



**Spectrum Research & Testing Lab., Inc.**  
No. 101-10, Ling 8,  
Shan-Tong Li, Chung-Li  
City, Taoyuan, Taiwan

# TEST REPORT

Reference No.: C05091308  
Report No.: FCCC05091308  
FCC ID: I4L-BM100  
Page: 1 of 45  
Date: Oct. 29, 2005

Product Name: Bluetooth Mouse  
Brand Name: Micro-Star  
Model Number: MB100  
Applicant: MICRO-STAR INT'L CO.,LTD.  
NO 69, LI-DE ST, JUNG-HE CITY,  
TAIPEI HSIEN, TAIWAN  
Date of Receipt: Sep. 13, 2005  
Finished date of Test: Oct. 29, 2005  
Applicable Standards: 47 CFR Part 15, Subpart C  
47 CFR Part 15, Subpart B  
ANSI C63.4:2003

We, **Spectrum Research & Testing Laboratory Inc.**, hereby certify that one sample of the above was tested in our laboratory with positive results according to the above-mentioned standards. The records in the report are an accurate account of the results. Details of the results are given in the subsequent pages of this report.

Checked By : Julian Chiang , Date: 10 / 29 / 2005  
(Julian Chiang)

Approved By : Johnson Ho , Date: Oct. 29, 2005  
(Johnson Ho, Director) *JVA*

**NVLAP**<sup>®</sup>

Lab Code: 200099-0



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Report No.:FCCC05091308  
FCC ID:I4L-BM100  
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Date: Oct. 29, 2005

## 1. DOCUMENT POLICY AND TEST STATEMENT

### 1.1 DOCUMENT POLICY

- The report shall not be reproduced except in full, without the written approval of SRT Lab, Inc.
- The report must not be used by the applicant to claim that the product is endorsed by NVLAP, TÜV, NEMKO and SRT.
- The NVLAP logo applies only to the applicable standards specified in this report.

### 1.2 TEST STATEMENT

- The test results in the report apply only to the unit tested by SRT Lab.
- There was no deviation from the requirements of test standards during the test.
- AC power source, 110 VAC/60 Hz, was used during the test.

### 1.3 EUT MODIFICATION

- No modification in SRT Lab.



## 2. DESCRIPTION OF EUT AND TEST MODE

### 2.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	Bluetooth Mouse
<b>BRAND NAME</b>	Micro-Star
<b>MODEL NO.</b>	BM100
<b>POWER SUPPLY</b>	DC 3.3V, 6~11mA
<b>FREQUENCY BAND</b>	2.400 MHz~2983.5MHz
<b>CARRIER FREQUENCY</b>	2.402~2.480GHz
<b>NUMBER OF CHANNEL</b>	79
<b>CHANNEL SPACING</b>	1 MHz
<b>RATED RF OUTPUT POWER</b>	0~+4dBm=1~2.5mW
<b>I.F. &amp; L.O.</b>	L.O.:16MHz
<b>MODULATION TYPE</b>	1Mbps(GFSK)
<b>BIT RATE OF TRANSMISSION</b>	1Mbps
<b>DUTY CYCLE</b>	Max 1600 hops/sec
<b>ANTENNA TYPE</b>	Dipole
<b>ANTENNA GAIN</b>	3dBi
<b>OPERATING TEMPERATURE</b>	0~65
<b>CHANNEL BANDWIDTH</b>	1MHz

**NOTE :**

For more detailed information, please refer to the EUT's specification or user's manual provided by manufacturer.

### 2.2 DESCRIPTION OF SUPPORT UNIT

The transmitter part of EUT was tested with a PC system and configured by the requirement of ANSI C63.4. All interface ports were connected to the appropriate support units via specific cables. The support units and cables are listed below.

NO	DEVICE	BRAND	MODEL #	FCC ID/DOC	CABLE
1	NOTEBOOK	DELL	PP01L	DOC	1.5m unshielded power cord with Ferrite core
2	PRINTER	EPSON	STYLUS C20SX	DOC	1.5m unshielded power cord 1.5m shielded data cord
3	MODEM	ACEEX	DM-1414	DOC	1.8m unshielded power cord 1.5m shielded data cord
4	BLUETOOTH DONGLE	MSI	MS-6970A	I4L-MS6970A	N/A

**NOTE :** For the actual test configuration, please refer to the photos of testing.



## 2.3 DESCRIPTION OF TEST MODE

This EUT is a FHSS system, we use BlueTest to control the EUT with RS232, Let EUT hopping on and transmit at every channel with highest power, Only output power use conducted method, others are using radiated method. After Sirfdemo330R1 send the command to EUT, it can be removed, and the EUT keep hopping.79 channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

Channel	Frequency(MHz)
0	2402
39	2441
78	2480

### NOTE :

1. Below 1 GHz, the channel 0, 39 and 78 were pre-tested in chamber. The channel 78, worst case one, was chosen for conducted and radiated emission test.
2. Above 1 GHz, the channel 0, 39 and 78 were tested individually.

## 3. DESCRIPTION OF APPLIED STANDARDS

The EUT is a kind of wireless product and to be connected with a PC system for normal use. According to the specifications provided by the applicant, it must comply with the requirements of the following standards:

47 CFR Part 15, Subpart C

47 CFR Part 15, Subpart B

ANSI C63.4: 2003

Public DA00-705 (March 2000)

All tests have been performed and recorded as the above standards.



## 4. CONDUCTED EMISSION TEST

### 4.1 CONDUCTED EMISSION LIMIT

FREQUENCY (MHz)	Class A (dB $\mu$ V)		Class B (dB $\mu$ V)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.5 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

#### NOTE:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

### 4.2 TEST EQUIPMENT

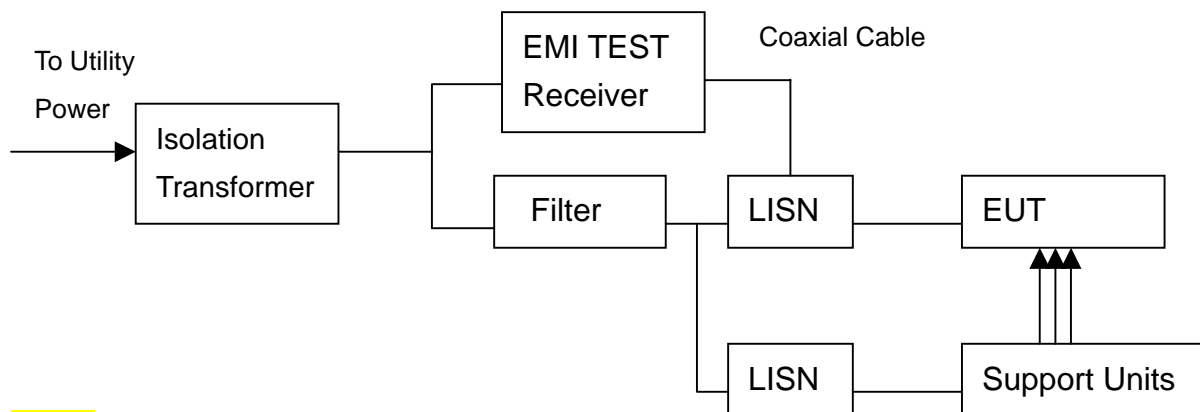
The following test equipment was used for the test:

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
EMI TEST RECEIVER	9 kHz TO 2.75 GHz	ROHDE & SCHWARZ	ESHS30/ 826003/008	AUG. 2006 ETC
LISN (for EUT)	50 $\mu$ H, 50 ohm	FCC	FCC-LISN-50-25-2 / 01017	NOV. 2005 ETC
LISN (for Peripheral)	50 $\mu$ H, 50 ohm	FCC	FCC-LISN-50-25-2 / 01018	NOV. 2005 ETC
50 ohm TERMINATOR	50 ohm	HP	11593A/ 2	OCT. 2006 ETC
COAXIAL CABLE	3m	SUNCITY	J400/ 3M	JUL. 2006 SRT
ISOLATION TRANSFORMER	N/A	APC	AFC-11015/ F102040016	N/A
FILTER	2 LINE, 30A	FIL.COIL	FC-943/ 771	N/A
GROUND PLANE	2.3M (H) x 2.4M (W)	SRT	N/A	N/A
GROUND PLANE	2.4M (H) x 2.4M (W)	SRT	N/A	N/A

**NOTE:** The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.



## 4.3 TEST SETUP



### NOTE:

1. The EUT was put on a wooden table with 0.8m heights above ground plane, and 0.4m away from reference ground plane (> 2mx2m).
2. For the actual test configuration, please refer to the photos of testing.
3. The serial no. of the LISN connected to EUT is 01017.
4. The serial no. of the LISN connected to support units is 01018.

## 4.4 TEST PROCEDURE

The EUT was tested according to the requirement of ANSI C63.4:2003 and CISPR22:2003. The frequency spectrum from 0.15 MHz to 30 MHz was investigated. The LISN used was 50 ohm/50 $\mu$ H as specified. All readings were quasi-peak and average values with 10 kHz resolution bandwidth of the test receiver. The EUT system was operated in all typical methods by users. Both lines of the power mains of EUT were measured and the cables connected to EUT and support units were moved to find the maximum emission levels for each frequency. First, find the margin or higher points at least 6 points by software, then use manual to find the maximum data. The procedure is referred on the test procedure of SRT LAB.

## 4.5 EUT OPERATING CONDITION

1. Set the EUT under transmission condition continuously at specific channel frequency.
2. Under Windows XP run "EMI TEST" program and PC sent "H" pattern or accessed the following peripherals directly or via EUT:
  - NOTEBOOK
  - PRINTER
  - MODEM
  - BLUETOOTH DONGLE





## 4.6 TEST RESULT

Temperature:	27°C	Humidity:	59 %RH
Ferquency Range:	0.15 – 30 MHz	Tested Mode:	Charge
Receiver Detector:	Q.P. and AV.	Tested By:	Julian Chiang
		Tested Date:	Oct. 17, 2005

Power Line Measured : Line

Freq. (MHz)	Correct. Factor (dB)	Reading Value (dBμV)		Emission Level (dBμV)		Limit (dBμV)		Margin (dB)	
		Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
0.150	0.30	33.74	25.55	34.04	25.85	65.98	55.98	-31.94	-30.13
0.504	0.24	21.86	6.33	22.10	6.57	56.00	46.00	-33.90	-39.43
1.210	0.14	10.90	-5.66	11.04	-5.52	56.00	46.00	-44.96	-51.52
12.064	0.10	-3.68	-7.70	-3.58	-7.60	60.00	50.00	-63.58	-57.60
14.267	0.10	-3.48	-7.73	-3.38	-7.63	60.00	50.00	-63.38	-57.63
15.687	0.10	10.10	9.32	10.20	9.42	60.00	50.00	-49.80	-40.58

Power Line Measured : Neutral

Freq. (MHz)	Correct. Factor (dB)	Reading Value (dBμV)		Emission Level (dBμV)		Limit (dBμV)		Margin (dB)	
		Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
0.486	0.26	26.48	1.56	26.74	1.82	56.22	46.22	-29.49	-44.41
0.500	0.24	26.12	6.94	26.36	7.18	55.98	45.98	-29.62	-38.80
1.220	0.14	13.14	-5.31	13.28	-5.17	56.00	46.00	-42.72	-51.17
13.607	0.10	4.82	-2.95	4.92	-2.85	60.00	50.00	-55.08	-52.85
13.716	0.10	4.20	-0.61	4.30	-0.51	60.00	50.00	-55.70	-50.51
29.719	0.10	-3.42	-7.45	-3.32	-7.35	60.00	50.00	-63.32	-57.35

### NOTE :

1. Measurement uncertainty is +/-1.32dB
2. Emission level = Reading value + Correction factor
3. Correction Factor = Cable loss + Insertion loss of LISN
4. Margin value = Emission level - Limit
5. The emission of other frequencies were very low against the limit.
6. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.



