

EMC TEST REPORT VERIFICATION OF DIGITAL DEVICE

for

WACOM Co., Ltd.

2-510-1, Toyonodai, Otone-machi, Kitasaitama-gun, Saitama 349-1148, JAPAN

Equipment Under Test: LCD Tablet, I/F Board
(model name : PL-400, PB-MAX)
Category: Part 15 Sub.part C Class B Digital Device
Token Report No.: T6T988302
Date of Issue: September 03, 1998


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Manager, Tsukuba Testing Lab.
Token EMC Engineering Co., Ltd.

-- ATTENTION --

The test results in this report relate only to the following EUTs, and this report shall not be reproduced except in full, without the written approval of the laboratory.

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1 DESCRIPTION OF DEVICE

- A) Kind of Equipment : LCD Tablet, I/F Board
- B) FCC ID : None
- C) Model Name : PL-400, PB-MAX
- D) Serial No. : ES03, ES1-25
- E) Type of Sample Tested : Pre-production
- F) High Frequency Used :
< LCD Tablet >
562.50kHz, 531.25kHz, 593.75kHz (Analog IC clock)
2MHz, 16MHz (X'tal clock)
52kHz, 250kHz (DC/DC converter clock)
45.45kHz (Back light inverter clock)

< I/F Board >
14.3181MHz (X'tal clock)
- G) Rating Power Supply : 1phase AC100V ~ 240V, Max 0.2A, 50/60Hz
- H) Tested Power Supply : 1phase AC120V, 60Hz
- I) Date of Manufacture : May 1998
- J) Manufacturer :
< LCD Tablet >
WACOM Co., Ltd.
2-510-1, Toyonodai, Otone-machi, Kitasaitama-gun,
Saitama 349-1148, JAPAN

< I/F Board >
I-O DATA DEVICE Inc.
24-1, Sakurada-machi, Kanazawa-shi, Ishikawa
920-8512, JAPAN

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Kazuyoshi Takao, Engineer

K) Description of the marketed and available configuration:

1. The interface cable such that the digital video signal (LVDS), the tablet interface signal and the power source for the LCD unit and tablet are integrated.
2. The split cable that divides the lines from the interface board into video connector for CRT monitor, RS-232C connector for connection to a computer and power jack.
3. A universal AC adapter that takes any AC voltage between 100V to 240V to supply 15V DC power source, aluminum plate control.

- L) Description of Operating :
1. LCD Signal Digital I/F
 2. All "H" display
 3. Communication speed 9600bps
 4. All "H" print out

M) Date of Sample Received : August 24, 1998

N) Test Engineer : Kazuyoshi Takao

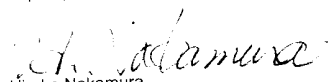
2 TEST FACILITY

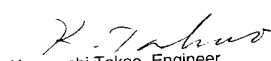
The open field test site and conducted measurement facility are used for this measurement, where is located following address. This site was fully described in a report dated Jan.31,1994, that was submitted to the FCC. And we had accepted in a letter dated Apr.8,1994 (31040/SIT). This laboratory is accredited by NVLAP for NVLAP Lab. Code : 200221-0.

Tokin EMC Engineering Co., Ltd.
Tsukuba Testing Laboratory, Open Field Test Site No.6 and Shielded Room No.2.

Address : 28-1, Kitahara-aza, Hanashimashinden-ohaza, Tsukuba-city, Ibaragi 305-0875, Japan

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3 SUMMARY OF RESULTS

3.1 Electromagnetic Emission

RFI Voltage Measurement **PASS**

RFI Field Strength Measurement **PASS**

Although the measured emissions indicate that the EUT complies with the required limits, some measurements are close to these limits. When the uncertainty of measurement is considered, there is some possibility that the EUT may not be compliant.

Test results are traceable to JQA, MKK and NIST.

3.2 Modifications to The EUT

This EUT was taken countermeasures.

