

Measurement Report

FCC ID:H8GNB30This report concerns (check one) : ☒ Original Grant ☐ Class II Change

Issued Date : Sep. 20, 2004
Project No. : 04E0588
Equipment : Wireless Battery Free Optical Mouse
Model No. : NB-30
Applicant : A-FOUR TECH CO., LTD.
6F, No. 108, Min-Chuan Rd., Hsin-Tien, Taipei,
Taiwan, R.O.C.

Tested by :

Neutron Engineering Inc. EMC Laboratory

Data of Test :

Sep. 14, 2004 ~ Sep. 20, 2004

Testing Engineer :**Technical Manager :****Authorized Signatory :**

Jeff Yang
NEUTRON ENGINEERING INC.
(Jeff Yang)
James Chiu
NEUTRON ENGINEERING INC.
(James Chiu)
Andy Chiu
NEUTRON ENGINEERING INC.
(Andy Chiu)

NEUTRON ENGINEERING INC.

No. 132-1, Lane 329, Sec. 2, Palain Rd.,

Shijr Jen, Taipei, Taiwan

TEL : (02) 2646-5426 FAX : (02) 2646-6815



Declaration

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For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Assessment Authorities



Test Standard/Scope/Item Acceptance

FCC Part 15 Subpart B
IEC/CISPR22
AS/NZS 3548
CNS 13438

FCC Part 15 Subpart B
CISPR 22/EN 55022
AS/NZS 3548
VCCI -Technical Requirement
CNS 13438

SS IEC/CISPR 22
IEC/EN 61000-3-2 IEC/EN 61000-4-5
IEC/EN 61000-3-3 IEC/EN 61000-4-6
IEC/EN 61000-4-2 IEC/EN 61000-4-8
IEC/EN 61000-4-3 IEC/EN 61000-4-11
IEC/EN 61000-4-4

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1. General Information**1.1 Applicant**

Name A-FOUR TECH CO., LTD.

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

1.2 Manufacturer

Name N/A

Address N/A

1.3 Equipment Under Tested

Name: Wireless Battery Free Optical Mouse

Model No.: NB-30

1.4 OEM Brand/Model (if applicable)

OEM Brand(s)/Model(s) except the basic model in sub-clause 1.3 is(are) the follows:

OEM Brand: N/A

Model No.: N/A

1.5 Model Difference (Series, Versions, if any)

Except the basic model no. (model designation of the sample tested in this test report), additional model no. covered is(are) :

N/A.

1.6 Product Descriptions(Application/Features/Specification)

The EUT is a Wireless Battery Free Optical Mouse. A major technical descriptions of EUT is described as following:

A. Operation Frequency	121 KHz – 128 KHz
B. Modulation Type	ASK
C. Antenna Designation	Integra (Induction coil)
D. Output Power	2.5 mW (Max.)
E. Mode of Operation	Simplex

Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual .

1.7 Connecting I/O Port(s)

Please refer to the User's Manual.

1.8 Power Supplied

Power Pad: DC 5 V, 400mA(Max.)/ Supplied from PC USB port

Wireless Battery Free Optical Mouse: DC 5 V, 80mA(Max.)/ Faradism

1.9 Products Covered (if applicable)

The sample tested including the following sub-system/module/accessory :

Sub-system/ Module/ Accessory	Model/Type No.	Int. Inst./ Ext. Cont.
N/A	N/A	N/A

1.10 Description of Test Mode(s)

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Mode 1	Low CH: 121.0KHz
Mode 2	Middle CH: 124.5KHz
Mode 3	High CH: 128.0KHz

The EUT system operated Mode 2, mentioned above was found to be the worst case during the pre-scanning test.

These operation modes were used for final testing and collecting test data included in this report.

1.11 Summary of Test Results

Test procedures according to the technical standards: (Antenna to EUT distance is 3 m)

FCC Part15, Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.207	Conducted Emission	Class B	0.15 - 30	PASS
15.209	Radiated Emission	Class B	0.09 -1000	PASS

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

2. RFI Emissions Measurement

2.1 Test Facility

The test facilities used to collect the test data in this report located at No.132-1, Lane 329, Sec. 2, Palain Road, Shijr City, Taipei, Taiwan.

