EMI TEST REPORT

Test Report No. : 13016121H-R2

Applicant	:	**OMRON Automotive Electronics Co. Ltd**
Type of Equipment	:	**Body Control Module**
Model No.	:	**K56RA**
FCC ID	:	**OUCK56RA**
Test regulation	:	**FCC Part 15 Subpart B: 2019 Class B**
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 13016121H-R1. 13016121H-R1 is replaced with this report.

Date of test: September 2, 2019

Representative test engineer:

Hiroyuki Furutaka
Engineer
Consumer Technology Division

Approved by:

Shinichi Miyazono
Engineer
Consumer Technology Division

NVLAP TESTING NVLAP LAB CODE 200572-0

ilac-MRA

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/

☐ 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.: 13016121H

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13016121H	September 6, 2019	-	-
1	13016121H-R1	September 12, 2019	P.5	Deletion of FCC15.111(b) from Clause 2.2
1	13016121H-R1	September 12, 2019	P.6	Correction of Procedures and results table of Clause 3.2
2	13016121H-R2	September 12, 2019	P.6	Correction of Procedures and results table of Clause 3.2

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)

AAN	Asymmetric Artificial Network
AC	Alternating Current
AM	Amplitude Modulation
AMN	Artificial Mains Network
Amp, AMP	Amplifier
ANSI	American National Standards Institute
Ant, ANT	Antenna
AP	Access Point
ASK	Amplitude Shift Keying
Atten., ATT	Attenuator
AV	Average
BPSK	Binary Phase-Shift Keying
BR	Bluetooth Basic Rate
BT	Bluetooth
BT LE	Bluetooth Low Energy
BW	BandWidth
C.F	Correction Factor
Cal Int	Calibration Interval
CAV	CISPR AV
CCK	Complementary Code Keying
CDN	Coupling Decoupling Network
Ch., CH	Channel
CISPR	Comite International Special des Perturbations Radioelectriques
Corr.	Correction
CPE	Customer premise equipment
CW	Continuous Wave
DBPSK	Differential BPSK
DC	Direct Current
DET	Detector
Dmax	maximum absolute voltage change during an observation period
DQPSK	Differential QPSK
DSSS	Direct Sequence Spread Spectrum
EDR	Enhanced Data Rate
e.i.r.p., EIRP	Equivalent Isotropically Radiated Power
EM clamp	Electromagnetic clamp
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EMS	ElectroMagnetic Susceptibility
EN	European Norm
e.r.p., ERP	Effective Radiated Power
EU	European Union
EUT	Equipment Under Test
Fac.	Factor
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
Freq.	Frequency
FSK	Frequency Shift Keying
Fund	Fundamental
FWD	Forward
GFSK	Gaussian Frequency-Shift Keying
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
Hori.	Horizontal
I/O	Input/Output
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
ISN	Impedance Stabilization Network
ISO	International Organization for Standardization
JAB	Japan Accreditation Board
LAN	Local Area Network
LCL	Longitudinal Conversion Loss
LIMS	Laboratory Information Management System
LISN	Line Impedance Stabilization Network
MRA	Mutual Recognition Arrangement
NIST	National Institute of Standards and Technology
NS	No signal detect.
NSA	Normalized Site Attenuation
NVLAP	National Voluntary Laboratory Accreditation Program
OBW	Occupied Band Width
OFDM	Orthogonal Frequency Division Multiplexing
PK	Peak
P_{LT}	long-term flicker severity
POHC(A)	Partial Odd Harmonic Current
Pol., Polar.	Polarization
PR-ASK	Phase Reversal ASK
P_{ST}	short-term flicker severity
QAM	Quadrature Amplitude Modulation
QP	Quasi-Peak
QPSK	Quadri-Phase Shift Keying
r.m.s., RMS	Root Mean Square
RBW	Resolution Band Width
RE	Radio Equipment
REV	Reverse
RF	Radio Frequency
RFID	Radio Frequency Identifier
Rx	Receiving
SINAD	Ratio of (Signal + Noise + Distortion) to (Noise + Distortion)
S/N	Signal to Noise ratio
SA, S/A	Spectrum Analyzer
SG	Signal Generator
SVSWR	Site-Voltage Standing Wave Ratio
THC(A)	Total Harmonic Current
THD(%)	Total Harmonic Distortion
TR	Test Receiver
Tx	Transmitting
VBW	Video BandWidth
Vert.	Vertical
WLAN	Wireless LAN
xDSL	Generic term for all types of DSL technology (DSL: Digital Subscriber Line)

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

Company Name	:	OMRON Automotive Electronics Co. Ltd
Address	:	6368 NENJOZAKA OKUSA KOMAKI AICHI, 485-0802 JAPAN
Telephone Number	:	+81-568-78-6159
Facsimile Number	:	+81-568-78-7659
Contact Person	:	Takashi Betsui

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.

