




RADIO TEST REPORT


Test Report No. : 14092308H-R3

Applicant : Pacific Industrial Company, LTD.
Type of EUT : TPMS
(Tire Pressure Monitoring System Transmitter)
Model Number of EUT : PMV-G000
FCC ID : PAXPMVG000A
Test regulation : FCC Part 15 Subpart C: 2021
Test Result : Complied (Refer to SECTION 3)

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan, Inc. has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 14092308H-R2. 14092308H-R2 is replaced with this report.

Date of test: November 18 and 26, 2021

Representative test engineer: 
Takafumi Noguchi
Engineer

Approved by: 
Shinichi Miyazono
Engineer



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”.

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REVISION HISTORY

Original Test Report No.: 14092308H

Revision	Test report No.	Date	Page revised	Contents
- (Original)	14092308H	December 16, 2021	-	-
1	14092308H-R1	December 22, 2021	P.9	Correction of mode name in Section 4.1
2	14092308H-R2	January 17, 2022	P.5	Deletion of “ASK” from Modulation in Clause.
2	14092308H-R2	January 17, 2022	P.6	Deletion of “<FSK>” from Procedures and results in Clause 3.2.
2	14092308H-R2	January 17, 2022	P.7	Correction of 3.4 Uncertainty table in Clause 3.4.
2	14092308H-R2	January 17, 2022	P.9	Correction of mode name in Section 4.1
2	14092308H-R2	January 17, 2022	P.13 to 19 (for original report)	- Deletion of the ASK data from Automatically deactivate test of APPENDIX 1. - Deletion of “(FSK)” from Automatically deactivate test data of APPENDIX 1.
2	14092308H-R2	January 17, 2022	P.21 (for original report)	Deletion of the ASK data from Radiated Emission (Fundamental and Spurious Emission) test of APPENDIX 1.
2	14092308H-R2	January 17, 2022	P.22 (for original report)	Deletion of “(FSK)” from Radiated Emission (Fundamental and Spurious Emission) test data of APPENDIX 1.
2	14092308H-R2	January 17, 2022	P.23 (for original report)	for Radiated Emission (Plot data, Worst case) of APPENDIX 1; - Correction of the title - Correction of the Plot data
2	14092308H-R2	January 17, 2022	P.24, 25 (for original report)	Deletion of the ASK data from Duty Cycle test of APPENDIX 1.
2	14092308H-R2	January 17, 2022	P.26 (for original report)	Deletion of “(FSK)” from Duty Cycle test data of APPENDIX 1.
2	14092308H-R2	January 17, 2022	P.27 (for original report)	Deletion of the ASK data from -20 dB Bandwidth / 99 % Occupied Bandwidth test of APPENDIX 1.
2	14092308H-R2	January 17, 2022	P.28 (for original report)	Deletion of “(FSK)” from -20 dB Bandwidth / 99 % Occupied Bandwidth test data of APPENDIX 1.
2	14092308H-R2	January 17, 2022	All page	Correction of the total pages
3	14092308H-R3	January 20, 2022	P.1	Correction of “Date of test” in cover sheet by ASK data deletion.
3	14092308H-R3	January 20, 2022	P.20	Correction of Silent period between transmissions

Reference: Abbreviations (Including words undescribed in this report)

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

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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 from the customer is as follows;

- Applicant, Type 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)
- 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

Type : TPMS (Tire Pressure Monitoring System Transmitter)
Model Number : PMV-G000
Serial Number : Refer to SECTION 4.2
Receipt Date : November 15, 2021
Condition : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification : No Modification by the test lab.

2.2. Product Description

Model: PMV-G000 (referred to as the EUT in this report) is a TPMS (Tire Pressure Monitoring System Transmitter).

General Specification

Rating : DC 3.0 V

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 315 MHz
Modulation : FSK
Antenna type : Flatplane antenna (Built-in type)
Clock frequency (Maximum) : 26 MHz

*This transmitter transmits unmodulated center frequency (315 MHz) of several hundred μ s before and after transmission.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on May 3, 2021 and effective July 2, 2021

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	FCC: Section 15.207	N/A	N/A	*1)
Automatically Deactivate	FCC: ANSI C63.10:2013 6 Standard test methods	FCC: Section 15.231(a)(2) Section 15.231(e)	N/A	Complied a)	Radiated
Electric Field Strength of Fundamental Emission	FCC: ANSI C63.10:2013 6 Standard test methods	FCC: Section 15.231(e)	3.4 dB 315.000 MHz, Horizontal, PK with Duty Factor	Complied# b)	Radiated
Electric Field Strength of Spurious Emission	FCC: ANSI C63.10:2013 6 Standard test methods	FCC: Section 15.205 Section 15.209 Section 15.231(e)	10.7 dB 2835.000 MHz, Horizontal, PK with Duty Factor	Complied b)	Radiated
-20dB Bandwidth	FCC: ANSI C63.10:2013 6 Standard test methods	FCC: Section 15.231(c)	N/A	Complied c)	Radiated

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

*1) The test is not applicable since the EUT does not have AC Mains.

a) Refer to APPENDIX 1 (data of Automatically deactivate)

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)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

FCC Part 15.31 (e)

The 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.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Bandwidth	ANSI C63.10:2013 6 Standard test methods	Reference data	N/A	-	Radiated

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

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

Test Item	Frequency range	Uncertainty (+/-)	
Conducted emission AMN (LISN)	0.15 MHz to 30 MHz	2.9 dB	
Radiated emission	3 m	9 kHz to 30 MHz	3.3 dB
		10 m	3.2 dB
	3 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
			5.0 dB
		200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
			6.3 dB
	10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
			4.8 dB
		200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
			5.0 dB
	3 m	1 GHz to 6 GHz	4.9 dB
		6 GHz to 18 GHz	5.2 dB
1 m	10 GHz to 26.5 GHz	5.5 dB	
	26.5 GHz to 40 GHz	5.5 dB	
10 m	1 GHz to 18 GHz	5.2 dB	
Automatically Deactivate	-	0.10 %	
-20 dB Bandwidth / 99 % Occupied Bandwidth	-	0.96 %	