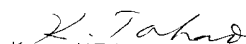
4 TESTED SYSTEM DETAILS

4.1 Peripherals and Others :

Description	Model Name	Serial No.	Manufacturer	FCC ID
Personal Computer	DESKPRO 2000	7808BK530058	Compaq Computer Corp.	Doc
Keyboard	Enhanced II Keyboard	108195730790	Compaq Computer Corp	ACJ8D7109232
Printer	J250	430091101326	STAR MICRONICS AMERICA Inc.	B6D8MFJ250
CRT Display	MA-1791	75172068-USF	NANAO Corporation	GCJMA-1791
AC Adapter	SWA1502W	9746Z	TAMURA Corporation	None
Mouse	M-S34	B04AB0H5BEX 0NGP	Compaq Computer Corp.	DZL211029

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4.2 Type of Used Cables :

Description	Length	Ferrite core	Type of shield	Connectors
I/F cable	2.8m	1turn	Double braided	Metal cover
Split cable	0.38m	3turn	Double braided	Plastic cover
Parallel cable	1.8m	None	Double braided	Plastic cover
RGB cable	1.8m	1turn x 2	Double braided	Plastic cover
AC cable (PC)	2.0m	None	Single braided	Plastic cover
AC cable (CRT)	2.0m	None	Single braided	Plastic cover
AC cable (AC Adapter)	2.0m	None	Single braided	Plastic cover

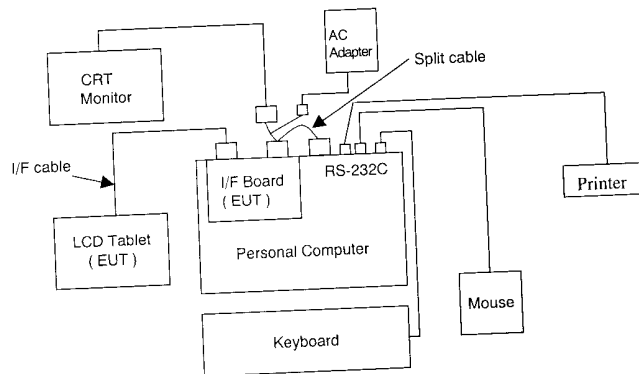


Figure 4-1 System Configuration Diagram

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5 TECHNICAL COUNTERMEASURE

- 5-1 It is covered Metal shield case.
- 5-2 Insert ferrite ring model ESD-SR-15 made from Tokin for DC cable of split cable.
- 5-3 Insert ferrite ring model BP53RB120070150M made from TAIYO YUDEN for I/F cable inside PL-400.

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6 TEST RESULTS

6.1 RFI Voltage Measurement

6.1.1 Measurement Instrumentation Used

(model/serial no./manufacturer/Tokin control no./last calibration/next calibration)

Field strength meter (ML428B/M17124/Anritsu/RE013/22 Jun.'98/Jun.'99)

L.I.S.N. (KNW-407/8-578-15/Kyoritsu/LI012/20 Aug.'98/Aug.'99)

Spectrum analyzer (TR4135/77800139/Advantest/SP013/24 Jul.'98/Jul.'99)

Coaxial cable..... (---/---/---/DK125/24 Feb.'98/Feb.'99)

Shielded Room (Tsukuba No.2-S/---/Tokin/SA017/---/---)

6.1.2 Measurement Procedure

The power line conducted interference measurements were performed according to ANSI C63.4-1992 in a shielded enclosure No.2 with peripherals placed on a table, 0.8m high over a metal floor. It was located more than required distance away from the shielded enclosure wall. Deviations from the standard was none.

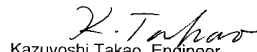
The EUT was plugged into the LISN and the frequency range of interest scanned.
Reported are maximized emission levels.

6.1.3 Measurement Uncertainty

Measurement uncertainty of RFI Voltage Measurement test was estimated at $\pm 1.8\text{dB}(k=2)$.

