

EMI TEST REPORT

Test Report No. : 23BE0062-HO-1

Applicant : DENSO CORPORATION

Type of Equipment : Transmitter of Remote Keyless Entry System

Model No. : 12BBX

Test standard : FCC Part 15 Subpart C Section 15.231

FCC ID : HYQ12BBX

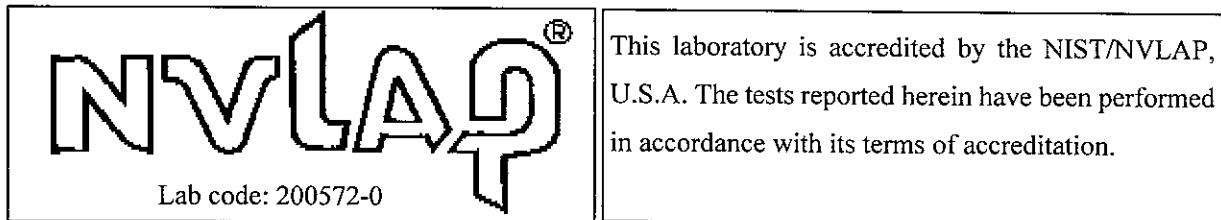
Test Result : Complied

1. This test report shall not be reproduced except 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 test 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 18, 2002

Tested by : 
Hiroka Umeysama
EMC Head Office Division

Approved by : 
Hironobu Shimoji
Group Leader of EMC Head Office Division



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MF060b(23.04.02)

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SECTION 1: Client information

Company Name : DENSO CORPORATION
Brand Name : DENSO CORPORATION
Address : 1-1 Showa-cho, Kariya-city, Aichi-prefecture, 448-8661, Japan
Telephone Number : +81-566-25-5922
Facsimile Number : +81-566-25-4548
Contact Person : YASUHIRO SHIMIZU

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

2.1 Identification of E.U.T.

Type of Equipment : Transmitter of Remote Keyless Entry System
Model No. : 12BBX
Rating : 3VDC(One lithium battery CR-2016)
Country of Manufacture : Japan
Receipt Date of Sample : September 13, 2002
Condition of EUT : Engineering prototype

2.2 Product description

DENSO CORPORATION, Model: 12BBX (referred to as the EUT in this report) is a transmitter of remote keyless entry system.

This system is mainly used for locking or unlocking the doors of the vehicle.
The transmitter send a radio wave signal while the button is pushed.
The receiver becomes active in response to the signal from the transmitter.

The specification is as following
Carrier Frequency : 314.35 MHz
Local oscillator frequency : 314.35 MHz SAW resonator
Type of Modulation : A1D
Information Antenna : Built-in type(Fixed)

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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

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result
Automatically Deactivate	ANSI C63.4:2000	Section15.231(a)(1)	N/A	-	Complied
Electric Field Strength of Fundamental Emission	ANSI C63.4:2000	Section15.231(b)	N/A	5.1 dB 314.34MHz Horizontal	Complied
Electric Field Strength of Spurious Emission	ANSI C63.4:2000	Section15.205 Section15.209 Section15.231(b)	N/A	15.4 dB 1571.70MHz Vertical	Complied
-20dB Bandwidth	ANSI C63.4:2000	Section15.231(b)	N/A	-	Complied

3.3 Additions to Standards

No addition,deviation or exclusion has been made from Standards.

3.4 Confirmation

A-Pex International Co., Ltd. hereby confirms that E.U.T., in the configuration tested, complies with the specifications FCC Part15 Subpart C Section 15.231.

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 test report may exceed the test limit because it does not have enough margin.
- The data listed in this test report has enough margin, more than the site margin.

3.6 Test location

A-Pex International Co., Ltd. EMC Head Office Division. No.2 semi Anechoic Chamber, 7.5 x 5.8 x 5.2 m.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8116 Facsimile: +81 596 24 8124
This site has been fully described in a report submitted to FCC office, and listed on June 05, 2002 (Registration number: 846015). *NVLAP Lab. code: 200572-0

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

Refer to APPENDIX 1 to 3.

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

4.1 Operating modes

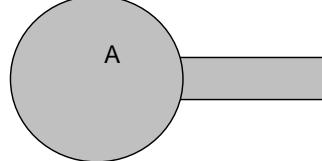
The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

The sequence is used : Transmitting

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

4.2 Configuration and peripherals

Top View



* Test data was taken under worse case conditions.

