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## EMC TEST REPORT

*for*

**WACOM Co., Ltd.**

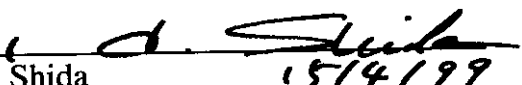
2-510-1, Toyonodai, Otone-machi,  
Kitasaitama-gun, Saitama 349-1148, JAPAN

Equipment Under Test: Digitizer  
model name : GD-1212-U

Category: FCC Part 15 Sub.part C Class B Digital Device

Tokin Report No.: T6G9933919

Date of Issue: April 14, 1999

  
Hiro Shida

15/4/99  
Manager, Tsukuba Testing Lab.  
Tokin 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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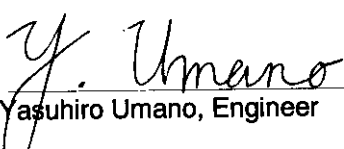
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## **1 DESCRIPTION OF DEVICE**

- A) Kind of Equipment : Digitizer
- B) Model Name : GD-1212-U
- C) Serial No. : 9CJP00001
- D) Type of Sample Tested : Pre-production
- E) High Frequency Used : 18.432MHz, 6MHz ( CPU clock )  
384.0kHz, 460.8kHz ( Operating frequency )
- F) Rating Power Supply : DC+5V, 0.5A
- G) Tested Power Supply : DC+5V, 0.5A from PC  
( PC power supply : 1phase AC120V, 50Hz )
- H) Date of Manufacture : March 1999
- I) Manufacturer : WACOM Co., Ltd.  
2-510-1, Toyonodai, Otone-machi, Kitasaitama-gun,  
Saitama 349-1148, JAPAN
- J) Description of Operating : DISPLAY : ALL H DISPLAY  
USB Communication
- K) Date of Sample Received : March 23, 1999
- L) Test Engineer : Yasuhiro Umano

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Akiko Oyama  
14/Apr./1999

  
Yasuhiro Umano, Engineer

## **2 TEST FACILITY**

The open field test site and conducted measurement facility are used for this measurement, where is located following address. This facility was fully described in a report dated Jan.31, 19994, 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

## **3 SUMMARY OF RESULTS**

### **3.1 Electromagnetic Emission**

RFI Voltage Measurement ..... **PASS**

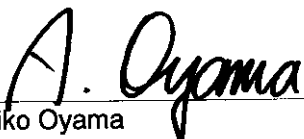
RFI Field Strength Measurement ..... **PASS**

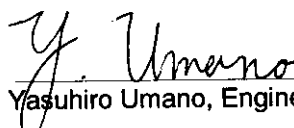
Although the measured emissions indicate that the EUT complies with the required limits, some measurements are close to these limits. When the uncertainty of measurement is considered, there is some possibility that the EUT may not be compliant.

Test results are traceable to JQA, MKK and NIST.

**3.2 Modifications to The EUT :**      This EUT had taken countermeasures.

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Akiko Oyama  
14/Apr./1999

  
Yasuhiro Umano, Engineer

## 4 TESTED SYSTEM DETAILS

### 4.1 Peripherals and Others :

| Description | Model Name           | Serial No.     | Manufacturer              | FCC ID              |
|-------------|----------------------|----------------|---------------------------|---------------------|
| PC          | DP2000<br>5166MMXJPN | 7725BK         | Compaq                    | DoC                 |
| Display     | 9060S                | 56475129 S-US  | Nanao                     | GCI9060             |
| Mouse       | M-S34                | None           | Compaq                    | DZL211029           |
| Printer     | J250                 | 4300911101326  | Star Micronics<br>America | B6Z8MFJ250          |
| Modem       | T1200-SD2            | S87309509      | Omnitel                   | D786JC<br>T1200-SD2 |
| Keyboard    | None                 | B07020A39EY2Y5 | Compaq                    | AQ6-72BC15          |
| CCD camera  | LPC-U20              | None           | LG                        | DoC                 |

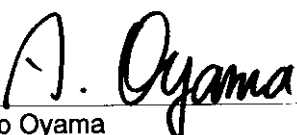
### 4.2 Type of Used Cables :

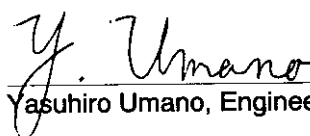
| Description       | Length  | Type of shield | Model name  | Manufacturer |
|-------------------|---------|----------------|-------------|--------------|
| Display AC cable  | 2.2m    | Non-shielded   | None        | Nanao        |
| Display I/F cable | 1.8m    | Shielded       | V20         | Nanao        |
| PC AC cable       | 2.0m    | Shielded       | None        | Compaq       |
| Printer cable     | 1.8m    | Shielded       | None        | None         |
| Modem I/F cable   | 1.5m    | Shielded       | C232N-J3115 | Elecom       |
| Modular cable     | 1.0m x2 | Non-shielded   | None        | None         |
| USB cable         | 1.5m    | Non-shielded   | None        | LG           |

## 5 TECHINICAL COUNTERMEASURE

| Parts number       | Description  | Circuit sign                                | Quantity | Maker                          |
|--------------------|--------------|---------------------------------------------|----------|--------------------------------|
| BLM11A601S         | Coil         | F 1,2,3,4,5,6,7,201,202,<br>203,204,205,206 | 13       | Murata manufacturing co., ltd. |
| PLP3216S551SL2     | Coil         | F 101                                       | 1        | Murata manufacturing co., ltd. |
| F6 RH 6.4x10.0x3.2 | Ferrite core |                                             | 1        | Ferrico corp.                  |
| CU7636R            | Copper tape  |                                             | 1        | Sony chemicals corporation     |
| 97-606-01          | Clip finger  |                                             | 1        | Kitagawa industries co., ltd.  |

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 Akiko Oyama  
 14/Apr./1999

  
 Yasuhiro Umano, Engineer

## 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 ..... ( FCKL1528/1528124/Schwarzbeck/RE039/02 Oct.'98/Oct.'99 )

L.I.S.N. .... ( KNW-407/8-578-14/Kyoirtsu/LI012/31 Aug.'98/Aug.'99 )

Spectrum analyzer ..... ( TR4135/67800030/Advantest/SP014/29 Sep.'98/Sep.'99 )

Coaxial cable..... ( ---/---/---/DK125/02 Mar.'98/Mar.'99 )

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

#### 6.1.2 Measurement Procedure

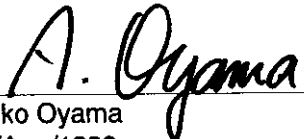
The power line conducted interference measurements were performed according to ANSI C63.4-1992 in a shielded enclosure No.2 with peripherals placed on a table, 0.8m high over a metal floor. It was located more than required distance away from the shielded enclosure wall. Deviations from the standard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

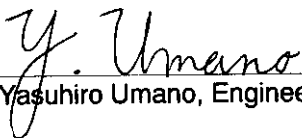
The EUT was plugged into the LISN and the frequency range of interest scanned.  
Reported are maximized emission levels.

