

EMI TEST REPORT

Test Report No. : 23IE0015-HO-4

Applicant : TOHOKU ALPS CO., LTD
AUTOMOTIVE PRODUCTS DIVISION

Type of Equipment : Control Unit

Model No. : TFWD1U613

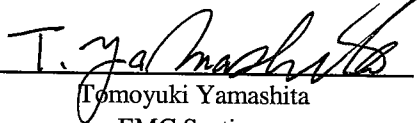
FCC ID : NHVWDU613

Test standard : FCC Part15 Subpart C 15.209 and
Subpart B 15.109

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 : May 21, 24, 26 and 29, 2003

Tested by :  
Yoshiaki Iwasa
EMC Section
Tomoyuki Yamashita
EMC Section

Approved by: 
Horonobu Shimoji
Group leader of EMC Section

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SECTION 1: Client information

Company name : TOHOKU ALPS CO., LTD
AUTOMOTIVE PRODUCTS DIVISION
Address : 6-3-36 Nakazato Furukawa-City Miyagi-pref 989-6181 JAPAN
Telephone Number : +81 229 23 5111
Facsimile Number : +81 229 22 3755
Contact Person : Hideki Ueno

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

Type of Equipment : Control Unit

Tx section

Model No.	TFWB1U613 (Hand Unit) *1)	TFWB1U613 (Control Unit)
Sample No.	1	1
Number of Channel	1	1
Frequency Characteristics	315MHz	125kHz
Modulation	FSK	ASK
Information antenna	Integral	Integral *2)
Rating	DC3.0V Lithium Battery (CR2032)	DC 12.0V (Car battery)
Country of Manufacture	Japan	Japan

Rx section

Model No.	TFWB1U613 (Control Unit)	TFWB1U613 (Hand Unit) *1)
Sample No.	1	1
Type of Receiver	Single Super Heterodyne	Turned Radio Frequency Receiver
Receiving Frequency	315 MHz	125kHz
Local Oscillator Frequency	322.825MHz	None
Intermediate Frequency	10.7MHz	None
Information antenna	Integral *2)	Integral
Rating	DC 12.0V (Car battery)	DC3.0V Lithium Battery (CR2032)

*1) See reference our test report No. 23IE0015-HO-3.

*2) As all the antennas have the same specification and do not operate simultaneously, the representative one was tested.

Country of Manufacture : Japan
Receipt Date of Sample : May 7, 2003
Condition of EUT : Production model

2.2 Product Description

The control unit of the passive entry system is a transmitter of 125kHz and a receiver of 315MHz.

The hand unit of passive entry system is a transmitter of 315MHz and a receiver of 125kHz.

These units are the new type of keyless entry system which communicates with each other.

UL Apex Co., Ltd.

Head Office EMC Lab.

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SECTION 3: Test specification, procedures and results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
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 Section 15.109 Radiated emission limits
Title : FCC 47CFR Part15 Radio Frequency Device
Subpart B Unintentional Radiators

3.2 Methods & Procedures

No.	Item	Test Procedure	Specification	Remarks
1	Electric Field Strength of Fundamental Emission	ANSI C63.4:2001	FCC Section 15.209	Radiated
2	Electric Field Strength of Spurious Emission	ANSI C63.4:2001	FCC Section 15.205 FCC Section 15.209	Radiated
3	-20dB Bandwidth	ANSI C63.4:2001	Reference data	-
4	Radiated emission	ANSI C63.4:2001	FCC Section 15.109(a)	Radiated
5	Conducted Emission	ANSI C63.4:2001	FCC Section 15.107(a) and 207	AC Mains only

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

3.3 Exclusion from standard

No.	Item	Test Procedure	Specification	Remarks
5	Conducted Emission	ANSI C63.4:2001	FCC Section 15.107(a) and 207	-

This test is not applicable since the EUT does not have AC power port.