2.2 Standard Compliance

The test data contained in this report relate only to the item(s) listed below :

FCC Part15, Subpart C / RSS-210: 2001/ ANCI C63.4 : 2000

2.3 Test Methodolog

Both conducted and radiated testing were performed during the max. EMI emission evaluation.

Test procedures according to the technical standards:

FCC Part15, Subpart C / ANSI C63.4 : 2000

2.4 Deviations from Standard Test Method

N/A

2.5 Sample(s) Tested

The representative sample tested in this reports is(are): NB-30

Test results in this test report relate only to the sample(s) tested.

The EUT has been tested according to the following environmental condition:

Input Power	AC: 120V/60Hz
Environmental Conditions	Please refer to the measurement data.

2.6 Measurement Instruments

Valid measurement instruments used in this report refer to **Table-1** enclosed.

2.7 Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

A. Conducted Measurement :5.05dB

B. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)	NOTE
OS-01	ANSI	30MHz ~ 200MHz	H	4.59	
		30MHz ~ 200MHz	V	4.80	
		200MHz ~ 1,000MHz	H	4.47	
		200MHz ~ 1,000MHz	V	5.03	

2.8 Tested System Set-Up/Configuration Details

The system was configured for testing in a typical fashion (as a user would normally use) or in accordance with the operating configuration specified in the user's manual. A Block Diagram (please refer to the Diagram - 1) and Photos (please refer to the attachment - A) showing the set-up/configuration of system tested. In addition, **Table-2** and **Table-3** provide a detail of all equipment items and cables information used in the system tested.

