



## EMI TEST REPORT

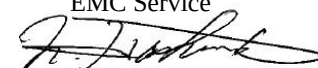
Test Report No. : 24HE0134-HO-3

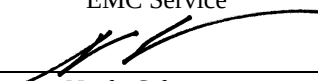
Applicant : Mitsubishi Electric Corporation Himeji Works  
Type of Equipment : Smart Keyless System (ECU)  
Model No. : SKE11A-01 (ECU)  
Test standard : FCC Part 15 Subpart C : 2004  
Section 15.209 (Certification)  
FCC Part 15 Subpart B : 2004  
Section 15.109 (Declaration of Conformity)  
FCC ID : BGBX1T406SKE11A01  
Test Result : Complied

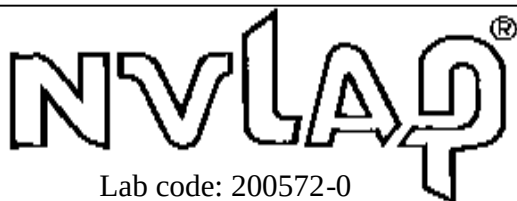
1. This test report shall not be reproduced in full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with above regulation. We hereby certify that the data contain a true representation of the 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 : October 30 and November 5, 2004

Tested by :   
Hiroka Umeyama  
EMC Service

:   
Norihisa Hashimoto  
EMC Service

Approved by :   
Naoki Sakamoto  
Group Leader of EMC Service



This laboratory is accredited by the NIST/NVLAP, U.S.A.  
The tests reported herein have been performed in accordance  
with its terms of accreditation.

\*As for the range of Accreditation in NVLAP, you may  
refer to the WEB address, <http://ulapex.jp/emc/nvlap.htm>

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## **SECTION 1: Client information**

Company Name : Mitsubishi Electric Corporation Himeji Works  
Address : 840 CHIYODA-MACHI HIMEJI HYOUGO 670-8677 JAPAN  
Telephone Number : +81-792-98-8896  
Facsimile Number : +81-792-98-9262  
Contact Person : Yoshiharu Goto

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

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

Type of Equipment : Smart keyless system (ECU)  
Model No. : SKE11A-01  
Serial No. : 1  
Country of Manufacture : Japan  
Receipt Date of Sample : October 19, 2004  
Condition of EUT : Production prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)

### **2.2 Product Description**

Equipment Type : Transceiver  
Rating : DC 12.0V (Car battery)  
Temperature of operation : -40 deg. C. -+85 deg. C.

#### **Transmitter**

|                                |                                 |
|--------------------------------|---------------------------------|
| Frequency Characteristics      | 132.45kHz                       |
| Modulation                     | PPM (Pulse Position Modulation) |
| Information antenna            | Inductive loop                  |
| Mode of Operation              | Simplex                         |
| Other Clock Frequency          | 10MHz                           |
| Method of frequency Generation | Crystal                         |
| Operating voltage (inner)      | DC5V                            |

#### **Receiver**

|                                |                  |
|--------------------------------|------------------|
| Type of Receiver               | Super Heterodyne |
| Receiving Frequency            | 315MHz           |
| Intermediate Frequency         | 10.7MHz          |
| Method of frequency Generation | Crystal          |
| Operating voltage (inner)      | DC5V             |

FCC 15.31 (e)

This test was performed with the New Battery.

The power supply of this EUT is transformed by ECU and provides stable voltage(DC5.0V) constantly to Radio part.  
Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

All Antennas are installed inside the vehicle doors and users cannot detach them from vehicle. Therefore, the equipment complies the requirement.

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

#### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C : 2004  
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.209 Radiated emission limits, general requirements.  
Test Specification : FCC Part 15 Subpart B : 2004  
Title : FCC 47CFR Part15 Radio Frequency Device  
Subpart B Unintentional Radiators  
Section 15.109 Radiated emission limits

Remarks : This equipment adopted section 15.101(b) procedure-「However, receivers indicated as being subject to Declaration of Conformity that are contained within a transceiver, the transmitter portion of which is subject to certification, shall be authorized under the verification procedure.

#### **3.2 Procedures and results**

##### **1) FCC Part 15 Subpart C: 2004**

| No. | Item                                            | Test Procedure  | Specification                            | Deviation            | Worst margin                     | Result   |
|-----|-------------------------------------------------|-----------------|------------------------------------------|----------------------|----------------------------------|----------|
| 1   | Electric Field Strength of Fundamental Emission | ANSI C63.4:2003 | FCC Section 15.209                       | N/A                  | 3.9dB<br>0.13245MHz<br>0 deg. AV | Complied |
| 2   | Electric Field Strength of Spurious Emission    | ANSI C63.4:2003 | FCC Section 15.205<br>FCC Section 15.209 | N/A                  | 9.4dB<br>0.662MHz<br>QP          | Complied |
| 3   | Conducted Emission                              | ANSI C63.4:2003 | FCC Section 15.207(a)                    | AC Mains only<br>*1) | N/A                              | N/A      |

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

\*1) This test is not applicable since the EUT does not have AC power port.

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

##### **2) FCC Part 15 Subpart B: 2004**

| No. | Item               | Test Procedure  | Specification                    | Deviation | Worst margin                      | Result   |
|-----|--------------------|-----------------|----------------------------------|-----------|-----------------------------------|----------|
| 1   | Radiated emission  | ANSI C63.4:2003 | FCC Section 15.109(a)            | N/A       | 15.2dB<br>69.803MHz<br>Horizontal | Complied |
| 2   | Conducted Emission | ANSI C63.4:2003 | FCC Section 15.107(a)<br>and 207 | N/A       | N/A*1)                            | N/A      |

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

\*1) This test is not applicable since the EUT does not have AC power port.

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

#### **3.3 Addition to standards**

| No. | Item                    | Test Procedure                                                                                              | Specification                                                                                               | Remarks  | Deviation | Worst margin | Results |
|-----|-------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|----------|-----------|--------------|---------|
| 1   | 99% Occupied Band Width | RSS210(issue 5):<br>2001<br>+ Amendment:2002<br>+ Amendment2:2003<br>+ Amendment3:2004<br>+ Amendment4:2004 | RSS210(issue 5):<br>2001<br>+ Amendment:2002<br>+ Amendment2:2003<br>+ Amendment3:2004<br>+ Amendment4:2004 | Radiated | N/A       | N/A          | N/A     |
| 2   | -26dB Bandwidth         | ANSI C63.4:2003                                                                                             | Reference data                                                                                              | Radiated | N/A       | N/A          | N/A     |

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### 3.4 Confirmation

UL Apex Co., Ltd. hereby confirms that E.U.T., in the configuration tested, complies with the specifications FCC Part 15 Subpart C : 2004 Section 15.209 and FCC Part 15 Subpart B : 2004 Section 15.109(a).

### 3.5 Uncertainty

#### Radiated Emission Test

The measurement uncertainty (with a 95% confidence level) for this test using Loop antenna is  $\pm 1.8$ 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 data listed in this test report has enough margin. (For FCC Part 15 Subpart C)  
The data listed in this report meets the limits unless the uncertainty is taken into consideration.  
(For FCC Part 15 Subpart B)

### 3.6 Test Location

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|                            | Listed date<br>(for FCC) | FCC<br>Registration<br>Number | IC<br>Registration<br>Number | Width x Depth x<br>Height (m) | Size of<br>reference ground<br>plane (m) /<br>horizontal<br>conducting plane | Other<br>rooms   |
|----------------------------|--------------------------|-------------------------------|------------------------------|-------------------------------|------------------------------------------------------------------------------|------------------|
| No.1 semi-anechoic chamber | February 01, 2002        | 313583                        | IC4247                       | 19.2 x 11.2 x 7.7m            | 7.0 x 6.0m                                                                   | Preparation room |
| No.2 semi-anechoic chamber | June 05, 2002            | 846015                        | IC4247-2                     | 7.5 x 5.8 x 5.2m              | 4.0 x 4.0m                                                                   | -                |
| No.3 shielded room         | -                        | -                             | -                            | 4.7 x 7.5 x 2.7m              | 4.7 x 7.5m                                                                   | -                |
| No.4 measurement room      | -                        | -                             | -                            | 3.1 x 5.0 x 2.7m              | N/A                                                                          | -                |

\* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1 and No.2 semi-anechoic and No.3 shielded room.

