RADIO TEST REPORT

Test Report No. 15163575M-B

Customer	**ALPS ALPINE CO., LTD.**
Description of EUT	**Connected Unit for EV**
Model Number of EUT	**AH00EV**
FCC ID	**A269ZUA172**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied**
Issue Date	**July 9, 2024**
Remarks	**Bluetooth (BR / EDR) parts**

Representative Test Engineer	Approved By
Kazuhiro Ando Engineer	Kenichi Suda Manager

CERTIFICATE 1266.01

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☒ 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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REVISION HISTORY

Original Test Report No.: 15163575M-B

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15163575M-B	July 9, 2024	-

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	ALPS ALPINE CO., LTD.
Address	20-1 Yoshima Industrial Park, Iwaki, Fukushima, 970-1192 Japan
Telephone Number	+81-246-36-4111
Contact Person	Nobuyuki Omi

The information provided by the customer is as follows;
- Customer, Description of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer Information
- SECTION 2: Equipment Under Test (EUT) other than the Receipt Date and Test Date
- SECTION 4: Operation of EUT during testing

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	Connected Unit for EV
Model Number	AH00EV
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	February 16, 2024
Test Date	April 4 to June 11, 2024

2.2 Product Description

General Specification

Rating	DC 13.2 V
Operating temperature	-20 deg. C to 60 deg. C

Radio Specification

This report contains data provided by the customer which can impact the validity of results. UL Japan, Inc. is only responsible for the validity of results after the integration of the data provided by the customer. The data provided by the customer is marked “a)” in the table below.

WLAN (IEEE802.11b/11g/11n-20)

Equipment Type	Transceiver
Frequency of Operation	2412 MHz to 2462 MHz
Type of Modulation	DSSS, OFDM
Antenna Gain[a)]	-7.76 dBi

Bluetooth (BR / EDR / Low Energy)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	BT: FHSS (GFSK, π/4 DQPSK, 8 DPSK) BT LE: GFSK
Antenna Gain[a)]	-3.33 dBi

SECTION 3: Test Specification, Procedures & Results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C The latest version on the first day of the testing period
Title	FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

*The customer has declared that the EUT has complies with FCC Part 15 Subpart B as SDoC.

3.2 Procedures and Results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods	**FCC:** Section 15.207	-	N/A	*1)
	ISED: RSS-Gen 8.8	**ISED:** RSS-Gen 8.8			
Carrier Frequency Separation	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)	See data.	Complied	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (b)			
20dB Bandwidth	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)		Complied	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (a)			
Number of Hopping Frequency	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)(iii)		Complied	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (d)			
Dwell time	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)(iii)		Complied	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (d)			
Maximum Peak Output Power	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(b)(1)		Complied	Conducted
	ISED: RSS-Gen 6.12	**ISED:** RSS-247 5.4 (b)			
Spurious Emission & Band Edge Compliance	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(d)	11.7 dB 166.359 MHz, QP, Vert. Tx, Hopping Off, 3DH5 2480 MHz	Complied	Conducted/ Radiated (above 30 MHz) *2)
	ISED: RSS-Gen 6.13	**ISED:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.
* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

*1) The test is not applicable since the EUT does not have AC Mains.
*2) Radiated test was selected over 30 MHz based on section 15.247(d).

FCC Part 15.31 (e)
The EUT provides stable voltage constantly to the RF Part regardless of input voltage. Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement
It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to Standard

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
99% Occupied Bandwidth	**ISED:** RSS-Gen 6.7	**ISED:** -	N/A	-	Conducted

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

3.4 Uncertainty

Measurement uncertainty is not taken into account when stating conformity with a specified requirement.
Note: When margins obtained from test results are less than the measurement uncertainty, the test results may exceed the limit.

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

Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.2 dB
	30 MHz to 200 MHz	6.2 dB
	200 MHz to 1000 MHz	6.3 dB
	1 GHz to 6 GHz	4.7 dB
	6 GHz to 18 GHz	5.1 dB
	18 GHz to 40 GHz	5.5 dB
1 m	1 GHz to 18 GHz	5.2 dB
	18 GHz to 40 GHz	5.6 dB
0.5 m	26.5 GHz to 40 GHz	5.8 dB

Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	1.2 %
Maximum Output Power	0.58 dB
Carrier Frequency Separation	2.1 x 10^-7
Dwell time / Burst Rate	0.20 %
Conducted Spurious Emission (below 6 GHz)	2.2 dB
Conducted Spurious Emission (6 GHz to 18 GHz)	2.0 dB
Conducted Spurious Emission (18 GHz to 26.5 GHz)	2.2 dB
Conducted Spurious Emission (26.5 GHz to 40 GHz)	2.1 dB

3.5 Test Location

UL Japan, Inc. Kashima EMC Lab.
1614 Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan
Telephone: +81-478-88-6500
A2LA Certificate Number: 1266.01 / FCC Test Firm Registration Number: 910230
ISED Lab Company Number: 4659A / CAB identifier: JP0006

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Open site	6.0 x 5.5 x 2.5	20 x 40	10 m
No.5 Open site	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	5.4 x 4.5 x 2.3	-	-
No.5 Shielded Room	4.2 x 3.1 x 2.5	-	-
No.9 Shielded Room	6.1 x 3.6 x 2.8	-	-
No.6 Semi-anechoic Chamber	8.5 x 5.5 x 5.2	-	3 m
No.10 Semi-anechoic Chamber	18.4 x 9.9 x 7.7	-	10 m
No.11 Semi-anechoic Chamber	9.0 x 6.5 x 5.2	-	3 m
No.1 Measurement room	5.0 x 3.7 x 2.6	-	-
No.2 Measurement room	4.3 x 4.4 x 2.7	-	-

3.6 Test Data, Test Instruments, and Test Set Up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Mode	Remarks*
Bluetooth (BT)	BR / EDR, Payload: PRBS9

*EUT has the power settings by the software as follows;
Power Setting: DH5: 8, 3DH5: 9
Software: Scrcpy Version: 2.3.1
(Date: 2024.2.21, Storage location: Driven by connected PC)

*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.

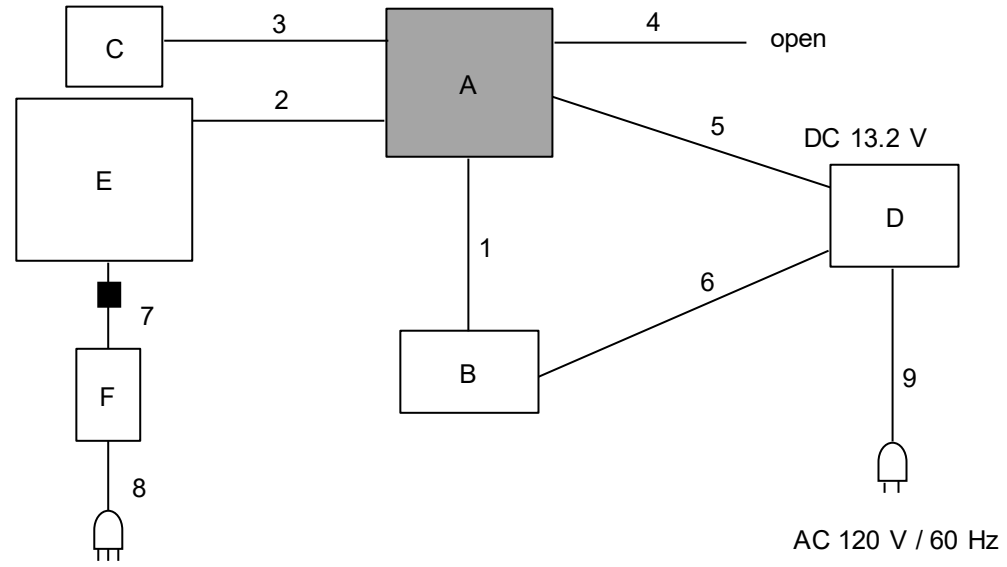
Details of Operating Mode(s)

Test Item	Mode	Hopping	Tested Frequency
Radiated Spurious Emission (Below 1 GHz)	Tx 3DH5 *1)	Off	2480 MHz
Radiated Spurious Emission (Above 1 GHz), Conducted Spurious Emission	Tx DH5 Tx 3DH5	Off	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx DH5 Tx 3DH5	On	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx DH5 Tx 3DH5	Off	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx DH5 Tx 3DH5	On	-
Dwell time	Tx DH1, DH3, DH5 Tx 3DH1, 3DH3, 3DH5	On	-
Maximum Peak Output Power	Tx DH5 Tx 2DH5 Tx 3DH5	Off	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5 Tx 3DH5	On Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5 Tx 3DH5	On Off	2402 MHz 2441 MHz 2480 MHz

*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)
*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.
*It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification.

*1) Conducted emissions and Spurious emissions for frequencies below 1 GHz were limited to the channel that had the highest power during the antenna terminal test, as preliminary testing indicated that changing the operating frequency had no significant impact on the emissions in those frequency bands.

4.2 Configuration and Peripherals



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

Description of EUT and Support Equipment

No.	Item	Model Number	Serial Number	Manufacturer	Remarks
A	Connected Unit for EV	AH00EV	31 *1) 40 *2)	ALPS ALPINE CO., LTD.	EUT
B	Display	AH00314A	No.6	ALPSALPINE CO., LTD.	-
C	GPS Antenna	C391120	-	ALPSALPINE CO., LTD.	-
D	DC Power Supply	GSV3000	60646702	DIAMOND ANTENNA	-
E	Laptop PC	Vostro3590	2474696559	DELL	-
F	AC Adapter	HA45NM140	CN-00285K-CH200-03H-0MGU-A07	DELL	-

*1) Used for Antenna Terminal conducted test
*2) Used for Radiated Emission test

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Monitor Cable	0.6	Shielded	Shielded	-
2	USB Cable	2.0	Shielded	Shielded	-
3	GPS Antenna	0.5	Shielded	Shielded	-
4	Debug Cable	2.0	Unshielded	Unshielded	-
5	DC Cable	2.2	Unshielded	Unshielded	-
6	DC Cable	2.2	Unshielded	Unshielded	-
7	DC Cable	1.8	Unshielded	Unshielded	-
8	AC Cable	0.9	Unshielded	Unshielded	3 wires
9	AC Cable	1.6	Unshielded	Unshielded	2 wires

SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]
EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane. 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 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.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	30 MHz to 1 GHz	Above 1 GHz
Antenna Type	Hybrid	Horn

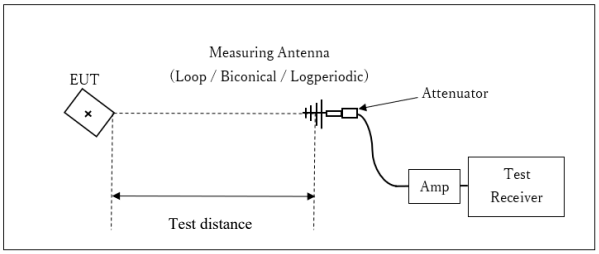
In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 1/T (T: burst length, refer to Burst rate confirmation sheet) Detector: Peak	RBW: 100 kHz VBW: 300 kHz

Figure 2: Test Setup

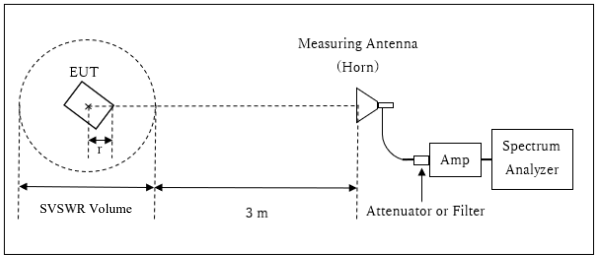
Below 1 GHz



× : 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

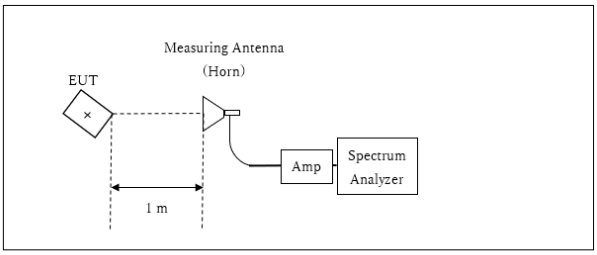
[10 site]
Distance Factor: 20 x log (4.38 m / 3.0 m) = 3.29 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 4.38 m

SVSWR Volume : 3.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.12 m

[11 site]
Distance Factor: 20 x log (3.88 m / 3.0 m) = 2.23 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.88 m

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.12 m

10 GHz to 26.5 GHz



× : Center of turn table

Distance Factor: 20 x log (1.0 m / 3.0 m) = -9.54 dB
*Test Distance: 1 m

The carrier level and noise levels were confirmed at each position of 6 deg, 20 deg and 34 deg of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Antenna polarization	Carrier	Spurious (30 MHz – 1 GHz)	Spurious (1 GHz – 2.8 GHz)	Spurious (2.8 GHz – 10 GHz)	Spurious (10 GHz – 18 GHz)	Spurious (18 GHz – 26.5 GHz)
Horizontal	6 deg	6 deg	6 deg	20 deg	6 deg	6 deg
Vertical	6 deg	6 deg	6 deg	20 deg	6 deg	6 deg

Test results are rounded off and limit are rounded down, so some differences might be observed.

Measurement Range : 30 MHz to 26.5 GHz
Test Data : APPENDIX
Test Result : Pass

SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument Used
20dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 160 MHz BW)
Carrier Frequency Separation	3 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	200 kHz	620 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz, 1 MHz	300 kHz, 3 MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3) *4)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9 kHz -150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)
*4) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohmes. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to 45.5 – 51.5 = -6.0 dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

Test results are rounded off and limit are rounded down, so some differences might be observed.
The equipment and cables were not used for factor 0 dB of the data sheets.

