FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

802.11a High power Bridge

Model: TT5800

Trade Name: TELETRONICS

Issued to

TELETRONICS TECHNOLOGY CO., LTD.
2 Choke Cherry Road Rockville,
MD 20850, USA

Issued by

Compliance Certification Services Inc.
No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang,
Taoyuan Hsien, (338) Taiwan, R.O.C.
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TABLE OF CONTENTS

TEST RESULT CERTIFICATION

Applicant: TELETRONICS TECHNOLOGY CO., LTD.
2 Choke Cherry Road Rockville,
MD 20850, USA

Equipment Under Test: 802.11a High power Bridge

Trade Name: TELETRONICS

Model: TT5800

Date of Test: November 17 ~ 22, 2005

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 Subpart C	No non-compliance noted

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4: 2003 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by: *Reviewed by:*

Gavin Lim
Section Manager
Compliance Certification Services Inc.

Amanda Wu
Section Manager
Compliance Certification Services Inc.

EUT DESCRIPTION

Product	802.11a High power Bridge
Trade Name	TELETRONICS
Model Number	TT5800
Model Discrepancy	N/A
Power Supply	**Power Adapter** SWITCHING / SP30-210150 I/P: AC 100-240Vac, 50-60Hz O/P: DC 48Vdc, 0.5A
Frequency Range	Base mode: 5.745~5.825 GHz Turbo mode: 5.760 GHz / 5.800 GHz
Transmit Power	Base mode: 24.86dBm Turbo mode: 25.00dBm
Modulation Technique	OFDM (QPSK, BPSK, 16-QAM, 64-QAM)
Transmit Data Rate	Base mode: 54, 48, 36, 24, 18, 12, 9, 6 Mbps Turbo mode: 108, 54, 48, 36, 24, 18, 12 Mbps
Number of Channels	5.745 ~ 5850 GHz: 3 Channels 5.760 GHz / 5.800 GHz: 2 Channels
Antenna Specification	Antenna Type: Subscriber antenna Antenna Gain: 23dBi

Remark:

1. *The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*
2. *This submittal(s) (test report) is intended for FCC ID: MFMTT5800 filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*

TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

1.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

1.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

1.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.

1.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	([2])
13.36 - 13.41	322 - 335.4		

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

[2] Above 38.6

(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.

1.5 DESCRIPTION OF TEST MODES

The EUT (model: TT5800) had been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

IEEE802.11a: Base mode: Channel Low(5745MHz), Channel Mid(5785MHz) and Channel High(5825MHz) with 54Mbps and Turbo mode Channel Low(5760MHz), Channel High(5800MHz) with 108 Mbps data rate were chosen for the final testing.

INSTRUMENT CALIBRATION

1.6 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

1.7 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: *Each piece of equipment is scheduled for calibration once a year.*

Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

Open Area Test Site # 3				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver	R&S	ESVS20	838804/004	01/08/2006
Spectrum Analyzer	R&S	FSP30	100112	09/23/2006
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006
Pre-Amplifier	MITEC	AFS42-00102650	924206	N.C.R.
Pre-Amplifier	MITEC	AMF-6F-260400	945377	N.C.R.
Bilog Antenna	SCHWAZBECK	VULB9163	145	07/05/2006
Horn Antenna	EMCO	3115	00022250	04/18/2006
Horn Antenna	EMCO	3116	2487	12/08/2005
Turn Table	EMCO	2081-1.21	9709-1885	N.C.R.
Antenna Tower	EMCO	2075-2	9707-2060	N.C.R.
Controller	EMCO	2090	9709-1256	N.C.R.
RF Switch	ANRITSU	MP59B	M53867	N.C.R.
Site NSA	C&C	N/A	N/A	09/06/2006

Remark: *The measurement uncertainty is less than +/- 2.16dB, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

Powerline Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI TEST RECEIVER 9kHz-30MHz	ROHDE & SCHWARZ	ESHS30	828144/003	09/24/2006
TWO-LINE V-NETWORK 9kHz-30MHz	SCHAFFNER	NNB41	03/10013	06/11/2006
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	02/17/2006
Test S/W	LABVIEW (V 6.1)			

Remark: *The measurement uncertainty is less than +/- 2.81dB, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

FACILTIES AND ACCREDITATIONS

1.8 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No. No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☒ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.9 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

1.10 LABORATORY ACCREDITATIONS AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200600-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (Registration no: 93105 and 90471).

1.11 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP*	EN 55011, EN 55014-1, AS/NZS 1044, CNS 13783-1, EN 55022, CNS 13438, EN 61000-3-2, EN 61000-3-3, ANSI C63.4, FCC OST/MP-5, AS/NZS CISPR 22, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11	NVLAP 200600-0
USA	FCC	3/10 meter Open Area Test Sites (93105, 90471) / 3M Semi Anechoic Chamber (965860) to perform FCC Part 15/18 measurements	FC 93105, 90471 965860
Japan	VCCI	3/10 meter Open Area Test Sites to perform conducted/radiated measurements	VCCI R-393/1066/725/879 C-402/747/912
Norway	NEMKO	EN 50081-1/2, EN 50082-1/2, IEC 61000-6-1/2, EN 50091-2, EN 50130-4, EN 55011, EN 55013, EN 55014-1/2, EN 55015, EN 55022, EN 55024, EN 61000-3-2/3, EN 61326-1, IEC 61000-4-2/3/4/5/6/8/11, EN 60601-1-2, EN 300 328-2, EN 300 422-2, EN 301 419-1, EN 301 489-01/03/07/08/09/17, EN 301 419-2/3, EN 300 454-2, EN 301 357-2	N ELA 124a ELA 124b ELA 124c
Taiwan	CNLA	EN 300 328-1/2, EN 300 220-1/2/3, EN 300 440-1/2, EN 61000-3-2, EN 61000-3-3, 47 CFR FCC Part 15 Subpart C/D/E, EN 55013, CNS 13439, EN 55014-1, CNS 13783-1, EN 55022, CNS 13438, CISPR 22, AS/NZS 3548, EN 61000-4-2/3/4/5/6/8/11, ENV 50204, IEEE Std 1528, FCC OET Bulletin, 65+Supplement C, EN50360, EN50361, EN50371, RSS102	CNLA 0363 ILAC MRA
Taiwan	BSMI	CNS 13438, CNS 13783-1, CNS 13439, CNS 14115	SL2-IS-E-0014 SL2-IN-E-0014 SL2-A1-E-0014 SL2-R1-E-0014 SL2-R2-E-0014 SL2-L1-E-0014
Canada	Industry Canada	3/10 meter Open Area Test Sites (IC 3991-3, IC 3991-4) / 3M Semi Anechoic Chamber (IC 6106) to perform RSS 212 Issue 1	Canada IC 3991-3 IC 3991-4 IC 6106

** No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.*

** Australia: MRA of NVLAP AS/NZS 4771 &AS/NZS 4268.*

SETUP OF EQUIPMENT UNDER TEST

1.12 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

1.13 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1	Notebook PC	IBM	2672(X31)	99PBTKB	FCC DoC	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core

Remark:

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

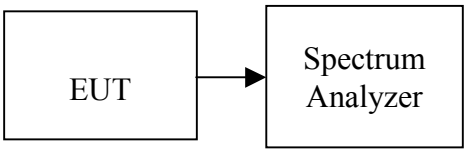
FCC PART 15.247 REQUIREMENTS

1.14 6DB BANDWIDTH

LIMIT

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100kHz, VBW = RBW, Span = Base mode: 50MHz / Turbo mode: 80MHz, Sweep = auto.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

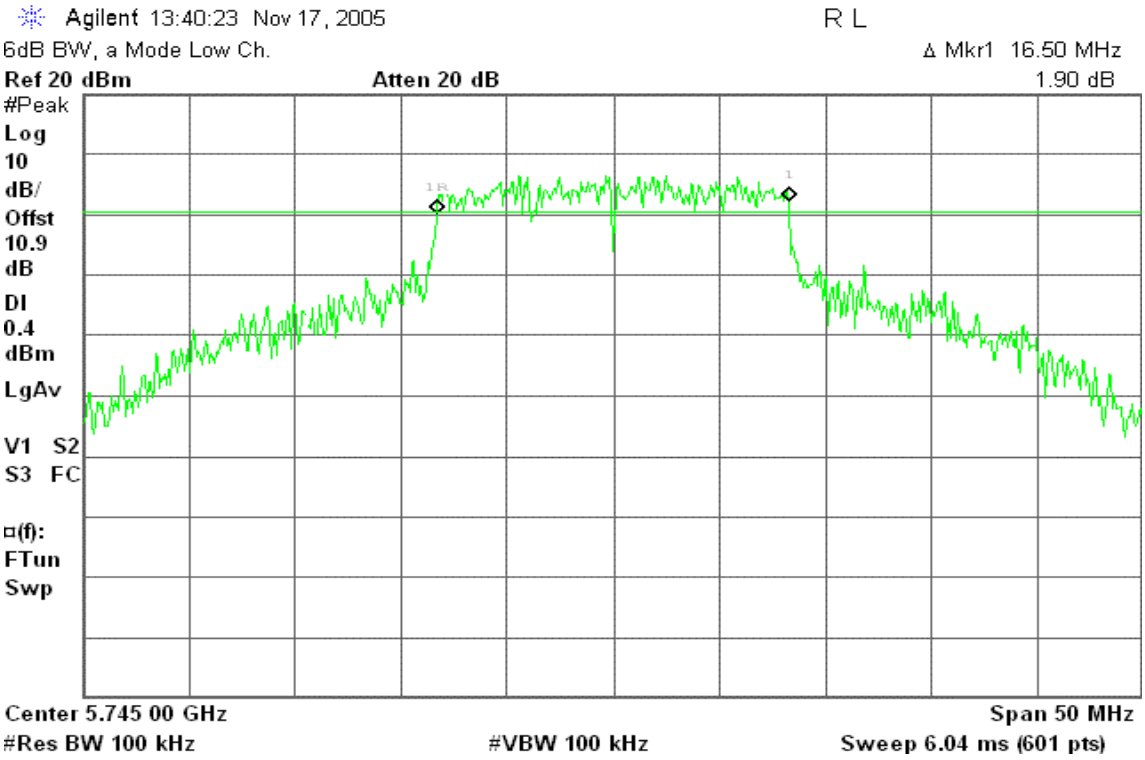
No non-compliance noted

Test Data

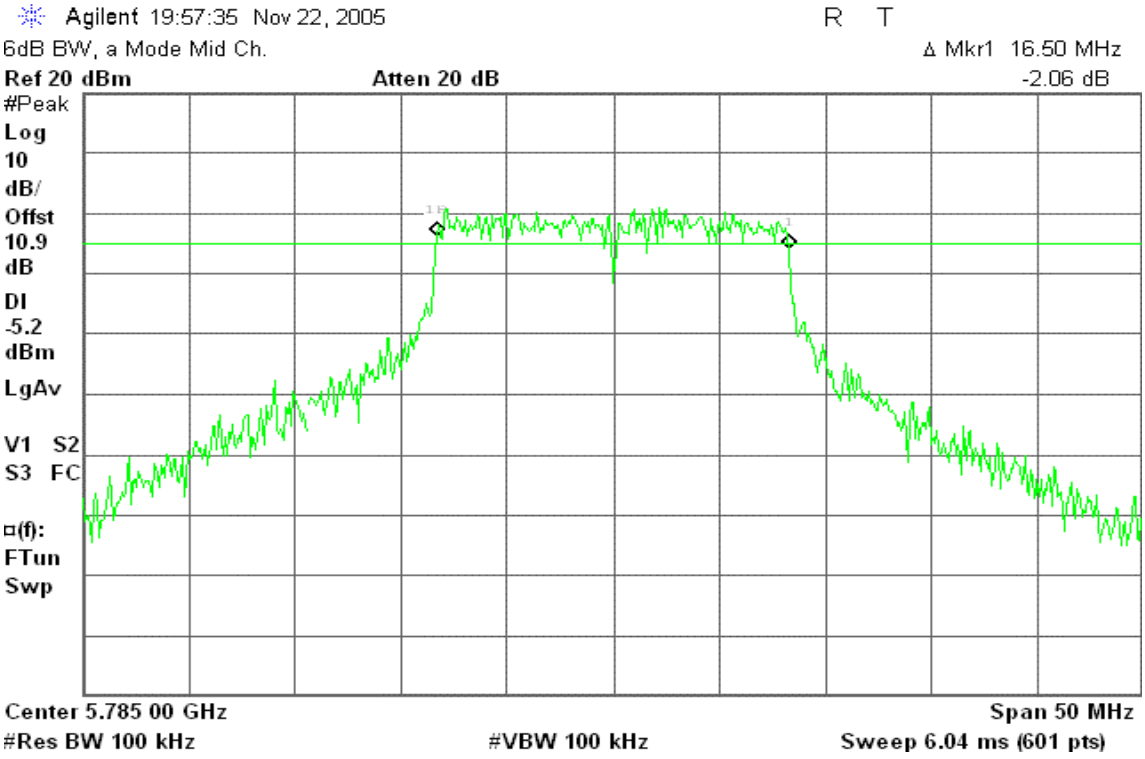
Channel	Frequency (MHz)		Bandwidth (kHz)	Limit (kHz)	Test Result
Low	Base mode	5745	16500	>500	PASS
Mid		5785	16500		PASS
High		5825	16500		PASS
Low	Turbo mode	5760	32930		PASS
High		5800	32800		PASS

