

EMISSION TEST REPORT

Test Report No. : **22AE0084-YW-1**

Applicant:

DENSO CORPORATION

Type of Equipment:

Keyless Entry System (Transmitter)

Model No.:

12BBM

FCC ID

HYQ12BBM

Test standard:

FCC Part 15 Subpart C Section 15.231

Test Result:

Complied

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The results in this report apply only to the sample tested.

Date of test: August 31, 2001

Tested by:



Makoto Kosaka

Approved by:



Kazutoyo Nakanishi
Site Operation Manager of EMC Section

Issued date: September 7, 2001

Revised date: December 6, 2001

Testing Laboratory

A-pex International Co., Ltd.

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1 GENERAL INFORMATION

APPLICANT : DENSO CORPORATION
ADDRESS : 1-1 Showa-cho, Kariya-shi, Aichi-ken
Telephone Number : +81-566-25-5922
Facsimile Number : +81-566-25-4548
REGULATION(S) : FCC Part 15 Subpart C Section 15.231
MODEL NUMBER : 12BBM
FCC ID : HYQ12BBM
SERIAL NUMBER : Sample No.10
CONDITION OF EUT : Engineering Prototype
KIND OF EQUIPMENT : Keyless Entry System (Transmitter)
TESTED DATE : August 31, 2001
RECEIPT DATE OF SAMPLE : August 31, 2001
REPORT FILE NUMBER : 22AE0084-YW-1
TEST SITE : A-PEX Yokowa No.3 Open Test Site

Testing Laboratory

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1.1 Product Description

Model: 12BBM(referred to as the EUT in this report) is a Keyless Entry System (Transmitter).

The specification is as following :

Carrier Frequency : 314.35 MHz
 Modulation : FSK
 Other Clock Frequency : 1MHz
 Information antenna : P.C.B pattern antenna
 Operation Voltage : Lithium Battery DC 3.0V(CR2025)

1.2 Test Specification

Test Specification : FCC Part 15 Subpart C
 Title : FCC 47CFR Part15 Radio Frequency Device
 Subpart C Intentional Radiators
 Section 15.231 Periodic operation in the band 40.66 – 40.70 MHz and above 70MHz

1.3 Methods & Procedures

No.	Item	Test Procedure	Specification	Remarks
1	Electric Field Strength of Fundamental Emission	ANSI C63.4:1992	Section 15.231	3m
2	Electric Field Strength of Spurious Emission	ANSI C63.4:1992	Section 15.205 Section 15.209 Section 15.231	3m
3	-20dB Bandwidth	ANSI C63.4:1992	Section 15.231	3m

1.4 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

This site has been fully described in a report submitted to FCC office, and listed on September 12, 2000 (Registration number: 90412).

*NVLAP Lab. code : 200109-0

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2 SYSTEM TEST CONFIGURATION

2.1 Operation Environment

Temperature : See data

Humidity : See data

2.2 Justification

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

2.3 EUT Exercise Software

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

The sequence is used:

Operation Mode : Transmitting

2.4 Test Procedure

Tabletop Equipment Radiated Emissions

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 measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength. The measurement distance was 3m.

Preliminary Radiated Emissions Tests were performed before Final Radiated Emissions Measurements as follows;

-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 condition 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.

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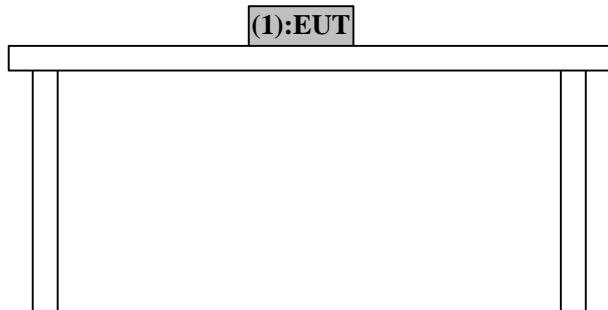
Telephone: +81 596 39 1485

Facsimile: +81 596 39 0232

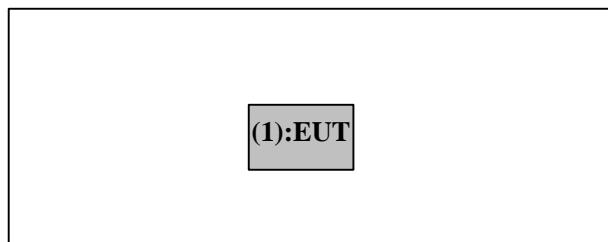
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Figure2.1 Configuration of Tested System

Front View



Top View



*Test data was taken under worse case conditions.

