



EMI TEST REPORT

Test Report No. : 13320239M-R1

Applicant : Takazono Technology Incorporated
Type of EUT : Film core drum
Model Number of EUT : JC-SE-R-001
Test regulation : FCC Part 15 Subpart C:2020
FCC ID : 2APN9JC-SE-R-001
Test Result : Complied (Refer to SECTION 3.2)

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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 Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Kashima 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 13320239M. 13320239M is replaced with this report.

Date of test: June 1 to 5, 2020

Representative test engineer:

K. Ando

Kazuhiro Ando
Engineer

Consumer Technology Division

Approved by:

T. Yamashita
Tomoyuki Yamashita
Leader

Consumer Technology Division



CERTIFICATE 1266.01

- ☐ 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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REVISION HISTORY

Original Test Report No.: 13320239M

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13320239M	June 30, 2020	-	-
1	13320239M-R1	July 13, 2020	P.10	Modify the RFID Tag from an EUT to a supported equipment (Configuration and Table)

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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		

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SECTION 1: Customer information

Company Name	:	Takazono Technology Incorporated
Address	:	2-8-1 Tsudayamate, Hirakata City, Osaka 573-0128 Japan
Telephone Number	:	+81-72-808-0200
Facsimile Number	:	+81-72-808-0209
Contact Person	:	Teruaki Satoh

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	:	Film core drum
Model Number	:	JC-SE-R-001
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 4.5 V to 5.25 V (Typ. DC 5 V), 150 mA
Receipt Date	:	May 29, 2020
Country of Manufacture	:	JAPAN
Condition	:	Production prototype (Not for Sale: This sample is not mass-produced items.)
Modification	:	No Modification by the test lab

2.2 Product Description

Model: JC-SE-R-001 (referred to as the EUT in this report) is a Film core drum.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	13.56 MHz
Modulation	:	ASK
Antenna type	:	Printed Loop Coil
Clock frequency (Maximum)	:	27.12 MHz
Operating Temperature	:	-2 deg. C. to +40 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
 FCC Part 15 final revised on May 26, 2020 and effective July 27, 2020 except 15.258
 *The revision does not affect the test result conducted before its effective date.

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
 Section 15.207 Conducted limits
 Section 15.225 Operation within the band 13.110-14.010 MHz.

* The customer has declared that the EUT has complies with FCC Part 15 Subpart B as SDoC.

3.2 Procedures and results

Item	Test Procedure	Specification	Test method	Worst margin	Results	Remarks
Conducted emission	ANSI C63.10:2013 6 Standard test methods	Section 15.207	-	8.4 dB 0.15000 MHz, QP, L	Complied a)	-
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.225(a)	Radiated	66.4 dB, 13.56000 MHz, QP, 180 deg.	Complied b)	-
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods	Section 15.225(b)(c)	Radiated	44.3 dB, 13.11000 MHz, QP, 0 deg.	Complied b)	-
20 dB Bandwidth	ANSI C63.10:2013 6 Standard test methods	Section 15.215(c)	Radiated	See data	Complied c)	-
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.209, Section 15.225 (d)	Radiated	11.7 dB 189.840 MHz, Horizontal, QP	Complied d)	-
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods	Section 15.225(e)	Radiated	See data	Complied e)	-

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

- a) Refer to APPENDIX 1 (data of Conducted Emission)
 b) Refer to APPENDIX 1 (data of Fundamental emission and Spectrum Mask)
 c) Refer to APPENDIX 1 (data of 20dB Bandwidth)
 d) Refer to APPENDIX 1 (data of Spurious emission)
 e) Refer to APPENDIX 1 (data of Frequency Tolerance)

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.

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FCC Part 15.31 (e)

The test was carried out with minimum and maximum rating of the product specification according to ANSI C63.10-2013, 5.13 b) because the rating range of the EUT is -10 % to +5%.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether laboratory uncertainty is applied.

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor $k = 2$.

Conducted emission

Frequency range	Required Uncertainty (+/-)	Uncertainty (+/-)
0.15 MHz to 30 MHz	3.4 dB	3.2dB

Radiated emission

Measurement distance	Frequency range	Required Uncertainty (+/-)	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	Not Defined	3.0 dB
	30 MHz to 200 MHz	6.3 dB	5.2 dB
	200 MHz to 1000 MHz		6.2 dB
	1 GHz to 6 GHz	5.2 dB	4.7 dB
	6 GHz to 18 GHz	5.5 dB	5.1 dB
	18 GHz to 40 GHz	Not Defined	5.4 dB
1 m	1 GHz to 18 GHz	Not Defined	5.2 dB
	18 GHz to 40 GHz		5.5 dB

Test Item	Required Uncertainty (+/-)	Uncertainty (+/-)
Frequency Tolerance	1.0×10^{-7}	7.9×10^{-8}
20 dB Bandwidth	Not Defined	1.6 %

3.4 Test Location

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JAB Accreditation No.:RTL02610 / FCC Test Firm Registration Number: 910230 / ISED Lab Company Number: 4659A

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Open site	6.0 x 5.5 x 2.5	20 x 40	10 m
No.5 Open site	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	5.4 x 4.5 x 2.3	-	-
No.5 Shielded Room	4.2 x 3.1 x 2.5	-	-
No.9 Shielded Room	6.1 x 3.6 x 2.8	-	-
No.6 Semi-anechoic Chamber	8.5 x 5.5 x 5.2	-	3 m
No.10 Semi-anechoic Chamber	18.4 x 9.9 x 7.7	-	10 m
No.11 Semi-anechoic Chamber	9.0 x 6.5 x 5.2	-	3 m
No.1 Measurement room	5.0 x 3.7 x 2.6	-	-
No.2 Measurement room	4.3 x 4.4 x 2.7	-	-
No.3 Measurement room	4.5 x 5.3 x 2.7	-	-

3.5 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

The mode is used :

Mode	Remarks
Transmitting and Receiving mode (with Passive Tag, without Passive Tag)	The EUT Transmits and Receives at the same time and there is no receiving mode.
The EUT was operated in a manner similar to typical use during the tests. The EUT has the power settings by the software as follows; Power settings : Fixed Software : YFWW190006 (Date: 2020.02.27, Storage location: embedded memory in Jig)	

Test Item	Operating mode
Conducted emission	Transmitting and Receiving, with Tag / without Tag
Electric Field Strength of Fundamental Emission	Transmitting and Receiving, with Tag / without Tag
Spectrum Mask	Transmitting and Receiving, with Tag / without Tag
20 dB Bandwidth	Transmitting and Receiving, with Tag / without Tag
Electric Field Strength of Spurious Emission	Transmitting and Receiving, with Tag / without Tag
Frequency Tolerance	Transmitting Mode off, without Tag

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

Frequency Tolerance:

Temperature : -20 deg. C to +50 deg. C Step 10 deg. C
 Voltage : Normal Voltage DC 5 V
 Maximum Voltage DC 5.25 V,
 Minimum Voltage DC 4.5 V (DC 5 V -10 % to +5 % *1))

*1) The specification of this EUT is DC 5 V -10 % to +5 %.

