RADIO TEST REPORT

Test Report No.: 14448116M-R1

Customer	**BANDAI (SHENZHEN) CO., LTD.**
Description of EUT	**NFC RW built-in toy**
Model Number of EUT	**2623107**
FCC ID	**PQ32623107**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied (Refer to SECTION 3)**
Issue Date	**December 5, 2022**
Remarks	**-**

Representative test engineer	**Approved by**
Hiromitsu Tanabe Engineer	Kazuhiro Ando Engineer

ACCREDITED
CERTIFICATE 1266.01

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☒ There is no testing item of "Non-accreditation".

UL Japan, Inc. Kashima EMC Lab.
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- The information provided from the customer for this report is identified in Section 1.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

REVISION HISTORY

Original Test Report No.: 14448116M

This report is a revised version of 14448116M. 14448116M is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14448116M	November 24, 2022	-
1	14448116M-R1	December 5, 2022	P.14 Correction of typo: Corrected Span from 300 kHz to 620 kHz, 680 kHz. Corrected RBW from 3 kHz to 6.2 kHz, 6.8 kHz. Corrected VBW from 10 kHz to Three times of RBW.

Reference: Abbreviations (Including words undescribed in this report)

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

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SECTION 1: Customer Information

Company Name	BANDAI (SHENZHEN) CO., LTD.
Address	13/F., Dingfeng Building, No.1036, Baoan Nan Rd, Luohu District, Shenzhen, China
Telephone Number	+86 755 25156588
Contact Person	AMY CHENG

*Remarks:
BANDAI (SHENZHEN) CO., LTD. designates Dong Guan Bao Hui Toys Co., Ltd. as manufacturer of the product (NFC RW built-in toy).

The information provided from the customer is as follows;
- Customer, Description 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 and Test 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

Description	NFC RW built-in toy
Model Number	2623107
Serial Number	Refer to SECTION 4.2
Condition	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	August 8, 2022
Test Date	August 24 to 29, 2022

2.2 Product Description

General Specification

Rating	DC 4.5 V Typ. (DC 3.6V to 5.4V, AA alkaline battery x 3)
Clock frequency (Maximum)	27.12 MHz

Radio Specification

Equipment Type	Transceiver
Frequency of Operation	13.56 MHz
Type of Modulation	ASK
Antenna Type	Aire Core coil
Operating Temperature	0 deg. C to +50 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C The latest version on the first day of the testing period
Title	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.225 Operation within the band 13.110-14.010 MHz.

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.207	N/A *1)	N/A	-
	<ISED> RSS-Gen 8.8	<ISED> RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(a)	44.0 dB, 13.56000 MHz, QP, Hor.	Complied a)	Radiated
	<ISED> RSS-Gen 6.4, 6.12	<ISED> RSS-210 B.6			
Spectrum Mask	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(b)(c)	24.0 dB, 13.55300 MHz, QP, Hor.	Complied a)	Radiated
	<ISED> RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6			
20 dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section15.215(c)	See data	Complied b)	Radiated
	<ISED> -	<ISED> -			
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.209, Section 15.225 (d)	11.5 dB 241.090 MHz, Vertical, QP	Complied c)	Radiated
	<ISED> RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6 RSS-Gen 8.9			
Frequency Tolerance	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(e)	See data	Complied d)	Radiated
	<ISED> RSS-Gen 6.11, 8.11	<ISED> RSS-210 B.6			

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.
*1) The test was not performed since the EUT was DC device.

a) Refer to APPENDIX 1 (data of Fundamental emission and Spectrum Mask)
b) Refer to APPENDIX 1 (data of 20 dB Bandwidth and 99% Occupied Bandwidth)
c) Refer to APPENDIX 1 (data of Spurious emission)
d) Refer to APPENDIX 1 (data of Frequency Tolerance)

FCC Part 15.31 (e)

The test was performed with the New Battery during the tests.
Therefore, the EUT complies with the requirement.
However, the supply voltage was varied and tested at 85 % and 115 % of the nominal rated supply voltage during frequency tolerance test according to Section 15.225(e).

FCC Part 15.203 Antenna requirement

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

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% emission bandwidth	<ISED>RSS-Gen 6.7	-	N/A	- a)	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. 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 $k = 2$.

Conducted emission

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

Radiated emission

Measurement distance	Frequency range	Required Uncertainty (+/-)	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	Not Defined	2.9 dB
	30 MHz to 200 MHz	6.3 dB	6.1 dB
	200 MHz to 1000 MHz		6.2 dB
	1 GHz to 6 GHz	5.2 dB	5.0 dB
	6 GHz to 18 GHz	5.5 dB	5.4 dB
	18 GHz to 40 GHz	Not Defined	5.5 dB
1 m	1 GHz to 18 GHz	Not Defined	5.4 dB
	18 GHz to 40 GHz		5.6 dB
0.5m	26.5 GHz to 40 GHz	Not Defined	5.9 dB

Other test

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

3.5 Test Location

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
A2LA Certificate Number: 1266.01 / FCC Test Firm Registration Number: 910230
ISED Lab Company Number: 4659A / CAB identifier: JP0006

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

3.6 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 :

Test mode	Remarks
Transmitting mode (Tx) - with Passive Tag - without Passive Tag	The EUT Transmits and Receives at the same time and there is no receiving mode.
The EUT was operated in a manner similar to typical use during the tests.	
*Power of the EUT was set by the software as follows; Power Setting: Fixed Software: db.bin Version DB_20220829a (Date: 2021.12.02, Storage location: embedded memory in Jig) *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.	