Test Data : APPENDIX
Test Result : Pass

APPENDIX 1: Test data

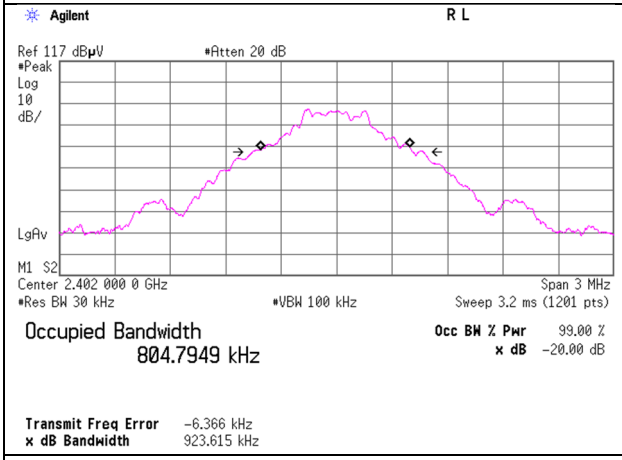
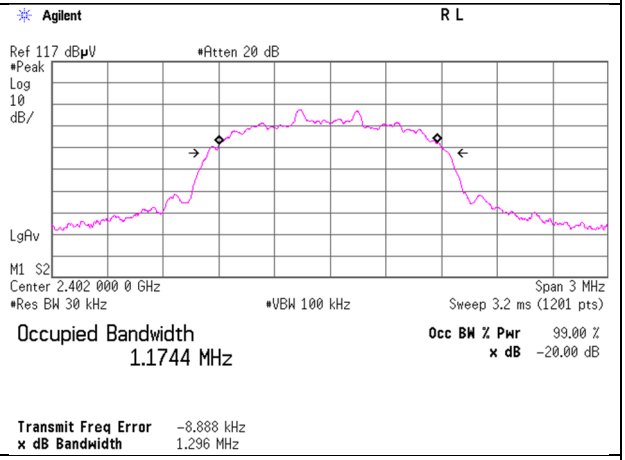
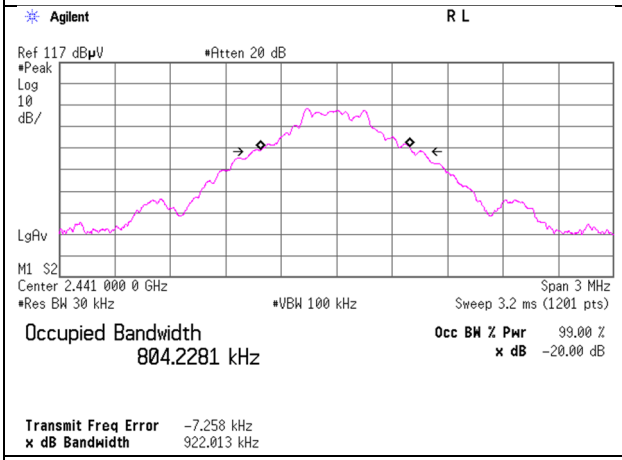
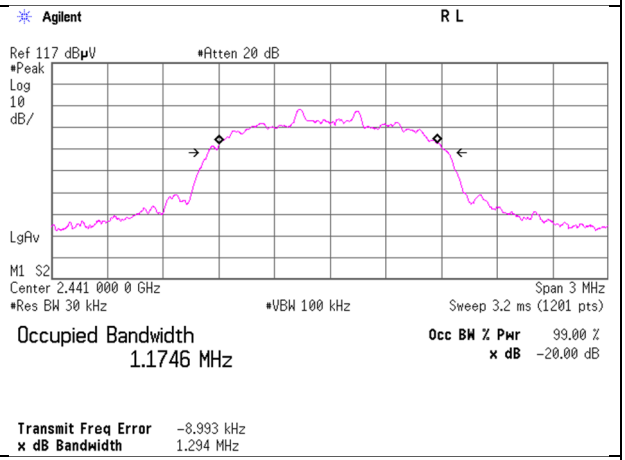
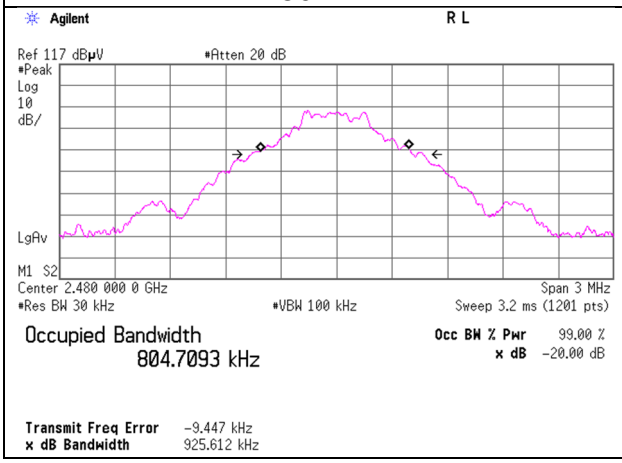
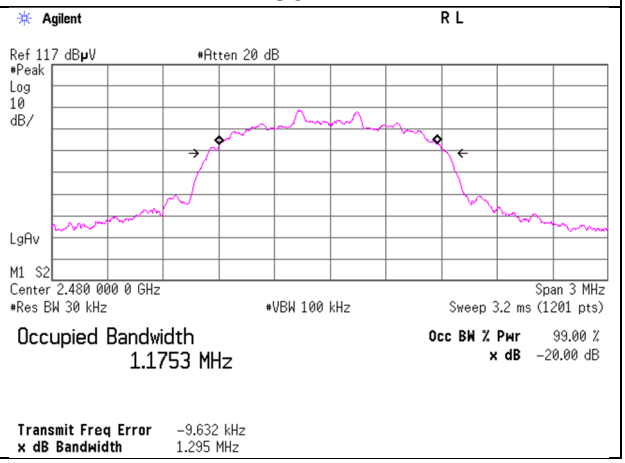
20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation

Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off, Tx, Hopping On

Mode	Freq. [MHz]	20 dB Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.924	***804.8***	1.000	>= 0.616
DH5	2441.0	0.922	804.2	1.000	>= 0.615
DH5	2480.0	0.926	804.7	1.000	>= 0.617
DH5	Hopping On	-	78598.6	-	-
3DH5	2402.0	1.296	1174.4	1.000	>= 0.864
3DH5	2441.0	1.294	1174.6	1.000	>= 0.863
3DH5	2480.0	1.295	***1175.3***	1.000	>= 0.863
3DH5	Hopping On	-	78694.7	-	-

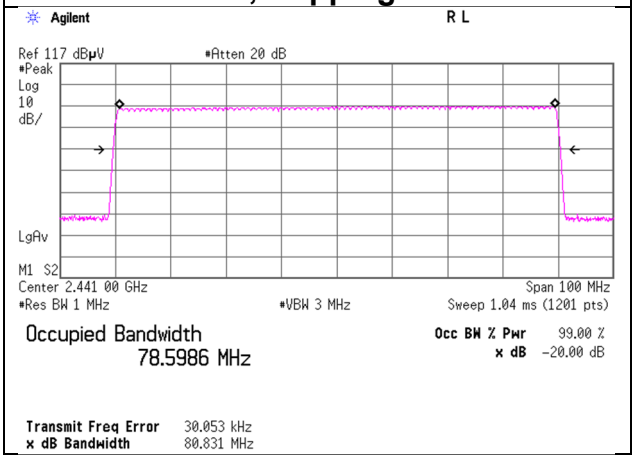
Limit: Two-thirds of 20 dB Bandwidth or 25 kHz (whichever is greater).
No limit applies to 20 dB Bandwidth.

20dB Bandwidth and 99% Occupied Bandwidth

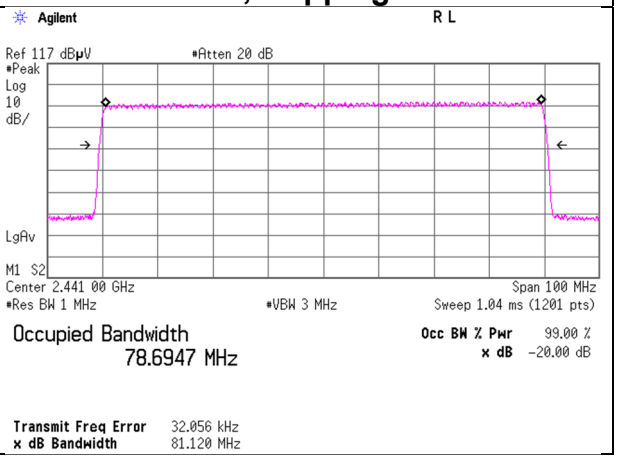
DH5	3DH5
2402 MHz	**2402 MHz**
	
2441 MHz	**2441 MHz**
	
2480 MHz	**2480 MHz**
	

20dB Bandwidth and 99% Occupied Bandwidth

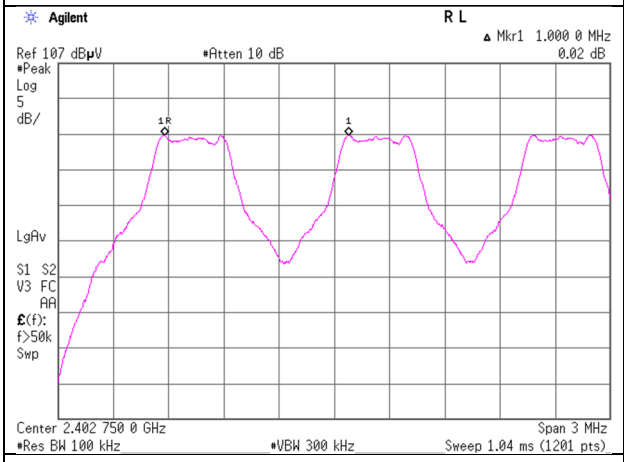
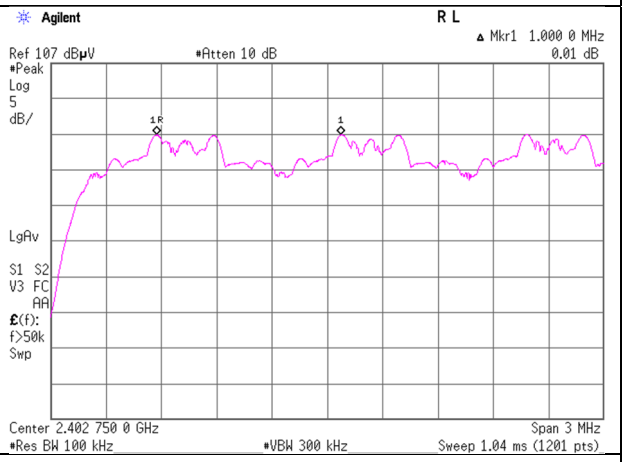
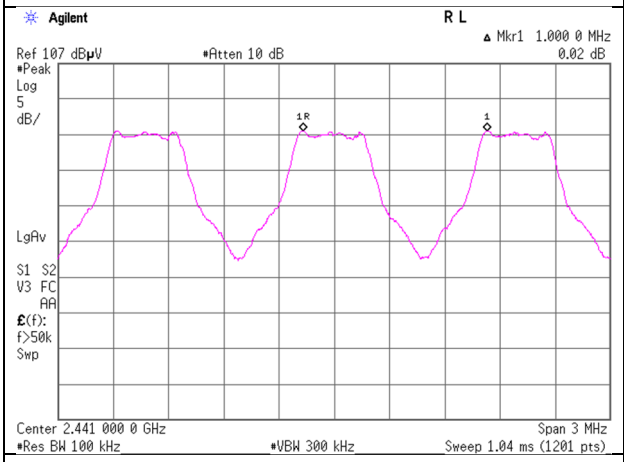
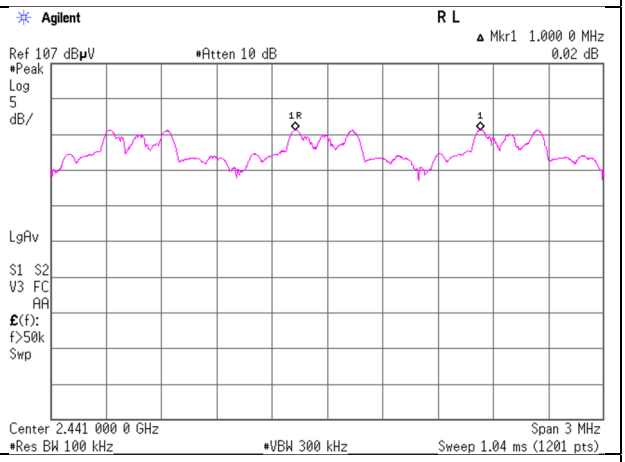
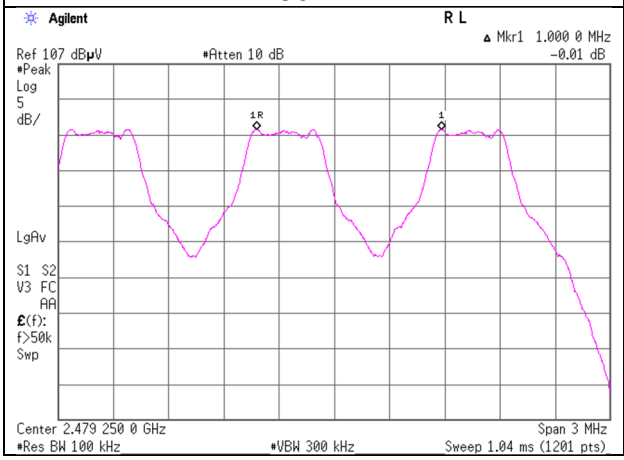
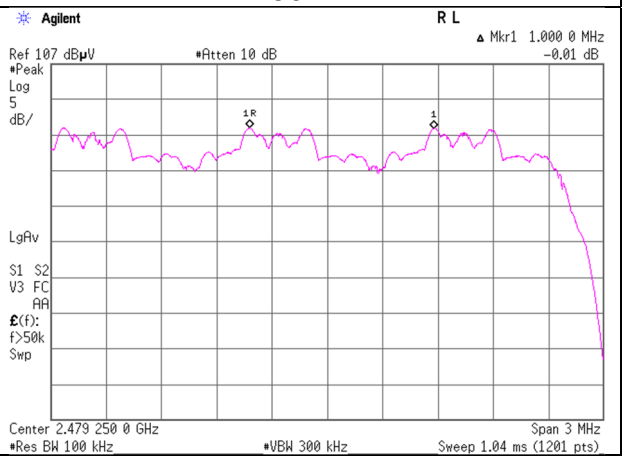
DH5, Hopping On



