

FCC TEST REPORT

for

47 CFR, Part 15, Subpart C

Equipment : Wireless Presentation Gateway
Model No. : WPG11
FCC ID : PKW-WPG11
Filing Type : Certification
Applicant : **The Linksys Group, Inc.**
17401 Armstrong Ave., Irvine, CA 92614

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SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

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History of this test report

Original Report Issue Date: Apr. 26, 2002

No additional attachment.

Additional attachment were issued as following record:

Attachment No.	Issue Date	Description

CERTIFICATE OF COMPLIANCE

for

47 CFR, Part 15, Subpart C

Equipment : Wireless Presentation Gateway

Model No. : WPG11

FCC ID : PKW-WPG11

Applicant : **The Linksys Group, Inc.**
17401 Armstrong Ave., Irvine, CA 92614

I **HEREBY** CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 1992** and the equipment under test was **passed** all test items required in FCC Part 15 subpart C, relative to the equipment under test. Testing was carried out on Apr. 24, 2002 at **SPORTON International Inc.** LAB.



K. J. Lin
Manager

SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

1. General Description of Equipment under Test

1.1. Applicant

The Linksys Group, Inc.
17401 Armstrong Ave., Irvine, CA 92614

1.2. Manufacturer

Same as 1.1.

1.3. Basic Description of Equipment under Test

Equipment	: Wireless Presentation Gateway
Model No.	: WPG11
FCC ID	: PKW-WPG11
Trade Name	: Linksys
Power Supply Type	: Switching
AC Power Cord	: Wall-Mount, 2 pin
DC Power Cable	: Non-Shielded, 1.7m, 2 pin

1.4. Feature of Equipment under Test

Items	Contents
1. Modulation type	DSSS
2. How to move out the modulation	Software Control
3. Number of channels	Default: 11,
4. Carrier frequency of each channel	2412, 2417, 2422, 2427, 2432, 2437, 2442, 2447, 2452, 2457, 2462,
5. Bandwidth of each channel	5 MHz
6. IF & L.O. frequency	IF=374 MHz, L.O.=2038 2098 MHz
7. Transmitter or Transceiver	Transceiver
8. Power Rating (DC or AC, Volt)	5V/1000mA
9. Maximum output power to Antenna	15 dBm
10. Duty Cycle	100%
11. Basic function of product	802.11b Wireless LAN
12. Operation Temperature	0 55
13. Antenna Connector Type	Detachable Antenna
14. Antenna Type	Dipole Antenna
15. Antenna Gain	2dBi
16. Adapter	LINKSYS / MS15-050102-3G

2. Test Configuration of Equipment under Test

2.1. Test Manner

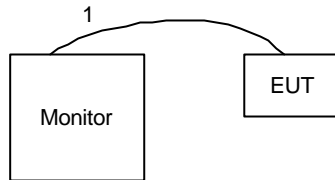
- a. The EUT has been associated with peripherals pursuant to ANSI C63.4-1992 and configuration operated in a manner which tended to maximize its emission characteristics in a typical application.
- b. The complete test system included SONY Monitor and EUT for EMI test.
- c. The EUT can operate on eleven channels from 2412.0MHz to 2462.0MHz. (as listed in section 1.4). According to 15.31(m), three channels (one near top, one near middle and one near bottom) were performed as following:
Mode 1: 2412MHz (Channel 1)
Mode 2: 2437MHz (Channel 6)
Mode 3: 2462MHz (Channel 11)
- d. Frequency range investigated: conduction 450 KHz to 30 MHz, radiation 30 MHz to 24.83GHz.

2.2. Description of Test System

Support Unit 1. -- Monitor (SONY)

FCC ID	: AK8GDM17SE2T
Model No.	: GDM-17SE2T
Power Supply Type	: Switching
Power Cord	: Non-Shielded
Serial No.	: SP0180
Data Cable	: Shielded, 1.15m

2.3. Connection Diagram of Test System



1. The I/O cable is connected from EUT to the support unit 1.

3. Operation of Equipment under Test

During testing, the software provided by the applicant enable the EUT under transmission condition continuously.

4. General Information of Test

4.1. Test Facility

Test Site Location : No. 30-2, Lin 6, Diing-Fwu Tsuen, Lin-Kou-Hsiang,
Taipei Hsien, Taiwan, R.O.C.
TEL : 886-2-2601-1640
FAX : 886-2-2601-1695

Test Site No. : CL01, OL02

4.2. Standard for Methods of Measurement

ANSI C63.4-1992

4.3. Test in Compliance with

FCC Part 15, Subpart C

4.4. Frequency Range Investigated

- a. Conduction: from 450 kHz to 30 MHz
- b. Radiation : from 30 MHz to 24.83GHz

4.5. Test Distance

The test distance of radiated emission from antenna to EUT is 3 M.

5. Report of Measurements and Examinations

5.1. List of Measurements and Examinations

FCC Rule	Description of Test	Result
15.207	Conducted Emission	Pass
<u>15.247(a)(2)</u>	6dB Bandwidth	Pass
<u>15.247(b)</u>	Maximum Peak Output Power	Pass
15.209	Radiated Emission	Pass
<u>15.247(c)</u>	100kHz Bandwidth of Frequency Band Edges	Pass
<u>15.247(d)</u>	Power Spectral Density	Pass
<u>15.203</u>	Antenna Requirement	Pass
1.1307 1.1310 2.1091 2.1093	RF Exposure Compliance	Pass

5.2. 6dB Bandwidth

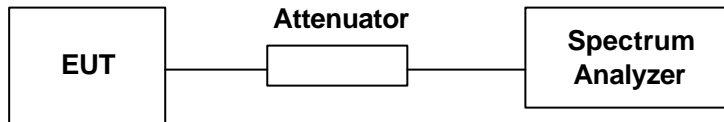
5.2.1. Measuring Instruments :

As described in chapter 6 of this test report.

5.2.2. Test Procedure :

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. The 6 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

5.2.3. Test Setup Layout :



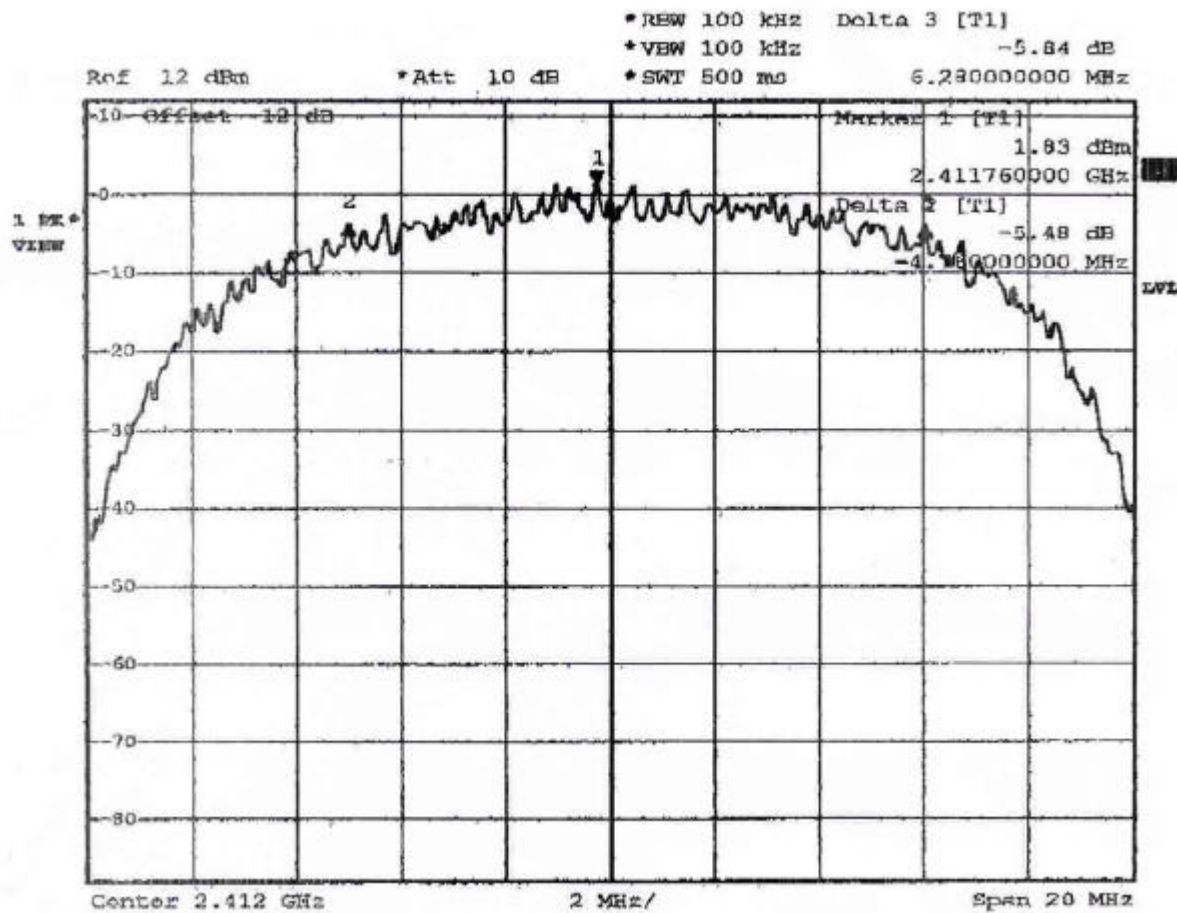
5.2.4. Test Result : The spectrum analyzer plots are attached as below