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

Refer to APPENDIX 1 to 3.

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

### **4.1 Operating Modes**

The mode is used :

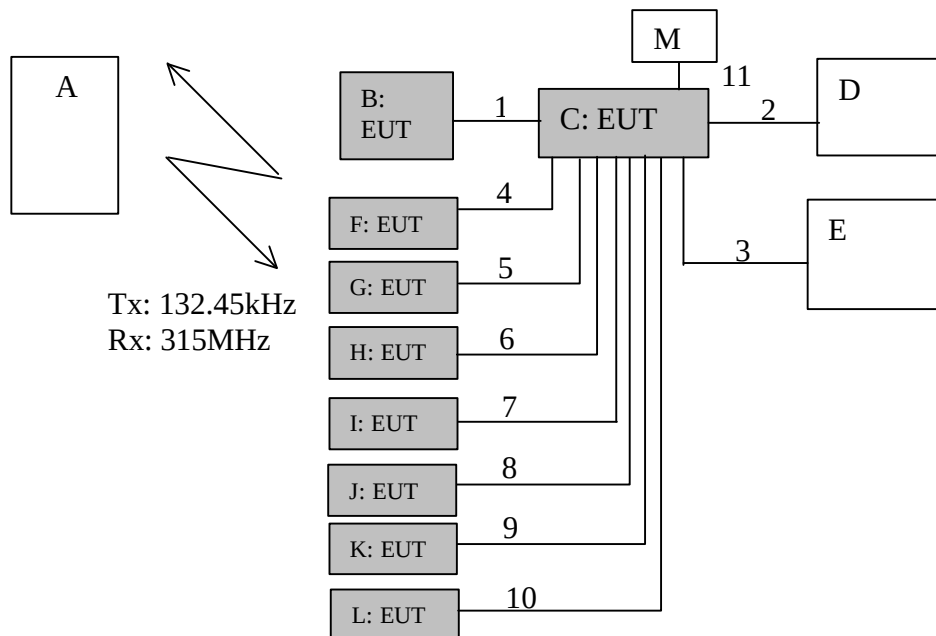
1. Continuous Transmitting mode (132.45kHz)
2. Continuous Receiving mode (315MHz)

\*Receiving mode: the test was performed under the signal from the transmitter.

Justification:

*The carrier level of antenna was confirmed by the antennas that have the maximum and minimum level as is demonstrated like in the actual usage. Output powers are controlled at the fixed point of antennas on a vehicle although all these antennas are the same type. The simultaneous transmitting mode of all antennas was not possible based on the specification of EUT. The test for antenna was confirmed in the directions of X, Y and Z. With the position that has the maximum level of antenna, the maximum level for Receiver was confirmed in the directions of X, Y and Z.*

### **4.2 Configuration and peripherals**



\* Test data was taken under worse case conditions.

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## **Description of EUT and Support Equipment**

### **[Continuous Receiving mode]**

| No. | Item                               | Model number | Serial number | Manufacturer                    | FCC ID            |
|-----|------------------------------------|--------------|---------------|---------------------------------|-------------------|
| A   | Smart keyless system (Transceiver) | SKE11A-01    | 1             | Mitsubishi Electric Corporation | BGBX1T458SKE11A01 |
| B   | Receiver                           | SKE11A-01    | N/A           | Mitsubishi Electric Corporation | DoC               |
| C   | SMART ECU                          | SKE11A-01    | N/A           | Mitsubishi Electric Corporation | BGBX1T406SKE11A01 |
| D   | SKE System Checker                 | N/A          | N/A           | Mitsubishi Electric Corporation | -                 |
| E   | SKE SW BOX                         | N/A          | N/A           | Mitsubishi Electric Corporation | -                 |
| F   | LF Antenna                         | ANT-A        | N/A           | Mitsubishi Electric Corporation | BGBX1T406SKE11A01 |
| G   | LF Antenna                         | ANT-B        | N/A           | Mitsubishi Electric Corporation | BGBX1T406SKE11A01 |
| H   | LF Antenna                         | ANT-C        | N/A           | Mitsubishi Electric Corporation | BGBX1T406SKE11A01 |
| I   | LF Antenna                         | ANT-D        | N/A           | Mitsubishi Electric Corporation | BGBX1T406SKE11A01 |
| J   | LF Antenna                         | ANT-E        | N/A           | Mitsubishi Electric Corporation | BGBX1T406SKE11A01 |
| K   | LF Antenna                         | ANT-F        | N/A           | Mitsubishi Electric Corporation | BGBX1T406SKE11A01 |
| L   | LF Antenna                         | ANT-G        | N/A           | Mitsubishi Electric Corporation | BGBX1T406SKE11A01 |
| M   | Car Battery                        | 50B24L       | N/A           | YUASA                           | -                 |

### **List of cables used (used for only Continuous Receiving mode)**

| No. | Name                 | Length (m) | Shield | Remark |
|-----|----------------------|------------|--------|--------|
| 1   | I/F Cable            | 2.0        | N      | -      |
| 2   | Cable for Checker    | 1.9        | N      | -      |
| 3   | Cable for SKE SW BOX | 2.3        | N      | -      |
| 4   | Antenna Cable        | 2.3        | N      | -      |
| 5   | Antenna Cable        | 2.3        | N      | -      |
| 6   | Antenna Cable        | 2.3        | N      | -      |
| 7   | Antenna Cable        | 2.3        | N      | -      |
| 8   | Antenna Cable        | 2.3        | N      | -      |
| 9   | Antenna Cable        | 2.3        | N      | -      |
| 10  | Antenna Cable        | 2.0        | N      | -      |
| 11  | DC Power Cable       | 0.5        | N      | -      |

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## **SECTION 5: Radiated emission (Fundamental and Spurious Emission)**

### **5.1 Operating environment**

Test place : No.1 and 2 semi anechoic chamber  
 Temperature : See data  
 Humidity : See data

#### **Test Procedure**

The Radiated Electric Field Strength intensity has been measured on No 2 semi anechoic chamber with a ground plane and at a distance of 3m.

1) Frequency : From 9kHz to 30MHz at distance 3m

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.  
 The measurements were performed for each antenna angle 0deg., 45deg. and 90deg.

2) Frequency : From 30MHz to 2GHz at distance 3m

The measuring antenna height varied between 1 and 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.

Measurements were performed with a QP, PK, and AV detector.

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

|               |                                                    |                            |                             |                            |                          |
|---------------|----------------------------------------------------|----------------------------|-----------------------------|----------------------------|--------------------------|
|               | From 9kHz to 90kHz<br>and<br>From 110kHz to 150kHz | From<br>90kHz to<br>110kHz | From<br>150kHz<br>to 490kHz | From<br>490kHz to<br>30MHz | From<br>30MHz to<br>1GHz |
| Detector Type | PK/AV                                              | QP                         | PK/AV                       | QP                         | QP                       |
| IF Bandwidth  | 200Hz                                              | 200Hz                      | 9kHz                        | 9kHz                       | 120kHz                   |

|                 |                        |
|-----------------|------------------------|
| Frequency       | Above 1GHz             |
| Instrument used | Spectrum Analyzer      |
| Detector        | PK: RBW:1MHz/VBW: 1MHz |
| IF Bandwidth    | AV: RBW:1MHz/VBW:10Hz  |

\*Part 15 Section 15.31 (f)(2) (9kHz-30MHz)

[Limit at 3m]=[Limit at 300m]-40 x log (3[m]/300[m])

