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SEIKO EPSON CORPORATION

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 : P112A

FCC ID NUMBER : BKMFBP112A

TEST REPORT No. : E-103-98088



NVLAP LAB CODE 200157-0

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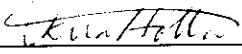
TEST CERTIFICATION**Applicant Information**

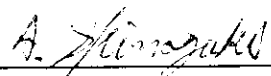
Company : SEIKO EPSON Corporation
 Division/Section : TP Product Safety Design Group
 Imaging & Information Products Operations
 Address : 80, Harashinden, Hirooka, Shiojiri-shi, Nagano, 399-0785 Japan
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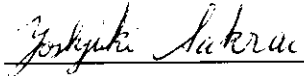
Test Performed

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 : 2 June, 1998
 Test completed : 4 June, 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 : Akira Hotta 
 EMC group, CS/Quality Assurance Office

Report checked by : Atsushi Shinozaki 
 Chief Engineer, EMC group, CS/Quality Assurance Office

Report approved by : Yoshiyuki Sakurai 
 Manager, EMC group, CS/Quality Assurance Office / NVLAP signatory

Report issue date : 30 June, 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	: P112A
FCC ID	: BKMFBP112A
Serial Number	: 12SC000032
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	0.8 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.

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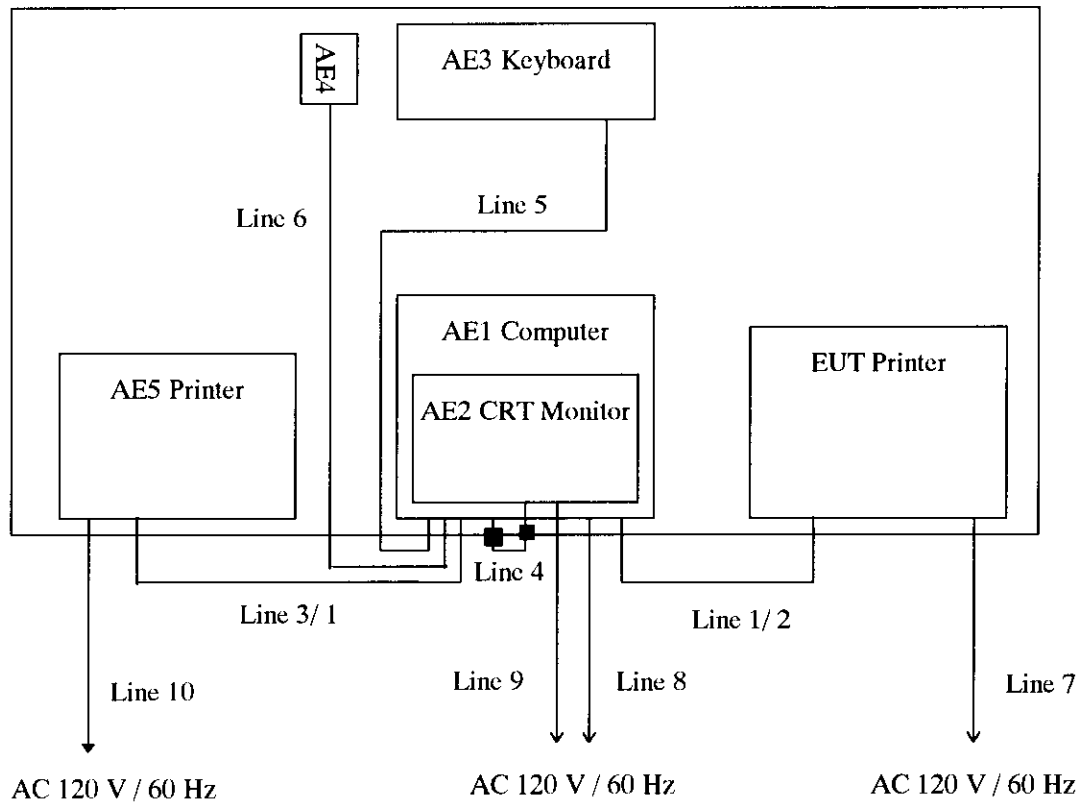
1-4 Positioning of Equipment

The positioning of EUT during testing is as follows.

