

MEASUREMENT/TECHNICAL REPORT

FCC PART 15, Class B (ANSI C63.4:1992)

Issued: March 22, 1998

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Test Item: 15 inch Color LCD Display Monitor

FCC ID: ACJ93312135

Identification: TX-D5L31NMF (TX-D5L31F, TX-D5L31**F)

Serial No.: FX8110014

Sample No.: 1

Sample Receipt Date: March 20, 1998

Test Result: PASS

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March 22, 1998
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MARCH 22, 1998
Date

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1. General Information

1.1 Product Description

The Matsushita Electric Industrial Co., Ltd., Model TX-D5L31NMF (TX-D5L31F, TX-D5L31**F) (referred to as the EUT in this report) is a 15 Inch Color LCD Display Monitor.

Rated input voltage is AC 120V.

EUT is featuring a 12.5, 32.5 MHz processor.

1.2 Related Submittal(s)/Grant(s)

Related Submittal Grant is not covered in this report.

1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system(including inserted cards, which have grants) are:

Model No.	Serial No.	FCC ID	Description	Cable Description
TX-D5L31NMF (TX-D5L31F, TX-D5L31**F)	FX8110014	ACJ93312135	EUT (15 Inch Color LCD Display Monitor)	AC Power Cord 1.8m Unshielded USB Cable 1.8m Shielded
D4557A	SG71201054	Doc	Persona Computer	AC Power Cord 1.8m Unshielded
C4565A	SG731140TZ	B94C4555X	Printer	AC Power Cord 1.8m Unshielded Printer Cable 3.0m Shielded
RT6656TWJP	52372112	AQ6-MTN4C15	Keyboard	Keyboard I/F Cable 2.5m Shielded
PS/2 Compatible Mouse	1003773	C3K76F400PS2	Mouse	Mouse I/F Cable 2.5m Shielded
5300AM	A2175300K306	BFJ5300AM	Modem	Modem I/F Cable 2.7m Shielded

1. General Information (Continued)**1.3 Tested System Details (Continued)**

Model No.	Serial No.	FCC ID	Description	Cable Description
T41-090800-A01	None	BFJ5300AM	AC Adapter	AC Power Cord 1.9m Unshielded
ECM-S3906	0000162	EW4ECM-S3906	USB Mouse	USB Mouse Cable 1.6m Shielded
ECM-S3906	0000163	EW4ECM-S3906	USB Mouse	USB Mouse Cable 1.6m Shielded
ECM-S3906	0000164	EW4ECM-S3906	USB Mouse	USB Mouse Cable 1.6m Shielded
ECM-S3906	0000168	EW4ECM-S3906	USB Mouse	USB Mouse Cable 1.6m Shielded
LT100	None	N/A	Headphone	Headphone Cable 2.4m Unshielded
None	None	IXW-PAS16	Sound Board	Audio Cable 1.8m Unshielded
DSV3365	S630USEICEC6	JF9- 1128BBPCIPRO	Video Board	Video I/F Cable 1.8m Shielded

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4:1992. Radiated testing was performed at an antenna to EUT distance of 10 meters. Final Result was converted in 3m, using $20 \log 10m / 3m$.

1.5 Test Facility

The open area test site, Cosmos EMC Lab., and conducted measurement facility used to the radiated data is located at 543 Shimesasu, Watarai-cho, Watarai-gun, Mie-ken, 516-2119, Japan. This site has been fully described in a report dated May 23, 1996 submitted to FCC, and accepted in a letter dated July 10, 1996 (31040/SIT 1300F2).

2. System Test Configuration

2.1 Justification

EUT was measured by max radiation mode user specified.

The measurement was conducted for the resolution 1024×768 and 640×480 and Video I/F Cable length 1.5m and 1.8m.

