



# EMI TEST REPORT

Test Report No. : 23LE0121-YW-1

Applicant : Orion Electric Co., Ltd.

Type of equipment : Video Cassette Recorder

Model number : VR313A

Test standard : FCC Part 15 Subpart B


Test result : Complied

1. This test report shall not be reproduced except in full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with above regulation. We hereby certify that the data contain a true representation of the EMC profile.
4. The test results in this test report are traceable to the national or international standards.
5. This test report does not constitute an endorsement by NIST/NVLAP or U.S. Government.


Date of test : July 26 to 29, 2003

Tested by:

  
Tsubasa Takayama  
EMC Service

  
Hiroya Tabata  
Leader of EMC Service

Approved by:

  
Kazutoyo Nakanishi  
Site Manager of EMC Service

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## **Contents**

	<b>Page</b>
<b>Section 1 : Client information</b>	<b>3</b>
<b>Section 2 : Equipment under test (E.U.T.)</b>	<b>3</b>
<b>Section 3 : Test specification, procedures &amp; results</b>	<b>4</b>
<b>Section 4 : Operation of E.U.T. during tests</b>	<b>6</b>
<b>Section 5 : Conducted emission</b>	<b>7</b>
<b>Section 6 : Radiated emission</b>	<b>10</b>
<b>Section 7 : Antenna terminal voltage</b>	<b>13</b>
<b>Section 8 : RF output level / spurious emission</b>	<b>14</b>
<b>Section 9 : Antenna transfer switch</b>	<b>15</b>
<b>Section 10 : Picture sensitivity</b>	<b>16</b>
<b>Section 11 : Noise figure</b>	<b>17</b>
 <b><u>Contents of Appendixes</u></b>	 <b>18</b>
<b>Appendix 1 : Photographs of test set up</b>	<b>19</b>
<b>Appendix 2 : Data of EMI tests</b>	<b>26</b>
<b>Appendix 3: Test instruments</b>	<b>83</b>

**Section 1 : Client information**

Company name : Orion Electric Co., Ltd.  
Address : 41-1 Iehisa-cho, Takefu-shi, Fukui-ken, 915-8555 JAPAN  
Telephone number : +81 778 23 0019  
Facsimile number : +81 778 23 7799  
Contact person : Hiroshi Tsujimoto

**Section 2 : Equipment under test (E.U.T.)****2.1 Identification of E.U.T.**

Type of equipment : Video Cassette Recorder  
Brand Name : ORION  
Model number : VR313A  
Rating : AC 120 V / 60 Hz  
Manufacturer : 1. World Electric (Thailand) Ltd.  
236 Moo 2 Nongchark, Banbung, Chonburi 20170, Thailand  
2. Korat Denki Ltd.  
149 Moo 10 Tambol Chokchai, Amphur Chokchai, Nakhonratchasima  
30190, Thailand  
228 Moo 3 Tambol Nongbuasala, Amphur Muang, Nakhonratchasima  
30000, Thailand  
3. Orion America, Inc.  
Hwy 41 North, Orion Place, Princeton, Indiana 47670, U.S.A  
Receipt Date of Sample : July 25, 2003  
Condition of EUT : Production Prototype

**2.2 Product description**

Model: VR313A (referred to as the EUT in this report) is a Video Cassette Recorder.  
The EUT specifications is as follows.

Tuner type : Quartz PLL frequency synthesized  
I / F : 45.75 MHz (Picture), 41.25 MHz (Sound)  
Receiving channel : VHF 2 – 13 ch / UHF 14 – 69 ch / CATV 1 – 125 ch  
Antenna input : 75 ohm  
Video signal : NTSC color  
Power source : AC 120 V / 60 Hz, 8W  
I / O terminal (Video) : RCA in 1Vp-p 75 ohm, RCA out 1 Vp-p 75 ohm  
I / O terminal (Audio) : RCA in –8 dB 47 k ohm, RCA out –8 dB 1 k ohm

**2.3 Similar apparatus**

There is no similar apparatus.

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### **Section 3 : Test specification, procedures and results**

#### **3.1 Test specification**

Test specification: FCC Part 15 Subpart B

Title : FCC 47 CFR Part 15 Radio Frequency Device  
Subpart B Unintentional Radiators

