



7.5 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)(5) and §1.1307(b)(1) of this chapter.

EUT Specification

EUT	IEEE802.11b/g Wireless Mini-PCI
Frequency band (Operating)	<input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5.825GHz <input type="checkbox"/> Others
Device category	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm ²) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna diversity	<input type="checkbox"/> Single antenna <input checked="" type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input checked="" type="checkbox"/> Tx/Rx diversity
Max. output power	20.94 dBm (124.17mW)
Antenna gain (Max)	Dipole Antenna: Model / Gain: SA2-05035-A5 / 5.0 dBi (Numeric gain: 3.16) Model / Gain: THW0551A1 / 2.0 dBi (Numeric gain: 1.58) Model / Gain: THW0234A / 2.0 dBi (Numeric gain: 1.58) PIFA Antenna: Model / Gain: THW1055A1 / 0.0 dBi (Numeric gain: 1.00) Model / Gain: THW0354A / -3.0 dBi (Numeric gain: 0.50)
Evaluation applied	<input checked="" type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation

Remark:

- The maximum output power is 20.94dBm (124.17mW) at 2412MHz (with 3.16 numeric antenna gain.)*
- DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.*
- 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 $E = \sqrt{\frac{30 \times P \times G}{d}}$ & $S = \frac{E^2}{3770}$

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:

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

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

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 / cm²

Substituting the logarithmic form of power and gain using:

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

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

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 / cm²



Maximum Permissible Exposure (2.4 GHz Band)

EUT output power = 124.17mW

Antenna Gain = 3.16 (Numeric gain)

S = 1.0 mW / cm² from 1.1310 Table 1

Substituting these parameters into the above Equation 1:

→ MPE Safe Distance = 5.59 cm

(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 SPURIOUS EMISSIONS

7.6.1 Conducted Measurement

LIMIT

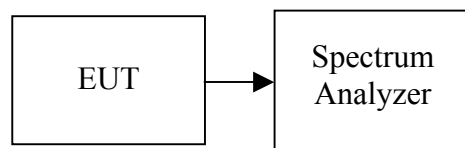
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

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

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 26GHz range with the transmitter set to the lowest, middle, and highest channels.

