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RFI MEASUREMENT TEST REPORT

FCC PART 15B CLASS B

***** CLASS B DIGITAL DEVICES AND PERIPHERALS *****

APPLICANT : SEIKO EPSON CORPORATION

EQUIPMENT : PRINTER

TRADE NAME : EPSON

MODEL NUMBER : P113A

FCC ID NUMBER : BKMFBP113A

TEST REPORT No. : E-103-98148



NVLAP LAB CODE 200157-0

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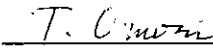
TEST CERTIFICATION**Applicant Information**


Company : SEIKO EPSON Corporation
 Division/Section : TP Product Safety Design Group
 Imaging & Information Products Operations
 Address : 80, Harashinden, Hirooka, Shiojiri-shi, Nagano, 399-0785 Japan
 PHONE : +81-263-53-6024 FAX : +81-263-53-3544

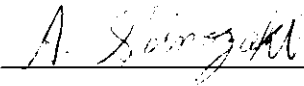
Test Performed

Company : SEIKO EPSON Corporation
 Division/Section : EMC Group, CS/Quality Assurance Office
 Location : 80, Harashinden, Hirooka, Shiojiri-shi, Nagano, 399-0785 Japan
 PHONE: +81-263-52-5094 FAX : +81-263-54-5806
 10 meter Semi-anechoic Chamber
 FCC File No. : 31040 / SIT 1300F2
 NVLAP Lab Code : 200157-0

Test started : 3 July, 1998
 Test completed : 9 July, 1998
 Purpose of test : Compliance with standards
 Test specification(s) : FCC Part 15B Class B (Unintentional Radiators)
 Test procedure(s) : ANSI C63.4-1992

Test engineer : Toshiyuki Omori 
 EMC group, CS/Quality Assurance Office

Report checked by : Takeshi Ono 
 Chief Engineer, EMC group, CS/Quality Assurance Office

Report approved by : Atsushi Shinozaki 
 EMC group, CS/Quality Assurance Office
 NVLAP signatory

Report issue date : 14 July, 1998

The test item under the test conditions and configuration shown in this test report complies with above standard.

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1. DETAILED DESCRIPTION OF TEST ITEM

1-1 Equipment Under Test (EUT)

Kind of equipment	: Printer
Shape	: Table-top type
Manufacturer	: SEIKO EPSON Corporation
Trade Name	: EPSON
Model Number	: P113A
FCC ID	: BKMFBP113A
Serial Number	: 13TM000042
Voltage input	: AC 120 V / 60 Hz
Rated current	: 0.4 A
Port(s) / Connector(s)	: Parallel (Centronics, standard) Serial (RS-422C, standard) USB(standard)
Oscillator(s) / Crystal(s)	: 48.00 MHz, 28 MHz (MAIN Board)
Maximum used frequency	: 48.00 MHz
Remarks	: -

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1-2 Auxiliary equipment (AE)

AE	Name	Model (Serial number)	Manufacturer	FCC ID	Voltage input Power consumption	
1	Personal computer	Vectra VL5/166 (SG73403695)	Hewlett-Packard	N/A (DoC)	AC 120 V/ 60 Hz 3.0 A	
2	CRT monitor	D2830A (KR70712444)	Hewlett-Packard	A3LCGC560	AC 120 V/ 60 Hz 1.2 A	
3	Keyboard	C3755B#ABJ (60552232)	Hewlett-Packard	AQ6ZG-RT687XT	DC 5.0 V 300 mA	a)
4	Mouse	M-S28 (LTC52900219)	Hewlett-Packard	D2L210472	DC 5.0 V 125 mA	a)
5	Printer	P850A (1YLY185764)	SEIKO EPSON Corporation	BKMP850A	AC 120 V/ 60 Hz 1.0 A	b)
6	Personal computer	M3979 (SG6331HS8FD)	Apple	BCGN3706	AC 120 V/ 60 Hz 7.0 A	
7	CRT monitor	M2978 (CY5252LS3CV)	Apple	BEJCA500	AC 120 V/ 60 Hz 1.4 A	
8	Keyboard	M3501 (AP62329E/M0312J)	Apple	BCGM3501	DC 5.0 V 300 mA	c)
9	Mouse	M2706 (MB6110ZRT18)	Apple	BCGM2706	DC 5.0 V 15 mA	c)
10	Film scanner	G621B (AB20003380)	SEIKO EPSON Corporation	BKMFBG621B	AC 120 V/ 60 Hz 0.5 A	

- a) Supply from AE1
- b) With Color upgrade kit (C832081)
- c) Supply from AE6

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1-3 Relevant Signal and Power lines

AE = Auxiliary equipment, EUT = Equipment Under Test = Test item

Configuration 1

Line	Name	From	To	Length	Shield	Remarks
1	Parallel I/F cable	EUT Parallel in / AE5 Parallel in	AE1 Parallel out	2.0 m	Yes	Metal connector
2	USB I/F cable	EUT USB in	AE1 USB out	1.8 m	Yes	Metal connector
3	Serial I/F cable	AE5 Serial in	AE1 Serial out	2.0 m	Yes	Metal connector
4	Video I/F cable	AE2 Video in	AE1 Video out	1.4 m	Yes	Metal connector
5	Keyboard I/F cable	AE3 Keyboard	AE1 Keyboard out	2.9 m	Yes	Metal connector
6	Mouse I/F cable	AE4 Mouse	AE1 Mouse out	1.8 m	Yes	Metal connector
7	Printer AC cable	EUT AC 120 V in	Main AC 120 V	1.9 m	No	
8	Computer AC cable	AE1 AC 120 V in	Main AC 120 V	1.9 m	No	
9	CRT AC cable	AE2 AC 120 V in	Main AC 120 V	1.9 m	No	
10	Printer AC cable	AE5 AC 120 V in	Main AC 120 V	1.9 m	No	

