



# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test report file number : E045R-014

Applicant : IPOne Inc.

Address : Gusang Bldg., 2F., 1009-5, Daechi-Dong, Gangnam-Gu, Seoul 135-280, Korea

Manufacturer : IPOne Inc.

Address : Gusang Bldg., 2F., 1009-5, Daechi-Dong, Gangnam-Gu, Seoul 135-280 Korea

Type of Equipment : Wireless LAN Device

FCC ID. : RV5AIRGATE2500

Model Name : AirGate2500

Serial number : None

Total page of Report : 35 pages (including this page)

Date of Incoming : November 11, 2003

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## SUMMARY

The equipment complies with the regulation; **FCC Part 15 Subpart C Section 15.247.**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

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**1. VERIFICATION OF COMPLIANCE**

APPLICANT : IPOne Inc.  
ADDRESS : Gusang Bldg., 2F., 1009-5, Daechi-Dong, Gangnam-Gu, Seoul 135-280, Korea  
CONTACT PERSON : Jeengee Kim / Principal Engineer  
TELEPHONE NO : +82-2-3011-0916  
FCC ID : RV5AIRGATE2500  
MODEL NO/NAME : AirGate2500  
SERIAL NUMBER : N/A  
DATE : May 07, 2004

|                                                         |                                                                    |
|---------------------------------------------------------|--------------------------------------------------------------------|
| DEVICE TYPE                                             | Wireless LAN Device<br>- <b><i>DIGITAL TRANSMISSION SYSTEM</i></b> |
| THIS REPORT CONCERNS                                    | ORIGINAL GRANT                                                     |
| MEASUREMENT PROCEDURES                                  | ANSI C63.4/2001                                                    |
| TYPE OF EQUIPMENT TESTED                                | PRE-PRODUCTION                                                     |
| KIND OF EQUIPMENT<br>AUTHORIZATION REQUESTED            | CERTIFICATION                                                      |
| EQUIPMENT WILL BE OPERATED<br>UNDER FCC RULES PART(S)   | FCC PART 15 SUBPART C Section 15.247                               |
| MODIFICATIONS ON THE EQUIPMENT<br>TO ACHIEVE COMPLIANCE | NONE                                                               |
| FINAL TEST WAS CONDUCTED ON                             | 3/1 METER(S) OPEN AREA TEST SITE                                   |

- This device has shown compliance with the conducted emissions limits in 15.207 adopted under FCC 02-107 (ET Docket 98-80). The device may be marketed after July 11, 2005 and is not affected by the 15.37(j) transition provisions.
- The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.



## 2. TEST SUMMARY

### 2.1 Test items and results

| SECTION           | TEST ITEMS                                          | RESULTS                |
|-------------------|-----------------------------------------------------|------------------------|
| 15.247 (a) (2)    | Minimum 6dB Bandwidth                               | Met the Limit / PASS   |
| 15.247 (b) (3)    | Maximum Peak Output Power                           | Met the Limit / PASS   |
| 15.247 (b) (5)    | Radio Frequency Exposure Level                      | Met the Limit / PASS   |
| 15.247 (c)        | 100 kHz Bandwidth Outside the Frequency Band        | Met the Limit / PASS   |
| 15.247 (c)        | Radiated Emission which fall in the Restricted Band | Met the Limit / PASS   |
| 15.247 (d)        | Peak Power Spectral Density                         | Met the Limit / PASS   |
| 15.209 and 15.109 | Radiated Emission Limits, General Requirement       | Met the Limit / PASS   |
| 15.207 and 15.107 | Conducted Limits                                    | Met the Limit / PASS   |
| 15.203            | Antenna Requirement                                 | Met requirement / PASS |

### 2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

### 2.3 Related Submittal(s) / Grant(s)

Original submittal only

### 2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

### 2.5 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4/2001. Radiated testing was performed at a distance of 3 meters from EUT to the antenna.

### 2.6 Test Facility

The Electromagnetic compatibility measurement facilities are located on at 426-1 Daessangryung-Ri, Chowol-Myeon, Gwangju-Si, Gyeonggi-Do 464-080 Korea. Description details of test facilities were submitted to the Federal Communications Commission on January 18, 2002 (Registration Number: 92819 and 340658), accredited by KOLAS (Korea Laboratory Accreditation Scheme, No: 85) and approved by TUV, DNV, SEMKO and MIC (Ministry of Information and Communications in Korea) according to the requirement of ISO17025.

### 3. GENERAL INFORMATION

#### 3.1 Product Description

The IPhone Inc., Model Airgate 2500 (referred to as the EUT in this report) is an Access Point, which is consisting of WLAN and ADSL port. The EUT aims to provide the wireless LAN service through Access Point which combines ADSL with wireless LAN. The integrated Access Point, composed of ADSL access device and 11M wireless point, is designed to provide the WLAN service over the high speed internet service via ADSL line. The product specification described herein was obtained from product data sheet or user's manual.

|                                             |                                                                                      |
|---------------------------------------------|--------------------------------------------------------------------------------------|
| DEVICE TYPE                                 | Wireless LAN & ADSL Combo Device                                                     |
| SPREAD SPECTRUM TYPE                        | DSSS                                                                                 |
| STANDARD                                    | IEEE 802.11b                                                                         |
| PROTOCOL                                    | CSMA/CA                                                                              |
| OPERATING FREQUENCY                         | 2412-2462 MHz                                                                        |
| OUTPUT POWER                                | Typ. 20dBm                                                                           |
| DATA TRANSFER RATE                          | 11 Mbps                                                                              |
| CHANNEL                                     | 11 Channels                                                                          |
| MODULATION TYPE                             | DBPSK, DQPSK, CCK                                                                    |
| DUTY CYCCLE                                 | 100%                                                                                 |
| ANTENNA                                     | SMA Type OMNI                                                                        |
| ANTENNA GAIN                                | 2.0dBi                                                                               |
| LIST OF EACH OSC. ORCRY. FREQ.(FREQ.>=1MHz) | 10.0, 25.0, 35.328 MHz                                                               |
| NUMBER OF LAYER                             | Main Board: 6 Layers                                                                 |
| POWER REQUIREMENT                           | DC 5V, 1.5A from AC/DC Adapter                                                       |
| TEMPERATURE CONDITION                       | Operation: -100°C ~ 50°C, Storage: -20°C ~ 70°C                                      |
| EXTERNAL CONNECTOR                          | 2 SMA Type Antenna Connectors, DC Input Port,<br>2 RJ 45 LAN Ports, and 2 RJ 11Ports |

#### 3.2 Alternative type(s)/model(s); also covered by this test report.

No other model differences have been mentioned.

### 4. EUT MODIFICATIONS

None



## 5. SYSTEM TEST CONFIGURATION

### 5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

| DEVICE TYPE | MANUFACTURER                 | MODEL/PART NUMBER           | FCC ID |
|-------------|------------------------------|-----------------------------|--------|
| MAIN BOARD  | IPOne Inc.                   | N/A                         | N/A    |
| RF MODULE   | Senao International Co., Ltd | SL-2511CD PLUS EXT2 MERCURY | N/A    |

### 5.3 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

| Model          | Manufacturer        | FCC ID     | Description               | Connected to |
|----------------|---------------------|------------|---------------------------|--------------|
| Airgate2500    | IPOne Inc.          |            | Wireless LAN Device (EUT) | HOST         |
| HES12-050240-8 | Hitron Electronics  | N/A        | AC/DC Adapter             | EUT          |
| PLL011         | Dell Computer Corp. | DoC        | Notebook PC (HOST)        | EUT          |
| ADP-70EB       | Delta Electronics   | N/A        | AC/DC Adapter             | HOST         |
| GS-460         | Telephone           | N/A        | Telephone                 | EUT          |
| X06-08477      | Dell Computer Corp. | DoC        | Mouse                     | HOST         |
| 2225C          | HP                  | DS16XU2225 | Printer                   | HOST         |

### 5.4 Mode of operation during the test

The EUT has a detachable antenna, so the antenna was fitted in a manner typical of normal intended use and the transmitting signal was modulated as specified by the manufacturer. The transmitting signal was set at maximum output power. For transmitting and receiving the RF signal between HOST and Notebook PC, software using Hyper terminal program was used supplied by the manufacturer.



## 5.5 Configuration of Test System

**Line Conducted Test:** The power cord of the EUT was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power lines Conducted Emission tests were performed by using the procedure in ANSI C63.4/2001 7.2.3 to determine the worse operating conditions.