3DH5, Hopping On



Carrier Frequency Separation

DH5	3DH5
2402 MHz	2402 MHz
	
2441 MHz	2441 MHz
	
2480 MHz	2480 MHz
	

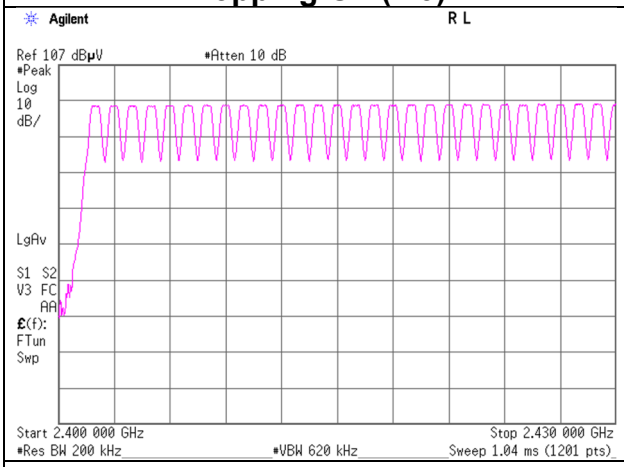
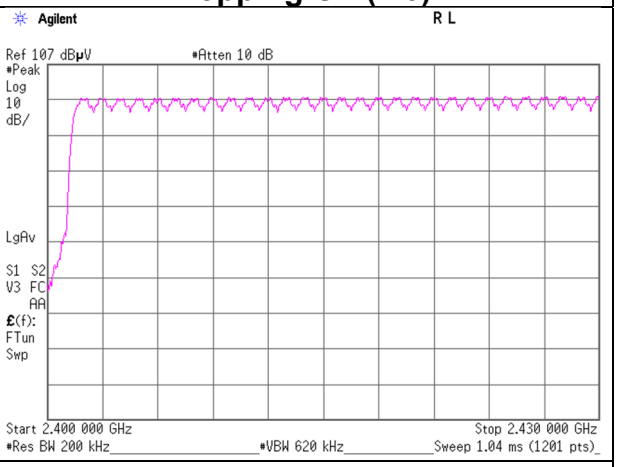
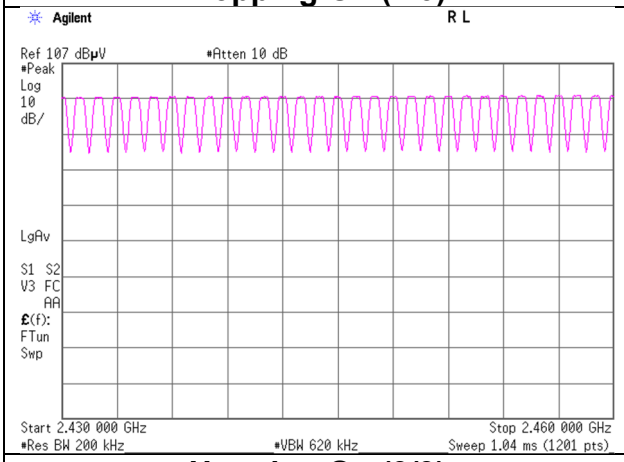
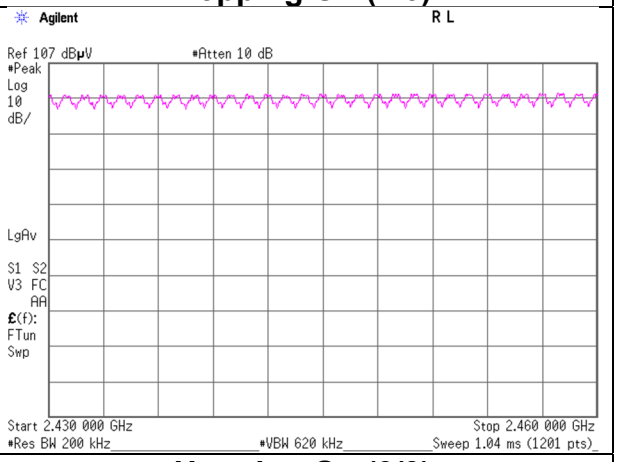
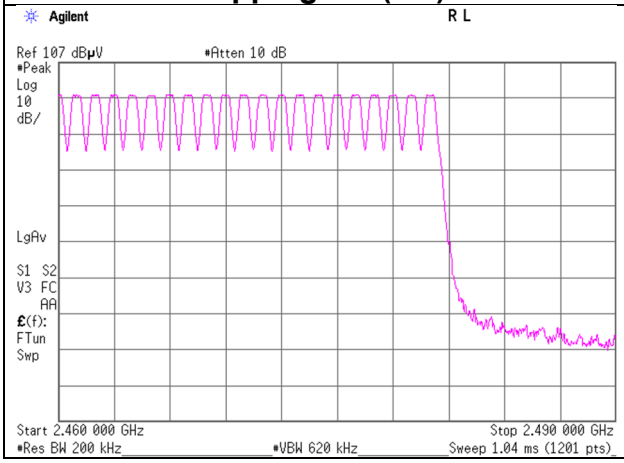
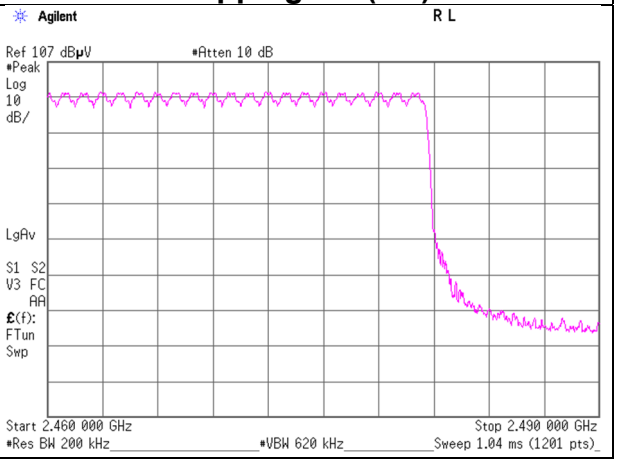
Number of Hopping Frequency

Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping On

Mode	Number of channel [channels]	Limit [channels]
DH5	79	>= 15
3DH5	79	>= 15

Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification.

Number of Hopping Frequency

DH5	3DH5
Hopping On (1/3)	Hopping On (1/3)
	
Hopping On (2/3)	Hopping On (2/3)
	
Hopping On (3/3)	Hopping On (3/3)
	

Dwell time

Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping On

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period							Length of transmission [ms]	Result [ms]	Limit [ms]
DH1	49.4 times	/	5 s	x	31.6 s	=	313 times	0.405	127	400
DH3	26.8 times	/	5 s	x	31.6 s	=	170 times	1.661	282	400
DH5	20.8 times	/	5 s	x	31.6 s	=	132 times	2.910	384	400
3DH1	49.0 times	/	5 s	x	31.6 s	=	310 times	0.411	127	400
3DH3	25.2 times	/	5 s	x	31.6 s	=	160 times	1.663	266	400
3DH5	19.6 times	/	5 s	x	31.6 s	=	124 times	2.913	361	400

Sample Calculation
Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

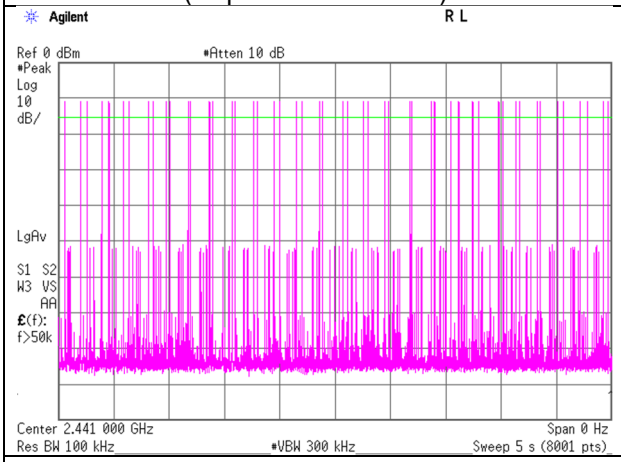
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	50	49	49	48	51	49.4
DH3	27	25	26	28	28	26.8
DH5	22	20	19	21	22	20.8
3DH1	50	48	49	47	51	49
3DH3	24	26	24	25	27	25.2
3DH5	21	17	19	18	23	19.6

Sample Calculation
Average = Summation (Sampling 1 to 5) / 5

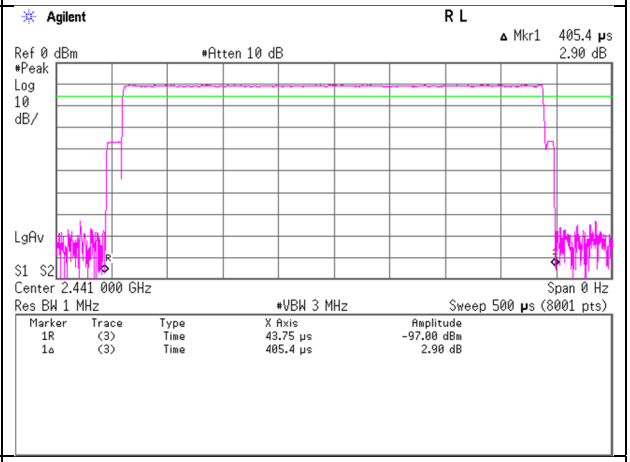
This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in N x 0.4 s, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4 s regardless of packet size. This is confirmed in the test report for N = 79.

Dwell time

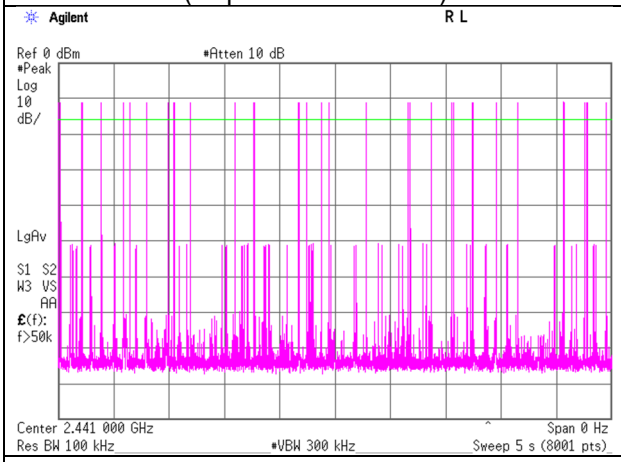
DH1 (1/2)
(Representative chart)



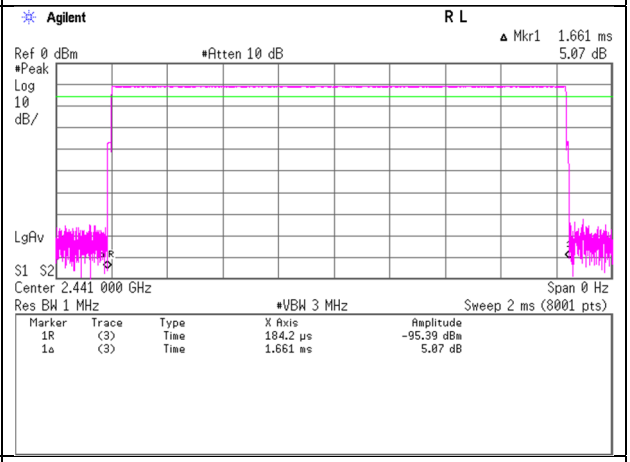
DH1 (2/2)



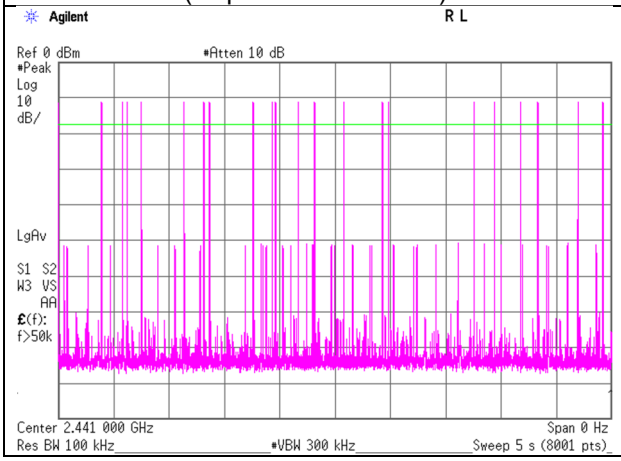
DH3 (1/2)
(Representative chart)



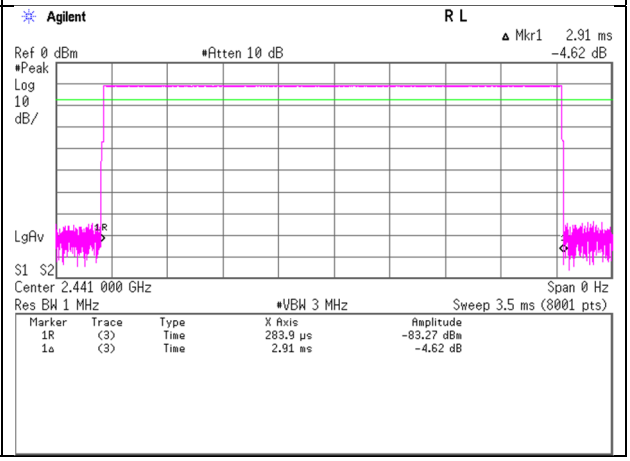
DH3 (2/2)



DH5 (1/2)
(Representative chart)

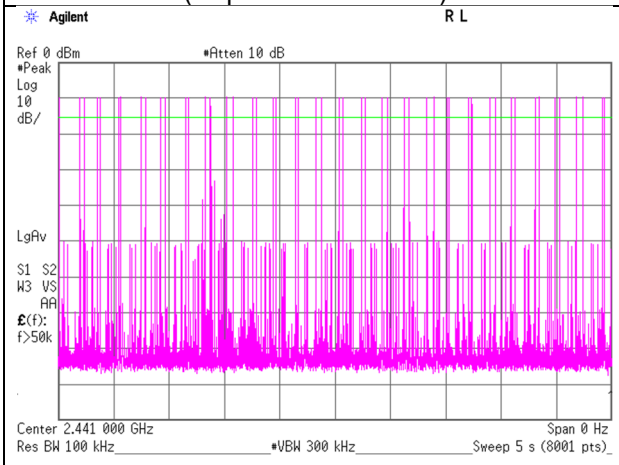


DH5 (2/2)

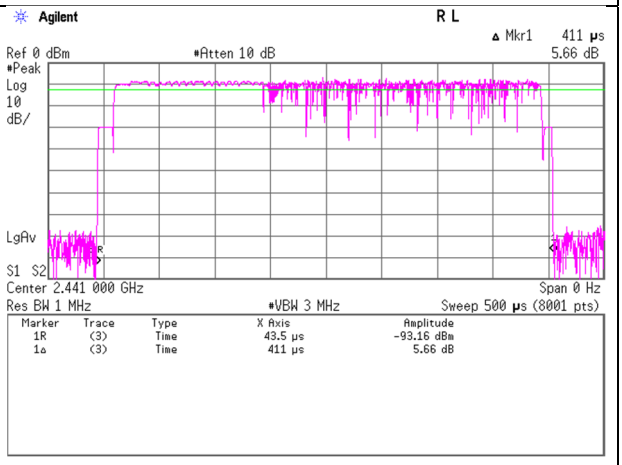


Dwell time

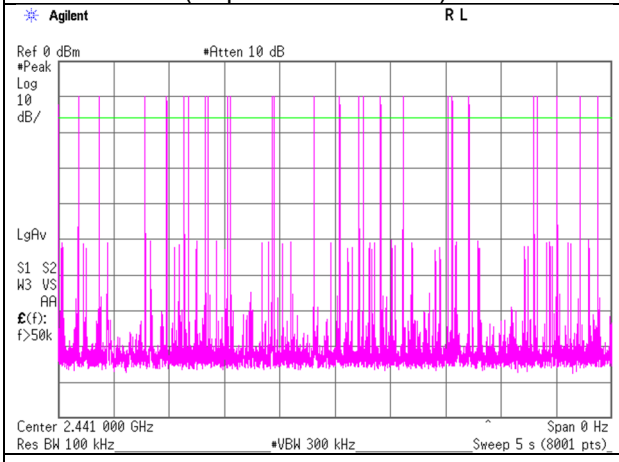
3DH1 (1/2)
(Representative chart)



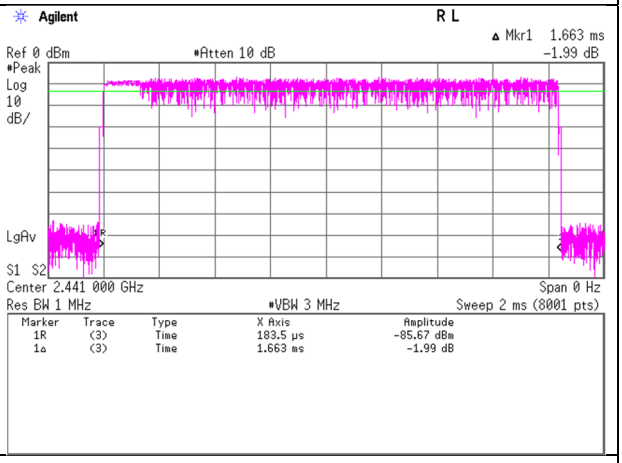
3DH1 (2/2)



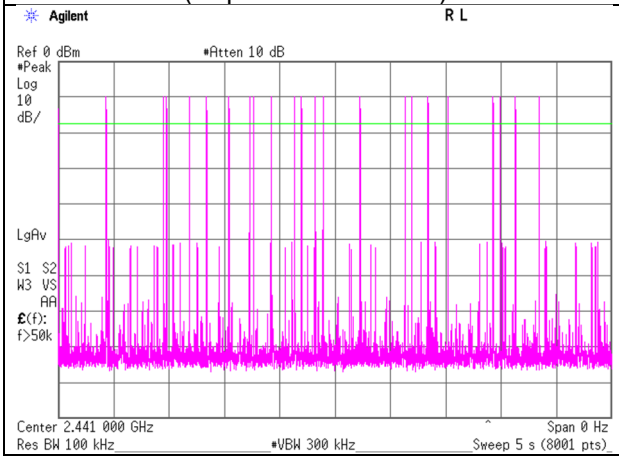
3DH3 (1/2)
(Representative chart)



