MEASUREMENT/TECHNICAL REPORT

APPLICANT: A-FOUR Tech CO., Ltd.

MODEL NO.: RFSOP-35A; RFSOP-35;
RF-1535;RP-35

FCC ID: H8GRSOP35A

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 :	Lydia Chiang	Lydia Chiang
Reviewed by :	Vincent Su	Vincent Su
Approved by :	George Yao	George Yao
Issued Date :	June 24, 2002	
Report No. :	NEI-FCCB-02130	
Company Stamp :		NEUTRON ENGINEERING INC.

NEUTRON ENGINEERING INC.

No. 132-1, Lane 329, Sec. 2, Palain Rd.,
Shijr Jen, Taipei, Taiwan
TEL：(02) 2646-5426 FAX：(02) 2646-6815

Table of Contents

1. GENERAL INFORMATION

1-1. Product Description

The A-FOUR TECH Co., Ltd. Model RFSOP-35A; RFSOP-35; RF-1535;RP-35 (referred to as the EUT in this report) The EUT is an short range, lower power, wireless Keyboard system designed as an " Input Device. It is designed by way of utilizing the FSK modulation achieves the system operating.

Details of technical specification for EUT, refer to the follows:

(1) Transmitter Frequency Designation

Operating Frequency Range : 26.96 MHz to 27.28 MHz

Frequency Band : 27.045 , 27.145(in MHz)
2 channels, selectable. Channel setting by dip switch.

Frequency Tolerance : ± 5 KHz @ center frequency for each channel.

Channel Separation : 100 KHz

(2) Effective Radiated Power and Distance
Radiated Power : 1 mW max.

(3) Power Rating
Keyboard: 3V , 30 mA(Max.)

(4) Operation Methodology
The keyboard encoder generates a pulse code serially transmit (typical designation) into the modulator(or called as mixer) stage in circuit. This pulse signal mixed with the carrier at modulator(mixer) stage by way of FSK mode frequency modulation. The modulation depth is designed such as ± 5KHz in this application, that means the pulse(may be at high level state or low level state) will trigger the oscillator to generate a frequency at a specified fundamental frequency +5KHz or −5KHz, depended on the designation. For example, if the carrier frequency defined as fundamental frequency +5KHz at high level state, then the alternative carrier frequency will be fundamental frequency −5KHz at low level state.
Then the modulator(mixer) will output a modulated signal into RF amplifier stage and finally to the transmit antenna.

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

This submittal(s) is intended for FCC ID: H8GRSOP35A filing to comply with Section 15.227 of the FCC Part 15, Subpart C Rules. The receiver in compliance with FCC Part 15, 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 June 4, 1999 Submitted to FCC office, and accepted in a letter dated Sep. 02, 1999 (Reg. No. 95335).

3. System Test Configuration

3-1. 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.

3-2. EUT Exercise

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

3-3. Test Procedure

3-3-1. Conducted Emissions

Conducted emissions from the EUT measured in the **frequency range between 0.45 MHz and 30MHz** were made with a **Spectrum Analyzer, HP Model 8568B,** using **CISPR Quasi-Peak detector mode** and appropriate broadband linearly polarized antenna.

3-3-2. 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.

3-4. Limitation

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

Frequency Range (MHz)	Quasi-Peak
0.45 - 30	48

(2) Radiated Emission

a. The field strength of any emission within this band (26.96-27.28MHz) 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 15.209 apply.