TEST RESULTS

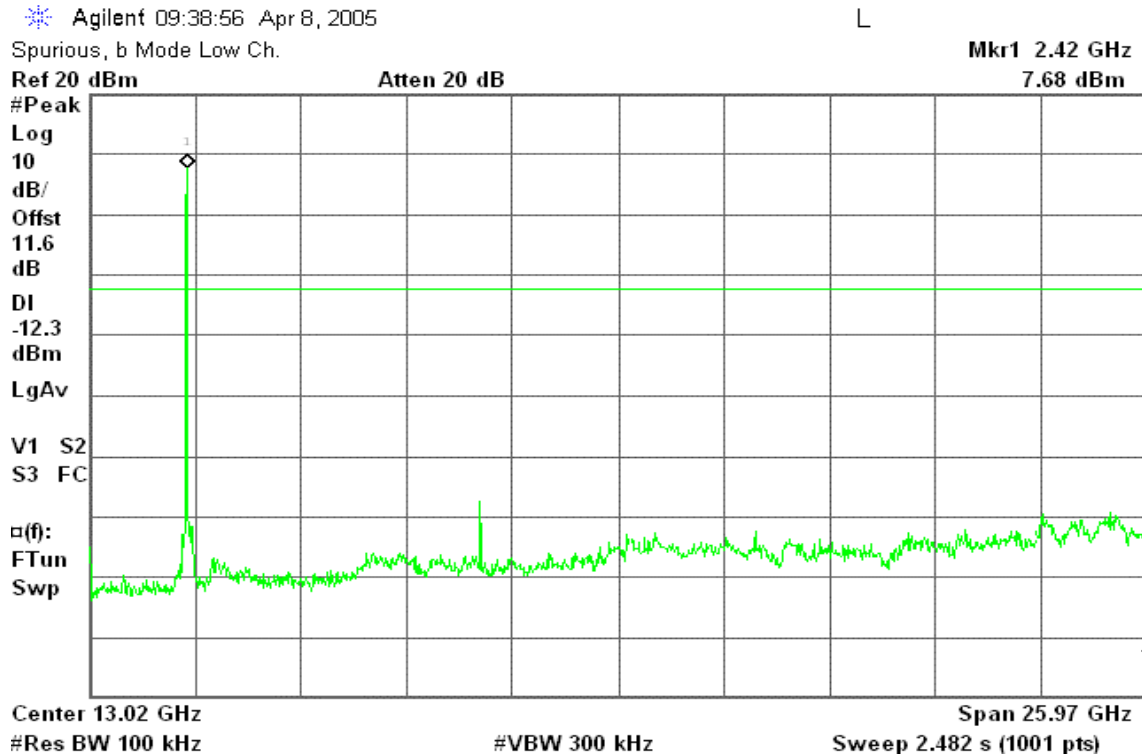
No non-compliance noted



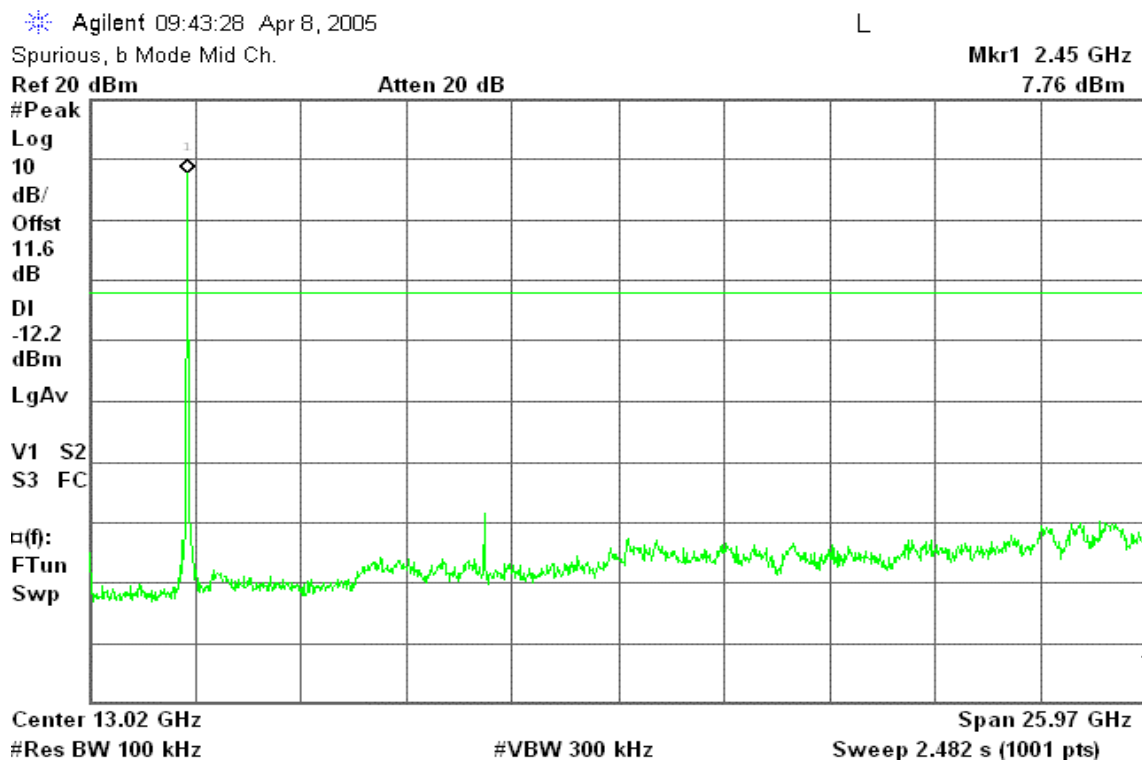
Test Plot

IEEE 802.11b Base mode

CH Low



CH Mid





CH High

Agilent 09:50:42 Apr 8, 2005

L

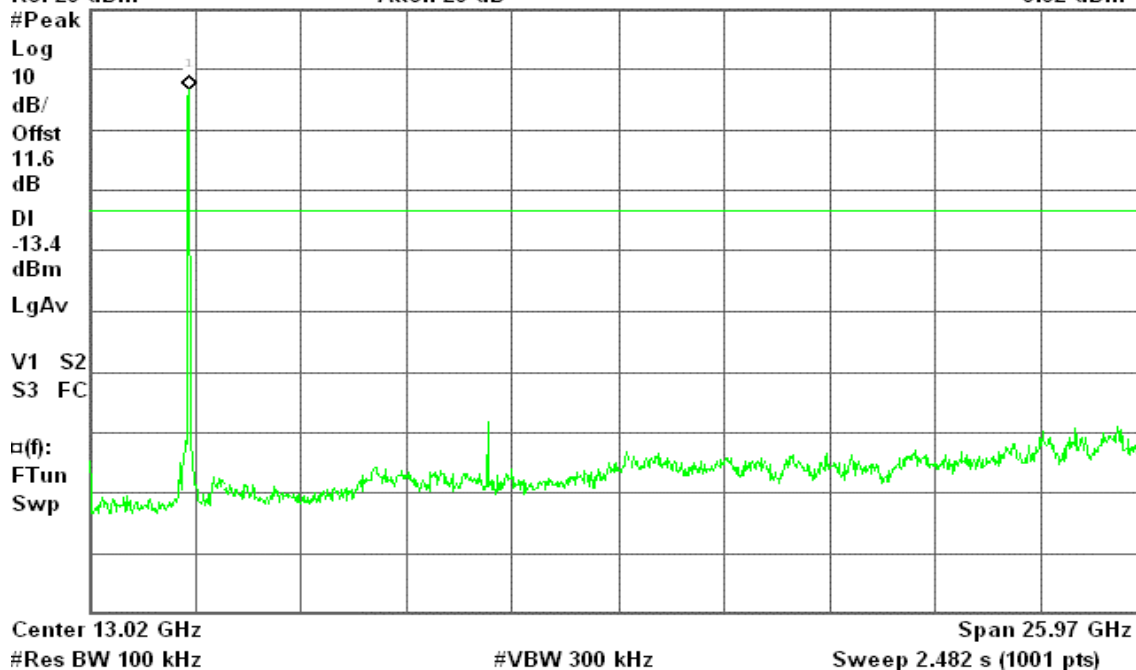
Spurious, b Mode High Ch.

