



EMI TEST REPORT

Test Report No. : 12768053H-B-R1

Applicant : M-SYSTEM CO., LTD.
Type of Equipment : MODBUS INTERFACE MODULE
Model No. : R3-NMW1F-R
FCC ID : 2AOTF-000009
Test regulation : FCC Part 15 Subpart B: 2018 Class A
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 the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC 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 12768053H-B. 12768053H-B is replaced with this report.

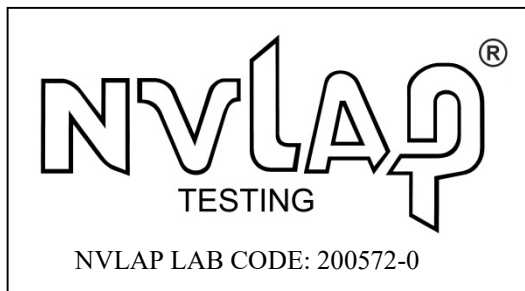
Date of test: April 1, 2019

Representative test engineer:

K. Yamamoto
Koji Yamamoto
Engineer
Consumer Technology Division

Approved by:

S. Matsuyama
Satofumi Matsuyama
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_accruited/

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

REVISION HISTORY

Original Test Report No.: 12768053H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12768053H-B	April 10, 2019	-	-
1	12768053H-B-R1	April 19, 2019	P.8	Correction of Remarks in Clause 4.1
1	12768053H-B-R1	April 19, 2019	P.9	Correction of length of Cable No.5 in Clause 4.2; From 2.5 m to 1.0 m

CONTENTS	PAGE
SECTION 1: Customer information	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results	5
SECTION 4: Operation of E.U.T. during testing.....	8
SECTION 5: Conducted Emission.....	10
SECTION 6: Radiated Emission.....	11
APPENDIX 1: Test data	13
Conducted Emission	13
Radiated emission	14
APPENDIX 2: Test instruments	16
APPENDIX 3: Photographs of test setup	17
Conducted Emission	17
Radiated Emission	18

SECTION 1: Customer information

Company Name : M-SYSTEM CO., LTD.
Address : 5-2-55 MINAMITSUMORI, NISHINARI-KU, OSAKA, 557-0063
JAPAN
Telephone Number : +81-6-6659-8258
Facsimile Number : +81-6-6659-8514
Contact Person : Juri Sugiyama

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 : MODBUS INTERFACE MODULE
Model No. : R3-NMW1F-R
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 24 V
Receipt Date of Sample : March 20, 2019
(Information from test lab.)
Country of Mass-production : Japan
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: R3-NMW1F-R (referred to as the EUT in this report) is a MODBUS INTERFACE MODULE.

General Specification

Clock frequency(ies) in the system : 40 MHz (Max)

Radio Specification

	IEEE802.15.4g
Frequency of operation	902 MHz - 928 MHz
Type of modulation	GFSK
Channel spacing	0.6 MHz
Antenna type	Sleeve antenna (model: MH920-ANT-F(S)) Rooftop antenna (model: MH920-ANT-F(R))
Antenna Connector type	Connector for connecting antenna
Antenna Gain	3 dBi (max) (Sleeve antenna) 2 dBi (max) (Rooftop antenna)
Clock frequency (maximum)	928 MHz

* The RF module is a FCC certificated module made by Oki Electric Industry Co., Ltd. Model number: MH920-Mod-F (FCC ID: 2AKGW-1TD3016A1).

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 B
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

Title : FCC 47CFR Part15 Radio Frequency Device
Subpart B Unintentional Radiators

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result	Remarks
Conducted emission	FCC: ANSI C63.4: 2014 7. AC power - line conducted emission measurements	Class A	N/A	[QP] 14.36 dB 0.20758 MHz, L	Complied a)	-
	IC: ICES-003 Issue 6: 2016 + Amendment 1: 2017			16.21 dB 26.76464 MHz, L		
Radiated emission	FCC: ANSI C63.4: 2014 8. Radiated emission measurements	Class A	N/A	2.48 dB 65.651 MHz, Vertical, QP	Complied# b)	-
	IC: ICES-003 Issue 6: 2016 + Amendment 1: 2017					
*Note: UL Japan, Inc's EMI Work Procedure 13-EM-W0420.						
a) Refer to APPENDIX 1 (data of Conducted Emission)						
b) Refer to APPENDIX 1 (data of Radiated emission)						
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.				

