

EMI TEST REPORT

Test Report No. : 25GE0235-HO-1

Applicant : **DENSO CORPORATION**
Type of Equipment : **Tire Pressure Monitoring System (Receiver)**
Model No. : **13BCE**
Test standard : **FCC Part 15 Subpart B Class B 2004**
FCC ID : **HYQ13BCE**
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:

March 31, 2005

Tested by:



Mitsuru Fujimura
EMC Service

Approved by :



Naoki Sakamoto
Group Leader of
EMC Service

UL Apex Co., Ltd.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b(10.04.03)

CONTENTS

PAGE

SECTION 1: Client information.....	3
SECTION 2: Equipment under test (E.U.T.)	3
SECTION 3: Test specification, procedures & results	4
SECTION 4: Operation of E.U.T. during testing.....	5
SECTION 5: Radiated Emission	6
APPENDIX 1: Photographs of test setup.....	7
Radiated Emission	7
Worst Case Position (X-axis:Horizontal / X-axis:Vertical)	8
APPENDIX 2: Test instruments	9
APPENDIX 3: Data of EMI test	10
Radiated Emission	10

UL Apex Co., Ltd.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b(10.04.03)

SECTION 1: Client information

Company name : DENSO CORPORATION
Address : 1-1 Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan

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

2.1 Identification of E.U.T.

Type of Equipment : Tire Pressure Monitoring System (Receiver)
Model No. : 13BCE
Serial No. : 1
Country of Manufacture : Japan
Receipt Date of Sample : March 24, 2005
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)

2.2 Product Description

Model No. 13BCE (Referred to EUT in this report) is Tire Pressure Monitoring System (Receiver).

Receiving frequency	314.98MHz
Intermediate Frequency (IF)	10.7MHz
Local Frequency (Local)	304.28MHz
Oscillator frequency	38.035MHz (Crystal)
Type of modulation	F2D
Type of receiving system	Super-heterodyne
Power Supply	Nominal supply voltage (12VDC)
Antenna	ANT1: Built-in type (Tire House ANT) ANT2: Built-in type (Tire House ANT)
Antenna Type	¼ lambda Top Loading Antenna

Section 15.111(b)

The receiving antenna (of this EUT) is installed inside the tire house so that it is impossible for end users to replace the antenna. The EUT has also a particular antenna. Therefore, this EUT complies with the requirement in section 15.111(b) and the test for Conducted was excluded.

UL Apex Co., Ltd.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b(10.04.03)

SECTION 3: Test specification, procedures & results

3.1 Test specification

Test Specification : FCC Part 15 Subpart B Class B 2004
Title : FCC 47CFR Part15 Radio Frequency Device
Subpart B Unintentional Radiators

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin *0)	Result
Conducted emission	ANSI C63.4: 2003 7. AC powerline conducted emission measurements	Class B	N/A	N/A *1)	N/A
Radiated emission	ANSI C63.4: 2003 8. Radiated emission measurements	Class B	N/A	20.6dB 912.840MHz, Horizontal, QP	Complied
*Note: UL Apex's EMI Work Procedure QPM05. *0) The result is rounded off to the second decimal place. Therefore, there may be 0.1 difference for the result. *1)The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.					

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

3.3 Uncertainty

Radiated Emission

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is $\pm 4.5\text{dB}(3\text{m})$.
The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is $\pm 5.2\text{dB}(3\text{m})$.
The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is $\pm 6.6\text{dB}$.
The data listed in this test report has enough margin, more than site margin.

3.4 Test Location

UL Apex Co., Ltd. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116 Facsimile: +81 596 24 8124

	FCC Registration Number	IC Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	313583	IC4247	19.2 x 11.2 x 7.7m	7.0 x 6.0m	Preparation room
No.2 semi-anechoic chamber	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.

3.5 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

UL Apex Co., Ltd.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b(10.04.03)

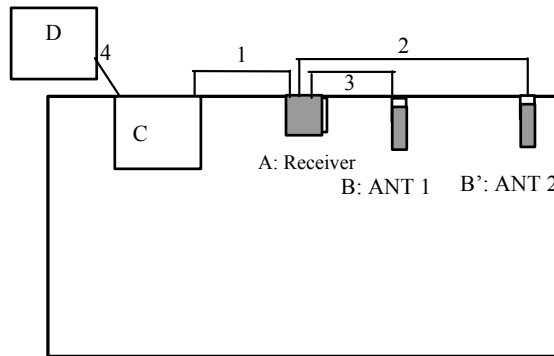
SECTION 4: Operation of E.U.T. during testing

4.1 Operating modes

The mode is used : Receiving mode

*The test sample is in the maximum receiving state without using Transmitter.

