

RADIO TEST REPORT

Test Report No. 15073959H-R1

Customer	Sumitomo Electric Industries, Ltd.
Description of EUT	Pedestrian Sensor
Model Number of EUT	SWR-A002
FCC ID	2A8U2SWR-A002
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied
Issue Date	February 1, 2024
Remarks	-

Representative test engineerJunki Nagatomi
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".

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

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- The information provided by the customer for this report is identified in SECTION 1.
- The laboratory is not responsible for information provided by the customer which can impact the validity of the results.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

REVISION HISTORY

Original Test Report No.: 15073959H

This report is a revised version of 15073959H. 15073959H is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15073959H	January 10, 2024	-
1	15073959H-R1	February 1, 2024	Deletion of "Antenna Gain" and "Steerable Antenna" from Radio Specification of SECTION 2.2.
1	15073959H-R1	February 1, 2024	Update to ANSI C63.10 version of Test Procedure in Section 3.2 and P.16, 17, 25, 29 and 33.
1	15073959H-R1	February 1, 2024	Correction of the Frequency for SECTION 4.1; From "61.128 GHz" to "61.133 GHz" (Pattern 1) From "61.360 GHz" to "61.365 GHz" (Pattern 2)
1	15073959H-R1	February 1, 2024	Addition of the "99 % Occupied bandwidth" in SECTION 4.1 and SECTION 7.
1	15073959H-R1	February 1, 2024	Correction of the Antenna size in SECTION 6 (page 17); From "0.01090 m" to "0.00700 m"
1	15073959H-R1	February 1, 2024	Deletion of LPF notation in Test configuration in SECTION 6 (page 18).
1	15073959H-R1	February 1, 2024	Addition of 99 % Occupied bandwidth table in 20 dB Bandwidth test data (page 24).
1	15073959H-R1	February 1, 2024	The following correction to EIRP(Peak) test data (page 25): - DSO Reading (RMS) value (Pattern 2: Tx 3) From "31.7" to "31.8" -Frequency From "61.128 GHz" to "61.133 GHz" (Pattern 1) From "61.360 GHz" to "61.365 GHz" (Pattern 2)
1	15073959H-R1	February 1, 2024	Deletion of the calculation under the chart in Plot data (page 30 and 34).
1	15073959H-R1	February 1, 2024	Addition of 99 % Occupied bandwidth result in Frequency Stability test data (page 35 and 39).
1	15073959H-R1	February 1, 2024	Addition of LIMS ID: 238712 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

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SECTION 1: Customer Information

Company Name	Sumitomo Electric Industries, Ltd.
Address	1-1-3, Shimaya, Konohana-ku, Osaka 554-0024, Japan
Telephone Number	+81-6-6466-5520
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

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	Pedestrian Sensor
Model Number	SWR-A002
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	December 5, 2023
Test Date	December 6 to 11, 2023

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
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 C63.10-2020, 6. Standard test methods	FCC: Section 15.207	5.12 dB, 14.21326 MHz, AV, Phase N / 14.21303 MHz, AV, Phase N	Complied	-
Duty cycle	FCC: -	FCC: Section FCC 15.255 (c)(2)(v)	See data.	Complied	Radiated
6dB Bandwidth	FCC: Section 15.255(e) (2) ANSI C63.10 2020, 9. Procedures for testing millimeter-wave systems	FCC: Section 15.255(e) (1)	-	N/A	*1)
20dB Bandwidth	FCC: ANSI C63.10 2020, 6. Standard test methods	FCC: Section 15.215 (c)	See data.	Complied	Radiated
99 % Occupied Bandwidth	FCC: ANSI C 63.10:2020, 9. Procedures for testing millimeter-wave systems	FCC: -	See data.	Complied	Radiated *2)
EIRP	FCC: ANSI C63.10 2020, 9. Procedures for testing millimeter-wave systems	FCC: Section FCC 15.255 (c)(2)(v)	See data.	Complied	Radiated
Spurious Emissions	FCC: ANSI C63.10 2020, 6. Standard test methods 9. Procedures for testing millimeter-wave systems	FCC: Section 15.255(d) Section 15.209	1.4 dB 47.8 MHz, Vertical, QP	Complied	Radiated
Frequency Stability	FCC: ANSI C63.10 2020, 9. Procedures for testing millimeter-wave systems	FCC: Section 15.255(f)	See data.	Complied	Radiated
Group Installation	FCC: -	FCC: Section 15.255(h)	-	N/A	*3)

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.

*1) The test is not applicable since the application of Section 15.255(e) is unnecessary due to the application of Section 15.255(c)(2)(v).

*2) The test was performed according to the General Measurement Guidance of TCB Workshop Part 15.255 Rules Amendment October 25, 2023.

*3) The test is not applicable since there are no external phase-locking inputs in this EUT.

FCC Part 15.31 (e)

This EUT provides 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

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		3.3 dB
10 m			3.1 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	4.9 dB
		Vertical	5.0 dB
3 m	1 GHz to 6 GHz	Test Receiver	5.1 dB
		Spectrum analyzer	4.9 dB
	6 GHz to 18 GHz	Test Receiver	5.4 dB
		Spectrum analyzer	5.2 dB
1 m	10 GHz to 26.5 GHz	Spectrum analyzer	5.6 dB
	26.5 GHz to 40 GHz	Spectrum analyzer	4.9 dB
0.5 m	26.5 GHz to 40 GHz	Spectrum analyzer	4.9 dB
10 m	1 GHz to 18 GHz	Test Receiver	5.4 dB
>= 0.5 m	40 GHz to 50 GHz		4.3 dB
>= 0.5 m	50 GHz to 75 GHz		5.9 dB
>= 0.5 m	75 GHz to 110 GHz		5.7 dB
>= 3.8 cm	110 GHz to 170 GHz		5.8 dB
>= 2.5 cm	170 GHz to 260 GHz		5.2 dB

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan

Telephone: +81-596-24-8999

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

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

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-
Large Chamber	16.9 x 22.1 x 10.17	16.9 x 22.1	-	10 m
Small Chamber	5.3 x 6.69 x 3.59	5.3 x 6.69	-	-

* 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.

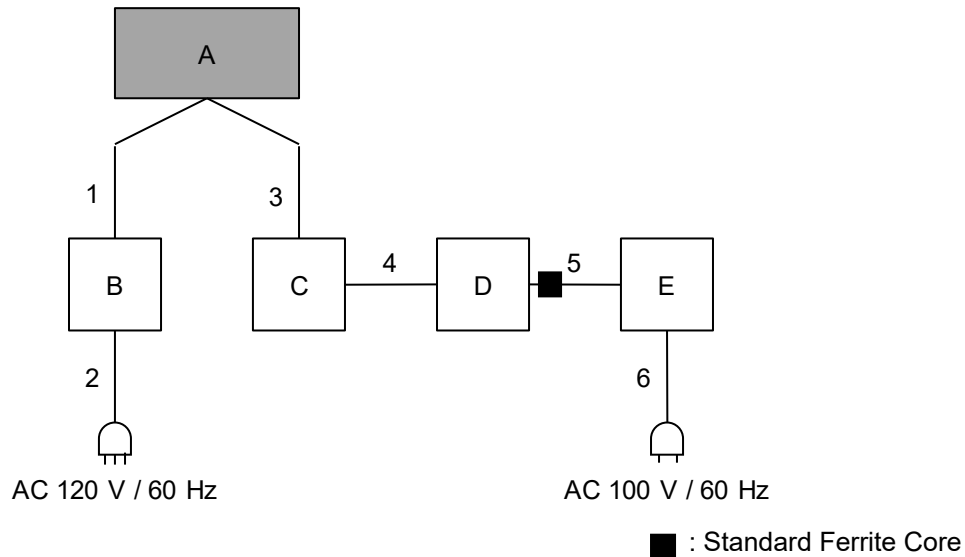
SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Mode	Transmission Pattern	Antenna	Frequency	Test Item
Normal operating mode	1	Tx1/Tx3	61.133 GHz	- Conducted Emission - Duty cycle - 20 dB Bandwidth - 99 % Occupied bandwidth
	2	Tx1/Tx3	61.365 GHz	- EIRP(Peak) - Spurious Emissions - Frequency stability
*Power of the EUT was set by the software as follows; Power Setting: 9 dBm Software: long_range_people_det_68xx_demo_srev30-0.bin Version: srev30-0 (Date: 2023.07 13, Storage location: EUT memory)				
*This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.				

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.

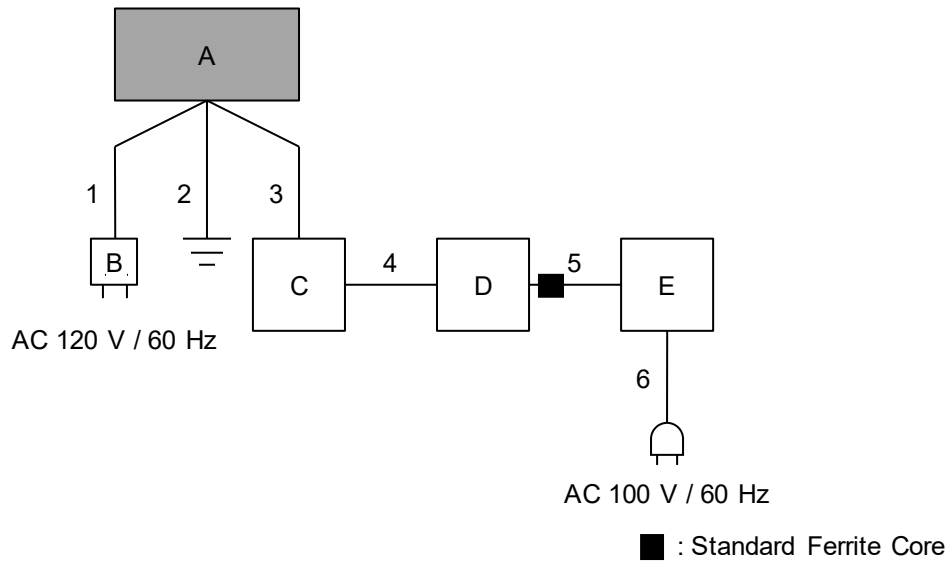
Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Pedestrian Sensor	SWR-A002	#10	Sumitomo Electric Industries, Ltd.	EUT
B	DC power supply	RPE-4323	824B168G2	RS COMPONENTS LTD	-
C	LAN Adapter	EDC-GUA3-B	12L167006338A	ELECOM	-
D	Laptop PC	X1 Carbon	R9-OH8TU 15/9	LENOVO	-
E	AC Adapter	ADLX45NCC2A	8SSA10E75794C1 SG59R0GHF	LENOVO	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	21.8	Unshielded	Unshielded	-
2	AC Cable	1.0	Unshielded	Unshielded	-
3	LAN Cable	23.0	Unshielded	Unshielded	-
4	USB Cable	0.1	Shielded	Shielded	-
5	DC Cable	1.7	Unshielded	Unshielded	-
6	AC Cable	1.0	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-A002	#10	Sumitomo Electric Industries, Ltd.	EUT
B	AC Adapter	ATS024T-W120U	WA-12200X-1	KYOHITSU ELECTRONIC INDUSTRY Co.,Ltd.	-
C	LAN Adapter	EDC-GUA3-B	12L167006338A	ELECOM	-
D	Laptop PC	X1 Carbon	R9-OH8TU 15/9	LENOVO	-
E	AC Adapter	ADLX45NCC2A	8SSA10E75794C1 SG59R0GHF	LENOVO	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	21.4	Unshielded	Unshielded	-
2	Functional ground cable	22.6	Unshielded	Unshielded	-
3	LAN Cable	23.0	Unshielded	Unshielded	-
4	USB Cable	0.1	Shielded	Shielded	-
5	DC Cable	1.7	Unshielded	Unshielded	-
6	AC Cable	1.0	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.

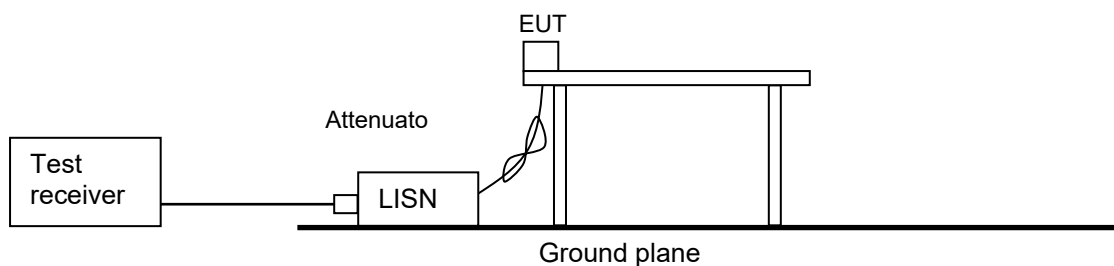
The EUT was connected to a LISN (AMN).

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.

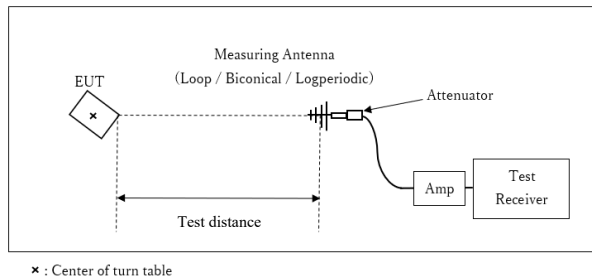
Test Antennas are used as below;

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 *a)	AV
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 1 / T

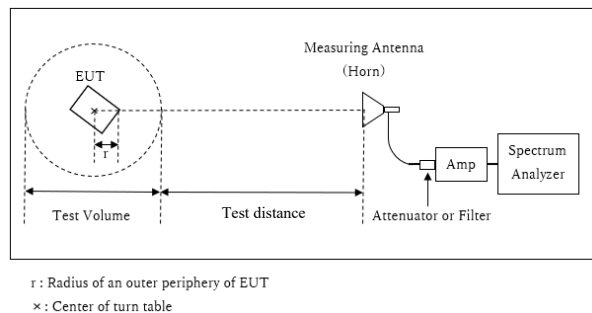
*a) The Spectrum Analyzer was used in 3 dB resolution bandwidth.

