平成17年3月24日

三和電子機器株式会社 御中

〒630-0101 奈良県生駒市高山町12128
社団法人 関西電子工業振興センター
生駒試験所

試験成績について

下記の通り試験結果を御報告申し上げます。

記

1. 受付番号 : A-004-05-C

2. 供試装置 : Transmitter and Module for radio control model

商 標 名 : Airtronics
型式番号 : M11(93375)

3. 適用規格 : FCC Rules and Regulations Part 95 and Part 2

4. 試験結果 : 添付 TEST REPORTの通り

5. その他 : スプリアスエミッションで許容値を超過し、対策後適合した。

本紙とTEST REPORTの総ページ数は 21 です。

担当 峯松 育弥

承認 計測技術部 部長 泉 誠一

KANSAI ELECTRONIC INDUSTRY DEVELOPMENT CENTER

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

KEC
Corporate Juridical Person

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

TEST REPORT

Report No.A-004-05-C

Date: 24 March 2005

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, Yoshidahonmachi, higashiosaka, osaka, 578-0982

2. Identification of Tested Device

Type of Device : Radio Control (R/C) Transmitter
Kind of Equipment Authorization : ☐: DoC ☒: Certification ☐: Verification
FCC ID : AXYATX037
Device Name : Transmitter and Module for radio control model
Trade Name : Airtronics
Model Number : M11(93375)
Serial Number : 20040701 ☐: Production ☒: Pre-production ☐: Prototype
Date of Manufacture : January 2005

3. Test Items and Procedure

☒: RF Power Output (Substitution Method)
☒: Modulation Characteristics
☒: Emission Bandwidth
☒: Spurious Radiation (Substitution Method)
☒: 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 : 14 February 2005
Condition of Test Sample : ☒: Damage is not found on the set.
☐: Damage is found on the set. (Details are described in this report)
Test Completed on : 22 March 2005

S. Izumi

Seiichi Izumi
General Manager of Ikoma Testing Laboratory

Table of Contents

1. GENERAL INFORMATION

1.1. Product Description

The Airtronics Model No. M11(93375) (referred to as EUT in this report) is the Transmitter for radio control model (Car).

(1) Technical Specifications

- TX Frequency : 75.410 ~ 75.990 MHz (75.790MHz in EUT)
- CPU : HD64F2318VTE25V
- LCD : FSTN 110 × 45
- EEPROM : 64kbit
- Power source : Nicel Cadmium Battery
  Output DC 10.0V

(2) Used Oscillating Frequency

- 24.00 MHz : CPU Clock
- 75.41 ~ 75.99MHz : RF Module

(3) Provided Terminals

- DSC Connector : for servo control
- Charging Jack : for battery charging
- 8pin connector : for RF module

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

1.3. Test Facility

All tests described in this report were performed by:

Name: KANSAI ELECTRONIC INDUSTRY DEVELOPMENT CENTER (KEC)
IKOMA TESTING LABORATORY

Open Area Test Site	☐	No.1	☒	No.4			
Anechoic Chamber	☐	No.1	☐	No.3			
Shielded Room	☐	No.1	☐	No.2	☐	No.4	☒ No.6

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

These test facilities have been filed with the FCC under the criteria of ANSI C63.4-2003.
The KEC has been accredited by the NVLAP (Lab. Code: 200207-0) based on ISO/IEC 17025.
Also the laboratory has been authorized by TUV Product Service (GER) and TUV Rheinland (GER) based on their criteria for testing laboratory (ISO/IEC 17025).

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.

[Note]

Measurement were performed 3-othganal axis, therefore test results that produce the maximum emission were reported at each frequency.

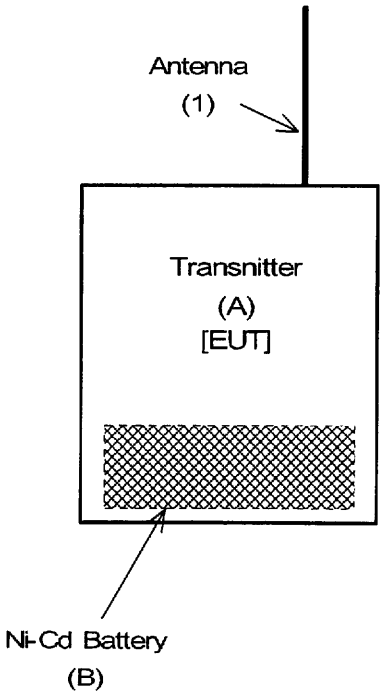
(2) Frequency Stability Measurement :

The EUT was continuously transmitted in un 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	Transmitter and Module for radio control model	M11(93375) (20040701)	AXYATX037 (Airtronics)		(1)
B	Ni-Cd Battery	109A19111A (-)	N/A (-)		

