

Plots of Band Edge for 802.11b (15.247), Radiated – Peak Mode



Plots of Band Edge for 802.11g (15.247), Conducted



Plots of Band Edge for 802.11g (15.247), Radiated – Average Mode



Plots of Band Edge for 802.11g (15.247), Radiated – Peak Mode



§15.247(d) & §15.407(a)(2) - POWER SPECTRAL DENSITY

Standard Applicable

According to §15.247 (d), for direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

According to §15.407(a) (1), for the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. 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.

According to §15.407(a) (2), for the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. 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 exceed 6 dBi.

According to §15.407(a) (3), for the band 5.725-5.825 GHz, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. 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.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 6MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value. (DTS)
4. Adjust the center frequency of SA on any frequency be measured and set SA to 50MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value. (UNII)
5. Repeat above procedures until all frequencies measured were complete.

Equipment Lists

Manufacturer	Model No.	Description	Calibration Date
Agilent	8564E	Spectrum Analyzer	2003-08-26

Measurement Results**Environmental Conditions**

Temperature:	15° C
Relative Humidity:	42%
ATM Pressure:	1018 mbar

The testing was performed by Hang Tan on 2004-03-23.

Test Result for 802.11b (15.247)

Channel	Frequency (MHz)	Peak Power Spectral Density (dBm)	Standard (dBm)	Result
Low	2412	-4.02	≤ 8	Compliant
Mid	2437	-3.73	≤ 8	Compliant
High	2462	-4.18	≤ 8	Compliant

Test Result for 802.11g (15.247)

Channel	Frequency (MHz)	Peak Power Spectral Density (dBm)	Standard (dBm)	Result
Low	2412	-8.46	≤ 8	Compliant
Mid	2437	-9.18	≤ 8	Compliant
High	2462	-9.63	≤ 8	Compliant

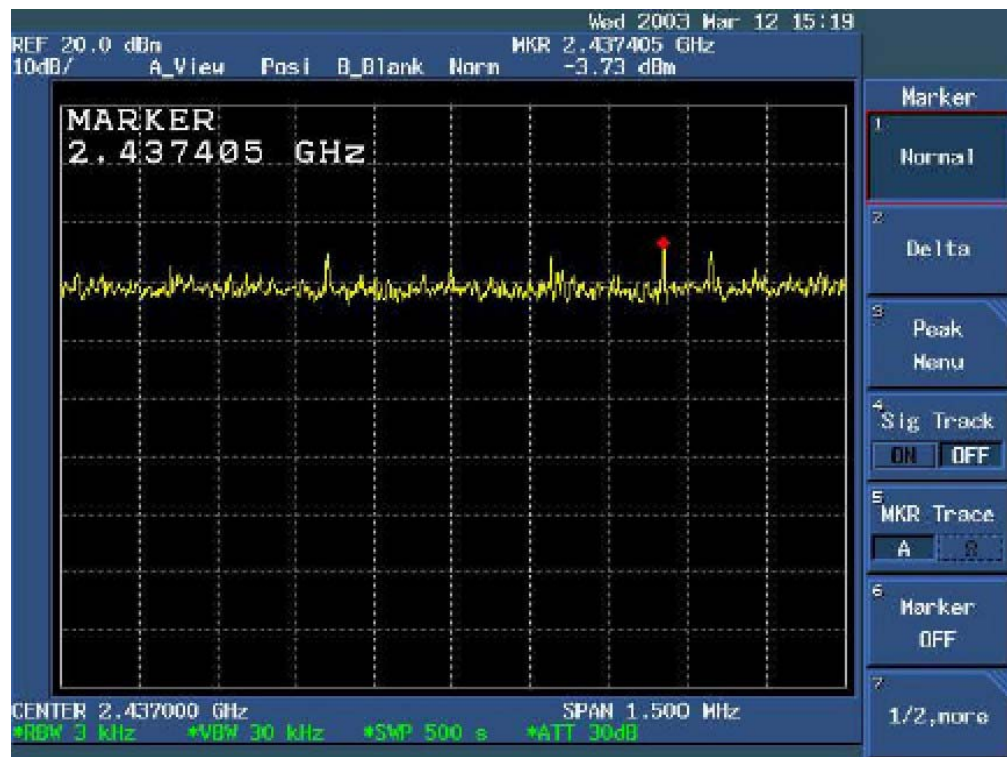
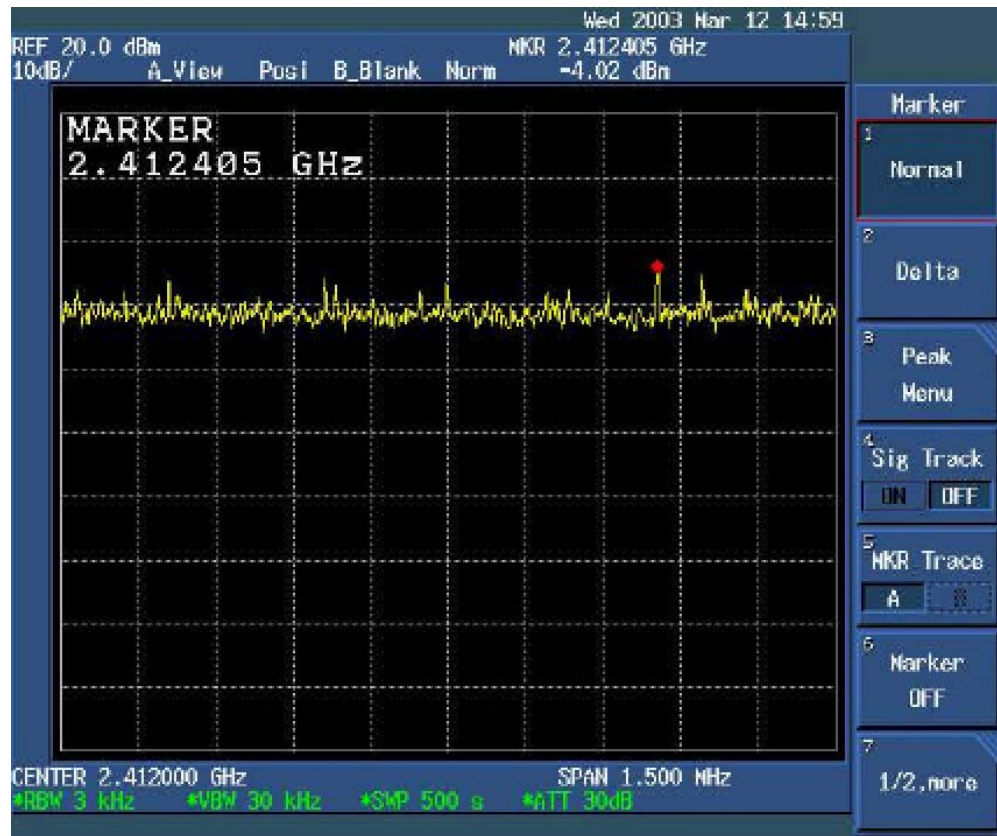
Test Result for 802.11a (15.407)**Band I & II:**