Configuration 2

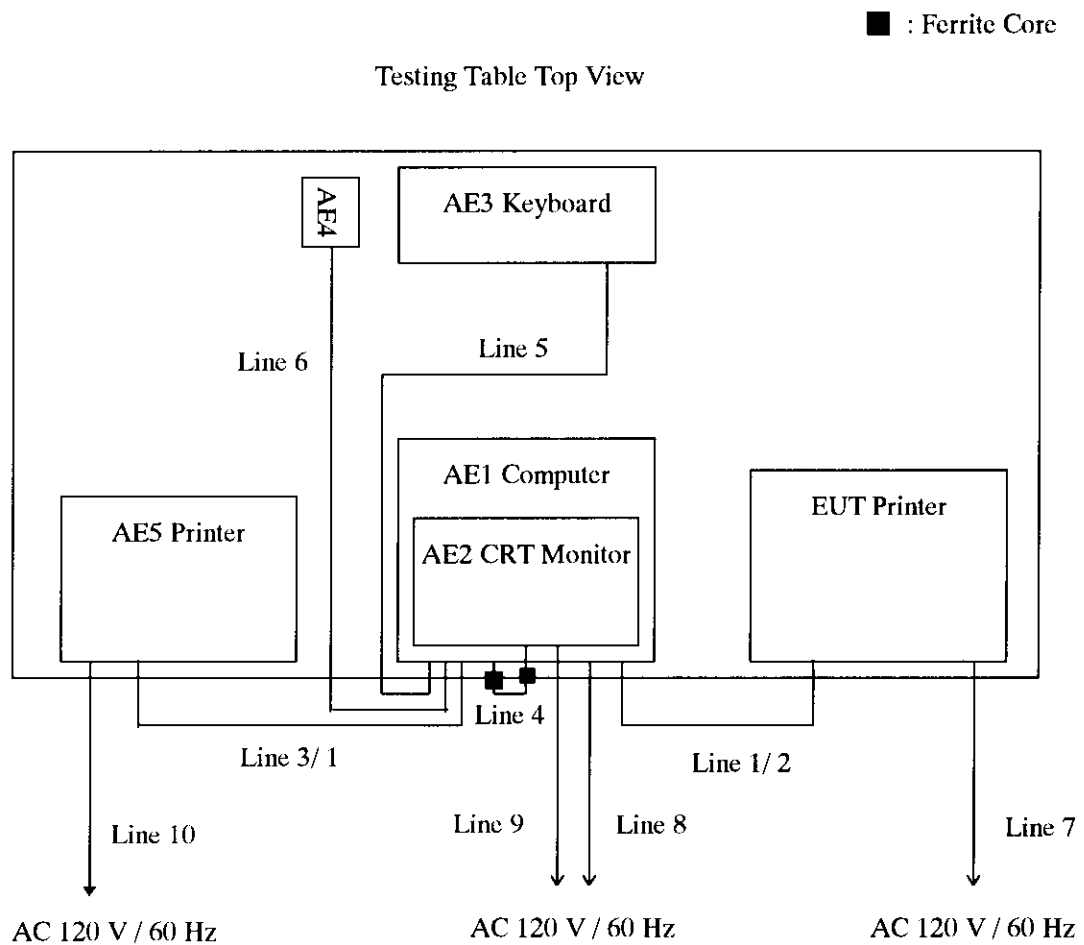
Line	Name	From	To	Length	Shield	Remarks
11	Serial I/F cable	EUT Serial in	AE6 Serial out	2.0 m	Yes	Metal connector
12	SCSI I/F cable	AE10 SCSI	AE6 SCSI	1.0 m	Yes	Metal connector
13	Video I/F cable	AE7 Video in	AE6 Video out	1.5 m	Yes	Metal connector
14	Keyboard I/F cable	AE8 Keyboard	AE6 Keyboard out	0.9 m	Yes	Metal connector
15	Mouse I/F cable	AE9 Mouse	AE8 Mouse out	0.8 m	Yes	Metal connector
16	Printer AC cable	EUT AC 120 V in	Main AC 120 V	1.9 m	No	
17	Computer AC cable	AE6 AC 120 V in	Main AC 120 V	1.9 m	No	
18	CRT AC cable	AE7 AC 120 V in	AE6 AC 120 V	1.5 m	No	
19	Film scanner AC cable	AE10 AC 120 V in	Main AC 120 V	2.0 m	No	

Note : Line 4 and 13(video I/F cable) have two ferrite cores permanently attached.

1-4 Positioning of Equipment

The positioning of EUT during testing is as follows.

