RADIO TEST REPORT

Test Report No. : 13674969H-B

Applicant	:	**Murata Manufacturing Co., Ltd.**
Type of EUT	:	**W-LAN + Bluetooth Module**
Model Number of EUT	:	**1PJ**
FCC ID	:	**VPYLBEE5ZZ1PJ**
Test regulation	:	**FCC Part 15 Subpart C: 2021 (Bluetooth (BR / EDR) parts) *For Permissive Change**
Test Result	:	**Complied (Refer to SECTION 3) *Maximum Peak Output Power, Radiated Spurious Emission and Conducted Spurious Emission tests only**

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3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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6. This test report covers Radio technical requirements.
   It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in Section 1.

Date of test: January 18 to 20, 2021

Representative test engineer:
Nachi Konegawa
Engineer
Consumer Technology Division

Approved by:
Takayuki Shimada
Leader
Consumer Technology Division

CERTIFICATE 5107.02

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

REVISION HISTORY

Original Test Report No.: 13674969H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13674969H-B	March 29, 2021	-	-

Reference: Abbreviations (Including words undescribed in this report)

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

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SECTION 1: Customer information

Company Name	:	Murata Manufacturing Co., Ltd.
Address	:	1-10-1 Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan
Telephone Number	:	+81-75-955-6736
Facsimile Number	:	+81-75-955-6634
Contact Person	:	Motoo Hayashi

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

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type	:	W-LAN + Bluetooth Module
Model Number	:	1PJ
Serial Number	:	Refer to SECTION 4.2
Rating	:	Typ. DC 3.3 V/ Min. DC 3.135 V/ Max. DC 3.465 V
Receipt Date	:	January 18, 2021
Country of Mass-production	:	China, Japan
Condition	:	Production model
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: 1PJ (referred to as the EUT in this report) is a W-LAN + Bluetooth Module.

Radio Specification

Specification of Wireless LAN (IEEE802.11b/g/a/n(HT20/40)/ac(VHT20/40/80))

Type of radio	IEEE802.11b	IEEE802.11g/n (20 M band)	IEEE802.11a/n/ac (20 M band)	IEEE802.11n/ac (40 M band)	IEEE802.11ac (80 M band)
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5720 MHz 5745 MHz - 5825 MHz	5190 MHz - 5230 MHz 5270 MHz - 5310 MHz 5510 MHz - 5710 MHz 5755 MHz - 5795 MHz	5210 MHz 5290 MHz 5530 MHz - 5690 MHz 5775 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM(IEEE802.11ac only))		
Channel spacing	5 MHz		20 MHz	40 MHz	80 MHz
Antenna type	Monopole Antenna				
Antenna Gain	2.4 GHz: 1.8 dBi 5 GHz: 2.0 dBi				

Bluetooth

	Bluetooth *1)
Frequency of operation	2402 MHz - 2480 MHz
Type of modulation	BT: FHSS (GFSK, π/4DQPSK, 8DPSK) LE: GFSK
Channel spacing	BT: 1 MHz LE: 2 MHz
Antenna type	Monopole Antenna
Antenna Gain	1.8 dBi

*1) This test report applies to Bluetooth BR/EDR part (2402 MHz - 2480 MHz) except for Bluetooth Low Energy.
* WLAN and Bluetooth do not transmit simultaneously.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on January 12, 2021 and effective February 11, 2021

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Maximum Peak Output Power	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(b)(1)	See data.	Complied a)	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)	19.8 dB 2390.000 MHz, AV, Vert.	Complied b) / c)	Conducted/ Radiated (above 30 MHz) *1)
	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 No. 13-EM-W0420 and 13-EM-W0422. *1) Radiated test was selected over 30 MHz based on section 15.247(d). a) Refer to APPENDIX 1 (data of Maximum Peak Output Power) b) Refer to APPENDIX 1 (data of Conducted Spurious Emission) c) Refer to APPENDIX 1 (data of Radiated Spurious Emission)					
Symbols: Complied: The data of this test item has enough margin, more than the measurement uncertainty. Complied#: The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.					

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

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

FCC Part 15.203 Antenna requirement
The antenna is not removable from the EUT.
Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

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

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

Ise EMC Lab.

Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %
Maximum Peak Output Power / Average Output Power	1.4 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.6 dB

Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
	(Vertical)	5.0 dB
	200 MHz to 1000 MHz (Horizontal)	5.2 dB
	(Vertical)	6.3 dB
10 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
	(Vertical)	4.8 dB
	200 MHz to 1000 MHz (Horizontal)	5.0 dB
	(Vertical)	5.0 dB
3 m	1 GHz to 6 GHz	4.9 dB
	6 GHz to 18 GHz	5.2 dB
1 m	10 GHz to 26.5 GHz	5.5 dB
	26.5 GHz to 40 GHz	5.5 dB
10 m	1 GHz to 18 GHz	5.2 dB

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967
ISED Lab Company Number: 2973C / CAB identifier: JP0002
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

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.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

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

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)

Bluetooth (BT): Transmitting (Tx), Payload: PRBS9

Details of Operating Mode(s)

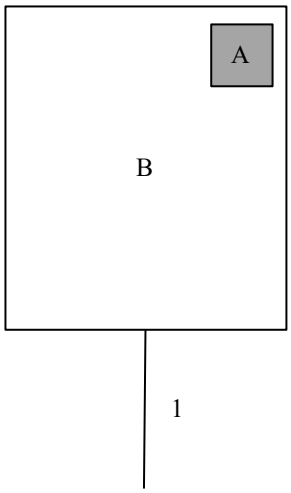
Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz

*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.

*EUT has the power settings by the software as follows;
Power settings: PL=8 plus3dB_from0 (ea20c55afb88536d3768845801289 6b4)
Software: Name: Qualcomm Radio Control Toolkit, Version : 3.0.276.0
(Date: 2020.12.23, 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.

4.2 Configuration and peripherals

Radiated Spurious Emission



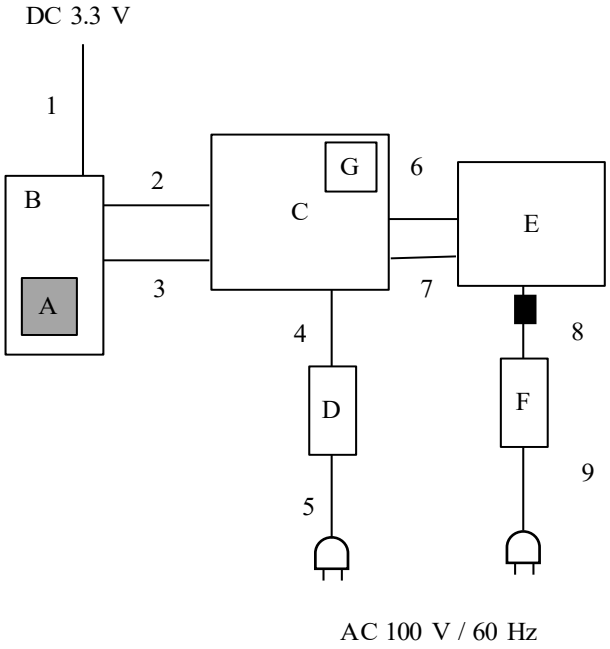
Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	W-LAN + Bluetooth Module	1PJ	7#	Murata Manufacturing Co., Ltd.	EUT
B	Jig	JS0941	7#	Murata Manufacturing Co., Ltd.	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.5	Unshielded	Unshielded	-

Antenna Terminal Conducted Tests



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	W-LAN + Bluetooth Module	1PJ	7#	Murata Manufacturing Co., Ltd.	EUT
B	jig	JS0941	7#	Murata Manufacturing Co., Ltd.	-
C	jig	iMX6ull	TR17112599	NXP Semiconductors	-
D	AC Adapter	ATS024T-A050	400-76027	ADAPTER TECH.	-
E	Laptop PC	CF-MX4	5FKSA17992	PANASONIC	-
F	AC Adapter	CF-AA62J2C	62J2CM2152251438SB	Panasonic	-
G	micro SD Card	110-7806 B	CERT-PL054	SanDisk	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.90	Unshielded	Unshielded	-
2	Serial Cable	0.24	Unshielded	Unshielded	-
3	Serial Cable	0.26	Unshielded	Unshielded	-
4	DC Cable	1.00	Unshielded	Unshielded	-
5	AC Cable	1.00	Unshielded	Unshielded	-
6	LAN Cable	3.00	Unshielded	Unshielded	-
7	USB Cable	1.00	Shielded	Shielded	-
8	DC Cable	1.60	Unshielded	Unshielded	-
9	AC Cable	0.80	Unshielded	Unshielded	-

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.

The height of the measuring antenna varied between 1 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (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 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	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.

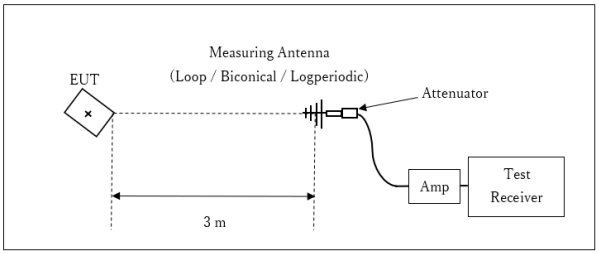
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	11.12.2.5.3 RBW: 1 MHz VBW: 3M Detector: Power Averaging (RMS) Trace : 100 trace Duty Factor was added to The results.	RBW: 100 kHz VBW: 300 kHz

*1) Average Power Measurement was performed based on KDB 558074 D01 15.247 Meas Guidance v05r02.