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 operating mode/system were as follows:

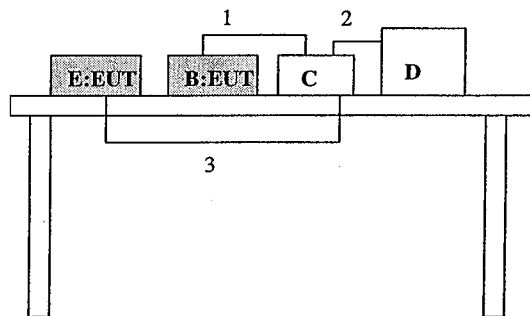
Operation mode is as follows;

- Transmitting mode
- Receiving mode

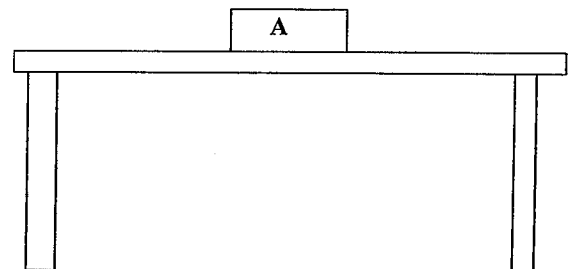
Justification: The system was configured in typical fashion (as a customer would normally use it) for testing.

4.2 Configuration and peripherals

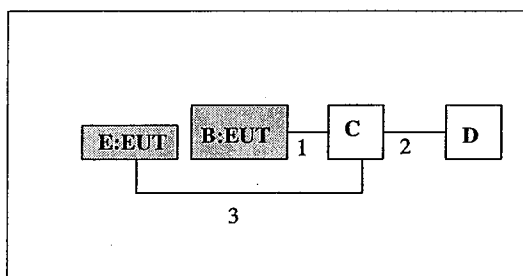
Front View (Control Unit)



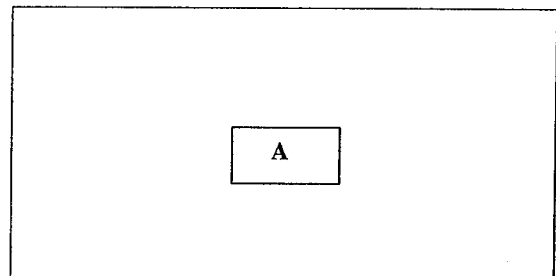
Front View (Hand Unit)



Top View (Control Unit)



Top View (Hand Unit)



UL Apex Co., Ltd.

Head Office EMC Lab.

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(Control Unit)

Description of EUT and Support Equipment

No.	Item	Model number	Serial number	Manufacturer	FCC ID
B	Control Unit	TFWD1U613	2	TOHOKU ALPS	NHVWDU613
C	Checker Box	N/A	N/A	TOHOKU ALPS	-
D	Car Battery	50B24L	N/A	YUASA	-
E	Bar antenna	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield	Remark
1	Signal & DC Power Cable	0.5	N	-
2	DC Power Cable	0.5	N	-
3	Antenna Cable	1.2	N	-

(Hand Unit)

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	FCC ID
A	Hand Unit	TFWB1U613	2	TOHOKU ALPS	NHVWDU613

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SECTION 5: Summary of test results

5.1 Test results

No.	Item	Test Procedure	Specification	Remarks	Result
1	Electric Field Strength of Fundamental Emission	ANSI C63.4:2001	FCC Section 15.209	Radiated	Complied
2	Electric Field Strength of Spurious Emission	ANSI C63.4:2001	FCC Section 15.205 FCC Section 15.209	Radiated	Complied
3	-20dB Bandwidth	ANSI C63.4:2001	Reference data	-	-
4	Radiated emission	ANSI C63.4:2001	FCC Section 15.109(a)	Radiated	Complied

5.2 Confirmation

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

5.3 Uncertainty

Radiated Emission Test

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

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

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

☐ The results is within Head Office EMC Lab's uncertainty.

☒ The data listed in this test report has enough margin.

5.4 Test Location

UL Apex Co., Ltd. EMC Head Office Division. No.1 and No.2 semi anechoic chambers.

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This site has been fully described in a report submitted to FCC office, and listed on February 01, 2002 / June 05, 2002 (Registration number: 313583 / 846015).

*NVLAP Lab. code: 200572-0

5.5 Photographs of test setup, Data of EMI Test and Test instruments

Refer to Appendix 1 to 3.

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SECTION 6: Radiated emissions and -20dB Bandwidth

6.1 Operating environment

The test was carried out in semi anechoic chamber.

