



| <b>CONTENTS</b>   | <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>5</b>    |
| <b>SECTION 4: OPERATION OF E.U.T. DURING TESTING .....</b>              | <b>7</b>    |
| <b>SECTION 5: CONDUCTED EMISSION, SECTION 15.207 .....</b>              | <b>8</b>    |
| <b>SECTION 6: 6dB BANDWIDTH, SECTION 15.247(A)(2) .....</b>             | <b>8</b>    |
| <b>SECTION 7: MAXIMUM PEAK OUTPUT POWER, SECTION 15.247(B)(3) .....</b> | <b>8</b>    |
| <b>SECTION 8: OUT OF BAND EMISSION, SECTION 15.247 (C) .....</b>        | <b>9</b>    |
| <b>SECTION 9: PEAK POWER DENSITY, SECTION 15.247 (D).....</b>           | <b>9</b>    |
| <b>APPENDIX 1: PHOTOGRAPHS OF TEST SETUP .....</b>                      | <b>10</b>   |
| Conducted Emission(Ext-Antenna)   | 10          |
| Conducted Emission(In-Antenna)  | 11          |
| Radiated Spurious Emission (Ext-Antenna)                                | 12          |
| Radiated Spurious Emission (In-Antenna)                                 | 13          |
| Radiated Spurious Emission X, Y, Z Positions (In-Antenna)               | 14          |
| <b>APPENDIX 2:TEST INSTRUMENTS .....</b>                                | <b>15</b>   |
| <b>APPENDIX 3: DATA OF EMI TEST .....</b>                               | <b>16</b>   |
| 6dB Bandwidth (Conducted)   | 23          |
| Maximum Peak OutPut Power (Conducted)                                   | 26          |
| Out of Band Radiated Emission : 30-1000MHz                              | 29          |
| Out of Band Radiated Emission : 1-25GHz                                 | 47          |
| Out of Band Emission : Restricted Band Edges (Radiated)                 | 65          |
| Out of Band Emission : Conducted  | 77          |
| Power Density (Conducted)   | 86          |

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## **SECTION 1: Client information**

Company Name : BROTHER INDUSTRIES , LTD.  
Address : 15-1, Naeshiro-cho, Mizuho-ku, Nagoya 467-8561 JAPAN  
Telephone Number : +81-52-824-2337  
Facsimile Number : +81-52-821-4460  
Contact Person : Takashi Maeda

## **SECTION 2: Equipment under test (E.U.T.)**

### **2.1 Identification of E.U.T.**

Type of Equipment : Wireless LAN Card  
Model No. : NC-7100  
Serial No. : BR1-009  
Country of Manufacture : JAPAN  
Receipt Date of Sample : November 14, 2003  
Condition of EUT : Production model

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## 2.2 Product Description

BROTHER INDUSTRIES, LTD., Model No: NC-7100 is the Wireless LAN Card.  
This Wireless LAN Card will be equipped only on Laser Printer which is produced by BROTHER INDUSTRIES or the manufacturer consigned the production by BROTHER INDUSTRIES, LTD.,

The clock frequency of EUT is 40MHz.

### Radio Specification

|                                |   |   |
|--------------------------------|---|---|
| Equipment Type                 | : | Transceiver   |
| Frequency band                 | : | 2400-2483.5MHz  |
| Frequency operation            | : | 2412-2462MHz  |
| Transmission method            | : | DSSS(IEEE802.11b)<br>OFDM(IEEE802.11g)  |
| Type of modulation             | : | DSSS CCK(5.5/11Mbps), DQPSK(2Mbps), DBPSK(1Mbps)<br>OFDM 64QAM(48/54Mbps), 16-QAM(24/36Mbps), QPSK(12/18Mbps),<br>BPSK(6/9Mbps) |
| Channel spacing                | : | 5MHz  |
| Mode of operation              | : | Simplex   |
| Antenna Type                   | : | Dipole Antenna(Internal Antenna)<br>Collinear Antenna(External Antenna)   |
| Antenna Gain                   | : | 0.7dBi(Internal Antenna)<br>4.0dBi(External Antenna)  |
| Antenna connector Type         | : | None (Internal Antenna)<br>TS-5(External Antenna)   |
| Method of Frequency Generation | : | Synthesizer   |
| Power Supply                   | : | DC3.3V  |
| Temperature of operation       | : | 0 deg. C. -+50 deg. C.  |

### FCC 15.31 (e)

This EUT provides stable voltage(DC3.3V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

### FCC Part 15.203 Antenna requirement

Internal Antenna is permanently installed and not detachable from the EUT. In addition, special connector, type TS-5 manufactured by SMK is used for external antenna. Therefore, the EUT meets the requirement of FCC Part 15.203.

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### SECTION 3: Test specification procedures & results

#### 3.1 Test Specification

Test Specification : FCC Part15 Subpart C  
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928MHz,  
2400-2483.5MHz, and 5725-5850MHz

#### 3.2 Procedures and results

| No. | Item                      | Test Procedure  | Specification        | Remarks   | Deviation | Worst margin  | Results  |
|-----|---------------------------|-----------------|----------------------|-----------|-----------|---|----------|
| 1   | Conducted emission        | ANSI C63.4:2001 | Section 15.207       | -         | N/A       | 16.9dB<br>0.152MHz<br>L, QP<br>IEEE802.11g 54M<br>Ext - Antenna       | Complied |
| 2   | 6dB Bandwidth             | ANSI C63.4:2001 | Section 15.247(a)(2) | Conducted | N/A       | -   | Complied |
| 3   | Maximum Peak Output Power | ANSI C63.4:2001 | Section 15.247(b)(3) | Conducted | N/A       | 13.3dB<br>IEEE802.11b 11M<br>Low ch                                   | Complied |
| 4   | Out of Band Emission      | ANSI C63.4:2001 | Section 15.247 (c)   | Radiated  | N/A       | 0.4dB<br>2483.9MHz<br>Vertical, AV<br>IEEE802.11g 36M<br>In - Antenna | Complied |
| 5   | Out of Band Emission      | ANSI C63.4:2001 | Section 15.247 (c)   | Conducted | N/A       | -   | Complied |
| 6   | Power Density             | ANSI C63.4:2001 | Section 15.247 (d)   | -         | N/A       | 13.3dB<br>IEEE802.11b 11M<br>Mid ch                                   | Complied |

Note: UL Apex's EMI Work Procedures No.QPM05.

\*These tests were also referred to "Guidance on Measurement for Digital Transmission Systems Section15.247".

\*These tests were performed without any deviations from test procedure except for additions or exclusions.

\*Regarding AC main conducted emission and radiated emission within 30MHz - 1000MHz band,, there was no change in emission when transmission mode and channel were changed.

As for AC main conducted emission, we tested In-Antenna and Ext -Antenna at low channel in IEEE802.11g 54Mps mode. For radiated emission within 30MHz-1000MHz band, we tested In-Antenna and Ext -Antenna at Low/Mid/High channels in IEEE802.11b 11Mbps and IEEE802.11g 54Mbps modes.

#### 3.4 Confirmation

UL ApexCo., Ltd. hereby confirms that E.U.T., in the configuration tested, complies with the specifications FCC Part 15 Subpart C Section 15.207 and 15.247.

Remarks : The EUT was separately tested in accordance with FCC Part 15 Subpart B and Declaration of Conformity was applied

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### 3.5 Uncertainty

#### Conducted Emission

The measurement uncertainty (with a 95% confidence level) for this test is  $\pm 1.3$ dB.

#### Spurious Emission (Radiated)

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is  $\pm 4.5$ dB(3m).

The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is  $\pm 5.2$ dB(3m).

The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is  $\pm 6.6$ dB.

### 3.6 Test Location

UL Apex Co., Ltd. Head Office EMC Lab.

No1, No.2 semi anechoic chamber and No3 Shield Room.

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No1 semi anechoic chamber has been fully described in a report submitted to FCC office, and listed on February 01, 2002

(Registration number: 313583).

\*NVLAP Lab. code: 200572-0

No.2 semi anechoic chamber has been fully described in a report submitted to FCC office, and listed on June 05, 2002. (Registration number: No.2:846015 Industry Canada: No.2: IC4247-2)

\*NVLAP Lab. code: 200572-0

### 3.7 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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## SECTION 4: Operation of E.U.T. during testing

### 4.1 Operating Modes

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

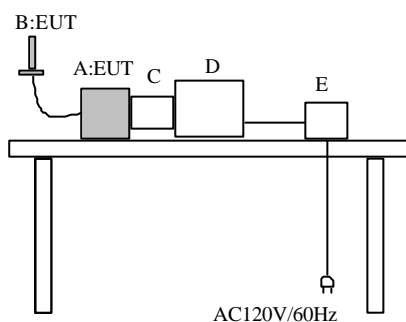
The sequence is used:

Transmitting mode (Internal & External Antenna)  
DSSS CCK(11Mbps)  
OFDM 64QAM(54Mbps) & 16-QAM(36Mbps)

Channel  
Low : 2412MHz(Ch1)  
Mid : 2437MHz(Ch6)  
High : 2462MHz(Ch11)

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 worstcase conditions.

#### Description of EUT and Support equipment

| No. | Item              | Model number  | Serial number | Manufacturer       | FCC ID    |
|-----|-------------------|---------------|---------------|--------------------|-----------|
| A   | Wireless LAN Card | NC-7100       | BR1-009       | Brother            | B3QNC7100 |
| B   | External Antenna  | WNA-206ST     | -             | HOKO Electric Inc. | -         |
| C   | PC                | PS181N-02T7HO | 61012700J     | TOSHIBA            | DOC       |
| D   | AC adapter        | ADP-60FB      | 012J0024137   | TOSHIBA            | DOC       |

#### List of cables used

| No. | Name           | Length (m) | Shield | Backshell Material |
|-----|----------------|------------|--------|--------------------|
| 1   | Antenna Cable  | 1.5        | Y      | Polyvinyl chloride |
| 2   | DC Power Cable | 2.0        | N      | Polyvinyl chloride |
| 3   | AC Power Cable | 2.0        | N      | Polyvinyl chloride |

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## **SECTION 5: Conducted Emission, Section 15.207**

### **Test Procedure**

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from LISN and excess AC cable was bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the input power source. All unused 50ohm connectors of the LISN were resistively terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT on a reference ground plane 7.0 x 6.0m in a No.1 / 4.0 x 4.0m in a No.2 semi Anechoic Chamber.

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 CISPR quasi-peak detector (IF BW 9 kHz).

Measurement range: 0.15-30MHz

Test data : APPENDIX 3  
Test result : Pass

## **SECTION 6: 6dB Bandwidth, Section 15.247(a)(2)**

### **Test Procedure**

The minimum 6dB bandwidth was measured with a spectrum analyzer connected to the antenna port.

Test data : APPENDIX 3  
Test result : Pass

## **SECTION 7: Maximum Peak Output Power, Section 15.247(b)(3)**

### **Test Procedure**

The Maximum Peak Output Power was measured with a Power Meter connected to the antenna port.

Test data : APPENDIX 3  
Test result : Pass

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## **SECTION 8: Out of Band Emission, Section 15.247 (c)**

### **[Radiated]**

#### **Test Procedure**

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization.

The Radiated Electric Field Strength intensity has been measured in No.2 semi anechoic chamber (7.5x5.8x5.2m) with a ground plane and at a distance of 3m(Below 10GHz) and 1m(Upper 10GHz).

The measuring antenna height was varied between 1 to 4m 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 noise was measured at each position of all 4 axes X, Y, Z-1, Z-2(with cradle) to compare the level, and the maximum noise level was recorded.

In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

The result was also satisfied the general limits specified in section 15.209(a).

**Test data** : **APPENDIX 3**

**Test result** : **Pass**

### **[Conducted]**

#### **Test Procedure**

The Out of Band Emission (Conducted) was measured with a spectrum analyzer connected to the antenna port.

**Test data** : **APPENDIX 3**

**Test result** : **Pass**

## **SECTION 9: Peak Power Density, Section 15.247 (d)**

### **[Conducted]**

#### **Test Procedure**

The Peak Power Density was measured with a spectrum analyzer connected to the antenna port.

**Test data** : **APPENDIX 3**

**Test result** : **Pass**

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**APPENDIX 1: Photographs of test setup**  
**Conducted Emission(Ext-Antenna)**

Front



Side

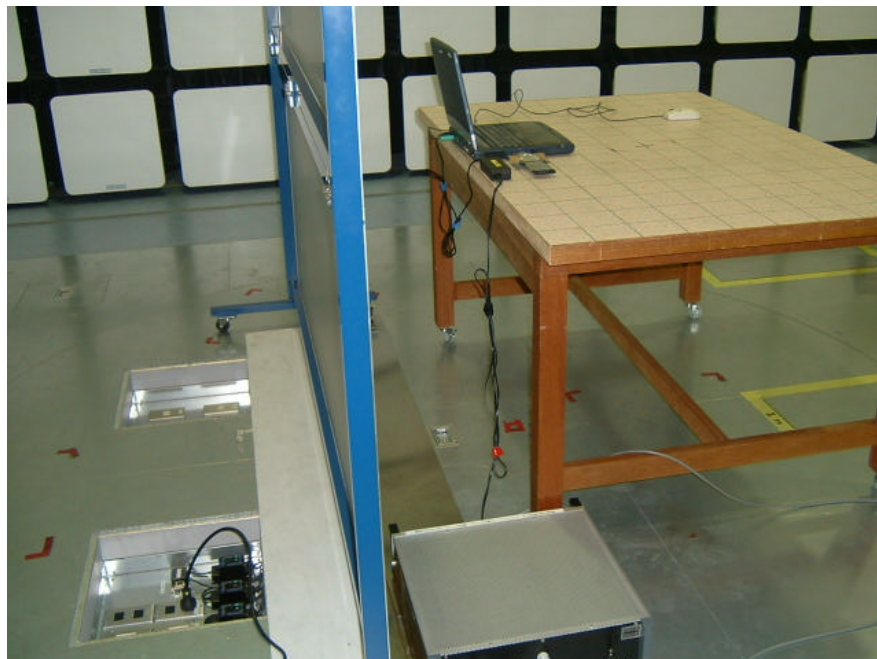


**Conducted Emission(In-Antenna)**

**Front**



**Side**

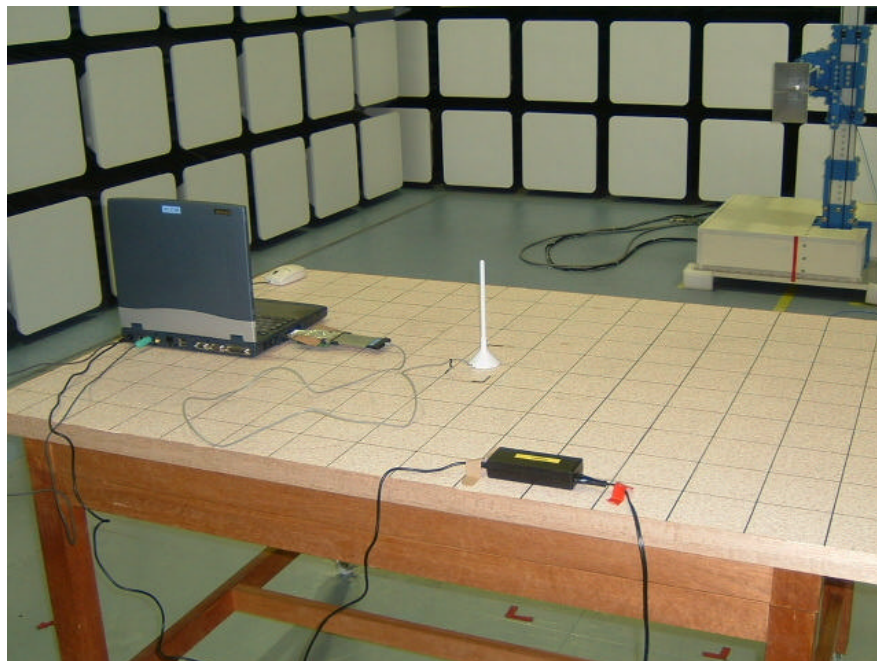


**Radiated Spurious Emission (Ext-Antenna)**

**Front**



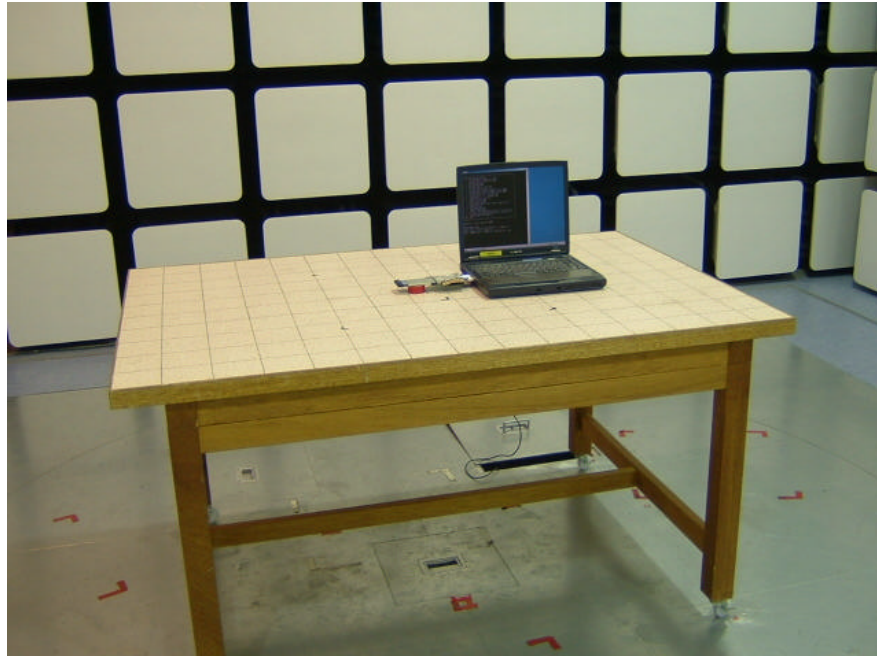
**Rear**



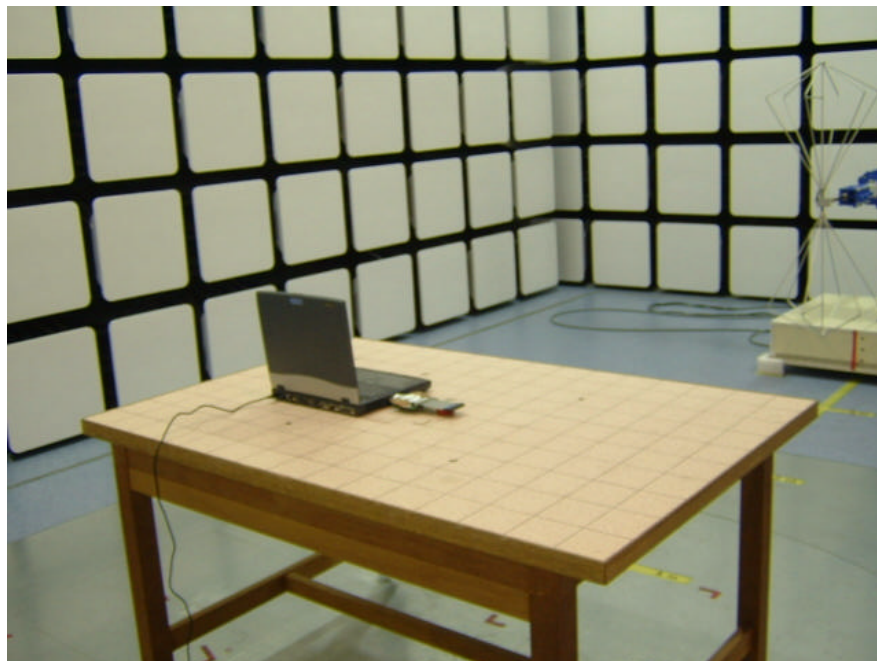


**Radiated Spurious Emission (In-Antenna)**

**Front**



**Rear**



**Radiated Spurious Emission X, Y, Z Positions (In-Antenna)**

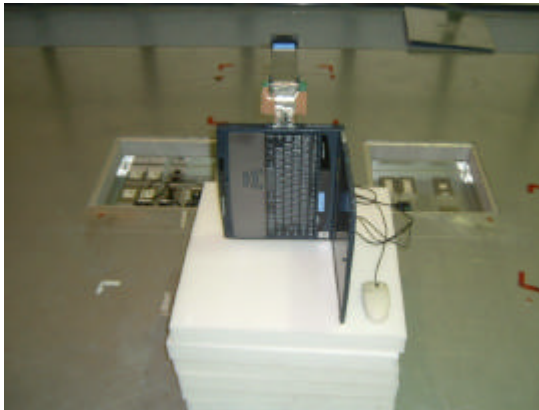
X-axis



Y-axis



Z-axis



## APPENDIX 2:Test instruments

### EMI test equipment

| Control No. | Instrument          | Manufacturer     | Model No              | Test Item  | Calibration Date *<br>Interval(month) |
|-------------|---------------------|------------------|-----------------------|------------|---------------------------------------|
| MAEC-01     | Anechoic Chamber    | TDK              | Semi Anechoic Chamber | 1 to 8     | 2002/12/27 * 12                       |
| MAEC-02     | Anechoic Chamber    | TDK              | Semi Anechoic Chamber | 1 to 8     | 2003/04/11 * 12                       |
| MCC-13      | Coaxial Cable       | Fujikura/Agilent | -                     | 1          | 2003/05/08 * 12                       |
| MLS-07      | LISN                | Schwarzbeck      | NSLK8127              | 1          | 2003/03/18 * 12                       |
| MRENT-07    | Spectrum Analyzer   | Advantest        | R3273                 | 1 to 6     | 2003/10/31 * 12                       |
| MTR-02      | Test Receiver       | Rohde & Schwarz  | ESCS30                | 1, 4       | 2003/01/31 * 12                       |
| MTR-01      | Test Receiver       | Rohde & Schwarz  | ESI40                 | 1, 4       | 2003/11/12 * 12                       |
| MCC-04      | Microwave Cable     | Storm            | 421-011               | 4          | 2003/01/14 * 12                       |
| MPM-01      | Power Meter         | Agilent          | E4417A                | 3          | 2003/11/12 * 12                       |
| MPSE-03     | Power sensor        | Agilent          | E9327A                | 3          | 2003/04/14 * 12                       |
| MBA-03      | Biconical Antenna   | Schwarzbeck      | BBA9106               | 4          | 2003/04/28 * 12                       |
| MLA-03      | Logperiodic Antenna | Schwarzbeck      | USLP9143              | 4          | 2003/04/28 * 12                       |
| MPA-02      | Pre Amplifier       | Agilent          | 87405A                | 4          | 2003/04/17 * 12                       |
| MAT-07      | Attenuator(6dB)     | Weinschel Corp   | 2                     | 2, 4, 5, 6 | 2002/12/24 * 12                       |
| MCC-12      | Coaxial Cable       | Fujikura/Agilent | -                     | 4          | 2003/05/08 * 12                       |
| MPA-01      | Pre Amplifier       | Agilent          | 8449B                 | 4          | 2003/02/08 * 12                       |
| MCC-24      | Microwave Cable     | Storm            | -                     | 4          | 2003/04/30 * 12                       |
| MHF-02      | High Pass Filter    | Tokimec          | TF323DCA              | 4          | 2003/09/19 * 12                       |
| MAT-19      | Attenuator(10dB)    | HIROSE           | AT-106                | 4          | 2003/12/16 * 12                       |
| MHA-01      | Horn Antenna        | EMCO             | 3160-09               | 4          | 2003/01/11 * 12                       |
| MHA-05      | Horn Antenna        | Schwarzbeck      | BBHA9120D             | 4          | 2003/01/11 * 12                       |

All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

#### Test Item :

- 1: AC Conducted emission,
- 2: 6dB Bandwidth
- 3: Maximum Peak Output Power
- 4: Out of Band Emission(Radiated)
- 5: Out of Band Emission(Conducted)
- 6: Peak Power Density

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