

# FCC TEST REPORT

**REPORT NO.:** RF961120H01

**MODEL NO.:** M-RBW145

**RECEIVED:** Nov. 19, 2007

**TESTED:** Nov. 21 to 23, 2007

**ISSUED:** Nov. 26, 2007

**APPLICANT:** LOGITECH FAR EAST LTD.

**ADDRESS:** #2 Creation Rd. 4, Science-Based Ind. Park  
Hsinchu Taiwan, R.O.C.

**ISSUED BY:** Advance Data Technology Corporation

**LAB LOCATION:** No. 81-1, Lu Liao Keng, 9 Ling, Wu Lung Tsuen,  
Chiung Lin Hsiang, Hsin Chu Hsien,  
Taiwan, R.O.C.

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## 1 CERTIFICATION

**PRODUCT :** 2.4GHz Cordless Mouse  
**BRAND NAME :** Logitech  
**MODEL NO :** M-RBW145  
**TESTED:** Nov. 21 to 23, 2007  
**TEST SAMPLE :** ENGINEERING SAMPLE  
**APPLICANT :** LOGITECH FAR EAST LTD.  
**STANDARDS :** 47 CFR Part 15, Subpart C (Section 15.249),  
ANSI C63.4-2003

The above equipment (Model: M-RBW145) 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 :**  , **DATE:** Nov. 26, 2007  
( Midoli Peng, Specialist )

**TECHNICAL ACCEPTANCE :**  , **DATE:** Nov. 26, 2007  
Responsible for RF ( Hank Chung, Deputy Manager )

**APPROVED BY :**  , **DATE:** Nov. 26, 2007  
( 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 Paragraph</b>	<b>Test Type</b>	<b>Result</b>	<b>Remark</b>
15.207	Conducted Emission Test	NA	Power supply is 3VDC from batteries
15.249	Radiated Emission Test	PASS	Minimum passing margin is -8.66dB at 2483.50MHz
15.249	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 -40GHz)	2.55 dB

### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	2.4GHz Cordless Mouse
<b>MODEL NO.</b>	M-RBW145
<b>FCC ID</b>	JNZMRBW145
<b>POWER SUPPLY</b>	3VDC from batteries
<b>MODULATION TYPE</b>	GFSK
<b>CARRIER FREQUENCY OF EACH CHANNEL</b>	2402MHz ~ 2479MHz
<b>NUMBER OF CHANNEL</b>	24
<b>ANTENNA TYPE</b>	PCB printed antenna, meander quarter wave with -2.76dBi antenna gain
<b>DATA CABLE</b>	NA
<b>I/O PORTS</b>	NA
<b>ASSOCIATED DEVICES</b>	NA

**NOTE:**

1. 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

Twenty-four channels are provided in this EUT.

Channel	Freq. (MHz)						
0	2402	6	2425	12	2452	18	2474
1	2420	7	2426	13	2453	19	2475
2	2421	8	2448	14	2454	20	2476
3	2422	9	2449	15	2471	21	2477
4	2423	10	2450	16	2472	22	2478
5	2424	11	2451	17	2473	23	2479

**NOTE:**

1. Below 1 GHz, the channel 0, 8, and 23 were pre-tested in chamber. The channel 0, worst case one, was chosen for final test.
2. Above 1 GHz, the channel 0, 8, and 23 were tested individually.

### 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a 2.4GHz Cordless Mouse. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

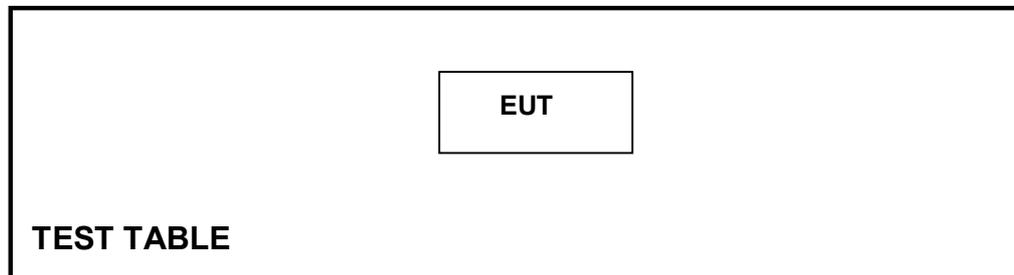
**47 CFR Part 15, Subpart C (Section 15.249)**  
**ANSI C63.4: 2003**