Description of EUT

No	Item	Model number	Serial number	Manufacturer	FCC ID
A	Transmitter of Remote Keyless Entry System	12BBX	No.1	DENSO CORPORATION	HYQ12BBX

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SECTION 5: Radiated emission

5.1 Operating environment

The test was carried out in No.2 semi Anechoic Chamber, 7.5 x 5.8 x 5.2 m.

Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above 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 was 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-3200MHz
Test distance : 3m
EUT position : Table top
EUT operation mode : Transmitting

5.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi anechoic chamber with a ground plane and at a distance of 3m. Measurements were performed with a quasi-peak detector (30MHz-1000MHz), Average and Peak detector (1000MHz-3200MHz).

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

Frequency	30MHz-1000MHz	1000MHz-3200MHz
Detector Type	Quasi-peak	Average/Peak
IF Bandwidth	120 kHz	1MHz

-The noise was measured at each position of all three axes X, Y and Z to compare the level, and the maximum noise occurred at the position showed in the photograph.

-The relative measurements were performed on the fundamental and the spurious emissions with each conduction of the key folded and the key set up. The key set-up condition was worse case under both the fundamental and the spurious emissions, we, therefore, tested while the key was set up. See the photograph.

-The reading level was reduced by 6dB for comparison to the limits as this EUT had 50% duty cycle.
See the data in Appendix 3.

5.5 Results

Summary of the test results: Pass

Date: September 18, 2002

Test engineer: Hiroka Umeyama

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APPENDIX 1: Photographs of test setup

Page 8 : Radiated emission

APPENDIX 2: Test instruments

Page 9 : Test instruments

APPENDIX 3: Data of EMI test

Page 10 -11 : Automatically Deactivate

Page 12 : Radiated emission (Electric Field Strength of Fundamental and Spurious emission)

Page 13 -14 : Duty cycle Under Normal Operation

Page 15 : -20dB Bandwidth

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APPENDIX 1: Photographs of test setup

Radiated emission(Worst case position)



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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	RE	2002/04/12 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	RE	2001/12/27 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	RE	2002/05/02 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	MCC-12-01(8D -2W-15m) MCC-12-02(5D -2W-0.7m) MCC-12-05(RF SW) MCC-12-03(5D -2W-0.8m) MCC-12-06(RF SW) MCC-12-04(5D -2W-1m)	RE	2002/05/10 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	RE	2002/05/02 * 12
MPA-04	Pre Amplifier	Agilent	8447D	RE	2002/03/13 * 12
MTR-02	Test Receiver	Rohde & Schwarz	ESCS30	RE	2001/10/05 * 12
SA-05	Spectrum Analyzer	Advantest	R3271	RE	2001/12/25 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	RE	2001/11/13 * 12
MCC-04	Microwave Cable	Storm	421-011	RE	2002/01/14 * 12
MHA-05	Horn Antenna	Schwarzbeck	BBHA9120D	RE	2002/01/13 * 12
MPA-01	Pre Amplifier	Agilent	8449B	RE	2002/02/09 * 12
MCC-06	Microwave Cable	Storm	421-011	RE	2002/01/14 * 12

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,

H/F: Harmonics and voltage fluctuation

RFI: RFI Power test,

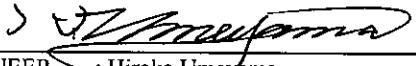
AT: Antenna terminal disturbance voltage

