

PHYCOMP, PCB ANTENNA**LEGACY MODE****7.4. CHANNEL TESTS FOR THE 5150 TO 5350 MHz BAND**

Please refer to Hitachi Antenna RF conducted test section.

7.4.1. PEAK POWER**LIMIT**

§15.407 (a) (1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.407 (a) (1) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

Following formula to calculate the array gain:

$$\text{Array gain} = 10 \cdot \log (10^{\text{(main gain/10)}} + 10^{\text{(aux gain/10)}})$$

5.15 – 5.25GHz band: 8.039 dBi

5.25 – 5.35GHz band: 7.686 dBi

LIMITS AND RESULTS

No non-compliance noted:

Limit in 5150 to 5250 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	17	19.616	16.926	8.039	14.89

Limit in 5250 to 5350 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Mid	5260	24	33.59	26.262	7.686	22.31
High	5300	24	33.219	26.214	7.686	22.31
High	5320	24	19.814	23.970	7.686	22.28

Results

Channel	Frequency (MHz)	Power Chain 0 (dBm)	Power Chain 1 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	7.32	7.20	10.27	14.89	-4.62
Mid	5260	15.83	16.95	19.44	22.31	-2.88
High	5300	14.21	15.51	17.92	22.31	-4.40
High	5320	14.95	16.02	18.53	22.28	-3.76

Results

Channel	Frequency (MHz)	Combiner Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	10.37	14.89	-4.52
Mid	5260	18.59	22.31	-3.72
High	5300	17.29	22.31	-5.02
High	5320	17.73	22.28	-4.55

7.4.2. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

CALCULATIONS

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm²

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm²

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.0795 * 10^{((P + G) / 10)} / (d^2)$$

LIMITS

From §1.1310 Table 1 (B), the maximum value of $S = 1.0 \text{ mW/cm}^2$

RESULTS

No non-compliance noted

Mode	MPE Distance (cm)	Output Power (dBm)	Output Power (dBm)	Total Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm ²)
802.11a	20.0	15.83	16.95	19.44	8.039	0.06

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

MIMO MODE

7.5. CHANNEL TESTS FOR THE 5150 TO 5350 MHz BAND

Please refer to Hitachi Antenna RF conducted test section.

7.5.1. PEAK POWER

LIMIT

§15.407 (a) (1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.407 (a) (1) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

LIMITS AND RESULTS

No non-compliance noted:

20 MHz TX BANDWIDTH - CHAIN 0 & CHAIN 1

Limit in 5150 to 5250 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B Chain 0 (MHz)	B Chain 1 (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	17	19.255	22.998	16.845	3.90	16.85

Limit in 5250 to 5350 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B Chain 0 (MHz)	B Chain 1 (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Mid	5260	24	35.328	31.637	26.002	3.90	24.00
High	5320	24	37.726	34.464	26.374	3.90	24.00

Results

Channel	Frequency (MHz)	Power Chain 0 (dBm)	Power Chain 1 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	10.34	10.29	13.33	16.85	-3.52
Mid	5260	16.22	16.34	19.29	24.00	-4.71
High	5320	14.22	14.32	17.28	24.00	-6.72

40 MHz TX BANDWIDTH - CHAIN 0 & CHAIN 1

Limit in 5150 to 5250 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B Chain 0 (MHz)	B Chain 1 (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5190	17	44.836	39.829	20.002	3.90	17.00

Limit in 5250 to 5350 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Mid	5270	24	76.184	74.998	29.750	3.90	24.00
High	5310	24	65.430	61.061	28.858	3.90	24.00

Results

Channel	Frequency (MHz)	Power Chain 0 (dBm)	Power Chain 1 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	12.37	12.36	15.38	17.00	-1.62
Mid	5270	17.13	17.22	20.19	24.00	-3.81
High	5310	12.73	12.72	15.74	24.00	-8.26

7.5.2. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

CALCULATIONS

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm²

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm²

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.0795 * 10^{((P + G) / 10)} / (d^2)$$

LIMITS

From §1.1310 Table 1 (B), the maximum value of $S = 1.0 \text{ mW/cm}^2$

RESULTS

No non-compliance noted

Mode	MPE Distance (cm)	Power Chain 0 (dBm)	Power Chain 1 (dBm)	Total Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm ²)
20 MHz TX BANDWIDTH	20.0	16.22	16.34	19.29	3.90	0.02
40 MHz TX BANDWIDTH	20.0	17.13	17.22	20.19	3.90	0.03

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

7.6. RADIATED EMISSIONS

7.6.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

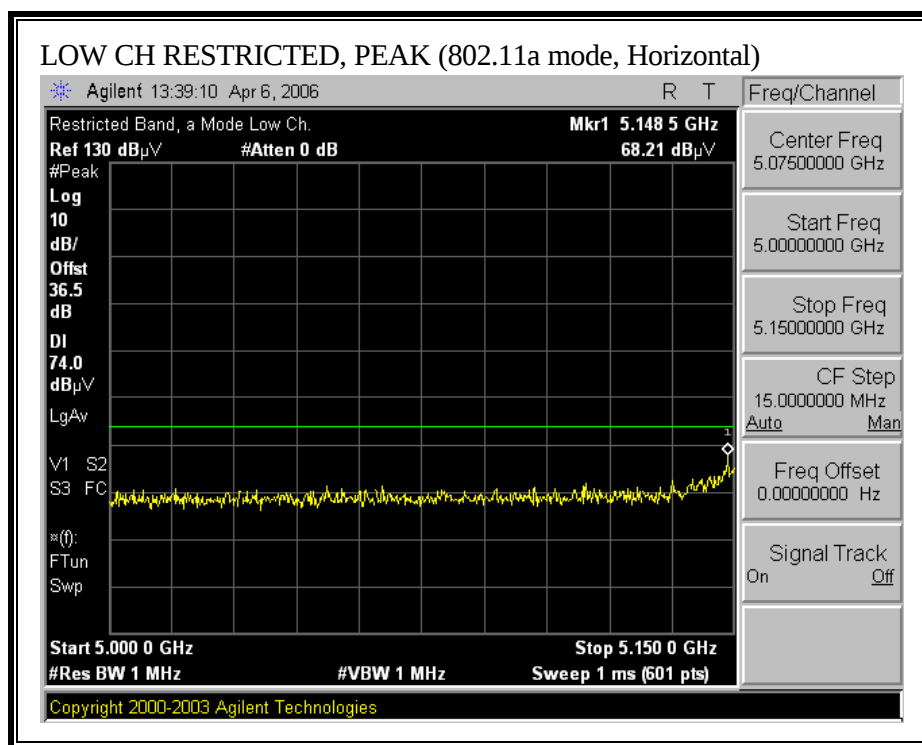
For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

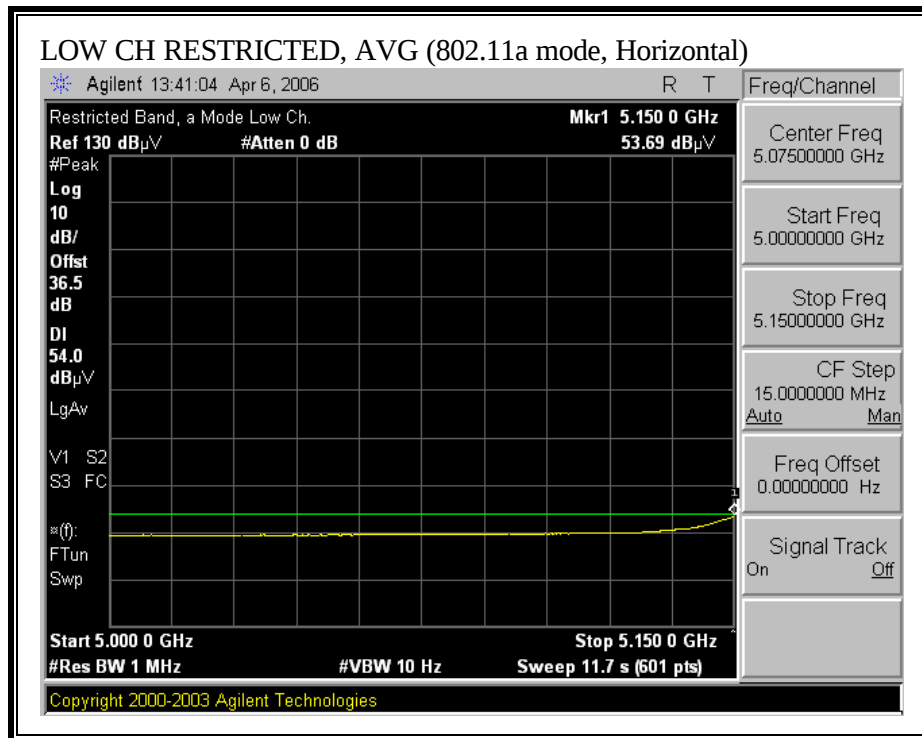
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

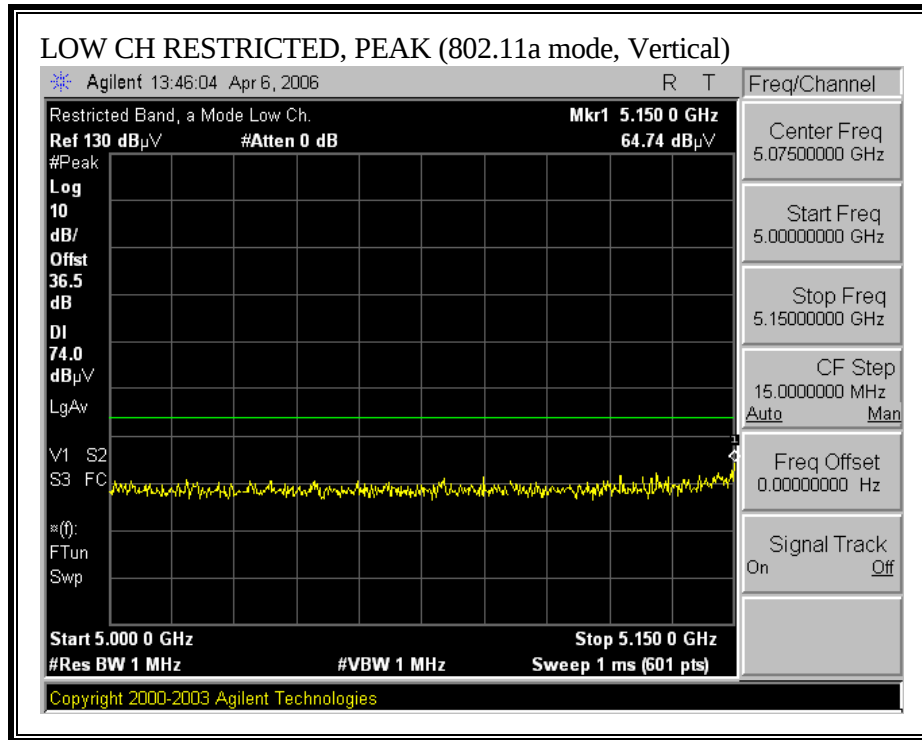
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

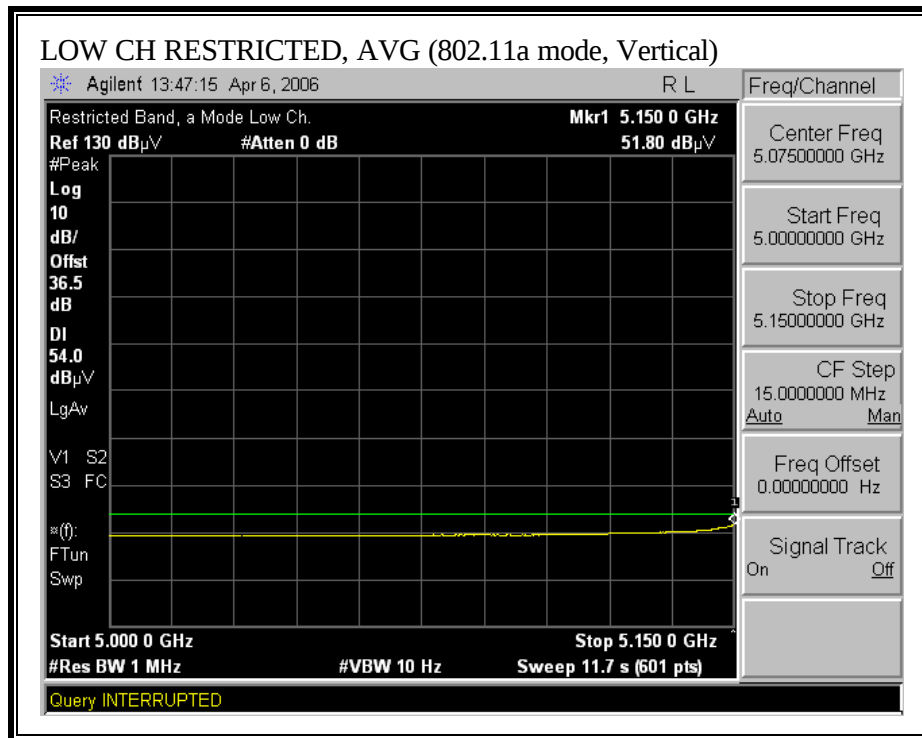
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

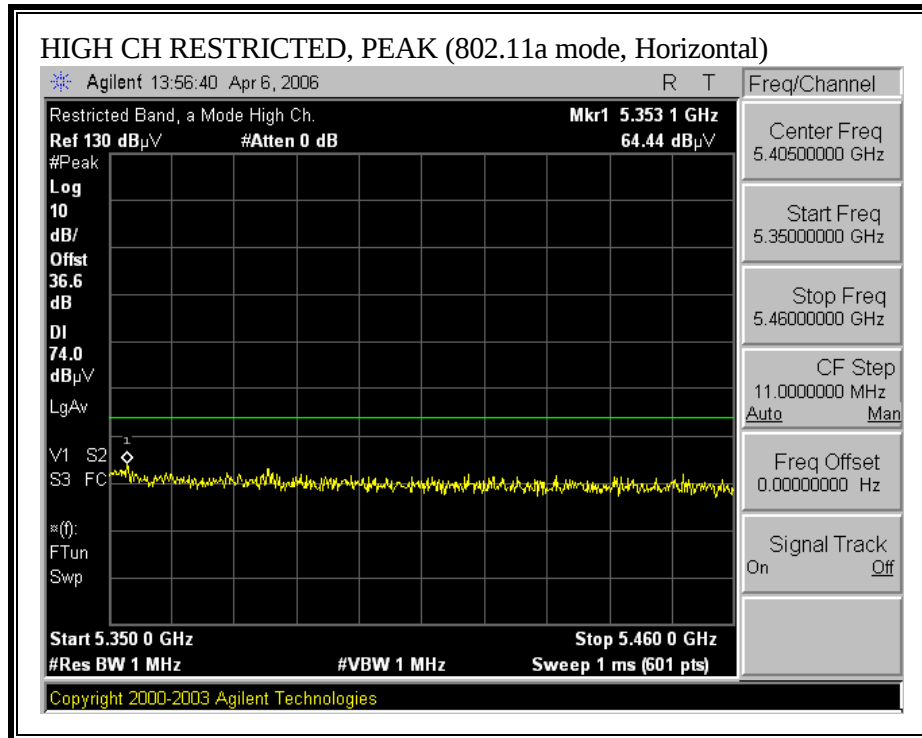
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

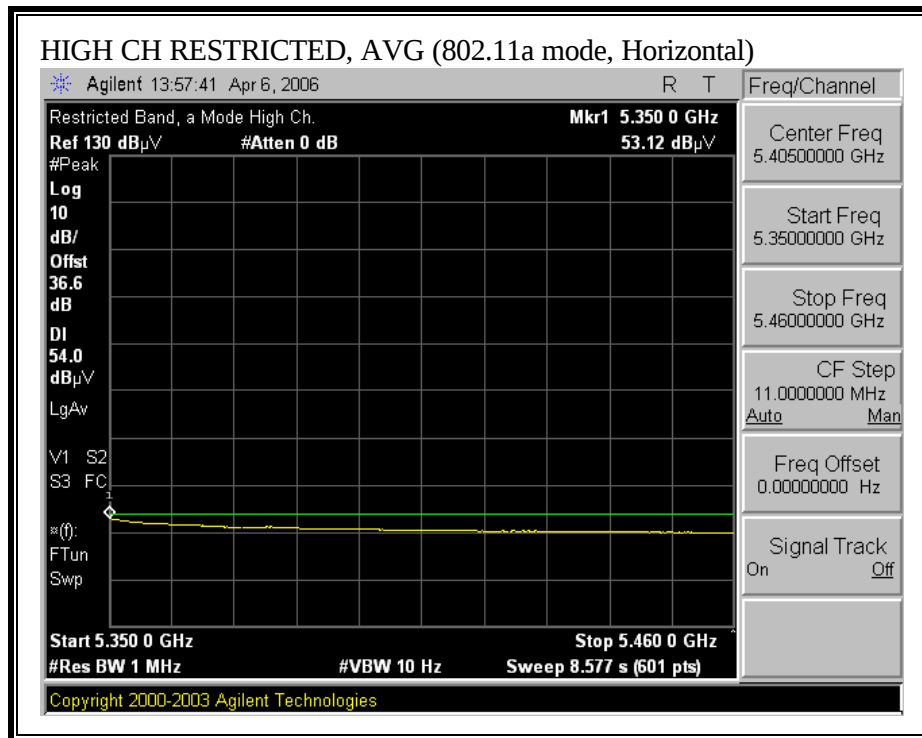
HITACHI, PIFA STAMPED METAL ANTENNA**LEGACY MODE****7.6.2. TRANSMITTER ABOVE 1 GHz FOR 5150 TO 5350 MHz BAND****RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, 5180 MHz - HORIZONTAL)**

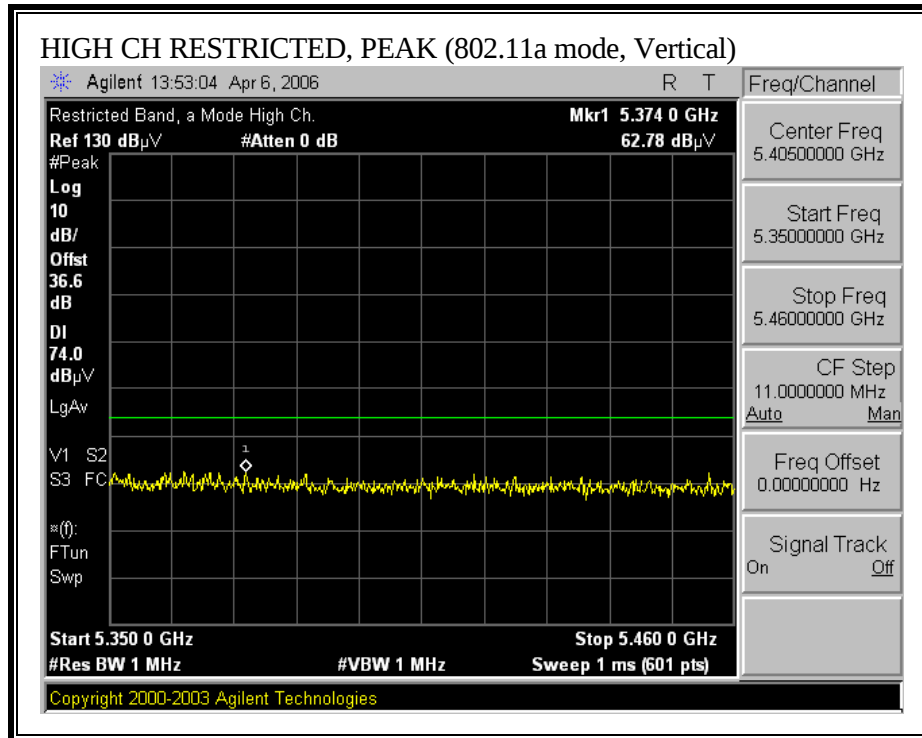


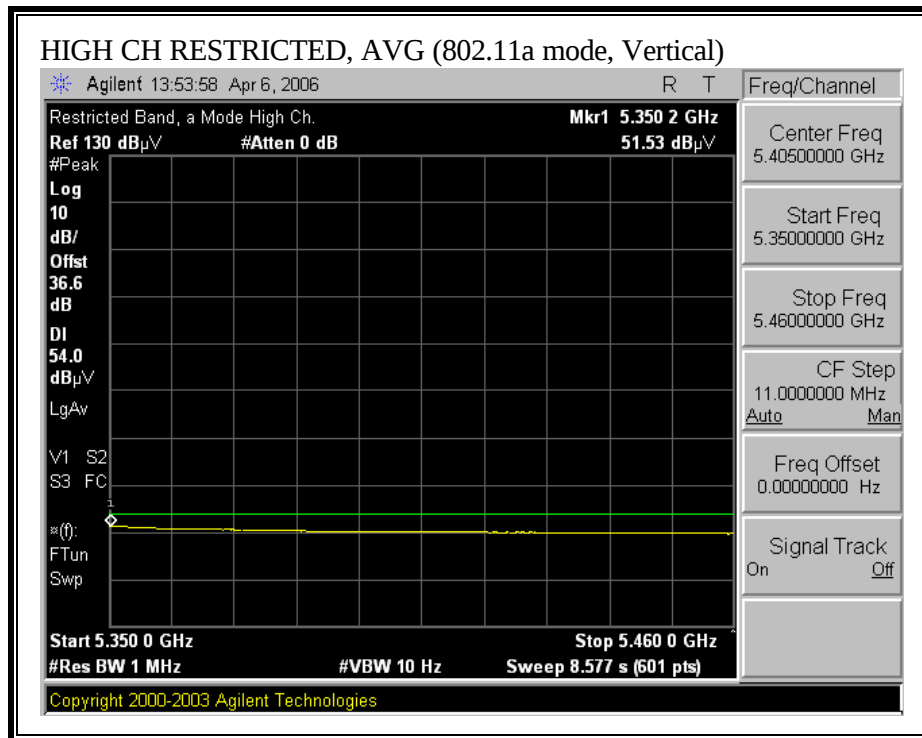
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, 5180 MHz - VERTICAL)