#### **3.2 Procedures & results**

Item	Test procedure	Limits	Worst margin	Result
Conducted emission	ANSI C63.4:2001 IEEE 213:1987	CISPR 22	5.8 dB (0.1500 MHz)	Complied
Radiated emission	ANSI C63.4:2001 IEEE 187:1990	30–88 MHz: 100 uV/m 88–216 MHz: 150 uV/m 216–960 MHz: 200 uV/m above 960 MHz: 500 uV/m	5.1 dB (100.00 MHz)	Complied
Antenna terminal voltage	ANSI C63.4:2001	2 nW (at 75 ohm)	22.8 dB (1261.41101 MHz)	Complied
RF output level	ANSI C63.4:2001	Video signal: 3000 uV Aural signal: 671 uV	3.7 dB (61.25 MHz)	Complied
Spurious emission		94.8 uV	19.6 dB (908.590 MHz)	Complied
Transfer switch	ANSI C63.4:2001	9.5 dB	2.0 dB (67.250 MHz)	Complied
Picture sensitivity	ANSI C63.4:2001	8 dB	5.8 dB	Complied
Noise figure	FCC/OET MP:2:1986	14 dB	7.4 dB (133.25 MHz)	Complied

#### **3.3 Additions or deviations to standard**

No addition, deviation or exclusion has been made from standards.

#### **3.4 Confirmation**

**UL Apex Co., Ltd. hereby confirms that E.U.T., in the configuration tests, complies with the specifications FCC Part15 Subpart B.**

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### 3.5 Uncertainty

#### **Conducted emission (150 kHz – 30 MHz)**

The measurement uncertainty (with a 95% confidence level) for this test was  $\pm 1.74$  dB.

The data listed in this test report has enough margin, more than site margin.

#### **Radiated emission**

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is  $\pm 4.4$  dB.

The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is  $\pm 4.8$  dB.

The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is  $\pm 5.8$  dB.

The data listed in this test report has enough margin, more than site margin.

#### **Antenna terminal voltage**

The measurement uncertainty (with a 95% confidence level) for this test was  $\pm 3.48$  dB.

The data listed in this test report has enough margin, more than site margin.

#### **RF output level test / spurious emission test**

The measurement uncertainty (with a 95% confidence level) for this test was  $\pm 3.48$  dB.

The data listed in this test report has enough margin, more than site margin.

#### **Antenna transfer switch**

The measurement uncertainty (with a 95% confidence level) for this test was  $\pm 3.48$  dB.

The result is within Yokowa EMC lab's uncertainty.

#### **Picture sensitivity test**

The measurement uncertainty (with a 95% confidence level) for this test was  $\pm 1.0$  dB.

The data listed in this test report has enough margin, more than site margin.

#### **Noise Figure Test**

The measurement uncertainty (with a 95% confidence level) for this test was  $\pm 1.2$  dB.

The data listed in this test report has enough margin, more than site margin.

### 3.7 Test location

UL Apex Co., Ltd. Yokowa EMC Lab. No.2 and No.3 Test site

108 Yokowa-cho, Ise-shi, Mie-ken, 516-1106 JAPAN

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FAX : +81 596 39 0232

#### **No.2 Test site**

This site has been fully described in a report submitted to FCC office, and listed on October 26, 2000.

(Registration number: 90411)

#### **No.3 Test site**

This site has been fully described in a report submitted to FCC office, and listed on September 12, 2000.

(Registration number: 90412)

\*NVLAP Lab. Code : 200109-0

### 3.8 Test setup, Data of EMI & Test instruments

Please refer to Appendix 1 to 3.

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## **Section 4 : Operation of E.U.T. during tests**

### **4.1 Operating modes**

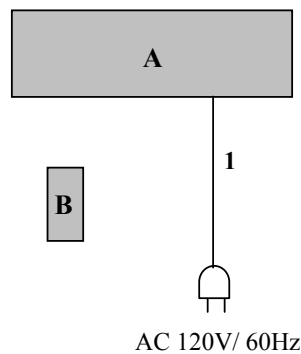
The EUT exercise program used during testing was designed exercise the various system components in a manner similar to typical use.

The sequence in used : \* TV reception + Rec. mode (0 dBmV input / 25 dBmV input)  
 \* AV input + Rec. mode (1 Vp-p input / 5 Vp-p input)  
 \* VCR playback mode

Operation : The EUT was tested at above operation mode.  
 (Using a video tape with a typical TV signal recorded on it, if necessary.)

Justification : The system was configured in typical fashion (as a customer would normally use it) for testing.

### **4.2 Configuration and peripherals**



\* Cabling was taken into consideration and test data was taken under worse case conditions.

#### **Description of EUT and support equipment**

Sign	Item	Model number	Serial number	Manufacturer	Remark
A	Video Cassette Recorder	VR313A	—	Orion Electric Co., Ltd.	EUT
B	Remote Controller	—	—	Orion Electric Co., Ltd.	EUT

#### **List of cable used**

No.	Item	Length (m)	Shield	Backshell material
1	AC Power Cable	1.6	Unshielded	Polyvinyl chloride

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## **Section 5 : Conducted emission**

### **5.1 Operation environment**

The test was carried out in a shielded room the size of 4.5 x 3.6 x 2.7m.