Configuration 1



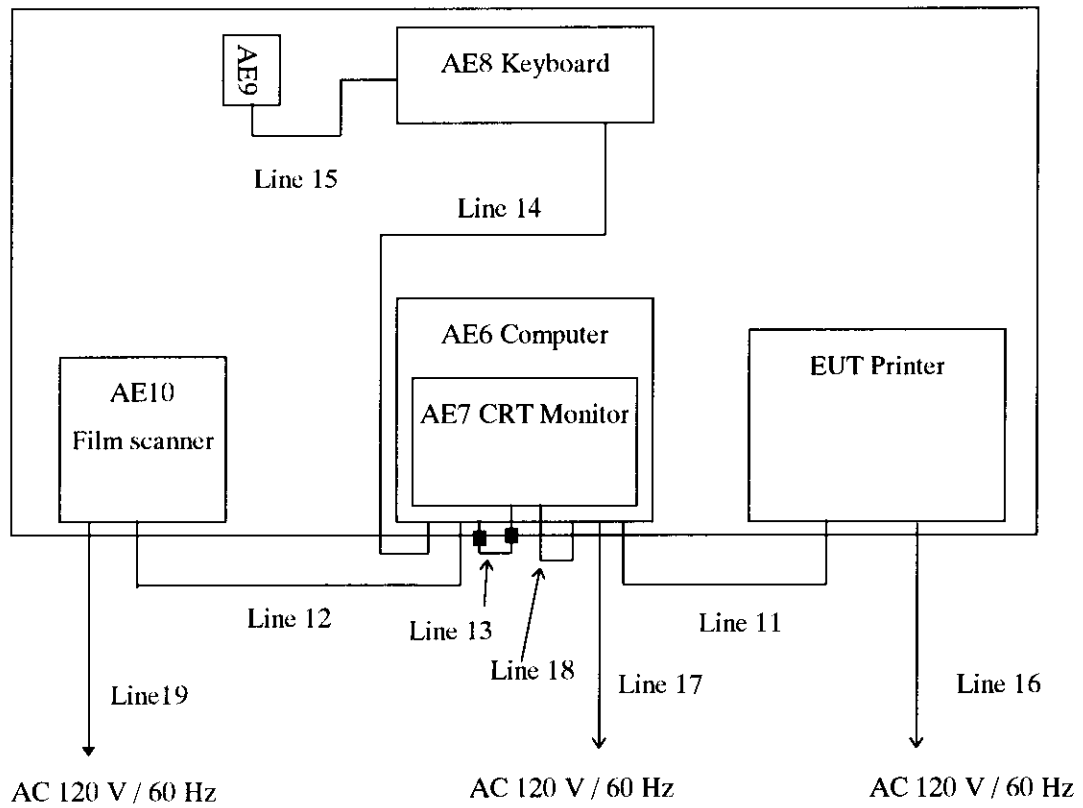
When the line 1 is connected between EUT and AE1, the line 3 is connected between AE1 and AE5 and when the line 2 is connected, the line 1 is connected as like.

Abbreviations shown in the above diagram correspond to equipment or cables in tables in Section 1-1, 1-2, 1-3.

Configuration 2

■ : Ferrite Core

Testing Table Top View



Abbreviations shown in the above diagram correspond to equipment or cables in tables in Section 1-1, 1-2, 1-3.

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2. OPERATING CONDITIONS

The EUT is operated under the following conditions during the tests.

2-1 Operating modes

Mode 1 : Parallel I/F mode

The EUT continuously printing character 'H' via the Parallel interface (line 1) with below operating cycles in configuration 1.

Mode 2 : USB I/F mode

The EUT continuously printing character 'H' via the USB interface (line 2) with below operating cycles in configuration 1.

Mode 3 : Serial I/F mode

The EUT continuously printing character 'H' via the Serial interface (line 11) with below operating cycles in configuration 2.

2-2 Operating cycles

Performed following operation continuously.

Configuration 1

- 1: Print data are transferred from computer(AE1)
- 2: Print 'H' characters by EUT
- 3: Monitor(AE2) displays 'H' characters on the full screen
- 4: Print 'H' characters by printer (AE5)

Configuration 2

- 1: Print data are transferred from computer(AE6)
- 2: Print 'H' characters by EUT
- 3: Monitor(AE7) displays 'H' characters on the full screen
- 4: Film scanner (AE10) stand-by condition

Note : The data transfer rate on the serial I/F (RS-422C) is 1.8M bps and USB I/F is 12M bps.

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3. TEST PROCEDURE(S)

This test is carried out with the test procedure(s) drawn up by our laboratory based on the following test procedure(s).

Test Item	Test procedure used	Scanned Frequency Range
Conducted Emission	ANSI C63.4 - 1992	0.45 - 30 MHz
Radiated Emission	ANSI C63.4 - 1992	30 - 1000 MHz



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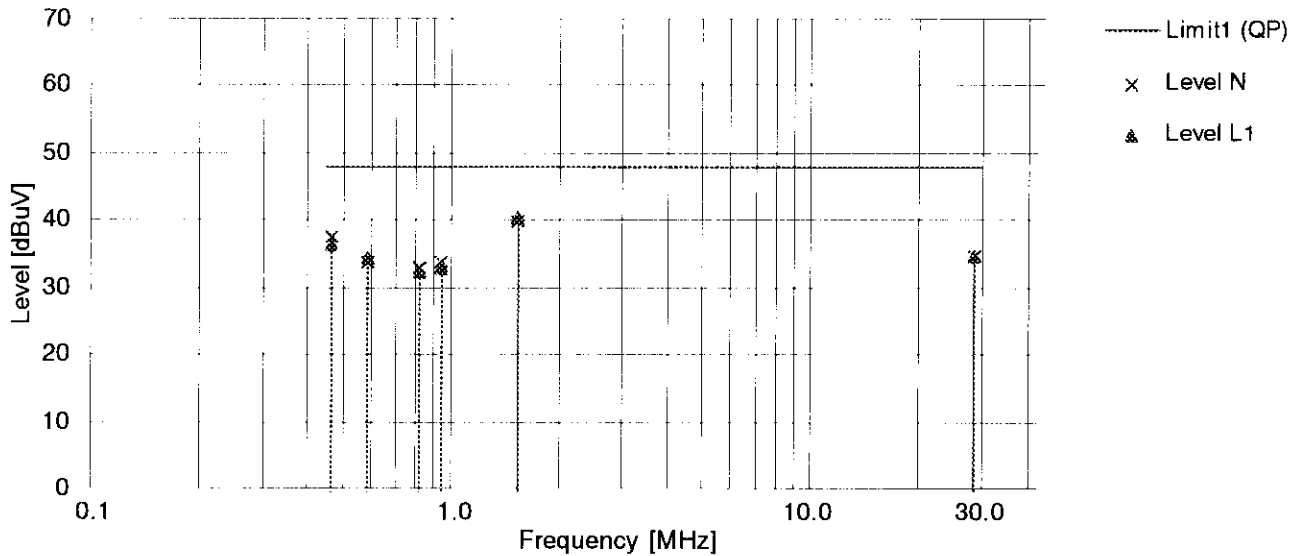
4. EVALUATION OF TEST RESULTS