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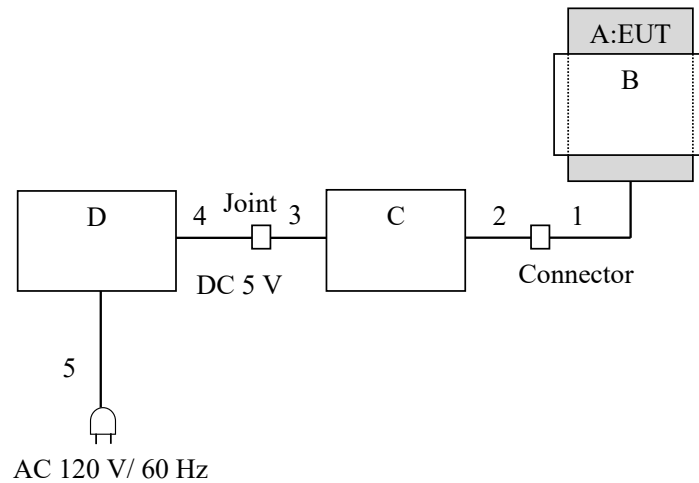
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4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Film core drum	JC-SE-R-001	132	Takazono Technology Incorporated	EUT
B	RFID Tag	YTBP01-129	1	Yoshikawakogyo RF Semicon Co., Ltd.	-
C	Jig	YRS-ADC20004	1	Yoshikawakogyo RF Semicon Co., Ltd.	-
D	DC Power Supply	GSV3000	1708192900	DIAMOND ANTENNA	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC & Signal	0.06	Unshielded	Unshielded	EUT
2	DC & Signal	0.04	Unshielded	Unshielded	-
3	DC	0.15	Unshielded	Unshielded	-
4	DC	1.2	Unshielded	Unshielded	-
5	AC	1.7	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a wooden platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane.

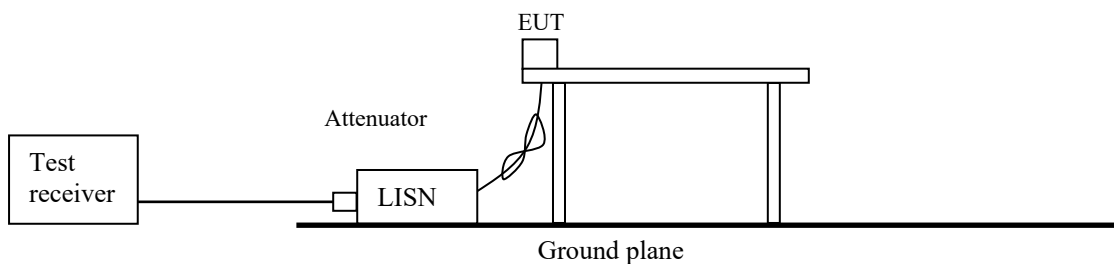
The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

I/O cables that were connected to the 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.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Shielded room. The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

Figure 1: Test Setup



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

Detector	: QP and CISPR AV
Measurement range	: 0.15 MHz - 30 MHz
Test data	: APPENDIX
Test result	: Pass

SECTION 6: Radiated emission (Fundamental , Spurious Emission and Spectrum Mask)

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 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 3 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 1 GHz
Antenna Type	Loop	Hybrid

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.

The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to $45.5 - 51.5 = -6.0 \text{ dBuA/m}$, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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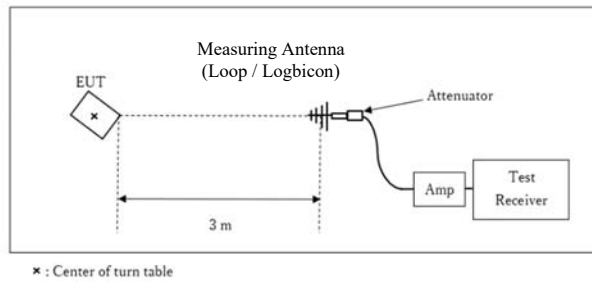
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Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

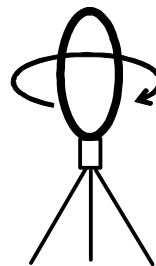
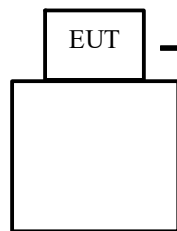
- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

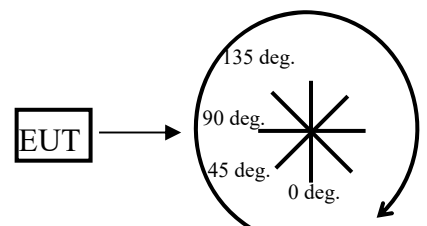
Figure 3: Direction of the Loop Antenna

Side View (Vertical)



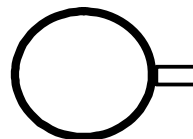
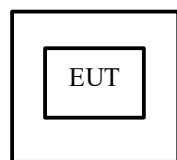
Front side: 0 deg.
 Forward direction: clockwise

Top View (Vertical)



Front side: 0 deg.
 Forward direction: clockwise

Top View (Horizontal)



Antenna was not rotated.

SECTION 7: Other test

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	300 kHz	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Frequency Tolerance *1)	-	-	-	-	-	-	Frequency Counter
*1) The temperature test was started after the temperature stabilization time of 30 minutes. The test was begun from 50 deg.C and the temperature was lowered each 10 deg.C.							

