



RADIO TEST REPORT

Test Report No. : 13053985H-A-R1

Applicant : NIDEC MOBILITY CORPORATION
(formerly OMRON Automotive Electronics Co. Ltd.)

Type of Equipment : ETACS

Model No. : GGM-M016

FCC ID : OUCGGM-M016

Test regulation : FCC Part 15 Subpart C: 2019

Test Result : Complied (Refer to SECTION 3.2)

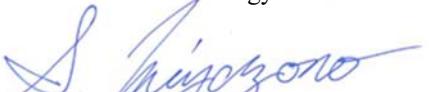
1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national 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 US Government.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 13053985H-A. 13053985H-A is replaced with this report.

Date of test: November 14 and 28, 2019

Representative test engineer:


Akihiko Maeda
Engineer
Consumer Technology Division

Approved by:


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/

This report contains data that are not covered by the NVLAP accreditation.

There is no testing item of "Non-accreditation".

**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

Report Cover Page - 13-EM-F0429 Issue # 15.0

REVISION HISTORY

Original Test Report No.: 13053985H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13053985H-A	December 18, 2019	-	-
1	13053985H-A-R1	January 21, 2020	P.1	<p>Correction of note 7. From: 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. To: 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 US Government.</p>
1	13053985H-A-R1	January 21, 2020	P.1	<p>Correction of note for the application scope. From: The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan. To: This report contains data that are not covered by the NVLAP accreditation.</p>
1	13053985H-A-R1	January 21, 2020	P.5	<p>Correction of erroneous description of SECTION 1; < Telephone Number > from +81-81-568-78-6394 to +81-568-78-6394 < Facsimile Number > from +81-81-568-78-6178 to +81-568-78-6178</p>
1	13053985H-A-R1	January 21, 2020	P.10	<p>Addition of the software information in Clause 4.1.</p>
1	13053985H-A-R1	January 21, 2020	P.11	<p>Addition of the note sentence in Clause 4.2.</p>
1	13053985H-A-R1	January 21, 2020	P.11	<p>Correction of the following cable name and length in "List of cables used" table in Clause 4.2; - Cable No.1: From Signal Cable 2.6(m) to DC and Signal Cable 0.4(m) - Cable No.2: From DC Cable 0.4(m) to DC and Signal Cable 2.6(m)</p>
1	13053985H-A-R1	January 21, 2020	P.18	<p>Correction of -26 dB Bandwidth unit; From kHz to Hz</p>

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

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	MCS	Modulation and Coding Scheme
AC	Alternating Current	MRA	Mutual Recognition Arrangement
AFH	Adaptive Frequency Hopping	N/A	Not Applicable
AM	Amplitude Modulation	NIST	National Institute of Standards and Technology
Amp, AMP	Amplifier	NS	No signal detect.
ANSI	American National Standards Institute	NSA	Normalized Site Attenuation
Ant, ANT	Antenna	NVLAP	National Voluntary Laboratory Accreditation Program
AP	Access Point	OBW	Occupied Band Width
ASK	Amplitude Shift Keying	OFDM	Orthogonal Frequency Division Multiplexing
Atten., ATT	Attenuator	P/M	Power meter
AV	Average	PCB	Printed Circuit Board
BPSK	Binary Phase-Shift Keying	PER	Packet Error Rate
BR	Bluetooth Basic Rate	PHY	Physical Layer
BT	Bluetooth	PK	Peak
BT LE	Bluetooth Low Energy	PN	Pseudo random Noise
BW	BandWidth	PRBS	Pseudo-Random Bit Sequence
Cal Int	Calibration Interval	PSD	Power Spectral Density
CCK	Complementary Code Keying	QAM	Quadrature Amplitude Modulation
Ch., CH	Channel	QP	Quasi-Peak
CISPR	Comite International Special des Perturbations Radioelectriques	QPSK	Quadri-Phase Shift Keying
CW	Continuous Wave	RBW	Resolution Band Width
DBPSK	Differential BPSK	RDS	Radio Data System
DC	Direct Current	RE	Radio Equipment
D-factor	Distance factor	RF	Radio Frequency
DFS	Dynamic Frequency Selection	RMS	Root Mean Square
DQPSK	Differential QPSK	RSS	Radio Standards Specifications
DSSS	Direct Sequence Spread Spectrum	Rx	Receiving
EDR	Enhanced Data Rate	SA, S/A	Spectrum Analyzer
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	SG	Signal Generator
EMC	ElectroMagnetic Compatibility	SVSWR	Site-Voltage Standing Wave Ratio
EMI	ElectroMagnetic Interference	TR	Test Receiver
EN	European Norm	Tx	Transmitting
ERP, e.r.p.	Effective Radiated Power	VBW	Video BandWidth
EU	European Union	Vert.	Vertical
EUT	Equipment Under Test	WLAN	Wireless LAN
Fac.	Factor		
FCC	Federal Communications Commission		
FHSS	Frequency Hopping Spread Spectrum		
FM	Frequency Modulation		
Freq.	Frequency		
FSK	Frequency Shift Keying		
GFSK	Gaussian Frequency-Shift Keying		
GNSS	Global Navigation Satellite System		
GPS	Global Positioning System		
Hori.	Horizontal		
ICES	Interference-Causing Equipment Standard		
IEC	International Electrotechnical Commission		
IEEE	Institute of Electrical and Electronics Engineers		
IF	Intermediate Frequency		
ILAC	International Laboratory Accreditation Conference		
ISED	Innovation, Science and Economic Development Canada		
ISO	International Organization for Standardization		
JAB	Japan Accreditation Board		
LAN	Local Area Network		
LIMS	Laboratory Information Management System		

