



EMI TEST REPORT

Test Report No. : 13325697H-B-R1

Applicant : ASAHI DENSO CO., LTD.
Type of EUT : IGNITION SW
Model Number of EUT : ZKM013A
FCC ID : T8VZKM013A
Test regulation : FCC Part 15 Subpart B: 2020
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 limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in Section 1.
10. This report is a revised version of 13325697H-B. 13325697H-B is replaced with this report.

Date of test: October 1, 2020

Representative test engineer: A. Maeda
Akihiko Maeda
Engineer
Consumer Technology Division

Approved by: S. Miyazono
Shinichi Miyazono
Engineer
Consumer Technology Division



CERTIFICATE 5107.02

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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Report Cover Page - 13-EM-F0429 Issue # 17.0

REVISION HISTORY

Original Test Report No.: 13325697H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13325697H-B	October 20, 2020	-	-
1	13325697H-B-R1	December 17, 2020	P.5	Correction of the Radio specification description in Clause 2.2
1	13325697H-B-R1	December 17, 2020	P.6	Correction of the Symbols for Radiated emission result in Clause 3.2; From “Complied#” to “Complied”

Reference: Abbreviations (Including words undescribed in this report)

AAN	Asymmetric Artificial Network	ILAC	International Laboratory Accreditation Conference
AC	Alternating Current	ISED	Innovation, Science and Economic Development Canada
AM	Amplitude Modulation	ISN	Impedance Stabilization Network
AMN	Artificial Mains Network	ISO	International Organization for Standardization
Amp, AMP	Amplifier	JAB	Japan Accreditation Board
ANSI	American National Standards Institute	LAN	Local Area Network
Ant, ANT	Antenna	LCL	Longitudinal Conversion Loss
AP	Access Point	LIMS	Laboratory Information Management System
ASK	Amplitude Shift Keying	LISN	Line Impedance Stabilization Network
Atten., ATT	Attenuator	MRA	Mutual Recognition Arrangement
AV	Average	N/A	Not Applicable
BPSK	Binary Phase-Shift Keying	NIST	National Institute of Standards and Technology
BR	Bluetooth Basic Rate	NS	No signal detect.
BT	Bluetooth	NSA	Normalized Site Attenuation
BT LE	Bluetooth Low Energy	NVLAP	National Voluntary Laboratory Accreditation Program
BW	BandWidth	OBW	Occupied Band Width
C.F	Correction Factor	OFDM	Orthogonal Frequency Division Multiplexing
Cal Int	Calibration Interval	PK	Peak
CAV	CISPR AV	PlT	long-term flicker severity
CCK	Complementary Code Keying	POHC(A)	Partial Odd Harmonic Current
CDN	Coupling Decoupling Network	Pol., Pola.	Polarization
Ch., CH	Channel	PR-ASK	Phase Reversal ASK
CISPR	Comite International Special des Perturbations Radioelectriques	Pst	short-term flicker severity
Corr.	Correction	QAM	Quadrature Amplitude Modulation
CPE	Customer premise equipment	QP	Quasi-Peak
CW	Continuous Wave	QPSK	Quadri-Phase Shift Keying
DBPSK	Differential BPSK	r.m.s., RMS	Root Mean Square
DC	Direct Current	RBW	Resolution Band Width
DET	Detector	RE	Radio Equipment
D-factor	Distance factor	REV	Reverse
Dmax	maximum absolute voltage change during an observation period	RF	Radio Frequency
DQPSK	Differential QPSK	RFID	Radio Frequency Identifier
DSSS	Direct Sequence Spread Spectrum	RSS	Radio Standards Specifications
EDR	Enhanced Data Rate	Rx	Receiving
e.i.r., EIRP	Equivalent Isotropically Radiated Power	SINAD	Ratio of (Signal + Noise + Distortion) to (Noise + Distortion)
EM clamp	Electromagnetic clamp	S/N	Signal to Noise ratio
EMC	ElectroMagnetic Compatibility	SA, S/A	Spectrum Analyzer
EMI	ElectroMagnetic Interference	SG	Signal Generator
EMS	ElectroMagnetic Susceptibility	SVSWR	Site-Voltage Standing Wave Ratio
EN	European Norm	THC(A)	Total Harmonic Current
e.r.p., ERP	Effective Radiated Power	THD(%)	Total Harmonic Distortion
EU	European Union	TR	Test Receiver
EUT	Equipment Under Test	Tx	Transmitting
Fac.	Factor	VBW	Video BandWidth
FCC	Federal Communications Commission	Vert.	Vertical
FHSS	Frequency Hopping Spread Spectrum	WLAN	Wireless LAN
FM	Frequency Modulation	xDSL	Generic term for all types of DSL technology (DSL: Digital Subscriber Line)
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		
ICES	Interference-Causing Equipment Standard		
I/O	Input/Output		
IEC	International Electrotechnical Commission		
IEEE	Institute of Electrical and Electronics Engineers		
IF	Intermediate Frequency		