3-5. Special Accessories

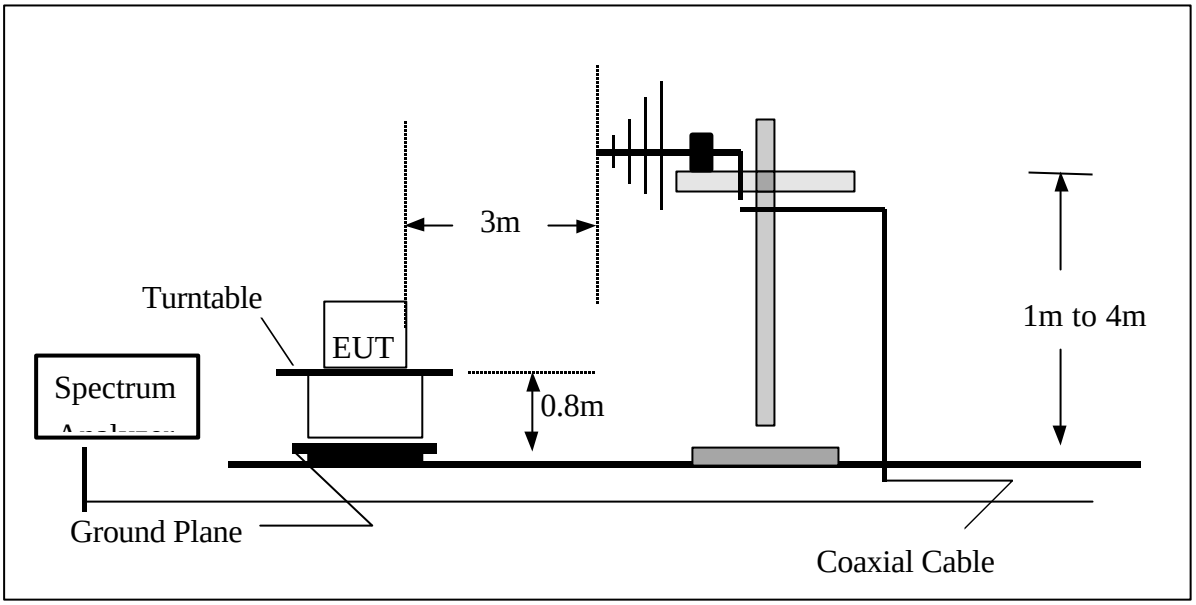
Not available for this EUT intended for grant.

3-6. Equipment Modifications

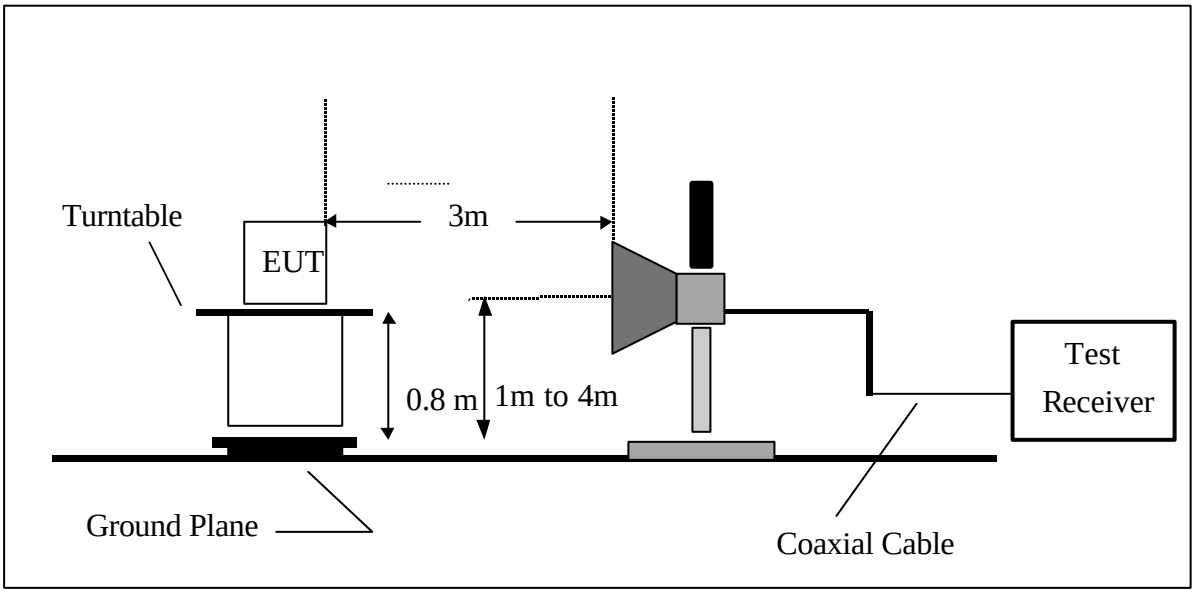
Not available for this EUT intended for grant.

