



RADIO TEST REPORT

Test Report No. : 12322276H

Applicant : Alps Electric Co., Ltd.
Type of Equipment : Immobilizer base station
Model No. : I61M0
FCC ID : CWTI61M0
Test regulation : FCC Part 15 Subpart C: 2018
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 covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. 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: June 18, 2018

Representative test engineer:

Shinya Watanabe

Engineer

Consumer Technology Division

Approved by:

Shinichi Miyazono

Engineer

Consumer Technology Division



NVLAP LAB CODE: 200572-0

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- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
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UL Japan, Inc.

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12322276H

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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 : Immobilizer base station
Model No. : I61M0
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 12.0 V
Receipt Date of Sample : June 8, 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: I61M0, (referred to as the EUT in this report), is the Immobilizer base station.

Radio Specification

Radio Type : Transmitter
Frequency of Operation : 125 kHz
Modulation : ASK
Antenna type : Loop Antenna
Clock Frequency (maximum) : 8 MHz

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 15.207 Conducted limits
Section 15.209 Radiated emission limits; general requirements.

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 8.8	<FCC> Section 15.207 <IC> RSS-Gen 8.8	-	N/A	N/A *1)	N/A
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.4, 6.12	<FCC> Section 15.209 <IC> RSS-210 4.4 RSS-Gen 8.9	Radiated	N/A	20.0 dB 125 kHz, 0 deg. PK with Duty Factor	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.4, 6.13	<FCC> Section 15.209 <IC> RSS-210 4.4 RSS-Gen 8.9	Radiated	N/A	9.8 dB 31.785 MHz Vertical, QP	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> -	<FCC> Reference data <IC> -	Radiated	N/A	N/A	Complied

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 is not the device that is designed to be connected to the public utility (AC) power line.

FCC 15.31 (e)

This EUT provides stable voltage constantly to RF Module regardless of input voltage. Therefore, this 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.

3.3 Addition to standard

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99 % Occupied Band Width	RSS-Gen 6.6	-	Radiated	N/A	N/A	Complied

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 to 30 MHz
3 m	3.8 dB
10 m	3.6 dB

*Measurement distance

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

* Measurement distance

Radiated emission test(3 m)

The data listed in this test report has enough margin, more than the site margin.

3.5 Test Location

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Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124
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 2.0m 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.

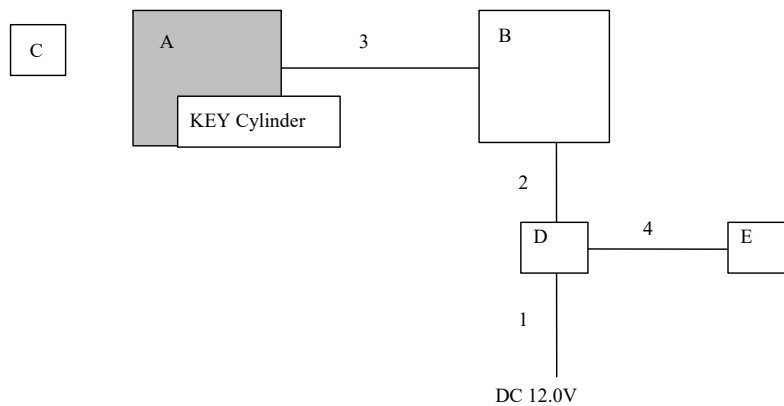
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

Test mode	Remarks
Transmitting mode (Tx) 125 kHz	-

Justification : The system was configured in typical fashion (as a user would normally use it) for testing.

4.2 Configuration and peripherals



* Cabling and setup were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Immobilizer base station	I61M0	2016032402	Alps Electric Co., Ltd.	EUT
B	BCM	-	2013110101	-	-
C	KEY	-	2013110102	-	-
D	I/F Board	-	-	-	-
E	Trigger timer	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.80	Unshielded	Unshielded	-
2	Signal and DC Cable	0.80	Unshielded	Unshielded	-
3	Signal and DC Cable	0.90	Unshielded	Unshielded	-
4	Signal and DC Cable	0.15	Unshielded	Unshielded	-

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SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 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.