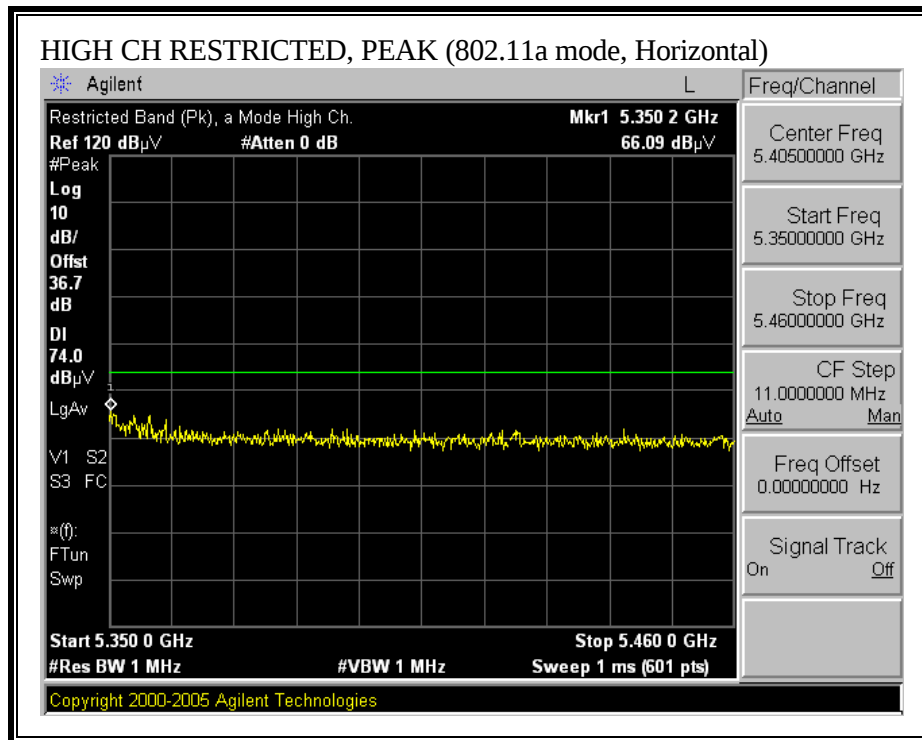


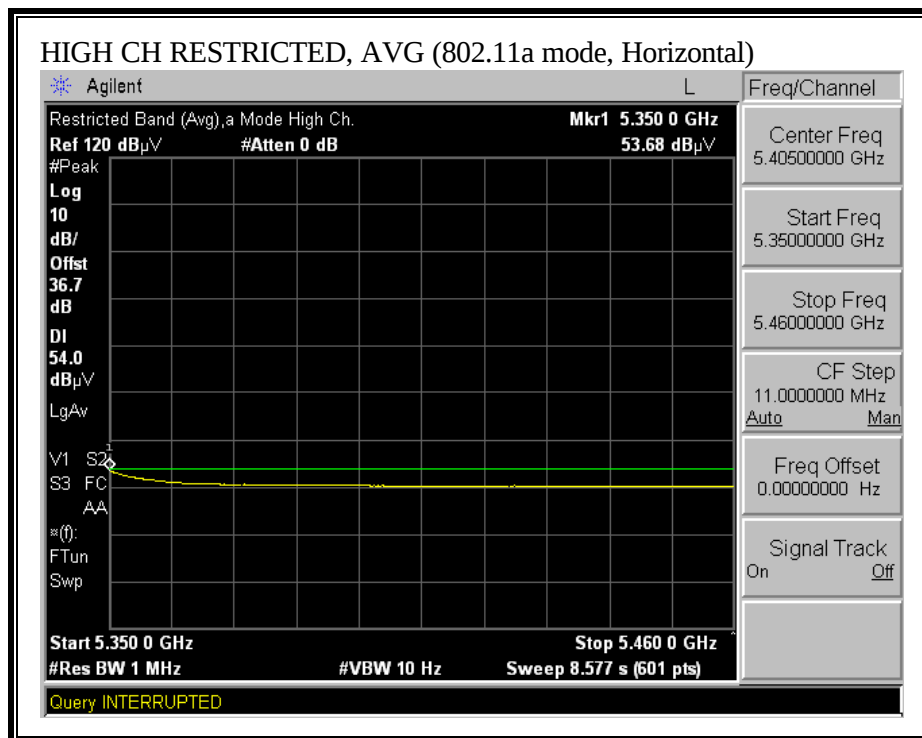
RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5300 MHz - HORIZONTAL)

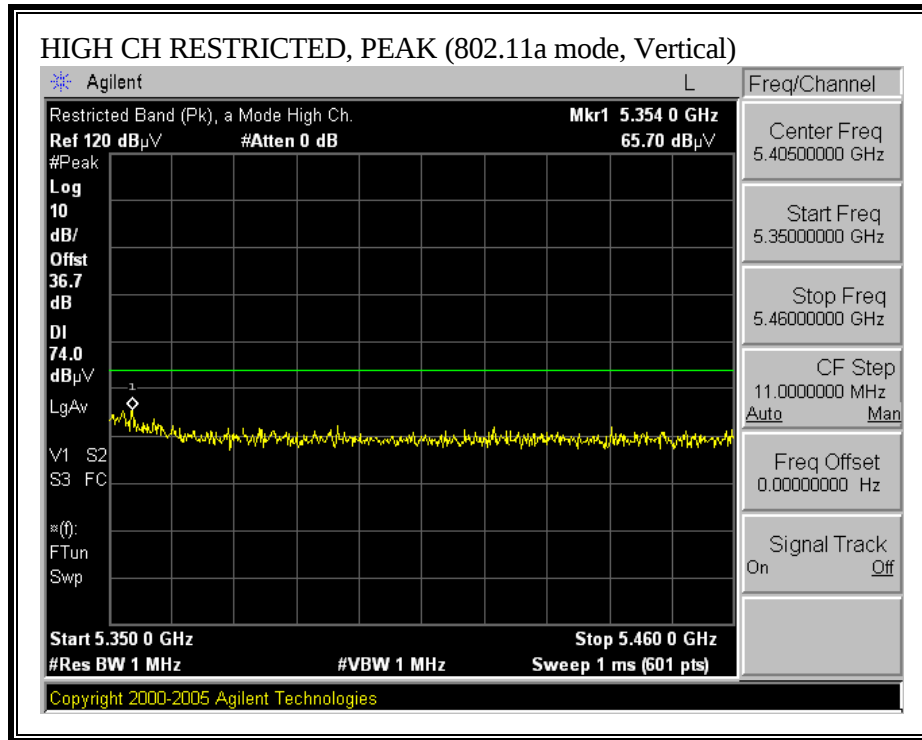


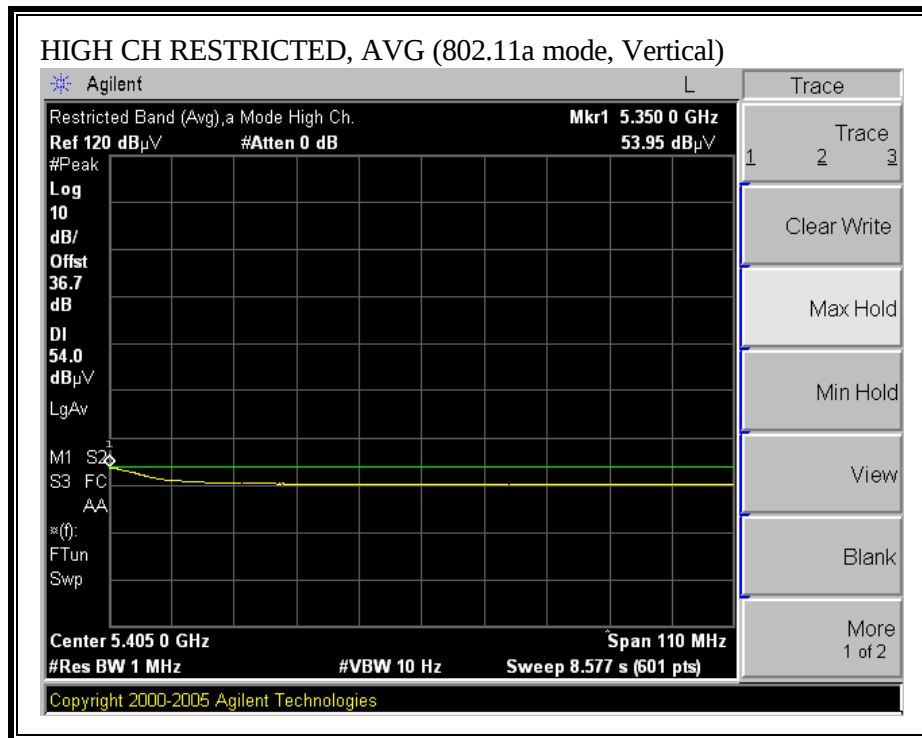
RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5300 MHz - VERTICAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - HORIZONTAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)**Compliance Certification Services, Morgan Hill Open Field Site**

Test Engineer: Ninous Davoudi

Project #:06U10233-1

Company: BroadCom Corporation

EUT Description:2x2 Dual Band MIMO Device

EUT M/N: BCM94321MC

EUT S/N: 107

Test Target: FCC UNII 15.407

Mode Of Operation: Tx 5.2 GHz

Average Power Meter: Low = 17.5 dBm, Mid = 17.5 dBm, High = 17.5dBm

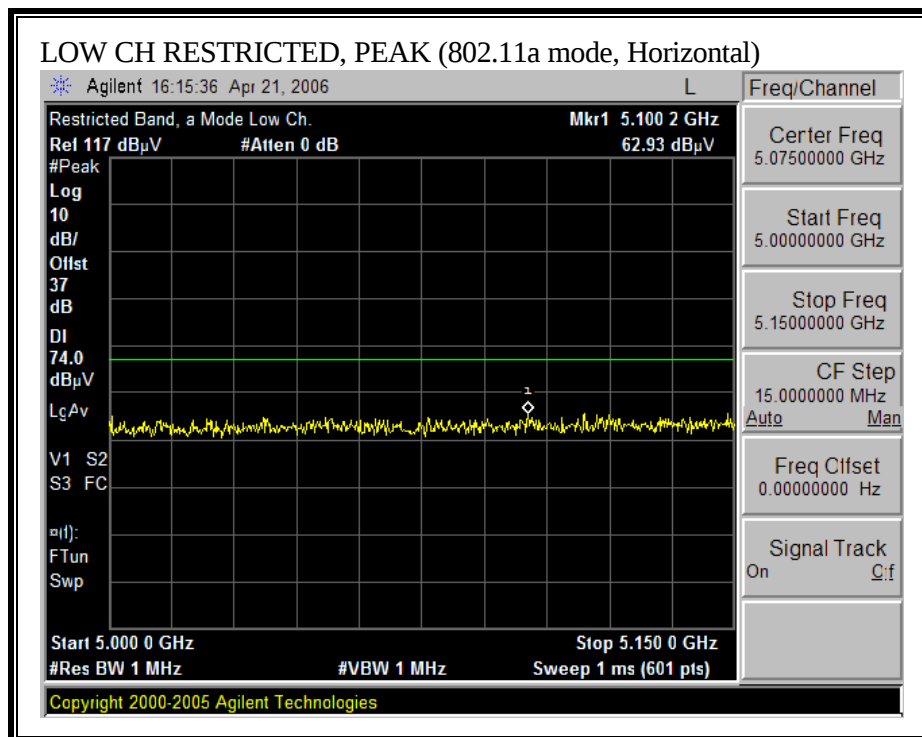
Test Equipment:

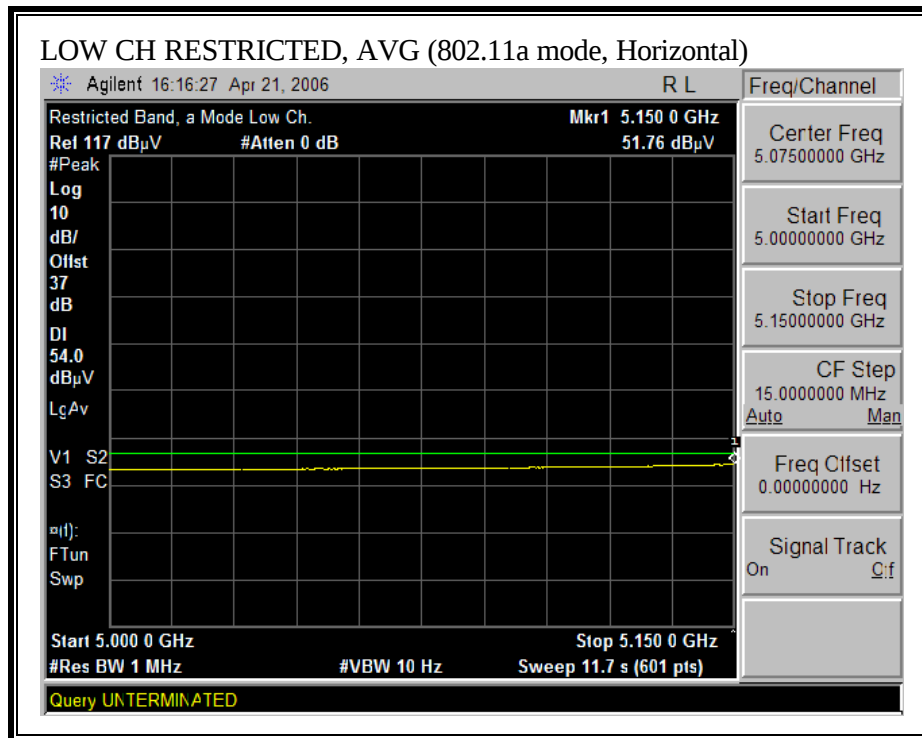
Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T120; S/N: 29310 @3m	T34 HP 8449B	T88 Miteq 26-40GHz	T89; ARA 18-26GHz; S/N:1049	FCC 15.209
Hi Frequency Cables				
2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
	Ninous 202575001	Ninous 208946002	HPF_7_6GHz	
Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz				

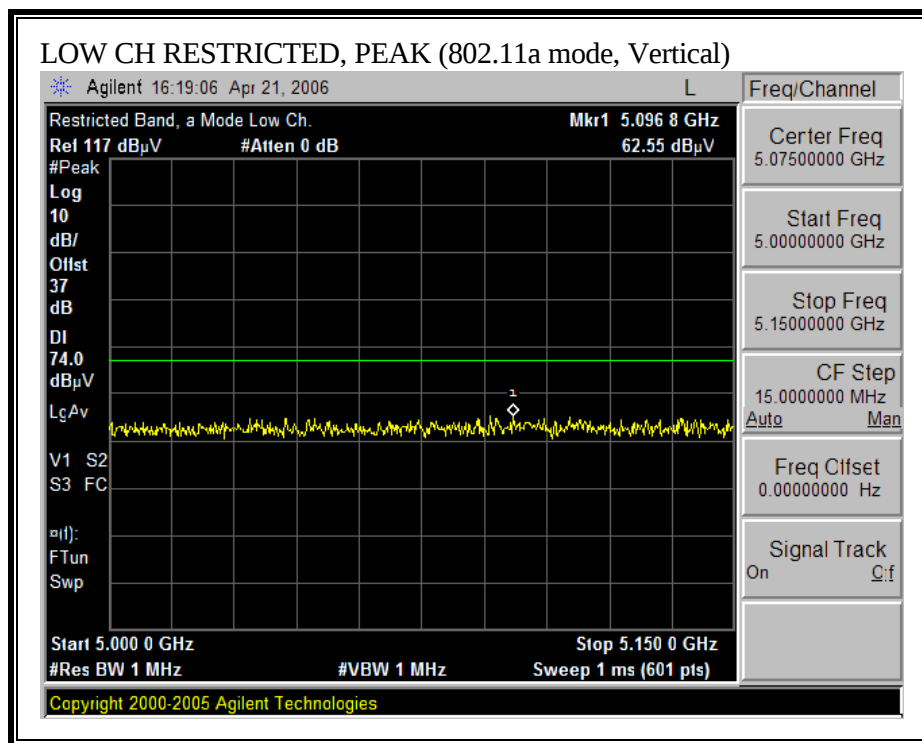
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fitr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
10.360	3.0	53.5	37.4	38.1	4.6	32.6	0.0	0.8	64.4	48.3	74	54	-9.6	-5.7	V
15.540	3.0	44.1	31.4	40.4	5.9	32.2	0.0	0.7	58.9	46.2	74	54	-15.1	-7.8	V
20.720	3.0	49.9	39.1	39.9	7.2	39.2	0.0	0.1	61.9	59.6	74	54	-22.7	-14.4	W
20.960	3.0	49.6	38.6	38.1	4.6	39.6	0.0	0.8	60.9	49.9	74	54	-13.5	-4.5	H
25.940	3.0	49.9	31.4	40.4	5.9	39.2	0.0	0.7	60.9	46.2	74	54	-15.7	-7.8	H
26.720	3.0	49.1	39.1	39.9	7.2	39.2	0.0	0.1	60.6	59.6	74	54	-21.4	-14.4	H
30.000	3.0	54.9	40.0	38.2	4.6	39.6	0.0	0.8	69.9	61.0	74	54	-8.5	-3.0	W
35.740	3.0	44.9	31.6	40.6	6.0	39.2	0.0	0.7	60.9	46.2	74	54	-14.1	-7.3	W
24.040	3.0	49.2	31.8	39.4	7.9	39.2	0.0	0.0	60.9	59.9	74	54	-21.3	-14.7	W
30.520	3.0	59.4	40.8	38.2	4.6	39.6	0.0	0.8	66.4	61.8	74	54	-7.6	-2.2	H
35.740	3.0	49.0	31.6	40.6	6.0	39.2	0.0	0.7	60.0	46.6	74	54	-14.0	-7.4	H
24.040	3.0	44.4	31.9	39.4	7.9	39.2	0.0	0.0	61.9	59.2	74	54	-22.1	-14.8	H
30.000	3.0	56.4	38.1	38.2	4.7	39.6	0.0	0.8	67.9	49.1	74	54	-6.5	-4.9	W
35.940	3.0	49.9	31.9	40.6	6.0	39.1	0.0	0.7	60.9	46.6	74	54	-13.5	-7.4	W
24.240	3.0	44.9	31.6	39.4	7.9	39.2	0.0	0.0	61.8	59.1	74	54	-22.2	-14.9	W
30.640	3.0	56.9	49.1	38.2	4.7	39.6	0.0	0.8	67.9	59.1	74	54	-6.1	-0.9	H
35.940	3.0	44.4	31.9	40.6	6.0	39.1	0.0	0.7	60.6	46.6	74	54	-14.4	-7.4	H
24.240	3.0	44.4	31.9	39.4	7.9	39.2	0.0	0.0	61.9	59.1	74	54	-22.1	-14.9	H

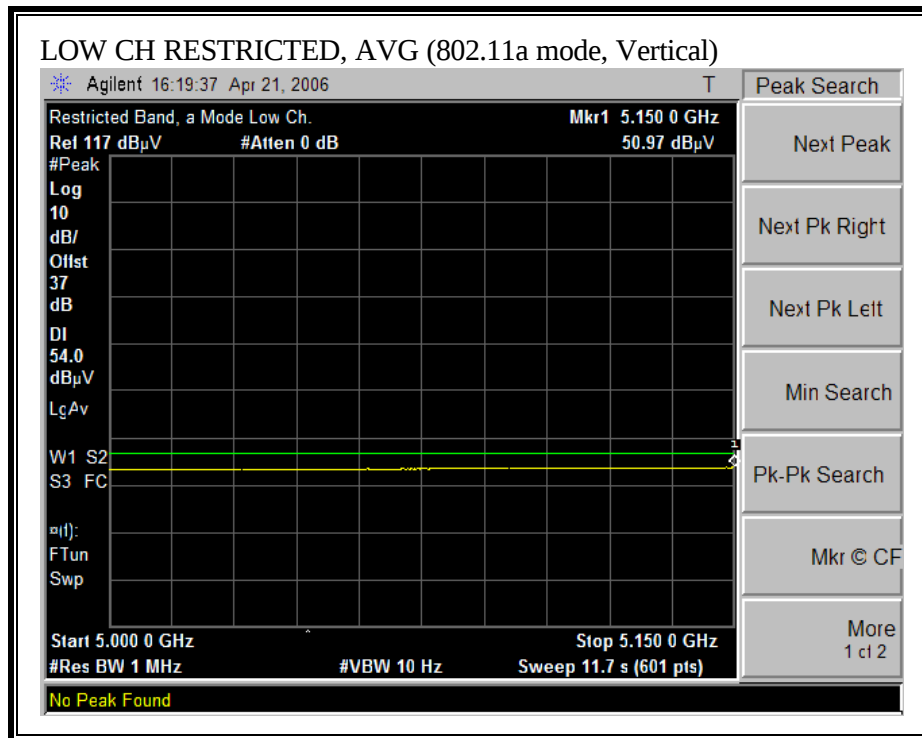
No other emissions were detected above system noise floor.

