

# MEASUREMENT REPORT

*of*

## 27MHz Wireless Mouse

**Applicant** : Acrox Technologies Co., Ltd.  
**FCC ID** : PRDMO40050812  
**Model** : MO4

Test by :

***Training Research Co., Ltd.***

**TEL : 886-2-26935155**      **FAX : 886-2-26934440**  
No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan


## CERTIFICATION

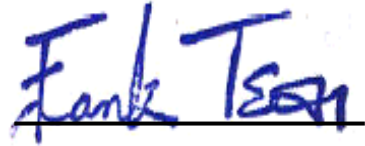
**We here by verify that:**

The test data, data evaluation, test procedures and equipment configurations shown in this report were made mainly in accordance with the procedures given in ANSI C63.4 (2003) as a reference. All tests were conducted by *Training Research Co., Ltd.*, No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan. Also, we attest to the accuracy of each.

We further submit that the energy emitted by the sample EUT tested as described in the report is **in compliance with** the technical requirements set forth in the FCC Rules Part 15 Subpart C Section 15.227.

**Applicant** : Acrox Technologies Co., Ltd.  
**Applicant address** : 8F, No. 437, Rui Guang Road, Nei Hu District, Taipei 114, Taiwan  
**Report No.** : A8515050617  
**Test Date** : August 19, 2005

Prepared by:   
Jack Tsai

Approved by:   
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**Conditions of issue :**

- (1) **This test report shall not be reproduced except in full, without written approval of TRC. And the test result contained within this report only relate to the sample submitted for testing.**
- (2) **This report must not be used by the client to claim product endorsement by NVLAP or any agency of U.S. Government.**
- (3) **This test report, measurements made by TRC are traceable to the NIST only Conducted and Radiated Method.**

★ NVLAP LAB CODE: 200174-0

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## **Chapter 1 General**

### **1.1 Introduction**

The following measurement report is submitted on behalf of Applicant in support of a RF mouse certification in accordance with Part 2 Subpart J and Part 15 Subpart C of the Commission's Rules and Regulations.

### **1.2 Description of EUT**

<b>Product Name</b>	: RF Optical Mouse
<b>Model</b>	: MO4
<b>Frequency Range</b>	: 26.96MHz ~ 27.28MHz
<b>Operating Frequency</b>	: 27.045MHz
<b>Modulation Skill</b>	: FSK
<b>Power Type</b>	: Powered by 1.5V batteries (SIZE AAA*2) or USB

### **1.3 Test method**

All measurements contained in this report were performed according to the techniques described in Measurement procedure ANSI C63.4 – 2003.

Pretest was found that the emission of operating mode is worse than standby mode. So, the final test is made at the operating mode (transmitted). The EUT set in 27.045MHz and continuously transmitting mode, which transmitted the maximum emission.

The test placement as the photographs showed is the worst case emission placed. (If the emission is close to the ambient, the resolution BW and view resolution will be reduced and the data will be recorded by detection of maximum hold peak mode.)

## 1.4 Description of Support Equipment

In order to construct the minimum testing, following equipment were used as the support units.

**PC** : **IBM 8434**  
Model No. : IVG  
Serial No. : 99CCZA3  
FCC ID : N/A, DoC (Declaration of Confirmation) Approved  
BSMI : R33026  
Power type : 100 ~ 127VAC / 6A, 200 ~ 240VAC/3A, 50 ~ 60Hz, Switching  
Power cord : Non-shielded, 1.80 m length, Plastic hood, No ferrite core

**Monitor** : **HP 15' Color Monitor**  
Model No. : D2827A  
Serial No. : KR91161719  
FCC ID : C5F7NFCMC1518X  
BSMI : 3872B039  
Power type : 110 ~ 240 VAC / 50 ~ 60 Hz, Switching  
Power cord : Shielded, 1.83m long, No ferrite core  
Data cable : Shielded, 1.46m long, with two ferrite cores

**PS/2 Keyboard** : **HP**  
Model No. : 5187-0343  
Serial No. : BE21700404  
FCC ID : DoC Approved  
BSMI : 3892C981  
Data cable : Shielded, 1.73m length, Plastic hood, No ferrite core

**PS/2 Mouse** : **HP**  
Model No. : M-S69  
Serial No. : 334684-002 323614-001  
FCC ID : DoC Approved  
BSMI : R41126  
Power type : By PC  
Power cord : Shielded, 1.90m length, No ferrite core

