RADIO TEST REPORT

Test Report No. : 14122162H-R3

Applicant	:	**OMRON CORPORATION**
Type of EUT	:	**RFID System**
Model Number of EUT	:	**V680-HA63B**
Test regulation	:	**FCC Part 15 Subpart C** ***For Permissive change**
FCC ID	:	**E4E6CYSIDV6800306**
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. Ise 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 14122162H-R2. 14122162H-R2 is replaced with this report.

Date of test: October 31, 2021 to January 12, 2022

Representative test engineer:
Junya Okuno
Engineer

Approved by:
Shinichi Miyazono
Engineer

CERTIFICATE 5107.02

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan, Inc.
☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 14122162H

Revision	Test report No.	Date	Page revised	Contents
- (Original)	14122162H	January 25, 2022	-	-
1	14122162H-R1	April 28, 2022	P.1, 6	Update for the FCC version
1	14122162H-R1	April 28, 2022	P.1, 5	Change the Type of EUT From “Amplifier” to “RFID System”
1	14122162H-R1	April 28, 2022	P.5	Correction of Rating in Clause 2.2; from DC 7.5 V to DC 7.5 V (inner) / DC 12.0 V (input)
1	14122162H-R1	April 28, 2022	P.9	Addition of “DC 12.0 V” in note sentence in Clause 4.1
1	14122162H-R1	April 28, 2022	P.10, 11	Correction of the Model number for Item B in Clause 4.2; from V680-HS65-W to V680-HS65
1	14122162H-R1	April 28, 2022	P.10, 11	Addition of "*1)" for the Remarks of No. A and B, and note * 1) under the table.
1	14122162H-R1	April 28, 2022	P.19, 20	The following additions; - unit in the data - notes under the data
2	14122162H-R2	May 26, 2022	P.1	Deletion of “: 2022” from Test regulation in cover page
2	14122162H-R2	May 26, 2022	P.5	Correction of Rating in Clause 2.2; from DC 7.5 V (inner) / DC 12.0 V (input) to DC 7.5 V
2	14122162H-R2	May 26, 2022	P.9	Correction of voltage notation in the note in Section 4.1. from "(DC 12.0 V)" to "(DC 7.5 V)"
2	14122162H-R2	May 26, 2022	P.10	Correction of No.2 cable name in Clause 4.2, From “DC and Signal Cable” to “Amplifier Cable”
3	14122162H-R3	June 6, 2022	P.5	Addition of the following sentence in Clause 2.2 A V680-series RFID System consists of an ID Controller, one or more Amplifiers, one or two Antennas, and RF Tags.
3	14122162H-R3	June 6, 2022	P.7	Correction of “FCC Part 15.31(e)” in Section 3.2.
3	14122162H-R3	June 6, 2022	P.9	Correction of the description for voltage in Section 4.1.

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation
AC	Alternating Current
AFH	Adaptive Frequency Hopping
AM	Amplitude Modulation
Amp, AMP	Amplifier
ANSI	American National Standards Institute
Ant, ANT	Antenna
AP	Access Point
ASK	Amplitude Shift Keying
Atten., ATT	Attenuator
AV	Average
BPSK	Binary Phase-Shift Keying
BR	Bluetooth Basic Rate
BT	Bluetooth
BT LE	Bluetooth Low Energy
BW	BandWidth
Cal Int	Calibration Interval
CCK	Complementary Code Keying
Ch., CH	Channel
CISPR	Comite International Special des Perturbations Radioelectriques
CW	Continuous Wave
DBPSK	Differential BPSK
DC	Direct Current
D-factor	Distance factor
DFS	Dynamic Frequency Selection
DQPSK	Differential QPSK
DSSS	Direct Sequence Spread Spectrum
EDR	Enhanced Data Rate
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EN	European Norm
ERP, e.r.p.	Effective Radiated Power
EU	European Union
EUT	Equipment Under Test
Fac.	Factor
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
Freq.	Frequency
FSK	Frequency Shift Keying
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
MCS	Modulation and Coding Scheme
MRA	Mutual Recognition Arrangement
N/A	Not Applicable
NIST	National Institute of Standards and Technology
NS	No signal detect.
NSA	Normalized Site Attenuation
NVLAP	National Voluntary Laboratory Accreditation Program
OBW	Occupied Band Width
OFDM	Orthogonal Frequency Division Multiplexing
P/M	Power meter
PCB	Printed Circuit Board
PER	Packet Error Rate
PHY	Physical Layer
PK	Peak
PN	Pseudo random Noise
PRBS	Pseudo-Random Bit Sequence
PSD	Power Spectral Density
QAM	Quadrature Amplitude Modulation
QP	Quasi-Peak
QPSK	Quadri-Phase Shift Keying
RBW	Resolution Band Width
RDS	Radio Data System
RE	Radio Equipment
RF	Radio Frequency
RMS	Root Mean Square
RSS	Radio Standards Specifications
Rx	Receiving
SA, S/A	Spectrum Analyzer
SG	Signal Generator
SVSWR	Site-Voltage Standing Wave Ratio
TR	Test Receiver
Tx	Transmitting
VBW	Video BandWidth
Vert.	Vertical
WLAN	Wireless LAN

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	OMRON CORPORATION
Address	:	3-2, NARUTANI, NAKAYAMA-CHO AYABE-SHI, KYOTO, JAPAN
Telephone Number	:	+81-773-42-6654
Contact Person	:	MAYUMI KIEDA

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 System
Model Number	:	V680-HA63B
Serial Number	:	Refer to SECTION 4.2
Receipt Date	:	October 11, 2021 (for Conducted emission test) December 10, 2021 (for other tests except for Conducted emission test)
Condition	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab

2.2 Product Description

Model: V680-HA63B (referred to as the EUT in this report) is a RFID System.
A V680-series RFID System consists of an ID Controller, one or more Amplifiers, one or two Antennas, and RF Tags.

