



RADIO TEST REPORT

Test Report No. : 11034480H

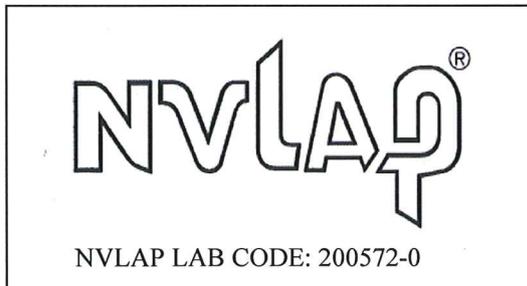
Applicant : DENSO CORPORATION
Type of Equipment : Electronic Key
Model No. : 14FFB
Test regulation : FCC Part 15 Subpart C: 2015
FCC ID : HYQ14FFB
Test Result : Complied

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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 test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: November 12 and 13, 2015

Representative test engineer: 
Keisuke Kawamura
Engineer
Consumer Technology Division

Approved by: 
Motoya Imura
Engineer
Consumer Technology Division



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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. : 14FFB
Serial No. : Refer to Clause 4.2
Rating : DC 3.0 V
Receipt Date of Sample : November 6, 2015
Country of Mass-production : Japan
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: 14FFB (referred to as the EUT in this report) is the Electronic Key.

Radio Type : Transceiver
Frequency of Operation : 433.58 MHz / 434.42 MHz*
Clock frequency(ies) in the system : 8 MHz (IC Clock)
13.08 MHz crystal (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)

* These two different frequencies are not emitted simultaneously.

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

* Original model: 14FFB has Type A and Type B in the shape of keyhole.

Also, it has 4 buttons.

Variation models have 3 buttons and 2 buttons.

They are completely identical in RF characteristics.

The worst case was confirmed with pre-check for both type, as a result, test was performed with Type A as representative.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on November 23, 2015
*Some parts are effective on and after December 17, 2015 or December 23, 2015.
The revision does not affect the test specification applied to the EUT.

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 ----- IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	N/A	N/A*1)	-
Automatically Deactivate	FCC: ANSI C63.4:2009 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 C63.4:2009 13. Measurement of intentional radiators ----- IC: RSS-Gen 6.12	FCC: Section 15.231(b) ----- IC: RSS-210 A1.1.2	3.6 dB Horizontal / Vertical PK (PK with Duty factor) (Tx 433.58 MHz)	Complied	Radiated
Electric Field Strength of Spurious Emission	FCC: ANSI C63.4:2009 13. Measurement of intentional radiators ----- IC: RSS-Gen 6.13	FCC: Section 15.205 Section 15.209 Section 15.231(b) ----- IC: RSS-210 A1.1.2, 2.5.1 RSS-Gen 8.9	7.4 dB 4335.800 MHz Vertical PK (PK with Duty factor) (Tx 433.58 MHz) 4334.200 MHz Horizontal PK (PK with Duty factor) (Tx 434.42 MHz)	Complied	Radiated
-20dB Bandwidth	FCC: ANSI C63.4:2009 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 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						
	(3 m*)(+dB)				(1 m*)(+dB)		(0.5 m*)(+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	4.3 dB	5.1 dB	6.2 dB	5.5 dB	5.8 dB	5.8 dB	4.3 dB
No.2	4.2 dB	5.1 dB	6.2 dB	5.4 dB	5.7 dB	5.9 dB	5.6 dB
No.3	4.4 dB	5.1 dB	6.3 dB	5.2 dB	5.5 dB	5.8 dB	5.5 dB
No.4	4.7 dB	5.3 dB	6.3 dB	5.3 dB	5.7 dB	5.9 dB	5.5 dB

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

Radiated emission test (3 m)

[Electric Field Strength of Fundamental Emission]

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

[Electric Field Strength of Spurious Emission]

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	4.0 x 4.5 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 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 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 Test data, Test instruments, and Test set up.

Refer to APPENDIX.