Date : July 28, 2003

Temperature : See data

Humidity : See data

### **5.2 Test configuration**

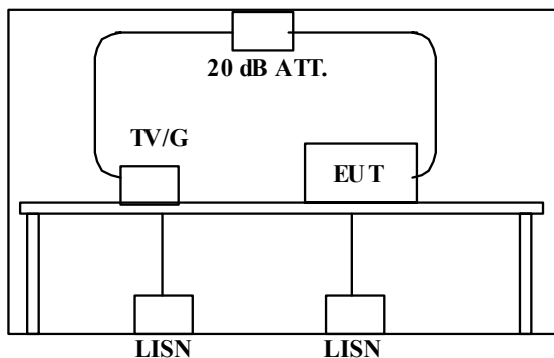
EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT was aligned and flushed with rear of tabletop. All other surfaces of tabletop was at least 80 cm from any other grounded conducting surface. I/O cables and AC cable were bundled in center. I/O cables were hanged at a 40cm height to the ground plane. Each EUT current-carrying power lead, except the ground (safety) lead, were individually connected through a LISN to the input power source. All unused 50 ohm connectors of the LISN were resistively terminated in 50 ohm when not connected to the measuring equipment.

A drawing of the set up is shown in figure 1 and photographs in Appendix 1.

**Figure 1. Conducted emission**

#### **TV reception + Rec. mode (0 dBmV input / 25 dBmV input)**

##### **Shielded room**



RF in: TV signal generator connected  
 Front video in: 75 ohm terminated  
 Front audio in: 47 k ohm terminated  
 Rear video out: 75 ohm terminated with video cable  
 Rear audio out: 1 k ohm terminated with audio cable  
 RF output: 75 ohm terminated with RF output cable

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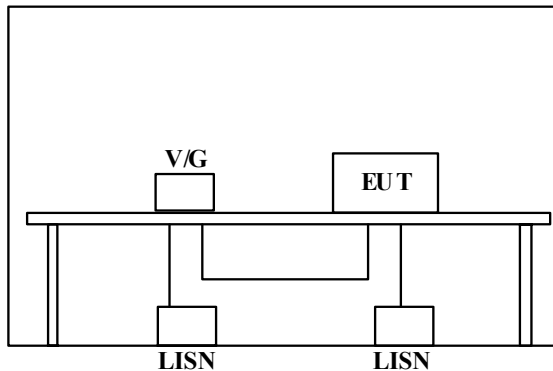
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### AV input + Rec. mode (1 Vp-p input / 5 Vp-p input)

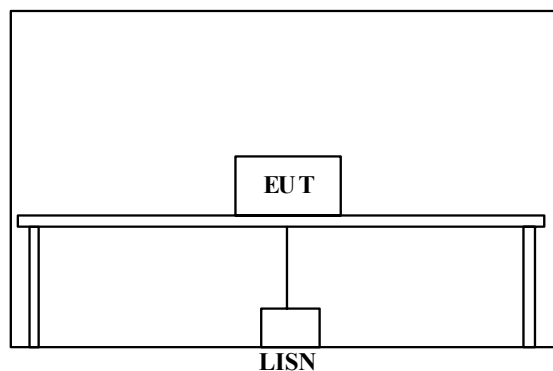
#### Shielded room



RF in: 75 ohm terminated  
 Front video in: Video signal generator connected  
 Front audio in: 47 k ohm terminated  
 Rear video out: 75 ohm terminated with video cable  
 Rear audio out: 1 k ohm terminated with audio cable  
 RF output: 75 ohm terminated with RF output cable

### VCR playback mode

#### Shielded room



RF in: 75 ohm terminated with RF input cable  
 Front video in: 75 ohm terminated with video cable  
 Front audio in: 47 k ohm terminated with audio cable  
 Rear video out: 75 ohm terminated with video cable  
 Rear audio out: 1 k ohm terminated with audio cable  
 RF output: 75 ohm terminated with RF output cable

### 5.3 Test conditions

Frequency range : 0.15 MHz – 30 MHz

EUT position : Table top

EUT operation mode: TV reception + Rec., AV input + Rec., VCR playback

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#### 5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT within a shielded room. The EUT was connected to a Line Impedance Stabilization Network (LISN). An overview sweep with peak detection has been performed. The measurements have been performed with a quasi-peak detector and if required, with an average detector.

EUT and desired signal generator should connect through 20 dB attenuator.

The conducted emission measurements were made with the following detector function of the test receiver.

Detector Type : QP

IF Bandwidth : 10 kHz

#### 5.5 Test result

##### **Passed**

Please refer to summary of the test results in Appendix 2.