General Specification

Rating	:	DC 7.5 V

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	13.56 MHz
Modulation	:	ASK
Antenna type	:	Loop Coil
Clock frequency (Maximum)	:	16 MHz (CPU)
Operating Temperature	:	-10 deg. C to +55 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 April 1, 2022 and effective May 2, 2022

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 revision does not affect the test result conducted before its effective date.

*EUT is an FCC 15.103 (b) exemption device.

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	1.99 dB 0.48830 MHz AV, Phase N <with Tag> / <without Tag>, 2.99800 MHz AV, Phase L <with Tag>	Complied# a)	-
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(a)	46.42 dB, 13.56000 MHz, QP, 0 deg. <without Tag>	Complied b)	Radiated
Spectrum Mask	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(b)(c)	27.12 dB, 13.55300 MHz, QP, 0 deg. <without Tag>	Complied b)	Radiated
20 dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section15.215(c)	See data	Complied c)	Radiated
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.209, Section 15.225 (d)	4.09 dB 85.351 MHz, Vertical, QP <without Tag>	Complied# d)	Radiated
Frequency Tolerance	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(e)	See data	Complied e)	Radiated

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 20 dB Bandwidth and 99% Occupied 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.

FCC Part 15.31 (e)
This EUT provides stable voltage constantly to RF part regardless of input voltage.
Therefore, this 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
The EUT has an external and particular antenna connector, but it is installed by the professionals.
Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% emission bandwidth	ANSI C63.10:2013 6 Standard test methods	Reference data	N/A	-	Radiated

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 $k = 2$.

Test Item		Frequency range		Uncertainty (+/-)
Conducted emission AMN (LISN)		0.009 MHz to 0.15 MHz		3.4 dB
		0.15 MHz to 30 MHz		2.9 dB
Radiated emission	3 m	9 kHz to 30 MHz		3.3 dB
	10 m			3.2 dB
	3 m	30 MHz to 200 MHz	(Horizontal)	4.8 dB
			(Vertical)	5.0 dB
		200 MHz to 1000 MHz	(Horizontal)	5.2 dB
			(Vertical)	6.3 dB
	10 m	30 MHz to 200 MHz	(Horizontal)	4.8 dB
			(Vertical)	4.8 dB
		200 MHz to 1000 MHz	(Horizontal)	5.0 dB
			(Vertical)	5.0 dB
Frequency Tolerance		-		0.0154 ppm
20 dB Bandwidth / 99 % Occupied Bandwidth		-		0.96 %

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967
ISED Lab Company Number: 2973C / CAB identifier: JP0002
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-

* Size of vertical conducting plane (for Conducted Emission test): 2.0 x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

The mode is used :

Mode	Remarks*
1) Transmitting mode (Tx)	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. * EUT was set by the software as follows; Software: V680-Demo Version 1.0 (Date: 2020.9.8, Storage location: EUT memory) *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.	

Test Item	Operating mode
Conducted Emission	Tx Mod on with Tag Tx Mod on without Tag Tx Mod on Antenna: 50 ohm terminated
Electric Field Strength of Fundamental Emission Spectrum Mask Electric Field Strength of Spurious Emission 20 dB Bandwidth and 99 % Occupied Bandwidth	Tx Mod on with Tag Tx Mod on without Tag
Frequency Tolerance	Tx Mod off

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

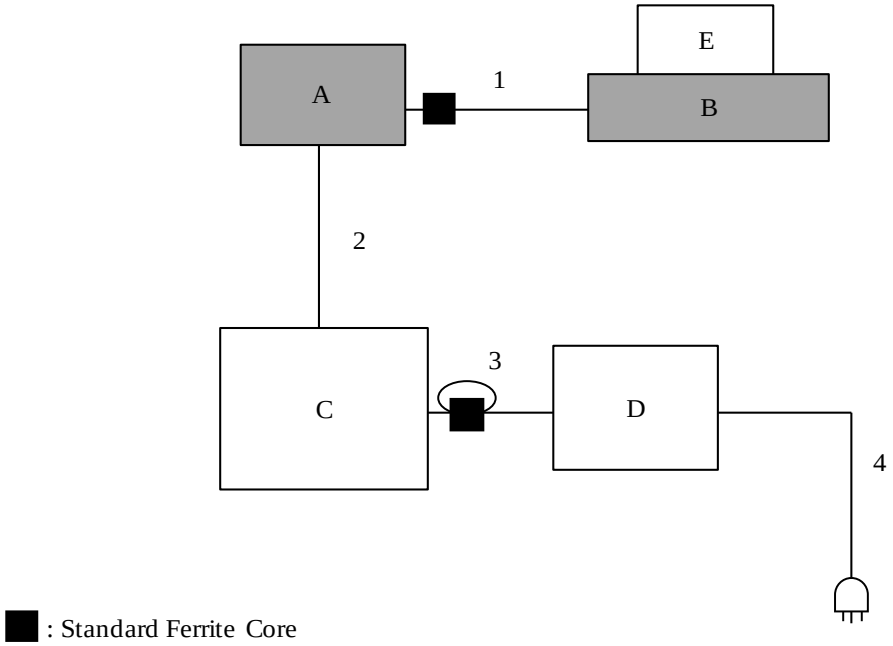
Frequency Tolerance:

Temperature : -20 deg. C to +50 deg. C Step 10 deg. C
Voltage : Normal Voltage DC 24 V
Maximum Voltage DC 27.6 V (DC 24 V +15 %)
Minimum Voltage DC 20.4 V (DC 24 V -15 %)

*An RFID system consists of an ID Controller, an Amplifier, and an Antennas, and the ID controller provides stable voltage (DC 7.5 V) constantly to this EUT. Since the ID Controller is a dedicated power supply for the EUT, the test was performed by varying the input voltage (DC 24 V) of the ID Controller.

