

# **Measurement Report**

## FCC ID:H8GRSW48

This report concerns (check one) : Class II Change

lssued Date	: Jan. 21, 2003
Project No.	: 03E0015
Equipment	: RF MOUSE
Model No.	: RFSW-48;RF-848;RF-748
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 : Jan. 10, 2003~ Jan.17, 2003



**Technical Manager :** 

Authorized Signatory :



### NEUTRON ENGINEERING INC.

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0659 ILAC MRA Code:200145-0

#### Report No. : NEI-FCC-P 03003

### 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	ISO Guide Adopted	Test Standard/Scope/Item Acceptance	
RVLAP	ISO Guide 17025	FCC Part 15 Subpart B/C IEC/CISPR22 AS/NZS 3548 CNS 13438	
	ISO Guide 17025	FCC Part 15 Subpart B/C 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:RF MOUSETrade Name:A4TECHModel No.:RFSW-48;RF-848;RF-748
- 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 Product Descriptions (Application/Features/Specification)

The EUT is a RF MOUSE. A major technical descriptions of EUT is described as following:

A .Operation Frequency	27.045 and 27.145MHz
B. Modulation Type	FSK
C. Antenna Designation	Integral
D. Number Of Channel	2
E. Channel Spacing	100 KHz
F. Operation Methodology	The EUT 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 $\pm$ 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.

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 (Attachment - E.)

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1.6 Connecting I/O Port(s) Please refer to the User's Manual (Attachment - E.)

1.7 Power Supplied Power Source: Battery supplied Power Cord: N/A Power Rating: DC 3 V

1.8 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

1.9 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) :

Model RFSW-48;RF-848 is identical to model RF-748 except the model designation.

1.10 EUT Modifications (if applicable)

No any modification required for the EUT to comply with the standards.

- 1.11 Electric Block Diagram Please refer to the Attachment – **A**
- 1.12 Photos of EUT Please refer to the Attachment – **D.**

#### 2. RFI Emissions Measurement

#### 2.1Test 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 / ANCI C63.4 : 1992

The composite system (including receiver and transmitter) in compliance with Subpart B is authorized under a DOC procedure.

#### 2.3 Test Conditions and Channel

Test Channel (1)	EUT Channel	Test Frequency(MHz)
1	CH 1	27.045
2 CH 2		27.145

Note:

(1)The measurements are performed at the highest and lowest available channels with the modulation enabled.

#### 2.4 Test Methodolog

Only radiated testing was performed during the max. EMI emission evaluation. Conducted testing excepted because of the EUT is a battery operating device and no any other cable connection to PC device.

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

FCC Part15 (15.227), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.209	Radiated Emission	Class B	30-1000	PASS
15.227	Radiated Emission	10000 µV/m (80dBµV/m) @ 3 m	26.96-27.28	PASS

2.5 Deviations from Standard Test Method

N/A

#### 2.6 Sample(s) Tested

The representative sample tested in this reports is(are): RFSW-48

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	DC:3V
Temperature	24
Relative Humidity	56 %

#### 2.7 Measurement Instruments

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

#### 2.8 Measurement Uncertainty

Measurement Uncertainty for a Level of Confidence of 95 % , U=2xUc(y)

Radiated Emission Measurement	± 2.47 dB
Conducted Emission Measurement	± 2.29 dB

### 2.9 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 - C) 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.

