平成 11年9月 20日

三和電子機器株式会社　御中

〒630-0101　奈良県生駒市高山町 2128 番地
社団法人　関西電子工業振興センター
生駒試験所

承認	担当

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-031-99-C

2. 供試装置　:RC-TRANCEMITTER

　　商 標 名　:AIRTRONICS
　　型式番号　:VG600

3. 試験内容　:FCC Part 95

4. 試験結果　:添付 ENGINEERING TEST REPORT の通り

5. その他　:

Designated by Ministry of International Trade and Industry

KANSAI ELECTRONIC INDUSTRY DEVELOPMENT CENTER

HEAD OFFICE
6-6-7, NISHITEMMA
KITA-KU, OSAKA, 530 JAPAN

KEC

IKOMA
TESTING LABORATORY
10630, TAKAYAMA-CHO
IKOMA-CITY, NARA, 630-01 JAPAN

Corporate Juridical Person

ENGINEERING TEST REPORT

REPORT NO. A-031-99-C Issued Date : September 20, 1999

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 HONMACHI YOSHIDA HIGASHIOSAKA CITY 578-0982 JAPAN

2. Identification of Tested Device

FCC ID	: AXYATX030
Device Name	: EC-TRANSMITTER
Trade Name	: AIRTRONICS
Model Number	: VG600
Serial Number	: No.1 : ☒ Prototype ☐ Pre-production ☐ Production
Date of Manufacture	: August, 1999

3. Test Items and Procedure

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

Above all tests were performed under : FCC Part 2 §2.1046, §2.1047, §2.1049, §2.1053, §2.1055 and §2.1057

4. Date

Receipt of Test Sample : August 30, 1999
Test Completed on : September 14, 1999

CERTIFIED BY : S. Izumi

Seiichi Izumi
Manager of Ikoma Testing Laboratory

ENGINEERING TEST REPORT

Table of Contents

ENGINEERING TEST REPORT

1. GENERAL INFORMATION

1.1 Product Description

The Model No.VG600(referred as EUT in this report) is the radio control(R/C) transmitter.

1)Technical Specifications

Transmitting Frequency	:	72.01~75.99MHz (75.73 MHz in EUT)
Designation of Emission	:	5K27F1D

2) Contained Oscillator

6th OVER-TONE	:	12.6216 MHz

3) Modulation Mode

PPM	:	Pulse Position Modulation

4) Rated Power Supply	:	DC 10.0 V (Ni-Cd battery)

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 Test Site No.2

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 ISO/IEC Guide 25.

ENGINEERING TEST REPORT

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 made of PPM.

2) Frequency Stability Measurement :

The EUT was continuously transmitted in the following two non-modulation mode.

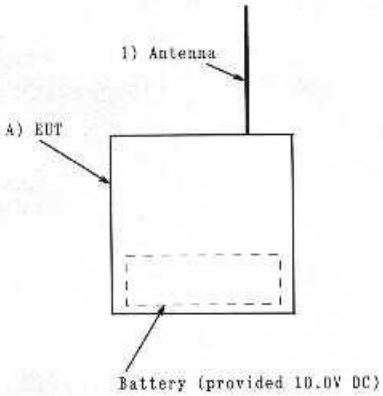
(1) F-Low

(2) F-High

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.

ENGINEERING TEST REPORT

2.3 List of EUT System

No	Device Name	Model Number (Serial Number)	FCC ID (Trade Name)	Note	Remark
A	Radio Control(R/C) Transmitter	VG600	AXYATX030 (AIRTRONICS)	Battery : Ni-Cd 10.0V	1)

[Remark]
1) : EUT

2.4 List of Antenna

No	Type	Length (m)	Note	Remark
1	Built-in Rod Antenna	0.80		1)

