



RADIO TEST REPORT

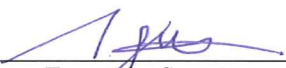
Test Report No. : 32IE0013-HO-01-R2

Applicant : Bridgestone Corporation
Type of Equipment : Tire Pressure Monitoring System
Model No. : B812 (SENSOR)
Test regulation : FCC Part 15 Subpart C: 2012
FCC ID : SBDB812
Test Result : Complied


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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This report is a revised version of 32IE0013-HO-01-R1. 32IE0013-HO-01-R1 is replaced with this report.

Date of test: May 17, 2012

Representative test engineer:


Tomotaka Sasagawa
Engineer of WiSE Japan,
UL Verification Service

Approved by:


Masanori Nishiyama
Leader of WiSE Japan,
UL Verification Service



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*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
<http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

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13-EM-F0429

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SECTION 1: Customer 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 : +81-42-345-6244
Contact Person : Toshihiro Miyazaki

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

2.1 Identification of E.U.T.

Type of Equipment : Tire Pressure Monitoring System
Model No. : B812 (SENSOR)
Serial No. : Refer to Clause 4.2
Rating : DC 3.0V
Receipt Date of Sample : May 14, 2012
Country of Mass-production : Japan
Condition of EUT : Engineer prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

General Specification

Clock frequency(ies) in the system : 2MHz (microcomputer)

Radio Specification

Radio Type : Transmitter
Frequency of Operation : 433.92MHz
Modulation : FSK
Power Supply (radio part input) : DC 3.0V
Antenna type : Loop Antenna

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : Test specification: FCC Part 15 Subpart C: 2012, final revised on May 17, 2012 and effective June 18, 2012

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

*The revision on May 17, 2012 does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	FCC: ANSI C63.4:2003 7. AC powerline conducted emission measurements	FCC: Section 15.207	N/A	N/A *1)	-
Automatically Deactivate	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section 15.231(a)(3) *2) FCC: Section 15.231(e) *3)	N/A	Complied	Radiated
Electric Field Strength of Fundamental Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section 15.231(e) *4)	6.6dB 433.920MHz Horizontal (PK with Duty factor)	Complied	Radiated
Electric Field Strength of Spurious Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section 15.205 Section 15.209 Section 15.231(e) *4)	11.8dB 3037.440MHz Horizontal (PK with Duty factor)	Complied	Radiated
-20dB Bandwidth	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section 15.231(c)	N/A	Complied	Radiated

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

*1) The test is not applicable since the EUT does not have AC Mains.

*2) In Normal mode, limit of 15.231(a)(3) was applied since the EUT is intended to be used for the purpose of security, monitoring the tire pressure.

*3) In Alarm mode, limit of 15.231(e) was applied.

*4) Limit of 15.231(e) was applied since the limit is more stringent than that of 15.231(b).

FCC 15.31 (e)

This test was performed with the New Battery (DC 3.0V) and the constant voltage was supplied to the EUT during the tests. Therefore, the 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.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 4.6.1	IC: RSS-Gen 4.6.1	N/A	N/A	Radiated

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

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3.4 Uncertainty

EMI

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

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(+dB)				(1m*)(+dB)		(0.5m*)(+dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.2dB	5.0dB	5.1dB	4.7dB	5.7dB	4.4dB	4.3dB
No.2	4.1dB	5.2dB	5.1dB	4.8dB	5.6dB	4.3dB	4.2dB
No.3	4.5dB	5.0dB	5.2dB	4.8dB	5.6dB	4.5dB	4.2dB
No.4	4.7dB	5.2dB	5.2dB	4.8dB	5.6dB	5.1dB	4.2dB

*3m/1m/0.5m = Measurement distance

Radiated emission test(3m)

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

3.5 Test Location

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	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	313583	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	4.75 x 5.4 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	-	8.0 x 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Data of EMI, Test instruments, and Test set up.

Refer to APPENDIX.

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

4.1 Operating Modes

Test Item*	Mode
Automatically Deactivate Duty Cycle	Normal use mode
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20dB & 99% Occupied Bandwidth	Transmitting mode (Tx) *1) *2)
<p>* The system was configured in typical fashion (as a customer would normally use it) for testing. *1) The software of this mode is the same as one of normal product, except that EUT continues to transmit when transmitter button is being pressed (For Normal use mode, EUT stops to transmit in a given time, even if transceiver button is being pressed.) End users cannot change the settings of the output power of the product. *2) As for the pulse train of sample used in this test, please refer to Appendix 4</p>	

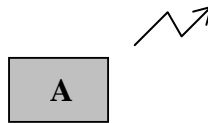
This EUT has two following modes.

