



RADIO TEST REPORT

Test Report No. : 12359186M-A-R2

Applicant : **Oki Data Corporation**
Type of Equipment : **Embedded RFID Read/Write System**
Model No. : **4666411A**
Test regulation : **FCC Part 15 Subpart C: 2018**
FCC ID : **B2K-4666411A**
Test Result : **Complied**

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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.
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6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Kashima EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. This report is a revised version of 12359186M-A-R1. 12359186M-A-R1 is replaced with this report.

Date of test: July 5, 9, 2018

**Representative
test operator:**

K. Ando

Kazuhiro Ando
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Approved by :

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Leader
Consumer Technology Division



- ☐ 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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13-EM-F0429

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SECTION 1: Customer information

Company Name	:	Oki Data Corporation
Address	:	3-1, Futaba-cho, Takasaki-city, Gunma-Pref 370-8585, Japan
Telephone Number	:	+81-27-328-6399
Facsimile Number	:	+81-27-328-6396
Contact Person	:	Hidetoshi Okazaki

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Embedded RFID Read/Write System
Model No.	:	4666411A
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 5 V, 0.2 A
Receipt Date of Sample	:	July 4, 2018
Country of Mass-production	:	China
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: 4666411A (referred to as the EUT in this report) is an Embedded RFID Read/Write System.

Radio Specification

Equipment Type	:	Transceiver
Frequency of Operation	:	13.56 MHz
Modulation	:	ASK
Antenna type	:	Printed Loop Coil
Antenna connector type	:	PH
Operation temperature range	:	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.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 8.8	Section 15.207 <IC>RSS-Gen 8.8	20.8 dB 21.23930 MHz, AV, L	Complied	-
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.4, 6.12	Section 15.225(a) <IC>RSS-210 B.6	76.9 dB, 13.56000 MHz, QP, 0 deg.	Complied	Radiated
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 6.4, 6.13	Section 15.225(b)(c) <IC> RSS-210 B.6	45.7 dB, 14.01000 MHz, QP, 0 deg.	Complied	Radiated
20dB Bandwidth	ANSI C63.10:2013 6 Standard test methods <IC> -	Section15.215(c) <IC> -	See data	Complied	Radiated
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 6.4, 6.13	Section 15.209, Section 15.225 (d) <IC>RSS-210 B.6	8.4 dB 230.520 MHz, Horizontal, QP	Complied	Radiated
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 6.11, 8.11	Section 15.225(e) <IC> RSS-210 B.6	See data	Complied	Radiated

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

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 RF Module has its own regulator. The RF Module is constantly provided voltage (DC4.0 V) through the regulator regardless of input voltage. 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 15.203/212 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 15.203/212.

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3.3 Addition to standard

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99 % Occupied Band Width	RSS-Gen 6.6	-	Radiated	N/A	N/A	Complied

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

EMI

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

Conducted emission

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

Radiated emission

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

Antenna Terminal test

Test Item	Required Uncertainty (+/-)	Uncertainty (+/-)
Frequency Tolerance	1.0×10^{-7}	7.9×10^{-8}
20 dB Bandwidth / 99 % Occupied Bandwidth	Not Defined	1.6 %

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3.5 Test Location

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 JAB Accreditation No. : RTL02610

Test site	ISED Assigned code	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Open site	4659A-1	6.0 x 5.5 x 2.5	20 x 40	10 m
No.2 Open site	4659A-2	4.4 x 4.4 x 2.15	18 x 20	10 m
No.5 Open site	4659A-5	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	4659A-1	5.4 x 4.5 x 2.3	-	-
No.2 Shielded room	4659A-2	3.6 x 2.7 x 2.3	-	-
No.3 Shielded room	-	5.4 x 3.6 x 2.3	-	-
No.4 Shielded Room	-	6.1 x 6.1 x 3.1	-	-
No.5 Shielded Room	4659A-5	4.2 x 3.1 x 2.5	-	-
No.3 Fully Anechoic Chamber	-	7.0 x 3.5 x 3.5	-	-
No.6 Semi-anechoic Chamber	4659A-6	8.5 x 5.5 x 5.2	-	3 m
No.10 Semi-anechoic Chamber	4659A-10	18.4 x 9.9 x 7.7	-	10 m
No.11 Semi-anechoic Chamber	4659A-7	9.0 x 6.5 x 5.2	-	3 m
No.1 Measurement room	-	5.0 x 3.7 x 2.6	-	-
No.2 Measurement room	-	4.3 x 4.4 x 2.7	-	-
No.3 Measurement room	-	4.3 x 4.4 x 2.7	-	-

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)

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

Test item	Operating mode	Tested frequency
All items except for Frequency tolerances	Transmitting and Receiving mode (with Tag, without Tag) • Modulation ASK10% • Data transfer rate 106kbps • 4ch serially transmitting (Continuous Transmitting with switching 4 antenna in order)	13.56MHz
Frequency tolerances	Transmitting Unmodulated	13.56MHz

The EUT has the power settings by the software as follows;

Power settings : Fixed
Software : Emi-4Ch YRMBCA30 YTB020H-066 v1.00

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

Frequency Tolerance:

Temperature : -20 deg. C to +50 deg. C Step 10 deg. C
Voltage : Normal Voltage DC 5.0 V
Maximum Voltage DC 5.75 V, Minimum Voltage DC 4.25 V (DC 5.0 V $\pm$ 15 %)