No.	Item	Model number	Serial number	Manufacturer	FCC ID
1	Keyless Entry System (Transmitter)	12BBM	Sample No.10	DENSO CORPORATION	HYQ12BBM

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3 RADIATED EMISSION DATA

The initial step in collecting radiated data was a spectrum analyzer peak scan of the measurement range (30MHz-3200MHz).

No	Ant Pol	Freq [MHz]	Reading [dBuV]	Antenna Factor [dB]	Cable Loss [dB]	ATT [dB]	AMP Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
1	H	314.36	77.3	14.4	3.6	5.8	27.6	73.5	75.6	2.1	Fundamental
2	H	628.71	39.4	19.3	5.4	5.9	27.3	42.7	55.6	12.9	Spurious

Remark:

Below 1GHz: Test Receiver Setting : QP Detect / IF Band width 120kHz

3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, Cable Factor and Antenna Pad, and subtracting the Amplifier Gain from the measured reading. The sample calculation is as follows :

$$FS = RA + AF + CF + AT - AG$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Factor

AT = Antenna Pad

AG = Amplifier Gain

Assume a receiver reading of 77.3 dBuV is obtained. The antenna Factor of 14.4 dB, Cable Factor of 3.6 dB and Antenna Pad of 5.8 dB is added. The Amplifier Gain of 27.6 dB is subtracted, giving a field strength of 73.5 dBuV/m.

$$FS = 77.3 + 14.4 + 3.6 + 5.8 - 27.6 = 73.5 \text{ dBuV/m}$$

3.2 -20dB Bandwidth

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

Bandwidth Limit	measurement data (20dB down) Center Freq: 314.301MHz	Result
Upper frequency Limit (314.7429375MHz:392.9375kHz)	314.525MHz(224kHz)	Pass
Lower frequency Limit (313.9570625MHz:392.9375kHz)	314.094MHz(207kHz)	Pass
-20dB Bandwidth (785.875kHz)	Uf + Lf = 431kHz	Pass

* See Appendix A2 and A3

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3.3 Measurement Uncertainty

Radiated Emission Test

■ Measurement distance of 3m (30-1000MHz):

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is ± 4.4 dB.
The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is ± 3.2 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 site margin.

■ Measurement distance of 3m (1000-3200MHz):

The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is ± 5.8 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 site margin.

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4 Test EQUIPMENT USED

Instrument	Mfr.	Model No.	Control No.	Calibration Date / Interval
Pre Amplifier	Hewlett Packard	8447D	AF-01	March 31, 2001 / 1 year
Pre Amplifier	Hewlett Packard	8449B	AF-04	November 5, 2000 / 1 year
Attenuator	Anritsu	MP721B	AT-06	March 31, 2001 / 1 year
Biconical Antenna	Schwarzbeck	BBA9106	BA-03	May 1, 2001 / 1 year
Logperiodic Antenna	Schwarzbeck	UHALP9108-A	LA-06	May 1, 2001 / 1 year
Horn Antenna	A.H. Systems	SAS200/571	HA-01	May 20, 2001 / 1 year
Spectrum Analyzer	Hewlett Packard	8567A	SA-04	March 31, 2001 / 1 year
Spectrum Analyzer	Advantest	R3265	APSPA03	November 2, 2000 / 1 year
Test Receiver	Rohde & Schwarz	ESVS30	TR-02	August 8, 2000 / 1 year

*All measurement equipment is traceable to national standard.