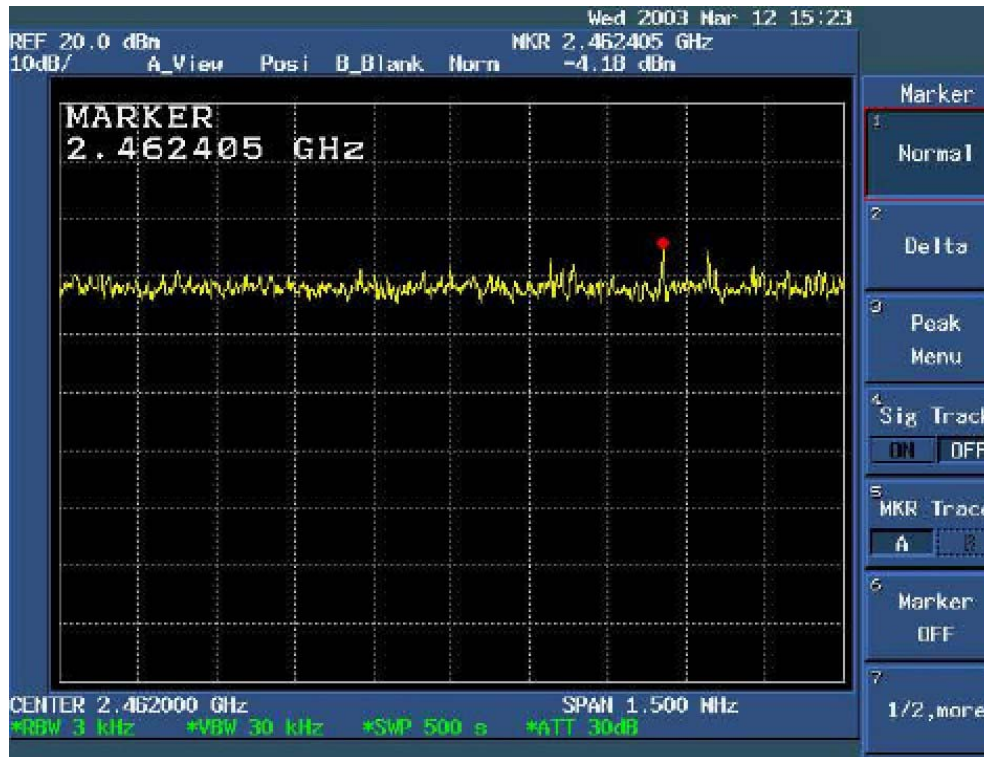
Channel	Frequency (MHz)	Peak Power Spectral Density (dBm)	Standard (dBm)	Result
Low	5180	0.13	≤ 4	Compliant
Mid	5240	0.45	≤ 4	Compliant
High	5320	4.78	≤ 11	Compliant

Band III:

Channel	Frequency (MHz)	Peak Power Spectral Density (dBm)	Standard (dBm)	Result
Low	5745	5.00	≤ 17	Compliant
Mid	5765	5.33	≤ 17	Compliant
High	5805	5.00	≤ 17	Compliant

Plots of Power Spectral Density for 802.11b (15.247)



