



RADIO TEST REPORT

Test Report No. : 11510862H-A

Applicant : ALPS ELECTRIC CO., LTD.
Type of Equipment : Hand Unit
Model No. : TWB1G0090
Test regulation : FCC Part 15 Subpart C: 2016
FCC ID : CWTWB1G0090
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: February 28 and March 1, 2017

Representative test engineer:

Shinichi Miyazono
Engineer

Consumer Technology Division

Approved by:

Motoya Imura

Engineer

Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11510862H-A

[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 : +81-229-23-5129
Contact Person : Yasuhiro Yabe

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

2.1 Identification of E.U.T.

Type of Equipment : Hand Unit
Model No. : TWB1G0090
Serial No. : Refer to Clause 4.2
Rating : DC 3.0 V
Receipt Date of Sample : February 21, 2017
Country of Mass-production : Mexico, 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: TWB1G0090 (referred to as the EUT in this report) is the Hand Unit.

General Specification

Clock frequency(ies) in the system : 27.6 MHz

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 433.92 MHz
Modulation : FSK
Antenna type : PWB Pattern Antenna
Method of Frequency Generation : Crystal + PLL IC

Radio Type : Receiver
Frequency of Operation : 125 kHz

TWB1G0090 has variant models.

In this report, TWB1G0090 is described as variation 1 (5SW), the variant model as variation 2 (4SW-1), the variant model as variation 3 (4SW-2) and variation 4 (3SW).

The differences of these variations are number of switch only.

There is not influence for Radio characteristics.

All tests were conducted by using the variation 2 (4SW-1).

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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 November 14, 2016 and effective December 14, 2016

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 C63.10:2013 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)	0.2 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)	4.7 dB 867.840 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

EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Test distance	Radiated emission (+/-)
	9 kHz - 30 MHz
3m	3.8 dB
10m	3.7 dB

*Measurement distance

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 MHz - 200 MHz	200 MHz - 1000 MHz	30 MHz - 200 MHz	200 MHz - 1000 MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1GHz)				
(3 m*)(+/-)		(1 m*)(+/-)		(10 m*)(+/-)
1 GHz - 6GHz	6 GHz - 18GHz	10 GHz - 26.5 GHz	26.5 GHz - 40GHz	1 GHz -18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 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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	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.

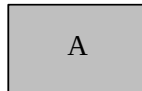
Refer to APPENDIX.

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 Duty Cycle	Continuous Transmitting mode (Tx)
* The system was configured in typical fashion (as a customer would normally use it) for testing.	

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	Hand Unit	TWB1G0090	17021616 *1) 17021620 *2)	ALPS ELECTRIC CO., LTD.	EUT

*1) Used for Continuous 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, 0.5 m by 1.0 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	Below 30 MHz	30 MHz to 200 MHz	200 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 (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	200 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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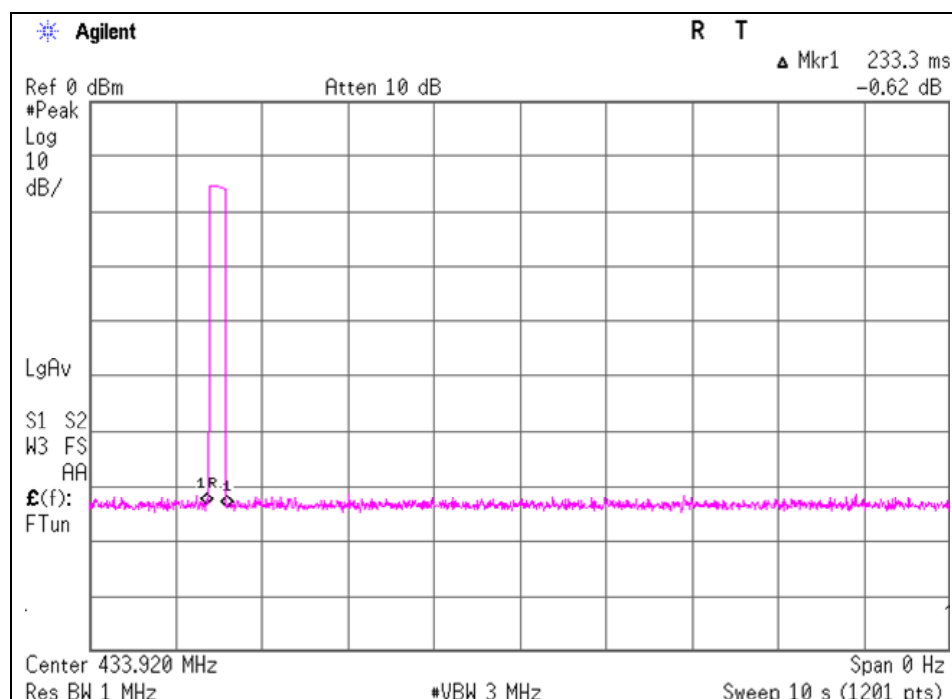
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APPENDIX 1: Test data