Alarm mode: System detects that the pressure of the tire is too low and/or temperature is too high.

Normal mode: System doesn't detect any emergency signal.

* The test was performed in Normal mode which was the worst case in 2 modes (Normal mode and Alarm mode).

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Tire Pressure Monitoring System	B812 (SENSOR)	265	Bridgestone Corporation	EUT

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SECTION 5: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m 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.

Photographs of the set up are shown in Appendix 3.

[Transmitting mode]

The Radiated Electric Field Strength has been measured on Semi anechoic chamber with a ground plane and at a distance of 3m.

The measuring antenna height was varied between 1 and 4m (frequency 9kHz - 30MHz: loop antenna was fixed height at 1.0m) and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization.

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

*Refer to Figure 1 about Direction of the Loop Antenna.

Test Antennas are used as below;

Frequency	Below 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

	From 9kHz to 90kHz and From 110kHz to 150kHz	From 90kHz to 110kHz	From 150kHz to 490kHz	From 490kHz to 30MHz	From 30MHz to 1GHz	Above 1GHz *1)
Detector Type	Peak	Peak	Peak	Peak	Peak and Peak with Duty factor	Peak and Peak with Duty factor
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz	PK: S/A:RBW 1MHz, VBW:3MHz

- The carrier level (or, noise levels) was (or were) measured at each position of all three axes X, Y and Z, and the position that has the maximum noise was determined.

Noise levels of all the frequencies were measured at the position.

*The result is rounded off to the second decimal place, so some differences might be observed.

Measurement range	: 9KHz-4.4GHz
Test data	: APPENDIX
Test result	: Pass

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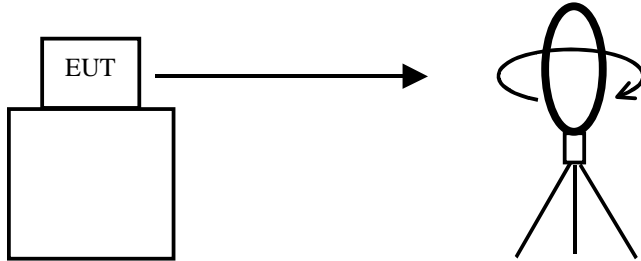
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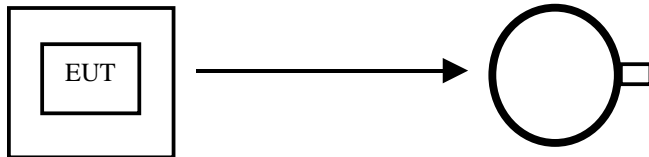
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Figure 1: Direction of the Loop Antenna

Side View (Vertical)

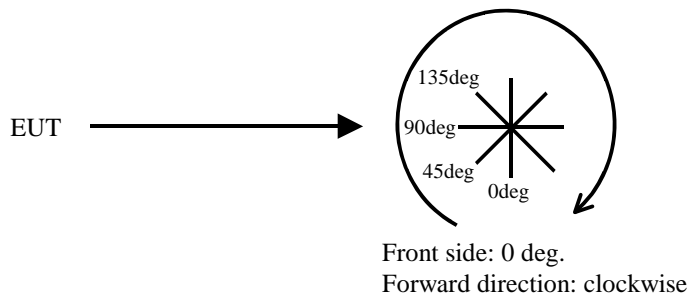


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



SECTION 6: Automatically deactivate

Test Procedure

The measurement was performed with Electric field strength using a spectrum analyzer.

Test data : APPENDIX
Test result : Pass

SECTION 7: -20dB and 99% Occupied Bandwidth

Test Procedure

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20dB Bandwidth	1MHz	15kHz	47kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Data of EMI test

