



RADIO TEST REPORT

Test Report No.: 30CE0195-SH-02-A

Applicant : BRIDGESTONE CORPORATION
Type of Equipment : TPMS(Tire Pressure Monitoring System)
Model No. : E612
FCC ID : SBDE612
Test regulation : FCC Part15 Subpart C: 2009
Test result : Complied

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Date of test: November 2, 4-5 and 8 2009

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1 Applicant information

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

2.1 Identification of E.U.T.

Type of Equipment : TPMS(Tire Pressure Monitoring System)
Model No. : E612
Serial No. : ECU:0000343908
RECEIVER:0000410509,0000420509,0000430509,0000440509
DISPLAY:0000352507
Rating : DC24V/2A
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No modification by the test lab.
Receipt Date of Sample : October 30, 2009

*) E612 is name of TPMS system and, E612 includes ECU(E612), RECEIVER(R612) and DISPLAY(D612).

2.2 Product description

Model: E612 (referred to as the EUT in this report) is a TPMS(Tire Pressure Monitoring System)

Clock frequency : ECU(CPU):16.000MHz
ECU(Bluetooth Module):26.000MHz

[Bluetooth(Ver.2.0+EDR)]

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Other Clock Frequency : 26MHz
Bandwidth & channel spacing : 1MHz
Type of modulation : FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK)
Mode of Operation : Simplex
Operating voltage : DC 10 to 32V
Antenna type : Inverted F-Type Antenna
Antenna gain with cable loss : 0dBi
Antenna connector type : GT-16 Connector
ITU code : F1D,G1D
Method of Frequency Generation : Synthesizer
Operation temperature range : -40 to +85 deg.C

[Receiver*1)]

Equipment type : Receiver
Type of Receiver : Super-heterodyne
Frequency of operation : 433.92MHz
Other Clock Frequency : 13.225625MHz/20.000MHz
Intermediate Frequency : 10.7MHz
Type of modulation : FSK
Mode of Operation : Simplex
Antenna type : Loop Antenna
Operating voltage : DC 8.0V
Operation temperature range : -40 to +85 deg.C

*1) Reference: EUT also this function Refer to 30CE0195-SH-02-C

FCC Part15.31 (e)

The Bluetooth transmitter is provided with stable power supply (DC 3.0 V), therefore, the equipment complies power supply regulation.

FCC Part15.203 Antenna requirement

The EUT has a unique coupling antenna connector. Therefore the equipment complies with the requirement of 15.203.

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3 Test specification, procedures and results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2009, final revised on February 27, 2009
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.209 Radiated emission limits, general requirements
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz,
and 5725-5850MHz

The EUT complies with FCC Part 15 Subpart B: 2009, final revised on February 27, 2009. Refer to the test report 30CE0195-SH-02-C.

3.2 Procedures & Results

| Item | Test Procedure | Specification | Remarks | Deviation | Worst Margin | Results |
|--|---|--|------------------------|------------|---|----------|
| Conducted emission | ANSI C63.4:2003 7. AC powerline conducted emission measurements | FCC Section 15.207 | - | N/A *1) | N/A | N/A |
| Carrier frequency separation | FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators | FCC Section15.247 (a)(1) | Conducted | N/A | *See data. | Complied |
| 20dB bandwidth | FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators | FCC Section15.247 (a)(1) | Conducted | N/A | | Complied |
| Number of hopping frequency | FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators | FCC Section15.247 (a)(1)(iii) | Conducted | N/A | | Complied |
| Dwell time | FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators | FCC Section15.247 (a)(1)(iii) | Conducted | N/A | | Complied |
| Maximum peak output power | FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators | FCC Section15.247 (b)(1) | Conducted | N/A | | Complied |
| Band edge compliance & Spurious emission | FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators | FCC Section15.247 (d) Section15.209 | Conducted/ Radiated | N/A | 1.2dB (143.991MHz, Vertical, Transmitting 3DH5_2402MHz) | Complied |

Note: UL Japan's EMI Work Procedures No.QPM05 and QPM15.

*1) The test is not applicable since the EUT has no AC mains.

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3.3 Addition to standard

| Item | Test Procedure | Specification | Remarks | Worst Margin | Results |
|--------------------------|--|---------------|-----------|--------------|----------|
| Occupied bandwidth (99%) | ANSI C63.4:2003 13. Measurement of intentional radiators RSS-Gen 4.6.1 | RSS-Gen 4.6.1 | Conducted | - | Complied |

* Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

| | No.1 semi anechoic chamber (±) | No.2 semi anechoic chamber (±) | No.3 semi anechoic chamber (±) |
|-------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Radiated emission (3m) | | | |
| 30-300MHz | 4.4 dB | 4.3 dB | 4.5 dB |
| 300-1000MHz | 4.3 dB | 4.2 dB | 4.5 dB |
| 1GHz< | 5.7 dB | 5.6 dB | 5.6 dB |

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

| Antenna port conducted test | (±) |
|------------------------------------|-------|
| Below 1GHz | 1.1dB |
| 1-3GHz | 1.2dB |
| 3-18GHz | 2.9dB |
| 18-26.5GHz | 3.4dB |

The data listed in this test report has enough margin, more than site margin.