3.3 Addition to standard

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 $k = 2$.

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz to 0.15 MHz	3.8 dB
0.15 MHz to 30 MHz	3.4 dB

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

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.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

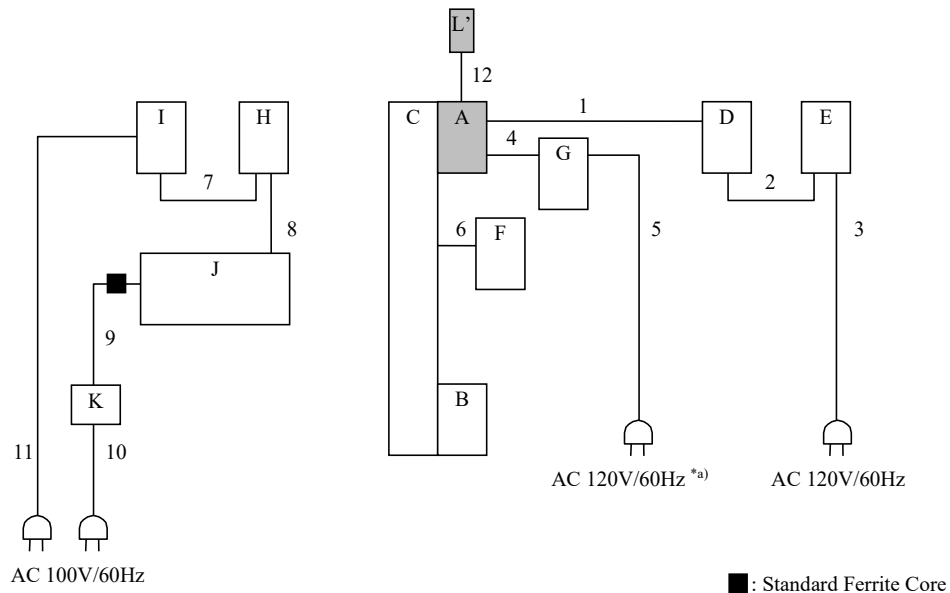
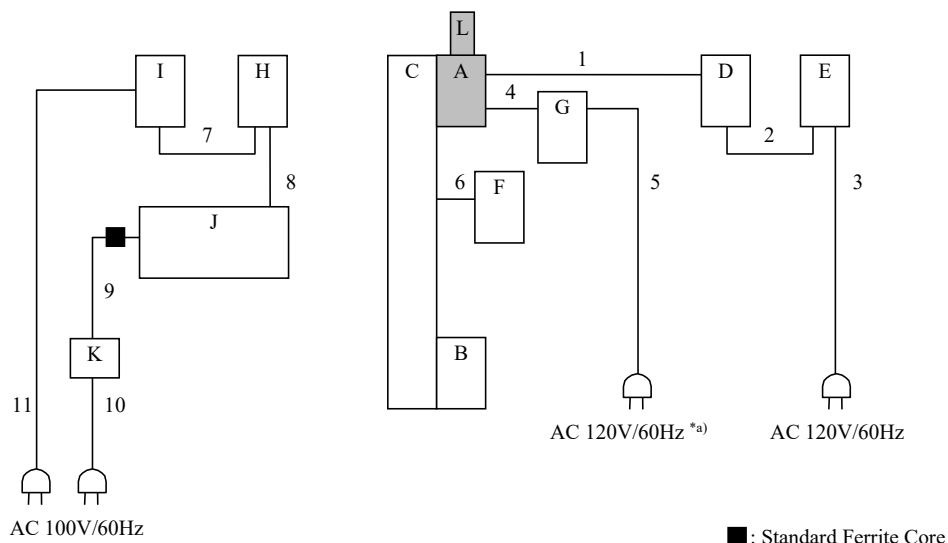
Facsimile : +81 596 24 8124

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

4.1 Operating Mode(s)

Mode	Remarks
1) Normal Operation mode	The following operations are performed under the Normal Operation mode. - Wireless Communication mode - Wired Communication mode

4.2 Configuration and peripherals



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

*a) Conducted emission test was performed on this port.