Automatically deactivate

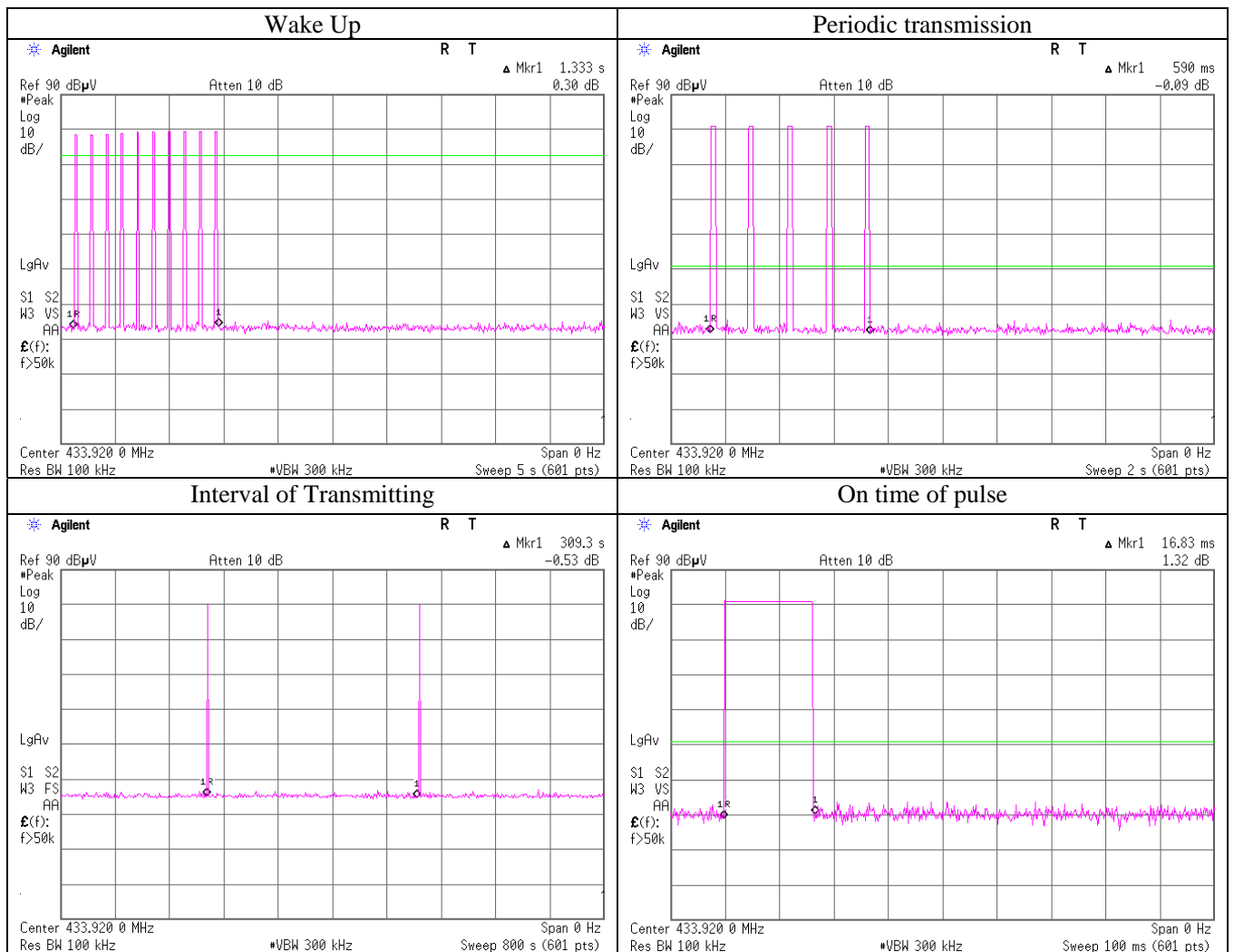
Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	32IE0013-HO-01
Date	05/17/2012
Temperature/ Humidity	25 deg. C / 39% RH
Engineer	Tomotaka Sasagawa
Mode	Normal use mode

Operation in FCC15.231(a)(3) (Limit: total ≤2sec per hour)

Total duration of transmissions at Wake UP: 16.83msec*10 = 168.3msec

Total duration of transmissions per time at Periodic transmission: 16.83msec * 5 = 84.15msec

Total transmission times per hour: 168.3msec + (84.15msec * 11) = 1093.95msec < 2sec



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

Test place Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No. 32IE0013-HO-01
Date 05/17/2012
Temperature/ Humidity 25 deg. C / 39% RH
Engineer Tomotaka Sasagawa
Mode Transmitting mode

