RADIO TEST REPORT

Test Report No. 15377688H-B-R1

Customer	**Kowa Company. Ltd.**
Description of EUT	**Hand-held Slit-Lamp**
Model Number of EUT	**KOWA SL-19**
FCC ID	**2BH7QA322330**
Test Regulation	**FCC Part 15 Subpart E**
Test Result	**Complied**
Issue Date	**September 26, 2024**
Remarks	**WLAN (5 GHz band) part**

Representative Test Engineer	**Approved By**
D. Matsui	Takayuki. S
Daiki Matsui Engineer	Takayuki Shimada Leader

CERTIFICATE 5107.02

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☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No. 15377688H-B

This report is a revised version of 15377688H-B. 15377688H-B is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15377688H-B	September 9, 2024	-
1	15377688H-B-R1	September 26, 2024	**Section 5** Figure 1: Test Setup -Modified tested frequency band. 10 GHz to 26.5 GHz→ 10 GHz to 40 GHz **APPENDIX 1** Maximum Conducted Output Power -Modified the limit. mobile and portable client device→ access point Maximum Power Spectral Density -Modified the limit. mobile and portable client device→ access point Burst rate confirmation -Modified worst rate for 11a. MCS 0→6 Mbps

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	Kowa Company. Ltd.
Address	3-1, Chofugaoka 3-chome, Chofu, Tokyo, 182-0021 Japan
Telephone Number	+81-042-440-7630
Contact Person	Yoshiharu Kawai

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	Hand-held Slit-Lamp
Model Number	KOWA SL-19
Serial Number	Refer to SECTION 4.2
Condition	Production model
Modification	No Modification by the test lab
Receipt Date	July 4, 2024
Test Date	July 31 to August 27, 2024

2.2 Product Description

General Specification

Rating	DC 3.6 V, 2 A
Operating temperature	10 deg. C to 35 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	20 MHz Band	2412 MHz to 2462 MHz
Type of Modulation	DSSS, OFDM	
Antenna Gain[a)]	3 dBi	

WLAN (IEEE802.11a/11n-20)

Equipment Type	Transceiver	
Frequency of Operation	20 MHz Band	5180 MHz to 5240 MHz
Type of Modulation	OFDM	
Antenna Gain[a)]	4 dBi	

SECTION 3: Test specification, Procedures & Results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart E The latest version on the first day of the testing period
Title	FCC 47 CFR Part 15 Radio Frequency Device Subpart E Unlicensed National Information Infrastructure Devices Section 15.407 General technical requirements

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and Results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013	**FCC:** 15.407 (b) (6) / 15.207	-	N/A	*1)
	ISED: RSS-Gen 8.8	**ISED:** RSS-Gen 8.8			
26 dB Emission Bandwidth	**FCC:** KDB Publication Number 789033	**FCC:** 15.407 (a) (1) (2) (3)	See data	N/A	*2)
	ISED: -	**ISED:** -			
Maximum Conducted Output Power	**FCC:** KDB Publication Number 789033	**FCC:** 15.407 (a) (1) (2) (3)		Complied	Conducted
	ISED: -	**ISED:** RSS-247 6.2.1.1 6.2.2.1 6.2.3.1 6.2.4.2			
Maximum Power Spectral Density	**FCC:** KDB Publication Number 789033	**FCC :** 15.407 (a) (1) (2) (3)		Complied	Conducted
	ISED: -	**ISED:** RSS-247 6.2.1.1 6.2.2.1 6.2.3.1 6.2.4.2			
Spurious Emission Restricted Band Edge	**FCC:** ANSI C63.10-2013 KDB Publication Number 789033	**FCC:** 15.407 (b), 15.205 and 15.209	3.6 dB 587.9 MHz, QP, Vertical	Complied	Conducted (< 30 MHz)/ Radiated (> 30 MHz) *3)
	ISED: -	**ISED:** RSS-247 6.2.1.2 6.2.2.2 6.2.3.2 6.2.4.3			
6 dB Emission Bandwidth	**FCC:** ANSI C63.10-2013	**FCC:** 15.407 (e)	See data	N/A	*4)
	ISED: -	**ISED:** RSS-247 6.2.4.2			

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 was not performed on since the EUT is not an AC power operated device.
*2) The test is not applicable since the EUT does not support to W53 and W56 bands.
*3) Radiated test was selected over 30 MHz based on FCC 15.407 (b) and KDB 789033 D02 G.3.b).
*4) The test is not applicable since the EUT does not support to W58 bands.

FCC Part 15.31 (e)
This EUT provides the stable voltage constantly to RF Part regardless of input voltage.
Therefore, this EUT complies with the requirement.

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

3.3 Addition to Standard

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
99 % Occupied Band Width	**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		Unit	Calculated Uncertainty (+/-)
3 m	9 kHz to 30 MHz		dB	3.3
10 m			dB	3.1
3 m	30 MHz to 200 MHz	Horizontal	dB	4.7
		Vertical	dB	4.7
	200 MHz to 1000 MHz	Horizontal	dB	4.8
		Vertical	dB	6.0
10 m	30 MHz to 200 MHz	Horizontal	dB	5.2
		Vertical	dB	5.1
	200 MHz to 1000 MHz	Horizontal	dB	5.2
		Vertical	dB	5.2
3 m	1 GHz to 6 GHz		dB	5.1
	6 GHz to 18 GHz		dB	5.4
1 m	10 GHz to 18 GHz		dB	5.4
	18 GHz to 26.5 GHz		dB	5.3
	26.5 GHz to 40 GHz		dB	4.8
0.5 m	26.5 GHz to 40 GHz		dB	5.0

Antenna Terminal Conducted

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

3.5 Test Location

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

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

3.6 Test Data, Test Instruments, and Test Set Up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

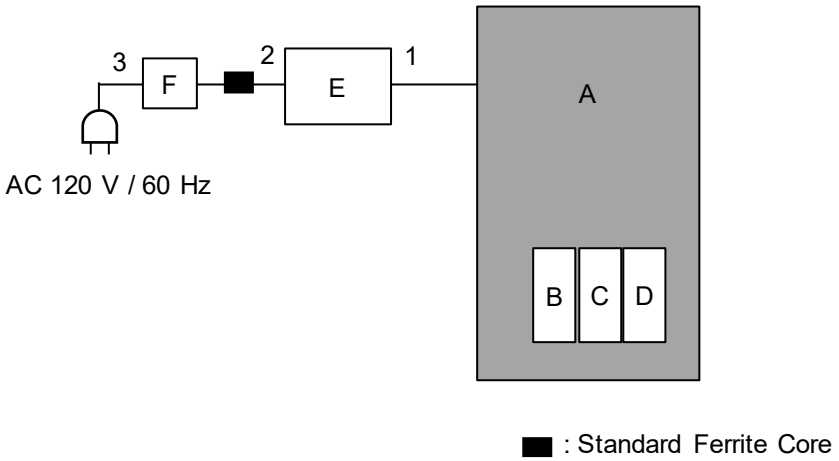
4.1 Operating Mode(s)

Mode	Remarks*
IEEE 802.11a (11a)	6 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 0, PN9
*The worst condition was determined based on the test result of Maximum Conducted Output Power.	
*Power of the EUT was set by the software as follows; Power Setting: 11a: 15, 11n-20: 15 Software: SL192 3110 FW RfTest 0007 (Date:05/17/2024, 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.	
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.	