3.5 Test Location

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

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

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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	-	-

3.6 Test data, Test instruments, and Test set up

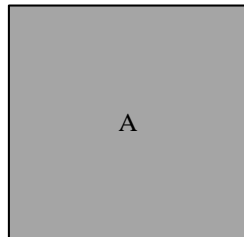
Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1. Operating Mode(s)

Test Item	Mode
Automatically Deactivate	1) Pressure alert 1a 2) Pressure alert 2a 3) Pressure alert 1b 4) Pressure alert 2b 5) Pressure alert after the Pressure change 6) Rotating mode 1 7) Rotating mode 2 8) Rotating mode 3 9) Stationary mode 1 10) Stationary mode 2
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission Duty Cycle -20 dB Bandwidth & 99 % Occupied Bandwidth	11) Transmitting mode (Tx)
<p>* The system was configured in typical fashion (as a user would normally use it) for testing. * EUT was set by the software as follows; Software: PMV-G000 Ver1.0 (Date: 2021.11.12, Storage location: EUT memory)</p> <p>*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.</p>	

4.2. Configuration and peripherals



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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	TPMS (Tire Pressure Monitoring System Transmitter)	PMV-G000	00024FF	Pacific Industrial Company, LTD.	EUT

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SECTION 5: Radiated emission (Fundamental and 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, 0.5 m by 1.0 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

	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

- 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 - 3.2 GHz

Test data : APPENDIX

Test result : Pass

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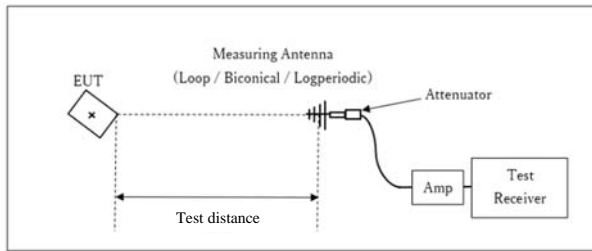
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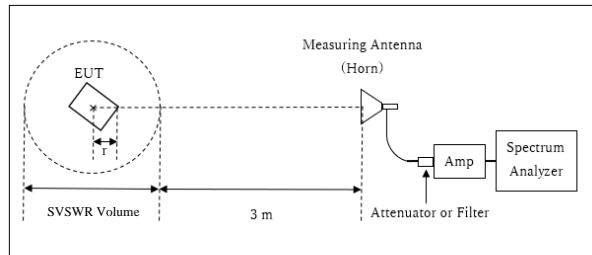
[Test Setup]
Below 1 GHz



* : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



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

Distance Factor: $20 \times \log(4.0 \text{ m} / 3.0 \text{ m}) = 2.5 \text{ dB}$

* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 4.0 \text{ m}$

SVSWR Volume : 2.0 m

(SVSWR Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.0 \text{ m}$

* The test was performed with $r = 0.0 \text{ m}$ since EUT is small and it was the rather conservative condition.

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% 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 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
*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.							

Test data : APPENDIX
Test result : Pass

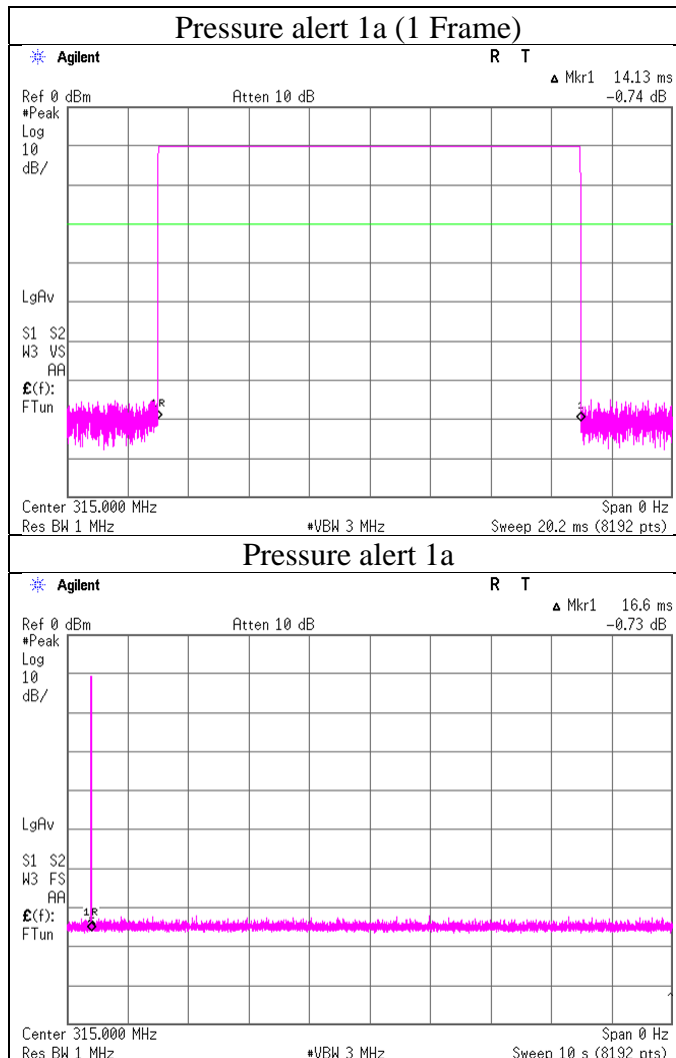
APPENDIX 1: Test data

Automatically deactivate

Report No. 14092308H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.8
Date November 26, 2021
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Takafumi Noguchi
Mode Pressure alert

Operation in FCC 15.231(a)(2)

Mode	Tx Frequency [MHz]	Time of Transmitting [sec]	Limit [sec]	Result
Pressure alert 1a	315	0.01413	5.00	Pass