Automatically deactivate

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11510862H
Date : 03/01/2017
Temperature / Humidity : 23 deg. C / 32 % RH
Engineer : Shinichi Miyazono
Mode : Normal use mode 433.92 MHz

Time of Transmitting [sec]	Limit [sec]	Result
0.2333	5.00	Pass



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

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11510862H
Date : 02/28/2017
Temperature / Humidity : 22 deg. C / 31 % RH
Engineer : Shinichi Miyazono
Mode : Continuous 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	81.4	82.6	16.4	9.5	27.9	-	79.4	80.6	100.8	21.4	20.2	Carrier
867.840	PK	50.2	47.5	21.7	11.1	26.9	-	56.1	53.4	80.8	24.7	27.4	Outside
1301.760	PK	50.7	50.7	24.9	3.7	35.5	-	43.8	43.8	73.9	30.1	30.1	Inside
1735.680	PK	49.1	48.0	26.2	3.9	35.1	-	44.1	43.0	80.8	36.7	37.8	Outside
2169.600	PK	43.9	43.9	27.3	4.2	34.7	-	40.7	40.7	80.8	40.1	40.1	Outside
2603.520	PK	43.2	43.2	27.6	4.5	34.6	-	40.7	40.7	80.8	40.1	40.1	Outside
3037.440	PK	42.9	42.9	28.4	4.7	34.6	-	41.4	41.4	80.8	39.4	39.4	Outside
3471.360	PK	42.0	42.0	27.9	4.9	34.2	-	40.6	40.6	80.8	40.2	40.2	Outside
3905.280	PK	43.4	41.4	29.1	5.1	33.8	-	43.8	41.8	73.9	30.1	32.1	Inside
4339.200	PK	43.3	41.9	29.5	5.3	33.8	-	44.3	42.9	73.9	29.6	31.0	Inside

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	81.4	82.6	16.4	9.5	27.9	0.0	79.4	80.6	80.8	1.4	0.2	Carrier
867.840	PK	50.2	47.5	21.7	11.1	26.9	0.0	56.1	53.4	60.8	4.7	7.4	Outside
1301.760	PK	50.7	50.7	24.9	3.7	35.5	0.0	43.8	43.8	53.9	10.1	10.1	Inside
1735.680	PK	49.1	48.0	26.2	3.9	35.1	0.0	44.1	43.0	60.8	16.7	17.8	Outside
2169.600	PK	43.9	43.9	27.3	4.2	34.7	0.0	40.7	40.7	60.8	20.1	20.1	Outside
2603.520	PK	43.2	43.2	27.6	4.5	34.6	0.0	40.7	40.7	60.8	20.1	20.1	Outside
3037.440	PK	42.9	42.9	28.4	4.7	34.6	0.0	41.4	41.4	60.8	19.4	19.4	Outside
3471.360	PK	42.0	42.0	27.9	4.9	34.2	0.0	40.6	40.6	60.8	20.2	20.2	Outside
3905.280	PK	43.4	41.4	29.1	5.1	33.8	0.0	43.8	41.8	53.9	10.1	12.1	Inside
4339.200	PK	43.3	41.9	29.5	5.3	33.8	0.0	44.3	42.9	53.9	9.6	11.0	Inside

Sample calculation:

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

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

For above 1GHz : Distance Factor: $20 \times \log(3.75 \text{ m}/3.0 \text{ m}) = 1.94 \text{ dB}$

