



UL Apex Co., Ltd.

Test report No. : 25BE0184-HO-1
Page : 1 of 14
Issued date : October 13, 2004
FCC ID : SBDITTWB315F02
Revised date : November 5, 2004
Revised date : November 29, 2004

EMI TEST REPORT

Test Report No. : 25BE0184-HO-1

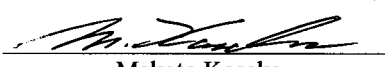
Applicant : **Bridgestone Corporation**
Type of Equipment : **Sensor Module**
Model No. : **B311**
Test standard : **FCC Part 15 Subpart C 2004**
Section 15.209, Section 15.231
FCC ID : **SBDITTWB315F02**
Test Result : **Complied**

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.

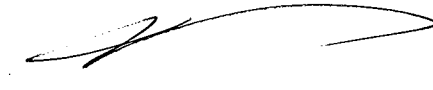
Date of test:

September 24, 2004

Tested by:


Makoto Kosaka
EMC Service

Approved by :


Naoki Sakamoto
Group Leader of
EMC Service

UL Apex Co., Ltd.

Head Office EMC Lab.

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MF060b(10.04.03)

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SECTION 1: Client information

Company Name : Bridgestone Corporation.
Address : 3-1-1, Ogawahigashi-Cho, Kodaira-Shi, Tokyo 187-8531 Japan
Telephone Number : +81-42-342-6326
Facsimile Number : +81-42-342-6596
Contact Person : Tsutomu Nakao

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

2.1 Identification of E.U.T.

Type of Equipment : Sensor Module
Model No. : B311
Sample No. : 0000F2
Country of Manufacture : Japan
Receipt Date of Sample : September 24, 2004
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)

2.2 Product Description

Model No: B311 is the Sensor Module.
The clock frequency of EUT is 9.84375MHz
This EUT is to measure the Tire Pressure or its temperature and transmit it as the radio wave within the fixed interval.
Equipment Type : Transmitter
Power Supply : DC 3.0V(BR-2450A(Lithium cell battery))

Transmitter Section

Frequency operation	315MHz
Type of modulation	FSK
Information antenna	Internal / Loop antenna

Receiver Section

Frequency operation	125kHz
Type of detection	Direct detect
Information antenna	Internal / Transponder antenna coil

FCC 15.31 (e)

This EUT provides stable voltage (DC3.0V) constantly to Sensor Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C 2004
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.231 Periodic operation in the band 40.66-40.70MHz
and above 70MHz

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Deviation	Worst margin	Results
1	Transmitting time and Interval	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.231(e)	N/A	-	Complied
2	Electric Field Strength of Fundamental Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.231(e)	N/A	17.5dB(AV(Pulse)) 314.969MHz Horizontal	Complied
3	Electric Field Strength of Spurious Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.205 Section 15.209 Section 15.231(e)	N/A	12.9dB(AV(Pulse)) 2.83511GHz Horizontal	Complied
4	-20dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.231(c)	N/A	-	Complied
5	Conducted emission AC Mains	ANSI C63.4:2003 7. AC powerline conducted emission measurements	Section 15.207	N/A*1)	N/A	N/A

Note: UL Apex's EMI Work procedures No. QPM05

*1) The test is not applicable since the EUT is DC drive and is not connected to the public utility (AC) power line.

3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-210(issue 5): 2001 + Amendment:2002 + Amendment2:2003 + Amendment3:2004 + Amendment4:2004	RSS-210(issue 5): 2001 + Amendment:2002 + Amendment2:2003 + Amendment3:2004 + Amendment4:2004	Conducted	N/A	N/A	N/A

3.4 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 report meets the limits unless the uncertainty is taken into consideration.

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3.5 Test Location

UL Apex Co., Ltd. Head Office EMC Lab. *NVLAP Lab. code: 200572-0

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	Listed date (for FCC)	FCC Registration Number	IC Registration 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.

3.6 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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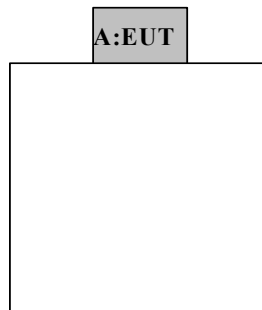
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

The EUT was operated in a manner similar to typical use during the tests.

The mode is used : Transmitting mode (315.0MHz)

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Sample No.	Manufacturer	FCC ID
A	Sensor Module	B311	0000F2	Bridgestone Corporation	SBDITTWB315F02

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SECTION 5: Radiated emission (Fundamental and Spurious 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 0.5m, 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 : Top of Polyurethane
EUT operation mode : 315MHz Transmitting

5.4 Test procedure

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 with the Test Receiver or the Spectrum Analyzer.