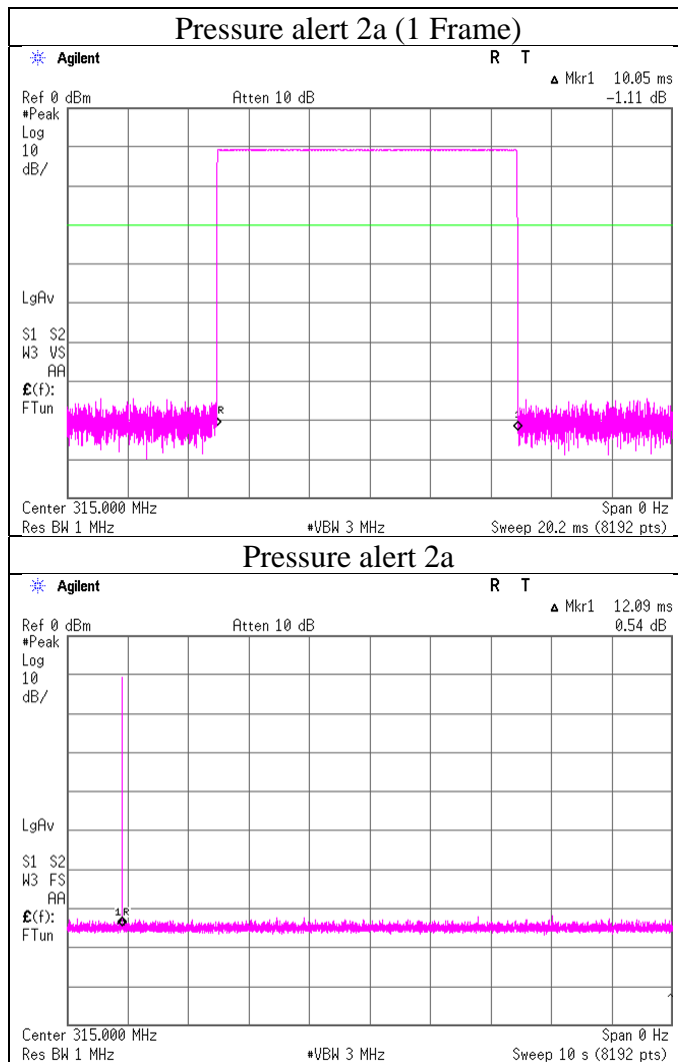


Automatically deactivate

Report No.	14092308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.8
Date	November 26, 2021
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Takafumi Noguchi
Mode	Pressure alert

Operation in FCC 15.231(a)(2)

Mode	Tx Frequency [MHz]	Time of Transmitting [sec]	Limit [sec]	Result
Pressure alert 2a	315	0.01005	5.00	Pass



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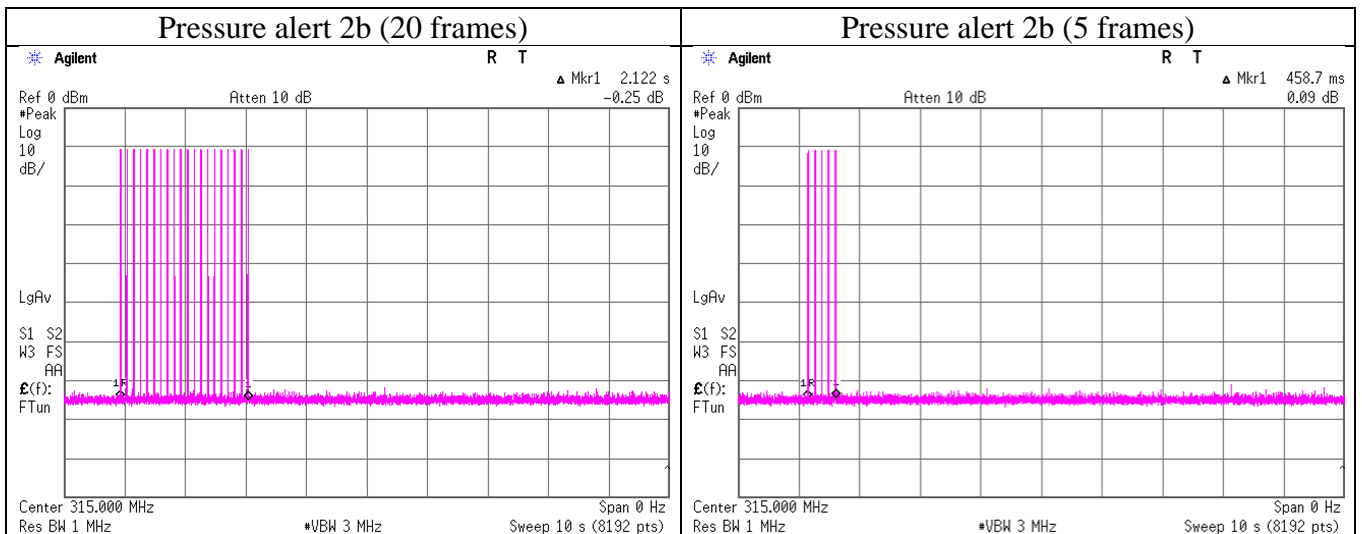
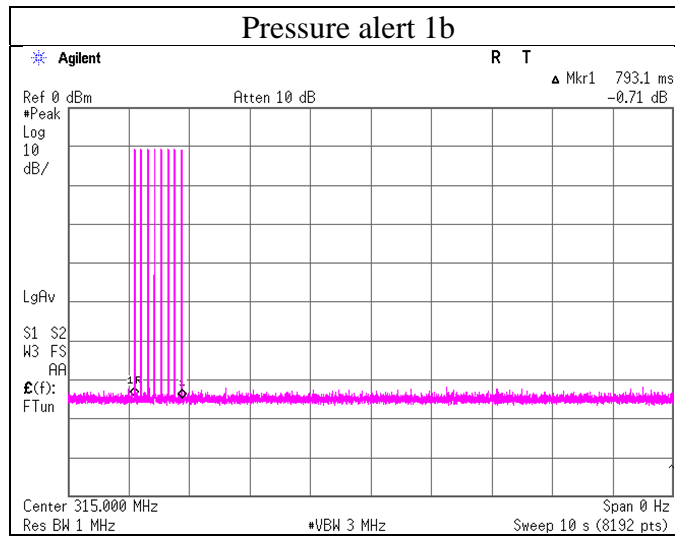
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Automatically deactivate