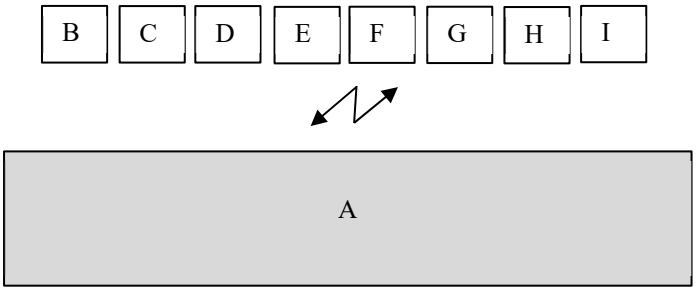
Test Item	Operating mode*
Electric Field Strength of Fundamental Emission	Tx Mod on, with Tag / without Tag
Spectrum Mask	Tx Mod on, with Tag / without Tag
20 dB Bandwidth and 99 % Occupied Bandwidth	Tx Mod on, with Tag / without Tag
Electric Field Strength of Spurious Emission	Tx Mod on, with Tag / without Tag
Frequency Tolerance	Tx Mod off

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

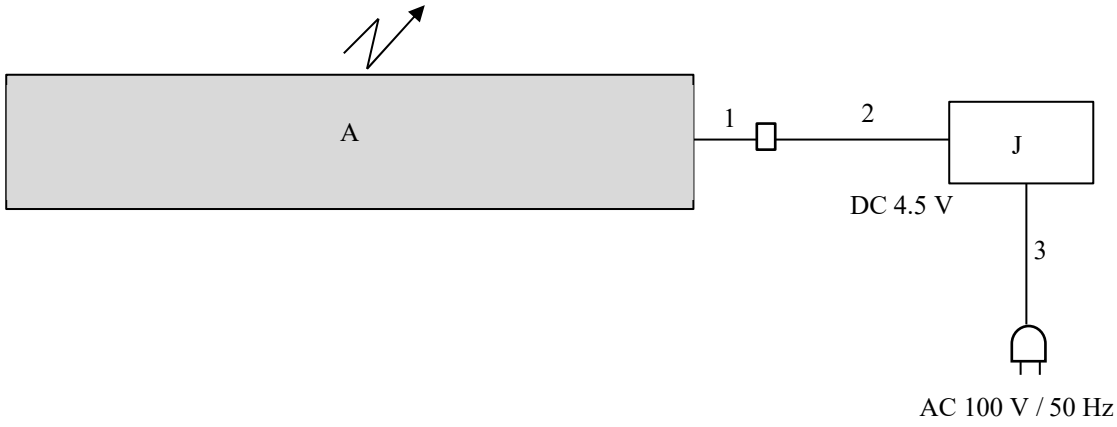
Frequency Tolerance:	
Temperature	-20 deg. C to +50 deg. C Step 10 deg. C
Voltage	Normal Voltage DC 4.5 V Maximum Voltage DC 5.175 V (DC 4.5 V +15 %) Minimum Voltage DC 3.825 V (DC 4.5 V -15 %)

4.2 Configuration and peripherals

Other than Frequency Tolerance test



Frequency Tolerance test



* Cabling and setup(s) 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	NFC RW built-in toy	2623107	74	Dong Guan Bao Hui Toys Co., Ltd	EUT
B	Tag		74-1		-
C	Tag		74-2		-
D	Tag		74-3		-
E	Tag		74-4		-
F	Tag		74-5		-
G	Tag		74-6		-
H	Tag		74-7		-
I	Tag		74-8		-
J	DC Power Supply	GSV3000	1708192899	DIAMOND ANTENNA	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.3	Unshield	Unshield	-
2	DC Cable	1.2	Unshield	Unshield	-
3	AC Cable	1.7	Unshield	Unshield	-

SECTION 5: Radiated emission (Fundamental, Spurious Emission and Spectrum Mask)

Test Procedure

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

Frequency: From 9 kHz to 30 MHz
The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.
*Refer to Figure 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 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 x log (3 m / 300 m) = -80 dB
*2) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

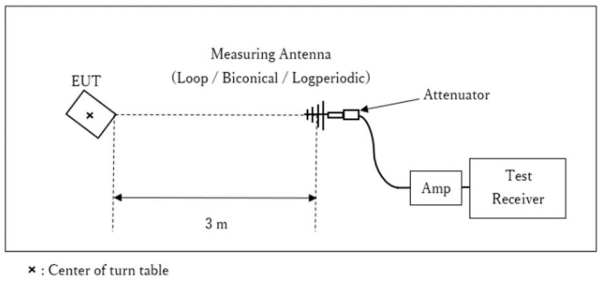
Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open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

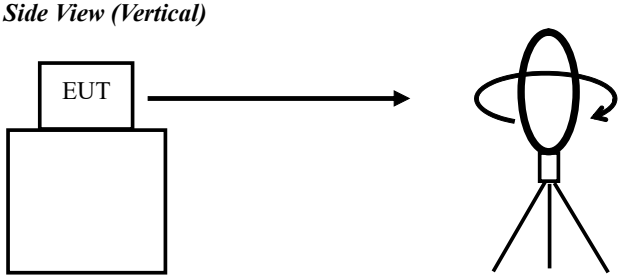
The test was made on EUT at the normal use position.

