RADIO TEST REPORT

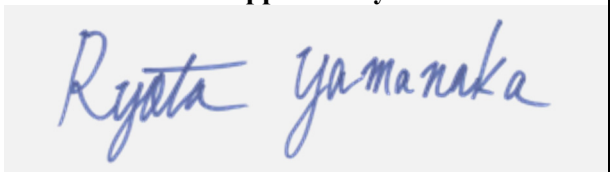
Test Report No.: 14392271H-R3

Customer	**Sumitomo Electric Industries, Ltd.**
Description of EUT	**Pedestrian Sensor**
Model Number of EUT	**SWR-A001**
FCC ID	**2A8U2SWR-A001**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied (Refer to SECTION 3)**
Issue Date	**November 25, 2022**
Remarks	**-**

Representative test engineer

Yuichiro Yamazaki
Engineer

Approved by



Ryota Yamanaka
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".

UL Japan, Inc. Ise EMC Lab.
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REVISION HISTORY

Original Test Report No.: 14392271H

This report is a revised version of 14392271H-R2. 14392271H-R2 is replaced with this report.

(1/2)

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14392271H	October 24, 2022	-
1	14392271H-R1	November 17, 2022	Correction of the Test Date in SECTION 2.1 due to the retest. From September 15 to October 4, 2022 To September 15 to November 9, 2022
1	14392271H-R1	November 17, 2022	Correction of the Antenna Gain in Radio Specification of SECTION 2.2 as follows; From 8 dBi to 8.01 dBi at 61.02 GHz 8.11 dBi at 61.13 GHz 8.21 dBi at 61.25 GHz 8.24 dBi at 61.36 GHz 8.24 dBi at 61.48 GHz
1	14392271H-R1	November 17, 2022	Correction of the worst margin for Spurious Emissions in Clause 3.2; From 6.0 dB, 14399.5 MHz, AV, Horizontal / Vertical To 3.82 dB, 122.955 MHz, AV
1	14392271H-R1	November 17, 2022	Deletion of Transmitter Identification and note *3) from the table in Clause 3.2
1	14392271H-R1	November 17, 2022	Correction of the antenna size of EUT for About fundamental measurement (Peak) in SECTION 6 From 0.00680 to 0.01090
1	14392271H-R1	November 17, 2022	Replacement of the data and value of Transmission Pattern 1 for 20 dB Bandwidth and 99 % Occupied bandwidth test; - Measured -20 dBc Frequency Lower Result: from 61.01156 to 61.00814 Upper Result: from 61.25069 to 61.25509 - 20 dB bandwidth From 239.13 to 246.95

(2/2)

Revision	Test Report No.	Date	Page Revised Contents
1	14392271H-R1	November 17, 2022	Replacement the test data for EIRP, Peak Output Power test. (retest by EIRP measurement method (VBW = 50 MHz))
1	14392271H-R1	November 17, 2022	Correction of EIIRP, Peak Output Power test data as follows; -EUT Ante. Gain Transmission Pattern 1, Test Antenna Tx1, 61.02 GHz From 8.00 to 8.01 Transmission Pattern 1, Test Antenna Tx1, 61.13 GHz From 8.00 to 8.11 Transmission Pattern 1, Test Antenna Tx1, 61.25 GHz From 8.00 to 8.21 Transmission Pattern 1, Test Antenna Tx3, 61.02 GHz From 8.00 to 8.01 Transmission Pattern 1, Test Antenna Tx3, 61.13 GHz From 8.00 to 8.11 Transmission Pattern 1, Test Antenna Tx3, 61.25 GHz From 8.00 to 8.21 Transmission Pattern 2, Test Antenna Tx1, 61.25 GHz From 8.00 to 8.21 Transmission Pattern 2, Test Antenna Tx1, 61.36 GHz From 8.00 to 8.24 Transmission Pattern 2, Test Antenna Tx1, 61.48 GHz From 8.00 to 8.24 Transmission Pattern 2, Test Antenna Tx3, 61.25 GHz From 8.00 to 8.21 Transmission Pattern 2, Test Antenna Tx3, 61.36 GHz From 8.00 to 8.24 Transmission Pattern 2, Test Antenna Tx3, 61.48 GHz From 8.00 to 8.24
1	14392271H-R1	November 17, 2022	- Addition of the following sentence under EIIRP, Peak Output Power test date *1) Refer to the application document. - Due to the above addition, the original *1) was changed to *2).
1	14392271H-R1	November 17, 2022	Correction of the Tx 1 Chirp ON time value for Duty Cycle test. From 47.029 to 47.027
1	14392271H-R1	November 17, 2022	Deletion of the description for Transmitter Identification from page 43.
1	14392271H-R1	November 17, 2022	Addition of the following item to the test equipment list in APPENDIX 2; RE: LA-17, MAT-34, MBA-05, MCC-50, MPA-14, MTR-10
2	14392271H-R2	November 22, 2022	Correction of the Test Date in SECTION 2.1 due to the retest. From September 15 to November 9, 2022 To September 15 to November 22, 2022
2	14392271H-R2	November 22, 2022	Correction of the Spurious Emissions worst margin frequency unit in Clause 3.2; from "MHz" to "GHz"
2	14392271H-R2	November 22, 2022	Deletion of ”EIRP(Average only)” from Test Item of Normal operating mode in Clause 4.1
2	14392271H-R2	November 22, 2022	Correction of [About fundamental measurement (Peak)] in SECTION 6
2	14392271H-R2	November 22, 2022	Replacement the data of EIRP, Peak Output Power test due to the retest
2	14392271H-R2	November 22, 2022	Replacement of the setup photo of EIRP / Peak Output Power test due to the retest in APPENDIX 3
2	14392271H-R2	November 22, 2022	Addition of "*1)" to calibration date for RE: MDO-10, MMX-02 and MPA-31 in APPENDIX 2
3	14392271H-R3	November 25, 2022	Update the Last Calibration Date for MDO-10, MMX-02, MPA-31 and MCC-50 in APPENDIX 2

Reference: Abbreviations (Including words undescribed in this report)

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

CONTENTS PAGE

SECTION 1: Customer Information

Company Name	Sumitomo Electric Industries, Ltd.
Address	1-1-3, Shimaya, Konohana-ku, Osaka 554-0024, Japan
Telephone Number	+81-6-6466-5643
Contact Person	Hideaki Shiranaga

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	Pedestrian Sensor
Model Number	SWR-A001
Serial Number	Refer to SECTION 4.2
Condition	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	September 14, 2022
Test Date	September 15 to November 22, 2022

2.2 Product Description

General Specification

Rating	DC 12 V
Operating temperature	-40 deg. C to 75 deg. C

Radio Specification

Equipment Type	Transceiver
Frequency of Operation range	61.0 GHz to 61.5 GHz
Bandwidth	250 MHz
Type of Modulation	Frequency modulation (FMCW)
Antenna Gain	8.01 dBi at 61.02 GHz 8.11 dBi at 61.13 GHz 8.21 dBi at 61.25 GHz 8.24 dBi at 61.36 GHz 8.24 dBi at 61.48 GHz
Steerable Antenna	electronically
Usage location	Fixed Field disturbance sensor

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 15.255 Operation within the band 57-71 GHz.

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	9.44 dB, 10.79330 MHz, AV Phase L <Transmission Pattern 1 (Normal operating mode)>	Complied a)	-
6dB Bandwidth	**FCC:** Section 15.255(e) (1) ANSI C63.10 2013, 9. Procedures for testing millimeter-wave systems	**FCC:** Section 15.255(e) (1)	See data.	Complied b)	Radiated *1)
20dB Bandwidth	**FCC:** ANSI C63.10 2013, 6. Standard test methods	**FCC:** Section 15.215 (c)		Complied b)	Radiated
EIRP Duty cycle	**FCC:** ANSI C63.10 2013, 9. Procedures for testing millimeter-wave systems	**FCC:** Section 15.255(c)		Complied c)	Radiated
Peak Output Power	**FCC:** Section 15.255(e) ANSI C63.10 2013, 9. Procedures for testing millimeter-wave systems	**FCC:** Section 15.255(e)		Complied c)	Radiated
Spurious Emissions	**FCC:** ANSI C63.10 2013, 6. Standard test methods 9. Procedures for testing millimeter-wave systems	**FCC:** Section 15.255(d) Section 15.209	3.82 dB 122.955 GHz, AV < Transmission Pattern 2 (Normal operating mode / Tx Test mode (Frequency sweep stop)) >	Complied d)	Radiated
Frequency Stability	**FCC:** ANSI C63.10 2013, 9. Procedures for testing millimeter-wave systems	**FCC:** Section 15.255(f)	See data.	Complied e)	Radiated
Group Installation	**FCC:** -	**FCC:** Section 15.255(h)	See data.	N/A	*2)
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. *1) Reference data. *2) The test is not applicable since there are no external phase-locking inputs in this EUT.					
a) Refer to APPENDIX 1 (data of Conducted Emission) b) Refer to APPENDIX 1 (data of 6 dB Bandwidth / 20 dB Bandwidth and 99 % Occupied bandwidth) c) Refer to APPENDIX 1 (data of Peak EIRP / Peak Output Power / Duty) d) Refer to APPENDIX 1 (data of Spurious Emission) e) Refer to APPENDIX 1 (data of Frequency Stability)					

FCC Part 15.31 (e)

This EUT provides the stable voltage constantly to RF Module regardless of input voltage.
Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The antenna is not removable from 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 6.6	**ISED:** -	N/A	Complied	Radiated

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.

Conducted emission

Using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.7 dB
	0.15 MHz to 30 MHz	3.3 dB

Radiated emission

Measurement distance	Frequency range		Uncertainty (+/-)
3 m	9 kHz to 30 MHz		3.2 dB
10 m			3.0 dB
3 m	30 MHz to 200 MHz	Horizontal	4.8 dB
		Vertical	5.0 dB
	200 MHz to 1000 MHz	Horizontal	5.1 dB
		Vertical	6.2 dB
10 m	30 MHz to 200 MHz	Horizontal	4.8 dB
		Vertical	4.8 dB
	200 MHz to 1000 MHz	Horizontal	5.0 dB
		Vertical	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		5.4 dB
	26.5 GHz to 40 GHz		5.4 dB
0.5 m	26.5 GHz to 40 GHz		5.4 dB
10 m	1 GHz to 18 GHz		5.4 dB
>= 0.5 m	40 GHz to 50 GHz		4.1 dB
>= 0.5 m	50 GHz to 75 GHz		5.1 dB
>= 0.5 m	75 GHz to 110 GHz		5.4 dB
>= 3.8 cm	110 GHz to 170 GHz		5.2 dB
>= 2.5 cm	170 GHz to 260 GHz		5.0 dB

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919
ISED Lab Company Number: 2973C / CAB identifier: JP0002
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan
Telephone: +81-596-24-8999

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	-	-

* Size of vertical conducting plane (for Conducted Emission test): 2.0 x 3.0 m for No.1, No.2, No.3, No. 4 and No.5 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, RF Exposure, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

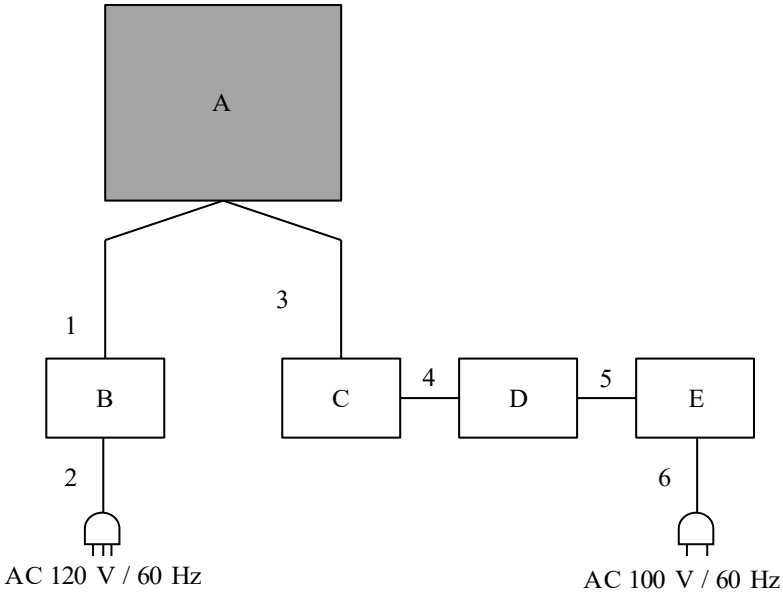
<table>
<tr><th>Mode</th><th>Transmission Pattern</th><th>Antenna</th><th>Frequency</th><th>Test Item</th></tr>
<tr><td rowspan="2">Normal operating mode</td><td>1</td><td>Tx1/Tx3</td><td>61.128 GHz</td><td rowspan="2">Conducted emission,
Duty cycle,
6 dB Bandwidth,
20 dB Bandwidth,
99 % Occupied bandwidth,
Peak Output Power,
Frequency stability,
Spurious Emissions *2)</td></tr>
<tr><td>2</td><td>Tx1/Tx3</td><td>61.360 GHz</td></tr>
<tr><td rowspan="4">Tx Test mode
(Frequency sweep stop) *1)</td><td rowspan="2">1</td><td>Tx1</td><td rowspan="2">Low 61.018 GHz
Mid 61.128 GHz
High 61.248 GHz</td><td rowspan="4">EIRP,
Peak Output Power,
Spurious Emissions *2)</td></tr>
<tr><td>Tx3</td></tr>
<tr><td rowspan="2">2</td><td>Tx1</td><td rowspan="2">Low 61.250 GHz
Mid 61.360 GHz
High 61.480 GHz</td></tr>
<tr><td>Tx3</td></tr>
<tr><td colspan="5">*Power of the EUT was set by the software as follows;
Power Setting: 10dBm
Software: mmwave_Studio_cli_xwr68xx.bin Version: 1.0.0
(Date: 2021.03 13, Storage location: EUT memory)</td></tr>
<tr><td colspan="5">*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.</td></tr>
</table>

*1) As requirement of 15.31 (c), EIRP/Peak Output Power stopped the frequency sweep and the test was performed.

*2) Spurious Emissions was tested in Normal operating mode.
The frequency sweep was stopped when signal was detected.
When the level is varied, the frequency sweep was stopped and the test was performed.
When the level is not varied, the test was performed in normal operating mode.

