



# **RADIO TEST REPORT**

**Test Report No. : 12789650H-R1**

**Applicant** : ALPS ALPINE CO., LTD.  
**Type of Equipment** : Remote Keyless Entry (Hand Unit)  
**Model No.** : TWB1G0076  
**FCC ID** : CWTWB1G0076  
**Test regulation** : FCC Part 15 Subpart C: 2018  
**Test Result** : Complied (Refer to SECTION 3.2)

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
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.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 12789650H. 12789650H is replaced with this report.

**Date of test:** April 20, 2019

**Representative test engineer:**

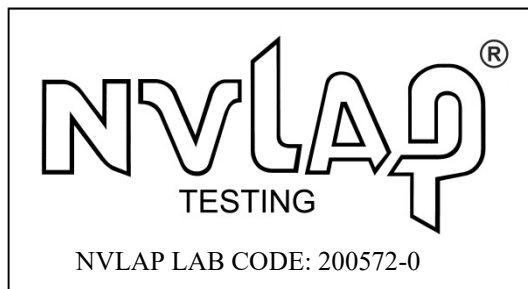
*T. Nakagawa*

Tomohisa Nakagawa  
Engineer  
Consumer Technology Division

**Approved by:**

*S. Miyazono*

Shinichi Miyazono  
Engineer  
Consumer Technology Division



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.  
\*As for the range of Accreditation in NVLAP, you may refer to the WEB address,  
[http://japan.ul.com/resources/emc\\_accredited/](http://japan.ul.com/resources/emc_accredited/)

- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.  
☒ There is no testing item of "Non-accreditation".

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## REVISION HISTORY

# Original Test Report No.: 12789650H

[illegible]

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## **SECTION 1: Customer information**

|                  |   |                                                                      |
|------------------|---|----------------------------------------------------------------------|
| Company Name     | : | ALPS ALPINE 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                                                        |

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No. on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

\* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

### **2.1 Identification of E.U.T.**

|                                                        |   |                                                                                            |
|--------------------------------------------------------|---|--------------------------------------------------------------------------------------------|
| Type of Equipment                                      | : | Remote Keyless Entry (Hand Unit)                                                           |
| Model No.                                              | : | TWB1G0076                                                                                  |
| Serial No.                                             | : | Refer to Section 4, Clause 4.2                                                             |
| Rating                                                 | : | DC 3.0 V                                                                                   |
| Receipt Date of Sample<br>(Information from test lab.) | : | April 17, 2019                                                                             |
| Country of Mass-production                             | : | China                                                                                      |
| Condition of EUT                                       | : | Engineering prototype<br>(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: TWB1G0076 (referred to as the EUT in this report) is a Remote Keyless Entry (Hand Unit).

#### **Radio Specification**

|                             |   |                          |
|-----------------------------|---|--------------------------|
| Radio Type                  | : | Transmitter              |
| Frequency of Operation      | : | 433.92 MHz               |
| Modulation                  | : | ASK                      |
| Antenna Type                | : | PWB Pattern antenna      |
| Operating temperature range | : | -10 deg. C to +60 deg. C |

### **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<br>6 Standard test methods<br>IC: RSS-Gen 8.8  | FCC: Section 15.207<br>IC: RSS-Gen 8.8                                                             | N/A                                                         | N/A            | *1)      |
| Automatically Deactivate                           | FCC: ANSI C63.10:2013<br>6 Standard test methods<br>IC: -            | FCC: Section 15.231(a)(1)<br>IC: RSS-210 A1.1                                                      | N/A                                                         | Complied<br>a) | Radiated |
| Electric Field Strength<br>of Fundamental Emission | FCC: ANSI C63.10:2013<br>6 Standard test methods<br>IC: RSS-Gen 6.12 | FCC: Section 15.231(b)<br>IC: RSS-210 A1.2                                                         | 17.4 dB<br>433.920 MHz<br>Horizontal<br>PK with Duty factor | Complied<br>b) | Radiated |
| Electric Field Strength<br>of Spurious Emission    | FCC: ANSI C63.10:2013<br>6 Standard test methods<br>IC: RSS-Gen 6.13 | FCC: Section 15.205<br>Section 15.209<br>Section 15.231(b)<br>IC: RSS-210 A1.2, 4.4<br>RSS-Gen 8.9 | 11.8 dB<br>867.840 MHz<br>PK with Duty factor               | Complied<br>b) | Radiated |
| -20dB Bandwidth                                    | FCC: ANSI C63.10:2013<br>6 Standard test methods<br>IC: -            | FCC: Section 15.231(c)<br>IC: Reference data                                                       | N/A                                                         | Complied<br>c) | 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.

a) Refer to APPENDIX 1 (data of Automatically deactivate)

b) Refer to APPENDIX 1 (data of Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission))

c) Refer to APPENDIX 1 (data of -20dB and 99% Occupied Bandwidth)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

#### **FCC Part 15.31 (e)**

This test was performed with the New Battery (DC 3.0 V) and the constant voltage was supplied to the EUT 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.