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

CONTENTS	PAGE
SECTION 1: Customer information	5
SECTION 2: Equipment under test (E.U.T.).....	5
SECTION 3: Test specification, procedures & results	7
SECTION 4: Operation of E.U.T. during testing.....	10
SECTION 5: Radiated emission (Fundamental and Spurious Emission).....	12
SECTION 6: -26dB Bandwidth.....	14
SECTION 7: 99% Occupied Bandwidth.....	14
APPENDIX 1: Test data	15
Radiated Emission below 30 MHz (Fundamental and Spurious Emission)	15
Radiated Emission above 30 MHz (Spurious Emission).....	16
-26 dB Bandwidth and 99 % Occupied Bandwidth	18
APPENDIX 2: Test instruments	19
APPENDIX 3: Photographs of test setup	20
Radiated Emission.....	20
Worst Case Position (EUT: X-axis / Antenna: Y-axis)	21

SECTION 1: Customer information

Company Name : NIDEC MOBILITY CORPORATION*¹⁾
Address : 6368 Nenjozaka, Okusa, komaki-City, Aichi-Prefecture 485-0802
JAPAN
Telephone Number : +81-568-78-6394
Facsimile Number : +81-568-78-6178
Contact Person : Yamasaki Kazushi

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No. FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the 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.

*¹⁾ The company name was changed from "OMRON Automotive Electronics Co. Ltd." to "NIDEC MOBILITY CORPORATION" on November 1, 2019.

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

2.1 Identification of E.U.T.

Type of Equipment : ETACS
Model No. : GGM-M016
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 12.0 V
Receipt Date of Sample : November 5, 2019
(Information from test lab.)
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

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

2.2 Product Description

Model: GGM-M016 (referred to as the EUT in this report) is a ETACS.

This EUT is to lock and unlock doors (gate/trunk) by receiving RF signal output by the operation of the registered transmitter (remote transmitter, hereafter referred to as T/M).

Also, the immobilizer function for antitheft and remote engine starter function to start up/stop an engine by where the key is placed to start the engine.

Radio Specification

[Transmitter part]

Radio Type	:	Transmitter
Frequency of Operation	:	125 kHz
Modulation	:	ASK
Antenna type	:	Coil Antenna
Clock frequency (Maximum)	:	8 MHz (inner = 32.00 MHz (4 multiple of 8 MHz))

[Receiver part]

Equipment Type	:	Receiver
Frequency of Operation	:	315 MHz
Local clock frequency	:	325.7 MHz (32 multiple of 10.178125 MHz)
Modulation	:	FSK
Antenna Type	:	Antenna type: Internal (L-shape antenna)

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

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
 FCC Part 15 final revised on July 19, 2019 and effective August 19, 2019 except 15.258

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
 Section 15.207 Conducted limits
 Section 15.209 Radiated emission limits; general requirements.