Temperature : See data

Humidity : See data

Test Procedure

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

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

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

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

The EUT was also previously checked at each position of three axes X, Y and Z to find the worst position. The position in which the maximum noise occurred was chosen to put into measurement. Worst cases are referred to following page.

It was operated under transmitting mode.

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

125kHz Transmitting mode

Measurement range : 9kHz to 90kHz AV/PK Detector, IF BW 200Hz (Test receiver)
: 90kHz to 110kHz CISPR QP Detector, IF BW 200Hz (Test receiver)
: 110kHz to 150kHz AV/PK Detector, IF BW 200Hz (Test receiver)
: 150kHz to 490kHz AV/PK Detector, IF BW 10kHz (Test receiver)
: 490kHz to 30MHz QP Detector, IF BW 10kHz (Test receiver)
: 30MHz to 1000MHz CISPR QP Detector, IF BW 120kHz (Test receiver)

Test data : 30MHz -1.0GHz : Page 13-14 (APPENDIX 3)

Test result : Pass

312.125MHz Receiving mode

Measurement range : 30MHz to 1000MHz CISPR QP Detector, IF BW 120kHz (Test receiver)

Test data : 30MHz -1000MHz : Page 15 (APPENDIX 3)

Test result : Pass

6.2 -20dB Bandwidth (Reference data)

Fundamental Frequency 125kHz:

Test data : Page 16 (APPENDIX 3)

UL Apex Co., Ltd.

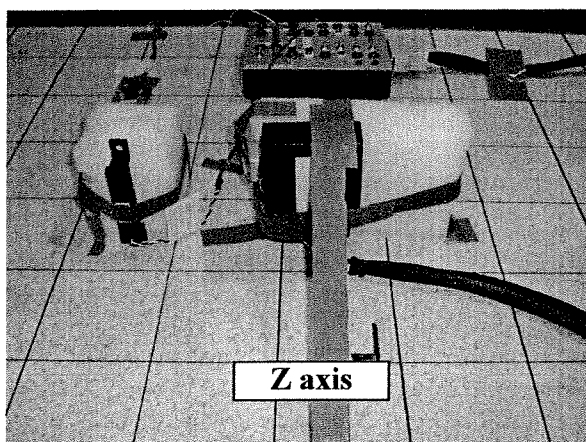
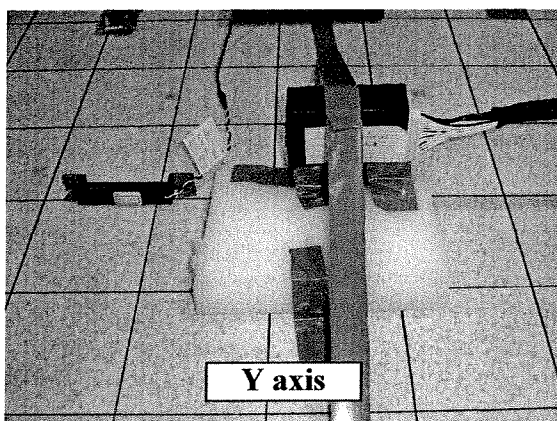
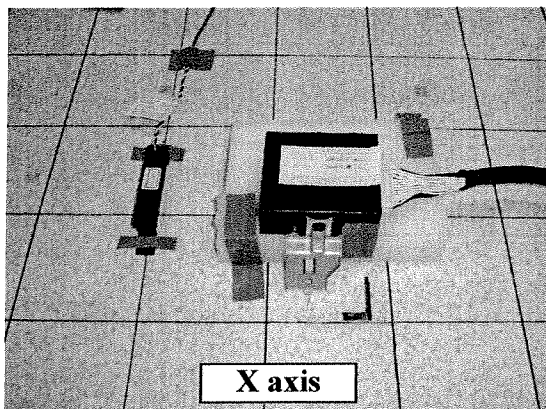
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Pre check of worse-case position



Worse case Z axis (9kHz – 30MHz, Measurement Loop antenna angle: 0deg)

