



RADIO TEST REPORT

Test Report No. : 10005021H

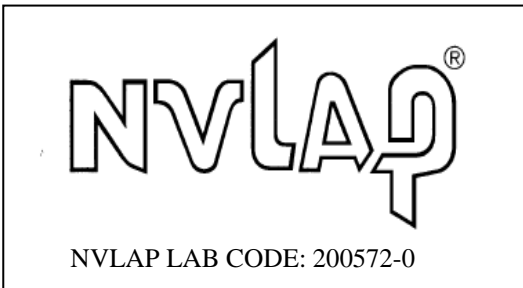
Applicant : TOKAI RIKA(THAILAND)Co., Ltd.
Type of Equipment : Immobilizer
Model No. : RI-46BTY
FCC ID : SKVRI-46BTY
Test regulation : FCC Part 15 Subpart C: 2012
Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
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.

Date of test: February 19 and 20, 2013

Representative test engineer: T. Nakagawa
Tomohisa Nakagawa
Engineer of WiSE Japan,
UL Verification Service

Approved by: M. Nishiyama
Masanori Nishiyama
Manager of WiSE Japan,
UL Verification Service



This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*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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SECTION 1: Customer information

Company Name : TOKAI RIKA(THAILAND)Co., Ltd.
Address : 7/114 Moo 4, T.Marbyangporn, A.Pluakdaeng, Rayong 21140, Thailand
Telephone Number : +66-3895-6212
Facsimile Number : +66-3895-6217
Contact Person : Samroeng Phonil

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

2.1 Identification of E.U.T.

Type of Equipment : Immobilizer
Model No. : RI-46BTY
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 12V
Receipt Date of Sample : February 13, 2013
Country of Mass-production : Thailand
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

2.2 Product Description

[Controller ECU with Amplifier]
Frequency of operation : 134.2kHz
Modulation Type : ASK
Output Power (max) : 60dBuV/m (@10m)

[Transponder]
Frequency of operation : 134.2kHz
Modulation Type : FSK
Output Power (max) : undetectably weak

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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 December 27, 2012 and effective January 28, 2013

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted Emission
Section 15.209 Radiated emission limits, general requirements

FCC 15.31 (e)

The stable voltage (DC5.0V) is constantly provided to RF Part through the regulator regardless of voltage fluctuation of car battery (DC12V). 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 vehicle. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted Emission	<FCC> ANSI C63.4:2003 7. AC powerline conducted emission measurements <IC> RSS-Gen 7.2.4	<FCC> Section 15.207 <IC> RSS-Gen 7.2.4	-	N/A *1)	N/A	N/A
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.8, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	34.6dB 0.13420MHz 0 deg., PK with Duty factor	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.9, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	2.1dB 79.992MHz, QP, Vertical	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> -	<FCC> Reference data <IC> -	Radiated	N/A	N/A	N/A

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

*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.

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3.3 Addition to standard

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 4.6.1	RSS-Gen 4.6.1	Radiated	N/A	N/A	N/A

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

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	4.3dB	5.0dB	5.1dB	4.9dB	5.8dB	4.4dB	4.3dB
No.2	4.3dB	5.2dB	5.1dB	5.0dB	5.7dB	4.3dB	4.2dB
No.3	4.6dB	5.0dB	5.1dB	5.0dB	5.7dB	4.5dB	4.2dB
No.4	4.8dB	5.2dB	5.0dB	5.0dB	5.7dB	5.2dB	4.2dB

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

Radiated emission test(3m)

[Electric Field Strength of Fundamental Emission]

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

[Electric Field Strength of Spurious Emission]

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 Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
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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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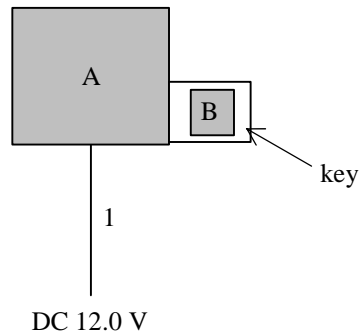
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

The mode is used : Normal transmission mode (Tx) 134.2kHz

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

4.2 Configuration and peripherals



* Cabling and setup were 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	Remarks
A	Immobilizer	RI-46BTY	001	TOKAI RIKAI (THAILAND)Co., Ltd.	EUT
B	Transponder	-	-	-	EUT

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.80	Unshielded	Unshielded	-

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SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure

The Radiated Electric Field Strength intensity has been measured on No 2 semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency : From 9kHz to 30MHz at distance 3m

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0deg.) and horizontal polarization.