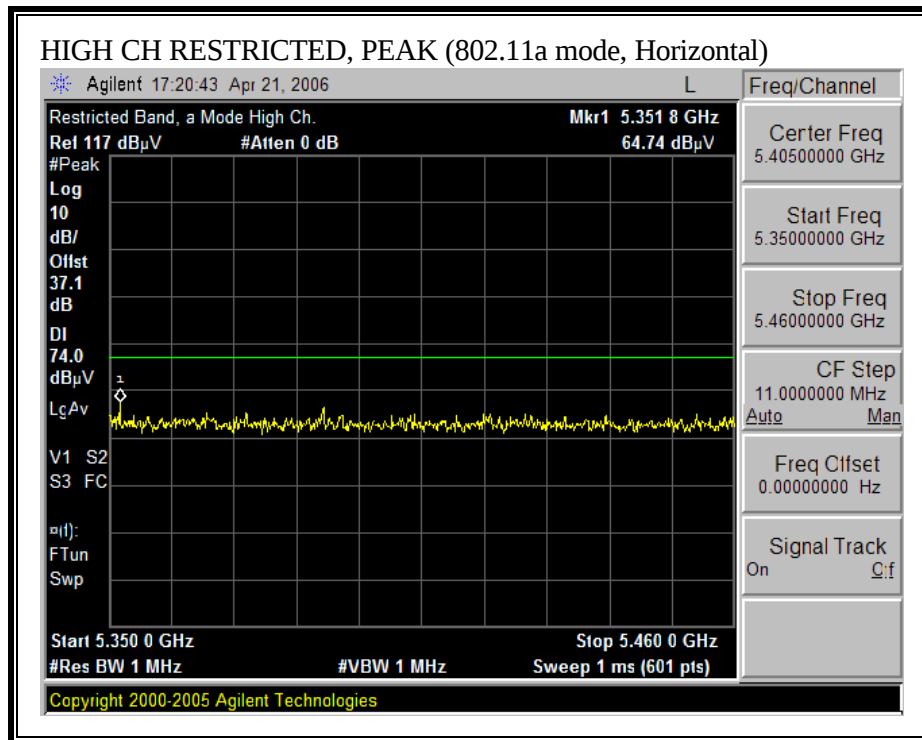
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correction to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

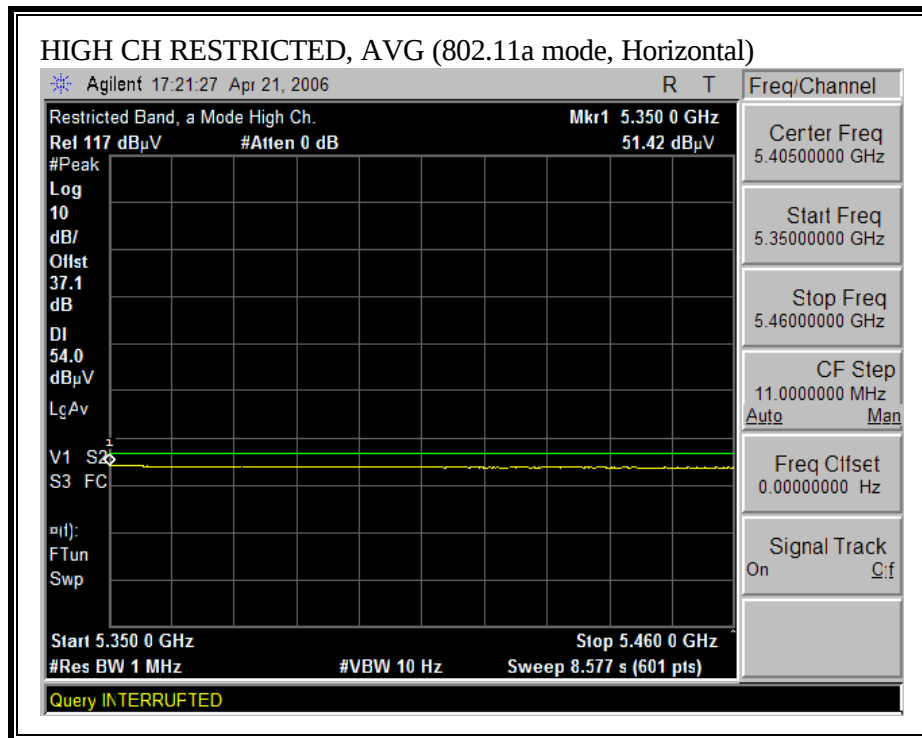
MIMO MODE**7.6.3. TRANSMITTER ABOVE 1 GHZ FOR 5150 TO 5350 MHz BAND****20 MHz TX BANDWIDTH****RESTRICTED BANDEDGE (LOW CHANNEL, 5180 MHz - HORIZONTAL)**

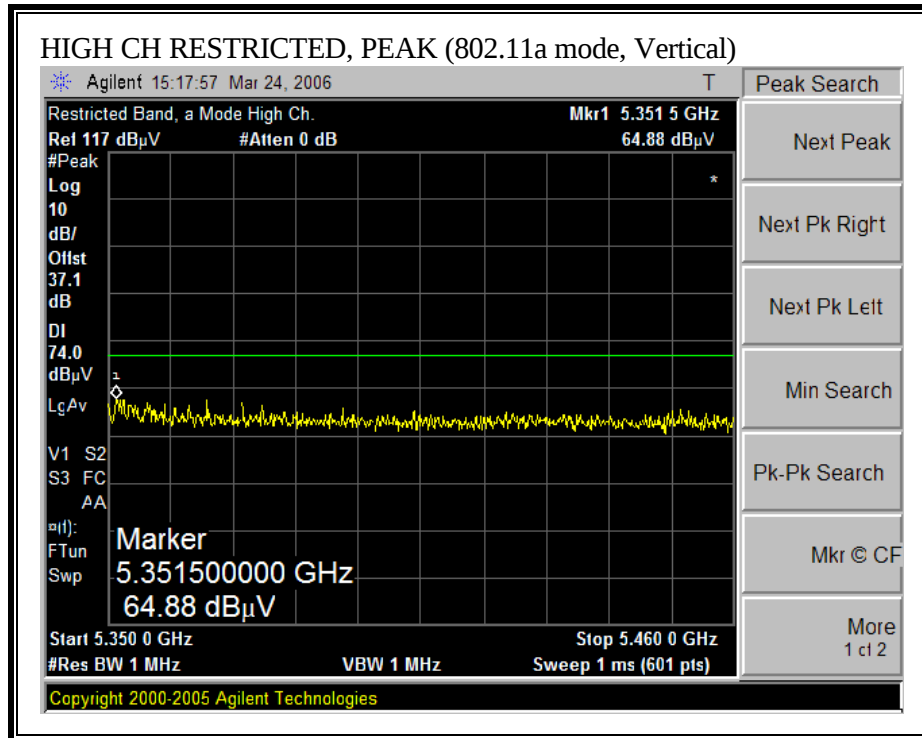


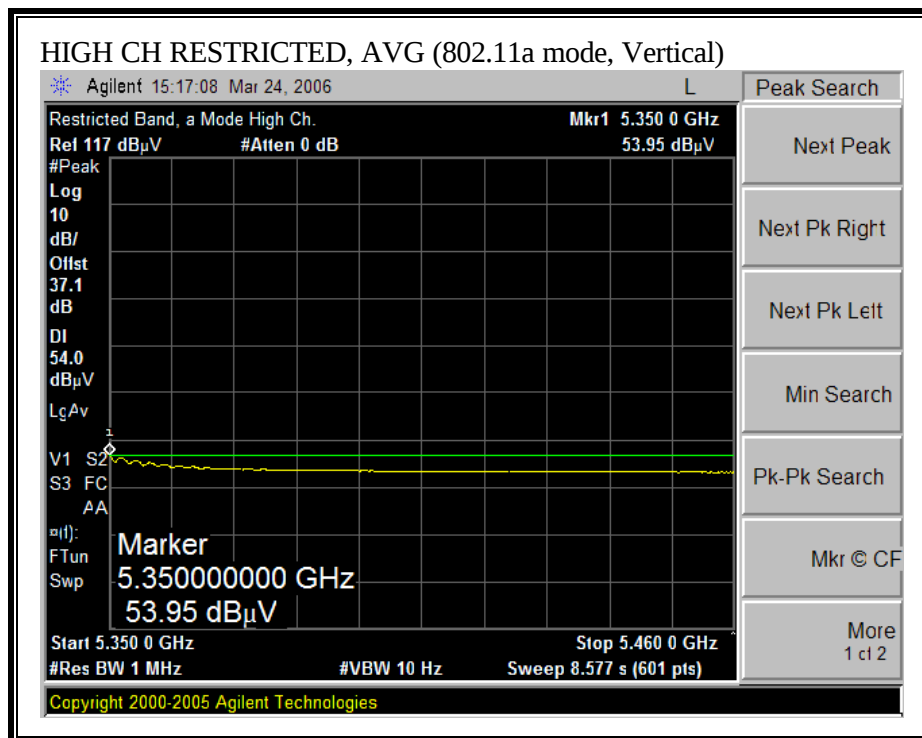
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, 5180 MHz - VERTICAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - HORIZONTAL)

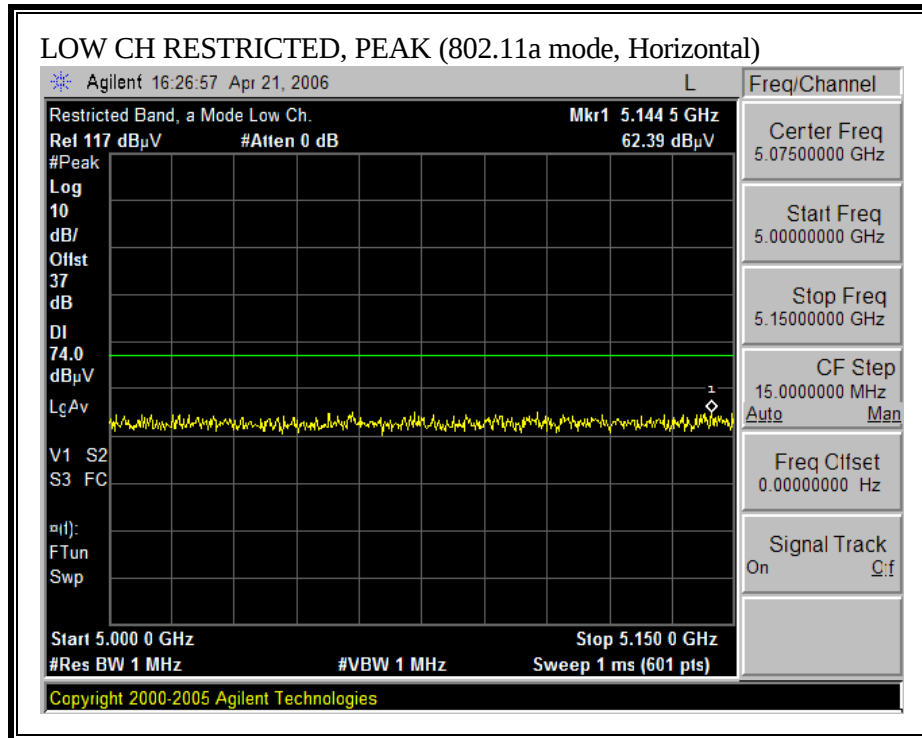


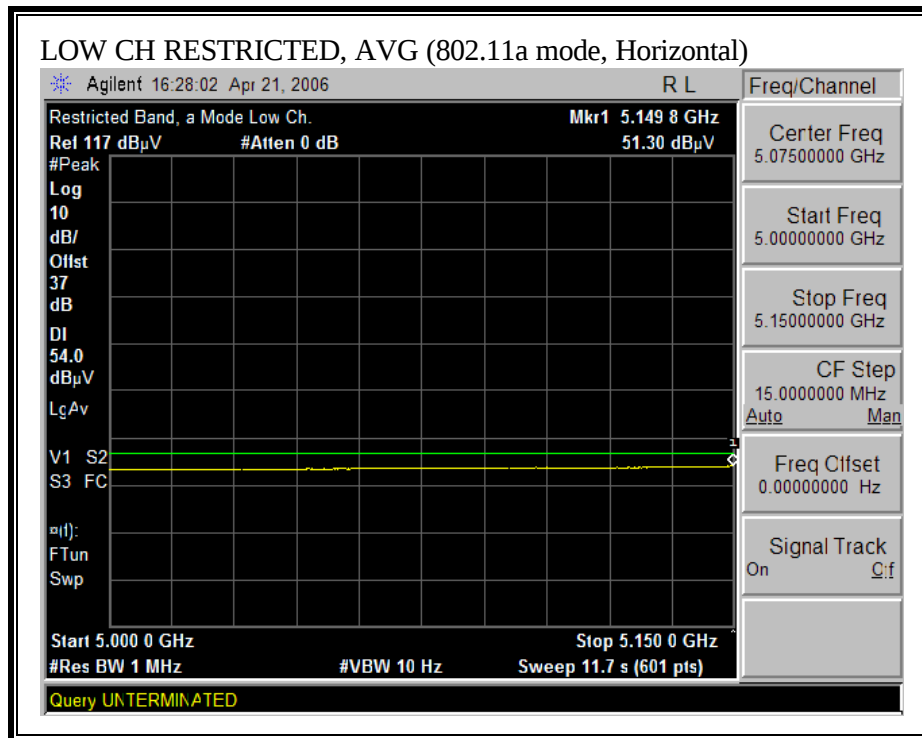
RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - VERTICAL)

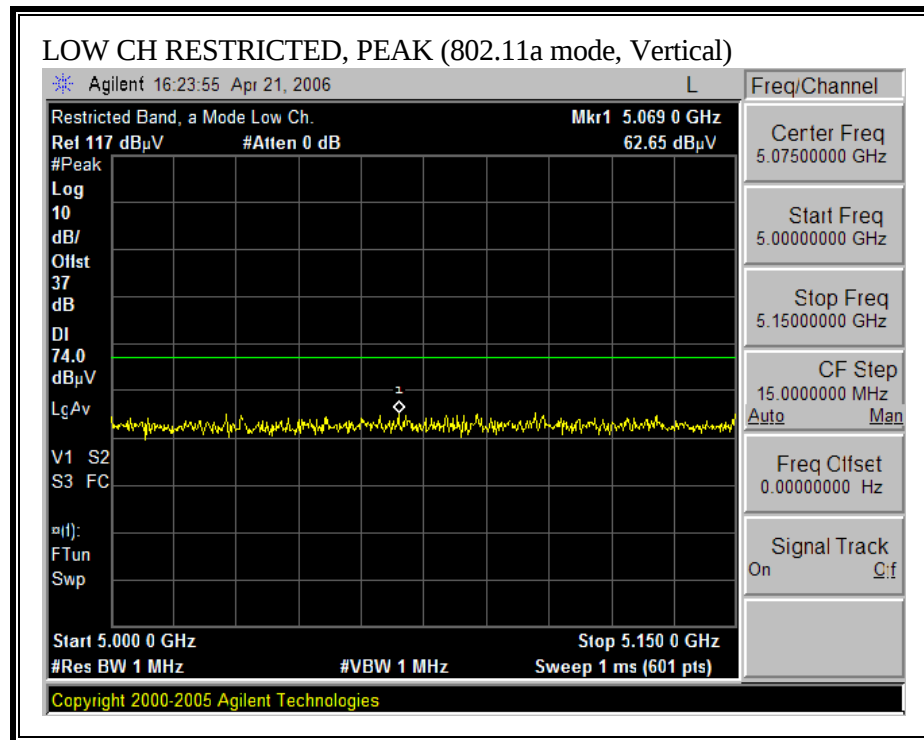


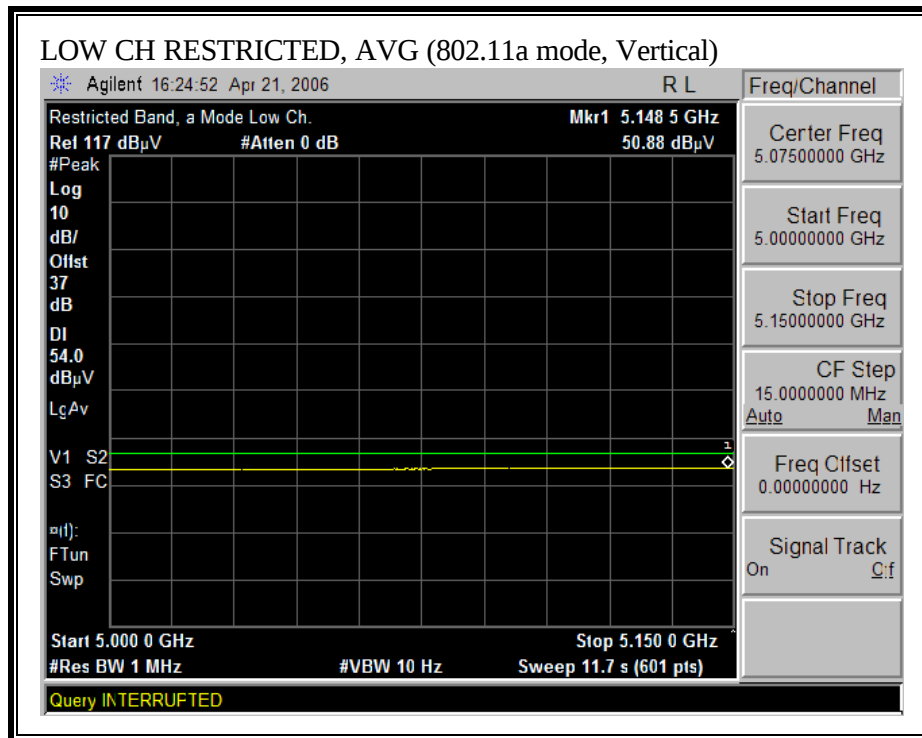
HARMONICS AND SPURIOUS EMISSIONS (802.11a – 20 MHz TX BANDWIDTH)

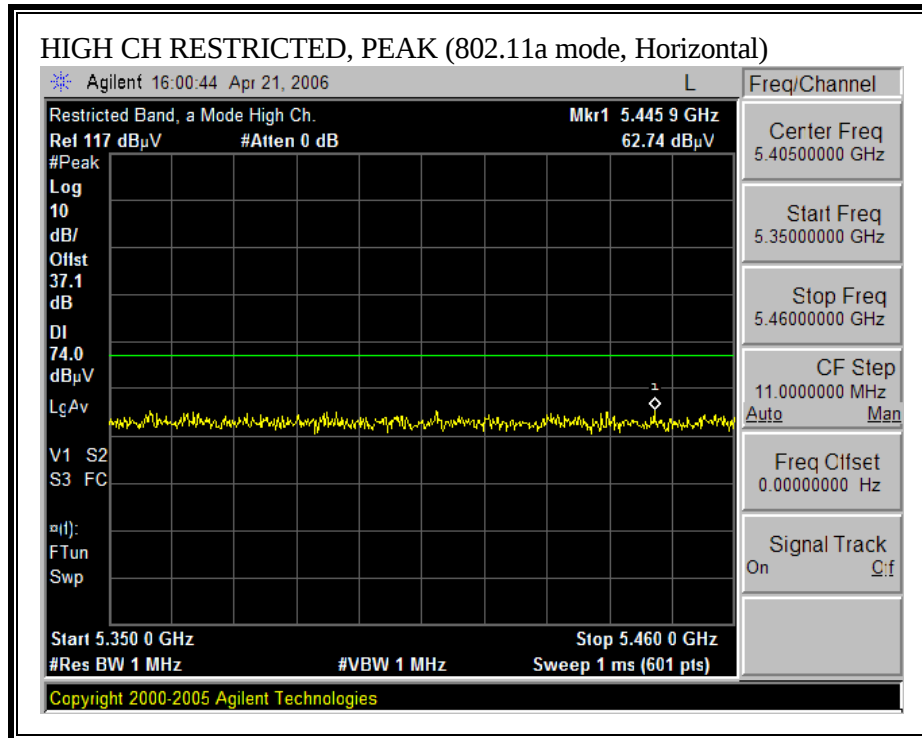
03/24/06 High Frequency Measurement																	
Compliance Certification Services, Morgan Hill Open Field Site																	
Test Engineer:		Vien Tran															
Project #:		06U10233															
Company:		Broadcom															
EUT Description:		2x2 Dual Band MIMO Device															
EUT M/N:		BCM94321MC															
EUT S/N:		107															
Test Target:		FCC 15.407															
Mode Of Operation:		5.2 GHz Band_Tx MIMO Tx bw 2_Mode 0 1															
Test Equipment:																	
Horn 1-18GHz				Pre-amplifier 1-26GHz				Pre-amplifier 26-40GHz				Horn > 18GHz				Limit	
T119; S/N: 29301 @3m				T145 Agilent 3008A0056												FCC 15.209	
Hi Frequency Cables																	
2 foot cable				3 foot cable				12 foot cable				HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz	
				Vien 187215002				Vien 197209005				HPF_7.6GHz					
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)		
Ch 36, 5180 MHz 15.5dBm																	
10.360	3.0	48.9	35.7	37.6	4.7	-34.6	0.0	0.8	57.4	44.2	74	54	-16.6	-9.8	V		
15.540	3.0	43.7	32.7	40.1	5.8	-32.3	0.0	0.7	58.0	47.0	74	54	-16.0	-7.0	V, Noise Floor		
10.360	3.0	46.2	35.3	37.6	4.7	-34.6	0.0	0.8	54.7	43.8	74	54	-19.3	-10.2	H		
15.540	3.0	44.0	32.5	40.1	5.8	-32.3	0.0	0.7	58.3	46.8	74	54	-15.7	-7.2	H, Noise Floor		
Ch 52, 5260 MHz 17dBm																	
10.520	3.0	55.6	42.2	37.6	4.7	-34.4	0.0	0.8	64.3	50.9	74	54	-9.7	-3.1	V		
15.780	3.0	43.0	32.6	40.3	5.8	-32.2	0.0	0.7	57.6	47.2	74	54	-16.4	-6.8	V, Noise Floor		
10.520	3.0	55.1	42.0	37.6	4.7	-34.4	0.0	0.8	63.8	50.7	74	54	-10.2	-3.3	H		
15.780	3.0	44.0	32.8	40.3	5.8	-32.2	0.0	0.7	58.6	47.4	74	54	-15.4	-6.6	H, Noise Floor		
Ch 64, 5320 MHz 17dBm																	
10.640	3.0	51.5	38.0	37.6	4.8	-34.2	0.0	0.8	60.4	46.9	74	54	-13.6	-7.1	V		
15.960	3.0	44.5	32.3	40.3	5.9	-32.2	0.0	0.7	59.2	47.0	74	54	-14.8	-7.0	V, Noise Floor		
10.640	3.0	49.8	37.2	37.6	4.8	-34.2	0.0	0.8	58.7	46.1	74	54	-15.3	-7.9	H		
15.960	3.0	43.0	32.0	40.3	5.9	-32.2	0.0	0.7	57.7	46.7	74	54	-16.3	-7.3	H, Noise Floor		
Note: No other emissions were detected above the noise floor																	
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit				
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit				
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit				
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit				
CL	Cable Loss					HPF	High Pass Filter										

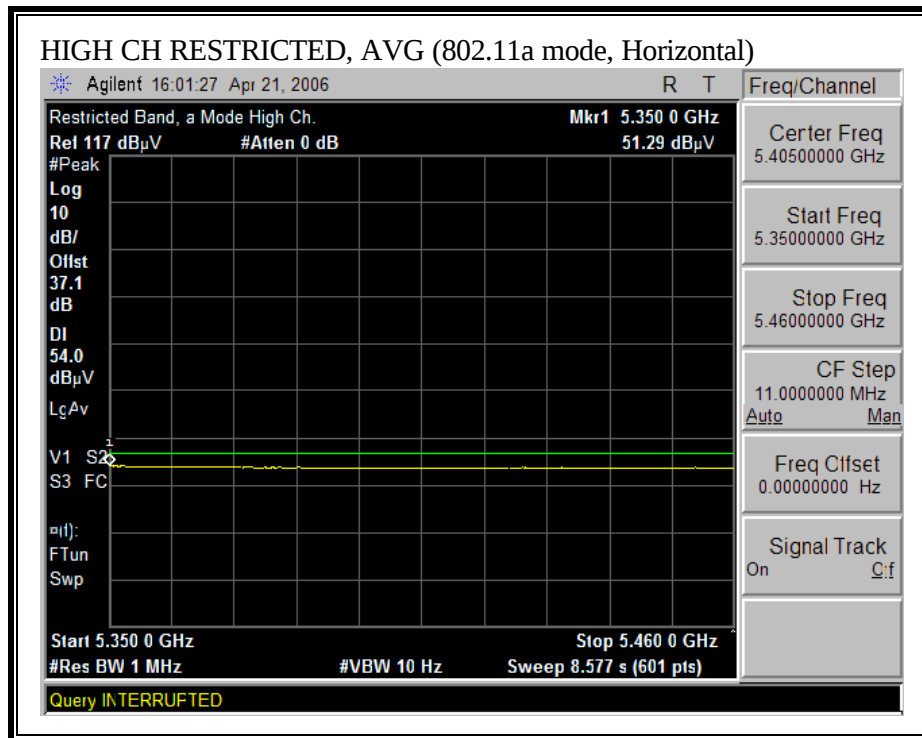
40 MHz TX BANDWIDTH**RESTRICTED BANEDGE (LOW CHANNEL, 5190 MHz - HORIZONTAL)**