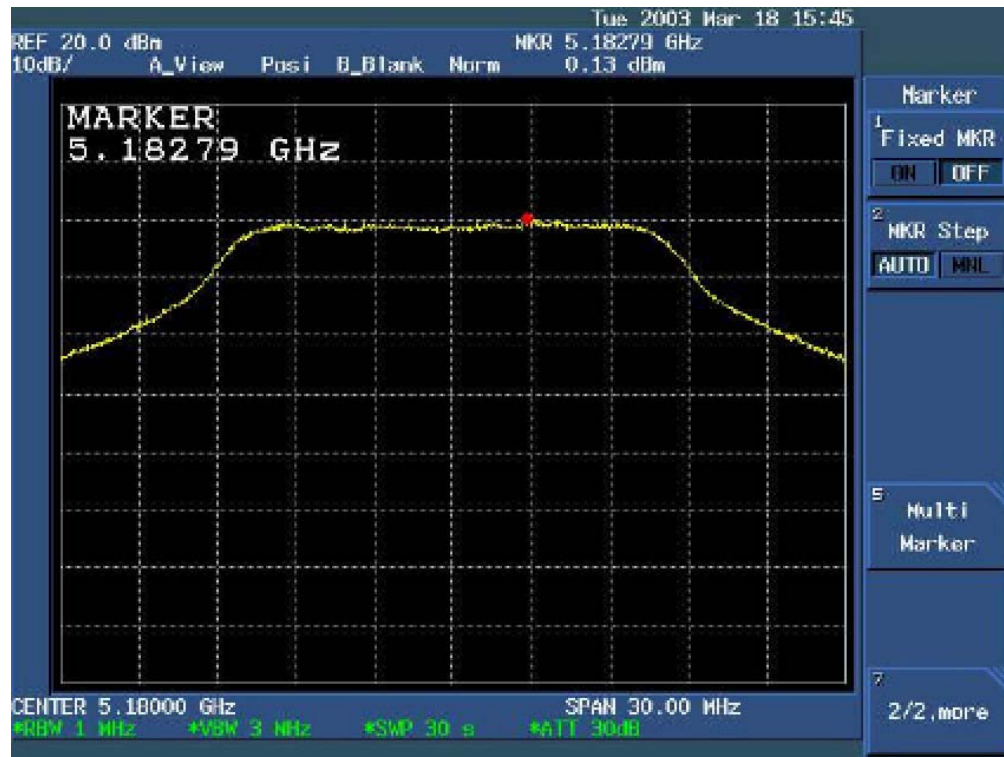


Plots of Power Spectral Density for 802.11g (15.247)