Report No.	14092308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.8
Date	November 26, 2021
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Takafumi Noguchi
Mode	Pressure alert

Operation in FCC 15.231(a)(2)

Mode	Tx Frequency [MHz]	Time of Transmitting [sec]	Limit [sec]	Result
Pressure alert 1b	315	0.7931	5.00	Pass
Pressure alert 2b (20 frames)	315	2.1220	5.00	Pass
Pressure alert 2b (5 frames)	315	0.4587	5.00	Pass



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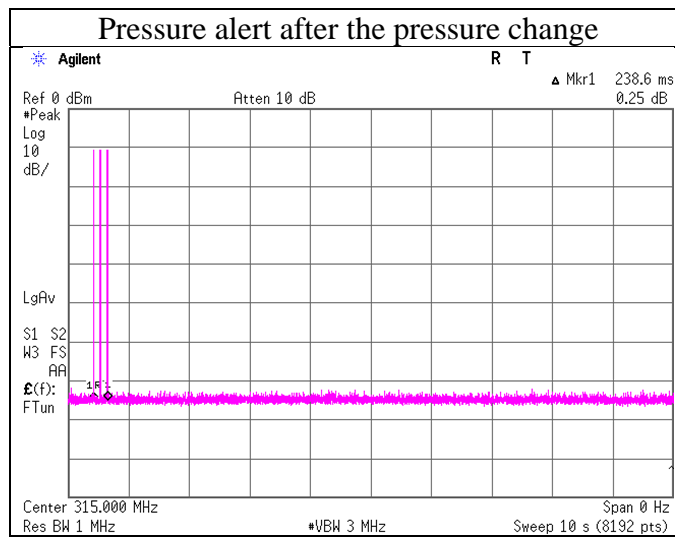
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Automatically deactivate

Report No.	14092308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.8
Date	November 26, 2021
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Takafumi Noguchi
Mode	Pressure alert

Operation in FCC 15.231(a)(2)

Mode	Tx Frequency [MHz]	Time of Transmitting [sec]	Limit [sec]	Result
Pressure alert after the pressure change	315	0.2386	5.00	Pass



Automatically deactivate

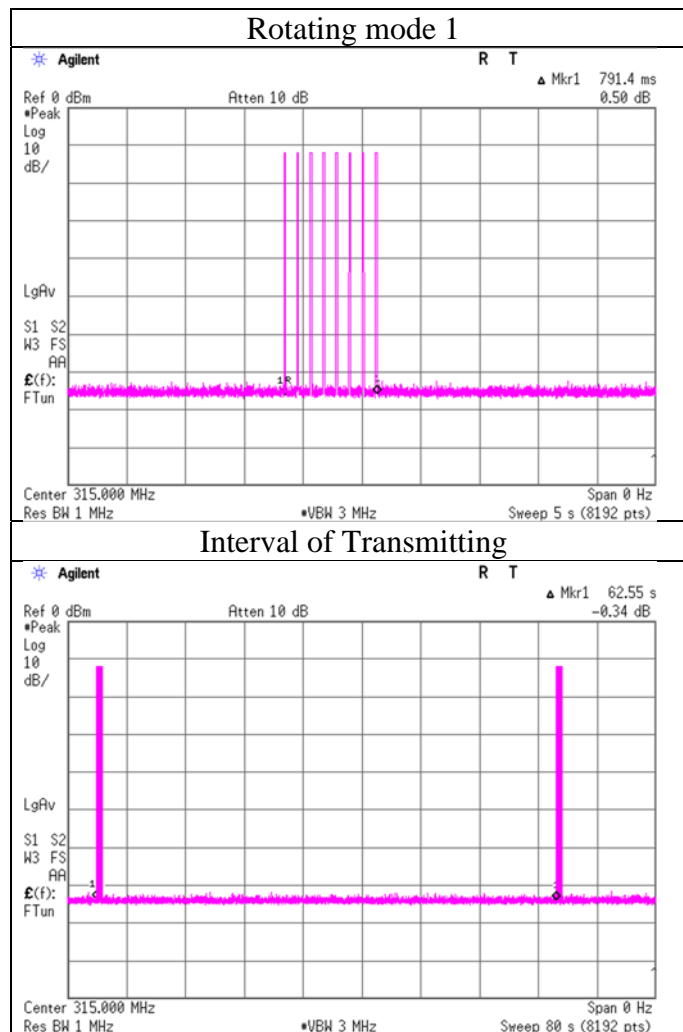
Report No. 14092308H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.8
Date November 26, 2021
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Takafumi Noguchi
Mode Rotating mode

Operation in FCC 15.231(e)

Rotating mode 1

Duration of transmission: 791.4 msec < 1 sec

Silent period between transmissions: 62.55 sec - 0.7914 sec = 61.7586 sec >30 times the duration of transmission and 10sec.