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6.1.4 Test Data

Table 6.1-1 RFI Voltage Measurement Results

Operating mode: 1. LCD Signal Digital I/F

2. All "H" display

3. Communication speed 9600bps

4. All "H" print out

Test procedure: ANSI C63.4-1992

Date of measurement: August 24, 1998

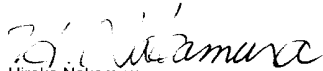
EUT: LCD Tablet

Temperature: 23 degree C

Humidity: 59 %

	Frequency (MHz)	Level (dBμV)	Total Factor(dB)	Result (dBμV)	Result (μV)	Limit (μV)	Margin (dB)
L1-E	0.536	43.5	0.2	43.7	153.11	250	4.3
	0.745	44.0	0.1	44.1	160.33	250	3.9
	0.860	44.0	0.1	44.1	160.33	250	3.9
	1.060	44.0	0.2	44.2	162.19	250	3.8
	1.170	43.0	0.2	43.2	144.55	250	4.8
	2.760	35.0	0.3	35.3	58.22	250	12.7
N-E	0.536	44.0	0.2	44.2	162.19	250	3.8
	0.745	44.5	0.1	44.6	169.83	250	3.4
	0.860	43.0	0.1	43.1	142.89	250	4.9
	1.060	45.0	0.2	45.2	181.98	250	2.8
	1.170	39.5	0.2	39.7	96.61	250	8.3
	2.760	35.0	0.2	35.2	57.55	250	12.8

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Table 6.1-2 RFI Voltage Measurement Results

Operating mode: 1. LCD Signal Digital I/F
 2. All "H" display
 3. Communication speed 9600bps
 4. All "H" print out

Test procedure: ANSI C63.4-1992
 EUT: I/F Board

Date of measurement: August 24, 1998
 Temperature: 23 degree C
 Humidity: 59 %

	Frequency (MHz)	Level (dBμV)	Total Factor(dB)	Result (dBμV)	Result (μV)	Limit (μV)	Margin (dB)
L1-E	0.486	37.0	0.2	37.2	72.45	250	10.8
	0.600	38.0	0.2	38.2	81.29	250	9.8
	0.713	38.5	0.1	38.6	85.12	250	9.4
	0.828	38.5	0.1	38.6	85.12	250	9.4
	0.940	36.5	0.2	36.7	68.40	250	11.3
	1.056	37.0	0.2	37.2	72.45	250	10.8
	4.590	39.0	0.4	39.4	93.33	250	8.6
N-E	0.486	38.5	0.2	38.7	86.10	250	9.3
	0.600	40.0	0.2	40.2	102.33	250	7.8
	0.713	39.5	0.1	39.6	95.50	250	8.4
	0.828	38.5	0.1	38.6	85.12	250	9.4
	0.940	35.0	0.2	35.2	57.55	250	12.8
	1.056	37.0	0.2	37.2	72.45	250	10.8
	4.590	39.0	0.2	39.2	91.21	250	8.8

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6.2 RFI Field Strength Measurement

6.2.1 Measurement Instrumentation Used

(model/serial no./manufacturer/Tokin control no./last calibration/next calibration)

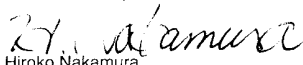
< 0.009MHz ~ 30MHz >

Loop Antenna..... (HFH2-Z2/893503-014/Rohde & Schwarz/AN009/06 May'98/May'99)
Field strength meter (ML428B/M17124/Anritsu/RE013/22 Jun.'98/Jun.'99)
Spectrum analyzer (TR4135/77800139/Advantest/SP013/24 Jul.'98/Jul.'99)
Coaxial cable..... (---/---/---/DK125/24 Feb.'98/Feb.'99)
Shielded Room (Tsukuba No.2-S/---/Tokin/SA017/---/---)

< 30MHz ~ 1000MHz >

Field strength meter (KNM-5002/4N-171-4/Kyoritsu/RE006/01 Oct.'97/Sep.'98)
Frequency converter (KCV-6002/4-248-1/Kyoritsu/RC006/01 Oct.'97/Sep.'98)
Biconical antenna (BBA9106/---/Schwarzbeck/TB006/27 Jul.'98/Jul.'99)
Logperiodic antenna..... (UHALP9108-A/0115/Schwarzbeck/TL021/07 Jul.'98/Jul.'99)
Pre-amplifier (8447D/2727A05431/Hewlett Packard/AM006/12 Mar.'98/Mar.'99)
Spectrum analyzer (R3261A/81720103/Advantest/SP006/27 Jul.'98/Jul.'99)
Coaxial cable..... (---/CL6/---/DK090/31 Jul.'98/Jul.'99)
Open field test site (Tsukuba No.6/---/Tokin/SA006/27 Jul.'98/Jul.'99)

