
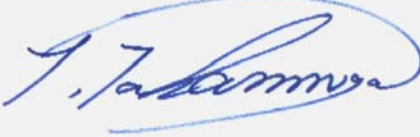




RADIO TEST REPORT

Test Report No. 15204675H-B-R1

Customer	Hosiden Corporation
Description of EUT	CRADLE ASSY, MOBILE WIRELESS CHARGER
Model Number of EUT	861C0-B2010-C0
FCC ID	VIYCBC4077
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied
Issue Date	June 3, 2024
Remarks	NFC part

Representative test engineer	Approved by
	
Junki Nagatomi Engineer	Tsubasa Takayama Leader
	
	
CERTIFICATE 5107.02	
<input type="checkbox"/> The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan, Inc.	
<input checked="" type="checkbox"/> There is no testing item of "Non-accreditation".	

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 23.0

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- The laboratory is not responsible for information provided by the customer which can impact the validity of the results.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

REVISION HISTORY

Original Test Report No. 15204675H-B

This report is a revised version of 15204675H-B. 15204675H-B is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15204675H-B	March 19, 2024	-
1	15204675H-B-R1	June 3, 2024	Correction of erroneous description for Item B in Clause 4.2.

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	Hosiden Corporation
Address	4-33, Kitakyuhoji 1-Chome, Yao-City, Osaka, 581-0071 Japan
Telephone Number	+81-72-924-1293
Contact Person	Fumitaka Sekiguchi

The information provided by 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

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	CRADLE ASSY, MOBILE WIRELESS CHARGER
Model Number	861C0-B2010-C0
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	January 22, 2024
Test Date	February 6 and 15, 2024

2.2 Product Description

General Specification

Rating	DC 14 V / 2 A
Operating frequency	-30 deg. C to +60 deg. C (Wireless power transmission (Qi)) -30 deg. C to +80 deg. C (NFC)

Radio Specification

Wireless power transmission (Qi)

Operating Frequency	127.70 kHz (Power transmit) / 125.73 kHz to 129.81 kHz (Communication)
Rated Output Power	15 W
Modulation	FSK
Coil system	Single Coil
Charging distance	Contact

NFC

Equipment Type	Transceiver
Frequency of Operation	13.56 MHz
Type of Modulation	ASK

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.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.207	N/A	Complied	*1)
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.225(a)	55.03 dB, 13.56000 MHz, QP, 0 deg. (With Tag Type A)	Complied	Radiated
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods	Section 15.225(b)(c)	35.73 dB, 13.56700 MHz, QP, 0 deg. (With Tag Type A)	Complied	Radiated
20 dB Bandwidth	ANSI C63.10:2013 6 Standard test methods	Section15.215(c)	See data	Complied	Radiated
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.209, Section 15.225 (d)	2.81 dB 40.680 MHz, Vertical, QP (With Tag Type A)	Complied	Radiated
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods	Section 15.225(e)	See data	Complied	Radiated

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.

FCC Part 15.31 (e)

The worst case stable voltage was provided to the EUT during the all tests.
And maximum and minimum voltage were provided to the EUT during the output power measurement test.
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

No addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

Measurement uncertainty is not taken into account when stating conformity with a specified requirement. Note: When margins obtained from test results are less than the measurement uncertainty, the test results may exceed the limit.

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

Radiated emission

Measurement distance	Frequency range	Unit	Calculated Uncertainty (+/-)
3 m	9 kHz to 30 MHz	dB	3.3
10 m		dB	3.1
3 m	30 MHz to 200 MHz	Horizontal	4.7
		Vertical	4.7
	200 MHz to 1000 MHz	Horizontal	4.8
		Vertical	6.0
10 m	30 MHz to 200 MHz	Horizontal	5.2
		Vertical	5.1
	200 MHz to 1000 MHz	Horizontal	5.2
		Vertical	5.2
3 m	1 GHz to 6 GHz	dB	5.0
	6 GHz to 18 GHz	dB	5.2
1 m	10 GHz to 18 GHz	dB	5.3
	18 GHz to 26.5 GHz	dB	5.2
	26.5 GHz to 40 GHz	dB	4.7
0.5 m	26.5 GHz to 40 GHz	dB	4.8

-20 dB Bandwidth and Frequency Tolerance

Item	Unit	Calculated Uncertainty (+/-)
Bandwidth (OBW)	%	0.96
Frequency Readout (Frequency counter)	ppm	0.67
Frequency Readout (Spectrum analyzer frequency readout function)	ppm	2.13

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan
Telephone: +81-596-24-8999

*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919

ISED Lab Company Number: 2973C / CAB identifier: JP0002

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	-	-
Large Chamber	16.9 x 22.1 x 10.17	16.9 x 22.1	-	10 m
Small Chamber	5.3 x 6.69 x 3.59	5.3 x 6.69	-	-

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)

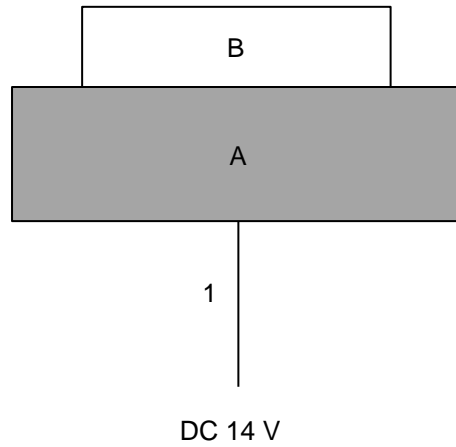
The mode is used:

Test mode	Remarks
1) Transmitting mode (Tx) - With Tag (Type A / Type B / FeliCa) - Without 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; Software: Wireless power transmission V1.02 (Date: 2022.06.07, 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.	
Justification: The system was configured in typical fashion (as a user would normally use it) for testing.	

