RADIO TEST REPORT

Test Report No. : 13329061H-B-R1

Applicant	:	**Pioneer Corporation**
Type of EUT	:	**Car Audio with Bluetooth / WLAN**
Model Number of EUT	:	**SA211**
FCC ID	:	**AJDK114**
Test regulation	:	**FCC Part 15 Subpart C: 2020** ***Bluetooth parts**
Test Result	:	**Complied (Refer to SECTION 3.2)**

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2. The results in this report apply only to the sample tested.
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.
5. This test report covers Radio technical requirements.
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6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 13329061H-B. 13329061H-B is replaced with this report.

Date of test: May 3 to 10, 2020

Representative test engineer:
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Approved by:
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☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 13329061H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13329061H-B	June 8, 2020	-	-
1	13329061H-B-R1	July 1, 2020	P.11	Correction of Power setting value from 0 dBm to 5.2 dBm (both BDR/EDR)
1	13329061H-B-R1	July 1, 2020	P.25	Correction of Antenna gain from -5.67 to -5.38, and recalculation of result and margin.
1	13329061H-B-R1	July 1, 2020	P.26	Correction of Reading at 3DH5 2402.0 MHz from -5.96 to -6.96, and recalculation of result.
1	13329061H-B-R1	July 1, 2020	P.31	Addition of Remark *2)

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

CONTENTS PAGE

SECTION 1: Customer information **5**
SECTION 2: Equipment under test (EUT) **5**
SECTION 3: Test specification, procedures & results **7**
SECTION 4: Operation of EUT during testing **11**
SECTION 5: Radiated Spurious Emission **13**
SECTION 6: Antenna Terminal Conducted Tests **15**
APPENDIX 1: Test data **16**
20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation 16
Number of Hopping Frequency 20
Dwell time 22
Maximum Peak Output Power 25
Average Output Power 26
Radiated Spurious Emission 28
Conducted Spurious Emission 39
Conducted Emission Band Edge compliance 45
APPENDIX 2: Test instruments **47**
APPENDIX 3: Photographs of test setup **48**
Radiated Spurious Emission 48
Worst Case Position 49

SECTION 1: Customer information

Company Name	:	Pioneer Corporation
Address	:	28-8, Honkomagome 2-chome, Bunkyo-ku, Tokyo, 113-0021, Japan
Telephone Number	:	+81-49-228-7681
Facsimile Number	:	+81-49-228-6172
Contact Person	:	Toshifumi Takahashi

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	:	Car Audio with Bluetooth / WLAN
Model Number	:	SA211
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 10 V - 16 V, 10 A
Receipt Date	:	April 23, 2020
Country of Mass-production	:	Thailand
Condition	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: SA211 (referred to as the EUT in this report) is a Car Audio with Bluetooth / WLAN.

Information of the Factory

Factory Name	:	PIONEER MANUFACTURING(THAILAND) CO., LTD.
Address	:	Rojana Industrial Park, 1/31 Moo 5 Tambol Kanham, Amphur U-Thai Pranakornsriayutthaya 13210 Thailand

Radio Specification

WLAN (IEEE 802.11b/g/n-20)

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Modulation	:	DSSS / CCK (11b) OFDM (11g/11n-20)
Antenna type	:	Custom Antenna
Antenna Gain	:	-5.67 dBi
Clock frequency (Maximum)	:	125 MHz

Bluetooth (BDR / EDR function) *1)

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	FHSS
Antenna type	:	Custom Antenna
Antenna Gain	:	-5.38 dBi
Clock frequency (Maxmum)	:	125 MHz

*1) This test report is applies to Bluetooth (BR/EDR function).

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C FCC Part 15 final revised on May 26, 2020 and effective July 27, 2020 except 15.258
Title	:	FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

* The revision does not affect the test result conducted before its effective date.

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods **ISED:** RSS-Gen 8.8	**FCC:** Section 15.207 **ISED:** RSS-Gen 8.8	N/A	N/A	*1)
Carrier Frequency Separation	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** -	**FCC:** Section15.247(a)(1) **ISED:** RSS-247 5.1 (b)	See data.	Complied a)	Conducted
20dB Bandwidth	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** -	**FCC:** Section15.247(a)(1) **ISED:** RSS-247 5.1 (a)		Complied a)	Conducted
Number of Hopping Frequency	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** -	**FCC:** Section15.247(a)(1)(iii) **ISED:** RSS-247 5.1 (d)		Complied b)	Conducted
Dwell time	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** -	**FCC:** Section15.247(a)(1)(iii) **ISED:** RSS-247 5.1 (d)		Complied c)	Conducted
Maximum Peak Output Power	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** RSS-Gen 6.12	**FCC:** Section15.247(a)(b)(1) **ISED:** RSS-247 5.4 (b)		Complied d)	Conducted
Spurious Emission & Band Edge Compliance	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** RSS-Gen 6.13	**FCC:** Section15.247(d) **ISED:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	13.5 dB 196.610 MHz, Vertical, QP	Complied e) / f)	Conducted/ Radiated (above 30 MHz) *2)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.
*2) Radiated test was selected over 30 MHz based on section 15.247(d).
a) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)
b) Refer to APPENDIX 1 (data of Number of Hopping Frequency)
c) Refer to APPENDIX 1 (data of Dwell time)
d) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
e) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
f) 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 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 Bandwidth	**ISED:** RSS-Gen 6.7	**ISED:** -	N/A	- a)	Conducted

a) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)

Other than above, 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
0.5 m	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.
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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)

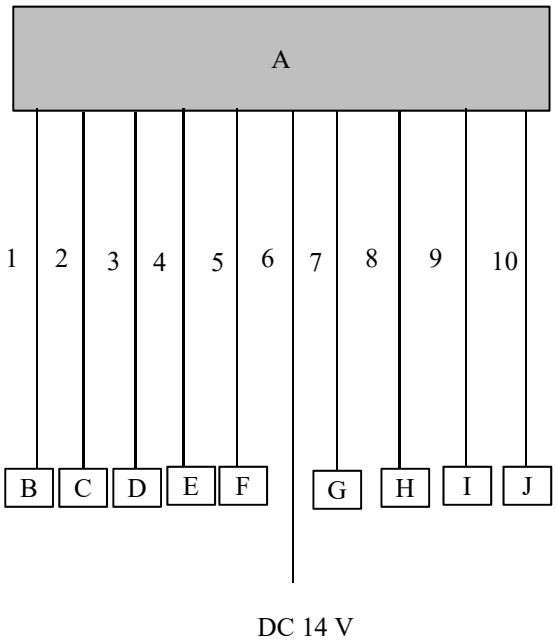
Test Item	Mode	Tested frequency
Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency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

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

*EUT has the power settings by the software as follows;
Power settings: BDR: 5.2 dBm
EDR: 5.2 dBm
Software: R.A5.00.12.25.20.00.00
(Date: May 3, 2020, Storage location: EUT memory)

*This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

4.2 Configuration and peripherals



* 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	Car Audio	SA211	K4TA007 for RE* K4TA006 for AT*	Pioneer Corporation	EUT
B	USB Memory	U202	1942QF0935MSQ1RL1L	TOSHIBA	-
C	Terminator	-	-	-	-
D	GNSS Antenna	DA15-D010	A388619	MITSUMI ELEC.	-
E	Terminator	-	-	-	-
F	Jig Board	-	-	-	-
G	Mic	39813-59S00	-	-	-
H	Dummy Speaker	-	-	-	-
I	Camera	-	-	-	-
J	Terminator	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-
2	DAB Cable	2.0	Shielded	Shielded	-
3	GNSS Antenna Cable	2.0	Shielded	Shielded	-
4	HDMI Cable	1.2	Shielded	Shielded	-
5	Signal Cable	2.0	Unshielded	Unshielded	-
6	DC Cable	2.8	Unshielded	Unshielded	-
7	MIC Cable	2.0	Unshielded	Unshielded	-
8	Speaker Cable	2.0	Unshielded	Unshielded	-
9	Signal Cable	2.2	Unshielded	Unshielded	-
10	AM/FM Cable	2.0	Shielded	Shielded	-

*RE: Radiated Spurious Emission test, AT: Antenna Terminal Conducted Tests

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.