[Test setup]
Below 1 GHz



Test Distance: 3 m

1 GHz to 10 GHz

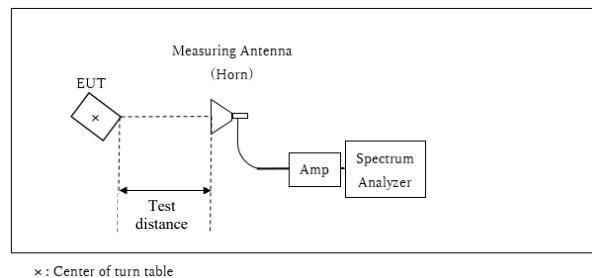


Distance Factor: $20 \times \log (3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.75 \text{ m}$

SVSWR Volume : 1.5 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.

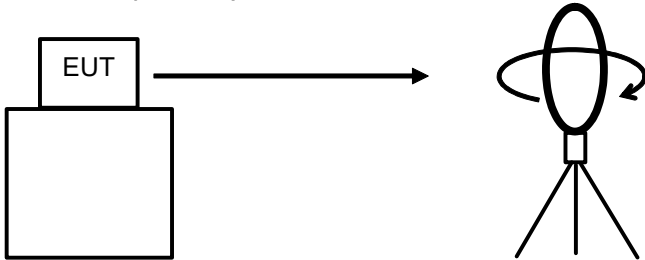
10 GHz to 40 GHz



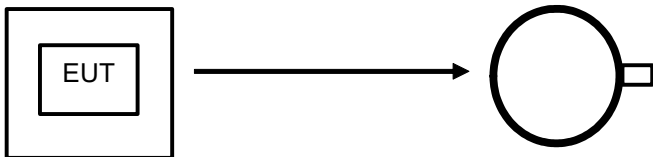
Distance Factor: $20 \times \log (1.0 \text{ m}^* / 3.0 \text{ m}) = -9.5 \text{ dB}$
*Test Distance: 1 m

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

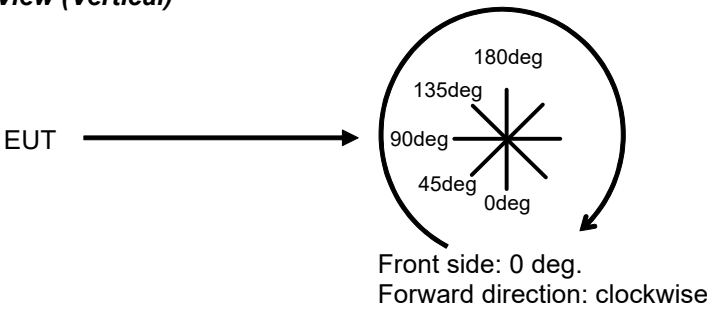


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



[Above 40 GHz]

The test was performed based on “Procedures for testing millimeter-wave systems” of ANSI C63.10-2020.

The EUT was placed on a urethane platform, raised 1.5 m above the conducting ground plane. The measurements were performed on handheld method.

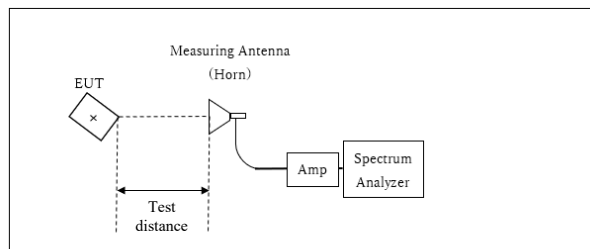
Set spectrum analyzer RBW, VBW, span, etc., to the proper values. Note these values. Enable two traces—one set to “clear write,” and the other set to “max hold.” Begin hand-held measurements with the test antenna (horn) at a distance of 1 m from the EUT in a horizontally polarized position. Slowly adjust 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
Final measurement distance with 1 MHz Peak detector	1.0 m	0.75 m	0.5 m	0.01 m

[Test setup]

40 GHz to 200 GHz



x : Center of turn table

*Test Distance: Refer to the above table.

[About fundamental measurement]

Test Procedure

The test was performed based on “Procedures for testing millimeter-wave systems” of ANSI C63.10-2020.

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

λ is the wavelength of the emission under investigation $[300/f \text{ (MHz)}]$, in m

Frequency [GHz]	Wavelength λ [mm]	Maximum Dimention			Far Field Boundary r [m]	Tested Distance [m]
		EUT [m]	Test Antenna [m]	Maximum D [m]		
61	4.9	0.00700	0.03759	0.03759	0.575	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.

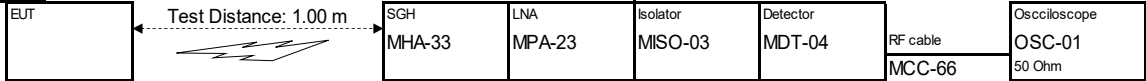
Without changing any settings, connect the mm-wave source to a wideband mm-wave power meter with a thermocouple detector or equivalent. Measure the power and record it as PM reading.

Stage 4:

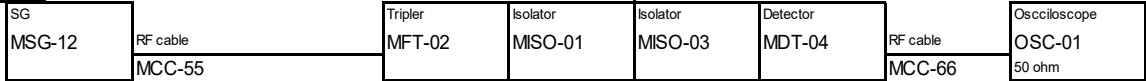
Correct the peak substitution power at the input to the measurement instrument, as recorded in Stage 3, for any external gain and/or attenuation between the measurement antenna and the measurement instrument that was not included in the substitution power measurement.

[Test configuration]

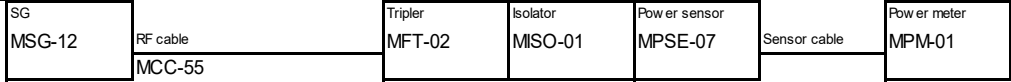
Stage 1



Stage 2



Stage 3



The Radiated power test was performed with the EUT that was attached on the jig, since the antenna array was mounted on angularly-tilted.

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

Measurement range : 9 kHz to 200 GHz
Test data : APPENDIX
Test result : Pass

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 (110 %), 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 and 99 % Occupied bandwidth were recorded.

Test data : **APPENDIX**
Test result : **Pass**

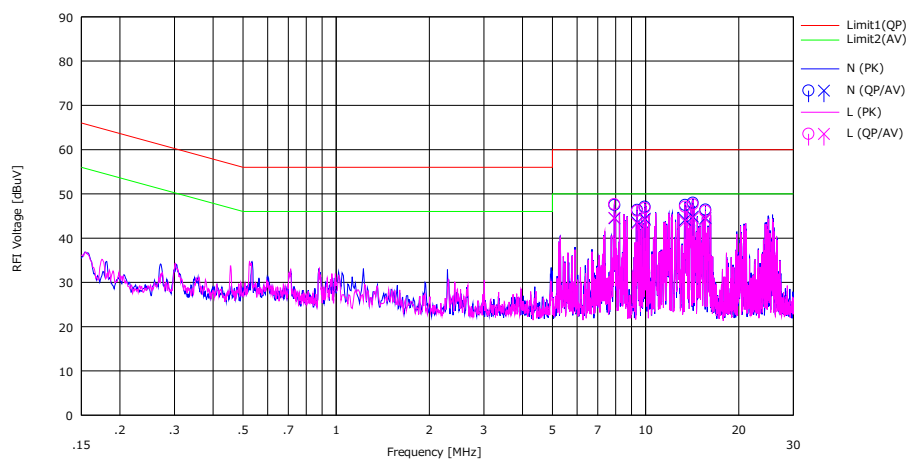
APPENDIX 1: Test data

Conducted Emission

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab.
No. 4
December 11, 2023
22 deg. C / 40 % RH
Junki Nagatomi
Transmission Pattern 1 (Normal operating mode)

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq. [MHz]	Reading		USN	LOSS	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(AV) [dBuV]			(QP) [dBuV]	(AV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	7.93240	33.70	30.70	0.20	13.57	47.47	44.47	60.00	50.00	12.53	5.53	N	
2	9.38921	32.50	29.70	0.23	13.61	46.34	43.54	60.00	50.00	13.66	6.46	N	
3	9.93902	33.20	30.50	0.24	13.63	47.07	44.37	60.00	50.00	12.93	5.63	N	
4	13.41910	33.40	30.10	0.33	13.72	47.45	44.15	60.00	50.00	12.55	5.85	N	
5	14.21326	33.90	30.80	0.34	13.74	47.98	44.88	60.00	50.00	12.02	5.12	N	
6	15.61821	32.30	30.40	0.35	13.77	46.42	44.52	60.00	50.00	13.58	5.48	N	
7	7.92338	33.90	30.80	0.19	13.57	47.66	44.56	60.00	50.00	12.34	5.44	L	
8	9.38894	32.30	29.50	0.22	13.61	46.13	43.33	60.00	50.00	13.87	6.67	L	
9	9.93936	32.90	30.20	0.23	13.63	46.76	44.06	60.00	50.00	13.24	5.94	L	
10	13.41883	33.00	29.70	0.34	13.72	47.06	43.76	60.00	50.00	12.94	6.24	L	
11	14.21372	33.50	30.40	0.35	13.74	47.59	44.49	60.00	50.00	12.41	5.51	L	
12	15.61722	32.00	30.10	0.37	13.77	46.14	44.24	60.00	50.00	13.86	5.76	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.

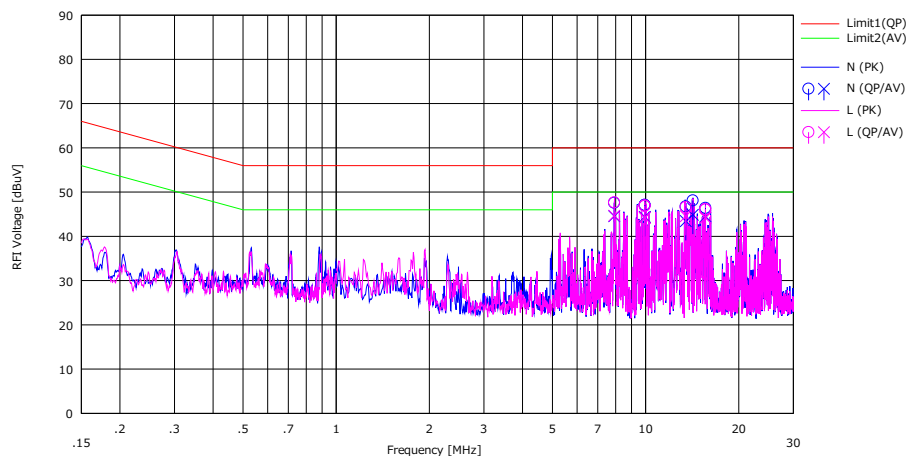
*The test result is rounded off to one or two decimal places, so some differences might be observed.

Conducted Emission

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab.
No. 4
December 11, 2023
22 deg. C / 40 % RH
Junki Nagatomi
Transmission Pattern 2 (Normal operating mode)

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq. [MHz]	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	7.92315	33.80	30.80	0.20	13.57	47.57	44.57	60.00	50.00	12.43	5.43	N	
2	9.93813	33.20	30.50	0.24	13.63	47.07	44.37	60.00	50.00	12.93	5.63	N	
3	9.93897	33.20	30.50	0.24	13.63	47.07	44.37	60.00	50.00	12.93	5.63	N	
4	13.47981	32.70	29.40	0.33	13.72	46.75	43.45	60.00	50.00	13.25	6.55	N	
5	14.21303	34.00	30.80	0.34	13.74	48.08	44.88	60.00	50.00	11.92	5.12	N	
6	15.61827	32.30	30.40	0.35	13.77	46.42	44.52	60.00	50.00	13.58	5.48	N	
7	7.92312	33.90	30.90	0.19	13.57	47.66	44.66	60.00	50.00	12.34	5.34	L	
8	9.93816	33.10	30.40	0.23	13.63	46.96	44.26	60.00	50.00	13.04	5.74	L	
9	9.93821	33.00	30.30	0.23	13.63	46.86	44.16	60.00	50.00	13.14	5.84	L	
10	13.48064	32.50	30.50	0.34	13.72	46.56	44.56	60.00	50.00	13.44	5.44	L	
11	15.61834	32.00	30.10	0.37	13.77	46.14	44.24	60.00	50.00	13.86	5.76	L	
12	15.62000	31.90	30.10	0.37	13.77	46.04	44.24	60.00	50.00	13.96	5.76	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.

