



EMI TEST REPORT

Test Report No. : 24HE0134-HO-1

Applicant : Mitsubishi Electric Corporation Himeji Works

Type of Equipment : Smart keyless system (Transceiver)

Model No. : SKE11A-01

Test standard : FCC Part 15 2004
Subpart C Section 15.209, Section 15.231
(Certification)
FCC Part 15 Subpart B : 2004
Section 15.109 (Verification)

FCC ID : BGBX1T458SKE11A01

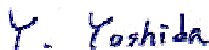
Test Result : Complied

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.

Date of test:

November 2, 5 and 19, 2004

Tested by:



Yutaka Yoshida
EMC Service



Norihisa Hashimoto
EMC Service

Approved by :



Naoki Sakamoto
Group Leader of
EMC Service

UL Apex Co., Ltd.

Head Office EMC Lab.

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SECTION 1: Client information

Company Name : Mitsubishi Electric Corporation Himeji Works
Address : 840 CHIYODA-MACHI HIMEJI HYOGO 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 (Transceiver)
Model No. : SKE11A-01
Serial No. : 3 (For Radiated Emission; Transmitter Fundamental and Spurious Emission only),
4 (For other test)
Country of Manufacture : Japan
Receipt Date of Sample : October 15, 2004
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)

2.2 Product Description

Model No: SKE11A-01 is the Smart keyless entry system.
The clock frequency of EUT is 5MHz(CPU).

Equipment Type : Transceiver
Frequency operation : 315MHz(Transmitter), 132.45kHz(Receiver)
Type of modulation : FSK(Frequency shift keying)
Mode of operation : Simplex
Antenna Type : Pattern Antenna (Transmitter)/ Inductive loop (Receiver)
Method of Frequency Generation : SAW RESONATOR (Transmitter)
Synthesizer (Receiver)
Power Supply : DC 3.0V
Temperature of operation : -40 deg.C. – 85deg.C.

FCC 15.31 (e)

This test was performed with the New Battery (DC 3.0V) and the constant voltage was supplied to this EUT during the tests. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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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 15.231 Periodic operation in the band 40.66 - 40.70MHz
and above 70MHz

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

3.2 Procedures and results

1) FCC Part 15 Subpart C: 2004

No.	Item	Test Procedure	Specification	Deviation	Worst margin	Results
1	Automatically Deactivate	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.231(a)(1)	N/A	-	Complied
2	Electric Field Strength of Fundamental Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.231(b)	N/A	4.8dB 315.00MHz Horizontal	Complied
3	Electric Field Strength of Spurious Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.205 Section 15.209 Section 15.231(b)	N/A	2.7dB (QP) 945.00MHz Horizontal	Complied
4	-20dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.231(c)	N/A	-	Complied

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

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 69.803MHz Horizontal	Complied
2	Conducted Emission	ANSI C63.4:2003	FCC Section 15.107(a) 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.

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3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS210(issue 5): 2001 + Amendment:2002 + Amendment2:2003 + Amendment3:2004	RSS210(issue 5): 2001 + Amendment:2002 + Amendment2:2003 + Amendment3:2004	Radiated	N/A	N/A	N/A

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 15.231 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 Biconical antenna is ± 4.5 dB.
The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is ± 5.2 dB.
The measurement uncertainty (with a 95% confidence level) for this test using Horn Antenna is ± 6.6 dB.
The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.6 Test Location

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	Listed date (for FCC)	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other 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.

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

4.1 Operating Modes

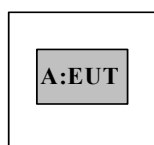
Test mode is used : Continuous Transmitting mode (315MHz)
Continuous Receiving mode (132.45kHz)

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

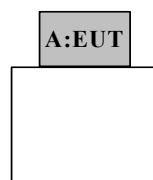
4.2 Configuration and peripherals

[Configuration of continuous transmitting mode]