Next Cali. Date Note Instruments Mfr/Brand Serial No. Calibrated Date ltem Model/Type No. LISN EMCO 3825/2 9605-2489 1 2002-06-10 2003-06-09 LISN 2 **Rolf Heine** NNB-2/16Z 98083 2002-11-01 2003-10-31 LISN **Rolf Heine** NNB-2/16Z 98048 2002-11-15 2003-11-14 3 Pulse Limiter 4 **Electro-Metrics** EM-7600 112644 2002-12-09 2003-12-08 5 50 Terminator N/A N/A N/A 2002-05-10 2003-05-09 Test Cable N/A N/A 6 C01 2002-12-10 2003-12-09  $\checkmark$ 7 **VULB 9160** 3058 2002-10-23 2003-10-22 Log-Bicon Antenna MESS-ELEKTRONIK 3060 8 MESS-ELEKTRONIK **VULB 9160** 2002-10-23 2003-10-22 Log-Bicon Antenna VULB 9161 4022 9 2002-07-25 2003-07-24 Log-Bicon Antenna MESS-ELEKTRONIK  $\checkmark$ Test Cable 10M\_OS01 N/A 2002-12-10 2003-12-09 10 N/A  $\checkmark$ N/A 11 Test Cable N/A OS01-1/-2 2002-12-10 2003-12-09 N/A N/A 12 Test Cable 10M OS02 2002-12-10 2003-12-09 Test Cable N/A N/A 2002-12-10 13 OS02-1/-2/-3 2003-12-09  $\checkmark$ MP59B 14 RF Switch Anritsu M65982 2001-12-09 2003-12-08 HP 2002-10-08 2003-04-07 15 Quasi-Peak Adapter 85650A 2521A00844 16 **RF Pre-Selector** ΗP 85685A 2648A00417 2002-10-08 2003-04-07 17 Spectrum Analyzer HP 85680B 2634A03025 2002-10-08 2003-04-07 HP 2002-10-08 85662B 18 Spectrum Monitor 2003-04-07 2648A13616  $\checkmark$ 19 Pre-Amplifier MH648A M09961 2002-12-09 2003-12-08 Anritsu ✓ 20 Spectrum Analyzer ADVAN TEST R3261C 81720298 2002-08-14 2003-08-13 21 R&S Test Receiver ESH3 860156/018 2002-10-22 2003-10-21 **ESVP** 22 Test Receiver R&S 860687/009 2002-12-06 2003-12-05 23 Test Receiver MEB SMV41 130 2002-12-06 2003-12-05 **PMM** PMM 9000 24 Test Receiver 2002-10-06 2003-10-03 4310J01002 25 Horn Antenna EMCO 9605-4803 2002-05-20 2003-05-19 3115  $\checkmark$ 26 Test Receiver R&S **ESMI** 2002-11-21 2003-11-20 843977/005 1045.5020.9801 27 Pre-Amplifier R&S ESMI-Z7 2002-05-20 2003-05-19 (612.278 041 00) Absorbing Clamp R&S MDS-21 2002-08-23 2003-08-22 28 841077/011 29 Voltage Probe R&S ESH2-Z3 841.800/023 2002-08-28 2003-08-27 HP 30 Signal Generator 8648A 2002-10-11 2004-10-08 3426A01034  $\checkmark$ Antenna Mast **CMTB-1.5** N/A 31 Chance Most N/A N/A  $\checkmark$ 32 Turn Table Chance Most N/A N/A N/A **CMTB-1.5** 

### **Table -1 Measurement Instruments List**

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Remark :

(1)"  $\checkmark$ " indicates the instrument used in Test Report.

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

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## Diagram - 1

Block diagram showing the configuration of system tested

E-1 RF Mouse

## Table - 2 Equipments Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
E-1	RF MOUSE	A4TECH	RFSW-48	H8GRSW48	N/A	EUT

Note:

- (1) Unless otherwise denoted as EUT in <sup></sup>Remark<sub>𝔅</sub> column , device(s) used in tested system is a support equipment.
- (2) Unless otherwise marked as in <sup>®</sup>Remark<sub>a</sub> 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
	N/A	N/A	N/A	

Note:

- (1) Unless otherwise marked as in <sup>r</sup>Remark<sub>a</sub> 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.

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#### 2.10 Max.(Worst Case) RF Emission Evaluation

- (a) Only radiated testing was performed during the max. EMI emission evaluation. Conducted testing excepted because of the EUT is a battery operating device and no any other cable connection to PC device.
- (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.
- 2.11 EUT Operation

The EUT exercise program used during radiated and emission measurement was designed to exercise the various system components in a manner similar to a typical use. The measurements are performed at the highest and lowest available channels with the modulation enabled.