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

Frequency : From 30MHz to 1GHz at distance 3m

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.

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

The radiated emission measurements were made with the following detector function of the test receiver (below 1GHz).

	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
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz

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

With the position, the noise levels of all the frequencies were measured.

This EUT has two modes which mechanical key is inserted or not. The worst case was confirmed with and without mechanical key, as a result, the test with mechanical key was the worst case. Therefore the test with mechanical key was performed only.

* Part 15 Section 15.31 (f)(2) (9kHz-30MHz)

[Limit at 3m]=[Limit at 300m]-40 x log (3[m]/300[m])

[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

Test data : **APPENDIX 1**

Test result : **Pass**

Date: February 19 and 20, 2013

Test engineer: Tomohisa Nakagawa

UL Japan, Inc.

Head Office EMC Lab.

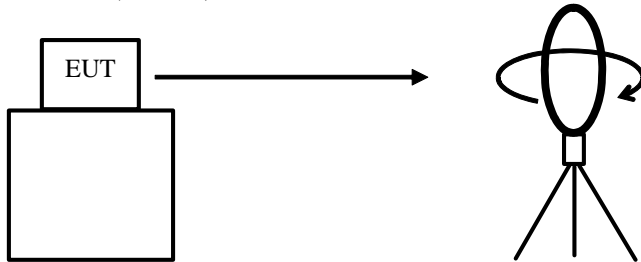
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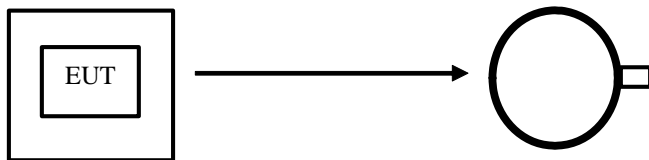
Facsimile : +81 596 24 8124

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

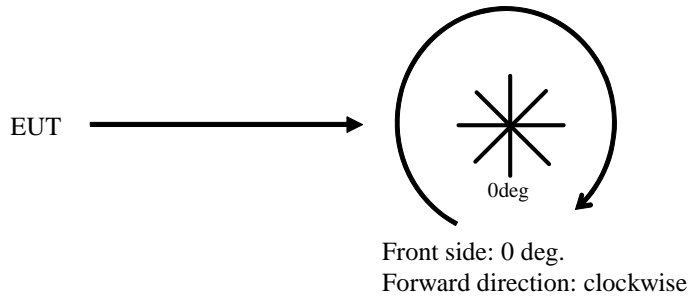


.....
Top View (Horizontal)



Antenna was not rotated.

.....
Top View (Vertical)



SECTION 6: -26dB 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
-26dB Bandwidth	100kHz	1kHz	3kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1

Test result : Pass

SECTION 7: 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
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 % of Span	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer

*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100%.

Test data : APPENDIX 1

Test result : Pass

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APPENDIX 1: Data of EMI test

Radiated Emission below 30MHz (Fundamental and Spurious Emission)

Test place : Head Office EMC Lab. No.2 Measurement Room /
Order No. : 10005021H
Date : 02/20/2013
Temperature/ Humidity : 23 deg. C / 38% RH
Engineer : Tomohisa Nakagawa
Mode : Tx 134.2kHz with Transponder

PK or QP

Ant Deg [deg]	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
0	0.13420	PK	77.9	19.2	6.0	32.2	-	70.9	125.1	54.2	Fundamental
0	0.26840	PK	41.4	19.1	6.1	32.2	-	34.4	119.0	84.6	
0	0.40260	PK	42.3	19.1	6.1	32.2	-	35.3	115.5	80.2	
0	0.53680	QP	32.1	19.1	6.1	32.2	-	25.1	73.0	47.9	
0	0.67100	QP	32.0	19.2	6.2	32.2	-	25.2	71.1	45.9	
0	0.80520	QP	31.2	19.2	6.2	32.2	-	24.4	69.5	45.1	
0	0.93940	QP	31.2	19.2	6.2	32.2	-	24.4	68.1	43.7	
0	1.07360	QP	30.8	19.1	6.2	32.2	-	23.9	66.9	43.0	
0	1.20780	QP	30.8	19.1	6.2	32.2	-	23.9	65.9	42.0	
0	1.34200	QP	30.9	19.1	6.3	32.2	-	24.1	65.0	40.9	