Table -1 Measurement Instruments List

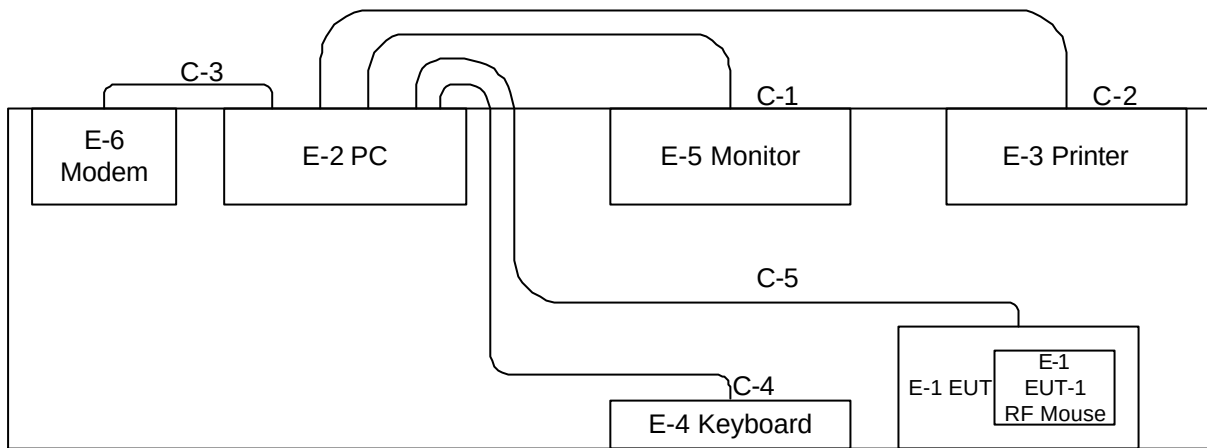
Item	Instruments	Mfr/Brand	Model/Type No.	Serial No.	Calibrated Date	Next Cali. Date	Note
1	LISN	EMCO	3825/2	9605-2539	2004-06-12	2005-06-11	✓
2	LISN	Rolf Heine	NNB-2/16Z	98083	2004-08-03	2005-08-02	
3	LISN	Rolf Heine	NNB-2/16Z	98053	2003-12-15	2004-12-14	✓
4	LISN	EMCO	4825/2	00028234	2003-10-01	2004-09-30	
5	Pulse Limiter	Electro-Metrics	EM-7600	112644	2003-12-08	2004-12-07	✓
6	50Ω Terminator	N/A	N/A	N/A	2004-05-08	2005-05-07	✓
7	Test Cable	N/A	C01	N/A	2003-12-09	2004-12-08	✓
8	Loop Antenna	R&S	HFH2-Z2	830749/020	2004-05-18	2005-05-17	✓
9	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9160	3058	2003-10-21	2004-10-20	✓
10	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9160	3115	2004-04-14	2005-04-13	
11	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9161	4022	2004-07-15	2005-07-14	
12	Test Cable	N/A	10M_OS01	N/A	2003-12-09	2004-12-08	✓
13	Test Cable	N/A	OS01-1/-2	N/A	2003-12-09	2004-12-08	✓
14	Test Cable	N/A	10M_OS02	N/A	2003-12-09	2004-12-08	
15	Test Cable	N/A	OS02-1/-2/-3	N/A	2003-12-09	2004-12-08	
16	RF Switch	Anritsu	MP59B	M65982	2003-12-08	2005-12-07	
17	Quasi-Peak Adapter	HP	85650A	2521A00844	2004-03-16	2005-03-15	
18	RF Pre-Selector	HP	85685A	2648A00417	2004-03-16	2005-03-15	
19	Spectrum Analyzer	HP	85680B	2634A03025	2004-01-09	2005-01-08	
20	Spectrum Monitor	HP	85662B	2648A13616	2004-01-09	2005-01-08	
21	Pre-Amplifier	Anritsu	MH648A	M09961	2003-12-08	2004-12-07	✓
22	Spectrum Analyzer	ADVAN TEST	R3261C	81720298	2004-08-19	2005-08-18	✓
23	Test Receiver	R&S	ESH3	860156/018	2003-10-21	2004-10-20	
24	Test Receiver	R&S	ESVP	860687/009	2003-12-05	2004-12-04	
25	Test Receiver	PMM	PMM 9000	4310J01002	2003-10-03	2004-10-02	✓
26	Horn Antenna	EMCO	3115	9605-4803	2004-05-28	2005-05-27	
27	Test Receiver	R&S	ESMI	843977/005	2004-01-12	2005-01-11	✓
28	Absorbing Clamp	R&S	MDS-21	841077/011	2004-08-25	2005-08-24	
29	Voltage Probe	R&S	ESH2-Z3	841.800/023	2004-08-24	2005-08-23	
30	Signal Generator	HP	8648A	3426A01034	2002-10-11	2004-10-08	
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	✓
33							
34							

Remark :

(1)" ✓" indicates the instrument used in Test Report.

(2)" N/A" denotes No Model No. / Serial No. and No Calibration specified.

Diagram - 1
Block diagram showing the configuration of system tested



C-1 Video Cable
C-2 Centronics Cable
C-3 Interface Cable
C-4 USB Cable
C-5 Keyboard Cable

Table - 2 Equipments Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID / DOC	Series No.	Note
E-1	Wireless Battery Free Optical Mouse	A4TECH	NB-30	H8GNB30	N/A	EUT
E- 2	PC	IBM	8196-I5V	DOC	99M1136	
E- 3	Printer	SII	DPU-414	DOC	1045105A	
E- 4	PS/2 K/B	HP	5181	DOC	N/A	
E- 5	Monitor	HITACHI	CM753ET	DOC	T8L000003	
E- 6	Modem	ACEEX	DM-1414V	DOC	8041708	

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 was authorized by Declaration of Confirmation.

Table - 3 Information of Interface Cable

Item	Shielded Type	Ferrite Core	Length	Note
C-1	YES	YES	1.8M	
C-2	YES	NO	1.8M	
C-3	YES	NO	1.5M	
C-4	YES	NO	1.5M	※
C-5	YES	NO	1.5M	

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 cm in 『Length』 column.