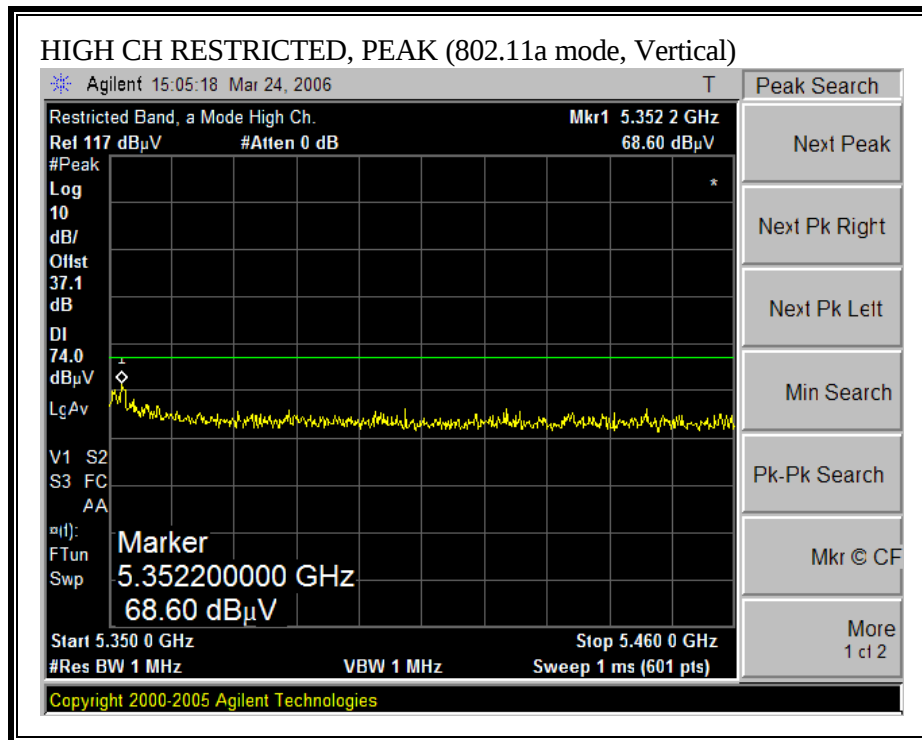


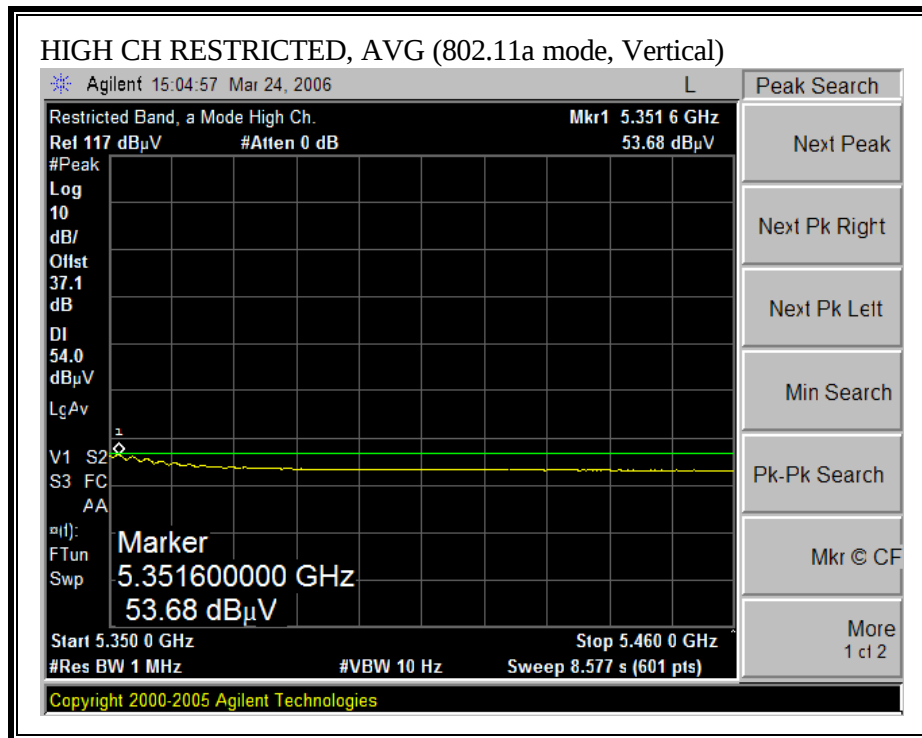
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, 5190 MHz - VERTICAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5310 MHz - HORIZONTAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5310 MHz - VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS (802.11a – 40 MHz TX BANDWIDTH)

03/27/06 High Frequency Measurement																	
Compliance Certification Services, Morgan Hill Open Field Site																	
Test Engineer:		Vien Tran															
Project #:		06U10233															
Company:		Broadcom															
EUT Description:		2x2 Dual Band MIMO Device															
EUT M/N:		BCM94321MC															
EUT S/N:		107															
Test Target:		FCC 15.407															
Mode Of Operation:		5.2 GHz Band_Tx MIMO Tx bw 4_Mode 0 1_Ch 38, 54 & 62															
Test Equipment:																	
Horn 1-18GHz				Pre-amplifier 1-26GHz				Pre-amplifier 26-40GHz				Horn > 18GHz				Limit	
T60; S/N: 2238 @3m				T145 Agilent 3008A0056												FCC 15.209	
Hi Frequency Cables																	
2 foot cable				3 foot cable				12 foot cable				HPF				Reject Filter	
				Vien 187215002				Vien 197209005				HPF_7.6GHz				R_001	
Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz																	
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)		
Ch 38, 5190 MHz, 17dBm																	
10.380	3.0	47.4	34.8	38.3	4.7	-34.6	0.0	0.8	56.6	44.0	74	54	-17.4	-10.0	V		
15.570	3.0	44.9	32.8	39.0	5.8	-32.3	0.0	0.7	58.1	46.0	74	54	-15.9	-8.0	V, Noise Floor		
10.380	3.0	48.7	37.0	38.3	4.7	-34.6	0.0	0.8	57.9	46.2	74	54	-16.1	-7.8	H		
15.570	3.0	44.1	32.5	39.0	5.8	-32.3	0.0	0.7	57.3	45.7	74	54	-16.7	-8.3	H, Noise Floor		
Ch 54, 5270 MHz, 17dBm																	
10.540	3.0	50.8	38.7	38.2	4.7	-34.4	0.0	0.8	60.2	48.1	74	54	-13.8	-5.9	V		
15.810	3.0	42.5	32.6	38.8	5.8	-32.2	0.0	0.7	55.6	45.7	74	54	-18.4	-8.3	V, Noise Floor		
10.540	3.0	48.9	38.5	38.2	4.7	-34.4	0.0	0.8	58.3	47.9	74	54	-15.7	-6.1	H		
15.810	3.0	44.4	32.6	38.8	5.8	-32.2	0.0	0.7	57.5	45.7	74	54	-16.5	-8.3	H, Noise Floor		
Ch 62, 5310 MHz, 17dBm																	
10.620	3.0	49.5	37.7	38.2	4.8	-34.3	0.0	0.8	58.9	47.1	74	54	-15.1	-6.9	V		
15.950	3.0	43.4	31.9	38.7	5.9	-32.2	0.0	0.7	56.5	45.0	74	54	-17.5	-9.0	V, Noise Floor		
10.620	3.0	50.1	39.9	38.2	4.8	-34.3	0.0	0.8	59.5	49.3	74	54	-14.5	-4.7	H		
15.950	3.0	43.6	32.2	38.7	5.9	-32.2	0.0	0.7	56.7	45.3	74	54	-17.3	-8.7	H, Noise Floor		
Note: No other emissions were detected above the noise floor																	
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit				
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit				
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit				
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit				
CL	Cable Loss					HPF	High Pass Filter										

7.6.4. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)****HORIZONTAL**

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 16 File#: 30-1000.EMI Date: 04-22-2006 Time: 11:48:19
Audix ATC

Condition: FCC CLASS-B HORIZONTAL

Test Operator : Vien Tran
Project # : 06U10233
Company : Broadcom
EUT : 2x2 Dual Band MIMO Device
Model No : BCM94321MCAG Rev. 3
S/N : 107
Configuration : EUT and Laptop
Mode of operation: Tx 5 GHz Band MIMO_Worst Case

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.000	10.02	20.45	30.47	40.00	-9.53	Peak
2	124.090	21.68	15.23	36.91	43.50	-6.59	Peak
3	290.930	23.93	15.33	39.26	46.00	-6.74	Peak
4	361.740	21.45	17.20	38.65	46.00	-7.35	Peak
5	643.040	21.88	22.23	44.11	46.00	-1.89	Peak
6	681.840	19.55	22.86	42.41	46.00	-3.59	Peak

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**VERTICAL**

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 18 File#: 30-1000.EMI Date: 04-22-2006 Time: 11:52:24
Audix ATC

Condition: FCC CLASS-B VERTICAL

Test Operator : Vien Tran
Project # : 06U10233
Company : Broadcom
EUT : 2x2 Dual Band MIMO Device
Model No : BCM94321MCAG Rev. 3
S/N : 107
Configuration : EUT and Laptop
Mode of operation: Tx 5 GHz Band MIMO_Worst Case

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	62.980	24.18	8.90	33.08	40.00	-6.92	Peak
2	126.030	20.38	15.25	35.63	43.50	-7.87	Peak
3	406.360	20.65	18.20	38.85	46.00	-7.15	Peak
4	573.200	20.48	21.16	41.64	46.00	-4.36	Peak
5	642.070	19.87	22.21	42.08	46.00	-3.92	Peak
6	707.060	17.27	23.20	40.47	46.00	-5.53	Peak

7.7. RADIATED EMISSIONS

7.7.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST PROCEDURE

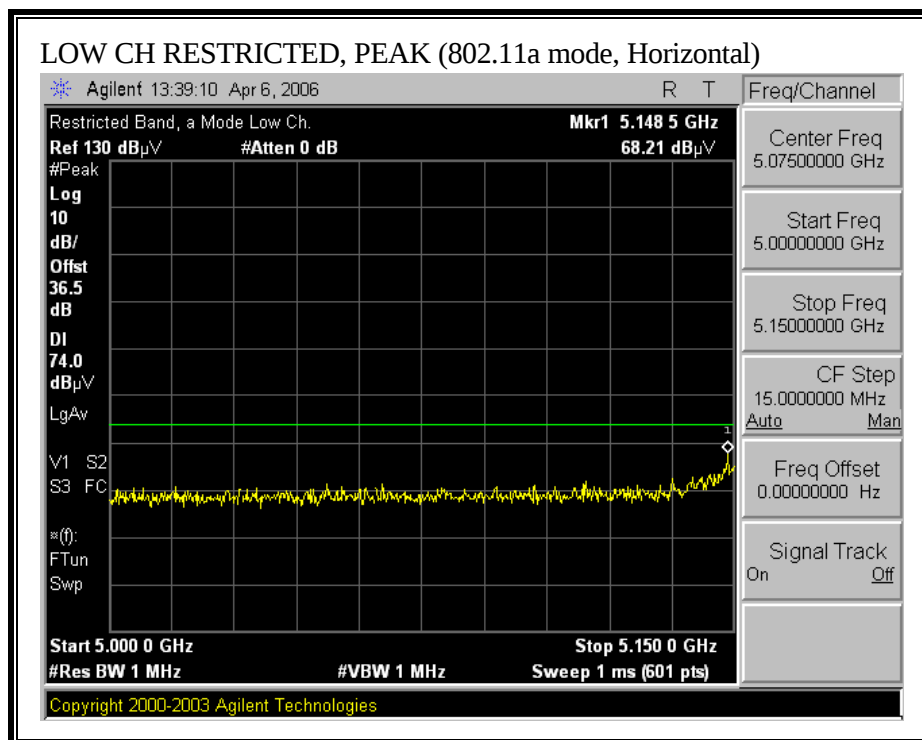
The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

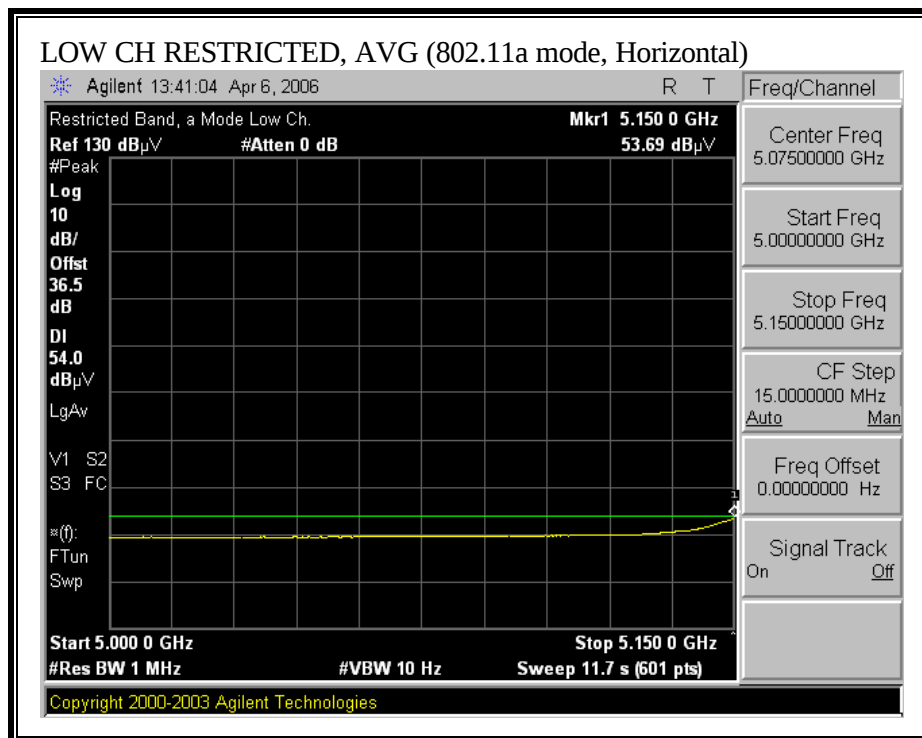
For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

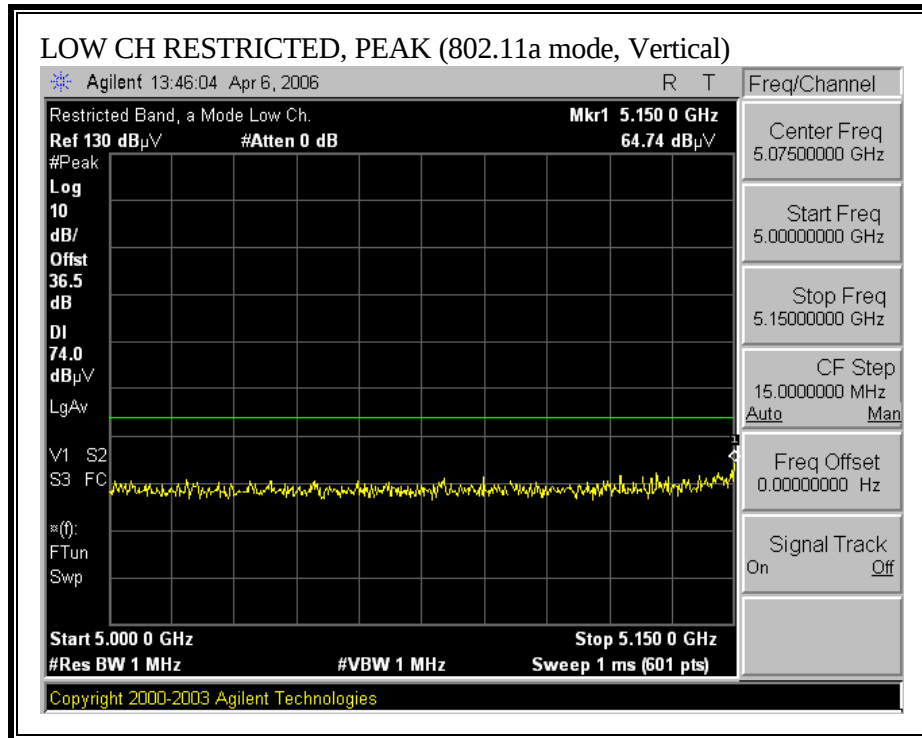
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

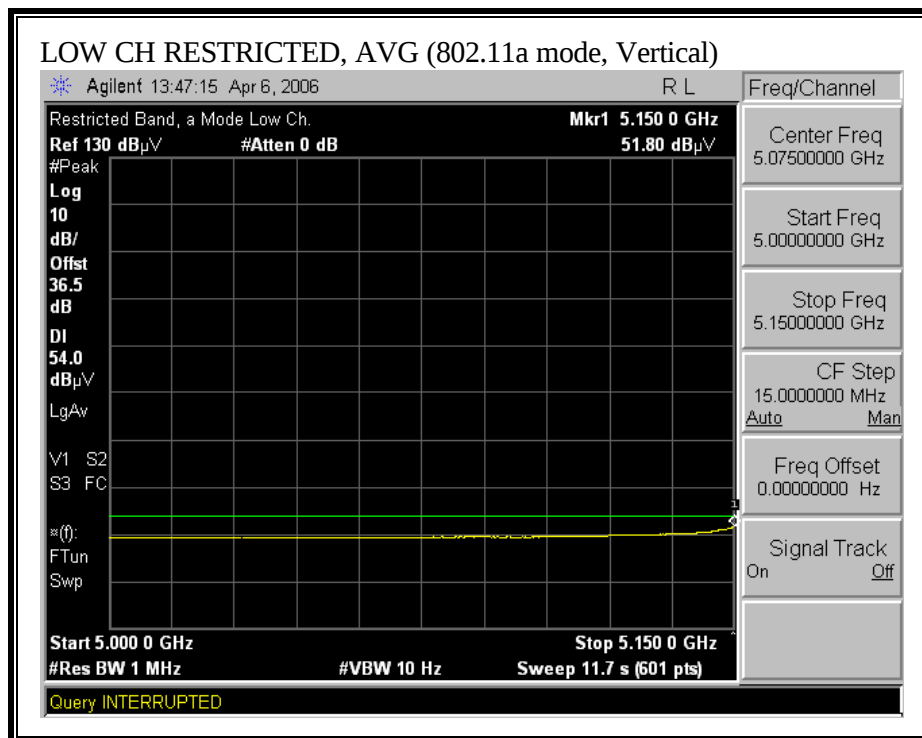
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle , and highest channels in each band.

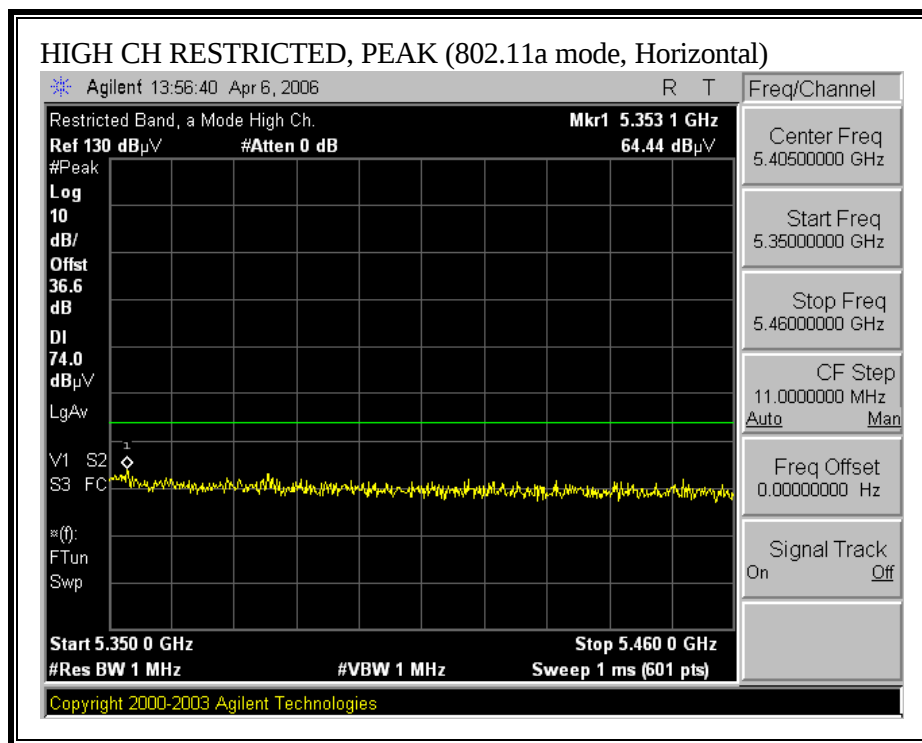
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

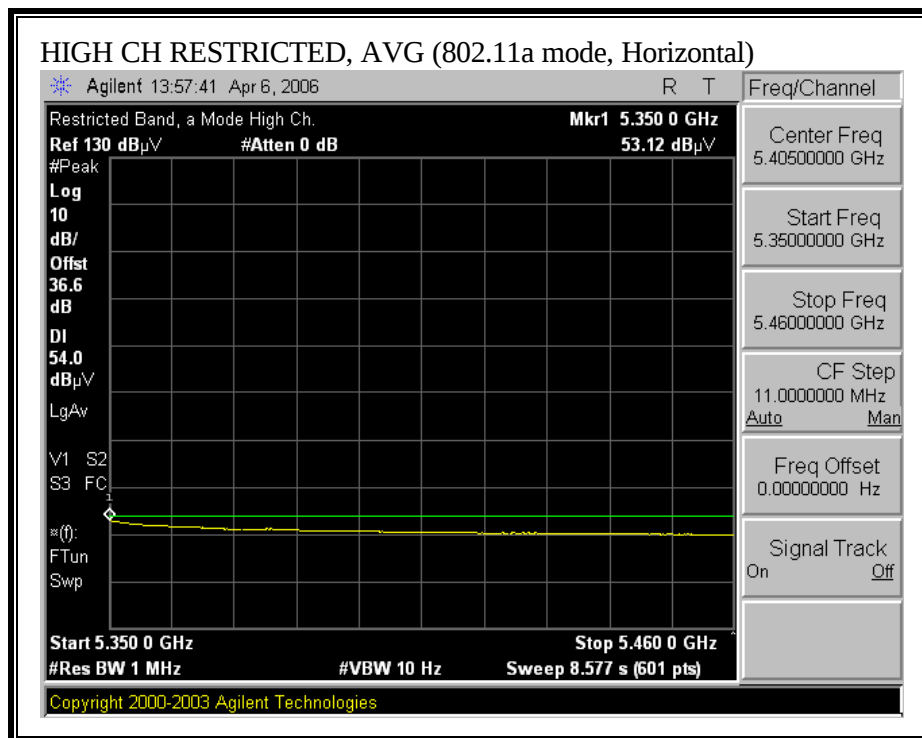
FOXCONN, PCB ANTENNA**LEGACY MODE****7.7.2. TRANSMITTER ABOVE 1 GHz FOR 5150 TO 5350 MHz BAND****RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, 5180 MHz - HORIZONTAL)**

