TEST REPORT

Report Number: 3160445MPK-002
Project Number: 3160445
September 30, 2008

Testing performed on the
802.11a/b/g/n Access Point
Model Number: XP3E6W

FCC ID: Q6G-XP3E6W
IC ID: 4657A-XP3E6W

to
FCC Part 15, Subpart E
RSS-210 Annex 8

For

WatchGuard Technologies, Inc.

Test Performed by:	Test Authorized by:
Intertek Testing Services	WatchGuard Technologies Inc.
1365 Adams Court	505 5th Ave.S. Suite 500
Menlo Park, CA 94025	Seattle, WA 98104 USA

Prepared by: David Chernomordik Date: September 30, 2008
David Chernomordik, EMC Technical Manager

Reviewed by: Ollie Moyrong Date: September 30, 2008
Ollie Moyrong, Engineering Manager

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1.0 Introduction

1.1 Summary of Tests

Test	Reference FCC	Reference RSS-210	Result
Output power	15.407(a)(2)	A9.2(1)	Complies
26 dB/Occupied Bandwidth	15.407(a)(2)	A9.2(1)	
Peak power spectral density	15.407(a)(2)	A9.2(1)	Complies
Out-of-band Antenna Conducted Emission	15.407(b)(3)	A9.3(1)	Complies
Peak excursion	15.407(a)(6)	-	Complies
Radiated Emission above 1 GHz	15.209, 15.205	A9.3(1)	Complies
Radiated Emission below 1 GHz	15.209	A9.3(1)	Complies
AC Line-conducted Emission	15.207		Complies
Frequency stability	15.407(g)	A9.5(5)	Complies
RF Exposure Requirement	2.1091	RSS-102	Complies, see exhibit “RF Exposure”
Antenna Requirement	15.203		Complies. Unique antenna connector is used

EUT receive date: September 4, 2008

EUT receive condition: The EUT was received in good condition with no apparent damage.

Test start date: September 8, 2008

Test completion date: September 30, 2008

The test results in this report pertain only to the item tested.

2.0 General Description

2.1 Product Description

The Equipment under Test (EUT) is an 802.11a/b/g/n Access Point operating in 2.4 GHz, 5.2 GHz, and 5.8 GHz bands. The EUT supports a wide range of data rates:

from 1 Mbps to 11 Mbps in 802.11b mode
from 6 Mbps to 54 Mbps in 802.11g mode
from 6 Mbps to 54 Mbps in 802.11a mode
from 6.5 Mbps to 130 Mbps in 802.11n HT20 mode
from 13.5 Mbps to 270 Mbps in 802.11n HT40 mode

Note: in 802.11n HT20 an 802.11n HT40 modes the nominal bandwidth is 20 MHz and 40 MHz respectively.

The EUT incorporates a MIMO function and contains three complete transmitters (Tx), receivers (Rx) and antennas.

The information about the radio, installed in the model XP3E6W, is presented below.

Applicant	WatchGuard Technologies Inc.
Model No.	XP3E6W
FCC Identifier	FCC ID: Q6G-XP3E6W
IC Identifier	IC ID: 4657A-XP3E6W
Use of Product	802.11a/b/g/n Access Point
Modulation Technique	DSSS, OFDM
Rated RF Output	500 mW (peak)
Frequency Range	2.4 GHz band: 2400 – 2483.5 MHz, 5 GHz band: 5150 – 5250 MHz 5725 – 5850 MHz
Type of modulation	DSSS: DBPSK, DQPSK, CCK OFDM: BPSK, QPSK, 16QAM, 64QAM
Number of Channel(s)	2.4 GHz band: 11 – in 802.11b/g and 802.11n HT20 modes 7 – in 802.11n HT40 mode 5 GHz band: 9 – in 802.11a and 802.11n HT20 modes 4 – in 802.11n HT40 mode
Antenna(s) & Gain,	Omni-directional. Operating frequencies: 2.4 – 2.5 GHz and 4.9 – 5.825 GHz Peak gain: 2.0 dBi typ. Reverse SMA connector.
Manufacturer Name & Address	WatchGuard Technologies, Inc. 505 5th Ave.S. Suite 500 Seattle, WA 98104 USA

The EUT supports the following configurations:

	2400 – 2483.5 MHz		5150 – 5250 MHz		5725 – 5850 MHz	
	1 Tx	3 Tx	1 Tx	3 Tx	1 Tx	3 Tx
802.11a			√		√	
802.11b	√					
802.11g	√					
802.11n HT20		√		√		√
802.11n HT40		√		√		√

List of channels:
√ - available
X - tested

Channels in 2.4 GHz band					
Number	Frequency, MHz	b/g/n HT20 mode		n HT40 mode	
1	2412	√	X		
2	2417	√			
3	2422	√		√	X
4	2427	√		√	
5	2432	√		√	
6	2437	√	X	√	X
7	2442	√		√	
8	2447	√		√	
9	2452	√		√	X
10	2457	√			
11	2462	√	X		

Channels in 5.2 GHz band					
Number	Frequency, MHz	a/n HT20 mode		n HT40 mode	
36	5180	√	X		
40	5200	√	X	√	X
44	5220	√	X	√	X
48	5240	√	X		

Channels in 5.8 GHz band					
Number	Frequency, MHz	a/n HT20 mode		n HT40 mode	
149	5745	√	X		
153	5765	√		√	X
157	5785	√	X	√	X
161	5805	√		√	X
165	5825	√	X		

Note: Testing of 2.4 GHz and 5.8 GHz bands is addressed in a separate report, 3160445MPK-001.

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Both conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Sheet"** of this Application. All other measurements were made in accordance with the procedures in parts 2 and 15 of CFR 47.

2.4 Test Facility

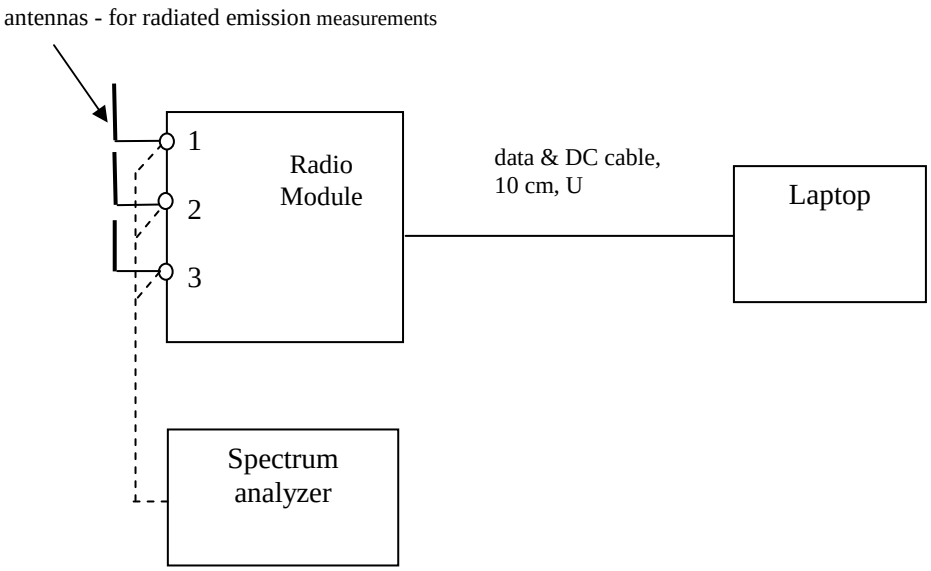
The test site and conducted measurement facility used to collect the radiated data is site 1, a10 meter semi-anechoic chamber. This test facility and site measurement data have been fully placed on file with the FCC and A2LA accredited.

3.0 System Test Configuration

3.1 Support Equipment

Description	Model No.	Serial No.
Toshiba Laptop	Tesra 8200	51213458PU

3.2 Block Diagram of Test Setup



S = Shielded	**F** = With Ferrite
U = Unshielded	**m** = Meter

3.3 Justification

Preliminary testing was performed for all modulation/data rate modes. The following modes, in which the highest power was detected, were selected for final measurements:

Frequency MHz	Standard	Date rate Mbps
5180	802.11a	6
	802.11n HT20	6.5
5200	802.11a	6
	802.11n HT20	6.5
	802.11n HT40	13.5
5220	802.11a	6
	802.11n HT20	6.5
	802.11n HT40	13.5
5240	802.11a	6
	802.11n HT20	6.5

3.4 Mode of Operation During Test

During testing, the transmitter was setup to transmit continuously at maximum RF power on low, middle and high channels.

3.5 Modifications required for Compliance

Intertek installed no modifications during compliance testing in order to bring the product into compliance. (Please note that this does not include changes made specifically by WatchGuard prior to compliance testing).

3.6 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 26-dB Bandwidth and Occupied Bandwidth

Procedure

The Procedure, described in the FCC Public Notice DA 02-2138, was used.

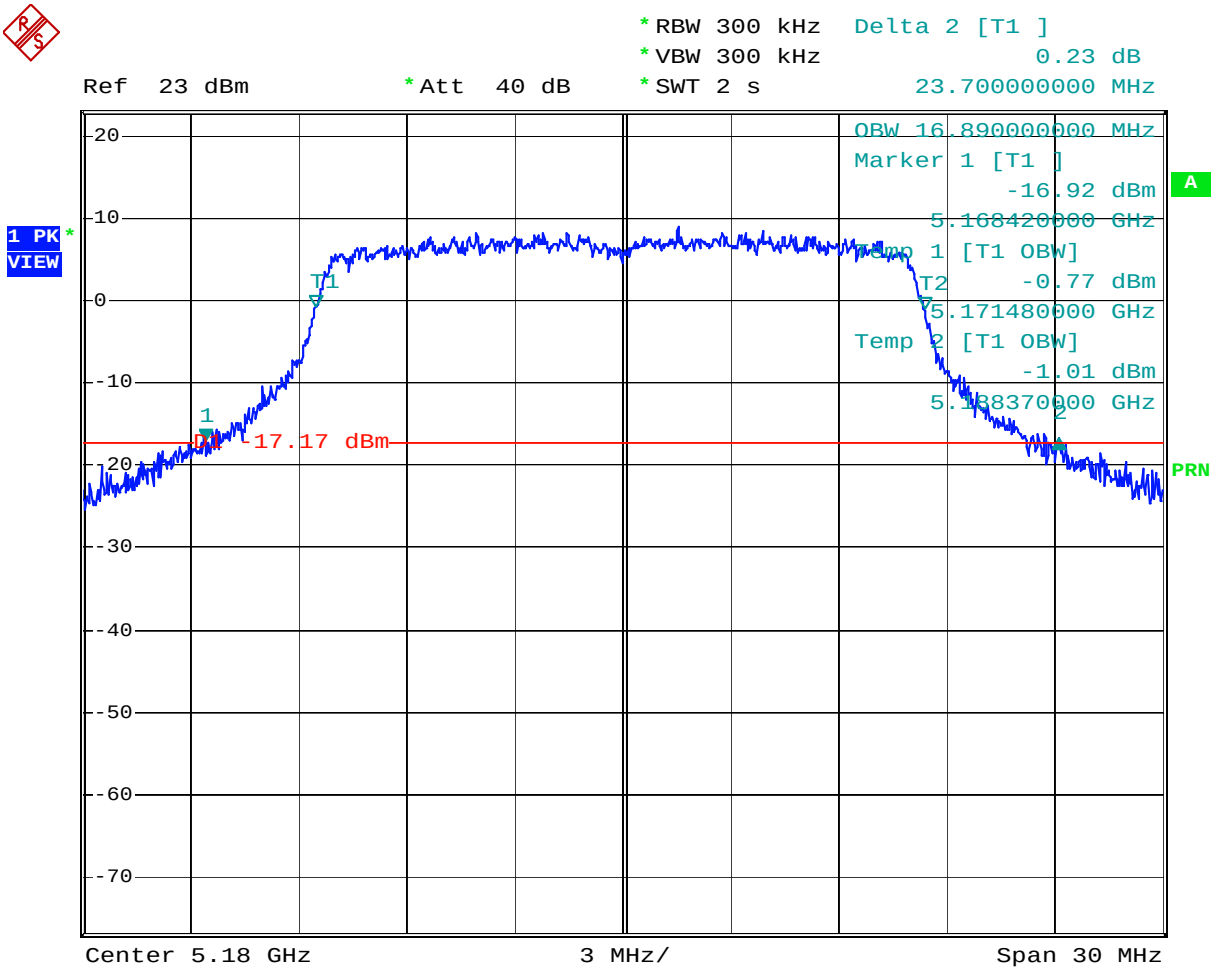
The antenna port of the EUT was connected to the input of a spectrum analyzer (SA). For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 26 dB lower than PEAK level. The 26-dB bandwidth was determined from where the channel output spectrum intersected the display line.

Test Result

Channel	Frequency MHz	Standard/ Data rate	26-dB Bandwidth, MHz	Occupied Bandwidth, MHz	Plot #
36	5180	802.11a 6 Mbps	23.7	16.9	1.1
		802.11n HT20 6.5 Mbps	24.3	18.0	1.2
40	5200	802.11a 6 Mbps	23.1	16.8	1.3
		802.11n HT20 6.5 Mbps	23.9	17.9	1.4
		802.11n HT40 13.5 Mbps	44.0	36.4	1.5
44	5220	802.11a 6 Mbps	23.2	16.8	1.6
		802.11n HT20 6.5 Mbps	24.1	17.9	1.7
		802.11n HT40 13.5 Mbps	44.8	36.4	1.8
48	5240	802.11a 6 Mbps	22.8	16.8	1.9
		802.11n HT20 6.5 Mbps	24.4	17.9	1.10

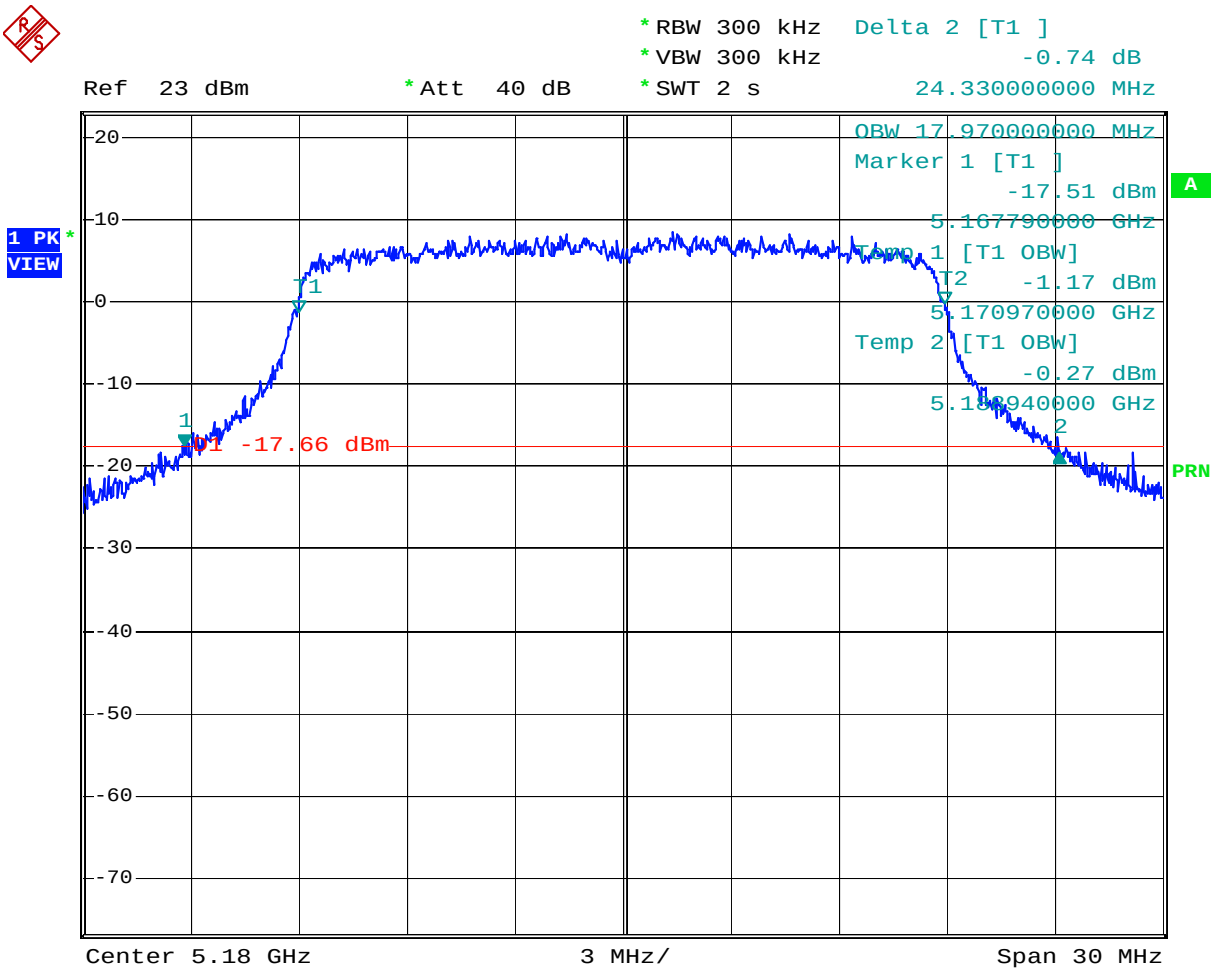
On the plots 1.1 – 1.10 the 26-dB bandwidth and Occupied Bandwidth are presented.

Plot 1.1



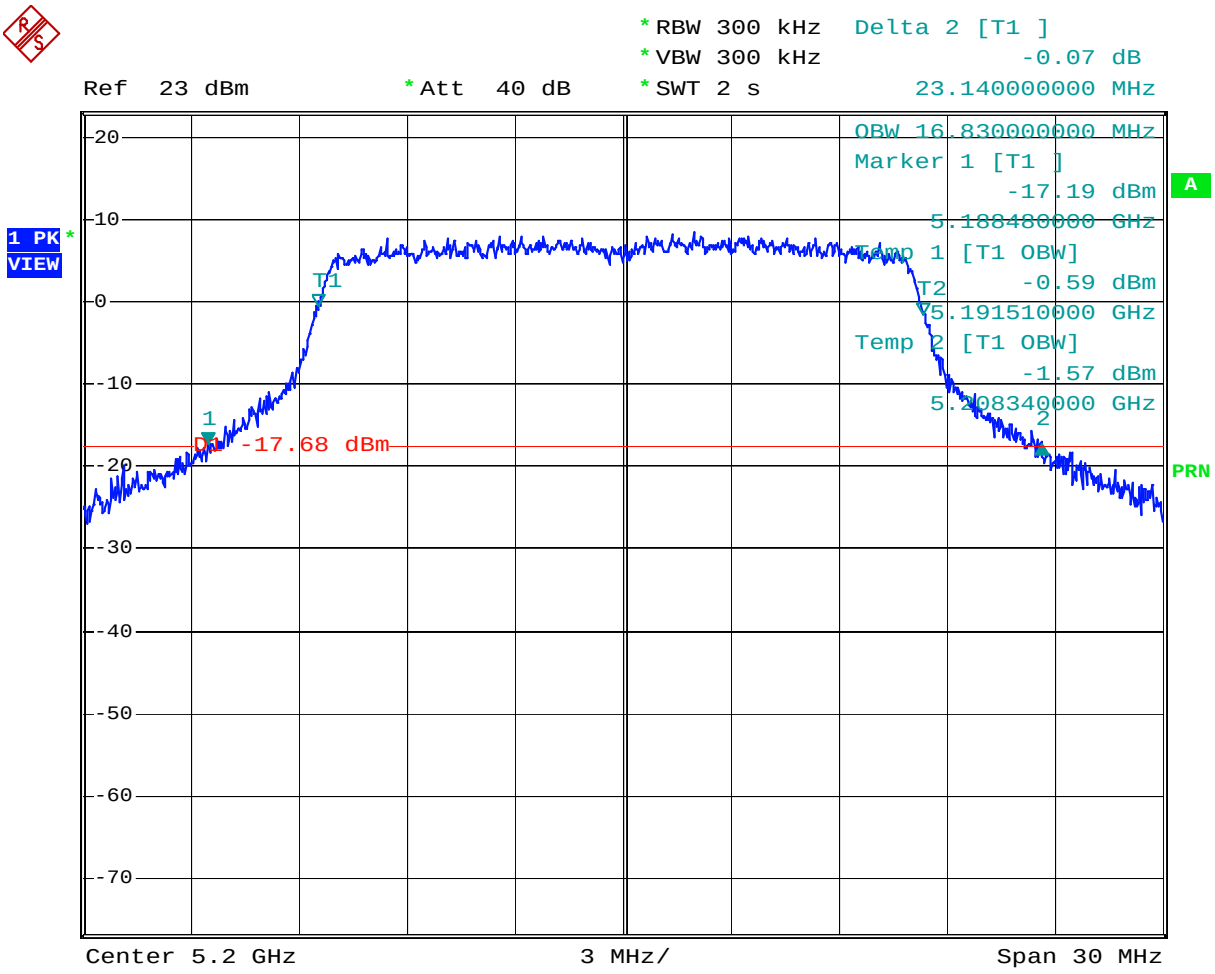
Comment: 26-dB bandwidth and OBW, 802.11a, 6 Mbps
Date: 10.SEP.2008 12:02:16

Plot 1.2



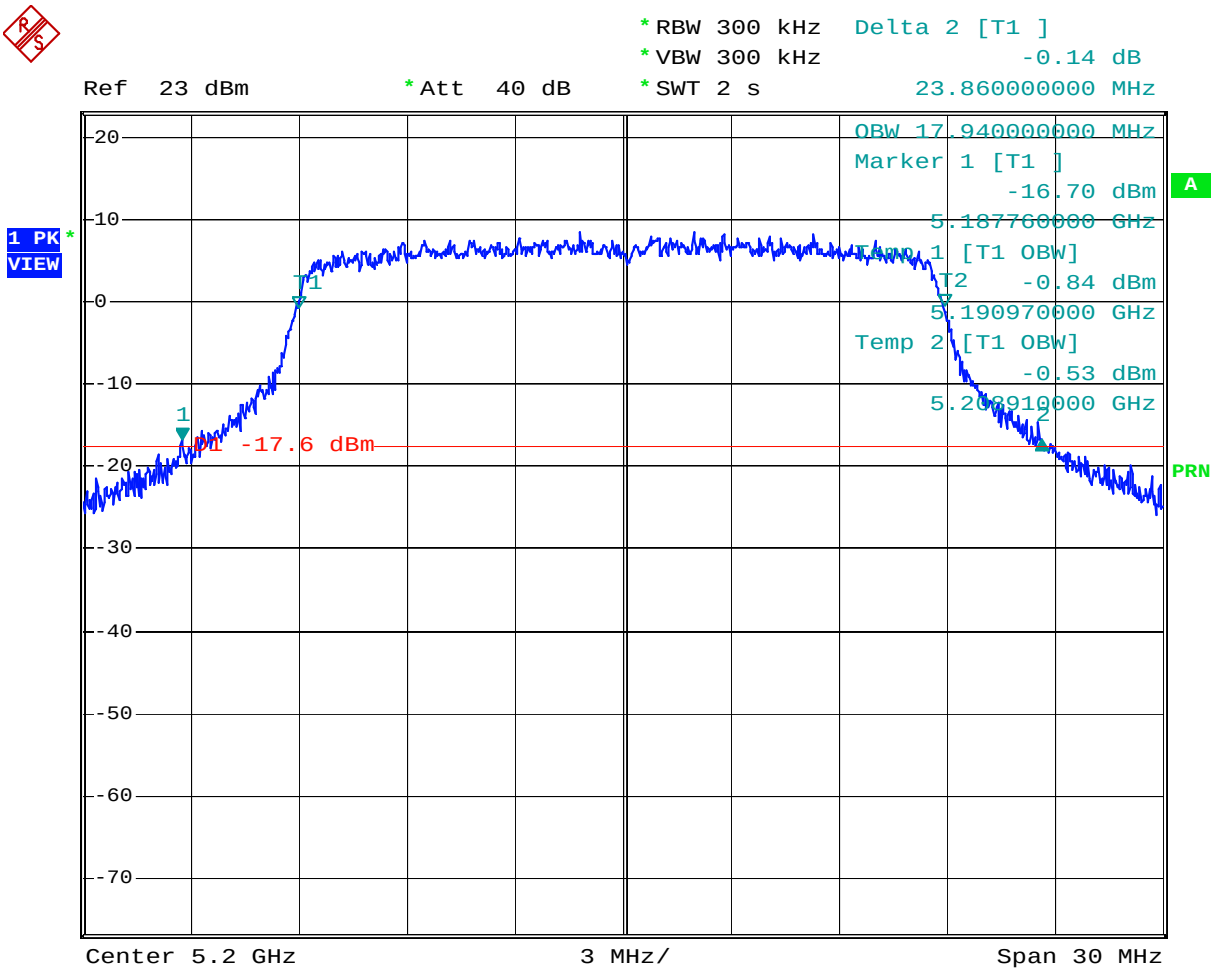
Comment: 26-dB bandwidth and OBW, 802.11n, HT20, 6.5 Mbps
Date: 9.SEP.2008 11:44:32

Plot 1.3



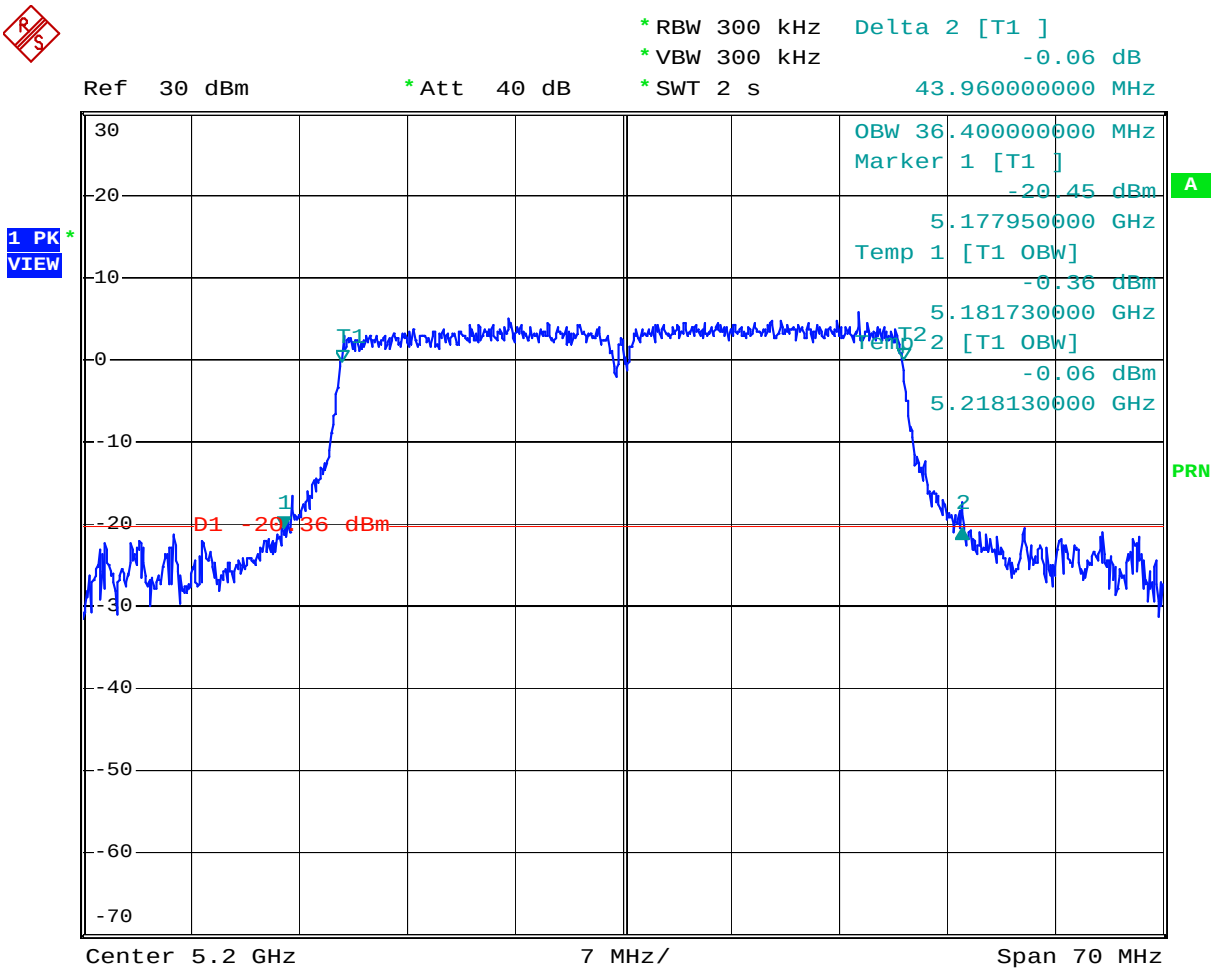
Comment: 26-dB bandwidth and OBW, 802.11a, 6 Mbps
Date: 10.SEP.2008 12:03:58

Plot 1.4



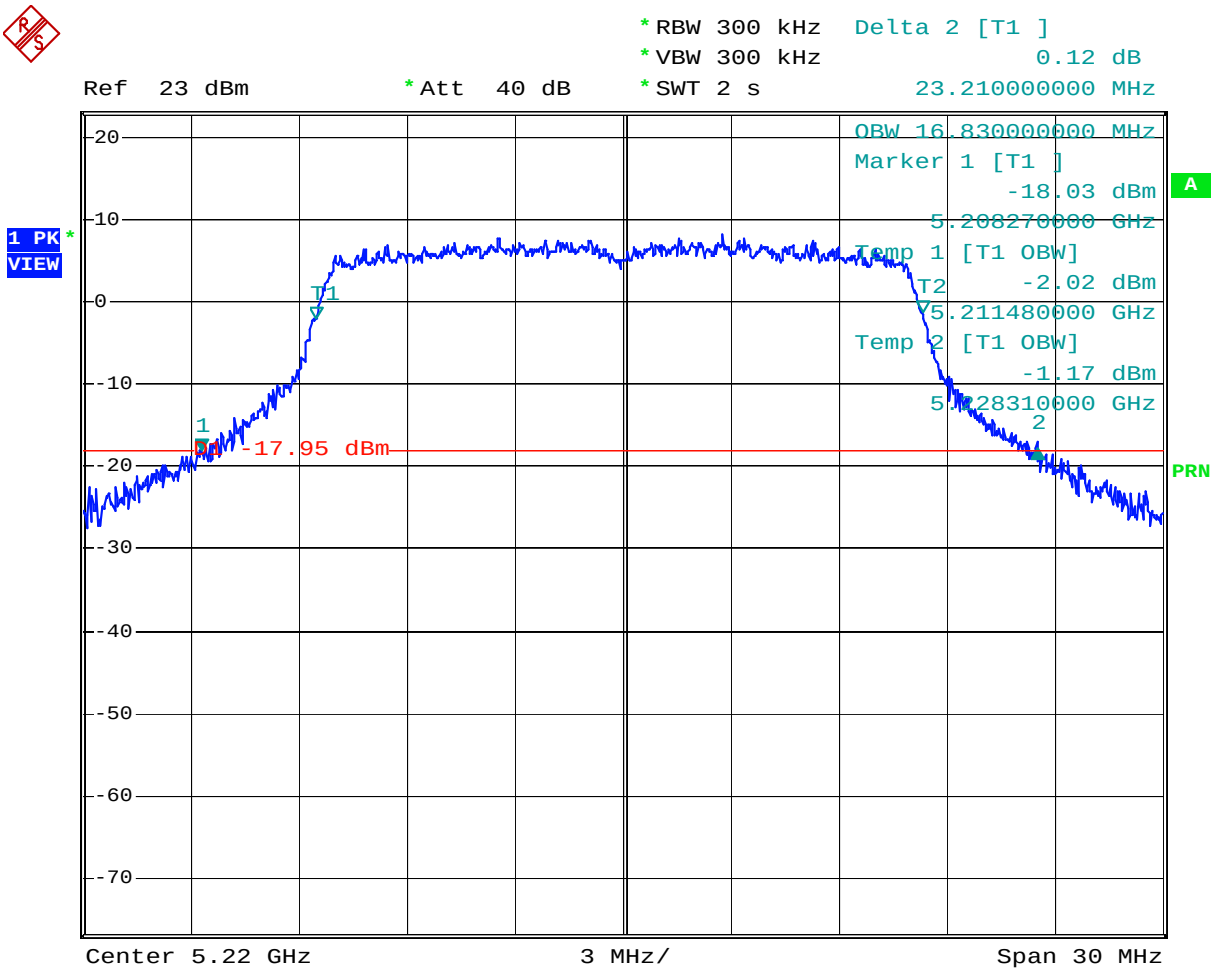
Comment: 26-dB bandwidth and OBW, 802.11n, HT20, 6.5 Mbps
Date: 9.SEP.2008 11:48:07

Plot 1.5



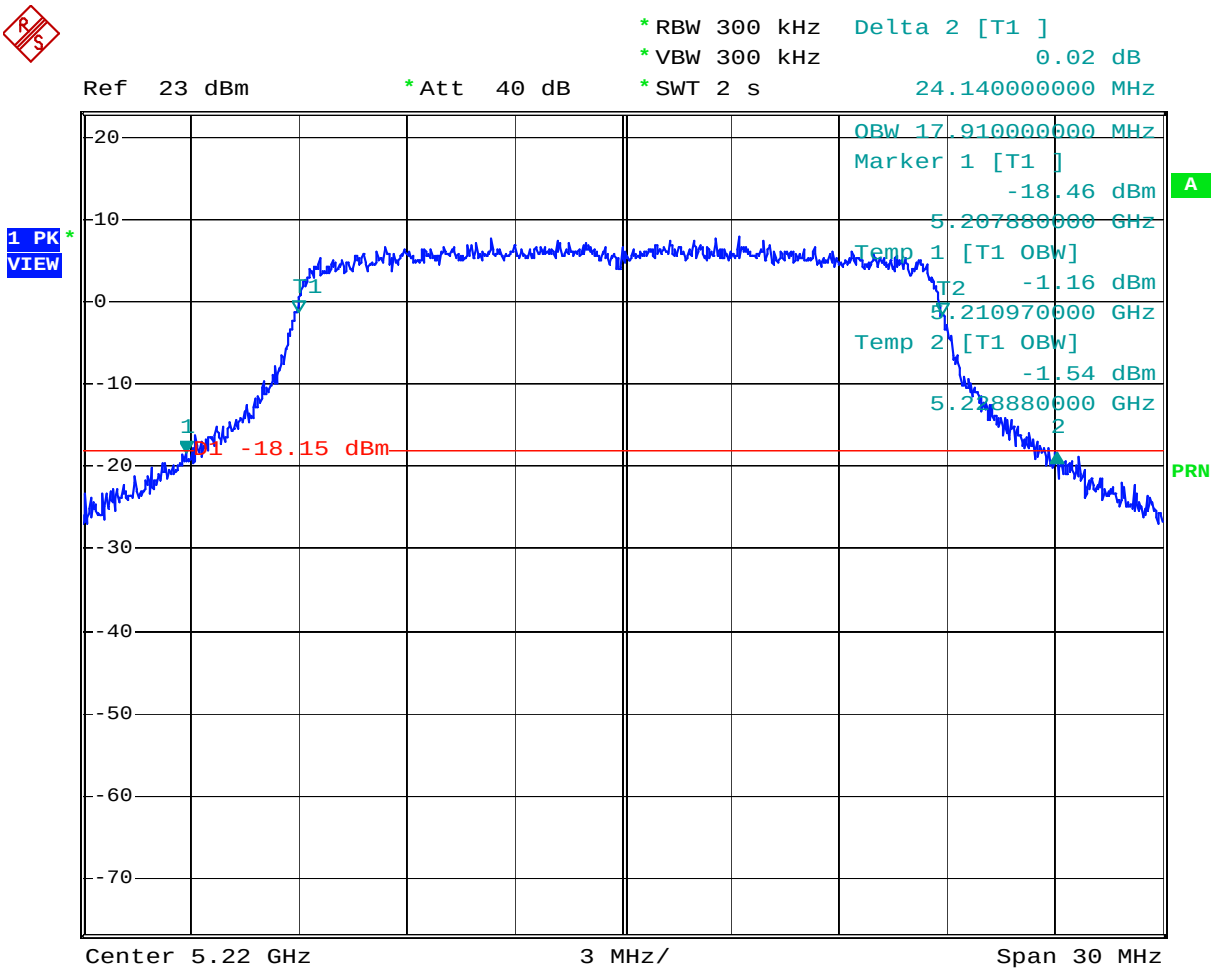
Comment: 26-dB bandwidth and OBW, 802.11n, HT40, 13.5 Mbps
Date: 10.SEP.2008 14:28:05

Plot 1.6



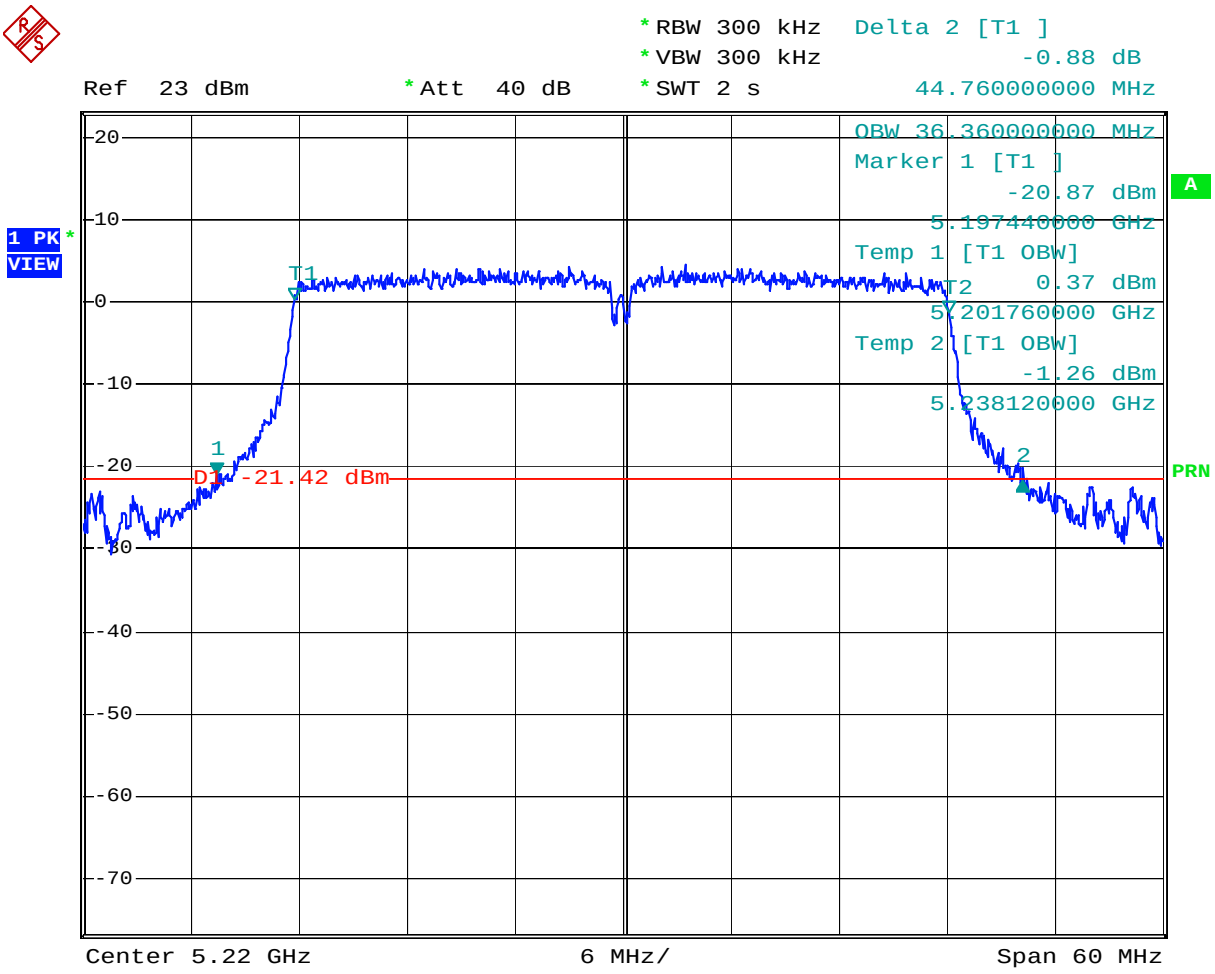
Comment: 26-dB bandwidth and OBW, 802.11a, 6 Mbps
Date: 10.SEP.2008 12:06:31

Plot 1.7



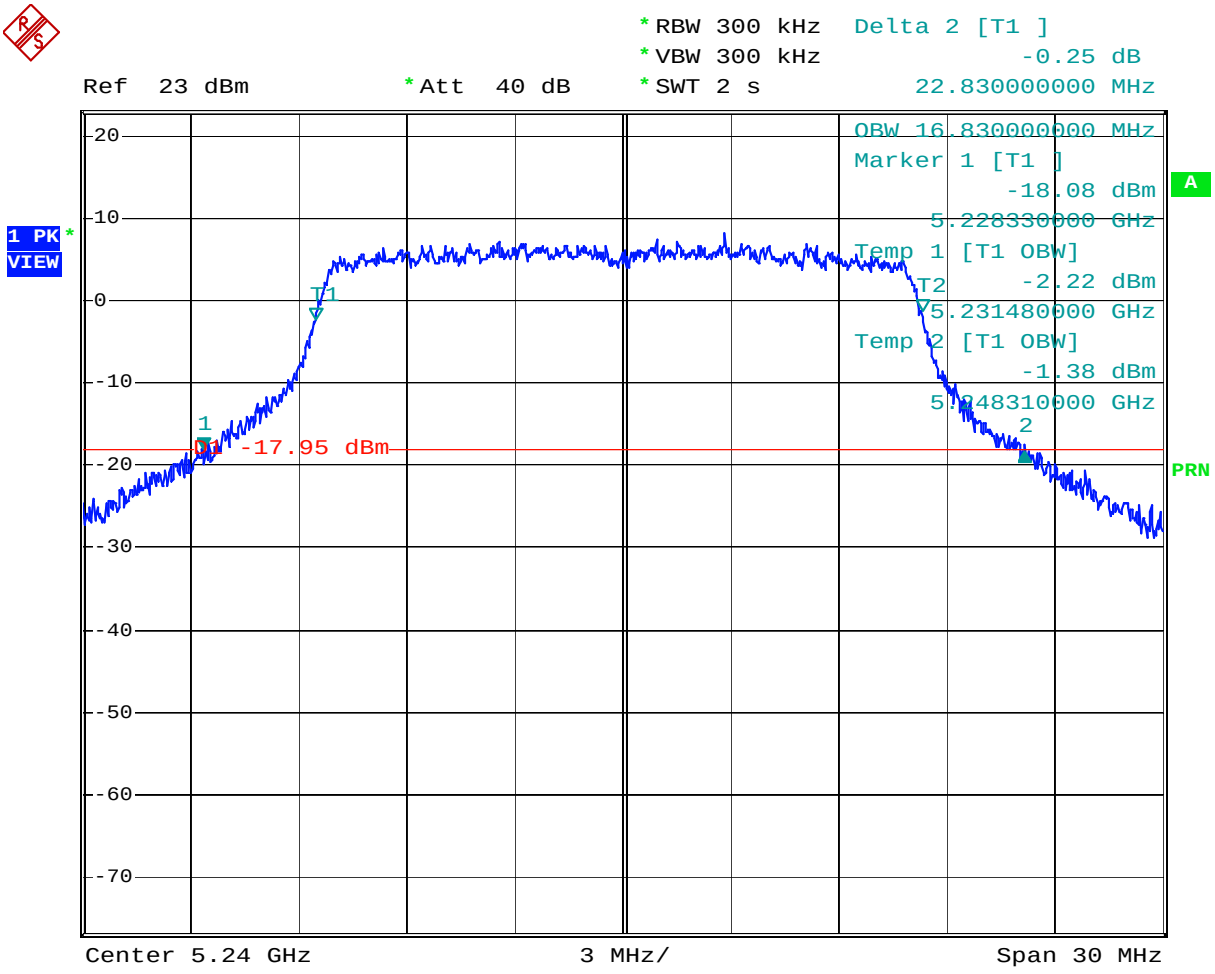
Comment: 26-dB bandwidth and OBW, 802.11n, HT20, 6.5 Mbps
Date: 9.SEP.2008 11:50:59

Plot 1.8



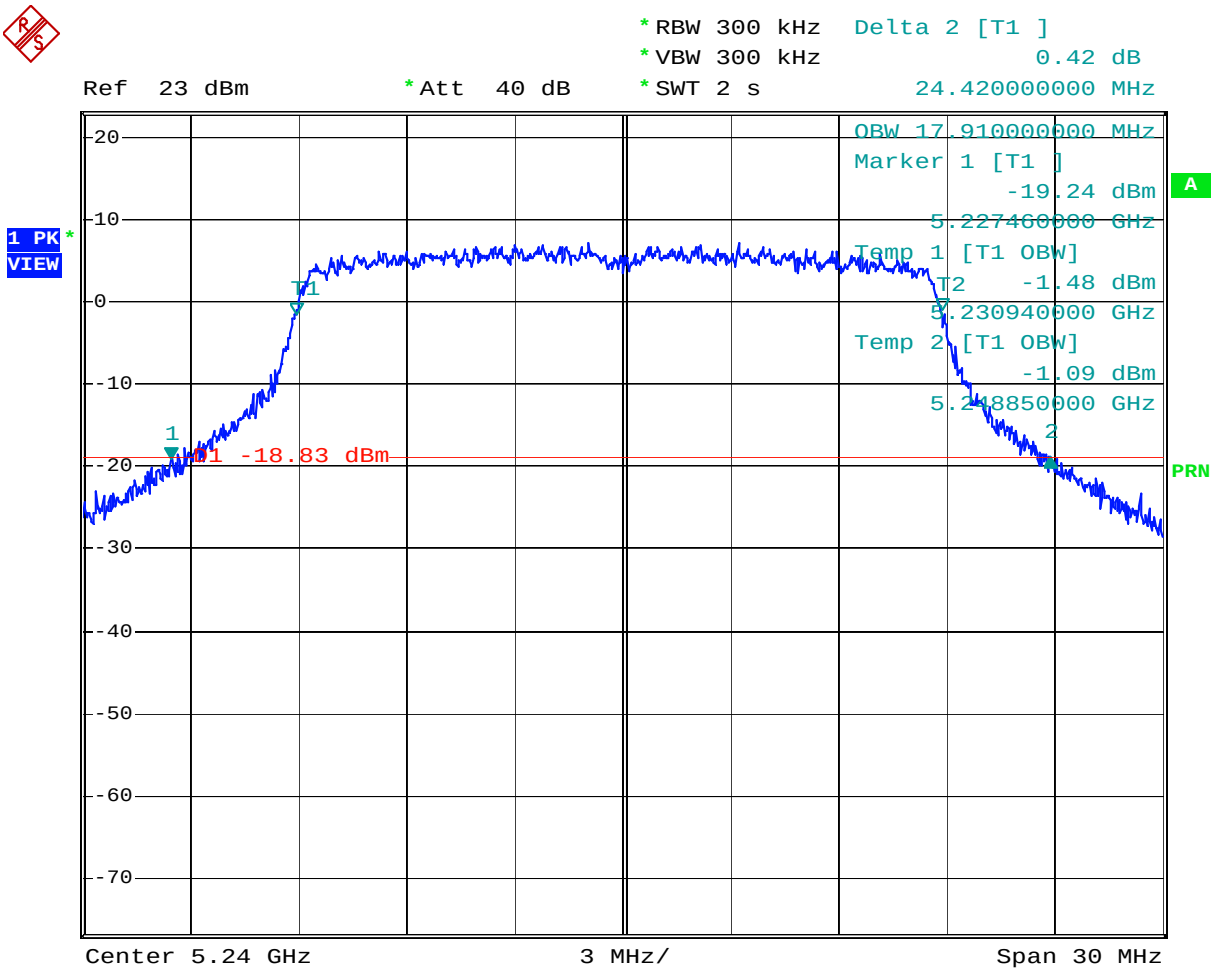
Comment: 26-dB bandwidth and OBW, 802.11n, HT40, 13.5 Mbps
Date: 10.SEP.2008 14:21:42

Plot 1.9



Comment: 26-dB bandwidth and OBW, 802.11a, 6 Mbps
Date: 10.SEP.2008 12:08:18

Plot 1.10



Comment: 26-dB bandwidth and OBW, 802.11n, HT20, 6.5 Mbps
Date: 9.SEP.2008 11:53:32

4.2 Conducted Output Power
FCC Rule: 15.407(a)(2)

Requirement

The maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or (4 dBm + 10Log B), where B is the 26-dB bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Procedure

The procedure described in the FCC Public Notice DA 02-2138 was used.