2.9 EUT Operating Conditions

- (a) Both conducted and radiated testing were performed during the max. EMI emission evaluation. The EUT was connected to support equipment-personal computer. Peripherals of PC, such as monitor, keyboard, modem and printer were contained in this system in order to comply with the CISPR22 Rules requirement. The PC operated in the default 800 x 600 / 35 KHz VGA Graphic mode. This operating condition was tested and used to collect the included data.
- (b) The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.
- (c) The EUT exercise program used during radiated and/or conducted emission measurement was designed to exercise the various system components in a manner similar to a typical use. The program contained on a PC hard disk and is auto-starting on power-up. Once loaded, the program sequentially exercises each system component in turn. The sequence used is:
 - 1. Read (write) from (to) mass storage device (Disk).
 - 2. Send "H" pattern to video port device (Monitor).
 - 3. Send " H " pattern to parallel port device (Printer).
 - 4. Send " H " pattern to serial port device (Modem).
 - 5. Repeated from 2 to 4 continuously.

3. Justification

3.1 Limitations

3.1.1 Power Line Conducted Emission

Measurement	Mains Terminal		Mains Terminals		Note
Frequency	Class A Limits		Class B Limits		CISPR
Range	(dBuV)		(dBuV)		FCC
(MHz)	QP Mode	AV Mode	QP Mode	AV Mode	Std.
0.15 - 0.50	79.00	66.00	66 - 56 *	56 - 46 *	CISPR
0.50 - 5.00	73.00	60.00	56.00	46.00	CISPR
5.00 - 30.0	73.00	60.00	60.00	50.00	CISPR
0.45-1.705	60.00	N/A	48.00	N/A	FCC
1.705-30.0	69.50	N/A	48.00	N/A	FCC

Notes:

- (1). The tighter limit applies at the band edges.
- (2). The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

3.1.2 Radiated Emission Limits

Frequency (MHz)	Field Strength Limitation		Field Strength Limitation at 3m Measurement Dist	
	(uV/m)	Dist	(uV/m)	(dBuV/m)
0.009 – 0.490	2400 / F(KHz)	300m	10000 * 2400/F(KHz)	20log 2400/F(KHz) + 80
0.490 – 1.705	24000 / F(KHz)	30m	100 * 24000/F(KHz)	20log 24000/F(KHz) + 40
1.705 – 30.00	30	30m	100* 30	20log 30 + 40
30.0 – 88.0	100	3m	100	20log 100
88.0 – 216.0	150	3m	150	20log 150
216.0 – 960.0	200	3m	200	20log 200
Above 960.0	500	3m	500	20log 500

Notes:

- (1). The tighter limit shall apply at the boundary between two frequency range.
- (2). Limitation expressed in dBuV/m is calculated by 20log Emission Level (uV/m).
- (3). If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula of $L_{d1} = L_{d2} * (d_2/d_1)^2$.
Example:
F.S Limit at 30m distance is 30uV/m , then F.S Limitation at 3m distance is adjusted as $L_{d1} = L_1 = 30uV/m * (10)^2 = 100 * 30 uV/m$

3.2 Measurement Justification

3.2.1 Conducted Emission

The EUT is placed on a table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4-1992. Conducted emissions from the EUT measured in the **frequency range between 0.15 MHz and 30MHz** were made with a **Spectrum Analyzer** using **CISPR Quasi-Peak detector mode**.

The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and these signals are then Quasi Peak detector mode and/or Average detector mode re-measured.

Data of **Table - 4** lists the significant emission frequencies, measured levels, limits and safe margins. All readings are Peak Mode measured unless otherwise stated as QP or AV in column of " Remark ".

If the Peak Mode measured value lower than both QP Mode and AV Mode Limit, EUT shall be deemed to compliance with both QP & AV Limits and then no additional QP Mode or AV Mode measurement performed.

If additional QP or AV Mode measurement needed, and if the QP Mode measured value compliance with the QP Mode Limit and lower than AV Mode Limit, the EUT shall be deemed to meet both QP & AV Limits and then only QP Mode was measured, but AV Mode was not performed.

