

RADIO TEST REPORT

Test Report No. 15553462H-R3

Customer	Pacific Industrial Company, LTD.
Description of EUT	TPMS (Tire Pressure Monitoring System Transmitter)
Model Number of EUT	PMV-E107
FCC ID	PAXPMVE107
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied
Issue Date	January 20, 2025
Remarks	-

Representative test engineerNachi Konegawa
Engineer**Approved by**Shinichi Miyazono
Leader

CERTIFICATE 5107.02

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

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

ANNOUNCEMENT

- This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
- The results in this report apply only to the sample tested. (Laboratory was not involved in sampling.)
- This sample tested is in compliance with the limits of the above regulation.
- The test results in this test report are traceable to the national or international standards.
- This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
- This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements.
(if applicable)
- The all test items in this test report are conducted by UL Japan, Inc. Ise 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 by the customer for this report is identified in SECTION 1.
- 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. 15553462H

This report is a revised version of 15553462H-R2. 15553462H-R2 is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15553462H	December 17, 2024	-
1	15553462H-R1	January 7, 2025	4.1 Operating Mode(s) Correction of *1) *1) The software of this mode is the same as one of normal product, except that EUT continues to transmit (For Normal use mode, EUT stops to transmit in a given time, even if transceiver button is being pressed.).=> *1) The software of this mode is the same as one of normal product, except that EUT continues to transmit.
1	15553462H-R1	January 7, 2025	APPENDIX 1: Test Data of Duty Cycle Data of Duty Cycle re-acquired due to oscilloscope change. APPENDIX 2: Test Instruments Correction of Digital Oscilloscope LIMS ID: 150449 => 141962 2.2 Identification of EUT Correction of Test Date November 22 and December 1, 2024 => November 22, 2024 to January 6, 2025
2	15553462H-R2	January 8, 2025	APPENDIX 1: Test Data of Duty Cycle Duty Cycle waveform (Left side) replaced with correct waveform.
3	15553462H-R3	January 20, 2025	APPENDIX 1: Test Data of Automatically deactivate (P.14) Correction of Silent period between transmissions for Stationary mode 3600 s => 36000 s

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	5
SECTION 2: Equipment Under Test (EUT).....	5
SECTION 3: Test Specification, Procedures & Results	6
SECTION 4: Operation of EUT during testing	9
SECTION 5: Radiated Spurious Emission.....	10
SECTION 6: Automatically deactivate	12
SECTION 7: -20 dB Bandwidth and 99% emission bandwidth	12
SECTION 8: Average Output Power	12
APPENDIX 1: Test Data	13
Automatically deactivate	13
Average Output Power.....	16
Radiated Emission (Fundamental and Spurious Emission)	17
Duty Cycle.....	19
-20 dB Bandwidth / 99% emission bandwidth.....	20
APPENDIX 2: Test Instruments	21
APPENDIX 3: Photographs of Test Setup	22
Radiated Spurious Emission.....	22
Worst Case Position	24
Average Output Power.....	25

SECTION 1: Customer Information

Company Name	Pacific Industrial Company, LTD.
Address	1300-1 YOKOI, GODO-CHO, ANPACHI-GUN, GIFU, 503-2397 JAPAN
Telephone Number	+81-584-28-0113
Contact Person	Takashi Takeyama

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	TPMS (Tire Pressure Monitoring System Transmitter)
Model Number	PMV-E107
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	November 7, 2024
Test Date	November 22, 2024 to January 6, 2025

2.2 Product Description

General Specification

Rating	DC 3 V
--------	--------

Radio Specification

[Transmitter]	
Equipment Type	Transmitter
Frequency of Operation	433.92 MHz
Type of Modulation	FSK
Antenna Gain	-20.0 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 15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