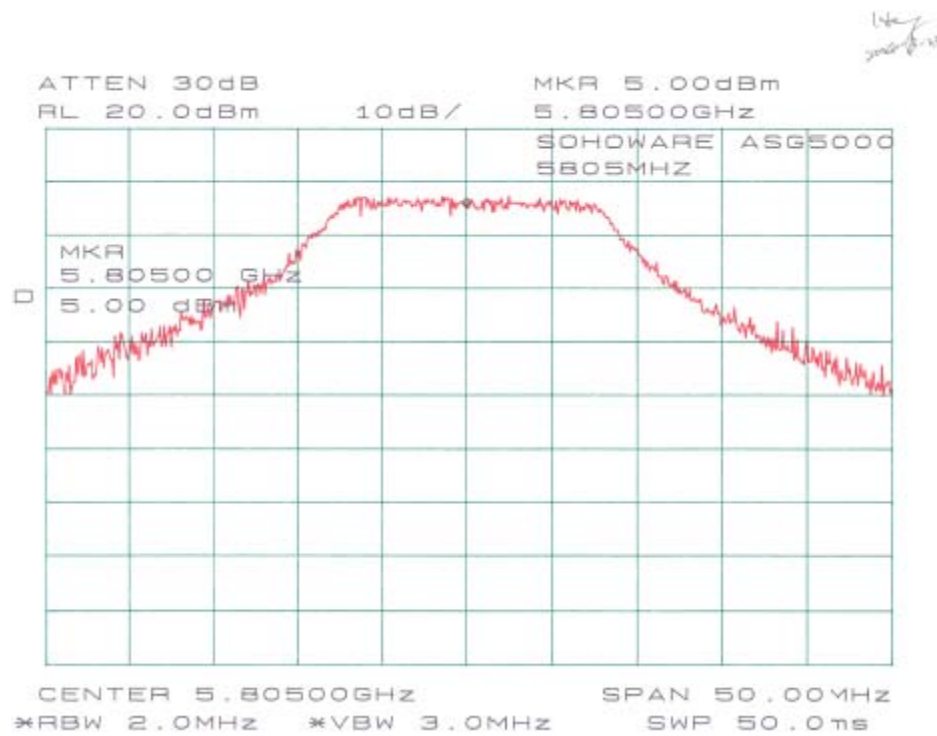


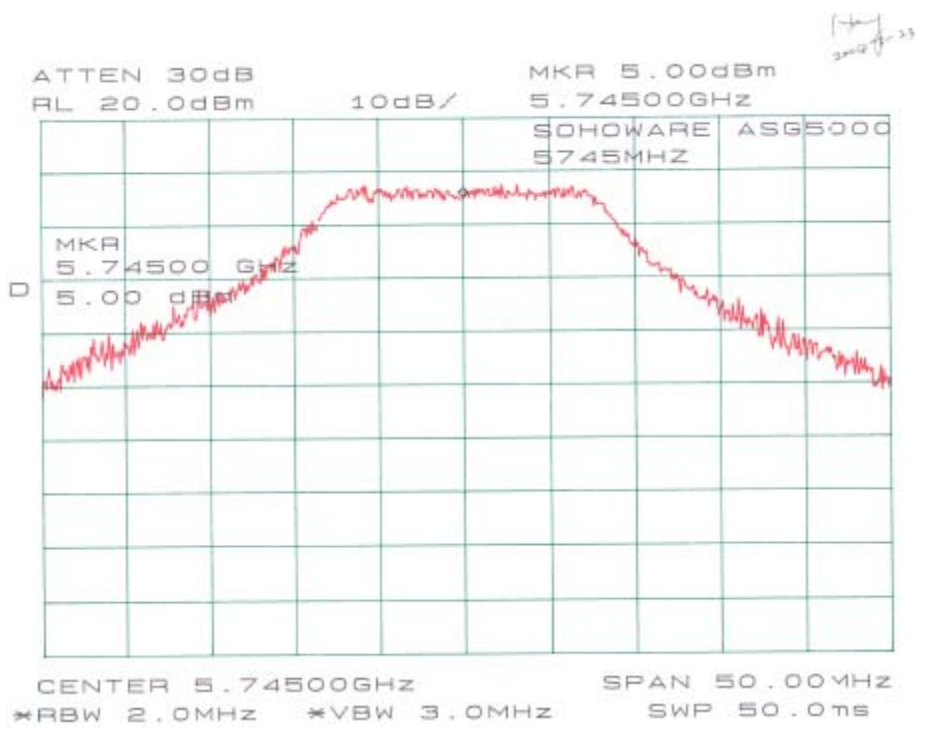
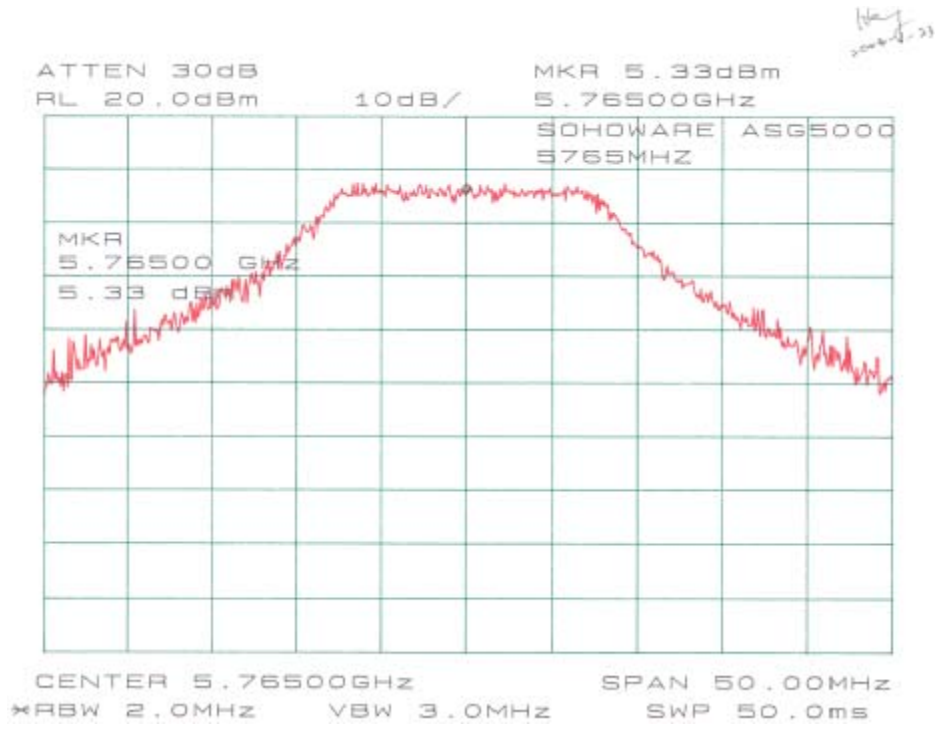
Plots of Spectral Density for 802.11a (15.407), Band I & II





Plots of Spectral Density for 802.11a (15.407), Band III





§15.407(a)(6) - Peak Excursion To Average Ratio

Standard Applicable

According to §15.407(a)(6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13dB across any 1MHz bandwidth or the emission bandwidth whichever is less.

Test Procedure

For this test, the EUT's antenna was removed and replaced with a SMA jack to UMP2.0 plug test cable, so output power levels were calculated from conducted emission levels.

The analyzer center frequency was set to the EUT carrier frequency. For the peak value trace A, the analyzer resolution and video bandwidth were set to 1MHz. Do a MAX HOLD, then VIEW. For the average value trace B, the analyzer resolution bandwidth was set to 1MHz, the video bandwidth was set to 30kHz. MAX HOLD then VIEW trace B also.

The delta from the peak value trace and the Average should not exceed 13dBm across any 1MHz bandwidth.

Equipment Lists

Manufacturer	Model No.	Description	Calibration Date
Agilent	8564E	Spectrum Analyzer	2003-08-26

Test Result for

Environmental Conditions

Temperature:	15° C
Relative Humidity:	42%
ATM Pressure:	1018 mbar

The testing was performed by Hang Tan on 2004-03-23.

Band I:

Channel	Frequency (MHz)	Reading (dB)	Limit (dBm)	Result
Low	5180	8.41	13	Compliant
Mid	5240	8.45	13	Compliant
High	5320	7.65	13	Compliant

