

# FCC PART 15 CLASS B EMI MEASUREMENT AND TEST REPORT

For

## **Fu Kuang Hui Electronics Co., Ltd (Shenzhen)**

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**FCC ID: P2DUSB Flash Disk**

November 6, 2001

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> USB Flash Disk - ITE
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<b>Test Date:</b> October 23, 2001	
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## 1 - GENERAL INFORMATION

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### 1.1 Product Description for Equipment Under Test (EUT)

The *Fu Kuang Hui Electronics Co., Ltd (Shenzhen)*. 's, model *USB Flash Disk* or the "EUT" as referred to in this report is a USB Flash Disk. The USB Flash Disk is a general – purpose flash disk. It compliant USB version 1.1 and supports full – speed (12Mbps) model. The USB Flash Disk comprises two blocks as the block diagram show. The flash memory IC is the storage part. All the data from the USB host storage in it. The USB controller core is 8031 compatible MCU. It responses the Host requirement and controls the data transmission between the host and memory. It run at 48MHz clock , this clock is created by a digital PLL circuit from an 8MHz crystal. The USB transceiver is the I/O between the USB host and the USB controller. The USB Flash Disk draws the power directly from USB host.

The EUT measures approximately 3.35”L x 1.00”W x 0.35”H.

### 1.2 Objective

This Class B report is prepared on behalf of *Fu Kuang Hui Electronics Co., Ltd (Shenzhen)* in accordance with Part 2, Subpart J, and Part 15, Subparts A and B of the Federal Communication Commissions rules and to ICES-003 of the Canadian Interference-Causing Equipment Regulations.

The objective of the manufacturer is to demonstrate compliance with FCC 15 Class B limits and to ICES-003 requirements for Information Technology Equipment.

### 1.3 Related Submittal(s)/Grant(s)

No Related Submittal(s).

### 1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 –1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 Meters.

### 1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Suite 2, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1400F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, IEC/CISPR 22: 1998, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

### 1.6 Equipment Under Test (EUT)

Manufacturer	Description	Model	Serial Number	FCC ID
Fu Kuang Hui Electronics Co., Ltd (Shenzhen)	USB Flash Disk	USB Flash Disk	UFD-GPB91/2-2	P2DUSB Flash Disk

### 1.7 Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Microsoft	Keyboard	5121	753622030114	E5XKBM104M10UC
Microsoft	Mouse	E06401PS2	83718-OEM-6073816	3872A462
KDS	Monitor	KD-1731	0891265478	EVOKD-1731
IBM	PC SYSTEM	520	AM707AR	DOC
HP	Printer	2225C	2821S14783	DS16XU2225
EVEREX	Modem	EV-945	None	E3E5UVEV-945
Kouwell Tech	USB HUB	580H	11118015872	DOC

### 1.8 External I/O Cabling List and Details

Cable Description	Length (M)	From/Port	To
Shielded KB Cable	1.6	KB Port/Host	Microsoft Keyboard
Shielded Mouse Cable	1.8	Mouse Port /Host	Microsoft Mouse
Shielded Video Cable	1.8	Video Port /Host	KDS Monitor
Shielded USB Cables	1.2	USB Port/EUT	USB Port /USB HUB
No Cable	0.1	USB Port/EUT	USB Port/USB HUB
Shielded Printer Cable	2.0	Parallel Port/Host	HP Printer
Shielded Modem Cable	2.0	Serial Port/Host	EVEREX Modem

## **2 - SYSTEM TEST CONFIGURATION**

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### **2.1 Justification**

The system was configured for testing in a typical fashion (as a normally used by a typical user).

The EUT was tested in the normal (native) operating mode to represent worst case results during the final qualification test.

Additionally, the EUT was tested the AC adapter, M/N: SCP 48-62500

### **2.2 EUT Exercise Software**

The EUT exercising program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The test software, EMCTest, contained on the hard drive, once loaded, the program sequentially exercises each system component.

The sequence used is as follows:

- 1) Lines of Hs scroll across the VGA monitor.
- 2) The modem(s) receives Hs.
- 3) The printer output Hs.

This process is continuous throughout all modes tested.

### **2.3 Special Accessories**

As shown in section 2.5, all interface cables used for compliance testing are shielded as normally supplied by INMAC, and from their respective support equipment manufacturers. The VGA monitor, the printer, the modem and all other peripherals featured shielded metal connectors.