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Automatically deactivate

Report No. 14092308H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.8
 Date November 26, 2021
 Temperature / Humidity 23 deg. C / 35 % RH
 Engineer Takafumi Noguchi
 Mode Rotating mode

Operation in FCC 15.231(e)

Rotating mode 2

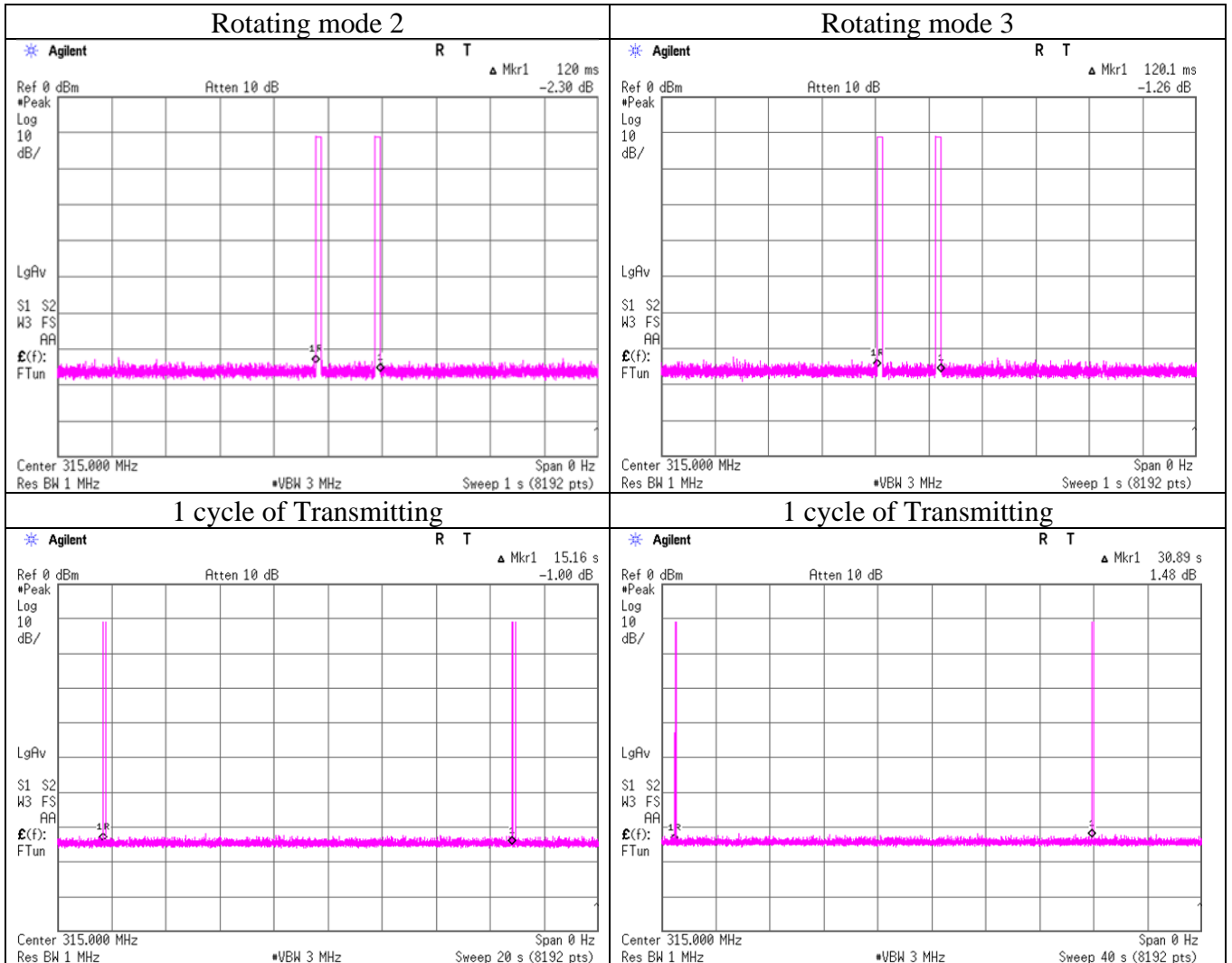
Duration of transmission: 120.0 msec < 1sec

Silent period between transmissions: 15.16 sec - 0.120 sec = 15.04sec >30 times the duration of transmission and 10 sec.

Rotating mode 3

Duration of transmission: 120.1 msec < 1 sec

Silent period between transmissions: 30.89 sec - 0.1201 sec = 30.7699 sec >30 times the duration of transmission and 10 sec.



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Automatically deactivate

Report No.	14092308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.8
Date	November 26, 2021
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Takafumi Noguchi
Mode	Stationary mode 1

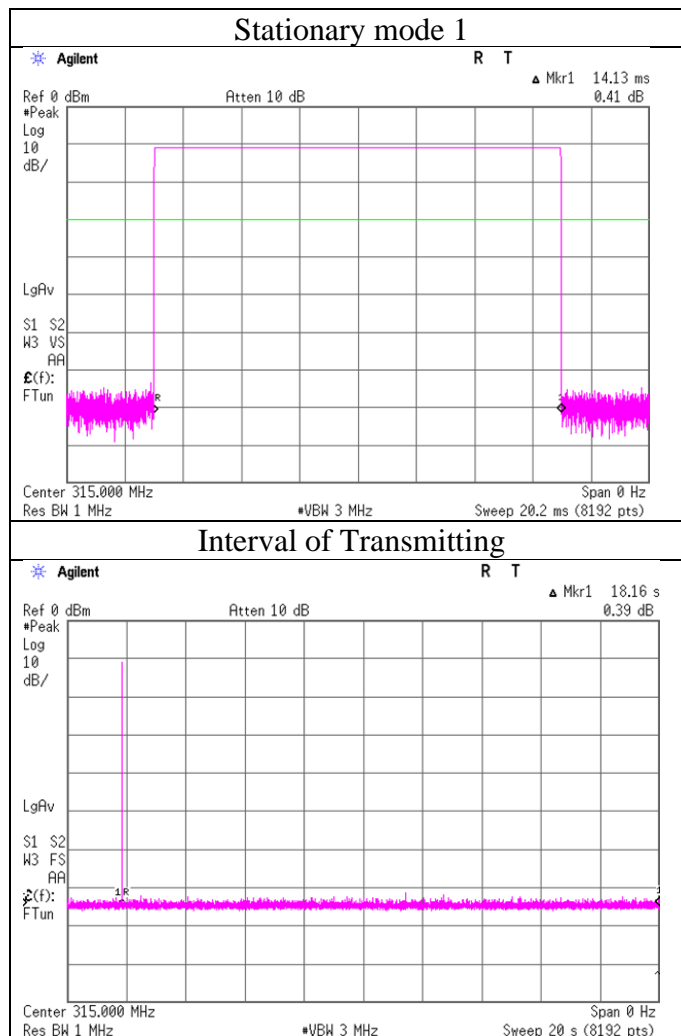
Operation in FCC 15.231(e)

Stationary mode 1

Duration of transmission: 14.13 msec < 1 sec

Silent period between transmissions: 36000 sec* - 0.01413 sec = 35999.98587 sec >30 times the duration of transmission and 10sec.