DATA OF AUTOMATICALLY DEACTIVATE

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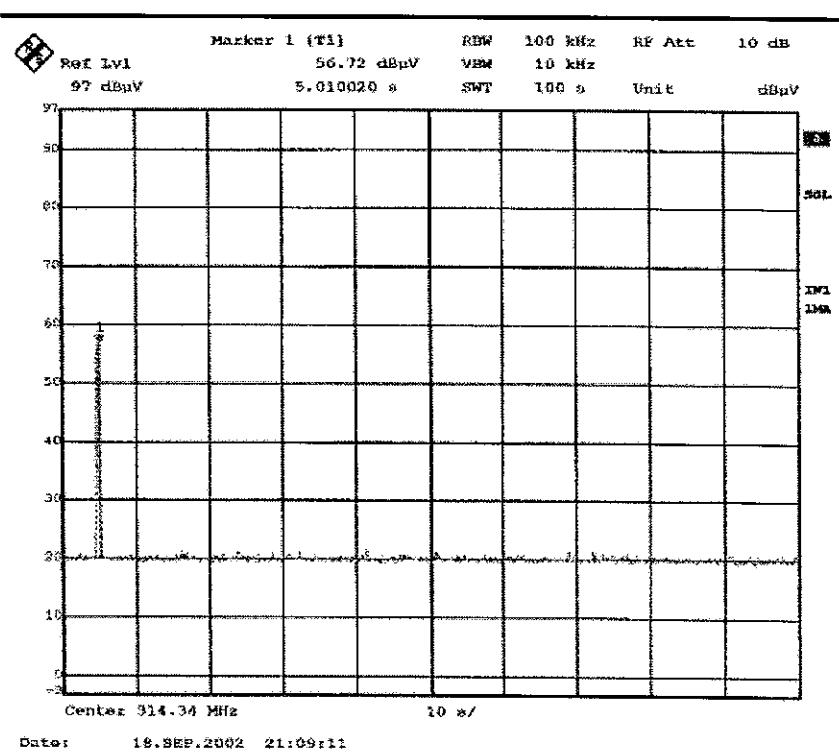
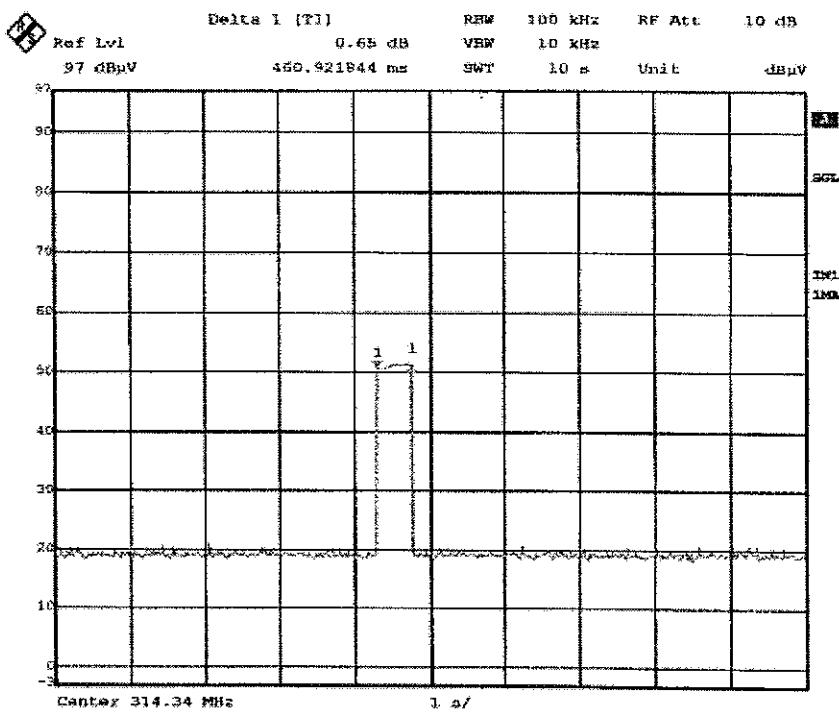
COMPANY : DENSO CORPORATION
EQUIPMENT : Transmitter of Remote Keyless Entry System
MODEL : 12BBX
S/N : NO.1
FCC ID : HYQ12BBX
POWER : DC3.0V
Mode : Transmitting

REPORT NO : 23BE0062-HO
REGULATION : Fcc Part15 Subpart C 231(a)(1)
TEST DISTANCE : 3m
DATE : 09/18/2002
TEMPERATURE : 27°C
HUMIDITY : 58%


ENGINEER : Hiroka Umeyama

Time of Transmitting [sec]	Limit [sec]	Result
0.46	5.00	Pass

AUTOMATICALLY DEACTIVATE



DATA OF RADIATED EMISSIONS

A-PEX INTERNATIONAL CO., LTD.
EMC HEAD OFFICE DIVISION No.2 SEMI ANECHOIC CHAMBER

COMPANY : DENSO CORPORATION
EQUIPMENT : Transmitter of Remote Keyless Entry System
MODEL : 12BBX
S/N : NO.1
FCC ID : HYQ12BBX
POWER : DC3.0V
Mode : Transmitting