Top view

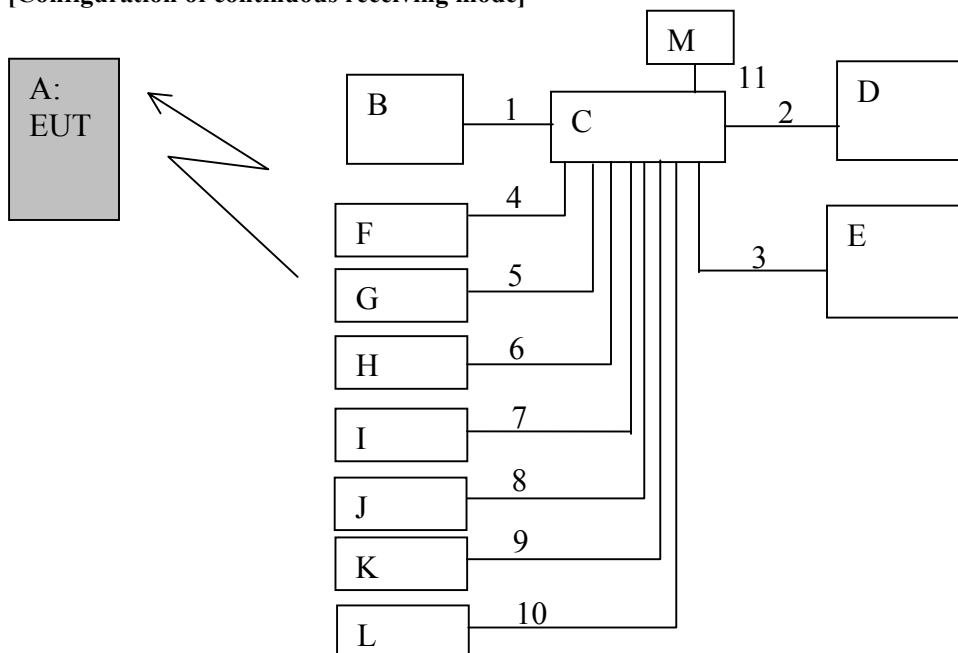


Front view



* Test data was taken under worse case conditions.

[Configuration of continuous receiving mode]



* Test data was taken under worse case conditions.

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Description of EUT and Support Equipment

[Continuous Transmitting mode]

No.	Item	Model number	Serial number	Manufacturer	FCC ID
A	Smart keyless system (Transceiver)	SKE11A-01	3 *1) 4 *2)	Mitsubishi Electric Corporation	BGBX1T458SKE11A01

*1) For Radiated Emission; Transmitter Fundamental and Spurious Emission only

*2) For other tests.

[Continuous Receiving mode]

No.	Item	Model number	Serial number	Manufacturer	FCC ID
A	Smart keyless system (Transceiver)	SKE11A-01	4	Mitsubishi Electric Corporation	BGBX1T458SKE11A01
B	Receiver	SKE11A-01	N/A	Mitsubishi Electric Corporation	BGBX1T406SKE11A01
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	-
G	LF Antenna	ANT-B	N/A	Mitsubishi Electric Corporation	-
H	LF Antenna	ANT-C	N/A	Mitsubishi Electric Corporation	-
I	LF Antenna	ANT-D	N/A	Mitsubishi Electric Corporation	-
J	LF Antenna	ANT-E	N/A	Mitsubishi Electric Corporation	-
K	LF Antenna	ANT-F	N/A	Mitsubishi Electric Corporation	-
L	LF Antenna	ANT-G	N/A	Mitsubishi Electric Corporation	-
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 No.2 semi anechoic chamber.
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a platform of table size (0.5m x 0.5m x 0.8m or 0.5m x 1.5m x 0.8m) on the conducting ground plane. The EUT was set on the center of the tabletop.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna varied in height above the conducting ground plane to obtain the maximum signal strength.

A drawing of the set up is shown in the photos of APPENDIX 1.

5.3 Test conditions

Frequency range : 30MHz – 300MHz (Biconical antenna) / 300MHz – 1000MHz (Logperiodic antenna)
1000-3200MHz (Horn antenna)
Test distance : 3m
EUT position : Tabletop
EUT operation mode : Transmitting

5.4 Test procedure

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 with the Test Receiver or the Spectrum Analyzer.