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	FCC ID	Remark
A	Receiver	13BCE	1	DENSO	HYQ13BCE	EUT
B	Antenna 1	-	-	DENSO	HYQ13BCE	EUT
B'	Antenna 2	-	-	DENSO	HYQ13BCE	EUT
C	Checker Bench	-	-	DENSO	-	-
D	Car Battery	40B19L	A030402	YUASA	-	-

List of cables used

No.	Name	Length (m)	Shield	Backshell Material
1	Signal Cable	1.0	N	Polyvinyl Chloride
2	Antenna Cable	3.8	N	Polyvinyl Chloride
3	Antenna Cable	2.15	N	Polyvinyl Chloride
4	DC Cable	0.5	N	Polyvinyl Chloride

UL Apex Co., Ltd.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b(10.04.03)

SECTION 5: Radiated Emission

5.1 Operating environment

Test place : No.2 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a platform of nominal size, 0.5m by 1.0m, raised 80cm above the conducting ground plane.

The EUT was set on the edge 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 – 300MHz (Biconical antenna) / 300MHz – 1000MHz (Logperiodic antenna)
1GHz – 2GHz (Horn antenna)
Test distance : 3m
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

The height of the measuring 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 (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

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

- 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.

5.5 Test result

Summary of the test results: Pass

Date: March 31, 2005

Test engineer: Mitsuru Fujimura

UL Apex Co., Ltd.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b(10.04.03)

APPENDIX 1: Photographs of test setup

Radiated Emission

Front



Rear



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

X-axis



Y-axis



Z-axis



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	2004/04/12 * 12
MRENT-14	Spectrum Analyzer	Advantest	R3273	RE	2005/02/21 * 12
MTR-02	Test Receiver	Rohde & Schwarz	ESCS30	RE	2005/02/02 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	RE	2004/10/14 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	RE	2004/10/14 * 12
MHA-06	Horn Antenna	Schwarzbeck	BBHA9120D	RE	2005/01/10 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	RE	2005/02/24 * 12
MCC-04	Microwave Cable 1-40G	Storm	421-011	RE	2005/01/05 * 12
MCC-21	Microwave Cable	Storm	-	RE	2004/05/01 * 12
MCC-22	Microwave Cable	Storm	-	RE	2004/05/01 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	RE	2004/12/16 * 12
MPA-06	Pre Amplifier	Hewlett Packard	8447D	RE	2004/08/29 * 12
MPA-05	Pre Amplifier	TSJ	TSJ 1-26.5GHz PreAmp	RE	2004/06/12 * 12

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

Test Item:

RE: Radiated emission

UL Apex Co., Ltd.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b(10.04.03)

APPENDIX 3: Data of EMI test

Radiated Emission

DATA OF RADIATED EMISSION TEST

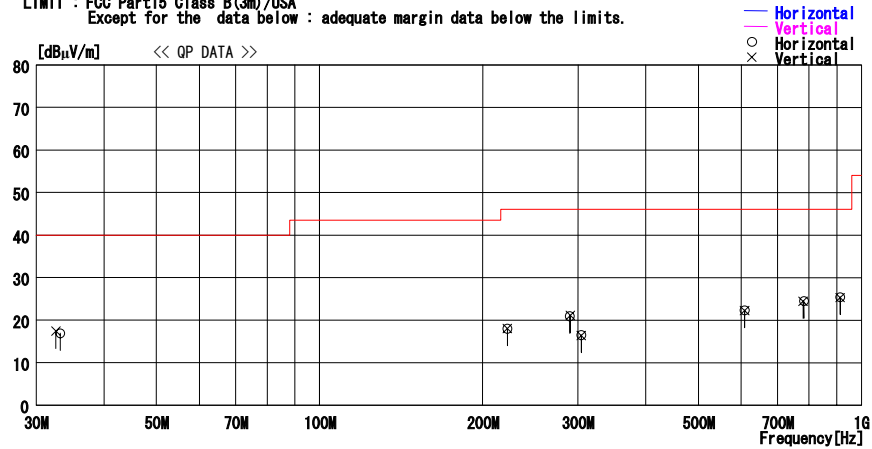
UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber

Applicant : DENSO CORPORATION
Kind of EUT : Tire Pressure Monitoring System (Receiver)
Model No. : 13BCE
Serial No. : 1

Report No. : 25GE0235-HO
Power : DC 12V
Temp./Humi. : 25 deg.C. / 30 %
Operator : Mitsuru Fujimura

Mode / Remarks : Receiving / X-axis

LIMIT : FCC Part15 Class B(3m)/USA
Except for the data below : adequate margin data below the limits.



No.	FREQ [MHz]	READING QP [dBμV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBμV/m]	LIMIT [dBμV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
Horizontal										
1	33.227	21.3	17.4	6.0	27.8	16.9	40.0	23.1	300	0
2	222.285	20.4	17.1	7.5	27.0	18.0	46.0	28.0	300	360
3	289.630	20.2	19.7	7.8	26.8	20.9	46.0	25.1	300	153
4	304.280	20.4	15.0	7.9	26.8	16.5	46.0	29.5	150	360
5	608.560	21.6	19.8	9.2	28.3	22.3	46.0	23.7	150	360
6	782.696	21.0	21.7	9.8	28.0	24.5	46.0	21.5	150	77
7	912.840	20.8	22.1	10.3	27.8	25.4	46.0	20.6	150	334
Vertical										
8	32.610	21.5	17.7	6.0	27.8	17.4	40.0	22.6	100	360
9	222.182	20.4	17.1	7.5	27.0	18.0	46.0	28.0	100	190
10	290.268	20.3	19.8	7.8	26.8	21.1	46.0	24.9	100	1
11	304.280	20.3	15.0	7.9	26.8	16.4	46.0	29.6	100	0
12	608.560	21.5	19.8	9.2	28.3	22.2	46.0	23.8	100	0
13	780.148	21.1	21.7	9.7	28.1	24.4	46.0	21.6	100	0
14	912.840	20.7	22.1	10.3	27.8	25.3	46.0	20.7	100	0

CHART:WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

UL Apex Co., Ltd.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b(10.04.03)

DATA OF RADIATED EMISSION TEST

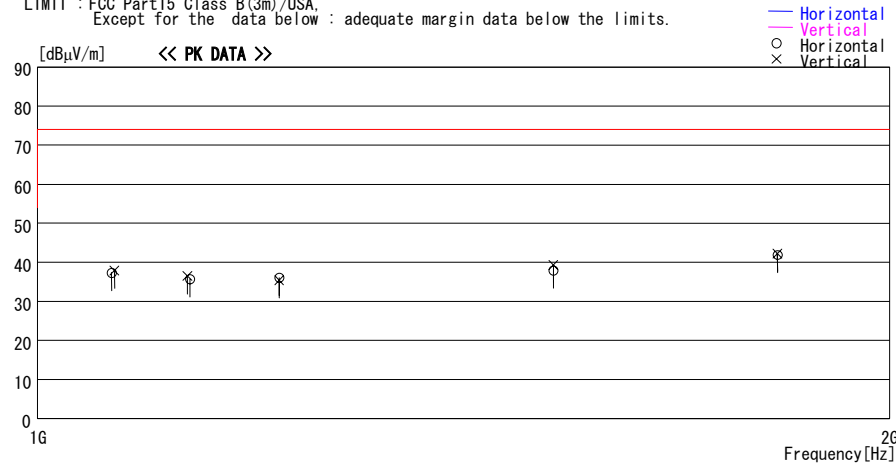
UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber

Applicant : DENSO CORPORATION
Kind of EUT : Tire Pressure Monitoring System (Receiver)
Model No. : 13BCE
Serial No. : 1

Report No. : 25GE0235-HO
Power : DC 12V
Temp./ Humi. : 25 deg.C. / 30 %
Operator : Mitsuru Fujimura

Mode / Remarks: Receiving / X-axis

LIMIT : FCC Part15 Class B(3m)/USA.
Except for the data below : adequate margin data below the limits.