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

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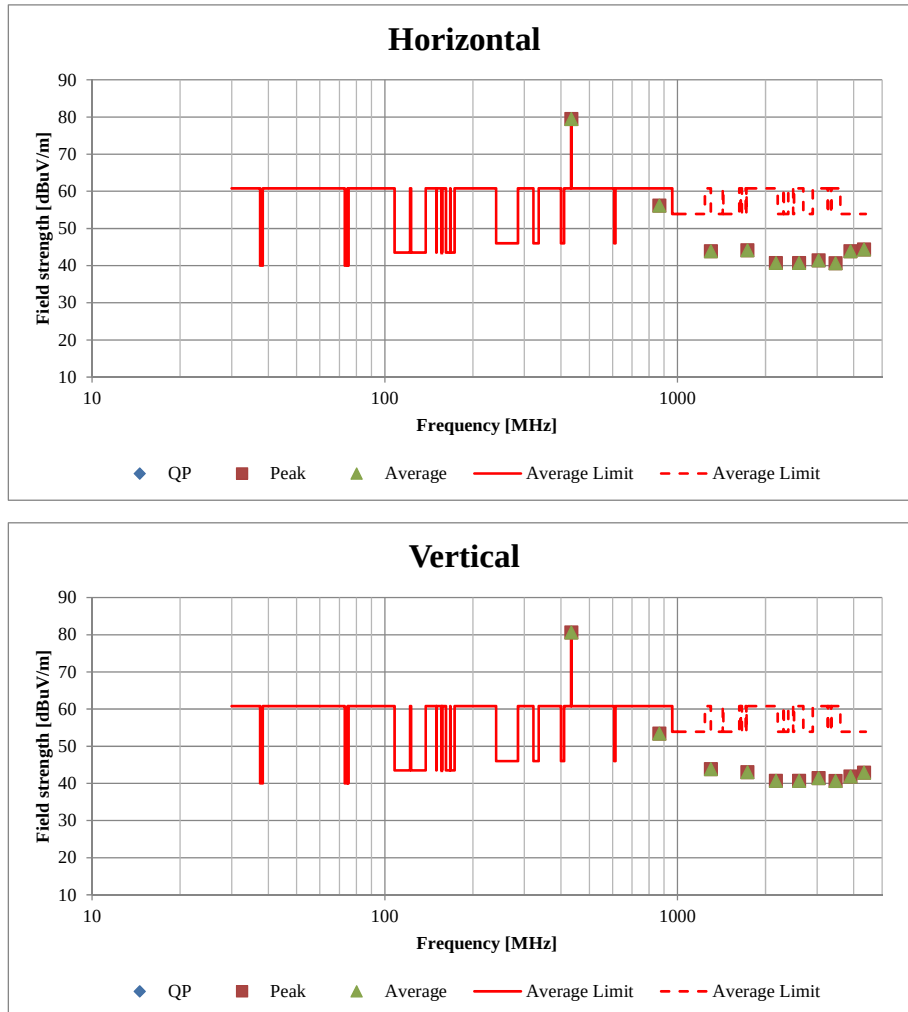
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Radiated Spurious Emission **(Plot data, Worst case)**

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11510862H
Date	02/28/2017
Temperature / Humidity	22 deg. C / 31 % RH
Engineer	Shinichi Miyazono
Mode	Continuous Transmitting mode 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

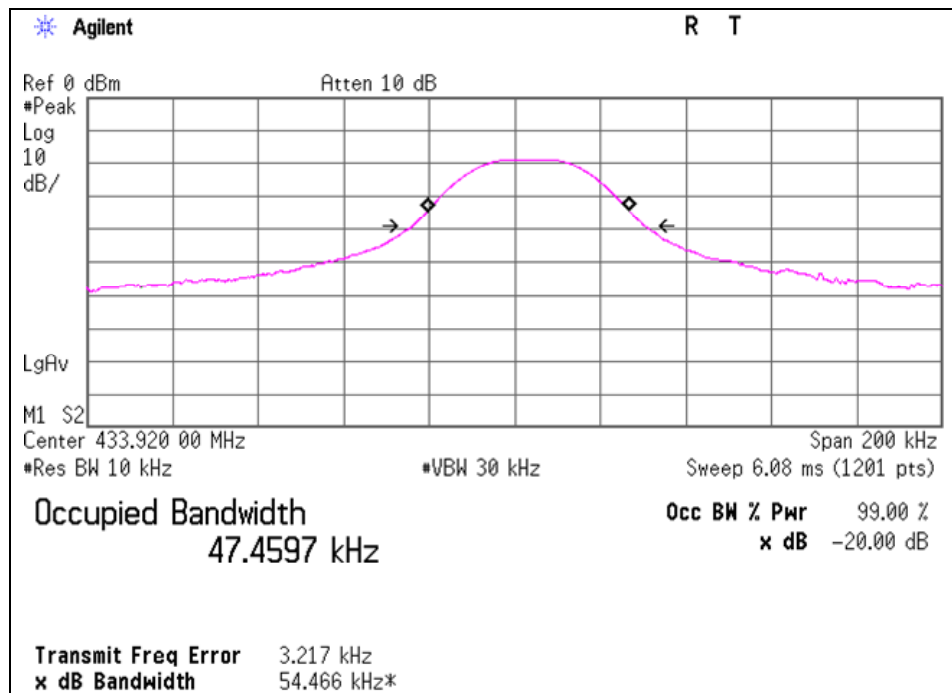
Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11510862H
Date : 03/01/2017
Temperature/ Humidity : 23 deg. C / 32 % RH
Engineer : Shinichi Miyazono
Mode : Continuous Transmitting mode 433.92 MHz