4-1 Conducted Emission Test

Mode 1 : Parallel interface

Kind of Equipment	: Printer	Temperature	: 22 C
Model Name	: P113A	Humidity	: 55 %
Serial No.	: 13TM000042	Engineer	: T. Omori
Comment	: Parallel I/F		
Detector	: QP	Date	: 98/7/9
Points	: 6	EMI Receiver(s)	: R/S ESH 2

Limit1 : [FCC] Class B



Frequency [MHz]	Reading N		Reading L1		QP-AVE [dB]	QP/AVE -13 [dB]	Correction Factor [dB]	Level N [dBuV]	Level L1 [dBuV]	Limit [dBuV]	Margin [dB]
	QP [dBuV]	AVE [dBuV]	QP [dBuV]	AVE [dBuV]							
0.4629	37.0	-	36.0	-	-	-	0.4	37.4	36.4	48.0	10.6
0.5882	33.5	-	34.0	-	-	-	0.3	33.8	34.3	48.0	13.7
0.8222	32.5	-	32.0	-	-	-	0.3	32.8	32.3	48.0	15.2
0.9397	33.5	-	32.5	-	-	-	0.3	33.8	32.8	48.0	14.2
1.5256	39.5	-	40.0	-	-	-	0.3	39.8	40.3	48.0	7.7
28.3169	32.0	-	32.0	-	-	-	2.7	34.7	34.7	48.0	13.3

Note :All other frequencies in the range from 450 kHz to 30 MHz have emission level of more than 10 dB below the limit.

Level = Reading + Correction Factor

Correction Factor = IJSN factor + Cable Loss

Level is rounded off to one decimal place.

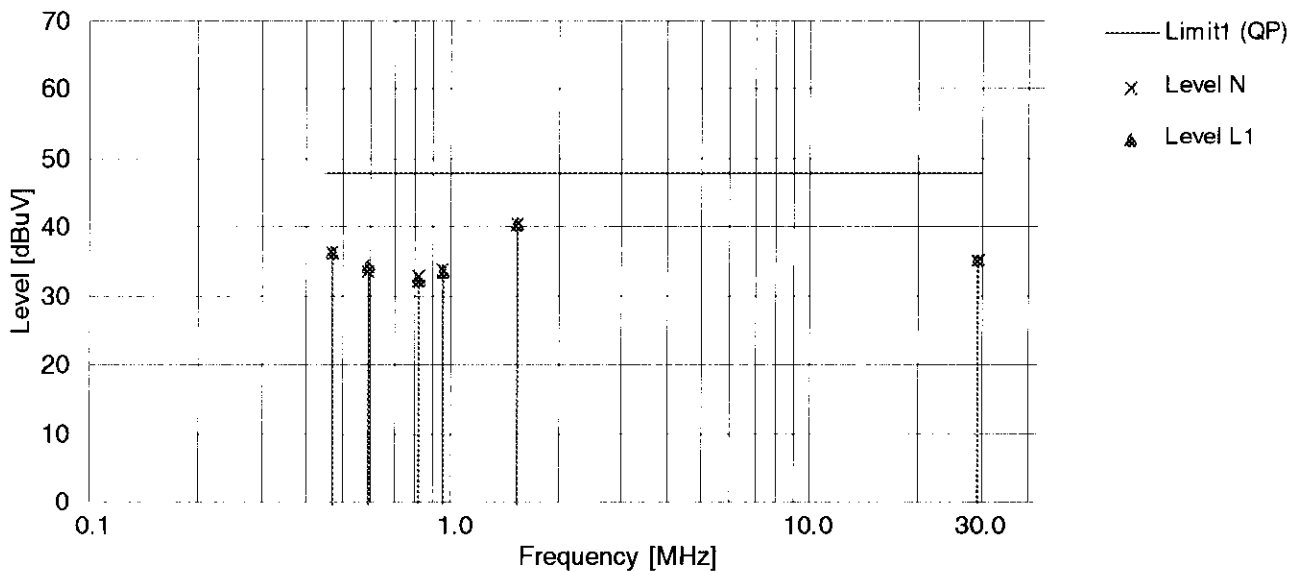


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Mode 2 : USB interface

Kind of Equipment	: Printer	Temperature	: 22 C
Model Name	: P113A	Humidity	: 55 %
Serial No.	: 13TM000042	Engineer	: T. Omori
Comment	: <u>USB I/F</u>		
Detector	: QP	Date	: 98/7/9
Points	: 6	EMI Receiver(s)	: R/S ESH 2

