RADIO TEST REPORT

Test Report No.: 14486836S-B-R1

Customer	**Canon Inc.**
Description of EUT	**Z-Wave Module**
Model Number of EUT	**NCP04A**
FCC ID	**AZD249**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied (Refer to SECTION 3)**
Issue Date	**November 16, 2022**
Remarks	**-**

Representative test engineer	Approved by
Takahiro Kawakami Engineer	Toyokazu Imamura Leader

CERTIFICATE 1266.03

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

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 21.0

ANNOUNCEMENT

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- The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
- The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan, Inc. has been accredited.
- 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.: 14486836S-B

This report is a revised version of 14486836S-B. 14486836S-B is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14486836S-B	November 10, 2022	-
1	14486836S-B-R1	November 16, 2022	Page 6 Corrected the description of “FCC Part 15.31 (e)” from: This EUT provides the stable voltage constantly to the host device. to: The RF Module has its own regulator. The RF Module is constantly provided with voltage through the regulator regardless of input voltage. Page 19 Corrected the title from: Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission) to: Radiated Emission (Electric Field Strength of Spurious Emission)

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

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	Canon Inc.
Address	30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo 146-8501, Japan
Telephone Number	+81-3-5482-8070
Contact Person	Hirotaka Seki

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	Z-Wave Module
Model Number	NCP04A
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	September 8, 2022
Test Date	October 2 to 12, 2022

2.2 Product Description

General Specification

Rating	DC 3.3 V (DC 2.97 V to 3.63 V)
Operating temperature	-25 deg. C to +65 deg. C

Radio Specification

Equipment Type	Transceiver
Frequency of Operation	908.4 MHz - 916 MHz
Type of Modulation	GFSK
Antenna Gain	-0.9 dBi

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 15.249 Operation within the bands 902-928MHz, 2400-2483.5MHz, 5725-5875MHz and 24.0-24.25GHz

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	ANSI C63.10-2013 6. Standard test methods	Section 15.207(a)	19.4 dB, 0.39024 MHz, N, QP Mode: Tx 908.42 MHz	Complied a)	-
Electric Field Strength of Fundamental Emission	ANSI C63.10-2013 6. Standard test methods	Section 15.249(a)(c)(e)	1.5 dB 908.420 MHz, Horizontal, QP Mode: Tx 908.42 MHz	Complied b)	Radiated
Electric Field Strength of Spurious Emission	ANSI C63.10-2013 6. Standard test methods	Section 15.205(a)(b)(d) Section 15.209(a) Section 15.249(a)(c)(d)(e)	5.0 dB 8175.600 MHz, Vertical, AV Mode: Tx 908.4 MHz	Complied b)	Radiated
20 dB Bandwidth	ANSI C63.10-2013 6. Standard test methods	FCC 15.215	N/A	Complied c)	Radiated
Frequency Tolerance	ANSI C63.10-2013 6. Standard test methods	Section 15.249(b)	N/A	N/A *1)	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. *1) The test is not required since this EUT does not operate with 24.05 GHz to 24.25 GHz.					
a) Refer to APPENDIX 1 (data of Conducted Emission) b) Refer to APPENDIX 1 (data of Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)) c) Refer to APPENDIX 1 (data of 20 dB Bandwidth and 99 % Occupied Bandwidth)					

FCC Part 15.31 (e)

The RF Module has its own regulator.
The RF Module is constantly provided with voltage through the regulator regardless of input voltage.
Therefore, this EUT complies with the requirement.

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 % Occupied Bandwidth	**ISED:** RSS-Gen 6.7	**ISED:** -	N/A	- a)	Conducted
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

EMI

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.

Item	Frequency range	Uncertainty (+/-)
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	3.1 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.3 dB
	30 MHz-200 MHz	4.8 dB
	200 MHz-1 GHz	6.1 dB
	1 GHz-6 GHz	4.7 dB
	6 GHz-18 GHz	5.3 dB
	18 GHz-40 GHz	5.5 dB
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.6 dB
	18 GHz-40 GHz	5.8 dB

3.5 Test Location

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

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 Shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up.

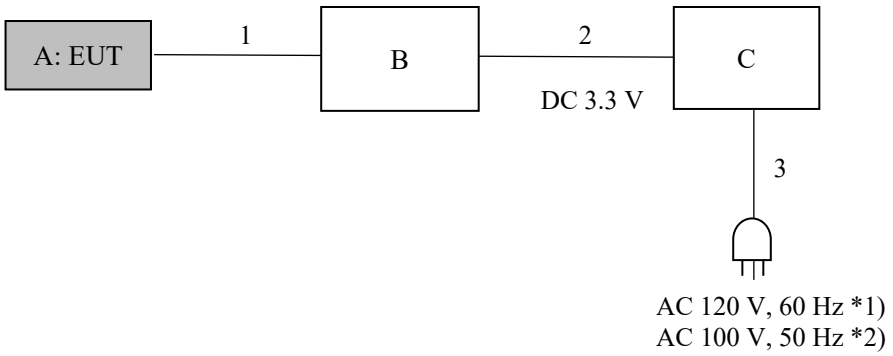
Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Modes

Test Item	Mode	Tested frequency
Conducted Emission *1) Duty Cycle	Transmitting (Tx)	908.42 MHz
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission Bandwidth	Transmitting (Tx)	908.40 MHz 908.42 MHz 916.00 MHz
The system was configured in typical fashion (as a customer would normally use it) for testing. *1) The mode was tested as a representative, because it had the highest power at electric field strength of fundamental emission.		
*Power of the EUT was set by the software as follows; Power Setting: 9 raw (-4 dBm) Software: RAILtest version:2.12.2 Built:May 6 2022 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting.		

4.2 Configuration and peripherals



* 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	Z-Wave Module	NCP04A	P25	Canon	EUT
B	Jig Board	PCB4001 Rev A03	190750418	SILICON LABS	-
C	Power Supply (DC)	PAN35-10A	NA000955	KIKUSUI	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.2	Unshielded	Unshielded	-
2	DC	2.0	Unshielded	Unshielded	-
3	AC	2.0	Unshielded	Unshielded	-

*1) Conducted Emission test
*2) Radiated Emission test

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals was aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)
I/O cable and AC 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 or a Measurement Room.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

Detector **: CISPR quasi-peak and average detector (IF BW 9 kHz)**
Measurement range **: 0.15 MHz - 30 MHz**
Test data **: APPENDIX 1**
Test result **: Pass**

SECTION 6: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)

Test Procedure and conditions

[For below 30 MHz]
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 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.