3.2.2 Radiated Emission

The EUT is placed on a turn table which is 0.8 m 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 emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-1992.

The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak, Peak or Average detector mode re-measured.

Data of **Table - 5** lists the significant emission frequencies, measured levels, limits and safe margins. All readings are Peak Mode measured unless otherwise stated as QP or AV in column of " Remark ".

If the Peak Mode measured value compliance with and lower than Quasi Peak or Average Mode Limit, the EUT shall be deemed to meet QP/AV Limits and then no additional QP/AV Mode measurement performed.

3.2.3 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 **$FS = RA + AF + CL - AG$**

Where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor (1)

CL = Cable Attenuation Factor(Cable Loss) (1)

AG = Amplifier Gain (1)

Remark :

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

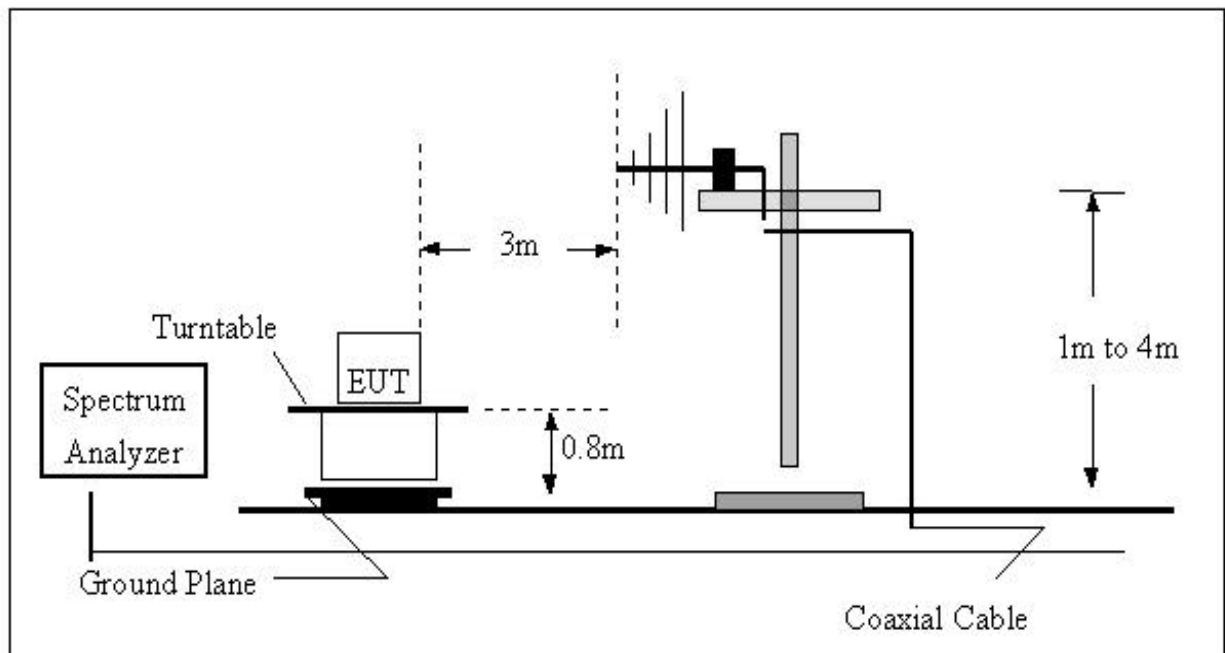
3.3 Measurement Data

Table - 4. Conducted Emission Data (0.15 – 30 MHz)

Table - 5. Radiated Emission Data (Below 30 MHz)

Radiated Emission Data (30 – 1000 MHz)