3.2 Procedures and Results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	FCC: ANSI C63.10:2013 6 Standard test methods ISED: RSS-Gen 8.8	FCC: Section 15.207 ISED: RSS-Gen 8.8	N/A	N/A	*1)
Automatically Deactivate	FCC: ANSI C63.10:2013 6 Standard test methods ISED: -	FCC: Section 15.231(a)(2) Section 15.231(e) ISED: RSS-210 A1.2 b RSS-210 A1.2 d	N/A	Complied	Radiated
Electric Field Strength of Fundamental Emission	FCC: ANSI C63.10:2013 6 Standard test methods ISED: RSS-Gen 6.12	FCC: Section 15.231(e) ISED: RSS-210 A1.3 a	10.3 dB 433.92 MHz Vertical, PK	Complied	Radiated
Electric Field Strength of Spurious Emission	FCC: ANSI C63.10:2013 6 Standard test methods ISED: RSS-Gen 6.13	FCC: Section 15.205 Section 15.209 Section 15.231(b) Section 15.231(e) ISED: RSS-210 A1.3 b RSS-Gen 8.9	13.2 dB 3037.440 MHz Vertical, PK	Complied	Radiated
-20 dB Bandwidth	FCC: ANSI C63.10:2013 6 Standard test methods ISED: -	FCC: Section 15.231(c) ISED: Reference data	N/A	Complied	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. *1) The test is not applicable since the EUT does not have AC Mains.					

FCC Part 15.31 (e)

The test was performed with the New Battery during the tests.
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% emission bandwidth	ANSI C63.10:2013 6 Standard test methods	Reference data	N/A	-	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.					

Other than above, 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	5.0
		Vertical	5.0
	200 MHz to 1000 MHz	Horizontal	5.2
		Vertical	6.2
10 m	30 MHz to 200 MHz	Horizontal	5.5
		Vertical	5.4
	200 MHz to 1000 MHz	Horizontal	5.5
		Vertical	5.5
3 m	1 GHz to 6 GHz	dB	5.1
	6 GHz to 18 GHz	dB	5.4
1 m	10 GHz to 18 GHz	dB	5.4
	18 GHz to 26.5 GHz	dB	5.3
	26.5 GHz to 40 GHz	dB	4.8
0.5 m	26.5 GHz to 40 GHz	dB	5.0

Antenna Terminal Conducted

Item	Unit	Calculated Uncertainty (+/-)
Antenna terminated conducted emission / Power density / Burst power	dB	3.47
Adjacent channel power (ACP)	dB	2.28
Bandwidth (OBW)	%	0.96
Time readout (time span upto 100 msec)	%	0.11
Time readout (time span upto 1000 msec)	%	0.11
Time readout (time span upto 60 sec)	%	0.02
Power measurement (Power meter < 8 GHz)	dB	1.46
Power measurement (Call box < 6 GHz)	dB	1.69
Frequency readout (Frequency counter)	ppm	0.67
Frequency readout (Spectrum analyzer frequency readout function)	ppm	2.13
Temperature (constant temperature bath)	deg. C	0.69
Humidity (constant temperature bath)	%RH	2.98
Modulation characteristics	%	6.93
Frequency for mobile	ppm	0.08
Contention-based protocol	dB	2.26

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.

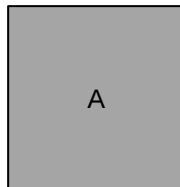
SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Test mode	Remarks
1) Shipping & Pressure Alert 2) Stationary mode 3) Rotating mode 1 4) Rotating mode 2	Automatically deactivate
5) Transmitting mode (Tx 433.92 MHz) *1)	Average Output Power Radiated Emission (Fundamental and Spurious Emission) Duty Cycle -20 dB Bandwidth / 99% emission bandwidth
* The system was configured in typical fashion (as a user would normally use it) for testing.	
*Power of the EUT was set by the software as follows; Software: PMV-E107 Version: 1.0 (Date: 2022.10 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.	

*1) The software of this mode is the same as one of normal product, except that EUT continues to transmit.

4.2 Configuration and Peripherals



* Setup(s) was taken into consideration and test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial Number	Manufacturer	Remark
A	TPMS (Tire Pressure Monitoring System Transmitter)	PMV-E107	00000162 *1) 00000164 *2)	Pacific Industrial Company, LTD.	EUT

*1) Used for Radiated Emission test

*2) Used for other tests except for Radiated Emission test

SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 30 MHz]

The noise level was checked by moving a search-coil (Loop Antenna) close to the EUT.

[For 30 MHz to 1 GHz]

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.

[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 measuring antenna height was varied between 1 and 4 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.