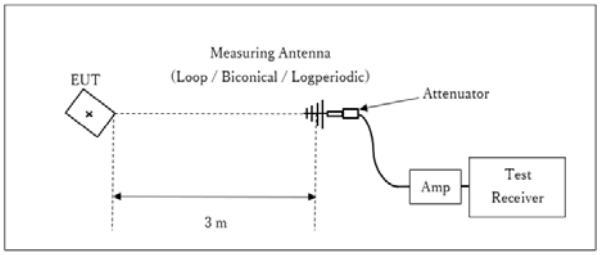
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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	RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces 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

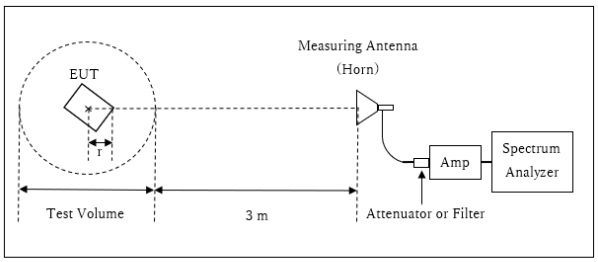
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz

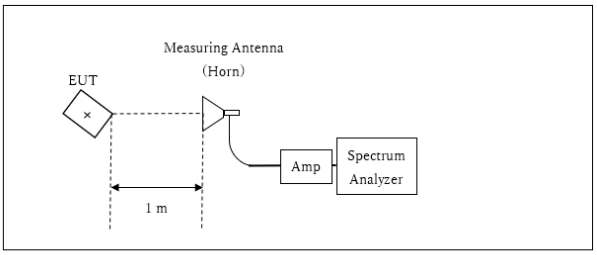


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.85 m / 3.0 m) = 2.17 dB
* Test Distance: (3 + Test Volume /2) - r = 3.85 m

Test Volume : 2.0 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.15 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 0 deg. and 40 deg. as tilt angle 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
20dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	200 kHz	620 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz, 1 MHz	300 kHz, 3 MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3) *4)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	9.1 kHz	27 kHz				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1)Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz).
*4) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohmes. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to 45.5 - 51.5 = -6.0 dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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

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

Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx, Hopping Off, Tx, Hopping On

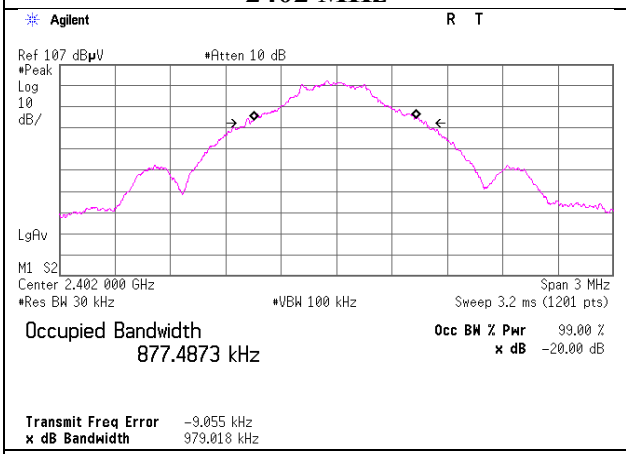
Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.979	877.5	1.000	>= 0.653
DH5	2441.0	1.016	889.8	1.000	>= 0.677
DH5	2480.0	0.964	879.7	1.000	>= 0.643
DH5	Hopping On	-	78623.7	-	-
3DH5	2402.0	1.324	1178.7	1.000	>= 0.883
3DH5	2441.0	1.319	1181.9	1.000	>= 0.879
3DH5	2480.0	1.307	1188.0	1.000	>= 0.871
3DH5	Hopping On	-	78664.9	-	-

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

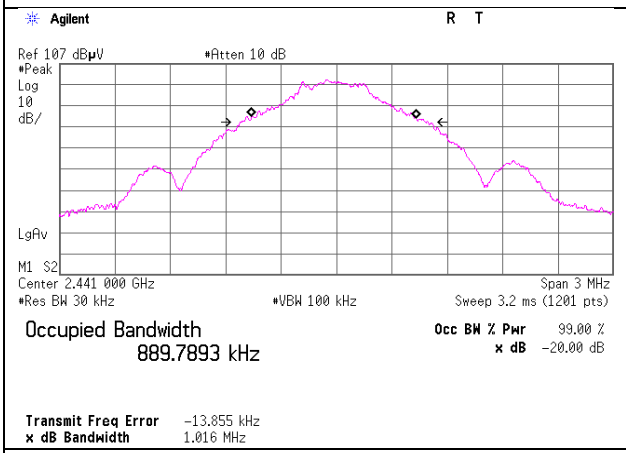
20dB Bandwidth and 99% Occupied Bandwidth