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

2.1 Identification of E.U.T.

Type of Equipment	:	Body Control Module
Model No.	:	K56RA
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12.0 V
Receipt Date of Sample (Information from test lab.)	:	August 30, 2019
Country of Mass-production	:	Japan and India
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

2.2 Product Description

Model: K56RA (referred to as the EUT in this report) is a Body Control Module.

General Specification

Clock frequency in the system	:	8 MHz (CPU)

Radio Specification

Frequency of operation	:	433.92 MHz
Local Oscillator Frequency	:	21.948717 MHz
Type of modulation	:	FSK
Antenna Type	:	Receiving:PWB pattern antenna
Operating Temperature	:	-40 deg. C to 85 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart B
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 B Unintentional Radiators

3.2 Procedures and results

[Receiver]

Item	Test Procedure	Limits	Deviation	Worst margin	Result	Remarks
Conducted emission	**FCC:** ANSI C63.4: 2014 7. AC power - line conducted emission measurements	**FCC:**Part 15 Subpart B 15.107(a)	N/A	N/A	N/A	*1)
	ISED: RSS-Gen 7.1	**ISED:** RSS-Gen 7.2				
Radiated emission	**FCC:** ANSI C63.4: 2014 8. Radiated emission measurements	**FCC:** Part 15 Subpart B 15.109(a)	N/A	27.77 dB 444.620 MHz, Vertical, QP	Complied a)	-
	ISED: RSS-Gen 7.1	**ISED:** RSS-Gen 7.3				
Antenna Terminal	**FCC:** ANSI C63.4: 2014 12. Measurement of unintentional radiators other than ITE	**FCC:** Part 15 Subpart B 15.111(a)	N/A	N/A	N/A	*2)
	ISED: - RSS-Gen 7.1	**ISED:** RSS-Gen 7.4				

*Note: UL Japan, Inc's EMI Work Procedure 13-EM-W0420.
*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.
*2) The receiving antenna (of this EUT) is installed inside the EUT and cannot be removed (permanently attached).
Therefore, Radiated emission test was performed.

a) 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 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	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
3 m	1 GHz to 6 GHz		5.0 dB
	6 GHz to 18 GHz		5.3 dB

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.

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

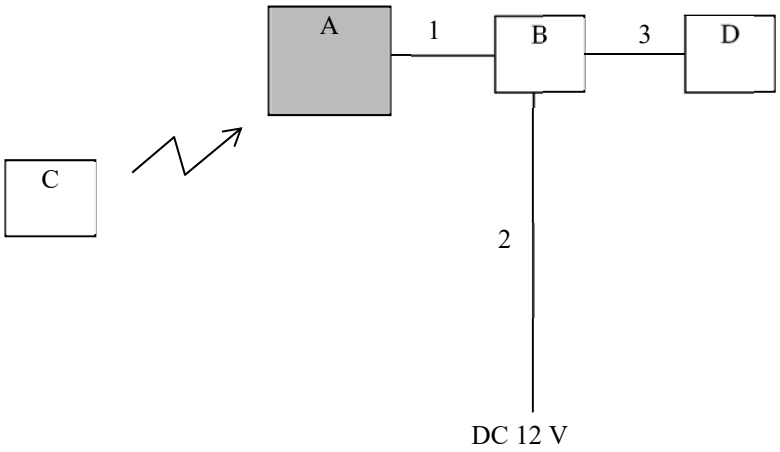
4.1 Operating Mode(s)

Mode	Remarks
1) Receiving mode (Rx) 433.92 MHz	-

*The test signal level was confirmed to be sufficient to stabilize the local oscillator of the EUT.

* It was confirmed by using LED of Jig that the EUT receives the signal from the transmitter (pair of EUT).

4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
*Item No. A includes Receiver Antenna.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Body Control Module	K56RA	001	OMRON Automotive Electronics Co. Ltd.	EUT
B	Switch Box	RV494	04	OMRON Automotive Electronics Co. Ltd.	-
C	Transmitter	T55R2	18	OMRON Automotive Electronics Co. Ltd.	-
D	Immobilizer	I55R0	009	OMRON Automotive Electronics Co. Ltd.	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC and Signal Cable	2.0	Unshielded	Unshielded	-
2	DC Cable	1.8	Unshielded	Unshielded	-
3	DC and Signal Cable	2.4	Unshielded	Unshielded	-

SECTION 5: Radiated Emission

5.1. Operating environment

Test place : No.4 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 EUT was set on the center 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.