#### 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

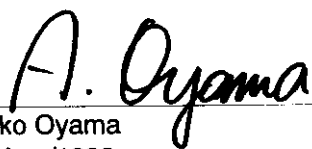
**Table 6.1-1** RFI Voltage Measurement Results

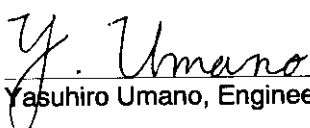
Operating mode: DISPLAY : ALL H DISPLAY  
 USB Communication  
 Test procedure: ANSI C63.4-1992

Date of measurement: March 24, 1999  
 Temperature: 24 degree C  
 Humidity: 45 %

|             | Frequency<br>(MHz) | Level<br>(dBμV) | Total<br>Factor(dB) | Result<br>(dBμV) | Result<br>(μV) | Limit<br>(μV) | Margin<br>(dB) |
|-------------|--------------------|-----------------|---------------------|------------------|----------------|---------------|----------------|
| <b>L1-E</b> | 0.462              | 28.5            | 0.2                 | 28.7             | 27.23          | 250           | 19.3           |
|             | 0.491              | 40.5            | 0.2                 | 40.7             | 108.39         | 250           | 7.3            |
|             | 0.606              | 38.5            | 0.2                 | 38.7             | 86.10          | 250           | 9.3            |
|             | 10.480             | 27.0            | 0.4                 | 27.4             | 23.44          | 250           | 20.6           |
|             | 15.970             | 27.0            | 0.6                 | 27.6             | 23.99          | 250           | 20.4           |
|             | 18.435             | 35.0            | 0.8                 | 35.8             | 61.66          | 250           | 12.2           |
| <b>N-E</b>  | 0.462              | 28.5            | 0.2                 | 28.7             | 27.23          | 250           | 19.3           |
|             | 0.491              | 40.5            | 0.2                 | 40.7             | 108.39         | 250           | 7.3            |
|             | 0.606              | 38.0            | 0.2                 | 38.2             | 81.28          | 250           | 9.8            |
|             | 10.480             | 29.0            | 0.4                 | 29.4             | 29.51          | 250           | 18.6           |
|             | 15.970             | 28.0            | 0.6                 | 28.6             | 26.92          | 250           | 19.4           |
|             | 18.435             | 35.0            | 0.8                 | 35.8             | 61.66          | 250           | 12.2           |

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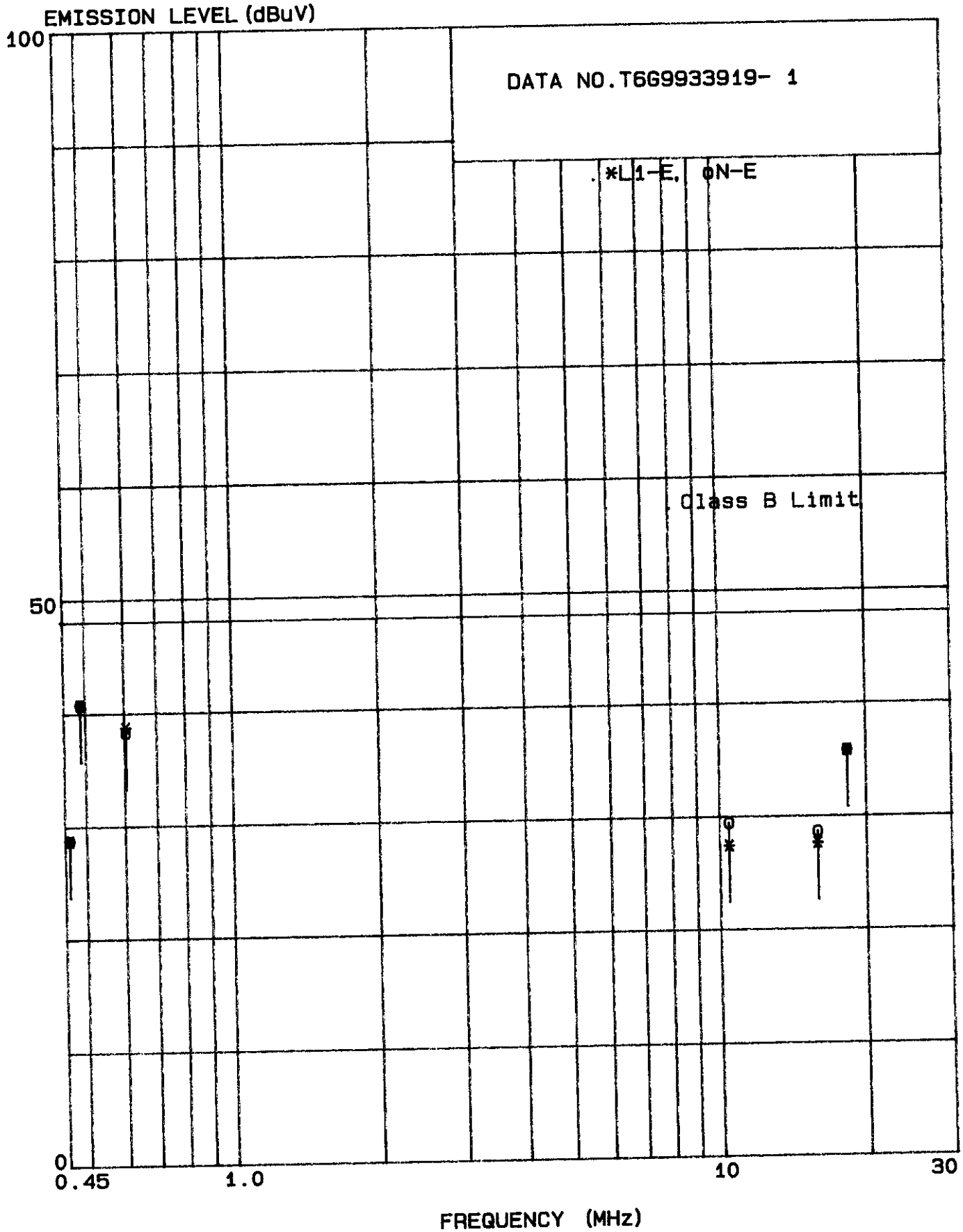


Figure 6.1-1 RFI Voltage Measurement Results

## 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 )  
Spectrum analyzer ..... ( TR4135/67800030/Advantest/SP014/29 Sep.'98/Sep.'99 )  
Coaxial cable..... ( ---/---/---/DK125/02 Mar.'98/Mar.'99 )  
Shielded Room No.2..... ( Tsukuba No.2/---/Tokin/SA017/---/--- )