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

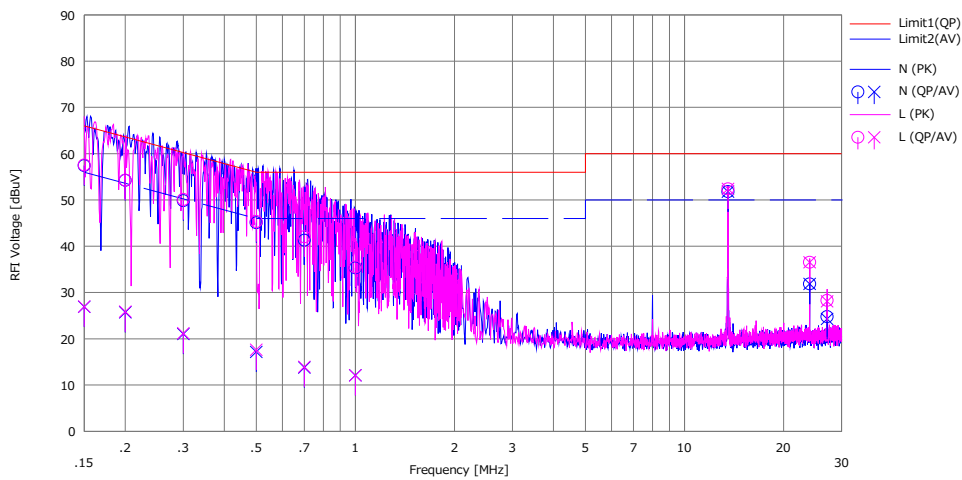
UL Japan, Inc. Kashima EMC Lab. No.5 Shielded Room
Date : 2020/06/05

Mode : Transmitting and Receiving
Order No. : 13320239M
Power : DC 5V (AC 120V / 60Hz)
Temp./Humi. : 23deg.C / 55%RH

Remarks : with Tag

Limit : FCC_Part 15 Subpart C(15.207)

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(AV) [dBuV]		(QP) [dBuV]	(AV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	47.30	16.80	10.11	57.41	26.91	66.00	56.00	8.5	29.0	N	
2	0.20000	44.10	15.60	10.12	54.22	25.72	63.61	53.61	9.3	27.8	N	
3	0.30000	39.70	10.90	10.14	49.84	21.04	60.24	50.24	10.4	29.2	N	
4	0.50000	34.90	7.00	10.17	45.07	17.17	56.00	46.00	10.9	28.8	N	
5	0.70000	31.10	3.60	10.19	41.29	13.79	56.00	46.00	14.7	32.2	N	
6	1.00000	25.10	1.90	10.22	35.32	12.12	56.00	46.00	20.6	33.8	N	
7	13.56000	40.70	40.70	11.10	51.80	51.80	60.00	50.00	8.2	-1.8	N	Carrier
8	24.00000	20.20	20.20	11.66	31.86	31.86	60.00	50.00	28.1	18.1	N	
9	27.12000	13.10	12.60	11.67	24.77	24.27	60.00	50.00	35.2	25.7	N	
10	0.15000	47.40	16.80	10.16	57.56	26.96	66.00	56.00	8.4	29.0	L	
11	0.20000	44.10	15.70	10.17	54.27	25.87	63.61	53.61	9.3	27.7	L	
12	0.30000	39.90	11.00	10.19	50.09	21.19	60.24	50.24	10.1	29.0	L	
13	0.50000	35.10	7.40	10.22	45.32	17.62	56.00	46.00	10.6	28.3	L	
14	0.70000	31.80	3.70	10.25	42.05	13.95	56.00	46.00	13.9	32.0	L	
15	1.00000	25.20	1.80	10.28	35.48	12.08	56.00	46.00	20.5	33.9	L	
16	13.56000	41.10	41.10	11.30	52.40	52.40	60.00	50.00	7.6	-2.4	L	Carrier
17	24.00000	24.60	24.60	11.94	36.54	36.54	60.00	50.00	23.4	13.4	L	
18	27.12000	16.30	16.10	11.99	28.29	28.09	60.00	50.00	31.7	21.9	L	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN+Cable+ATT)[dB]
LISN:CLS-11

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Conducted Emission

DATA OF CONDUCTED EMISSION TEST

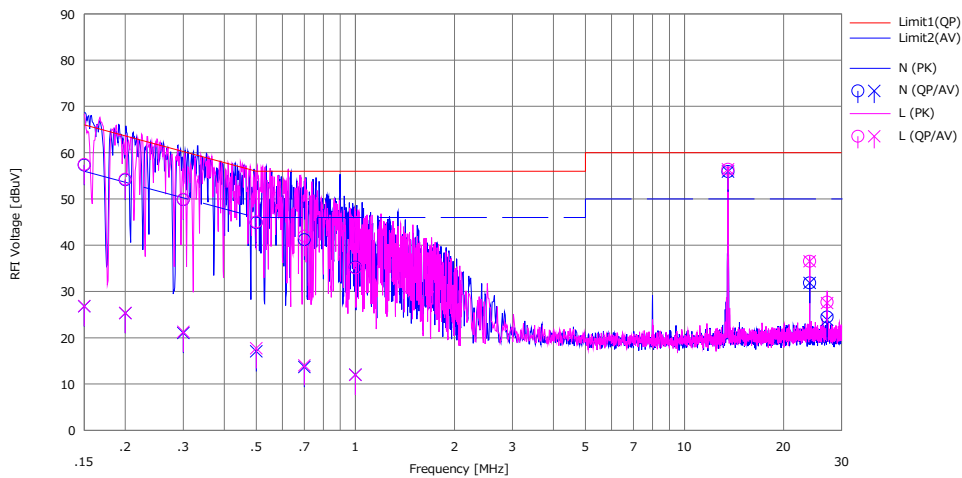
UL Japan, Inc. Kashima EMC Lab. No.5 Shielded Room
Date : 2020/06/05

Mode : Transmitting and Receiving
Order No. : 13320239M
Power : DC 5V (AC 120V / 60Hz)
Temp./Humi. : 23deg.C / 55%RH

Remarks : without Tag

Limit : FCC_Part 15 Subpart C(15.207)