[Remark]
(1) : EUT

2.4. List of Antenna

No	Type	Length (m)	Note	Remark
1	Built-in Rod Antenna	0.7		

3. RF OUTPUT POWER AND RADIATED SPURIOUS EMISSIONS

3.1. Reference Rule and Specification

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

3.2. Test Procedure

(1) Place the transmitter to be tested (EUT) on the turntable.
(2) Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier.
(3) For each spurious frequency, raise and lower the test antenna from 1m to 4m to obtain a maximum reading on the spectrum analyzer (*1) with the test antenna at horizontal polarity. Then the turntable should be rotated 360° to determine the maximum reading. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.
(4) Repeat step (3) for each spurious frequency with the test antenna polarized vertically.
(5) Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3m above the ground.
(6) Feed the substitution 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 a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.
(7) Repeat step (6) with both antennas vertically polarized for each spurious frequency.
(8) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps (6) and (7) by the power loss in the cable between the generator and the antenna and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna.
(9) The levels record in step (8) are the absolute levels of radiated spurious emissions in dBm. The radiated spurious emissions in dB can be calculated by the following:

$$\text{Radiated spurious emissions (dB)} = 10\log_{10}\left[\frac{\text{TX power in watts}}{0.001}\right] - \text{the levels in step (8)}$$

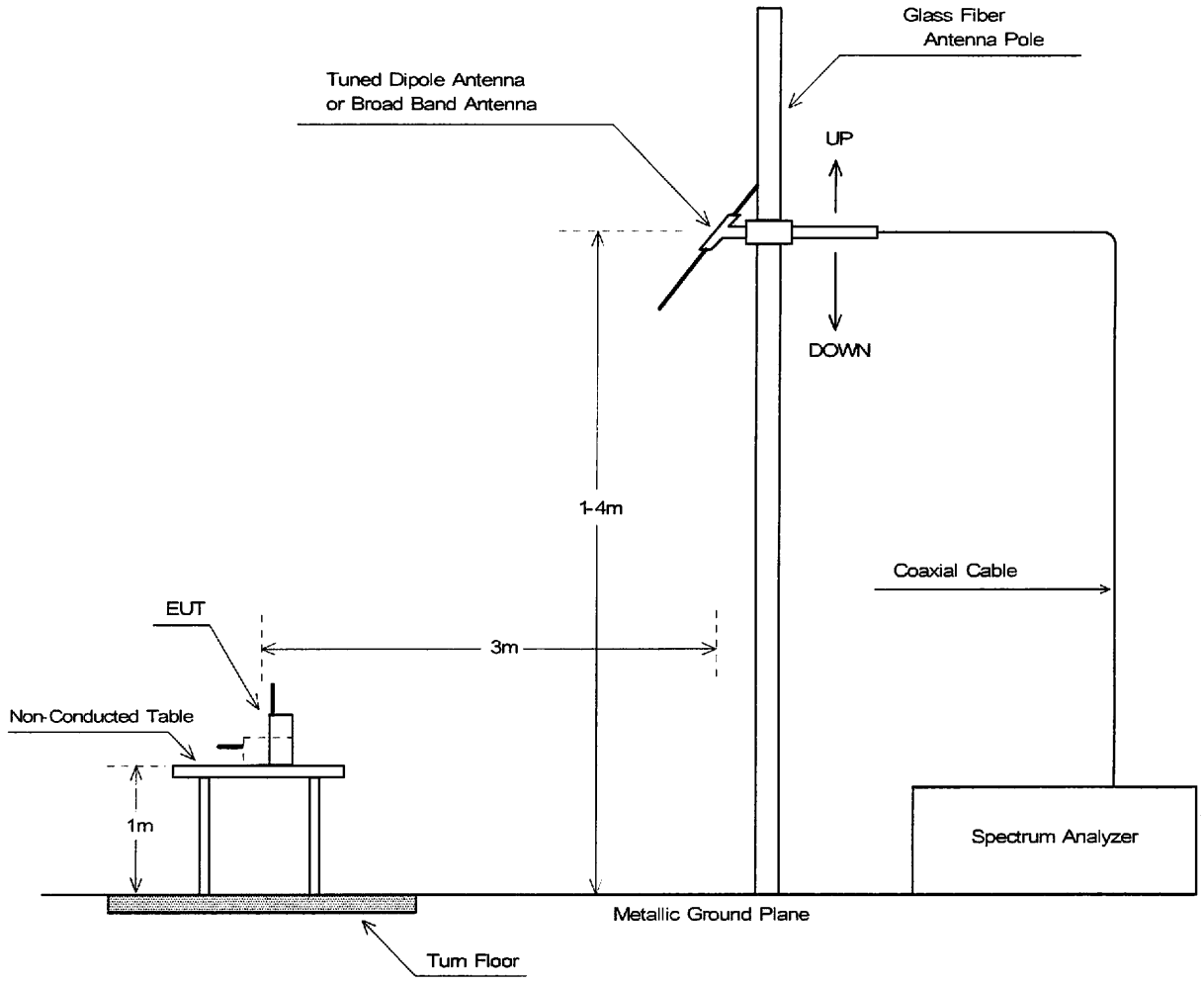
Note : It is permissible to use other antennas provided they can be referenced to a dipole.

