



# EMI TEST REPORT

Test Report No. : 23KE0038-HO-1

**Applicant** : Matsushita Electric Industrial Co.,Ltd.  
Panasonic System Solutions Company

**Type of Equipment** : Center Module

**Model No.** : WX-CC2010

**Test standard** : FCC Part 90

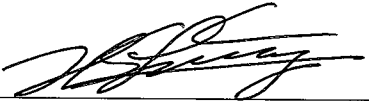
**FCC ID** : ACJ9TAWX-CC2010

**Test Result** : Complied

1. This test report shall not be reproduced 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 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 : June 26, 27, 30, July 1,10 and 11, 2003

Tested by :   
Hiroka Umeyama  
EMC Service

Approved by :   
Hironobu Shimoji  
Group Leader of EMC Service

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## **SECTION 1: Client information**

Company name : Matsushita Electric Industrial Co.,Ltd.  
Panasonic System Solutions Company

Brand name : Panasonic

Address : 4-3-1, TSUNASHIMA-HIGASHI, YOKOHAMA-CITY,  
KANAGAWA, 223-8639 JAPAN

Telephone Number : +81 45 540 5525

Facsimile Number : +81 45 540 5511

Contact Person : Shinichi ohgo

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

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

Type of Equipment : Center Module

Model No. : WX-CC2010

Serial No. : CF0001

Rating : AC12V/1.2A

Country of Manufacture : Japan

Receipt Date of Sample : June 23, 2003

Condition of EUT : Engineering prototype

## 2.2 Product Description

Matsushita Electric Industrial Co.,Ltd., Panasonic System Solutions Company.,  
Model: WX-CC2010 (referred to as the EUT in this report) is the Center Module.

The clock frequency of this EUT is as follows;

|                                       |   |   |
|---------------------------------------|---|---|
| Equipment identification              | : | Center Module   |
| Intended use/Purpose of the equipment | : | Drive Through System for the fast food store  |
| Equipment Type                        | : | Transceiver   |
| Frequency of Operation                | : | from 468.6125MHz to 469.3875MHz   |
| Other Clock Frequency                 | : | AF CPU clock 8.38MHz<br>DSP clock 16.384MHz<br>RF CPU clock 4.19MHz<br>Baseband clock 3.58MHz<br>PLL clock 21.85MHz<br>Receive VCO 447.2125-447.9875MHz |
| Modulation                            | : | Frequency modulation  |
| Bandwidth / Channel spacing           | : | 12.5kHz / 25MHz   |
| Transmit power or power range         | : | 25mW (not including the antenna gain)   |
| Channel access protocol               | : | Rotary SW   |
| Mode of operation                     | : | Duplex  |
| Antenna Gain                          | : | -3dB  |
| Antenna Connector Type                | : | BNC   |
| Method of Frequency Generation        | : | Synthesizer   |
| Operating temperature range           | : | -10 deg. C. to 50 deg. C.   |

### SECTION 3: Test specification, procedures & results

#### 3.1 Test Specification

Test Specification : FCC Part90  
Title : PRIVATE LAND MOBILE RADIO SERVICES

#### 3.2 Procedures and results

| No. | Item                                | Test Procedure                   | Specification     | Deviation | Worst margin                    | Results  |
|-----|-------------------------------------|----------------------------------|-------------------|-----------|---------------------------------|----------|
| 1   | RF Output Power                     | Section 2.1046<br>Section 2.1053 | Section 90.217    | N/A       | -                               | Complied |
| 2   | Modulation Characteristics          | Section 2.1047(a)<br>and (b)     | -                 | N/A       | -                               | Complied |
| 3   | Emission Bandwidth                  | Section 2.1049                   | -                 | N/A       | -                               | Complied |
| 4   | Field Strength of Spurious Emission | Section 2.1053                   | Section 90.217    | N/A       | 10.1dB<br>937.87MHz<br>Vertical | Complied |
| 5   | Frequency Stability Measurement     | Section 2.1055                   | Section 90.217(c) | N/A       | -                               | Complied |

Note: UL Apex's EMI Work Test Procedure QPM05.

#### 3.3 Additions to Standards

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 tested, complies with the specifications FCC Part 90.

### 3.5 Uncertainty

#### Spurious Emission(Radiated)

The measurement uncertainty (with a 95% confidence level) for this test using Loop antenna is  $\pm 1.9$ dB.

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

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

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

The result is within Head Office EMC Lab's uncertainty.

The data listed in this test report has enough margin.