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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	MODBUS INTERFACE MODULE	R3-NMW1F-R	P-38116	M-SYSTEM CO., LTD.	EUT
B	THERMOCOUPLE INPUT MODULE	R3-TS8A	P-37576	M-SYSTEM CO., LTD.	-
C	BASE	R3-BS06	71044542	M-SYSTEM CO., LTD.	-
D	MODBUS I/O MODULE	R7M-DA16F-R	6K019029	M-SYSTEM CO., LTD.	-
E	DC Power Supply	MDC6-12024A-M2	8I002105	M-SYSTEM CO., LTD.	-
F	Dummy Load	-	-	-	-
G	DC Power Supply	MDC5-06024A-M2	5C036884	M-SYSTEM CO., LTD.	-
H	WIRELESS GATEWAY	WL40EW2F-R	P-35078	M-SYSTEM CO., LTD.	-
I	DC Power Supply	MDC5-06024A-M2	2L013871	M-SYSTEM CO., LTD.	-
J	Laptop PC	2672-C2J	99-PPBKH	IBM	-
K	AC Adapter	08K8212	7UB4160FD	IBM	-
L	Sleeve antenna	MH920-ANT-F(S)	001	OKI	EUT *1)
L'	Rooftop antenna	MH920-ANT-F(R)	001	OKI	EUT *1)

*1) The test was performed with Sleeve antenna which has been found to be worst in pre-check.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Modbus Cable	1.0	Shielded	Shielded	-
2	DC Cable	0.5	Unshielded	Unshielded	-
3	AC Cable	1.0	Unshielded	Unshielded	-
4	DC Cable	0.5	Unshielded	Unshielded	-
5	AC Cable	1.0	Unshielded	Unshielded	-
6	Dummy Cable	0.5	Unshielded	Unshielded	-
7	DC Cable	0.5	Unshielded	Unshielded	-
8	LAN Cable	2.0	Unshielded	Unshielded	-
9	DC Cable	2.0	Shielded	Shielded	-
10	AC Cable	1.0	Unshielded	Unshielded	-
11	AC Cable	1.5	Unshielded	Unshielded	-
12	Antenna Cable	2.5	Shielded	Shielded	-

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: Conducted Emission

5.1 Operating environment

Test place : No.1 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2 Test configuration

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 rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT and its peripherals was aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from the LISN/AMN and excess AC cable was bundled in center. I/O cables that were connected to the other peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN/AMN to the input power source. All unused 50 ohm connectors of the LISN/AMN were resistivity terminated in 50 ohm when not connected to the measuring equipment.

Photographs of the set up are shown in Appendix 3.

Frequency range : 0.15 MHz - 30 MHz
EUT position : Table top
EUT operation mode : See Clause 4.1

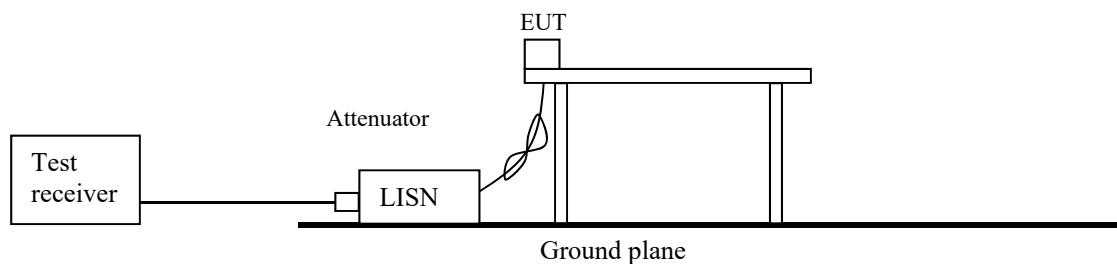
5.3 Test procedure

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT within a semi anechoic chamber. The EUT was connected to a Line Impedance Stabilization Network (LISN)/ Artificial Mains network (AMN). An overview sweep with peak detection has been performed. The measurements have been performed with a quasi-peak detector and if required, with an average detector.

