



Test report No. : 10795306H-A-R1
Page : 1 of 18
Issued date : June 5, 2015
Revised date : June 17, 2015
FCC ID : HYQ14AHK

RADIO TEST REPORT

Test Report No. : 10795306H-A-R1

Applicant : DENSO CORPORATION
Type of Equipment : Electronic Key
Model No. : 14AHK
Test regulation : FCC Part 15 Subpart C: 2015
FCC ID : HYQ14AHK
Test Result : Complied

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6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 10795306H-A. 10795306H-A is replaced with this report.

Date of test: May 13 and 14, 2015

Representative test engineer:

Keisuke Kawamura
Engineer
Consumer Technology Division

Approved by:

Motoya Imura
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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.
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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10795306H-A

[illegible]

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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. : 14AHK
Serial No. : Refer to Clause 4.2
Rating : DC 3.0 V
Receipt Date of Sample : May 13, 2015
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: 14AHK (referred to as the EUT in this report) is the Electronic Key.

Radio Type : Transceiver
Frequency of Operation : 433.92 MHz
Clock frequency(ies) in the system : 8 MHz (IC Clock)
13.08 MHz (RF)
Modulation : FSK (F1D)
Power Supply (radio part input) : DC 3.0 V
Type of Battery : One lithium battery
Antenna type : Built-in type (Fixed)
Receiving frequency of Operation : 134.2 kHz *1)

*1) The test of receiver part was performed separately from this test report, and the conformability is confirmed.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on January 21, 2015

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 C63.4:2009 7. AC powerline conducted emission measurements	FCC: Section 15.207	N/A	N/A*1)	-
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
Automatically Deactivate	FCC: ANSI C63.4:2009 13. Measurement of intentional radiators	FCC: Section 15.231(a)(1)	N/A	Complied	Radiated
	IC: -	IC: RSS-210 A1.1.1			
Electric Field Strength of Fundamental Emission	FCC: ANSI C63.4:2009 13. Measurement of intentional radiators	FCC: Section 15.231(b)	5.3 dB Horizontal, Vertical, PK with Duty factor	Complied	Radiated
	IC: RSS-Gen 6.12	IC: RSS-210 A1.1.2			
Electric Field Strength of Spurious Emission	FCC: ANSI C63.4:2009 13. Measurement of intentional radiators	FCC: Section 15.205 Section 15.209 Section 15.231(b)	7.2 dB 3037.440 MHz Vertical PK with Duty factor	Complied	Radiated
	IC: RSS-Gen 6.13	IC: RSS-210 A1.1.2, 2.5.1 RSS-Gen 8.9			
-20dB Bandwidth	FCC: ANSI C63.4:2009 13. Measurement of intentional radiators	FCC: Section 15.231(c)	N/A	Complied	Radiated
	IC: -	IC: Reference data			
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 Part 15.31 (e)

This test was performed with the New Battery (DC 3.0 V) 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 6.6	IC: RSS-210 A1.1.3	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)
	9 kHz -30 MHz	30 MHz - 300 MHz	300 MHz - 1 GHz	1 GHz - 10 GHz	10 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz
No.1	4.0 dB	5.1 dB	5.0 dB	5.1 dB	6.0 dB	4.9 dB	4.3 dB
No.2	3.9 dB	5.2 dB	5.0 dB	4.9 dB	5.9 dB	4.7 dB	4.2 dB
No.3	4.3 dB	5.1 dB	5.2 dB	5.2 dB	6.0 dB	4.8 dB	4.2 dB
No.4	4.6 dB	5.2 dB	5.0 dB	5.2 dB	6.0 dB	5.7 dB	4.2 dB

*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 7.7 m	7.0 x 6.0 m	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2 m	4.0 x 4.0 m	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9 m	6.8 x 5.75 m	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7 m	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9 m	6.8 x 5.75 m	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7 m	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9 m	6.0 x 6.0 m	-
No.6 shielded room	-	4.0 x 4.5 x 2.7 m	4.75 x 5.4 m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0 m	4.75 x 4.15 m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7 m	4.7 x 7.5 m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7 m	N/A	-
No.9 measurement room	-	8.8 x 4.6 x 2.8 m	2.4 x 2.4 m	-
No.11 measurement room	-	3.1 x 3.4 x 3.0 m	4.8 x 4.6 m	-

* 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 Test data, 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	Normal use mode, 433.92 MHz
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20dB & 99% Occupied Bandwidth	Transmitting mode (Tx), 433.92 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

A

* 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	14AHK	001 *1) 002 *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, 0.5 m by 1.0 m, raised 0.8 m 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 30 MHz)

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

(Above 30 MHz)

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

	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	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	200 Hz	200 Hz	9.1 kHz	9.1 kHz	120 kHz	PK: S/A:RBW 1 MHz, VBW 3 MHz

- 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 with mechanical key was the worst case. Therefore the test with mechanical key was performed only.