The antenna port of the EUT was connected to the input of a spectrum analyzer (SA).

Transmitter operates continuously therefore the Method #1 was selected for the measurement. A build-in SA channel power measurement facility with a sample detector and averaging 100 traces in power averaging mode (linear power terms) was used. The channel bandwidth was set to 26-dB bandwidth.

In 802.11n modes (3 Tx transmit simultaneously), the output power is summarized for all 3 transmitters.

Test Results

The test results are presented on the following plots 2.1 – 2.30 and summarized in the tables below.

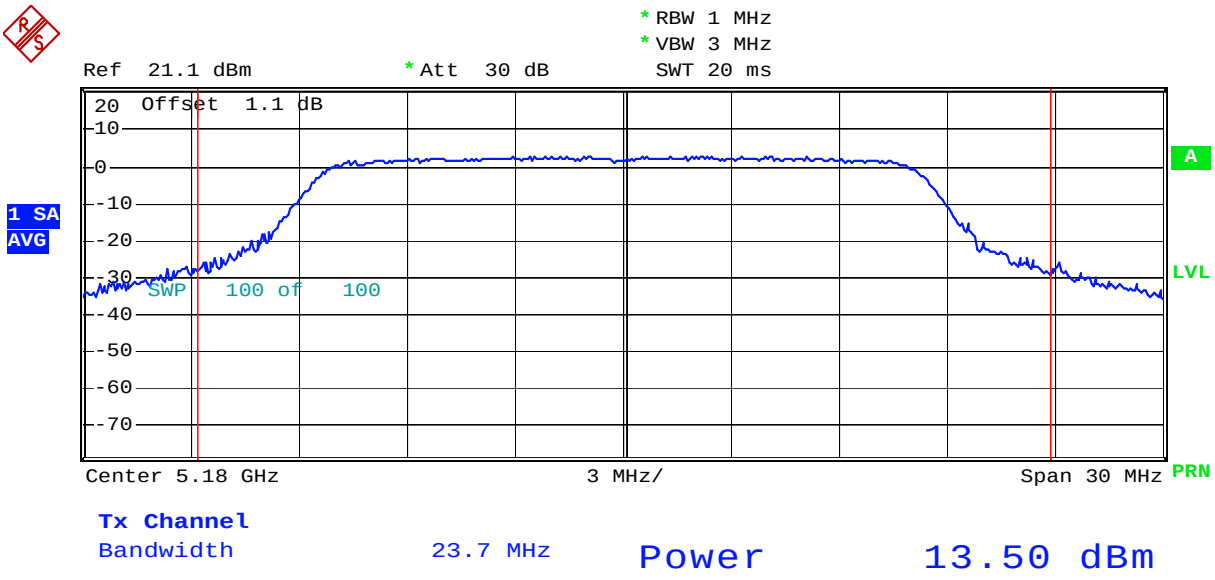
Note: to comply with radiated emission requirements in the restricted bands, the following power settings (ps) are used:

ps = 15 - in 802.11a mode
ps = 12 - in 802.11n HT20 and HT40 modes

Channel	Frequency MHz	Standard/ Data rate		Conducted power (average) dBm	Σ power mW	Σ power dBm	Conducted power Limit dBm	Margin dB
36	5180	802.11a 6 Mbps	Output 1	13.5	-	-	17	-2.4
			Output 2	14.6 *				
			Output 3	13.8				
36	5180	802.11n HT20 6.5 Mbps	Output 1	10.8	37.8	15.8	17	-1.2
			Output 2	11.7				
			Output 3	10.4				
40	5200	802.11a 6 Mbps	Output 1	13.5	-	-	17	-2.5
			Output 2	14.5 *				
			Output 3	13.8				
40	5200	802.11n HT20 6.5 Mbps	Output 1	10.1	33.5	15.3	17	-1.7
			Output 2	11.3				
			Output 3	9.9				
40	5200	802.11n HT40 13.5 Mbps	Output 1	11.0	38.0	15.8	17	-1.2
			Output 2	11.6				
			Output 3	10.4				
44	5220	802.11a 6 Mbps	Output 1	13.3	-	-	17	-2.6
			Output 2	14.4 *				
			Output 3	13.2				
44	5220	802.11n HT20 6.5 Mbps	Output 1	10.3	34.0	15.3	17	-1.7
			Output 2	11.3				
			Output 3	9.9				
44	5220	802.11n HT40 13.5 Mbps	Output 1	10.7	37.7	15.8	17	-1.2
			Output 2	11.6				
			Output 3	10.6				
48	5240	802.11a 6 Mbps	Output 1	12.8	-	-	17	-2.5
			Output 2	14.5 *				
			Output 3	13.4				
48	5240	802.11n HT20 6.5 Mbps	Output 1	9.4	31.3	15.0	17	-2.0
			Output 2	11.3				
			Output 3	9.6				

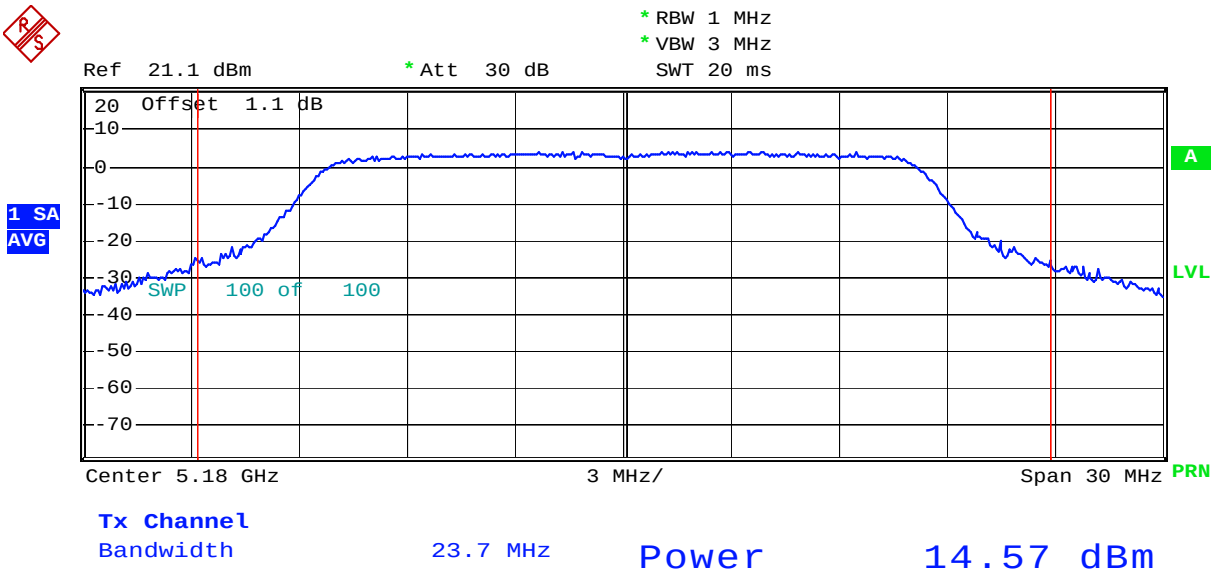
* The highest level to be compared to the limit

Plot 2.1



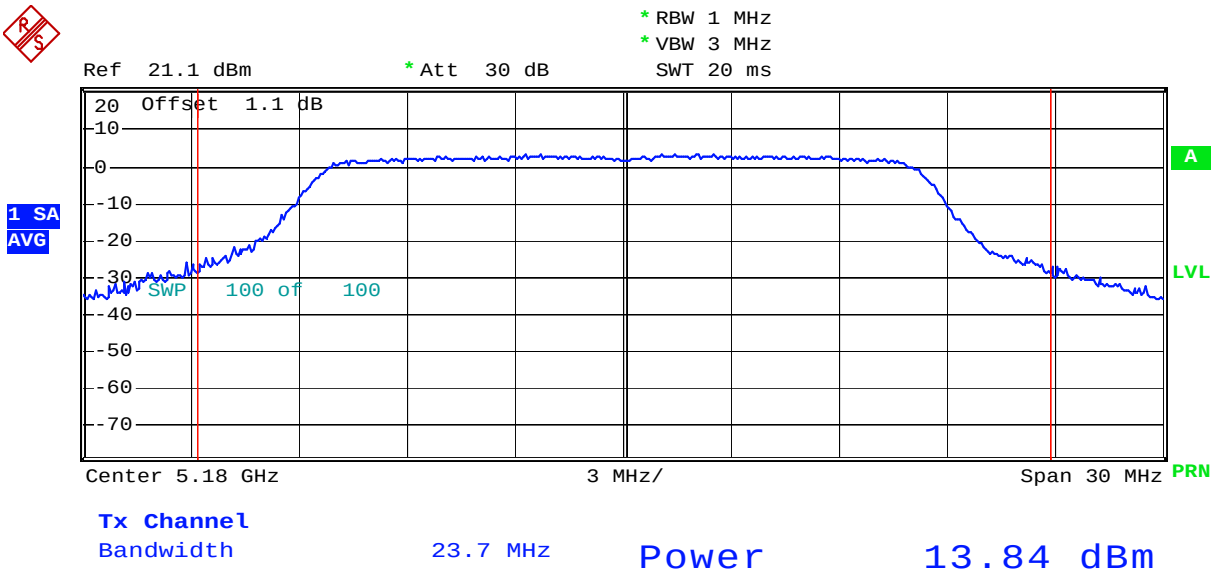
Comment: Channel power, 5180MHz, 802.11a, 6 Mbps, output 1
Date: 30.OCT.2008 16:38:40

Plot 2.2



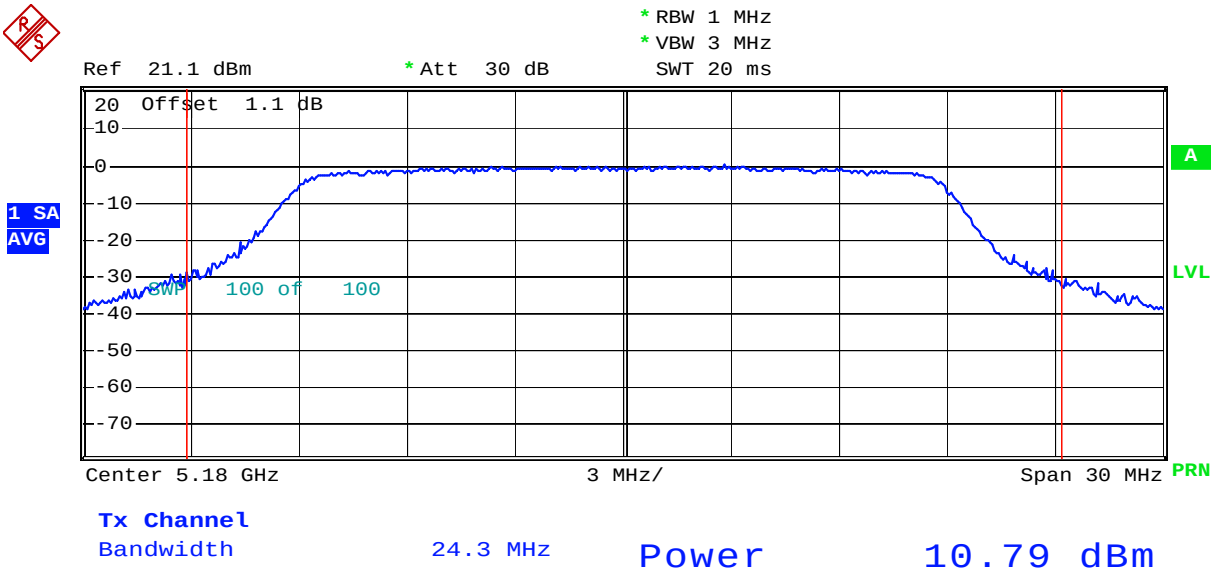
Comment: Channel power, 5180MHz, 802.11a, 6 Mbps, output 2
Date: 30.OCT.2008 16:29:39

Plot 2.3



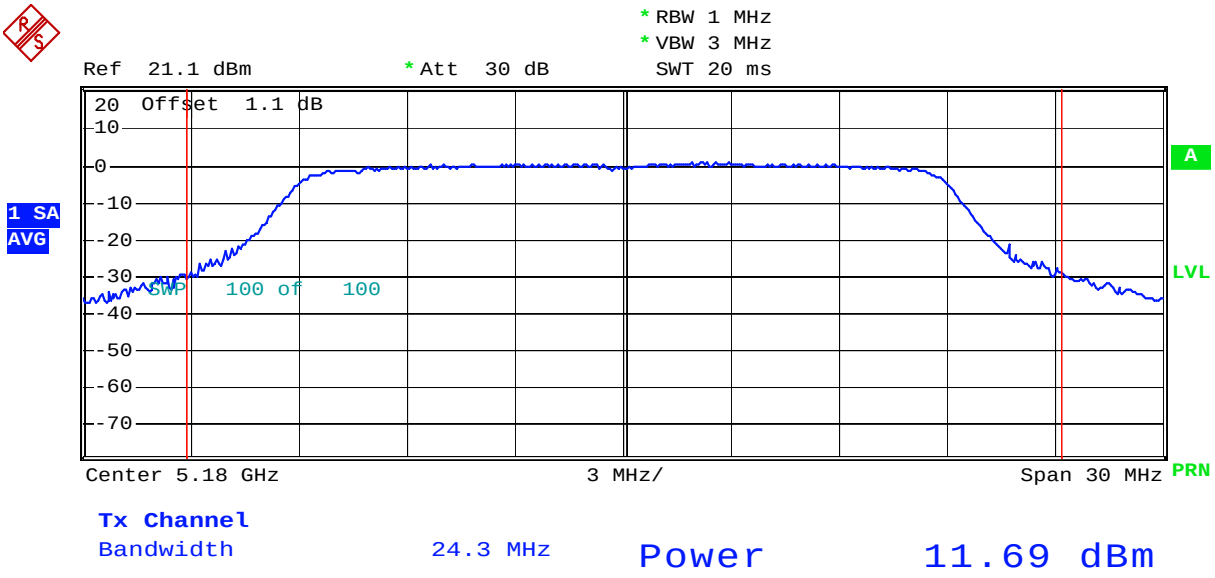
Comment: Channel power, 5180MHz, 802.11a, 6 Mbps, output 3
Date: 30.OCT.2008 17:08:36

Plot 2.4



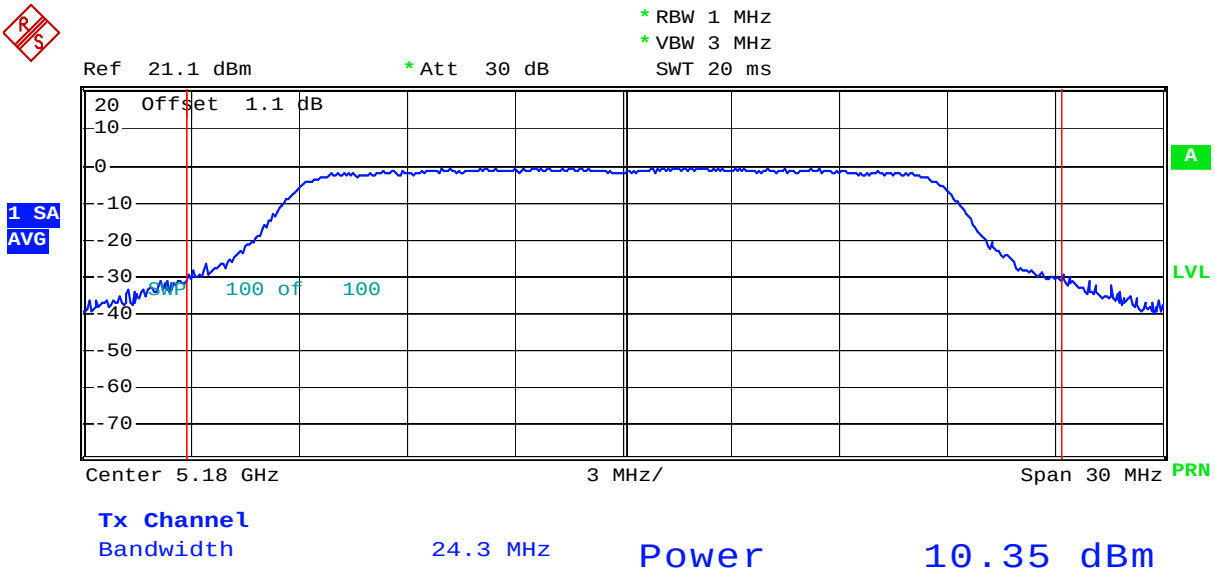
Comment: Channel power, 5180MHz, 802.11n HT20, 6.5 Mbps, output 1
Date: 30.OCT.2008 17:30:47

Plot 2.5



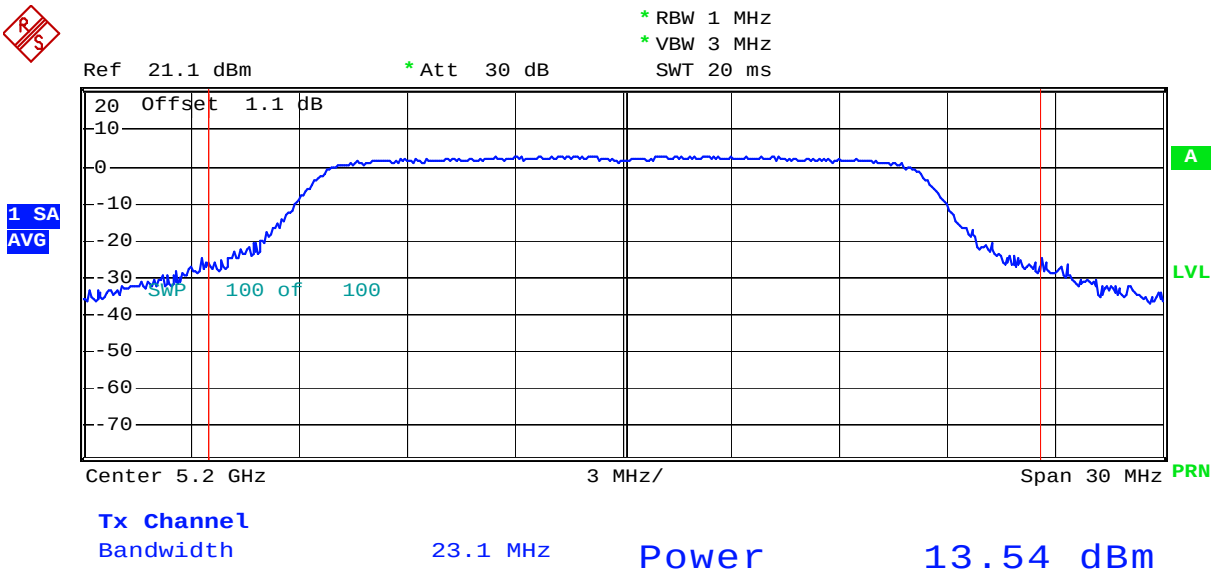
Comment: Channel power, 5180MHz, 802.11n HT20, 6.5 Mbps, output 2
Date: 30.OCT.2008 17:21:56

Plot 2.6



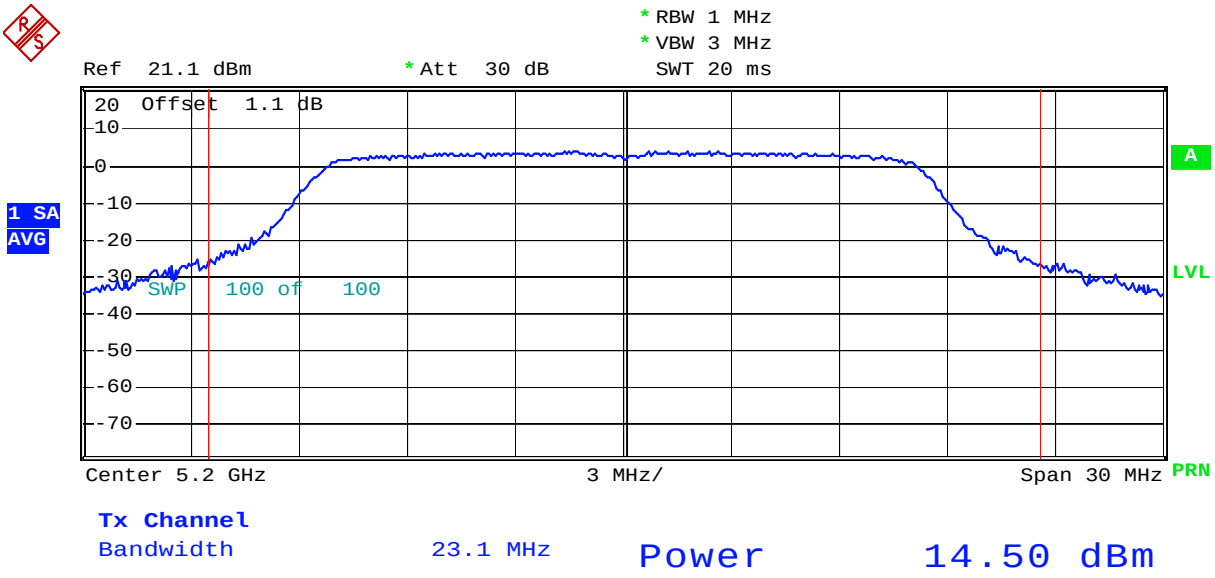
Comment: Channel power, 5180MHz, 802.11n HT20, 6.5 Mbps, output 3
Date: 30.OCT.2008 17:19:35

Plot 2.7



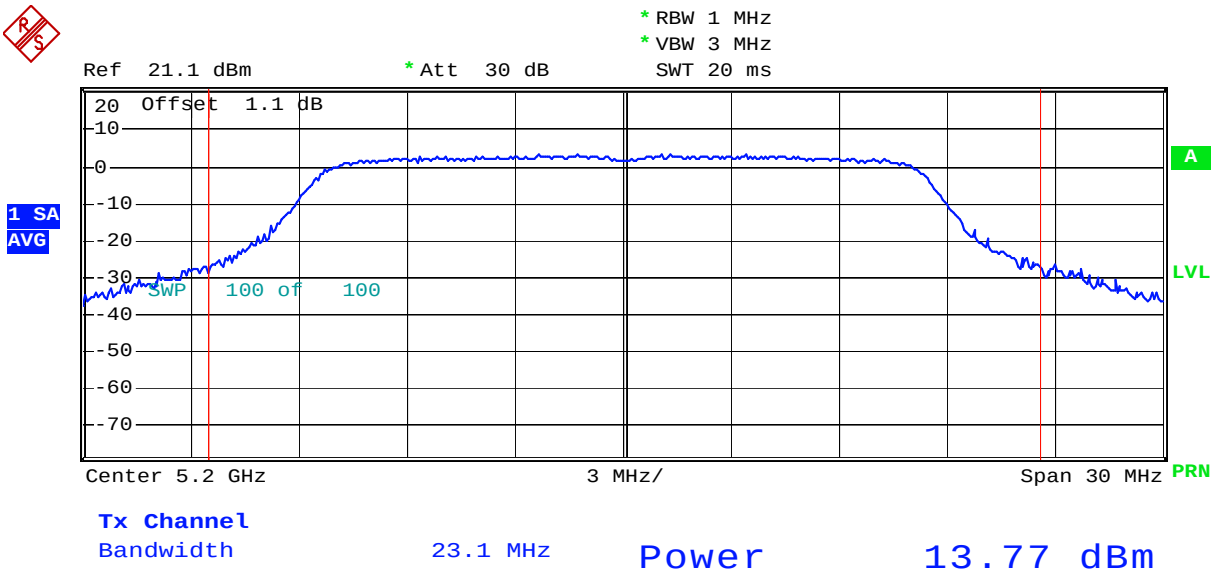
Comment: Channel power, 5200MHz, 802.11a, 6 Mbps, output 1
Date: 30.OCT.2008 16:37:09

Plot 2.8



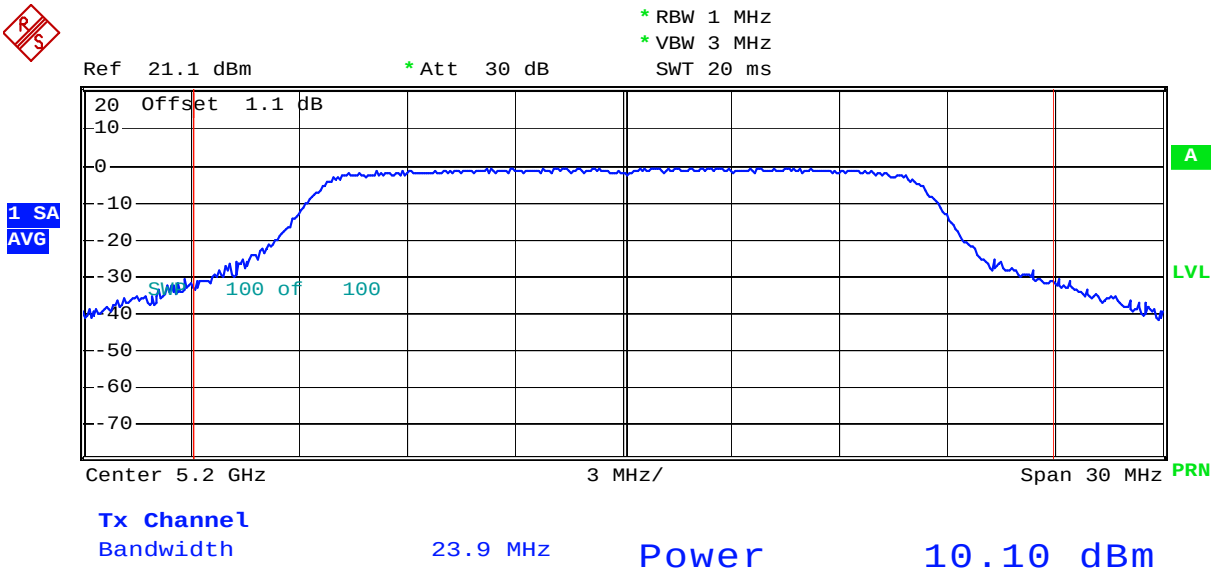
Comment: Channel power, 5200MHz, 802.11a, 6 Mbps, output 2
Date: 30.OCT.2008 16:28:11

Plot 2.9



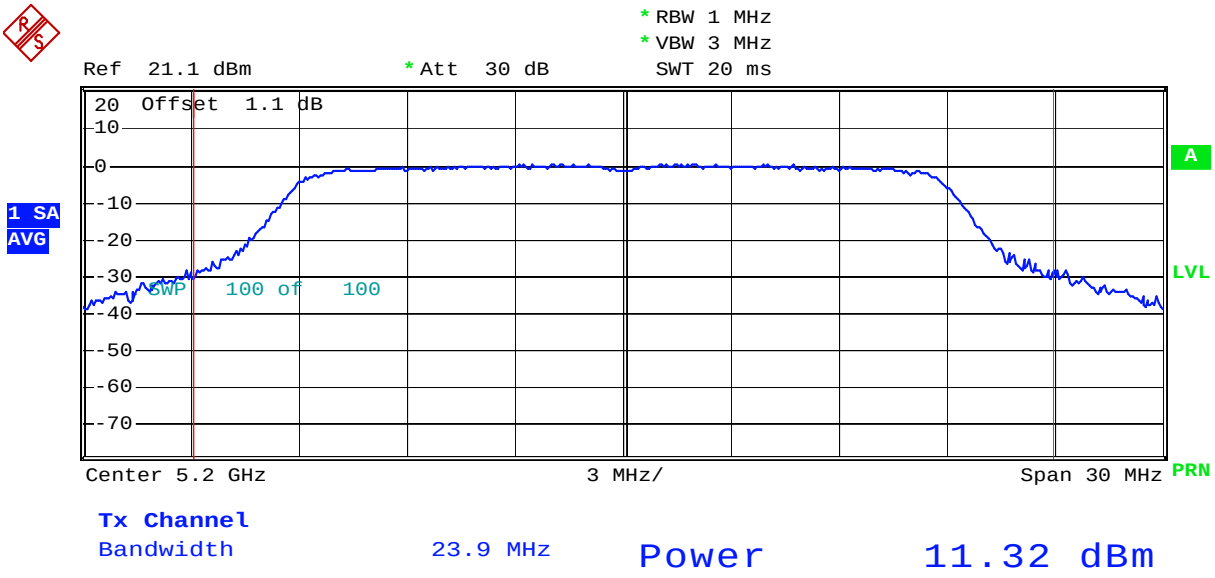
Comment: Channel power, 5200MHz, 802.11a, 6 Mbps, output 3
Date: 30.OCT.2008 17:10:38

Plot 2.10



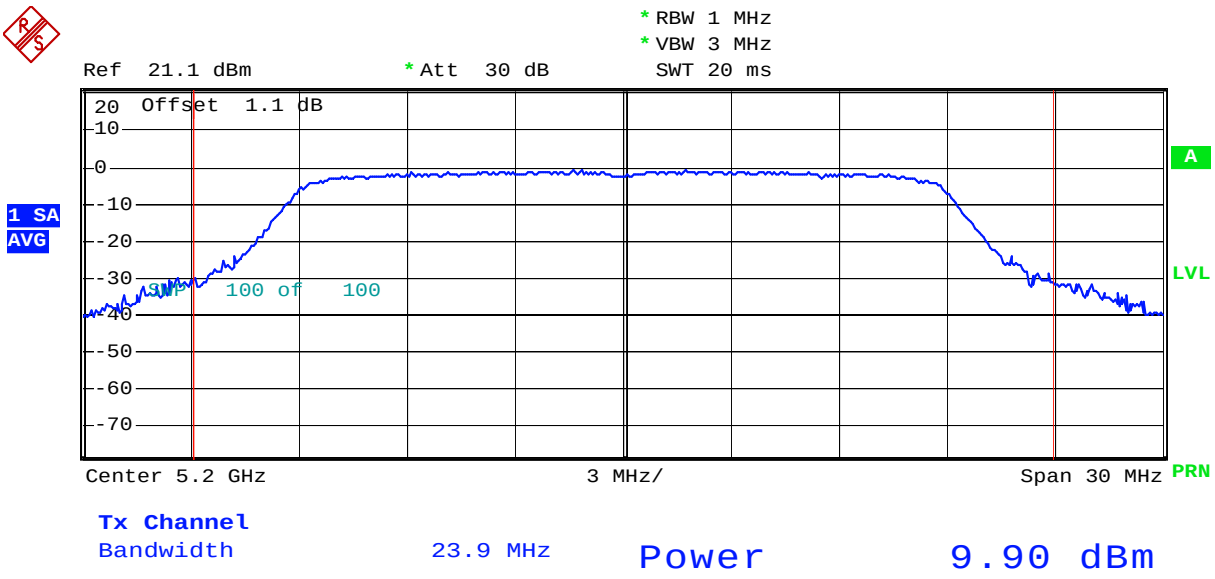
Comment: Channel power, 5200MHz, 802.11n HT20, 6.5 Mbps, output 1
Date: 30.OCT.2008 19:01:27

Plot 2.11



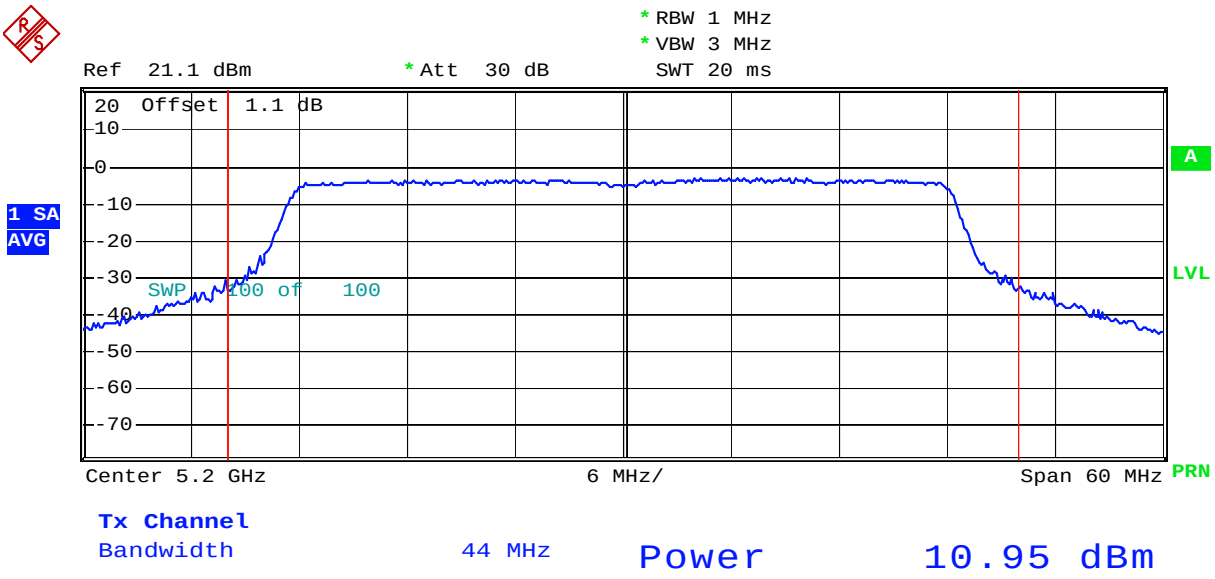
Comment: Channel power, 5200MHz, 802.11n HT20, 6.5 Mbps, output 2
Date: 30.OCT.2008 17:23:21

Plot 2.12



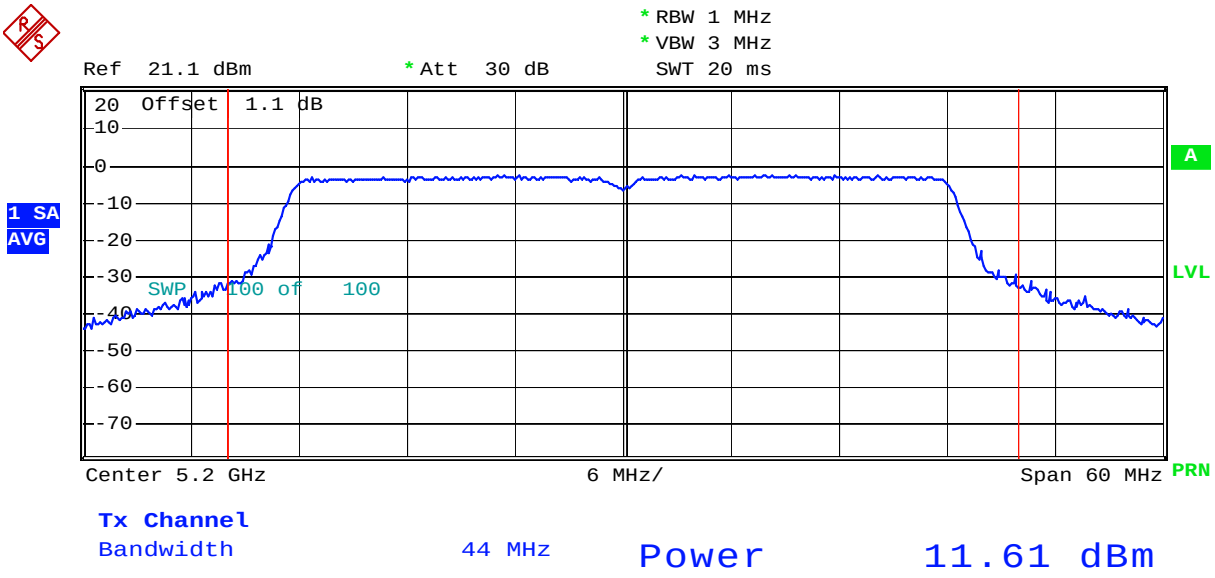
Comment: Channel power, 5200MHz, 802.11n HT20, 6.5 Mbps, output 3
Date: 30.OCT.2008 17:18:27