**Printer** : **EPSON**  
Model No. : B241A  
Serial No. : FAPY155090  
FCC ID : N/A, DoC Approved  
BSMI : R33126  
Power type : Switching adaptor  
Power cord : Non-shielded, 198cm length, No ferrite core  
Data cable : Shielded, 1.50m length, No ferrite core

**Modem** : **ACEEX**  
Model No. : DM-1414  
Serial No. : 9010583  
FCC ID : IFAXDM1414  
Power type : Linear  
Power cord : Non-shielded, 1.9m length, No ferrite cord  
Data cable : RS232, Shielded, 1.2m length, No ferrite core  
RJ11C x 2, 7' length non-shielded, No ferrite core

**USB Game pad** : **Logitech**  
Model No. : G-UC3B  
Serial No. : AE3500500  
FCC ID : DoC Approved  
BSMI : 4902A047  
Power type : Powered by PC  
Power Cable : Shielded, 187cm length, Plastic hood, No ferrite core

**Receiver** : **ACROX**  
Model No. : MO4

## 1.5 Test Procedure

All measurements contained in this report were performed mainly according to the techniques described in Measurement procedure ANSI C63.4 (2003).

## 1.6 Location of the Test Site

The radiated emissions measurements required by the rules were performed on the **three-meter, Anechoic Chamber (FCC Registration Number: 93906)** maintained by *Training Research Co., Ltd.* 1F, No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. Complete description and measurement data have been placed on file with the commission. The conducted power line emissions tests and other test items were performed in an anechoic chamber also located at Training Research Co., Ltd. 1F, No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. *Training Research Co., Ltd.* is listed by the FCC as a facility available to do measurement work for others on a contract basis.

## 1.7 General Test Condition

The conditions under which the EUT operates were varied to determine their effect on the equipment's emission characteristics. The final configuration of the test system and the mode of operation used during these tests was chosen as that which produced the highest emission levels. However, only those conditions which the EUT was considered likely to encounter in normal use were investigated.

In test, they were set in high power and continuously transmitting mode. The setting up procedure is recorded on 1.3 Test Method.

## ***Chapter 2 Conducted Emissions Measurements***

### **2.1 Test Condition & Setup**

The power line conducted emission measurements were performed in an anechoic chamber. The EUT was assembled on a wooden table, which is 80 centimeters high, was placed 40 centimeters from the backwall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and Line Impedance Stabilization Networks (LISNs). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer (or EMI receiver) was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPR quasi-peak and average detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

The spectrum was scanned from 150 KHz to 30 MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 2.3



## 2.2 List of Test Instruments

Instrument Name	Model	Brand	Serial No.	Calibration Date
				Next time
EMI Receiver	8546A	HP	3520A00242	11/05/05
RF Filter Section	85460A	HP	3448A00217	11/05/05
LISN (EUT)	LISN-01	TRC	99-05	10/07/05
LISN (Support E.)	LISN-01	TRC	9912-03, 04	11/04/05
Pre-amplifier	15542 ZFL-500	Mini – Circuits	0 0117	05/20/06
6dB Attenuator	MCL BW-S6W2	Mini – Circuits	9915 – Conducted	05/20/06
10dB Attenuator	A5542 VAT010	Mini – Circuits	0215 – Conducted	05/20/06
Coaxial Cable (2 meter)	A30A30-0058-50FS-2M	Jyebao	SMA-08	05/20/06
Coaxial Cable (1.1 meter)	A30A30-0058-50FS-1M	Jyebao	SMA-09	05/20/06
Coaxial Cable (20 meter)	RG-214/U	Jyebao	NP-01	05/20/06
Coaxial Cable (20 meter)	RG-214/U	Jyebao	NP-02	05/20/06
Auto Switch Box (< 30MHz)	ASB-01	TRC	9904-01	05/20/06

### 2.3 Test Result of Conducted Emissions

The following table shows a summary of the highest emissions of power line conducted emissions on the LIVE and NETURAL conductors of the EUT power cord. Show as follows.