[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

### **5.5 Results**

Summary of the test results: Pass

Date: October 30 and November 5, 2004

Tested by: Hiroka Umeyama and Norihisa Hashimoto

## **SECTION 6: -26dB Bandwidth (Reference data)**

Fundamental Frequency : 132.4kHz  
 Test data : APPENDIX 3  
 Test result : N/A

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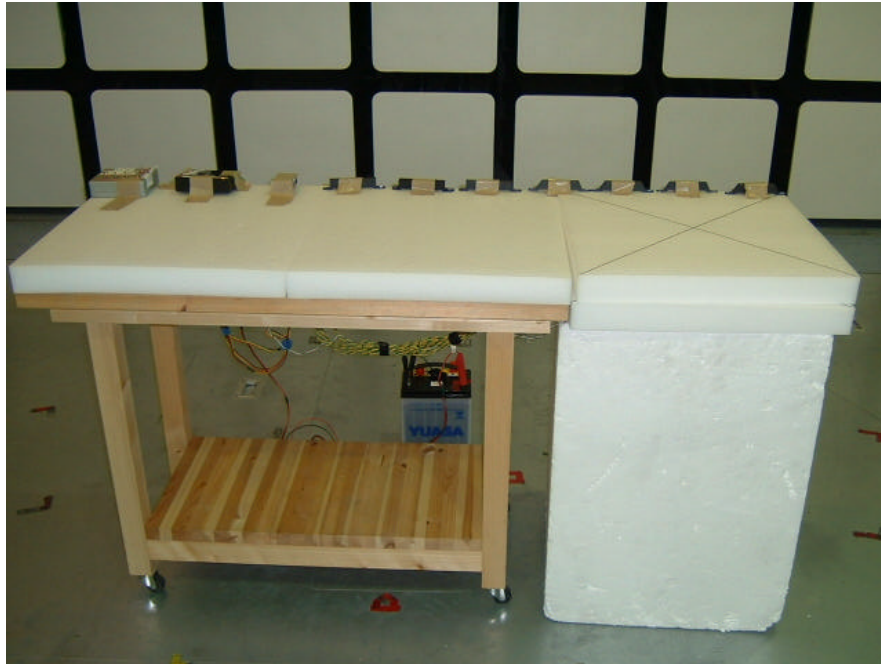
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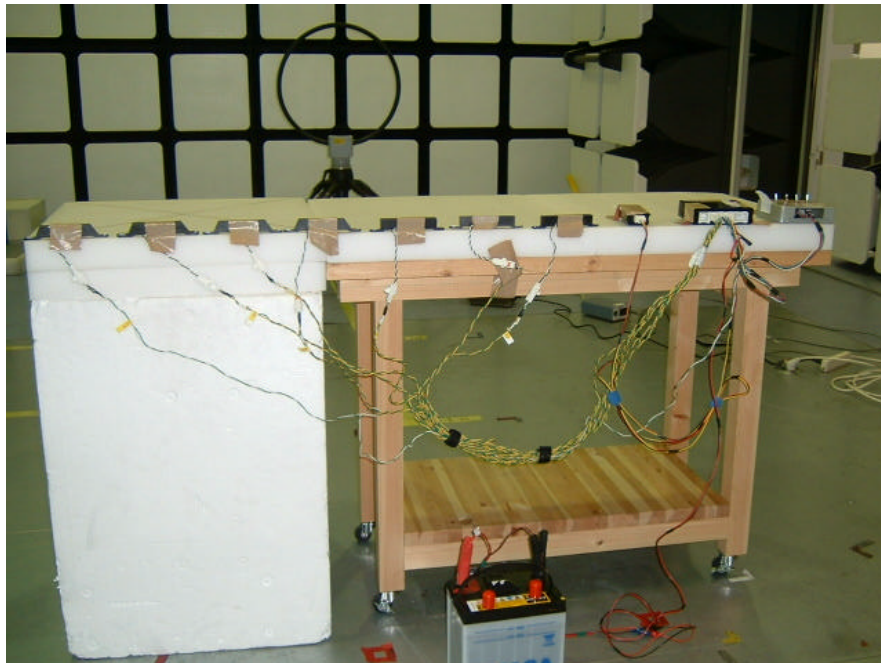
## **APPENDIX 1: Photographs of test setup**