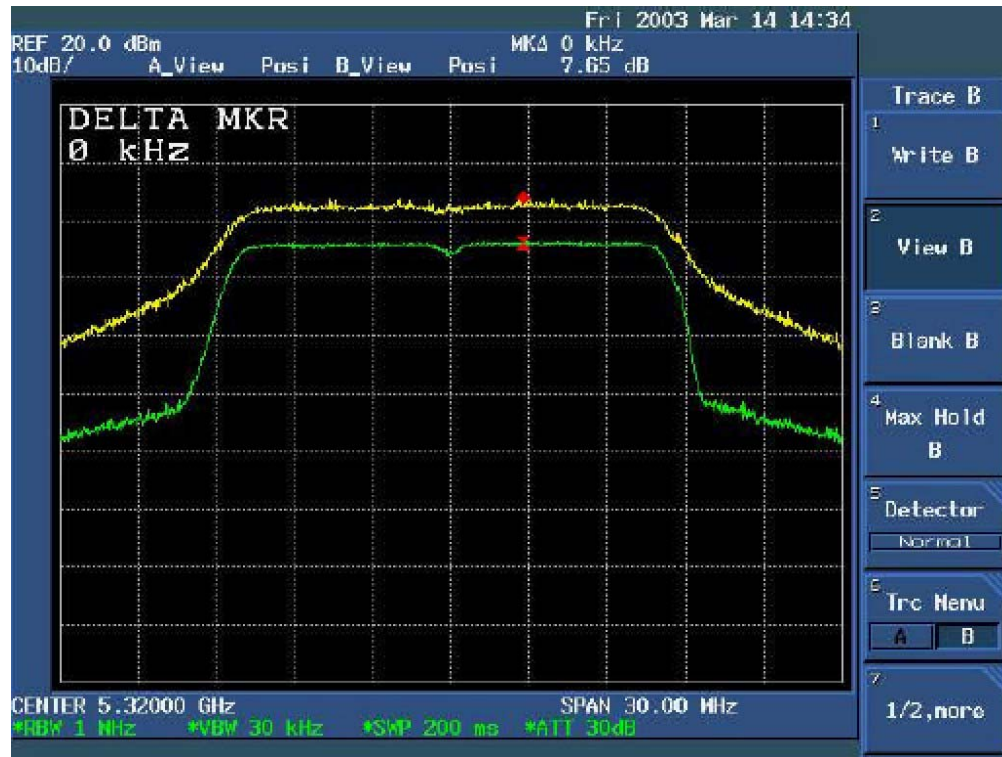
Band II:

Channel	Frequency (MHz)	Reading (dB)	Limit (dBm)	Result
Low	5805	6.34	13	Compliant
Mid	5765	6.33	13	Compliant
High	5745	5.83	13	Compliant

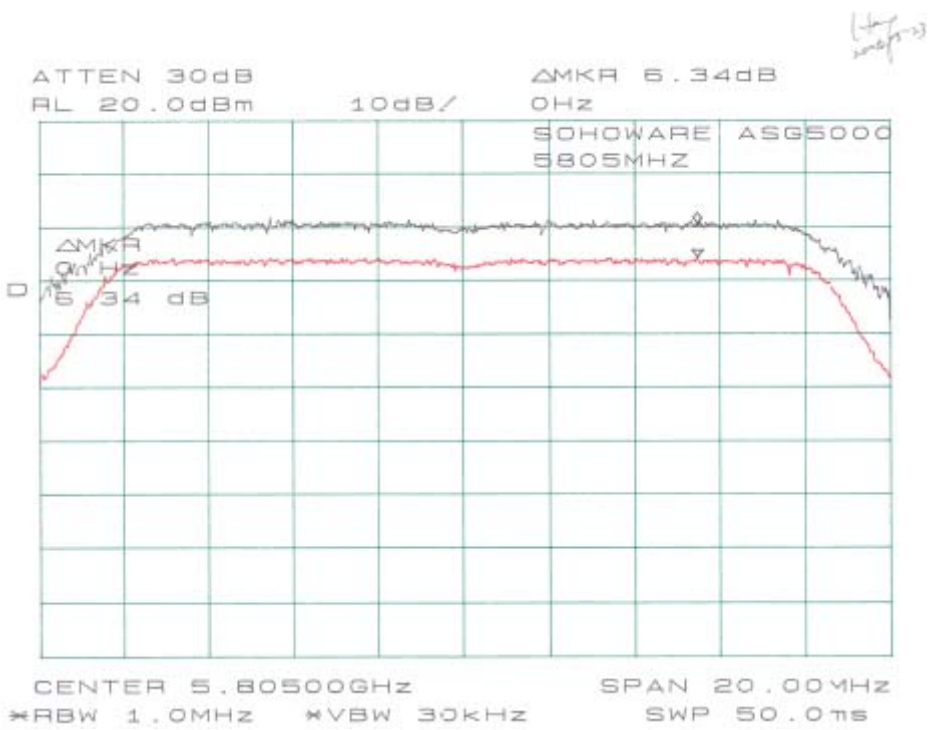
Please see the hereinafter plots for more detail.