4.2 Configuration and peripherals

Conducted Emission and Frequency Stability tests



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

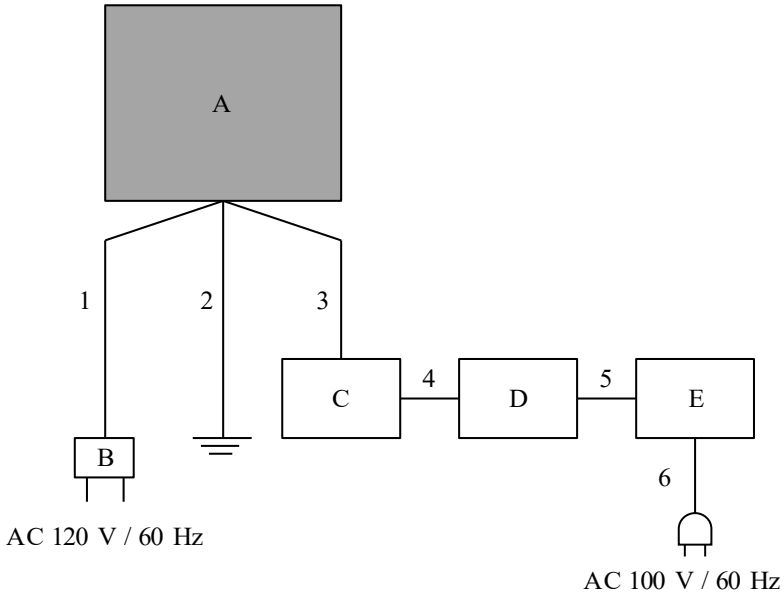
Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Pedestrian Sensor	SWR-A001	001	Sumitomo Electric Industries, Ltd.	EUT
B	DC power supply	RPE-4323	824B168G2	RS COMPONENTS LTD	-
C	LAN Adapter	EDC-GUA3-B	12L167006339A	ELECOM	-
D	Laptop PC	PG83MTCCGL7A311	2K143238H	Dynabook Inc.	-
E	AC Adapter	PA5177U-1ACA	PA-14590-59	TOSHIBA	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	3.5	Unshielded	Unshielded	-
2	AC Cable	1.9	Unshielded	Unshielded	-
3	LAN Cable	1.6	Unshielded	Shielded	-
4	USB Cable	0.1	Shielded	Shielded	-
5	DC Cable	1.8	Unshielded	Unshielded	-
6	AC Cable	1.5	Unshielded	Unshielded	-

Other tests except for Conducted Emission and Frequency Stability tests



* 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	Pedestrian Sensor	SWR-A001	001	Sumitomo Electric Industries, Ltd.	EUT
B	AC Adapter	ATS024T-W120U	WA-12200X-1	KYOHRITSU ELECTRONIC INDUSTRY Co.,Ltd.	-
C	LAN Adapter	EDC-GUA3-B	12L167006339A	ELECOM	-
D	Laptop PC	PG83MTCCGL7A311	2K143238H	Dynabook Inc.	-
E	AC Adapter	PA5177U-1ACA	PA-14590-59	TOSHIBA	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	23.5	Unshielded	Unshielded	-
2	Earth Cable	24.1	Unshielded	Unshielded	-
3	LAN Cable	24.7	Unshielded	Shielded	-
4	USB Cable	0.1	Shielded	Shielded	-
5	DC Cable	1.8	Unshielded	Unshielded	-
6	AC Cable	1.5	Unshielded	Unshielded	-

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 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.

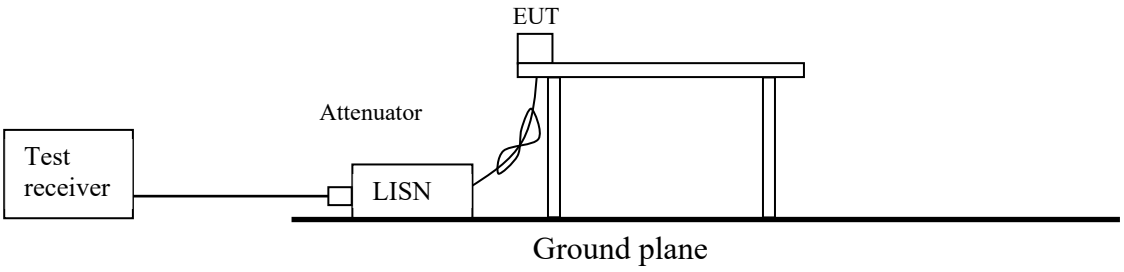
For the tests on EUT with other peripherals (as a whole system)
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50 ohm connectors of the LISN (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.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

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

Detector : QP and CISPR AV
Measurement Range : 0.15 MHz to 30 MHz
Test Data : APPENDIX
Test Result : Pass

Figure 1: Test Setup



SECTION 6: Radiated Emissions

Test Procedure

[For below 30 MHz]

The 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 absorbent materials lined on a ground plane.
The loop antenna was fixed height at 1.0 m.
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., 135 deg., and 180 deg.) and horizontal polarization.
*Refer to Figure 1 about Direction of the Loop Antenna.

[For above 30 MHz, up to 1 GHz]

The 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.
The height of the measuring antenna varied between 1 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

[For above 1 GHz, up to 40 GHz]

The 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 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.
The test was made with the detector (RBW/VBW) in the following table.

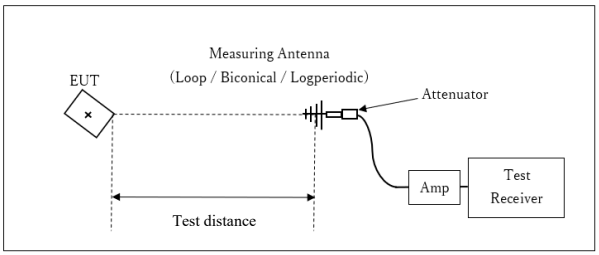
Test Antennas are used as below;

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	From 1 GHz to 40 GHz	
Instrument used	Test Receiver					Spectrum Analyzer	
Detector	PK / AV	QP	PK / AV	QP	QP	PK	AV
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz
Test Distance	3 m	3 m	3 m	3 m	3 m	4 m (below 10 GHz), 1 m (above 10 GHz)	

[Test setup]

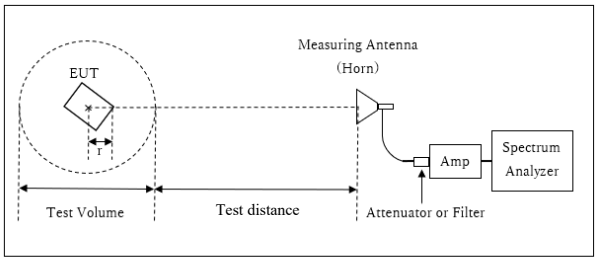
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz to 10 GHz

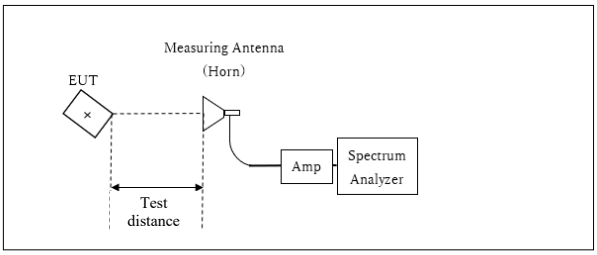


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (4.0 m*/3.0 m) = 2.5 dB
* Test Distance: (3 + Test Volume /2) - r = 4.0 m

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

10 GHz to 40 GHz

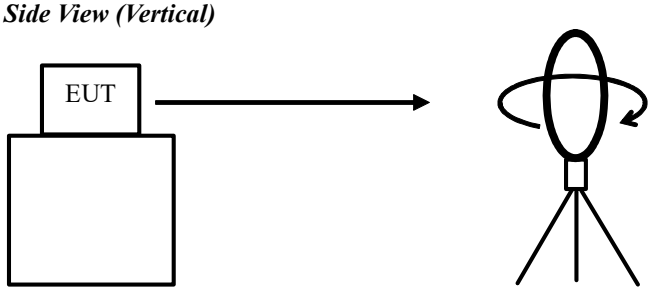


× : Center of turn table

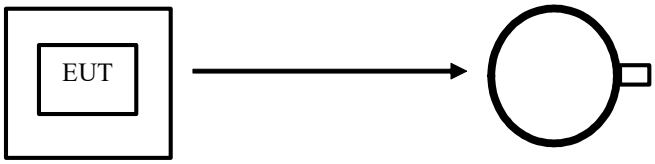
Distance Factor: 20 x log (1.0 m* / 3.0 m) = -9.5 dB
*Test Distance: 1 m

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

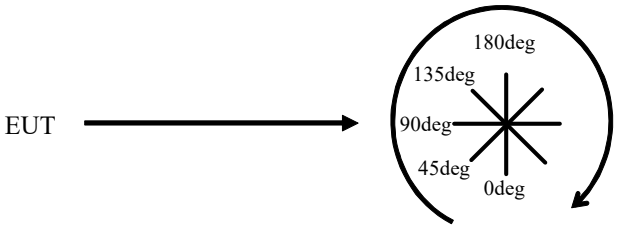


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

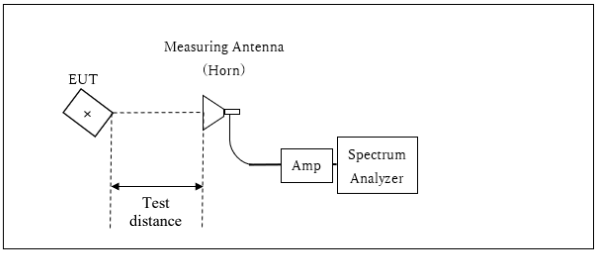
[Above 40 GHz]
The test was performed based on "Procedures for testing millimeter-wave systems" of ANSI C63.10-2013.
The EUT was placed on a urethane platform, raised 1.5 m above the conducting ground plane. The measurements were performed on handheld method.

Set spectrum analyzer RBW, VBW, span, etc., to the proper values. Note these values. Enable two traces—one set to "clear write," and the other set to "max hold." Begin hand-held measurements with the test antenna (horn) at a distance of 1 m from the EUT in a horizontally polarized position. Slowly adjust its position, entirely covering the plane 1 m from the EUT. Observation of the two active traces on the spectrum analyzer will allow refined horn positioning at the point(s) of maximum field intensity. Repeat with the horn in a vertically polarized position. If the emission cannot be detected at 1 m, reduce the RBW to increase system sensitivity. Note the value. If the emission still cannot be detected, move the horn closer to the EUT, noting the distance at which a measurement is made.

Note the maximum level indicated on the spectrum analyzer. Adjust this level, if necessary, by the antenna gain, filter loss, conversion loss of the external mixer and gain of LNA used, at the frequency under investigation. Calculate the field strength of the emission at the measurement distance from the Friis' transmission equation.

Frequency	40 GHz to 50 GHz	50 GHz to 75 GHz	75 GHz to 110 GHz	110 GHz to 200 GHz (except for 122 GHz to 123 GHz)	122 GHz to 123 GHz
Final measurement distance with 1 MHz Peak detector	1.0 m	0.75 m	0.5 m	0.01 m	0.22 m

[Test setup]
40 GHz to 200 GHz



× : Center of turn table

*Test Distance: Refer to the above table.

[About fundamental measurement (Peak)]

Test Procedure

The test was performed based on "Procedures for testing millimeter-wave systems" of ANSI C63.10-2013.
The peak power were measured with an RF detector that has a detection bandwidth that encompasses the 57-71 GHz band and has a video bandwidth of at least 10 MHz.

The carrier levels were measured in the far field. The distance of the far field was calculated from follow equation.

$$r = \frac{2D^2}{\lambda}$$

where

r is the distance from the radiating element of the EUT to the edge of the far field, in m
D is the largest dimension of both the radiating element and the test antenna (horn), in m
Lambda is the wavelength of the emission under investigation [300/f (MHz)], in m

Frequency	Wavelength	Maximum Dimention			Far Field Boundary	Tested Distance
		EUT	Test Antenna	Maximum		
	Lambda			*D*	*r*	
[GHz]	[mm]	[m]	[m]	[m]	[m]	[m]
75	4.0	0.01090	0.03759	0.03759	0.707	0.75

The test was performed based on stages 1-4 following;
Stage 1:
Connect the measurement antenna for the fundamental frequency band to the mm-wave RF detector. Place the measurement antenna at a test distance that is in the far-field of the measurement antenna.
Place the measurement antenna in the main beam of the EUT then maximize the fundamental emission.
The maximum direction was searched under carefully since beam-widths are extremely narrow.
Record the peak voltage from DSO as DSO Reading.

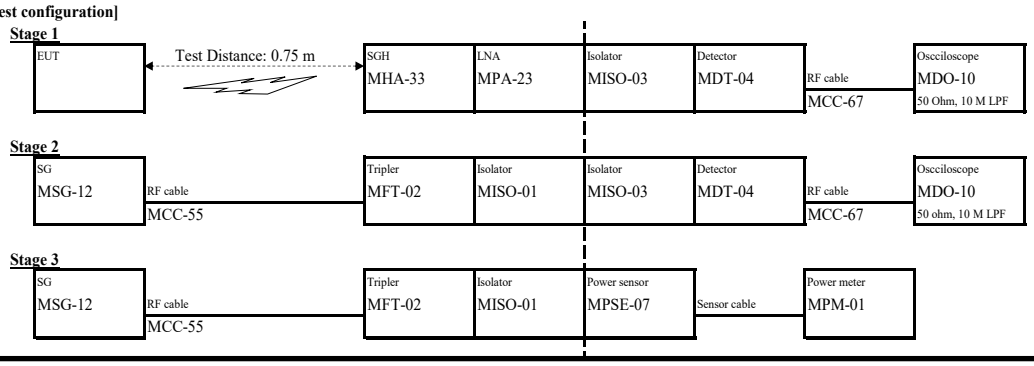
Stage 2:
Disconnect the measurement antenna from the RF input port of the instrumentation system.
Connect the mm-wave source to the RF input port of the instrumentation system.
The mm-wave source shall be unmodulated.
Adjust the frequency of the mm-wave source to the center of the frequency range occupied by the transmitter.
Adjust the amplitude of the mm-wave source such that the DSO indicates a voltage equal to the peak voltage recorded in Stage 1.
The output level of mm-wave source at this time is recorded as SG Reading.

Stage 3:
Disconnect the mm-wave source from the RF input port of the instrumentation system.
Without changing any settings, connect the mm-wave source to a wideband mm-wave power meter with a thermocouple detector or equivalent. Measure the power and record it as PM reading.

Stage 4:
Correct the peak substitution power at the input to the measurement instrument, as recorded in Stage 3, for any external gain and/or attenuation between the measurement antenna and the measurement instrument that was not included in the substitution power measurement.

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

[Test configuration]



SECTION 7: Frequency Stability

Test Procedure
The block downconverter was placed in side of the temperature chamber's drain hole.

The power supply was set to nominal operating voltage (100 %), and the spectrum mask was measured at 20 deg. C. After that, EUT power supply was varied between 85 % and 115 % of nominal voltage and the frequency excursion of the EUT emission mask was recorded.

The EUT operating temperature was raised to 50 deg. C., and the frequency excursion of the EUT emission mask was recorded. Measurements were repeated at each 10 deg. C. decrement down to -20 deg. C.

In addition, additional tests were performed with some temperatures according to the customer's request.

Both lower and upper frequencies of the -20 dB Bandwidth were recorded.

