

FCC Part 15 Subpart C
EMI TEST REPORT

of

E.U.T. : 18" LCD Pen Tablet System

FCC ID. : HV4PL800

MODEL: PL-800

Working Frequency: 531.25 kHz(CH1),
562.50 kHz(CH2),
593.75 kHz(CH3)

Issued Dated: Apr. 12, 2002

for

APPLICANT : Wacom Co., Ltd.

ADDRESS : 2-510-1 Toyonodai, Otone-machi, Kitasaitama-gun,
Saitama 349-1148, Japan

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN
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Report Number : ET91S-03-196

TEST REPORT CERTIFICATION

Applicant : Wacom Co., Ltd.
2-510-1 Toyonodai, Otone-machi, Kitasaitama-gun, Saitama 349-1148, Japan

Manufacturer : GBM Ray System Technology Inc.
3F-7, No. 102, Chung Shan Rd., Sec. 3, Chung Ho City, Taipei Hsien, Taiwan,
R. O. C.

Description of EUT :

a) Type of EUT : 18" LCD Pen Tablet System
b) Trade Name : WACOM
c) Model No. : PL-800
d) FCC ID : HV4PL800
e) Working Frequency : 531.25 kHz, 562.50 kHz, 593.75 kHz
f) Power Supply : AC100~240V

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C (2001)

I HEREBY CERTIFY THAT; The data shown in this report were made in accordance with the procedures given in ANSI C63.4 and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note: 1. The results of the testing report relate only to the items tested.
2. The testing report shall not be reproduced except in full, without the written approval of ETC.

Test Date : Mar. 28, 2002

Test Engineer : 

Approve & Authorized
Signer : 

Win-Po Tsai, Manager, NVLAP Signatory
EMC Dept. I of ELECTRONICS
TESTING CENTER, TAIWAN

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1. GENERAL INFORMATION

1.1 Product Description

a) Type of EUT	: 18" LCD Pen Tablet System
b) Trade Name	: WACOM
c) Model No.	: PL-800
d) FCC ID	: HV4PL800
e) Working Frequency	: 531.25kHz, 562.50kHz, 593.75kHz
f) Power Supply	: AC100~240V

1.2 Characteristics of Device:

PL-800 is an input/ output integrated device for a computer, using Wacom' s sensor, an erasing UltraPen and a 18.0 inch TFT color Monitor.

The tablet continuously transmits data to and from a UltraPen.

When transmitting, the tablet sends a signal to the UltraPen. The UltraPen stores energy from the signal.

When receiveing, the UltraPen sends a signal that carries coordinated, switch, and pressure data back to the tablet. The tablet sends this data to the computer.

PL-800 provides a Pen computing.

1.3 Test Methodology

Radiated testing were performed according to the procedures in chapter 13 of ANSI C63.4.

The 18" LCD Pen Tablet System under test was operated continuously in its normal operating mode for the purpose of the measurements. In order to secure the continuous operation of the device under test, rewiring in the circuit was done by the manufacturer so as to affect its intended operation.

The receiving antenna was varied from 1 to 4 meters and the wooden turntable was rotated through 360 degrees to obtain the highest reading on the field strength meter or on the display of the spectrum analyzer. And also, each emission was to be maximized by changing the orientation of the 18" LCD Pen Tablet System under test. The hand-held or body-worn devices rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relatives to the limit.

1.4 Test Facility

The semi-anechoic chamber and conducted measurement facility used to collect the radiated and conducted data are located inside the Building at No.8, Lane 29, Wen-ming Road, Lo-shan Tsun, Kweishan Hsiang, Taoyuan, Taiwan, R.O.C.

This site has been accreditation as a FCC filing site.

