

# FCC TEST REPORT

**REPORT NO.:** RF970506H05

**MODEL NO.:** E-VC12

**RECEIVED:** May 06, 2008

**TESTED:** May 14 to 22, 2008

**ISSUED:** May 26, 2008

**APPLICANT:** LOGITECH FAR EAST LTD.

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Hsinchu Taiwan, R.O.C.

**ISSUED BY:** Advance Data Technology Corporation

**LAB LOCATION:** No. 81-1, Lu Liao Keng, 9 Ling, Wu Lung Tsuen,  
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## TABLE OF CONTENTS

1	CERTIFICATION .....	4
2	SUMMARY OF TEST RESULTS.....	5
2.1	MEASUREMENT UNCERTAINTY .....	6
3	GENERAL INFORMATION .....	7
3.1	GENERAL DESCRIPTION OF EUT .....	7
3.2	DESCRIPTION OF TEST MODES .....	8
3.3	TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL: .....	9
3.4	GENERAL DESCRIPTION OF APPLIED STANDARDS .....	11
3.5	DESCRIPTION OF SUPPORT UNITS.....	12
3.6	CONFIGURATION OF SYSTEM UNDER TEST .....	13
4	TEST PROCEDURES AND RESULTS .....	14
4.1	CONDUCTED EMISSION MEASUREMENT .....	14
4.1.1	LIMITS OF CONDUCTED EMISSION MEASUREMENT .....	14
4.1.2	TEST INSTRUMENTS.....	14
4.1.3	TEST PROCEDURES .....	15
4.1.4	TEST SETUP .....	15
4.1.5	EUT OPERATING CONDITIONS.....	16
4.1.6	TEST RESULTS .....	17
4.2	NUMBER OF HOPPING FREQUENCY USED .....	19
4.2.1	LIMIT OF HOPPING FREQUENCY USED .....	19
4.2.2	TEST INSTRUMENTS.....	19
4.2.3	TEST PROCEDURES .....	20
4.2.4	DEVIATION FROM TEST STANDARD .....	20
4.2.5	TEST SETUP .....	21
4.2.6	TEST RESULTS .....	21
4.3	DWELL TIME ON EACH CHANNEL.....	23
4.3.1	LIMIT OF DWELL TIME USED .....	23
4.3.2	TEST INSTRUMENTS.....	23
4.3.3	TEST PROCEDURES .....	24
4.3.4	DEVIATION FROM TEST STANDARD .....	24
4.3.5	TEST SETUP .....	24
4.3.6	TEST RESULTS .....	25
4.4	CHANNEL BANDWIDTH .....	27
4.4.1	TEST INSTRUMENTS.....	27
4.4.2	TEST PROCEDURE.....	28
4.4.3	DEVIATION FROM TEST STANDARD .....	28
4.4.4	TEST SETUP .....	28
4.4.5	EUT OPERATING CONDITION .....	28
4.4.6	TEST RESULTS .....	29
4.5	HOPPING CHANNEL SEPARATION .....	31
4.5.1	LIMIT OF HOPPING CHANNEL SEPARATION .....	31
4.5.2	TEST INSTRUMENTS.....	31
4.5.3	TEST PROCEDURES .....	32

4.5.4	DEVIATION FROM TEST STANDARD .....	32
4.5.5	TEST SETUP .....	32
4.5.6	TEST RESULTS .....	33
4.6	MAXIMUM PEAK OUTPUT POWER.....	35
4.6.1	LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT .....	35
4.6.2	INSTRUMENTS.....	35
4.6.3	TEST PROCEDURES .....	36
4.6.4	DEVIATION FROM TEST STANDARD .....	36
4.6.5	TEST SETUP .....	37
4.6.6	EUT OPERATING CONDITION.....	37
4.6.7	TEST RESULTS .....	38
4.7	RADIATED EMISSION MEASUREMENT .....	40
4.7.1	LIMITS OF RADIATED EMISSION MEASUREMENT .....	40
4.7.2	TEST INSTRUMENTS.....	41
4.7.3	TEST PROCEDURES .....	42
4.7.4	DEVIATION FROM TEST STANDARD .....	42
4.7.5	TEST SETUP .....	43
4.7.6	TEST RESULTS .....	44
4.8	BAND EDGES MEASUREMENT.....	52
4.8.1	LIMITS OF BAND EDGES MEASUREMENT .....	52
4.8.2	TEST INSTRUMENTS.....	52
4.8.3	TEST PROCEDURE.....	52
4.8.4	DEVIATION FROM TEST STANDARD .....	52
4.8.5	EUT OPERATING CONDITION.....	52
4.8.6	TEST RESULTS .....	53
4.9	ANTENNA REQUIREMENT .....	55
4.9.1	STANDARD APPLICABLE.....	55
4.9.2	ANTENNA CONNECTED CONSTRUCTION.....	55
5	INFORMATION ON THE TESTING LABORATORIES .....	56
6	APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB .....	57

## 1 CERTIFICATION

**PRODUCT :** Logitech® Wireless Speed Force™  
**BRAND NAME :** Logitech  
**MODEL NO. :** E-VC12  
**APPLICANT :** LOGITECH FAR EAST LTD.  
**TESTED DATE :** May 14 to 22, 2008  
**TEST SAMPLE :** ENGINEERING SAMPLE  
**STANDARDS :** 47 CFR Part 15, Subpart C (Section 15.247),  
ANSI C63.4-2003

The above equipment (Model: E-VC12) has been tested by **Advance Data Technology Corporation**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY :** Midoli Peng , **DATE:** May 26, 2008  
( Midoli Peng, Specialist )

**TECHNICAL ACCEPTANCE** : Hank Chung , **DATE:** May 26, 2008  
Responsible for RF ( Hank Chung, Deputy Manager )

**APPROVED BY :** May Chen , **DATE:** May 26, 2008  
( May Chen, Deputy Manager )

## 2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

<b>APPLIED STANDARD: 47 CFR Part 15, Subpart C</b>			
<b>Standard Section</b>	<b>Test Type and Limit</b>	<b>Result</b>	<b>REMARK</b>
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit Minimum passing margin is -11.89dB at 0.191MHz
15.247(a)(1)(I)-(ii)	Number of Hopping Frequency Used Spec.: At least 15 channels	PASS	Meet the requirement of limit
15.247(a)(1)(ii)	Dwell Time on Each Channel Spec. : Max. 0.4 second within 31.6 second	PASS	Meet the requirement of limit
15.247(a)(1)(I)-(ii)	Hopping Channel Separation Spec. : Min. 25 kHz or two-thirds of 20 dB bandwidth, which ever is greater	PASS	Meet the requirement of limit
15.247(a)(2)	Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Report reference
15.247(b)	Maximum Peak Output Power Spec.: max. 125mW	PASS	Meet the requirement of limit
15.247(c)	Transmitter Radiated Emissions Spec.: Table 15.209	PASS	Meet the requirement of limit Minimum passing margin is -0.51dB at 2483.50MHz
15.247(c)	Band Edge Measurement	PASS	Meet the requirement of limit

## 2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

<b>Measurement</b>	<b>Value</b>
Conducted emissions	2.44 dB
Radiated emissions (30MHz-1GHz)	3.94 dB
Radiated emissions (1GHz ~18GHz)	2.33 dB
Radiated emissions (18GHz ~20GHz)	2.55 dB

### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	Logitech® Wireless Speed Force™
<b>MODEL NO.</b>	E-VC12
<b>FCC ID</b>	JNZEVC12
<b>POWER SUPPLY</b>	DC 24V from power adapter
<b>MODULATION TECHNOLOGY</b>	FHSS
<b>MODULATION TYPE</b>	FSK
<b>FREQUENCY RANGE</b>	2402MHz ~ 2480MHz
<b>NUMBER OF CHANNEL</b>	79
<b>OUTPUT POWER</b>	0.374mW
<b>ANTENNA TYPE</b>	PCB printed antenna with -1.04dBi antenna gain
<b>DATA CABLE</b>	NA
<b>ASSOCIATED DEVICES</b>	NA

**NOTE:**

1. The EUT must be supplied with a power adapter as following :

Brand	Model No.	Spec.
Logitech	ADP-18LB B	Input: 100-120V, 0.4A, 50/60Hz Output: 24V, 0.75A Cable : 3.6m / Unshielded / without core

2. The above EUT information was declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

### 3.2 DESCRIPTION OF TEST MODES

Seventy-nine channels are provided to this EUT.