~~/~~ Temperature : 25°C

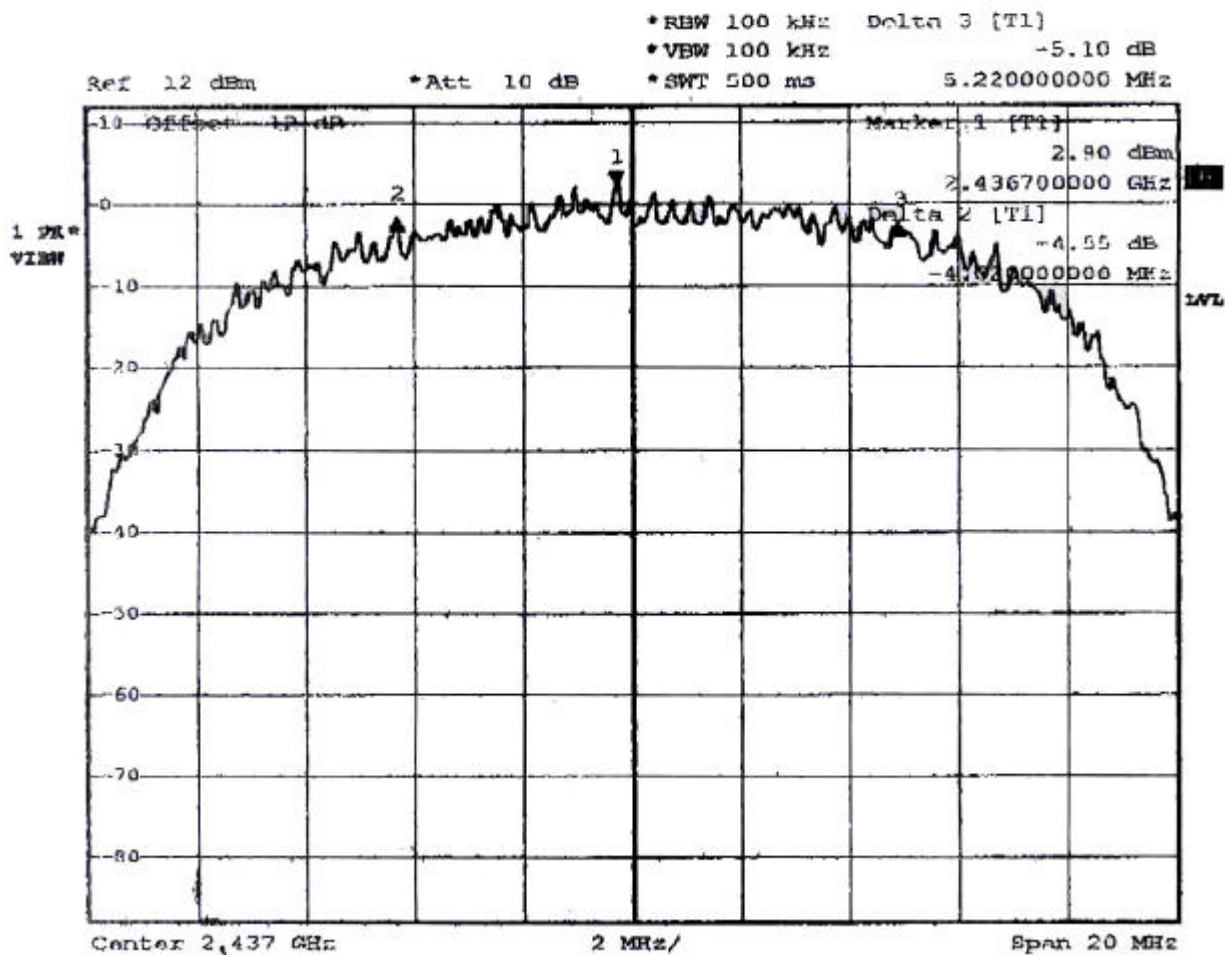
~~/~~ Relative Humidity : 54 %

Channel	Frequency (MHz)	6dB Emission bandwidth (MHz)	Limits (MHz)	Plot Ref. No.
1	2412	11.04	0.5	1
6	2437	9.24	0.5	2
11	2462	7.96	0.5	3

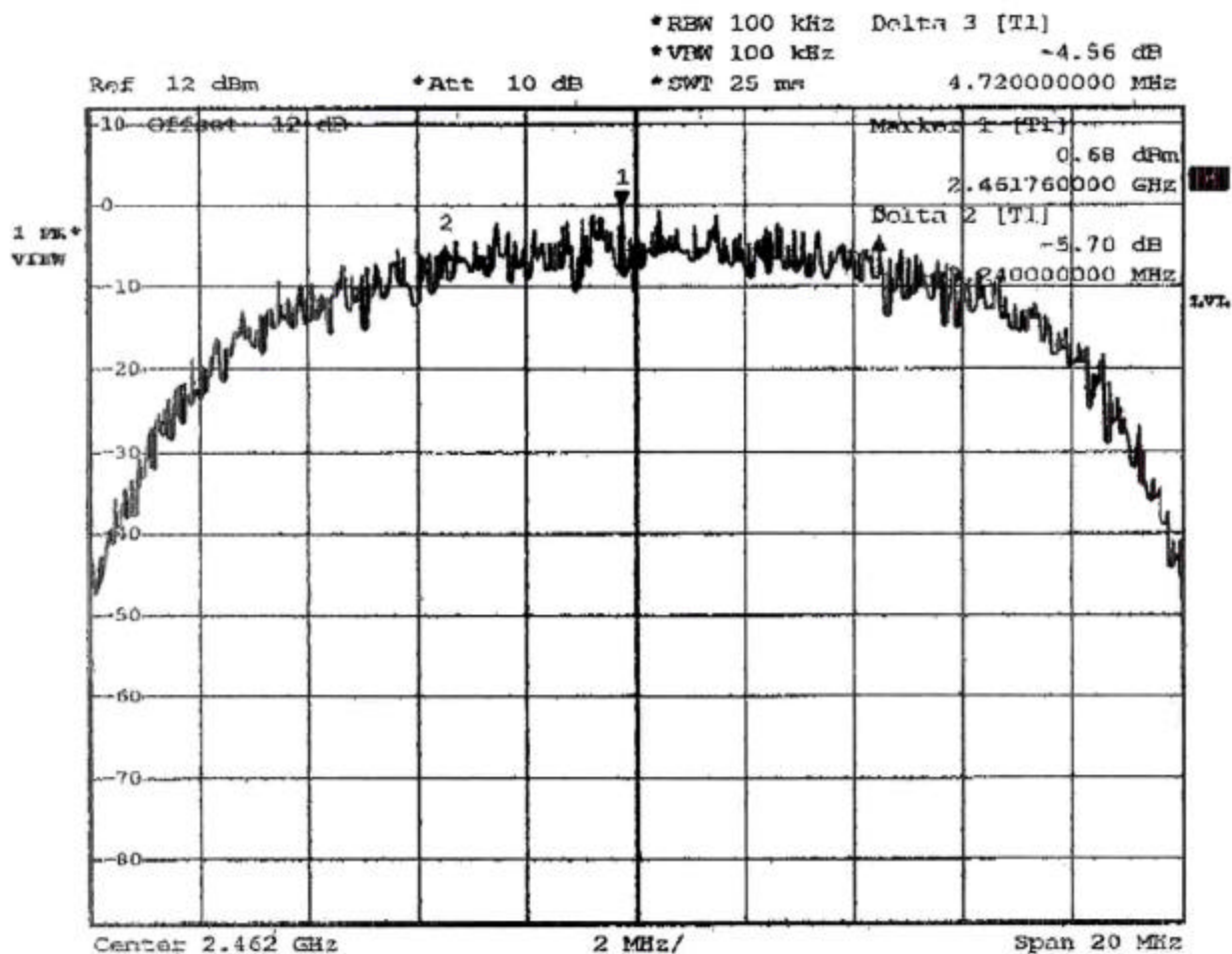
Plot1(Channel 1) :