### **2.4 Block Diagram**

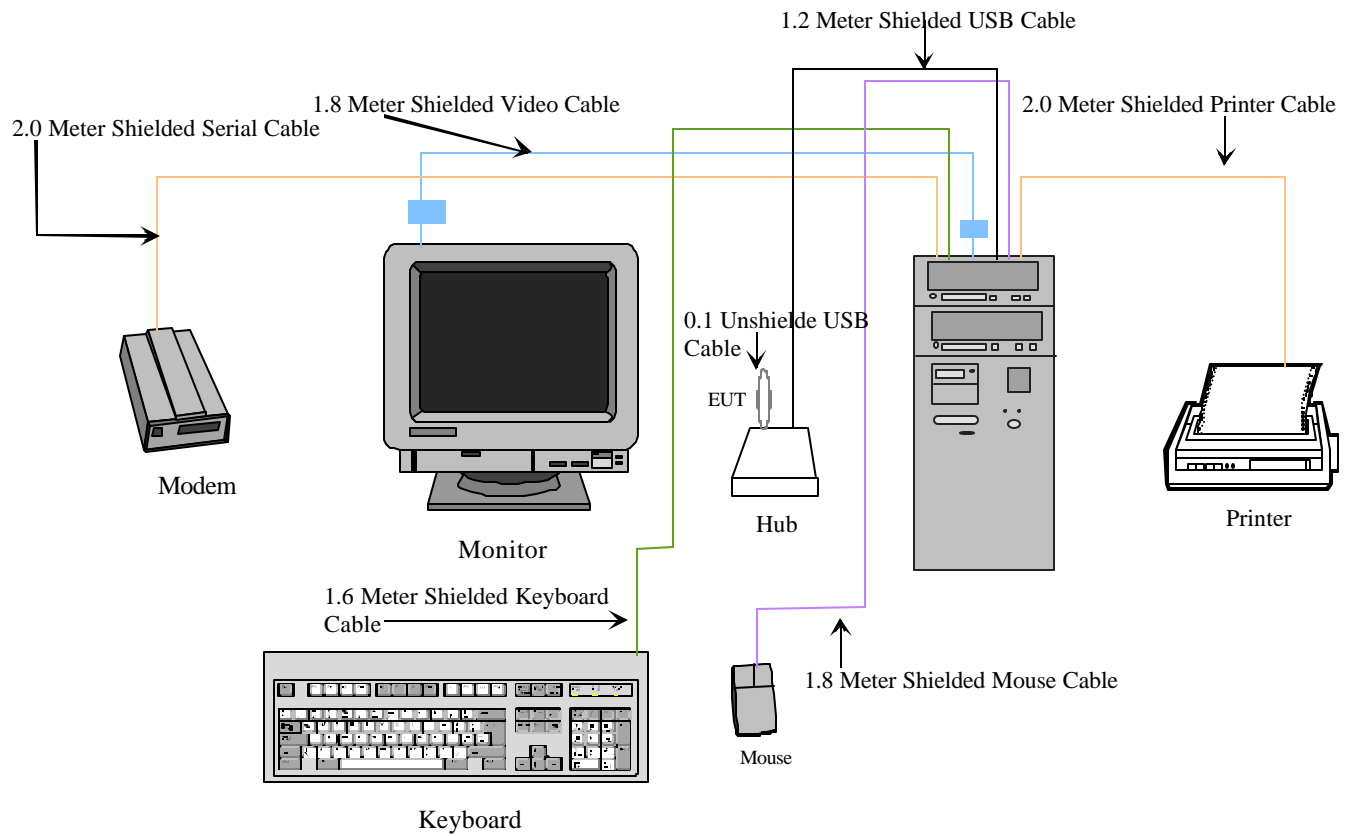
A copy of the EUT's schematics or block diagram is provided in appendix A of this report as reference.

### **2.5 Equipment Modifications**

No modification(s) were made to ensure the EUT to comply with the applicable limits.