*The Details of Operation Mode(s)

Test Item	Operating Mode	Tested Frequency
Radiated Spurious Emission (Below 1 GHz), Conducted Spurious Emission	Tx 11n-20 *1)	5220 MHz
99 % Occupied Bandwidth, Maximum Conducted Output Power, Maximum Power Spectral Density	Tx 11a Tx 11n-20	5180 MHz 5220 MHz 5240 MHz
Radiated Spurious Emission (Above 1 GHz)	Tx 11n-20 *2)	5180 MHz 5220 MHz 5240 MHz
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) Since 11a and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest output power.		

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	Hand-held Slit-Lamp	KOWA SL-19	32213400251 (For AT*) 32213400250 (For RE*)	Kowa Company. Ltd.	EUT
B	Nickel metal hydride battery	BK-3MCC	-	Panasonic Corporation	-
C	Nickel metal hydride battery	BK-3MCC	-	Panasonic Corporation	-
D	Nickel metal hydride battery	BK-3MCC	-	Panasonic Corporation	-
E	Laptop PC	Latitude 3500	CYXJWZ2	DELL	-
F	AC Adapter	HA65NS5-00	CN-0G6J41-CH600-04E-0LPM-A07	DELL	-

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	1.00	Shielded	Shielded	-
2	DC Cable	1.75	Unshielded	Unshielded	-
3	AC Cable	0.90	Unshielded	Unshielded	-

*AT: Antenna Terminal Conducted test
*RE: Radiated Emission

SECTION 5: Radiated Spurious Emission and Band Edge Compliance

Test Procedure

< Below 1 GHz >
EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

< 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.

< Below 1 GHz >
The result also satisfied with the general limits specified in section 15.209 (a).

< Above 1 GHz >
Inside of restricted bands (Section 15.205):
Apply to limit in the Section 15.209 (a).

Outside of the restricted bands:
Apply to limit 68.2 dBuV/m, 3 m (-27 dBm e.i.r.p.*) in the Section 15.407 (b) (1) (2) (3).

Restricted band edge:
Apply to limit in the Section 15.209 (a).
Since this limit is severer than the limit of the inside of restricted bands.

*Electric field strength to e.i.r.p. conversion:
$E = \frac{1000000\sqrt{30P}}{3}$ (uV/m) :*P* is the e.i.r.p. (Watts)

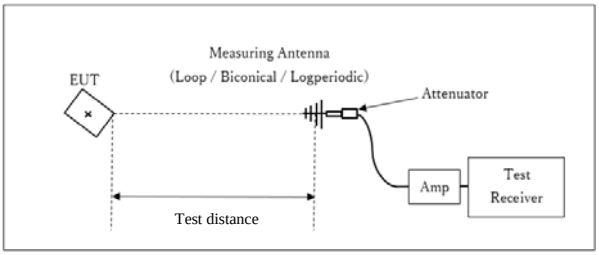
Test Antennas are used as below;

Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

Frequency	Below 1 GHz	Above 1 GHz	
Instrument Used	Test Receiver	Spectrum Analyzer	
Detector	QP	Peak	Average
IF Bandwidth	BW: 120 kHz	RBW: 1 MHz VBW: 3 MHz	Method AD RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: ≥ 100 traces If duty cycle was less than 98%, a duty factor was added to the results.

Figure 1: Test Setup

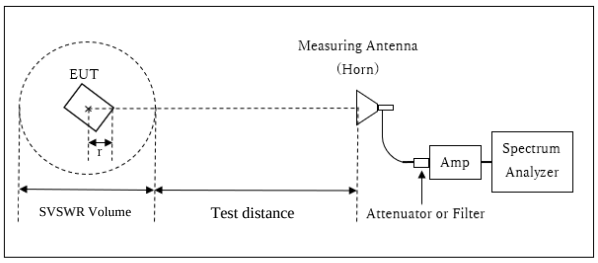
Below 1 GHz



× : 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

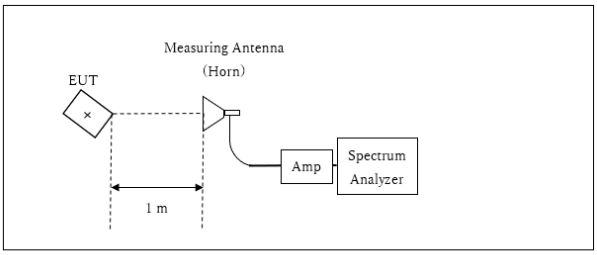
[1 GHz to 6 GHz]
Distance Factor: 20 x log (3.95 m*/3.0 m) = 2.39 dB
*(Test Distance + SVSWR Volume /2) - r = 3.95 m

Test Distance: 3 m
SVSWR Volume: 2 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r: 0.05 m

[6 GHz to 10 GHz]
Distance Factor: 20 x log (4.95 m*/3.0 m) = 4.35 dB
*(Test Distance + SVSWR Volume /2) - r = 4.95 m

Test Distance: 4.3 m
SVSWR Volume: 1.4 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r: 0.05 m

10 GHz to 40 GHz



× : Center of turn table

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

The test was made on EUT at the normal use position.

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

Measurement Range : 30 MHz to 40 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 and Test method
26 dB Bandwidth	Enough to capture the emission	Close to 1 % of EBW	> RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 % to 5 % of OBW	≥ 3 RBW	Auto	Peak	Max Hold	Spectrum Analyzer
6 dB Bandwidth	Enough to capture the emission	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Conducted Output Power	-	-	-	Auto	Average	-	Power Meter (Sensor: 20 MHz BW) (Method PM-G)
Maximum Power Spectral Density	Encompass the entire EBW	1 MHz	≥ 3 RBW	Auto	RMS or Sample Power Averaging (200 times)	Clear Write	Spectrum Analyzer
Conducted Spurious Emission*2) *3)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	9.1 kHz	27 kHz				

*1) Peak hold was applied as Worst-case measurement.
*2) In the frequency range below 30 MHz, 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 to 150 kHz: RBW = 200 Hz, 150 kHz to 30 MHz: RBW = 10 kHz)
*3) 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

99 % Occupied Bandwidth

Test place	Ise EMC Lab. No.8 Measurement Room
Date	July 31, 2024
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Takumi Nishida
Mode	Tx

11a

Tested Frequency [MHz]	99 % Occupied Bandwidth [kHz]
5180	***16653.7***
5220	16630.6
5240	16603.8