**Radiated Emission Test:** Preliminary radiated emissions test were conducted using the procedure in ANSI C63.4/2001 8.3.1.1 and 13.1.4.1 to determine the worse operating conditions. Final radiated emission tests were conducted at 3meter open area test site.  
The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

## 5.6 Antenna Requirement

For intentional device, according to 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.

### Antenna Construction:

The transmitter antenna of the EUT is counter clockwise SMA Type, so no consideration of replacement by the user.



## 6. PRELIMINARY TEST

### 6.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

| Operation Mode | The Worse operating condition (Please check one only) |
|----------------|-------------------------------------------------------|
| Stand-by mode  |                                                       |
| Charging mode  |                                                       |
| TX mode        | X                                                     |

### 6.2 General Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

| Operation Mode | The Worse operating condition (Please check one only) |
|----------------|-------------------------------------------------------|
| Stand-by mode  |                                                       |
| Charging mode  |                                                       |
| TX mode        | X                                                     |

## 7. MINIMUM 6dB BANDWIDTH

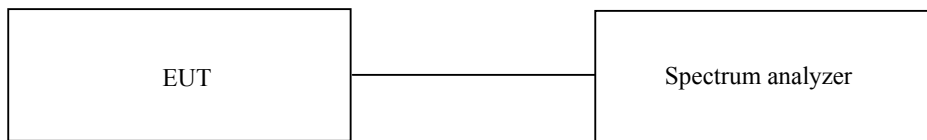
### 7.1 Operating environment

Temperature : 19°C

Relative humidity : 35 %

### 7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



### 7.3 Test equipment used

|     | Model Number | Manufacturer | Description       | Serial Number | Due Cal       |
|-----|--------------|--------------|-------------------|---------------|---------------|
| ■ - | 8564E        | HP           | Spectrum Analyzer | 3650A00756    | July 10, 2004 |

All test equipment used is calibrated on a regular basis.



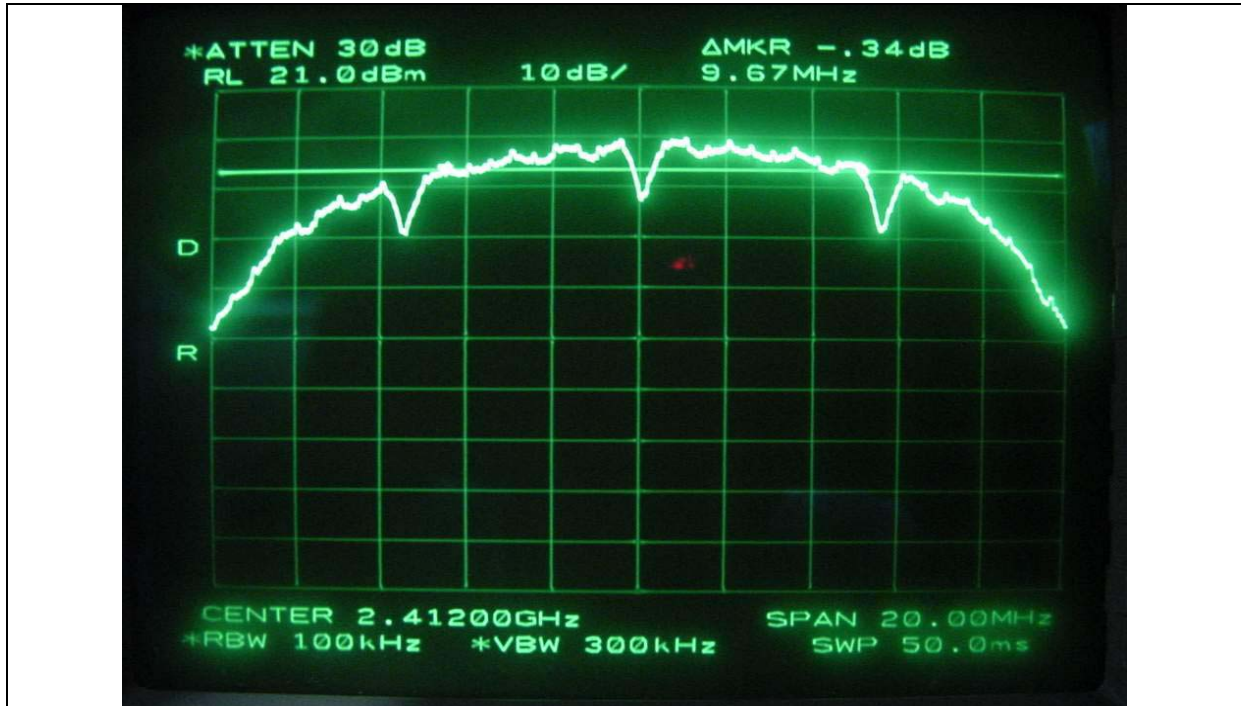
## 7.4 Test data

- Test Date : December 12, 2003  
- Test Result : Pass

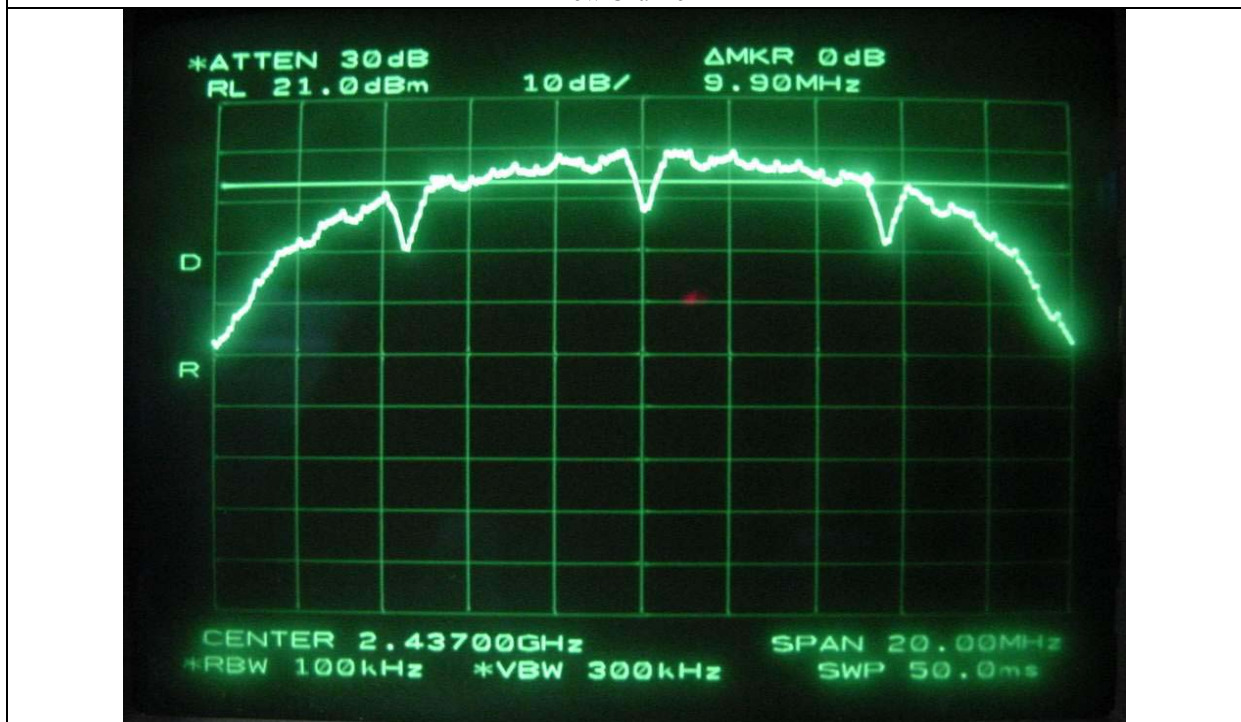
| CHANNEL | FREQUENCY(MHz) | MEASURED VLAUE (kHz) | LIMIT (kHz) | MARGIN (kHz) |
|---------|----------------|----------------------|-------------|--------------|
| Low     | 2412           | 9670                 | 500         | 9170         |
| Middle  | 2442           | 9900                 | 500         | 9400         |
| High    | 2462           | 10000                | 500         | 9500         |

Remark: See next page for an overview sweep performed with peak detector.