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver	Spectrum Analyzer
IF Bandwidth	QP:BW 120kHz	PK: RBW:1MHz/VBW: 1MHz AV: RBW:1MHz/VBW:10Hz

- The carrier level and noise levels were confirmed at each position of X, Y and Z axis of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

With the position, the noise levels of all the frequencies were measured.

5.5 Results

Summary of the test results: Pass

Date: November 2, 5 and 19, 2004

Tested by: Yutaka Yoshida and Norihisa Hashimoto

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APPENDIX 1: Photographs of test setup

Radiated emission(Worst case position)(Transmitting mode)

Front



Rear



Worst Case Position (Horizontal : X-axis/ Vertical: Y-axis) (Transmitting mode)

X-axis



Y-axis



Z-axis

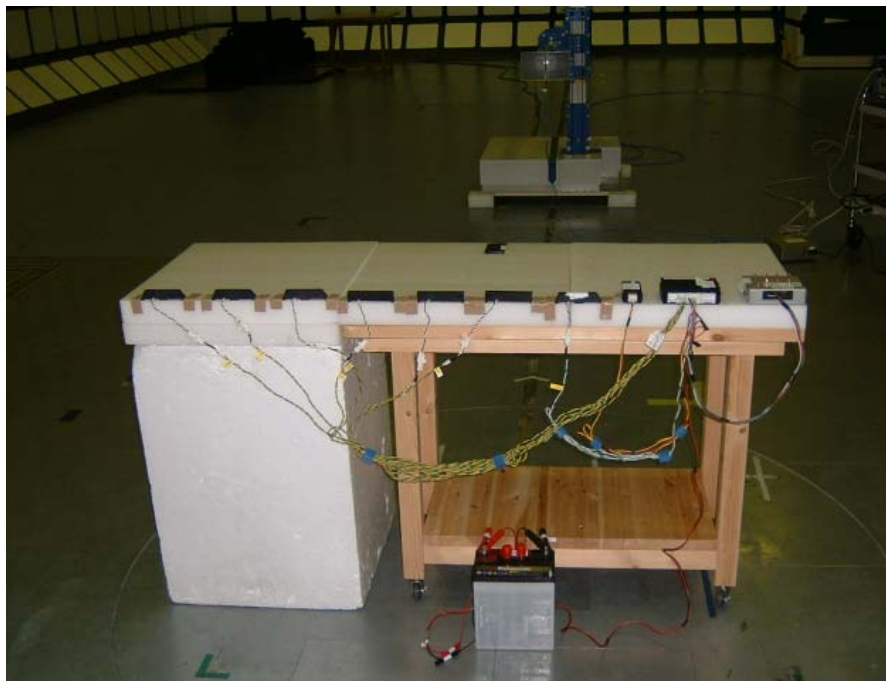


Radiated emission(Worst case position)(Receiving mode)

Front



Rear



APPENDIX 2:Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Test Item	Calibration Date * Interval(month)
MAEC-02	Anechoic Chamber	TDK	Semi Anechoic Chamber 3m	1,2	2004/04/12 * 12
MRENT-09	Spectrum Analyzer	Advantest	R3273	1,2	2004/02/18 * 12
MHA-06	Horn Antenna	Schwarzbeck	BBHA9120D	2	2004/01/10 * 12
MPA-01	Pre Amplifier	Agilent	8449B	2	2004/02/06 * 12
MCC-04	Microwave Cable	Storm	421-011	2	2004/01/06 * 12
MCC-24	Microwave Cable	Storm	-	2	2004/05/01 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	2	2004/10/14 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	1,2	2004/10/14 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	1,2	2003/12/16 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	1,2	2004/02/24 * 12
MTR-02	Test Receiver	Rohde & Schwarz	ESCS30	1,2	2004/02/03 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	3	2004/06/12 * 12
MAEC-01	Anechoic Chamber	TDK	Semi Anechoic Chamber 10m	2	2003/12/27 * 12
MCC-01	Coaxial Cable	Suhner/storm/Agilent/TSJ	-	2	2003/12/19 * 12
MBA-01	Biconical Antenna	Schwarzbeck	BBA9106	2	2004/10/14 * 12
MLA-01	Logperiodic Antenna	Schwarzbeck	USLP9143	2	2004/10/14 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	2	2003/11/12 * 12
MPA-04	Pre Amplifier	Pre Amplifier	8447D	2	2004/05/25 * 12
MAT-06	Attenuator(6dB)	Weinschel Corp	2	2	2003/12/16 * 12