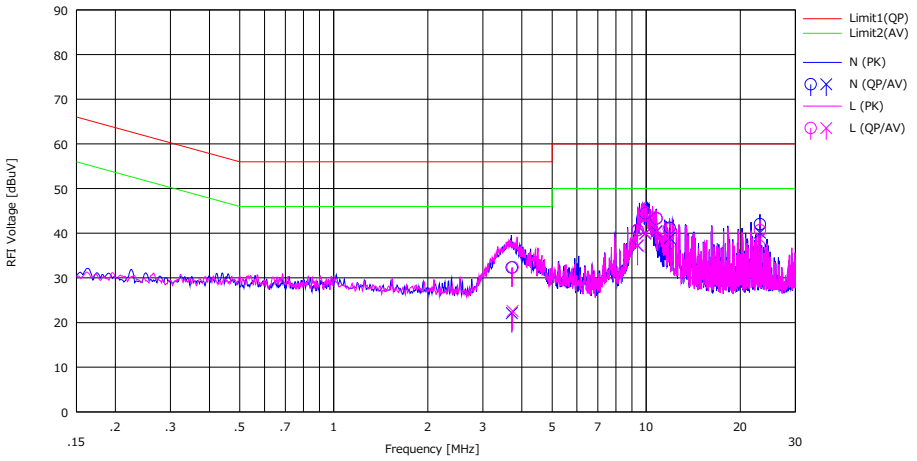
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No. 5
Date	October 3, 2022
Temperature / Humidity	21 deg. C / 62 % RH
Engineer	Yuichiro Yamazaki
Mode	Transmission Pattern 1 (Normal operating mode)

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq.	Reading ⟨QP⟩	Reading ⟨AV⟩	LISN	LOSS	Results ⟨QP⟩	Results ⟨AV⟩	Limit ⟨QP⟩	Limit ⟨AV⟩	Margin ⟨QP⟩	Margin ⟨AV⟩	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	3.71323	19.10	8.90	0.11	13.09	32.30	22.10	56.00	46.00	23.70	23.90	N	
2	9.38918	27.30	23.80	0.21	13.20	40.71	37.21	60.00	50.00	19.29	12.79	N	
3	9.93860	31.10	26.50	0.22	13.21	44.53	39.93	60.00	50.00	15.47	10.07	N	
4	10.79367	29.80	26.90	0.25	13.22	43.27	40.37	60.00	50.00	16.73	9.63	N	
5	11.89365	27.70	25.40	0.29	13.23	41.22	38.92	60.00	50.00	18.78	11.08	N	
6	23.12879	28.20	26.30	0.48	13.34	42.02	40.12	60.00	50.00	17.98	9.88	N	
7	3.73452	19.20	9.40	0.09	13.09	32.38	22.58	56.00	46.00	23.62	23.42	L	
8	9.38898	27.30	23.90	0.20	13.20	40.70	37.30	60.00	50.00	19.30	12.70	L	
9	9.94070	31.20	26.60	0.21	13.21	44.62	40.02	60.00	50.00	15.38	9.98	L	
10	10.79330	29.90	27.10	0.24	13.22	43.36	40.56	60.00	50.00	16.64	9.44	L	
11	11.81160	27.40	24.80	0.28	13.23	40.91	38.31	60.00	50.00	19.09	11.69	L	
12	23.12881	26.90	25.00	0.42	13.34	40.66	38.76	60.00	50.00	19.34	11.24	L	

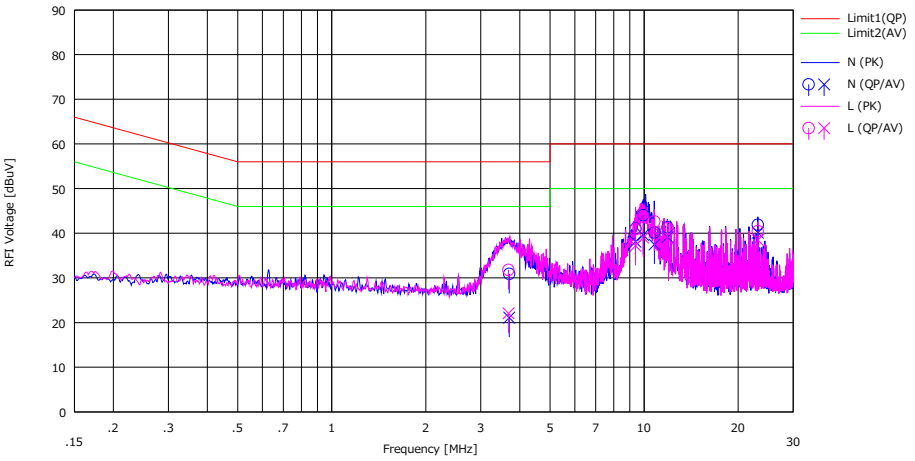
CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Conducted Emission

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No. 5
Date	October 3, 2022
Temperature / Humidity	21 deg. C / 62 % RH
Engineer	Yuichiro Yamazaki
Mode	Transmission Pattern 2 (Normal operating mode)

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq.	Reading ⟨QP⟩	Reading ⟨AV⟩	LISN	LOSS	Results ⟨QP⟩	Results ⟨AV⟩	Limit ⟨QP⟩	Limit ⟨AV⟩	Margin ⟨QP⟩	Margin ⟨AV⟩	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	3.70022	17.70	7.90	0.11	13.09	30.90	21.10	56.00	46.00	25.10	24.90	N	
2	9.38919	27.60	24.70	0.21	13.20	41.01	38.11	60.00	50.00	18.99	11.89	N	
3	9.93878	30.60	26.20	0.22	13.21	44.03	39.63	60.00	50.00	15.97	10.37	N	
4	10.79326	26.70	24.00	0.25	13.22	40.17	37.47	60.00	50.00	19.83	12.53	N	
5	11.89290	27.80	25.60	0.29	13.23	41.32	39.12	60.00	50.00	18.68	10.88	N	
6	23.12881	28.10	26.30	0.48	13.34	41.92	40.12	60.00	50.00	18.08	9.88	N	
7	3.67930	18.60	8.90	0.09	13.09	31.78	22.08	56.00	46.00	24.22	23.92	L	
8	9.38911	27.50	23.80	0.20	13.20	40.90	37.20	60.00	50.00	19.10	12.80	L	
9	9.93820	30.30	25.60	0.21	13.21	43.72	39.02	60.00	50.00	16.28	10.98	L	
10	10.79320	29.20	26.90	0.24	13.22	42.66	40.36	60.00	50.00	17.34	9.64	L	
11	11.89289	27.60	25.30	0.28	13.23	41.11	38.81	60.00	50.00	18.89	11.19	L	
12	23.12839	26.70	24.70	0.42	13.34	40.46	38.46	60.00	50.00	19.54	11.54	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

6 dB Bandwidth
(Reference data)

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No. 4
Date	September 30, 2022
Temperature / Humidity	21 deg. C / 52 % RH
Engineer	Junki Nagatomi
Mode	Normal operating mode

Transmission Pattern	Center Frequency [GHz]	Measured -6 dBc Frequency		6 dB bandwidth [MHz]	Peak Output Power Limit [mW]
		Lower Result [GHz]	Upper Result [GHz]		
1	61.128	61.01583	61.24733	231.50	500
2	61.360	61.24767	61.47913	231.46	500

Calculating formula:

6 dB bandwidth = (Measured -6 dBc Frequency Upper Result) - (Measured -6 dBc Frequency Lower Result)

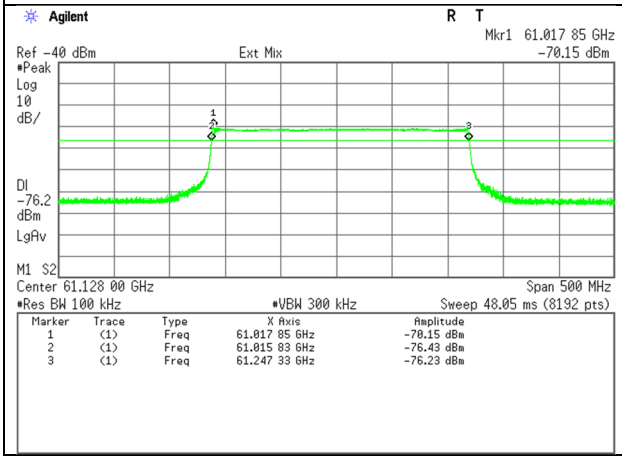
Peak Output Power Limit:

6 dB bandwidth >= 100 MHz: 500 mW

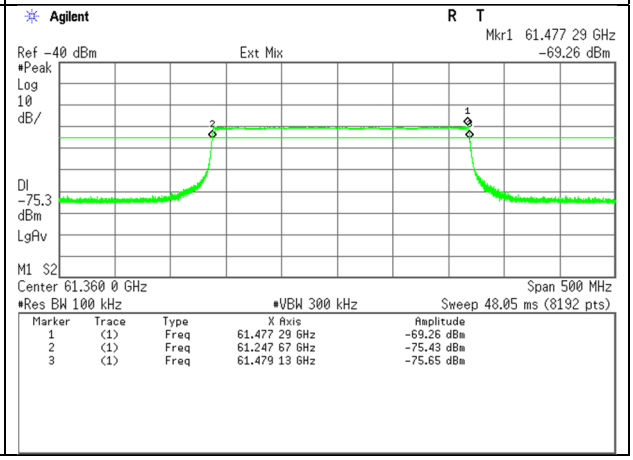
6 dB bandwidth < 100 MHz: (6 dB bandwidth / 100 MHz) * 500 mW

[Data]6 dB Bandwidth

Transmission Pattern 1



Transmission Pattern 2



The measurement was performed with Peak detector and Max Hold since the duty cycle was not 100 %.

20 dB Bandwidth and 99 % Occupied bandwidth

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 2	No. 4	No. 4
Date	September 15, 2022	September 30, 2022	November 9, 2022
Temperature / Humidity	20 deg. C / 61 % RH	21 deg. C / 52 % RH	22 deg. C / 42 % RH
Engineer	Yuichiro Yamazaki	Junki Nagatomi	Yuichiro Yamazaki
Mode	Normal operating mode		

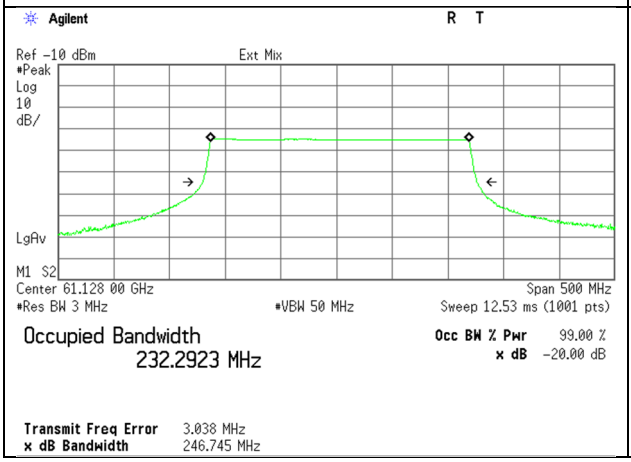
Transmission Pattern	Center Frequency [GHz]	99% Occupied bandwidth [MHz]	Measured -20 dBc Frequency Lower Result [GHz]	Measured -20 dBc Frequency Upper Result [GHz]	20 dB bandwidth [MHz]	Lower Limit [GHz]	Upper Limit [GHz]	Result
1	61.128	232.2923	61.00814	61.25509	246.95	61.0	61.5	Pass
2	61.360	232.0984	61.23997	61.48691	246.94			Pass

Calculating formula:

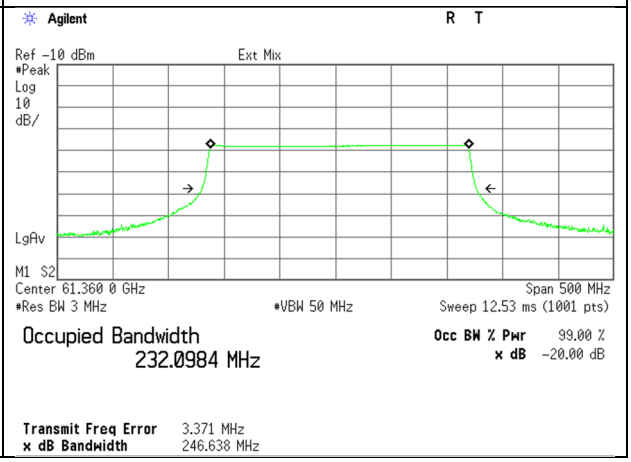
20 dB bandwidth = (Measured -20 dBc Frequency Upper Result) - (Measured -20 dBc Frequency Lower Result)

[Data]99% OBW

Transmission Pattern 1

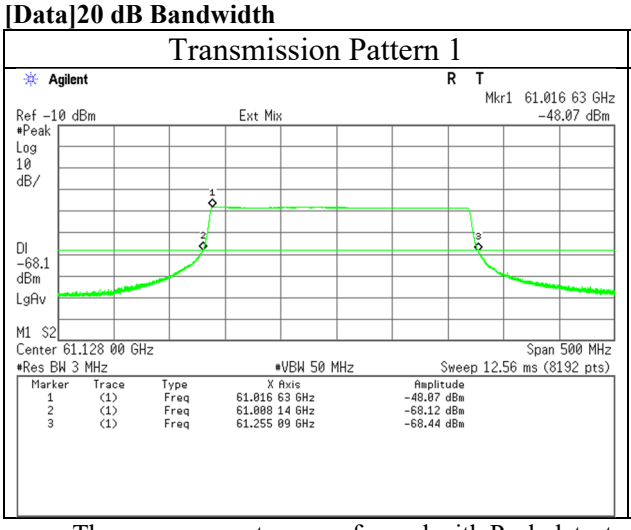


Transmission Pattern 2

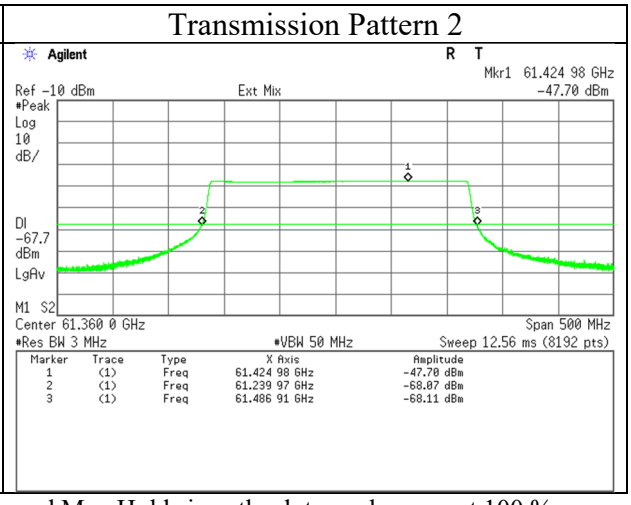


[Data]20 dB Bandwidth

Transmission Pattern 1



Transmission Pattern 2



The measurement was performed with Peak detector and Max Hold since the duty cycle was not 100 %.

