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KANSAI ELECTRONIC INDUSTRY DEVELOPMENT CENTER

HEAD OFFICE
6-8-7 NISHITENMA
KITA-KU OSAKA 530-0047 JAPAN

KEC

IKOMA TESTING LABORATORY
12128 TAKAYAMA-CHO
IKOMA-CITY NARA 630-0101 JAPAN

Corporate Juridical Person

TEST REPORT

Report No.A-011-02-C Date: 26April 2002

This test report is to certify that the tested device properly complies with the requirements of:

FCC Rules and Regulations Part 95 : Radio Control (R/C) Radio Service.

The tests necessary to show compliance to the requirements were performed and these results met the specifications of requirement. The results of this report should not be construed to imply compliance of equipment other than that, which was tested. Unless the laboratory permission, this report should not be copied in part.

1. Applicant

Company Name : SANWA ELECTRONIC INSTRUMENT CO., LTD.

Mailing Address : 1-2-50, YOSHIDA, HONMACHI-CHO, HIGASHIOSAKA-CITY, OSAKA, 578-0982 JAPAN

2. Identification of Tested Device

Type of Device : Radio Control (R/C) Radio Service.
Kind of Equipment Authorization : ☐: DoC ☒: Certification ☐: Verification
FCC ID : AXYATX033
Device Name : RADIO CONTROL TRANSMITTER
Trade Name : AIRTRONICS
Model Number : MX-3
Serial Number : ES2-05 ☐: Prototype ☒: Pre-production ☐: Production
Date of Manufacture : April 2002

3. Test Items and Procedure

☒: RF Power Output (Substitution Method)
☒: Modulation Characteristics
☒: Emission Bandwidth
☒: Field Strength of Spurious Radiation
☒: Frequency Stability Measurement

Above all tests were performed under: FCC Part 2 Sec2.1046, Sec2..1047, Sec2.1049, Sec2.1053, Sec2.1055 and Sec2.1057.

☒: without deviation, ☐: with deviation(details are found inside of this report)

4. Date of Test

Receipt of Test Sample : 11 April 2002
Test Completed on : 24 April 2002

S. Izumi

Seiichi Izumi
General Manager of Ikoma Testing Laboratory

Table of Contents

1. GENERAL INFORMATION

1.1 Product Description

The AIRTRONICS Model No. MX-3 (referred to as EUT in this report) is the RADIO CONTROL TRANSMITTER.

(1) Transmitting Frequency : 75.41 ~ 75.99 MHz (75.73 MHz in EUT)

(2) Contained Oscillator : 6th OVER-TONE

(3) Rated Power Supply : DC 12.0 V (AA type battery × 8)

1.2 Description for Equipment Authorization

(1) Rules Part(s) under which Equipment operated

FCC Rule Part 95 ; Radio Control(R/C) Radio Service

(2) Kind of Equipment Authorization

☒ Certification ☐ Verification

(3) Procedure of Application

☒ Original Equipment ☐ Modification

1.3 Test Facility

Name : KANSAI ELECTRONIC INDUSTRY DEVELOPMENT CENTER (KEC)
IKOMA TESTING LABORATORY
Open Area Site No.4

Address : 12128, Takayama-cho Ikoma-city, Nara, 630-0101 Japan

This test facility has been filed in FCC under the criteria in ANSI C63.4-1992.
The laboratory has been accredited by the NVLAP(Lab.Code:200207-0) based on ISO17025.

2. TESTED SYSTEM

2.1 Test Mode

The compliance tests were performed under the following operation mode.

(1) Measurement of Field Strength of Spurious Radiation :

The EUT was continuously transmitted in modulation mode.

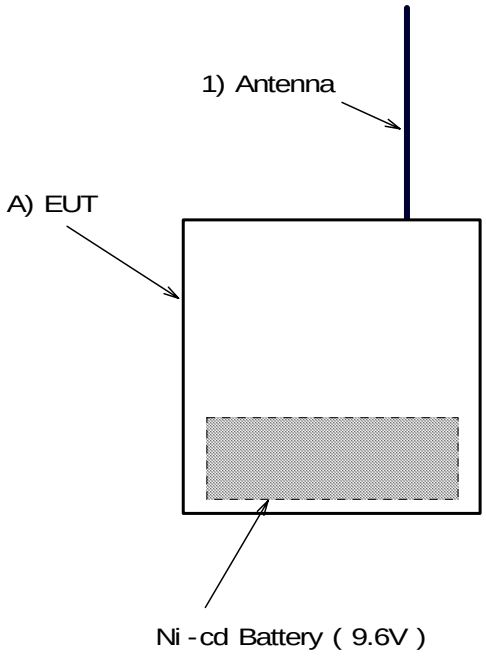
(2) Frequency Stability Measurement :

The EUT was continuously transmitted in non-modulation mode.

(3) Except above two test items :

See the page of each test items.

2.2 Block Diagram of EUT System



[Note]
See 2.3 List of EUT System and 2.4 List of Antenna.

2.3 List of EUT System

No	Device Name	Model Number (Serial Number)	FCC ID (Trade Name)	Note	Remark
A	RADIO CONTROL TRANSMITTER	MX-3 (ES2-05)	AXYATX033 (AIRTRONICS)	EUT	