3-7. Test SET-UP (Block Diagram of Configuration)

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



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



3-8 Tested Equipments

Item	Instruments	Mfr/Brand	Model/Type No.	Serial No.	本次校正日期	下次校正日期	Note
1	LISN	EMCO	3825/2	9605-2539	2002-05-20	2003-05-19	
2	LISN	Rolf Heine	NNB-2/16Z	98083	2001-10-20	2002-10-19	✓
3	LISN	Rolf Heine	NNB-2/16Z	98053	2001-11-22	2002-11-21	✓
4	Pulse Limiter	Electro-Metrics	EM-7600	112644	2001-12-10	2002-12-19	✓
5	50Ω Terminator	N/A	N/A	N/A	2002-05-10	2003-05-09	✓
6	Test Cable	N/A	C01	N/A	2001-12-08	2002-12-07	✓
7	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9160	3058	2001-10-27	2002-10-26	✓
8	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9160	3060	2001-10-20	2002-10-19	
9	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9161	4022	2001-07-04	2002-07-03	
10	Test Cable	N/A	10M_OS01	N/A	2001-12-08	2002-12-07	
11	Test Cable	N/A	OS01-1/-2	N/A	2001-12-08	2002-12-07	
12	Test Cable	N/A	10M_OS02	N/A	2001-12-08	2002-12-07	✓
13	Test Cable	N/A	OS02-1/-2/-3	N/A	2001-12-08	2002-12-07	✓
14	RF Switch	Anritsu	MP59B	M65982	2001-12-10	2002-12-09	✓
15	Quasi-Peak Adapter	HP	85650A	2521A00844	2002-04-08	2002-10-07	✓
16	RF Pre-Selector	HP	85685A	2648A00417	2002-04-08	2002-10-07	✓
17	Spectrum Analyzer	HP	85680B	2634A03025	2002-04-08	2002-10-07	✓
18	Spectrum Monitor	HP	85662B	2648A13616	2002-04-08	2002-10-07	✓
19	Pre-Amplifier	Anritsu	MH648A	M09961	2001-12-10	2002-12-09	✓
20	Spectrum Analyzer	ADVAN TEST	R3261C	81720298	2001-08-17	2002-08-16	
21	Test Receiver	R&S	ESH3	860156/018	2001-10-23	2002-10-22	
22	Test Receiver	R&S	ESVP	860687/009	2001-10-23	2002-10-22	
23	Test Receiver	MEB	SMV41	130	2001-12-05	2002-12-04	✓
24	Test Receiver	PMM	PMM 9000	4310J01002	2001-12-31	2002-12-30	
25	Horn Antenna	EMCO	3115	9605-4803	2001-05-09	2002-05-08	
26	Test Receiver	R&S	ESMI	843977/005	2001-11-14	2002-11-05	
27	Pre-Amplifier	R&S	ESMI-Z7	1045.5020	2001-05-21	2002-05-20	
28	Absorbing Clamp	R&S	MDS-21	841077/011	2001-08-18	2002-08-17	
29	Voltage Probe	R&S	ESH2-Z3	841.800/023	2001-08-20	2002-08-19	
30	Signal Generator	HP	8648A	3426A01034	2000-02-10	2003-09-23	✓
31	Antenna Mast	Chance Most	CMTB-1.5	N/A	N/A	N/A	✓
32	Turn Table	Chance Most	CMTB-1.5	N/A	N/A	N/A	✓

Remark：

(1) ✓ indicates the instrument used in Test Report.
(2) N/A denotes No Model No. / Serial No. and No Calibration specified.

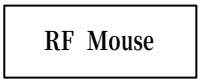
4. Block Diagram(s)