REPORT NO : 23BE0062-HO
REGULATION : Fcc Part15 Subpart C 231(b) / 205
TEST DISTANCE : 3m
DATE : 09/18/2002
TEMPERATURE : 27°C
HUMIDITY : 58%


ENGINEER : Hiroka Umayama

No.	FREQ [MHz]	T/R READING : PK		ANT Factor [dB]	AMP GAIN [dB]	LOSS [dB]	Duty Factor [dB]	RESULT		Limit [dBuV/m]	MARGIN	
		HOR	VER [dBuV/m]					HOR	VER [dBuV/m]		HOR	VER [dB]
1	314.34	80.2	76.2	14.8	26.3	7.8	-6.0	70.5	66.5	75.6	5.1	9.1

No.	FREQ [MHz]	T/R READING : QP		ANT Factor [dB]	AMP GAIN [dB]	LOSS [dB]	Duty Factor [dB]	RESULT		Limit [dBuV/m]	MARGIN	
		HOR	VER [dBuV/m]					HOR	VER [dBuV/m]		HOR	VER [dB]
2	628.68	27.9	29.3	19.1	27.7	9.2	0.0	28.5	29.9	55.6	27.1	25.7
3	943.02	26.4	26.3	22.7	27.0	9.7	0.0	31.8	31.7	55.6	23.8	23.9

No.	FREQ [MHz]	T/R READING : PK		ANT Factor [dB]	AMP GAIN [dB]	LOSS [dB]	Duty Factor [dB]	RESULT		Limit [dBuV/m]	MARGIN	
		HOR	VER [dBuV/m]					HOR	VER [dBuV/m]		HOR	VER [dB]
4	1257.36	46.3	46.4	25.2	37.3	3.4	0.0	37.6	37.7	75.6	38.0	37.9
5	1571.70	52.9	55.2	25.7	37.1	3.7	0.0	45.2	47.5	74.0	28.8	26.5
6	1886.04	44.3	44.2	26.3	36.9	4.2	0.0	37.9	37.8	75.6	37.7	37.8
7	2200.38	45.7	45.0	27.0	36.8	4.7	0.0	40.6	39.9	74.0	33.4	34.1
8	2514.72	44.8	44.6	27.7	36.7	5.2	0.0	41.0	40.8	75.6	34.6	34.8
9	2829.06	43.7	44.0	28.1	36.8	5.4	0.0	40.4	40.7	74.0	33.6	33.3
10	3143.40	43.3	43.6	28.4	36.8	5.7	0.0	40.6	40.9	75.6	35.0	34.7

No.	FREQ [MHz]	T/R READING : AV		ANT Factor [dB]	AMP GAIN [dB]	LOSS [dB]	Duty Factor [dB]	RESULT		Limit [dBuV/m]	MARGIN	
		HOR	VER [dBuV/m]					HOR	VER [dBuV/m]		HOR	VER [dB]
4	1257.36	33.5	33.8	25.2	37.3	3.4	0.0	24.8	25.1	55.6	30.8	30.5
5	1571.70	43.8	46.3	25.7	37.1	3.7	0.0	36.1	38.6	54.0	17.9	15.4
6	1886.04	32.9	32.1	26.3	36.9	4.2	0.0	26.5	25.7	55.6	29.1	29.9
7	2200.38	32.5	32.1	27.0	36.8	4.7	0.0	27.4	27.0	54.0	26.6	27.0
8	2514.72	31.6	31.5	27.7	36.7	5.2	0.0	27.8	27.7	55.6	27.8	27.9
9	2829.06	31.3	31.3	28.1	36.8	5.4	0.0	28.0	28.0	54.0	26.0	26.0
10	3143.40	31.2	31.2	28.4	36.8	5.7	0.0	28.5	28.5	55.6	27.1	27.1

REMARKS

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

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

*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.