The conducted emission measurements were made with the following detector function of the test receiver.

Detector Type : Quasi-Peak and CISPR AV
IF Bandwidth : 9 kHz

Figure 1: Test Setup



5.4 Test result

Summary of the test results: Pass

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

Date: April 1, 2019 (Night)

Test engineer: Koji Yamamoto

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: Radiated Emission

6.1 Operating environment

Test place : No.1 semi anechoic chamber
Temperature : See data
Humidity : See data

6.2 Test configuration

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 EUT was set on the edge of the tabletop.

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.

6.3 Test conditions

Frequency range : 30 MHz - 200 MHz (Biconical antenna) / 200 MHz - 1000 MHz (Logperiodic antenna)
1000 MHz - 10000 MHz (Horn antenna)
Test distance : 10 m (30 MHz - 1000 MHz) / 3 m (1000 MHz - 10000 MHz)
EUT position : Table top
EUT operation mode : See Clause 4.1

6.4 Test procedure

The height of the measuring antenna 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 with the Test Receiver.

The radiated emission measurements were made with the following detector function of the Test Receiver.

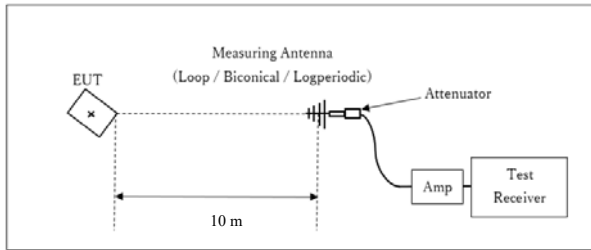
Frequency	Below 1GHz	Above 1GHz *1)
Instrument used	Test Receiver	Test Receiver
IF Bandwidth	QP: BW 120 kHz	PK: BW 1 MHz, CISPR AV: BW 1 MHz

*1) The measurement data was adjusted to a 10 m distance using the following Distance Factor.

Distance Factor: $20 \times \log(3.6 \text{ m} / 10 \text{ m}) = -8.9 \text{ dB}$

Figure 2: Test Setup

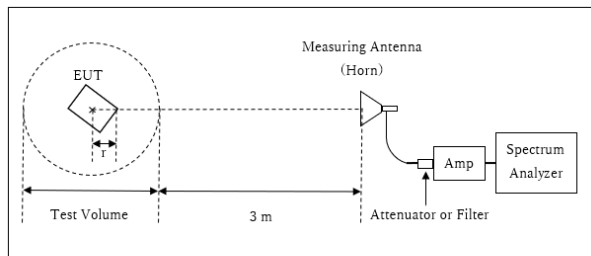
Below 1 GHz



× : Center of turn table

Test Distance: 10 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

× : Center of turn table

Distance Factor: $20 \times \log(3.6 \text{ m}^*/10.0 \text{ m}) = -8.9 \text{ dB}$

* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.6 \text{ m}$

Test Volume: 2 m

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

$r = 0.4 \text{ m}$

The test was made on EUT at the normal use position.

6.5 Test result

Summary of the test results: Pass

The limit is rounded down to one decimal place.