Test engineer: Hiroya Tabata

## **Section 6 : Radiated emission**

### **6.1 Operation environment**

The test was carried out in an open site.

Date : July 26 and 28, 2003

Temperature : See data

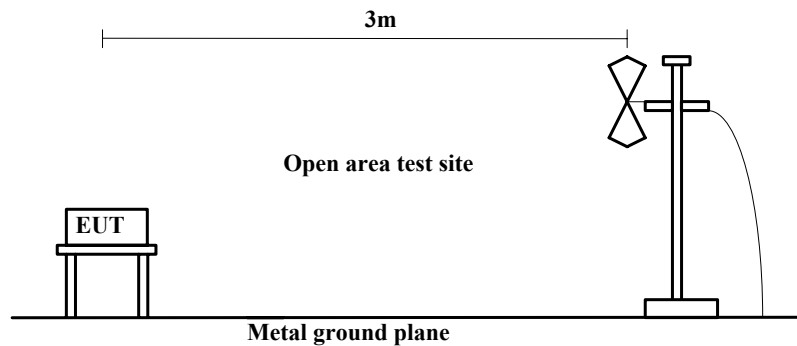
Humidity : See data

### **6.2 Test configuration**

EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The rear of EUT was aligned and flushed with rear of tabletop. AC cable was bundled in center. I/O cables were hanged 40 cm height to the ground plane. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.

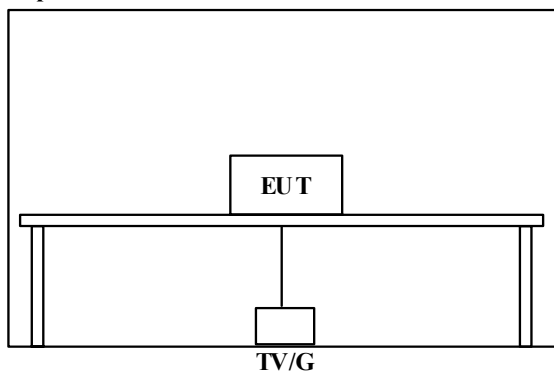
A drawing of the set up is shown in figure 2 and photographs in Appendix 1.

**Figure 2. Radiated emission**



**TV reception + Rec. mode (0 dBmV / 25 dBmV)**

**Open test site**



RF in: TV signal generator connected

Front video in: 75 ohm terminated

Front audio in: 47 k ohm terminated

Rear video out: 75 ohm terminated with video cable

Rear audio out: 1 k ohm terminated with audio cable

RF output: 75 ohm terminated with RF output cable

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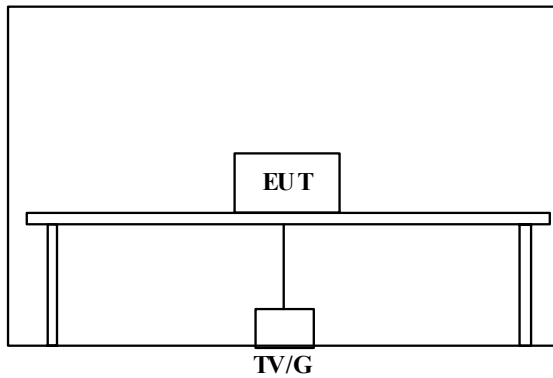
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### AV input + Rec. mode (1 Vp-p input / 5 Vp-p input)

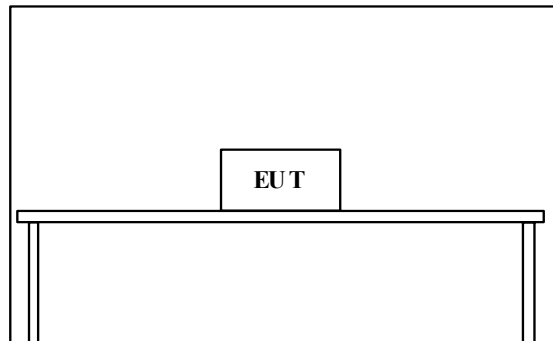
#### Open test site



RF in: 75 ohm terminated  
Front video in: Video signal generator connected  
Front audio in: 47 k ohm terminated  
Rear video out: 75 ohm terminated with video cable  
Rear audio out: 1 k ohm terminated with audio cable  
RF output: 75 ohm terminated with RF output cable

### VCR playback mode

#### Open test site



RF in: 75 ohm terminated with RF input cable  
Front video in: 75 ohm terminated with video cable  
Front audio in: 47 k ohm terminated with audio cable  
Rear video out: 75 ohm terminated with video cable  
Rear audio out: 1 k ohm terminated with audio cable  
RF output: 75 ohm terminated with RF output cable

### 6.3 Test conditions

Frequency range : 30 MHz – 2000 MHz

Test distance : 3 m

EUT position : Table top

EUT operation mode: TV reception + Rec., AV input + Rec., VCR playback

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#### 6.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on an open test site with a ground plane and at a distance of 3 m.