Configuration 1

■ : Ferrite Core

Testing Table Top View



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.

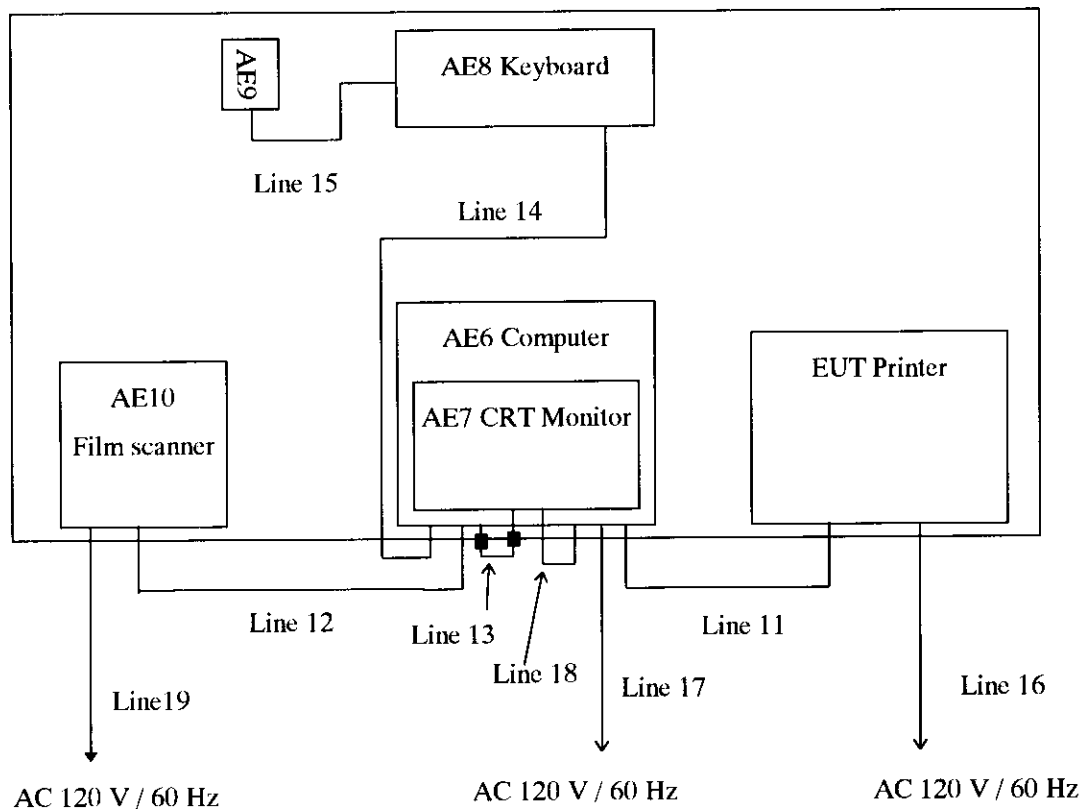
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Configuration 2

■ : 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 with below operating cycles in configuration 1.

