



RADIO TEST REPORT

Test Report No. : 12322277H

Applicant : Alps Electric Co., Ltd.
Type of Equipment : Passive Keyless Entry
Model No. : R53R0
Test regulation : FCC Part 15 Subpart C: 2018
FCC ID : CWTR53R0
Test Result : Complied

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4. The test results in this report are traceable to the national or international standards.
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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. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.

Date of test: June 2, 2018

Representative test engineer:

Ryota Yamanaka
Ryota Yamanaka
Engineer
Consumer Technology Division

Approved by:

S. Miyazono
Shinichi Miyazono
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12322277H

[illegible]

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SECTION 1: Customer information

Company Name : Alps Electric Co., Ltd.
Address : 6-3-36, Nakazato, Furukawa, Osaki-city, Miyagi-pref, 989-6181, Japan
Telephone Number : +81-229-23-5111
Facsimile Number : +81-229-22-6290
Contact Person : Yasuhiro Yabe

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

2.1 Identification of E.U.T.

Type of Equipment : Passive Keyless Entry
Model No. : R53R0
Serial No. : Refer to Clause 4.2
Rating : DC 3.0 V
Receipt Date of Sample : May 30, 2018
Country of Mass-production : 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: R53R0 (referred to as the EUT in this report) is the Passive Keyless Entry.

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 433.92 MHz
Modulation : FSK
Antenna type : PWB Pattern Antenna
Clock Frequency (maximum) : 13.08148 MHz

Radio Type : Receiver
Frequency of Operation : 125 kHz *1)

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

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	FCC: ANSI C63.10:2013 6 Standard test methods	FCC: Section 15.207	N/A	N/A *1)	-
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
Automatically Deactivate	FCC: ANSI C63.10:2013 6 Standard test methods	FCC: Section 15.231(a)(1)	N/A	Complied	Radiated
	IC: -	IC: RSS-210 A1.1			
Electric Field Strength of Fundamental Emission	FCC: ANSI C63.10:2013 6 Standard test methods	FCC: Section 15.231(b)	4.2 dB 433.920 MHz Vertical PK with Duty factor	Complied	Radiated
	IC: RSS-Gen 6.12	IC: RSS-210 A1.2			
Electric Field Strength of Spurious Emission	FCC: ANSI C63.10:2013 6 Standard test methods	FCC: Section 15.205 Section 15.209 Section 15.231(b)	3.6 dB 3905.280 MHz Horizontal PK with Duty factor	Complied	Radiated
	IC: RSS-Gen 6.13	IC: RSS-210 A1.2, 4.4 RSS-Gen 8.9			
-20dB Bandwidth	FCC: ANSI C63.10:2013 6 Standard test methods	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 A1.3	N/A	Complied	Radiated

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

3.4 Uncertainty

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 MHz to 200 MHz	200 MHz to 1000 MHz	30 MHz to 200 MHz	200 MHz to 1000 MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	5.0 dB	6.3 dB	4.9 dB	5.0 dB

Radiated emission (Above 1 GHz)				
(3 m*)(+/-)		(1 m*)(+/-)		(10 m*)(+/-)
1 GHz to 6 GHz	6 GHz to 18 GHz	10 GHz to 26.5 GHz	26.5 GHz to 40 GHz	1 GHz to 18 GHz
5.2 dB	5.5 dB	5.9 dB	5.9 dB	5.5 dB

* Measurement distance

Radiated emission test (3 m)

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

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3.5 Test Location

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NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0 m 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

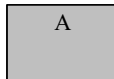
Test Item	Mode
Automatically Deactivate	Normal use mode *
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20dB & 99% Occupied Bandwidth	Transmitting mode (Tx)
The system was configured in typical fashion (as a customer would normally use it) for testing.	

* Normal use mode has the following two operations;

- Transmission by a button-pressed operation
- Smart operation to transmit after LF signal is received

The test was performed by a button-pressed operation as representative, since they are completely identical in RF characteristics.

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	Passive Keyless Entry	R53R0	28-2 *1) 28-1 *2)	Alps Electric Co., Ltd.	EUT

*1) Used for Transmitting mode

*2) Used for Normal use mode

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

Test Procedure and conditions

[For below 1GHz]

EUT was placed on a urethane platform of nominal size, 1.0 m by 0.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

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	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	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 (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.