Contents of Appendixes

APPENDIX 1: Photographs of test setup

Page 11 : Radiated emission

APPENDIX 2: Test instruments

Page 12 : Test instruments

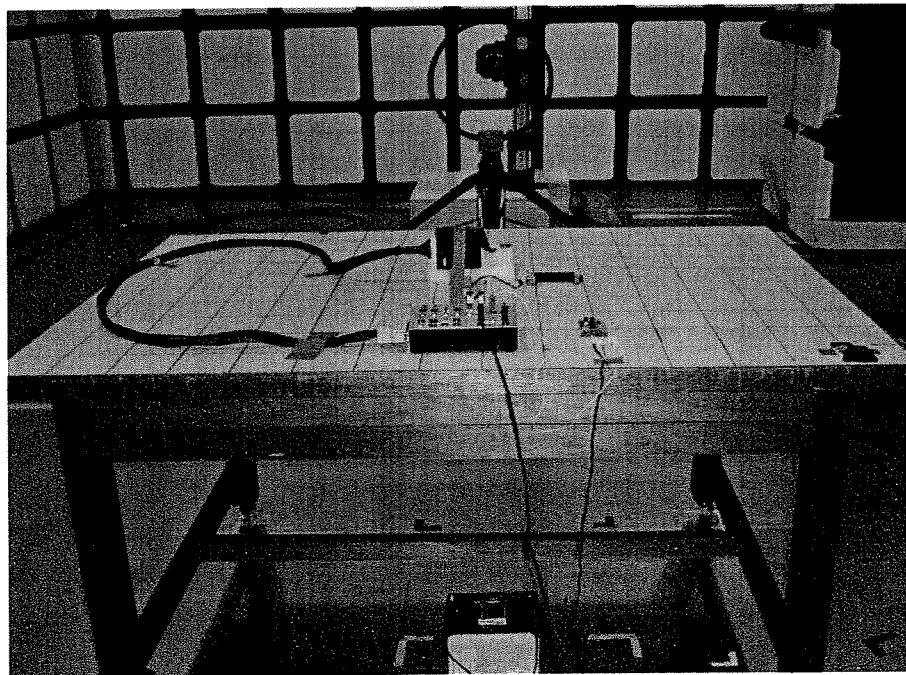
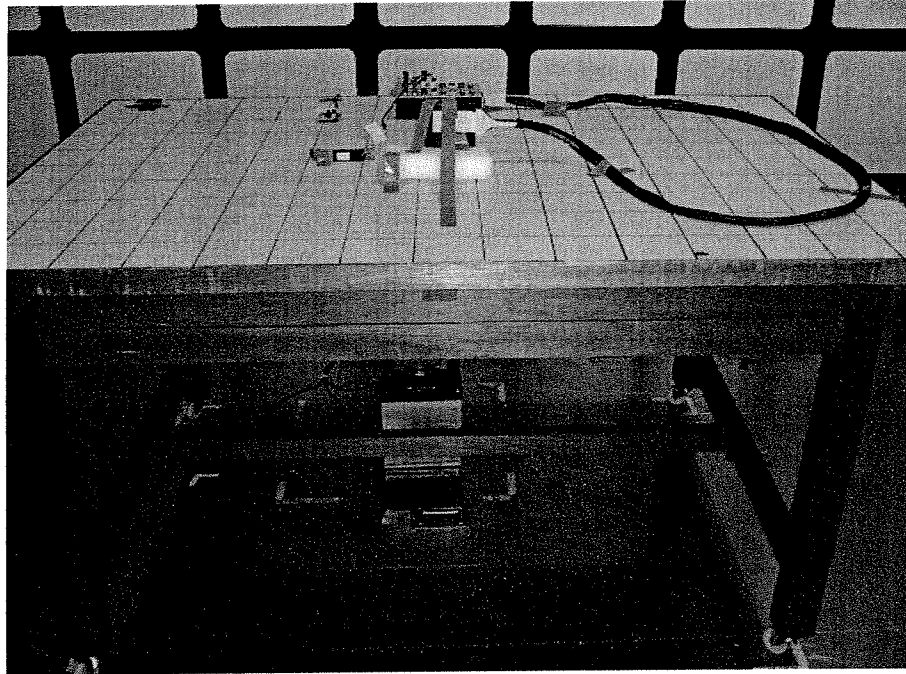
APPENDIX 3: Data of EMI test

