



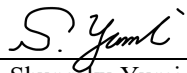
RADIO TEST REPORT

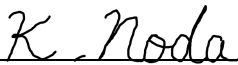
Test Report No. : 14033706S-A-R1

Applicant : YASKAWA Electric Corporation
Type of EUT : RFID reader writer
Model Number of EUT : EGM-XR3BTY
Test regulation : FCC Part 15 Subpart C: 2021
FCC ID : 2ATA6XR3BTY
Test Result : **Complied (Refer to SECTION 3)**

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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. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan, Inc. 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 14033706S-A. 14033706S-A is replaced with this report.

Date of test: December 15 to 20, 2021

Representative test engineer: 
Shunsaku Yumi
Engineer

Approved by: 
Kazuya Noda
Leader



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".

UL Japan, Inc.
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1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
Telephone : +81 463 50 6400
Facsimile : +81 463 50 6401

REVISION HISTORY

Original Test Report No.: 14033706S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	14033706S-A	January 17, 2022	-	-
1	14033706S-A-R1	January 21, 2022	11	Added ISO 15693 to Remarks of “Description of EUT and Support equipment”. Added Note *3) to “List of cables used”.

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		

UL Japan, Inc.

Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

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SECTION 1: Customer information

Company Name	:	YASKAWA Electric Corporation
Address	:	2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu-shi, Fukuoka Japan 806-0004
Telephone Number	:	+81-930-23-4804
Contact Person	:	Ryuichiro Tokuyama

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	:	RFID reader writer
Model Number	:	EGM-XR3BTY
Serial Number	:	Refer to 4.2
Condition	:	Production model
Receipt Date	:	December 14, 2021
Modification	:	No modification by the test lab.

2.2 Product Description

Model: EGM-XR3BTY (referred to as the EUT in this report) is an RFID reader writer.

General specification

Rating	:	DC 3.7 V, 1050 mAh (Lithium ion battery)
Size	:	57.3 mm x 92.3 mm x 29.5 mm (Width x Depth x Height (mm))
Clock frequency (ies) in the system	:	Bluetooth 2.5 GHz (max)

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	13.56 MHz
Modulation	:	ASK
Antenna Type	:	Loop antenna
Operating Temperature	:	0 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 3, 2021 and effective July 2, 2021

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	ANSI C63.10:2013 6 Standard test methods	Section 15.207	8.8 dB, 13.56 MHz, QP, N, with Tag (Tag1)	Complied a)	-
	<ISED>RSS-Gen 8.8	<ISED>RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.225(a)	71.5 dB, 13.560 MHz, QP,Vertical, 0 deg. with Tag (Tag1)	Complied b)	Radiated
	<ISED> RSS-Gen 6.4, 6.12	<ISED>RSS-210 B.6			
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods	Section 15.225(b)(c)	41.7 dB, 13.110 MHz, QP,Vertical, 0 deg. with Tag (Tag1).	Complied b)	Radiated
	<ISED>RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6			
20 dB Bandwidth	ANSI C63.10:2013 6 Standard test methods	Section15.215(c)	See data	Complied c)	Radiated
	<ISED> -	<ISED> -			
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.209, Section 15.225 (d)	0.1 dB 40.680 MHz, Vertical, QP, with Tag (Tag2).	Complied# d)	Radiated
	<ISED>RSS-Gen 6.4, 6.13	<ISED>RSS-210 B.6			
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods	Section 15.225(e)	See data	Complied e)	Radiated
	<ISED>RSS-Gen 6.11, 8.11	<ISED> 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 and Spurious emission within the band)
c) Refer to APPENDIX 1 (data of 20 dB Bandwidth and 99 % Occupied Bandwidth)
d) Refer to APPENDIX 1 (data of Radiated 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.

UL Japan, Inc.

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1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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FCC Part 15.31 (e)

This EUT provides stable voltage constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

However, the supply voltage was varied and tested at 3.65 V and 4.225 V (3.7 V + 15 %) of the nominal rated supply voltage during frequency tolerance test according to Section 15.225(e), since EUT cannot operate at 85 % of the nominal rated voltage (the EUT operation will stop if less than 3.65 v is supplied).

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because it is printed pattern circuit on the circuit board. Therefore the equipment complies with the requirement of 15.203.