DH5

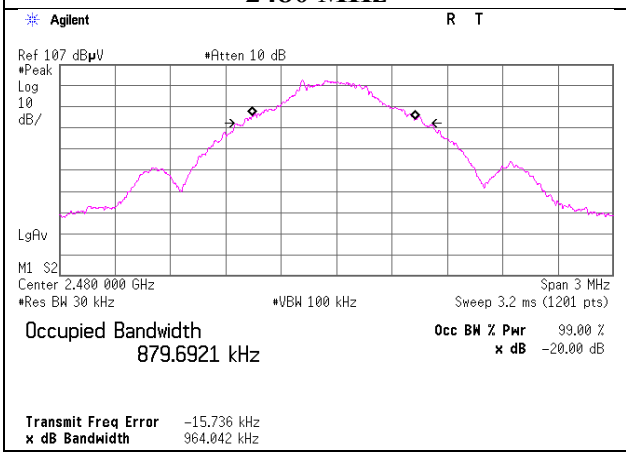
2402 MHz



2441 MHz

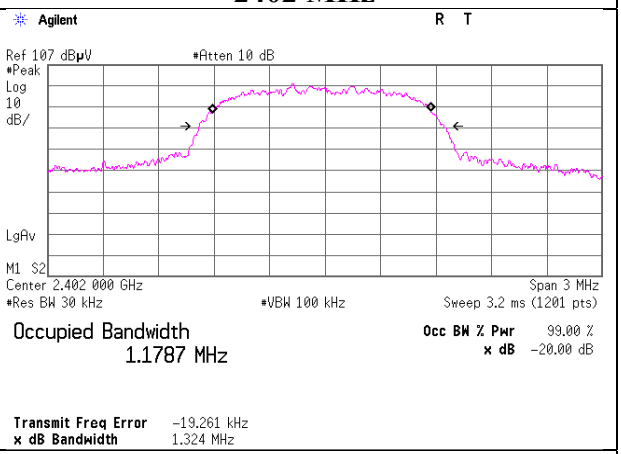


2480 MHz

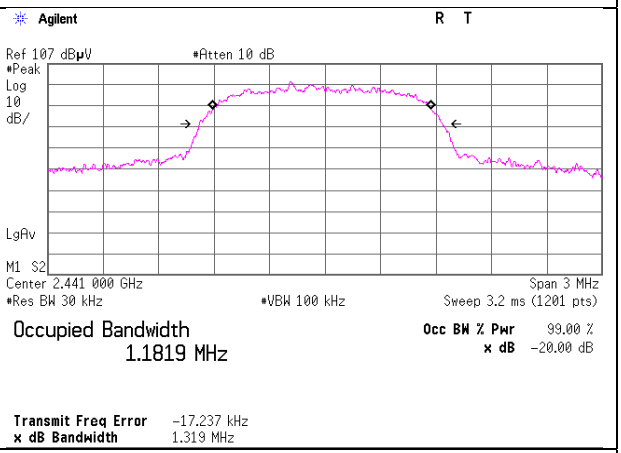


3DH5

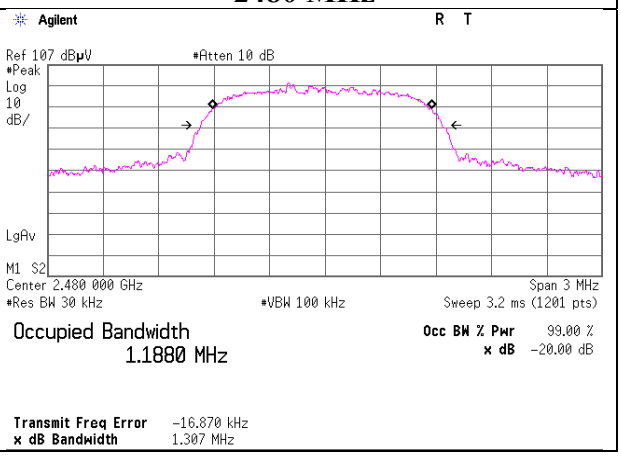
2402 MHz



2441 MHz

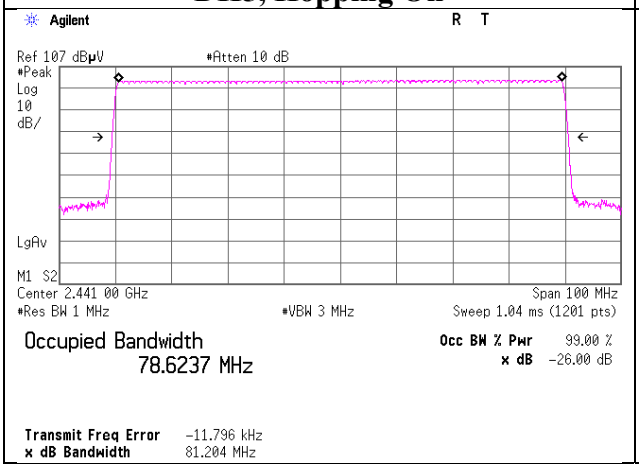


2480 MHz

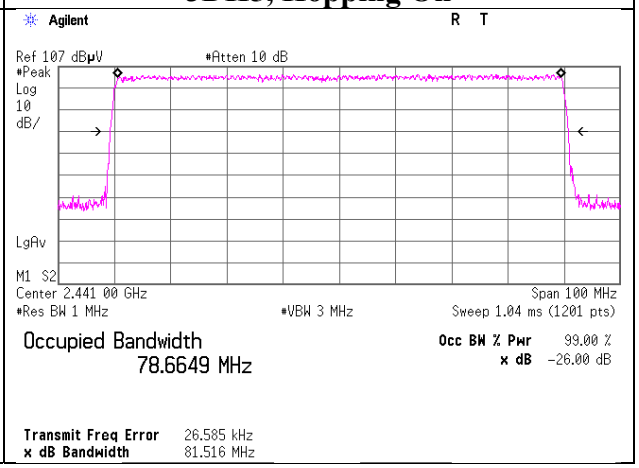


20dB Bandwidth and 99% Occupied Bandwidth

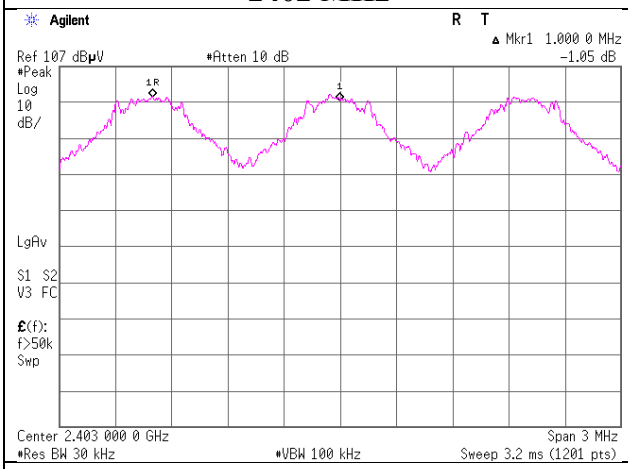
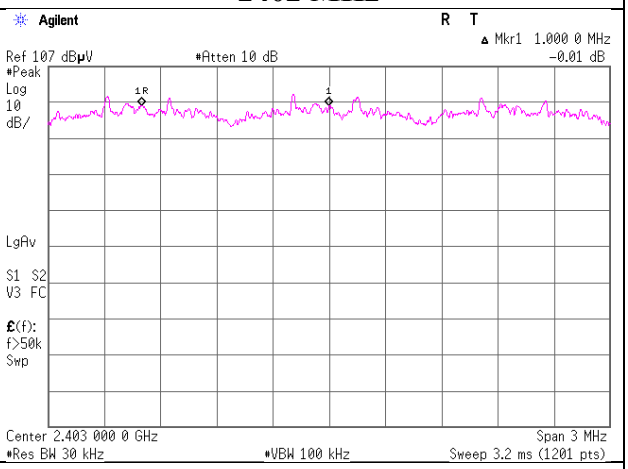
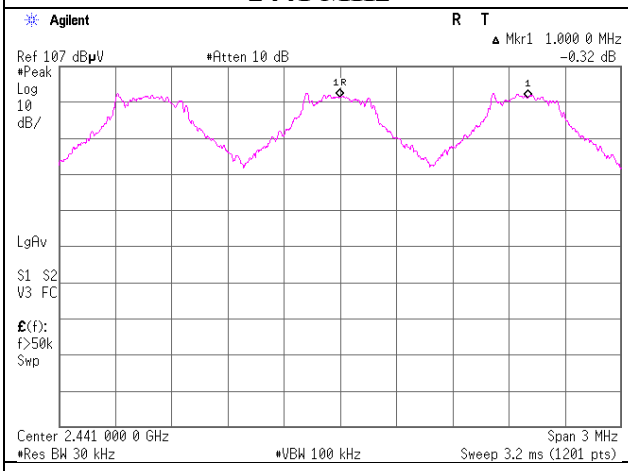
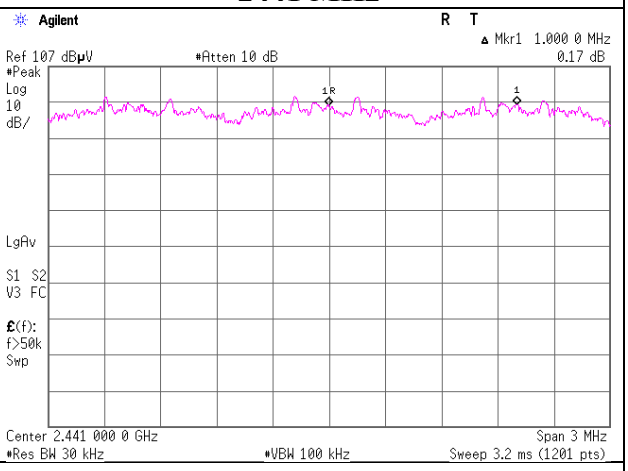
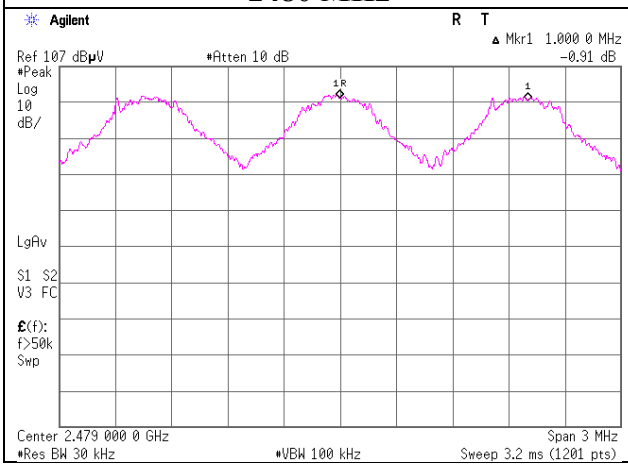
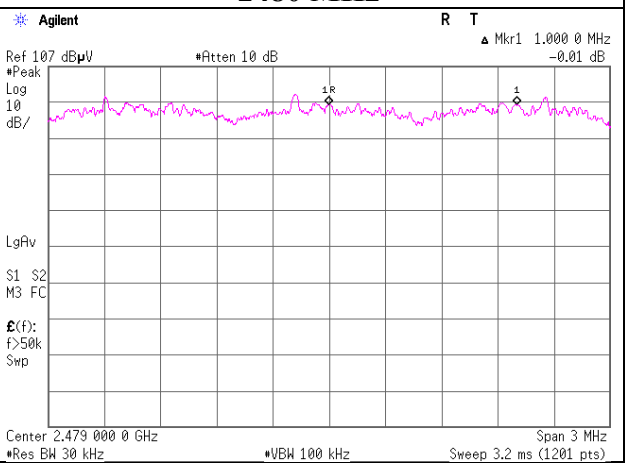
DH5, Hopping On



3DH5, Hopping On



Carrier Frequency Separation

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

Number of Hopping Frequency

Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx, Hopping On

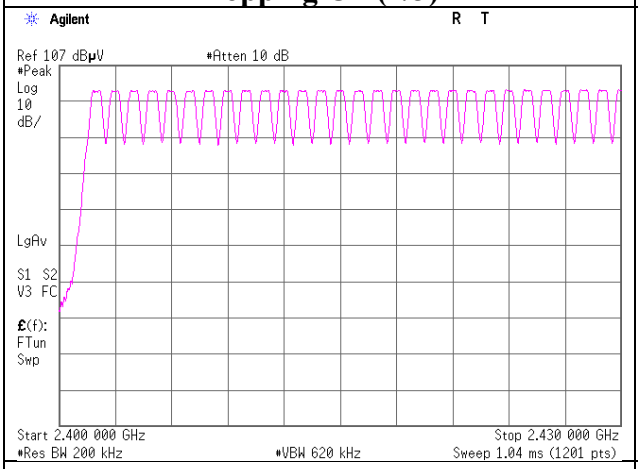
Mode	Number of channel [channels]	Limit [channels]
DH5	79	>= 15
3DH5	79	>= 15