Frequency : From 9 kHz to 30 MHz

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz

The measuring antenna height varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

The test was made with the detector (RBW / VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz
Antenna Type	Loop	Biconical	Logperiodic

Frequency	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
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m

*1) Distance Factor: $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

*2) Distance Factor: $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

This EUT has two modes which transponder key is inserted or not. The worst case was confirmed with and without transponder key, as a result, the test without transponder key was the worst case. Therefore the test without transponder key was performed only.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 9 kHz - 1 GHz
Test data : APPENDIX 1
Test result : Pass

Date: June 18, 2018

Test engineer: Shinya Watanabe

UL Japan, Inc.

Ise EMC Lab.

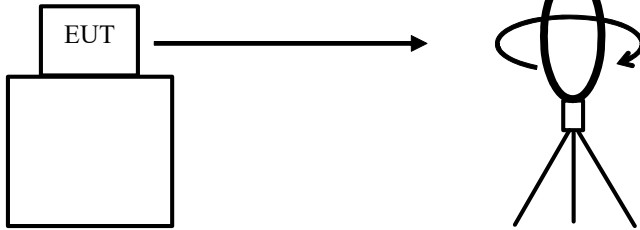
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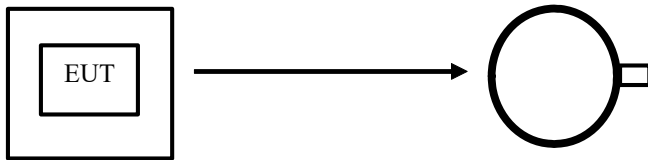
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Figure 1: Direction of the Loop Antenna

Side View (Vertical)

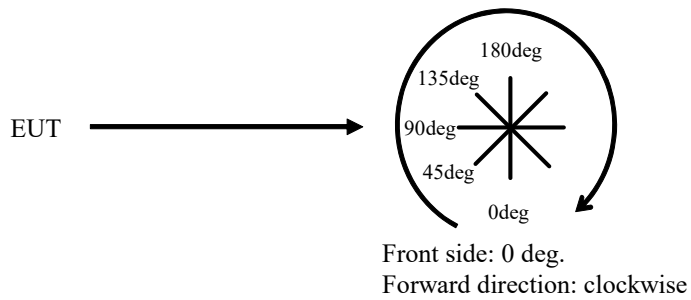


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



SECTION 6: -26dB Bandwidth

Test Procedure

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

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26 dB Bandwidth	100 kHz	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1
Test result : Pass

SECTION 7: 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
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 1
Test result : Pass

APPENDIX 1: Test data

Radiated Emission below 30 MHz (Fundamental and Spurious Emission)

Report No. 12322276H
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Date 06/18/2018
Temperature/ Humidity 24 deg. C / 61 % RH
Engineer Shinya Watanabe
Mode Tx 125 kHz

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	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
0	0.12500	PK	91.8	19.8	-73.8	32.2	0.0	5.6	45.6	40.0	
0	0.25000	PK	44.6	19.7	-73.8	32.2	0.0	-41.7	39.6	81.3	
0	0.37500	PK	53.4	19.7	-73.8	32.2	0.0	-32.9	36.1	69.0	
0	0.50000	QP	38.1	19.7	-33.8	32.1	0.0	-8.1	33.6	41.7	
0	0.62500	QP	43.1	19.7	-33.7	32.2	0.0	-3.1	31.7	34.8	
0	0.75000	QP	37.2	19.7	-33.7	32.2	0.0	-9.0	30.1	39.1	
0	0.87500	QP	42.4	19.7	-33.7	32.2	0.0	-3.8	28.7	32.5	
0	1.00000	QP	37.5	19.7	-33.7	32.2	0.0	-8.7	27.6	36.3	
0	1.12500	QP	40.4	19.7	-33.7	32.2	0.0	-5.8	26.5	32.3	
0	1.25000	QP	37.2	19.7	-33.7	32.2	0.0	-9.0	25.6	34.6	