2. DEFINITION AND LIMITS

2.1 Definition

Intentional radiator:

A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.25
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

Remark “**” : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.3 Limitation

(1) Conducted Emission Limits :

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the conducted limit is the following:

Frequency (MHz)	Emission (μ V)	Emission (dB μ V)
0.45 - 30.0	250	48.0

(2) Radiated Emission Limits:

According to 15.209 the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Frequency (MHz)	Distance Meters	Radiated $\mu\text{V/m}$	Radiated $\text{dB}\mu\text{V/m}$
0.490-1.705	30	24000/F (kHz)	20 Log (24000/F)
1.705-30	30	30	29.5
30-88	3	100	40.0
88-216	3	150	43.5
216-960	3	200	46.0
Above 960	3	500	54.0

As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

3. RADIATED EMISSION MEASUREMENT

3.1 Applicable Standard

1. The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in Section 15.209.

3.2 Devices for Tested System

Description	Model	Manufacturer	Cable
18" LCD Pen Tablet System *	PL-800	GBM Ray System Technology Inc.	Signal Cable: 2.0 m, Unshielded with core *2 Power Cable, Unshielded/ Adaptor I/O: 1.8m, Unshielded O/P: 1.5m, Unshielded with core
Notebook PC	L7300	ASUS	Power cable:3.3m, Unshielded/ Adaptor

“*” -- Equipment Under Test

3.3 Measurement Procedure

a. Below 30MHz

1. Setup the configuration per figure 1 for frequencies measured below 30MHz. Turn on EUT and make sure that it is in normal function.
2. For emission frequencies measured is performed in a OATS.
3. For emission measured, set the spectrum analyzer on a 9 kHz resolution bandwidth respectively for fundamental frequency measured in step 2.
4. Change the orientation of EUT on the table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the EMI test receiver. Rotate Loop Antenna over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the EMI test receiver. Vary the Loop Antenna height and record the highest value as a final reading. The Loop Antenna is to be raised and lowered over a range from 1 to 1.8m.
5. Repeat step 4 until all frequencies that need to be measured were complet.

b. Above 30MHz and below 1GHz

1. Setup the configuration per figure 2 for frequencies measured above 30 MHz and below 1 GHz. Turn on EUT and make sure that it is in normal function.
2. For emission frequencies measured is performed in a semi-anechoic chamber.
3. For emission measured, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer ~~analyzed~~ then change the orientation of EUT on test table over a range from 0 a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
5. Repeat step 4 until all frequencies that need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the frequencies of highest emission with varying the placement of cables (if any) associated with EUT to obtain the worse case and record the result.