Limit1 : [FCC] Class B



Frequency [MHz]	Reading N		Reading L1		QP-AVE [dB]	QP/AVE -13 [dB]	Correction Factor [dB]	Level N [dBuV]	Level L1 [dBuV]	Limit [dBuV]	Margin [dB]
	QP [dBuV]	AVE [dBuV]	QP [dBuV]	AVE [dBuV]							
0.4722	36.0	-	36.0	-	-	-	0.4	36.4	36.4	48.0	11.6
0.5927	33.0	-	34.0	-	-	-	0.3	33.3	34.3	48.0	13.7
0.8146	32.5	-	32.0	-	-	-	0.3	32.8	32.3	48.0	15.2
0.9492	33.5	-	33.0	-	-	-	0.3	33.8	33.3	48.0	14.2
1.5344	40.0	-	40.0	-	-	-	0.3	40.3	40.3	48.0	7.7
29.3695	32.5	-	32.5	-	-	-	2.6	35.1	35.1	48.0	12.9

Note :All other frequencies in the range from 450 kHz to 30 MHz have emission level of more than 10 dB below the limit.

Level = Reading + Correction Factor

Correction Factor = LISN factor + Cable Loss

Level is rounded off to one decimal place.

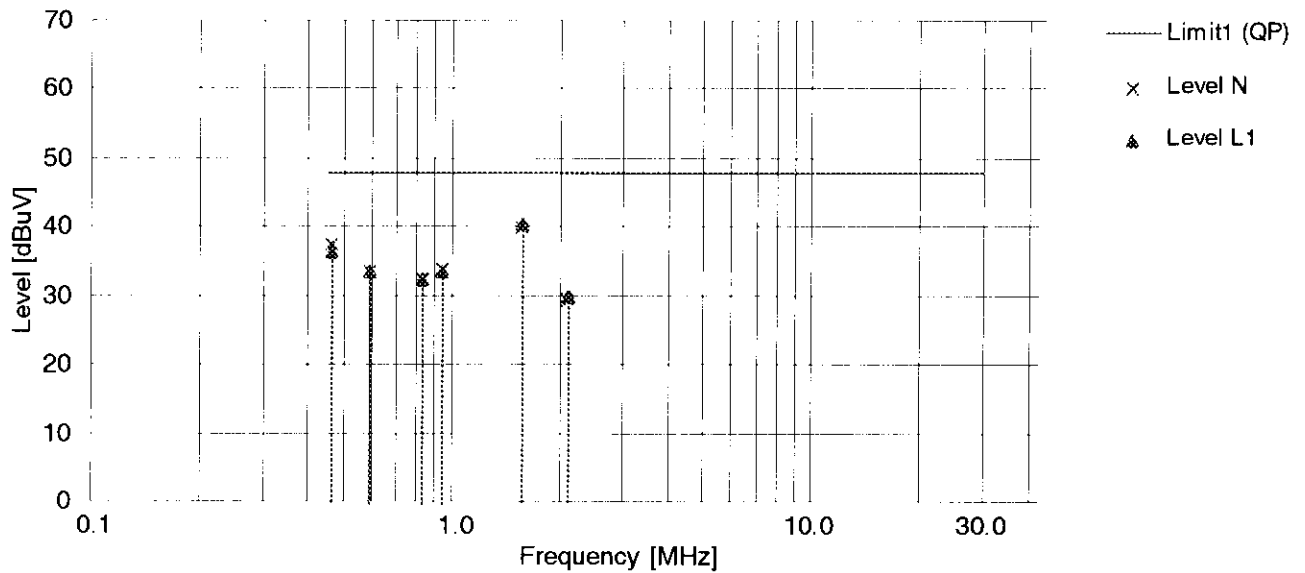


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Mode 3 : Serial interface

Kind of Equipment	: Printer	Temperature	: 22 C
Model Name	: P113A	Humidity	: 55 %
Serial No.	: 13TM000042	Engineer	: T. Omori
Comment	: Serial I/F		
Detector	: QP	Date	: 98/7/9
Points	: 6	EMI Receiver(s)	: R/S ESH 2

Limit1 : [FCC] Class B



Frequency [MHz]	Reading N		Reading L1		QP-AVE [dB]	QP/AVE -13 [dB]	Correction Factor [dB]	Level N [dBuV]	Level L1 [dBuV]	Limit [dBuV]	Margin [dB]
	QP [dBuV]	AVE [dBuV]	QP [dBuV]	AVE [dBuV]							
0.4626	37.0	-	36.0	-	-	-	0.4	37.4	36.4	48.0	10.6
0.5920	33.0	-	33.0	-	-	-	0.3	33.3	33.3	48.0	14.7
0.8288	32.0	-	32.0	-	-	-	0.3	32.3	32.3	48.0	15.7
0.9456	33.5	-	33.0	-	-	-	0.3	33.8	33.3	48.0	14.2
1.5722	39.5	-	40.0	-	-	-	0.3	39.8	40.3	48.0	7.7
2.1010	29.0	-	29.5	-	-	-	0.4	29.4	29.9	48.0	18.1

Note :All other frequencies in the range from 450 kHz to 30 MHz have emission level of more than 10 dB below the limit.

Level = Reading + Correction Factor

Correction Factor = LISN factor + Cable Loss

Level is rounded off to one decimal place.

