MEASUREMENT/TECHNICAL REPORT

APPLICANT: A-FOUR Tech CO., Ltd.

MODEL NO.: RFW-23

FCC ID: H8GRW23

This report concerns (check one) : **Original Grant** ✓
Class II Change _____

Equipment type: RF Mouse

Deferred grant requested per 47CFR 0.457(d)(1)(ii)?
Yes _____ No ✓ If yes, defer until: _____ (date)

We, the undersigned, agree to notify the Commission by (date) _____ / _____ / _____ of the intended date of announce ment of the product so that the grant can be issued on that date.

Transiyion Rules Request per 15.37? Yes _____ No ✓
If no, assumed Part 15, Subpart B for unintentional radiator the new 47 CFR (10-1-90 Edition) provision.

Report Prepared

by Testing House : **Neutron Engineering Inc.**

for Company :

Name A-FOUR Tech CO., Ltd.

Address : 6F., No. 108, Min-Chuan Rd., Hsin-Tien, Taipei, Taiwan, R.O.C.

Applicant Signature :

David King/ R&D Manager

CERTIFICATION

We hereby certify that:

The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (1992) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15, Subpart C.

Prepared by :	Carol Chen	Carol Chen
Reviewed by :	Vincent Su	Vincent Su
Approved by :	George Yao	George Yao
Issued Date :	Dec. 27, 2000	
Report No. :	NEI-FCCB-00173	
Company Stamp :		NEUTRON ENGINEERING INC. 東研股份有限公司

NEUTRON ENGINEERING INC.

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Table of Contents

1. GENERAL INFORMATION

1-1. Product Description

The A-FOUR Tech CO., Ltd. Model: RFW-23 (referred to as the EUT in the report) is a RF mouse transmitter that use FSK radio frequency technology to operate a special designed receiver which associated with an IBM compatible PC. Center frequency designed for EUT operation is 27.045 or 27.145MHz (select by switch). It is considered as a low power Communication device transmitter.

1-2. Related Submittal(s) / Grant (s)

1-2-1. Models Covered

This submittal(s) (test report) is intended for FCC ID: H8GRW23 filing to comply with Section 15.227 of the FCC Part 15, Subpart C Rules. The receiver in compliance with Subpart B is authorized under a doc procedure.

1-3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (1992). Radiated testing was performed at an antenna to EUT distance 3 meters.

1-4. Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the address of No. 132-1, Lane 329, Sec. 2, Palain Road, Shijr Jen, Taipei, Taiwan, R.O.C. of NEUTRON ENGINEERING INC. This site has been fully described in report dated Jun. 4, 1999 Submitted to your office, and accepted in a letter dated Sep. 02, 1999 (Reg. No. 95335).

2. System Test Configuration

2-1. EUT Configuration

The EUT was placed on a turn table which is 0.8m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

2-2. EUT Exercise

The EUT (Transimitter) was operated continuously in its normal operating mode for the purpose of the measurements. and used the block new battery.

2-3. Test Procedure

2-2-1. Conducted Emissions

(Not applicable in this report)

2-2-2. Radiated Emissions

Radiated emissions from the EUT measured in the **frequency range between 25 MHz and 1000MHz** were made with a **Spectrum Analyzer, HP Model 8568B,** using **CISPR Quasi-Peak detector mode** and appropriate broadband linearly polarized antenna.

Radiated emissions measurement for **frequency above 1000MHz** were made with a **Test Receiver, R&S model ESMI**, plus a **Pre-amplifier R&S model ESMI-Z7**, and a **Horn Antenna, EMCO model 3115** to measure its **Peak Detector Mode** level and **Average Detector Mode** level.

2-4. Limitation

(1) Conducted Emission (Not applicable in this report)

(2) Radiated Emission

a. The field strength of any emission within this band shall not exceed 10000 micro volts/meter at 3 meters. (80dBμV at 3m) The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in section 15.35 for limiting peak emissions apply.

b. The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in section 15.209(Unintentional Radiators general limit).as below.

Frequency (MHz)	Field strength mV/m	Distance(m)	Field strength at 3m dBmV/m
1.705-30	30	30	69.54
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46

Remark: 1. Emission level in dBuV/m=20 log (uV/m)
2. Measurement was performed at an antenna to the colsed point of EUT distance of
3. meters.
4. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of ξ 15.205
5. Emission spurious frequency which appearing within the Restricted Bands specified in provision of ξ15.205, then the general radiated emission limits in ξ 15.109 apply.

