



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.

TABLE OF CONTENTS

	Page
1 Documentation	
1.1 Test Regulation	<u>3</u>
1.2 General Information	<u>3</u>
1.3 Test Condition	<u>4 - 7</u>
1.4 EUT Modifications	<u>8</u>
1.5 Test results	<u>9</u>
1.6 Summary	<u>10</u>
1.7 Test Configuration / Operation of EUT	<u>11</u>
1.8 Preliminary Test and Test-setup (Drawings)	<u>12 - 16</u>
1.9 EUT Arrangement (Photographs)	<u>17 - 18</u>
2 Test Data	
2.1 AC Power Line Conducted Emission 0.45 MHz - 30 MHz	<u>N/A</u>
2.2 Radiated Emission (Electric Field)	<u>19 - 26</u>
2.3 Frequency Stability	<u>N/A</u>
2.4 Occupied Bandwidth	<u>27 - 29</u>



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.

x - 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
___ - Field Strength Meter	ESH-2	Rohde & Schwarz	880370/016	May 1999	1 Year
___ - Field Strength Meter	ESH-3	Rohde & Schwarz	881460/016	May 1999	1 Year
___ - Field Strength Meter	ESH-3	Rohde & Schwarz	881460/030	Nov 1999	1 Year
___ - LISN	KNW-407	Kyoritsu Electrical	8-833-6	Apr. 1999	1 Year
___ - LISN	KNW-407	Kyoritsu Electrical	8-855-2	Apr. 1999	1 Year
___ - LISN	KNW-407	Kyoritsu Electrical	8-757-1	Apr. 1999	1 Year
___ - RF Cable	3D-2W	Fujikura	155-21-005	Apr. 1999	1 Year
___ - 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)

 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 - 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
<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> x </u> - Log-Periodic Antenna	HL 025	Rohde & Schwarz	340182/015	Nov. 1999	1 Year
<u> x </u> - RF Cable	S 04272B	Suhner	155-21-011	May 1999	1 Year

**1.3.4 The measurement of the Frequency Stability**

☐ - was performed.

☒ - was not applicable.

Used test instruments :

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

1.3.5 The measurement of the Occupied Bandwidth

☒ - was performed.

☐ - was not applicable.

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 type="checkbox"/> - Function Generator	3325A	Hewlett Packard	2512A21776	June 1999	1 Year
<input type="checkbox"/> - FM Linear Detector	MS61A	Anritsu Corp.	M77486	Sep. 1999	1 Year
<input type="checkbox"/> - Level Meter	ML422C	Anritsu Corp.	M87571	June 1999	1 Year



1.4 EUT MODIFICATION

- x -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 :

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1.5 TEST RESULTS

AC Power Line Conducted Emission - Applicable x - NOT Applicable

The requirements are - PASSED - NOT PASSED

Remarks :

Radiated Emission [\$15.209(a),\$15.231(b)] x - Applicable - NOT Applicable

The requirements are x - PASSED - NOT PASSED

Remarks:

Frequency Stability - Applicable x - NOT Applicable

The requirements are - PASSED - NOT PASSED

Remarks:

Occupied Bandwidth [\$15.231(c)] x - Applicable - NOT Applicable

The requirements are x - 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;

- x - 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

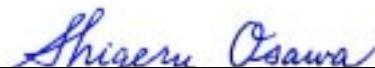
End of testing : December 24, 1999

- 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.

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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.

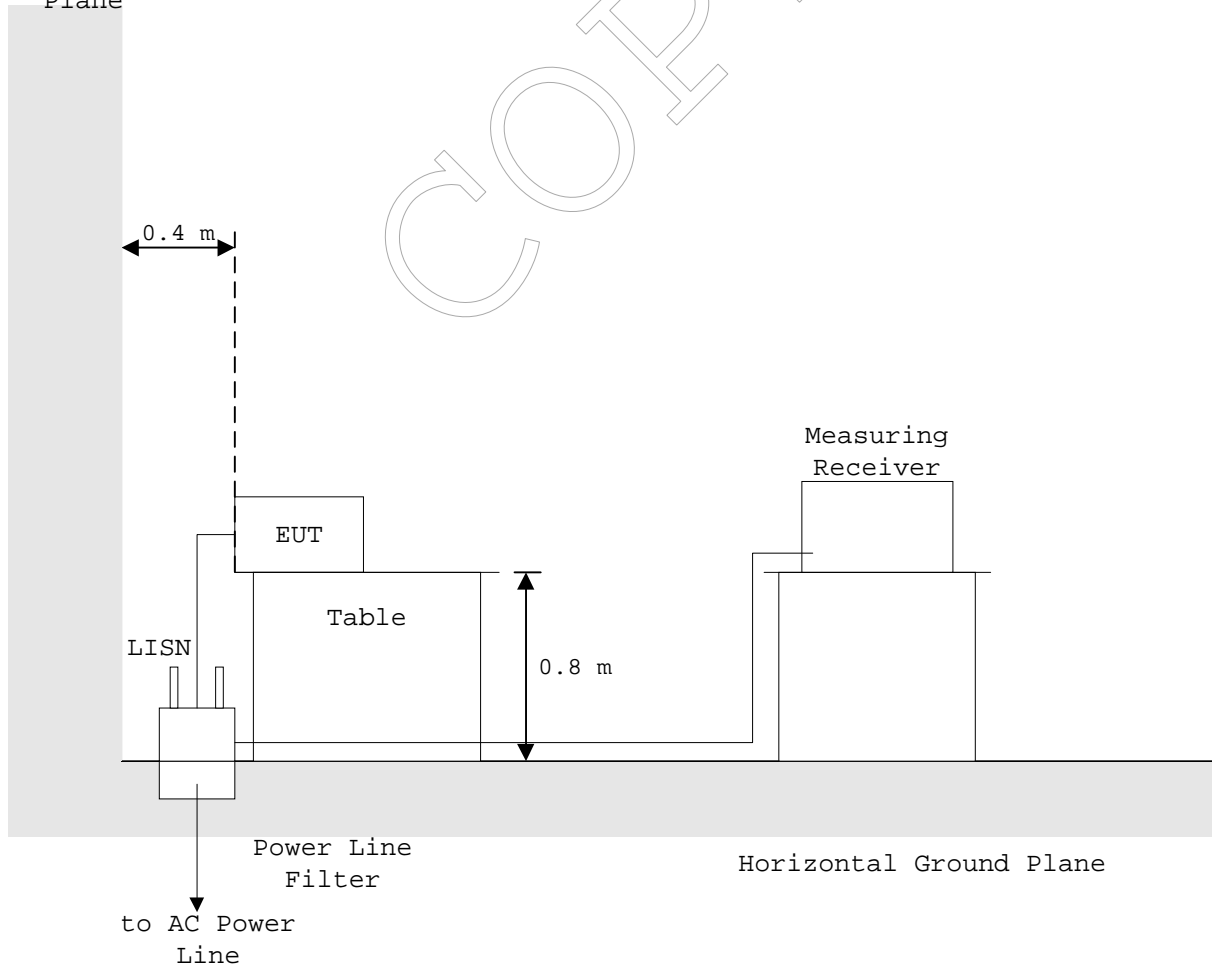
The preliminary conducted measurements were performed using the spectrum analyzer to observe the emission characteristics of the EUT.

