

# **FCC TEST REPORT**

**for**

## **47 CFR, Part 15, Subpart C**

Equipment : Network Camera  
Model No. : IPC-4000, IPC-2000  
FCC ID : RF9-GSIPS-IPC4000  
Filing Type : Certification  
Applicant : **GemSOC Innovision Inc.**  
9F, No. 516, Sec. 1, Neihu Rd., Taipei, Taiwan

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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: Sep. 01, 2003

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 : Network Camera  
Model No. : IPC-4000, IPC-2000  
FCC ID : RF9-GSIPS-IPC4000  
Filing Type : Certification  
Applicant : **GemSOC Innovision Inc.**  
9F, No. 516, Sec. 1, Neihu Rd., Taipei, Taiwan

I **HEREBY** CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 2001** 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 Aug. 16, 2003 at **SPORTON International Inc. LAB.**



Alex Chen  
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**

GemSOC Innovision Inc.  
9F, No. 516, Sec. 1, Neihu Rd., Taipei, Taiwan

### **1.2. Manufacturer**

Same as 1.1

### **1.3. Basic Description of Equipment under Test**

Equipment	: Network Camera
Model No.	: IPC-4000, IPC-2000
FCC ID.	: RF9-GSIPS-IPC4000
Trade Name	: GemSOC
TP Cable	: Non-Shielded, 1m
AV Cable	: Shielded, 2m
Power Supply Type	: Switching
AC Power Input	: Wall-Mount, 2pin
DC Power Cable	: Non-Shielded, 1.8m, 2pin

**1.4. Feature of Equipment under Test**

Product Feature & Specification	
1. Host/Radio Interface	DSSS
2. Type of Modulation	11Mbps and 5.5 Mbps CCK 2Mbps DQPSK ; 1Mbps DBPSK
3. Number of Channels	11
4. Frequency Band	2400~2483.5 MHz
5. Carrier Frequency of each channel	2412MHz+(n-1)5MHz, n=channel no.
6. Bandwidth of each channel	11MHz
7. Maximum Output Power of Antenna	16.26dBm
8. IF & L.O. frequency	Intermediate Frequency: 0 MHz Local Oscillator: 5,000 MHz
9. Type of Antenna Connector (Ex: SMA,TNC, MCX, MMCX, UFC.....etc)	SMA
10. Type of Antenna	1/2 Dipole
11. Antenna Gain	1.8 dBi
12. Function Type	Transceiver
13. Power Rating (DC/AC , Voltage)	TOUCH / M1-10S05 Input: 100-120V, 0.5A, 47-63Hz Output: +5.0V, 2.0A
14. Duty Cycle	100%
15. Basic function of product	Data transmit & receive

## 2. Test Configuration of Equipment under Test

### 2.1. Test Manner

- a. The EUT has been associated with notebook and peripherals pursuant to ANSI C63.4-2001 and configuration operated in a manner, which tended to maximize its emission characteristics in a typical application.
- b. The complete test system included COMPAQ Notebook, VIEWSONIC Monitor, LOGITECH PS/2 Keyboard, LOGITECH USB Mouse, EPSON Printer, GALAXY Headset and EUT for EMI test.
- c. For EMI test, vertical polarity of RF antenna generates worse case, so the following test modes were tested with vertical:
  - Mode 1: CH01 ( 2412MHz )
  - Mode 2: CH06 ( 2437MHz )
  - Mode 3: CH11 ( 2462MHz )
- d. Frequency range investigated: conduction 150 KHz to 30 MHz, radiation 30 MHz to 25000MHz.

### 2.2. Description of Test System

#### Support Unit 1. -- Notebook (COMPAQ)

FCC ID	: N/A
Model No.	: PRESARIO 1500
Power Supply Type	: Switching
Power Cord	: Non-Shielded
Serial No.	: SP0127
Remark	: This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

#### Support Unit 2. -- Monitor (VIEWSONIC)

FCC ID	: N/A
Model No.	: VCDTS21553-3P
Power Supply Type	: Switching
Power Cord	: Non-Shielded
Serial No.	: SP0051
Data Cable	: Shielded, 1.7m
Remark	: This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

## Support Unit 3. – PS/2 Keyboard (LOGITECH)

FCC ID : N/A  
Model No. : Y-SJ17  
Serial No. : SP0054  
Data Cable : Shielded, 360 degree via metal backshells, 1.7m  
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

## Support Unit 4. – USB Mouse (LOGITECH)

FCC ID : N/A  
Model No. : M-BE58  
Serial No. : SP0041  
Data Cable : Shielded, 1.7m  
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

## Support Unit 5. -- Printer (EPSON)

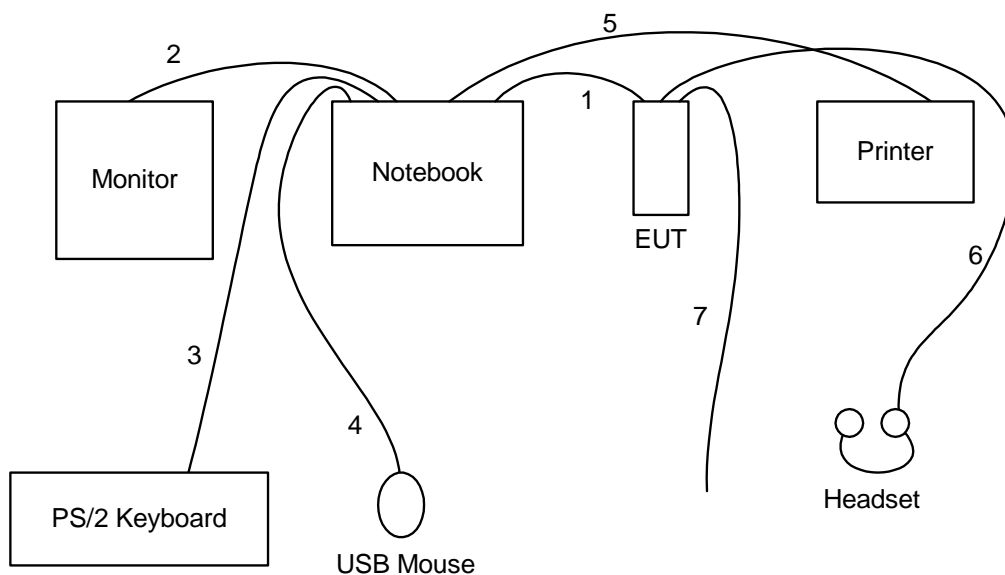
FCC ID : N/A  
Model No. : STYLUS COLOR 680  
Power Supply Type : Linear  
Power Cord : Non-Shielded  
Serial No. : SP0048  
Data Cable : Shielded, 1.35m  
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

## Support Unit 6. – Headset (GALAXY)

FCC ID : N/A  
Model No. : HP-316  
Serial No. : SP0214  
Data Cable : Non-Shielded, 360 degree via metal backshells, 1.7m



2.3. Connection Diagram of Test System



1. The TP cable is connected from the Notebook to the EUT.
2. The I/O cable is connected from the Notebook to the support unit 2.
3. The I/O cable is connected from the Notebook to the support unit 3.
4. The I/O cable is connected from the Notebook to the support unit 4.
5. The I/O cable is connected from the Notebook to the support unit 5.
6. The I/O cable is connected from the EUT to the support unit 6.
7. The AV cable is floating.

### **3. Test Software**

An executive programs, EMCTEST.EXE under WIN XP, which generate a complete line of continuously repeating “ H “ pattern was used as the test software.

The program was executed as follows:

- a. Turn on the power of all equipment.
- b. The PC reads the test program from the hard disk drive and runs it.
- c. The PC sends “ H “ messages to the monitor, and the monitor displays “ H “ patterns on the screen.
- d. The PC sends “ H “ messages to the printer, then the printer prints them on the paper.
- e. The PC sends “ H ” messages to the internal Hard Disk, and the Hard Disk reads and writes the message.
- f. Repeat the steps from c to e.

At the same time, “Explorer” was executed to keep transmitting signals at fixed frequency.