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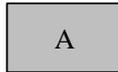
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SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

Test Item	Mode
Automatically Deactivate	Normal use mode, 433.58 MHz Normal use mode, 434.42 MHz
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20dB & 99% Occupied Bandwidth	Transmitting mode (Tx), 433.58 MHz *1) Transmitting mode (Tx), 434.42 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	14FFB	001 *1) 002 *2)	DENSO CORPORATION	EUT

*1) Used for Normal use mode.

*2) Used for Transmitting mode.

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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 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 3 m.
The measuring antenna height was varied between 1 and 4 m 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 30 MHz to 1 GHz	Above 1 GHz
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 - 4.4 GHz
Test data : APPENDIX
Test result : Pass

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: -20 dB and 99 % Occupied Bandwidth

Test Procedure

The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	150 kHz	1.5 kHz	5.1 kHz	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

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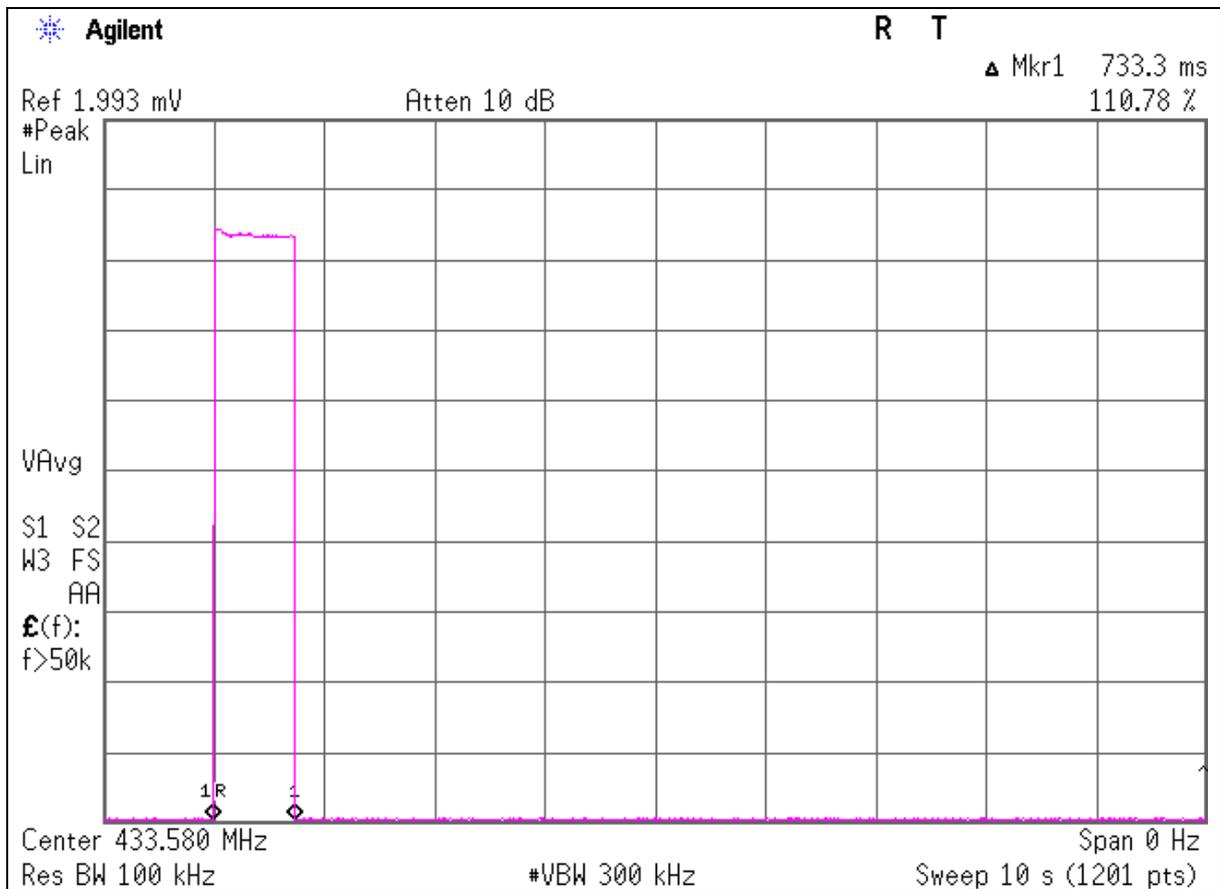
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APPENDIX 1: Test data