*Calculated from the technical documents.



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Automatically deactivate

Report No.	14092308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.8
Date	November 26, 2021
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Takafumi Noguchi
Mode	Stationary mode 2

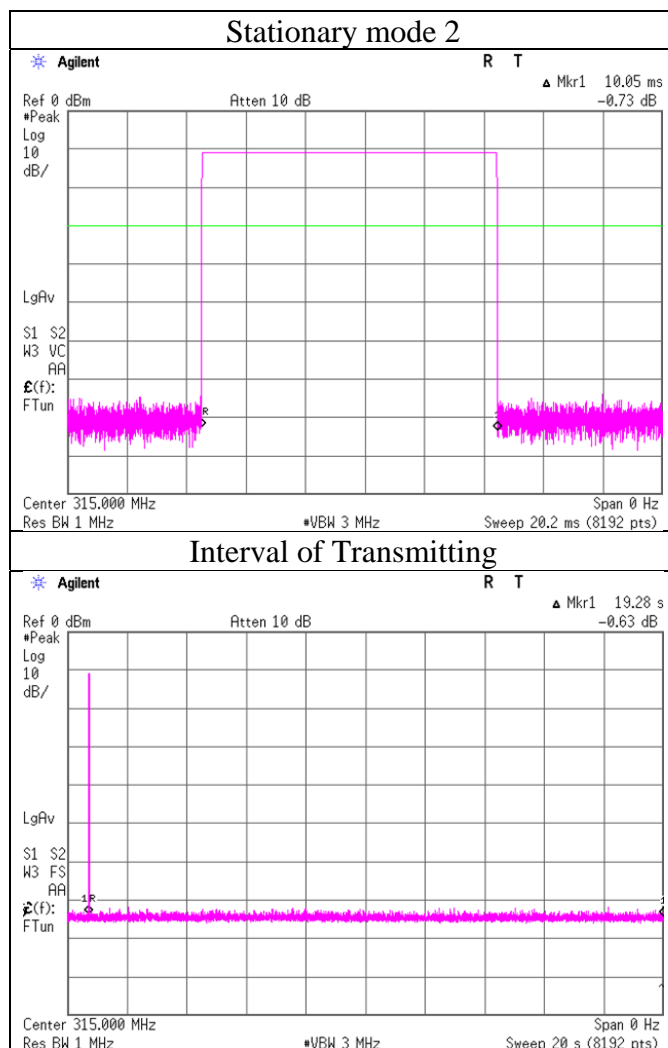
Operation in FCC 15.231(e)

Stationary mode 2

Duration of transmission: 10.05 msec < 1sec

Silent period between transmissions: 36000 sec* - 0.01005 sec = 35999.98995 sec >30 times the duration of transmission and 10 sec.

*Calculated from the technical documents.



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Radiated Emission (Fundamental and Spurious Emission)

Report No. 14092308H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date November 18, 2021
Temperature / Humidity 23 deg. C / 40 % RH
Engineer Takafumi Noguchi
Mode Tx 315 MHz

Polarity [Hori/Vert]	Frequency [MHz]	Reading (PK) [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dut Factor [dB]	Result (PK) [dBuV/m]	Result (PK / W) [dBuV/m]	Limit (PK) [dBuV/m]	Limit (AV) [dBuV/m]	Margin (PK) [dB]	Margin (AV) [dB]	Inside or Outside of Restricted Bands	Remarks
Hori.	315.000	89.2	14.2	9.6	31.9	16.9	81.1	64.2	87.6	67.6	6.5	3.4	Carrier	
Hori.	630.000	38.9	19.5	11.3	32.1	16.9	37.6	20.7	67.6	47.6	30.0	26.9	Outside	
Hori.	945.000	26.6	22.2	12.5	31.0	16.9	30.3	13.4	67.6	47.6	37.3	34.2	Outside	Floor noise
Hori.	1260.000	44.4	25.3	6.1	33.9	16.9	41.9	25.0	67.6	47.6	25.7	22.6	Outside	Floor noise
Hori.	1575.000	42.8	24.9	5.5	33.1	16.9	40.1	23.2	67.6	47.6	27.5	24.4	Inside	Floor noise
Hori.	1890.000	49.5	25.5	5.6	32.2	16.9	48.4	31.5	67.6	47.6	19.2	16.1	Outside	
Hori.	2205.000	48.2	28.1	5.6	31.8	16.9	50.1	33.2	67.6	47.6	17.5	14.4	Inside	
Hori.	2520.000	47.1	27.7	5.7	31.7	16.9	48.8	31.9	67.6	47.6	18.8	15.7	Outside	
Hori.	2835.000	51.0	28.5	5.8	31.5	16.9	53.8	36.9	67.6	47.6	13.8	10.7	Inside	
Hori.	3150.000	41.1	28.8	5.9	31.3	16.9	44.5	27.6	67.6	47.6	23.1	20.0	Outside	Floor noise
Vert.	315.000	85.7	14.2	9.6	31.9	16.9	77.6	60.7	87.6	67.6	10.0	6.9	Carrier	
Vert.	630.000	35.9	19.5	11.3	32.1	16.9	34.6	17.7	67.6	47.6	33.0	29.9	Outside	
Vert.	945.000	26.9	22.2	12.5	31.0	16.9	30.6	13.7	67.6	47.6	37.0	33.9	Outside	Floor noise
Vert.	1260.000	44.3	25.3	6.1	33.9	16.9	41.8	24.9	67.6	47.6	25.8	22.7	Outside	Floor noise
Vert.	1575.000	42.8	24.9	5.5	33.1	16.9	40.1	23.2	67.6	47.6	27.5	24.4	Inside	Floor noise
Vert.	1890.000	49.2	25.5	5.6	32.2	16.9	48.1	31.2	67.6	47.6	19.5	16.4	Outside	
Vert.	2205.000	46.8	28.1	5.6	31.8	16.9	48.7	31.8	67.6	47.6	18.9	15.8	Inside	
Vert.	2520.000	46.4	27.7	5.7	31.7	16.9	48.1	31.2	67.6	47.6	19.5	16.4	Outside	
Vert.	2835.000	49.9	28.5	5.8	31.5	16.9	52.7	35.8	67.6	47.6	14.9	11.8	Inside	
Vert.	3150.000	41.2	28.8	5.9	31.3	16.9	44.6	27.7	67.6	47.6	23.0	19.9	Outside	Floor noise