Mode 2 : USB I/F mode

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

Mode 3 : Serial I/F mode

The EUT continuously printing character 'H' via the Serial interface 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 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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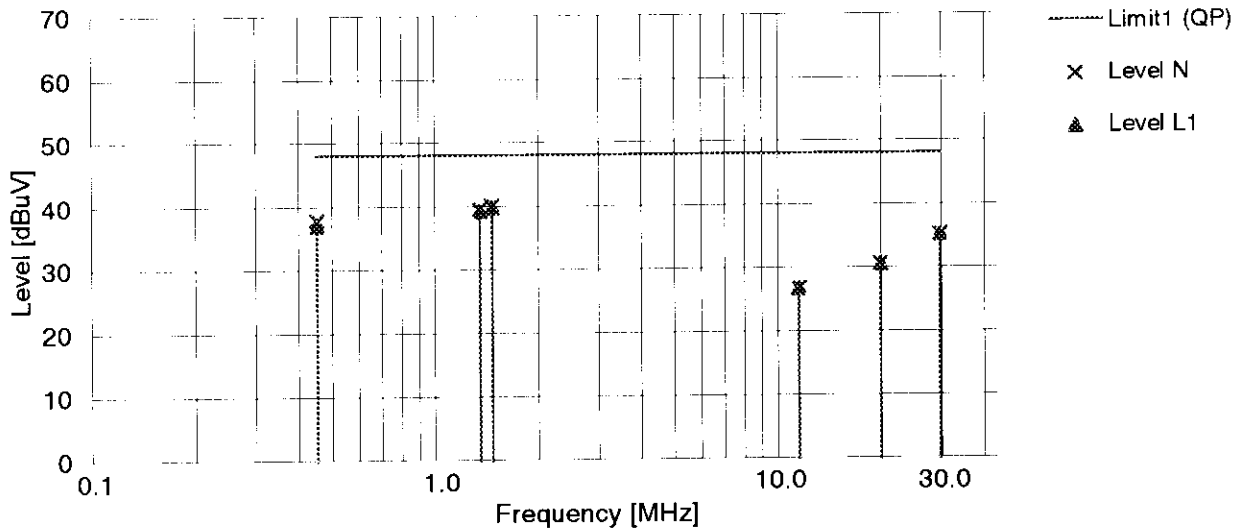
4. EVALUATION OF TEST RESULTS

4-1 Conducted Emission Test

Mode 1 : Parallel interface

Kind of Equipment	: Printer	Temperature	: 24 C
Model Name	: P112A	Humidity	: 55 %
Serial No.	: 12SC000032	Engineer	: A. Hotta
Comment	: Parallel I/F		
Detector	: QP	Date	: 98/6/4
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]							
0.4529	37.5	-	36.5	-	-	-	0.3	37.8	36.8	48.0	10.2
1.3557	39.2	-	38.9	-	-	-	0.3	39.5	39.2	48.0	8.5
1.4743	39.8	-	39.4	-	-	-	0.3	40.1	39.7	48.0	7.9
11.5580	25.0	-	25.0	-	-	-	1.7	26.7	26.7	48.0	21.3
19.9389	27.8	-	27.8	-	-	-	2.7	30.5	30.5	48.0	17.5
29.7731	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.