3.3 Deviation from standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Band Width	<ISED>RSS-Gen 6.7	-	N/A	- a)	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. a) Refer to APPENDIX 1 (data of 20 dB Bandwidth and 99 % Occupied Bandwidth)					

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	No. 4,5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.9 dB	2.9 dB	3.0 dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.2 dB	3.1 dB	3.1 dB	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.6 dB	-
	200 MHz-1 GHz	6.0 dB	6.1 dB	6.1 dB	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Other test	Uncertainty (+/-)
Bandwidth Measurement	0.012 %
Temperature_SCH-01	0.93 deg.C.
Humidity_SCH-01	4.1 %
Temperature_SCH-02	2.0 deg.C.
Humidity_SCH-02	6.6 %
Voltage	0.97 %
Frequency Measurement (Spectrum Analyzer)	1.2×10^{-8}
Frequency Measurement (Frequency Counter)	8.3×10^{-8}

3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401
A2LA Certificate Number: 1266.03
(FCC test firm registration number: 626366, ISED lab company number: 2973D / CAB identifier: JP0001)

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 EUT during testing

4.1 Operating Mode(s)

The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

The mode used :

Mode	Operating mode	Tested frequency
All items, with tag	Transmitting	13.56 MHz
All items, without tag	Transmitting	13.56 MHz
The EUT was operated in a manner similar to typical use during the tests.		
* EUT was set by the software as follows; Firmware : Ver. 1.0.1 (Data : 2021.12.15, Storage location: EUT memory) Power setting: Fixed *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.		

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.

Combinations of the worst case:

Conducted emission	Radiated emission (carrier)	Radiated emission (below 30 MHz)	Radiated emission (above 30 MHz)
with tag (Tag1)	with tag (Tag1)	with tag (Tag1)	with tag (Tag2)

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

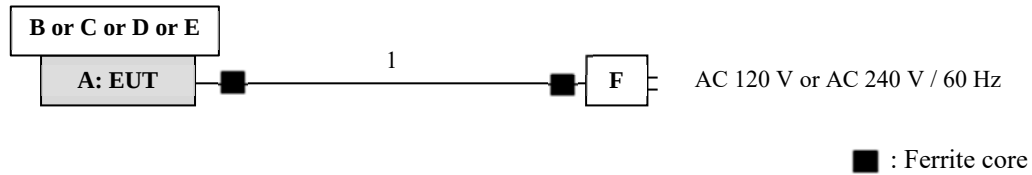
Frequency Tolerance:

Temperature : 0 deg. C to +40 deg. C
Voltage : Normal Voltage DC 3.7 V (USB Power 5 V)
Maximum Voltage DC 4.255 V (DC 3.7 V +15 %)
Minimum Voltage DC 3.65 V
(the EUT operation will stop if less than 3.65 v is supplied)

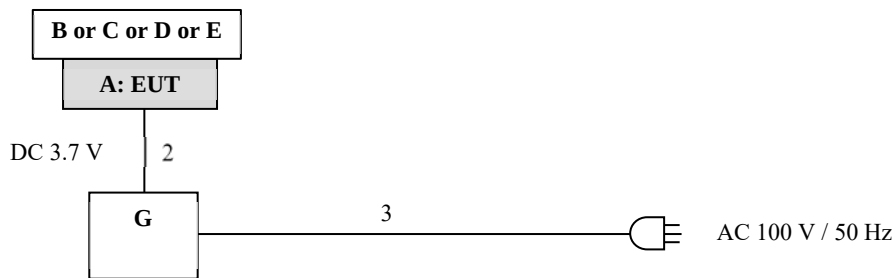
*This EUT provides stable voltage constantly to RF Part regardless of input voltage.

4.2 Configuration and peripherals

[Conducted emission and Radiated emission test]



[Other test]



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

*As a result of comparing AC 120 V and AC 240 V at pre-check, conducted emission test was performed with AC 120 V of the worst voltage as representative.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	RFID reader writer	EGM-XR3BTY	E002 E004 *1) E005 *2)	e-Tec	EUT
B	IC Tag	Tag-it JIS II card	-	PHOENIX	ISO15693, Tag1
C	IC Tag	I CODE-SLI P100(50)xW50	-	-	ISO15693, Tag2
D	IC Tag	I CODE-SLI P86xW54	-	SANKYO	ISO15693, Tag3
E	IC Tag	Overmolded Metal Stick Tag	-	SAG	ISO15693, Tag4
F	AC Adapter	A1385	-	Apple	-
G	Power Supply (DC)	PW18-2ATP	19050351	TEXIO	-

*1) Used for Other test (Modulated)

*2) Used for Other test (Non-Modulated)

List of cables used

No.	Cable name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	1.0	Shielded	Shielded	*3)
2	DC	3.25	Unshielded	Unshielded	-
3	AC	2.0	Unshielded	Unshielded	-

*3) Used the cable included with the product.

UL Japan, Inc.

Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

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.

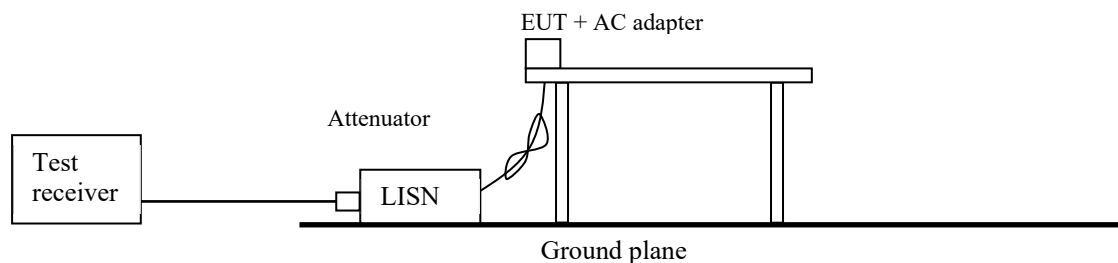
The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals, was aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization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

The AC Mains Terminal Continuous Disturbance Voltage has been measured with the EUT via AC adapter in a Shielded room.