Figure 4.1 Block diagram of system, Page 10.A

Configuration of Tested System

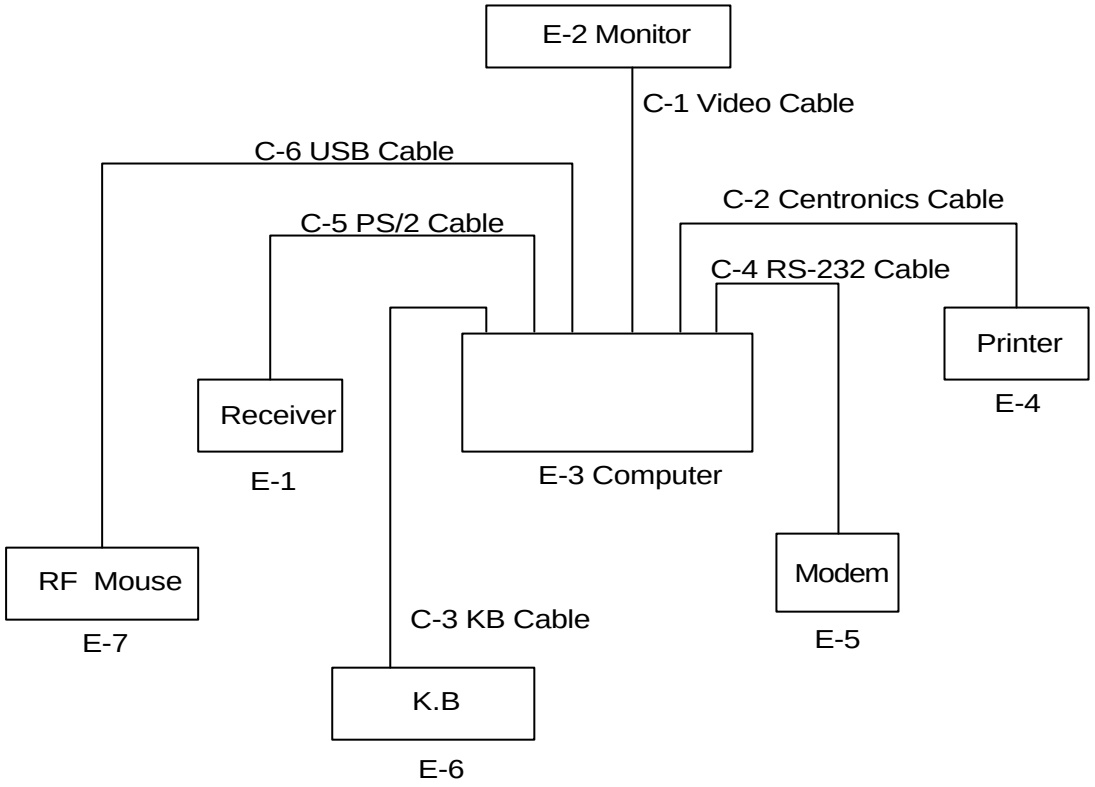
Mode : Powered by battery

(for radiated)



E-7

Mode : powered by USB port
(for conducted and radiated)



Support Equipments Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Port Connected	FCC ID	Series No.	Note
E-1	Mouse -Rx	A4Tech	RXM-15	PS/2 Port; USB Port	N/A(3)	N/A	※
E-2	Monitor	HITACHI	CM753ET	VGA Port	N/A(3)	T8L000003	
E-3	PC	HP	8801		N/A(3)	SG12461065	
E-4	Printer	SII	DPU-414	Centronic Port	N/A(3)	1045103A	
E-5	Modem	ACEEX	DM-1414V	Com2 Port	N/A(3)	8041708	
E-6	Keyboard	Forward	FDA-104GA	K/B Port	F4ZFDA-104G	FDKB8110136	
E-7	Mouse-Tx	A4Tech	RFSOP-35A	USB Port	H8GRSOP35A	N/A	EUT

Note:

(1) Unless otherwise denoted as EUT in『Remark』column , device(s) used in tested system is a support equipment.

(2) Unless otherwise marked as ※ in『Remark』column, Neutron consigns the support equipment to the tested system.

(3) The support equipment obtained Certification Authorized under Declaration of Conformity.

Information of Interface Cable

Item	I/O Cable	Device Connected	Shielded	Ferrite Core	Detachable / Permanently	L(cm)	Note
C-1	VGA Cable	PC-Monitor	Yes	No	Permanently attached on Monitor	150	
C-2	Centronics Cable	PC-Printer	Yes	No	Part of Printer, Detachable	200	
C-3	KB Cable	PC-KB	Yes	No	Permanently attached on KB	200	
C-4	RS-232C Cable	PC-Modem	Yes	No	Part of Modem, Detachable	180	
C-5	Receiver Cable	Receiver -PC	Yes	No	Permanently attached on Receiver	180	※
C-6	USB Cable	EUT-PC	Yes	No	Part of Transmitter, Detachable	100	※

Note:

(1) Unless otherwise marked as ※ in『Remark』column, Neutron consigns the support equipment to the tested system.

(2) For detachable type I/O cable should be specified the length in『L (cm)』column.