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

PK with Duty factor

Ant Deg [deg]	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
0	0.12500	PK	91.8	19.8	-73.8	32.2	0.0	5.6	25.6	20.0	
0	0.25000	PK	44.6	19.7	-73.8	32.2	0.0	-41.7	19.6	61.3	
0	0.37500	PK	53.4	19.7	-73.8	32.2	0.0	-32.9	16.1	49.0	

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

* Since the peak emission result satisfied the average limit, duty factor was omitted.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	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
0	0.12500	PK	91.8	19.8	6.2	32.2	-	85.6	-	-	Fundamental

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

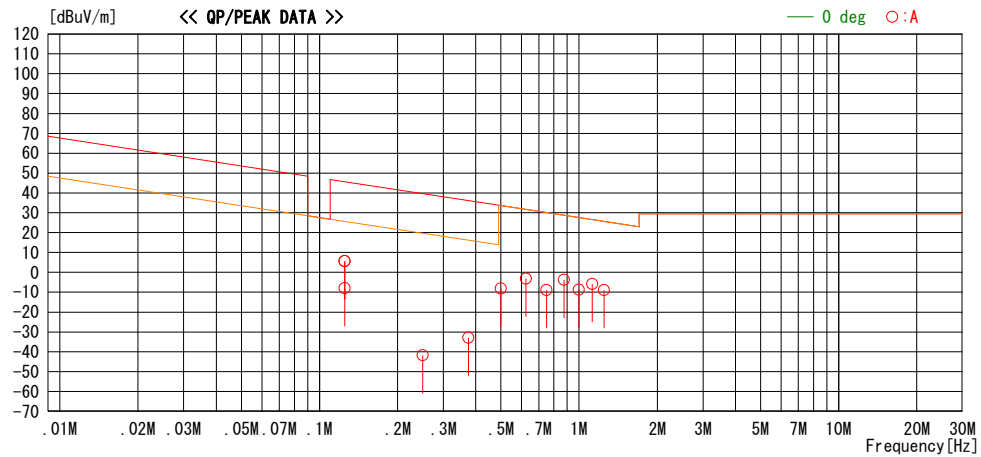
* All spurious emissions lower than this result.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Radiated Emission below 30 MHz (Fundamental and Spurious Emission)

Report No. 12322276H
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Date 06/18/2018
Temperature/ Humidity 24 deg. C / 61 % RH
Engineer Shinya Watanabe
Mode Tx 125 kHz

LIMIT : FCC15.209 (a), 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15.209 (a), 9-90kHz:AV, 110-490kHz:AV, other:QP

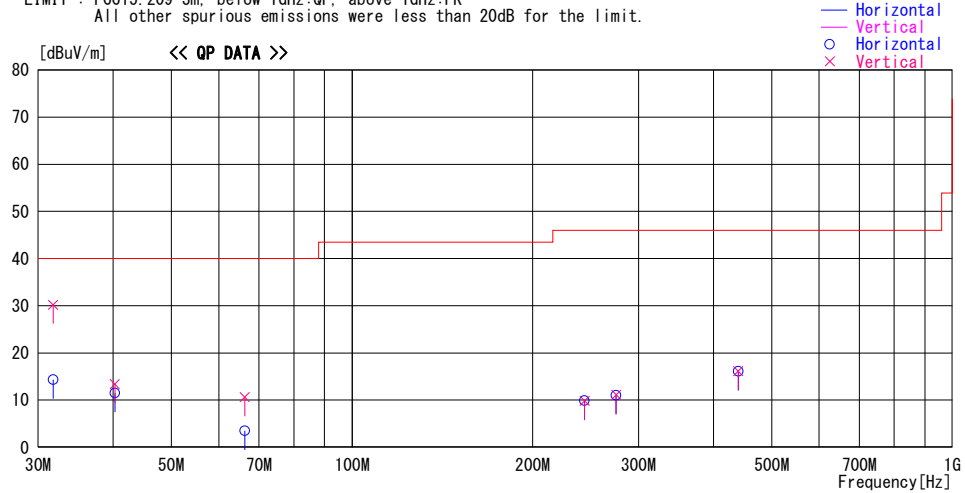


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Radiated Emission above 30 MHz (Spurious Emission)

