



RADIO TEST REPORT

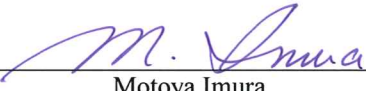
Test Report No. : 10448781H-A

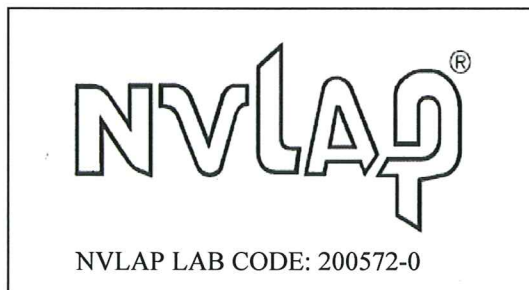
Applicant : DENSO CORPORATION
Type of Equipment : Electronic Key
Model No. : 14FBB
Test regulation : FCC Part 15 Subpart C: 2014
FCC ID : HYQ14FBB
Test Result : Complied

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: August 19 to September 3, 2014

Representative test engineer: 
Masatoshi Nishiguchi
Engineer
Consumer Technology Division

Approved by: 
Motoya Imura
Engineer
Consumer Technology Division



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 : DENSO CORPORATION
Address : 1-1 Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan
Telephone Number : +81-566-61-5242
Facsimile Number : +81-566-25-4837
Contact Person : MASAYUKI YAMAMOTO

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

2.1 Identification of E.U.T.

Type of Equipment : Electronic Key
Model No. : 14FBB
Serial No. : Refer to Clause 4.2
Rating : DC 3.0V
Receipt Date of Sample : August 8, 2014
Country of Mass-production : Japan, United States of America, and China
Condition of EUT : Engineering 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

Model No: 14FBB (referred to as the EUT in this report) is the Electronic Key.

General Specification

Clock frequency(ies) in the system : 8 MHz (IC Clock)

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 314.35 MHz / 312.10 MHz *
Modulation : FSK (F1D)
Power Supply (radio part input) : DC 3.0V
Type of Battery : One lithium battery
Antenna type : Built-in type (Fixed)

*These two different frequencies are not emitted simultaneously.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2014, final revised on May 1, 2014 and effective June 2, 2014

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

Item	Test Procedure	Specification	Worst margin	Results	Remarks
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	N/A*1)	-
Automatically Deactivate	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: -	FCC: Section 15.231(a)(1) IC: RSS-210 A1.1.1	N/A	Complied	Radiated
Electric Field Strength of Fundamental Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: RSS-Gen 4.8	FCC: Section 15.231(b) IC: RSS-210 A1.1.2	6.9dB Horizontal PK with Duty factor (Tx 312.10MHz)	Complied	Radiated
Electric Field Strength of Spurious Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: RSS-Gen 4.9	FCC: Section 15.205 Section 15.209 Section 15.231(b) IC: RSS-210 A1.1.2, 2.5.1 RSS-Gen 7.2.5	7.0dB 3121.000MHz Horizontal PK with Duty factor (Tx 312.10MHz)	Complied	Radiated
-20dB Bandwidth	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: -	FCC: Section 15.231(c) IC: Reference data	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.

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.

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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	Complied	Radiated

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	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	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.

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3.5 Test Location

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	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	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	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	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	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	-	8.8 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	3.1 x 3.4 x 3.0m	4.8 x 4.6m	-

* 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.

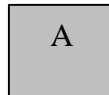
Refer to APPENDIX.

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

4.1 Operating Modes

Test Item	Mode
Automatically Deactivate Duty Cycle	Normal use mode, 314.35 MHz Normal use mode, 312.10 MHz
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20dB & 99% Occupied Bandwidth	Transmitting mode (Tx), 314.35 MHz *1) Transmitting mode (Tx), 312.10 MHz *1)
* 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, the EUT transmits when it receives 134.2kHz radio signal and transmitter button is being pressed.) End users cannot change the settings of the output power of the product.	

4.2 Configuration and peripherals



* Setup was taken into consideration and test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Electronic Key	14FBB	No.2 *1) No.1 *2)	DENSO CORPORATION	EUT

*1) Used for Normal use mode only.