## 4. General Information of Test

Test Site Location : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,  
Kwei-Shan Hsiag, Tao Yuan Hsien, Taiwan, R.O.C.  
TEL : 886-3-327-3456  
FAX : 886-3-318-0055

Test Site No : CO01-HY, 03CH03-HY

### 4.1. Test Voltage

110V/60Hz

### 4.2. Standard for Methods of Measurement

ANSI C63.4-2001 for conducted power line test and radiated emission test

["Guidance on Measurements for Direct Sequence Spread Spectrum Systems"](#) for test of 6dB Bandwidth

["Guidance on Measurements for Direct Sequence Spread Spectrum Systems"](#) for test of Maximum Peak Output Power

["Guidance on Measurements for Direct Sequence Spread Spectrum Systems"](#) for test of 100kHz Bandwidth of Frequency Band Edges

["Guidance on Measurements for Direct Sequence Spread Spectrum Systems"](#) for test of Power Spectral Density

### 4.3. Test in Compliance with

FCC Part 15, Subpart C, 15.247

### 4.4. Frequency Range Investigated

- a. Conduction: from 150 kHz to 30 MHz
- b. Radiation: from 30 MHz to 25000MHz

### 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**

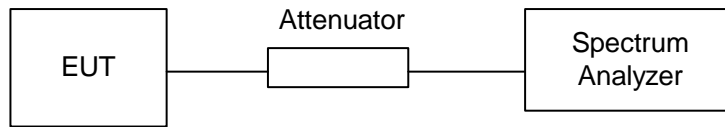
5.2.1. Measuring Instruments :

As described in chapter 7 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 :

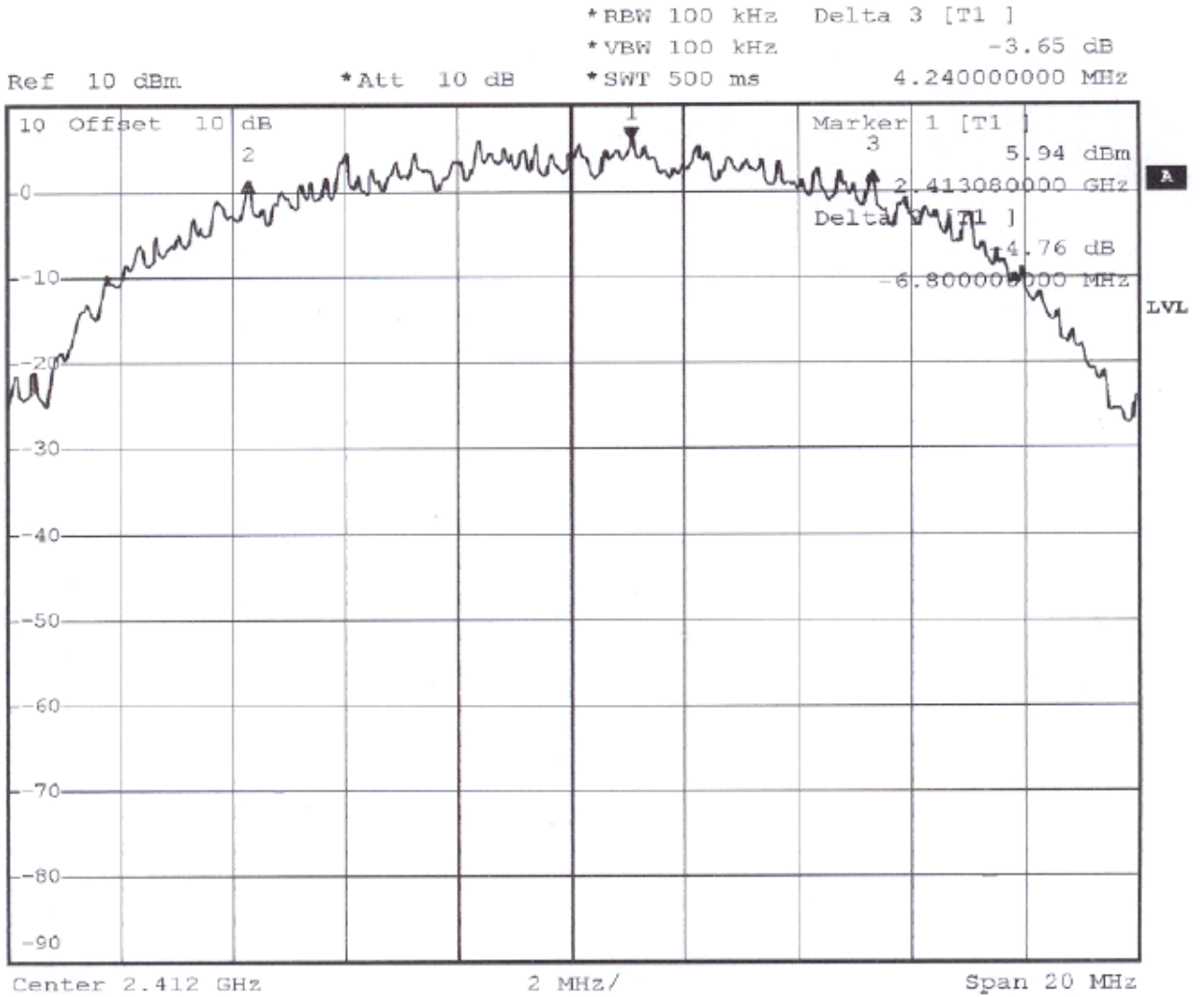


5.2.4. Test Result : The spectrum analyzer plots are attached as below

- Temperature: 27 °C
- Relative Humidity: 62%

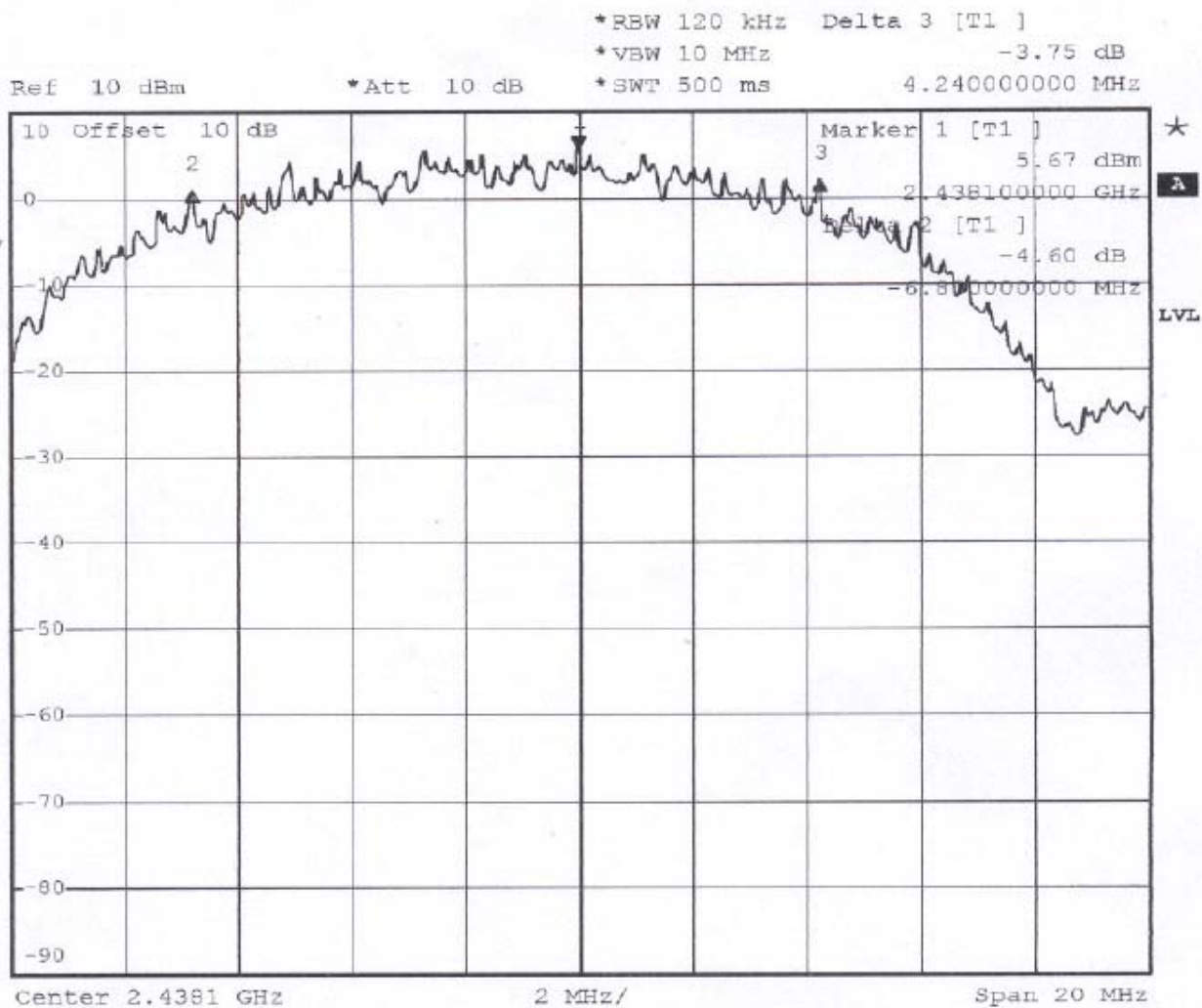
Channel	Frequency ( MHz )	6dB Emission bandwidth ( MHz )	Limits ( MHz )	Plot Ref. No.
01	2412	11.04	0.5	1
06	2437	11.04	0.5	2
11	2462	11.08	0.5	3

Plot1(Channel 1) :



