

JQA APPLICATION NO.: 400-90621
Issue Date : January 11, 2000
Page 1 of 29

EMI TEST REPORT

JQA APPLICATION NO. : 400-90621

Model No. : RC-R1110

Type of Equipment : Remote Control Transmitter

Regulations Applied : CFR 47 FCC Rules and Regulations Part 15

FCC ID : IOM701349

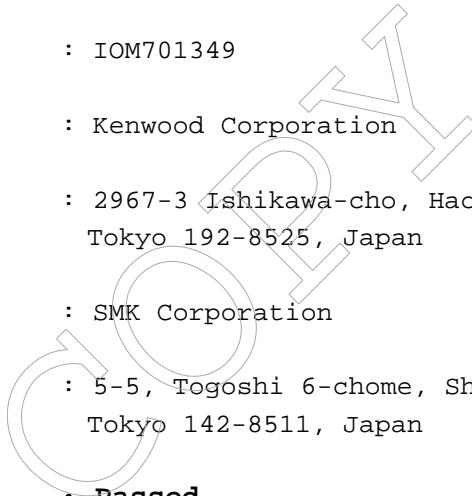
Applicant : Kenwood Corporation

Address : 2967-3 Ishikawa-cho, Hachioji-shi,
Tokyo 192-8525, Japan

Manufacture : SMK Corporation

Address : 5-5, Togoshi 6-chome, Shinagawa-ku,
Tokyo 142-8511, Japan

Final Judgment : **Passed**



TEST RESULTS IN THIS REPORT are obtained in use of equipment that is traceable to
Electrotechnical Lab. of MITI Japan and Communications Research Lab. of MPT Japan.

The **test results** only respond to the tested sample. It is not allowed to copy this
report even partly without the allowance of the JQA EMC Engineering Dept. Testing Div.

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1 DOCUMENTATION**1.1 TEST REGULATION**

FCC Rules and Regulations Part 15 Subpart A and C (June 23, 1989) Intentional Radiators

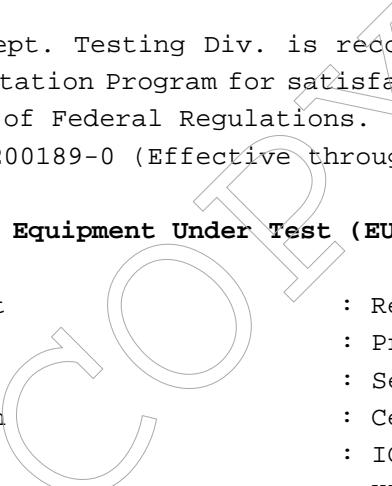
Test procedure :

AC power line conducted emission, radiated emission, frequency stability and occupied bandwidth tests were performed according to the procedures in ANSI C63.4-1992.

1.2 GENERAL INFORMATION**1.2.1 Test facility :**

1) Test Facility located at EMC Engineering Dept. Testing Div. : No.2 and 3 Anechoic Chambers(3 meters Site)
FCC filing No. : 31040/SIT 1300F2

2) EMC Engineering Dept. Testing Div. is recognized under the National Voluntary Laboratory accreditation Program for satisfactory compliance established in title 15, Part 285 Code of Federal Regulations.
NVLAP Lab Code : 200189-0 (Effective through : June 30, 2000)

1.2.2 Description of the Equipment Under Test (EUT) :

1) Type of Equipment	: Remote Control Transmitter
2) Product Type	: Prototype
3) Category	: Security/Remote Control Transmitter
4) EUT Authorization	: Certification
5) FCC ID	: IOM701349
6) Trade Name	: KENWOOD
7) Model No.	: RC-R1110
8) Operating Frequency Range	: 422 MHz to 428 MHz
9) Highest Frequency Used in the EUT	: 428 MHz
10) Serial No.	: None
11) Date of Manufacture	: None
12) Power Rating	: DC 3.0(Battery)
13) EUT Grounding	: None

1.2.3 Definitions for symbols used in this test report :

x - indicates that the listed condition, standard or equipment is applicable for this report.
— - indicates that the listed condition, standard or equipment is not applicable for this report.

1.3 TEST CONDITION**1.3.1 The measurement of the AC Power Line Conducted Emission**

- was performed in the following test site.
 - was not applicable.

Test location :

Safety Testing Center EMC Engineering Dept. Testing Div.
21-25, Kinuta 1-chome, Setagaya-ku, Tokyo 157-8573, Japan

- Shielded Enclosure
 - Anechoic Chamber No. 2 (portable Type)

Used test instruments :

Type	Model No.	Manufacturer	Serial No.	Last Cal.	Interval
<input type="checkbox"/> - Field Strength Meter	ESH-2	Rohde & Schwarz	880370/016	May 1999	1 Year
<input type="checkbox"/> - Field Strength Meter	ESH-3	Rohde & Schwarz	881460/016	May 1999	1 Year
<input type="checkbox"/> - Field Strength Meter	ESH-3	Rohde & Schwarz	881460/030	Nov 1999	1 Year
<input type="checkbox"/> - LISN	KNW-407	Kyoritsu Electrical	8-833-6	Apr. 1999	1 Year
<input type="checkbox"/> - LISN	KNW-407	Kyoritsu Electrical	8-855-2	Apr. 1999	1 Year
<input type="checkbox"/> - LISN	KNW-407	Kyoritsu Electrical	8-757-1	Apr. 1999	1 Year
<input type="checkbox"/> - RF Cable	3D-2W	Fujikura	155-21-005	Apr. 1999	1 Year
<input type="checkbox"/> - RF Cable	3D-2W	Fujikura	155-21-006	Apr. 1999	1 Year

1.3.2 The measurement of the Radiated Emission(30 MHz - 1000 MHz)

x - was performed in the following test site.
 - was not applicable.

Test location :

Safety Testing Center EMC Engineering Dept. Testing Div.
21-25, Kinuta 1-chome, Setagaya-ku, Tokyo 157-8573, Japan

x - Anechoic Chamber No. 2 (3 meters)
 - Anechoic Chamber No. 3 (3 meters)

Validation of Site Attenuation :

1) Last Confirmed Date :March, 1999
2) Interval :1 year

Used test instruments :

Type	Model No.	Manufacturer	Serial No.	Last Cal.	Interval
<u> </u> - Field Strength Meter	ESV	Rohde & Schwarz	872148/039	May 1999	1 Year
<u> </u> - Field Strength Meter	ESVP	Rohde & Schwarz	879783/030	May 1999	1 Year
<u>x</u> - Field Strength Meter	ESVP	Rohde & Schwarz	881487/004	May 1999	1 Year
<u> </u> - Field Strength Meter	ESVP	Rohde & Schwarz	881487/005	May 1999	1 Year
<u> </u> - Antenna	KBA-511A	Kyoritsu Electrical	0-201-13	Nov. 1999	1 Year
<u>x</u> - Antenna	KBA-511A	Kyoritsu Electrical	0-170-1	Nov. 1999	1 Year
<u> </u> - Antenna	KBA-611	Kyoritsu Electrical	0-210-5	Nov. 1999	1 Year
<u>x</u> - Antenna	KBA-611	Kyoritsu Electrical	0-147-14	Nov. 1999	1 Year
<u>x</u> - RF Cable	5D-2W	Fujikura	155-21-001	Feb. 1999	1 Year
<u> </u> - RF Cable	5D-2W	Fujikura	155-21-002	Feb. 1999	1 Year

1.3.3 The measurement of the Radiated Emission(Above 1000 MHz)

- was performed in the following test site.
 - was not applicable.