Power Measurement uncertainty above 1GHz (with a 95% confidence level) for this test was: (±) 0.8dB

Frequency Measurement uncertainty (with a 95% confidence level) for this test was: (±) 2.1%

Bandwidth Measurement uncertainty (with a 95% confidence level) for this test was: (±) 5.4%

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3.5 Test location

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JAB Accreditation No. : RTL02610

No.1/ No.2/ No.3 anechoic chamber has been fully described in a report submitted to FCC office, and accepted on April 17, 2009 (Registration No.: 697847).

IC Registration No. : 2973D-1 (No1 anechoic chamber)

2973D-2 (No2 anechoic chamber)

2973D-3 (No3 anechoic chamber)

| Test room | Width x Depth x Height (m) | Test room | Width x Depth x Height (m) |
|-------------------------------|---|--------------------|----------------------------|
| No.1 Semi-anechoic chamber | 20.6 x 11.3 x 7.65 Maximum measurement distance: 10m | No.1 Shielded room | 6.8 x 4.1 x 2.7 |
| No.2 Semi-anechoic chamber | 20.6 x 11.3 x 7.65 Maximum measurement distance: 10m | No.2 Shielded room | 6.8 x 4.1 x 2.7 |
| No.3 Semi-anechoic chamber | 12.7 x 7.7 x 5.35 Maximum measurement distance: 5m | No.3 Shielded room | 6.3 x 4.7 x 2.7 |
| No.4 Full-anechoic chamber | 8.1 x 5.1 x 3.55 | No.4 Shielded room | 4.4 x 4.7 x 2.7 |
| | | No.5 Shielded room | 7.8 x 6.4 x 2.7 |
| | | No.6 Shielded room | 7.8 x 6.4 x 2.7 |

3.6 Test setup, Data of EMI & Test instruments

Refer to Appendix 1 to 3.

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4 System test configuration

4.1 Justification

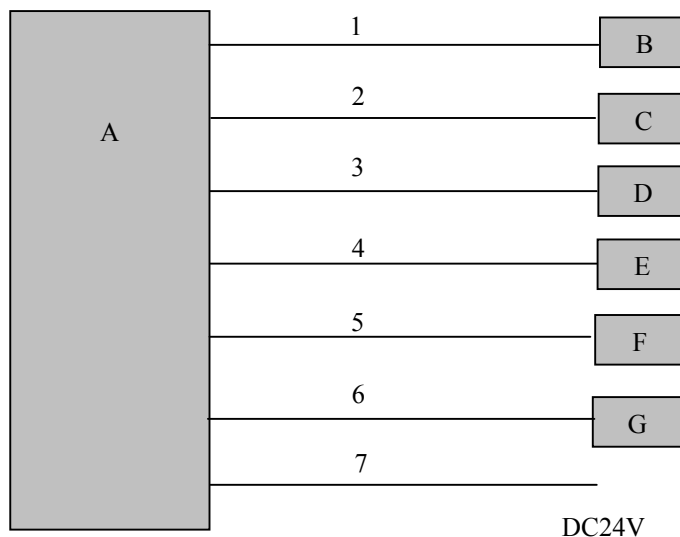
The system was configured in typical fashion (as a customer would normally use it) for testing.

| Test item | Operating mode | Tested frequency |
|--|---|---|
| Carrier frequency separation | Transmitting Hopping ON (DH5/3DH5)/Inquiry, Payload: PRBS9 | - |
| 20dB bandwidth | Transmitting Hopping OFF (DH5/3DH5)/Inquiry, Payload: PRBS9 | 2402MHz, 2441MHz, 2480MHz |
| Number of hopping frequency | Transmitting Hopping ON (DH5/3DH5)/Inquiry, Payload: PRBS9 | - |
| Dwell time | Transmitting (Hopping ON) -DH1, -DH3, -DH5 -3DH1, -3DH3, -3DH5 -Inquiry | - |
| Maximum peak output power | Transmitting Hopping OFF (DH5/3DH5)/Inquiry, Payload: PRBS9 -DH5 -2DH5 -3DH5 | 2402MHz, 2441MHz, 2480MHz |
| Band edge compliance & Spurious emission (Conducted) | Transmitting (DH5/3DH5), Payload: PRBS9 -Hopping ON/Inquiry -Hopping OFF | Band edge compliance: 2402MHz, 2480MHz |
| (Radiated) | Transmitting (DH5/3DH5), Payload: PRBS9 | Spurious emission: 2402MHz, 2441MHz, 2480MHz |
| 99% occupied bandwidth | Transmitting (DH5/3DH5), Payload: PRBS9 -Hopping ON -Hopping OFF | 2402MHz, 2441MHz, 2480MHz |

*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload (except Dwell time test)

*Remarks: Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.
 However, the limit level 125mWof AFH mode was used for the test.