Test Item	Operating mode
Electric Field Strength of Fundamental Emission	Tx Mod on
Spectrum Mask	Tx Mod on
20 dB Bandwidth	Tx Mod on
Electric Field Strength of Spurious Emission	Tx Mod on
Frequency Tolerance	Tx Mod on

Frequency Tolerance	
Temperature	-30 deg. C to +50 deg. C (Step 10 deg. C)
Voltage	Normal Voltage DC 14 V Maximum Voltage DC 16.1 V (DC 14 V +15 %) Minimum Voltage DC 11.9 V (DC 14 V -15 %)
*This EUT provides stable voltage constantly to RF Part regardless of input voltage	

4.2 Configuration and peripherals



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

Description of EUT and Support Equipment

No.	Item	Model number	Serial Number	Manufacturer	Remark
A	CRADLE ASSY, MOBILE WIRELESS CHARGER	861C0-B2010-C0	101	Hosiden Corporation	EUT
B	NFC card	-	-	-	Type A, B, FeliCa

List of Cables Used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	2.5	Unshielded	Unshielded	-

SECTION 5: 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.

[Limit conversion]

The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to $45.5 - 51.5 = -6.0$ 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.

[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 2 about Direction of the Loop Antenna.

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.

[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.

[Test instruments and test settings]

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

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.

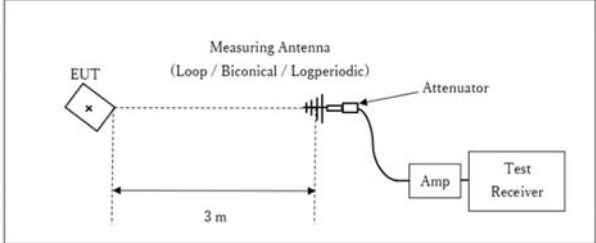
Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)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

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

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

Figure 1: Test Setup

Below 1 GHz

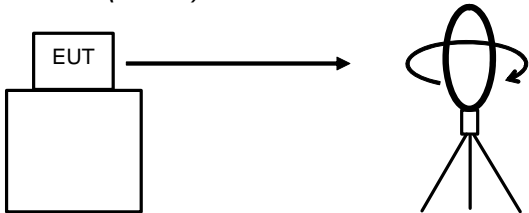


Test Distance: 3 m

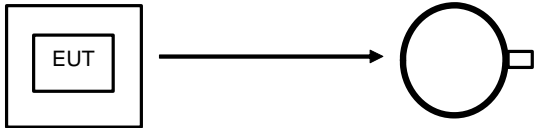
x : Center of turn table

Figure 2: Direction of the Loop Antenna

Side View (Vertical)

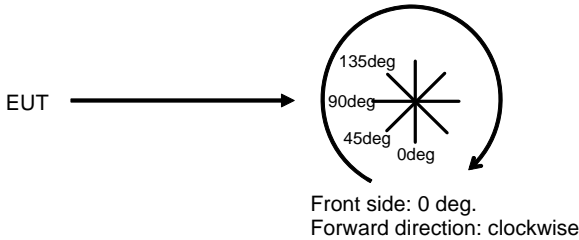


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



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

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
Test result : Pass

SECTION 6: Other tests

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	2 MHz	30 kHz	91 kHz	Auto	Peak	Max Hold	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.

* For without Tag mode, a settings are not followed by ANSI requirement, because signal is almost sine wave, the smaller RBW setting is, the narrower result is. So actual settings are 10 kHz for RBW.

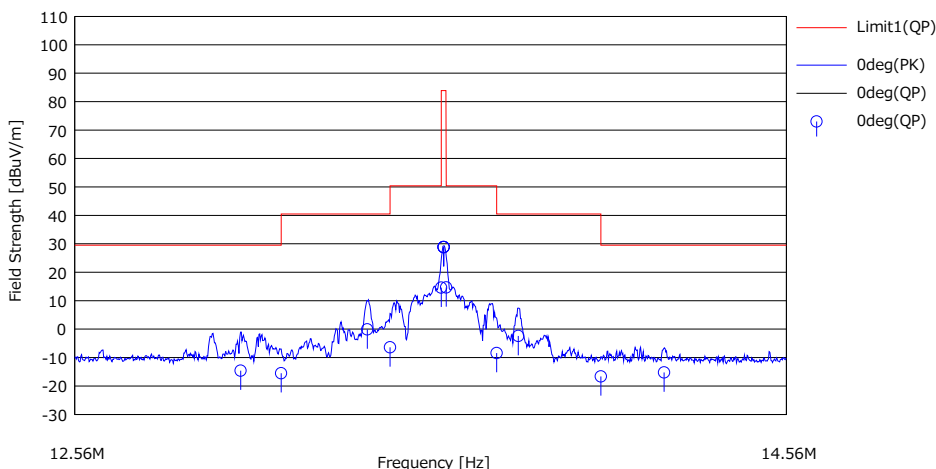
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Fundamental Emission and Spectrum Mask