2-5. Special Accessories

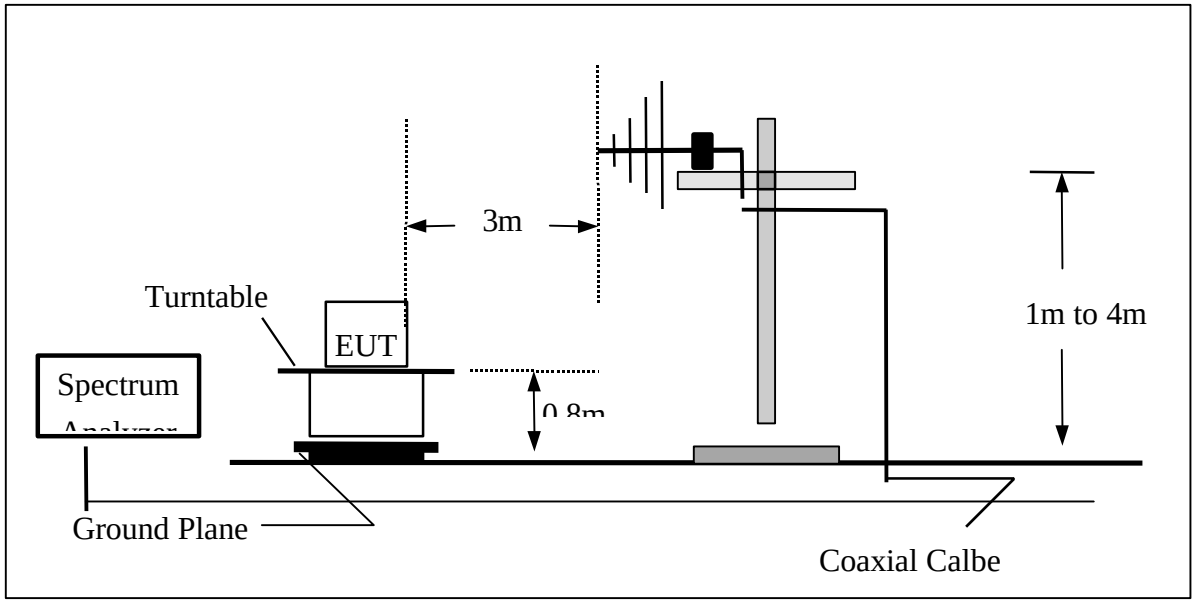
Not available for this EUT intended for grant.

2-6. Equipment Modifications

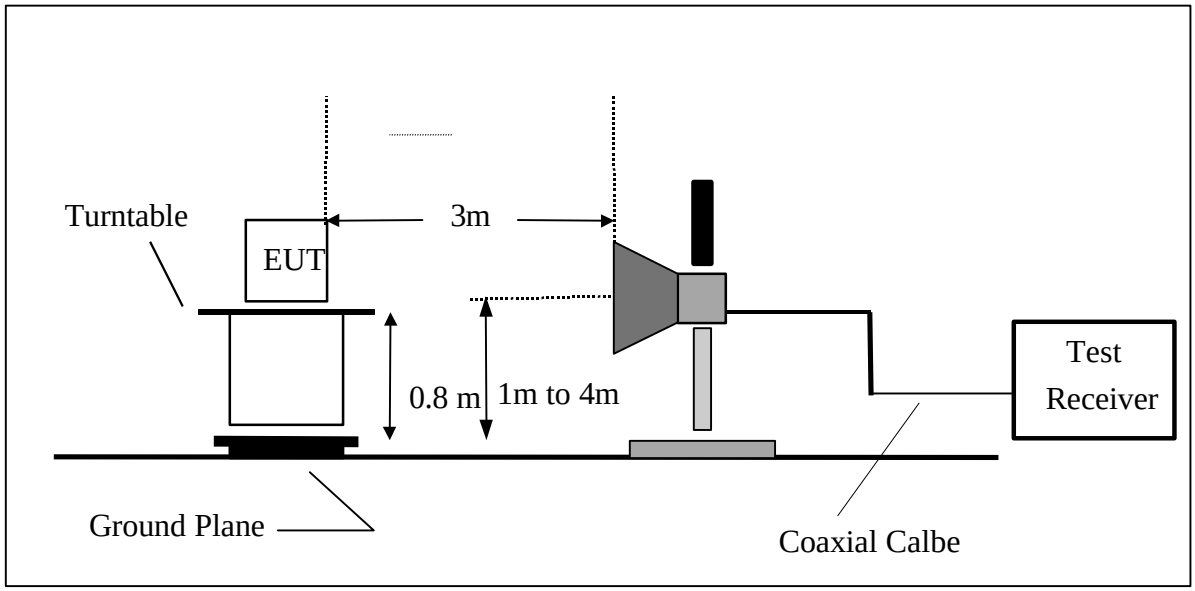
Not available for this EUT intended for grant.