Plot 2.13



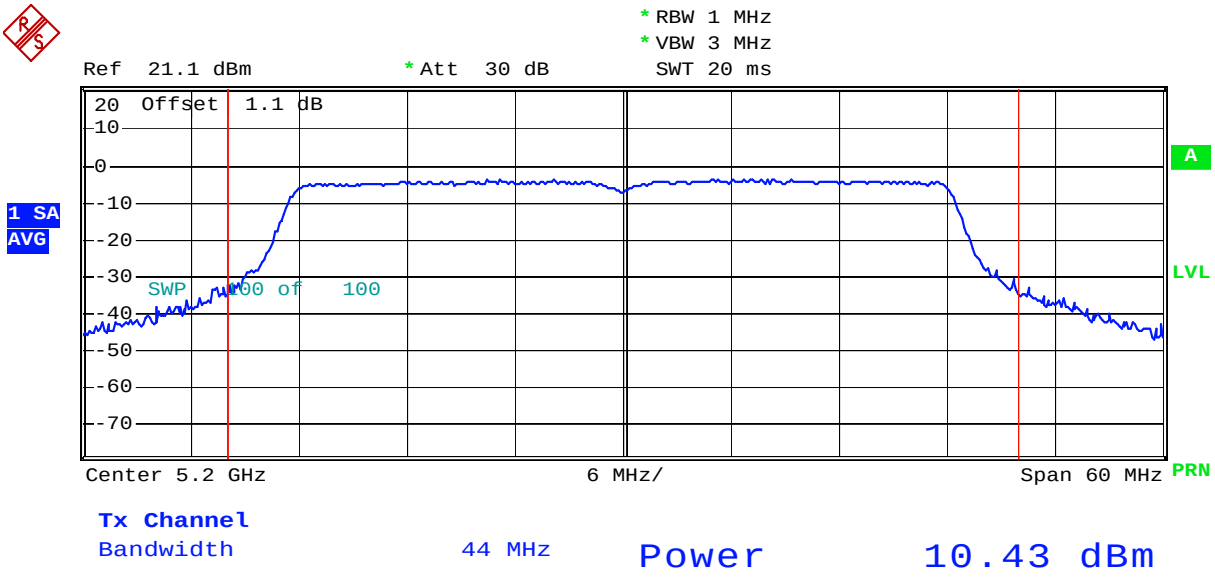
Comment: Channel power, 5200MHz, 802.11n HT40, 13.5 Mbps, output 1
Date: 30.OCT.2008 17:34:03

Plot 2.14



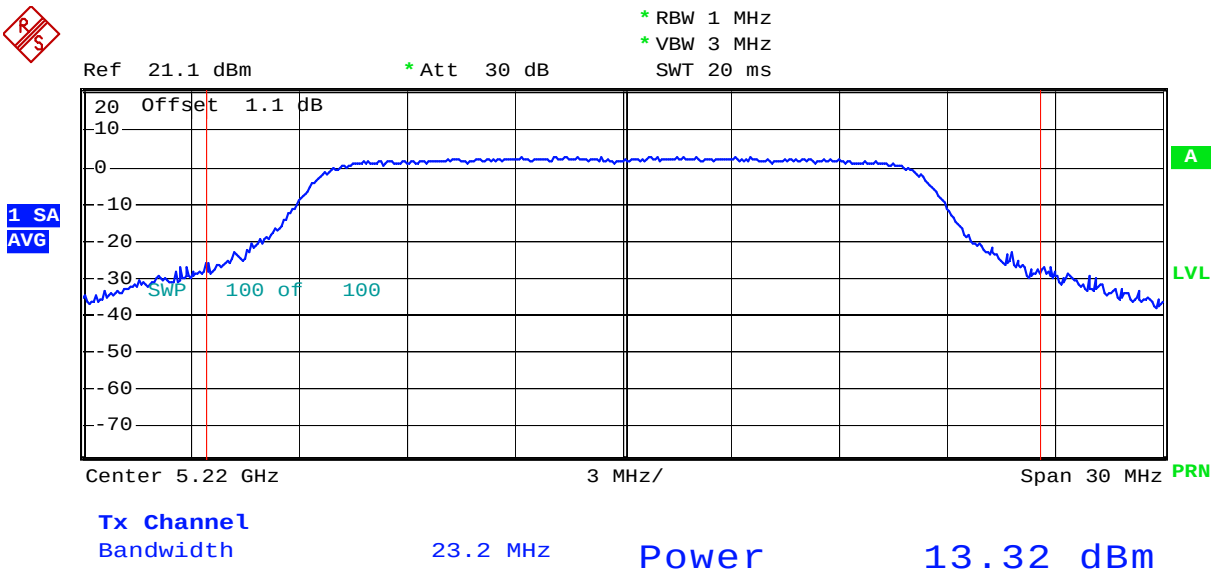
Comment: Channel power, 5200MHz, 802.11n HT40, 13.5 Mbps, output 2
Date: 30.OCT.2008 17:38:26

Plot 2.15



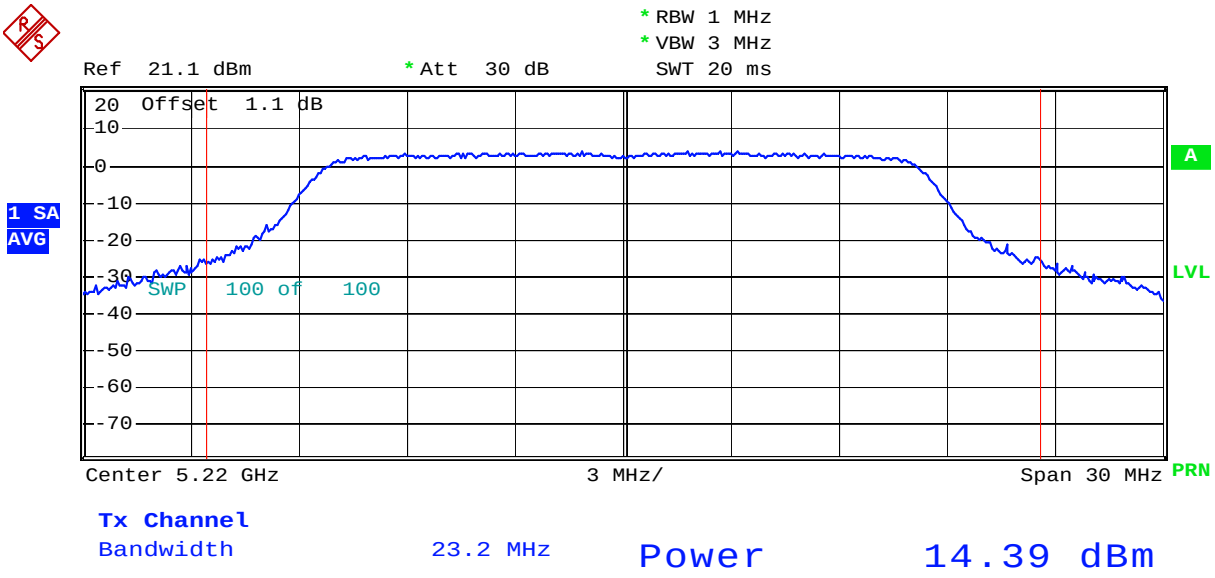
Comment: Channel power, 5200MHz, 802.11n HT40, 13.5 Mbps, output 3
Date: 30.OCT.2008 17:40:46

Plot 2.16



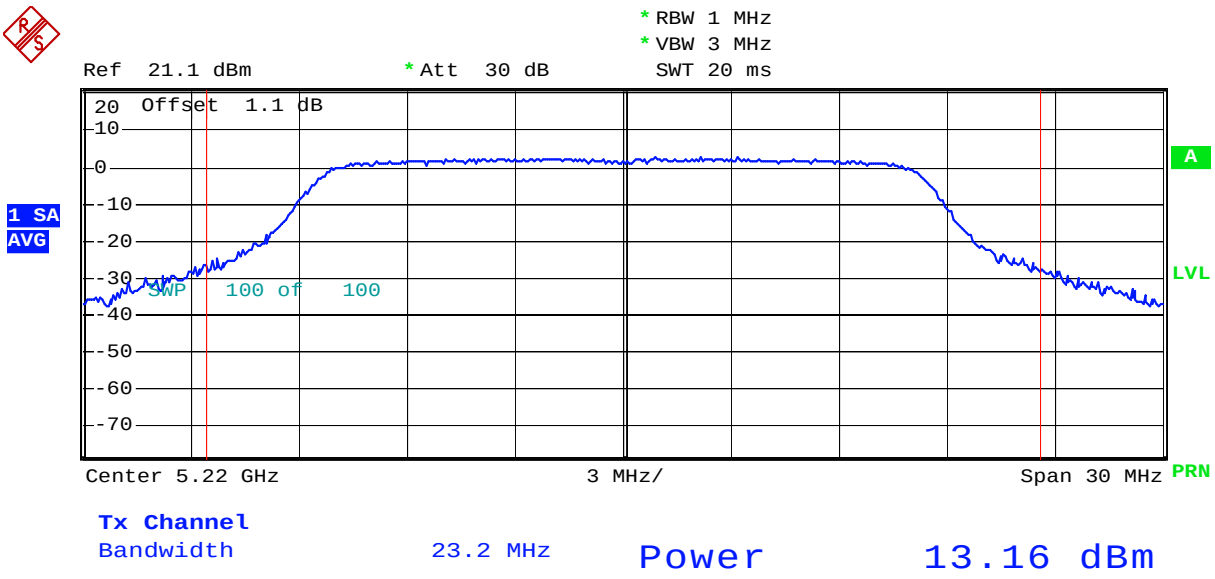
Comment: Channel power, 5220MHz, 802.11a, 6 Mbps, output 1
Date: 30.OCT.2008 16:35:52

Plot 2.17



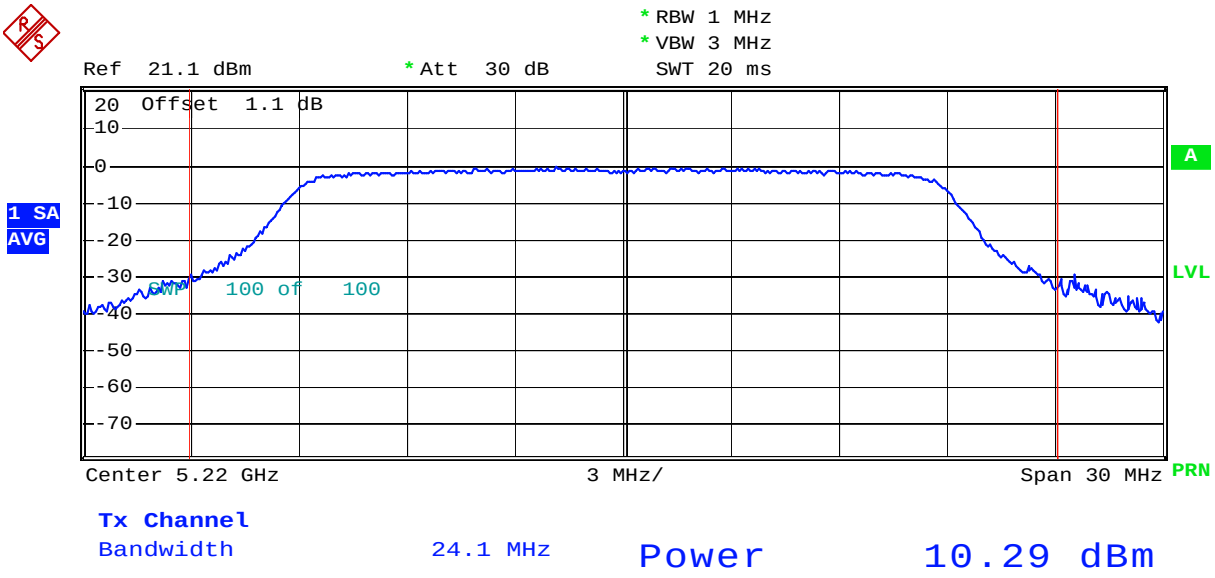
Comment: Channel power, 5220MHz, 802.11a, 6 Mbps, output 2
Date: 30.OCT.2008 16:31:19

Plot 2.18



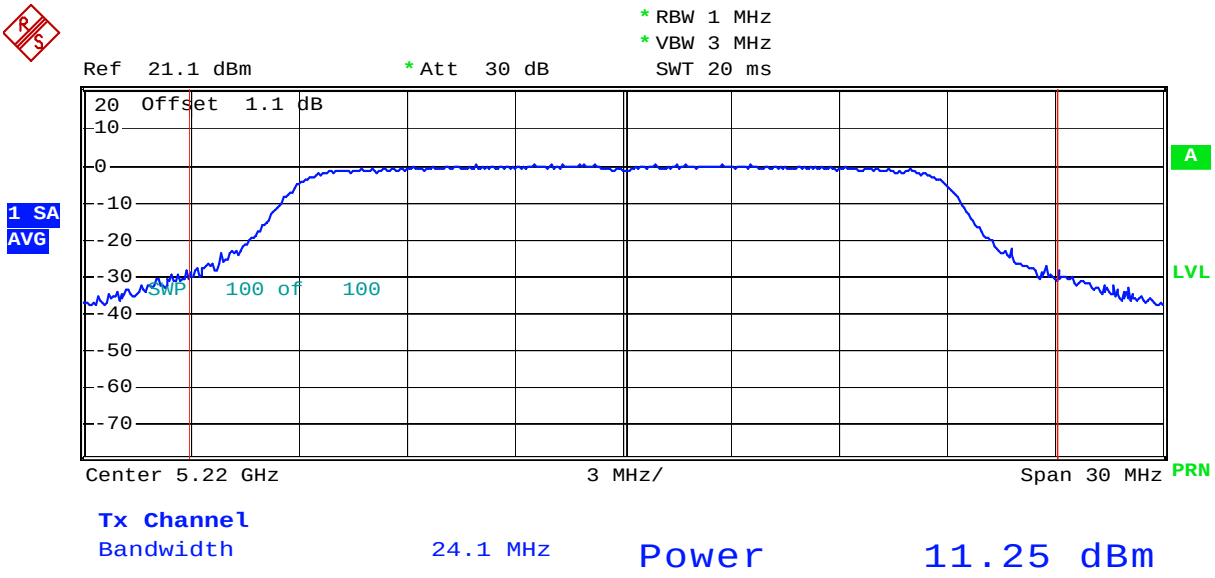
Comment: Channel power, 5220MHz, 802.11a, 6 Mbps, output 3
Date: 30.OCT.2008 17:11:49

Plot 2.19



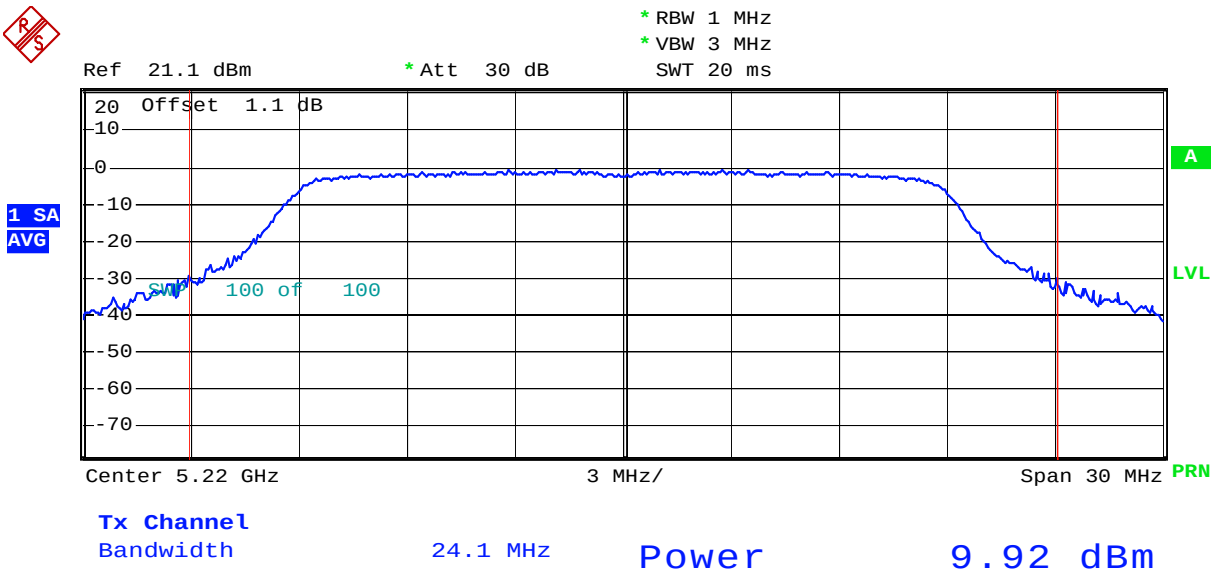
Comment: Channel power, 5220MHz, 802.11n HT20, 6.5 Mbps, output 1
Date: 30.OCT.2008 17:29:41

Plot 2.20



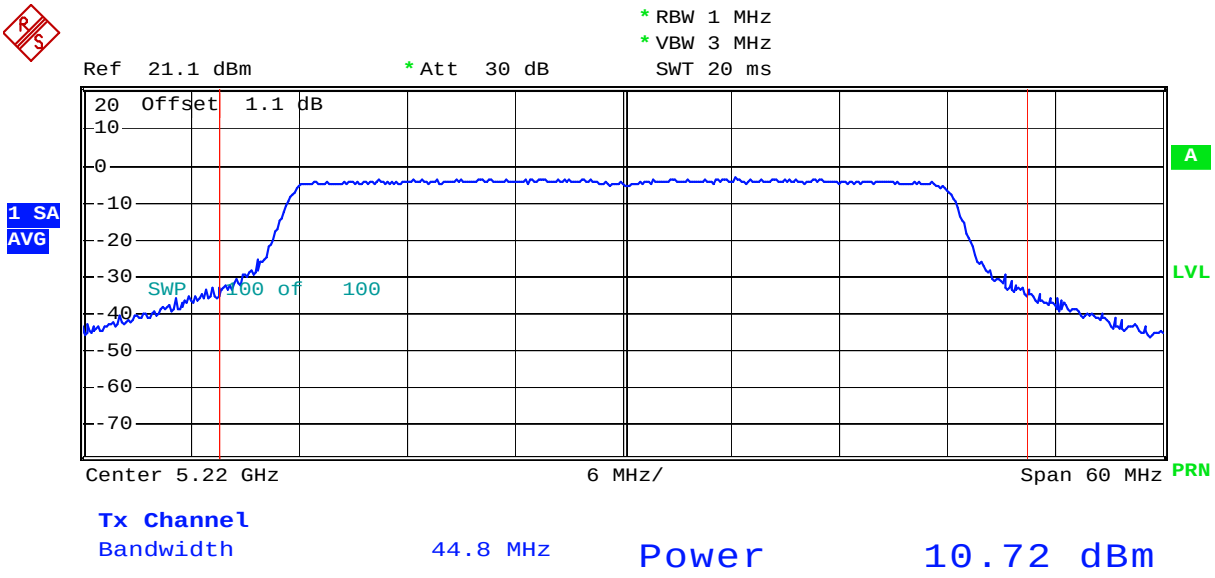
Comment: Channel power, 5220MHz, 802.11n HT20, 6.5 Mbps, output 2
Date: 30.OCT.2008 17:24:57

Plot 2.21



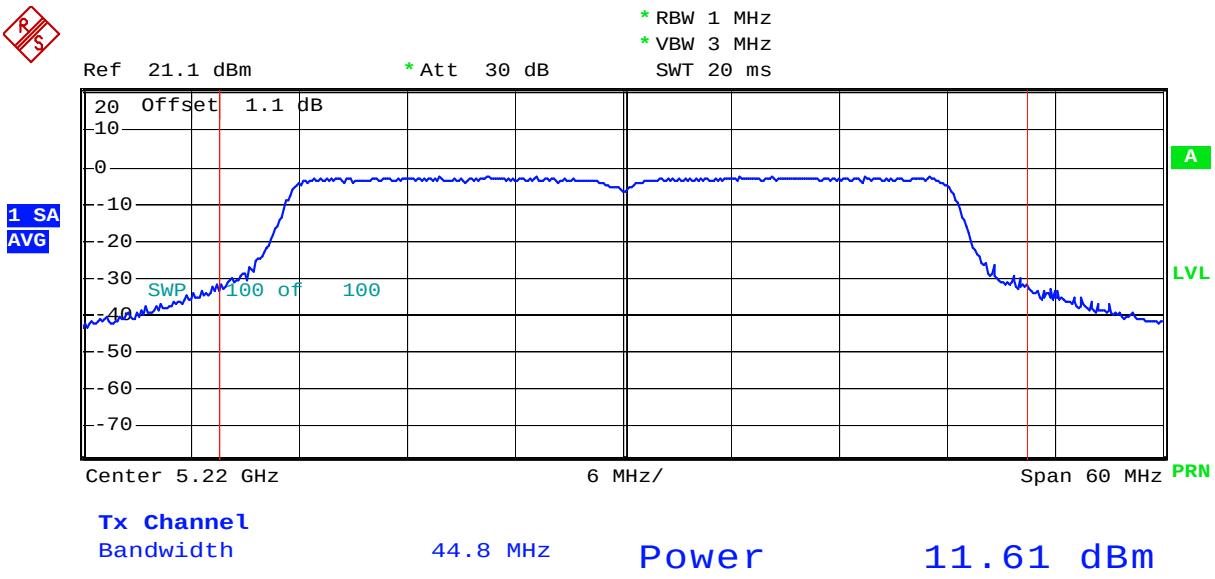
Comment: Channel power, 5220MHz, 802.11n HT20, 6.5 Mbps, output 3
Date: 30.OCT.2008 17:17:13

Plot 2.22



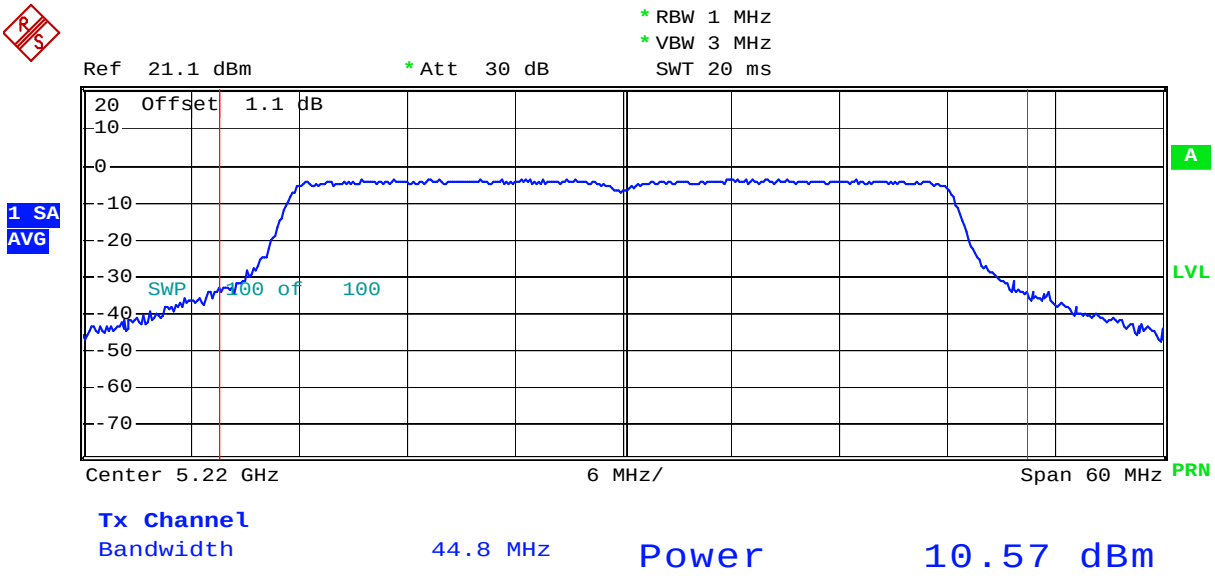
Comment: Channel power, 5220MHz, 802.11n HT40, 13.5 Mbps, output 1
Date: 30.OCT.2008 17:35:31

Plot 2.23



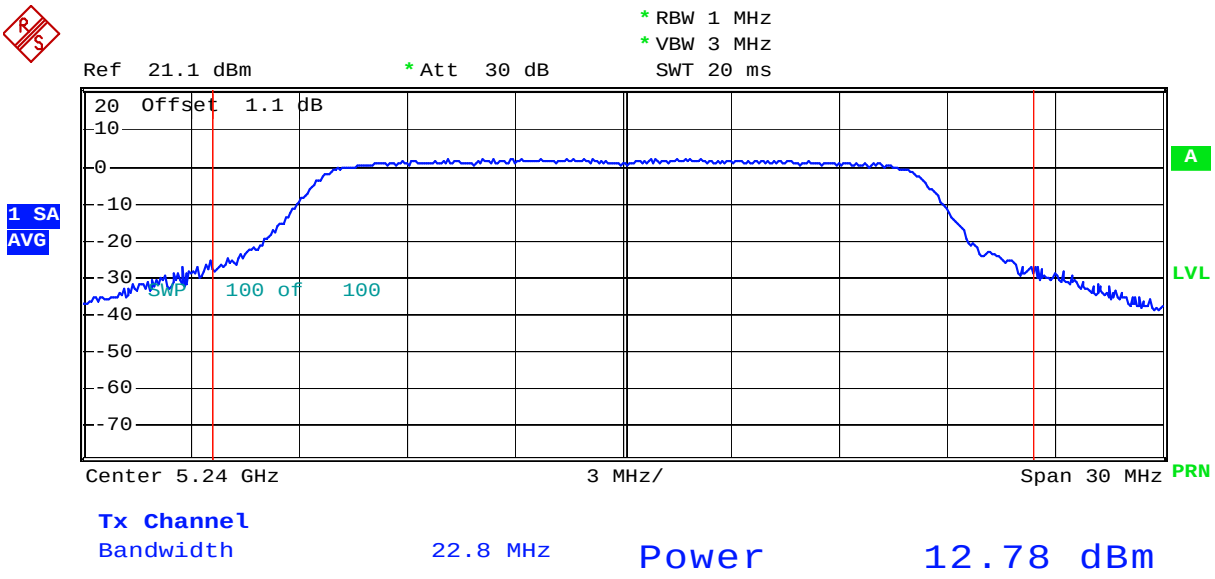
Comment: Channel power, 5220MHz, 802.11n HT40, 13.5 Mbps, output 2
Date: 30.OCT.2008 17:37:19

Plot 2.24



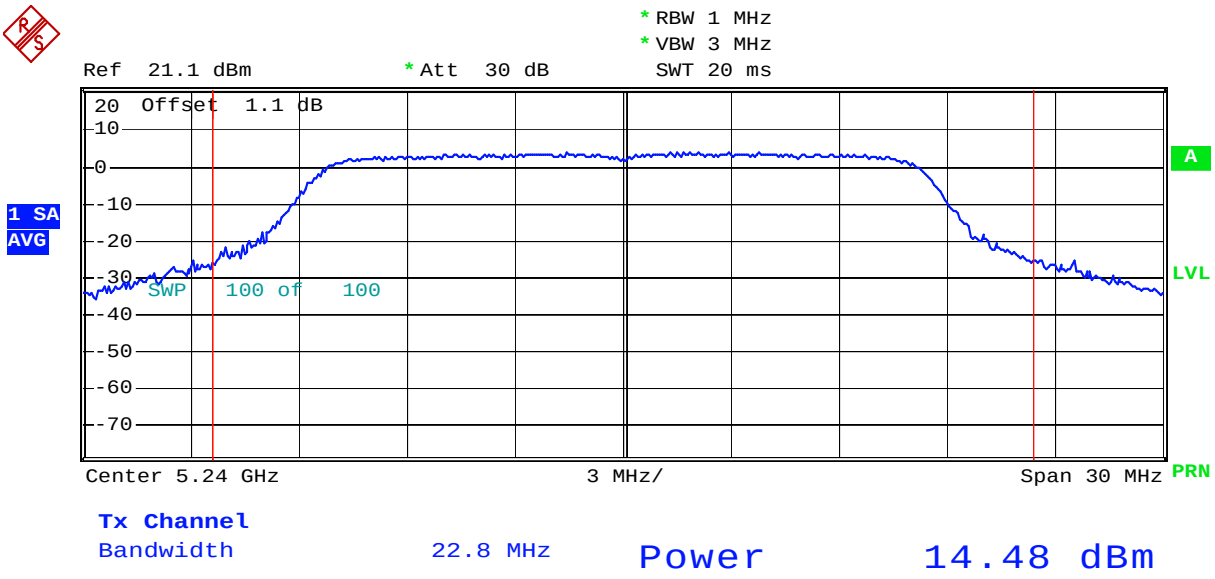
Comment: Channel power, 5220MHz, 802.11n HT40, 13.5 Mbps, output 3
Date: 30.OCT.2008 17:41:49

Plot 2.25



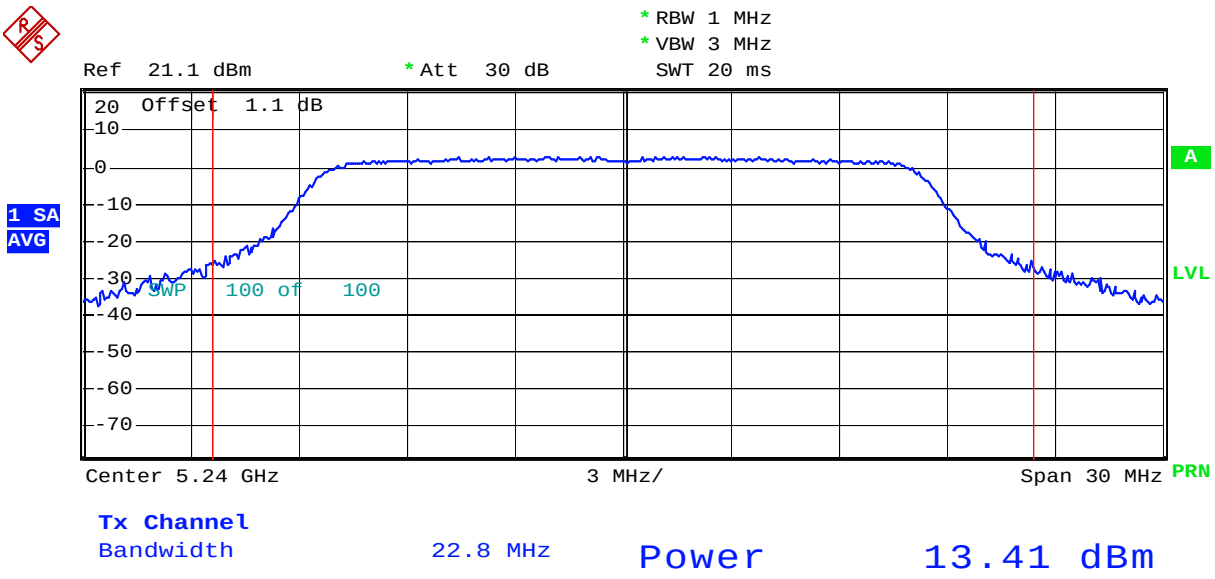
Comment: Channel power, 5240MHz, 802.11a, 6 Mbps, output 1
Date: 30.OCT.2008 16:34:36

Plot 2.26



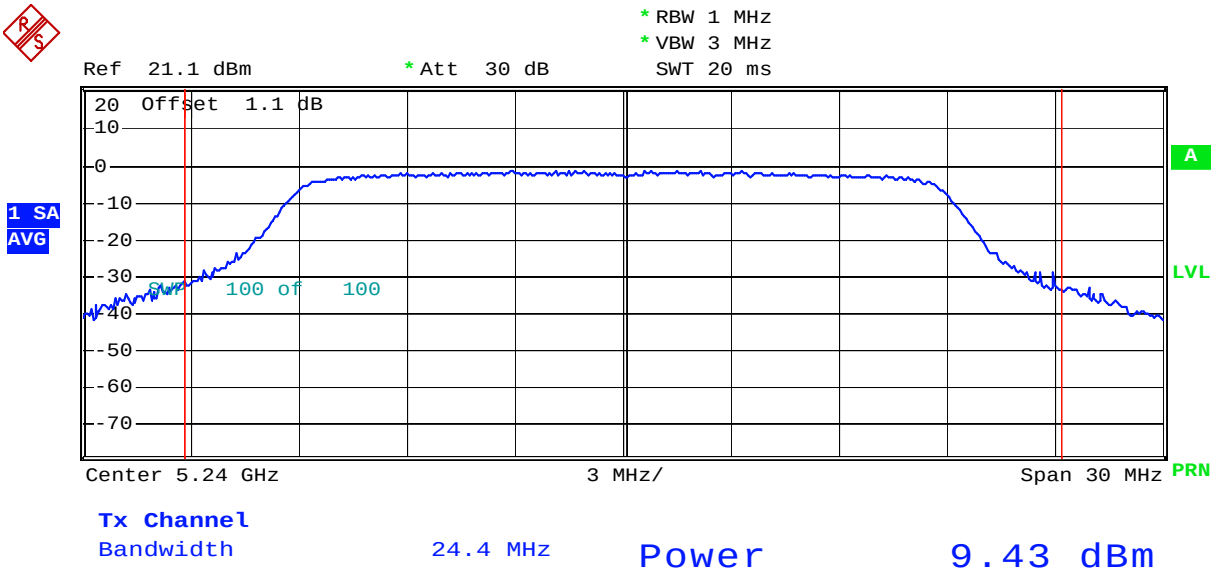
Comment: Channel power, 5240MHz, 802.11a, 6 Mbps, output 2
Date: 30.OCT.2008 16:32:32

Plot 2.27



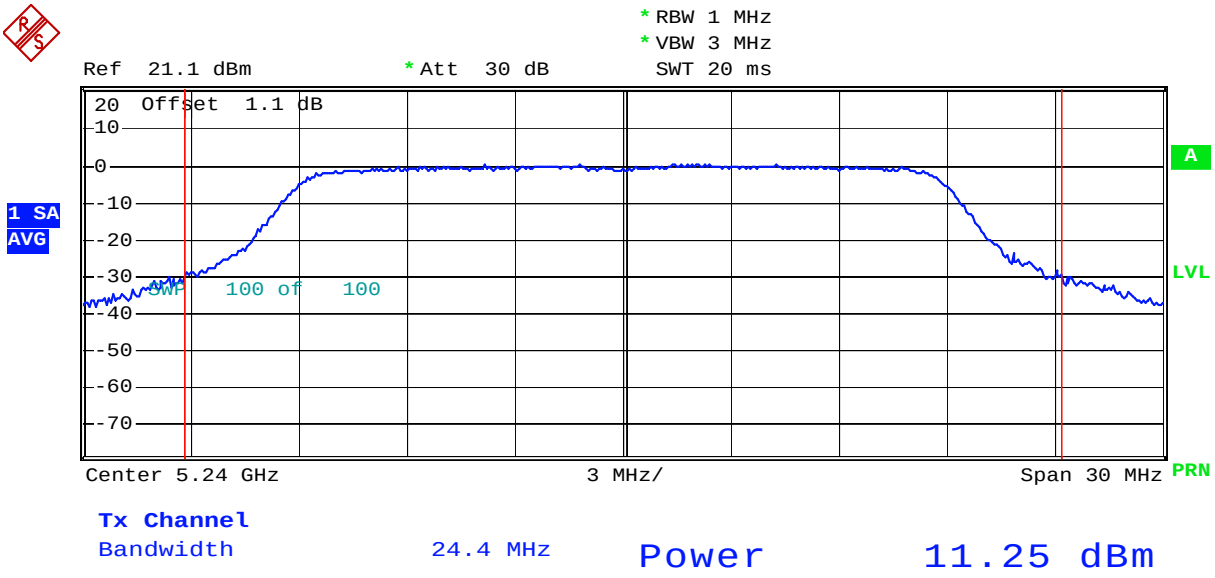
Comment: Channel power, 5240MHz, 802.11a, 6 Mbps, output 3
Date: 30.OCT.2008 17:13:00

Plot 2.28



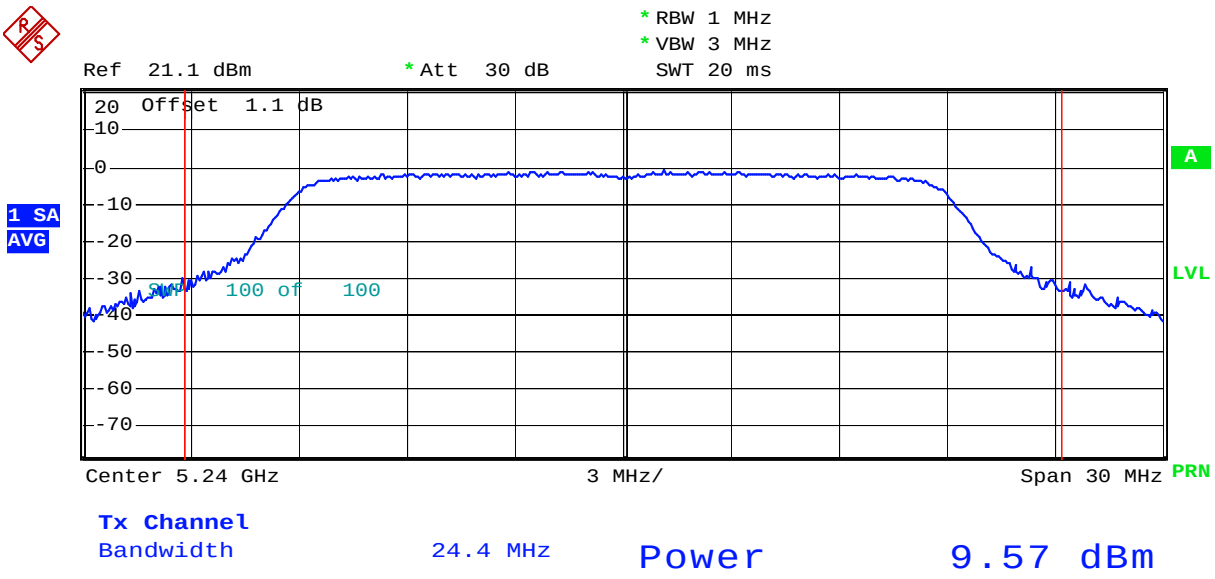
Comment: Channel power, 5240MHz, 802.11n HT20, 6.5 Mbps, output 1
Date: 30.OCT.2008 17:28:07

Plot 2.29



Comment: Channel power, 5240MHz, 802.11n HT20, 6.5 Mbps, output 2
Date: 30.OCT.2008 17:26:13

Plot 2.30



Comment: Channel power, 5240MHz, 802.11n HT20, 6.5 Mbps, output 3
Date: 30.OCT.2008 17:15:47

4.3 Peak Power Spectral Density
FCC Rule: 15.407(a)(2)

Requirement

The peak power spectral density (PPSD) shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Procedure

The procedure described in the FCC Public Notice DA 02-2138 was used. The Method #2 (with the sample detector and averaging over 100 sweeps) was selected for the measurement. The antenna port of the EUT was connected to the input of a spectrum analyzer. The spectrum analyzer Resolution Bandwidth was set to 1 MHz.

Separate measurements were made on each of the 3 Output Ports. Measurement plots from the worst case port are shown in the test report.

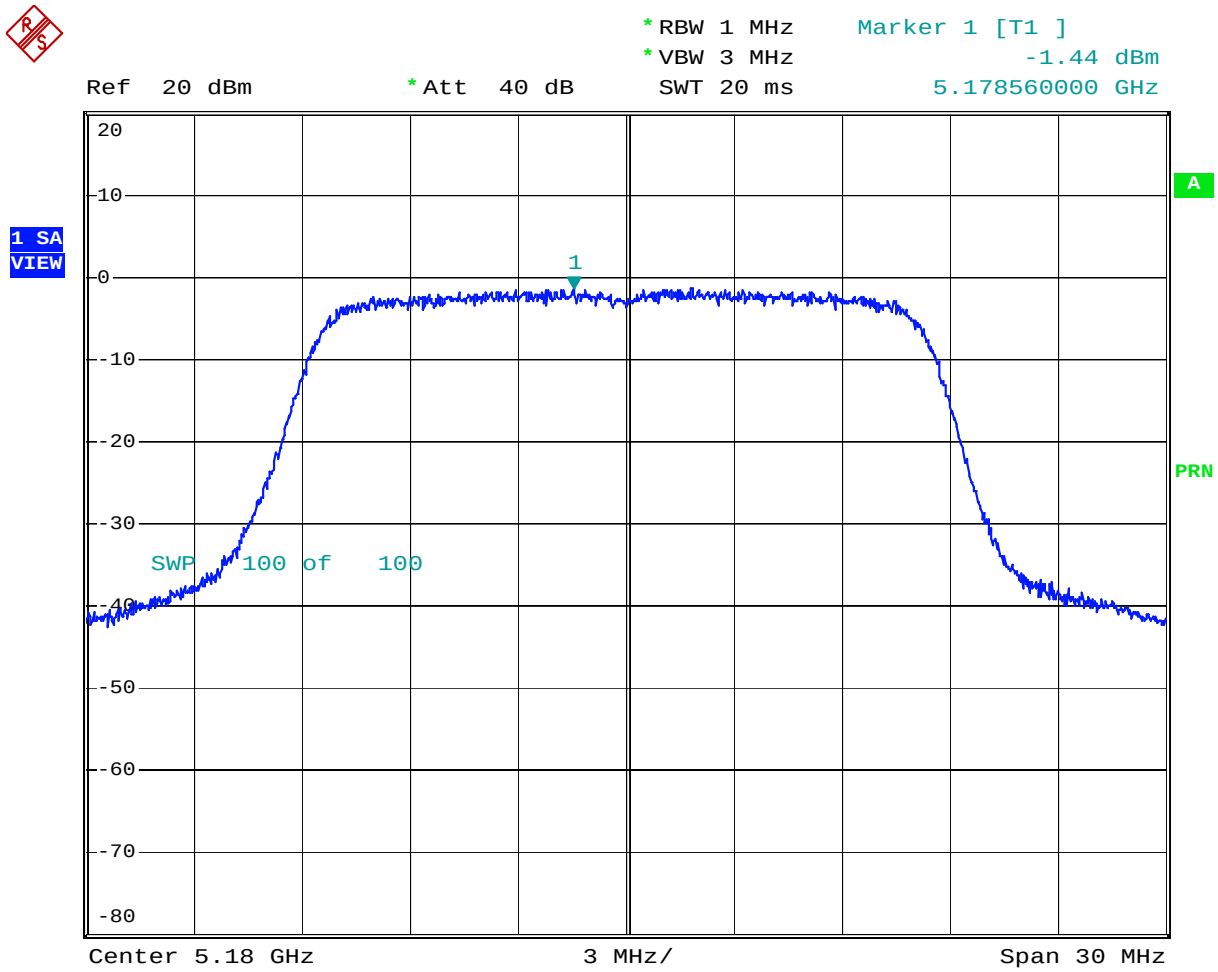
In 802.11n modes (3 Tx transmit simultaneously), the peak power spectral density (PPSD) is summarized for all 3 transmitters.

Test Result

The test results are presented on the following plots 3.1 – 3.10 and summarized in the table below.