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
54.466	1084.80	Pass

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
47.460	1084.80	Pass



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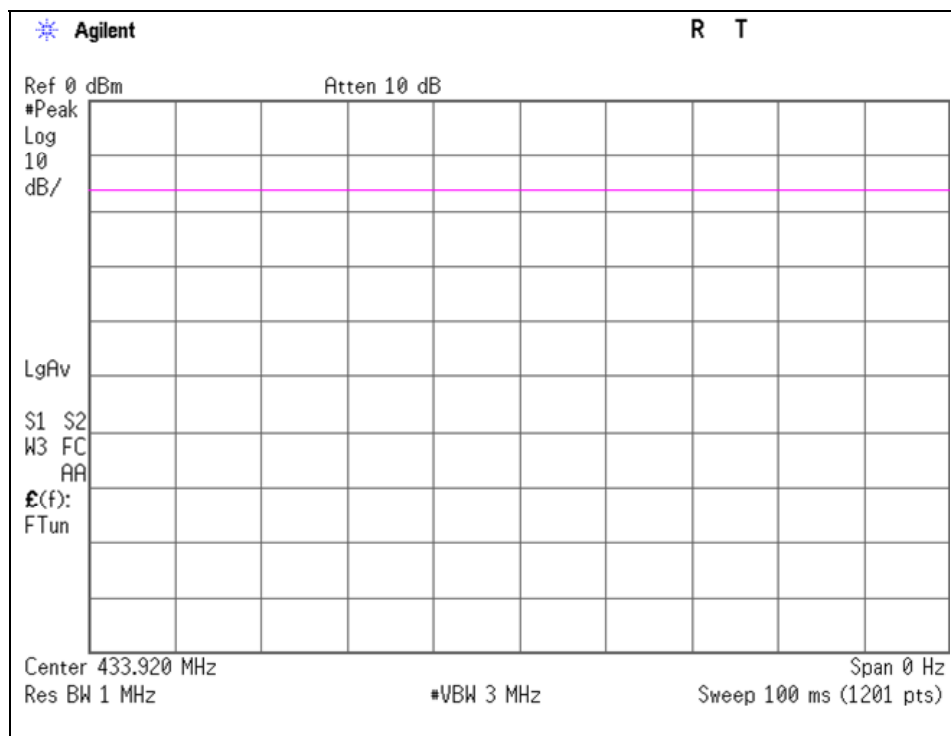
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Duty Cycle

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11510862H
Date	03/01/2017
Temperature/ Humidity	23 deg. C / 32 % RH
Engineer	Shinichi Miyazono
Mode	Continuous Transmitting mode 433.92 MHz

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
100.000	100.00	1.0000	0.00

* Duty = $20\log_{10}(\text{ON time/Cycle})$



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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-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2016/08/02 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2016/12/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MRENT-126	Spectrum Analyzer	KEYSIGHT	E4440A	MY46185516	RE	2016/07/01 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2016/10/21 * 12
MBA-08	Biconical Antenna	Schwarzbeck	VHA9103B	08031	RE	2016/09/29 * 12
MLA-21	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2017/01/05 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2017/02/24 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2016/11/28 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2016/09/13 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2016/08/23 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2016/09/28 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2016/08/29 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2017/01/16 * 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, -20 dB bandwidth, Automatically deactivate and Duty cycle tests

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