Test location :

Safety Testing Center EMC Engineering Dept. Testing Div.
21-25, Kinuta 1-chome, Setagaya-ku, Tokyo 157-8573, Japan

- No. 2 site (3 meters)
 - No. 3 site (3 meters)

Validation of Site Attenuation :

1) Last Confirmed Date :March, 1999
2) Interval :1 year

Used test instruments :

Type	Model No.	Manufacturer	Serial No.	Last Cal.	Interval
<input type="checkbox"/> - Spectrum Analyzer	8566B	Hewlett Packard	2140A01091	Apr. 1999	1 Year
<input checked="" type="checkbox"/> - Spectrum Analyzer	8566B	Hewlett Packard	2747A05855	May 1999	1 Year
<input checked="" type="checkbox"/> - Log-Periodic Antenna	HL 025	Rohde & Schwarz	340182/015	Nov. 1999	1 Year
<input checked="" type="checkbox"/> - RF Cable	S 04272B	Suhner	155-21-011	May 1999	1 Year

1.3.4 The measurement of the Frequency Stability - was performed.x - was not applicable.**Used test instruments :**

Type	Model No.	Manufacturer	Serial No.	Last Cal.	Interval
<u> </u> - Frequency Counter	53131A	Hewlett Packard	3546A11807	June 1999	1 Year
<u> </u> - Oven	-	Ohnishi Co. Ltd.	-	Aug. 1999	1 Year
<u> </u> - DC Power Supply	6628A	Hewlett Packard	3224A00284	July 1999	1 Year

1.3.5 The measurement of the Occupied Bandwidthx - was performed. - was not applicable.**Used test instruments :**

Type	Model No.	Manufacturer	Serial No.	Last Cal.	Interval
<u> </u> - Spectrum Analyzer	8566B	Hewlett Packard	2140A01091	Apr. 1999	1 Year
<u>x</u> - Spectrum Analyzer	8566B	Hewlett Packard	2747A05855	May 1999	1 Year
<u> </u> - Function Generator	3325A	Hewlett Packard	2512A21776	June 1999	1 Year
<u> </u> - FM Linear Detector	MS61A	Anritsu Corp.	M77486	Sep. 1999	1 Year
<u> </u> - Level Meter	ML422C	Anritsu Corp.	M87571	June 1999	1 Year

1.4 EUT MODIFICATION

-No modifications were conducted by JQA to achieve compliance to Class B levels.
 -To achieve compliance to Class B levels, the following changes were made by JQA during the compliance test.

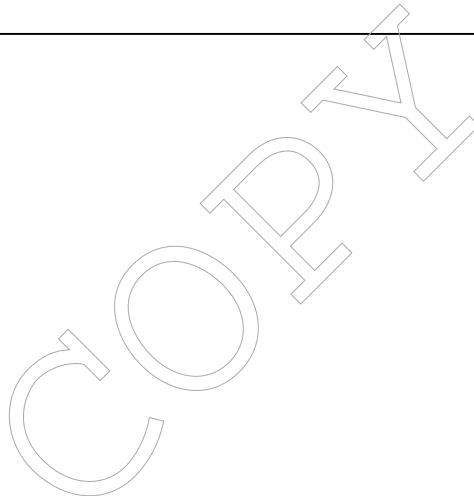
The modifications will be implemented in all production models of this equipment.

Applicant :

Date :

Typed Name :

Position :

A large, stylized, italicized text "COPY" is centered on the page. A single vertical line is drawn through the middle of the letter "O", extending from the top to the bottom of the letter.

1.5 TEST RESULTS**AC Power Line Conducted Emission** - Applicable - NOT ApplicableThe requirements are - PASSED - NOT PASSED**Remarks :****Radiated Emission [§15.209(a),§15.231(b)]** - Applicable - NOT ApplicableThe requirements are - PASSED - NOT PASSED**Remarks:****Frequency Stability** - Applicable - NOT ApplicableThe requirements are - PASSED - NOT PASSED**Remarks:****Occupied Bandwidth [§15.231(c)]** - Applicable - NOT ApplicableThe requirements are - PASSED - NOT PASSED**Remarks:**

1.6 SUMMARY**General Remarks :**

The EUT was tested according to the requirements of FCC Rules and Regulations Part 15 Subpart A and C (June 23, 1989) under the test configuration, as shown in clause 1.7 to 1.9.

The conclusion for the test items of which are required by the applied regulation is indicated under the final judgment.

Final Judgment :

The "as received" sample;

- fulfill the test requirements of the regulation mentioned on clause 1.1.
- fulfill the test requirements of the regulation mentioned on clause 1.1, but with certain qualifications.
- doesn't fulfill the test regulation mentioned on clause 1.1.

Begin of testing : December 24, 1999

End of testing : December 24, 1999

- JAPAN QUALITY ASSURANCE ORGANIZATION -

Signatories:



Masaaki Takahashi
Manager
JQA EMC Engineering Dept.



Shigeru Osawa
Assistant Manager
JQA EMC Engineering Dept.

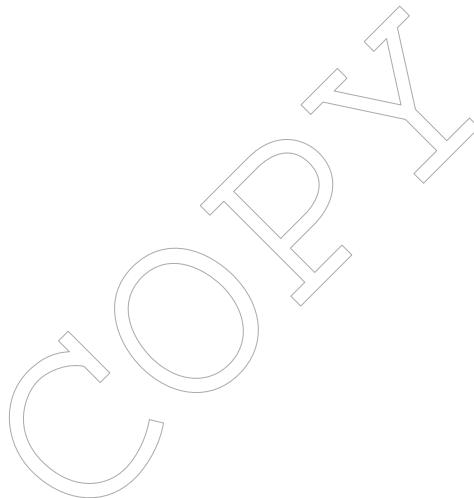
1.7 TEST CONFIGURATION / OPERATION OF EUT**1.7.1 Test Configuration****The equipment under test (EUT) consists of :**

Item	Manufacturer	Model No.	FCC ID	Serial No.
Remote Control Transmitter	SMK Corporation	RC-R1110	IOM701349	-

1.7.2 Operating condition

Power supply Voltage : 3.0 VDC(Battery)

The tests have been carried out under the transmitting condition.



1.8 PRELIMINARY TEST AND TEST-SETUP (DRAWINGS)

1.8.1 AC Power Line Conducted Emission (450 kHz - 30 MHz) :

According to description of ANSI C63.4-1992 sec.13.1.3.1, the AC power line preliminary conducted emissions measurements were carried out.