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.

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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	500 kHz	1 kHz	3 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	Max Hold	Spectrum Analyzer
Peak hold was applied as Worst-case measurement.							

Test data : APPENDIX
Test result : Pass

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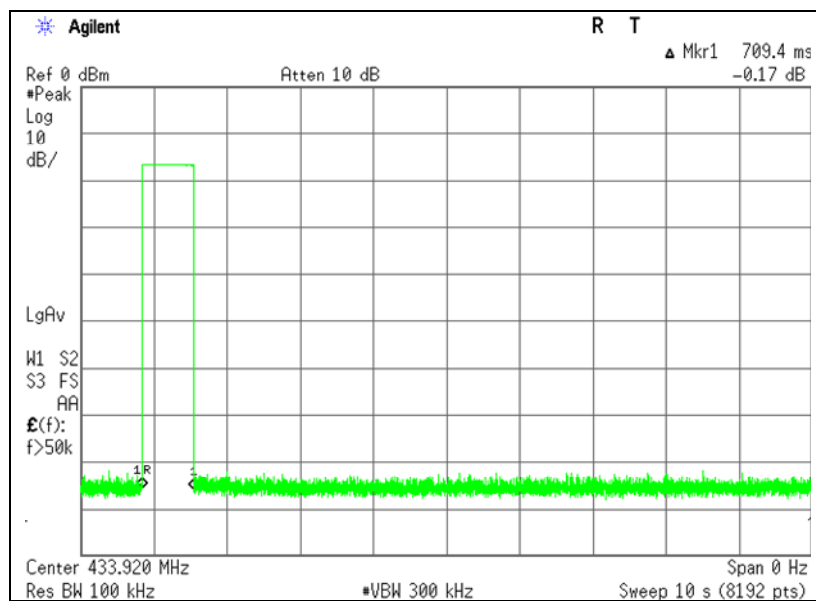
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APPENDIX 1: Test data

Automatically deactivate

Report No. 12322277H
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
Date 06/02/2018
Temperature/ Humidity 23 deg. C / 55 % RH
Engineer Ryota Yamanaka
Mode Normal use mode

Time of Transmitting [sec]	Limit [sec]	Result
0.7094	5.00	Pass



* The EUT transmits UHF when LF signal is received from a car or a button on the EUT is pressed. In both cases, the UHF transmission is stopped within 5 seconds. So the test was performed by a button-pressed operation as the worst case. Please refer to the "Theory of Operation" for details.

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

Report No. 12322277H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date 06/02/2018
Temperature / Humidity 23 deg. C / 55 % RH
Engineer Ryota Yamanaka
Mode Transmitting mode (Tx 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	80.0	81.6	16.2	10.9	32.1	-	75.0	76.6	100.8	25.8	24.2	Carrier
867.840	PK	39.3	32.7	21.5	13.3	31.2	-	42.9	36.3	80.8	37.9	44.5	Outside
1301.760	PK	45.8	45.6	25.4	6.1	34.4	-	42.9	42.7	73.9	31.0	31.2	Inside
1735.680	PK	47.5	46.6	26.3	5.7	33.4	-	46.1	45.2	80.8	34.7	35.6	Outside
2169.600	PK	44.3	45.7	27.3	5.8	32.9	-	44.5	45.9	80.8	36.3	34.9	Outside
2603.520	PK	45.7	46.0	27.8	5.9	32.6	-	46.8	47.1	80.8	34.0	33.7	Outside
3037.440	PK	43.4	43.5	28.5	6.1	32.5	-	45.5	45.6	80.8	35.3	35.2	Outside
3471.360	PK	44.8	43.4	28.4	6.3	32.3	-	47.2	45.8	80.8	33.6	35.0	Outside
3905.280	PK	46.9	45.4	29.0	6.5	32.1	-	50.3	48.8	73.9	23.6	25.1	Inside
4339.200	PK	45.1	42.4	30.2	6.8	31.9	-	50.2	47.5	73.9	23.7	26.4	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	80.0	81.6	16.2	10.9	32.1	0.0	75.0	76.6	80.8	5.8	4.2	Carrier
867.840	PK	39.3	32.7	21.5	13.3	31.2	0.0	42.9	36.3	60.8	17.9	24.5	Outside
1301.760	PK	45.8	45.6	25.4	6.1	34.4	0.0	42.9	42.7	53.9	11.0	11.2	Inside
1735.680	PK	47.5	46.6	26.3	5.7	33.4	0.0	46.1	45.2	60.8	14.7	15.6	Outside
2169.600	PK	44.3	45.7	27.3	5.8	32.9	0.0	44.5	45.9	60.8	16.3	14.9	Outside
2603.520	PK	45.7	46.0	27.8	5.9	32.6	0.0	46.8	47.1	60.8	14.0	13.7	Outside
3037.440	PK	43.4	43.5	28.5	6.1	32.5	0.0	45.5	45.6	60.8	15.3	15.2	Outside
3471.360	PK	44.8	43.4	28.4	6.3	32.3	0.0	47.2	45.8	60.8	13.6	15.0	Outside
3905.280	PK	46.9	45.4	29.0	6.5	32.1	0.0	50.3	48.8	53.9	3.6	5.1	Inside
4339.200	PK	45.1	42.4	30.2	6.8	31.9	0.0	50.2	47.5	53.9	3.7	6.4	Inside