### 3.6 Test Location

UL Apex Co., Ltd. Head Office EMC Lab. No.2 semi anechoic chamber, 7.5 x 5.8 x 5.2m. No.3 measurement room,  
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This 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 )

\*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**

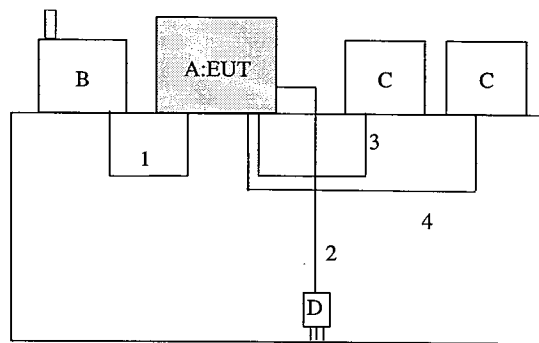
**4.1 Operating Modes**

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 : Continuous Transmitting mode

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

**4.2 Configuration and peripherals**



AC120V/60Hz

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

**Description of EUT and Support equipment**

| No. | Item          | Model number | Serial number | Manufacturer | FCC ID          | Remark |
|-----|---------------|--------------|---------------|--------------|-----------------|--------|
| A   | Center Module | WX-CC2010    | CF0001        | Panasonic    | ACJ9TAWX-CC2010 | EUT    |
| B   | Transceiver   | WX-CT2030    | CF0001        | Panasonic    | ACJ9TAWX-CT2030 | -      |
| C   | Speaker       | -            | -             | Panasonic    | -               | -      |
| D   | AC Adaptor    | WX-C516      | AH0099        | Panasonic    | UL E140898      | -      |

**List of cables used**

| No. | Name          | Length (m) | Shield | Backshell Material |
|-----|---------------|------------|--------|--------------------|
| 1   | LAN Cable     | 3.0        | N      | Polyvinyl chloride |
| 2   | Power Cable   | 3.0        | Y      | Polyvinyl chloride |
| 3   | Speaker Cable | 0.9        | N      | Polyvinyl chloride |
| 4   | Speaker Cable | 1.2        | N      | Polyvinyl chloride |

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## **SECTION 5: RF Output power**

### **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 lowering the antenna and rotating the turntable until the highest possible signal Obtains. Record this maximum reading.
- (4) Repeat step3 with the antenna polarized vertically.
- (5) Remove the transmitter and replace it with the half-wave dipole antenna. The center of this antenna is approximately at the same location as the center of the transmitter.
- (6) Feed the input of the half-wave dipole antenna with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both transmitting and receiving antennas 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 maximum reading at the Spectrum Analyzer is obtained.
- (7) Repeat step6 with both transmitting and receiving antennas vertically polarized.

**Test data** : **APPENDIX 3**  
**Test result** : **Pass**  
**Test instruments** : **MAEC-02, MTR-02, SA-07, MCC-12, MPA-02, MLA-03,  
MDA-03/04, MSG-03, MAT-07**

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**SECTION 6: Modulation Characteristics**

