

EMI TEST REPORT

Test Report No. : 23AE0036-YW-2

Applicant: Tohoku Alps Co., Ltd.

Type of Equipment: Passive Entry System

Model No.: TFWD1U611 (Control Unit)

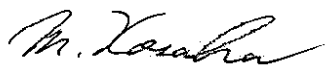
FCC ID NHVWDU61

Test standard: FCC Part 15 Subpart C Section 15.209 and
FCC Part 15 Subpart B Section 15.109

Test Result: Complied

1. This test report shall not be reproduced in full or partial, without the written approval of A-Pex International 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: September 13 and 30, 2002



Tested by: _____

Makoto Kosaka
EMC Section



Approved by: _____

Kazutoyo Nakanishi
Site Operation Manager of EMC Section

A-pex International Co., Ltd.

YOKOWA LAB.

108 Yokowa-cho, Ise-shi, Mie-ken 516-1106 JAPAN

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SECTION 1: Client information

Company name : Tohoku Alps Co., Ltd.
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 : Tomosuke Takata

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

Type of Equipment : Passive Entry System / (Car Lock / Unlock devices)

Tx section

Model No.	TFWD1U611(Control Unit)
Sample No.	No.1
Number of Channel	1
Frequency Characteristics	125kHz
Modulation	Amplitude
Information antenna	External / Bar antenna
Rating	DC 12.0V (Car battery)

Rx section

Type of Receiver	Single Super Heterodyne
Receiving Frequency	433.92MHz
Local Oscillator Frequency	423.22MHz
Intermediate Frequency	10.7MHz
Information antenna	Integral / (monopole)
Rating	DC 12.0V (Car battery)

Country of Manufacture : Japan
Receipt Date of Sample : September 11, 2002
Condition of EUT : Engineering prototype

2.2 Product Description

The control unit of the passive entry system is a transmitter of 125kHz and a receiver of 433.92MHz.
The hand unit of passive entry system is a transmitter of 433.92MHz and a receiver of 125kHz.
These units are the new type of keyless entry system which communicates with each other.

See reference our test report No. 23AE0036-YW-1. (Hand Unit)

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SECTION 3: Test specification, methods & procedures

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
2	Electric Field Strength of Fundamental Emission	ANSI C63.4:2000	FCC Section 15.209	Radiated
3	Electric Field Strength of Spurious Emission	ANSI C63.4:2000	FCC Section 15.205 FCC Section 15.209	Radiated
4	-20dB Bandwidth	ANSI C63.4:2000	Reference data	Radiated
5	Radiated emission	ANSI C63.4:2000	FCC Section 15.109(a)	Radiated
6	Conducted Emission	ANSI C63.4:2000	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
6	Conducted Emission	ANSI C63.4:2000	FCC Section 15.107(a) and 207	

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

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

4.1 Operating Modes

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

The operating mode/system were as follows:

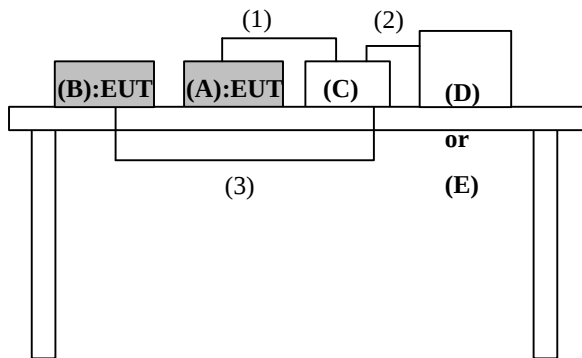
Operation mode is as follows;

- Transmitting mode
- Receiving mode

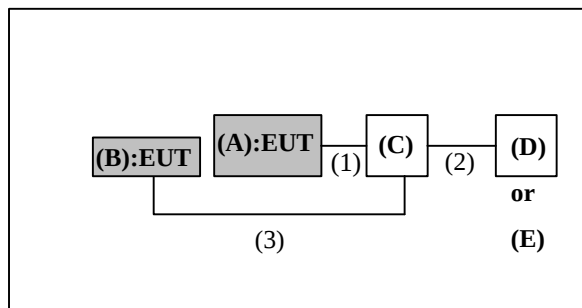
Justification: The system was configured in typical fashion (as a customer would normally use it) for testing.