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



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

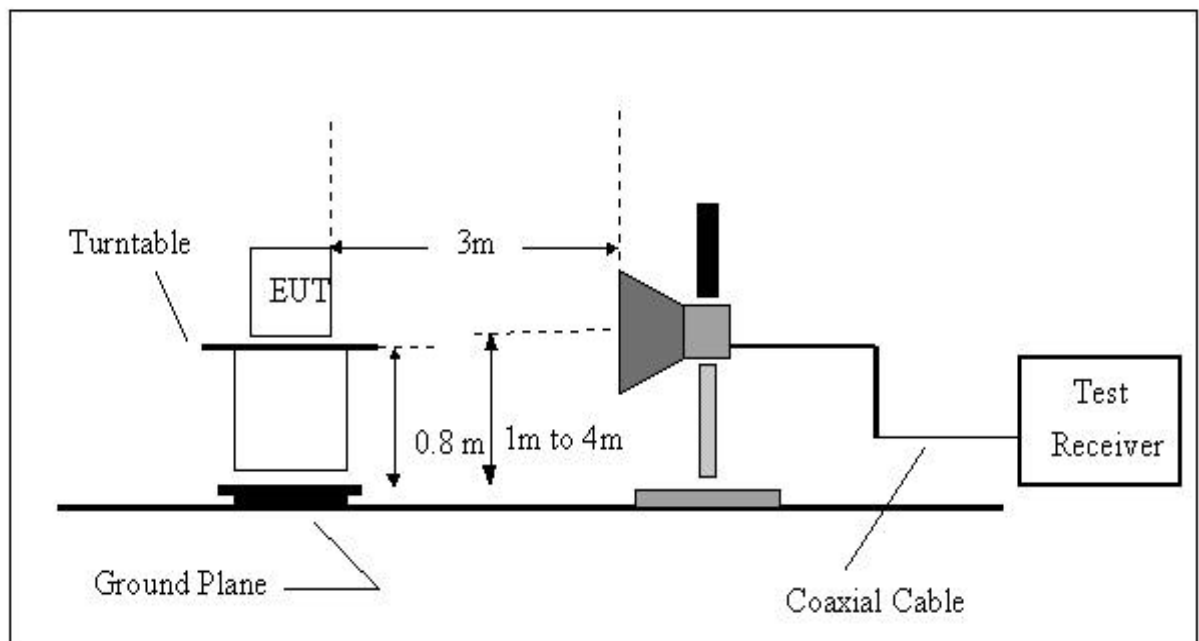


Table 4 Conducted Emission Data

EUT : Wireless Battery Free Optical Mouse Model/Type No. : NB-30Temperature : 25 °C Relative Humidity : 55 % Pressure : 1011.1 hPa

Special Notes : (EUT Operation Mode or Test Configuration Mode, if applicable)

Mode 2

Freq. (MHz)	Terminal L/N	Measured(dBuV)		Limits(dBuV)		Safe Margins	
		QP-Mode	AV-Mode	QP-Mode	AV-Mode	(dBuV)	Note
0.18	Line	40.79	*	64.30	54.30	-23.51	(QP)
0.60	Line	37.21	*	56.00	46.00	-18.79	(QP)
0.80	Line	38.01	*	56.00	46.00	-17.99	(QP)
13.48	Line	44.87	*	60.00	50.00	-15.13	(QP)
19.43	Line	43.76	*	60.00	50.00	-16.24	(QP)
26.28	Line	44.44	*	60.00	50.00	-15.56	(QP)
0.15	Neutral	44.16	*	65.94	55.94	-21.78	(QP)
0.19	Neutral	41.60	*	64.21	54.21	-22.61	(QP)
0.60	Neutral	37.01	*	56.00	46.00	-18.99	(QP)
5.90	Neutral	34.56	*	60.00	50.00	-25.44	(QP)
13.62	Neutral	44.47	*	60.00	50.00	-15.53	(QP)
25.59	Neutral	47.83	*	60.00	50.00	-12.17	(QP)

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 with instrument setting in RBW=1MHz,VBW=10Hz, Swp. Time =0.3 sec./MHz。
- (2) All readings are QP Mode value unless otherwise stated AVG in column of 『Note』 . If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform。 In this case, a “ * ” marked in AVG Mode column of Interference Voltage Measured。
- (3) Measuring frequency range from 150KHz to 30MHz。