Figure 2: Test Setup

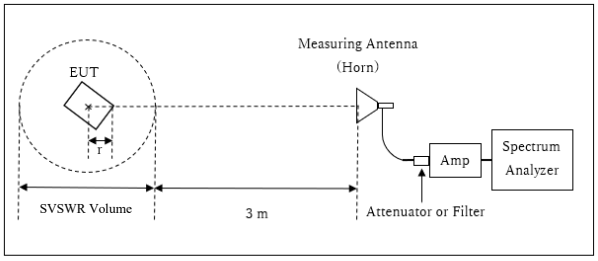
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz

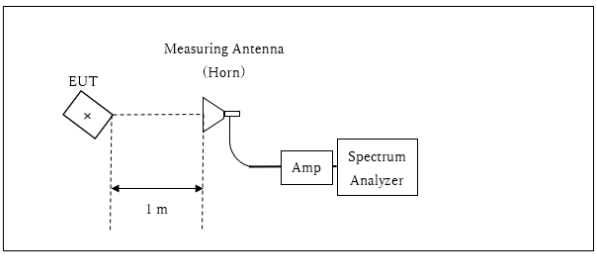


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.55 m / 3.0 m) = 1.47 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.55 m

SVSWR Volume : 1.5 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.2 m

10 GHz - 26.5 GHz



× : Center of turn table

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

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

Measurement range : 30 MHz - 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
Maximum Peak Output Power	-	-	-	Auto	Peak Average *1)	-	Power Meter (Sensor: 50MHz BW)
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				
	30 MHz to 25 GHz	100 kHz	300 kHz				

*1) Reference data
*2) 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 = 9.1 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.

The test results and limit are rounded off to two decimals place, 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

Maximum Peak Output Power

Report No.	13674969H
Test place	Ise EMC Lab. No.2 Measurement Room
Date	January 20, 2021
Temperature / Humidity	21 deg. C / 33 % RH
Engineer	Nachi Konegawa
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	-6.47	1.50	10.02	5.05	3.20	20.96	125	15.91	1.80	6.85	4.84	36.02	4000	29.17
DH5	2441.0	-6.45	1.50	10.02	5.07	3.21	20.96	125	15.89	1.80	6.87	4.86	36.02	4000	29.15
DH5	2480.0	-6.85	1.50	10.02	4.67	2.93	20.96	125	16.29	1.80	6.47	4.44	36.02	4000	29.55
2DH5	2402.0	-4.67	1.50	10.02	6.85	4.84	20.96	125	14.11	1.80	8.65	7.33	36.02	4000	27.37
2DH5	2441.0	-4.69	1.50	10.02	6.83	4.82	20.96	125	14.13	1.80	8.63	7.29	36.02	4000	27.39
2DH5	2480.0	-5.08	1.50	10.02	6.44	4.41	20.96	125	14.52	1.80	8.24	6.67	36.02	4000	27.78
3DH5	2402.0	-4.16	1.50	10.02	7.36	5.45	20.96	125	13.60	1.80	9.16	8.24	36.02	4000	26.86
3DH5	2441.0	-4.19	1.50	10.02	7.33	5.41	20.96	125	13.63	1.80	9.13	8.18	36.02	4000	26.89
3DH5	2480.0	-4.52	1.50	10.02	7.00	5.01	20.96	125	13.96	1.80	8.80	7.59	36.02	4000	27.22

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

Average Output Power
(Reference data for RF Exposure)

Report No.	13674969H
Test place	Ise EMC Lab. No.2 Measurement Room
Date	January 20, 2021
Temperature / Humidity	21 deg. C / 33 % RH
Engineer	Nachi Konegawa
Mode	Tx, Hopping Off

Mode	Freq.	Reading	Cable Loss	Atten. Loss	Result (Burst power average)	
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
DH5	2402.0	-6.77	1.50	10.02	4.75	2.99
DH5	2441.0	-6.80	1.50	10.02	4.72	2.96
DH5	2480.0	-7.20	1.50	10.02	4.32	2.70
2DH5	2402.0	-7.29	1.50	10.02	4.23	2.65
2DH5	2441.0	-7.31	1.50	10.02	4.21	2.64
2DH5	2480.0	-7.71	1.50	10.02	3.81	2.40
3DH5	2402.0	-7.29	1.50	10.02	4.23	2.65
3DH5	2441.0	-7.25	1.50	10.02	4.27	2.67
3DH5	2480.0	-7.67	1.50	10.02	3.85	2.43

Sample Calculation:
Result (Burst power average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
*The test was conducted by the use of Gate function.

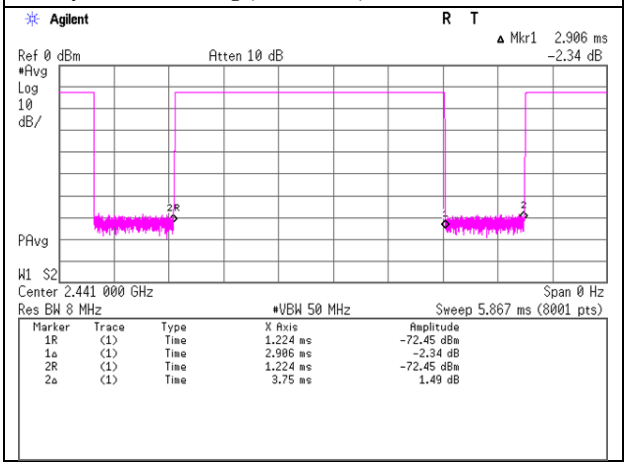
*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst Rate Confirmation

Report No.	13674969H
Test place	Ise EMC Lab. No.2 Measurement Room
Date	January 20, 2021
Temperature / Humidity	21 deg. C / 33 % RH
Engineer	Nachi Konegawa
Mode	Tx, Hopping Off

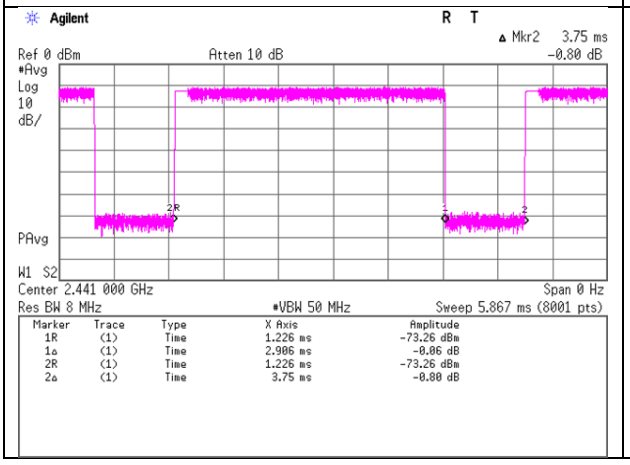
DH5

Tx on / (Tx on + Tx off) =	**0.775**
Tx on / (Tx on + Tx off) * 100 =	**77.5 %**
Duty factor = 10 * log (3.75 / 2.906) =	**1.11 dB**



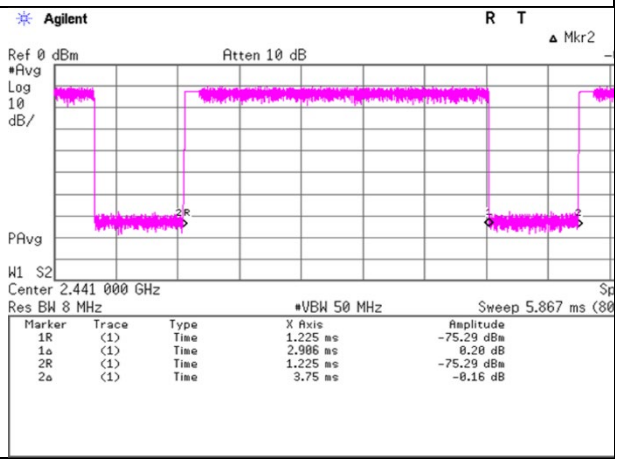
2DH5

Tx on / (Tx on + Tx off) =	**0.775**
Tx on / (Tx on + Tx off) * 100 =	**77.5 %**
Duty factor = 10 * log (3.75 / 2.906) =	**1.11 dB**



3DH5

Tx on / (Tx on + Tx off) =	**0.775**
Tx on / (Tx on + Tx off) * 100 =	**77.5 %**
Duty factor = 10 * log (3.75 / 2.906) =	**1.11 dB**



Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	24 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata	Nachi Konegawa	Nachi Konegawa
	(Below 1GHz)	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	42.868	QP	21.2	13.7	6.9	28.6	-	13.2	40.0	26.8	Floor noise
Hori.	75.640	QP	27.0	6.3	7.3	28.6	-	12.0	40.0	28.0	
Hori.	124.381	QP	22.1	13.1	7.7	28.4	-	14.5	43.5	29.1	Floor noise
Hori.	228.653	QP	21.7	11.2	8.4	27.9	-	13.4	46.0	32.6	Floor noise
Hori.	306.079	QP	21.9	13.8	8.9	27.8	-	16.8	46.0	29.2	Floor noise
Hori.	419.266	QP	22.3	16.1	9.6	28.7	-	19.3	46.0	26.8	Floor noise
Hori.	2390.000	PK	44.3	27.6	4.5	34.6	-	41.8	73.9	32.1	
Hori.	4804.000	PK	44.2	31.6	5.9	33.7	-	47.9	73.9	26.0	Floor noise
Hori.	7206.000	PK	44.0	35.8	7.1	33.6	-	53.3	73.9	20.6	Floor noise
Hori.	9608.000	PK	44.9	38.6	8.1	34.2	-	57.4	73.9	16.5	Floor noise
Hori.	2390.000	AV	33.8	27.6	4.5	34.6	1.1	32.4	53.9	21.5	*1)
Hori.	4804.000	AV	34.2	31.6	5.9	33.7	-	37.9	53.9	16.0	Floor noise
Hori.	7206.000	AV	35.0	35.8	7.1	33.6	-	44.3	53.9	9.6	Floor noise
Hori.	9608.000	AV	34.1	38.6	8.1	34.2	-	46.6	53.9	7.3	Floor noise
Vert.	42.868	QP	21.4	13.7	6.9	28.6	-	13.4	40.0	26.6	Floor noise
Vert.	75.640	QP	33.9	6.3	7.3	28.6	-	18.9	40.0	21.1	
Vert.	124.381	QP	21.2	13.1	7.7	28.4	-	13.6	43.5	30.0	Floor noise
Vert.	228.653	QP	21.8	11.2	8.4	27.9	-	13.5	46.0	32.5	Floor noise
Vert.	306.079	QP	21.8	13.8	8.9	27.8	-	16.7	46.0	29.3	Floor noise
Vert.	419.266	QP	22.3	16.1	9.6	28.7	-	19.3	46.0	26.8	Floor noise
Vert.	2390.000	PK	44.4	27.6	4.5	34.6	-	41.9	73.9	32.0	
Vert.	4804.000	PK	44.1	31.6	5.9	33.7	-	47.8	73.9	26.1	Floor noise
Vert.	7206.000	PK	44.2	35.8	7.1	33.6	-	53.5	73.9	20.4	Floor noise
Vert.	9608.000	PK	45.2	38.6	8.1	34.2	-	57.7	73.9	16.2	Floor noise
Vert.	2390.000	AV	34.1	27.6	4.5	34.6	1.1	32.7	53.9	21.2	*1)
Vert.	4804.000	AV	34.2	31.6	5.9	33.7	-	37.9	53.9	16.0	Floor noise
Vert.	7206.000	AV	34.2	35.8	7.1	33.6	-	43.5	53.9	10.4	Floor noise
Vert.	9608.000	AV	35.1	38.6	8.1	34.2	-	47.5	53.9	6.4	Floor noise

Result = 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).

Distance factor: 1 GHz - 10 GHz 20log (3.55 m / 3.0 m) = 1.47 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	78.8	27.5	4.5	34.6	76.2	-	-	Carrier
Hori.	2400.000	PK	36.5	27.6	4.5	34.6	34.0	56.2	22.3	
Vert.	2402.000	PK	80.5	27.5	4.5	34.6	77.9	-	-	Carrier
Vert.	2400.000	PK	36.7	27.6	4.5	34.6	34.1	57.9	23.8	

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

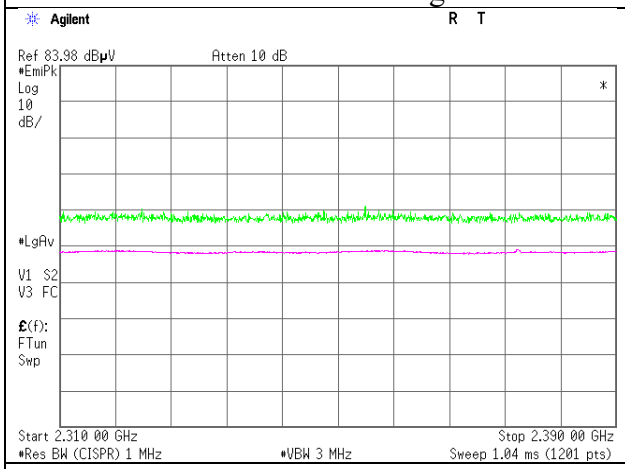
***These results have sufficient margin without taking account Duty cycle correction factor.**

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13674969H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	January 19, 2021
Temperature / Humidity	22 deg. C / 31 % RH
Engineer	Nachi Konegawa
	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz

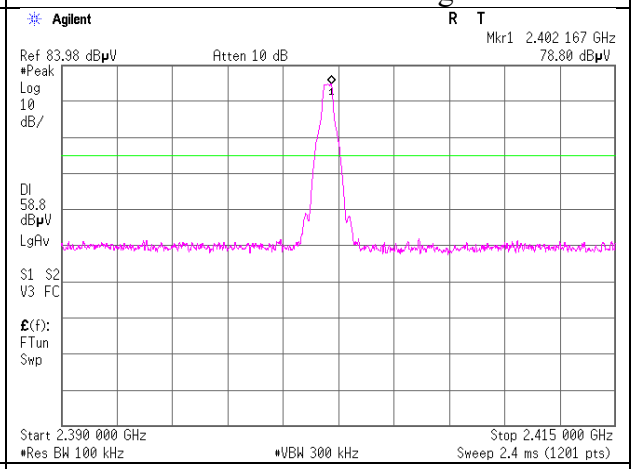
Horizontal

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

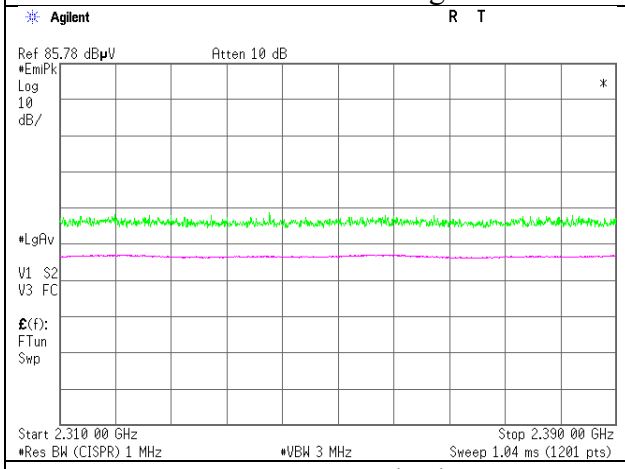
Authorized-band band-edge Plot



20dBc Plot

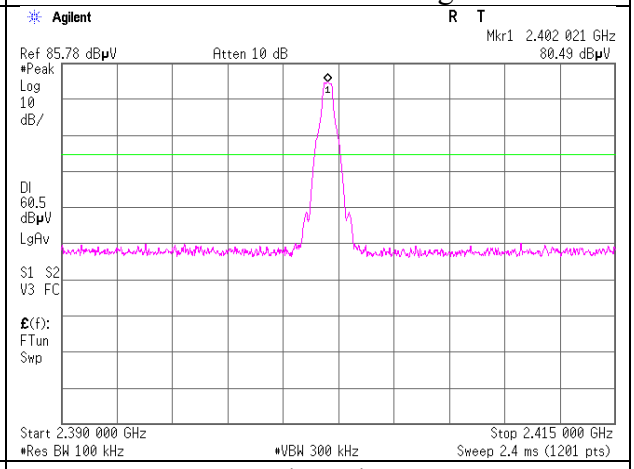
Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Authorized-band band-edge 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 was shown in tabular data.

Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	24 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata	Nachi Konegawa	Nachi Konegawa
	(Below 1GHz)	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, DH5 2441 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	41.684	QP	21.3	14.2	6.9	28.6	-	13.8	40.0	26.3	Floor noise
Hori.	75.978	QP	27.5	6.3	7.3	28.6	-	12.5	40.0	27.5	
Hori.	128.919	QP	21.6	13.5	7.7	28.4	-	14.4	43.5	29.2	Floor noise
Hori.	222.884	QP	21.8	11.2	8.4	28.0	-	13.4	46.0	32.6	Floor noise
Hori.	304.338	QP	21.8	13.7	8.9	27.8	-	16.6	46.0	29.4	Floor noise
Hori.	482.556	QP	22.1	17.4	9.8	29.1	-	20.2	46.0	25.8	Floor noise
Hori.	4882.000	PK	42.6	31.6	5.9	33.8	-	46.3	73.9	27.6	Floor noise
Hori.	7323.000	PK	42.3	36.2	7.1	33.6	-	52.0	73.9	21.9	Floor noise
Hori.	9764.000	PK	42.3	38.9	8.2	34.2	-	55.0	73.9	18.9	Floor noise
Hori.	4882.000	AV	33.5	31.6	5.9	33.8	-	37.2	53.9	16.7	Floor noise
Hori.	7323.000	AV	33.0	36.2	7.1	33.6	-	42.7	53.9	11.2	Floor noise
Hori.	9764.000	AV	33.4	38.9	8.2	34.2	-	46.1	53.9	7.8	Floor noise
Vert.	41.684	QP	21.4	14.2	6.9	28.6	-	13.9	40.0	26.2	Floor noise
Vert.	75.978	QP	33.5	6.3	7.3	28.6	-	18.5	40.0	21.5	
Vert.	128.919	QP	21.8	13.5	7.7	28.4	-	14.6	43.5	29.0	Floor noise
Vert.	222.884	QP	21.9	11.2	8.4	28.0	-	13.5	46.0	32.5	Floor noise
Vert.	304.338	QP	21.8	13.7	8.9	27.8	-	16.6	46.0	29.4	Floor noise
Vert.	482.556	QP	22.0	17.4	9.8	29.1	-	20.1	46.0	25.9	Floor noise
Vert.	4882.000	PK	42.0	31.6	5.9	33.8	-	45.7	73.9	28.2	Floor noise
Vert.	7323.000	PK	42.4	36.2	7.1	33.6	-	52.1	73.9	21.8	Floor noise
Vert.	9764.000	PK	42.5	38.9	8.2	34.2	-	55.2	73.9	18.7	Floor noise
Vert.	4882.000	AV	33.3	31.6	5.9	33.8	-	37.0	53.9	16.9	Floor noise
Vert.	7323.000	AV	33.0	36.2	7.1	33.6	-	42.7	53.9	11.2	Floor noise
Vert.	9764.000	AV	33.3	38.9	8.2	34.2	-	46.0	53.9	7.9	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.55 m / 3.0 m) = 1.47 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	24 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata	Nachi Konegawa	Nachi Konegawa
	(Below 1GHz)	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	42.829	QP	21.6	13.7	6.9	28.6	-	13.6	40.0	26.4	Floor noise
Hori.	75.568	QP	27.1	6.3	7.3	28.6	-	12.1	40.0	27.9	
Hori.	122.987	QP	22.3	13.0	7.6	28.4	-	14.6	43.5	29.0	Floor noise
Hori.	245.661	QP	21.8	11.7	8.5	27.8	-	14.2	46.0	31.8	Floor noise
Hori.	351.179	QP	21.9	15.1	9.3	28.1	-	18.1	46.0	27.9	Floor noise
Hori.	459.482	QP	22.3	16.8	9.7	29.0	-	19.8	46.0	26.2	Floor noise
Hori.	2483.500	PK	44.5	27.4	4.6	34.6	-	41.9	73.9	32.0	
Hori.	4960.000	PK	41.7	31.6	5.9	33.8	-	45.4	73.9	28.5	Floor noise
Hori.	7440.000	PK	42.9	36.0	7.2	33.7	-	52.5	73.9	21.4	Floor noise
Hori.	9920.000	PK	43.0	38.9	8.2	34.3	-	55.9	73.9	18.0	Floor noise
Hori.	2483.500	AV	33.7	27.4	4.6	34.6	1.1	32.2	53.9	21.8	*1)
Hori.	4960.000	AV	32.8	31.6	5.9	33.8	-	36.5	53.9	17.4	Floor noise
Hori.	7440.000	AV	33.1	36.0	7.2	33.7	-	42.7	53.9	11.2	Floor noise
Hori.	9920.000	AV	31.9	38.9	8.2	34.3	-	44.8	53.9	9.1	Floor noise
Vert.	42.829	QP	21.5	13.7	6.9	28.6	-	13.5	40.0	26.5	Floor noise
Vert.	75.568	QP	33.8	6.3	7.3	28.6	-	18.8	40.0	21.2	
Vert.	122.987	QP	21.3	13.0	7.6	28.4	-	13.6	43.5	30.0	Floor noise
Vert.	245.661	QP	21.9	11.7	8.5	27.8	-	14.3	46.0	31.7	Floor noise
Vert.	351.179	QP	21.7	15.1	9.3	28.1	-	17.9	46.0	28.1	Floor noise
Vert.	459.482	QP	22.2	16.8	9.7	29.0	-	19.7	46.0	26.3	Floor noise
Vert.	2483.500	PK	45.3	27.4	4.6	34.6	-	42.7	73.9	31.2	
Vert.	4960.000	PK	41.9	31.6	5.9	33.8	-	45.6	73.9	28.3	Floor noise
Vert.	7440.000	PK	42.5	36.0	7.2	33.7	-	52.1	73.9	21.8	Floor noise
Vert.	9920.000	PK	42.7	38.9	8.2	34.3	-	55.6	73.9	18.3	Floor noise
Vert.	2483.500	AV	34.6	27.4	4.6	34.6	1.1	33.1	53.9	20.8	*1)
Vert.	4960.000	AV	32.5	31.6	5.9	33.8	-	36.2	53.9	17.7	Floor noise
Vert.	7440.000	AV	32.2	36.0	7.2	33.7	-	41.8	53.9	12.1	Floor noise
Vert.	9920.000	AV	33.5	38.9	8.2	34.3	-	46.4	53.9	7.5	Floor noise

Result = 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).

Distance factor: 1 GHz - 10 GHz 20log (3.55 m / 3.0 m) = 1.47 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

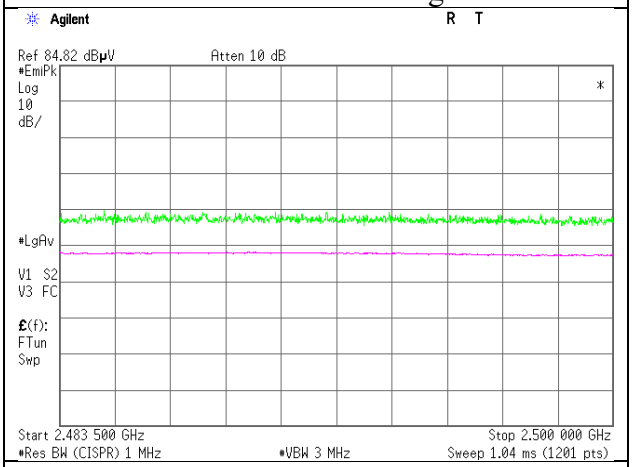
***These results have sufficient margin without taking account Duty cycle correction factor.**

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13674969H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	January 19, 2021
Temperature / Humidity	22 deg. C / 31 % RH
Engineer	Nachi Konegawa
	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz

Horizontal

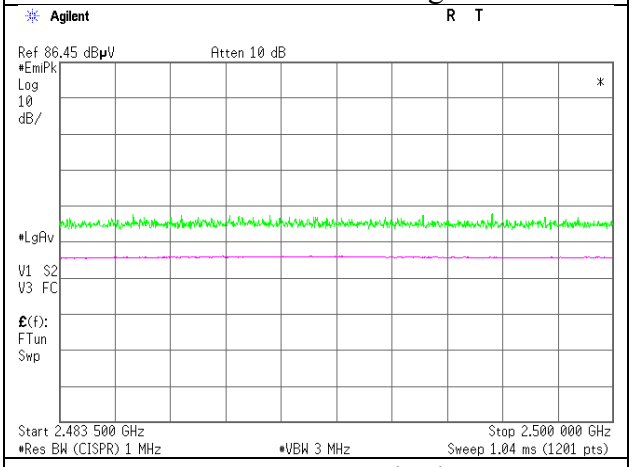
Restricted-band band-edge Plot



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

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	24 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata	Nachi Konegawa	Nachi Konegawa
	(Below 1GHz)	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	43.815	QP	21.4	13.3	6.9	28.6	-	13.0	40.0	27.0	Floor noise
Hori.	75.963	QP	27.1	6.3	7.3	28.6	-	12.1	40.0	27.9	
Hori.	117.468	QP	21.5	12.6	7.6	28.4	-	13.2	43.5	30.3	Floor noise
Hori.	225.085	QP	21.7	11.2	8.4	27.9	-	13.3	46.0	32.7	Floor noise
Hori.	320.227	QP	21.8	14.2	9.0	27.9	-	17.1	46.0	29.0	Floor noise
Hori.	438.547	QP	22.2	16.4	9.6	28.9	-	19.4	46.0	26.6	Floor noise
Hori.	2390.000	PK	44.4	27.6	4.5	34.6	-	41.9	73.9	32.0	
Hori.	4804.000	PK	43.3	31.6	5.9	33.7	-	47.0	73.9	26.9	Floor noise
Hori.	7206.000	PK	42.1	35.8	7.1	33.6	-	51.4	73.9	22.5	Floor noise
Hori.	9608.000	PK	42.4	38.6	8.1	34.2	-	54.9	73.9	19.0	Floor noise
Hori.	2390.000	AV	35.4	27.6	4.5	34.6	1.1	34.0	53.9	19.9	*1)
Hori.	4804.000	AV	32.9	31.6	5.9	33.7	-	36.6	53.9	17.3	Floor noise
Hori.	7206.000	AV	33.1	35.8	7.1	33.6	-	42.4	53.9	11.5	Floor noise
Hori.	9608.000	AV	33.8	38.6	8.1	34.2	-	46.3	53.9	7.6	Floor noise
Vert.	43.815	QP	21.3	13.3	6.9	28.6	-	12.9	40.0	27.1	Floor noise
Vert.	75.963	QP	33.5	6.3	7.3	28.6	-	18.5	40.0	21.5	
Vert.	117.468	QP	21.7	12.6	7.6	28.4	-	13.4	43.5	30.1	Floor noise
Vert.	225.085	QP	21.9	11.2	8.4	27.9	-	13.5	46.0	32.5	Floor noise
Vert.	320.227	QP	21.9	14.2	9.0	27.9	-	17.2	46.0	28.9	Floor noise
Vert.	438.547	QP	22.3	16.4	9.6	28.9	-	19.5	46.0	26.5	Floor noise
Vert.	2390.000	PK	44.3	27.6	4.5	34.6	-	41.8	73.9	32.1	
Vert.	4804.000	PK	43.1	31.6	5.9	33.7	-	46.8	73.9	27.1	Floor noise
Vert.	7206.000	PK	42.1	35.8	7.1	33.6	-	51.4	73.9	22.5	Floor noise
Vert.	9608.000	PK	41.9	38.6	8.1	34.2	-	54.4	73.9	19.5	Floor noise
Vert.	2390.000	AV	35.5	27.6	4.5	34.6	1.1	34.1	53.9	19.8	*1)
Vert.	4804.000	AV	33.2	31.6	5.9	33.7	-	36.9	53.9	17.0	Floor noise
Vert.	7206.000	AV	33.5	35.8	7.1	33.6	-	42.8	53.9	11.1	Floor noise
Vert.	9608.000	AV	33.0	38.6	8.1	34.2	-	45.5	53.9	8.5	Floor noise

Result = 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).