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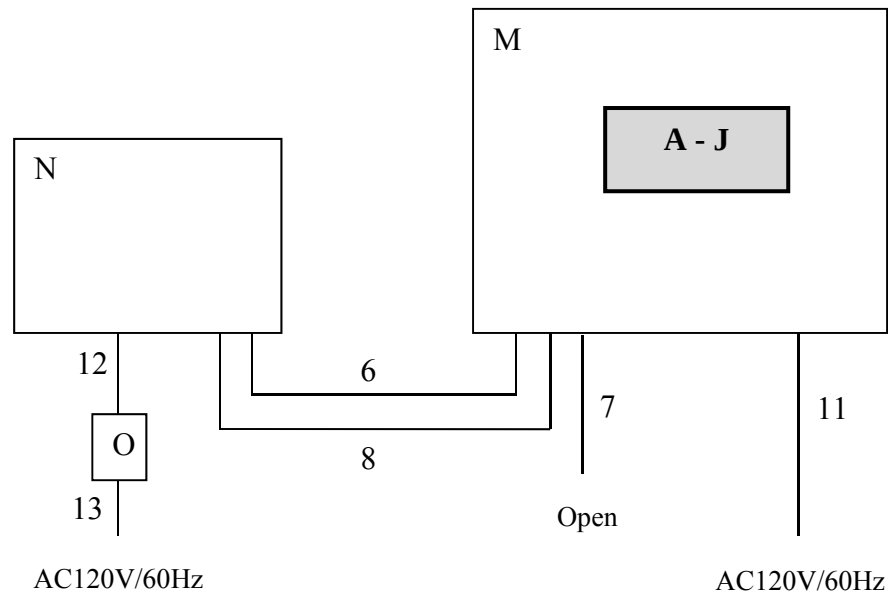
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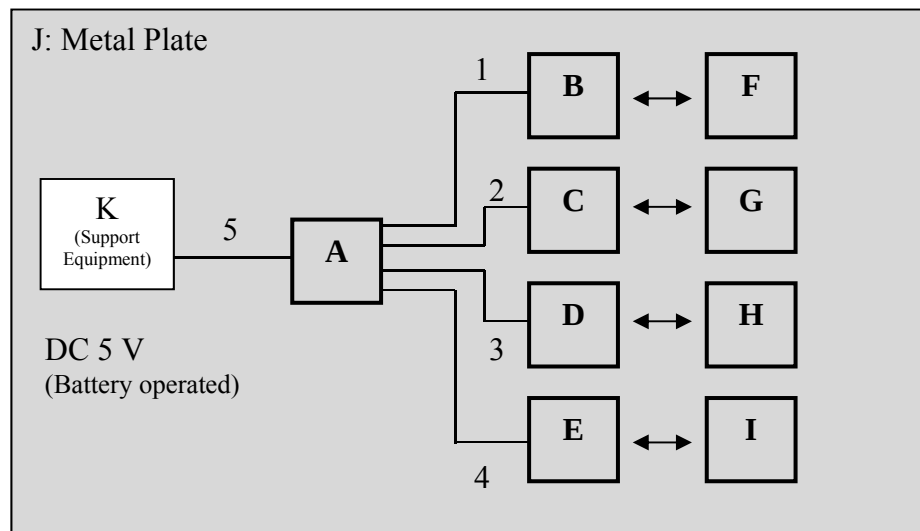
Facsimile : +81 478 82 3373

4.2 Configuration and peripherals

Conducted Emissions



Radiated Emissions



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

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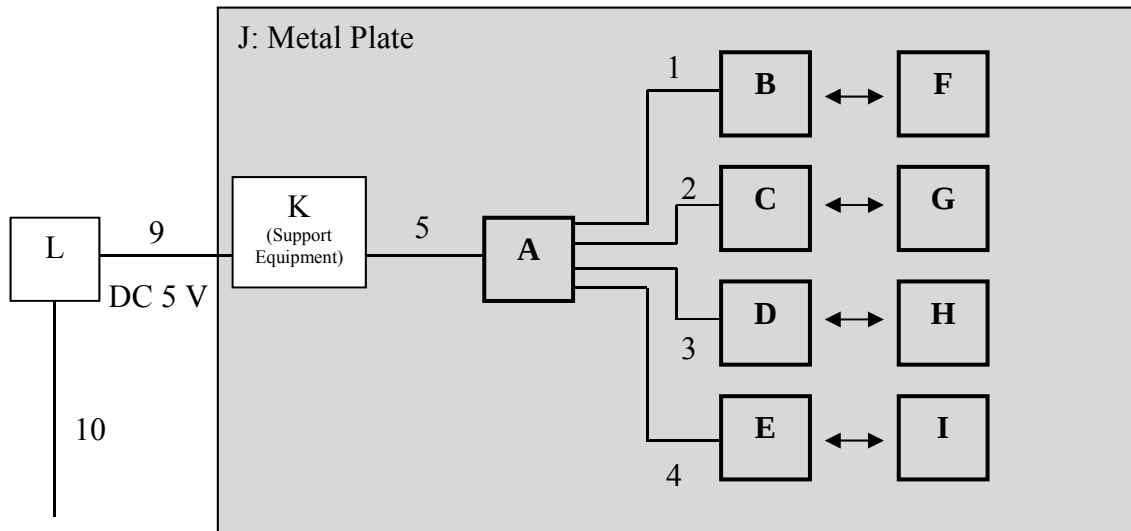
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Frequency stability Test condition