Pre check measurements were performed within a search coil at high level of 80MHz – 90MHz, 270MHz – 290MHz and 500MHz – 700MHz in a shielded room to distinguish disturbances of EUT from the ambient noise. Measurements were performed with quasi-peak detector and peak detector.

The measuring antenna height was varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.

The radiated emission measurements were made with the following detector function of the test receiver and spectrum analyzer.

	<u>30-1000MHz (Test receiver)</u>	<u>1000-2000MHz (Spectrum analyzer)</u>
Detector Type	: QP	: PK
IF Bandwidth	: 120kHz	: RBW 1MHz / VBW 1MHz

#### 6.5 Test result

##### Passed

Please refer to summary of the test results in Appendix 2.

Test engineer: Tsubasa Takayama (July 26, 2003)  
Hiroya Tabata (July 28, 2003)

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## **Section 7 : Antenna terminal voltage**

### **7.1 Operation environment**

The test was carried out in a shielded room the size of 3.6 x 7.2 x 2.4 m.

Date : August 1, 2003

Temperature : See data

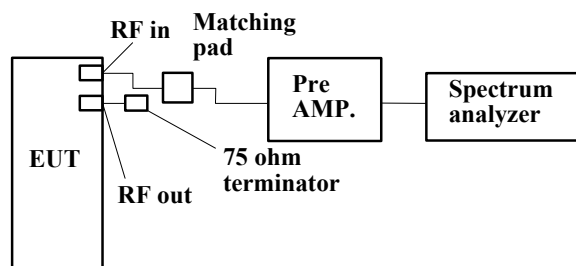
Humidity : See data

### **7.2 Test configuration**

The EUT was placed on a non-metallic platform 0.8 m above a reference ground plane.

A drawing of the set up is shown in figure 3 and photographs in Appendix 1.

**Figure 3. Antenna terminal voltage**



### **7.3 Test conditions**

Frequency range : 30 MHz – 2000 MHz

EUT position : Table top

EUT operation mode: Tuning (TV receiver / CATV receiver)

### **7.4 Test procedure**

Connect EUT and spectrum analyzer through pre-amplifier. Set EUT to CH investigation mode then measure the voltage of local leakage from antenna terminal. Spectrum analyzer should be hold in maximum mode during the measurement.

Detector Type : Peak (30-2000 MHz)

### **7.5 Test result**

#### **Passed**

Please refer to summary of the test results in Appendix 2.

Test engineer: Tsubasa Takayama

## **Section 8 : RF output level / spurious emission**

### **8.1 Operation environment**

The test was carried out in a shielded room the size of 4.5 x 3.6 x 2.7 m.

Date : July 29, 2003

Temperature : See data

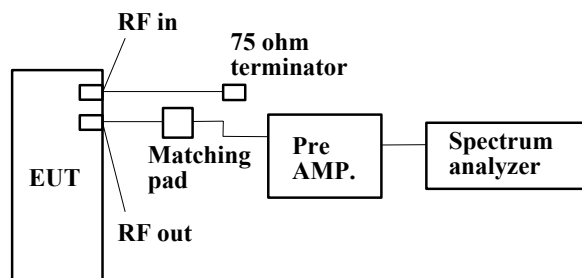
Humidity : See data

### **8.2 Test configuration**

The EUT was placed on a non-metallic platform 0.8 m above a reference ground plane.

A drawing of the set up is shown in figure 4 and photographs in Appendix 1.

**Figure 4. RF output level**



### **8.3 Test conditions**

EUT position : Table top

EUT operation mode: TV reception + Rec., AV input + Rec., VCR playback

### **8.4 Test procedure**

EUT was connected spectrum analyzer through matching pad by accessory cable. RF channel selected 3ch or 4ch. Picture carrier, sound carrier and spurious levels are measured. Both sound carrier levels (upper and lower side bands) of modulator output are measured.

Detector Type : Peak

### **8.5 Test result**

#### **Passed**

Please refer to summary of the test results in Appendix 2.

Test engineer: Tsubasa Takayama

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## **Section 9 : Antenna transfer switch**

### **9.1 Operation environment**

The test was carried out in a shielded room the size of 4.5 x 3.6 x 2.7 m.

Date : July 29, 2003

Temperature : 23 deg.C.