Test Conditions: Temperature : 25 °C Humidity : 73 % RH

*Test mode: Powered by USB, Charging mode*

<i>Power Connected Emissions</i>					<i>Class B</i>		
<i>Conductor</i>	<i>Frequency (KHz)</i>	<i>Peak (dBµV)</i>	<i>QP (dBµV)</i>	<i>Average (dBµV)</i>	<i>QP-limit (dBµV)</i>	<i>AVG-limit (dBµV)</i>	<i>Margin (dB)</i>
Line 1	201.000	34.12	---	---	64.54	54.54	-20.42
	331.000	32.88	---	---	60.83	50.83	-17.95
	533.000	33.66	---	---	56.00	46.00	-12.34
	795.000	31.86	---	---	56.00	46.00	-14.14
	989.000	30.88	---	---	56.00	46.00	-15.12
	1464.000	27.79	---	---	56.00	46.00	-18.21
	1994.000	26.27	---	---	56.00	46.00	-19.73
	9780.000	34.12	---	---	60.00	50.00	-15.88
Line 2	199.000	34.12	---	---	64.60	54.60	-20.48
	267.000	29.86	---	---	62.66	52.66	-22.80
	331.000	29.28	---	---	60.83	50.83	-21.55
	533.000	31.21	---	---	56.00	46.00	-14.79
	795.000	27.84	---	---	56.00	46.00	-18.16
	1464.000	26.41	---	---	56.00	46.00	-19.59
	2925.000	26.41	---	---	56.00	46.00	-19.59
	8870.000	30.63	---	---	60.00	50.00	-19.37

NOTE:

- (1)Margin = Peak Amplitude – Limit, *The reading amplitudes are all under limit.*
- (2)A "+" sign in the margin column means the emission is OVER the Class B Limit and "-" sign of means UNDER the Class B limit

## ***Chapter 3 Radiated Emission Measurements***

### **3.1 Harmonic and Spurious Emission**

#### **3.1.1 Test Condition and Setup**

***Pretest:***

Prior to the final test ,the EUT is placed in an anechoic chamber, and scan from 27MHz to 1GHz. The devices to determine which attitude and configuration produces the highest emission relative to the limit. This is done to ensure the radiation exactly emits form the EUT.

***Final test:***

Final radiation measurements is made on a **3-meter** anechoic chamber.. The EUT's maximum emission of radiation is placed on a nonconductive table, which is 0.8m height, the top surface is 1.0 x 1.5 meter. All placement is according to ANSI C63.4 - 2003.

The spectrum is examined from 30MHz to 1000MHz measured by HP spectrum. The whole range antenna is used to measure frequency from 30MHz to 1GHz.

The final test is used the spectrum analyzer. Measure more than six top marked frequencies generated form pretest by computer step by step at each frequency. The EUT is rotated 360 degrees, and antenna is raised and lowered from 1 to 4 meters to find the maximum emission levels. The antenna is used with both horizontal and vertical polarization.

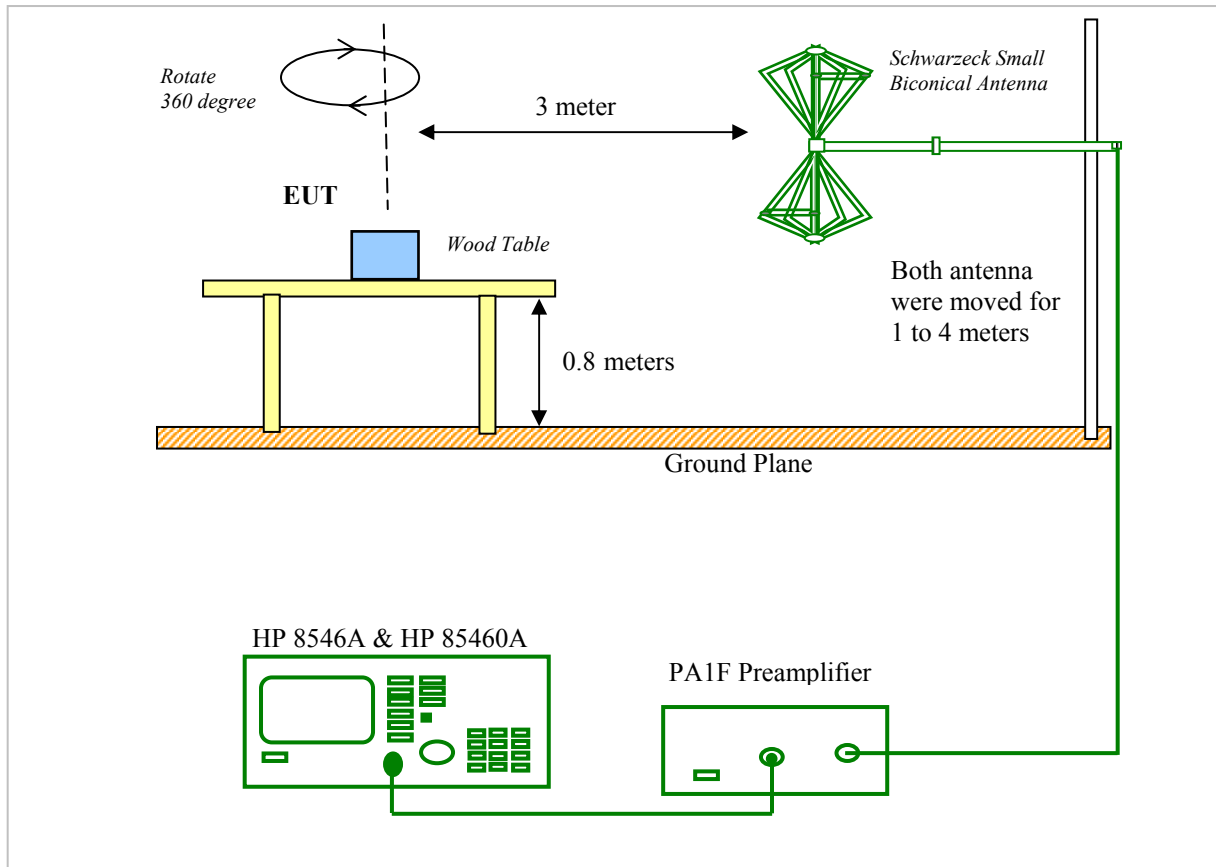
Appropriated preamplifier, which is made by TRC is used for improving sensitivity and precautions is taken to avoid overloading. The spectrum analyzer's 6dB bandwidth is set to 120 kHz, and the EUT is measured at quasi-peak mode. (30MHz to 1GHz)