Page 13-16 : Radiated emissions (Radiated)

Page 17 : -20dB Bandwidth

APPENDIX 1: Photographs of test setup

Radiated emission



APPENDIX 2

Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Test Item	Calibration Date * Interval(month)
MAEC-01	Anechoic Chamber	TDK	Semi Anechoic Chamber 10m	RE / CE	2002/12/28 * 12
MAT-06	Attenuator(6dB)	Weinschel Corp	2	RE	2002/12/24 * 12
MBA-01	Biconical Antenna	Schwarzbeck	BBA9106	RE	2002/10/16 * 12
MLA-01	Logperiodic Antenna	Schwarzbeck	USLP9143	RE/RS	2002/10/16 * 12
MOS-01	Digital Humidity Indicator	N.T	NT-1800		2002/12/10 * 12
MPA-02	Pre Amplifier	Agilent	87405A	RE	2003/04/17 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ES140	RE / CE	2002/11/01 * 12
MAEC-02	Anechoic Chamber	TDK	Semi Anechoic Chamber 3m	RE / CE	2003/04/11 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	RE	2002/12/24 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	MCC-12-01(8D-2W15m),MCC-12-02(5D-2W-0.7),MCC-12-03(5D-2W-0.8),MCC-12-04(5D-2W-1m),MCC-12-05(RF SW),MCC-12-06(RF SW),※MCC-12-07(5D-2W-0.4m)5/8追加	RE	2003/05/08 * 12
MCC-13	Coaxial Cable	Fujikura/Agilent	-	CE	2003/05/08 * 12
MOS-02	Digital Humidity Indicator	N.T	NT-1800	RE	2002/12/10 * 12
MPA-04	Pre Amplifier	Agilent	8447D	RE	2003/03/13 * 12
MTR-02	Test Receiver	Rohde & Schwarz	ESCS30	RE/CE	2003/01/31 * 12
SA-07	Spectrum Analyzer	Advantest	R3273	RE / CE	2002/12/10 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	RE	2002/10/16 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	RE	2002/10/16 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	RE	2002/12/13 * 12
MPSU-01	Power Supply	Rohde & Schwarz	HZ-9	EMI	Pre Check
MCB-01	Car Battery	Panasonic	B19L	RE	Pre Check

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

Test Item:

CE: Conducted emission,
RE: Radiated emission,

DATA OF RADIATED EMISSIONS (9kHz-30MHz)

UL Apex Co., Ltd.

Head Office EMC Lab. No.2 Semi Anechoic Chamber

COMPANY : ALPS ELECTRIC CO.,LTD (TOHOKU ALPS CO.,LTD)
EQUIPMENT : Control Unit
MODEL : TFWD1U613
S/N : 1
FCC ID : NHVWDU613
POWER : DC 12V
Mode : Transmitting
Axis : Y-axis

REPORT NO : 23IE0015-HO - 4
REGULATION : Fcc Part15 Subpart C 209
TEST DISTANCE : 3m
DATE : 05/24/2003
TEMPERATURE : 28°C
HUMIDITY : 44%

Y. Iwasa
ENGINEER : Yoshiaki Iwasa

No.	FREQ [kHz]	Loop Max Angle [deg.]	Detector type	T/R READING [dBuV/m]	ANT Factor [dB]	ATTEN [dB]	CABLE LOSS [dB]	AMP GAIN [dB]	RESULT [dBuV/m]	Limit [dBuV/m]	MARGIN [dB]
1	125	0	PK	100.0	19.9	6.1	0.1	26.3	99.8	125.7	25.9
2	125	0	AV	69.2	19.9	6.1	0.1	26.3	69.0	105.7	36.7
3	250	0	PK	53.3	19.9	6.0	0.1	27.4	51.9	119.6	67.7
4	250	0	AV	36.5	19.9	6.0	0.1	27.4	35.1	99.6	64.5
5	375	0	PK	61.4	19.9	6.0	0.1	27.8	59.6	116.1	56.5
6	375	0	AV	41.0	19.9	6.0	0.1	27.8	39.2	96.1	56.9
7	500	0	QP	29.1	19.9	5.9	0.1	27.8	27.2	73.6	46.4
8	625	0	QP	42.1	19.8	5.9	0.1	27.8	40.1	71.7	31.6
9	750	0	QP	28.9	19.8	5.9	0.2	27.8	27.0	70.1	43.1
10	875	0	QP	34.1	19.8	5.9	0.2	27.9	32.1	68.8	36.7
11	1000	0	QP	27.6	19.8	5.9	0.2	28.1	25.4	67.6	42.2
12	1125	0	QP	28.8	19.8	5.9	0.2	28.1	26.6	66.6	40.0
13	1250	0	QP	27.7	19.8	5.9	0.2	28.1	25.5	65.7	40.2