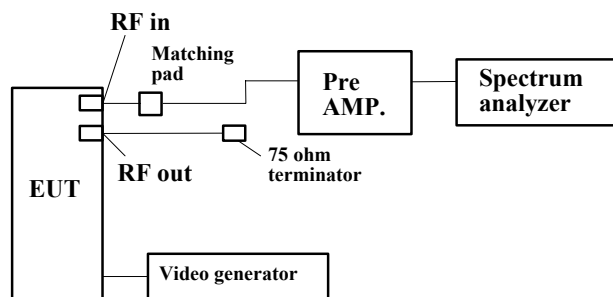
Humidity : 43 %

### **9.2 Test configuration**

The EUT was placed on a non-metallic platform 0.8 m above a reference ground plane.

A drawing of the set up is shown in figure 5 and photographs in Appendix 1.

**Figure 5. Transfer switch**



### **9.3 Test conditions**

EUT position : Table top

EUT operation mode: AV input + Rec., VCR playback

### **9.4 Test procedure**

EUT was connected spectrum analyzer through matching pad by accessory cable. RF channel selected 3ch or 4ch. The EUT exercised AV input + Rec. mode and Playback mode during the test, and interference signals were measured from RF input terminal.

Detector Type : Peak

### **9.5 Test result**

#### **Passed**

Please refer to summary of the test results in Appendix 2.

Test engineer: Tsubasa Takayama

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## **Section 10 : Picture sensitivity**

### **10.1 Operation environment**

The test was carried out in a shielded room the size of 4.5 x 3.6 x 2.7 m.

Date : July 29, 2003

Temperature : See data

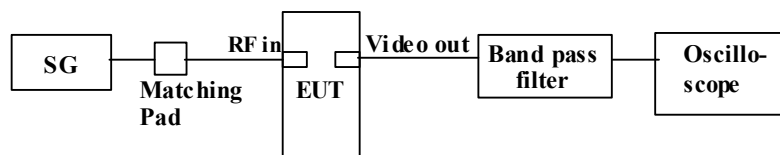
Humidity : See data

### **10.2 Test configuration**

The EUT was placed on a non-metallic platform 0.8 m above a reference ground plane.

A drawing of the set up is shown in figure 6 and photographs in Appendix 1.

**Figure 6. Picture sensitivity**



### **10.3 Test conditions**

EUT position : Table top

EUT operation mode: TV reception

### **10.4 Test procedure**

Signal generator setup is as follows, (Example: 2ch – 55.25 MHz, AM, 1 kHz, 30 %)

The EUT was tuned to appropriate channel.

Output level of signal generator was adjusted to near the frequency output level of EUT output.

EUT output level was adjusted to maximum output level by frequency adjustment of signal generator.

Signal generator output level was adjusted to reference output level of EUT and output level had read.

### **10.5 Test result**

#### **Passed**

Please refer to summary of the test results in Appendix 2.

Test engineer: Tsubasa Takayama

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## **Section 11 : Noise figure**

### **11.1 Operating environment**

The test was carried out in a shielded room the size of 4.5 x 3.6 x 2.7 m.

Date : July 29, 2003

Temperature : See data

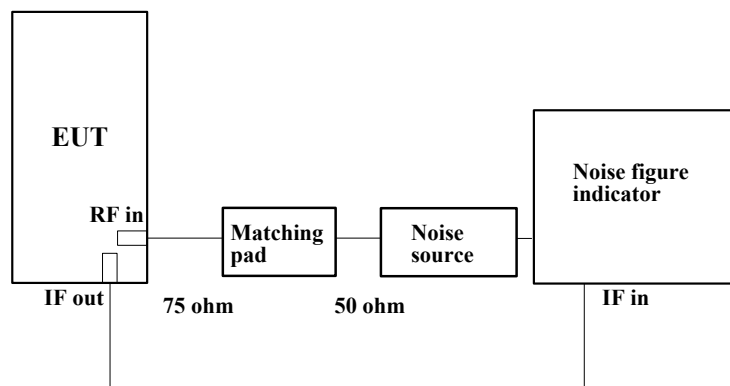
Humidity : See data

### **11.2 Test configuration**

The EUT was placed on a non-metallic table.

A drawing of the set up is shown in figure 7 and photographs in Appendix 1.

**Figure 7. Noise figure**



### **11.3 Test condition**

EUT position : Table top

EUT operation mode: TV reception

### **11.4 Test procedure**

This test should be performed in a shielded room or an low noise environment. Connect solid state noise source to antenna input terminal of EUT. Connect IF output terminal of EUT to noise meter through ceramic condenser. Measurement has been performed for VHF,UHF, Mid-band and Super-band receiver range.

### **11.5 Test result**

#### **Passed**

Please refer to summary of the test results in Appendix 2.