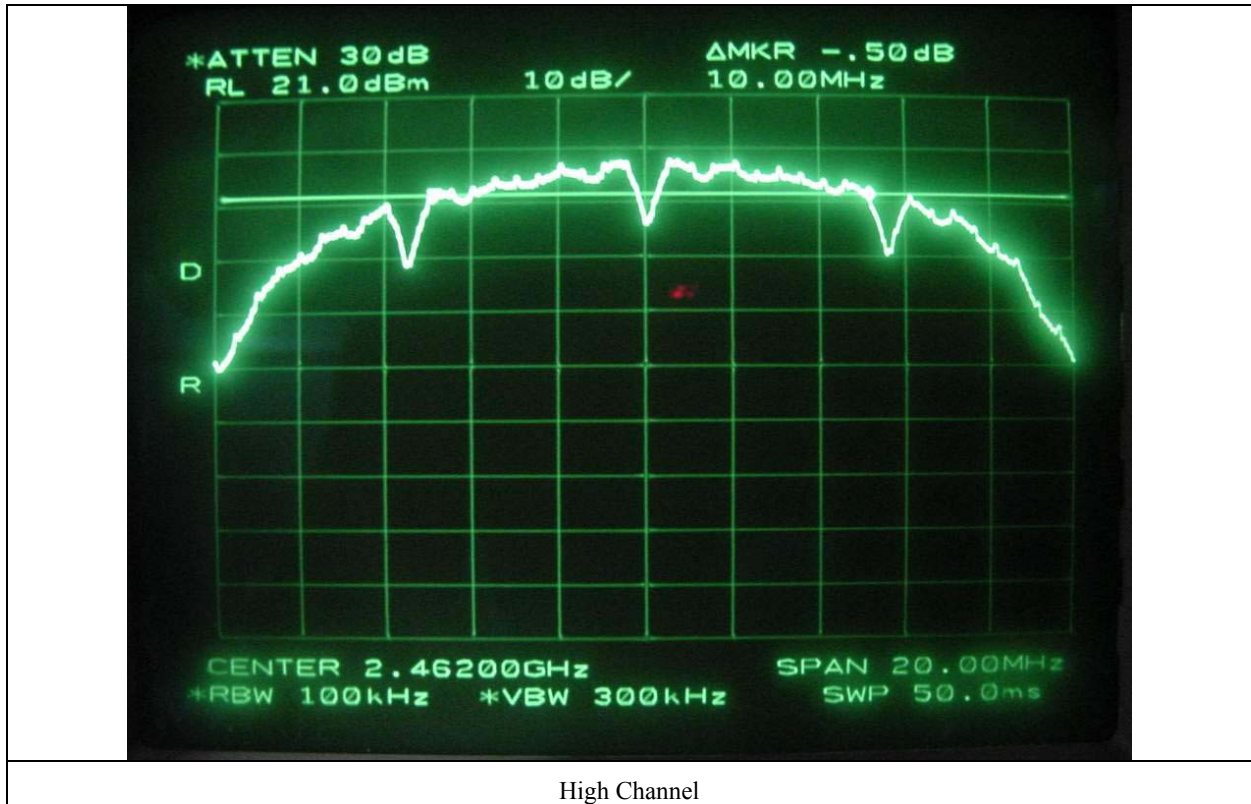
Tested by: Dan-Gi Lee / Project Engineer



Low Channel



Middle Channel



## 8. MAXIMUM PEAK OUTPUT POWER

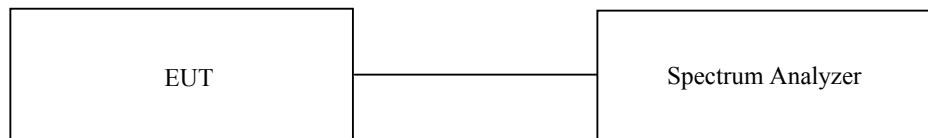
### 8.1 Operating environment

Temperature : 19°C

Relative humidity : 35 %

### 8.2 Test set-up

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The spectrum analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth. The EUT was operating in transmit mode at the appropriate center frequency.



### 8.3 Test equipment used

|     | Model Number | Manufacturer | Description       | Serial Number | Due Cal       |
|-----|--------------|--------------|-------------------|---------------|---------------|
| ■ - | 8564E        | HP           | Spectrum Analyzer | 3650A00756    | July 10, 2004 |

All test equipment used is calibrated on a regular basis.

**8.4 Test data**

- Test Date : December 12, 2003  
- Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 99% Occupied<br>Bandwidth (MHz) | MEASURED VLAUE<br>(dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|---------------------------------|-------------------------|----------------|----------------|
| Low     | 2412               | 15.0                            | 21.20                   | 30.0           | -8.80          |
| Middle  | 2437               | 15.0                            | 21.20                   | 30.0           | -8.80          |
| High    | 2462               | 15.2                            | 20.10                   | 30.0           | -9.90          |

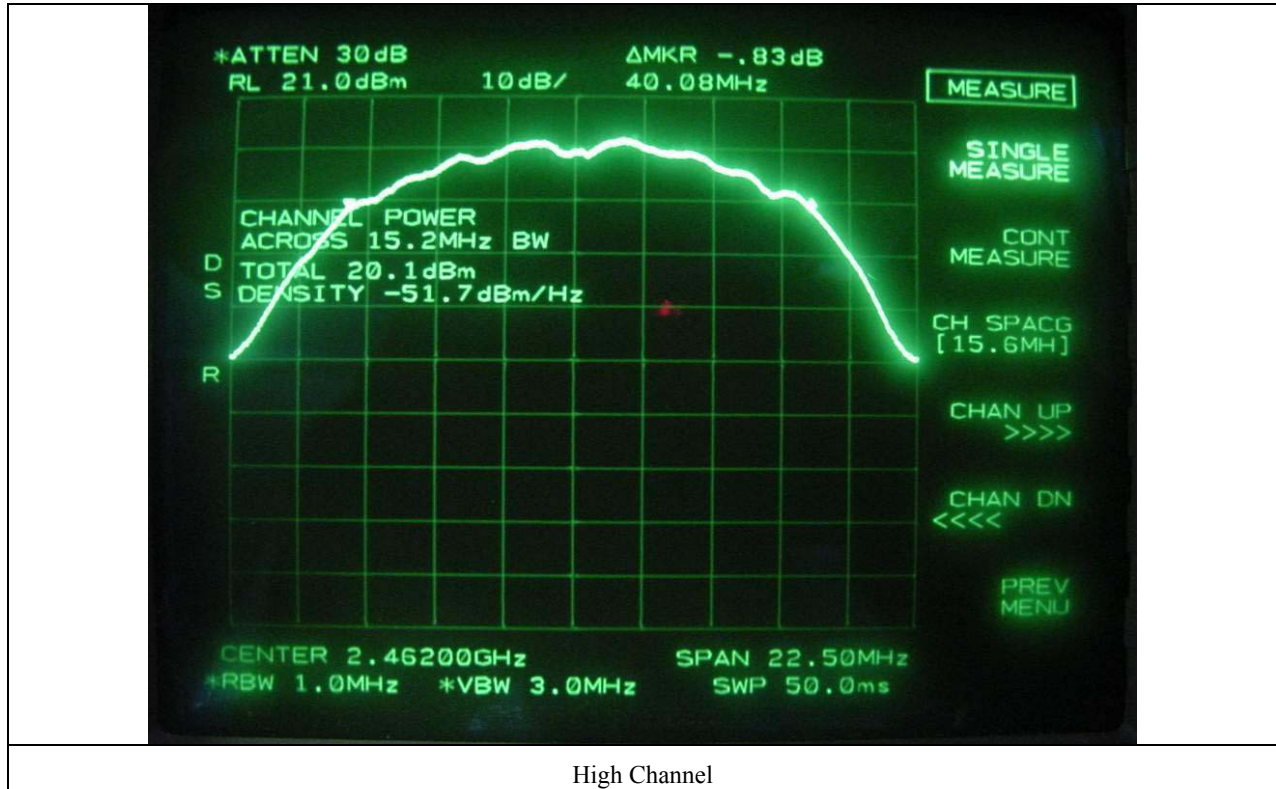
Tested by: Dan-Gi Lee / Project Engineer



Low Channel



Middle Channel



High Channel



## 9. MAXIMUM PERMISSIBLE EXPOSURE

### 9.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment is  $1\text{mW}/\text{cm}^2$ .

The electric field generated for a  $1\text{mW}/\text{cm}^2$  exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 3770, \text{ because } 1\text{mW} / \text{cm}^2 = 10\text{W} / \text{m}^2$$

Where

$S$  = Power density in  $\text{mW}/\text{cm}^2$ ,  $Z$  = Impedance of free space,  $377\Omega$

$E$  = Electric field strength in Volts/m,  $G$  = Numeric antenna gain, and  $d$  = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (3770 * S)}$$

Changing to units of mW and cm, using  $P (\text{mW}) = P (\text{W}) / 1000$ ,  $d (\text{cm}) = 100 * d (\text{m})$

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

$d$  = distance in cm,  $P$  = Power in mW,  $G$  = Numeric antenna gain, and  $S$  = Power density in  $\text{mW}/\text{cm}^2$

### 7.2 Calculated MPE Safe Distance

According to above equation, the following result was obtained.

| Peak Output Power |        | Antenna Gain | Calculated RF Exposure   |
|-------------------|--------|--------------|--------------------------|
| (dBm)             | (mW)   | dBi          | Separation Distance (cm) |
| 21.20             | 131.83 | 2.0          | 4.58                     |

Following Caution on the manual will be described.