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6.2.2 Measurement Procedure

< 0.009MHz ~ 30MHz >

Final test was performed according to ANSI C63.4-1992 at the shielded room No.2. Deviations from the standard was none.

The EUT was placed in a 0.8m high table along with the peripherals. The EUT was separated from the antenna distance 3meters. Reported are maximized emission levels.

< 30MHz ~ 1000MHz >

Final test was performed according to ANSI C63.4-1992 at the open field test site No.3. Deviations from the standard was none.

The EUT was placed in a 0.8m high table along with the peripherals. The EUT was separated from the antenna distance 3meters. Cables were placed in a position to produce maximum emissions as determined by experimentation, and operation mode was selected for maximum.

The frequencies and amplitudes of maximum emission were measured at varying azimuths, antenna heights and antenna polarities. Reported are maximized emission levels.

6.2.3 Measurement Uncertainty

Measurement uncertainty of RFI Field Strength Measurement test was estimated at $\pm 3.4\text{dB}(k=2)$.

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6.2.4 Test Data

Table 6.2-1 RFI Field Strength Measurement Results (0.009MHz ~ 30MHz)

Operating mode:

1. LCD Signal Digital I/F

2. All "H" display

3. Communication speed 9600bps

4. All "H" print out

Test procedure:

ANSI C63.4-1992

Date of measurement:

August 24, 1998

Temperature:

23 degree C

Humidity:

59 %

Frequency (MHz)	Level (dBμV)	Ant. Factor (dB/m)	Result (dBμV/m)	Result (μV/m)	3 Meter (μV/m)	Margin (dB)
0.531	18.0	20.0	38.0	79.44	453	19.0
0.563	19.0	20.0	39.0	89.13	427	17.5

Class B limit

Radiated Emission - 3 meter distance		
Frequency (MHz)	dBμV/m	μV/m
0.009 ~ 0.490	88.5 ~ 53.8	2400/F(kHz) + 40
0.490 ~ 1.705	53.8 ~ 43.0	2400/F(kHz) + 20
1.705 ~ 30	29.5	30

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Table 6.2-2 RFI Field Strength Measurement Results (30MHz ~ 1000MHz)

Operating mode: 1. LCD Signal Digital I/F
 2. All "H" display
 3. Communication speed 9600bps
 4. All "H" print out

Test procedure: ANSI C63.4-1992

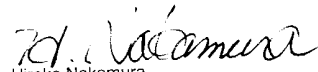
Date of measurement: August 24, 1998
 Temperature: 29 degree C
 Humidity: 46 %