4.2 Configuration and peripherals

[Conducted emission and Radiated emission tests]



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

Description of EUT and Support equipment

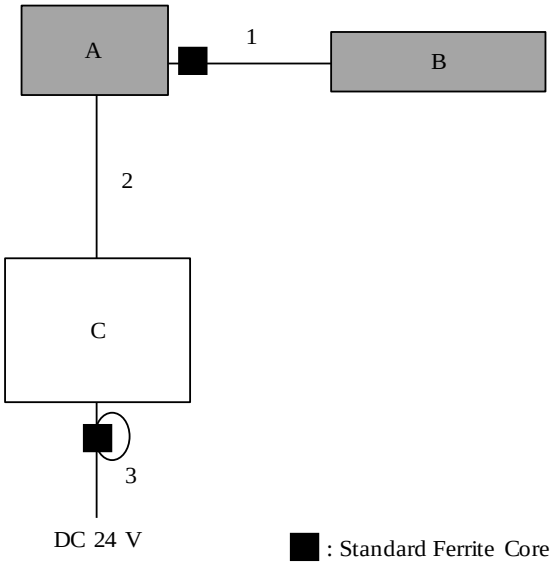
No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Amplifier	V680-HA63B	25319	OMRON CORPORATION	EUT *1)
B	Antenna	V680-HS65	06614	OMRON CORPORATION	EUT *1)
C	ID Controller	V680-CA5D02-V2	30X19A	OMRON CORPORATION	-
D	Power Supply	S8VS-03024	-	OMRON CORPORATION	-
E	Tag	V680-D1KP66T	11618	OMRON CORPORATION	-

*1) RFID System (Model Number: V680-HA63B) is composed of these items.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	2.00	Shielded	Shielded	-
2	Amplifier Cable	5.00	Shielded	Shielded	-
3	DC Cable	0.15	Unshielded	Unshielded	-
4	AC Cable	1.90	Unshielded	Unshielded	-

[Frequency Tolerance test]



* 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	Amplifier	V680-HA63B	25319	OMRON CORPORATION	EUT *1)
B	Antenna	V680-HS65	06614	OMRON CORPORATION	EUT *1)
C	ID Controller	V680-CA5D02-V2	30X19A	OMRON CORPORATION	-

*1) RFID System (Model Number: V680-HA63B) is composed of these items.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	2.00	Shielded	Shielded	-
2	Amplifier Cable	5.00	Shielded	Shielded	-
3	DC Cable	0.15	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

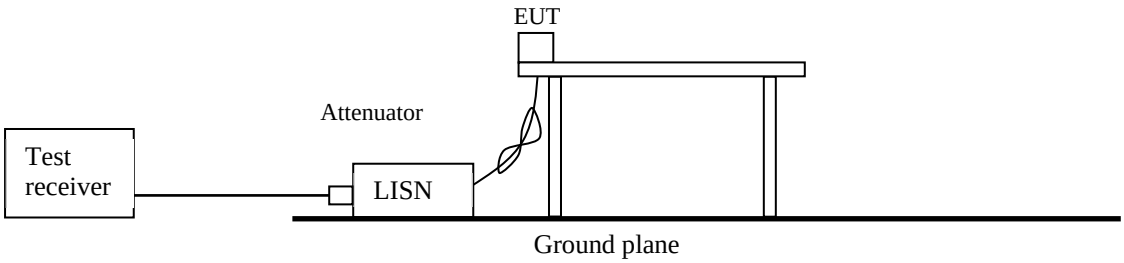
Test Procedure and conditions

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.

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. All unused 50 ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber. 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**

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., 135 deg., and 180 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
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

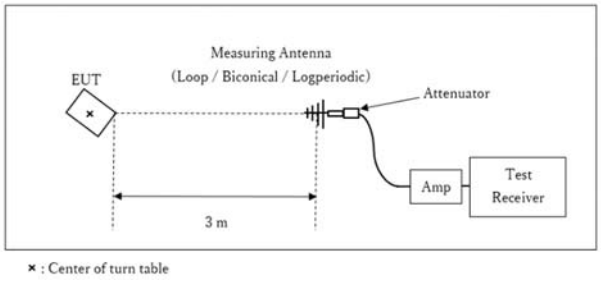
*1) Distance Factor: 40 x log (3 m / 300 m) = -80 dB
*2) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

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 Ohmes. 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 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.

[Test Setup]
Below 1 GHz



Test Distance: 3 m

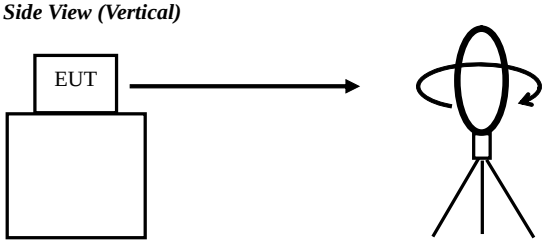
- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

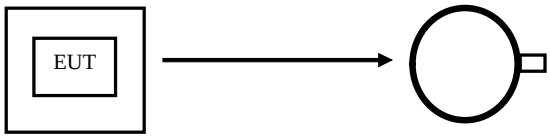
Measurement range : 9 kHz - 1 GHz
Test data : APPENDIX 1
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