### 3. Justification

#### 3.1 Limitations

3.1.1 Power Line Conducted Emission

Measurement Frequency Range	Mains Terminal Class A Limits (dBuV)		Mains Te Class B (dBi	Note CISPR 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 1.705-30.0	60.00 69.50	N/A N/A	48.00 48.00	N/A N/A	FCC 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 Range 30MHz-1000MHz)

,	• •	•		,		
Measurement	Quasi-Pe	Quasi-Peak Mode		Quasi-Peak Mode		
Frequency	Class A	Class A Limits		Class B Limits		
Range	(dBuV/m)		(dBu	FCC		
(MHz)	10m	30m	10m	3m	Std.	
30.00 -230.00	40.00	30.00	30.00	40.00	CISPR	
230.0 -1000.0	47.00	37.00	37.00	47.00	CISPR	
30.00 - 88.00	39.00	N/A	30.00	40.00	FCC	
88.00 - 216.0	43.50	N/A	33.50	43.50	FCC	
216.0 -960.0	46.00	N/A	36.00	46.00	FCC	
above 960.0	49.50	N/A	46.00	54.00	FCC	

Notes:

- (1). The tighter limit applies at the band edges.
- (2). Emission level (dBuV/m)=20log Emission level (uV/m).
- (3). A measuring distance 0f 10m is a primary used. However, either 3m or 10m (instead of 10m) distance my be allowed. If the distance is 3m, add 10dB to the QP-limit above. If the distance is 10m, subtract 10dB from the QP-limit above.

#### 3.2 Measurement Justification

#### 3.2.1 Conducted Emission

The EUT is a placed on as 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 a placed on as 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.

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#### 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)

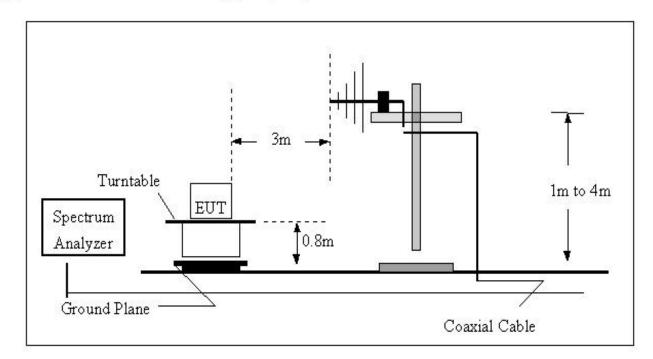
Remark :

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

3.3 Measurement Data

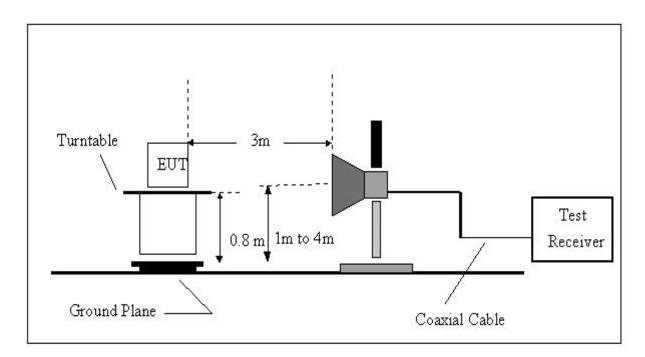
Table - 4. Conducted Emission Data (015-30MHz) - Not Applicable

Table - 5. Radiated Emission Data (30-1000MHz)



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

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



## Table 5 Radiated Emission Data (30-1000MHz)

Special Notes : (EUT Operation Mode or Test Configuration Mode, if applicable) CH 1

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
	<u> </u>				·	/		F
27.040	-	Peak	80.20	-29.60	50.60	80.00	-29.40	
26.960	V	Peak	73.50	-29.60	43.90	69.50	-25.60	Е
27.280	V	Peak	53.00	-29.61	23.39	69.50	-46.11	Е
54.110	V	Peak	29.05	-13.05	16.00	40.00	-24.00	Н
81.090	V	Peak	30.75	-15.96	14.79	40.00	-25.21	Н
135.200	V	Peak	27.60	-10.73	16.87	40.00	-23.13	Н
162.310	V	Peak	37.67	-10.13	27.54	43.50	-15.96	Н
189.330	V	Peak	24.67	-12.59	12.08	43.50	-31.42	Н
27.035	Н	Peak	69.60	-29.60	40.00	80.00	-40.00	F
26.960	Н	Peak	62.70	-29.60	33.10	69.50	-36.40	Е
27.280	Н	Peak	41.80	-29.61	12.19	69.50	-57.31	Е
54.110	Н	Peak	38.59	-13.05	25.54	40.00	-14.46	Н
81.310	Н	Peak	38.82	-15.95	22.87	40.00	-17.13	Н
135.200	Н	Peak	25.60	-10.73	14.87	40.00	-25.13	Н
162.317	Н	Peak	40.35	-10.13	30.22	43.50	-13.28	Н
189.330	Н	Peak	27.45	-12.59	14.86	43.50	-28.64	Н