[For 30 MHz to 1 GHz]
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.

[For above 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 m and 4 m (frequency range 9 kHz - 30 MHz: loop antenna was fixed height at 1.0 m) and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear voltage average mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

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

Frequency	9 kHz - 150 kHz	150 kHz - 30 MHz	30 MHz - 1 GHz	1 GHz - 10 GHz	
Instrument used	Test Receiver	Test Receiver	Test Receiver	Spectrum Analyzer	
Detector	QP, Average *1)	QP, Average *1)	QP	Peak	Average *2)
IF Bandwidth	BW 200 Hz	BW 9 kHz	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz

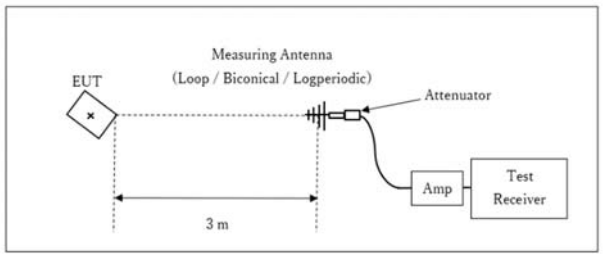
*1) Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open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

*2) VBW was set to 10 Hz and linear voltage average mode was used.

Figure 1: Test Setup

[Test setup]

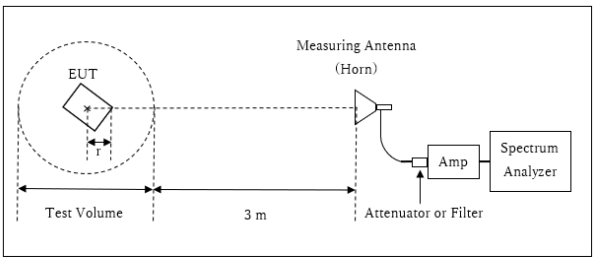
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz to 10 GHz



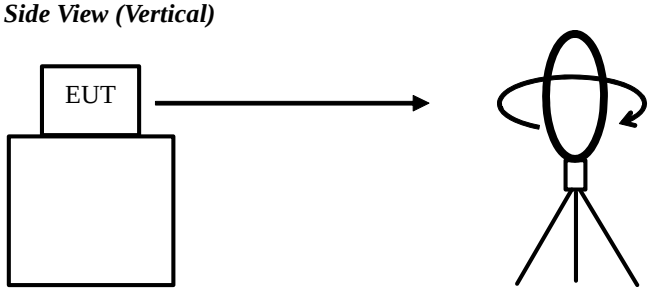
r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.98 m*/3.0 m) = 2.46 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.98 m

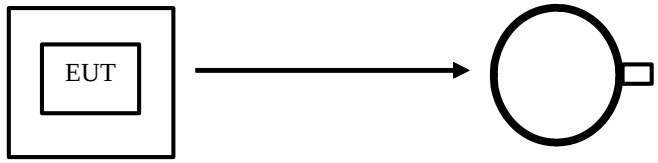
SVSWR Volume: 2 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.02m

Figure 2: Direction of the Loop Antenna

Side View (Vertical)

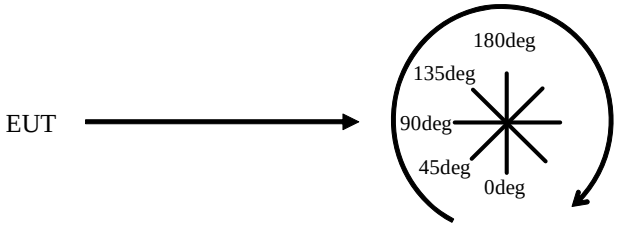


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

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.

Antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz -10 GHz)
Horizontal	Z	X	Y
Vertical	Z	X	X

*The result is rounded off to the second decimal place, so some differences might be observed.

Measurement range : 30 MHz to 10 GHz
Test data : APPENDIX 1
Test result : Pass

SECTION 7: Bandwidth and Duty Cycle

Test Procedure

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
Duty Cycle	zero span	8 MHz	50 MHz	100 msec	Peak	Single	Spectrum Analyzer
20 dB Bandwidth	1 MHz	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	1 MHz	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold *1)	Spectrum Analyzer
*1) Peak hold was applied as Worst-case measurement.							

Test data : APPENDIX 1
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

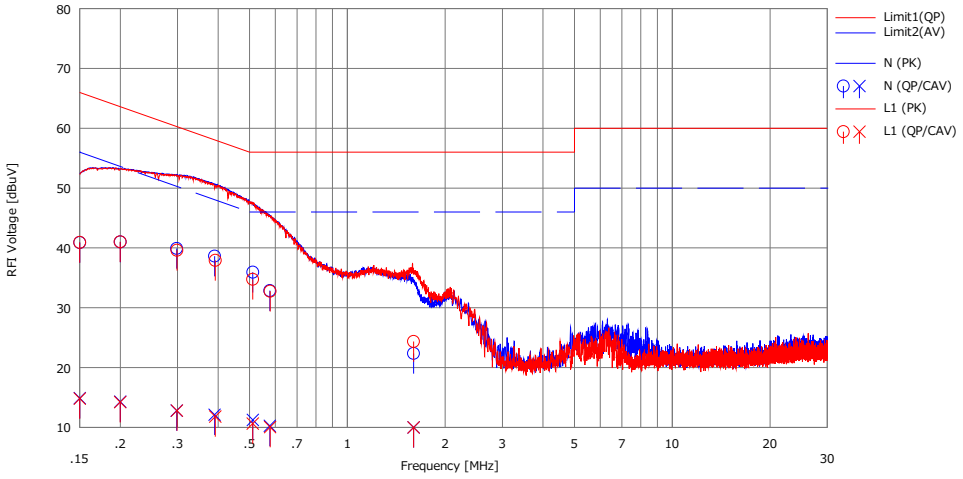
UL Japan,Inc. Shonan EMC Lab. No.3 Semi-Anechoic Chamber
Date : 2022/10/11