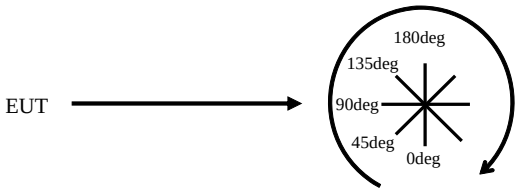


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

SECTION 7: Other test

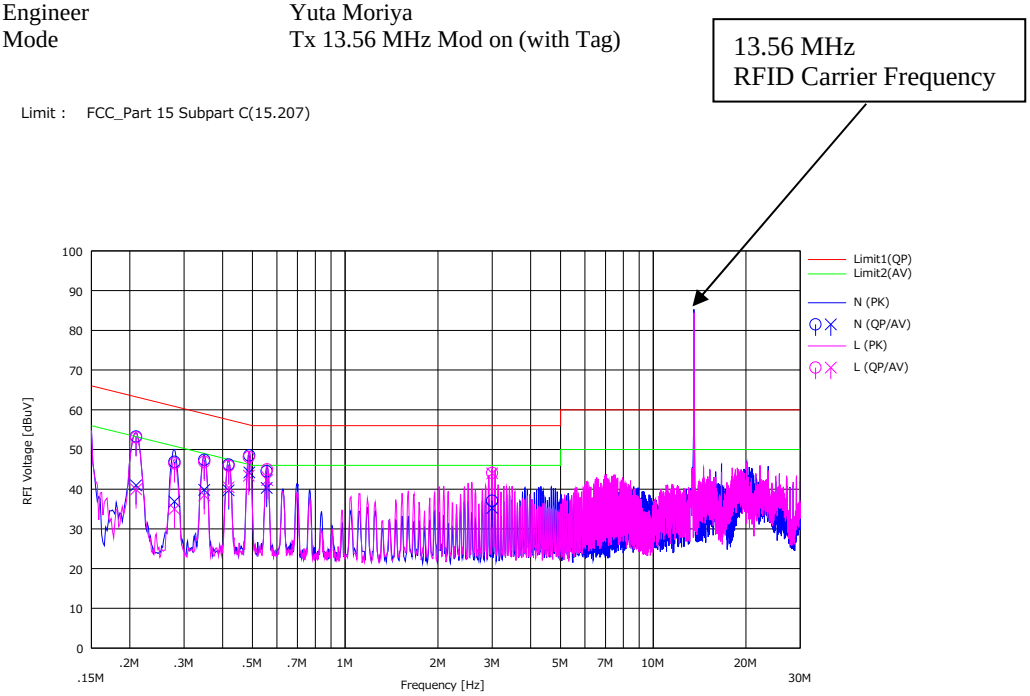
Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	100 kHz (with Tag) 250kHz (without Tag)	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
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
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Report No.	14122162H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	October 31, 2021
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx 13.56 MHz Mod on (with Tag)



No.	Freq.	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		(QP)	(AV)			(QP)	(AV)	(QP)	(AV)	(QP)	(AV)		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.20950	39.98	27.69	0.08	13.20	53.26	40.97	63.23	53.23	9.97	12.26	N	
2	0.27920	33.60	23.60	0.08	13.21	46.89	36.89	60.84	50.84	13.95	13.95	N	
3	0.34890	34.10	26.54	0.08	13.21	47.39	39.83	58.99	48.99	11.60	9.16	N	
4	0.41860	32.90	26.40	0.08	13.22	46.20	39.70	57.48	47.48	11.28	7.78	N	
5	0.48830	35.20	30.90	0.08	13.23	48.51	44.21	56.20	46.20	7.69	1.99	N	
6	0.55630	31.20	27.00	0.08	13.24	44.52	40.32	56.00	46.00	11.48	5.68	N	
7	2.99800	23.55	21.70	0.12	13.41	37.08	35.23	56.00	46.00	18.92	10.77	N	
8	0.20950	39.80	26.70	0.05	13.20	53.05	39.95	63.23	53.23	10.18	13.28	L	
9	0.27920	33.20	21.70	0.06	13.21	46.47	34.97	60.84	50.84	14.37	15.87	L	
10	0.34890	33.60	25.20	0.06	13.21	46.87	38.47	58.99	48.99	12.12	10.52	L	
11	0.41860	32.60	27.20	0.05	13.22	45.87	40.47	57.48	47.48	11.61	7.01	L	
12	0.48660	34.80	30.10	0.05	13.23	48.08	43.38	56.23	46.23	8.15	2.85	L	
13	0.55800	31.70	29.00	0.05	13.24	44.99	42.29	56.00	46.00	11.01	3.71	L	
14	2.99800	30.60	30.50	0.10	13.41	44.11	44.01	56.00	46.00	11.89	1.99	L	

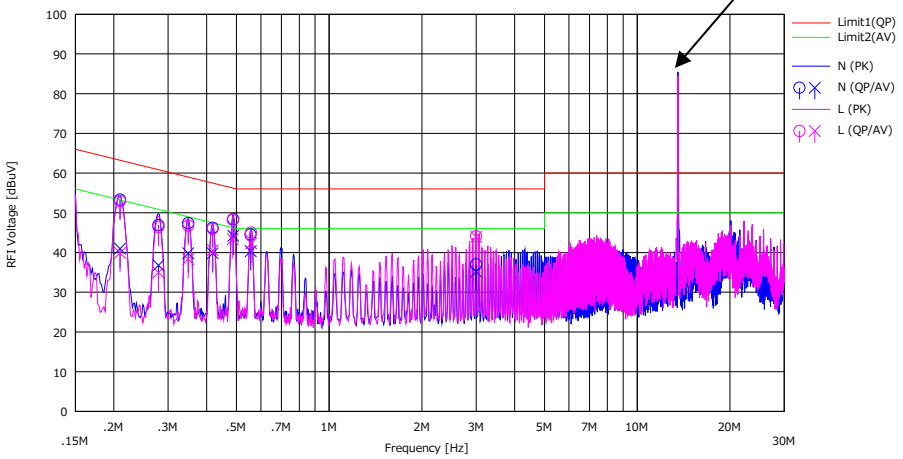
CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission

Report No.	14122162H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	October 31, 2021
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx 13.56 MHz Mod on (without Tag)

13.56 MHz
RFID Carrier Frequency

Limit : FCC_Part 15 Subpart C(15.207)