If the emission is close to the frequency band of ambient, the tester will recheck the data and the corrected data will be written in the test data sheet. If the emission is just within the ambient, the data from shield room will be taken as the final data.

### 3.1.2 List of Test Instruments

Instrument Name	Model	Brand	Serial No.	Calibration Date
				Next time
EMI Receiver	8546A	HP	3520A00242	11/05/05
RF Filter Section	85460A	HP	3448A00217	11/05/05
Pre-amplifier	PA1F	TRC	1FAC	05/20/06
Small Biconical Antenna	UBAA9114 & BBVU9135	SCHWARZECK	127	10/11/05
Auto Switch Box (>30MHz)	ASB-01	TRC	9904-01	05/20/06
Coaxial Cable (Double shielded, 15 meter)	A30A30-0058-50FS-15 M	JYEBAO	SMA-01	05/20/06
Coaxial Cable (1.1 meter)	A30A30-0058-50FS-1M	JYEBAO	SMA-02	05/20/06

### 3.1.3 Configuration of System Under Test



### 3.1.4 Test Result of Harmonic and Spurious Emission

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following.

Testing room : Temperature : 25 ° C Humidity : 73 % RH

#### *Test Result of Harmonic and Spurious Emission for Horizontal*

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dBμV	m	degree	dB/m	dBμV/m	dBμV/m	dB
68.80	25.82	1.00	316	1.45	27.27	40.00	-12.73
103.96	34.17	1.00	167	-1.45	32.72	43.50	-10.78
402.24	30.17	1.00	247	-0.91	29.26	46.00	-16.74
434.97	31.64	1.00	225	0.41	32.05	46.00	-13.95
500.45	32.08	1.00	76	2.92	35.00	46.00	-11.00
813.27	22.01	1.00	349	12.03	34.04	46.00	-11.96

#### *Test Result of Harmonic and Spurious Emission for Vertical*

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dBμV	m	degree	dB/m	dBμV/m	dBμV/m	dB
48.19	26.38	1.00	76	3.98	30.36	40.00	-9.64
68.80	25.58	1.00	65	1.45	27.03	40.00	-12.97
99.11	32.08	1.00	200	-1.15	30.93	43.50	-12.57
123.36	31.49	1.00	211	-2.31	29.18	43.50	-14.32
436.19	27.50	1.00	171	0.45	27.95	46.00	-18.05
565.92	26.25	1.00	331	5.54	31.79	46.00	-14.21

Note:

1. Margin = Amplitude – limit, *if margin is minus means under limit.*
2. Corrected Amplitude = Reading Amplitude + Correction Factors
3. Correction factor = Antenna factor + (Cable Loss – Amplitude gain) + Switching Box Loss