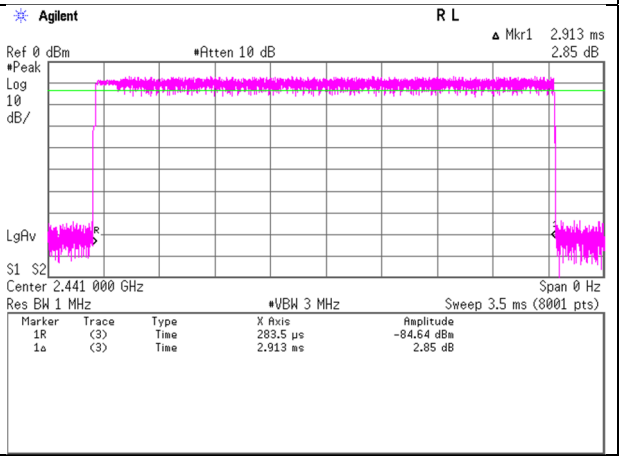
3DH3 (2/2)



3DH5 (1/2)
(Representative chart)



3DH5 (2/2)



Maximum Peak Output Power

Test place	Kashima EMC Lab. No.2 Measurement Room
Date	April 12, 2024
Temperature / Humidity	22 deg. C / 45 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off

					Conducted Power					e.i.r.p. for RSS-247					
Mode	Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
DH5	2402.0	-10.21	2.66	10.05	2.50	1.78	20.96	125	18.46	-3.33	-0.83	0.83	36.02	4000	36.85
DH5	2441.0	-9.52	2.67	10.05	3.20	2.09	20.96	125	17.76	-3.33	-0.13	0.97	36.02	4000	36.15
DH5	2480.0	-9.15	2.68	10.05	***3.58***	***2.28***	20.96	125	17.38	-3.33	***0.25***	***1.06***	36.02	4000	35.77
2DH5	2402.0	-7.57	2.66	10.05	5.14	3.27	20.96	125	15.82	-3.33	1.81	1.52	36.02	4000	34.21
2DH5	2441.0	-6.78	2.67	10.05	5.94	3.93	20.96	125	15.02	-3.33	2.61	1.82	36.02	4000	33.41
2DH5	2480.0	-5.51	2.68	10.05	***7.22***	***5.27***	20.96	125	13.74	-3.33	***3.89***	***2.45***	36.02	4000	32.13
3DH5	2402.0	-7.59	2.66	10.05	5.12	3.25	20.96	125	15.84	-3.33	1.79	1.51	36.02	4000	34.23
3DH5	2441.0	-6.82	2.67	10.05	5.90	3.89	20.96	125	15.06	-3.33	2.57	1.81	36.02	4000	33.45
3DH5	2480.0	-6.43	2.68	10.05	***6.30***	***4.27***	20.96	125	14.66	-3.33	***2.97***	***1.98***	36.02	4000	33.05

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

Test was not performed at AFH mode, because the decrease of number of channel (min: 20 ch) at AFH mode does not influence on the output power and bandwidth of the EUT.

Average Output Power
(Reference data for RF Exposure)

Test place	Kashima EMC Lab. No.2 Measurement Room
Date	April 12, 2024
Temperature / Humidity	22 deg. C / 45 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off

Mode	Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
DH5	2402.0	-12.04	2.66	10.05	0.67	1.17	1.10	1.77	1.50
DH5	2441.0	-11.26	2.67	10.05	1.46	1.40	1.10	2.56	1.80
DH5	2480.0	-10.95	2.68	10.05	***1.78***	***1.51***	1.10	***2.88***	***1.94***
2DH5	2402.0	-12.11	2.66	10.05	0.60	1.15	1.10	1.70	1.48
2DH5	2441.0	-11.28	2.67	10.05	1.44	1.39	1.10	2.54	1.80
2DH5	2480.0	-11.01	2.68	10.05	***1.72***	***1.49***	1.10	***2.82***	***1.92***
3DH5	2402.0	-12.24	2.66	10.05	0.47	1.11	1.10	1.57	1.44
3DH5	2441.0	-11.43	2.67	10.05	1.29	1.35	1.10	2.39	1.73
3DH5	2480.0	-11.10	2.68	10.05	***1.63***	***1.46***	1.10	***2.73***	***1.88***

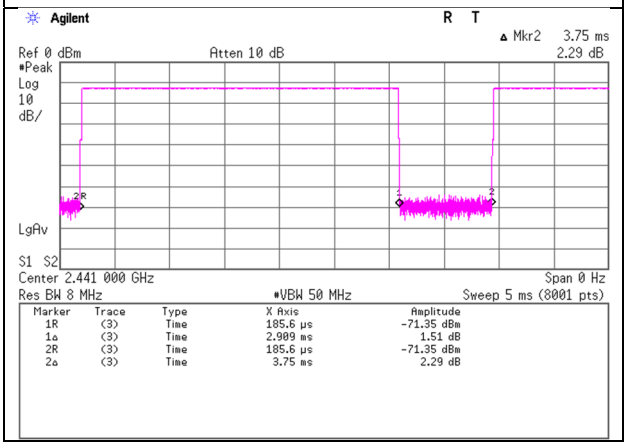
Sample Calculation:
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Lo
Result (Burst power average) = Time average + Duty factor

Burst Rate Confirmation

Test place	Kashima EMC Lab. No.2 Measurement Room
Date	April 16, 2024
Temperature / Humidity	21 deg. C / 50 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off

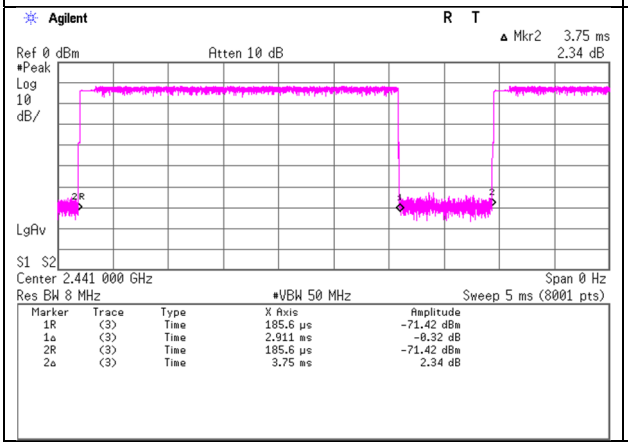
DH5

Tx on / (Tx on + Tx off) =	**0.776**
Tx on / (Tx on + Tx off) * 100 =	**77.6 %**
Duty factor = 10 * log (3.75 / 2.909) =	**1.10 dB**
VBW: 1 / on time = 343.8 Hz <	**360 Hz**



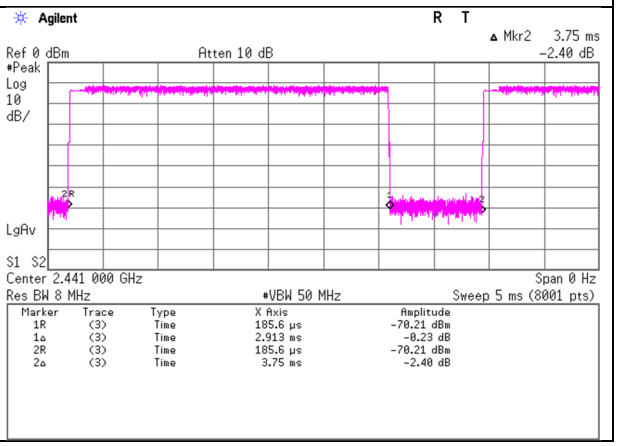
2DH5

Tx on / (Tx on + Tx off) =	**0.776**
Tx on / (Tx on + Tx off) * 100 =	**77.6 %**
Duty factor = 10 * log (3.75 / 2.911) =	**1.10 dB**
VBW: 1 / on time = 343.5 Hz <	**360 Hz**



3DH5

Tx on / (Tx on + Tx off) =	**0.777**
Tx on / (Tx on + Tx off) * 100 =	**77.7 %**
Duty factor = 10 * log (3.75 / 2.913) =	**1.10 dB**
VBW: 1 / on time = 343.3 Hz <	**360 Hz**



Radiated Spurious Emission

Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.11	No.10	No.11	No.11
Date	April 15, 2024	June 11, 2024	April 15, 2024	April 15, 2024
Temperature / Humidity	21 deg. C / 41 % RH	23 deg. C / 56 % RH	21 deg. C / 41 % RH	21 deg. C / 41 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Hiromitsu Tanabe	Hiromitsu Tanabe
	(1 GHz to 2.8 GHz)	(2.8 GHz to 10 GHz)	(10 GHz to 18 GHz)	(18 GHz to 26.5 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz			

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	55.32	27.46	13.60	46.26	2.23	52.35	73.9	21.5	237	47	-
Hori.	4804.000	PK	50.39	32.53	5.29	45.10	3.29	46.40	73.9	27.5	150	0	Floor noise
Hori.	6396.000	PK	52.00	35.30	6.17	45.06	3.29	51.70	73.9	22.2	115	267	-
Hori.	7206.000	PK	48.87	37.14	6.56	43.99	3.29	51.87	73.9	22.0	150	0	Floor noise
Hori.	9608.000	PK	47.28	38.01	7.39	41.93	3.29	54.04	73.9	19.8	150	0	Floor noise
Hori.	2390.000	AV	41.73	27.46	13.60	46.26	2.23	38.76	53.9	15.1	237	47	VBW: 360 Hz
Hori.	4804.000	AV	38.57	32.53	5.29	45.10	3.29	34.58	53.9	19.3	150	0	Floor noise
Hori.	6396.000	AV	40.82	35.30	6.17	45.06	3.29	40.52	53.9	13.3	115	267	VBW: 10 Hz
Hori.	7206.000	AV	37.54	37.14	6.56	43.99	3.29	40.54	53.9	13.3	150	0	Floor noise
Hori.	9608.000	AV	35.54	38.01	7.39	41.93	3.29	42.30	53.9	11.6	150	0	Floor noise
Vert.	2390.000	PK	55.37	27.46	13.60	46.26	2.23	52.40	73.9	21.5	318	100	-
Vert.	4804.000	PK	50.13	32.53	5.29	45.10	3.29	46.14	73.9	27.7	150	0	Floor noise
Vert.	6396.000	PK	51.74	35.30	6.17	45.06	3.29	51.44	73.9	22.4	158	201	-
Vert.	7206.000	PK	49.21	37.14	6.56	43.99	3.29	52.21	73.9	21.6	150	0	Floor noise
Vert.	9608.000	PK	47.13	38.01	7.39	41.93	3.29	53.89	73.9	20.0	150	0	Floor noise
Vert.	2390.000	AV	41.59	27.46	13.60	46.26	2.23	38.62	53.9	15.2	318	100	VBW: 360 Hz
Vert.	4804.000	AV	38.60	32.53	5.29	45.10	3.29	34.61	53.9	19.2	150	0	Floor noise
Vert.	6396.000	AV	41.66	35.30	6.17	45.06	3.29	41.36	53.9	12.5	158	201	VBW: 10 Hz
Vert.	7206.000	AV	37.52	37.14	6.56	43.99	3.29	40.52	53.9	13.3	150	0	Floor noise
Vert.	9608.000	AV	35.63	38.01	7.39	41.93	3.29	42.39	53.9	**11.5**	150	0	Floor noise

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

Distance factor : 1 GHz - 2.8 GHz : 20log (3.88 m / 3.0 m) = 2.23 dB (11 site) / 2.8 GHz - 10 GHz : 20log (4.38 m / 3.0 m) = 3.29 dB (10 site)

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	103.94	27.45	13.61	46.25	2.23	100.98	-	-	Carrier
Hori.	2400.000	PK	48.19	27.44	13.61	46.25	2.23	45.22	81.0	35.7	-
Vert.	2402.000	PK	100.95	27.45	13.61	46.25	2.23	97.99	-	-	Carrier
Vert.	2400.000	PK	46.13	27.44	13.61	46.25	2.23	43.16	78.0	34.8	-

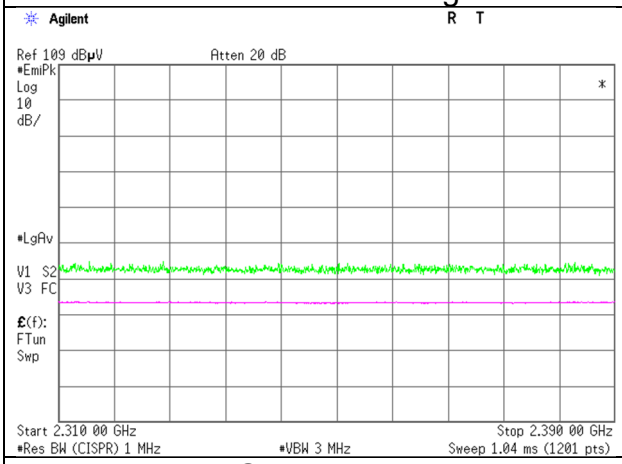
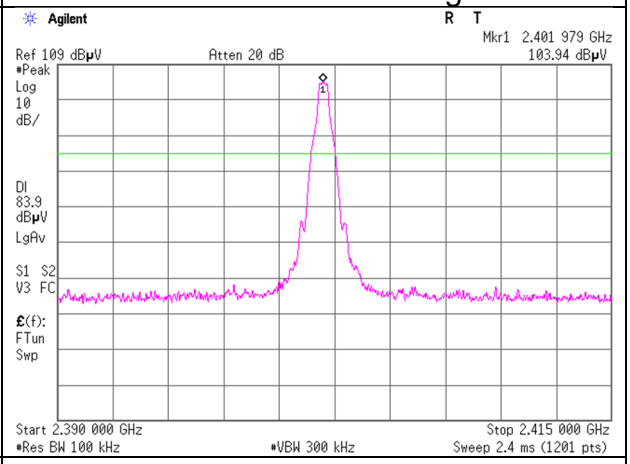
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

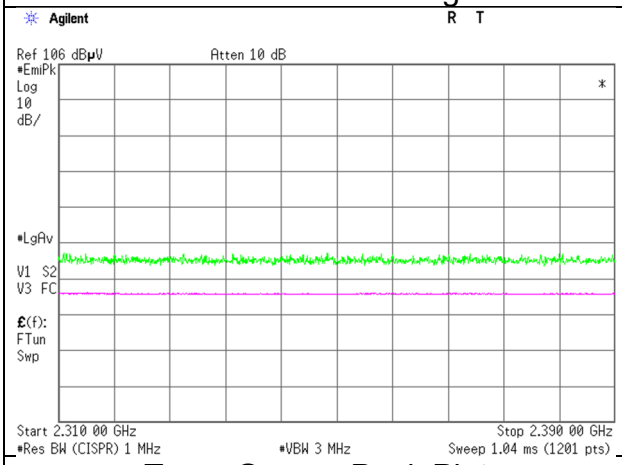
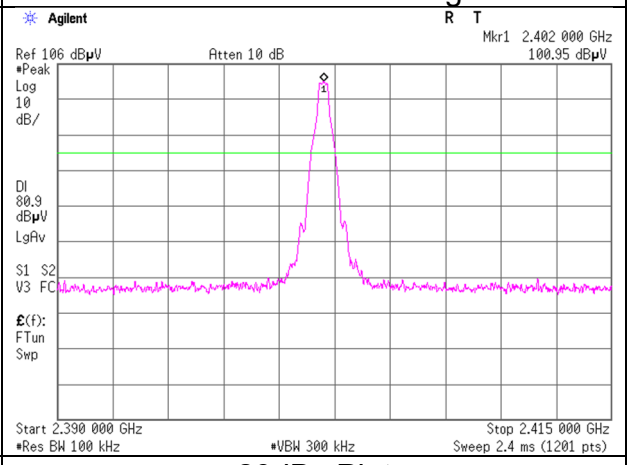
Distance factor : 1 GHz - 2.8 GHz : 20log (3.88 m / 3.0 m) = 2.23 dB (11 site) / 2.8 GHz - 10 GHz : 20log (4.38 m / 3.0 m) = 3.29 dB (10 site)

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab.
Semi Anechoic Chamber	No.11
Date	April 15, 2024
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Kazuhiro Ando
	(1 GHz to 2.8 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge and authorized band edge were shown in tabular data.