PK

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]		Limit [dBuV/m]	Margin [dB]		Remark Inside or Outside of Restricted Bands
		Hor	Ver					Hor	Ver		Hor	Ver	
433.920	PK	82.9	82.3	17.7	9.5	28.4	-	81.7	81.1	92.8	11.1	11.7	Carrier
867.840	PK	38.1	37.3	22.1	11.1	28.0	-	43.3	42.5	72.8	29.5	30.3	Outside
1301.760	PK	55.6	56.7	25.8	3.0	35.6	-	48.8	49.9	73.9	25.1	24.0	Inside
1735.680	PK	53.1	59.3	26.8	3.4	35.2	-	48.1	54.3	73.9	25.8	19.6	Outside
2169.600	PK	47.4	46.2	27.3	3.8	34.9	-	43.6	42.4	73.9	30.3	31.5	Outside
2603.520	PK	59.2	49.3	27.7	4.1	34.8	-	56.2	46.3	73.9	17.7	27.6	Outside
3037.440	PK	59.3	52.7	28.5	4.4	34.6	-	57.6	51.0	73.9	16.3	22.9	Outside
3471.360	PK	47.9	46.5	29.4	4.7	34.2	-	47.8	46.4	73.9	26.1	27.5	Outside
3905.280	PK	47.5	47.9	30.1	4.9	33.9	-	48.6	49.0	73.9	25.3	24.9	Inside
4339.200	PK	48.8	46.7	30.3	5.1	33.9	-	50.3	48.2	73.9	23.6	25.7	Inside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

PK with Duty factor

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]		Limit [dBuV/m]	Margin [dB]		Remark
		Hor	Ver					Hor	Ver		Hor	Ver	
433.920	PK	82.9	82.3	17.7	9.5	28.4	-15.5	66.2	65.6	72.8	6.6	7.2	Carrier
867.840	PK	38.1	37.3	22.1	11.1	28.0	-15.5	27.8	27.0	52.8	25.0	25.8	Outside
1301.760	PK	55.6	56.7	25.8	3.0	35.6	-15.5	33.3	34.4	53.9	20.6	19.5	Inside
1735.680	PK	53.1	59.3	26.8	3.4	35.2	-15.5	32.6	38.8	53.9	21.3	15.1	Outside
2169.600	PK	47.4	46.2	27.3	3.8	34.9	-15.5	28.1	26.9	53.9	25.8	27.0	Outside
2603.520	PK	59.2	49.3	27.7	4.1	34.8	-15.5	40.7	30.8	53.9	13.2	23.1	Outside
3037.440	PK	59.3	52.7	28.5	4.4	34.6	-15.5	42.1	35.5	53.9	11.8	18.4	Outside
3471.360	PK	47.9	46.5	29.4	4.7	34.2	-15.5	32.3	30.9	53.9	21.6	23.0	Outside
3905.280	PK	47.5	47.9	30.1	4.9	33.9	-15.5	33.1	33.5	53.9	20.8	20.4	Inside
4339.200	PK	48.8	46.7	30.3	5.1	33.9	-15.5	34.8	32.7	53.9	19.1	21.2	Inside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

* The test above 1GHz was performed with PK detect. Average emission measurements were calculated with PK detect and Duty cycle factor.

* Duty Factor was calculated with the assumption of the worst condition in 100msec.

* The noise measured with PK detect was pulse emission.

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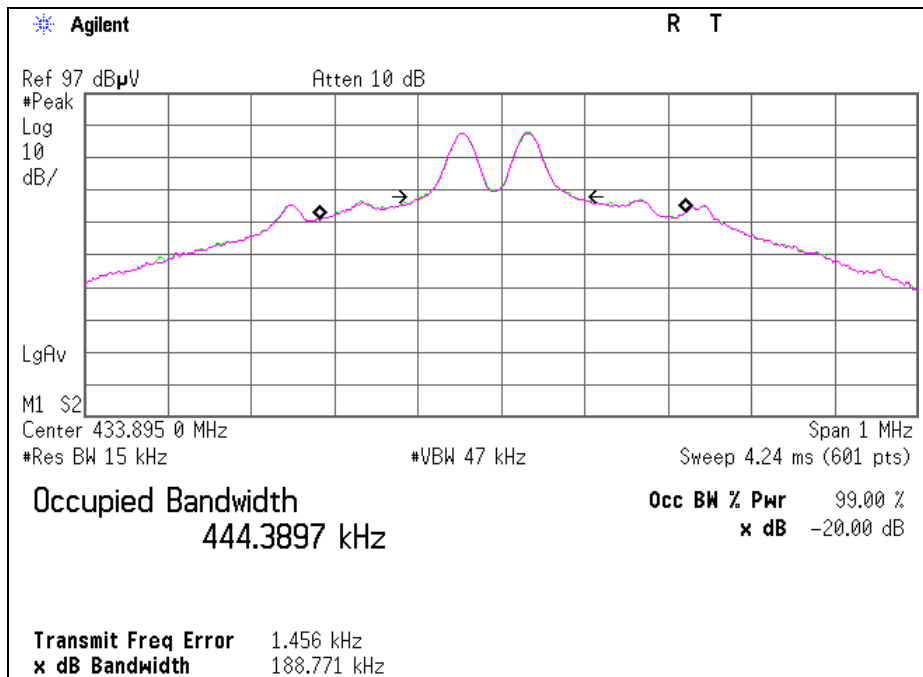
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-20dB Bandwidth