IEEE 802.11a Base mode

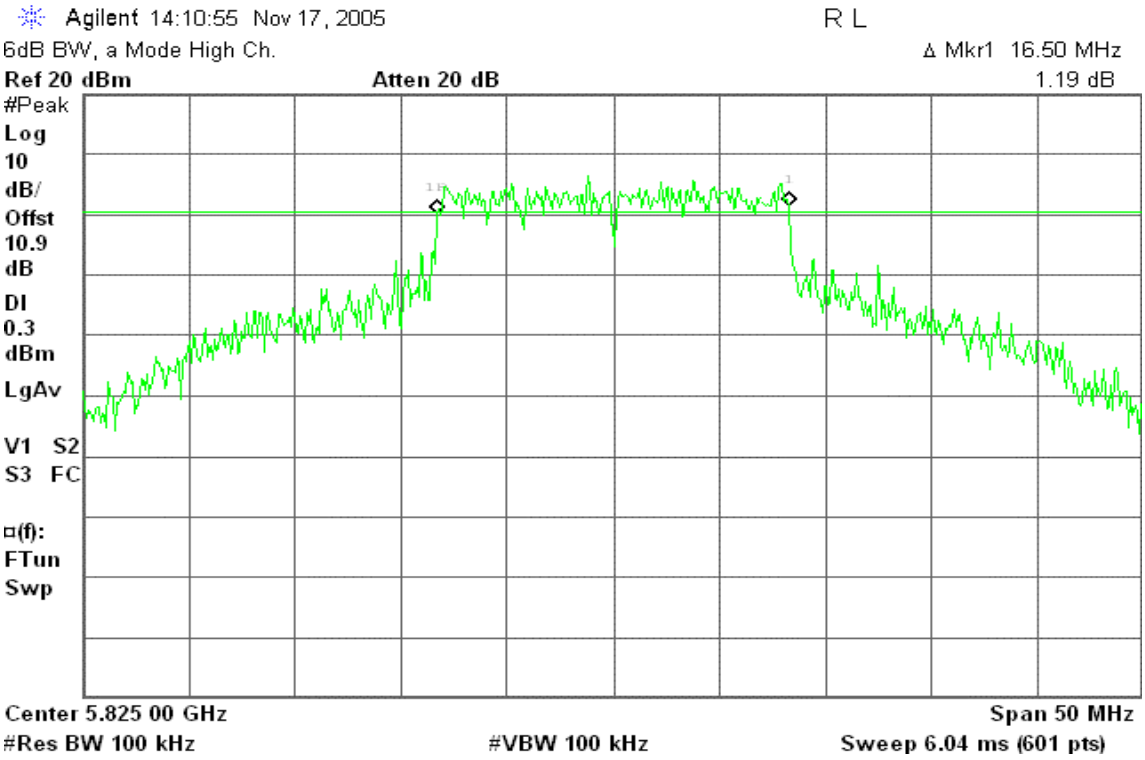
CH Low



CH Mid

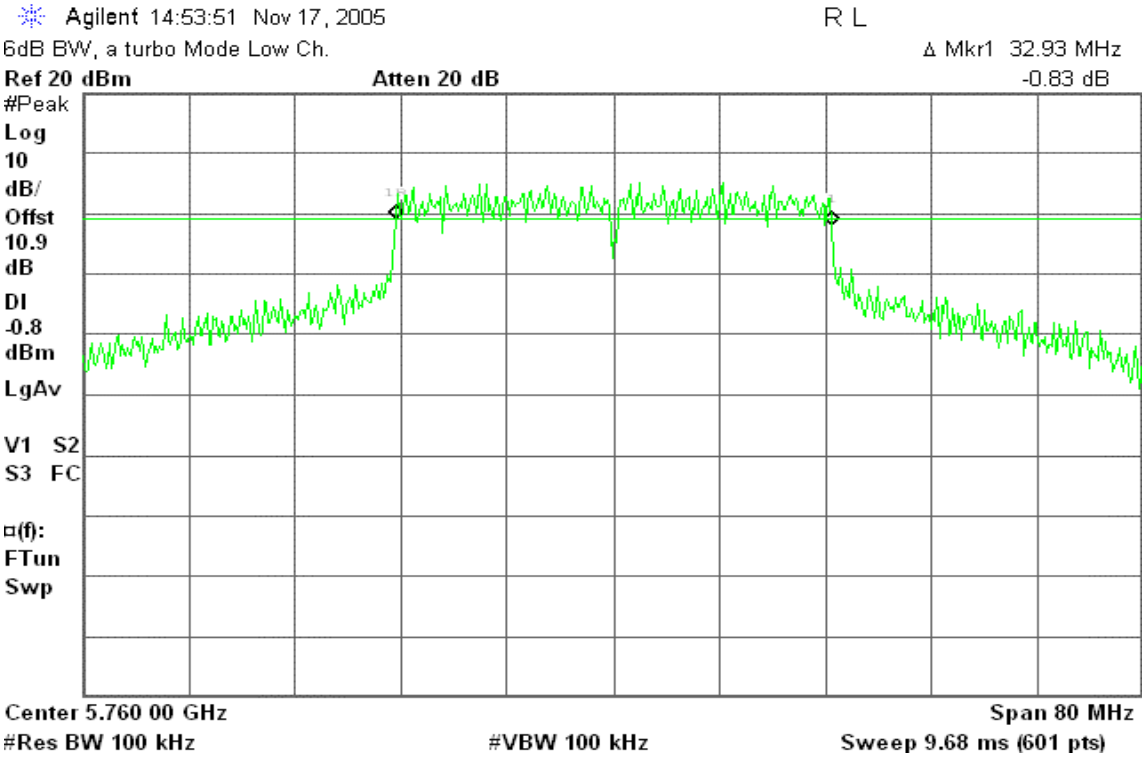


CH High

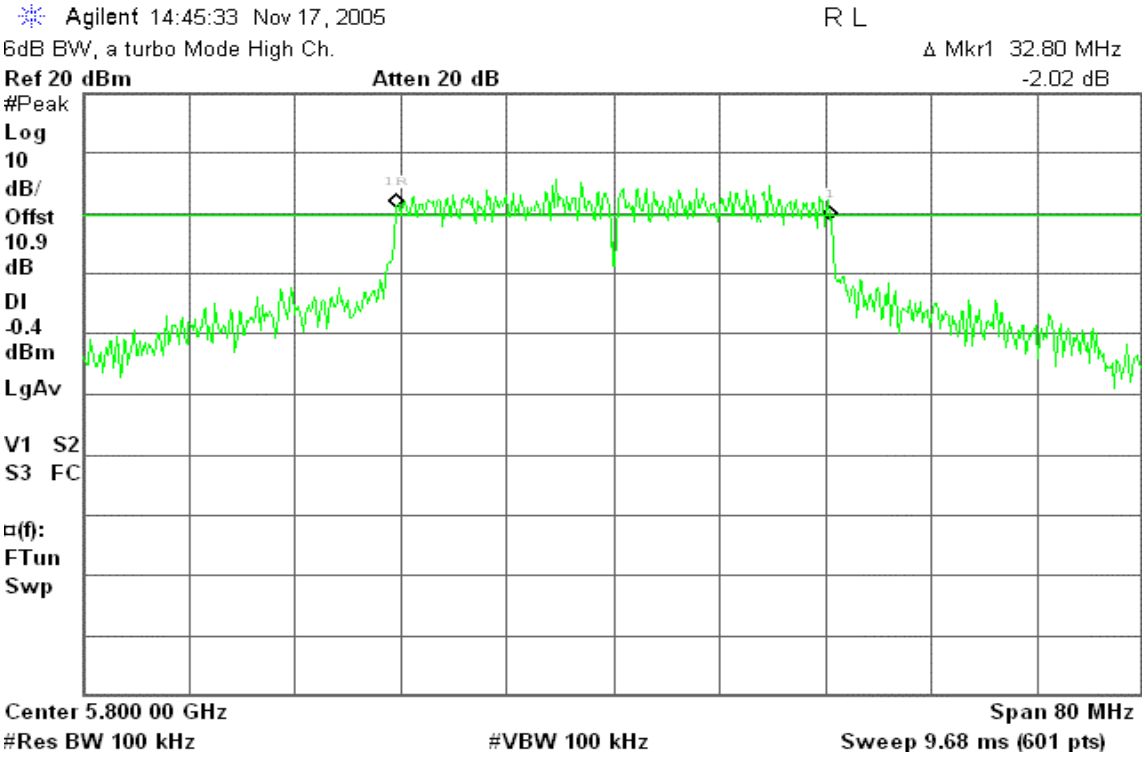

Agilent 14:10:55 Nov 17, 2005
R L
6dB BW, a Mode High Ch.
Δ Mkr1 16.50 MHz
Ref 20 dBm
Atten 20 dB
1.19 dB
#Peak
Log
10
dB/
Offst
10.9
dB
Dl
0.3
dBm
LgAv
V1 S2
S3 FC
¤(f):
FTun
Swp
Center 5.825 00 GHz
Span 50 MHz
#Res BW 100 kHz
#VBW 100 kHz
Sweep 6.04 ms (601 pts)

IEEE 802.11a Turbo mode

CH Low



CH High



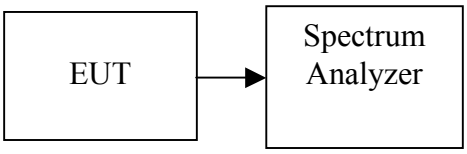
1.15 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
3. Operation with directional antenna gains greater than 6 dBi.
   (i) Fixed point-to-point operation:
   (ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.
   (iii) Fixed, point-to-point operation, as used in paragraphs (c)(4)(i) and (c)(4)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.