NS: No signal detected

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.

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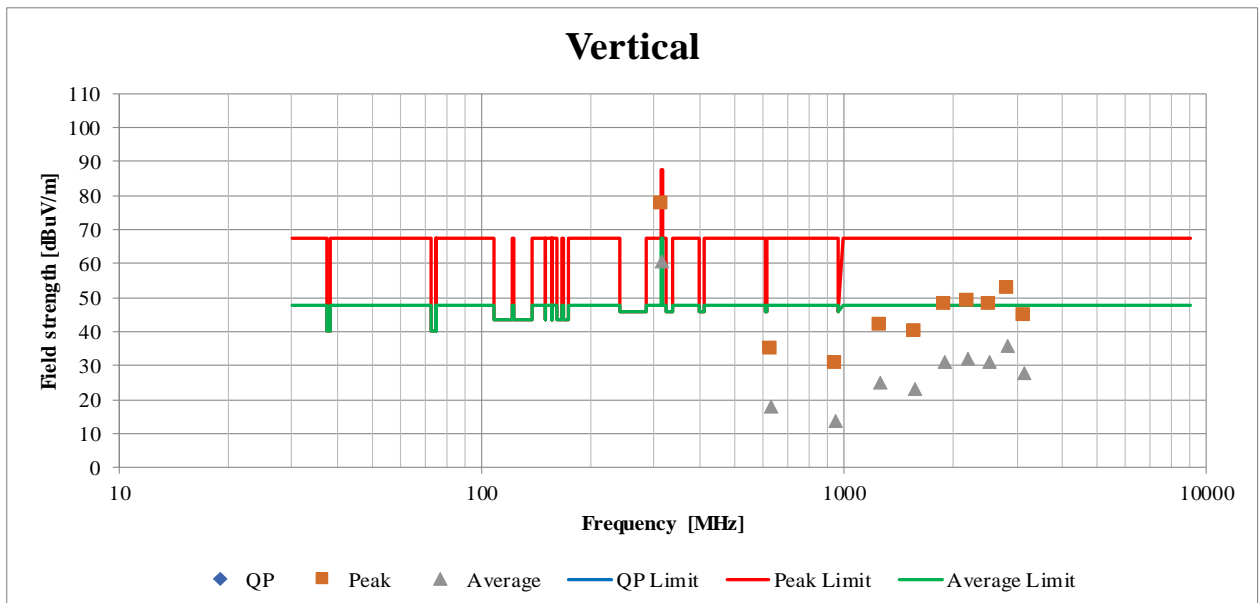
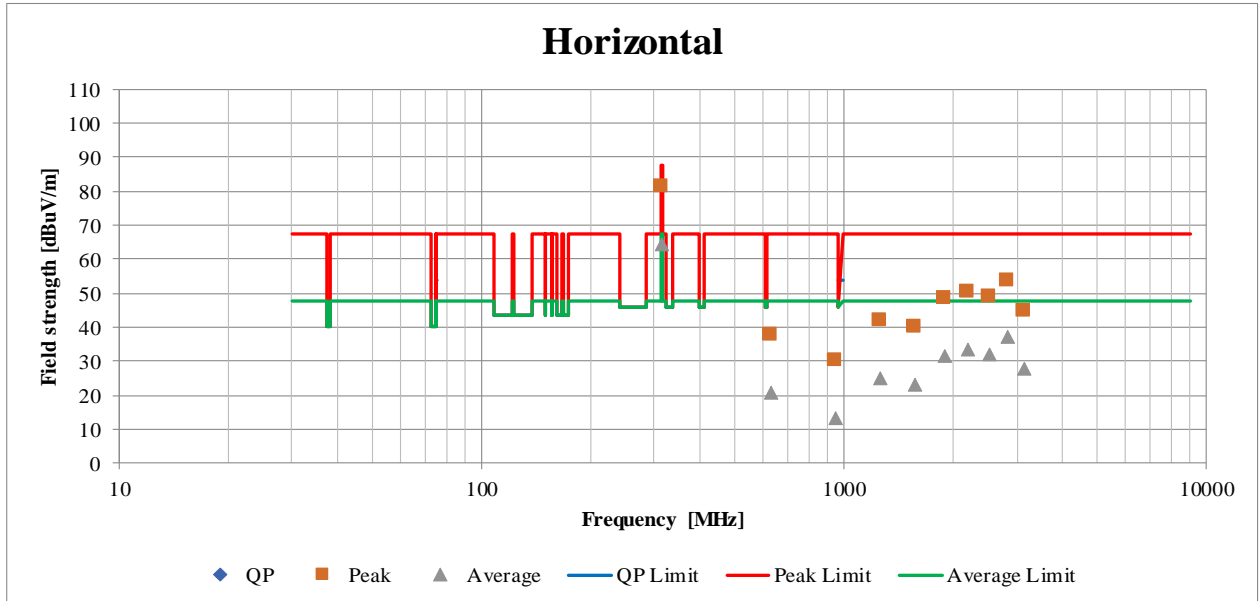
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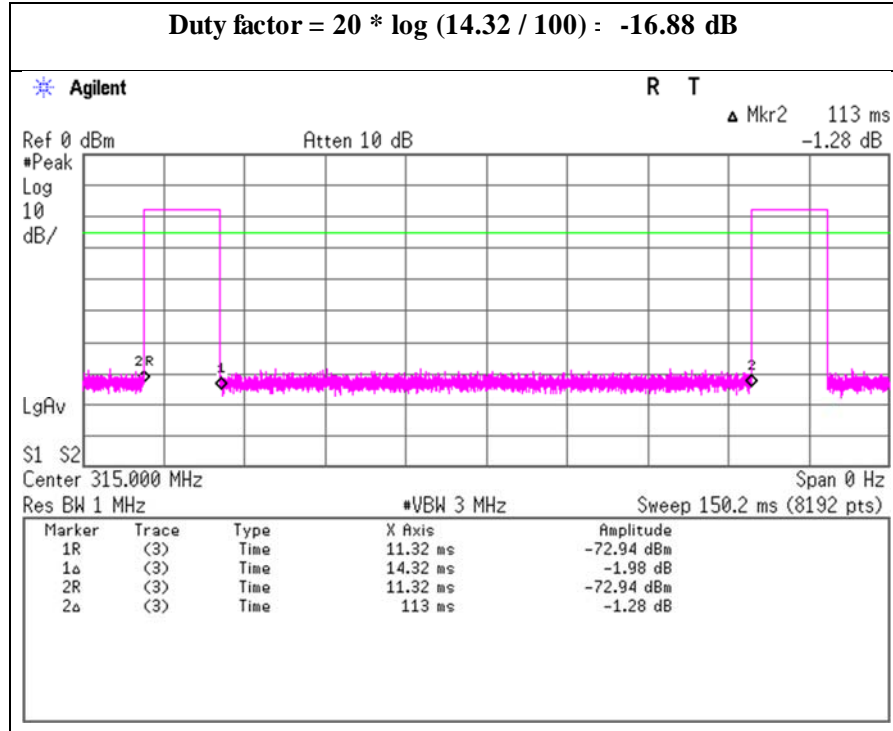
Radiated Spurious Emission
(Plot data, Worst case for Fundamental Emission)