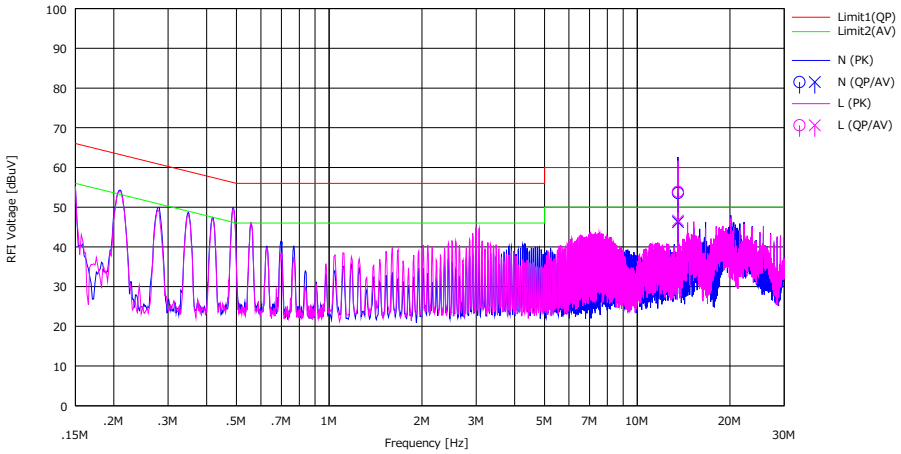
No.	Freq.	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		(QP)	(AV)			(QP)	(AV)	(QP)	(AV)	(QP)	(AV)		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.20950	40.00	27.70	0.08	13.20	53.28	40.98	63.23	53.23	9.95	12.25	N	
2	0.27920	33.60	23.50	0.08	13.21	46.89	36.79	60.84	50.84	13.95	14.05	N	
3	0.34890	34.10	26.50	0.08	13.21	47.39	39.79	58.99	48.99	11.60	9.20	N	
4	0.41860	32.90	26.50	0.08	13.22	46.20	39.80	57.48	47.48	11.28	7.68	N	
5	0.48830	35.10	30.90	0.08	13.23	48.41	44.21	56.20	46.20	7.79	1.99	N	
6	0.55630	31.20	27.00	0.08	13.24	44.52	40.32	56.00	46.00	11.48	5.68	N	
7	2.99800	23.45	21.65	0.12	13.41	36.98	35.18	56.00	46.00	19.02	10.82	N	
8	0.20950	39.70	26.70	0.05	13.20	52.95	39.95	63.23	53.23	10.28	13.28	L	
9	0.27920	33.20	21.70	0.06	13.21	46.47	34.97	60.84	50.84	14.37	15.87	L	
10	0.34890	33.50	25.10	0.06	13.21	46.77	38.37	58.99	48.99	12.22	10.62	L	
11	0.41860	32.70	27.30	0.05	13.22	45.97	40.57	57.48	47.48	11.51	6.91	L	
12	0.48660	34.90	30.10	0.05	13.23	48.18	43.38	56.23	46.23	8.05	2.85	L	
13	0.55800	31.70	29.00	0.05	13.24	44.99	42.29	56.00	46.00	11.01	3.71	L	
14	2.99800	30.60	30.40	0.10	13.41	44.11	43.91	56.00	46.00	11.89	2.09	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission

Report No.	14122162H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	October 31, 2021
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx 13.56 MHz Mod on (Antenna: 50 ohm terminated)

Limit : FCC_Part 15 Subpart C(15.207)



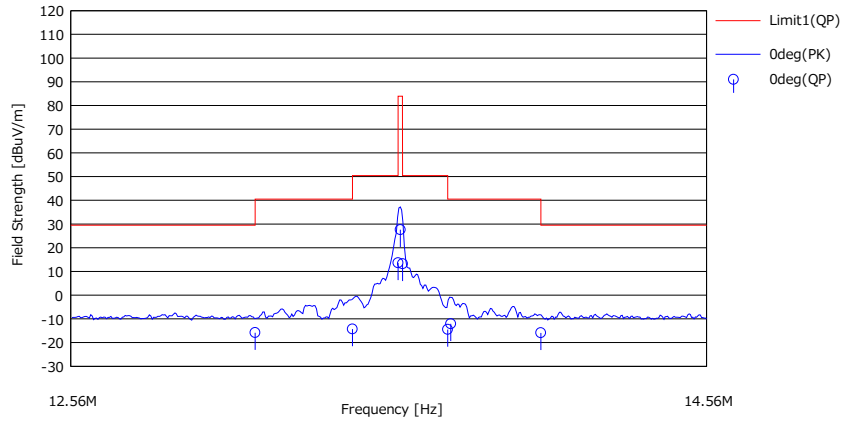
No.	Freq.	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		(QP)	(AV)			(QP)	(AV)	(QP)	(AV)	(QP)	(AV)		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	13.56000	39.50	32.20	0.29	13.77	53.56	46.26	60.00	50.00	6.44	3.74	N	
2	13.56000	39.80	32.60	0.30	13.77	53.87	46.67	60.00	50.00	6.13	3.33	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Fundamental emission and Spectrum Mask

Report No.	14122162H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	December 16, 2021
Temperature / Humidity	22 deg. C / 32 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx 13.56 MHz Mod on, with Tag

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



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]	Antenna	Table [deg]	Comment
1	13.11000	30.60	19.26	-33.38	32.32	-15.84	29.50	45.34	0deg	173	
2	13.41000	32.10	19.27	-33.37	32.32	-14.32	40.50	54.82	0deg	173	
3	13.55300	60.00	19.27	-33.37	32.32	13.58	50.40	36.82	0deg	173	
4	13.56000	74.00	19.27	-33.37	32.32	27.58	83.90	56.32	0deg	173	
5	13.56700	59.60	19.27	-33.37	32.32	13.18	50.40	37.22	0deg	173	
6	13.71000	31.90	19.27	-33.36	32.32	-14.51	40.50	55.01	0deg	173	
7	13.71980	34.30	19.27	-33.36	32.32	-12.11	40.50	52.61	0deg	187	
8	14.01000	30.50	19.28	-33.35	32.32	-15.89	29.50	45.39	0deg	173	

RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))
*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

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
0	13.56000	QP	74.00	19.27	6.63	32.32	-	67.58	-	-	Fundamental

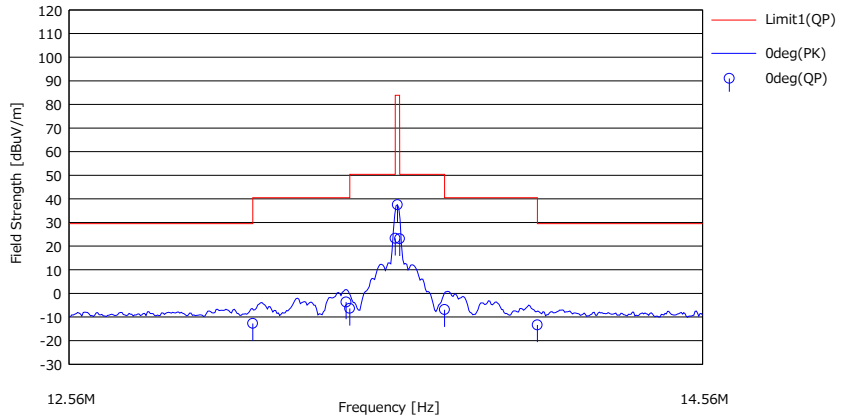
Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amprifier)

* All spurious emissions lower than this result.
* The test result is rounded off to one or two decimal places, so some differences might be observed.