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

Test Item:

1:Fundamental emission

2:Spurious emission

3:-20dB Bandwidth, 99% Occupied Bandwidth, Automatically Deactivate

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APPENDIX 3: Data of EMI test

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

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 Part15 Subpart C 231(b) / 205
MODEL : SKE11A-01 TEST DISTANCE : 3m
S/N : 3 DATE : 11/02/2004
POWER : DC 3.0V TEMPERATURE : 23 deg.C.
Mode : Continuous Transmitting HUMIDITY : 60 %
Axis : Hor.: X-axis , Ver.: Y-axis ENGINEER : Yutaka Yoshida

(below 1GHz) QP DETECT at No.2 semi Anechoic Chamber

No.	FREQ [MHz]	T/R READING: QP HOR VER [dBuV]		ANT Factor [dB/m]	AMP GAIN [dB]	LOSS [dB]	Duty Factor [dB]	RESULT HOR VER [dBuV/m]		Limit [dBuV/m]	MARGIN HOR VER [dB]	
1	315.00	73.9	71.2	15.4	26.9	8.4	0.0	70.8	68.1	75.6	4.8	7.5
2	630.00	35.8	36.4	19.9	28.2	9.9	0.0	37.4	38.0	55.6	18.2	17.6
3	945.00	47.0	43.9	22.6	27.7	11.0	0.0	52.9	49.8	55.6	2.7	5.8

(above 1GHz)

PK DETECT (RBW: 1MHz , VBW: 1MHz) at No.2 semi Anechoic Chamber

No.	FREQ [MHz]	S/A READING HOR VER [dBuV]		ANT Factor [dB/m]	AMP GAIN [dB]	LOSS [dB]	Duty Factor [dB]	RESULT HOR VER [dBuV/m]		Limit [dBuV/m]	MARGIN HOR VER [dB]	
4	1260.00	56.1	54.3	23.2	36.8	4.5	0.0	47.0	45.2	74.0	27.0	28.8
5	1575.00	47.8	46.3	25.0	36.5	5.0	0.0	41.3	39.8	74.0	32.7	34.2
6	1890.00	44.9	45.3	28.9	36.4	5.6	0.0	43.0	43.4	74.0	31.0	30.6
7	2205.00	45.0	45.4	30.5	36.3	6.2	0.0	45.4	45.8	74.0	28.6	28.2
8	2520.00	44.7	44.6	31.1	36.2	6.6	0.0	46.2	46.1	74.0	27.8	27.9
9	2835.00	44.9	45.7	31.9	36.4	7.0	0.0	47.4	48.2	74.0	26.6	25.8
10	3150.00	43.0	44.1	32.0	36.4	7.4	0.0	46.0	47.1	74.0	28.0	26.9

AV DETECT (RBW: 1MHz , VBW: 10Hz) at No.2 semi Anechoic Chamber

No.	FREQ [MHz]	S/A READING HOR VER [dBuV]		ANT Factor [dB/m]	AMP GAIN [dB]	LOSS [dB]	Duty Factor [dB]	RESULT HOR VER [dBuV/m]		Limit [dBuV/m]	MARGIN HOR VER [dB]	
4	1260.00	50.0	47.0	23.2	36.8	4.5	0.0	40.9	37.9	54.0	13.1	16.1
5	1575.00	36.7	35.0	25.0	36.5	5.0	0.0	30.2	28.5	54.0	23.8	25.5
6	1890.00	31.9	32.5	28.9	36.4	5.6	0.0	30.0	30.6	54.0	24.0	23.4
7	2205.00	32.3	32.2	30.5	36.3	6.2	0.0	32.7	32.6	54.0	21.3	21.4
8	2520.00	31.8	31.5	31.1	36.2	6.6	0.0	33.3	33.0	54.0	20.7	21.0
9	2835.00	32.4	32.4	31.9	36.4	7.0	0.0	34.9	34.9	54.0	19.1	19.1
10	3150.00	31.4	31.4	32.0	36.4	7.4	0.0	34.4	34.4	54.0	19.6	19.6

REMARKS

ANTENNA TYPE:30-300MHz Biconical / 300-1000MHz Logperiodic / 1-3.2GHz Horn

CALCULATION RESULT=Reading + ANT Factor - AMP GAIN + LOSS (Cable+ ATTN.)+Duty Factor

* The result is rounded off to the second decimal place. Therefore, there may be 0.1 difference for the result.