The EUT via AC adapter 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

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 or 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 was varied between 1 m 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.

Measurements were performed with QP, PK, and AV detector.

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

Test Antennas are used as below;

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

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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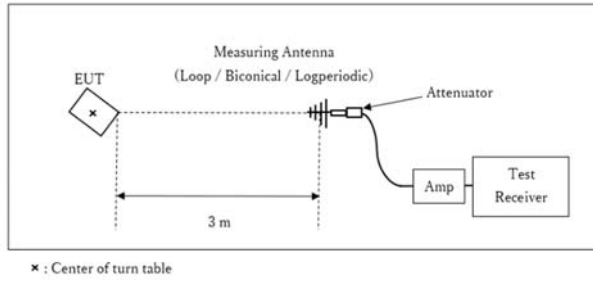
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Facsimile : +81 463 50 6401

Figure 1. Test Setup

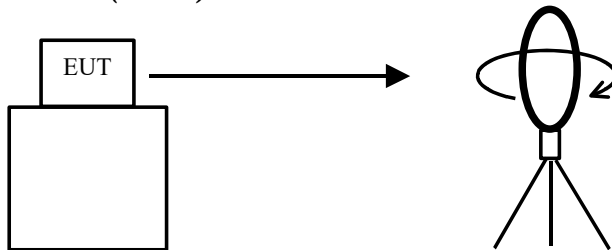
Below 1 GHz



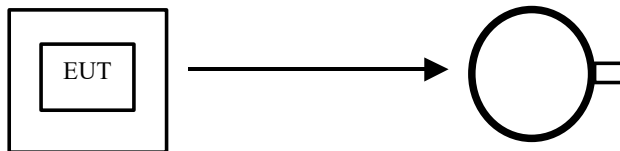
Test Distance: 3 m

Figure 2. Direction of the Loop Antenna

Side View (Vertical)

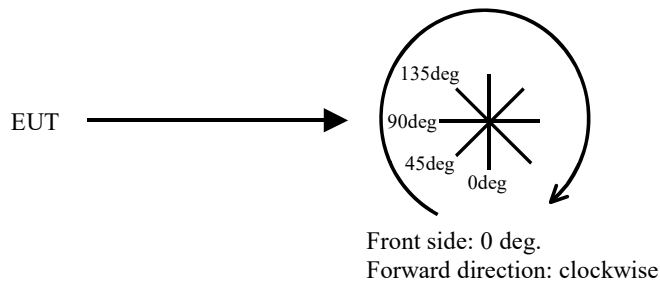


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



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.

Combinations of the worst case

	Frequency Antenna polarization	Below 30 MHz	Above 30 MHz
Module	Horizontal	X	Y
	Vertical	Z	Y

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

SECTION 7: Other tests

Test Procedure

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	2 to 5 time of OBW	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Frequency counter
*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %. Peak hold was applied as Worst-case measurement.							

Test data : APPENDIX 1
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2021/12/17

Mode : Transmitting (13.56 MHz)