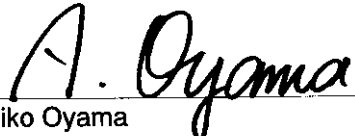
#### < 30MHz ~ 1000MHz >

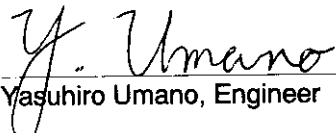
Field strength meter ..... ( KNM-5002/4N-171-4/Kyoritsu/RE006/28 Sep.'98/Sep.'99 )  
Frequency converter ..... ( KCV-6002/4-248-1/Kyoritsu/RC006/28 Sep.'98/Sep.'99 )  
Biconical antenna ..... ( BBA9106/TB006/Schwarzbeck/TB006/10 Sep.'98/Sep.'99 )  
Logperiodic antenna..... ( UHALP9108-A/0115/Schwarzbeck/TL021/07 Jul.'98/Jul.'99 )  
Pre-amplifier ..... ( 8447D/2727A05431/Hewlett Packard/AM006/12 Mar.'98/Mar.'99 )  
Spectrum analyzer ..... ( R3261A/81720103/Advantest/SP006/12 Nov.'98/Nov.'99 )  
Coaxial cable..... ( ---/CL6/---/DK090/31 Jul.'98/Jul.'99 )  
Open field test site ..... ( Tsukuba No.6/---/Tokin/SA006/17 Nov.'98/Nov.'99 )

#### < Over 1000MHz >

Double ridged guide  
horn antenna..... ( 3115/90053420/EMCO/AN003/03 Feb.'98/Feb.'99 )  
Pre-amplifier ..... ( 8449B/3008A00681/Hewlett Packard/rental/24 Nov.'98/Nov.'99 )  
Coaxial cable..... ( SUCOFLEX 104 2m/49402-4/SUCOFLEX/DK001/24 Nov.'98/Nov.'99 )  
Coaxial cable..... ( SUCOFLEX 104/51100-4/SUCOFLEX/DK002/24 Nov.'98/Nov.'99 )  
Coaxial cable..... ( SUCOFLEX 104 15m/51507-4/SUCOFLEX/DK003/24 Nov.'98/Nov.'99 )  
Coaxial cable..... ( MW3.0D-FF-2500/910215-8/Hitachi/DK006/24 Nov.'98/Nov.'99 )  
Coaxial cable..... ( MW3.0D-FF-2500/910215-10/Hitachi/DK007/24 Nov.'98/Nov.'99 )  
Open field test site ..... ( Tsukuba No.6/---/Tokin/SA006/17 Nov.'98/Nov.'99 )

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Yasuhiro Umano, Engineer

### 6.2.2 Measurement Procedure

Final test was performed according to ANSI C63.4-1992 at the open field test site No.6. Deviations from the standard was none.

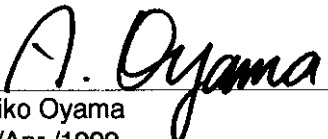
The EUT was placed in a 0.8m high table along with the peripherals. The turn table was separated from the antenna distance 3meters. Cables were placed in a position to produce maximum emissions as determined by experimentation, and operation mode was selected for maximum.

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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Yasuhiro Umano, Engineer

## 6.2.4 Test Data

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

Operating mode: DISPLAY : ALL H DISPLAY  
 USB Communication  
 Test procedure: ANSI C63.4-1992

Date of measurement: March 23, 1999  
 Temperature: 24 degree C  
 Humidity: 45 %

| Frequency<br>(MHz) | Level<br>Ver. Hor.<br>(dBμV) | Ant.<br>Factor<br>(dB/m) | Cable<br>Loss<br>(dB) | Amp.<br>Gain<br>(dB) | Result<br>Ver. Hor.<br>(dBμV/m) | Result<br>Ver. Hor.<br>(μV/m) | 3 Meter<br>Limit<br>(μV/m) | Margin<br>Ver. Hor.<br>(dB) |
|--------------------|------------------------------|--------------------------|-----------------------|----------------------|---------------------------------|-------------------------------|----------------------------|-----------------------------|
|--------------------|------------------------------|--------------------------|-----------------------|----------------------|---------------------------------|-------------------------------|----------------------------|-----------------------------|

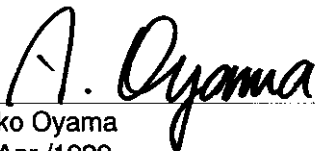
Test results were under the required limit with 20dB margin or more.

### 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 | 24000/F(kHz) +20 |
| 1.705 ~ 30      | 29.5        | 30               |

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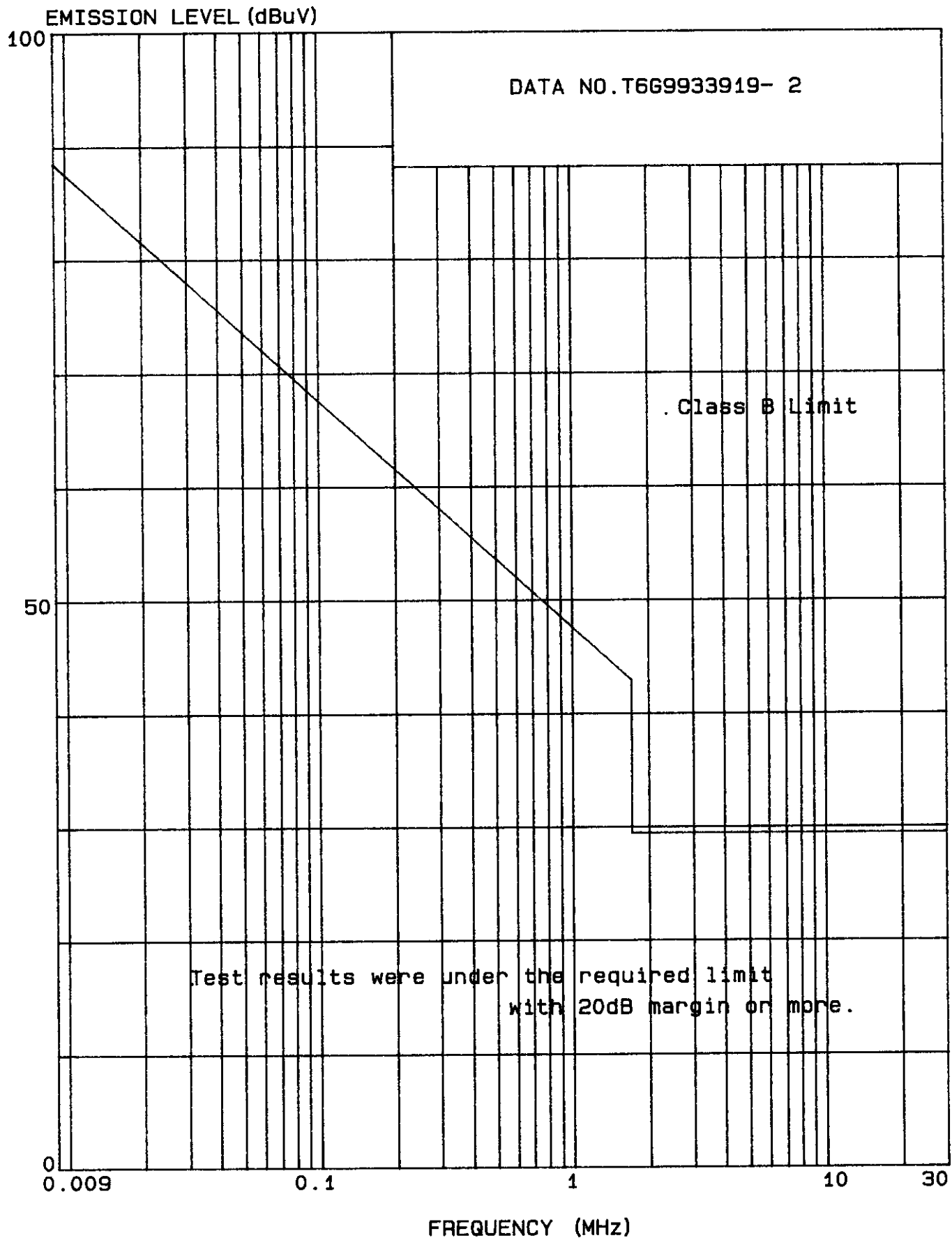