[Remark]
1) : Accessory of EUT

ENGINEERING TEST REPORT

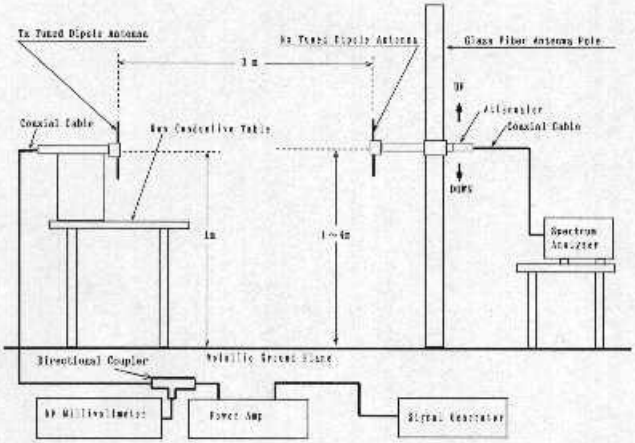
3. RF POWER OUTPUT

3.1 Reference Rule and Specification

FCC Rule Part 95 [§95.639] and Part 2 Subpart J [§2.1046]

3.2 Test Configuration

[Open Site]



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.

ENGINEERING TEST REPORT

3.4 Test Results

CARRIER FREQUENCY	SPECTRUM ANALYZER READING [dBμV]		RF METER READING [dBm]		CABLE LOSS	RF OUTPUT POWER	LIMIT
[MHz]	Horiz.	Vert.	Horiz.	Vert.	[dB]	[mW]	[mW]
75.73	112.3	110.1	23.3	23.4	0.6	190.5	750

The RF Power Output can be calculated from following formula:

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

where,

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

[Environment]

Temperature : 28 ℃ Humidity : 54 %

[Summary of Test Results]

Above data shows that the test device complies with the requirements.
Minimum margin was 6.0 dB, vertical polarization.

Tested Date : September 8, 1999 Tester Signature Y. Kawai
Yasunari Kawai

ENGINEERING TEST REPORT

4. MODULATION CHARACTERISTICS

4.1 Reference Rule and Specification

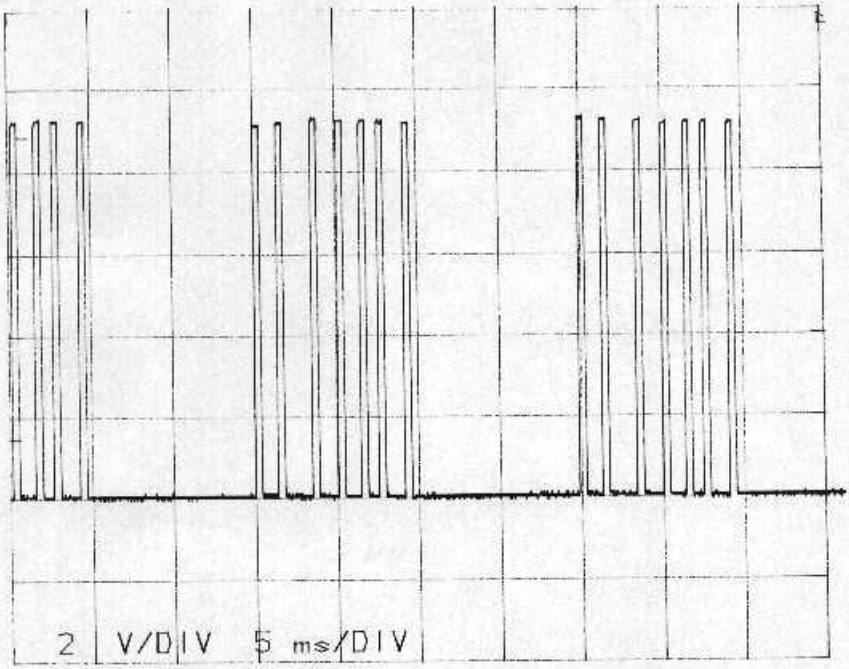
FCC Rule Part 2 Subpart J [§2.1047]