“CAUTION: Exposure to Radio Frequency Radiation.

Antenna shall be mounted in such a manner to minimize the potential for human contact during normal operation. The antenna should not be contacted during operation to avoid the possibility of exceeding the FCC radio frequency exposure limit.”

## 10. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

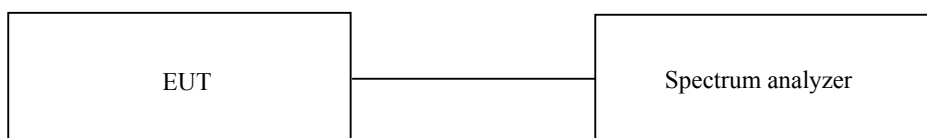
### 10.1 Operating environment

Temperature : 19°C

Relative humidity : 35 %

### 10.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 kHz, and peak detection was used.



### 10.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3meters, open-field test site. The EUT was placed on a non-conductive turntable approximately 0.8 meters above the ground plane.

The frequency spectrum from 30MHz to 25GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 and 4.0 meters in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

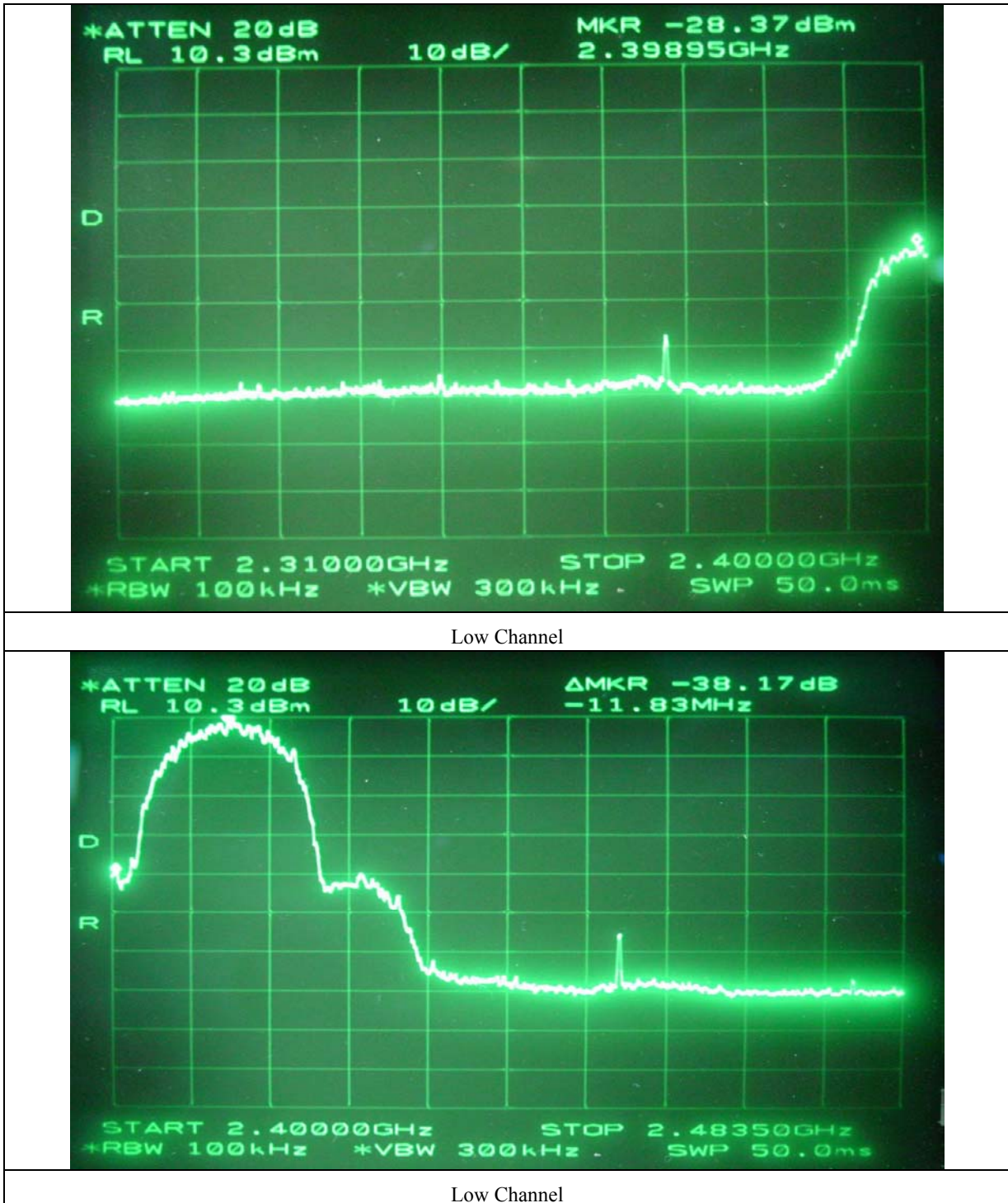
### 10.4 Test equipment used

|     | Model Number | Manufacturer    | Description            | Serial Number | Due Cal.      |
|-----|--------------|-----------------|------------------------|---------------|---------------|
| ■ - | 8564E        | Hewlett-Packard | Spectrum Analyzer      | 3650A00756    | July 10, 2004 |
| ■ - | 8449B        | Hewlett-Packard | Preamplifier           | 3008A00833    | June 10, 2004 |
| □ - | 83051A       | Agilent         | Preamplifier           | 3950M00201    | June 10, 2004 |
| ■ - | MA220        | HD              | Turn Table             | N/A           | N/A           |
| ■ - | HD240        | HD              | Antenna Mast           | N/A           | N/A           |
| ■ - | BBHA9170     | Schwarzbeck     | Horn Antenna           | BBHA9170178   | June 6, 2004  |
| ■ - | YSE 500B     | YoungShin Eng.  | Frequency Converter    | 950413001     | N/A           |
| ■ - | ETCR-10      | DaeHa           | Automatic Voltage Com. | N/A           | N/A           |

All test equipment used is calibrated on a regular basis.