Test place Ise EMC Lab.
Measurement room No.3
Date February 6, 2024
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Junki Nagatomi
Mode Card Type A

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



No.	Freq. [MHz]	Reading	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result	Limit	Margin	Antenna	Table [deg]	Comment
		[dBuV]				[dBuV/m]	[dBuV/m]	[dB]			
1	13.00040	31.30	19.72	-3.344	32.20	-14.62	29.50	44.12	Odeg	0	
2	13.11000	30.40	19.71	-3.344	32.20	-15.53	29.50	45.03	Odeg	0	
3	13.34673	45.80	19.70	-3.343	32.19	-0.12	40.50	40.62	Odeg	0	
4	13.41000	39.50	19.70	-3.343	32.19	-6.42	40.50	46.92	Odeg	0	
5	13.55300	60.50	19.69	-3.343	32.19	14.57	50.40	35.83	Odeg	0	
6	13.56000	74.80	19.69	-3.343	32.19	28.87	83.90	55.03	Odeg	0	Fundamental (DC 11.9V)
7	13.56000	74.80	19.69	-3.343	32.19	28.87	83.90	55.03	Odeg	0	Fundamental (DC 14.0V)
8	13.56000	74.80	19.69	-3.343	32.19	28.87	83.90	55.03	Odeg	0	Fundamental (DC 16.1V)
9	13.56700	60.60	19.69	-3.343	32.19	14.67	50.40	35.73	Odeg	0	
10	13.71000	37.50	19.68	-3.342	32.19	-8.43	40.50	48.93	Odeg	0	
11	13.77195	43.50	19.67	-3.341	32.19	-2.43	40.50	42.93	Odeg	0	
12	14.01000	29.30	19.66	-3.341	32.19	-16.64	29.50	46.14	Odeg	0	
13	14.19490	30.70	19.65	-3.340	32.19	-15.24	29.50	44.74	Odeg	0	

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

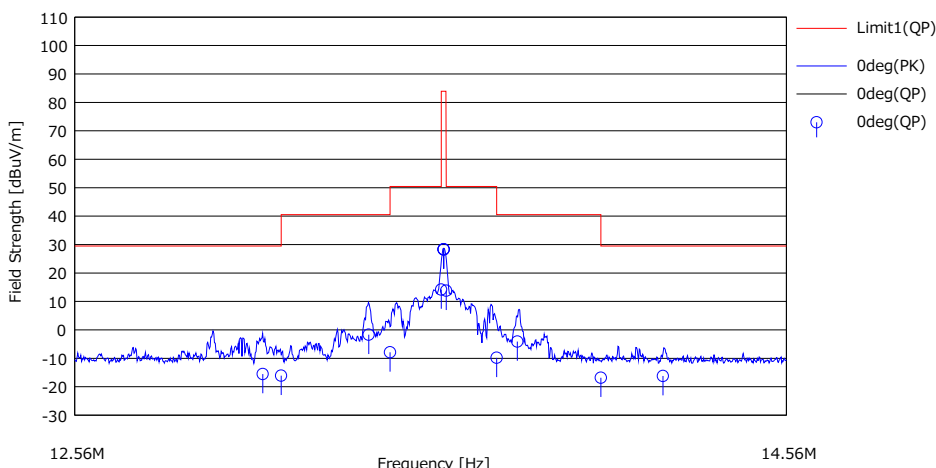
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	74.80	19.69	6.57	32.19	-	68.87	-	-	Fundamental (DC 11.9V)
0	13.56000	QP	74.80	19.69	6.57	32.19	-	68.87	-	-	Fundamental (DC 14.0V)
0	13.56000	QP	74.80	19.69	6.57	32.19	-	68.87	-	-	Fundamental (DC 16.1V)

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

Fundamental Emission and Spectrum Mask

Test place Ise EMC Lab.
Measurement room No.3
Date February 6, 2024
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Junki Nagatomi
Mode Card Type B

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



No.	Freq. [MHz]	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
		<QP> [dBuV]	[dB/m]	[dB]	[dB]	<QP> [dBuV/m]	<QP> [dBuV/m]	<QP> [dB]			
1	13.06017	30.40	19.72	-3.344	32.20	-15.52	29.50	45.02	Odeg	0	
2	13.11000	29.80	19.71	-3.344	32.20	-16.13	29.50	45.63	Odeg	0	
3	13.35066	44.20	19.70	-3.343	32.19	-1.72	40.50	42.22	Odeg	0	
4	13.41000	38.00	19.70	-3.343	32.19	-7.92	40.50	48.42	Odeg	0	
5	13.55300	60.10	19.69	-3.343	32.19	14.17	50.40	36.23	Odeg	0	
6	13.56000	74.20	19.69	-3.343	32.19	28.27	83.90	55.63	Odeg	0	Fundamental (DC 11.9V)
7	13.56000	74.20	19.69	-3.343	32.19	28.27	83.90	55.63	Odeg	0	Fundamental (DC 14.0V)
8	13.56000	74.20	19.69	-3.343	32.19	28.27	83.90	55.63	Odeg	0	Fundamental (DC 16.1V)
9	13.56700	59.70	19.69	-3.343	32.19	13.77	50.40	36.63	Odeg	0	
10	13.71000	36.10	19.68	-3.342	32.19	-9.83	40.50	50.33	Odeg	0	
11	13.76920	41.80	19.67	-3.341	32.19	-4.13	40.50	44.63	Odeg	0	
12	14.01000	29.10	19.66	-3.341	32.19	-16.84	29.50	46.34	Odeg	0	
13	14.19165	29.70	19.65	-3.340	32.19	-16.24	29.50	45.74	Odeg	0	