2.4 List of Antenna

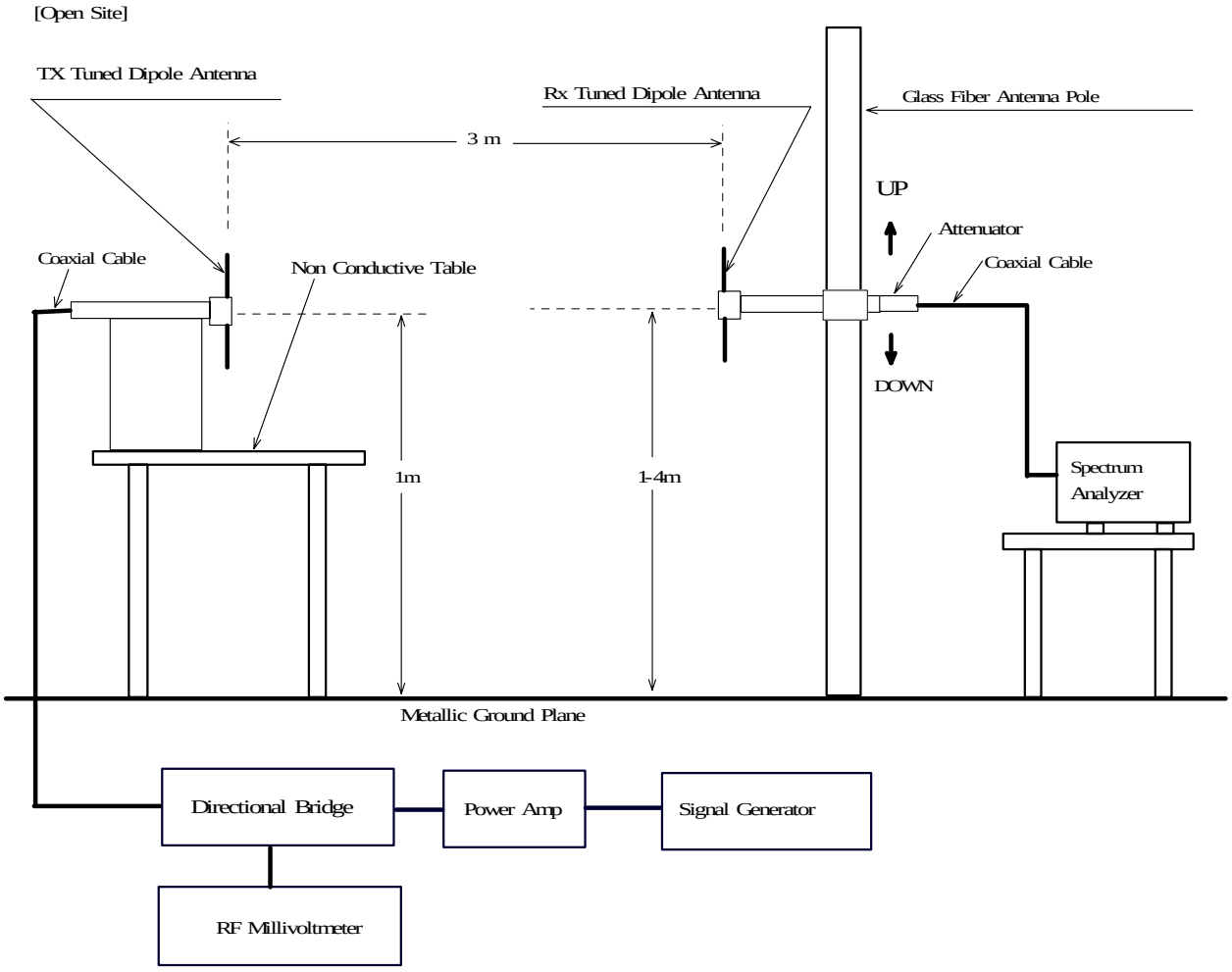
No	Type	Length (m)	Note	Remark
1	Built-in Rod Antenna	0.78	Accessory of EUT	

3. RF POWER OUTPUT

3.1 Reference Rule and Specification

FCC Rule Part 95 [Section95.639] and Part 2 Subpart J [Section2.1046]

3.2 Test Configuration



3.3 Test Procedure

(1) Tune-up the transmitter.

(2) The receiving antenna is adjusted to the correct length for the carrier frequency.

(3) Raise and lower the receiving antenna to obtain a maximum reading on the Spectrum Analyzer with the antenna at horizontal polarity. Then the turntable is rotated to further increase this maximum reading. Repeat this procedure of raising and lower the antenna and rotating the turntable until the highest possible signal has been obtain.
Record this maximum reading.

(4) Repeat step3 with the antenna polarized vertically.

(5) Remove the transmitter and replace it with the half-wave antenna. The center of these antennas are approximately at the same location as the center of the transmitter.

(6) Feed the half-wave antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable.
With the antennas at both ends horizontally polarized and with the signal generator tuned to the carrier frequency, raise and lower the receiver antenna to obtain a maximum reading at the Spectrum Analyzer. Adjust the level of the signal generator output until the previous recording maximum reading for this set of conditions its obtained.

(7) Repeat step6 with both antennas vertically polarized.

3.4 Test Results

CARRIER FREQUENCY [MHz]	SPECTRUM ANALYZER READING [dBμV]		RF METER READING [dBm]		CABLE LOSS [dB]	RF OUTPUT POWER [mW]	LIMIT [mW]
	Horiz.	Vert.	Horiz.	Vert.			
75.73	109.0	106.2	18.9	17.6	0.6	67.3	750.0

The RF Power Output can be calculated from following formula:

$$RF\ Power(mW) = 10^{\frac{Mr-Lo}{10}}$$

where,

Mr: RF Meter Reading (dBm)
Lo: Loss of Cable (dB)

[Environment]

Temperature : 24 °C Humidity : 39 %

[Summary of Test Results]

Above data shows that the test device complies with the requirements.
Minimum margin was 10.4 dB, horizontal polarization.