Test place Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No. 32IE0013-HO-01
Date 05/17/2012
Temperature/ Humidity 25 deg. C / 39% RH
Engineer Tomotaka Sasagawa
Mode Normal use mode

Bandwidth Limit : Fundamental Frequency $433.92 \text{ MHz} \times 0.25\% = 1084.80 \text{ kHz}$

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
188.77	1084.80	Pass



Duty Cycle

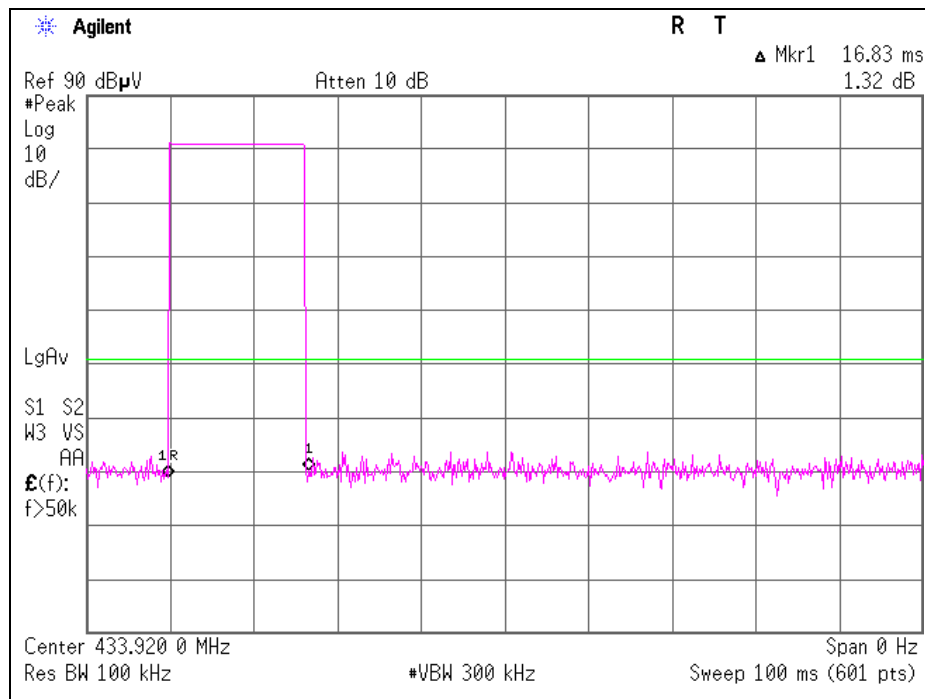
Test place Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No. 32IE0013-HO-01
Date 05/17/2012
Temperature/ Humidity 25 deg. C / 39% RH
Engineer Tomotaka Sasagawa
Mode Normal use mode

(Total)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
16.83	100.00	0.17	-15.5

*1) Duty = $20\log_{10}(\text{ON time/Cycle})$

*2) The train of pulse was exceeding 100msec, and that sampled 100msec was the worst against the pulse train.



APPENDIX 2: Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2011/06/21 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2012/02/06 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2012/04/06 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2012/04/03 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2011/10/19 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	RE	2012/02/16 * 12
MCC-30	Coaxial cable	UL Japan	-	-	RE	2011/07/28 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2012/03/16 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2011/11/02 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2011/10/23 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2011/10/23 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2012/02/16 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2011/09/26 * 12
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2011/07/10 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2012/02/08 * 12
MJM-01	Measure	KDS	ES19-55	-	RE	-
MHA-05	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	253	RE	2011/06/19 * 12
MCC-134	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336167/4(1m) / 340641(5m)	RE	2011/09/07 * 12
MPA-01	Pre Amplifier	Agilent	8449B	3008A01671	RE	2012/02/28 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item:

RE: Radiated emission, 99% Occupied Bandwidth, -20dB bandwidth , Automatically deactivate and Duty cycle tests

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