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		(QP)	(AV)		(QP)	(AV)	(QP)	(AV)	(QP)	(AV)		
		[dBuV]	[dBuV]		[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	47.20	16.70	10.11	57.31	26.81	66.00	56.00	8.6	29.1	N	Carrier
2	0.20000	44.00	15.20	10.12	54.12	25.32	63.61	53.61	9.4	28.2	N	
3	0.30000	39.70	10.90	10.14	49.84	21.04	60.24	50.24	10.4	29.2	N	
4	0.50000	34.70	6.90	10.17	44.87	17.07	56.00	46.00	11.1	28.9	N	
5	0.70000	31.00	3.50	10.19	41.19	13.69	56.00	46.00	14.8	32.3	N	
6	1.00000	25.00	1.80	10.22	35.22	12.02	56.00	46.00	20.7	33.9	N	
7	13.56000	44.80	44.80	11.10	55.90	55.90	60.00	50.00	4.1	-5.9	N	
8	24.00000	20.20	20.20	11.66	31.86	31.86	60.00	50.00	28.1	18.1	N	
9	27.12000	12.80	12.20	11.67	24.47	23.87	60.00	50.00	35.5	26.1	N	
10	0.15000	47.30	16.70	10.16	57.46	26.86	66.00	56.00	8.5	29.1	L	
11	0.20000	44.10	15.20	10.17	54.27	25.37	63.61	53.61	9.3	28.2	L	Carrier
12	0.30000	39.70	11.10	10.19	49.89	21.29	60.24	50.24	10.3	28.9	L	
13	0.50000	34.80	7.50	10.22	45.02	17.72	56.00	46.00	10.9	28.2	L	
14	0.70000	31.70	3.80	10.25	41.95	14.05	56.00	46.00	14.0	31.9	L	
15	1.00000	24.80	1.70	10.28	35.08	11.98	56.00	46.00	20.9	34.0	L	
16	13.56000	45.10	45.10	11.30	56.40	56.40	60.00	50.00	3.6	-6.4	L	
17	24.00000	24.60	24.60	11.94	36.54	36.54	60.00	50.00	23.4	13.4	L	
18	27.12000	15.70	15.50	11.99	27.69	27.49	60.00	50.00	32.3	22.5	L	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN+Cable+ATT)[dB]
LISN:CLS-11

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

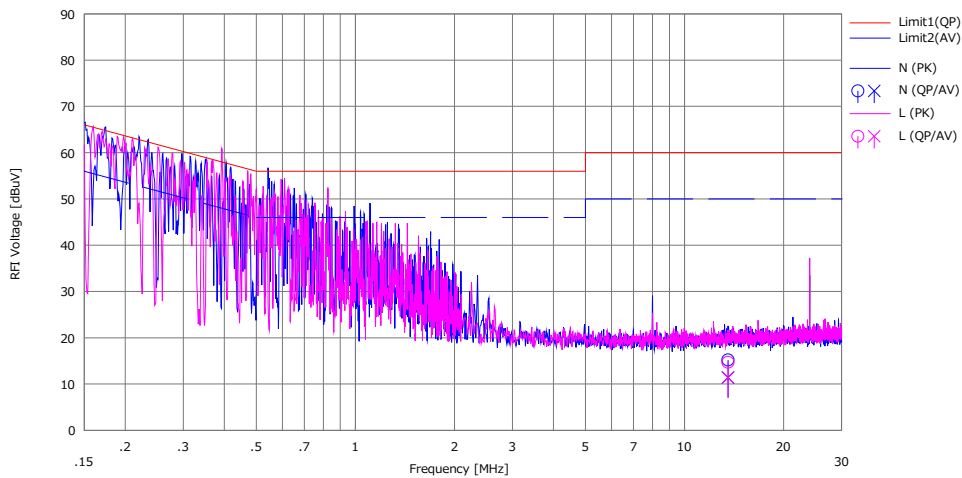
UL Japan, Inc. Kashima EMC Lab. No.5 Shielded Room
Date : 2020/06/05

Mode : Transmitting and Receiving
Order No. : 13320239M
Power : DC 5V (AC 120V / 60Hz)
Temp./Humi. : 23deg.C / 55%RH

Remarks : Antenna Terminated

Limit : FCC_Part 15 Subpart C(15.207)

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	13.56000	4.10	0.30	11.10	15.20	11.40	60.00	50.00	44.8	38.6	N	
2	13.56000	3.40	0.10	11.30	14.70	11.40	60.00	50.00	45.3	38.6	L	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN+Cable+ATT)[dB]
LISN:CLS-11

Fundamental emission and Spectrum Mask

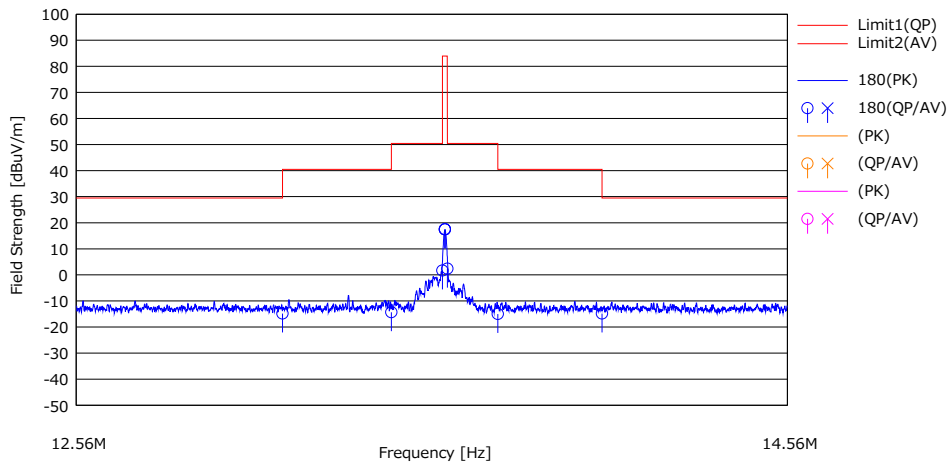
DATA OF RADIATED EMISSION(below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2020/06/02

Mode : Transmitting and Receiving
Order No. : 13320239M
Power : DC 5V
Temp./Humi. : 21deg.C / 47%RH

Remarks : X-axis, with tag

Limit : FCC15.225,PK/AV/QP,9-90 kHz:PK/AV,110-490 kHz:PK/AV,other:QP(<490 kHz:300 m,>490 kHz:30 m)
Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna [deg]	Table [deg]	Comment
		(QP) [dBuV]	(AV) [dBuV]				(QP) [dBuV/m]	(AV) [dBuV/m]	(QP) [dBuV/m]	(AV) [dBuV/m]	(QP) [dB]	(AV) [dB]			
		[dBuV]	[dBuV]				[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]			
1	13.11000	23.10	---	19.35	-33.05	24.24	-14.84	---	29.50	---	44.3	---	180	0	
2	13.41000	23.60	---	19.35	-33.04	24.25	-14.34	---	40.50	---	54.8	---	180	0	
3	13.55300	39.60	---	19.35	-33.02	24.26	1.67	---	50.40	---	48.7	---	180	0	
4	13.56000	55.40	---	19.35	-33.02	24.26	17.47	---	83.90	---	66.4	---	180	0	DC 5V
5	13.56000	55.40	---	19.35	-33.02	24.26	17.47	---	83.90	---	66.4	---	180	0	DC 4.5V
6	13.56000	55.40	---	19.35	-33.02	24.26	17.47	---	83.90	---	66.4	---	180	0	DC 5.25V
7	13.56700	40.30	---	19.35	-33.02	24.26	2.37	---	50.40	---	48.0	---	180	0	
8	13.71000	22.90	---	19.36	-33.02	24.26	-15.02	---	40.50	---	55.5	---	180	0	
9	14.01000	23.10	---	19.36	-33.01	24.28	-14.83	---	29.50	---	44.3	---	180	0	