4.2 Test Results

Encoded Waveform

1) Operation Mode of EUT

Modulation : PPM



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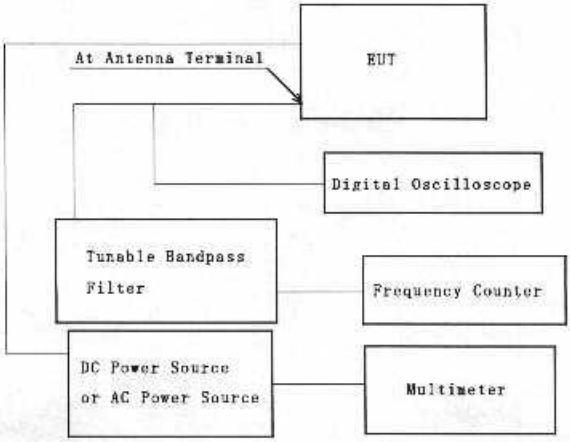
5. NECESSARY BANDWIDTH

5.1 Reference Rule and Specification

FCC Rule Part 95 Subpart E [§95.633(b)]

5.2 Test Configuration



5.3 Test Results

1) Measurement of the Peak Frequency Deviation(D)

Flow (low frequency of carrier) : 75.728285[MHz]
Fhigh (high frequency of carrier) : 75.731694[MHz]

[Environment]

Temperature : 20 ℃ Humidity : 60%

[Calculation of the Peak Frequency Deviation]

D = (Fhigh - Flow) / 2 = 1.70 [kHz]

D [kHz] : the Peak Frequency Deviation

ENGINEERING TEST REPORT

- Cotinued -

2) Measurement of the Maximum Moduration Frequency(M)

Encoded Waveform
(See the Test Results of 4. MODULATION CHARACTERISTICS)

[Environment]

Temperature : 20 ℃ Humidity : 60%

[Calculation of the Maximum Moduration Frequency]

From Encoded Waveform, the Modulation Pulse Width (most minimum) was readed on the plotted graph.

T = 3.7 [mm] / 17.3 [mm / DIV]×5 [ms / DIV]
= 1.07 [ms]

M= 1 / T
= 0.935 [kHz]

T [ms] : the Modulation Pulse Width (most minimum)
M [kHz] : the Maximum Moduration Frequency

3) Culculation of the Necessary Bandwidth(B)

From the result 1) and 2) , the Necessary Bandwidth(B) was culculated as follows

B = 2M + 2D = 5.27[kHz]

B [kHz] : the Necessary Bandwidth

[Summary of Test Result]

Above test results show that the Necessary Bandwidth is less than 8.0 kHz

Tested Date: September 10, 1999 Tester Signature M. Kawai
Yasunari Kawai

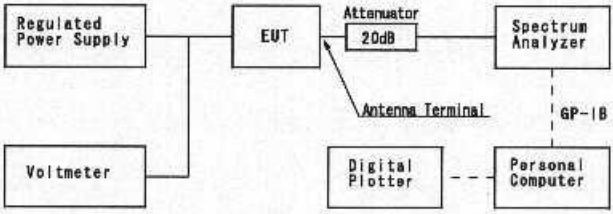
ENGINEERING TEST REPORT

6. EMISSION BANDWIDTH

6.1 Reference Rule and Specification

FCC Rule Part 95 [§95.633],[§95.635] and Part 2 Subpart J [§2.1049]

6.2 Test Configuration



ENGINEERING TEST REPORT

6.3 Test Results

See next figure (the picture of spectrum analyzer)

Occupied Bandwidth

I measured by the spectrum analyzer TR4172 which could measure 99% occupied bandwidth(OBW).
There are 1001 data on horizontal axe of display.
One of them is Vn. Then all power P becomes following fomula.

$$P = \sum_{n=1}^{1001} \frac{V_n^2}{R} \qquad (1)$$

where, R is input impedance of TR4172.