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

### 3.3 Addition to standard

| Item                    | Test Procedure  | Specification    | Worst margin | Results | Remarks  |
|-------------------------|-----------------|------------------|--------------|---------|----------|
| 99 % Occupied Bandwidth | IC: RSS-Gen 6.7 | IC: RSS-210 A1.3 | N/A          | -       | Radiated |

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

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

### 3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

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           | 3.3 dB                  |
| 10 m          | 3.2 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              |

| 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 |
| 5.0 dB                          | 5.3 dB          | 5.8 dB             | 5.8 dB             | 5.2 dB          |

\* Measurement distance

| Automatically Deactivate |
|--------------------------|
| 0.10 %                   |

| Bandwidth |
|-----------|
| 0.96 %    |

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**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

### 3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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            | 3.1 x 5.0                                                        | -                      | -                            |
| 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

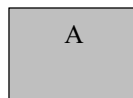
Refer to APPENDIX.

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

### **4.1 Operating Mode(s)**

| Test Item*                                                                                                                                                                                                                                                                                                                                                                                                                                 | Mode                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Automatically Deactivate<br>Duty Cycle                                                                                                                                                                                                                                                                                                                                                                                                     | Model1: Normal use mode           |
| Electric Field Strength of Fundamental Emission<br>Electric Field Strength of Spurious Emission<br>-20 dB & 99 % Occupied Bandwidth                                                                                                                                                                                                                                                                                                        | Mode2: Transmitting mode (Tx) *1) |
| * The system was configured in typical fashion (as a user would normally use it) for testing.<br>*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, EUT stops to transmit in a given time, even if transceiver button is being pressed.)<br>End users cannot change the settings of the output power of the product. |                                   |

### **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   | Remote Keyless Entry<br>(Hand Unit) | TWB1G0076    | 19041601 *1)<br>19041602 *2) | ALPS ALPINE CO., LTD. | EUT     |

\*1) Used for "Mode1"

\*2) Used for "Mode2"

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**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

### **Test Procedure and conditions**

[For below 30 MHz]

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

[For 30 MHz to 1 GHz]

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 1 GHz]

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.

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.

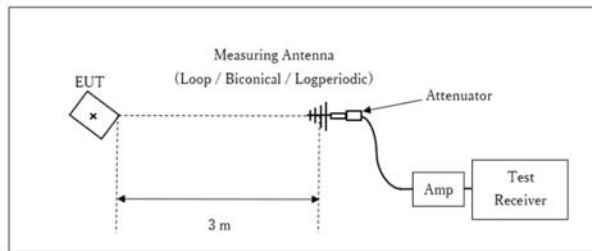
### **Test Antennas are used as below;**

| 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<br>to 90 kHz and<br>From 110 kHz<br>to 150 kHz | From<br>90 kHz<br>to 110 kHz | From<br>150 kHz<br>to 490 kHz | From<br>490 kHz<br>to 30 MHz | From<br>30 MHz<br>to 1 GHz           | Above 1 GHz                       |
|------------------|-----------------------------------------------------------|------------------------------|-------------------------------|------------------------------|--------------------------------------|-----------------------------------|
| Detector<br>Type | Peak                                                      | Peak                         | Peak                          | Peak                         | Peak and<br>Peak with<br>Duty factor | Peak and<br>Peak with Duty factor |
| IF Bandwidth     | 200 Hz                                                    | 200 Hz                       | 9.0 kHz                       | 9.0 kHz                      | 120 kHz                              | PK: S/A: RBW 1 MHz,<br>VBW: 3 MHz |

## [Test Setup]

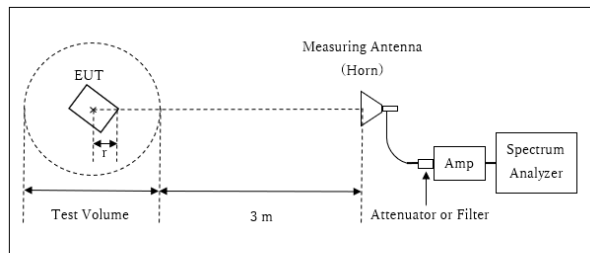
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor:  $20 \times \log(4 \text{ m} / 3.0 \text{ m}) = 2.50 \text{ dB}$

\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 4 \text{ m}$

Test Volume : 2 m

(Test Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.0 \text{ m}$

\* The test was performed with  $r = 0.0 \text{ m}$  since EUT is small and it was the rather conservative condition.