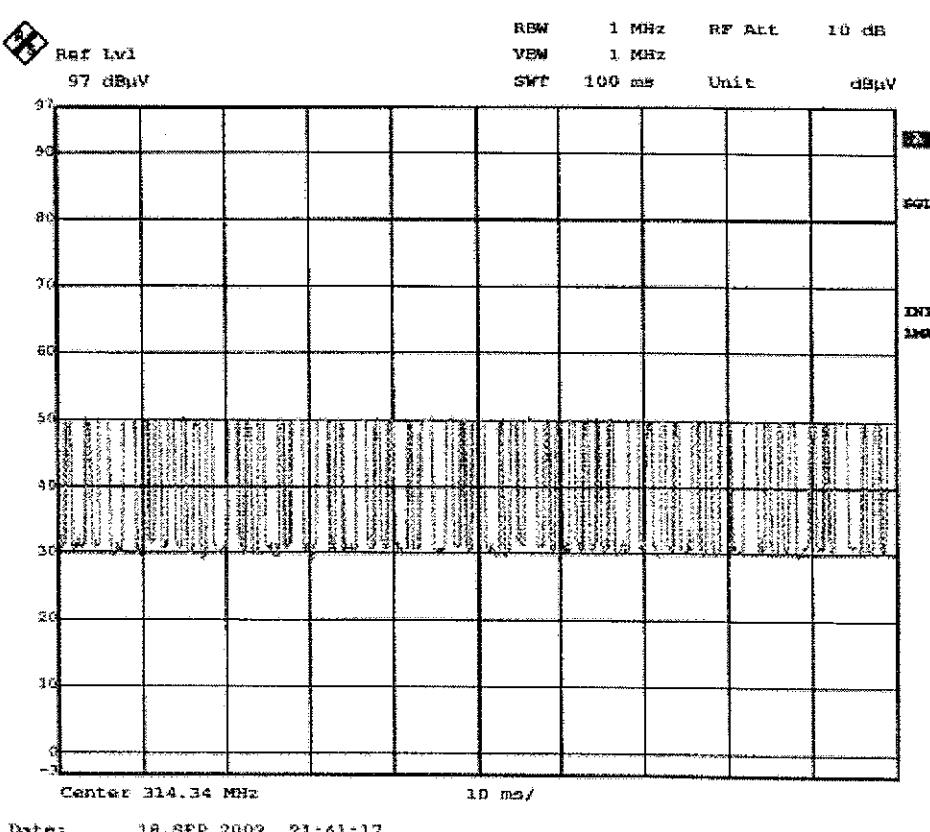
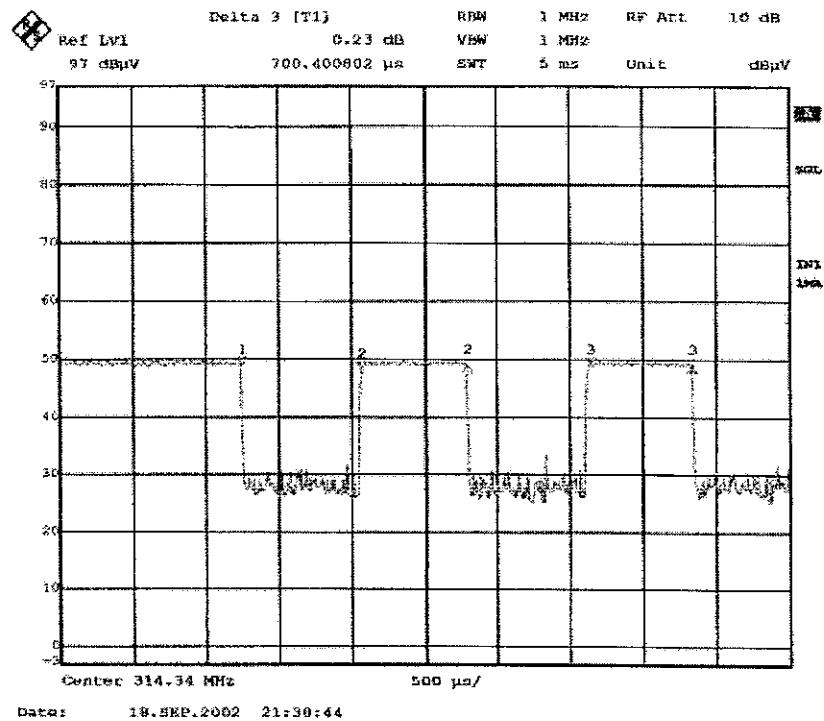
*EUT was placed in Y axis when the measurement antenna was positioned vertically.