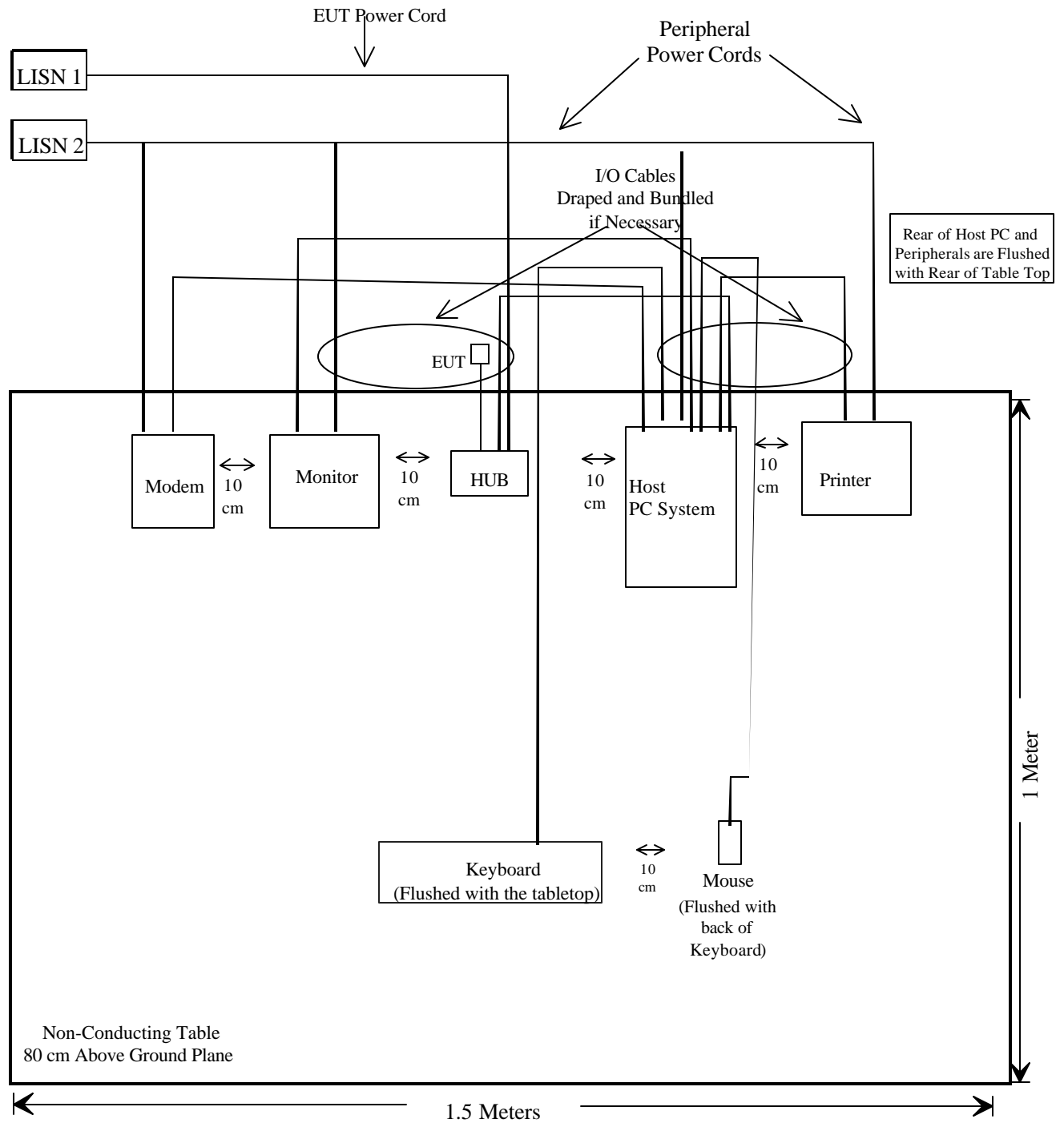
## 2.6 Configuration of Test System

EUT: USB Flash Disk



## 2.7 Test Setup Block Diagram

EUT: USB Flash Disk



### 3 - CONDUCTED EMISSIONS TEST DATA

#### 3.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is  $\pm 2.4$  dB.

#### 3.2 EUT Setup

The measurement was performed at the **Open Area Test Site**, using the same setup per ANSI C63.4 - 1992 measurement procedure. The specification used was with FCC Class B limits.

The EUT was connected with the USB Hub which was connected with the host PC system. The host PC system was placed on the center of the back edge on the test table with the monitor, the Hub and the modem on its left side, and the printer on its right side. The rear of the host PC system and all other peripheral were flushed with the rear of the test table.

The keyboard was put directly in front of the monitor, flushed with the front edge of the test table. The mouse was placed next to the keyboard. The rear of the mouse was flushed and bundled with the rear of the keyboard.

The spacing between the peripherals was 10 centimeters.

External Input / Output cables were draped over edge of the test table and bundle when necessary.

The Hub was connected to 110Vac / 60Hz power adapter.