Channel	Freq. (MHz)						
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

### 3.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL:

EUT configure mode	Applicable to				Description
	PLC	RE<1G	RE≥1G	APCM	
-	√	√	√	√	Modulation Type: FSK

Where PLC: Power Line Conducted Emission RE<1G RE: Radiated Emission below 1GHz  
 RE≥1G: Radiated Emission above 1GHz APCM: Antenna Port Conducted Measurement

#### **Power Line Conducted Emission Test:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type
0 to 78	0	FHSS	FSK

#### **Radiated Emission Test (Below 1 GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type
0 to 78	0	FHSS	FSK

#### **Radiated Emission Test (Above 1 GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type
0 to 78	0, 39, 78	FHSS	FSK
Receiver	0, 39, 78	FHSS	-

**Bandedge Measurement:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type
0 to 78	0, 78	FHSS	FSK

**Antenna Port Conducted Measurement:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type
0 to 78	0, 39, 78	FHSS	FSK

### **3.4 GENERAL DESCRIPTION OF APPLIED STANDARDS**

The EUT is a Logitech® Wireless Speed Force™. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C. (15.247)**

**ANSI C63.4 : 2003**

All test items have been performed and recorded as per the above standards.

### 3.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

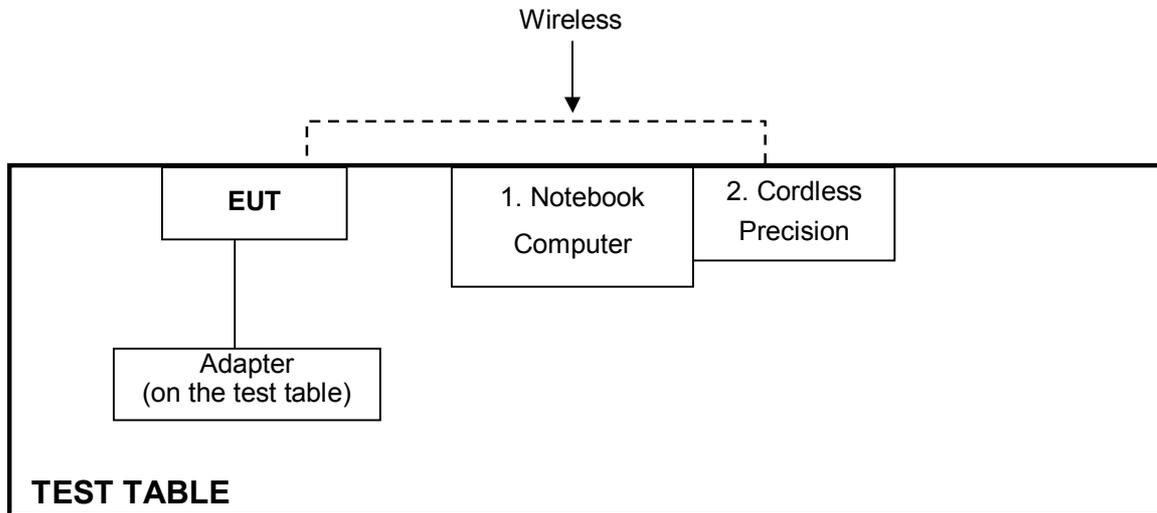
No.	Product	Brand	Model No.	Serial No.	FCC ID
1	Notebook Computer	DELL	PP17L	CN-ONF743-48643-7AV-0124	DoC
2	Cordless Precision	Logitech	C-X5A57	NA	NA

No.	Signal cable description
1	NA
2	NA

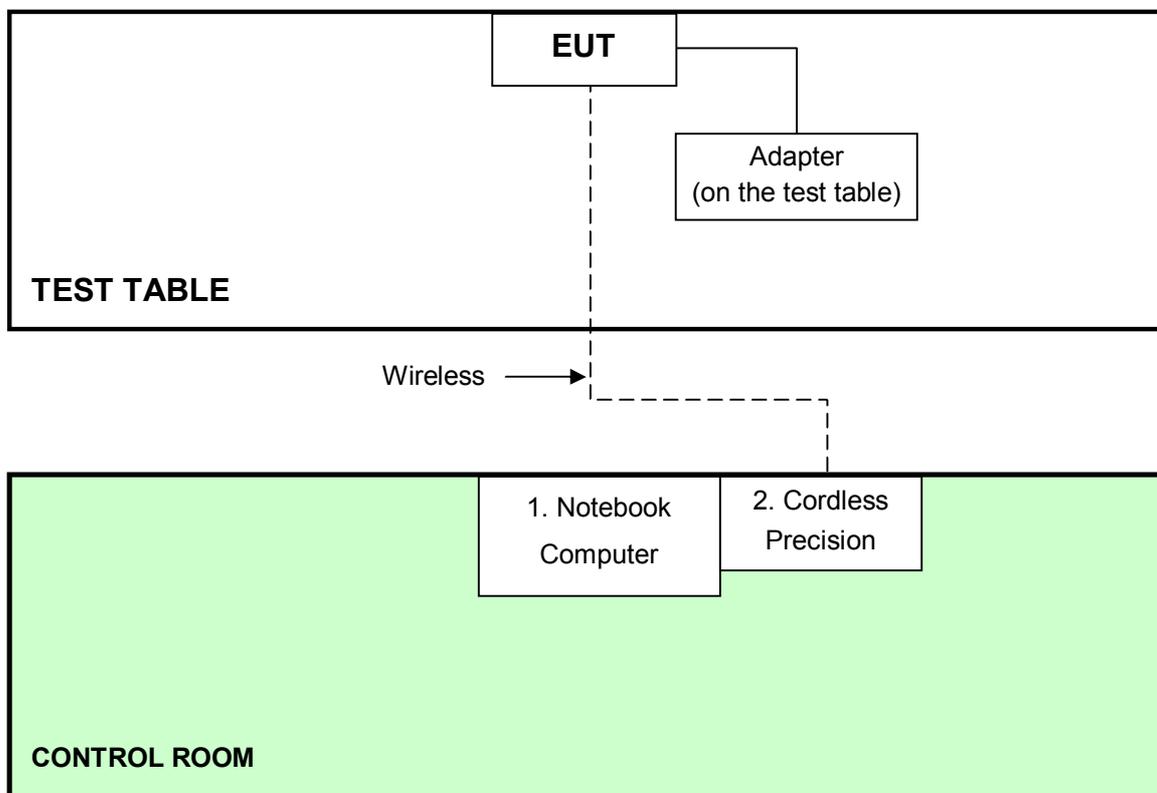
Note: 1. All power cords of the above support units are unshielded (1.8m).

### 3.6 CONFIGURATION OF SYSTEM UNDER TEST

For Conducted test:



For Radiated test:



## 4 TEST PROCEDURES AND RESULTS

### 4.1 CONDUCTED EMISSION MEASUREMENT

#### 4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. All emanations from a class B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

#### 4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
Test Receiver	ESCS 30	847124/029	Feb. 28, 2009
Line-Impedance Stabilization Network(for EUT)	ESH3-Z5	848773/004	Nov. 08, 2008
Line-Impedance Stabilization Network(for Peripheral)	ENV-216	100071	Nov. 26, 2008
RF Cable (JETBAO)	RG233/U	Cable_CB_01	Dec. 09, 2008
50 ohms Terminator	50	3	Nov. 15, 2008
Software	ADT_Cond_V7.3.2	NA	NA

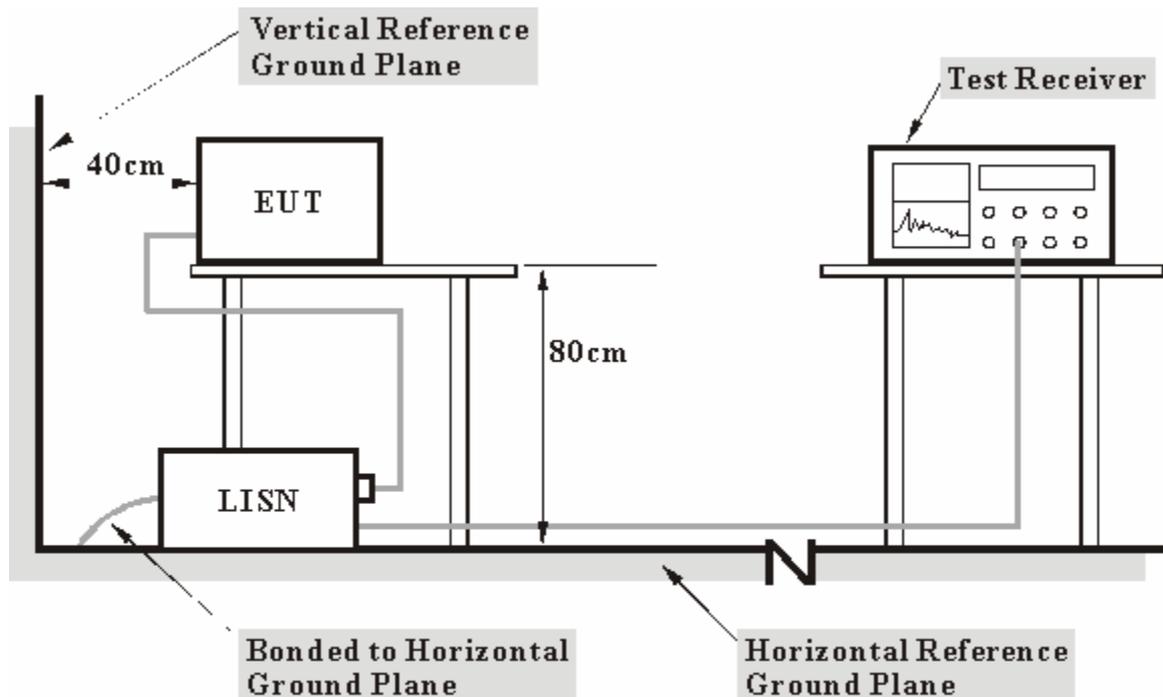
**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in ADT Shielded Room No. B.
- 3 The VCCI Con B Registration No. is C-2193.