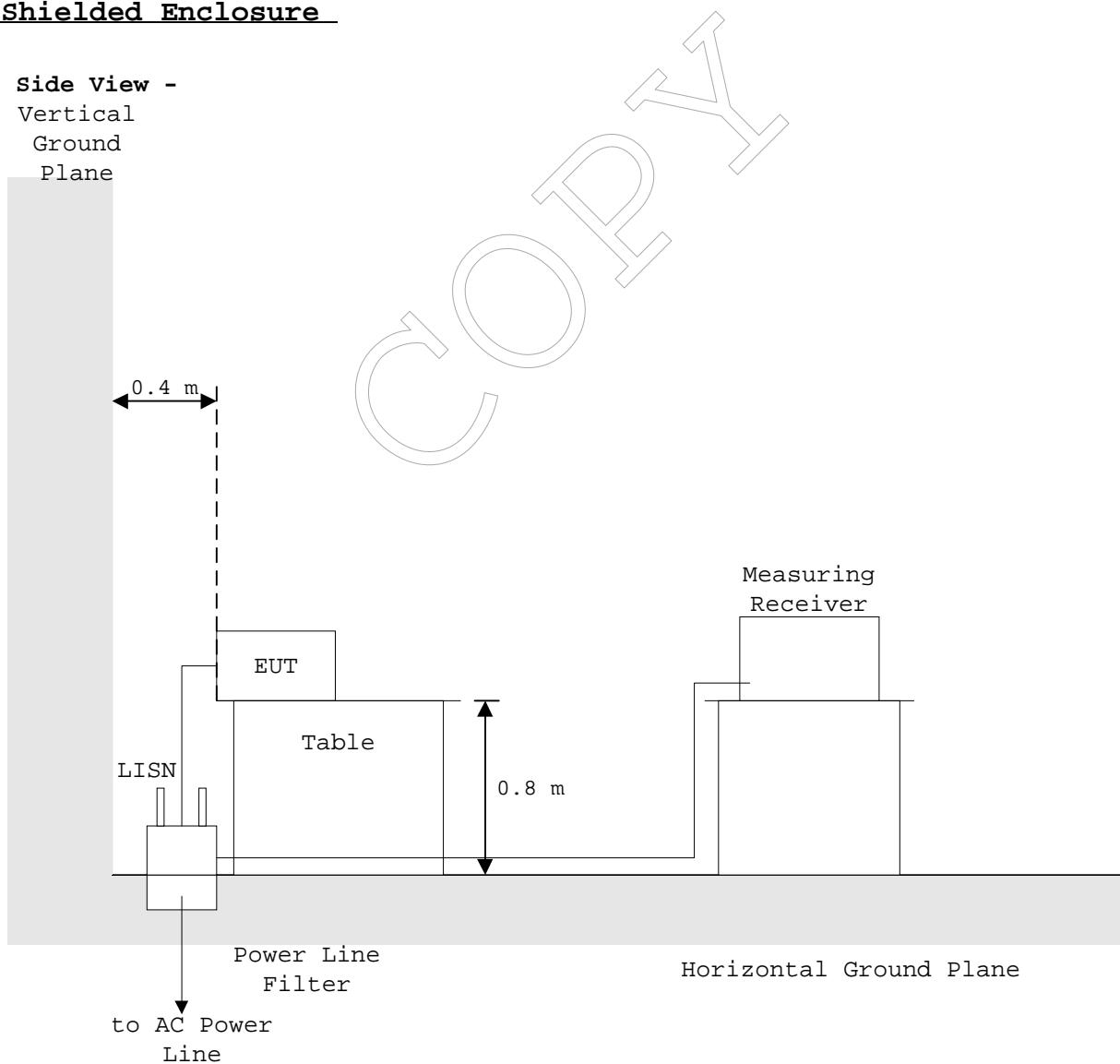
The preliminary conducted measurements were performed using the spectrum analyzer to observe the emission characteristics of the EUT.

The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emissions. These configurations were used for final AC power line conducted emissions measurements.

Shielded Enclosure

- Side View -

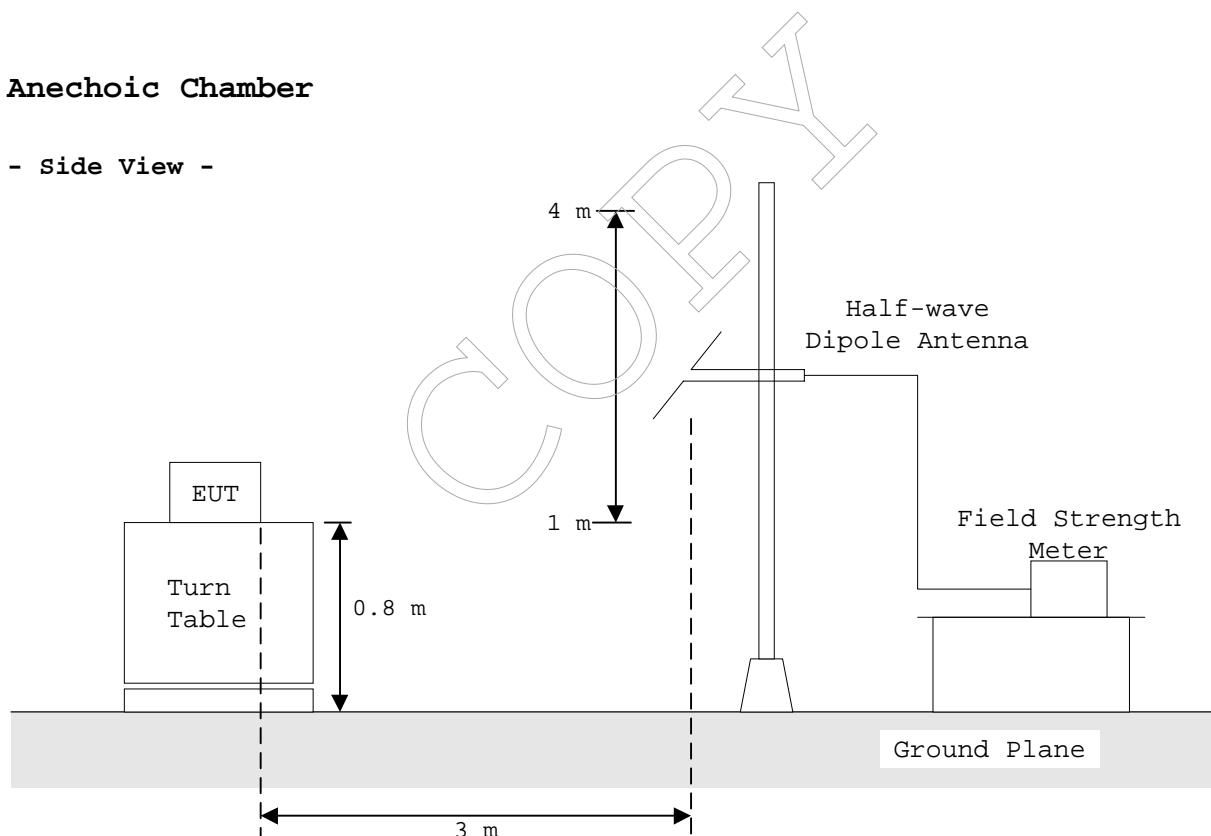
Vertical
Ground
Plane



1.8.2 Radiated Emission (30 MHz - 1000 MHz) :

According to description of ANSI C63.4-1992 sec.13.1.4.1, the preliminary radiated emissions measurement were carried out. The preliminary radiated measurements were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.