### 3.2 Peak Power Measurement of Fundamental Frequency

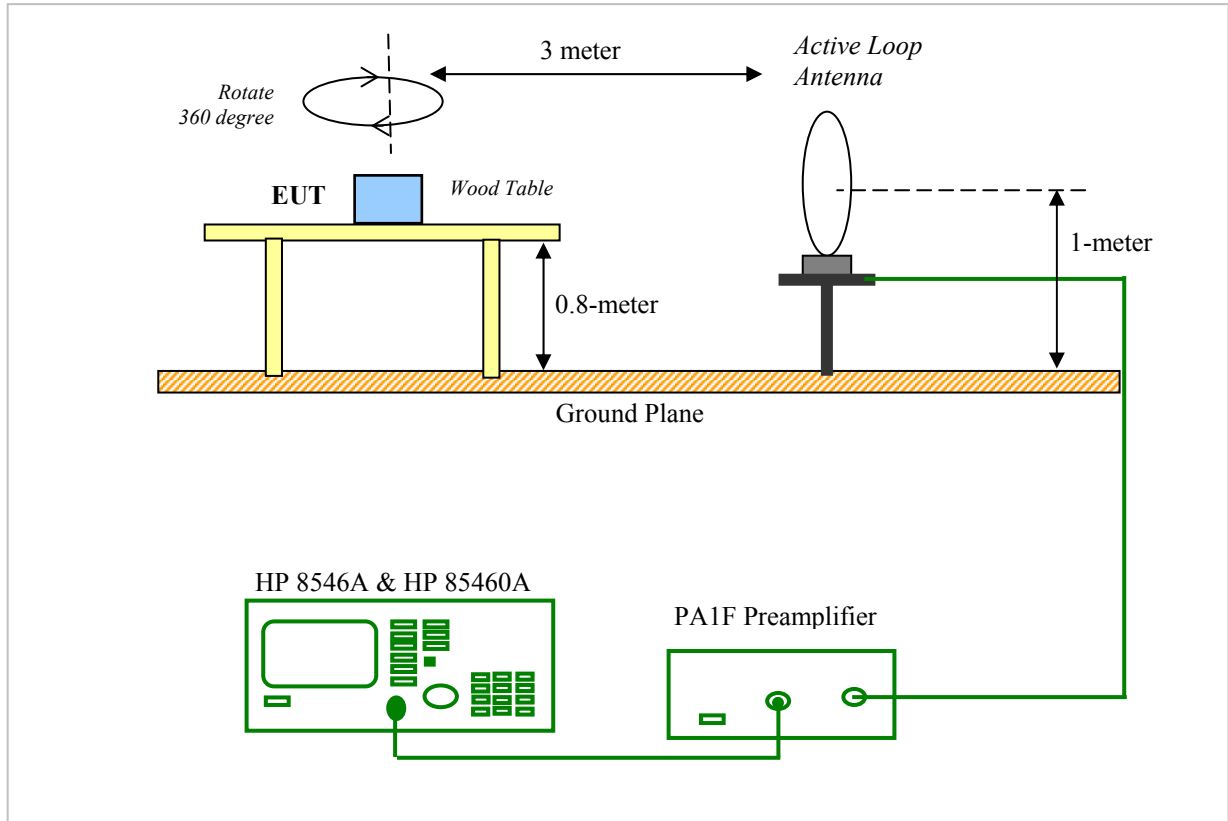
#### 3.2.1 Test Condition and Setup

- A) The EUT was setup in the anechoic chamber
- B) Set the Loop Antenna height 1m, Vertical and rotate the antenna to find the azimuth of the highest emission and record the reading.
- C) Keep the antenna azimuth and turn the EUT 360 degree and record the highest emission.
- D) Raise the antenna to 2 meters and repeat set (B) and (C).
- E) Change the antenna Horizontal and repeat (B) to (D).
- F) Record the highest reading in test report.

#### 3.2.2 List of Test Instruments

Instrument Name	Model	Brand	Serial No.	Calibration Date
				Next time
EMI Receiver	8546A	HP	3520A00242	11/05/05
RF Filter Section	85460A	HP	3448A00217	11/05/05
Pre-amplifier	PA1F	TRC	1FAC	05/20/06
Active Loop Antenna	AL-130	COM-POWER	17090	02/16/06

### 3.2.3 Configuration of System Under Test





### 3.2.4 Test Result of Fundamental Emission

Testing room : Temperature : 25 ° C Humidity : 73 % RH

***Test Result of Fundamental Emission for Horizontal***

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dBμV	m	degree	dB/m	dBμV/m	dBμV/m	dB
27.045	56.26	1.00	236	11.38	67.64	80.00	-12.36