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

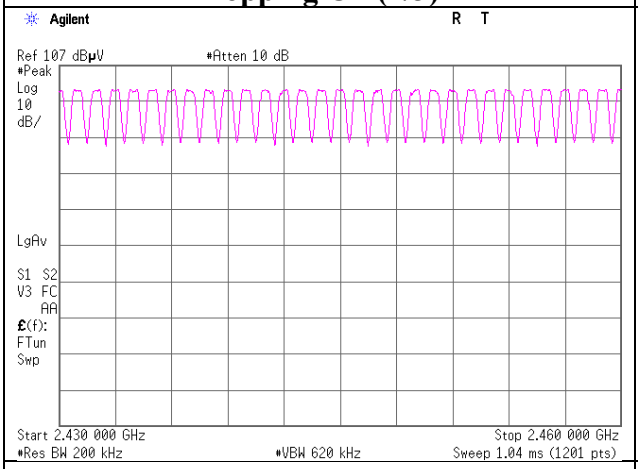
Number of Hopping Frequency

DH5

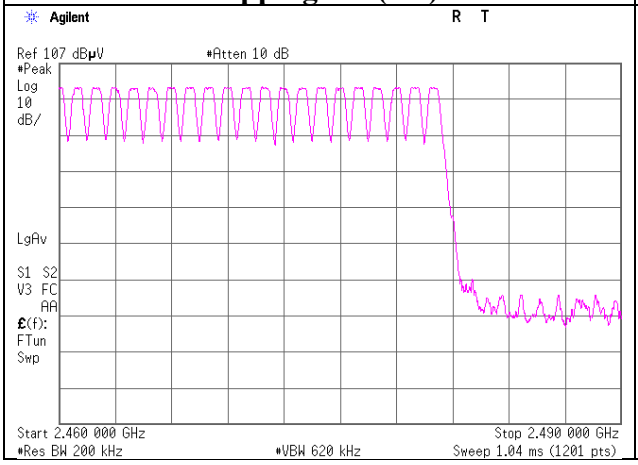
Hopping On (1/3)



Hopping On (2/3)

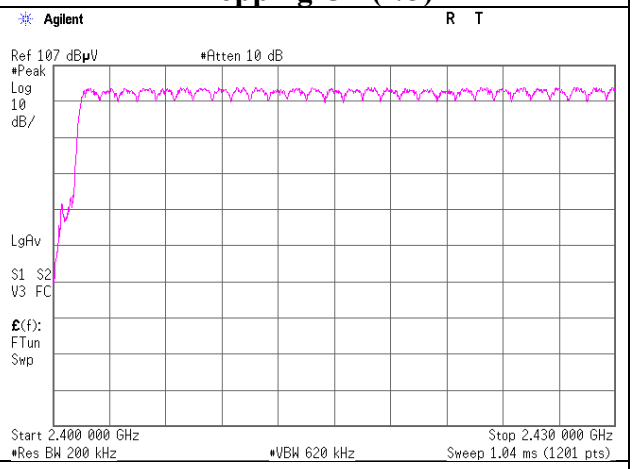


Hopping On (3/3)

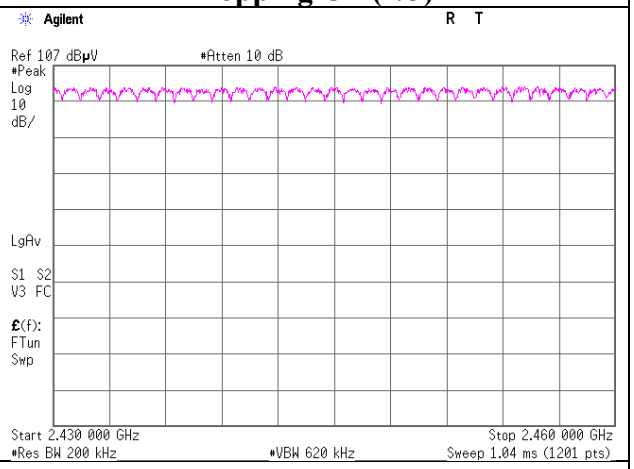


3DH5

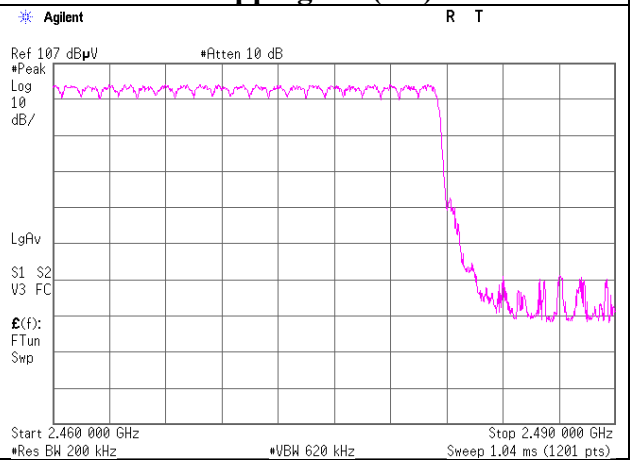
Hopping On (1/3)



Hopping On (2/3)



Hopping On (3/3)



Dwell time

Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx, Hopping On

Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period					Length of transmission [msec]	Result [msec]	Limit [msec]
DH1	49.2 times	/	5 sec. x	31.6 sec. =	311 times	0.410	128	400
DH3	26.6 times	/	5 sec. x	31.6 sec. =	169 times	1.685	285	400
DH5	20.6 times	/	5 sec. x	31.6 sec. =	131 times	2.923	383	400
3DH1	49.6 times	/	5 sec. x	31.6 sec. =	314 times	0.412	129	400
3DH3	28.4 times	/	5 sec. x	31.6 sec. =	180 times	1.677	302	400
3DH5	21.4 times	/	5 sec. x	31.6 sec. =	136 times	2.923	398	400

Sample Calculation
Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

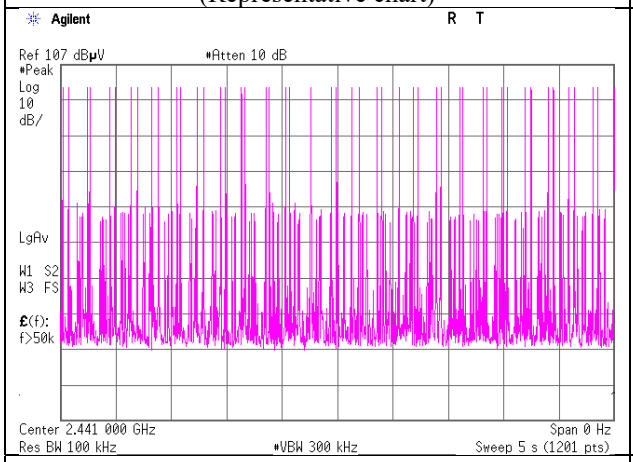
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	48	49	50	50	49	49.2
DH3	26	27	24	28	28	26.6
DH5	22	19	19	19	24	20.6
3DH1	49	47	50	50	52	49.6
3DH3	26	33	27	29	27	28.4
3DH5	21	22	22	20	22	21.4

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

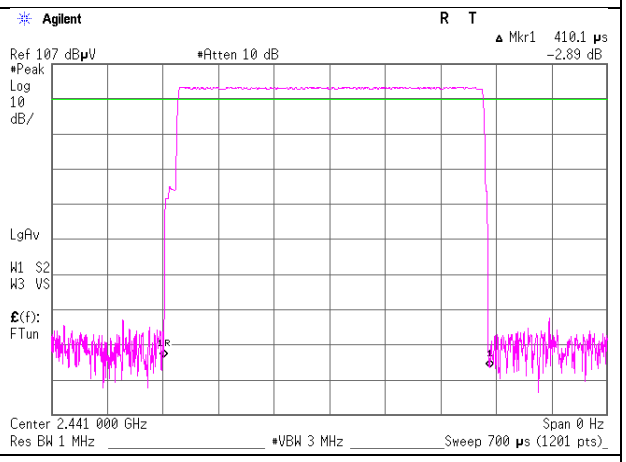
This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in N x 0.4s, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4s regardless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