REMARKS

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

CALCULATION RESULT=Reading + ANT Factor + LOSS (ATTEN.+Cable) - Amp Gain

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

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: $100.0 \text{ dBuV/m} - 40 \log(300/3) = 100.0 - 80 = 20.0 \text{ dB at } 300 \text{ m}$

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

Average: $69.2 \text{ dBuV/m} - 40 \log(300/3) = 69.2 - 80 = -10.8 \text{ dBuV at } 300 \text{ m}$

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

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.

DATA OF RADIATION TEST

UL Apex Co., Ltd. Head Office EMC Lab.
No.2 Semi Anechoic Chamber
Report No. : 231E0015-H0- 4

Applicant : ALPS ELECTRIC CO.,LTD (TOHOKU ALPS CO.,LTD)
Kind of Equipment : Keyless Entry system
Model No. : TFWD1U613
Serial No. : 1
Power : DC 12V
Mode : Tx 125kHz
Remarks : DETECTOR: QP , Y-axis , FCC ID: NHVWU613
Date : 5/29/2003
Test Distance : 3 m
Temperature : 25 °C
Humidity : 62 %
Regulation : FCC Part15C § 15.209(a)

Engineer : Yoshiaki Iwasa

No.	FREQ. [MHz]	ANT TYPE	READING		ANT FACTOR [dB/m]	AMP GAIN [dB]	CABLE LOSS [dB]	ATTEN. [dB]	RESULT		LIMITS [dB μV/m]	MARGIN	
			HOR [dB μV]	VER [dB μV]					HOR [dB μV/m]	VER [dB μV/m]		HOR [dB]	VER [dB]
1.	38.51	BB	26.6	32.2	15.2	27.9	0.6	6.0	20.5	26.1	40.0	19.5	13.9
2.	48.00	BB	24.3	28.9	11.7	27.9	0.8	6.0	14.9	19.5	40.0	25.1	20.5
3.	59.65	BB	33.4	37.5	8.3	27.7	0.9	6.0	20.9	25.0	40.0	19.1	15.0
4.	90.00	BB	30.5	36.6	7.7	27.2	1.1	6.1	18.2	24.3	43.5	25.3	19.2
5.	434.00	BB	20.1	20.1	17.7	27.5	0.8	6.2	17.3	17.3	46.0	28.7	28.7
6.	867.84	BB	21.0	21.0	21.8	28.5	1.6	6.1	22.0	22.0	46.0	24.0	24.0

CALCULATION: READING + ANT.FACTOR + CABLE LOSS - AMP.GAIN + ATTEN.

Except for the above table:adequate margin data below the limits.
ANT.TYPE:30-300MHz Biconical, 300-1000MHz Logperiodic

DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber

Applicant : TOHOKU ALPS CO.,LTD.
Kind of EUT : Keyless Entry System
Model No. : TFWD1U613
Serial No. : 1