Following is the worst condition:

Conducted Emission: 1024×768
Dot Clock Frequency: 80 MHz
Vertical Frequency: 75.0 Hz
Horizontal Frequency: 60.24 kHz
Video I/F Cable length 1.8m

Radiated Emission: 1024×768
Dot Clock Frequency: 80 MHz
Vertical Frequency: 75.0 Hz
Horizontal Frequency: 60.24 kHz
Video I/F Cable length 1.8m

2.2 EUT Exercise Software

EUT did not exercise program during radiated and conducted testing.

2.3 Special Accessories

This cable model and part numbers are instructed with their installation manual.

2.4 Equipment Modifications

No equipment modification to achieve compliance to Class B levels was done during test.

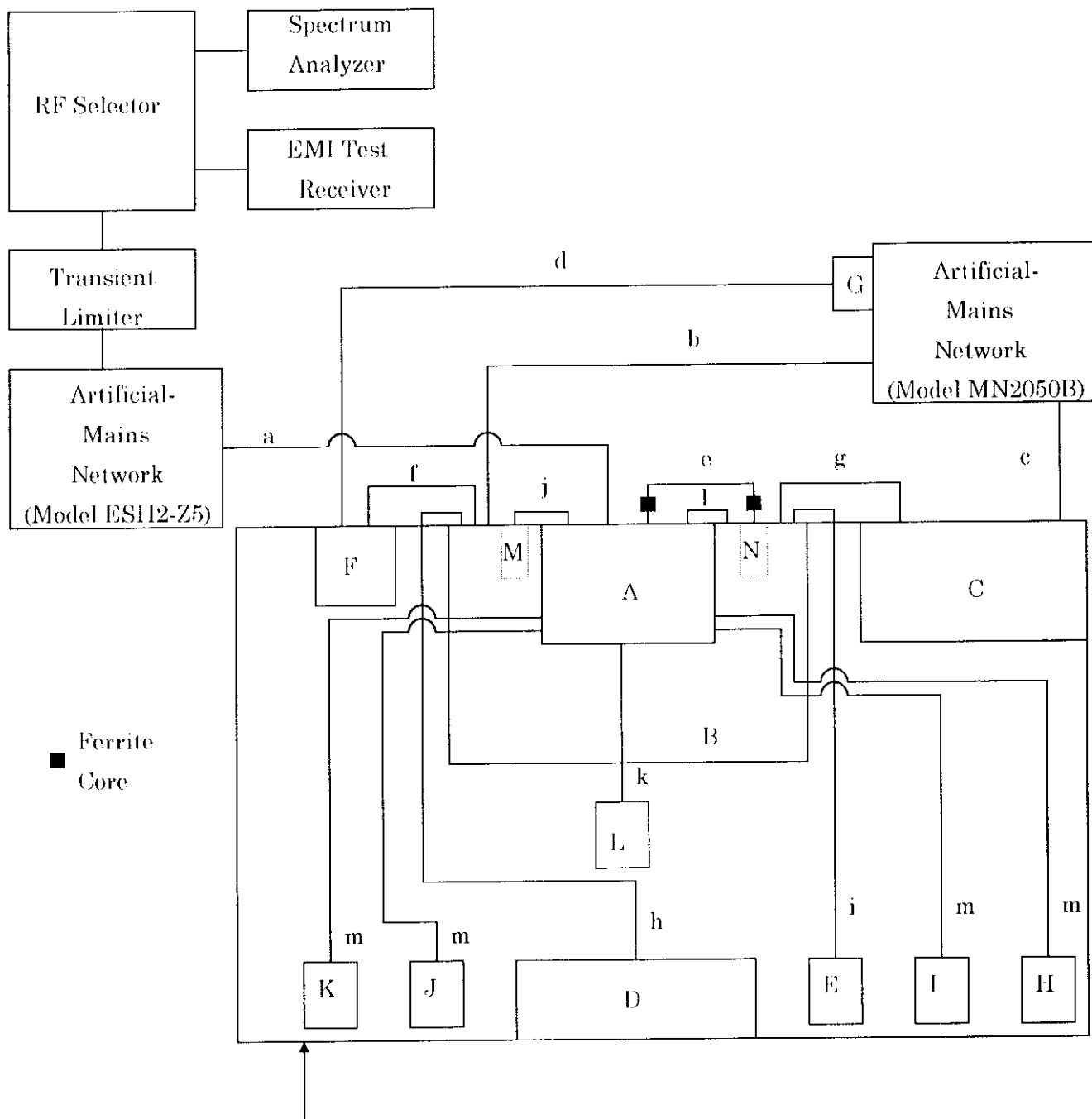
2. System Test Configuration (Continued)**2.5 Configuration of Tested System**