Figure 6.2-1 RFI Field Strength Measurement Results

**Table 6.2-2** RFI Field Strength Measurement Results ( Over 30MHz )

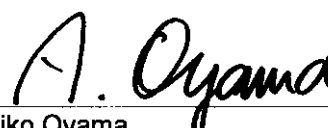
| Operating mode: DISPLAY : ALL H DISPLAY |        |      |                          |                       |                      | Date of measurement: March 23, 1999 |      |             |        |                            |        |      |
|-----------------------------------------|--------|------|--------------------------|-----------------------|----------------------|-------------------------------------|------|-------------|--------|----------------------------|--------|------|
| USB Communication                       |        |      |                          |                       |                      | Temperature:                        |      | 24 degree C |        |                            |        |      |
| Test procedure: ANSI C63.4-1992         |        |      |                          |                       |                      | Humidity:                           |      | 45 %        |        |                            |        |      |
| Frequency<br>(MHz)                      | Level  |      | Ant.<br>Factor<br>(dB/m) | Cable<br>Loss<br>(dB) | Amp.<br>Gain<br>(dB) | Result                              |      | Result      |        | 3 Meter<br>Limit<br>(μV/m) | Margin |      |
|                                         | Ver.   | Hor. |                          |                       |                      | Ver.                                | Hor. | Ver.        | Hor.   |                            | Ver.   | Hor. |
|                                         | (dBμV) |      |                          |                       |                      | (dBμV/m)                            |      | (μV/m)      |        |                            | (dB)   |      |
| 51.40                                   | -      | 30.5 | 11.6                     | 2.6                   | 27.6                 | -                                   | 17.1 | -           | 7.16   | 100                        | -      | 22.9 |
| 68.90                                   | 42.0   | -    | 5.8                      | 3.2                   | 27.7                 | 23.3                                | -    | 14.62       | -      | 100                        | 16.7   | -    |
| 75.16                                   | 44.5   | 45.0 | 6.2                      | 3.4                   | 27.7                 | 26.4                                | 26.9 | 20.89       | 22.13  | 100                        | 13.6   | 13.1 |
| 110.33                                  | -      | 37.0 | 11.9                     | 4.2                   | 27.5                 | -                                   | 25.6 | -           | 19.05  | 150                        | -      | 17.9 |
| 158.07                                  | -      | 37.0 | 14.6                     | 5.0                   | 27.3                 | -                                   | 29.3 | -           | 29.17  | 150                        | -      | 14.2 |
| 158.08                                  | 35.0   | -    | 14.6                     | 5.0                   | 27.3                 | 27.3                                | -    | 23.17       | -      | 150                        | 16.2   | -    |
| 332.79                                  | 41.5   | 42.0 | 13.7                     | 7.2                   | 27.0                 | 35.4                                | 35.9 | 58.88       | 62.37  | 200                        | 10.6   | 10.1 |
| 408.00                                  | 39.5   | 40.0 | 15.7                     | 8.2                   | 27.5                 | 35.9                                | 36.4 | 62.37       | 66.07  | 200                        | 10.1   | 9.6  |
| 665.58                                  | 34.0   | -    | 20.1                     | 10.9                  | 28.5                 | 36.5                                | -    | 66.83       | -      | 200                        | 9.5    | -    |
| 665.60                                  | -      | 32.0 | 20.1                     | 10.9                  | 28.5                 | -                                   | 34.5 | -           | 53.09  | 200                        | -      | 11.5 |
| 998.35                                  | 31.5   | 33.0 | 22.8                     | 13.7                  | 27.3                 | 40.7                                | 42.2 | 108.39      | 128.82 | 500                        | 13.3   | 11.8 |
| 1331.00                                 | 38.5   | 37.8 | 25.6                     | 6.9                   | 34.3                 | 36.7                                | 36.0 | 68.39       | 63.10  | 500                        | 17.3   | 18.0 |

### Class B limit

#### Radiated Emission – 3 meter distance

| Frequency (MHz) | dB $\mu$ V/m | $\mu$ V/m |
|-----------------|--------------|-----------|
| 30 - 88         | 40.0         | 100       |
| 88 - 216        | 43.5         | 150       |
| 216 - 960       | 46.0         | 200       |
| > 960           | 54.0         | 500       |