Mode : Tx, 908.42 MHz

Power : AC 120 V / 60 Hz
Temp./Humi. : 24 deg.C / 50 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Takahiro Kawakami



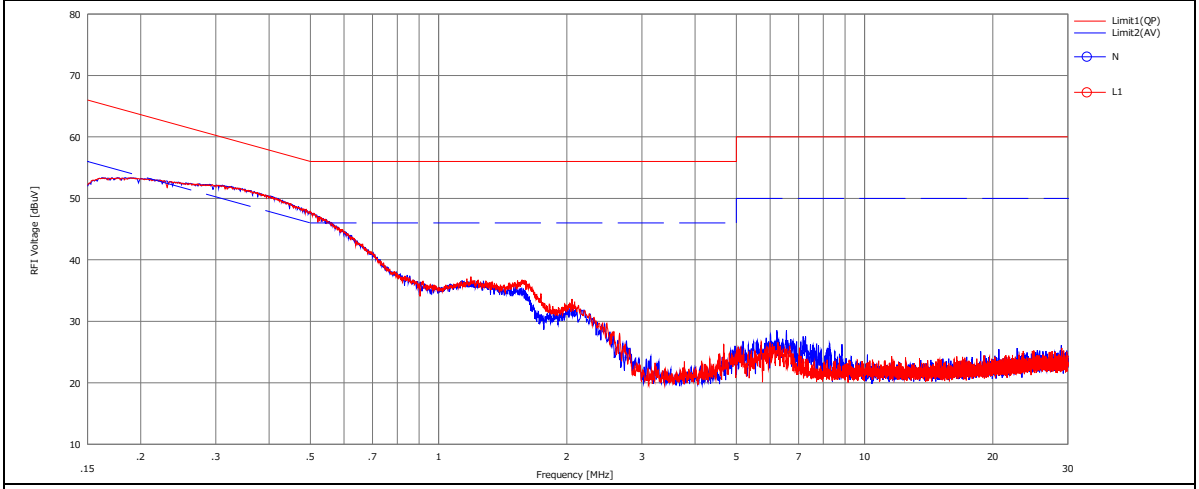
No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		〈QP〉	〈CAV〉		〈QP〉	〈CAV〉	〈QP〉	〈AV〉	〈QP〉	〈AV〉		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	28.40	2.40	12.48	40.88	14.88	66.00	56.00	25.1	41.1	N	
2	0.19994	28.50	1.80	12.49	40.99	14.29	63.61	53.61	22.6	39.3	N	
3	0.29824	27.40	0.30	12.50	39.90	12.80	60.29	50.29	20.3	37.4	N	
4	0.39024	26.10	-0.40	12.51	38.61	12.11	58.06	48.06	19.4	35.9	N	
5	0.51161	23.40	-1.30	12.52	35.92	11.22	56.00	46.00	20.0	34.7	N	
6	0.57696	20.30	-2.30	12.54	32.84	10.24	56.00	46.00	23.1	35.7	N	
7	1.59835	9.70	-4.80	12.65	22.35	7.85	56.00	46.00	33.6	38.1	N	
8	0.15000	28.40	2.30	12.50	40.90	14.80	66.00	56.00	25.1	41.2	L1	
9	0.19981	28.50	1.70	12.50	41.00	14.20	63.62	53.62	22.6	39.4	L1	
10	0.29889	27.10	0.30	12.50	39.60	12.80	60.27	50.27	20.6	37.4	L1	
11	0.39220	25.40	-0.70	12.51	37.91	11.81	58.02	48.02	20.1	36.2	L1	
12	0.51124	22.20	-1.90	12.54	34.74	10.64	56.00	46.00	21.2	35.3	L1	
13	0.57819	20.20	-2.50	12.55	32.75	10.05	56.00	46.00	23.2	35.9	L1	
14	1.59892	11.70	-4.50	12.65	24.35	8.15	56.00	46.00	31.6	37.8	L1	

Calculation:Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN):SLS-05

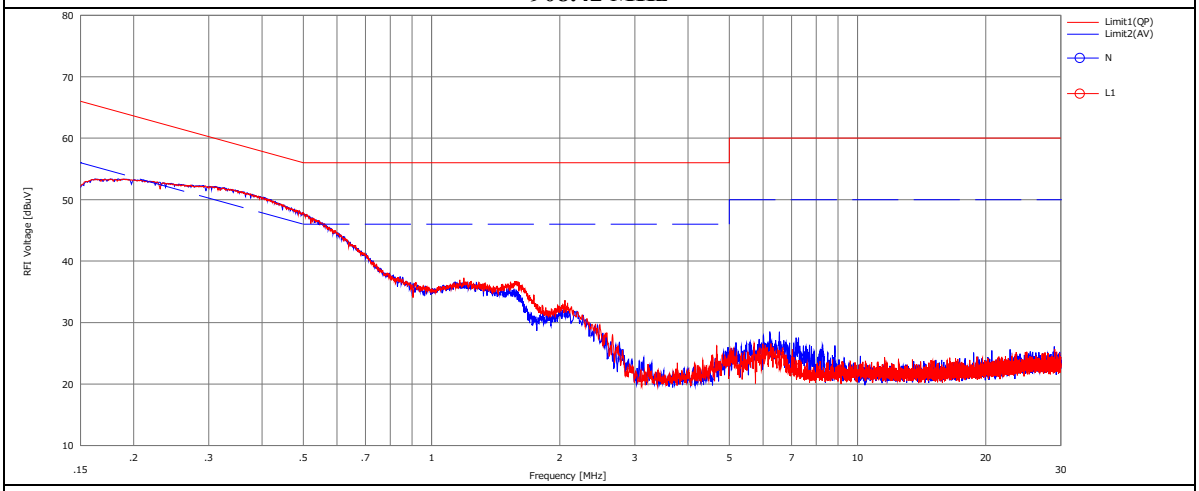
Conducted Emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date	October 12, 2022
Temperature/ Humidity	24 deg. C. / 50 % RH
Engineer	Takahiro Kawakami
Mode	Tx