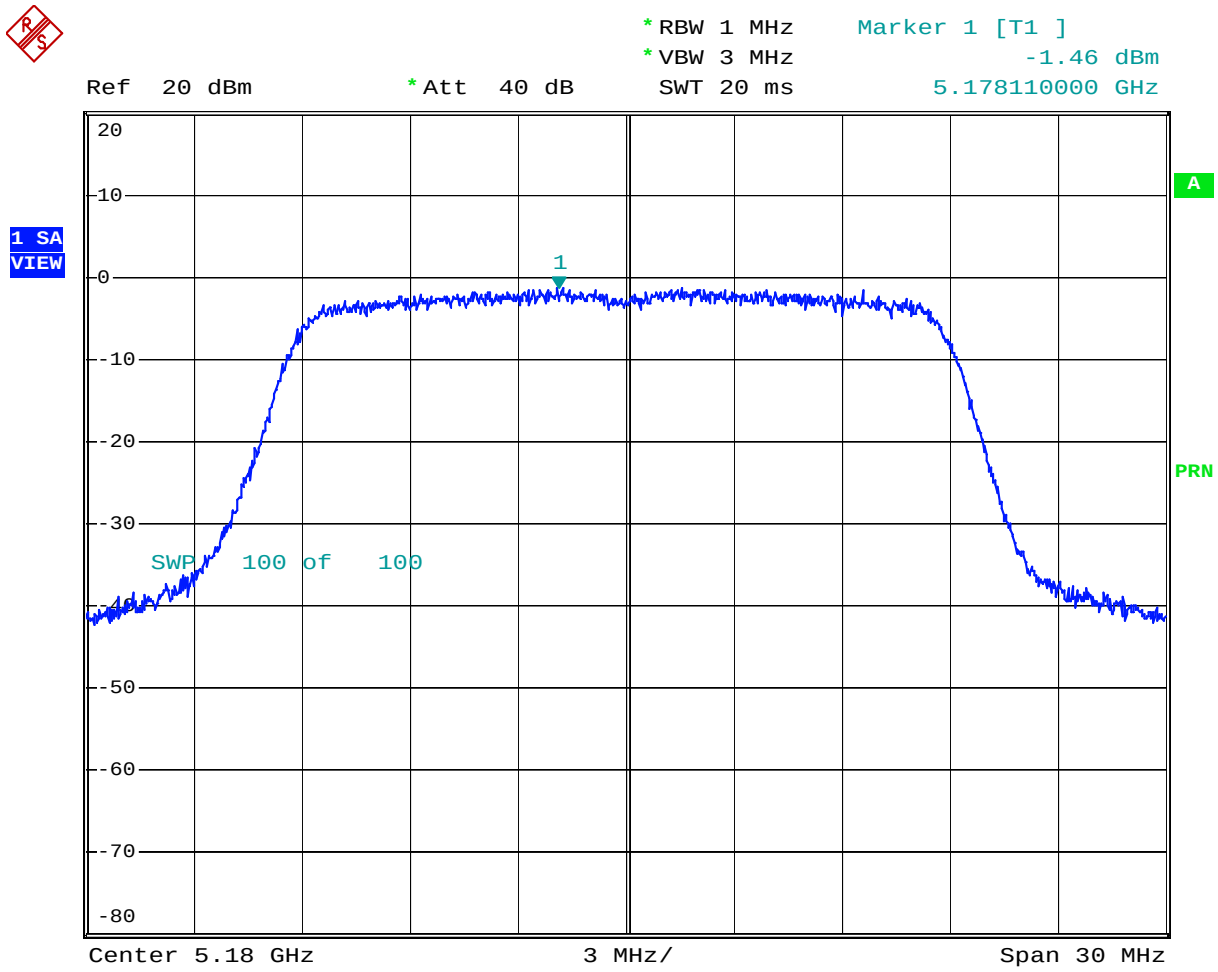
Channel	Frequency MHz	Standard/ Data rate	Peak PSD dBm	Σ PSD dBm	Margin to 4 dBm limit dB	Plot #
36	5180	802.11a 6 Mbps	-1.4	-	-5.4	3.1
		802.11n HT20 6.5 Mbps	-1.5 (Output 2) -2.4 (Output 1) -2.8 (Output 3)	2.58	-1.42	3.2
40	5200	802.11a 6 Mbps	-1.5	-	-5.5	3.3
		802.11n HT20 6.5 Mbps	-1.9 (Output 2) -3.1 (Output 1) -3.3 (Output 3)	2.07	-1.93	3.4
		802.11n HT40 13.5 Mbps	-4.1 (Output 2) - (Output 1) - (Output 3)	0.13	-3.87	3.5
44	5220	802.11a 6 Mbps	-1.6	-	-5.6	3.6
		802.11n HT20 6.5 Mbps	-1.3 (Output 2) -2.3 (Output 1) -2.7 (Output 3)	2.72	-1.28	3.7
		802.11n HT40 13.5 Mbps	-4.6 (Output 2) -5.5 (Output 1) -5.6 (Output 3)	-0.41	-4.41	3.8
48	5240	802.11a 6 Mbps	-1.4	-	-5.4	3.9
		802.11n HT20 6.5 Mbps	-1.3 (Output 2) -3.2 (Output 1) -3.0 (Output 3)	2.36	-1.64	3.10

Plot 3.1



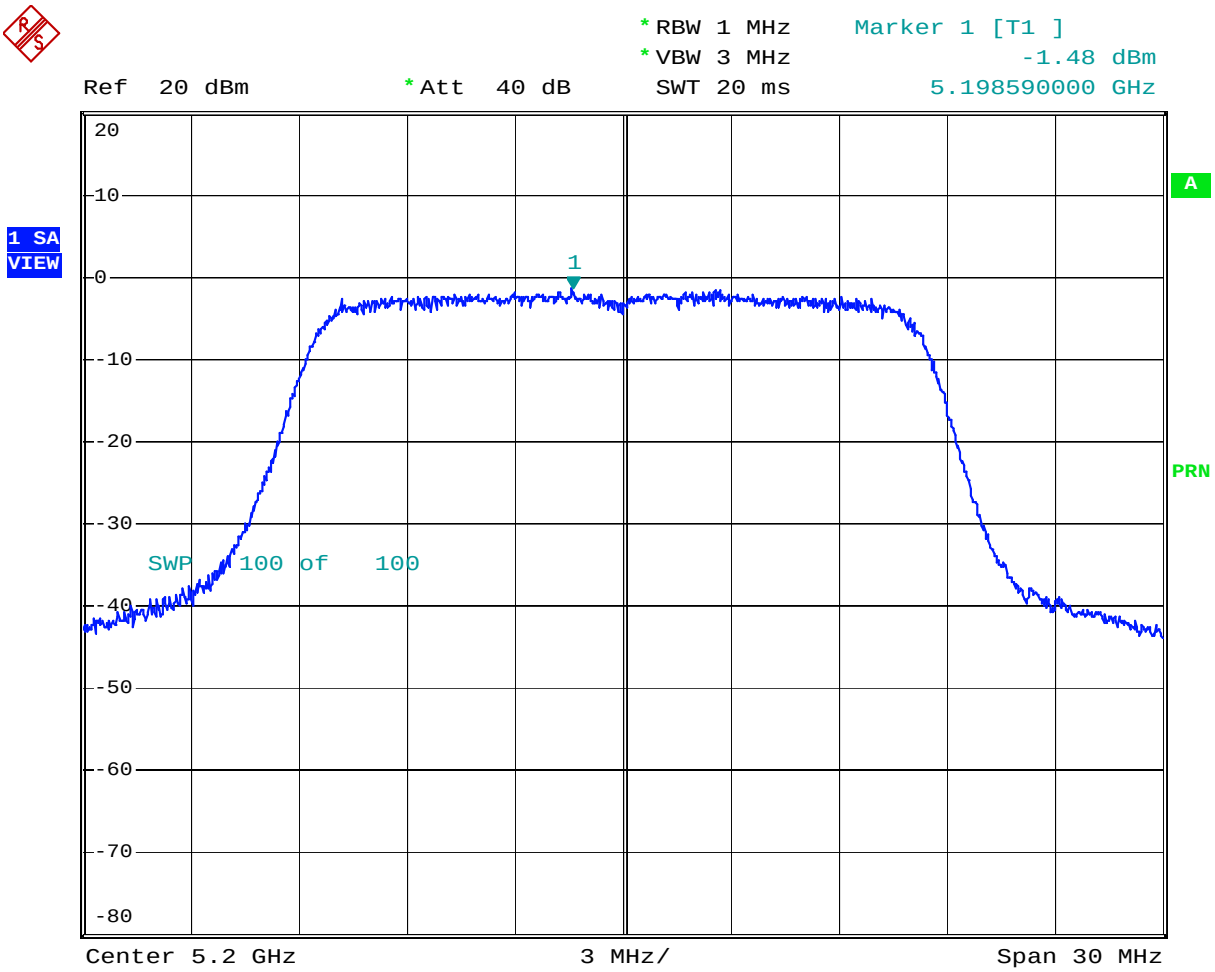
Comment: Peak power spectral density, 802.11a, 6 Mbps, output 2
Date: 10.SEP.2008 15:50:05

Plot 3.2



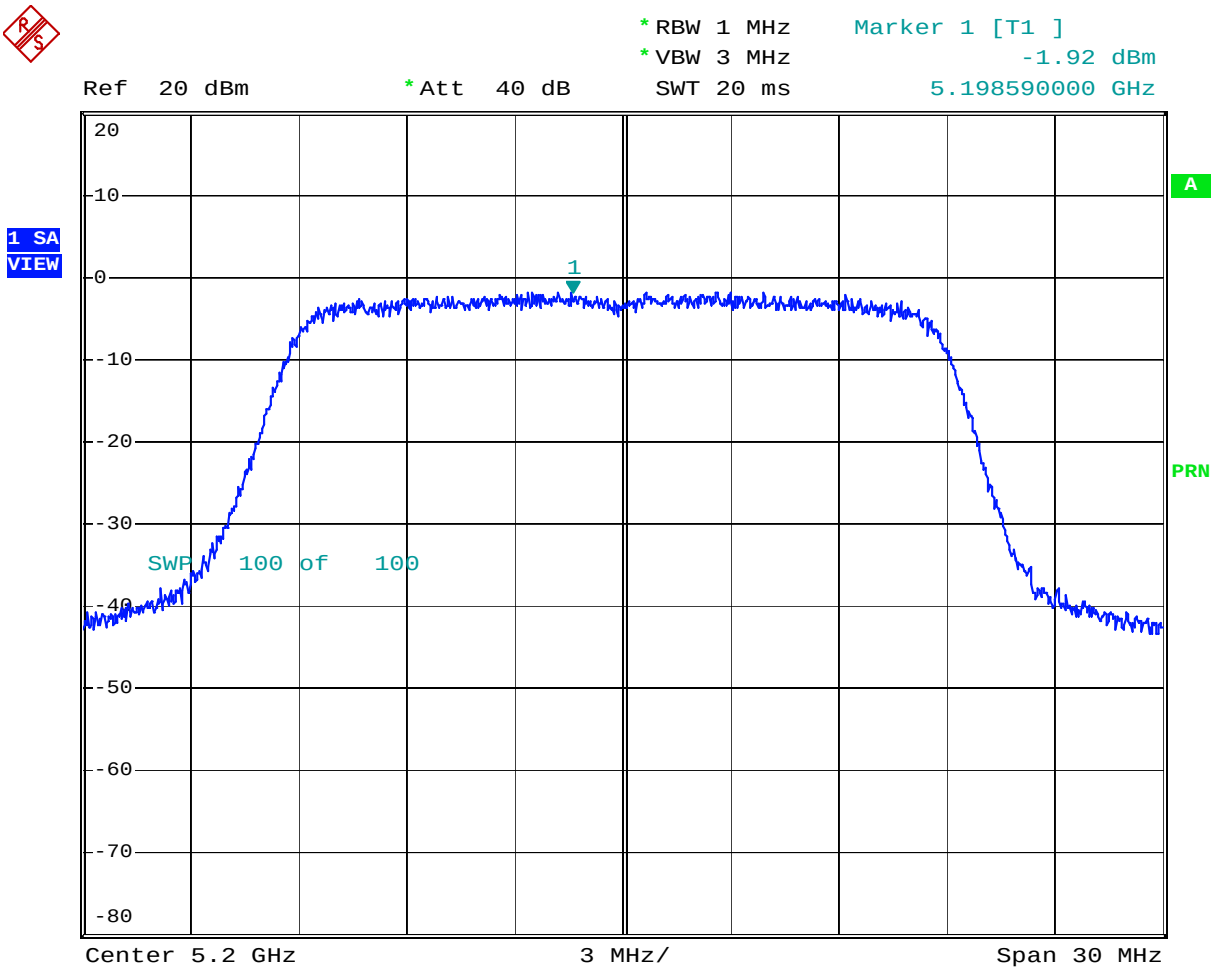
Comment: Peak power spectral density, 802.11n, HT20, 6.5 Mbps, output
Comment: 2
Date: 10.SEP.2008 15:40:38

Plot 3.3



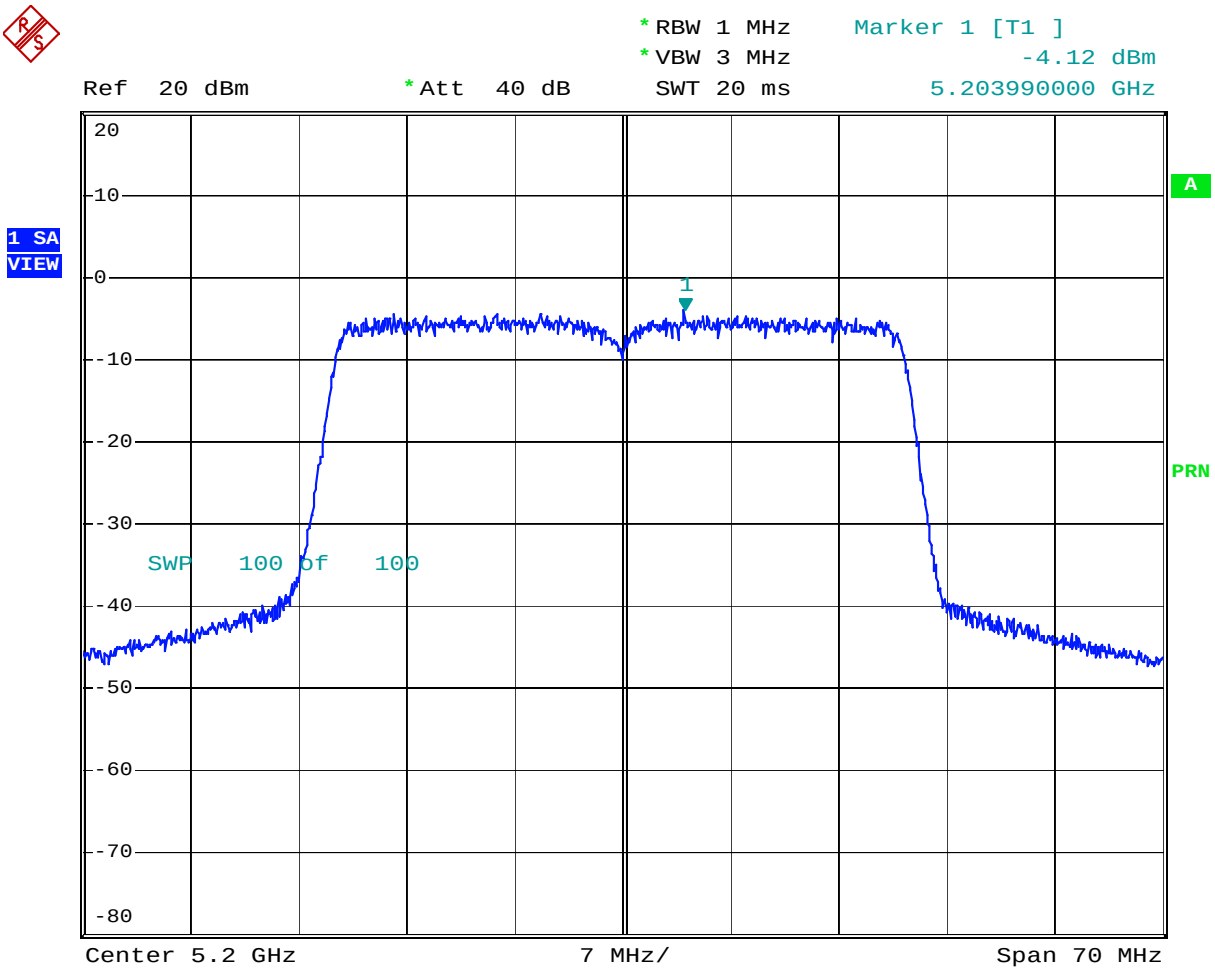
Comment: Peak power spectral density, 802.11a, 6 Mbps, output 2
Date: 10.SEP.2008 15:48:27

Plot 3.4



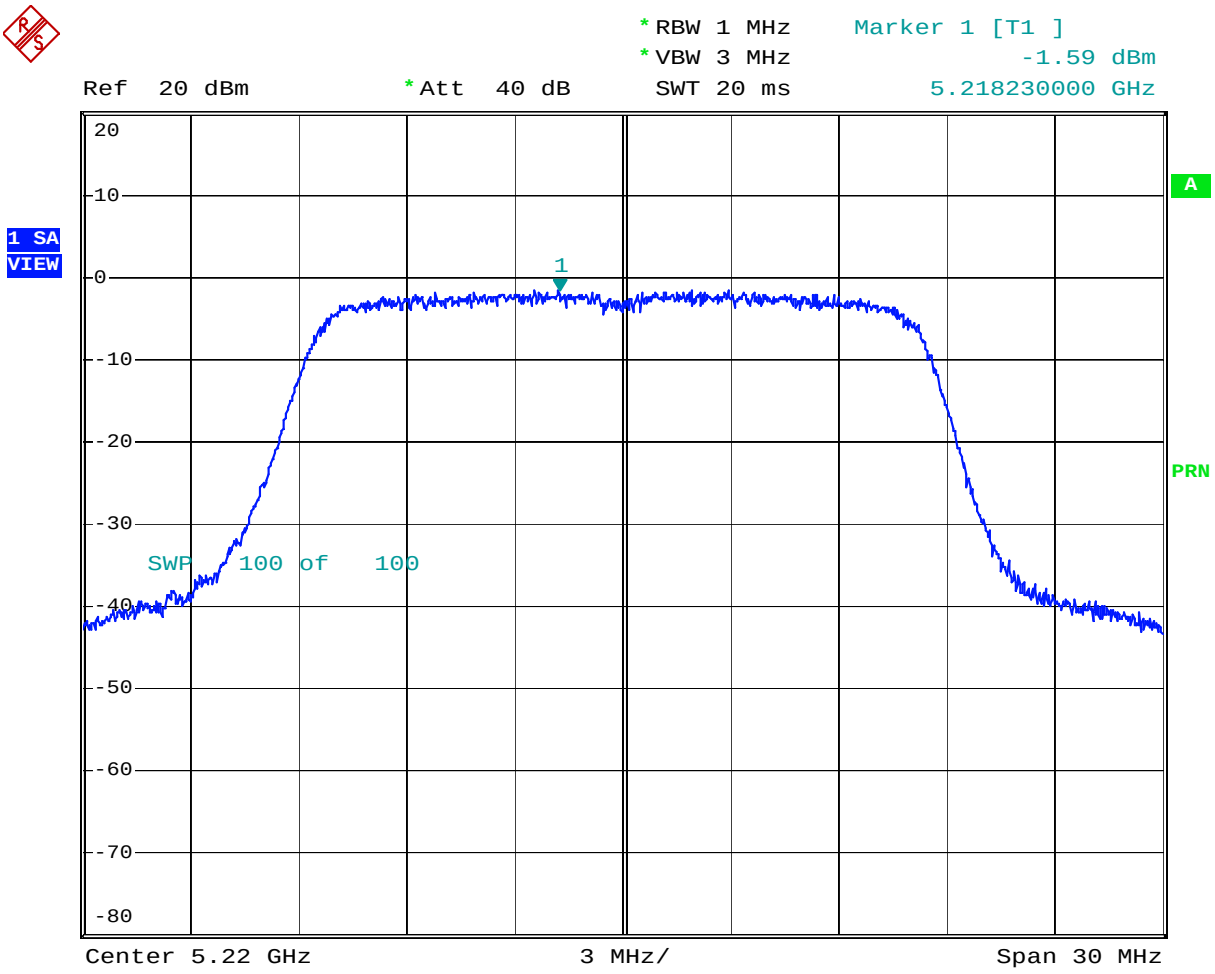
Comment: Peak power spectral density, 802.11n, HT20, 6.5 Mbps, output
Comment: 2
Date: 10.SEP.2008 15:39:07

Plot 3.5



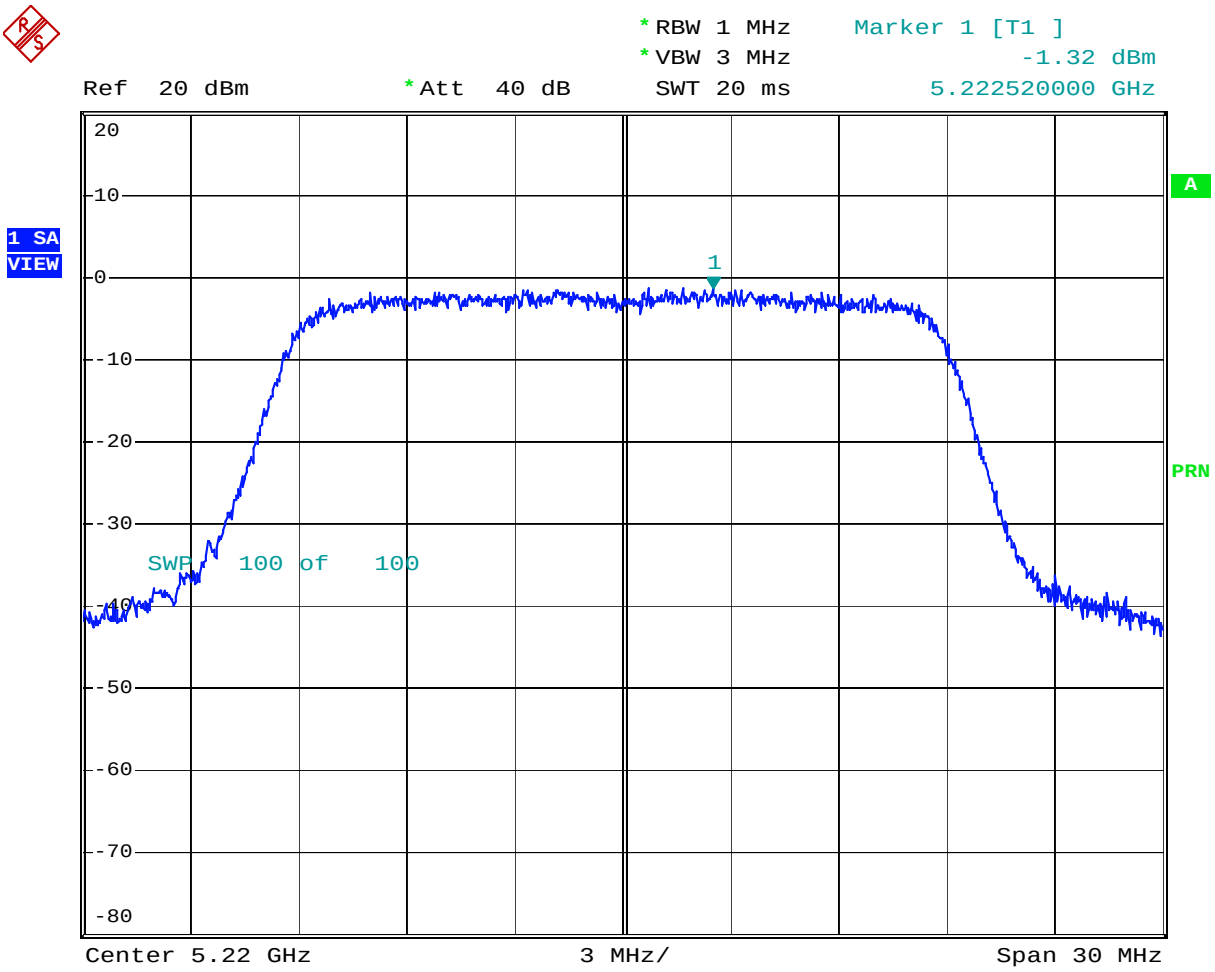
Comment: Peak power spectral density, 802.11n, HT40, 13.5 Mbps, outpu
Comment: t 2
Date: 10.SEP.2008 15:33:42

Plot 3.6



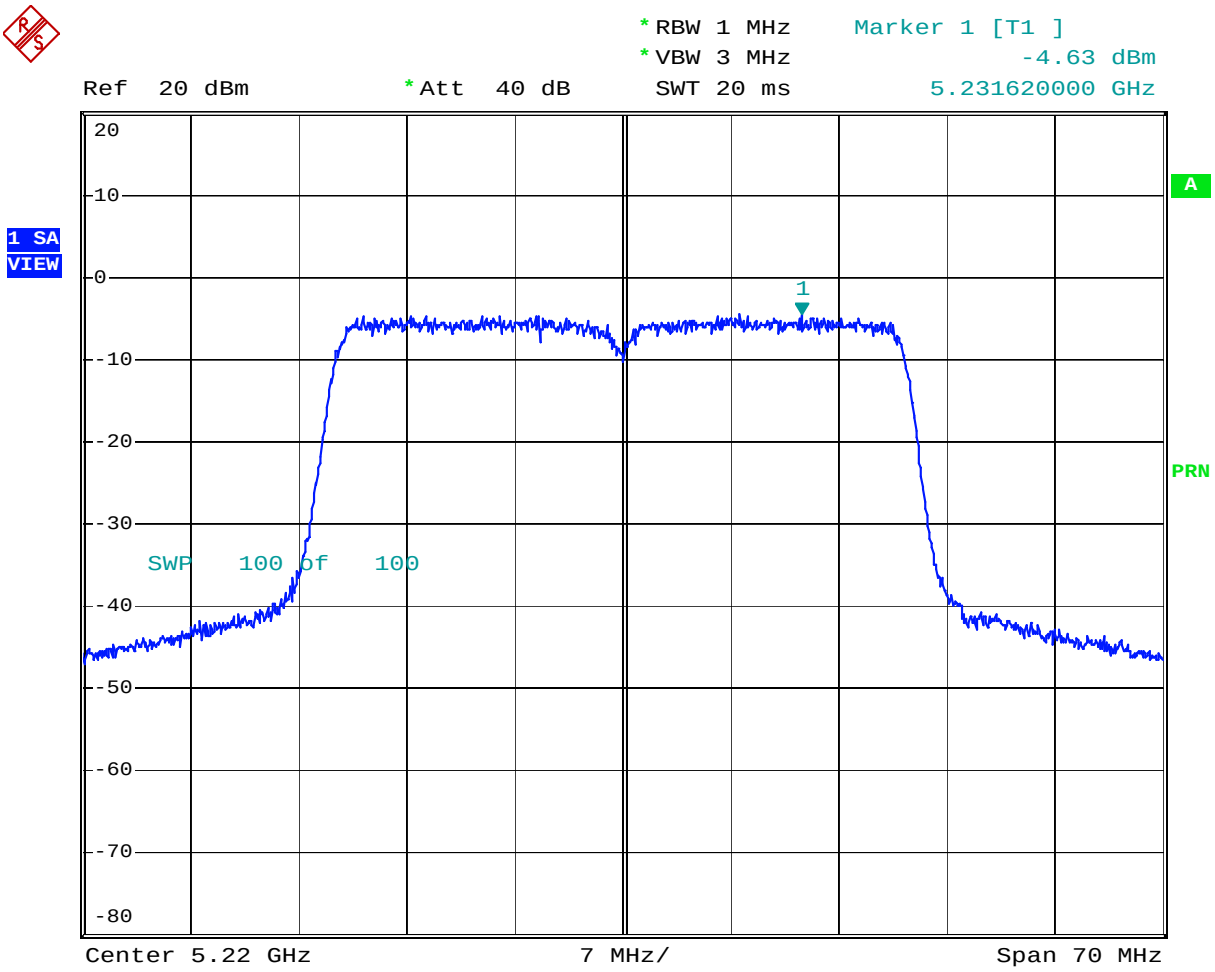
Comment: Peak power spectral density, 802.11a, 6 Mbps, output 2
Date: 10.SEP.2008 15:47:18

Plot 3.7



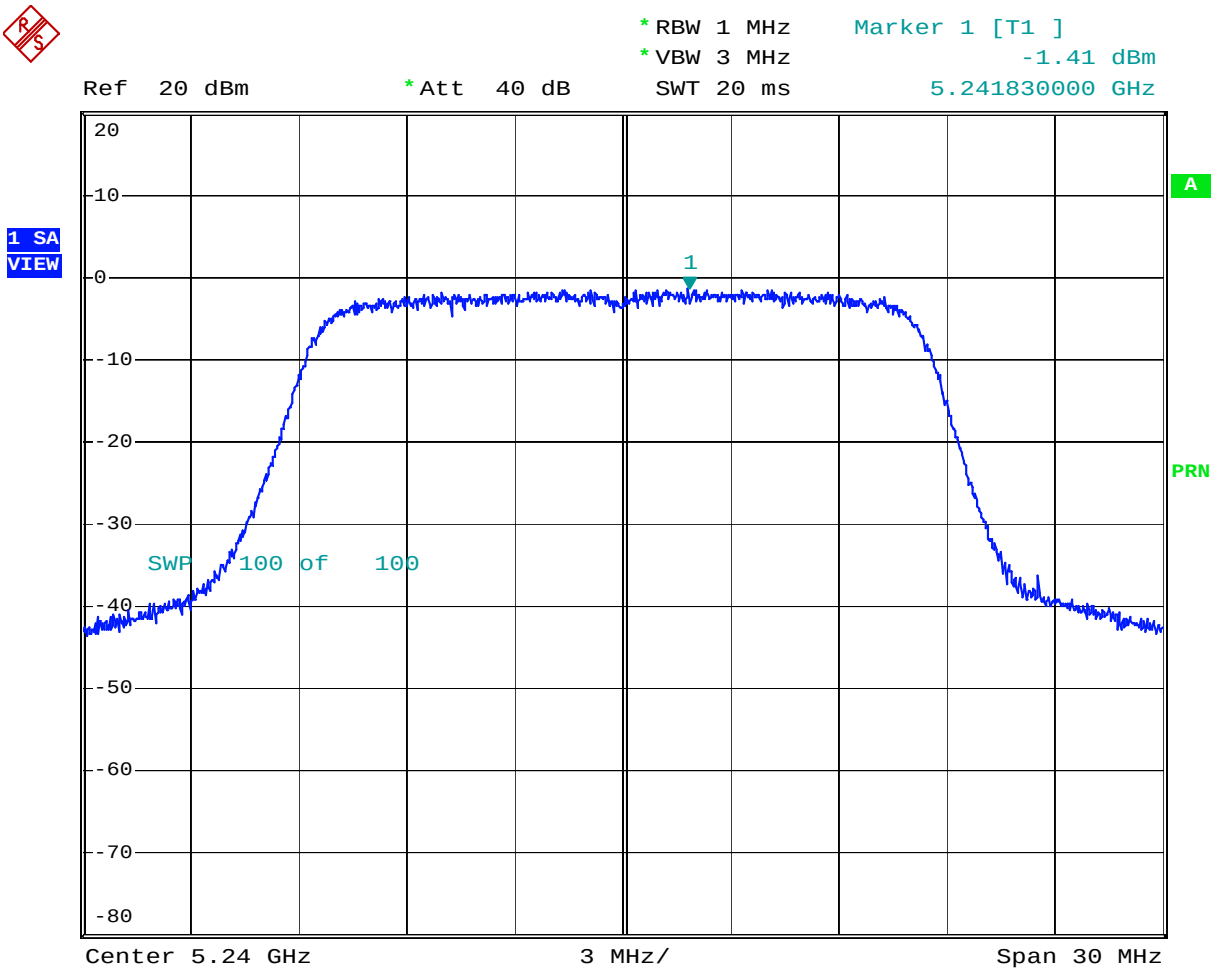
Comment: Peak power spectral density, 802.11n, HT20, 6.5 Mbps, output
Comment: 2
Date: 10.SEP.2008 15:41:47

Plot 3.8



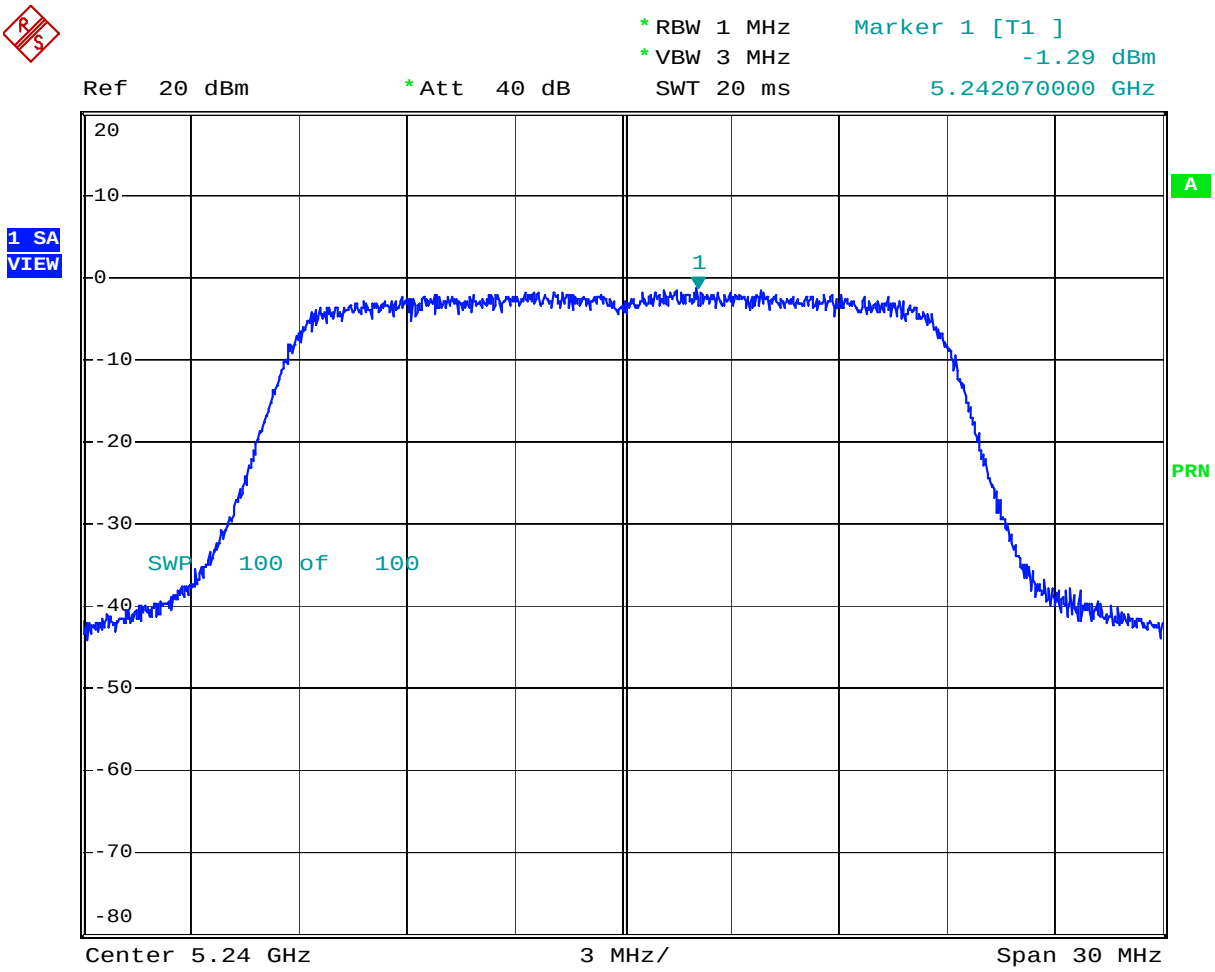

```
Comment: Peak power spectral density, 802.11n, HT40, 13.5 Mbps, outpu
Comment: t 2
Date:      10.SEP.2008  15:32:15
```

Plot 3.9



Comment: Peak power spectral density, 802.11a, 6 Mbps, output 2
Date: 10.SEP.2008 15:45:52

Plot 3.10



Comment: Peak power spectral density, 802.11n, HT20, 6.5 Mbps, output
Comment: 2
Date: 10.SEP.2008 15:42:48

4.4 Ratio of the peak excursion of the modulation envelope
FCC Rule: 15.407(a)(6)

Requirement

The Ratio of the peak excursion of the modulation envelope to the maximum conducted output power shall not exceed 13 dB across any 1 megahertz bandwidth.

Procedure

The Procedure described in the FCC Public Notice DA 02-2138 was used.

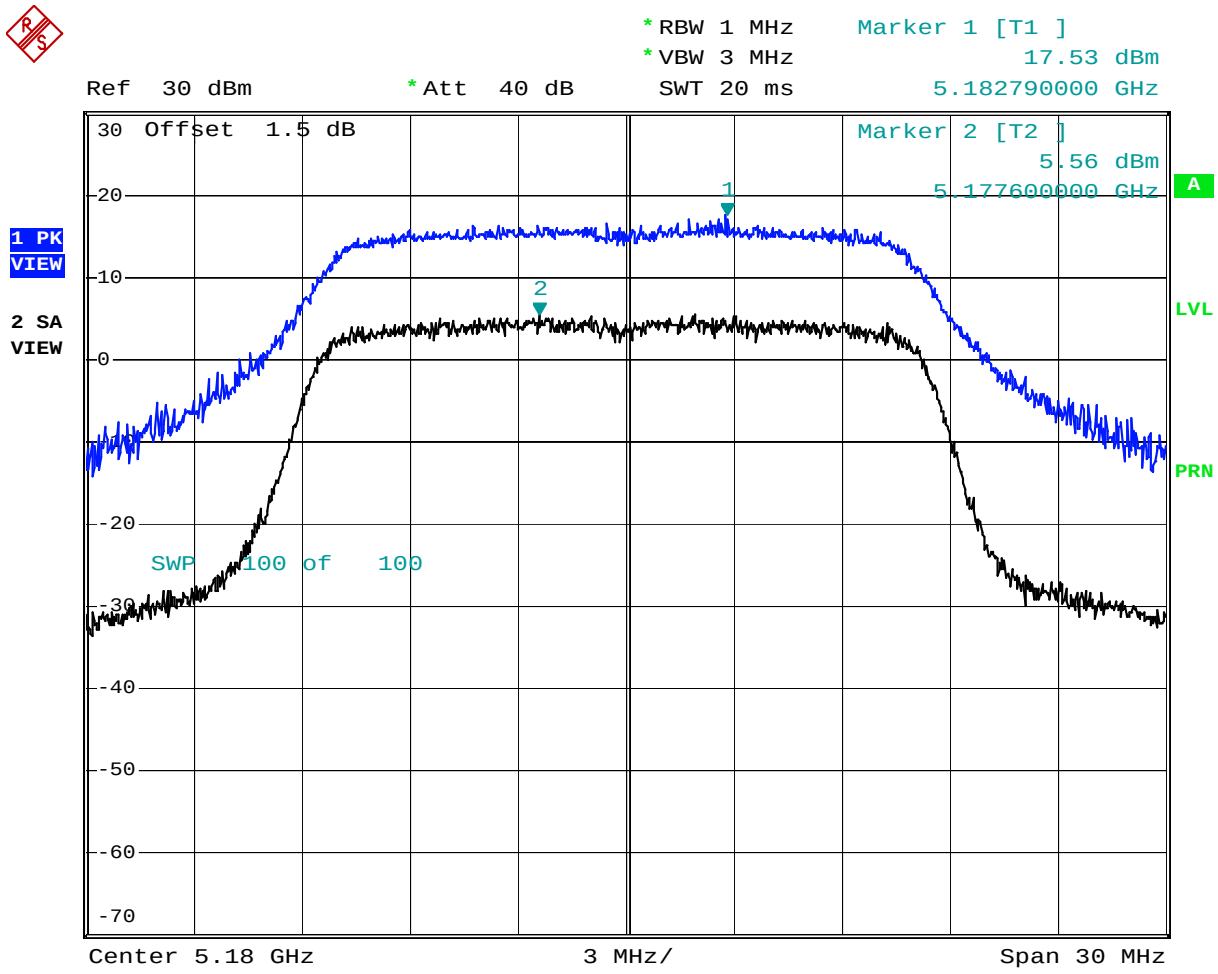
Results

The test results are presented on the following plots 4.1 – 4.10 and summarized in the table below

Channel	Frequency MHz	Standard/ Data rate	Ratio of the peak excursion dBm	Margin to 13 dBm limit dB	Plot #
36	5180	802.11a 6 Mbps	12.0	-1.0	4.1
		802.11n HT20 6.5 Mbps	11.1	-1.9	4.2
40	5200	802.11a 6 Mbps	11.7	-1.3	4.3
		802.11n HT20 6.5 Mbps	10.9	-2.1	4.4
		802.11n HT40 13.5 Mbps	11.5	-1.5	4.5
44	5220	802.11a 6 Mbps	11.7	-1.3	4.6
		802.11n HT20 6.5 Mbps	11.0	-2.0	4.7
		802.11n HT40 13.5 Mbps	11.7	-1.3	4.8
48	5240	802.11a 6 Mbps	11.9	-1.1	4.9
		802.11n HT20 6.5 Mbps	11.0	-2.0	4.10

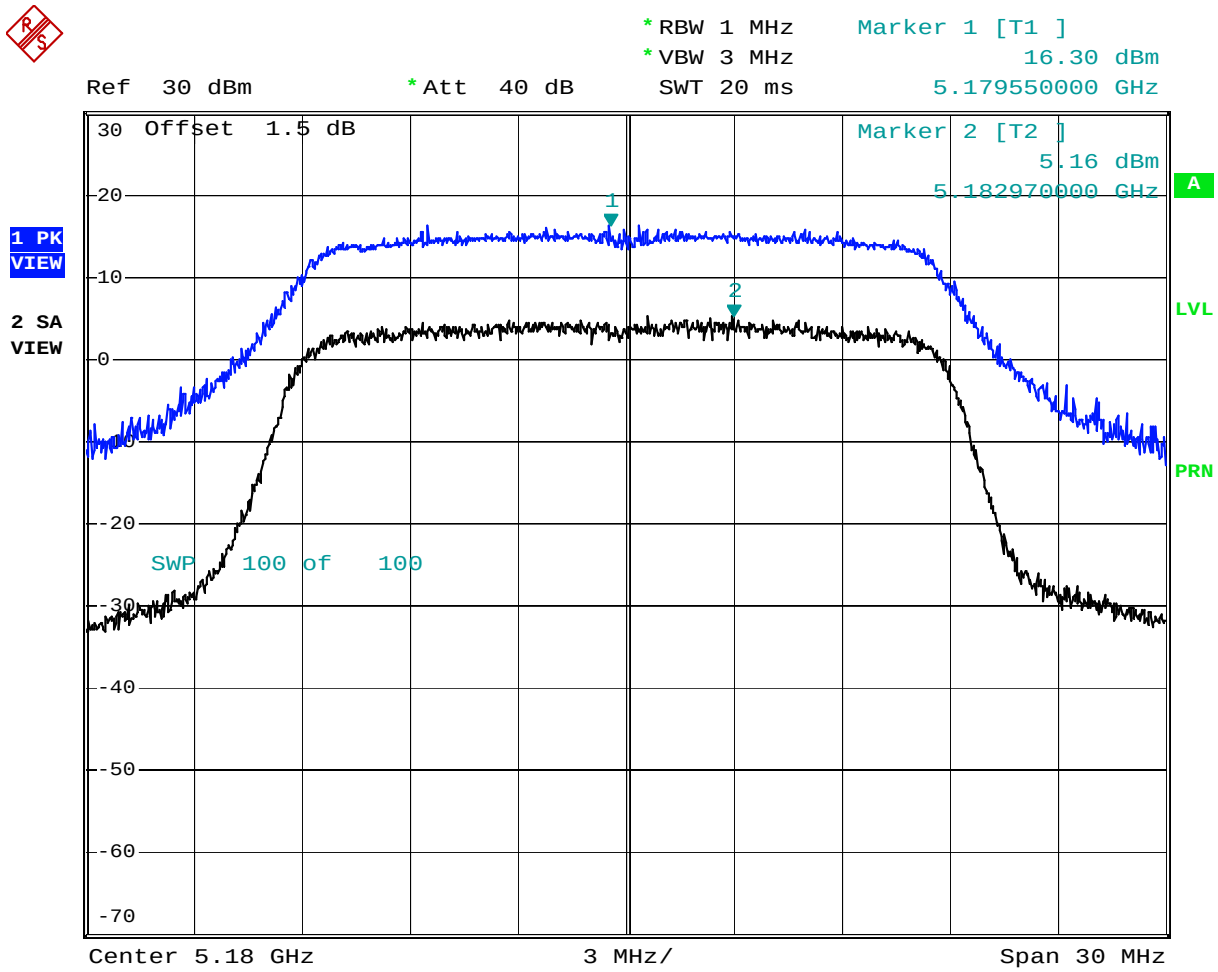
The EUT passed by 1.0 dB.