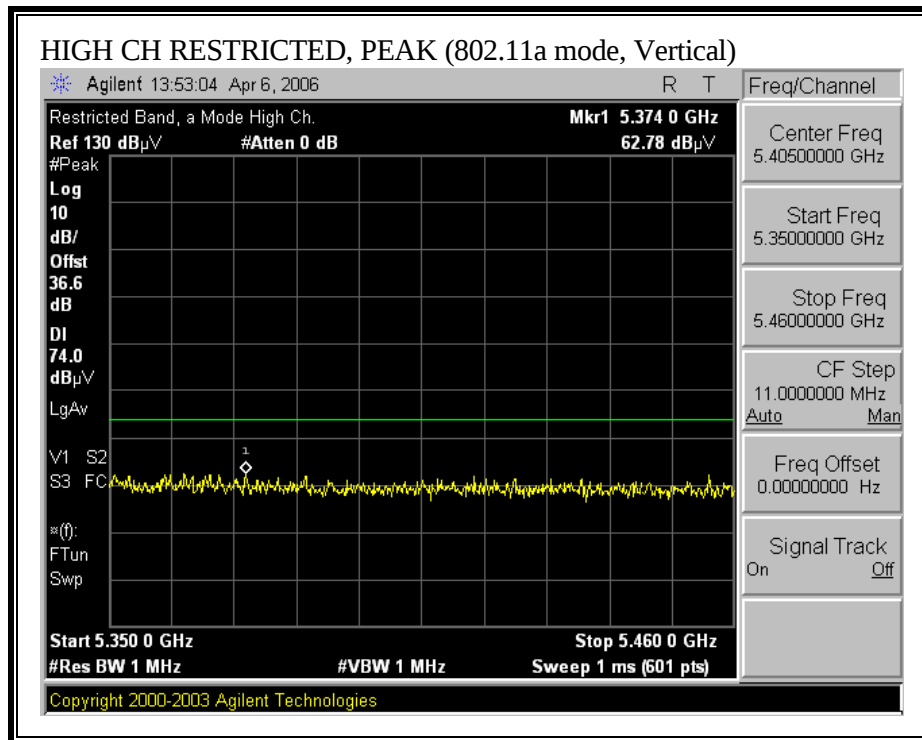


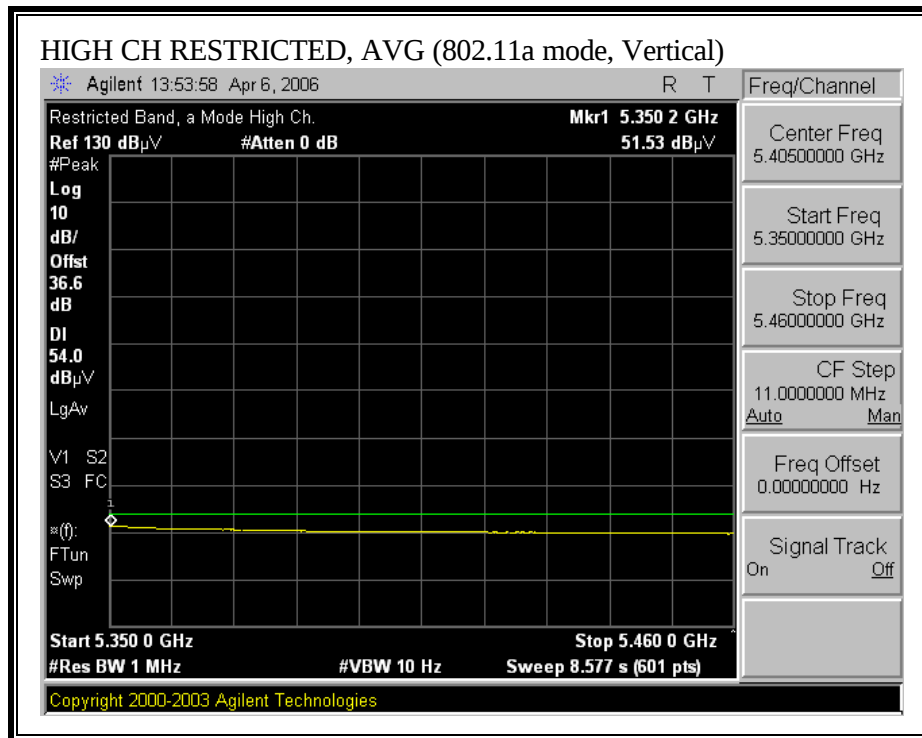
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, 5180 MHz - VERTICAL)

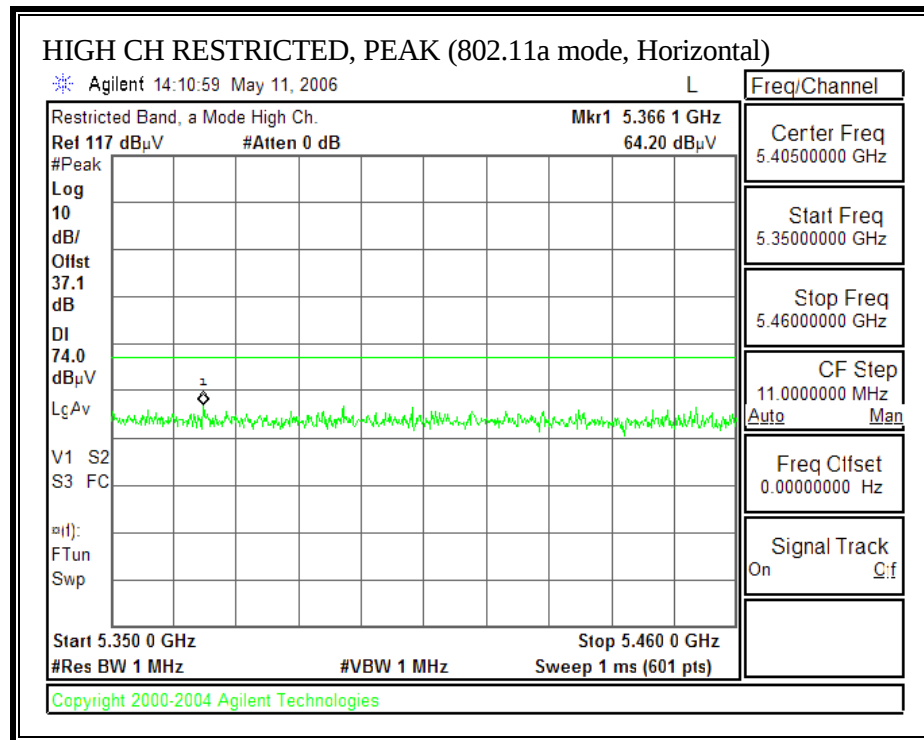


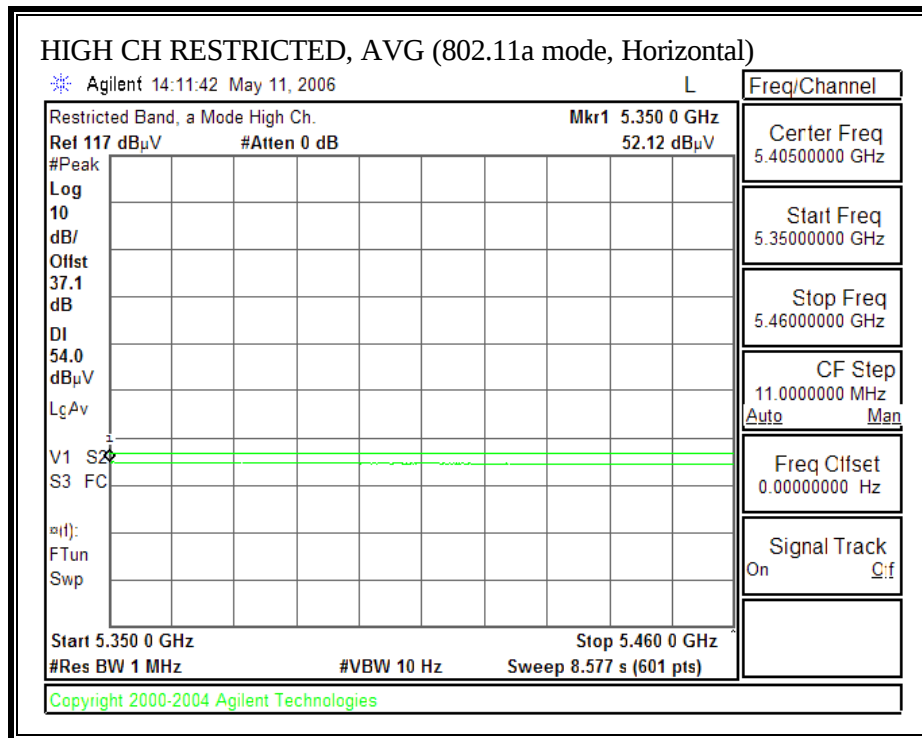
RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5300 MHz - HORIZONTAL)

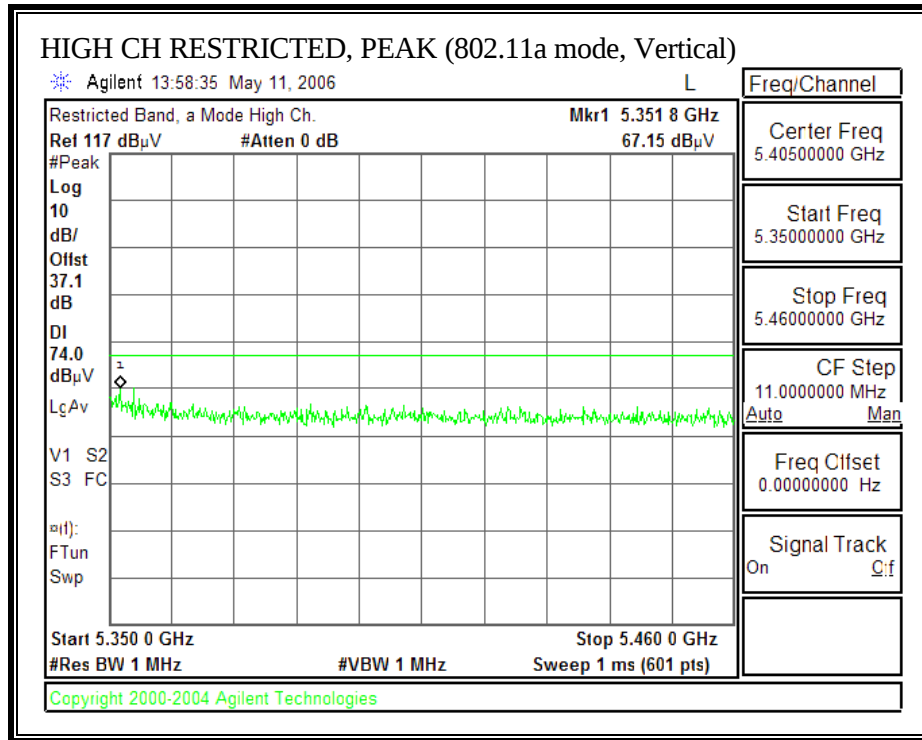


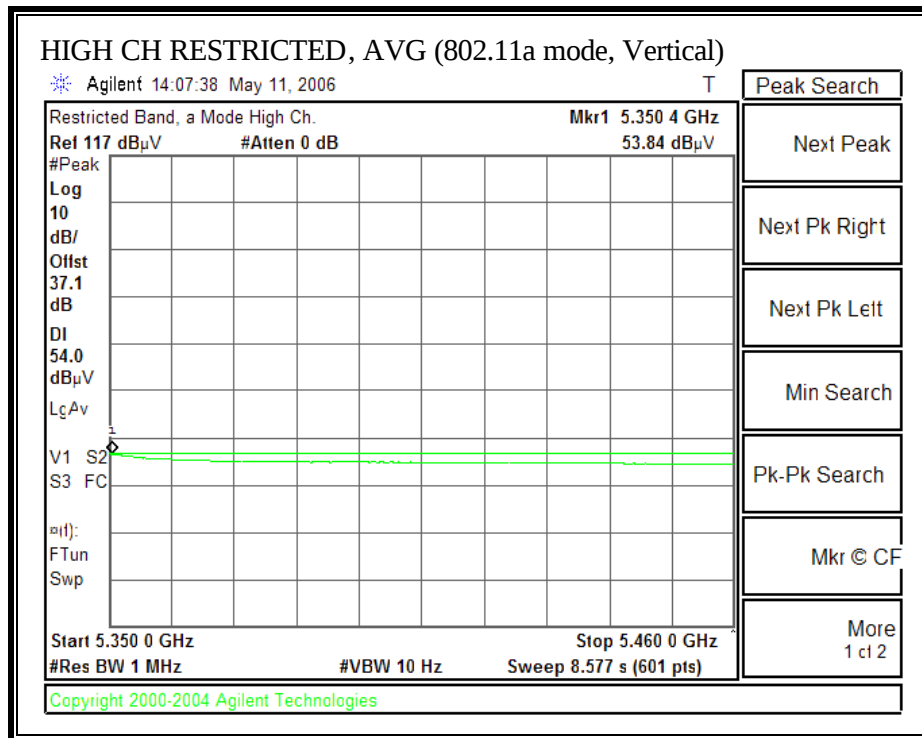
RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5300 MHz - VERTICAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - HORIZONTAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

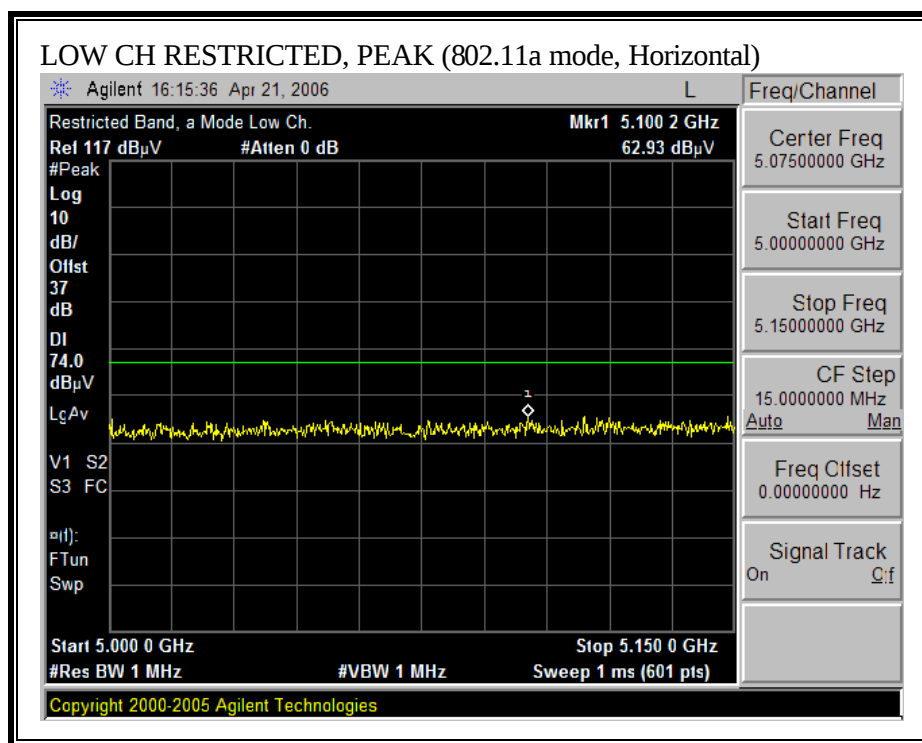
High Frequency Measurement															
Compliance Certification Services, Morgan Hill Open Field Site															
Company: Broadcom Project #: 06U10233 Date: 05/10/06 Test Engineer: Vien Tran Configuration: EUT & Low Gain Antenna_BCM94321MC, S/N 316 Mode: Tx Legacy 11a Mode_5.2 GHz Band Average Power Meter: Low = 17.5 dBm, Mid = 17.5 dBm, High = 17.5dBm															
Test Equipment:															
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit							
T73; S/N: 6717 @3m		T144 Miteq 3008A00931						FCC 15.209							
Hi Frequency Cables 2 foot cable 3 foot cable 12 foot cable Vien 187215002 Vien 197209005 HPF Reject Filter HPF_7.6GHz Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz															
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
LOW CH, 5180 MHz															
10.360	3.0	59.1	43.4	37.0	4.7	-36.8	0.0	0.8	64.8	49.1	74	54	-9.2	-4.9	V
15.540	3.0	45.4	34.5	38.1	5.8	-34.8	0.0	0.7	55.1	44.2	74	54	-18.9	-9.8	V
10.360	3.0	55.5	44.2	37.0	4.7	-36.8	0.0	0.8	61.2	49.9	74	54	-12.8	-4.1	H
15.540	3.0	44.8	34.2	38.1	5.8	-34.8	0.0	0.7	54.5	43.9	74	54	-19.5	-10.1	H
MID CH, 5260 MHz															
10.520	3.0	52.3	38.9	37.1	4.7	-36.7	0.0	0.8	58.2	44.8	74	54	-15.8	-9.2	V
15.780	3.0	45.6	34.3	37.5	5.8	-34.6	0.0	0.7	55.0	43.7	74	54	-19.0	-10.3	V
10.520	3.0	53.2	41.2	37.1	4.7	-36.7	0.0	0.8	59.1	47.1	74	54	-14.9	-6.9	H
15.780	3.0	43.7	34.3	37.5	5.8	-34.6	0.0	0.7	53.1	43.7	74	54	-20.9	-10.3	H
HI CH, 5320 MHz															
10.640	3.0	55.5	42.8	37.1	4.8	-36.6	0.0	0.8	61.5	48.8	74	54	-12.5	-5.2	V
15.960	3.0	44.6	33.9	37.1	5.9	-34.5	0.0	0.7	53.8	43.1	74	54	-20.2	-10.9	V
10.640	3.0	56.9	44.8	37.1	4.8	-36.6	0.0	0.8	62.9	50.8	74	54	-11.1	-3.2	H
15.960	3.0	44.2	33.9	37.1	5.9	-34.5	0.0	0.7	53.4	43.1	74	54	-20.6	-10.9	H
No other emissions were detected above system noise floor.															
f	Measurement Frequency		Amp	Preamp Gain		Avg Lim		Average Field Strength Limit							
Dist	Distance to Antenna		D Corr	Distance Correct to 3 meters		Pk Lim		Peak Field Strength Limit							
Read	Analyzer Reading		Avg	Average Field Strength @ 3 m		Avg Mar		Margin vs. Average Limit							
AF	Antenna Factor		Peak	Calculated Peak Field Strength		Pk Mar		Margin vs. Peak Limit							
CL	Cable Loss		HPF	High Pass Filter											

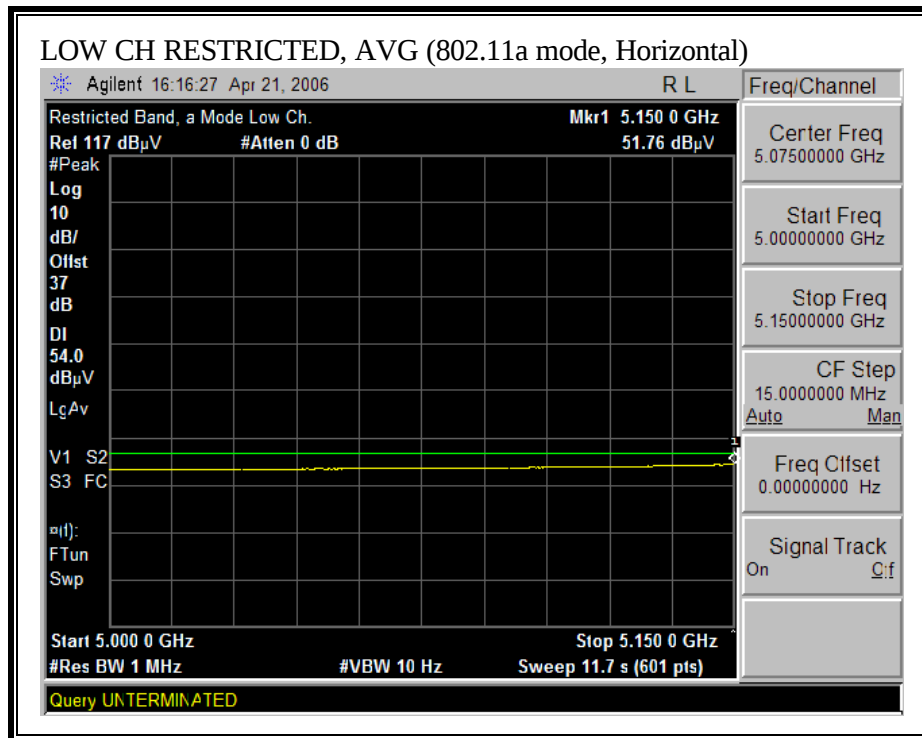
MIMO MODE

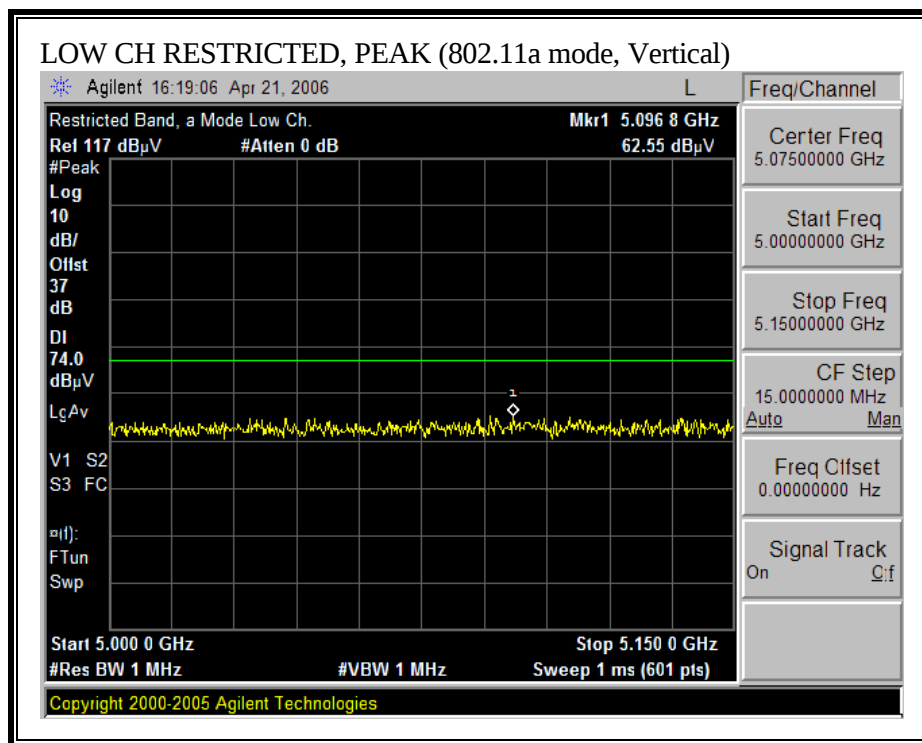
7.7.3. TRANSMITTER ABOVE 1 GHZ FOR 5150 TO 5350 MHz BAND