### **Radiated Magnetic Field Strength (Transmitting)**

**Front**

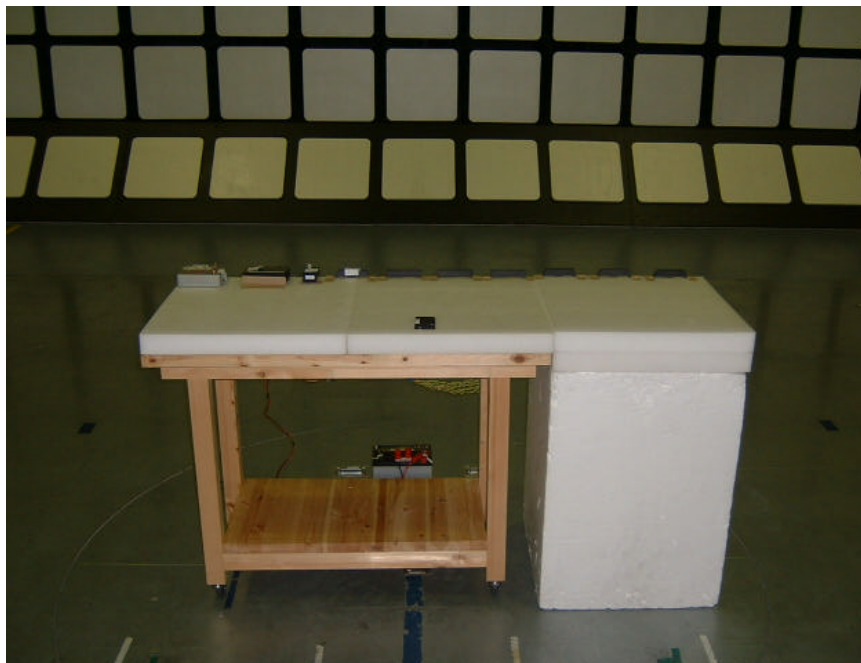


**Rear**

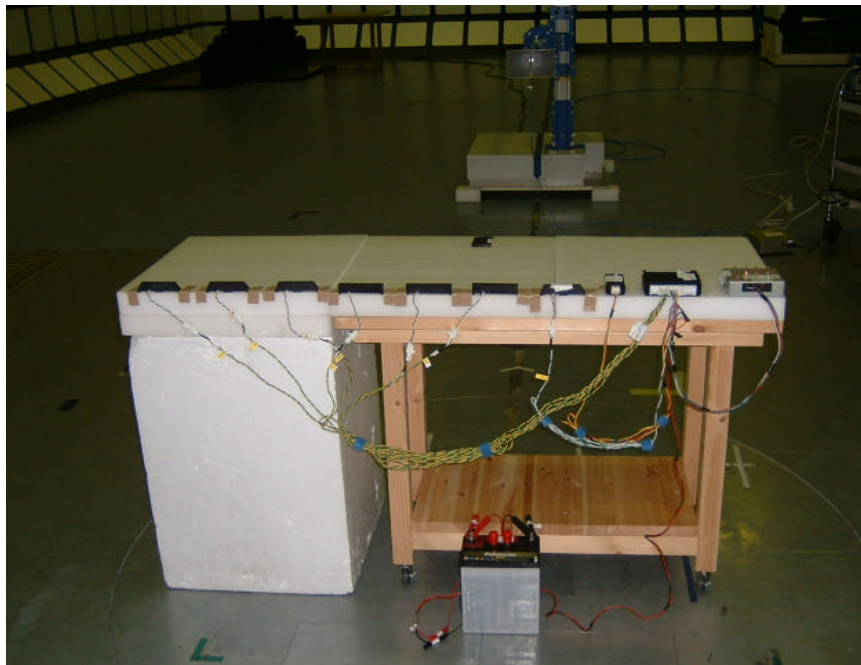


**Radiated emission(Transmitting and Receiving mode)**

**Front**

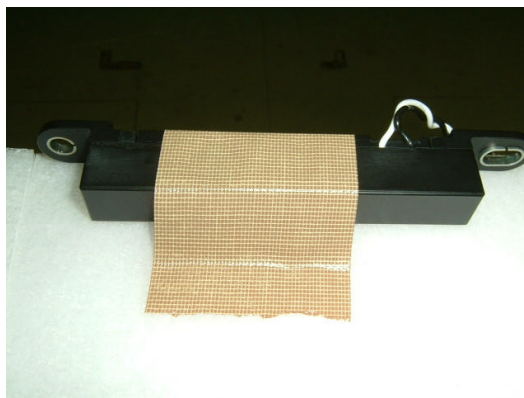


**Rear**

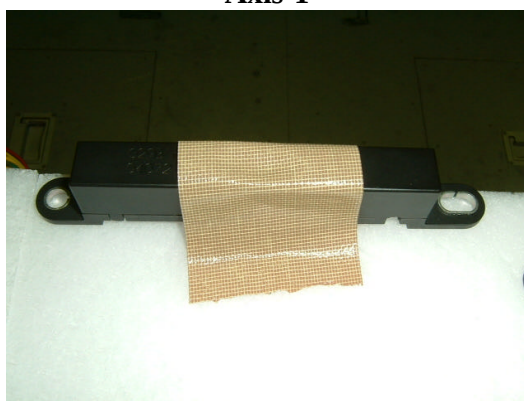


**Worst Case Position:Antenna(Axis Y)**

**Axis X**



**Axis Y**



**Axis Z**

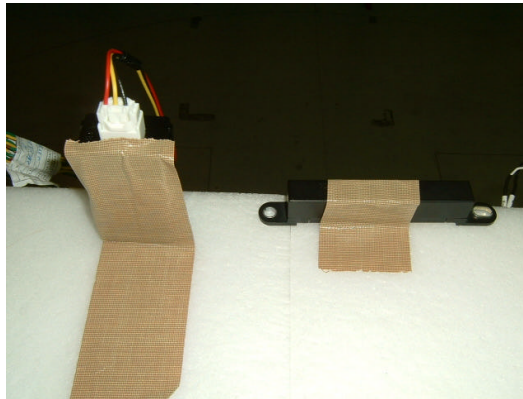


**Worst Case Position:Receiver (Axis X)**

**Axis X**



**Axis Y**



**Axis Z**



## **APPENDIX 2: Test Instruments**

| Control No. | Instrument          | Manufacturer                 | Model No                  | Test Item | Calibration Date *<br>Interval(month) |
|-------------|---------------------|------------------------------|---------------------------|-----------|---------------------------------------|
| MAEC-02     | Anechoic Chamber    | TDK                          | Semi Anechoic Chamber 3m  | RE /ME    | 2004/04/12 * 12                       |
| MTR-02      | Test Receiver       | Rohde & Schwarz              | ESCS30                    | ME        | 2004/02/03 * 12                       |
| MRENT-09    | Spectrum Analyzer   | Advantest                    | R3273                     | ME        | 2004/02/18 * 12                       |
| MCC-13      | Coaxial Cable       | Fujikura/Agilent             | -                         | ME        | 2004/02/24 * 12                       |
| MCC-31      | coaxial cable       | ULApex                       | -                         | ME        | 2004/06/12 * 12                       |
| MAT-07      | Attenuator(6dB)     | Weinschel Corp               | 2                         | ME        | 2003/12/16 * 12                       |
| MPA-06      | Pre Amplifier       | Hewlett Packard              | 8447D                     | ME        | 2004/08/29 * 12                       |
| MLPA-01     | Loop Antenna        | Rohde & Schwarz              | HFH2-Z2                   | ME        | 2004/01/08 * 12                       |
| MCC-01      | Coaxial Cable       | Suhner/storm/Agilent/<br>TSJ | -                         | RE        | 2003/12/19 * 12                       |
| MCC-05      | Microwave Cable     | Storm                        | 421-011                   | RE        | 2004/01/06 * 12                       |
| MCC-23      | Microwave Cable     | Storm                        | -                         | RE        | 2004/05/01 * 12                       |
| MBA-01      | Biconical Antenna   | Schwarzbeck                  | BBA9106                   | RE        | 2004/10/14 * 12                       |
| MLA-01      | Logperiodic Antenna | Schwarzbeck                  | USLP9143                  | RE        | 2004/10/14 * 12                       |
| MHA-05      | Horn Antenna        | Schwarzbeck                  | BBHA9120D                 | RE        | 2004/01/10 * 12                       |
| MTR-01      | Test Receiver       | Rohde & Schwarz              | ESI40                     | RE        | 2003/11/12 * 12                       |
| MPA-04      | Pre Amplifier       | Agilent                      | 8447D                     | RE        | 2004/05/25 * 12                       |
| MPA-05      | Pre Amplifier       | TSJ                          | TSJ 1-26.5GHz<br>PreAmp   | RE        | 2004/06/12 * 12                       |
| MAT-06      | Attenuator(6dB)     | Weinschel Corp               | 2                         | RE        | 2003/12/16 * 12                       |
| MAEC-01     | Anechoic Chamber    | TDK                          | Semi Anechoic Chamber 10m | RE        | 2003/12/27 * 12                       |

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

Test Item:

RE: Radiated emission

ME: Radiated Magnetic Field Strength 150kHz – 30MHz

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### APPENDIX 3: Data of EMI test