#### 4.1.3 TEST PROCEDURES

- a. The EUT/HOST was placed 0.4 meters from the conducting wall of the shielded room with EUT/HOST being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT/HOST were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits could not be reported

#### 4.1.4 TEST SETUP



- Note:**
1. Support units were connected to second LISN.
  2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

#### 4.1.5 EUT OPERATING CONDITIONS

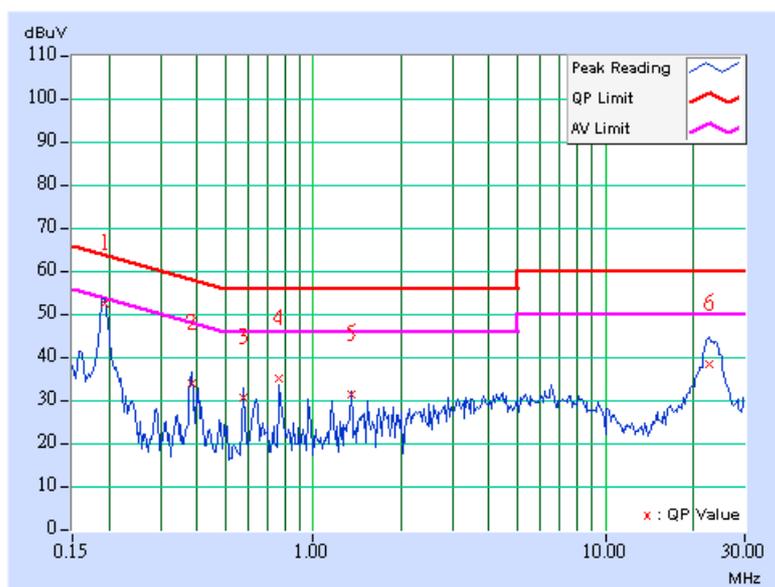
The support unit 1(Notebook Computer) run a test program “HIDIO-WS.exe” to enable EUT under transmission condition continuously via wireless.

#### 4.1.6 TEST RESULTS

<b>INPUT POWER</b>	120Vac, 60 Hz	<b>6DB BANDWIDTH</b>	9 kHz
<b>ENVIRONMENTAL CONDITIONS</b>	24 deg. C, 67%RH, 972 hPa	<b>PHASE</b>	Line (L)
<b>TESTED BY</b>	Phoenix Huang		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.193	9.65	42.22	-	51.87	-	63.91	53.91	-12.04	-
2	0.384	9.66	23.96	-	33.62	-	58.18	48.18	-24.57	-
3	0.576	9.69	20.62	-	30.31	-	56.00	46.00	-25.69	-
4	0.767	9.72	25.04	-	34.76	-	56.00	46.00	-21.24	-
5	1.344	9.79	21.44	-	31.23	-	56.00	46.00	-24.77	-
6	22.684	10.22	28.11	-	38.33	-	60.00	50.00	-21.67	-

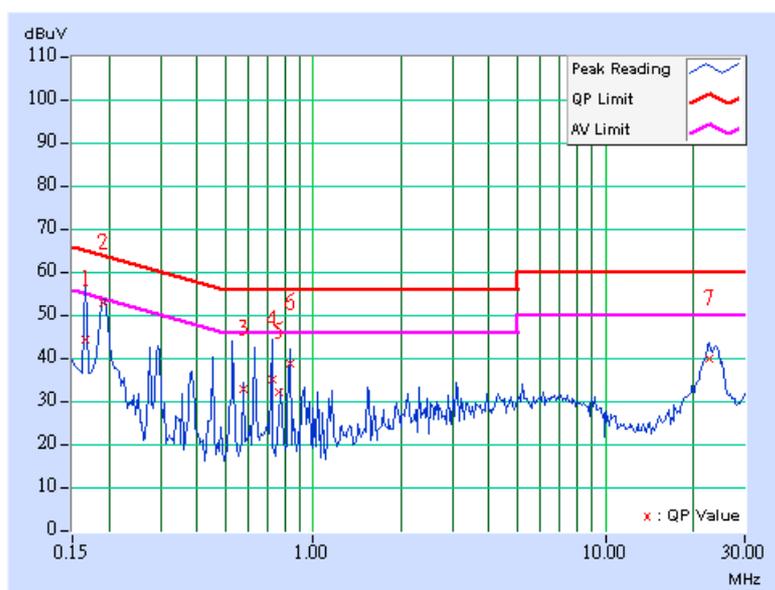
- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.



<b>INPUT POWER</b>	120Vac, 60 Hz	<b>6dB BANDWIDTH</b>	9 kHz
<b>ENVIRONMENTAL CONDITIONS</b>	24 deg. C, 67%RH, 972 hPa	<b>PHASE</b>	Neutral (N)
<b>TESTED BY</b>	Phoenix Huang		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.166	9.65	34.01	-	43.66	-	65.18	55.18	-21.52	-
<b>2</b>	<b>0.191</b>	<b>9.65</b>	<b>42.47</b>	-	<b>52.12</b>	-	<b>64.01</b>	<b>54.01</b>	<b>-11.89</b>	-
3	0.574	9.68	22.69	-	32.37	-	56.00	46.00	-23.63	-
4	0.724	9.70	25.00	-	34.70	-	56.00	46.00	-21.30	-
5	0.767	9.71	21.94	-	31.65	-	56.00	46.00	-24.35	-
6	0.830	9.72	28.62	-	38.34	-	56.00	46.00	-17.66	-
7	22.555	10.37	29.64	-	40.01	-	60.00	50.00	-19.99	-

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.



## 4.2 NUMBER OF HOPPING FREQUENCY USED

### 4.2.1 LIMIT OF HOPPING FREQUENCY USED

At least 15 hopping frequencies, and should be equally spaced.

### 4.2.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100036	Dec. 17, 2008

**Note:**

1. The measurement uncertainty is less than +/- 2.6dB, which is calculated as per the NAMAS document NIS81. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

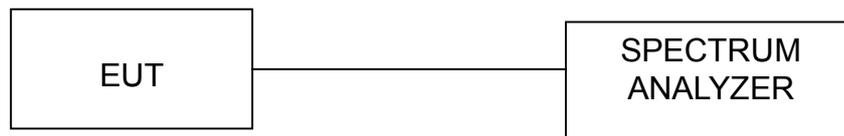
#### 4.2.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