- 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 folded or not. The worst case was confirmed folded and un-folded mechanical key, as a result, the test un-folded mechanical key was the worst case. Therefore the test un-folded 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

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

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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: -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         | Enough width to display emission skirts | 1 to 5 % of OBW | Three times of RBW | Auto  | Peak *1) | Max Hold *1) | 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.

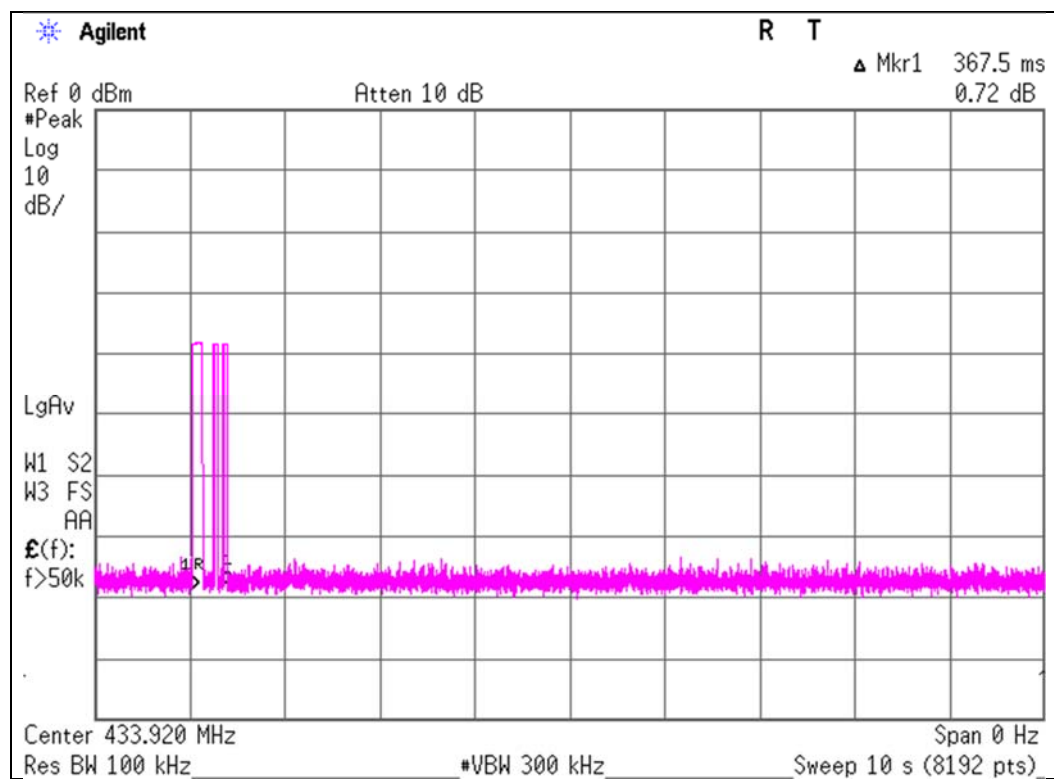
Test data : APPENDIX  
Test result : Pass

## APPENDIX 1: Test data

### Automatically deactivate

|                        |                     |
|------------------------|---------------------|
| Report No.             | 12789650H           |
| Test place             | Ise EMC Lab.        |
| Semi Anechoic Chamber  | No.3                |
| Date                   | April 20, 2019      |
| Temperature / Humidity | 20 deg. C / 37 % RH |
| Engineer               | Tomohisa Nakagawa   |
| Mode                   | Mode 1              |

| Time of Transmitting<br>[sec] | Limit<br>[sec] | Result |
|-------------------------------|----------------|--------|
| 0.3675                        | 5.00           | Pass   |