#### Radiated Emission (Transmitting)

| UL Apex Co., LTD.                                                                                                                                                                          |         |       |          |         |        |       |       |      |          | Head office EMC Lab. No.2 Semi Anechoic Chamber |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|----------|---------|--------|-------|-------|------|----------|-------------------------------------------------|--------|
| Company : Mitsubishi Electric Corporation                                                                                                                                                  |         |       |          |         |        |       |       |      |          | Report No. : 24HE0134-HO                        |        |
| Equipment : SMART KEYLESS SYSTEM                                                                                                                                                           |         |       |          |         |        |       |       |      |          | Regulation : FCC Part15C Section 15.209         |        |
| Model : SKE11A-01 (Receiver and Antenna)                                                                                                                                                   |         |       |          |         |        |       |       |      |          | Test Distance : 3m                              |        |
| Sample No. : 1                                                                                                                                                                             |         |       |          |         |        |       |       |      |          | Date : 2004/10/30                               |        |
| Power : DC12.0V (ECU)                                                                                                                                                                      |         |       |          |         |        |       |       |      |          | Engineer : Hiroka Umeyama                       |        |
| Mode : Transmitting (132.45kHz)                                                                                                                                                            |         |       |          |         |        |       |       |      |          |                                                 |        |
| : Antenna B Y-Axis, Receiver X-Axis (MAX)                                                                                                                                                  |         |       |          |         |        |       |       |      |          |                                                 |        |
| Temperature : 24deg.C                                                                                                                                                                      |         |       |          |         |        |       |       |      |          |                                                 |        |
| Humidity : 60%                                                                                                                                                                             |         |       |          |         |        |       |       |      |          |                                                 |        |
| No.                                                                                                                                                                                        | FREQ    | Loop  | detector | T/R     | ANT    | ATTEN | CABLE | AMP  | RESULT   | LIMIT                                           | MARGIN |
|                                                                                                                                                                                            |         | Max   | type     | READING | Factor |       | LOSS  | GAIN |          |                                                 |        |
|                                                                                                                                                                                            | [kHz]   | [deg] |          | [dBuV]  | [dB]   | [dB]  | [dB]  | [dB] | [dBuV/m] | [dBuV/m]                                        | [dB]   |
| 1                                                                                                                                                                                          | 132.45  | 0     | PK       | 103.4   | 19.9   | 5.7   | 0.1   | 26.4 | 102.7    | 125.1                                           | 22.4   |
| 2                                                                                                                                                                                          | 132.45  | 0     | AV       | 101.9   | 19.9   | 5.7   | 0.1   | 26.4 | 101.2    | 105.1                                           | 3.9    |
| 3                                                                                                                                                                                          | 264.90  | 0     | PK       | 80.0    | 19.9   | 5.7   | 0.1   | 27.3 | 78.4     | 119.1                                           | 40.7   |
| 4                                                                                                                                                                                          | 264.90  | 0     | AV       | 64.9    | 19.9   | 5.7   | 0.1   | 27.3 | 63.3     | 99.1                                            | 35.8   |
| 5                                                                                                                                                                                          | 397.35  | 0     | PK       | 69.2    | 19.8   | 5.7   | 0.1   | 27.6 | 67.2     | 115.6                                           | 48.4   |
| 6                                                                                                                                                                                          | 397.35  | 0     | AV       | 55.4    | 19.8   | 5.7   | 0.1   | 27.6 | 53.4     | 95.6                                            | 42.2   |
| 7                                                                                                                                                                                          | 529.80  | 0     | QP       | 59.5    | 19.8   | 5.8   | 0.1   | 27.7 | 57.5     | 73.1                                            | 15.6   |
| 8                                                                                                                                                                                          | 662.25  | 0     | QP       | 63.7    | 19.8   | 5.8   | 0.1   | 27.7 | 61.7     | 71.1                                            | 9.4    |
| 9                                                                                                                                                                                          | 794.70  | 0     | QP       | 59.0    | 19.8   | 5.7   | 0.1   | 27.8 | 56.8     | 69.6                                            | 12.8   |
| 10                                                                                                                                                                                         | 927.15  | 0     | QP       | 60.6    | 19.8   | 5.8   | 0.1   | 27.8 | 58.5     | 68.2                                            | 9.7    |
| 11                                                                                                                                                                                         | 1059.60 | 0     | QP       | 53.0    | 19.8   | 5.8   | 0.1   | 27.8 | 50.9     | 67.1                                            | 16.2   |
| 12                                                                                                                                                                                         | 1192.05 | 0     | QP       | 57.8    | 19.8   | 5.8   | 0.1   | 27.8 | 55.7     | 66.0                                            | 10.3   |
| 13                                                                                                                                                                                         | 1324.50 | 0     | QP       | 51.8    | 19.8   | 5.8   | 0.1   | 27.8 | 49.7     | 65.1                                            | 15.4   |
| REMARKS                                                                                                                                                                                    |         |       |          |         |        |       |       |      |          |                                                 |        |
| ANTENNA TYPE : 10kHz-30MHz (Loop Antenna)                                                                                                                                                  |         |       |          |         |        |       |       |      |          |                                                 |        |
| CALCULATION: READING + ANT Factor + ATTEN + Cable Loss - AMP Gain                                                                                                                          |         |       |          |         |        |       |       |      |          |                                                 |        |
| For fundamental, the measured field strength was extrapolated to distance 300m, using the formula that field strength varies as the inverse distance square (40dB per decade of distance). |         |       |          |         |        |       |       |      |          |                                                 |        |
| Sample calculation:                                                                                                                                                                        |         |       |          |         |        |       |       |      |          |                                                 |        |
| Peak: 102.2dBuV/m -40log(300/3)= 102.2 - 80 = 22.2dBuV/m at 300m                                                                                                                           |         |       |          |         |        |       |       |      |          |                                                 |        |
| Limits for fundamental (section 15.209(a)) =20log(2400/125) + 20 = 45.7dBuV/m                                                                                                              |         |       |          |         |        |       |       |      |          |                                                 |        |
| Average: 76.7dBuV/m -40log(300/3)= 76.7 - 80 = -3.3dBuV/m at 300m                                                                                                                          |         |       |          |         |        |       |       |      |          |                                                 |        |
| Limits for fundamental (section 15.209(a)) =20log(2400/125) = 25.7dBuV/m                                                                                                                   |         |       |          |         |        |       |       |      |          |                                                 |        |
| Limit: (9kHz - 490kHz): 2400/Freq (Converted dBuV/m) + 40log(300/3)                                                                                                                        |         |       |          |         |        |       |       |      |          |                                                 |        |
| Limit: (490kHz - 1.705MHz): 24000/Freq (Converted dBuV/m) + 40log(30/3)                                                                                                                    |         |       |          |         |        |       |       |      |          |                                                 |        |
| Limit: (1.705MHz - 30MHz): 30(Converted dBuV/m) + 40log(30/3)                                                                                                                              |         |       |          |         |        |       |       |      |          |                                                 |        |
| All other spurious emissions are more than 20dB below the limits.                                                                                                                          |         |       |          |         |        |       |       |      |          |                                                 |        |

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MF060b(10.04.03)

Test report No. : 24HE0134-HO-3  
Page : 15 of 21  
Issued date : November 26, 2004  
FCC ID : BGBX1T406SKE11A01  
Revised date : December 7, 2004

## Radiated Emission (Transmitting)

UL Apex Co., LTD.  
Head office EMC Lab. No.2 Semi Anechoic Chamber

Company : Mitsubishi Electric Corporation  
Equipment : SMART KEYLESS SYSTEM  
Model : SKE11A-01 (Receiver and Antenna)  
Sample No. : 1  
Power : DC12.0V (ECU)  
Mode : Transmitting (132.45kHz)  
: Antenna D Y-Axis MIN), Receiver X-Axis  
Temperature : 24deg.C  
Humidity : 60%

Report No. : 24HE0134-HO  
Regulation : FCC Part15C Section 15.209  
Test Distance : 3m  
Date : 2004/10/30  
Engineer : Hiroka Umeyama

| No. | FREQ<br>[kHz] | Loop<br>Max<br>Angle<br>[deg] | detector | T/R     | ANT<br>Factor | ATTEN | CABLE<br>LOSS | AMP<br>GAIN | RESULT   | LIMIT    | MARGIN |
|-----|---------------|-------------------------------|----------|---------|---------------|-------|---------------|-------------|----------|----------|--------|
|     |               |                               | type     | READING |               |       |               |             |          |          |        |
|     |               |                               |          | [dBuV]  | [dB]          | [dB]  | [dB]          | [dB]        | [dBuV/m] | [dBuV/m] | [dB]   |
| 1   | 132.40        | 0                             | PK       | 85.3    | 19.9          | 5.7   | 0.1           | 26.4        | 84.6     | 125.1    | 40.5   |
| 2   | 132.40        | 0                             | AV       | 83.4    | 19.9          | 5.7   | 0.1           | 26.4        | 82.7     | 105.1    | 22.4   |
| 3   | 264.80        | 0                             | PK       | 58.7    | 19.9          | 5.7   | 0.1           | 27.3        | 57.1     | 119.1    | 62.0   |
| 4   | 264.80        | 0                             | AV       | 42.7    | 19.9          | 5.7   | 0.1           | 27.3        | 41.1     | 99.1     | 58.0   |
| 5   | 397.20        | 0                             | PK       | 64.8    | 19.8          | 5.7   | 0.1           | 27.6        | 62.8     | 115.6    | 52.8   |
| 6   | 397.20        | 0                             | AV       | 50.5    | 19.8          | 5.7   | 0.1           | 27.6        | 48.5     | 95.6     | 47.1   |
| 7   | 529.60        | 0                             | QP       | 53.8    | 19.8          | 5.8   | 0.1           | 27.7        | 51.8     | 73.1     | 21.3   |
| 8   | 662.00        | 0                             | QP       | 53.8    | 19.8          | 5.8   | 0.1           | 27.7        | 51.8     | 71.1     | 19.3   |
| 9   | 794.40        | 0                             | QP       | 42.3    | 19.8          | 5.7   | 0.1           | 27.8        | 40.1     | 69.6     | 29.5   |
| 10  | 926.80        | 0                             | QP       | 48.3    | 19.8          | 5.8   | 0.1           | 27.8        | 46.2     | 68.2     | 22.0   |
| 11  | 1059.20       | 0                             | QP       | 39.7    | 19.8          | 5.8   | 0.1           | 27.8        | 37.6     | 67.1     | 29.5   |
| 12  | 1191.60       | 0                             | QP       | 45.7    | 19.8          | 5.8   | 0.1           | 27.8        | 43.6     | 66.0     | 22.4   |
| 13  | 1324.00       | 0                             | QP       | 37.5    | 19.8          | 5.8   | 0.1           | 27.8        | 35.4     | 65.1     | 29.7   |

### REMARKS

ANTENNA TYPE : 10kHz-30MHz (Loop Antenna)

CALCULATION: READING + ANT Factor + ATTEN + Cable Loss - AMP Gain

For fundamental, the measured field strength was extrapolated to distance 300m, using the formula that field strength varies as the inverse distance square (40dB per decade of distance).