Frequency (MHz)	Level Ver. Hor. (dBμV)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp. Gain (dB)	Result Ver. Hor. (dBμV/m)	Result Ver. Hor. (μV/m)	3 Meter Limit (μV/m)	Margin Ver. Hor. (dB)
33.00	39.0 -	17.0	1.6	27.8	29.8 -	30.91 -	100	10.2 -
36.00	40.0 -	16.5	1.9	27.8	30.6 -	33.89 -	100	9.4 -
39.00	40.0 -	16.2	2.0	27.8	30.4 -	33.12 -	100	9.6 -
42.00	38.0 -	15.3	2.0	27.6	27.7 -	24.27 -	100	12.3 -
47.99	48.0 37.0	12.7	2.2	27.7	35.2 24.2	57.55 16.22	100	4.8 15.8
51.00	48.0 33.0	11.3	2.4	27.6	34.1 19.1	50.70 9.02	100	5.9 20.9
73.73	39.0 -	6.2	3.0	27.6	20.6 -	10.72 -	100	19.4 -
88.76	45.0 44.0	8.3	3.2	27.5	29.0 28.0	28.19 25.12	150	14.5 15.5
131.78	- 37.0	13.9	4.2	27.5	- 27.6	- 23.99	150	- 15.9
233.30	- 29.5	16.6	5.7	26.9	- 24.9	- 17.58	200	- 21.1
260.60	35.0 36.0	17.7	6.1	26.8	32.0 33.0	39.82 44.67	200	14.0 13.0
325.75	42.0 38.0	14.5	6.9	26.9	36.5 32.5	66.84 42.17	200	9.5 13.5
337.59	43.0 37.0	14.6	7.0	27.0	37.6 31.6	75.86 38.02	200	8.4 14.4
349.45	42.0 39.0	14.7	7.1	27.0	36.8 33.8	69.19 48.98	200	9.2 12.2
379.05	40.0 39.0	14.9	7.5	27.1	35.3 34.3	58.22 51.89	200	10.7 11.7
390.90	44.0 47.0	15.0	7.7	27.2	39.5 42.5	94.41 133.36	200	6.5 3.5
453.42	39.5 34.5	16.6	8.4	27.9	36.6 31.6	67.61 38.02	200	9.4 14.4
544.10	43.0 40.0	18.6	9.4	28.4	42.6 39.6	134.90 95.50	200	3.4 6.4
562.66	35.0 38.0	18.7	9.5	28.4	34.8 37.8	54.96 77.63	200	11.2 8.2

Class B limit

Radiated Emission - 3 meter distance		
Frequency (MHz)	dBμV/m	μV/m
30 - 88	40.0	100
88 - 216	43.5	150
216 - 960	46.0	200
> 960	54.0	500

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6.3 Minimum Margin

Table 6.3-1 Minimum Margin

Conducted emission			
LCD Signal Digital I/F All "H" display Communication Speed 9600bps All "H" print out LCD Tablet	operation mode	1.060 MHz,	2.8 dB
Radiated emission			
LCD Signal Digital I/F All "H" display Communication Speed 9600bps All "H" print out	operation mode	544.10 MHz,	3.4 dB

6.4 Sample Calculation

Table 6.4-1 Sample Calculation

The maximum radiating emission can be obtained at the frequency of 544.10 MHz,
 Vertical polarization on operation mode.

Each value at frequency is as follows;

R:	Field strength meter reading	=	43.0	(dBμV)
A:	Antenna factor	=	18.6	(dB/m)
C:	Cable loss	=	9.4	(dB)
G:	Amplifier gain	=	28.4	(dB)

Then radiated emission E(dBμV/m) is ;

$$E = R + A - C - G$$

Therefore, the maximum radiated emission is ;