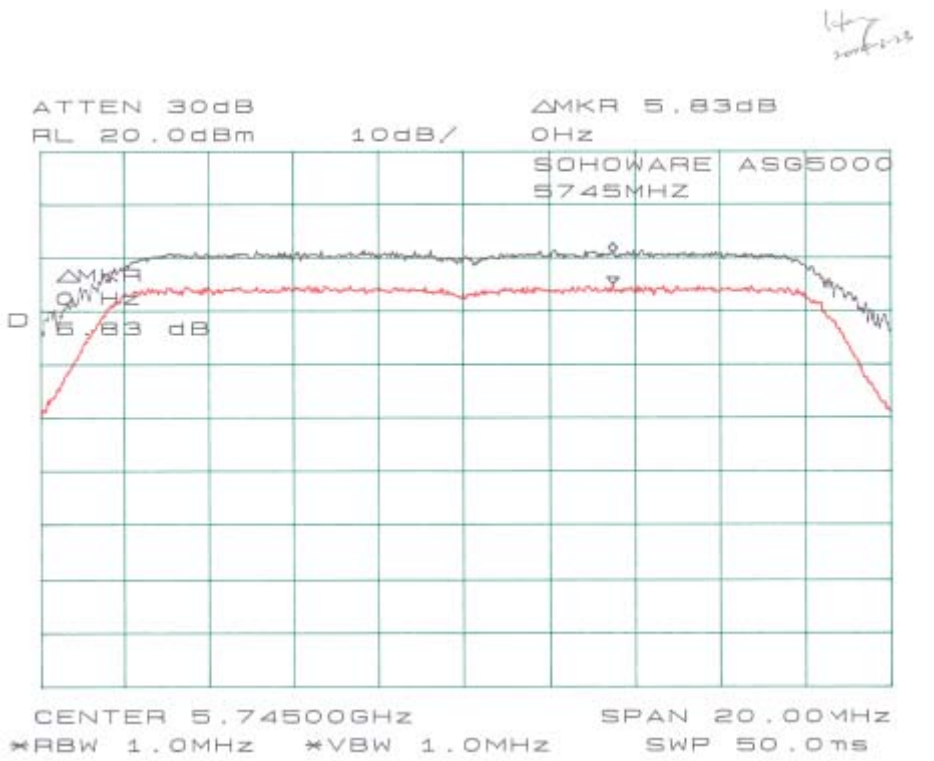
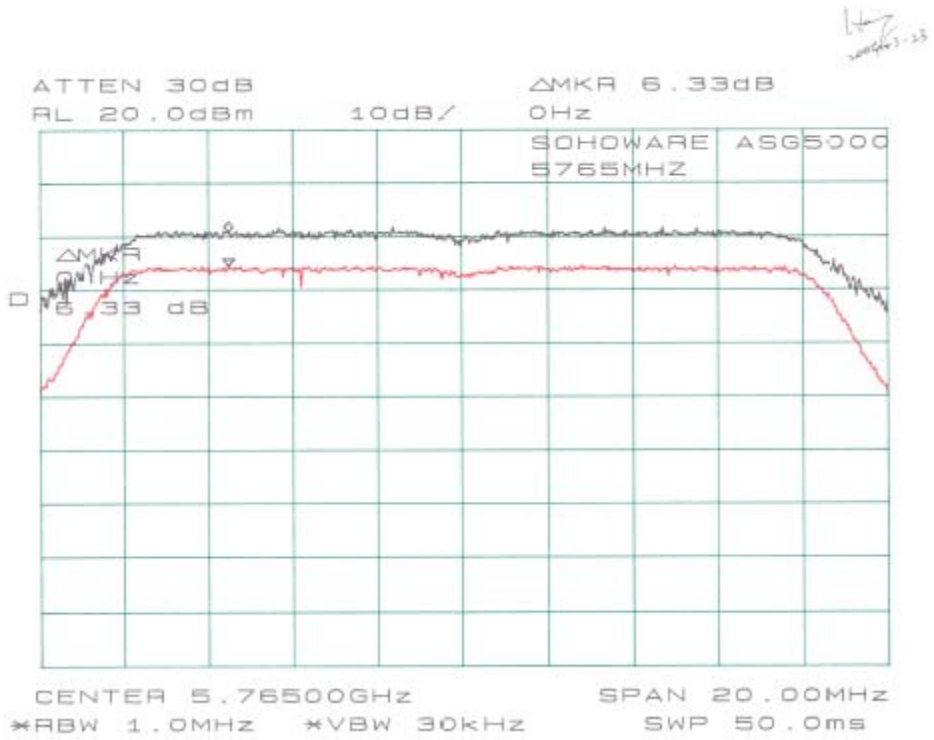
Band I & II:





Band III:





§15.407(b) - Out Of Band Emission

Standard Applicable

§15.407 (b), undesirable emission limits: except as shown in paragraph (b)(6) of this section, the peak emission outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

§15.407 (b)(1), for transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

§15.407 (b)(2), for transmitters operating in the 5.25 – 5.35 GHz band: all emissions outside of the 5.15 – 5.25 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25 – 5.35 GHz band that generate emissions in the 5.15 – 5.25 GHz band must meet all applicable technical requirements for operation in the 5.15 – 5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15 – 5.25 GHz band.

§15.407 (b)(3), for transmitters operating in the 5.725 – 5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EURP of -17dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emission shall not exceed an EIRP of -27 dBm/MHz.

Test Procedure

For this test, the EUT's antenna was removed and replaced with a low loss cable, so output power levels were calculated from conducted emission levels.

The analyzer center frequency was set to the EUT carrier frequency. The analyzer resolution and video bandwidth were set to 1MHz. The entire band from 30kHz to 40GHz was investigated.

Every suspected signal was also investigated through radiated emission. Refer to section 15.205 restricted bands of operation.

Equipment Lists

Manufacturer	Model No.	Description	Calibration Date
Agilent	8564E	Spectrum Analyzer	2003-08-26

Test Result**Environmental Conditions**

Temperature:	12° C
Relative Humidity:	48%
ATM Pressure:	1100 mbar

Band I & II:

Channel	Frequency (MHz)	Reading (dBuV)	ERP (dBm)	Limit (dBm)	Result
Low	5149	64.15	-34.58	≤-27	Pass
High	5353	67.97	-30.76	≤-27	Pass

Band III:

Channel	Frequency (MHz)	Reading (dBuV)	ERP (dBm)	Limit (dBm)	Result
Low	5745	57.23	-41.50	≤-27	Pass
High	5805	58.71	-40.02	≤-27	Pass