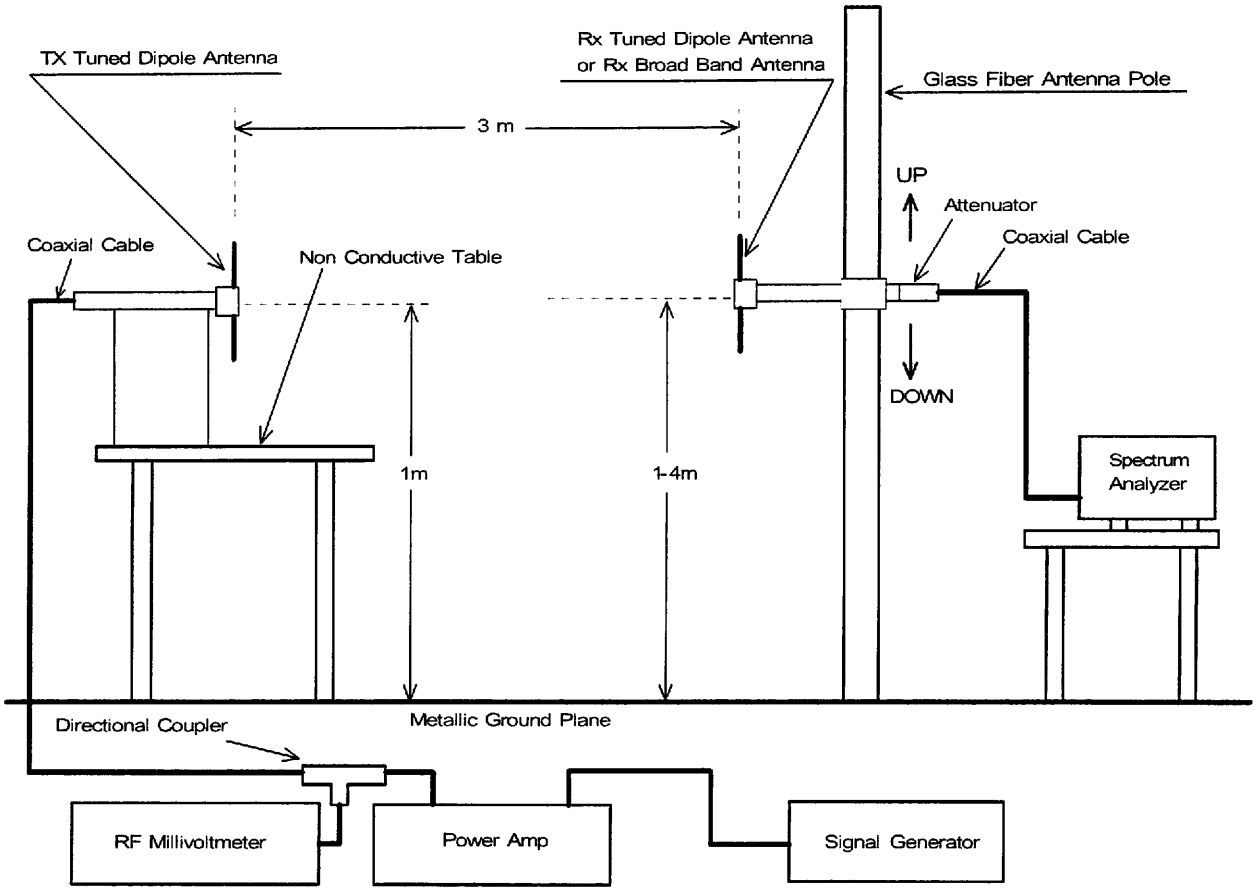
[Note]

(*1) Spectrum Analyzer Set Up Condition

Frequency Span	: 10 MHz
Resolution Bandwidth	: 100 kHz
Video Bandwidth	: ≧ RBW
Sweep time	: Auto