If, at number X points from the left edge of display, sum of power becomes 0.5% of P and at number Y points, sum of power become 99.5% of P,

$$0.005P = \sum_{n=1}^{X} \frac{V_n^2}{R} \qquad (2)$$

$$0.995P = \sum_{n=1}^{Y} \frac{V_n^2}{R} \qquad (3)$$

From(1)~(3), OBW becomes next.

$$OBW = \frac{f_{SPAN}(Y-X)}{1000}$$

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

ENGINEERING TEST REPORT

Operation Mode of EUT

Modulation : PPM

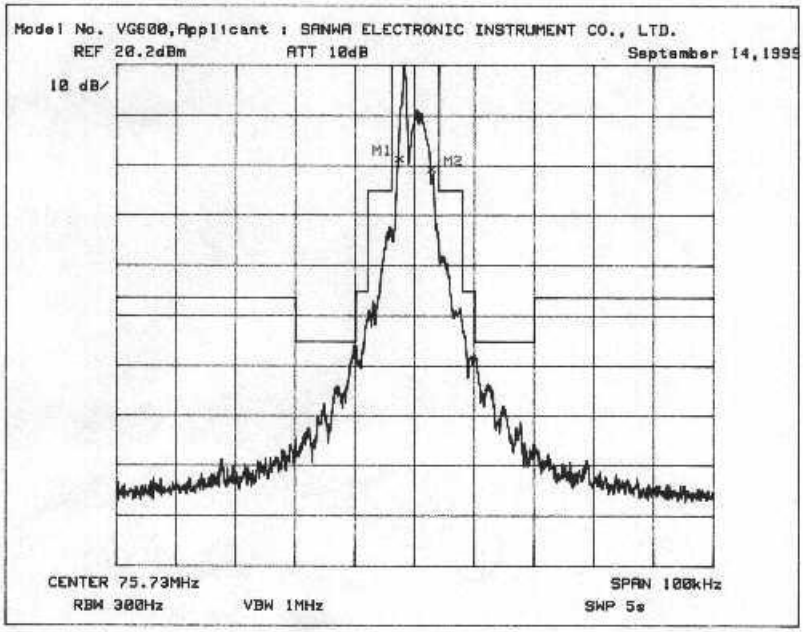
EUT was operated the various positions of JOY STICK & OTHER SWITCHES. (Reference level is the unmodulated level.)

Trace mode of Spectrum Analyzer : Maxumum Hold

Occupied Bandwidth = 5.4kHz (99% Power)

M1=75.7274MHz(0.5% Power Point)

M2=75.7328MHz(99.5% Power Point)



ENGINEERING TEST REPORT

Operation Mode of EUT

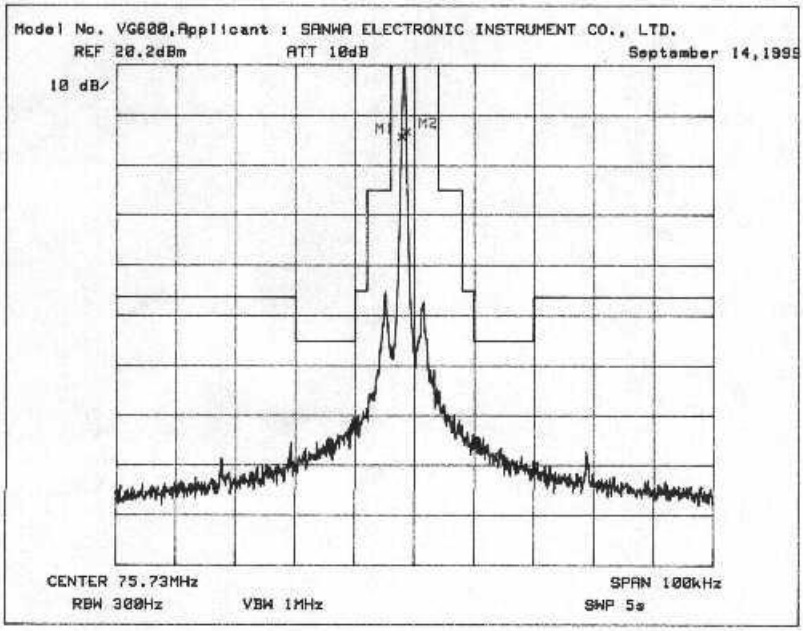
Non modulation

[F Low]