Sample calculation:

Peak:  $102.2\text{dBuV/m} - 40\log(300/3) = 102.2 - 80 = 22.2\text{dBuV/m}$  at 300m

Limits for fundamental (section 15.209(a))  $= 20\log(2400/125) + 20 = 45.7\text{dBuV/m}$

Average:  $76.7\text{dBuV/m} - 40\log(300/3) = 76.7 - 80 = -3.3\text{dBuV/m}$  at 300m

Limits for fundamental (section 15.209(a))  $= 20\log(2400/125) = 25.7\text{dBuV/m}$

Limit: (9kHz - 490kHz):  $2400/\text{Freq (Converted dBuV/m)} + 40\log(300/3)$

Limit: (490kHz - 1.705MHz):  $24000/\text{Freq (Converted dBuV/m)} + 40\log(30/3)$

Limit: (1.705MHz - 30MHz):  $30(\text{Converted dBuV/m}) + 40\log(30/3)$

All other spurious emissions are more than 20dB below the limits.

Page:

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MF060b(10.04.03)

## Radiated Emission (Transmitting) above 30MHz

### DATA OF RADIATED EMISSION TEST

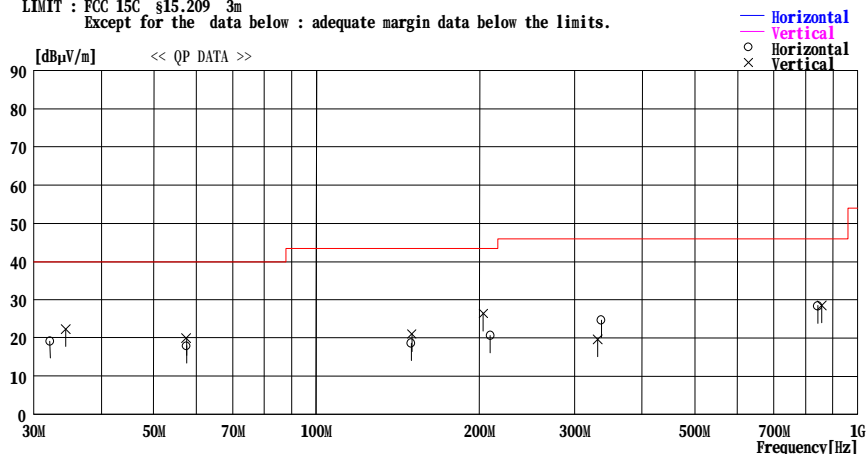
UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber  
Date : 2004/11/05 14:04:55

Applicant : Mitsubishi Electric Corporation  
Kind of EUT : SMART KEYLESS SYSTEM  
Model No. : SKE11A-01  
Serial No. : 1  
Report No. : 24HE0134-HO  
Power : DC12.0V  
Temp°C/Humi% : 23deg.C / 40%  
Operator : Norihisa Hashimoto

Mode / Remarks : Transmitting:132.45kHz

LIMIT : FCC 15C §15.209 3m

Except for the data below : adequate margin data below the limits.



| No.                    | FREQ<br>[MHz] | READING<br>QP<br>[dBμV] | ANT<br>FACTOR<br>[dB/m] | LOSS<br>[dB] | GAIN<br>[dB] | RESULT<br>[dBμV/m] | LIMIT<br>[dBμV/m] | MARGIN<br>[dB] | ANTENNA<br>[cm] | TABLE<br>[DEG] |
|------------------------|---------------|-------------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|-----------------|----------------|
| ----- Horizontal ----- |               |                         |                         |              |              |                    |                   |                |                 |                |
| 1                      | 32.188        | 21.9                    | 17.9                    | 7.0          | 27.7         | 19.1               | 40.0              | 20.9           | 121             | 304            |
| 2                      | 57.478        | 29.4                    | 8.8                     | 7.4          | 27.7         | 17.9               | 40.0              | 22.1           | 359             | 166            |
| 3                      | 149.638       | 22.7                    | 15.0                    | 8.5          | 27.6         | 18.6               | 43.5              | 24.9           | 119             | 238            |
| 4                      | 209.475       | 21.5                    | 17.2                    | 9.3          | 27.3         | 20.7               | 43.5              | 22.8           | 299             | 331            |
| 5                      | 335.716       | 26.2                    | 15.8                    | 10.1         | 27.5         | 24.6               | 46.0              | 21.4           | 106             | 206            |
| 6                      | 844.252       | 22.8                    | 21.3                    | 12.9         | 28.6         | 28.4               | 46.0              | 17.6           | 291             | 134            |
| ----- Vertical -----   |               |                         |                         |              |              |                    |                   |                |                 |                |
| 7                      | 34.405        | 26.1                    | 16.9                    | 7.2          | 27.9         | 22.3               | 40.0              | 17.7           | 395             | 9              |
| 8                      | 57.480        | 31.5                    | 8.8                     | 7.4          | 27.7         | 20.0               | 40.0              | 20.0           | 118             | 238            |
| 9                      | 149.977       | 25.1                    | 15.0                    | 8.5          | 27.6         | 21.0               | 43.5              | 22.5           | 145             | 207            |
| 10                     | 203.350       | 27.2                    | 17.1                    | 9.3          | 27.2         | 26.4               | 43.5              | 17.1           | 140             | 251            |
| 11                     | 330.706       | 21.5                    | 15.6                    | 10.1         | 27.5         | 19.7               | 46.0              | 26.3           | 385             | 42             |
| 12                     | 858.458       | 22.9                    | 21.3                    | 12.9         | 28.6         | 28.5               | 46.0              | 17.5           | 354             | 195            |

CHART:WITHOUT FACTOR ANT TYPE : -30MHz LOOP,30-300MHz BICONICAL,300MHz-1000MHz LOGPERIODIC,1000MHz- HORN  
CALCULATION : READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - AMP.GAIN

Page:

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MF060b(10.04.03)



-26dB Bandwidth

UL Apex Co., LTD.  
Head office EMC Lab. No.2 Semi Anechoic Chamber

Company

Equipment

Model

Sample No.

Power

Mode

Temperature

Humidity

: Mitsubishi Electric Corporation

: SMART KEYLESS SYSTEM

: SKE11A-01 (Receiver and Antenna)

: 1

: DC12.0V (ECU)

: Transmitting (132.45kHz)

: 24deg.C

: 60%

Report No.