3.3. Test Configuration

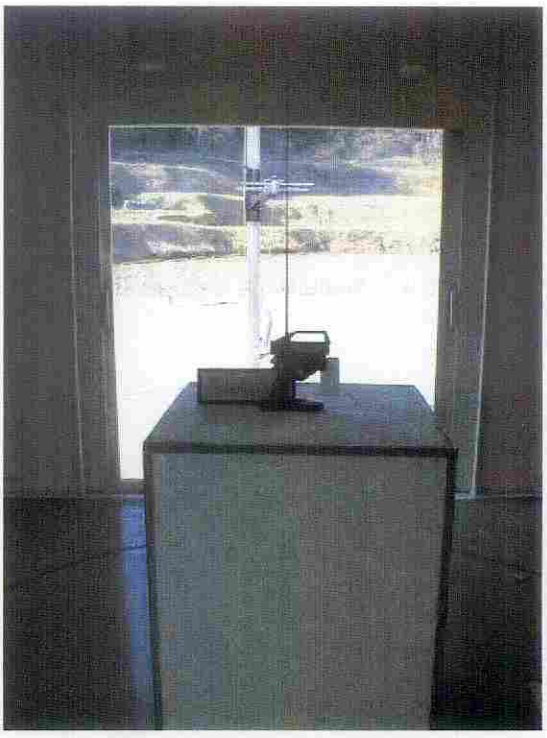



TX Tuned Dipole Antenna
Rx Tuned Dipole Antenna
or Rx Broad Band Antenna
Glass Fiber Antenna Pole
3 m
UP
Attenuator
Coaxial Cable
Coaxial Cable
Non Conductive Table
DOWN
1m
1-4m
Spectrum
Analyzer
Directional Coupler
Metallic Ground Plane
RF Millivoltmeter
Power Amp
Signal Generator

3.4. Photographs of EUT System Configuration

(X axis)

(Y axis)



(Z axis)

3.5. Test Results

Measured Frequency [MHz]	Correction Factor (*1) [dB]	Power Meter Reading Horizontal Polarization [dBm]	Power Meter Reading Vertical Polarization [dBm]	Effective Radiated Power [dBm]	Limit [mW]	Margin For Limits [dB]
75.79	8.3	10.5	10.1	18.8	750	10.0

Measured Frequency [MHz]	Correction Factor (*1) [dB]	Power Meter Reading Horizontal Polarization [dBm]	Power Meter Reading Vertical Polarization [dBm]	Tx Antenna Gain [dBi]	Effective Radiated Power [dBm]	Limits (*2) [dBm]	Margin For Limits [dB]
(Harmonics and Other Emission)							
50.53	8.4	-32.9	-33.0	-2.3	-29.0	-26.0	3.0
63.16	8.3	-49.8	-52.1	-0.4	-44.1	-26.0	18.1
88.42	8.2	-36.3	-47.1	2.2	-28.1	-25.0	3.1
101.07	8.2	-47.5	-51.5	2.2	-39.3	-26.0	13.3
151.58	8.0	-39.2	-48.1	2.2	-31.2	-26.0	5.2
227.37	7.9	-53.1	-52.5	2.2	-44.6	-26.0	18.6
303.16	7.7	-49.9	-53.1	2.2	-42.2	-26.0	16.2
378.95	7.5	-47.5	-49.7	2.2	-40.0	-26.0	14.0
454.74	7.3	-44.1	-47.6	2.2	-36.8	-26.0	10.8
530.53	7.1	-49.6	-50.1	2.2	-42.5	-26.0	16.5
606.32	7.1	-62.3	-60.3	2.2	-53.2	-26.0	27.2
682.11	7.0	-55.9	-58.4	2.2	-48.9	-26.0	22.9
757.90	6.9	-55.2	-55.0	2.2	-48.1	-26.0	22.1

[Note]

(1) (*1) : Correction factor is included the loss of cable and directional coupler, insertion loss of attenuator and the coupling factor of directional coupler.

(2) (*2) : Limit = Carrier power (dBm) – (56 + 10log (Carrier Power [mW] / 1000))
Measured Carrier power : 18.8dBm = 75.9mW
Limit = 18.8 – (56 + 10log (75.9/1000)) = -26dBm

(3) Measurement Frequency below 80MHz, transmitting antenna is used 80MHz tuned dipole antenna.

[Sample Calculation]

Effective Radiated Power [dBm]
= Connection Factor (dB) + Maximum Meter Reading (dBm) + Tx antenna Gain (dBi) – 2.15 (dBi)
2.15dB : half wave dipole antenna isotropic gain.

[Environment]

Temperature : 22℃ Humidity : 34%

[Summary of Test Results]

Minimum Margin was 3.0 dB at 50.53 MHz, horizontal polarization.