## 10.5. Test data

### 10.5.1. Test data for conducted emission





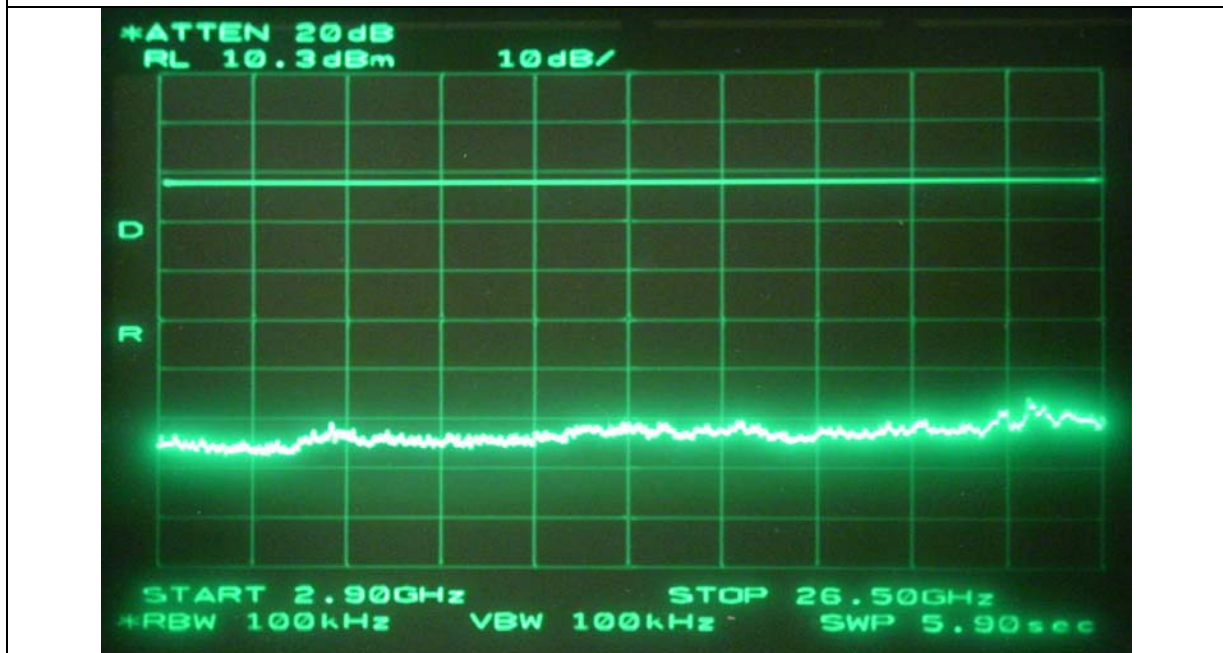
High Channel



High Channel



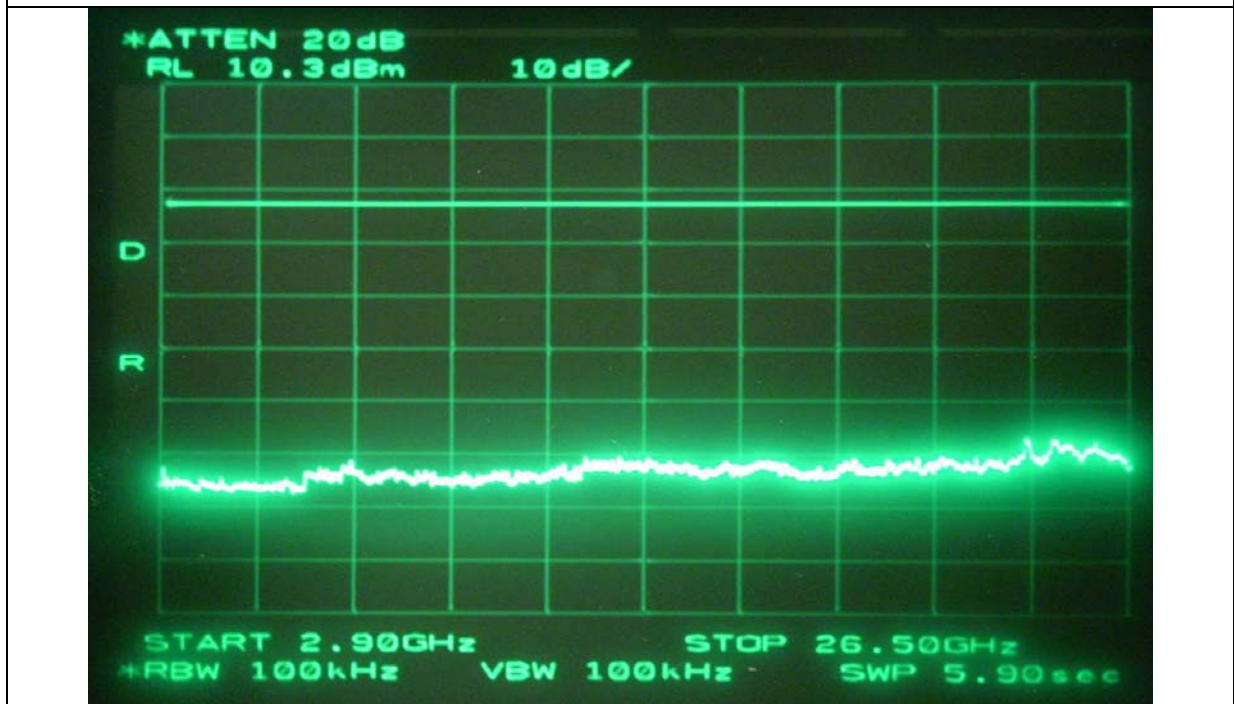
Low Channel



Low Channel



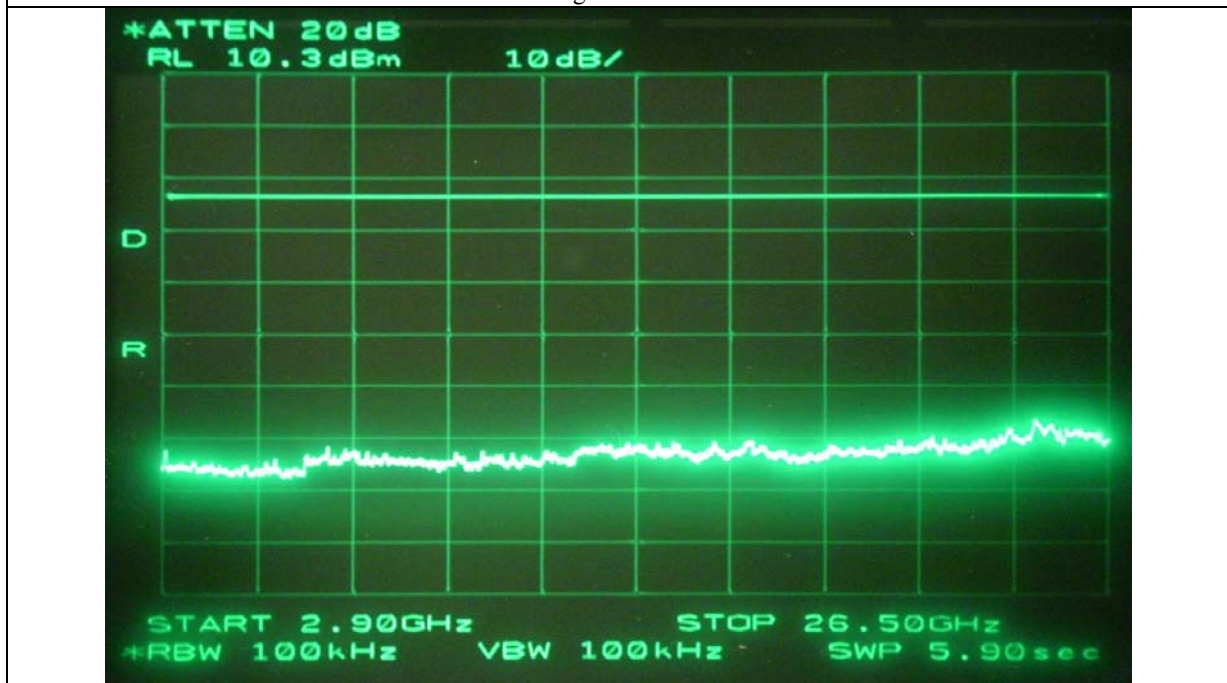
Middle Channel



Middle Channel



High Channel



High Channel

**10.5.2. Test data for radiated emission****10.5.2.1. Radiated Emission which fall in the Restricted Band**

- Test Date : December 16, 2003
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 25GHz
- Measurement distance : 1m
- Operating Condition : Low / High Channel
- Result : PASSED BY -1.72 dB at High Channel

| Frequency<br>(MHz)         | Reading<br>(dBuV) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Dist.<br>Factor | Total<br>(dBuV/m) | Limits<br>(dBuV/m) | Margin<br>(dB) |
|----------------------------|-------------------|------------------|--------------------|----------------|---------------|-------------|-----------------|-------------------|--------------------|----------------|
| Test Data for Low Channel  |                   |                  |                    |                |               |             |                 |                   |                    |                |
| 2386.47                    | 40.80             | Peak             | H                  | 27.62          | 2.5           | -           | 9.5             | 61.42             | 74.0               | -12.58         |
|                            | 39.70             | Peak             | V                  |                |               |             |                 | 60.32             | 74.0               | -13.68         |
|                            | 30.00             | Average          | H                  |                |               |             |                 | 51.62             | 54.0               | -2.38          |
|                            | 28.70             | Average          | V                  |                |               |             |                 | 49.32             | 54.0               | -4.68          |
| Test Data for High Channel |                   |                  |                    |                |               |             |                 |                   |                    |                |
| 2485.91                    | 41.80             | Peak             | H                  | 27.58          | 2.6           | -           | 9.5             | 62.48             | 74.0               | -11.52         |
|                            | 41.00             | Peak             | V                  |                |               |             |                 | 61.68             | 74.0               | -12.32         |
|                            | 31.60             | Average          | H                  |                |               |             |                 | 52.28             | 54.0               | -1.72          |
|                            | 30.40             | Average          | V                  |                |               |             |                 | 51.08             | 54.0               | -3.92          |