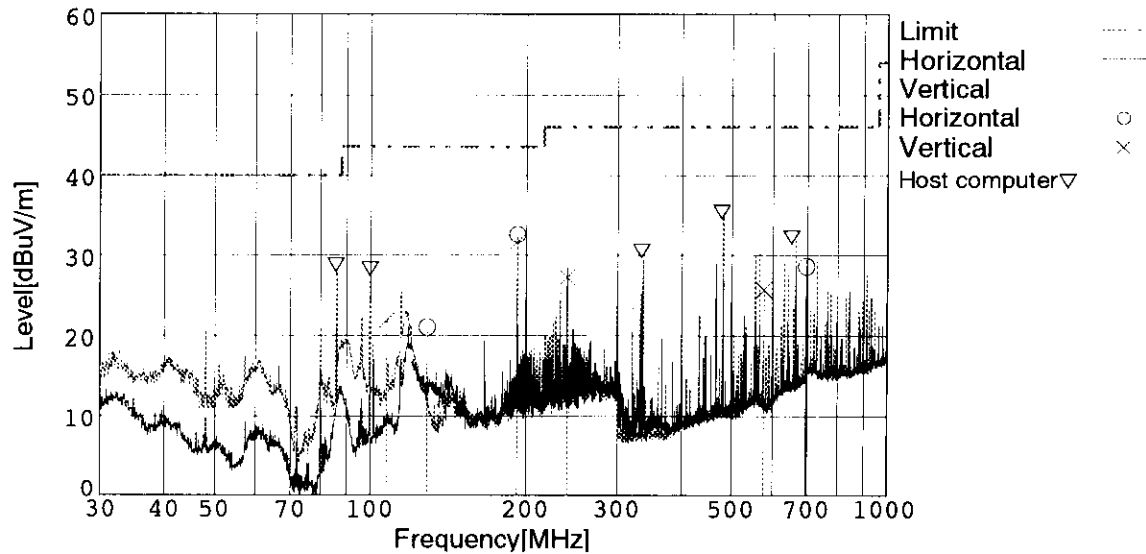
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4-3 Radiated Emission Test

Mode 1 : Parallel interface

Kind of Equipment : Printer	Temperature : 22 C
Model Name : P113A	Humidity : 55 %
Serial No. : 13TM000042	Engineer : T. omori
Comment : Parallel I/F	
Detector : QP	
Points : 7	Date : 1998/7/3 14:00
Limit: [FCC] Class B<3m>	EMI Receiver(s) : ESS



Frequency [MHz]	Meter Reading [dBuV]	Ant. Type	Antenna Factor [dB]	Total Loss [dB]	Level [dBuV/m]	Angle [degree]	Height [cm]	Pola.	Limit [dBuV/m]	Margin [dB]
107.440	29.5	BC	11.1	-18.8	21.8	2	100	Vert.	43.5	21.7
128.800	26.0	BC	13.6	-18.6	21.0	265	247	Hori.	43.5	22.5
192.005	33.0	BC	16.5	-17.8	31.7	331	100	Vert.	43.5	11.8
192.006	34.0	BC	16.5	-17.8	32.7	139	321	Hori.	43.5	10.8
240.004	27.0	BC	17.6	-17.3	27.3	358	100	Vert.	46.0	18.7
576.009	23.0	LP	17.6	-14.8	25.8	179	100	Vert.	46.0	20.2
696.006	21.9	LP	20.6	-13.9	28.6	22	119	Hori.	46.0	17.4

Note : All other frequencies in the range from 30 MHz to 1000 MHz have emission level of more than 10 dB below the limit.

Level=Meter Reading+Antenna Factor+Total Loss (Total Loss=Cable Loss+Antenna Pad Loss-Amplifier Gain)

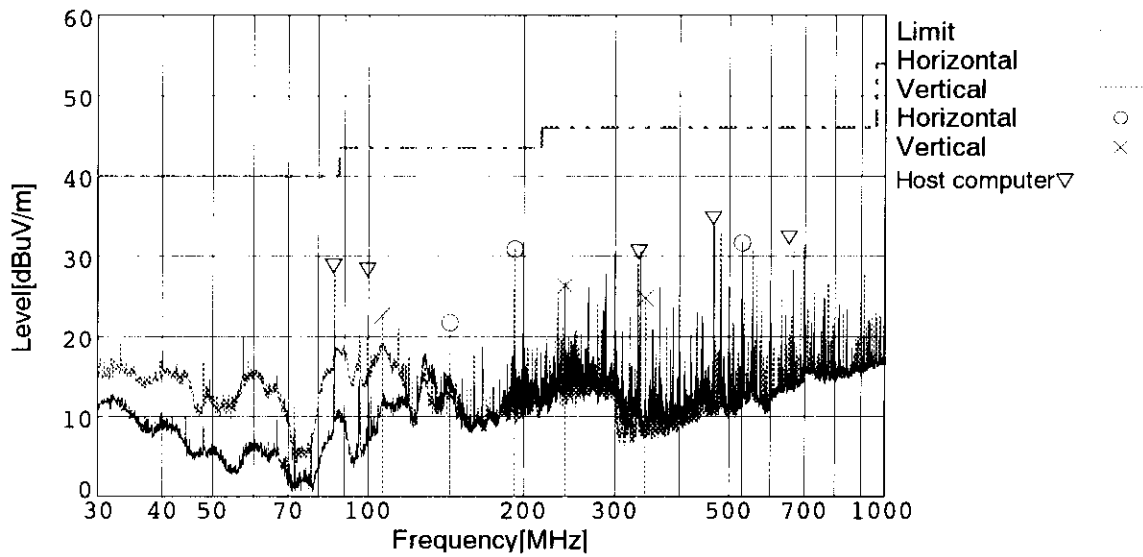
Level is rounded off to one decimal place.