Fundamental emission and Spectrum Mask

Report No.	14122162H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	December 16, 2021
Temperature / Humidity	22 deg. C / 32 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx 13.56 MHz Mod on, without Tag

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



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]	Antenna	Table [deg]	Comment
1	13.11000	33.70	19.26	-33.38	32.32	-12.74	29.50	42.24	0deg	174	
2	13.39864	42.70	19.26	-33.37	32.32	-3.73	40.50	44.23	0deg	158	
3	13.41000	40.00	19.27	-33.37	32.32	-6.42	40.50	46.92	0deg	174	
4	13.55300	69.70	19.27	-33.37	32.32	23.28	50.40	27.12	0deg	174	
5	13.56000	83.90	19.27	-33.37	32.32	37.48	83.90	46.42	0deg	174	
6	13.56700	69.50	19.27	-33.37	32.32	23.08	50.40	27.32	0deg	174	
7	13.71000	39.50	19.27	-33.36	32.32	-6.91	40.50	47.41	0deg	174	
8	14.01000	33.00	19.28	-33.35	32.32	-13.39	29.50	42.89	0deg	174	

RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))
*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

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
0	13.56000	QP	83.90	19.27	6.63	32.32	-	77.48	-	-	Fundamental

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

* All spurious emissions lower than this result.
* The test result is rounded off to one or two decimal places, so some differences might be observed.

Spurious emission

Report No.	14122162H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	December 16, 2021	January 11, 2022
Temperature / Humidity	22 deg. C / 32 % RH	22 deg. C / 28 % RH
Engineer	Kiyoshiro Okazaki	Junya Okuno
	(Below 30 MHz)	(Above 30 MHz)
Mode	Tx 13.56 MHz Mod on, with Tag	

QP

Ant Deg [deg] or Polarity [Hori/Vert]	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
0deg	27.120	QP	31.50	19.43	-33.01	32.28	-	-14.36	29.5	43.86	Floor Noise
Hori.	98.572	QP	43.30	10.03	8.11	32.24	-	29.20	43.5	14.32	
Hori.	129.105	QP	39.80	13.70	8.45	32.22	-	29.73	43.5	13.79	
Hori.	288.009	QP	37.70	13.86	9.91	32.10	-	29.37	46.0	16.65	
Hori.	311.880	QP	34.20	14.12	10.10	32.09	-	26.33	46.0	19.69	
Hori.	339.000	QP	34.50	15.22	10.29	32.09	-	27.92	46.0	18.10	
Hori.	352.560	QP	32.80	15.27	10.40	32.09	-	26.38	46.0	19.64	
Vert.	84.003	QP	51.40	7.50	7.93	32.26	-	34.57	40.0	5.43	
Vert.	86.091	QP	52.20	7.85	7.96	32.25	-	35.76	40.0	4.24	
Vert.	87.468	QP	51.40	8.12	7.98	32.25	-	35.25	40.0	4.75	
Vert.	146.545	QP	37.80	14.77	8.65	32.21	-	29.01	43.5	14.51	
Vert.	160.000	QP	39.70	15.45	8.78	32.20	-	31.73	43.5	11.79	
Vert.	224.005	QP	40.60	11.85	9.38	32.15	-	29.68	46.0	16.34	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor(Below 30 MHz)) - Gain(Amprifier)

Spurious emission

Report No.	14122162H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	December 16, 2021	January 11, 2022
Temperature / Humidity	22 deg. C / 32 % RH	22 deg. C / 28 % RH
Engineer	Kiyoshiro Okazaki	Junya Okuno
	(Below 30 MHz)	(Above 30 MHz)
Mode	Tx 13.56 MHz Mod on, without Tag	