Figure 1: Below 30 MHz OATS Setup Diagram

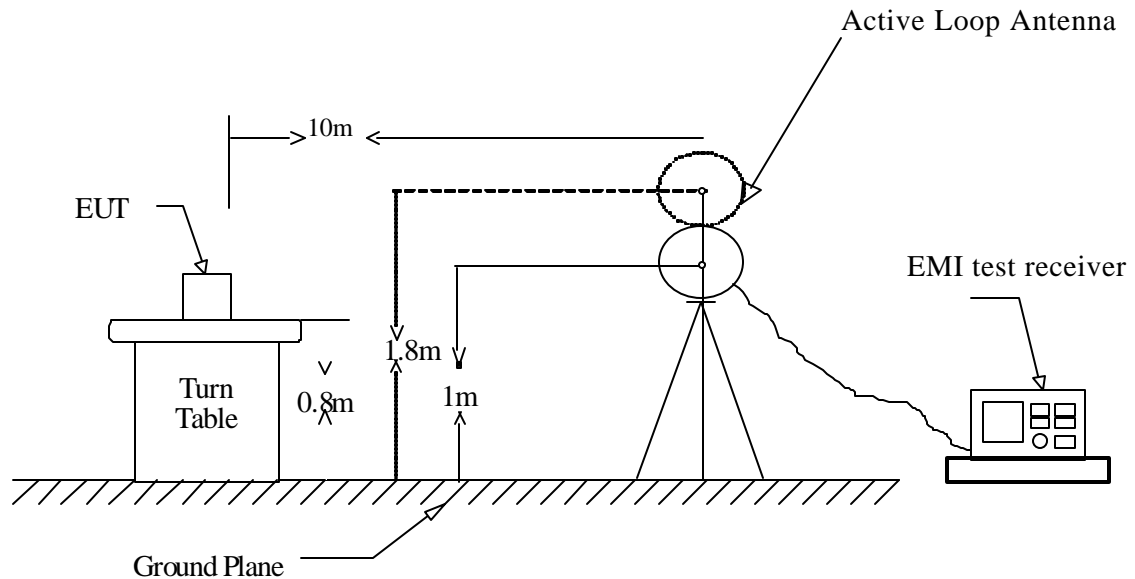
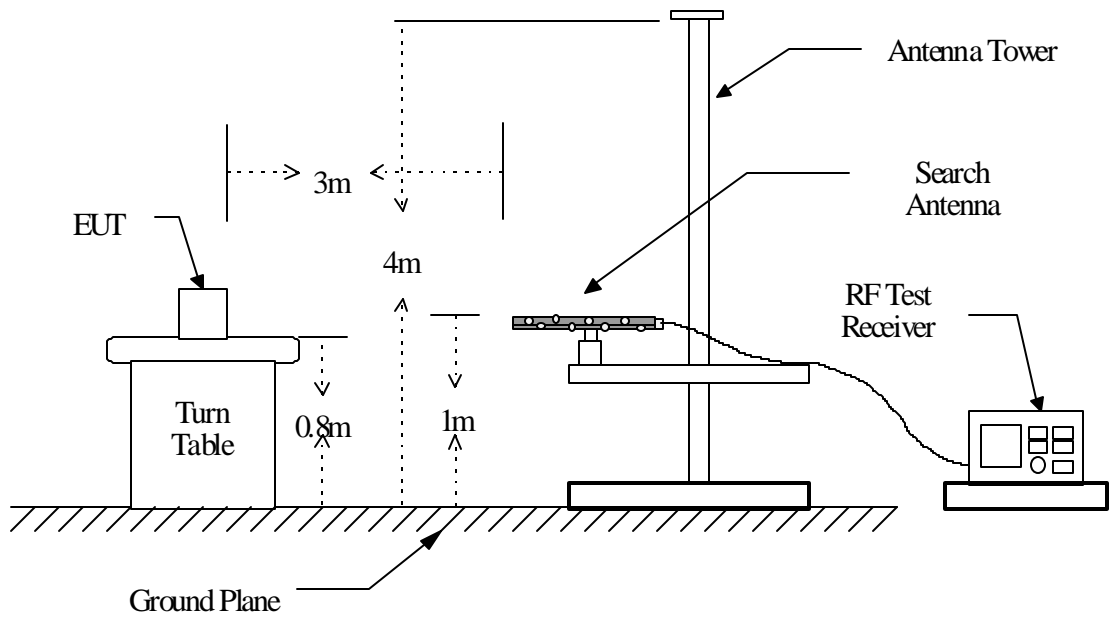


Figure 2: Above 30 MHz chamber Setup Diagram



3.4 Test Data

Data 1: Fundamental & Harmonics

Temperature : 20
 Humidity : 69%
 Test Date : Mar. 28, 2002
 EUT Operation : CH 2

Frequency (kHz)	Reading (dBuV) Peak	Correct Factor (dB)	Result @10m (dBuV/m) Peak	Limit @10m (dBuV/m) Q.P.	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
562.5	25.5	22.9	48.4	62.6	14.2	0	1.0
1125.0	***	17.5	***	41.3	***	***	***
1687.5	***	15.4	***	34.2	***	***	***
2250.0	***	13.5	***	50.0	***	***	***
2812.5	***	11.5	***	50.0	***	***	***
3375.0	***	9.4	***	50.0	***	***	***
3937.5	***	8.3	***	50.0	***	***	***
4500.0	***	7.4	***	50.0	***	***	***
5062.5	***	6.5	***	50.0	***	***	***