*2) Used for Transmitting mode only.

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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]

(Below 30MHz)

The noise level was checked by moving a search-coil (Loop Antenna) close to the EUT.

(Above 30MHz)

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 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.

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
Detector Type	Peak	Peak	Peak	Peak	Peak and Peak with Duty factor	Peak and Peak with Duty factor
IF Bandwidth	200Hz	200Hz	9.1kHz	9.1kHz	120kHz	PK: S/A:RBW 1MHz, VBW 3MHz

- 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.

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

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 without mechanical key was the worst case. Therefore the test without mechanical key was performed only.

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

Measurement range : 9kHz-3.2GHz

Test data : APPENDIX

Test result : Pass

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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	300kHz	3kHz	9.1kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 % of Span	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX
Test result : Pass

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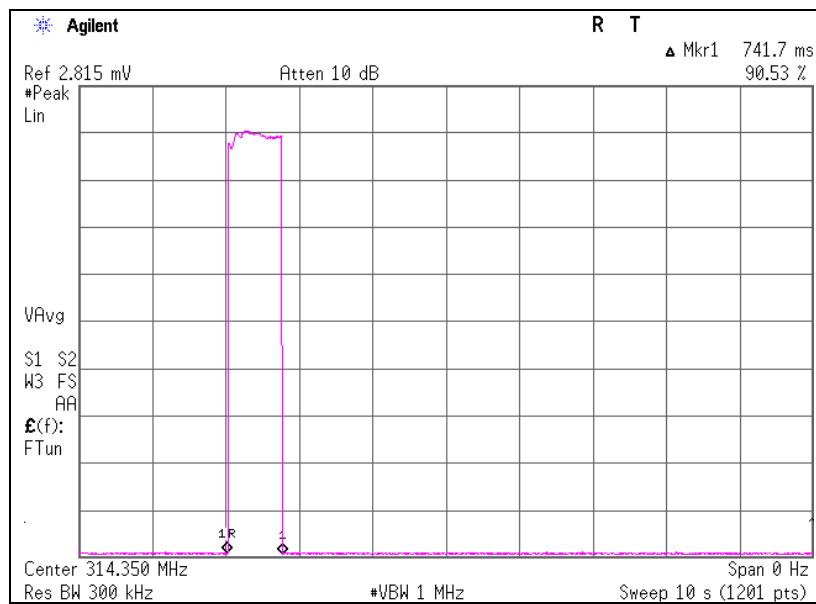
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APPENDIX 1: Data of EMI test

Automatically deactivate
314.35 MHz

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 10448781H
Date : 09/03/2014
Temperature/ Humidity : 23 deg. C / 62% RH
Engineer : Masatoshi Nishiguchi
Mode : Normal use mode 314.35MHz

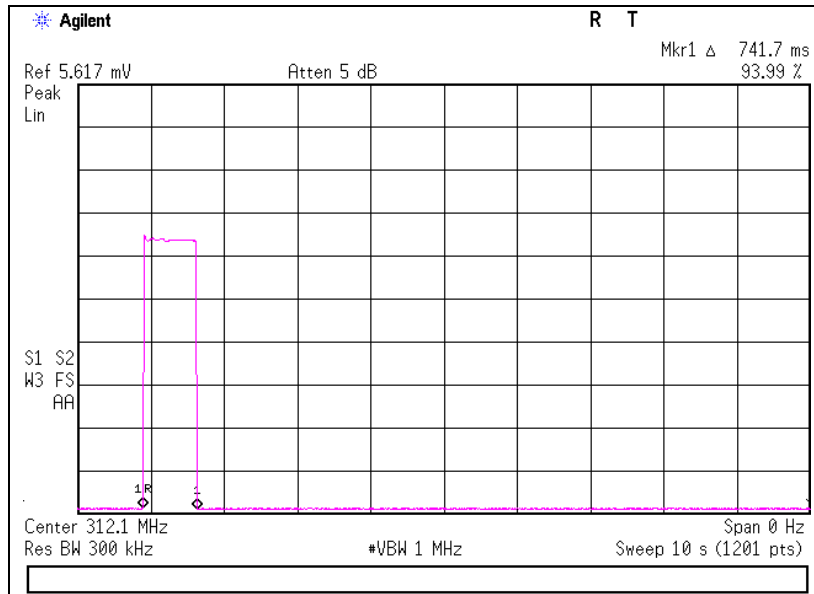
Time of Transmitting [sec]	Limit [sec]	Result
0.7417	5.00	Pass