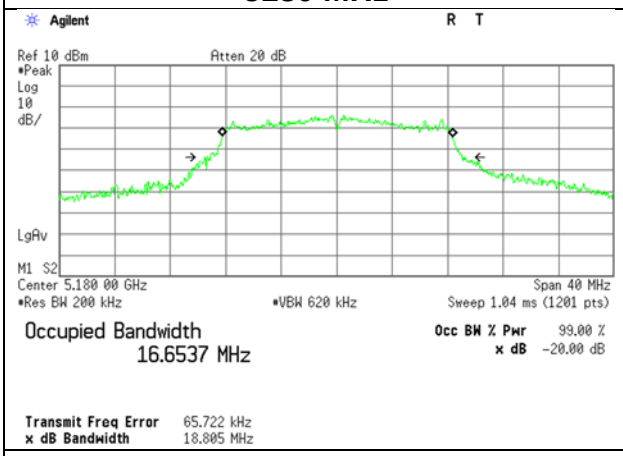
11n-20

Tested Frequency [MHz]	99 % Occupied Bandwidth [kHz]
5180	17768.3
5220	17736.2
5240	17725.4

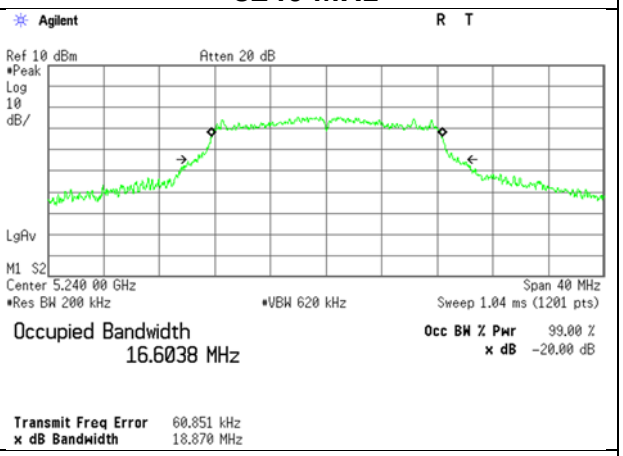
99 % Occupied Bandwidth

11a

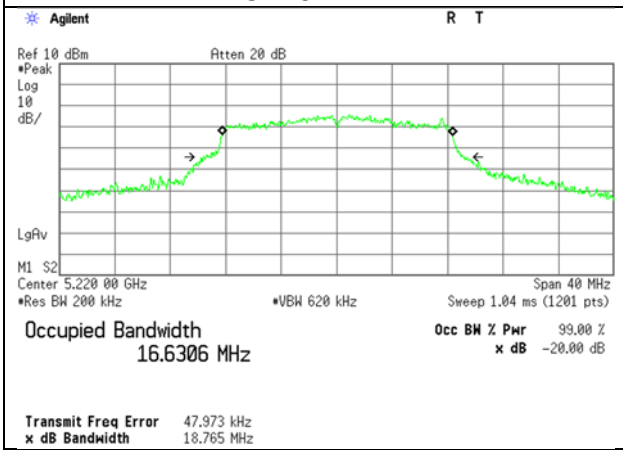
5180 MHz



5240 MHz



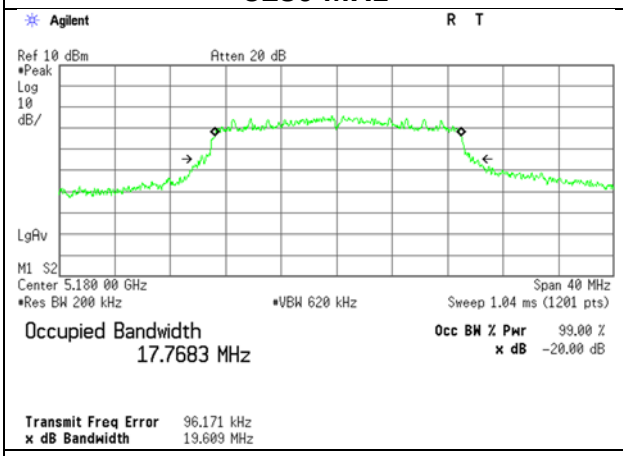
5220 MHz



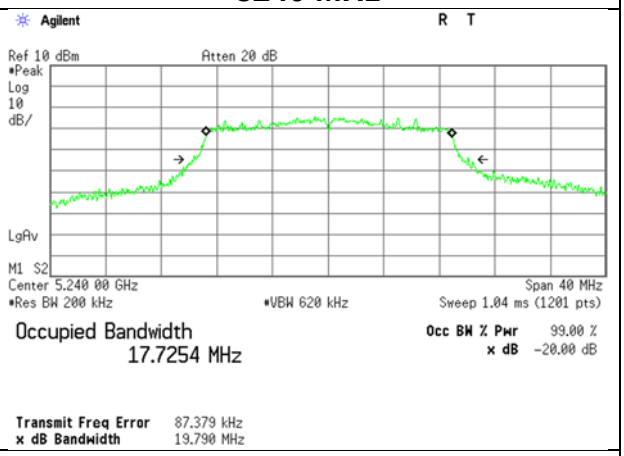
99 % Occupied Bandwidth

11n-20

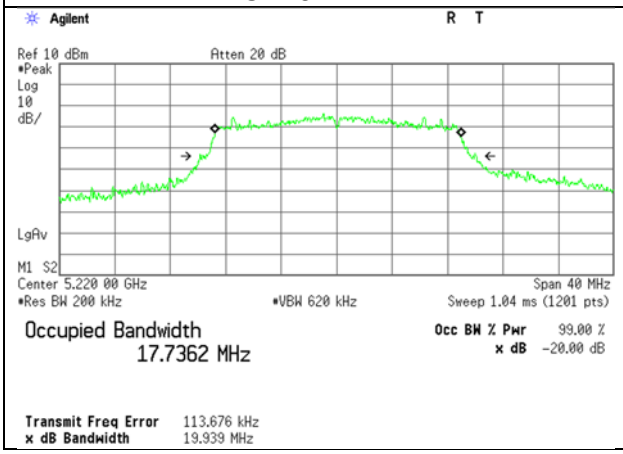
5180 MHz



5240 MHz



5220 MHz



Maximum Conducted Output Power

Test place	Ise EMC Lab. No.8 Measurement Room
Date	August 27, 2024
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Takumi Nishida
Mode	Tx 11a

11a

Applied limit: 15.407, access point

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for IC) [MHz]	Conducted Power Result [dBm]	Conducted Power Result [mW]	Conducted Power Limit [dBm]	Conducted Power Margin [dB]	e.i.r.p. Result [dBm]	e.i.r.p. Result [mW]	e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
5180	3.32	0.98	9.99	4.0	-	16.654	14.29	26.85	30.00	15.71	18.29	67.45	36.00	17.71
5220	3.43	0.98	9.99	4.0	-	16.631	***14.40***	***27.54***	30.00	15.60	***18.40***	***69.18***	36.00	17.60
5240	3.41	0.98	9.99	4.0	-	16.604	14.38	27.42	30.00	15.62	18.38	68.87	36.00	17.62

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

Maximum Conducted Output Power

Test place	Ise EMC Lab. No.8 Measurement Room
Date	August 27, 2024
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Takumi Nishida
Mode	Tx 11n-20