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
Conducted Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 8.8	<FCC> Section 15.207 <ISED> RSS-Gen 8.8	-	N/A	N/A	N/A *1)
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.5, 6.12	<FCC> Section 15.209 <ISED> RSS-210 4.4 RSS-Gen 8.9	Radiated	N/A	4.8 dB 125 kHz 0 deg. PK with Duty factor	Complied a)
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.5, 6.6, 6.13	<FCC> Section 15.209 <ISED> RSS-210 4.4 RSS-Gen 8.9	Radiated	N/A	11.9 dB 152.006 MHz, QP	Complied a)
-26dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> -	<FCC> Reference data <ISED> -	Radiated	N/A	N/A	Complied b)
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.						
a) Refer to APPENDIX 1 (data of Radiated emission) b) Refer to APPENDIX 1 (data of -26 dB Bandwidth 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 15.31 (e)

The test was performed with the New Battery and the EUT constantly provides the stable voltage to RF part through the regulator regardless of input voltage from New Battery. 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 vehicle. 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	Remarks	Deviation	Worst margin	Results
99 % Occupied Band Width	RSS-Gen 6.7	-	Radiated	N/A	N/A	-

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.

Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
	(Vertical)	5.0 dB
	200 MHz to 1000 MHz (Horizontal)	5.2 dB
	(Vertical)	6.3 dB
10 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
	(Vertical)	4.8 dB
	200 MHz to 1000 MHz (Horizontal)	5.0 dB
	(Vertical)	5.0 dB
3 m	1 GHz to 6 GHz	4.9 dB
	6 GHz to 18 GHz	5.2 dB
1 m	10 GHz to 26.5 GHz	5.5 dB
	26.5 GHz to 40 GHz	5.5 dB
10 m	1 GHz to 18 GHz	5.2 dB

Antenna Terminal test

Test Item	Uncertainty (+/-)
-20dB Bandwidth / 99 % Occupied Bandwidth	0.96 %

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

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

*NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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

Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	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	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	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	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	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.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
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 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.

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

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

4.1 Operating Modes

Test mode	Remarks
1) Transmitting mode (Tx) 125 kHz	-

*EUT was set by the software as follows;
Software: ETACS_3V00 Version 00.02.15.FF
(Date: 2016.11.03, Storage location: IC1)

*This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

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

UL Japan, Inc.

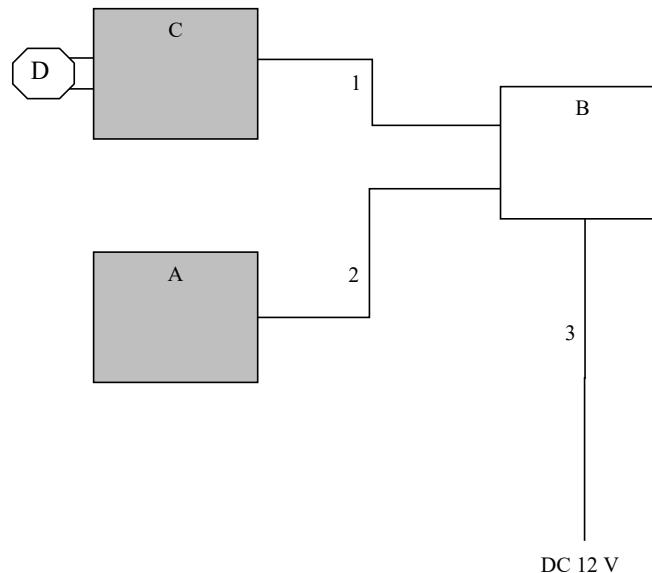
Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

4.2 Configuration and peripherals



- * Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
- * Item A and Item C are directly connected in Item B.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	ETACS	GGM-M016	No.1	NIDEC MOBILITY CORPORATION	EUT
B	Control Box	-	-	-	-
C	Key Cylinder (with Antenna Coil)	-	No.1	-	EUT
D	Transmitter with Immobilizer	J166N	No.1	NIDEC MOBILITY CORPORATION	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC and Signal Cable	0.4	Unshielded	Unshielded	-
2	DC and Signal Cable	2.6	Unshielded	Unshielded	-
3	DC Cable	2.0	Unshielded	Unshielded	-