Note:

1. Limit on the field strength of fundamental (Average)
 $50\text{mV/m} = 20 \times \log(50000) = 94.0 \text{ dB } \mu \text{ V/m}$
2. Limit on the field strength of Harmonics(Average)
 $500 \mu \text{ V/m} = 20 \times \log(500) = 54.0 \text{ dB } \mu \text{ V/m}$
3. If the measured frequencies fall in the restricted frequency band, the limit employed is § 15.209 general requirement when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function, no duty factor applied.
4. The radiation emissions have been measured to beyond the tenth harmonic of the fundamental frequency and show the significant frequencies, other means the value is too low to be detected.
5. If the data table appeared symbol of “***” means the value is too low to be measured.

Data 2: Other emissions

Temperature : 20
 Humidity : 69%
 Test Date : Mar. 28, 2002
 EUT Operation : CH 2

Frequency (MHz)	Ant Pol H/V	Reading (dBuV) Peak	Correct Factor (dB)	Result @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Q.P.	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
64.710	V	26.0	9.6	35.6	40.0	-4.4	200	1.4
105.960	V	29.8	9.8	39.6	43.5	-3.9	180	1.0
109.540	H	29.5	9.8	39.3	43.5	-4.2	180	1.0
119.240	H	28.1	9.8	37.9	43.5	-5.6	160	1.0
123.838	H	21.9	9.8	31.7	43.5	-11.8	164	2.0
473.290	H	15.9	23.4	39.3	46.0	-6.7	200	1.5
475.230	V	20.3	23.4	43.7	46.0	-2.3	180	1.4
703.180	H	13.0	29.0	42.0	46.0	-4.0	180	1.0
703.180	V	13.6	29.0	42.6	46.0	-3.4	180	1.0
788.540	V	10.6	31.4	42.0	46.0	-4.0	180	1.0
902.030	V	6.5	33.3	39.8	46.0	-6.2	180	1.0
909.790	H	6.9	33.3	40.2	46.0	-3.8	180	1.0

Note:

1. AH means antenna height, DRT means degrees of rotation of turntable.
2. If the data table appeared symbol of “***” means the value is too low to be measured.
3. The system amplitude accuracy of the measurement made during the radiated emission tests was ± 4 dB.

3.5 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:

$$\mathbf{RESULT = READING + CORR. FACTOR}$$

where CORR. FACTOR = Antenna FACTOR + Cable FACTOR

Assume a receiver reading of 22.5 dB μ V is obtained. The Antenna Factor of 14.5 and a Cable Factor of 1.5 is added. The total of field strength is 38.5 dB μ V/m.

$$\text{RESULT} = 22.5 + 14.5 + 1.5 = 38.5 \text{ dB } \mu \text{ V/m}$$

$$\begin{aligned} \text{Level in } \mu \text{ V/m} &= \text{Common Antilogarithm}[(38.5 \text{ dB } \mu \text{ V/m})/20] \\ &= 84.14 \mu \text{ V/m} \end{aligned}$$

3.6 Radiated Test Equipment

The following instrument are used for radiated emissions measurement:

Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
EMI Test Receiver	Hewlett-Packard	8546A	13054404-001	Jun. 20, 2002
LogBicone Antenna	Schwarzbeck	VULB9160	13057310-001	Oct. 18, 2002
Loop Antenna	EMCO	6512	13054104-001	Mar. 25, 2003
Pre Amplifier	Advantest	BB525C	13040708-001	Mar. 25, 2003

Note: The standards used to perform this calibration are traceable to NML/ROC, NIST/USA and NPL.