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CONTENTS	PAGE
SECTION 1: Customer information	5
SECTION 2: Equipment under test (EUT).....	5
SECTION 3: Test specification, procedures & results	6
SECTION 4: Operation of EUT during testing.....	9
SECTION 5: Radiated Emission.....	10
APPENDIX 1: Test data	12
Radiated Emission	12
APPENDIX 2: Test instruments	14
APPENDIX 3: Photographs of test setup	15
Radiated Emission	15
Worst Case Position (Horizontal: X-axis / Vertical: X-axis).....	17

SECTION 1: Customer information

Company Name : ASAHI DENSO CO., LTD.
Address : 6-2-1 Somejidai, Hamakita-ku, Hamamatsu, Shizuoka 434-0046, Japan
Telephone Number : +81-53-586-7383
Facsimile Number : +81-53-584-1589
Contact Person : Tomohiro Yaguchi

The information provided from the customer is as follows;

- Applicant, Type of EUT, Model Number of EUT, 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 (EUT) other than the Receipt Date

- SECTION 4: Operation of EUT 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 (EUT)

2.1 Identification of EUT

Type : IGNITION SW
Model Number : ZKM013A
Serial Number : Refer to SECTION 4.2
Rating : DC 12.0 V
Receipt Date : August 18, 2020
Country of Mass-production : Thailand
Condition : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification : No Modification by the test lab

2.2 Product Description

Model: ZKM013A (referred to as the EUT in this report) is a IGNITION SW.

Radio Specification

[Transmitter part]

Radio Type : Transmitter
Frequency of Operation : 134.2 kHz
Modulation : ASK
Antenna type : Coil Antenna
Clock frequency (Maximum) : 4 MHz

[Receiver part]

Radio Type : Receiver
Type of Receiver : Super Heterodyne
Receiving Frequency : 315 MHz
Oscillator Frequency : 21.948717 MHz
Local Oscillator Frequency : 1st: 304.3 MHz
2nd: 10.97 MHz
Intermediate Frequency : 1st: 10.7 MHz
2nd: 274 kHz
Antenna Type : Pattern Antenna

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart B
 FCC Part 15 final revised on June 26, 2020 and effective July 27, 2020
 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	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	8.89 dB 39.444 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.

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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
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

3.5 Test Location

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*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C
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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.

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SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

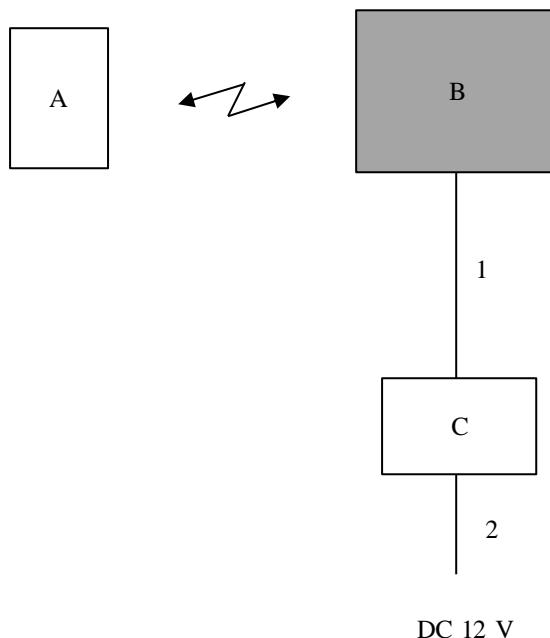
Mode	Remarks
1) Receiving mode	-

*EUT was set by the software as follows;
 Software: ZKM010-810 Ver1.0

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

* It was confirmed by using checker 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	Remarks
A	SMART KEY	ZKM013A-903	00000004	ASAHI DENSO CO., LTD.	-
B	IGNITION SW	ZKM013A	00000003	ASAHI DENSO CO., LTD.	EUT
C	Operation Jig	-	-	ASAHI DENSO CO., LTD.	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC and Signal Cable	0.5	Unshielded	Unshielded	-
2	DC Cable	2.0	Unshielded	Unshielded	-

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SECTION 5: Radiated Emission

5.1 Operating environment

Test place : No.2 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 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.