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

Tested by: Dan-Gi Lee / Project Engineer



## 10.5.2.2. Spurious & Harmonic Radiated Emission

- Test Date : December 16, 2003
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,  
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 25 GHz
- Measurement distance : 1m
- Result : PASSED BY -8.11 dB at Low Channel

| Frequency<br>(GHz)                                       | Reading<br>(dBuV) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Dist.<br>Factor | Total<br>(dBuV/m) | Limits<br>(dBuV/m) | Margin<br>(dB) |
|----------------------------------------------------------|-------------------|------------------|--------------------|----------------|---------------|-------------|-----------------|-------------------|--------------------|----------------|
| Test Data for Low Channel Fundamental Freq.: 2.412GHz    |                   |                  |                    |                |               |             |                 |                   |                    |                |
| 2.412                                                    | 101.0             | Peak             | H                  | 27.62          | 2.6           | -           | 9.5             | 121.72            | -                  |                |
|                                                          | 88.0              | Peak             | V                  |                |               |             |                 | 108.72            | -                  |                |
| 2.033                                                    | 55.80             | Peak             | H                  | 25.89          | 2.4           | 24.8        | 9.5             | 49.79             | 101.72             | -51.93         |
| 4.813*                                                   | 53.30             | Peak             | H                  | 31.26          | 4.7           | 25.2        | 9.5             | 54.56             | 74.00              | -19.44         |
|                                                          | 41.00             | Average          | H                  |                |               |             |                 | 42.26             | 54.00              | -11.74         |
| 7.250*                                                   | 48.80             | Peak             | H                  | 36.59          | 6.5           | 25.1        | 9.5             | 57.29             | 74.00              | -16.71         |
|                                                          | 38.30             | Average          | H                  |                |               |             |                 | 45.89             | 54.00              | -8.11          |
| Test Data for Middle Channel Fundamental Freq.: 2.442GHz |                   |                  |                    |                |               |             |                 |                   |                    |                |
| 2.442                                                    | 98.40             | Peak             | H                  | 27.62          | 2.6           | -           | 9.5             | 119.12            | -                  |                |
|                                                          | 87.50             | Peak             | V                  |                |               |             |                 | 108.22            | -                  |                |
| 2.060                                                    | 55.20             | Peak             | H                  | 25.89          | 2.5           | 24.8        | 9.5             | 49.29             | 99.12              | -49.83         |
| 4.873*                                                   | 49.60             | Peak             | H                  | 31.41          | 4.7           | 25.2        | 9.5             | 51.01             | 74.00              | -22.99         |
|                                                          | 38.80             | Average          | H                  |                |               |             |                 | 40.21             | 54.00              | -13.79         |
| 7.330*                                                   | 44.00             | Peak             | H                  | 36.59          | 6.6           | 25.2        | 9.5             | 52.49             | 74.00              | -21.51         |
|                                                          | 35.20             | Average          | H                  |                |               |             |                 | 43.69             | 54.00              | -10.31         |

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "\*" Frequency fall in restricted band



-Continued

| Frequency<br>(GHz)                                            | Reading<br>(dBuV) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Dist.<br>Factor | Total<br>(dBuV/m) | Limits<br>(dBuV/m) | Margin<br>(dB) |
|---------------------------------------------------------------|-------------------|------------------|--------------------|----------------|---------------|-------------|-----------------|-------------------|--------------------|----------------|
| <b>Test Data for High Channel Fundamental Freq.: 2.462GHz</b> |                   |                  |                    |                |               |             |                 |                   |                    |                |
| 2.462                                                         | 99.10             | Peak             | H                  | 27.58          | 2.6           | -           | 9.5             | 119.78            | -                  |                |
|                                                               | 85.00             | Peak             | V                  |                |               |             |                 | 105.68            | -                  |                |
| 2.093                                                         | 55.20             | Peak             | H                  | 27.14          | 2.5           | 24.9        | 9.5             | 50.44             | 100.38             | -49.94         |
| 4.923*                                                        | 52.60             | Peak             | H                  | 31.41          | 4.7           | 25.0        | 9.5             | 54.21             | 74.00              | -19.79         |
|                                                               | 41.70             | Average          | H                  |                |               |             |                 | 43.31             | 54.00              | -10.69         |
| 7.400*                                                        | 45.10             | Peak             | H                  | 36.59          | 6.6           | 25.2        | 9.5             | 53.59             | 74.00              | -20.41         |
|                                                               | 34.70             | Average          | H                  |                |               |             |                 | 43.19             | 54.00              | -10.81         |

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "\*" Frequency fall in restricted band

Tested by: Dan-Gi Lee / Project Engineer

## 11. PEAK POWER SPECTRUL DENSITY

### 11.1 Operating environment

Temperature : 26°C

Relative humidity : 43 %

### 11.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 3 kHz, the video bandwidth is set to 3 times the resolution bandwidth, and sweep time was set to span / 3 kHz. The sweep time was allowed to be longer than span / 3 kHz for a full response of the mixer in the spectrum analyzer.

The maximum level from the EUT in a 3 kHz bandwidth was measured with above condition.



### 11.3 Test equipment used

| Model Number | Manufacturer | Description       | Serial Number | Due Cal       |
|--------------|--------------|-------------------|---------------|---------------|
| ■ - 8564E    | HP           | Spectrum Analyzer | 3650A00756    | July 10, 2004 |

All test equipment used is calibrated on a regular basis.



## 11.4 Test data

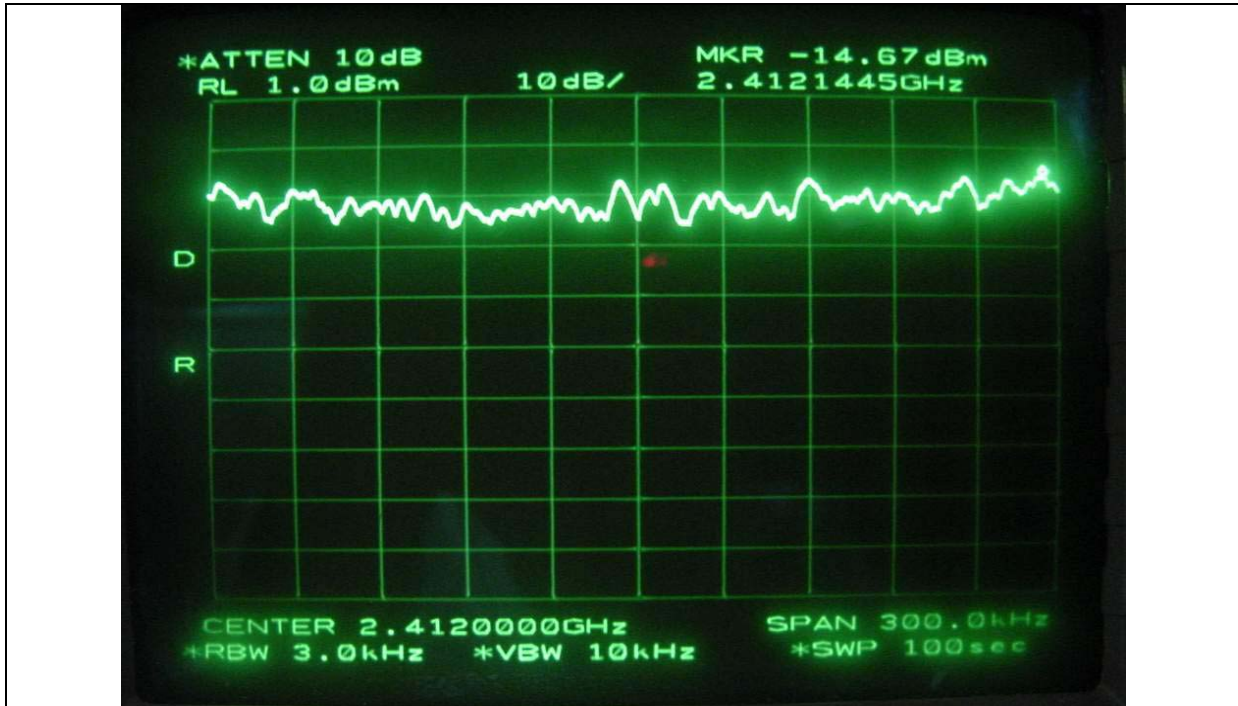
- Test Date : December 12, 2003
- Result : PASSED BY -22.33 dB at High Channel

| CHANNEL | FREQUENCY(MHz) | MEASURED VLAUE (dBm) | LIMIT (dBm) | MARGIN (dB) |
|---------|----------------|----------------------|-------------|-------------|
| Low     | 2412           | -14.67               | 8.0         | -22.67      |
| Middle  | 2437           | -14.33               | 8.0         | -22.33      |
| High    | 2462           | -15.67               | 8.0         | -23.67      |