Automatically deactivate
433.58 MHz

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11034480H
Date	11/13/2015
Temperature/ Humidity	23 deg. C / 51% RH
Engineer	Takafumi Noguchi
Mode	Normal use mode 433.58 MHz

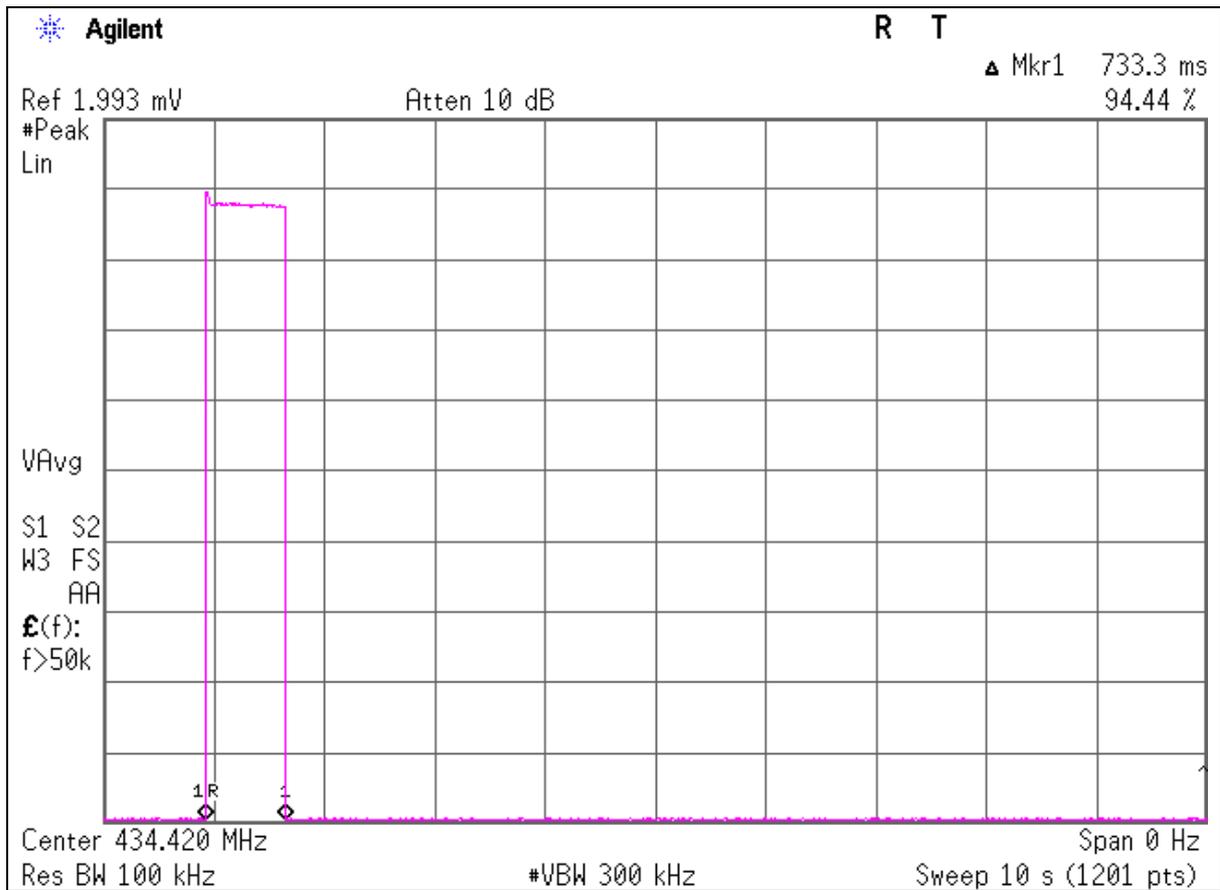
Time of Transmitting [sec]	Limit [sec]	Result
0.7333	5.00	Pass