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**Ise EMC Lab.**

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Telephone : +81 596 24 8999

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

Report No. 12789650H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 20, 2019  
Temperature / Humidity 20 deg. C / 37 % RH  
Engineer Tomohisa Nakagawa  
Mode Mode 2

### PK

| Frequency<br>[MHz] | Detector | Reading<br>[dBuV] |      | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] |      | Limit<br>[dBuV/m] | Margin<br>[dB] |      | Remark<br>Inside or Outside<br>of Restricted Bands |
|--------------------|----------|-------------------|------|-------------------------|--------------|--------------|------------------------|--------------------|------|-------------------|----------------|------|----------------------------------------------------|
|                    |          | Hor               | Ver  |                         |              |              |                        | Hor                | Ver  |                   | Hor            | Ver  |                                                    |
| 433.920            | PK       | 77.2              | 75.9 | 16.2                    | 11.0         | 32.0         | -                      | 72.5               | 71.2 | 100.8             | 28.3           | 29.6 | Carrier                                            |
| 867.840            | PK       | 53.7              | 52.3 | 22.0                    | 13.5         | 31.1         | -                      | 58.1               | 56.7 | 80.8              | 22.7           | 24.1 | Outside                                            |
| 1301.760           | PK       | 52.0              | 52.0 | 25.9                    | 4.3          | 34.6         | -                      | 47.6               | 47.6 | 73.9              | 26.3           | 26.3 | Inside                                             |
| 1735.680           | PK       | 45.1              | 44.6 | 25.5                    | 4.5          | 33.6         | -                      | 41.5               | 41.0 | 80.8              | 39.3           | 39.8 | Outside                                            |
| 2169.600           | PK       | 45.5              | 44.4 | 28.3                    | 4.8          | 32.9         | -                      | 45.7               | 44.7 | 80.8              | 35.1           | 36.1 | Outside                                            |
| 2603.520           | PK       | 41.6              | 42.9 | 27.9                    | 5.0          | 32.7         | -                      | 41.9               | 43.2 | 80.8              | 38.9           | 37.6 | Outside                                            |
| 3037.440           | PK       | 41.7              | 41.8 | 28.9                    | 5.2          | 32.4         | -                      | 43.4               | 43.5 | 80.8              | 37.4           | 37.3 | Outside                                            |
| 3471.360           | PK       | 42.4              | 41.2 | 29.1                    | 5.4          | 32.3         | -                      | 44.6               | 43.4 | 80.8              | 36.2           | 37.4 | Outside                                            |
| 3905.280           | PK       | 42.3              | 41.0 | 30.0                    | 5.6          | 32.1         | -                      | 45.9               | 44.6 | 73.9              | 28.0           | 29.3 | Inside                                             |
| 4339.200           | PK       | 41.9              | 39.9 | 30.7                    | 5.8          | 31.9         | -                      | 46.5               | 44.4 | 73.9              | 27.4           | 29.5 | Inside                                             |

### PK with Duty factor

| Frequency<br>[MHz] | Detector | Reading<br>[dBuV] |      | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] |      | Limit<br>[dBuV/m] | Margin<br>[dB] |      | Remark  |
|--------------------|----------|-------------------|------|-------------------------|--------------|--------------|------------------------|--------------------|------|-------------------|----------------|------|---------|
|                    |          | Hor               | Ver  |                         |              |              |                        | Hor                | Ver  |                   | Hor            | Ver  |         |
| 433.920            | PK       | 77.2              | 75.9 | 16.2                    | 11.0         | 32.0         | -9.1                   | 63.4               | 62.1 | 80.8              | 17.4           | 18.7 | Carrier |
| 867.840            | PK       | 53.7              | 52.3 | 22.0                    | 13.5         | 31.1         | -9.1                   | 49.0               | 47.6 | 60.8              | 11.8           | 13.2 | Outside |
| 1301.760           | PK       | 52.0              | 52.0 | 25.9                    | 4.3          | 34.6         | -9.1                   | 38.5               | 38.5 | 53.9              | 15.4           | 15.4 | Inside  |
| 1735.680           | PK       | 45.1              | 44.6 | 25.5                    | 4.5          | 33.6         | -9.1                   | 32.4               | 31.9 | 60.8              | 28.4           | 28.9 | Outside |
| 2169.600           | PK       | 45.5              | 44.4 | 28.3                    | 4.8          | 32.9         | -9.1                   | 36.6               | 35.6 | 60.8              | 24.2           | 25.2 | Outside |
| 2603.520           | PK       | 41.6              | 42.9 | 27.9                    | 5.0          | 32.7         | -9.1                   | 32.8               | 34.1 | 60.8              | 28.0           | 26.7 | Outside |
| 3037.440           | PK       | 41.7              | 41.8 | 28.9                    | 5.2          | 32.4         | -9.1                   | 34.3               | 34.4 | 60.8              | 26.5           | 26.4 | Outside |
| 3471.360           | PK       | 42.4              | 41.2 | 29.1                    | 5.4          | 32.3         | -9.1                   | 35.5               | 34.3 | 60.8              | 25.3           | 26.5 | Outside |
| 3905.280           | PK       | 42.3              | 41.0 | 30.0                    | 5.6          | 32.1         | -9.1                   | 36.7               | 35.5 | 53.9              | 17.2           | 18.4 | Inside  |
| 4339.200           | PK       | 41.9              | 39.9 | 30.7                    | 5.8          | 31.9         | -9.1                   | 37.3               | 35.3 | 53.9              | 16.6           | 18.6 | Inside  |