Tested Date : 18 April 2002 Tester Signature

Hironobu Matsuyama

4. MODULATION CHARACTERISTICS

4.1 Reference Rule and Specification

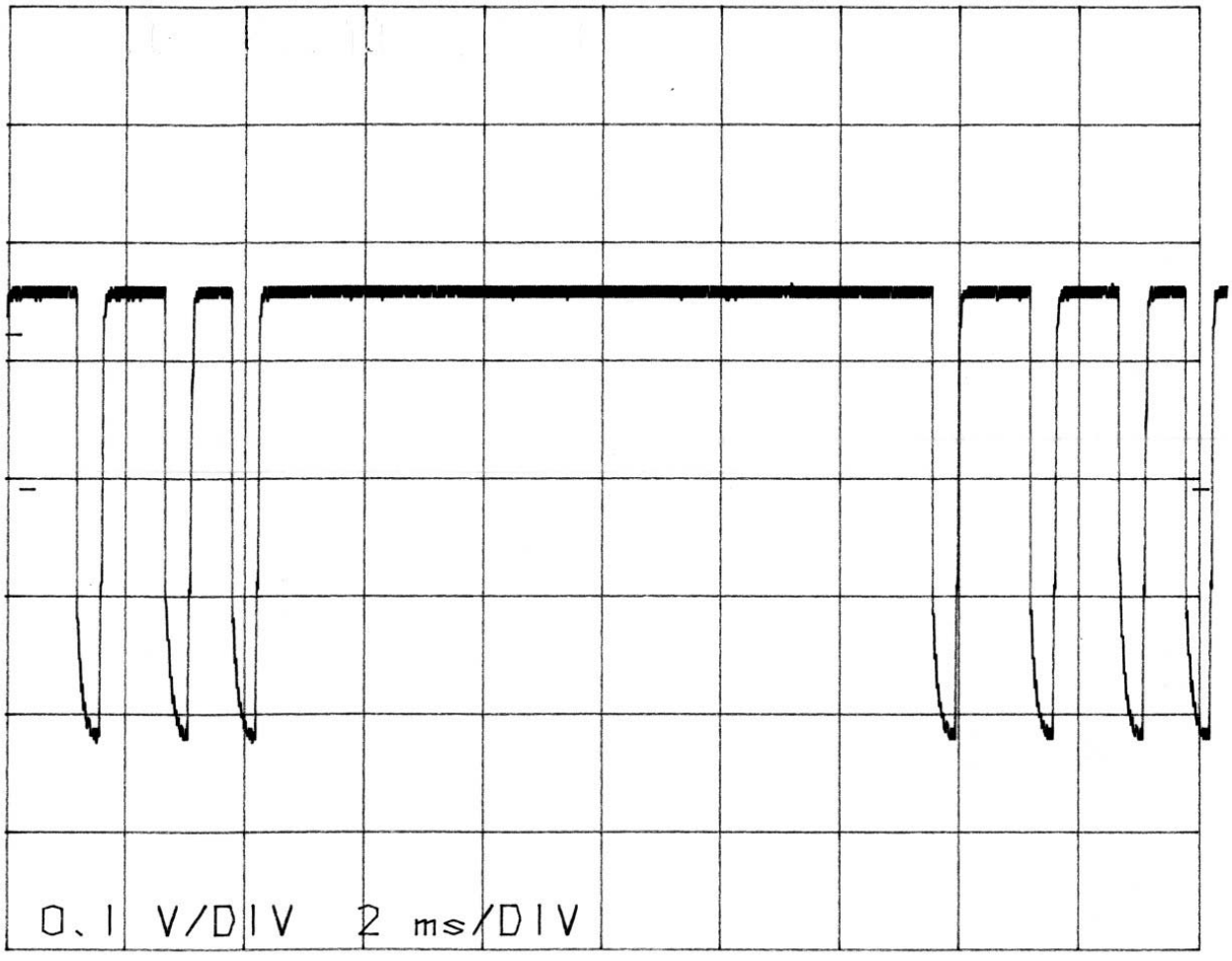
FCC Rule Part 2 Subpart J [Section2.1047]