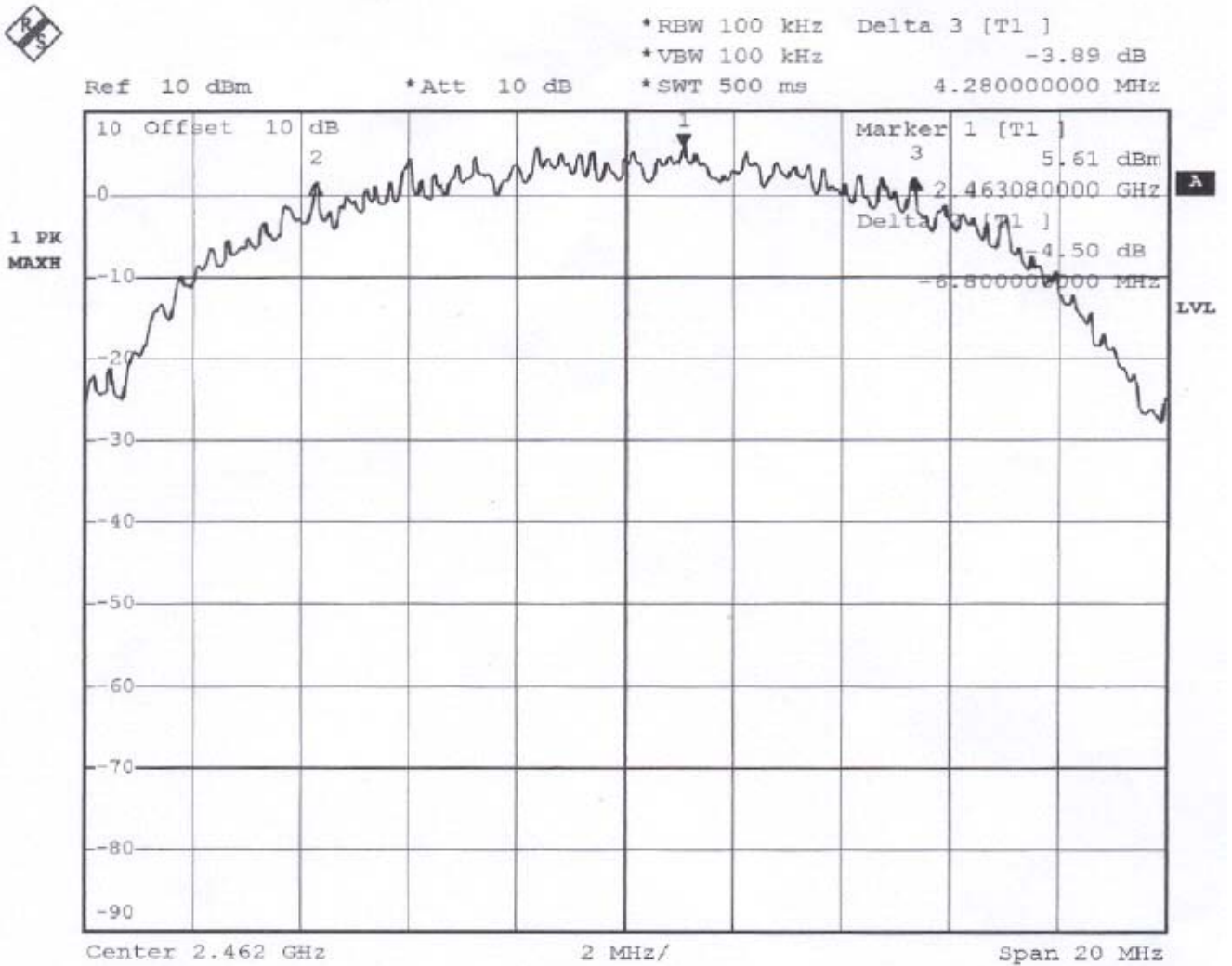
Date: 24.JUL.2003 16:12:42

Plot2(Channel 6) :



Date: 24.JUL.2003 16:05:34

Plot3(Channel 11) :



Date: 24.JUL.2003 15:32:42

Comments : 6dB Emission bandwidth>500kHz



**5.3. Peak Output Power**

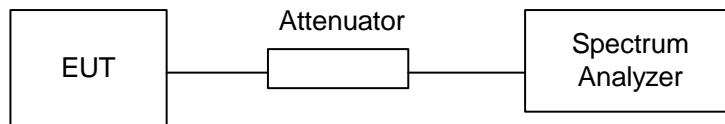
5.3.1. Measuring Instruments :

As described in chapter 7 of this test report.

5.3.2. Test Procedure :

The antenna port ( RF output ) of the EUT was connected to the input ( RF input ) of a power meter. Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

5.3.3. Test Setup Layout :



5.3.4. Test Result : See spectrum analyzer plots below

- Temperature: 27°C
- Relative Humidity: 62 %

Channel	Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (mW)	Limits (Watt/dBm )
01	2412	16.20	41.68693835	1W/30 dBm
06	2437	16.26	42.26686143	1W/30 dBm
11	2462	15.90	38.90451450	1W/30 dBm

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

**5.4. Power Spectral Density**

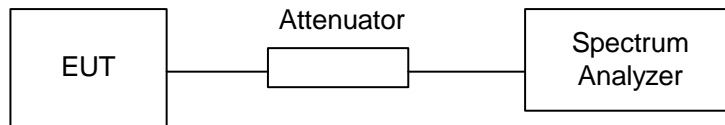
5.4.1. Measuring Instruments :

As described in chapter 7 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 :