AC100V/50Hz

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	RFID Module	466411A	18110089 18110013 *1)	Oki Data Corporation	EUT
B-E	Antenna Unit	-	-	Oki Data Corporation	EUT
F-I	Tag	-	-	Oki Data Corporation	EUT Internal coil size: 13[mm]*18[mm] Internal coil turns: 13
J	Metal Plate	-	-	Oki Data Corporation	EUT
K	Micro-Computer for Test	None	None	Oki Data Corporation	Support equipment
L	DC Power Supply	GSV3000	60646742	Diamond Antenna	-
M	Printer	N35301A	ALPHA00046A0	Oki Data Corporation	-
N	PC	3358-3VJ	LR-L593L	lenovo	-
O	AC Adapter	92P1156	11S92P1156Z1ZDXN 26D4TC	lenovo	-

*1) 18110089: for Conducted emission test, 18110013: for other tests

List of cables used

No.	Item	Length(m)	Shield		Remarks
			Cable	Connector	
1	Antenna cable 0	0.135	Unshielded	Unshielded	44658601YS
2	Antenna cable 1	0.070	Unshielded	Unshielded	44658601YS
3	Antenna cable 2	0.070	Unshielded	Unshielded	44658601YS
4	Antenna cable 3	0.135	Unshielded	Unshielded	44658601YS
5	Signal	0.930	Unshielded	Unshielded	-
6	USB	2.0	Shielded	Shielded	-
7	USB	1.0	Shielded	Shielded	-
8	LAN	3.0	Unshielded	Unshielded	-
9	DC	2.0	Unshielded	Unshielded	-
10	AC	1.7	Unshielded	Unshielded	DC Power Supply
11	AC	1.8	Unshielded	Unshielded	Printer
12	DC	1.8	Unshielded	Unshielded	AC Adapter
13	AC	1.5	Unshielded	Unshielded	AC Adapter

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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.

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.

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

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

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

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

Frequency: From 9 kHz to 30 MHz

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for vertical polarization (antenna angle: 0 deg.) 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 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.

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

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

Test Antennas are used as below;

Frequency	Below 30 MHz	30 MHz to 1 GHz
Antenna Type	Loop	Hybrid

Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m

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

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

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

The 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

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SECTION 7: Other test

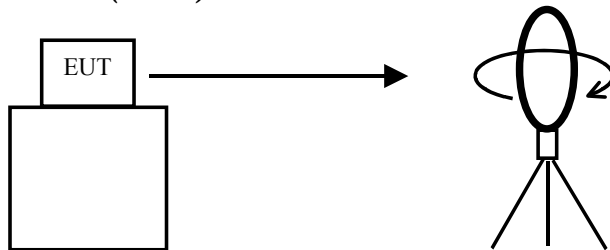
Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	50 kHz	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *2)	Spectrum Analyzer
Frequency Tolerance*3)	-	-	-	-	-	-	Frequency counter

*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %.
*2) The measurement was performed with Max Hold since the duty cycle was not 100 %.
*3) The temperature test was started after the temperature stabilization time of 30 minutes.
The test was begun from 50 deg.C and the temperature was lowered each 10 deg.C.

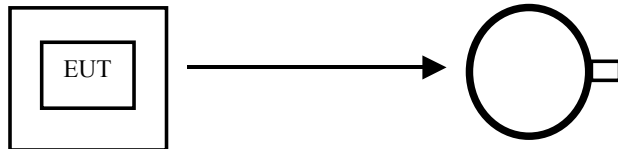
Test data : APPENDIX
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

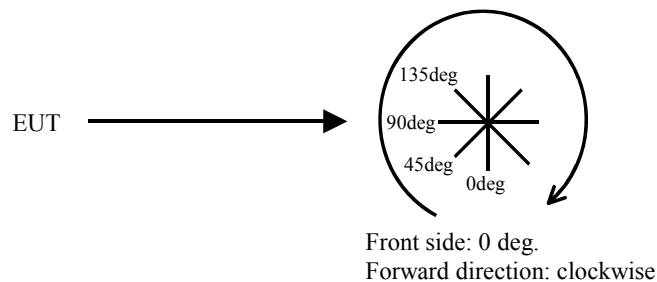


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



APPENDIX 1: Test data

Conducted Emission

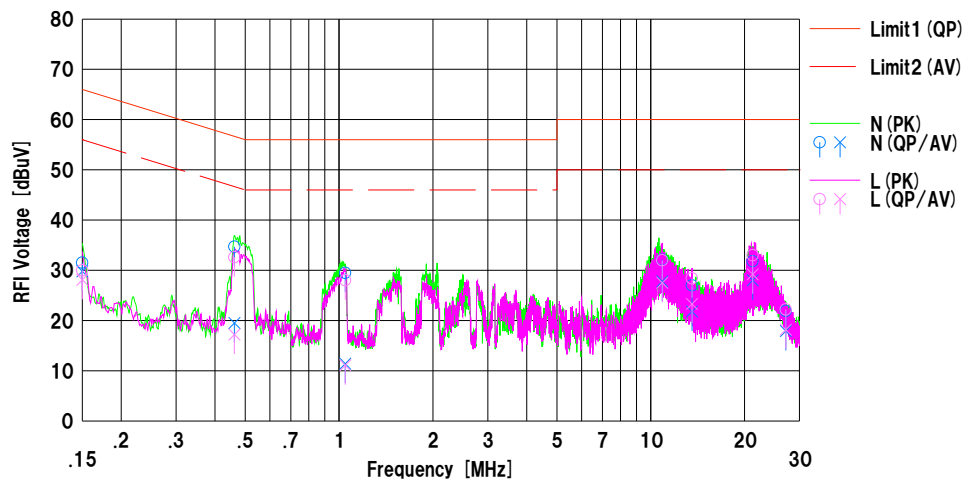
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.11 Semi-Anechoic Chamber
Date : 2018/07/05