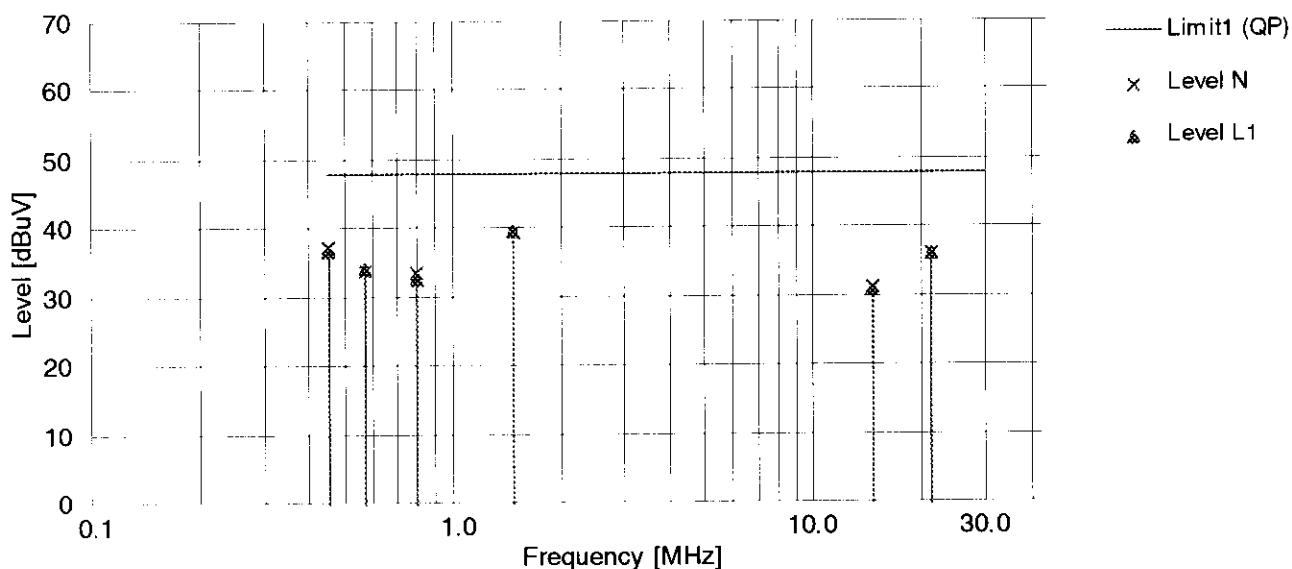


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Mode 2 : USB interface

Kind of Equipment	: Printer	Temperature	: 24 C
Model Name	: P112A	Humidity	: 55 %
Serial No.	: 12SC000032	Engineer	: A.Hotta
Comment	: USB I/F		
Detector	: QP	Date	: 98/6/4
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]							
0.4562	36.8	-	36.3	-	-	-	0.3	37.1	36.6	48.0	10.9
0.5685	33.5	-	33.8	-	-	-	0.3	33.8	34.1	48.0	13.9
0.7950	33.0	-	32.2	-	-	-	0.3	33.3	32.5	48.0	14.7
1.4690	39.0	-	39.3	-	-	-	0.3	39.3	39.6	48.0	8.4
14.5480	28.8	-	28.5	-	-	-	2.2	31.0	30.7	48.0	17.0
21.0977	33.3	-	33.3	-	-	-	2.8	36.1	36.1	48.0	11.9

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.

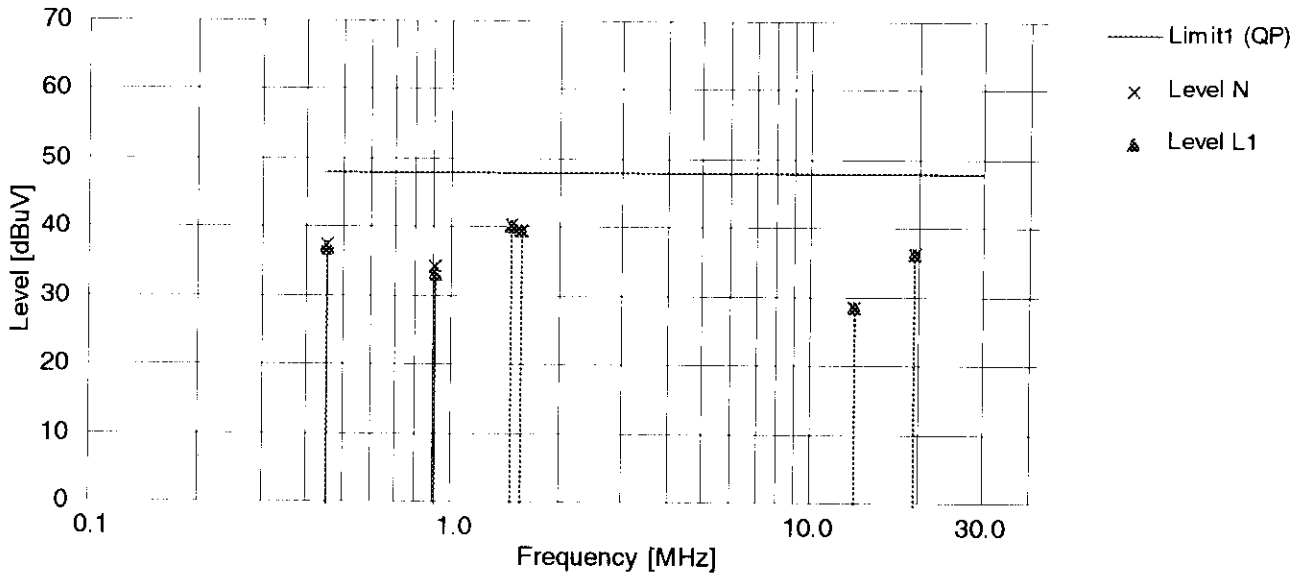


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Mode 3 : Serial interface

Kind of Equipment	: Printer	Temperature	: 24 C
Model Name	: P112A	Humidity	: 55 %
Serial No.	: 12SC000032	Engineer	: A.Hotta
Comment	: Serial I/F	Date	: 98/6/4
Detector	: QP	EMI Receiver(s)	: R/S ESH 2
Points	: 6		