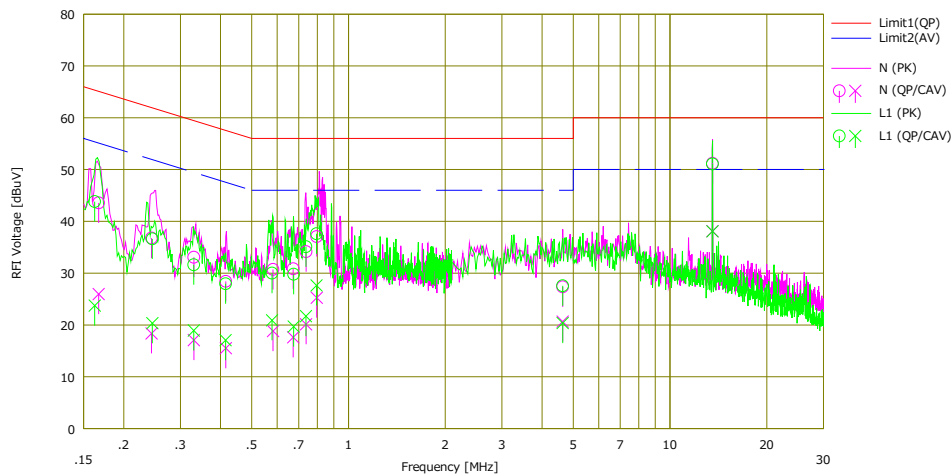
Power : AC 120 V / 60 Hz

Temp./Humi. : 26 deg.C / 33 %RH

Remarks : Tag1

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Shunsaku Yumi



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	0.16712	31.00	13.40	12.56	43.56	25.96	65.10	55.10	21.5	29.1	N	
2	0.24410	24.20	5.80	12.57	36.77	18.37	61.96	51.96	25.1	33.5	N	
3	0.33036	20.50	4.50	12.58	33.08	17.08	59.44	49.44	26.3	32.3	N	
4	0.41532	15.80	2.90	12.61	28.41	15.51	57.54	47.54	29.1	32.0	N	
5	0.58258	18.10	6.20	12.62	30.72	18.82	56.00	46.00	25.2	27.1	N	
6	0.67310	18.20	5.00	12.62	30.82	17.62	56.00	46.00	25.1	28.3	N	
7	0.73791	21.50	7.50	12.64	34.14	20.14	56.00	46.00	21.8	25.8	N	
8	0.79645	24.40	12.60	12.65	37.05	25.25	56.00	46.00	18.9	20.7	N	
9	4.63741	14.30	7.60	13.04	27.34	20.64	56.00	46.00	28.6	25.3	N	
10	13.56000	37.30	24.20	13.90	51.20	38.10	60.00	50.00	8.8	11.9	N	
11	0.16246	31.20	11.10	12.62	43.82	23.72	65.34	55.34	21.5	31.6	L1	
12	0.24537	24.00	7.70	12.62	36.62	20.32	61.91	51.91	25.2	31.5	L1	
13	0.33018	19.00	6.30	12.63	31.63	18.93	59.45	49.45	27.8	30.5	L1	
14	0.41485	15.30	4.40	12.65	27.95	17.05	57.55	47.55	29.6	30.5	L1	
15	0.57825	17.30	8.20	12.70	30.00	20.90	56.00	46.00	26.0	25.1	L1	
16	0.67510	17.10	7.00	12.68	29.78	19.68	56.00	46.00	26.2	26.3	L1	
17	0.73738	22.40	9.00	12.70	35.10	21.70	56.00	46.00	20.9	24.3	L1	
18	0.79561	24.90	14.90	12.71	37.61	27.61	56.00	46.00	18.3	18.3	L1	
19	4.63692	14.50	7.30	13.06	27.56	20.36	56.00	46.00	28.4	25.6	L1	
20	13.56000	37.30	24.30	13.76	51.06	38.06	60.00	50.00	8.9	11.9	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN): SLS-02

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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Data of Electric field strength of Fundamental emission and Spurious emission within the band

Report No. 14033706S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date December 16, 2021
Temperature / Humidity 20 deg. C / 33 % RH
Engineer Shunsaku Yumi
Mode Transmitting (13.56 MHz)
with Tag (Tag1),
Vertical polarization (antenna angle) of the worst case: 0 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	45.9	57.1	20.6	6.6	31.8	-40.0	1.2	12.4	83.9	82.7	71.5

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 (30 m)

• 13.553 MHz to 13.567 MHz : 83.9 dBuV/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	29.9	32.5	20.5	6.6	31.8	-40.0	-14.8	-12.2	29.5	44.3	41.7
2	13.136	30.5	35.9	20.5	6.6	31.8	-40.0	-14.2	-8.8	40.5	54.7	49.3
3	13.410	29.7	29.9	20.6	6.6	31.8	-40.0	-15.0	-14.8	40.5	55.5	55.3
4	13.533	30.5	35.6	20.6	6.6	31.8	-40.0	-14.2	-9.1	50.4	64.6	59.5
5	13.553	34.1	44.4	20.6	6.6	31.8	-40.0	-10.6	-0.3	50.4	61.0	50.7
6	13.567	32.8	42.6	20.6	6.6	31.8	-40.0	-11.9	-2.1	50.4	62.3	52.5
7	13.586	30.3	35.5	20.6	6.6	31.8	-40.0	-14.4	-9.2	50.4	64.8	59.6
8	13.710	29.7	29.8	20.6	6.6	31.8	-40.0	-15.0	-14.9	40.5	55.5	55.4
9	13.983	30.2	35.3	20.6	6.6	31.8	-40.0	-14.4	-9.3	40.5	54.9	49.8
10	14.010	29.9	32.1	20.6	6.6	31.8	-40.0	-14.7	-12.5	29.5	44.2	42.0

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

Outside filed strength frequencies

- $F_c \pm 7 \text{ kHz}$: 13.553 MHz to 13.567 MHz
- $F_c \pm 150 \text{ kHz}$: 13.410 MHz to 13.710 MHz
- $F_c \pm 450 \text{ kHz}$: 13.110 MHz to 14.010 MHz
- $F_c = 13.56 \text{ MHz}$

Limits (30m)