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

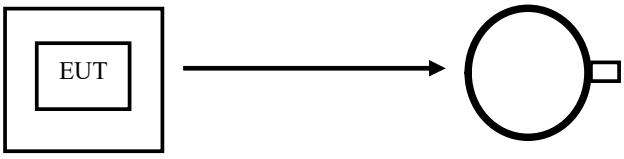
Measurement range : 9 kHz to 1 GHz
Test data : APPENDIX 1
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

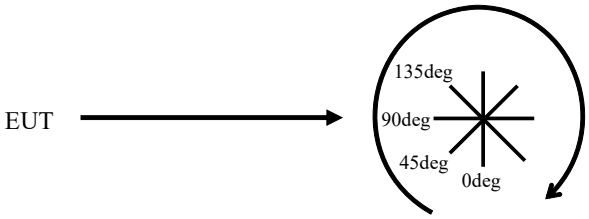


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

SECTION 6: Other test

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	620 kHz, 680 kHz	6.2 kHz, 6.8 kHz	Three times of RBW	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 *2)	-	-	-	-	-	-	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.
*2) The temperature test was started after the temperature stabilization time of 30 minutes.
The test was begun from 50 deg.C and the temperature was lowered each 10 deg.C.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Fundamental emission and Spectrum Mask

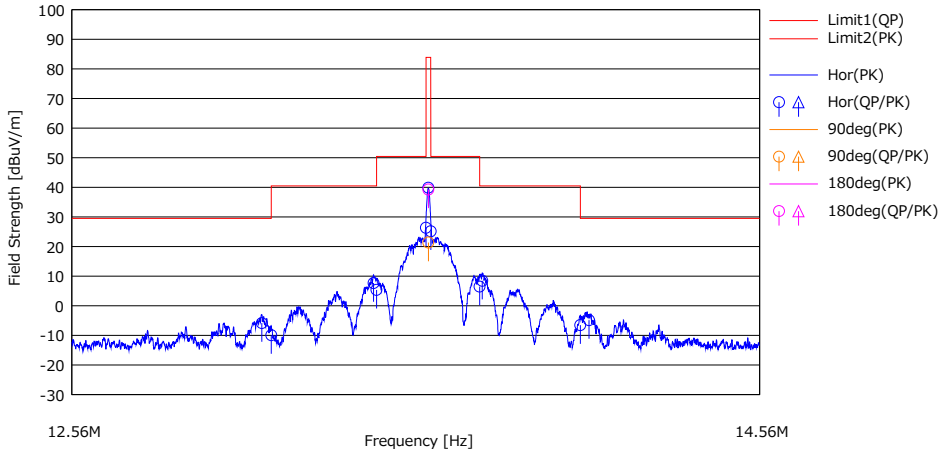
DATA OF RADIATED EMISSION(below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2022/08/24

Mode : Transmitting and Receiving mode
Order No. : 14448116
Power : DC 4.5 V
Temp./Humi. : 23 deg.C / 50 %RH

Remarks : Without Tag

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



No.	Freq.	Reading 〈QP〉	Reading 〈PK〉	Ant.Fac	Loss	Gain	Result 〈QP〉	Result 〈PK〉	Limit 〈QP〉	Limit 〈PK〉	Margin 〈QP〉	Margin 〈PK〉	Antenna	Table	Comment
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		[deg]	
1	13.08352	32.00	---	19.38	-33.05	24.21	-5.88	---	29.50	---	35.3	---	Hor	120	
2	13.11000	27.90	---	19.39	-33.05	24.21	-9.97	---	29.50	---	39.4	---	Hor	120	
3	13.40128	45.50	---	19.39	-33.03	24.22	7.64	---	40.50	---	32.8	---	Hor	120	
4	13.41000	43.20	---	19.39	-33.03	24.22	5.34	---	40.50	---	35.1	---	Hor	120	
5	13.55300	64.20	---	19.39	-33.03	24.23	26.33	---	50.40	---	24.0	---	Hor	120	
6	13.56000	77.70	---	19.39	-33.03	24.23	39.83	---	83.90	---	44.0	---	Hor	120	
7	13.56700	63.00	---	19.39	-33.03	24.23	25.13	---	50.40	---	25.2	---	Hor	120	
8	13.71000	44.30	---	19.40	-33.02	24.23	6.45	---	40.50	---	34.0	---	Hor	120	
9	13.71786	46.30	---	19.40	-33.02	24.24	8.44	---	40.50	---	32.0	---	Hor	120	
10	14.01000	31.30	---	19.40	-33.01	24.25	-6.56	---	29.50	---	36.0	---	Hor	120	
11	14.03605	33.00	---	19.40	-33.01	24.25	-4.86	---	29.50	---	34.3	---	Hor	120	
12	13.56000	59.20	---	19.39	-33.03	24.23	21.33	---	83.90	---	62.5	---	90deg	260	
13	13.56000	77.10	---	19.39	-33.03	24.23	39.23	---	83.90	---	44.6	---	180deg	129	

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]+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
Hor	13.56000	QP	77.70	19.39	6.97	24.23	-	79.83	-	-	Fundamental