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

PK with Duty factor

Ant Deg [deg]	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
0	0.13420	AV	77.9	19.2	6.0	32.2	-0.4	70.5	105.1	34.6	
0	0.26840	AV	41.4	19.1	6.1	32.2	-0.4	34.0	99.0	65.0	
0	0.40260	AV	42.3	19.1	6.1	32.2	-0.4	34.9	95.5	60.6	

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

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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Radiated Emission above 30MHz (Spurious Emission)

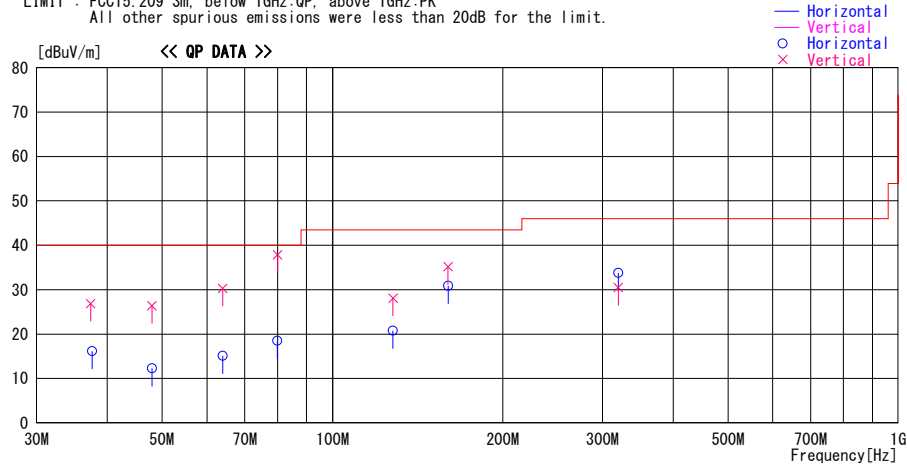
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2013/02/19

Report No. : 10005021H
Temp./Humi. : 23deg. C / 42% RH
Engineer : Tomohisa Nakagawa

Mode / Remarks : 134.2kHz Tx

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor	Gain					[dBuV/m]	[dB]	
			[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
37.372	33.2	QP	15.5	-21.8	26.9	0	100	Vert.	40.0	13.1	
37.598	22.6	QP	15.4	-21.8	16.2	0	100	Hori.	40.0	23.8	
47.995	36.6	QP	11.4	-21.6	26.4	0	100	Vert.	40.0	13.6	
48.000	22.5	QP	11.4	-21.6	12.3	0	100	Hori.	40.0	27.7	
63.993	44.4	QP	7.4	-21.5	30.3	0	100	Vert.	40.0	9.7	
63.994	29.2	QP	7.4	-21.5	15.1	110	300	Hori.	40.0	24.9	
79.950	33.3	QP	6.4	-21.2	18.5	150	180	Hori.	40.0	21.5	
79.992	52.7	QP	6.4	-21.2	37.9	0	100	Vert.	40.0	2.1	
127.987	27.7	QP	13.6	-20.5	20.8	298	203	Hori.	43.5	22.7	
127.988	35.0	QP	13.6	-20.5	28.1	143	100	Vert.	43.5	15.4	
159.986	40.1	QP	15.3	-20.2	35.2	259	100	Vert.	43.5	8.3	
160.049	35.8	QP	15.3	-20.2	30.9	335	242	Hori.	43.5	12.6	
319.833	34.6	QP	14.7	-18.8	30.5	97	100	Vert.	46.0	15.5	
319.966	37.9	QP	14.7	-18.8	33.8	135	111	Hori.	46.0	12.2	

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)