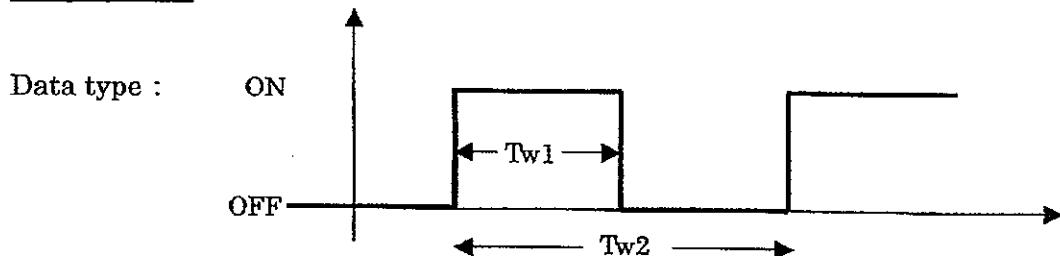
*The noise was measured at each position of all three axes X, Y and Z to compare the level, and the maximum noise.

Duty cycle Factor Measurement

The duty cycle factor = $20\log(\Delta 1: 1199 + \Delta 2: 650 + \Delta 3: 650 / 5000) = -6.00$

DUTY CYCLE UNDER NORMAL OPERATION



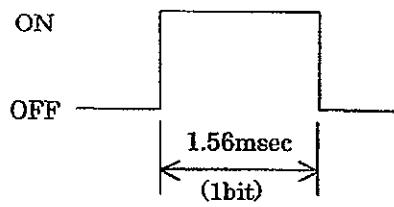
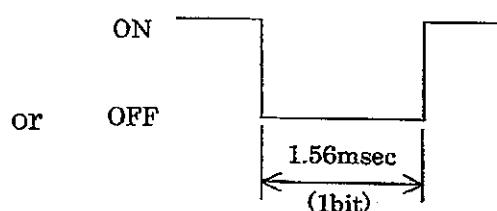
Duty cycle :Frame Format :

Header (8bit)	Parity bit (8bit)	Function bit (16bit)	ID and Counter bit (64bit)
88bit			

Data Time :

	Tw_1/Tw_2	
Header	0.78msec / 1.56msec	
Parity bit	Data "0"	0.78msec / 1.56msec
Function bit		
ID and Counter bit	Data "1"	1.56msec / 1.56msec or 0msec / 1.56msec *

* Data "1"

Pattern APattern BCalculation of the duty factor

$$\text{header} = 0.78\text{msec} / 1.56\text{msec} \times 8\text{bit} = 0.5$$

Duty of Parity bit, Function bit, ID and Counter bit are as follows;

In case of all data = "0"

$$0.78\text{msec} / 1.56\text{msec} \times 88\text{bit} = 0.5$$

In case of all data = "1"

Pattern A and Pattern B are appeared alternately.

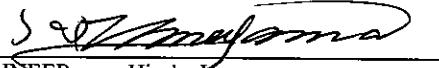
$$(1.56\text{msec} / 1.56\text{msec}) \times (88\text{bit} / 2) + (0\text{msec} / 1.56\text{msec}) \times (88\text{bit} / 2) = 0.5$$

$$\text{Duty Factor} = 20\log 0.5 = -6.0$$

DATA OF -20dB-Bandwidth

A-PEX INTERNATIONAL CO., LTD.
EMC HEAD OFFICE DIVISION No.2 SEMI ANECHOIC CHAMBER

COMPANY	: DENSO CORPORATION	REPORT NO	: 23BE0062-HO
EQUIPMENT	: Transmitter of Remote Keyless Entry System	REGULATION	: Fcc Part15 Subpart C 231(c)
MODEL	: 12BBX	TEST DISTANCE	: 3m
S/N	: NO.1	DATE	: 09/18/2002
FCC ID	: HYQ12BBX	TEMPERATURE	: 27°C
POWER	: DC3.0V	HUMIDITY	: 58%
Mode	: Transmitting		



ENGINEER : Hiroka Umeyama

Bandwidth Limit : Fundamental Frequency $314.35\text{MHz} \times 0.25\% = 785.875\text{kHz}$

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
321.64	785.88	Pass