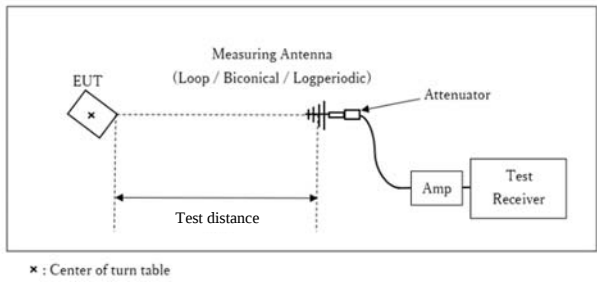
The radiated emission measurements were made with the following detector function of the test receiver / spectrum analyzer.

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

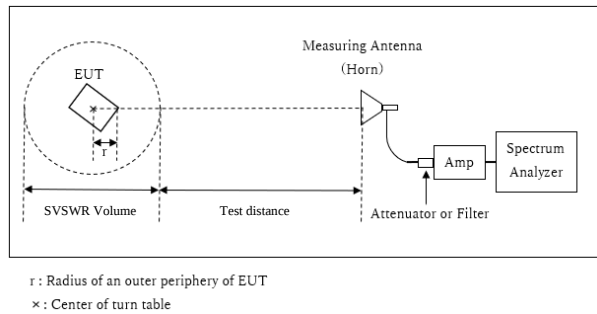
Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz	Above 1 GHz
Detector Type	Peak	Peak	Peak	Peak	Peak and Peak with Duty factor	Peak and Peak with Duty factor
IF Bandwidth	200 Hz	200 Hz	9.1 kHz	9.1 kHz	120 kHz	PK: S/A: RBW: 1 MHz, VBW: 3 MHz

[Test Setup]
Below 1 GHz



Test Distance: 3 m

1 GHz to 4.4 GHz



Distance Factor: $20 \times \log (4.0 \text{ m}^* / 3.0 \text{ m}) = 2.50 \text{ dB}$
*(Test Distance + SVSWR Volume / 2) - r = 4.0 m

Test Distance: 3 m
SVSWR Volume: 2 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r: 0.0 m

(The test was performed with r = 0.0 m since EUT is small and it was the rather conservative condition.)

- 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 4.4 GHz
Test data : APPENDIX
Test result : Pass

SECTION 6: Automatically deactivate

Test Procedure

The measurement was performed with Electric field strength using a spectrum analyzer.

Test data : APPENDIX
Test result : Pass

SECTION 7: -20 dB Bandwidth and 99% emission bandwidth

Test Procedure

The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-20 dB Bandwidth / 99% emission bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
*1) Peak hold was applied as Worst-case measurement.							

Test data : APPENDIX
Test result : Pass

SECTION 8: Average Output Power

Test Procedure

Average Output Power was measured with a Power Meter to measure Burst Average.
The test data is reference data for RF Exposure.

Test data : APPENDIX

APPENDIX 1: Test Data

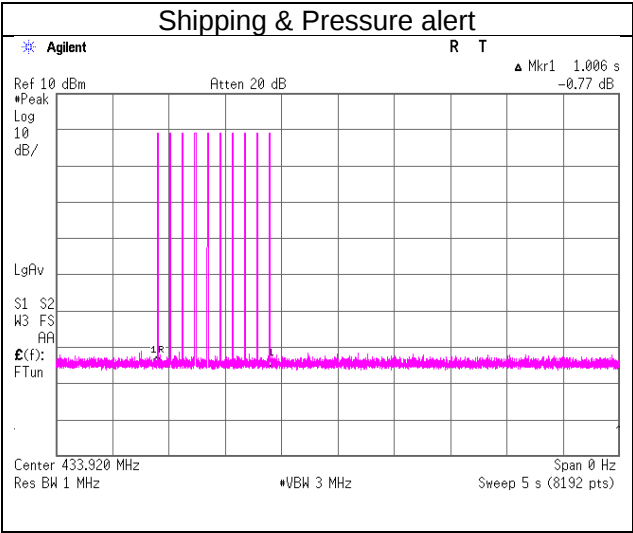
Automatically deactivate

Test place
Measurement Room
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab.
No.8
November 22, 2024
23 deg. C / 37 % RH
Nachi Konegawa
Mode 1

Operation in FCC 15.231(a)(2)

Mode	Tx Frequency	Time of Transmitting	Limit	Result
	[MHz]	[s]	[s]	
Shipping & Pressure alert	433.92	1.006	5.000	Pass