Distance factor: 1 GHz - 10 GHz 20log (3.55 m / 3.0 m) = 1.47 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	79.6	27.5	4.5	34.6	77.0	-	-	Carrier
Hori.	2400.000	PK	35.5	27.6	4.5	34.6	33.0	57.0	24.0	
Vert.	2402.000	PK	80.4	27.5	4.5	34.6	77.9	-	-	Carrier
Vert.	2400.000	PK	35.9	27.6	4.5	34.6	33.3	57.9	24.6	

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

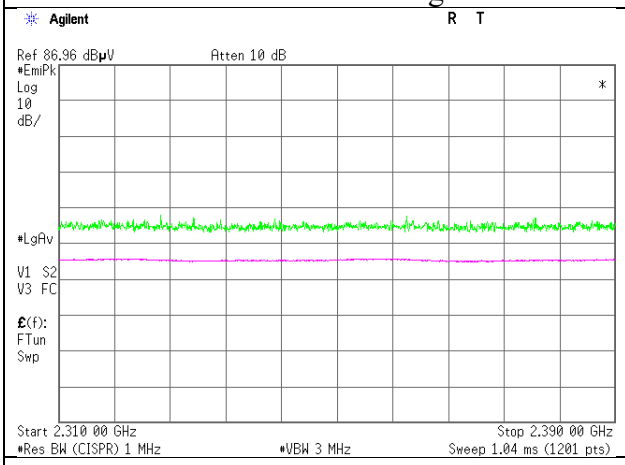
***These results have sufficient margin without taking account Duty cycle correction factor.**

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13674969H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	January 19, 2021
Temperature / Humidity	22 deg. C / 31 % RH
Engineer	Nachi Konegawa
	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz

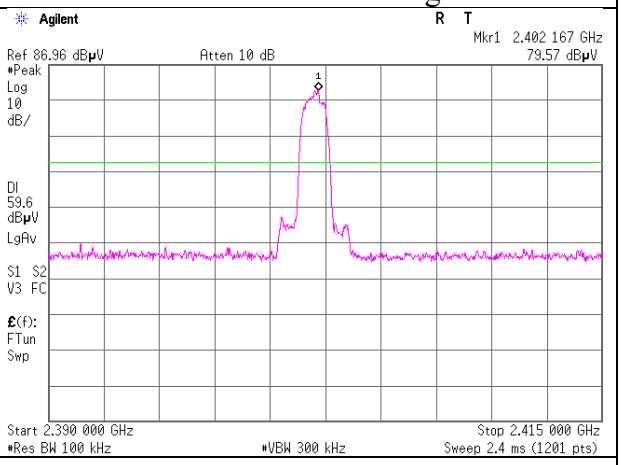
Horizontal

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

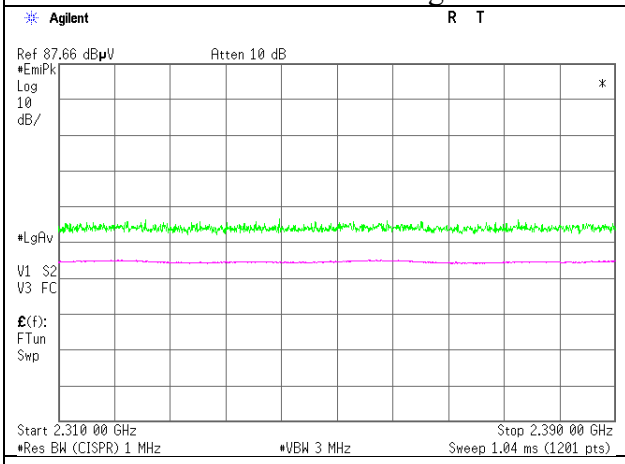
Authorized-band band-edge Plot



20dBc Plot

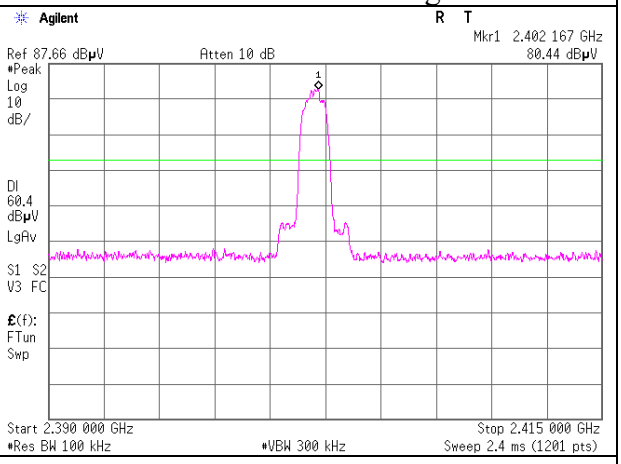
Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Authorized-band band-edge 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 was shown in tabular data.

Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	24 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata	Nachi Konegawa	Nachi Konegawa
	(Below 1GHz)	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	41.912	QP	21.3	14.1	6.9	28.6	-	13.7	40.0	26.3	Floor noise
Hori.	75.545	QP	27.3	6.3	7.3	28.6	-	12.3	40.0	27.7	
Hori.	122.698	QP	21.4	13.0	7.6	28.4	-	13.6	43.5	29.9	Floor noise
Hori.	224.086	QP	21.8	11.2	8.4	27.9	-	13.4	46.0	32.6	Floor noise
Hori.	320.795	QP	21.8	14.2	9.0	27.9	-	17.1	46.0	28.9	Floor noise
Hori.	416.434	QP	22.2	16.0	9.6	28.7	-	19.1	46.0	26.9	Floor noise
Hori.	4882.000	PK	43.0	31.6	5.9	33.8	-	46.7	73.9	27.2	Floor noise
Hori.	7323.000	PK	42.0	36.2	7.1	33.6	-	51.7	73.9	22.2	Floor noise
Hori.	9764.000	PK	43.0	38.9	8.2	34.2	-	55.8	73.9	18.1	Floor noise
Hori.	4882.000	AV	33.0	31.6	5.9	33.8	-	36.7	53.9	17.2	Floor noise
Hori.	7323.000	AV	33.2	36.2	7.1	33.6	-	42.9	53.9	11.0	Floor noise
Hori.	9764.000	AV	32.0	38.9	8.2	34.2	-	44.8	53.9	9.2	Floor noise
Vert.	41.912	QP	21.3	14.1	6.9	28.6	-	13.7	40.0	26.3	Floor noise
Vert.	75.545	QP	33.4	6.3	7.3	28.6	-	18.4	40.0	21.6	
Vert.	122.698	QP	21.8	13.0	7.6	28.4	-	14.0	43.5	29.5	Floor noise
Vert.	224.086	QP	21.9	11.2	8.4	27.9	-	13.5	46.0	32.5	Floor noise
Vert.	320.795	QP	21.8	14.2	9.0	27.9	-	17.1	46.0	28.9	Floor noise
Vert.	416.434	QP	22.2	16.0	9.6	28.7	-	19.1	46.0	26.9	Floor noise
Vert.	4882.000	PK	42.5	31.6	5.9	33.8	-	46.2	73.9	27.7	Floor noise
Vert.	7323.000	PK	43.4	36.2	7.1	33.6	-	53.1	73.9	20.8	Floor noise
Vert.	9764.000	PK	42.1	38.9	8.2	34.2	-	54.9	73.9	19.0	Floor noise
Vert.	4882.000	AV	32.9	31.6	5.9	33.8	-	36.6	53.9	17.3	Floor noise
Vert.	7323.000	AV	34.0	36.2	7.1	33.6	-	43.7	53.9	10.2	Floor noise
Vert.	9764.000	AV	33.3	38.9	8.2	34.2	-	46.1	53.9	7.8	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (3.55 m / 3.0 m) = 1.47 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