[Tested Date / Tester]

8 March 2005 Signature

Ikuya Minematsu

4. MODULATION CHARACTERISTICS

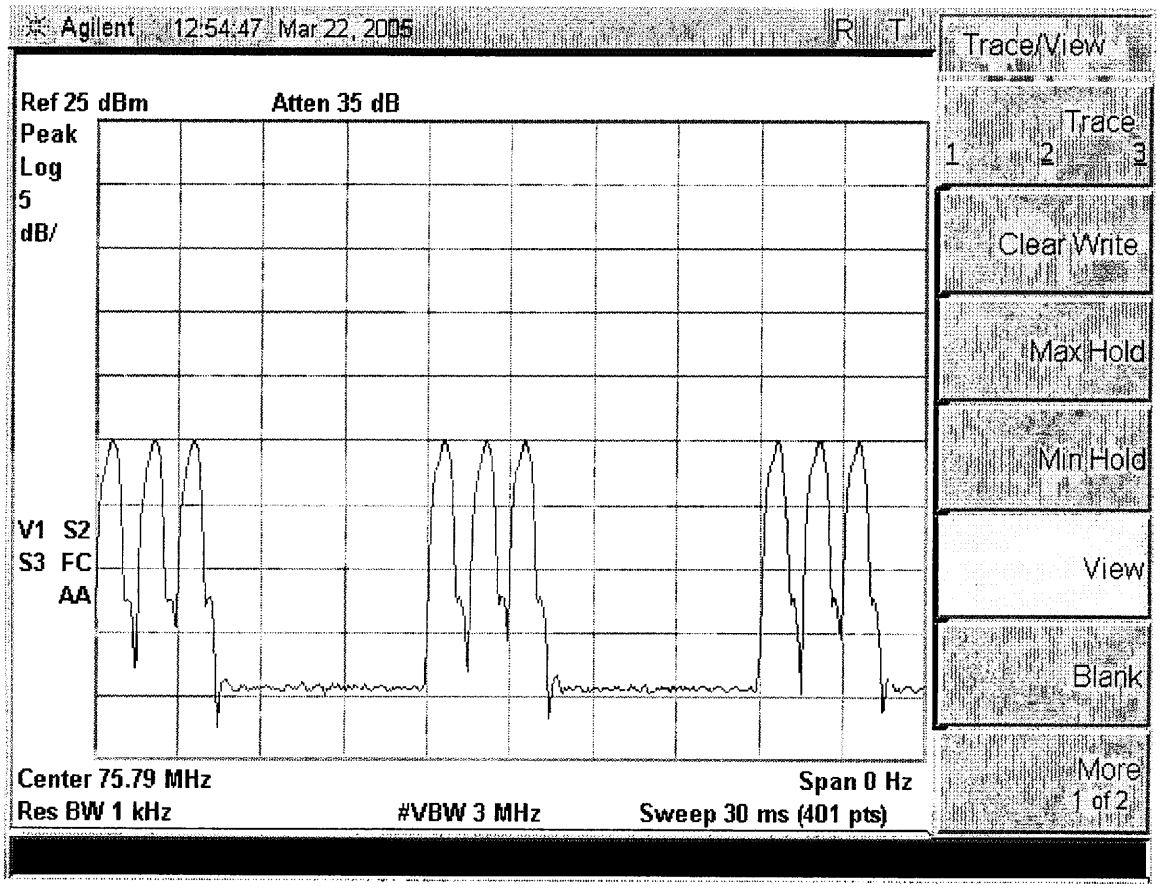
4.1. Reference Rule and Specification

FCC Rule Part 2 Subpart J [Section2.1047]

4.2. Test Results

Encoded Waveform

Modulation type (F1D)

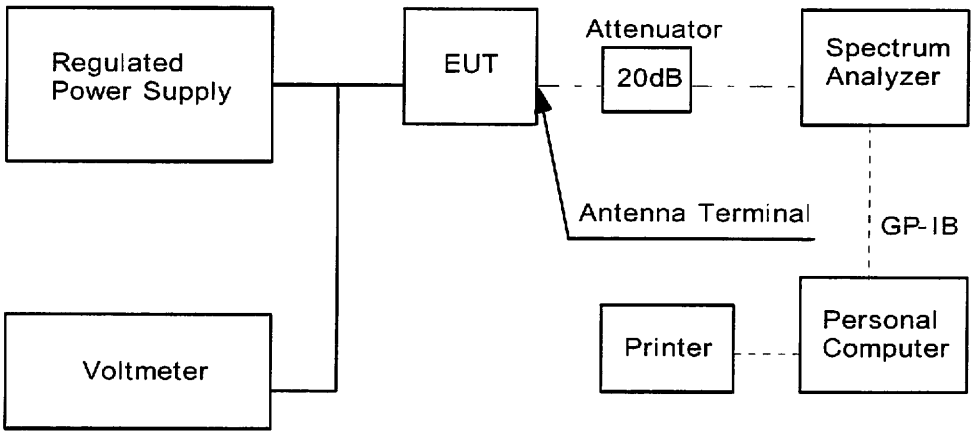


5. EMISSION BANDWIDTH

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 R3261B 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 R3261B.