Dwell time

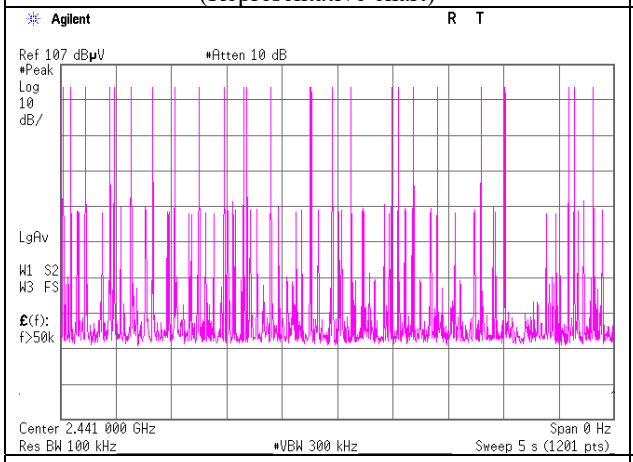
DH1 (1/2)
(Representative chart)



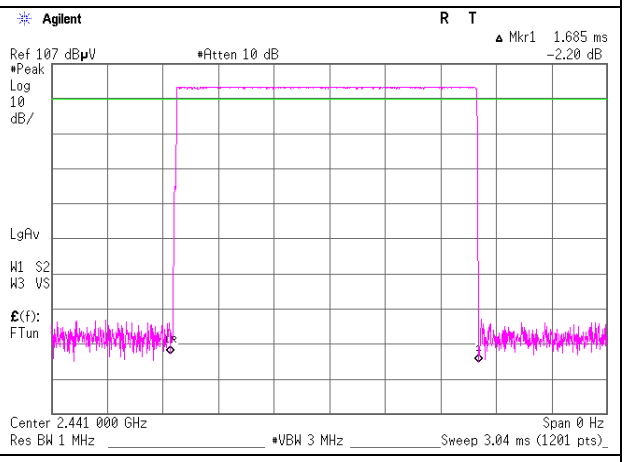
DH1 (2/2)



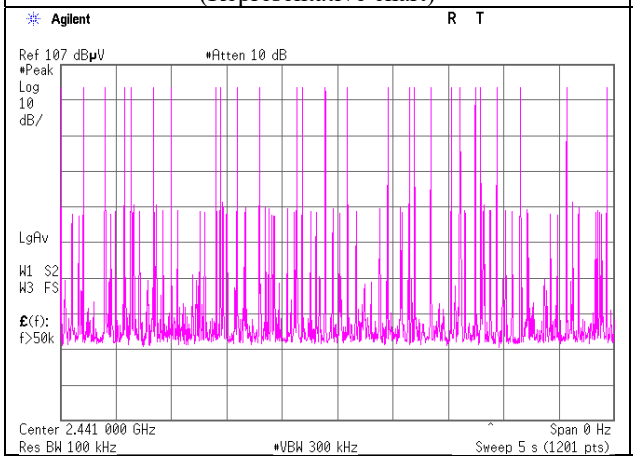
DH3 (1/2)
(Representative chart)



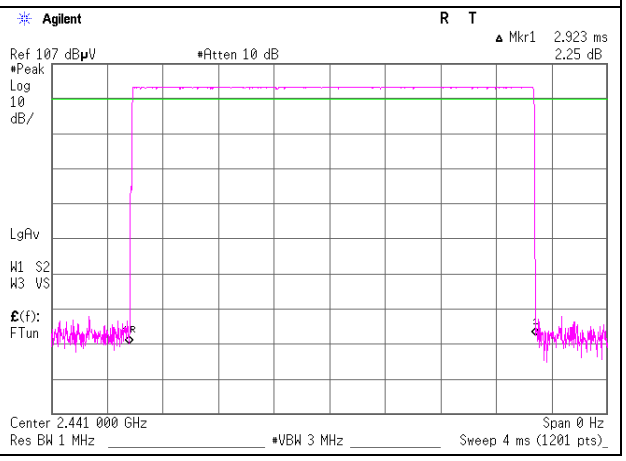
DH3 (2/2)



DH5 (1/2)
(Representative chart)

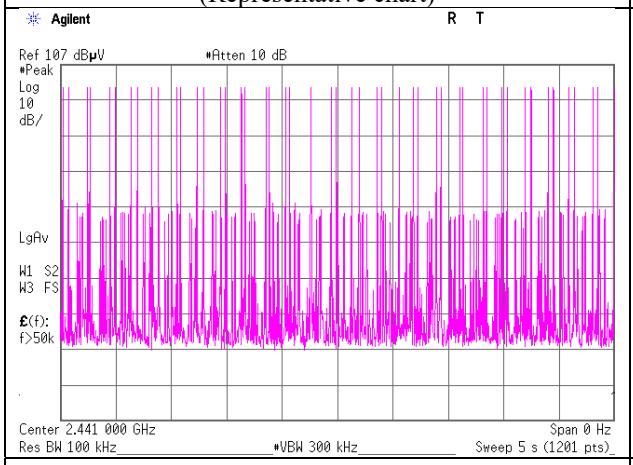


DH5 (2/2)

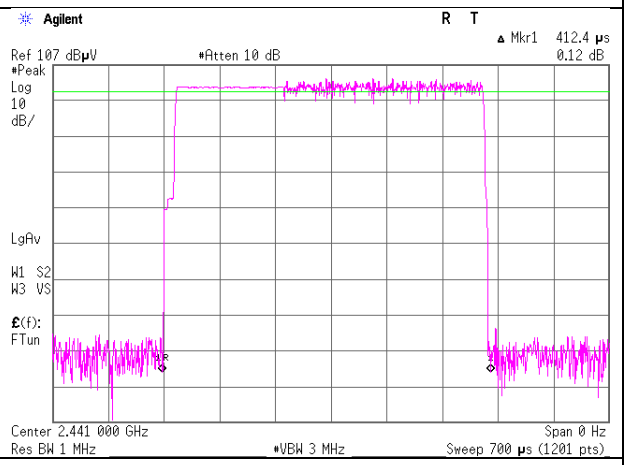


Dwell time

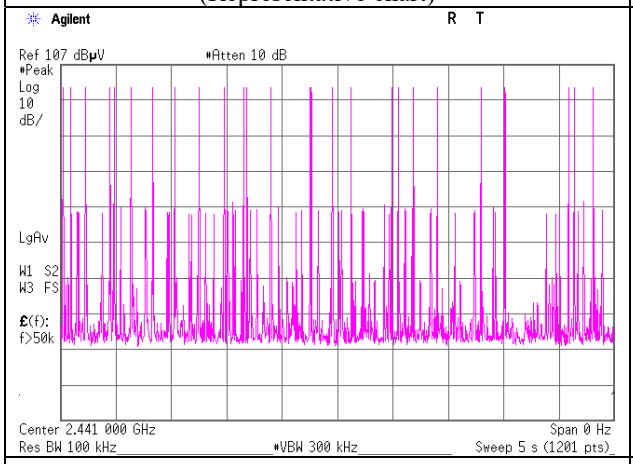
3DH1 (1/2)
(Representative chart)



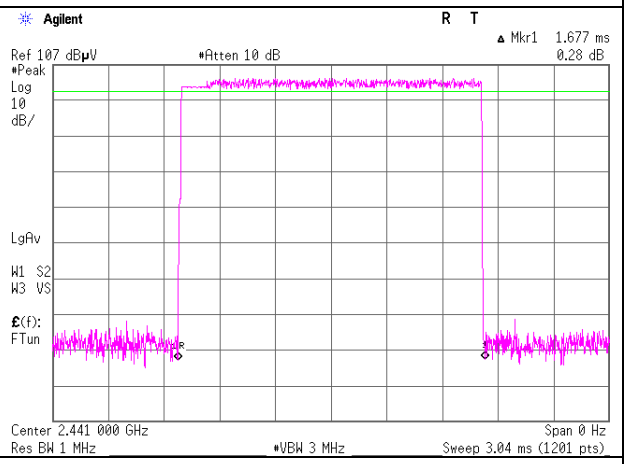
3DH1 (2/2)