Plot 4.1



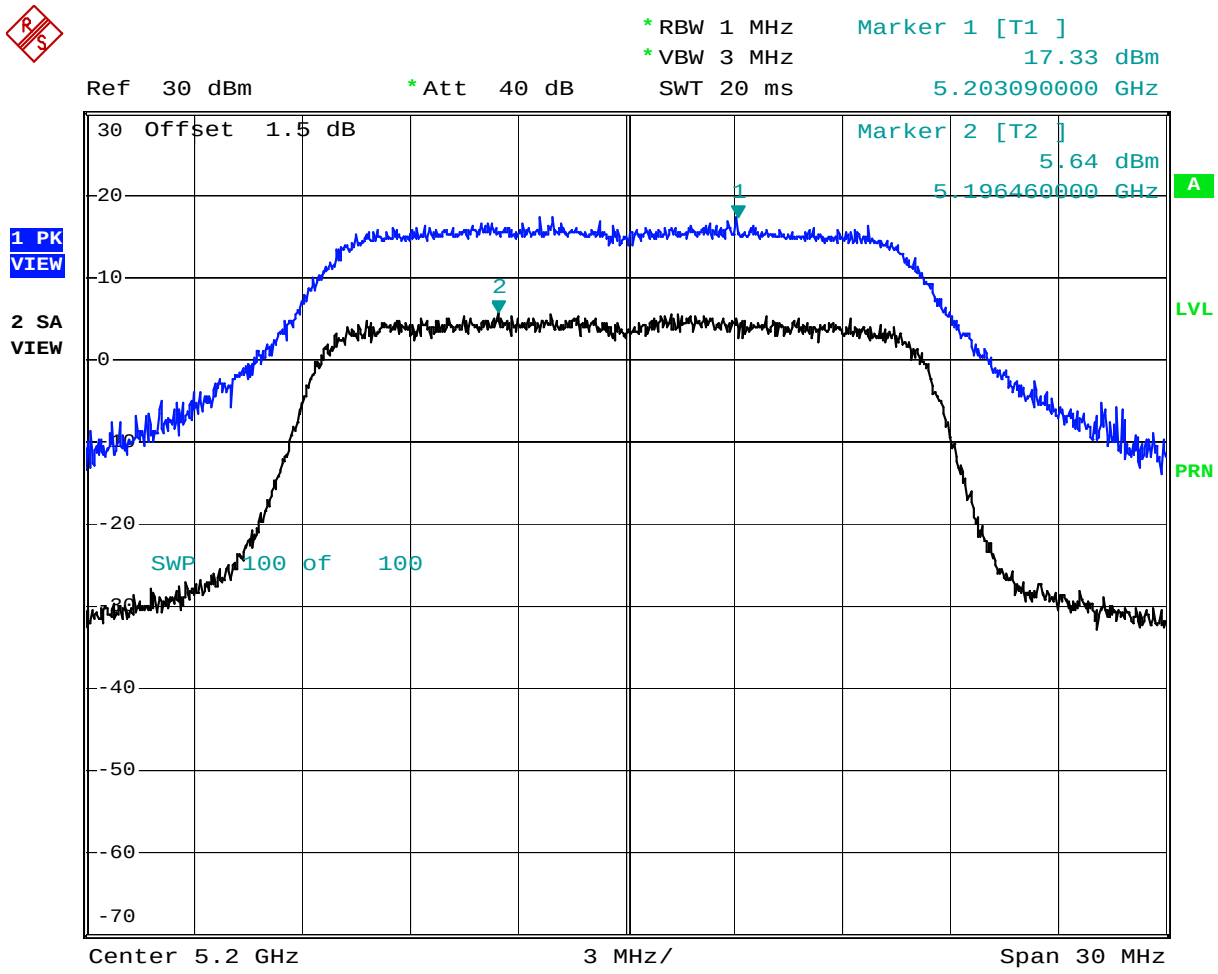
Comment: Peak excursion, 802.11a, 6 Mbps, output 2
Date: 12.SEP.2008 10:03:45

Plot 4.2



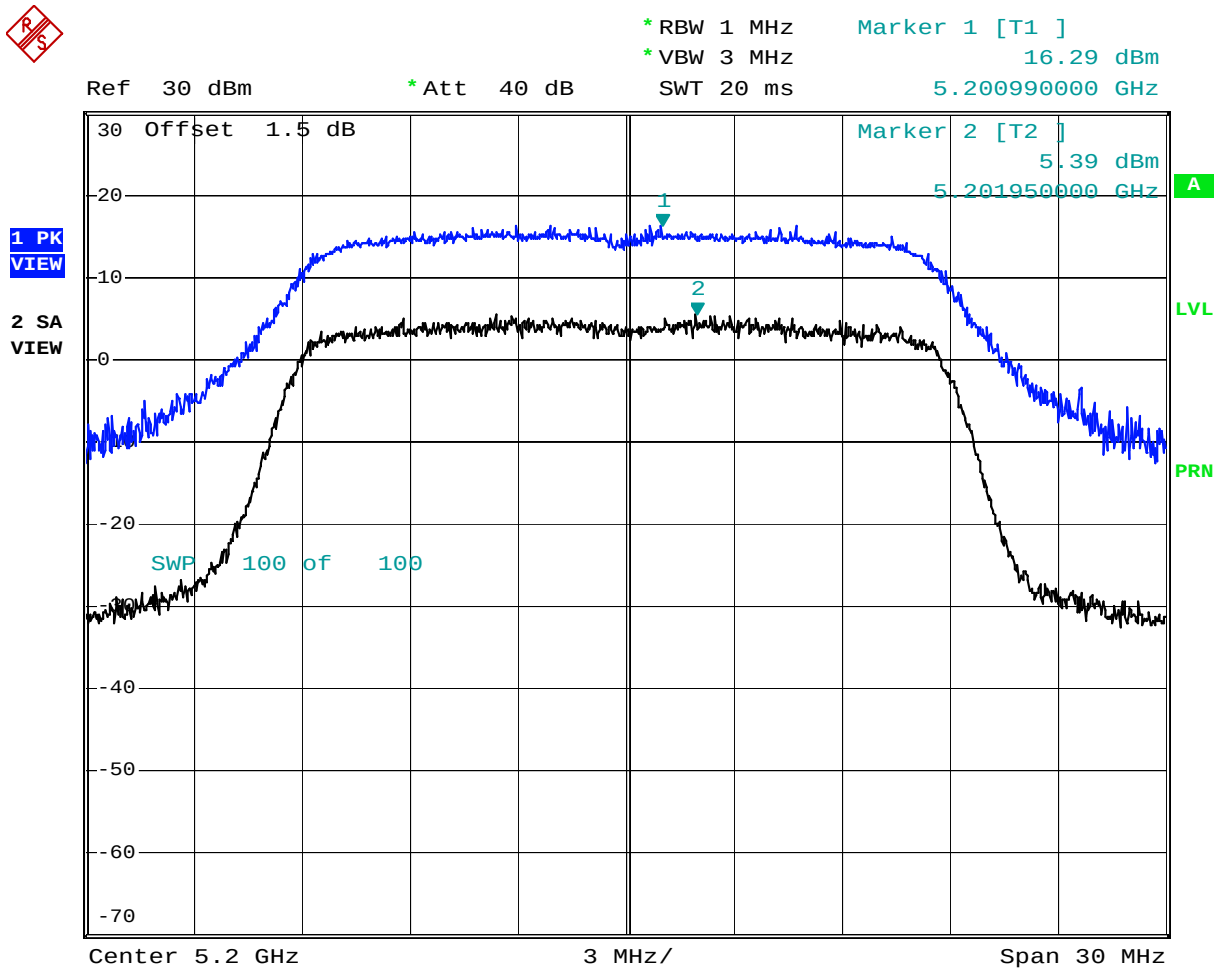
Comment: Peak excursion, 802.11n, HT20, 6.5 Mbps, output 2
Date: 12.SEP.2008 10:46:27

Plot 4.3



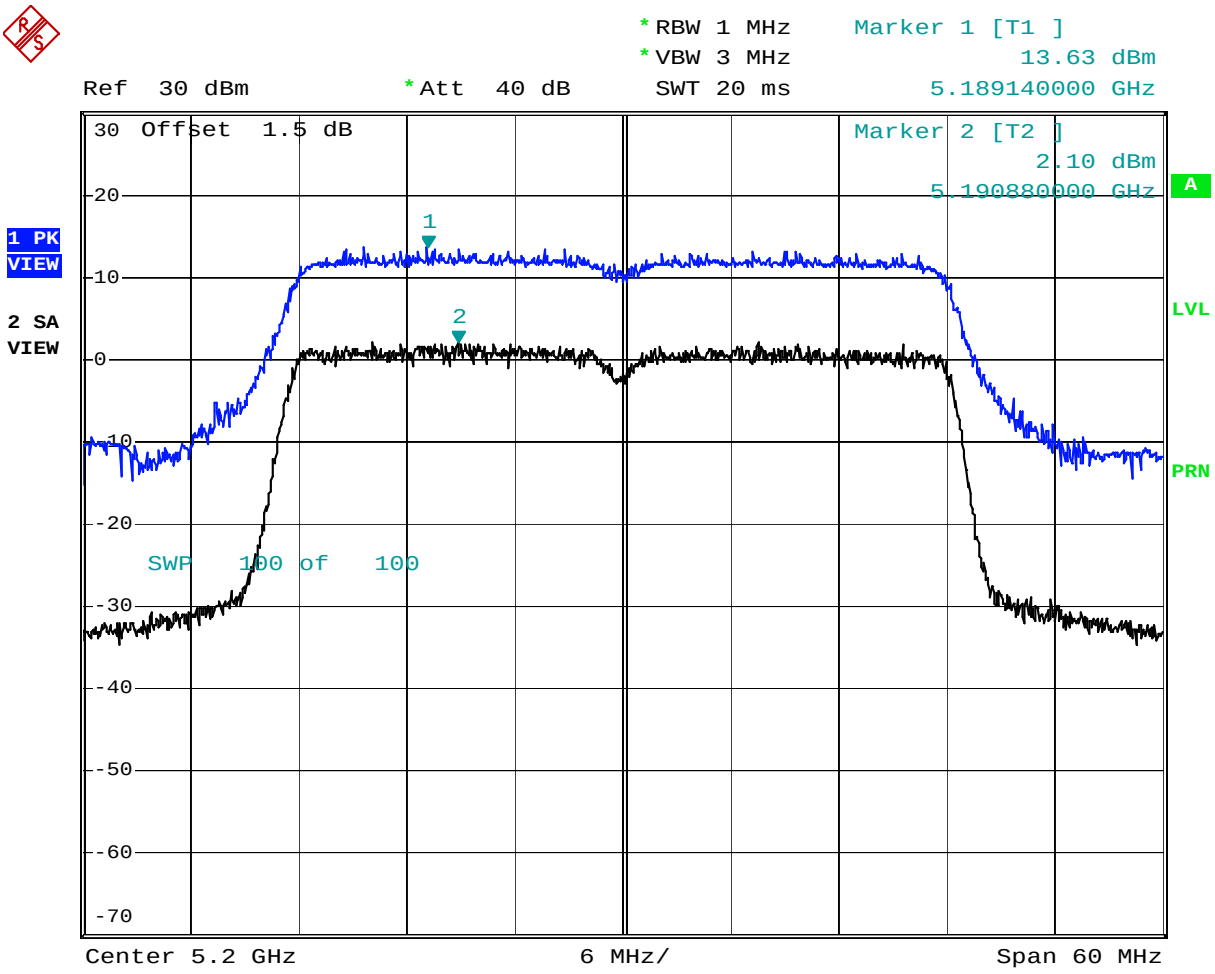
Comment: Peak excursion, 802.11a, 6 Mbps, output 2
Date: 12.SEP.2008 10:50:12

Plot 4.4



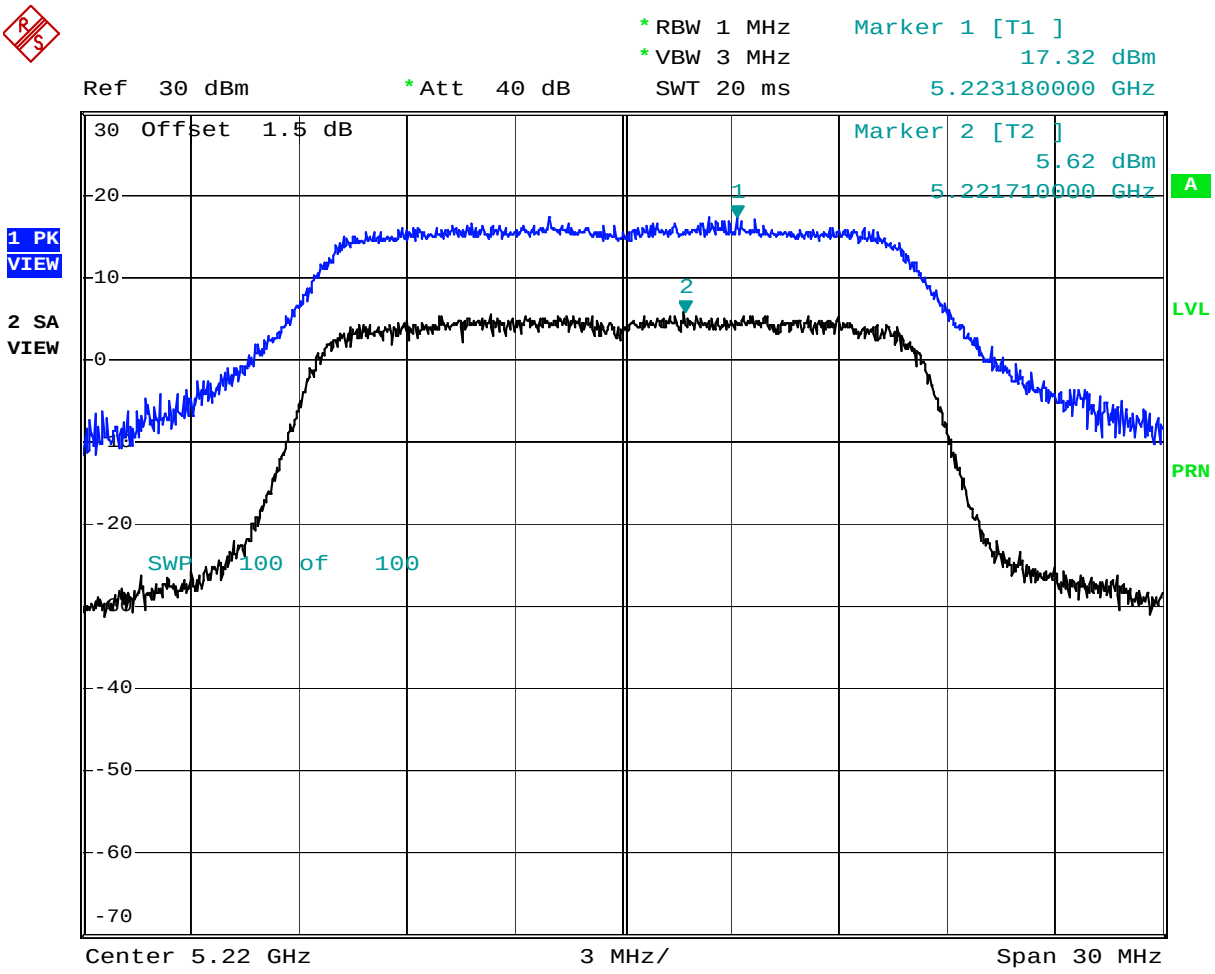
Comment: Peak excursion, 802.11n, HT20, 6.5 Mbps, output 2
Date: 12.SEP.2008 10:42:26

Plot 4.5



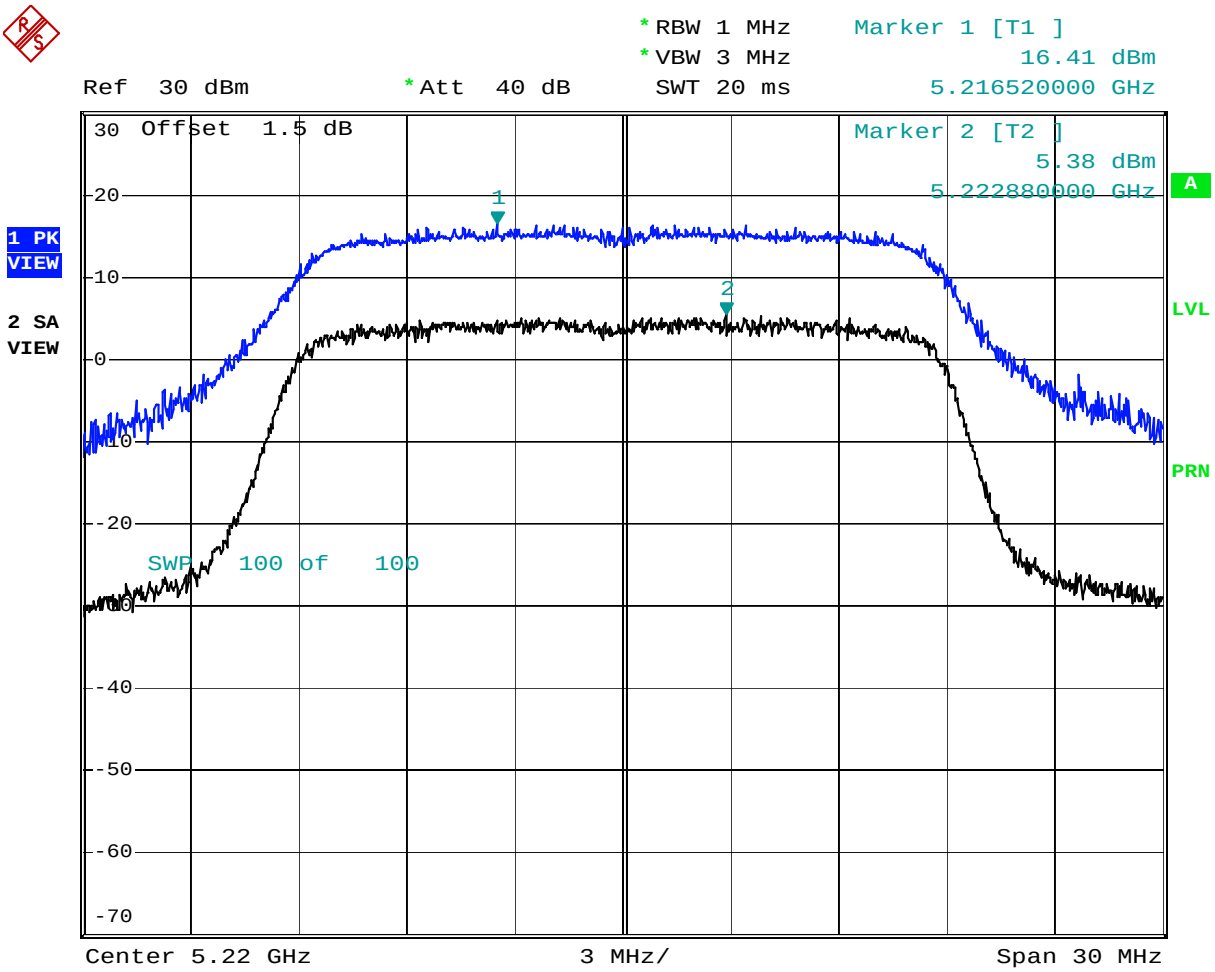
Comment: Peak excursion, 802.11n, HT40, 13.5 Mbps, output 2
Date: 12.SEP.2008 10:55:13

Plot 4.6



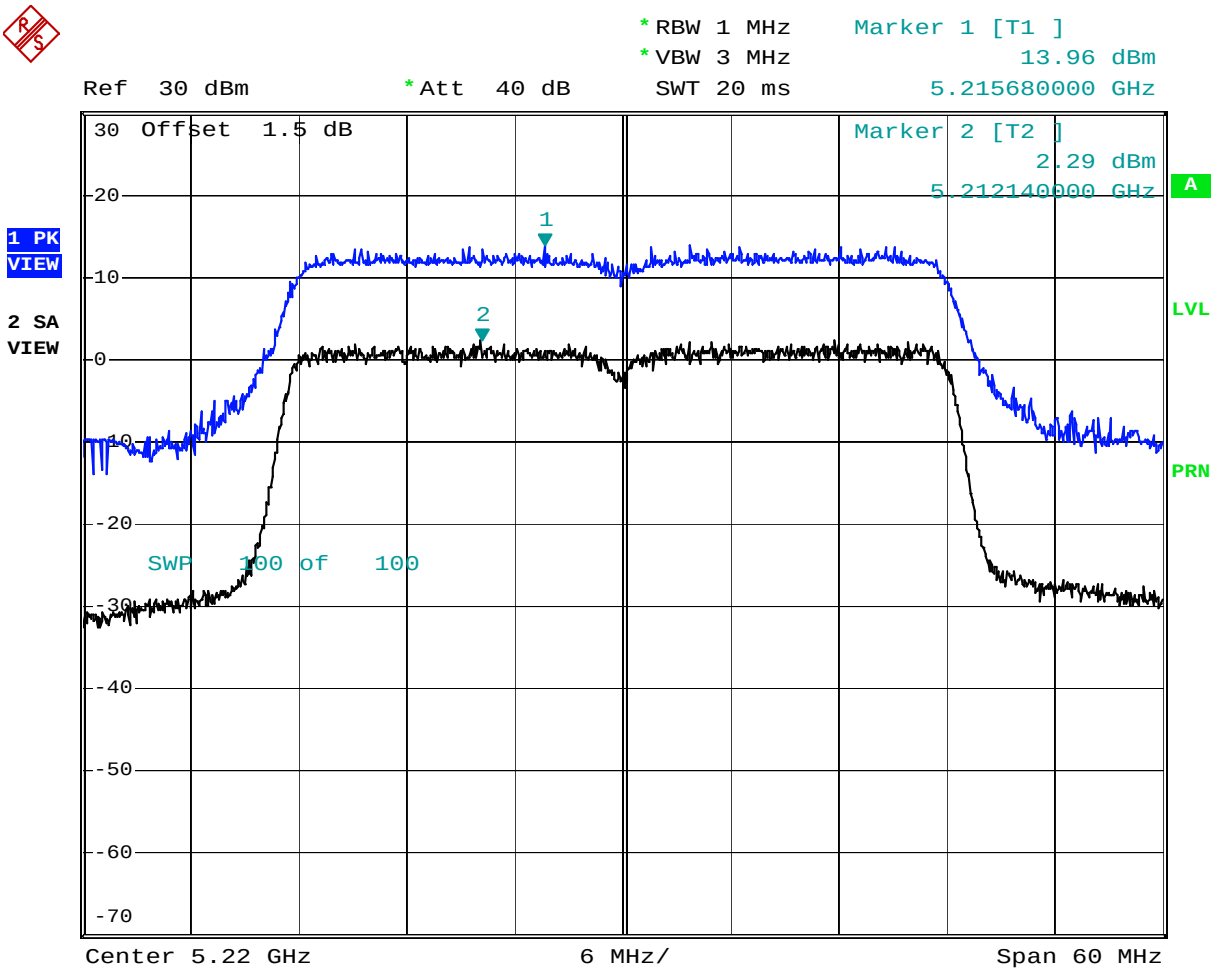
Comment: Peak excursion, 802.11a, 6 Mbps, output 2
Date: 12.SEP.2008 11:12:34

Plot 4.7



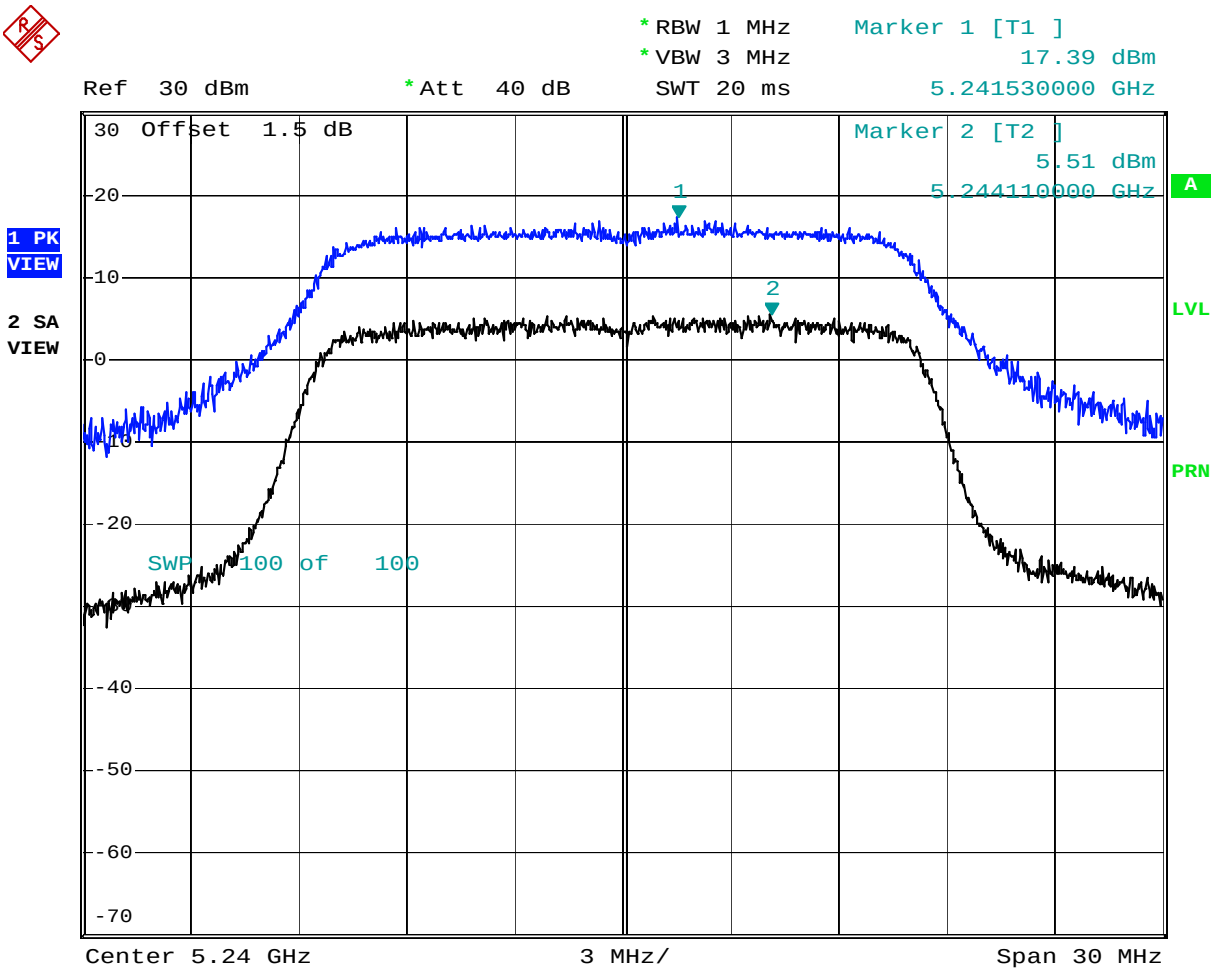
Comment: Peak excursion, 802.11n, HT20, 6.5 Mbps, output 2
Date: 12.SEP.2008 11:03:15

Plot 4.8



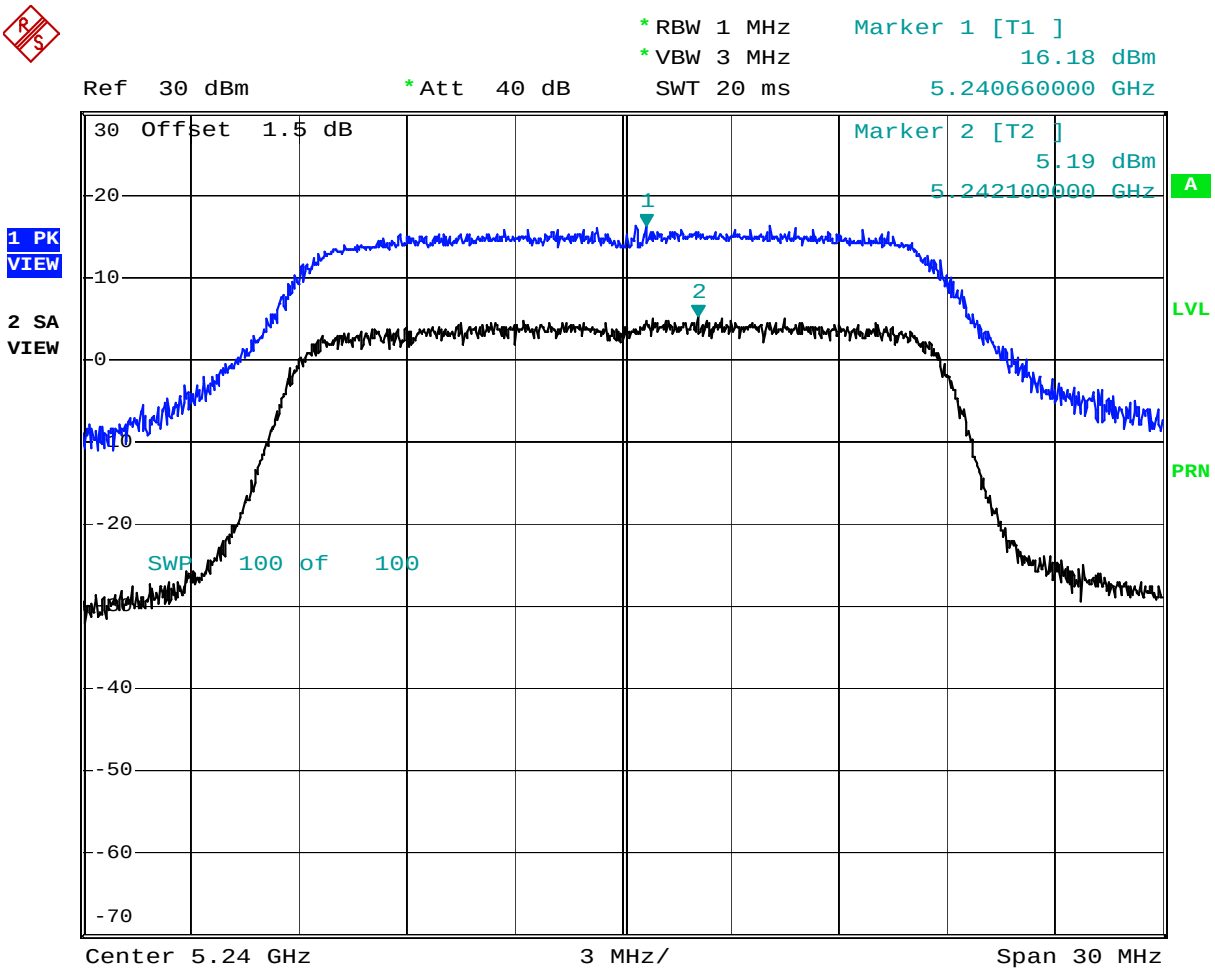
Comment: Peak excursion, 802.11n, HT40, 13.5 Mbps, output 2
Date: 12.SEP.2008 10:58:40

Plot 4.9



Comment: Peak excursion, 802.11a, 6 Mbps, output 2
Date: 12.SEP.2008 11:59:26

Plot 4.10



Comment: Peak excursion, 802.11n, HT20, 6.5 Mbps, output 2
Date: 12.SEP.2008 12:02:52

4.5 Out-of-Band Conducted Emissions
FCC Rule: 15.407(b)

Requirements

All emissions outside of the 5.15 – 5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

Procedure

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 1 MHz. The out-of-band emissions were measured from 30 MHz to 40 GHz for low, middle and high channel.

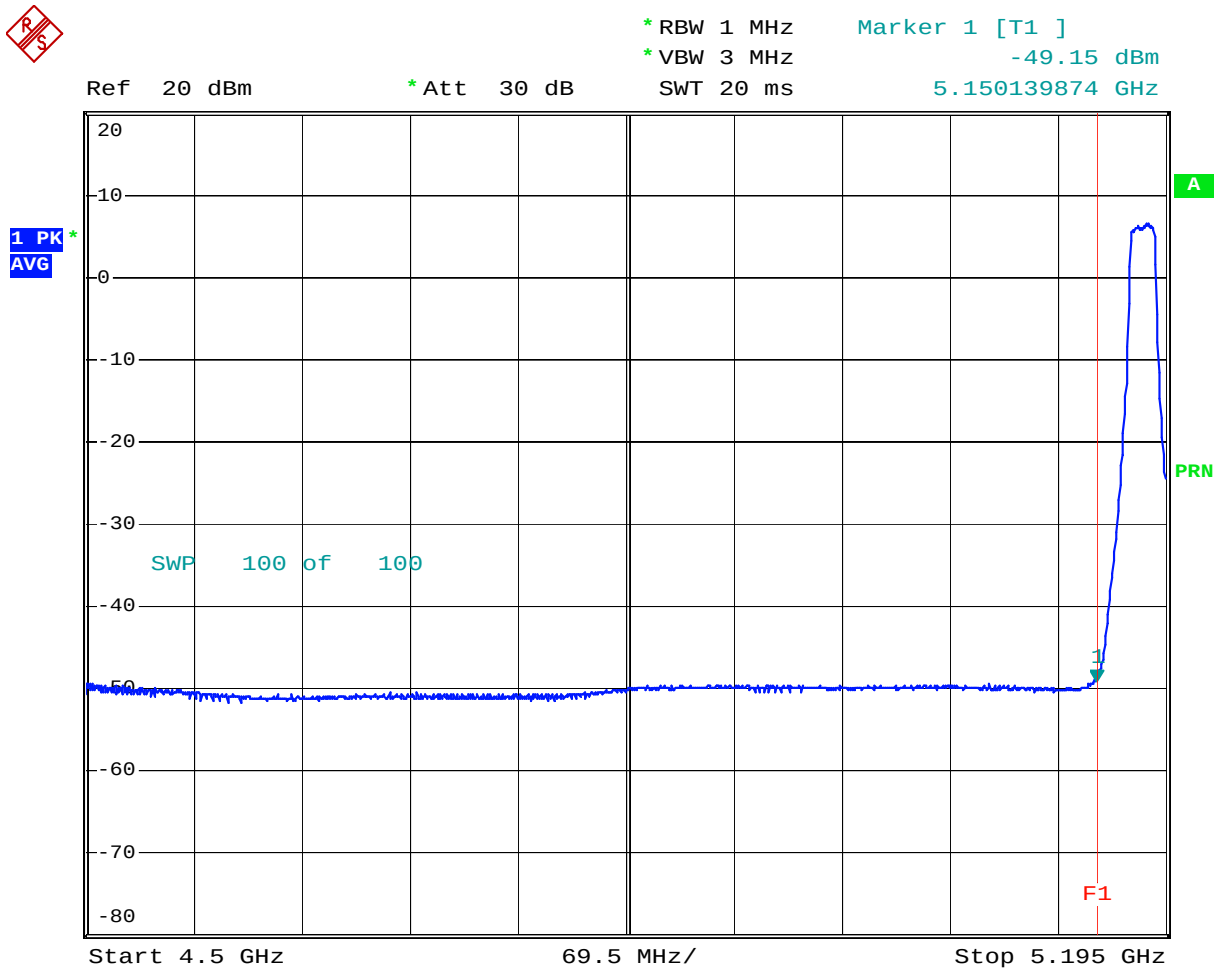
Test Result

Refer to the plots below for the test result.

The EUT passed by 16.2 dB.