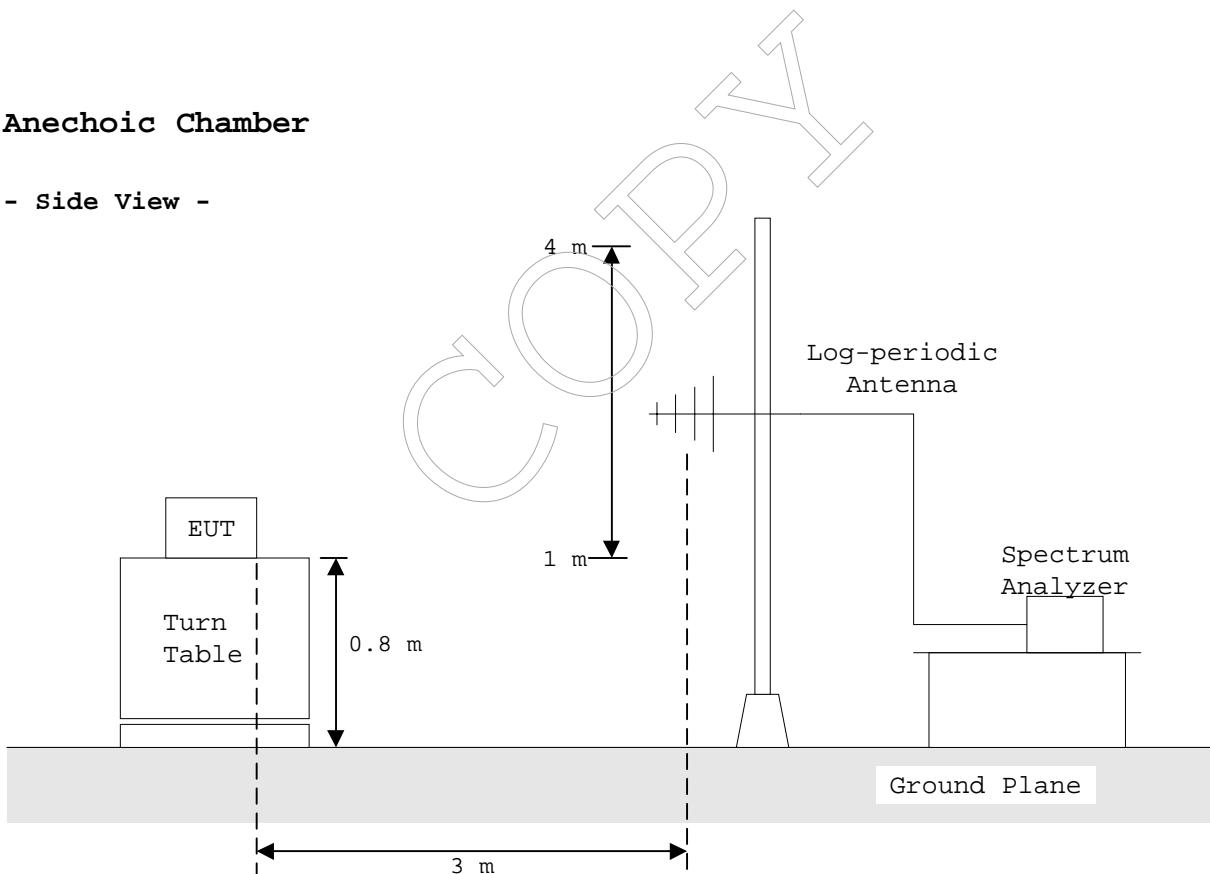
The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emissions. These configurations were used for the final radiated emissions measurements.

Anechoic Chamber**- Side View -**

1.8.3 Radiated Emission (Above 1 GHz) :

According to description of ANSI C63.4-1992 sec.13.1.4.1, the preliminary radiated emissions measurements were carried out. The preliminary radiated measurements were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.

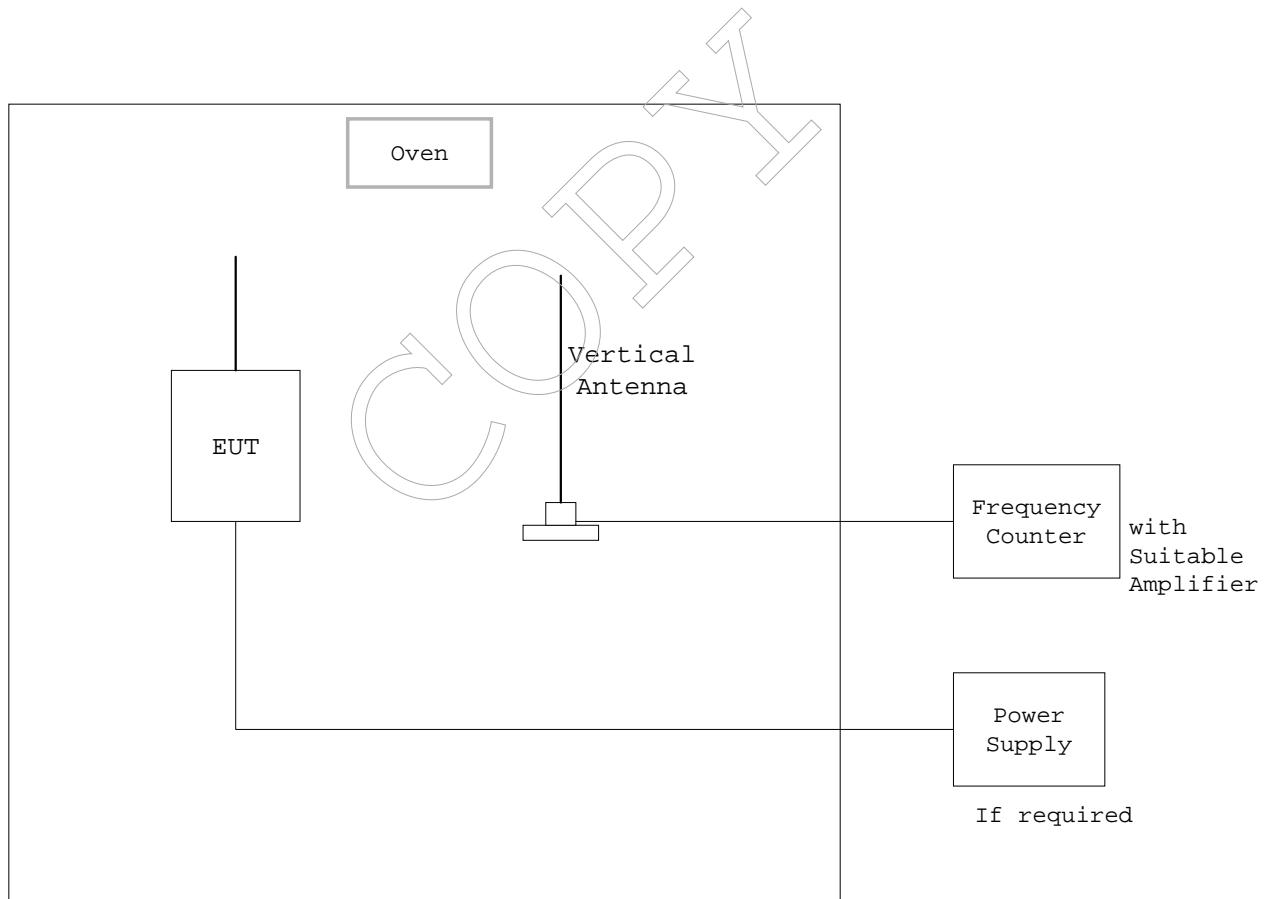
The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emissions. These configurations were used for the final radiated emissions measurements.

Anechoic Chamber**- Side View -**

1.8.4 Frequency Stability :

According to description of ANSI C63.4-1992 sec.13.1.5 and sec.13.1.6, the frequency stability measurements were carried out. By using frequency counter with suitable RF amplifier, the carrier frequency of the transmitter under test was measured with a temperature variation of -20°C to $+50^{\circ}\text{C}$ at the normal supply voltage, and if required, with a variation in the primary voltage from 85 % to 115 % the rated supply voltage at the temperature of $+20^{\circ}\text{C}$.