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 .

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

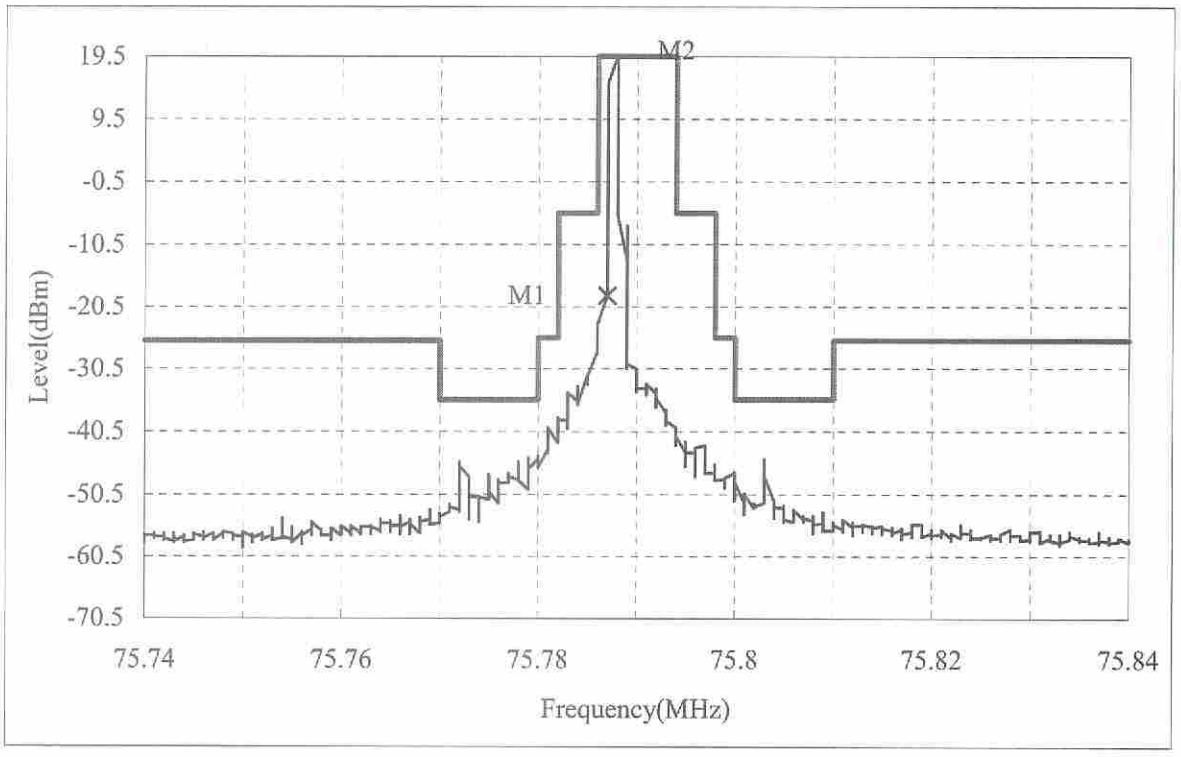
where, F_{span} is frequency span of the spectrum analyzer.

Operation Mode of EUT

Un Modulation
Trace mode of Spectrum Analyzer : Maximum Hold

Ref Level	Start Frequency	Stop Frequency	Center Frequency	RBW	VBW
(dBm)	MHz	(MHz)	(MHz)	(kHz)	(kHz)
19.50	75.74	75.84	75.79	0.30	1000.00

M1/M2 Point	Level	Occupied Bandwith	Authorized Bandwith
(MHz)	(dBm)	(kHz)	(kHz)
75.78700	-18.7	1.00	8.00
75.78800	19.7		