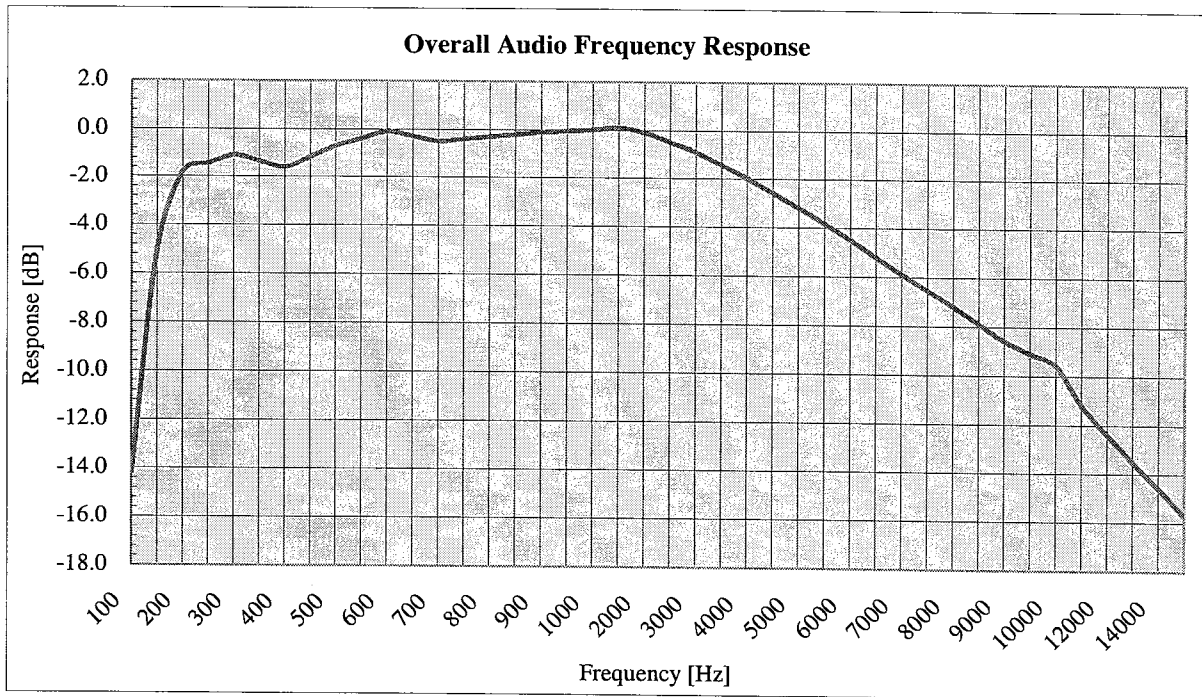
Test Procedure : FCC part 2.1047

Test instruments : MS616B (Anritsu), UPA3 (Rohde & Schwarz), MST-01, MLA-02

Test data

(a) Overall Audio Frequency Response

Temperature : 25 deg.C  
Humidity : 58 %  
Input level : -30dBm  
0 dB = -7.72dBVrms. at 1kHz



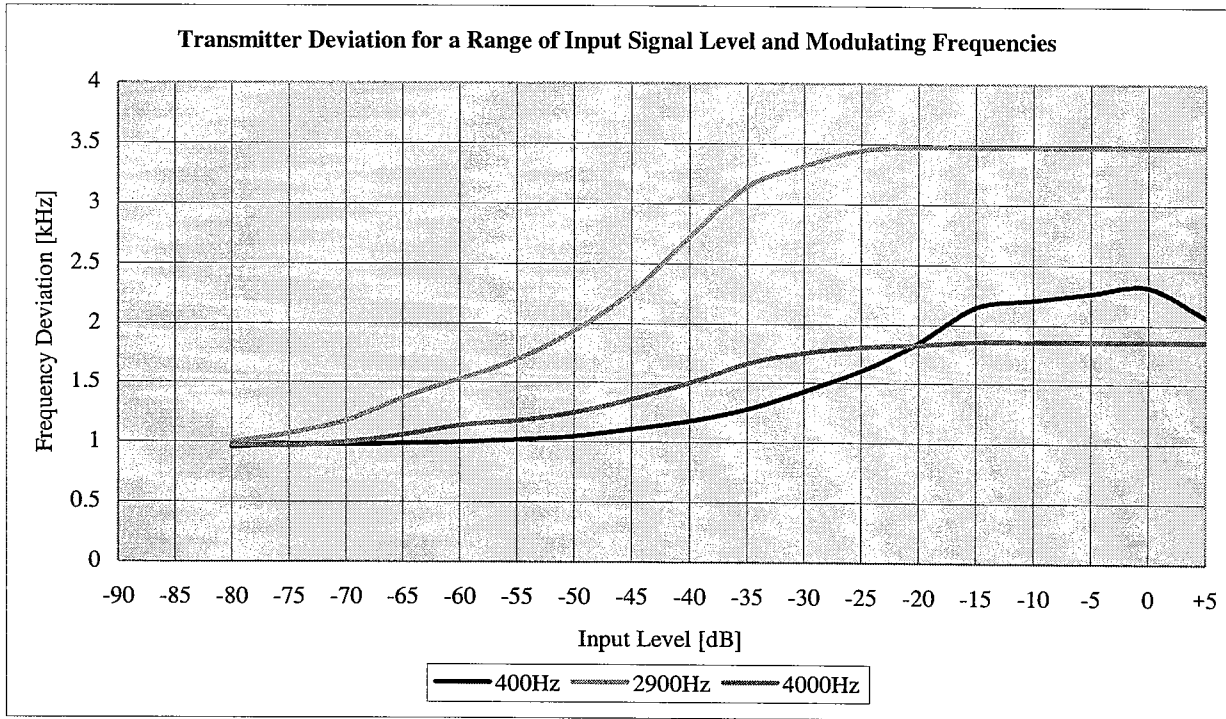
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(b) Transmitter Deviation for a Range of Input Signal Level and Modulating Frequencies