6. Conducted Emission Datas

6.1 The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Judgement: Passed by **-7.60 dB** in mode of **Neutral** terminal **22.45 MHz**

Test Mode : CH1,3V power by USB port of pc

Freq. (MHz)	Terminal L/N	Measured(dBuV) QP-Mode	Limits(dBuV) QP-Mode	Safe Margins (dBuV)	Note
0.47	Line	31.81	48.00	-16.19	
0.64	Line	36.41	48.00	-11.59	
0.83	Line	39.01	48.00	-8.99	
9.69	Line	30.80	48.00	-17.20	
13.51	Line	38.87	48.00	-9.13	
23.71	Line	32.10	48.00	-15.90	
1.28	Neutral	27.36	48.00	-20.64	
3.67	Neutral	22.37	48.00	-25.63	
10.03	Neutral	31.07	48.00	-16.93	
13.45	Neutral	37.27	48.00	-10.73	
22.45	Neutral	40.40	48.00	-7.60	
25.36	Neutral	36.42	48.00	-11.58	

Remark :

(1) Reading in which marked as QP means measurements by using are Quasi-Peak Mode with Detector BW=9KHz；SPA setting in RBW=10KHz,VBW =10KHz, Swp. Time = 0.3 sec./MHz. Reading in which marked as AV means measurements by using are Average Mode detector.

(2) Measuring frequency range from 450KHz to 30MHz.

Review: Vincent Test Engr.: David Test Date： June 17, 2002

6. Radiated Emission Data

6-2. 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 -8.10 dB at 27.041 MHz Ant.Pol.: Ver.

Operation frequency 27.045MHz Mode: CH1/ Powered by battery

Freq. (MHz)	Ant.Pol. H/V	DetectorMode (PK/AV)	Reading (dBuV)	Ant./CL/ Amp. CF(dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)	Note
27.041	V	Peak	85.40	-13.50	71.90	80.00	-8.10	F
81.145	V	Peak	36.90	-15.84	21.06	40.00	-18.94	H
135.217	V	Peak	31.90	-10.91	20.99	43.50	-22.51	H
189.341	V	Peak	32.00	-12.86	19.14	43.50	-24.36	H
216.370	V	Peak	34.40	-13.31	21.09	46.00	-24.91	H
243.375	V	Peak	35.00	-12.21	22.79	46.00	-23.21	H
27.040	H	Peak	79.30	-13.50	65.80	80.00	-14.20	F
80.891	H	Peak	34.00	-15.87	18.13	40.00	-21.87	H
108.040	H	Peak	41.60	-13.11	28.49	43.50	-15.01	H
243.381	H	Peak	29.60	-12.21	17.39	46.00	-28.61	H
270.460	H	Peak	31.30	-11.26	20.04	46.00	-25.96	H

Remark：

(1) Measuring frequencies from 25 MHz to the 1GHz.

(2) Radiated emissions measured in frequency range from 25MHz to 1000MHz were made with an instrument using Peak detector mode.

(3) 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.

(4) "F" denotes fundamental frequency; " H" denotes spurious frequency. "E" denotes band edge frequency.

(5) * 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.

(6) Datas of measurement within this frequency range shown "-" in the table above menas the reading of emissions are attenuated more than 20Db below the permissible limits or the field strength is too small to be measured.

(7) The IF bandwidth of SPA between 25MHz to 30MHz was 10KHz; 30MHz to 1GHz was 100KHz.

Review: Vincent. Test Engr.: David Test Date： June 17, 2002

6. Radiated Emission Data

6-2. 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 -14.90 dB at 27.041 MHz Ant.Pol.: Ver.

Operation frequency 27.045MHz Mode : Powered by USB Port

Freq. (MHz)	Ant.Pol. H/V	DetectorMode (PK/AV)	Reading (dBuV)	Ant./CL/ Amp. CF(dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)	Note
27.041	V	Peak	78.60	-13.50	65.10	80.00	-14.90	F
54.202	V	Peak	35.30	-12.27	23.03	40.00	-16.97	H
81.169	V	Peak	35.20	-15.84	19.36	40.00	-20.64	H
108.166	V	Peak	36.90	-13.11	23.79	43.50	-19.71	H
135.247	V	Peak	41.90	-10.91	30.99	43.50	-12.51	H
162.286	V	Peak	34.90	-10.39	24.51	43.50	-18.99	H
216.328	V	Peak	40.00	-13.31	26.69	46.00	-19.31	H
243.417	V	Peak	39.40	-12.20	27.20	46.00	-18.80	H
270.408	V	Peak	39.00	-11.26	27.74	46.00	-18.26	H
297.523	V	Peak	36.50	-10.15	26.35	46.00	-19.65	H
405.717	V	Peak	34.80	-7.84	26.96	46.00	-19.04	H
27.041	H	Peak	73.70	-13.50	60.20	80.00	-19.80	F
81.135	H	Peak	37.50	-15.84	21.66	40.00	-18.34	H
135.191	H	Peak	31.10	-10.91	20.19	43.50	-23.31	H
243.421	H	Peak	31.30	-12.21	19.09	46.00	-26.91	H
270.408	H	Peak	34.90	-11.26	23.64	46.00	-22.36	H
405.739	H	Peak	31.30	-7.84	23.46	46.00	-22.54	H