Automatically deactivate
434.42 MHz

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11034480H
Date	11/13/2015
Temperature/ Humidity	23 deg. C / 51% RH
Engineer	Takafumi Noguchi
Mode	Normal use mode, 434.42 MHz

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



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

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No. 4
Report No.	11034480H	
Date	11/12/2015	11/13/2015
Temperature/ Humidity	21 deg. C / 42% RH	23 deg. C / 45% RH
Engineer	Keisuke Kawamura	Koji Yamamoto
	(Below 1GHz)	(Above 1GHz)
Mode	Transmitting mode (Tx), 434.42 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	
434.420	PK	80.4	80.3	17.6	10.9	32.1	-	76.8	76.7	100.8	24.0	24.1	Carrier
868.840	PK	29.3	28.6	22.2	13.1	31.2	-	33.4	32.7	80.8	47.4	48.1	Outside
1303.260	PK	45.9	45.8	25.0	2.0	34.1	-	38.8	38.7	73.9	35.1	35.2	Inside
1737.680	PK	57.3	57.1	26.4	2.3	32.9	-	53.1	52.9	80.8	27.7	27.9	Outside
2172.100	PK	44.6	44.7	27.7	2.5	32.2	-	42.6	42.7	80.8	38.2	38.1	Outside
2606.520	PK	44.3	43.4	28.1	2.8	32.0	-	43.2	42.3	80.8	37.6	38.5	Outside
3040.940	PK	43.8	43.5	28.3	3.0	31.9	-	43.2	42.9	80.8	37.6	37.9	Outside
3475.360	PK	44.3	43.6	28.7	3.2	31.7	-	44.5	43.8	80.8	36.3	37.0	Outside
3909.780	PK	43.1	43.2	29.9	3.4	31.5	-	44.9	45.0	73.9	29.0	28.9	Inside
4344.200	PK	43.0	42.9	31.3	3.6	31.4	-	46.5	46.4	73.9	27.4	27.5	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	
434.420	PK	80.4	80.3	17.6	10.9	32.1	0.0	76.8	76.7	80.8	4.0	4.1	Carrier
868.840	PK	29.3	28.6	22.2	13.1	31.2	0.0	33.4	32.7	60.8	27.4	28.1	Outside
1303.260	PK	45.9	45.8	25.0	2.0	34.1	0.0	38.8	38.7	53.9	15.1	15.2	Inside
1737.680	PK	57.3	57.1	26.4	2.3	32.9	0.0	53.1	52.9	60.8	7.7	7.9	Outside
2172.100	PK	44.6	44.7	27.7	2.5	32.2	0.0	42.6	42.7	60.8	18.2	18.1	Outside
2606.520	PK	44.3	43.4	28.1	2.8	32.0	0.0	43.2	42.3	60.8	17.6	18.5	Outside
3040.940	PK	43.8	43.5	28.3	3.0	31.9	0.0	43.2	42.9	60.8	17.6	17.9	Outside
3475.360	PK	44.3	43.6	28.7	3.2	31.7	0.0	44.5	43.8	60.8	16.3	17.0	Outside
3909.780	PK	43.1	43.2	29.9	3.4	31.5	0.0	44.9	45.0	53.9	9.0	8.9	Inside
4344.200	PK	43.0	42.9	31.3	3.6	31.4	0.0	46.5	46.4	53.9	7.4	7.5	Inside