[Environment]
Temperature : 18℃ Humidity : 56%

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

[Tested Date / Tester]
22 March 2005 Signature

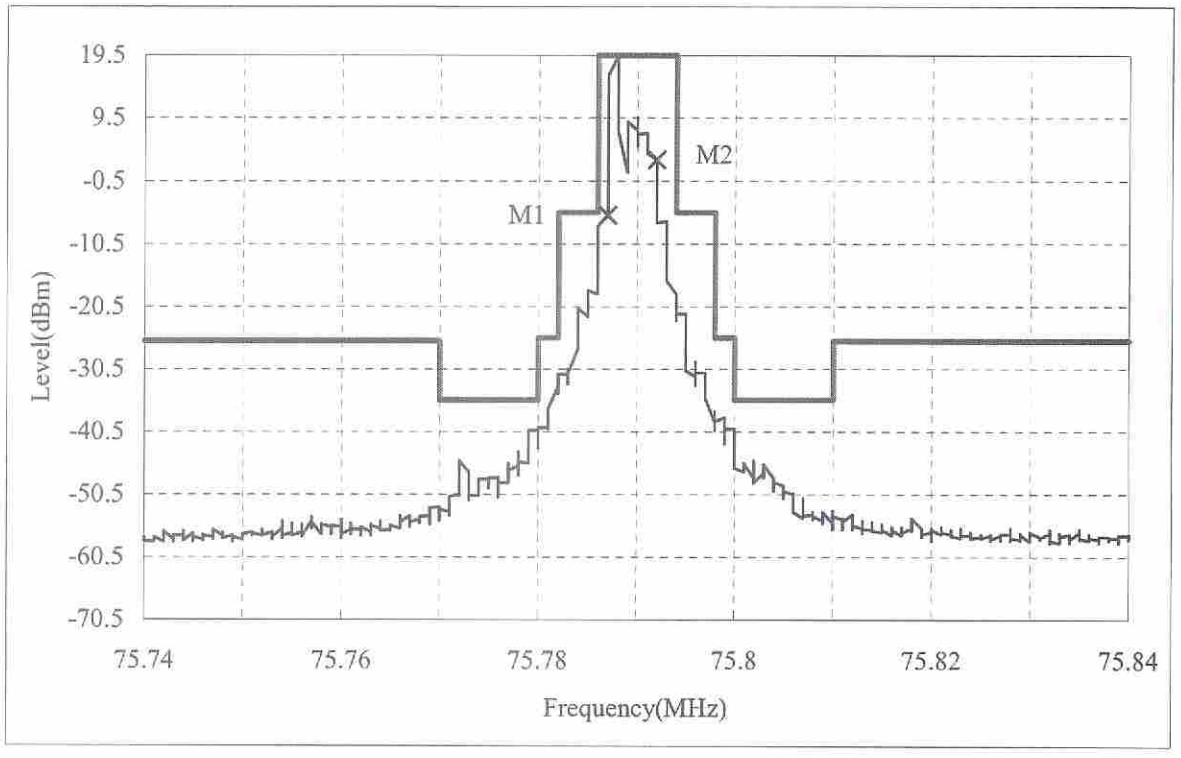
Ikuya Minematsu

Operation Mode of EUT

Modulation
Trace mode of Spectrum Analyzer : Maximum Hold

Ref Level	Start Frequency	Stop Frequency	Center Frequency	RBW	VBW
(dBm)	MHz	(MHz)	(MHz)	(kHz)	(kHz)
19.50	75.74	75.84	75.79	0.30	1000.00

M1/M2 Point	Level	Occupied Bandwith	Authorized Bandwith
(MHz)	(dBm)	(kHz)	(kHz)
75.78700	-5.9	5.00	8.00
75.79200	2.9		



[Environment]
Temperature : 18℃ Humidity : 56%

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

[Tested Date / Tester]
22 March 2005 Signature

Ikuya Minematsu

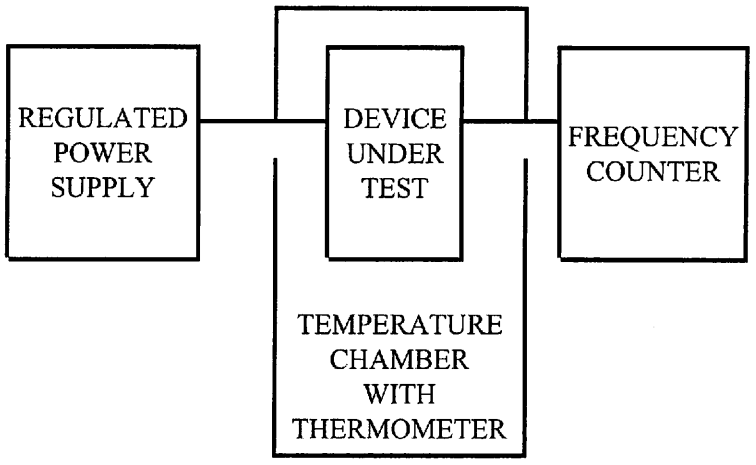
6. FREQUENCY STABILITY MEASUREMENT

6.1. Reference Rule and Specification

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

6.2. Frequency vs Temperature Test

Test Setup Diagram



Test Result Test Voltage: 10.0V

REFERENCE FREQUENCY [MHz]	TEMPERATURE [℃]	FREQUENCY DRIFT [%]	LIMIT [%]
75.79	-30	-0.000647	±0.002
	-20	-0.000218	
	-10	-0.000040	
	0	0.000053	
	+10	0.000059	
	+20	0.000099	
	+30	0.000119	
	+40	0.000264	
	+50	0.000409	