	Instrument		Cord / Cable
A)	EUT	a)	AC Power Cord 1.8m Unshielded
B)	Personal Computer	b)	AC Power Cord 1.8m Unshielded
C)	Printer	c)	AC Power Cord 1.8m Unshielded
D)	Keyboard	d)	AC Power Cord 1.9m Unshielded
E)	Mouse	e)	Video I/F Cable 1.8m Shielded
F)	Modem	f)	Modem I/F Cable 2.7m Shielded
G)	AC Adapter	g)	Printer Cable 3.0m Shielded
H)	USB Mouse (S/N: 0000162)	h)	Keyboard I/F Cable 2.5m Shielded
I)	USB Mouse (S/N: 0000163)	i)	Mouse I/F Cable 2.5m Shielded
J)	USB Mouse (S/N: 0000164)	j)	Audio Cable 1.8m Unshielded
K)	USB Mouse (S/N: 0000168)	k)	Headphone Cable 2.4m Unshielded
L)	Headphone	l)	USB Cable 1.8m Shielded
M)	Sound Board	m)	USB Mouse Cable 1.6m Shielded
N)	Video Board		

2. System Test Configuration (Continued)

2.5 Configuration of Tested System (Continued)

Conducted Emission

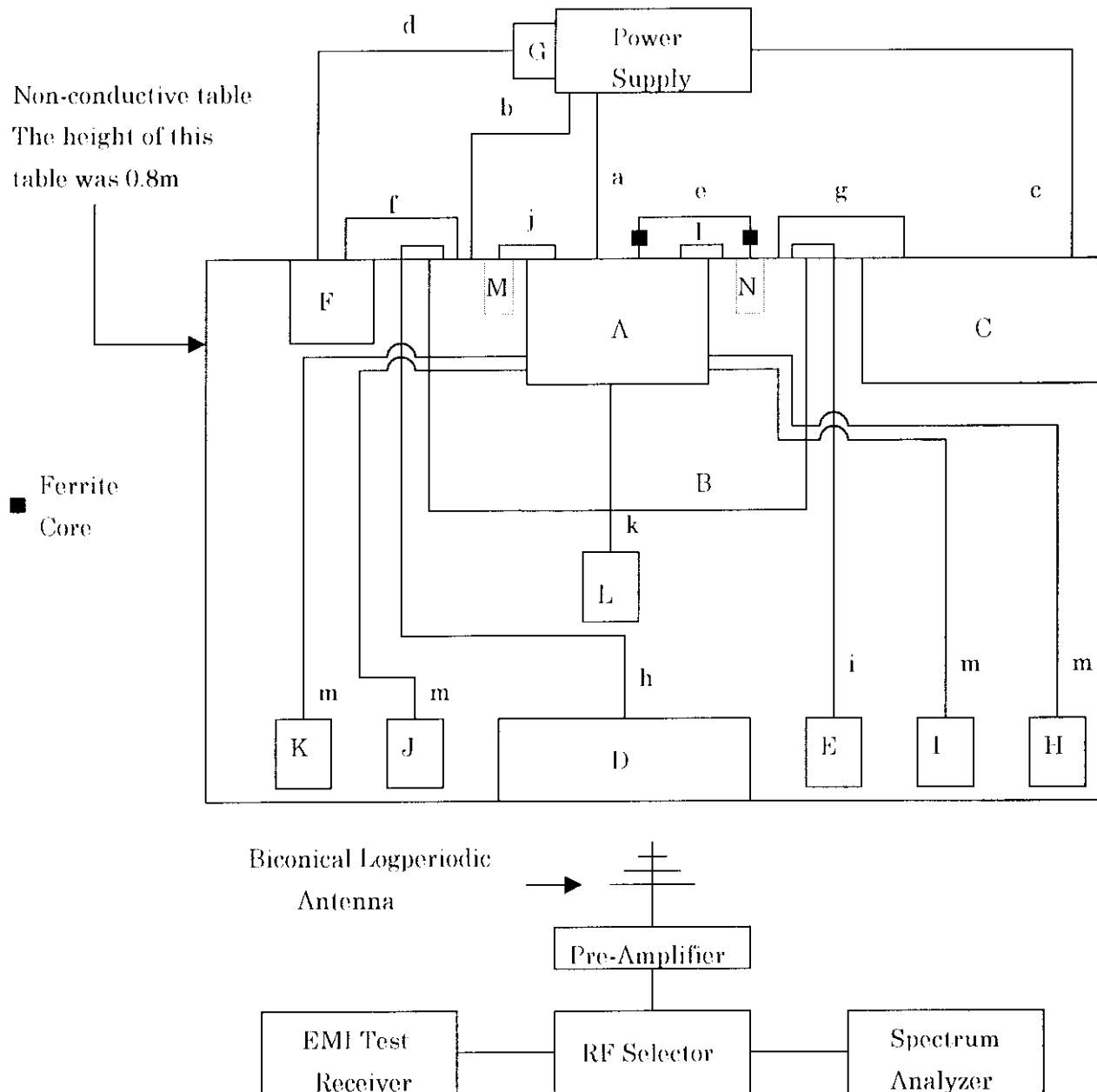


Non-conductive table
The height of this
table was 0.8m

2. System Test Configuration (Continued)

2.5 Configuration of Tested System (Continued)

Radiated Emission



2. System Test Configuration (Continued)

2.5 Configuration of Tested System (Continued)

Conducted Emission

- 1) EUT is put on the Personal Computer.
- 2) Sound Board is inserted in Personal Computer.
- 3) Video Board is inserted in Personal Computer.
- 4) Personal Computer and Modem located at 0.1m intervals.
- 5) Personal Computer and Printer located at 0.1m intervals.
- 6) Keyboard and Mouse located at 0.1m intervals.
- 7) Keyboard and USB Mouse (S/N 0000164) located at 0.1m intervals.
- 8) USB Mouse (S/N 0000164) and USB Mouse (S/N 0000168) located at 0.1m intervals.
- 9) Mouse and USB Mouse (S/N 0000163) located at 0.1m intervals.