Duty Cycle

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

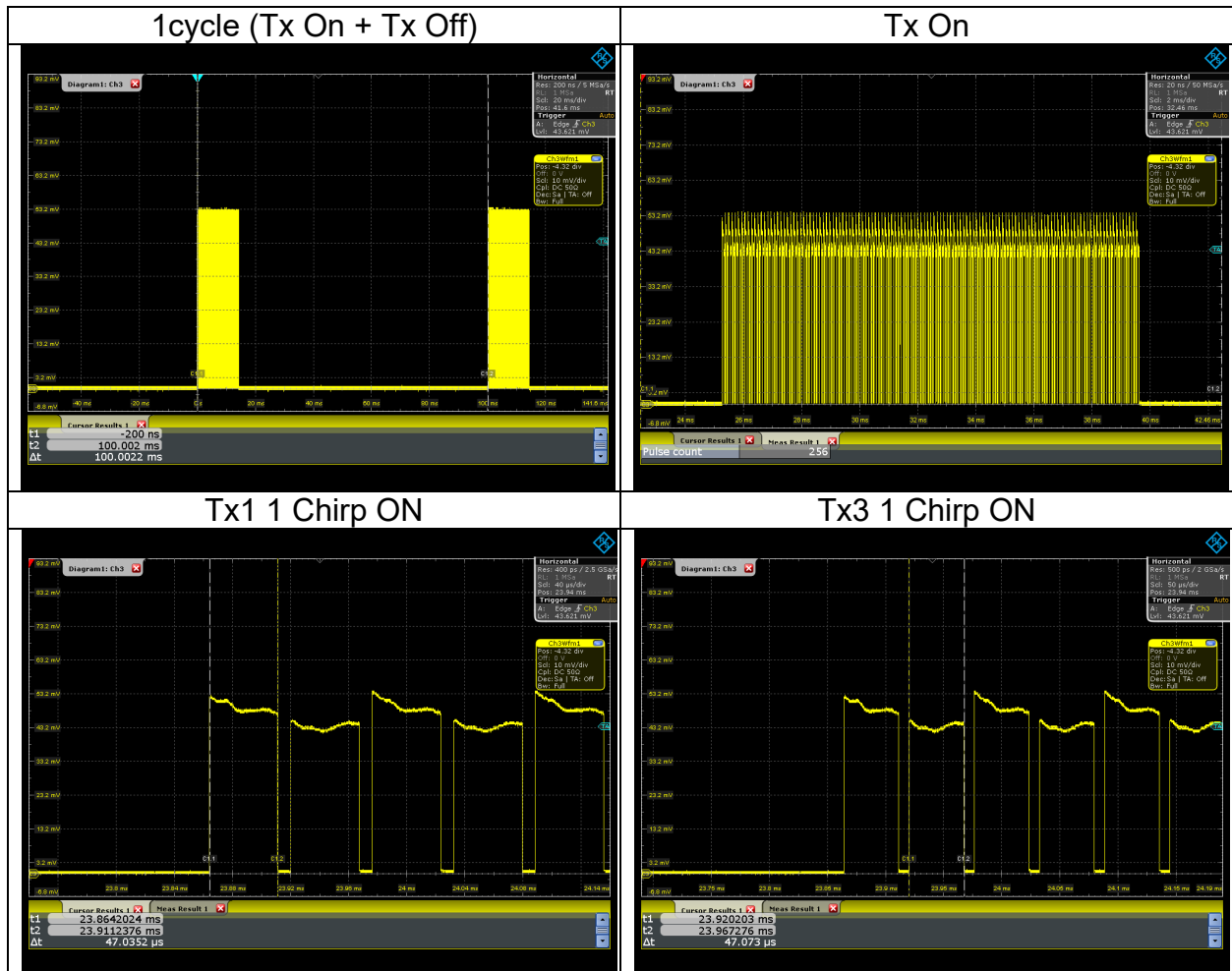
Ise EMC Lab.
No. 3
December 10, 2023
22 deg. C / 42 % RH
Junki Nagatomi
Transmission Pattern 1 (Normal operating mode)

	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	47.035	47.073	256	12.046	12.0

Calculating formula:

$\text{Tx On time} = (\text{Tx Chirp ON time} + \text{Tx3 Chirp ON time}) \times \text{Number of Chirp} / 2$

$\text{Duty} = (\text{Tx On time} / \text{Tx On} + \text{Tx Off time}) \times 100$



Duty Cycle

Test place

Semi Anechoic Chamber

Date

Temperature / Humidity

Engineer

Mode

Ise EMC Lab.

No. 3

December 10, 2023

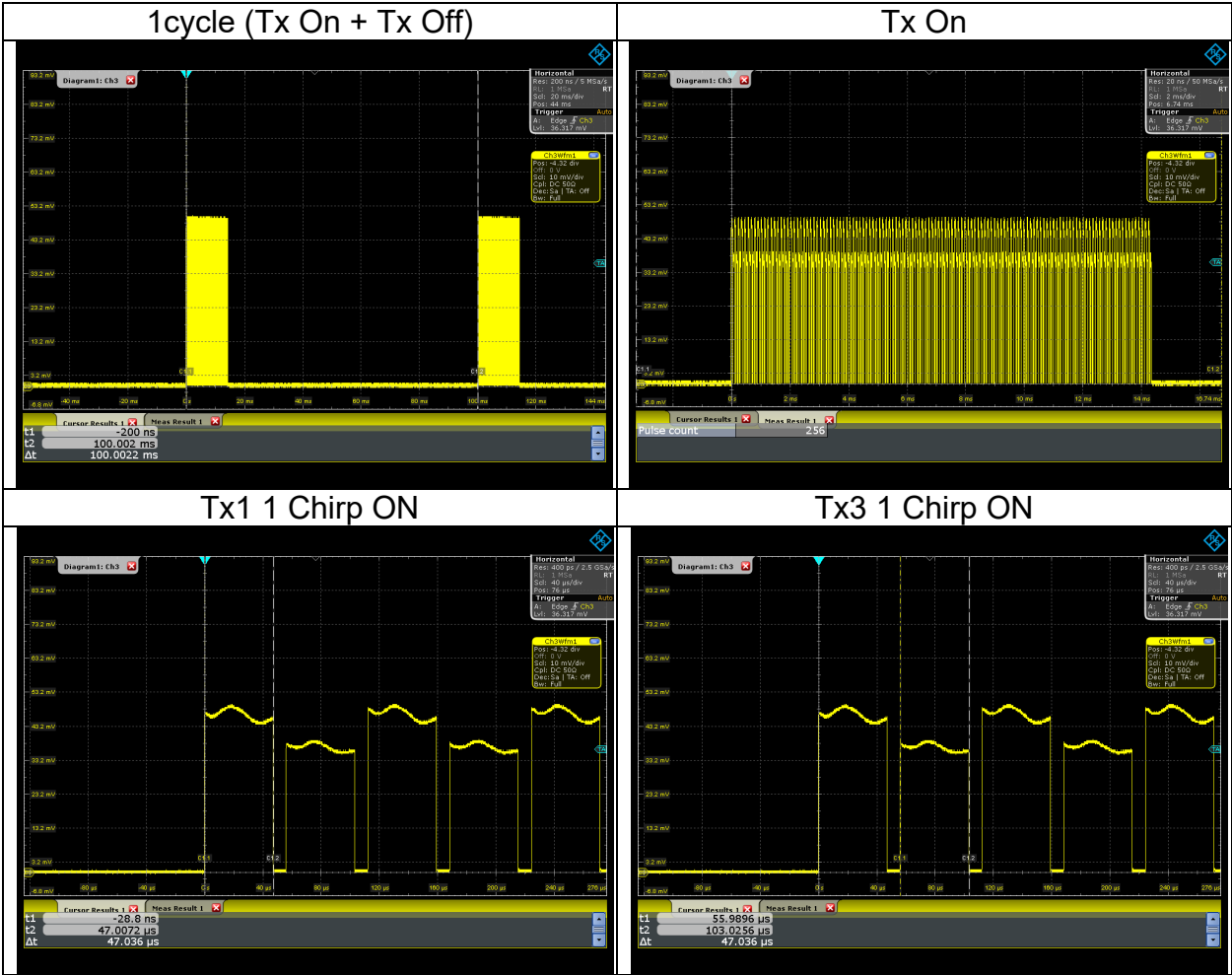
22 deg. C / 42 % RH

Junki Nagatomi

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	100.002	47.036	47.036	256	12.041	12.0

Calculating formula:
$$\text{Tx On time} = (\text{Tx Chirp ON time} + \text{Tx3 Chirp ON time}) \times \text{Number of Chirp} / 2$$
$$\text{Duty} = (\text{Tx On time} / \text{Tx On} + \text{Tx Off time}) \times 100$$



20 dB Bandwidth, 99 % Occupied bandwidth

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No. 3
Date	December 7, 2023
Temperature / Humidity	22 deg. C / 31 % RH
Engineer	Junki Nagatomi
Mode	Normal operating mode

[20 dB Bandwidth]

Transmission	Center	Frequency	20 dB	20 dB Bandwidth		Lower	Upper	Result
Pattern	Frequency	error	Bandwidth	The Lower	The Upper	Limit	Limit	
	[GHz]	[MHz]	[MHz]	frequency	frequency	[GHz]	[GHz]	
1	61.128	3.301	246.720	61.008	61.255	61.0	61.5	Pass
2	61.360	3.305	246.396	61.240	61.487			Pass

Calculation:

The Lower frequency = Center frequency + Frequency error – 20 dB Bandwidth / 2

The Upper frequency = Center frequency + Frequency error + 20 dB Bandwidth / 2

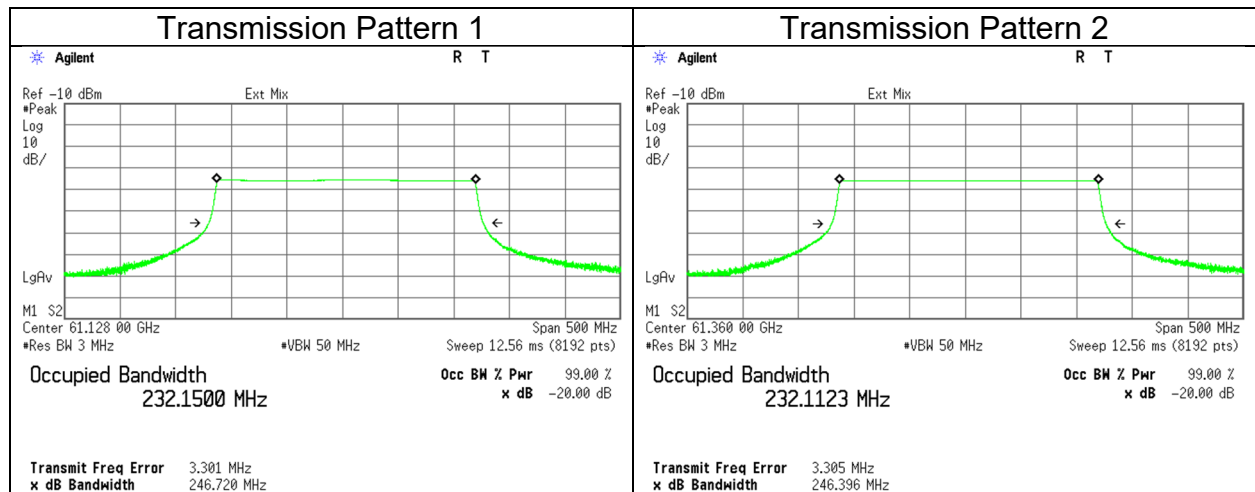
[99 % Occupied Bandwidth]

Transmission	Center	Frequency	99%	99 % OBW		Lower	Upper	Result
Pattern	Frequency	error	OBW	The Lower	The Upper	Limit	Limit	
	[GHz]	[MHz]	[MHz]	frequency	frequency	[GHz]	[GHz]	
1	61.128	3.301	232.150	61.015	61.247	61.0	61.5	Pass
2	61.360	3.305	232.112	61.247	61.479			Pass

Calculation:

The Lower frequency = Center frequency + Frequency error – 99 % OBW / 2

The Upper frequency = Center frequency + Frequency error + 99 % OBW / 2



EIRP(Peak)

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No. 3
Date	December 7, 2023
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Junki Nagatomi
Mode	Tx Test mode

Transmission Pattern	Test Antenna	Frequency [GHz]	Stage 1		Stage 2		Stage 3		Stage 4		Tested Distance [m]	FSL [dB]
			DSO Reading		S/G Setting Power		P/M Reading		LNA Gain	Rx Ant. Gain		
			(PK)	(RMS)	(PK)	(RMS)	(PK)	(RMS)				
			[mV]	[mV]	[dBm]	[dBm]	[dBm]	[dBm]	[dB]	[dBi]		
1	Tx 1	61.133	49.1	42.0	17.81	17.02	-1.12	-1.47	24.97	23.80	1.00	68.17
	Tx 3	61.133	37.7	32.2	16.32	15.75	-2.22	-2.87	24.97	23.80	1.00	68.17
2	Tx 1	61.365	48.3	41.6	17.63	16.89	-0.64	-1.36	24.86	23.80	1.00	68.20
	Tx 3	61.365	36.1	31.8	16.21	15.55	-2.07	-2.79	24.86	23.80	1.00	68.20

Transmission Pattern	Test Antenna	Frequency [GHz]	EIRP Result (Peak)		Limit (Peak) [dBm]	EIRP Result (Average)		(Average) [dBm]	Margin	
			[dBm]	[mW]		[dBm]	[mW]		(Peak) [dB]	(Average) [dB]
1	Tx 1	61.133	18.29	67.46	43	17.94	62.23	40	24.71	22.06
	Tx 3	61.133	17.18	52.24	43	16.53	44.98	40	25.82	23.47
2	Tx 1	61.365	18.91	77.81	43	18.18	65.77	40	24.09	21.82
	Tx 3	61.365	17.48	55.98	43	16.75	47.32	40	25.52	23.25

Calculating formula:

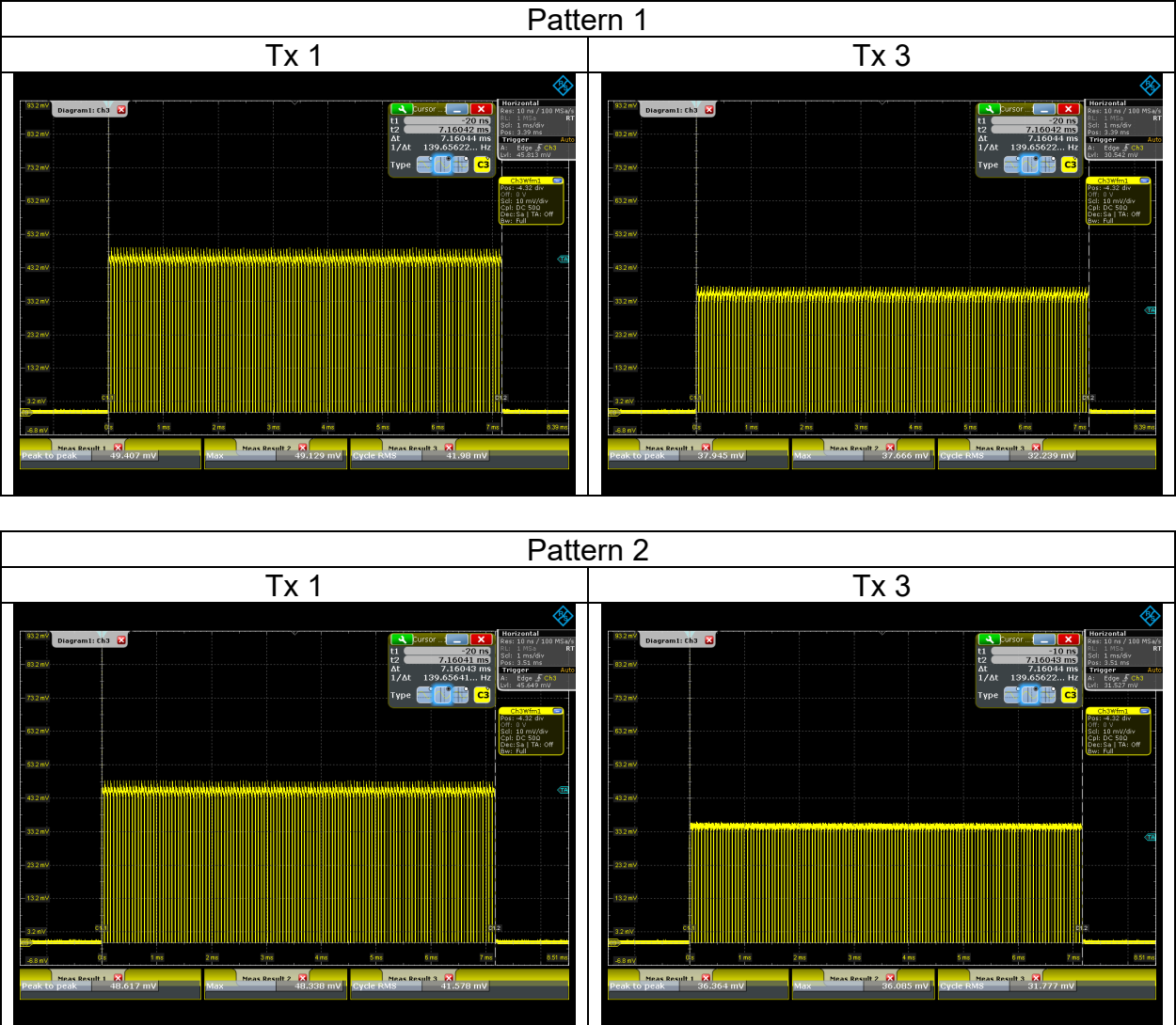
FSL (Free Space path Loss) = $10 * \log_{10}((4 * \pi * \text{Tested Distance} / \text{Lambda})^2)$

EIRP(Peak) = P/M Reading - Rx Ant. Gain - LNA Gain + FSL

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2020.

EIRP(Peak)

[Data]



Spurious Emissions (Below 40 GHz)

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 3	No. 2	No. 4
Date	December 6, 2023	December 11, 2023	December 11, 2023
Temperature / Humidity	22 deg. C / 43 % RH	21 deg. C / 46 % RH	22 deg. C / 40 % RH
Engineer	Junki Nagatomi (30 MHz to 1000 MHz, 26.5 GHz to 40 GHz)	Yuichiro Yamazaki (1 GHz to 26.5 GHz)	Junki Nagatomi (Below 30 MHz)
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.	43.6	22.5	-	13.5	7.1	32.2	11.0	-	40.0	-	29.0	-	
Hori.	47.8	22.8	-	12.0	7.2	32.2	9.8	-	40.0	-	30.2	-	
Hori.	73.9	24.1	-	6.4	7.6	32.1	6.0	-	40.0	-	34.0	-	
Hori.	94.4	24.6	-	9.4	7.8	32.1	9.7	-	43.5	-	33.9	-	
Hori.	98.4	33.3	-	10.1	7.9	32.1	19.1	-	43.5	-	24.4	-	
Hori.	104.7	24.2	-	11.1	8.0	32.1	11.1	-	43.5	-	32.4	-	
Hori.	1799.9	51.2	47.7	25.3	4.0	35.3	45.2	41.7	73.9	53.9	28.7	12.2	
Hori.	2399.9	54.3	52.0	27.6	4.3	34.9	51.3	49.0	73.9	53.9	22.6	4.9	
Hori.	2699.9	48.2	42.5	28.1	4.4	34.8	45.9	40.2	73.9	53.9	28.0	13.7	
Hori.	14399.5	46.9	39.6	40.4	-3.4	32.6	51.4	44.1	73.9	53.9	22.5	9.8	
Hori.	28799.1	47.8	37.3	43.7	-3.1	36.3	52.1	41.5	73.9	53.9	21.9	12.4	
Vert.	43.5	42.6	-	13.6	7.1	32.2	31.2	-	40.0	-	8.8	-	
Vert.	47.8	51.6	-	12.0	7.2	32.2	38.6	-	40.0	-	1.4	-	
Vert.	73.9	45.6	-	6.5	7.6	32.1	27.5	-	40.0	-	12.5	-	
Vert.	94.4	47.2	-	9.4	7.8	32.1	32.3	-	43.5	-	11.3	-	
Vert.	98.4	52.8	-	10.1	7.9	32.1	38.6	-	43.5	-	4.9	-	
Vert.	104.7	43.0	-	11.1	8.0	32.1	29.9	-	43.5	-	13.6	-	
Vert.	1799.9	50.9	47.4	25.3	4.0	35.3	44.9	41.4	73.9	53.9	29.0	12.6	
Vert.	2399.9	54.9	52.5	27.6	4.3	34.9	51.9	49.5	73.9	53.9	22.0	4.5	
Vert.	2699.9	45.6	36.8	28.1	4.4	34.8	43.3	34.5	73.9	53.9	30.6	19.4	
Vert.	14399.5	47.0	39.7	40.4	-3.4	32.6	51.5	44.2	73.9	53.9	22.4	9.7	
Vert.	28799.1	47.7	36.7	43.7	-3.1	36.3	51.9	41.0	73.9	53.9	22.0	12.9	

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

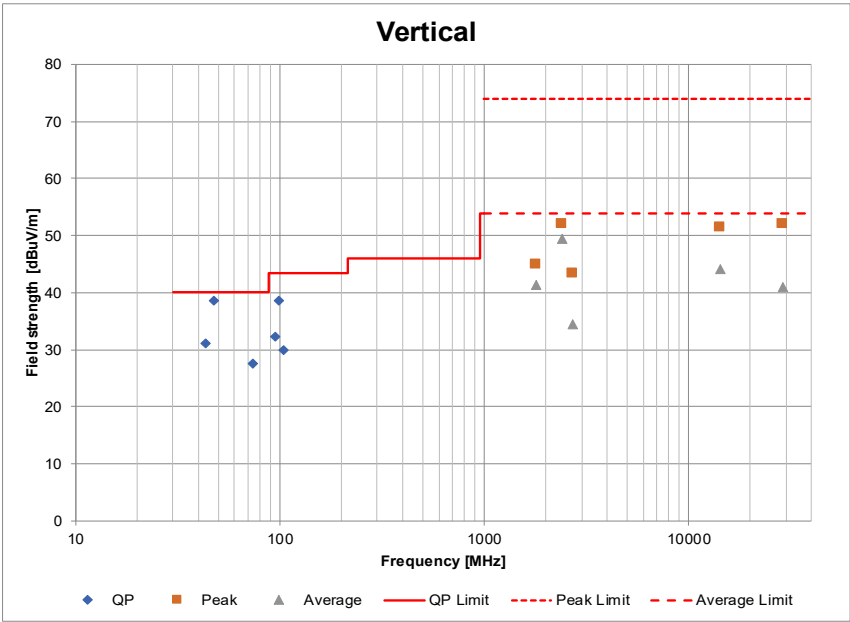
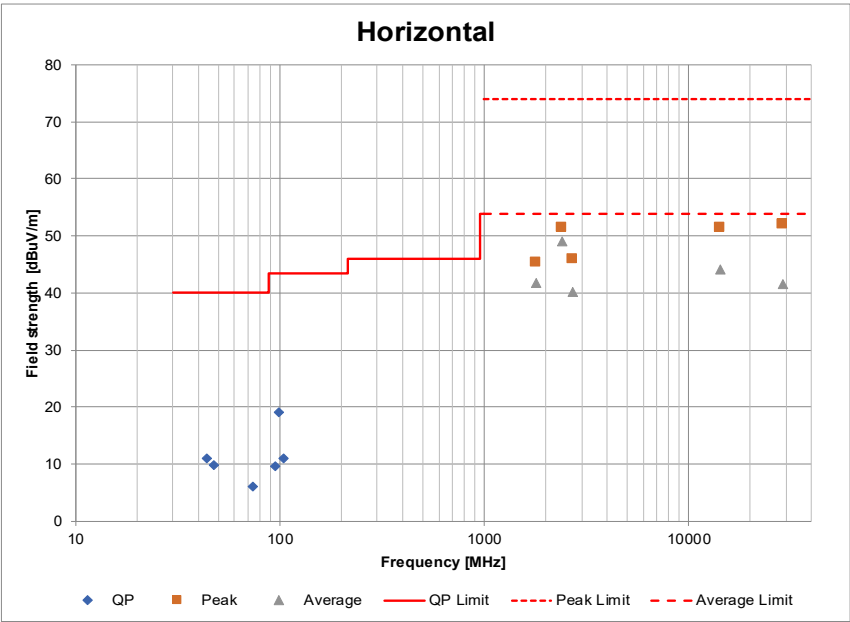
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

*QP detector was used up to 1GHz.

Distance factor:	1 GHz - 10 GHz	20log (3.75 m / 3.0 m) = 1.94 dB
	10 GHz - 40 GHz	20log (1.0 m / 3.0 m) = -9.5 dB

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

Test place	Ise EMC Lab.	No. 2	No. 4
Semi Anechoic Chamber	No. 3	December 11, 2023	December 11, 2023
Date	December 6, 2023	21 deg. C / 46 % RH	22 deg. C / 40 % RH
Temperature / Humidity	22 deg. C / 43 % RH	Yuichiro Yamazaki	Junki Nagatomi
Engineer	Junki Nagatomi (30 MH to 1000 MHz, 26.5 GHz to 40 GHz)	(1 GHz to 26.5 GHz)	(Below 30 MHz)
Mode	Transmission Pattern 1 (Normal operating mode)		



Spurious Emissions (Above 40 GHz)

Test place	Ise EMC Lab.	No. 3	No. 3
Semi Anechoic Chamber	No. 3	No. 3	No. 3
Date	December 7, 2023	December 8, 2023	December 10, 2023
Temperature / Humidity	22 deg. C / 40 % RH	20 deg. C / 38 % RH	22 deg. C / 42 % RH
Engineer	Junki Nagatomi	Junki Nagatomi	Junki Nagatomi
Mode	(40 GHz to 75 GHz)	(75 GHz to 110 GHz)	(110 GHz to 200 GHz)
	Transmission Pattern 1 (Normal operating mode)		

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

Freq. [GHz]	Reading (Peak) [dBm]	Rx Ant. Gain [dBi]	Filter Loss [dB]	LNA Gain [dB]	Mixer Conv. Loss [dB]	IF Amp. Gain [dB]	IF Cable Loss [dB]	Test Distance D [m]	FSL [dB]	EIRP						Remarks
										Result		Limit (Average) [dBm]	Margin (Average) [dB]	Limit (Peak) [dBm]	Margin (Peak) [dB]	
59.488	-91.32	23.70	0.00	25.45	45.90	0.00	0.00	0.75	65.44	-29.13	0.001221	10	39.13	13	42.13	NS
60.999	-79.93	23.80	0.00	25.03	46.02	0.00	0.00	0.75	65.65	-17.09	0.019557	10	27.09	13	30.09	NS
62.034	-91.33	23.80	0.00	24.55	45.86	0.00	0.00	0.75	65.80	-28.02	0.001579	10	38.02	13	41.02	NS
63.597	-91.33	23.95	0.00	24.45	47.21	0.00	0.00	0.75	66.02	-26.50	0.002238	10	36.50	13	39.50	NS
68.456	-91.27	24.24	0.00	22.50	48.00	0.00	0.00	0.75	66.66	-23.35	0.004629	10	33.35	13	36.35	NS