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

Fundamental emission and Spectrum Mask

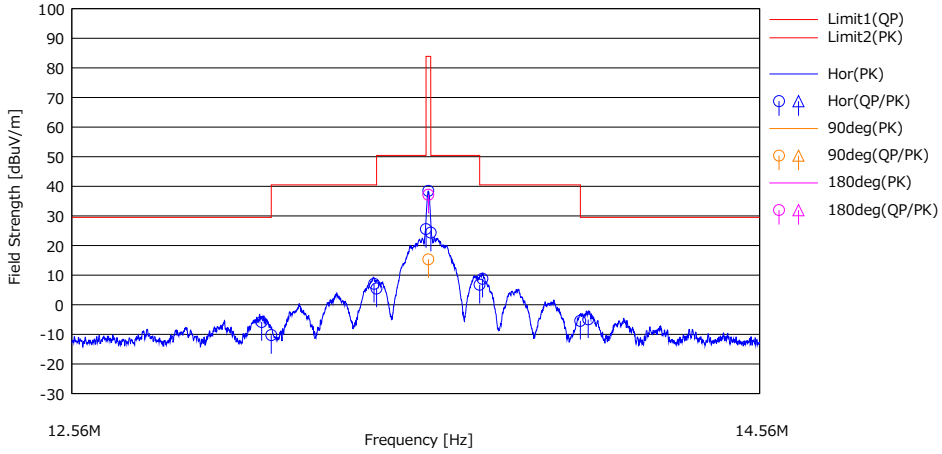
DATA OF RADIATED EMISSION(below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2022/08/24

Mode : Transmitting and Receiving mode
Order No. : 14448116
Power : DC 5.4 V
Temp./Humi. : 23 deg.C / 50 %RH

Remarks : With Tag (Tag Position: Vertical)

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



No.	Freq.	Reading		Ant.Fac	Loss	Gain	Result		Limit		Margin		Antenna	Table	Comment
		〈QP〉	〈PK〉				〈QP〉	〈PK〉	〈QP〉	〈PK〉	〈QP〉	〈PK〉			
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		[deg]	
1	13.083 07	32.00	---	19.38	-33.05	24.21	-5.88	---	29.50	---	35.3	---	Hor	148	
2	13.111 000	27.60	---	19.39	-33.05	24.21	-10.27	---	29.50	---	39.7	---	Hor	148	
3	13.402 70	44.90	---	19.39	-33.03	24.22	7.04	---	40.50	---	33.4	---	Hor	148	
4	13.411 000	43.30	---	19.39	-33.03	24.22	5.44	---	40.50	---	35.0	---	Hor	148	
5	13.553 00	63.40	---	19.39	-33.03	24.23	25.53	---	50.40	---	24.8	---	Hor	148	
6	13.556 000	76.30	---	19.39	-33.03	24.23	38.43	---	83.90	---	45.4	---	Hor	148	
7	13.556 700	62.20	---	19.39	-33.03	24.23	24.33	---	50.40	---	26.0	---	Hor	148	
8	13.711 000	44.60	---	19.40	-33.02	24.23	6.75	---	40.50	---	33.7	---	Hor	148	
9	13.71 842	46.60	---	19.40	-33.02	24.24	8.74	---	40.50	---	31.7	---	Hor	148	
10	14.011 000	32.40	---	19.40	-33.01	24.25	-5.46	---	29.50	---	34.9	---	Hor	148	
11	14.03 380	32.90	---	19.40	-33.01	24.25	-4.96	---	29.50	---	34.4	---	Hor	148	
12	13.556 000	53.20	---	19.39	-33.03	24.23	15.33	---	83.90	---	68.5	---	90deg	230	
13	13.556 000	75.00	---	19.39	-33.03	24.23	37.13	---	83.90	---	46.7	---	180deg	120	

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]+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
Hor	13.56000	QP	76.30	19.39	6.97	24.23	-	78.43	-	-	Fundamental

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

Spurious emission

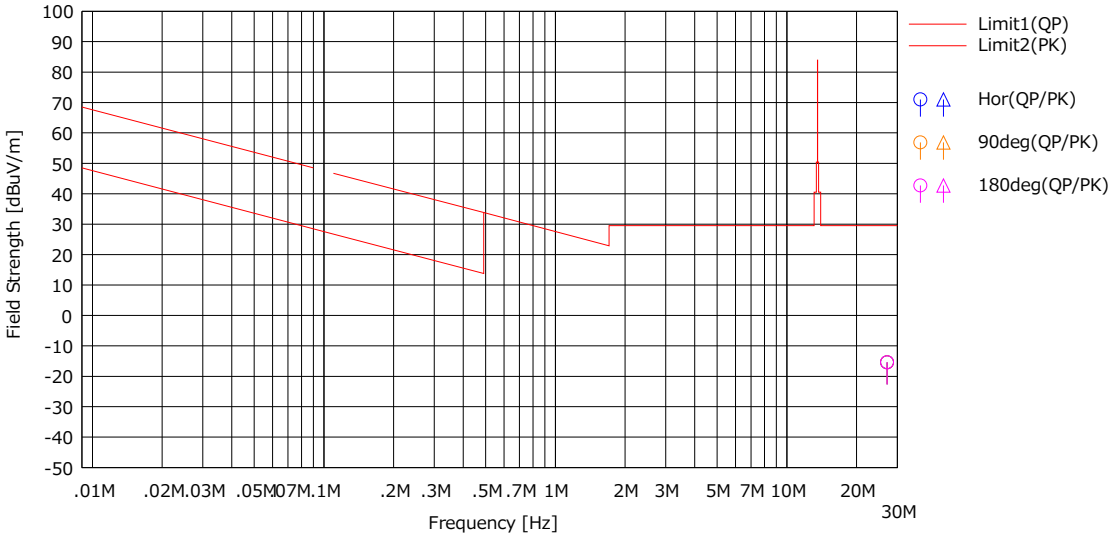
DATA OF RADIATED EMISSION(below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2022/08/24