- 10) USB Mouse (S/N 0000163) and USB Mouse (S/N 0000162) located at 0.1m intervals.
- 11) EUT is connected to Artificial-Mains Network (Model ESH2-Z5) by the AC Power Cord.
- 12) Personal Computer is connected to Artificial-Mains Network (Model MN2050B) by the AC Power Cord.
- 13) Printer is connected to Artificial-Mains Network (Model MN2050B) by the AC Power Cord.
Extended Cord was folded at the center of Cord by 0.4m length, and the Cord was hung in the middle between ground and table.
- 14) AC Adapter is connected to Artificial-Mains Network (Model MN2050B).
- 15) Modem is connected to AC Adapter by the AC Power Cord.
- 16) EUT is connected to Video Board by the Video I/F Cable.
Extended Cable was folded at the center of Cable by 0.3m length, and the Cable was hung in the middle between ground and table.
- 17) Personal Computer is connected to Modem by the Modem I/F Cable.
Extended Cable was folded at the center of Cable by 0.4m length, and the Cable was hung in the middle between ground and table.
- 18) Personal Computer is connected to Printer by the Printer Cable.
Extended Cable was folded at the center of Cable by 0.4m length, and the Cable was hung in the middle between ground and table.
- 19) Personal Computer is connected to Keyboard by the Keyboard I/F Cable.
- 20) Personal Computer is connected to Mouse by the Mouse I/F Cable.
Extended Cable was folded at the center of Cable by 0.4m length, and the Cable was hung in the middle between ground and table.
- 21) EUT is connected to Sound Board by the Audio Cable.
Extended Cable was folded at the center of Cable by 0.3m length, and the Cable was hung in the middle between ground and table.