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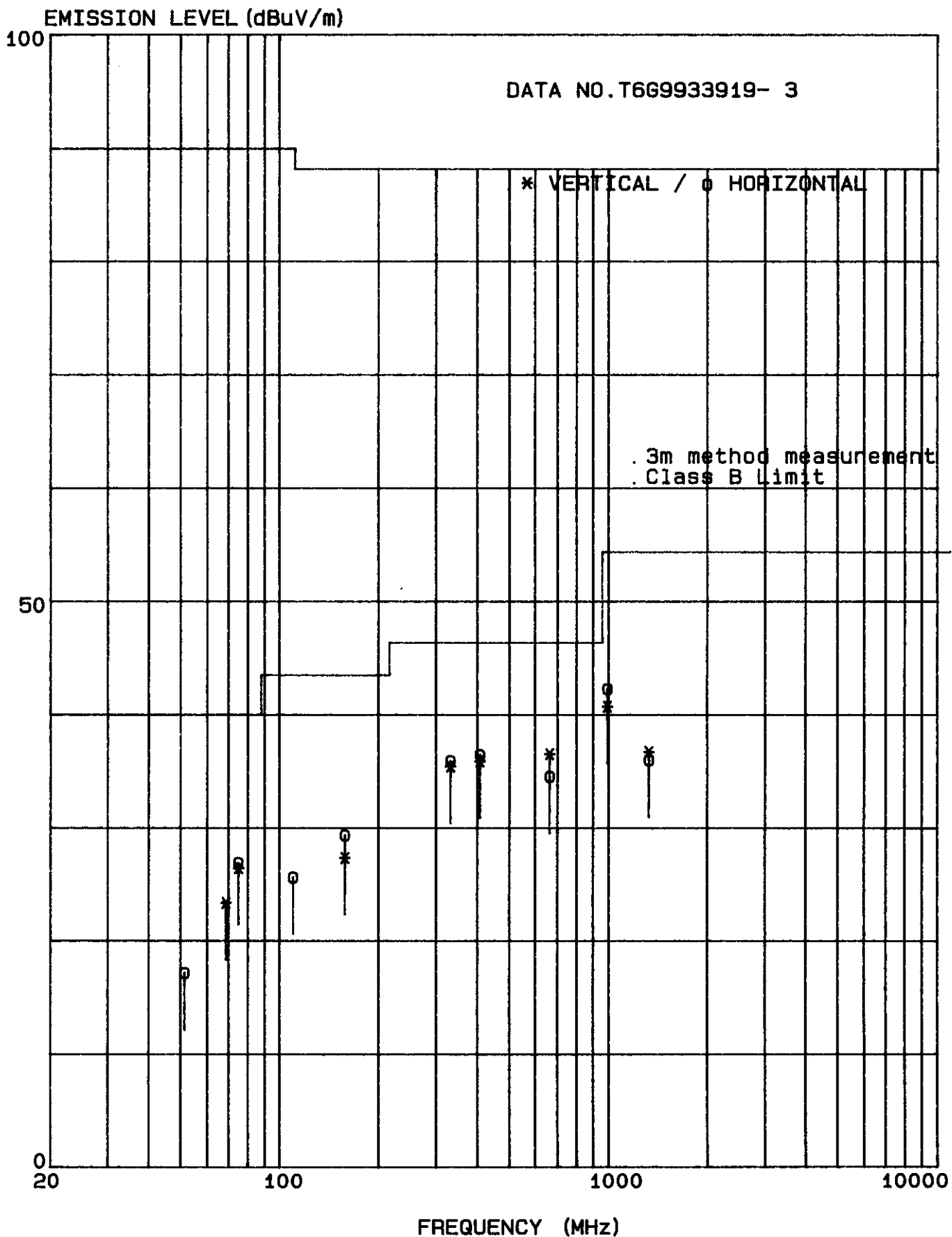


Figure 6.2-2 RFI Field Strength Measurement Results

### 6.3 Minimum Margin

Table 6.3-1 Minimum Margin

|                                     |                |             |        |
|-------------------------------------|----------------|-------------|--------|
| Conducted emission                  |                |             |        |
| DISPLAY : ALL H DISPLAY             | operation mode | 0.491 MHz,  | 7.3 dB |
| USB Communication Radiated emission |                |             |        |
|                                     | operation mode | 665.58 MHz, | 9.5 dB |

### 6.4 Sample Calculation

Table 6.4-1 Sample Calculation

The maximum radiating emission can be obtained at the frequency of 665.58 MHz,  
 Vertical polarization on DISPLAY : ALL H DISPLAY operation mode.  
 USB Communication

Each value at frequency is as follows;

|     |                              |   |             |
|-----|------------------------------|---|-------------|
| R : | Field strength meter reading | = | 34.0 (dBμV) |
| A : | Antenna factor               | = | 20.1 (dB/m) |
| C : | Cable loss                   | = | 10.9 (dB)   |
| G : | Amplifier gain               | = | 28.5 (dB)   |

Then radiated emission E(dBμV/m) is ;

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

Therefore, the maximum radiated emission is ;

$$36.5 \text{ (dBμV/m)}$$

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Y. Umamo  
 Yasuhiro Umamo, Engineer

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## EMC TEST REPORT

*for*

**WACOM Co., Ltd.**

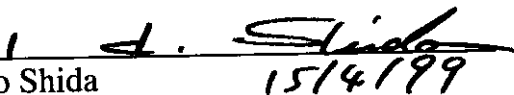
2-510-1, Toyonodai, Otone-machi,  
Kitasaitama-gun, Saitama 349-1148, JAPAN

Equipment Under Test: Digitizer  
model name : GD-1212-U

Category: FCC Part 15 Sub.part B Class B Digital Device

Tokin Report No.: T6G9933923

Date of Issue: April 14, 1999

  
Hiro Shida  
Manager, Tsukuba Testing Lab.  
Tokin 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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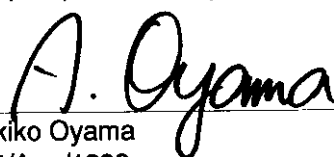
### ***Page***

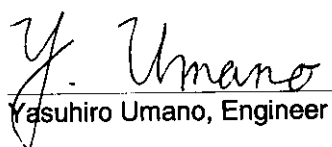
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## **1 DESCRIPTION OF DEVICE**

- A) Kind of Equipment : Digitizer
- B) Model Name : GD-1212-U
- C) Serial No. : 9CJP00001
- D) Type of Sample Tested : Pre-production
- E) High Frequency Used : 18.432MHz, 6MHz ( CPU clock )  
384.0kHz, 460.8kHz ( Operating frequency )
- F) Rating Power Supply : DC+5V, 0.5A
- G) Tested Power Supply : DC+5V, 0.5A from PC  
( PC power supply : 1phase AC120V, 50Hz )
- H) Date of Manufacture : March 1999
- I) Manufacturer : WACOM Co., Ltd.  
2-510-1, Toyonodai, Otone-machi, Kitasaitama-gun,  
Saitama 349-1148, JAPAN
- J) Description of Operating : DISPLAY : ALL H DISPLAY  
USB Communication
- K) Date of Sample Received : March 23, 1999
- L) Test Engineer : Yasuhiro Umano

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Akiko Oyama  
14/Apr./1999

  
Yasuhiro Umano, Engineer

## 2 TEST FACILITY

The open field test site and conducted measurement facility are used for this measurement, where is located following address. This facility was fully described in a report dated Jan.31, 19994, 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

## 3 SUMMARY OF RESULTS

### 3.1 Electromagnetic Emission

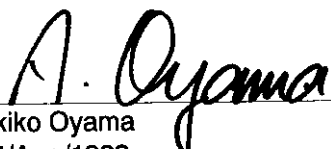
RFI Voltage Measurement ..... **PASS**

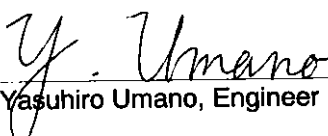
RFI Field Strength Measurement ..... **PASS**

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 had taken countermeasures.