Mode : Transmitting and Receiving mode
Order No. : 14448116
Power : DC 4.5 V
Temp./Humi. : 23 deg.C / 50 %RH

Remarks : Without Tag

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



No.	Freq.	Reading		Ant.Fac	Loss	Gain	Result		Limit		Margin		Antenna	Table	Comment
		〈QP〉	〈PK〉				〈QP〉	〈PK〉	〈QP〉	〈PK〉	〈QP〉	〈PK〉			
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		[deg]	
1	27.12000	21.70	---	19.88	-32.57	24.42	-15.41	---	29.50	---	44.9	---	Hor	0	
2	27.12000	21.70	---	19.88	-32.57	24.42	-15.41	---	29.50	---	44.9	---	90deg	0	
3	27.12000	21.70	---	19.88	-32.57	24.42	-15.41	---	29.50	---	44.9	---	180deg	0	

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

Spurious emission

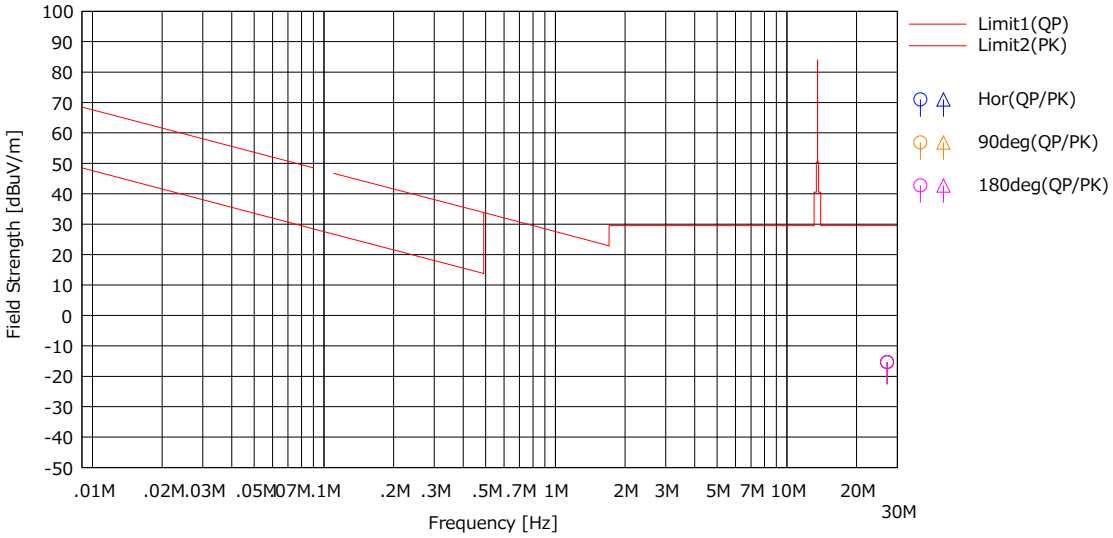
DATA OF RADIATED EMISSION(below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2022/08/24

Mode : Transmitting and Receiving mode
Order No. : 14448116
Power : DC 4.5 V
Temp./Humi. : 23 deg.C / 50 %RH

Remarks : With Tag (Tag Position: Vertical)

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



No.	Freq.	Reading		Ant.Fac	Loss	Gain	Result		Limit		Margin		Antenna	Table	Comment
		〈QP〉	〈PK〉				〈QP〉	〈PK〉	〈QP〉	〈PK〉	〈QP〉	〈PK〉			
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		[deg]	
1	27.12000	21.80	---	19.88	-32.57	24.42	-15.31	---	29.50	---	44.8	---	Hor	0	
2	27.12000	21.70	---	19.88	-32.57	24.42	-15.41	---	29.50	---	44.9	---	90deg	0	
3	27.12000	21.70	---	19.88	-32.57	24.42	-15.41	---	29.50	---	44.9	---	180deg	0	