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



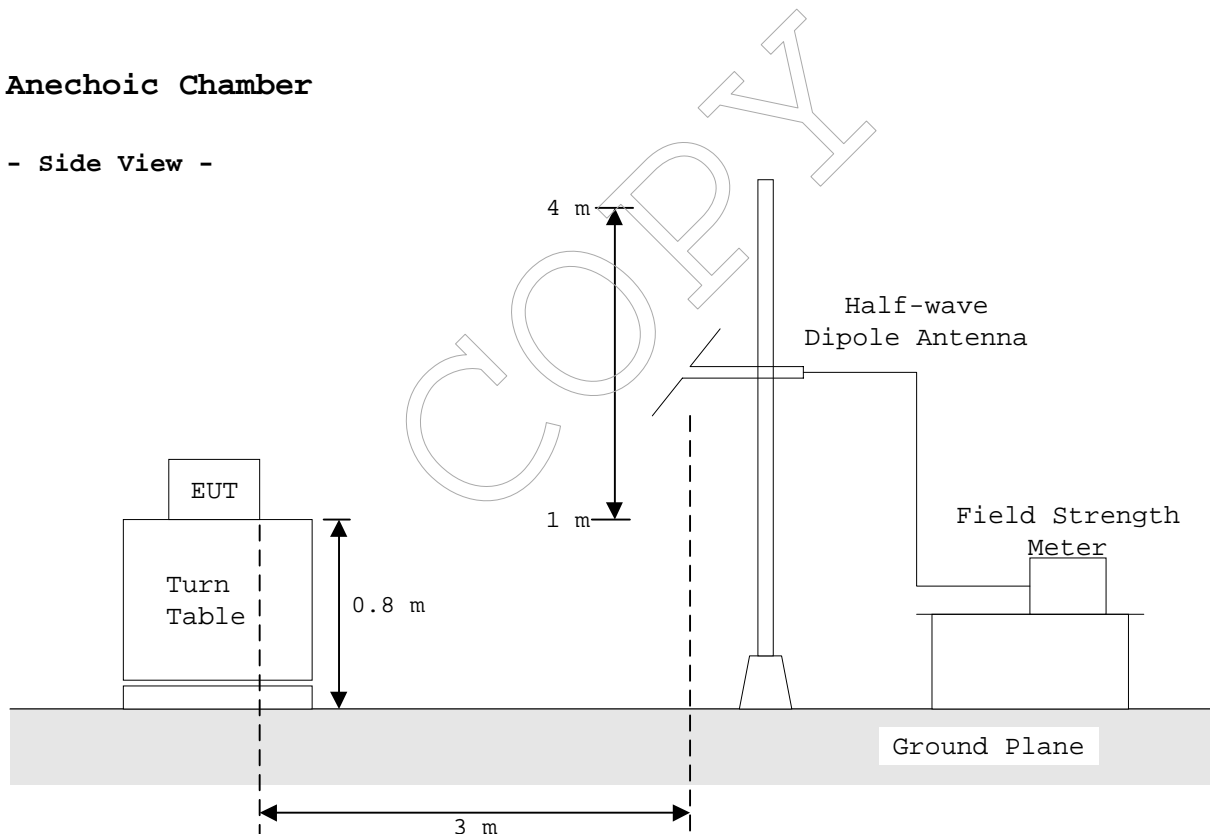
1.8.2 Radiated Emission (30 MHz - 1000 MHz) :

