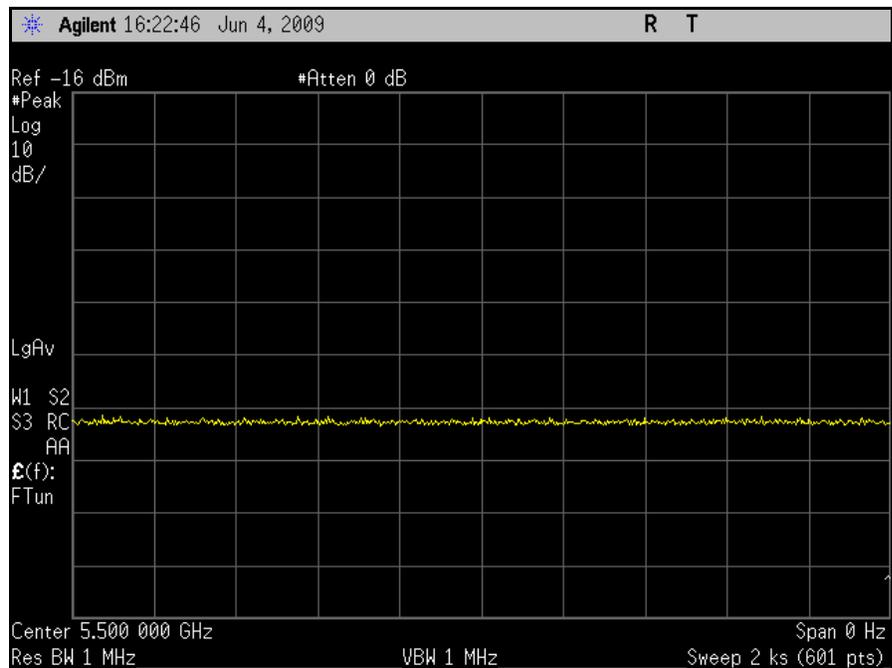
Plot 174. Channel Closing Time in a 10 sec Move Time



Plot 175. Channel Closing Time in a 10 sec Move Time (Markers)



**Plot 176. Channel Closing Time in a 200 ms Time Frame**



**Plot 177. 30 Minute Non-Occupancy**



## 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
1S2484	BILOG ANTENNA	TESEQ	CBL6112D	1/21/2009	1/21/2010
1S2121	PREAMP	HEWLETT PACKARD	8449B	10/26/2008	10/26/2009
1S2198	ANTENNA, HORN	EMCO	3115	08/31/2008	08/31/2009
1S2202	ANTENNA, HORN, 1 METER	EMCO	3116	04/10/2007	04/10/2010
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2482	SHIELDED TEST CHAMBER	PANASHIELD	5 METER SEMI-ANECHOIC CHAMBER	11/18/2007	11/18/2009
1S2041	COUPLER, BI DIRECTIONAL COAXIAL	NARDA	N/A	SEE NOTE	
1S2583	ANALYZER, SPECTRUM 3HZ-42.98GHZ	AGILENT	E4447A	7/12/2009	7/12/2010
1S2034	COUPLER, DIRECTIONAL 1-20 GHZ	KRYTAR	101020020	SEE NOTE	
1S2041	COUPLER, BI DIRECTIONAL COAXIAL	NARDA	N/A	SEE NOTE	

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



Description	Manufacturer	Model	Serial No.	Cal date	Cal due
LAPTOP COMPUTER	DELL	INSPIRON 630M	4WVH891	SEE NOTE	
MXI-EXPRESS CONTROLLER	NATIONAL INSTRUMENTS	PXI-8360	N/A	SEE NOTE	
ARBITRARY WAVEFORM GENERATOR 16-BIT 100 MS/S	NATIONAL INSTRUMENTS	PXI-5421	N/A	SEE NOTE	
RF UPCONVERTER 250 KHZ TO 2.7 GHZ	NATIONAL INSTRUMENTS	PXI-5610	N/A	SEE NOTE	
RF UPCONVERTER 4.9 TO 6 GHZ	ASCOR	7206	N/A	SEE NOTE	
ANALYZER, SPECTRUM 3HZ-42.98GHZ	AGILENT	E4447A	MY48250027	7/12/2009	7/12/2010
PRE-AMPLIFIER 30 DB 1 TO 26.5 GHZ	HEWLETT-PACKARD	8449B	3008A01981	SEE NOTE	
POWER SPLITTER 2.95 TO 7.1 GHZ	MINI-CIRCUITS	ZX10-2-71	N/A	SEE NOTE	
ATTENUATOR 10 DB DC TO 18 GHZ	PASTERNAK ENTERPRISES	PE7005-10	N/A	SEE NOTE	
ATTENUATOR 30 DB DC TO 18 GHZ	PASTERNAK ENTERPRISES	PE7005-30	N/A	SEE NOTE	

### DFS Equipment List

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

**End of Report**