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

Spurious emission

DATA OF RADIATED EMISSION TEST

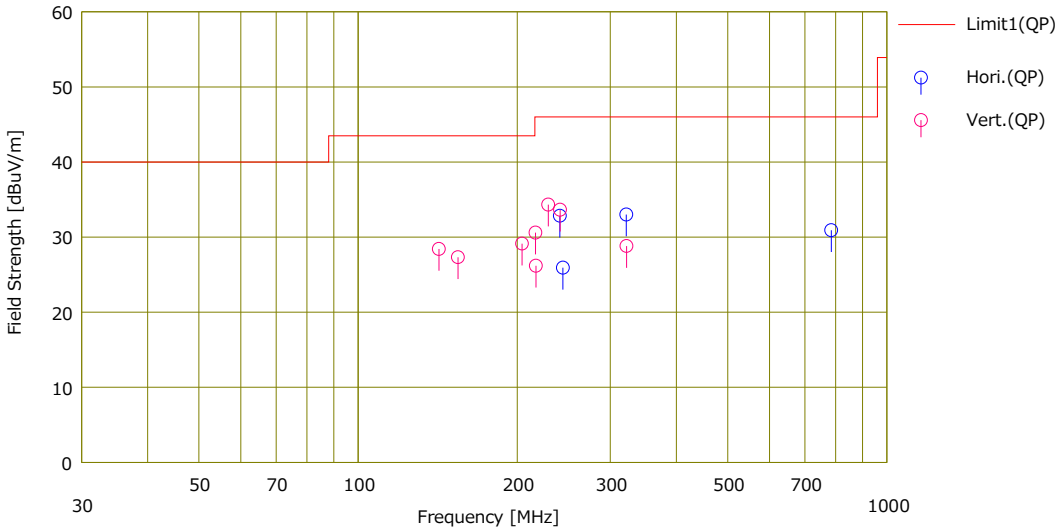
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2022/08/24

Mode : Transmitting and Receiving mode
Order No. : 14448116
Power : DC 4.5 V
Temp./Humi. : 23 deg.C / 50 %RH

Remarks : Without Tag

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

Tested by : Hiromitsu Tanabe



No.	Freq. [MHz]	Reading 〈QP〉 [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result 〈QP〉 [dBuV/m]	Limit 〈QP〉 [dBuV/m]	Margin 〈QP〉 [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	240.880	44.60	11.36	8.19	31.31	32.84	46.00	13.1	Hori.	139	98	HB	
2	244.080	37.50	11.52	8.22	31.32	25.92	46.00	20.0	Hori.	121	275	HB	
3	321.630	41.30	14.02	8.96	31.28	33.00	46.00	13.0	Hori.	100	313	HB	
4	785.250	28.20	22.16	11.51	30.95	30.92	46.00	15.0	Hori.	100	353	HB	
5	142.200	39.50	13.04	7.30	31.42	28.42	43.50	15.0	Vert.	100	177	HB	
6	154.580	37.90	13.41	7.42	31.41	27.32	43.50	16.1	Vert.	100	0	HB	
7	204.220	42.80	9.76	7.89	31.32	29.13	43.50	14.3	Vert.	100	71	HB	
8	216.530	44.00	9.91	7.99	31.31	30.59	46.00	15.4	Vert.	100	267	HB	
9	216.960	39.60	9.91	7.99	31.31	26.19	46.00	19.8	Vert.	100	269	HB	
10	228.940	47.60	9.93	8.09	31.30	34.32	46.00	11.6	Vert.	100	87	HB	
11	241.050	45.40	11.36	8.19	31.31	33.64	46.00	12.3	Vert.	100	93	HB	
12	321.930	37.10	14.03	8.96	31.28	28.81	46.00	17.1	Vert.	154	304	HB	

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

Spurious emission

DATA OF RADIATED EMISSION TEST

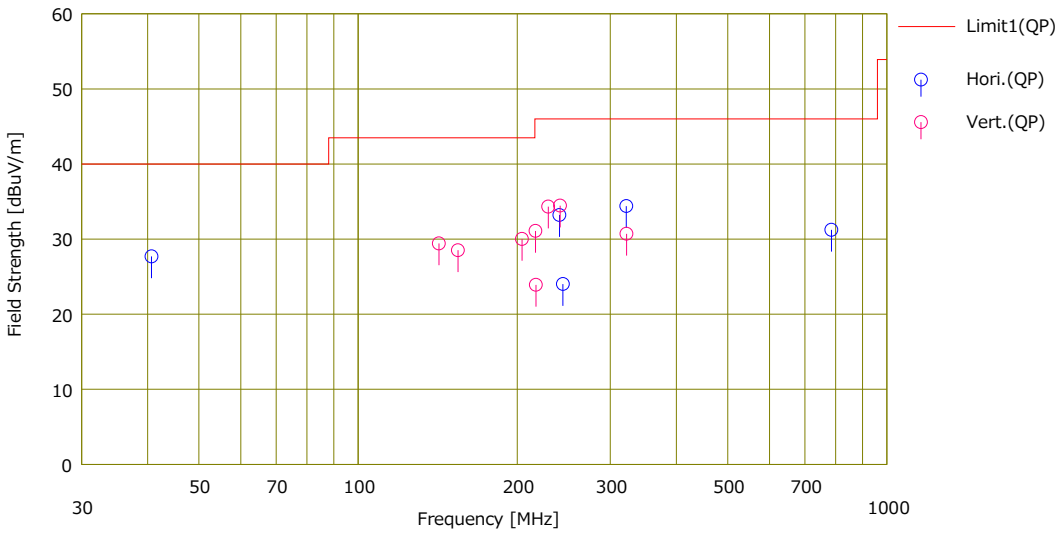
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2022/08/24

Mode : Transmitting and Receiving mode
Order No. : 14448116
Power : DC 4.5 V
Temp./Humi. : 23 deg.C / 50 %RH

Remarks : With Tag (Tag Position: Horizontal)