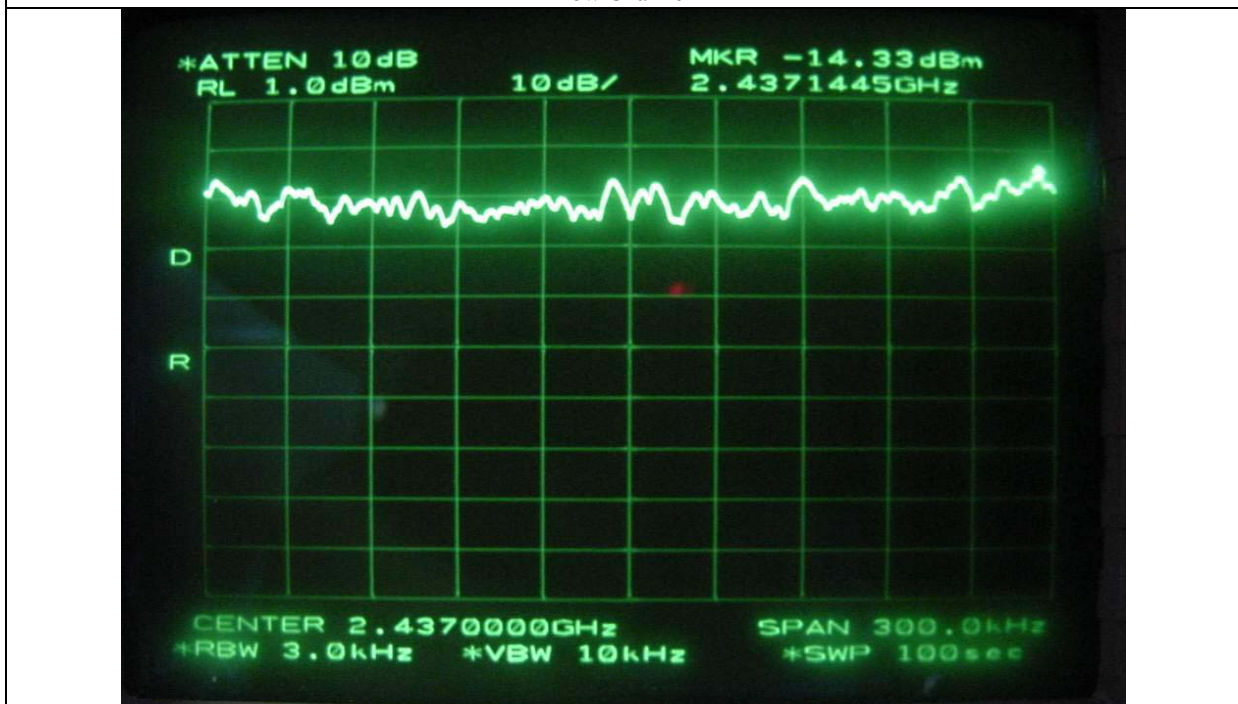
Tabulated test data for Peak Power Spectral Density.

Remark: See next page for measurement data.

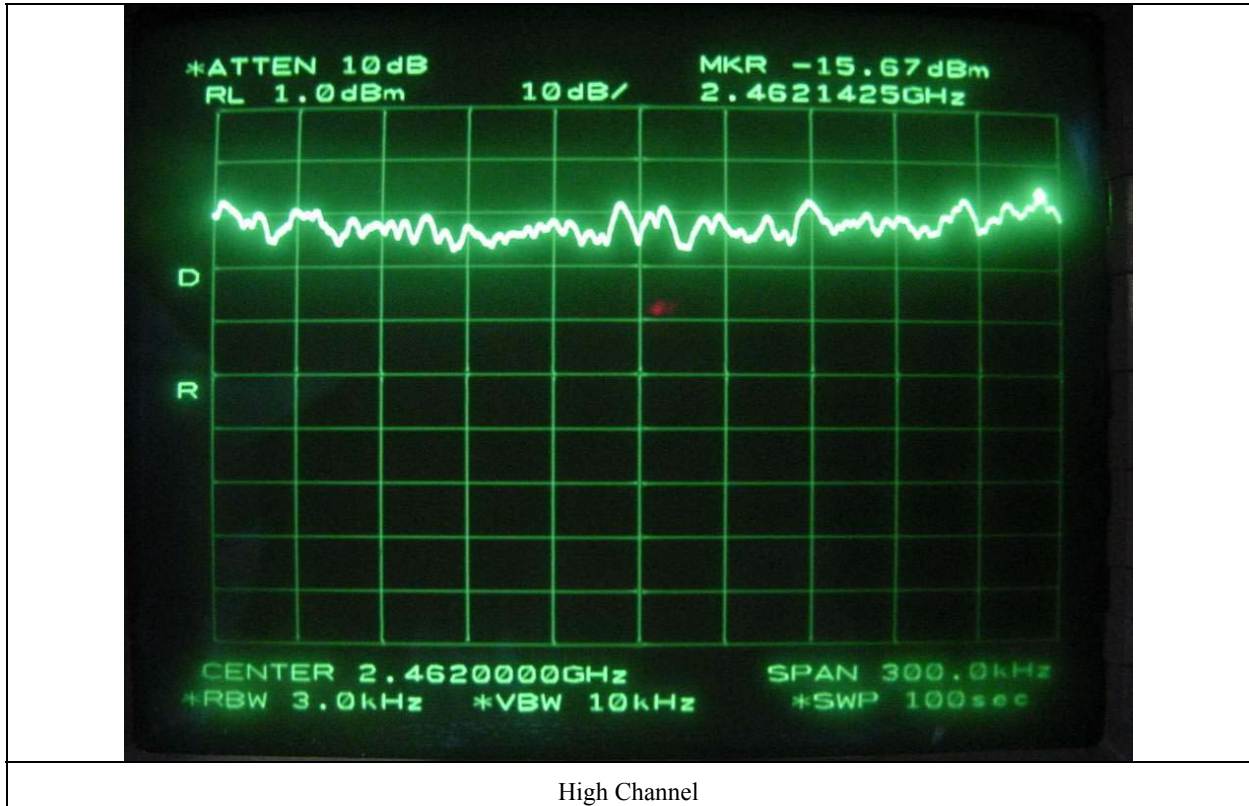
Tested by: Dan-Gi Lee / Project Engineer



Low Channel



Middle Channel





## 12. RADIATED EMISSION TEST, GENERAL REQUIREMENT

### 12.1 Operating environment

Temperature : 14°C

Relative humidity : 39 %

### 12.2 Test set-up

The radiated emissions measurements were on the 3 meters, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30MHz to 1000MHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 and 4.0 meters in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

Test set-up photos are included in appendix VI.