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 -



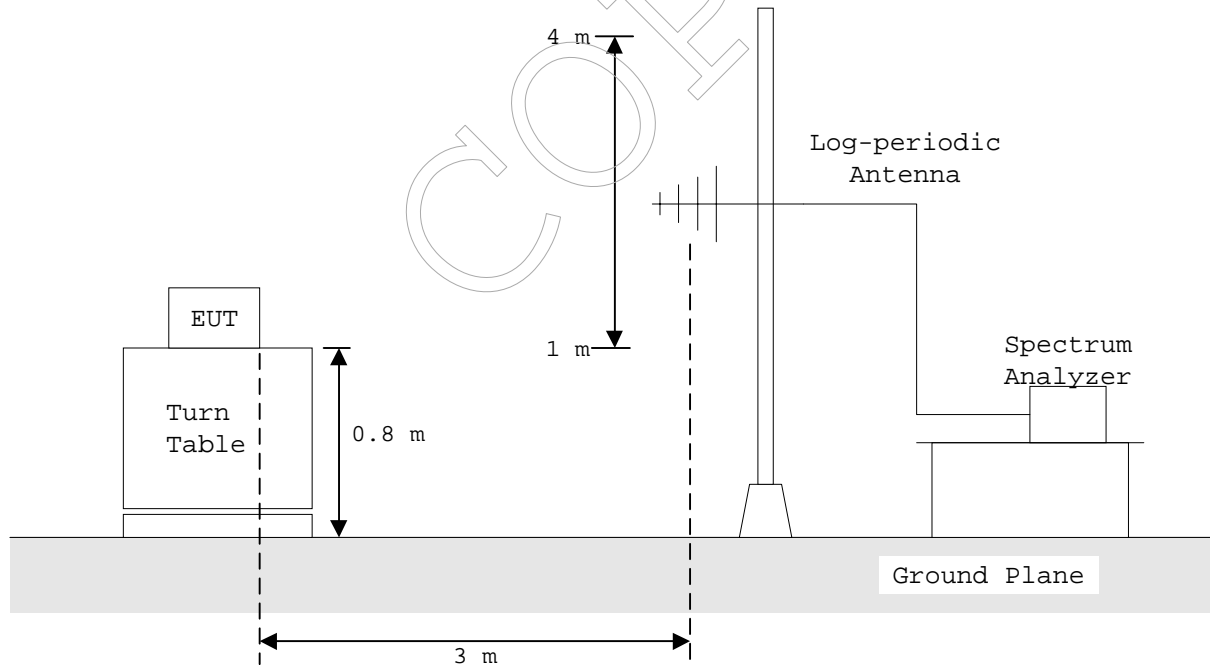
1.8.3 Radiated Emission (Above 1 GHz) :

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

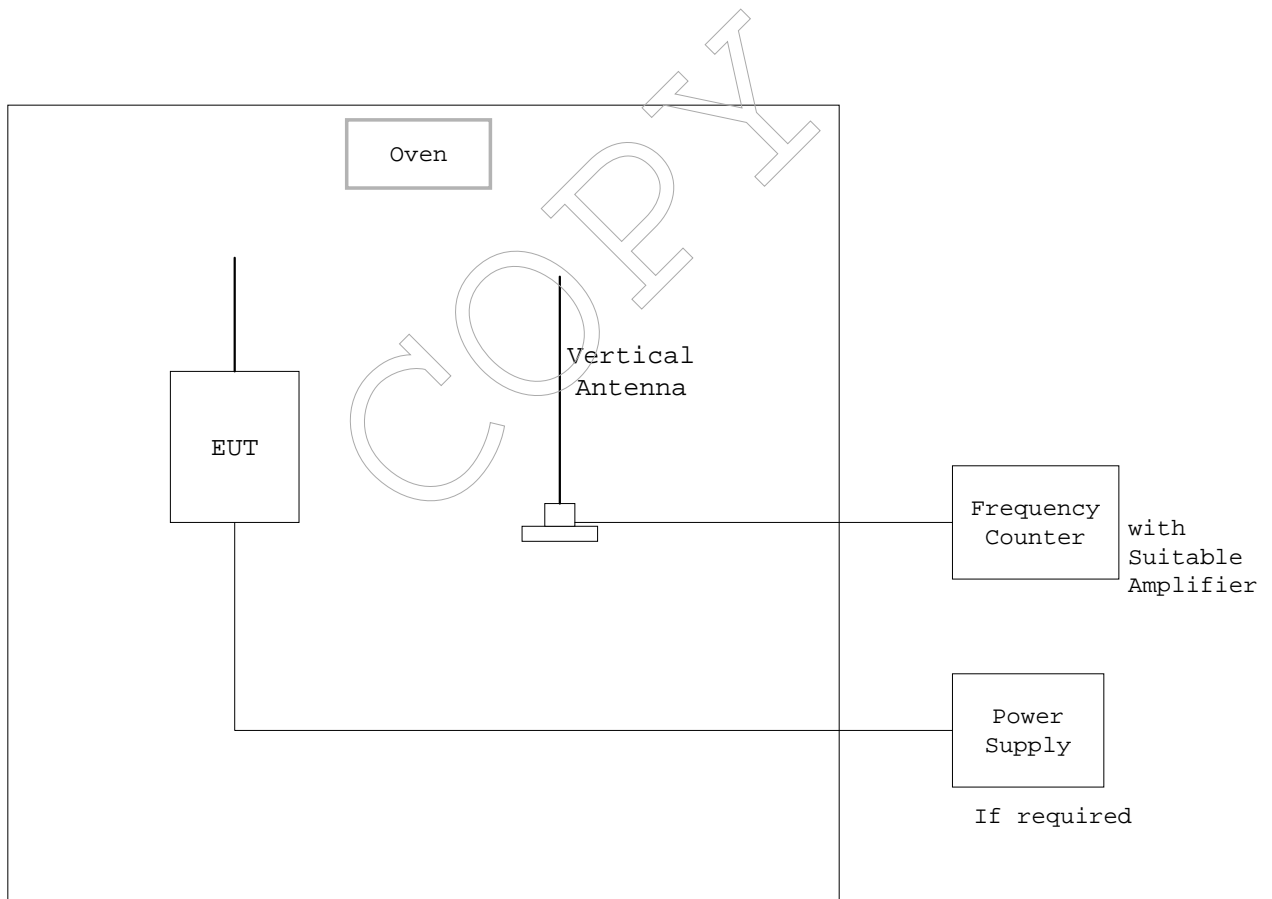
- Side View -



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 $+20^{\circ}\text{C}$.