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

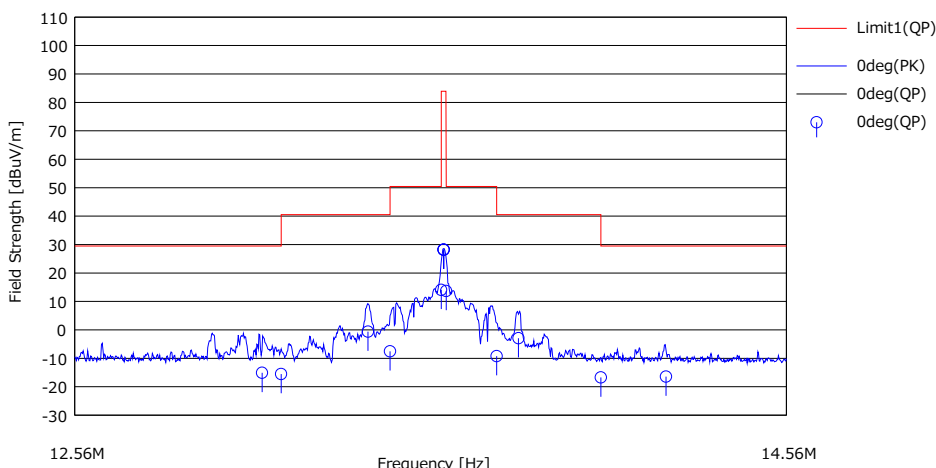
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	74.20	19.69	6.57	32.19	-	68.27	-	-	Fundamental (DC 11.9V)
0	13.56000	QP	74.20	19.69	6.57	32.19	-	68.27	-	-	Fundamental (DC 14.0V)
0	13.56000	QP	74.20	19.69	6.57	32.19	-	68.27	-	-	Fundamental (DC 16.1V)

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

Fundamental Emission and Spectrum Mask

Test place Ise EMC Lab.
Measurement room No.3
Date February 6, 2024
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Junki Nagatomi
Mode Felica

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



No.	Freq. [MHz]	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
		<QP> [dBuV]	[dB/m]	[dB]	[dB]	<QP> [dBuV/m]	<QP> [dBuV/m]	<QP> [dB]			
1	13.05840	30.80	19.72	-3.344	32.20	-15.12	29.50	44.62	Odeg	3	
2	13.11000	30.40	19.71	-3.344	32.20	-15.53	29.50	45.03	Odeg	0	
3	13.34868	45.30	19.70	-3.343	32.19	-0.62	40.50	41.12	Odeg	3	
4	13.41000	38.40	19.70	-3.343	32.19	-7.52	40.50	48.02	Odeg	0	
5	13.55300	60.00	19.69	-3.343	32.19	14.07	50.40	36.33	Odeg	0	
6	13.56000	74.10	19.69	-3.343	32.19	28.17	83.90	55.73	Odeg	0	Fundamental (DC 11.9V)
7	13.56000	74.10	19.69	-3.343	32.19	28.17	83.90	55.73	Odeg	0	Fundamental (DC 14.0V)
8	13.56000	74.10	19.69	-3.343	32.19	28.17	83.90	55.73	Odeg	0	Fundamental (DC 16.1V)
9	13.56700	59.60	19.69	-3.343	32.19	13.67	50.40	36.73	Odeg	0	
10	13.71000	36.70	19.68	-3.342	32.19	-9.23	40.50	49.73	Odeg	0	
11	13.77225	43.00	19.67	-3.341	32.19	-2.93	40.50	43.43	Odeg	3	
12	14.01000	29.20	19.66	-3.341	32.19	-16.74	29.50	46.24	Odeg	0	
13	14.20061	29.50	19.65	-3.340	32.19	-16.44	29.50	45.94	Odeg	3	

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

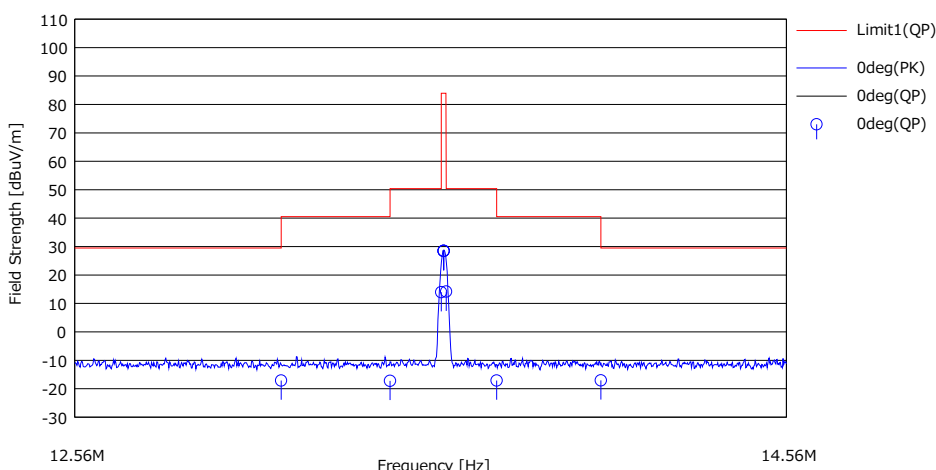
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	74.10	19.69	6.57	32.19	-	68.17	-	-	Fundamental (DC 11.9V)
0	13.56000	QP	74.10	19.69	6.57	32.19	-	68.17	-	-	Fundamental (DC 14.0V)
0	13.56000	QP	74.10	19.69	6.57	32.19	-	68.17	-	-	Fundamental (DC 16.1V)