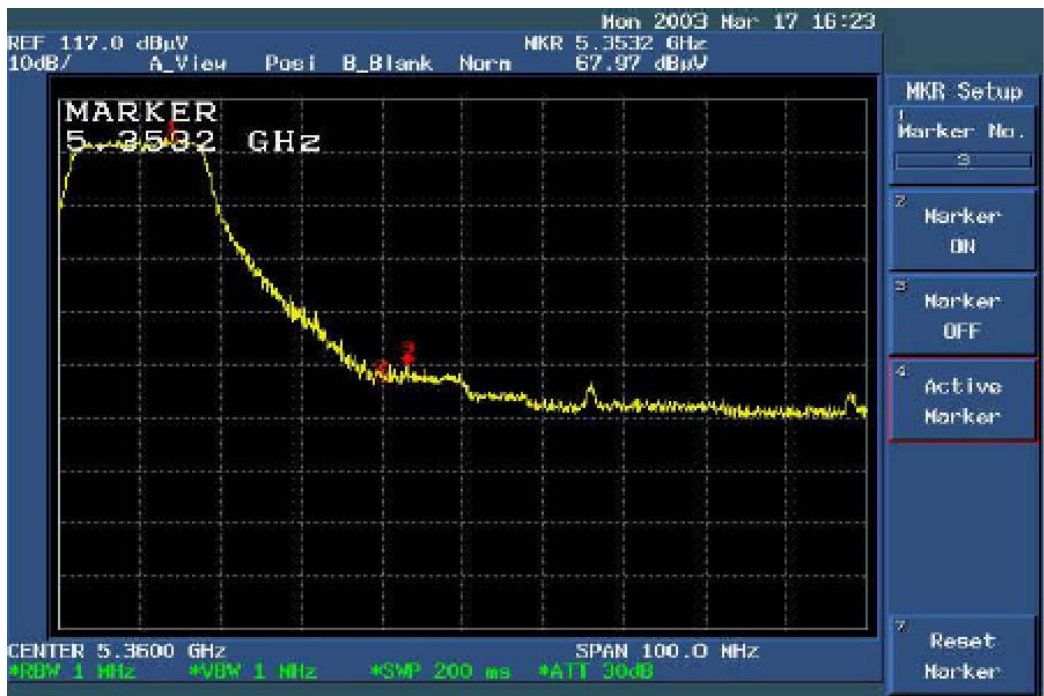
Out of band emission power was calculated by following formula:

$$P = (Exd)^2 / (30G)$$

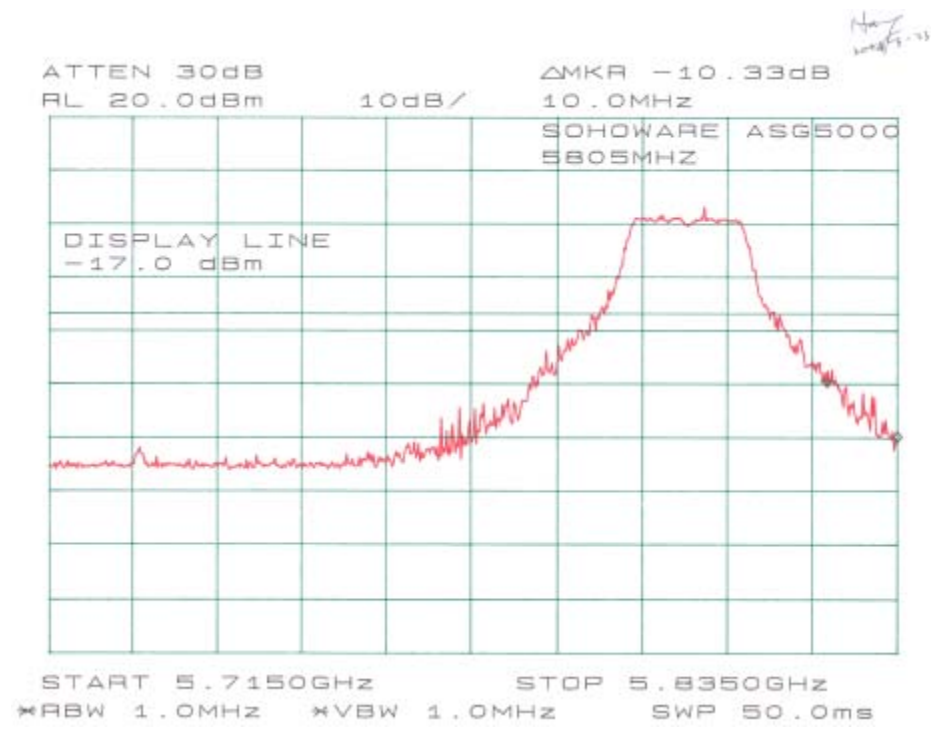
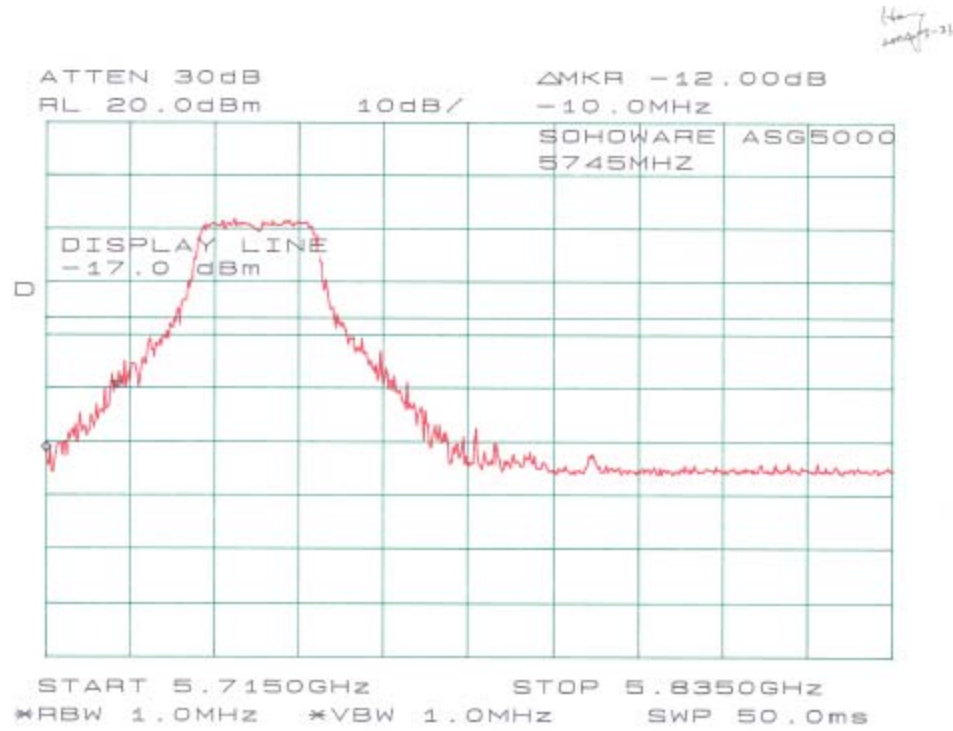
Where G is 3.5 dBi, given by manufacturer.