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

### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

### 3.5 CONFIGURATION OF SYSTEM UNDER TEST



## 4 TEST PROCEDURES AND RESULTS

### 4.1 CONDUCTED EMISSION MEASUREMENT

NA

### 4.2 RADIATED EMISSION MEASUREMENT

#### 4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

According to 15.249 the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBuV/m)	
	Peak	Average
2400 ~ 2483.5	114	94
	Field Strength of Harmonics (dBuV/m)	
	74	54

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

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

<b>Frequencies (MHz)</b>	<b>Field strength (microvolts/meter)</b>	<b>Measurement distance (meters)</b>
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.

#### 4.2.2 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. 26, 2008
CHASE Broadband Antenna	VULB 9168	138	July 26, 2008
Schwarzbeck Horn_Antenna	BBHA9120	D124	Jan. 01, 2008
Schwarzbeck Horn_Antenna	BBHA 9170	BBHA9170153	Jan. 25, 2008
TRILOG Broad Band Antenna	VULB 9168	138	July 26, 2008
RF Switches (ARNITSU)	CS-201	1565157	Aug. 13, 2008
RF CABLE (Chaintek)	SF102	22054-2	Nov. 14. 2008
RF Cable(RICHTEC)	9913-30M N-N Cable	STCCAB-30M-1 GHz	Aug. 13, 2008
Software	ADT_Radiated_V 7.6.15.7	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 4824A-3.

### 4.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. 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.

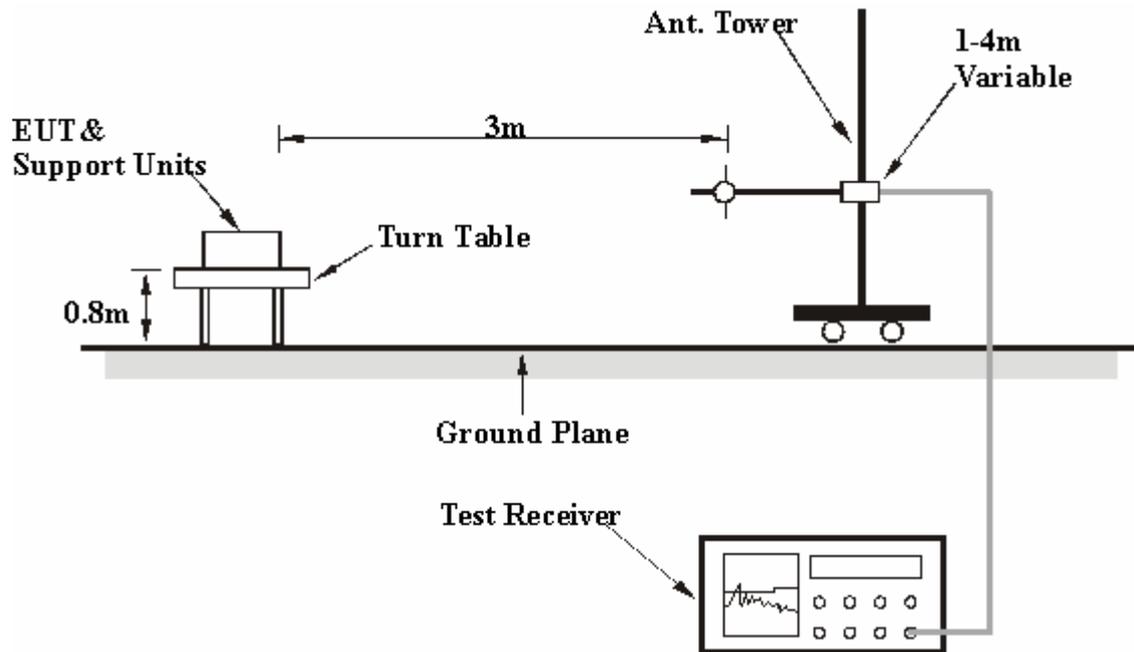
**NOTE:**

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 and video bandwidth of test receiver/spectrum analyzer is 1 MHz 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.

### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.2.5 TEST SETUP



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

#### 4.2.6 EUT OPERATING CONDITIONS

Set the EUT under transmission/ receiver condition continuously at specific channel frequency.

#### 4.2.7 TEST RESULTS

<b>MODE</b>	Channel 0	<b>INPUT POWER</b>	3 VDC
<b>FREQUENCY RANGE</b>	30-1000 MHz	<b>DETECTOR FUNCTION &amp; BANDWIDTH</b>	Quasi-Peak, 120kHz
<b>ENVIRONMENTAL CONDITIONS</b>	22 deg. C, 68%RH, 960 hPa	<b>TESTED BY</b>	Sky Liao

#### 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	120.00	27.20 QP	43.50	-16.30	1.68 H	158	14.33	12.87
2	144.00	28.60 QP	43.50	-14.90	1.62 H	228	14.10	14.50
3	160.00	31.20 QP	43.50	-12.30	1.44 H	26	15.95	15.25
4	240.00	34.40 QP	46.00	-11.60	1.68 H	72	21.73	12.67
5	360.00	34.60 QP	46.00	-11.40	1.18 H	28	17.46	17.14
6	480.00	33.50 QP	46.00	-12.50	1.58 H	104	12.92	20.58
7	720.00	34.70 QP	46.00	-11.30	1.28 H	92	9.08	25.62
8	800.00	34.80 QP	46.00	-11.20	1.48 H	136	6.75	28.05

#### 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	120.00	28.40 QP	43.50	-15.10	1.00 V	36	15.53	12.87
2	144.00	29.60 QP	43.50	-13.90	1.00 V	68	15.10	14.50
3	160.00	32.00 QP	43.50	-11.50	1.00 V	266	16.75	15.25
4	240.00	35.20 QP	46.00	-10.80	1.02 V	196	22.53	12.67
5	360.00	34.20 QP	46.00	-11.80	1.00 V	96	17.06	17.14
6	480.00	32.60 QP	46.00	-13.40	1.00 V	26	12.02	20.58
7	720.00	33.80 QP	46.00	-12.20	1.42 V	82	8.18	25.62
8	800.00	33.70 QP	46.00	-12.30	1.36 V	52	5.65	28.05

- 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.

<b>MODE</b>	Channel 0	<b>INPUT POWER</b>	3 VDC
<b>FREQUENCY RANGE</b>	1000~25000MHz	<b>DETECTOR FUNCTION &amp; BANDWIDTH</b>	Peak (PK) Average (AV) 1 MHz
<b>ENVIRONMENTAL CONDITIONS</b>	22 deg. C, 68%RH, 960 hPa	<b>TESTED BY</b>	Sky Liao

#### 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	55.03 PK	74.00	-18.97	1.40 H	10	24.63	30.40
2	2390.00	43.87 AV	54.00	-10.13	1.40 H	10	13.47	30.40
3	*2402.00	92.20 PK	114.00	-21.80	1.40 H	10	61.75	30.45
4	*2402.00	71.20 AV	94.00	-22.80	1.40 H	10	40.75	30.45
5	4804.00	54.20 PK	74.00	-19.80	1.56 H	86	18.55	35.65
6	4804.00	33.20 AV	54.00	-20.80	1.56 H	86	-2.45	35.65
7	7206.00	55.60 PK	74.00	-18.40	1.34 H	42	13.47	42.13
8	7206.00	34.60 AV	54.00	-19.40	1.34 H	42	-7.53	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	56.84 PK	74.00	-17.16	1.50 V	165	26.45	30.40
2	2390.00	43.89 AV	54.00	-10.11	1.50 V	165	13.49	30.40
3	*2402.00	92.70 PK	114.00	-21.30	1.50 V	165	62.25	30.45
4	*2402.00	71.70 AV	94.00	-22.30	1.50 V	165	40.65	30.45
5	4804.00	55.00 PK	74.00	-19.00	1.32 V	65	19.35	35.65
6	4804.00	34.00 AV	54.00	-20.00	1.32 V	65	-1.65	35.65
7	7206.00	56.60 PK	74.00	-17.40	1.22 V	20	14.47	42.13
8	7206.00	35.60 AV	54.00	-18.40	1.22 V	20	-6.53	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. Margin value = Emission level - Limit value
4. " \* " : Fundamental frequency
5. The other emission levels were very low against the limit.