- 13.410 MHz to 13.553 MHz and 13.567 MHz to 13.710 MHz : 50.4 dBuV/m (FCC 15.225(b))
- 13.110 MHz to 13.410 MHz and 13.710 MHz to 14.010 MHz : 40.5 dBuV/m (FCC 15.225(c))
- Below 13.110 MHz and Above 14.010 MHz : 29.5 dBuV/m (FCC 15.225(d) and FCC 15.209)

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Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious emission

Report No.	14033706S-A-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.1	No.1
Date	December 16, 2021	December 15, 2021
Temperature / Humidity	20 deg. C / 33 % RH	20 deg. C / 32 % RH
Engineer	Shunsaku Yumi (Below 30 MHz)	Shunsaku Yumi (Above 30 MHz)
Mode	Transmitting (13.56 MHz) [Below 30 MHz]: with Tag (Tag1), Vertical polarization (antenna angle) of the worst case: 0 deg. [Above 30 MHz]: with Tag (Tag2)	

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.	27.12	QP	28.4	21.6	6.9	31.8	-40.0	-14.9	29.5	44.4	-	359	* Limit: 30 m
Hori.	40.680	QP	38.1	14.6	7.3	31.8	0.0	28.2	43.5	15.3	272	327	
Hori.	635.364	QP	30.9	19.4	8.6	32.1	0.0	26.8	43.5	16.7	141	103	
Vert.	27.12	QP	28.4	21.6	6.9	31.8	-40.0	-14.9	29.5	44.4	-	158	* Limit: 30 m
Vert.	40.680	QP	49.8	14.6	7.3	31.8	0.0	39.9	40.0	0.1	100	46	
Vert.	67.800	QP	54.5	6.8	7.4	31.8	0.0	36.9	43.5	6.6	100	65	
Vert.	94.920	QP	42.5	9.2	8.3	31.8	0.0	28.2	46.0	17.8	100	86	
Vert.	122.040	QP	33.0	13.2	8.2	31.8	0.0	22.7	46.0	23.3	100	51	
Vert.	203.40	QP	39.3	11.4	5.8	31.8	0.0	24.7	46.0	21.3	100	352	
Vert.	605.96	QP	26.3	19.4	8.4	32.0	0.0	22.0	46.0	24.0	100	81	
Vert.	625.63	QP	29.8	19.5	8.5	32.1	0.0	25.7	46.0	20.3	100	82	
Vert.	941.47	QP	20.5	21.9	10.1	31.1	0.0	21.4	46.0	24.6	100	350	

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

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

* Carrier level (Result at 3 m): Hor= 41.2 dBuV/m, Ver= 52.4 dBuV/m

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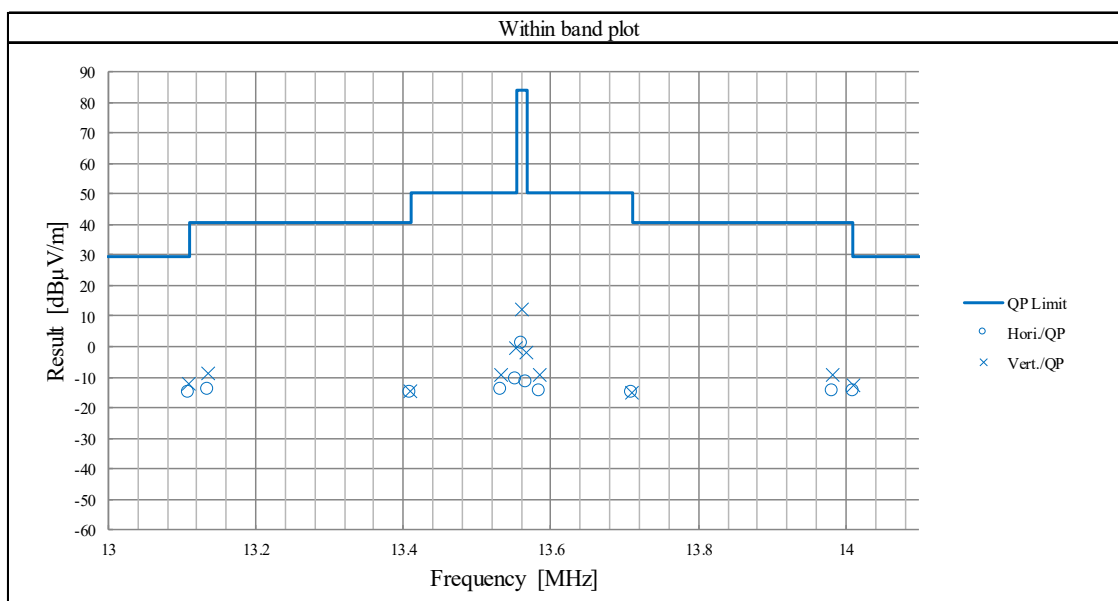
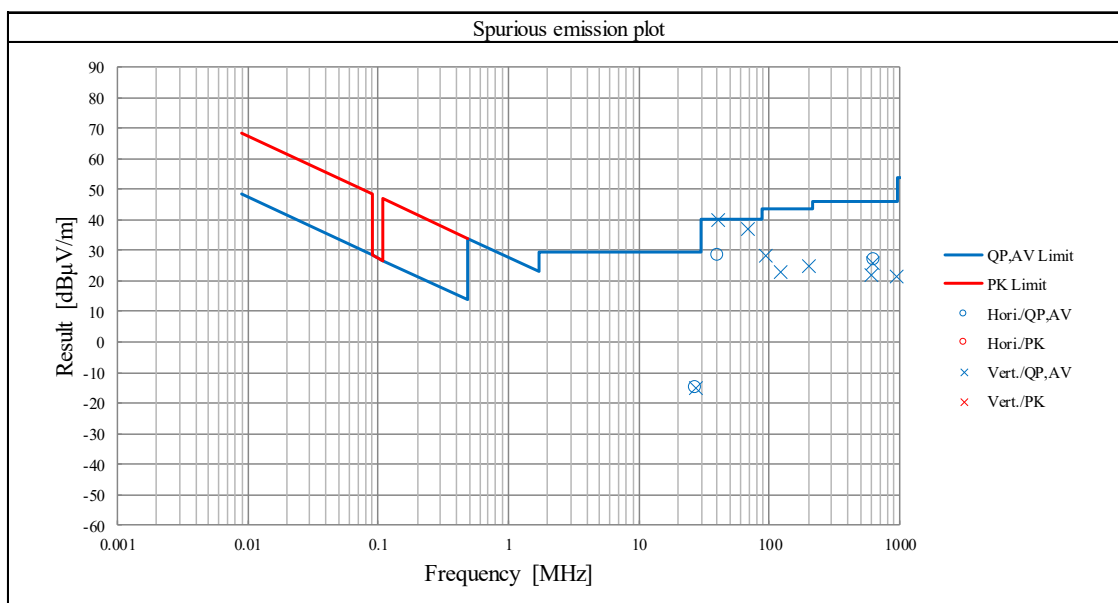
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Emission Plot data, Worst case