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

Fundamental Emission and Spectrum Mask

Test place Ise EMC Lab.
Measurement room No.3
Date February 6, 2024
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Junki Nagatomi
Mode Without Tag

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



No.	Freq. [MHz]	Reading <QP>	Ant.Fac	Loss	Gain	Result <QP>	Limit <QP>	Margin <QP>	Antenna	Table	Comment
		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]			
1	13.11000	28.80	19.71	-3.344	32.20	-17.13	29.50	46.63	Odeg	0	
2	13.41000	28.70	19.70	-3.343	32.19	-17.22	40.50	57.72	Odeg	0	
3	13.55300	59.90	19.69	-3.343	32.19	13.97	50.40	36.43	Odeg	0	
4	13.56000	74.40	19.69	-3.343	32.19	28.47	83.90	55.43	Odeg	0	Fundamental (DC 11.9V)
5	13.56000	74.40	19.69	-3.343	32.19	28.47	83.90	55.43	Odeg	0	Fundamental (DC 14.0V)
6	13.56000	74.40	19.69	-3.343	32.19	28.47	83.90	55.43	Odeg	0	Fundamental (DC 16.1V)
7	13.56700	60.10	19.69	-3.343	32.19	14.17	50.40	36.23	Odeg	0	
8	13.71000	28.80	19.68	-3.342	32.19	-17.13	40.50	57.63	Odeg	0	
9	14.01000	28.90	19.66	-3.341	32.19	-17.04	29.50	46.54	Odeg	0	

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

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	74.40	19.69	6.57	32.19	-	68.47	-	-	Fundamental (DC 11.9V)
0	13.56000	QP	74.40	19.69	6.57	32.19	-	68.47	-	-	Fundamental (DC 14.0V)
0	13.56000	QP	74.40	19.69	6.57	32.19	-	68.47	-	-	Fundamental (DC 16.1V)

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

Spurious Emission

Test place Ise EMC Lab.
 Measurement room No.3
 Date February 6, 2024
 Temperature / Humidity 23 deg. C / 35 % RH
 Engineer Junki Nagatomi
 Mode Card Type A

PK or 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	28.70	20.29	-33.23	32.17	-	-16.41	29.5	45.91	
Hori.	40.680	QP	41.40	11.25	7.10	32.16	-	27.59	40.0	12.41	
Hori.	52.402	QP	27.20	9.68	7.28	32.16	-	12.00	40.0	28.00	
Hori.	67.800	QP	32.10	9.03	7.50	32.15	-	16.48	40.0	23.52	
Hori.	80.010	QP	25.10	9.08	7.67	32.14	-	9.71	40.0	30.29	
Hori.	94.942	QP	27.10	9.68	7.84	32.13	-	12.49	43.5	31.03	
Hori.	325.440	QP	24.60	14.30	9.83	31.97	-	16.76	46.0	29.26	
Vert.	39.837	QP	29.80	11.40	7.09	32.17	-	16.12	40.0	23.88	
Vert.	40.680	QP	51.00	11.25	7.10	32.16	-	37.19	40.0	2.81	
Vert.	49.160	QP	28.20	10.01	7.23	32.16	-	13.28	40.0	26.72	
Vert.	67.800	QP	45.40	9.03	7.50	32.15	-	29.78	40.0	10.22	
Vert.	94.920	QP	33.10	9.68	7.84	32.13	-	18.49	43.5	25.03	
Vert.	325.440	QP	29.90	14.30	9.83	31.97	-	22.06	46.0	23.96	

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

Spurious Emission

Test place Ise EMC Lab.
Measurement room No.3
Date February 6, 2024
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Junki Nagatomi
Mode Type B

PK or 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	28.70	20.29	-33.23	32.17	-	-16.41	29.5	45.91	
Hori.	40.680	QP	35.80	11.25	7.10	32.16	-	21.99	40.0	18.01	
Hori.	49.160	QP	27.20	10.01	7.23	32.16	-	12.28	40.0	27.72	
Hori.	52.402	QP	25.90	9.68	7.28	32.16	-	10.70	40.0	29.30	
Hori.	67.800	QP	34.80	9.03	7.50	32.15	-	19.18	40.0	20.82	
Hori.	94.920	QP	27.40	9.68	7.84	32.13	-	12.79	43.5	30.73	
Hori.	352.560	QP	22.80	15.08	10.03	31.97	-	15.94	46.0	30.08	
Vert.	40.680	QP	49.70	11.25	7.10	32.16	-	35.89	40.0	4.11	
Vert.	49.178	QP	27.70	10.01	7.23	32.16	-	12.78	40.0	27.22	
Vert.	52.402	QP	30.40	9.68	7.28	32.16	-	15.20	40.0	24.80	
Vert.	67.800	QP	48.50	9.03	7.50	32.15	-	32.88	40.0	7.12	
Vert.	94.920	QP	39.50	9.68	7.84	32.13	-	24.89	43.5	18.63	
Vert.	352.560	QP	29.50	15.08	10.03	31.97	-	22.64	46.0	23.38	