### 12.3 Measurement uncertainty

Radiated emission electric field intensity, 30 MHz ~ 200 MHz : ±4.3 dB

Radiated emission electric field intensity, 200 MHz ~ 1000 MHz : ±4.1 dB

### 12.4 Test equipment used

|     | Model Number | Manufacturer    | Description            | Serial Number | Due Cal.      |
|-----|--------------|-----------------|------------------------|---------------|---------------|
| ■ - | ESVS10       | Rohde & Schwarz | EMI Test Receiver      | 827864/005    | Nov. 01, 2004 |
| ■ - | 85650A       | Hewlett Packard | Quasi-Peak Adapter     | 3107A01542    | July 10, 2004 |
| ■ - | 8568B        | Hewlett-Packard | Spectrum Analyzer      | 3109A05456    | July 10, 2004 |
| ■ - | 85685A       | Hewlett-Packard | RF Preselector         | 3107A01264    | July 10, 2004 |
| □ - | 8449B        | Hewlett-Packard | RF Amplifier           | 3008A00833    | June 10, 2004 |
| □ - | 8447F        | Hewlett-Packard | RF Amplifier           | 3113A04554    | June 10, 2004 |
| ■ - | MA220        | HD              | Turn Table             | N/A           | N/A           |
| ■ - | HD240        | HD              | Antenna Mast           | N/A           | N/A           |
| ■ - | 3104C        | EMCO            | Biconical Antenna      | 9109-4441     | July 11, 2004 |
| ■ - | 3146         | EMCO            | Log Periodic Antenna   | 9109-3214     | July 11, 2004 |
| ■ - | YSE 500B     | YoungShin Eng.  | Frequency Converter    | 950413001     | N/A           |
| ■ - | ETCR-10      | DaeHa           | Automatic Voltage Com. | N/A           | N/A           |

All test equipment used is calibrated on a regular basis.

**12.5 Test data**

- Test Date : December 17, 2003
- Resolution bandwidth : 120 kHz
- Frequency range : 30MHz ~ 1000MHz
- Measurement distance : 3m
- Operating Condition : Low Channel

| Frequency (MHz) | Reading (dBuV) | Ant. Pol. (H/V) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dBuV/m) | Limits (dBuV/m) | Margin (dB) |
|-----------------|----------------|-----------------|--------------------|------------|------------------------|-----------------|-------------|
| 117.11          | 27.90          | V               | 9.72               | 0.21       | 37.83                  | 43.50           | -5.67       |
| 323.62          | 27.10          | H               | 13.84              | 1.63       | 42.57                  | 46.00           | -3.43       |
| 360.44          | 25.90          | V               | 14.91              | 1.72       | 42.53                  | 46.00           | -3.47       |
| 400.17          | 25.10          | V               | 15.63              | 1.73       | 42.46                  | 46.00           | -3.54       |
| 456.38          | 24.20          | V               | 16.27              | 1.75       | 42.22                  | 46.00           | -3.78       |
| 794.38          | 18.56          | H               | 21.00              | 3.08       | 42.64                  | 46.00           | -3.36       |
| 866.26          | 16.49          | H               | 21.79              | 3.58       | 41.86                  | 46.00           | -4.14       |
| 937.97          | 16.30          | H               | 22.42              | 3.87       | 42.59                  | 46.00           | -3.41       |

Tabulated test data for Radiated Electromagnetic Field

Remark: "H": Horizontal, "V": Vertical

- Operating Condition : Middle Channel

| Frequency (MHz) | Reading (dBuV) | Ant. Pol. (H/V) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dBuV/m) | Limits (dBuV/m) | Margin (dB) |
|-----------------|----------------|-----------------|--------------------|------------|------------------------|-----------------|-------------|
| 360.44          | 24.36          | H               | 14.91              | 1.72       | 40.99                  | 46.00           | -5.01       |
| 400.17          | 25.10          | V               | 15.63              | 1.73       | 42.46                  | 46.00           | -3.54       |
| 456.37          | 24.77          | V               | 16.27              | 1.75       | 42.79                  | 46.00           | -3.21       |
| 794.56          | 18.12          | H               | 21.00              | 3.08       | 42.20                  | 46.00           | -3.80       |
| 866.26          | 16.30          | V               | 21.79              | 3.58       | 41.67                  | 46.00           | -4.33       |
| 937.97          | 15.60          | H               | 22.42              | 3.87       | 41.89                  | 46.00           | -4.11       |

Tabulated test data for Radiated Electromagnetic Field

Remark: "H": Horizontal, "V": Vertical



- Operating Condition : High Channel

| Frequency<br>(MHz) | Reading<br>(dBuV) | Ant. Pol.<br>(H/V) | Ant. Factor<br>(dB/m) | Cable<br>Loss | Emission<br>Level(dBuV/m) | Limits<br>(dBuV/m) | Margin<br>(dB) |
|--------------------|-------------------|--------------------|-----------------------|---------------|---------------------------|--------------------|----------------|
| 360.44             | 24.70             | V                  | 14.91                 | 1.72          | 41.33                     | 46.00              | -4.67          |
| 433.17             | 23.10             | H                  | 16.17                 | 1.64          | 40.91                     | 46.00              | -5.09          |
| 505.79             | 20.10             | V                  | 17.44                 | 1.89          | 39.43                     | 46.00              | -6.57          |
| 650.18             | 19.78             | H                  | 19.54                 | 2.47          | 41.79                     | 46.00              | -4.21          |
| 794.56             | 17.36             | H                  | 21.00                 | 3.08          | 41.44                     | 46.00              | -4.56          |
| 866.26             | 15.98             | H                  | 21.79                 | 3.58          | 41.35                     | 46.00              | -4.65          |
| 937.97             | 16.10             | H                  | 22.42                 | 3.87          | 42.39                     | 46.00              | -3.61          |

Tabulated test data for Radiated Electromagnetic Field

Remark: "H": Horizontal, "V": Vertical

Tested by: Dan-Gi Lee / Project Engineer



### 13. CONDUCTED EMISSION TEST

#### 13.1 Operating environment

Temperature : 20°C

Relative humidity : 34 %

#### 13.2 Test set-up

The conducted emission measurements of power line were performed in a shielded room. The EUT was placed on a wooden table, 0.8 meters height above the floor. Power was fed to the EUT through a 50 ohm/ 50 microhenry Line Impedance Stabilization Network (LISN). The ground plane was electrically bonded to the shield room ground system and all power lines entering the shield room were filtered.

#### 13.3 Measurement uncertainty

Conducted emission, quasi-peak detect :  $\pm 3.0$  dBConducted emission, average detect :  $\pm 3.0$  dB

#### 13.4 Test equipment used

|     | Model Number | Manufacturer        | Description            | Serial Number | Due Cal.      |
|-----|--------------|---------------------|------------------------|---------------|---------------|
| ■ - | ESHS10       | Rohde & Schwarz     | EMI Test Receiver      | 834467/007    | Apr. 29, 2005 |
| ■ - | 3825/2       | EMCO                | AMN                    | 9109-1869     | Oct. 20, 2004 |
| ■ - | N/A          | HanKook Shield room | Shield Room            | N/A           | N/A           |
| ■ - | YSE 500B     | YoungShin Eng.      | Frequency Converter    | 950413001     | N/A           |
| ■ - | ETCR-10      | DaeHa               | Automatic Voltage Com. | N/A           | N/A           |

All test equipment used is calibrated on a regular basis.

**13.5 Test data**

- Test Date : December 12, 2003
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15MHz ~ 30MHz
- Result : PASSED BY -3.35 dB at 0.53 MHz with Average Detector

| Frequency<br>(MHz) | Line | Quasi-Peak (dBuV) |                |        | Margin<br>(dB) | Average (dBuV)    |        | Margin<br>(dB) |
|--------------------|------|-------------------|----------------|--------|----------------|-------------------|--------|----------------|
|                    |      | Emission<br>level | Detect<br>Mode | Limits |                | Emission<br>level | Limits |                |
| 0.43               | N    | 49.71             | P              | 57.35  | -7.64          | 43.28             | 47.35  | -4.07          |
| 0.53               | N    | 51.07             | P              | 56.00  | -4.93          | 42.65             | 46.00  | -3.35          |
| 0.74               | H    | 48.74             | P              | 56.00  | -7.26          | 38.34             | 46.00  | -7.66          |
| 0.85               | H    | 50.95             | P              | 56.00  | -5.42          | 40.32             | 46.00  | -5.68          |
| 1.16               | N    | 50.03             | P              | 56.00  | -5.97          | 40.63             | 46.00  | -5.37          |
| 1.18               | H    | 50.25             | P              | 56.00  | -5.75          | 38.64             | 46.00  | -7.36          |

Line Conducted Emissions Tabulated Data

Remark : "H": Hot Line, "N": Neutral line, "P": Peak detect.

See next page for an overview sweep performed with peak and average detector.

Tested by: Dan-Gi Lee / Project Engineer