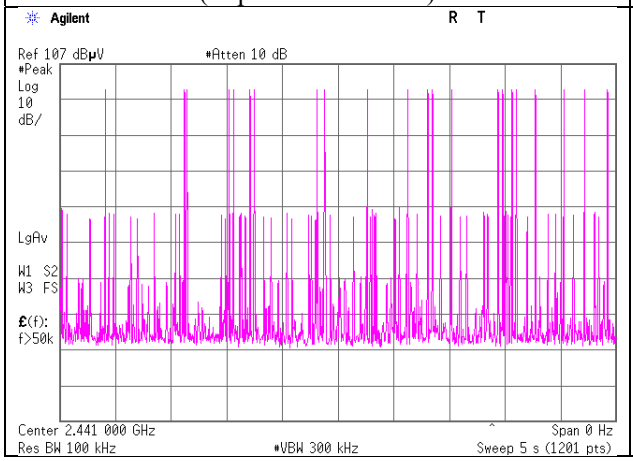
3DH3 (1/2)
(Representative chart)



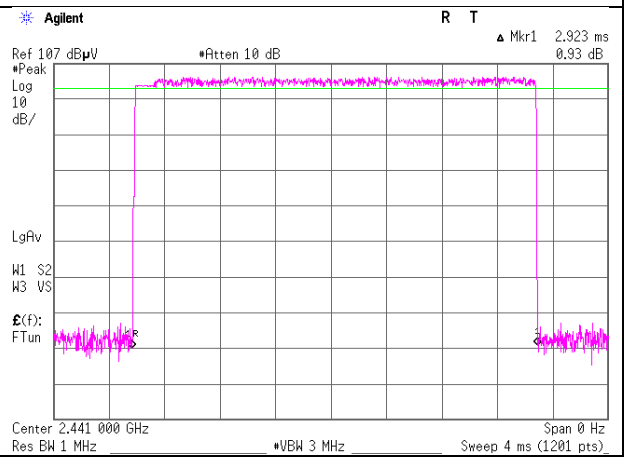
3DH3 (2/2)



3DH5 (1/2)
(Representative chart)



3DH5 (2/2)



Maximum Peak Output Power

Report No.	13329061H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	May 3, 2020
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Akihiko Maeda
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	-6.13	1.00	10.06	4.93	3.11	20.96	125	16.03	-5.38	-0.45	0.90	36.02	4000	36.47
DH5	2441.0	-5.84	1.00	10.06	5.22	3.33	20.96	125	15.74	-5.38	-0.16	0.96	36.02	4000	36.18
DH5	2480.0	-5.73	1.00	10.06	5.33	3.41	20.96	125	15.63	-5.38	-0.05	0.99	36.02	4000	36.07
2DH5	2402.0	-3.25	1.00	10.06	7.81	6.04	20.96	125	13.15	-5.38	2.43	1.75	36.02	4000	33.59
2DH5	2441.0	-2.93	1.00	10.06	8.13	6.50	20.96	125	12.83	-5.38	2.75	1.88	36.02	4000	33.27
2DH5	2480.0	-2.88	1.00	10.06	8.18	6.58	20.96	125	12.78	-5.38	2.8	1.91	36.02	4000	33.22
3DH5	2402.0	-2.98	1.00	10.06	8.08	6.43	20.96	125	12.88	-5.38	2.7	1.86	36.02	4000	33.32
3DH5	2441.0	-2.67	1.00	10.06	8.39	6.90	20.96	125	12.57	-5.38	3.01	2.00	36.02	4000	33.01
3DH5	2480.0	-2.61	1.00	10.06	8.45	7.00	20.96	125	12.51	-5.38	3.07	2.03	36.02	4000	32.95

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

Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.
As this device had AFH mode and frequency separation could not meet the requirement of over 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

Average Output Power
(Reference data for RF Exposure)

Report No.	13329061H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	May 3, 2020
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Akihiko Maeda
Mode	Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average) [dBm]	Result (Time average) [mW]	Duty factor [dB]	Result (Burst power average) [dBm]	Result (Burst power average) [mW]
DH5	2402.0	-7.51	1.00	10.06	3.55	2.26	1.09	4.64	2.91
DH5	2441.0	-7.22	1.00	10.06	3.84	2.42	1.09	4.93	3.11
DH5	2480.0	-7.11	1.00	10.06	3.95	2.48	1.09	5.04	3.19
2DH5	2402.0	-6.99	1.00	10.06	4.07	2.55	1.10	5.17	3.29
2DH5	2441.0	-6.70	1.00	10.06	4.36	2.73	1.10	5.46	3.52
2DH5	2480.0	-6.64	1.00	10.06	4.42	2.77	1.10	5.52	3.56
3DH5	2402.0	-6.96	1.00	10.06	4.10	2.57	1.09	5.19	3.30
3DH5	2441.0	-6.71	1.00	10.06	4.35	2.72	1.09	5.44	3.50
3DH5	2480.0	-6.65	1.00	10.06	4.41	2.76	1.09	5.50	3.55

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

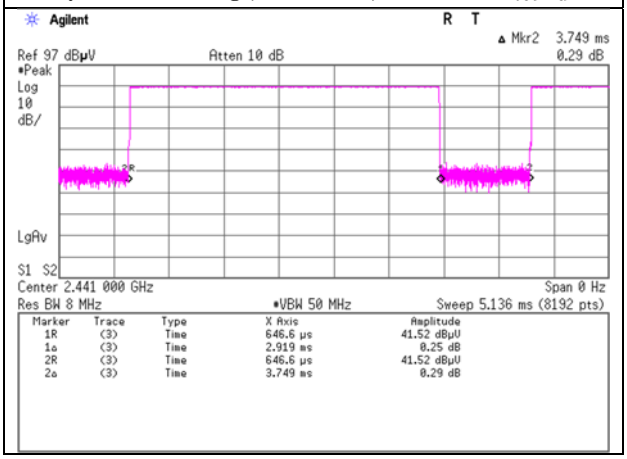
*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst Rate Confirmation

Report No.	13329061H
Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Date	May 4, 2020
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off

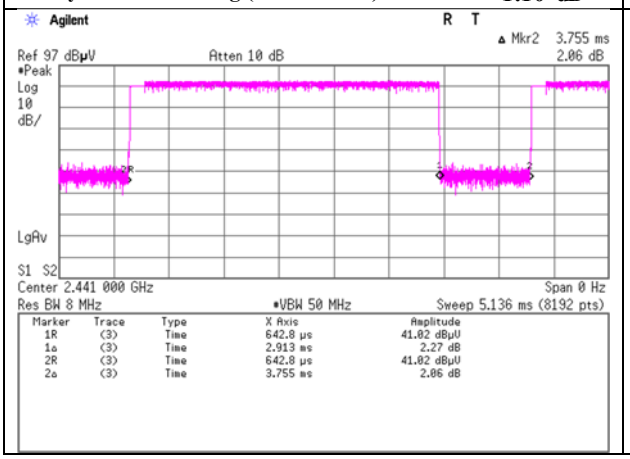
DH5

Tx on / (Tx on + Tx off) =	**0.779**
Tx on / (Tx on + Tx off) * 100 =	**77.9 %**
Duty factor = 10 * log (3.749 / 2.919) =	**1.09 dB**



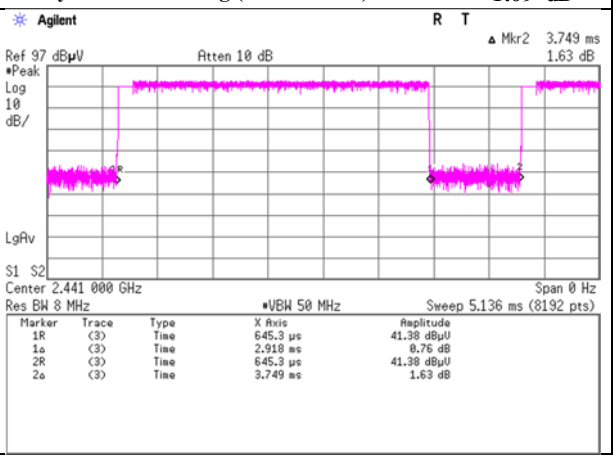
2DH5

Tx on / (Tx on + Tx off) =	**0.776**
Tx on / (Tx on + Tx off) * 100 =	**77.6 %**
Duty factor = 10 * log (3.755 / 2.913) =	**1.10 dB**



3DH5

Tx on / (Tx on + Tx off) =	**0.778**
Tx on / (Tx on + Tx off) * 100 =	**77.8 %**
Duty factor = 10 * log (3.749 / 2.918) =	**1.09 dB**