<b>MODE</b>	Channel 8	<b>INPUT POWER</b>	3 VDC
<b>FREQUENCY RANGE</b>	1000~25000MHz	<b>DETECTOR FUNCTION &amp; BANDWIDTH</b>	Peak (PK) Average (AV) 1 MHz
<b>ENVIRONMENTAL CONDITIONS</b>	22 deg. C, 68%RH, 960 hPa	<b>TESTED BY</b>	Sky Liao

#### 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	*2448.00	92.60 PK	114.00	-21.40	1.42 H	25	61.94	30.66
2	*2448.00	71.60 AV	94.00	-22.40	1.42 H	25	40.94	30.66
3	4896.00	54.00 PK	74.00	-20.00	1.62 H	72	18.16	35.84
4	4896.00	33.00 AV	54.00	-21.00	1.62 H	72	-2.84	35.84
5	7344.00	55.80 PK	74.00	-18.20	1.40 H	58	13.16	42.64
6	7344.00	34.80 AV	54.00	-19.20	1.40 H	58	-7.84	42.64

#### 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	*2448.00	92.80 PK	114.00	-21.20	1.12 V	168	62.14	30.66
2	*2448.00	71.80 AV	94.00	-22.20	1.12 V	168	41.14	30.66
3	4896.00	55.20 PK	74.00	-18.80	1.28 V	76	19.36	35.84
4	4896.00	34.20 AV	54.00	-19.80	1.28 V	76	-1.64	35.84
5	7344.00	56.80 PK	74.00	-17.20	1.32 V	8	14.16	42.64
6	7344.00	35.80 AV	54.00	-18.20	1.32 V	8	-6.84	42.64

#### 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. Margin value = Emission level - Limit value
4. “ \* “ : Fundamental frequency
5. The other emission levels were very low against the limit.

<b>MODE</b>	Channel 23	<b>INPUT POWER</b>	3 VDC
<b>FREQUENCY RANGE</b>	1000~25000MHz	<b>DETECTOR FUNCTION &amp; BANDWIDTH</b>	Peak (PK) Average (AV) 1 MHz
<b>ENVIRONMENTAL CONDITIONS</b>	22 deg. C, 68%RH, 960 hPa	<b>TESTED BY</b>	Sky Liao

#### 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	*2479.00	92.20 PK	114.00	-21.80	1.44 H	21	61.40	30.80
2	*2479.00	71.20 AV	94.00	-22.80	1.44 H	21	40.40	30.80
3	2483.50	55.21 PK	74.00	-18.79	1.44 H	21	24.39	30.82
4	2483.50	44.95 AV	54.00	-9.05	1.44 H	21	14.13	30.82
5	4958.00	53.50 PK	74.00	-20.50	1.75 H	68	17.53	35.97
6	4958.00	32.50 AV	54.00	-21.50	1.75 H	68	-3.47	35.97
7	7437.00	55.70 PK	74.00	-18.30	1.44 H	64	12.71	42.99
8	7437.00	34.70 AV	54.00	-19.30	1.44 H	64	-8.29	42.99

#### 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	*2479.00	92.90 PK	114.00	-21.10	1.14 V	162	62.10	30.80
2	*2479.00	71.90 AV	94.00	-22.10	1.14 V	162	41.10	30.80
3	2483.50	55.10 PK	74.00	-18.90	1.14 V	162	24.28	30.82
4	<b>2483.50</b>	<b>45.34 AV</b>	<b>54.00</b>	<b>-8.66</b>	<b>1.14 V</b>	<b>162</b>	<b>14.52</b>	<b>30.82</b>
5	4958.00	54.80 PK	74.00	-19.20	1.38 V	98	18.83	35.97
6	4958.00	33.80 AV	54.00	-20.20	1.38 V	98	-2.17	35.97
7	7437.00	56.40 PK	74.00	-17.60	1.44 V	15	13.41	42.99
8	7437.00	35.40 AV	54.00	-18.60	1.44 V	15	-7.59	42.99

#### 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. Margin value = Emission level - Limit value
4. “ \* “ : Fundamental frequency
5. The other emission levels were very low against the limit.