11n-20

Applied limit: 15.407, access point

Tested Frequency	Power Meter Reading	Cable Loss	Atten. Loss	Antenna Gain	26 dB EBW (B for FCC)	99% OBW (B for IC)	Conducted Power Result		Conducted Power Limit	Conducted Power Margin	e.i.r.p. Result		e.i.r.p. Limit	e.i.r.p. Margin
[MHz]	[dBm]	[dB]	[dB]	[dBi]	[MHz]	[MHz]	[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5180	3.40	0.98	9.99	4.0	-	17.768	14.37	27.35	30.00	15.63	18.37	68.71	36.00	17.63
5220	3.67	0.98	9.99	4.0	-	17.736	***14.64***	***29.11***	30.00	15.36	***18.64***	***73.11***	36.00	17.36
5240	3.55	0.98	9.99	4.0	-	17.725	14.52	28.31	30.00	15.48	18.52	71.12	36.00	17.48

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

Maximum Conducted Output Power

Test place	Ise EMC Lab. No.8 Measurement Room
Date	July 31, 2024
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Takumi Nishida
Mode	Tx 11a

5180 MHz

Mode	Rate Mbps	Burst power [dBm]	Remarks
11a	6	-7.32	*
	9	-7.60	
	12	-7.58	
	18	-7.55	
	24	-7.88	
	36	-7.88	
	48	-7.64	
	54	-7.74	

* Worst rate

Sample Calculation:Burst power = Reading (Burst average)

All comparison were carried out on same frequency and measurement factors.

Maximum Conducted Output Power

Test place	Ise EMC Lab. No.8 Measurement Room
Date	July 31, 2024
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Takumi Nishida
Mode	Tx 11n-20

5180 MHz

Mode	MCS Number	Burst power [dBm]	Remarks
11n-20	0	-9.80	*
	1	-10.07	
	2	-9.98	
	3	-9.89	
	4	-9.85	
	5	-9.92	
	6	-9.87	
	7	-9.93	

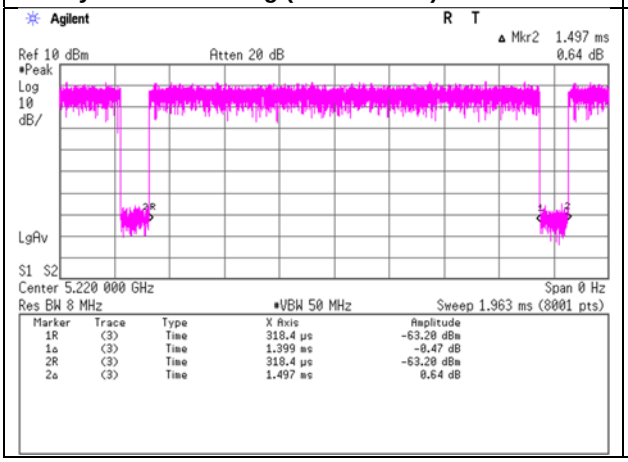
* Worst rate
Sample Calculation:Burst power = Reading (Burst average)
All comparison were carried out on same frequency and measurement factors.

Burst rate confirmation
(Worst Rate)

Test place	Ise EMC Lab. No.8 Measurement Room
Date	July 31, 2024
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Takumi Nishida
Mode	Tx

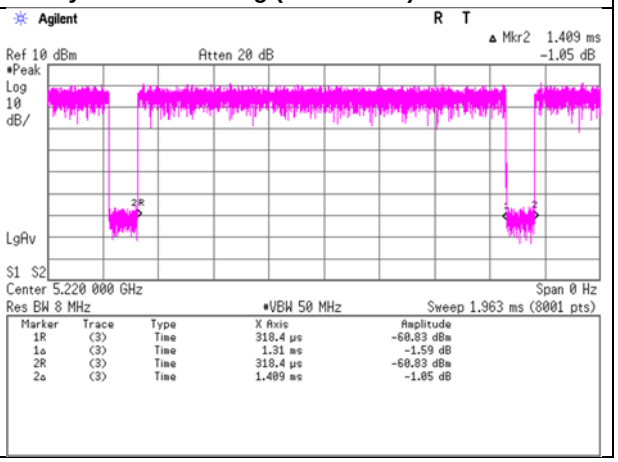
11a 6 Mbps

Tx on / (Tx on + Tx off) =	**0.935**
Tx on / (Tx on + Tx off) * 100 =	**93.5 %**
Duty factor = 10 * log (1.497 / 1.399) =	**0.29 dB**



11n-20 MCS 0

Tx on / (Tx on + Tx off) =	**0.930**
Tx on / (Tx on + Tx off) * 100 =	**93.0 %**
Duty factor = 10 * log (1.409 / 1.31) =	**0.32 dB**



Maximum Power Spectral Density

Test place	Ise EMC Lab. No.8 Measurement Room
Date	August 27, 2024
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Takumi Nishida
Mode	Tx 11a

Applied limit: 15.407, access point

Tested Frequency	PSD Reading	Cable Loss	Atten. Loss	Duty Factor	Antenna Gain	RBW Correction Factor	PSD (Conducted)			PSD (e.i.r.p.)		
							Result	Limit	Margin	Result	Limit	Margin
[MHz]	[dBm/MHz]	[dB]	[dB]	[dB]	[dBi]	[dB]	[dBm/MHz]	[dBm/MHz]	[dB]	[dBm/MHz]	[dBm/MHz]	[dB]
5180	-15.33	0.98	19.82	0.29	4.0	0.00	***5.76***	17.00	11.24	***9.76***	23.00	13.24
5220	-15.37	0.98	19.82	0.29	4.0	0.00	5.72	17.00	11.28	9.72	23.00	13.28
5240	-15.08	0.97	19.82	0.29	4.0	0.00	6.00	17.00	11.00	10.00	23.00	13.00

Sample Calculation:
PSD: Power Spectral Density
PSD Result (Conducted) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor + RBW Correction Factor
PSD Result (e.i.r.p.) = Conducted PSD Result + Antenna Gain

Maximum Power Spectral Density

Test place	Ise EMC Lab. No.8 Measurement Room
Date	August 27, 2024
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Takumi Nishida
Mode	Tx 11n-20

Applied limit: 15.407, access point

Tested Frequency [MHz]	PSD Reading [dBm/MHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted) Result [dBm/MHz]	PSD (Conducted) Limit [dBm/MHz]	PSD (Conducted) Margin [dB]	PSD (e.i.r.p.) Result [dBm/MHz]	PSD (e.i.r.p.) Limit [dBm/MHz]	PSD (e.i.r.p.) Margin [dB]
5180	-16.01	0.98	19.90	0.32	4.0	0.00	5.19	17.00	11.81	9.19	23.00	13.81
5220	-15.75	0.98	19.90	0.32	4.0	0.00	***5.45***	17.00	11.55	***9.45***	23.00	13.55
5240	-16.05	0.97	19.90	0.32	4.0	0.00	5.14	17.00	11.86	9.14	23.00	13.86