Temperature : 24 deg.C

Humidity : 58 %

Input level : -30dBm (-26.2dBV) at 1kHz



**SECTION 7: Emission Bandwidth**

**Test Procedure**

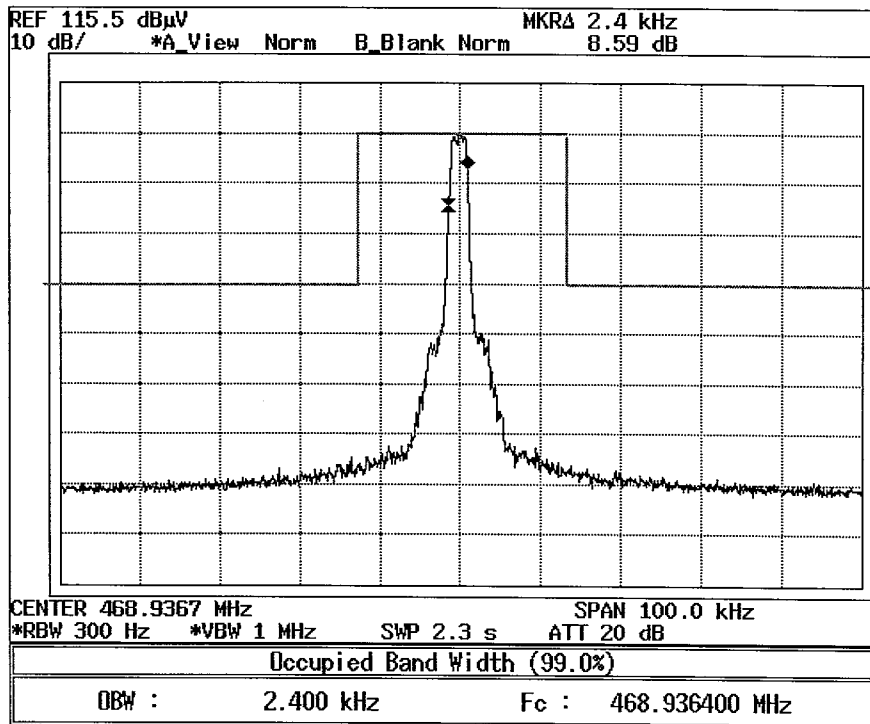
- (1) Set the reference level the spectrum analyzer to the unmodulated carrier level of the EUT.
- (2) Search maximum response of audio frequency and read maximum frequency deviation.
- (3) Then EUT was modulation by 2.5kHz and it's level was increased 16dB.

Test instruments : SA-07, MCC-12, MPA-02, MLA-02, UPA3, MAT-07

Test result : Pass

(a) No input

Operation mode : No audio input.  
Temperature : 26 deg. C  
Humidity : 53 %



468.937MHz : 105.52dBuV

-26dB Bandwidth : 3.1kHz ,      99% Occupied Bandwidth : 2.400kHz

(b) 2.5kHz modulation

Operation mode:

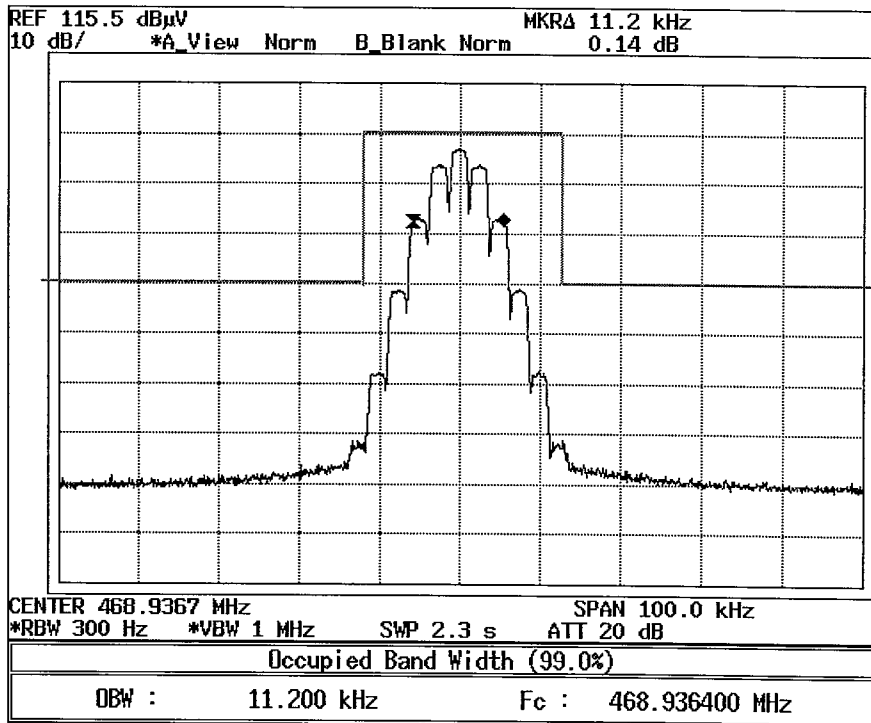
Modulated by 2.5 kHz tone at input level 16 dB greater than that necessary to produce 50% modulation.