Radiated Spurious Emission

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	24 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata	Nachi Konegawa	Nachi Konegawa
	(Below 1GHz)	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	42.158	QP	21.4	14.0	6.9	28.6	-	13.7	40.0	26.3	Floor noise
Hori.	75.289	QP	27.3	6.3	7.3	28.6	-	12.3	40.0	27.7	
Hori.	110.139	QP	21.3	11.7	7.6	28.5	-	12.0	43.5	31.5	Floor noise
Hori.	228.173	QP	21.8	11.2	8.4	27.9	-	13.5	46.0	32.5	Floor noise
Hori.	313.529	QP	21.8	14.0	9.0	27.9	-	16.8	46.0	29.2	Floor noise
Hori.	424.860	QP	22.2	16.2	9.6	28.8	-	19.2	46.0	26.8	Floor noise
Hori.	2483.500	PK	43.6	27.4	4.6	34.6	-	41.0	73.9	32.9	
Hori.	4960.000	PK	42.8	31.6	5.9	33.8	-	46.5	73.9	27.4	Floor noise
Hori.	7440.000	PK	44.1	36.0	7.2	33.7	-	53.7	73.9	20.2	Floor noise
Hori.	9920.000	PK	42.8	38.9	8.2	34.3	-	55.7	73.9	18.2	Floor noise
Hori.	2483.500	AV	34.6	27.4	4.6	34.6	1.1	33.1	53.9	20.8	*1)
Hori.	4960.000	AV	34.0	31.6	5.9	33.8	-	37.7	53.9	16.2	Floor noise
Hori.	7440.000	AV	32.1	36.0	7.2	33.7	-	41.7	53.9	12.2	Floor noise
Hori.	9920.000	AV	34.3	38.9	8.2	34.3	-	47.2	53.9	6.7	Floor noise
Vert.	42.158	QP	21.4	14.0	6.9	28.6	-	13.7	40.0	26.3	Floor noise
Vert.	75.289	QP	33.5	6.3	7.3	28.6	-	18.5	40.0	21.5	
Vert.	110.139	QP	21.8	11.7	7.6	28.5	-	12.5	43.5	31.0	Floor noise
Vert.	228.173	QP	21.8	11.2	8.4	27.9	-	13.5	46.0	32.5	Floor noise
Vert.	313.529	QP	21.9	14.0	9.0	27.9	-	16.9	46.0	29.1	Floor noise
Vert.	424.860	QP	22.2	16.2	9.6	28.8	-	19.2	46.0	26.8	Floor noise
Vert.	2483.500	PK	44.5	27.4	4.6	34.6	-	41.9	73.9	32.0	
Vert.	4960.000	PK	43.9	31.6	5.9	33.8	-	47.6	73.9	26.3	Floor noise
Vert.	7440.000	PK	44.0	36.0	7.2	33.7	-	53.6	73.9	20.3	Floor noise
Vert.	9920.000	PK	44.7	38.9	8.2	34.3	-	57.6	73.9	16.3	Floor noise
Vert.	2483.500	AV	34.5	27.4	4.6	34.6	1.1	33.0	53.9	20.9	*1)
Vert.	4960.000	AV	33.9	31.6	5.9	33.8	-	37.6	53.9	16.3	Floor noise
Vert.	7440.000	AV	32.8	36.0	7.2	33.7	-	42.4	53.9	11.5	Floor noise
Vert.	9920.000	AV	35.0	38.9	8.2	34.3	-	47.9	53.9	6.0	Floor noise

Result = 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).

Distance factor: 1 GHz - 10 GHz 20log (3.55 m / 3.0 m) = 1.47 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

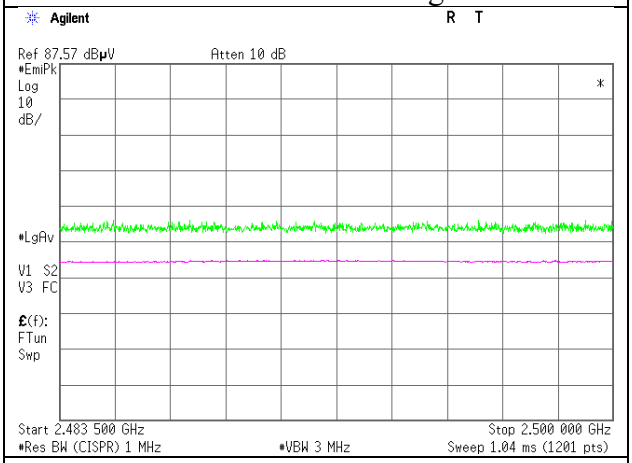
***These results have sufficient margin without taking account Duty cycle correction factor.**

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13674969H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	January 19, 2021
Temperature / Humidity	22 deg. C / 31 % RH
Engineer	Nachi Konegawa
	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz

Horizontal

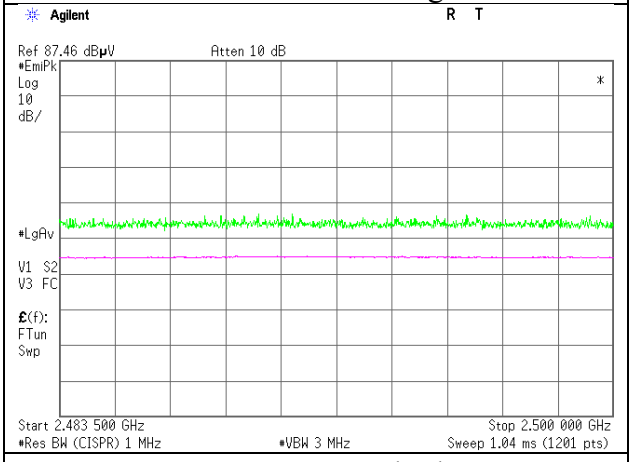
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

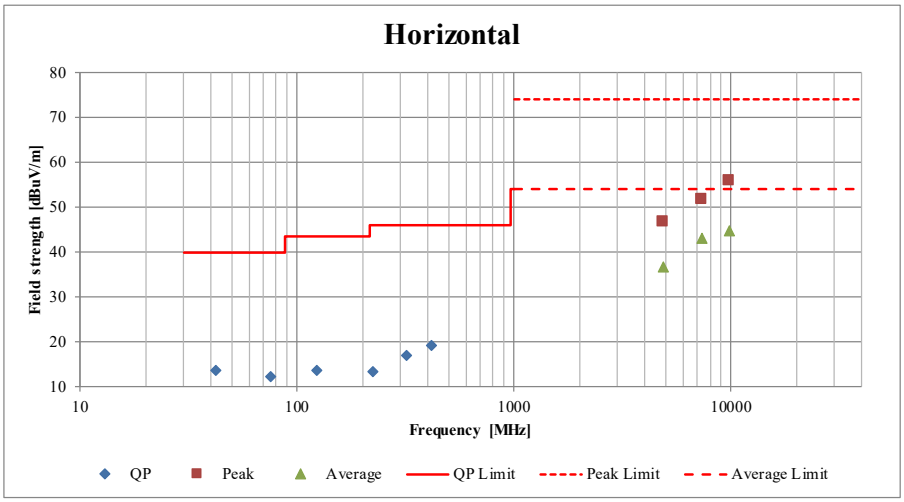


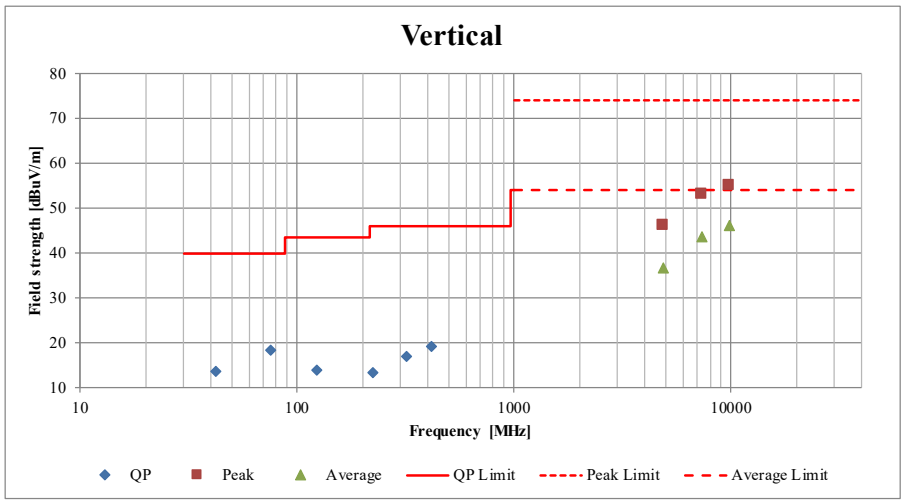
Trace Green : Peak Plot
Trace Purple : Average Plot

* 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)

Report No.	13674969H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	January 18, 2021	January 19, 2021	January 20, 2021
Temperature / Humidity	24 deg. C / 34 % RH	22 deg. C / 31 % RH	21 deg. C / 33 % RH
Engineer	Hiroki Numata	Nachi Konegawa	Nachi Konegawa
	(Below 1GHz)	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz		





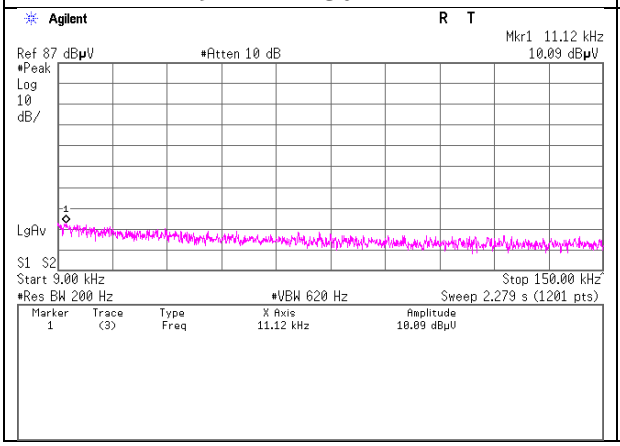
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