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

-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: September 24, 2004

Tested by: Makoto Kosaka

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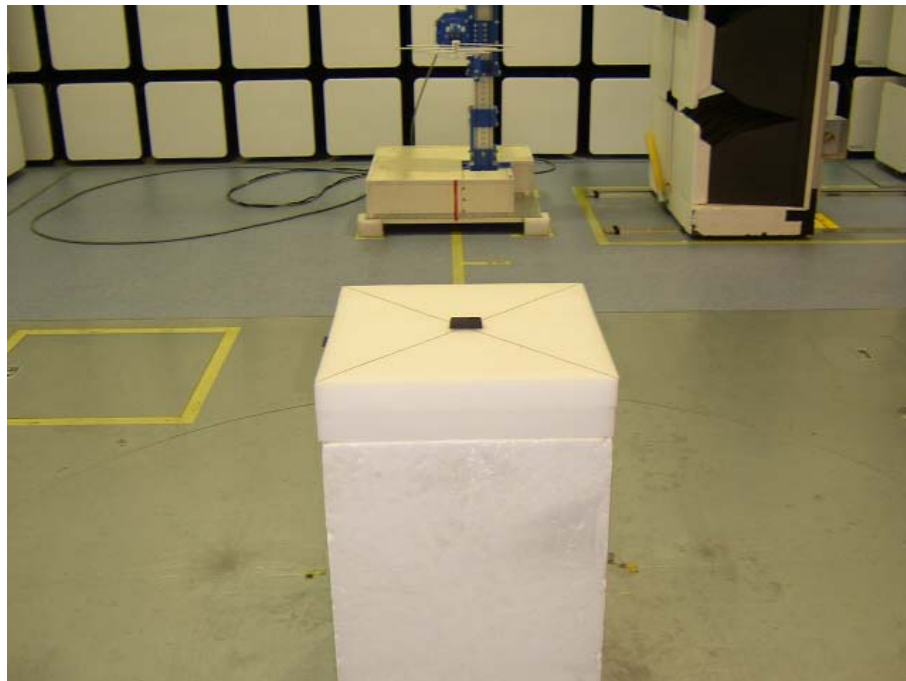
APPENDIX 1: Photographs of test setup

Radiated emission(Worst case position)

Front



Rear



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

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
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	RE	2003/10/15 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	RE	2003/10/15 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	RE	2003/12/16 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	RE	2004/02/24 * 12
MPA-06	Pre Amplifier	Hewlett Packard	8447D	RE	2004/08/29 * 12
MHA-06	Horn Antenna	Schwarzbeck	BBHA9120D	RE	2004/01/10 * 12
MCC-04	Microwave Cable	Storm	421-011	RE	2004/01/06 * 12
MCC-24	Microwave Cable	Storm	-	RE	2004/05/01 * 12
MPA-03	Microwave System Power Amplifier	Agilent	83050A	RE	2004/06/12 * 12
MTR-02	Test Receiver	Rohde & Schwarz	ESCS30	RE	2004/02/03 * 12
MRENT-09	Spectrum Analyzer	Advantest	R3273	RE	2004/02/18 * 12

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

Test Item:

RE: Radiated emission

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APPENDIX 3: Data of EMI test

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

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

COMPANY : Bridgestone Corporation
EQUIPMENT : Sensor Module
MODEL : ITTWB315F02
SAMPLE No. : ITTWB315F02-F2
FCC ID : SBDITTWB315F02
IC No. : 5381A-YOP1010
POWER : DC 3.0V(BR-2450A)
Mode : Transmitting (315MHz)
EUT Position : X-axis(Hor) and X-axis(Ver)

REPORT NO : 24HE0054-HO
REGULATION : FCC Part 15 Subpart C 231(e)
:
TEST DISTANCE : 3m
DATE : 2004/09/24
Temperature : 27deg.C
Humidity : 67%
ENGINEER : Makoto Kosaka

PK DETECT(T/R : IF BW 120kHz)

No.	FREQ [MHz]	T/R READING HOR VER [dBuV]		ANT Factor [dB/m]	AMP GAIN [dB]	CABLE LOSS [dB]	ATT [dB]	Duty Factor [dB]	RESULT HOR VER [dBuV/m]		Limit AV(pulse) [dBuV/m]	MARGIN HOR VER [dB]	
1	314.969	74.0	69.8	14.6	26.9	2.4	6.0	-20.0	50.1	45.9	67.6	17.5	21.7
2	629.934	39.8	37.9	19.9	28.2	3.7	6.2	-20.0	21.4	19.5	47.7	26.3	28.2
3	944.901	36.7	35.2	22.3	27.7	4.8	6.2	-20.0	22.3	20.8	47.7	25.4	26.9