Mode : Transmitting and Receiving
Order No. : 12359186M
Power : DC 5 V (Printer: AC 120 V / 60 Hz)
Temp./Humi. : 22 deg.C / 54 %RH

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	21.3	19.6	10.2	31.5	29.8	66.0	56.0	34.5	26.2	N	
2	0.46154	24.5	9.3	10.2	34.7	19.5	56.7	46.7	22.0	27.2	N	
3	1.04641	19.1	1.0	10.4	29.5	11.4	56.0	46.0	26.5	34.6	N	
4	10.88700	20.9	16.6	11.2	32.1	27.8	60.0	50.0	27.9	22.2	N	
5	13.56000	15.5	10.3	11.5	27.0	21.8	60.0	50.0	33.0	28.2	N	
6	21.23930	19.8	16.0	12.0	31.8	28.0	60.0	50.0	28.2	22.0	N	
7	27.12000	9.6	5.6	12.3	21.9	17.9	60.0	50.0	38.1	32.1	N	
8	0.15000	19.8	17.9	10.2	30.0	28.1	66.0	56.0	36.0	27.9	L	
9	0.46154	22.4	7.0	10.2	32.6	17.2	56.7	46.7	24.1	29.5	L	
10	1.04641	17.6	0.7	10.4	28.0	11.1	56.0	46.0	28.0	34.9	L	
11	10.88700	20.8	16.3	11.2	32.0	27.5	60.0	50.0	28.0	22.5	L	
12	13.56000	16.9	11.8	11.5	28.4	23.3	60.0	50.0	31.6	26.7	L	
13	21.23930	21.0	17.2	12.0	33.0	29.2	60.0	50.0	27.0	20.8	L	
14	27.12000	9.9	5.9	12.3	22.2	18.2	60.0	50.0	37.8	31.8	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN:CLS-07

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Fundamental emission and Spectrum Mask (without tag)

DATA OF RADIATED EMISSION (below 30MHz) TEST

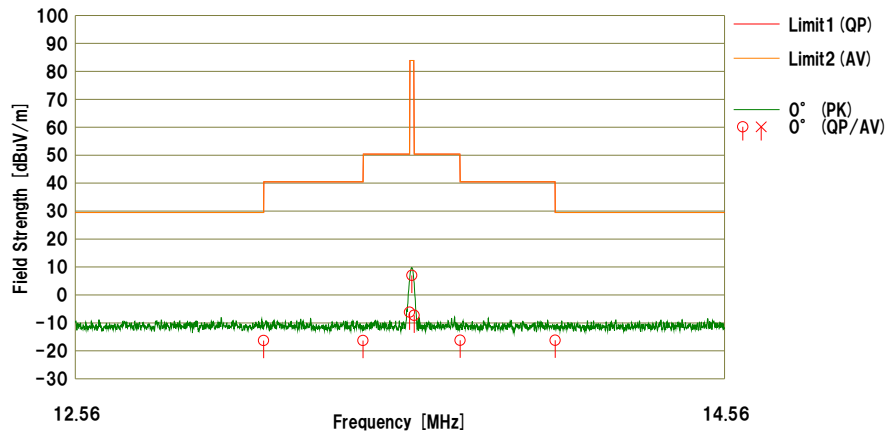
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/07/05

Mode : Transmitting and Receiving
Order No. : 12359186M
Power : DC 5 V
Temp./Humi. : 22 deg.C / 54 %RH

Remarks : without tag

Limit1 : FCC15.225.PKQP, 9~90kHz:PK, 110~490kHz:PK
Limit2 : FCC15.225.AVQP, 9~90kHz:AV, 110~490kHz:AV

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		AntFac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna [deg]	Table	Comment
		<QP> [dBuV]	<AV> [dBuV]				<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dB]	<AV> [dB]			
1	13.11000	29.4	---	19.6	-33.0	32.3	-16.3	---	29.5	29.5	45.8	---	0°	262	
2	13.41000	29.4	---	19.6	-33.0	32.3	-16.3	---	40.5	40.5	56.8	---	0°	262	
3	13.55300	39.6	---	19.5	-33.0	32.3	-6.2	---	50.4	50.4	56.6	---	0°	262	
4	13.56000	52.8	---	19.5	-33.0	32.3	7.0	---	83.9	83.9	76.9	---	0°	262	
5	13.56700	38.5	---	19.5	-33.0	32.3	-7.3	---	50.4	50.4	57.7	---	0°	262	
6	13.71000	29.6	---	19.5	-33.0	32.3	-16.2	---	40.5	40.5	56.7	---	0°	262	
7	14.01000	29.6	---	19.5	-33.0	32.3	-16.2	---	29.5	29.5	45.7	---	0°	262	

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

Result of the fundamental emission at 3 m without Distance factor

QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	52.8	19.5	7.0	32.3	-	47.0	-	-	Fundamental

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

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Spurious emission
(with tag)