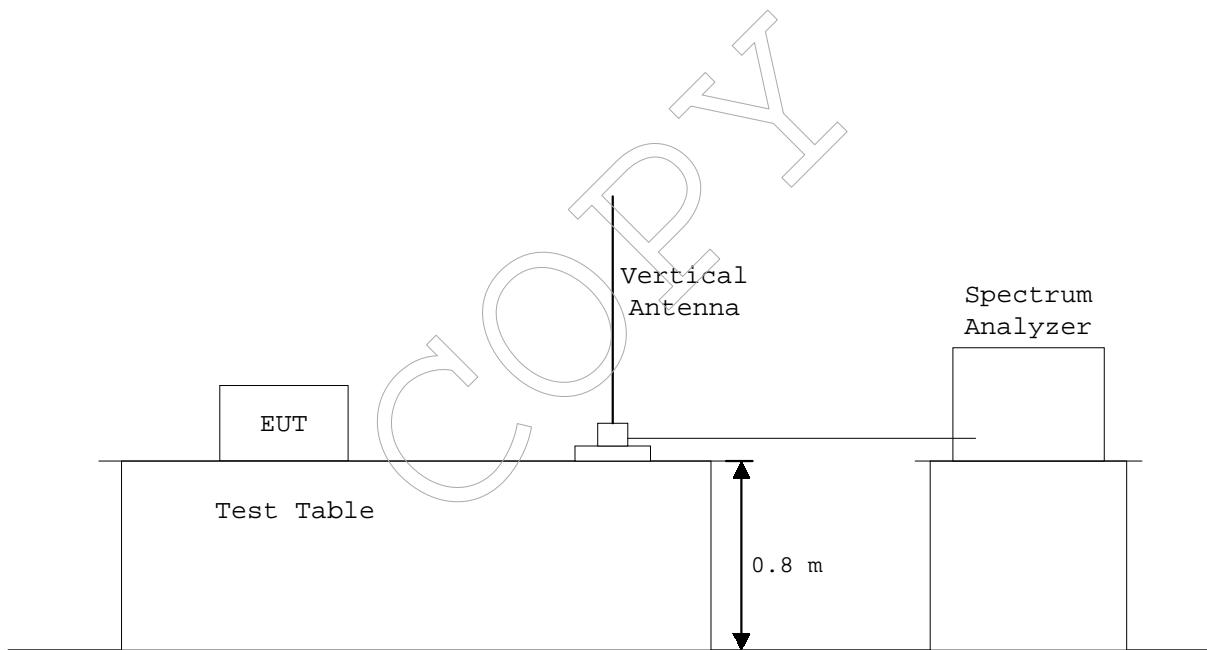
These measurements were carried out after allowing sufficient time (approximately 1 hour) for the temperature of the chamber to stabilize.



1.8.5 Occupied Bandwidth :

According to description of ANSI C63.4-1992 sec.13.1.7, the occupied bandwidth measurements were carried out. By using a spectrum analyzer with a vertical antenna for picking up the signal, the measurements of the emission were made under the transmitting modes of the EUT.

The resolution bandwidth of spectrum analyzer was set to the value specified in sec.13.1.7.



1.9 TEST ARRANGEMENT (PHOTOGRAPHS)

PHOTOGRAPHS OF EUT CONFIGURATION FOR RADIATED EMISSIONS MEASUREMENT

Photograph present configuration with maximum emission





COF1

TEST DATA**2.2 Radiated Emissions Measurement**Date : December 24, 1999Temp.: 21 °C Humi.: 46 %

§15.209(a)

Distance of Measurement : 3.0 meters

Frequency (MHz)	Factor (dB/m)	Antenna Meter Reading		Limits (dB μ V/m)	Field Strength at 3 m	
		Horiz. (dB μ V)	Vert. (dB μ V)		Horiz. (dB μ V/m)	Vert. (dB μ V/m)
50.305	3.6	11.2	13.6	40.0	14.8	17.2
70.433	6.7	20.3	21.1	40.0	27.0	27.8
90.565	9.0	12.6	13.6	43.5	21.6	22.6
130.829	12.4	7.7	7.4	43.5	20.1	19.8
150.913	13.8	10.2	4.9	43.5	24.0	18.7
171.056	15.0	12.5	7.2	43.5	27.5	22.2
191.098	16.0	6.3	1.0	43.5	22.3	17.0
211.174	17.0	7.0	2.5	43.5	24.0	19.5

Note: 1. The spectrum was checked from 30 MHz to 1000 MHz.

All emissions not listed were found to be more than 20 dB below the limits.

2. The symbol of "<" means "or less".

3. The cable loss was included in the antenna factor.

4. Sample calculation :

at 50.305 MHz

$$Af + Mr = 3.6 + 13.6 = 17.2 \text{ dB}\mu\text{V/m}$$

Where,

Af = Antenna Factor including the cable loss.

Mr = Meter Reading

5. Measuring Instrument Setting:

Harmonics & other Frequency components

Detector function : CISPR quasi-peak

IF Bandwidth : 120 kHz

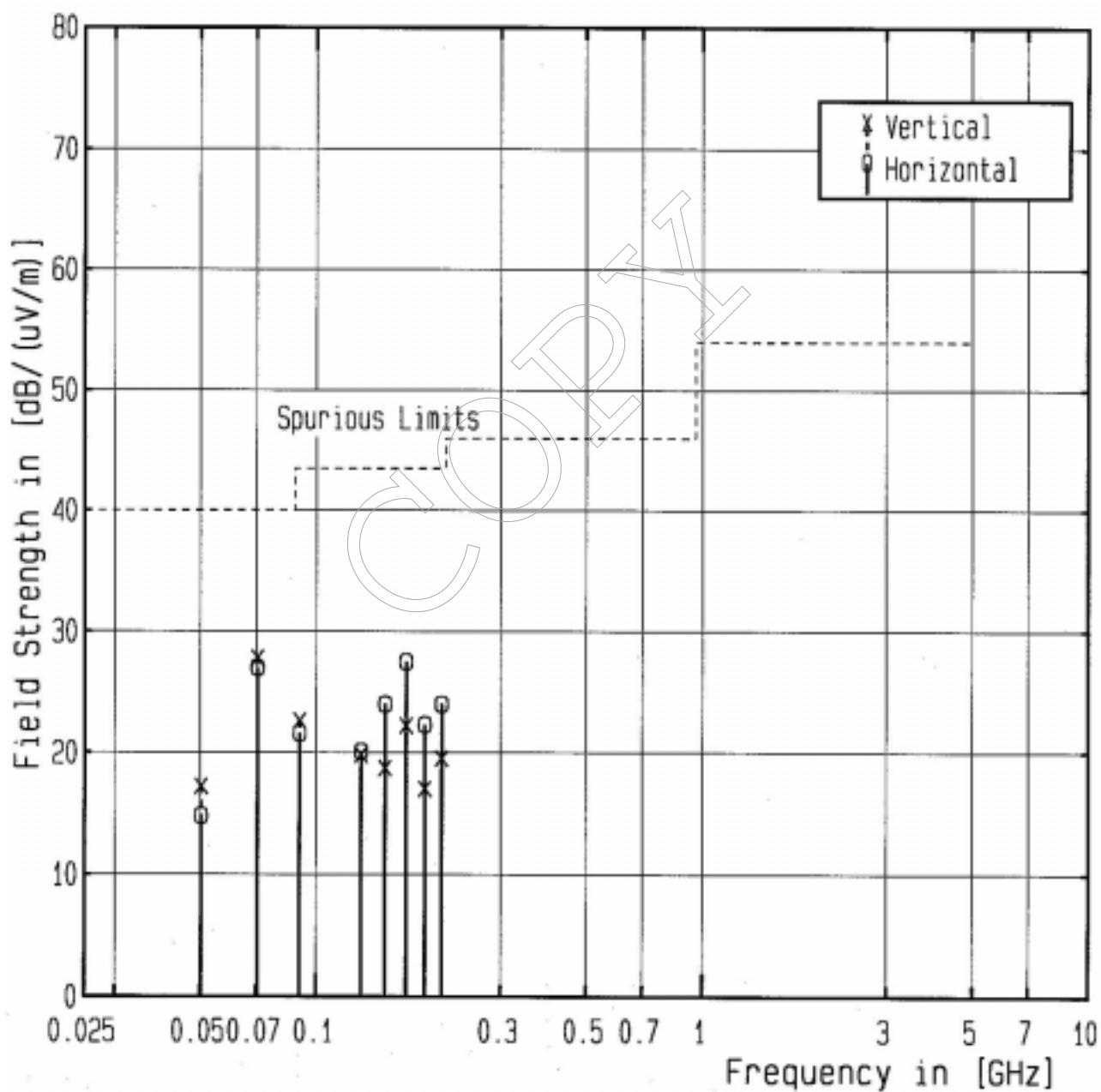
Tested by :