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

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

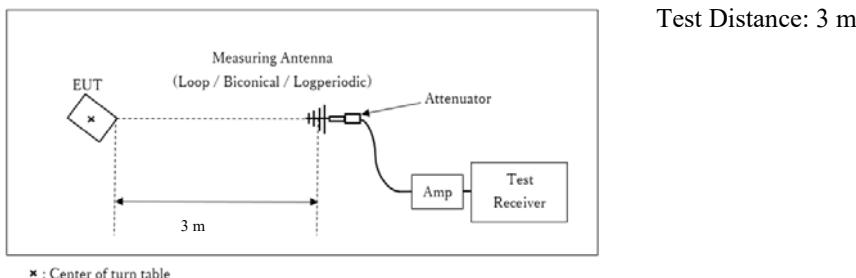
Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open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

[Test Setup]

Below 1 GHz



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

- 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.

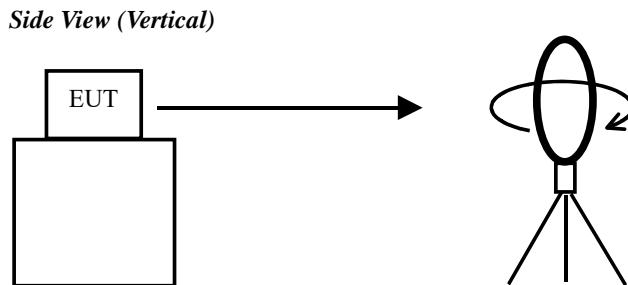
The test results and limit are rounded off to one decimal place, so some differences might be observed.

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

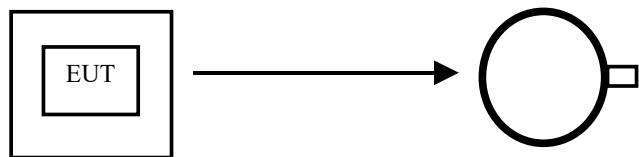
Date: November 14, 2019

Test engineer: Akihiko Maeda

Figure 1: Direction of the Loop Antenna

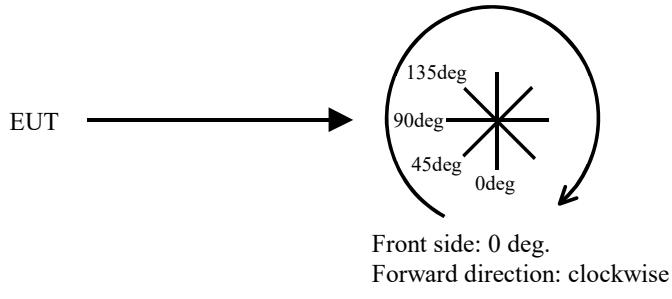


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



**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

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	1 kHz	3 Hz	9.1 Hz	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

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

APPENDIX 1: Test data

Radiated Emission below 30 MHz (Fundamental and Spurious Emission)

Report No. 13053985H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.4
 Date November 14, 2019
 Temperature / Humidity 24 deg. C / 40 % RH
 Engineer Akihiko Maeda
 Mode Mode 1

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
0deg	0.125	PK	87.2	19.9	-74.1	32.3	-	0.8	25.6	24.8	Fundamental
0deg	0.250	PK	26.5	19.9	-74.0	32.3	-	-60.0	19.6	79.6	
0deg	0.375	PK	53.6	19.9	-74.0	32.3	-	-32.8	16.1	48.9	
0deg	0.500	QP	32.0	19.8	-34.0	32.2	-	-14.4	33.6	48.0	
0deg	0.625	QP	42.4	19.8	-34.0	32.2	-	-4.1	31.7	35.8	
0deg	0.750	QP	31.1	19.8	-34.0	32.3	-	-15.4	30.1	45.5	
0deg	0.875	QP	37.8	19.8	-34.0	32.3	-	-8.7	28.7	37.4	
0deg	1.000	QP	30.6	19.8	-34.0	32.3	-	-15.9	27.6	43.5	
0deg	1.125	QP	35.1	19.8	-34.0	32.3	-	-11.4	26.5	37.9	
0deg	1.250	QP	30.5	19.8	-33.9	32.3	-	-16.0	25.6	41.6	

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

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
0deg	0.125	PK	87.2	19.9	-74.1	32.3	0.0	0.8	5.6	4.8	
0deg	0.250	PK	26.5	19.9	-74.0	32.3	0.0	-60.0	-0.4	59.6	
0deg	0.375	PK	53.6	19.9	-74.0	32.3	0.0	-32.8	-3.9	28.9	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amprifier) + 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	0.125	PK	87.2	19.9	6.0	32.3	-	80.8	-	-	Fundamental