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

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

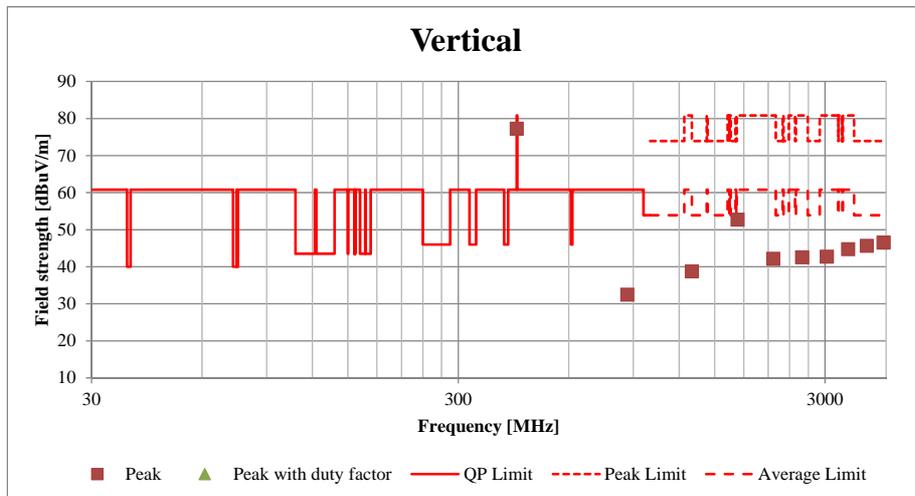
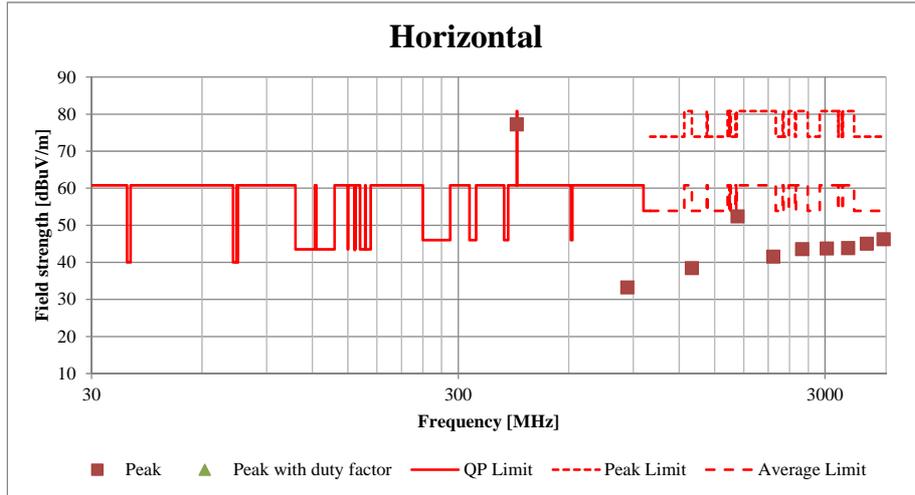
Since the peak emission result satisfied the average limit, duty factor was omitted.
Although Duty of this product was 100% or less, the result of AV (PK with Duty factor) was calculated by applying Duty 100% as worst.

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Radiated Spurious Emission
(Plot data, Worst case)

Test place Ise EMC Lab. No.3 and 4 Semi Anechoic Chamber
Report No. 11034480H
Date 11/12/2015 11/13/2015
Temperature/ Humidity 21 deg. C / 42% RH 23 deg. C / 45% RH
Engineer Keisuke Kawamura Koji Yamamoto
(Below 1GHz) (Above 1GHz)
Mode Transmitting mode (Tx), 433.58 MHz



*These plots data contains sufficient number to show the trend of characteristic features for EUT.

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-20dB and 99% Occupied Bandwidth
433.58 MHz / 434.42 MHz

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11034480H
Date	11/12/2015
Temperature/ Humidity	21 deg. C / 42% RH
Engineer	Keisuke Kawamura
Mode	Transmitting mode (Tx)

Bandwidth Limit : Fundamental Frequency **433.58** MHz x 0.25% = 1083.95 kHz
* The above limit was calculated from more stringent nominal frequency.
* Method of KDB 926416 for systems employing non sweeping frequencies was referred.