5.3. Test conditions

Frequency range	:	30 MHz - 200 MHz (Biconical antenna) / 200 MHz - 1000 MHz (Logperiodic antenna) 1000 MHz - 2000 MHz (Horn antenna)
Test distance	:	3 m
EUT position	:	Table top
EUT operation mode	:	See Clause 4.1

5.4. Test procedure

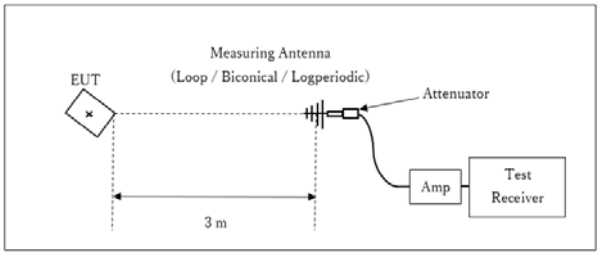
The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver.
The radiated emission measurements were made with the following detector function of the Test Receiver.
For above 1 GHz, test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

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 3 m distance using the following Distance Factor.
Distance Factor: 20 x log (3.60 m / 3 m) = 1.59 dB

Figure 2: Test Setup

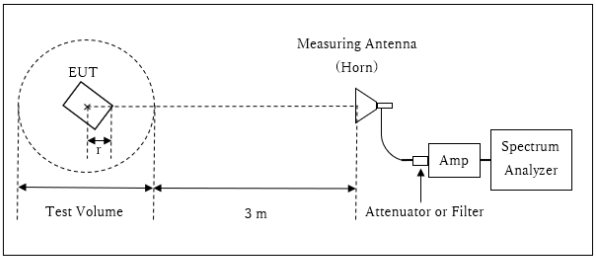
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz



r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.60 m*/3.0 m) = 1.59 dB
* Test Distance: (3 + Test Volume /2) - r = 3.6 m

Test Volume: 2 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.40 m

The 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 representative X-axis since no difference was found among each position.

5.5. 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.

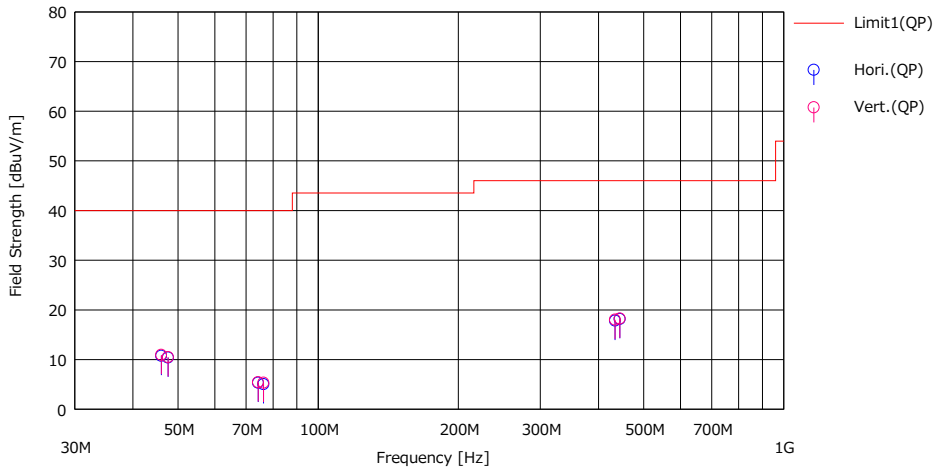
Date: September 2, 2019 Test engineer: Hiroyuki Furutaka