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

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

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

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

Radiated Emission above 30 MHz (Spurious Emission)

Report No. 13053985H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date November 14, 2019
Temperature / Humidity 24 deg. C / 40 % RH
Engineer Akihiko Maeda
Mode Mode 1

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	33.751	QP	23.1	17.2	7.1	32.2	15.2	40.0	24.8	
Hori.	128.006	QP	36.6	13.7	8.4	32.1	26.5	43.5	17.0	
Hori.	152.006	QP	32.2	15.1	8.7	32.1	23.9	43.5	19.6	
Hori.	168.050	QP	34.5	15.7	8.8	32.1	27.0	43.5	16.5	
Hori.	296.012	QP	35.6	13.4	9.9	31.9	27.0	46.0	19.0	
Hori.	328.013	QP	34.6	14.4	10.2	31.9	27.3	46.0	18.7	
Vert.	33.751	QP	35.2	17.2	7.1	32.2	27.3	40.0	12.7	
Vert.	128.006	QP	41.2	13.7	8.4	32.1	31.1	43.5	12.4	
Vert.	152.006	QP	39.9	15.1	8.7	32.1	31.6	43.5	11.9	
Vert.	168.006	QP	35.8	15.7	8.8	32.1	28.3	43.5	15.2	
Vert.	296.012	QP	31.9	13.4	9.9	31.9	23.3	46.0	22.7	
Vert.	328.044	QP	31.4	14.4	10.2	31.9	24.1	46.0	21.9	

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

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

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

UL Japan, Inc.

Ise EMC Lab.

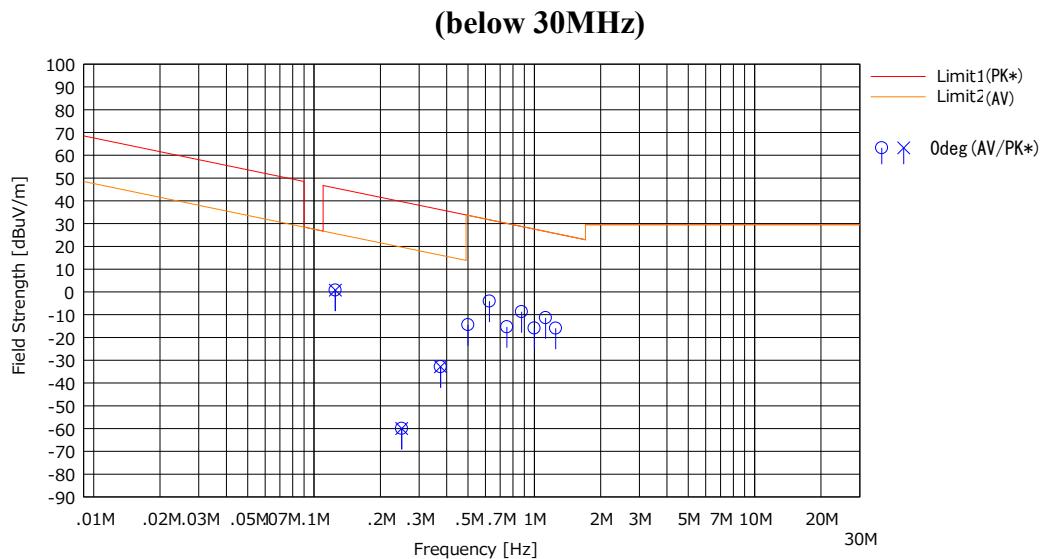
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