Plot2(Channel 6) :



Plot3(Channel 11) :



Comments : 6dB Emission bandwidth>500kHz

5.3. Peak Output Power

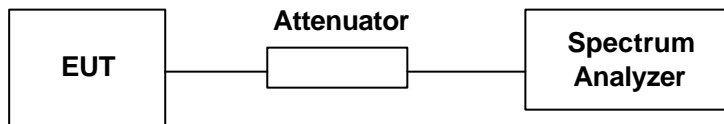
5.3.1. Measuring Instruments :

As described in chapter 6 of this test report.

5.3.2. Test Procedure :

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The center of the spectrum analyzer is set to the fundamental frequency and using 3 MHz RBW and 3MHz VBW.
3. The span of the spectrum analyzer should be larger than 6dB bandwidth plus 10MHz.
4. Use Peak Search after Maximum Hold function is activated.
5. Shift the marker to +/- 3MHz and +/- 6MHz, and record the reading.
6. The Maximum Peak Output Power is the linear summation of the 5 reading in (4) and (5).

5.3.3. Test Setup Layout :



5.3.4. Test Result : See spectrum analyzer plots below

~~✂~~ Temperature : 25°C

~~✂~~ Relative Humidity : 54 %

~~✂~~ Antenna Gain: 2 dBi

Channel	Frequency (MHz)	Measured Output Power (mWatt)	Measured Output Power (dBm)	Limits (Watt/dBm)
1	2412	50.35	17.02	1W/30 dBm
6	2437	128.84	21.10	1W/30 dBm
11	2462	46.38	16.66	1W/30 dBm

Comments : Maximum Peak Output Power < 30dBm (1Watt)

5.4. Power Spectral Density

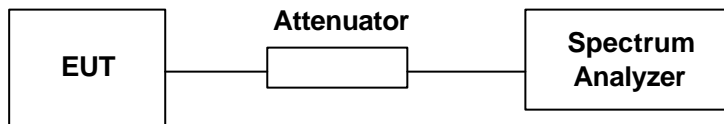
5.4.1. Measuring Instruments :

As described in chapter 6 of this test report.

5.4.2. Test Procedure :

1. The transmitter output was connected to spectrum analyzer through an attenuator.
2. The spectrum analyzer's resolution bandwidth were set at 3KHz RBW and 30KHz VBW as that of the fundamental frequency. Set the sweep time=span/3KHz.
3. The power spectral density was measured and recorded.
4. The Sweep time is allowed to be longer than span/3KHz for a full response of the mixer in the spectrum analyzer.

5.4.3. Test Setup Layout :



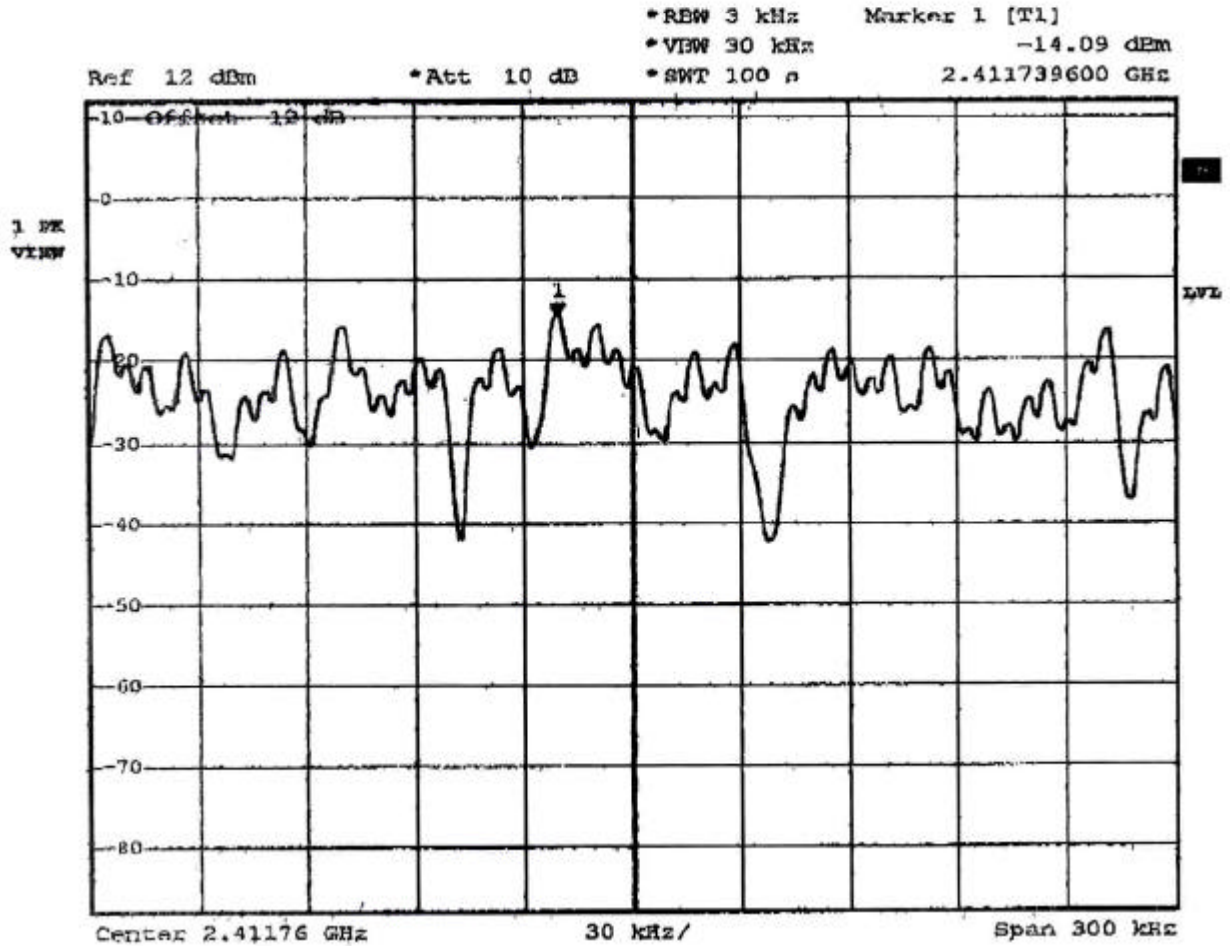
5.4.4. Test Result : See spectrum analyzer plots below