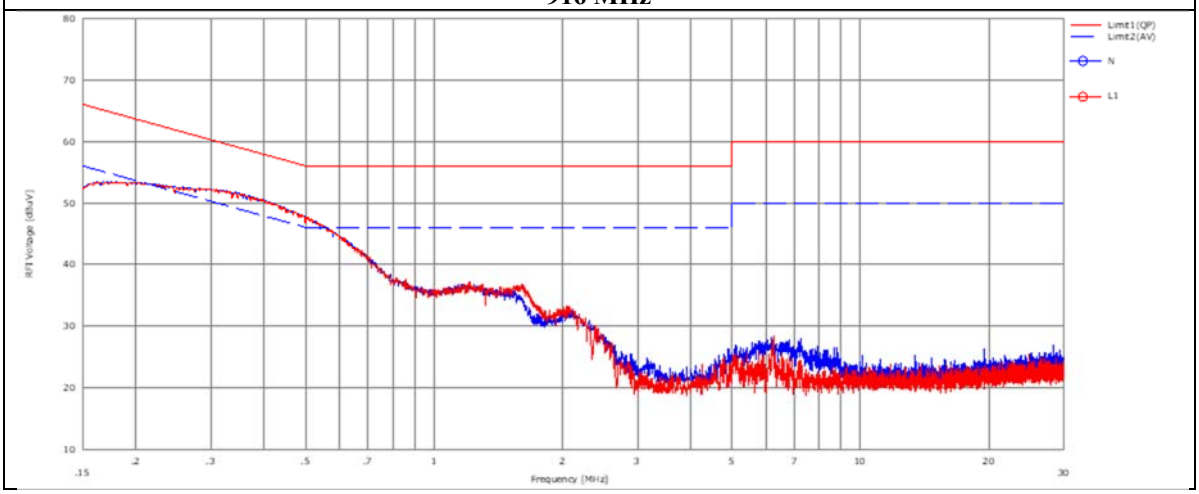
908.4 MHz



908.42 MHz



916 MHz



Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.1
Date	October 12, 2022	October 10, 2022	October 2, 2022
Temperature/ Humidity	22 deg.C./ 50 % RH	23 deg.C./ 52 % RH	23 deg.C./ 50 % RH
Engineer	Takahiro Kawakami	Miku Ikudome	Miku Ikudome
	(9 kHz - 30 MHz)	(30 MHz - 1 GHz)	(1 GHz - 10 GHz)
Mode	Tx 908.4 MHz		

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	114.720	QP	24.76	12.51	7.23	32.11	0.00	12.39	43.5	31.1	262	0	-
Hori.	902.000	QP	20.16	22.07	10.96	30.95	0.00	22.24	46.0	23.7	110	101	-
Hori.	908.400	QP	89.76	22.07	10.98	30.91	0.00	91.90	93.9	**2.0**	110	101	Carrier
Hori.	1816.800	PK	46.48	25.13	5.12	39.36	2.46	39.83	73.9	34.0	198	245	-
Hori.	2725.200	PK	47.38	27.92	5.73	39.55	2.46	43.94	73.9	29.9	180	293	-
Hori.	3633.600	PK	45.78	29.08	6.53	39.61	2.46	44.24	73.9	29.6	150	0	-
Hori.	4542.000	PK	46.19	30.59	7.22	39.64	2.46	46.82	73.9	27.0	115	332	-
Hori.	5450.400	PK	49.20	31.82	8.00	39.85	2.46	51.63	73.9	22.2	171	289	-
Hori.	6358.800	PK	48.38	33.76	8.72	39.93	2.46	53.39	73.9	20.5	326	216	-
Hori.	7267.200	PK	45.74	36.90	9.25	39.50	2.46	54.85	73.9	19.0	150	0	-
Hori.	8175.600	PK	47.44	37.16	9.83	39.29	2.46	57.60	73.9	16.3	182	205	-
Hori.	9084.000	PK	45.69	37.48	10.62	39.45	2.46	56.80	73.9	17.1	150	0	-
Hori.	1816.800	AV	35.73	25.13	5.12	39.36	2.46	29.08	53.9	24.8	198	245	VBW:10 Hz
Hori.	2725.200	AV	36.67	27.92	5.73	39.55	2.46	33.23	53.9	20.6	180	293	VBW:10 Hz
Hori.	3633.600	AV	33.26	29.08	6.53	39.61	2.46	31.72	53.9	22.1	150	0	VBW:10 Hz
Hori.	4542.000	AV	34.95	30.59	7.22	39.64	2.46	35.58	53.9	18.3	115	332	VBW:10 Hz
Hori.	5450.400	AV	41.86	31.82	8.00	39.85	2.46	44.29	53.9	9.6	171	289	VBW:10 Hz
Hori.	6358.800	AV	34.90	33.76	8.72	39.93	2.46	39.91	53.9	13.9	326	216	VBW:10 Hz
Hori.	7267.200	AV	33.12	36.90	9.25	39.50	2.46	42.23	53.9	11.6	150	0	VBW:10 Hz
Hori.	8175.600	AV	38.45	37.16	9.83	39.29	2.46	48.61	53.9	5.2	182	205	VBW:10 Hz
Hori.	9084.000	AV	33.45	37.48	10.62	39.45	2.46	44.56	53.9	9.3	150	0	VBW:10 Hz
Vert.	114.720	QP	29.78	12.51	7.23	32.11	0.00	17.41	43.5	26.0	218	347	-
Vert.	902.000	QP	19.96	22.07	10.96	30.95	0.00	22.04	46.0	23.9	130	99	-
Vert.	908.400	QP	85.61	22.07	10.98	30.91	0.00	87.75	93.9	6.1	130	99	Carrier
Vert.	1816.800	PK	45.41	25.13	5.12	39.36	2.46	38.76	73.9	35.1	157	55	-
Vert.	2725.200	PK	47.23	27.92	5.73	39.55	2.46	43.79	73.9	30.1	214	350	-
Vert.	3633.600	PK	45.11	29.08	6.53	39.61	2.46	43.57	73.9	30.3	150	0	-
Vert.	4542.000	PK	47.25	30.59	7.22	39.64	2.46	47.88	73.9	26.0	298	352	-
Vert.	5450.400	PK	49.05	31.82	8.00	39.85	2.46	51.48	73.9	22.4	395	169	-
Vert.	6358.800	PK	46.83	33.76	8.72	39.93	2.46	51.84	73.9	22.0	205	299	-
Vert.	7267.200	PK	45.57	36.90	9.25	39.50	2.46	54.68	73.9	19.2	150	0	-
Vert.	8175.600	PK	47.29	37.16	9.83	39.29	2.46	57.45	73.9	16.4	332	176	-
Vert.	9084.000	PK	45.73	37.48	10.62	39.45	2.46	56.84	73.9	17.0	150	0	-
Vert.	1816.800	AV	34.11	25.13	5.12	39.36	2.46	27.46	53.9	26.4	157	55	VBW:10 Hz
Vert.	2725.200	AV	35.41	27.92	5.73	39.55	2.46	31.97	53.9	21.9	214	350	VBW:10 Hz
Vert.	3633.600	AV	33.29	29.08	6.53	39.61	2.46	31.75	53.9	22.1	150	0	VBW:10 Hz
Vert.	4542.000	AV	34.79	30.59	7.22	39.64	2.46	35.42	53.9	18.4	298	352	VBW:10 Hz
Vert.	5450.400	AV	41.52	31.82	8.00	39.85	2.46	43.95	53.9	9.9	395	169	VBW:10 Hz
Vert.	6358.800	AV	35.08	33.76	8.72	39.93	2.46	40.09	53.9	13.8	205	299	VBW:10 Hz
Vert.	7267.200	AV	33.22	36.90	9.25	39.50	2.46	42.33	53.9	11.5	150	0	VBW:10 Hz
Vert.	8175.600	AV	38.69	37.16	9.83	39.29	2.46	48.85	53.9	5.0	332	176	VBW:10 Hz
Vert.	9084.000	AV	33.47	37.48	10.62	39.45	2.46	44.58	53.9	9.3	150	0	VBW:10 Hz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.98 m / 3.0 m) = 2.46 dB