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5 RADIATED MEASUREMENT PHOTOS

5.1 Radiated Measurement Photos (Worse case position)



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APPENDIX

A : Test Data

Radiated emissions and -20dB Bandwidth

A1 – A3

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DATA OF RADIATION TEST

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

COMPANY : DENSO CORPORATION

TRADE NAME:

EQUIPMENT : Keyless Entry System (Transmitter)

MODEL : 12BBM

POWER : DC3.0V(CR2025)

Mode : Transmitting

Serial No. : sample No.10

Temperature : 20°C

Humidity : 60%

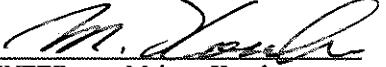
REPORT NO : 22AE0084-YW-1

REGULATION : FCC15.231(b) / 15.205

TEST DISTANCE : 3m

DATE : 2001/8/31

FCC ID : HYQ12BBM


ENGINEER : Makoto Kosaka

Below 1GHz QP DETECT (Test Receiver: BW 120kHz)

Above 1GHz PK DETECT (Spectrum Analyzer : RBW 1MHz and VBW 1MHz)

No.	FREQ [MHz]	ANT TYPE	READING		ANT Factor [dB]	ATTEN [dB]	CABLE LOSS [dB]	AMP GAIN [dB]	RESULT		LIMIT [dB]	MARGIN	
			HOR [dB μ V]	VER [dB μ V]					HOR [dB μ V/m]	VER [dB μ V/m]		HOR [dB]	VER [dB]
1	314.36	BB	77.3	57.6	14.4	5.8	3.6	27.6	73.5	53.8	75.6	2.1	21.8
2	628.71	BB	39.4	32.1	19.3	5.9	5.4	27.3	42.7	35.4	55.6	12.9	20.2
3	943.04	BB	32.2	24.5	22.8	5.9	7.1	26.7	41.3	33.6	55.6	14.3	22.0
4	1257.380	BB	47.9	45.6	26.1	0.0	4.9	35.1	43.8	41.5	75.6	31.8	34.1
5	1571.726	BB	49.6	47.2	27.8	0.0	5.5	34.7	48.2	45.8	74.0	25.8	28.2
6	1886.073	BB	47.1	44.5	29.6	0.0	6.2	34.5	48.4	45.8	75.6	27.2	29.8
7	2200.416	BB	42.7	42.8	30.8	0.0	6.7	34.4	45.8	45.9	74.0	28.2	28.1
8	2514.766	BB	41.5	42.5	31.6	0.0	7.2	34.5	45.8	46.8	75.6	29.8	28.8
9	2829.116	BB	42.2	42.0	31.5	0.0	7.5	34.9	46.3	46.1	74.0	27.7	27.9
10	3143.466	BB	42.3	42.1	31.6	0.0	7.9	34.9	46.9	46.7	75.6	28.7	28.9

Above 1GHz AV DETECT (Spectrum Analyzer : RBW 1MHz and VBW 10Hz)

No.	FREQ [MHz]	ANT TYPE	READING		ANT Factor [dB]	ATTEN [dB]	CABLE LOSS [dB]	AMP GAIN [dB]	RESULT		LIMIT [dB]	MARGIN	
			HOR [dB μ V]	VER [dB μ V]					HOR [dB μ V/m]	VER [dB μ V/m]		HOR [dB]	VER [dB]
4	1257.380	BB	37.4	33.4	26.1	0.0	4.9	35.1	33.3	29.3	55.6	22.3	26.3
5	1571.726	BB	38.7	37.0	27.8	0.0	5.5	34.7	37.3	35.6	54.0	16.7	18.4
6	1886.073	BB	33.5	32.2	29.6	0.0	6.2	34.5	34.8	33.5	55.6	20.8	22.1
7	2200.416	BB	31.3	31.1	30.8	0.0	6.7	34.4	34.4	34.2	54.0	19.6	19.8
8	2514.766	BB	30.4	30.7	31.6	0.0	7.2	34.5	34.7	35.0	55.6	20.9	20.6
9	2829.116	BB	30.4	30.2	31.5	0.0	7.5	34.9	34.5	34.3	54.0	19.5	19.7
10	3143.466	BB	30.5	30.1	31.6	0.0	7.9	34.9	35.1	34.7	55.6	20.5	20.9