TEST RESULTS

No non-compliance noted

Test Data

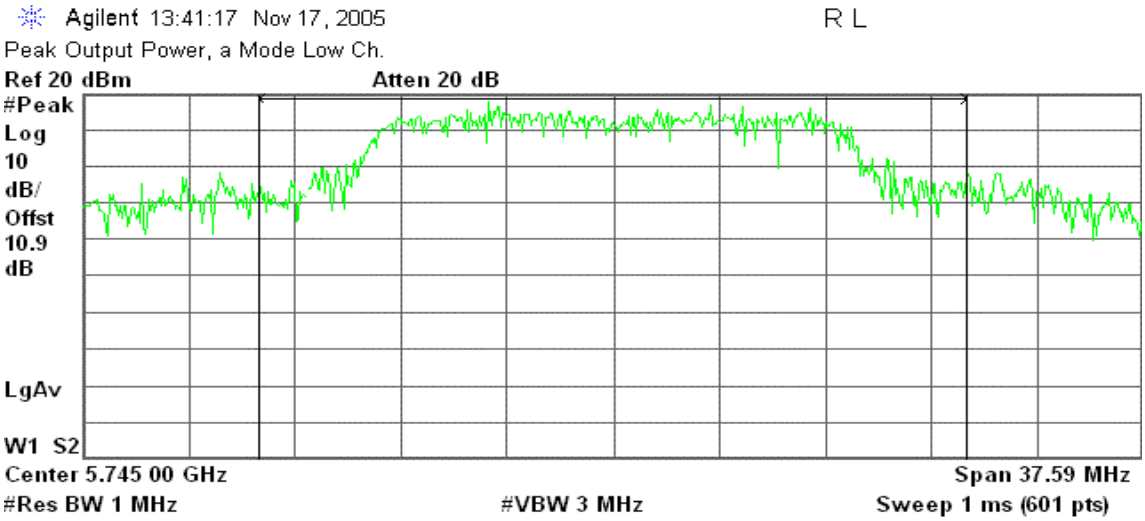
Channel	Frequency (MHz)		Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	Base mode	5745	24.86	0.30620	1	PASS
Mid		5785	19.34	0.08590		
High		5825	24.81	0.30269		
Low	Turbo mode	5760	25.00	0.31623		
High		5800	24.89	0.30832		

Remark: *The EUT is a fixed, point to point device, so no reduction due to the antenna gain at 5745-5850MHz band.*

Test Plot

IEEE 802.11a Base mode

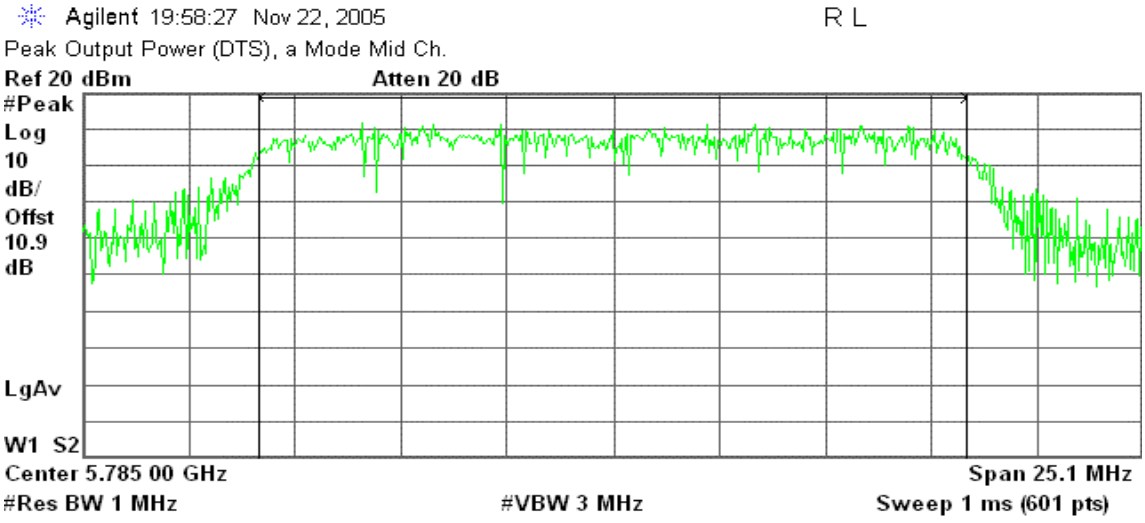
CH Low



Channel Power
24.86 dBm / 25.0620 MHz

Power Spectral Density
-49.13 dBm/Hz

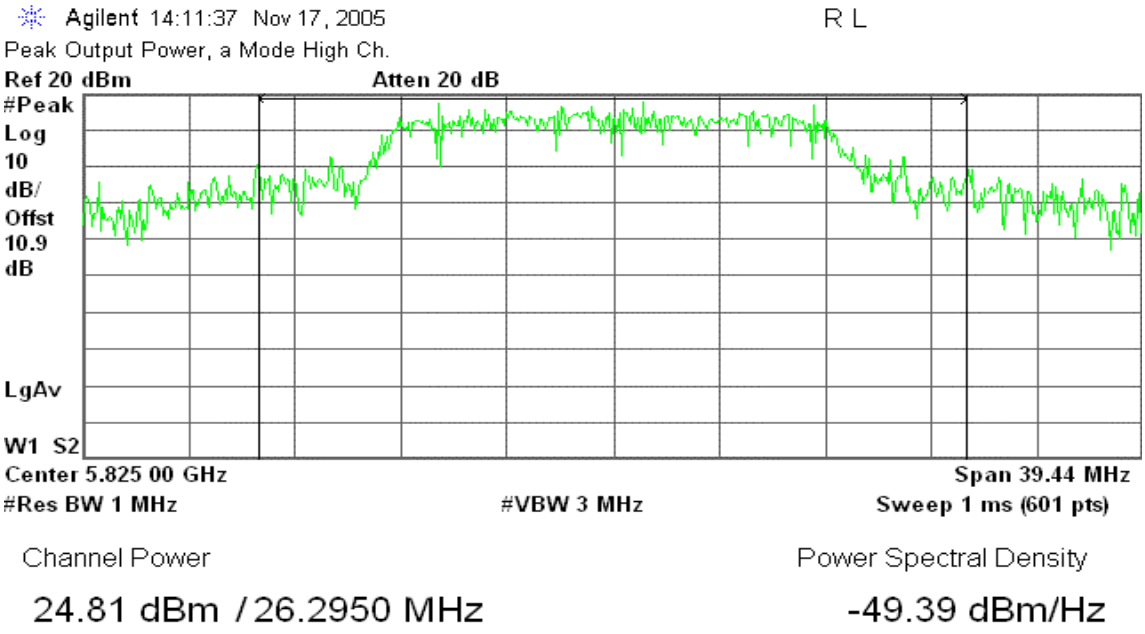
CH Mid



Channel Power
19.34 dBm / 16.7360 MHz

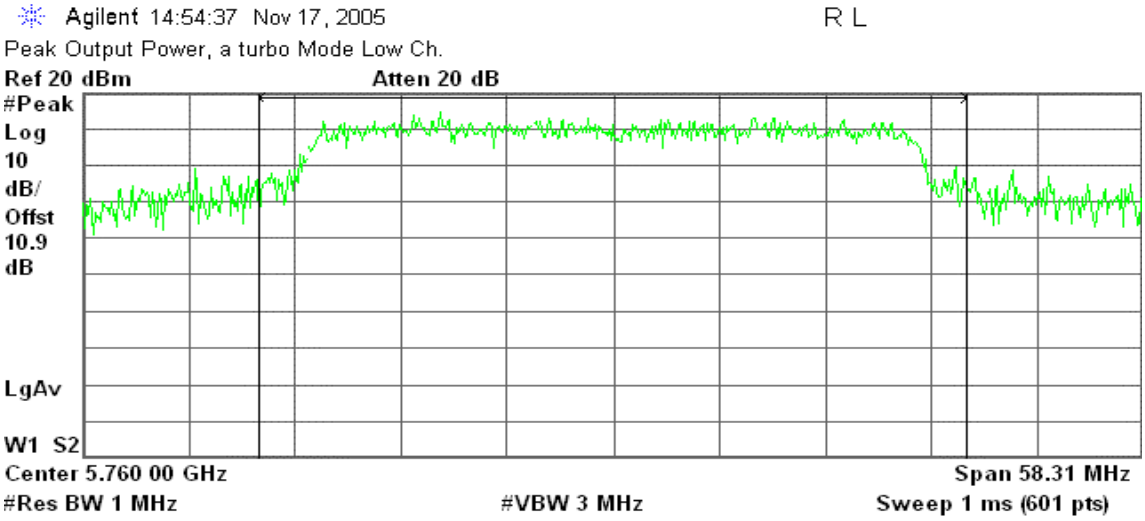
Power Spectral Density
-52.90 dBm/Hz

CH High


Agilent 14:11:37 Nov 17, 2005
R L
Peak Output Power, a Mode High Ch.
Ref 20 dBm
Atten 20 dB
#Peak
Log
10
dB/
Offst
10.9
dB
LgAv
W1 S2
Center 5.825 00 GHz
Span 39.44 MHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 1 ms (601 pts)
Channel Power
24.81 dBm / 26.2950 MHz
Power Spectral Density
-49.39 dBm/Hz

IEEE 802.11a Turbo mode

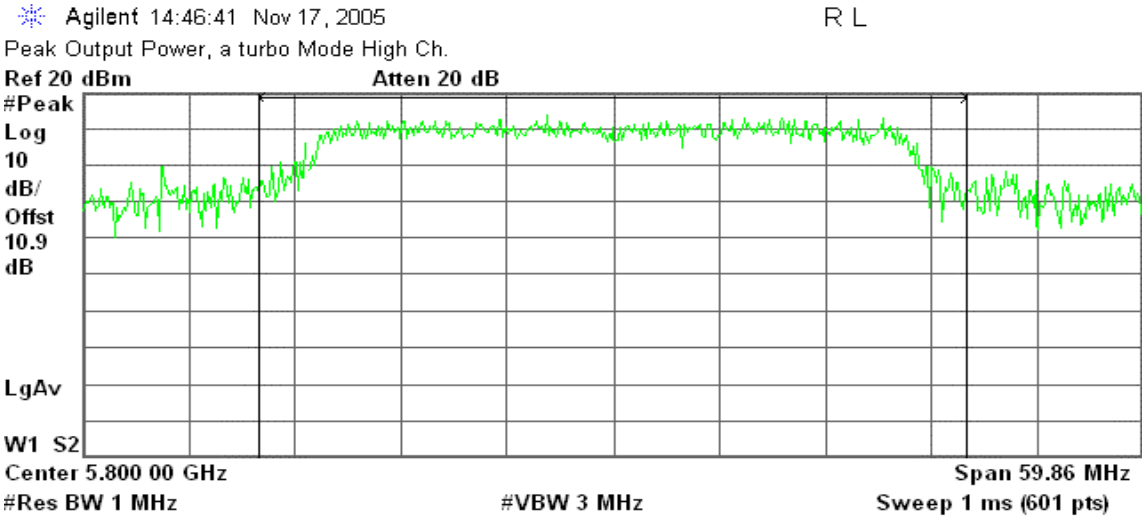
CH Low



Channel Power
25.00 dBm / 38.8740 MHz

Power Spectral Density
-50.89 dBm/Hz

CH High



Channel Power
24.89 dBm / 39.9050 MHz

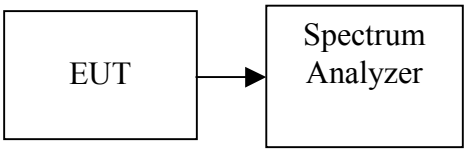
Power Spectral Density
-51.12 dBm/Hz

1.16 AVERAGE POWER

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the average power detection.

TEST RESULTS

No non-compliance noted.