Shigeru Osawa

Testing Engineer

Radiated Spurious Emissions

FCC ID : IOM701349
Test Condition : Transmit



§15.231(b)

Operating Frequency : 422 MHz

Distance of Measurement : 3.0 meters

Frequency (MHz)	Factor (dB/m)	Correction Meter Reading		Factor* (dB/m)	Limits (dB μ V/m)	Field Strength at 3 m	
		Horiz. (dB μ V)	Vert. (dB μ V)			Horiz. (dB μ V/m)	Vert. (dB μ V/m)
Fundamental							
422.000	23.7	49.5	54.0	-15.3	80.4	57.9	62.4
Harmonics & other Frequency components							
844.000	31.3	24.5	25.5	-15.3	60.4	40.5	41.5
1266.000	26.8	18.8	20.7	-15.3	60.4	30.3	32.2
1688.000	30.4	21.2	22.2	-15.3	60.4	36.3	37.3
2110.000	-13.8	59.1	59.7	-15.3	60.4	30.0	30.6
2532.000	-12.2	61.6	61.3	-15.3	60.4	34.1	33.8
2954.000	-10.3	57.1	56.4	-15.3	60.4	31.5	30.8
3376.000	-8.6	54.2	52.8	-15.3	60.4	30.3	28.9
3798.000	-7.1	50.2	< 47.0	-15.3	60.4	27.8	< 24.6
4220.000	-5.6	< 47.0	< 47.0	-15.3	60.4	< 26.1	< 26.1

Operating Frequency : 428 MHz

Distance of Measurement : 3.0 meters

Frequency (MHz)	Factor (dB/m)	Correction Meter Reading		Factor* (dB/m)	Limits (dB μ V/m)	Field Strength at 3 m	
		Horiz. (dB μ V)	Vert. (dB μ V)			Horiz. (dB μ V/m)	Vert. (dB μ V/m)
Fundamental							
428.000	23.8	49.3	54.1	-15.3	80.6	57.8	62.6
Harmonics & other Frequency components							
856.000	31.5	23.9	25.0	-15.3	60.6	40.1	41.2
1284.000	26.9	18.1	20.2	-15.3	60.6	29.7	31.8
1712.000	30.5	19.8	18.6	-15.3	60.6	35.0	33.8
2140.000	-13.6	56.6	55.0	-15.3	60.6	27.7	26.1
2568.000	-12.1	59.8	59.1	-15.3	60.6	32.4	31.7
2996.000	-10.2	58.9	59.9	-15.3	60.6	33.4	34.4
3424.000	-8.5	52.3	51.9	-15.3	60.6	28.5	28.1
3852.000	-6.9	< 47.0	< 47.0	-15.3	60.6	< 24.8	< 24.8
4220.000	-5.6	< 47.0	< 47.0	-15.3	60.6	< 26.2	< 26.2

Note: 1. The spectrum was checked from 30 MHz to tenth harmonics.

All emissions not listed were found to be more than 20 dB below the limits.

2. The symbol of "<" means "or less".

3. The cable loss and amplifier gain were included in the correction factor.

4. Sample calculation :

at 422.000 MHz

$$Cf + Mr + F = 23.7 + 54.0 - 15.3 = 62.4 \text{ dB}\mu\text{V/m}$$

Where,

Cf = Correction Factor

Mr = Meter Reading

F = Peak to Average Factor

5. "*": The factor due to the pulsed waveform as shown in the attached sheet.

6. Measuring Instrument Setting:

Less than 1000 MHz

Detector function

IF Bandwidth

: Peak

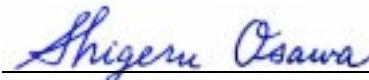
: 120 kHz

Above 1000 MHz

Resolution Bandwidth

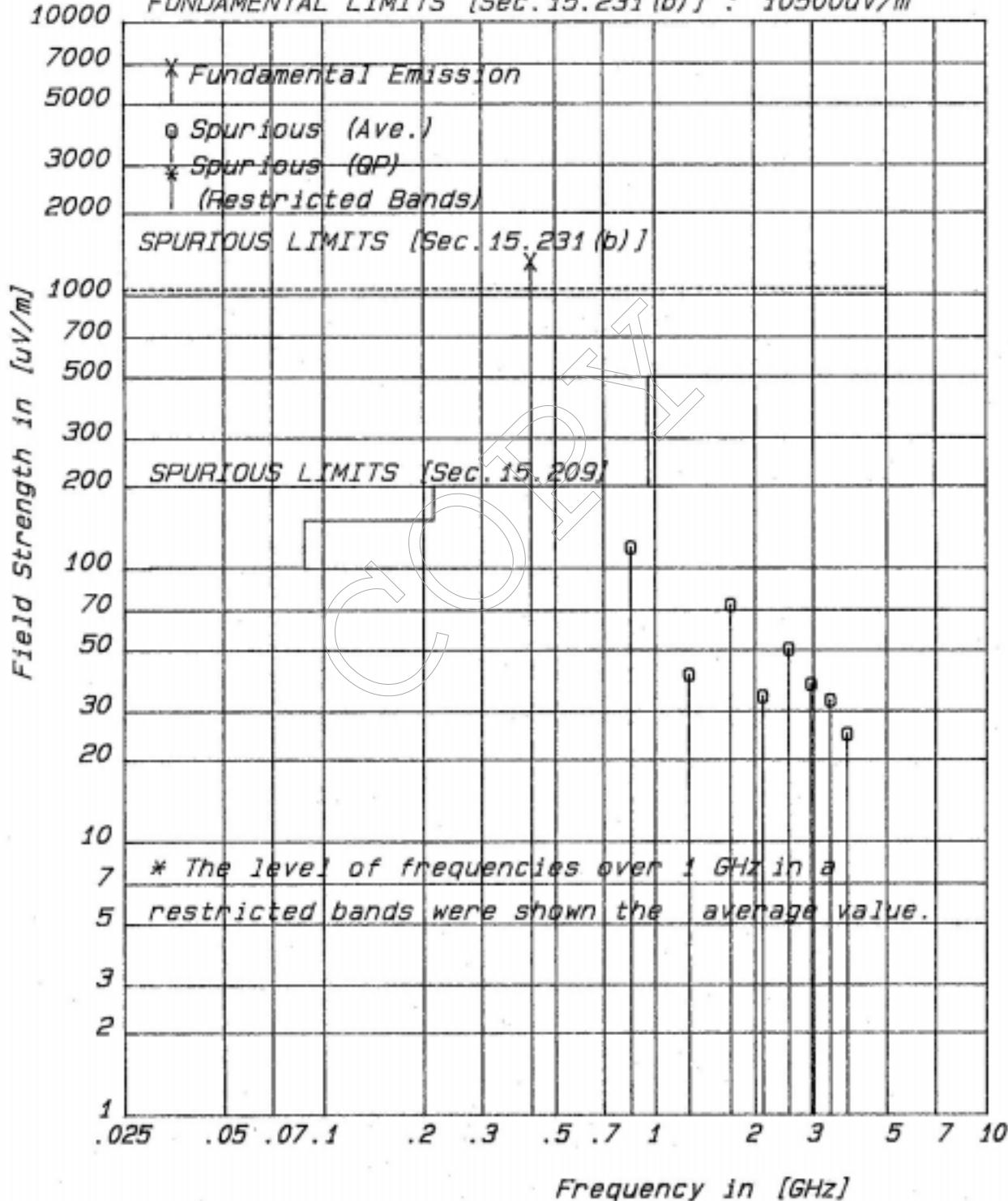
: 1 MHz

Tested by :