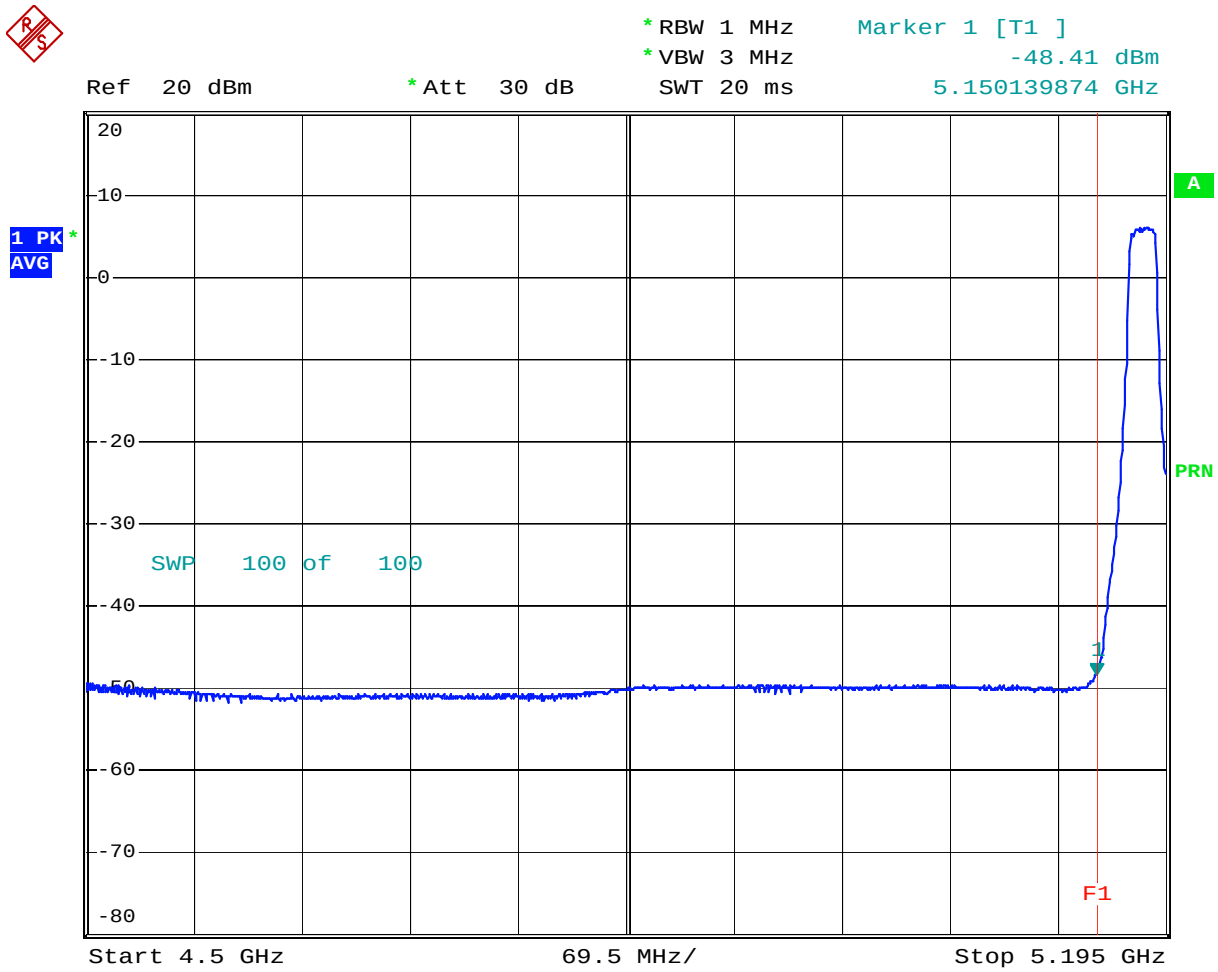
Frequency MHz	Description	Margin to –27dBm/MHz EIRP limit (antenna gain up to 6 dBi), dB	Plot #
5180	Scan 4.5 GHz – 5.195 GHz, 802.1a, output 1	> 20	5.1
	Scan 4.5 GHz – 5.195 GHz, 802.1n HT20, output 1	> 20	5.2
	Scan 4.5 GHz – 5.195 GHz, 802.1a, output 2	> 20	5.3
	Scan 4.5 GHz – 5.195 GHz, 802.1n HT20, output 2	> 20	5.4
	Scan 4.5 GHz – 5.195 GHz, 802.1a, output 3	> 20	5.5
	Scan 4.5 GHz – 5.195 GHz, 802.1n HT20, output 3	> 20	5.6
	Scan 30 MHz – 1 GHz, 802.1n HT20, output 2	> 20	5.7
	Scan 1 GHz – 4.5 GHz, 802.1a, output 2	18.0	5.8
	Scan 1 GHz – 4.5 GHz, 802.1a, output 2	18.0	5.9
5200	Scan 4.5 GHz – 5.9 GHz, 802.1a, output 2	> 20	5.10
	Scan 4.5 GHz – 5.9 GHz, 802.1n HT40, output 2	16.9	5.11
	Scan 30 MHz – 1 GHz, 802.1n HT40, output 2	> 20	5.12
	Scan 1 GHz – 4.5 GHz, 802.1n HT40, output 2	18.2	5.13
5220	Scan 4.5 GHz – 5.9 GHz, 802.1a, output 2	> 20	5.14
	Scan 4.5 GHz – 5.9 GHz, 802.1n HT40, output 2	> 20	5.15
	Scan 5.9 GHz – 40 GHz, 802.1n HT40, output 2	16.6	5.16
5240	Scan 5.15 GHz – 5.9 GHz, 802.1a, output 2	> 20	5.17
	Scan 5.15 GHz – 5.9 GHz, 802.1n HT20, output 1	> 20	5.18
	Scan 5.15 GHz – 5.9 GHz, 802.1n HT20, output 2	> 20	5.19
	Scan 5.15 GHz – 5.9 GHz, 802.1n HT20, output 3	> 20	5.20
	Scan 5.9 GHz – 40 GHz, 802.1a, output 2	16.2	5.21
	Scan 5.9 GHz – 40 GHz, 802.1n HT20, output 2	19.0	5.22

Plot 5.1



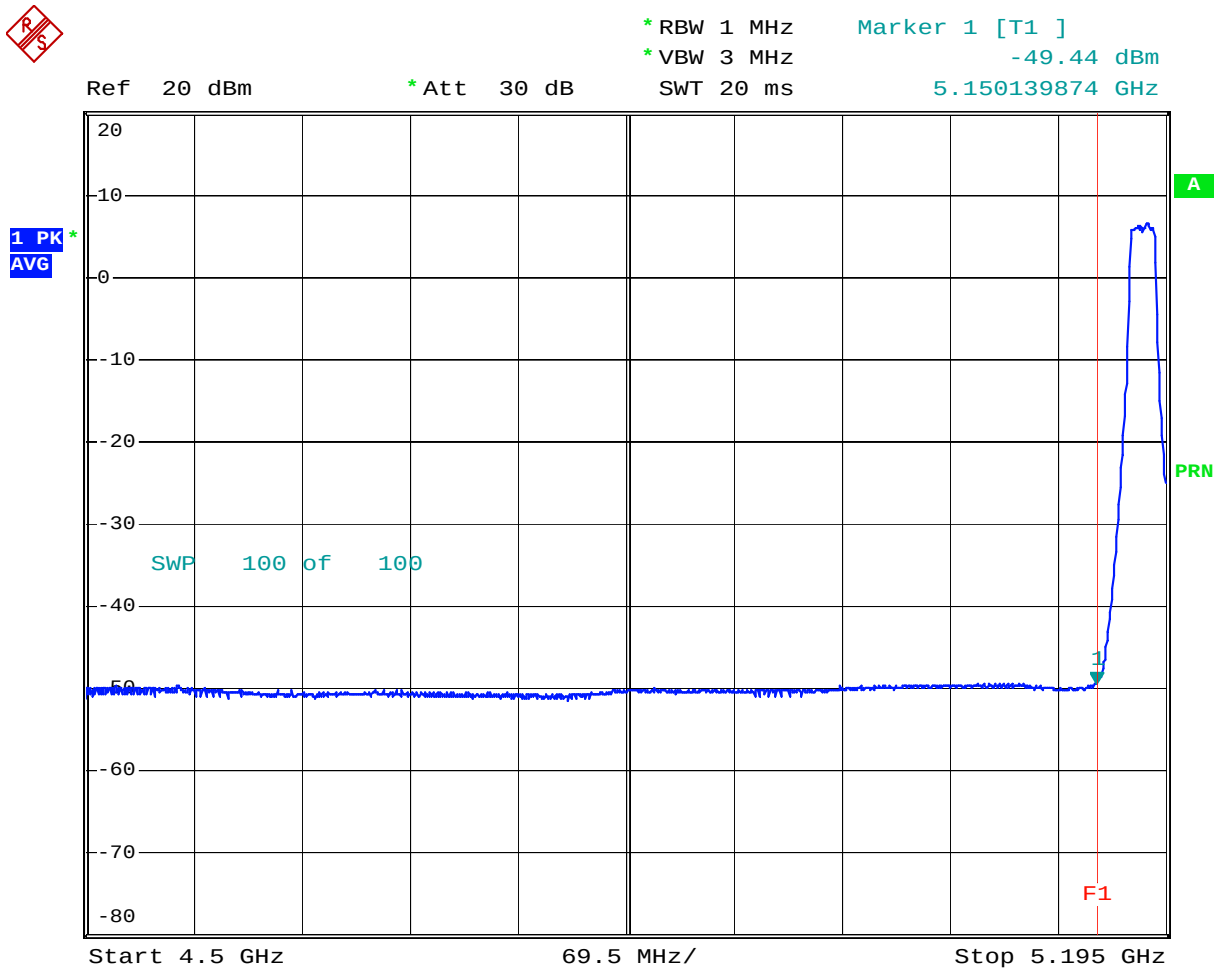
Comment: Out-of-band emis., 5.18GHz, 802.11a, 6Mbps, output 1
Date: 15.SEP.2008 14:16:23

Plot 5.2



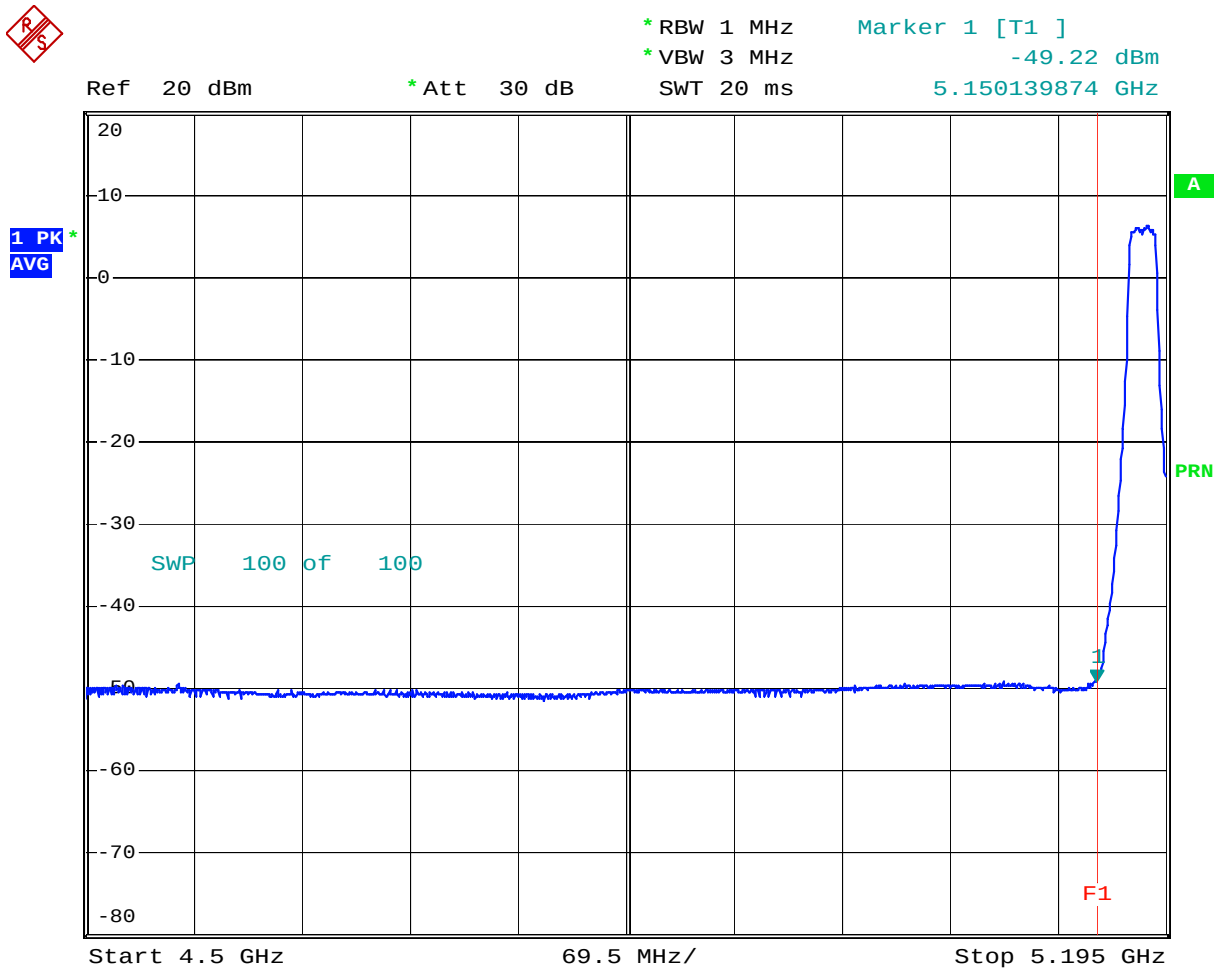
Comment: Out-of-band emis., 5.18GHz, 802.11n, HT20, 6.5Mbps, output 1
Date: 15.SEP.2008 14:15:29

Plot 5.3



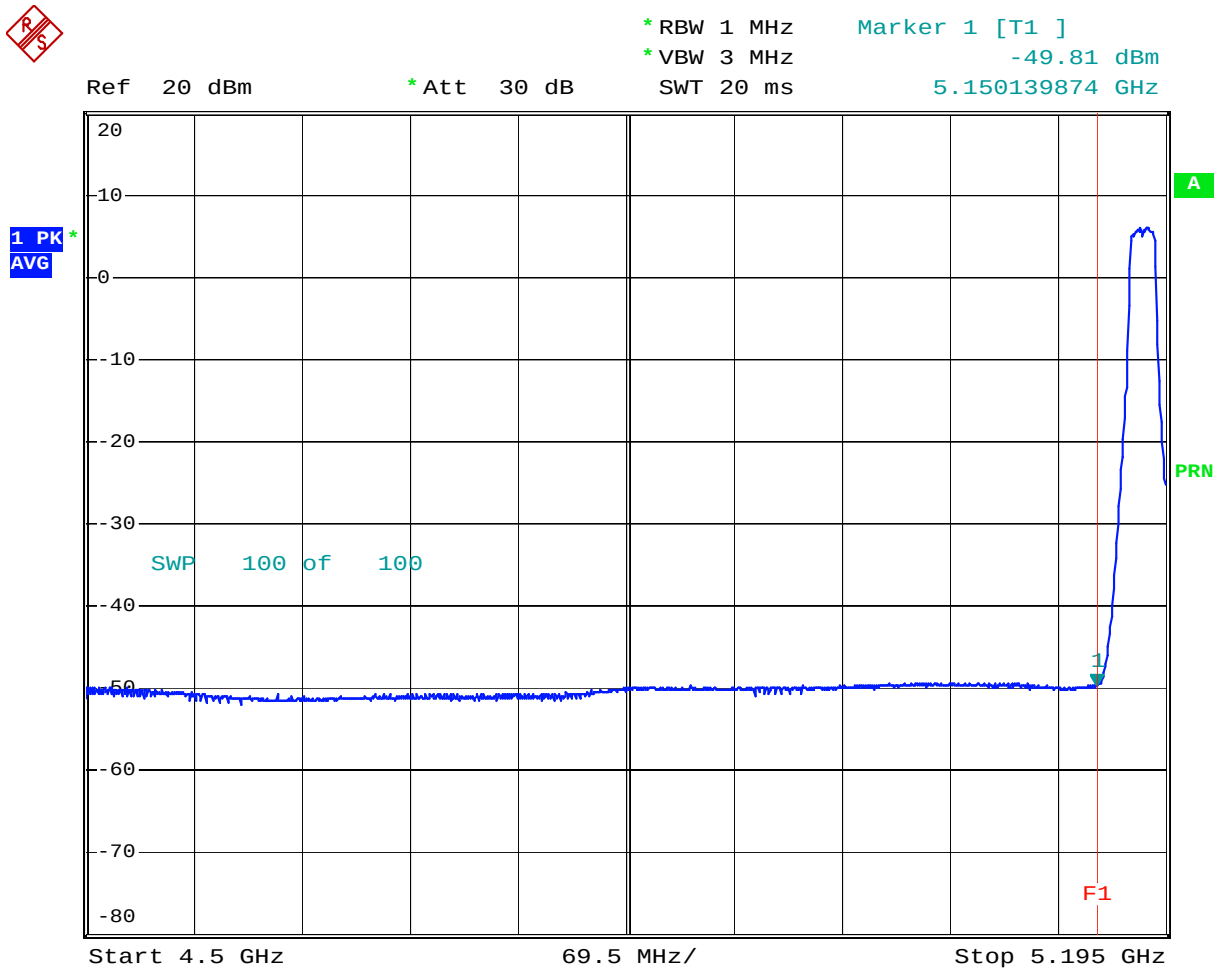
Comment: Out-of-band emis., 5.18GHz, 802.11a, 6Mbps, output 2
Date: 15.SEP.2008 13:04:17

Plot 5.4



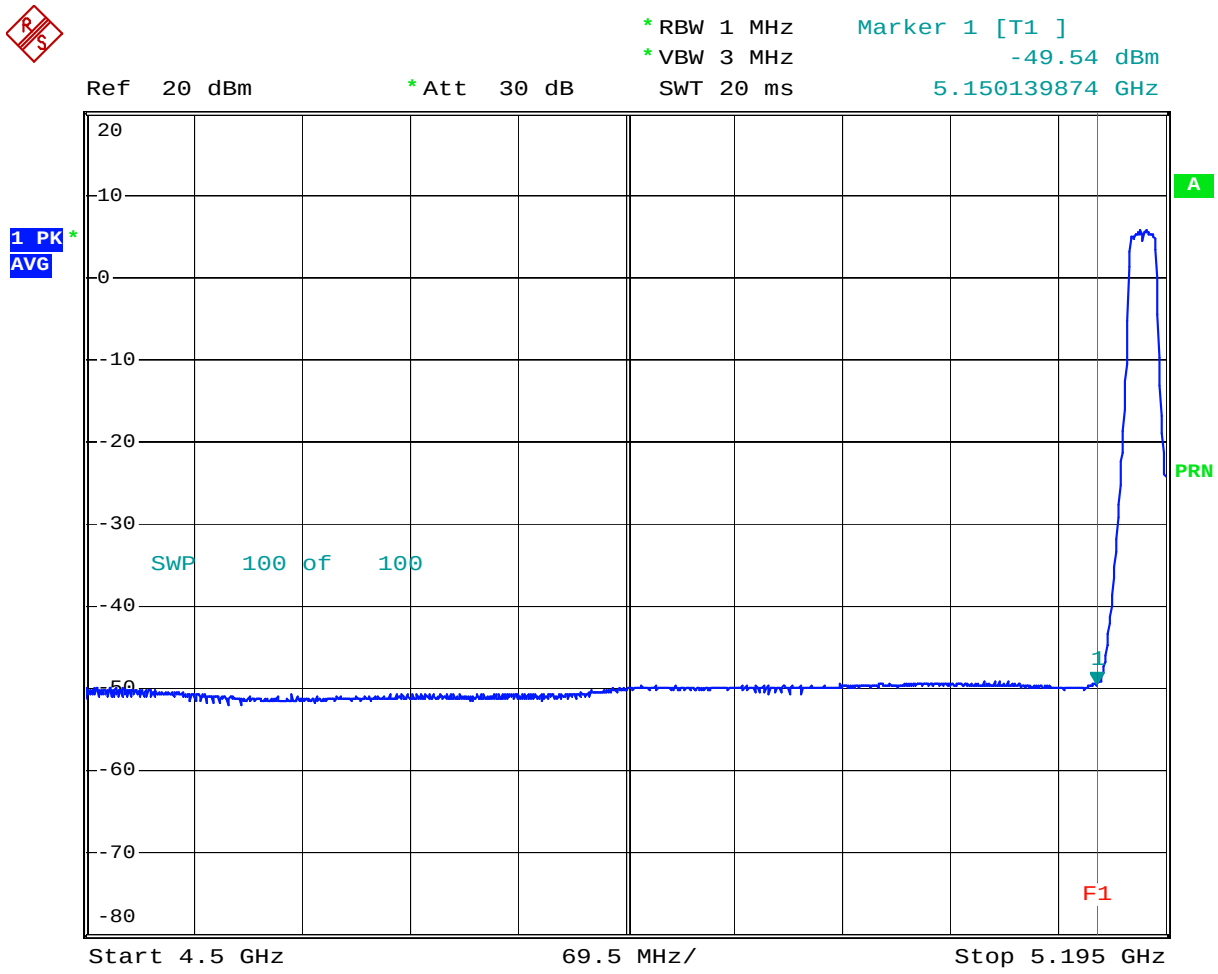
Comment: Out-of-band emis., 5.18GHz, 802.11n, HT20, 6.5Mbps, output 2
Date: 15.SEP.2008 13:05:43

Plot 5.5



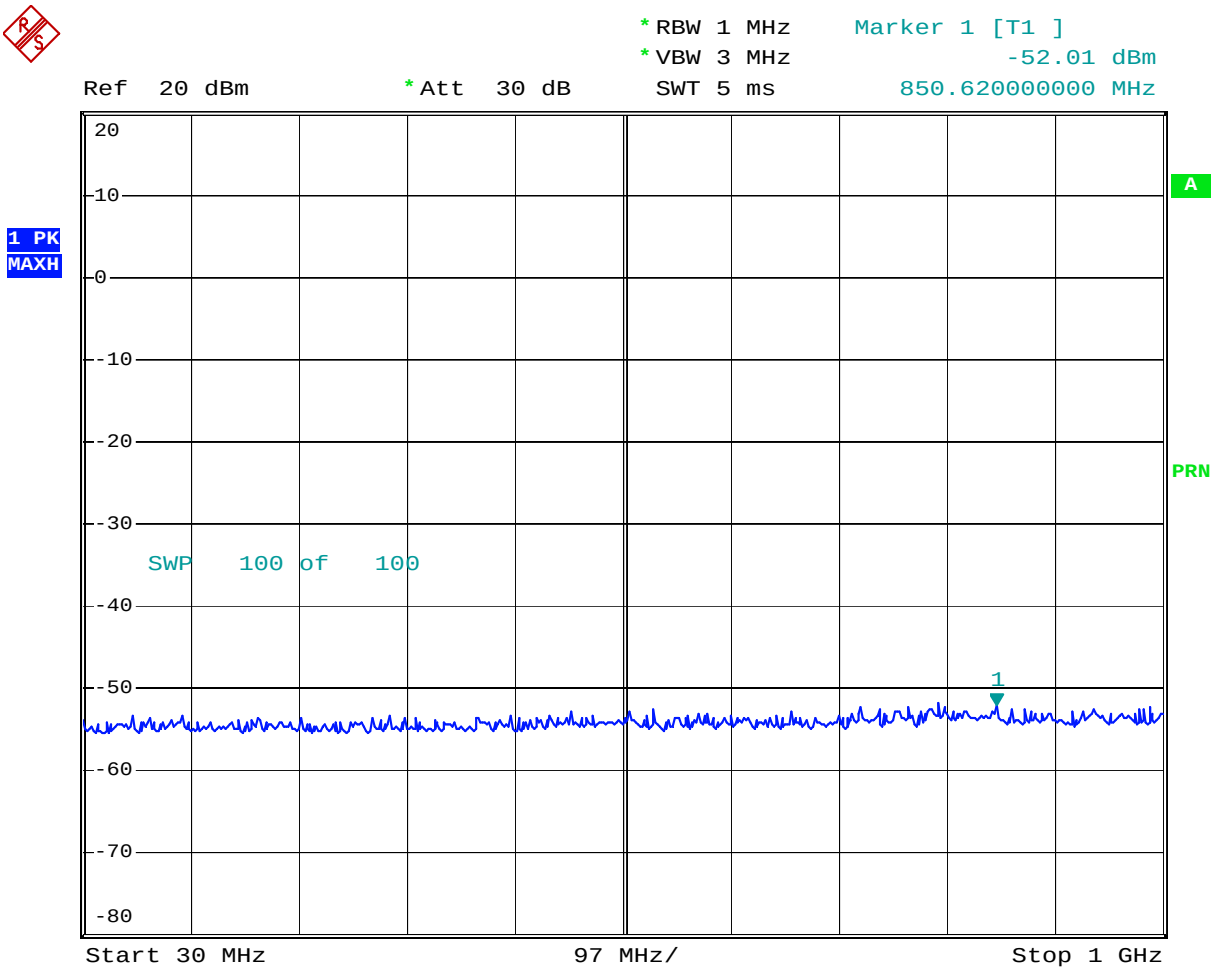
Comment: Out-of-band emis., 5.18GHz, 802.11a, 6Mbps, output 3
Date: 15.SEP.2008 13:02:39

Plot 5.6



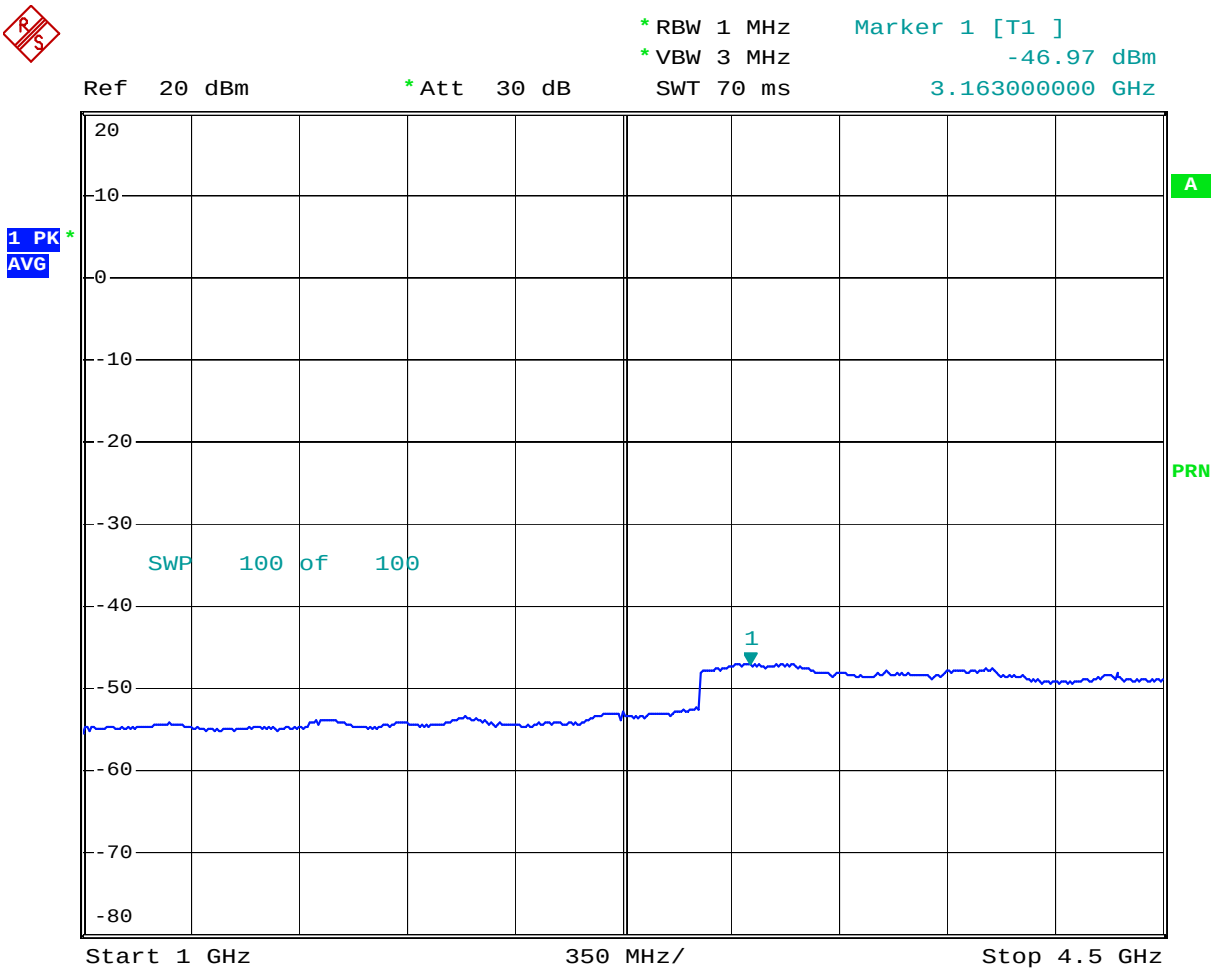
Comment: Out-of-band emis., 5.18GHz, 802.11n, HT20, 6.5Mbps, output 3
Date: 15.SEP.2008 13:01:27

Plot 5.7



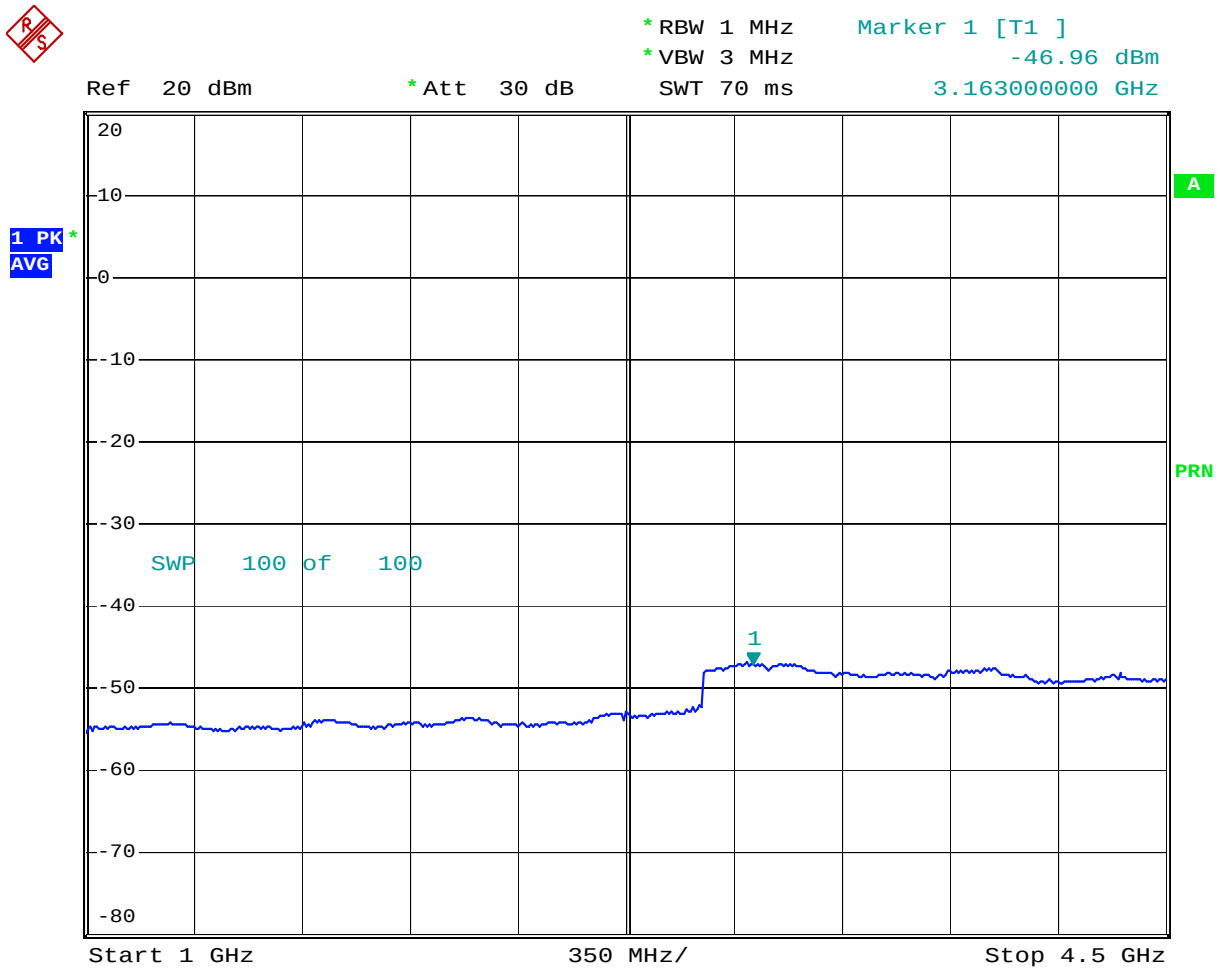
Comment: Out-of-band emissions, 5.18 GHz, 802.11n HT20, 6.5 Mbps, out
Comment: put 2
Date: 15.SEP.2008 14:43:32

Plot 5.8



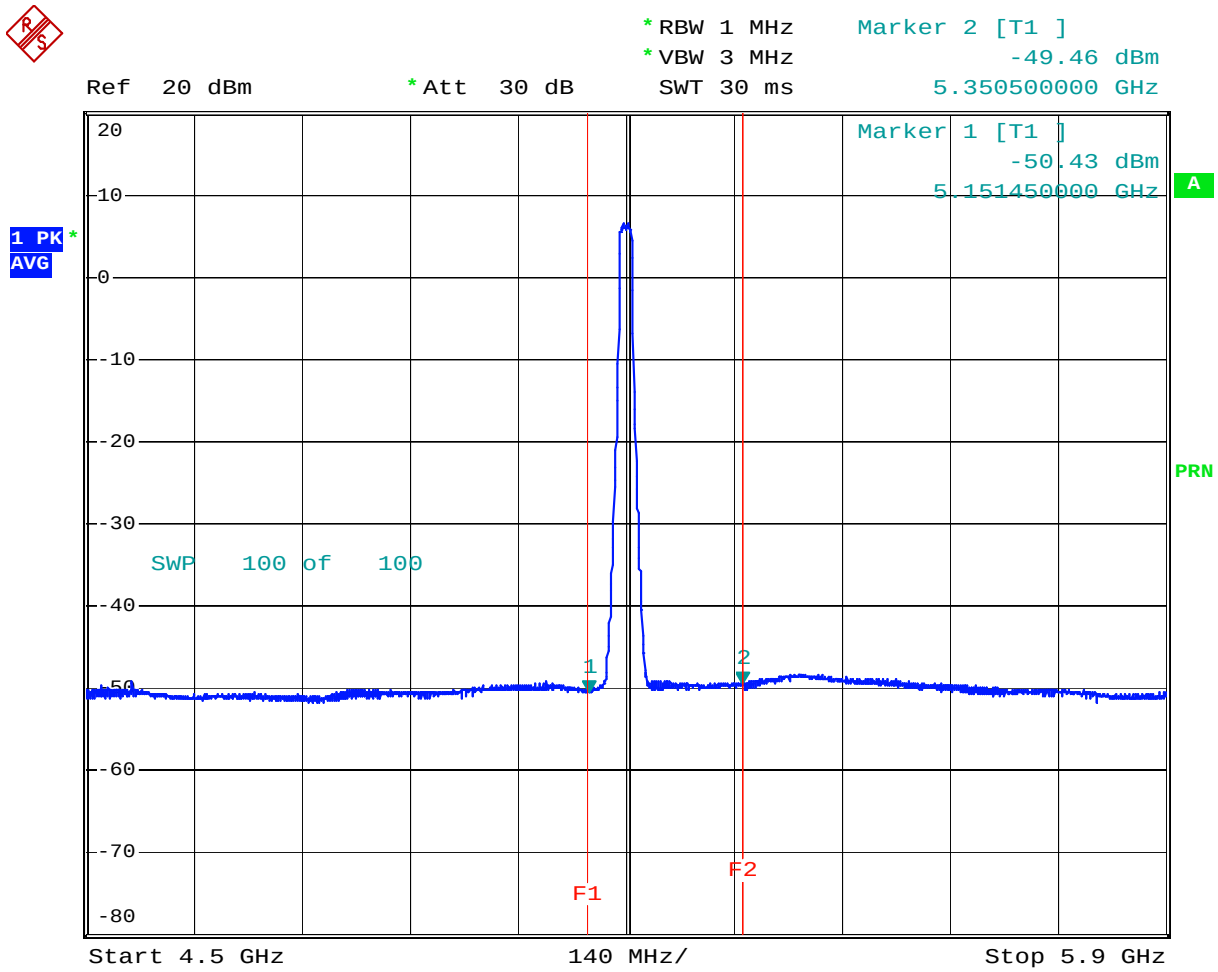
Comment: Out-of-band emissions, 5.18 GHz, 802.11a 6 Mbps, output 2
Date: 15.SEP.2008 14:40:05

Plot 5.9



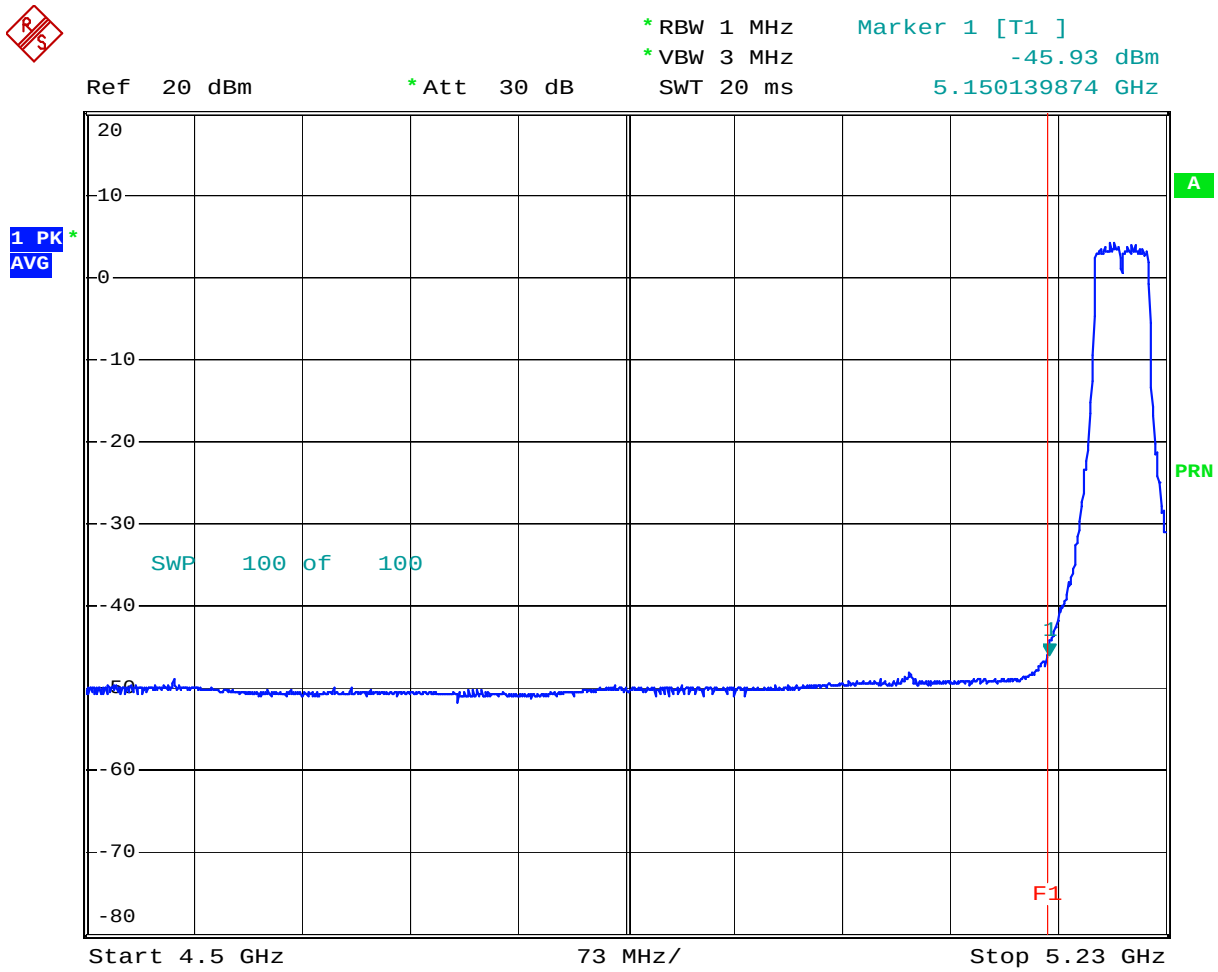
Comment: Out-of-band emissions, 5.18 GHz, 802.11n HT20, 6.5 Mbps, out
Comment: put 2
Date: 15.SEP.2008 14:42:32

Plot 5.10



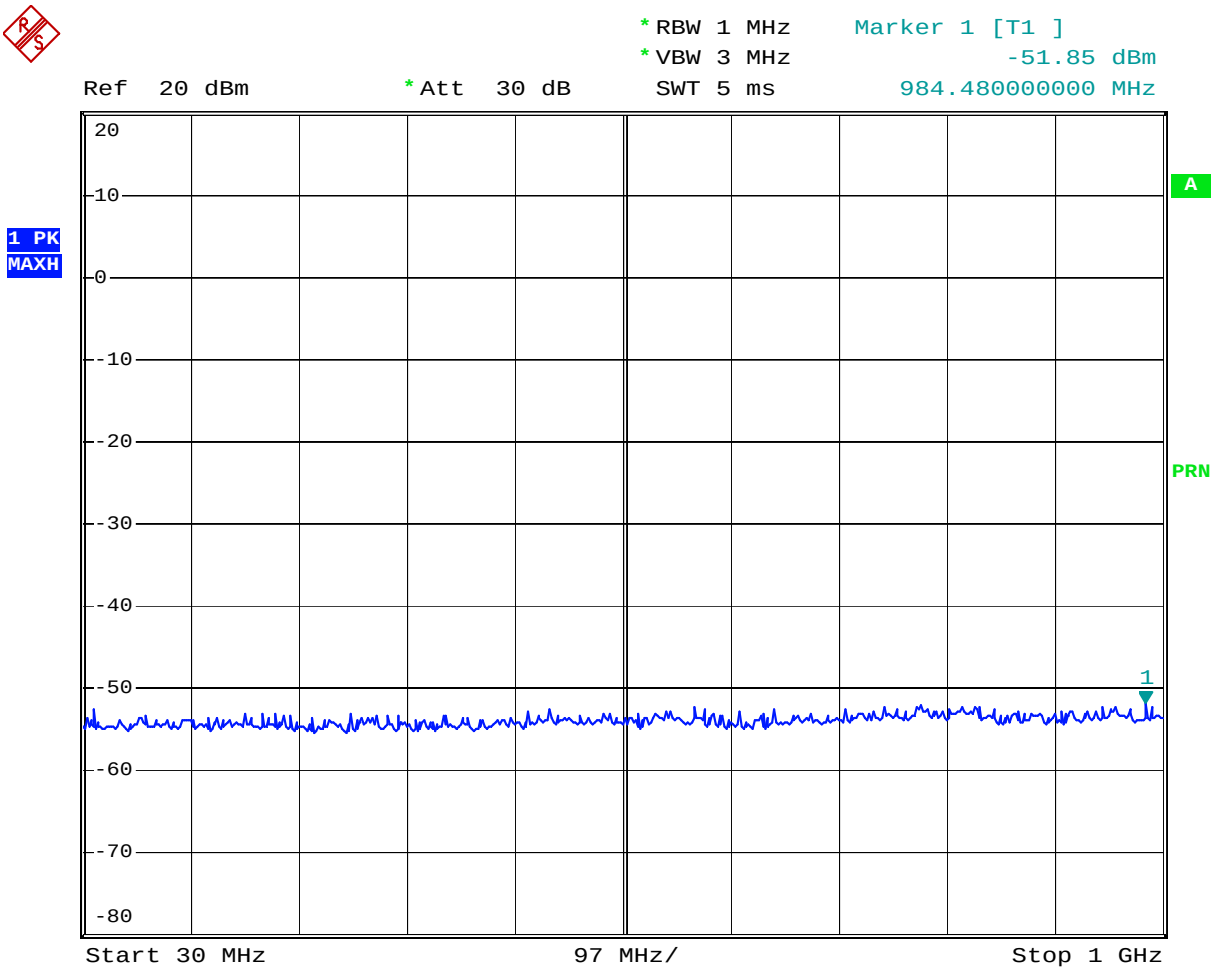
Comment: Out-of-band emis., 5.2GHz, 802.11a, 6Mbps, output 2
Date: 15.SEP.2008 16:15:21