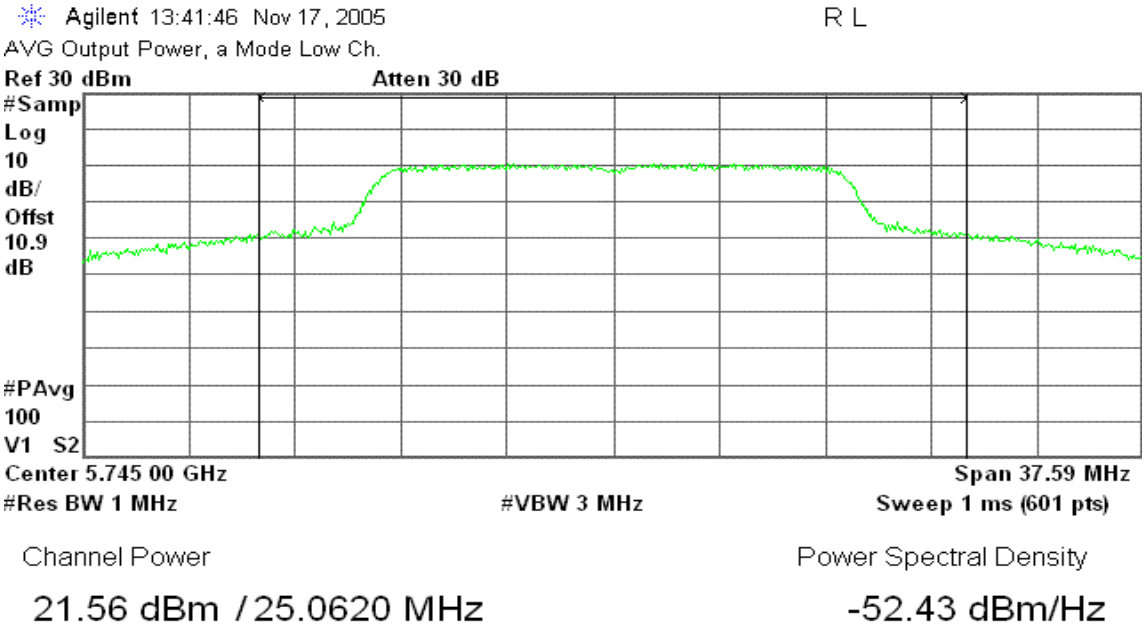
Test Data

Channel	Frequency (MHz)		Output Power (dBm)	Output Power (W)	Result
Low	Base mode	5745	21.56	0.14322	PASS
Mid		5785	15.84	0.03837	
High		5825	20.99	0.12560	
Low	Turbo mode	5760	21.19	0.13152	
High		5800	21.29	0.13459	

Test Plot

IEEE 802.11a Base mode

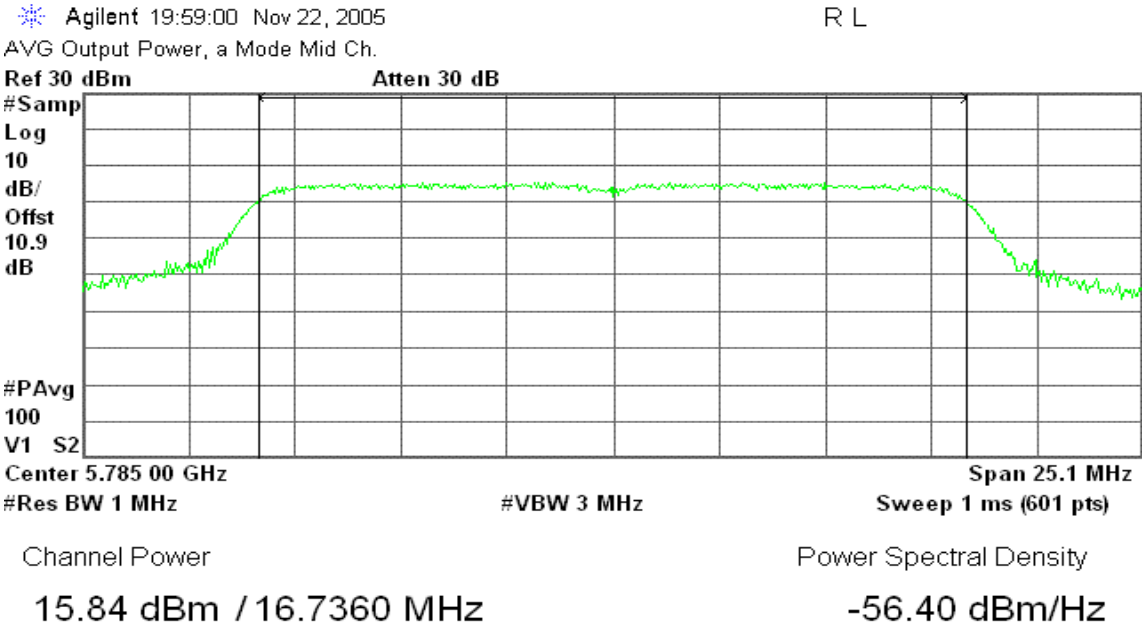
CH Low



Channel Power
21.56 dBm / 25.0620 MHz

Power Spectral Density
-52.43 dBm/Hz

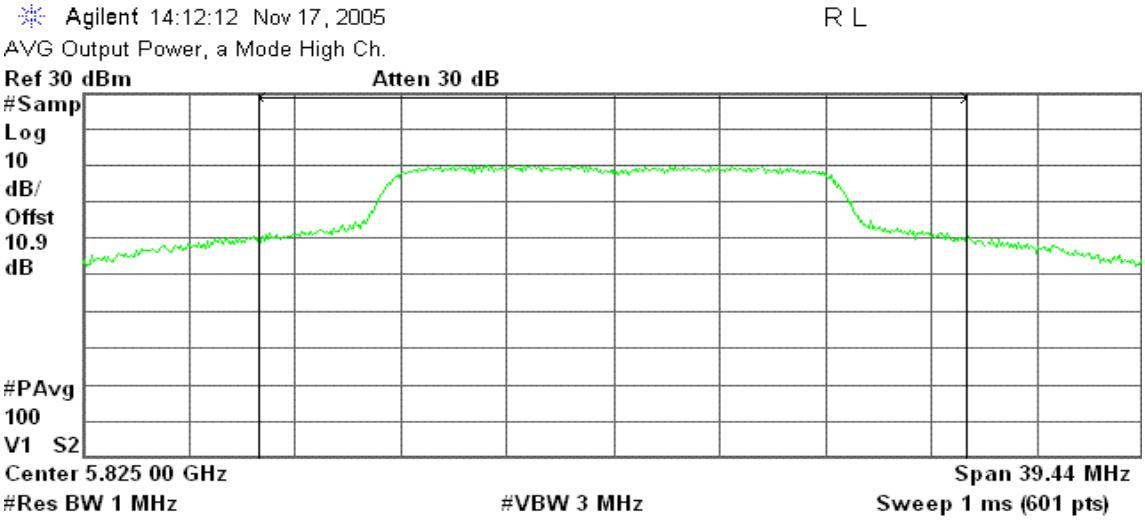
CH Mid



Channel Power
15.84 dBm / 16.7360 MHz

Power Spectral Density
-56.40 dBm/Hz

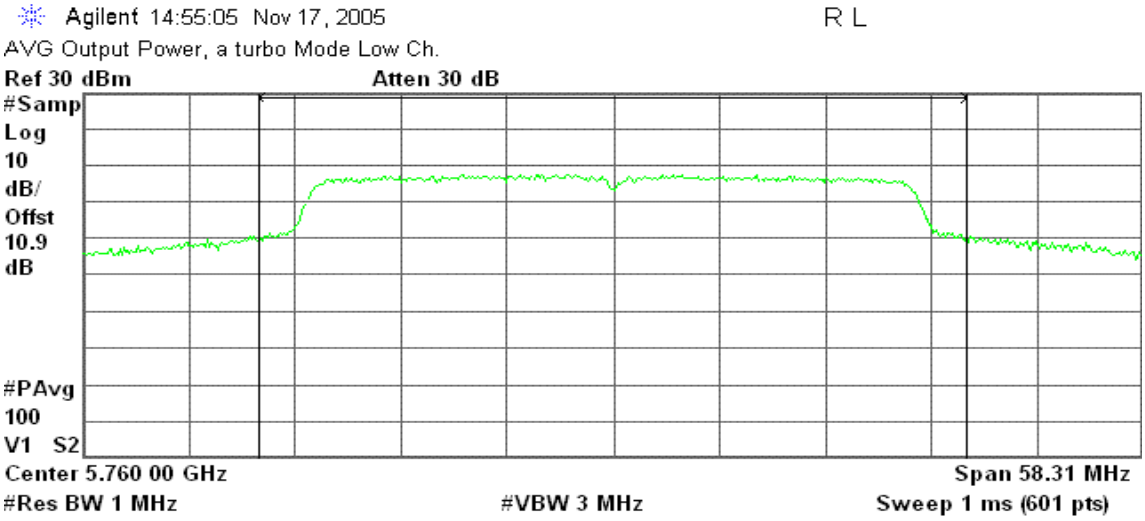
CH High



Channel Power	Power Spectral Density
20.99 dBm / 26.2950 MHz	-53.21 dBm/Hz

IEEE 802.11a Turbo mode

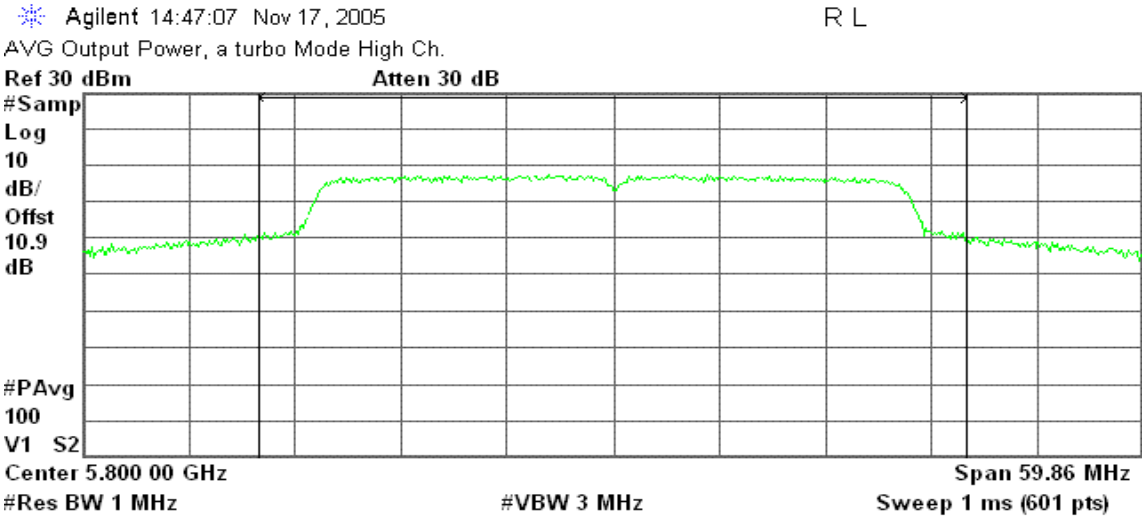
CH Low



Channel Power
21.19 dBm / 38.8740 MHz

Power Spectral Density
-54.71 dBm/Hz

CH High



Channel Power
21.29 dBm / 39.9050 MHz

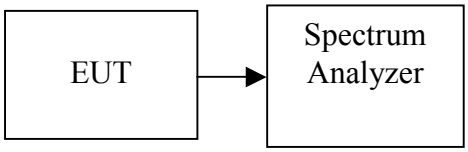
Power Spectral Density
-54.72 dBm/Hz

1.17 PEAK POWER SPECTRAL DENSITY

LIMIT

1. According to §15.247(e), for digitally modulated systems, the 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.
2. According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3 kHz, VBW = 10 kHz, Span = 300 kHz, Sweep = 100 s
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