EIRP, Peak Output Power

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No. 4
Date	November 22, 2022
Temperature / Humidity	20 deg. C / 43 % RH
Engineer	Yuichiro Yamazaki
Mode	Tx Test mode

				Stage 1		Stage 2	Stage 3	Stage 4			
Transmission Pattern	Test Antenna	Test Mode	Frequency	DSO Reading		S/G Setting Power	P/M Reading	LNA Gain	Rx Ant. Gain	Tested Distance	FSL
				(PK)	(RMS)						
			[GHz]	[mV]	[mV]	[dBm]	[dBm]	[dB]	[dBi]	[m]	[dB]
1	Tx 1	CW Low	61.02	52.4	51.3	18.16	-1.00	25.06	23.80	0.75	65.65
		CW Mid	61.13	49.1	47.8	17.87	-1.37	25.03	23.80	0.75	65.67
		CW High	61.25	48.1	47.0	17.56	-1.41	24.99	23.80	0.75	65.68
	Tx 3	CW Low	61.02	48.1	46.8	17.63	-1.52	25.06	23.80	0.75	65.65
		CW Mid	61.13	44.7	43.7	17.39	-1.86	25.03	23.80	0.75	65.67
		CW High	61.25	44.4	43.3	17.08	-1.87	24.99	23.80	0.75	65.68
2	Tx 1	CW Low	61.25	47.7	46.7	17.54	-1.47	24.99	23.80	0.75	65.69
		CW Mid	61.36	45.7	44.5	17.36	-1.60	24.95	23.80	0.75	65.70
		CW High	61.48	45.1	43.9	17.39	-1.50	24.91	23.80	0.75	65.72
	Tx 3	CW Low	61.25	45.1	44.0	17.20	-1.78	24.99	23.80	0.75	65.69
		CW Mid	61.36	44.4	43.3	17.22	-1.74	24.95	23.80	0.75	65.70
		CW High	61.48	44.1	42.9	17.27	-1.62	24.91	23.80	0.75	65.72

				EIRP							
Transmission Pattern	Test Antenna	Test Mode	Frequecny	Result (Peak)		Limit (Peak)		Limit (Average)		Margin (Peak)	Margin (Average)
		[GHz]	[GHz]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dB]
1	Tx 1	CW Low	61.02	15.80	38.02	43	19952.62	40	10000.00	27.20	24.20
		CW Mid	61.13	15.47	35.24	43	19952.62	40	10000.00	27.53	24.53
		CW High	61.25	15.49	35.40	43	19952.62	40	10000.00	27.51	24.51
	Tx 3	CW Low	61.02	15.28	33.73	43	19952.62	40	10000.00	27.72	24.72
		CW Mid	61.13	14.98	31.48	43	19952.62	40	10000.00	28.02	25.02
		CW High	61.25	15.03	31.84	43	19952.62	40	10000.00	27.97	24.97
2	Tx 1	CW Low	61.25	15.43	34.91	43	19952.62	40	10000.00	27.57	24.57
		CW Mid	61.36	15.36	34.36	43	19952.62	40	10000.00	27.64	24.64
		CW High	61.48	15.51	35.56	43	19952.62	40	10000.00	27.49	24.49
	Tx 3	CW Low	61.25	15.12	32.51	43	19952.62	40	10000.00	27.88	24.88
		CW Mid	61.36	15.22	33.27	43	19952.62	40	10000.00	27.78	24.78
		CW High	61.48	15.39	34.59	43	19952.62	40	10000.00	27.61	24.61

					Peak Output Power				
Transmission Pattern	Test Antenna	Test Mode	Frequecny	EUT Ant. Gain *1)	Result		Limit *2)		Margin
		[GHz]	[GHz]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
1	Tx 1	CW Low	61.02	8.01	7.79	6.01	26.99	500	19.20
		CW Mid	61.13	8.11	7.36	5.45	26.99	500	19.63
		CW High	61.25	8.21	7.28	5.35	26.99	500	19.71
	Tx 3	CW Low	61.02	8.01	7.27	5.33	26.99	500	19.72
		CW Mid	61.13	8.11	6.87	4.86	26.99	500	20.12
		CW High	61.25	8.21	6.82	4.81	26.99	500	20.17
2	Tx 1	CW Low	61.25	8.21	7.22	5.27	26.99	500	19.77
		CW Mid	61.36	8.24	7.12	5.15	26.99	500	19.87
		CW High	61.48	8.24	7.27	5.33	26.99	500	19.72
	Tx 3	CW Low	61.25	8.21	6.91	4.91	26.99	500	20.08
		CW Mid	61.36	8.24	6.98	4.99	26.99	500	20.01
		CW High	61.48	8.24	7.15	5.19	26.99	500	19.84

Calculating formula:
FSL (Free Space path Loss) = 10 * log10((4 * Pi * Tested Distance / Lambda) ^2)
EIRP(Peak) = P/M Reading - Rx Ant. Gain - LNA Gain + FSL
Peak Output Power =EIRP (Peak) - EUT Ant. Gain

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.
The equipment were not used for factor 0 dB of the data sheets.

*1) Refer to the application document.
*2) Refer to the test result for 6 dB Bandwidth.

* The peak result is less than the average limit.

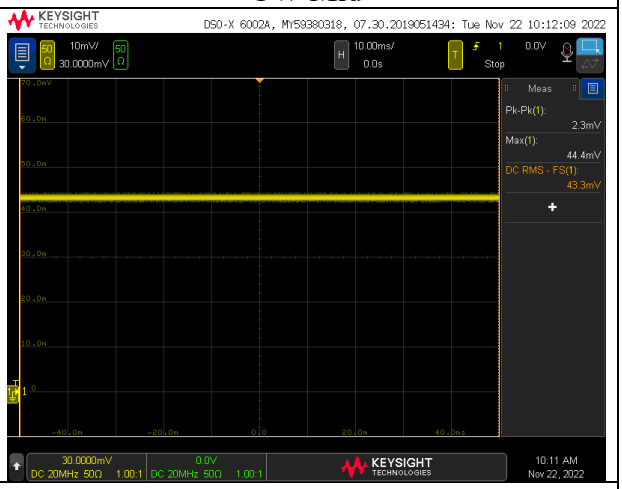
EIRP, Peak Output Power

[Data]

Transmission Pattern 1	
Tx 1	Tx 3
CW Low	CW Low
	
CW Mid	CW Mid
	
CW High	CW High
	

EIRP, Peak Output Power

[Data]

Transmission Pattern 2	
Tx 1	Tx 3
CW Low	CW Low
	
CW Mid	CW Mid
	
CW High	CW High
	

Duty Cycle

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No. 4
Date	October 4, 2022
Temperature / Humidity	20 deg. C / 60 % RH
Engineer	Yuichiro Yamazaki
Mode	Transmission Pattern 1 (Normal operating mode)

	Tx On + Tx Off time [ms]	Tx1 Chirp ON time [us]	Tx3 Chirp ON time [us]	Number of Chirp	Tx On time [ms]	Duty [%]
Measured	100.002	47.038	47.029	256	12.041	12.0

Calculating formula:

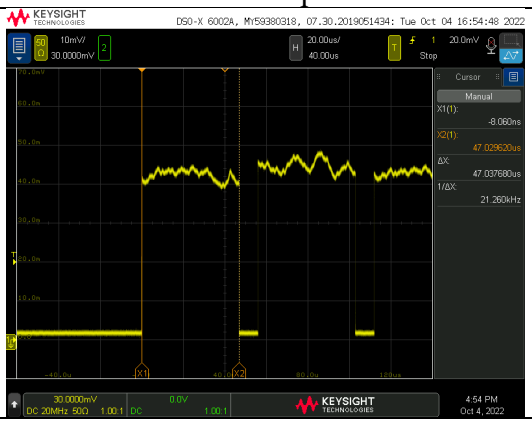
Tx On time = (Tx Chirp ON time +Tx3 Chirp ON time) * Number of Chirp / 2

Duty = (Tx On time / Tx On + Tx Off time) * 100

1cycle (Tx On + Tx Off)

Tx On

Tx1 1 Chirp ON



Tx3 1 Chirp ON

Duty Cycle

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No. 4
Date	October 4, 2022
Temperature / Humidity	20 deg. C / 60 % RH
Engineer	Yuichiro Yamazaki
Mode	Transmission Pattern 2 (Normal operating mode)

	Tx On + Tx Off time [ms]	Tx1 Chirp ON time [us]	Tx3 Chirp ON time [us]	Number of Chirp	Tx On time [ms]	Duty [%]
Measured	100.003	47.027	47.028	256	12.039	12.0

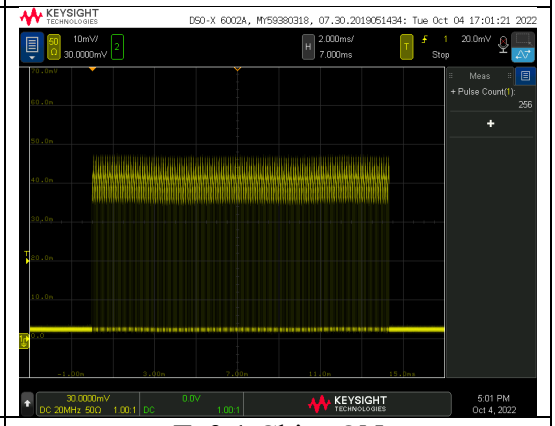
Calculating formula:

Tx On time = (Tx Chirp ON time +Tx3 Chirp ON time) * Number of Chirp / 2

Duty = (Tx On time / Tx On + Tx Off time) * 100

1cycle (Tx On + Tx Off)

Tx On



Tx1 1 Chirp ON

Tx3 1 Chirp ON

Spurious Emissions
(Below 40 GHz)

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 2	No. 4	No. 4
Date	September 21, 2022	September 22, 2022	September 23, 2022
Temperature / Humidity	20 deg. C / 40 % RH	20 deg. C / 50 % RH	23 deg. C / 58 % RH
Engineer	Junki Nagatomi	Junki Nagatomi	Junki Nagatomi
	(26.5 GHz - 40 GHz)	(Below 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Transmission Pattern 1 (Normal operating mode)		

Polarity	Frequency	Reading (QP / PK)	Reading (AV)	Ant. Factor	Loss	Gain	Result (QP / PK)	Result (AV)	Limit (QP / PK)	Limit (AV)	Margin (QP / PK)	Margin (AV)	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	81.2	36.5	-	7.1	7.7	32.1	19.1	-	40.0	-	20.9	-	
Hori.	86.0	29.4	-	7.9	7.7	32.1	12.9	-	40.0	-	27.1	-	
Hori.	145.2	26.5	-	14.7	8.3	32.0	17.5	-	43.5	-	26.1	-	
Hori.	354.8	38.3	-	15.0	9.8	32.1	31.0	-	46.0	-	15.0	-	
Hori.	360.8	38.8	-	15.0	9.8	32.1	31.5	-	46.0	-	14.5	-	
Hori.	391.2	32.6	-	15.4	10.0	32.1	25.9	-	46.0	-	20.1	-	
Hori.	2400.0	46.5	-	27.8	5.1	31.7	47.6	-	73.9	-	26.3	-	
Hori.	14399.5	48.2	42.3	40.8	-2.9	32.2	53.9	48.0	73.9	53.9	20.0	6.0	
Hori.	28798.7	47.3	-	39.7	-3.1	32.1	51.8	-	73.9	-	22.1	-	
Vert.	53.9	44.6	-	9.8	7.4	32.1	29.7	-	40.0	-	10.3	-	
Vert.	62.8	50.8	-	7.2	7.5	32.1	33.4	-	40.0	-	6.6	-	
Vert.	66.3	48.8	-	6.6	7.5	32.1	30.8	-	40.0	-	9.2	-	
Vert.	81.2	52.1	-	7.1	7.7	32.1	34.7	-	40.0	-	5.3	-	
Vert.	86.0	46.5	-	7.9	7.7	32.1	30.0	-	40.0	-	10.0	-	
Vert.	354.8	34.4	-	15.0	9.8	32.1	27.1	-	46.0	-	18.9	-	
Vert.	2400.0	47.2	-	27.8	5.1	31.7	48.3	-	73.9	-	25.6	-	
Vert.	14399.5	48.0	42.2	40.8	-2.9	32.2	53.7	47.9	73.9	53.9	20.3	6.0	
Vert.	28798.7	48.6	-	39.7	-3.1	32.1	53.1	-	73.9	-	20.8	-	

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

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

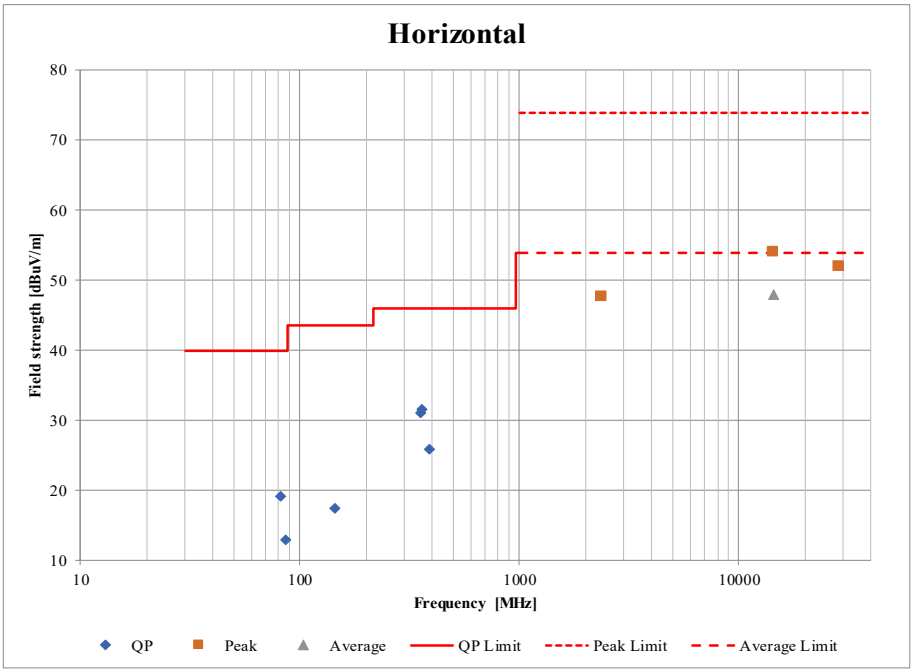
*QP detector was used up to 1GHz.

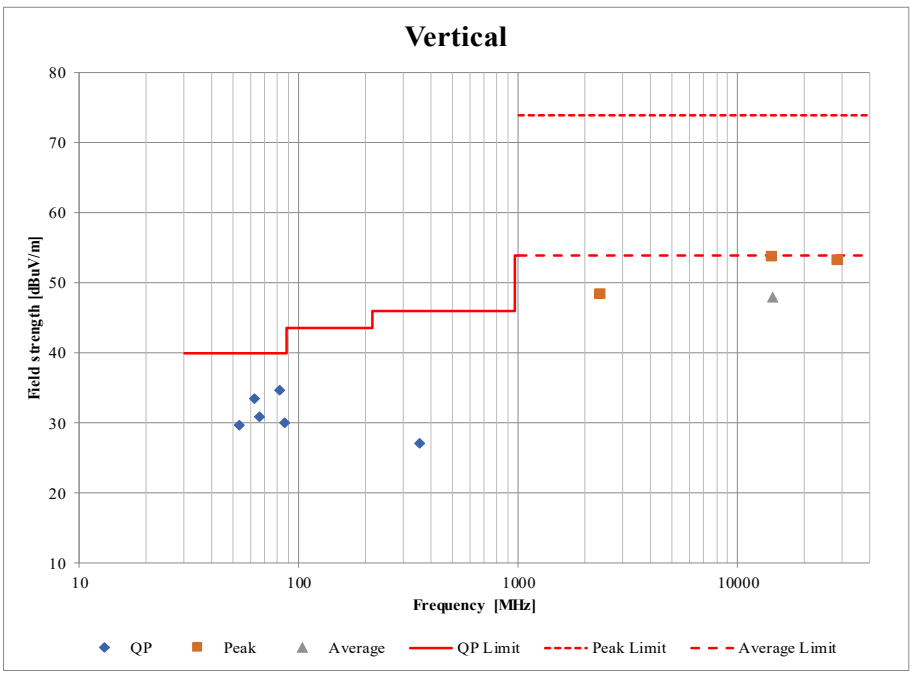
Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

* The peak result is less than the average limit. The peak emission result fall below the average limit except for 14399.5 MHz.