$$42.6 \text{ (dBμV/m)}$$

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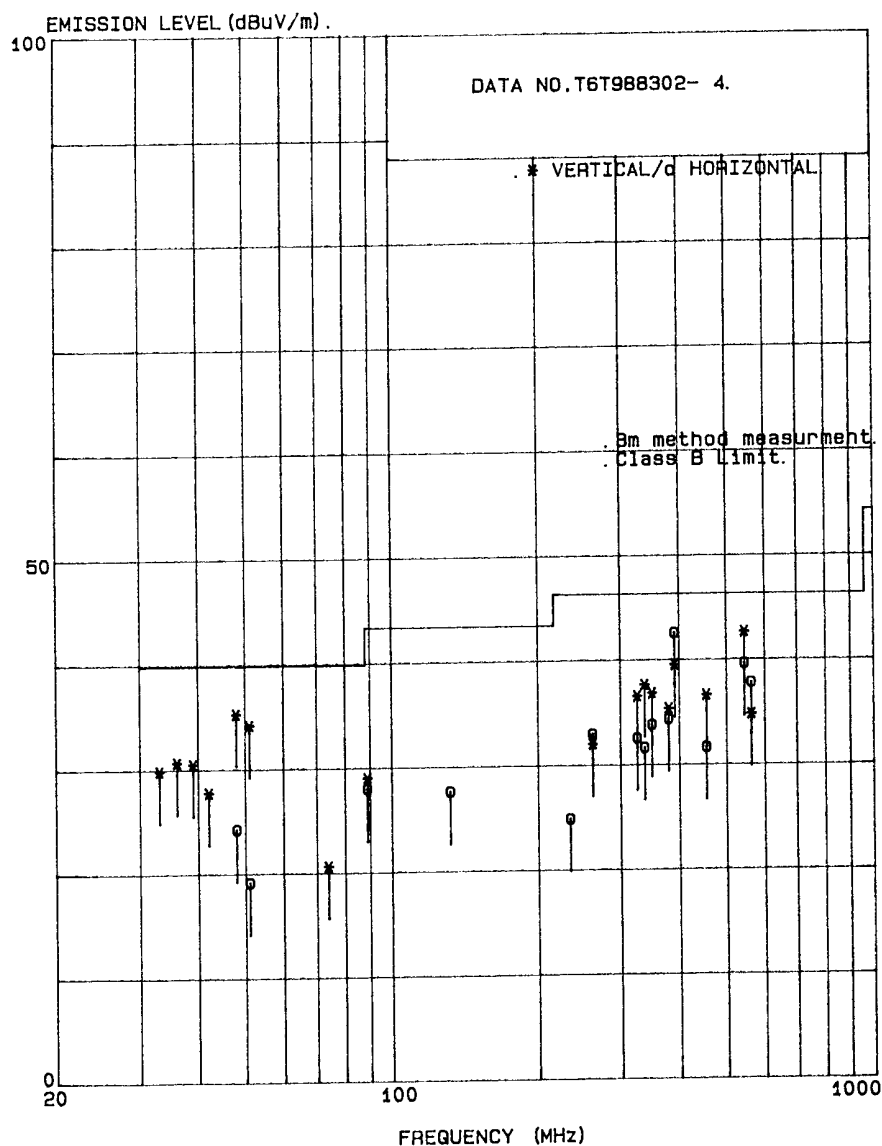