Mkr1 2.47 GHz

Ref 20 dBm

Atten 20 dB

6.62 dBm



IEEE 802.11g Base mode

CH Low

Agilent 09:56:00 Apr 8, 2005

L

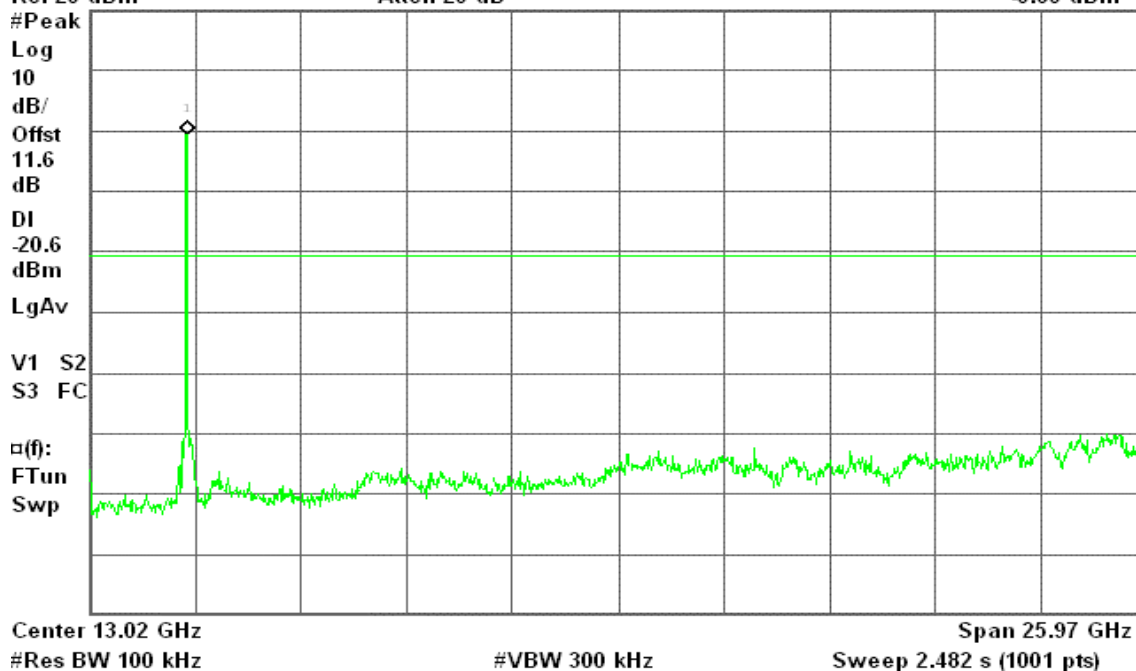
Spurious, g Mode Low Ch.

Mkr1 2.42 GHz

Ref 20 dBm

Atten 20 dB

-0.60 dBm





CH Mid

* Agilent 10:01:15 Apr 8, 2005

L

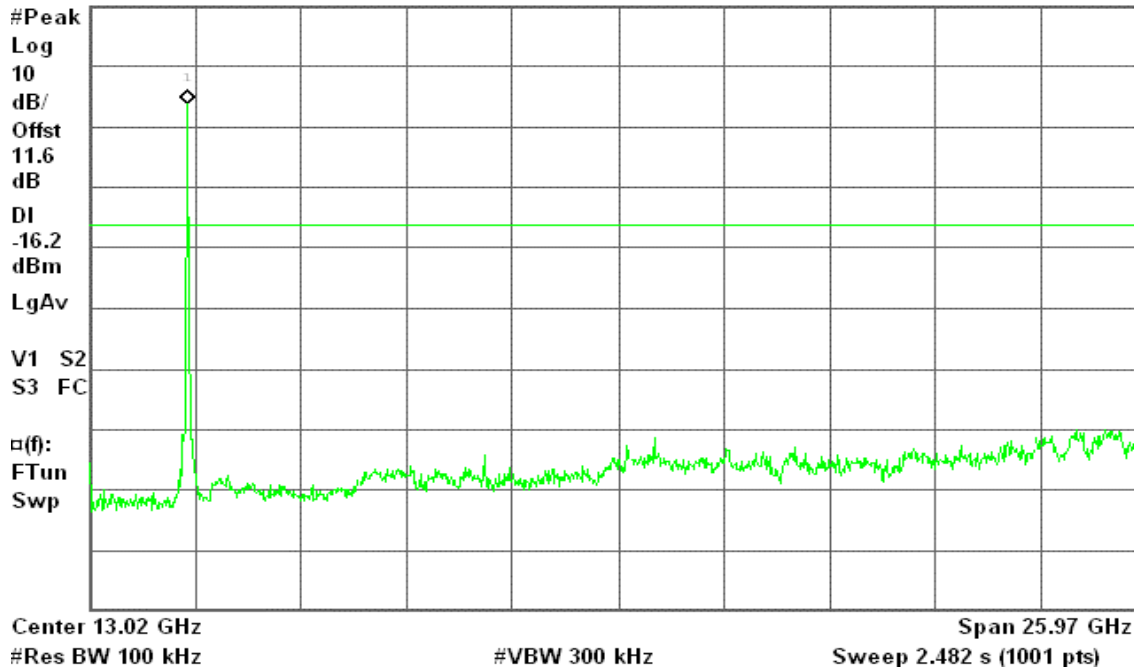
Spurious, g Mode Mid Ch.