4.2 Test Results

Encoded Waveform

(1) Operation Mode of EUT

Modulation type （F1D）



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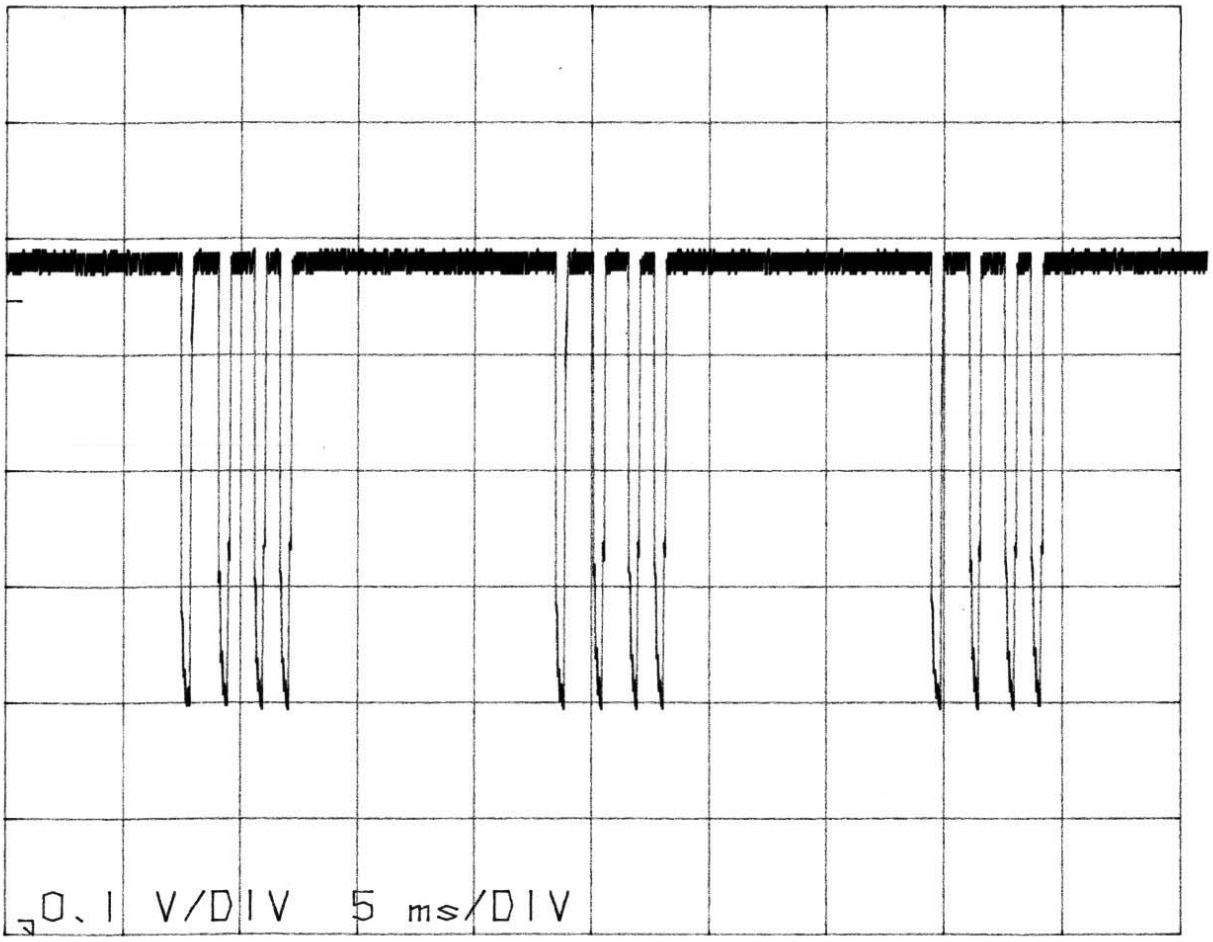
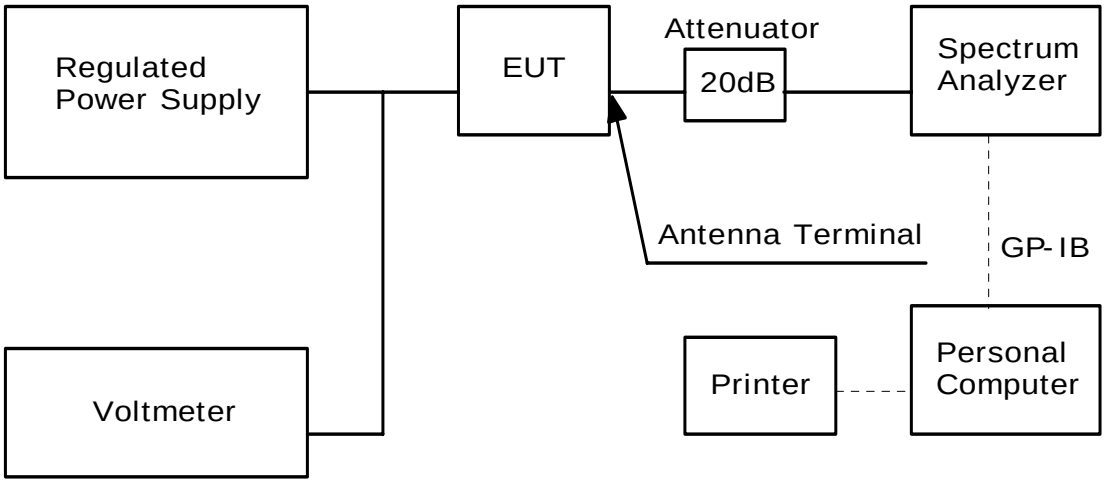


5. EMISSION BANDWIDTH

5.1 Reference Rule and Specification

FCC Rule Part 95 [Section95.633], [Section95.635] and Part 2 Subpart J [Section2.1049]

5.2 Test Configuration



5.3 Test Results

See next figure (the picture of spectrum analyzer)

Occupied Bandwidth

I have measured the OBW by the spectrum analyzer R3261C which could measure 99% occupied bandwidth (OBW).
There are 701 data on horizontal axis of display.
One of them is Vn. Then total power P can be calculated from the following formula.

$$P = \sum_{n=1}^{701} \frac{Vn^2}{R} \qquad \text{..... (1)}$$

where, R is input impedance of R3261C.

Let, x is the point which gives 0.5% of the total power and y is the point which gives 99.5% of the total power. Then we can get the following formula.

$$0.005P = \sum_{n=1}^{x} \frac{Vn^2}{R} \qquad \text{..... (2)}$$

$$0.995P = \sum_{n=1}^{y} \frac{Vn^2}{R} \qquad \text{..... (3)}$$

From(1)- (3), OBW becomes .