Automatically deactivate

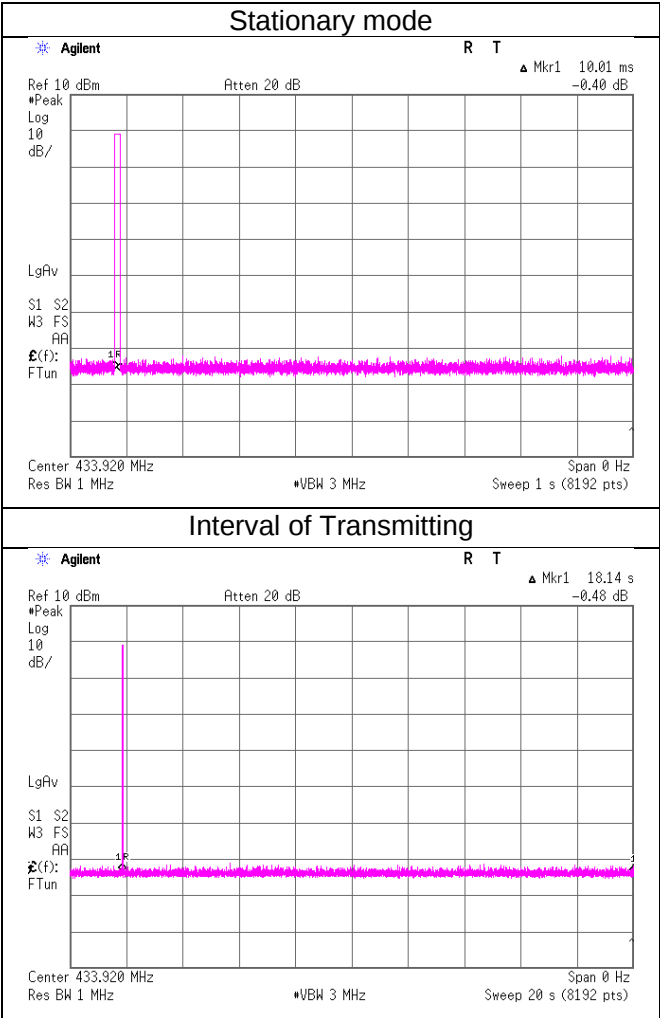
Test place	Ise EMC Lab.
Measurement Room	No.8
Date	November 22, 2024
Temperature / Humidity	23 deg. C / 37 % RH
Engineer	Nachi Konegawa
Mode	Mode 2

Operation in FCC 15.231(e)

Stationary mode

Duration of transmission: 10.01 ms < 1 s
Silent period between transmissions: 36000 s* - 0.01001 s = 35999.98999 s >30 times the duration of transmission and 10 s.

*Calculated from the technical documents



Automatically deactivate

Test place	Ise EMC Lab.
Measurement Room	No.8
Date	November 22, 2024
Temperature / Humidity	23 deg. C / 37 % RH
Engineer	Nachi Konegawa
Mode	Mode 3, 4