## 5. TECHNICAL CHARACTERISTICS TEST

### 5.1 CHANNEL SEPARATION TEST

#### 5.1.1 LIMIT

FCC Part15, Subpart C Section 15.247(a)(1). Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

FREQUENCY RANGE (MHz)	Limit(kHz)
902-928	>25kHz
2400-2483.5	>25kHz
5725-5850	>25kHz

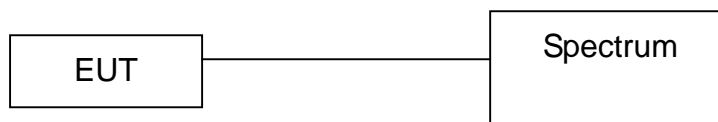
#### 5.1.2 TEST EQUIPMENT

The following test equipment was used during the radiated emission test :

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM	9kHz-7GHz	ROHDE & SCHWARZ	FSP7/ 839511/010	APR. 2006 R&S

**NOTE:** The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

#### 5.1.3 TEST SET-UP



The EUT was connected to a spectrum through a 50 RF cable.

#### 5.1.4 TEST PROCEDURE

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.



## 5.1.5 EUT OPERATING CONDITION

1. Under Windows XP ran "Media Player" program and PC sent "H" pattern or accessed the following peripherals directly or via EUT:

- Color Monitor
- RS232
- Printer
- FDD
- HDD

## 5.1.6 TEST RESULT

Temperature:	<u>25°C</u>	Humidity:	<u>55%RH</u>
Spectrum Detector:	<u>PK</u>	Tested by:	<u>Julian Chiang</u>
Test Result:	<u>PASS</u>	Tested Date:	<u>Sep. 9, 2005</u>

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	SEPARATION READ VALUE (kHz)	SEPARATION LIMIT (kHz)
0	2402	1004.000	>25kHz
39	2441	1008.000	>25kHz
78	2480	1004.000	>25kHz

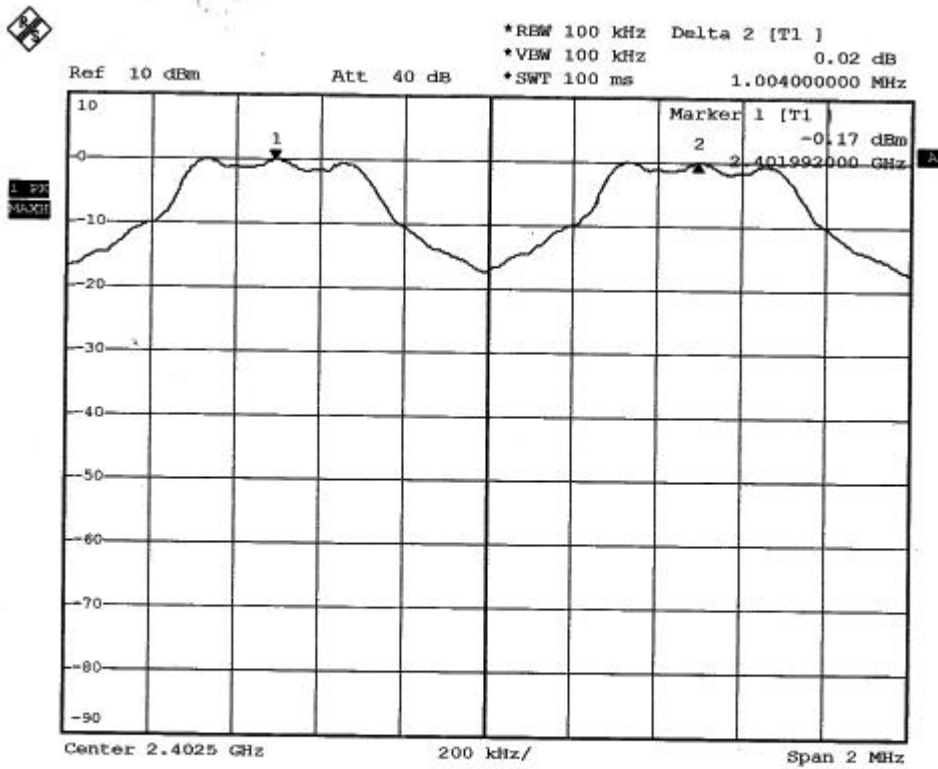


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CH0:



Date: 9.SEP.2005 17:11:30

CH0 Separation

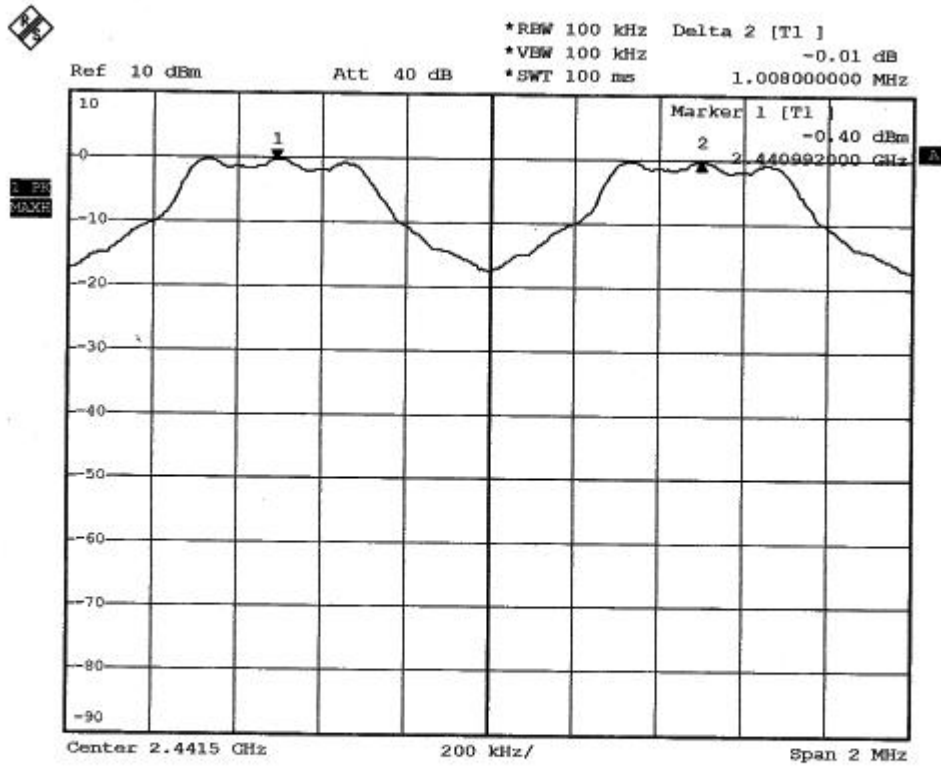


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CH39:



Date: 9.SEP.2005 17:13:22

CH39 Separation

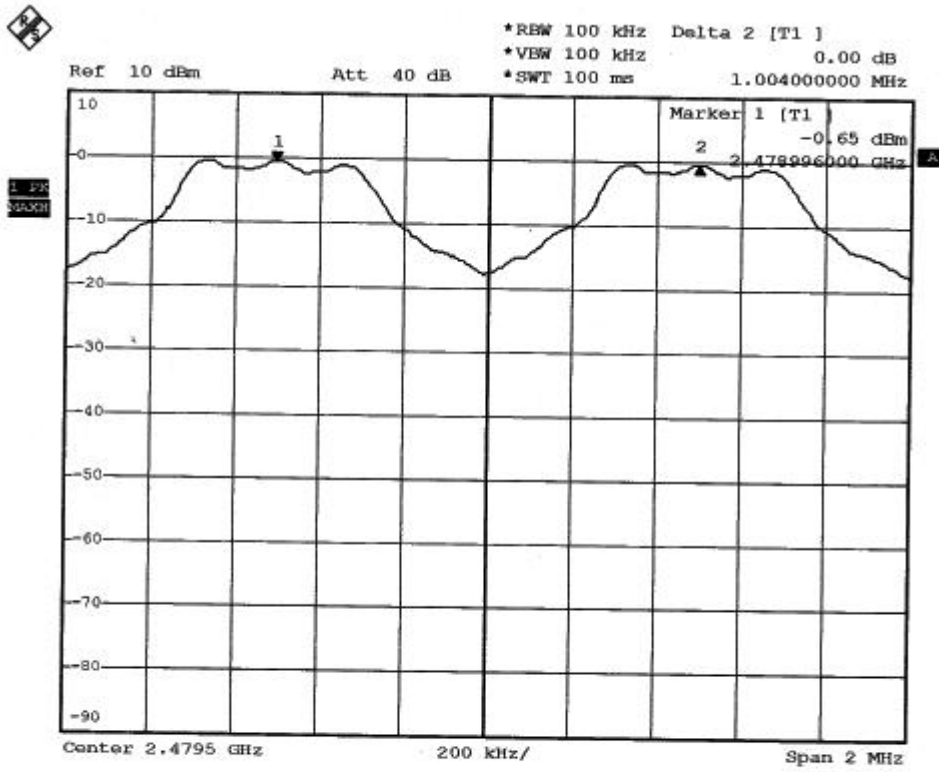


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CH78:



Date: 9.SEP.2005 17:17:56

CH78      Separation



## 5.2 20dB Bandwidth

### 5.2.1 LIMIT

Frequency Range (MHz)	Quantity of Hopping Channel	Limit(kHz)			
		50	25	15	75
902-928		<250	>250	NA	NA
2400-2483.5		NA	NA	>1000	<1000

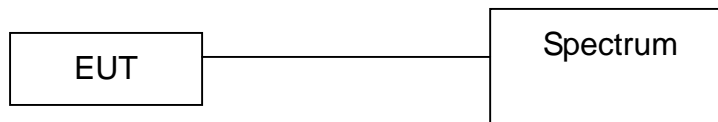
### 5.2.2 TEST EQUIPMENT

The following test equipment was used during the test:

EQUIPMENT/FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM	9kHz-7GHz	ROHDE & SCHWARZ	FSP7/ 839511/010	APR. 2006 R&S

**NOTE:** The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

### 5.2.3 TEST SET-UP



The EUT was connected to a spectrum through a 50 RF cable.

### 5.2.4 TEST PROCEDURE

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

### 5.2.5 EUT OPERATING CONDITION

Same as section 4.1.5 of this report.



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### 5.2.6 TEST RESULT

Temperature: 25°C Humidity: 56%RH  
Spectrum Detector: PK Tested by: Julian Chiang  
Test Result: PASS Tested Date: Sep. 09, 2005

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	20dB DOWN BW (kHz)
0	2402	784
39	2441	788
78	2480	804



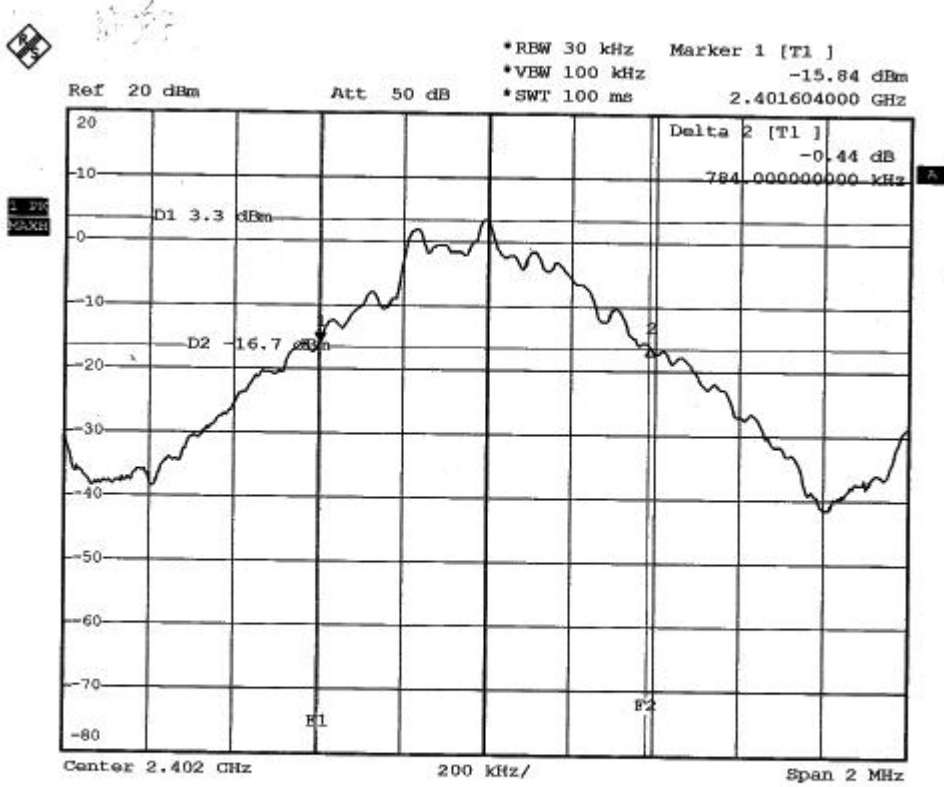


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CH0:



Date: 9.SEP.2005 10:46:58

CH0 Bandwidth

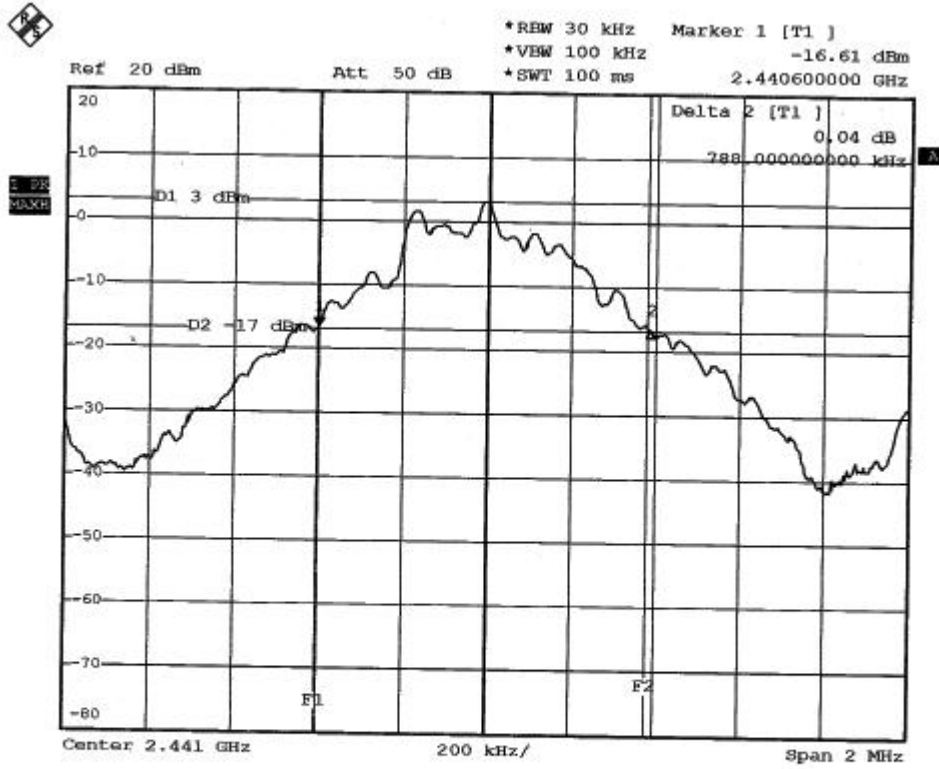


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Ch39:



Date: 9.SEP.2005 10:50:46

Ch39 Bandwidth

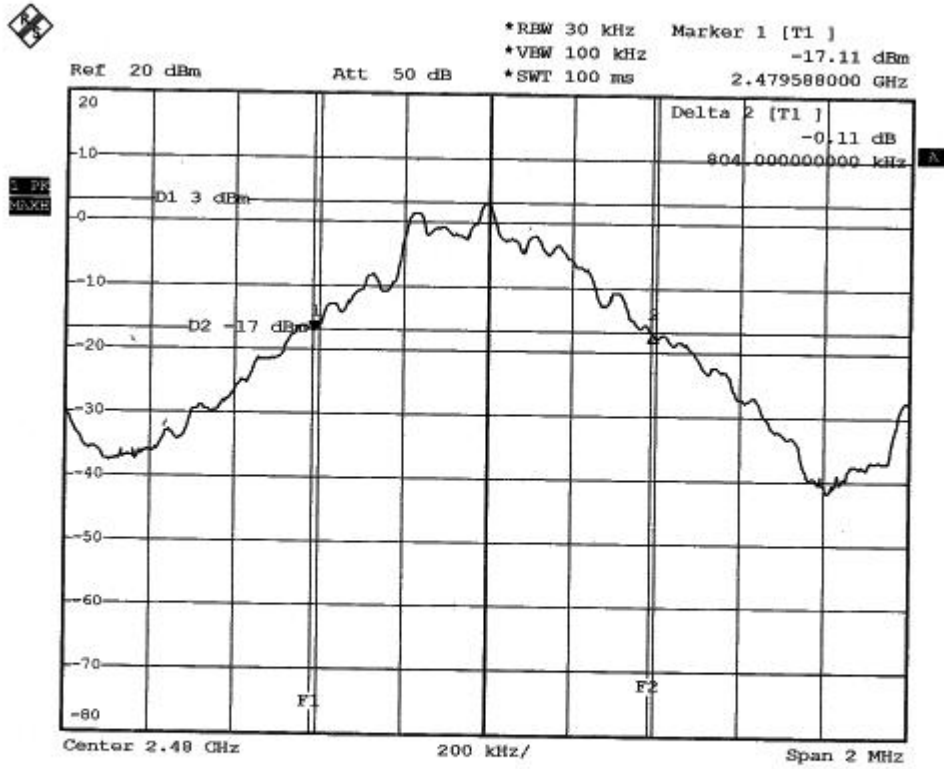


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Date: 9.SEP.2005 10:56:16

CH 78 Bandwidth



## 5.3 QUANTITY OF HOPPING CHANNEL TEST

### 5.3.1 LIMIT

FCC Part15, Subpart C Section 15.247.

FREQUENCY RANGE (MHz)	Limit (Quantity of Hopping Channel)			
	20dB bandwidth <250kHz	20dB bandwidth >250kHz	20dB bandwidth <1MHz	20dB bandwidth >1MHz
902-928	50	25	N/A	N/A
2400-2483.5	N/A	N/A	75	15
5725-5850	N/A	N/A	75	N/A

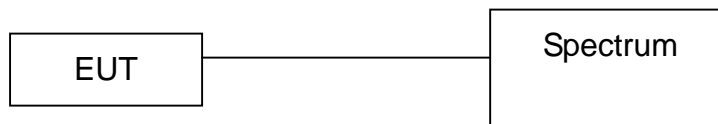
### 5.3.2 TEST EQUIPMENT

The following test equipment was used during the test:

EQUIPMENT/FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM	9kHz-7GHz	ROHDE & SCHWARZ	FSP7/ 839511/010	APR. 2006 R&S

**NOTE:** The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

### 5.3.3 TEST SET-UP



The EUT was connected to a spectrum through a 50 RF cable.

### 5.3.4 TEST PROCEDURE

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

### 5.3.5 EUT OPERATING CONDITION

Same as section 4.1.5 of this report.



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# TEST REPORT

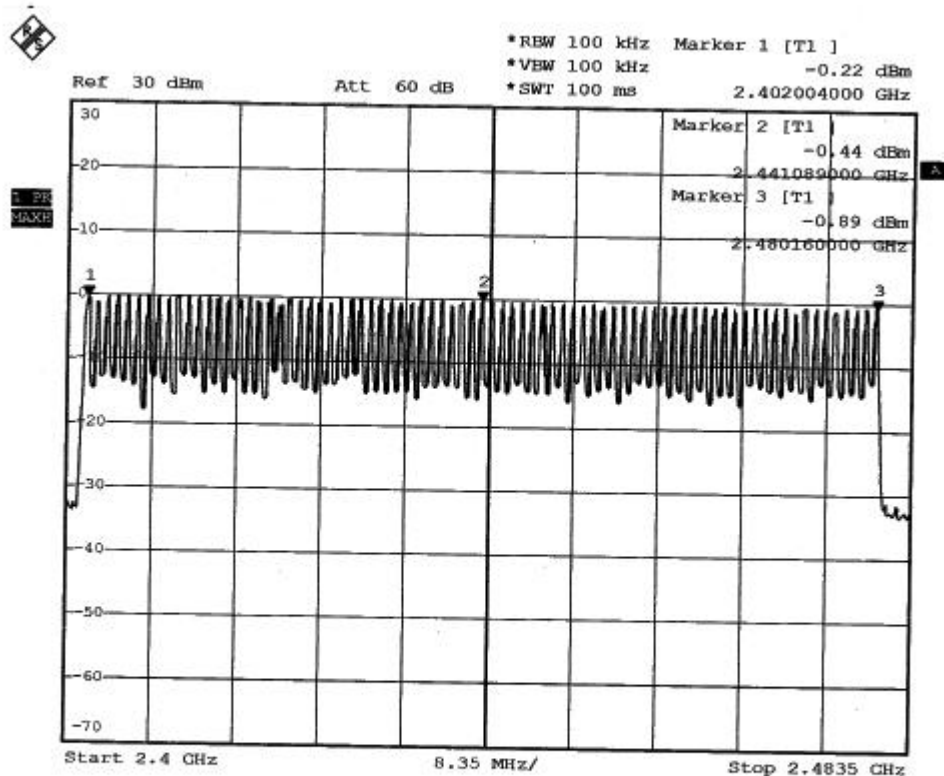
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## 5.3.6 TEST RESULT

Temperature:	<u>25°C</u>	Humidity:	<u>56%RH</u>
Spectrum Detector:	<u>PK</u>	Tested by:	<u>Julian Chiang</u>
Test Result:	<u>PASS</u>	Tested Date:	<u>Sep. 09, 2005</u>

HOPPING CHANNEL FREQUENCY RANGE	QUANTITY OF HOPPING CHANNEL READ VALUE	QUANTITY OF HOPPING CHANNEL LIMIT
2402~2480	79	75

CH0-CH78



Date: 9.SEP.2005 17:23:52

79 Channels



## 5.4 Time of occupancy (Dwell Time)

### 5.4.1 LIMIT

FCC Part15, Subpart C Section 15.247.

FREQUENCY RANGE (MHz)	LIMIT (ms)		
	20dB bandwidth <250kHz(50Channel)	20dB bandwidth >250kHz(25Channel)	20dB bandwidth <1MHz(75Channel)
902-928	400(20s)	400(10s)	NA
2400-2483.5	NA	NA	400(30s)
5725-5850	NA	NA	400(30s)

**NOTE:** The “()” is all channel’s average time of occupancy.

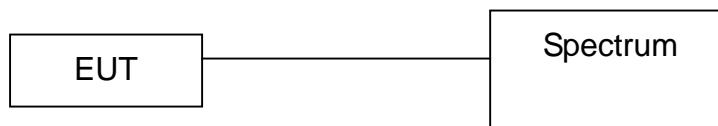
### 5.4.2 TEST EQUIPMENT

The following test equipment was used during the test:

EQUIPMENT/FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM	9kHz-7GHz	ROHDE & SCHWARZ	FSP7/ 839511/010	APR. 2006 R&S

**NOTE:** The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

### 5.4.3 TEST SET-UP



The EUT was connected to a spectrum through a 50 Ohm RF cable.

### 5.4.4 TEST PROCEDURE

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

### 5.4.5 EUT OPERATING CONDITION

Same as section 4.1.5 of this report.