$$OBW = \frac{Fspan \times (Y - X)}{700}$$

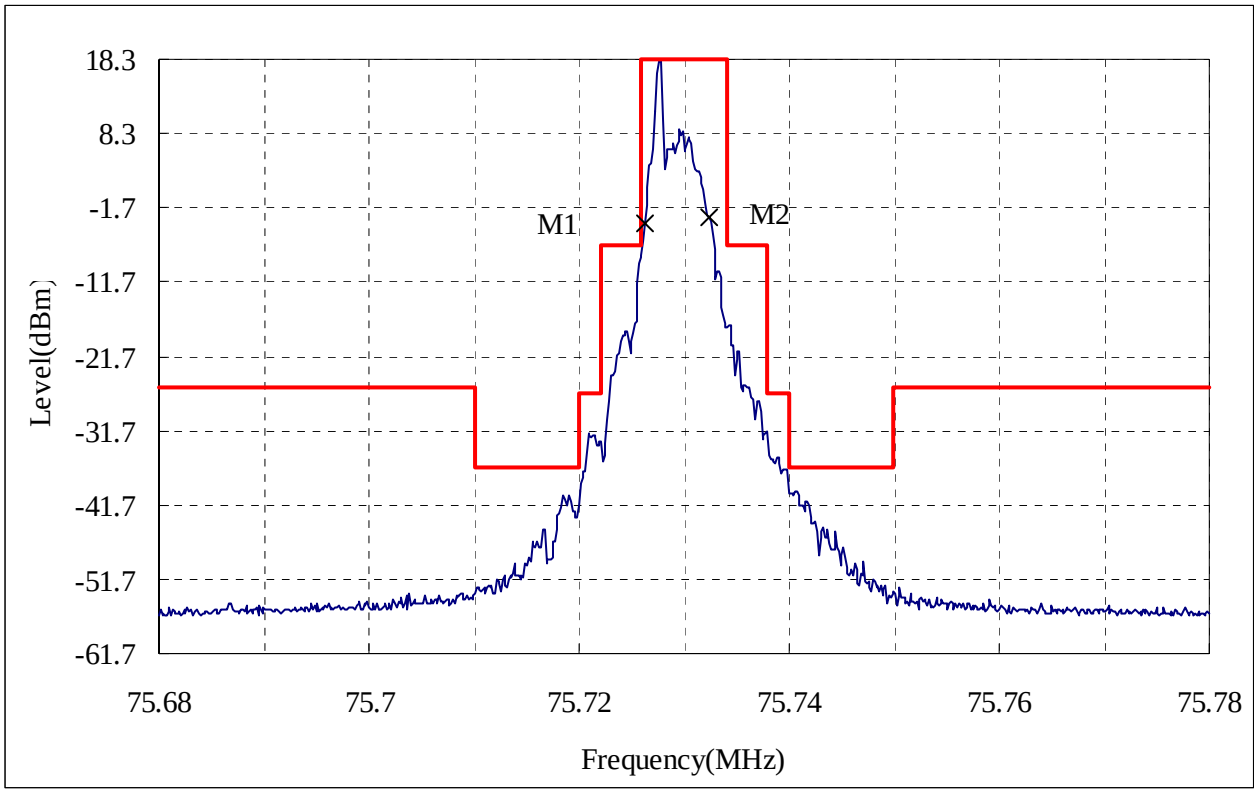
where, F_{span} is frequency span of the spectrum analyzer.

Operation Mode of EUT

Modulation
EUT was operated the various positions of JOY STICK & OTHER SWITCHES.
(Reference level is the unmodulated level.)
Trace mode of Spectrum Analyzer : Maximum Hold

Ref Level	Start Frequency	Stop Frequency	Center Frequency	RBW	VBW
(dBm)	MHz	(MHz)	(MHz)	(kHz)	(kHz)
18.30	75.68	75.78	75.73	0.30	1000.00

M1/M2 Point	Level	Occupied Bandwith	Authorized Bandwith
(MHz)	(dBm)	(kHz)	(kHz)
75.72629	-3.7	6.14	8.00
75.73243	-2.9		



[Environment]
Temperature: 22℃ Humidity: 34%

[Summary of Test Results]
Above data shows that the test device complies with the requirements.

Tested Date : 24 April 2002 Tester Signature

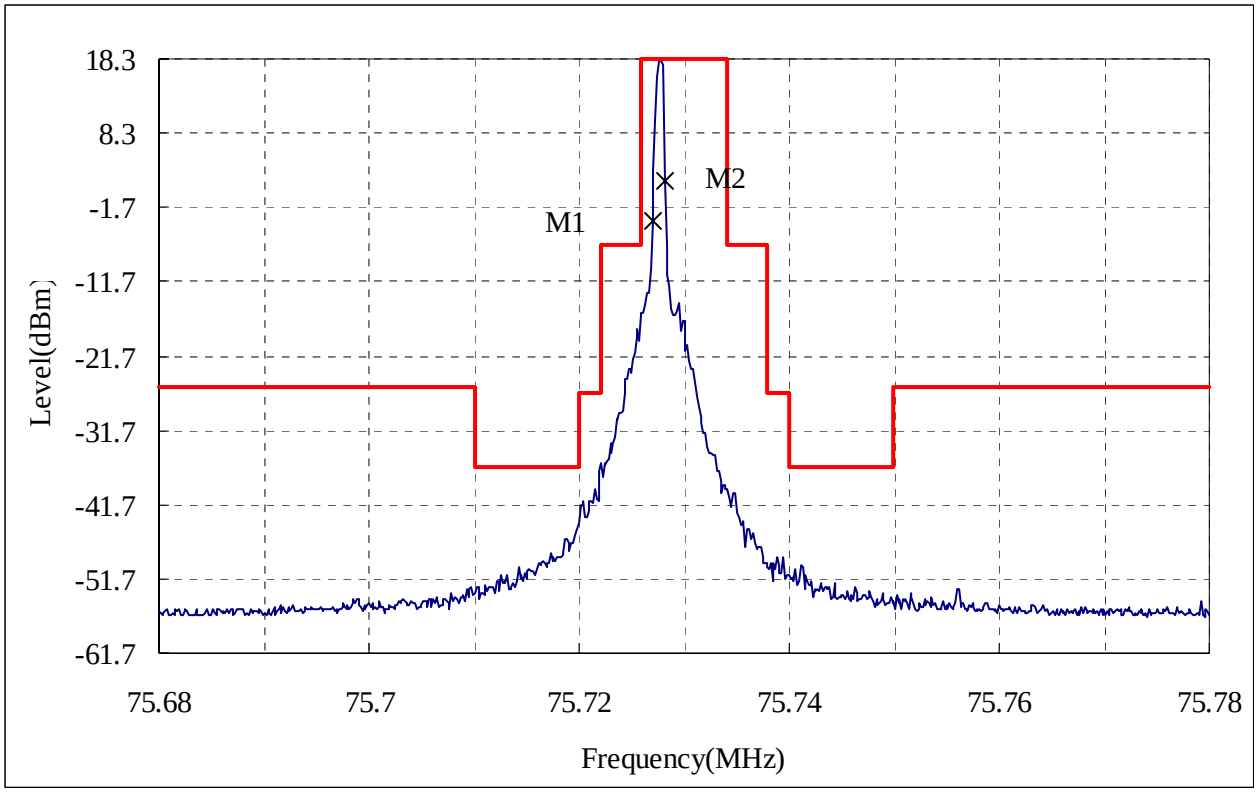
Hironobu Matsuyama

Operation Mode of EUT

Non modulation (F Low)

Ref Level	Start Frequency	Stop Frequency	Center Frequency	RBW	VBW
(dBm)	MHz	(MHz)	(MHz)	(kHz)	(kHz)
18.30	75.68	75.78	75.73	0.30	1000.00

M1/M2 Point	Level	Occupied Bandwith	Authorized Bandwith
(MHz)	(dBm)	(kHz)	(kHz)
75.72700	-3.5	1.14	8.00
75.72814	1.9		



[Environment]

Temperature: 22℃ Humidity: 34%

[Summary of Test Results]

Above data shows that the test device complies with the requirements.