Shigeru Osawa

Testing Engineer

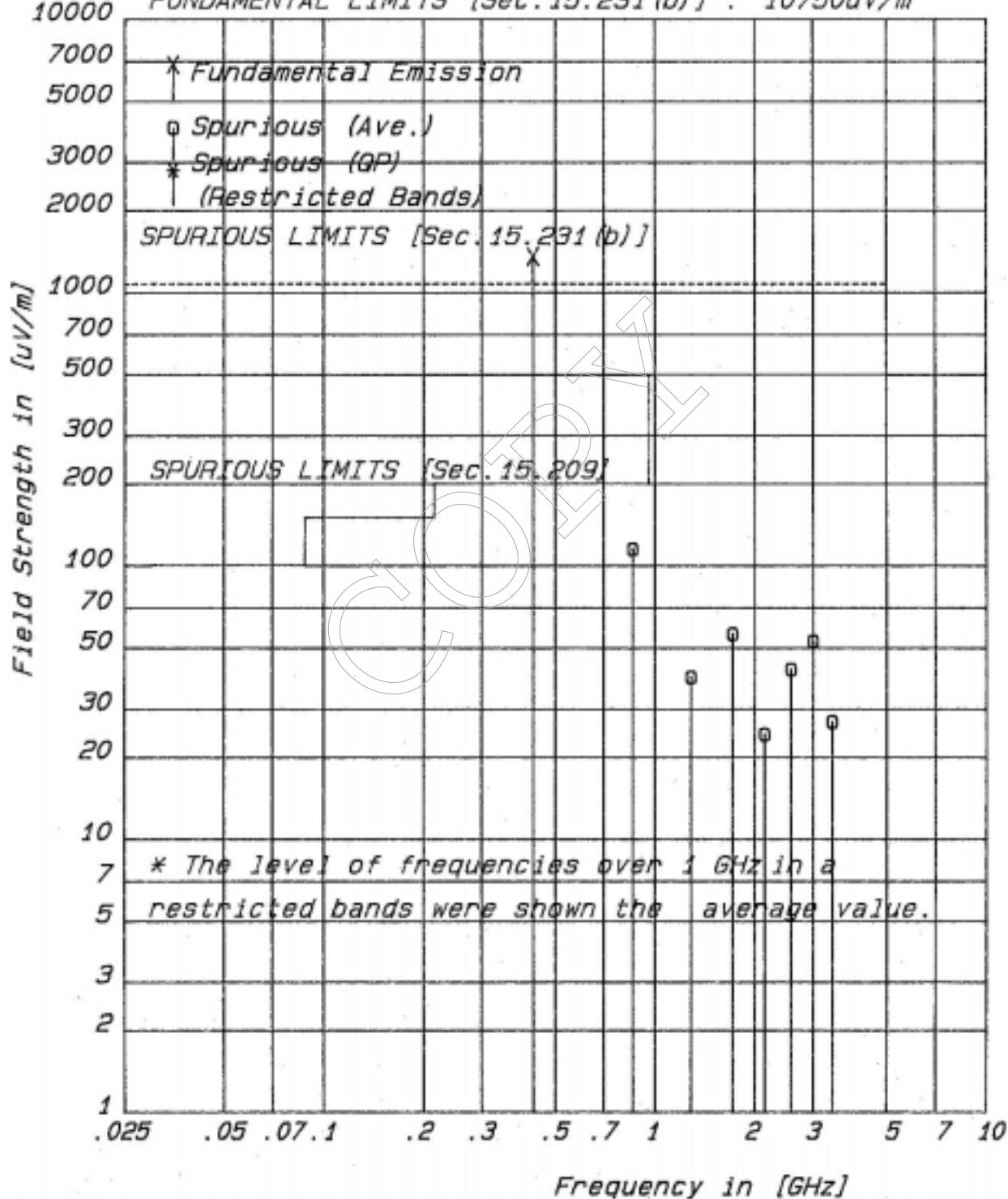
*Radiated Fundamental & Spurious Emissions**FCC ID : IOM701349**Operating Frequency : 422 MHz**FUNDAMENTAL LIMITS [Sec. 15.231 (b)] : 10500uV/m*

Radiated Fundamental & Spurious Emissions

FCC ID : IOM701349

Operating Frequency : 428 MHz

FUNDAMENTAL LIMITS [Sec. 15.231 (b)] : 10750uV/m



The encoded waveform in the time domain

ECC ID : 10M701349

Model : BC-B1110

Mode of EUT : Transmit (422 MHz)

REF 10mV CENTER 422.000MHz SPAN 0kHz
RES BW 3000.0kHz VBW 100.0kHz SWP 100.0msec

10

0

Time (msec)

The above waveform indicates the case when field strength averaged over 100 milliseconds was maximum value. In order to obtain the peak to average factor, calculation of the period of total on-time was computed by personal computer. Results was obtained by following.

$$\text{Duty cycle} = (\text{Maximum total on-time} / 100 \text{ msec}) \times 100$$