Limit1 : [FCC] Class B



Frequency [MHz]	Reading N		Reading L1		QP-AVE	QP/AVE -13	Correction Factor	Level N	Level L1	Limit	Margin
	QP [dBuV]	AVE [dBuV]	QP [dBuV]	AVE [dBuV]							
0.4533	37.3	-	36.5	-	-	-	0.3	37.6	36.8	48.0	10.4
0.9074	34.0	-	32.8	-	-	-	0.3	34.3	33.1	48.0	13.7
1.4775	40.1	-	39.9	-	-	-	0.3	40.4	40.2	48.0	7.6
1.5827	39.2	-	39.3	-	-	-	0.3	39.5	39.6	48.0	8.4
13.1273	26.5	-	26.5	-	-	-	2.0	28.5	28.5	48.0	19.5
19.3144	33.5	-	33.5	-	-	-	2.7	36.2	36.2	48.0	11.8

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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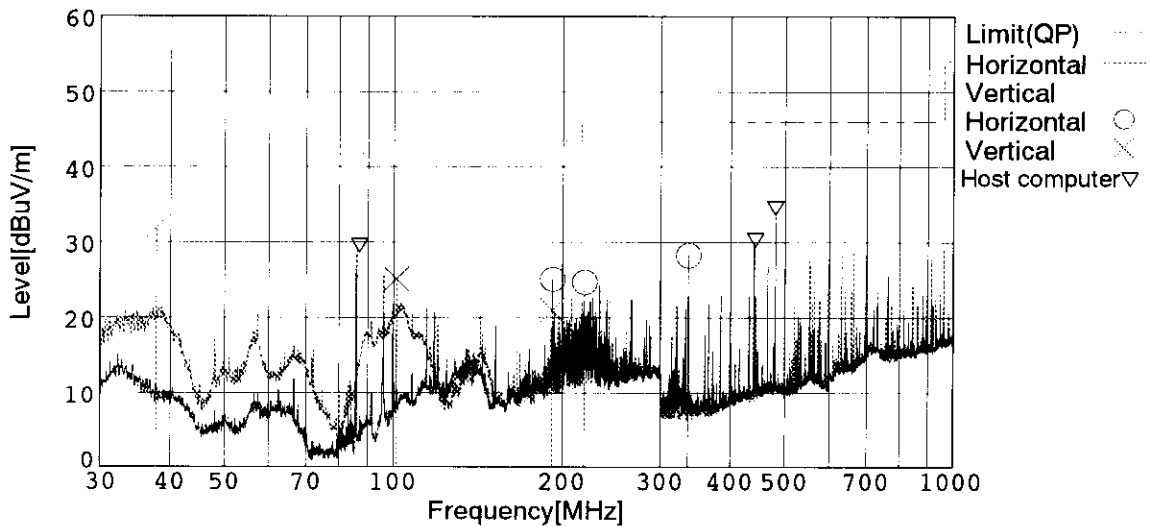
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4-3 Radiated Emission Test

Mode 1 : Parallel interface

Kind of Equipment : Printer
 Model Name : P112A
 Serial No. : 12SC000032
 Comment : Parallel I/F
 Detector : QP
 Points : 6
 Limit: [FCC] Class B<3m>

Temperature : 22 C
 Humidity : 45 %
 Engineer : A. Hotta
 Date : 1998/6/2 17:03
 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]
37.800	35.8	BC	16.3	-20.2	31.9	292	100	Vert.	40.0	8.1
101.413	33.9	BC	10.1	-18.9	25.1	260	100	Vert.	43.5	18.4
192.003	26.4	BC	16.5	-17.8	25.1	166	165	Hori.	43.5	18.4
192.003	22.3	BC	16.5	-17.8	21.0	0	100	Vert.	43.5	22.5
219.050	25.2	BC	17.1	-17.6	24.7	231	139	Hori.	46.0	21.3
336.003	31.1	LP	13.6	-16.4	28.3	177	100	Hori.	46.0	17.7

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.