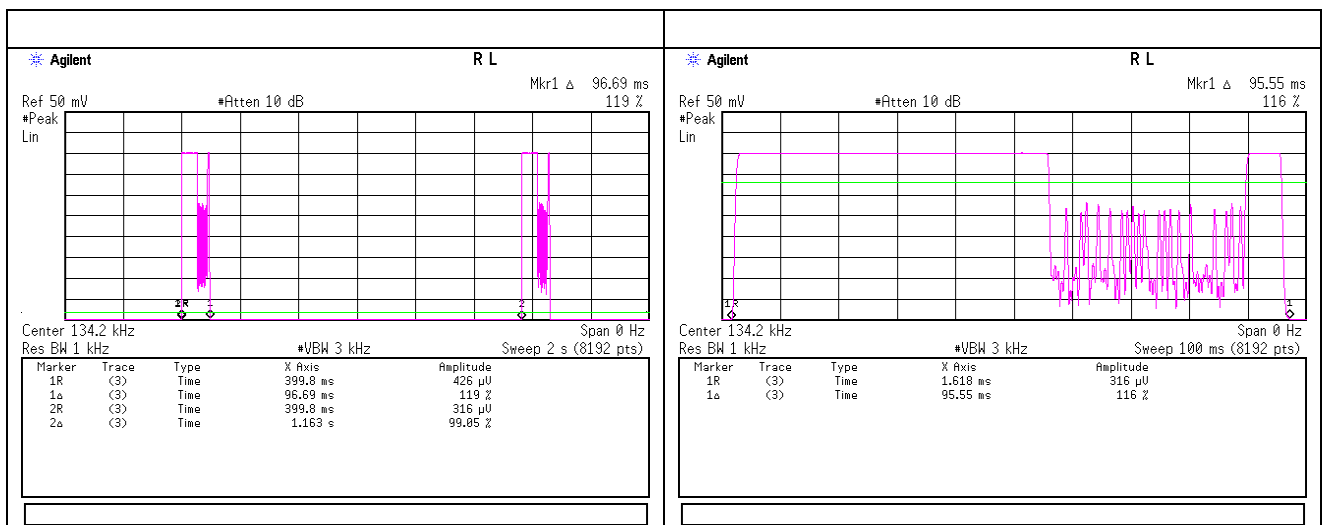
*The test result is rounded off to one or two decimal places, so some differences might be observed.

Duty factor data sheet

Report No. 10005021H
Test place Head Office EMC Lab.
Semi Anechoic Chamber No.2
Date 02/20/2013
Temperature / Humidity 18 deg. C / 38 % RH
Engineer Tomohisa Nakagawa
Mode Tx 134.2 kHz

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
95.55	100.00	0.96	-0.4

Duty = 20log10(ON time/Cycle)



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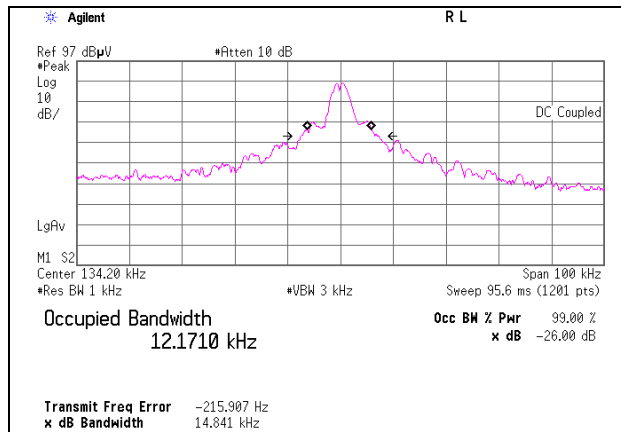
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-26dB Bandwidth and 99% Occupied Bandwidth

Report No. 10005021H
Test place Head Office EMC Lab.
Semi Anechoic Chamber No.2
Date 02/20/2013
Temperature / Humidity 18 deg. C / 38 % RH
Engineer Tomohisa Nakagawa
Mode Tx 134.2 kHz

-26dB Bandwidth [kHz]
14.841

99% Occupied Bandwidth [kHz]
12.1710



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	2012/06/29 * 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	2012/10/12 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	RE	2013/02/06 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2012/07/27 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2012/03/16 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2012/11/06 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2012/10/08 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2012/10/08 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2013/02/06 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2012/09/11 * 12
MRENT-95	Spectrum Analyzer	Agilent	E4440A	MY46185823	RE	2012/06/19 * 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: Spurious emission

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