Tested Date : 24 April 2002 Tester Signature

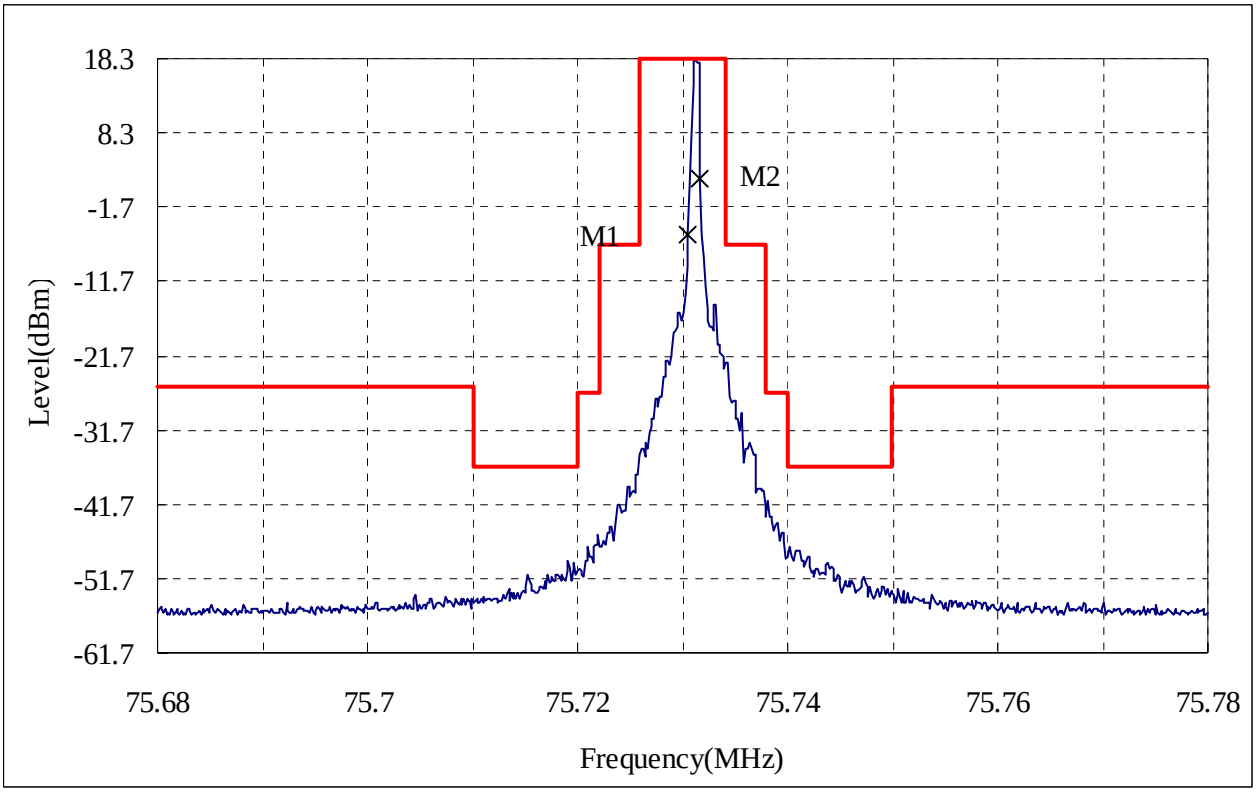
Hironobu Matsuyama

Operation Mode of EUT

Non modulation (F High)

Ref Level	Start Frequency	Stop Frequency	Center Frequency	RBW	VBW
(dBm)	MHz	(MHz)	(MHz)	(kHz)	(kHz)
18.30	75.68	75.78	75.73	0.30	1000.00

M1/M2 Point	Level	Occupied Bandwith	Authorized Bandwith
(MHz)	(dBm)	(kHz)	(kHz)
75.73057	-5.3	1.14	8.00
75.73171	2.1		



[Environment]

Temperature: 22℃ Humidity: 34%

[Summary of Test Results]

Above data shows that the test device complies with the requirements.

Tested Date : 24 April 2002 Tester Signature

Hironobu Matsuyama

6. FIELD STRENGTH OF SPURIOUS RADIATION

6.1 Reference Rule and Specification

FCC Rule Part 95 [Section 95.635] and Part 2 Subpart J [Section 2.1053]

6.2 Test Procedure

(1) Tune-up the transmitter(EUT).

(2) Device Vertical : Place the device so that it's longest axis is vertical.

(3) For each spurious measurement the receiving antenna is adjusted to the correct length for the frequency involved. These measurements are made from the lowest radio frequency generated in the EUT or 25MHz to the tenth harmonic of the carrier.

(4) For each spurious frequency, raise and lower the receiving antenna to obtain a maximum reading on the spectrum analyzer with the antenna at horizontal polarity. Then the turntable is rotated to further increase this maximum reading. Repeat this procedure of raising and lower the antenna and rotating the turntable until highest possible signal has been obtain. Record this maximum reading.

(5) Repeat Step4 for each spurious frequency with the antennae polarized vertically.

