# EMI TEST REPORT

## Test Report No. : 25DE0278-HO-1

| | | |
|---|---|---|
| **Applicant** | : | **TOYOTA MOTOR CORPORATION** |
| **Type of Equipment** | : | **Tire Pressure Monitoring System (Receiver)** |
| **Model No.** | : | **TMTPS-1** |
| **Test standard** | : | **FCC Part 15 Subpart B Class B 2004** |
| **FCC ID** | : | **NI4TMTPS-1** |
| **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:** December 24, 2004

**Tested by:** M. Fujimura
Mitsuru Fujimura
EMC Service

**Approved by :**
Naoki Sakamoto
Group Leader of
EMC Service

**CONTENTS** **PAGE**

## SECTION 1: Client information

| | | |
|---|---|---|
| Company name | : | TOYOTA MOTOR CORPORATION |
| Address | : | 1 Toyota-cho, Toyota-shi, Aichi-ken, 471-8572 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. | : | TMTPS-1 |
| Serial No. | : | 1 |
| Country of Manufacture | : | Japan |
| Receipt Date of Sample | : | December 24, 2004 |
| Condition of EUT | : | Production prototype<br>(Not for Sale: This sample is equivalent to mass-produced items.) |

### 2.2 Product Description

Model No. TMTPS-1 (Referred to EUT in this report) is Tire Pressure Monitoring System, which are Receiver and Door Antennas.

| | |
|---|---|
| Nominal frequency | 314.98MHz |
| 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 (Door Mirror ANT)<br>ANT2: Built-in type (Door Mirror ANT) |

Section 15.111(b)
The receiving antenna (of this EUT) is installed inside of Door mirror 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.

# SECTION 3: Test specification, procedures & results

## 3.1 Test specification

Test Specification : FCC Part 15 Subpart 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 | 16.2dB 949.562MHz, 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 ±4.5dB(3m).
The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is ±5.2dB(3m).
The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is ±6.6dB.

### 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

| | Listed date (for FCC) | 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 | February 01, 2002 | 313583 | IC4247 | 19.2 x 11.2 x 7.7m | 7.0 x 6.0m | Preparation room |
| No.2 semi-anechoic chamber | June 05, 2002 | 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, Data of EMI, and Label and Label location

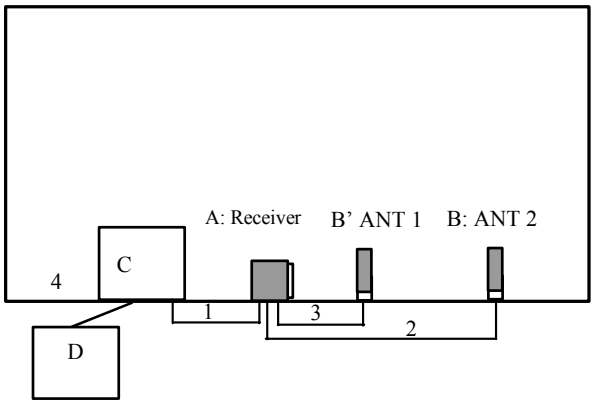
Refer to APPENDIX 1 to 4.

# 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 | TMTPS-1 | 1 | DENSO | NI4TMTPS-1 | EUT |
| B | Antenna | - | - | TOKAI RIKA | NI4TMTPS-1 | EUT |
| B' | Antenna | - | - | TOKAI RIKA | NI4TMTPS-1 | 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 | 4.0 | N | Polyvinyl Chloride |
| 3 | Antenna Cable | 2.6 | N | Polyvinyl Chloride |
| 4 | DC Cable | 1.2 | N | Polyvinyl Chloride |

# SECTION 5: Radiated Emission

## 5.1 Operating environment

Test place : No.1 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 measuring antenna height 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.

| Frequency | Below 1GHz | Above 1GHz |
|---|---|---|
| Instrument used | Test Receiver | Spectrum Analyzer |
| Detector<br>IF Bandwidth | QP: BW 120kHz | PK: RBW:1MHz/VBW: 1MHz<br>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