Radiated Spurious Emission

Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.11	No.10	No.11	No.11
Date	April 15, 2024	June 11, 2024	April 15, 2024	April 15, 2024
Temperature / Humidity	21 deg. C / 41 % RH	23 deg. C / 56 % RH	21 deg. C / 41 % RH	21 deg. C / 41 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Hiromitsu Tanabe	Hiromitsu Tanabe
	(1 GHz to 2.8 GHz)	(2.8 GHz to 10 GHz)	(10 GHz to 18 GHz)	(18 GHz to 26.5 GHz)
Mode	Tx, Hopping Off, DH5 2441 MHz			

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4882.000	PK	50.53	32.55	5.35	45.15	3.29	46.57	73.9	27.3	150	0	Floor noise
Hori.	6396.000	PK	51.35	35.30	6.17	45.06	3.29	51.05	73.9	22.8	168	266	-
Hori.	7323.000	PK	48.49	37.38	6.62	43.71	3.29	52.07	73.9	21.8	150	0	Floor noise
Hori.	9764.000	PK	47.28	37.92	7.46	41.76	3.29	54.19	73.9	19.7	150	0	Floor noise
Hori.	4882.000	AV	38.71	32.55	5.35	45.15	3.29	34.75	53.9	19.1	150	0	Floor noise
Hori.	6396.000	AV	40.92	35.30	6.17	45.06	3.29	40.62	53.9	13.2	168	266	VBW: 10 Hz
Hori.	7323.000	AV	36.87	37.38	6.62	43.71	3.29	40.45	53.9	13.4	150	0	Floor noise
Hori.	9764.000	AV	35.77	37.92	7.46	41.76	3.29	42.68	53.9	11.2	150	0	Floor noise
Vert.	4882.000	PK	51.15	32.55	5.35	45.15	3.29	47.19	73.9	26.7	150	0	Floor noise
Vert.	6396.000	PK	52.68	35.30	6.17	45.06	3.29	52.38	73.9	21.5	178	202	-
Vert.	7323.000	PK	49.07	37.38	6.62	43.71	3.29	52.65	73.9	21.2	150	0	Floor noise
Vert.	9764.000	PK	47.41	37.92	7.46	41.76	3.29	54.32	73.9	19.5	150	0	Floor noise
Vert.	4882.000	AV	38.76	32.55	5.35	45.15	3.29	34.80	53.9	19.1	150	0	Floor noise
Vert.	6396.000	AV	41.72	35.30	6.17	45.06	3.29	41.42	53.9	12.4	178	202	VBW: 10 Hz
Vert.	7323.000	AV	36.88	37.38	6.62	43.71	3.29	40.46	53.9	13.4	150	0	Floor noise
Vert.	9764.000	AV	35.84	37.92	7.46	41.76	3.29	42.75	53.9	**11.1**	150	0	Floor noise

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

Distance factor : 1 GHz - 2.8 GHz : 20log (3.88 m / 3.0 m) = 2.23 dB (11 site) / 2.8 GHz - 10 GHz : 20log (4.38 m / 3.0 m) = 3.29 dB (10 site)

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

Radiated Spurious Emission

Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.11	No.10	No.11	No.11
Date	April 15, 2024	June 11, 2024	April 15, 2024	April 15, 2024
Temperature / Humidity	21 deg. C / 41 % RH	23 deg. C / 56 % RH	21 deg. C / 41 % RH	21 deg. C / 41 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Hiromitsu Tanabe	Hiromitsu Tanabe
	(1 GHz to 2.8 GHz)	(2.8 GHz to 10 GHz)	(10 GHz to 18 GHz)	(18 GHz to 26.5 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz			

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	55.79	27.94	13.68	46.16	2.23	53.48	73.9	20.4	223	42	-
Hori.	4960.000	PK	50.61	32.64	5.40	45.20	3.29	46.74	73.9	27.1	150	0	Floor noise
Hori.	6396.000	PK	51.60	35.30	6.17	45.06	3.29	51.30	73.9	22.6	122	263	-
Hori.	7440.000	PK	49.15	37.41	6.68	43.45	3.29	53.08	73.9	20.8	150	0	Floor noise
Hori.	9920.000	PK	47.07	38.11	7.55	41.76	3.29	54.26	73.9	19.6	150	0	Floor noise
Hori.	2483.500	AV	42.61	27.94	13.68	46.16	2.23	40.30	53.9	13.6	223	42	VBW: 360 Hz
Hori.	4960.000	AV	38.86	32.64	5.40	45.20	3.29	34.99	53.9	18.9	150	0	Floor noise
Hori.	6396.000	AV	41.01	35.30	6.17	45.06	3.29	40.71	53.9	13.1	122	263	VBW: 10 Hz
Hori.	7440.000	AV	37.05	37.41	6.68	43.45	3.29	40.98	53.9	12.9	150	0	Floor noise
Hori.	9920.000	AV	35.35	38.11	7.55	41.76	3.29	42.54	53.9	11.3	150	0	Floor noise
Vert.	2483.500	PK	54.87	27.94	13.68	46.16	2.23	52.56	73.9	21.3	320	96	-
Vert.	4960.000	PK	51.06	32.64	5.40	45.20	3.29	47.19	73.9	26.7	150	0	Floor noise
Vert.	6396.000	PK	51.86	35.30	6.17	45.06	3.29	51.56	73.9	22.3	158	201	-
Vert.	7440.000	PK	48.64	37.41	6.68	43.45	3.29	52.57	73.9	21.3	150	0	Floor noise
Vert.	9920.000	PK	47.46	38.11	7.55	41.76	3.29	54.65	73.9	19.2	150	0	Floor noise
Vert.	2483.500	AV	42.35	27.94	13.68	46.16	2.23	40.04	53.9	13.8	320	96	VBW: 360 Hz
Vert.	4960.000	AV	38.91	32.64	5.40	45.20	3.29	35.04	53.9	18.8	150	0	Floor noise
Vert.	6396.000	AV	41.14	35.30	6.17	45.06	3.29	40.84	53.9	13.0	158	201	VBW: 10 Hz
Vert.	7440.000	AV	36.99	37.41	6.68	43.45	3.29	40.92	53.9	12.9	150	0	Floor noise
Vert.	9920.000	AV	35.45	38.11	7.55	41.76	3.29	42.64	53.9	**11.2**	150	0	Floor noise

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

Distance factor : 1 GHz - 2.8 GHz : 20log (3.88 m / 3.0 m) = 2.23 dB (11 site) / 2.8 GHz - 10 GHz : 20log (4.38 m / 3.0 m) = 3.29 dB (10 site)

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

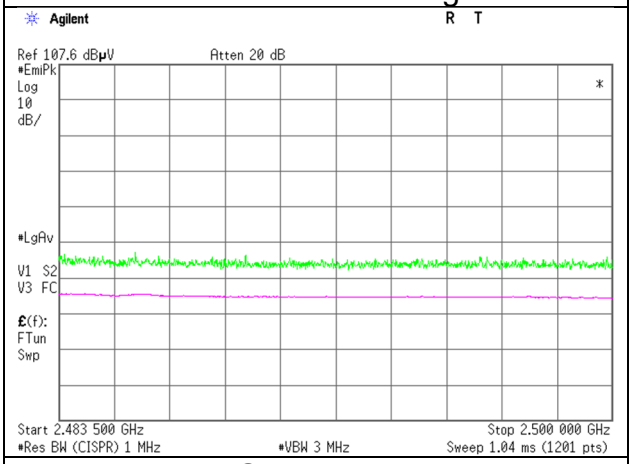
*These results have sufficient margin without taking account Duty cycle correction factor.

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab.
Semi Anechoic Chamber	No.11
Date	April 15, 2024
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Kazuhiro Ando
	(1 GHz to 2.8 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz

Horizontal

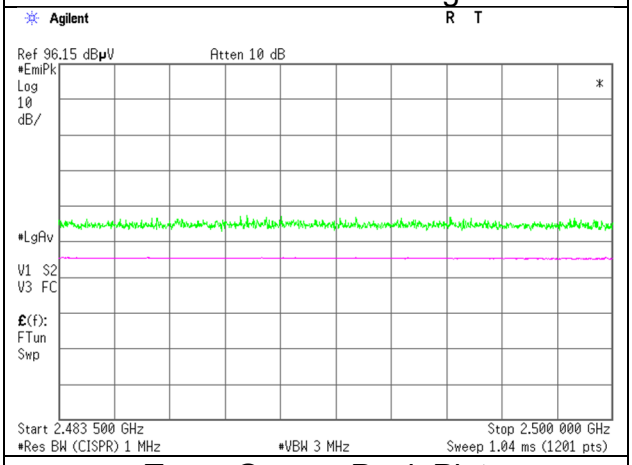
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.11	No.10	No.11	No.11
Date	April 15, 2024	June 11, 2024	April 15, 2024	April 15, 2024
Temperature / Humidity	21 deg. C / 41 % RH	23 deg. C / 56 % RH	21 deg. C / 41 % RH	21 deg. C / 41 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Hiromitsu Tanabe	Hiromitsu Tanabe
	(1 GHz to 2.8 GHz)	(2.8 GHz to 10 GHz)	(10 GHz to 18 GHz)	(18 GHz to 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz			

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	55.23	27.46	13.60	46.26	2.23	52.26	73.9	21.6	200	46	-
Hori.	4804.000	PK	51.34	32.53	5.29	45.10	3.29	47.35	73.9	26.5	150	0	Floor noise
Hori.	6396.000	PK	53.16	35.30	6.17	45.06	3.29	52.86	73.9	21.0	126	271	-
Hori.	7206.000	PK	49.91	37.14	6.56	43.99	3.29	52.91	73.9	20.9	150	0	Floor noise
Hori.	9608.000	PK	48.08	38.01	7.39	41.93	3.29	54.84	73.9	19.0	150	0	Floor noise
Hori.	2390.000	AV	41.76	27.46	13.60	46.26	2.23	38.79	53.9	15.1	200	46	VBW: 360 Hz
Hori.	4804.000	AV	38.87	32.53	5.29	45.10	3.29	34.88	53.9	19.0	150	0	Floor noise
Hori.	6396.000	AV	40.78	35.30	6.17	45.06	3.29	40.48	53.9	13.4	126	271	VBW: 10 Hz
Hori.	7206.000	AV	37.56	37.14	6.56	43.99	3.29	40.56	53.9	13.3	150	0	Floor noise
Hori.	9608.000	AV	35.68	38.01	7.39	41.93	3.29	42.44	53.9	**11.4**	150	0	Floor noise
Vert.	2390.000	PK	55.11	27.46	13.60	46.26	2.23	52.14	73.9	21.7	386	96	-
Vert.	4804.000	PK	51.65	32.53	5.29	45.10	3.29	47.66	73.9	26.2	150	0	Floor noise
Vert.	6396.000	PK	52.78	35.30	6.17	45.06	3.29	52.48	73.9	21.4	176	204	-
Vert.	7206.000	PK	51.68	37.14	6.56	43.99	3.29	54.68	73.9	19.2	150	0	Floor noise
Vert.	9608.000	PK	47.80	38.01	7.39	41.93	3.29	54.56	73.9	19.3	150	0	Floor noise
Vert.	2390.000	AV	41.59	27.46	13.60	46.26	2.23	38.62	53.9	15.2	386	96	VBW: 360 Hz
Vert.	4804.000	AV	38.98	32.53	5.29	45.10	3.29	34.99	53.9	18.9	150	0	Floor noise
Vert.	6396.000	AV	41.27	35.30	6.17	45.06	3.29	40.97	53.9	12.9	176	204	VBW: 10 Hz
Vert.	7206.000	AV	38.91	37.14	6.56	43.99	3.29	41.91	53.9	11.9	150	0	Floor noise
Vert.	9608.000	AV	35.61	38.01	7.39	41.93	3.29	42.37	53.9	11.5	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 2.8 GHz : 20log (3.88 m / 3.0 m) = 2.23 dB (11 site) / 2.8 GHz - 10 GHz : 20log (4.38 m / 3.0 m) = 3.29 dB (10 site)
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
*These results have sufficient margin without taking account Duty cycle correction factor.

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

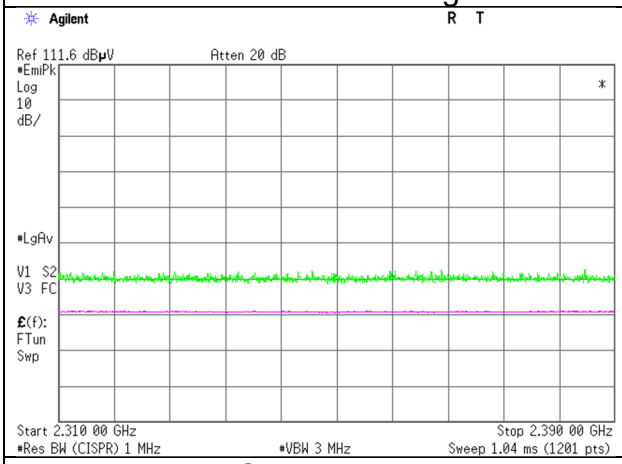
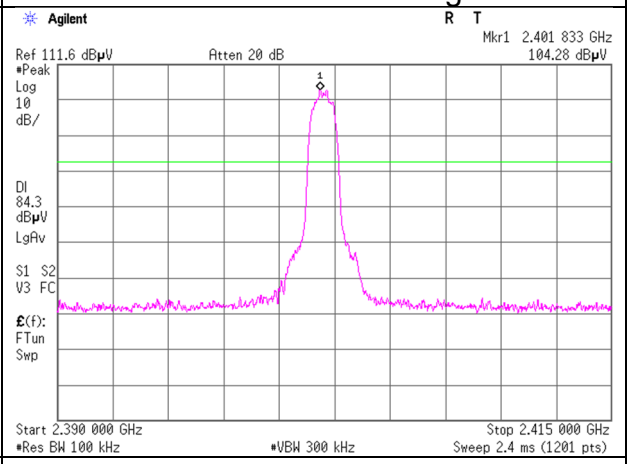
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	104.28	27.45	13.61	46.25	2.23	101.32	-	-	Carrier
Hori.	2400.000	PK	48.97	27.44	13.61	46.25	2.23	46.00	81.3	35.3	-
Vert.	2402.000	PK	100.79	27.45	13.61	46.25	2.23	97.83	-	-	Carrier
Vert.	2400.000	PK	47.14	27.44	13.61	46.25	2.23	44.17	77.8	33.6	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 2.8 GHz : 20log (3.88 m / 3.0 m) = 2.23 dB (11 site) / 2.8 GHz - 10 GHz : 20log (4.38 m / 3.0 m) = 3.29 dB (10 site)
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

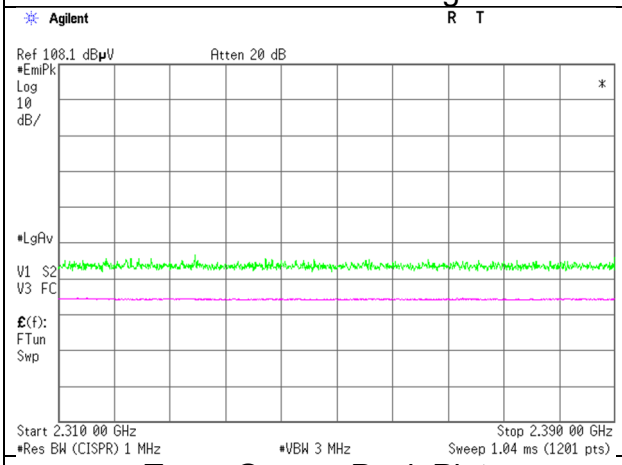
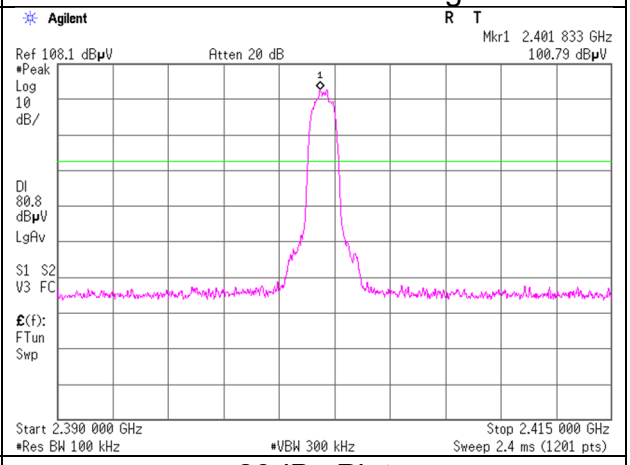
Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab.
Semi Anechoic Chamber	No.11
Date	April 15, 2024
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Kazuhiro Ando
	(1 GHz to 2.8 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz

Horizontal

Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical

Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge and authorized band edge were shown in tabular data.