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### 5.4.6 TEST RESULT

Temperature: 20°C Humidity: 56%RH  
Spectrum Detector: PK Tested by: Julian Chiang  
Test Result: PASS Tested Date: Sep. 09, 2005

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	Pulse Time (μs)	Burts (in 1 sec.)	Time of occupancy (Dwell Time) (ms)	Average time of occupancy LIMIT (ms)
0	2402.00	416	10	124.8	400
39	2441.00	416	10	124.8	400
78	2480.00	418	10	125.4	400

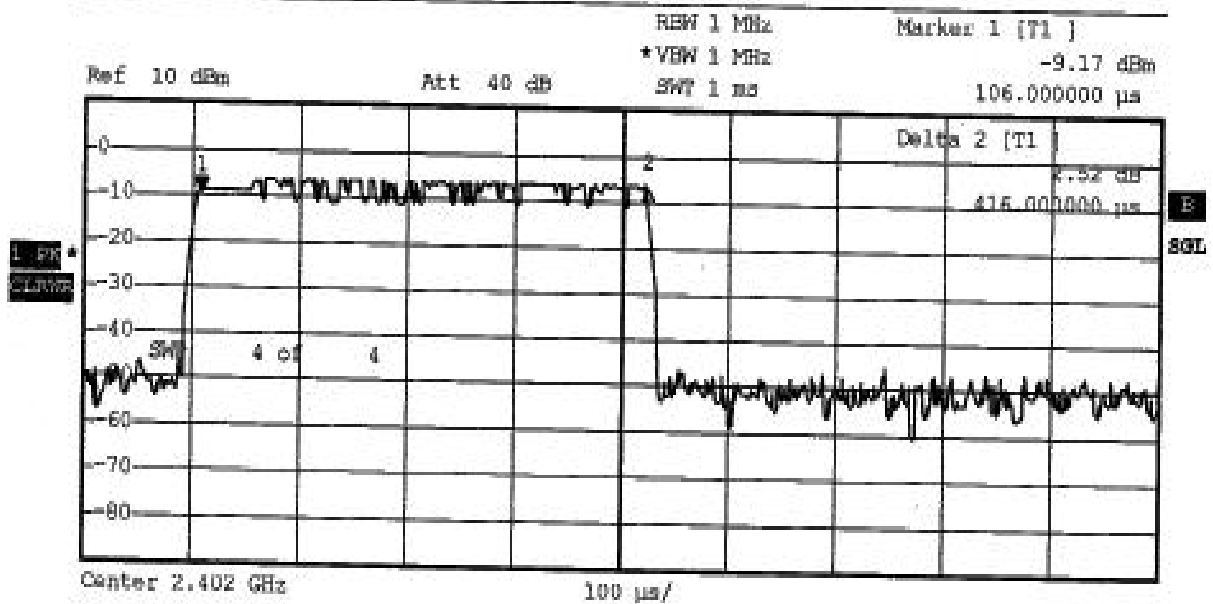
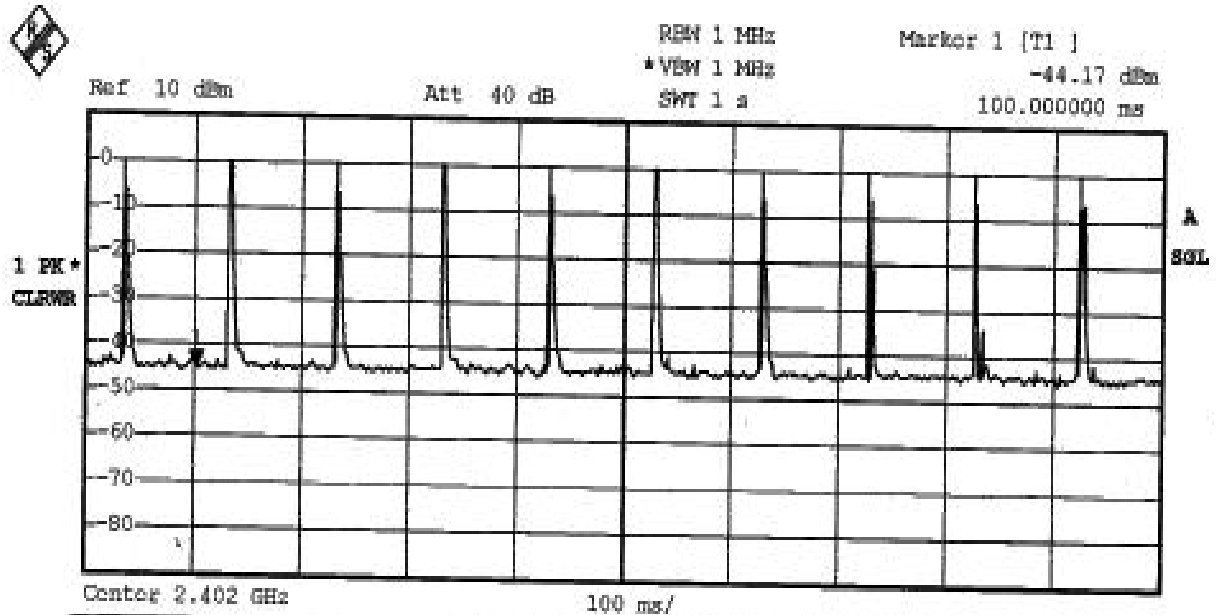
Note:

Dwell Time:

Pulse Time\*Burts\*30



CH0:



Date: 9.SEP.2005 17:54:43

CH0 Dwell Time



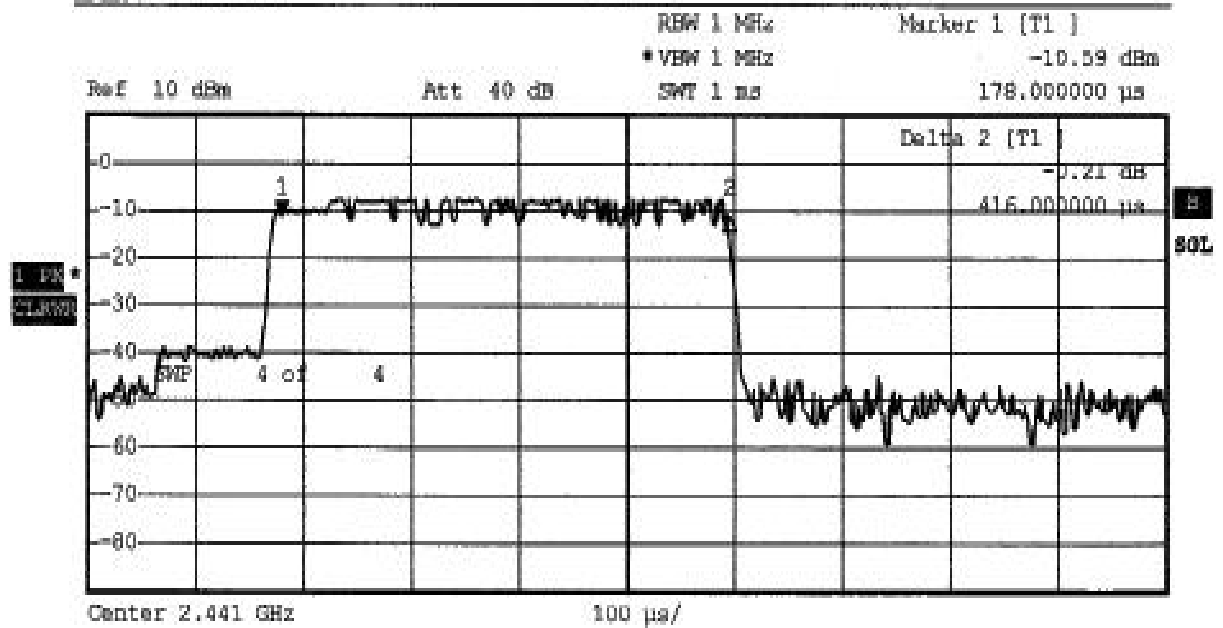


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Ch39:



Date: 9.SEP.2005 18:22:23

DHJ CH39 Duall Time

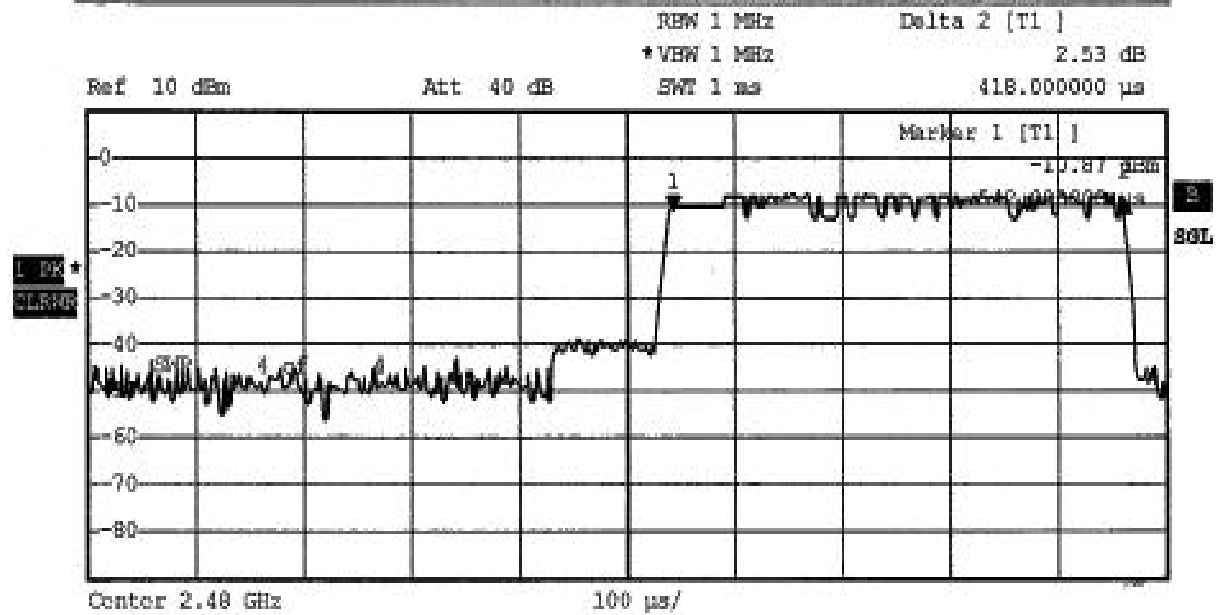
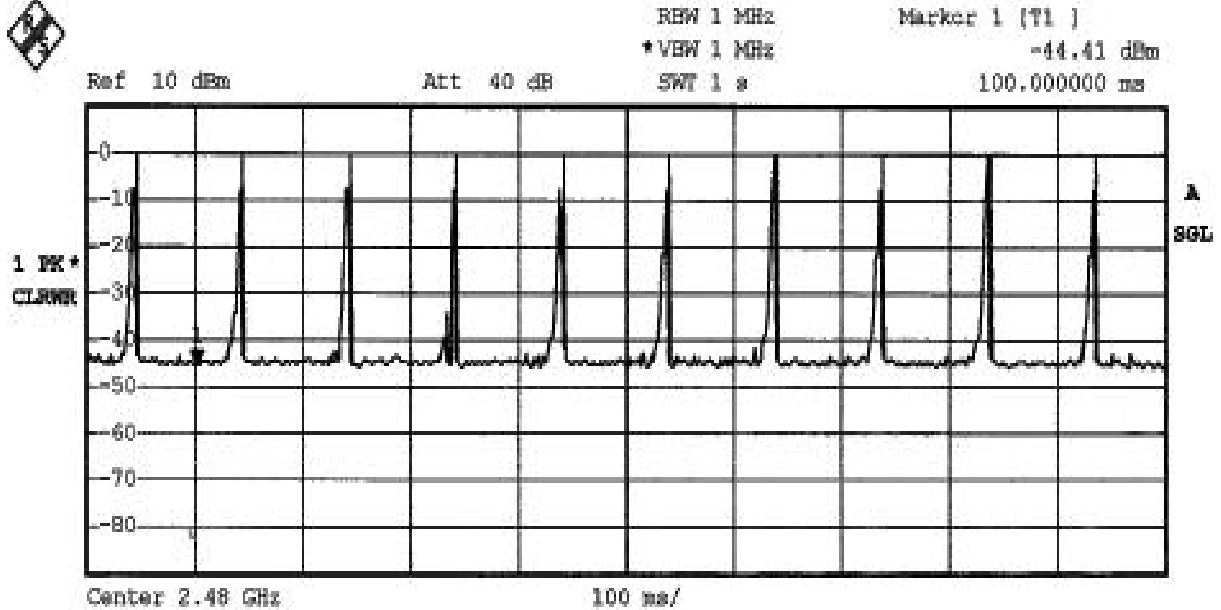


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CH78:



Date: 9.SEP.2005 18:31:21

DH1 CH78 Dwell Time



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## 5.5 PEAK POWER TEST

### 5.5.1 LIMIT

FCC Part15, Subpart C Section 15.247.