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

Measurement range	: 9 kHz - 4.5 GHz
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	150kHz	1.5kHz	5.1kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display emission skirts	1 to 5% of OBW	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%.
Peak hold was applied as Worst-case measurement.

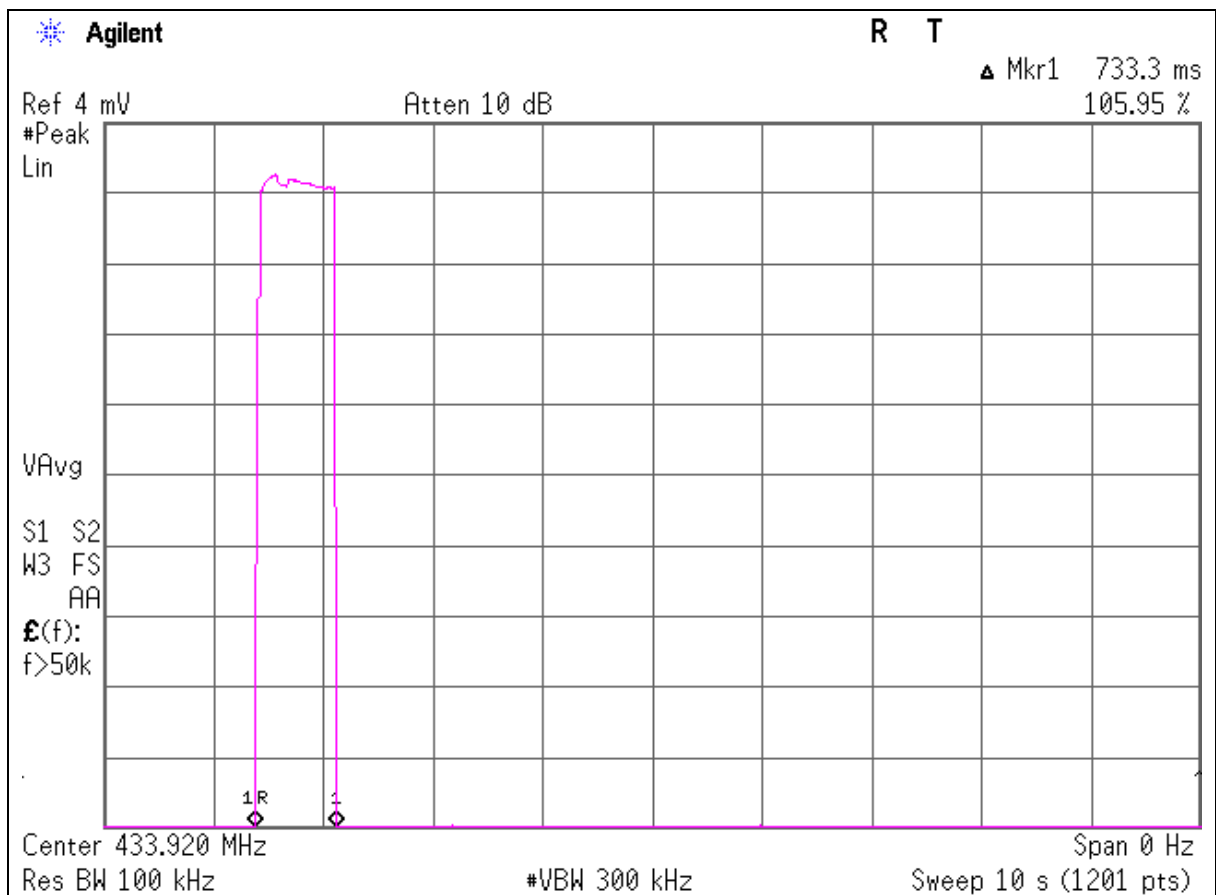
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Automatically deactivate

Test place	Ise EMC Lab. No.4 measurement room
Report No.	10795306H
Date	05/13/2015
Temperature/ Humidity	22 deg. C / 53% RH
Engineer	Keisuke Kawamura
Mode	Normal use mode 433.92 MHz

Time of Transmitting [sec]	Limit [sec]	Result
0.7333	5.00	Pass



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

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 10795306H
Date : 05/13/2015 05/14/2015
Temperature/ Humidity : 22 deg. C / 53% RH 22 deg. C / 43% RH
Engineer : Keisuke Kawamura Shinya Watanabe
(Below 1GHz) (Above 1GHz)
Mode : Transmitting mode 433.92 MHz