4.2 Configuration and peripherals

Front View (Control Unit)



Top View (Control Unit)



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

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Description of EUT and Support Equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Passive Entry System (Control Unit)	TFWD1U611	Sample No.1	Tohoku Alps	EUT
B	Bar antenna	TFWS1Z171A	Sample No.1	Tohoku Alps	EUT
C	Checker Box	N/A	N/A	Tohoku Alps	-
D	Car Battery	50B24L	N/A	YUASA	-
E	DC Power Supply	PMC35-2A	13090501	Kikusui	-

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)	Aantenna Cable	1.2	N	

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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 C63.4:2000	FCC Section 15.231(b)	Radiated	Complied
2	Electric Field Strength of Spurious Emission	ANSI C63.4:2000	FCC Section 15.205 FCC Section 15.209	Radiated	Complied
3	-20dB Bandwidth	ANSI C63.4:2000	Reference data	Radiated	-
4	Radiated emission	ANSI C63.4:2000	FCC Section 15.109(a)	Radiated	Complied

A-PEX INTERNATIONAL 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)

5.2 Uncertainty

Radiated Emission Test

The measurement uncertainty (with a 95% confidence level) for this test using Loop antenna is $\pm 2.5\text{dB}$.

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is $\pm 4.4\text{dB}$.

The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is $\pm 4.8\text{dB}$.

☐ The data listed in this test report may exceed the test limit because it does not have enough margin.

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

5.3 Test Location

A-PEX International Co., Ltd. Yokowa No.3 test site

108 Yokowa-cho, Ise-shi, Mie-ken 516-1106 Japan

Telephone number : +81 596 39 1485

Facsimile number : +81 596 39 0232

The site has been fully described in a report submitted to FCC office, and listed on September 12, 2000

(Registration number: 90412) and they were accepted by Industry Canada on May 1, 2001(IC2973-3)

*NVLAP Lab. code : 200109-0

A-PEX International Co., Ltd. EMC Head Office Devision. No.1Semi Anechoic Chamber, 19.2 x 11.2 x 7.7m

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan

Telephone number : +81 596 24 8116

Facsimile number : +81 596 24 8124

This site has been fully described in a report submitted to FCC office and Industry Canada based on RSS 212, and listed on February, 2002 (Registration number: 313583 for FCC, IC4247 for IC).

*NVLAP Lab. code: 200572-0

5.4 Photographs of test setup

Refer to Appendix 1.

5.5 Test instruments

Refer to Appendix 2.

5.6 Data of EMI Test

Refer to Appendix 3.

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SECTION 6: Radiated emissions and -20dB Bandwidth

6.1 Operating environment

The test was carried out in an open site.

Temperature : See data
Humidity : See data

Test Procedure

9kHz – 30MHz

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane. In the frequency range of 9kHz to 30MHz, the measurement was performed with the loop antenna which was positioned with its plane vertical at the distance of 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The loop antenna was also positioned horizontally at the distance of 3m from the EUT. The center of the loop was 1m above the ground.

30MHz –1000MHz

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 an open test site 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 and receiving mode.

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

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 : 9kHz - 1000MHz: Page A1-A3 (APPENDIX 3)

Photographs of test setup : Page 11

Test result : Pass

6.2 -20dB Bandwidth (Reference data)

Test data : Page A4 (APPENDIX 3)