APPENDIX 1: Test data

Radiated Emission

Report No.	13016121H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	September 2, 2019
Temperature / Humidity	24 deg. C / 45 % RH
Engineer	Hiroyuki Furutaka (Below 1 GHz)
Mode	Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading (QP) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP) [dBuV/m]	Limit (QP) [dBuV/m]	Margin (QP) [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	46.031	22.80	12.37	7.73	32.17	10.73	40.00	29.27	Hori.	300	0	BC	
2	47.597	23.00	11.80	7.75	32.17	10.38	40.00	29.62	Hori.	300	0	BC	
3	74.313	23.20	6.13	8.13	32.14	5.32	40.00	34.68	Hori.	300	0	BC	
4	76.329	22.70	6.30	8.15	32.13	5.02	40.00	34.98	Hori.	300	0	BC	
5	434.194	22.60	16.18	10.99	31.96	17.81	46.00	28.19	Hori.	100	0	LA23	
6	444.620	22.70	16.34	11.05	31.96	18.13	46.00	27.87	Hori.	100	0	LA23	
7	46.031	23.00	12.37	7.73	32.17	10.93	40.00	29.07	Vert.	100	0	BC	
8	47.597	23.10	11.80	7.75	32.17	10.48	40.00	29.52	Vert.	100	0	BC	
9	74.313	23.30	6.13	8.13	32.14	5.42	40.00	34.58	Vert.	100	0	BC	
10	76.329	23.00	6.30	8.15	32.13	5.32	40.00	34.68	Vert.	100	0	BC	
11	434.194	22.80	16.18	10.99	31.96	18.01	46.00	27.99	Vert.	100	0	LA23	
12	444.620	22.80	16.34	11.05	31.96	18.23	46.00	27.77	Vert.	100	0	LA23	

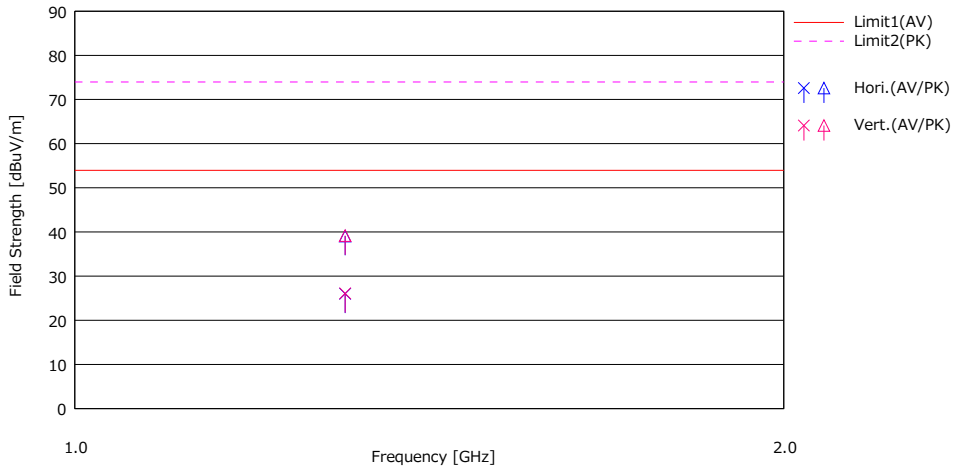
* Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

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(CABLE + ATT) - GAIN(AMP)

Radiated Emission

Report No.	13016121H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	September 2, 2019
Temperature / Humidity	24 deg. C / 45 % RH
Engineer	Hiroyuki Furutaka
	(Above 1 GHz)
Mode	Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq.	Reading		Ant.Fac	Loss	Gain	Result		Limit		Margin		Pola.	Height	Angle	Ant. Type	Comment
		(AV)	(PK)				(AV)	(PK)	(AV)	(PK)	(AV)	(PK)					
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	[H/V]	[cm]	[deg]		
1	1302.582	30.50	43.60	25.24	3.55	33.30	25.99	39.09	54.00	74.00	28.01	34.91	Hori.	100	0	H21	
2	1302.582	30.60	43.70	25.24	3.55	33.30	26.09	39.19	54.00	74.00	27.91	34.81	Vert.	100	0	H21	

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

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

APPENDIX 2: Test instruments

Test Instruments

Test item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/04/2019	04/30/2021	24
RE	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/08/2019	02/29/2020	12
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	141508	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	05/16/2019	05/31/2020	12
RE	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	06/27/2019	06/30/2020	12
RE	142227	Measure	KOMELON	KMC-36	-	-	-	-
RE	141581	MicroWave System Amplifier	AGILENT	83017A	650	10/04/2018	10/31/2019	12
RE	141412	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	06/17/2019	06/30/2020	12
RE	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/28/2018	06/30/2020	24
RE	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/11/2019	01/31/2020	12
RE	148898	Attenuator	KEYSIGHT	8491A	MY52462282	10/03/2018	10/31/2019	12
RE	141425	Biconical Antenna	Schwarzbeck	VHA9103+BBA9106	1302	08/24/2019	08/31/2020	12
RE	141397	Coaxial Cable	UL Japan	-	-	06/18/2019	06/30/2020	12
RE	141267	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	9111B-192	08/24/2019	08/31/2020	12
RE	141545	DIGITAL HiTESTER	HIOKI	3805	51201148	01/29/2019	01/31/2020	12

***Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test item:

RE: Radiated emission