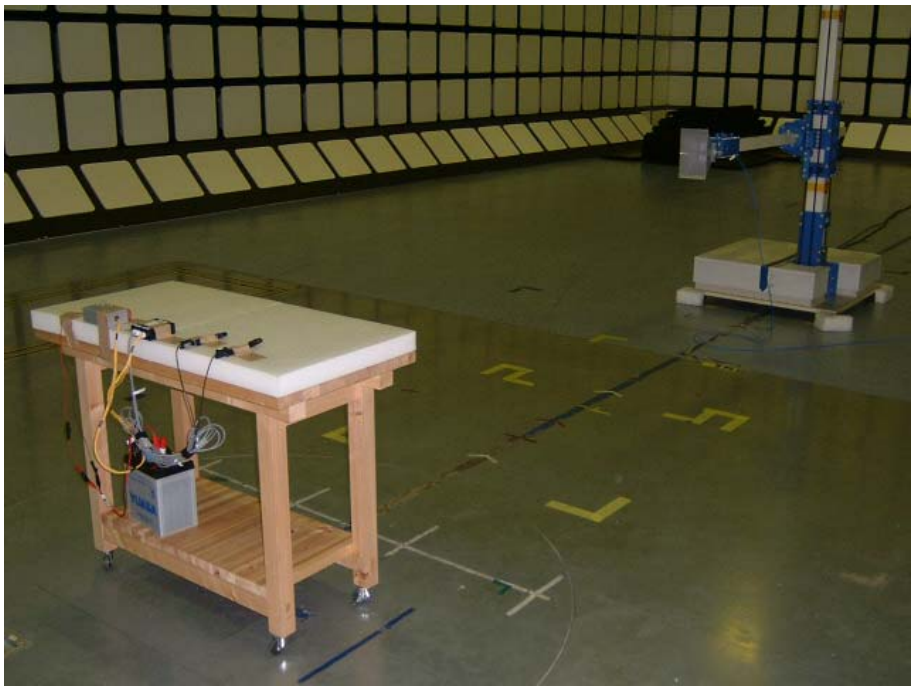
Date: December 24, 2004 Test engineer: Mitsuru Fujimura