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

Date: April 1, 2019 (Day)
April 1, 2019 (Night)

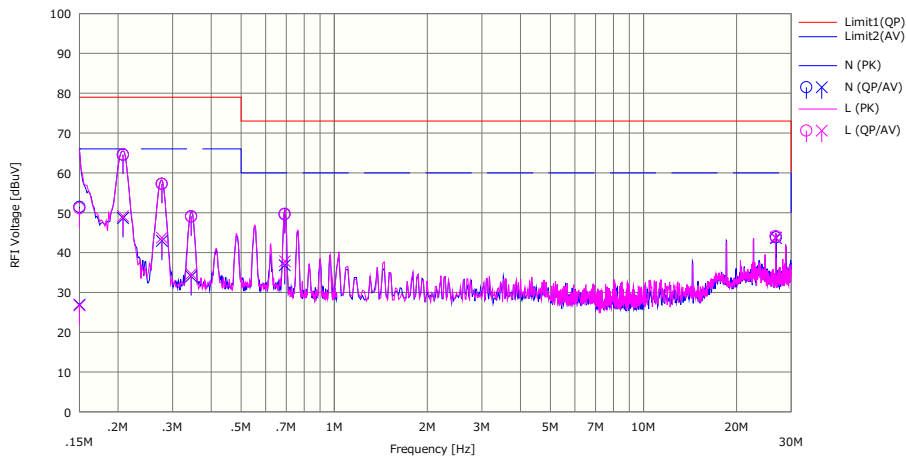
Test engineer: Shinya Watanabe
Koji Yamamoto

APPENDIX 1: Test data

Conducted Emission

Report No. 12768053H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.1
Date April 1, 2019
Temperature / Humidity 22 deg. C / 33 % RH
Engineer Koji Yamamoto
Mode Mode 1

Limit : FCC_Part 15 Subpart B(15.107)_Class A



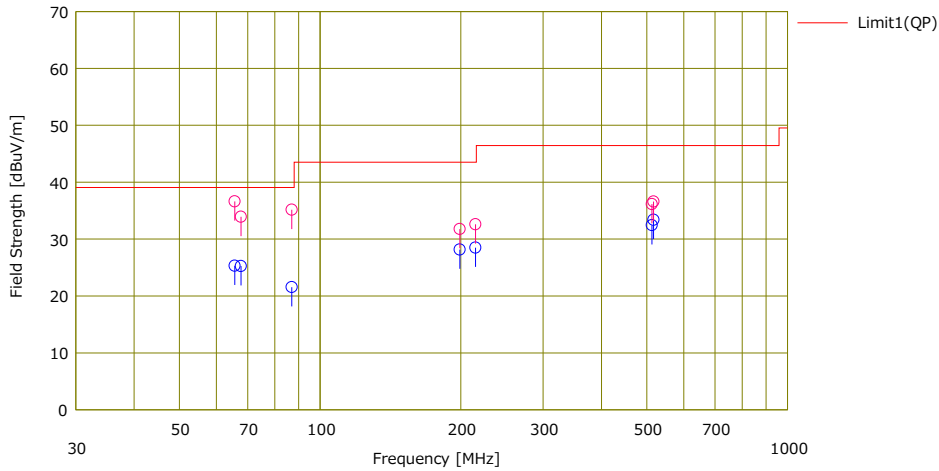
No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP>	<AV>			<QP>	<AV>	<QP>	<AV>				
		[dBuV]	[dBuV]			[dBuV]	[dBuV]	[dB]	[dB]				
1	0.15000	38.30	13.80	0.05	13.07	51.42	26.92	79.00	66.00	27.58	39.08	N	
2	0.20758	51.40	35.50	0.05	13.09	64.54	48.64	79.00	66.00	14.46	17.36	N	
3	0.27702	44.10	29.80	0.03	13.11	57.24	42.94	79.00	66.00	21.76	23.06	N	
4	0.34488	35.90	20.90	0.03	13.12	49.05	34.05	79.00	66.00	29.95	31.95	N	
5	0.69114	36.40	23.60	0.03	13.18	49.61	36.81	73.00	60.00	23.39	23.19	N	
6	26.83210	28.60	28.40	0.59	14.60	43.79	43.59	73.00	60.00	29.21	16.41	N	
7	0.15000	38.00	13.60	0.05	13.07	51.12	26.72	79.00	66.00	27.88	39.28	L	
8	0.20758	51.50	36.00	0.05	13.09	64.64	49.14	79.00	66.00	14.36	16.86	L	
9	0.27702	44.10	30.60	0.03	13.11	57.24	43.74	79.00	66.00	21.76	22.26	L	
10	0.34488	35.90	21.50	0.03	13.12	49.05	34.65	79.00	66.00	29.95	31.35	L	
11	0.69288	36.50	24.60	0.03	13.18	49.71	37.81	73.00	60.00	23.29	22.19	L	
12	26.76464	28.90	28.60	0.59	14.60	44.09	43.79	73.00	60.00	28.91	16.21	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Radiated emission