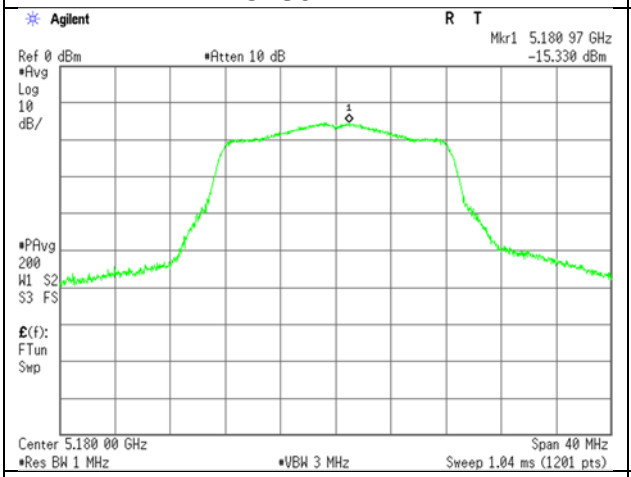
Sample Calculation:
PSD: Power Spectral Density
PSD Result (Conducted) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor + RBW Correction Factor
PSD Result (e.i.r.p.) = Conducted PSD Result + Antenna Gain

Maximum Power Spectral Density

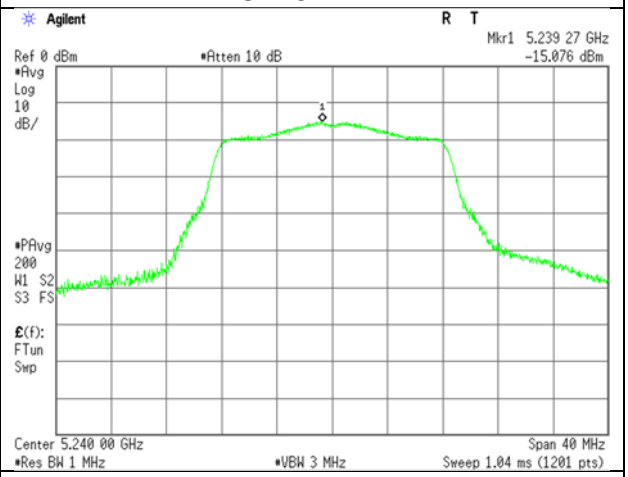
Test place	Ise EMC Lab. No.8 Measurement Room
Date	August 27, 2024
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Takumi Nishida
Mode	Tx 11a

11a

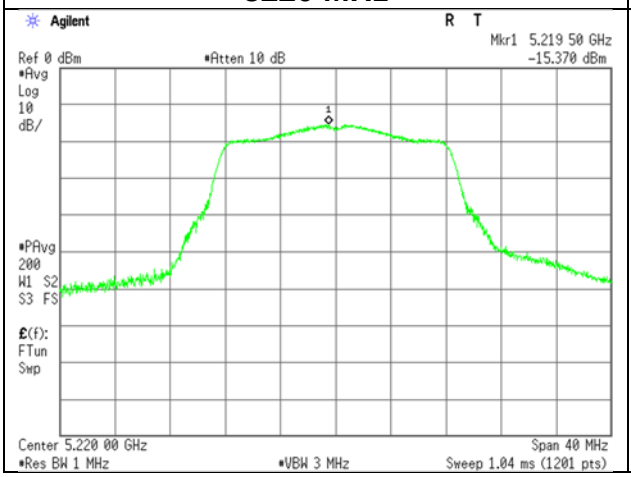
5180 MHz



5240 MHz



5220 MHz

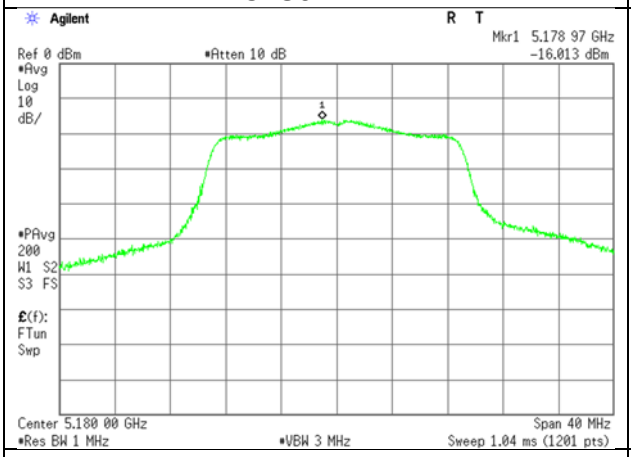


Maximum Power Spectral Density

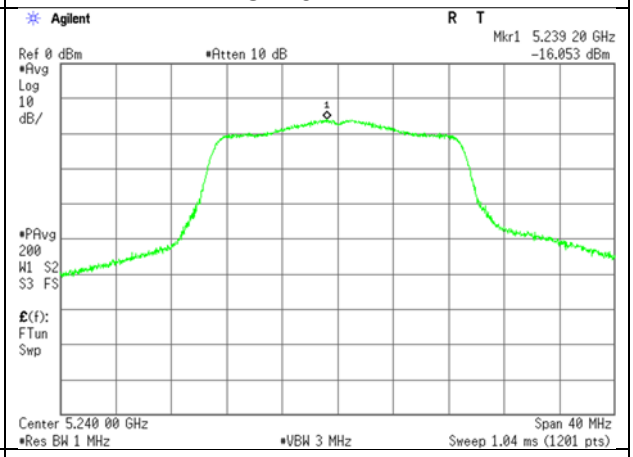
Test place	Ise EMC Lab. No.8 Measurement Room
Date	August 27, 2024
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Takumi Nishida
Mode	Tx 11n-20

11n-20

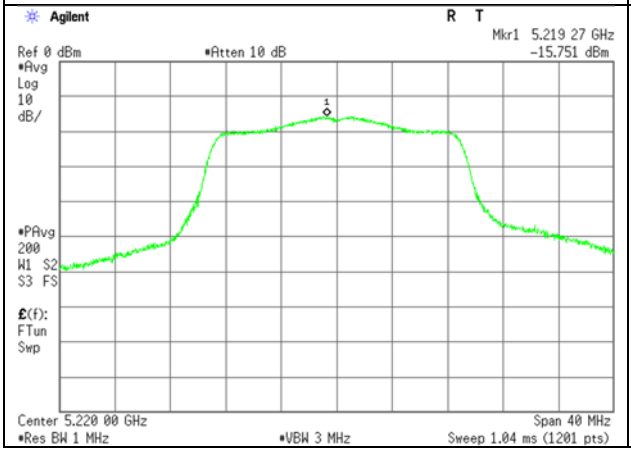
5180 MHz



5240 MHz



5220 MHz



Radiated Spurious Emission

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	August 1, 2024	August 1, 2024
Temperature / Humidity	22 deg. C / 57 % RH	25 deg. C / 55 % RH
Engineer	Daiki Matsui	Takumi Nishida
	(1 GHz to 18 GHz)	(18 GHz to 40 GHz)
Mode	Tx 11n-20 5180 MHz	