6.3. Frequency vs Voltage Test

Test Setup Diagram : Same as (1)

Test Result Temperature : +20°C

REFERENCE FREQUENCY [MHz]	SUPPLIED VOLTAGE [Volt]	FREQUENCY DRIFT [%]	LIMIT [%]
75.79	9.0	-0.000152	±0.002

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

[Environment]
Temperature : 21℃ Humidity : 32%

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

[Tested Date / Tester]
17 March 2005 Signature

Ikuya Minematsu

7. USED TEST EQUIPMENTS AND CALIBRATION STATUS

Equipment	Manufacturer	Model No.	Specifications	KEC Control No.	Test Item (*)	Last Cal.	Next Cal.
Spectrum Analyzer	Advantest	R3261C	Frequency Range 9kHz – 2.6GHz	SA-32	1,3,4	2004/6	2005/6
	Agilent Technologies	E4403	Frequency Range 9kHz – 3.0GHz	SA-48	2	2003/6	2004/6
Test Receiver	Rhode & Schwarz	ESHS10	Frequecy Range 9kHz – 30 MHz	FS-67	N/A	2005/2	2006/2
		ESVS10	Frequecy Range 20 MHz – 1 GHz	FS-82	1,4	2005/1	2006/1
Pre-Amplifier	Hewlett Packard	8449B	Frequecy Range 1GHz – 26.5GHz Typ. Gain 30 dB	AM-52	N/A	2005/2	2006/2
		MH648A	Frequecy Range 0.1MHz – 1.3GHz Typ. Gain 30 dB	AM-41	2	2004/6	2005/6
Biconical Antenna	Schwarzbeck	VHA9103	Frequency Range 30MHz – 300MHz	AN-94	1,4	2005/2	2006/2
Log Periodic Antenna	Schwarzbeck	UHAL9108A	Frequency Range 300MHz – 1 GHz	AN-217	4	2005/2	2006/2
Tuned Dipole Antenna	Kyoritsu	KBA-511AS	Frequency Range 25MHz – 500MHz	AN-135	1,4	2005/2	2007/2
		KBA-611S	Frequency Range 500MHz – 1GHz	AN-137	4	2005/2	2007/2
LISN	Kyoritsu	KNW407	Frequency Range 150kHz – 30MHz	FL-105	N/A	2004/5	2005/5
		KNW242	Frequency Range 10kHz – 30MHz	FL-108	N/A	2004/5	2005/5
Signal Generator	Anritsu	MG3601A	Frequency Range 10 kHz – 1280 MHz	SG-40	1,4	2004/8	2005/8
Power Amp	ENI	601L	Frequency Range 0.8 MHz – 1 GHz	AM-24	1	2004/6	2005/6
RF Power Meter	Anritsu	ML2438A	Frequency Range 10MHz – 18 GHz	VV-37	1,4	2005/3	2006/3
RF Power Sensor	Anritsu	ML2474A	Frequency Range 10MHz – 18 GHz	VV-40-2	1,4	2005/3	2006/3
Coaxial Cable	Suhner	SUCOFLEX 106	Length : 20m [N (p) - N (p)]	CL-504	1,4	2005/2	2006/2
Attenuator	Weinschel	46-20-43	Frequency Range DC – 18 GHz 20 dB	AT-29-1	2,3	2005/1	2006/1
		WA2-10	Frequency Range DC – 18GHz -10 dB	AT-80	1,4	2005/1	2006/1
Regurated DC Power Supply	Kikusui	PAB18-3A	Output 0 – 18V, 3A	PD-32	2,3,5	–	–
Temperature Chamber With Thermometer	Tabai Mfg.	MC-710	Temperature Range -75 – +100 °C	CH-31	5	–	–
Frequency Counter	Anritsu	MF2412B	Freq.Range 10Hz – 20 GHz	CU-18	5	2005/3	2006/3

- Continued -

Equipment	Manufacturer	Model No.	Specifications	KEC Control No.	Test Item (*)	Last Cal.	Next Cal.
Digital Oscilloscope	Hewlett Packard	54616B	Frequency Range 500 MHz Sampling	OS-26	2	2005/3	2006/3
Directional Coupler	Hewlett Packard	86205A	Frequency Range 300 kHz – 6 GHz	AX-55	1,4	2004/8	2005/8

[Note]

Test Item (*):
1 : RF Power Output (Substitution Method)
2 : Modulation Characteristics
3 : Emission Bandwidth
4 : Spurious Radiation (Substitution Method)
5 : Frequency Stability Measurement
N/A : Not Applicable.

The overall program of calibration and verification of equipment is designed and operated so as to ensure that measurements made by KEC are traceable to national standards of measurement or equivalent abroad.