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Mode 2 : USB interface

Kind of Equipment : Printer	Temperature : 22 C
Model Name : P113A	Humidity : 55 %
Serial No. : 13TM000042	Engineer : T. omori
Comment : USB I/F	
Detector : QP	
Points : 7	Date : 1998/7/3 15:07
Limit: [FCC] Class B<3m>	EMI Receiver(s) : ESS



Frequency [MHz]	Meter Reading [dBuV]	Ant. Type	Antenna Factor [dB]	Total Loss [dB]	Level [dBuV/m]	Angle [degree]	Height [cm]	Pola.	Limit [dBuV/m]	Margin [dB]
106.560	30.5	BC	10.9	-18.8	22.6	201	100	Vert.	43.5	20.9
143.997	26.0	BC	14.2	-18.5	21.7	272	169	Hori.	43.5	21.8
192.001	32.2	BC	16.5	-17.8	30.9	152	204	Hori.	43.5	12.6
192.006	31.8	BC	16.5	-17.8	30.5	322	100	Vert.	43.5	13.0
240.036	26.0	BC	17.6	-17.3	26.3	197	100	Vert.	46.0	19.7
343.460	27.5	LP	13.7	-16.4	24.8	333	100	Vert.	46.0	21.2
528.132	30.0	LP	16.9	-15.2	31.7	217	100	Hori.	46.0	14.3

Note : All other frequencies in the range from 30 MHz to 1000 MHz have emission level of more than 10 dB below the limit.

Level=Meter Reading+Antenna Factor+Total Loss (Total Loss=Cable Loss+Antenna Pad Loss-Amplifier Gain)

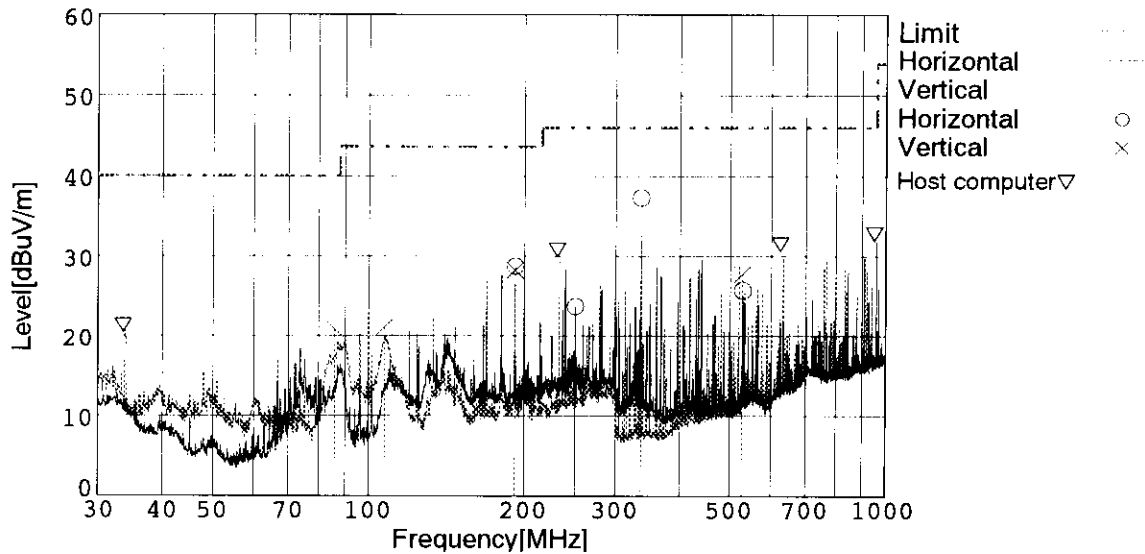
Level is rounded off to one decimal place.

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Mode 3 : Serial interface

Kind of Equipment : Printer	Temperature : 22 C
Model Name : P113A	Humidity : 55 %
Serial No. : 13TM000042	Engineer : T. omori
Comment : Mac Serial I/F	
Detector : QP	
Points : 8	Date : 1998/7/3 18:00
Limit: [FCC] Class B<3m>	EMI Receiver(s) : ESS



Frequency [MHz]	Meter Reading [dBuV]	Ant. Type	Antenna Factor [dB]	Total Loss [dB]	Level [dBuV/m]	Angle [degree]	Height [cm]	Pola.	Limit [dBuV/m]	Margin [dB]
86.025	32.5	BC	7.5	-19.1	20.9	218	125	Vert.	40.0	19.1
107.540	28.8	BC	11.1	-18.8	21.1	218	100	Vert.	43.5	22.4
192.000	30.1	BC	16.5	-17.8	28.8	139	208	Hori.	43.5	14.7
192.003	29.5	BC	16.5	-17.8	28.2	289	100	Vert.	43.5	15.3
250.650	23.0	BC	17.9	-17.2	23.7	59	160	Hori.	46.0	22.3
336.009	40.1	LP	13.6	-16.4	37.3	175	100	Hori.	46.0	8.7
528.002	24.0	LP	16.9	-15.2	25.7	86	100	Hori.	46.0	20.3
528.002	26.0	LP	16.9	-15.2	27.7	300	100	Vert.	46.0	18.3

Note : All other frequencies in the range from 30 MHz to 1000 MHz have emission level of more than 10 dB below the limit.