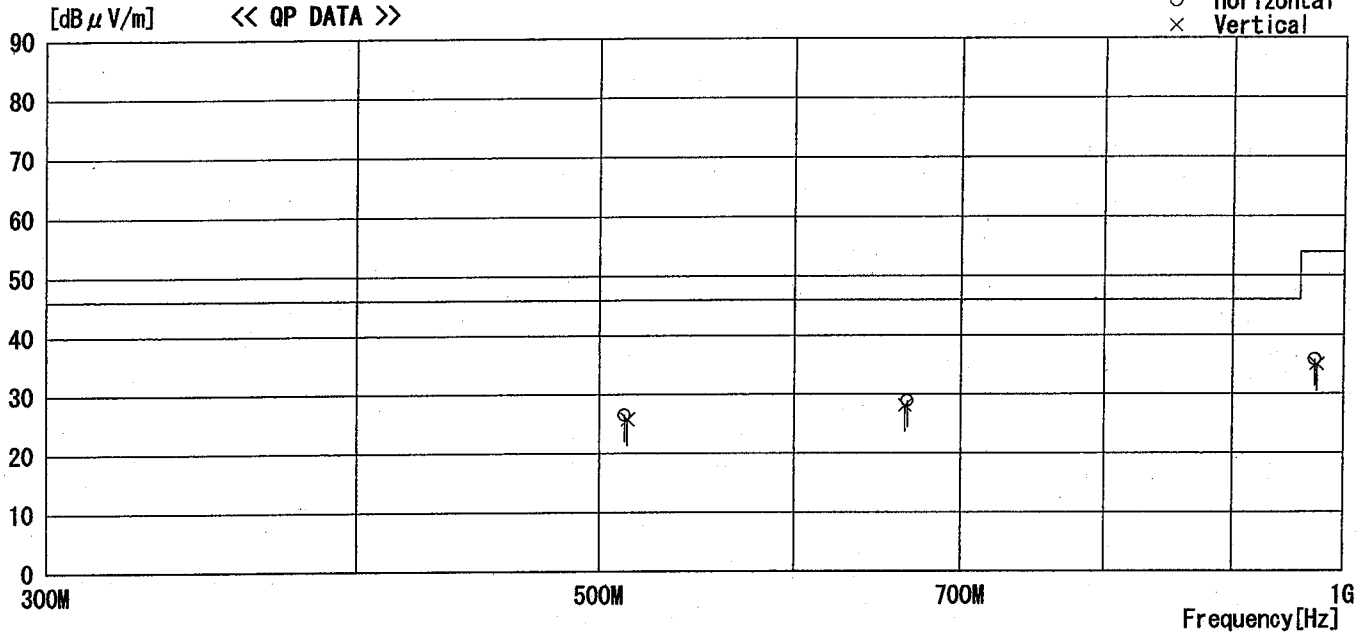
Report No. : 231E0015-H0 = 4
Power : DC 12V
Temp°C/Humi% : 26 / 40
Operator : Tomoyuki Yamashita

Mode / Remarks : Receiving mode , FCC ID: NHVWDU613

LIMIT : FCC Part15 Class B(3m)/USA

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

— Horizontal
— Vertical
○ Horizontal
× Vertical



No.	FREQ [MHz]	READING QP [dB μ V]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dB μ V/m]	LIMIT [dB μ V/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
Horizontal										
1	511.823	20.1	18.5	11.0	23.1	26.5	46.0	19.5	100	97
2	666.135	20.0	20.2	11.8	23.2	28.8	46.0	17.2	100	284
3	973.355	21.5	24.0	13.2	23.0	35.7	54.0	18.3	100	159
Vertical										
4	513.226	19.2	18.6	11.1	23.1	25.8	46.0	20.2	100	81
5	664.732	19.3	20.2	11.8	23.2	28.1	46.0	17.9	100	148
6	974.758	20.8	24.0	13.2	23.0	35.0	54.0	19.0	100	171

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:

DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber

Applicant : TOHOKU ALPS CO.,LTD.
Kind of EUT : Keyless Entry System
Model No. : TFWD1U613
Serial No. : 1