Calculation: FSL (Free Space path Loss) = $10 \cdot \log((4 \cdot \pi \cdot D / \lambda)^2)$
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 C63.10-2020.
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. [GHz]	Reading (Peak) [dBm]	Rx Ant. Gain [dBi]	Filter Loss [dB]	LNA Gain [dB]	Mixer Conv. Loss [dB]	IF Amp. Gain [dB]	IF Cable Loss [dB]	Test Distance D [m]	FSL [dB]	EIRP		Power density Result at 3 m (Peak) [pW/cm ²]	Limit		Margin		Remarks
										[dBm]	[mW]		Average [pW/cm ²]	Peak [pW/cm ²]	Average [dB]	Peak [dB]	
41.618	-56.26	21.28	0.00	32.28	0.00	0.00	7.78	1.00	64.83	-37.21	0.000190	0.17	90	9000	27.29	47.29	NS
49.390	-54.07	22.35	0.00	32.06	0.00	0.00	8.39	1.00	66.31	-33.78	0.000419	0.37	90	9000	23.85	43.85	NS
50.105	-67.34	22.90	0.00	26.35	46.99	32.09	0.07	0.75	63.94	-37.68	0.000171	0.15	90	9000	27.76	47.76	NS
72.218	-67.88	24.35	0.00	21.07	49.50	32.09	0.07	0.75	67.12	-28.70	0.001349	1.19	90	9000	18.78	38.78	NS
81.127	-58.37	23.40	0.48	34.92	40.89	31.97	0.10	0.50	64.60	-42.58	0.000055	0.05	90	9000	32.66	52.66	NS
87.267	-57.13	23.80	0.43	31.82	41.86	31.97	0.10	0.50	65.24	-37.09	0.000195	0.17	90	9000	27.17	47.17	NS
94.861	-56.75	24.25	0.31	34.02	42.80	31.97	0.10	0.50	65.96	-37.81	0.000165	0.15	90	9000	27.89	47.89	NS
100.820	-56.25	24.53	0.51	33.80	43.80	31.97	0.10	0.50	66.49	-35.65	0.000272	0.24	90	9000	25.72	45.72	NS
109.496	-56.99	24.85	1.65	20.90	45.70	31.97	0.10	0.50	67.21	-20.05	0.009879	8.73	90	9000	10.13	30.13	NS
117.681	-83.30	22.56	0.00	18.37	54.09	0.00	0.00	0.01	33.86	-36.29	0.000235	0.21	90	9000	26.37	46.37	NS
119.045	-84.15	22.61	0.00	18.70	51.96	0.00	0.00	0.01	33.96	-39.54	0.000111	0.10	90	9000	29.62	49.62	NS
129.020	-86.04	22.92	0.00	20.02	52.30	0.00	0.00	0.01	34.65	-42.03	0.000063	0.06	90	9000	32.10	52.10	NS
131.119	-86.25	22.98	0.00	19.82	52.39	0.00	0.00	0.01	34.80	-41.87	0.000065	0.06	90	9000	31.95	51.95	NS
141.496	-86.87	23.21	0.00	18.82	53.45	0.00	0.00	0.01	35.46	-39.99	0.000100	0.09	90	9000	30.07	50.07	NS
154.618	-89.00	23.37	0.00	17.29	56.30	0.00	0.00	0.01	36.23	-37.14	0.000193	0.17	90	9000	27.21	47.21	NS
161.883	-89.00	23.40	0.00	15.53	57.55	0.00	0.00	0.01	36.63	-33.75	0.000421	0.37	90	9000	23.83	43.83	NS
163.316	-89.47	23.40	0.00	15.27	59.37	0.00	0.00	0.01	36.70	-32.07	0.000621	0.55	90	9000	22.15	42.15	NS
176.702	-86.08	22.56	0.00	0.00	57.70	0.00	0.00	0.01	37.39	-13.55	0.044133	39.02	90	9000	3.63	23.63	NS
178.528	-85.33	22.60	0.00	0.00	57.29	0.00	0.00	0.01	37.48	-13.16	0.048305	42.71	90	9000	3.24	23.24	NS
192.982	-85.72	22.90	0.00	0.00	56.73	0.00	0.00	0.01	38.15	-13.74	0.042287	37.39	90	9000	3.81	23.81	NS
194.714	-86.72	22.93	0.00	0.00	57.83	0.00	0.00	0.01	38.23	-13.59	0.043759	38.69	90	9000	3.67	23.67	NS

Calculation: FSL (Free Space path Loss) = $10 \cdot \log((4 \cdot \pi \cdot D / \lambda)^2)$
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 / $(4 \cdot \pi \cdot 300^2)$

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2020.
The equipment were not used for factor 0 dB of the data sheets.

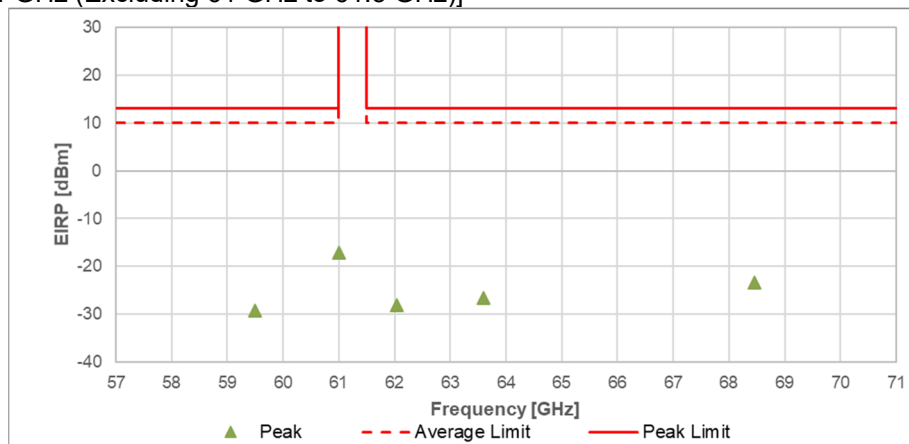
NS: No signal detected.

* The peak result is less than the average limit.

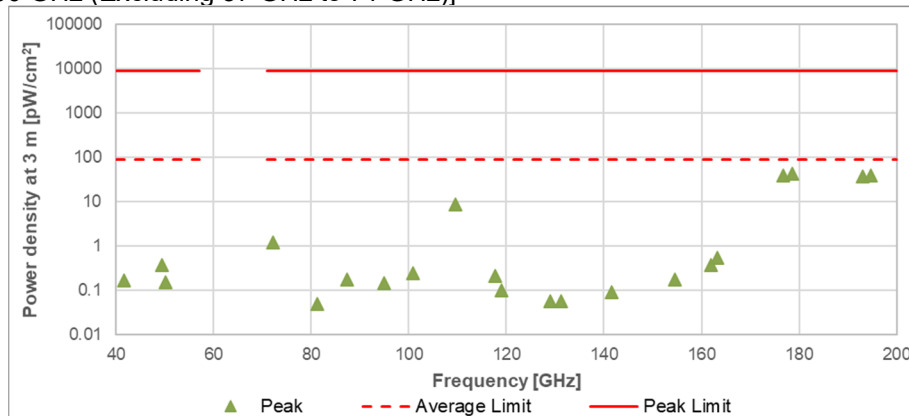
Spurious Emissions
(Above 40 GHz)
(Plot data, Worst case)

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 3	No. 3	No. 3
Date	December 7, 2023	December 8, 2023	December 10, 2023
Temperature / Humidity	22 deg. C / 40 % RH	20 deg. C / 38 % RH	22 deg. C / 42 % RH
Engineer	Junki Nagatomi	Junki Nagatomi	Junki Nagatomi
	(40 GHz to 75 GHz)	(75 GHz to 110 GHz)	(110 GHz to 200 GHz)
Mode	Transmission Pattern 1 (Normal operating mode)		

[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.	No. 2	No. 4
Semi Anechoic Chamber	No. 3	December 11, 2023	December 11, 2023
Date	December 6, 2023	December 11, 2023	December 11, 2023
Temperature / Humidity	22 deg. C / 43 % RH	21 deg. C / 46 % RH	22 deg. C / 40 % RH
Engineer	Junki Nagatomi	Yuichiro Yamazaki	Junki Nagatomi
	(30 MHz to 1000 MHz, 26.5 GHz to 40 GHz)	(1 GHz to 26.5 GHz)	(Below 30 MHz)
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.	43.6	23.3	-	13.5	7.1	32.2	11.8	-	40.0	-	28.2	-	
Hori.	47.8	32.5	-	12.0	7.2	32.2	19.5	-	40.0	-	20.5	-	
Hori.	73.9	26.1	-	6.4	7.6	32.1	8.0	-	40.0	-	32.0	-	
Hori.	94.4	30.1	-	9.4	7.8	32.1	15.2	-	43.5	-	28.4	-	
Hori.	98.4	33.8	-	10.1	7.9	32.1	19.6	-	43.5	-	23.9	-	
Hori.	104.8	27.4	-	11.1	8.0	32.1	14.3	-	43.5	-	29.2	-	
Hori.	1799.9	51.4	47.9	25.3	4.0	35.3	45.4	41.9	73.9	53.9	28.5	12.0	
Hori.	2399.9	54.7	52.3	27.6	4.3	34.9	51.7	49.3	73.9	53.9	22.2	4.6	
Hori.	2699.9	47.9	41.8	28.1	4.4	34.8	45.6	39.5	73.9	53.9	28.3	14.4	
Hori.	14399.5	47.2	39.3	40.4	-3.4	32.6	51.7	43.8	73.9	53.9	22.2	10.1	
Hori.	28799.1	45.4	35.1	43.7	-3.1	36.3	49.6	39.3	73.9	53.9	24.3	14.6	
Vert.	43.8	41.8	-	13.5	7.2	32.2	30.3	-	40.0	-	9.8	-	
Vert.	47.8	50.8	-	12.0	7.2	32.2	37.8	-	40.0	-	2.2	-	
Vert.	73.9	43.9	-	6.5	7.6	32.1	25.8	-	40.0	-	14.2	-	
Vert.	94.4	47.9	-	9.4	7.8	32.1	33.0	-	43.5	-	10.6	-	
Vert.	98.5	52.5	-	10.1	7.9	32.1	38.3	-	43.5	-	5.2	-	
Vert.	104.7	43.6	-	11.1	8.0	32.1	30.5	-	43.5	-	13.0	-	
Vert.	1799.9	51.4	47.7	25.3	4.0	35.3	45.4	41.7	73.9	53.9	28.5	12.2	
Vert.	2399.9	54.8	52.6	27.6	4.3	34.9	51.8	49.6	73.9	53.9	22.1	4.3	
Vert.	2699.9	45.6	36.6	28.1	4.4	34.8	43.3	34.3	73.9	53.9	30.6	19.6	
Vert.	14399.5	47.1	39.6	40.4	-3.4	32.6	51.6	44.1	73.9	53.9	22.3	9.9	
Vert.	28799.1	46.7	35.9	43.7	-3.1	36.3	50.9	40.1	73.9	53.9	23.0	13.8	

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 $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$
 10 GHz - 40 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer

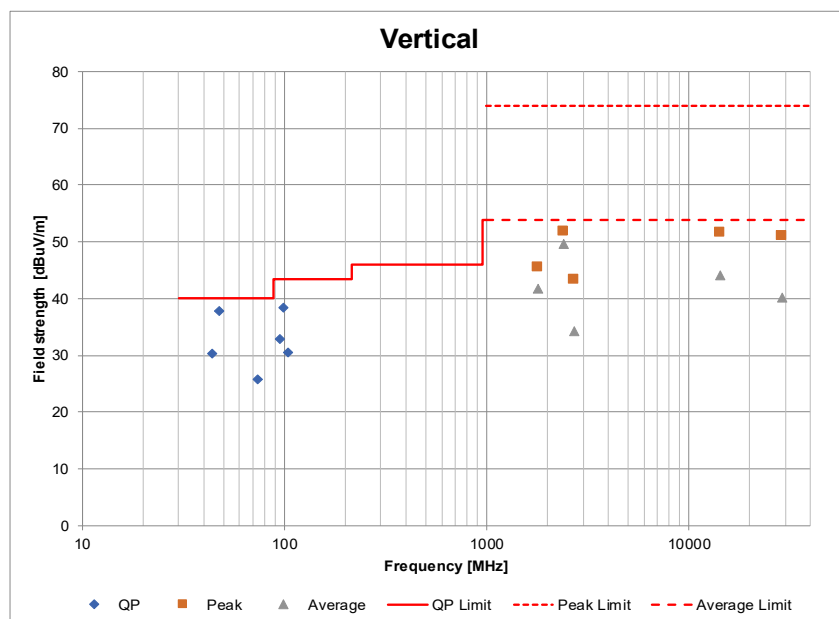
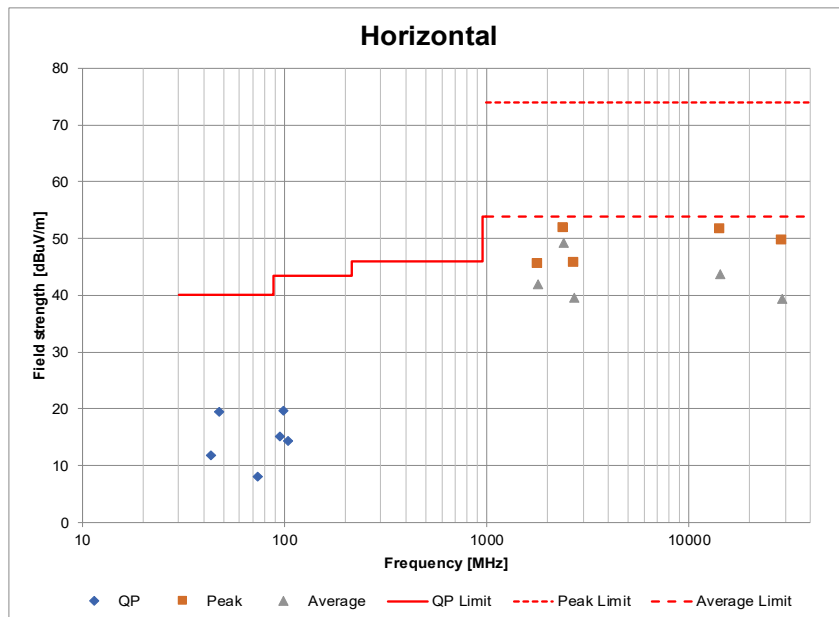
Ise EMC Lab.
No. 3
December 6, 2023
22 deg. C / 43 % RH
Junki Nagatomi
(30 MHz to 1000 MHz,
26.5 GHz to 40 GHz)