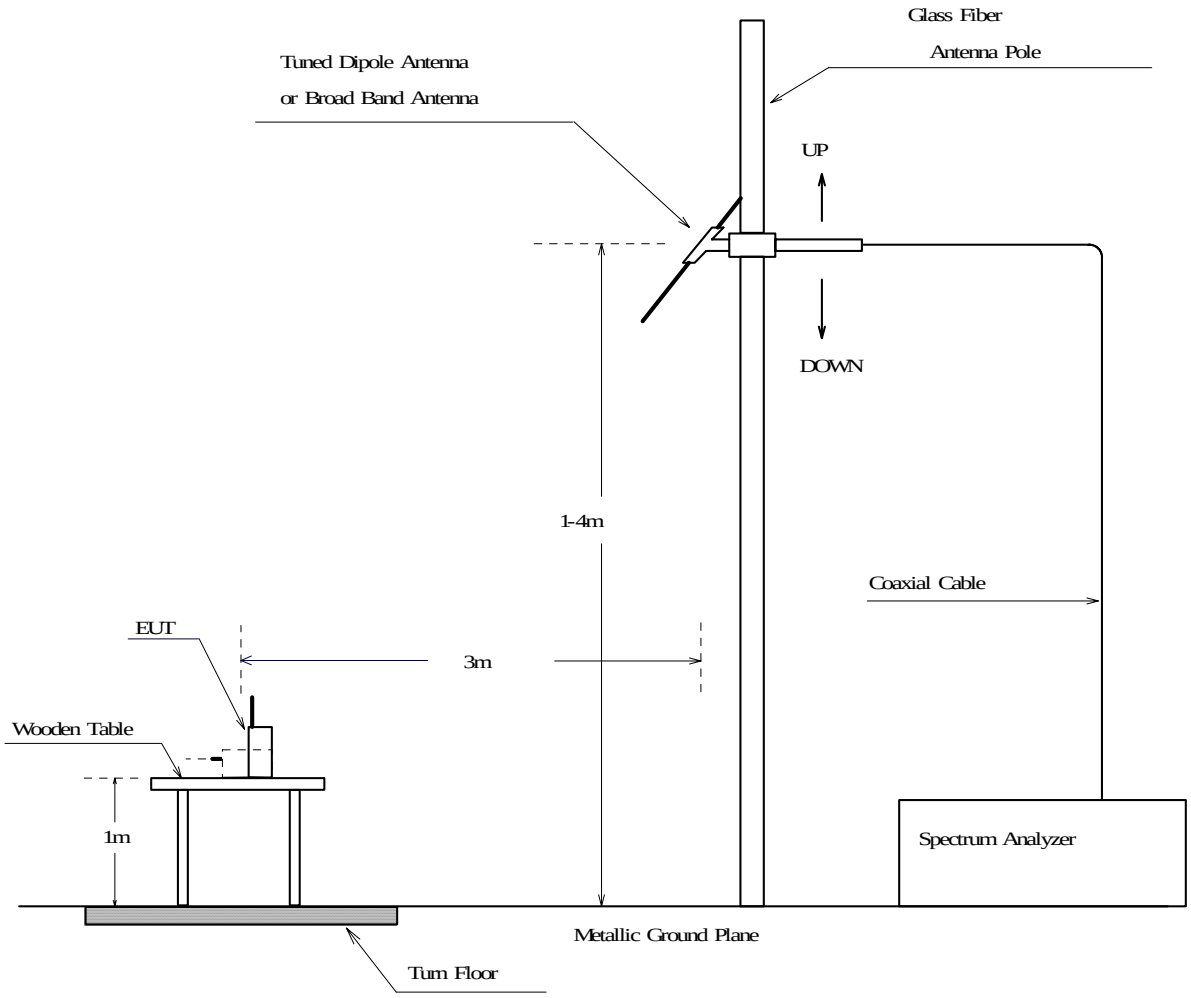
(6) Device Horizontal : Place the device so that it's longest axis is horizontal.

(7) Repeat Step3, Step4, and Step5

(8) The attenuation of the spurious in dB can be calculated from the following formula:

Spurious Emission Attenuation [dB]	=	Field Strength of Carrier Emission [dBμV/m]	–	Field Strength of Spurious Emission [dBμV/m]

6.3 Test Configuration



6.4 Photographs of EUT System Configuration

Horizontal Placing

Vertical Placing

6.5 Test Results

Measurement Frequency	Antenna Factor	Mater Reading		Maximum Field Strength	Attenuation From Carrier	Limits	Margin for Limits
		Horizontal	Vertical				
(MHz)	(dB/m)	(dBuV)	(dBuV)	(dBuV/m)	(dB)	(dB)	(dB)
Carrier Emission							
75.73	8.3	109.0	106.2	117.3	-	-	-
Spurious Emission							
50.49	4.2	43.3	43.1	47.5	69.8	44.3	25.5
63.11	6.5	52.1	51.4	58.6	58.7	44.3	14.4
88.35	9.7	51.8	48.8	61.5	55.8	44.3	11.5
151.46	14.5	52.7	47.2	67.2	50.1	44.3	5.8
227.19	18.8	39.0	34.2	57.8	59.5	44.3	15.2
302.92	16.7	38.4	32.5	55.1	62.2	44.3	17.9
378.65	18.8	45.6	41.8	64.4	52.9	44.3	8.6
454.38	20.4	42.6	38.3	63.0	54.3	44.3	10.0
530.11	21.9	40.3	33.0	62.2	55.1	44.3	10.8
605.84	23.3	39.9	35.4	63.2	54.1	44.3	9.8
681.57	24.5	43.8	34.6	68.3	49.0	44.3	4.7
757.30	25.6	37.8	31.0	63.4	53.9	44.3	9.6

[Note]

Limit of the attenuation of the spurious in dB:

56 + 10Log(Power) = 56 + 10Log(0.0673) = 44.3dB

[Environment]

Temperature : 24°C Humidity : 39%

[Summary of Test Results]

Minimum Margin was 4.7 dB at 681.57 MHz, horizontal polarization.