#### 3.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conduction test:

Start Frequency .....	450 kHz
Stop Frequency .....	30 MHz
Sweep Speed.....	Auto
IF Bandwidth.....	100 kHz
Video Bandwidth .....	100 kHz
Quasi-Peak Adapter Bandwidth.....	9 kHz
Quasi-Peak Adapter Mode.....	Normal



### 3.4 Test Procedure

During the conducted emission test, the power cord of the AC Adapter used by the Hub was connected to the auxiliary outlet of the first LISN. The host PC system, the VGA monitor, all other support equipment power cords were connected to the auxiliary outlet of the second LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dB $\mu$ V of specification limits). Quasi-peak readings are distinguished with a "Qp".

The Hub was tested with the Power Adapter, M/N: SCP 48-62500 to represent worst case results during the final qualification test. Therefore, the configuration was used for final test data recorded in the tables listed in section 3.6 of this report.

### 3.5 Summary of Test Results

According to the data in section 3.6, the EUT: *USB Flash Disk* complied with the FCC Conducted margin for a Class B device and these test results is deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

**-17.4 dBmV at 13.22 MHz in the Neutral mode with the Power Adapter, M/N: SCP 48-62500, 0.45 – 30 MHz.**

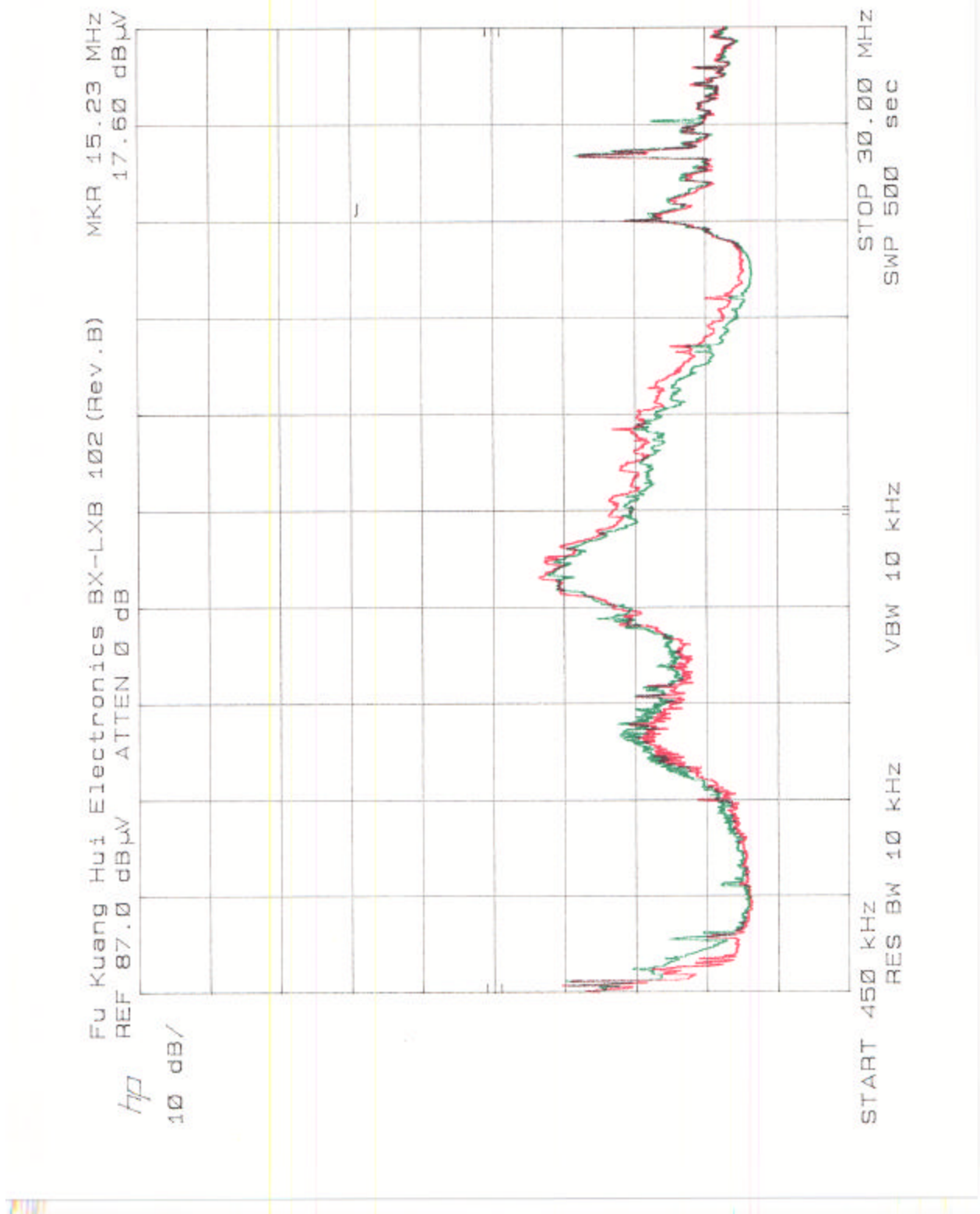
### 3.6 Conducted Emissions Test Data

#### 3.6.1 Test Data Power Adapter, M/N: SCP 48-62500, 0.45 - 30 MHz.

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency	Amplitude	Detector	Phase	Limit	Margin
MHz	dB $\mu$ V	Qp/Ave/Peak	Line/Neutral	dB $\mu$ V	dB
13.22	30.6	QP	Neutral	48	-17.4
13.30	29.3	QP	Line	48	-18.7
0.66	27.5	QP	Neutral	48	-20.5
0.66	26.7	QP	Line	48	-21.3
26.10	25.3	QP	Line	48	-22.7
26.10	24.7	QP	Neutral	48	-23.3

### 3.7 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data with Power Adapter, M/N: SCP 48-62500 is presented hereinafter as reference.



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## 4 - RADIATED EMISSION DATA

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### 4.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is  $\pm 4.0$  dB.

### 4.2 EUT Setup

The radiated emission tests were performed in the open area 10-meter test site, using the setup accordance with the ANSI C63.4 - 1992. The specification used was the EN55022 Class B limits.

The EUT was connected with the USB Hub which was connected with the host PC system. The host PC system was placed on the center of the back edge on the test table with the monitor, the Hub and the modem on its left side, and the printer on its right side. The rear of the host PC system and all other peripheral were flushed with the rear of the test table.