Then input level was established at frequency of maximum response of the modulation circuit.

Temperature : 26 deg. C

Humidity : 53 %

Input level : -19dBm



468.937MHz : 102.61dBuV

-26dB Bandwidth : 12.6kHz , 99% Occupied Bandwidth : 11.200kHz

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## **SECTION 8: Field Strength of Spurious Emission**

### **Test Procedure**

- (1) Tune-up the transmitter (EUT).
- (2) Device Vertical: Place the device so that it's longest axis of antenna 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 harmonics 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 lowering 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 of antenna is horizontal.
- (7) Repeat Step3, Step4, and Step5.
- (8) The attenuation of the spurious in dB can be calculated from the following formula:

$$\begin{array}{lcl} \text{Spurious Emission} & & \text{Carrier} \\ \text{Attenuation} & = & \text{Power} \\ \text{[dB]} & & \text{[dBm]} \end{array} \quad - \quad \begin{array}{l} \text{Spurious Emission} \\ \text{Power} \\ \text{[dBm]} \end{array}$$

Test data : APPENDIX 3  
Test result : Pass  
Test instruments : MAEC-02, MTR-02, SA-07, MCC-12, MCC-05/06, MHA-05/06, MPA-01/02  
MAT-07, MBA-03, MLA-03, MDA-03/04, MSG-01/03, MCC-10

## **SECTION 9: Frequency Stability Measurement**

Test data : APPENDIX 3  
Test result : Pass  
Test instruments : UC-01, MCH-01

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### **APPENDIX 1: Photographs of test setup**

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### **APPENDIX 2: Test instruments**

Page 16 : Test instruments

### **APPENDIX 3: Data of EMI test**

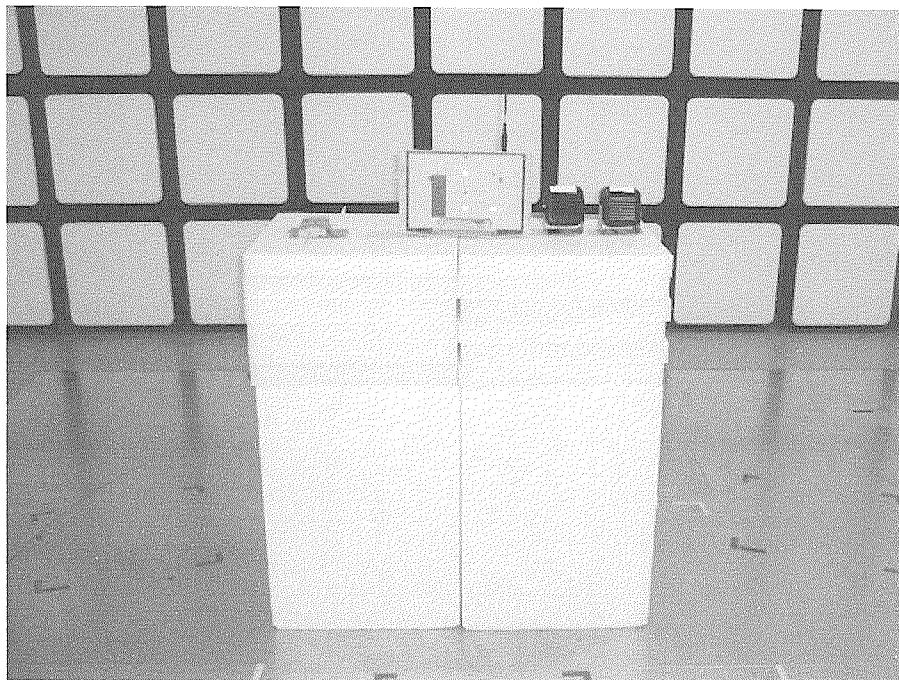
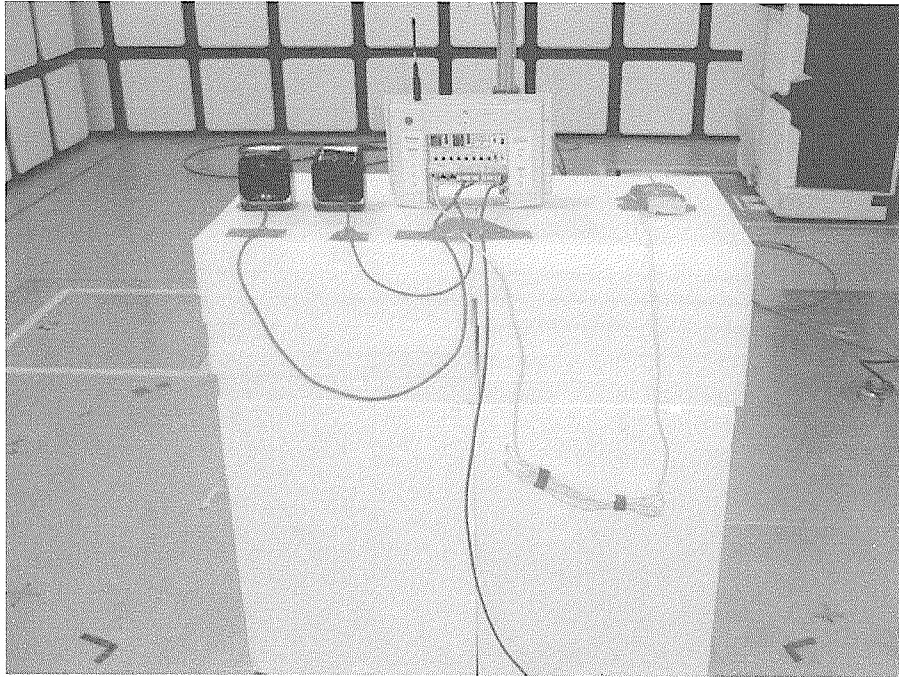
Page 17 : RF Output Power