Report No.	14033706S-A-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.1	No.1
Date	December 16, 2021	December 15, 2021
Temperature / Humidity	20 deg. C / 33 % RH	20 deg. C / 32 % RH
Engineer	Shunsaku Yumi	Shunsaku Yumi
	(Below 30 MHz)	(Above 30 MHz)
Mode	Transmitting (13.56 MHz)	
	[Below 30 MHz]: with Tag (Tag1),	
	Vertical polarization (antenna angle) of the worst case: 0 deg.	
	[Above 30 MHz]: with Tag (Tag2)	



*These plots data contains sufficient number to show the trend of characteristic features for EUT.

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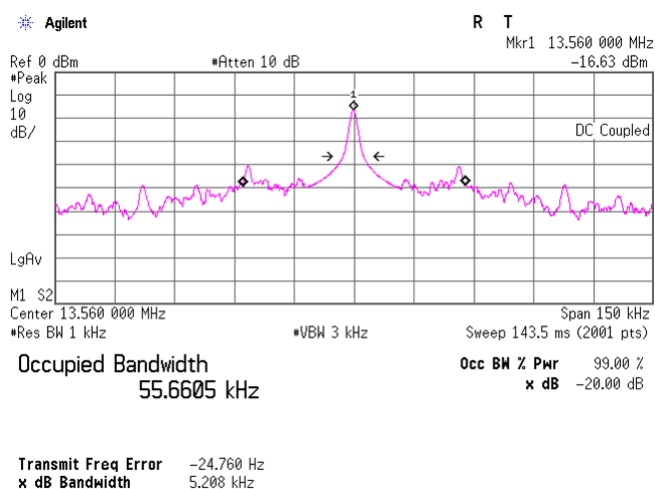
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

20 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	14033706S-A-R1
Test place	Shonan EMC Lab.
Shielded room	No.5
Date	December 20, 2021
Temperature / Humidity	23 deg. C / 31 % RH
Engineer	Shunsaku Yumi
Mode	Transmitting (13.56 MHz) with Tag (Tag1)

FREQ [MHz]	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.56	5.21	55.66

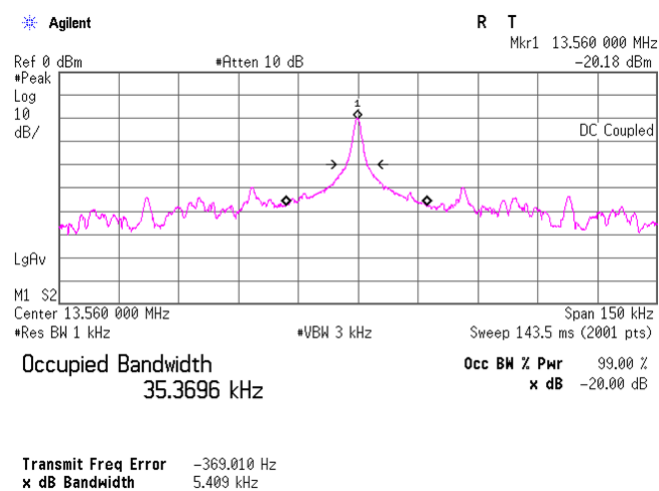


*Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 – 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