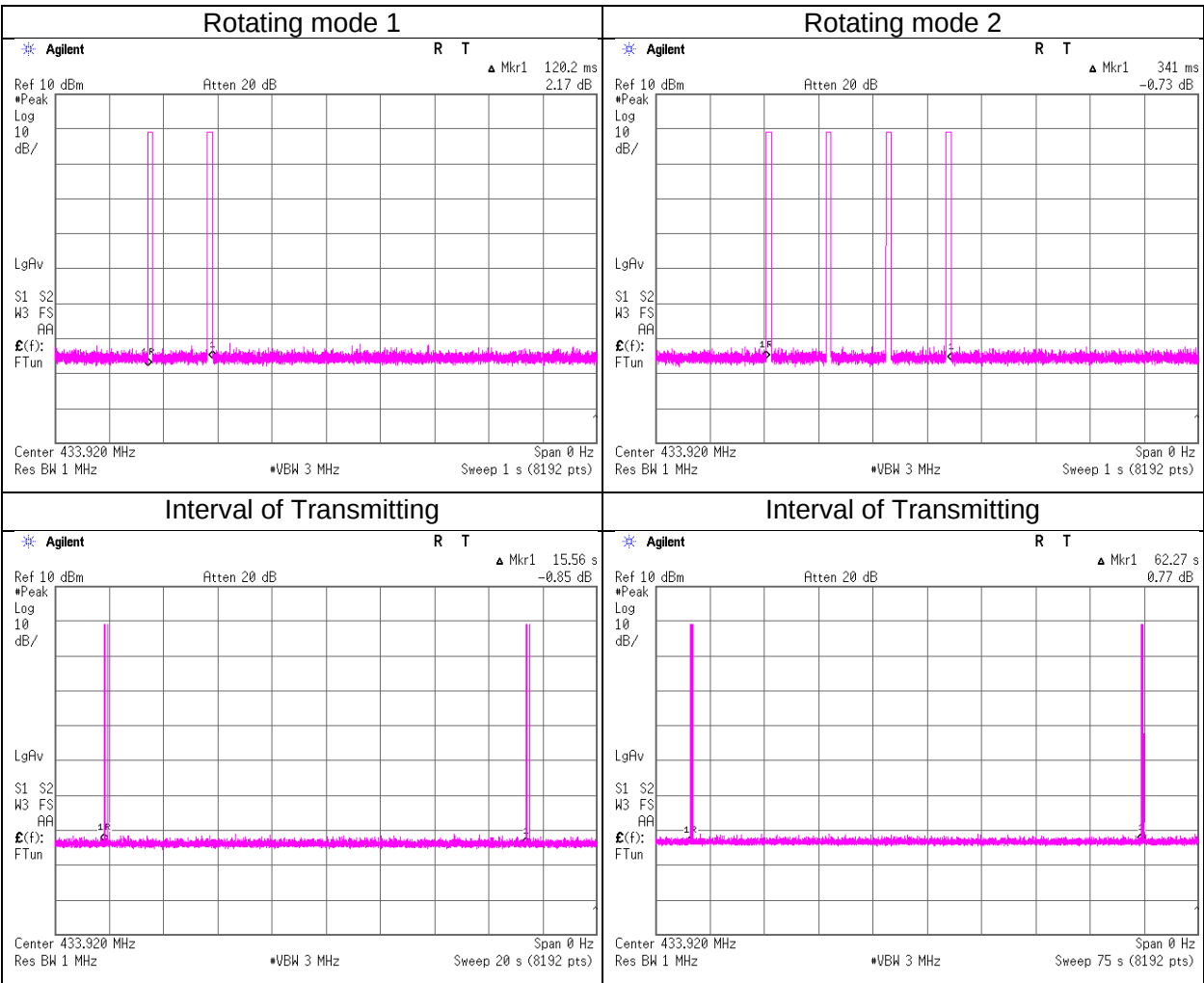
Operation in FCC 15.231(e)

Rotating mode 1

Duration of transmission: 120.2 ms < 1 s
Silent period between transmissions: 16 s - 0.1202 s = 15.8798 s >30 times the duration of transmission and 10 s.

Rotating mode 2

Duration of transmission: 341.0 ms < 1 s
Silent period between transmissions: 64 s - 0.3410 s = 63.6590 s >30 times the duration of transmission and 10 s.



Average Output Power
(Reference data for RF Exposure)

Test place	Ise EMC Lab.
Measurement Room	No.8
Date	November 22, 2024
Temperature / Humidity	23 deg. C / 37 % RH
Engineer	Nachi Konegawa
Mode	Mode 5

Freq.	Reading (P/M) [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power	
				Result (Burst)	
				[dBm]	[mW]
433.92	-0.88	0.00	9.89	9.01	7.96

Sample Calculation:

Conducted Power Result = Reading + Cable Loss + Atten. Loss

*The equipment and cables were not used for factor 0 dB of the data sheets.

*Since Burst Power is higher than Time Average Power, the test was performed at Burst Power to be more conservative.

*The measurement of Burst Power used Gate function.