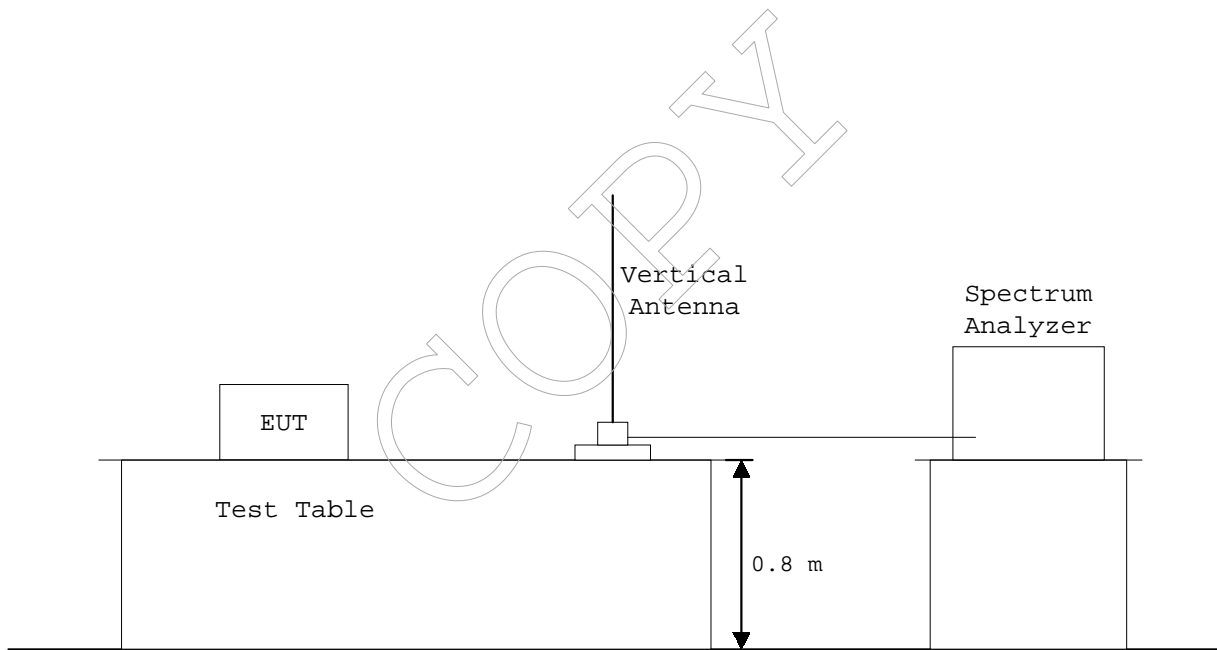
These measurements were carried out after allow sufficient time (approximately 1 hour) for the temperature of the chamber to stabilize.



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





TEST DATA

2.2 Radiated Emissions Measurement

Date : December 24, 1999

Temp.: 21 °C Humi.: 46 %

§15.209(a)

Distance of Measurement : 3.0 meters

Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading		Limits (dBμV/m)	Field Strength at 3 m	
		Horiz. (dBμV)	Vert. (dBμV)		Horiz. (dBμV/m)	Vert. (dBμV/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

 $Af + Mr = 3.6 + 13.6 = 17.2 \text{ dBμV/m}$

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 :