DATA OF RADIATED EMISSION (below 30MHz) TEST

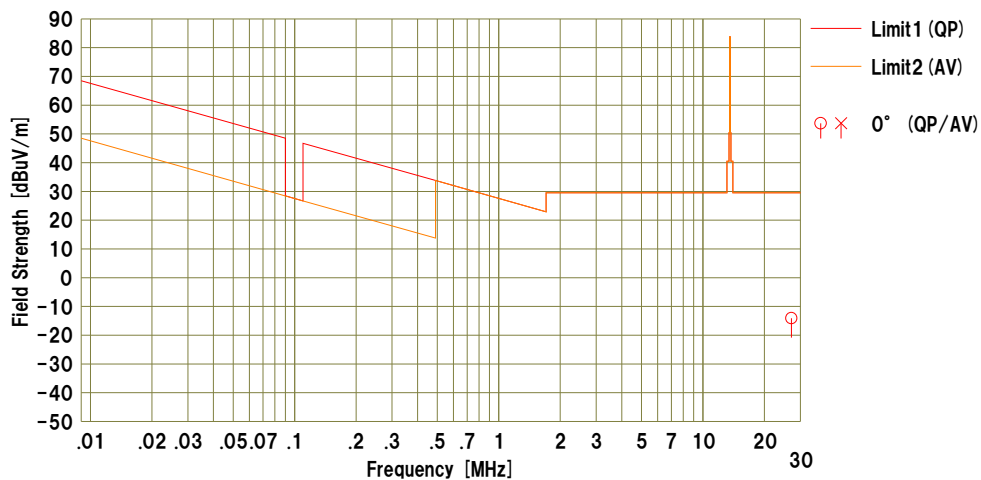
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/07/05

Mode : Transmitting and Receiving
Order No. : 12359186M
Power : DC 5 V
Temp./Humi. : 22 deg.C / 54 %RH

Remarks : with tag

Limit1 : FCC15_225_PKQP, 9-90kHz-PK, 110-490kHz-PK
Limit2 : FCC15_225_AVQP, 9-90kHz-AV, 110-490kHz-AV

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		AntFac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna	Table	Comment
		<QP> [dBuV]	<AV> [dBuV]				<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dB]	<AV> [dB]			
1	27.12000	30.5	---	20.1	-32.5	32.2	-14.1	---	29.5	29.5	43.6	---	0°	268	

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

Spurious emission
(without tag)

DATA OF RADIATED EMISSION (below 30MHz) TEST

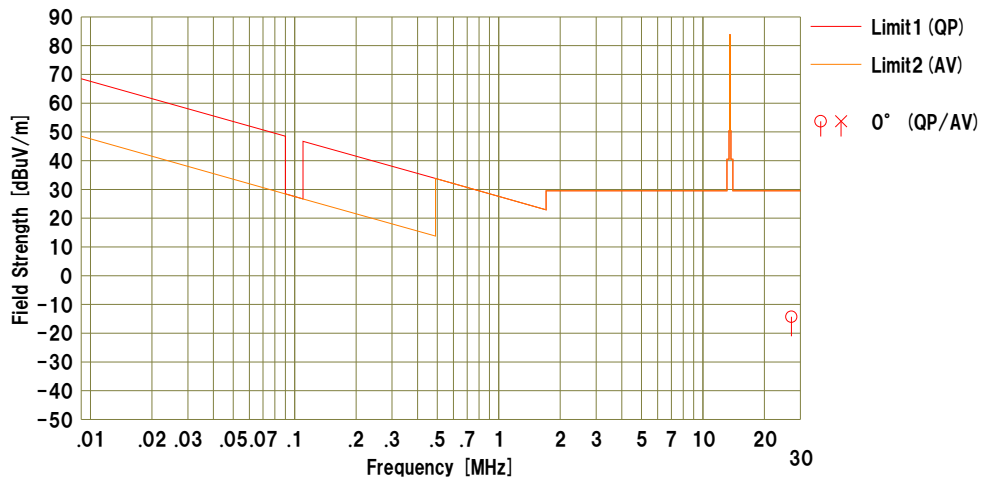
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/07/05

Mode : Transmitting and Receiving
Order No. : 12359186M
Power : DC 5 V
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Remarks : without tag

Limit1 : FCC15_225_PKQP, 9-90kHz-PK, 110-490kHz-PK
Limit2 : FCC15_225_AVQP, 9-90kHz-AV, 110-490kHz-AV

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		AntFac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna	Table	Comment
		<QP> [dBuV]	<AV> [dBuV]				<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dB]	<AV> [dB]			
1	27.12000	30.3	---	20.1	-32.5	32.2	-14.3	---	29.5	29.5	43.8	---	0*	258	

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

Spurious emission
(with tag)

DATA OF RADIATED EMISSION TEST

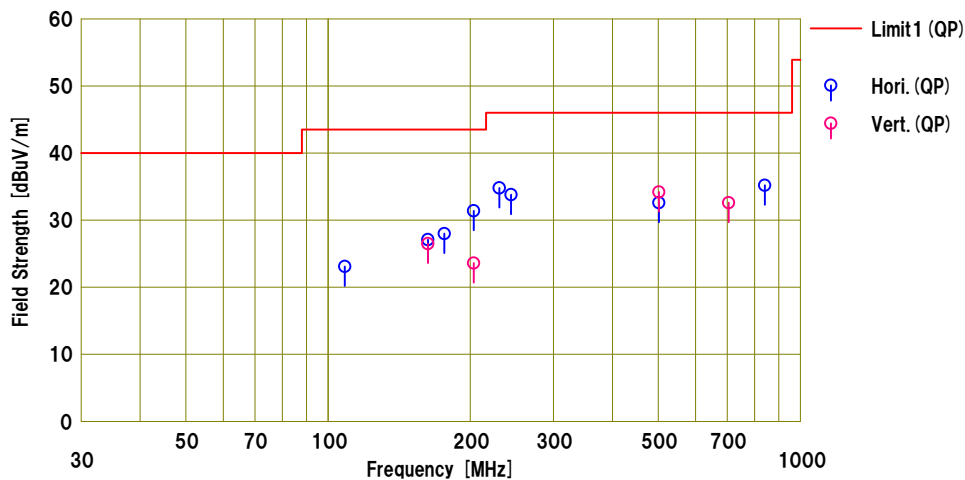
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/07/05