Occupied Bandwidth = .8kHz (99% Power)

M1=75.7279MHz(0.5% Power Point)

M2=75.7287MHz(99.5% Power Point)



ENGINEERING TEST REPORT

Operation Mode of EUT

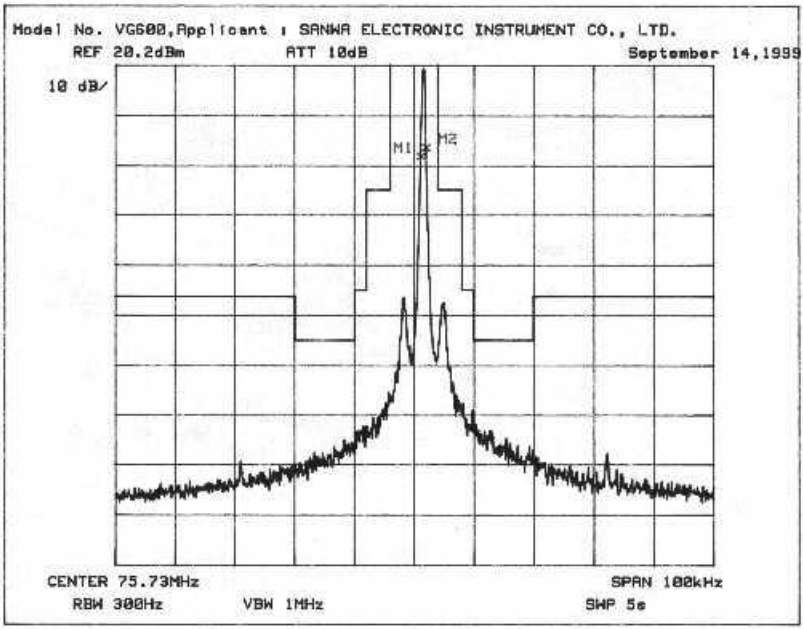
Non modulation

[F High]

Occupied Bandwidth = .9kHz (99% Power)

M1=75.7312MHz(0.5% Power Point)

M2=75.7321MHz(99.5% Power Point)



ENGINEERING TEST REPORT

Operation Mode of EUT

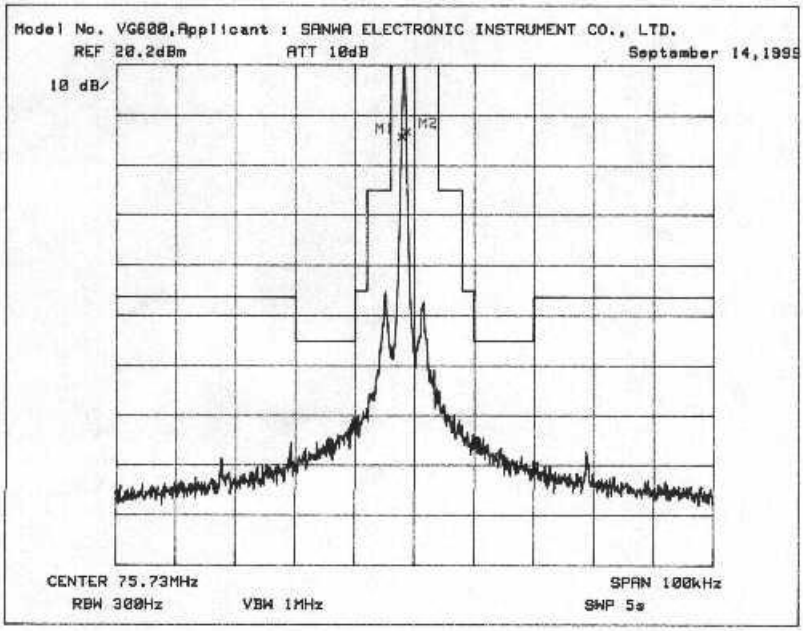
Non modulation

[F Low]