Tested Date : 18 April 2002 Tester Signature

Hironobu Matsuyama

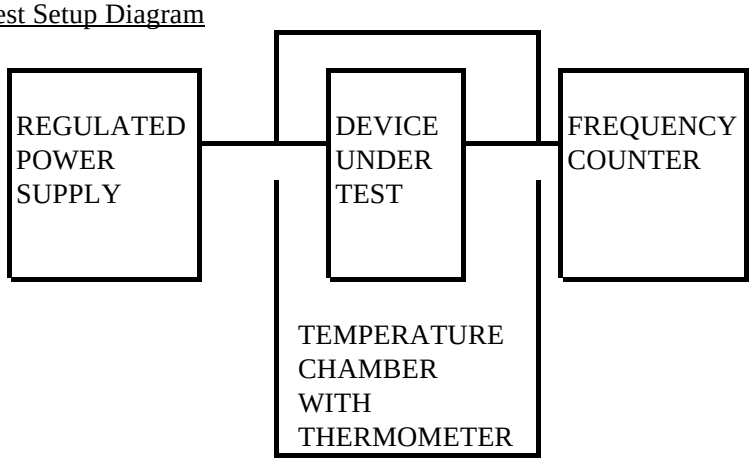
7. FREQUENCY STABILITY MEASUREMENT

7.1 Reference Rule and Specification

FCC Rule Part 95 [Section95.623] and Part 2 Subpart J [Section2.1055]

7.2 Frequency vs Temperature Test

Test Setup Diagram



Test Result Test Voltage: 12.0V

REFERENCE FREQUENCY [MHz]	TEMPERATURE [℃]	FREQUENCY DRIFT [%]	LIMIT [%]
75.73	-30	0.000277	±0.002
	-20	0.000494	
	-10	0.000515	
	0	0.000384	
	+10	0.000135	
	+20	-0.000145	
	+30	0.000839	
	+40	-0.000741	
	+50	-0.000907	

7.3 Frequency vs Voltage Test

Test Setup Diagram : Same as (1)

Test Result Temperature : +20°C

REFERENCE FREQUENCY [MHz]	SUPPLIED VOLTAGE [Volt]	FREQUENCY DRIFT [%]	LIMIT [%]
75.73	9.0	-0.000125	±0.002

Note Reduced primary supply voltage to the operating and point which shall be specified by the manufacturer.

[Environment] Temperature : 20°C Humidity : 42%

[Summary of Test Results]

Above data shows that the test device complies with the requirements.

Tested Date : 19 & 22 April 2002 Tester Signature _____

Hironobu Matsuyama

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8. USED TEST EQUIPMENTS AND CALIBRATION STATUS

Instrument	Manufacturer	Model No	Specifications	KEC Control No.	if used, checked by "X".	Last Cal.	Next Cal.
Spectrum Analyzer	Advantest	R3261C	Frequency Range 9 kHz – 2.6 GHz	SA-41	☒	2001/10	2002/10
Biconical Antenna	Schwarzbeck	BBA9106	Frequency Range 30 MHz - 300 MHz	AN-94	☐	2002/3	2003/3
Log-Periodic	Schwarzbeck	UHAL9108A	Frequency Range 300 MHz - 1 GHz	AN-217	☒	2002/3	2003/3
Tuned Dipole Antenna (Tx)	Kyoritsu	KBA-511S	Frequency Range 25 MHz - 500 MHz	AN-134	☒	2001/4	2002/4
	Kyoritsu	KBA-611S	Frequency Range 500 MHz - 1 GHz	AN-136	☐	2001/4	2002/4
Tuned Dipole Antenna (Rx)	Kyoritsu	KBA-511S	Frequency Range 25 MHz - 500 MHz	AN-135	☒	2001/4	2002/4
	Kyoritsu	KBA-611S	Frequency Range 500 MHz - 1 GHz	AN-137	☐	2001/4	2002/4
Signal Generator	Hewlett Packard	8662A	Frequency Range 10 kHz - 1280 MHz	SG-49	☒	2002/4	2003/4
Power Amp.	ENI	601L	Frequency Range 0.8 MHz - 1 GHz	AM-24	☒	2001/6	2002/6
Power Meter	Hewlett Packard	E4419B	Frequency Range 100 kHz - 50 GHz	VV-39	☒	2001/8	2002/8
Directional Bridge	Hewlett Packard	86205A	Frequency Range 300 kHz - 6 GHz	AX-62	☒	2001/8	2002/8
Coaxial Cable	Suhner	SUCOFLEX 104	Length : 10m [SMA(p)-SMA(p)]	CL-47	☒	2002/1	2003/1
Attenuator	WEINSCHEL	46-20-43	Frequency Range 0 -18 GHz 10 dB , 25W	AT-29-2	☒	2002/1	2003/1
Regurated DC Power Supply	Kikusui	PAB18-3A	Output 0-18V, 3A	PD-32	☒	–	–
Temperature Chamber With Thermometer	Tabai Mfg.	MC-710	Temperature Range -75 - +100 °C	CH-31	☒	–	–
Frequency Counter	Advantest	TR5823H	Freq.Range 1 mHz-1300 MHz	CU-17	☒	2001/5	2002/5
Spectrum Analyzer	Advantest	R3261B	Frequency Range 9 kHz – 3.6 GHz	SA-33	☒	2001/5	2002/5
Multimeter	John Fluke	37	Volt Range 0.1mV - 1000 V Ampere Range 0.01 mA - 20 A	MM-91	☒	2002/2	2003/2
Digital Oscilloscope	Matsushita Communication Ind.	VP-5740A	Frequency Range DC -10 MHz	OS-22	☒	2001/5	2002/5