Please refer to the following plots.

Band I & II:



Band III:



15.407(c) - Discontinue Transmitting With Absence Of Data Or Operational Failure

According to § 15.407 (c), the device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the user of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application a description of how this requirement is met.

Please refer to respective technical description.

§15.407(g) - Frequency Stability

Standard Applicable

According to §15.407 (g), manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation .

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Analyzer, Spectrum	8565EC	3946A00131	6/30/2003
HP	Amplifier, Pre, microwave	8449B	3147A00400	3/14/2003
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	2455-261	8/1/2003
Tenney	Oven, Temperature	VersaTenn	12222-193	4/23/2003
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	2455-261	8/1/2003

* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Measurement Result

Environmental Conditions

Temperature:	15° C
Relative Humidity:	42%
ATM Pressure:	1018 mbar

The testing was performed by Hang Tan on 2004-03-23.

Operating Frequency: 5180MHz		Limit: +/- 0.02%					
Temp. (°C)	Power Supply (V AC)	2 minutes		5 minutes		10 minutes	
		(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
35	132	5179.9762	-0.000459	5179.9769	-0.000446	5179.9767	-0.000450
	115	5179.9764	-0.000456	5179.9766	-0.000452	5179.9765	-0.000454
	97	5179.9764	-0.000456	5179.9769	-0.000446	5179.9764	-0.000456
0	132	5179.9857	-0.000276	5179.9863	-0.000264	5179.9859	-0.000272
	115	5179.9853	-0.000284	5179.9858	-0.000274	5179.9856	-0.000278
	97	5179.9854	-0.000282	5179.9859	-0.000272	5179.9855	-0.000280
20	132	5180.0085	0.000164	5180.0091	0.000176	5180.0099	0.000191
	115	5180.0081	0.000156	5180.0088	0.000170	5180.0095	0.000183
	97	5180.0079	0.000153	5180.0075	0.000145	5180.0088	0.000170

Operating Frequency: 5320 MHz		Limit: +/- 0.02%					
Temp. (°C)	Power Supply (V AC)	2 minutes		5 minutes		10 minutes	
		(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
35	132	5319.9759	-0.000453	5319.9766	-0.000440	5319.9762	-0.000447
	115	5319.9753	-0.000464	5319.9762	-0.000447	5319.9759	-0.000453
	97	5319.9755	-0.000461	5319.9763	-0.000445	5319.9761	-0.000449
0	132	5319.9825	-0.000329	5319.9829	-0.000321	5319.9827	-0.000325
	115	5319.9829	-0.000321	5319.9831	-0.000318	5319.9826	-0.000327
	97	5319.9823	-0.000333	5319.9827	-0.000325	5319.9823	-0.000333
20	132	5320.0095	0.000179	5320.0101	0.000190	5320.0109	0.000205
	115	5320.0091	0.000171	5320.0098	0.000184	5320.0102	0.000192
	97	5320.0089	0.000167	5320.0096	0.000180	5320.0103	0.000194

Operating Frequency: 5765 MHz		Limit: +/- 0.02%					
Temp. (°C)	Power Supply (V AC)	2 minutes		5 minutes		10 minutes	
		(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
35	132	5764.9435	-0.000980	5764.9423	-0.001001	5764.9443	-0.000966
	115	5764.9745	-0.000442	5764.9635	-0.000633	5764.9650	-0.000607
	97	5764.9489	-0.000886	5764.9518	-0.000836	5764.9515	-0.000841
0	132	5764.9645	-0.000616	5764.9590	-0.000711	5764.9586	-0.000718
	115	5764.9766	-0.000406	5764.9780	-0.000382	5764.9775	-0.000390
	97	5764.9820	-0.000312	5764.9841	-0.000276	5764.9815	-0.000321
20	132	5765.0072	0.000125	5765.0083	0.000144	5765.0077	0.000134
	115	5765.0018	0.000031	5765.0021	0.000036	5765.0023	0.000040
	97	5765.0085	0.000147	5765.0092	0.000160	5765.0083	0.000144