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]
Ant.Type=LOOP:Loop Antenna

Result of the fundamental emission at 3 m without Distance factor

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
180	13.56000	QP	55.40	19.35	6.98	24.26	-	57.47	-	-	Fundamental

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

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Fundamental emission and Spectrum Mask

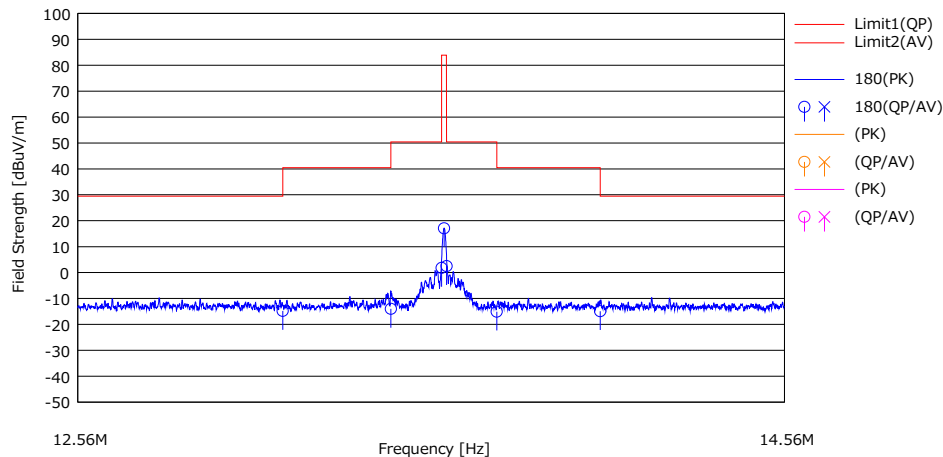
DATA OF RADIATED EMISSION(below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2020/06/02

Mode : Transmitting and Receiving
Order No. : 13320239M
Power : DC 5V
Temp./Humi. : 21deg.C / 47%RH

Remarks : X-axis, without tag

Limit : FCC15.225,PK/AV/QP,9-90 kHz:PK/AV,110-490 kHz:PK/AV,other:QP(<490 kHz:300 m,>490 kHz:30 m)
Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna [deg]	Table [deg]	Comment
		[dBUV]	[dBUV]				[dBUV/m]	[dBUV/m]	[dBUV/m]	[dBUV/m]	[dB]	[dB]			
1	13.11000	23.10	---	19.35	-33.05	24.24	-14.84	---	29.50	---	44.3	---	180	0	
2	13.41000	23.90	---	19.35	-33.04	24.25	-14.04	---	40.50	---	54.5	---	180	0	
3	13.55300	39.70	---	19.35	-33.02	24.26	1.77	---	50.40	---	48.6	---	180	0	
4	13.56000	55.00	---	19.35	-33.02	24.26	17.07	---	83.90	---	66.8	---	180	0	
5	13.56700	40.40	---	19.35	-33.02	24.26	2.47	---	50.40	---	47.9	---	180	0	
6	13.71000	22.80	---	19.36	-33.02	24.26	-15.12	---	40.50	---	55.6	---	180	0	
7	14.01000	23.00	---	19.36	-33.01	24.28	-14.93	---	29.50	---	44.4	---	180	0	

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]
Ant. Type=LOOP: Loop Antenna

Result of the fundamental emission at 3 m without Distance factor

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
180	13.56000	QP	55.00	19.35	6.98	24.26	-	57.07	-	-	Fundamental

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

UL Japan, Inc.

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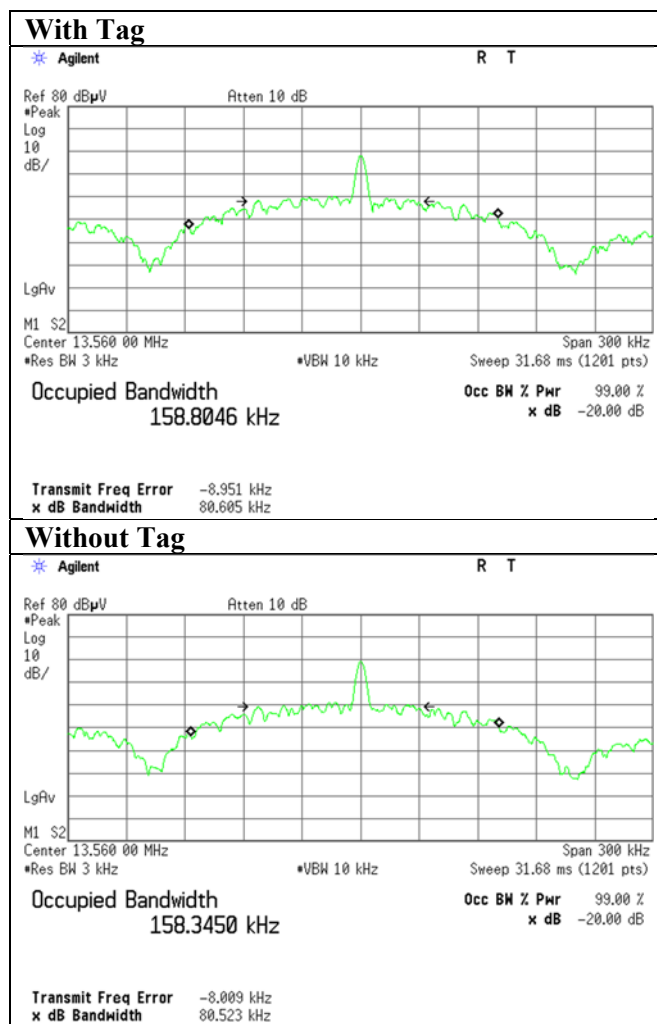
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20 dB Bandwidth

Report No.	13320239M-R1
Test place	Kashima EMC Lab. No.2 Measurement room
Date	June 3, 2020
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Kazuhiro Ando
Mode	Transmitting and Receiving mode