Sample calculation:

Result of PK = Reading + Ant Factor + Loss {Cable + Attenuator + Distance factor (above 1 GHz)} - Gain (Amplifier)

Result of PK with Duty factor = Reading + Ant Factor + Loss {Cable + Attenuator + Distance factor (above 1 GHz)} - Gain (Amplifier) + Duty factor

After the product specifications and actual measured value were compared, 35%(Max.) of the product specifications was the worst result.

Therefore, -9.1 [dB] was applied to the Duty factor.

Please refer to the "Theory of Operation" for details.

Duty factor =  $20 \times \log(35/100) = -9.1$  dB

For above 1GHz : Distance Factor:  $20 \times \log(4.0 \text{ m}/3.0 \text{ m}) = 2.50$  dB

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

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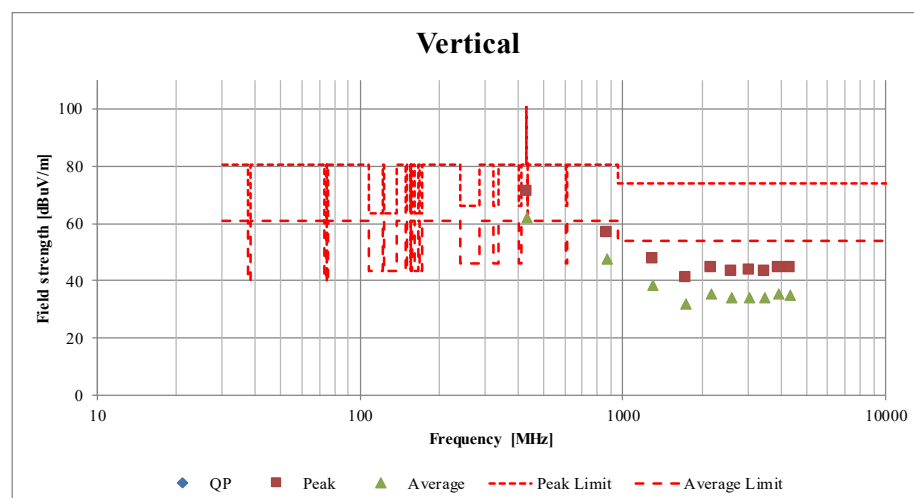
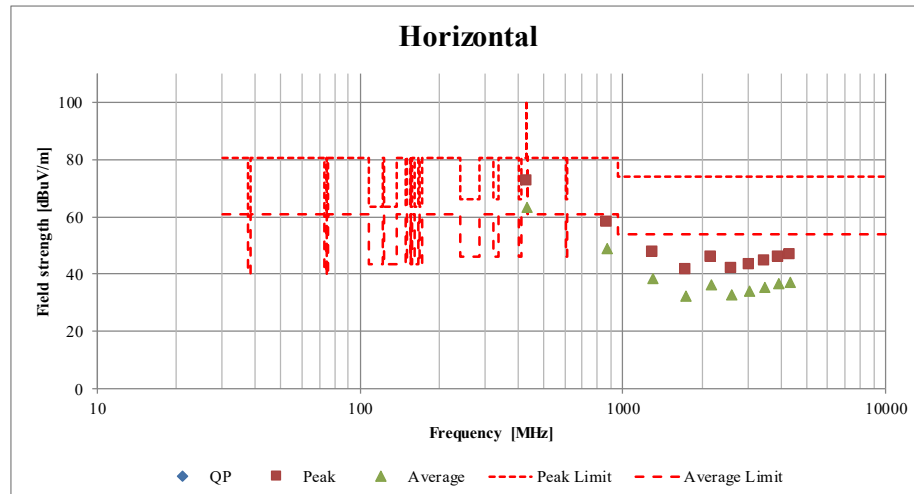
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