FREQUENCY RANGE (MHz)	LIMIT (W)				
	Quantity of Hopping Channel	50	25	15	75
902-928	1(30dBm)	0.125(21dBm)	NA	NA	NA
2400-2483.5	NA	NA	0.125(21dBm)	1(30dBm)	1(30dBm)
5725-5850	NA	NA	NA	NA	1(30dBm)

### 5.5.2 TEST EQUIPMENT

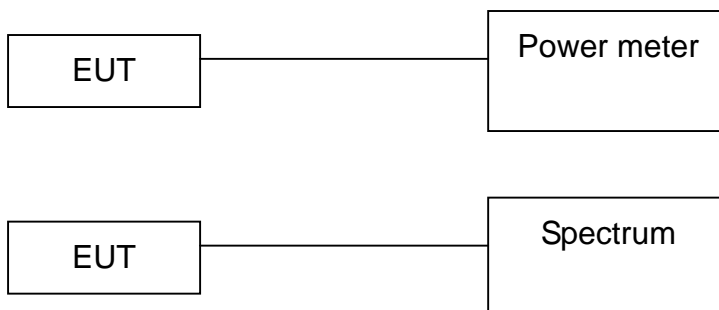
The following test equipment was used during the test :

EQUIPMENT/FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM	9kHz-7GHz	ROHDE & SCHWARZ	FSP7/ 839511/010	APR. 2006 R&S
POWER METER	N/A	BOONTON	4232A/ 29001	MAY 2006 ETC
POWER SENSOR	DC-18GHz 0.3 $\mu$ W-100mW 50	BOONTON	51011-EMC/ 31184	JUN. 2006 ETC

**NOTE:** The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.



### 5.5.3 TEST SET-UP



The EUT was connected to a spectrum through a 50 RF cable.

### 5.5.4 TEST PROCEDURE

The EUT was operating in hopping mode or could control its channel.  
 Printed out the test result from the spectrum by hard copy function.  
 Recorded the read value of the power meter.

### 5.5.5 EUT OPERATING CONDITION

Same as section 4.1.5 of this report.

### 5.5.6 TEST RESULT

Temperature:	<u>20°C</u>	Humidity:	<u>55%RH</u>
Spectrum Detector:	<u>PK</u>	Tested by:	<u>Julian Chiang</u>
Test Result:	<u>PASS</u>	Tested Date:	<u>Sep. 09, 2005</u>

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)
0	2402.0000	-1.03	30
39	2441.0000	-0.89	30
78	2480.0000	-1.14	30

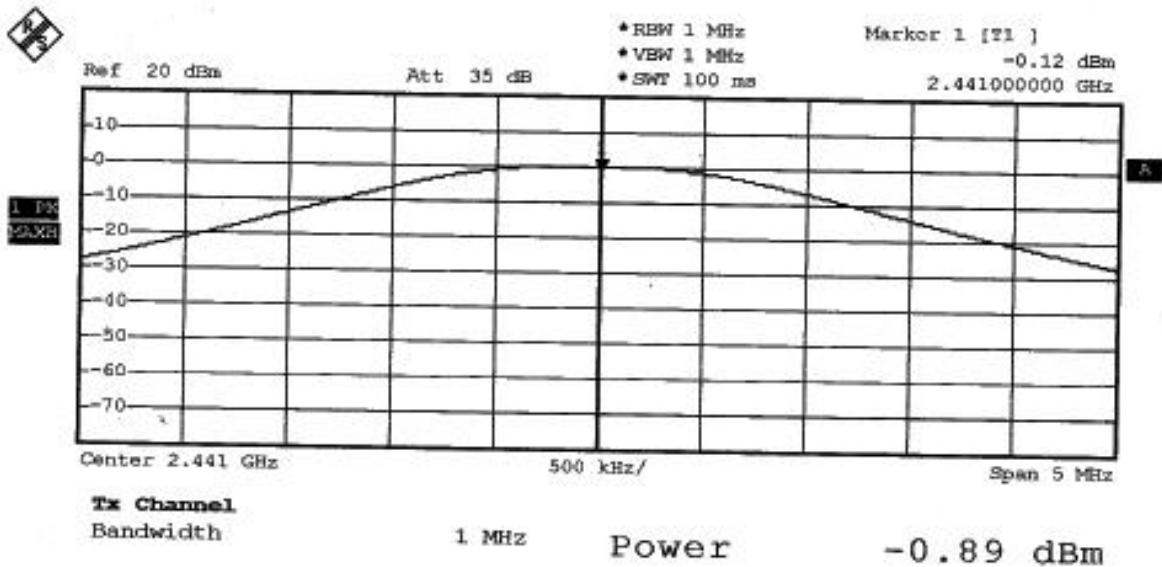
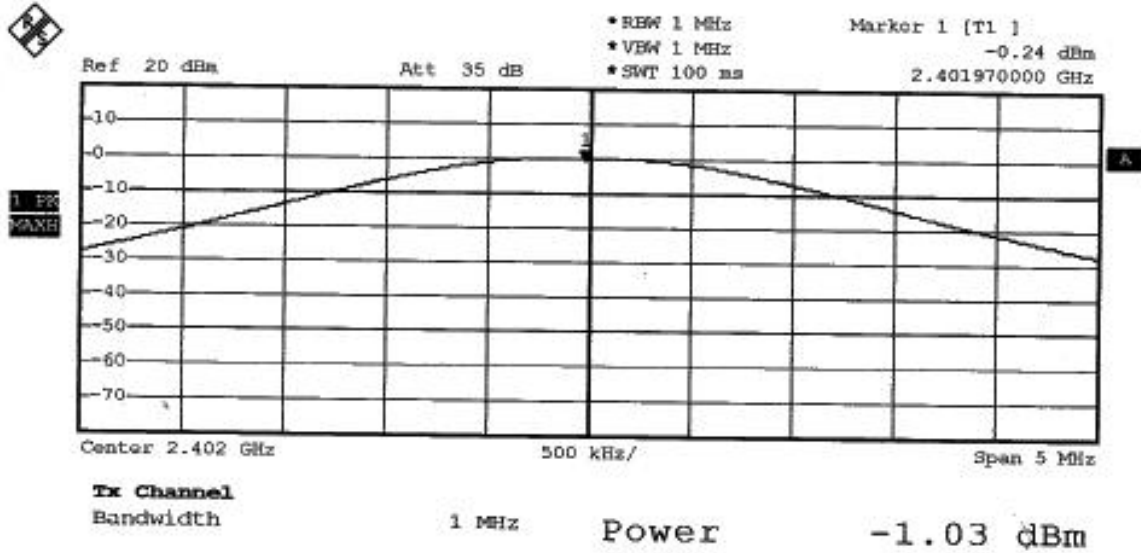


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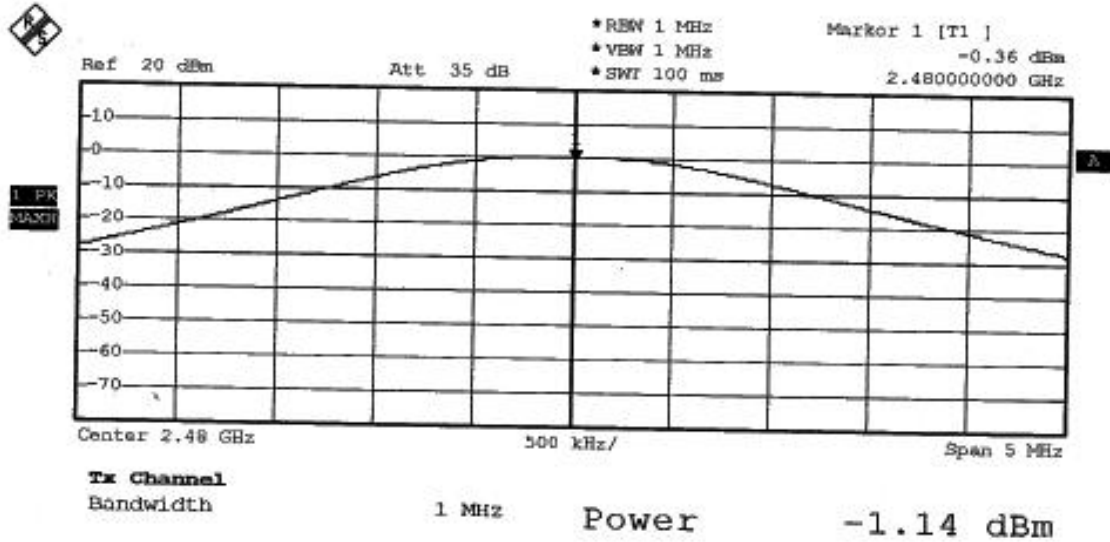


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CH78:





## 5.6 BAND EDGE TEST

### 5.6.1 LIMIT

FCC Part15, Subpart C Section 15.247. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

OPERATING FREQUENCY RANGE (MHz)	SPURIOUS EMISSION FREQUENCY (MHz)	LIMIT	
		Peak power ration to emission(dBc)	Emission level(dBuV/m)
902-928	<902	>20	NA
	>928	>20	NA
	960-1240	NA	54
2400-2483.5	<2400	>20	NA
	>2483.5-2500	NA	54
5725-5850	<5350-5460	NA	54
	<5725	>20	NA
	>5850	>20	NA



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### 5.6.2 TEST EQUIPMENT

The following test equipment was used during the test :

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM	9kHz-7GHz	ROHDE & SCHWARZ	FSP7/ 839511/010	APR. 2006 R&S
EMI TEST RECEIVER	9 kHz TO 2750 MHz	ROHDE & SCHWARZ	ESCS30/ 830245/012	AUG. 2006 R&S
SPECTRUM	9KHz-26.5GHz	HP	8593E/ 3710A03220	MAY 2006 ETC
PRE-AMPLIFIER	1GHz-26.5GHz Gain:30dB	HP	8449B/ 3008A01019	NOV. 2005 ETC
BI-LOG ANTENNA	25 MHz TO 2 GHz	EMCO	3142/ 9701-1124	FEB. 2006 SRT
HORN ANTENNA	1GHz to 18GHz	EMCO	3115/ 9602-4681	DEC. 2005 ETC
OATS	3 - 10 M measurement	SRT	SRT-1	APR. 2006 SRT

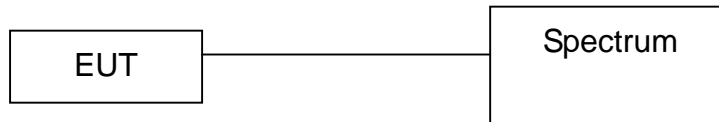
**NOTE:** The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.





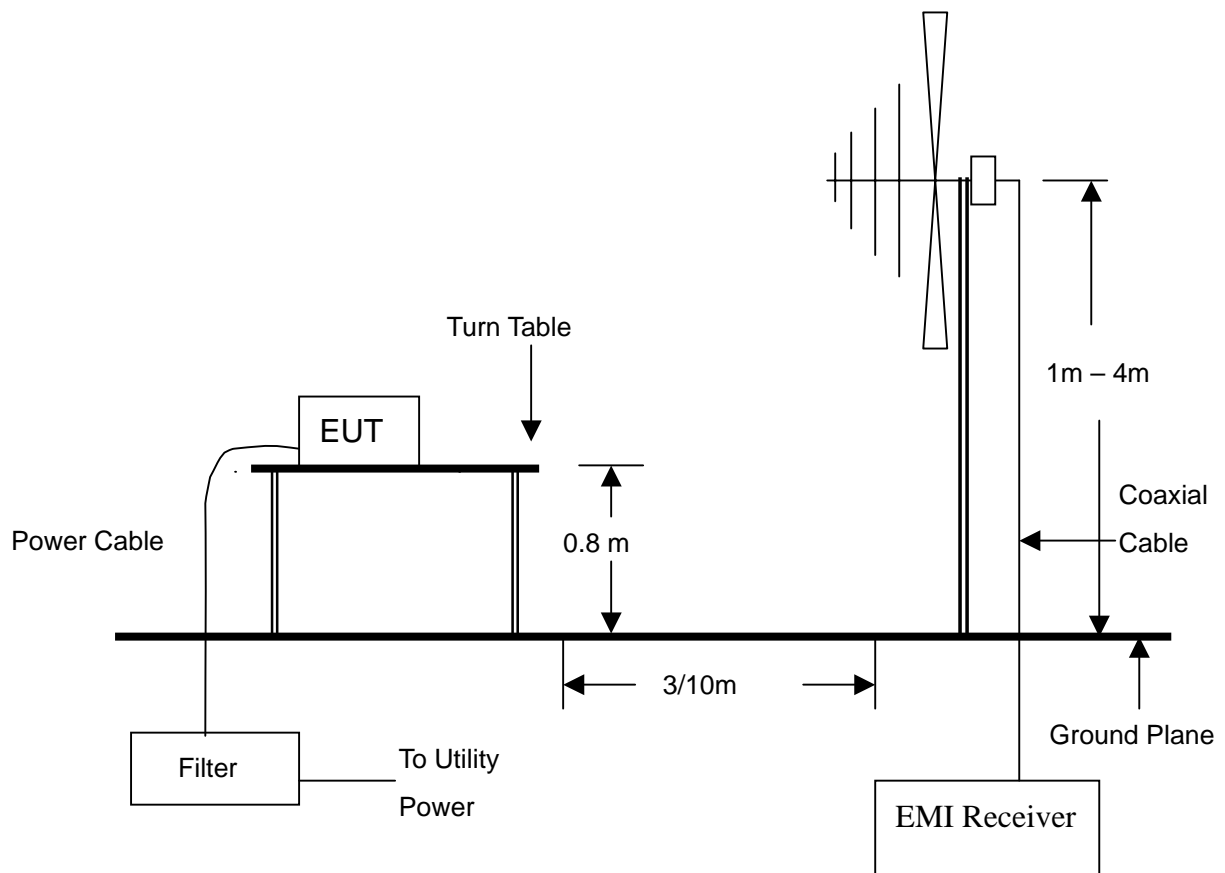
## 5.6.3 TEST SET-UP

### FOR RF CONDUCTED TEST (dBc)



The EUT was connected to the spectrum through a 50 Ω RF cable.