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.

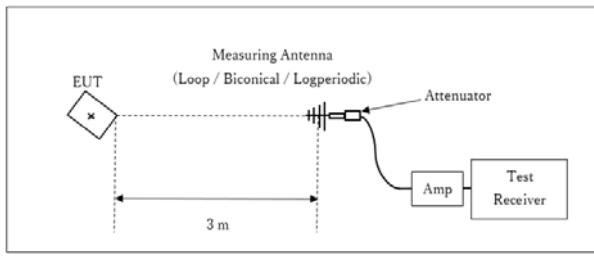
Frequency	Below 1GHz	Above 1GHz *1)
Instrument used	Test Receiver	Test Receiver
IF Bandwidth	QP: BW 120 kHz	PK: BW 1 MHz, CISPR AV: BW 1 MHz

*1) The measurement data was adjusted to a 3 m distance using the following Distance Factor.

Distance Factor: See Figure 2.

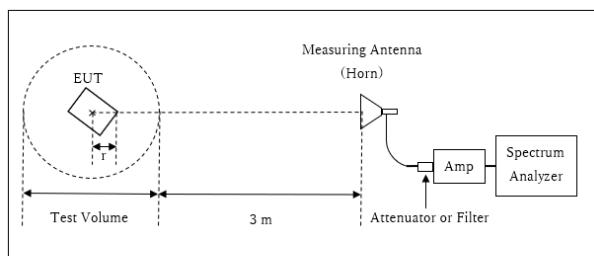
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz - 2 GHz



Distance Factor: $20 \times \log (3.6 \text{ m}^* / 3.0 \text{ m}) = 1.58 \text{ dB}$
 * Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.6 \text{ m}$

Test Volume: 1.5 m
 (Test Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.15 \text{ m}$

- 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 the position that has the maximum noise.

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: October 1, 2020

Test engineer: Akihiko Maeda

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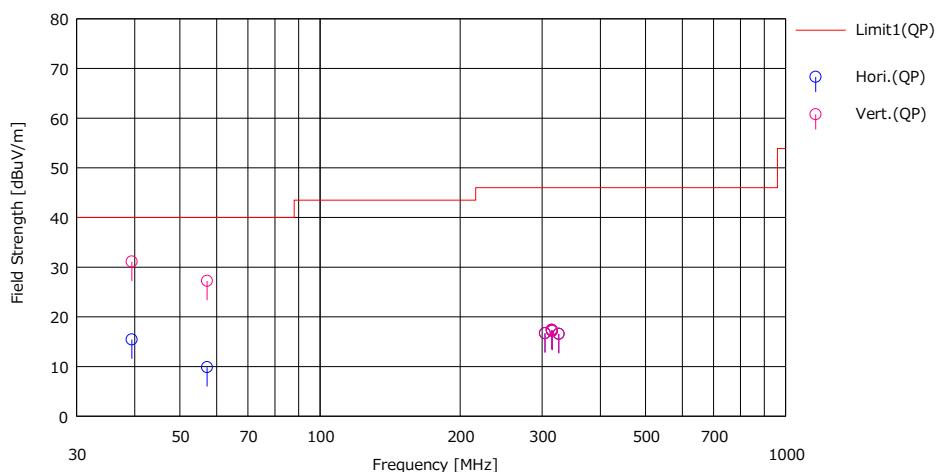
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APPENDIX 1: Test data

Radiated Emission

Report No. 13325697H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.2
 Date October 1, 2020
 Temperature / Humidity 22 deg. C / 58 % RH
 Engineer Akihiko Maeda
 (Below 1 GHz)
 Mode Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class B