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

Tested by : Hiromitsu Tanabe



No.	Freq. [MHz]	Reading 〈QP〉 [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result 〈QP〉 [dBuV/m]	Limit 〈QP〉 [dBuV/m]	Margin 〈QP〉 [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	40.680	39.90	13.34	6.06	31.60	27.70	40.00	12.3	Hori.	237	40	HB	
2	240.380	45.00	11.33	8.19	31.31	33.21	46.00	12.7	Hori.	139	94	HB	
3	244.080	35.60	11.52	8.22	31.32	24.02	46.00	21.9	Hori.	124	271	HB	
4	321.630	42.70	14.02	8.96	31.28	34.40	46.00	11.6	Hori.	100	308	HB	
5	785.920	28.50	22.17	11.52	30.95	31.24	46.00	14.7	Hori.	100	0	HB	
6	142.200	40.50	13.04	7.30	31.42	29.42	43.50	14.0	Vert.	100	173	HB	
7	154.580	39.10	13.41	7.42	31.41	28.52	43.50	14.9	Vert.	100	255	HB	
8	204.150	43.70	9.76	7.88	31.33	30.01	43.50	13.4	Vert.	100	11	HB	
9	216.540	44.50	9.91	7.99	31.31	31.09	46.00	14.9	Vert.	100	0	HB	
10	216.960	37.32	9.91	7.99	31.31	23.91	46.00	22.0	Vert.	100	53	HB	
11	228.940	47.60	9.93	8.09	31.30	34.32	46.00	11.6	Vert.	100	0	HB	
12	241.090	46.20	11.37	8.20	31.31	34.46	46.00	11.5	Vert.	100	0	HB	
13	321.930	39.00	14.03	8.96	31.28	30.71	46.00	15.2	Vert.	169	0	HB	

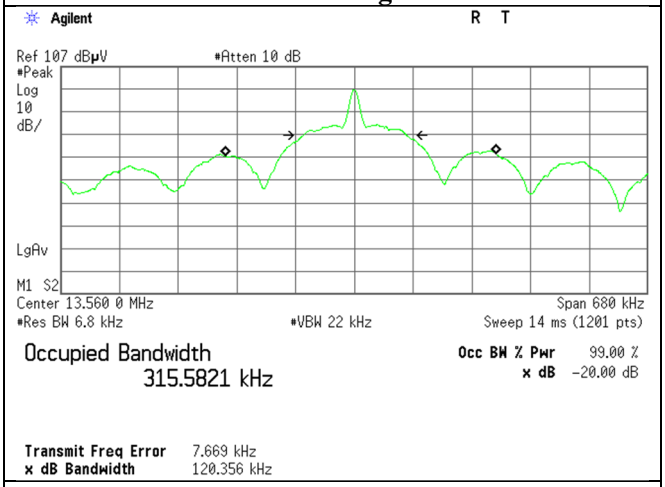
Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]
Ant.Type=HB:Hybrid Antenna

20 dB Bandwidth and 99% Occupied Bandwidth

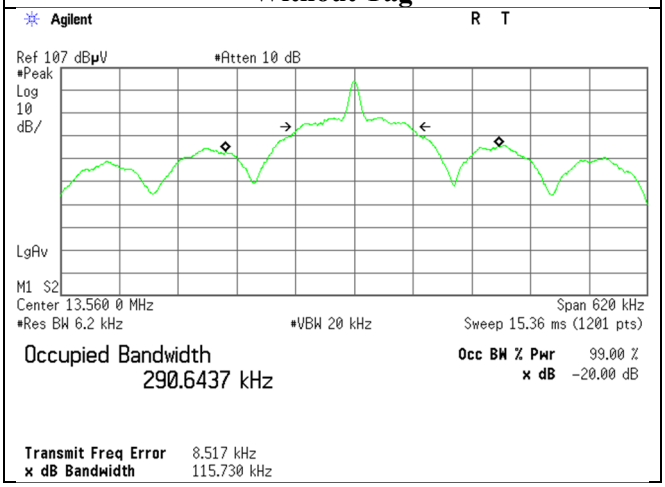
Test place	Kashima EMC Lab. No.2 Measurement room
Date	August 29, 2022
Temperature / Humidity	22 deg. C / 50 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx Mod on

FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	With Tag	120.36	315.58
	Without Tag	115.73	290.64

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

Test place	Kashima EMC Lab. No.2 Measurement room
Date	August 29, 2022
Temperature / Humidity	22 deg. C / 50 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx Mod off