Remark：

(1) Measuring frequencies from 25 MHz to the 1GHz.

(2) Radiated emissions measured in frequency range from 25MHz to 1000MHz were made with an instrument using Peak detector mode.

(3) 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.

(4) “F” denotes fundamental frequency; “ H” denotes spurious frequency. “E” denotes band edge frequency.

(5) * 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.

(6) Datas of measurement within this frequency range shown “-“ in the table above menas the reading of emissions are attenuated more than 20Db below the permissible limits or the field strength is too small to be measured.

(7) The IF bandwidth of SPA between 25MHz to 30MHz was 10KHz; 30MHz to 1GHz was 100KHz.

Review: Vincent. Test Engr.: David Test Date： June 17, 2002

6-2. 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

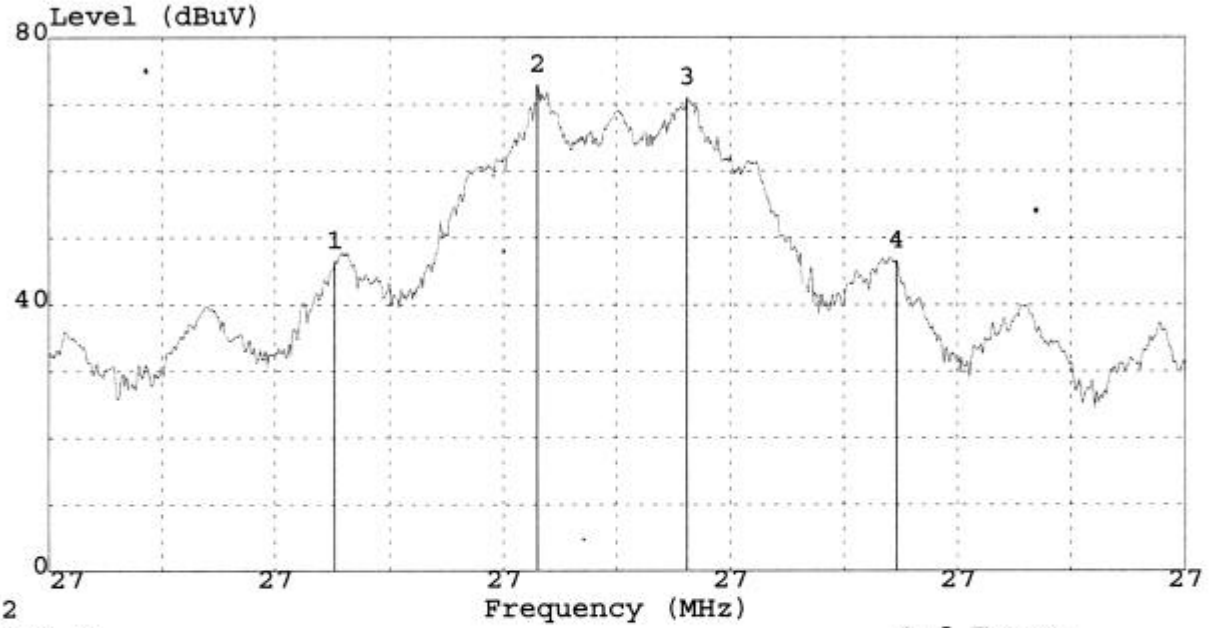
to its corresponding level in uV/m as:

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

6.3 Bandwidth requirement Mode : Operation frequency: 27.045 MHz, CH 1

NEUTRON ENGINEERING INC.