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

Spurious Emission

Test place Ise EMC Lab.
 Measurement room No.3
 Date February 6, 2024
 Temperature / Humidity 23 deg. C / 35 % RH
 Engineer Junki Nagatomi
 Mode Without Tag

PK or 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	28.70	20.29	-33.23	32.17	-	-16.41	29.5	45.91	
Hori.	49.158	QP	33.50	10.01	7.23	32.16	-	18.58	40.0	21.42	
Hori.	80.009	QP	33.70	9.08	7.67	32.14	-	18.31	40.0	21.69	
Hori.	488.160	QP	30.30	17.45	10.85	31.97	-	26.63	46.0	19.39	
Hori.	596.640	QP	33.60	19.32	11.45	31.95	-	32.42	46.0	13.60	
Hori.	623.760	QP	31.30	19.24	11.59	31.94	-	30.19	46.0	15.83	
Hori.	650.880	QP	30.30	19.26	11.74	31.93	-	29.37	46.0	16.65	
Vert.	52.341	QP	34.50	9.69	7.28	32.16	-	19.31	40.0	20.69	
Vert.	55.827	QP	29.60	9.41	7.33	32.16	-	14.18	40.0	25.82	
Vert.	488.160	QP	33.60	17.45	10.85	31.97	-	29.93	46.0	16.09	
Vert.	596.640	QP	30.50	19.32	11.45	31.95	-	29.32	46.0	16.70	
Vert.	623.760	QP	29.00	19.24	11.59	31.94	-	27.89	46.0	18.13	
Vert.	650.880	QP	28.00	19.26	11.74	31.93	-	27.07	46.0	18.95	

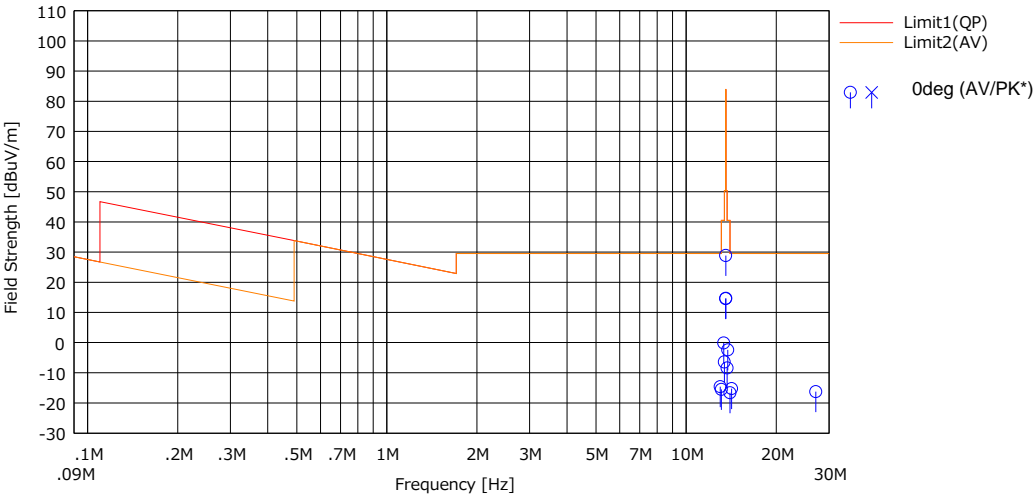
Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amplifier)

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

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	February 6, 2024	February 6, 2024
Temperature / Humidity	23 deg. C / 35 % RH	23 deg. C / 35 % RH
Engineer	Junki Nagatomi (Below 30 MHz)	Junki Nagatomi (Above 30 MHz)
Mode	Card Type A	

(below 30MHz)

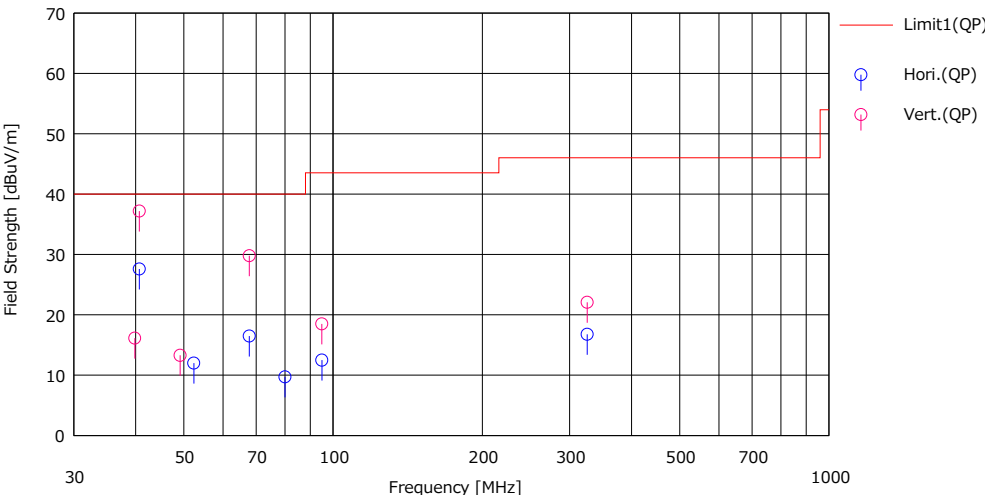
Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



* Data above 490 kHz were measured using a QP detector.