#### 4.2.4 DEVIATION FROM TEST STANDARD

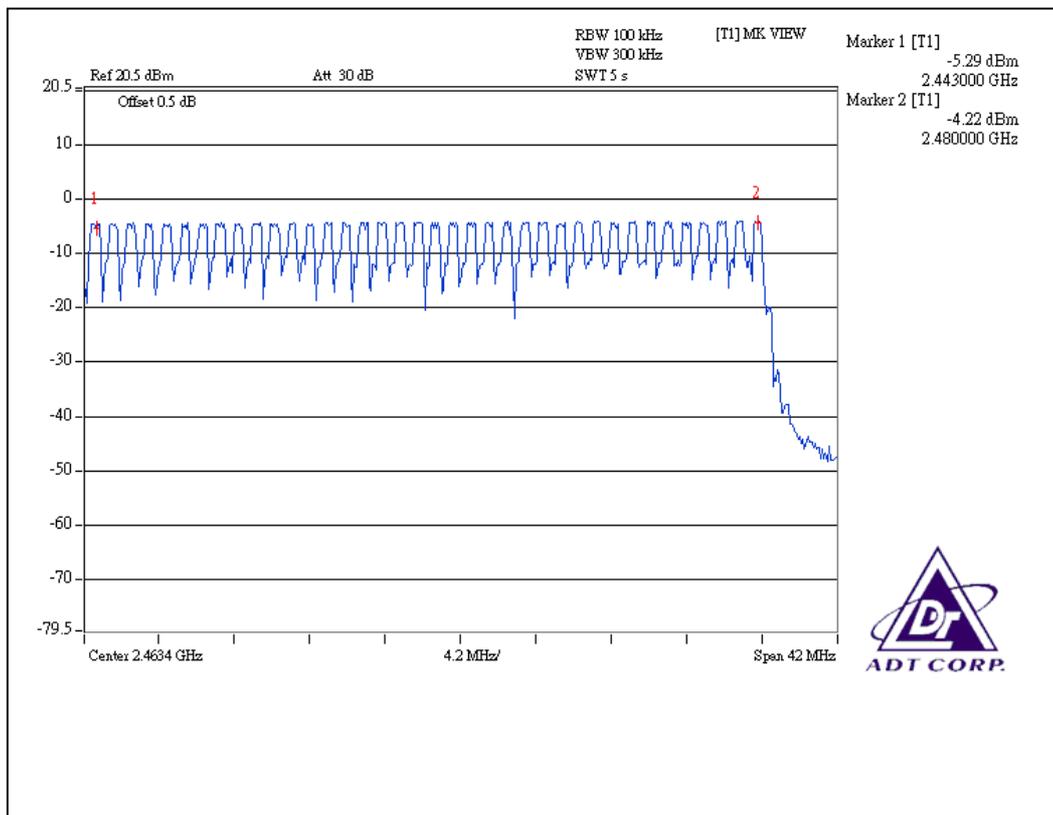
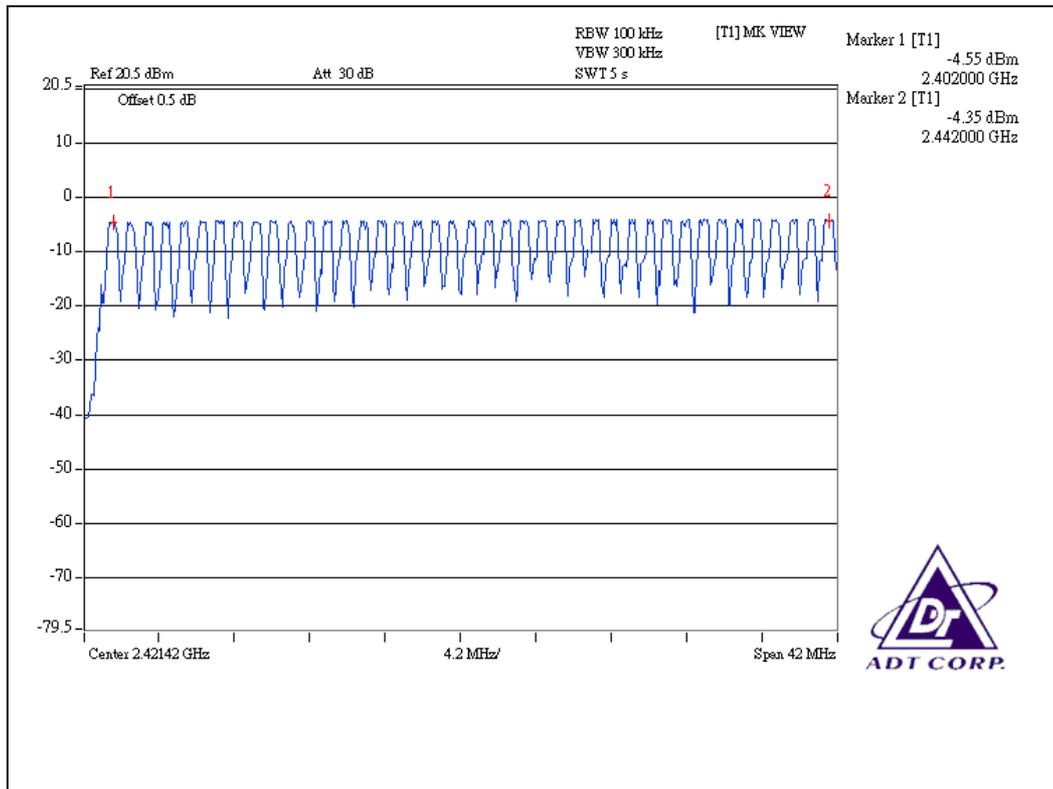
No deviation

#### 4.2.5 TEST SETUP



#### 4.2.6 TEST RESULTS

There are 79 hopping frequencies in the hopping mode. Please refer to next pages for the test result. On the plots, it shows that the hopping frequencies are equally spaced.



### 4.3 DWELL TIME ON EACH CHANNEL

#### 4.3.1 LIMIT OF DWELL TIME USED

For FHSS, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 31.6 second period. For hybrid systems, the average time of occupancy on any frequency should not exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.

#### 4.3.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100036	Dec. 17, 2008

**Note:**

1. The measurement uncertainty is less than +/- 2.6dB, which is calculated as per the NAMAS document NIS81. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

#### 4.3.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

#### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation

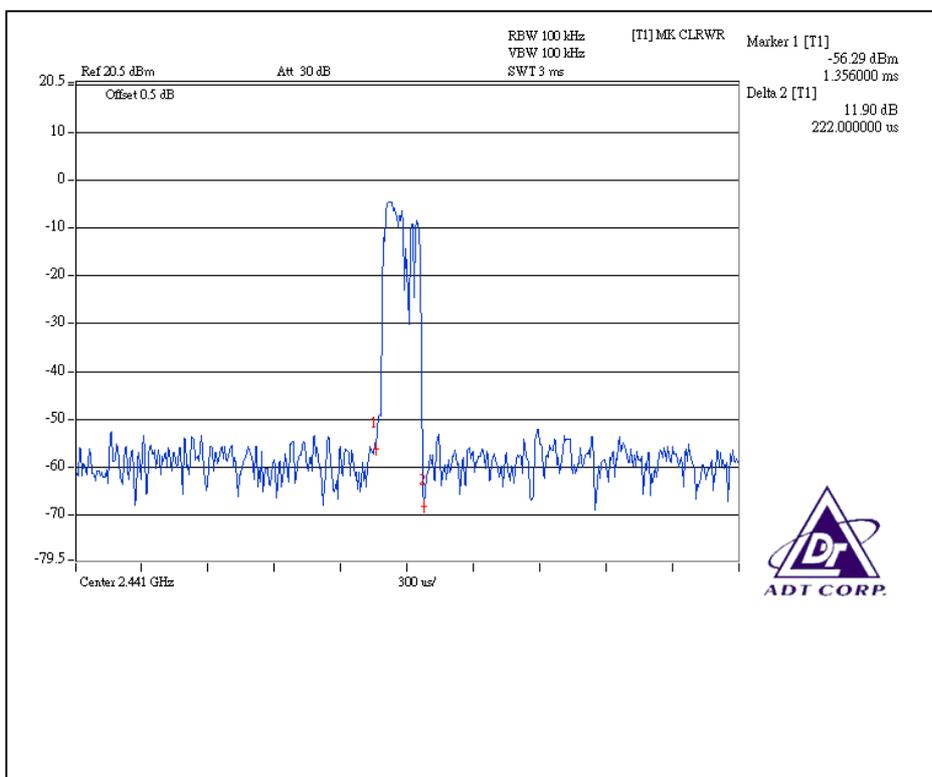
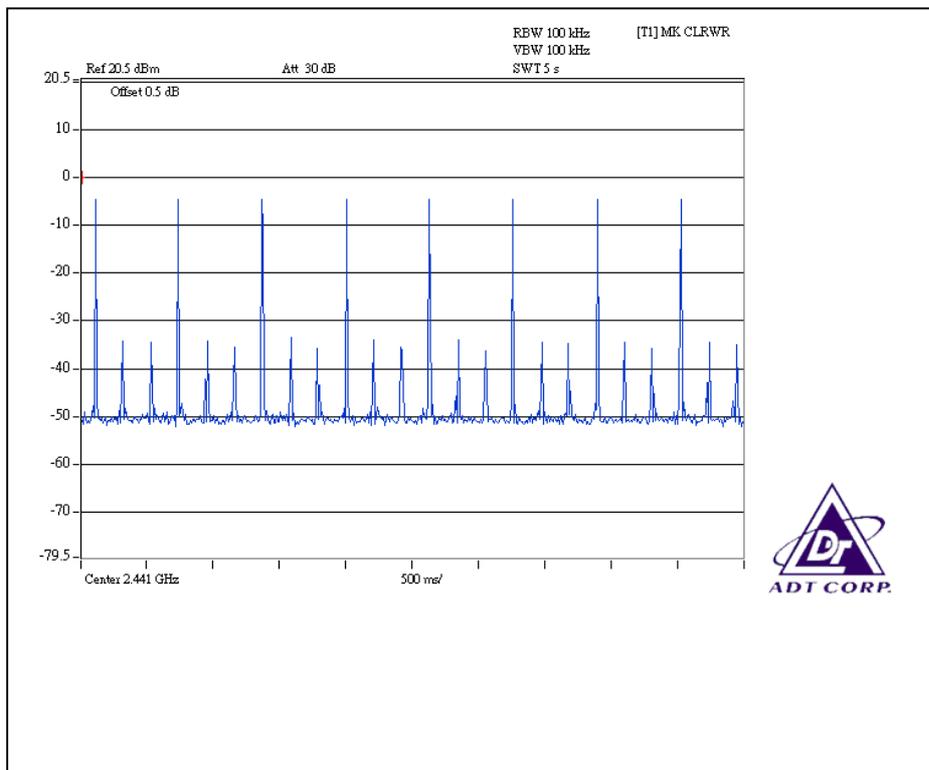
#### 4.3.5 TEST SETUP