FREQ [MHz]	Mode	20dB Bandwidth [kHz]
13.56	With Tag	80.61
	Without Tag	80.52



Spurious emission

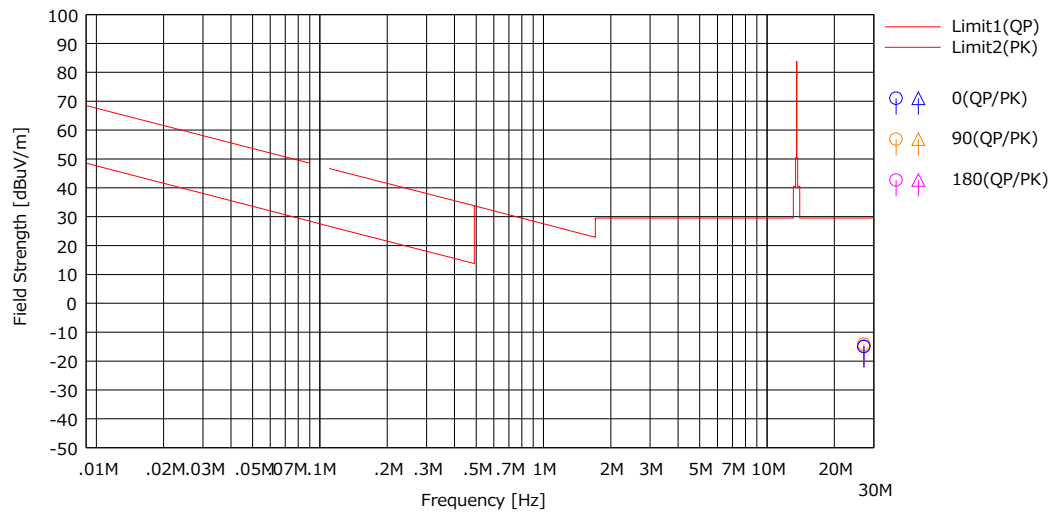
DATA OF RADIATED EMISSION(below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2020/06/02

Mode : Transmitting and Receiving
Order No. : 13320239M
Power : DC 5V
Temp./Humi. : 21deg.C / 47%RH

Remarks : X-axis, with tag

Limit : FCC15.225,PK/AV/QP,9-90 kHz:PK/AV,110-490 kHz:PK/AV,other:QP(<490 kHz:300 m,>490 kHz:30 m)
Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna	Table	Comment
		(QP)	(PK)				(QP)	(PK)	(QP)	(PK)	(QP)	(PK)			
		[dBuV]	[dBuV]				[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]			
1	27.12000	22.50	---	19.68	-32.56	24.45	-14.83	---	29.50	---	44.3	---	180	317	
2	27.12000	23.20	---	19.68	-32.56	24.45	-14.13	---	29.50	---	43.6	---	90	0	
3	27.12000	22.30	---	19.68	-32.56	24.45	-15.03	---	29.50	---	44.5	---	0	0	

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]
Ant. Type=LOOP: Loop Antenna

Spurious emission

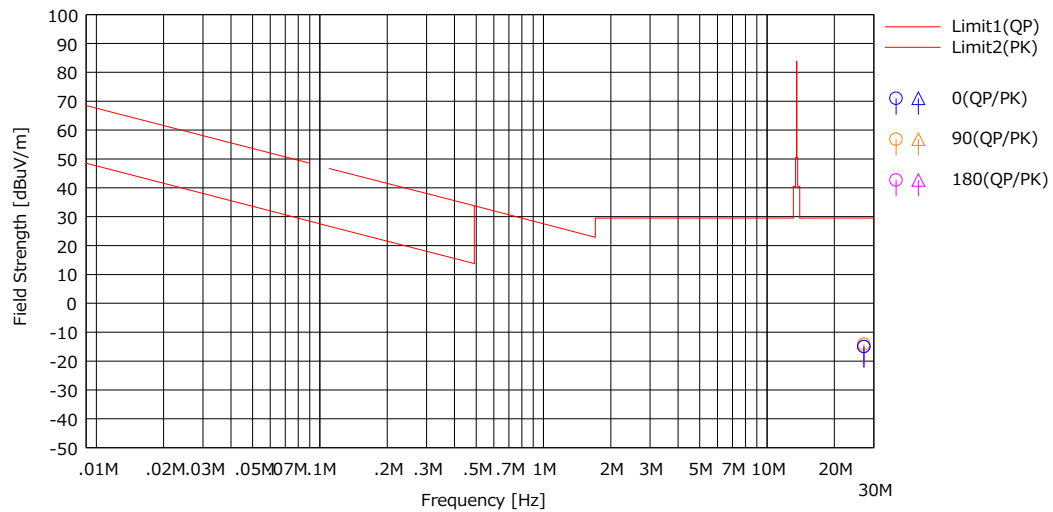
DATA OF RADIATED EMISSION(below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2020/06/02

Mode : Transmitting and Receiving
Order No. : 13320239M
Power : DC 5V
Temp./Humi. : 21deg.C / 47%RH

Remarks : X-axis, without tag

Limit : FCC15.225,PK/AV/QP,9-90 kHz:PK/AV,110-490 kHz:PK/AV,other:QP(<490 kHz:300 m,>490 kHz:30 m)
Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna	Table [deg]	Comment
		(QP)	(PK)				(QP)	(PK)	(QP)	(PK)	(QP)	(PK)			
		[dBuV]	[dBuV]				[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]			
1	27.12000	22.40	---	19.68	-32.56	24.45	-14.93	---	29.50	---	44.4	---	180	0	
2	27.12000	23.20	---	19.68	-32.56	24.45	-14.13	---	29.50	---	43.6	---	90	0	
3	27.12000	22.30	---	19.68	-32.56	24.45	-15.03	---	29.50	---	44.5	---	0	0	

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]
Ant. Type=LOOP: Loop Antenna

Spurious emission

DATA OF RADIATED EMISSION TEST

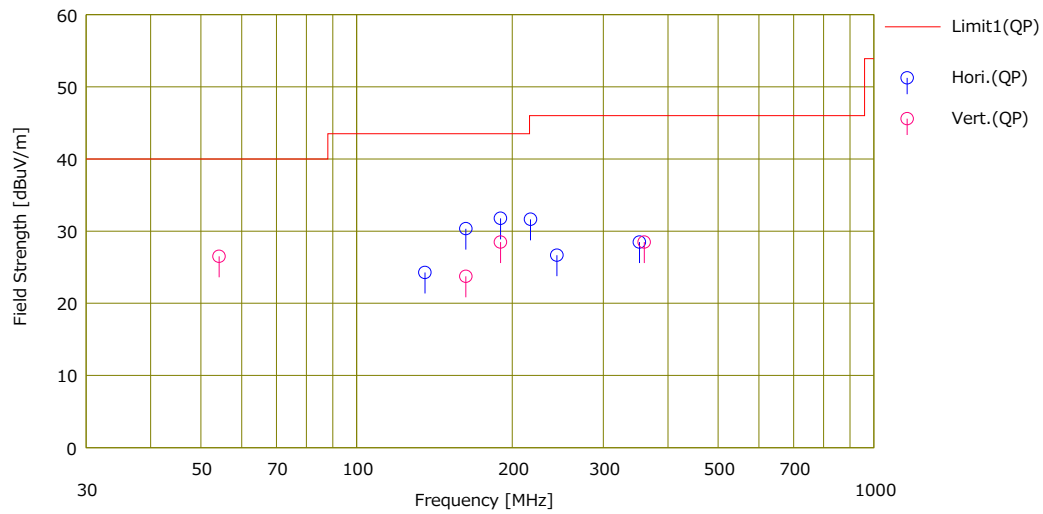
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2020/06/01

Mode : Transmitting and Receiving
Order No. : 13320239M
Power : DC 5V
Temp./Humi. : 23deg.C / 42%RH

Remarks : X-axis, with tag

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK

Tested by : Kazuhiro Ando



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	135.600	35.90	12.72	7.26	31.61	24.27	43.50	19.2	Hori.	224	203	HB	
2	162.720	41.00	13.39	7.52	31.58	30.33	43.50	13.1	Hori.	180	200	HB	
3	189.840	44.90	10.64	7.77	31.54	31.77	43.50	11.7	Hori.	142	199	HB	
4	216.960	45.40	9.74	8.00	31.50	31.64	46.00	14.3	Hori.	144	173	HB	
5	244.080	38.40	11.54	8.23	31.51	26.66	46.00	19.3	Hori.	100	0	HB	
6	352.560	36.50	14.35	9.11	31.48	28.48	46.00	17.5	Hori.	100	12	HB	
7	54.240	38.30	13.70	6.28	31.77	26.51	40.00	13.4	Vert.	100	136	HB	
8	162.720	34.40	13.39	7.52	31.58	23.73	43.50	19.7	Vert.	223	283	HB	
9	189.840	41.60	10.64	7.77	31.54	28.47	43.50	15.0	Vert.	201	126	HB	
10	360.010	36.20	14.58	9.17	31.47	28.48	46.00	17.5	Vert.	155	229	HB	

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]
Ant. Type=HB:Hybrid Antenna

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Spurious emission

DATA OF RADIATED EMISSION TEST

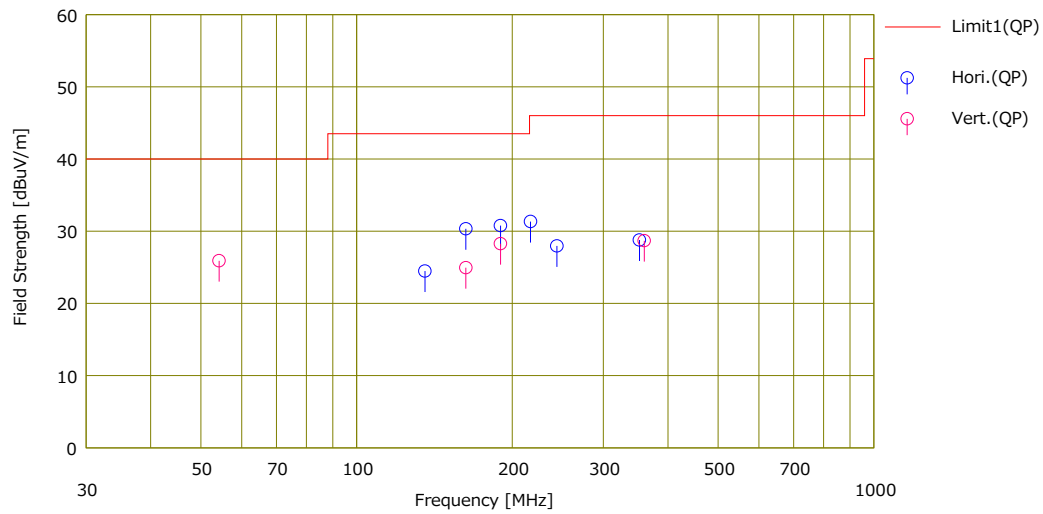
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2020/06/01

Mode : Transmitting and Receiving
Order No. : 13320239M
Power : DC 5V
Temp./Humi. : 23deg.C / 42%RH

Remarks : X-axis, without tag

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK

Tested by : Kazuhiro Ando



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
		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]		
1	135.600	36.10	12.72	7.26	31.61	24.47	43.50	19.0	Hori.	224	213	HB	
2	162.720	41.00	13.39	7.52	31.58	30.33	43.50	13.1	Hori.	183	221	HB	
3	189.840	43.90	10.64	7.77	31.54	30.77	43.50	12.7	Hori.	138	192	HB	
4	216.960	45.10	9.74	8.00	31.50	31.34	46.00	14.6	Hori.	150	162	HB	
5	244.080	39.70	11.54	8.23	31.51	27.96	46.00	18.0	Hori.	140	359	HB	
6	362.560	36.80	14.35	9.11	31.48	28.78	46.00	17.2	Hori.	103	33	HB	
7	54.240	37.70	13.70	6.28	31.77	25.91	40.00	14.0	Vert.	100	157	HB	
8	162.720	35.60	13.39	7.52	31.58	24.93	43.50	18.5	Vert.	270	127	HB	
9	189.840	41.40	10.64	7.77	31.54	28.27	43.50	15.2	Vert.	193	120	HB	
10	360.041	36.40	14.58	9.17	31.47	28.68	46.00	17.3	Vert.	132	103	HB	

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]
Ant. Type=HB:Hybrid Antenna

UL Japan, Inc.

Kashima EMC Lab.