### FOR RADIATED EMISSION TEST



#### NOTE :

1. The EUT system was put on a wooden table with 0.8m heights above a ground plane.
2. For the actual test configuration, please refer to the photos of testing.



## 5.6.4 TEST PROCEDURE

1. The EUT was operating in hopping mode or could be controlled its channel.  
Printed out the test result from the spectrum by hard copy function.
2. The EUT was tested according to the requirement of ANSI C63.4 and CISPR 22.  
The measurements were made at an open area test site with 10 meter measurement distance under 1 GHz and with 3m distance above 1GHz. The frequency spectrum measured started from 30 MHz. Under 1 GHz. All readings were quasi-peak values with 120 kHz resolution bandwidth of the test receiver. Above 1 GHz, the measurements were made at an open area test site with 3 meter measurement distance and all readings were peak and average values with 1 MHz resolution bandwidth of the test receiver. The EUT system was operated in all typical methods by users. The cables connected to EUT and support units were moved to find the maximum emission levels for each frequency.

## 5.6.5 EUT OPERATING CONDITION

Same as section 4.1.5 of this report.

## 5.6.6 TEST RESULT

Temperature:	<u>20°C</u>	Humidity:	<u>56%RH</u>
Spectrum Detector:	<u>PK &amp; AV</u>	Tested by:	<u>Julian Chiang</u>
Test Result:	<u>PASS</u>	Tested Date:	<u>Sep. 09, 2005</u>

### 1. Conducted test

Frequency (MHz)	PEAK POWER OUTPUT (dBm)	Emission read Value(dBm)	Result of Band edge (dBc)	Band edge LIMIT (dBc)
<2400	-0.33	-41.88	41.38	>20dBc
>2483.5	-42.66	-42.65	44.66	>20dBc

### 2. Radiated emission test

Frequency (MHz)	Antenna polarization (H/V)	Reading (dBuV)		Emission (dBuV/m)		Band edge Limit (dBuV/m)	
		PK	AV	PK	AV	PK	AV
<2400	H	26.6	*	22.4	*	74.0	54.0
>2483.5	V	29.7	*	37.1	*	74.0	54.0

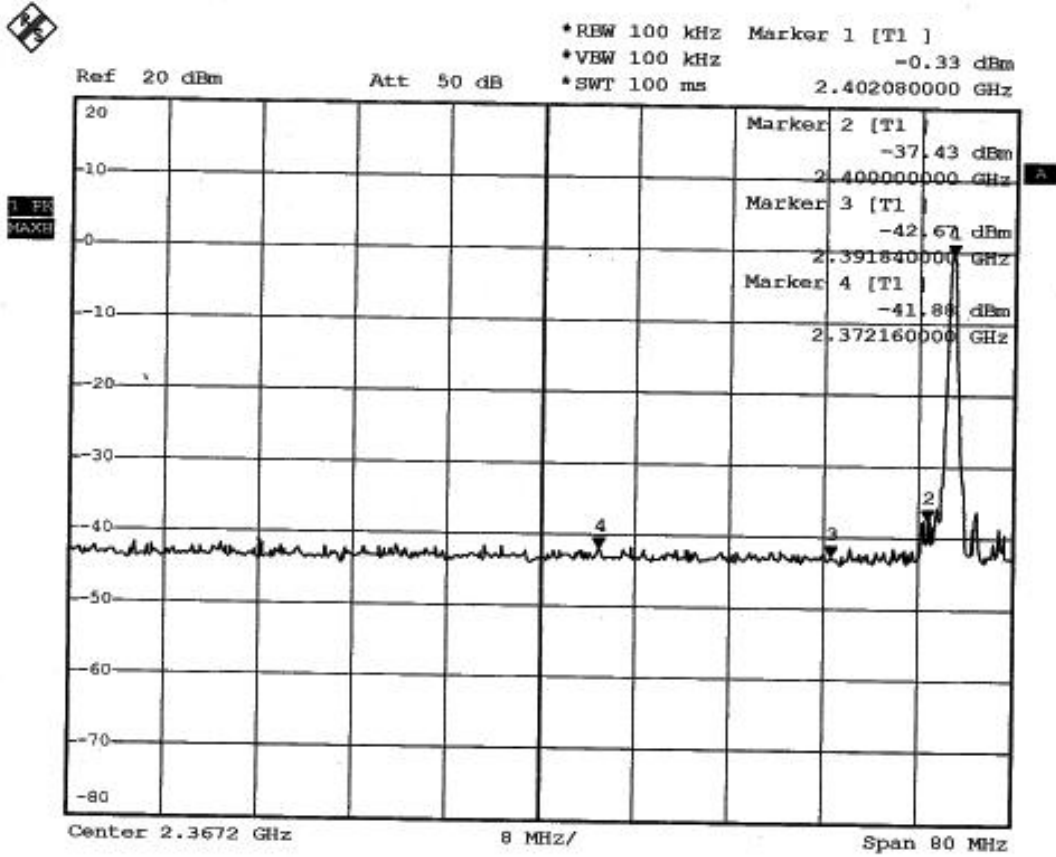


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<2400MHz:



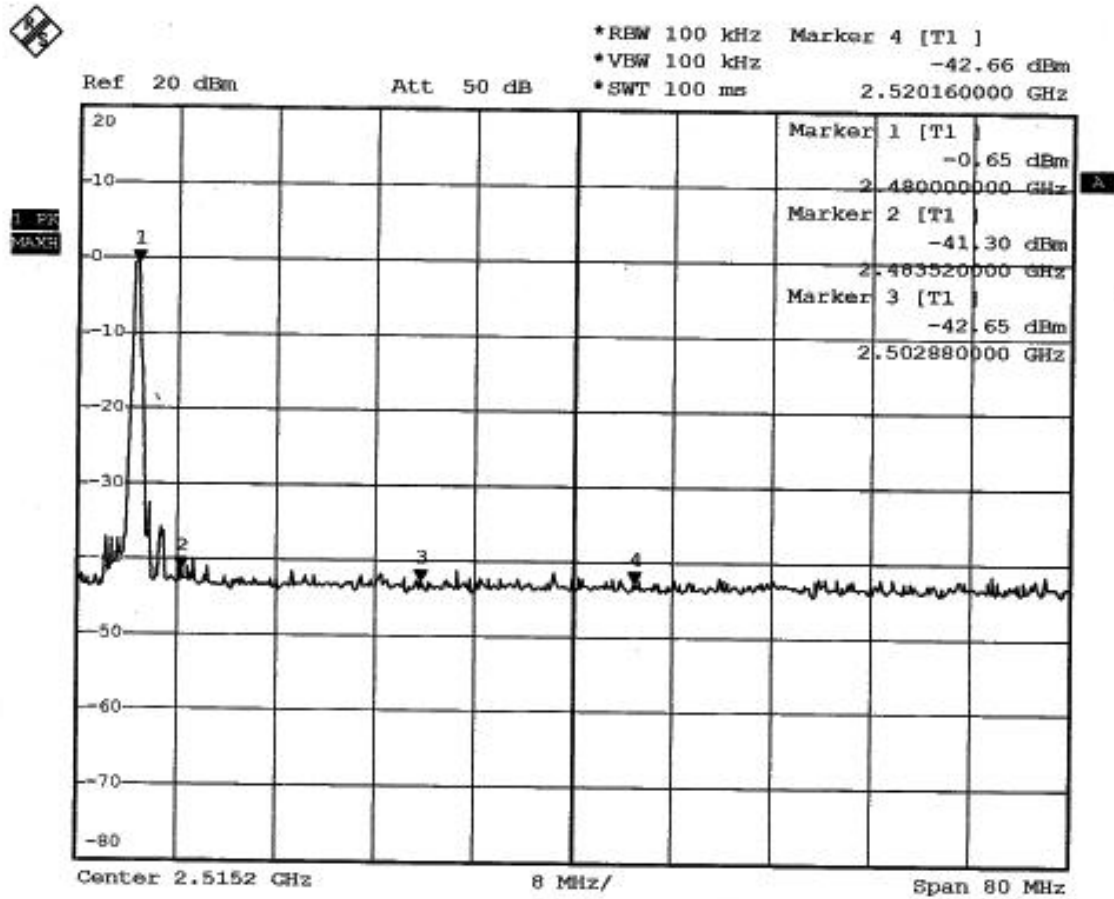


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>2483.5MHz





## 5.7 SPURIOUS RADIATED EMISSION TEST

### 5.7.1 LIMIT

FCC Part15, Subpart C Section 15.209 limit of radiated emission for frequency below1000MHz. The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

FREQUENCY (MHz)	DISTANCE (m)	FIELD STRENGTH (dB $\mu$ V/m)
30 - 88	3	40.0
88 - 216	3	43.5
216 - 960	3	46.0
ABOVE 960	3	54.0

- NOTE** :
1. In the emission tables above , the tighter limit applies at the band edges.
  2. Distance refers to the distance between measuring instrument , antenna , and the closest point of any part of the device or system.