#### 4.3.6 TEST RESULTS

<b>Number of transmission in a 31.6 (79Hopping*0.4)</b>	<b>Length of transmission time (msec)</b>	<b>Result (msec)</b>	<b>Limit (msec)</b>
8 (times / 5 sec) *6.32=50.56 times	0.222	11.224	400

Test plots of the transmitting time slot are shown on next page.



## 4.4 CHANNEL BANDWIDTH

### 4.4.1 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100036	Dec. 17, 2008

**Note:**

1. The measurement uncertainty is less than +/- 2.6dB, which is calculated as per the NAMAS document NIS81. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

#### 4.4.2 TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

#### 4.4.3 DEVIATION FROM TEST STANDARD

No deviation

#### 4.4.4 TEST SETUP



#### 4.4.5 EUT OPERATING CONDITION

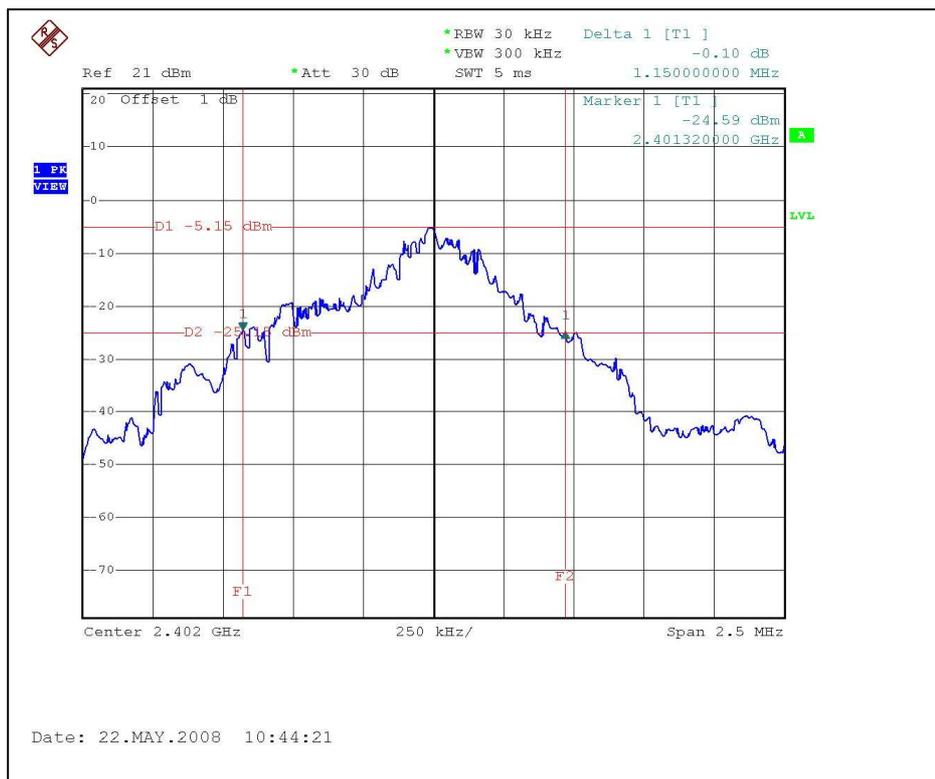
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

#### 4.4.6 TEST RESULTS

<b>MODULATION TYPE</b>	FSK	<b>INPUT POWER</b>	120Vac, 60 Hz
<b>ENVIRONMENTAL CONDITIONS</b>	25deg. C, 60%RH, 972 hPa	<b>TESTED BY</b>	Rex Huang

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (kHz)
0	2402	1150
39	2441	990
78	2480	1110

#### Channel 0





## 4.5 HOPPING CHANNEL SEPARATION

### 4.5.1 LIMIT OF HOPPING CHANNEL SEPARATION

At least 25 kHz or two-thirds of 20dB hopping channel bandwidth (whichever is greater).

### 4.5.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100036	Dec. 17, 2008

**Note:**

1. The measurement uncertainty is less than +/- 2.6dB, which is calculated as per the NAMAS document NIS81. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

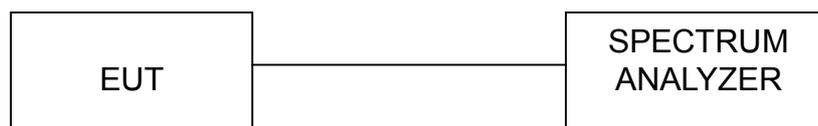
#### 4.5.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

#### 4.5.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.5.5 TEST SETUP



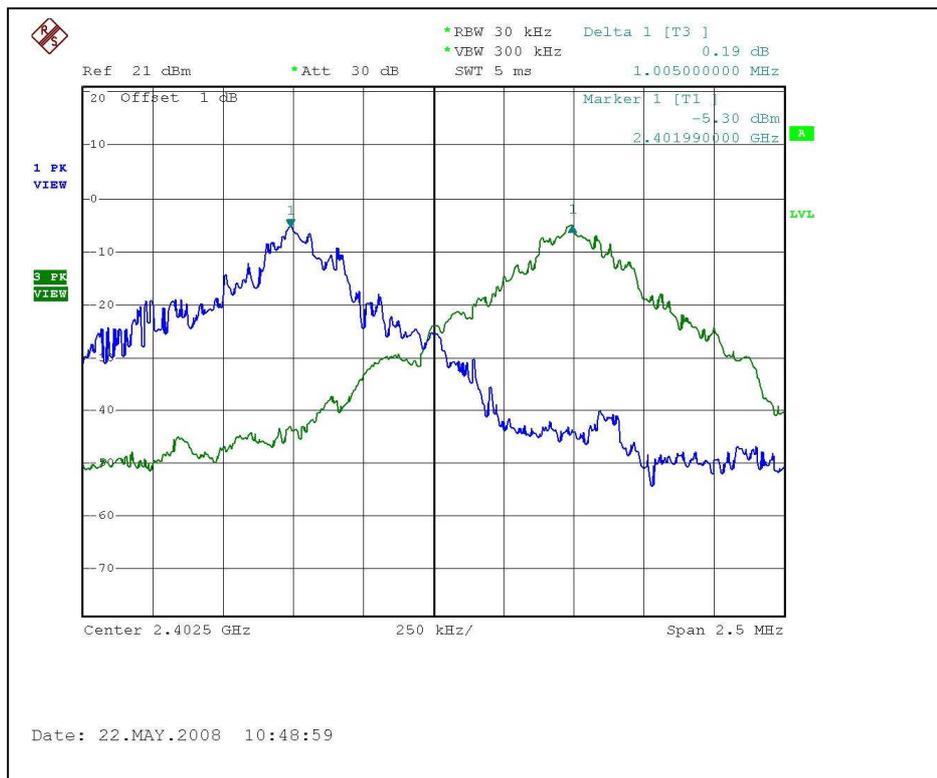
#### 4.5.6 TEST RESULTS

<b>MODULATION TYPE</b>	FSK	<b>INPUT POWER</b>	120Vac, 60 Hz
<b>ENVIRONMENTAL CONDITIONS</b>	20deg. C, 60%RH, 963 hPa	<b>TESTED BY</b>	Rex Huang

Channel	Frequency (MHz)	Adjacent Channel Separation	Minimum Limit (kHz)	Pass / Fail
0	2402	1.005MHz	766.67	PASS
39	2441	1.000MHz	660	PASS
78	2480	1.020MHz	740	PASS

The minimum limit is two-thirds of 20dB bandwidth. Test results please refer as following.