The keyboard was put directly in front of the monitor, flushed with the front edge of the test table. The mouse was placed next to the keyboard. The rear of the mouse was flushed and bundled with the rear of the keyboard.

The spacing between the peripherals was 10 centimeters.

External Input / Output cables were draped over edge of the test table and bundle when necessary.

The Hub was connected to 110Vac / 60Hz power adapter.

### 4.3 Spectrum Analyzer Setup

According to FCC Rules, the system was tested to 1000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Start Frequency .....	30 MHz
Stop Frequency .....	1000 MHz
Sweep Speed.....	Auto
IF Bandwidth.....	100 kHz
Video Bandwidth .....	1 MHz
Quasi-Peak Adapter Bandwidth.....	120 kHz
Quasi-Peak Adapter Mode.....	Normal
Resolution Bandwidth.....	1MHz

#### 4.4 Test Procedure

For the radiated emissions test, the power cord of AC adapter, the host system, VGA monitor and all support equipment was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT is compliant with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dBμV of specification limits), and are distinguished with a "Qp" in the data table.

#### 4.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

#### 4.6 Summary of Test Results

According to the data in section 4.7, the EUT: *USB Flash Disk*, complied with the FCC Class B standards and these test results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, and had the worst margin of:

**-7.1 dBmV at 336 MHz in the Vertical polarization, 30 – 1000MHz, 3 meters**

## 4.7 Radiated Emissions Test Data

### 4.7.1 Final Test Data, 30 – 1000MHz, 3 meters

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC CLASS B	
Frequency MHz	Ampl. dBμV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
336	43.1	45	1.2	V	15.4	5.4	25	38.9	46.0	-7.1
120	44.2	180	1.2	V	12.1	3.4	25	34.7	43.5	-8.8
144	42.7	90	2	H	13.2	3.6	25	34.5	43.5	-9.0
144	41.8	180	1.2	V	13.2	3.6	25	33.6	43.5	-9.9
416	38.7	0	1.8	V	15.8	5.8	25	35.3	46.0	-10.7
48.00	40.8	120	1.2	V	11.3	2.2	25	29.3	40.0	-10.7
120	42.2	200	2	H	12.1	3.4	25	32.7	43.5	-10.8
192	38.7	270	1.2	V	14.4	4.3	25	32.4	43.5	-11.1
240	43.1	240	1.5	V	11.3	4.6	25	34.0	46.0	-12.0
376	38.0	30	1.5	V	14.9	5.7	25	33.6	46.0	-12.4
40	38.3	320	2	H	12.1	1.9	25	27.3	40.0	-12.7
528	32.8	200	1.8	H	18.5	6.6	25	32.9	46.0	-13.1
168	38.2	180	1.2	V	13.3	3.8	25	30.3	43.5	-13.2
240	41.4	90	1.5	H	11.3	4.6	25	32.3	46.0	-13.7
288	39.2	200	1.2	H	12.6	4.9	25	31.7	46.0	-14.3