Spurious Emission
(Below 40 GHz)
(Plot data, Worst case)

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 2	No. 4	No. 4
Date	September 21, 2022	September 22, 2022	September 23, 2022
Temperature / Humidity	20 deg. C / 40 % RH	20 deg. C / 50 % RH	23 deg. C / 58 % RH
Engineer	Junki Nagatomi	Junki Nagatomi	Junki Nagatomi
	(26.5 GHz - 40 GHz)	(Below 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Transmission Pattern 1 (Normal operating mode)		





Spurious Emission
(Above 40 GHz)

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No. 2	No. 4
Date	September 21, 2022	September 30, 2022
Temperature / Humidity	20 deg. C / 42 % RH	21 deg. C / 52 % RH
Engineer	Junki Nagatomi	Junki Nagatomi
	(40 GHz - 50 GHz)	(50 GHz - 200 GHz)
Mode	Transmission Pattern 1 (Normal operating mode / Tx Test mode (Frequency sweep stop))	

[57 GHz to 71 GHz (Excluding 61 GHz to 61.5 GHz)]

Freq.	Reading (Peak)	Rx Ant. Gain	Filter Loss	LNA Gain	Mixer Conv. Loss	IF Amp. Gain	IF Cable Loss	Test Distance *D*	FSL	EIRP Result		EIRP Limit (Average)	EIRP Margin (Average)	EIRP Limit (Peak)	EIRP Margin (Peak)	Remarks
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[dBm]	[dB]	[dBm]	[dB]	
57.291	-91.33	23.51	0.00	25.75	45.62	0.00	0.00	0.75	65.11	-29.86	0.001033	10	39.86	13	42.86	NS
61.000	-81.68	23.80	0.00	25.07	46.05	0.00	0.00	0.75	65.65	-18.85	0.013044	10	28.85	13	31.85	*1)
62.367	-92.24	23.86	0.00	24.65	46.08	0.00	0.00	0.75	65.85	-28.82	0.001313	10	38.82	13	41.82	NS
65.686	-90.99	24.06	0.00	23.41	47.59	0.00	0.00	0.75	66.30	-24.57	0.003493	10	34.57	13	37.57	NS
68.381	-91.42	24.23	0.00	22.54	48.00	0.00	0.00	0.75	66.65	-23.54	0.004429	10	33.54	13	36.54	NS

Calculation: FSL (Free Space path Loss) = 10 * log ((4 * Pi * *D* / λ) ^{2})
EIRP = Reading - Rx Ant. Gain + Filter Loss - LNA Gain + Mixer Conv. Loss - IF Amp. Gain + IF Cable Loss + FSL

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.
The equipment were not used for factor 0 dB of the data sheets.

NS: No signal detected.

[40 GHz to 200 GHz (Excluding 57 GHz to 71 GHz)]

Freq.	Reading (Peak)	Rx Ant. Gain	Filter Loss	LNA Gain	Mixer Conv. Loss	IF Amp. Gain	IF Cable Loss	Test Distance *D*	FSL	EIRP		Power density Result at 3 m (Peak)	Limit Average	Limit Peak	Margin Average	Margin Peak	Remarks
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[pW/cm^2]	[pW/cm^2]	[pW/cm^2]	[dB]	[dB]	
44.592	-55.37	21.71	0.00	32.12	0.00	0.00	8.09	1.00	65.43	-35.68	0.000270	0.24	90	9000	25.76	45.76	NS
49.404	-52.92	22.36	0.00	32.11	0.00	0.00	9.04	1.00	66.32	-32.04	0.000626	0.55	90	9000	22.11	42.11	NS
51.443	-61.42	22.94	0.00	26.47	45.91	38.84	0.10	0.75	64.17	-39.49	0.000112	0.10	90	9000	29.57	49.57	NS
72.091	-62.03	24.34	0.00	20.99	49.23	38.84	0.10	0.75	67.10	-29.77	0.001054	0.93	90	9000	19.85	39.85	NS
79.478	-50.95	23.26	0.63	36.49	40.26	38.84	0.11	0.50	64.43	-44.11	0.000039	0.03	90	9000	34.19	54.19	NS
84.783	-50.63	23.67	0.51	31.71	41.48	38.84	0.11	0.50	64.99	-37.76	0.000167	0.15	90	9000	27.84	47.84	NS
94.919	-49.47	24.26	0.34	33.99	42.59	38.84	0.11	0.50	65.97	-37.55	0.000176	0.16	90	9000	27.62	47.62	NS
101.812	-49.64	24.50	0.35	32.78	43.47	38.84	0.11	0.50	66.58	-35.26	0.000298	0.26	90	9000	25.33	45.33	NS
108.661	-49.66	24.82	1.07	22.17	44.33	38.84	0.11	0.50	67.14	-22.84	0.005203	4.60	90	9000	12.91	32.91	NS
116.767	-83.44	22.53	0.00	17.59	56.07	0.00	0.00	0.01	33.79	-33.70	0.000426	0.38	90	9000	23.78	43.78	NS
120.228	-84.26	22.65	0.00	18.89	53.51	0.00	0.00	0.01	34.04	-38.25	0.000150	0.13	90	9000	28.32	48.32	NS
122.251	-84.79	22.71	0.00	19.85	51.55	0.00	0.00	0.22	61.02	-14.18	0.038155	33.74	90	9000	4.26	24.26	*2)
126.230	-85.13	22.84	0.00	21.47	53.58	0.00	0.00	0.01	34.47	-41.39	0.000073	0.06	90	9000	31.47	51.47	NS
131.431	-85.40	22.99	0.00	19.97	53.90	0.00	0.00	0.01	34.82	-39.64	0.000109	0.10	90	9000	29.72	49.72	NS
142.921	-85.79	23.24	0.00	18.87	56.13	0.00	0.00	0.01	35.54	-36.22	0.000239	0.21	90	9000	26.30	46.30	NS
148.421	-86.08	23.31	0.00	18.16	56.69	0.00	0.00	0.01	35.87	-34.99	0.000317	0.28	90	9000	25.06	45.06	NS
160.765	-86.72	23.40	0.00	16.16	60.39	0.00	0.00	0.01	36.57	-29.32	0.001169	1.03	90	9000	19.40	39.40	NS
163.228	-87.26	23.40	0.00	15.31	60.77	0.00	0.00	0.01	36.70	-28.50	0.001412	1.25	90	9000	18.58	38.58	NS
173.323	-84.86	22.47	0.00	0.00	56.81	0.00	0.00	0.01	37.22	-13.30	0.046805	41.38	90	9000	3.37	23.37	NS
179.719	-86.14	22.63	0.00	0.00	56.39	0.00	0.00	0.01	37.53	-14.84	0.032792	28.99	90	9000	4.92	24.92	NS
189.136	-86.20	22.83	0.00	0.00	57.23	0.00	0.00	0.01	37.98	-13.82	0.041469	36.67	90	9000	3.90	23.90	NS
196.674	-87.18	22.96	0.00	0.00	58.04	0.00	0.00	0.01	38.32	-13.78	0.041867	37.02	90	9000	3.86	23.86	NS

Calculation: FSL (Free Space path Loss) = 10 * log ((4 * Pi * *D* / λ) ^{2})
EIRP = Reading - Rx Ant. Gain + Filter Loss - LNA Gain + Mixer Conv. Loss - IF Amp. Gain + IF Cable Loss + FSL
Power density Result at 3 m = EIRP / (4 * Pi * 300 ^{2})

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.
The equipment were not used for factor 0 dB of the data sheets.

NS: No signal detected.

*1) Normal Operating mode and Tx Test mode (Frequency sweep stop) was compared, the value of Normal Operating mode of high level was applied.

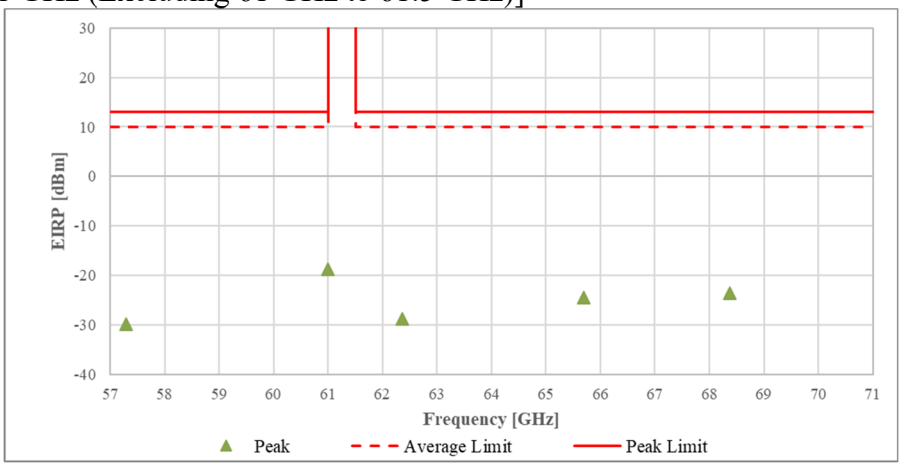
*2) Among the second harmonics: Tx Test mode (Frequency sweep stop), the value of Tx 1 Mid of high level was applied.

* The peak result is less than the average limit.

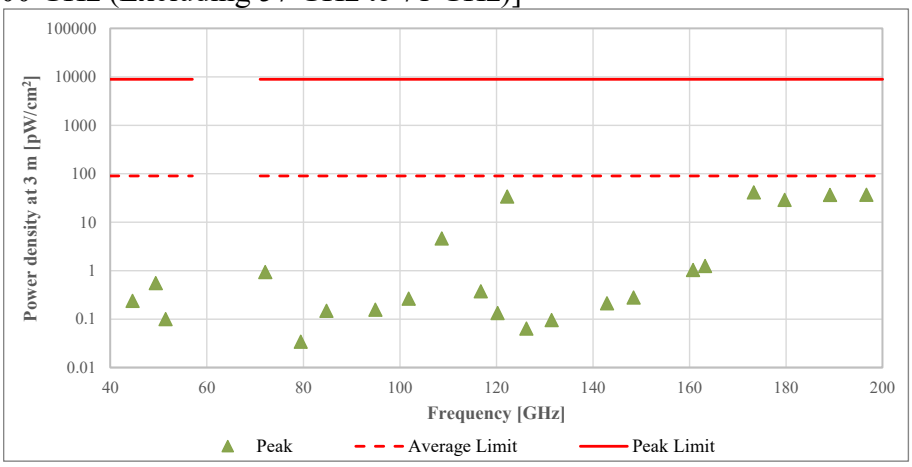
Spurious Emission
(Above 40 GHz)
(Plot data, Worst case)

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No. 2	No. 4
Date	September 21, 2022	September 30, 2022
Temperature / Humidity	20 deg. C / 42 % RH	21 deg. C / 52 % RH
Engineer	Junki Nagatomi	Junki Nagatomi
	(40 GHz - 50 GHz)	(50 GHz - 200 GHz)
Mode	Transmission Pattern 1 (Normal operating mode / Tx Test mode (Frequency sweep stop))	

[57 GHz to 71 GHz (Excluding 61 GHz to 61.5 GHz)]



[40 GHz to 200 GHz (Excluding 57 GHz to 71 GHz)]



Spurious Emissions
(Below 40 GHz)

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 2	No. 4	No. 4
Date	September 21, 2022	September 22, 2022	September 23, 2022
Temperature / Humidity	20 deg. C / 40 % RH	20 deg. C / 50 % RH	23 deg. C / 58 % RH
Engineer	Junki Nagatomi	Junki Nagatomi	Junki Nagatomi
	(26.5 GHz - 40 GHz)	(Below 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Transmission Pattern 2 (Normal operating mode)		

Polarity	Frequency	Reading (QP / PK)	Reading (AV)	Ant. Factor	Loss	Gain	Result (QP / PK)	Result (AV)	Limit (QP / PK)	Limit (AV)	Margin (QP / PK)	Margin (AV)	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	81.2	38.8	-	7.1	7.7	32.1	21.4	-	40.0	-	18.6	-	
Hori.	86.0	31.7	-	7.9	7.7	32.1	15.2	-	40.0	-	24.8	-	
Hori.	145.2	30.2	-	14.7	8.3	32.0	21.2	-	43.5	-	22.4	-	
Hori.	356.7	41.6	-	15.0	9.8	32.1	34.3	-	46.0	-	11.7	-	
Hori.	360.8	41.1	-	15.0	9.8	32.1	33.8	-	46.0	-	12.2	-	
Hori.	393.3	30.3	-	15.5	10.0	32.1	23.7	-	46.0	-	22.4	-	
Hori.	2400.0	46.5	-	27.8	5.1	31.7	47.6	-	73.9	-	26.3	-	
Hori.	14399.5	48.2	42.2	40.8	-2.9	32.2	53.9	47.9	73.9	53.9	20.0	6.1	
Hori.	28798.7	47.2	-	39.7	-3.1	32.1	51.7	-	73.9	-	22.2	-	
Vert.	53.9	44.8	-	9.8	7.4	32.1	29.9	-	40.0	-	10.1	-	
Vert.	62.8	51.9	-	7.2	7.5	32.1	34.5	-	40.0	-	5.5	-	
Vert.	66.3	48.3	-	6.6	7.5	32.1	30.3	-	40.0	-	9.7	-	
Vert.	81.2	52.4	-	7.1	7.7	32.1	35.0	-	40.0	-	5.0	-	
Vert.	86.0	46.6	-	7.9	7.7	32.1	30.1	-	40.0	-	9.9	-	
Vert.	331.2	41.6	-	14.4	9.6	32.1	33.5	-	46.0	-	12.5	-	
Vert.	2400.0	47.1	-	27.8	5.1	31.7	48.2	-	73.9	-	25.7	-	
Vert.	14399.5	47.9	42.1	40.8	-2.9	32.2	53.6	47.8	73.9	53.9	20.3	6.1	
Vert.	28798.7	48.5	-	39.7	-3.1	32.1	53.0	-	73.9	-	20.9	-	

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

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

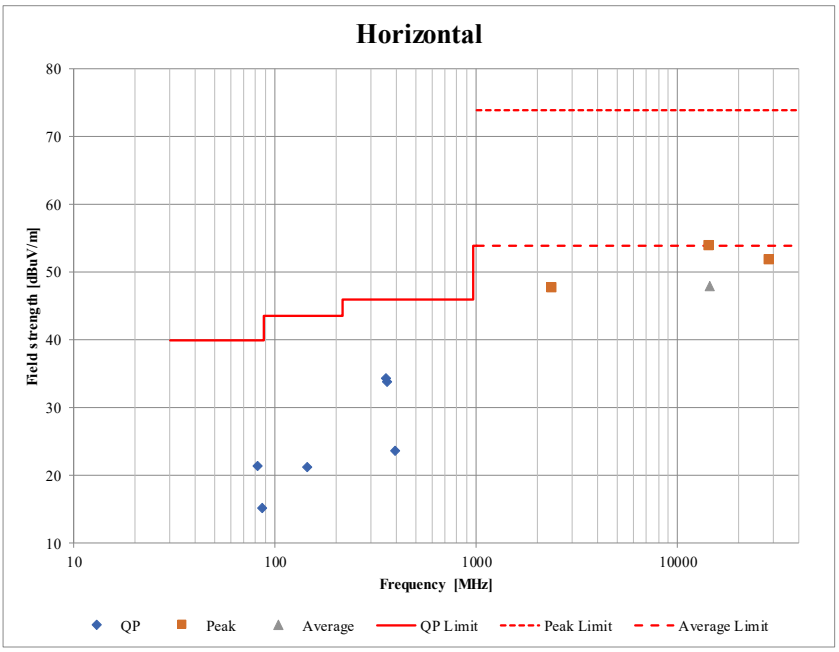
*QP detector was used up to 1GHz.