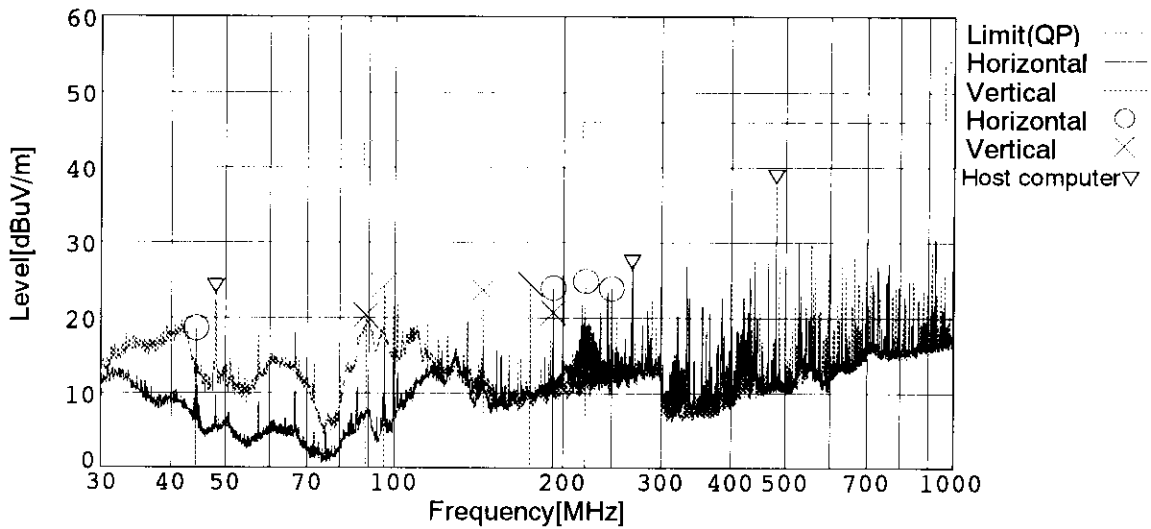
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Mode 2 : USB interface

Kind of Equipment : Printer
 Model Name : P112A
 Serial No. : 12SC000032
 Comment : USB I/F
 Detector : QP
 Points : 9
 Limit: [FCC] Class B<3m>

Temperature : 22 C
 Humidity : 45 %
 Engineer : A. Hotta
 Date : 1998/6/2 14:12
 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]
44.306	25.0	BC	13.7	-20.0	18.7	5	400	Hori.	40.0	21.3
89.040	31.5	BC	7.9	-19.1	20.3	245	100	Vert.	43.5	23.2
96.000	34.1	BC	9.2	-19.0	24.3	259	100	Vert.	43.5	19.2
144.002	28.0	BC	14.2	-18.5	23.7	202	100	Vert.	43.5	19.8
174.503	26.5	BC	16.2	-18.1	24.6	328	100	Vert.	43.5	18.9
192.001	22.0	BC	16.5	-17.8	20.7	354	100	Vert.	43.5	22.8
192.003	25.3	BC	16.5	-17.8	24.0	203	178	Hori.	43.5	19.5
219.036	25.4	BC	17.1	-17.6	24.9	14	155	Hori.	46.0	21.1
243.750	23.5	BC	17.7	-17.3	23.9	67	153	Hori.	46.0	22.1

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.