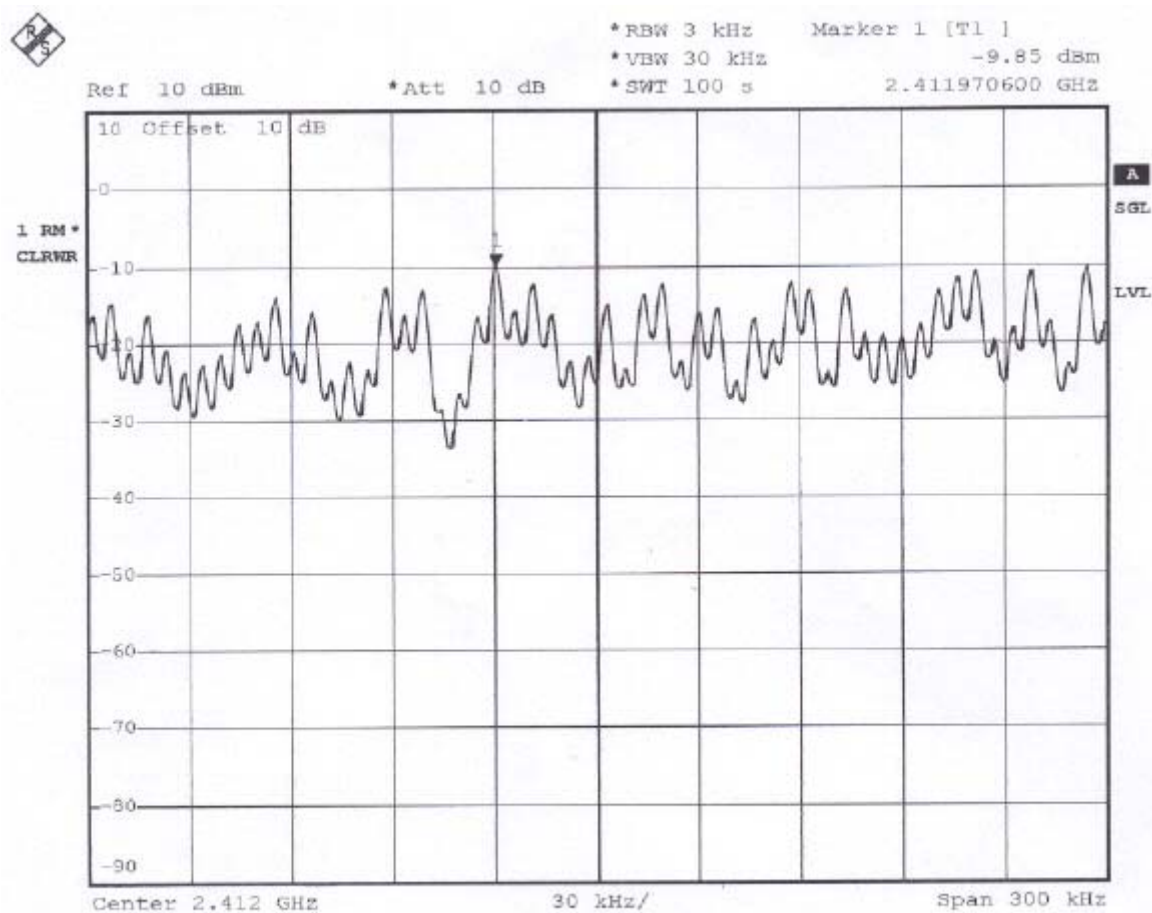


5.4.4. Test Result : See spectrum analyzer plots below

- Temperature: 27°C
- Relative Humidity: 62 %

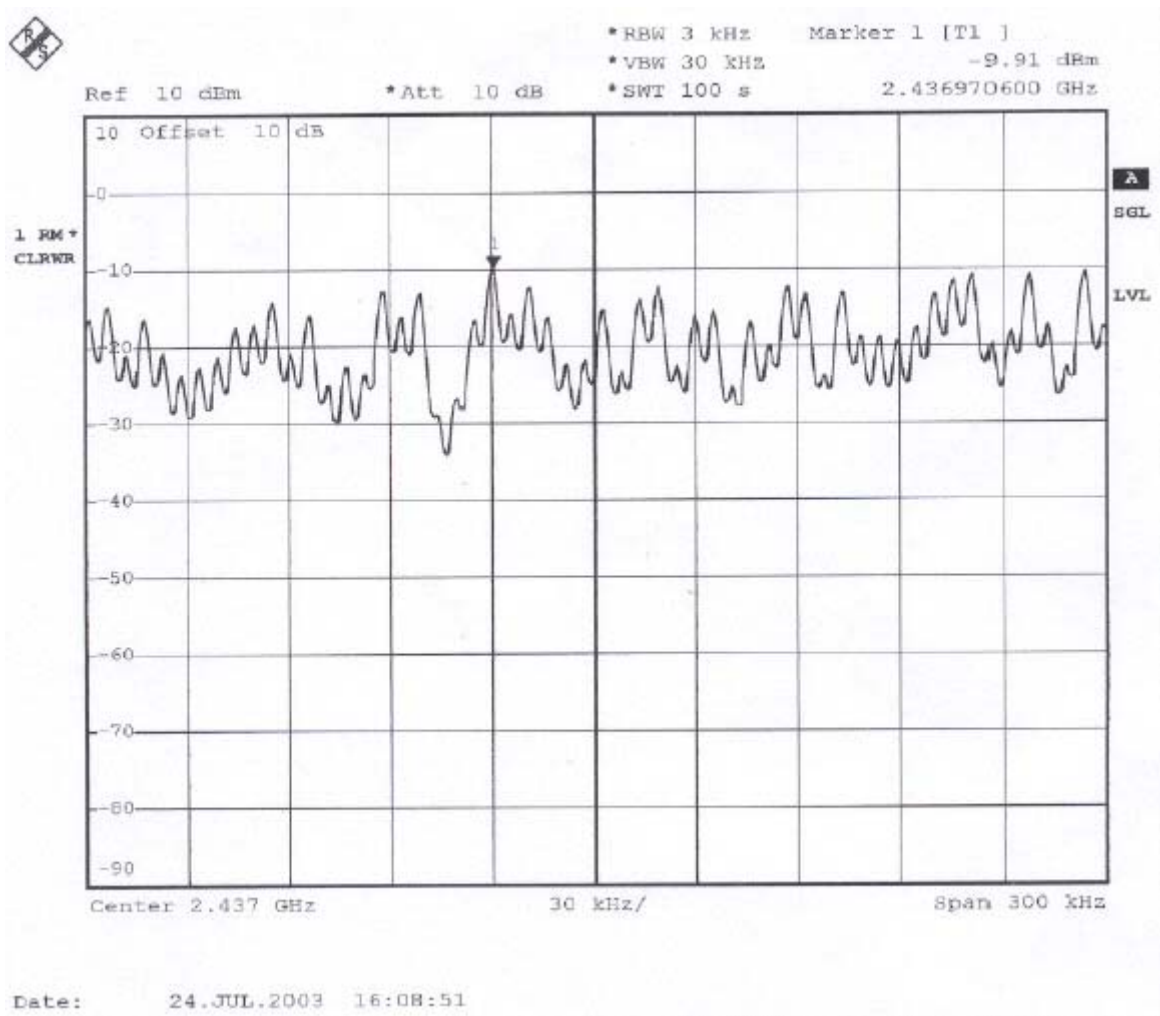
Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limits (dBm)	Plot Ref. No.
01	2412	-9.85	8	1
06	2437	-9.91	8	2
11	2462	-9.92	8	3

Plot1(Channel 1):

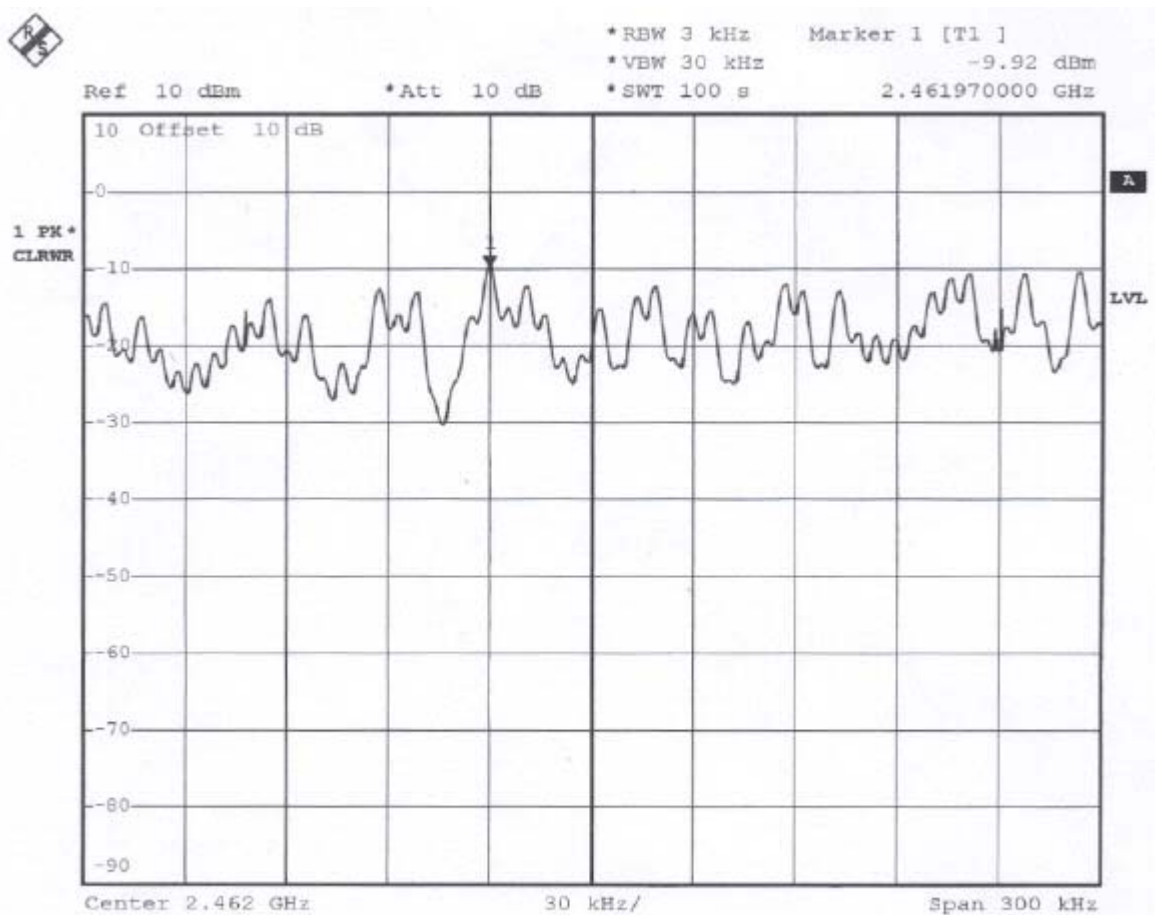


Date: 24.JUL.2003 16:10:54

Plot2(Channel 6):



Plot3(Channel 11):



Date: 24.JUL.2003 15:53:04

## 5.5. Test of Conducted Emission

Conducted Emissions were measured from 150 KHz to 30 MHz with a bandwidth of 9 KHz and return leads of the EUT according to the methods defined in ANSI C63.4-2001 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	(R&S ESCS 30)
Attenuation	10 dB
Start Frequency	0.15 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 150 KHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

5.5.3. Test Result of Conducted Emission :

- Test Mode: Mode 1
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 29.3°C
- Relative Humidity: 70 %
- Test Date: Aug. 16, 2003
- All emissions not reported here are more than 10 dB below the prescribed limit.