~~///~~ Temperature : 25°C

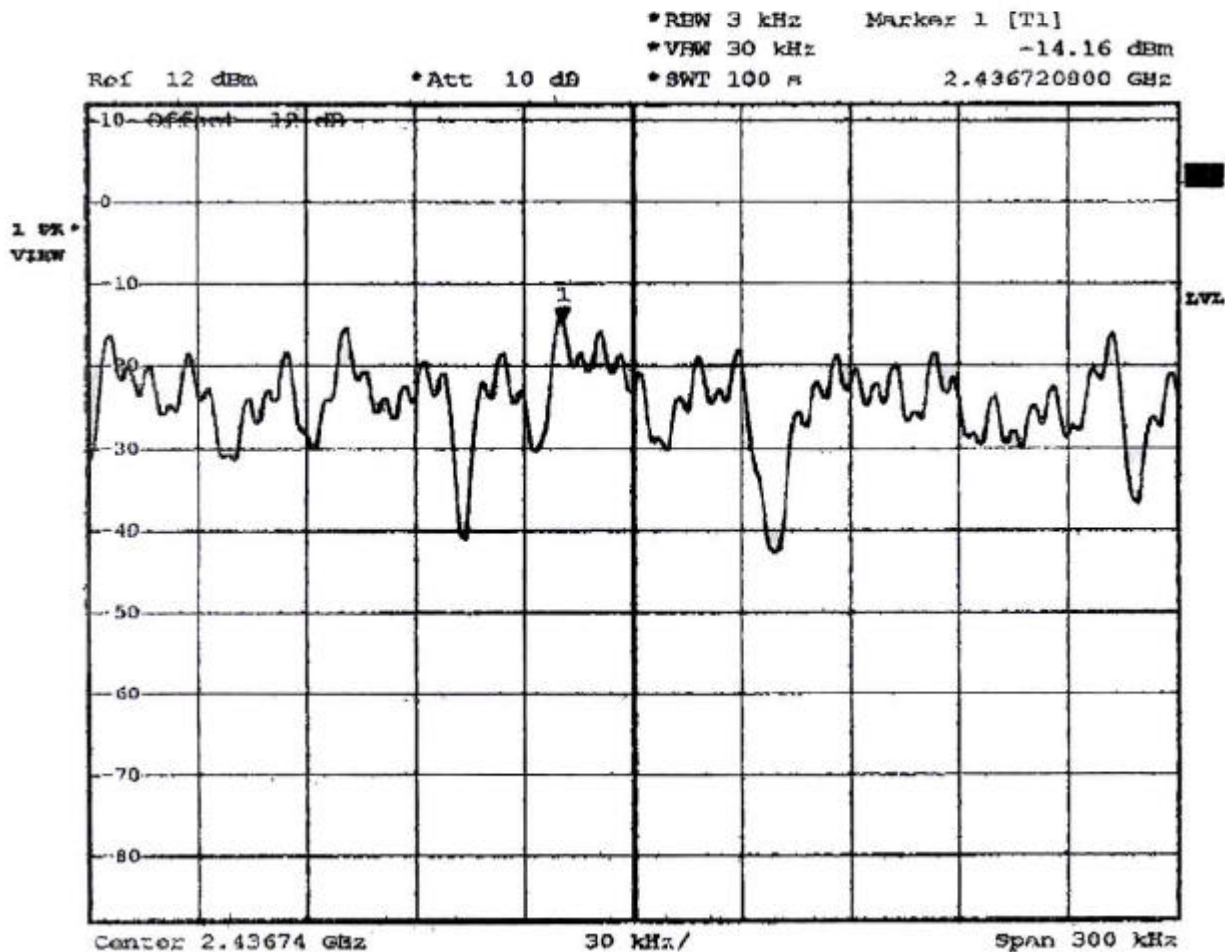
~~///~~ Relative Humidity : 54 %

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limits (dBm)	Plot Ref. No.
1	2412	-14.09	8	1
6	2437	-14.16	8	2
11	2462	-15.38	8	3

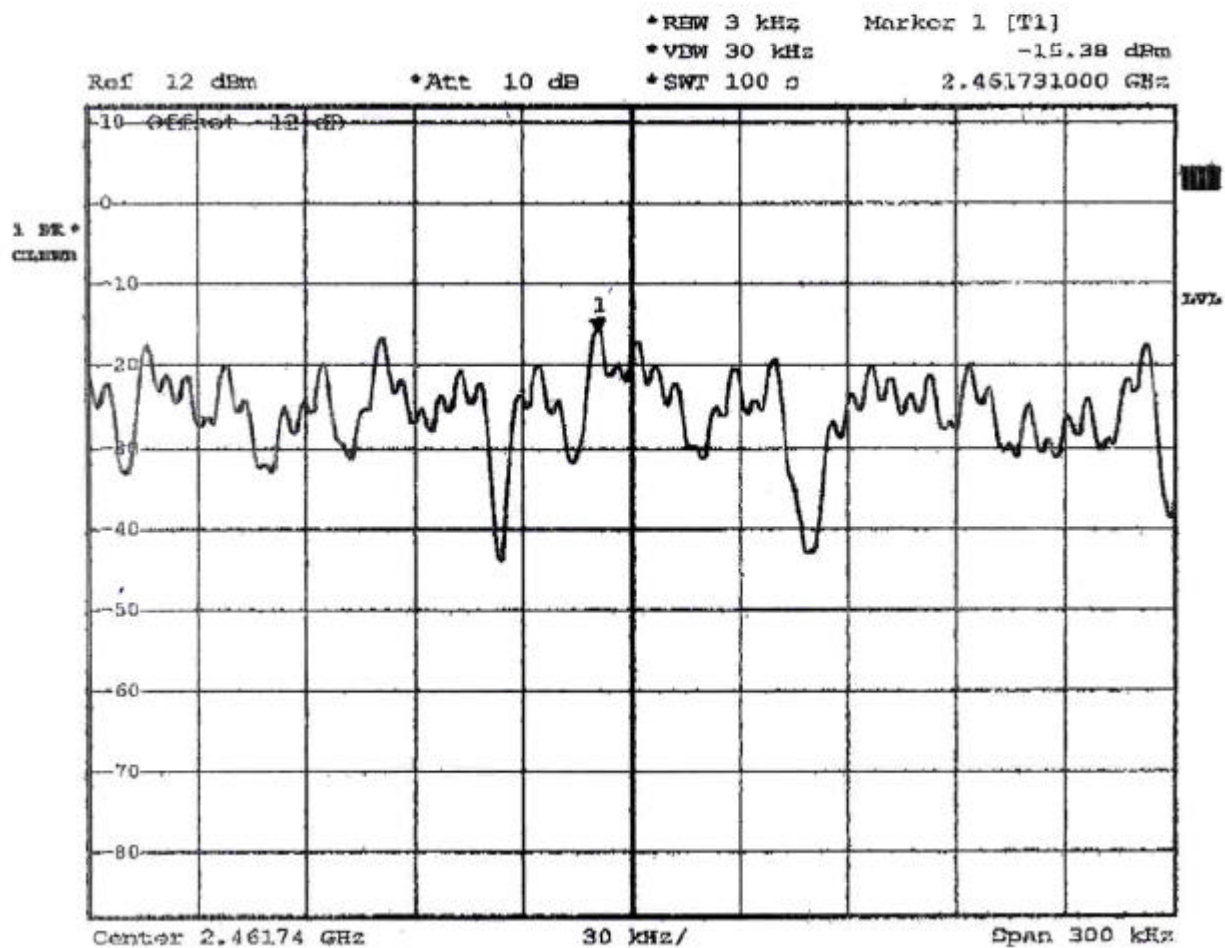
Plot1(Channel 1):



Plot2(Channel 6):



Plot3(Channel 11):



Comments : Maximum Power Spectral Density < 8dBm

5.5. Test of Conducted Emission

Conducted Emissions were measured from 450 kHz to 30 MHz with a bandwidth of 9 KHz on the 115 VAC power and return leads of the EUT according to the methods defined in ANSI C63.4-1992 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

5.5.1. Major Measuring Instruments :

Test Receiver	HP 8591EM
Attenuation	10 dB
Start Frequency	0.45 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

5.5.2. Test Procedures :

- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connect to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 450 kHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- i. If the emission level of the EUT in peak mode was 6 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 6 dB margin will be retested one by one using the quasi-peak method and reported.