Radiated Emission (Fundamental and Spurious Emission)

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	December 1, 2024
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Nachi Konegawa
Mode	Mode 5

Polarity [Hori/Vert]	Frequency [MHz]	Reading (PK) [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result (PK) [dBuV/m]	Result (PK with Duty Factor) [dBuV/m]	Limit (PK) [dBuV/m]	Limit (AV) [dBuV/m]	Margin (PK) [dB]	Margin (AV) [dB]	Inside or Outside of Restricted Bands	Remarks
Hori.	433.920	86.4	16.3	10.1	32.1	-20.5	80.7	60.2	92.8	72.8	12.1	12.6	Carrier	
Hori.	867.840	41.8	21.9	12.1	31.3	-20.5	44.5	24.0	72.8	52.8	28.3	28.8	Outside	
Hori.	1301.760	46.0	25.5	4.8	33.9	-20.5	42.4	21.9	73.9	53.9	31.5	32.0	Inside	
Hori.	1735.680	56.6	25.0	5.1	32.8	-20.5	53.9	33.4	73.9	53.9	20.0	20.5	Outside	
Hori.	2169.600	55.7	27.8	5.3	32.1	-20.5	56.7	36.2	73.9	53.9	17.2	17.7	Outside	
Hori.	2603.520	45.3	27.8	5.6	31.8	-20.5	46.9	26.4	73.9	53.9	27.0	27.5	Outside	
Hori.	3037.440	56.7	28.6	5.8	31.6	-20.5	59.5	39.0	73.9	53.9	14.4	14.9	Outside	
Hori.	3471.360	48.1	28.7	6.1	31.5	-20.5	51.4	30.9	73.9	53.9	22.5	23.0	Outside	
Hori.	3905.280	44.9	29.7	6.4	31.3	-20.5	49.7	29.2	73.9	53.9	24.2	24.7	Inside	
Hori.	4339.200	46.1	30.4	6.6	31.1	-20.5	52.0	31.5	73.9	53.9	21.9	22.4	Inside	
Vert.	433.920	88.2	16.3	10.1	32.1	-20.5	82.5	62.0	92.8	72.8	10.3	10.8	Carrier	
Vert.	867.840	32.9	21.9	12.1	31.3	-20.5	35.6	15.1	72.8	52.8	37.2	37.7	Outside	
Vert.	1301.760	45.7	25.5	4.8	33.9	-20.5	42.1	21.6	73.9	53.9	31.8	32.3	Inside	
Vert.	1735.680	57.5	25.0	5.1	32.8	-20.5	54.8	34.3	73.9	53.9	19.1	19.6	Outside	
Vert.	2169.600	55.5	27.8	5.3	32.1	-20.5	56.5	36.0	73.9	53.9	17.4	17.9	Outside	
Vert.	2603.520	45.3	27.8	5.6	31.8	-20.5	46.9	26.4	73.9	53.9	27.0	27.5	Outside	
Vert.	3037.440	57.9	28.6	5.8	31.6	-20.5	60.7	40.2	73.9	53.9	13.2	13.7	Outside	
Vert.	3471.360	48.1	28.7	6.1	31.5	-20.5	51.4	30.9	73.9	53.9	22.5	23.0	Outside	
Vert.	3905.280	44.2	29.7	6.4	31.3	-20.5	49.0	28.5	73.9	53.9	24.9	25.4	Inside	
Vert.	4339.200	44.5	30.4	6.6	31.1	-20.5	50.4	29.9	73.9	53.9	23.5	24.0	Inside	

Sample calculation:

Result of PK = Reading + Ant Factor + Loss {Cable + Attenuator + Filter (above 1 GHz) + Distance factor (above 1 GHz)} - Gain (Amplifier)

Result of PK with Duty factor (PK / W) = Reading + Ant Factor + Loss {Cable + Attenuator + Filter (above 1 GHz) +Distance factor (above 1 GHz)} - Gain (Amplifier) + Duty factor (Refer to Duty cycle data sheet)