Report No. 12789650H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 20, 2019  
Temperature / Humidity 20 deg. C / 37 % RH  
Engineer Tomohisa Nakagawa  
Mode Mode 2



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

## -20dB and 99% Occupied Bandwidth

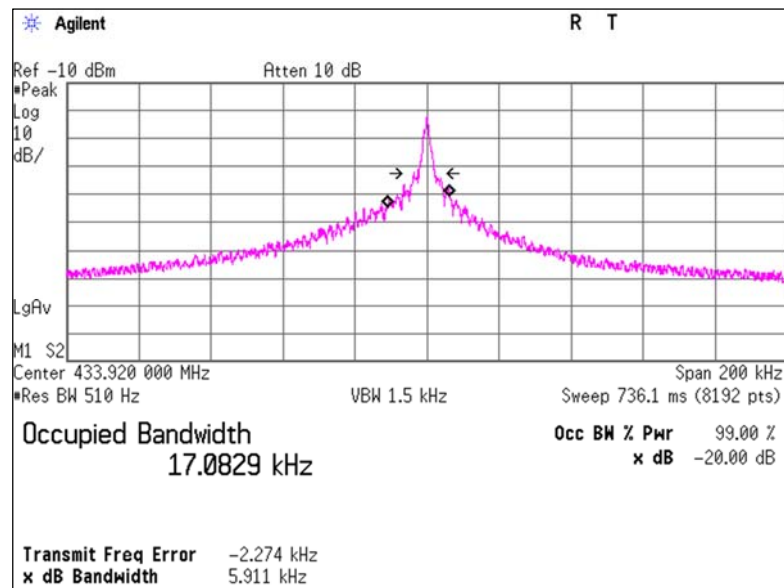
|                        |                     |
|------------------------|---------------------|
| Report No.             | 12789650H           |
| Test place             | Ise EMC Lab.        |
| Semi Anechoic Chamber  | No.3                |
| Date                   | April 20, 2019      |
| Temperature / Humidity | 20 deg. C / 37 % RH |
| Engineer               | Tomohisa Nakagawa   |
| Mode                   | Mode 2              |

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<br>[kHz] | Bandwidth Limit<br>[kHz] | Result |
|--------------------------|--------------------------|--------|
| 5.911                    | 1084.80                  | Pass   |

| 99% Occupied Bandwidth<br>[kHz] | Bandwidth Limit<br>[kHz] | Result |
|---------------------------------|--------------------------|--------|
| 17.0829                         | 1084.80                  | Pass   |



### Duty Cycle

Report No. 12789650H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 20, 2019  
Temperature / Humidity 20 deg. C / 37 % RH  
Engineer Tomohisa Nakagawa  
Mode Mode 2

| Type | Times | ON time(One pulse)<br>[ms] | ON time(in 100ms)<br>[ms] |
|------|-------|----------------------------|---------------------------|
| A    | 15    | 0.489                      | 7.3275                    |
| B    | 1     | 4.141                      | 4.141                     |
| C    | 25    | 0.906                      | 22.64                     |

\*1)ON time(in 100ms) = Times \* ON time(One pulse)

\*2)The train of pulses was exceeding 100msec, and that sampled 100msec was the worst case against the pulse train.

#### **(Total)**

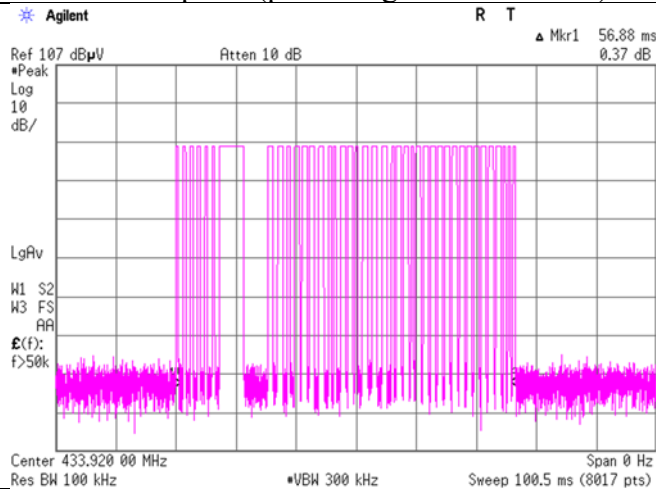
| ON time<br>[ms] | Cycle<br>[ms] | Duty<br>(On time/Cycle) | Duty<br>[dB] |
|-----------------|---------------|-------------------------|--------------|
| 34.11           | 100.00        | 0.34                    | -9.3         |