5.5.3. Test Result of Conducted Emission :

Frequency Range of Test : from 0.45 MHz to 30 MHz

6dB Bandwidth : 10KHz

~~✍~~ Test Mode : Mode 1

~~✍~~ Temperature : 22°C

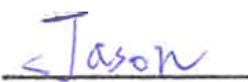
~~✍~~ Relative Humidity : 60 %

~~✍~~ Test Date: Apr. 24, 2002

The Conducted Emission test was passed at minimum margin NEUTRAL 15.760 MHz / 44.40 dBuV.

Frequency (MHz)	Line / Neutral	Meter Reading		Limits		Margin (dB)
		(dBuV)	(uV)	(dBuV)	(uV)	
0.638	L	41.90	124.45	48.00	251.19	-6.1
0.850	L	42.30	130.32	48.00	251.19	-5.7
1.217	L	42.20	128.82	48.00	251.19	-5.8
2.451	L	42.10	127.35	48.00	251.19	-5.9
16.036	L	43.40	147.91	48.00	251.19	-4.6
15.760	N	44.40	165.96	48.00	251.19	-3.6

Test Engineer :



Jason Chang

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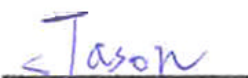
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- ~~/~~ Test Mode : Mode 2
- ~~/~~ Temperature : 22°C
- ~~/~~ Relative Humidity : 60 %
- ~~/~~ Test Date: Apr. 24, 2002

The Conducted Emission test was passed at minimum margin LINE 0.612 MHz / 42.50 dBuV.

Frequency (MHz)	Line / Neutral	Meter Reading		Limits		Margin (dB)
		(dBuV)	(uV)	(dBuV)	(uV)	
0.612	L	42.50	133.35	48.00	251.19	-5.5
0.814	L	41.40	117.49	48.00	251.19	-6.6
1.146	L	41.20	114.82	48.00	251.19	-6.8
16.899	L	38.90	88.10	48.00	251.19	-9.1
0.612	N	39.80	97.72	48.00	251.19	-8.2
16.367	N	39.30	92.26	48.00	251.19	-8.7

Test Engineer :



Jason Chang

- ~~/~~ Test Mode : Mode 3
- ~~/~~ Temperature : 22°C
- ~~/~~ Relative Humidity : 60 %
- ~~/~~ Test Date: Apr. 24, 2002

The Conducted Emission test was passed at minimum margin NEUTRAL 15.729 MHz / 43.10 dBuV.

Frequency (MHz)	Line / Neutral	Meter Reading		Limits		Margin
		(dBuV)	(uV)	(dBuV)	(uV)	(dB)
0.648	L	41.60	120.23	48.00	251.19	-6.4
0.862	L	41.70	121.62	48.00	251.19	-6.3
1.182	L	41.20	114.82	48.00	251.19	-6.8
2.499	L	40.20	102.33	48.00	251.19	-7.8
0.648	N	40.30	103.51	48.00	251.19	-7.7
15.729	N	43.10	142.89	48.00	251.19	-4.9

Test Engineer :



Jason Chang

5.5.4. Photographs of Conducted Emission Test Configuration

✍ The photographs show the configuration that generates the maximum emission.

FRONT VIEW



REAR VIEW



SIDE VIEW



5.6. Test of Radiated Emission

Radiated emissions from 30 MHz to 24.83 GHz were measured according to the methods defines in ANSI C63.4-1992. The EUT was placed on a nonmetallic stand in the open-field site, 0.8 meter above the ground plane, as shown in section 4.6.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

5.6.1. Major Measuring Instruments

~~EE~~ from 30MHz to 1GHz

EE Amplifier	(HP 87405A)
Attenuation	10 dB
RF Gain	25 dB
Signal Input	10 MHz to 1.3 GHz

EE Spectrum Analyzer	(HP 8560E)
Attenuation	10 dB
Start Frequency	30 MHz
Stop Frequency	1000 MHz
Resolution Bandwidth	1 MHz
Video Bandwidth	1 MHz
Signal Input	30 Hz to 2.9 GHz

EE Test Receiver	(R&S ESVP)
Resolution Bandwidth	120 KHz
Frequency Band	20 MHz to 1.3 GHz
Quasi-Peak Detector	ON for Quasi-Peak Mode OFF for Peak Mode

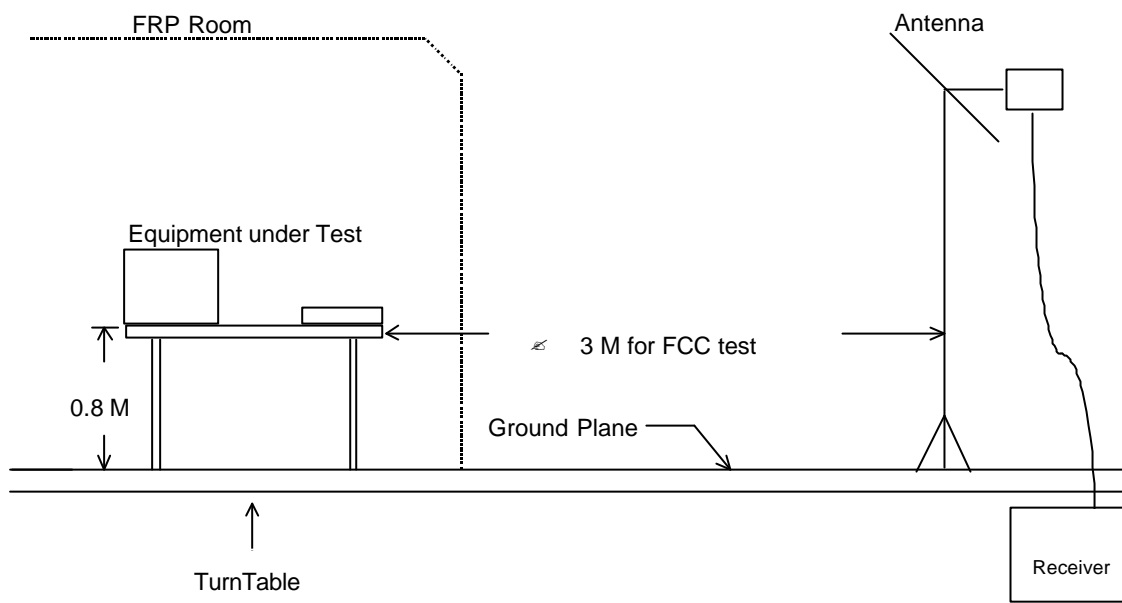
~~2.2~~ above 1GHz

2.2 Spectrum	(R&S FSP30)
Attenuation	10 dB
Start Frequency	1000 MHz
Stop Frequency	30GHz
Resolution Bandwidth	1 MHz
Video Bandwidth	For peak mode: 1MHz For average mode: 300Hz
Signal Input	30 MHz to 30 GHz

5.6.2. Test Procedures

1. The EUT was placed on a rotatable table top 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
5. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.

5.6.3. Typical Test Setup Layout of Radiated Emission



5.6.4. Test Result of Radiated Emission

- ~~///~~ Test Mode: Mode 1
- ~~///~~ Test Distance : 3 M
- ~~///~~ Temperature : 27°C
- ~~///~~ Relative Humidity : 56 %
- ~~///~~ Test Date : Apr. 20, 2002
- ~~///~~ Emission level (dBuV/m) = 20 log Emission level (uV/m)

The Radiated Emission test was passed at minimum margin:

VERTICAL 48.20 MHz / 36.98 dBuV/m Antenna Height 1 Meter , Turntable Degree 74°.