PK DETECT(S/A : RBW 1MHz and VBW 1MHz)

No.	FREQ [GHz]	S/A READING HOR VER [dBuV]		ANT Factor [dB/m]	AMP GAIN [dB]	CABLE LOSS [dB]	ATT [dB]	none	RESULT HOR VER [dBuV/m]		Limit AV(pulse) [dBuV/m]	MARGIN HOR VER [dB]	
4	1.26011	37.1	37.8	23.3	27.1	4.5	0.0	-20.0	17.8	18.5	47.7	29.9	29.2
5	1.57511	51.0	40.3	25.1	27.3	5.1	0.0	-20.0	33.9	23.2	47.7	13.8	24.5
6	1.89011	47.8	41.4	28.8	27.6	5.7	0.0	-20.0	34.7	28.3	47.7	13.0	19.4
7	2.20519	38.6	36.7	30.5	27.5	6.2	0.0	-20.0	27.8	25.9	47.7	19.9	21.8
8	2.52039	41.1	38.3	31.0	27.4	6.6	0.0	-20.0	31.3	28.5	47.7	16.4	19.2
9	2.83511	43.0	38.7	32.0	27.2	7.0	0.0	-20.0	34.8	30.5	47.7	12.9	17.2
10	3.15012	37.0	40.8	32.0	27.1	7.4	0.0	-20.0	29.3	33.1	47.7	18.4	14.6

Sample Calculation :

RESULT=Reading + ANT Factor - Amp Gain + Cable Loss + ATT + Duty Factor(PK detect only)

* Except for the above table : All other spurious emissions were less than 20dB for the limit.

* ATTEN was not used for Antenna Factor 0.0dB of the above table.

* The result is rounded off to the second decimal place. Therefore, there may be 0.1 difference for the result.

Used Equipment: MBA-02, MLA-02, MAT-07, MPA-06, MCC-12, MHA-06, MPA-03, MCC-04 + MCC-24, MRENT-09

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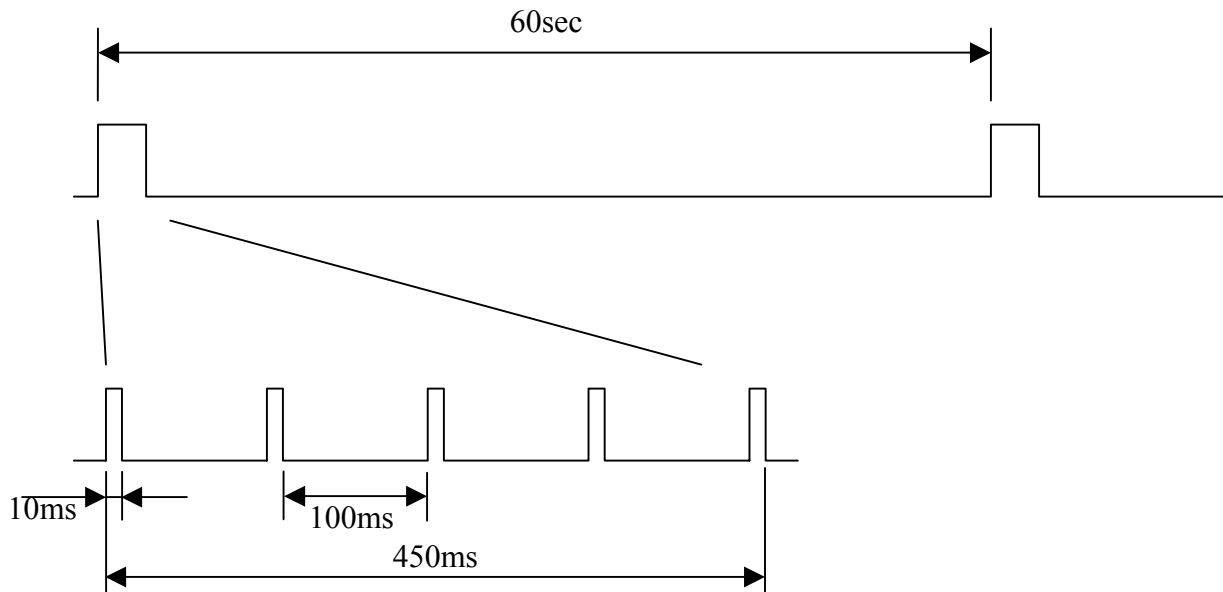
Duty Factor Calculation and Transmitting time and interval

The data of Manufacturer's specification has worse case than those of the actual data.