20 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	14033706S-A-R1
Test place	Shonan EMC Lab.
Shielded room	No.5
Date	December 20, 2021
Temperature / Humidity	23 deg. C / 31 % RH
Engineer	Shunsaku Yumi
Mode	Transmitting (13.56 MHz) with Tag (Tag2)

FREQ [MHz]	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.56	5.41	35.37

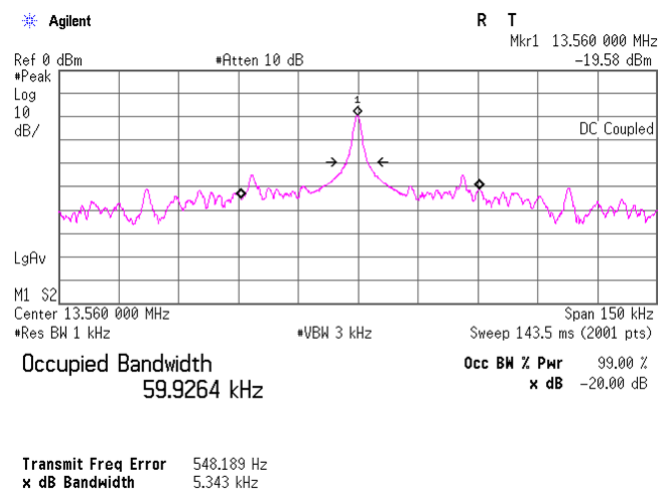


*Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 – 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

20 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	14033706S-A-R1
Test place	Shonan EMC Lab.
Shielded room	No.5
Date	December 20, 2021
Temperature / Humidity	23 deg. C / 31 % RH
Engineer	Shunsaku Yumi
Mode	Transmitting (13.56 MHz) with Tag (Tag3)

FREQ [MHz]	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.56	5.34	59.93

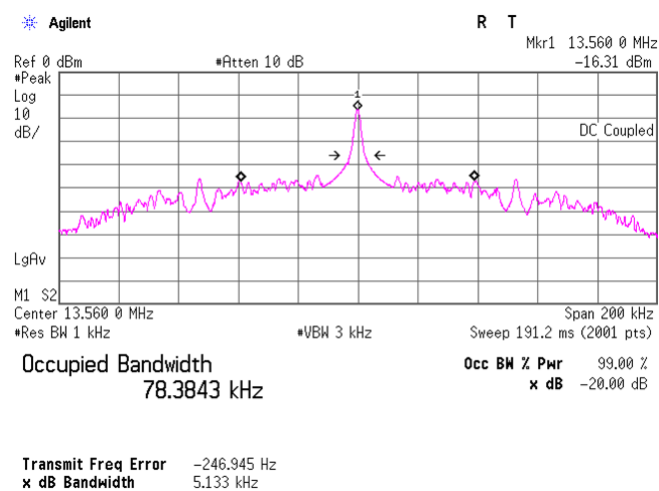


*Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 – 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

20 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	14033706S-A-R1
Test place	Shonan EMC Lab.
Shielded room	No.5
Date	December 20, 2021
Temperature / Humidity	23 deg. C / 31 % RH
Engineer	Shunsaku Yumi
Mode	Transmitting (13.56 MHz) with Tag (Tag4)

FREQ [MHz]	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.56	5.13	78.38



*Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 – 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

Frequency Tolerance

Report No. 14033706S-A-R1
Test place Shonan EMC Lab.
Shielded room No.5
Date December 20, 2021
Temperature / Humidity 23 deg. C / 31 % RH
Engineer Shunsaku Yumi
Mode Transmitting (13.56 MHz)