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.1
Date	October 12, 2022	October 10, 2022	October 2, 2022
Temperature/ Humidity	22 deg.C./ 50 % RH	23 deg.C./ 52 % RH	23 deg.C./ 50 % RH
Engineer	Takahiro Kawakami	Miku Ikudome	Miku Ikudome
	(9 kHz - 30 MHz)	(30 MHz - 1 GHz)	(1 GHz - 10 GHz)
Mode	Tx 908.42 MHz		

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	114.724	QP	24.26	12.51	7.23	32.11	0.00	11.89	43.5	31.6	265	1	-
Hori.	908.420	QP	90.22	22.07	10.98	30.91	0.00	92.36	93.9	**1.5**	100	102	Carrier
Hori.	1816.840	PK	46.76	25.13	5.12	39.36	2.46	40.11	73.9	33.7	202	252	-
Hori.	2725.260	PK	47.03	27.92	5.73	39.55	2.46	43.59	73.9	30.3	140	301	-
Hori.	3633.680	PK	45.88	29.08	6.53	39.61	2.46	44.34	73.9	29.5	150	0	-
Hori.	4542.100	PK	46.57	30.59	7.22	39.64	2.46	47.20	73.9	26.7	159	319	-
Hori.	5450.520	PK	49.17	31.82	8.00	39.85	2.46	51.60	73.9	22.3	145	293	-
Hori.	6358.940	PK	47.01	33.76	8.72	39.93	2.46	52.02	73.9	21.8	156	278	-
Hori.	7267.360	PK	45.71	36.90	9.25	39.50	2.46	54.82	73.9	19.0	150	0	-
Hori.	8175.780	PK	47.46	37.16	9.83	39.29	2.46	57.62	73.9	16.2	162	222	-
Hori.	9084.200	PK	45.93	37.48	10.62	39.45	2.46	57.04	73.9	16.8	150	0	-
Hori.	1816.840	AV	35.97	25.13	5.12	39.36	2.46	29.32	53.9	24.5	202	252	VBW:10 Hz
Hori.	2725.260	AV	37.12	27.92	5.73	39.55	2.46	33.68	53.9	20.2	140	301	VBW:10 Hz
Hori.	3633.680	AV	33.29	29.08	6.53	39.61	2.46	31.75	53.9	22.1	150	0	VBW:10 Hz
Hori.	4542.100	AV	34.69	30.59	7.22	39.64	2.46	35.32	53.9	18.5	159	319	VBW:10 Hz
Hori.	5450.520	AV	41.93	31.82	8.00	39.85	2.46	44.36	53.9	9.5	145	293	VBW:10 Hz
Hori.	6358.940	AV	34.60	33.76	8.72	39.93	2.46	39.61	53.9	14.2	156	278	VBW:10 Hz
Hori.	7267.360	AV	33.21	36.90	9.25	39.50	2.46	42.32	53.9	11.5	150	0	VBW:10 Hz
Hori.	8175.780	AV	38.23	37.16	9.83	39.29	2.46	48.39	53.9	5.5	162	222	VBW:10 Hz
Hori.	9084.200	AV	33.34	37.48	10.62	39.45	2.46	44.45	53.9	9.4	150	0	VBW:10 Hz
Vert.	114.725	QP	28.70	12.51	7.23	32.11	0.00	16.33	43.5	27.1	197	346	-
Vert.	908.420	QP	88.04	22.07	10.98	30.91	0.00	90.18	93.9	3.7	127	241	Carrier
Vert.	1816.840	PK	46.71	25.13	5.12	39.36	2.46	40.06	73.9	33.8	148	307	-
Vert.	2725.260	PK	46.64	27.92	5.73	39.55	2.46	43.20	73.9	30.7	184	289	-
Vert.	3633.680	PK	45.31	29.08	6.53	39.61	2.46	43.77	73.9	30.1	150	0	-
Vert.	4542.100	PK	46.70	30.59	7.22	39.64	2.46	47.33	73.9	26.5	214	346	-
Vert.	5450.520	PK	48.97	31.82	8.00	39.85	2.46	51.40	73.9	22.5	118	311	-
Vert.	6358.940	PK	46.11	33.76	8.72	39.93	2.46	51.12	73.9	22.7	135	82	-
Vert.	7267.360	PK	45.36	36.90	9.25	39.50	2.46	54.47	73.9	19.4	150	0	-
Vert.	8175.780	PK	47.00	37.16	9.83	39.29	2.46	57.16	73.9	16.7	338	157	-
Vert.	9084.200	PK	45.82	37.48	10.62	39.45	2.46	56.93	73.9	16.9	150	0	-
Vert.	1816.840	AV	34.57	25.13	5.12	39.36	2.46	27.92	53.9	25.9	148	307	VBW:10 Hz
Vert.	2725.260	AV	35.26	27.92	5.73	39.55	2.46	31.82	53.9	22.0	184	289	VBW:10 Hz
Vert.	3633.680	AV	33.25	29.08	6.53	39.61	2.46	31.71	53.9	22.1	150	0	VBW:10 Hz
Vert.	4542.100	AV	34.74	30.59	7.22	39.64	2.46	35.37	53.9	18.5	214	346	VBW:10 Hz
Vert.	5450.520	AV	39.86	31.82	8.00	39.85	2.46	42.29	53.9	11.6	118	311	VBW:10 Hz
Vert.	6358.940	AV	34.50	33.76	8.72	39.93	2.46	39.51	53.9	14.3	135	82	VBW:10 Hz
Vert.	7267.360	AV	33.13	36.90	9.25	39.50	2.46	42.24	53.9	11.6	150	0	VBW:10 Hz
Vert.	8175.780	AV	38.04	37.16	9.83	39.29	2.46	48.20	53.9	5.7	338	157	VBW:10 Hz
Vert.	9084.200	AV	33.22	37.48	10.62	39.45	2.46	44.33	53.9	9.5	150	0	VBW:10 Hz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.98 m / 3.0 m) = 2.46 dB