\*3)ON time = sum of the type A,B and C (in 100msec)

\*4)Duty =  $20\log_{10}(\text{ON time/Cycle})$

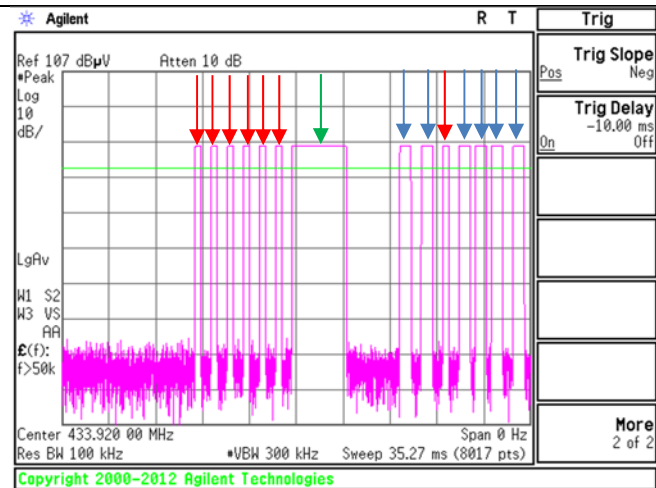
## Duty Cycle

### Overview of pulse (pulse length is 56.88msec)



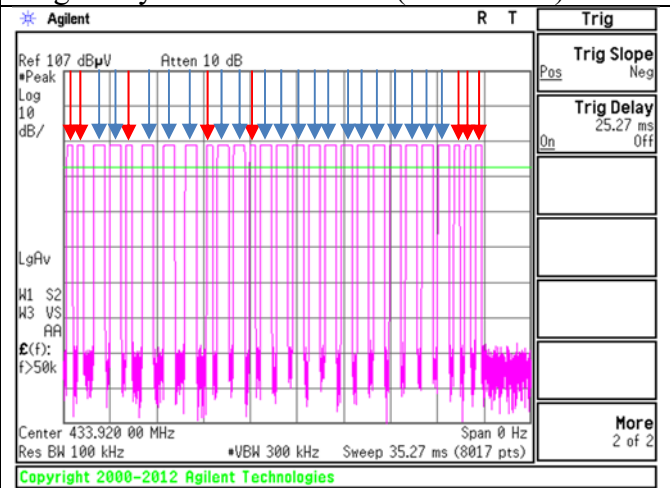
Type A is red arrow  
Type B is green arrow  
Type C is Blue arrow