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	3.7	Power on	13.559810	-0.000190	-0.00140	-14.0	0.01
		+ 2 min.	13.559825	-0.000175	-0.00129	-12.9	0.01
		+ 5 min.	13.559831	-0.000169	-0.00125	-12.5	0.01
		+ 10 min.	13.559834	-0.000166	-0.00122	-12.2	0.01
40	3.7	Power on	13.559820	-0.000180	-0.00133	-13.3	0.01
		+ 2 min.	13.559818	-0.000182	-0.00134	-13.4	0.01
		+ 5 min.	13.559819	-0.000181	-0.00133	-13.3	0.01
		+ 10 min.	13.559820	-0.000180	-0.00133	-13.3	0.01
30	3.7	Power on	13.559833	-0.000167	-0.00123	-12.3	0.01
		+ 2 min.	13.559824	-0.000176	-0.00130	-13.0	0.01
		+ 5 min.	13.559821	-0.000179	-0.00132	-13.2	0.01
		+ 10 min.	13.559820	-0.000180	-0.00133	-13.3	0.01
20	3.7	Power on	13.559845	-0.000155	-0.00114	-11.4	0.01
		+ 2 min.	13.559834	-0.000166	-0.00122	-12.2	0.01
		+ 5 min.	13.559831	-0.000169	-0.00125	-12.5	0.01
		+ 10 min.	13.559830	-0.000170	-0.00125	-12.5	0.01
20	3.65	Power on	13.559842	-0.000158	-0.00117	-11.7	0.01
		+ 2 min.	13.559832	-0.000168	-0.00124	-12.4	0.01
		+ 5 min.	13.559831	-0.000169	-0.00125	-12.5	0.01
		+ 10 min.	13.559832	-0.000168	-0.00124	-12.4	0.01
20	4.255 (3.7 V +15 %)	Power on	13.559842	-0.000158	-0.00117	-11.7	0.01
		+ 2 min.	13.559833	-0.000167	-0.00123	-12.3	0.01
		+ 5 min.	13.559831	-0.000169	-0.00125	-12.5	0.01
		+ 10 min.	13.559830	-0.000170	-0.00125	-12.5	0.01
10	3.7	Power on	13.559852	-0.000148	-0.00109	-10.9	0.01
		+ 2 min.	13.559845	-0.000155	-0.00114	-11.4	0.01
		+ 5 min.	13.559854	-0.000146	-0.00108	-10.8	0.01
		+ 10 min.	13.559843	-0.000157	-0.00116	-11.6	0.01
0	3.7	Power on	13.559846	-0.000154	-0.00114	-11.4	0.01
		+ 2 min.	13.559852	-0.000148	-0.00109	-10.9	0.01
		+ 5 min.	13.559852	-0.000148	-0.00109	-10.9	0.01
		+ 10 min.	13.559852	-0.000148	-0.00109	-10.9	0.01
-10	3.7	Power on	13.559822	-0.000178	-0.00131	-13.1	0.01
		+ 2 min.	13.559844	-0.000156	-0.00115	-11.5	0.01
		+ 5 min.	13.559842	-0.000158	-0.00117	-11.7	0.01
		+ 10 min.	13.559848	-0.000152	-0.00112	-11.2	0.01
-20	3.7	Power on	13.559761	-0.000239	-0.00176	-17.6	0.01
		+ 2 min.	13.559817	-0.000183	-0.00135	-13.5	0.01
		+ 5 min.	13.559826	-0.000174	-0.00128	-12.8	0.01
		+ 10 min.	13.559828	-0.000172	-0.00127	-12.7	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)

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	SAT3-13	150923	Attenuator	JFW	50HF-003N	-	2021/01/26	12
CE	SCC-A12/A13/SRSE-01	144966	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-269(RF Selector)	2021/04/12	12
CE	SLS-02	145539	LISN	Rohde & Schwarz	ENV216	100512	2021/02/24	12
CE	SOS-16	167990	Humidity Indicator	CUSTOM. Inc	CTH-202	708Q08R	2021/10/14	12
CE,RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
CE,RE	SJM-21	207278	Measuring Tool, Tape Measure	ASKUL	-	-	-	-
CE,RE	STR-01	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2021/04/27	12
CE,RE	STS-01	145792	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997812	2021/09/14	12
FT	SCH-01	145200	Temperature and Humidity Chamber	Espec	PL-1KT	14020837	2021/04/02	12
FT	SFC-03	183119	Microwave Counter	Keysight Technologies Inc	53151A	US40511493	2021/11/12	12
FT,OBW	SOS-19	175823	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/10/14	12
FT,OBW	SSCA-01	146178	Search coil	Langer	RF-R 400-1	02-0634	-	-
FT,OBW	STS-05	146212	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997828	2021/09/14	12
OBW	SRENT-15	160899	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185516	2021/01/26	12
RE	KAT6-04	144899	Attenuator	Inmet	18N-6dB	-	2021/12/10	12
RE	SAEC-01(NSA)	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2021/04/30	12
RE	SAF-01	145003	Pre Amplifier	SONOMA	310N	290211	2021/02/10	12
RE	SAT3-09	144959	Attenuator	JFW	50HF-003N	-	2021/08/16	12
RE	SAT6-15	167096	Attenuator	JFW	50HF-006N	-	2021/02/10	12
RE	SBA-01	145161	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032664	2021/04/10	12
RE	SCC-A1/A3/A5/A7/A8/A13/SRSE-01	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2021/04/13	12
RE	SCC-A2/A4/A6/A7/A8/A13/SRSE-01	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2021/04/12	12
RE	SCC-M1	194601	Coaxial Cable	Fujikura	5D-2W	-	2021/12/10	12
RE	SLA-05	145527	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	193	2021/04/10	12
RE	SLP-02	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2021/04/06	12
RE	SOS-20	191837	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	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
OBW: Occupied Bandwidth

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Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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