Data#: 22 File#: 02E2335.EMI Date: 2002-06-28 Time: 13:59:53



SR02
Trace: 21 Ref Trace:
Limit : Probe:
Operator : Vincent Su
Project Code: 02E2335
E.U.T. : RF mouse
Model No. : RFSOP-35A
Test Mode : 27.045MHz/CH1
Temp/ RH : 25/50
Memo : RBW=1KHz,VBW=3KHz, Span= 50KHz

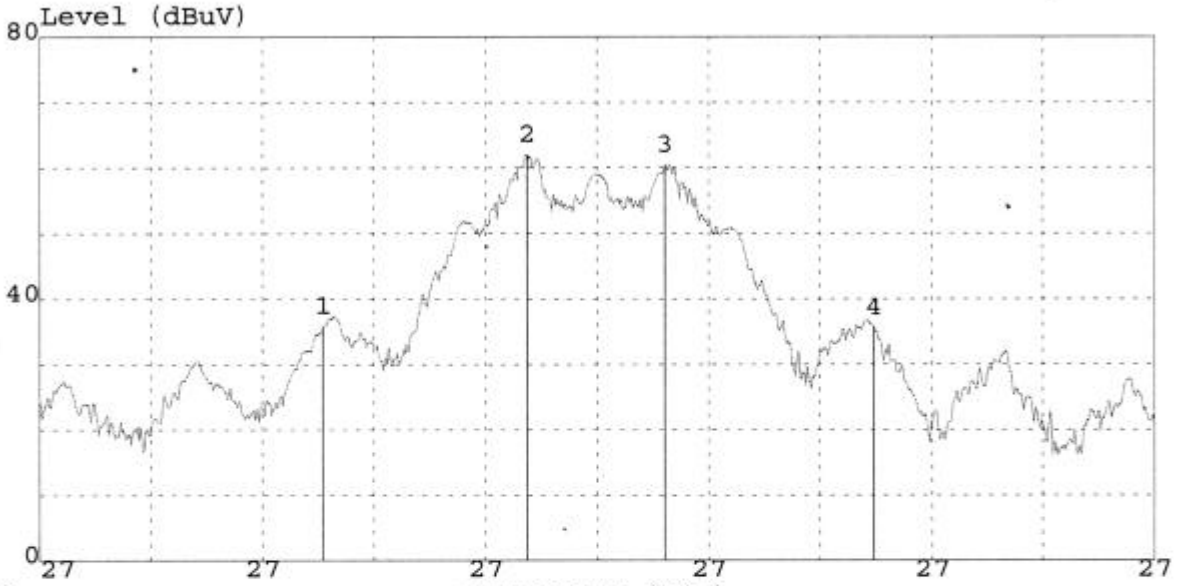
Page: 1

	Freq	Level	Over Limit	Limit Line	Read Level	Factor	Ant Pos	Table Pos	Remark
	MHz	dB	dB	dB	dB	dB	cm	deg	
1	27.041	46.51	------	------	46.51	0.00	---	---	
2	27.049	72.89	------	------	72.89	0.00	---	---	
3	27.056	70.96	------	------	70.96	0.00	---	---	
4	27.065	46.53	------	------	46.53	0.00	---	---	

6.3 Bandwidth requirement Mode : Operation frequency: 27.045 MHz, CH 2

NEUTRON ENGINEERING INC.

Data#: 24 File#: 02E2335.EMI Date: 2002-06-28 Time: 14:03:21



SR02
Trace: 23 Ref Trace:
Limit : Probe:
Operator : Vincent Su
Project Code: 02E2335
E.U.T. : RF mouse
Model No. : RFSOP-35A
Test Mode : 27.145MHz/CH2
Temp/ RH : 25/50
Memo : RBW=1KHz,VBW=3KHz, Span= 50KHz

Page: 1

	Freq	Level	Over Limit	Limit Line	Read Level	Factor	Ant Pos	Table Pos	Remark
	MHz	dB	dB	dB	dB	dB	cm	deg	
1	27.141	35.84	------	------	35.84	0.00	---	---	
2	27.150	62.02	------	------	62.02	0.00	---	---	
3	27.156	60.42	------	------	60.42	0.00	---	---	
4	27.165	35.61	------	------	35.61	0.00	---	---	

Attachment

Photos of Tested EUT

1. **Photo # 1. Front View**
2. **Photo # 2. Rear View**
3. **Photo # 3 Unit partially Disassembled**
4. **Photo # 4 Unit partially Disassembled**
5. **Photo # 5 Unit partially Disassembled**
6. **Photo # 6 Unit partially Disassembled**

Attachment

User's Manual