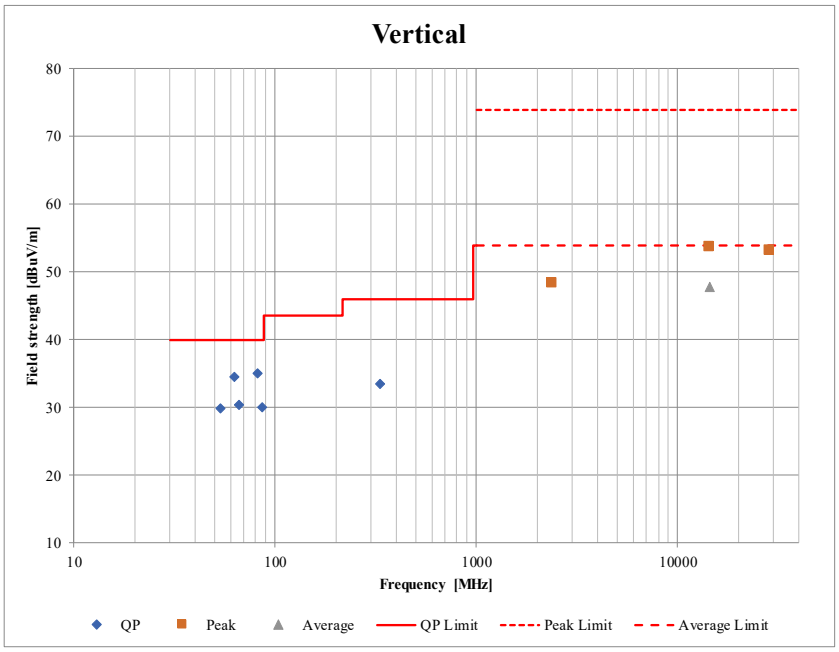
Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

* The peak result is less than the average limit. The peak emission result fall below the average limit except for 14399.5 MHz.

Spurious Emission
(Below 40 GHz)
(Plot data, Worst case)

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 2	No. 4	No. 4
Date	September 21, 2022	September 22, 2022	September 23, 2022
Temperature / Humidity	20 deg. C / 40 % RH	20 deg. C / 50 % RH	23 deg. C / 58 % RH
Engineer	Junki Nagatomi	Junki Nagatomi	Junki Nagatomi
	(26.5 GHz - 40 GHz)	(Below 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Transmission Pattern 2 (Normal operating mode)		





Spurious Emission
(Above 40 GHz)

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 2	No. 2	No. 4
Date	September 16, 2022	September 21, 2022	September 25, 2022
Temperature / Humidity	22 deg. C / 53 % RH	20 deg. C / 42 % RH	23 deg. C / 45 % RH
Engineer	Yuichiro Yamazaki (50 GHz - 75 GHz)	Junki Nagatomi (40 GHz - 50 GHz)	Yuichiro Yamazaki (75 GHz - 200 GHz)
Mode	Transmission Pattern 2 (Normal operating mode / Tx Test mode (Frequency sweep stop))		

[57 GHz – 71 GHz (Excluding 61 GHz – 61.5 GHz)]

Freq.	Reading (Peak)	Rx Ant. Gain	Filter Loss	LNA Gain	Mixer Conv. Loss	IF Amp. Gain	IF Cable Loss	Test Distance *D*	FSL	EIRP Result		EIRP Limit (Average)	EIRP Margin (Average)	EIRP Limit (Peak)	EIRP Margin (Peak)	Remarks
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[dBm]	[dB]	[dBm]	[dB]	
59.932	-91.24	23.67	0.00	25.53	45.81	0.00	0.00	0.75	65.50	-29.13	0.001221	10	39.13	13	42.13	NS
60.762	-91.67	23.77	0.00	25.17	45.99	0.00	0.00	0.75	65.62	-29.00	0.001260	10	39.00	13	42.00	NS
61.500	-83.84	23.79	0.00	24.90	45.97	0.00	0.00	0.75	65.73	-20.83	0.008264	10	30.83	13	33.83	*1)
60.998	-91.31	23.80	0.00	25.07	46.05	0.00	0.00	0.75	65.65	-28.48	0.001419	10	38.48	13	41.48	NS
68.924	-91.49	24.33	0.00	22.05	48.18	0.00	0.00	0.75	66.72	-22.97	0.005051	10	32.97	13	35.97	NS

Calculation: FSL (Free Space path Loss) = 10 * log $((4 * Pi * D / \lambda)^2)$
EIRP = Reading - Rx Ant. Gain + Filter Loss - LNA Gain + Mixer Conv. Loss - IF Amp. Gain + IF Cable Loss + FSL

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.
The equipment were not used for factor 0 dB of the data sheets.

NS: No signal detected.

[40 GHz – 200 GHz (Excluding 57 GHz –71 GHz)]

Freq.	Reading (Peak)	Rx Ant. Gain	Filter Loss	LNA Gain	Mixer Conv. Loss	IF Amp. Gain	IF Cable Loss	Test Distance *D*	FSL	EIRP		Power density Result at 3 m (Peak)	Limit Average	Limit Peak	Margin Average	Margin Peak	Remarks
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[pW/cm^2]	[pW/cm^2]	[pW/cm^2]	[dB]	[dB]	
44.695	-54.65	21.71	0.00	32.24	0.00	0.00	8.10	1.00	65.45	-35.05	0.000313	0.28	90	9000	25.13	45.13	NS
49.494	-52.36	22.40	0.00	32.03	0.00	0.00	9.05	1.00	66.33	-31.41	0.000723	0.64	90	9000	21.49	41.49	NS
53.906	-61.33	23.23	0.00	26.69	45.77	38.84	0.10	0.75	64.58	-39.65	0.000108	0.10	90	9000	29.72	49.72	NS
72.774	-62.31	24.42	0.00	21.55	50.19	38.84	0.10	0.75	67.18	-29.65	0.001084	0.96	90	9000	19.73	39.73	NS
83.079	-50.48	23.52	0.69	33.10	41.36	38.84	0.11	0.50	64.81	-38.97	0.000127	0.11	90	9000	29.04	49.04	NS
84.044	-50.89	23.59	0.63	32.03	41.01	38.84	0.11	0.50	64.91	-38.69	0.000135	0.12	90	9000	28.77	48.77	NS
92.868	-50.25	24.06	0.36	33.16	42.74	38.84	0.11	0.50	65.78	-37.32	0.000185	0.16	90	9000	27.39	47.39	NS
100.827	-49.60	24.53	0.53	33.78	43.83	38.84	0.11	0.50	66.49	-35.78	0.000264	0.23	90	9000	25.86	45.86	NS
108.308	-50.05	24.77	0.90	22.87	43.92	38.84	0.11	0.50	67.11	-24.48	0.003561	3.15	90	9000	14.56	34.56	NS
116.654	-84.44	22.52	0.00	17.49	56.41	0.00	0.00	0.01	33.78	-34.26	0.000375	0.33	90	9000	24.34	44.34	NS
120.105	-84.84	22.65	0.00	18.83	53.57	0.00	0.00	0.01	34.03	-38.71	0.000135	0.12	90	9000	28.79	48.79	NS
122.955	-84.50	22.74	0.00	20.33	52.74	0.00	0.00	0.22	61.09	-13.74	0.042220	37.33	90	9000	3.82	23.82	*2)
130.294	-84.65	22.95	0.00	20.72	53.77	0.00	0.00	0.01	34.74	-39.81	0.000104	0.09	90	9000	29.89	49.89	NS
131.301	-85.31	22.98	0.00	20.06	53.99	0.00	0.00	0.01	34.81	-39.55	0.000111	0.10	90	9000	29.63	49.63	NS
141.753	-85.87	23.22	0.00	18.73	55.56	0.00	0.00	0.01	35.47	-36.79	0.000210	0.19	90	9000	26.86	46.86	NS
147.425	-86.59	23.30	0.00	18.86	57.39	0.00	0.00	0.01	35.81	-35.54	0.000279	0.25	90	9000	25.62	45.62	NS
156.468	-87.02	23.38	0.00	17.54	59.02	0.00	0.00	0.01	36.33	-32.59	0.000551	0.49	90	9000	22.66	42.66	NS
163.132	-87.60	23.40	0.00	15.44	60.68	0.00	0.00	0.01	36.69	-29.06	0.001241	1.10	90	9000	19.14	39.14	NS
177.696	-85.30	22.58	0.00	0.00	56.04	0.00	0.00	0.01	37.44	-14.40	0.036285	32.08	90	9000	4.48	24.48	NS
180.299	-85.79	22.64	0.00	0.00	56.39	0.00	0.00	0.01	37.56	-14.48	0.035634	31.51	90	9000	4.56	24.56	NS
189.121	-85.94	22.83	0.00	0.00	57.18	0.00	0.00	0.01	37.98	-13.61	0.043567	38.52	90	9000	3.69	23.69	NS
194.741	-86.82	22.93	0.00	0.00	57.47	0.00	0.00	0.01	38.23	-14.05	0.039345	34.79	90	9000	4.13	24.13	NS

Calculation: FSL (Free Space path Loss) = 10 * log $((4 * Pi * D / \lambda)^2)$
EIRP = Reading - Rx Ant. Gain + Filter Loss - LNA Gain + Mixer Conv. Loss - IF Amp. Gain + IF Cable Loss + FSL
Power density Result at 3 m = EIRP / $(4 * Pi * 300^2)$

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.
The equipment were not used for factor 0 dB of the data sheets.

NS: No signal detected.

*1) Normal Operating mode and Test mode CW was compared, the value of Normal Operating mode of more power was applied.

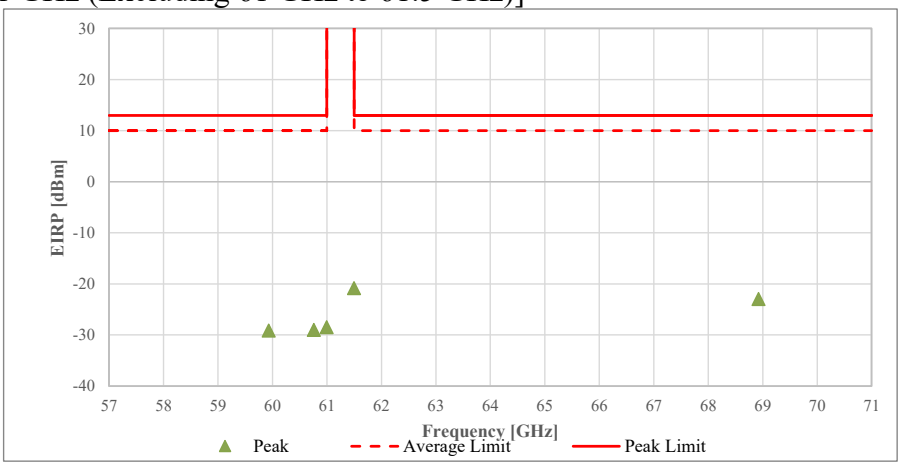
*2) Among the second harmonics: Test mode CW, the value of Tx 3 High of more power was applied.

* The peak result is less than the average limit.

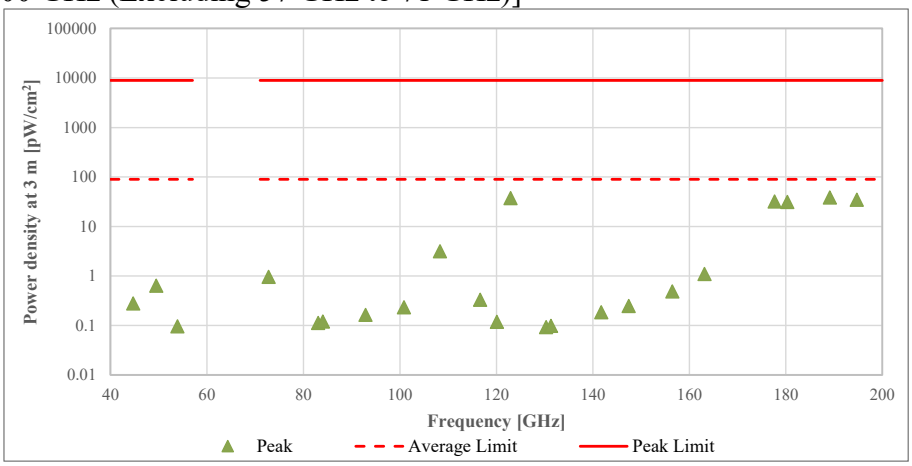
Spurious Emission
(Above 40 GHz)
(Plot data, Worst case)

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 2	No. 2	No. 4
Date	September 16, 2022	September 21, 2022	September 25, 2022
Temperature / Humidity	22 deg. C / 53 % RH	20 deg. C / 42 % RH	23 deg. C / 45 % RH
Engineer	Yuichiro Yamazaki	Junki Nagatomi	Yuichiro Yamazaki
	(50 GHz - 75 GHz)	(40 GHz - 50 GHz)	(75 GHz - 200 GHz)
Mode	Transmission Pattern 2 (Normal operating mode / Tx Test mode (Frequency sweep stop))		

[57 GHz to 71 GHz (Excluding 61 GHz to 61.5 GHz)]



[40 GHz to 200 GHz (Excluding 57 GHz to 71 GHz)]



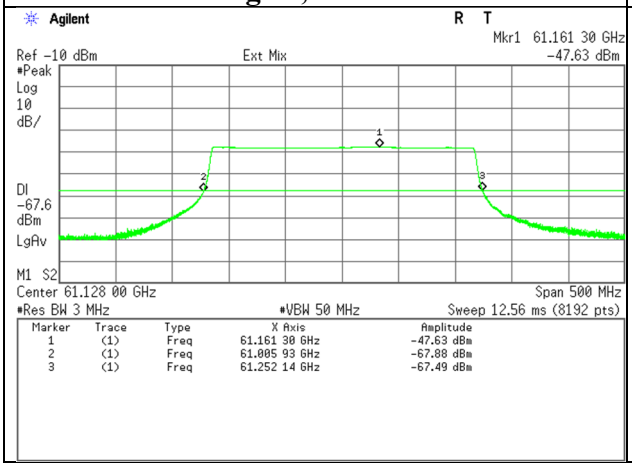
Frequency Stability

Test place	Ise EMC Lab. No. 6 Measurement Room
Date	September 29, 2022
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Junki Nagatomi
Mode	Transmission Pattern 1 (Normal operating mode)