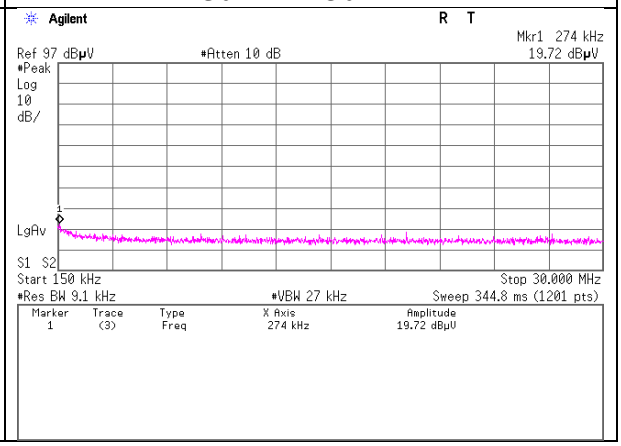
Report No.	13674969H
Test place	Ise EMC Lab. No.2 Measurement Room
Date	January 20, 2021
Temperature / Humidity	21 deg. C / 33 % RH
Engineer	Nachi Konegawa
Mode	Tx, Hopping Off, DH5

2402 MHz

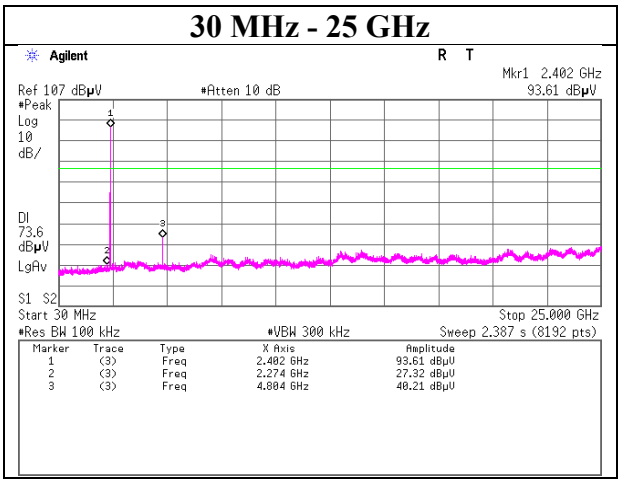
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

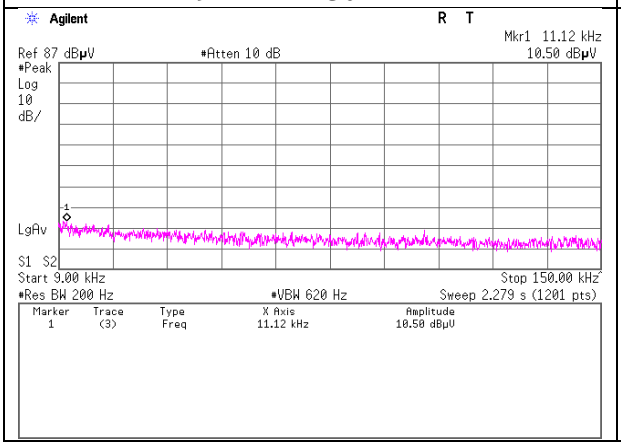


Conducted Spurious Emission

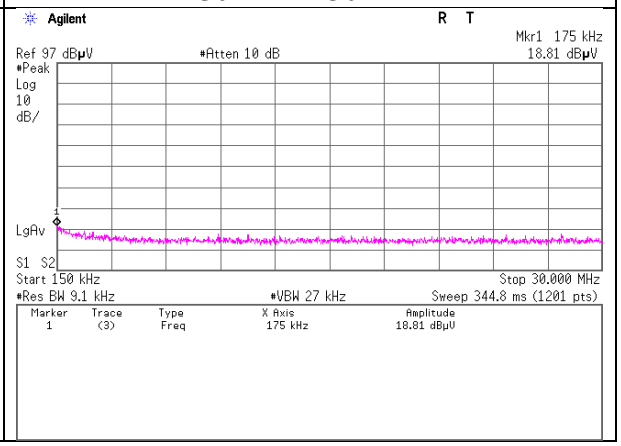
Report No.	13674969H
Test place	Ise EMC Lab. No.2 Measurement Room
Date	January 20, 2021
Temperature / Humidity	21 deg. C / 33 % RH
Engineer	Nachi Konegawa
Mode	Tx, Hopping Off, DH5

2441 MHz

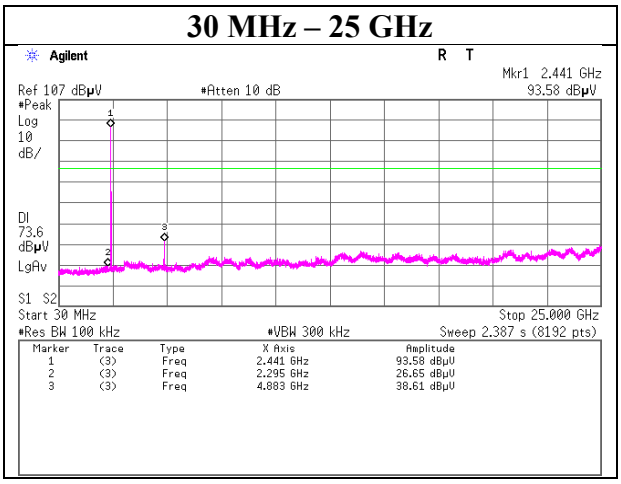
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 25 GHz

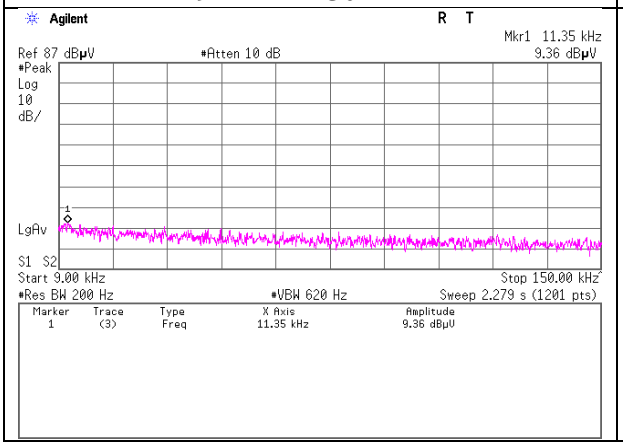


Conducted Spurious Emission

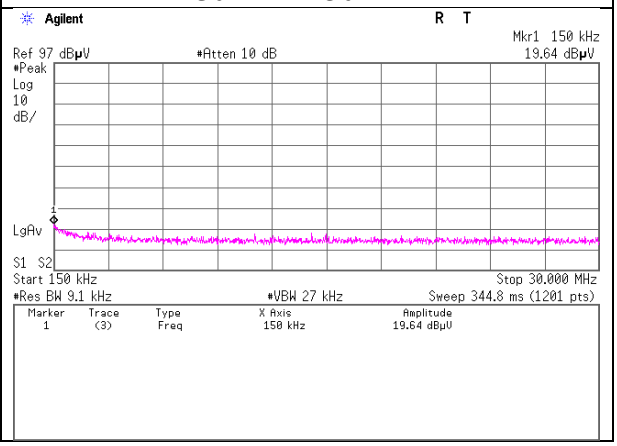
Report No.	13674969H
Test place	Ise EMC Lab. No.2 Measurement Room
Date	January 20, 2021
Temperature / Humidity	21 deg. C / 33 % RH
Engineer	Nachi Konegawa
Mode	Tx, Hopping Off, DH5

2480 MHz

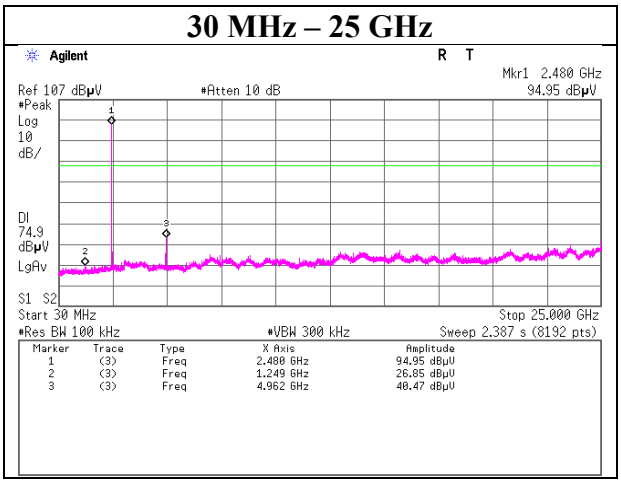
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 25 GHz

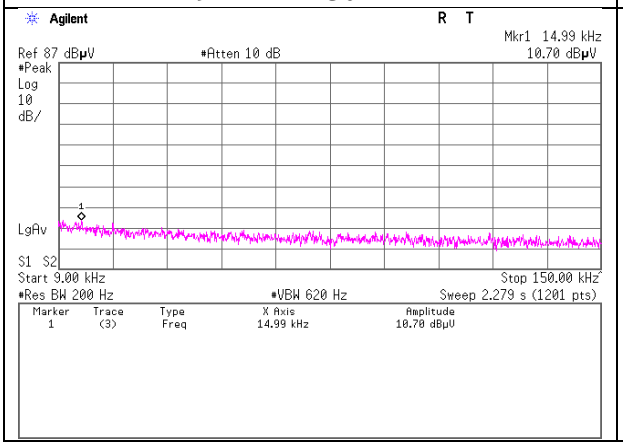


Conducted Spurious Emission

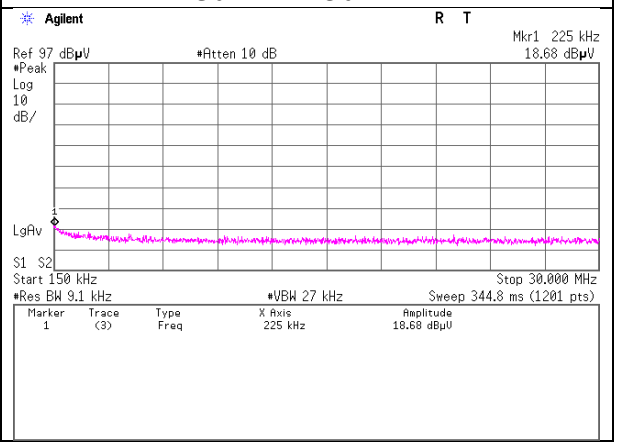
Report No.	13674969H
Test place	Ise EMC Lab. No.2 Measurement Room
Date	January 20, 2021
Temperature / Humidity	21 deg. C / 33 % RH
Engineer	Nachi Konegawa
Mode	Tx, Hopping Off, 3DH5