- ~~///~~ For 30MHz to 1000MHz
- ~~///~~ Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

Frequency (MHz)	Polarity	Antenna Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	(uV/m)	Emission (dBuV/m)	Level (uV/m)	Margin (dB)
231.10	H	11.50	1.00	27.52	46.02	199.99	40.02	100.23	-6.00
244.30	H	12.35	1.04	26.62	46.02	199.99	40.01	100.12	-6.01
48.20	V	9.04	0.59	27.35	40.00	100.00	36.98	70.63	-3.02
52.00	V	7.42	0.62	26.23	40.00	100.00	34.27	51.70	-5.73
66.00	V	5.85	0.73	28.36	40.00	100.00	34.94	55.85	-5.06
443.90	V	16.55	1.33	22.97	46.02	199.99	40.85	110.28	-5.17

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~~///~~ For above 1000MHz

~~///~~ Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

Frequency (MHz)	Antenna Polarity Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m) (uV/m)	Emission Level (dBuV/m) (mV/m)	Margin (dB)	Detect Mode
2412.00	V	30.79	70.17		80.43 10.508		A.V.
2412.00	H	30.79	84.17		94.43 52.662		A.V.
4824.00	H/V				-		Peak, A.V.
7236.00	H/V				-		Peak, A.V.
9648.00	H/V				-		Peak, A.V.
12060.00	H/V				-		Peak, A.V.
14472.00	H/V				-		Peak, A.V.
16884.00	H/V				-		Peak, A.V.
19296.00	H/V				-		Peak, A.V.
21708.00	H/V				-		Peak, A.V.
24120.00	H/V				-		Peak, A.V.

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above,

Test Engineer : 

JONES JAN

- ~~✂~~ Test Mode: Mode 2
- ~~✂~~ Test Distance : 3 M
- ~~✂~~ Temperature : 27°C
- ~~✂~~ Relative Humidity : 56 %
- ~~✂~~ Test Date : Apr. 20, 2002
- ~~✂~~ Emission level (dBuV/m) = 20 log Emission level (uV/m)

The Radiated Emission test was passed at minimum margin:

VERTICAL 66.00 MHz / 35.78 dBuV/m Antenna Height 3 Meter , Turntable Degree 55 °.

~~✂~~ For 30MHz to 1000MHz

~~✂~~ Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

Frequency (MHz)	Polarity	Antenna Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	(uV/m)	Emission (dBuV/m)	Level (uV/m)	Margin (dB)
37.10	H	15.62	0.46	18.51	40.00	100.00	34.59	53.64	-5.41
47.50	H	9.63	0.58	25.51	40.00	100.00	35.72	61.09	-4.28
346.40	H	14.76	1.33	24.14	46.02	199.99	40.23	102.68	-5.79
43.30	V	11.99	0.55	21.55	40.00	100.00	34.09	50.64	-5.91
55.10	V	6.75	0.64	26.75	40.00	100.00	34.14	50.93	-5.86
66.00	V	8.58	0.73	26.47	40.00	100.00	35.78	61.52	-4.22

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~~For~~ For above 1000MHz

~~Corrected~~ Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

Frequency (MHz)	Antenna Polarity Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	(uV/m)	Emission Level (dBuV/m) (mV/m)		Margin (dB)	Detect Mode
2437.00	V	30.76	86.71			97.00	70.794		A.V.
2437.00	H	30.76	76.51			86.80	21.878		A.V.
4824.00	H/V					-			Peak, A.V.
7236.00	H/V					-			Peak, A.V.
9648.00	H/V					-			Peak, A.V.
12060.00	H/V					-			Peak, A.V.
14472.00	H/V					-			Peak, A.V.
16884.00	H/V					-			Peak, A.V.
19296.00	H/V					-			Peak, A.V.
21708.00	H/V					-			Peak, A.V.
24120.00	H/V					-			Peak, A.V.

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above,

Test Engineer : 

JONES JAN

- ~~/~~ Test Mode: Mode 3
- ~~/~~ Test Distance : 3 M
- ~~/~~ Temperature : 27°C
- ~~/~~ Relative Humidity : 56 %
- ~~/~~ Test Date : Apr. 20, 2002
- ~~/~~ Emission level (dBuV/m) = 20 log Emission level (uV/m)
- ~~/~~ Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

The Radiated Emission test was passed at minimum margin:

VERTICAL 66.00 MHz / 37.34 dBuV/m Antenna Height 2 Meter , Turntable Degree 65°.

- ~~/~~ For 30MHz to 1000MHz
- ~~/~~ Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

Frequency (MHz)	Polarity	Antenna Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	(uV/m)	Emission (dBuV/m)	Level (uV/m)	Margin (dB)
244.30	H	12.35	1.04	26.78	46.02	199.99	40.17	101.98	-5.85
346.70	H	14.76	1.33	24.64	46.02	199.99	40.73	108.77	-5.29
415.30	H	15.92	1.34	23.81	46.02	199.99	41.07	113.11	-4.95
66.00	V	5.85	0.73	30.76	40.00	100.00	37.34	73.62	-2.66
132.10	V	11.63	0.76	25.57	43.52	149.97	37.96	79.07	-5.56
421.60	V	16.07	1.34	23.97	46.02	199.99	41.38	117.22	-4.64

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For above 1000MHz

Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

Frequency (MHz)	Polarity	Antenna Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m) (uV/m)	Emission Level		Margin (dB)	Detect Mode
						(dBuV/m)	(mV/m)		
2462.00	V	30.73	6.78	90.00		100.34	103.992		A.V.
2462.00	H	30.73	6.78	72.19		82.53	13.381		A.V.
4824.00	H/V					-			Peak, A.V.
7236.00	H/V					-			Peak, A.V.
9648.00	H/V					-			Peak, A.V.
12060.00	H/V					-			Peak, A.V.
14472.00	H/V					-			Peak, A.V.
16884.00	H/V					-			Peak, A.V.
19296.00	H/V					-			Peak, A.V.
21708.00	H/V					-			Peak, A.V.
24120.00	H/V					-			Peak, A.V.

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above,

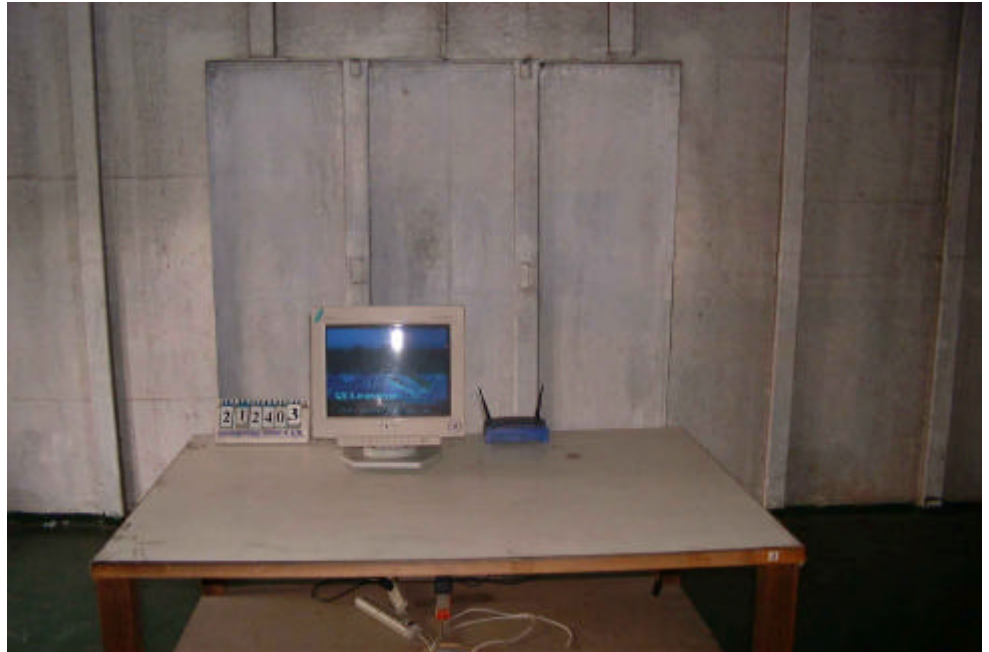
Test Engineer : 

JONES JAN

5.6.5. Photographs of Radiated Emission Test Configuration

EE The photographs show the configuration that generates the maximum emission.

FRONT VIEW



REAR VIEW



5.7. Band Edges Measurement

5.7.1. Measuring Instruments :

As described in chapter 6 of this test report.

5.7.2. Test Procedure :

1. The transmitter output was connected to the spectrum analyzer via a low lose cable.
2. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100 KHz bandwidth from band edge.
3. The band edges was measured and recorded.