Test engineer: Tsubasa Takayama

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### **Appendix 1 : Photographs of test set up**

Page 19 : Test set up of conducted emission  
Page 20 : Test set up of radiated emission  
Page 21 : Test set up of antenna terminal voltage  
Page 22 : Test set up of RF output level / spurious emission  
Page 23 : Test set up of antenna transfer switch  
Page 24 : Test set up of picture sensitivity  
Page 25 : Test set up of noise figure

### **Appendix 2 : Data of EMI tests**

Page 26 - 40 : Conducted emission  
Page 41 - 57 : Radiated emission  
Page 58 - 59 : Antenna terminal voltage  
Page 60 - 74 : RF output level / spurious emission  
Page 75 - 80 : Antenna transfer switch  
Page 81 : Picture sensitivity  
Page 82 : Noise figure

### **Appendix 3 : Test instruments**

Page 83 : Test instruments

## Conducted emission



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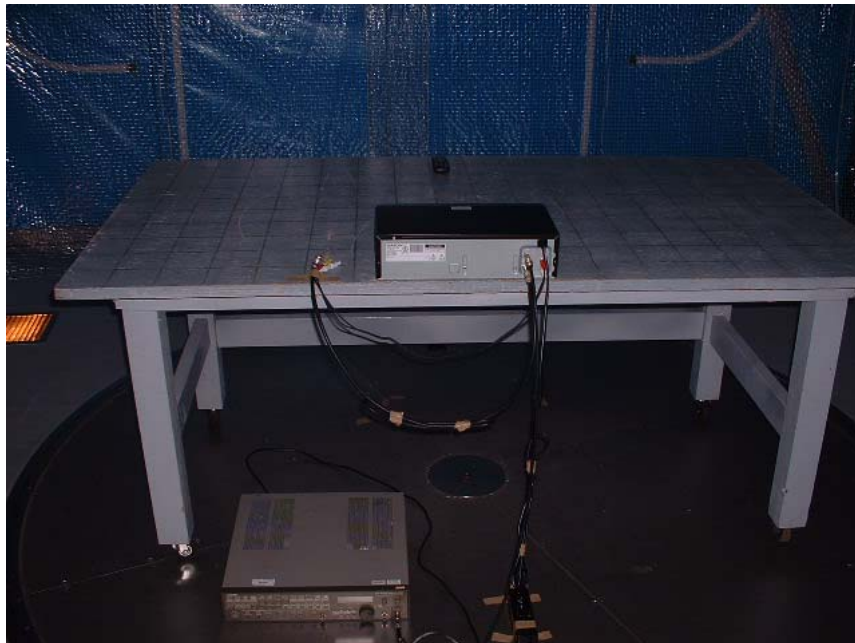
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## Radiated emission



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## Antenna terminal voltage



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## RF output level / spurious emission



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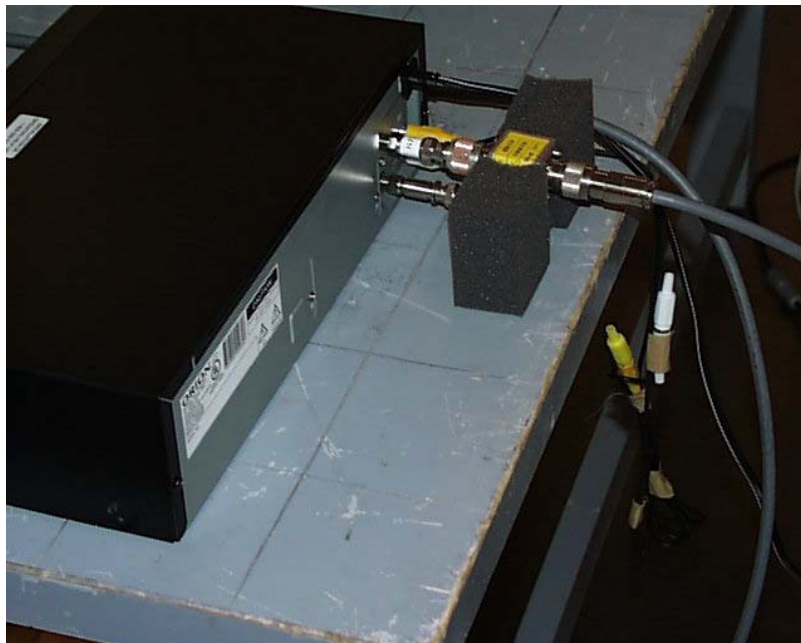
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## Antenna transfer switch