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.1
Date	October 12, 2022	October 10, 2022	October 2, 2022
Temperature/ Humidity	22 deg.C./ 50 % RH	23 deg.C./ 52 % RH	23 deg.C./ 50 % RH
Engineer	Takahiro Kawakami	Miku Ikudome	Miku Ikudome
	(9 kHz - 30 MHz)	(30 MHz - 1 GHz)	(1 GHz - 10 GHz)
Mode	Tx 916 MHz		

(* PK: Peak, AV: Average, QP: Quasi-Peak)

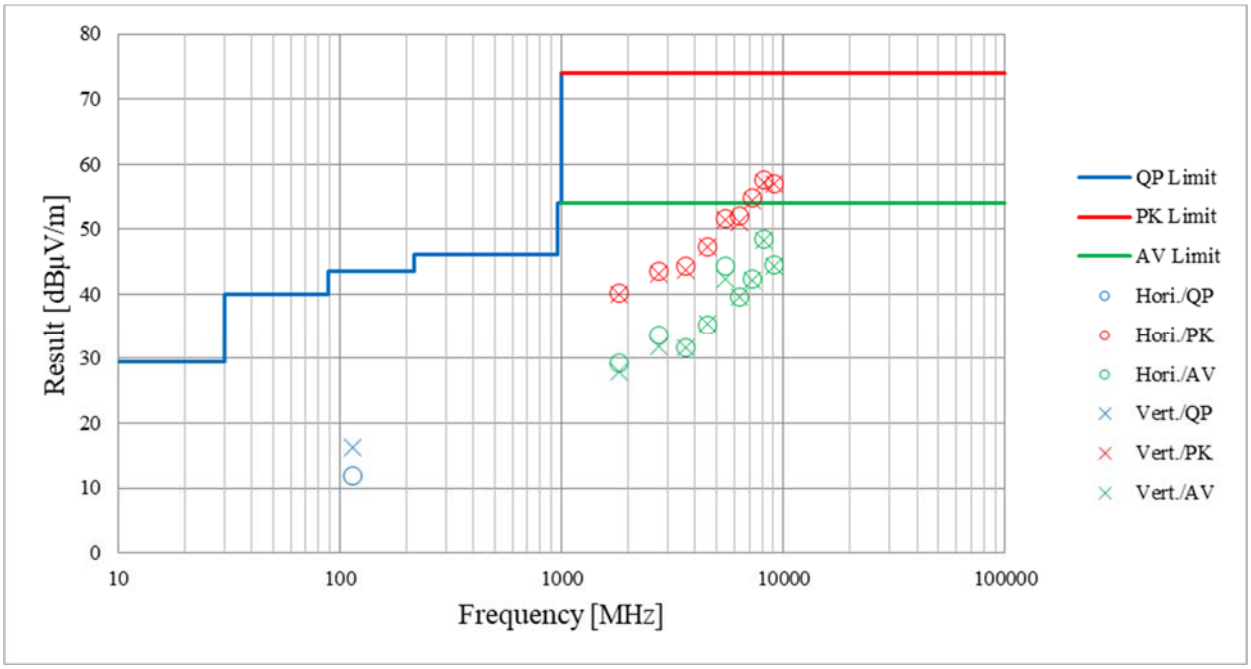
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	114.722	QP	23.37	12.51	7.23	32.11	0.00	11.00	43.5	32.5	387	7	-
Hori.	916.000	QP	89.89	22.03	11.00	30.87	0.00	92.05	93.9	**1.8**	100	104	Carrier
Hori.	928.000	QP	20.05	21.98	11.05	30.80	0.00	22.28	46.0	23.7	100	104	-
Hori.	1832.000	PK	46.61	25.18	5.13	39.37	2.46	40.01	73.9	33.8	199	251	-
Hori.	2748.000	PK	47.08	27.99	5.75	39.54	2.46	43.74	73.9	30.1	226	258	-
Hori.	3664.000	PK	44.57	29.16	6.56	39.60	2.46	43.15	73.9	30.7	228	359	-
Hori.	4580.000	PK	46.47	30.68	7.27	39.65	2.46	47.23	73.9	26.6	184	195	-
Hori.	5496.000	PK	48.73	31.90	8.04	39.86	2.46	51.27	73.9	22.6	183	288	-
Hori.	6412.000	PK	46.22	34.02	8.75	39.92	2.46	51.53	73.9	22.3	162	222	-
Hori.	7328.000	PK	45.19	36.94	9.28	39.48	2.46	54.39	73.9	19.5	150	0	-
Hori.	8244.000	PK	47.84	36.86	9.89	39.36	2.46	57.69	73.9	16.2	160	220	-
Hori.	9160.000	PK	45.73	37.78	10.71	39.50	2.46	57.18	73.9	16.7	150	0	-
Hori.	1832.000	AV	36.43	25.18	5.13	39.37	2.46	29.83	53.9	24.0	199	251	VBW:10 Hz
Hori.	2748.000	AV	36.63	27.99	5.75	39.54	2.46	33.29	53.9	20.6	226	258	VBW:10 Hz
Hori.	3664.000	AV	33.28	29.16	6.56	39.60	2.46	31.86	53.9	22.0	228	359	VBW:10 Hz
Hori.	4580.000	AV	35.52	30.68	7.27	39.65	2.46	36.28	53.9	17.6	184	195	VBW:10 Hz
Hori.	5496.000	AV	41.47	31.90	8.04	39.86	2.46	44.01	53.9	9.8	183	288	VBW:10 Hz
Hori.	6412.000	AV	34.45	34.02	8.75	39.92	2.46	39.76	53.9	14.1	162	222	VBW:10 Hz
Hori.	7328.000	AV	33.34	36.94	9.28	39.48	2.46	42.54	53.9	11.3	150	0	VBW:10 Hz
Hori.	8244.000	AV	38.59	36.86	9.89	39.36	2.46	48.44	53.9	5.4	160	220	VBW:10 Hz
Hori.	9160.000	AV	33.31	37.78	10.71	39.50	2.46	44.76	53.9	9.1	150	0	VBW:10 Hz
Vert.	114.722	QP	27.81	12.51	7.23	32.11	0.00	15.44	43.5	28.0	206	345	-