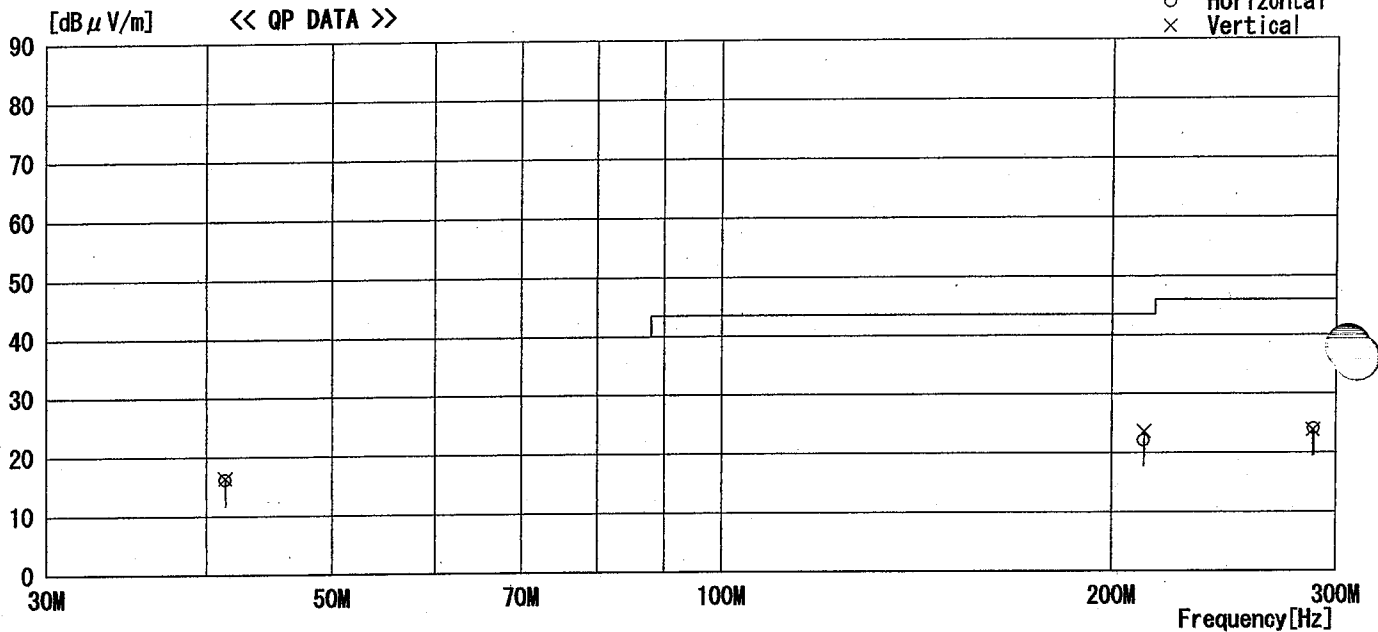
Report No. : 23IE0015-H0 - 4
Power : DC 12V
Temp°C/Humi% : 26 / 40
Operator : Tomoyuki Yamashita

Mode / Remarks : Receiving mode , FCC ID: NHVWU613

LIMIT : FCC Part15 Class B(3m)/USA

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

— Horizontal
— Vertical
○ Horizontal
× Vertical



No.	FREQ [MHz]	READING QP [dB μ V]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dB μ V/m]	LIMIT [dB μ V/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
Horizontal										
1	41.363	18.5	14.1	7.2	23.7	16.1	40.0	23.9	400	191
2	211.803	19.4	16.7	9.2	23.2	22.1	43.5	21.4	400	117
3	288.095	18.2	19.2	9.7	23.1	24.0	46.0	22.0	400	4
Vertical										
4	41.363	18.8	14.1	7.2	23.7	16.4	40.0	23.6	100	2
5	212.026	20.9	16.7	9.2	23.2	23.6	43.5	19.9	100	5
6	287.554	18.1	19.2	9.7	23.1	23.9	46.0	22.1	100	334

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

DATA OF -20dB BANDWIDTH

UL Apex Co., Ltd.

Head Office EMC Lab. No.2 Semi Anechoic Chamber

COMPANY : ALPS ELECTRIC CO.,LTD (TOHOKU ALPS CO.,LTD)
EQUIPMENT : Control Unit
MODEL : TFWD1U613
S/N : 1
FCC ID : NHVWDU613
POWER : DC 12V
MODE : Transmitting

REPORT NO. : 23IE0015-HO- 4
REGULATION : Fcc Part15 Subpart C 231(b) / 205
TEST DISTANCE : 3 m
DATE : 05/26/2003
TEMPERATURE : 25°C
HUMIDITY : 52%

Engineer :  Yoshiaki Iwasa

-20dB Bandwidth	Bandwidth Limit	Result
[kHz]	[kHz]	
8.58	-	-