Mkr1 2.45 GHz

Ref 20 dBm

Atten 20 dB

3.83 dBm



CH High

* Agilent 10:17:09 Apr 8, 2005

L

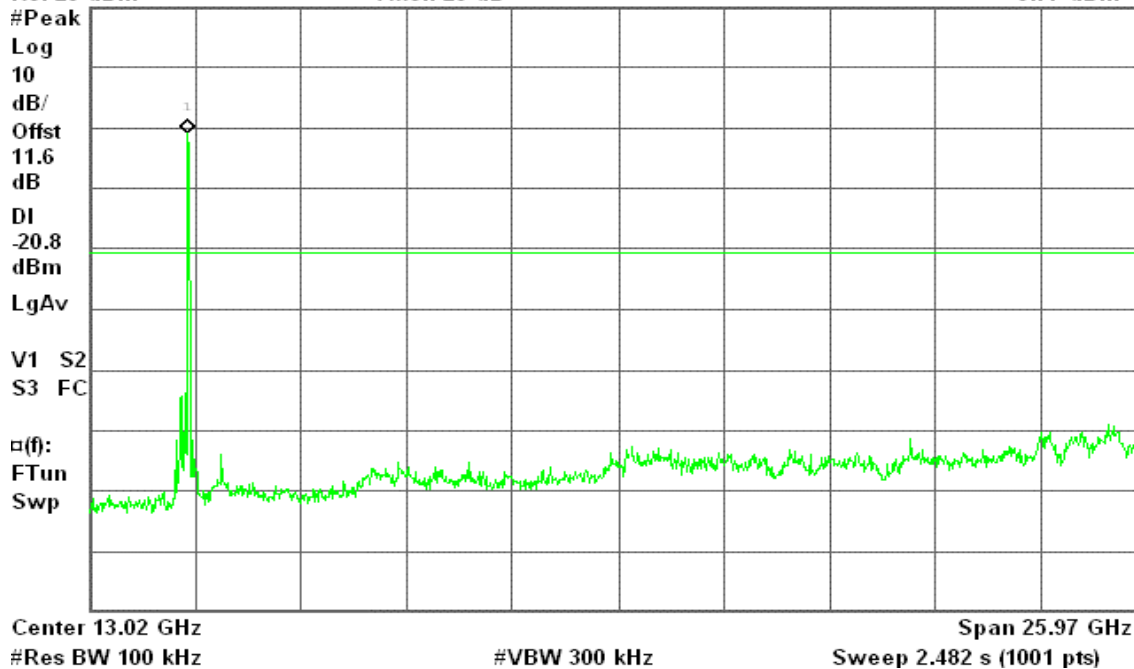
Spurious, g Mode High Ch.

Mkr1 2.45 GHz

Ref 20 dBm

Atten 20 dB

-0.77 dBm





IEEE 802.11g Turbo mode

CH Mid

Agilent 10:25:24 Apr 8, 2005

L

Spurious, g turbo Mode Mid Ch.

Mkr1 2.42 GHz

Ref 20 dBm

Atten 20 dB

1.24 dBm

#Peak

Log

10

dB/

Offst

11.6

dB

DI

-18.8

dBm

LgAv

V1 S2

S3 FC

□(f):

FTun

Swp

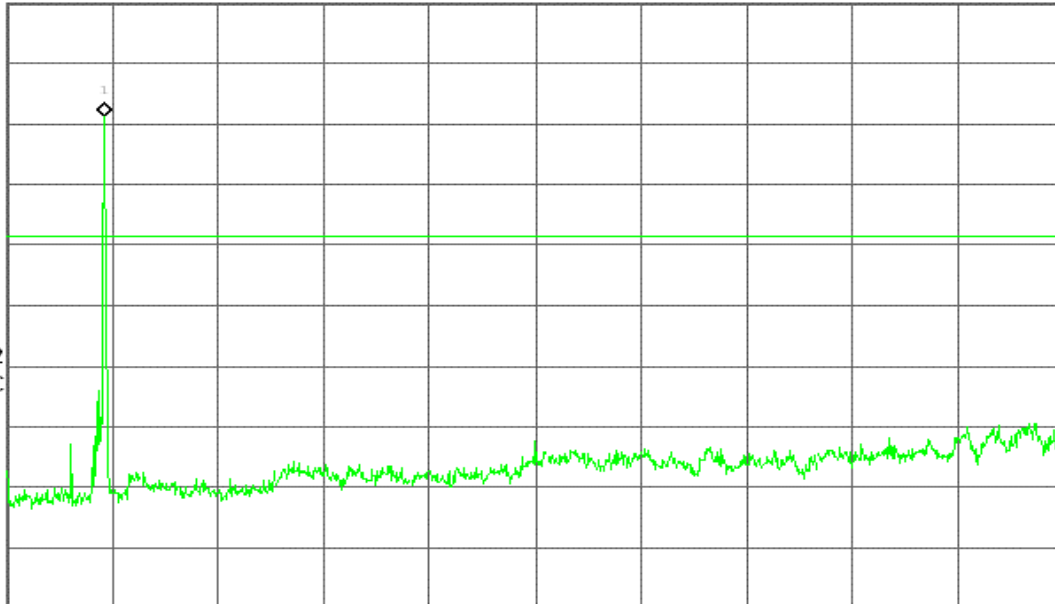
Center 13.02 GHz

#Res BW 100 kHz

#VBW 300 kHz

Span 25.97 GHz

Sweep 2.482 s (1001 pts)





7.6.2 RADIATED EMISSIONS

LIMIT

1. 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 (mV/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 above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength (μ V/m at 3-meter)	Field Strength (dB μ V/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

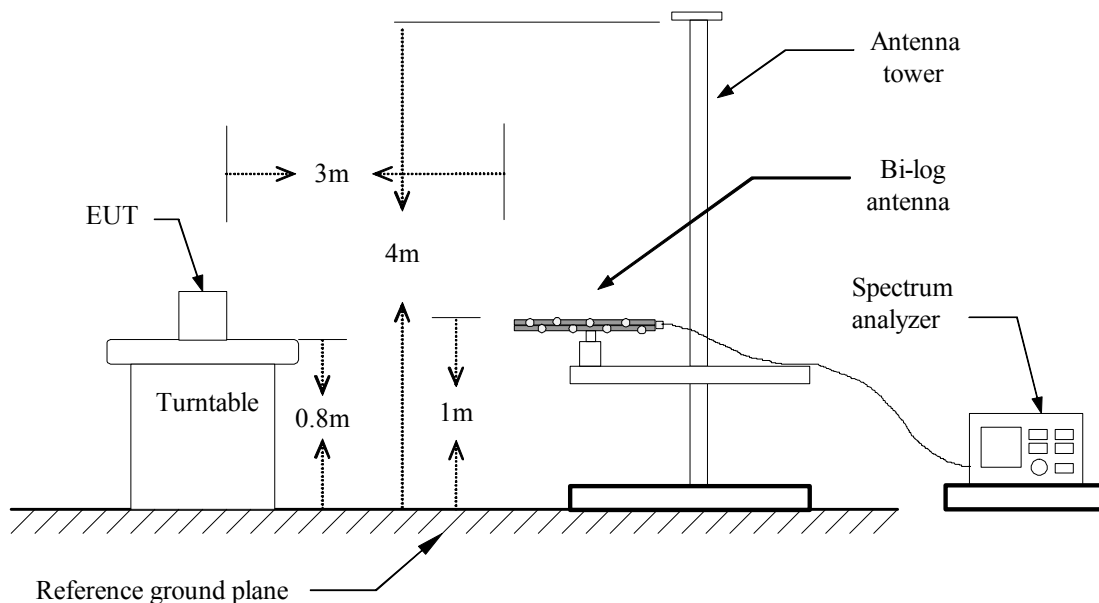
MEASUREMENT EQUIPMENT USED

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	09/23/2005
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	07/05/2005
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	09/06/2005

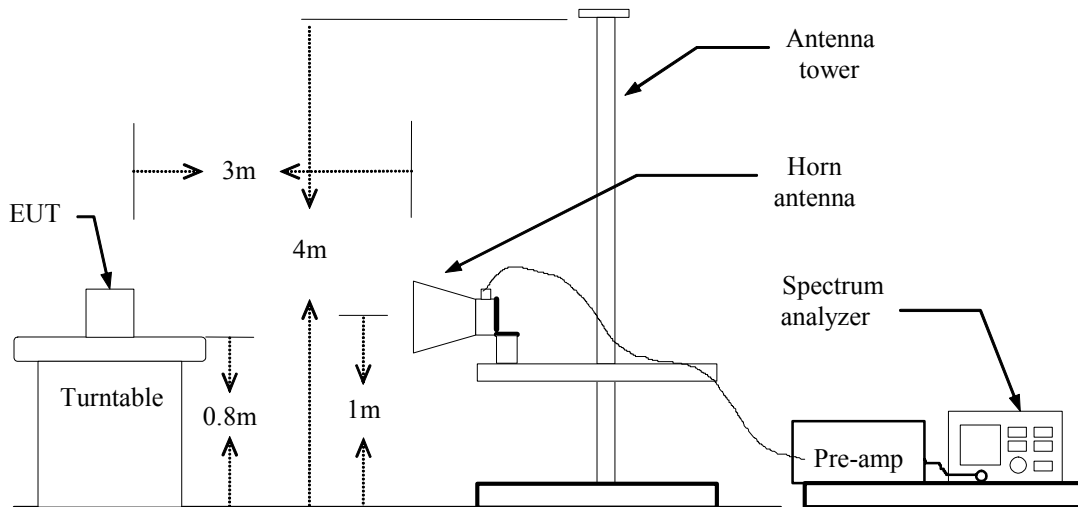
Remark: Each piece of equipment is scheduled for calibration once a year.

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

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



TEST RESULTS

Below 1 GHz

Operation Mode: Normal Link**Test Date:** April 13, 2005**Temperature:** 24°C**Tested by:** Roy Cheng**Humidity:** 67 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
166.35	V	Peak	14.12	11.87	25.99	43.50	-17.51
171.75	V	Peak	13.64	12.29	25.93	43.50	-17.57
232.95	V	Peak	11.87	15.53	27.40	46.00	-18.60
270.30	V	Peak	10.25	15.82	26.07	46.00	-19.93
365.33	V	Peak	7.42	18.85	26.27	46.00	-19.73
568.33	V	Peak	3.62	24.68	28.30	46.00	-17.70
100.20	H	Peak	23.36	14.10	37.46	43.50	-6.04
133.05	H	Peak	21.52	11.11	32.63	43.50	-10.87
200.50	H	Peak	16.37	14.93	31.30	43.50	-12.20
233.85	H	Peak	17.70	15.67	33.37	46.00	-12.63
315.17	H	Peak	19.16	17.09	36.25	46.00	-9.75
367.67	H	Peak	18.47	18.98	37.45	46.00	-8.55

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 detector mode.
3. 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.
4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.

**Above 1 GHz****Test mode: Dipole Antenna / SA2-05035-A5 / 5.0 dBi****Operation Mode:** TX / IEEE 802.11b Base mode / CH Low **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1073.00	V	58.83	---	-13.11	45.72	---	74.00	54.00	-8.28	Peak
3222.00	V	49.79	---	-7.94	41.85	---	74.00	54.00	-12.15	Peak
9650.00	V	48.47	43.54	6.58	55.05	50.12	74.00	54.00	-3.88	AVG
N/A										
1197.00	H	60.46	---	-12.56	47.90	---	74.00	54.00	-6.10	Peak
3222.00	H	51.33	---	-7.94	43.39	---	74.00	54.00	-10.61	Peak
9650.00	H	46.90	42.33	6.58	53.48	48.91	74.00	54.00	-5.09	AVG
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11b Base mode / CH Mid **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1597.00	V	63.96	---	-11.12	52.84	---	74.00	54.00	-1.16	Peak
4878.00	V	50.51	---	-5.41	45.10	---	74.00	54.00	-8.90	Peak
9747.00	V	48.55	43.62	6.71	55.26	50.33	74.00	54.00	-3.67	AVG
N/A										
1070.00	H	62.95	---	-13.11	49.84	---	74.00	54.00	-4.16	Peak
5508.00	H	49.86	---	-5.06	44.80	---	74.00	54.00	-9.20	Peak
9747.00	H	46.55	41.83	6.71	53.26	48.54	74.00	54.00	-5.46	AVG
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11b Base mode / CH High **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1600.00	V	61.14	---	-11.12	50.02	---	74.00	54.00	-3.98	Peak
9848.00	V	46.84	42.13	6.85	53.69	48.98	74.00	54.00	-5.02	AVG
N/A										
1600.00	H	59.20	----	-11.12	48.08	---	74.00	54.00	-5.92	Peak
9848.00	H	43.36	---	6.85	50.21	---	74.00	54.00	-3.79	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11g Base mode / CH Low **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1602.00	V	58.08	---	-11.12	46.96	---	74.00	54.00	-7.04	Peak
7235.00	V	53.97	45.17	-0.24	53.73	44.93	74.00	54.00	-9.07	AVG
9638.00	V	53.17	35.16	6.55	59.72	41.71	74.00	54.00	-12.29	AVG
N/A										
1063.00	H	65.57	---	-13.15	52.42	---	74.00	54.00	-1.58	Peak
1201.00	H	56.39	---	-12.51	43.88	---	74.00	54.00	-10.12	Peak
3222.00	H	52.11	---	-7.94	44.17	---	74.00	54.00	-9.83	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11g Base mode / CH Mid **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1068.00	V	60.12	---	-13.15	46.97	---	74.00	54.00	-7.03	Peak
7317.00	V	53.08	46.52	-0.08	53.00	46.44	74.00	54.00	-7.56	AVG
9743.00	V	53.30	36.18	6.71	60.01	42.89	74.00	54.00	-11.11	AVG
N/A										
1068.00	H	63.16	---	-13.15	50.01	---	74.00	54.00	-3.99	Peak
3245.00	H	50.60	---	-7.92	42.68	---	74.00	54.00	-11.32	Peak
9743.00	H	44.76	---	6.71	51.47	---	74.00	54.00	-2.53	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11g Base mode / CH High **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1600.00	V	56.85	---	-11.12	45.73	---	74.00	54.00	-8.27	Peak
7395.00	V	51.31	---	0.08	51.39	---	74.00	54.00	-2.61	Peak
9837.00	V	51.64	35.02	6.84	58.48	41.86	74.00	54.00	-12.14	AVG
N/A										
1067.00	H	62.79	----	-13.15	49.64	---	74.00	54.00	-4.36	Peak
1200.00	H	57.37	---	-12.51	44.86	---	74.00	54.00	-9.14	Peak
3280.00	H	51.50	---	-7.88	43.62	---	74.00	54.00	-10.38	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11g Turbo mode / CH Mid **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1065.00	V	58.33	---	-13.15	45.18	---	74.00	54.00	-8.82	Peak
3250.00	V	49.77	---	-7.91	41.86	---	74.00	54.00	-12.14	Peak
6890.00	V	49.38	---	-1.04	48.34	---	74.00	54.00	-5.66	Peak
N/A										
1065.00	H	61.02	----	-13.15	47.87	---	74.00	54.00	-6.13	Peak
3250.00	H	52.20	---	-7.91	44.29	---	74.00	54.00	-9.71	Peak
7998.00	H	49.40	---	1.55	50.95	---	74.00	54.00	-3.05	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Test mode: PIFA Antenna / THW1055A1 / 0.0 dBi****Operation Mode:** TX / IEEE 802.11b Base mode / CH Low **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1203.00	V	60.70	---	-12.51	48.19	---	74.00	54.00	-5.81	Peak
4583.00	V	50.24	---	-5.79	44.45	---	74.00	54.00	-9.55	Peak
N/A										
1067.00	H	62.38	---	-13.15	49.23	---	74.00	54.00	-4.77	Peak
6183.00	H	50.46	---	-3.45	47.01	---	74.00	54.00	-6.99	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11b Base mode / CH Mid **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1063.00	V	60.98	---	-13.15	47.83	---	74.00	54.00	-6.17	Peak
3250.00	V	50.50	---	-7.91	42.59	---	74.00	54.00	-11.41	Peak
N/A										
1067.00	H	59.05	---	-13.15	45.90	---	74.00	54.00	-8.10	Peak
4867.00	H	49.82	---	-5.42	44.40	---	74.00	54.00	-9.60	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11b Base mode / CH High **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1602.00	V	58.47	---	-11.12	47.35	---	74.00	54.00	-6.65	Peak
3942.00	V	49.88	---	-6.73	43.15	---	74.00	54.00	-10.85	Peak
N/A										
1068.00	H	61.49	----	-13.15	48.34	---	74.00	54.00	-5.66	Peak
3283.00	H	50.48	---	-7.88	42.60	---	74.00	54.00	-11.40	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11g Base mode / CH Low **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1065.00	V	57.51	---	-13.15	44.36	---	74.00	54.00	-9.64	Peak
3217.00	V	50.90	---	-7.95	42.95	---	74.00	54.00	-11.05	Peak
N/A										
1068.00	H	61.23	---	-13.15	48.08	---	74.00	54.00	-5.92	Peak
3217.00	H	50.45	---	-7.95	42.50	---	74.00	54.00	-11.50	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11g Base mode / CH Mid **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1604.00	V	59.33	---	-11.12	48.21	---	74.00	54.00	-5.79	Peak
3250.00	V	49.69	---	-7.91	41.78	---	74.00	54.00	-12.22	Peak
N/A										
1068.00	H	60.11	---	-13.15	46.96	---	74.00	54.00	-7.04	Peak
3250.00	H	51.22	---	-7.91	43.31	---	74.00	54.00	-10.69	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11g Base mode / CH High **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1600.00	V	57.91	---	-11.12	46.79	---	74.00	54.00	-7.21	Peak
3283.00	V	50.46	---	-7.88	42.58	---	74.00	54.00	-11.42	Peak
N/A										
1065.00	H	59.67	----	-13.15	46.52	---	74.00	54.00	-7.48	Peak
3283.00	H	51.95	---	-7.88	44.07	---	74.00	54.00	-9.93	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11g Turbo mode / CH Mid **Test Date:** April 13, 2005**Temperature:** 23°C**Tested by:** Roy Cheng**Humidity:** 68 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1600.00	V	60.32	---	-13.15	47.17	---	74.00	54.00	-6.83	Peak
3283.00	V	51.60	---	-7.91	43.69	---	74.00	54.00	-10.31	Peak
N/A										
1595.00	H	57.99	----	-11.12	46.87	---	74.00	54.00	-7.13	Peak
3250.00	H	49.85	---	-7.91	41.94	---	74.00	54.00	-12.06	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.



7.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI TEST RECEIVER 9kHz-30MHz	ROHDE & SCHWARZ	ESHS30	828144/003	09/24/2005
TWO-LINE V-NETWORK 9kHz-30MHz	SCHAFFNER	NNB41	03/10013	06/11/2005
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	02/17/2006

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

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:** March 21, 2005
Temperature: 25°C **Tested by:** Jason Lin
Humidity: 55% RH

Freq. (MHz)	QP Reading	AV Reading	Corr. factor	QP Result	AV Result	QP Limit	AV Limit	QP Margin	AV Margin	Note
0.19	48.06	39.14	0.13	48.19	39.27	64.26	54.26	-16.07	-14.99	L1
0.28	38.26	29.99	0.10	38.36	30.09	60.85	50.85	-22.49	-20.76	L1
0.38	33.04	29.32	0.10	33.14	29.42	58.39	48.39	-25.25	-18.97	L1
0.84	29.44	26.48	0.10	29.54	26.58	56.00	46.00	-26.46	-19.42	L1
0.94	30.18	27.10	0.10	30.28	27.20	56.00	46.00	-25.72	-18.80	L1
1.21	30.58	27.72	0.10	30.68	27.82	56.00	46.00	-25.32	-18.18	L1
0.19	44.94	35.72	0.12	45.06	35.84	63.99	53.99	-18.94	-18.16	L2
0.37	33.00	29.77	0.10	33.10	29.87	58.52	48.52	-25.42	-18.65	L2
0.47	32.48	30.99	0.10	32.58	31.09	56.60	46.60	-24.02	-15.51	L2
0.93	31.28	28.77	0.10	31.38	28.87	56.00	46.00	-24.62	-17.13	L2
1.21	31.58	27.44	0.10	31.68	27.54	56.00	46.00	-24.32	-18.46	L2
1.86	30.70	26.90	0.10	30.80	27.00	56.00	46.00	-25.20	-19.00	L2

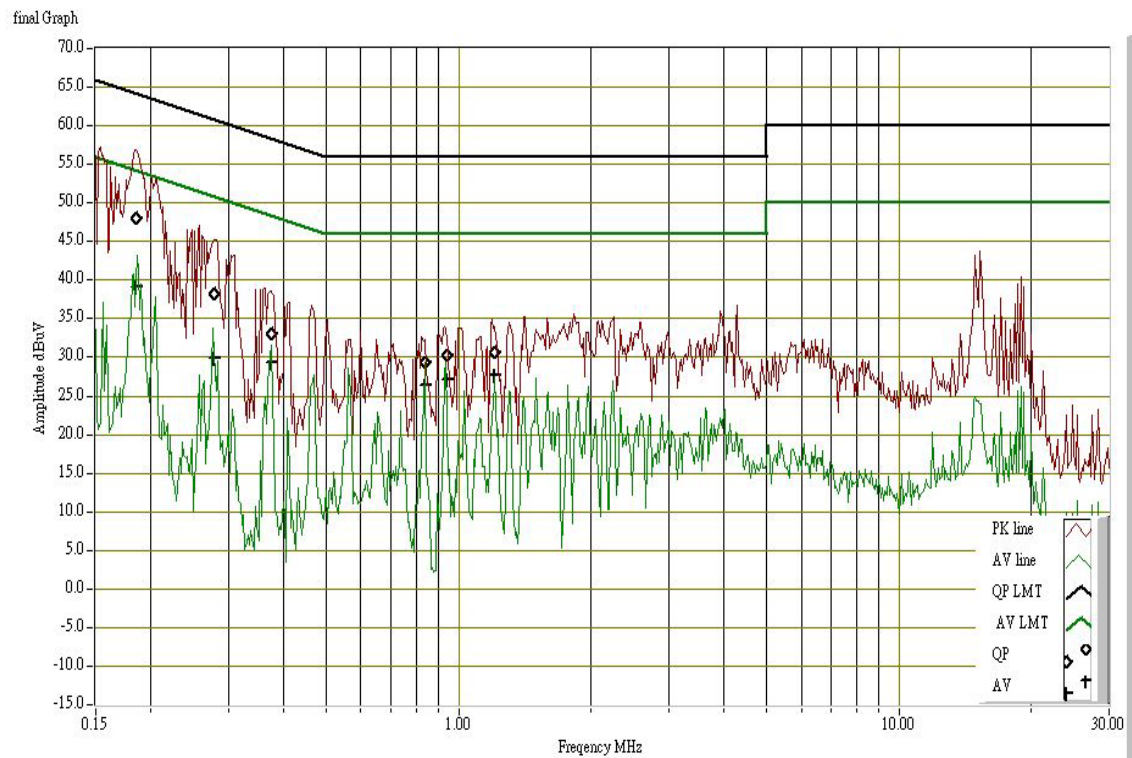
Remark:

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. "---" denotes the emission level was or more than 2dB below the Average limit
4. The IF bandwidth of SPA between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz;
5. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)



Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)