**The test was passed at the minimum margin that marked under gray area in the following table**

Frequency ( MHz )	Line or Neutral	Meter Reading		Limits		Margin	
		Q.P. ( dBuV )	A.V. ( dBuV )	Q.P. ( dBuV )	A.V. ( dBuV )	Q.P. ( dB )	A.V. ( dB )
0.202	L	47.97	34.60	63.53	53.53	-15.56	-18.93
0.707	L	37.32	34.56	56.00	46.00	-18.68	-11.44
3.626	L	39.30	35.78	56.00	46.00	-16.70	-10.22
4.834	L	40.57	35.48	56.00	46.00	-15.43	-10.52
6.444	L	43.90	38.62	60.00	50.00	-16.10	-11.38
7.352	L	42.66	36.04	60.00	50.00	-17.34	-13.96
0.202	N	48.05	40.39	63.53	53.53	-15.48	-13.14
0.303	N	43.35	34.13	60.16	50.16	-16.81	-16.03
0.403	N	38.20	28.17	57.79	47.79	-19.59	-19.62
0.604	N	35.00	27.48	56.00	46.00	-21.00	-18.52
0.907	N	35.20	32.04	56.00	46.00	-20.80	-13.96
6.045	N	39.15	32.59	60.00	50.00	-20.85	-17.41

Test Engineer :




John Huang

- Test Mode: Mode 2
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 29.3°C
- Relative Humidity: 70 %
- Test Date: Aug. 16, 2003
- All emissions not reported here are more than 10 dB below the prescribed limit.

**The test was passed at the minimum margin that marked under gray area in the following table**

Frequency ( MHz )	Line or Neutral	Meter Reading		Limits		Margin	
		Q.P. ( dBuV )	A.V. ( dBuV )	Q.P. ( dBuV )	A.V. ( dBuV )	Q.P. ( dB )	A.V. ( dB )
0.202	L	47.51	34.12	63.53	53.53	-16.02	-19.41
0.503	L	38.48	35.54	56.00	46.00	-17.52	-10.46
3.625	L	39.41	35.93	56.00	46.00	-16.59	-10.07
4.836	L	39.24	33.99	56.00	46.00	-16.76	-12.01
6.445	L	43.90	39.67	60.00	50.00	-16.10	-10.33
7.350	L	42.73	37.02	60.00	50.00	-17.27	-12.98
0.202	N	47.59	35.02	63.53	53.53	-15.94	-18.51
0.302	N	43.12	34.04	60.19	50.19	-17.07	-16.15
0.404	N	37.03	26.62	57.77	47.77	-20.74	-21.15
3.623	N	36.39	32.79	56.00	46.00	-19.61	-13.21
6.442	N	40.31	36.77	60.00	50.00	-19.69	-13.23
7.150	N	40.24	33.32	60.00	50.00	-19.76	-16.68


Test Engineer :   
 \_\_\_\_\_  
 John Huang



- Test Mode: Mode 3
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 29.3°C
- Relative Humidity: 70 %
- Test Date: Aug. 15, 2003
- All emissions not reported here are more than 10 dB below the prescribed limit.

**The test was passed at the minimum margin that marked under gray area in the following table**

Frequency ( MHz )	Line or Neutral	Meter Reading		Limits		Margin	
		Q.P. ( dBuV )	A.V. ( dBuV )	Q.P. ( dBuV )	A.V. ( dBuV )	Q.P. ( dB )	A.V. ( dB )
0.203	L	47.73	34.71	63.49	53.49	-15.76	-18.78
0.302	L	43.98	34.93	60.19	50.19	-16.21	-15.26
4.535	L	35.58	32.41	56.00	46.00	-20.42	-13.59
4.836	L	40.80	36.72	56.00	46.00	-15.20	-9.28
6.048	L	40.47	34.58	60.00	50.00	-19.53	-15.42
6.952	L	44.42	39.91	60.00	50.00	-15.58	-10.09
0.203	N	48.00	34.96	63.49	53.49	-15.49	-18.53
0.301	N	43.91	34.75	60.22	50.22	-16.31	-15.47
0.505	N	35.85	32.82	56.00	46.00	-20.15	-13.18
0.807	N	35.82	32.21	56.00	46.00	-20.18	-13.79
2.117	N	34.23	28.27	56.00	46.00	-21.77	-17.73
6.550	N	41.88	36.56	60.00	50.00	-18.12	-13.44

Test Engineer :   
 John Huang

## 5.6. Test of Radiated Emission

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defines in ANSI C63.4-2001. The EUT was placed, 0.8 meter above the ground plane, as shown in section 5.6.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

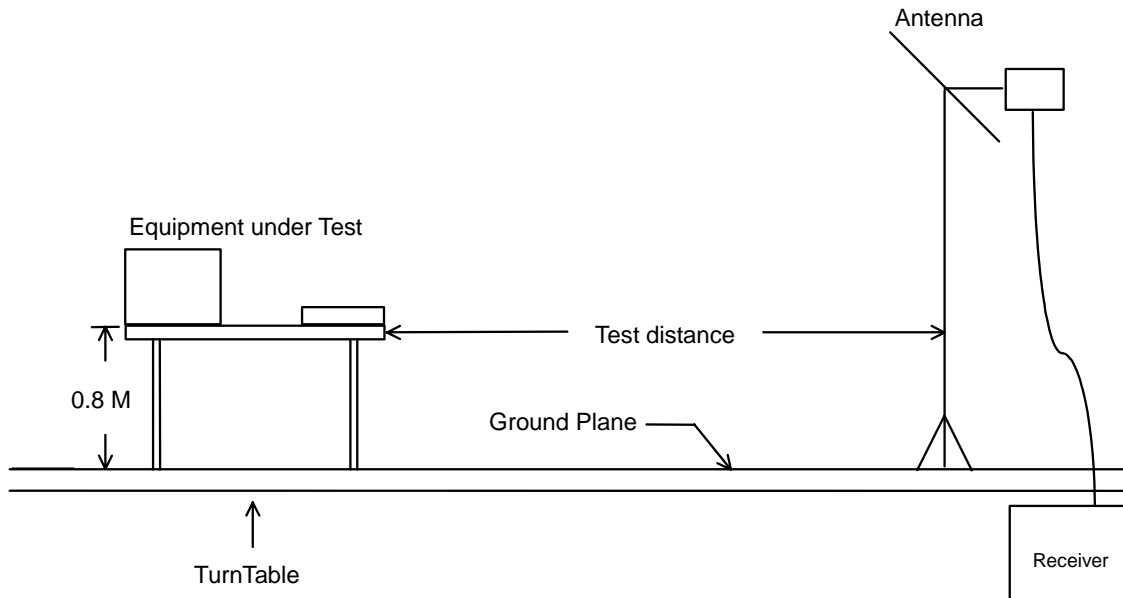
### 5.6.1. Major Measuring Instruments

- Amplifier (HP 8447D)
  - RF Gain 30 dB
  - Signal Input 100 KHz to 1.3 GHz
  
- Amplifier (MITEQ AFS44)
  - RF Gain 40 dB
  - Signal Input 100 MHz to 26.5 GHz
  
- Spectrum analyzer (R&S FSEK30)
  - Attenuation 10 dB
  - Start Frequency 1 GHz
  - Stop Frequency 25 GHz
  - Resolution Bandwidth 1 MHz
  - Video Bandwidth 1 MHz
  - Signal Input 20 Hz to 40 GHz
  
- Test Receiver (SCHAFFNER SCR3501)
  - Resolution Bandwidth 120 KHz
  - Frequency Band 9 K – 1 GHz
  - Quasi-Peak Detector ON for Quasi-Peak Mode  
OFF for Peak Mode

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.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again 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: 62 %
- Test Date: Aug. 04, 2003
- 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**

**The test was passed at the minimum margin that marked under gray area in the following table, and its antenna height is 1 m, turn table degree is 105 °**

- Spurious Emission
- For 30MHz to 1GHz

Frequency ( MHz )	Antenna Polarity	Antenna Factor ( dB/m )	Cable Loss ( dB )	Reading ( dBuV )	Limits ( dBuV/m )	Emission ( uV/m )	Level ( dBuV/m )	Level ( uV/m )	Margin ( dB )	Detect Mode
343.400	H	12.79	3.40	24.50	46.00	199.53	40.69	108.27	-5.31	Peak
764.100	H	18.51	4.98	18.88	46.00	199.53	42.37	131.37	-3.63	Peak
841.800	H	19.05	5.16	15.20	46.00	199.53	39.41	93.43	-6.59	Peak
50.250	V	6.44	1.43	27.58	40.00	100.00	35.45	59.22	-4.55	Peak
53.490	V	6.02	1.40	28.97	40.00	100.00	36.39	65.99	-3.61	Peak
152.850	V	9.02	2.10	26.70	43.50	149.62	37.82	77.80	-5.68	Peak

- For 1GHz to 5GHz

Frequency ( MHz )	Antenna Polarity	Cable Factor	Reading Loss	Limits ( dBuV )	Emission ( dBuV/m )	Level ( uV/m )	Margin ( dB )	Detect Mode		
1068.000	H	24.28	4.04	13.98	74.00	5011.87	42.30	130.32	-31.70	Peak
1068.000	H	24.28	4.04	3.28	54.00	501.19	31.60	38.02	-22.40	A.V.
1222.000	H	24.66	4.28	14.98	74.00	5011.87	43.92	157.04	-30.08	Peak
1222.000	H	24.66	4.28	3.65	54.00	501.19	32.59	42.61	-21.41	A.V.
1452.000	H	25.22	4.63	13.19	74.00	5011.87	43.04	141.91	-30.96	Peak
1452.000	H	25.22	4.63	4.05	54.00	501.19	33.90	49.55	-20.10	A.V.
2036.000	H	27.48	5.73	12.10	54.00	501.19	45.31	184.29	-8.69	A.V.
2036.000	H	27.48	5.73	15.82	74.00	5011.87	49.03	282.81	-24.97	Peak
4036.000	H	32.58	9.32	15.22	74.00	5011.87	57.12	717.79	-16.88	Peak
4036.000	H	32.58	9.32	8.65	54.00	501.19	50.55	336.90	-3.45	A.V.
3980.000	V	32.59	9.32	15.51	74.00	5011.87	57.42	743.02	-16.58	Peak
3980.000	V	32.59	9.32	8.86	54.00	501.19	50.77	345.54	-3.23	A.V.