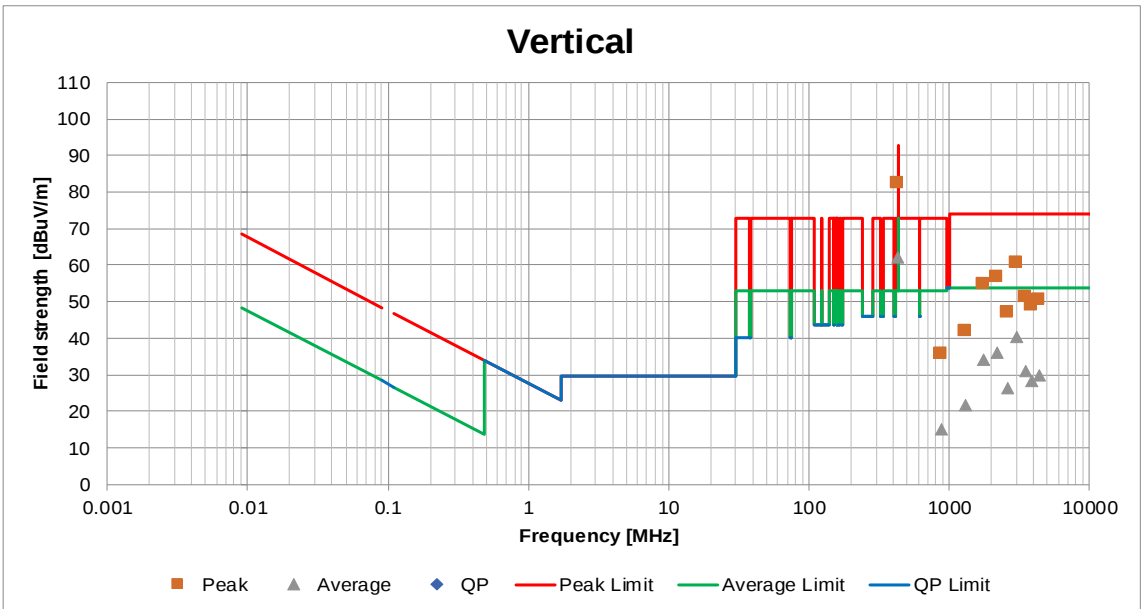
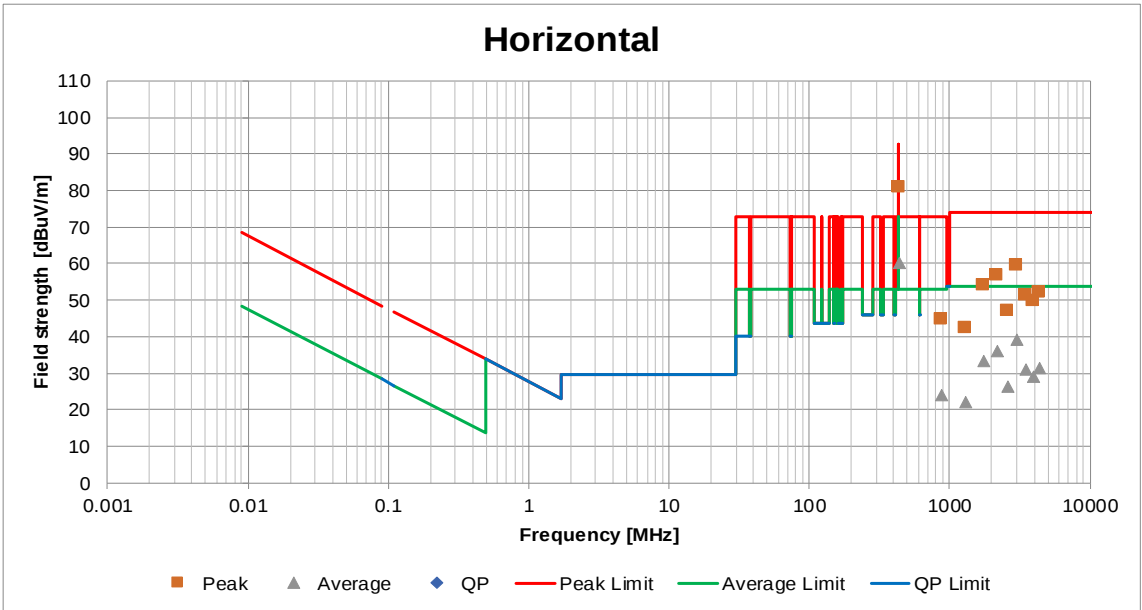
For above 1 GHz: Distance Factor: $20 \times \log (4.0 \text{ m}/3.0 \text{ m}) = 2.50 \text{ dB}$

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

If Gain 0.0 dB shown in the above table, pre-amplifier was not used to avoid the influence of carrier power. The pre-amplifier used for carrier frequency measurement was not saturated.