FCC Part 15, Section15.35(b) limit of radiated emission for frequency above 1000 MHz

FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
Above 1000	80.0	60.0	74.0	54.0

FCC Part 15, Subpart C Section 15.249. The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

FUNDAMENTAL FREQUENCY (MHz)	FIELD STRENGTH OF FUNDAMENTAL (dBuV/m) (at 3m)		FIELD STRENGTH OF HARMONICS (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
902-928	114	94	74.0	54.0
2400-2483.5	114	94	74.0	54.0
5725-5875	114	94	74.0	54.0
24000-24250	128	108	88.0	68.0



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### 5.7.2 TEST EQUIPMENT

The following test equipment was used during the radiated emission test :

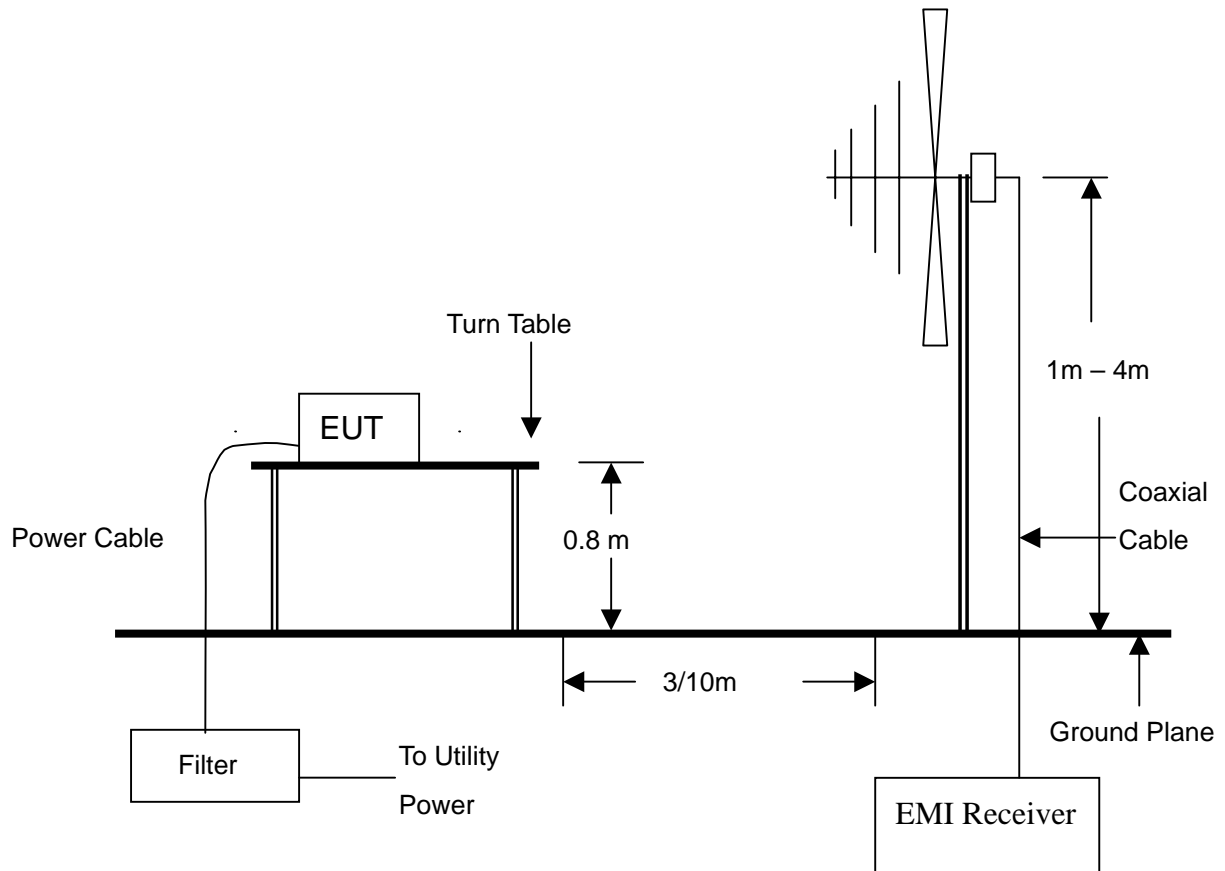
EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
EMI TEST RECEIVER	20 kHz TO 1 GHz	ROHDE & SCHWARZ	ESCS30/ 830245/012	OCT. 2006 ETC
BI-LOG ANTENNA	25 MHz TO 2 GHz	EMCO	3143/ 9509-1141	SEP. 2006 SRT
OATS	3 – 10 M MEASUREMENT	SRT	SRT-1	DEC. 2005 SRT
COAXIAL CABLE	25M	SUNCITY	J400/ 25M	AUG. 2006 SRT
FILTER	2 LINE, 30A	FIL.COIL	FC-943/ 869	N/A
FREQUENCY CONVERTER	N/A	APC	AFC-2KBB/ F100030031	AUG. 2006 SRT

#### NOTE:

1. The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.
2. The Open Area Test Site (SRT-1) is registered by FCC with No. 90957 and VCCI with No. R-1081.
3. The Open Area Test Site (SRT-2) is registered by FCC with No. 98458 and VCCI with No. R-1168.



## 5.7.3 TEST SET-UP



### NOTE :

1. The EUT system was put on a wooden table with 0.8m heights above a ground plane.
2. For the actual test configuration, please refer to the photos of testing.



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### **5.7.4 TEST PROCEDURE**

The EUT was tested according to the requirement of ANSI C63.4 and CISPR 22. The measurements were made at an open area test site with 10 meter measurement distance under 1 GHz and with 3m distance above 1GHz. The frequency spectrum measured started from 30 MHz. Under 1 GHz. All readings were quasi-peak values with 120 kHz resolution bandwidth of the test receiver. Above 1 GHz, the measurements were made at an open area test site with 3 meter measurement distance and all readings were peak and average values with 1 MHz resolution bandwidth of the test receiver. The EUT system was operated in all typical methods by users. The cables connected to EUT and support units were moved to find the maximum emission levels for each frequency.

### **5.7.5 EUT OPERATING CONDITION**

Same as section 4.1.5 of this report.





## 5.7.6 TEST RESULT

Temperature:	17 °C	Humidity:	53%RH
Frequency Range:	30 – 1000 MHz	Measured Distance:	3m
Receiver Detector:	Q.P.	Tested Mode:	Link
Tested By:	Julian Chiang	Tested Date:	Sep. 09, 2005

Antenna Polarization: Horizontal

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Reading Data (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	AZ(°)	EL(m)
213.5810	2.00	9.95	11.5	23.4	43.5	-20.1	125.4	1.3
234.7540	2.09	10.83	12.3	25.2	46.0	-20.8	147.6	1.2
503.4710	3.52	17.55	8.9	30.0	46.0	-16.0	129.6	1.5
603.4230	3.78	19.26	14.7	37.7	46.0	-8.3	25.7	1.5
667.1870	4.51	20.54	15.3	40.4	46.0	-5.6	324.7	1.2
802.6210	5.20	21.46	10.4	37.1	46.0	-8.9	26.8	1.3

Antenna Polarization: Vertical

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Reading Data (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	AZ(°)	EL(m)
56.1240	1.00	4.62	8.9	14.5	40.0	-25.5	48.1	2.4
233.5210	2.09	10.79	8.7	21.6	46.0	-24.4	36.4	1.8
465.1870	3.12	17.05	10.6	30.8	46.0	-15.2	312.9	2.0
568.2540	3.69	18.66	12.7	35.0	46.0	-11.0	267.4	1.8
704.5870	4.02	21.21	10.1	35.3	46.0	-10.7	248.9	1.4
803.2470	5.19	21.48	11.9	38.6	46.0	-7.4	211.3	1.7

### NOTE :

1. Measurement uncertainty is +/-2dB.
2. "\*": Measurement does not apply for this frequency.
3. Emission Level = Reading Value + Ant. Factor + Cable Loss.
4. The field strength of other emission frequencies were very low against the limit.



# TEST REPORT

Temperature:	17 °C	Humidity:	53%RH
Frequency Range:	30 – 1000 MHz	Measured Distance:	3m
Receiver Detector:	Q.P.	Tested Mode:	Charge
Tested By:	Julian Chiang	Tested Date:	Sep. 09, 2005

Antenna Polarization: Horizontal

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Reading Data (dB $\mu$ V)	Emission Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	AZ(°)	EL(m)
30.2580	0.31	13.60	8.3	22.2	40.0	-17.8	157.4	1.3
75.9420	1.21	6.80	7.2	15.2	40.0	-24.8	136.5	1.2
359.1340	3.26	15.34	7.5	26.1	46.0	-19.9	268.6	1.4
598.1220	3.72	19.17	8.1	31.0	46.0	-15.0	33.7	1.2
631.7120	4.38	19.82	8.4	32.6	46.0	-13.4	169.8	1.5
847.2680	4.59	22.72	9.1	36.4	46.0	-9.6	84.3	1.3

Antenna Polarization: Vertical

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Reading Data (dB $\mu$ V)	Emission Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	AZ(°)	EL(m)
37.8210	0.76	10.73	9.4	20.9	40.0	-19.1	135.7	1.5
64.7950	1.07	4.74	9.8	15.6	40.0	-24.4	35.6	1.6
192.5630	2.04	9.36	9.6	21.0	43.5	-22.5	78.4	1.5
292.4820	2.59	13.68	9.7	26.0	46.0	-20.0	45.6	1.5
715.6240	4.06	21.23	9.6	34.9	46.0	-11.1	35.1	1.7
933.4120	4.85	23.31	8.7	36.9	46.0	-9.1	74	1.6

**NOTE :**

1. Measurement uncertainty is +/-2dB.
2. "": Measurement does not apply for this frequency.
3. Emission Level = Reading Value + Ant. Factor + Cable Loss.
4. The field strength of other emission frequencies were very low against the limit.



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Temperature:	<u>25 °C</u>	Humidity:	<u>53 %RH</u>
Frequency Range:	<u>1 – 25 GHz</u>	Test mode:	<u>Ch 0</u>
Receiver Detector:	<u>PK. or AV.</u>	Measured Distance:	<u>3m</u>
Tested by:	<u>Julian Chiang</u>		

## Antenna Polarization : Horizontal

Freq./MHz	Cable Loss (dB)	Ant. Fact. (dB)	Reading (dBuV)		Emission (dBuV/m)		Limit Line (dBuV/m)		Margin (dBuV/m)		AZ (o)	EL (m)
			PK	AV	PK	AV	PK	AV	PK	AV		
2402.00(F)	-32.16	28.54	65.8	60.4	62.2	56.8	N/A	N/A	N/A	N/A	268.4	1.0
4804.00	-30.47	33.64	30.5	*	33.7	*	74.0	54.0	-40.3	*	127.5	1.2
7206.00	-28.90	36.26	28.7	*	36.1	*	74.0	54.0	-37.9	*	35.4	1.3
2387.45	-32.21	27.97	26.6	*	22.4	*	74.0	54.0	-51.6	*	36.7	1.2
2400.12	-32.16	28.00	28.4	*	24.2	*	74.0	54.0	-49.8	*	327.1	1.3
2485.71	-32.18	28.17	29.7	*	25.7	*	74.0	54.0	-48.3	*	128.7	1.2

## Antenna Polarization : Vertical

Freq./MHz	Cable Loss (dB)	Ant. Fact. (dB)	Reading (dBuV)		Emission (dBuV/m)		Limit Line (dBuV/m)		Margin (dBuV/m)		AZ (o)	EL (m)
			PK	AV	PK	AV	PK	AV	PK	AV		
2402.00(F)	-32.16	28.00	67.5	61.9	63.3	57.7	N/A	N/A	N/A	N/A	26.7	1.4
4804.00	-30.47	33.64	32.2	*	35.3	*	74.0	54.0	-38.7	*	62.4	1.5
7206.00	-28.90	36.26	29.7	*	37.1	*	74.0	54.0	-36.9	*	84.5	1.5
2374.58	-32.26	27.95	34.1	*	29.8	*	74.0	54.0	-44.2	*	228.4	1.4
2400.19	-32.16	28.00	38.5	*	34.3	*	74.0	54.0	-39.7	*	36.7	1.6
2485.74	-32.18	28.17	30.2	*	26.2	*	74.0	54.0	-47.8	*	34.7	1.8

- NOTE :**
1. Measurement uncertainty is less than +/-2dB
  2. "\*\*": Measurement does not apply for this frequency.
  3. Emission Level = Reading Value + Ant. Factor + Cable Loss
  4. The field strength of other emission frequencies were very low against the limit.
  - 5.(F):The field strength of fundamental frequency.