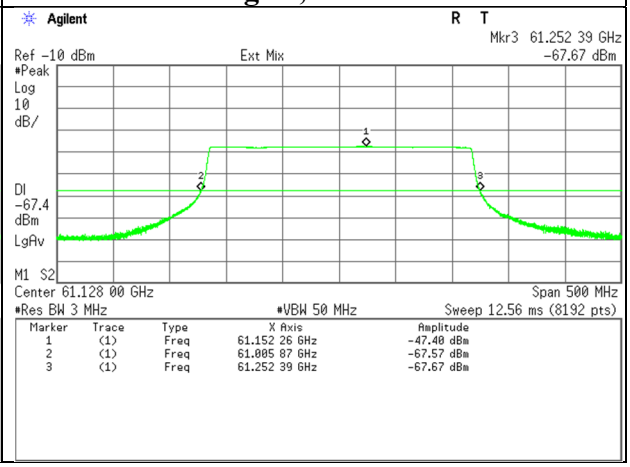
Test Condition		Measured -20 dBc Frequency		Remarks
Temperature [deg. C]	Power Supply [V]	Lower Result [GHz]	Upper Result [GHz]	
75	12.0	61.006	61.252	Customer requested temperature
50	12.0	61.006	61.252	
40	12.0	61.008	61.254	
30	12.0	61.009	61.255	
20	12.0	61.009	61.255	
20	10.2	61.007	61.253	85 % of the minimum operating voltage, DC 12 V * 0.85
20	13.8	61.007	61.253	115 % of the maximum operating voltage, DC 12 V * 1.15
10	12.0	61.009	61.255	
0	12.0	61.010	61.256	
-10	12.0	61.011	61.257	
-20	12.0	61.012	61.258	
-40	12.0	61.012	61.259	Customer requested temperature

[Data]

75 deg. C, DC 12.0 V

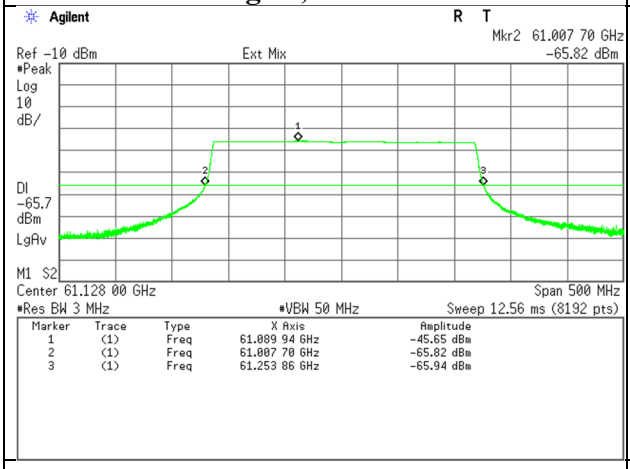


50 deg. C, DC 12.0 V

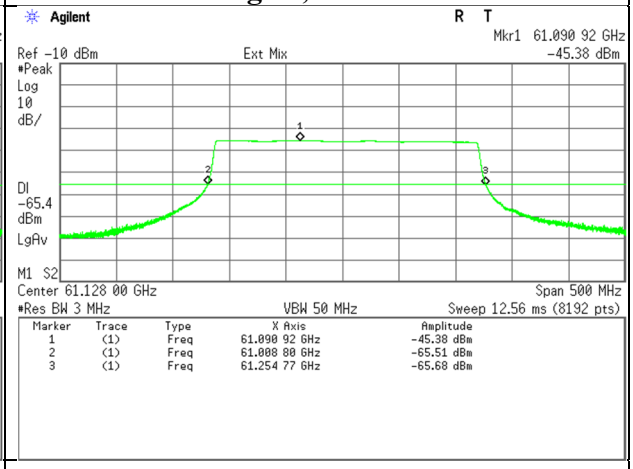


Frequency Stability

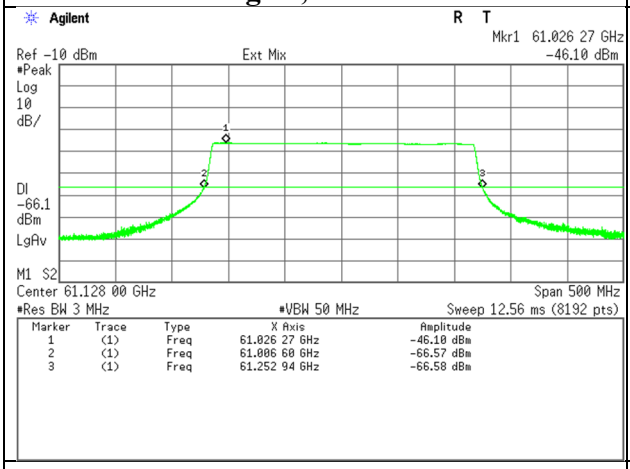
40 deg. C, DC 12.0 V



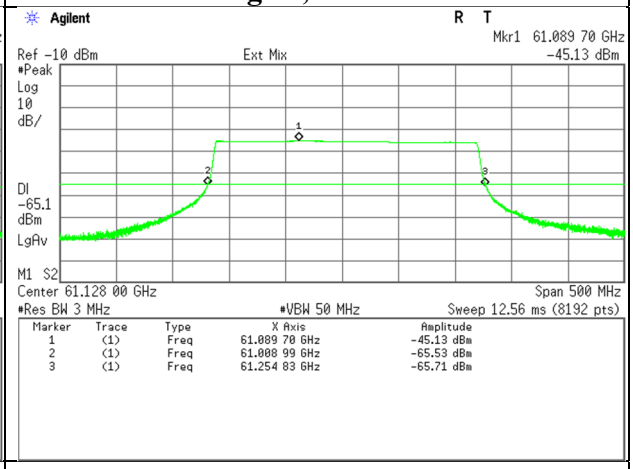
30 deg. C, DC 12.0 V



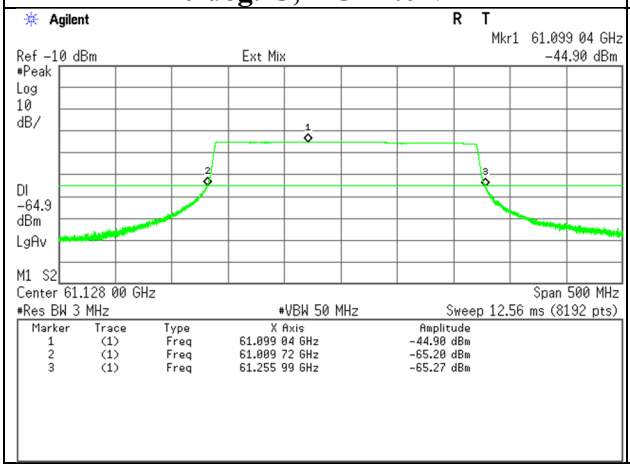
20 deg. C, DC 12.0 V



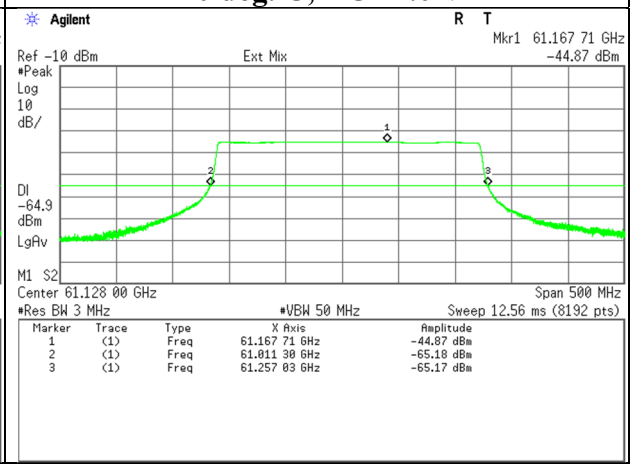
10 deg. C, DC 12.0 V



0 deg. C, DC 12.0 V

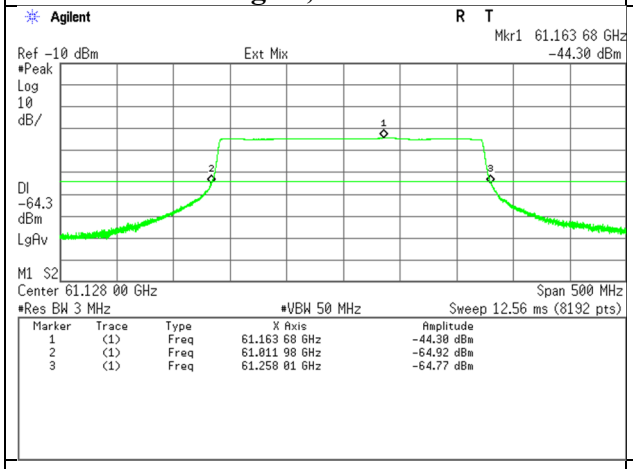


-10 deg. C, DC 12.0 V

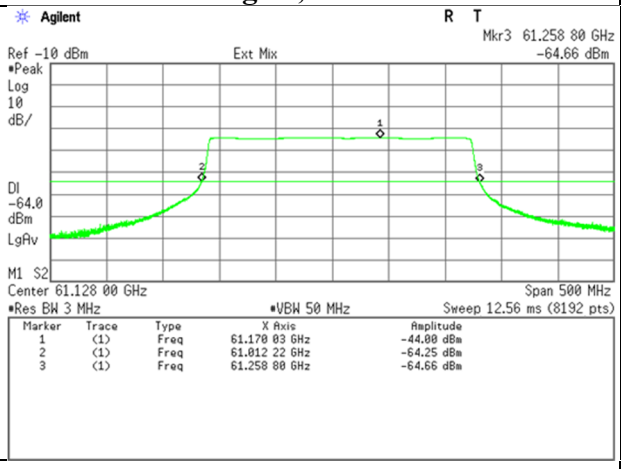


Frequency Stability

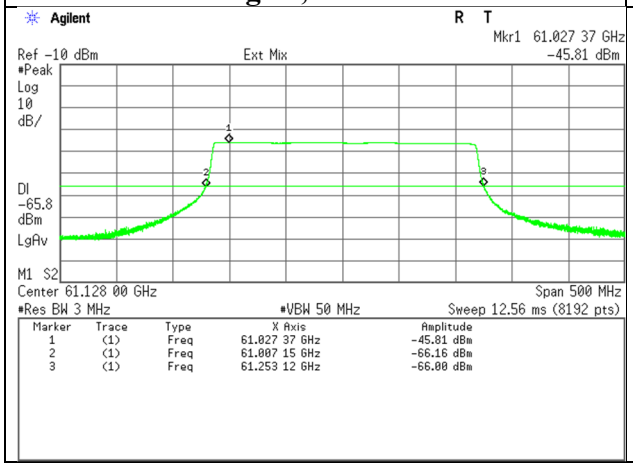
-20 deg. C, DC 12.0 V



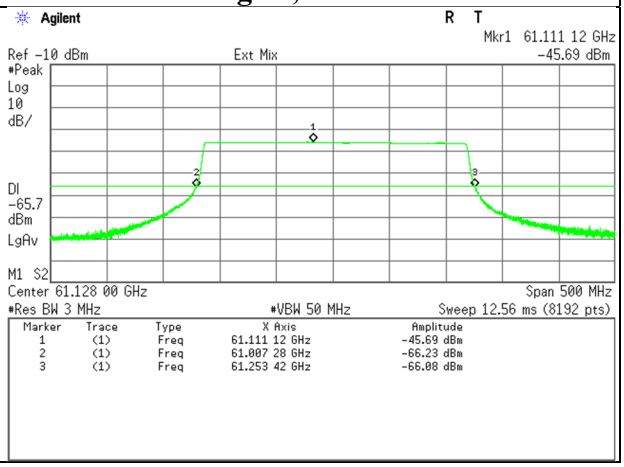
-40 deg. C, DC 12.0 V



20 deg. C, DC 10.2 V



20 deg. C, DC 13.8 V



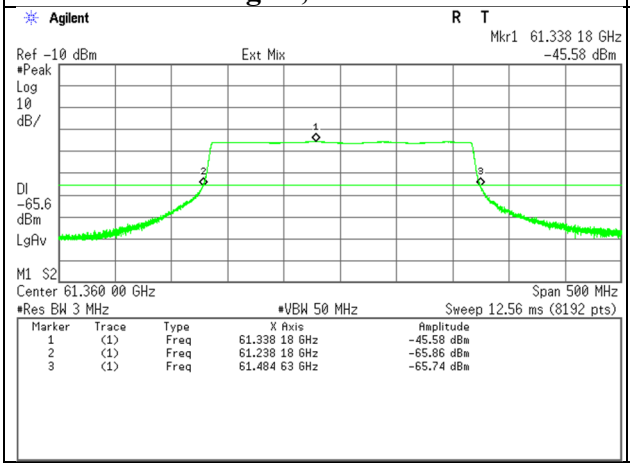
Frequency Stability

Test place	Ise EMC Lab. No. 6 Measurement Room
Date	September 29, 2022
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Junki Nagatomi
Mode	Transmission Pattern 2 (Normal operating mode)

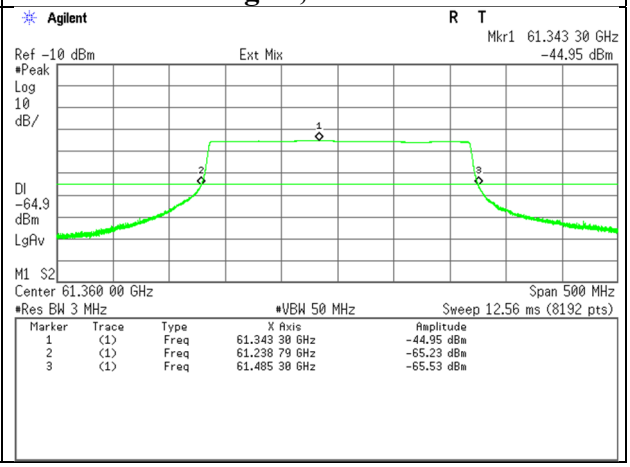
Test Condition		Measured -20 dBc Frequency		Remarks
Temperature [deg. C]	Power Supply [V]	Lower Result [GHz]	Upper Result [GHz]	
75	12.0	61.238	61.485	Customer requested temperature
50	12.0	61.239	61.485	
40	12.0	61.240	61.486	
30	12.0	61.240	61.486	
20	12.0	61.240	61.486	
20	10.2	61.240	61.487	85 % of the minimum operating voltage, DC 12 V * 0.85
20	13.8	61.239	61.486	115 % of the maximum operating voltage, DC 12 V * 1.15
10	12.0	61.242	61.488	
0	12.0	61.243	61.489	
-10	12.0	61.243	61.489	
-20	12.0	61.244	61.490	
-40	12.0	61.244	61.490	Customer requested temperature

[Data]