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

Sample calculation:

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

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

For above 1GHz : Distance Factor: $20 \times \log(4.0 \text{ m}/3.0 \text{ m}) = 2.5 \text{ dB}$

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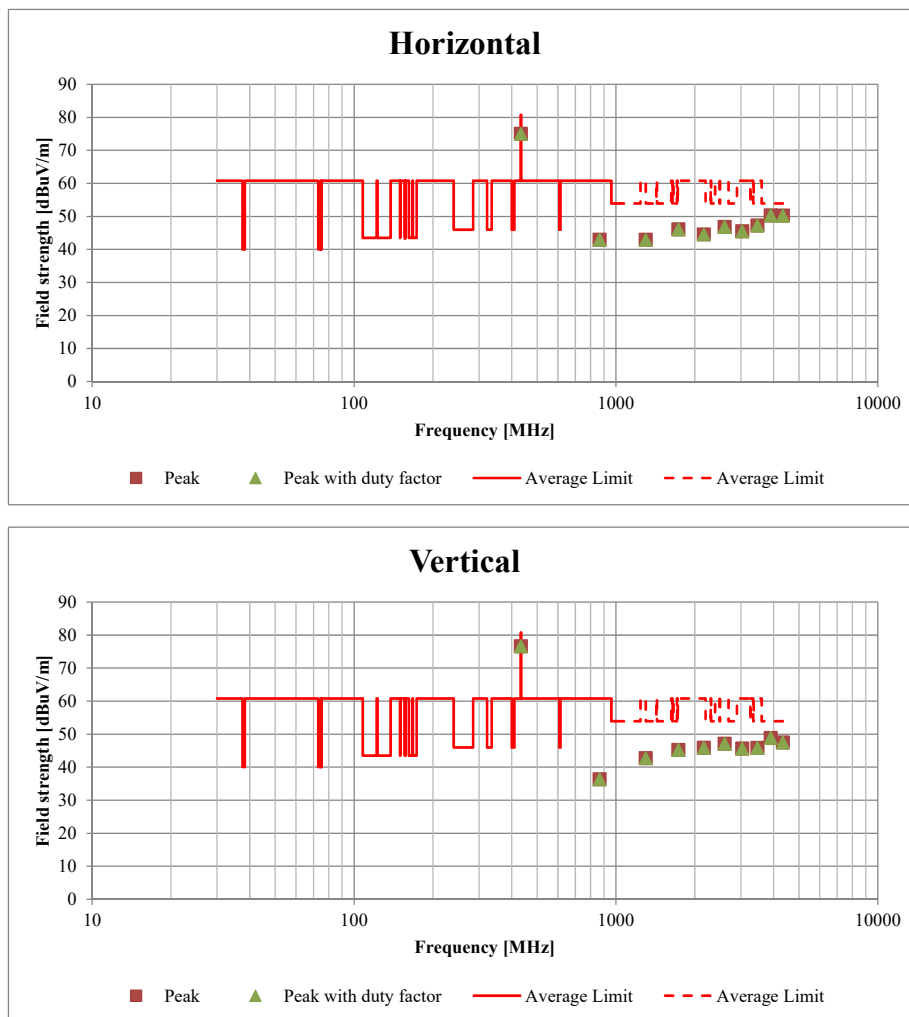
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Radiated Spurious Emission **(Plot data, Worst case)**