3.7 Measuring Instrument Setup

Explanation of measuring instrument setup in frequency band measured is as following:

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	EMI Test Receiver	Quasi Peak	120 kHz	300 kHz
		Peak	120 kHz	300 kHz
Below 30	EMI Test Receiver	Quasi-Peak	9 kHz	30 kHz
		Peak	9 kHz	30 kHz

3.8 Radiated Measurement Photos



4. CONDUCTED EMISSION MEASUREMENT

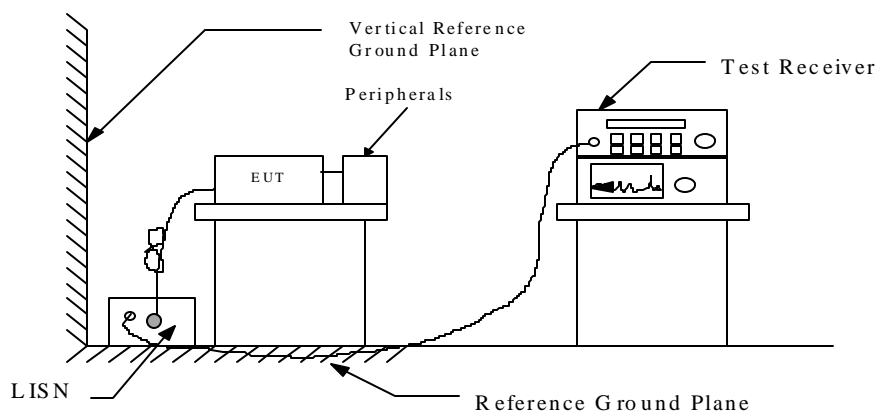
4.1 Applicable Standard

For unintentional digital devices, Line Conducted Emission Limits are in accordance to § 15.107(a) . And according to § 15.107(e), an alternative to the conducted limits is CISPR 22.

4.2 Measurement Procedure

1. Setup the configuration per figure 3.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 4 to 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 3 : Conducted emissions measurement configuration



4.3 Conducted Emission Data

Temperature : 20
 Humidity : 69%
 Test Date : Mar. 28, 2002
 EUT Operation : CH 2

Emission Frequency (MHz)	Meter Reading (dBuV)		CORR'd Factor (dB)	Results (dBuV)		Limit (dBuV)	Margins (dB)
	L1	L2		L1	L2		
6.402	36.7	37.4	0.2	36.9	37.6	48.0	-10.4
6.750	36.9	38.6	0.2	37.1	38.8	48.0	-9.2
8.508	39.0	38.7	0.3	39.3	39.0	48.0	-8.7
9.035	37.6	38.9	0.3	37.9	39.2	48.0	-8.8
10.766	38.8	38.7	0.4	39.2	39.1	48.0	-8.8
13.117	36.4	37.3	0.4	36.8	37.7	48.0	-10.4
24.019	33.3	33.7	0.5	33.8	34.2	48.0	-13.8

Note :