Polarity [Hori/Vert]	Frequency [MHz]	Reading (QP / PK) [dBuV]	Reading (AV) [dBuV]	Ant. Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result (QP / PK) [dBuV/m]	Result (AV) [dBuV/m]	Limit (QP / PK) [dBuV/m]	Limit (AV) [dBuV/m]	Margin (QP / PK) [dB]	Margin (AV) [dB]	Remark
Hori.	5150.0	55.0	40.0	32.2	6.5	30.9	0.3	62.8	48.1	73.9	53.9	11.1	5.8	*1)
Hori.	10360.0	44.1	35.2	35.9	-1.5	32.6	-	45.9	37.0	73.9	53.9	28.0	16.9	Floor noise
Hori.	15540.0	44.6	35.8	39.3	0.0	32.2	-	51.7	42.9	73.9	53.9	22.2	11.0	Floor noise
Vert.	5150.0	55.9	39.8	32.2	6.5	30.9	0.3	63.6	47.9	73.9	53.9	10.3	6.0	*1)
Vert.	10360.0	44.2	35.1	35.9	-1.5	32.6	-	46.0	36.9	73.9	53.9	27.9	17.0	Floor noise
Vert.	15540.0	44.2	36.2	39.3	0.0	32.2	-	51.3	43.2	73.9	53.9	22.6	10.7	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Result (AV)= Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor
*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.
*1) Not Out of Band emission(Leakage Power)

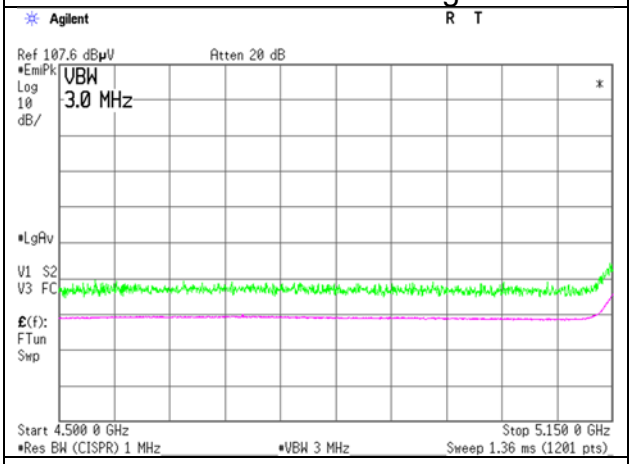
Distance factor:	1 GHz - 6 GHz	20log (3.95 m / 3.0 m) = 2.39 dB
	6 GHz - 10 GHz	20log (4.95 m / 3.0 m) = 4.35 dB
	10 GHz - 40 GHz	20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	August 1, 2024
Temperature / Humidity	22 deg. C / 57 % RH
Engineer	Daiki Matsui
Mode	Tx 11n-20 5180 MHz

Horizontal

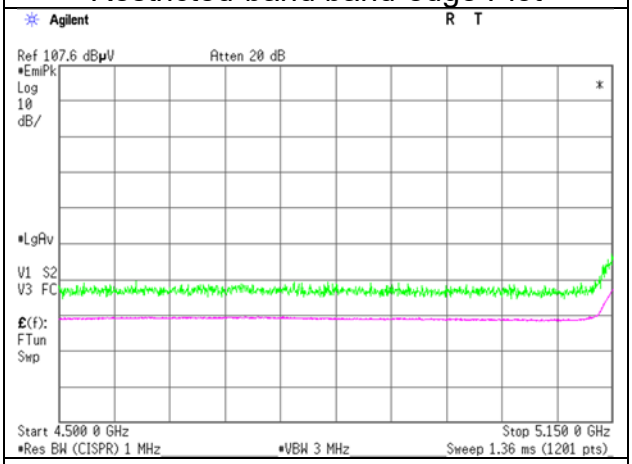
Restricted-band band-edge Plot



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	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	August 1, 2024	August 1, 2024	August 1, 2024
Temperature / Humidity	22 deg. C / 57 % RH	25 deg. C / 55 % RH	23 deg. C / 59 % RH
Engineer	Daiki Matsui (1 GHz to 18 GHz)	Takumi Nishida (18 GHz to 40 GHz)	Daiki Matsui (Below 1 GHz)
Mode	Tx 11n-20 5220 MHz		

Polarity [Hori/Vert]	Frequency [MHz]	Reading (QP / PK) [dBuV]	Reading (AV) [dBuV]	Ant. Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result (QP / PK) [dBuV/m]	Result (AV) [dBuV/m]	Limit (QP / PK) [dBuV/m]	Limit (AV) [dBuV/m]	Margin (QP / PK) [dB]	Margin (AV) [dB]	Remark
Hori.	111.4	40.9	-	12.0	8.0	28.4	-	32.4	-	43.5	-	11.1	-	
Hori.	222.8	46.8	-	11.2	8.9	27.9	-	39.1	-	46.0	-	6.9	-	
Hori.	259.9	41.7	-	12.2	9.3	27.7	-	35.4	-	46.0	-	10.6	-	
Hori.	371.3	39.0	-	15.1	10.0	28.2	-	35.8	-	46.0	-	10.2	-	
Hori.	550.0	37.4	-	17.8	11.0	29.3	-	36.9	-	46.0	-	9.1	-	
Hori.	588.0	40.3	-	19.0	11.2	29.3	-	41.2	-	46.0	-	4.8	-	
Hori.	10440.0	43.5	34.8	35.9	-1.5	32.6	-	45.3	36.6	73.9	53.9	28.6	17.3	Floor noise
Hori.	15660.0	44.3	35.9	39.3	0.0	32.2	-	51.4	43.0	73.9	53.9	22.5	10.9	Floor noise
Vert.	111.4	37.4	-	12.0	8.0	28.4	-	28.9	-	43.5	-	14.6	-	
Vert.	259.9	40.5	-	12.2	9.3	27.7	-	34.2	-	46.0	-	11.8	-	
Vert.	334.1	40.1	-	14.7	9.8	27.9	-	36.6	-	46.0	-	9.4	-	
Vert.	371.2	42.8	-	15.1	10.0	28.2	-	39.6	-	46.0	-	6.4	-	
Vert.	530.7	31.0	-	17.6	10.9	29.2	-	30.3	-	46.0	-	15.7	-	
Vert.	587.9	41.5	-	19.0	11.2	29.3	-	42.4	-	46.0	-	3.6	-	
Vert.	10440.0	43.4	34.9	35.9	-1.5	32.6	-	45.2	36.7	73.9	53.9	28.7	17.2	Floor noise
Vert.	15660.0	44.7	35.9	39.3	0.0	32.2	-	51.8	43.0	73.9	53.9	22.2	10.9	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Result (AV)= Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor
*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 - 6 GHz	20log (3.95 m / 3.0 m) = 2.39 dB
	6 GHz - 10 GHz	20log (4.95 m / 3.0 m) = 4.35 dB
	10 GHz - 40 GHz	20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	August 1, 2024	August 1, 2024
Temperature / Humidity	22 deg. C / 57 % RH	25 deg. C / 55 % RH
Engineer	Daiki Matsui	Takumi Nishida
	(1 GHz to 18 GHz)	(18 GHz to 40 GHz)
Mode	Tx 11n-20 5240 MHz	