No. 2
December 11, 2023
21 deg. C / 46 % RH
Yuichiro Yamazaki
(1 GHz to 26.5 GHz)

No. 4
December 11, 2023
22 deg. C / 40 % RH
Junki Nagatomi
(Below 30 MHz)

Mode

Transmission Pattern 2 (Normal operating mode)



Spurious Emissions (Above 40 GHz)

Test place	Ise EMC Lab.	No. 3	No. 3
Semi Anechoic Chamber	No. 3	December 8, 2023	December 8, 2023
Date	December 8, 2023	December 8, 2023	December 10, 2023
Temperature / Humidity	22 deg. C / 40 % RH	20 deg. C / 38 % RH	22 deg. C / 42 % RH
Engineer	Junki Nagatomi	Junki Nagatomi	Junki Nagatomi
	(40 GHz to 75 GHz)	(75 GHz to 110 GHz)	(110 GHz to 200 GHz)
Mode	Transmission Pattern 2 (Normal operating mode)		

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

Tx Pattern2										ERP							Remarks
Freq.	Reading (Peak)	Rx Ant. Gain	Filter Loss	LNA Gain	Mixer Conv. Loss	IF Amp. Gain	IF Cable Loss	Test Distance D	FSL	Result		Limit (Average)	Margin (Average)	Limit (Peak)	Margin (Peak)		
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[dBm]	[dB]	[dBm]	[dB]		
59.265	-91.52	23.71	0.00	25.49	45.98	0.00	0.00	0.75	65.40	-29.34	0.001164	10	39.34	13	42.34	NS	
60.443	-91.70	23.73	0.00	25.22	45.85	0.00	0.00	0.75	65.57	-29.23	0.001194	10	39.23	13	42.23	NS	
61.500	-82.03	23.79	0.00	24.79	45.93	0.00	0.00	0.75	65.73	-18.95	0.012738	10	28.95	13	31.95	NS	
66.111	-90.93	24.06	0.00	23.39	47.66	0.00	0.00	0.75	66.35	-24.37	0.003656	10	34.37	13	37.37	NS	
69.215	-91.60	24.33	0.00	21.81	48.29	0.00	0.00	0.75	66.75	-22.70	0.005369	10	32.70	13	35.70	NS	

Calculation: FSL (Free Space path Loss) = $10 \cdot \log((4 \cdot \pi \cdot D / \lambda)^2)$
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 C63.10-2020.
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		Margin		Remarks
										[dBm]	[mW]	[pW/cm ²]	Average	Peak	Average	Peak	
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[pW/cm ²]	[pW/cm ²]	[pW/cm ²]	[dB]	[dB]	
41.538	-56.13	21.29	0.00	32.45	0.00	0.00	7.76	1.00	64.81	-37.30	0.000186	0.16	90	9000	27.38	47.38	NS
48.390	-54.09	22.20	0.00	32.55	0.00	0.00	8.19	1.00	66.14	-34.52	0.000353	0.31	90	9000	24.59	44.59	NS
50.217	-66.62	22.88	0.00	26.35	46.91	32.09	0.07	0.75	63.96	-37.00	0.000200	0.18	90	9000	27.08	47.08	NS
71.595	-67.78	24.36	0.00	20.93	49.17	32.09	0.07	0.75	67.04	-28.88	0.001295	1.14	90	9000	18.96	38.96	NS
78.207	-58.17	23.16	0.56	37.03	39.87	31.97	0.10	0.50	64.29	-45.52	0.000028	0.02	90	9000	35.59	55.59	NS
87.719	-56.77	23.86	0.44	32.41	41.74	31.97	0.10	0.50	65.28	-37.44	0.000180	0.16	90	9000	27.52	47.52	NS
95.739	-56.99	24.22	0.39	34.76	42.91	31.97	0.10	0.50	66.04	-38.49	0.000142	0.13	90	9000	28.57	48.57	NS
101.731	-56.05	24.50	0.35	33.04	43.65	31.97	0.10	0.50	66.57	-34.89	0.000324	0.29	90	9000	24.97	44.97	NS
109.406	-56.78	24.85	1.57	21.05	45.48	31.97	0.10	0.50	67.20	-20.29	0.009348	8.27	90	9000	10.37	30.37	NS
117.603	-84.40	22.56	0.00	18.31	54.03	0.00	0.00	0.01	33.85	-37.39	0.000182	0.16	90	9000	27.47	47.47	NS
120.145	-84.66	22.65	0.00	18.58	50.38	0.00	0.00	0.01	34.04	-41.47	0.000071	0.06	90	9000	31.55	51.55	NS
128.995	-85.69	22.92	0.00	20.02	52.32	0.00	0.00	0.01	34.65	-41.66	0.000068	0.06	90	9000	31.73	51.73	NS
131.927	-86.00	23.00	0.00	19.06	50.85	0.00	0.00	0.01	34.85	-42.36	0.000058	0.05	90	9000	32.43	52.43	NS
143.278	-87.75	23.24	0.00	18.78	53.98	0.00	0.00	0.01	35.57	-40.22	0.000095	0.08	90	9000	30.30	50.30	NS
148.695	-88.53	23.31	0.00	17.93	54.86	0.00	0.00	0.01	35.89	-39.02	0.000125	0.11	90	9000	29.09	49.09	NS
157.559	-89.62	23.38	0.00	17.12	56.85	0.00	0.00	0.01	36.39	-36.88	0.000205	0.18	90	9000	26.95	46.95	NS
163.169	-89.46	23.40	0.00	15.34	59.22	0.00	0.00	0.01	36.69	-32.29	0.000591	0.52	90	9000	22.36	42.36	NS
177.338	-86.79	22.57	0.00	0.00	56.83	0.00	0.00	0.01	37.42	-15.11	0.030802	27.24	90	9000	5.19	25.19	NS
178.318	-85.84	22.59	0.00	0.00	56.76	0.00	0.00	0.01	37.47	-14.21	0.037972	33.57	90	9000	4.28	24.28	NS
190.779	-85.71	22.86	0.00	0.00	57.48	0.00	0.00	0.01	38.05	-13.04	0.049675	43.92	90	9000	3.12	23.12	NS
194.580	-86.93	22.93	0.00	0.00	57.39	0.00	0.00	0.01	38.22	-14.24	0.037651	33.29	90	9000	4.32	24.32	NS

Calculation: FSL (Free Space path Loss) = $10 \cdot \log((4 \cdot \pi \cdot D / \lambda)^2)$
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 * π * 300²)

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2020.
The equipment were not used for factor 0 dB of the data sheets.

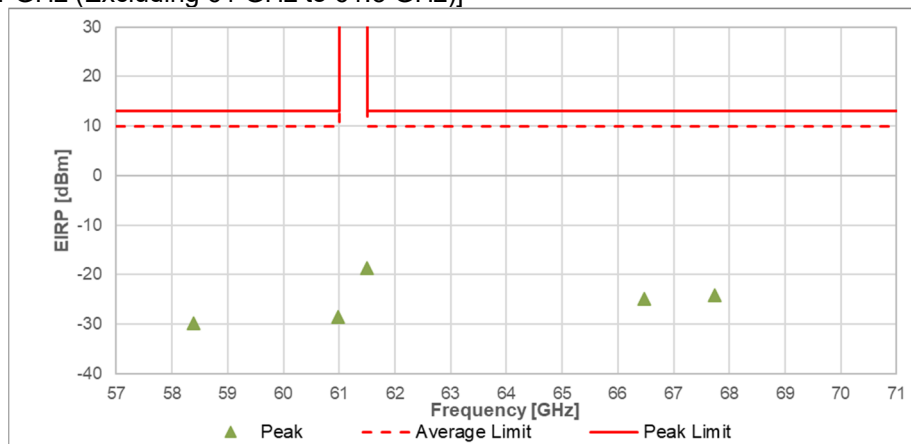
NS: No signal detected.

* The peak result is less than the average limit.

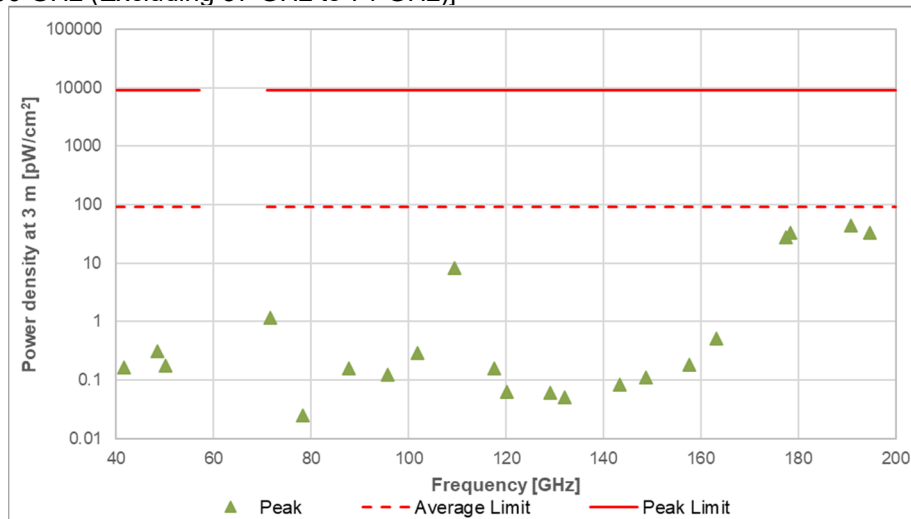
Spurious Emissions
(Above 40 GHz)
(Plot data, Worst case)

Test place	Ise EMC Lab.	No. 3	No. 3
Semi Anechoic Chamber	No. 3	No. 3	No. 3
Date	December 8, 2023	December 8, 2023	December 10, 2023
Temperature / Humidity	22 deg. C / 40 % RH	20 deg. C / 38 % RH	22 deg. C / 42 % RH
Engineer	Junki Nagatomi	Junki Nagatomi	Junki Nagatomi
	(40 GHz to 75 GHz)	(75 GHz to 110 GHz)	(110 GHz to 200 GHz)
Mode	Transmission Pattern 2 (Normal operating mode)		

[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 December 10, 2023
Temperature / Humidity 23 deg. C / 37 % RH
Engineer Yuichiro Yamazaki
Mode Transmission Pattern 1 (Normal operating mode)

[20 dB Bandwidth]

Test Condition		Center frequency [GHz]	Frequency error [MHz]	20 dB Bandwidth [MHz]	20 dB Bandwidth		Remarks
Temperature [deg. C]	Power Supply [V]				The lower frequency [GHz]	The Upper frequency [GHz]	
75	12.0	61.128	1.622	246.820	61.006	61.253	Customer requested temperature
50	12.0	61.128	2.268	246.765	61.007	61.254	
40	12.0	61.128	2.728	246.811	61.007	61.254	
30	12.0	61.128	3.248	246.594	61.008	61.255	
20	12.0	61.128	3.905	246.371	61.009	61.255	
20	10.2	61.128	3.904	246.268	61.009	61.255	85 % of the rated voltage, DC 12 V * 0.85
20	13.8	61.128	3.934	246.704	61.009	61.255	115 % of the rated voltage, DC 12 V * 1.15
10	12.0	61.128	4.902	246.099	61.010	61.256	
0	12.0	61.128	5.635	246.068	61.011	61.257	
-10	12.0	61.128	6.395	245.887	61.011	61.257	
-20	12.0	61.128	6.898	246.507	61.012	61.258	
-40	12.0	61.128	7.672	246.463	61.012	61.259	Customer requested temperature

Fundamental emissions were contained within the frequency band 61.0 GHz to 61.5 GHz during all conditions of operation.

Calculation:

The lower frequency = Center frequency + Frequency error – 20 dB Bandwidth / 2

The higher frequency = Center frequency + Frequency error + 20 dB Bandwidth / 2

[99 % Occupied Bandwidth]

Test Condition		Center frequency [GHz]	Frequency error [MHz]	99% OBW [MHz]	99% OBW		Remarks
Temperature [deg. C]	Power Supply [V]				The lower frequency [GHz]	The Upper frequency [GHz]	
75	12.0	61.128	1.622	232.206	61.014	61.246	Customer requested temperature
50	12.0	61.128	2.268	232.150	61.014	61.246	
40	12.0	61.128	2.728	232.034	61.015	61.247	
30	12.0	61.128	3.248	231.994	61.015	61.247	
20	12.0	61.128	3.905	232.014	61.016	61.248	
20	10.2	61.128	3.904	232.004	61.016	61.248	85 % of the rated voltage, DC 12 V * 0.85
20	13.8	61.128	3.934	232.009	61.016	61.248	115 % of the rated voltage, DC 12 V * 1.15
10	12.0	61.128	4.902	231.913	61.017	61.249	
0	12.0	61.128	5.635	231.961	61.018	61.250	
-10	12.0	61.128	6.395	231.923	61.018	61.250	
-20	12.0	61.128	6.898	232.081	61.019	61.251	
-40	12.0	61.128	7.672	231.974	61.020	61.252	Customer requested temperature

Fundamental emissions were contained within the frequency band 61.0 GHz to 61.5 GHz during all conditions of operation.