Report No.	12322277H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	06/02/2018
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Ryota Yamanaka
Mode	Transmitting mode (Tx 433.92 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

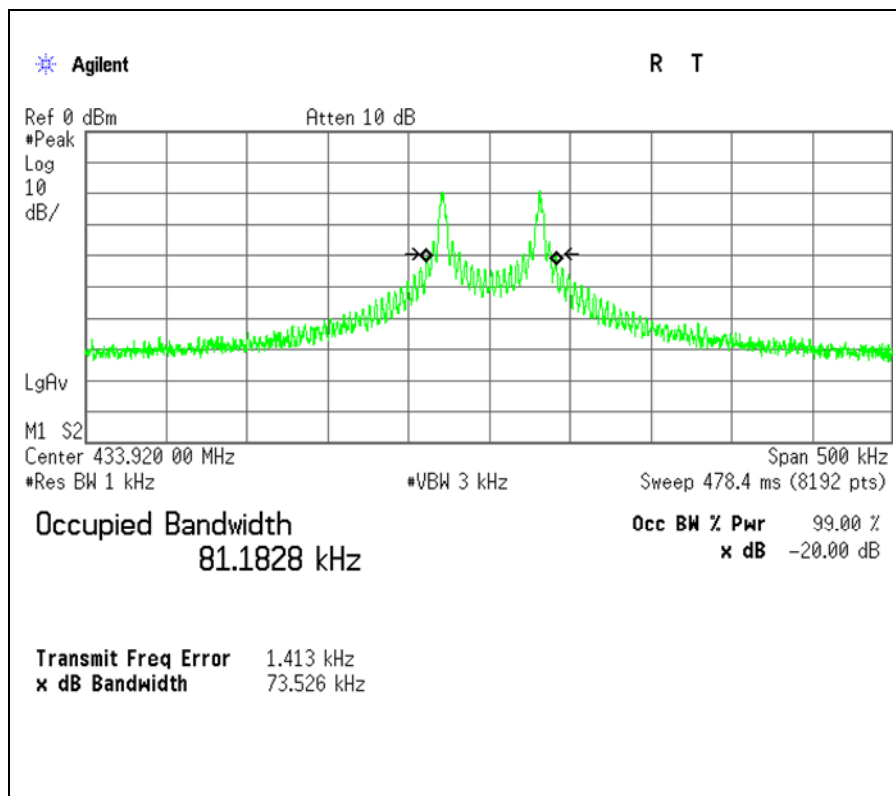
Report No. 12322277H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date 06/02/2018
Temperature / Humidity 23 deg. C / 55 % RH
Engineer Ryota Yamanaka
Mode Transmitting mode (Tx 433.92 MHz)

Bandwidth Limit : Fundamental Frequency **433.92** MHz x 0.25% = 1084.800 kHz

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

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
73.5260	1084.800	Pass

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
81.1828	1084.800	Pass



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APPENDIX 2: Test Instruments

Test Instruments

Test item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	148897	Attenuator	KEYSIGHT	8491A	MY52462349	12/18/2017	12/31/2018	12
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	8/22/2017	8/31/2018	12
RE	141323	Coaxial cable	UL Japan	-	-	7/12/2017	7/31/2018	12
RE	141532	DIGITAL HiTESTER	HIOKI	3805	51201197	1/9/2018	1/31/2019	12
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	141266	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	1/30/2018	1/31/2019	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	11/5/1900	260834	2/27/2018	2/28/2019	12
RE	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	1/24/2018	1/31/2019	12
RE	141514	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	1611	9/14/2017	9/29/2018	12
RE	141580	MicroWave System Amplifier	AGILENT	83017A	MY39500779	3/13/2018	3/31/2019	12
RE	141417	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	5/7/2018	5/31/2019	12
RE	141900	Spectrum Analyzer	AGILENT	E4440A	MY46185823	11/16/2017	11/30/2018	12
RE	142183	Measure	KOMELON	KMC-36	-	-	-	-
RE	142008	AC3 Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	10/31/2017	10/31/2018	12
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	10/2/2017	10/31/2018	12
RE	142645	Loop Antenna	UL Japan	-	-	-	-	-

*Hyphens for Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

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, -20 dB bandwidth, and Automatically deactivate tests

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