No.	FREQ [MHz]	READING PK [dBμV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBμV/m]	LIMIT [dBμV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1062.000	50.8	22.7	3.8	40.0	37.3	74.0	36.7	100	0
2	1132.000	48.8	23.0	3.8	39.9	35.7	74.0	38.3	100	0
3	1217.120	48.5	23.3	4.1	39.8	36.1	74.0	37.9	100	0
4	1521.400	48.5	24.6	4.4	39.6	37.9	74.0	36.1	100	0
5	1825.680	48.2	28.2	4.9	39.4	41.9	74.0	32.1	100	0
----- Vertical -----										
6	1064.620	51.4	22.7	3.8	40.0	37.9	74.0	36.1	200	0
7	1129.400	49.6	23.0	3.8	39.9	36.5	74.0	37.5	200	0
8	1217.120	47.8	23.3	4.1	39.8	35.4	74.0	38.6	200	0
9	1521.400	49.9	24.6	4.4	39.6	39.3	74.0	34.7	200	0
10	1825.680	48.5	28.2	4.9	39.4	42.2	74.0	31.8	200	0

CHART:WITH FACTOR ANT TYPE: -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

UL Apex Co., Ltd.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b(10.04.03)

DATA OF RADIATED EMISSION TEST

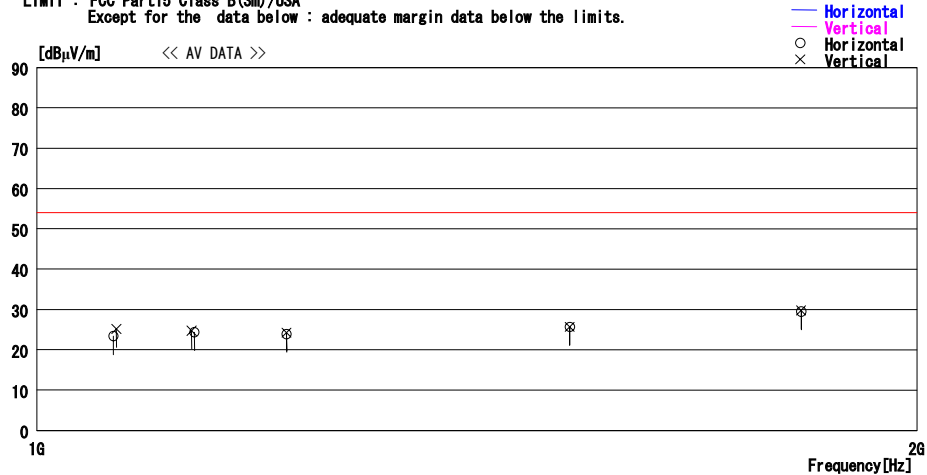
UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber

Applicant : DENSO CORPORATION
Kind of EUT : Tire Pressure Monitoring System (Receiver)
Model No. : 13BCE
Serial No. : 1

Report No. : 25GE0235-HO
Power : DC 12V
Temp./Humi. : 25 deg. C. / 30 %
Operator : Mitsuru Fujimura

Mode / Remarks : Receiving / X-axis

LIMIT : FCC Part15 Class B(3m)/USA
Except for the data below : adequate margin data below the limits.



No.	FREQ [MHz]	READING AV [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	1062.000	36.9	22.7	3.8	40.0	23.4	54.0	30.6	100	0
2	1132.000	37.4	23.0	3.8	39.9	24.3	54.0	29.7	100	0
3	1217.120	36.3	23.3	4.1	39.8	23.9	54.0	30.1	100	0
4	1521.400	36.3	24.6	4.4	39.6	25.7	54.0	28.3	100	0
5	1825.680	35.8	28.2	4.9	39.4	29.5	54.0	24.5	100	0
Vertical										
6	1064.620	38.6	22.7	3.8	40.0	25.1	54.0	28.9	200	0
7	1129.400	37.8	23.0	3.8	39.9	24.7	54.0	29.3	200	0
8	1217.120	36.6	23.3	4.1	39.8	24.2	54.0	29.8	200	0
9	1521.400	36.3	24.6	4.4	39.6	25.7	54.0	28.3	200	0
10	1825.680	36.1	28.2	4.9	39.4	29.8	54.0	24.2	200	0

CHART:WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

UL Apex Co., Ltd.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b(10.04.03)