#### Channel 0





## 4.6 MAXIMUM PEAK OUTPUT POWER

### 4.6.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Measurement is 125mW.

### 4.6.2 INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100036	Dec. 17, 2008

**Note:**

1. The measurement uncertainty is less than +/- 2.6dB, which is calculated as per the NAMAS document NIS81. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

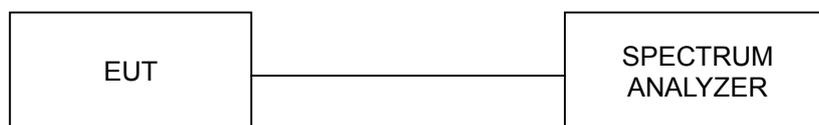
#### 4.6.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3 MHz RBW and 3 MHz VBW.
4. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
5. Repeat above procedures until all frequencies measured were complete.

#### 4.6.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.6.5 TEST SETUP



For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

#### 4.6.6 EUT OPERATING CONDITION

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.





## 4.7 RADIATED EMISSION MEASUREMENT

### 4.7.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

#### 4.7.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
ADVANTEST Spectrum Analyzer	R3271A	85060311	July 15, 2008
HP Pre_Amplifier	8449B	3008A01922	Oct. 04, 2008
ROHDE & SCHWARZ Test Receiver	ESCS30	100375	Mar. 31, 2009
SCHWARZBECK TRILOG Broadband Antenna	VULB 9168	138	July 26, 2008
Schwarzbeck Horn_Antenna	BBHA9120	D124	Dec. 16, 2008
Schwarzbeck Horn_Antenna	BBHA 9170	BBHA9170153	Jan. 27, 2009
R&S Loop Antenna	HFH2-Z2	881058/15	Nov. 29, 2008
RF Switches (ARNITSU)	CS-201	1565157	Aug. 13, 2008
RF CABLE (Chaintek)	SF102	22054-2	Dec. 06. 2008
RF Cable(RICHTEC)	9913-30M N-N Cable	STCCAB-30M-1 GHz	Aug. 13, 2008
Software	ADT_Radiated_V 7.6.15.8	NA	NA
CHANCE MOST Antenna Tower	AT-100	0203	NA
CHANCE MOST Turn Table	TT-100	0203	NA

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
 2. The horn antenna, HP preamplifier (model: 8449B) and Spectrum Analyzer (model: R3271A) are used only for the measurement of emission frequency above 1GHz if tested.  
 3. The test was performed in ADT Open Site No. C.  
 4. The FCC Site Registration No. is 656396.  
 5. The VCCI Site Registration No. is R-1626.  
 6. The CANADA Site Registration No. is IC 3789C-3.

### 4.7.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

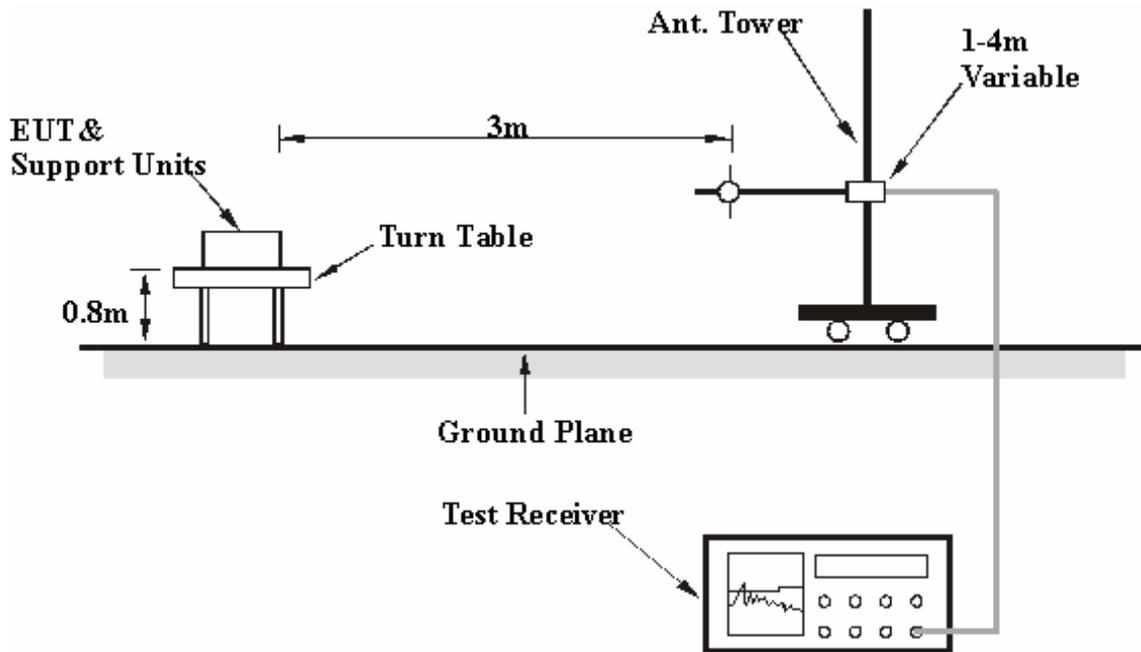
**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.

### 4.7.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.7.5 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

#### 4.7.6 TEST RESULTS

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	Below 1000MHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	27deg. C, 52%RH 963hPa	TESTED BY	Rex Huang

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	73.18	24.43 QP	40.00	-15.57	2.10 H	300	13.02	11.41
2	121.84	35.15 QP	43.50	-8.35	1.50 H	316	22.15	13.00
3	138.02	30.10 QP	43.50	-13.40	2.04 H	63	15.93	14.17
4	154.16	31.29 QP	43.50	-12.21	1.83 H	64	16.31	14.98
5	162.57	36.19 QP	43.50	-7.31	1.69 H	57	21.19	15.00
6	194.90	31.49 QP	43.50	-12.01	1.11 H	58	19.13	12.36
7	227.38	27.86 QP	46.00	-18.14	1.33 H	51	15.39	12.47

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	73.11	26.84 QP	40.00	-13.16	1.00 V	21	15.41	11.43
2	122.03	33.99 QP	43.50	-9.51	1.00 V	315	20.97	13.02
3	138.13	28.92 QP	43.50	-14.58	1.00 V	358	14.74	14.18
4	154.28	25.99 QP	43.50	-17.51	1.00 V	169	11.01	14.98
5	170.76	19.95 QP	43.50	-23.55	1.00 V	354	5.73	14.22
6	194.91	27.71 QP	43.50	-15.79	1.00 V	18	15.35	12.36
7	227.12	22.20 QP	46.00	-23.80	1.00 V	232	9.74	12.46

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	27deg. C, 52%RH 999hPa	TESTED BY	Rex Huang

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	63.75 PK	74.00	-10.25	1.57 H	77	33.35	30.40
2	2390.00	43.49 AV	54.00	-10.51	1.57 H	77	13.09	30.40
3	*2402.00	96.83 PK			1.57 H	77	66.38	30.45
4	*2402.00	65.01 AV			1.57 H	77	34.56	30.45
5	4804.00	50.39 PK	74.00	-23.61	1.44 H	84	14.74	35.65
6	4804.00	18.57 AV	54.00	-35.43	1.44 H	84	-17.08	35.65
7	7206.00	54.78 PK	74.00	-19.22	1.32 H	211	12.65	42.13
8	7206.00	22.96 AV	54.00	-31.04	1.32 H	211	-19.17	42.13
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	60.39 PK	74.00	-13.61	1.02 V	268	29.99	30.40
2	2390.00	43.49 AV	54.00	-10.51	1.02 V	268	13.09	30.40
3	*2402.00	92.92 PK			1.02 V	268	62.47	30.45
4	*2402.00	61.10 AV			1.02 V	268	30.65	30.45
5	4804.00	48.67 PK	74.00	-25.33	1.18 V	338	13.02	35.65
6	4804.00	16.85 AV	54.00	-37.15	1.18 V	338	-18.80	35.65
7	7206.00	53.90 PK	74.00	-20.10	1.28 V	45	11.77	42.13
8	7206.00	22.08 AV	54.00	-31.92	1.28 V	45	-20.05	42.13

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. “ \* “: Fundamental frequency.
  6. Duty cycle =2.56%
  7. Average value = peak reading + 20log(duty cycle).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	27deg. C, 52%RH 999hPa	TESTED BY	Rex Huang

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2441.00	97.55 PK			1.50 H	78	66.93	30.62
2	*2441.00	65.73 AV			1.50 H	78	35.11	30.62
3	4882.00	49.63 PK	74.00	-24.37	1.49 H	6	13.82	35.81
4	4882.00	17.81 AV	54.00	-36.19	1.49 H	6	-18.00	35.81
5	7323.00	53.11 PK	74.00	-20.89	1.35 H	4	10.55	42.56
6	7323.00	21.29 AV	54.00	-32.71	1.35 H	4	-21.27	42.56
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2441.00	93.98 PK			1.34 V	282	63.36	30.62
2	*2441.00	62.16 AV			1.34 V	282	31.54	30.62
3	4882.00	49.00 PK	74.00	-25.00	1.55 V	28	13.19	35.81
4	4882.00	17.18 AV	54.00	-36.82	1.55 V	28	-18.63	35.81
5	7323.00	52.90 PK	74.00	-21.10	1.23 V	108	10.34	42.56
6	7323.00	21.08 AV	54.00	-32.92	1.23 V	108	-21.48	42.56