Occupied Bandwidth = .8kHz (99% Power)

M1=75.7279MHz(0.5% Power Point)

M2=75.7287MHz(99.5% Power Point)



ENGINEERING TEST REPORT

Operation Mode of EUT

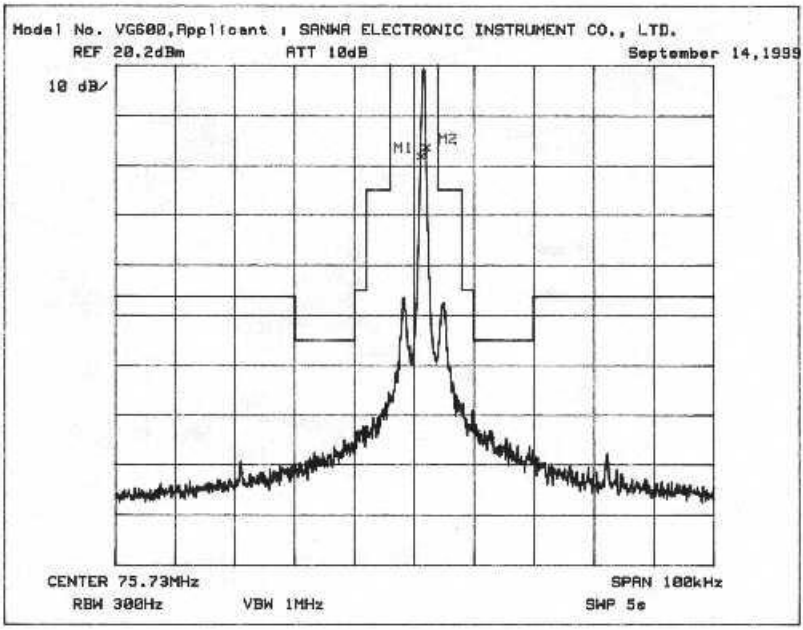
Non modulation

[F High]

Occupied Bandwidth = .9kHz (99% Power)

M1=75.7312MHz(0.5% Power Point)

M2=75.7321MHz(99.5% Power Point)



ENGINEERING TEST REPORT

7. FIELD STRENGTH OF SPURIOUS RADIATION

7.1 Reference Rule and Specification

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

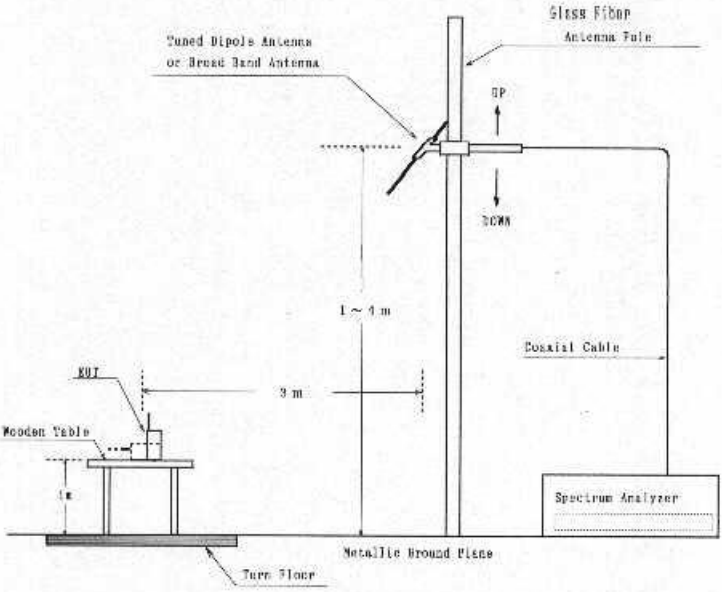
7.2 Test Procedure

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:

$$\text{Spurious Attenuation}\,[\text{dB}] = \text{Field Strength of Carrier Emission}\,[\text{dB}\mu\text{V/m}] - \text{Field Strength of Spurious Emission}\,[\text{dB}\mu\text{V/m}]$$