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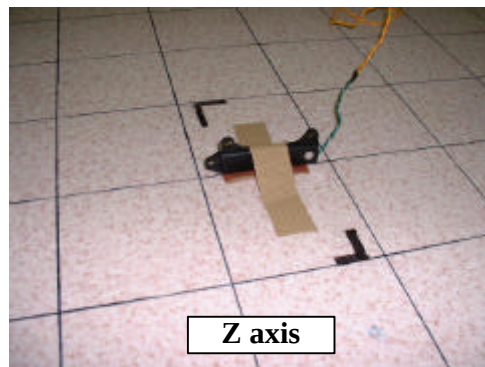
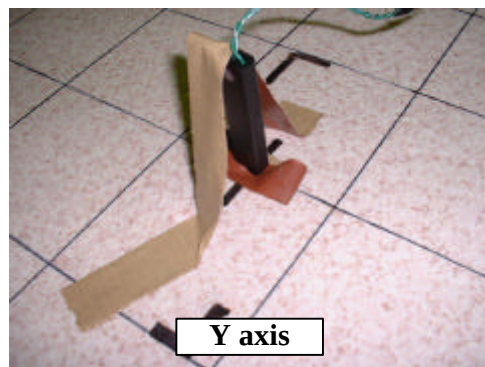
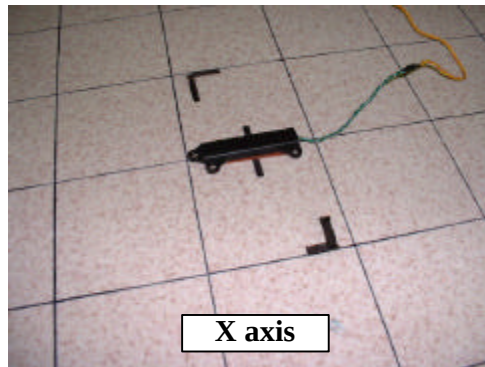
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6.3 Pre check of worse-case position



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

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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 A1-A3: Radiated emissions

Page A4: -20dB Bandwidth (Reference data)

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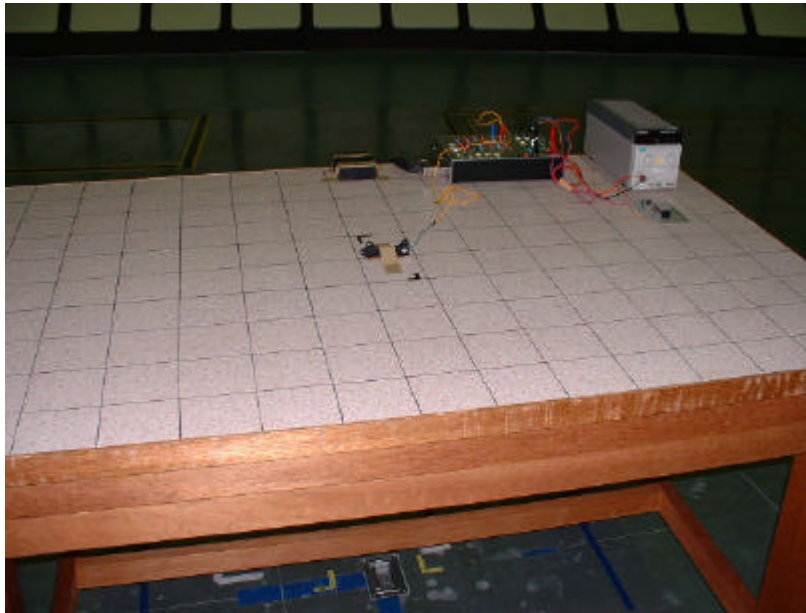
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APPENDIX 1: Photographs of test setup

Radiated emission(<30MHz)



Radiated emission(30 –1000MHz)



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APPENDIX 2

Test Instruments

Radio tsst equipment

Control No.	Instrument	Manufacturer	Model No.	Calibration Date Interval (month)
AF-01	Pre Amplifier	Hewlett Packard	8447D	2002/04/01 *12
AT-06	6dB Attenuator	Anritsu	MP721B	2002/04/04 *12
BA-06	Biconical Antenna	Schwarzbeck	BBA9106	2002/02/16 *12
LA-07	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	2002/09/09 *12
SA-06	Spectrum Analyzer	Advantest	R3273	2001/11/20 *12
TR-06	Test Receiver	Rohde & Schwarz	ESVS10	2001/11/22 *12
CC-3ORC	Yokowa No.3 open Coaxial(0.01-1000MHz)	A-PEX	CC31-38, SW31-32	2002/03/30 *12
YOATS-03	Open test site	JSE	10m	2002/05/02 *12
MPA-04	Pre Amplifier	Hewlett Packard	8447D	2002/03/13 *12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	2001/12/18 *12
MTR-01	Test Receiver	Rohde & Schwarz	ESI 40	2001/11/13 *12
	Anechoic Chamber	TDK	Semi Anechoic Chamber 10m	

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

A-pex International Co., Ltd.