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14/Apr./1999

  
Yasuhiro Umano, Engineer

## 4 TESTED SYSTEM DETAILS

### 4.1 Peripherals and Others :

| Description | Model Name           | Serial No.     | Manufacturer              | FCC ID              |
|-------------|----------------------|----------------|---------------------------|---------------------|
| PC          | DP2000<br>5166MMXJPN | 7725BK         | Compaq                    | DoC                 |
| Display     | 9060S                | 56475129 S-US  | Nanao                     | GCJ9060             |
| Mouse       | M-S34                | None           | Compaq                    | DZL211029           |
| Printer     | J250                 | 4300911101326  | Star Micronics<br>America | B6Z8MFJ250          |
| Modem       | T1200-SD2            | S87309509      | Omnitel                   | D786JC<br>T1200-SD2 |
| Keyboard    | None                 | B07020A39EY2Y5 | Compaq                    | AQ6-72BC15          |
| CCD camera  | LPC-U20              | None           | LG                        | DoC                 |

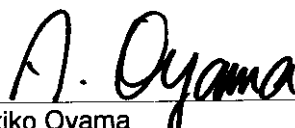
### 4.2 Type of Used Cables :

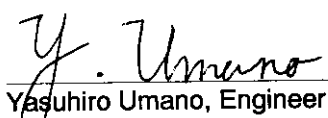
| Description       | Length  | Type of shield | Model name  | Manufacturer |
|-------------------|---------|----------------|-------------|--------------|
| Display AC cable  | 2.2m    | Non-shielded   | None        | Nanao        |
| Display I/F cable | 1.8m    | Shielded       | V20         | Nanao        |
| PC AC cable       | 2.0m    | Shielded       | None        | Compaq       |
| Printer cable     | 1.8m    | Shielded       | None        | None         |
| Modem I/F cable   | 1.5m    | Shielded       | C232N-J3115 | Elecom       |
| Modular cable     | 1.0m x2 | Non-shielded   | None        | None         |
| USB cable         | 1.5m    | Non-shielded   | None        | LG           |

## 5 TECHINICAL COUNTERMEASURE

| Parts number       | Description  | Circuit sign                                | Quantity | Maker                          |
|--------------------|--------------|---------------------------------------------|----------|--------------------------------|
| BLM11A601S         | Coil         | F 1,2,3,4,5,6,7,201,202,<br>203,204,205,206 | 13       | Murata manufacturing co., ltd. |
| PLP3216S551SL2     | Coil         | F 101                                       | 1        | Murata manufacturing co., ltd. |
| F6 RH 6.4×10.0×3.2 | Ferrite core |                                             | 1        | Ferrico corp.                  |
| CU7636R            | Copper tape  |                                             | 1        | Sony chemicals corporation     |
| 97-606-01          | Clip finger  |                                             | 1        | Kitagawa industries co., ltd.  |

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 14/Apr./1999

  
 Yasuhiro Umano, Engineer

## 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 ..... ( FCKL1528/1528124/Schwarzbeck/RE039/02 Oct.'98/Oct.'99 )

L.I.S.N. .... ( KNW-407/8-578-14/Kyoirtsu/LI012/31 Aug.'98/Aug.'99 )

Spectrum analyzer ..... ( TR4135/67800030/Advantest/SP014/29 Sep.'98/Sep.'99 )

Coaxial cable..... ( ---/---/---/DK125/02 Mar.'98/Mar.'99 )

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

#### 6.1.2 Measurement Procedure

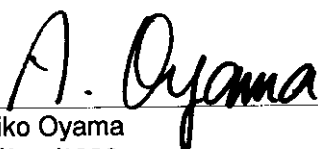
The power line conducted interference measurements were performed according to ANSI C63.4-1992 in a shielded enclosure No.2 with peripherals placed on a table, 0.8m high over a metal floor. It was located more than required distance away from the shielded enclosure wall. Deviations from the standard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

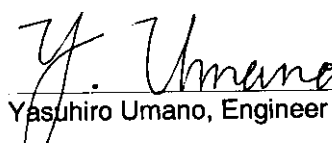
The EUT was plugged into the LISN and the frequency range of interest scanned.  
Reported are maximized emission levels.

#### 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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Yasuhiro Umano, Engineer

## 6.1.4 Test Data

**Table 6.1-1** RFI Voltage Measurement Results

Operating mode: DISPLAY : ALL H DISPLAY  
 USB Communication  
 Test procedure: ANSI C63.4-1992

Date of measurement: March 24, 1999  
 Temperature: 24 degree C  
 Humidity: 45 %

|             | Frequency<br>(MHz) | Level<br>(dBμV) | Total<br>Factor(dB) | Result<br>(dBμV) | Result<br>(μV) | Limit<br>(μV) | Margin<br>(dB) |
|-------------|--------------------|-----------------|---------------------|------------------|----------------|---------------|----------------|
| <b>L1-E</b> | 0.462              | 28.5            | 0.2                 | 28.7             | 27.23          | 250           | 19.3           |
|             | 0.491              | 40.5            | 0.2                 | 40.7             | 108.39         | 250           | 7.3            |
|             | 0.606              | 38.5            | 0.2                 | 38.7             | 86.10          | 250           | 9.3            |
|             | 10.480             | 27.0            | 0.4                 | 27.4             | 23.44          | 250           | 20.6           |
|             | 15.970             | 27.0            | 0.6                 | 27.6             | 23.99          | 250           | 20.4           |
|             | 18.435             | 35.0            | 0.8                 | 35.8             | 61.66          | 250           | 12.2           |
| <b>N-E</b>  | 0.462              | 28.5            | 0.2                 | 28.7             | 27.23          | 250           | 19.3           |
|             | 0.491              | 40.5            | 0.2                 | 40.7             | 108.39         | 250           | 7.3            |
|             | 0.606              | 38.0            | 0.2                 | 38.2             | 81.28          | 250           | 9.8            |
|             | 10.480             | 29.0            | 0.4                 | 29.4             | 29.51          | 250           | 18.6           |
|             | 15.970             | 28.0            | 0.6                 | 28.6             | 26.92          | 250           | 19.4           |
|             | 18.435             | 35.0            | 0.8                 | 35.8             | 61.66          | 250           | 12.2           |