7.3 Test Configuration

[Open Site]



ENGINEERING TEST REPORT

7.5 Test Results

EMISSION FREQUENCY	METER READING at 3m [dBμV]		ANTENNA FACTOR	MAXIMUM FIELD STRENGTH	ATTENUATION FROM CARRIER	LIMIT
[MHz]	Horiz.	Vert.	[dB]	[dBμV/m]	[dB]	[dB]
Carrier Emission						
75.73	112.3	110.1	7.7	120.0	—	—
Spurious Emission						
63.11	45.0	43.7	9.3	54.3	65.7	48.8
88.35	32.3	28.9	9.5	41.8	78.2	48.8
151.46	46.3	42.0	17.1	63.4	56.6	48.8
227.19	33.0	32.8	19.7	52.7	67.3	48.8
302.92	39.4	35.4	17.6	57.0	63.0	48.8
378.65	24.4	29.6	19.5	49.1	70.9	48.8
454.38	26.7	26.5	21.4	48.1	71.9	48.8
530.11	22.9	22.7	23.1	46.0	74.0	48.8
605.84	19.0	15.0	24.7	43.7	76.3	48.8
681.57	31.3	26.4	25.6	56.9	63.1	48.8
757.30	25.9	25.4	27.0	52.9	67.1	48.8

[Note]

Limit of the attenuation of the spurious in dB:
56 + 10Log(Power) = 56 + 10Log(0.1905) = 48.8 dB

[Environment]

Temperature : 28°C Humidity : 54%

[Summary of Test Results]

Minimum Margin was 7.8 dB at 151.46 MHz, horizontal polarization.

Tested Date : September 8, 1999 Tester Signature Y. Kawai
Yasunari Kawai

ENGINEERING TEST REPORT

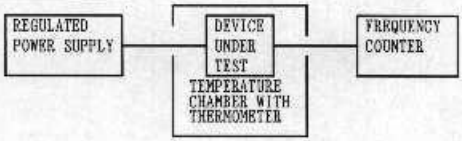
8. FREQUENCY STABILITY MEASUREMENT

8.1 Reference Rule and Specification

FCC Rule Part 95 [§95.623] and Part 2 Subpart J [§2.1055]

8.2 Frequency vs Temperature Test

Test Setup Diagram



Test Result Test Voltage: 10.0V

REFERENCE FREQUENCY [MHz]	TEMPERATURE [°C]	FREQUENCY DRIFT [%]	LIMIT [%]
75.73	-30	-0.000158	±0.002
	-20	0.000172	
	-10	0.000342	
	0	0.000333	
	+10	0.000197	
	+20	-0.000014	
	+30	-0.000235	
	+40	-0.000437	
	+50	-0.000555	

8.3 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	-0.000008	±0.002

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

[Environment] Temperature : 20°C Humidity : 60%

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

Tested Date : September 10, 1999 Tester Signature Y. Kawai
Yasunari Kawai

ENGINEERING TEST REPORT

9. LIST OF TEST INSTRUMENTS

Instrument	Manufacturer	Model No	Specifications	KEC Control No.	If item checked by "X".	Last Cal.	Next Cal.
Test Receiver	Rohde & Schwarz	ESVP	Frequency Range 20 MHz - 1 GHz	FS-48-3	☐	1999/5	2000/5
Spectrum Analyzer	Advantest	TR4172	Frequency Range 50 Hz - 1.8 GHz	FS-44	☒	1999/5	2000/5
Biconical Antenna	Schwarzbeck	BBA9106	Frequency Range 30 MHz - 300 MHz	AN-80	☒	1999/2	2000/2
Log-Periodic	Schwarzbeck	UHALP 9107	Frequency Range 300 MHz - 1 GHz	AN-215	☒	1999/2	2000/2
Tuned Dipole	Kyoritsu	KBA-511S	Frequency Range 25 MHz - 500 MHz	AN-135	☒	1999/3	2000/3
	Kyoritsu	KBA-611S	Frequency Range 500 MHz - 1 GHz	AN-137	☐	1999/3	2000/3