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

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	December 1, 2024
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Nachi Konegawa
Mode	Mode 5



Duty Cycle

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	January 6, 2025
Temperature / Humidity	23 deg. C / 48 % RH
Engineer	Nachi Konegawa
Mode	Mode 5

(Pulse length)

Type	Times	ON time(One pulse) [ms]	ON time(in 100 ms) [ms]
A	1	9.4166	9.4166

$$\text{ON time(in 100 ms)} = \text{Times} * \text{ON time(One pulse)}$$

(Total)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
9.4166	100	0.0942	-20.5

ON time[ms] = Type A's On Time(in 100 ms)

$$\text{Duty} = 20 * \log_{10}(\text{ON time/Cycle})$$

* "Timing of transmission" of the application documents was referred, since Intentional off time was unrealizable in measurement circumstance.



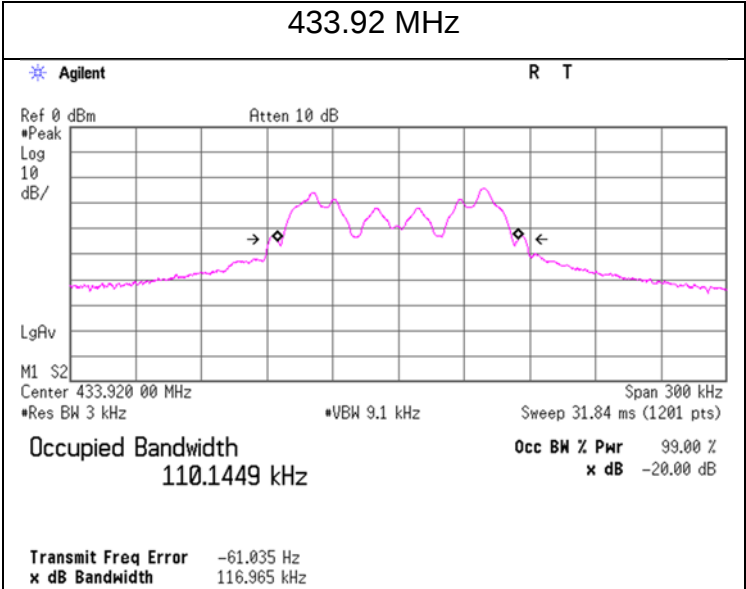
The ON Time (9.4166 ms) appears 1 times in 100 ms.

-20 dB Bandwidth / 99% emission bandwidth

Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date December 1, 2024
Temperature / Humidity 22 deg. C / 40 % RH
Engineer Nachi Konegawa
Mode Mode 5

Bandwidth Limit : Fundamental Frequency 433.92 MHz x 0.25 % = 1084.800 kHz		
-20 dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
116.9650	1084.800	Pass

99% emission bandwidth [kHz]	Bandwidth Limit [kHz]	Result
110.1449	1084.800	Pass



APPENDIX 2: Test Instruments

Test Equipment

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-192	09/18/2024	12
RE	141397	Coaxial Cable	UL-ISE EMC	-	-	11/29/2024 *1)	12
RE	141405	High Pass Filter 0.7-5GHz	TOKIMEC	TF305CCA	601	06/06/2024	12
RE	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	VHA 91031302	08/23/2024	12
RE	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	557	05/17/2024	12
RE	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	02/01/2024	12
RE	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	10/30/2024	12
RE	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	04/04/2024	12
RE	141899	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180655	05/09/2024	12
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	06/05/2024	12
RE	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	12/13/2023	24
RE	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/14/2023	24
RE	142230	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
RE	142645	Loop Antenna	UL Japan	-	-	-	-
RE	141962	Digital Oscilloscope	Rohde & Schwarz	RT01004	200355	2024/05/13	12
RE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	202512	Loop Antenna	UL-ISE	-	-	-	-
RE	220646	Attenuator	Huber+Suhner	6806 N-50-1	-	03/12/2024	12
RE	234602	Microwave Cable	Huber+Suhner	SF126E/11PC35/11 PC35/1000M,5000M	537063/126E / 537074/126E	03/08/2024	12
RE	244710	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202104	01/25/2024	12
AT	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/11/2024	12
AT	141809	Power Meter	Anritsu Corporation	ML2495A	825002	05/22/2024	12
AT	141830	Power sensor	Anritsu Corporation	MA2411B	738285	05/22/2024	12
AT	141855	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187750	11/14/2024	12
AT	244711	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202105	01/25/2024	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.

The expiration*1) This test equipment was used for the tests before the expiration date of the calibration.

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

Test item:

RE: Radiated Emission

AT: Antenna Terminal Conducted