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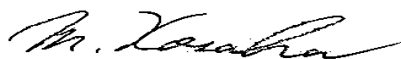
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Date of carrier and supurious emissions(9kHz to 30MHz)

A-PEX INTERNATIONAL CO., LTD.
Head office No.1 Semi Anechoic Chamber

Company : TOHOKU ALPS CO., LTD.
Equipment : Passive Entry System (Control Unit)
Model : TFWD1U611
Sample No. : 1
Power : DC12.0V
Mode : Transmitting (125kHz)
Temperature : 28deg.C
Humidity : 58%

Report No. : 23AE0036-YW-2
Regulation : FCC Part15C Section 15.209
Test Distance : 3m
Date : 2002/9/30
FCC ID : NHVWDU61
IC : 3495A-FWD1U61



ENGINEER : Makoto Kosaka

No.	FREQ [kHz]	Loop Max Angle [deg]	detector	T/R	ANT Factor [dB]	ATTEN [dB]	CABLE LOSS [dB]	AMP GAIN [dB]	RESULT	LIMIT	MARGIN
			type	READING [dBuV]					[dBuV/m]	[dBuV/m]	[dB]
1	125.00	0	PK	109.0	19.8	0.0	0.2	26.8	102.2	125.7	23.5
2	125.00	0	AV	83.5	19.8	0.0	0.2	26.8	76.7	105.7	29.0
3	250.00	0	PK	68.5	19.8	0.0	0.2	27.5	61.0	119.6	58.6
4	250.00	0	AV	49.9	19.8	0.0	0.2	27.5	42.4	99.6	57.2
5	375.00	0	PK	62.1	19.8	0.0	0.2	27.9	54.2	116.1	61.9
6	375.00	0	AV	42.5	19.8	0.0	0.2	27.9	34.6	96.1	61.5
7	500.00	0	QP	40.3	19.8	0.0	0.2	28.0	32.3	73.6	41.3
8	625.00	0	QP	51.3	19.7	0.0	0.2	28.0	43.2	71.7	28.5
9	725.00	0	QP	33.7	19.7	0.0	0.0	28.1	25.3	70.4	45.1
10	875.00	0	QP	44.9	19.7	0.0	0.2	28.1	36.7	68.8	32.1
11	1000.00	0	QP	33.2	19.7	0.0	0.3	28.1	25.1	67.6	42.5
12	1125.00	0	QP	34.5	19.7	0.0	0.3	28.1	26.4	66.6	40.2
13	1250.00	0	QP	32.7	19.7	0.0	0.4	28.1	24.7	65.7	41.0

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

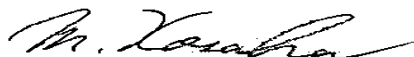
All other spurious emissions are more than 20dB below the limits.

Data of supurious emissions(30MHz to 1000MHz)

A-PEX INTERNATIONAL CO., LTD.
YOKOWA NO.3 OPEN SITE

Company : TOHOKU ALPS CO., LTD.
Equipment : Passive Entry System (Control Unit)
Model : TFWD1U611
Sample No. : 1
Power : DC 12.0V (Car battery)
Mode : Transmitting (125kHz)
FCC ID : NHVWDU61
IC No : 3495A-FWD1U61

Report No. : 23AE0036-YW-2
Regulation : FCC Part15C Section 15.209
Test Distance : 3m
Date : 2002/09/13
Temperature : 21deg.C
Humidity : 82%



ENGINEER : Makoto Kosaka

QP DETECT(Test Receiver: BW 120kHz)

No.	FREQ [MHz]	READING		ANT Factor [dB]	AMP GAIN [dB]	CABLE LOSS [dB]	ATTEN [dB]	RESULT		LIMIT [dBuV/m]	MARGIN	
		HOR	VER					HOR	VER		HOR	VER
		[dBuV]						[dBuV/m]			[dB]	
1	33.550	20.6	23.5	16.6	27.9	1.4	6.0	16.7	19.6	40.0	23.3	20.4
2	52.900	31.2	28.7	9.9	27.9	1.5	6.0	20.7	18.2	40.0	19.3	21.8
3	66.700	41.9	34.2	7.0	27.9	1.7	6.0	28.7	21.0	40.0	11.3	19.0
4	82.120	40.4	29.8	6.5	27.9	1.9	6.1	27.0	16.4	40.0	13.0	23.6
5	117.500	38.0	31.7	12.6	27.9	2.3	6.0	31.0	24.7	43.5	12.5	18.8
6	423.220	36.0	29.1	18.8	27.8	4.7	6.0	37.7	30.8	46.0	8.3	15.2
7	846.440	19.6	18.0	24.2	27.0	7.1	6.1	30.0	28.4	46.0	16.0	17.6