Test Data

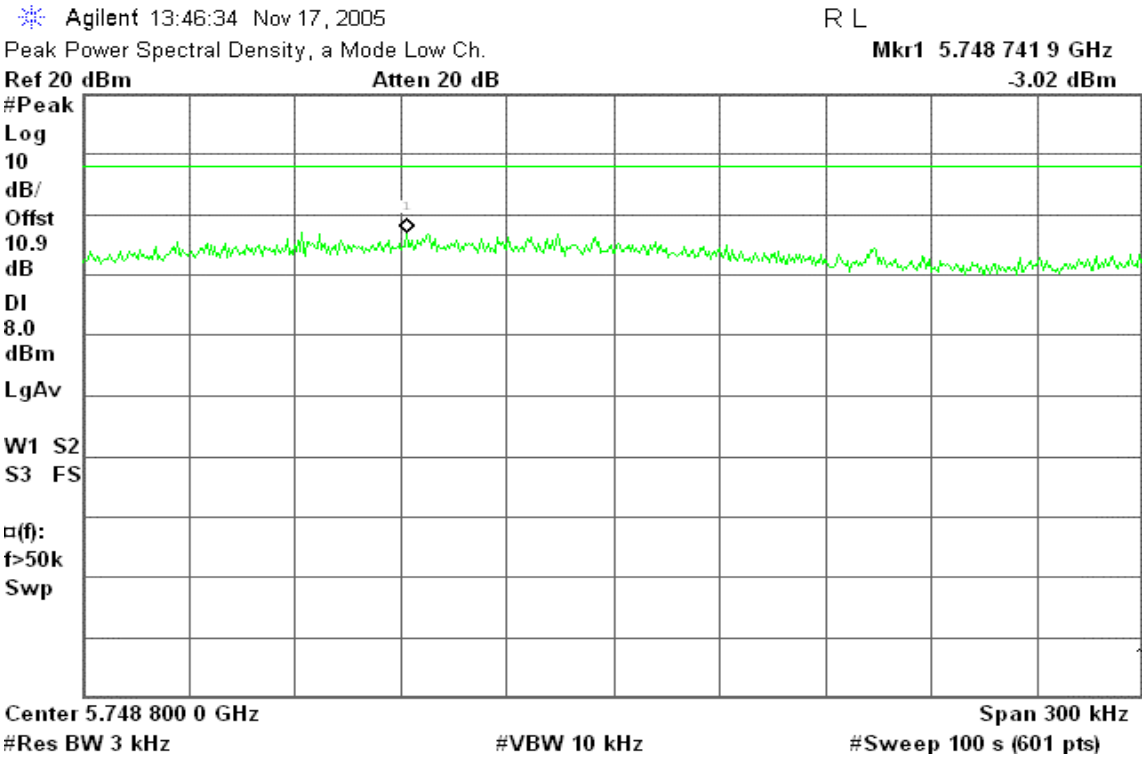
Channel	Frequency (MHz)		PPSD (dBm)	Limit (dBm)	Result
Low	Base mode	5745	-3.02	8	PASS
Mid		5785	-8.22		PASS
High		5825	-2.84		PASS
Low	Turbo mode	5760	-5.66		PASS
High		5800	-5.42		PASS

Remark: *The EUT is a fixed, point to point device, so no reduction due to the antenna gain at 5745-5850MHz band.*