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. “ \* “: Fundamental frequency.
  6. Duty cycle =2.56%
  7. Average value = peak reading + 20log(duty cycle).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	27deg. C, 52%RH 999hPa	TESTED BY	Rex Huang

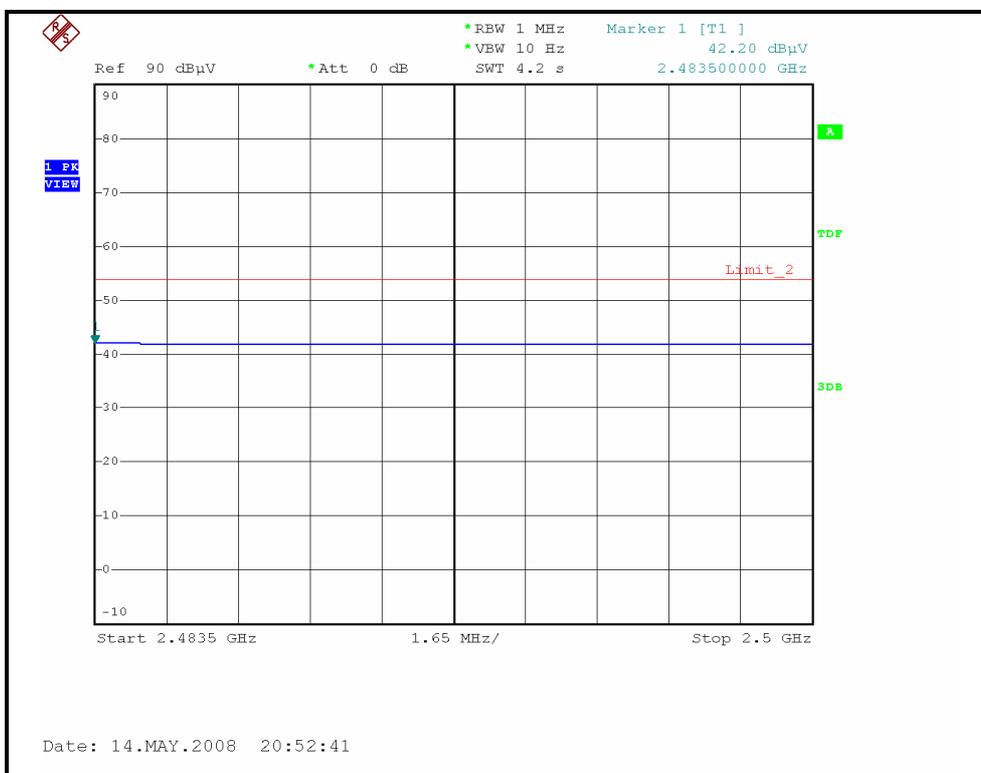
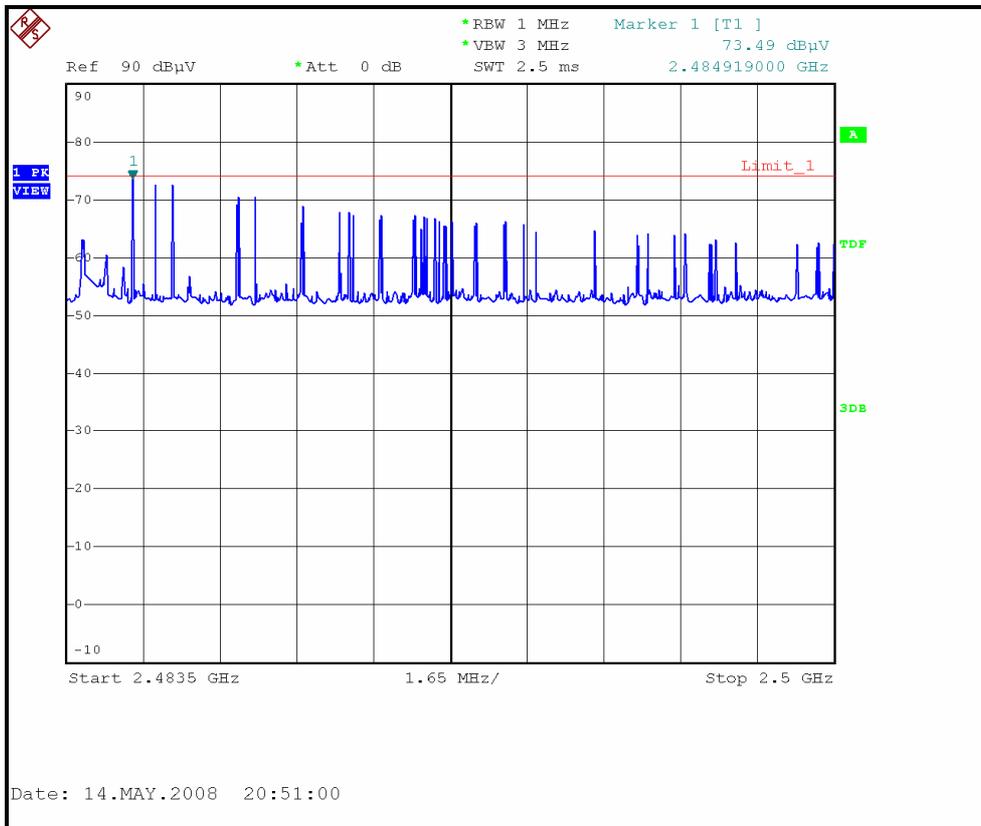
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	99.68 PK			1.52 H	82	68.88	30.80
2	*2480.00	67.86 AV			1.52 H	82	37.06	30.80
3	2483.50	73.49 PK	74.00	-0.51	1.52 H	82	42.67	30.82
4	2483.50	42.20 AV	54.00	-11.80	1.52 H	82	11.38	30.82
5	4960.00	50.10 PK	74.00	-23.90	1.43 H	10	14.12	35.98
6	4960.00	18.28 AV	54.00	-35.72	1.43 H	10	-17.70	35.98
7	7440.00	53.15 PK	74.00	-20.85	1.36 H	27	10.15	43.00
8	7440.00	21.33 AV	54.00	-32.67	1.36 H	27	-21.67	43.00
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	94.45 PK			1.00 V	268	63.65	30.80
2	*2480.00	62.63 AV			1.00 V	268	31.83	30.80
3	2483.50	72.11 PK	74.00	-1.89	1.00 V	268	41.29	30.82
4	2483.50	43.76 AV	54.00	-10.24	1.00 V	268	12.94	30.82
5	4960.00	49.07 PK	74.00	-24.93	1.42 V	32	13.09	35.98
6	4960.00	17.25 AV	54.00	-36.75	1.42 V	32	-18.73	35.98
7	7440.00	52.83 PK	74.00	-21.17	1.27 V	189	9.83	43.00
8	7440.00	21.01 AV	54.00	-32.99	1.27 V	189	-21.99	43.00

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. “ \* “: Fundamental frequency.
  6. Duty cycle =2.56%
  7. Average value = peak reading + 20log(duty cycle).





RESTRICTED BANDEDGE (,CH11, HORIZONTAL )





## 4.8 BAND EDGES MEASUREMENT

### 4.8.1 LIMITS OF BAND EDGES MEASUREMENT

Below  $-20\text{dB}$  of the highest emission level of operating band (in 100KHz RBW).

### 4.8.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100036	Dec. 17, 2008

**Note:**

1. The measurement uncertainty is less than  $\pm 2.6\text{dB}$ , which is calculated as per the NAMAS document NIS81. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 4.8.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low loss cable. Set RBW of spectrum analyzer to 100 kHz and VBW of spectrum analyzer to 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges were measured and recorded.