Radiated Spurious Emission

Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.11	No.10	No.11	No.11
Date	April 15, 2024	June 11, 2024	April 15, 2024	April 15, 2024
Temperature / Humidity	21 deg. C / 41 % RH	23 deg. C / 56 % RH	21 deg. C / 41 % RH	21 deg. C / 41 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Hiromitsu Tanabe	Hiromitsu Tanabe
	(1 GHz to 2.8 GHz)	(2.8 GHz to 10 GHz)	(10 GHz to 18 GHz)	(18 GHz to 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz			

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4882.000	PK	51.24	32.55	5.35	45.15	3.29	47.28	73.9	26.6	150	0	Floor noise
Hori.	6396.000	PK	52.24	35.30	6.17	45.06	3.29	51.94	73.9	21.9	199	61	-
Hori.	7323.000	PK	49.90	37.38	6.62	43.71	3.29	53.48	73.9	20.4	150	0	Floor noise
Hori.	9764.000	PK	48.20	37.92	7.46	41.76	3.29	55.11	73.9	18.7	150	0	Floor noise
Hori.	4882.000	AV	39.06	32.55	5.35	45.15	3.29	35.10	53.9	18.8	150	0	Floor noise
Hori.	6396.000	AV	40.77	35.30	6.17	45.06	3.29	40.47	53.9	13.4	199	61	VBW: 10 Hz
Hori.	7323.000	AV	37.30	37.38	6.62	43.71	3.29	40.88	53.9	13.0	150	0	Floor noise
Hori.	9764.000	AV	35.58	37.92	7.46	41.76	3.29	42.49	53.9	**11.4**	150	0	Floor noise
Vert.	4882.000	PK	52.38	32.55	5.35	45.15	3.29	48.42	73.9	25.4	150	0	Floor noise
Vert.	6396.000	PK	53.15	35.30	6.17	45.06	3.29	52.85	73.9	21.0	181	202	-
Vert.	7323.000	PK	49.22	37.38	6.62	43.71	3.29	52.80	73.9	21.1	150	0	Floor noise
Vert.	9764.000	PK	48.89	37.92	7.46	41.76	3.29	55.80	73.9	18.1	150	0	Floor noise
Vert.	4882.000	AV	39.04	32.55	5.35	45.15	3.29	35.08	53.9	18.8	150	0	Floor noise
Vert.	6396.000	AV	41.23	35.30	6.17	45.06	3.29	40.93	53.9	12.9	181	202	VBW: 10 Hz
Vert.	7323.000	AV	37.23	37.38	6.62	43.71	3.29	40.81	53.9	13.0	150	0	Floor noise
Vert.	9764.000	AV	35.53	37.92	7.46	41.76	3.29	42.44	53.9	**11.4**	150	0	Floor noise

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

Distance factor : 1 GHz - 2.8 GHz : 20log (3.88 m / 3.0 m) = 2.23 dB (11 site) / 2.8 GHz - 10 GHz : 20log (4.38 m / 3.0 m) = 3.29 dB (10 site)

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

Radiated Spurious Emission

Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.11	No.11	No.10	No.11
Date	April 4, 2024	April 15, 2024	June 11, 2024	April 15, 2024
Temperature / Humidity	22 deg. C / 50 % RH	21 deg. C / 41 % RH	23 deg. C / 56 % RH	21 deg. C / 41 % RH
Engineer	Hiromitsu Tanabe	Kazuhiro Ando	Kazuhiro Ando	Hiromitsu Tanabe
	(30 MHz to 1 GHz)	(1 GHz to 2.8 GHz)	(2.8 GHz to 10 GHz)	(10 GHz to 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz			

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	99.819	QP	45.60	9.00	6.39	32.12	0.00	28.87	43.5	14.6	289	170	-
Hori.	166.359	QP	39.00	13.13	6.86	32.06	0.00	26.93	43.5	16.5	157	233	-
Hori.	499.093	QP	35.30	17.83	8.52	31.96	0.00	29.69	46.0	16.3	188	172	-
Hori.	698.730	QP	34.30	20.86	9.25	32.00	0.00	32.41	46.0	13.5	100	243	-
Hori.	2483.500	PK	54.54	27.94	13.68	46.16	2.23	52.23	73.9	21.6	200	46	-
Hori.	4960.000	PK	51.52	32.64	5.40	45.20	3.29	47.65	73.9	26.2	150	0	Floor noise
Hori.	6396.000	PK	52.14	35.30	6.17	45.06	3.29	51.84	73.9	22.0	200	259	-
Hori.	7440.000	PK	50.76	37.41	6.68	43.45	3.29	54.69	73.9	19.2	150	0	Floor noise
Hori.	9920.000	PK	48.37	38.11	7.55	41.76	3.29	55.56	73.9	18.3	150	0	Floor noise
Hori.	2483.500	AV	42.29	27.94	13.68	46.16	2.23	39.98	53.9	13.9	200	46	VBW: 360 Hz
Hori.	4960.000	AV	39.20	32.64	5.40	45.20	3.29	35.33	53.9	18.5	150	0	Floor noise
Hori.	6396.000	AV	40.81	35.30	6.17	45.06	3.29	40.51	53.9	13.3	200	259	VBW: 10 Hz
Hori.	7440.000	AV	37.43	37.41	6.68	43.45	3.29	41.36	53.9	12.5	150	0	Floor noise
Hori.	9920.000	AV	35.98	38.11	7.55	41.76	3.29	43.17	53.9	**10.7**	150	0	Floor noise
Vert.	36.421	QP	38.60	12.94	5.74	32.17	0.00	25.11	40.0	14.8	100	224	-
Vert.	45.076	QP	36.50	13.78	5.85	32.17	0.00	23.96	40.0	16.0	100	178	-
Vert.	99.819	QP	45.10	9.00	6.39	32.12	0.00	28.37	43.5	15.1	100	125	-
Vert.	166.359	QP	43.80	13.13	6.86	32.06	0.00	31.73	43.5	11.7	100	277	-
Vert.	210.360	QP	42.30	9.87	7.13	32.02	0.00	27.28	43.5	16.2	100	125	-
Vert.	499.094	QP	33.80	17.83	8.52	31.96	0.00	28.19	46.0	17.8	100	0	-
Vert.	631.079	QP	33.50	20.57	9.07	32.01	0.00	31.13	46.0	14.8	100	65	-
Vert.	2483.500	PK	54.82	27.94	13.68	46.16	2.23	52.51	73.9	21.3	384	93	-
Vert.	4960.000	PK	51.54	32.64	5.40	45.20	3.29	47.67	73.9	26.2	150	0	Floor noise
Vert.	6396.000	PK	53.95	35.30	6.17	45.06	3.29	53.65	73.9	20.2	154	199	-
Vert.	7440.000	PK	49.98	37.41	6.68	43.45	3.29	53.91	73.9	19.9	150	0	Floor noise
Vert.	9920.000	PK	48.78	38.11	7.55	41.76	3.29	55.97	73.9	17.9	150	0	Floor noise
Vert.	2483.500	AV	42.15	27.94	13.68	46.16	2.23	39.84	53.9	14.0	384	93	VBW: 360 Hz
Vert.	4960.000	AV	39.20	32.64	5.40	45.20	3.29	35.33	53.9	18.5	150	0	Floor noise
Vert.	6396.000	AV	41.22	35.30	6.17	45.06	3.29	40.92	53.9	12.9	154	199	VBW: 10 Hz
Vert.	7440.000	AV	37.46	37.41	6.68	43.45	3.29	41.39	53.9	12.5	150	0	Floor noise
Vert.	9920.000	AV	35.88	38.11	7.55	41.76	3.29	43.07	53.9	10.8	150	0	Floor noise

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

Distance factor : 1 GHz - 2.8 GHz : 20log (3.88 m / 3.0 m) = 2.23 dB (11 site) / 2.8 GHz - 10 GHz : 20log (4.38 m / 3.0 m) = 3.29 dB (10 site)

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

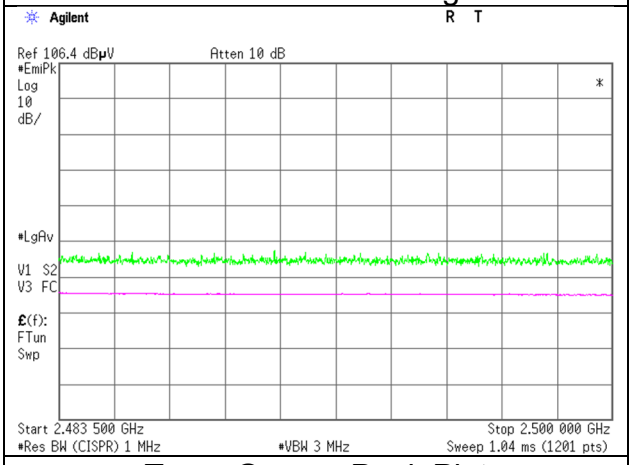
*These results have sufficient margin without taking account Duty cycle correction factor.

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab.
Semi Anechoic Chamber	No.11
Date	April 15, 2024
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Kazuhiro Ando
	(1 GHz to 2.8 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz

Horizontal

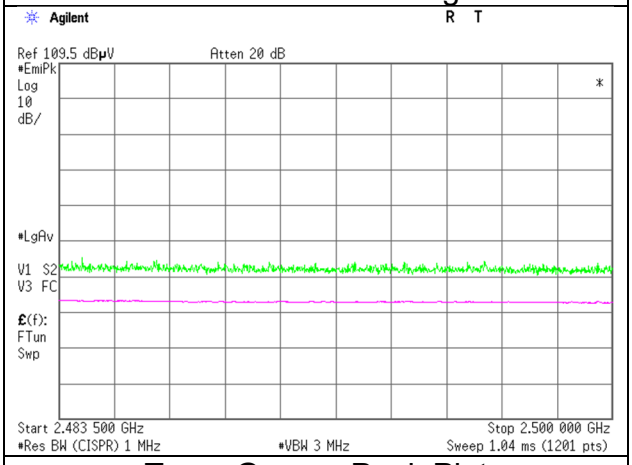
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

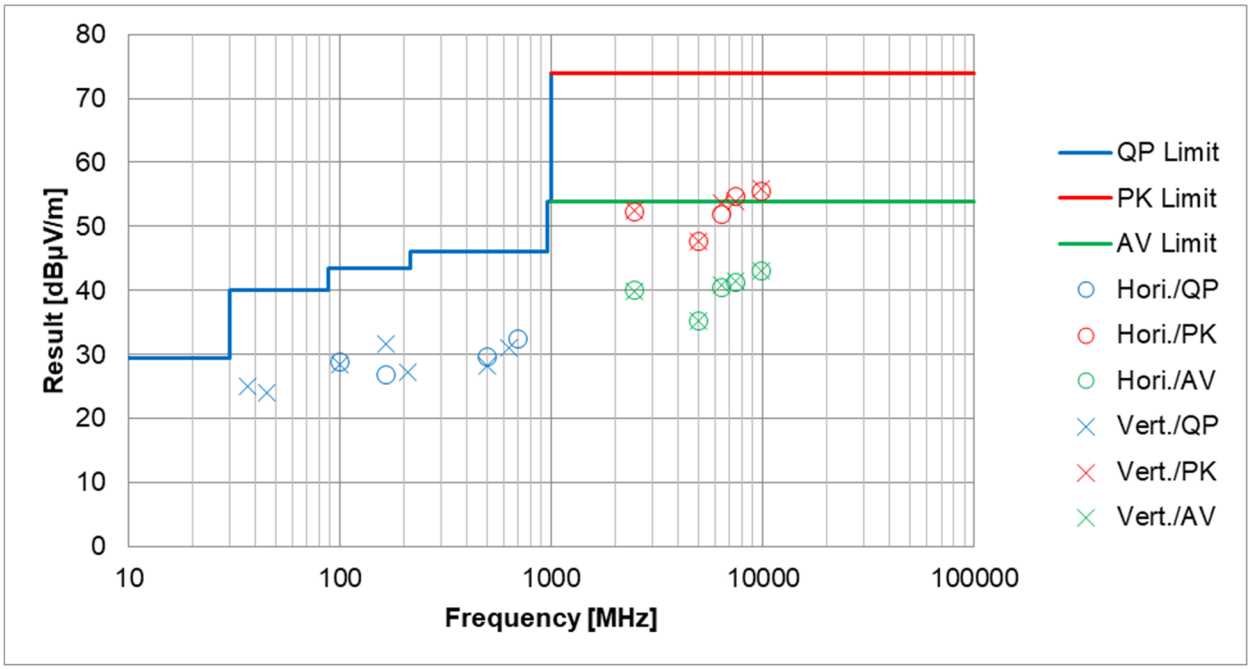


Trace Green : Peak Plot
Trace Purple : Average Plot

* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case mode for Maximum Peak Output Power)

Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.11	No.11	No.10	No.11
Date	April 4, 2024	April 15, 2024	June 11, 2024	April 15, 2024
Temperature / Humidity	22 deg. C / 50 % RH	21 deg. C / 41 % RH	23 deg. C / 56 % RH	21 deg. C / 41 % RH
Engineer	Hiromitsu Tanabe	Kazuhiro Ando	Kazuhiro Ando	Hiromitsu Tanabe
	(30 MHz to 1 GHz)	(1 GHz to 2.8 GHz)	(2.8 GHz to 10 GHz)	(10 GHz to 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz			



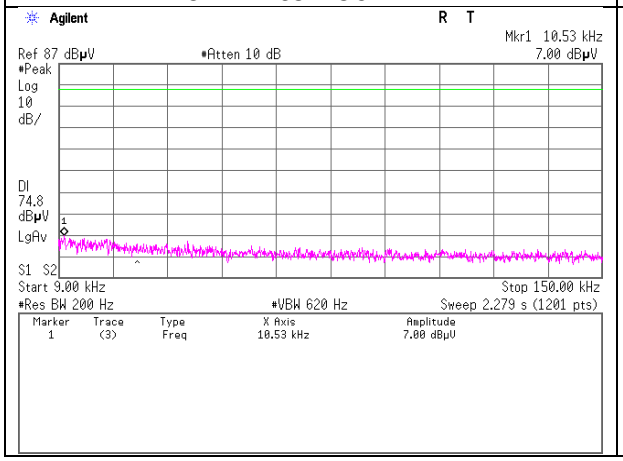
*These plots data contain sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