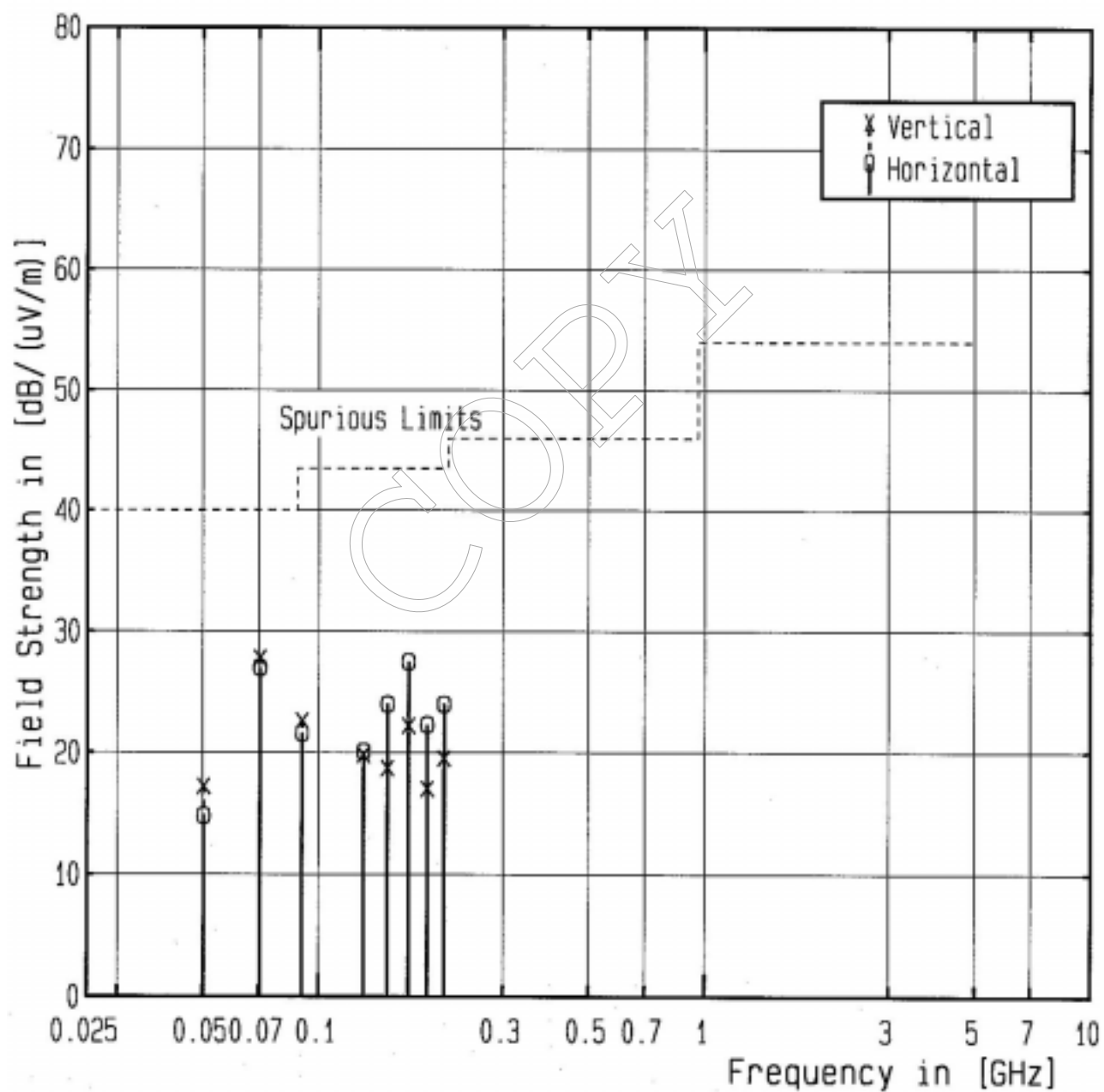
Shigeru Osawa

Testing Engineer

Radiated Spurious Emissions

FCC ID : IOM701349

Test Condition : Transmit



§15.231(b)

Operating Frequency : 422 MHz

Distance of Measurement : 3.0 meters

Correction		Meter Reading		Field Strength at 3 m			
Frequency	Factor	Horiz.	Vert.	Factor*	Limits	Horiz.	Vert.
(MHz)	(dB/m)	(dBμV)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dBμV/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

Correction		Meter Reading		Field Strength at 3 m			
Frequency	Factor	Horiz.	Vert.	Factor*	Limits	Horiz.	Vert.
(MHz)	(dB/m)	(dBμV)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dBμV/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 : Peak

IF Bandwidth : 120 kHz

Above 1000 MHz

Resolution Bandwidth : 1 MHz

Tested by :