2. System Test Configuration (Continued)

2.5 Configuration of Tested System (Continued)

Conducted Emission (Continued)

- 22) EUT is connected to Headphone by the Headphone Cable.
- 23) EUT is connected to Personal Computer by the USB Cable.
Extended Cable was folded at the center of Cable by 0.4m length,
and the Cable was hung in the middle between ground and table.
- 24) EUT is connected to USB Mouse (S/N 0000162) by the USB Mouse Cable.
- 25) EUT is connected to USB Mouse (S/N 0000163) by the USB Mouse Cable.
- 26) EUT is connected to USB Mouse (S/N 0000164) by the USB Mouse Cable.
- 27) EUT is connected to USB Mouse (S/N 0000168) by the USB Mouse Cable.

Radiated Emission

- 1) EUT is put on the Personal Computer.
- 2) Sound Board is inserted in Personal Computer.
- 3) Video Board is inserted in Personal Computer.
- 4) Personal Computer and Modem located at 0.1m intervals.
- 5) Personal Computer and Printer located at 0.1m intervals.
- 6) Keyboard and Mouse located at 0.1m intervals.
- 7) Keyboard and USB Mouse (S/N 0000164) located at 0.1m intervals.
- 8) USB Mouse (S/N 0000164) and USB Mouse (S/N 0000168)
located at 0.1m intervals.
- 9) Mouse and USB Mouse (S/N 0000163) located at 0.1m intervals.
- 10) USB Mouse (S/N 0000163) and USB Mouse (S/N 0000162)
located at 0.1m intervals.
- 11) EUT is connected to Power Supply by the AC Power Cord.
- 12) Personal Computer is connected to Power Supply by the AC Power Cord.
Extended Cord was folded at the center of Cord by 0.4m length,
and the Cord was hung in the middle between ground and table.
- 13) Printer is connected to Power Supply by the AC Power Cord.
- 14) AC Adapter is connected to Power Supply.
- 15) Modem is connected to AC Adapter by the AC Power Cord.
Extended Cord was folded at the center of Cord by 0.4m length,
and the Cord was hung in the middle between ground and table.
- 16) EUT is connected to Video Board by the Video I/F Cable.
Extended Cable was folded at the center of Cable by 0.3m length,
and the Cable was hung in the middle between ground and table.
- 17) Personal Computer is connected to Modem by the Modem I/F Cable.
Extended Cable was folded at the center of Cable by 0.4m length,
and the Cable was hung in the middle between ground and table.

2. System Test Configuration (Continued)

2.5 Configuration of Tested System (Continued)

Radiated Emission (Continued)

- 18) Personal Computer is connected to Printer by the Printer Cable.
Extended Cable was folded at the center of Cable by 0.4m length,
and the Cable was hung in the middle between ground and table.
- 19) Personal Computer is connected to Keyboard by the Keyboard I/F Cable.
- 20) Personal Computer is connected to Mouse by the Mouse I/F Cable.
Extended Cable was folded at the center of Cable by 0.4m length,
and the Cable was hung in the middle between ground and table.
- 21) EUT is connected to Sound Board by the Audio Cable.
Extended Cable was folded at the center of Cable by 0.3m length,
and the Cable was hung in the middle between ground and table.
- 22) EUT is connected to Headphone by the Headphone Cable.
- 23) EUT is connected to Personal Computer by the USB Cable.
Extended Cable was folded at the center of Cable by 0.4m length,
and the Cable was hung in the middle between ground and table.
- 24) EUT is connected to USB Mouse (S/N 0000162) by the USB Mouse Cable.
- 25) EUT is connected to USB Mouse (S/N 0000163) by the USB Mouse Cable.
- 26) EUT is connected to USB Mouse (S/N 0000164) by the USB Mouse Cable.
- 27) EUT is connected to USB Mouse (S/N 0000168) by the USB Mouse Cable.