Automatically deactivate
312.10 MHz

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	10448781H
Date	09/03/2014
Temperature/ Humidity	23 deg. C / 62% RH
Engineer	Masatoshi Nishiguchi
Mode	Normal use mode 312.10MHz

Time of Transmitting [sec]	Limit [sec]	Result
0.7417	5.00	Pass



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

Test place : Ise EMC Lab. No.1 Semi Anechoic Chamber
Report No. : 10448781H
Date : 08/19/2014 08/21/2014
Temperature/ Humidity : 23 deg. C / 56% RH 21 deg. C / 54% RH
Engineer : Takumi Shimada Takumi Shimada
(Below 1GHz) (Above 1GHz)
Mode : Transmitting mode 314.35MHz

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	
314.350	PK	81.7	78.2	14.8	10.5	38.5	-	68.5	65.0	95.5	27.0	30.5	Carrier
628.700	PK	NS	NS	-	-	-	-	-	-	75.5	-	-	Outside
943.050	PK	NS	NS	-	-	-	-	-	-	75.5	-	-	Outside
1257.400	PK	36.9	38.8	24.7	1.9	37.0	-	26.5	28.4	75.5	49.0	47.1	Outside
1571.750	PK	36.8	39.0	25.1	2.1	36.8	-	27.2	29.4	73.9	46.7	44.5	Inside
1886.100	PK	38.8	38.4	25.9	2.2	36.7	-	30.2	29.8	75.5	45.3	45.7	Outside
2200.450	PK	37.5	36.9	26.4	2.4	36.6	-	29.7	29.1	73.9	44.2	44.8	Inside
2514.800	PK	38.2	38.6	26.9	2.6	36.7	-	31.0	31.4	75.5	44.5	44.1	Outside
2829.150	PK	47.1	49.1	27.4	2.7	36.8	-	40.4	42.4	73.9	33.5	31.5	Inside
3143.500	PK	50.7	53.6	27.7	2.9	36.8	-	44.5	47.4	75.5	31.0	28.1	Outside

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

NS: No signal detected.

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	
314.350	PK	81.7	78.2	14.8	10.5	38.5	0.0	68.5	65.0	75.5	7.0	10.5	Carrier
628.700	PK	NS	NS	-	-	-	-	-	-	55.5	-	-	Outside
943.050	PK	NS	NS	-	-	-	-	-	-	55.5	-	-	Outside
1257.400	PK	36.9	38.8	24.7	1.9	37.0	0.0	26.5	28.4	55.5	29.0	27.1	Outside
1571.750	PK	36.8	39.0	25.1	2.1	36.8	0.0	27.2	29.4	53.9	26.7	24.5	Inside
1886.100	PK	38.8	38.4	25.9	2.2	36.7	0.0	30.2	29.8	55.5	25.3	25.7	Outside
2200.450	PK	37.5	36.9	26.4	2.4	36.6	0.0	29.7	29.1	53.9	24.2	24.8	Inside
2514.800	PK	38.2	38.6	26.9	2.6	36.7	0.0	31.0	31.4	55.5	24.5	24.1	Outside
2829.150	PK	47.1	49.1	27.4	2.7	36.8	0.0	40.4	42.4	53.9	13.5	11.5	Inside
3143.500	PK	50.7	53.6	27.7	2.9	36.8	0.0	44.5	47.4	55.5	11.0	8.1	Outside

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

NS: No signal detected.