### Pulse train (1 of 2)

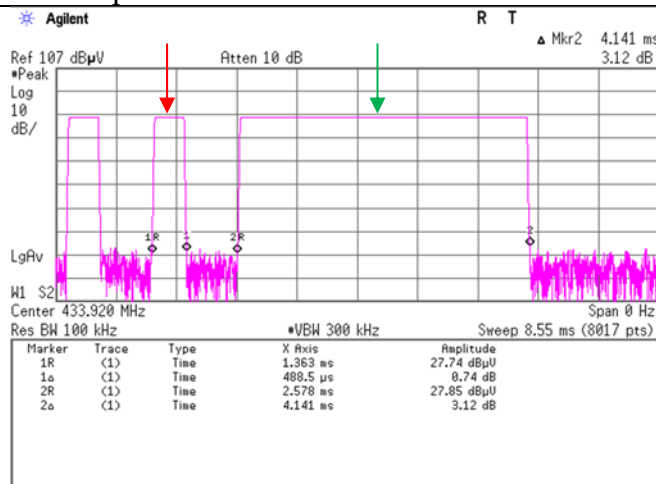


### Pulse train (2 of 2)

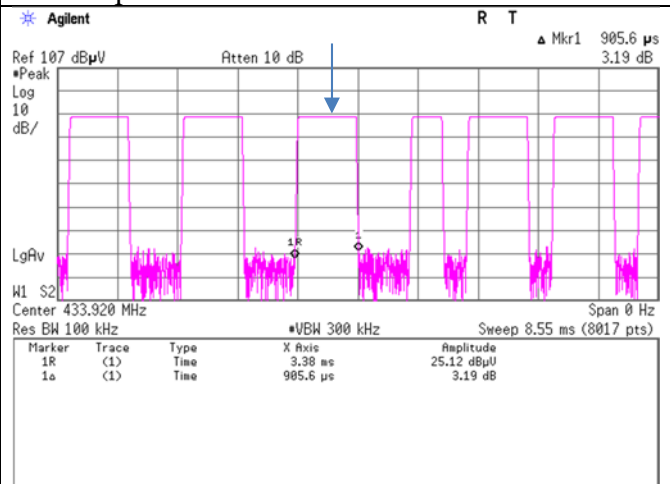
Trig Delay is set as 25.27 ms (-10 + 35.27)



### Zoom up



### Zoom up



**UL Japan, Inc.**

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## APPENDIX 2: Test instruments

| Test item | LIMS ID | Description                      | Manufacturer      | Model                    | Serial                        | Last Calibration Date | Calibration Due Date | Cal Int |
|-----------|---------|----------------------------------|-------------------|--------------------------|-------------------------------|-----------------------|----------------------|---------|
| RE        | 141899  | Spectrum Analyzer                | AGILENT           | E4448A                   | MY46180655                    | 8/10/2018             | 8/31/2019            | 12      |
| RE        | 142183  | Measure                          | KOMELON           | KMC-36                   | -                             | -                     | -                    | -       |
| RE        | 141424  | Biconical Antenna                | Schwarzbeck       | BBA9106                  | 1915                          | 6/4/2018              | 6/30/2019            | 12      |
| RE        | 141266  | Logperiodic Antenna(200-1000MHz) | Schwarzbeck       | VUSLP9111B               | 911B-191                      | 3/25/2019             | 3/31/2020            | 12      |
| RE        | 141323  | Coaxial cable                    | UL Japan          | -                        | -                             | 7/3/2018              | 7/31/2019            | 12      |
| RE        | 141532  | DIGITAL HiTESTER                 | HIOKI             | 3805                     | 51201197                      | 1/29/2019             | 1/31/2020            | 12      |
| RE        | 141152  | EMI measurement program          | TSJ               | TEPTO-DV                 | -                             | -                     | -                    | -       |
| RE        | 141582  | Pre Amplifier                    | SONOMA INSTRUMENT | 310                      | 260834                        | 2/8/2019              | 2/29/2020            | 12      |
| RE        | 142008  | AC3_Semi Anechoic Chamber(NSA)   | TDK               | Semi Anechoic Chamber 3m | DA-10005                      | 6/26/2018             | 6/30/2020            | 24      |
| RE        | 141949  | Test Receiver                    | Rohde & Schwarz   | ESCI                     | 100767                        | 8/6/2018              | 8/31/2019            | 12      |
| RE        | 141554  | Thermo-Hygrometer                | CUSTOM            | CTH-180                  | 1301                          | 1/11/2019             | 1/31/2020            | 12      |
| RE        | 142013  | AC3_Semi Anechoic Chamber(SVSWR) | TDK               | Semi Anechoic Chamber 3m | DA-10005                      | 4/6/2018              | 4/30/2019            | 12      |
| RE        | 141507  | Horn Antenna 1-18GHz             | Schwarzbeck       | BBHA9120D                | 258                           | 6/7/2018              | 6/30/2019            | 12      |
| RE        | 141580  | MicroWave System Amplifier       | AGILENT           | 83017A                   | MY39500779                    | 3/5/2019              | 3/31/2020            | 12      |
| RE        | 177964  | Microwave Cable                  | Junkosha INC.     | MMX221                   | 1901S329(1m)/<br>1902S579(5m) | 3/5/2019              | 3/31/2020            | 12      |
| RE        | 148897  | Attenuator                       | KEYSIGHT          | 8491A                    | MY52462349                    | 12/20/2018            | 12/31/2019           | 12      |
| RE        | 142645  | Loop Antenna                     | UL Japan          | -                        | -                             | -                     | -                    | -       |

\*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: Radiated emission, 99 % Occupied Bandwidth, -20 dB bandwidth, Automatically deactivate and Duty cycle tests

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Telephone : +81 596 24 8999

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