Report No. 12322276H
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Date 06/18/2018
Temperature/ Humidity 24 deg. C / 61 % RH
Engineer Shinya Watanabe
Mode Tx 125 kHz

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency	Reading	DET	Antenna Factor	Loss & Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
31.785	21.8	QP	17.4	-24.9	14.3	0	100	Hori.	40.0	25.7	
31.785	37.7	QP	17.4	-24.9	30.2	285	100	Vert.	40.0	9.8	
40.261	21.8	QP	14.4	-24.7	11.5	0	100	Hori.	40.0	28.5	
40.261	23.7	QP	14.4	-24.7	13.4	172	100	Vert.	40.0	26.6	
66.268	21.1	QP	6.7	-24.3	3.5	0	100	Hori.	40.0	36.5	
66.268	28.2	QP	6.7	-24.3	10.6	272	100	Vert.	40.0	29.4	
243.951	20.6	QP	11.8	-22.5	9.9	224	143	Hori.	46.0	36.1	
243.951	20.5	QP	11.8	-22.5	9.8	0	100	Vert.	46.0	36.2	
275.351	20.5	QP	12.7	-22.2	11.0	356	100	Hori.	46.0	35.0	
275.351	20.6	QP	12.7	-22.2	11.1	257	100	Vert.	46.0	34.9	
440.000	20.6	QP	16.6	-21.1	16.1	55	200	Hori.	46.0	29.9	
440.000	20.6	QP	16.6	-21.1	16.1	0	200	Vert.	46.0	29.9	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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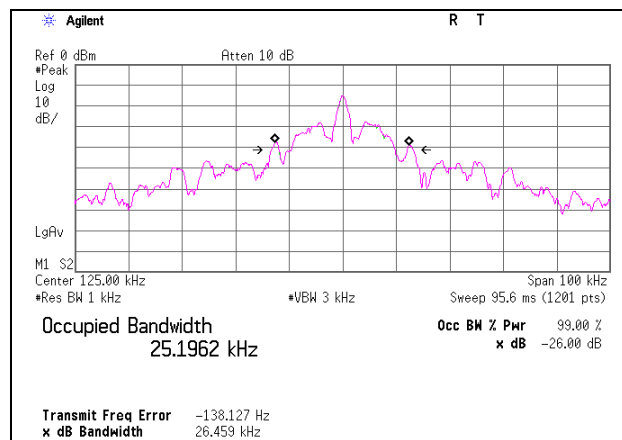
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-26dB Bandwidth and 99% Occupied Bandwidth

Report No. 12322276H
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Date 06/18/2018
Temperature/ Humidity 24 deg. C / 61 % RH
Engineer Shinya Watanabe
Mode Tx 125 kHz

Frequency [kHz]	-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
125	26.459	25.1962



APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	141885	Spectrum Analyzer	AGILENT	E4448A	US44300523	11/14/2017	11/30/2018	12
RE	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	1/30/2018	1/31/2019	12
RE	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/421-010/sucoform141-P	-/04178	6/13/2018	6/30/2019	12
RE	141413	Coaxial Cable	UL Japan	-	-	6/12/2018	6/30/2019	12
RE	141254	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	10/11/2017	10/31/2018	12
RE	141562	Thermo-Hygrometer	CUSTOM	CTH-180	1501	1/24/2018	1/31/2019	12
RE	141583	Pre Amplifier	SONOMA INSTRUMENT	11/5/1900	260833	2/27/2018	2/28/2019	12
RE	148898	Attenuator	KEYSIGHT	8491A	MY52462282	10/12/2017	10/31/2018	12
RE	141267	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-192	12/10/2017	12/31/2018	12
RE	141425	Biconical Antenna	Schwarzbeck	BBA9106	1302	11/23/2017	11/30/2018	12
RE	141397	Coaxial Cable	UL Japan	-	-	6/13/2018	6/30/2019	12
RE	142011	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	10/30/2017	10/31/2018	12

*Hyphens for Last Calibration Date, 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: Spurious emission

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