#### Remark :

- (1) Spectrum Setting : 30MHz 1000MHz , RBW= 100KHz, VBW=100KHz, Sweep time = 200 ms. 1GHz- 25GHz, RBW= 1MHz, VBW= 1MHz, Sweep time = 200 ms
- (2) All readings are Peak unless otherwise stated QP in column of <sup>®</sup> Note <sup>』</sup>. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform<sub>o</sub>
- (3) Measuring frequency range from 25MHz to 1000MHz or the 10th harmonic of highest fundamental frequency, "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (4) Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Peak detector mode or QP detector mode of the emission 。
- (5) 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 (30-1000MHz)

Special Notes : (EUT Operation Mode or Test Configuration Mode, if applicable) CH 2

Freq. (MHz)	Ant.Pol. H/V	DetectorMod (PK/AV)	e Reading (dBuV)	Ant./CL/ Amp. CF(dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)	Note
27.150	<u></u> V	Peak	79.20	-29.61	49.59	80.00	-30.41	
26.960	V	Peak	58.70	-29.60	29.10	69.50	-40.40	E
27.280	V	Peak	65.40	-29.61	35.79	69.50	-33.71	Е
54.110	V	Peak	29.85	-13.05	16.80	40.00	-23.20	Н
81.090	V	Peak	31.49	-15.96	15.53	40.00	-24.47	Н
135.200	V	Peak	28.44	-10.73	17.71	40.00	-22.29	Н
162.310	V	Peak	39.50	-10.13	29.37	43.50	-14.13	Н
189.330	V	Peak	25.27	-12.59	12.68	43.50	-30.82	Н
								_
27.140	Н	Peak	70.60	-29.60	41.00	80.00	-39.00	F
26.960	Н	Peak	50.80	-29.60	21.20	69.50	-48.30	Е
27.280	Н	Peak	57.20	-29.61	27.59	69.50	-41.91	Е
54.110	Н	Peak	39.87	-13.50	26.37	40.00	-13.63	Н
81.310	Н	Peak	39.96	-15.95	24.01	40.00	-15.99	Н
135.200	Н	Peak	26.34	-10.73	15.61	40.00	-24.39	Н
162.317	Н	Peak	41.86	-10.13	31.73	43.50	-11.77	Н
189.330	Н	Peak	28.19	-13.29	14.90	43.50	-28.60	Н

#### Remark :

- (1) Spectrum Setting : 30MHz 1000MHz , RBW= 100KHz, VBW=100KHz , Sweep time = 200 ms. 1GHz- 25GHz, RBW= 1MHz, VBW= 1MHz, Sweep time = 200 ms
- (2) All readings are Peak unless otherwise stated QP in column of <sup>II</sup> Note <sup>II</sup>. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (3) Measuring frequency range from 25MHz to 1000MHz or the 10th harmonic of highest fundamental frequency, "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (4) Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Peak detector mode or QP detector mode of the emission 。
- (5) 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.

### Attachment

### **Table Contents**

- A. Electric Block Diagram
- B. EUT Modification Description
- C. EUT Photos
- D. EUT Test Photos
- E. User's Manual
- F. Product Labeling
- G. Bandwidth Requirement (Plot)
- H. Laboratory Accreditation Certificate

Attachment - A.

**Electric Block Diagram** 

## Attachment - B.

## **EUT Modification Description**

Attachment - C.

**EUT Test Photos** 

Attachment – D

**EUT Photos** 

Attachment – E

User's Manual

Attachment - F

**Product Labeling** 

Attachment - G.

**Bandwidth Requirement** 

## Attachment - H.

## Laboratory Accreditation Certificate