## APPENDIX 1: Photographs of test setup

### Radiated Emission

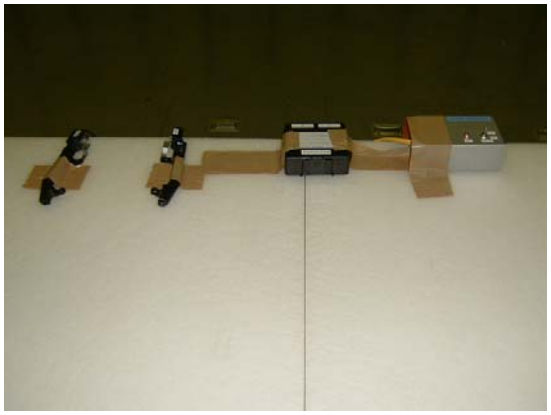
**Front**


**Rear**

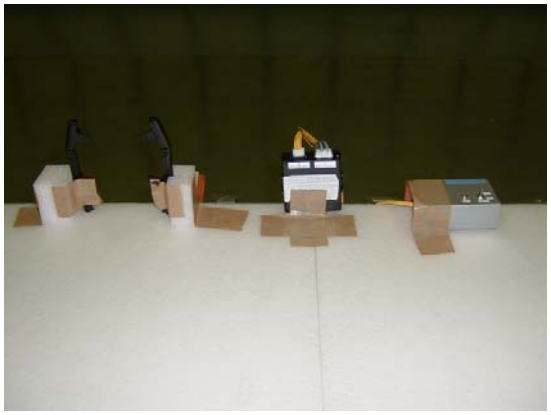


## Worst Case Position (X-axis:Horizontal / X-axis:Vertical)

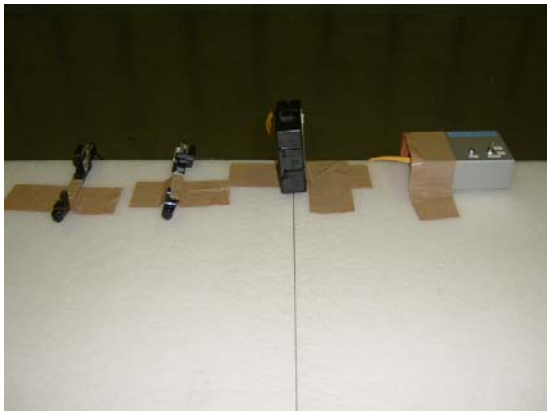
**X-axis**



**Y-axis**



**Z-axis**



## APPENDIX 2: Test instruments

**EMI test equipment**

| Control No. | Instrument | Manufacturer | Model No | Test Item | Calibration Date * Interval(month) |
|---|---|---|---|---|---|
| MAEC-01 | Anechoic Chamber | TDK | Semi Anechoic Chamber 10m | RE | 2003/12/27 * 12 |
| MBA-01 | Biconical Antenna | Schwarzbeck | BBA9106 | RE | 2004/10/14 * 12 |
| MLA-01 | Logperiodic Antenna | Schwarzbeck | USLP9143 | RE | 2004/10/14 * 12 |
| MCC-01 | Coaxial Cable 0.1-3000Mz | Suhner/storm/Agilent/TSJ | - | RE | 2004/12/19 * 12 |
| MAT-06 | Attenuator(6dB) | Weinschel Corp | 2 | RE | 2004/12/16 * 12 |
| MPA-04 | Pre Amplifier | Agilent | 8447D | RE | 2004/05/25 * 12 |
| MTR-01 | Test Receiver | Rohde & Schwarz | ESI40 | RE | 2004/11/12 * 12 |
| MHA-05 | Horn Antenna | Schwarzbeck | BBHA9120D | RE | 2004/01/10 * 12 |
| MCC-23 | Microwave Cable | Storm | - | RE | 2004/05/01 * 12 |
| MCC-05 | Microwave Cable | Storm | 421-011 | RE | 2004/01/06 * 12 |
| MPA-01 | Pre Amplifier | Agilent | 8449B | RE | 2004/02/06 * 12 |

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

**Test Item:**

**RE: Radiated emission**

# APPENDIX 3: Data of EMI test

## Radiated Emission

### DATA OF RADIATED EMISSION TEST

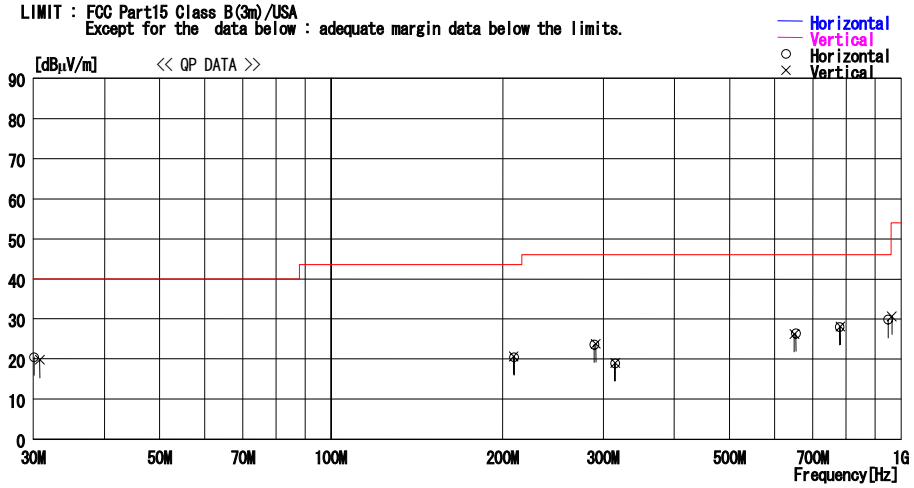
UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber

Applicant : TOYOTA MOTOR CORPORATION
Kind of EUT : Tire Pressure Monitoring System (Receiver)
Model No. : TMTPS-1
Serial No. : 1

Report No. : 25DE0278-HO
Power : DC12V
Temp°C/Humi% : 20 / 28
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 | 30.090 | 22.2 | 19.0 | 6.9 | 27.6 | 20.5 | 40.0 | 19.5 | 300 | 0 |
| 2 | 209.421 | 21.3 | 17.2 | 9.3 | 27.3 | 20.5 | 43.5 | 23.0 | 300 | 0 |
| 3 | 289.322 | 21.1 | 19.8 | 9.9 | 27.2 | 23.6 | 46.0 | 22.4 | 300 | 0 |
| 4 | 654.170 | 22.6 | 20.4 | 12.0 | 28.6 | 26.4 | 46.0 | 19.6 | 100 | 0 |
| 5 | 780.656 | 22.9 | 21.1 | 12.6 | 28.6 | 28.0 | 46.0 | 18.0 | 100 | 0 |
| 6 | 949.562 | 22.8 | 22.4 | 13.2 | 28.6 | 29.8 | 46.0 | 16.2 | 100 | 0 |
| 7 | 314.980 | 21.2 | 15.1 | 10.1 | 27.4 | 19.0 | 46.0 | 27.0 | 100 | 0 |
| —— Vertical —— | | | | | | | | | | |
| 8 | 30.811 | 21.9 | 18.6 | 6.9 | 27.6 | 19.8 | 40.0 | 20.2 | 100 | 0 |
| 9 | 209.052 | 21.3 | 17.2 | 9.3 | 27.2 | 20.6 | 43.5 | 22.9 | 100 | 0 |
| 10 | 291.191 | 21.1 | 20.0 | 9.9 | 27.2 | 23.8 | 46.0 | 22.2 | 100 | 0 |
| 11 | 649.300 | 22.5 | 20.3 | 12.0 | 28.6 | 26.2 | 46.0 | 19.8 | 100 | 0 |
| 12 | 782.762 | 22.9 | 21.1 | 12.7 | 28.6 | 28.1 | 46.0 | 17.9 | 100 | 0 |
| 13 | 963.297 | 23.1 | 22.7 | 13.3 | 28.5 | 30.6 | 54.0 | 23.4 | 100 | 0 |
| 14 | 314.980 | 21.2 | 15.1 | 10.1 | 27.4 | 19.0 | 46.0 | 27.0 | 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)

# DATA OF RADIATED EMISSION TEST

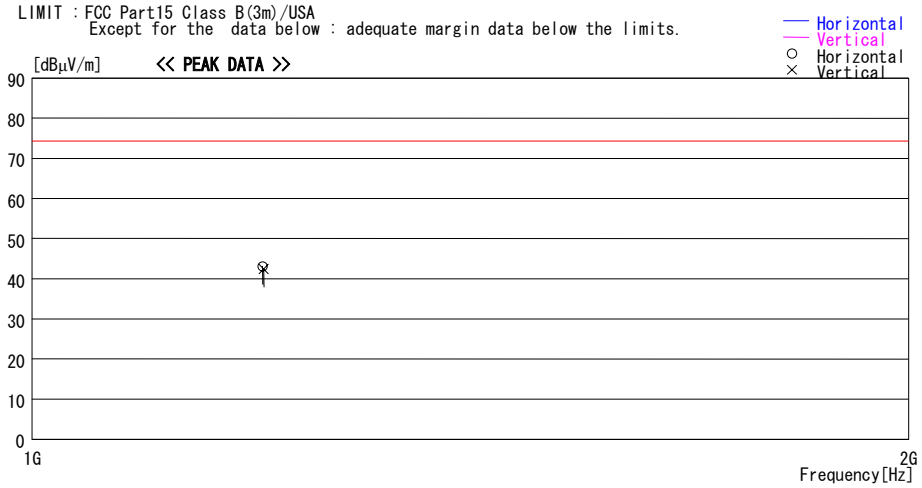
UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber

Applicant : TOYOTA MOTOR CORPORATION
Kind of EUT : Tire Pressure Monitoring System(Receiver)
Model No. : TMTPS-1
Serial No. : 1

Report No. : 25DE0278-HO
Power : DC12V
Temp℃/Humi% : 20 / 28
Operator : Mitsuru Fujimura

Mode / Remarks: Receiving / X-axis 1-2GHz

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 | 1200.041 | 53.1 | 23.1 | 3.8 | 36.9 | 43.1 | 74.0 | 30.9 | 100 | 0 |
| ----- Vertical ------ | | | | | | | | | | |
| 2 | 1201.340 | 52.4 | 23.1 | 3.8 | 36.9 | 42.4 | 74.0 | 31.6 | 350 | 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)

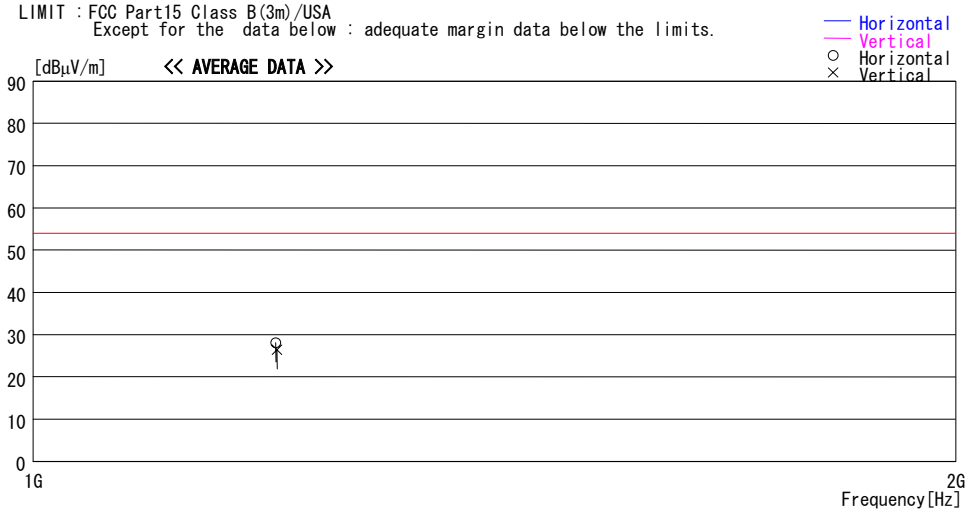
# DATA OF RADIATED EMISSION TEST

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

| | | | |
|---|---|---|---|
| Applicant | : TOYOTA MOTOR CORPORATION | Report No. | : 25DE0278-HO |
| Kind of EUT | : Tire Pressure Monitoring System(Receiver) | Power | : DC12V |
| Model No. | : TMTPS-1 | Temp℃/Humi% | : 20 / 28 |
| Serial No. | : 1 | Operator | : Mitsuru Fujimura |

Mode / Remarks: Receiving / X-axis 1-2GHz

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




| No. | FREQ [MHz] | READING AV [dBμV] | ANT FACTOR [dB/m] | LOSS [dB] | GAIN [dB] | RESULT [dBμV/m] | LIMIT [dBμV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- Horizontal ------ | | | | | | | | | | |
| 1 | 1200.041 | 38.1 | 23.1 | 3.8 | 36.9 | 28.1 | 54.0 | 25.9 | 100 | 0 |
| ----- Vertical ------ | | | | | | | | | | |
| 2 | 1201.340 | 36.4 | 23.1 | 3.8 | 36.9 | 26.4 | 54.0 | 27.6 | 350 | 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)