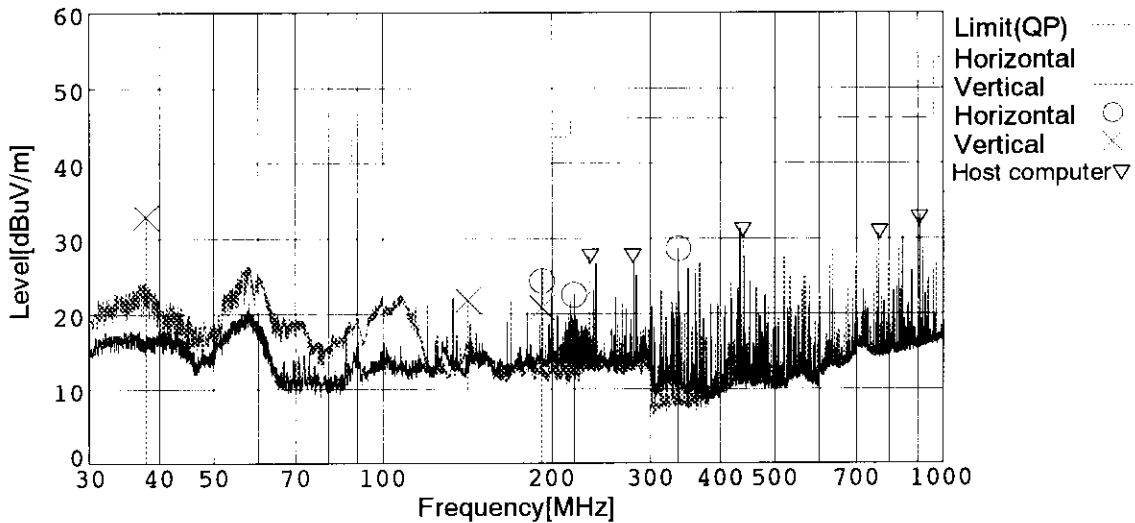


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Mode 3 : Serial interface

Kind of Equipment : Printer
 Model Name : P112A
 Serial No. : 12SC000032
 Comment : Serial I/F
 Detector : QP
 Points : 6
 Limit: [FCC] Class B<3m>

Temperature : 22 C
 Humidity : 45 %
 Engineer : A.Hotta
 Date : 1998/6/2 19:07
 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]
37.854	36.8	BC	16.3	-20.2	32.9	253	100	Vert.	40.0	7.1
142.004	26.3	BC	14.0	-18.5	21.8	0	100	Vert.	43.5	21.7
192.000	25.7	BC	16.5	-17.8	24.4	261	185	Hori.	43.5	19.1
192.000	22.1	BC	16.5	-17.8	20.8	2	100	Vert.	43.5	22.7
219.103	23.0	BC	17.1	-17.6	22.5	11	147	Hori.	46.0	23.5
336.003	31.5	LP	13.6	-16.4	28.7	197	100	Hori.	46.0	17.3

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 7.6 dB at 1.4775 MHz (Mode 3)
- Radiation measurement 7.1 dB at 37.854 MHz (Mode 3)

This data represent the worst case emissions.

5-2 Sample Calculations

5-2-1 Conducted Emission

Example 1.4775 MHz

$$\begin{array}{rcl}
 \text{Emission Level} & = & \text{Meter Reading} & 40.1 \text{ dBuV} \\
 & & + \text{ Correction Factor} & + 0.3 \text{ dB} \\
 & & & \hline
 & = & & 40.4 \text{ dBuV}
 \end{array}$$

$$\begin{array}{rcl}
 \text{Margin} & = & \text{Limit} & 48.0 \text{ dBuV} \\
 & & - \text{ Emission Level} & - 40.4 \text{ dBuV} \\
 & & & \hline
 & = & & 7.6 \text{ dB}
 \end{array}$$

Meter reading = Test receiver reading

The numerical value are rounded off to one decimal place.

5-2-2 Radiated Emission

Example 37.854 MHz

$$\begin{array}{rcl}
 \text{Emission Level} & = & \text{Meter Reading} & 36.8 \text{ dBuV} \\
 & & + \text{ Antenna Factor} & + 16.3 \text{ dB} \\
 & & + \text{ Total Loss} & - 20.2 \text{ dB} \\
 & & & \hline
 & = & & 32.9 \text{ dBuV/m}
 \end{array}$$

$$\begin{array}{rcl}
 \text{Margin} & = & \text{Limit} & 40.0 \text{ dBuV/m} \\
 & & - \text{ Emission Level} & - 32.9 \text{ dBuV/m} \\
 & & & \hline
 & = & & 7.1 \text{ dB}
 \end{array}$$

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
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.
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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)