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	78.0	78.0	18.6	10.8	31.9	-	75.5	75.5	100.8	25.3	25.3	Carrier
867.840	PK	29.3	28.8	24.1	13.1	31.3	-	35.2	34.7	80.8	45.6	46.1	Outside
2603.520	PK	53.3	52.0	27.8	2.6	32.2	-	51.5	50.2	80.8	29.3	30.6	Outside
3037.440	PK	54.0	54.4	28.4	2.9	32.1	-	53.2	53.6	80.8	27.6	27.2	Outside
3471.360	PK	53.0	50.3	29.2	3.1	32.0	-	53.3	50.6	80.8	27.5	30.2	Outside
3905.280	PK	NS	NS	-	-	-	-	-	-	73.9	-	-	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	78.0	78.0	18.6	10.8	31.9	0.0	75.5	75.5	80.8	5.3	5.3	Carrier
867.840	PK	29.3	28.8	24.1	13.1	31.3	0.0	35.2	34.7	60.8	25.6	26.1	Outside
2603.520	PK	53.3	52.0	27.8	2.6	32.2	0.0	51.5	50.2	60.8	9.3	10.6	Outside
3037.440	PK	54.0	54.4	28.4	2.9	32.1	0.0	53.2	53.6	60.8	7.6	7.2	Outside
3471.360	PK	53.0	50.3	29.2	3.1	32.0	0.0	53.3	50.6	60.8	7.5	10.2	Outside
3905.280	PK	NS	NS	-	-	-	0.0	-	-	53.9	-	-	Inside

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

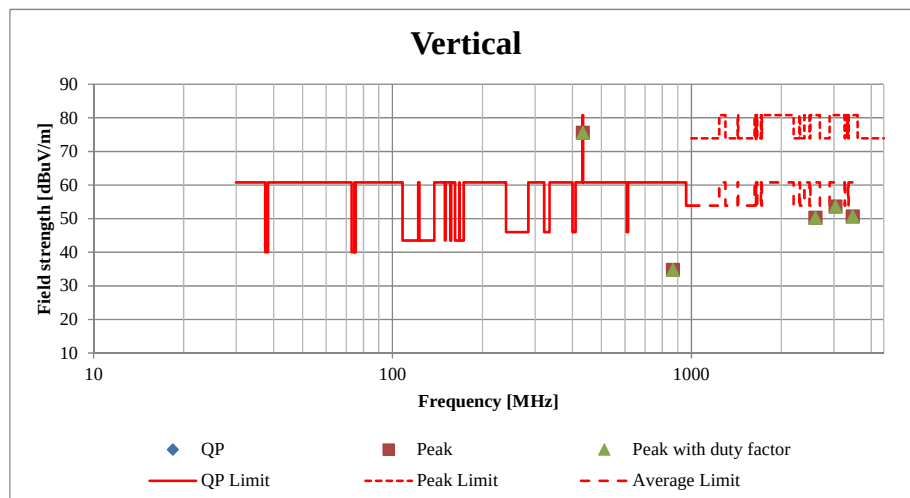
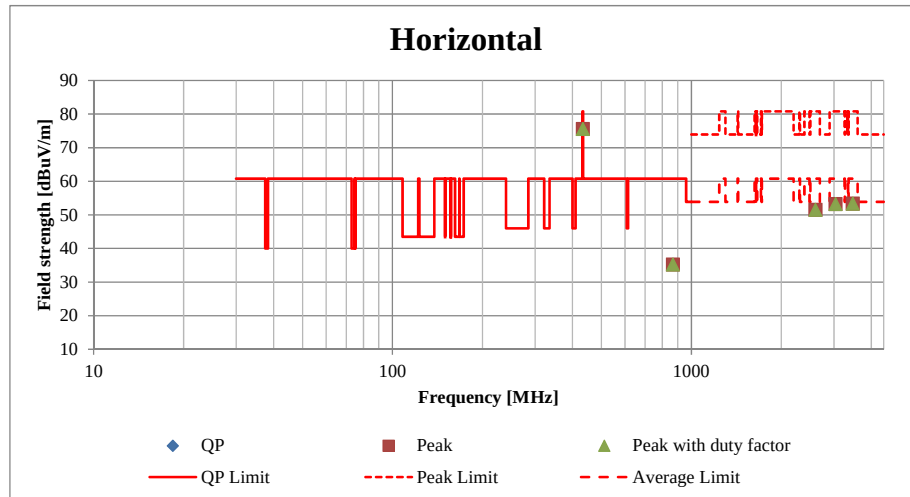
NS: No signal detected.

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

Since the peak emission result satisfied the average limit, duty factor was omitted.
Although Duty of this product was 100% or less, the result of AV (PK with Duty factor) was calculated by applying Duty 100% as worst.