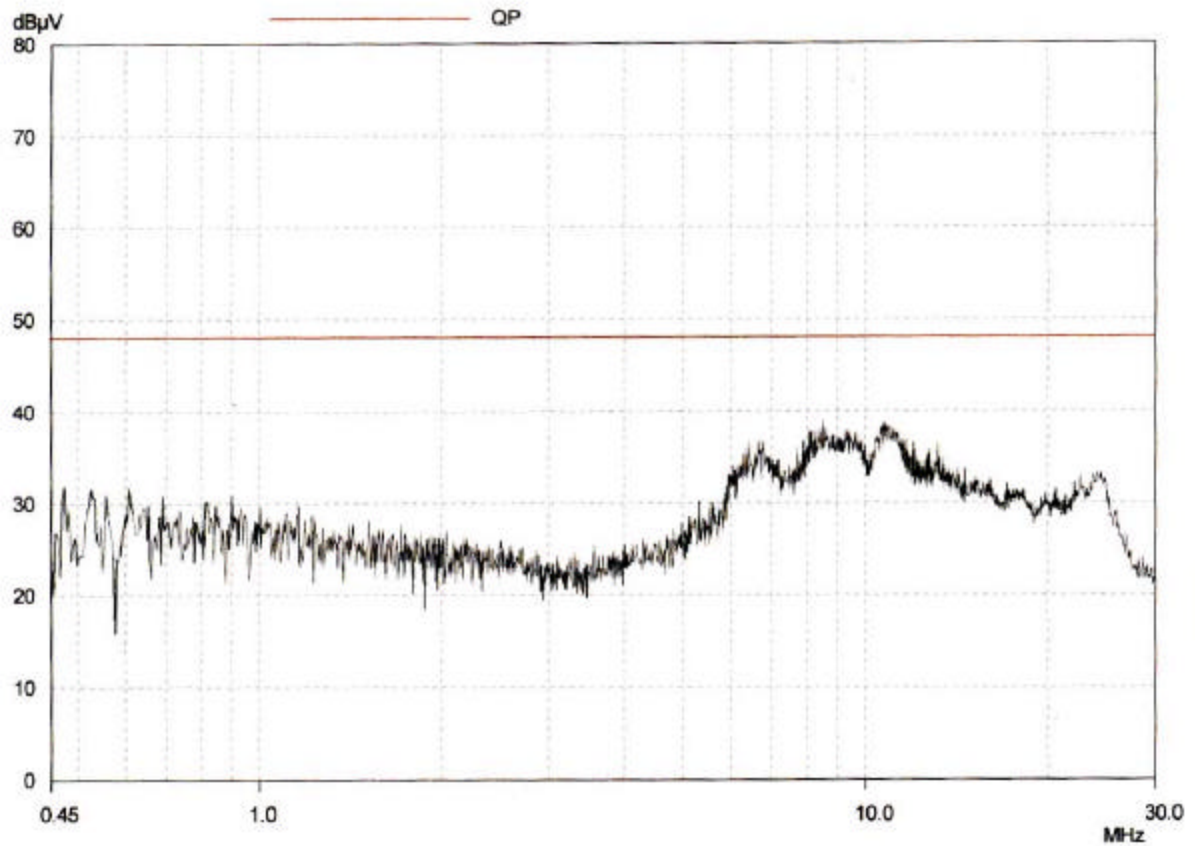
1. The full frequency range scanning test data is shown in next two pages.
2. If the data table appeared symbol of “****” means the value is too low to be measured.
3. The system amplitude accuracy of the measurement made during the radiated emission tested was ± 3 dB.

Graphic of Conducted Emission 1

**Conducted Emission
Peak Value**

EUT: LCD TABLET
Manuf:
Op Cond: Working
Operator: Andy Kuo
Test Spec: FCC Class B
Comment: L1

Prescan Measurement: Detector: X PK
 Meas Time: see scan settings
 Peaks: 8
 Acc Margin: 10 dB