Test condition		Tested	Measured	Frequency	Result		Limit
Temp.	Voltage	timing	frequency	error			
[deg. C]	[V]		[MHz]	[MHz]	[%]	[ppm]	[+/- %]
50	4.5	Power on	13.559780	-0.000220	-0.00162	-16.2	0.01
		+ 2 min.	13.559773	-0.000227	-0.00167	-16.7	0.01
		+ 5 min.	13.559774	-0.000226	-0.00167	-16.7	0.01
		+ 10 min.	13.559775	-0.000225	-0.00166	-16.6	0.01
40	4.5	Power on	13.559799	-0.000201	-0.00148	-14.8	0.01
		+ 2 min.	13.559782	-0.000218	-0.00161	-16.1	0.01
		+ 5 min.	13.559779	-0.000221	-0.00163	-16.3	0.01
		+ 10 min.	13.559778	-0.000222	-0.00164	-16.4	0.01
30	4.5	Power on	13.559833	-0.000167	-0.00123	-12.3	0.01
		+ 2 min.	13.559810	-0.000190	-0.00140	-14.0	0.01
		+ 5 min.	13.559806	-0.000194	-0.00143	-14.3	0.01
		+ 10 min.	13.559805	-0.000195	-0.00144	-14.4	0.01
20	4.5	Power on	13.559872	-0.000128	-0.00094	-9.4	0.01
		+ 2 min.	13.559840	-0.000160	-0.00118	-11.8	0.01
		+ 5 min.	13.559833	-0.000167	-0.00123	-12.3	0.01
		+ 10 min.	13.559832	-0.000168	-0.00124	-12.4	0.01
20	3.825	Power on	13.559878	-0.000122	-0.00090	-9.0	0.01
	(4.5V -15%)	+ 2 min.	13.559851	-0.000149	-0.00110	-11.0	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	5.175	Power on	13.559877	-0.000123	-0.00091	-9.1	0.01
	(4.5V +15%)	+ 2 min.	13.559828	-0.000172	-0.00127	-12.7	0.01
		+ 5 min.	13.559822	-0.000178	-0.00131	-13.1	0.01
		+ 10 min.	13.559820	-0.000180	-0.00133	-13.3	0.01
10	4.5	Power on	13.559906	-0.000094	-0.00069	-6.9	0.01
		+ 2 min.	13.559873	-0.000127	-0.00094	-9.4	0.01
		+ 5 min.	13.559864	-0.000136	-0.00100	-10.0	0.01
		+ 10 min.	13.559862	-0.000138	-0.00102	-10.2	0.01
0	4.5	Power on	13.559922	-0.000078	-0.00058	-5.8	0.01
		+ 2 min.	13.559896	-0.000104	-0.00077	-7.7	0.01
		+ 5 min.	13.559890	-0.000110	-0.00081	-8.1	0.01
		+ 10 min.	13.559888	-0.000112	-0.00083	-8.3	0.01
-10	4.5	Power on	13.559918	-0.000082	-0.00060	-6.0	0.01
		+ 2 min.	13.559916	-0.000084	-0.00062	-6.2	0.01
		+ 5 min.	13.559912	-0.000088	-0.00065	-6.5	0.01
		+ 10 min.	13.559911	-0.000089	-0.00066	-6.6	0.01
-20	4.5	Power on	13.559882	-0.000118	-0.00087	-8.7	0.01
		+ 2 min.	13.559924	-0.000076	-0.00056	-5.6	0.01
		+ 5 min.	13.559923	-0.000077	-0.00057	-5.7	0.01
		+ 10 min.	13.559923	-0.000077	-0.00057	-5.7	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
RE	COTS-CEMI-03	178804	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3 (RE,CE,ME,PE)	Ver 3.1.0484	-	-
RE	CBL-08	143121	LOGBICON	Schwarzbeck Mess-Elektronik OHG	VULB 9168	343	2022/04/18	12
RE	CAT5-03	178806	5dB Fixed Atten.	Pasternack Enterprises	PE7047-5	none	2022/04/01	12
RE	CCC-S10-R3	143165	10 Site RE 3m System	UL Japan	none	none	2021/08/10	12
RE	CAF-28	183880	Pre-Amplifier	UL Japan	ZKL-2	001	2022/04/06	12
RE	CTR-09	144199	Test Receiver	Keysight Technologies Inc	N9038A	MY53290016	2022/07/21	12
RE	CAEC-10(NSA)	144632	Semi Anechoic Chamber	TDK	NSA (No.10)	10	2022/05/15	12
RE	KLP-01	143833	Loop Antenna	Rohde & Schwarz	HFH2-Z2	827779/008	2021/10/06	12
RE	CCC-M01	143161	Coaxial Cable	Fujikura,HP,Mini-Circits,Fujikura	3D2W	none	2022/05/16	12
RE	CAT6-17	144245	6dB Fixed Atten.	Suhner	6906.01.A	none	2022/07/20	12
RE	CAF-24	171927	Pre Amplifier	UL Japan	GALI-84+	001	2022/07/06	12
RE	CCC-S10-C	143157	10 Site CE System	UL Japan	none	none	2022/08/27	12
RE	CSCL-26	222745	Measure	SHINWA RULES CO., LTD.	80862	none	-	-
RE	COS-10	143542	Temperature & Humidity Indicator	HIOKI E.E. CORPORATION	3641/9680-50	090999895/090905406	2022/06/20	12
RE	CTS-14	144216	Digital Multimeter	Fluke Corporation	115	994460954	2021/10/20	12
FT	CCH-04	143181	Temperature and Humidity Chamber	Espec	PL-1J	15004059	2021/10/14	12
FT	CFC-02	143423	Frequency Counter	Keysight Technologies Inc	53151A	US40511823	2022/04/13	12
FT, BW	CMS-07	143942	Near Field Probe	Langer	LF-R400	02-0815	-	-
FT, BW	CTS-08	144210	Digital Multimeter	Fluke Corporation	112	89790193	2021/10/11	12
FT, BW	COS-27	200034	Temperature & Humidity Logger	HIOKI E.E. CORPORATION	LR5001/LR9504	200636456/200699552	2022/07/22	12
FT, BW	CSA-07	143643	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY52490024	2022/06/23	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:

RE: Radiated Emission
FT: Frequency Tolerance
BW: Bandwidth