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

Duty Cycle
314.35 MHz

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 10448781H
Date : 09/03/2014
Temperature/ Humidity : 23 deg. C / 62% RH
Engineer : Masatoshi Nishiguchi
Mode : Normal use mode 314.35MHz

314.35MHz

(duty)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
100.00	100.00	1.00	0.0

*Duty = 20log₁₀(ON time/Cycle)



Duty Cycle
312.10 MHz

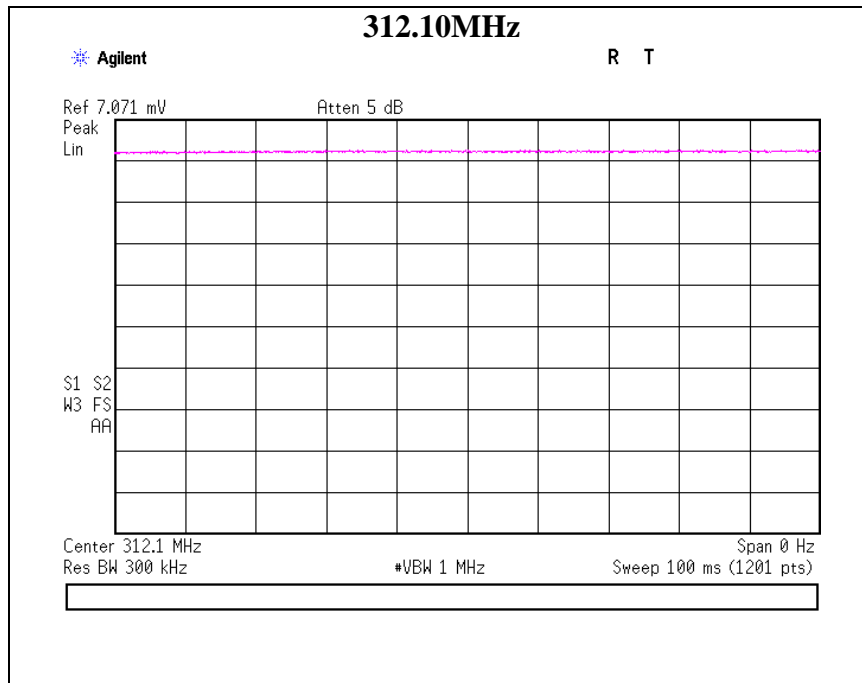
Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 10448781H
Date : 09/03/2014
Temperature/ Humidity : 23 deg. C / 62% RH
Engineer : Masatoshi Nishiguchi
Mode : Normal use mode 312.10MHz

312.10MHz

(duty)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
100.00	100.00	1.00	0.0

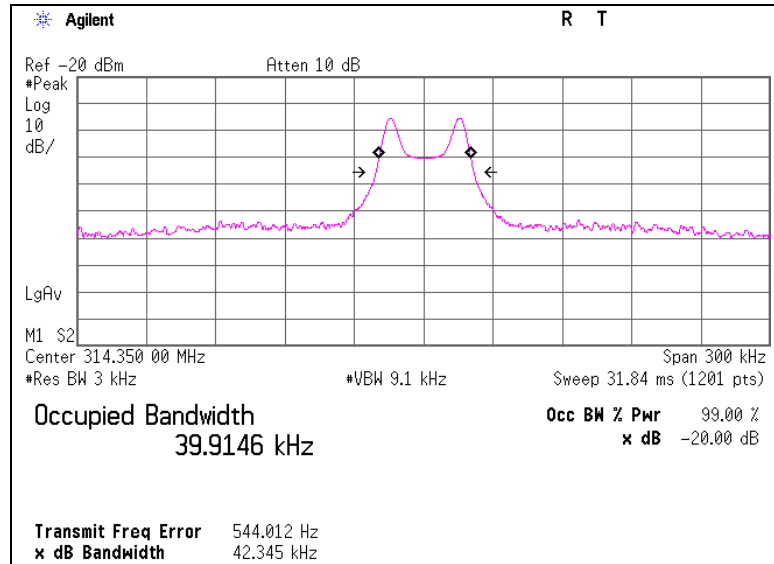
*Duty = 20log₁₀(ON time/Cycle)