Mode : Transmitting and Receiving
Order No. : 12359186M
Power : DC 5 V
Temp./Humi. : 22 deg.C / 54 %RH

Remarks : with tag

Limit1 : FCC15.209 3m, below 1GHz:QP, above 1GHz:AV

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	108.480	34.1	10.3	5.4	26.7	23.1	43.5	20.4	Hori.	285	273	HB	
2	162.720	34.1	13.4	6.0	26.4	27.1	43.5	16.4	Hori.	169	0	HB	
3	176.280	35.8	12.4	6.2	26.4	28.0	43.5	15.5	Hori.	168	350	HB	
4	203.400	41.3	9.9	6.4	26.2	31.4	43.5	12.1	Hori.	166	335	HB	
5	230.520	44.0	10.2	6.7	26.1	34.8	46.0	11.2	Hori.	136	342	HB	
6	244.080	41.4	11.6	6.9	26.1	33.8	46.0	12.2	Hori.	129	344	HB	
7	501.720	33.0	17.9	9.1	27.4	32.6	46.0	13.4	Hori.	187	204	HB	
8	840.720	29.0	22.9	10.7	27.4	35.2	46.0	10.8	Hori.	102	54	HB	
9	162.720	33.5	13.4	6.0	26.4	26.5	43.5	17.0	Vert.	100	315	HB	
10	203.400	33.5	9.9	6.4	26.2	23.6	43.5	19.9	Vert.	100	283	HB	
11	501.720	34.6	17.9	9.1	27.4	34.2	46.0	11.8	Vert.	113	314	HB	
12	705.120	29.3	20.9	10.0	27.6	32.6	46.0	13.4	Vert.	100	266	HB	

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

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Spurious emission
(without tag)

DATA OF RADIATED EMISSION TEST

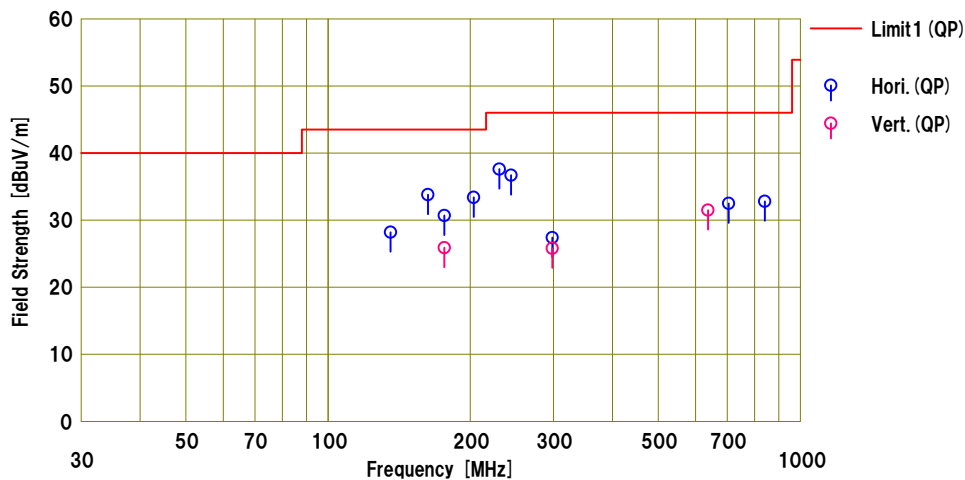
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/07/05

Mode : Transmitting and Receiving
Order No. : 12359186M
Power : DC 5 V
Temp./Humi. : 22 deg.C / 54 %RH

Remarks : without tag

Limit1 : FCC15.209 3m, below 1GHz:QP, above 1GHz:AV

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	135.600	36.4	12.7	5.7	26.6	28.2	43.5	15.3	Hori.	229	187	HB	
2	162.720	40.8	13.4	6.0	26.4	33.8	43.5	9.7	Hori.	190	169	HB	
3	176.280	38.5	12.4	6.2	26.4	30.7	43.5	12.8	Hori.	165	0	HB	
4	203.400	43.3	9.9	6.4	26.2	33.4	43.5	10.1	Hori.	154	0	HB	
5	230.520	46.8	10.2	6.7	26.1	37.6	46.0	8.4	Hori.	145	0	HB	
6	244.080	44.3	11.6	6.9	26.1	36.7	46.0	9.3	Hori.	122	355	HB	
7	298.320	32.5	13.4	7.5	26.0	27.4	46.0	18.6	Hori.	100	31	HB	
8	705.120	29.2	20.9	10.0	27.6	32.5	46.0	13.5	Hori.	121	150	HB	
9	840.720	26.6	22.9	10.7	27.4	32.8	46.0	13.2	Hori.	100	137	HB	
10	176.280	33.7	12.4	6.2	26.4	25.9	43.5	17.6	Vert.	100	104	HB	
11	298.320	30.9	13.4	7.5	26.0	25.8	46.0	20.2	Vert.	197	248	HB	
12	637.320	29.0	20.4	9.7	27.6	31.5	46.0	14.5	Vert.	100	240	HB	