5.7.3. Test Result :

Test Result in lower band (Channel 1) : PASS

Test Result in higher band(Channel 11) : PASS

5.7.4 Note on Band edge Emission

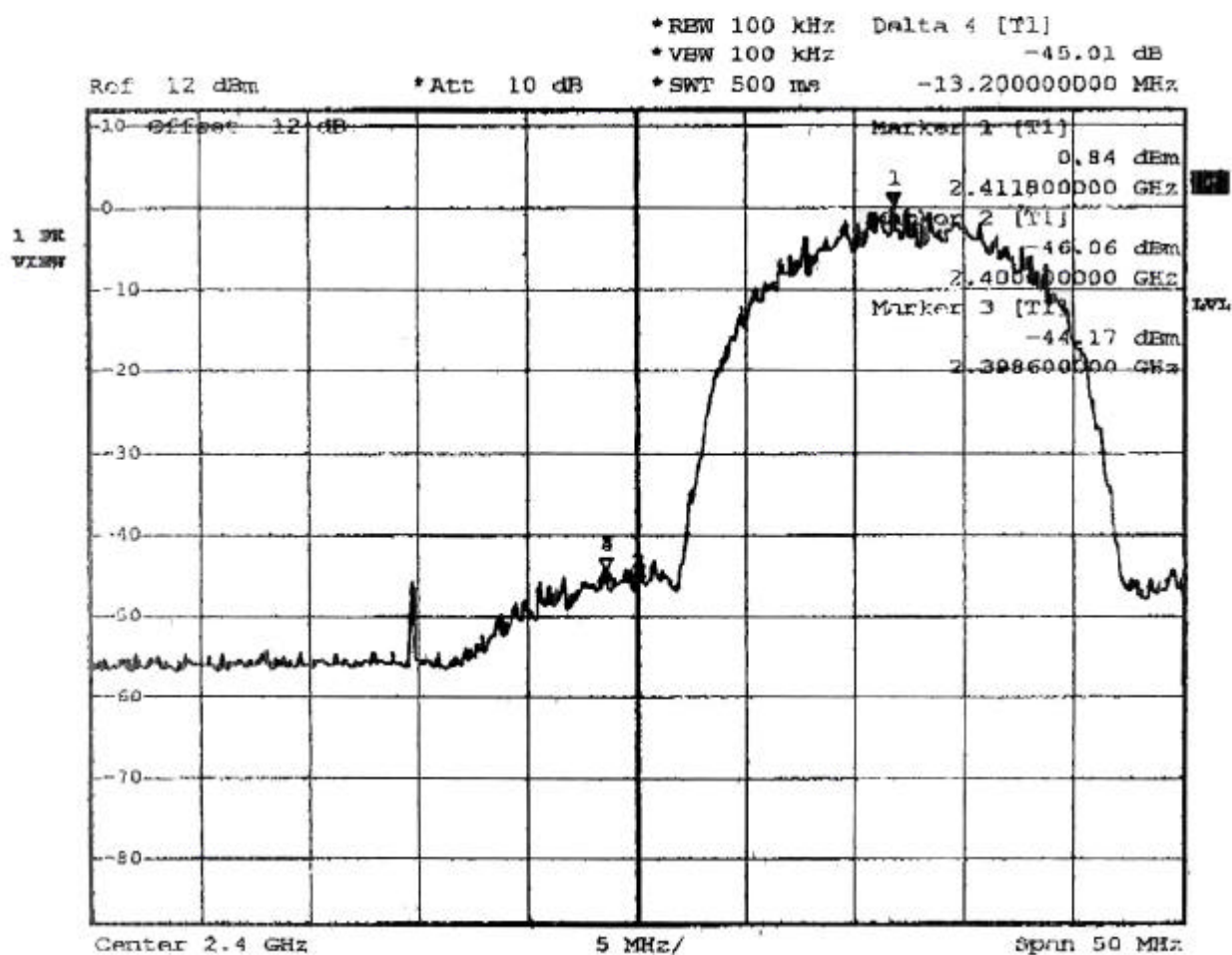
The band edge emission plot on page 36. shows 54.56dB delta between carrier maximum power and local maximum emission in the restricted band (2.4837GHz).

Polarity	The emission of carrier power strength (dB μ V/m)	The maximum field strength in restrict band (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
V	100.34	45.78	54	-8.24	Pass
H	82.53	27.97	54	-26.03	Pass

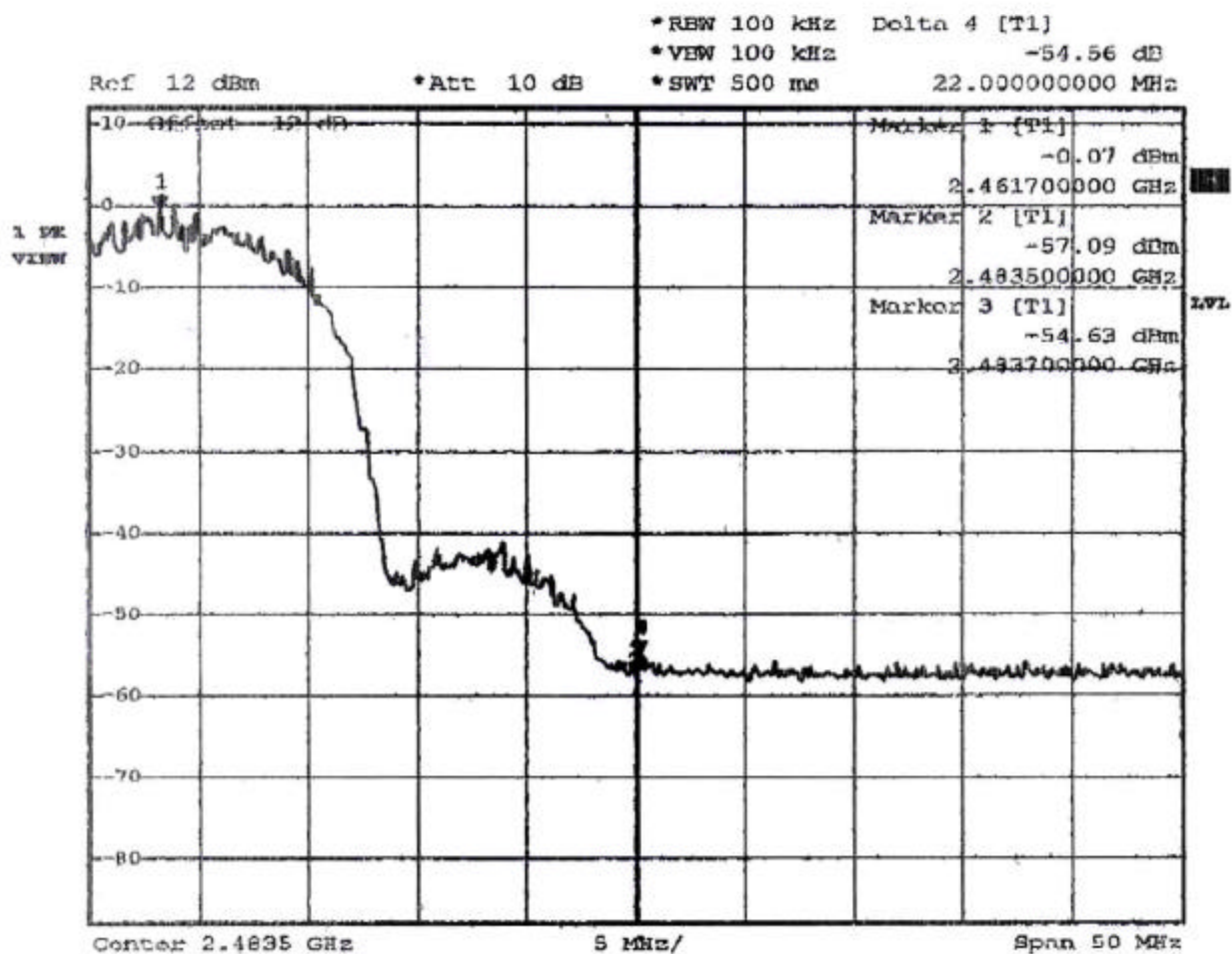
* The maximum field strength in restricted band is the emission of carrier power strength subtract to the delta between carrier maximum power and local maximum emission in the restricted band.