QP

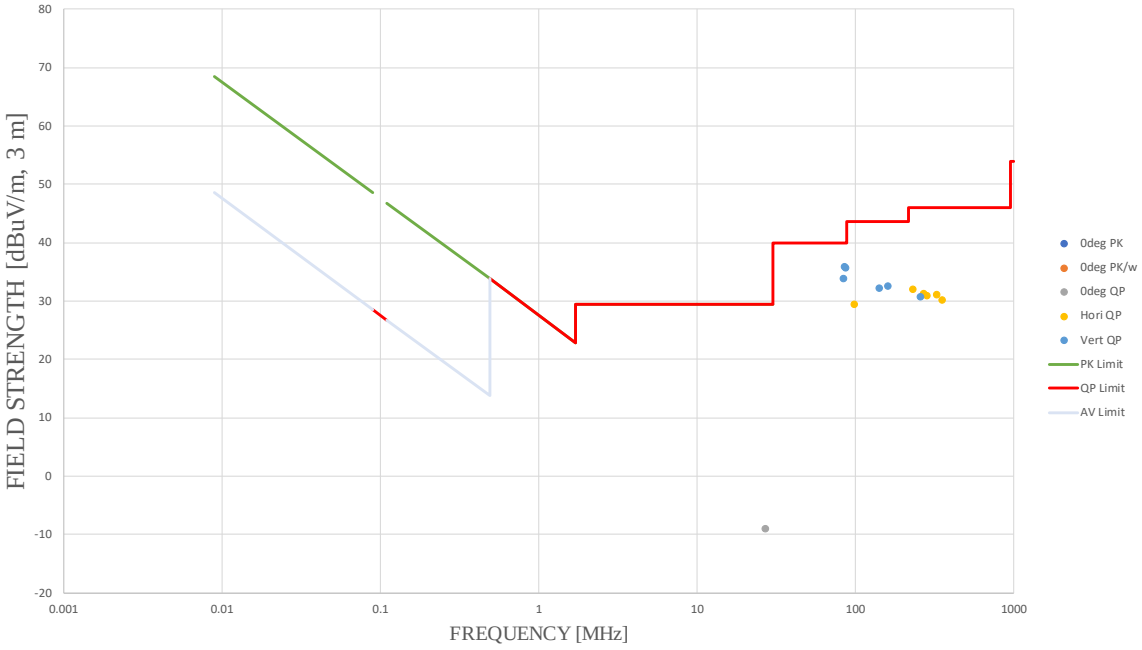
Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	27.120	QP	36.80	19.43	-33.01	32.28	-	-9.06	29.5	38.56	Floor Noise
Hori.	97.849	QP	43.60	9.92	8.10	32.24	-	29.38	43.5	14.14	
Hori.	230.520	QP	42.80	11.99	9.43	32.15	-	32.07	46.0	13.95	
Hori.	271.200	QP	40.10	13.42	9.78	32.11	-	31.19	46.0	14.83	
Hori.	284.760	QP	39.30	13.87	9.89	32.10	-	30.96	46.0	15.06	
Hori.	325.440	QP	38.20	14.79	10.19	32.09	-	31.09	46.0	14.93	
Hori.	352.560	QP	36.50	15.27	10.40	32.09	-	30.08	46.0	15.94	
Vert.	83.971	QP	50.60	7.50	7.93	32.26	-	33.77	40.0	6.23	
Vert.	85.351	QP	52.50	7.71	7.95	32.25	-	35.91	40.0	4.09	
Vert.	87.430	QP	51.90	8.11	7.98	32.25	-	35.74	40.0	4.26	
Vert.	142.005	QP	41.30	14.56	8.60	32.21	-	32.25	43.5	11.27	
Vert.	160.000	QP	40.60	15.45	8.78	32.20	-	32.63	43.5	10.89	
Vert.	257.640	QP	40.80	12.33	9.66	32.12	-	30.67	46.0	15.35	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor(Below 30 MHz)) - Gain(Amprifier)

Radiated Spurious Emission
(Plot data, Worst case for Spurious Emission)

Report No.	14122162H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	December 16, 2021	January 11, 2022
Temperature / Humidity	22 deg. C / 32 % RH	22 deg. C / 28 % RH
Engineer	Kiyoshiro Okazaki (Below 30 MHz)	Junya Okuno (Above 30 MHz)
Mode	Tx 13.56 MHz Mod on, without Tag	

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



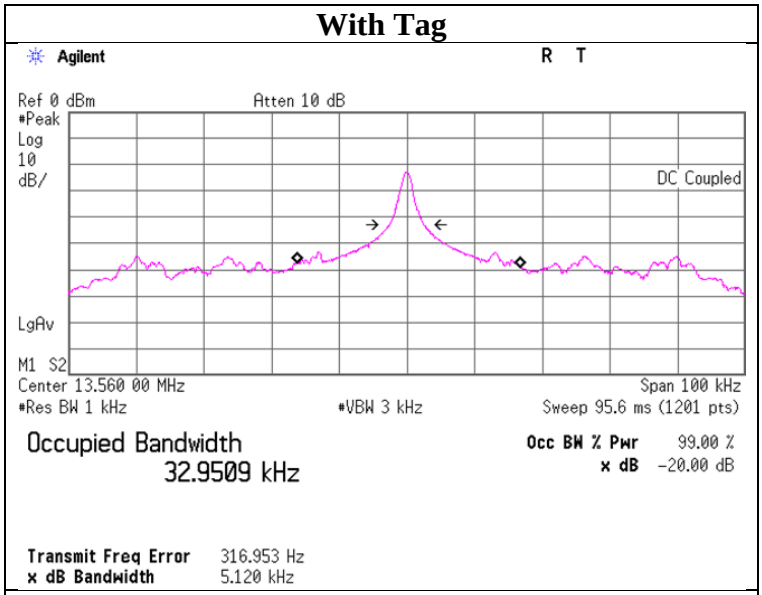
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

20 dB Bandwidth and 99% Occupied Bandwidth

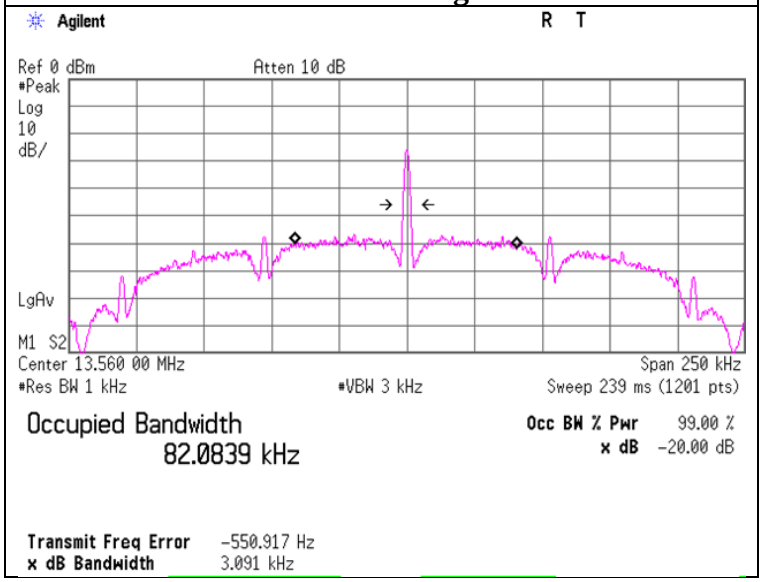
Report No.	14122162H	
Test place	Ise EMC Lab.	
Measurement Room	No.6	No.2
Date	December 24, 2021	January 12, 20222
Temperature / Humidity	23 deg. C / 26 % RH	21 deg. C / 30 % RH
Engineer	Hiroyuki Furutaka	Hiroyuki Furutaka
Mode	Tx 13.56 MHz Mod off	

FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	With Tag	5.120	32.9509
	Without Tag	3.091	82.0839

With Tag



Without Tag



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.	14122162H
Test place	Ise EMC Lab.
Measurement Room	No.6
Date	December 24, 2021
Temperature / Humidity	23 deg. C / 26 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx 13.56 MHz Mod off

Test condition		Tested	Measured	Frequency	Result		Limit
Temp.	Voltage	timing	frequency	error			
[deg. C]	[V]		[MHz]	[MHz]	[%]	[ppm]	[+/- %]
50	24	Power on	13.559972	-0.000028	-0.00021	-2.1	0.01
		+ 2 min.	13.559974	-0.000026	-0.00019	-1.9	0.01
		+ 5 min.	13.559987	-0.000013	-0.00010	-1.0	0.01
		+ 10 min.	13.560000	0.000000	0.00000	0.0	0.01
40	24	Power on	13.559980	-0.000020	-0.00015	-1.5	0.01
		+ 2 min.	13.559972	-0.000028	-0.00021	-2.1	0.01
		+ 5 min.	13.559971	-0.000029	-0.00021	-2.1	0.01
		+ 10 min.	13.559972	-0.000028	-0.00021	-2.1	0.01
30	24	Power on	13.559987	-0.000013	-0.00010	-1.0	0.01
		+ 2 min.	13.559979	-0.000021	-0.00015	-1.5	0.01
		+ 5 min.	13.559977	-0.000023	-0.00017	-1.7	0.01
		+ 10 min.	13.559974	-0.000026	-0.00019	-1.9	0.01
20	24	Power on	13.560019	0.000019	0.00014	1.4	0.01
		+ 2 min.	13.560006	0.000006	0.00004	0.4	0.01
		+ 5 min.	13.559997	-0.000003	-0.00002	-0.2	0.01
		+ 10 min.	13.559991	-0.000009	-0.00007	-0.7	0.01
20	20.4	Power on	13.560075	0.000075	0.00055	5.5	0.01
	(24V -15%)	+ 2 min.	13.560000	0.000000	0.00000	0.0	0.01
		+ 5 min.	13.559995	-0.000005	-0.00004	-0.4	0.01
		+ 10 min.	13.559992	-0.000008	-0.00006	-0.6	0.01
20	27.6	Power on	13.559994	-0.000006	-0.00004	-0.4	0.01
	(24V +15%)	+ 2 min.	13.559993	-0.000007	-0.00005	-0.5	0.01
		+ 5 min.	13.559991	-0.000009	-0.00007	-0.7	0.01
		+ 10 min.	13.559990	-0.000010	-0.00007	-0.7	0.01
10	24	Power on	13.560052	0.000052	0.00038	3.8	0.01
		+ 2 min.	13.560041	0.000041	0.00030	3.0	0.01
		+ 5 min.	13.560024	0.000024	0.00018	1.8	0.01
		+ 10 min.	13.560012	0.000012	0.00009	0.9	0.01
0	24	Power on	13.560062	0.000062	0.00046	4.6	0.01
		+ 2 min.	13.560059	0.000059	0.00044	4.4	0.01
		+ 5 min.	13.560050	0.000050	0.00037	3.7	0.01
		+ 10 min.	13.560042	0.000042	0.00031	3.1	0.01
-10	24	Power on	13.560052	0.000052	0.00038	3.8	0.01
		+ 2 min.	13.560062	0.000062	0.00046	4.6	0.01
		+ 5 min.	13.560058	0.000058	0.00043	4.3	0.01
		+ 10 min.	13.560058	0.000058	0.00043	4.3	0.01
-20	24	Power on	13.560031	0.000031	0.00023	2.3	0.01
		+ 2 min.	13.560050	0.000050	0.00037	3.7	0.01
		+ 5 min.	13.560059	0.000059	0.00044	4.4	0.01
		+ 10 min.	13.560062	0.000062	0.00046	4.6	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 test was begun from 50 deg. C and the temperature was lowered each 10 deg. C.

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
CE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/15/2021	12
CE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/07/2021	12
CE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
CE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
CE	MLS-25	141537	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-731	07/20/2021	12
CE	MSA-04	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/10/2021	12
CE	MTA-52	141934	Terminator	TME	CT-01BP	-	04/12/2021	12
CE	MAT-67	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	12/17/2021	12
CE	MCC-113	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/ 421-010/ sucoform141-PE/ RFM-E121(SW)	-/04178	06/02/2021	12
CE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/05/2021	12
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2020	24
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/15/2021	12
RE	MMM-08	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	01/07/2021	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MCC-112	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/ sucoform141-PE/ 421-010/ RFM-E321(SW)	-/00640	07/19/2021	12
RE	MLPA-01	141254	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	04/17/2021	12
RE	MCC-255	207745	Coaxial Cable	UL Japan Inc.	-	-	05/17/2021	12
RE	MAT-95	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/09/2021	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/05/2021	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/18/2021	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	VHA 91031302	08/28/2021	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	07/19/2021	12
RE	MLA-22	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/21/2021	12
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/05/2021	12
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	2021/12/19	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	2021/08/10	12
RE	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/10/2022	12
RE	MMM-18	141558	Digital Tester(TRUE RMS MULTIMETER)	Fluke Corporation	115	17930030	05/24/2021	12
RE	MSA-16	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	01/07/2022	12
RE	MLPA-08	202511	Loop Antenna	UL Japan	-	-	-	-
FT	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/15/2021	12
FT	MMM-18	141558	Digital Tester(TRUE RMS MULTIMETER)	Fluke Corporation	115	17930030	05/24/2021	12
FT	MSA-16	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	12/18/2020	12
FT	MLPA-08	202511	Loop Antenna	UL Japan	-	-	-	-
FT	MCH-04	141429	Temperature and Humidity Chamber	Espec	PL-2KP	14015723	2021/08/05	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