2-7. Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frezuency Over 1 GHz



2-8 Tested Equipments

Item	Instruments	Mfr/Brand	Model/Type No.	Serial No.	Calibrated Date	Next Cali. Date	Note
1	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9160	3058	2000-10-28	2001-10-27	
2	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9160	3060	2000-10-21	2001-10-20	✓
3	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9161	4022	2000-07-05	2001-07-04	
4	LISN	EMCO	3825/2	9605-2539	2000-06-23	2001-06-22	
5	LISN	Rolf Heine	NNB-2/16Z	98083	2000-10-21	2001-10-20	✓
6	LISN	Rolf Heine	NNB-2/16Z	98053	1999-11-29	2000-11-28	✓
7	Horn Antenna	EMCO	3115	9605-4803	2000-05-10	2001-05-09	
8	Quasi-eakAdapter	HP	85650A	2521A00844	2000-09-26	2001-03-25	✓
9	RF Pre-Selector	HP	85685A	2648A00417	2000-09-26	2001-03-25	✓
10	Spectrum Analyzer	HP	85680B	2634A03025	2000-09-26	2001-03-25	✓
11	Spectrum Monitor	HP	85662B	2648A13616	2000-09-26	2001-03-25	✓
12	Pre-Amplifier	Anritsu	MH648A	M09961	1999-12-05	2000-12-04	✓
13	Test Receiver	R&S	ESMI	843977/005	2000-11-01	2001-10-31	
14	Pre-Amplifier	R&S	ESMI-Z7	1045.5020	2000-05-22	2001-05-21	
15	Test Receiver	R&S	ESH3	860156/018	2000-10-24	2001-10-23	
16	Test Receiver	R&S	ESVP	860687/009	2000-10-24	2001-10-23	
17	Test Receiver	MEB	SMV41	130	1999-12-21	2000-12-20	✓
18	Absorbing Clamp	R&S	MDS-21	841077/011	2000-08-19	2001-08-18	
19	Voltage Probe	R&S	ESH2-Z3	841.800/023	2000-08-21	2001-08-20	
20	Pulse Limiter	Electro-Metrics	EM-7600	112644	2000-02-08	2001-02-09	✓
21	Spectrum Analyzer	ADVAN TEST	R3261C	81720298	2000-08-18	2001-08-17	
22	TV Pattern Generator	FLUKE	PM5415TX	9452 054 15103	N/A	N/A	
23	Oscilloscope	Tektronix	2465B	J305135	2000-11-02	2001-11-01	
24	Impedance Match	HRS	N/A	0264			
25	Attenuator	Stack	N/A	N/A	2000-03-16	2001-03-15	
26	Audio Generator	Good Will	GAG808A	21845	N/A	N/A	
27	Antenna Mast	Chance Most	CMTB-1.5	N/A			✓
28	Turn Table	Chance Most	CMTB-1.5	N/A			✓

Remark :

(1) ✓ indicates the instrument used in this test report.

(2) N/A denotes No Brand measurement facility.

3. Block Diagram(s)

4. Radiated Emission Data

4-1. The following data lists the significant emission frequencies, measured emission levels, correction factor (including cable loss antenna factor, and if any needed, the duty cycle correction factor), the corrected field strength, as well as the limitation.

Judgement : Passed by -11.39 DB at 54.092 MHz Ant.Pol.: Horizontal

Operation frequency 27.04MHz

Freq. (MHz)	Ant. Pol. H/V	Detector Mode (PK/AV)	Reading (dBuV)	Ant/CL/Amp.CF (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)	Note
27.043	V	Peak	48.00	-15.21	32.79	80.00	-47.21	F
26.962	V	Peak	33.00	-15.21	17.79	69.54	-62.21	E
27.280	V	Peak	30.90	-15.21	15.69	69.54	-64.31	E
54.092	V	Peak	*					H
81.138	V	Peak	*					H
27.046	H	Peak	60.90	-15.21	45.69	80.00	-34.31	F
26.960	H	Peak	28.40	-15.21	13.19	69.54	-66.81	E
27.282	H	Peak	29.20	-15.21	13.99	69.54	-55.01	E
54.092	H	Peak	41.50	-12.89	28.61	40.00	-11.39	H
81.138	H	Peak	35.00	-16.48	18.52	40.00	-21.48	H