Regulation

Test Distance

Date

Engineer

: 24HE0134-HO

: -

: 3m

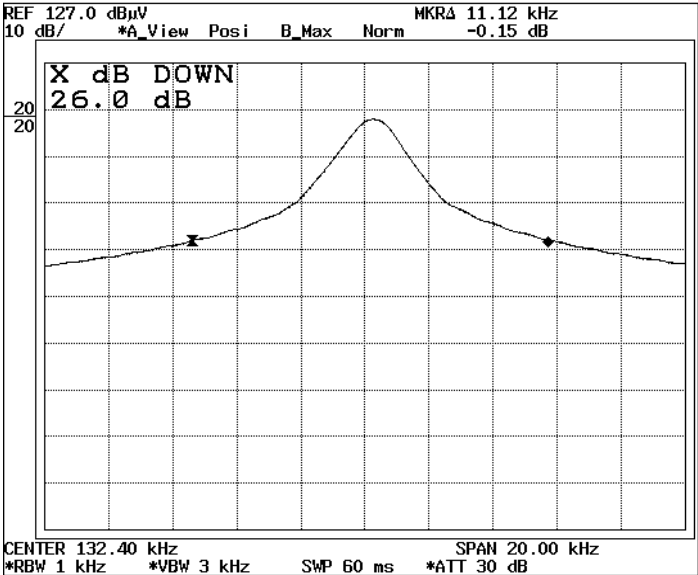
: 2004/10/30

: Hiroka Umeyama

: Antenna B Y-Axis, Receiver X-Axis

: MAX)

| -26dB Bandwidth | Bandwidth Limit | Result |
|-----------------|-----------------|--------|
| [kHz]           | [kHz]           |        |
| 11.12           | -               | -      |



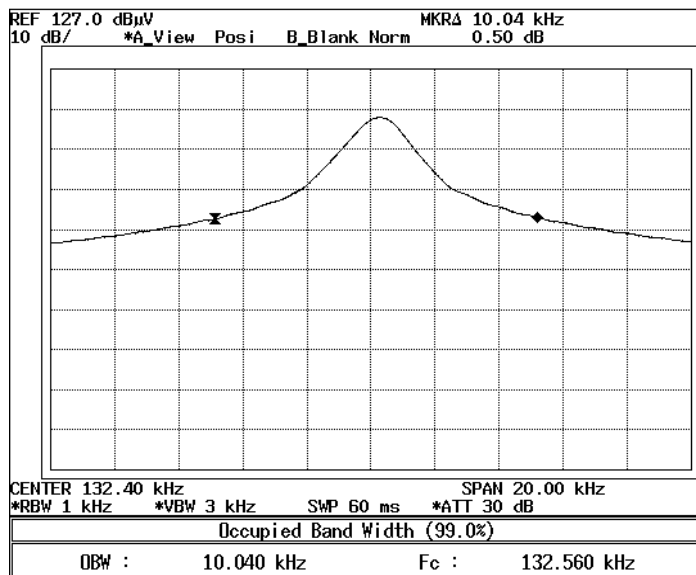
## 99% Occupied Bandwidth

UL Apex Co., LTD.  
Head office EMC Lab. No.2 Semi Anechoic Chamber

|             |                                           |
|-------------|-------------------------------------------|
| Company     | : Mitsubishi Electric Corporation         |
| Equipment   | : SMART KEYLESS SYSTEM                    |
| Model       | : SKE11A-01 (Receiver and Antenna)        |
| Sample No.  | : 1                                       |
| Power       | : DC12.0V (ECU)                           |
| Mode        | : Transmitting (132.45kHz)                |
|             | : Antenna B Y-Axis, Receiver X-Axis (MAX) |
| Temperature | : 24deg.C                                 |
| Humidity    | : 60%                                     |

|               |                  |
|---------------|------------------|
| Report No.    | : 24HE0134-HO    |
| Regulation    | : RSS210         |
| Test Distance | : 3m             |
| Date          | : 2004/10/30     |
| Engineer      | : Hiroka Umeyama |

| 99% Occupied Bandwidth | Bandwidth Limit | Result |
|------------------------|-----------------|--------|
| [kHz]                  | [kHz]           |        |
| 10.04                  | -               | -      |



## Radiated Emission (Receiving)

### DATA OF RADIATED EMISSION TEST

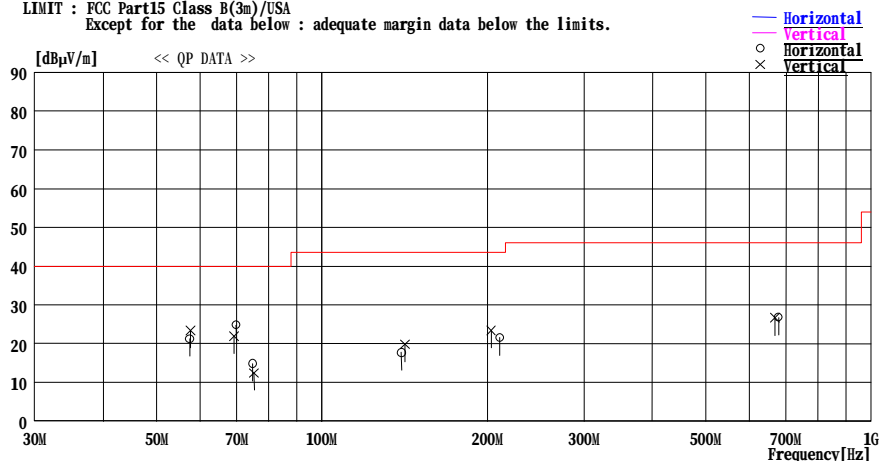
UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber  
Date : 2004/11/05 11:02:33

Applicant : Mitsubishi Electric Corporation  
Kind of EUT : SMART KEYLESS SYSTEM  
Model No. : SKE11A-01  
Serial No. : 1

Report No. : 24HE0134-HO  
Power : DC12.0V  
Temp°C/Humi% : 23deg.C / 40%  
Operator : Norihisa Hashimoto

Mode / Remarks : Receiving:315MHz

LIMIT : FCC Part15 Class B(3m)/USA  
Except for the data below : adequate margin data below the limits.



| No.                    | FREQ<br>[MHz] | READING<br>QP<br>[dBμV] | ANT<br>FACTOR<br>[dB/m] | LOSS<br>[dB] | GAIN<br>[dB] | RESULT<br>[dBμV/m] | LIMIT<br>[dBμV/m] | MARGIN<br>[dB] | ANTENNA<br>[cm] | TABLE<br>[DEG] |
|------------------------|---------------|-------------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|-----------------|----------------|
| ----- Horizontal ----- |               |                         |                         |              |              |                    |                   |                |                 |                |
| 1                      | 57.469        | 32.7                    | 8.8                     | 7.4          | 27.7         | 21.2               | 40.0              | 18.8           | 325             | 177            |
| 2                      | 69.803        | 38.1                    | 6.9                     | 7.6          | 27.8         | 24.8               | 40.0              | 15.2           | 266             | 185            |
| 3                      | 74.910        | 28.2                    | 6.8                     | 7.4          | 27.6         | 14.8               | 40.0              | 25.2           | 269             | 187            |
| 4                      | 139.587       | 22.3                    | 14.4                    | 8.5          | 27.6         | 17.6               | 43.5              | 25.9           | 241             | 294            |
| 5                      | 210.721       | 22.3                    | 17.2                    | 9.3          | 27.3         | 21.5               | 43.5              | 22.0           | 270             | 131            |
| 6                      | 678.720       | 22.8                    | 20.6                    | 12.2         | 28.8         | 26.8               | 46.0              | 19.2           | 100             | 190            |
| ----- Vertical -----   |               |                         |                         |              |              |                    |                   |                |                 |                |
| 7                      | 57.622        | 35.0                    | 8.8                     | 7.4          | 27.8         | 23.4               | 40.0              | 16.6           | 100             | 270            |
| 8                      | 69.261        | 35.1                    | 7.0                     | 7.6          | 27.8         | 21.9               | 40.0              | 18.1           | 100             | 246            |
| 9                      | 75.271        | 25.9                    | 6.7                     | 7.4          | 27.6         | 12.4               | 40.0              | 27.6           | 100             | 258            |
| 10                     | 141.606       | 24.3                    | 14.5                    | 8.6          | 27.6         | 19.8               | 43.5              | 23.7           | 102             | 203            |
| 11                     | 203.225       | 24.2                    | 17.1                    | 9.3          | 27.2         | 23.4               | 43.5              | 20.1           | 100             | 256            |
| 12                     | 667.796       | 22.7                    | 20.5                    | 12.1         | 28.7         | 26.6               | 46.0              | 19.4           | 100             | 202            |

CHART:WITH FACTOR ANT TYPE : -30MHz LOOP,30-300MHz BICONICAL,300MHz-1000MHz LOGPERIODIC,1000MHz- HORN  
CALCULATION : READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - AMP.GAIN Page:

Test report No. : 24HE0134-HO-3  
Page : 20 of 21  
Issued date : November 26, 2004  
FCC ID : BGBX1T406SKE11A01  
Revised date : December 7, 2004

## DATA OF RADIATED EMISSION TEST

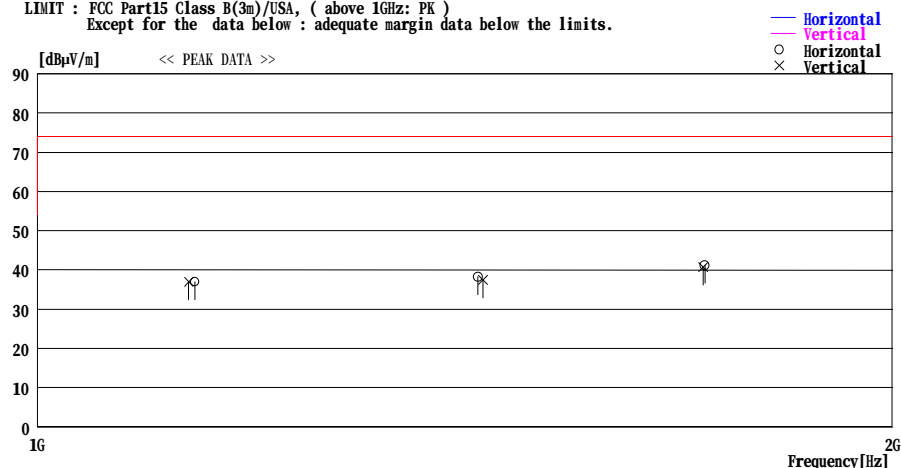
UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber  
Date : 2004/11/05 16:04:27

Applicant : Mitsubishi Electric Corporation  
Kind of EUT : SMART KEYLESS SYSTEM  
Model No. : SKE11A-01  
Serial No. : 1

Report No. : 24HE0134-HO  
Power : DC12.0V  
Temp°C/Humi% : 23deg.C / 40%  
Operator : Norihisa Hashimoto

Mode / Remarks : Receiving:315MHz

LIMIT : FCC Part15 Class B(3m)/USA, ( above 1GHz: PK )  
Except for the data below : adequate margin data below the limits.



| No.                    | FREQ<br>[MHz] | READING<br>PK<br>[dBμV] | ANT<br>FACTOR<br>[dB/m] | LOSS<br>[dB] | GAIN<br>[dB] | RESULT<br>[dBμV/m] | LIMIT<br>[dBμV/m] | MARGIN<br>[dB] | ANTENNA<br>[cm] | TABLE<br>[DEG] |
|------------------------|---------------|-------------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|-----------------|----------------|
| ----- Horizontal ----- |               |                         |                         |              |              |                    |                   |                |                 |                |
| 1                      | 1136.274      | 50.3                    | 22.8                    | 3.7          | 39.9         | 36.9               | 74.0              | 37.1           | 100             | 353            |
| 2                      | 1428.862      | 49.9                    | 23.9                    | 4.1          | 39.7         | 38.2               | 74.0              | 35.8           | 100             | 133            |
| 3                      | 1717.442      | 49.2                    | 26.9                    | 4.6          | 39.5         | 41.2               | 74.0              | 32.8           | 100             | 342            |
| ----- Vertical -----   |               |                         |                         |              |              |                    |                   |                |                 |                |
| 4                      | 1130.262      | 50.4                    | 22.8                    | 3.6          | 39.9         | 36.9               | 74.0              | 37.1           | 100             | 353            |
| 5                      | 1434.874      | 49.0                    | 24.0                    | 4.1          | 39.7         | 37.4               | 74.0              | 36.6           | 100             | 210            |
| 6                      | 1715.438      | 48.8                    | 26.8                    | 4.6          | 39.5         | 40.7               | 74.0              | 33.3           | 100             | 67             |

CHART:WITH FACTOR ANT TYPE : -30MHz LOOP,30-300MHz BICONICAL,300MHz-1000MHz LOGPERIODIC,1000MHz- HORN  
CALCULATION : READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - AMP.GAIN Page:

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MF060b(10.04.03)

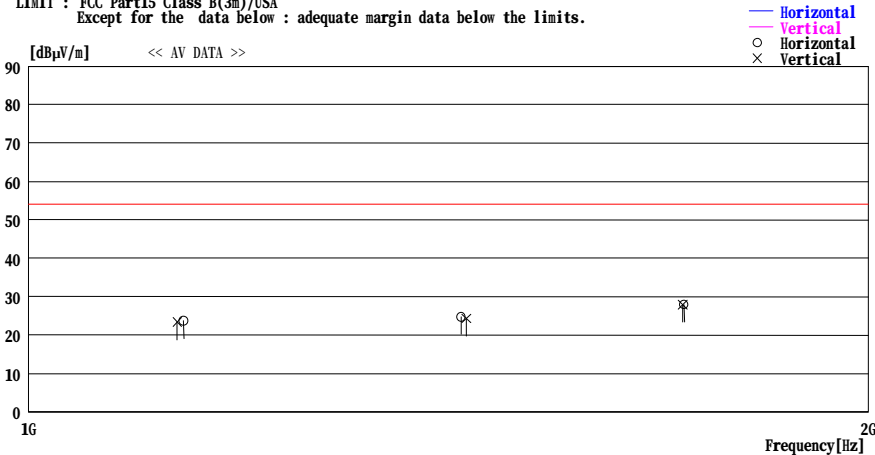
DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber  
Date : 2004/11/05 16:04:27

Applicant : Mitsubishi Electric Corporation  
Kind of EUT : SMART KEYLESS SYSTEM  
Model No. : SKE11A-01  
Serial No. : 1  
Report No. : 24HE0134-HO  
Power : DC12.0V  
Temp°C/Humi% : 23deg.C / 40%  
Operator : Norihisa Hashimoto

Mode / Remarks : Receiving:315MHz

LIMIT : FCC Part15 Class B(3m)/USA  
Except for the data below : adequate margin data below the limits.



| No.                    | FREQ<br>[MHz] | READING<br>AV<br>[dBμV] | ANT<br>FACTOR<br>[dB/m] | LOSS<br>[dB] | GAIN<br>[dB] | RESULT<br>[dBμV/m] | LIMIT<br>[dBμV/m] | MARGIN<br>[dB] | ANTENNA<br>[cm] | TABLE<br>[DEG] |
|------------------------|---------------|-------------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|-----------------|----------------|
| ----- Horizontal ----- |               |                         |                         |              |              |                    |                   |                |                 |                |
| 1                      | 1136.274      | 37.1                    | 22.8                    | 3.7          | 39.9         | 23.7               | 54.0              | 30.3           | 100             | 353            |
| 2                      | 1428.862      | 36.4                    | 23.9                    | 4.1          | 39.7         | 24.7               | 54.0              | 29.3           | 100             | 133            |
| 3                      | 1717.442      | 36.0                    | 26.9                    | 4.6          | 39.5         | 28.0               | 54.0              | 26.0           | 100             | 342            |
| ----- Vertical -----   |               |                         |                         |              |              |                    |                   |                |                 |                |
| 4                      | 1130.262      | 36.9                    | 22.8                    | 3.6          | 39.9         | 23.4               | 54.0              | 30.7           | 100             | 353            |
| 5                      | 1434.874      | 35.9                    | 24.0                    | 4.1          | 39.7         | 24.3               | 54.0              | 29.7           | 100             | 210            |
| 6                      | 1715.438      | 36.0                    | 26.8                    | 4.6          | 39.5         | 27.9               | 54.0              | 26.1           | 100             | 67             |

CHART:WITH FACTOR ANT TYPE : -30MHz LOOP,30-300MHz BICONICAL,300MHz-1000MHz LOGPERIODIC,1000MHz- HORN  
CALCULATION : READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - AMP.GAIN Page: