

# EMI TEST REPORT


Test Report No. : 12750387S-R1

**Applicant** : YASKAWA Electric Corporation  
**Type of Equipment** : RFID reader writer  
**Model No.** : EGM-20R3UM2Y  
**Test regulation** : FCC Part 15 Subpart C: 2018  
**FCC ID** : 2ATA6UM2Y  
**Test Result** : Complied (Refer to SECTION 3.2)

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Shonan 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 12750387S. 12750387S is replaced with this report.

**Date of test:** April 4 to 9, 2019

**Representative test engineer:**   
Makoto Hosaka  
Engineer  
Consumer Technology Division

**Approved by:**   
Hikaru Shirasawa  
Engineer  
Consumer Technology Division



CERTIFICATE 1266.03

- 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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<b>CONTENTS</b>	<b>PAGE</b>
<b>SECTION 1: Customer information.....</b>	<b>4</b>
<b>SECTION 2: Equipment under test (E.U.T.).....</b>	<b>4</b>
<b>SECTION 3: Test specification, procedures &amp; results.....</b>	<b>5</b>
<b>SECTION 4: Operation of E.U.T. during testing.....</b>	<b>8</b>
<b>SECTION 5: Conducted Emission.....</b>	<b>10</b>
<b>SECTION 6: Radiated emission (Fundamental , Spurious Emission and Spectrum Mask).....</b>	<b>11</b>
<b>SECTION 7: 20 dB bandwidth &amp; Occupied bandwidth(99 %).....</b>	<b>14</b>
<b>SECTION 8: Frequency Tolerance.....</b>	<b>14</b>
<b>APPENDIX 1: Test data .....</b>	<b>15</b>
Conducted Emission.....	15
Radiated Emission.....	18
Frequency Tolerance .....	20
20 dB Bandwidth and 99 % Occupied Bandwidth .....	23
<b>APPENDIX 2: Test instruments .....</b>	<b>26</b>
<b>APPENDIX 3: Photographs of test setup .....</b>	<b>27</b>
Conducted Emission.....	27
Radiated Emission.....	28
Tag used for the test as representative.....	29

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## **SECTION 1: Customer information**

Company Name : YASKAWA Electric Corporation  
Address : 2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu-shi, Fukuoka-ken  
Telephone Number : +81-930-23-4804  
Facsimile Number : +81-930-25-4369  
Contact Person : Yuji Tashima

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 : RFID reader writer  
Model No. : EGM-20R3UM2Y  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 5.0 V (USB)  
Receipt Date of Sample : April 4, 2019  
(Information from test lab.)  
Country of Mass-production : Japan  
Condition of EUT : Production model  
Modification of EUT : No Modification by the test lab

### **2.2 Product Description**

Model: EGM-20R3UM2Y (referred to as the EUT in this report) is a RFID reader writer.

### **Radio Specification**

Radio Type : Transceiver  
Frequency of Operation : 13.56 MHz  
Modulation : ASK  
Antenna type : Loop antenna  
Clock frequency (Maximum) : 20 MHz  
Operating Temperature : 0 deg. C. to +50 deg. C

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## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

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.

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

### **3.2 Procedures and results**

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.207	16.0 dB (0.47623 MHz, AV, N)	Complied a)	-
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.225 (a)	63.7 dB (Vertical, QP)	Complied b)	Radiated
	IC: RSS-Gen 6.4, 6.12	IC: RSS-210 B.6			
Electric Field Strength of Spurious Emission (within the 13.110-14.010 MHz band)	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.225 (b)(c)	44.2 dB (13.567 MHz, Vertical, QP)	Complied c)	Radiated
	IC: RSS-Gen 6.4, 6.13	IC: RSS-210 B.6			
Electric Field Strength of Spurious Emission (outside of the 13.110- 14.010 MHz band)	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.209 Section 15.225 (d)	6.3 dB (569.534 MHz, Horizontal, QP)	Complied d)	Radiated
	IC: RSS-Gen 6.4, 6.13	IC: RSS-210 B.6			
20dB Bandwidth	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.215 (c)	-	Complied e)	Radiated
	IC: -	IC: -			
Frequency tolerance	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.225 (e)	-	Complied f)	Radiated
	IC: RSS-Gen 6.11, 8.11	IC: RSS-210 B.6			

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 Electric Field Strength of Fundamental Emission)  
c) Refer to APPENDIX 1 (data of Electric Field Strength of Spurious Emission (within the 13.110-14.010 MHz band))  
d) Refer to APPENDIX 1 (data of Electric Field Strength of Spurious Emission (outside of the 13.110-14.010 MHz band))  
e) Refer to APPENDIX 1 (data of 20dB Bandwidth and 99% Occupied Bandwidth)  
f) 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.

#### **FCC Part 15.31 (e)**

The stable voltage was supplied by the end product which was required to have a power supply regulator.

Therefore, the EUT complies with the requirement.

However, the supply voltage was varied and tested at 85 % and 115 % of the nominal rated supply voltage during frequency tolerance test according to Section 15.225(e).

#### **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.

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### 3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Band Width	<IC>RSS-Gen 6.7	-	N/A	- f)	Radiated

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

f) Refer to APPENDIX 1 (data of 20dB Bandwidth and 99% Occupied Bandwidth)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

Other than above, no addition, exclusion nor deviation has been made from the standard.

### 3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

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

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Item	Frequency range	Uncertainty (+/-)		
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.9 dB	2.8 dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	3.0 dB	3.1 dB
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.7 dB
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.1 dB
	1 GHz-6 GHz	4.8 dB	4.8 dB	4.8 dB

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Bandwidth Measurement	0.61 %
Temperature	0.59 deg.C.
Voltage	0.74 %
Humidity	3.6 %

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### 3.5 Test Location

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A2LA Certificate Number: 1266.03  
FCC Test Firm Registration Number: 626366

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

### 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)**

Test item	Operating mode	Tested frequency
All items except for Frequency Tolerance	NFC Communication	13.56 MHz
Frequency Tolerance	NFC Transmitting (Unmodulated)	13.56 MHz

Software: CardReader for EGM-20R3U ver.: 1.03

Power setting: Fixed

The carrier level and noise levels were confirmed with and without Tag, and the test was made with the condition that has the maximum noise.

Worst case: Refer to the test data

Frequency Tolerance:

Temperature : -20 deg. C. to +50 deg. C Step 10 deg. C

Voltage : Normal Voltage DC 5.0 V

Maximum Voltage DC 5.75 V,

Minimum Voltage DC 4.25 V (DC 5.0 V  $\pm$ 15 %)

\*This EUT provides stable voltage constantly to RF Part regardless of input voltage

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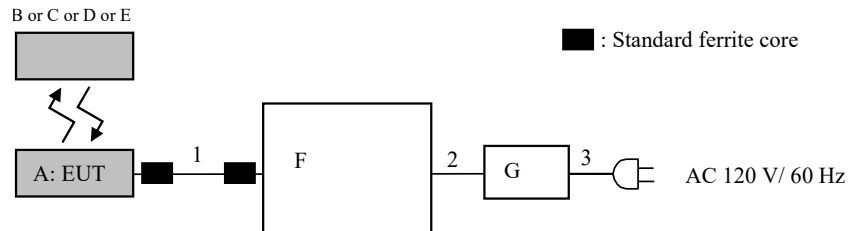
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## 4.2 Configuration and peripherals



\* 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	RFID reader writer	EGM-20R3UM2Y	Y0102 Y0102C *1)	YASKAWA Electric Corporation	EUT
B	Tag	FRAM	ct101	FUJITSU	EUT
C	Tag	Tag-it	P133	SATO	EUT
D	Tag	I CODE-SLI P100(50)xW50	itl001	SATO	EUT
E	Tag	I CODE-SLI P86xW54	its001	SATO	EUT
F	Laptop Computer	dynabook Satellite B453 M	ZE127581H	TOSHIBA	-
G	AC Adapter	PA3917U-1ACA	G71C000DP410	TOSHIBA	-

\*1) Used for Conducted Emission test.(Antenna terminated)

### List of cables used

No.	Cable Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	1.0	Shielded	Shielded	Accessory of EUT
2	DC	1.8	Unshielded	Unshielded	-
3	AC	1.8	Unshielded	Unshielded	-

## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

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, 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.

#### 1) For the tests on EUT with other peripherals (as a whole system)

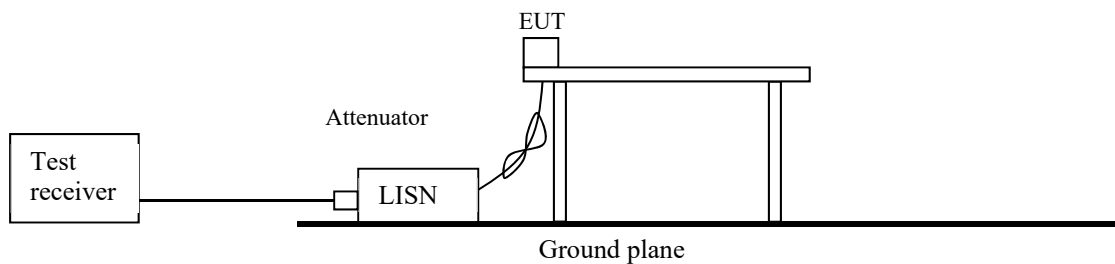
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

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.

[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

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

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

Frequency: From 9 kHz to 30 MHz

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

\*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz

The measuring antenna height varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

**Test Antennas are used as below;**

Frequency	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

	9 kHz to 90 kHz & 110 kHz to 150 kHz	90 kHz to 110 kHz	150 kHz to 490 kHz	490 kHz to 30 MHz	30 MHz to 1 GHz
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Distance factor *1)	-80 dB	-80 dB	-80 dB	-40 dB	-
Measuring antenna	Loop antenna				Biconical (30 MHz - 199.99 MHz) Logperiodic (200 MHz - 1 GHz)

\*1) FCC 15.31 (f)(2) (9 kHz-30 MHz)

Distance Factor:  $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

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.

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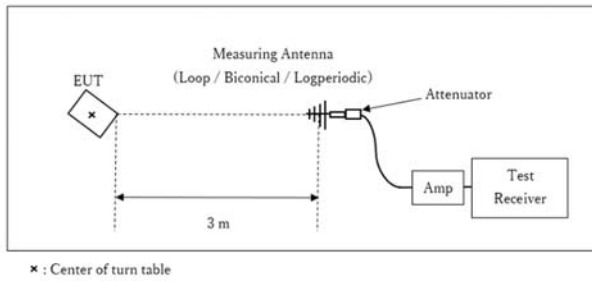
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[Test Setup]  
Below 1 GHz



Test Distance: 3 m

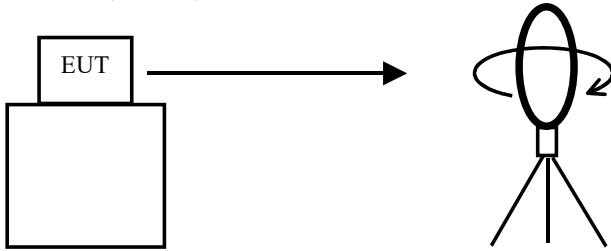
The test was made on EUT at the normal use position.

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

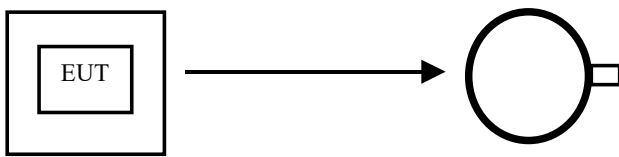
**Measurement range** : 9 kHz - 1 GHz  
**Test data** : APPENDIX 1  
**Test result** : Pass

**Figure 1: Direction of the Loop Antenna**

*Side View (Vertical)*

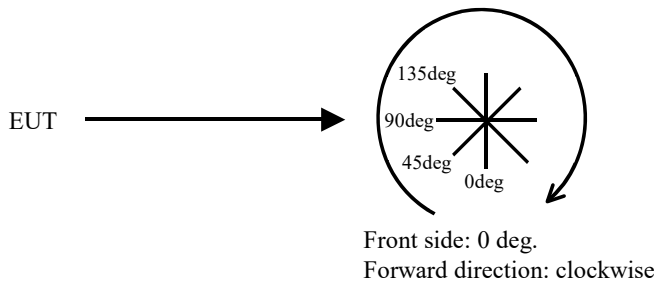


*Top View (Horizontal)*

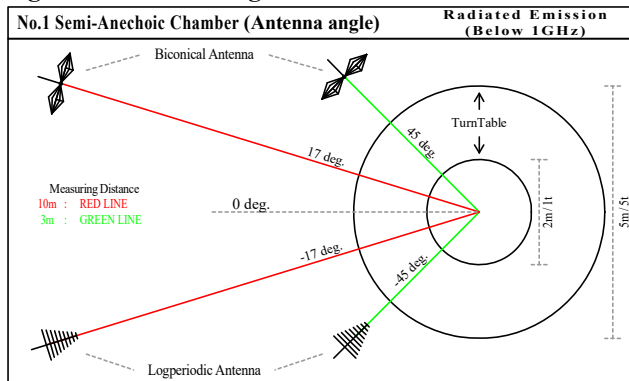


Antenna was not rotated.

*Top View (Vertical)*



**Figure 2: Antenna angle**



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## **SECTION 7: 20 dB bandwidth & Occupied bandwidth(99 %)**

### **Test Procedure**

The test was measured with spectrum analyzer using a test fixture.

<b>Test</b>	<b>Span</b>	<b>RBW</b>	<b>VBW</b>	<b>Sweep</b>	<b>Detector</b>	<b>Trace</b>
20 dB Bandwidth	2 to 5 times of OBW	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold

**Test data** : APPENDIX  
**Test result** : Pass

## **SECTION 8: Frequency Tolerance**

### **Test Procedure**

The test was measured with frequency counter using a test fixture.  
The temperature 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

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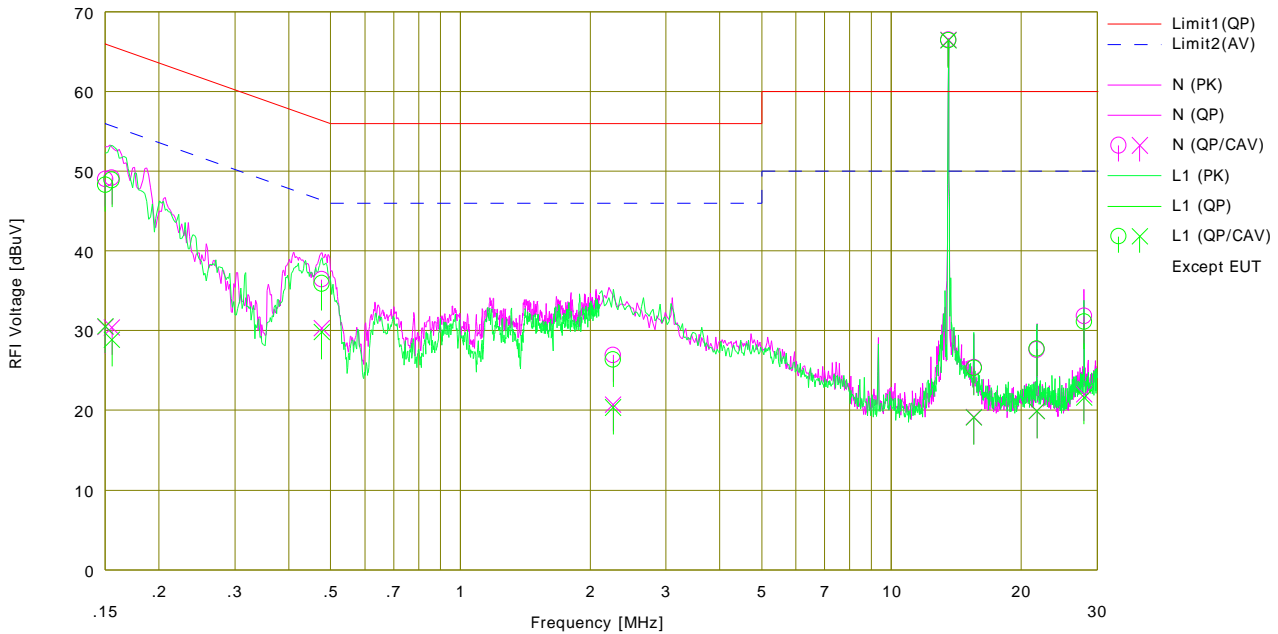
# DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room  
Date : 2019/04/04

Company	: YASKAWA Electric Corporation	Mode	: NFC Communication
Kind of EUT	: RFID reader writer	Order No.	: 12750387S
Model No.	: EGM-20R3UM2Y	Power	: DC 5.0 V (USB)
Serial No.	: Y0102	Temp./Humi.	: 21 deg.C / 25 %RH
Remarks	: without Tag, Refer to the data on the next page for the carrier frequency(13.56 MHz).		

Limit : FCC\_Part 15 Subpart C(15.207)

Engineer : Makoto Hosaka



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<CAV> [dBuV]		<QP> [dBuV]	<CAV> [dBuV]	<QP> [dB]	<AV> [dB]	<QP> [dB]	<AV> [dB]		
1	0.15000	36.50	18.00	12.49	48.99	30.49	66.00	56.00	17.0	25.5	N	
2	0.15560	36.70	17.90	12.48	49.18	30.38	65.70	55.70	16.5	25.3	N	
3	0.47623	23.90	17.80	12.51	36.41	30.31	56.40	46.40	19.9	16.0	N	
4	2.26448	14.30	8.10	12.65	26.95	20.75	56.00	46.00	29.0	25.2	N	
5	13.56000	53.30	53.30	13.21	66.51	66.51	60.00	50.00	-6.6	-16.6	N	Reference
6	15.54115	12.10	5.90	13.28	25.38	19.18	60.00	50.00	34.6	30.8	N	
7	21.75400	14.10	6.40	13.50	27.60	19.90	60.00	50.00	32.4	30.1	N	
8	27.97590	18.10	8.30	13.71	31.81	22.01	60.00	50.00	28.1	27.9	N	
9	0.15000	35.80	18.10	12.49	48.29	30.59	66.00	56.00	17.7	25.4	L1	
10	0.15560	36.40	16.40	12.48	48.88	28.88	65.70	55.70	16.8	26.8	L1	
11	0.47623	23.40	17.30	12.51	35.91	29.81	56.40	46.40	20.4	16.5	L1	
12	2.26448	13.70	7.70	12.65	26.35	20.35	56.00	46.00	29.6	25.6	L1	
13	13.56000	53.20	53.20	13.21	66.41	66.41	60.00	50.00	-6.5	-16.5	L1	Reference
14	15.54115	12.00	5.80	13.28	25.28	19.08	60.00	50.00	34.7	30.9	L1	
15	21.75400	14.20	6.40	13.50	27.70	19.90	60.00	50.00	32.3	30.1	L1	
16	27.97590	17.40	7.90	13.71	31.11	21.61	60.00	50.00	28.8	28.3	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]  
LISN(AMN)=SLS-01

# DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room  
Date : 2019/04/04

Company : YASKAWA Electric Corporation  
 Kind of EUT : RFID reader writer  
 Model No. : EGM-20R3UM2Y  
 Serial No. : Y0102C  
 Remarks : Antenna:terminated

Mode : NFC Communication  
 Order No. : 12750387S  
 Power : DC 5.0 V (USB)  
 Temp./Humi. : 21 deg.C / 25 %RH

Limit : FCC\_Part 15 Subpart C(15.207)

Engineer : Makoto Hosaka

<< QP/CAV DATA >>

No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<CAV> [dBuV]		<QP> [dBuV]	<CAV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
		1	13.56000		11.30	7.20	13.21	24.51	20.41	60.00		
2	13.56000	11.30	7.10	13.21	24.51	20.31	60.00	50.00	35.4	29.6	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]  
 LISN(AMN)=SLS-01



## Data of Electric field strength of Fundamental emission and Spurious emission within the band: FCC15.225(a)(b)(c)

UL Japan, Inc.  
Shonan EMC Lab., No.1 Semi Anechoic Chamber

Company: YASKAWA Electric Corporation	Regulation: FCC Part15 Subpart C 15.225
Equipment: RFID reader writer	Test Distance: 3m
Model: EGM-20R3UM2Y	Date: April 4, 2019
Sample No.: Y0102	Temperature: 19 deg.C
Power: DC 5.0 V (USB)	Humidity: 25 %RH
Mode: NFC Communication	ENGINEER: Makoto Hosaka

Remarks: :(Hor) I CODE-SLI P100(50)xW50, with Tag  
:(Ver) I CODE-SLI P86xW54, with Tag , Vertical polarization (antenna angle) of the worst case: 135 deg

### Fundamental emission

No.	FREQ [MHz]	Test Receiver Reading		Antenna Factor [dB/m]	Loss [dB]	AMP GAIN [dB]	Distance factor [dB]	RESULT		LIMIT (30m) [dBuV/m]	MARGIN	
		Hor [dBuV]	Ver [dBuV]					Hor [dBuV/m]	Ver [dBuV/m]		Hor [dB]	Ver [dB]
1	13.560	60.8	66.6	18.7	6.7	31.9	-40.0	14.3	20.2	83.9	69.6	63.7

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]+Distance factor[dB]

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

Limits (30m)

•13.553MHz to 13.567MHz : 83.9dBuV/m (FCC 15.225(a))

### Spurious emission within the band

No.	FREQ [MHz]	Test Receiver Reading		Antenna Factor [dB/m]	Loss [dB]	AMP GAIN [dB]	Distance factor [dB]	RESULT		LIMIT (30m) [dBuV/m]	MARGIN	
		Hor [dBuV]	Ver [dBuV]					Hor [dBuV/m]	Ver [dBuV/m]		Hor [dB]	Ver [dB]
1	13.110	29.6	29.6	18.7	6.7	31.9	-40.0	-16.9	-16.9	29.5	46.4	46.4
2	13.410	29.7	29.7	18.7	6.7	31.9	-40.0	-16.8	-16.8	40.5	57.3	57.3
3	13.553	45.4	51.2	18.7	6.7	31.9	-40.0	-1.1	4.7	50.4	51.5	45.7
4	13.567	46.9	52.7	18.7	6.7	31.9	-40.0	0.4	6.2	50.4	50.0	44.2
5	13.710	29.6	29.7	18.7	6.7	31.9	-40.0	-16.8	-16.8	40.5	57.3	57.3
6	14.010	29.7	29.7	18.7	6.7	31.9	-40.0	-16.8	-16.8	29.5	46.3	46.3

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]+Distance factor[dB]

Outside filed strength frequencies

•Fc±7kHz:13.553MHz to 13.567MHz

•Fc±150kHz:13.410MHz to 13.710MHz

•Fc±450kHz:13.110MHz to 14.010MHz

Fc = 13.56MHz

Limits (30m)

•13.410MHz to 13.553MHz and 13.567MHz to 13.710MHz : 50.4dBuV/m (FCC 15.225(b))

•13.110MHz to 13.410MHz and 13.710MHz to 14.010MHz : 40.5dBuV/m (FCC 15.225(c))

•Below 13.110MHz and Above 14.010MHz : 29.5dBuV/m (FCC 15.225(d)and FCC 15.209)

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## Radiated Emission

UL Japan, Inc.

Shonan EMC Lab. No.1 Semi Anechoic Chamber

Company: YASKAWA Electric Corporation  
 Equipment: RFID reader writer  
 Model: EGM-20R3UM2Y  
 Sample No.: Y0102  
 Power: DC 5.0 V (USB)  
 Mode: NFC Communication  
 EUT axis: Below 30 MHz (1 CODE-SLI P100(50)xW50, with Tag , Vertical polarization (antenna angle) of the worst case: 90 deg )  
 Above 30MHz, without Tag

Regulation: FCC Part15 Subpart C 15.225  
 Test Distance: 3m  
 Date: April 4, 2019 April 8, 2019  
 Temperature: 19 deg.C 20 deg.C  
 Humidity: 25 %RH 31 %RH  
 ENGINEER: Makoto Hosaka Takahiro Kawakami

Remarks:

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	27.91	QP	29.4	18.3	7.0	31.8	-40.0	-17.2	29.5	46.7	-	354	* Limit: 30m
Hori.	379.639	QP	43.6	15.8	7.4	31.8	0.0	35.0	46.0	11.0	198	346	
Hori.	393.277	QP	41.7	16.2	7.5	31.8	0.0	33.6	46.0	12.4	201	348	
Hori.	569.534	QP	44.6	18.8	8.2	32.0	0.0	39.7	46.0	<b>6.3</b>	173	95	
Hori.	596.665	QP	42.5	18.9	8.3	32.0	0.0	37.7	46.0	8.3	166	92	
Hori.	610.265	QP	33.9	19.0	8.4	32.0	0.0	29.4	46.0	16.6	144	24	
Hori.	664.505	QP	34.5	19.7	8.6	32.0	0.0	30.8	46.0	15.3	248	16	
Hori.	894.96	QP	34.7	22.1	9.7	31.4	0.0	35.1	46.0	10.9	103	79	
Vert.	27.91	QP	44.6	18.3	7.0	31.8	-40.0	-2.0	29.5	31.5	-	59	* Limit: 30m
Vert.	34.10	QP	37.4	17.1	7.1	31.8	0.0	29.8	40.0	10.2	100	153	
Vert.	89.731	QP	45.7	8.3	8.4	31.8	0.0	30.5	43.5	13.0	100	136	
Vert.	119.963	QP	40.1	13.1	8.2	31.8	0.0	29.5	43.5	14.0	100	247	
Vert.	569.568	QP	40.1	18.8	8.2	32.0	0.0	35.2	46.0	10.8	107	173	

Result = Reading + Ant Factor + Loss (Cable+ATT+ΔAF(above 30MHz)) - Gain(Amplifier) + Distance factor(below 30MHz)

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

\* Carrier level (Result at 3m): Hor= 54.3dBuV/m, Ver= 60.2 dBuV/m

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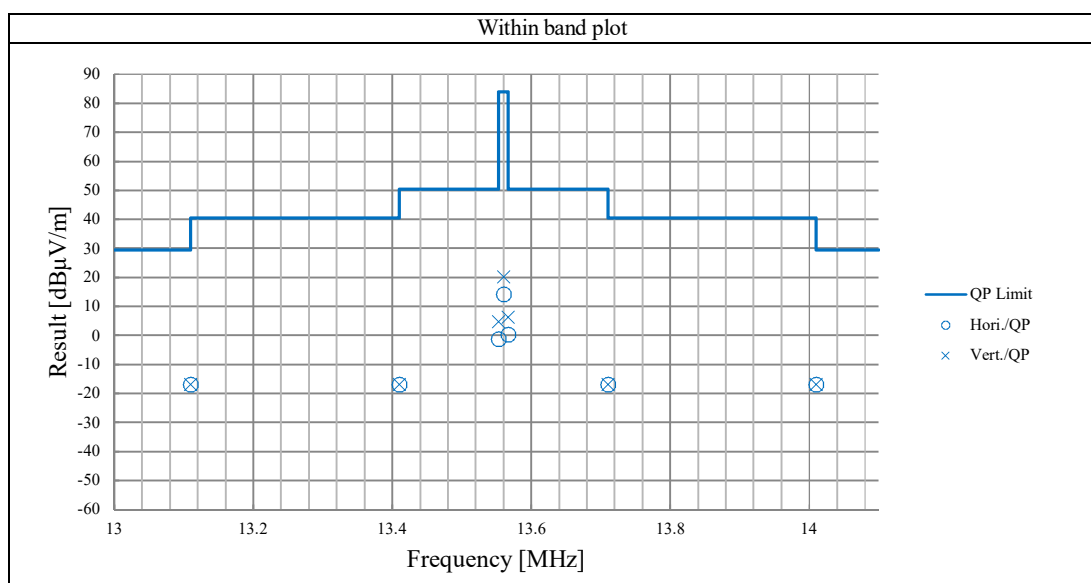
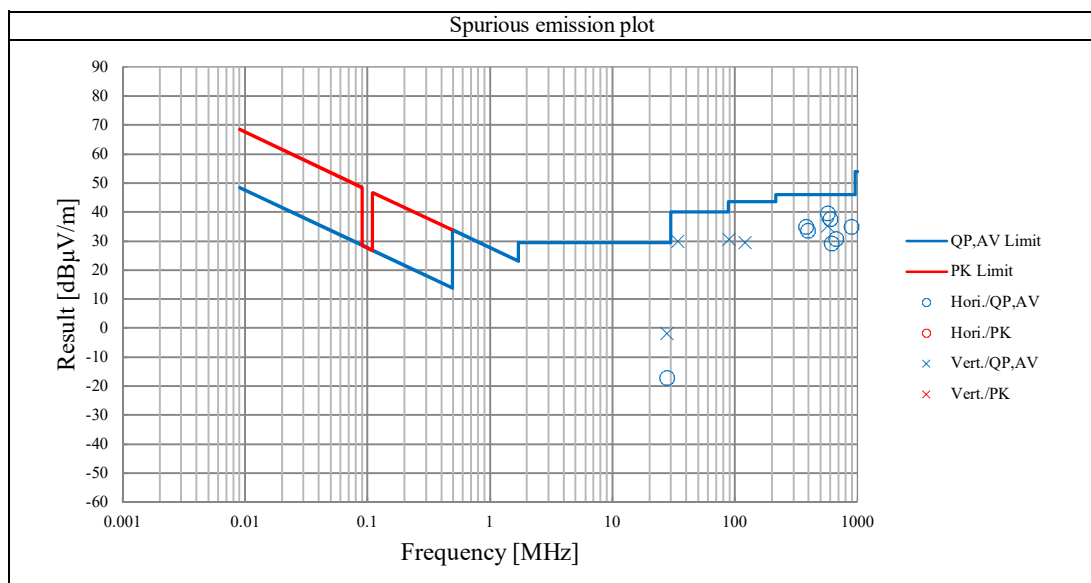
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## Radiated Emission (Worst mode plot)

UL Japan, Inc.  
Shonan EMC Lab. No.1 Semi Anechoic Chamber

Company:	YASKAWA Electric Corporation	Regulation:	FCC Part15 Subpart C 15.225
Equipment:	RFID reader writer	Test Distance:	3m
Model:	EGM-20R3UM2Y	Date:	April 4, 2019    April 8, 2019
Sample No.:	Y0102	Temperature:	19 deg.C    20 deg.C
Power:	DC 5.0 V (USB)	Humidity:	25 %RH    31 %RH
Mode:	NFC Communication	ENGINEER:	Makoto Hosaka Takahiro Kawakami
EUT axis:	Below 30 MHz (1 CODE-SLI P100(50)xW50, with Tag , Vertical polarization (antenna angle) of the worst case: 90 deg ) Above 30MHz, without Tag		
Remarks:	These plots data contains sufficient number to show the trend of characteristic features for EUT.		



## Data of Frequency Tolerance

UL Japan, Inc.

Shonan EMC Lab. No.5 Shielded room

Company YASKAWA Electric Corporation  
 Equipment RFID reader writer  
 Model EGM-20R3UM2Y  
 Serial No. Y0102  
 Power DC 5.0 V (USB)  
 Mode NFC Transmitting(Unmodulated)

Regulation FCC Part15 Subpart C 15.225 (e)  
 Date April 9, 2019  
 Temperature 22 deg.C  
 Humidity 48 %RH  
 ENGINEER Takahiro Kawakami

### Temperature Variation: -20deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560188	0.000188	0.00139	0.010
after 2minutes	13.56	13.560188	0.000188	0.00139	0.010
after 5minutes	13.56	13.560188	0.000188	0.00139	0.010
after 10minutes	13.56	13.560187	0.000187	0.00138	0.010

### Temperature Variation: -10deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560216	0.000216	0.00159	0.010
after 2minutes	13.56	13.560217	0.000217	0.00160	0.010
after 5minutes	13.56	13.560217	0.000217	0.00160	0.010
after 10minutes	13.56	13.560217	0.000217	0.00160	0.010

### Temperature Variation: 0deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560223	0.000223	0.00164	0.010
after 2minutes	13.56	13.560224	0.000224	0.00165	0.010
after 5minutes	13.56	13.560224	0.000224	0.00165	0.010
after 10minutes	13.56	13.560224	0.000224	0.00165	0.010

### Temperature Variation: 10deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560216	0.000216	0.00159	0.010
after 2minutes	13.56	13.560216	0.000216	0.00159	0.010
after 5minutes	13.56	13.560216	0.000216	0.00159	0.010
after 10minutes	13.56	13.560216	0.000216	0.00159	0.010

### Temperature Variation: 20deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560215	0.000215	0.00158	0.010
after 2minutes	13.56	13.560258	0.000258	0.00190	0.010
after 5minutes	13.56	13.560203	0.000203	0.00150	0.010
after 10minutes	13.56	13.560202	0.000202	0.00149	0.010

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## Data of Frequency Tolerance

### Temperature Variation: 30deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560187	0.000187	0.00138	0.010
after 2minutes	13.56	13.560187	0.000187	0.00138	0.010
after 5minutes	13.56	13.560187	0.000187	0.00138	0.010
after 10minutes	13.56	13.560187	0.000187	0.00138	0.010

### Temperature Variation: 40deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560179	0.000179	0.00132	0.010
after 2minutes	13.56	13.560179	0.000179	0.00132	0.010
after 5minutes	13.56	13.560179	0.000179	0.00132	0.010
after 10minutes	13.56	13.560179	0.000179	0.00132	0.010

### Temperature Variation: 50deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560181	0.000181	0.00133	0.010
after 2minutes	13.56	13.560182	0.000182	0.00134	0.010
after 5minutes	13.56	13.560183	0.000183	0.00135	0.010
after 10minutes	13.56	13.560186	0.000186	0.00137	0.010

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## Data of Frequency Tolerance

UL Japan, Inc.

Shonan EMC Lab. No.5 Shielded room

Company YASKAWA Electric Corporation  
 Equipment RFID reader/writer  
 Model EGM-20R3UM2Y  
 Serial No. Y0102  
 Power DC 5.0 V (USB)  
 Mode NFC Transmitting(Unmodulated)

Regulation FCC Part15 Subpart C 15.225 (e)  
 Date April 9, 2019  
 Temperature 22 deg.C  
 Humidity 48 %RH  
 ENGINEER Takahiro Kawakami

### Voltage Variation: DC 4.25 V

### Temperature Variation: 20deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560190	0.000190	0.00140	0.010
after 2minutes	13.56	13.560191	0.000191	0.00141	0.010
after 5minutes	13.56	13.560192	0.000192	0.00142	0.010
after 10minutes	13.56	13.560192	0.000192	0.00142	0.010

### Voltage Variation: DC 5.75 V

### Temperature Variation: 20deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560214	0.000214	0.00158	0.010
after 2minutes	13.56	13.560211	0.000211	0.00156	0.010
after 5minutes	13.56	13.560210	0.000210	0.00155	0.010
after 10minutes	13.56	13.560209	0.000209	0.00154	0.010

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## 20dB bandwidth & 99% Occupied bandwidth: FCC 15.215 / RSS-Gen

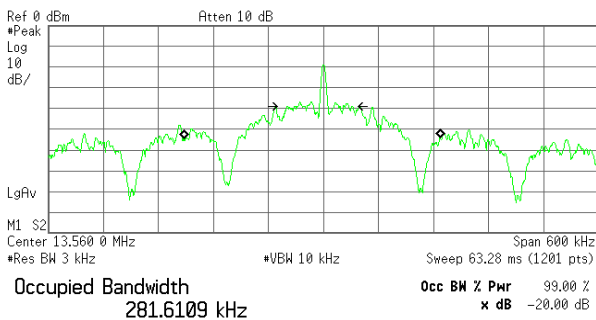
UL Japan, Inc.  
 Shonan EMC Lab. No.5 Shielded Room

Company: YASKAWA Electric Corporation  
 Equipment: RFID reader writer  
 Model: EGM-20R3UM2Y  
 Sample No.: Y0102  
 Power: DC 5.0 V (USB)  
 Mode: NFC Communication

Regulation: FCC Part15 Subpart C 15.215  
 Date: April 9, 2019  
 Temperature: 22 deg.C  
 Humidity: 48 %RH  
 ENGINEER: Takahiro Kawakami

### FRAM

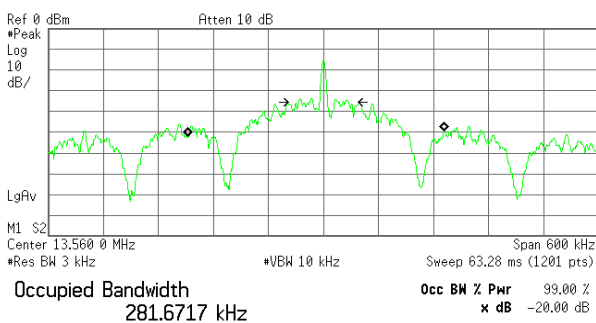
**20dB Bandwidth:** 67.812 kHz  
**99 % Occupied Bandwidth:** 281.611 kHz  
 \* Agilent R T



Transmit Freq Error -12.342 kHz  
 x dB Bandwidth 67.812 kHz

### Tag-it

**20 dB Bandwidth:** 55.483 kHz  
**99 % Occupied Bandwidth:** 281.672 kHz  
 \* Agilent R T



Transmit Freq Error -8.177 kHz  
 x dB Bandwidth 55.483 kHz

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## 20dB bandwidth & 99% Occupied bandwidth: FCC 15.215 / RSS-Gen

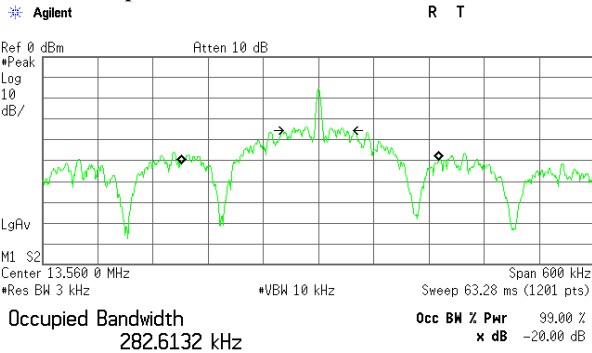
UL Japan, Inc.  
 Shonan EMC Lab. No.5 Shielded Room

Company: YASKAWA Electric Corporation  
 Equipment: RFID reader/writer  
 Model: EGM-20R3UM2Y  
 Sample No.: Y0102  
 Power: DC 5.0 V (USB)  
 Mode: NFC Communication

Regulation: FCC Part15 Subpart C 15.215  
 Date: April 9, 2019  
 Temperature: 22 deg.C  
 Humidity: 48 %RH  
 ENGINEER: Takahiro Kawakami

### I CODE-SLI P100(50)xW50

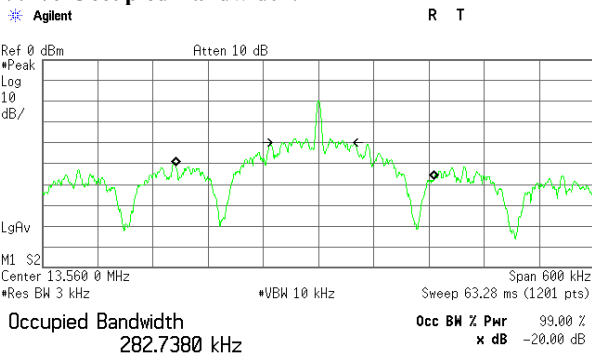
**20dB Bandwidth:** 55.869 kHz  
**99 % Occupied Bandwidth:** 282.613 kHz



Transmit Freq Error -9.152 kHz  
 x dB Bandwidth 55.869 kHz

### I CODE-SLI P86xW54

**20 dB Bandwidth:** 67.757 kHz  
**99 % Occupied Bandwidth:** 282.738 kHz



Transmit Freq Error -14.852 kHz  
 x dB Bandwidth 67.757 kHz

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## 20dB bandwidth & 99% Occupied bandwidth: FCC 15.215 / RSS-Gen

UL Japan, Inc.  
Shonan EMC Lab. No.5 Shielded Room

Company: YASKAWA Electric Corporation  
 Equipment: RFID reader/writer  
 Model: EGM-20R3UM2Y  
 Sample No.: Y0102  
 Power: DC 5.0 V (USB)  
 Mode: NFC Communication

Regulation: FCC Part15 Subpart C 15.215  
 Date: April 9, 2019  
 Temperature: 22 deg.C  
 Humidity: 48 %RH  
 ENGINEER: Takahiro Kawakami

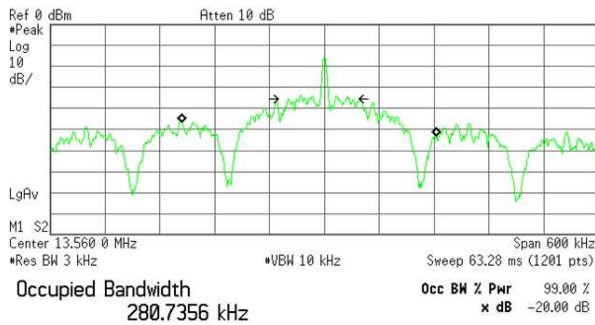
**without Tag**

**20dB Bandwidth:** 67.496 kHz

**99 % Occupied Bandwidth:** 280.736 kHz

※ Agilent

R T



Transmit Freq Error -16.451 kHz  
 x dB Bandwidth 67.496 kHz

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**APPENDIX 2**

## Test Instruments

## EMI test equipment

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SAT3-13	CE	150923	Attenuator	JFW	50HF-003N		2019/1/25	2020/1/31	12
SCC-A12/A13/SRS E-01	CE	144966	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-269(RF Selector)	2018/4/9	2019/4/30	12
SLS-01	CE	145538	LISN	Rohde & Schwarz	ENV216	100511	2019/2/19	2020/2/29	12
SOS-16	CE	167990	Humidity Indicator	CUSTOM	CTH-202	708Q08R	2019/1/11	2020/1/31	12
COTS-SEMI-5	CE,RE	170932	EMI Software	TSJ	TEPTO-DV3(RE,CE,ME,PE)	-	-	-	-
KJM-09	CE,RE	145929	Measure	KOMELON	KMC-36	-	-	-	-
SAF-01	CE,RE	145003	Pre Amplifier	SONOMA	310N	290211	2019/2/5	2020/2/29	12
STR-06	CE,RE	146208	Test Receiver	Rohde & Schwarz	ESCI	101259	2019/3/19	2020/3/31	12
STS-01	CE,RE	145792	Digital Hitester	HIOKI	3805-50	80997812	2018/10/16	2019/10/31	12
KSA-08	FT,BW	145089	Spectrum Analyzer	AGILENT	E4446A	MY46180525	2018/10/7	2019/10/31	12
SCH-01	FT,BW	145200	Temperature and Humidity Chamber	ESPEC	PL-1KT	14020837	2018/4/11	2019/4/30	12
SOS-19	FT,BW	175823	Humidity Indicator	CUSTOM	CTH-201	-	2018/12/5	2019/12/31	12
SSCA-01	FT,BW	146178	Search coil	Langer	RF-R 400-1	02-0634	-	-	-
STS-05	FT,BW	146212	Digital Hitester	HIOKI	3805-50	80997828	2018/10/16	2019/10/31	12
KAT6-04	RE	144899	Attenuator	Inmet	18N-6dB	-	2018/12/25	2019/12/31	12
KBA-01	RE	146343	Biconical Antenna	Schwarzbeck	BBA9106	1748	2018/6/22	2019/6/30	12
SAEC-01(NSA)	RE	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2019/4/2	2020/4/30	12
SAT3-09	RE	144959	Attenuator	JFW	50HF-003N	-	2018/8/23	2019/8/31	12
SAT6-12	RE	145158	Attenuator	THROSE ELECTRIC CO., LTD	AT-406(40)	-	2018/8/23	2019/8/31	12
SCC-A1/A3/A5/A7/A8/A13/SRSE-01	RE	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/141PE/141PE	-/0901-269(RF Selector)	2018/4/9	2019/4/30	12
SCC-A2/A4/A6/A7/A8/A13/SRSE-01	RE	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/141PE	-/0901-269(RF Selector)	2018/4/9	2019/4/30	12
SLA-01	RE	145531	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP9108-A0888	2018/6/29	2019/6/30	12
SLP-02	RE	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2018/10/10	2019/10/31	12
SOS-01	RE	146316	Humidity Indicator	A&D	AD-5681	4062555	2018/10/25	2019/10/31	12

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

BW: Bandwidth measurement