# TEST REPORT

Temperature:	25°C	Humidity:	53 %RH
Frequency Range:	1 – 25 GHz	Test mode:	Ch39
Receiver Detector:	PK. or AV.	Measured Distance:	3m
Tested by:	Julian Chiang		

## Antenna Polarization : Horizontal

Freq./MHz	Cable Loss (dB)	Ant. Fact. (dB)	Reading (dBuV)		Emission (dBuV/m)		Limit Line (dBuV/m)		Margin (dBuV/m)		AZ (o)	EL (m)
			PK	AV	PK	AV	PK	AV	PK	AV		
2441.00(F)	-32.23	28.62	63.7	58.2	60.1	54.6	N/A	N/A	N/A	N/A	131.5	1.5
4882.00	-30.26	33.71	33.4	*	36.8	*	74.0	54.0	-37.2	*	158.4	1.3
7323.00	-29.04	36.36	29.7	*	37.0	*	74.0	54.0	-37.0	*	352.2	1.2
2421.85	-32.19	28.04	31.4	*	27.2	*	74.0	54.0	-46.8	*	269.6	1.3
2468.74	-32.21	28.14	31.5	*	27.4	*	74.0	54.0	-46.6	*	258.4	1.2
2597.14	-32.06	28.74	28.4	*	25.1	*	74.0	54.0	-48.9	*	26.7	1.5

## Antenna Polarization : Vertical

Freq./MHz	Cable Loss (dB)	Ant. Fact. (dB)	Reading (dBuV)		Emission (dBuV/m)		Limit Line (dBuV/m)		Margin (dBuV/m)		AZ (o)	EL (m)
			PK	AV	PK	AV	PK	AV	PK	AV		
2441.00(F)	-32.23	28.08	68.2	62.8	64.1	58.7	N/A	N/A	N/A	N/A	135.8	1.3
4882.00	-30.26	33.71	29.5	*	32.9	*	74.0	54.0	-41.1	*	182.6	1.5
7323.00	-29.04	36.36	28.4	*	35.7	*	74.0	54.0	-38.3	*	34.8	1.8
2406.98	-32.17	28.01	30.2	*	26.0	*	74.0	54.0	-48.0	*	32.9	1.4
2417.92	-32.19	28.03	31.6	*	27.4	*	74.0	54.0	-46.6	*	95.4	1.7
2500.37	-32.16	28.20	32.4	*	28.5	*	74.0	54.0	-45.5	*	187.2	1.5

- NOTE :**
1. Measurement uncertainty is less than +/-2dB
  2. "\*": Measurement does not apply for this frequency.
  3. Emission Level = Reading Value + Ant. Factor + Cable Loss
  4. The field strength of other emission frequencies were very low against the limit.
  - 5.(F):The field strength of fundamental frequency.



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Shan-Tong Li, Chung-Li  
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# TEST REPORT

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Temperature:	<u>28°C</u>	Humidity:	<u>53%RH</u>
Frequency Range:	<u>1 – 25GHz</u>	Test mode:	<u>Ch78</u>
Receiver Detector:	<u>PK. or AV.</u>	Measured Distance:	<u>3m</u>
Tested by:	<u>Julian Chiang</u>		

Antenna Polarization : Horizontal

Freq./MHz	Cable Loss (dB)	Ant. Fact. (dB)	Reading (dBuV)		Emission (dBuV/m)		Limit Line (dBuV/m)		Margin (dBuV/m)		AZ (o)	EL (m)
			PK	AV	PK	AV	PK	AV	PK	AV		
2480.00(F)	-32.19	28.73	66.2	60.9	62.7	57.4	N/A	N/A	N/A	N/A	132.4	1.3
4960.00	-30.26	33.77	34.5	*	38.0	*	74.0	54.0	-36.0	*	167.2	1.1
7440.00	-28.95	36.45	31.8	*	39.3	*	74.0	54.0	-34.7	*	158.6	1.2
2405.98	-32.17	28.01	36.4	*	32.2	*	74.0	54.0	-41.8	*	324.8	1.3
2451.82	-32.24	28.10	33.8	*	29.7	*	74.0	54.0	-44.3	*	33.9	1.5
2483.50	-32.19	28.17	34.7	*	30.7	*	74.0	54.0	-43.3	*	267.4	1.6

Antenna Polarization : Vertical

Freq./MHz	Cable Loss (dB)	Ant. Fact. (dB)	Reading (dBuV)		Emission (dBuV/m)		Limit Line (dBuV/m)		Margin (dBuV/m)		AZ (o)	EL (m)
			PK	AV	PK	AV	PK	AV	PK	AV		
2480.00(F)	-32.19	28.16	69.1	63.7	65.1	59.7	N/A	N/A	N/A	N/A	145.7	1.4
4960.00	-30.26	33.77	36.4	*	39.9	*	74.0	54.0	-34.1	*	263.4	1.6
7440.00	-28.95	36.45	35.8	*	43.3	*	74.0	54.0	-30.7	*	147.8	1.7
2411.62	-32.18	28.02	34.7	*	30.5	*	74.0	54.0	-43.5	*	26.5	1.5
2428.95	-32.20	28.06	32.1	*	28.0	*	74.0	54.0	-46.0	*	85.4	1.8
2483.50	-32.19	28.17	33.9	*	29.9	*	74.0	54.0	-44.1	*	48.9	1.9

- NOTE :**
1. Measurement uncertainty is less than +/- 2dB
  2. "\*": Measurement does not apply for this frequency.
  3. Emission Level = Reading Value + Ant. Factor + Cable Loss
  4. The field strength of other emission frequencies were very low against the limit.
  - 5.(F):The field strength of fundamental frequency.



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### **6 Antenna application**

#### **6.1 Antenna requirement**

The EUT's antenna is met the requirement of FCC part15C section15.203 and 15.204.

FCC part15C section15.247 requirement:

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

#### **6.2 Result**

The EUT's antenna used a dipole antenna and integrated on PCB. The antenna's gain is 1dBi and meets the requirement.



## 7. PHOTOS OF TESTING

- Conducted test (Charge)





- Radiated test (Tx)





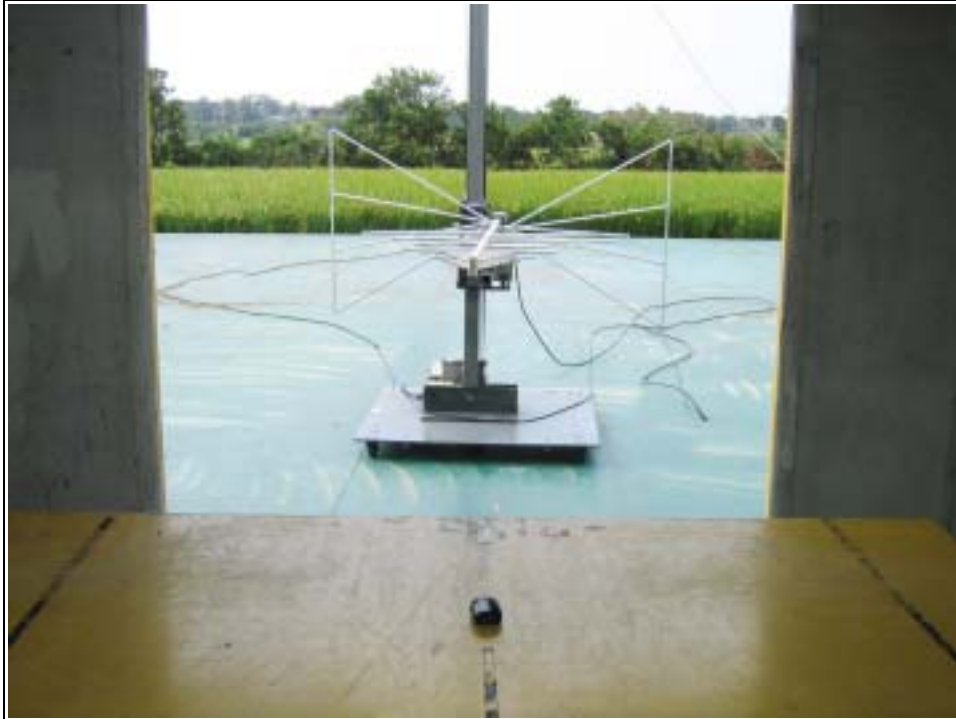


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# TEST REPORT

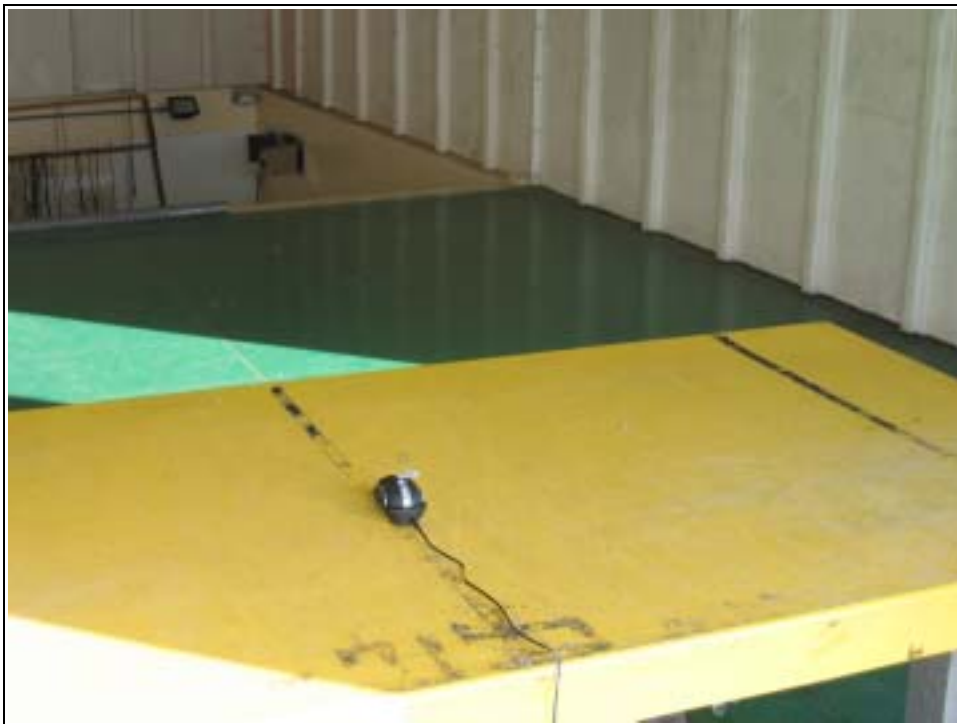
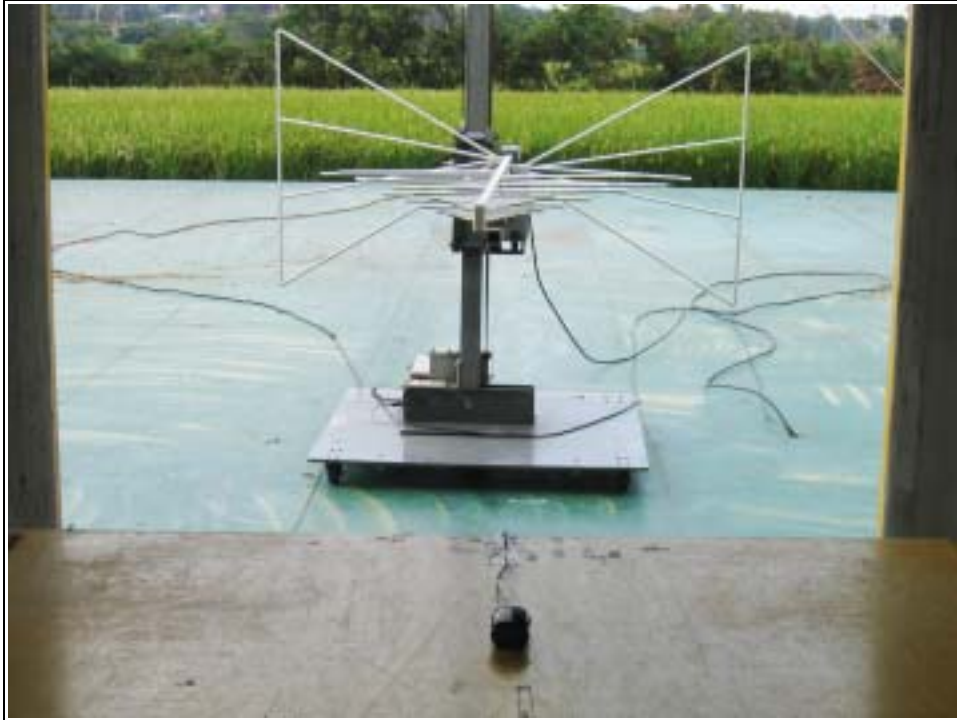
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- Radiated test (Link)





- Radiated test (Charge)





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## TEST REPORT

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### 8. TERMS OF ABRIVATION

AV.	Average detection
AZ(°)	Turn table azimuth
Correct.	Correction
EL(m)	Antenna height (meter)
EUT	Equipment Under Test
Horiz.	Horizontal direction
LISN	Line Impedance Stabilization Network
NSA	Normalized Site Attenuation
Q.P.	Quasi-peak detection
SRT Lab	Spectrum Research & Testing Laboratory, Inc.
Vert.	Vertical direction