REMARKS

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

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

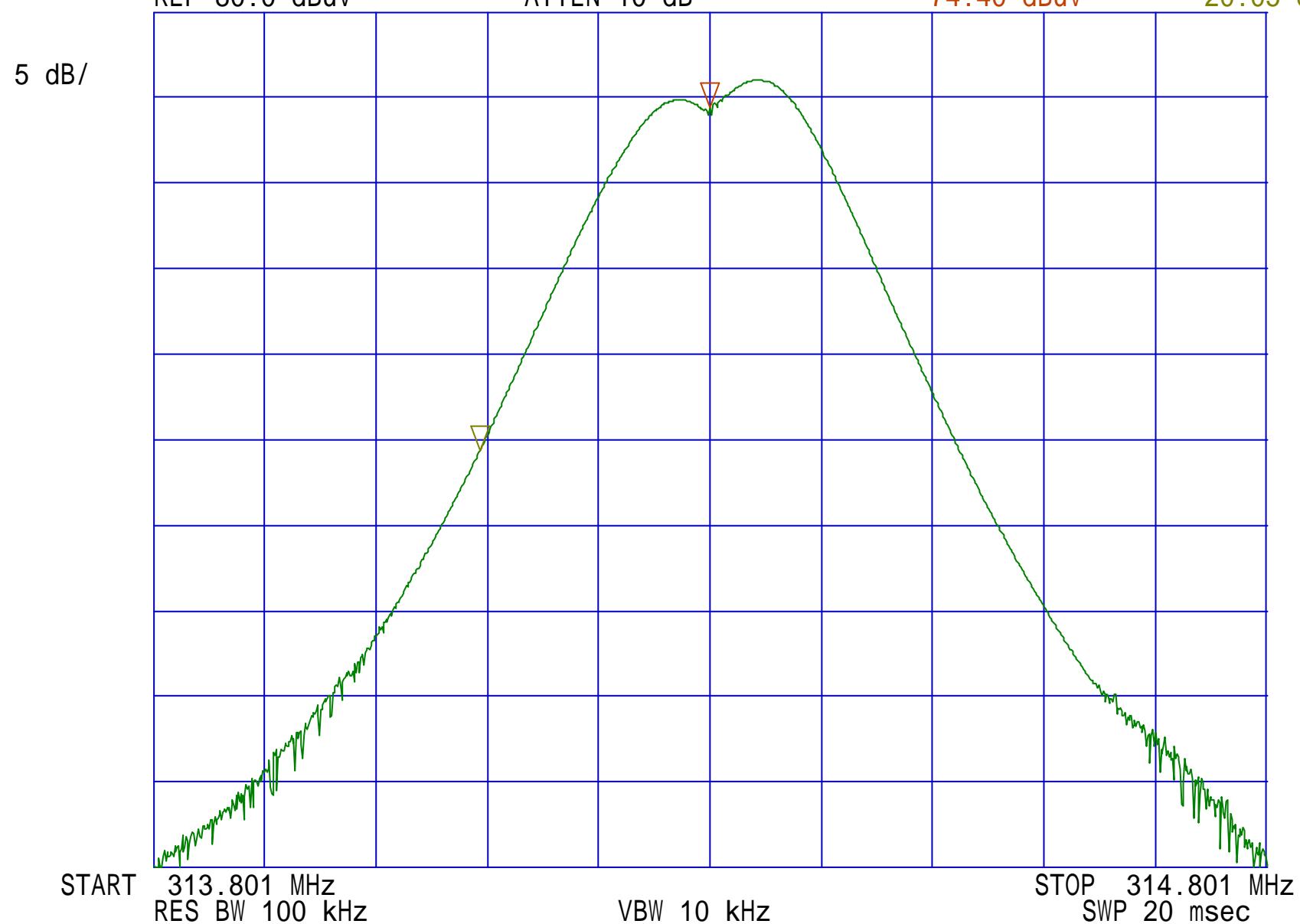
CALCULATION(1.0GHz to 3.3GHz) : READING + ANT Factor + Cable Loss - AMP Gain

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

DENSO / 12BBM / FCC ID: HIYQ
-20dB Bandwidth(Hor) 15.231(c) / Page A2
REF 80.0 dBuV ATTEN 10 dB

MAKER
314.3010 MHz
74.40 dBuV

MAKER
-207.0000 kHz
-20.05 dBuV



DENSO / 12BBM / FCC ID: HIYQ
-20dB Bandwidth(Hor) 15.231(c) / Page A3
REF 80.0 dBuV ATTEN 10 dB

MAKER
314.3010 MHz
74.40 dBuV

MAKER
224.0000 kHz
-20.10 dBuV