Nb.	Freq. [MHz]	Reading (QP)		Ant.Foc [dB/m]	Loss [dB]	Gan [dB]	Result (QP)		Limit (QP) [dBuV/m]	Margin [dB]	Pda [dB]	Height [H/V]	Angle [deg]	Ant. Type	Comment
		[dBuV]	[dBm]				[dB]	[dBuV/m]							
1	39.444	22.20	14.98	6.84	28.61	15.41	40.00	24.59	Hori.	100	0	BA			
2	57.228	22.70	8.68	7.05	28.59	9.84	40.00	30.16	Hori.	100	0	BA			
3	304.300	21.90	13.74	8.87	27.83	16.68	46.00	29.32	Hori.	100	0	LA21			
4	314.726	22.30	13.98	8.95	27.89	17.34	46.00	28.66	Hori.	100	0	LA21			
5	315.274	22.10	13.99	8.96	27.89	17.16	46.00	28.84	Hori.	100	0	LA21			
6	325.700	21.10	14.36	9.04	27.95	16.55	46.00	29.45	Hori.	100	0	LA21			
7	39.444	37.90	14.98	6.84	28.61	31.11	40.00	8.89	Vert.	100	121	BA			
8	57.228	40.10	8.68	7.05	28.59	27.24	40.00	12.76	Vert.	100	109	BA			
9	304.300	21.90	13.74	8.87	27.83	16.68	46.00	29.32	Vert.	100	0	LA21			
10	314.726	22.30	13.98	8.95	27.89	17.34	46.00	28.66	Vert.	100	0	LA21			
11	315.274	22.10	13.99	8.96	27.89	17.16	46.00	28.84	Vert.	100	0	LA21			
12	325.700	21.10	14.36	9.04	27.95	16.55	46.00	29.45	Vert.	100	0	LA21			

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)

Except for the above table: adequate margin data below the limits.

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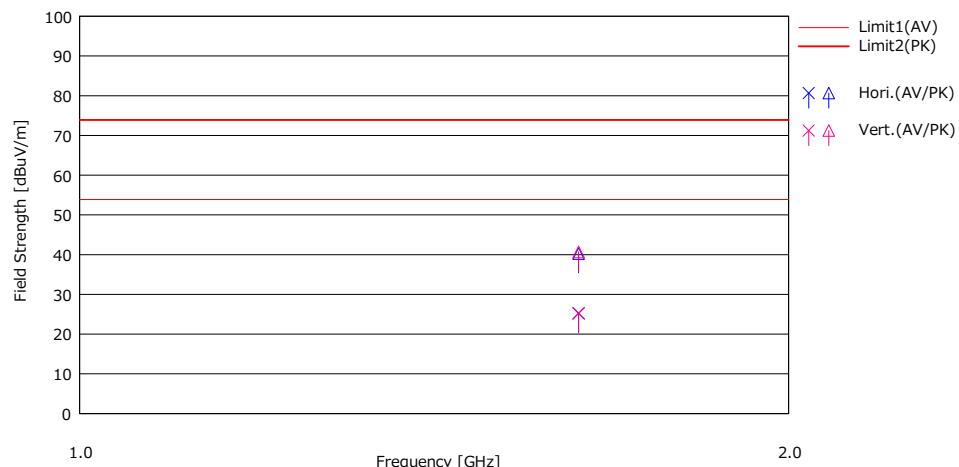
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Radiated Emission

Report No. 13325697H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.2
 Date October 1, 2020
 Temperature / Humidity 22 deg. C / 58 % RH
 Engineer Akihiko Maeda
 (Above 1 GHz)
 Mode Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class B



Nb.	Freq. [MHz]	Reading		Ant.Foc	Loss	Gain	Result		Limit		Margin		Pola.	Height [cm]	Angle [deg]	Ant. Type	Comment
		(AV) [dBuV]	(PK) [dBuV]				(AV) [dB]	(PK) [dB]	(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dBuV/m]	(PK) [dBuV/m]					
1	1628.759	32.20	47.30	25.07	3.62	35.71	25.18	40.28	53.90	73.90	28.72	33.62	Hori.	100	0	HA6	
2	1628.759	32.30	47.70	25.07	3.62	35.71	25.28	40.68	53.90	73.90	28.62	33.22	Vert.	100	0	HA6	

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)

Except for the above table: adequate margin data below the limits.

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APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/26/2020	24
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/19/2019	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/18/2020	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-ME MI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-02-SVSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/01/2019	24
RE	MAT-07	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	11/07/2019	12
RE	MBA-08	141427	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103B+BBA9106	8031	07/29/2020	12
RE	MCC-12	141317	Coaxial Cable	UL Japan Inc.	-	-	09/25/2020	12
RE	MLA-21	141265	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-190	07/29/2020	12
RE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	02/10/2020	12
RE	MTR-09	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	06/03/2020	12
RE	MHA-06	141512	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	254	09/14/2020	12
RE	MCC-217	141393	Microwave Cable	Junkosha	MWX221	1604S254(1 m) / 1608S088(5 m)	08/03/2020	12
RE	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	01/07/2020	12

*Hyphens for Last Calibration 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.

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

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

Test item:

RE: Radiated emission

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