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT and support equipment

| No. | Item | Model number | Serial number | Manufacturer | Remarks |
|-----|-------------------|--------------|---------------|-----------------|---------|
| A | ECU | E612 | 0000343908 | Yokowo Co.,Ltd. | EUT |
| B | Display | D612 | 0000352507 | Yokowo Co.,Ltd | EUT |
| C | Bluetooth Antenna | BTA6 | 000020 | Yokowo Co.,Ltd | EUT |
| D | Receiver1 | R612 | 0000410509 | Yokowo Co.,Ltd | EUT |
| E | Receiver2 | R612 | 0000420509 | Yokowo Co.,Ltd | EUT |
| F | Receiver3 | R612 | 0000430509 | Yokowo Co.,Ltd | EUT |
| G | Receiver4 | R612 | 0000440509 | Yokowo Co.,Ltd | EUT |

List of cables used

| No. | Name | Length (m) | Shield | | Remark |
|-----|-----------------|------------|------------|------------|--------|
| | | | Cable | Connector | |
| 1 | Display Cable | 5.0 | Unshielded | Unshielded | - |
| 2 | Antenna Cable | 0.5 | Unshielded | Unshielded | - |
| 3 | Receiver1 Cable | 13.5 | Unshielded | Unshielded | - |
| 4 | Receiver2 Cable | 13.5 | Unshielded | Unshielded | - |
| 5 | Receiver3 Cable | 8.5 | Unshielded | Unshielded | - |
| 6 | Receiver4 Cable | 8.5 | Unshielded | Unshielded | - |
| 7 | DC Power Cable | 5.0 | Unshielded | Unshielded | - |

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5 Carrier frequency separation

Test procedure

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass

6 20dB bandwidth & Occupied bandwidth (99%)

Test procedure

The bandwidth was measured with a spectrum analyzer connected to the antenna port.

The channel separation in Hopping mode and Inquiry mode was separated by 25kHz and 2/3 of the 20dB bandwidth.

Summary of the test results: Pass

7 Number of hopping frequency

Test procedure

The Number of Hopping Frequency was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass

8 Dwell time

Test procedure

The Dwell time was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass

9 Maximum peak output power

Test procedure

The Maximum Peak Output Power was measured with a power meter connected to the antenna port.

Summary of the test results: Pass

10 Out of band emissions (Antenna port conducted)

Test procedure

The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port.

In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a conducted measurement.

Summary of the test results: Pass

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11 Out of band emissions (Radiated)

11.1 Operating environment

The test was carried out in No.3 semi anechoic chamber.

11.2 Test configuration

EUT was placed on a urethane platform of nominal size, 1.8m by 0.9m, raised 80cm above the conducting ground plane to prevent the reflection influence. The configuration was set in accordance with ANSI C63.4: 2003. Photographs of the set up are shown in Appendix 1.

11.3 Test conditions

Frequency range : 30MHz - 26GHz
Test distance : 3m

11.4 Test procedure

The Radiated Electric Field Strength intensity has been measured with a ground plane and at a distance of 3m. The measuring antenna height was 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.

Measurements were performed with QP, PK, and AV detector.

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

| Frequency | Below 1GHz | Above 1GHz |
|-----------------------|--|---|
| Instrument used | Test Receiver | Spectrum Analyzer |
| Detector IF Bandwidth | QP: BW 120kHz | PK: RBW: 1MHz/VBW: 1MHz, AV(pulse): PK with Dwell Factor |
| Measuring antenna | Biconical (30-300MHz) Logperiodic (300MHz-1GHz) | Horn |

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.

| | Below 1GHz | | Above 1GHz | |
|------------|------------|---------|------------|---------|
| | Module | Antenna | Module | Antenna |
| Horizontal | Z | Z | X | X |
| Vertical | Z | Z | X | Z |

11.5 Band edge

Band edge level at 2390MHz and 2483.5MHz is below the limits of FCC 15.209 and band edge level at 2400MHz is below the 20dBc. Refer to the data.

11.6 Results

Summary of the test results : Pass *No noise was detected above the 5th order harmonics.

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APPENDIX 1: Photographs of test setup

| | | |
|---------|---|---------------------------------|
| Page 13 | : | Radiated emission |
| Page 14 | : | Pre-check of the worst position |

APPENDIX 2: Test data

| | | |
|--------------|---|---|
| Page 15- 18 | : | 20dB bandwidth and Carrier frequency separation |
| Page 19 - 21 | : | Number of hopping frequency |
| Page 22 - 25 | : | Dwell time |
| Page 26 | : | Peak output power |
| Page 27- 37 | : | Out of band emissions (Antenna Port Conducted) |
| Page 38 - 50 | : | Out of band emissions (Radiated) |
| Page 51 - 52 | : | Occupied bandwidth (99%) |

APPENDIX 3: Test instruments

| | | |
|---------|---|------------------|
| Page 53 | : | Test instruments |
|---------|---|------------------|