*Except for the above table : All other spurious emissions were less than 20dB for the limit.

*EUT was placed in X axis when the measurement antenna was positioned horizontally.

*EUT was placed in Y axis when the measurement antenna was positioned vertically.

The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

*The duty was not used in the data above 1GHz, and the test was made with AV detector which is severer for the limit.

The test result was applied to the limit in Section 15.209.

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-20dB Bandwidth and 99% Occupied Bandwidth

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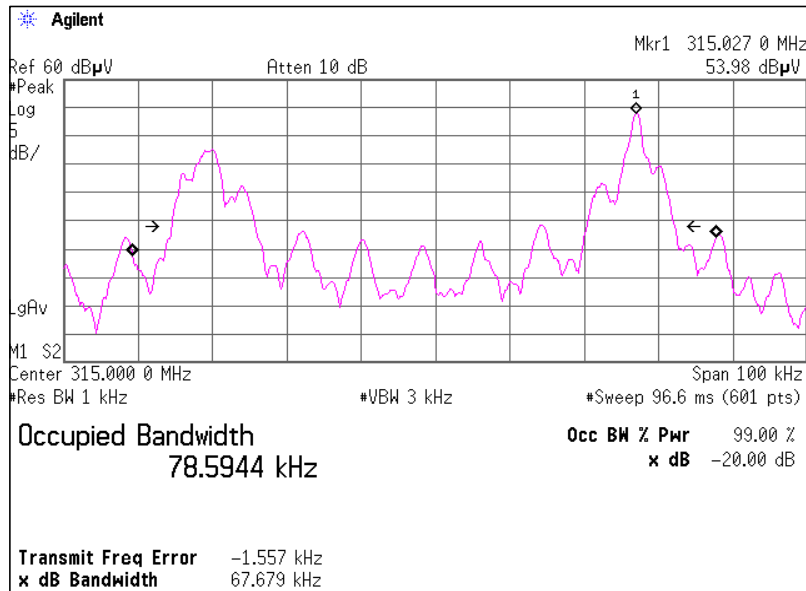
COMPANY : Mitsubishi Electric Corporation
EQUIPMENT : SMART KEYLESS SYSTEM
MODEL : SKE11A-01
S/N : 4
POWER : DC 3.0V
Mode : Transmitting

REPORT NO : 24HE0134-HO
REGULATION : Fcc Part15 Subpart C 231(c)
/ RSS-210
TEST DISTANCE : -
DATE : 11/19/2004
TEMPERATURE : 23 deg.C.
HUMIDITY : 32 %
ENGINEER : Yutaka Yoshida

Bandwidth Limit : Fundamental Frequency 315 MHz X 0.25% = 787.5 kHz

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result	Margin [kHz]	(RBW:1kHz) (VBW:3kHz)
67.68	787.50	Pass	719.82	

99% Occupied Bandwidth [kHz]	(RBW:1kHz) (VBW:3kHz)
78.59	



Automatically deactivate

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Head Office EMC Lab. No.2 Semi Anechoic Chamber

COMPANY : Mitsubishi Electric Corporation
EQUIPMENT : SMART KEYLESS SYSTEM
MODEL : SKE11A-01
S/N : 4
POWER : DC 3.0V
Mode : Transmitting

REPORT NO : 24HE0134-HO
REGULATION : Fcc Part15 Subpart C 231(a)
TEST DISTANCE : -
DATE : 11/19/2004
TEMPERATURE : 23 deg.C.
HUMIDITY : 32%

ENGINEER : Yutaka Yoshida

Time of Transmitting [sec]	Limit [sec]	Result	Margin [sec]
0.28	5.00	Pass	4.72