Page 18 : Spurious Emission

Page 19 : Frequency Stability

**APPENDIX 1: Photographs of test setup**

**Test Setup**



## APPENDIX 2: Test Instrument

| Control No. | Instrument           | Manufacturer     | Model No  | Test Item | Calibration Date *<br>Interval(month) |
|-------------|----------------------|------------------|---|-----------|---------------------------------------|
| UC-01       | Universal Counter    | Agilent          | 53131A  |           | 2002/10/24 * 12                       |
| MCH-01      | Temp.&Humid. Chamber | Tabai Spec       | PL-2KP  | RE        | 2002/12/18 * 12                       |
| MAEC-02     | Anechoic Chamber     | TDK              | Semi Anechoic Chamber 3m  | RE        | 2003/04/11 * 12                       |
| MTR-02      | Test Receiver        | Rohde & Schwarz  | ESCS30  | RE        | 2003/01/31 * 12                       |
| SA-07       | Spectrum Analyzer    | Advantest        | R3273   | RE        | 2002/12/10 * 12                       |
| MCC-12      | Coaxial Cable        | Fujikura/Agilent | MCC-12-01(8D-2W15m),MC<br>C-12-02(5D-2W-0.7),MCC-1<br>2-03(5D-2W-0.8),MCC-12-0<br>4(5D-2W-1m),MCC-12-05(R<br>F SW),MCC-12-06(RF SW),<br>※<br>MCC-12-07(5D-2W-0.4m)5/8<br>追加 | RE        | 2003/05/08 * 12                       |
| MPA-02      | Pre Amplifier        | Agilent          | 87405A  | RE        | 2003/04/17 * 12                       |
| MLA-03      | Logperiodic Antenna  | Schwarzbeck      | USLP9143  | RE        | 2003/04/28 * 12                       |
| MDA-03      | Dipole Antenna       | Schwarzbeck      | UHAP  | RE        | 2002/12/20 * 12                       |
| MDA-04      | Dipole Antenna       | Schwarzbeck      | UHAP  | RE        | 2002/10/16 * 12                       |
| MSG-03      | Signal Generator     | Rohde & Schwarz  | SML03   | RE        | 2002/10/08 * 12                       |
| MSG-01      | Signal Generator     | Rohde & Schwarz  | SMR40   | RE        | 2002/11/25 * 12                       |
| MHA-05      | Horn Antenna         | Schwarzbeck      | BBHA9120D   | RE        | 2003/01/11 * 12                       |
| MHA-06      | Horn Antenna         | Schwarzbeck      | BBHA9120D   | RE        | 2003/01/11 * 12                       |
| MCC-05      | Microwave Cable      | Storm            | 421-011   | RE        | 2003/01/14 * 12                       |
| MCC-06      | Microwave Cable      | Storm            | 421-011   | RE        | 2003/01/14 * 12                       |
| MCC-10      | Coaxial cable        | Storm            | 90-195-394  | RE        | 2003/03/26 * 12                       |
| MPA-01      | Pre Amplifier        | Agilent          | 8449B   | RE        | 2003/02/08 * 12                       |
| MAT-07      | Attenuator(6dB)      | Weinschel Corp   | 2   | RE        | 2002/12/24 * 12                       |
| UPA3        | Audio Analyzer       | Rohde&Schwarz    | UPA3  | RE        | 2002/06/26 * 12                       |
| MS616B      | Modulation Analyzer  | Anritsu          | MS616B  | RE        | 2002/06/26 * 12                       |

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

Test Item:

RE: Radiated emission

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## DATA OF RADIATED EMISSIONS

UL Apex Co., Ltd.  
Head Office EMC Lab. No.2 Semi Anechoic Chamber

|   |   |
|---|---|
| COMPANY : Matsushita Electric Industrial Co.,Ltd. | REPORT NO : 23KE0038-HO - <b>1</b>      |
| EQUIPMENT : Center Module                         | REGULATION : Fcc Part 90 Section 90.217 |
| MODEL : WX-CC2010                                 | TEST METHOD : Fcc Part 2 Section 2.1046 |
| S/N : CF0001                                      | TEST METHOD : Fcc Part 2 Section 2.1053 |
| FCC ID : ACJ9TAWX-CC2010                          | TEST DISTANCE : 3m                      |
| IC Number : 216A-CC2010                           | DATE : 06/27/2003                       |
| POWER : AC120V                                    | TEMPERATURE : 26 deg.C                  |
| MODE : Transmitting ( Mid : 468.9375MHz)          | HUMIDITY : 60 %                         |


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 ENGINEER : Hiroka Umeyama

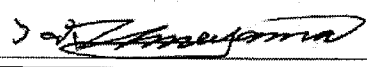
| No. | FREQ<br>[MHz] | SG READING   |              | CABLE<br>LOSS<br>[dB] | ATTEN<br>[dB] | RESULT       |              | RESULT      |             | LIMITS<br>(ERP)<br>[mW] |
|-----|---------------|--------------|--------------|-----------------------|---------------|--------------|--------------|-------------|-------------|-------------------------|
|     |               | HOR<br>[dBm] | VER<br>[dBm] |                       |               | HOR<br>[dBm] | VER<br>[dBm] | HOR<br>[mW] | VER<br>[mW] |                         |
| 1   | 468.94        | 15.0         | 18.0         | 1.5                   | 9.9           | 3.6          | 6.6          | 2.3         | 4.6         | 120.0                   |

CALCULATION:READING(SG)-LOSS(CABLE)-ATTEN  
Tx/Rx ANTENNA:Dipole Antenna

# DATA OF SPURIOUS EMISSIONS TEST (30MHz-5GHz)

UL Apexex Co., Ltd.  
Head Office EMC Lab. No.2 Semi Anechoic Chamber

|   |   |
|---|---|
| COMPANY : Matsushita Electric Industrial Co.,Ltd. | REPORT NO : 23KE0038-HO - 1             |
| EQUIPMENT : Center Module                         | REGULATION : FCC Part 90 Section 90.217 |
| MODEL : WX-CC2010                                 | TEST METHOD : FCC Part 2 Section 2.1053 |
| S/N : CF0001                                      |   |
| FCC ID : ACJ9TAWX-CC2010                          | TEST DISTANCE : 3m                      |
| IC No : 216A-CC2010                               | DATE : 07/10/2003 and 07/11/2003        |
| POWER : AC120V/60Hz                               | TEMPERATURE : 25 deg.C and 27deg.C      |
| MODE : Transmitting ( Mid : 468.9375MHz)          | HUMIDITY : 60% and 60%                  |