1. Normal Mode

Interval of the transmission : 60sec

Duration of the transmission : 450ms



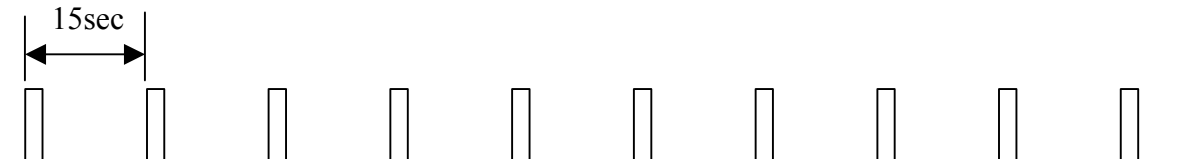
Duty Factor Calculation

Therefore, Duty Factor is $20\log(10\text{ms}/100\text{ms}) = -20\text{dB}$

2. Alarm Mode

Interval of the transmission : 15sec (Silent period: $14.55\text{sec} > 450\text{ms} \times 30 = 13.5\text{sec}$)

Duration of the transmission : 450ms



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-20dB Bandwidth

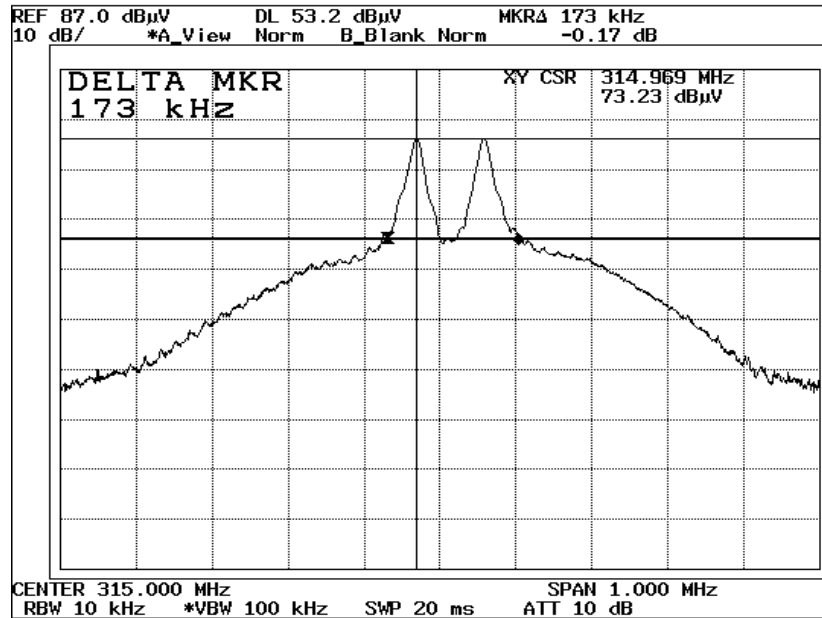
UL Apex Co., Ltd.
Head Office EMC Lab. No.2 Semi Anechoic Chamber

COMPANY : Bridgestone Corporation
EQUIPMENT : Sensor Module
MODEL : B311
Sample No. : 0000F2
FCC ID : SBDITTWB315F02
IC No. : 5381A-YOP1010
POWER : DC 3.0V(BR-2450A)
Mode : Transmitting (315MHz)

REPORT NO : 25BE0184-HO
REGULATION : Fcc Part15 Subpart C 231(c) / 205
DATE : 2004/09/24
TEMPERATURE : 27deg.C
HUMIDITY : 67%
ENGINEER : Makoto Kosaka

Bandwidth Limit : Fundamental Frequency 315MHz X 0.25% = 787.5 kHz

-20dB Bandwidth	Bandwidth Limit	Result
[kHz]	[kHz]	
173.00	787.50	Pass



99%Occupied Bandwidth

DATA OF 99% OCCUPIED BANDWIDTH

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

COMPANY : Bridgestone Corporation
EQUIPMENT : Sensor Module
MODEL : B311
S/N : 0000F2
FCC ID : SBDITTWB315F02
IC No. : 5381A-YOP1010
POWER : DC 3.0V(BR-2450A)
Mode : Transmitting (315MHz)

REPORT NO. : 25BE0184-HO
REGULATION : RSS210
DATE : 2004/09/24
TEMPERATURE : 27deg.C
HUMIDITY : 67%
ENGINEER : Makoto Kosaka

99% Occpied Bandwidth
[kHz]
333.00