Radiated Spurious Emission **(Plot data, Worst case)**

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber	
Report No.	10795306H	
Date	05/13/2015	05/14/2015
Temperature/ Humidity	22 deg. C / 53% RH	22 deg. C / 43% RH
Engineer	Keisuke Kawamura (Below 1GHz)	Shinya Watanabe (Above 1GHz)
Mode	Transmitting mode 433.92 MHz	



-20dB and 99% Occupied Bandwidth

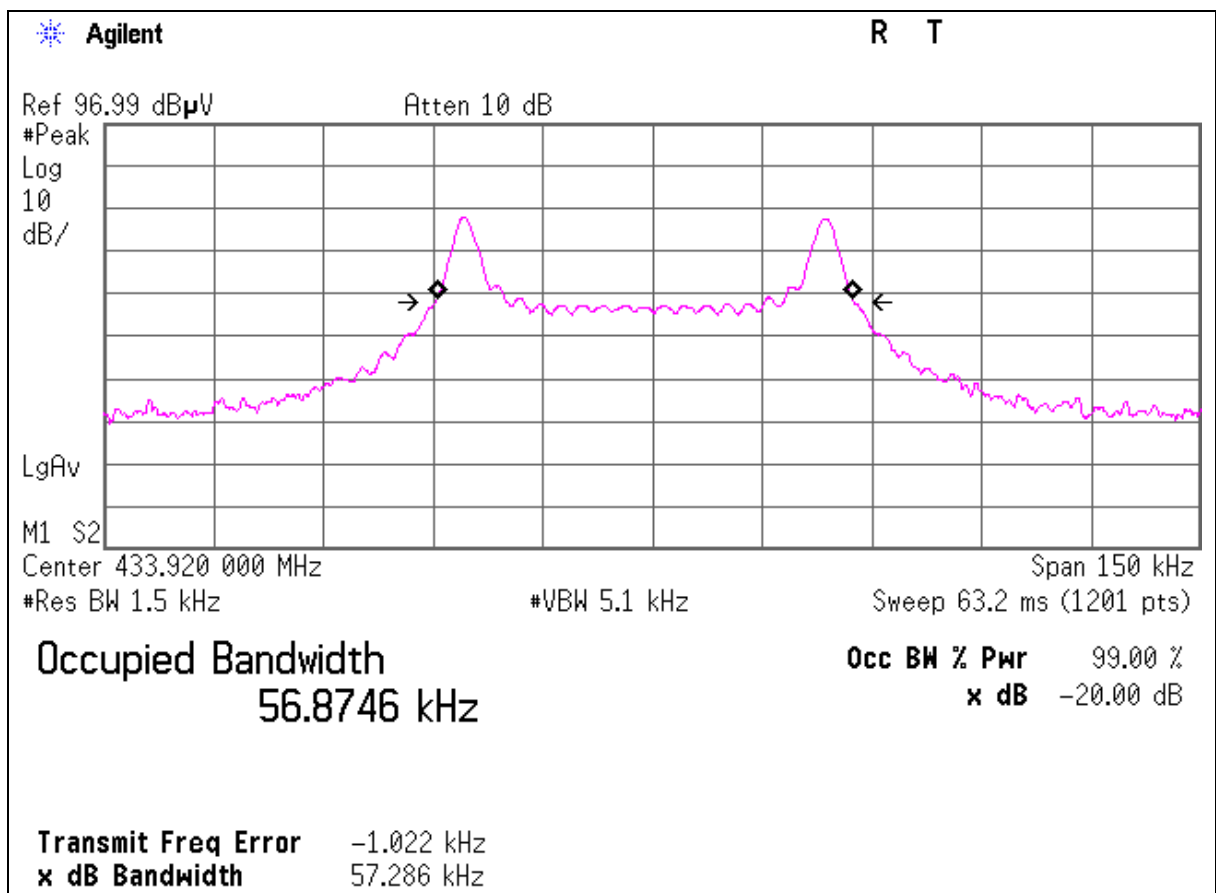
Test place : Ise EMC Lab. No.4 measurement room
Report No. : 10795306H
Date : 05/13/2015
Temperature/ Humidity : 22 deg. C / 53% RH
Engineer : Keisuke Kawamura
Mode : Transmitting mode 433.92 MHz

Bandwidth Limit : Fundamental Frequency **433.92** MHz x 0.25% = 1084.80 kHz

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

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
57.29	1084.80	Pass

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
56.87	1084.80	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-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/02/26 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2015/01/13 * 12
MJM-23	Measure	ASKUL	-	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2014/11/10 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2014/11/22 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2014/11/22 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2014/06/02 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2014/11/11 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2015/03/09 * 12
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	RE	2014/10/17 * 12
MTW-04	Torque wrench	HUBER+SUHNER	74 Z-0-0-21	17129	RE	2015/01/16 * 36
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2014/08/12 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2014/06/11 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2015/03/12 * 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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