Figure 6.2-2 RFI Field Strength Measurement Results

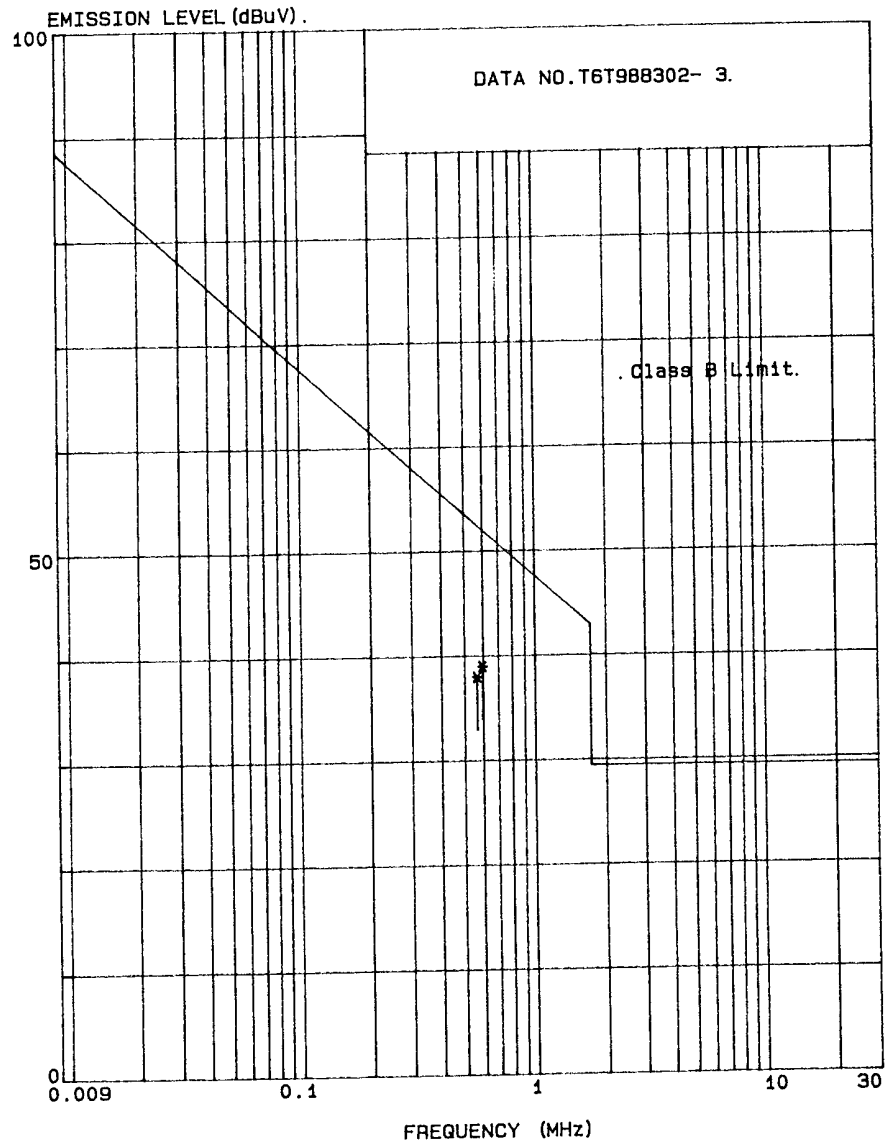


Figure 6.2-1 RFI Field Strength Measurement Results