- For 5GHz ~ 25GHz

Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

■ Field strength of fundamental and harmonics

Frequency ( MHz )	Antenna Polarity	Cable Factor ( dB/m )	Reading Loss ( dB )	Reading ( dBuV )	Limits ( dBuV/m )	Emission ( uV/m )	Level ( dBuV/m )	Margin ( uV/m )	Detect ( dB )	Mode
2412.000	H	28.24	6.22	61.53	-	-	95.99	63023.13		AV
2412.000	H	28.24	6.22	69.62	-	-	104.08	159955.80		Peak
2414.000	V	28.25	6.23	67.89	-	-	102.37	131371.15		Peak
2414.000	V	28.25	6.23	60.71	-	-	95.19	57477.78		AV
4824.000	V/H						-			AV/Peak
7236.000	V/H						-			AV/Peak
9648.000	V/H						-			AV/Peak
12060.000	V/H						-			AV/Peak
14472.000	V/H						-			AV/Peak
16884.000	V/H						-			AV/Peak
19296.000	V/H						-			AV/Peak
21708.000	V/H						-			AV/Peak
24120.000	V/H						-			AV/Peak

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

Test Engineer: Steve  
Steve Chen

- Test Mode: Mode 2
- Test Distance: 3 M
- Temperature: 27°C
- Relative Humidity: 62 %
- Test Date: Aug. 04, 2003
- 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**

**The test was passed at the minimum margin that marked under gray area in the following table, and its antenna height is 1 m, turn table degree is 100 °**

- Spurious Emission
- For 30MHz to 1GHz

Frequency ( MHz )	Antenna Polarity	Cable Factor	Reading Loss	Limits ( dBuV )	Emission ( dBuV/m )	Level ( uV/m )	Margin ( dB )	Detect Mode		
382.600	H	14.09	3.50	23.33	46.00	199.53	40.92	111.17	-5.08	Peak
764.100	H	18.51	4.98	17.49	46.00	199.53	40.98	111.94	-5.02	Peak
841.800	H	19.05	5.16	18.61	46.00	199.53	42.82	138.36	-3.18	QP
50.250	V	6.44	1.43	29.08	40.00	100.00	36.95	70.39	-3.05	Peak
56.730	V	5.60	1.47	29.41	40.00	100.00	36.48	66.68	-3.52	QP
152.850	V	9.02	2.10	26.73	43.50	149.62	37.85	78.07	-5.65	Peak

- For 1GHz to 5GHz

Frequency ( MHz )	Antenna Polarity	Cable Factor	Reading Loss	Limits ( dBuV )	Emission ( dBuV/m )	Level ( uV/m )	Margin ( dB )	Detect Mode		
1222.000	H	24.66	4.28	16.77	74.00	5011.87	45.71	192.97	-28.29	Peak
1222.000	H	24.66	4.28	5.08	54.00	501.19	34.02	50.23	-19.98	A.V.
1452.000	H	25.22	4.63	15.19	74.00	5011.87	45.04	178.65	-28.96	Peak
1452.000	H	25.22	4.63	4.51	54.00	501.19	34.36	52.24	-19.64	A.V.
2062.000	H	27.53	5.76	16.57	74.00	5011.87	49.86	311.17	-24.14	Peak
2062.000	H	27.53	5.76	12.06	54.00	501.19	45.35	185.14	-8.65	A.V.
4020.000	H	32.59	9.34	15.15	74.00	5011.87	57.08	714.50	-16.92	Peak
4020.000	H	32.59	9.34	8.83	54.00	501.19	50.76	345.14	-3.24	A.V.
2062.000	V	27.53	5.76	12.84	74.00	5011.87	46.13	202.53	-27.87	Peak
2062.000	V	27.53	5.76	9.05	54.00	501.19	42.34	130.92	-11.66	A.V.
4956.000	V	33.34	9.14	14.50	74.00	5011.87	56.98	706.32	-17.02	Peak
4956.000	V	33.34	9.14	8.39	54.00	501.19	50.87	349.54	-3.13	A.V.

- For 5GHz ~ 25GHz

Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured



■ Field strength of fundamental and harmonics

Frequency ( MHz )	Antenna Polarity	Cable Factor ( dB/m )	Cable Loss ( dB )	Reading ( dBuV )	Limits ( dBuV/m )	Emission ( uV/m )	Level ( dBuV/m )	Margin ( uV/m )	Detect ( dB )	Mode
2438.000	H	28.30	6.26	69.03	-	-	103.59	151181.97		Peak
2438.000	H	28.30	6.26	60.97	-	-	95.53	59772.30		AV
2438.000	V	28.30	6.26	64.32	-	-	98.88	87902.25		Peak
2438.000	V	28.30	6.26	56.62	-	-	91.18	36224.30		AV
4874.000	V/H						-			AV/Peak
7311.000	V/H						-			AV/Peak
9748.000	V/H						-			AV/Peak
12185.000	V/H						-			AV/Peak
14622.000	V/H						-			AV/Peak
17059.000	V/H						-			AV/Peak
19496.000	V/H						-			AV/Peak
21933.000	V/H						-			AV/Peak
24370.000	V/H						-			AV/Peak

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

Test Engineer: Steve Chen  
Steve Chen

- Test Mode: Mode 3
- Test Distance: 3 M
- Temperature: 27°C
- Relative Humidity: 62 %
- Test Date: Aug. 04, 2003
- 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**

**The test was passed at the minimum margin that marked under gray area in the following table, and its antenna height is 1 m, turn table degree is 105 °**

- Spurious Emission
- For 30MHz to 1GHz

Frequency ( MHz )	Antenna Polarity	Cable Factor	Reading Loss	Limits ( dBuV )	Emission ( dBuV/m )	Level ( uV/m )	Margin ( dB )	Detect Mode		
382.600	H	14.09	3.50	23.93	46.00	199.53	41.52	119.12	-4.48	Peak
764.100	H	18.51	4.98	19.06	46.00	199.53	42.55	134.12	-3.45	Peak
841.800	H	19.05	5.16	16.38	46.00	199.53	40.59	107.03	-5.41	Peak
50.250	V	6.44	1.43	28.38	40.00	100.00	36.25	64.94	-3.75	Peak
56.730	V	5.60	1.47	29.92	40.00	100.00	36.99	70.71	-3.01	QP
152.850	V	9.02	2.10	26.68	43.50	149.62	37.80	77.62	-5.70	Peak

- For 1GHz to 5GHz

Frequency ( MHz )	Antenna Polarity	Cable Factor	Reading Loss	Limits ( dBuV )	Emission ( dBuV/m )	Level ( uV/m )	Margin ( dB )	Detect Mode		
1222.000	H	24.66	4.28	15.72	74.00	5011.87	44.66	171.00	-29.34	Peak
1222.000	H	24.66	4.28	5.20	54.00	501.19	34.14	50.93	-19.86	A.V.
1452.000	H	25.22	4.63	14.23	74.00	5011.87	44.08	159.96	-29.92	Peak
1452.000	H	25.22	4.63	4.01	54.00	501.19	33.86	49.32	-20.14	A.V.
2086.000	H	27.58	5.80	17.37	74.00	5011.87	50.75	344.75	-23.25	Peak
2086.000	H	27.58	5.80	13.05	54.00	501.19	46.43	209.65	-7.57	A.V.
1222.000	V	24.66	4.28	15.33	74.00	5011.87	44.27	163.49	-29.73	Peak
1222.000	V	24.66	4.28	6.21	54.00	501.19	35.15	57.21	-18.85	A.V.
2086.000	V	27.58	5.80	13.15	74.00	5011.87	46.53	212.08	-27.47	Peak
2086.000	V	27.58	5.80	5.07	54.00	501.19	38.45	83.66	-15.55	A.V.
3936.000	V	32.46	9.21	15.57	74.00	5011.87	57.24	727.78	-16.76	Peak
3936.000	V	32.46	9.21	9.21	54.00	501.19	50.88	349.95	-3.12	A.V.