Report No. 14092308H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.4
 Date November 18, 2021
 Temperature / Humidity 23 deg. C / 40 % RH
 Engineer Takafumi Noguchi
 Mode Tx 315 MHz



Duty Cycle

Report No. 14092308H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.4
 Date November 18, 2021
 Temperature / Humidity 23 deg. C / 40 % RH
 Engineer Takafumi Noguchi
 Mode Tx 315 MHz



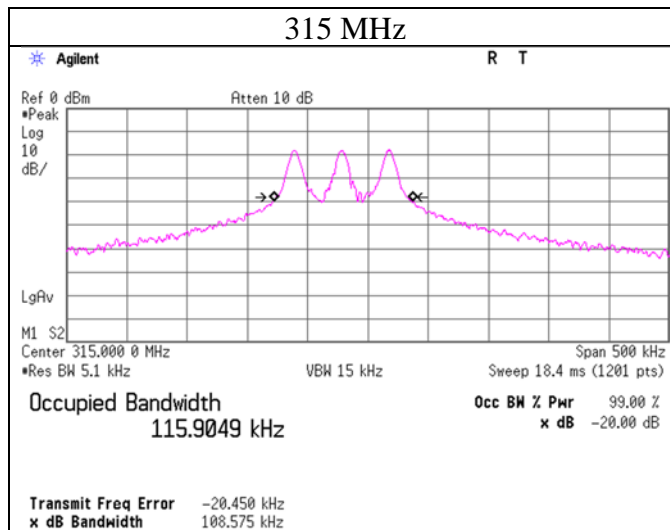
-20 dB Bandwidth / 99 % Occupied Bandwidth

Report No. 14092308H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.4
 Date November 18, 2021
 Temperature / Humidity 23 deg. C / 40 % RH
 Engineer Takafumi Noguchi
 Mode Tx 315 MHz

Bandwidth Limit : Fundamental Frequency 315.00 MHz x 0.25% = 787.500 kHz

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
108.5750	787.500	Pass

99% Occupied Bandwidth Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
115.9049	787.500	Pass



APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MOS-24	90289	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0005	01/15/2021	12
RE	MBM-10	141345	Barometer	Sunoh	SBR121	832	12/11/2019	36
RE	MMM-12	141547	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	60500120	02/01/2021	12
RE	MSA-13	141900	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185823	09/30/2021	12
RE	MLPA-09	202512	Loop Antenna	UL Japan	-	-	-	-
RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/15/2021	12
RE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/07/2021	12
RE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-ME MI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-04-SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/12/2021	24
RE	MAT-08	141213	Attenuator(6dB)	Weinschel Corp	2	BK7971	11/09/2021	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	VHA 91031302	08/28/2021	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	11/03/2021	12
RE	MLA-23	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-192	08/28/2021	12
RE	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/18/2021	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/05/2021	12
RE	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	557	05/10/2021	12
RE	MCC-257	208936	Microwave Cable	Huber+Suhner	SF126E/11PC35/11PC35/1000M,5000M	537061/126E / 537076/126E	07/18/2021	12
RE	MSA-14	141901	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250080	12/18/2020	12
RE	MHF-27	141297	High Pass Filter (1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	01/14/2021	12
RE	MLPA-08	202511	Loop Antenna	UL Japan	-	-	-	-
RE	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/10/2021	12
RE	MSA-16	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	12/18/2020	12
RE	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/15/2021	12

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

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

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

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

Test item: RE: Radiated Emission

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