The spectrum analyzer plots are attached as below :

Plot1 (Channel 1) :



Plot2 (Channel 11) :



Comments : All emissions in any 100kHz bandwidth outside the band edge are attenuated more then 20dB from the carrier.

Antenna Requirements

The EUT use a detachable antenna via TNC-reversed external connector. It is considered meet antenna requirement of FCC.

5.7.4. Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

5.7.5. Antenna Connected Construction

The maximum Gain antenna used in this product is dipole antenna. The antenna connector type is TNC-reversed.

5.8. RF Exposure

FCC Rules and Regulations Part 1.1307,1.1310,2.1091,2.1093:

RF Exposure Compliance

5.8.1. Limit For Maximum Permissible Exposure (MPE)

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

F=frequency in MHz

*Plane-wave equivalent power density

5.8.2. MPE Calculations

$$E \text{ (V/m)} = \frac{\sqrt{30 \cdot P \cdot G}}{d} \quad \text{Power Density: } Pd \text{ (mW/cm}^2\text{)} = \frac{E^2}{3770}$$

- E = Electric field (V/m)
- P = Peak output power (mW)
- G = Antenna numeric gain (numeric)
- d = Separation distance (m)

Because the EUT is belong to General Population/ Uncontrolled Exposure. So the Limit of Power Density is 1.0 mW/cm² We can change the formula to:

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

Channel No.	Gain (dBi)	Gain Numeric	Peak Output Power (mW)	Calculated RF Exposure Separation Distance (cm)	Minimum RF Exposure Separation Distance (cm)
Channel 1	2	1.58	44.87	0.751	20
Channel 6	2	1.58	52.60	0.813	20
Channel 11	2	1.58	33.73	0.651	20

5.8.3. FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation. Proposed RF exposure safety information to include in User's Manual.

6. Antenna Factor & Cable Loss

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)
30	17.4	0.5
35	16.5	0.4
40	14.4	0.5
45	10.8	0.6
50	7.9	0.6
55	6.8	0.6
60	5.6	0.7
65	5.8	0.7
70	6.0	0.8
75	6.7	0.5
80	7.5	0.7
85	8.8	0.7
90	10.0	0.8
95	10.8	0.8
100	11.6	0.8
110	11.8	0.8
120	11.9	0.8
130	11.7	0.7
140	11.3	0.8
150	10.9	0.9
160	10.2	1.0
170	9.5	1.0
180	9.3	0.8
190	9.4	1.1
200	9.6	1.0
220	10.8	1.0
240	12.0	1.0
260	13.0	1.2
280	13.5	1.2
300	14.1	1.3
320	14.4	1.3
340	14.7	1.3
360	15.0	1.3
380	15.3	1.3
400	15.6	1.3
450	16.7	1.3
500	17.7	1.7
550	18.7	1.8
600	19.6	1.5
650	19.2	1.8
700	18.8	1.8
750	19.0	1.8
800	19.2	2.0
850	19.8	2.2
900	20.5	2.3
950	21.4	2.7
1000	22.4	2.0

7. List of Measuring Equipments Used

Reference Number	Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date
1	Bi-Log periodic Antenna	Schaffner	CBL6112B	2445	30MHz~1GHz	2002/2/8
2	Horn Antenna	Com-Power	AH-118	10091	1GHz~18GHz	2002/2/7
3	Preamplifier	MITEQ	Nsp2650-NF	805858	0.1~26.5GHz	2001/7/9
4	Test Receiver	R&S	esvp	893610/003	20~1300MHz	2001/5/4
5	Spectrum Analyzer	R&S	FSP30	100023	9KHz~30GHz	2002/4/2
6	Spectrum Analyzer	HP	8560E	3728A03185	30Hz~2.9GHz	2001/9/3
7	Multi-Device Controller	EMCO	2090	-	-	N/A
8	Turn Table	HD	DS630	-	-	N/A
9	Antenna Mas(site 4)	HD	MA240	-	-	N/A
10	RF Cable	Jyebao	L142 Cable	-	-	N/A
11	Attenuator	Jyebao	3A-3dB	-	3dB	N/A
12	L.I.S.N.	Mess Tec	Nnb-2/16Z	98087	-	2001/12/17
13	L.I.S.N.	Mess Tec	Nnb-2/16Z	98009	-	2001/12/17
14	Spectrum	HP	8591EM	3710A01187	9KHz ~ 1.8GHz	Sep. 21, 2001
15	LISN (site 2)	Rolf Heine	NNB-2/16Z	98009	9KHz ~ 30MHz	Dec. 17, 2001
16	LISN(site 2)	Rolf Heine	NNB-2/16Z	980877	9KHz ~ 30MHz	Dec. 17, 2001
17	Spectrum Analyzer (Site 4)	HP	8560E	3728A03190	30Hz - 2.9GHz	Sep. 03, 2001
18	Test Receiver (Site 4)	R&S	ESVP	893610/003	20MHz - 1.3GHz	May 04, 2001
19	Amplifier (Site 4)	HP	87405A	3207A01441	10MHz - 3GHz	Aug. 14, 2001
20	Bilog Antenna (Site 4)	CHASE	CBL6112A	2445	30MHz -2GHz	Feb. 08, 2002
21	Half-wave dipole antenna	EMCO	3121C	9705-1285	28 M - 1GHz	May 17, 2001
22	Turn Table (site 4)	EMCO	2080	9711-1090	0 ? 360 degree	N/A
23	Antenna Mast (site 4)	EMCO	2075	9711-2114	1 m- 4 m	N/A
24	Spectrum analyzer	R&S	FSP30	100024	30MHZ~30GHZ	Mar. 30, 2002
25	Horn Antenna	EMCO	3115	4976	1GHz~18GHz	Jul. 13, 2001

Calibration Interval of instruments listed above is one year.

8. Uncertainty of Test Site

Uncertainty of Conducted Emission Measurement

Contribution	Probability Distribution	150KHz – 30MHz
Cable and I/P attenuator calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2.5
LISN coupling specification	rectangular	±1.5
Transducer factor frequency interpolation	rectangular	±0.2
Mismatch Receiver VSWR ? 1=0.09 LISN VSWR ? 2=0.33 Uncertainty=20log(1-? 1*? 2)	U-shaped	0.2
combined standard uncertainty Ue(y)	normal	±1.7
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	normal (k=2)	±3.4

$$U = \sqrt{\{(0.3/2)^2 + (2.5^2 + 1.5^2 + 0.2^2)/3 + (0.2)^2/2\}} = 1.7$$

Uncertainty of Radiated Emission Measurement

Contribution	Probability Distribution	3m	10m
Antenna factor calibration	normal(k=2)	±1.6	±1.6
cable loss calibration	normal(k=2)	±0.3	±0.3
RCV/SPA specification	rectangular	±2	±2
Antenna Directivity	rectangular	±3	±0.5
Antenna Factor V.S. Height	rectangular	±2	±2
Antenna Factor Interpolation for Frequency	rectangular	±0.25	±0.25
site imperfection	rectangular	±2	±2
Mismatch Receiver VSWR ? 1=0.09 Antenna VSWR ? 2=0.67 Uncertainty=20log(1-? 1*? 2)	U-shaped	±0.54	±0.54
combined standard uncertainty Ue(y)	normal	±2.8	±2.2
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	normal (k=2)	±5.6	±4.4

$$U = \sqrt{\{(1.6/2)^2 + (0.3/2)^2 + (3^2 + 0.5^2 + 2^2 + 0.25^2 + 2^2)/3 + (0.54)^2/2\}} = 2.6 \text{ for 10m test distance}$$

$$U = \sqrt{\{(1.6/2)^2 + (0.3/2)^2 + (3^2 + 3^2 + 2^2 + 0.25^2 + 2^2)/3 + (0.54)^2/2\}} = 3.1 \text{ for 3m test distance}$$