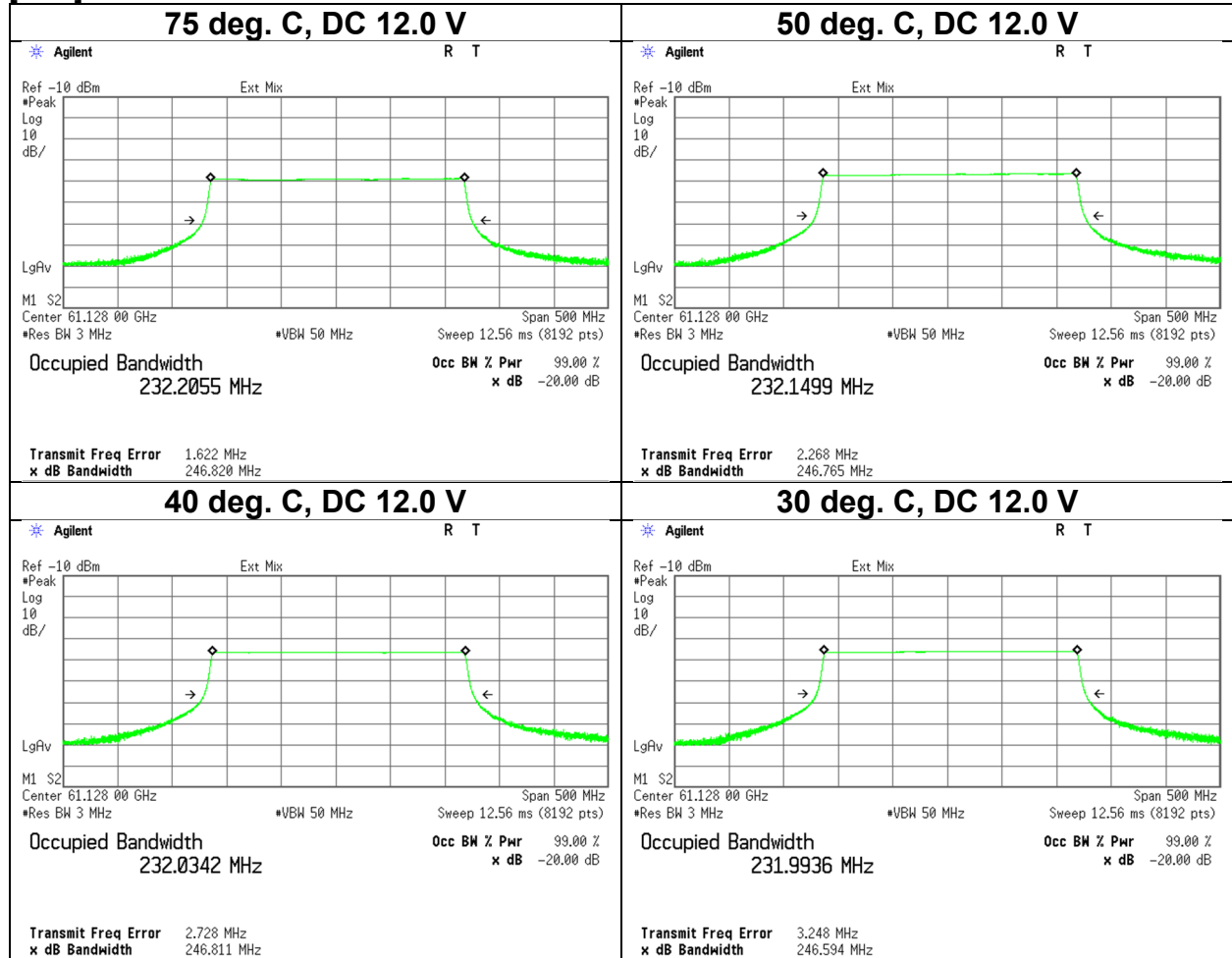
Calculation:

The Lower frequency = Center frequency + Frequency error – 99 % OBW / 2

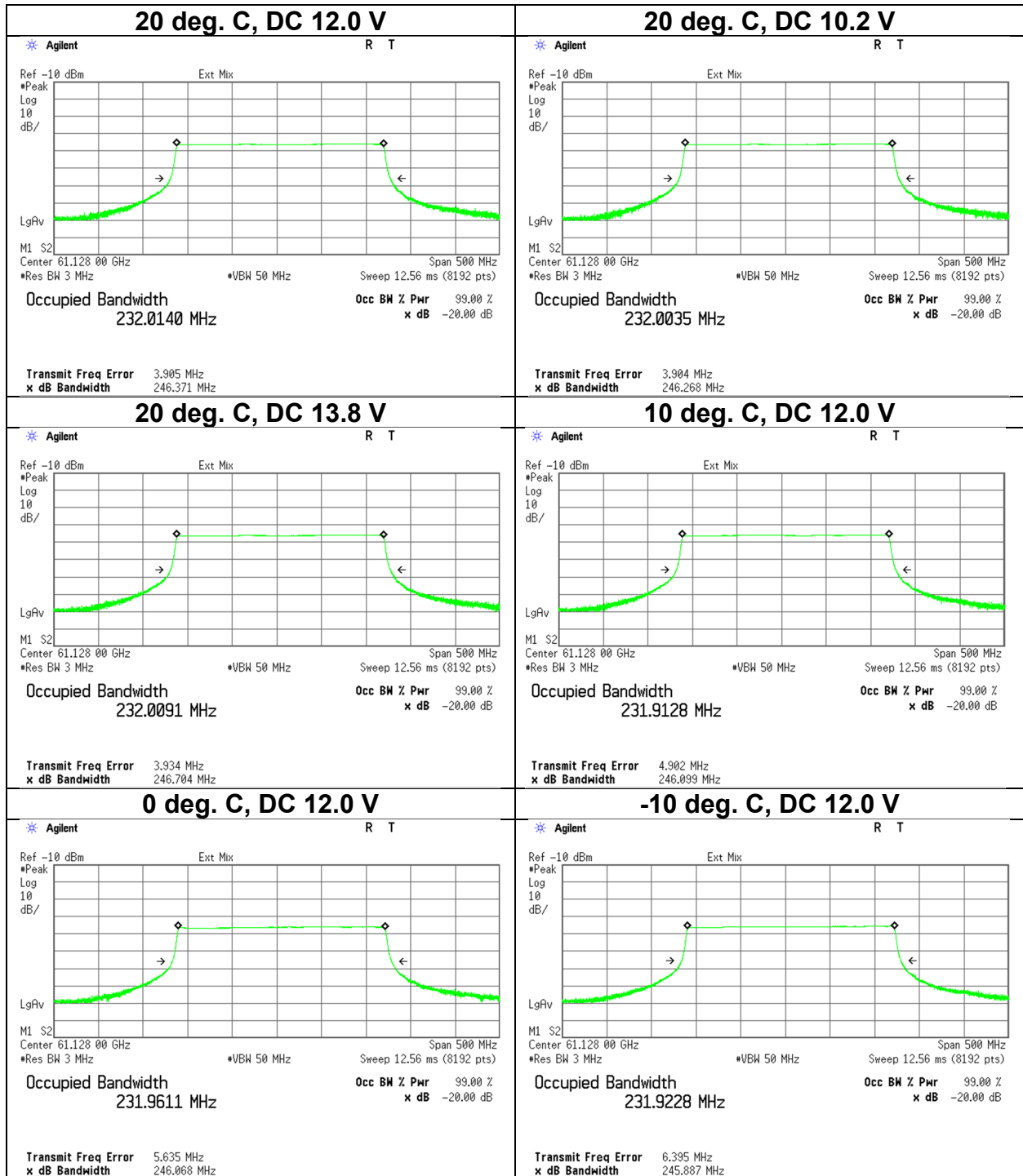
The Upper frequency = Center frequency + Frequency error + 99 % OBW / 2

Frequency Stability

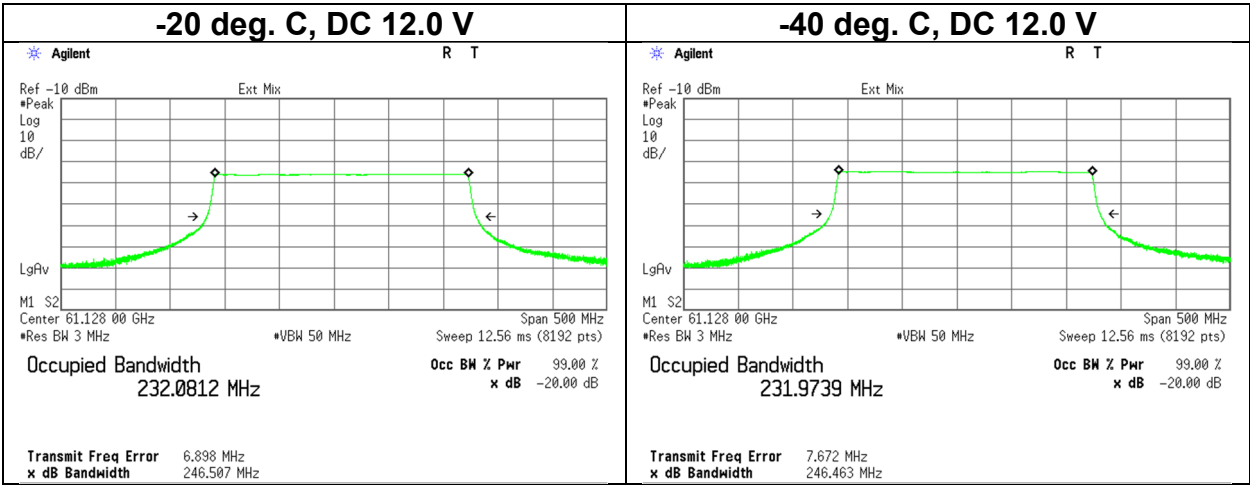
[Data]



Frequency Stability



Frequency Stability



Frequency Stability

Test place Ise EMC Lab. No. 6 Measurement Room
Date December 10, 2023
Temperature / Humidity 23 deg. C / 37 % RH
Engineer Yuichiro Yamazaki
Mode Transmission Pattern 2 (Normal operating mode)

[20 dB Bandwidth]

Test Condition		Center frequency [GHz]	Frequency error [MHz]	20 dB Bandwidth [MHz]	20 dB Bandwidth		Remarks
Temperature [deg. C]	Power Supply [V]				The lower frequency [GHz]	The Upper frequency [GHz]	
75	12.0	61.360	1.551	246.703	61.238	61.485	Customer requested temperature
50	12.0	61.360	2.044	246.325	61.239	61.485	
40	12.0	61.360	2.742	246.825	61.239	61.486	
30	12.0	61.360	3.170	246.801	61.240	61.487	
20	12.0	61.360	3.729	246.446	61.241	61.487	
20	10.2	61.360	3.714	246.332	61.241	61.487	85 % of the rated voltage, DC 12 V * 0.85
20	13.8	61.360	3.744	246.303	61.241	61.487	115 % of the rated voltage, DC 12 V * 1.15
10	12.0	61.360	4.587	246.441	61.241	61.488	
0	12.0	61.360	5.391	246.504	61.242	61.489	
-10	12.0	61.360	6.003	246.024	61.243	61.489	
-20	12.0	61.360	6.691	245.950	61.244	61.490	
-40	12.0	61.360	7.593	246.347	61.244	61.491	Customer requested temperature

Fundamental emissions were contained within the frequency band 61.0 GHz to 61.5 GHz during all conditions of operation.

Calculation:

The lower frequency = Center frequency + Frequency error – 20 dB Bandwidth / 2

The higher frequency = Center frequency + Frequency error + 20 dB Bandwidth / 2

[99 % Occupied Bandwidth]

Test Condition		Center frequency [GHz]	Frequency error [MHz]	20 dB Bandwidth [MHz]	20 dB Bandwidth		Remarks
Temperature [deg. C]	Power Supply [V]				The lower frequency [GHz]	The Upper frequency [GHz]	
75	12.0	61.360	1.551	231.966	61.246	61.478	Customer requested temperature
50	12.0	61.360	2.044	232.013	61.246	61.478	
40	12.0	61.360	2.742	232.214	61.247	61.479	
30	12.0	61.360	3.170	232.198	61.247	61.479	
20	12.0	61.360	3.729	232.096	61.248	61.480	
20	10.2	61.360	3.714	232.088	61.248	61.480	85 % of the rated voltage, DC 12 V * 0.85
20	13.8	61.360	3.744	232.094	61.248	61.480	115 % of the rated voltage, DC 12 V * 1.15
10	12.0	61.360	4.587	232.005	61.249	61.481	
0	12.0	61.360	5.391	232.005	61.249	61.481	
-10	12.0	61.360	6.003	231.999	61.250	61.482	
-20	12.0	61.360	6.691	231.951	61.251	61.483	
-40	12.0	61.360	7.593	232.011	61.252	61.484	Customer requested temperature

Fundamental emissions were contained within the frequency band 61.0 GHz to 61.5 GHz during all conditions of operation.