### 4.3 BAND EDGES MEASUREMENT

#### 4.3.1 LIMITS OF BAND EDGES MEASUREMENT

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

#### 4.3.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100036	Aug. 12, 2008

**NOTE:**

- 1.The measurement uncertainty is less than +/- 2.6dB, which is calculated as per the NAMAS document NIS81.
- 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 PROCEDURE

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

#### 4.3.4 DEVIATION FROM TEST STANDARD

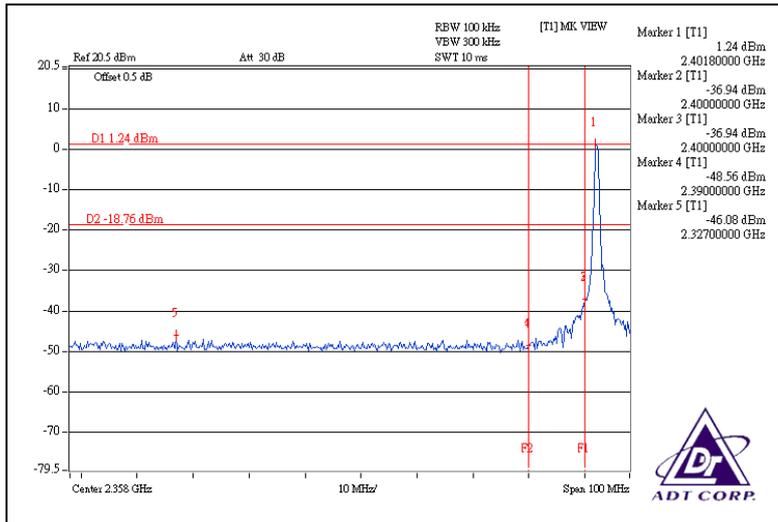
No deviation

#### 4.3.5 EUT OPERATING CONDITION

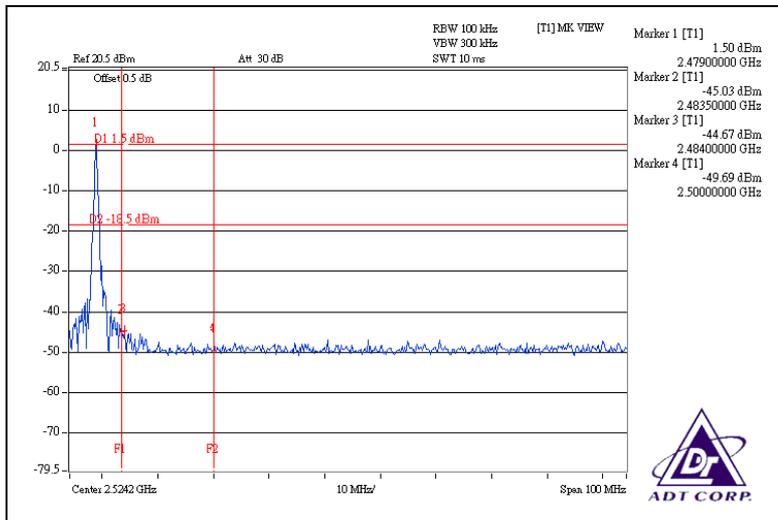
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

### 4.3.6 TEST RESULTS

Emissions radiated outside of the specified frequency bands, please refer pages form 13 to 16 for met the requirement of the general radiated emission limits in § 15.209.  
CH0



CH23



## 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).

If you have any comments, please feel free to contact us at the following:

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**Web Site:** [www.adt.com.tw](http://www.adt.com.tw)

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.