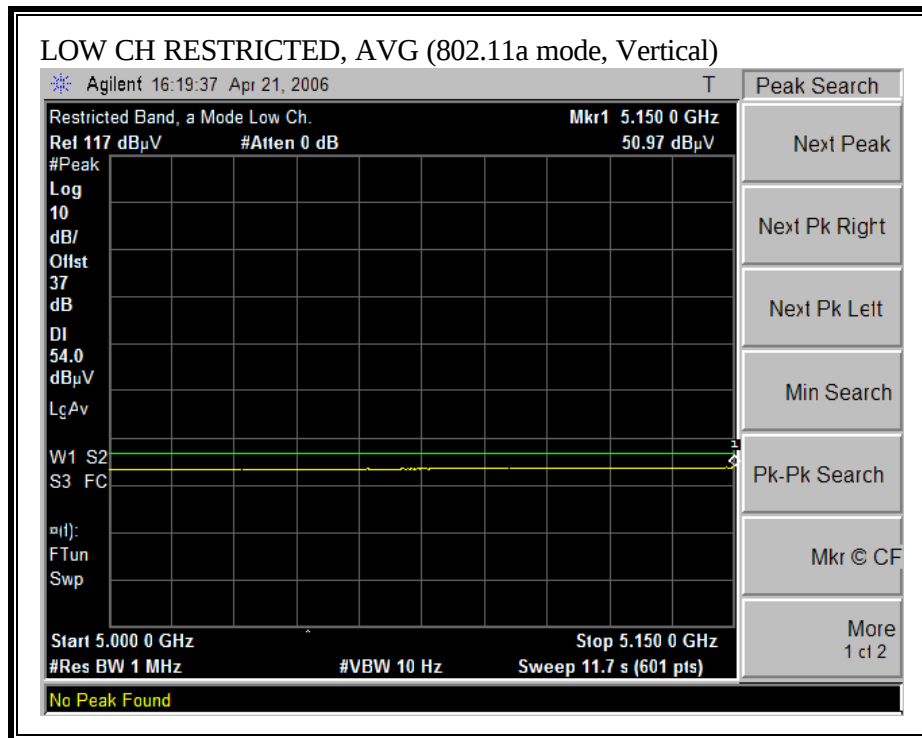
20 MHz TX BANDWIDTH

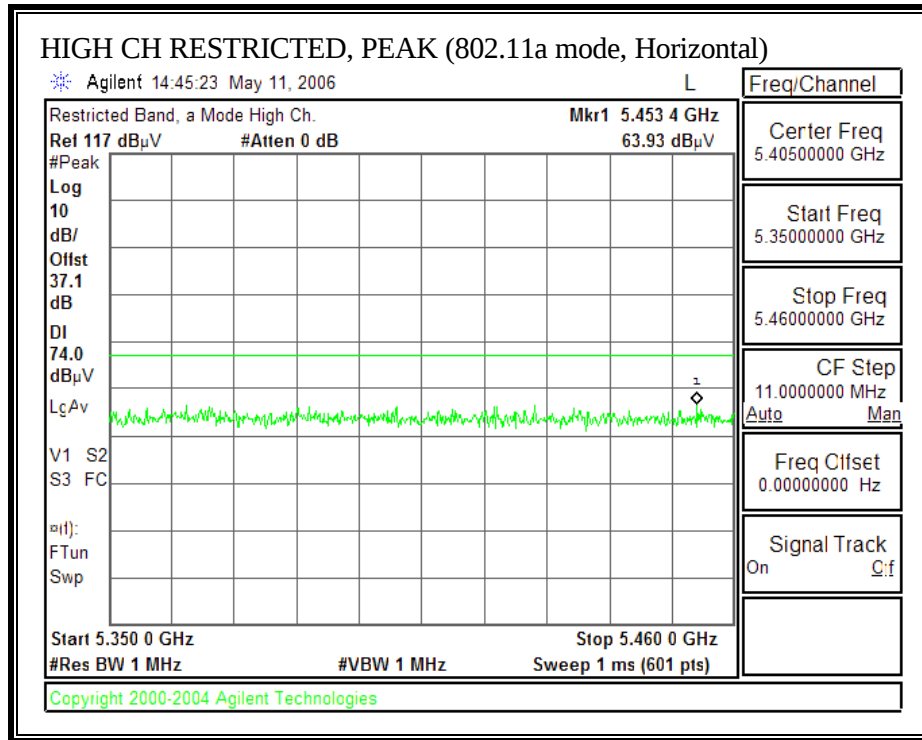
RESTRICTED BANDEDGE (LOW CHANNEL, 5180 MHz - HORIZONTAL)

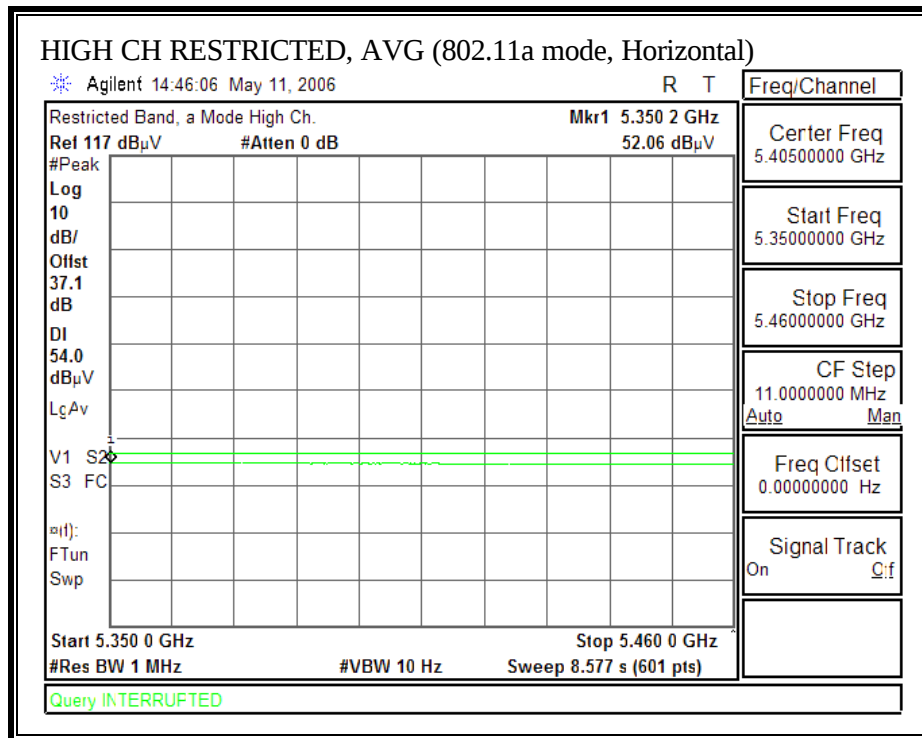


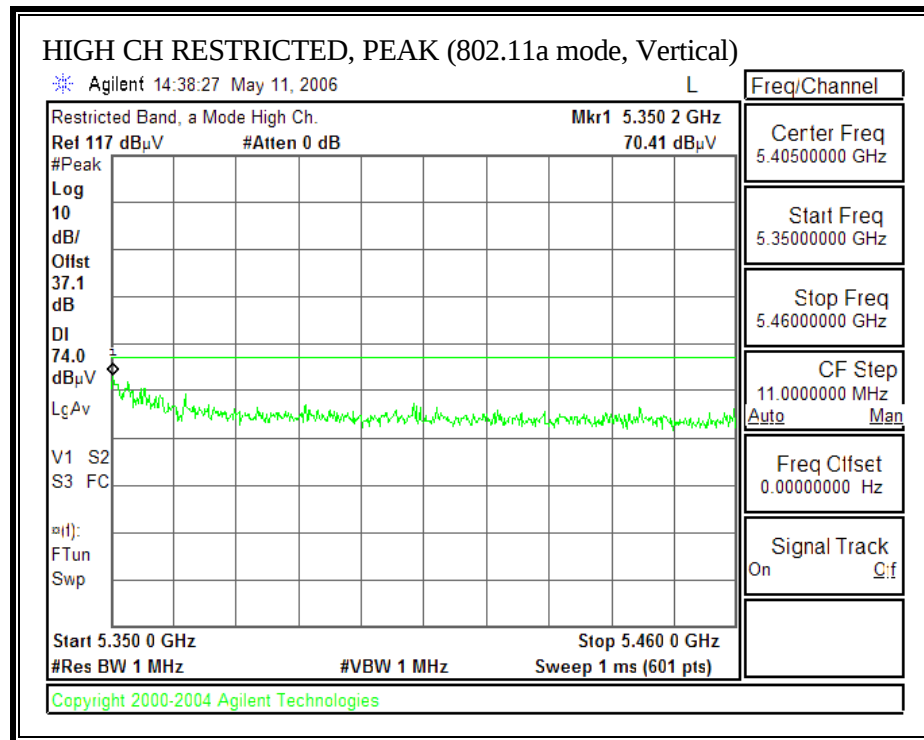


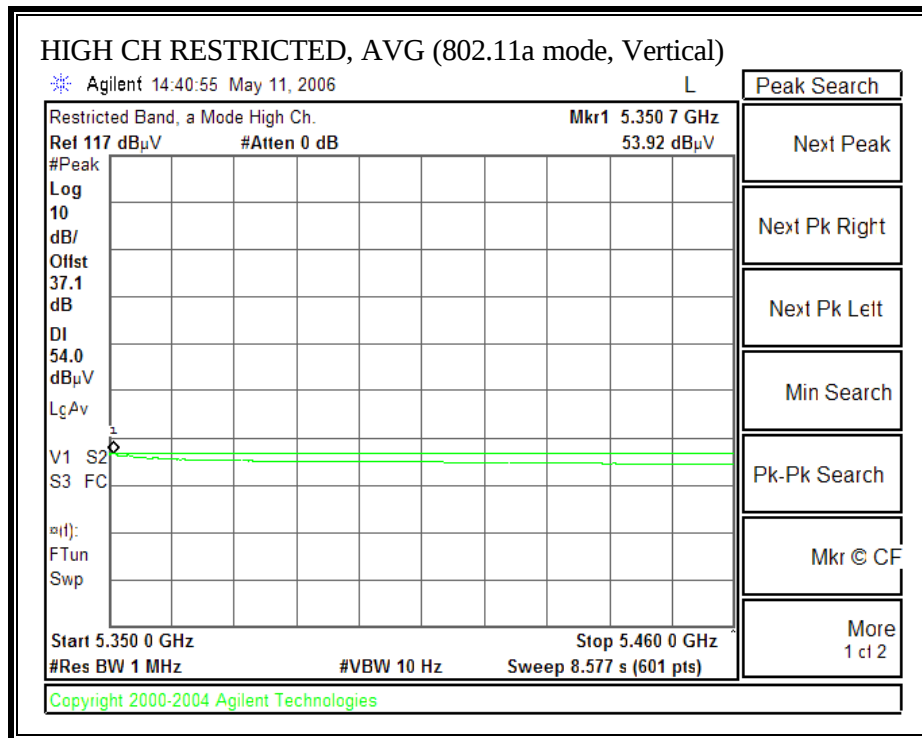
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, 5180 MHz - VERTICAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - HORIZONTAL)

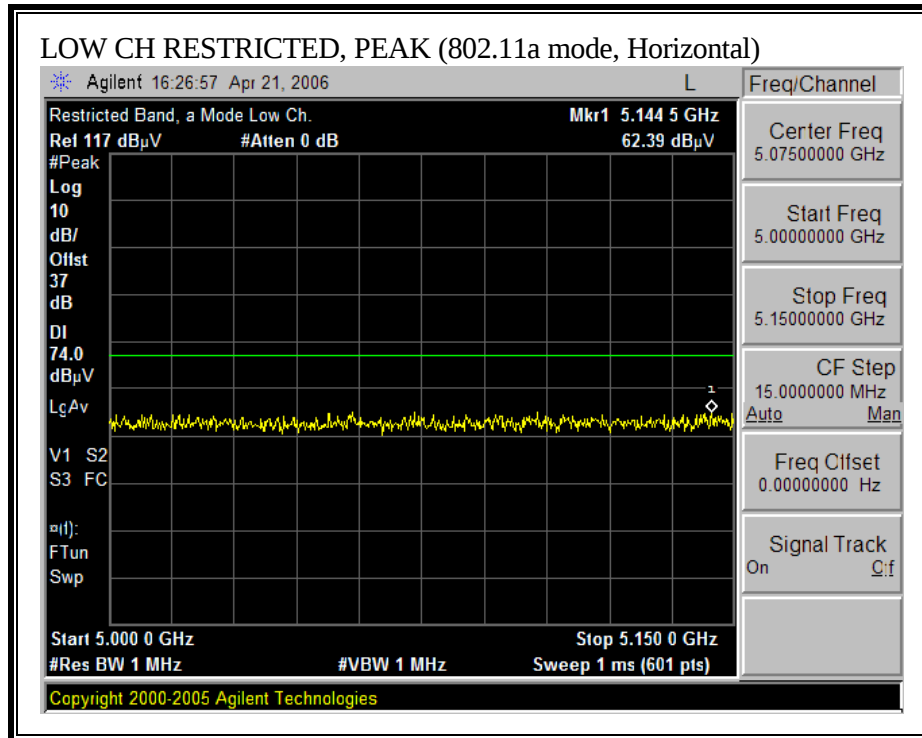


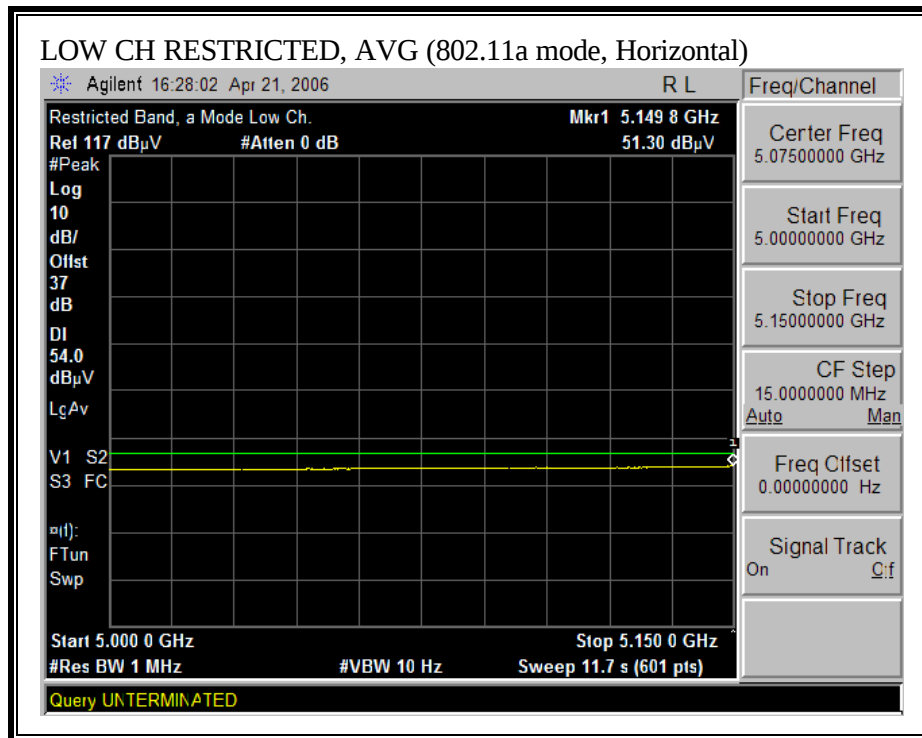
RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - VERTICAL)

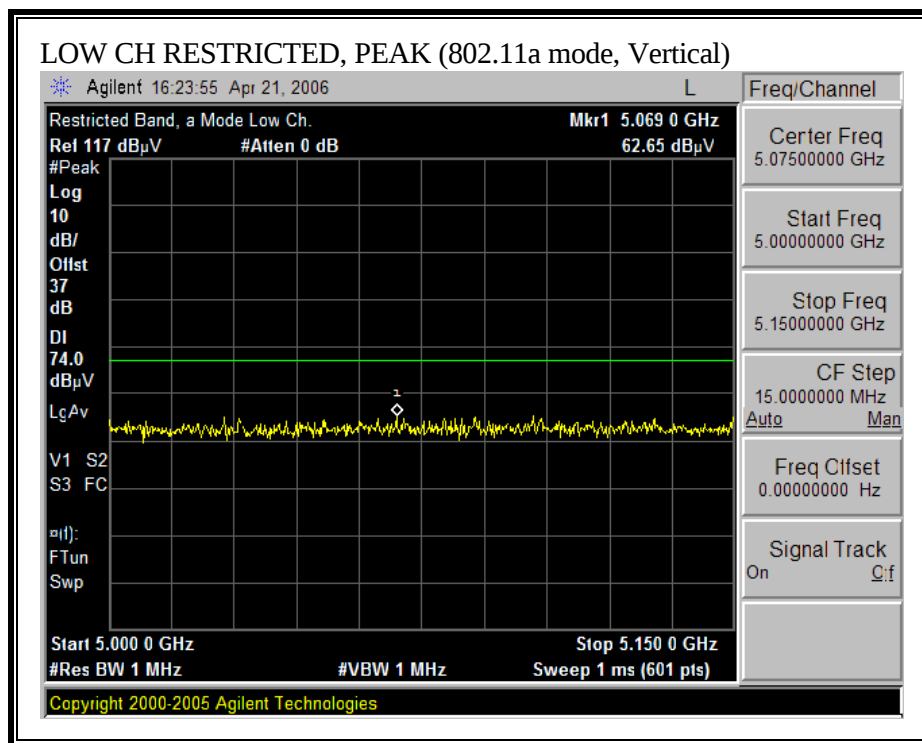


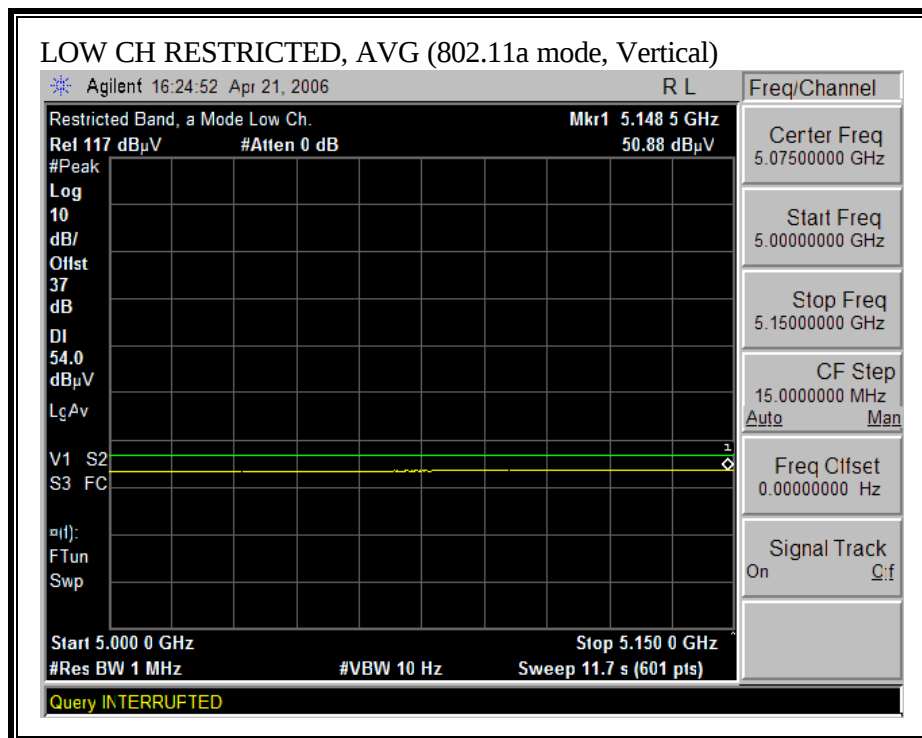
HARMONICS AND SPURIOUS EMISSIONS (802.11a – 20 MHz TX BANDWIDTH)

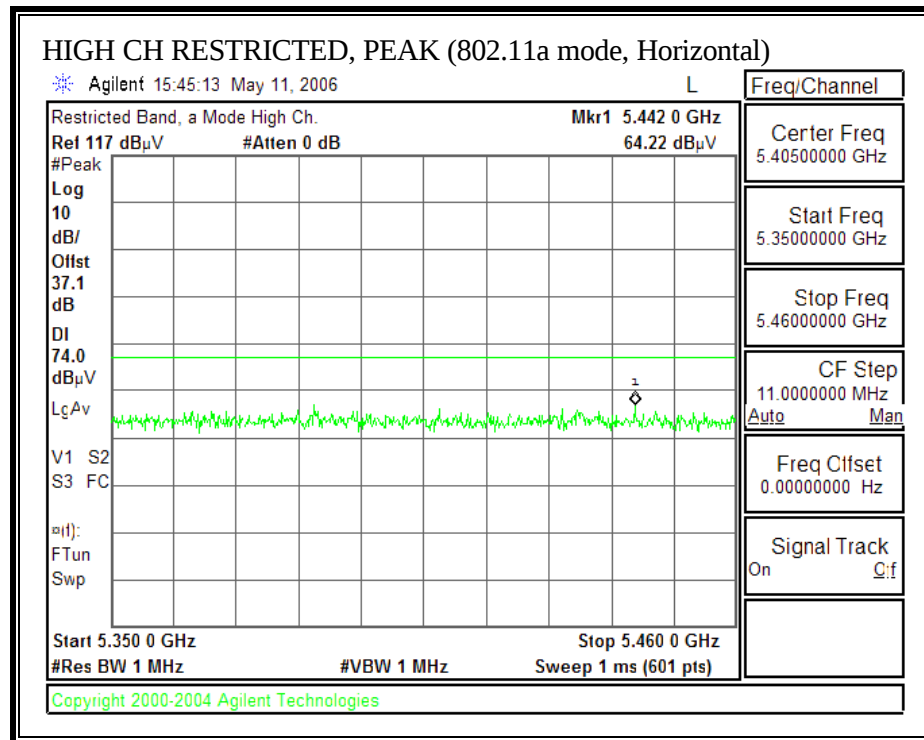
High Frequency Measurement																
Compliance Certification Services, Morgan Hill Open Field Site																
Company: Broadcom Project #: 06U10233 Date: 05/10/06 Test Engineer: Vien Tran Configuration: EUT (BCM94321MC, S/N 316) & Apple PCB Antenna Mode: MIMO 20MHz Tx BW 11a Mode 5.2 GHz Band Average Power Meter: Low = 16 dBm, Mid = 16 dBm, High = 16 dBm																
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T73; S/N: 6717 @3m			T144 Miteq 3008A00931									FCC 15.209				
Hi Frequency Cables																
2 foot cable			3 foot cable			12 foot cable			HPF			Reject Filter			Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz	
			Vien 187215002			Vien 197209005			HPF_7.6GHz							
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
LOW CH, 5180 MHz																
10.360	3.0	59.1	43.1	37.0	4.7	-36.8	0.0	0.8	64.8	48.8	74	54	-9.2	-5.2	V	
15.540	3.0	43.7	34.4	38.1	5.8	-34.8	0.0	0.7	53.4	44.1	74	54	-20.6	-9.9	V	
10.360	3.0	55.5	40.3	37.0	4.7	-36.8	0.0	0.8	61.2	46.0	74	54	-12.8	-8.0	H	
15.540	3.0	43.8	33.9	38.1	5.8	-34.8	0.0	0.7	53.5	43.6	74	54	-20.5	-10.4	H	
MID CH, 5260 MHz																
10.520	3.0	55.6	41.2	37.1	4.7	-36.7	0.0	0.8	61.5	47.1	74	54	-12.5	-6.9	V	
15.780	3.0	43.6	34.3	37.5	5.8	-34.6	0.0	0.7	53.0	43.7	74	54	-21.0	-10.3	V	
10.520	3.0	53.8	39.8	37.1	4.7	-36.7	0.0	0.8	59.7	45.7	74	54	-14.3	-8.3	H	
15.780	3.0	43.3	33.9	37.5	5.8	-34.6	0.0	0.7	52.7	43.3	74	54	-21.3	-10.7	H	
HI CH, 5320 MHz																
10.640	3.0	55.1	40.9	37.1	4.8	-36.6	0.0	0.8	61.1	46.9	74	54	-12.9	-7.1	V	
15.960	3.0	43.2	33.7	37.1	5.9	-34.5	0.0	0.7	52.4	42.9	74	54	-21.6	-11.1	V	
10.640	3.0	53.8	40.5	37.1	4.8	-36.6	0.0	0.8	59.8	46.5	74	54	-14.2	-7.5	H	
15.960	3.0	43.5	34.2	37.1	5.9	-34.5	0.0	0.7	52.7	43.4	74	54	-21.3	-10.6	H	
No other emissions were detected above system noise floor.																
f	Measurement Frequency		Amp	Preamp Gain		Avg Lim	Average Field Strength Limit									
Dist	Distance to Antenna		D Corr	Distance Correct to 3 meters		Pk Lim	Peak Field Strength Limit									
Read	Analyzer Reading		Avg	Average Field Strength @ 3 m		Avg Mar	Margin vs. Average Limit									
AF	Antenna Factor		Peak	Calculated Peak Field Strength		Pk Mar	Margin vs. Peak Limit									
CL	Cable Loss		HPF	High Pass Filter												