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

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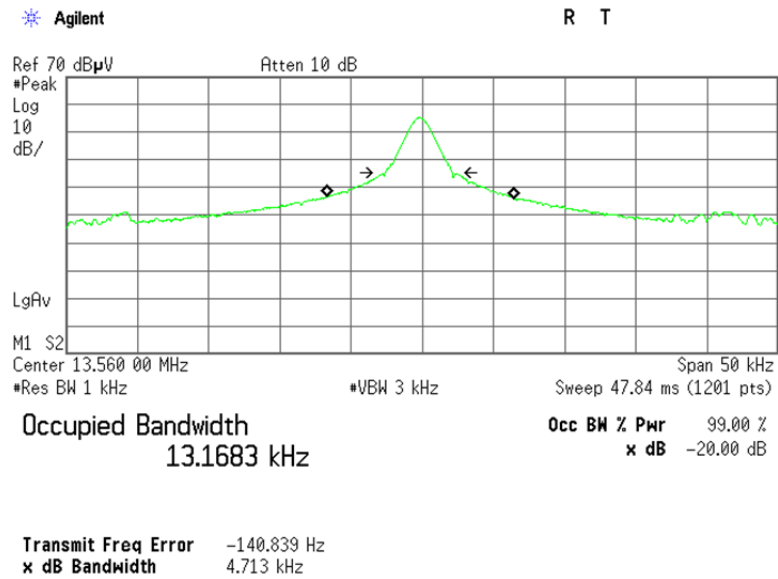
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Facsimile : +81 478 82 3373

20dB Bandwidth and 99% Occupied Bandwidth

Report No.	12359186M-A
Test place	Kashima EMC Lab. No.2 measurement room
Date	July 9, 2018
Temperature / Humidity	24 deg. C / 55 % RH
Engineer	Kazuhiro Ando
Mode	Tx Mod on (with tag)

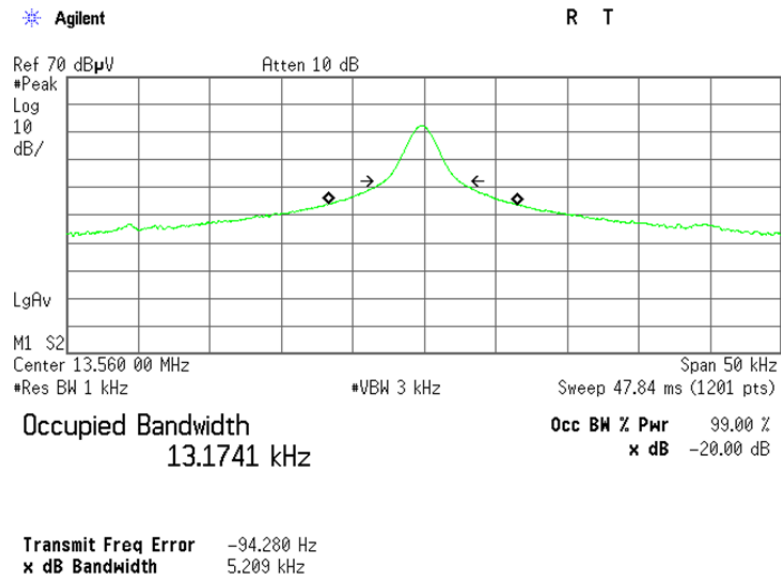
FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	4.71	13.17



20dB Bandwidth and 99% Occupied Bandwidth

Report No.	12359186M-A
Test place	Kashima EMC Lab. No.2 measurement room
Date	July 9, 2018
Temperature / Humidity	24 deg. C / 55 % RH
Engineer	Kazuhiro Ando
Mode	Tx Mod on (without tag)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	5.21	13.17



Frequency Tolerance

Report No. 12359186M-A
Test place Kashima EMC Lab. No.2 measurement room
Date July 9, 2018
Temperature / Humidity 24 deg. C / 55 % RH
Engineer Kazuhiro Ando
Mode Tx Mod off

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	5	Power on	13.559762	-0.000238	-0.00176	-17.6	0.01
		+ 2 min.	13.559760	-0.000240	-0.00177	-17.7	0.01
		+ 5 min.	13.559760	-0.000240	-0.00177	-17.7	0.01
		+ 10 min.	13.559760	-0.000240	-0.00177	-17.7	0.01
40	5	Power on	13.559788	-0.000212	-0.00156	-15.6	0.01
		+ 2 min.	13.559784	-0.000216	-0.00159	-15.9	0.01
		+ 5 min.	13.559784	-0.000216	-0.00159	-15.9	0.01
		+ 10 min.	13.559784	-0.000216	-0.00159	-15.9	0.01
30	5	Power on	13.559819	-0.000181	-0.00133	-13.3	0.01
		+ 2 min.	13.559815	-0.000185	-0.00136	-13.6	0.01
		+ 5 min.	13.559814	-0.000186	-0.00137	-13.7	0.01
		+ 10 min.	13.559814	-0.000186	-0.00137	-13.7	0.01
20	5	Power on	13.559849	-0.000151	-0.00111	-11.1	0.01
		+ 2 min.	13.559844	-0.000156	-0.00115	-11.5	0.01
		+ 5 min.	13.559844	-0.000156	-0.00115	-11.5	0.01
		+ 10 min.	13.559844	-0.000156	-0.00115	-11.5	0.01
20	4.25 (5V -15%)	Power on	13.559849	-0.000151	-0.00111	-11.1	0.01
		+ 2 min.	13.559845	-0.000155	-0.00114	-11.4	0.01
		+ 5 min.	13.559845	-0.000155	-0.00114	-11.4	0.01
		+ 10 min.	13.559845	-0.000155	-0.00114	-11.4	0.01
20	5.75 (5V +15%)	Power on	13.559848	-0.000152	-0.00112	-11.2	0.01
		+ 2 min.	13.559844	-0.000156	-0.00115	-11.5	0.01
		+ 5 min.	13.559843	-0.000157	-0.00116	-11.6	0.01
		+ 10 min.	13.559843	-0.000157	-0.00116	-11.6	0.01
10	5	Power on	13.559867	-0.000133	-0.00098	-9.8	0.01
		+ 2 min.	13.559865	-0.000135	-0.00100	-10.0	0.01
		+ 5 min.	13.559865	-0.000135	-0.00100	-10.0	0.01
		+ 10 min.	13.559865	-0.000135	-0.00100	-10.0	0.01
0	5	Power on	13.559873	-0.000127	-0.00094	-9.4	0.01
		+ 2 min.	13.559873	-0.000127	-0.00094	-9.4	0.01
		+ 5 min.	13.559873	-0.000127	-0.00094	-9.4	0.01
		+ 10 min.	13.559873	-0.000127	-0.00094	-9.4	0.01
-10	5	Power on	13.559855	-0.000145	-0.00107	-10.7	0.01
		+ 2 min.	13.559859	-0.000141	-0.00104	-10.4	0.01
		+ 5 min.	13.559859	-0.000141	-0.00104	-10.4	0.01
		+ 10 min.	13.559859	-0.000141	-0.00104	-10.4	0.01
-20	5	Power on	13.559803	-0.000197	-0.00145	-14.5	0.01
		+ 2 min.	13.559812	-0.000188	-0.00139	-13.9	0.01
		+ 5 min.	13.559812	-0.000188	-0.00139	-13.9	0.01
		+ 10 min.	13.559813	-0.000187	-0.00138	-13.8	0.01