### 4.8.4 DEVIATION FROM TEST STANDARD

No deviation

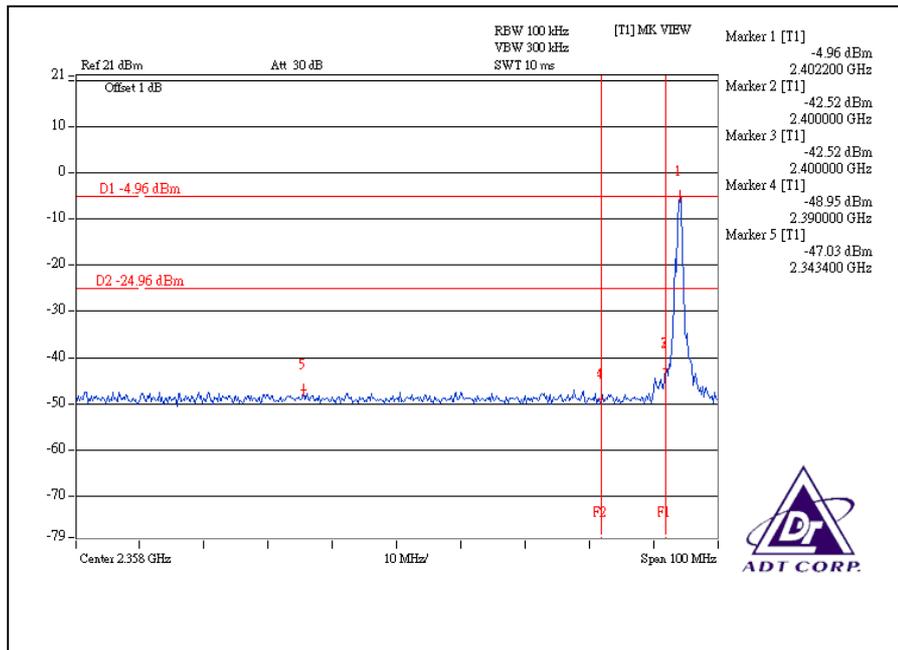
### 4.8.5 EUT OPERATING CONDITION

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

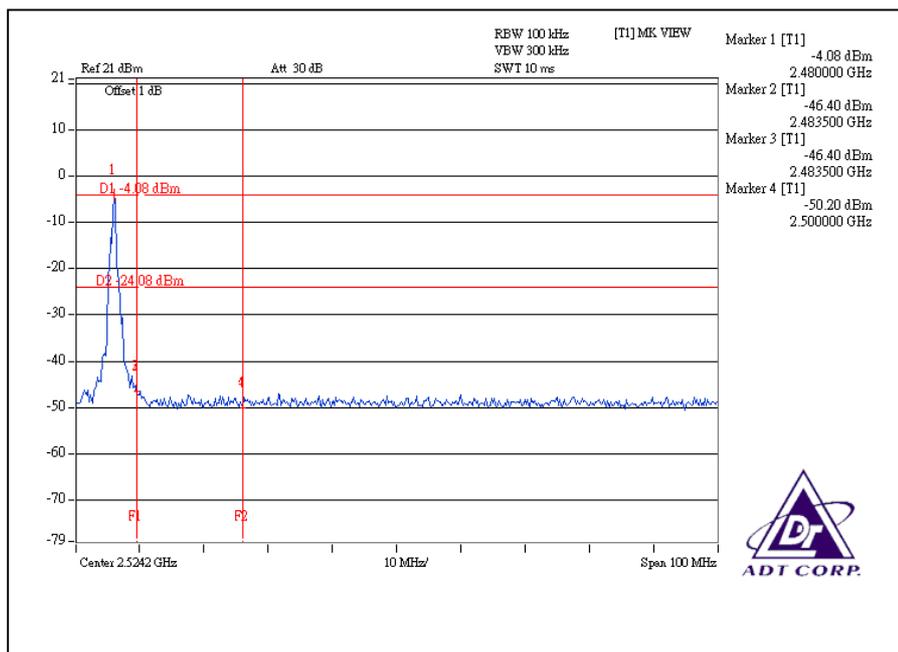
### 4.8.6 TEST RESULTS

Emissions radiated outside of the specified frequency bands, please refer pages form 44 to 47 for met the requirement of the general radiated emission limits in § 15.209.

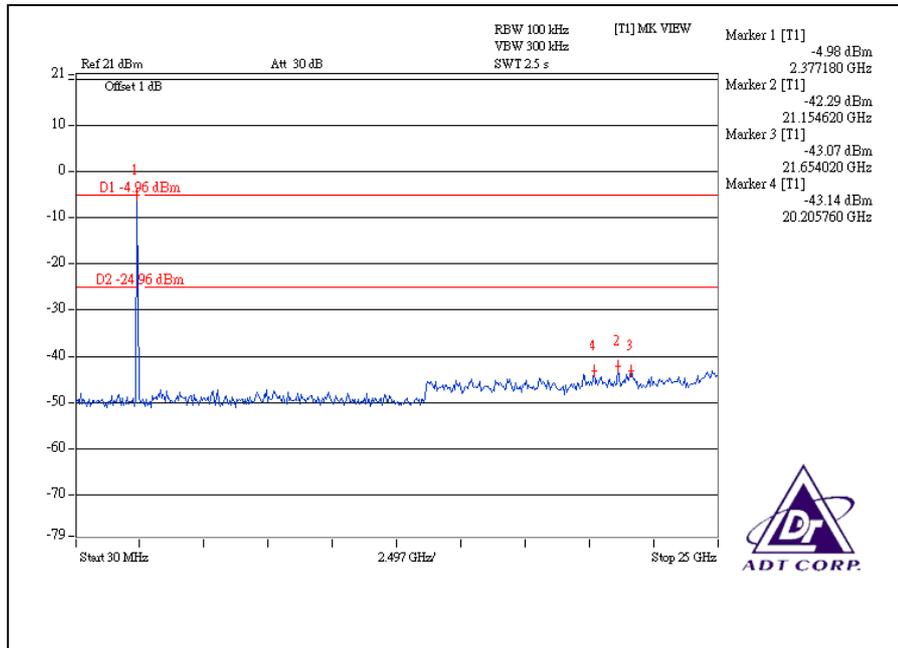
#### CH0



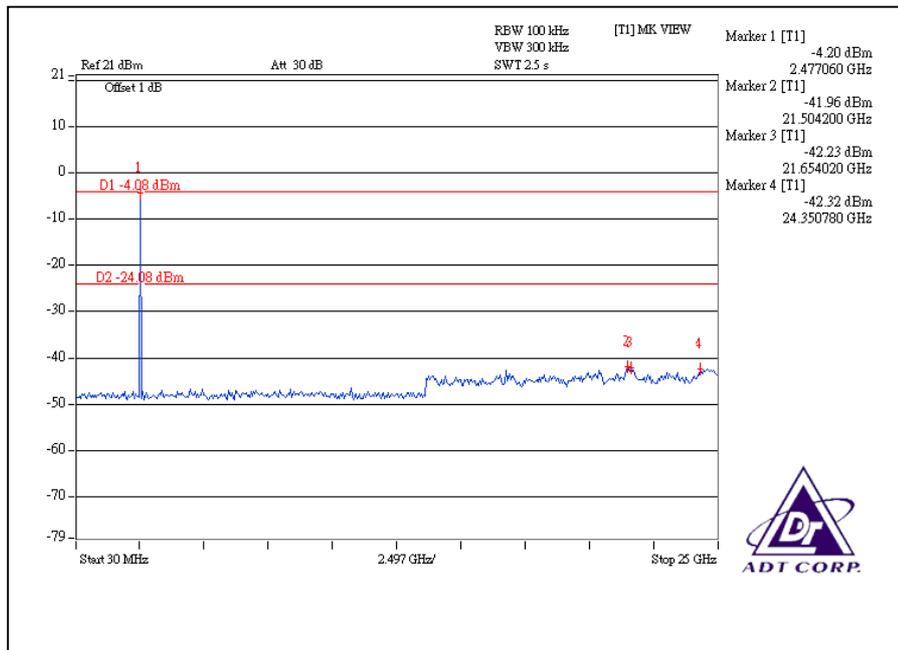
#### CH78



### CH0



### CH78



## **4.9 ANTENNA REQUIREMENT**

### **4.9.1 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 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **4.9.2 ANTENNA CONNECTED CONSTRUCTION**

The antenna used in this product is PCB printed antenna without connector. The maximum Gain of the antenna is -1.04dBi.

## 5 INFORMATION ON THE TESTING LABORATORIES

We, ADT Corp., were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025:

<b>USA</b>	FCC, UL, A2LA
<b>Germany</b>	TUV Rheinland
<b>Japan</b>	VCCI
<b>Norway</b>	NEMKO
<b>Canada</b>	INDUSTRY CANADA, CSA
<b>R.O.C.</b>	TAF, BSMI, NCC
<b>Netherlands</b>	Telefication
<b>Singapore</b>	GOST-ASIA (MOU)
<b>Russia</b>	CERTIS (MOU)

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: [www.adt.com.tw/index.5/phtml](http://www.adt.com.tw/index.5/phtml).

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The address and road map of all our labs can be found in our web site also.

## **6 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications are made to the EUT by the lab during the test.