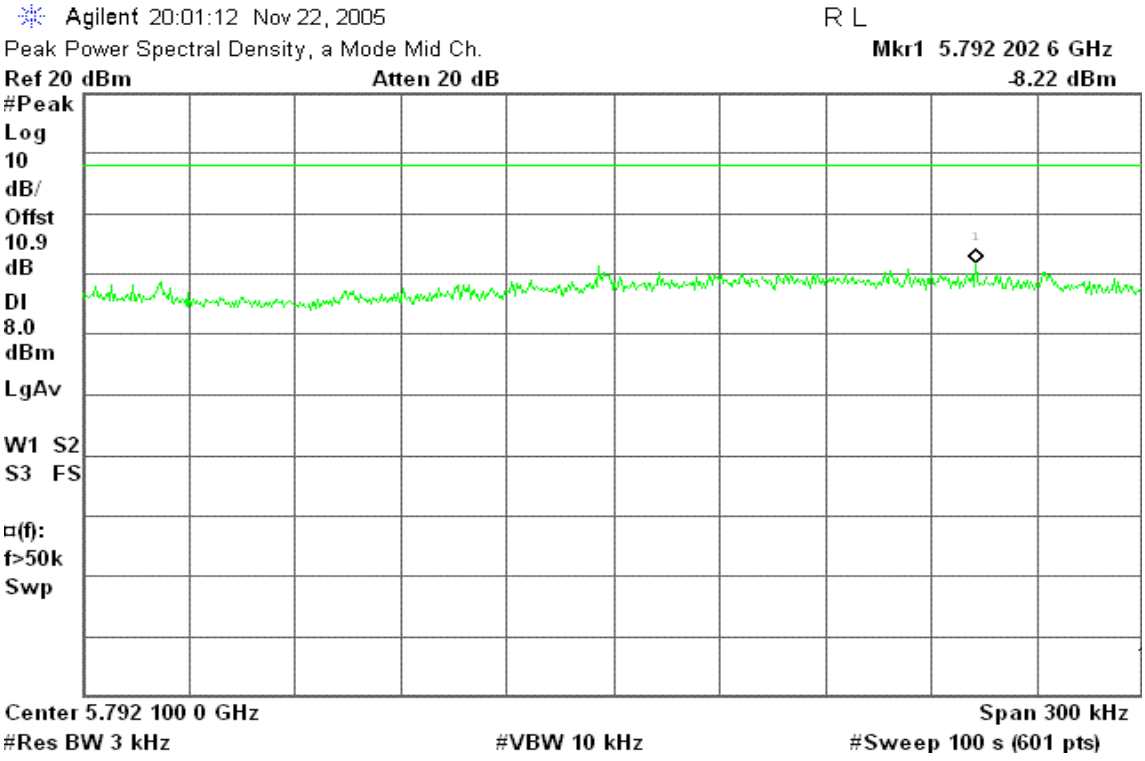
Test Plot

IEEE 802.11a Base mode

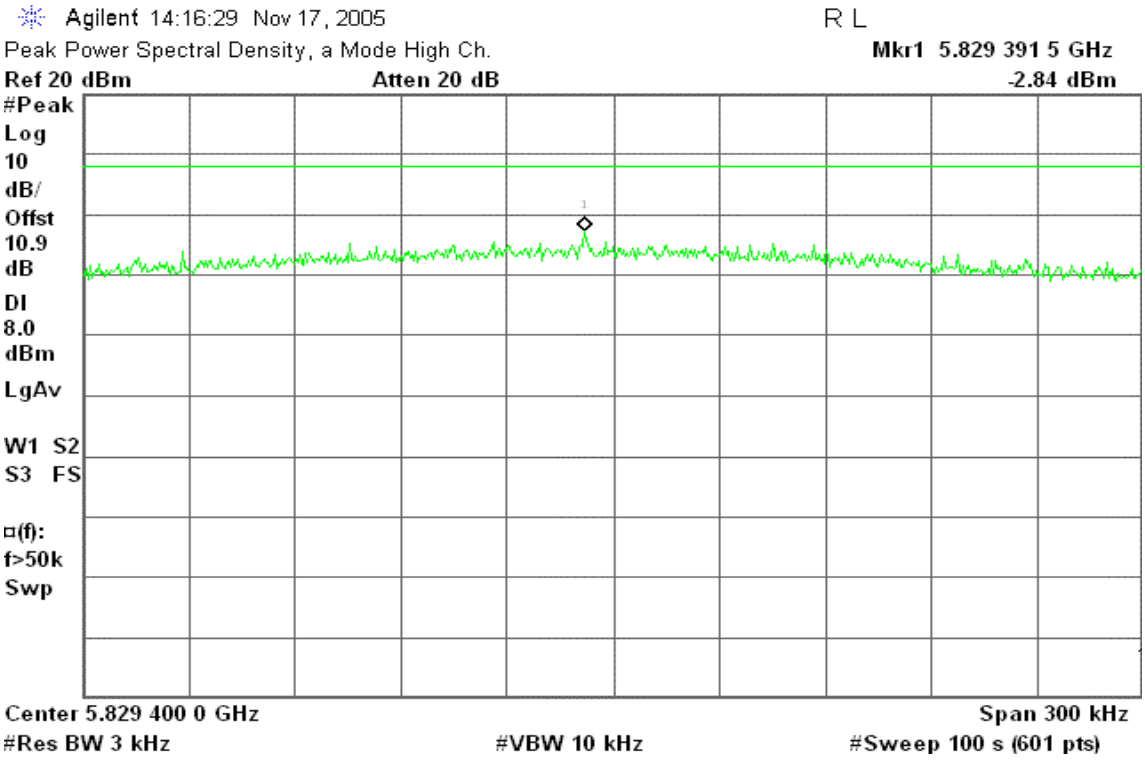
CH Low



CH Mid

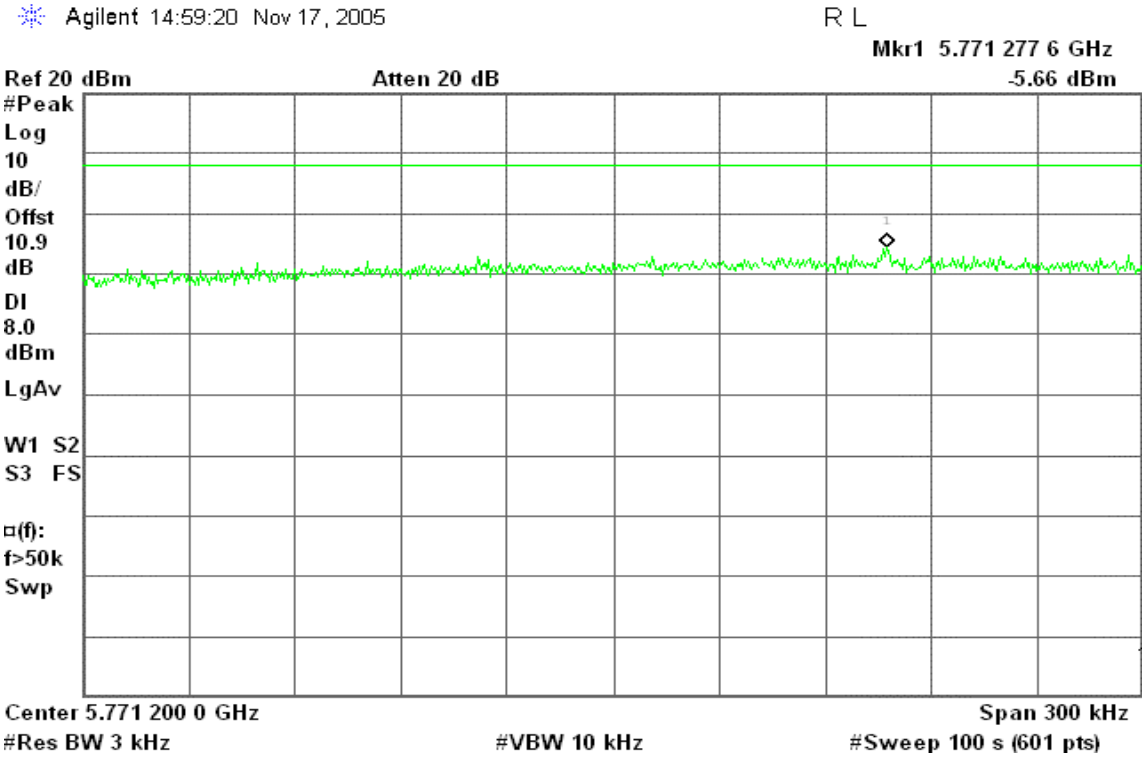


CH High

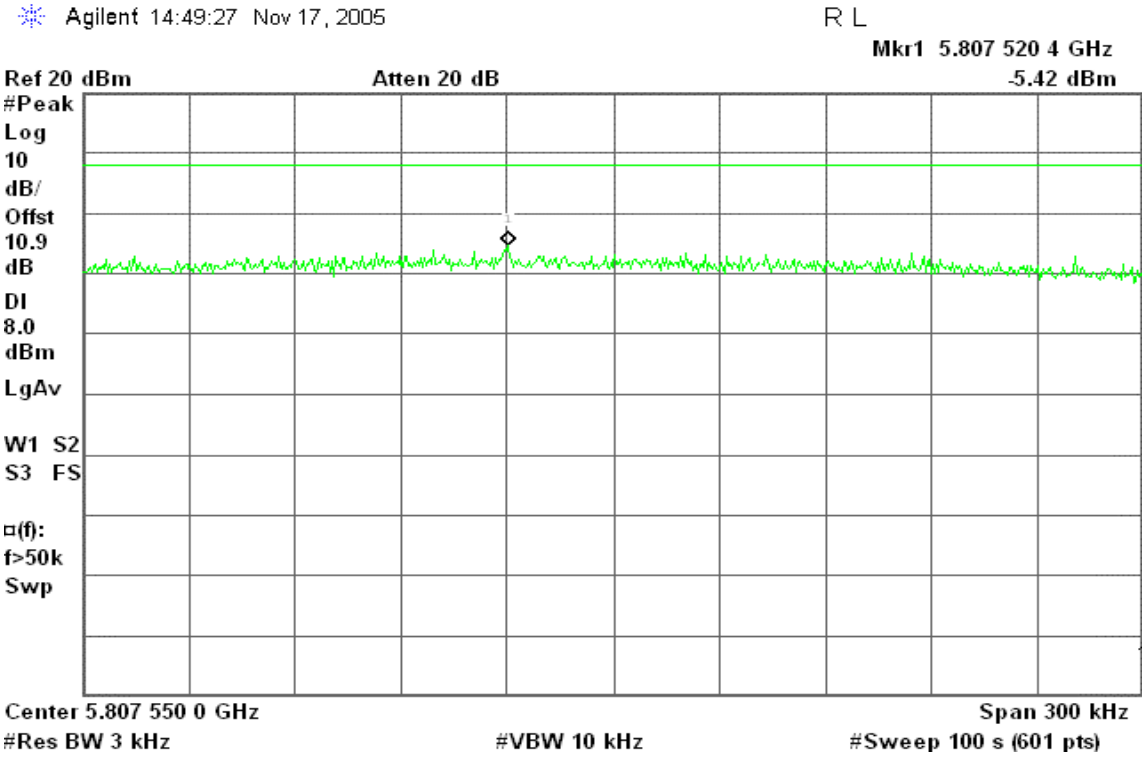

Agilent 14:16:29 Nov 17, 2005
R L
Peak Power Spectral Density, a Mode High Ch.
Mkr1 5.829 391 5 GHz
Ref 20 dBm
Atten 20 dB
-2.84 dBm
#Peak
Log
10
dB/
Offst
10.9
dB
Dl
8.0
dBm
LgAv
W1 S2
S3 FS
¤(f):
f>50k
Swp
Center 5.829 400 0 GHz
Span 300 kHz
#Res BW 3 kHz
#VBW 10 kHz
#Sweep 100 s (601 pts)

IEEE 802.11a Turbo mode

CH Low



CH High



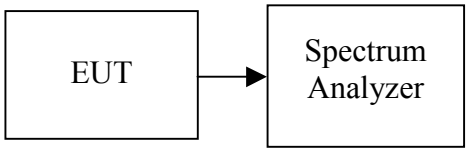
1.18 SPURIOUS EMISSIONS

1.18.1 Conducted Measurement

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

Measurements are made over the 30MHz to 40GHz range with the transmitter set to the lowest, middle, and highest channels.