- For 5GHz ~ 25GHz

Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

■ Field strength of fundamental and harmonics

Frequency ( MHz )	Polarity	Antenna Factor ( dB/m )	Cable Loss ( dB )	Reading ( dBuV )	Limits ( dBuV/m ) ( uV/m )	Emission ( dBuV/m ) ( uV/m )	Level ( dB )	Margin ( dB )	Detect Mode	
2462.000	H	28.35	6.29	68.75	-	103.39	147740.65		Peak	
2462.000	H	28.35	6.29	59.39	-	94.03	50292.13		AV	
2462.000	V	28.35	6.29	63.90	-	98.54	84527.88		Peak	
2462.000	V	28.35	6.29	56.46	-	91.10	35892.19		AV	
4924.000	H	33.27	9.12	15.29	74.00	5011.87	57.68	765.60	-16.32	Peak
4924.000	H	33.27	9.12	8.37	54.00	501.19	50.76	345.14	-3.24	AV
4924.000	H						-			AV/Peak
7386.000	V/H						-			AV/Peak
9848.000	V/H						-			AV/Peak
12310.000	V/H						-			AV/Peak
14772.000	V/H						-			AV/Peak
17234.000	V/H						-			AV/Peak
19696.000	V/H						-			AV/Peak
22158.000	V/H						-			AV/Peak
24620.000	V/H						-			AV/Peak

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

Test Engineer: Steve Chen  
Steve Chen

**5.7. Band Edges Measurement**

5.7.1. Measuring Instruments :

As described in chapter 7 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

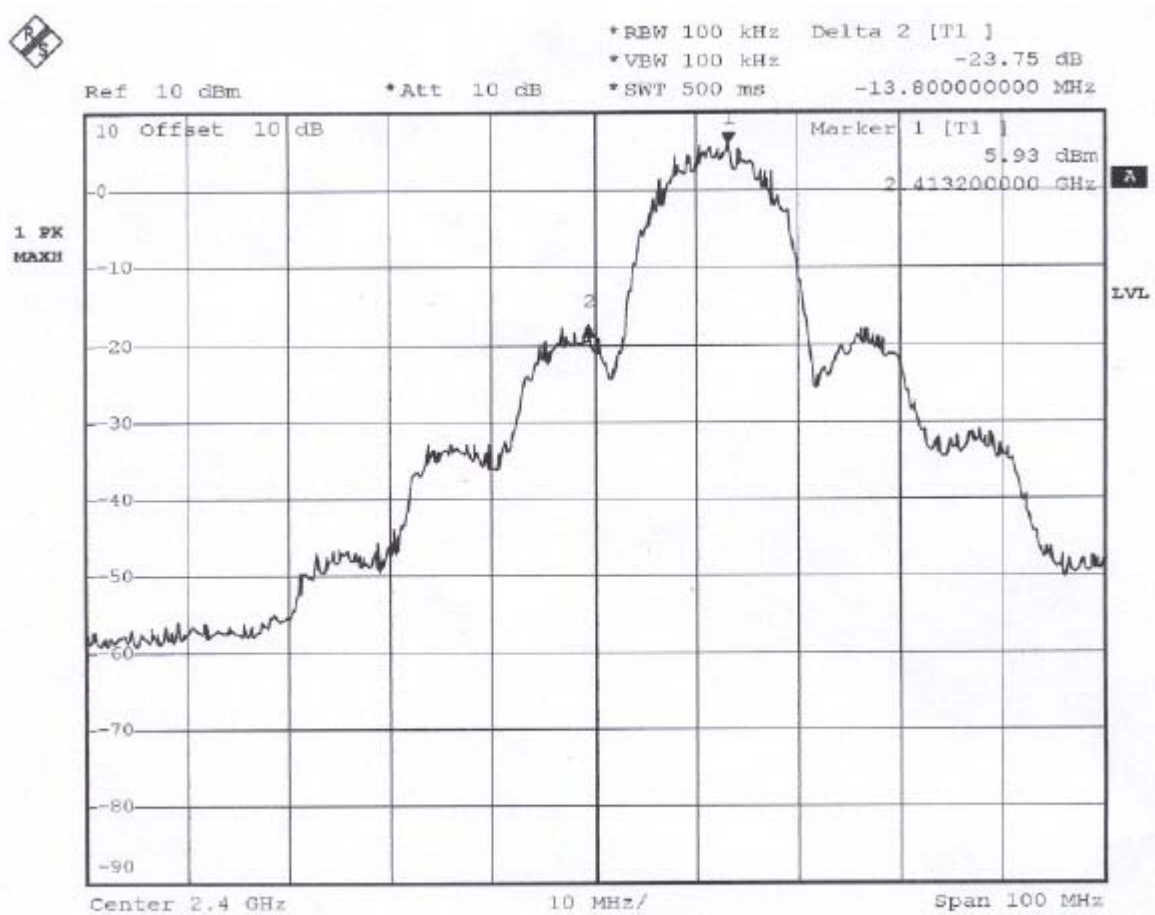
The band edge emission plot on page 39 shows 40.84dB delta between carrier maximum power and local maximum emission in the restricted band (2.483.5GHz).

Polarity	The emission of carrier power strength (dB $\mu$ V/m)	The maximum field strength in restrict band (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
H	103.39	62.55	74.00	-11.45	Peak
H	94.03	53.19	54.00	-0.81	Average
V	98.54	57.70	74.00	-16.30	Peak
V	91.10	50.26	54.00	-3.74	Average

\* 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.

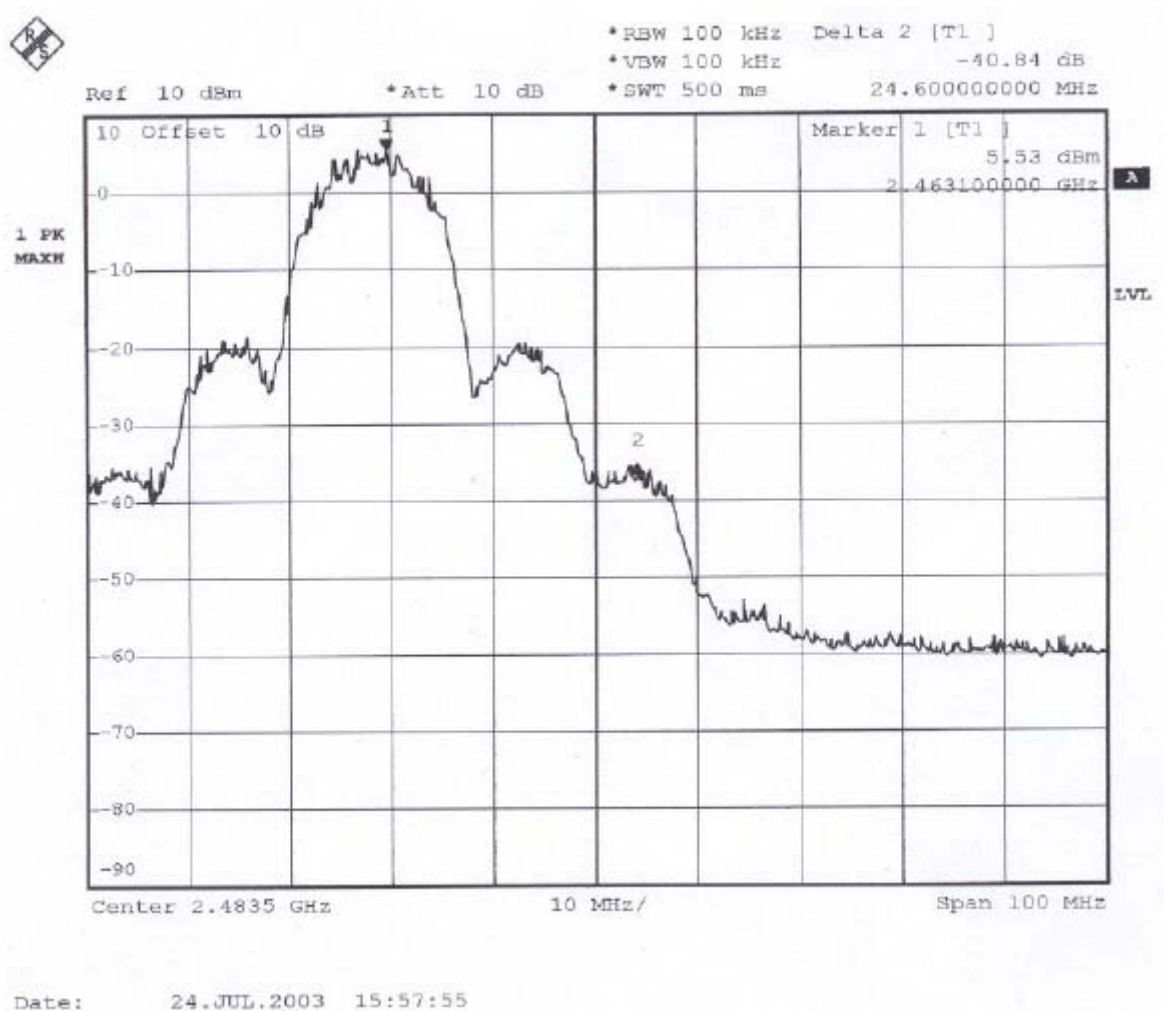
The spectrum analyzer plots are attached as below :

Plot1 (Channel 01) :



Date: 24.JUL.2003 16:12:02

Plot2 (Channel 11) :



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

## **5.8. Antenna Requirements**

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

### **5.8.1. 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.

### **5.8.2. Antenna Connected Construction**

The maximum Gain antenna used in this product is dipole antenna. The antenna connector type is SMA-reversed The coaxial cable of the antenna is fixed to the antenna.