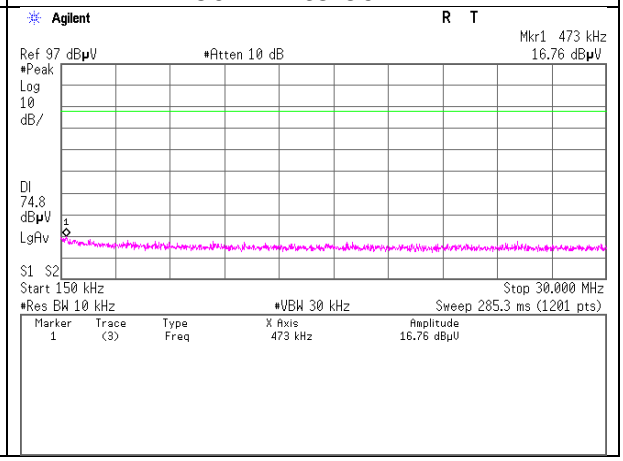
Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off, DH5

2402 MHz

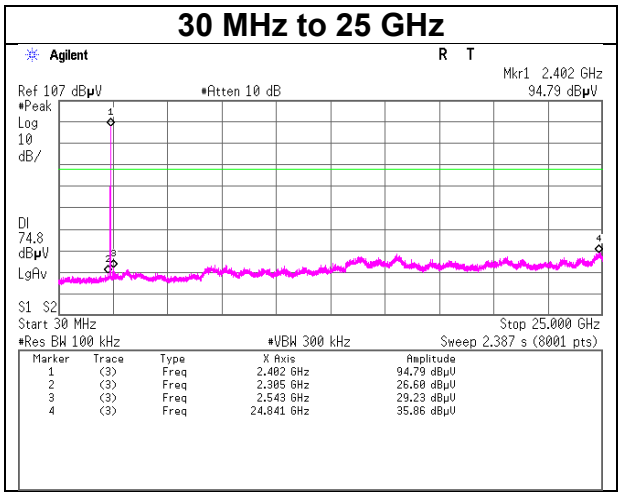
9 kHz to 150 kHz



150 kHz to 30 MHz



30 MHz to 25 GHz

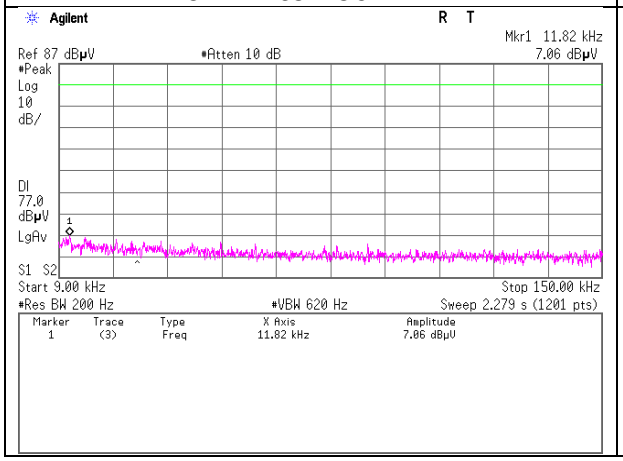


Conducted Spurious Emission

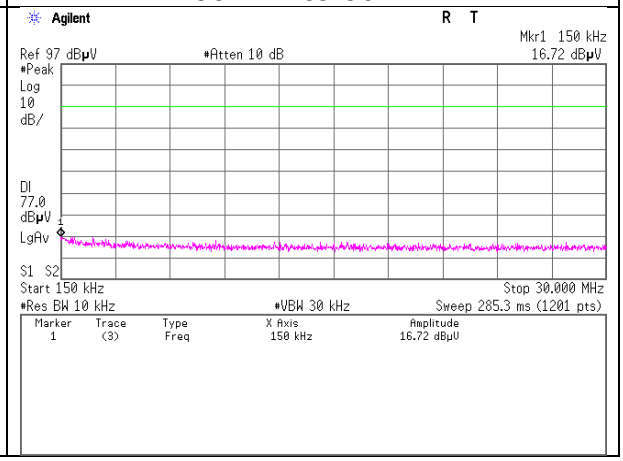
Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off, DH5

2441 MHz

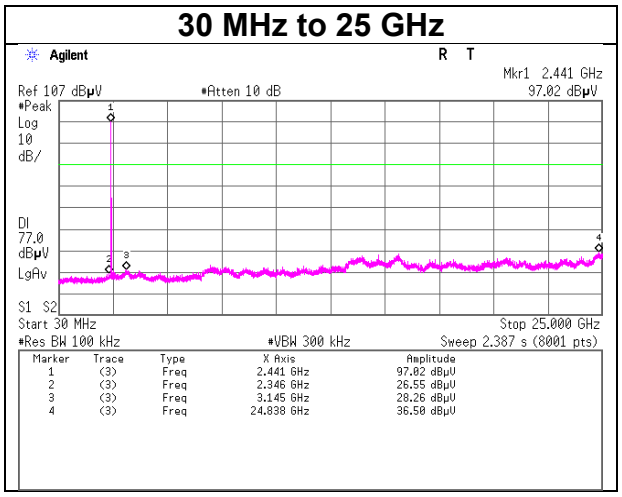
9 kHz to 150 kHz



150 kHz to 30 MHz



30 MHz to 25 GHz

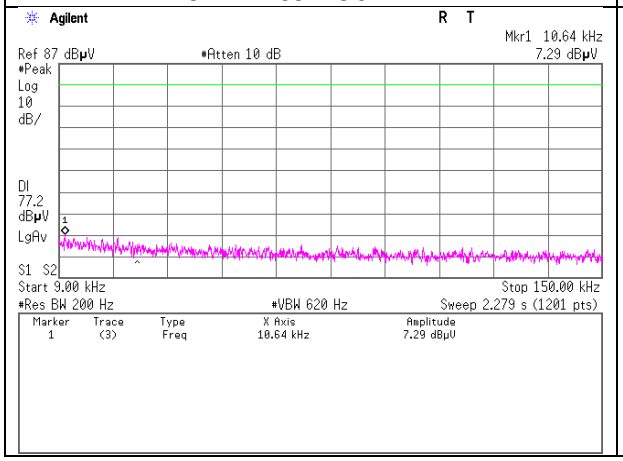


Conducted Spurious Emission

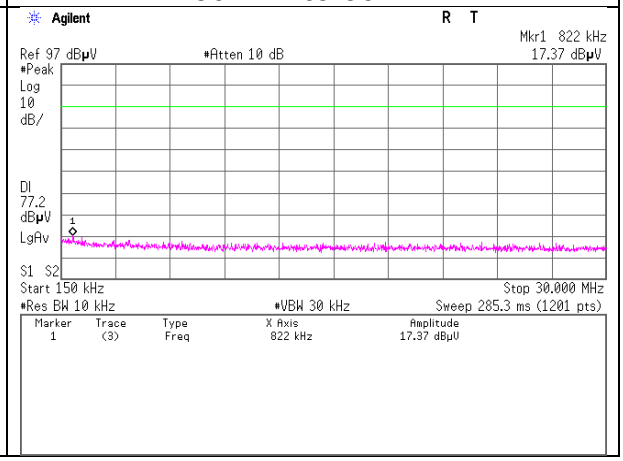
Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off, DH5

2480 MHz

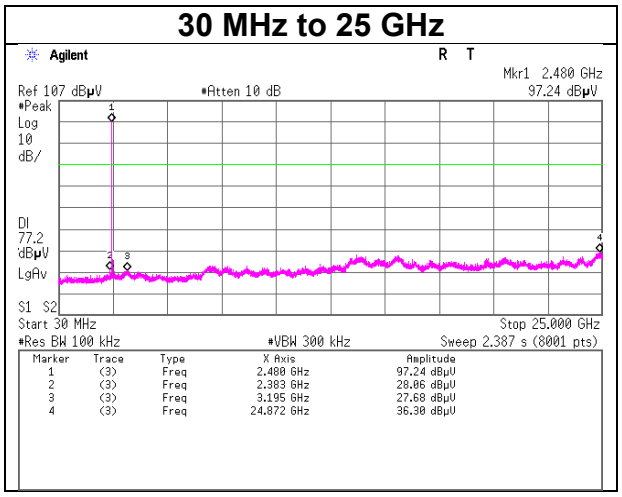
9 kHz to 150 kHz



150 kHz to 30 MHz



30 MHz to 25 GHz

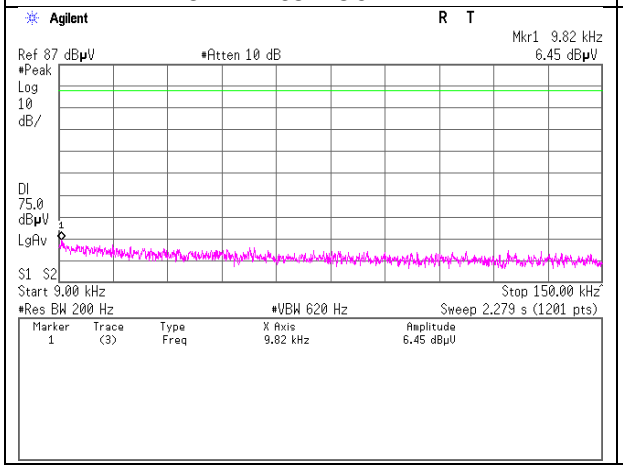


Conducted Spurious Emission

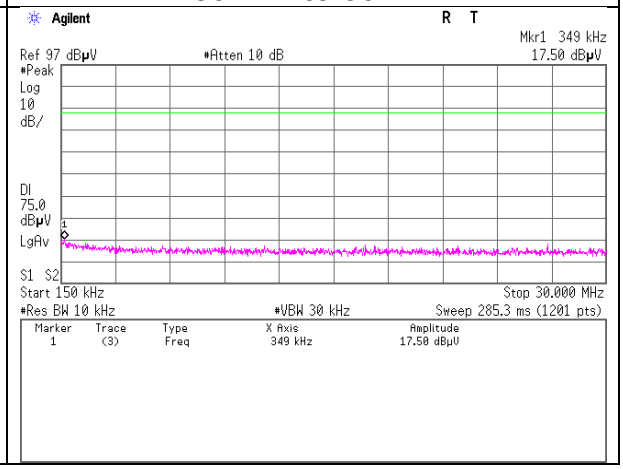
Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off, 3DH5

2402 MHz

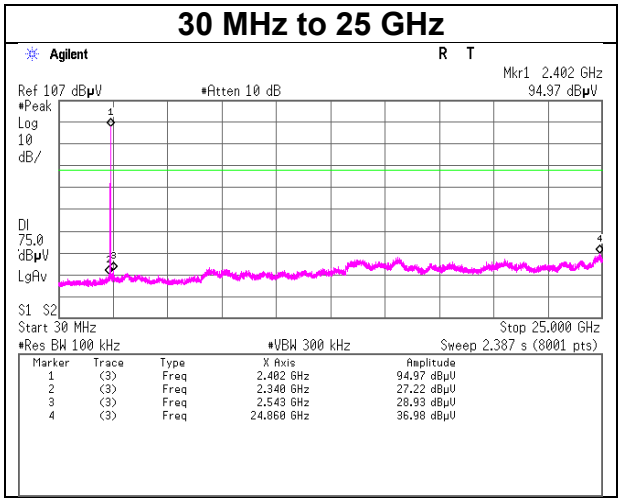
9 kHz to 150 kHz



150 kHz to 30 MHz



30 MHz to 25 GHz

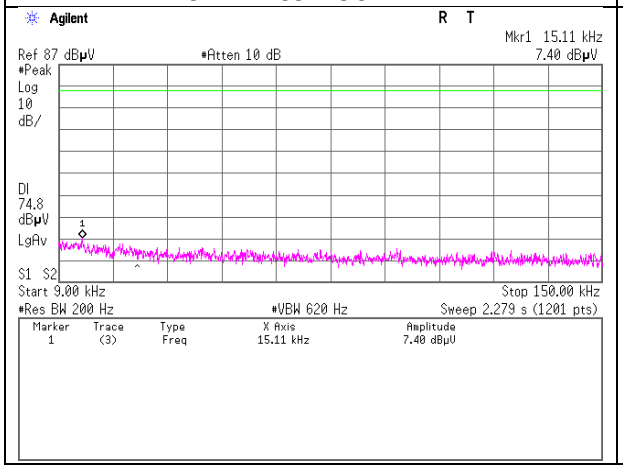


Conducted Spurious Emission

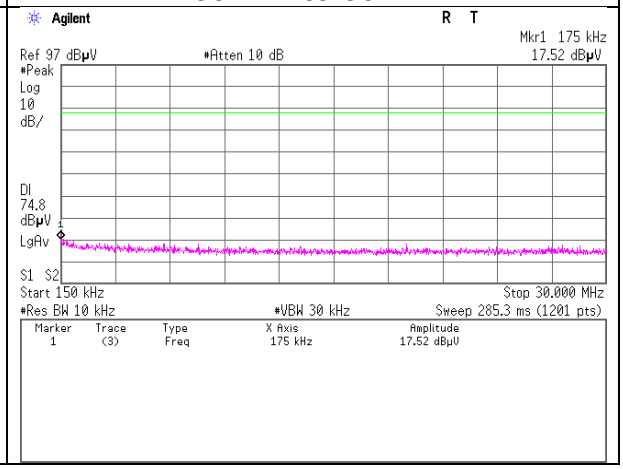
Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off, 3DH5

2441 MHz

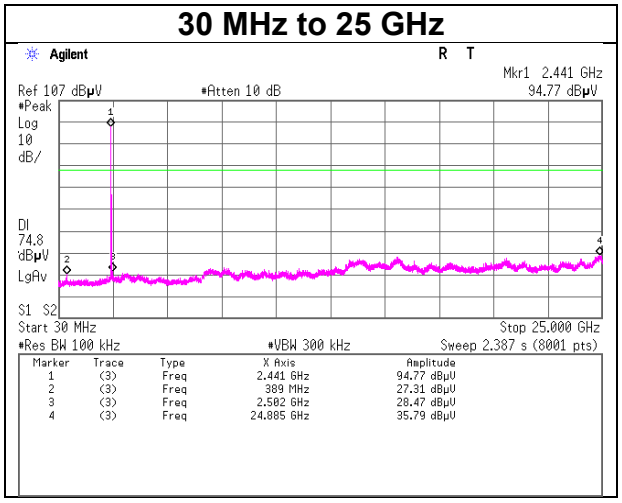
9 kHz to 150 kHz



150 kHz to 30 MHz



30 MHz to 25 GHz

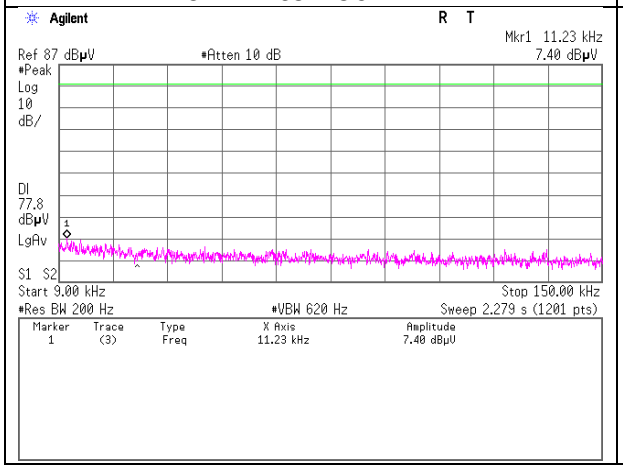


Conducted Spurious Emission

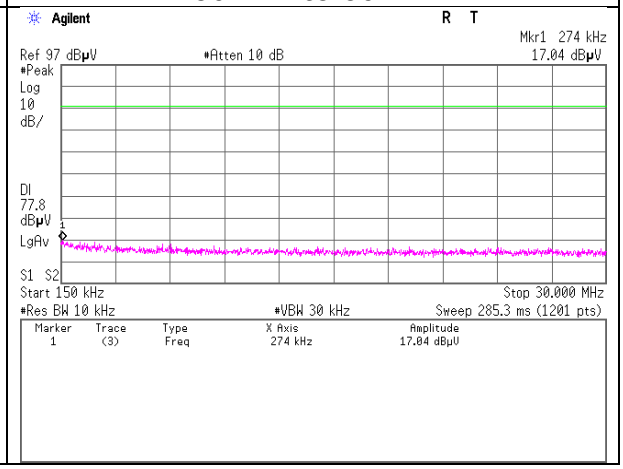
Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off, 3DH5