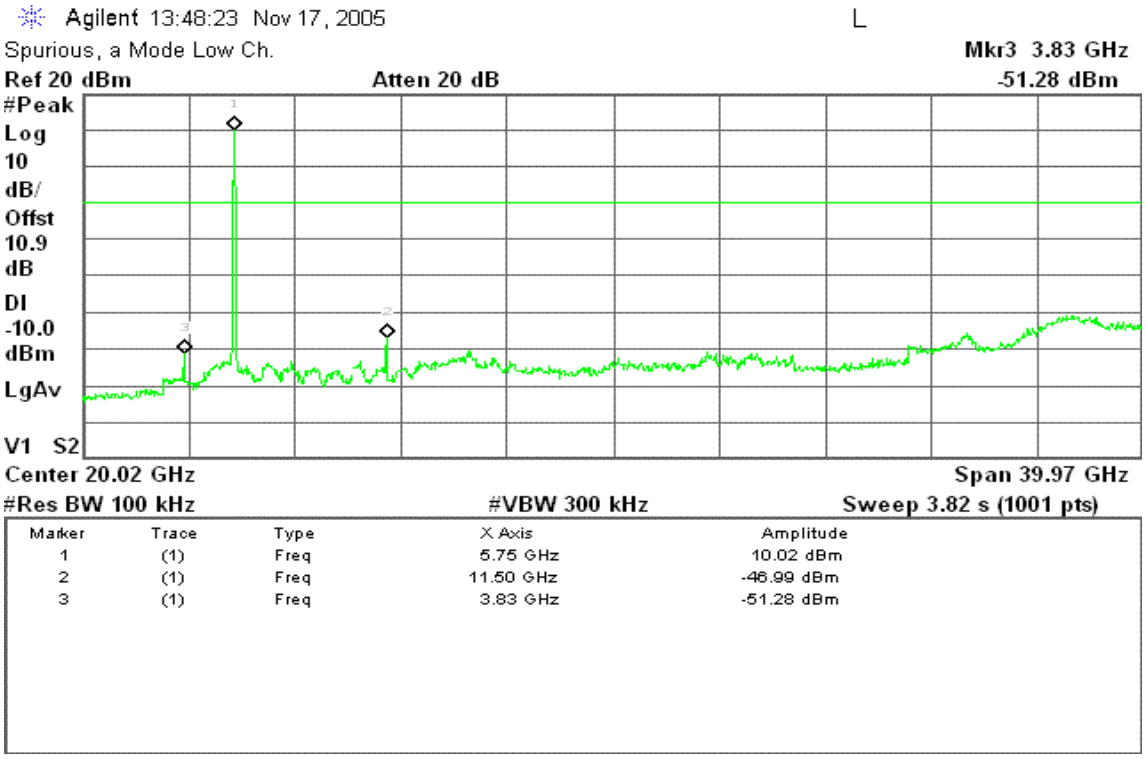
TEST RESULTS

No non-compliance noted

Test Plot

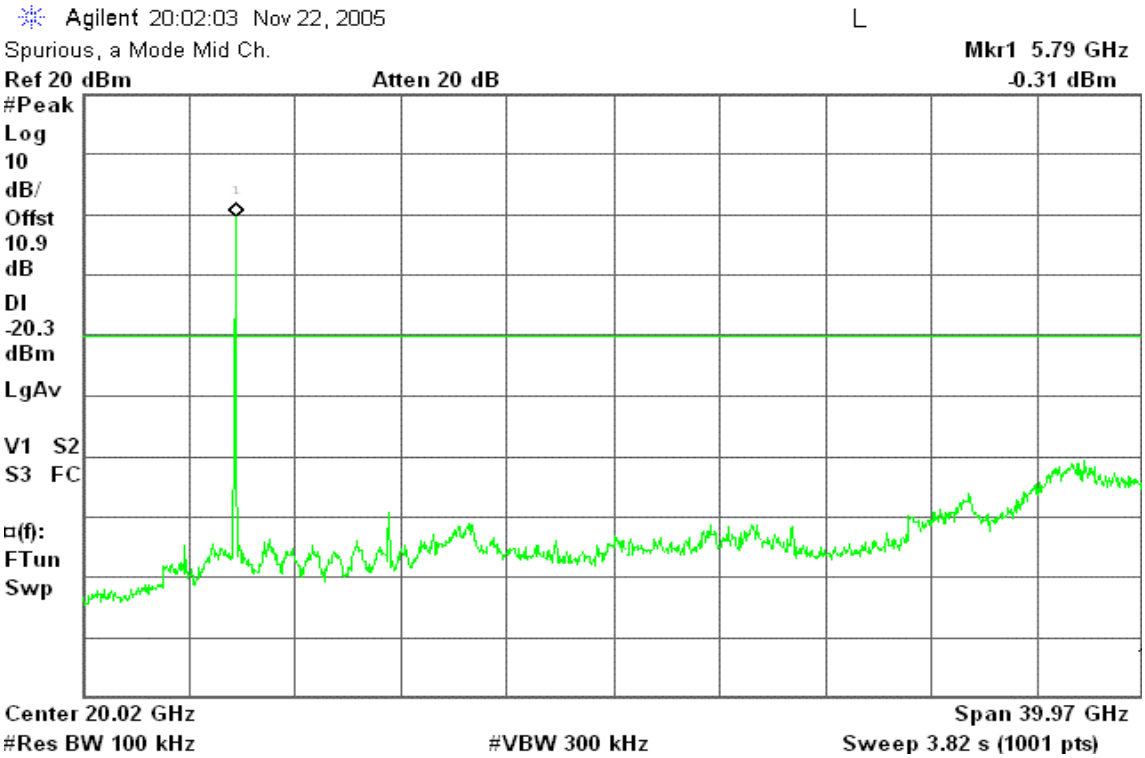
IEEE 802.11a Base mode / CH Low

30MHz ~ 40GHz



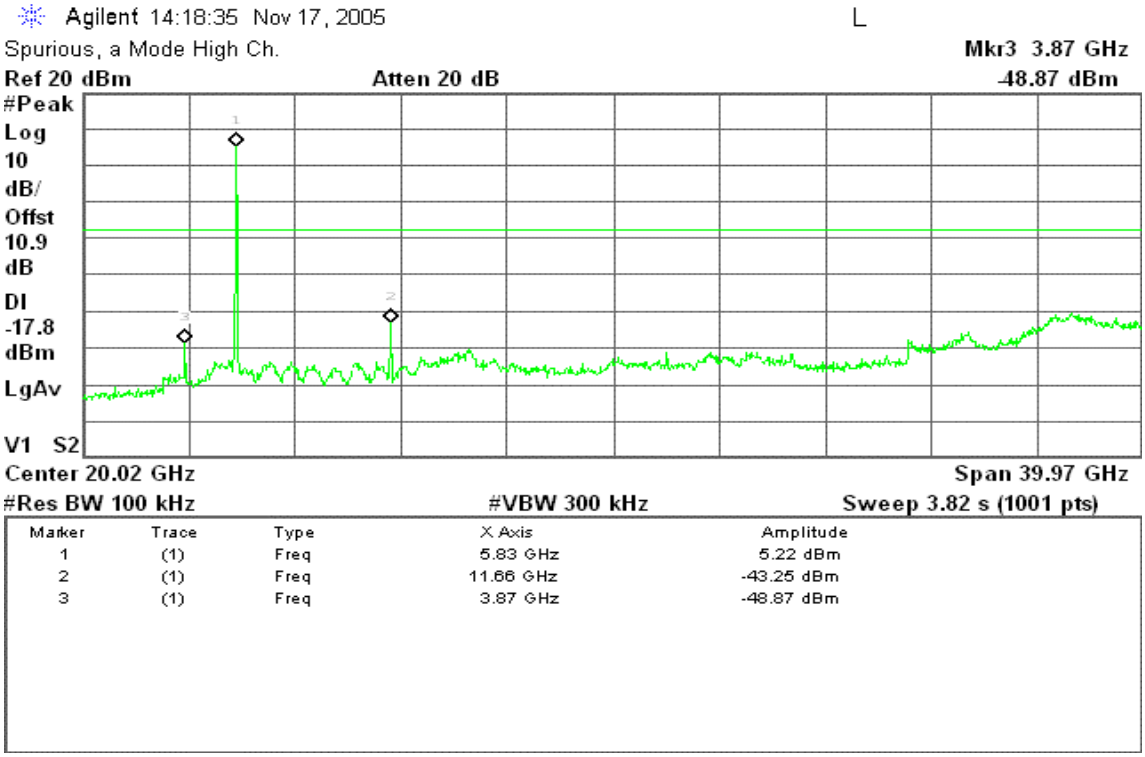
IEEE 802.11a Base mode / CH Mid

30MHz ~ 40GHz



IEEE 802.11a Base mode / CH High

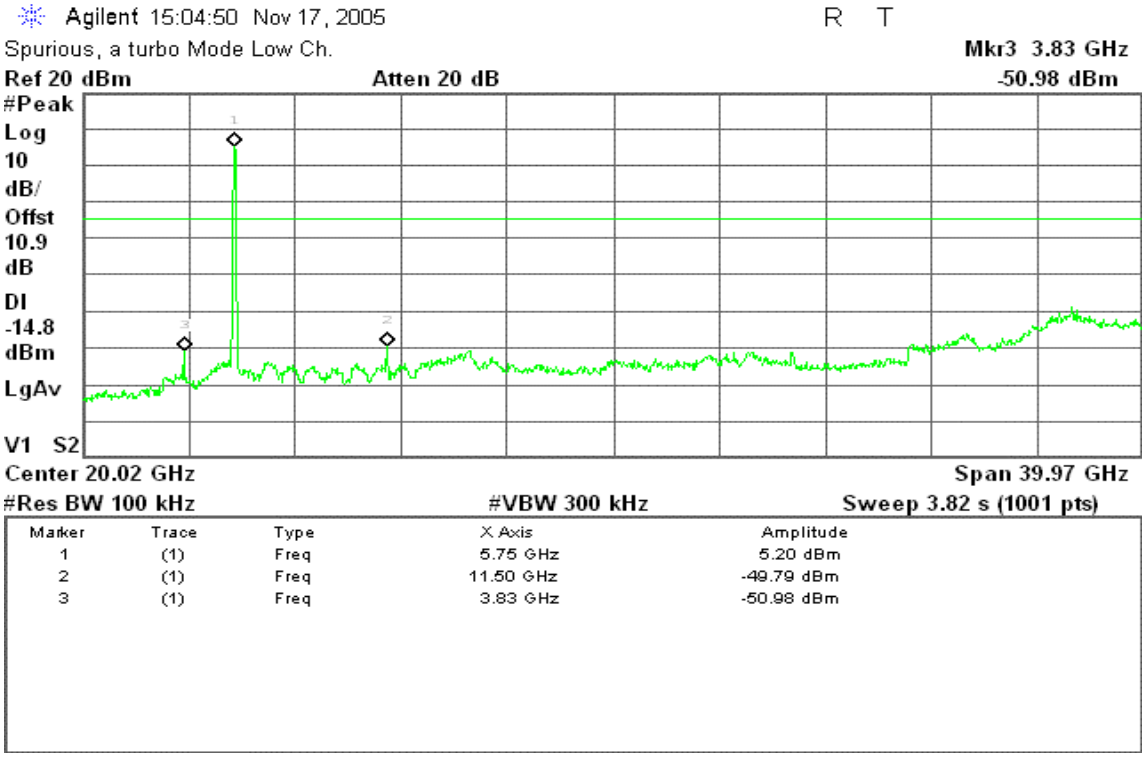
30MHz ~ 40GHz



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.83 GHz	5.22 dBm
2	(1)	Freq	11.66 GHz	-43.25 dBm
3	(1)	Freq	3.87 GHz	-48.87 dBm

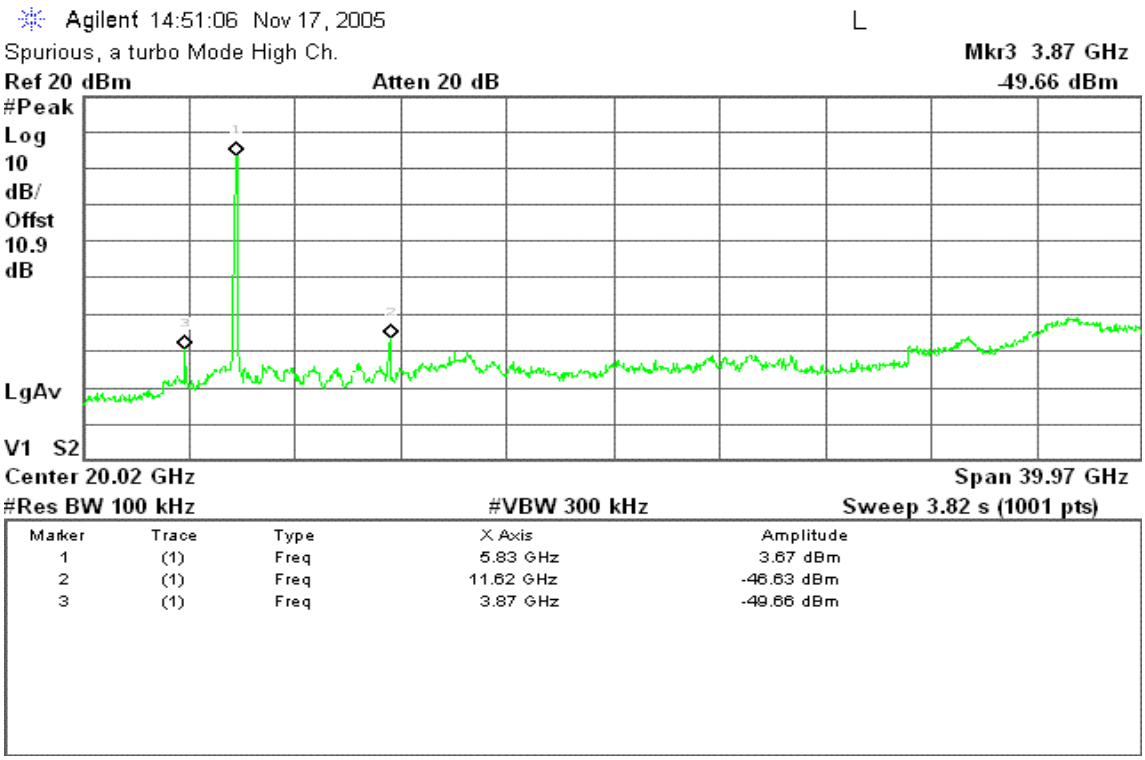
IEEE 802.11a Turbo mode / CH Low

30MHz ~ 40GHz



IEEE 802.11a Turbo mode / CH High

30MHz ~ 40GHz



1.18.2 Radiated Emissions

LIMIT

1. According to §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 (μV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

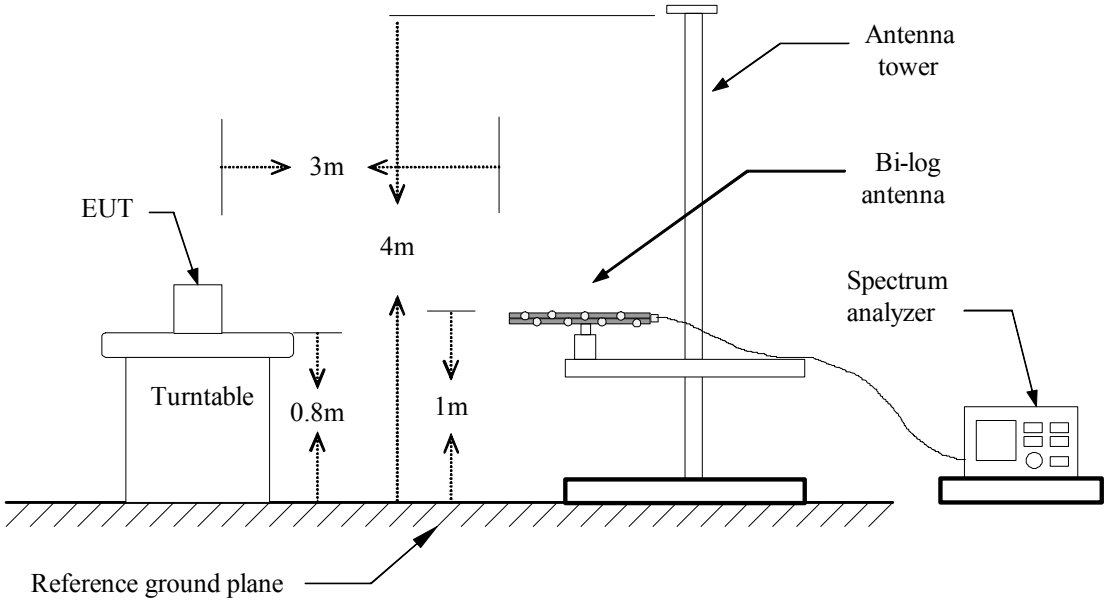
Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

2. In the emission table above, the tighter limit applies at the band edges.

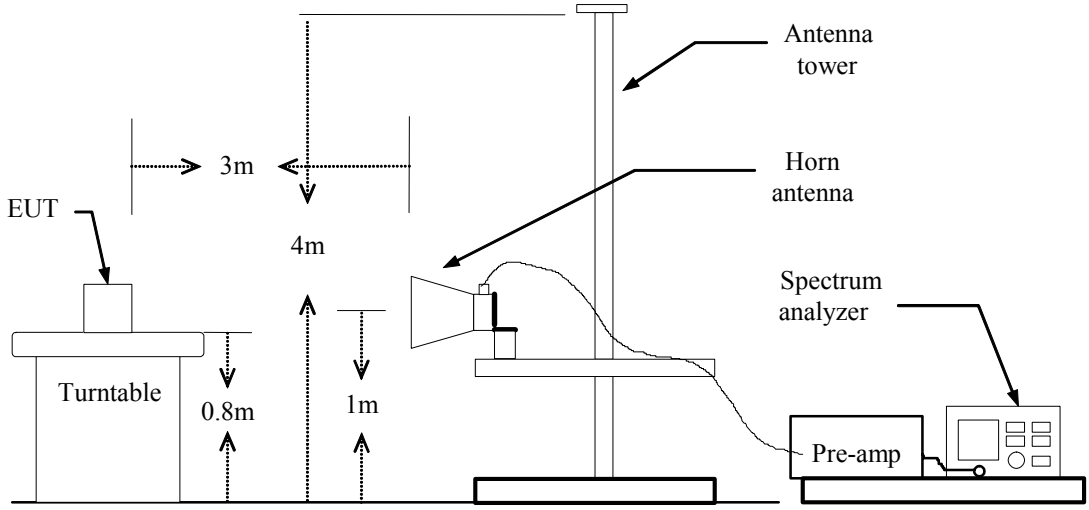
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

Below 1 GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

   Below 1GHz:

   RBW=100kHz / VBW=300kHz / Sweep=AUTO

   Above 1GHz:

   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

Repeat above procedures until the measurements for all frequencies are complete.

TEST RESULTS

Below 1 GHz

Operation Mode: Normal Link **Test Date:** November 21, 2005

Temperature: 26°C **Tested by:** Bruce Chen

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (QP) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (QP) (dBuV/m)	Limit (QP) (dBuV/m)	Margin (dB)	Remark
137.00	V	48.76	---	-16.73	32.03	---	43.50	-11.47	Peak
247.30	V	49.33	---	-12.16	37.17	---	46.00	-8.83	Peak
389.00	V	40.05	---	-9.36	30.69	---	46.00	-15.31	Peak
454.50	V	38.51	---	-8.95	29.56	---	46.00	-16.44	Peak
632.80	V	37.26	---	-5.86	31.40	---	46.00	-14.60	Peak
855.80	V	35.91	---	-3.12	32.79	---	46.00	-13.21	Peak
178.30	H	48.90	---	-15.28	33.62	---	43.50	-9.88	Peak
232.30	H	41.77	---	-12.70	29.07	---	46.00	-16.93	Peak
332.30	H	38.44	---	-10.23	28.21	---	46.00	-17.79	Peak
458.00	H	39.92	---	-8.89	31.03	---	46.00	-14.97	Peak
559.95	H	46.46	---	-7.10	39.36	---	46.00	-6.64	Peak
753.25	H	36.84	---	-4.63	32.21	---	46.00	-13.79	Peak

Remark:

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
3. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m)*

Above 1 GHz

Operation Mode: TX IEEE 802.11a Base mode / CH Low **Test Date:** November 21, 2005

Temperature: 26°C **Tested by:** Bruce Chen

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
11484.00	V	52.63	38.77	10.71	63.34	49.48	74.00	54.00	-4.52	AVG
N/A										
11484.00	H	45.94	32.22	10.71	56.65	42.93	74.00	54.00	-11.07	AVG
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX IEEE 802.11a Base mode / CH Mid **Test Date:** November 21, 2005