4. Conducted Emission Data

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

	Frequency (MHz)	Measured * (dB μ V)	Limit (dB μ V)
Neutral Line	0.65301	39.3	48.0
Neutral Line	0.86670	37.7	48.0
Neutral Line	15.00224	40.1	48.0
Neutral Line	16.50831	38.1	48.0
Neutral Line	21.00356	44.6	48.0
Neutral Line	22.50532	41.9	48.0
L Line	1.10027	35.8	48.0
L Line	1.52802	36.1	48.0
L Line	15.00182	39.3	48.0
L Line	16.50129	41.8	48.0
L Line	19.50225	40.5	48.0
L Line	21.00402	44.4	48.0

* All readings are quasi-peak unless stated otherwise.

Environment:

Temperature 17 °C

Humidity 51 %

Tested Personnel:

Tester Signature Hiroshi Wakabayashi

Typed/Printed Name Hiroshi Wakabayashi

5. Radiated Emission Data

The following data lists the significant emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit. Explanation of the Correction Factor is given in paragraph.

Frequency (MHz)	Polarity (H/V)	Receiver * Reading (dB μ V)	Correction Factor (dB/m)	Corrected Reading (dB μ V/m)	3 Meter Limit (dB μ V/m)
37.745	Vertical	47.6	-14.2	33.4	40.0
76.832	Vertical	55.3	-21.2	34.1	40.0
141.844	Vertical	51.7	-15.9	35.8	43.5
156.618	Vertical	56.3	-16.7	39.6	43.5
162.541	Vertical	58.5	-17.1	41.4	43.5
227.561	Vertical	57.1	-16.1	41.0	46.0

*All readings are quasi-peak unless stated otherwise, with an IF bandwidth of 120 kHz, along with an 1 S sweep time. A video filter was not used.

Environment:

Temperature 13 °C
Humidity 45 %

Tested Personnel:

Tester Signature Hiroshi Wakabayashi

Typed/Printed Name Hiroshi Wakabayashi

5. Radiated Emission Data (Continued)

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:

$$FS = RA + AF + CF - AG$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/m. The 32 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(32 \text{ dBuV/m})/20] = 39.8 \text{ uV/m}$$

6. List of Test and Measurement Instruments**Conducted Emission**

Manufacturer	Instruments	Model / Type	Serial No.	Calibration Date Next Calibration
ROHDE & SCHWARZ	Spectrum Analyzer	FSB / DISPLAY	838497/005 /	May, 1997
			838301/009	May, 1998
ROHDE & SCHWARZ	EMI Test Receiver	ESHS10	842121/012	April, 1997
				April, 1998
ROHDE & SCHWARZ	Artificial-Mains Network	ESH2-Z5	842210/010	May, 1997
				May, 1998
CHASE ELECTRONICS LIMITED	Artificial-Mains Network	MN2050B	1140	April, 1997
				April, 1998

Radiated Emission

Manufacturer	Instruments	Model / Type	Serial No.	Calibration Date Next Calibration
ROHDE & SCHWARZ	Spectrum Analyzer	FSB / DISPLAY	838497/005 /	May, 1997
			838301/009	May, 1998
ROHDE & SCHWARZ	EMI Test Receiver	ESVS10	842122/014	April, 1997
				April, 1998
CHASE ELECTRONICS LIMITED	Pre-Amplifier	CPA9231	3045	February, 1998
				February, 1999
CHASE ELECTRONICS LIMITED	Biconical Logperiodic Antenna	CBL6111A	1732	March, 1997
				March, 1998