433.58MHz

-20dB Bandwidth [kHz]
38.23

434.42MHz

-20dB Bandwidth [kHz]
38.13

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
38.23+38.13=76.36	1083.95	Pass

Bandwidth Limit : Fundamental Frequency **433.58** MHz x 0.25% = 1083.95 kHz

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
37.76	1083.95	Pass

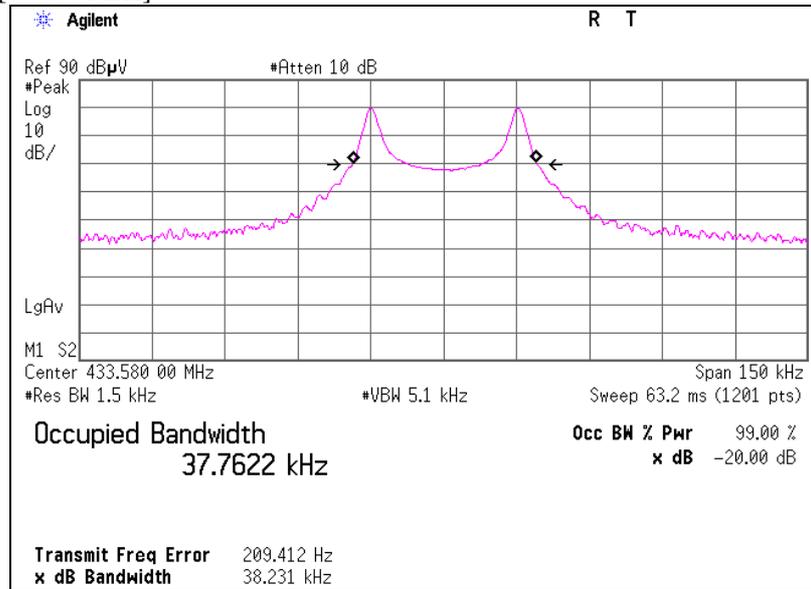
Bandwidth Limit : Fundamental Frequency **434.42** MHz x 0.25% = 1086.05 kHz

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
37.69	1086.05	Pass

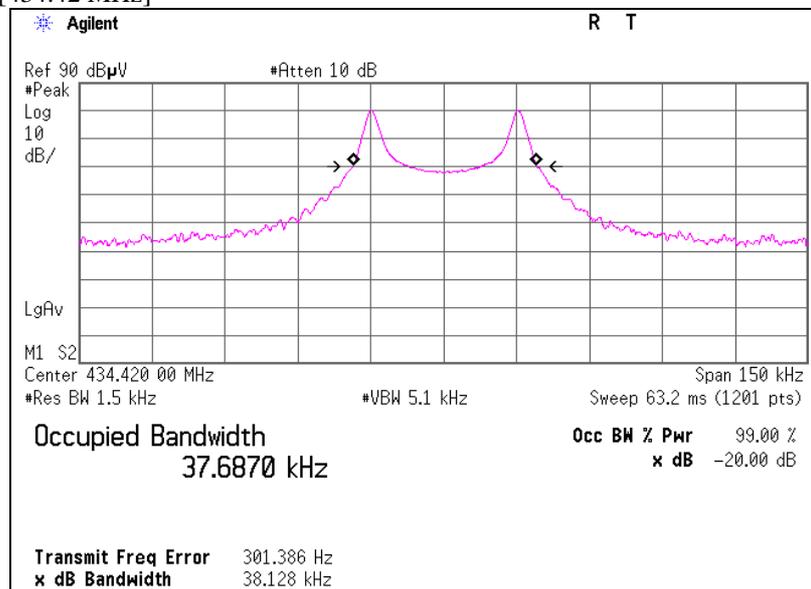
-20dB and 99% Occupied Bandwidth
433.58 MHz / 434.42 MHz

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11034480H
Date	11/12/2015
Temperature/ Humidity	21 deg. C / 42% RH
Engineer	Keisuke Kawamura
Mode	Transmitting mode (Tx)

[433.58 MHz]



[434.42 MHz]



APPENDIX 2: Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/01 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2015/01/13 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2015/05/18 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2015/09/02 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2015/10/11 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2015/10/11 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2015/07/13 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2015/04/08 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2015/03/10 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/02 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2015/01/13 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2015/02/26 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2015/08/10 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2015/05/21 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2015/10/01 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2015/07/01 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2015/01/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	RE	2015/02/16 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2015/08/19 * 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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