REMARKS

ANTENNA TYPE: 30-300MHz Biconical / 300-1000MHz Logperiodic

CALCULATION(30MHz to 1000MHz) : READING + ANT Factor - AMP Gain + Cable Loss + ATTEN

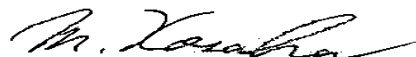
*Except for the above table : All other spurious emissions were less than 20dB for the limit.

Data of supurious emissions(30MHz to 1000MHz)

A-PEX INTERNATIONAL CO., LTD.
YOKOWA NO.3 OPEN SITE

Company : TOHOKU ALPS CO., LTD.
Equipment : Passive Entry System (Control Unit)
Model : TFWD1U611
Sample No. : 1
Power : DC 12.0V (Car battery)
Mode : Receiving (433.92MHz)
FCC ID : NHVWDU61
IC No : 3495A-FWD1U61

Report No. : 23AE0036-YW-2
Regulation : FCC Part15B Section 15.109(a)
Test Distance : 3m
Date : 2002/09/13
Temperature : 21deg.C
Humidity : 82%



ENGINEER : Makoto Kosaka

QP DETECT(Test Receiver: BW 120kHz)

No.	FREQ [MHz]	READING		ANT Factor [dB]	AMP GAIN [dB]	CABLE LOSS [dB]	ATTEN [dB]	RESULT		LIMIT [dBuV/m]	MARGIN	
		HOR	VER					HOR	VER		HOR	VER
		[dBuV]						[dBuV/m]			[dB]	
1	32.000	23.1	23.0	17.0	28.0	1.4	6.1	19.6	19.5	40.0	20.4	20.5
2	48.000	26.7	28.5	11.5	28.0	1.4	6.0	17.6	19.4	40.0	22.4	20.6
3	55.000	23.3	23.6	9.4	27.8	1.6	6.0	12.5	12.8	40.0	27.5	27.2
4	64.000	26.8	27.8	7.4	27.8	1.7	6.0	14.1	15.1	40.0	25.9	24.9
5	96.000	26.3	33.1	9.1	27.8	2.0	6.0	15.6	22.4	43.5	27.9	21.1
6	128.000	22.6	24.7	13.6	27.9	2.4	6.0	16.7	18.8	43.5	26.8	24.7
7	160.000	22.9	26.9	15.0	27.8	2.8	6.0	18.9	22.9	43.5	24.6	20.6
8	240.000	22.0	22.1	16.8	27.5	3.1	6.0	20.4	20.5	46.0	25.6	25.5
9	423.220	35.7	29.3	18.8	27.8	4.7	6.0	37.4	31.0	46.0	8.6	15.0
10	846.440	20.2	19.5	24.2	27.0	7.1	6.1	30.6	29.9	46.0	15.4	16.1

REMARKS

ANTENNA TYPE: 30-300MHz Biconical / 300-1000MHz Logperiodic

CALCULATION(30MHz to 1000MHz) : READING + ANT Factor - AMP Gain + Cable Loss + ATTEN

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

-20dB Bandwidth

A-PEX INTERNATIONAL CO., LTD.
Head office No.1 Semi Anechoic Chamber

Company : TOHOKU ALPS CO., LTD.
Equipment : Passive Entry System (Control Unit)
Model : TFWD1U611
Sample No. : 1
Power : DC12.0V
Mode : Transmitting (125kHz)
Temperature : 28deg.C
Humidity : 58%

Report No. : 23AE0036-YW-2
Regulation : FCC Part15C Section 15.209
Test Distance : 3m
Date : 2002/9/30
FCC ID : NHVWDU61
IC : 3495A-FWD1U61

M. Kosaka

ENGINEER : Makoto Kosaka