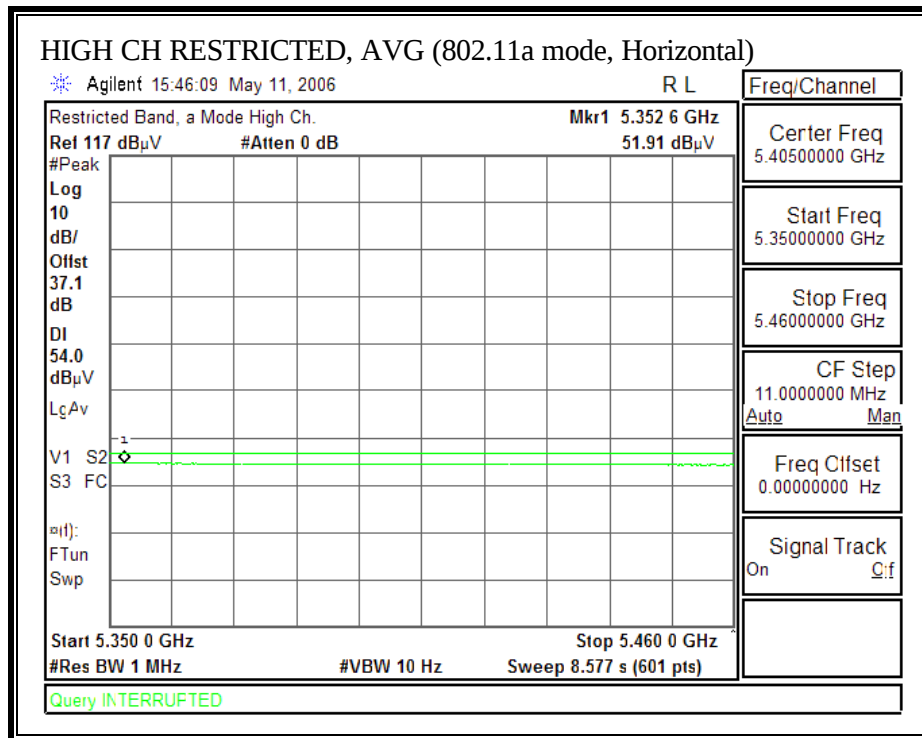
40 MHz TX BANDWIDTH**RESTRICTED BANEDGE (LOW CHANNEL, 5190 MHz - HORIZONTAL)**

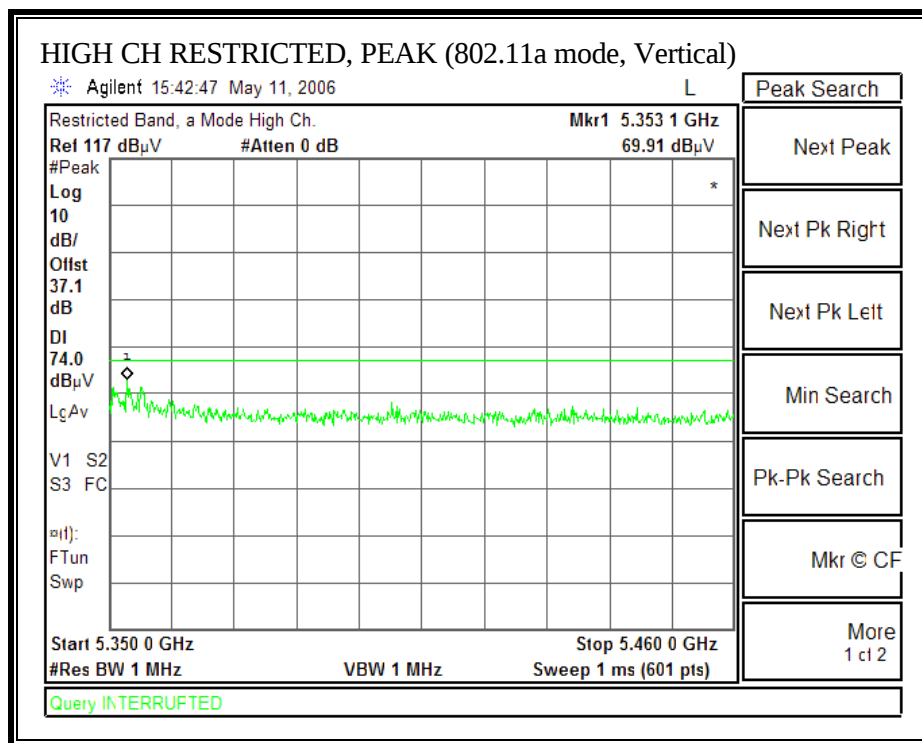


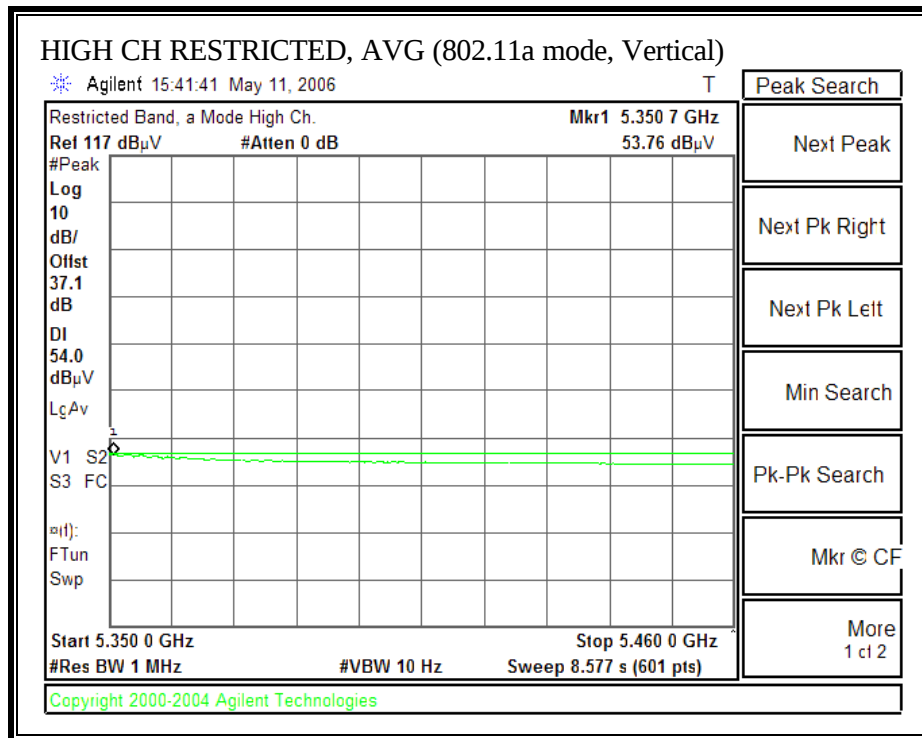
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, 5190 MHz - VERTICAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5310 MHz - HORIZONTAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5310 MHz - VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS (802.11a – 40 MHz TX BANDWIDTH)

High Frequency Measurement																
Compliance Certification Services, Morgan Hill Open Field Site																
Company: Broadcom Project #: 06U10233 Date: 05/12/06 Test Engineer: Vien Tran Configuration: EUT (BCM94321MC, S/N 316) & Apple PCB Antenna Mode: MIMO 40MHz Tx BW 11a Mode_5.2 GHz Band Average Power Meter: Low = 16.5 dBm, Mid = 16.5 dBm, High = 16.5 dBm																
Test Equipment:																
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit								
T73; S/N: 6717 @3m		T144 Miteq 3008A00931						FCC 15.209								
Hi Frequency Cables																
2 foot cable		3 foot cable		12 foot cable		HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz						
		Vien 187215002		Vien 197209005		HPF_7.6GHz										
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
Ch 38, 5190 MHz																
10.380	3.0	56.3	43.9	37.9	4.7	-36.8	0.0	0.8	62.9	50.5	74	54	-11.1	-3.5	V	
15.570	3.0	44.9	34.3	39.5	5.8	-34.8	0.0	0.7	56.1	45.5	74	54	-17.9	-9.5	V, Noise Floor	
10.380	3.0	54.9	43.1	37.9	4.7	-36.8	0.0	0.8	61.5	49.7	74	54	-12.5	-4.3	H	
15.570	3.0	46.7	34.0	39.5	5.8	-34.8	0.0	0.7	57.9	45.2	74	54	-16.1	-8.8	H, Noise Floor	
Ch 54, 5270 MHz																
10.540	3.0	56.9	45.3	37.9	4.7	-36.7	0.0	0.8	63.7	52.1	74	54	-10.3	-1.9	V	
15.810	3.0	45.5	34.3	39.1	5.8	-34.6	0.0	0.7	56.5	45.3	74	54	-17.5	-9.7	V, Noise Floor	
10.540	3.0	55.5	44.9	37.9	4.7	-36.7	0.0	0.8	62.3	51.7	74	54	-11.7	-2.3	H	
15.810	3.0	45.0	34.2	39.1	5.8	-34.6	0.0	0.7	56.0	45.2	74	54	-18.0	-9.8	H, Noise Floor	
Ch 62, 5310 MHz																
10.620	3.0	55.3	43.5	38.0	4.8	-36.6	0.0	0.8	62.2	50.4	74	54	-11.8	-3.6	V	
15.930	3.0	44.4	34.1	38.9	5.9	-34.5	0.0	0.7	55.4	45.1	74	54	-18.6	-9.9	V, Noise Floor	
10.620	3.0	55.0	43.0	38.0	4.8	-36.6	0.0	0.8	61.9	49.9	74	54	-12.1	-4.1	H	
15.930	3.0	43.0	33.4	38.9	5.9	-34.5	0.0	0.7	54.0	44.4	74	54	-20.0	-9.6	H, Noise Floor	
1/3 & 2/3 of Fundamental																
1.600	3.0	52.2	38.3	25.9	2.2	-38.6	0.0	0.0	41.7	27.8	74	54	-32.3	-26.2	V	
3.530	3.0	44.8	34.2	31.6	2.6	-37.0	0.0	0.0	42.0	31.4	74	54	-32.0	-22.6	V	
1.600	3.0	49.0	38.0	25.9	2.2	-38.6	0.0	0.0	38.5	27.5	74	54	-35.5	-26.5	H	
3.530	3.0	43.5	34.0	31.6	2.6	-37.0	0.0	0.0	40.7	31.2	74	54	-33.3	-22.8	H	
Note: No other emissions were detected above the noise floor																
f	Measurement Frequency			Amp	Preamp Gain			Avg Lim	Average Field Strength Limit							
Dist	Distance to Antenna			D Corr	Distance Correct to 3 meters			Pk Lim	Peak Field Strength Limit							
Read	Analyzer Reading			Avg	Average Field Strength @ 3 m			Avg Mar	Margin vs. Average Limit							
AF	Antenna Factor			Peak	Calculated Peak Field Strength			Pk Mar	Margin vs. Peak Limit							
CL	Cable Loss			HPF	High Pass Filter											

7.7.4. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)****HORIZONTAL**

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 18 File#: 30-1000 Apple.EMI Date: 05-15-2006 Time: 14:48:04
Audix ATC

Condition: FCC CLASS-B HORIZONTAL
Test Operator: : Vien Tran
Company: : Broadcom
Project #: : 06U10233
EUT Description: : 2x2 Dual Band MIMO Device_Card #316,
: with Apple PCB Antenna
Model No: : BCM94321_Rev 4.0
S/N: : 316
Configuration : EUT
Mode of Operation: Tx MIMO 5 GHz Band_Worst Case
TEST Target: : FCC Class B

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.970	9.42	20.45	29.87	40.00	-10.13	Peak
2	101.780	29.83	11.77	41.60	43.50	-1.90	Peak
3	407.330	22.44	18.21	40.65	46.00	-5.35	Peak
4	507.240	21.54	20.31	41.85	46.00	-4.15	Peak
5	575.140	18.84	21.20	40.04	46.00	-5.96	Peak
6	681.840	17.95	22.86	40.81	46.00	-5.19	Peak

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**VERTICAL**

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 16 File#: 30-1000 Apple.EMI Date: 05-15-2006 Time: 14:39:28
Audix ATC

Condition: FCC CLASS-B VERTICAL

Test Operator: : Vien Tran

Company: : Broadcom

Project #: : 06U10233

EUT Description: : 2x2 Dual Band MIMO Device_Card #316,
: with Apple PCB Antenna

Model No: : BCM94321_Rev 4.0

S/N: : 316

Configuration : EUT

Mode of Operation: Tx MIMO 5 GHz Band_Worst Case

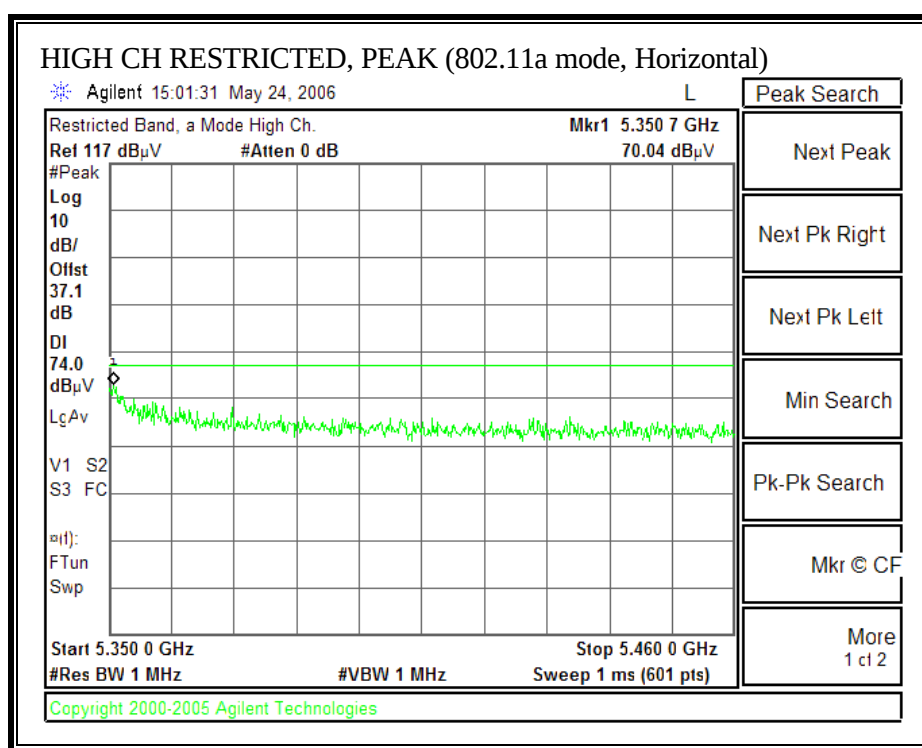
TEST Target: : FCC Class B

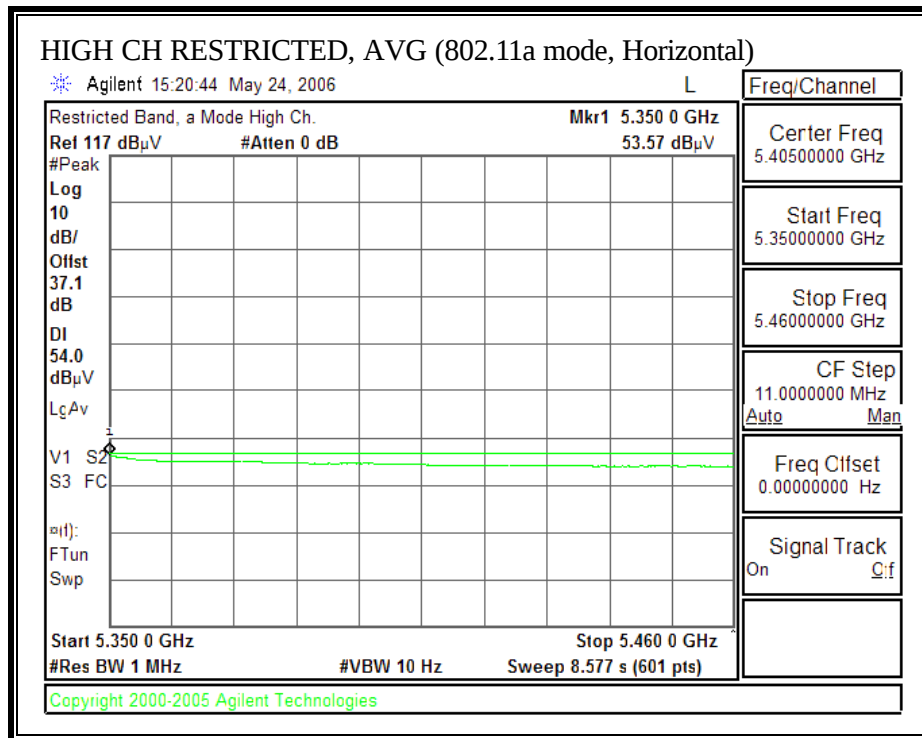
Page: 1

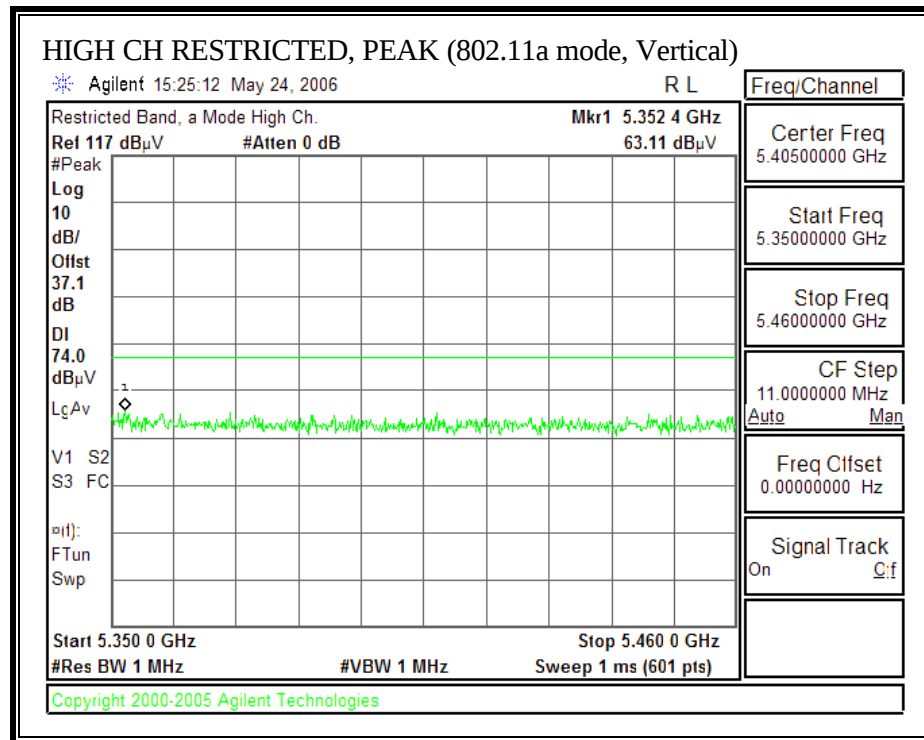
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	31.940	13.62	19.94	33.56	40.00	-6.44	Peak
2	103.720	27.84	12.23	40.07	43.50	-3.43	Peak
3	407.330	20.47	18.21	38.68	46.00	-7.32	Peak
4	507.240	21.42	20.31	41.73	46.00	-4.27	Peak
5	574.170	16.25	21.18	37.43	46.00	-8.57	Peak
6	643.040	16.95	22.23	39.18	46.00	-6.82	Peak

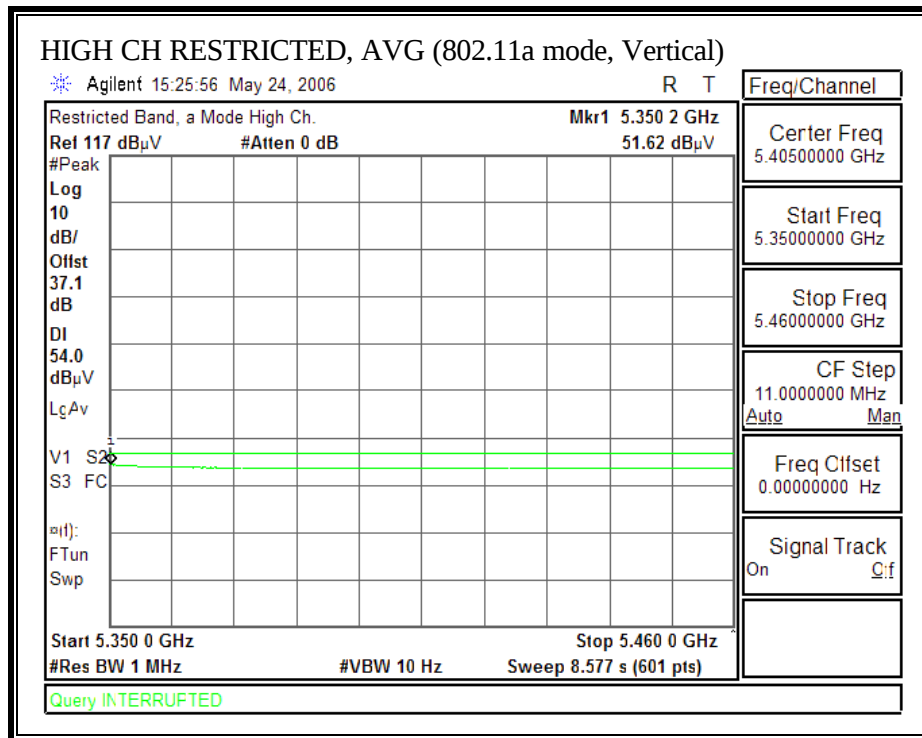
PHYCOMP, PCB ANTENNA**LEGACY MODE****7.7.5. TRANSMITTER ABOVE 1 GHz FOR 5150 TO 5350 MHz BAND**

Pease refer to Hitachi antenna section, below just spot check for the upper bandedge.

RESTRICTED BANDEGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - HORIZONTAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - VERTICAL)

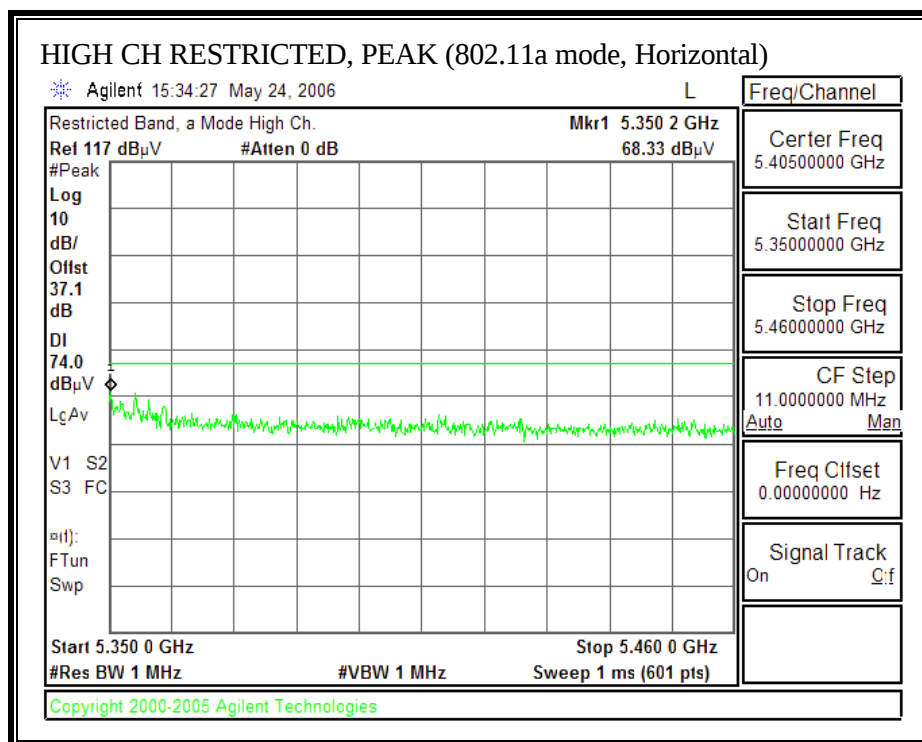


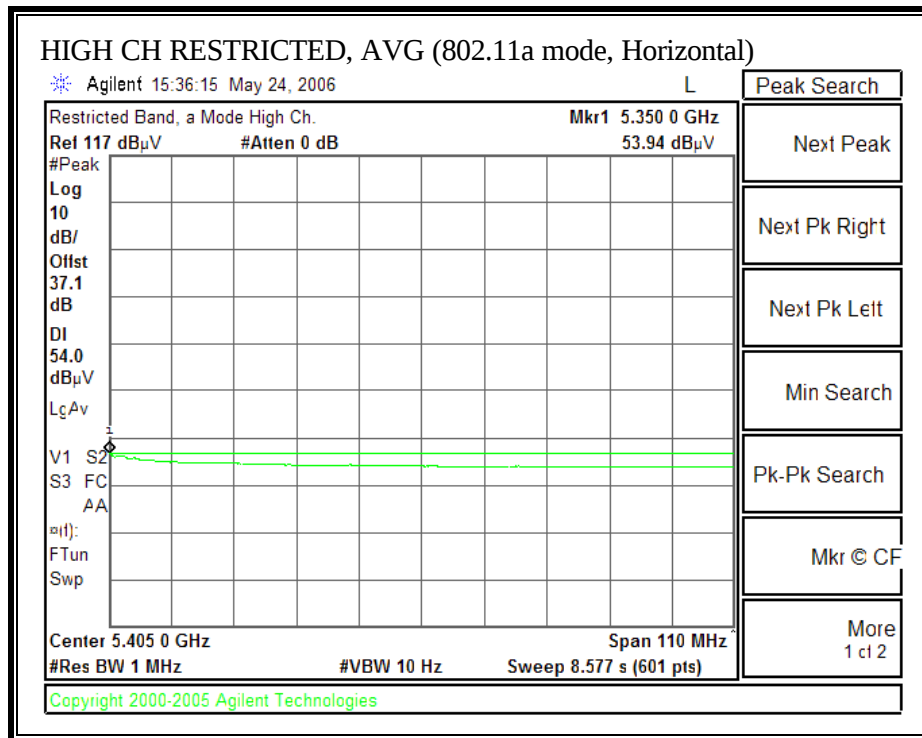
HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

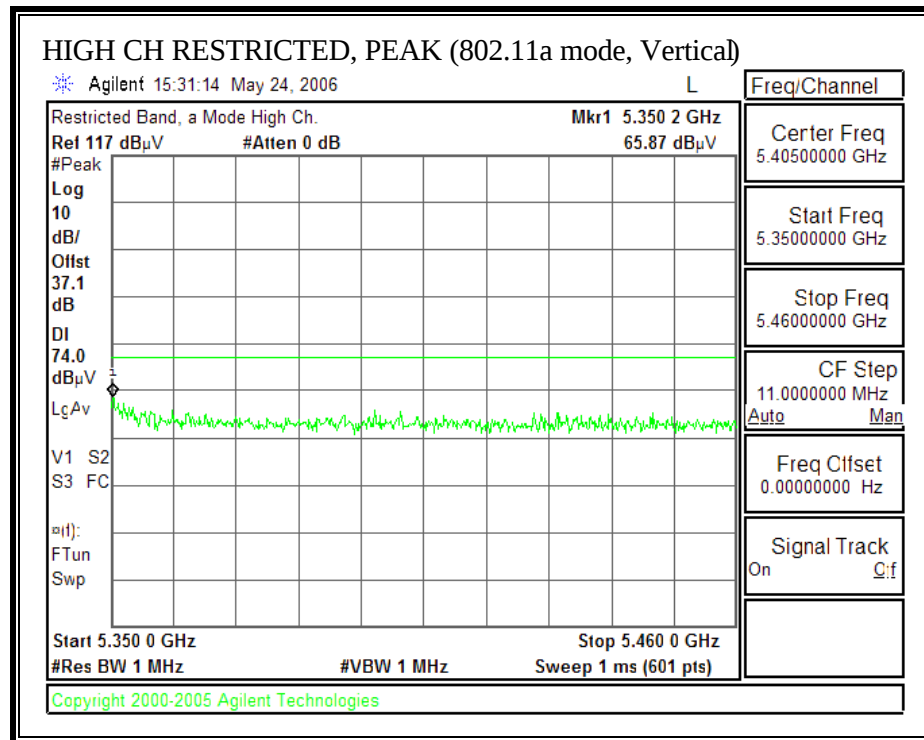
Pease refer to Hitachi antenna section.

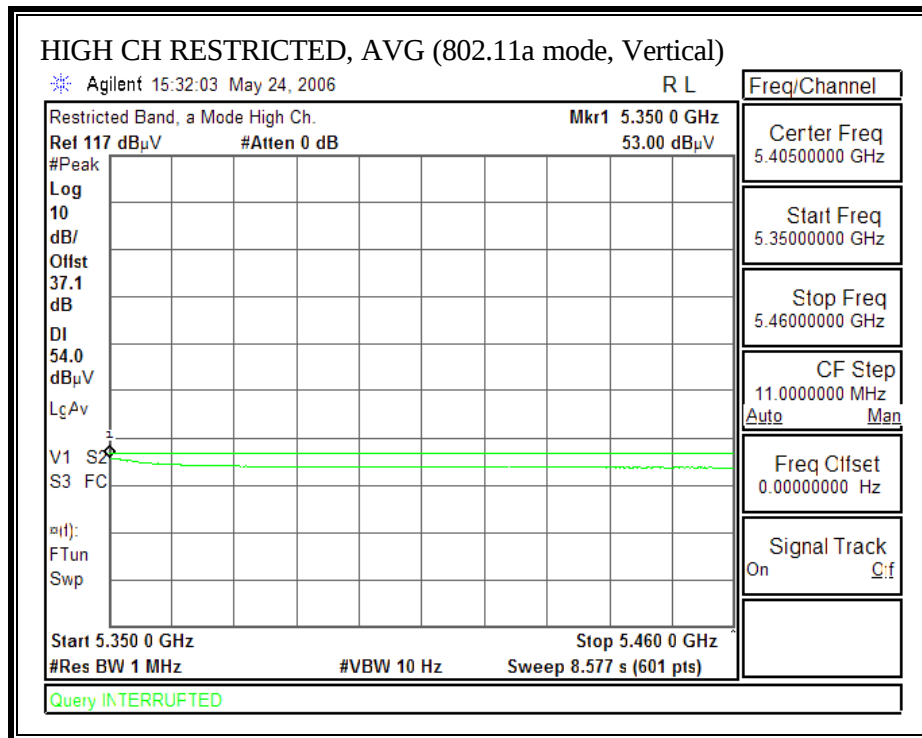
MIMO MODE**7.7.6. TRANSMITTER ABOVE 1 GHZ FOR 5150 TO 5350 MHz BAND**

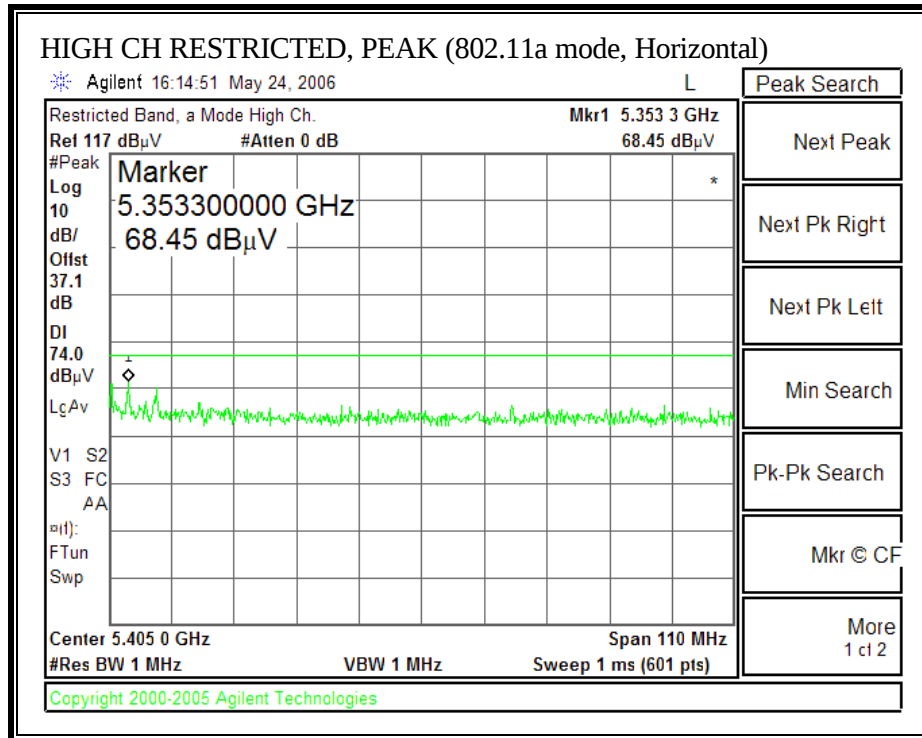
Pease refer to Hitachi antenna section, below just spot check for the upper bandedge.

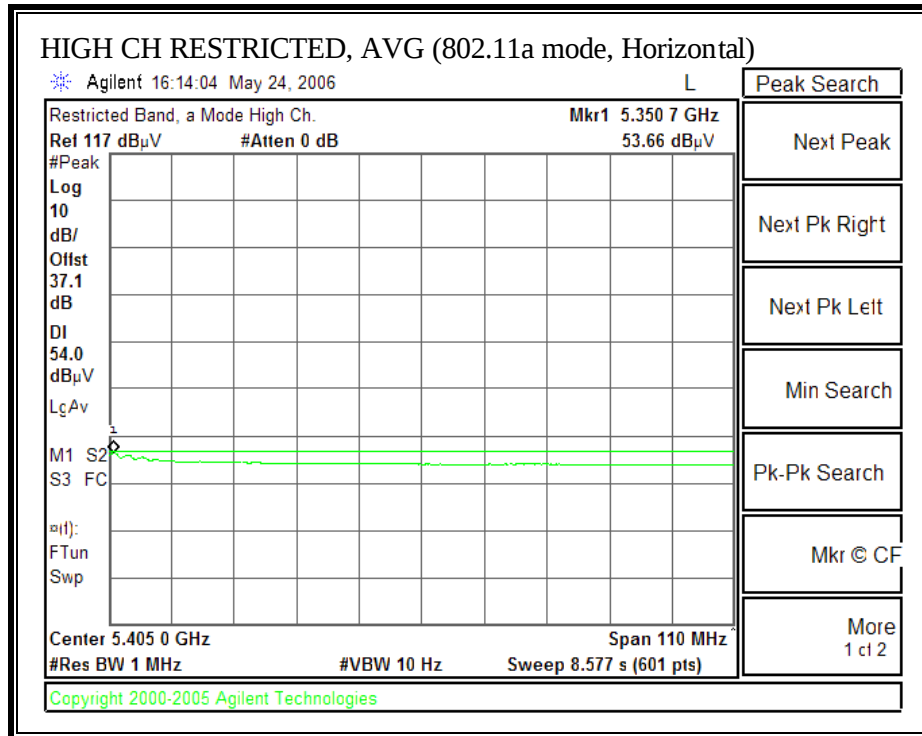
20 MHz TX BANDWIDTH**RESTRICTED BANDEGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - HORIZONTAL)**

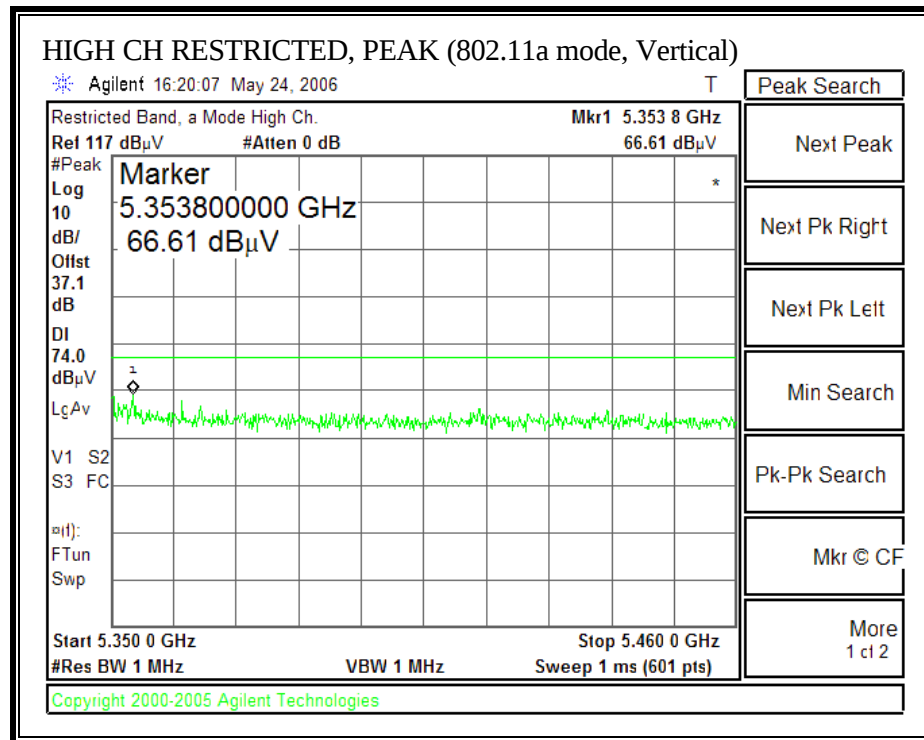


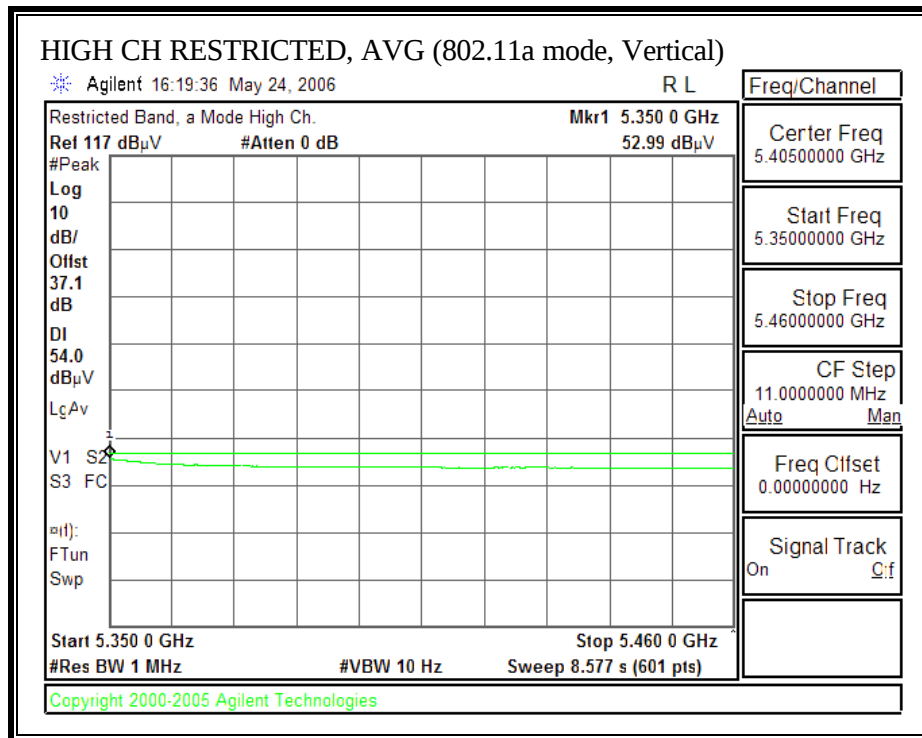
RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5320 MHz - VERTICAL)



40 MHz TX BANDWIDTH**RESTRICTED BANEDGE (802.11a MODE, HIGH CHANNEL, 5310 MHz - HORIZONTAL)**



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, 5310 MHz - VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS (802.11a – 20 MHz & 40MHz TX BANDWIDTH)

Pease refer to Hitachi antenna section.

7.7.7. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz

Pease refer to Hitachi antenna section.

7.8. FREQUENCY STABILITY

LIMIT

§15.407 (g) Manufacturers of UNII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation as specified in the user manual.

TEST PROCEDURE

Frequency stability versus environmental temperature

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed through attenuators. The EUT was placed inside the temperature chamber. After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

Frequency Stability versus Input Voltage

At room temperature ($25\pm 5^{\circ}\text{C}$), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage.

RESULTS

Refer to the test result attached as separate file.

7.9. POWERLINE CONDUCTED EMISSIONS

LIMIT

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 [*]	56 to 46 [*]
0.5-5	56	46
5-30	60	50

^{*} Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

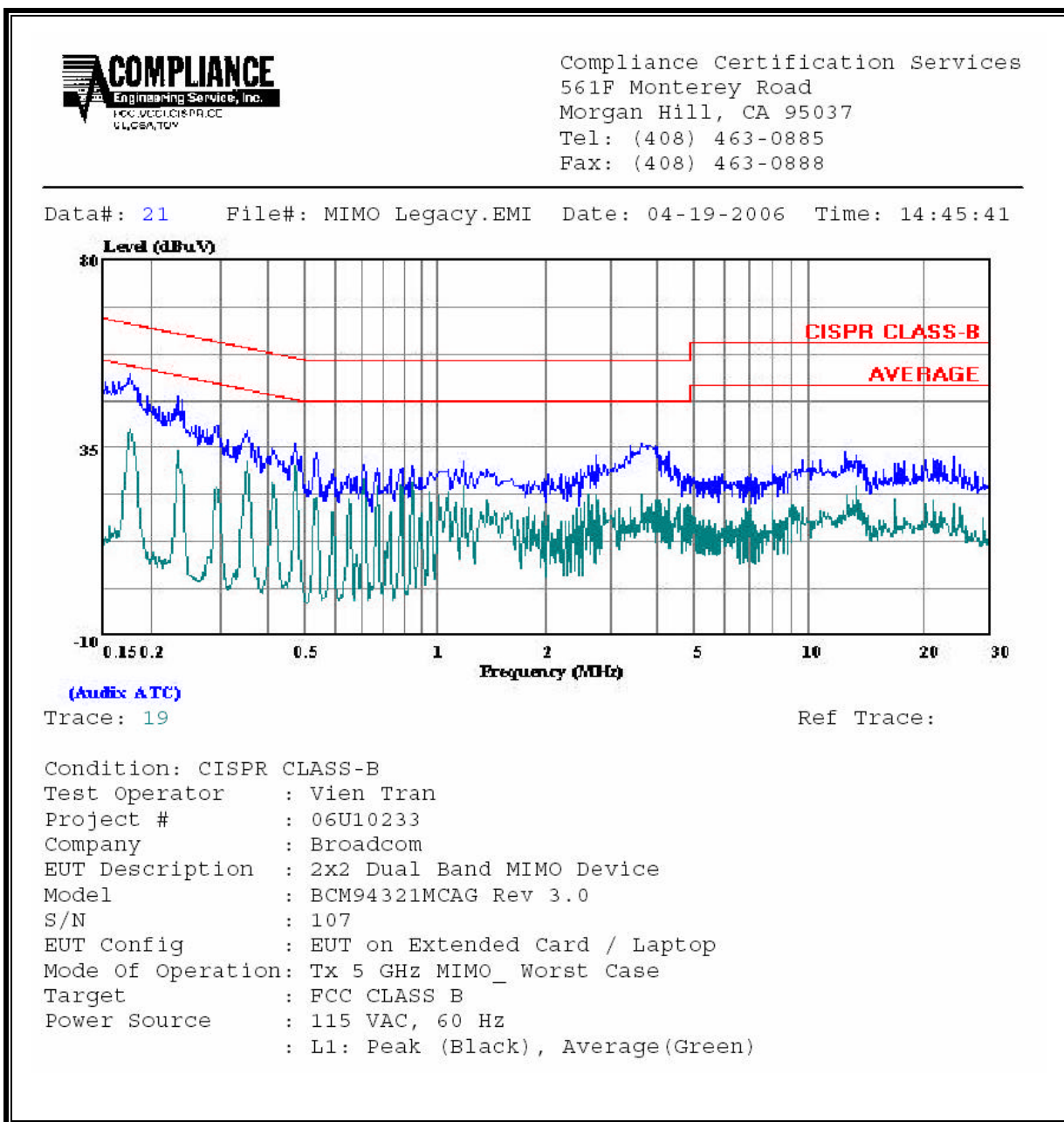
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

No non-compliance noted:

6 WORST EMISSIONS**5 GHz BAND _ MIMO _ WORST CASE**

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.18	52.88	--	39.62	0.00	64.67	54.67	-11.79	-15.05	L1
0.23	47.40	--	34.36	0.00	62.31	52.31	-14.91	-17.95	L1
3.74	35.94	--	24.00	0.00	56.00	46.00	-20.06	-22.00	L1
0.18	50.76	--	38.68	0.00	64.67	54.67	-13.91	-15.99	L2
0.23	43.24	--	29.90	0.00	62.31	52.31	-19.07	-22.41	L2
3.74	35.80	--	21.00	0.00	56.00	46.00	-20.20	-25.00	L2
6 Worst Data									

LINE 1 RESULTS

LINE 2 RESULTS