Polarity [Hori/Vert]	Frequency [MHz]	Reading (QP / PK) [dBuV]	Reading (AV) [dBuV]	Ant. Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result (QP / PK) [dBuV/m]	Result (AV) [dBuV/m]	Limit (QP / PK) [dBuV/m]	Limit (AV) [dBuV/m]	Margin (QP / PK) [dB]	Margin (AV) [dB]	Remark
Hori.	5350.0	41.4	31.4	31.8	6.6	30.9	0.3	48.8	39.2	73.9	53.9	25.1	14.8	*1)
Hori.	10480.0	43.2	34.6	36.1	-1.5	32.6	-	45.1	36.6	73.9	53.9	28.8	17.3	Floor noise
Hori.	15720.0	44.5	35.7	39.5	0.0	32.2	-	51.8	43.0	73.9	53.9	22.1	10.9	Floor noise
Vert.	5350.0	41.6	32.4	31.8	6.6	30.9	0.3	49.0	40.1	73.9	53.9	24.9	13.8	*1)
Vert.	10480.0	42.8	34.7	36.1	-1.5	32.6	-	44.8	36.6	73.9	53.9	29.1	17.3	Floor noise
Vert.	15720.0	44.2	35.6	39.5	0.0	32.2	-	51.5	42.9	73.9	53.9	22.4	11.0	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Result (AV)= Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor
*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.
*1) Not Out of Band emission(Leakage Power)

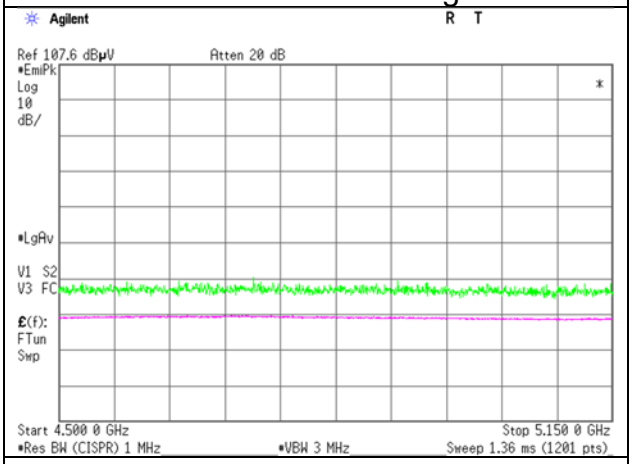
Distance factor:	1 GHz - 6 GHz	20log (3.95 m / 3.0 m) = 2.39 dB
	6 GHz - 10 GHz	20log (4.95 m / 3.0 m) = 4.35 dB
	10 GHz - 40 GHz	20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	August 1, 2024
Temperature / Humidity	22 deg. C / 57 % RH
Engineer	Daiki Matsui
Mode	Tx 11n-20 5240 MHz

Horizontal

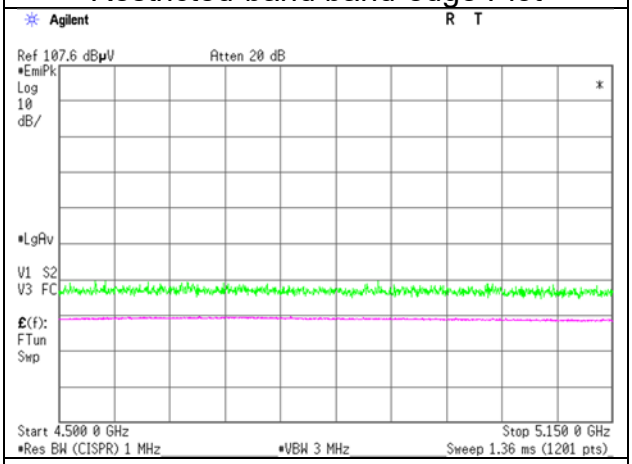
Restricted-band band-edge Plot



Trace Green: Peak Plot
Trace Purple: Average Plot

Vertical

Restricted-band band-edge Plot

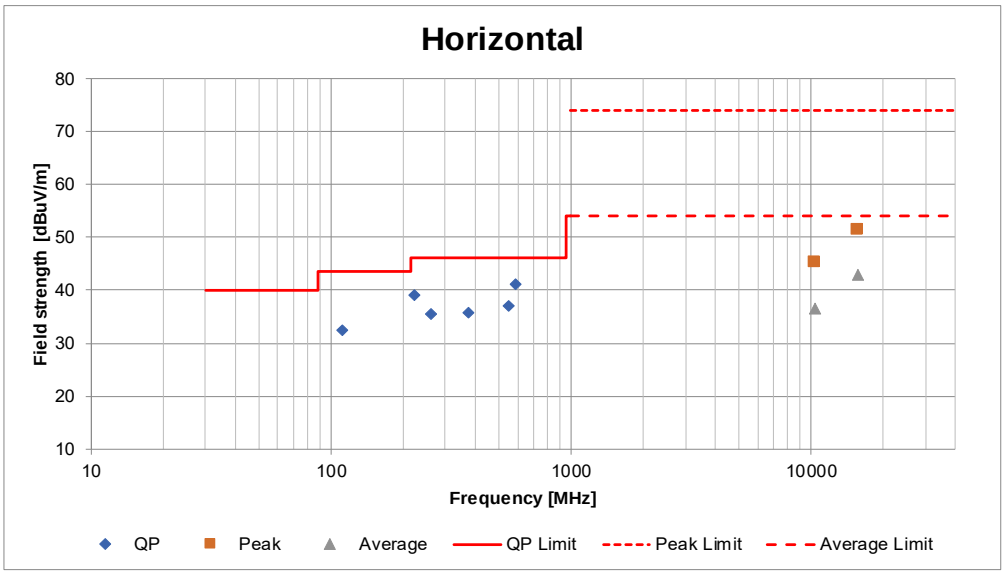


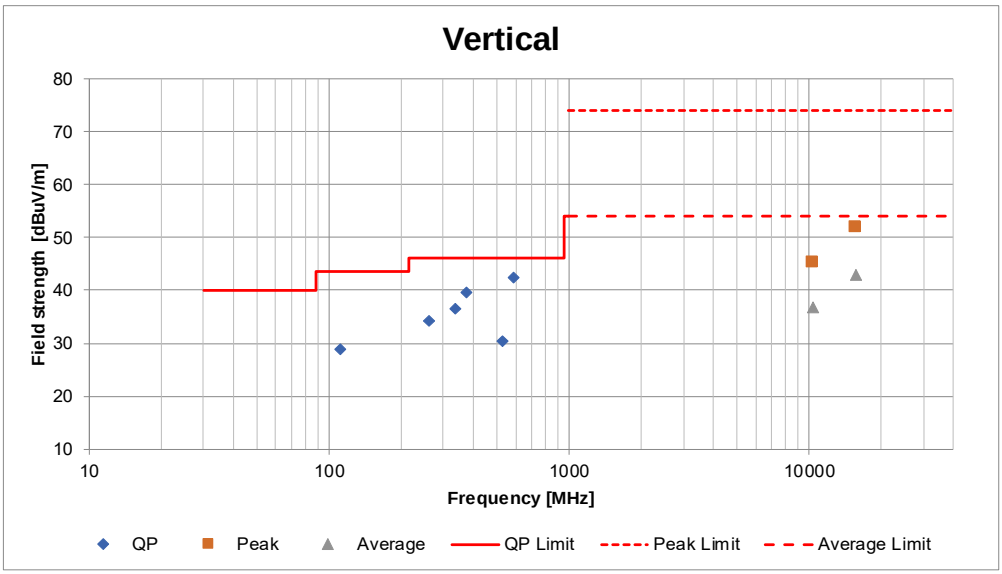
Trace Green: Peak Plot
Trace Purple: Average Plot