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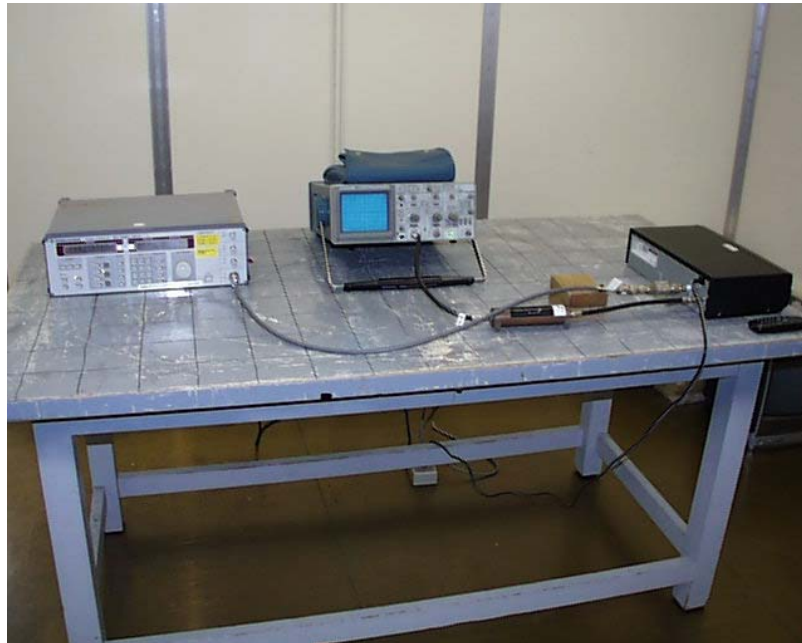
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## Picture sensitivity



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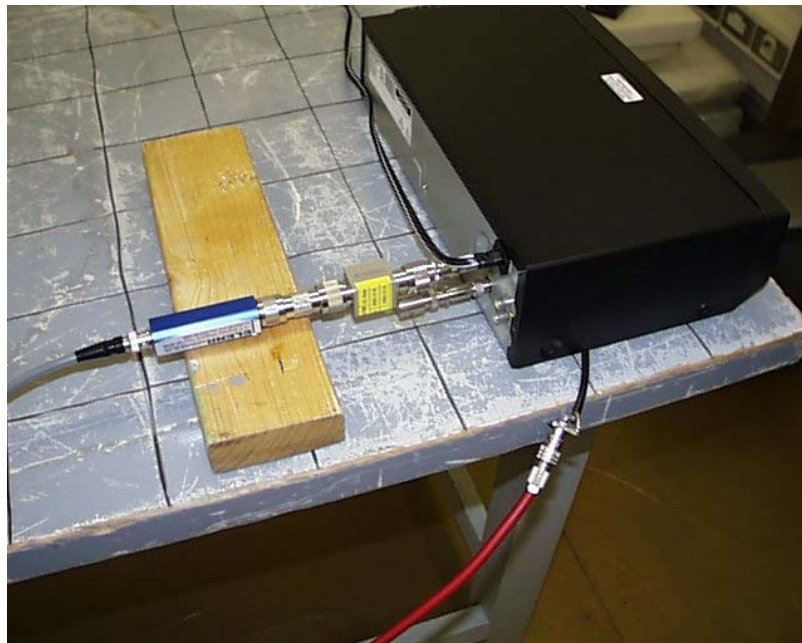
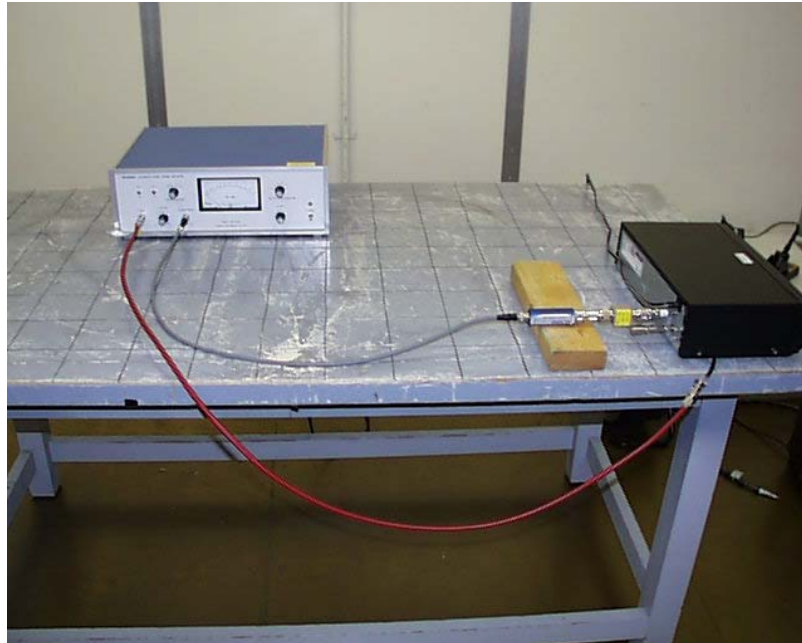
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## Noise figure



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