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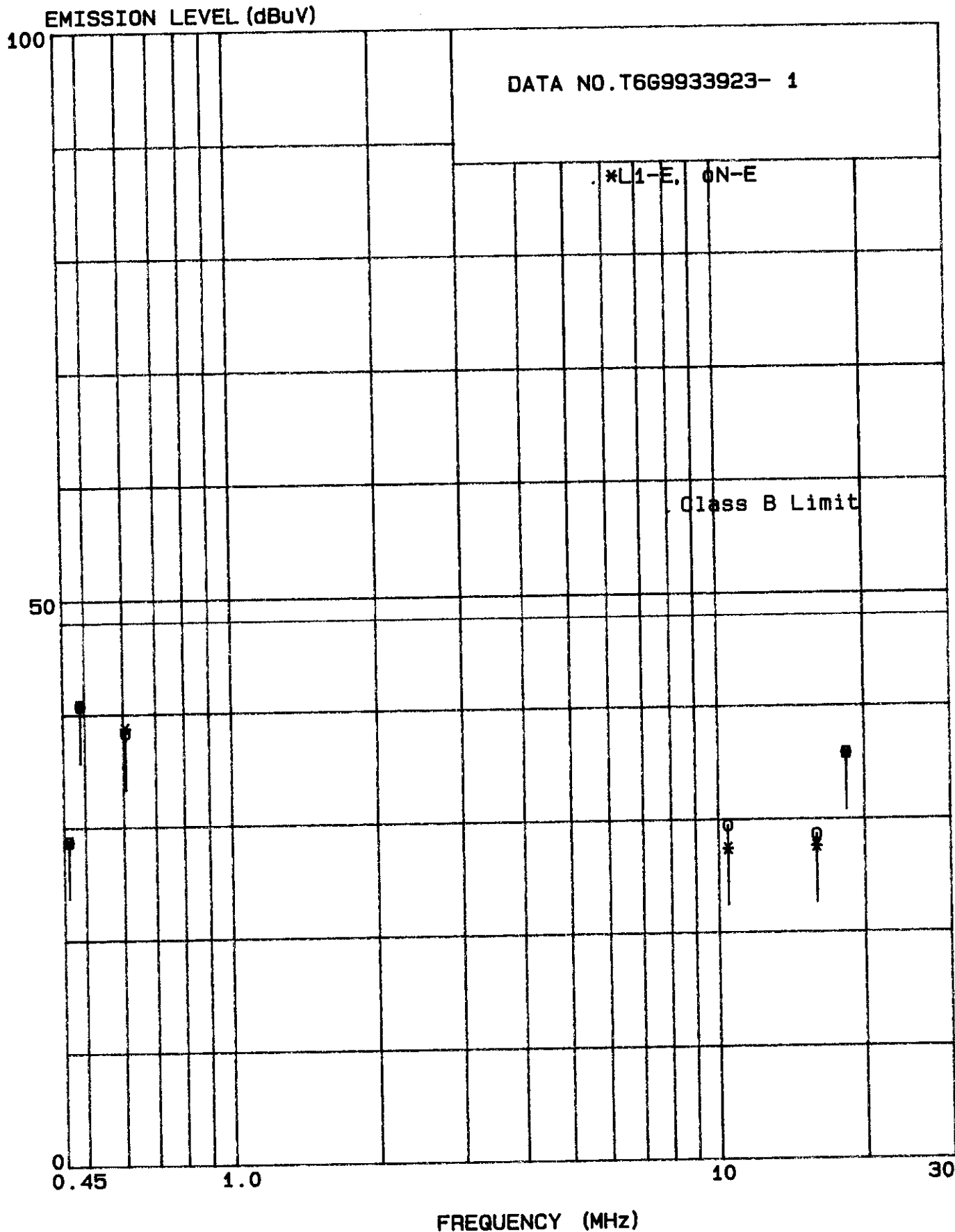


Figure 6.1-1 RFI Voltage Measurement Results

## 6.2 RFI Field Strength Measurement

### 6.2.1 Measurement Instrumentation Used

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

Field strength meter ..... ( KNM-5002/4N-171-4/Kyoritsu/RE006/28 Sep.'98/Sep.'99 )  
Frequency converter ..... ( KCV-6002/4-248-1/Kyoritsu/RC006/28 Sep.'98/Sep.'99 )  
Biconical antenna ..... ( BBA9106/TB006/Schwarzbeck/TB006/10 Sep.'98/Sep.'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/SP006/12 Nov.'98/Nov.'99 )  
Coaxial cable..... ( ---/CL6/---/DK090/31 Jul.'98/Jul.'99 )  
Open field test site ..... ( Tsukuba No.6/---/Tokin/SA006/17 Nov.'98/Nov.'99 )

### 6.2.2 Measurement Procedure

Final test was performed according to ANSI C63.4-1992 at the open field test site No.6. Deviations from the standard was none.

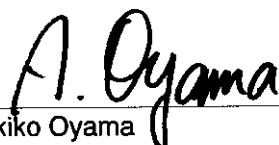
The EUT was placed in a 0.8m high table along with the peripherals. The turn table was separated from the antenna distance 3meters. Cables were placed in a position to produce maximum emissions as determined by experimentation, and operation mode was selected for maximum.

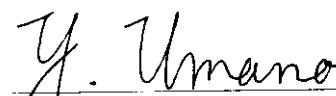
The frequencies and amplitudes of maximum emission were measured at varying azimuths, antenna heights and antenna polarities. Reported are maximized emission levels.

### 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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14/Apr./1999

  
Yasuhiro Umano, Engineer

## 6.2.4 Test Data

**Table 6.2-1** RFI Field Strength Measurement Results

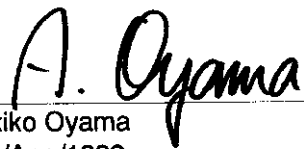
| Operating mode: DISPLAY : ALL H DISPLAY |                              |                          |                       |                      |                                 | Date of measurement: March 23, 1999 |                               |        |                            |                             |      |
|-----------------------------------------|------------------------------|--------------------------|-----------------------|----------------------|---------------------------------|-------------------------------------|-------------------------------|--------|----------------------------|-----------------------------|------|
| USB Communication                       |                              |                          |                       |                      |                                 | Temperature: 24 degree C            |                               |        |                            |                             |      |
| Test procedure: ANSI C63.4-1992         |                              |                          |                       |                      |                                 | Humidity: 45 %                      |                               |        |                            |                             |      |
| Frequency<br>(MHz)                      | Level<br>Ver. Hor.<br>(dBμV) | Ant.<br>Factor<br>(dB/m) | Cable<br>Loss<br>(dB) | Amp.<br>Gain<br>(dB) | Result<br>Ver. Hor.<br>(dBμV/m) |                                     | Result<br>Ver. Hor.<br>(μV/m) |        | 3 Meter<br>Limit<br>(μV/m) | Margin<br>Ver. Hor.<br>(dB) |      |
| 51.40                                   | - 30.5                       | 11.6                     | 2.6                   | 27.6                 | -                               | 17.1                                | -                             | 7.16   | 100                        | -                           | 22.9 |
| 68.90                                   | 42.0 -                       | 5.8                      | 3.2                   | 27.7                 | 23.3                            | -                                   | 14.62                         | -      | 100                        | 16.7                        | -    |
| 75.16                                   | 44.5 45.0                    | 6.2                      | 3.4                   | 27.7                 | 26.4                            | 26.9                                | 20.89                         | 22.13  | 100                        | 13.6                        | 13.1 |
| 110.33                                  | - 37.0                       | 11.9                     | 4.2                   | 27.5                 | -                               | 25.6                                | -                             | 19.05  | 150                        | -                           | 17.9 |
| 158.07                                  | - 37.0                       | 14.6                     | 5.0                   | 27.3                 | -                               | 29.3                                | -                             | 29.17  | 150                        | -                           | 14.2 |
| 158.08                                  | 35.0 -                       | 14.6                     | 5.0                   | 27.3                 | 27.3                            | -                                   | 23.17                         | -      | 150                        | 16.2                        | -    |
| 332.79                                  | 41.5 42.0                    | 13.7                     | 7.2                   | 27.0                 | 35.4                            | 35.9                                | 58.88                         | 62.37  | 200                        | 10.6                        | 10.1 |
| 408.00                                  | 39.5 40.0                    | 15.7                     | 8.2                   | 27.5                 | 35.9                            | 36.4                                | 62.37                         | 66.07  | 200                        | 10.1                        | 9.6  |
| 665.58                                  | 34.0 -                       | 20.1                     | 10.9                  | 28.5                 | 36.5                            | -                                   | 66.83                         | -      | 200                        | 9.5                         | -    |
| 665.60                                  | - 32.0                       | 20.1                     | 10.9                  | 28.5                 | -                               | 34.5                                | -                             | 53.09  | 200                        | -                           | 11.5 |
| 998.35                                  | 31.5 33.0                    | 22.8                     | 13.7                  | 27.3                 | 40.7                            | 42.2                                | 108.39                        | 128.82 | 500                        | 13.3                        | 11.8 |