Remark :

(1) Measuring frequencies from 25 MHz to the 10th harmonic of fundamental frequency of 27.045 MHz.
(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(3) Radiated emissions measured in frequency range from 25 MHz to 1000MHz were made with an instrument using Peak detector mode.
(4) Emission frequencies above 1000MHz were measured with an instrument using both Average detector mode and peak detector mode.
(5) Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB
(6) "F" denotes fundamental frequency; "H" denotes Harmonics frequency. "E" denotes band edge frequency.
(7) ***** denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.109 apply.
(8) Data of spurious emissions frequency weren't attached that were less than 20dB from the limit.
(9) The IF bandwidth between 25 to 30MHz was 9KHz.

Review: Test Engr.: Test Date : Dec. 05, 2000

4.1 The following data lists the significant emission frequencies, measured emission levels, correction factor (including cable loss antenna factor, and if any needed, the duty cycle correction factor), the corrected field strength, as well as the limitation.

Judgement : Passed by -21.58 dB at 81.438 MHz Ant.Pol.: Horizontal

Operation frequency 27.14 MHz

Freq. (MHz)	Ant. Pol. H/V	Detector Mode (PK/AV)	Reading (dBuV)	Ant/CL/Amp.CF (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)	Note
27.142	V	Peak	46.40	-15.21	31.19	80.00	-48.81	F
26.960	V	Peak	29.10	-15.21	13.89	69.54	-66.11	E
27.282	V	Peak	27.70	-15.21	12.49	69.54	-56.51	E
54.292	V	Peak	*					H
81.438	V	Peak	*					H
27.146	H	Peak	62.40	-15.21	47.19	80.00	-32.81	F
26.963	H	Peak	29.40	-15.21	14.19	69.54	-65.81	E
27.282	H	Peak	28.40	-15.21	13.19	69.54	-55.81	E
54.292	H	Peak	41.20	-12.89	28.31	40.00	-37.69	H
81.438	H	Peak	34.70	-16.28	18.42	40.00	-21.58	H

Remark :

(1) Measuring frequencies from 25 MHz to the 10th harmonic of fundamental frequency of 27.143 MHz.
(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(3) Radiated emissions measured in frequency range from 25 MHz to 1000MHz were made with an instrument using Peak detector mode.
(4) Emission frequencies above 1000MHz were measured with an instrument using both Average detector mode and peak detector mode.
(5) Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB
(6) "F" denotes fundamental frequency; "H" denotes Harmonics frequency. "E" denotes band edge frequency.
(7) ***** denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.109 apply.
(8) Data of spurious emissions frequency weren't attached that were less than 20dB from the limit.
(9) The IF bandwidth between 25 to 30MHz was 9KHz.

4-2. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor (1)

CL = Cable Attenuation Factor (1)

AG = Amplifier Gain (1) (2)

Remark :

(1) The Correction Factor = AF + CF - AG, as shown in the data tables' Correction Factor column.

(2) AG is not available for Neutron's Open Site Facility

Example of Calculation:

Assume a Receiver Reading of 23.7 dBuV is obtained with an Antenna Factor of 7.2 dB and a Cable Factor of 1.1 dBuV. Then:

1. The Correction Factor will be caculated by

Correction Factor = AF + CF - AG = 7.2 + 1.1 - 0 = 8.3 (dB)

as shown in the data tables' Correction Factor column.

2. The Field Strength will be calculated by

FS = RA + Correction Factor = 23.7 + 8.3 = 32 (dBuV/m).

FS is the value shown in the data tables' Corrected Reading column and RA is the value shown in

the data tables' Receiver Reading column. The 32 dBuV/m value was mathematically converted

to its corresponding level in uV/m as:

$$\mathbf{Log^{-1}\{(32.0dBuV/m)/20\}\ \times 39.8\ (uV/m)}$$

Attachment

Photos of Tested EUT

1. **Photo # 1.** **Front View / Rear View**
2. **Photo # 2.** **Unit partially Disassembled**
3. **Photo # 3** **Unit partially Disassembled**
4. **Photo # 4** **Unit partially Disassembled**

Attachment

User's Manual