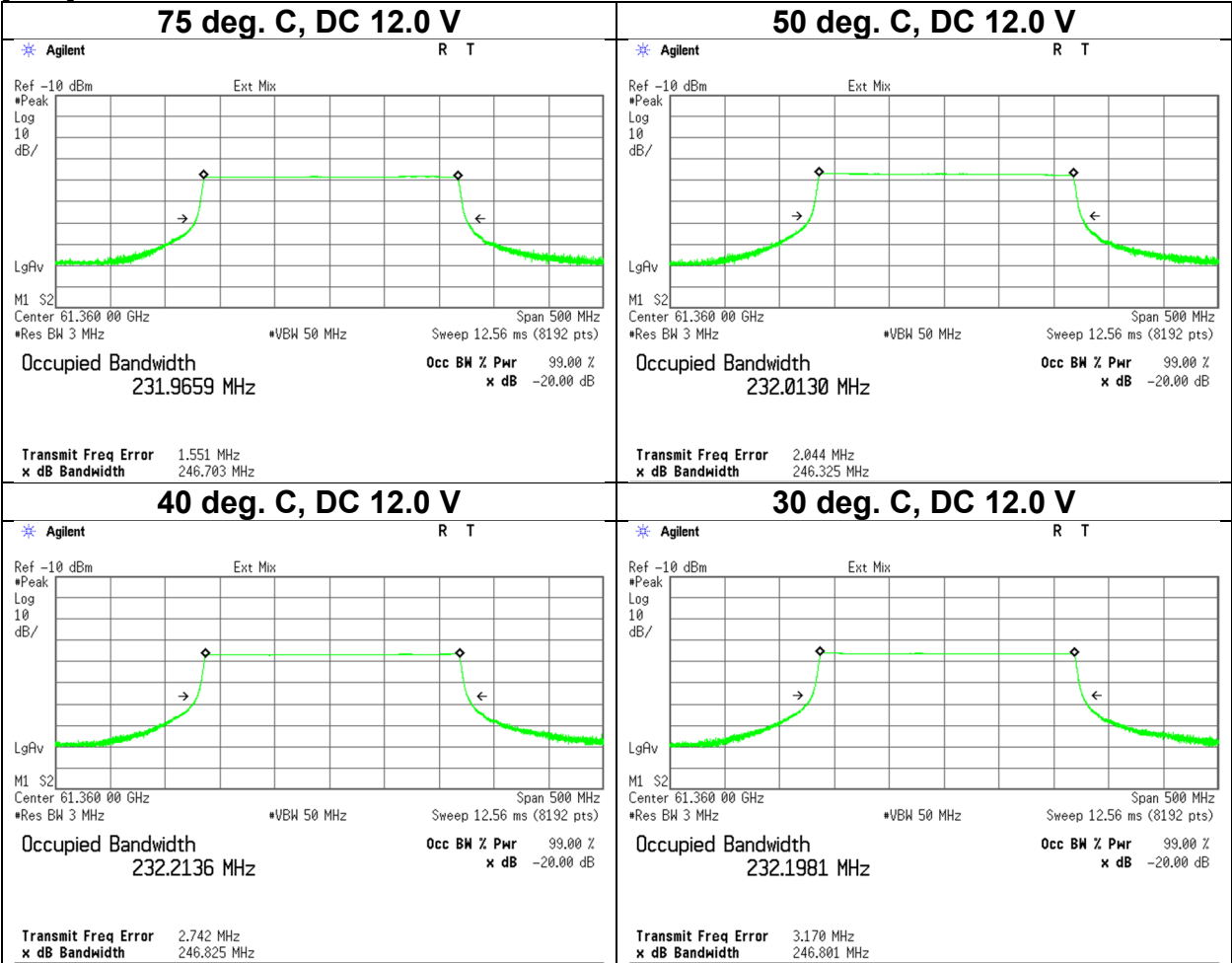
Calculation:

The Lower frequency = Center frequency + Frequency error – 99 % OBW / 2

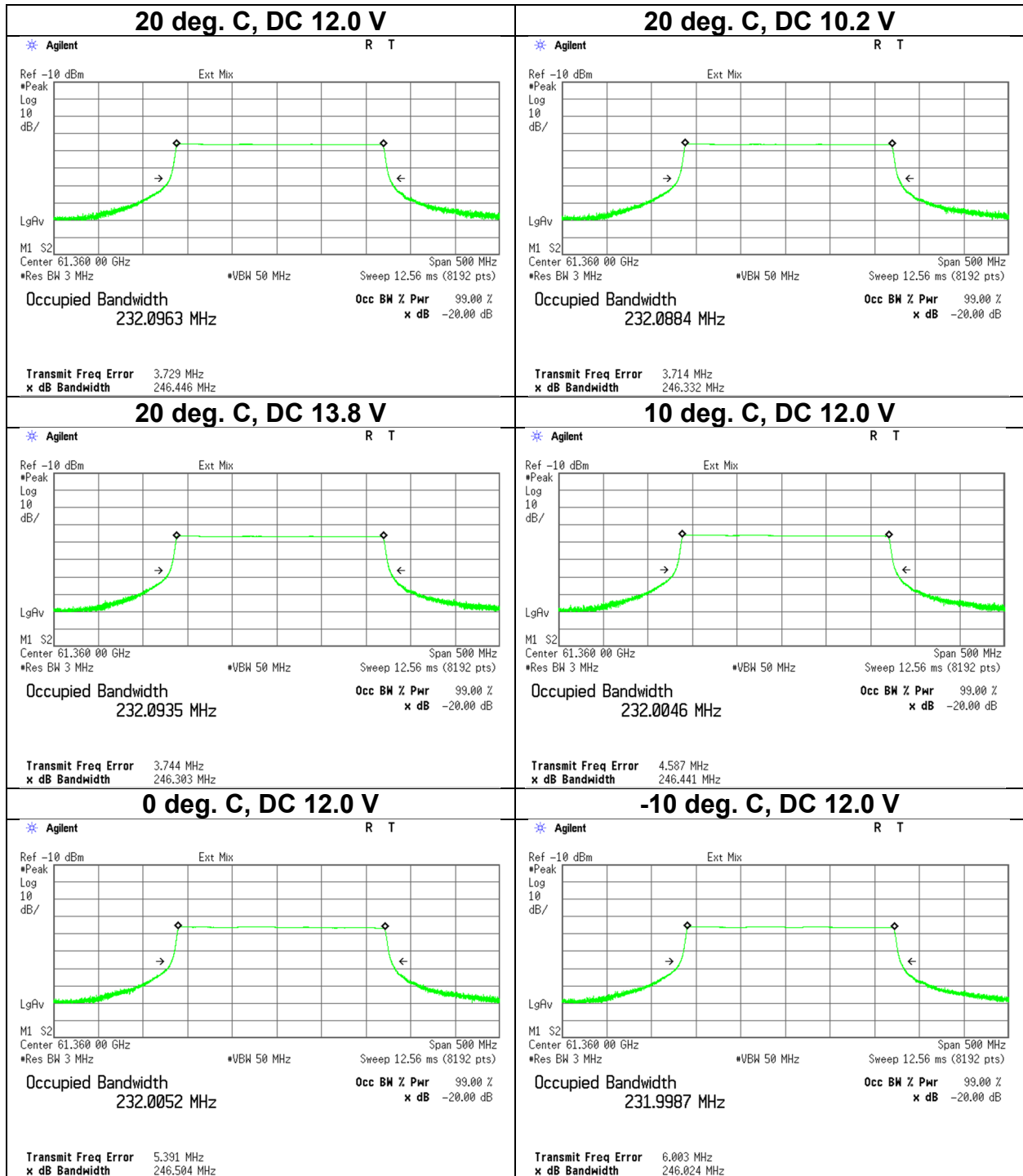
The Upper frequency = Center frequency + Frequency error + 99 % OBW / 2

Frequency Stability

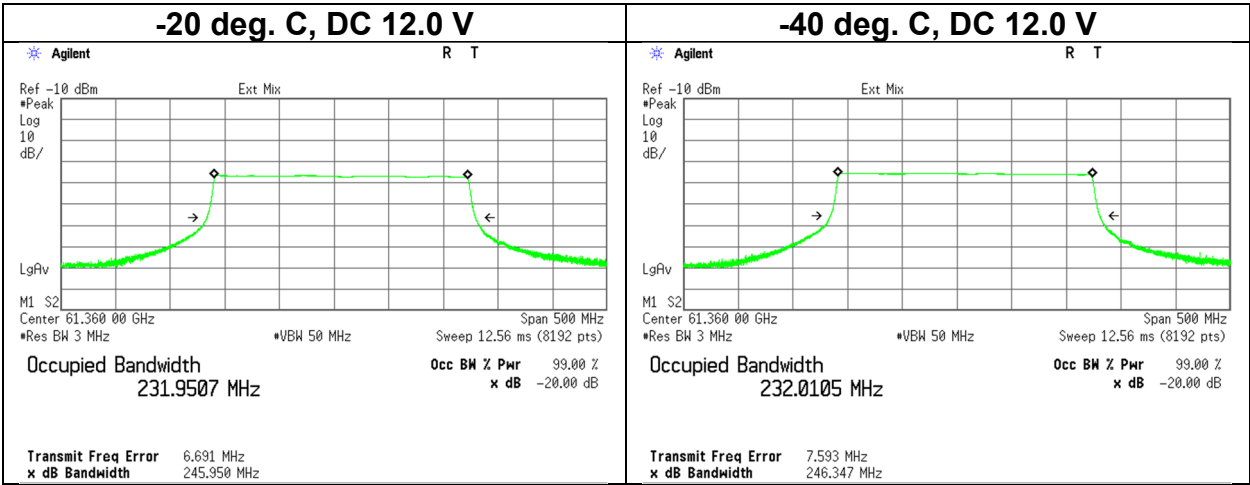
[Data]



Frequency Stability



Frequency Stability



Group Instillation

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	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/421-010/sucoform141-PE/RFM-E121(SW)	-/04178	06/27/2023	12
CE	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	12/08/2023	12
CE	141357	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-729	07/05/2023	12
CE	141358	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-730	07/13/2023	12
CE	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/18/2023	12
CE	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/13/2023	12
CE	141936	Terminator	TME	CT-01BP	-	12/04/2023	12
CE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	05/17/2023	12
CE	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	04/10/2023	12
CE	142011	AC4 Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2022	24
CE	142230	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
CE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/421-010/sucoform141-PE/RFM-E121(SW)	-/04178	06/27/2023	12
RE	141226	Microwave Cable	Junkosha	MMX221-00500DMSDMS	1502S304	03/03/2023	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/10/2023	12
RE	141323	Coaxial cable	UL Japan	-	-	09/10/2023	12
RE	141326	Microwave Cable	Suhner	SUCOFLEX101	2874(1m) / 2877(5m)	03/07/2023	12
RE	141328	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	04/10/2023	12
RE	141331	Attenuator(6dB)	TME	UFA-01	-	02/01/2023	12
RE	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	VHA 91031302	08/10/2023	12
RE	141503	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	06/23/2023	12
RE	141504	Horn Antenna 26.5-40GHz	EMCO	3160-10	1150	09/21/2023	12
RE	141512	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	254	10/17/2023	12
RE	141517	Horn Antenna 26.5-40GHz	ETS-Lindgren	3160-10	152399	11/20/2023	12
RE	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	01/17/2023	12
RE	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/18/2023	12
RE	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/13/2023	12
RE	141558	Digital Tester(TRUE RMS MULTIMETER)	Fluke Corporation	115	17930030	05/29/2023	12
RE	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/13/2023	12
RE	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/13/2023	12
RE	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	02/14/2023	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/07/2023	12
RE	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	04/05/2023	12
RE	141801	Power Meter	Keysight Technologies Inc	E4417A	GB41290639	04/11/2023	12
RE	141892	Signal Generator	Keysight Technologies Inc	E8257D	US49280311	11/24/2023	12
RE	141901	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250080	01/16/2023	12
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	05/17/2023	12
RE	141962	Digital Oscilloscope	Rohde & Schwarz	RTO1004	200355	05/16/2023	12

Test equipment (2/2)

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	141978	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180899	03/06/2023	12
RE	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/30/2022	24
RE	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	10/20/2023	12
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/23/2022	24
RE	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2022	24
RE	142013	AC3_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	10/18/2023	12
RE	142026	Diplexer	OML INC.	DPL26	-	-	-
RE	142032	Microwave Cable	Huber+Suhner	SUCOFLEX102	37511/2	-	-
RE	142033	Microwave Cable	Huber+Suhner	SUCOFLEX102	37512/2	-	-
RE	142039	Horn Antenna	Custom Microwave Inc.	HO4R	-	09/05/2023	12
RE	142041	Horn Antenna	Oshima Prototype Engineering Co.	A16-187	1	09/05/2023	12
RE	142047	Preselected Millimeter Mixer	Keysight Technologies Inc	11974V-E01	3001A00412	11/14/2023	12
RE	142049	Harmonic Mixer	OML INC.	M06HWD	D100709-1	12/04/2023	12
RE	142053	Harmonic Mixer	OML INC.	M04HWD	Y100709-1	05/16/2023	12
RE	142055	Power Amplifier	SAGE Millimeter, Inc.	SBP-5037532015-1515-N1	11599-01	03/22/2023	12
RE	142152	Loop Antenna	Rohde & Schwarz	HFH2-Z2	836553/009	10/17/2023	12
RE	142183	Measure	KOMELON	KMC-36	-	10/20/2023	12
RE	142225	Tape Measure	ASKUL	-	-	-	-
RE	142228	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
RE	142230	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
RE	142238	Power sensor	Keysight Technologies Inc	V8486A	MY44420112	06/16/2023	12
RE	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/23/2023	12
RE	142528	Detector	Millitech	DET-15-RPFW0	34	-	-
RE	142545	Fullband Tripler	Millitech	MUT-15-LF000	19	-	-
RE	142590	Waveguide Isolator	Keysight Technologies Inc	V365A	60004	-	-
RE	142592	Waveguide Isolator	Millitech	FBI-15-RSES0	1858	-	-
RE	151897	Microwave Cable	Huber+Suhner	SF101EA/11PC24/11PC24/2.5M	SN MY1726/1EA	04/11/2023	12
RE	159919	Power Amplifier	SAGE Millimeter, Inc.	SBP-4035033018-2F2F-S1	12559-01	06/19/2023	12
RE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	180634	Horn Antenna	SAGE Millimeter, Inc.	SAZ-2410-15-S1	17343-01	06/20/2023	12
RE	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/17/2022	12
RE	207745	Coaxial Cable	UL Japan	-	-	05/16/2023	12
RE	237927	Broadband Amplifier	ERAVANT	SBB-0115033218-2F2F-E3	27554-01	07/10/2023	12
RE	240023	Microwave Cable	Huber+Suhner	SF126E/11PC35/11PC35/1000MM,5000MM	537060/126E / 537075/126E	09/08/2023	12
RE	238712	Double Ridge Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	687	08/10/2023	12

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

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

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

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

Test item: CE: Conducted Emission, RE: Radiated Emission