Temperature: 26°C **Tested by:** Bruce Chen

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
11567.00	V	57.43	41.39	10.67	68.10	52.06	74.00	54.00	-1.94	AVG
N/A										
11567.00	H	48.20	31.67	10.67	58.87	42.34	74.00	54.00	-11.66	AVG
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX IEEE 802.11a Base mode / CH High **Test Date:** November 21, 2005

Temperature: 26°C **Tested by:** Bruce Chen

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
11655.00	V	53.13	39.64	10.65	63.78	50.29	74.00	54.00	-3.71	AVG
N/A										
11655.00	H	51.98	37.70	10.65	62.63	48.35	74.00	54.00	-5.65	AVG
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX IEEE 802.11a Turbo mode / CH Low **Test Date:** November 21, 2005

Temperature: 26°C **Tested by:** Bruce Chen

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
11528.00	V	49.93	35.81	10.68	60.61	46.49	74.00	54.00	-7.51	AVG
N/A										
11528.00	H	47.03	32.66	10.68	57.71	43.34	74.00	54.00	-10.66	AVG
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX IEEE 802.11a Turbo mode / CH High **Test Date:** November 21, 2005

Temperature: 26°C **Tested by:** Bruce Chen

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
11596.00	V	56.74	41.52	10.66	67.40	52.18	74.00	54.00	-1.82	AVG
N/A										
11596.00	H	48.52	33.95	10.66	59.18	44.61	74.00	54.00	-9.39	AVG
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

1.19 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §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 μH/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 Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

***** *Decreases with the logarithm of the frequency.*

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Test Data

Operation Mode:	Normal Link	**Test Date:**	November 22, 2005
Temperature:	25°C	**Tested by:**	Bruce Chen
Humidity:	55% RH		

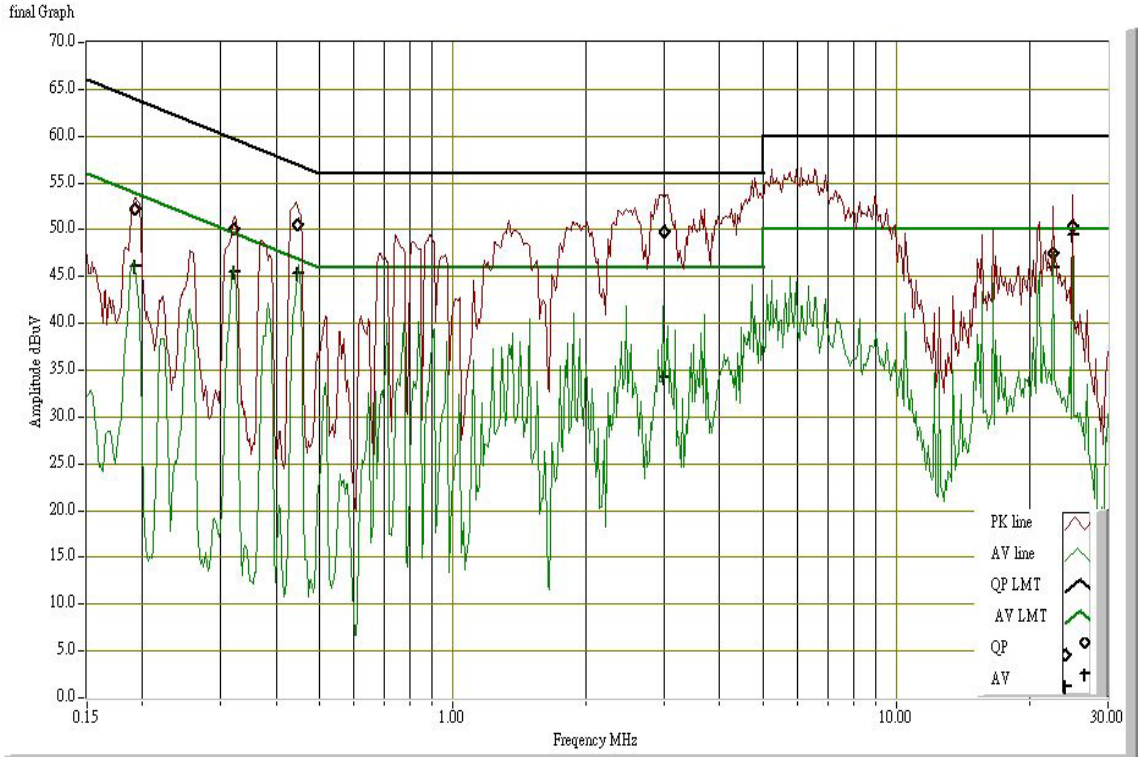
Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB)	QP Result (dBuV)	AV Result (dBuV)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.192	52.200	46.050	0.116	52.316	46.166	63.950	53.950	-11.634	-7.784	L1
0.322	50.110	45.470	0.100	50.210	45.570	59.655	49.655	-9.445	-4.085	L1
0.447	50.490	45.280	0.100	50.590	45.380	56.931	46.931	-6.341	-1.551	L1
3.001	49.690	34.200	0.100	49.790	34.300	56.000	46.000	-6.210	-11.700	L1
22.530	47.490	45.910	1.200	48.690	47.110	60.000	50.000	-11.310	-2.890	L1
24.989	50.340	47.460	1.200	51.540	48.660	60.000	50.000	-8.460	-1.340	L1
0.191	50.490	45.950	0.118	50.608	46.068	63.993	53.993	-13.385	-7.925	L2
0.450	49.480	45.880	0.100	49.580	45.980	56.875	46.875	-7.295	-0.895	L2
3.073	48.480	32.570	0.100	48.580	32.670	56.000	46.000	-7.420	-13.330	L2
5.768	53.450	44.530	0.277	53.727	44.807	60.000	50.000	-6.273	-5.193	L2
22.530	47.170	45.160	1.200	48.370	46.360	60.000	50.000	-11.630	-3.640	L2
24.989	49.780	46.870	1.200	50.980	48.070	60.000	50.000	-9.020	-1.930	L2

Remark:

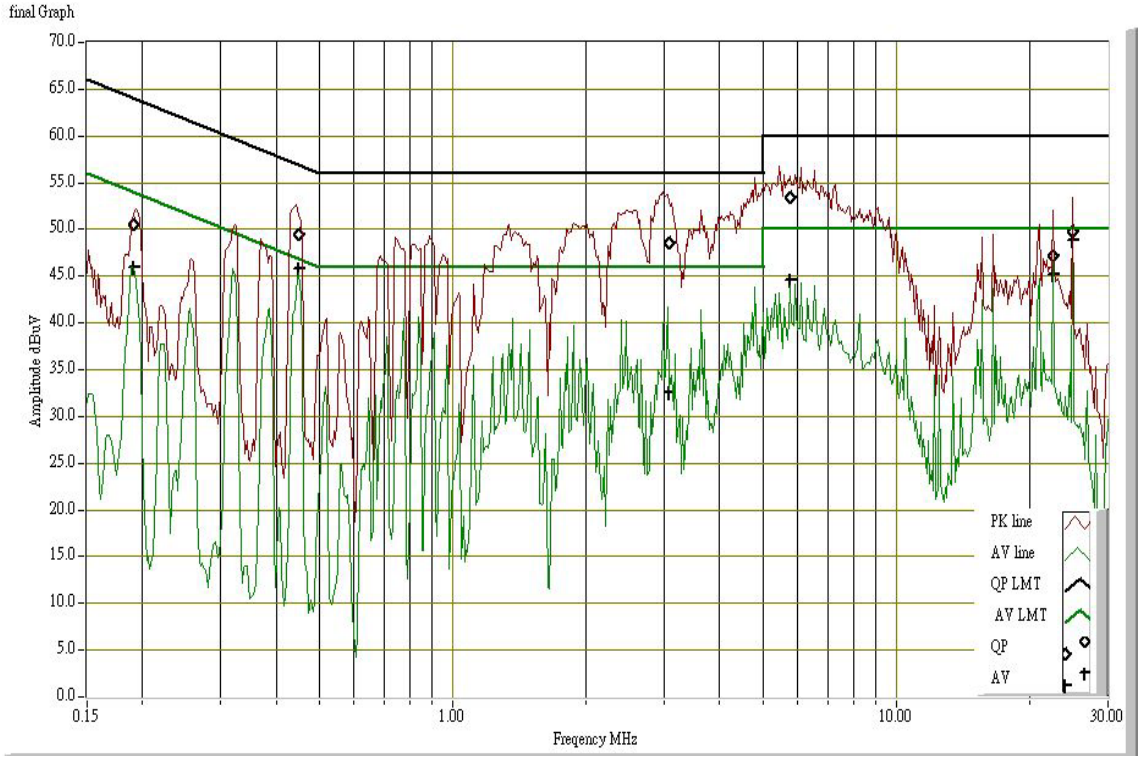
1. *Measuring frequencies from 0.15 MHz to 30MHz.*
2. *The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.*
3. *The IF bandwidth of SPN between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz;*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)



APPENDIX I
RADIO FREQUENCY EXPOSURE

LIMIT

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §15.247(b)(4) and §1.1307(b)(1) of this chapter.

EUT Specification

EUT	802.11a High power Bridge
Frequency band (Operating)	☐ WLAN: 2.412GHz ~ 2.462GHz ☒ WLAN: 5.745GHz ~ 5.825GHz ☐ Others _____
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm2) ☒ General Population/Uncontrolled exposure *(S=1mW/cm2)*
Antenna diversity	☒ Single antenna ☐ Multiple antennas ☐ TX diversity ☐ RX diversity ☐ TX/RX diversity
Max. output power	Base mode: 24.86 dBm (306.20mW) Turbo mode: 25.00dBm (316.23mW)
Antenna gain (Max)	23 dBi (Numeric gain: 199.53)
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A

Remark:

1. *The maximum output power is 25.00dBm (316.23mW) at 5760MHz (with 199.53 numeric antenna gain.)*
2. *DTS device is not subject to routine RF evaluation, MPE estimate is used to justify the compliance.*
3. *For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is 1.0 mW/cm2 even if the calculation indicates that the power density would be larger.*
4. *For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20 cm, even if the calculations indicate that the MPE distance would be lesser.*

TEST RESULTS

No non-compliance noted.

Calculation

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{3770}$

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 re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

d (cm) = d(m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ ***Equation 1***

Where *d = Distance in cm*
P = Power in mW
G = Numeric antenna gain
S = Power density in mW / cm²

Maximum Permissible Exposure

EUT output power = 316.23mW

Numeric Antenna gain = 199.53

Substituting the MPE safe distance using d = 20 cm into Equation 1:

Yields

$$S = 0.000199 \times P \times G$$

Where *P = Power in mW*
G = Numeric antenna gain
S = Power density in mW / cm²

→ Power density = 12.56 mW / cm²

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm² even if the calculation indicates that the power density would be larger.)

Calculation

Given $E = \sqrt{\frac{30 \times P \times G}{d}}$ & $S = \frac{E^2}{3770}$

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 re-arranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{\frac{30 \times P \times G}{3770 \times S}}$$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

*d (cm) =100 * d (m)*

Yields

$$d = 100 \times \sqrt{\frac{30 \times (P/1000) \times G}{3770 \times S}} = 0.282 \times \sqrt{\frac{P \times G}{S}}$$

Where *d = distance in cm*
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW / cm^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and

G (numeric) = 10 ^ (G (dBi) / 10)

Yields

$$d = 0.282 \times \frac{10^{(P+G)/20}}{\sqrt{20}}$$ ***Equation 1***

Where *d = MPE safe distance in cm*
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW / cm^2

Maximum Permissible Exposure

EUT output power = 316.23 mW

Antenna Gain = 199.53

S = 1.0 mW / cm^2 from 1.1310 Table 1

Substituting these parameters into the above Equation 1:

→ *MPE Safe Distance =70.86cm*

(For mobile or fixed location transmitters, the minimum separation distance is 100 cm, even if calculations indicate that the MPE distance would be less.)