Shigeru Osawa

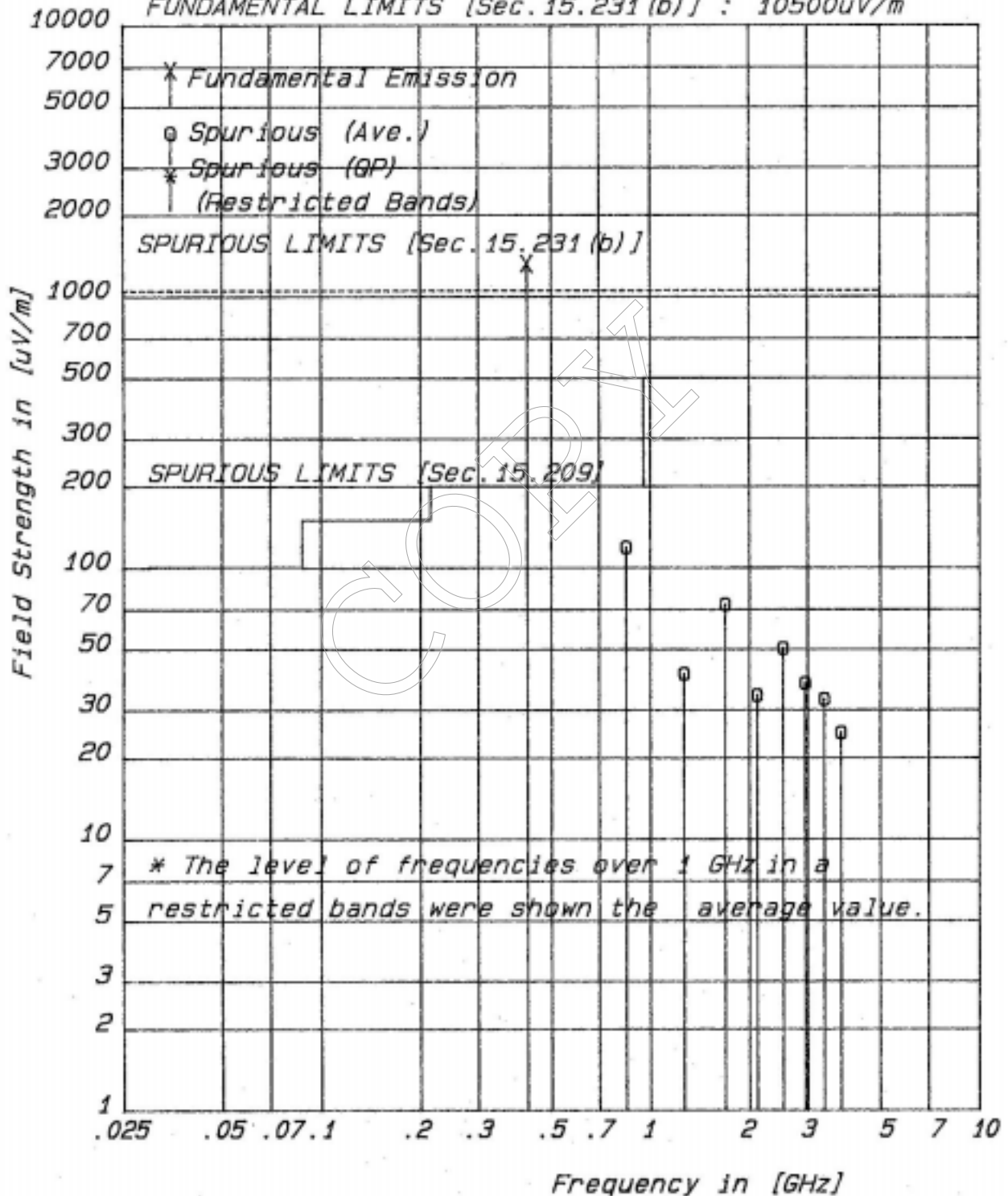
Testing Engineer

Radiated Fundamental & Spurious Emissions

FCC ID : IOM701349

Operating Frequency : 422 MHz

FUNDAMENTAL LIMITS [Sec.15.231(b)] : 10500uV/m

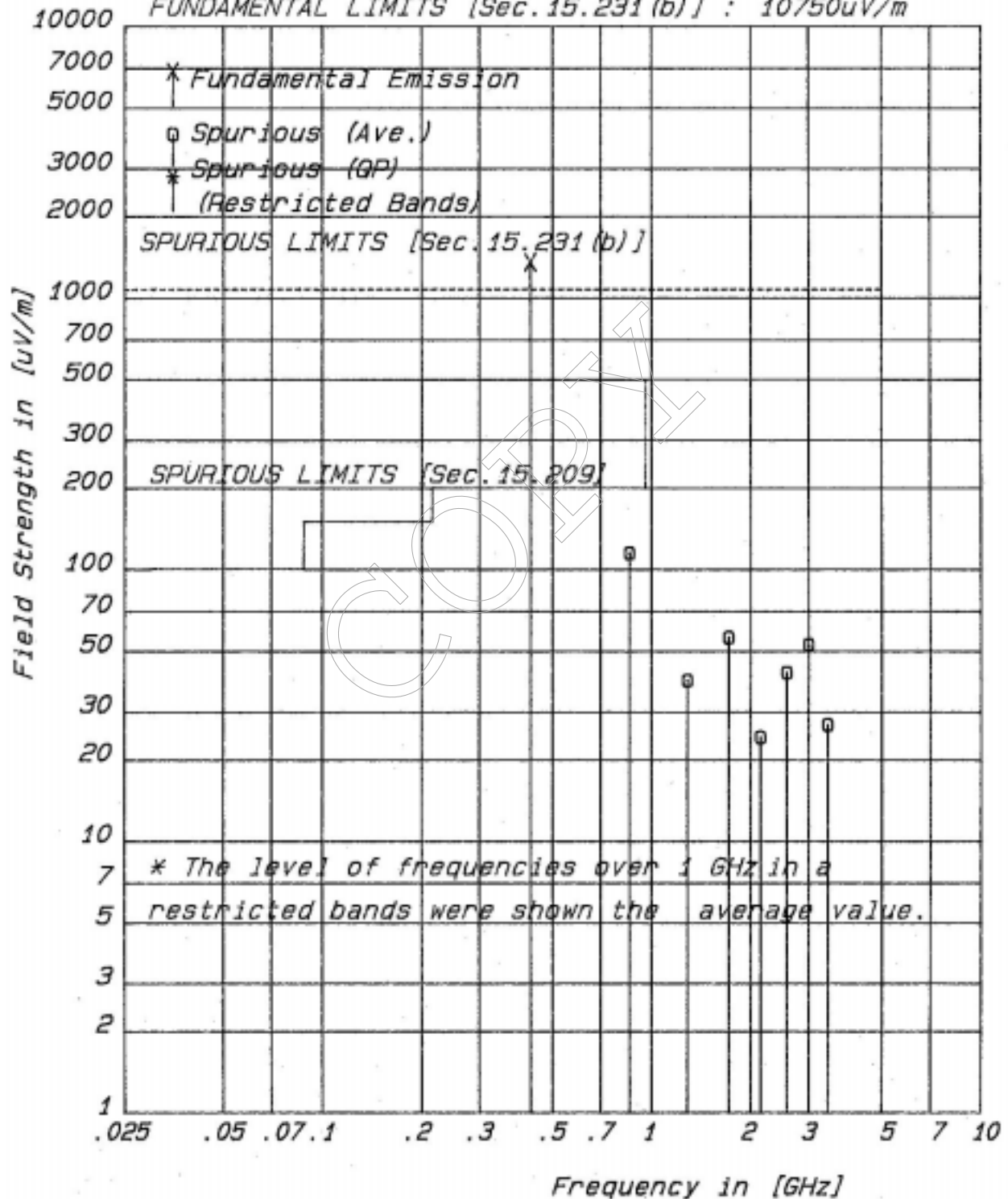


Radiated Fundamental & Spurious Emissions

FCC ID : IOM701349

Operating Frequency : 428 MHz