2480 MHz

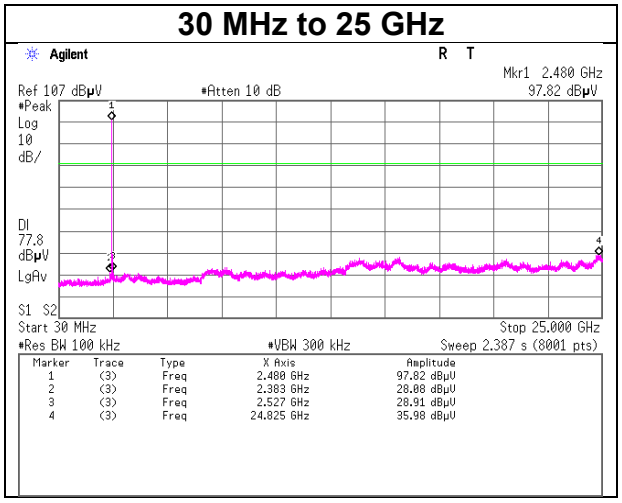
9 kHz to 150 kHz



150 kHz to 30 MHz



30 MHz to 25 GHz

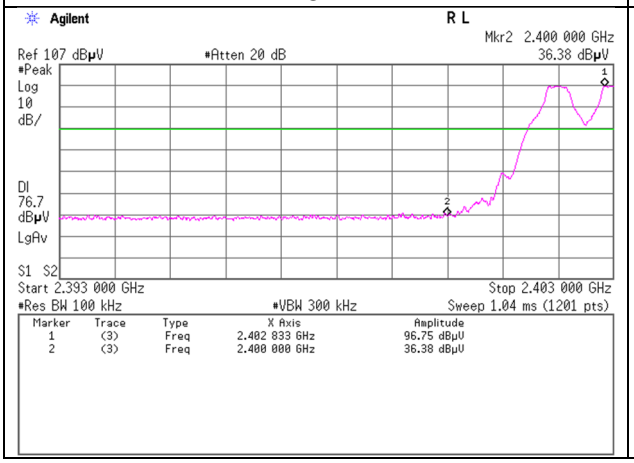


Conducted Emission Band Edge compliance

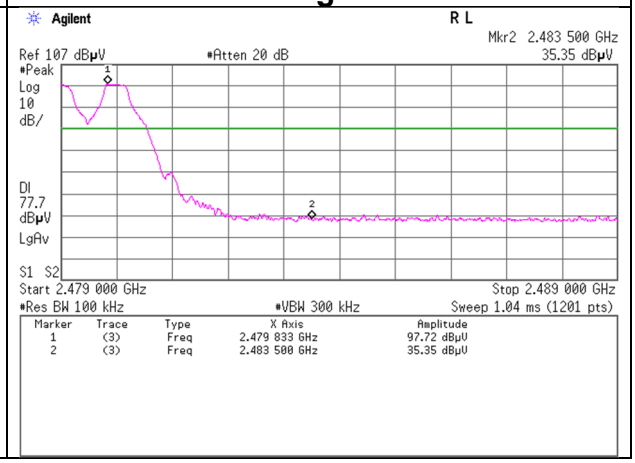
Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx DH5

Hopping On

Low

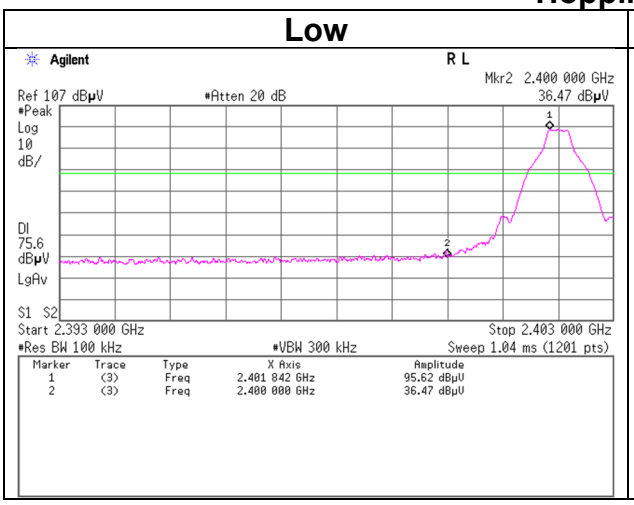


High

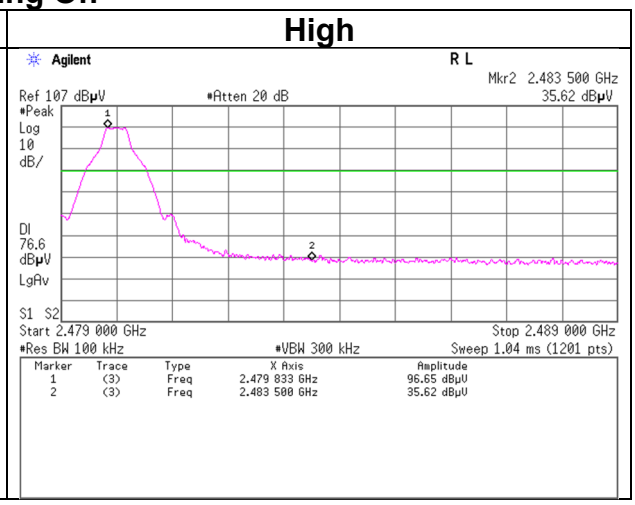


Hopping Off

Low



High

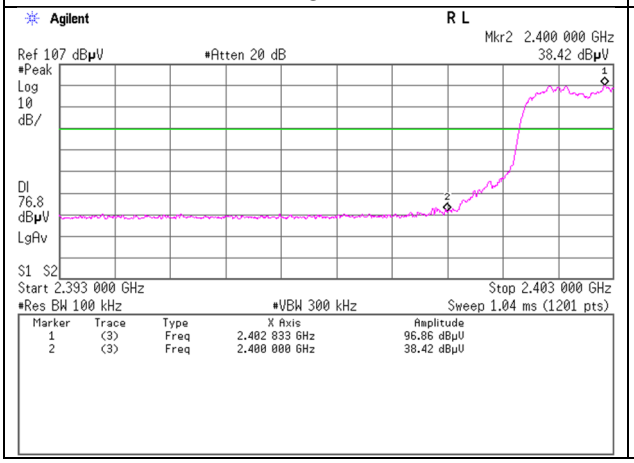


Conducted Emission Band Edge compliance

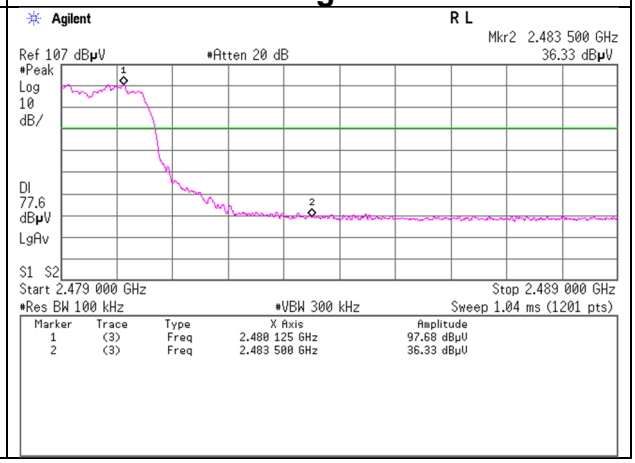
Test place	Kashima EMC Lab. No.2 Measurement Room
Date	May 1, 2024
Temperature / Humidity	21 deg. C / 53 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx 3DH5

Hopping On

Low

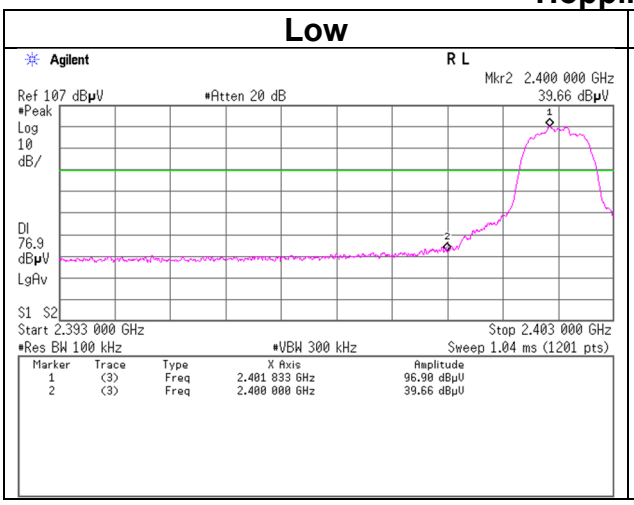


High

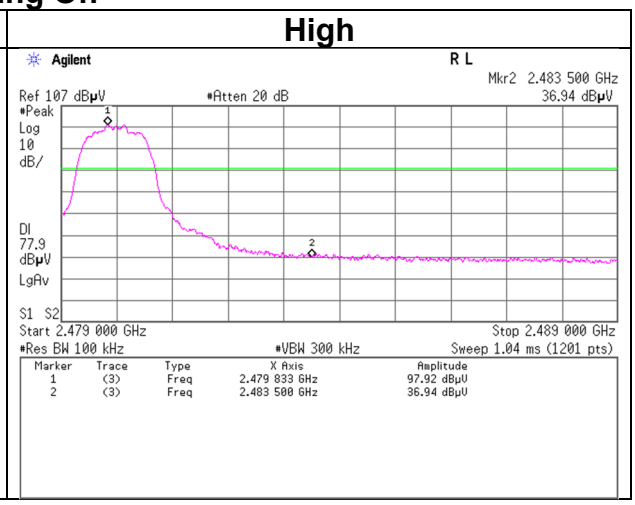


Hopping Off

Low



High



APPENDIX 2: Test Instruments

Test Equipment

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	143643	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY52490024	2023/06/21	12
AT	143023	10dB Fixed Atten.	Weinschel - API Technologies Corp	54A-10	56251	2024/05/12	12
AT	143110	Micro Wave Cable	Suhner	SUCOFLEX102	MY3773/2	2024/05/12	12
AT	143588	Peak Power Analyzer	Keysight Technologies Inc	8990B	MY51000276	2023/06/20	12
AT	143606	Power Sensor	Keysight Technologies Inc	N1923A	MY54070024	2023/06/20	12
AT	222747	Measure	SHINWA RULES CO., LTD.	80862	none	-	-
AT	144210	Digital Multimeter	Fluke Corporation	112	89790193	2023/10/24	12
AT	200034	Temperature & Humidity Logger	HIOKI E.E. CORPORATION	LR5001/LR9504	200636456/200699552	2023/07/18	12
AT	143133	Barometer	Sanoh Co., Ltd	SBR-151	001439	2023/03/10	36
RE	143122	LOGBICON	Schwarzbeck Mess-Elektronik OHG	VULB 9168	508	2024/04/15	12
RE	178807	5dB Fixed Atten.	Pasternack Enterprises	PE7047-5	none	2024/04/22	12
RE	143169	11Site RE 3m System	N/A	none(No.11 RE)	none	2023/11/15	12
RE	142936	Pre-Amplifier	SONOMA INSTRUMENT	310N	325015	2024/05/28	12
RE	144193	Test Receiver	Rohde & Schwarz	ESU40	100426	2024/06/03	12
RE	144648	Semi Anechoic Chamber	TDK	NSA (No.11)	11	2024/05/02	12
RE	143456	Double Ridged Wave Guide	ETS-Lindgren (Cedar Park, Texas)	3115	00204573	2024/02/09	12
RE	192241	Microwave Cable	Huber+Suhner	SF104/PC35m/PC35m/1000mm	805411/4	2024/01/19	12
RE	231901	Micro Wave Cable	Junkosha	MWX221	FEB-20-23-020	2024/03/02	12
RE	175395	Pre Amplifier	Erzia Technologies S.L.	ERZ-LNA-0100-2700-45-4	16A2001702002	2023/12/07	12
RE	143023	10dB Fixed Atten.	Weinschel - API Technologies Corp	54A-10	56251	2024/05/12	12
RE	143442	HPF	Micro-Tronics	HPM50111-02	009	2024/06/05	12
RE	143642	Spectrum Analyzer	Keysight Technologies Inc	N9030A	MY53310670 Version A.13.12	2024/05/23	12
RE	143643	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY52490024	2023/06/21	12
RE	144644	Semi Anechoic Chamber	TDK	SVSWR (No.11)	11	2024/05/01	12
RE	143438	Double Ridged Horn	ETS-Lindgren (Cedar Park, Texas)	3160-09	00166043	2023/06/19	12
RE	142937	Pre-Amplifier	TOYO	HAP18-26W	00000035	2023/06/19	12
RE	142992	Micro Wave Cable	Suhner	SUCOFLEX102	MY010/2A	2023/06/04	12
RE	222746	Measure	SHINWA RULES CO., LTD.	80862	none	-	-
RE	200033	Temperature & Humidity Logger	HIOKI E.E. CORPORATION	LR5001/LR9504	200636447/200699543	2023/07/18	12
RE	144215	Digital Multimeter	Fluke Corporation	FLK-83-V	14610320	2023/10/24	12
RE	143455	Double Ridged Wave Guide	ETS-Lindgren (Cedar Park, Texas)	3115	00204569	2024/02/09	12

RE	143140	Micro Wave Cable	Junkosha	MWX221	1407S222	2023/11/17	12
RE	192243	Microwave Cable	Huber+Suhner	SF104/11N/11PC 35/8000MM	808995/4	2024/01/19	12
RE	142940	Pre-Amplifier	Micro Wave Factory	MPR-1G26.5-35	161399	2023/06/08	12
RE	143459	HPF	Micro-Tronics	HPM50111-02	G015	2024/03/02	12
RE	144199	Test Receiver	Keysight Technologies Inc	N9038A	MY53290016	2023/07/05	12
RE	144633	Semi Anechoic Chamber	TDK	SVSWR (No.10)	10	2024/05/07	12
RE	222745	Measure	SHINWA RULES CO., LTD.	80862	none	-	-
RE	143542	Temperature & Humidity Indicator	HIOKI E.E. CORPORATION	3641/9680-50	090999895/09 0905406	2023/06/27	12
RE	143133	Barometer	Sanoh Co., Ltd	SBR-151	001439	2023/03/10	36
RE	144216	Digital Multimeter	Fluke Corporation	115	994460954	2023/10/24	12
RE	178804	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3 (RE,CE,ME,PE)	Ver 3.1.0546	-	-

***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:

AT: Antenna Terminal Conducted test
RE: Radiated Emission