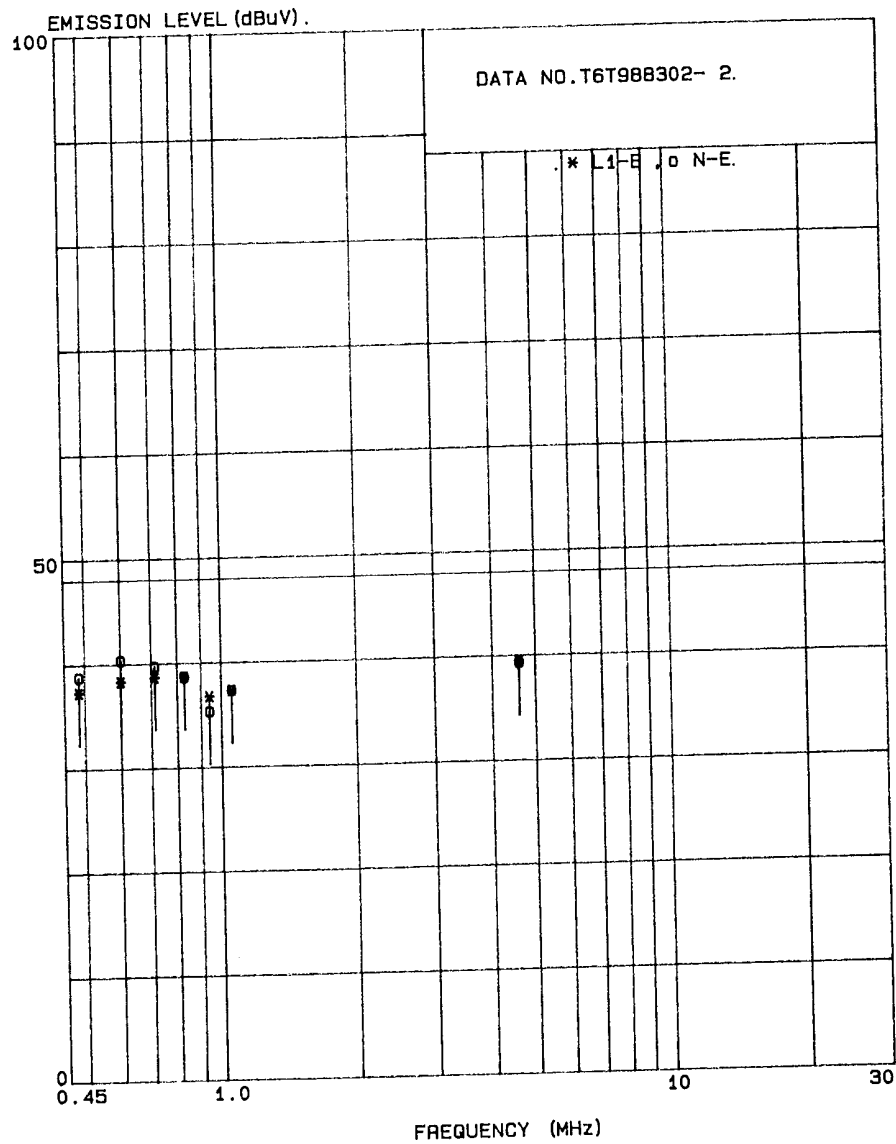


Figure 6.1-2 RFI Voltage Measurement Results

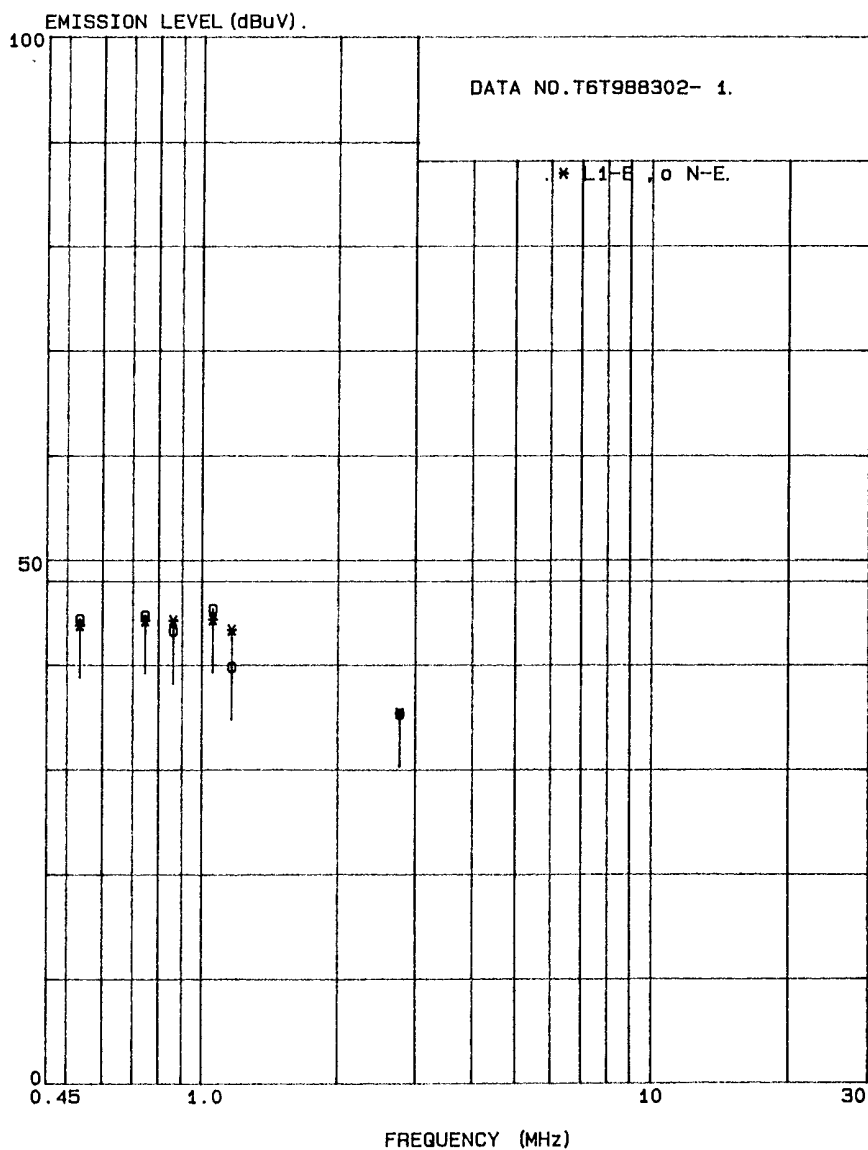


Figure 6.1-1 RFI Voltage Measurement Results