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Frequency Tolerance

Report No. 13320239M-R1
Test place Kashima EMC Lab. No.2 Measurement room
Date June 3, 2020
Temperature / Humidity 23 deg. C / 52 % RH
Engineer Kazuhiro Ando
Mode Transmitting mode

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- %]
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	5	Power on	13.560086	0.000086	0.00063	6.3	0.01
		+ 2 min.	13.560106	0.000106	0.00078	7.8	0.01
		+ 5 min.	13.560125	0.000125	0.00092	9.2	0.01
		+ 10 min.	13.560136	0.000136	0.00100	10.0	0.01
40	5	Power on	13.560085	0.000085	0.00063	6.3	0.01
		+ 2 min.	13.560089	0.000089	0.00066	6.6	0.01
		+ 5 min.	13.560097	0.000097	0.00072	7.2	0.01
		+ 10 min.	13.560102	0.000102	0.00075	7.5	0.01
30	5	Power on	13.560097	0.000097	0.00072	7.2	0.01
		+ 2 min.	13.560086	0.000086	0.00063	6.3	0.01
		+ 5 min.	13.560086	0.000086	0.00063	6.3	0.01
		+ 10 min.	13.560086	0.000086	0.00063	6.3	0.01
20	5	Power on	13.560109	0.000109	0.00080	8.0	0.01
		+ 2 min.	13.560092	0.000092	0.00068	6.8	0.01
		+ 5 min.	13.560088	0.000088	0.00065	6.5	0.01
		+ 10 min.	13.560086	0.000086	0.00063	6.3	0.01
20	4.5 (5V -10%)	Power on	13.560109	0.000109	0.00080	8.0	0.01
		+ 2 min.	13.560094	0.000094	0.00069	6.9	0.01
		+ 5 min.	13.560090	0.000090	0.00066	6.6	0.01
		+ 10 min.	13.560088	0.000088	0.00065	6.5	0.01
20	5.25 (5V +5%)	Power on	13.560108	0.000108	0.00080	8.0	0.01
		+ 2 min.	13.560091	0.000091	0.00067	6.7	0.01
		+ 5 min.	13.560087	0.000087	0.00064	6.4	0.01
		+ 10 min.	13.560086	0.000086	0.00063	6.3	0.01
10	5	Power on	13.560116	0.000116	0.00086	8.6	0.01
		+ 2 min.	13.560104	0.000104	0.00077	7.7	0.01
		+ 5 min.	13.560098	0.000098	0.00072	7.2	0.01
		+ 10 min.	13.560096	0.000096	0.00071	7.1	0.01
0	5	Power on	13.560107	0.000107	0.00079	7.9	0.01
		+ 2 min.	13.560115	0.000115	0.00085	8.5	0.01
		+ 5 min.	13.560110	0.000110	0.00081	8.1	0.01
		+ 10 min.	13.560107	0.000107	0.00079	7.9	0.01
-10	5	Power on	13.560076	0.000076	0.00056	5.6	0.01
		+ 2 min.	13.560119	0.000119	0.00088	8.8	0.01
		+ 5 min.	13.560118	0.000118	0.00087	8.7	0.01
		+ 10 min.	13.560117	0.000117	0.00086	8.6	0.01
-20	5	Power on	13.560014	0.000014	0.00010	1.0	0.01
		+ 2 min.	13.560109	0.000109	0.00080	8.0	0.01
		+ 5 min.	13.560118	0.000118	0.00087	8.7	0.01
		+ 10 min.	13.560120	0.000120	0.00088	8.8	0.01

Calculation formula: Frequency error = Measured frequency - Tested frequency
Result [%] = Frequency error / Tested frequency * 100

Tested frequency: 13.56 MHz
Limit (+/-): 0.01 % (+/- 100ppm)

*The specification of this EUT is DC 5 V -10 % to +5 %.

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	CBL-08	143121	LOGBICON	Schwarzbeck Mess – Elektronik	VULB 9168	343	2020/04/07	12
RE	CAT5-03	178806	5dB Fixed Atten.	PASTERNAK	PE7047-5	none	2020/04/01	12
RE	CCC-S10-R3	143165	10 Site RE 3m System	UL Japan Inc.	none	none	2019/08/04	12
RE	CAF-28	183880	Pre-Amplifier	UL Japan Inc.	ZKL-2	001	2020/04/14	12
RE	CTR-09	144199	Test Receiver	Keysight Technologies Inc	N9038A	MY53290016	2019/07/17	12
RE	KLP-01	143833	Loop Antenna	Rohde & Schwarz	HFH2-Z2	827779/008	2019/10/04	12
RE	CCC-M01	143161	Coaxial Cable	Fujikura,HP,Mini-Circuits, Fujikura	3D2W	none	2020/05/15	12
RE	CAT6-17	144245	6dB Fixed Atten.	Suhner	6906.01.A	none	2019/07/10	12
RE	CAF-24	171927	Pre Amplifier	UL Japan Inc.	GALI-84+	001	2019/07/12	12
RE	CCC-S10-C	143157	10 Site CE System	UL Japan Inc.	none	none	2019/08/04	12
RE	CSCL-13	143654	Ruler	TAJIMA	L19-55	none	-	-
RE	COS-10	143542	Temperature & Humidity Indicator	Hioki	3641/9680-50	090999895/090905406	2019/06/21	12
RE	CTS-14	144216	Digital Multimeter	Fluke Corporation	115	994460954	2019/10/27	12
RE, CE	COTS-CEMI-03	178804	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3 (RE,CE,ME,PE)	-	-	-
CE	CLS-11	143505	A.M.N.	Rohde & Schwarz	ESH3-Z5	835239/022	2019/07/08	12
CE	CCC-S5-C(2/9/10/11)	143167	Coaxial Cable	Fujikura,Fujikura,Fujikura, Fujikura	5D-2W,5D-2W, 5D-2W,5D-2W	-	2019/07/19	12
CE	CTR-06	143739	Test Receiver	Rohde & Schwarz	ESCI	100107	2019/09/27	12
CE	CSCL-06	143666	Ruler	TAJIMA	L19-55S	none	-	-
CE	COS-05	143537	Temperature & Humidity Indicator	A&D Company	AD-5681	6975761	2019/07/24	12
CE	CTS-09	144211	Digital Multimeter	Fluke Corporation	112	89790194	2019/10/27	12
FT	CSA-07	143643	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY52490024	2019/06/01	12
FT	CCH-04	143181	Temperature and Humidity Chamber	ESPEC	PL-1J	15004059	2019/07/26	12
FT	CFC-02	143423	Frequency Counter	Keysight Technologies Inc	53151A	US40511823	2020/04/08	12
FT	CTS-08	144210	Digital Multimeter	Fluke Corporation	112	89790193	2019/10/27	12
FT	COS-02	143534	Temperature & Humidity Indicator	A&D Company	AD-5681	6878345	2019/07/24	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:

CE: Conducted Emission
RE: Radiated Emission
FT: Frequency Tolerance

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