$$= (17.1 \text{ msec} / 100 \text{ msec}) \times 100 = 17.1 \%$$

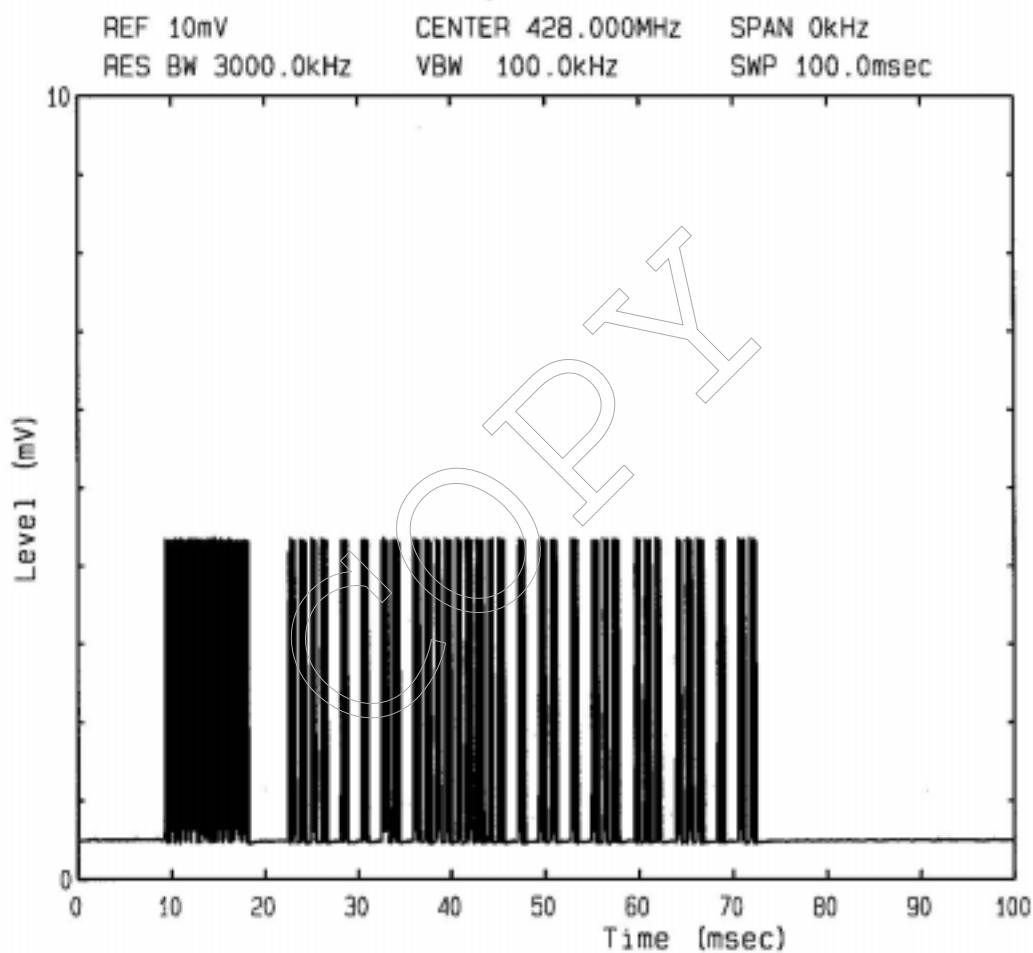
Therefore

Factor is $20 \log(0.1710) = -15.3$ dB

The encoded waveform in the time domain

FCC ID : IOM701349
Model : RC-R1110

Mode of EUT : Transmit (428 MHz)



The above waveform indicates the case when field strength averaged over 100 milliseconds was maximum value. In order to obtain the peak to average factor, calculation of the period of total on-time was computed by personal computer. Results was obtained by following.

$$\begin{aligned}\text{Duty cycle} &= (\text{Maximum total on-time} / 100 \text{ msec}) \times 100 \\ &= (17.1 \text{ msec} / 100 \text{ msec}) \times 100 = 17.1 \%\end{aligned}$$

Therefore

$$\text{Factor is } 20 \log (0.1710) = -15.3 \text{ dB}$$

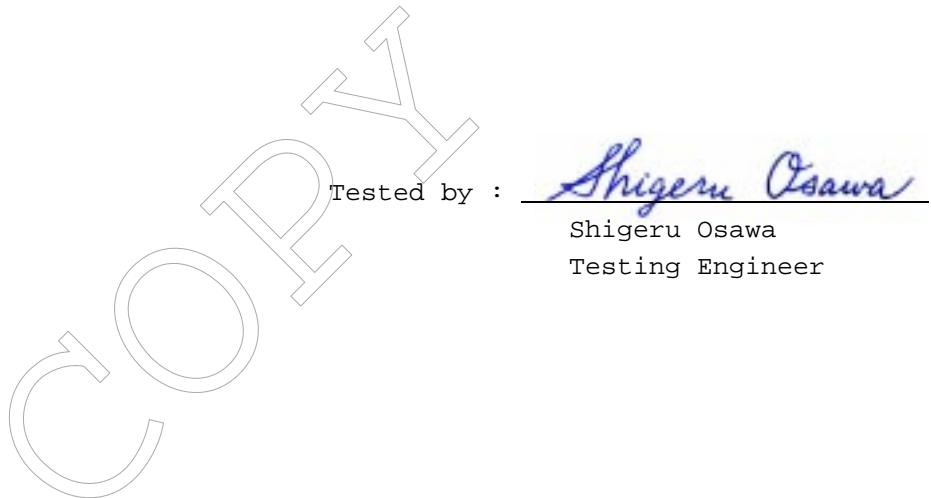
2.4 Occupied Bandwidth MeasurementDate : December 24, 1999Temp.: 21 °C Humi.: 46 %Measurements Results :

Specified Limits : 0.25 % of the fundamental frequency

$$422 \text{ MHz} \times 0.0025 = 1055 \text{ kHz}$$

$$428 \text{ MHz} \times 0.0025 = 1070 \text{ kHz}$$

Refer to the attached graphs.



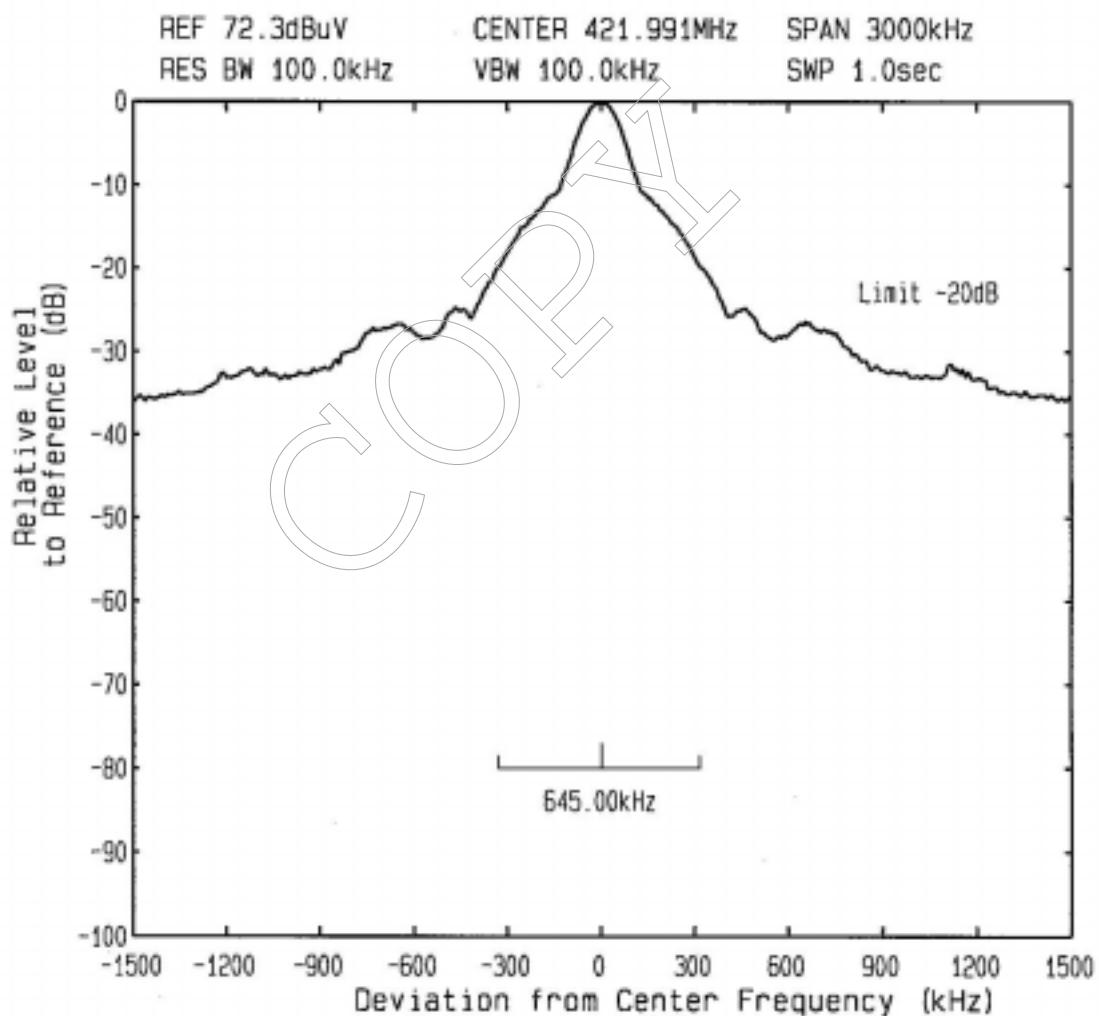
Tested by : Shigeru Osawa
Shigeru Osawa
Testing Engineer

Emission Limitation

FCC ID : IOM701349

Model : RC-R1110

Mode of EUT : Transmit (422 MHz)



Emission Limitation

FCC ID : IOM701349

Model : RC-R1110

Mode of EUT : Transmit (428 MHz)