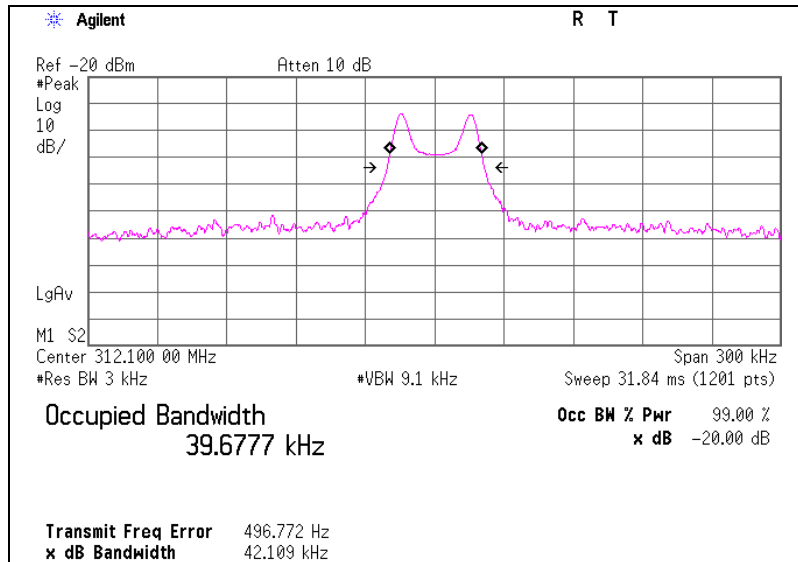
-20dB and 99% Occupied Bandwidth
314.35 MHz / 312.10 MHz

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	10448781H
Date	09/03/2014
Temperature/ Humidity	23 deg. C / 62% RH
Engineer	Masatoshi Nishiguchi
Mode	Transmitting mode 314.35MHz / 312.10MHz

【314.35MHz】



【312.10MHz】



-20dB and 99% Occupied Bandwidth
314.35 MHz / 312.10 MHz

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 10448781H
Date : 09/03/2014
Temperature/ Humidity : 23 deg. C / 62% RH
Engineer : Masatoshi Nishiguchi
Mode : Transmitting mode 314.35MHz / 312.10MHz

Bandwidth Limit : Fundamental Frequency **312.10** MHz x 0.25% = 780.25 kHz

* The above limit was calculated from more stringent nominal frequency.

* Method of KDB 926416 for systems employing non sweeping frequencies was referred.

314.35MHz

-20dB Bandwidth [kHz]
42.35

312.10MHz

-20dB Bandwidth [kHz]
42.11

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
42.35+42.11=84.46	780.25	Pass

Bandwidth Limit : Fundamental Frequency **314.35** MHz x 0.25% = 785.88 kHz

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
39.91	785.88	Pass

Bandwidth Limit : Fundamental Frequency **312.10** MHz x 0.25% = 780.25 kHz

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
39.68	780.25	Pass

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APPENDIX 2: Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2014/09/01 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2014/02/20 * 12
MJM-21	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	RE	2014/06/06 * 12
KBA-05	Biconical Antenna	Schwarzbeck	BBA9106	2513	RE	2013/11/24 * 12
KLA-04	Logperiodic Antenna	Schwarzbeck	USLP9143	361	RE	2013/11/24 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2013/11/26 * 12
MCC-02	Coaxial Cable	Suhner/storm/Agilent /TSJ	-	-	RE	2013/09/12 * 12
MPA-19	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	RE	2014/02/17 * 12
MHA-05	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	253	RE	2014/05/16 * 12
MPA-01	Pre Amplifier	Agilent	8449B	3008A01671	RE	2014/02/05 * 12
MCC-165	Microwave Cable	Junkosha	MWX221	1203S213(1m) / 1311S166(5m)	RE	2013/11/27 * 12
MOS-34	Thermo-Hygrometer	Custom	CTH-201	3401	RE	2014/02/20 * 12
MSA-06	Spectrum Analyzer	Agilent	E4407B	MY45107638	RE	2014/04/02 * 12
MLPA-07	Loop Antenna	UL Japan	-	-	RE	Pre Check

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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