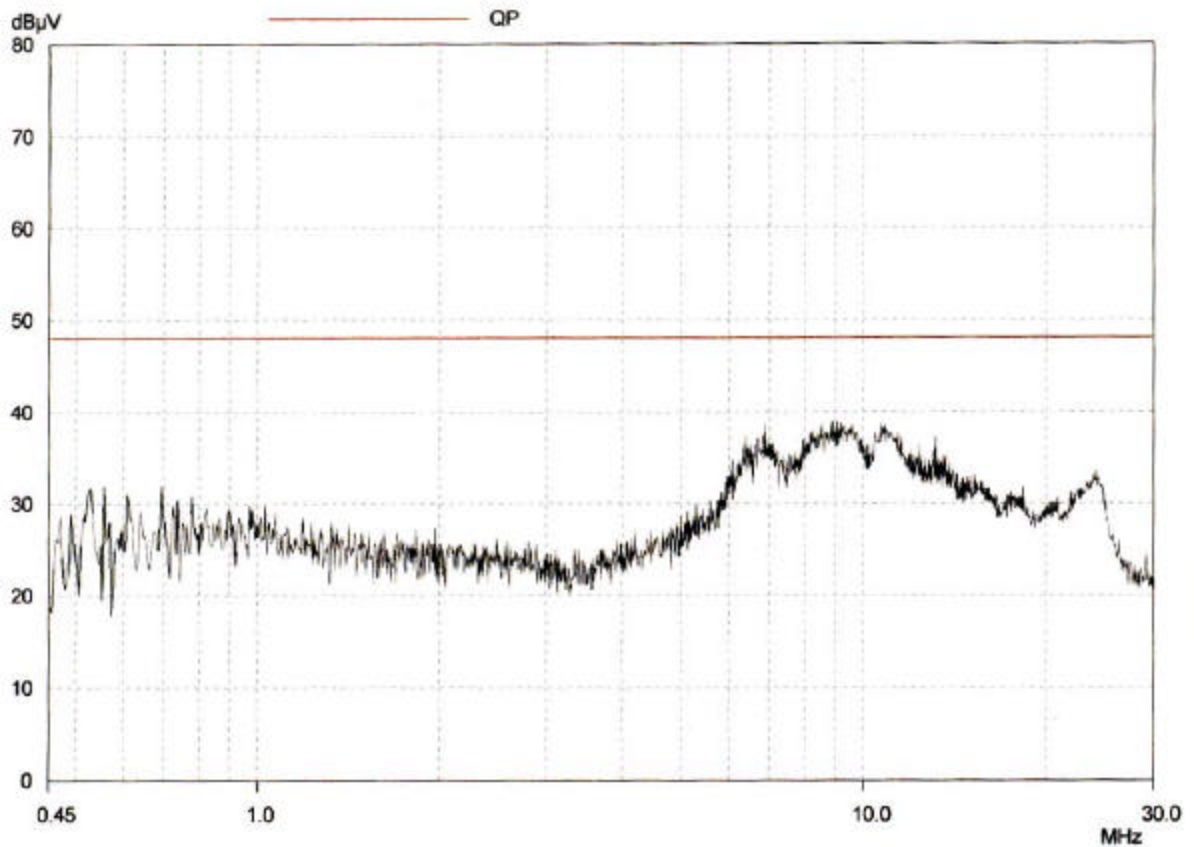


Graphic of Conducted Emission 2

Conducted Emission Peak Value

EUT: LCD TABLET
Manuf:
Op Cond: Working
Operator: Andy Kuo
Test Spec: FCC Class B
Comment: L2

Prescan Measurement: Detector: X PK
 Meas Time: see scan settings
 Peaks: 8
 Acc Margin: 10 dB



4.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

$$\mathbf{RESULT = READING + LISN FACTOR}$$

Assume a receiver reading of 22.5 dB μ V is obtained, and LISN Factor is 0.1 dB, then the total of field strength is 22.6 dB μ V.

$$\text{RESULT} = 22.5 + 0.1 = 22.6 \text{ dB } \mu \text{ V}$$

$$\begin{aligned} \text{Level in } \mu \text{ V} &= \text{Common Antilogarithm}[(22.6 \text{ dB } \mu \text{ V})/20] \\ &= 13.48 \mu \text{ V} \end{aligned}$$

4.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test .

Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
EMI Test Receiver	Rohde and Schwarz	ESH30	13054409-001	Sep.18,2002
Line Impedance Stabilization Network	EMCO	3825	13057704-001	Oct. 27, 2002
Line Impedance Stabilization Network	Telemeter	NNB-2/ 16Z	13057706-001	Apr.04,2002
Printer	Hewlett-Packard	970Cxi	----	N/A

Note: The standards used to perform this calibration are traceable to NML/ROC and NIST/USA.

4.6 Photos of Conduction Measuring Setup