Level=Meter Reading+Antenna Factor+Total Loss (Total Loss=Cable Loss+Antenna Pad Loss-Amplifier Gain)

Level is rounded off to one decimal place.

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5. SUMMARY**5-1 Test Results**

This test report clearly shows that the EUT complies with the FCC Part 15B Class B specification.

The minimum margins to the limits are as follows:

- Conducted measurement	7.7 dB	at	1.5256 MHz (Mode 1)
			1.5344 MHz (Mode 2)
			1.5722 MHz (Mode 3)
- Radiation measurement	8.7 dB	at	336.009 MHz (Mode 3)

This data represent the worst case emissions.

5-2 Sample Calculations**5-2-1 Conducted Emission**

Example 1.5256 MHz

$$\begin{array}{rcl}
 \text{Emission Level} & = & \text{Meter Reading} & 40.0 \text{ dBuV} \\
 & & + \text{ Correction Factor} & + 0.3 \text{ dB} \\
 & & & \hline
 & = & & 40.3 \text{ dBuV}
 \end{array}$$

$$\begin{array}{rcl}
 \text{Margin} & = & \text{Limit} & 48.0 \text{ dBuV} \\
 & & - \text{ Emission Level} & - 40.3 \text{ dBuV} \\
 & & & \hline
 & = & & 7.7 \text{ dB}
 \end{array}$$

Meter reading = Test receiver reading

The numerical value are rounded off to one decimal place.

5-2-2 Radiated Emission

Example 336.009 MHz

$$\begin{array}{rcl}
 \text{Emission Level} & = & \text{Meter Reading} & 40.1 \text{ dBuV} \\
 & & + \text{ Antenna Factor} & + 13.6 \text{ dB} \\
 & & + \text{ Total Loss} & - 16.4 \text{ dB} \\
 & & & \hline
 & = & & 37.3 \text{ dBuV/m}
 \end{array}$$

$$\begin{array}{rcl}
 \text{Margin} & = & \text{Limit} & 46.0 \text{ dBuV/m} \\
 & & - \text{ Emission Level} & - 37.3 \text{ dBuV/m} \\
 & & & \hline
 & = & & 8.7 \text{ dB}
 \end{array}$$

Meter reading = Test receiver reading

The numerical values are rounded off to one decimal place.

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6. LIST OF UTILIZED TEST EQUIPMENT**6-1 Conducted Emission Measurement**

Instrument	Manufacturer	Model Number	Serial Number	Last Calibration Date	Period
Spectrum Analyzer	Hewlett Packard	8567A	2718A00363	April 28, 1998	1 Year
Quasi-peak Adapter	Hewlett Packard	85650A	2521A00798	April 3, 1998	1 Year
Test Receiver	Rhode & Schwarz	ESH2	879013/027	April 1, 1998	1 Year
LISN	Rhode & Schwarz	ESH2-Z5	890484/004	August 20,1997	1 Year

6-2 Radiated Emission Measurement

Instrument	Manufacturer	Model Number	Serial Number	Last Calibration Date	Period
Spectrum Analyzer	Hewlett Packard	8566B	2332A02675	July 25, 1997	1 Year
Quasi-peak Adapter	Hewlett Packard	85650A	2043A00284	July 25, 1997	1 Year
Pre-amplifier	Hewlett-Packard	87405A	3207A00888	March 18,1998	1 Year
Test Receiver	Rhode & Schwarz	ESS	844362/001	August 14, 1997	1 Year
Biconical Antenna	Schwarzbeck	BBA9106	-	February 11, 1998	1 Year
Log-periodic Antenna	EMCO	3146	8910-2511	November 24, 1997	1 Year

Note : The utilized instruments are calibrated by a body that can provide traceability to a national standard.

The abbreviation of antenna types which indicate on the radiated emission test table are follows:

BC : Biconical Antenna LP : Log-periodic Antenna

6-3 Measurement Uncertainties

Measurement uncertainties are shown as below.

Conducted Emission Measurement	± 2.33 dB
Radiated Emission Measurement	5.15 dB / -4.56 dB

Repeating and reproducing maximum emission set-up are not discussed herein.

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7. VALIDITY OF TEST REPORT

- 1: The test result of this report is effective for equipment under test itself and test configuration described on the report.
- 2: This test report shall not be reproduced without the written approval of the laboratory.
- 3: This test report must not be used by client to claim product endorsement by NVLAP or any agency of the U.S. Government.

EPSON

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8. DESCRIPTION OF TEST LABORATORY

Bibliography

Since commencing operation in 1942 as a watch manufacturer, Seiko Epson Corporation has utilized its own original micromechatronics technologies, gained while developing quartz watches, to diversify into a variety of fields, as computers, printers and electronic devices, including semiconductors and liquid crystal displays. The phrase "highly functional and highly compact" best describes the policy of our product development activities.

Since the initial electrical printer was manufactured in 1971, Seiko Epson Corporation has been working for EMC field. It is a combination of precise machine technology and electric technology.

Now EMC group has 3 semi-anechoic chambers and 8 EMI/EMC test facilities and full responsibilities on EMC testing. It is independent from any other business organizations and admired by the president as neutral and it's independency.

Filing, Certification and Accreditation List

EMC testing

FCC	(USA)
NVLAP (Lab. Code: 200157-0)	(USA)
NMi	(Netherlands)
VCCI	(Japan)
NEMKO	(Norway)