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

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

APPENDIX 2: Test instruments

Test Instruments

Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
CE	143029	10dB Fixed Atten.	Suhner	6810.01.A	none	2017/07/14	2018/07/31	12
CE	143500	A.M.N.	Rohde & Schwarz	ESH3-Z5	838576/017	2017/07/13	2018/07/31	12
CE	143501	A.M.N.	Rohde & Schwarz	ESH3-Z5	844982/034	2017/07/13	2018/07/31	12
CE	143157	Coaxial Cable	FUJIKURA,FUJIKURA,FUJIKURA,FUJIKURA,FUJIKURA	5D-2W,5D-2W,5D-2W,5D-2W,5D-2W,	-	2017/08/25	2018/08/31	12
CE	143718	Terminator	Suhner	65_BNC-50-0-2/133_NE	none	2017/11/01	2018/11/30	12
CE	144193	Test Receiver	Rohde & Schwarz	ESU40	100426	2018/04/10	2019/04/30	12
RE	143050	3dB Fixed Atten.	TAMAGAWA	UFA-01	none	2017/09/04	2018/09/30	12
RE	143165	Coaxial Cable	Fujikura,Fujikura,Agilent,Fujikura,Fujikura,Fujikura,Fujikura,Fujikura,Fujikura	5D-2W,5D-2W,8494A,5D-2W,5D-2W,5D-2	MY41110200(Step Att)	2017/08/25	2018/08/31	12
RE	143121	LOGBICON	Schwarzbeck	VULB 9168	343	2018/04/05	2019/04/30	12
RE	142930	Pre-Amplifier	HEWLETT PACKARD	8447D	2944A09041	2017/08/25	2018/08/31	12
AT	144215	Digital Multimeter	Fluke Corporation	FLK-83- V	14610320	2017/09/11	2018/09/30	12
AT	143543	Temperature & Humidity Indicator	T&D	TR-73U	F8060468	2018/05/24	2019/05/31	12
AT	143423	Frequency Counter	AGILENT	53151A	US40511823	2018/04/25	2019/04/30	12
AT	143643	Spectrum Analyzer	AGILENT	E4448A	MY52490024	2018/05/23	2019/05/31	12
AT	143010	Temperature and Humidity Chamber	ESPEC	PR-4KPH	14010754	2018/01/19	2019/01/31	12
EMI	143133	Barometer	Sunoh	SBR-151	001439	2015/11/18	2018/11/30	36
EMI	144216	Digital Multimeter	Fluke Corporation	115	994460954	2017/10/02	2018/10/31	12
EMI	142901	EMI Software	TSJ	TEPTO-DV(RE,CE,MF,PE)	Ver.3.3	-	-	-
EMI	143654	Ruler	TAJIMA	L19-55	-	-	-	-
EMI	143542	Temperature & Humidity Indicator	HIOKI	3641/9680-50	090999895/090905406	2018/05/30	2019/05/31	12
ME	144245	6dB Fixed Atten.	Suhner	6906.01.A	none	2018/07/04	2019/07/31	12
ME	143157	Coaxial Cable	FUJIKURA,FUJIKURA,FUJIKURA,FUJIKURA,FUJIKURA	5D-2W,5D-2W,5D-2W,5D-2W,5D-2W,	-	2017/08/25	2018/08/31	12
ME	143168	Coaxial Cable	Fujikura,Suhner,Suhner,Agilent,Suhner,-,Suhner	5D-2W,SF106,SF104,8496B+8494B,SF10	MY42143380,US0431042(Step Att)	2017/11/02	2018/11/30	12
ME	142936	Pre-Amplifier	SONOMA INSTRUMENT	310N	325015	2018/05/29	2019/05/31	12
ME	143833	Loop Antenna	Rohde & Schwarz	HFH2-Z2	827779/008	2017/10/02	2018/10/31	12
ME	143161	Coaxial Cable	FUJIKURA	3D2W	none	2018/05/25	2019/05/31	12

The expiration date of the calibration is the end of the expired month.

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

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

Test item:

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

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