Plot 5.11



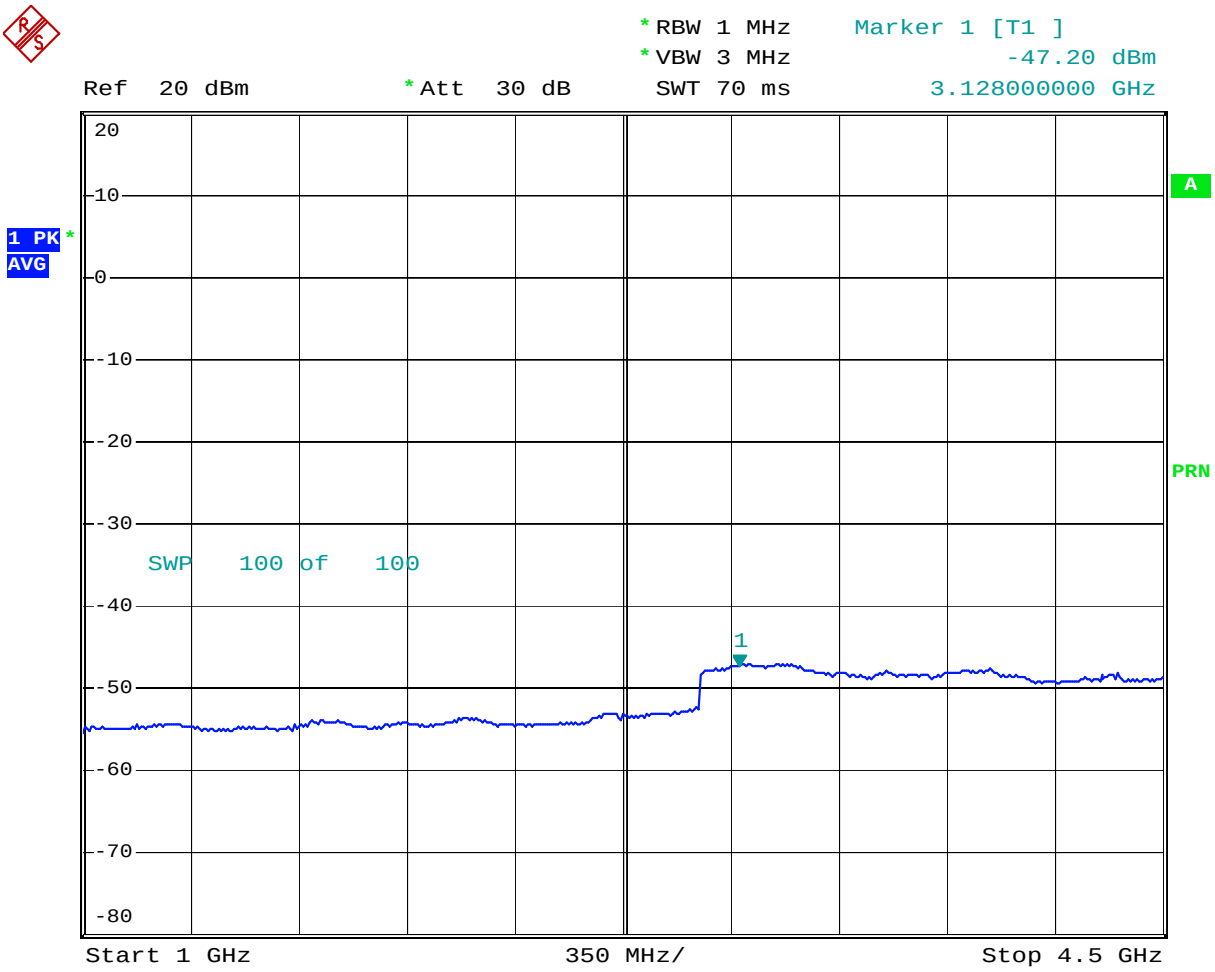
Comment: Out-of-band emis., 5.2GHz, 802.11n, 13.5Mbps, output 2
Date: 15.SEP.2008 14:22:55

Plot 5.12



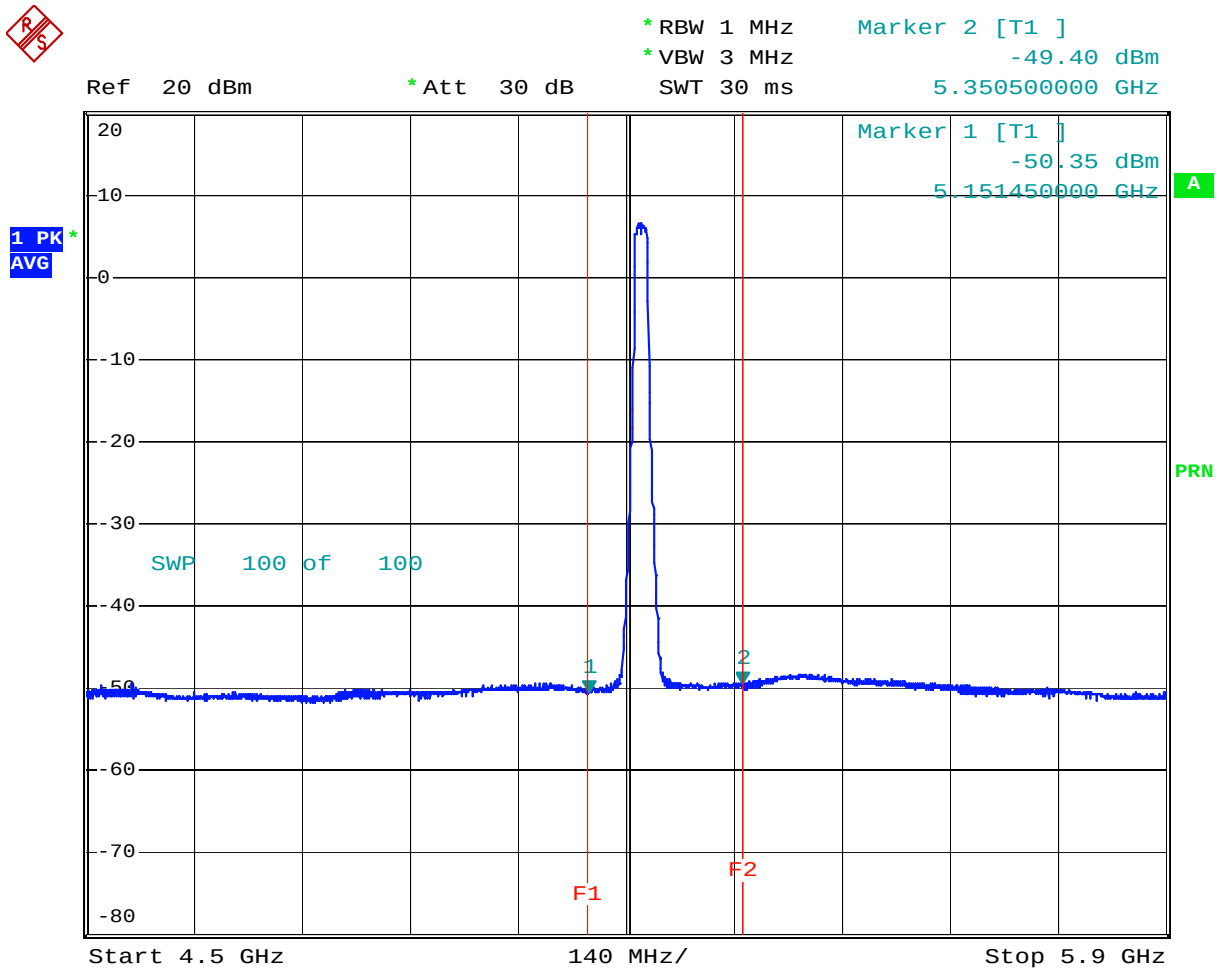
Comment: Out-of-band emissions, 5.2 GHz, 802.11n, HT40, 13.5 Mbps, ou
Comment: tput 2
Date: 15.SEP.2008 15:45:53

Plot 5.13



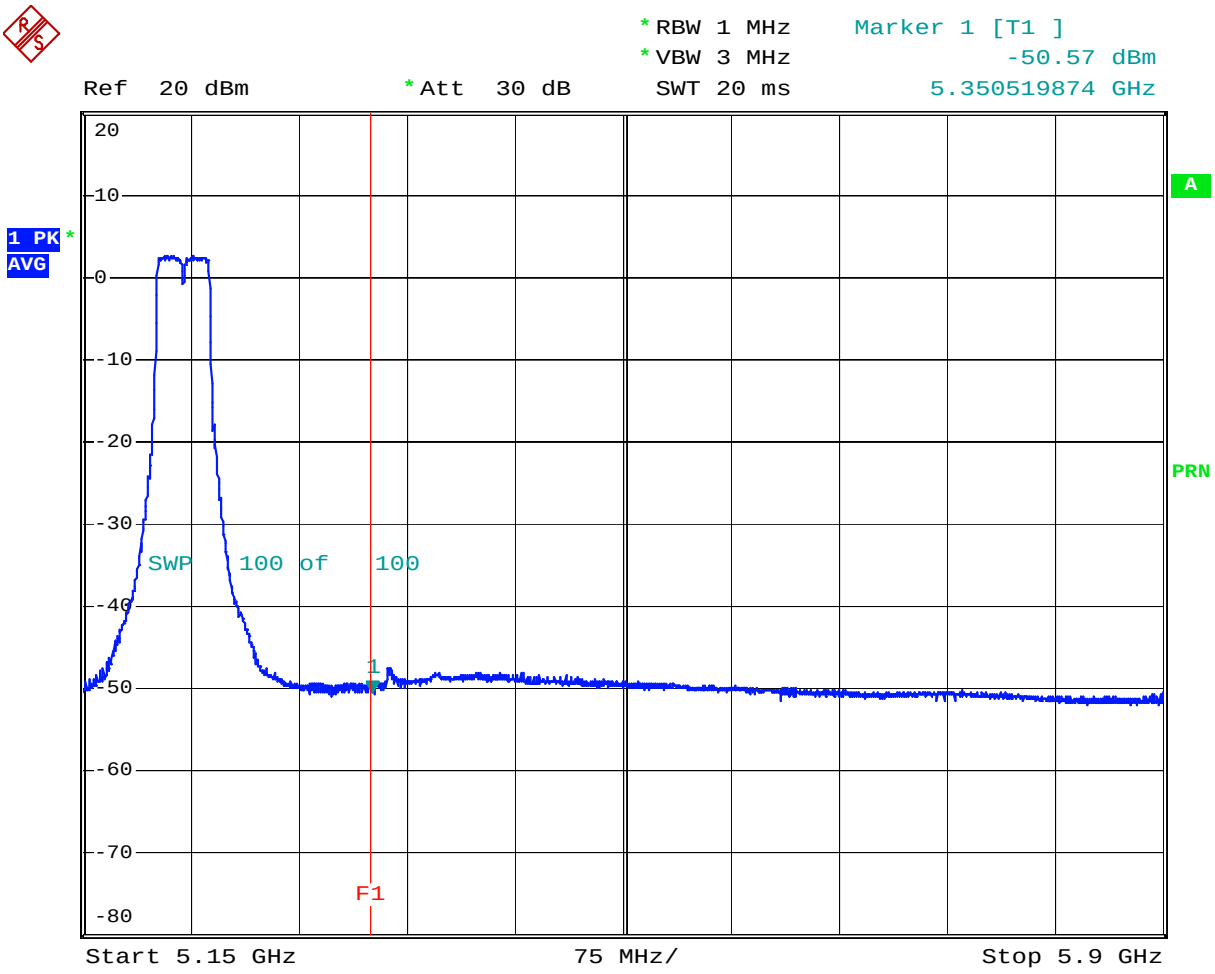
Comment: Out-of-band emissions, 5.2 GHz, 802.11n, HT40, 13.5 Mbps, ou
Comment: tput 2
Date: 15.SEP.2008 15:47:06

Plot 5.14



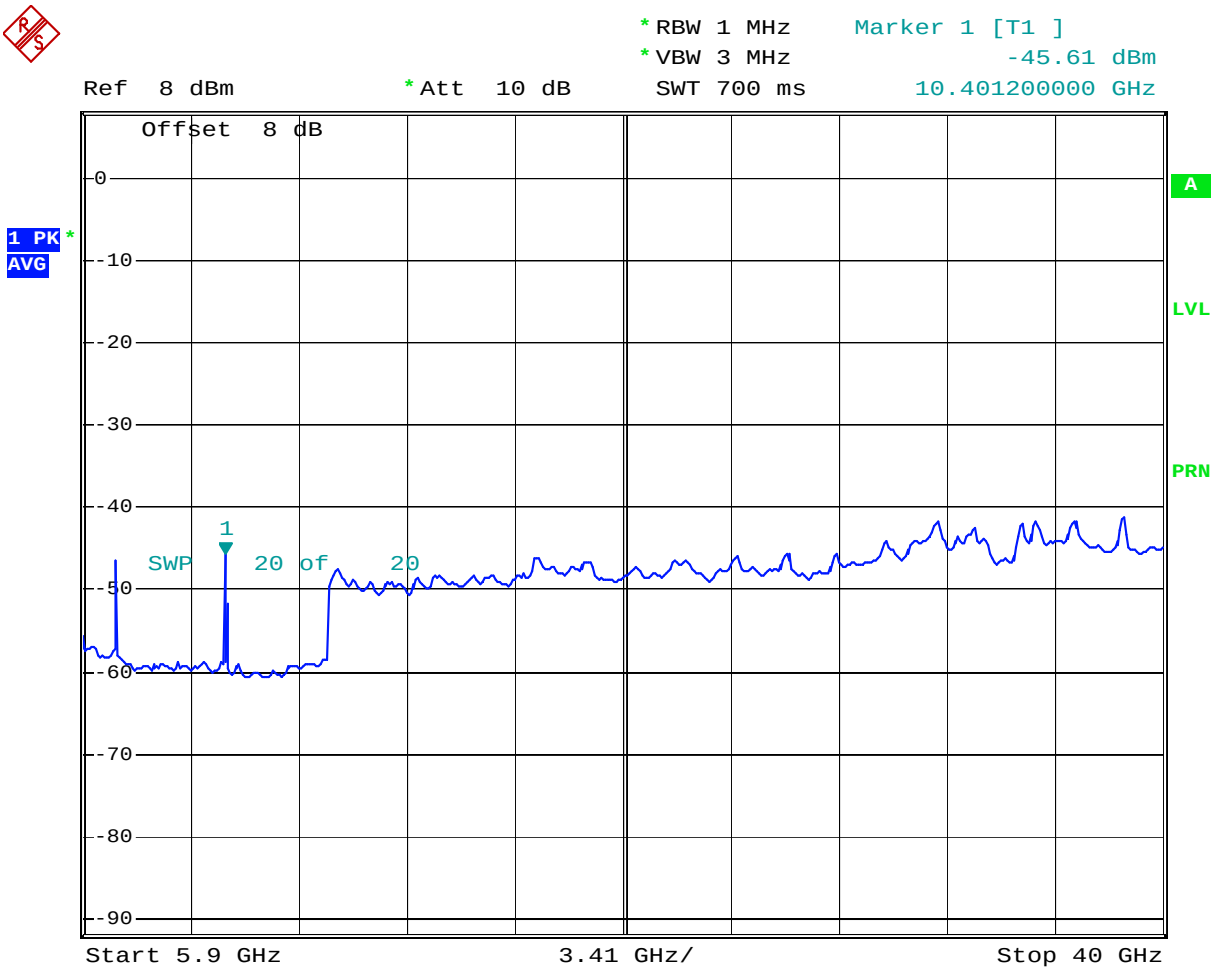
Comment: Out-of-band emis., 5.22GHz, 802.11a, 6Mbps, output 2
Date: 15.SEP.2008 16:17:20

Plot 5.15



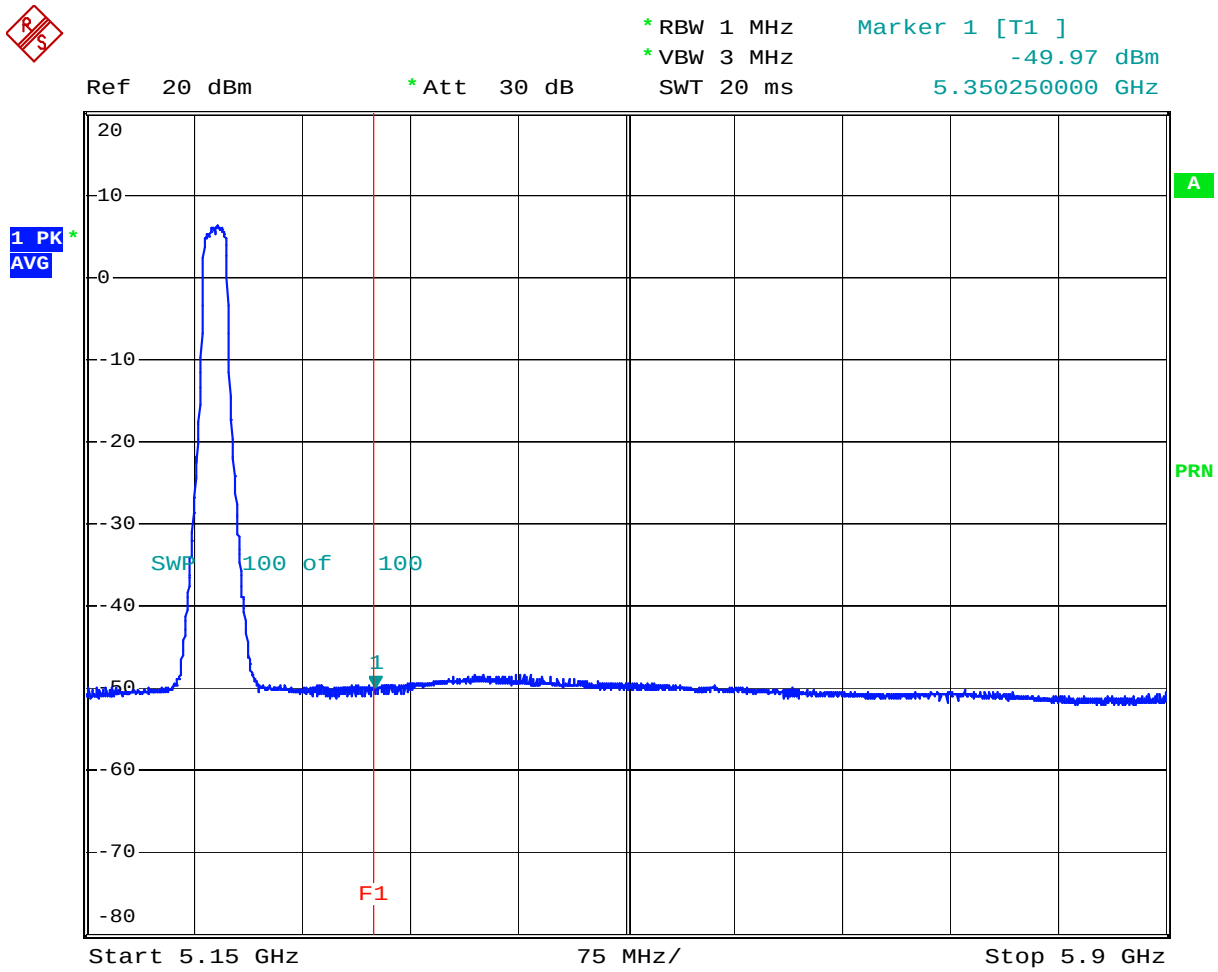
Comment: Out-of-band emis., 5.22GHz, 802.11n, HT40 13.5Mbps, output 2
Date: 15.SEP.2008 15:08:09

Plot 5.16



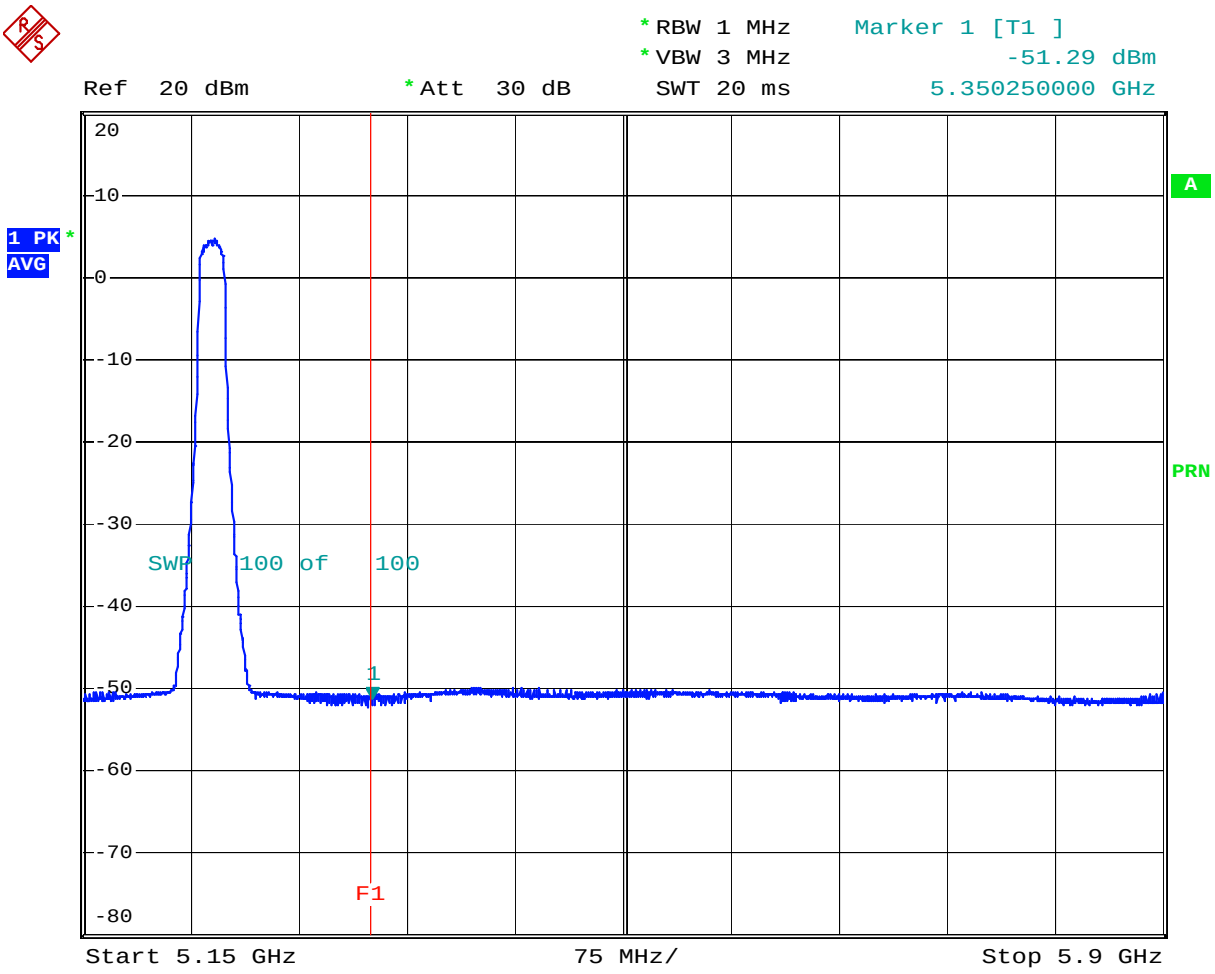
Comment: Out-of-band emissions, 5.22 GHz, 802.11n, HT40, 13.5 Mbps, o
Comment: utput 2
Date: 15.SEP.2008 15:43:07

Plot 5.17



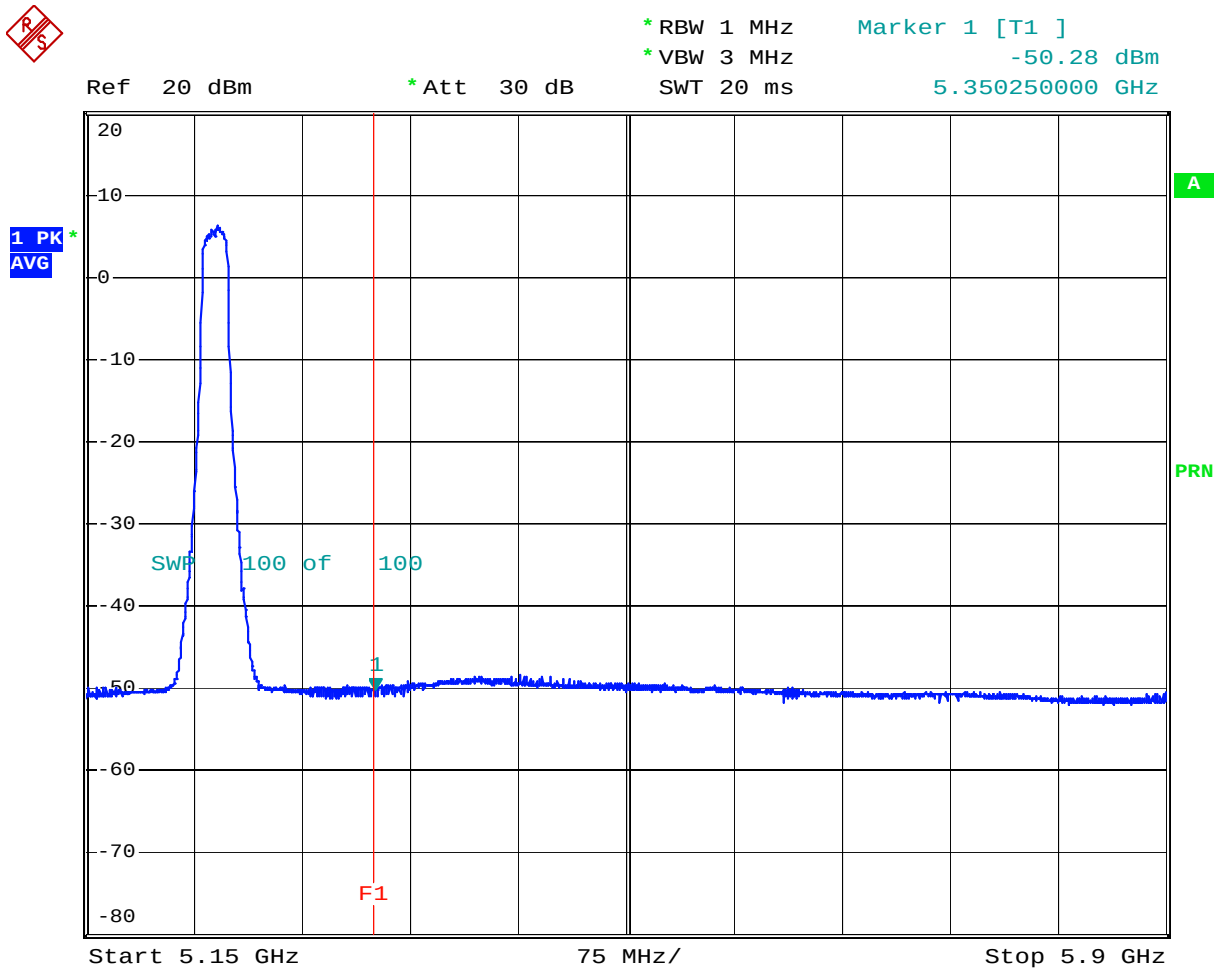
Comment: Out-of-band emis., 5.24GHz, 802.11a, 6Mbps, output 2
Date: 15.SEP.2008 16:11:43

Plot 5.18



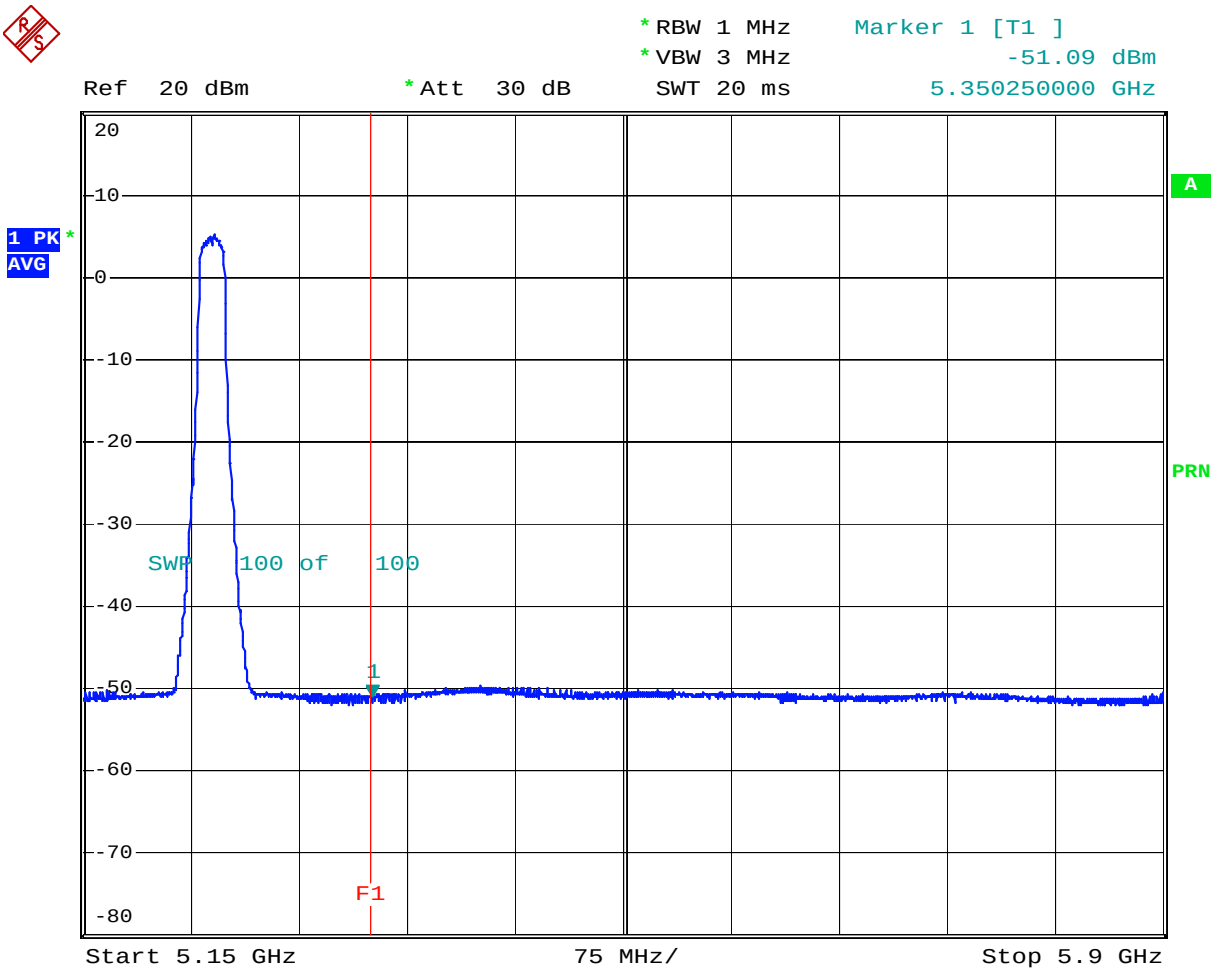
Comment: Out-of-band emis., 5.24GHz, 802.11n, HT20, 6.5Mbps, output 1
Date: 15.SEP.2008 16:09:34

Plot 5.19



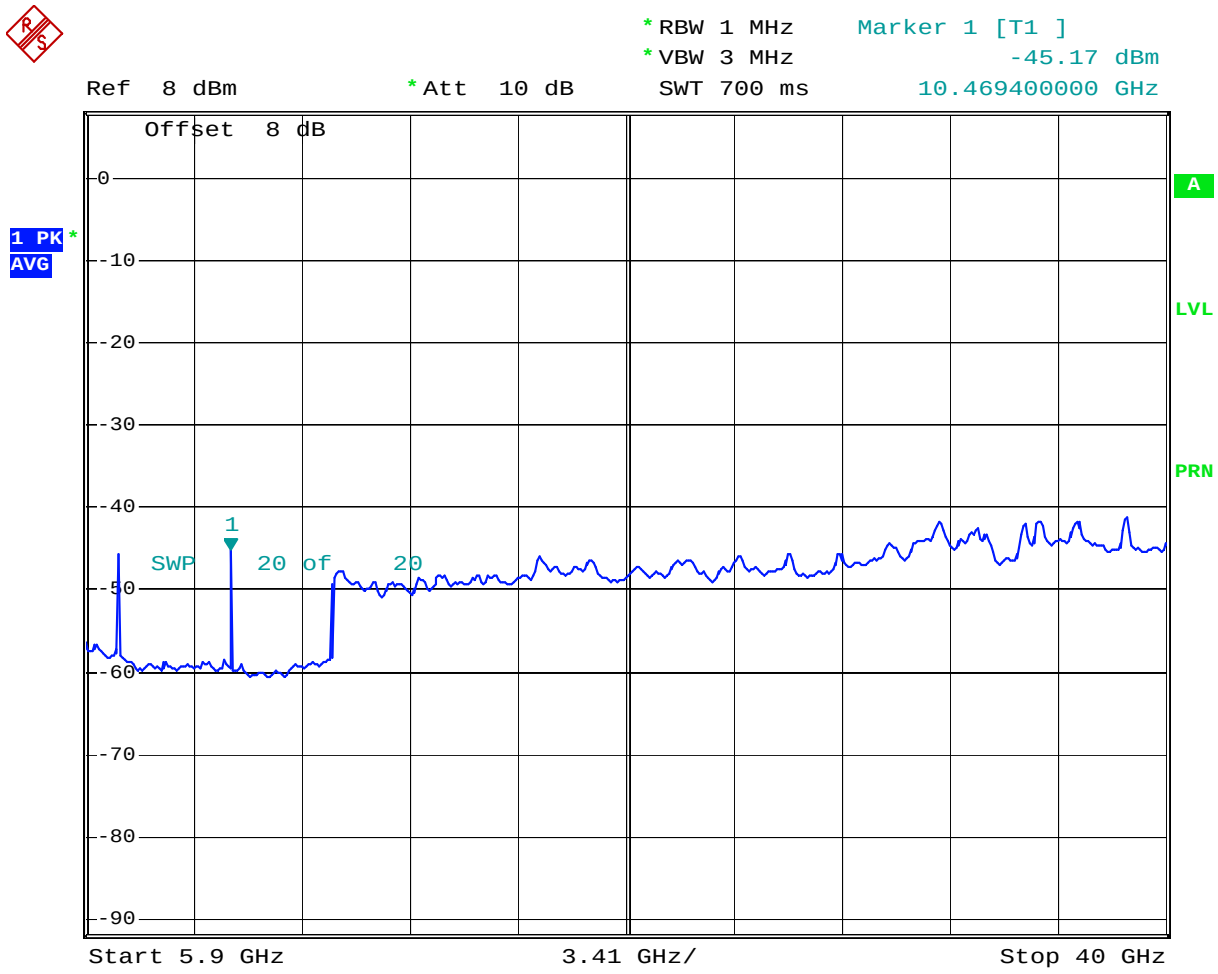
Comment: Out-of-band emis., 5.24GHz, 802.11n, HT20, 6.5Mbps, output 2
Date: 15.SEP.2008 15:16:06

Plot 5.20



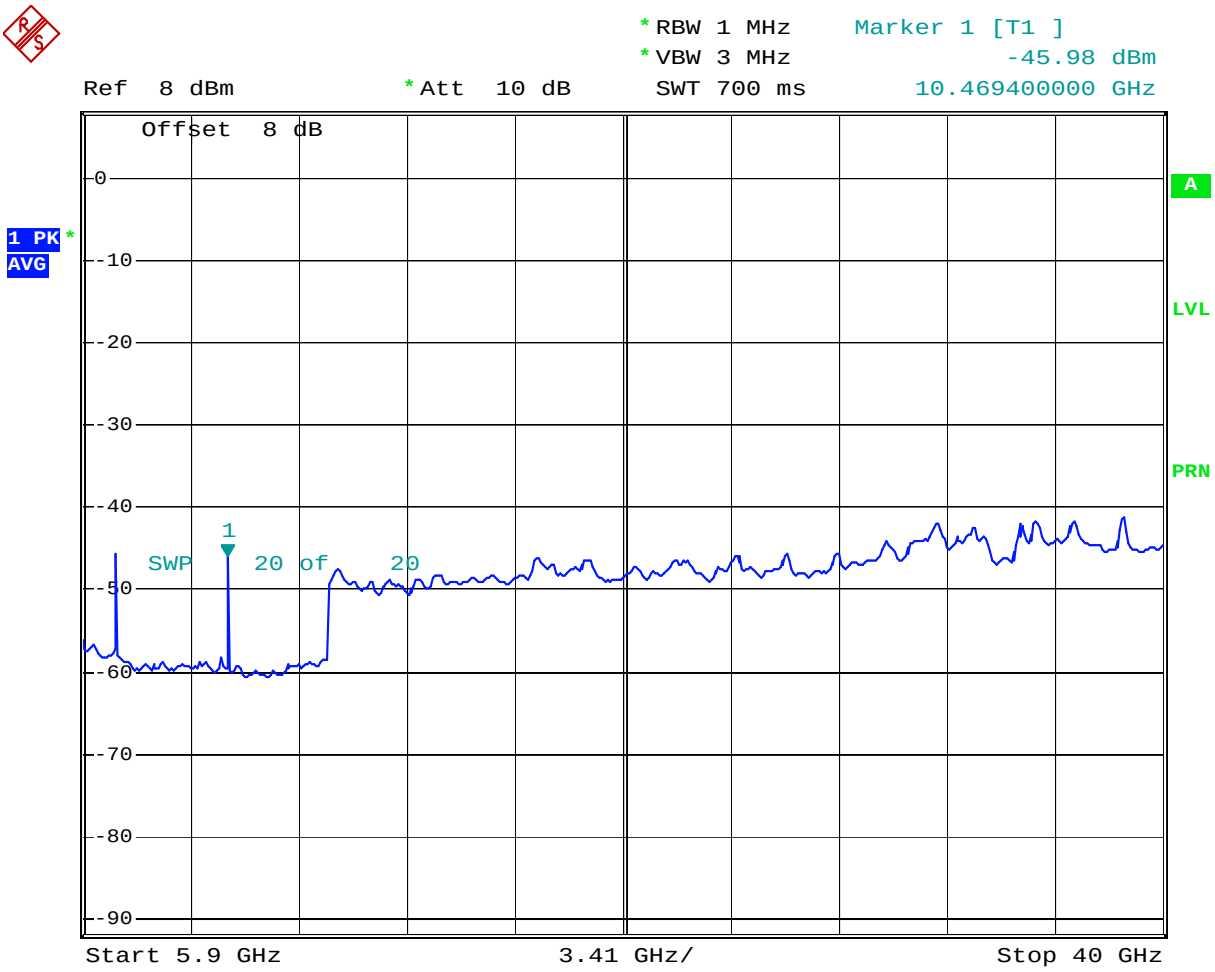
Comment: Out-of-band emis., 5.24GHz, 802.11n, HT20, 6.5Mbps, output 3
Date: 15.SEP.2008 15:14:46

Plot 5.21



Comment: Out-of-band emissions, 5.24 GHz, 802.11a, 6 Mbps, output 2
Date: 15.SEP.2008 14:53:16

Plot 5.22



Comment: Out-of-band emissions, 5.24 GHz, 802.11n, HT20, 6.5 Mbps, ou
Comment: tput 2
Date: 15.SEP.2008 14:54:46

4.6 Radiated Emissions above 1 GHz
FCC Rules: 15.407(b)(3)(7), 15.205, 15.209

Requirement

All emissions outside of the 5.15 –5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.
Note: Except for emissions in restricted bands, that corresponds to the field strength level of 68.3 dB(µV/m) at 3 m distance when measure with 1 MHz resolution bandwidth.

Emissions in restricted bands shall not exceed 15.209 limits.

Procedure

Radiated emission measurements were performed from 30 MHz to 40,000 MHz. Spectrum Analyzer Resolution Bandwidth is 1 MHz for frequencies above 1000 MHz.

The EUT is placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at 3 m unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three-meter reading using inverse scaling with distance.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Since the EUT passed out-of-band (spurious) antenna conducted emission test, the only radiated emission measurements in the restricted bands were performed.

Field Strength Calculation

FS = RA + AF + CF - AG
Where FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude (including preamplifier) in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(1/m)
AG = Amplifier Gain in dB
Assume a receiver reading of 52.0 dB(µV) is obtained. The antenna factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(µV/m). This value in dB(µV/m) was converted to Intertek corresponding level in µV/m.
RA = 52.0 dB(µV); CF = 1.6 dB; AF = 7.4 dB(1/m); AG = 29.0 dB
FS = 52 + 7.4 + 1.6 - 29 = 32 dB(µV/m)
Level in µV/m = Common Antilogarithm [(32 dB(µV/m)/20] = 39.8 µV/m

Result

The data listed on the following tables list the significant emission frequencies, the limit and the margin of compliance. The EUT passed by 3.1 dB.

The data listed on the following tables were the only emissions found in the investigation up to 40 GHz. No other emissions were found above the system noise floor, which is at least 6 dB below the regulatory limit.

All radiated spurious emissions in the restricted bands, including the emissions in the adjacent channels, are below the limits listed in FCC section 15.205.