Vert.	916.000	QP	87.92	22.03	11.00	30.87	0.00	90.08	93.9	3.8	128	241	Carrier
Vert.	928.000	QP	19.95	21.98	11.05	30.80	0.00	22.18	46.0	23.8	128	241	-
Vert.	1832.000	PK	45.92	25.18	5.13	39.37	2.46	39.32	73.9	34.5	156	205	-
Vert.	2748.000	PK	46.57	27.99	5.75	39.54	2.46	43.23	73.9	30.6	167	234	-
Vert.	3664.000	PK	44.91	29.16	6.56	39.60	2.46	43.49	73.9	30.4	150	0	-
Vert.	4580.000	PK	46.95	30.68	7.27	39.65	2.46	47.71	73.9	26.1	178	217	-
Vert.	5496.000	PK	48.48	31.90	8.04	39.86	2.46	51.02	73.9	22.8	180	172	-
Vert.	6412.000	PK	46.43	34.02	8.75	39.92	2.46	51.74	73.9	22.1	176	210	-
Vert.	7328.000	PK	44.82	36.94	9.28	39.48	2.46	54.02	73.9	19.8	150	0	-
Vert.	8244.000	PK	48.09	36.86	9.89	39.36	2.46	57.94	73.9	15.9	195	150	-
Vert.	9160.000	PK	45.01	37.78	10.71	39.50	2.46	56.46	73.9	17.4	150	0	-
Vert.	1832.000	AV	34.54	25.18	5.13	39.37	2.46	27.94	53.9	25.9	156	205	VBW:10 Hz
Vert.	2748.000	AV	35.23	27.99	5.75	39.54	2.46	31.89	53.9	22.0	167	234	VBW:10 Hz
Vert.	3664.000	AV	33.24	29.16	6.56	39.60	2.46	31.82	53.9	22.0	150	0	VBW:10 Hz
Vert.	4580.000	AV	35.62	30.68	7.27	39.65	2.46	36.38	53.9	17.5	178	217	VBW:10 Hz
Vert.	5496.000	AV	39.06	31.90	8.04	39.86	2.46	41.60	53.9	12.3	180	172	VBW:10 Hz
Vert.	6412.000	AV	34.46	34.02	8.75	39.92	2.46	39.77	53.9	14.1	176	210	VBW:10 Hz
Vert.	7328.000	AV	33.35	36.94	9.28	39.48	2.46	42.55	53.9	11.3	150	0	VBW:10 Hz
Vert.	8244.000	AV	38.32	36.86	9.89	39.36	2.46	48.17	53.9	5.7	195	150	VBW:10 Hz
Vert.	9160.000	AV	33.27	37.78	10.71	39.50	2.46	44.72	53.9	9.1	150	0	VBW:10 Hz

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.98 m / 3.0 m) = 2.46 dB

Radiated Emission (Electric Field Strength of Spurious Emission)
(Plot data, Worst case mode for Electric field strength of fundamental emission)

Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.1
Date	October 12, 2022	October 10, 2022	October 2, 2022
Temperature/ Humidity	22 deg.C./ 50 % RH	23 deg.C./ 52 % RH	23 deg.C./ 50 % RH
Engineer	Takahiro Kawakami	Miku Ikudome	Miku Ikudome
	(9 kHz - 30 MHz)	(30 MHz - 1 GHz)	(1 GHz - 10 GHz)
Mode	Tx 908.42 MHz		