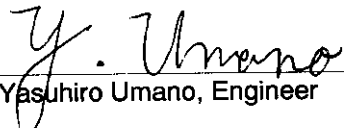
### Class B limit

#### 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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 Yasuhiro Umano, Engineer

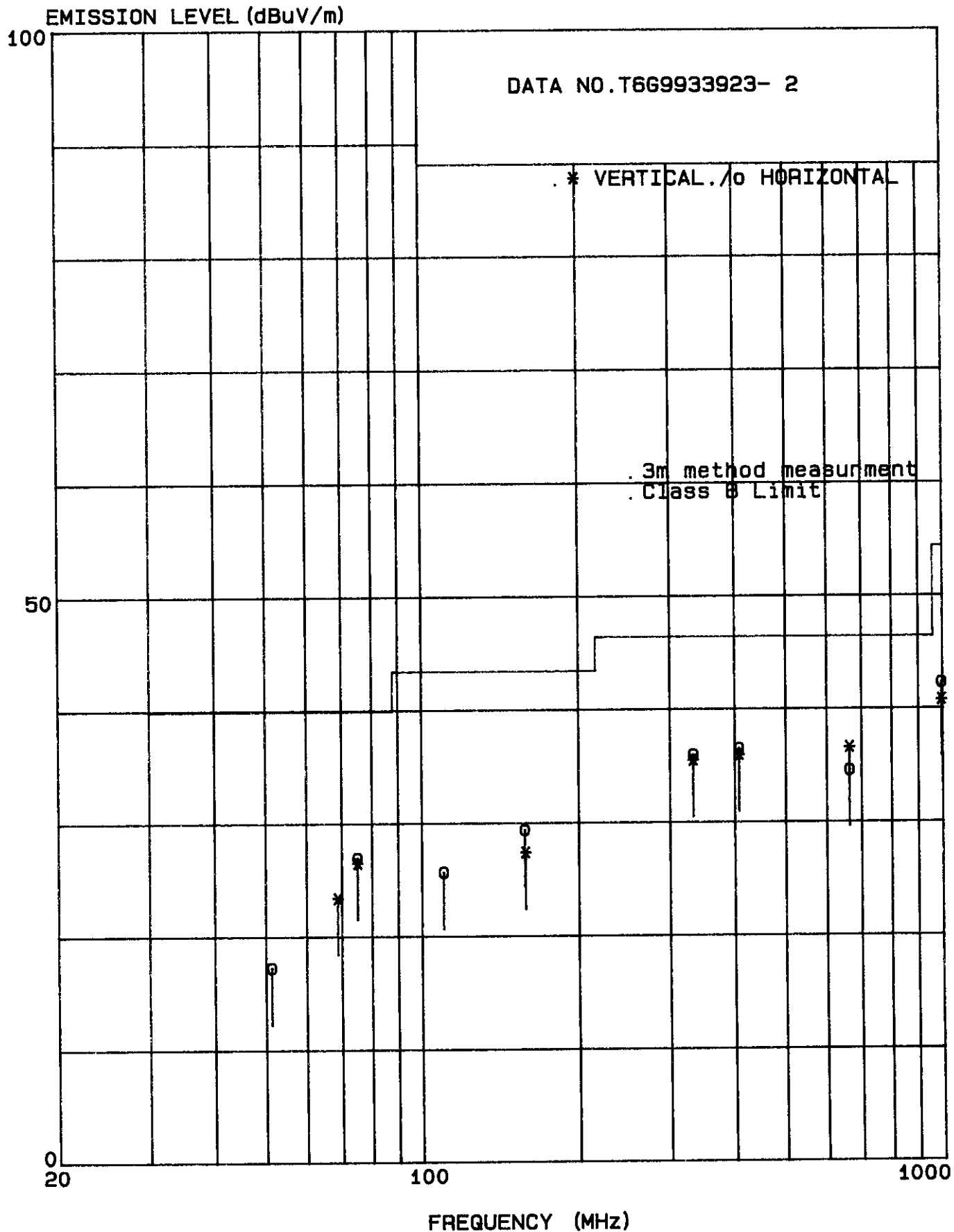


Figure 6.2-1 RFI Field Strength Measurement Results

### 6.3 Minimum Margin

Table 6.3-1 Minimum Margin

|                                       |                     |
|---------------------------------------|---------------------|
| Conducted emission                    |                     |
| DISPLAY: ALL H DISPLAY operation mode | 0.491 MHz, 7.3 dB   |
| USB Communication                     |                     |
| Radiated emission                     |                     |
| DISPLAY: ALL H DISPLAY operation mode | 66.5.58 MHz, 9.5 dB |
| USB Communication                     |                     |

### 6.4 Sample Calculation

Table 6.4-1 Sample Calculation

The maximum radiating emission can be obtained at the frequency of 66.5.58 MHz,  
 Vertical polarization on DISPLAY: ALL H DISPLAY operation mode.  
 USB Communication

Each value at frequency is as follows;

|     |                              |   |      |        |
|-----|------------------------------|---|------|--------|
| R : | Field strength meter reading | = | 34.0 | (dBμV) |
| A : | Antenna factor               | = | 20.1 | (dB/m) |
| C : | Cable loss                   | = | 10.9 | (dB)   |
| G : | Amplifier gain               | = | 28.5 | (dB)   |

Then radiated emission E(dBμV/m) is ;

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

Therefore, the maximum radiated emission is ;

36.5 (dBμV/m)

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