**5.9. RF Exposure**

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

RF Exposure Compliance

5.9.1. 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 <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> 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 <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> 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

5.9.2. MPE Calculations

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

- 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/cm<sup>2</sup>. We can change the formula to:

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

Channel NO.	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power ( W )	Calculated RF Exposure Separation Distance ( m )	Minimum RF Exposure Separation Distance ( m )
Channel 1	1.80	1.51	16.20	0.0417	0.0224	0.20
Channel 6	1.80	1.51	16.26	0.0423	0.0226	0.20
Channel 11	1.80	1.51	15.90	0.0389	0.0216	0.20

5.9.3. 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. EMI Suppression Component List**

1. Add a metal plate to main board to increase ground area.  
(As the Internal photo No. 5)
2. Connect separate ground.  
(As the Internal photo No. 4、 5)
3. Add a metal spring finger to main board.  
(As the Internal photo No. 4)
4. Connect CCD board ground to metal plate with a wire.  
(As the Internal photo No. 2)
5. Add two ferrite cores to antenna cable.  
(As the Internal photo No. 2、 3)
6. Add a ferrite core on power adapter cable.  
(As the External photo No. 4)
7. Add gasket on main board.  
(As the Internal photo No. 4)

**7. Antenna Factor & Cable Loss**

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)
30	15.35	1.01	1000	24.10	3.92
35	13.63	1.04	2000	27.40	5.66
40	11.11	1.09	3000	30.00	7.20
45	10.59	1.24	4000	32.60	9.36
50	6.47	1.43	5000	33.40	9.16
55	5.83	1.39	6000	34.20	10.70
60	5.18	1.59	7000	35.30	12.16
65	4.81	1.41	8000	36.90	13.12
70	4.43	1.43	9000	38.10	13.81
75	5.10	1.55	10000	39.00	14.83
80	5.91	1.56	11000	38.60	15.83
85	7.33	1.62	12000	39.50	17.11
90	8.74	1.41	13000	39.30	17.62
95	9.05	1.81	14000	41.60	18.37
100	9.36	1.68	15000	40.60	19.10
110	9.65	1.73	16000	37.20	19.72
120	9.97	1.79	17000	40.20	21.98
130	10.51	1.93	18000	48.90	21.22
140	10.32	2.06	19000	37.60	23.90
150	9.42	2.09	20000	37.30	24.07
160	8.09	2.12	21000	37.00	25.49
170	7.43	2.12	22000	38.00	24.92
180	7.60	2.12	23000	38.70	25.60
190	7.43	2.21	24000	38.60	25.70
200	7.26	2.29	25000	38.90	26.54
220	9.11	2.42			
240	10.88	2.54			
260	11.75	2.66			
280	11.55	2.76			
300	11.36	2.85			
320	12.03	3.10			
340	12.69	3.36			
360	13.33	3.49			
380	14.00	3.50			
400	14.63	3.51			
450	15.33	3.55			
500	16.03	3.81			
550	16.65	4.05			
600	17.29	4.23			
650	17.64	4.63			
700	18.00	4.74			
750	18.39	4.95			
800	18.79	5.06			
850	19.10	5.18			
900	19.42	5.40			
950	19.58	5.91			
1000	19.75	5.58			

## 8. List of Measuring Equipments Used

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMC Receiver	R&S	ESCS 30	100132	9 KHz – 2.75 GHz	Jun. 12, 2003	Conduction (CO01-HY)
LISN	MessTec	NNB-2/16Z	2001-008	9 KHz – 30 MHz	Apr. 29, 2003	Conduction (CO01-HY)
LISN (Support Unit)	MessTec	NNB-2/16Z	2001-009	9 KHz – 30 MHz	Apr. 29, 2003	Conduction (CO01-HY)
EMI Filter	LINDGREN	LRE-2060	1004	< 450 Hz	N/A	Conduction (CO01-HY)
EMI Filter	LINDGREN	N6006	201052	0 ~ 60 Hz	N/A	Conduction (CO01-HY)
RF Cable-CON	Suhner Switzerland	RG223/U	CB029	9KHz~30MHz	Jan. 07, 2003	Conduction (CO01-HY)
50 ohm BNC type Terminal	NOBLE	50ohm	TM013	50 ohm	Apr. 24, 2003	Conduction (CO01-HY)
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	Jun. 21, 2003	Radiation (03CH03-HY)
Spectrum analyzer	R&S	FSEK30	100189	20Hz~40GHz	Aug. 04, 2003	Radiation (03CH03-HY)
Receiver	SCHAFFNER	SCR 3501	417	9 KHz –1GHz	Feb. 20, 2003	Radiation (03CH03-HY)
Amplifier	HP	8447D	2944A09072	100KHz – 1.3GHz	Oct. 21, 2002	Radiation (03CH03-HY)
Bilog Antenna	SCHAFFNER	CBL6112B	2687	30MHz –2GHz	Dec. 21, 2002	Radiation (03CH03-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz~1GHz	Jan. 02, 2003	Radiation (03CH03-HY)
Amplifier	MITEQ	NSP2650-NF	805858	100MHz~26.5GHz	Jul. 10, 2003	Radiation (03CH03-HY)
Horn Antenna	COM-POWER	AH-118	10094	1GHz – 18GHz	Apr. 10, 2003	Radiation (03CH03-HY)
Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170154	15GHz~40GHz	Jun. 02, 2003	Radiation (03CH03-HY)
RF Cable-HIGH	Jye Bao	RG142	CB030-HIGH	1GHz~29.5GHz	Mar. 14, 2003	Radiation (03CH03-HY)
Power meter	R&S	NRVS	100444	DC~40GHz	May 28, 2003	Conducted
Power sensor	R&S	NRV-Z55	100049	DC~40GHz	May 28, 2003	Conducted
Power Sensor	R&S	NRV-Z32	100057	30MHz-6GHz	May 28, 2003	Conducted
AC power source	HPC	HPA-500W	HPA-9100024	AC 0~300V	May 27, 2003	Conducted
Temp. and Humidity Chamber	KSON	THS-C3L	612	N/A	Oct. 02, 2002	Conducted

Calibration Interval of instruments listed above is one year.

**9. Uncertainty of Test Site**

Uncertainty of Radiated Emission Measurement

Contribution	Probability Distribution	3m
Antenna factor calibration	normal(k=2)	±1
cable loss calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
Antenna Directivity	rectangular	±3
Antenna Factor V.S. Height	rectangular	±2
Antenna Factor Interpolation for Frequency	rectangular	±0.25
site imperfection	rectangular	±2
Mismatch Receiver VSWR $\Gamma_1=0.09$ Antenna VSWR $\Gamma_2=0.67$ Uncertainty= $20\log(1-\Gamma_1*\Gamma_2)$	U-shaped	±0.54
combined standard uncertainty $U_e(y)$	normal	±2.7
Measuring uncertainty for a level of confidence of 95% $U=2U_e(y)$	normal (k=2)	±5.4

$U = \{ (1/2)^2 + (0.3/2)^2 + (2^2 + 0.5^2 + 2^2 + 0.25^2 + 2^2) / 3 + (0.54)^2 / 2 \} = 2.2$  for 10m test distance

$U = \{ (1/2)^2 + (0.3/2)^2 + (2^2 + 3^2 + 2^2 + 0.25^2 + 2^2) / 3 + (0.54)^2 / 2 \} = 2.7$  for 3m test distance

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
LISN coupling specification	rectangular	±1.5
Transducer factor frequency interpolation	rectangular	±0.2
Mismatch Receiver VSWR $\Gamma_1=0.09$ LISN VSWR $\Gamma_2=0.33$ Uncertainty= $20\log(1-\Gamma_1*\Gamma_2)$	U-shaped	0.2
combined standard uncertainty $U_e(y)$	normal	±1.66
Measuring uncertainty for a level of confidence of 95% $U=2U_e(y)$	normal (k=2)	±3.32

$U = \{ (0.3/2)^2 + (2^2 + 1.5^2 + 0.2^2) / 3 + (0.2)^2 / 2 \} = 1.66$