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

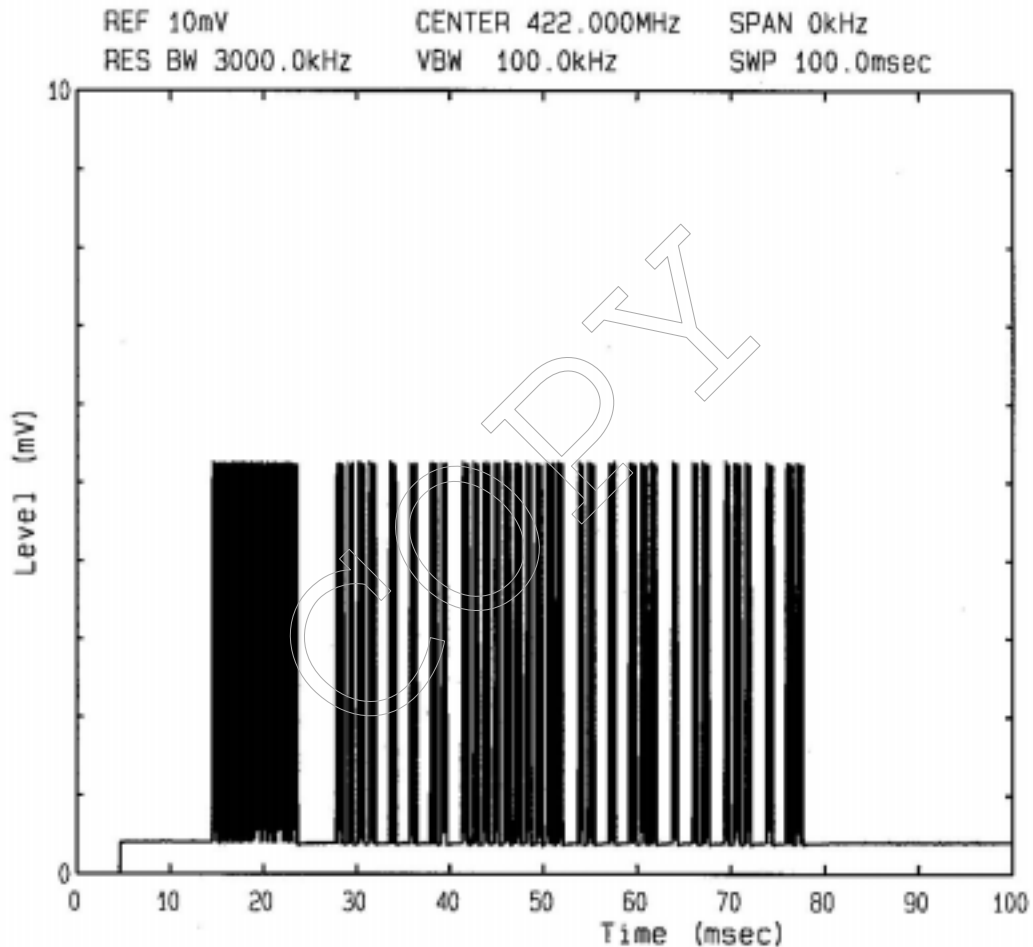


The encoded waveform in the time domain

FCC ID : IOM701349

Model : RC-R1110

Mode of EUT : Transmit (422 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

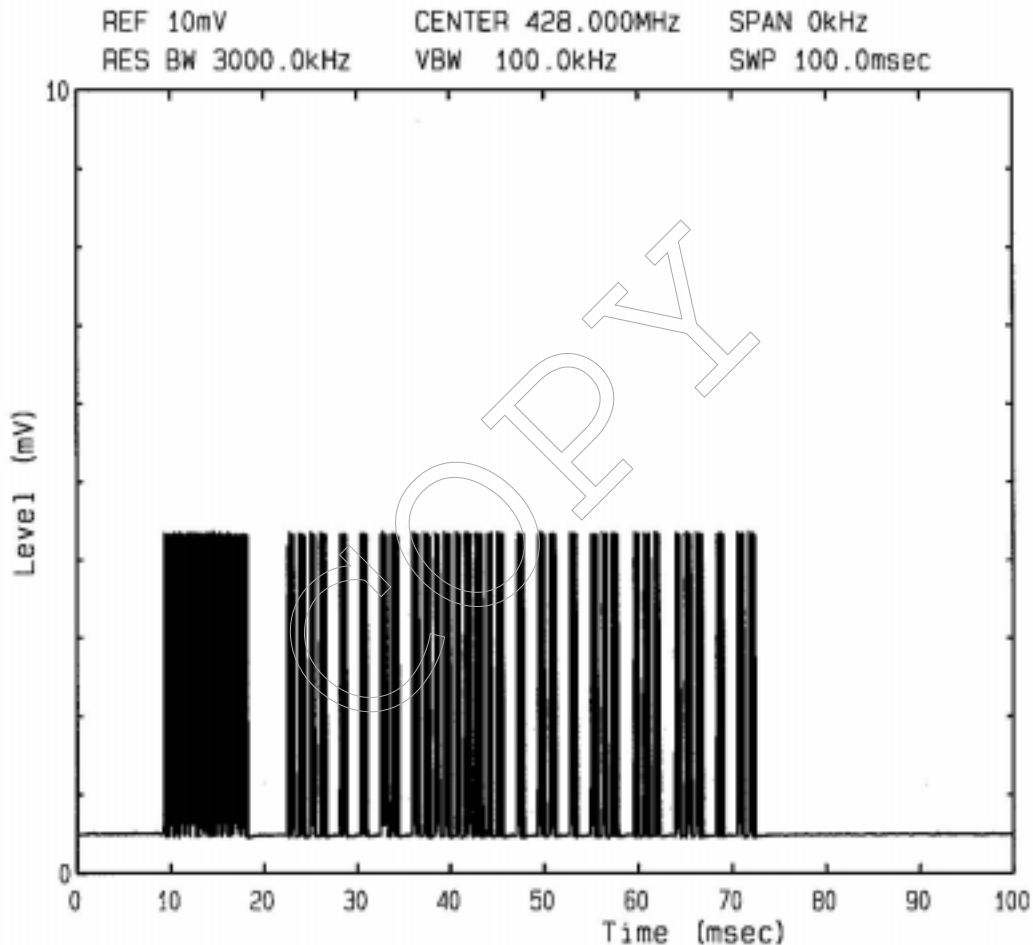
$$\text{Factor is } 20\log(0.1710) = -15.3 \text{ dB}$$