7. The Treatment of Uncertainty In EMC Measurement

Uncertainty Budget

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7.1 Radiated Emission

Measurement of vertically polarised field strength between 30 dB μ V/m and 60 dB μ V/m over the frequency range 30 MHz to 1 GHz on an open area test site at 10m and 30m

Contribution	Probability Distribution	Uncertainty = [dB]	
		Biconical Logperiodic Antenna	
		10m	30m
Ambient Signals			
Antenna factor calibration	normal [k = 2]	1.0	1.0
Cable loss calibration	normal [k = 2]	0.5	0.8
Receiver specification	rectangular	1.5	1.5
Antenna directivity	rectangular	0.3	0
Antenna factor variation with height	rectangular	2.2	2.2
Antenna phase centre variation	rectangular	0.2	0.1
Antenna factor frequency interpolation	rectangular	0.2	0.2
Measurement distance variation	rectangular	0.4	0.2
Site imperfections	rectangular	1.5	1.5
Mismatch Receiver VRC: $\Gamma_1 = 0.2$ Antenna VRC: $\Gamma_R = 0.67$ [Bi] 0.3 [Lp] Uncertainty limits $20 \log [1 + \Gamma_1 \Gamma_R]$	U-shaped	1.1	1.1
System repeatability (previous assessment of $s(q_k)$ from 5 repeats, 1 reading on EUT)	Std Deviation	0.5	0.5
Repeatability of EUT*			
Combined standard uncertainty u_c [y]	normal	2.09	2.098
Expanded uncertainty U	normal [k = 2]	4.18	4.197

7.1 Radiated Emission (Continued)

Calculation for 10m biconical Logperiodic antenna, positive value:

$$u_{c \text{ [y]}} = \sqrt{\left(\frac{1.0}{2}\right)^2 + \left(\frac{0.5}{2}\right)^2 + \frac{1.5^2 + 0.3^2 + 2.2^2 + 0.2^2 + 0.2^2 + 0.4^2 + 1.5^2}{3} + \frac{1.1^2}{2} + 0.5^2}$$

k=2:

$$U = 2 u_{c \text{ [y]}} = 2 \times \pm 2.09 = \pm 4.18 \text{ dB}$$

7.2 Conducted Emission

Measurement of conducted emissions between 30 dB μ V and 60 dB μ V over the frequency range 9 kHz to 30 MHz .

Contribution	Probability Distribution	Uncertainty [$\pm$ dB]	
		9 kHz - 150 MHz	150 - 30 MHz
Receiver specification	rectangular	1.3	1.3
LISN coupling specification	rectangular	1.3	1.3
Cable and input attenuator calibration	normal [k = 2]	0.3	0.5
Mismatch Receiver VRC: $\Gamma_1 = 0.03$ LISN VRC: $\Gamma_g = 0.8$ [9 kHz] - 0.2 [30 MHz] Uncertainty limits $20\log [1 \pm \Gamma_1 \Gamma_g]$	U-shaped	0.2	0.05
System repeatability [previous assessment of s(q _k) from 10 repeats, 1 reading on EUT]	Standard dev.	0.2	0.35
Repeatability of EUT*			
Combined standard uncertainty u _c [y]	normal	1.12	1.13
Expanded uncertainty U	normal [k = 2]	2.24	2.26

Calculation for 9 kHz to 150 kHz range:

$$u_c [y] = + \sqrt{\frac{1.3^2 + 1.3^2}{3} + \left(\frac{0.3}{2}\right)^2 + \frac{0.2^2}{2} + 0.2^2} = \pm 1.12 \text{ dB}$$

k=2:

$$U = 2 \times u_c [y] = 2 \times \pm 1.12 = \pm 2.24 \text{ dB}$$