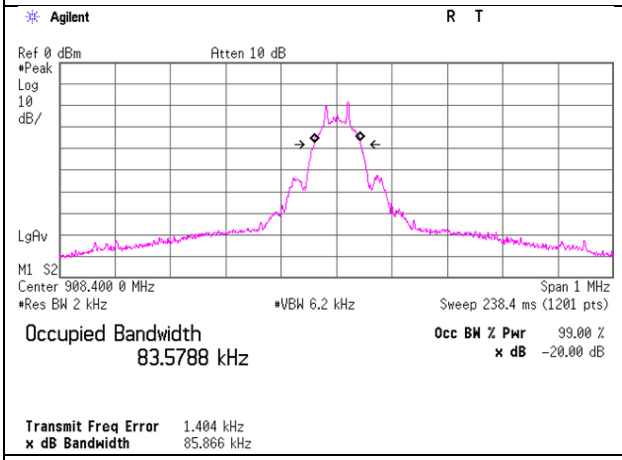


20 dB Bandwidth and 99 % Occupied Bandwidth

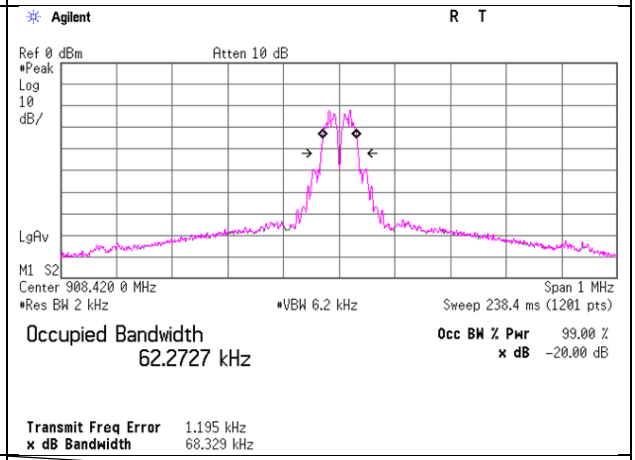
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date	October 10, 2022
Temperature/ Humidity	23 deg.C./ 52 % RH
Engineer	Miku Ikudome
Mode	Tx

Freq. [MHz]	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
908.40	85.866	83.579
908.42	68.329	62.273
916.00	122.738	113.300

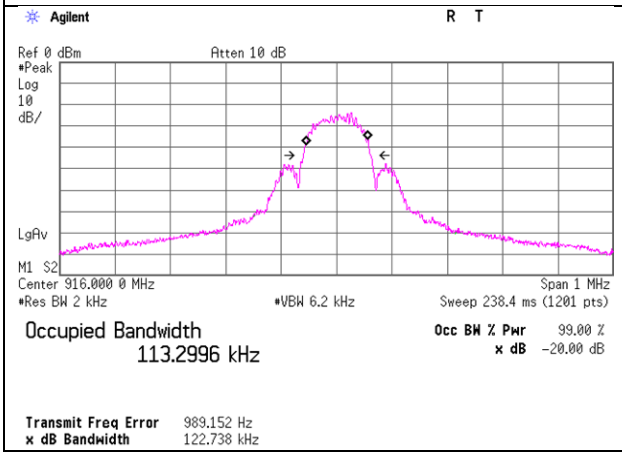
908.4 MHz



908.42 MHz



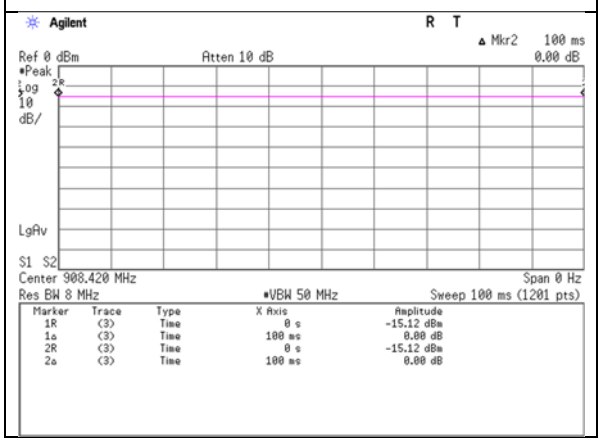
916 MHz



Duty Cycle

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date	October 10, 2022
Temperature/ Humidity	23 deg.C./ 52 % RH
Engineer	Miku Ikudome
Mode	Tx

Tx on / (Tx on + Tx off) = **1.000**
Tx on / (Tx on + Tx off) * 100 = **100.0 %**



APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	SAT3-10	144960	Attenuator	JFW	50HF-003N	-	2022/08/23	12
CE	SCC-C6/C7/C8/C10/SRSE-03	145034	Coaxial Cable&RF Selector	Suhner/Fujikura/Suhner/Suhner/TOYO	141PE/12DSFA/141PE/141PE/NS4906	-/0901-271(RF Selector)	2022/04/20	12
CE	SLS-05	145542	LISN	Rohde & Schwarz	ENV216	100516	2022/02/24	12
CE,RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
CE,RE	KJM-02	146432	Measure	TAJIMA	GL19-55	-	-	-
CE,RE	SOS-23	191840	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2022/08/08	12
CE,RE	STR-09	213530	Test Receiver	Rohde & Schwarz	ESW44	103068	2022/01/17	12
CE,RE	STS-03	146210	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997823	2022/09/20	12
RE	SAEC-01(SVSWR)	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	2022/05/13	12
RE	SAEC-03(NSA)	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2022/04/15	12
RE	SAEC-ALL	145568	Semi Anechoic Chamber(ME)	TDK	Semi Anechoic Chamber 3m/10m	1, 2, 3	2020/12/25	24
RE	SAF-03	145126	Pre Amplifier	SONOMA	310N	290213	2022/02/24	12
RE	SAF-04	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2022/05/20	12
RE	SAT10-06	145137	Attenuator	Keysight Technologies Inc	8493C-010	74865	2021/10/05	12
RE	SAT6-13	167094	Attenuator	JFW	50HF-006N	-	2022/02/21	12
RE	SBA-03	145023	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032666	2022/05/14	12
RE	SCC-C1/C2/C3/C4/C5/C10/SRSE-03	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	2022/04/20	12
RE	SCC-G05	145039	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	2022/01/06	12
RE	SCC-G41	151617	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S006	2022/01/06	12
RE	SCC-G62	196985	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803650/2	2022/03/08	12
RE	SCC-M1	194601	Coaxial Cable	Fjikura	5D-2W	-	2021/12/10	12
RE	SFL-22	168802	Highpass Filter	MICRO-TRONICS	HPM50114	G035	2022/03/02	12
RE	SHA-01	145383	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-725	2022/03/01	12
RE	SJM-22	207279	Measuring Tool, Tape Measure	ASKUL	-	-	-	-
RE	SLA-07	145529	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	196	2022/05/14	12
RE	SLP-02	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2022/04/07	12
RE	SOS-20	191837	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2022/08/06	12
RE	SRENT-22	202830	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250036	2021/12/01	12
RE	STS-01	145792	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997812	2022/09/20	12

***Hyphens for Last Calibration Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

The expiration date of the calibration is the end of the expired month.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

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

Test item:

CE: Conducted emission
RE: Radiated emission, Bandwidth, and Duty cycle