2402 MHz

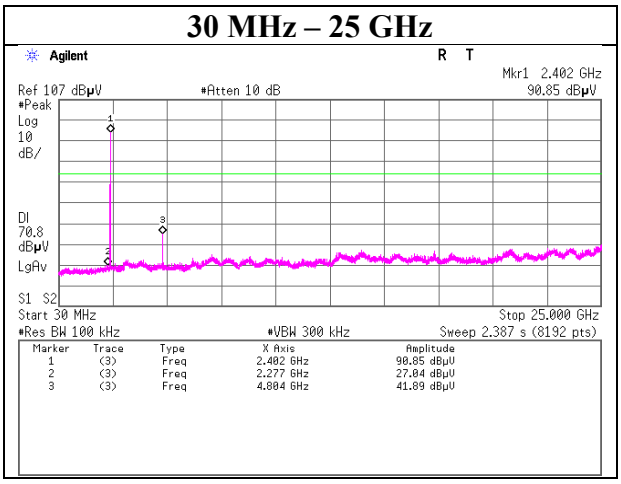
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 25 GHz

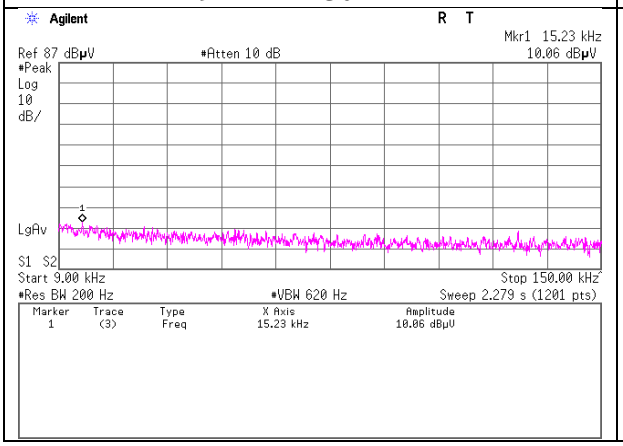


Conducted Spurious Emission

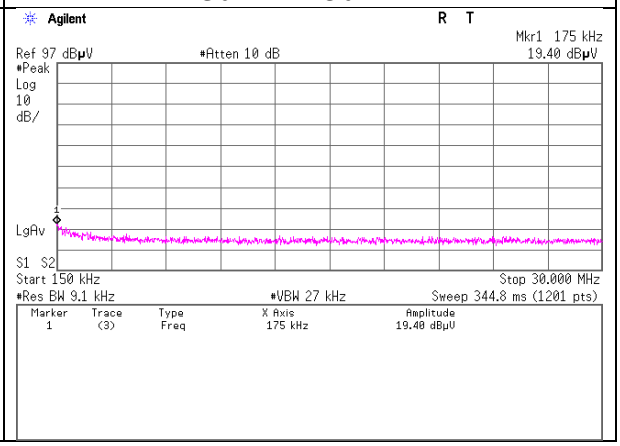
Report No.	13674969H
Test place	Ise EMC Lab. No.2 Measurement Room
Date	January 20, 2021
Temperature / Humidity	21 deg. C / 33 % RH
Engineer	Nachi Konegawa
Mode	Tx, Hopping Off, 3DH5

2441 MHz

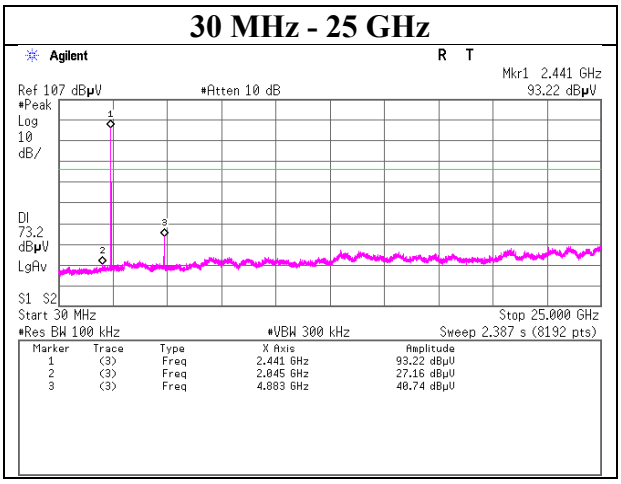
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

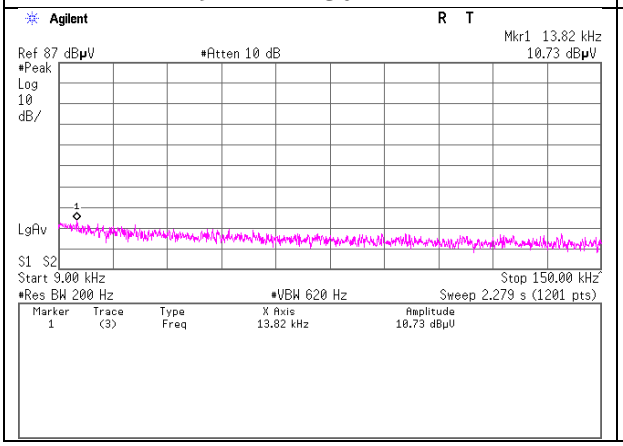


Conducted Spurious Emission

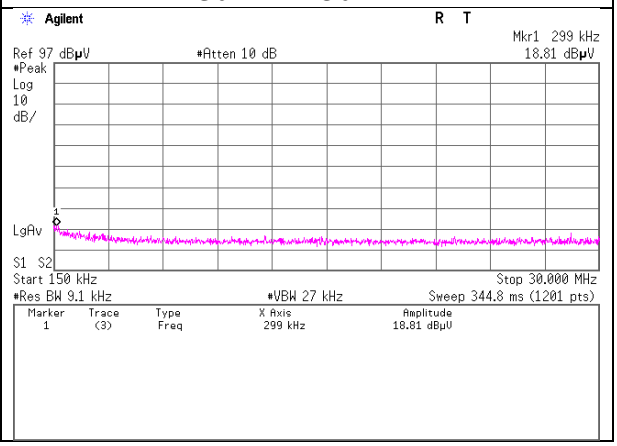
Report No.	13674969H
Test place	Ise EMC Lab. No.2 Measurement Room
Date	January 20, 2021
Temperature / Humidity	21 deg. C / 33 % RH
Engineer	Nachi Konegawa
Mode	Tx, Hopping Off, 3DH5

2480 MHz

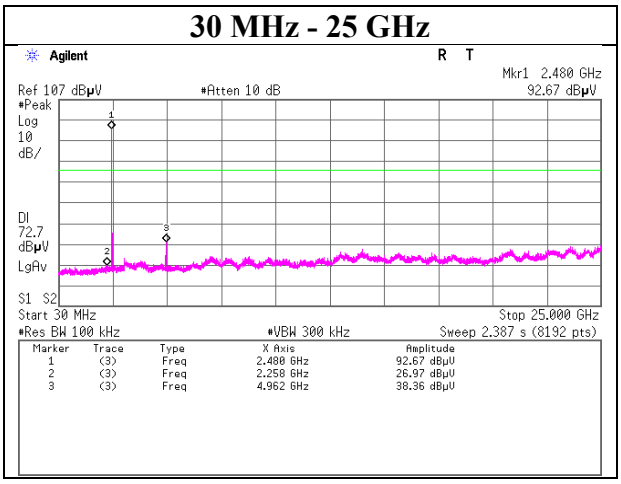
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz



APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE/ AT	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/04/2020	12
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/18/2020	12
RE	MCC-12	141317	Coaxial Cable	UL Japan Inc.	-	-	09/25/2020	12
RE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	02/10/2020	12
RE	MBA-08	141427	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103B+BBA9106	8031	07/29/2020	12
RE	MLA-21	141265	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-190	07/29/2020	12
RE	MAT-07	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	11/13/2020	12
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/26/2020	24
RE/ AT	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/06/2020	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/18/2020	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-02-SVSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/01/2019	24
RE	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	01/12/2021	12
RE	MHF-26	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	09/23/2020	12
RE	MCC-216	141392	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 537073/126E(5 m)	02/18/2020	12
RE	MHA-06	141512	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	254	09/14/2020	12
RE	MHA-02	141503	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	06/15/2020	12
AT	MAT-58	141334	Attenuator(10dB)	Suhner	6810.19.A	-	12/07/2020	12
AT	MPM-12	141809	Power Meter	ANRITSU	ML2495A	825002	05/07/2020	12
AT	MPSE-17	141830	Power sensor	ANRITSU	MA2411B	738285	05/07/2020	12

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

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

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

Test item:

RE: Radiated Emission test
AT: Antenna Terminal Conducted Tests