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

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



JQA Application No. :400-90621

Model No. :RC-R1110

Standard

:CFR 47 FCC Rules Part 15

FCC ID :IOM701349

Issue Date :January 11, 2000

Page 27 of 29

2.4 Occupied Bandwidth Measurement

Date : December 24, 1999

Temp.: 21 °C Humi.: 46 %

Measurements Results :

Specified Limits : 0.25 % of the fundamental frequency

422 MHz x 0.0025 = 1055 kHz

428 MHz x 0.0025 = 1070 kHz

Refer to the attached graphs.

Tested by :

Shigeru Osawa

Shigeru Osawa

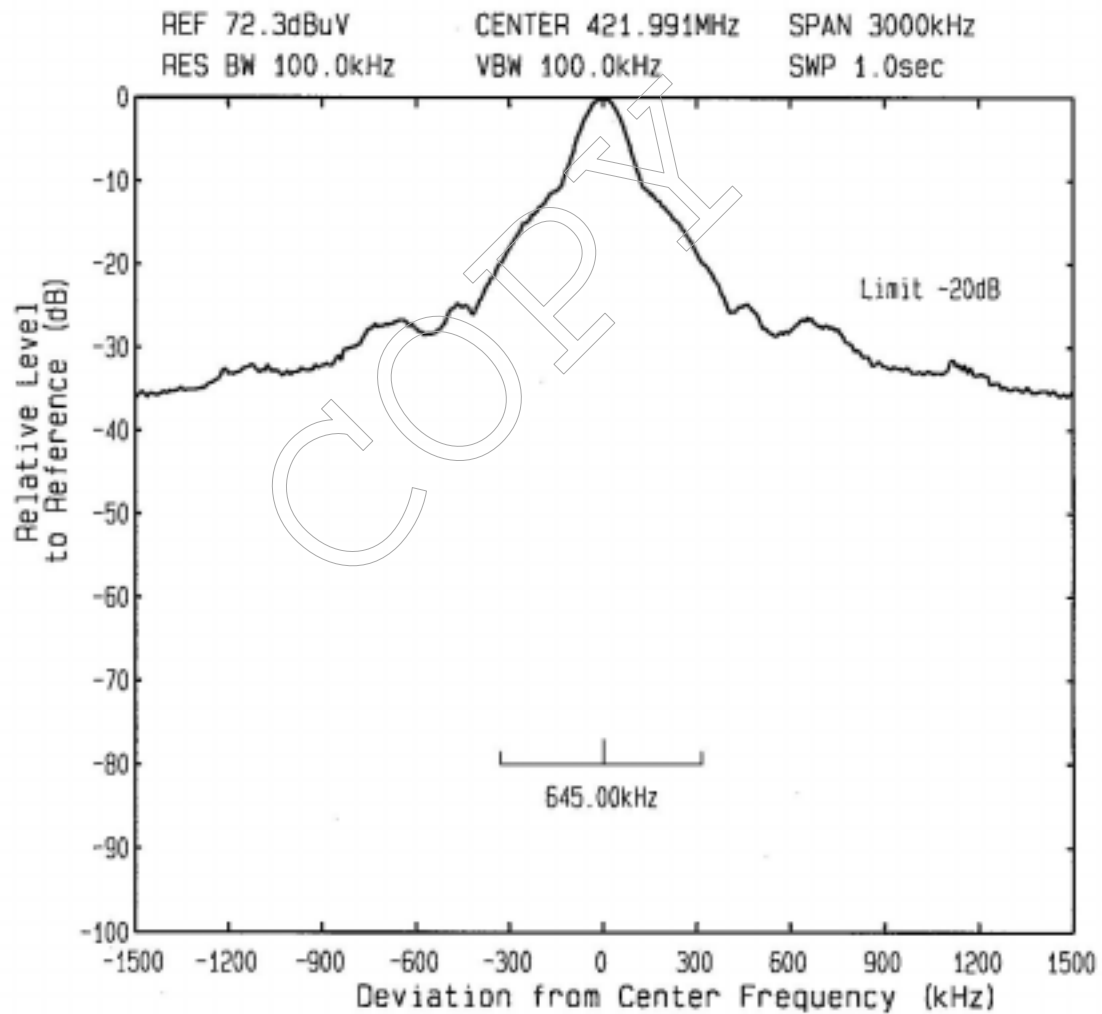
Testing Engineer

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)