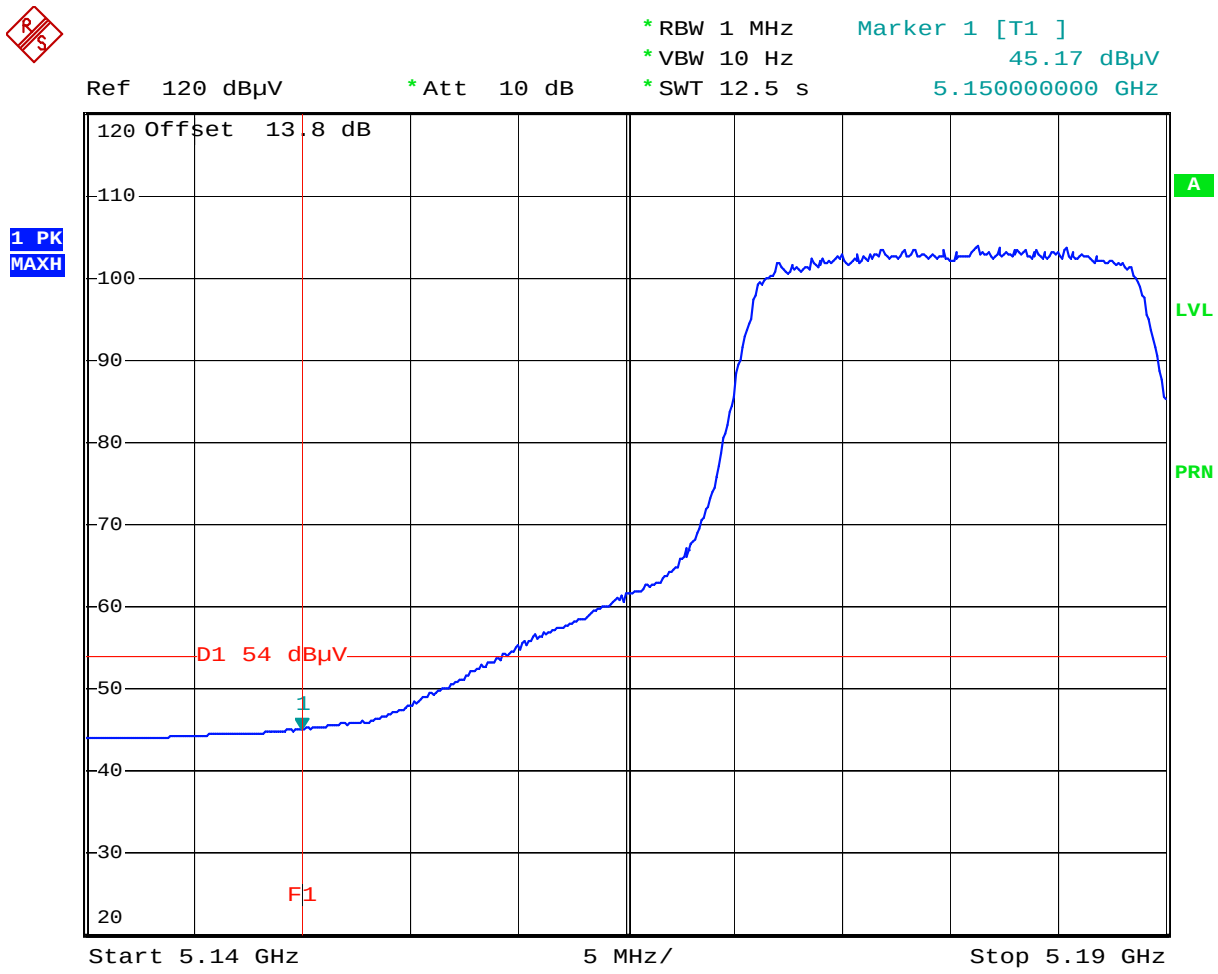
Frequency		FS at 3m	SA reading	Corr. Factor *	Antenna factor	FS Limit	Margin
MHz		dB(uV/m)	dB(uV)	dB	dB(1/m)	dB(uV/m)	dB
Ch. 36, 5180 MHz							
10360	Peak	53.9	40.7	25.7	38.9	88.3	-34.4
10360	Average	38.5	25.3	25.7	38.9	68.3	-29.8
15540 **	Peak	60.1	46.6	24.9	38.4	74.0	-13.9
15540 **	Average	45.0	31.5	24.9	38.4	54.0	-9.0
20720	Peak	50.0	50.7	41.0	40.3	88.3	-38.3
20720	Average	36.4	37.1	41.0	40.3	68.3	-31.9
25900	Peak	59.0	49.6	31.1	40.5	88.3	-29.3
25900	Average	45.6	36.2	31.1	40.5	68.3	-22.7
31080	Peak	62.1	48.0	29.4	43.5	88.3	-26.2
31080	Average	49.0	34.9	29.4	43.5	68.3	-19.3
36260	Peak	61.0	49.6	32.1	43.5	88.3	-27.3
36260	Average	47.4	36.0	32.1	43.5	68.3	-20.9
Ch 44, 5220 MHz							
10440	Peak	51.6	38.6	25.8	38.8	88.3	-36.7
10440	Average	37.1	24.1	25.8	38.8	68.3	-31.2
15660 **	Peak	57.6	43.2	24.2	38.6	74.0	-16.4
15660 **	Average	43.7	29.3	24.2	38.6	54.0	-10.3
20880	Peak	48.7	48.4	40.0	40.3	88.3	-39.6
20880	Average	35.6	35.3	40.0	40.3	68.3	-32.7
26100	Peak	55.9	48.3	32.9	40.5	88.3	-32.4
26100	Average	43.6	36.0	32.9	40.5	68.3	-24.7
31320	Peak	62.5	49.7	30.7	43.5	88.3	-25.8
31320	Average	48.4	35.6	30.7	43.5	68.3	-19.9
36540	Peak	60.7	48.8	31.7	43.6	88.3	-27.6
36540	Average	47.5	35.6	31.7	43.6	68.3	-20.8
Ch 48, 5240 MHz							
10480	Peak	51.5	38.5	25.8	38.8	88.3	-36.8
10480	Average	36.4	23.4	25.8	38.8	68.3	-31.9
15720 **	Peak	57.5	42.1	23.3	38.7	74.0	-16.5
15720 **	Average	43.6	28.2	23.3	38.7	54.0	-10.4
20960	Peak	47.5	47.8	40.6	40.3	88.3	-40.8
20960	Average	34.2	34.5	40.6	40.3	68.3	-34.1
26200	Peak	54.8	47.2	32.9	40.5	88.3	-33.5
26200	Average	41.7	34.1	32.9	40.5	68.3	-26.6
31440	Peak	58.1	48.1	33.5	43.5	88.3	-30.2
31440	Average	45.1	35.1	33.5	43.5	68.3	-23.2
36680	Peak	62.8	49.6	30.4	43.6	88.3	-25.5
36680	Average	49.5	36.3	30.4	43.6	68.3	-18.8

* Correction factor = AG-CF

** In restricted band

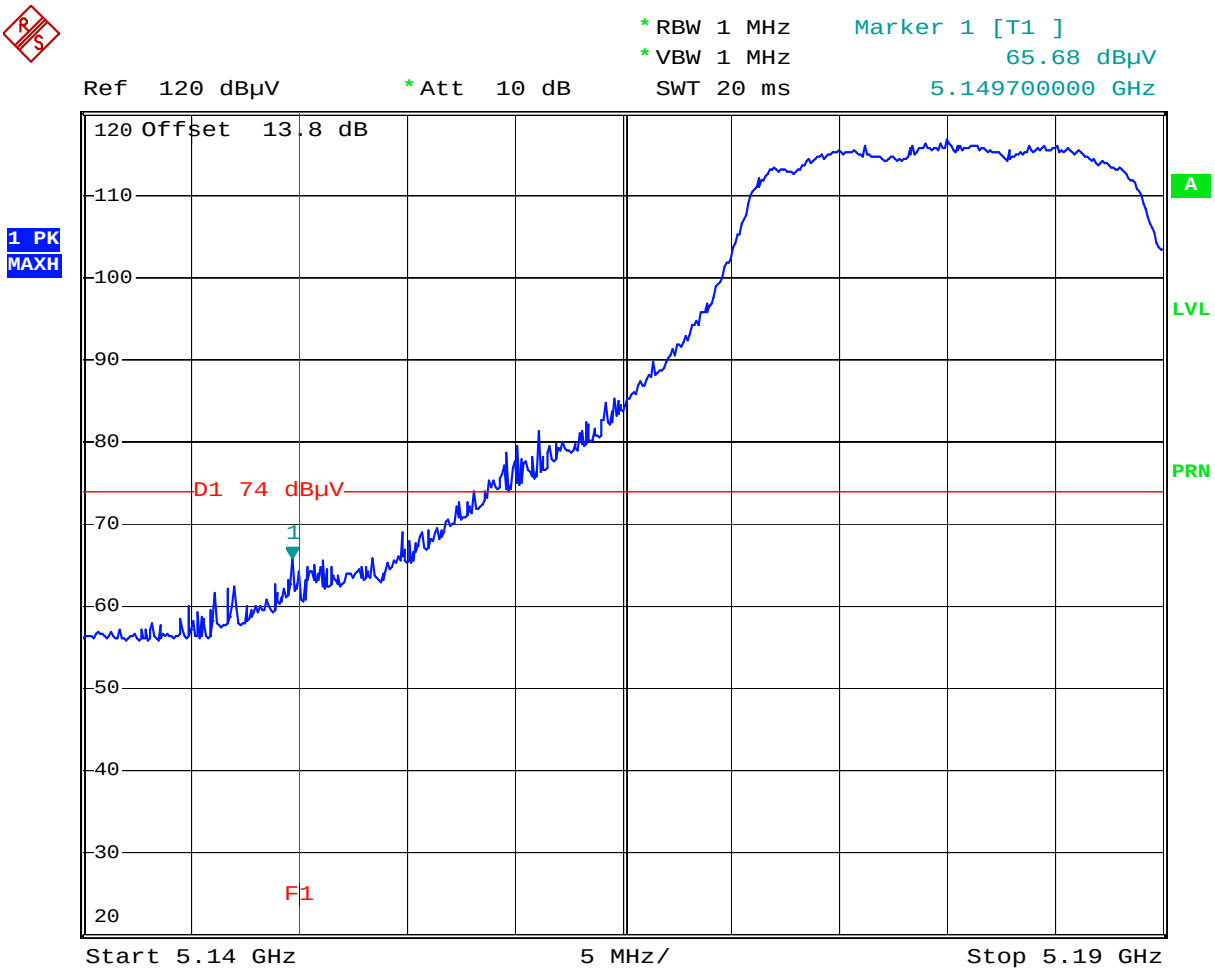
Result - restricted bands: 4.5 – 5.15 GHz and 5.35 – 5.46 GHz

Plot 6.1



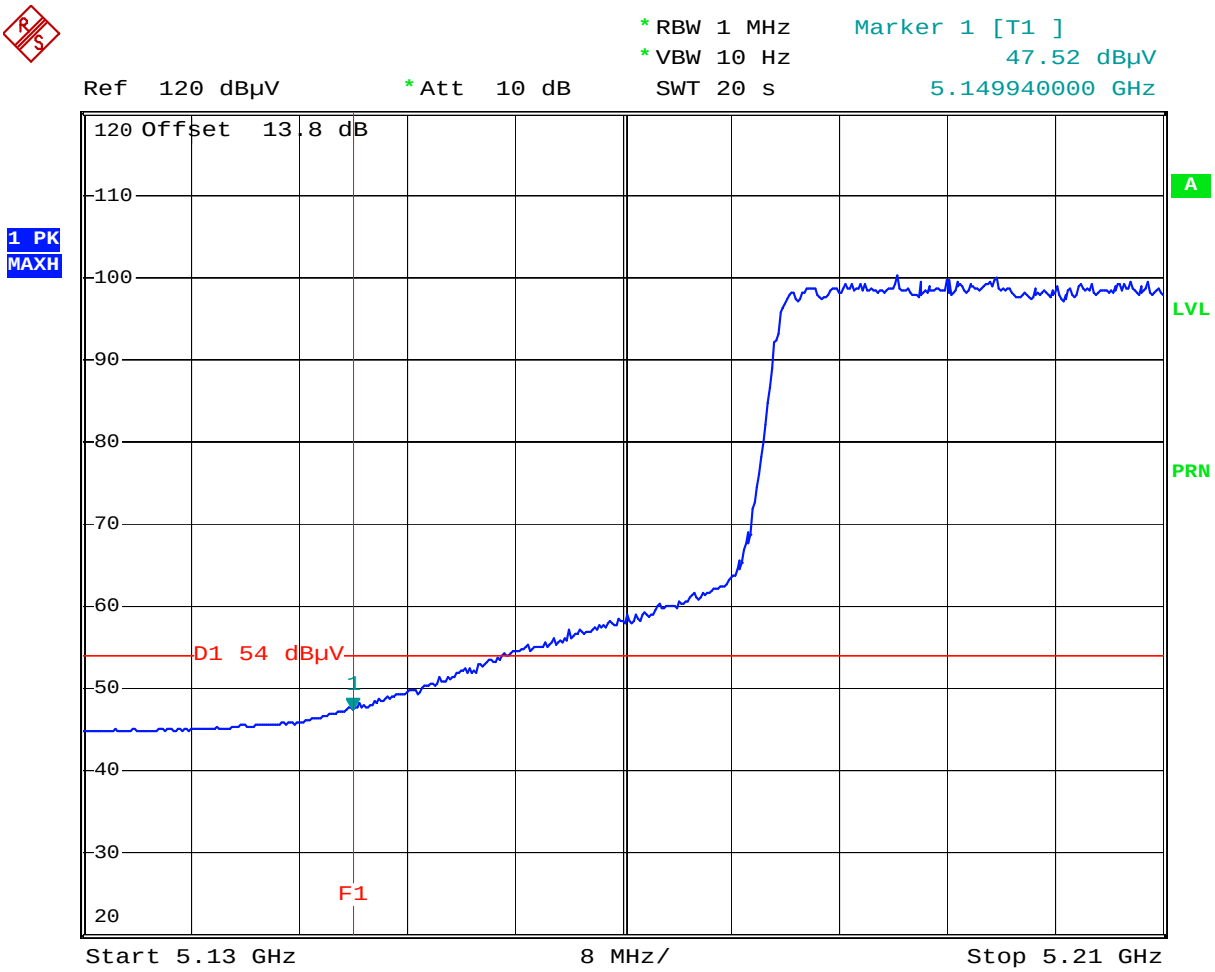
Comment: Radiated emissions, band-edge, 802.11n HT20 6.5Mbps,average
Date: 28.OCT.2008 10:27:00

Plot 6.2



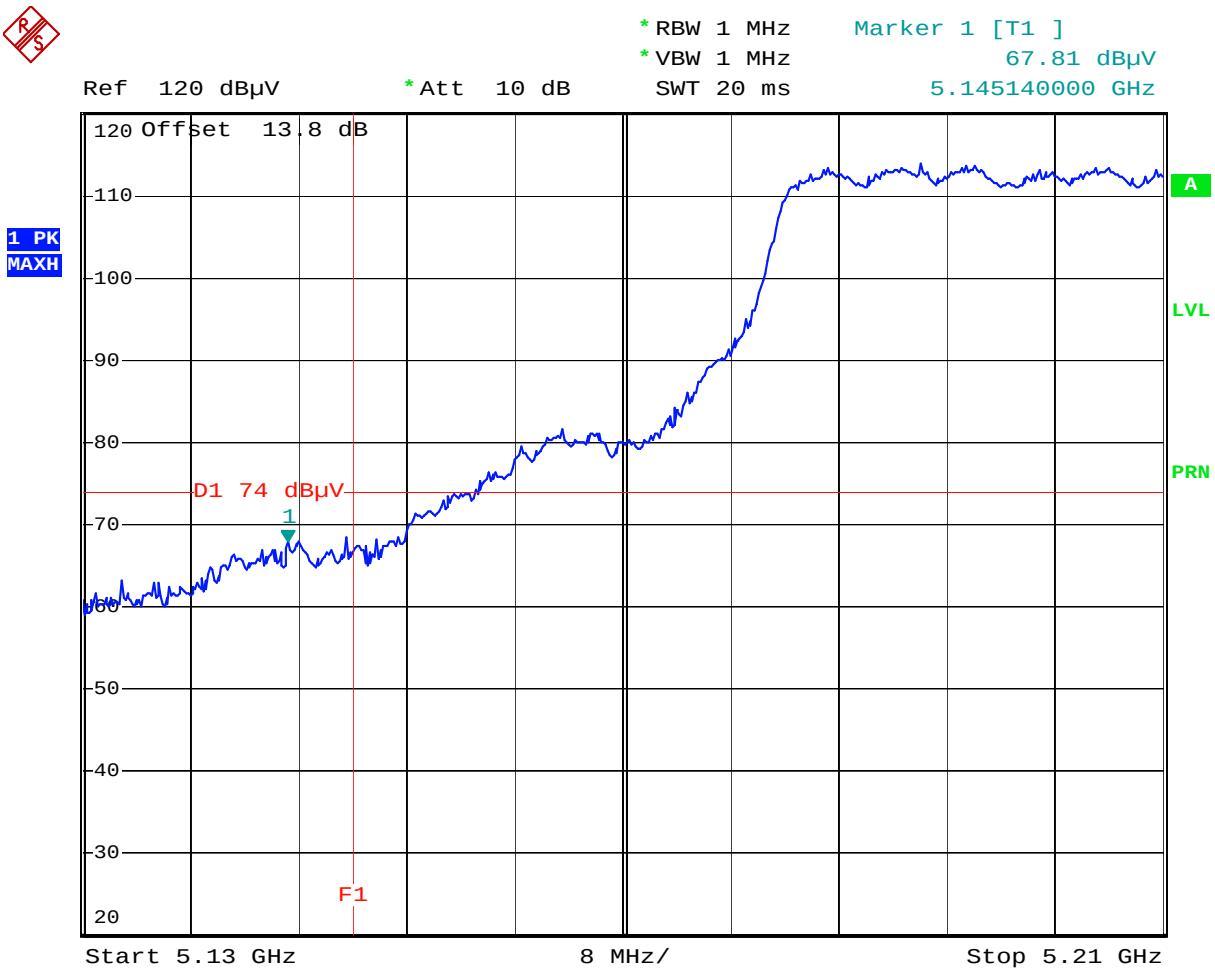
Comment: Radiated emissions, band-edge, 802.11n HT20 6.5Mbps,peak
Date: 28.OCT.2008 10:28:40

Plot 6.3



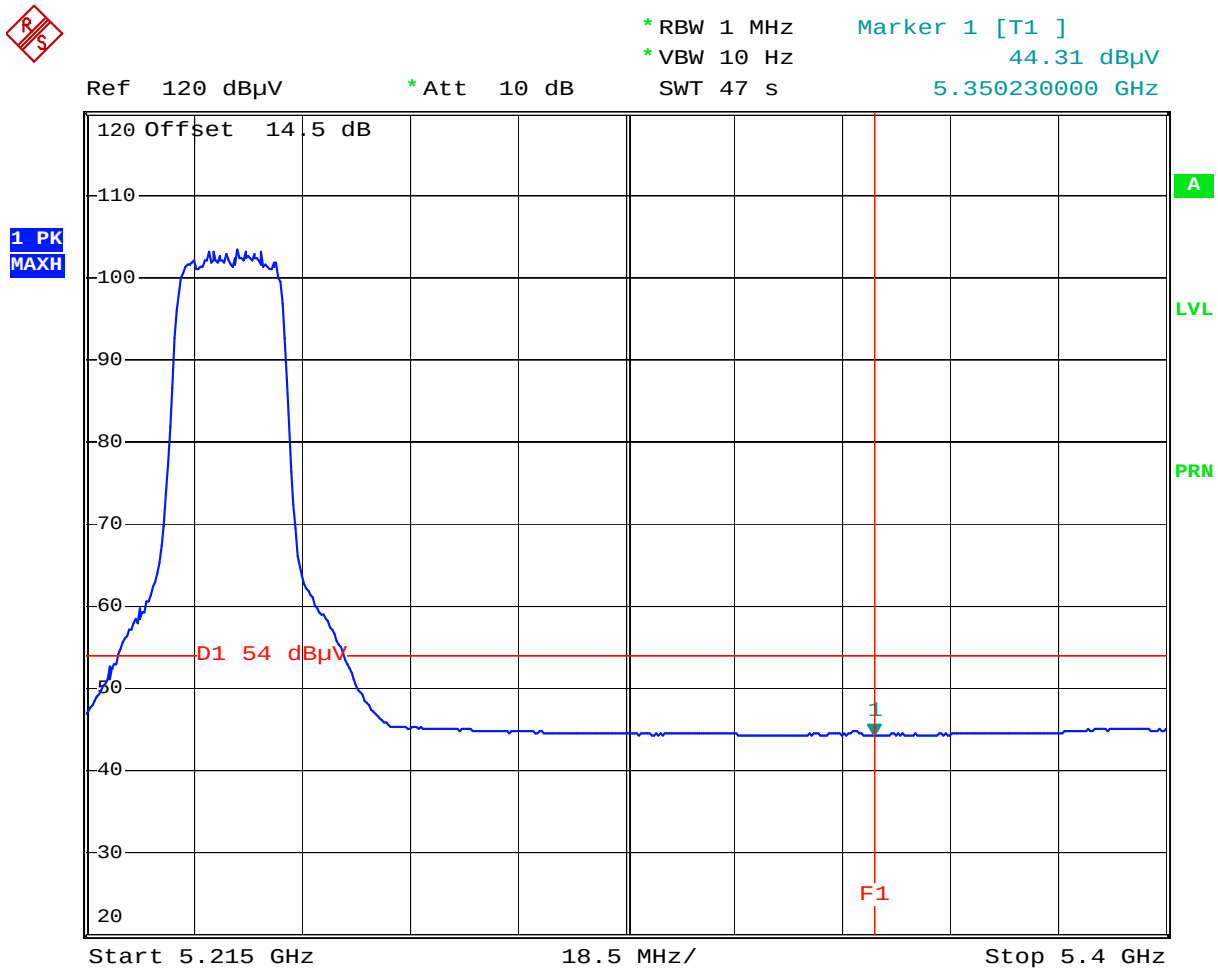
Comment: Radiated emissions, band-edge, 802.11n HT40 13.5Mbps,average
Date: 28.OCT.2008 10:34:10

Plot 6.4



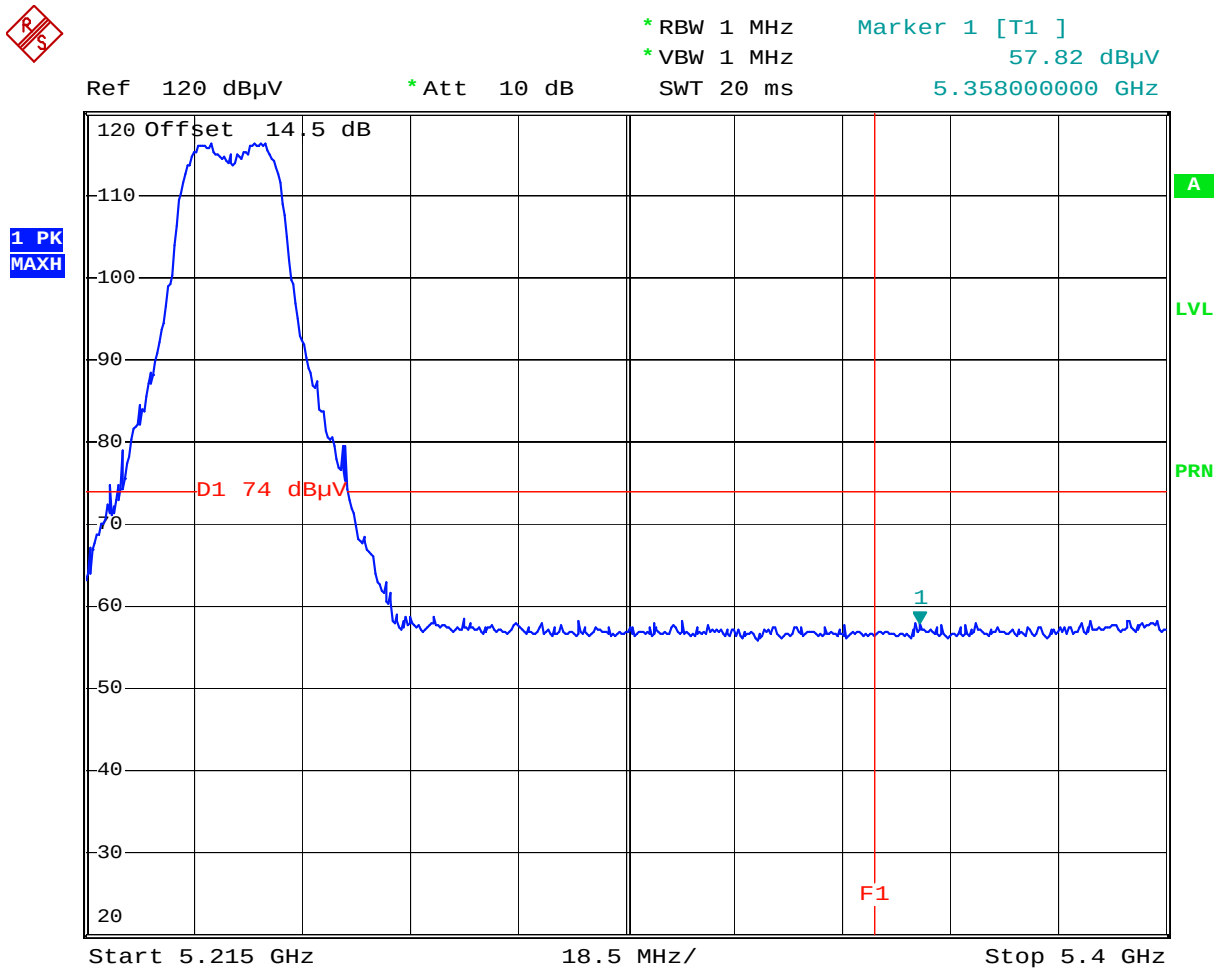
Comment: Radiated emissions, band-edge, 802.11n HT40 13.5Mbps,peak
Date: 28.OCT.2008 10:32:47

Plot 6.5



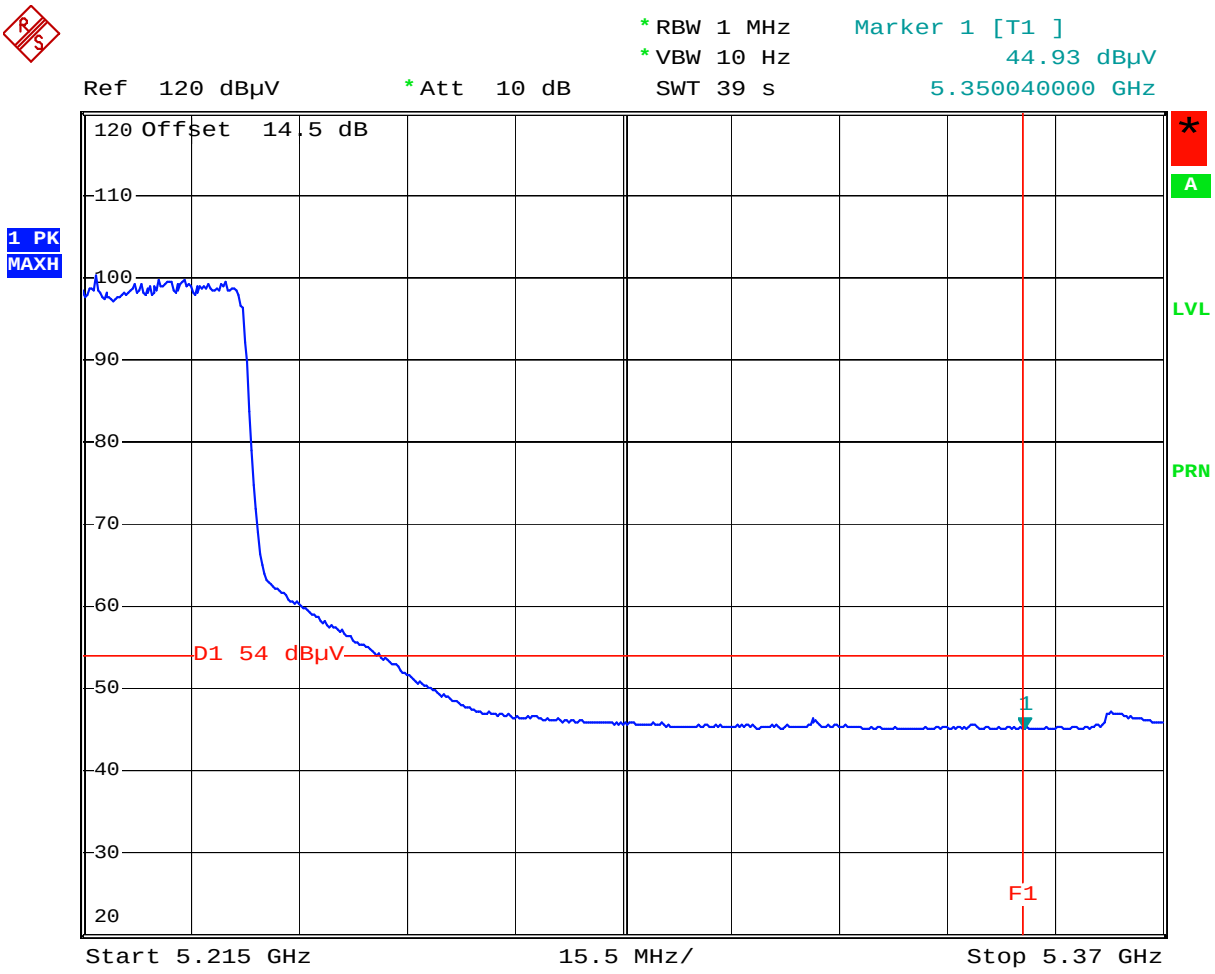
Comment: Radiated emissions, band-edge, 802.11n HT20 6.5Mbps,average
Date: 28.OCT.2008 11:08:56

Plot 6.6



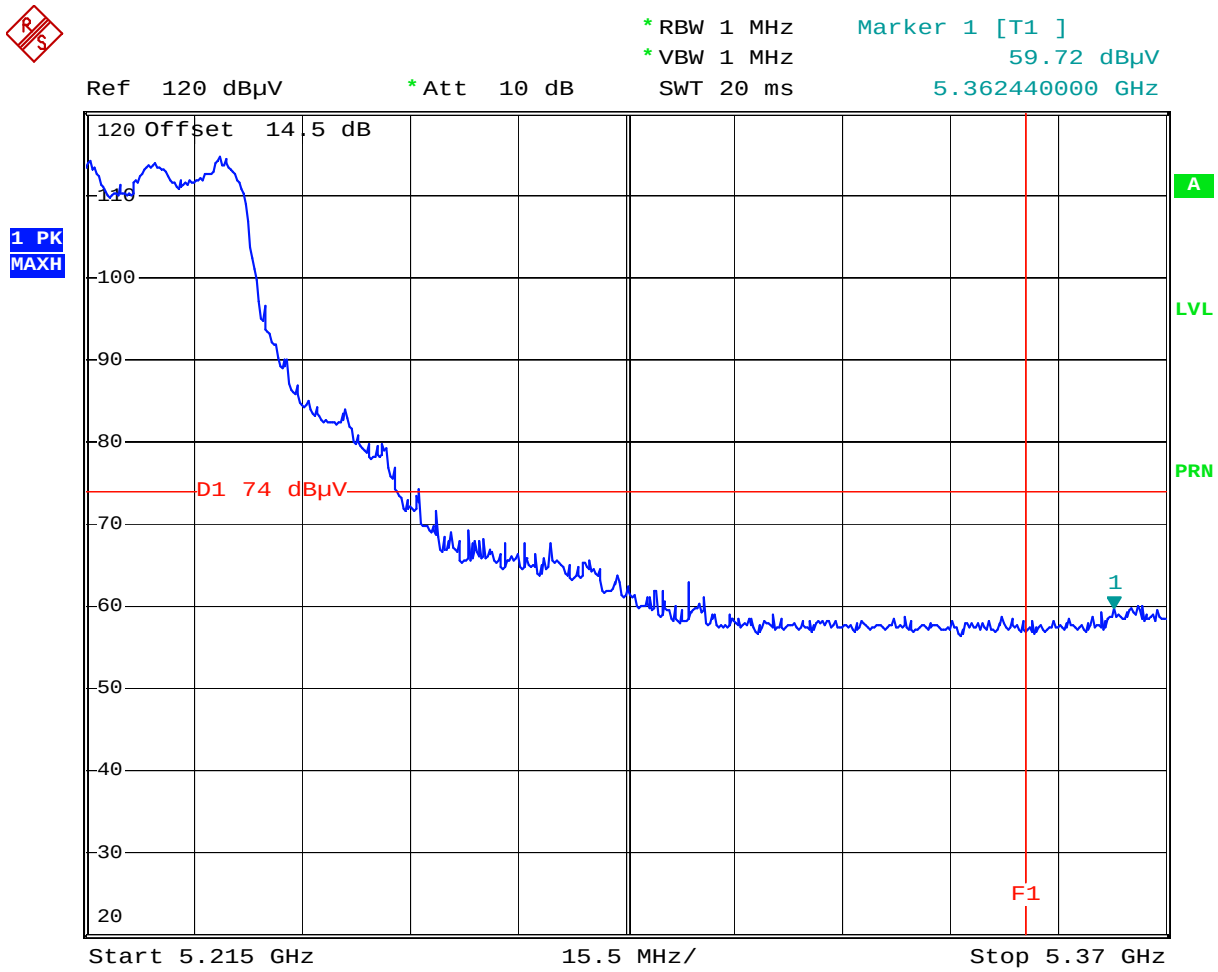
Comment: Radiated emissions, band-edge, 802.11n HT20 6.5Mbps,peak
Date: 28.OCT.2008 11:06:47

Plot 6.7



Comment: Radiated emissions, band-edge, 802.11n HT40 13.5Mbps,average
Date: 28.OCT.2008 11:01:32

Plot 6.8



Comment: Radiated emissions, band-edge, 802.11n HT40 13.5Mbps,peak
Date: 28.OCT.2008 11:03:14

4.7 Radiated Emissions below 1 GHz
FCC Ref: 15.209

Procedure

Radiated emission measurements were performed from 30 MHz to 1000 MHz. Spectrum Analyzer Resolution Bandwidth is 120 kHz. See also section 4.6 for the test procedure and field strength calculation.

Result

The result is presented on the table below.
The EUT passed by 0.7dB

Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15/EN 55022 Class B, Quasi-peak

Operator: DC
Test distance: 10m

Frequency	Quasi Pk FS	Limit@10m	Margin	RA	AG	CF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
265.0	33.0	37.0	-4.0	45.1	27.0	1.7	13.2
298.2	35.0	37.0	-2.0	46.7	27.2	1.8	13.7
397.6	36.3	37.0	-0.7	45.8	27.9	2.1	16.3
497.0	35.3	37.0	-1.7	43.4	28.4	2.4	17.9
530.1	36.3	37.0	-0.7	44.0	28.5	2.4	18.4
566.5	30.7	37.0	-6.3	38.1	28.7	2.6	18.7
629.5	31.6	37.0	-5.4	38.9	28.8	2.7	18.8
800.0	28.4	37.0	-8.6	33.1	28.6	2.9	21.0

Test Mode: 802.11n HT20, Channel 48
Temperature: 20 C
Humidity: 49.5 %

4.8 Frequency stability
FCC 15.407(g)

Requirement

An emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

Procedure

The EUT was placed in a temperature chamber and setup to transmit a carrier without modulation.

The carrier frequency was measured with the spectrum analyzer with resolution bandwidth of 300 Hz. The temperature was varied from 0^0C to 40^0C, as stated in the user manual.

In normal operation, the XP3E6W model is powered from AC/DC adaptor which is designed to be connected to AC power from 100 V to 240 V. The radio module, installed into XP3E6W, is powered from 3.3 VDC (nominal).

It was verified that the DC voltage, supplied to the radio module, remains unchanged (3.268 V) when AC voltage is varied from 90 V to 264 V. Therefore, frequency stability with voltage was not performed.

Result

Nominal Frequency: 5200 MHz

Temperature, ^{0}C	Frequency, MHz	Deviation, ppm
0	5199.980920	-3.7
10	5199.977440	-4.3
20	5199.982700	-3.3
30	9199.991840	-1.6
40	5200.010200	2.0

4.9 AC Line Conducted Emission
FCC Rule 15.207:

Requirement

The following line conducted emission limits apply to Class B devices:

Frequency Band MHz	Class B Limit dB (µV)	
	Quasi-Peak	**Average**
0.15-0.50	66 to 56 Decreases linearly with the logarithm of the frequency	56 to 46 Decreases linearly with the logarithm of the frequency
0.50-5.00	56	46
5.00-30.00	60	50

Note: At the transition frequency the lower limit applies.

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Test Procedure

These measurements were performed in accordance with the test arrangements and methods defined in ANSI C63-4 (2003).

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. A LISN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. A LISN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the LISN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

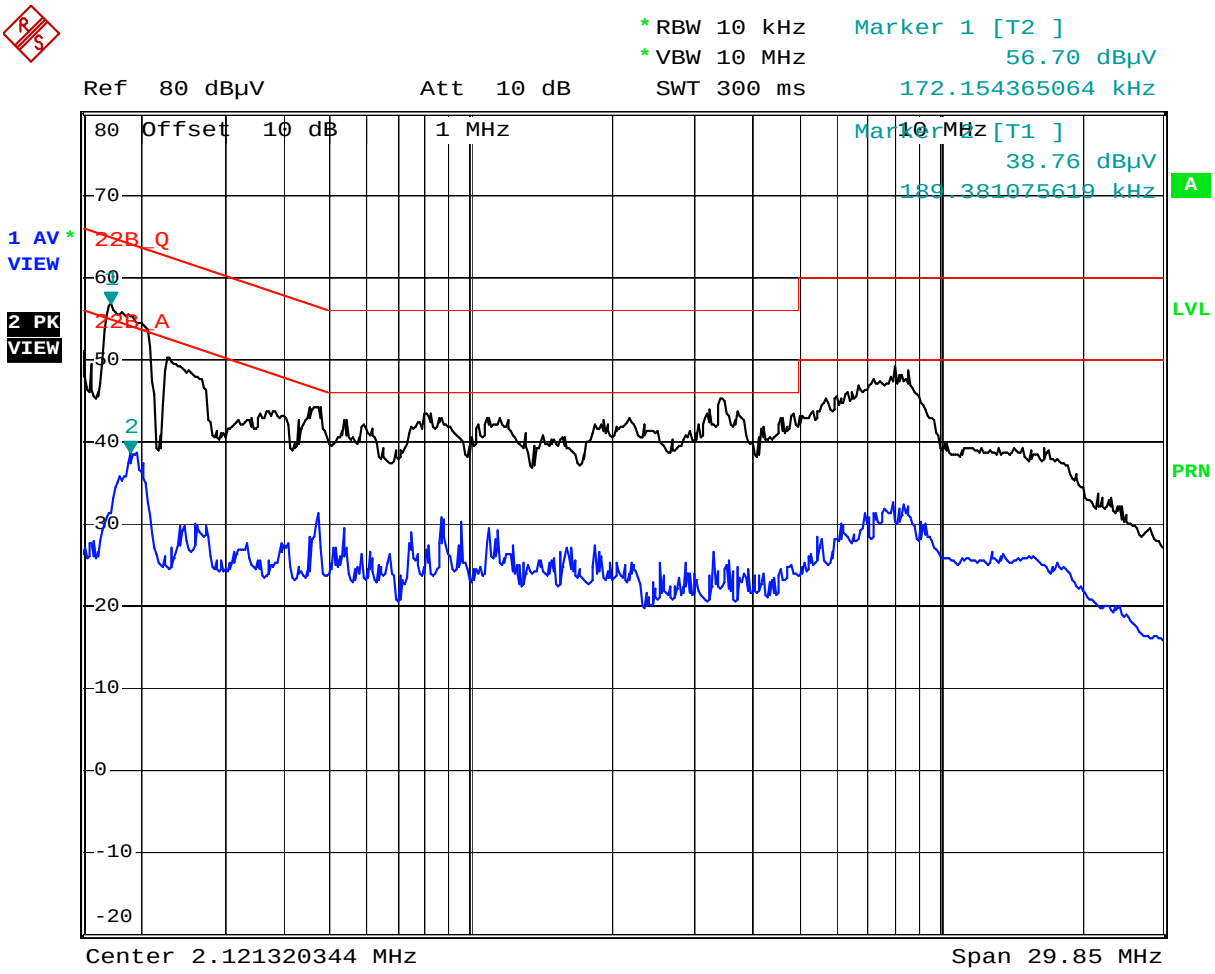
Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to

12 mm of insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Test Result

The test result is presented on the following plots 8.1. and 8.2
The EUT passed by 8 dB

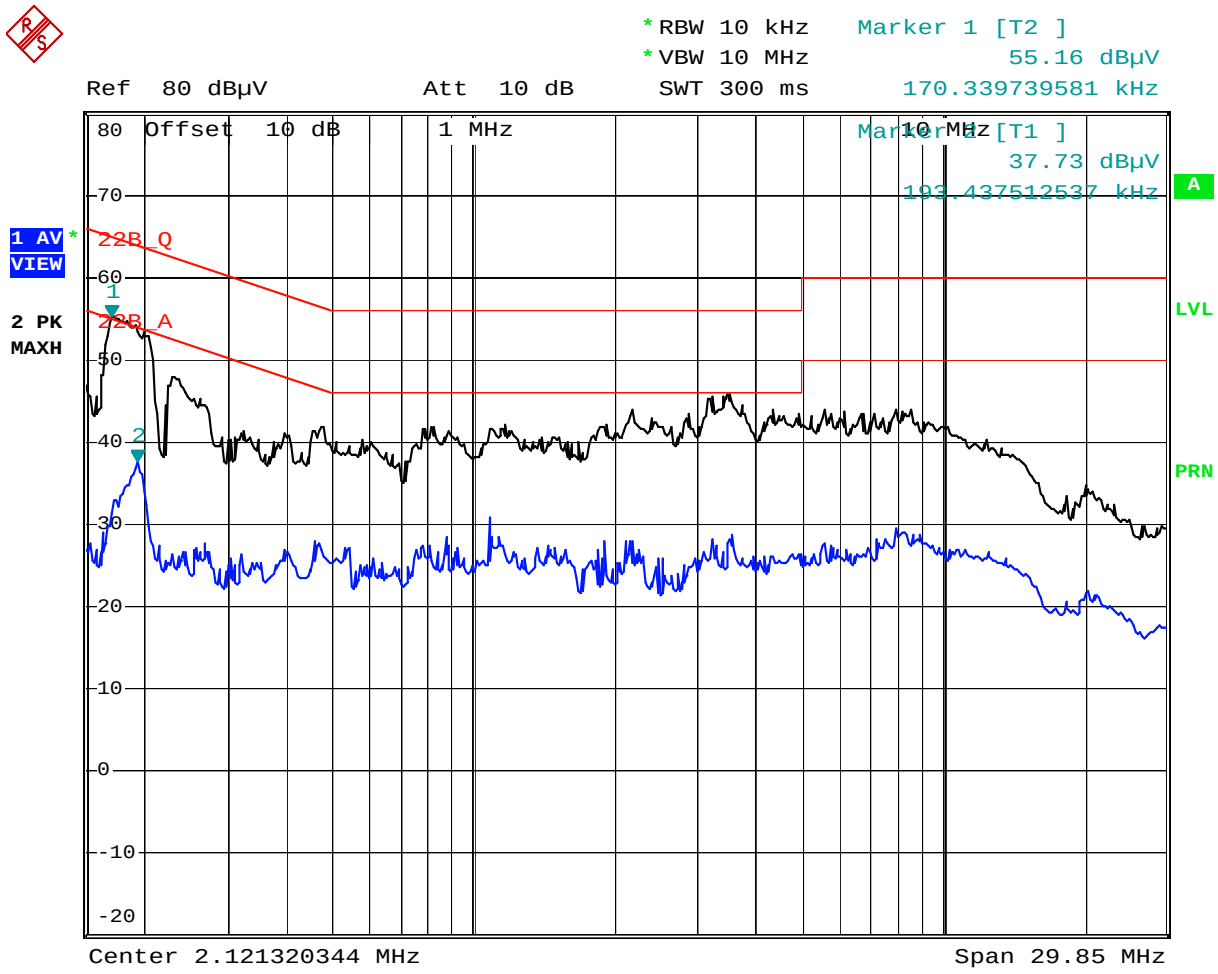
Plot 8.1



Comment: AC line conducted, Line 1, 120 V, 60 Hz
Date: 4.NOV.2008 16:02:17

Black trace – Peak
Blue trace - Average

Plot 8.2



Comment: AC line conducted, Line 2, 120 V, 60 Hz
Date: 4.NOV.2008 16:05:46

Black trace – Peak
Blue trace - Average

5.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	10/03/09
Spectrum Analyzer	R & S	FSP40	036612004	12	10/03/09
BI-Log Antenna	Antenna Research	LPB-2513	1154	12	06/11/09
Double-rigged Horn Antenna	EMCO	3115	8812-3049	12	07/29/09
Pyramidal Horn Antenna	EMCO	3160-09	Not Labeled	#	#
Pyramidal Horn Antenna	EMCO	3160-10	Not Labeled	#	#
Pre-Amplifier	Hewlett Packard	HP8447D	2944A09519	12	07/01/09
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	07/28/09
LISN	FCC	FCC-LISN-50-50-M-H	2012	12	09/19/09

No Calibration required

6.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3160445	DC	September 30, 2008	Original document