Table 5 Radiated Emission Data (Below 30MHz)EUT : Wireless Battery Free Optical Mouse Model/Type No. : NB-30Temperature : 27 °C Relative Humidity : 62 % Pressure : 1016.1 hPa

Special Notes : (EUT Operation Mode or Test Configuration Mode, if applicable)

Mode 2

Freq. (KHz)	Receiver Reading in dBuV/m	Factor (dB)	Field Strength Limit (uV/m)	Required Measurement Distance(m)	Limitation Converted 3 m dist. (dBuV/m)	Over Limit	Dectector Mode PK/AV
124.50	76.40	20.10	19.28	300.00	105.70	-9.20	Peak
249.00	50.50	20.10	9.64	300.00	99.68	-29.08	Peak
3735.00	39.30	20.10	30.00	30.00	69.54	-10.14	Peak
498.00	56.50	0.10	48.19	30.00	73.66	-17.06	Peak
622.50	41.03	20.20	38.55	30.00	71.72	-10.49	Peak
747.00	32.40	20.20	32.13	30.00	70.14	-17.54	Peak
871.50	-	0.20	27.54	30.00	68.80	-	Peak
996.00	-	0.30	24.10	30.00	67.64	-	Peak
1120.50	-	0.30	21.42	30.00	66.62	-	Peak
1245.00	-	0.30	19.28	30.00	65.70	-	Peak

Remark :

- (1) Spectrum Setting :
9 KHz – 150 KHz , RBW= 1 KHz, VBW=1 KHz, Sweep time = 200 ms.
150 K Hz – 30 MHz , RBW= 9 KHz, VBW=9 KHz, Sweep time = 200 ms.
30 MHz – 1000 MHz , RBW= 100KHz, VBW=100KHz, Sweep time = 200 ms.
- (2) All receiver readings (the measured field strength levels) are measured from loop antenna directly.
- (3) The emission limits shown in the above table are base on measurements employing a quasi-peak detector except for the frequency bands 9-90 KHz, 110-490 KHz and above 1000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
- (4) Data 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.

Table 5 Radiated Emission Data (30 – 1000 MHz)EUT : Wireless Battery Free Optical Mouse Model/Type No. : NB-30Temperature : 27 °C Relative Humidity : 62 % Pressure : 1016.1 hPa

Special Notes : (EUT Operation Mode or Test Configuration Mode, if applicable)

Mode 2

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
35.600	V	Peak	29.47	-3.76	25.71	40.00	-14.29	
73.879	V	Peak	29.33	-5.27	24.06	40.00	-15.94	
98.540	V	Peak	24.56	-4.33	20.23	43.50	-23.27	
143.236	V	Peak	27.91	-0.07	27.84	43.50	-15.66	
195.886	V	Peak	28.22	-2.77	25.45	43.50	-18.05	
33.024	H	Peak	32.90	-4.02	28.88	40.00	-11.12	
92.050	H	Peak	38.30	-4.86	33.44	40.00	-6.56	
120.450	H	Peak	36.30	-2.05	34.25	43.50	-9.25	
143.710	H	Peak	32.50	-0.04	32.46	43.50	-11.04	
165.803	H	Peak	32.40	-0.36	32.04	43.50	-11.46	

Remark :

(1) Spectrum Setting :

9 KHz – 150 KHz , RBW= 1 KHz, VBW=1 KHz, Sweep time = 200 ms.

150 K Hz – 30 MHz , RBW= 9 KHz, VBW=9 KHz, Sweep time = 200 ms.

30 MHz – 1000 MHz , RBW= 100KHz, VBW=100KHz, Sweep time = 200 ms.

(2) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.

(3) Measuring frequency range from 30MHz to 1000MHz.

(4) If the peak scan value lower limit more than 20dB, then this signal data does not show in table.

Attachment

Table Contents

- A. EUT Test Photos
- B. Product Labeling

Attachment - A.

EUT Test Photos

Attachment – B.

Product Labeling