Report No. 12768053H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.1
Date April 1, 2019
Temperature / Humidity 21 deg. C / 31 % RH
Engineer Shinya Watanabe
(Below 1 GHz)
Mode Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class A



No.	Freq. [MHz]	Reading (QP)	Ant. Type	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	S.Fac [dB]	Result (QP)	Height [cm]	Angle [deg]	Pola. [H/V]	Limit (QP)	Margin (QP)
		[dBuV]						[dBuV/m]				[dBuV/m]	[dB]
1	65.651	49.20	BA	7.08	8.03	38.99	0.00	25.32	343	228	Hori	39.10	13.78
2	67.701	49.34	BA	6.84	8.06	38.99	0.00	25.25	326	176	Hori	39.10	13.85
3	86.999	44.80	BA	7.44	8.36	39.04	0.00	21.56	400	332	Hori	39.10	17.54
4	198.998	41.00	BA	16.53	9.73	39.10	0.00	28.16	343	176	Hori	43.50	15.34
5	214.998	46.60	LA20	11.08	9.89	39.07	0.00	28.50	385	25	Hori	43.50	15.00
6	513.032	40.90	LA20	17.78	12.29	38.52	0.00	32.45	384	157	Hori	46.40	13.95
7	517.100	41.90	LA20	17.68	12.32	38.51	0.00	33.39	219	151	Hori	46.40	13.01
8	65.651	60.50	BA	7.08	8.03	38.99	0.00	36.62	100	79	Vert.	39.10	2.48
9	67.701	58.00	BA	6.84	8.06	38.99	0.00	33.91	100	62	Vert.	39.10	5.19
10	86.999	58.40	BA	7.44	8.36	39.04	0.00	35.16	133	267	Vert.	39.10	3.94
11	198.998	44.60	BA	16.53	9.73	39.10	0.00	31.76	100	351	Vert.	43.50	11.74
12	214.998	50.70	LA20	11.08	9.89	39.07	0.00	32.60	100	9	Vert.	43.50	10.90
13	513.032	44.60	LA20	17.78	12.29	38.52	0.00	36.15	100	100	Vert.	46.40	10.25
14	517.100	45.10	LA20	17.68	12.32	38.51	0.00	36.59	100	54	Vert.	46.40	9.81

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))

UL Japan, Inc.

Ise EMC Lab.

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

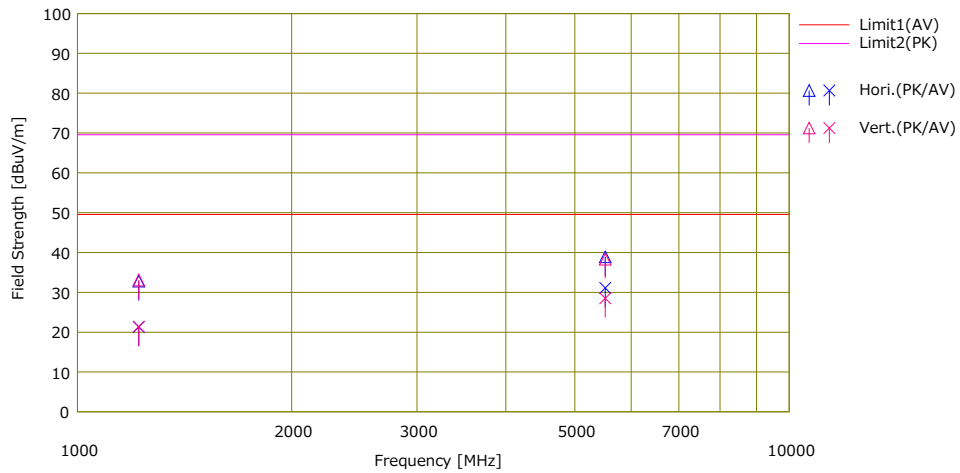
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated emission