75 deg. C, DC 12.0 V

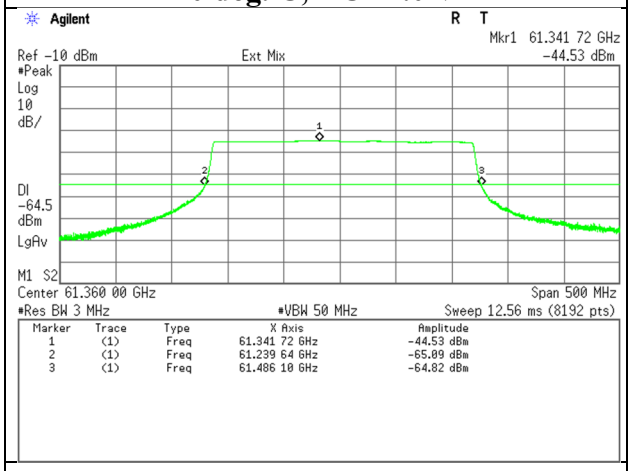


50 deg. C, DC 12.0 V

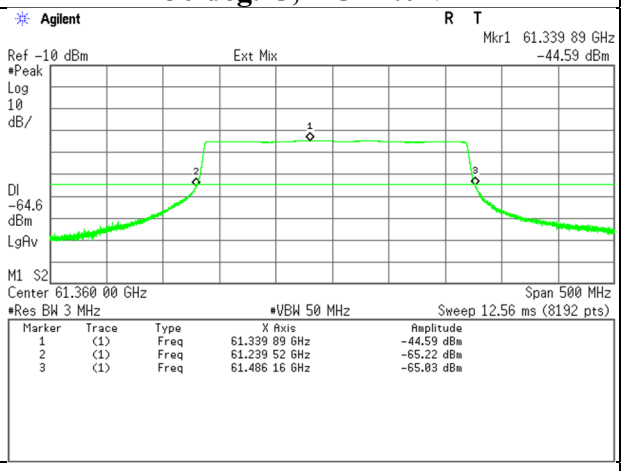


Frequency Stability

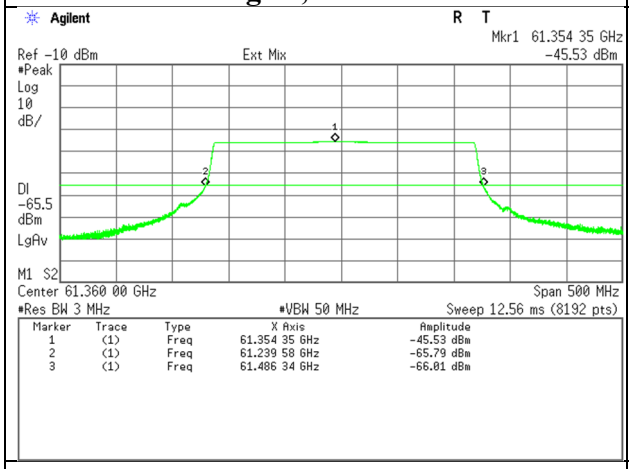
40 deg. C, DC 12.0 V



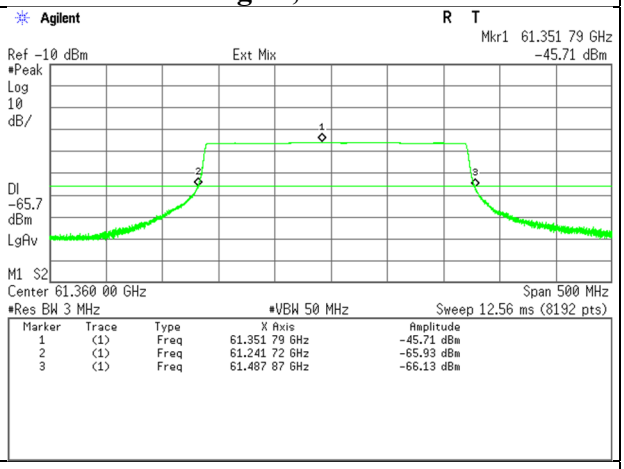
30 deg. C, DC 12.0 V



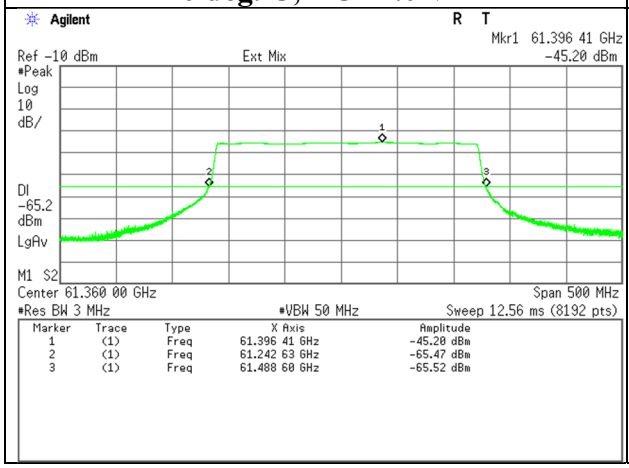
20 deg. C, DC 12.0 V



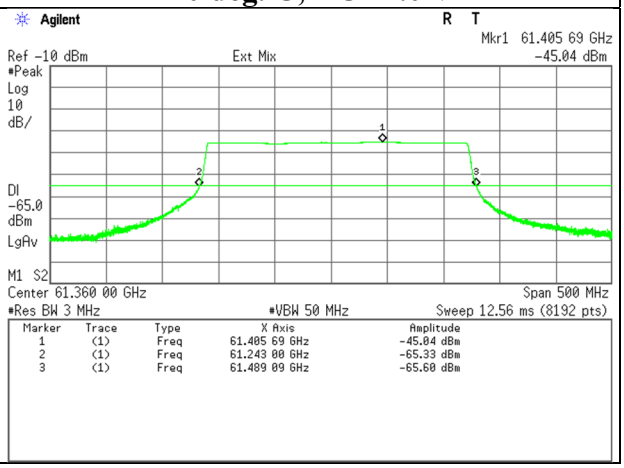
10 deg. C, DC 12.0 V



0 deg. C, DC 12.0 V

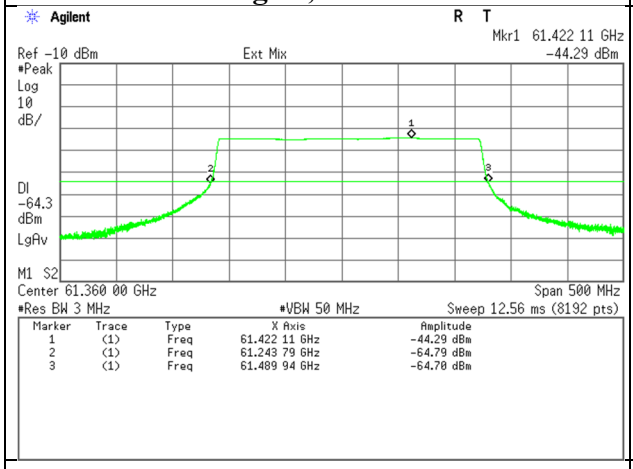


-10 deg. C, DC 12.0 V

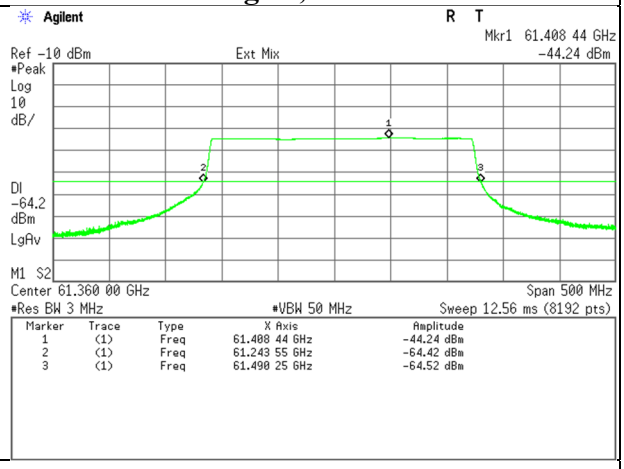


Frequency Stability

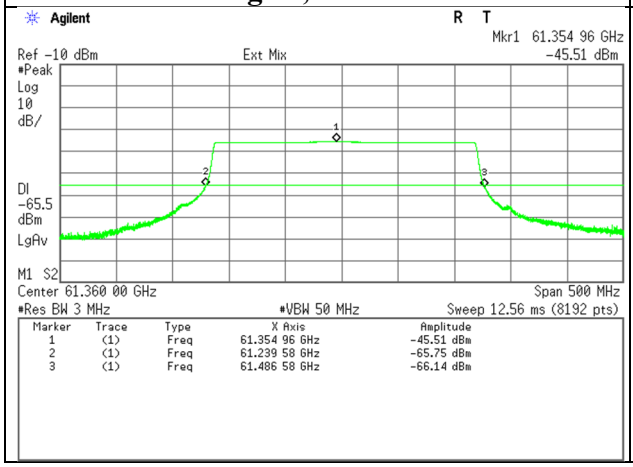
-20 deg. C, DC 12.0 V



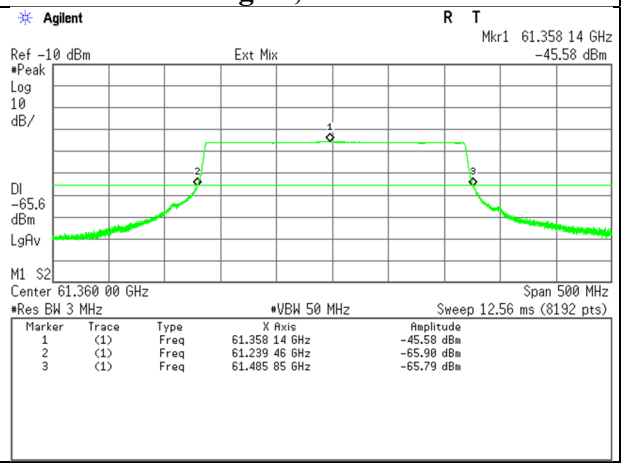
-40 deg. C, DC 12.0 V



20 deg. C, DC 10.2 V



20 deg. C, DC 13.8 V



Group Instllation

There are no external phase-locking inputs in this EUT.
Therefore, the EUT comply this requirement.

APPENDIX 2: Test instruments

Test equipment (1/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
CE	MAT-64	141290	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	12/17/2021	12
CE	MCC-225	166638	Coaxial cable	UL Japan	MP4/6-5D-2W	MP4/6	12/22/2021	12
CE	MJM-28	142229	Measure	KOMELON	KMC-36	-	-	-
CE	MLS-23	141357	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-729	07/28/2022	12
CE	MLS-24	141358	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-730	07/28/2022	12
CE	MMM-11	141546	Digital HiTESTER	HIOKI E.E. CORPORATION	3805	060100600	05/16/2022	12
CE	MOS-17	141563	Thermo-Hygrometer	TFA	CTH-180	1005	01/10/2022	12
CE	MTA-21	142817	Terminator	TME	CT-03NP	1257646E	-	-
CE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	07/25/2022	12
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/30/2022	24
RE	MAEC-02-SVSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/09/2021	24
RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2022	24
RE	MAEC-04-SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/12/2021	24
RE	MCC-135	142032	Microwave Cable	Huber+Suhner	SUCOFLEX102	37511/2	09/28/2022	12
RE	MCC-136	142033	Microwave Cable	Huber+Suhner	SUCOFLEX102	37512/2	09/28/2022	12
RE	MCC-177	141226	Microwave Cable	Junkosha	MMX221-00500DMSDMS	1502S304	03/17/2022	12
RE	MCC-178	141227	Microwave Cable	Junkosha	MMX221-00500DMSDMS	1502S305	03/15/2022	12
RE	MCC-218	141394	Microwave Cable	Junkosha	MWX221	1607S141(1 m) / 1608S264(5 m)	09/12/2022	12
RE	MCC-220	151897	Microwave Cable	Huber+Suhner	SF101EA/11PC24/ 11PC24/2.5M	SN MY1726/1EA	04/25/2022	12
RE	MCC-67	141329	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	04/01/2022	12
RE	MCH-04	141429	Temperature and Humidity Chamber	Espec	PL-2KP	14015723	08/11/2022	12
RE	MDO-10	211944	Digital Storage Oscilloscope	Keysight Technologies Inc	DSOX6002A	MY59380318	11/07/2022	12
RE	MDPLX-01	142026	Diplexer	OML INC.	DPL26	-	11/25/2021	12
RE	MDT-04	142528	Detector	Millitech	DET-15-RPFW0	34	-	-
RE	MHA-16	141513	Horn Antenna 15-40GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9170	BBHA9170306	07/05/2022	12
RE	MHA-17	141506	Horn Antenna 15-40GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9170	BBHA9170307	07/22/2022	12
RE	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	557	05/20/2022	12
RE	MHA-24	142036	Horn Antenna	Custom Microwave Inc.	HO6R	-	09/01/2022	12
RE	MHA-27	142039	Horn Antenna	Custom Microwave Inc.	HO4R	-	09/01/2022	12
RE	MHA-31	142041	Horn Antenna	Oshima Prototype Engineering Co.	A16-187	1	09/01/2022	12
RE	MHA-33	180634	Horn Antenna	SAGE Millimeter, Inc.	SAZ-2410-15-S1	17343-01	06/09/2022	12
RE	MHA-35	180544	Horn Antenna	SAGE Millimeter, Inc.	SAZ-2410-10-S1	17343-01	06/27/2022	12
RE	MHF-31	199856	WR-10 HighPass Filter	Oshima Prototype Engineering Co.	A20-110-A01	001	09/29/2021 *1)	12
RE	MISO-03	142592	Waveguide Isolator	Millitech	FBI-15-RSES0	1858	-	-
RE	MJM-24	142225	Measure	ASKUL	-	-	-	-
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/12/2022	12
RE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/16/2022	12

Test equipment (2/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MMM-18	141558	Digital Tester (TRUE RMS MULTIMETER)	Fluke Corporation	115	17930030	05/17/2022	12
RE	MMX-01	142047	Preselected Millimeter Mixer	Keysight Technologies Inc	11974V-E01	3001A00412	11/16/2021	12
RE	MMX-02	142048	Harmonic Mixer	Keysight Technologies Inc	11970W	2521 A01909	10/06/2022	12
RE	MMX-03	142049	Harmonic Mixer	OML INC.	M06HWD	D100709-1	11/17/2021	12
RE	MMX-04	142053	Harmonic Mixer	OML INC.	M04HWD	Y100709-1	12/07/2021	12
RE	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/10/2022	12
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/10/2022	12
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/19/2021	12
RE	MPA-12	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	10/05/2022	12
RE	MPA-19	141585	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	02/28/2022	12
RE	MPA-22	141588	Pre Amplifier	MITEQ, Inc	AMF-6F-2600400-33-8P / AMF-4F-2600400-33-8P	1871355 / 1871328	09/29/2022	12
RE	MPA-23	142055	Power Amplifier	SAGE Millimeter, Inc.	SBP-5037532015-1515-N1	11599-01	03/04/2022	12
RE	MPA-25	159919	Power Amplifier	SAGE Millimeter, Inc.	SBP-4035033018-2F2F-S1	12559-01	06/10/2022	12
RE	MPA-29	176027	D-Band Low Noise Amplifier	SAGE Millimeter, Inc.	SBL-1141741860-0606-EI	15235-01	07/15/2022	12
RE	MPA-31	180607	Power Amplifier	SAGE Millimeter, Inc.	SBP-7531142515-1010-E1	17343-01	10/07/2022	12
RE	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/31/2022	12
RE	MSA-10	141899	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180655	02/18/2022	12
RE	MSA-22	141978	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180899	03/24/2022	12
RE	LA-17	160924	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	225	11/13/2021	12
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/25/2022	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	VHA 91031302	08/26/2022	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	11/18/2022	12
RE	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	04/04/2022	12
RE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	07/25/2022	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:

CE: Conducted Emission
RE: Radiated Emission