(above 30MHz)

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

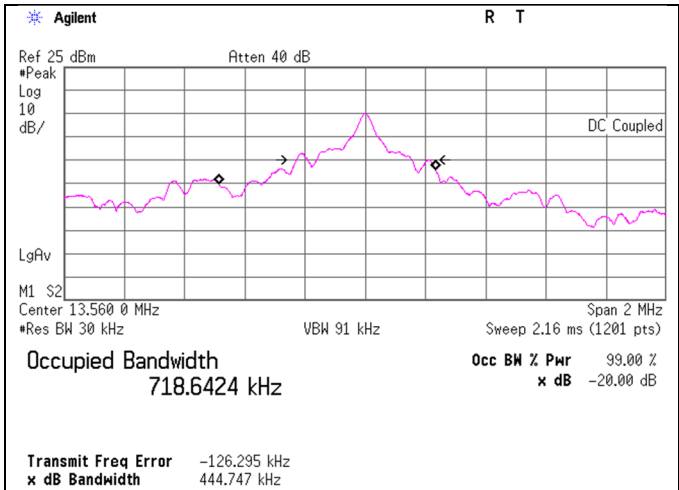


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

-20 dB Bandwidth

Test place Ise EMC Lab.
Measurement room No.11
Date February 6, 2024
Temperature / Humidity 20 deg. C / 46 % RH
Engineer Takeshi Hiyaji
Mode Card Type A

-20 dB Bandwidth [kHz]
444.747

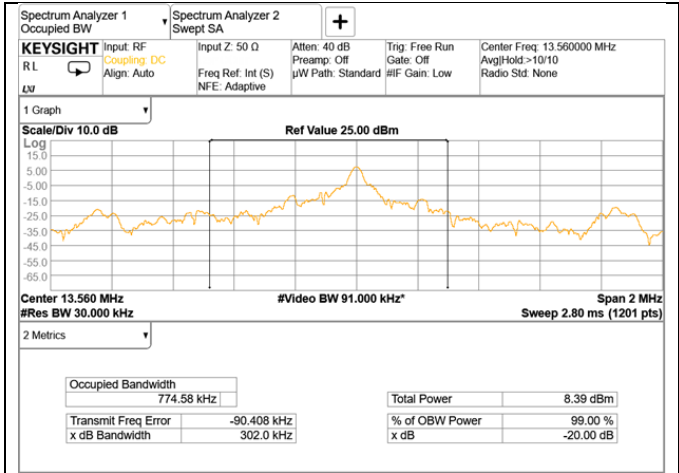


-20 dB Bandwidth

Test place
 Measurement room
 Date
 Temperature / Humidity
 Engineer
 Mode

Ise EMC Lab.
 No.11
 February 6, 2024
 22 deg. C / 33 % RH
 Junki Nagatomi
 Card Type B

-20 dB Bandwidth [kHz]
302.000

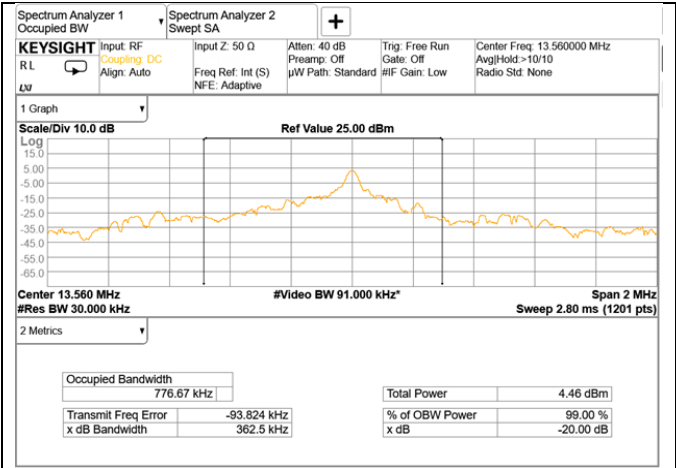


-20 dB Bandwidth

Test place
Measurement room
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab.
No.11
February 6, 2024
22 deg. C / 33 % RH
Junki Nagatomi
Felica

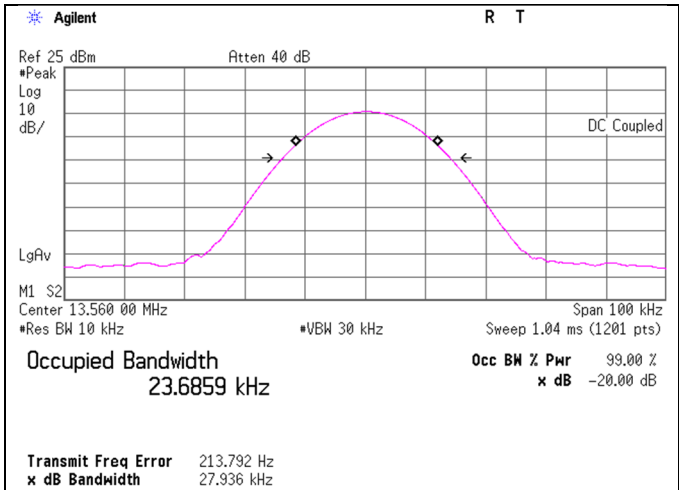
-20 dB Bandwidth [kHz]
362.500



-20 dB Bandwidth

Test place Ise EMC Lab.
Measurement room No.11
Date February 6, 2024
Temperature / Humidity 20 deg. C / 46 % RH
Engineer Takeshi Hiyaji
Mode Without Tag