ENGINEERING TEST REPORT

- Continued -

Instrument	Manufacturer	Model No	Specifications	KEC Control No.	If used, checked by 'X'.	Last Cal.	Next Cal.
Tuned Dipole Antenna	Kyoritsu	KBA-511S	Frequency Range 25 MHz - 500 MHz	AN-134	☒	1999/3	2000/3
	Kyoritsu	KBA-611S	Frequency Range 500 MHz - 1 GHz	AN-136	☐	1999/3	2000/3
Signal Generator	Wiltron	6759A-10	Frequency Range 10 MHz - 26.5 GHz	SG-38	☐	1998/9	1999/9
		6769B	Frequency Range 10 MHz - 40.0 GHz	SG-42	☐	1998/9	1999/9
	Anritsu	MG3601A	Frequency Range 0.1 MHz - 1040 MHz	SG-40	☐	1998/9	1999/9
				SG-41	☒	1998/9	1999/9
Power Amp.	BNI	601L	Frequency Range 0.8 MHz - 1 GHz	AM-24	☒	1999/6	2000/6
		411LA	Frequency Range 0.15 MHz - 300 MHz	AM-25	☐	1999/6	2000/6
	Amplifier Research	100W1000 M1	Frequency Range 80 MHz - 1 GHz	AM-55	☐	1999/6	2000/6
RF Millivolt-meter	Rohde & Schwarz	URV5	Frequency Range 10 kHz - 2 GHz	VV-24	☐	1999/3	2000/3
				VV-28	☐	1999/3	2000/3
				VV-29	☒	1999/3	2000/3
				VV-32	☐	1999/3	2000/3
Coaxial Cable	Suhner	SUCOFLEX 104	Length : 1m [SMA(p)-SMA(p)]	CL-42	☐	1999/2	2000/2
			Length : 10m [SMA(p)-SMA(p)]	CL-45	☐	1999/2	2000/2
				CL-46	☒	1999/2	2000/2
Attenuator	Weinschel Engineering	2	Frequency Range 1 MHz - 20 GHz -10 dB	AT-26-3	☐	1999/2	2000/2

ENGINEERING TEST REPORT

- Continued -

Instrument	Manufacturer	Model No	Specifications	KEC Control No.	Item checked by "X"	Last Cal.	Next Cal.
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	☒	1999/5	2000/5
Spectrum Analyzer	Advantest	TR4172	Frequency Range 50 Hz ~ 1.8 GHz	SA-27	☒	1999/7	2000/7
Digital Plotterr	Hewlett Packard	7090A	Plot Area A3 size	RE-17	☒	—	—
Multimeter	John Fluke	37	Volt Range 0.1mV 1000 V Ampere Range 0.01 mA ~ 20 A	MM-91	☒	1999/2	2000/2
Personal Computer	Hewlett Packard	9121	Memory 512kB Language BASIC	PC-38-2	☒	—	—
Digital Oscilloscope	Matsushita Communication Ind.	VP-5740A	Frequency Range DC ~10 MHz	OS-22	☒	1999/5	2000/5

ENGINEERING TEST REPORT

- Continued -

Instrument	Manufacturer	Model No	Specifications	KEC Control No.	Used checked by ☒.	Last Cal.	Next Cal.
Regurated DC Power Supply	Xikusui	PAB18.3A	Output 0~18V, 3A	PD.32	☒	—	—
Frequency Counter	Advantest	TR5823H	Freq.Range 1 mHz.1300 MHz	CU.17	☒	1999/5	2000/5
Digital Plotterr	Hewlett Packard	7090A	Plot Area A3 size	RR.17	☒	—	—
Multimeter	John Fluke	37	Volt Range 0.1mV . 1000 V Ampere Range 0.01 mA . 20 A	MM.91	☒	1999/3	2000/3
Digital Oscilloscope	Matsushita Communication Ind.	VP.5740A	Frequency Range DC .10 MHz	OS.22	☒	1999/5	2000/5