Engineer : Hiroka Umeyama

| No. | FREQ<br>[MHz] | SG READING   |       | CABLE<br>LOSS<br>[dB] | ANT<br>GAIN<br>[dBi] | ATTEN<br>[dB] | E.R.P        |       | RESULT       |      | LIMIT<br>[dBc] | MARGIN      |      |
|-----|---------------|--------------|-------|-----------------------|----------------------|---------------|--------------|-------|--------------|------|----------------|-------------|------|
|     |               | HOR<br>[dBm] | VER   |                       |                      |               | HOR<br>[dBm] | VER   | HOR<br>[dBc] | VER  |                | HOR<br>[dB] | VER  |
| 1   | 937.87        | -25.7        | -21.2 | 2.1                   | 2.15                 | 10.2          | -38.0        | -33.5 | 44.6         | 40.1 | 30.0           | 14.6        | 10.1 |
| 2   | 1406.81       | -52.5        | -53.7 | 2.2                   | 7.5                  | 0.0           | -49.4        | -50.6 | 56.0         | 57.2 | 30.0           | 26.0        | 27.2 |
| 3   | 1875.75       | -44.1        | -48.7 | 2.6                   | 10.2                 | 0.0           | -38.7        | -43.3 | 45.3         | 49.9 | 30.0           | 15.3        | 19.9 |
| 4   | 2344.69       | -54.9        | -54.8 | 2.7                   | 11.0                 | 0.0           | -48.8        | -48.7 | 55.4         | 55.3 | 30.0           | 25.4        | 25.3 |
| 5   | 2813.63       | -55.5        | -53.4 | 3.0                   | 11.1                 | 0.0           | -49.6        | -47.5 | 56.2         | 54.1 | 30.0           | 26.2        | 24.1 |
| 6   | 3282.56       | -48.0        | -53.3 | 3.3                   | 11.5                 | 0.0           | -42.0        | -47.3 | 48.6         | 53.9 | 30.0           | 18.6        | 23.9 |
| 7   | 3751.50       | -54.4        | -54.7 | 3.6                   | 12.0                 | 0.0           | -48.2        | -48.5 | 54.8         | 55.1 | 30.0           | 24.8        | 25.1 |
| 8   | 4220.44       | -55.4        | -54.5 | 3.9                   | 12.3                 | 0.0           | -49.2        | -48.3 | 55.8         | 54.9 | 30.0           | 25.8        | 24.9 |
| 9   | 4689.38       | -46.0        | -49.0 | 4.1                   | 12.6                 | 0.0           | -39.7        | -42.7 | 46.3         | 49.3 | 30.0           | 16.3        | 19.3 |

CALCULATION: E.R.P=READING(SG)-LOSS(CABLE)+ANT.GAIN-ATTEN-2.15

RESULT: DEVIATION FROM CARRIER(6.6dBm)

RxANTENNA: Biconical Antenna(30-300MHz), Logperiodic Antenna(300-1000MHz), Horn Antenna(1-13GHz)

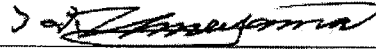
TxANTENNA: Dipole Antenna(30-1000MHz), Horn Antenna(1-13GHz)

All other emissions were at least 20dB below the specification limit.

# DATA OF FREQUENCY STABILITY

UL Apex Co., Ltd.  
Head Office EMC Lab. No.3 Measurement Room

|           |   |               |   |
|-----------|---|---------------|---|
| COMPANY   | : Matsushita Electric Industrial Co.,Ltd. | REPORT NO     | : 23KE0038-HO - 1                       |
| EQUIPMENT | : Center Module                           | REGULATION    | : Fcc Part 90 Section 90.217( c )       |
| MODEL     | : WX-CC2010                               | TEST METHOD   | : Fcc Part 2 Section 2.1055(a)(1)and(b) |
| S/ N      | : CF0001                                  |               | : Fcc Part 2 Section 2.1055(d)(1)and(b) |
| FCC ID    | : ACJ9TAWX-CC2010                         | TEST DISTANCE | : -                                     |
| IC Number | : 216A-CC2010                             | DATE          | : 06/26/2003                            |
| POWER     | : AC120V                                  | TEMPERATURE   | : 20 deg.C                              |
| MODE      | : Transmitting ( Mid : 468.9375MHz)       | HUMIDITY      | : 60 %                                  |



Engineer : Hiroka Umeyama

| Temp.   | Volt. | Frequency Reading | Frequency Error | Limit |
|---------|-------|-------------------|-----------------|-------|
| [deg.C] | [V]   | [MHz]             | [kHz]           | [kHz] |
| -30.0   | 120.0 | 468.938921        | 1.37            | 12.5  |
| -20.0   | 120.0 | 468.931976        | 5.57            | 12.5  |
| -10.0   | 120.0 | 468.939670        | 2.12            | 12.5  |
| 0.0     | 120.0 | 468.939091        | 1.54            | 12.5  |
| 10.0    | 120.0 | 468.938401        | 0.85            | 12.5  |
| 20.0    | 120.0 | 468.937547        | 0.00            | 12.5  |
| 30.0    | 120.0 | 468.936270        | 1.28            | 12.5  |
| 40.0    | 120.0 | 468.935616        | 1.93            | 12.5  |
| 50.0    | 120.0 | 468.935674        | 1.87            | 12.5  |

| Temp.   | Volt.  | Frequency Reading | Frequency Error | Limit |
|---------|--------|-------------------|-----------------|-------|
| [deg.C] | [V]    | [MHz]             | [kHz]           | [kHz] |
| 20.0    | 102.00 | 468.937516        | 0.03            | 12.5  |
| 20.0    | 120.00 | 468.937547        | 0.00            | 12.5  |
| 20.0    | 138.00 | 468.938890        | 1.34            | 12.5  |