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dBμV	m	degree	dB/m	dBμV/m	dBμV/m	dB
26.29	22.25	1.00	106	11.42	33.67	48.52	-14.85
27.29	24.72	1.00	351	11.36	36.08	48.52	-12.44

***Test Result of Fundamental Emission for Vertical***

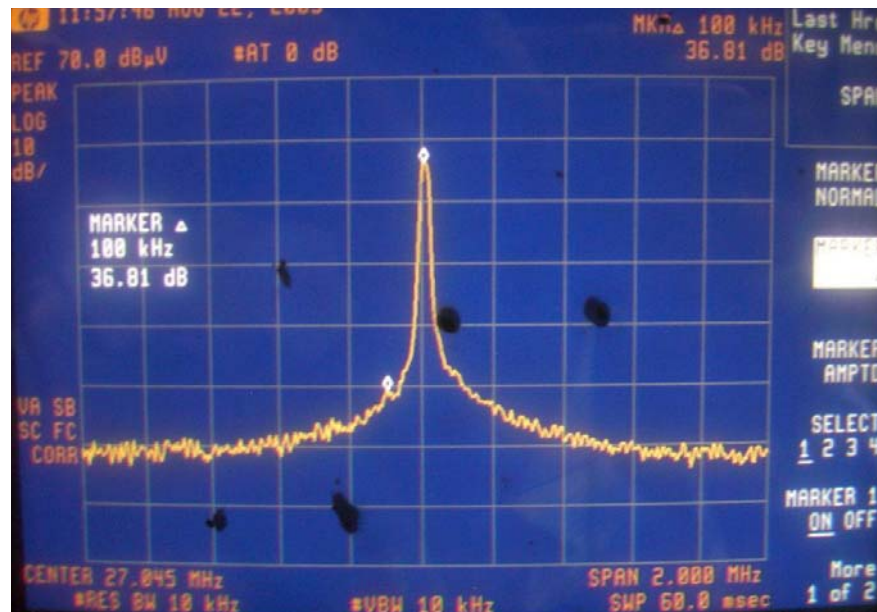
Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dBμV	m	degree	dB/m	dBμV/m	dBμV/m	dB
27.045	48.47	1.00	178	10.20	58.67	80.00	-21.33

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dBμV	m	degree	dB/m	dBμV/m	dBμV/m	dB
26.29	18.57	1.00	323	10.24	28.81	48.52	-19.71
27.28	22.00	1.00	27	10.18	32.18	48.52	-16.34

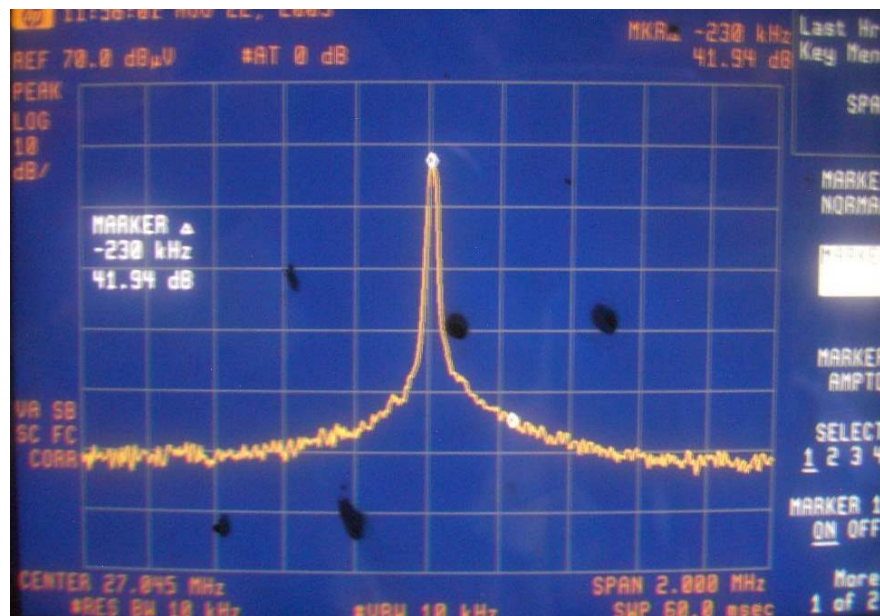
### 3.3 Test Result of the Bandedge

The following show our observations referring to the lowest channel and highest channel respectively. Test Condition & Setup same as 3.2.1 to 3.2.2.

**Frequency Band: 26.96 ~ 27.28**



26.96MHz << Class B limit



27.28MHz << Class B limit