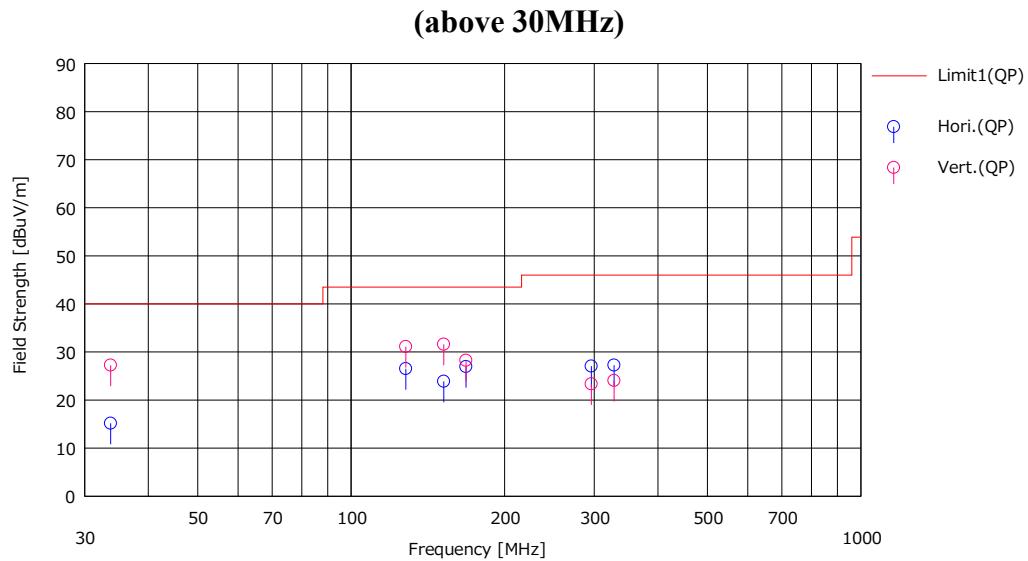
Facsimile : +81 596 24 8124

Radiated Emission Plot data, Worst case

Report No. 13053985H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.4
 Date November 14, 2019
 Temperature / Humidity 24 deg. C / 40 % RH
 Engineer Akihiko Maeda
 Mode Mode 1



* Data above 490 kHz were measured using a QP detector.



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

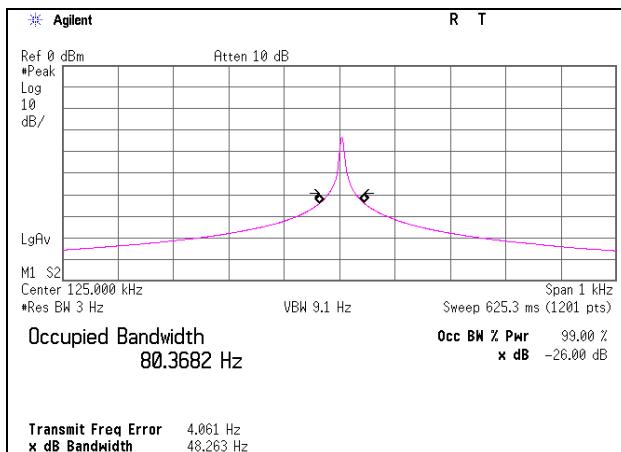
**UL Japan, Inc.
 Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
 Telephone : +81 596 24 8999
 Facsimile : +81 596 24 8124

-26 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 13053985H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.8
Date November 28, 2019
Temperature / Humidity 24 deg. C / 35% RH
Engineer Ken Fujita
Mode Mode 1

-26 dB Bandwidth [Hz]	99 % Occupied Bandwidth [Hz]
48.263	80.3682



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

APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	141413	Coaxial Cable	UL Japan	-	-	06/07/2019	06/30/2020	12
RE	141254	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	10/04/2019	10/31/2020	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/08/2019	02/29/2020	12
RE	141323	Coaxial cable	UL Japan	-	-	07/02/2019	07/31/2020	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	9111B-191	08/24/2019	08/31/2020	12
RE	141424	Biconical Antenna	Schwarzbeck	VHA9103+BBA9106	1915	08/24/2019	08/31/2020	12
RE	178648	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	142183	Measure	KOMELON	KMC-36	-	-	-	-
RE	141532	DIGITAL HiTESTER	HIOKI	3805	51201197	01/29/2019	01/31/2020	12
RE	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	01/11/2019	01/31/2020	12
RE	142314	Attenuator	Pasternack	PE7390-6	D/C 1504	06/11/2019	06/30/2020	12
RE	146754	Test Receiver	Rohde & Schwarz	ESCI	100299	10/08/2019	10/31/2020	12
RE	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/sucoform141-PE/421-010	-/00640	07/02/2019	07/31/2020	12
RE	141884	Spectrum Analyzer	AGILENT	E4448A	MY44020357	03/13/2019	03/31/2020	12
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	06/30/2020	24

*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

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