* 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 Conducted Output Power)

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	August 1, 2024	August 1, 2024	August 1, 2024
Temperature / Humidity	22 deg. C / 57 % RH	25 deg. C / 55 % RH	23 deg. C / 59 % RH
Engineer	Daiki Matsui (1 GHz to 18 GHz)	Takumi Nishida (18 GHz to 40 GHz)	Daiki Matsui (Below 1 GHz)
Mode	Tx 11n-20 5220 MHz		



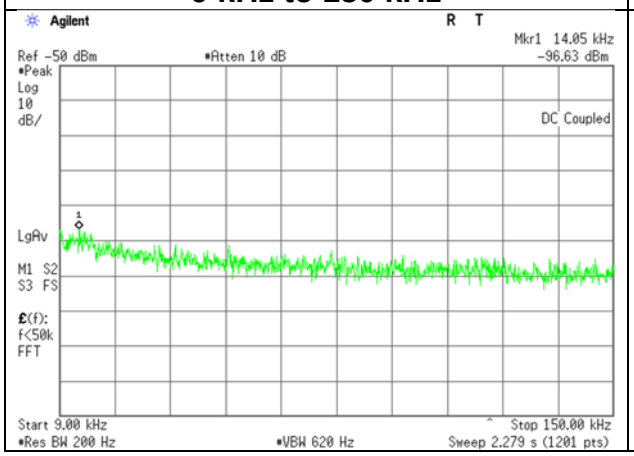


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

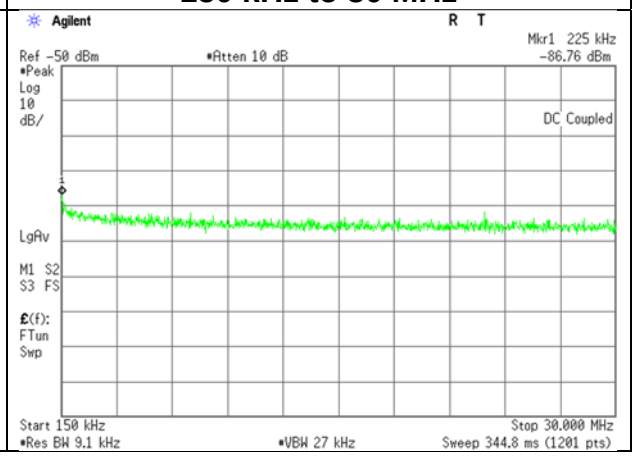
Conducted Spurious Emission

Test place	Ise EMC Lab. No.8 Measurement Room
Date	July 31, 2024
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Takumi Nishida
Mode	Tx 11n-20 5220 MHz

9 kHz to 150 kHz



150 kHz to 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
14.05	-96.6	0.00	9.7	4.0	1	-82.9	300	6.0	-21.7	44.6	66.3	
225.00	-86.8	0.01	9.7	4.0	1	-73.1	300	6.0	-11.8	20.5	32.3	

E [dBuV/m] = EIRP [dBm] - 20 log (Distance [m]) + Ground bounce [dB] + 104.8 [dBuV/m]

EIRP[dBm] = Reading [dBm] + Cable loss [dB] + Attenuator Loss [dB] + Antenna gain [dBi] + 10 * log (N)

N: Number of output

APPENDIX 2: Test Instruments

Test Equipment

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	141244	Attenuator(10dB)	Weinschel - API Technologies Corp	WA8-10-34	A198	02/17/2024	12
AT	141269	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	03/08/2024	12
AT	141327	Coaxial Cable	UL Japan	-	-	02/09/2024	12
AT	141391	Microwave Cable	RS Pro	R-132G7210200CD	-	04/01/2024	12
AT	141419	Attenuator	Weinschel Associates	WA56-10	56100305	05/22/2024	12
AT	141557	DIGIITAL HiTESTER	HIOKI E.E. CORPORATION	3805	070900530	01/31/2024	12
AT	141810	Power Meter	Anritsu Corporation	ML2495A	824014	12/12/2023	12
AT	141832	Power sensor	Anritsu Corporation	MA2411B	738174	12/12/2023	12
AT	141902	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187105	05/30/2024	12
AT	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	01/26/2024	12
AT	196430	Microwave Cable	Huber+Suhner	SF102D/11PC24/ 11PC24/1000mm	537059/126EA	02/26/2024	12
AT	244707	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202102	01/25/2024	12
AT	244711	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202105	01/25/2024	12
AT	246360	Microwave Cable	RS Pro	R-132G7210200CD	-	03/22/2024	12
AT	141420	Attenuator	Weinschel Associates	WA56-10	56100307	05/22/2024	12
RE	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-192	09/21/2023	12
RE	141294	High Pass Filter 7-20GHz	TOKIMEC	TF37NCCC	603	02/15/2024	12
RE	141331	Attenuator(6dB)	TME	UFA-01	-	02/17/2024	12
RE	141377	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	30819/2	05/27/2024	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	06/25/2024	12
RE	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	557	05/17/2024	12
RE	141517	Horn Antenna 26.5-40GHz	ETS-Lindgren	3160-10	152399	11/20/2023	12
RE	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	02/01/2024	12
RE	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	10/05/2023	12
RE	141588	Pre Amplifier	L3 Narda-MITEQ	AMF-6F-2600400-33-8P /AMF-4F-2600400-33-8P	1871355 / 1871328	01/22/2024	12
RE	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	02/17/2024	12
RE	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/29/2023	12
RE	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	05/17/2024	12
RE	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	12/13/2023	24
RE	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/14/2023	24
RE	142230	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
RE	160324	Coaxial Cable	Huber+Suhner	SUCOFLEX 102A	MY009/2A	10/05/2023	12
RE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	234602	Microwave Cable	Huber+Suhner	SF126E/11PC35/ 11PC35/ 1000M,5000M	537063/126E / 537074/126E	03/08/2024	12
RE	244710	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202104	01/25/2024	12
RE	245788	Double Ridge Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	690	03/06/2024	12

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

The expiration date of the calibration is the end of the expired month.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

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