Report No. 12768053H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.1
Date April 1, 2019
Temperature / Humidity 22 deg. C / 33 % RH
Engineer Koji Yamamoto
(Above 1 GHz)
Mode Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class A



No.	Freq. [MHz]	Reading		Ant. Type	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	S.Fac [dB]	Result		Height [cm]	Angle [deg]	Pola. [H/V]	Limit		Margin	
		<PK> [dBuV]	<AV> [dBuV]						<PK> [dBuV/m]	<AV> [dBuV/m]				<AV> [dBuV/m]	<PK> [dBuV/m]	<AV> [dB]	<PK> [dB]
1	1219.565	50.20	38.70	HA5	24.95	-5.18	37.18	0.00	32.79	21.29	100	51	Hori.	49.50	69.50	28.21	36.71
2	5517.585	47.90	40.10	HA5	31.47	-4.37	36.11	0.00	38.89	31.09	100	64	Hori.	49.50	69.50	18.41	30.61
3	1219.565	50.50	38.80	HA5	24.95	-5.18	37.18	0.00	33.09	21.39	100	113	Vert.	49.50	69.50	28.11	36.41
4	5517.585	47.30	37.50	HA5	31.47	-4.37	36.11	0.00	38.29	28.49	100	0	Vert.	49.50	69.50	21.01	31.21

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 + Filter - GAIN(AMP) + D-factor)

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
CE	141537	LISN(AMN)	Schwarzbeck	NSLK8127	8127-731	7/12/2018	7/31/2019	12
CE	141538	LISN(AMN)	Schwarzbeck	NSLK8127	8127-732	7/12/2018	7/31/2019	12
CE	141925	Terminator	TME	CT-01	-	11/7/2018	11/30/2019	12
CE	141290	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	12/27/2018	12/31/2019	12
CE	141215	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W/3D-2W/R G400u/RFM-E421 (SW)	-/01068 (Switcher)	6/4/2018	6/30/2019	12
RE	141994	AC1_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 10m	DA-06881	4/4/2018	4/30/2019	12
RE	141585	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	2/8/2019	2/29/2020	12
RE	141511	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	253	6/4/2018	6/30/2019	12
RE	141297	High Pass Filter(1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	1/10/2019	1/31/2020	12
RE	141393	Microwave Cable	Junkosha	MWX221	1604S254(1 m) / 1608S088(5 m)	8/8/2018	8/31/2019	12
RE	141576	Pre Amplifier	AGILENT	8449B	3008A01671	2/8/2019	2/29/2020	12
RE	141350	Coaxial Cable	Suhner/storm/Agilent/TSJ	-	-	6/4/2018	6/30/2019	12
RE	141198	Biconical Antenna	Schwarzbeck	BBA9106	2513	6/1/2018	6/30/2019	12
RE	141264	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-189	3/21/2019	3/30/2020	12
RE	141213	Attenuator(6dB)	Weinschel Corp	2	BK7971	11/5/2018	11/30/2019	12
RE/CE	141566	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	1/11/2019	1/31/2020	12
RE/CE	142226	Measure	KOMELON	KMC-36	-	-	-	-
RE/CE	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	6/15/2018	6/30/2019	12
RE/CE	141530	Digital Tester	Fluke Corporation	FLUKE 26-3	78030621	8/21/2018	8/31/2019	12
RE/CE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE/CE	141998	AC1_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	6/18/2018	6/30/2020	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:

CE: Conducted emission

RE: Radiated 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