-20 dB Bandwidth [kHz]
27.936



Frequency Tolerance

Test place Ise EMC Lab.
 Measurement Room No.4
 Date February 15, 2024
 Temperature / Humidity 22 deg. C / 33 % RH
 Engineer Junki Nagatomi
 Mode Tx 13.56 MHz

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- %]
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	14	Power on	13.559961	-0.000039	-0.00029	-2.9	0.01
		+ 2 min.	13.559956	-0.000044	-0.00032	-3.2	0.01
		+ 5 min.	13.559953	-0.000047	-0.00035	-3.5	0.01
		+ 10 min.	13.559952	-0.000048	-0.00035	-3.5	0.01
40	14	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.	13.559982	-0.000018	-0.00013	-1.3	0.01
		+ 10 min.	13.559983	-0.000017	-0.00013	-1.3	0.01
30	14	Power on	13.560011	0.000011	0.00008	0.8	0.01
		+ 2 min.	13.560064	0.000064	0.00047	4.7	0.01
		+ 5 min.	13.560056	0.000056	0.00041	4.1	0.01
		+ 10 min.	13.560055	0.000055	0.00041	4.1	0.01
20	14	Power on	13.560084	0.000084	0.00062	6.2	0.01
		+ 2 min.	13.560065	0.000065	0.00048	4.8	0.01
		+ 5 min.	13.560052	0.000052	0.00038	3.8	0.01
		+ 10 min.	13.560036	0.000036	0.00027	2.7	0.01
20	11.9 (14V -15%)	Power on	13.560047	0.000047	0.00035	3.5	0.01
		+ 2 min.	13.560034	0.000034	0.00025	2.5	0.01
		+ 5 min.	13.560030	0.000030	0.00022	2.2	0.01
		+ 10 min.	13.560025	0.000025	0.00018	1.8	0.01
20	16.1 (14V +15%)	Power on	13.560028	0.000028	0.00021	2.1	0.01
		+ 2 min.	13.560018	0.000018	0.00013	1.3	0.01
		+ 5 min.	13.560008	0.000008	0.00006	0.6	0.01
		+ 10 min.	13.560003	0.000003	0.00002	0.2	0.01
10	14	Power on	13.560318	0.000318	0.00235	23.5	0.01
		+ 2 min.	13.560278	0.000278	0.00205	20.5	0.01
		+ 5 min.	13.560239	0.000239	0.00176	17.6	0.01
		+ 10 min.	13.560216	0.000216	0.00159	15.9	0.01
0	14	Power on	13.560352	0.000352	0.00260	26.0	0.01
		+ 2 min.	13.560328	0.000328	0.00242	24.2	0.01
		+ 5 min.	13.560325	0.000325	0.00240	24.0	0.01
		+ 10 min.	13.560323	0.000323	0.00238	23.8	0.01
-10	14	Power on	13.560369	0.000369	0.00272	27.2	0.01
		+ 2 min.	13.560365	0.000365	0.00269	26.9	0.01
		+ 5 min.	13.560359	0.000359	0.00265	26.5	0.01
		+ 10 min.	13.560357	0.000357	0.00263	26.3	0.01
-20	14	Power on	13.560347	0.000347	0.00256	25.6	0.01
		+ 2 min.	13.560370	0.000370	0.00273	27.3	0.01
		+ 5 min.	13.560370	0.000370	0.00273	27.3	0.01
		+ 10 min.	13.560373	0.000373	0.00275	27.5	0.01
-30	14	Power on	13.560320	0.000320	0.00236	23.6	0.01
		+ 2 min.	13.560359	0.000359	0.00265	26.5	0.01
		+ 5 min.	13.560363	0.000363	0.00268	26.8	0.01
		+ 10 min.	13.560365	0.000365	0.00269	26.9	0.01

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

*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	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	141902	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187105	2023/05/23	12
RE	202511	Loop Antenna	UL Japan	-	-	-	-
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	2023/12/11	24
RE	244709	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202103	2024/01/25	12
RE	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	051201197	2024/01/31	12
RE	142183	Measure	KOMELON	KMC-36	-	2023/10/20	12
RE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	2023/05/17	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	2023/02/07	12
RE	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	2023/06/23	12
RE	142152	Loop Antenna	Rohde & Schwarz	HFH2-Z2	836553/009	2023/10/17	12
RE	159670	Coaxial Cable	UL Japan	-	-	2023/11/21	12
RE	197990	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHBB 9124 + BBA 9106	01365	2023/11/29	12
RE	141323	Coaxial cable	UL Japan	-	-	2023/09/10	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	2023/08/10	12
RE	182484	Signal Analyzer	Keysight Technologies Inc	N9030B	MY57143159	2023/04/14	12
RE	141498	Microwave Counter	ADVANTEST	R5373	120100309	2023/07/24	12
RE	142645	Loop Antenna	UL Japan	-	-	-	-
RE	141548	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	070500636	2023/05/29	12
RE	88581	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/07/18	12
RE	141275	Barometer	Sanoh Co., Ltd	SBR121	873	2021/02/01	36

*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, Frequency Tolerance