Radiated Spurious Emission

Report No.	13329061H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	May 4, 2020	May 5, 2020	May 10, 2020
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH	23 deg. C / 60 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)	Hiroyuki Furutaka (10 GHz - 26.5 GHz)	Junya Okuno (Below 1 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.	196.610	QP	32.6	16.7	9.1	32.0	-	26.3	43.5	17.2	
Hori.	208.895	QP	39.2	11.2	9.2	32.0	-	27.6	43.5	16.0	
Hori.	221.182	QP	41.6	11.1	9.3	32.0	-	30.0	46.0	16.0	
Hori.	233.472	QP	38.8	11.3	9.4	32.0	-	27.5	46.0	18.5	
Hori.	276.480	QP	33.5	13.2	9.8	32.0	-	24.5	46.0	21.6	
Hori.	294.910	QP	34.2	13.4	9.9	32.0	-	25.6	46.0	20.4	
Hori.	2390.000	PK	43.7	27.7	5.3	32.7	-	43.9	73.9	30.0	
Hori.	4804.000	PK	40.4	31.6	7.4	31.7	-	47.7	73.9	26.2	Floor noise
Hori.	7206.000	PK	42.7	36.0	8.8	32.6	-	54.9	73.9	19.0	Floor noise
Hori.	9608.000	PK	41.7	38.5	9.3	33.3	-	56.2	73.9	17.7	Floor noise
Hori.	2390.000	AV	33.6	27.7	5.3	32.7	1.1	34.9	53.9	19.0	*1)
Hori.	4804.000	AV	32.4	31.6	7.4	31.7	-	39.7	53.9	14.2	Floor noise
Hori.	7206.000	AV	33.5	36.0	8.8	32.6	-	45.7	53.9	8.2	Floor noise
Hori.	9608.000	AV	33.2	38.5	9.3	33.3	-	47.7	53.9	6.2	Floor noise
Vert.	196.610	QP	35.9	16.7	9.1	32.0	-	29.6	43.5	13.9	
Vert.	221.182	QP	38.7	11.1	9.3	32.0	-	27.1	46.0	18.9	
Vert.	227.320	QP	39.6	11.1	9.4	32.0	-	28.1	46.0	17.9	
Vert.	233.473	QP	41.0	11.3	9.4	32.0	-	29.7	46.0	16.3	
Vert.	245.753	QP	38.0	11.7	9.5	32.0	-	27.2	46.0	18.8	
Vert.	294.910	QP	37.5	13.4	9.9	32.0	-	28.9	46.0	17.1	
Vert.	2390.000	PK	41.5	27.7	5.3	32.7	-	41.7	73.9	32.2	
Vert.	4804.000	PK	41.0	31.6	7.4	31.7	-	48.3	73.9	25.6	Floor noise
Vert.	7206.000	PK	42.0	36.0	8.8	32.6	-	54.2	73.9	19.7	Floor noise
Vert.	9608.000	PK	41.3	38.5	9.3	33.3	-	55.8	73.9	18.1	Floor noise
Vert.	2390.000	AV	33.1	27.7	5.3	32.7	1.1	34.4	53.9	19.5	*1)
Vert.	4804.000	AV	32.3	31.6	7.4	31.7	-	39.6	53.9	14.3	Floor noise
Vert.	7206.000	AV	33.7	36.0	8.8	32.6	-	45.9	53.9	8.0	Floor noise
Vert.	9608.000	AV	33.1	38.5	9.3	33.3	-	47.6	53.9	6.3	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 (3.85 m / 3.0 m) = 2.17 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

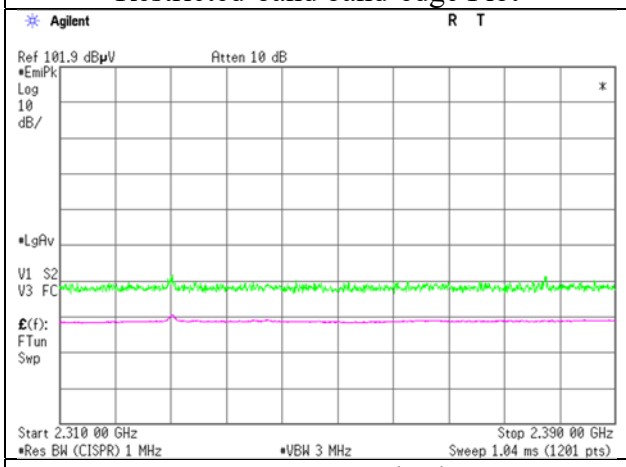
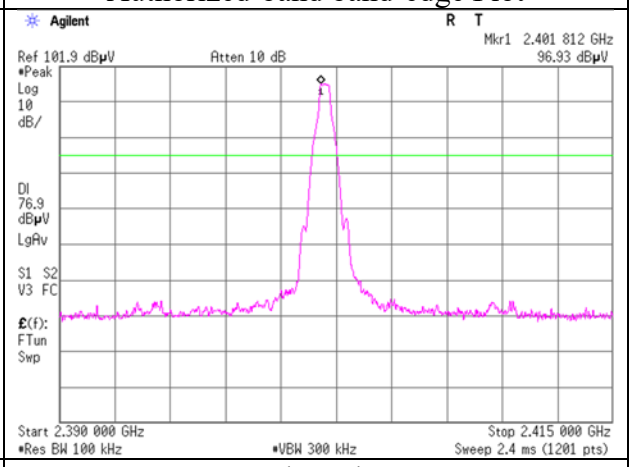
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	96.9	27.7	5.3	32.7	97.1	-	-	Carrier
Hori.	2400.000	PK	39.6	27.7	5.3	32.7	39.8	77.1	37.3	
Vert.	2402.000	PK	93.7	27.7	5.3	32.7	94.0	-	-	Carrier
Vert.	2400.000	PK	37.8	27.7	5.3	32.7	38.0	74.0	35.9	

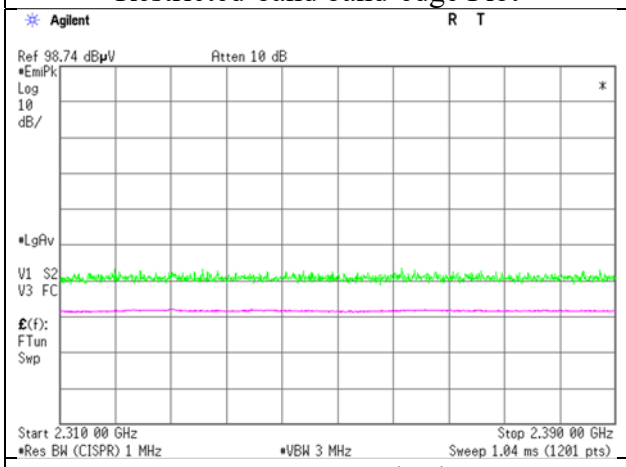
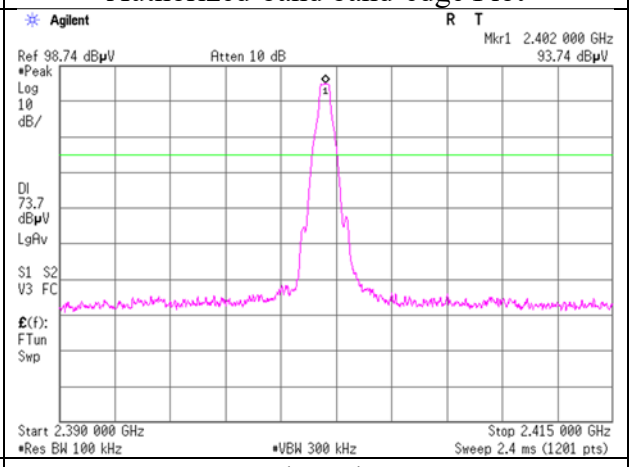
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13329061H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 4, 2020
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz

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

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

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

Radiated Spurious Emission

Report No.	13329061H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	May 4, 2020	May 5, 2020	May 10, 2020
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH	23 deg. C / 60 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)	Hiroyuki Furutaka (10 GHz - 26.5 GHz)	Junya Okuno (Below 1 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.	196.610	QP	32.6	16.7	9.1	32.0	-	26.3	43.5	17.2	
Hori.	208.895	QP	39.6	11.2	9.2	32.0	-	28.0	43.5	15.6	
Hori.	221.182	QP	41.5	11.1	9.3	32.0	-	29.9	46.0	16.1	
Hori.	233.472	QP	38.9	11.3	9.4	32.0	-	27.6	46.0	18.4	
Hori.	276.480	QP	33.6	13.2	9.8	32.0	-	24.6	46.0	21.5	
Hori.	294.910	QP	34.5	13.4	9.9	32.0	-	25.9	46.0	20.1	
Hori.	4882.000	PK	40.8	31.5	7.4	31.6	-	48.1	73.9	25.8	Floor noise
Hori.	7323.000	PK	41.5	36.2	8.8	32.6	-	53.8	73.9	20.1	Floor noise
Hori.	9764.000	PK	41.4	38.8	9.3	33.4	-	56.1	73.9	17.8	Floor noise
Hori.	4882.000	AV	32.4	31.5	7.4	31.6	-	39.7	53.9	14.2	Floor noise
Hori.	7323.000	AV	33.3	36.2	8.8	32.6	-	45.6	53.9	8.3	Floor noise
Hori.	9764.000	AV	33.2	38.8	9.3	33.4	-	47.9	53.9	6.0	Floor noise
Vert.	196.610	QP	36.1	16.7	9.1	32.0	-	29.8	43.5	13.7	
Vert.	221.182	QP	38.4	11.1	9.3	32.0	-	26.8	46.0	19.2	
Vert.	227.320	QP	40.0	11.1	9.4	32.0	-	28.5	46.0	17.5	
Vert.	233.473	QP	41.1	11.3	9.4	32.0	-	29.8	46.0	16.2	
Vert.	245.753	QP	37.8	11.7	9.5	32.0	-	27.0	46.0	19.0	
Vert.	294.910	QP	37.8	13.4	9.9	32.0	-	29.2	46.0	16.8	
Vert.	4882.000	PK	40.8	31.5	7.4	31.6	-	48.1	73.9	25.8	Floor noise
Vert.	7323.000	PK	42.2	36.2	8.8	32.6	-	54.5	73.9	19.4	Floor noise
Vert.	9764.000	PK	41.9	38.8	9.3	33.4	-	56.6	73.9	17.3	Floor noise
Vert.	4882.000	AV	32.4	31.5	7.4	31.6	-	39.7	53.9	14.2	Floor noise
Vert.	7323.000	AV	33.7	36.2	8.8	32.6	-	46.0	53.9	7.9	Floor noise
Vert.	9764.000	AV	33.2	38.8	9.3	33.4	-	47.9	53.9	6.0	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 (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13329061H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	May 4, 2020	May 5, 2020	May 10, 2020
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH	23 deg. C / 60 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)	Hiroyuki Furutaka (10 GHz - 26.5 GHz)	Junya Okuno (Below 1 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.	196.610	QP	32.8	16.7	9.1	32.0	-	26.5	43.5	17.0	
Hori.	208.895	QP	38.3	11.2	9.2	32.0	-	26.7	43.5	16.9	
Hori.	221.182	QP	41.2	11.1	9.3	32.0	-	29.6	46.0	16.4	
Hori.	233.472	QP	38.8	11.3	9.4	32.0	-	27.5	46.0	18.5	
Hori.	276.480	QP	33.3	13.2	9.8	32.0	-	24.3	46.0	21.8	
Hori.	294.910	QP	33.3	13.4	9.9	32.0	-	24.7	46.0	21.3	
Hori.	2483.500	PK	45.5	27.5	5.3	32.7	-	45.6	73.9	28.3	
Hori.	2488.051	PK	46.3	27.4	5.3	32.7	-	46.4	73.9	27.5	
Hori.	4960.000	PK	40.5	31.6	7.4	31.6	-	47.8	73.9	26.1	Floor noise
Hori.	7440.000	PK	42.7	36.3	8.8	32.7	-	55.1	73.9	18.8	Floor noise
Hori.	9920.000	PK	42.5	38.9	8.8	33.5	-	56.8	73.9	17.1	Floor noise
Hori.	2483.500	AV	36.2	27.5	5.3	32.7	1.1	37.4	53.9	16.5	*1)
Hori.	2488.051	AV	36.1	27.4	5.3	32.7	1.1	37.3	53.9	16.6	*2)
Hori.	4960.000	AV	32.4	31.6	7.4	31.6	-	39.7	53.9	14.2	Floor noise
Hori.	7440.000	AV	34.3	36.3	8.8	32.7	-	46.7	53.9	7.2	Floor noise
Hori.	9920.000	AV	33.5	38.9	8.8	33.5	-	47.8	53.9	6.1	Floor noise
Vert.	196.610	QP	35.8	16.7	9.1	32.0	-	29.5	43.5	14.0	
Vert.	221.182	QP	38.5	11.1	9.3	32.0	-	26.9	46.0	19.1	
Vert.	227.320	QP	39.8	11.1	9.4	32.0	-	28.3	46.0	17.7	
Vert.	233.473	QP	41.4	11.3	9.4	32.0	-	30.1	46.0	15.9	
Vert.	245.753	QP	38.2	11.7	9.5	32.0	-	27.4	46.0	18.6	
Vert.	294.910	QP	37.3	13.4	9.9	32.0	-	28.7	46.0	17.3	
Vert.	2483.500	PK	44.0	27.5	5.3	32.7	-	44.1	73.9	29.8	
Vert.	2488.010	PK	44.4	27.4	5.3	32.7	-	44.5	73.9	29.4	
Vert.	4960.000	PK	41.0	31.6	7.4	31.6	-	48.3	73.9	25.6	Floor noise
Vert.	7440.000	PK	42.2	36.3	8.8	32.7	-	54.6	73.9	19.3	Floor noise
Vert.	9920.000	PK	42.0	38.9	8.8	33.5	-	56.3	73.9	17.6	Floor noise
Vert.	2483.500	AV	34.6	27.5	5.3	32.7	1.1	35.8	53.9	18.1	*1)
Vert.	2488.010	AV	34.5	27.4	5.3	32.7	1.1	35.7	53.9	18.2	*2)
Vert.	4960.000	AV	32.1	31.6	7.4	31.6	-	39.4	53.9	14.5	Floor noise
Vert.	7440.000	AV	34.3	36.3	8.8	32.7	-	46.7	53.9	7.2	Floor noise
Vert.	9920.000	AV	33.5	38.9	8.8	33.5	-	47.8	53.9	6.1	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).

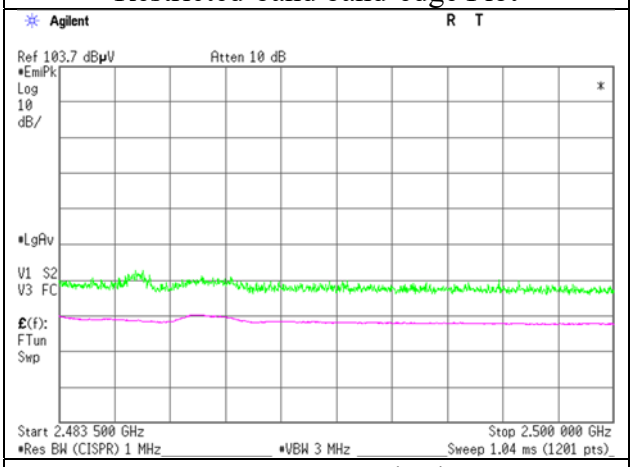
Distance factor: 1 GHz - 10 GHz 20log (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
*1) Not Out of Band emission(Leakage Power)
*2) Noise synchronized with duty of carrier frequency.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13329061H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 4, 2020
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 10 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz

Horizontal

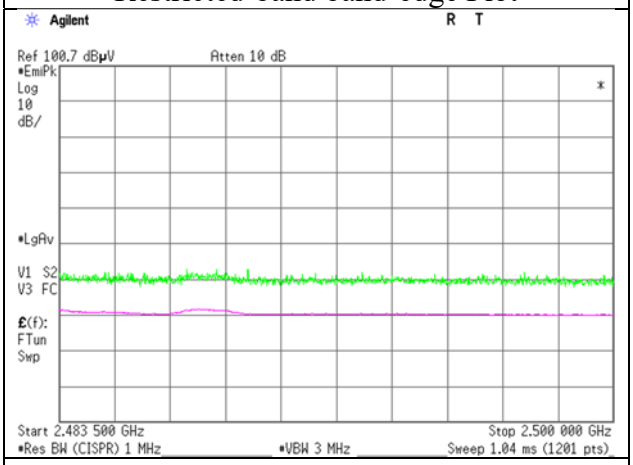
Restricted-band band-edge Plot



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.	13329061H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 5, 2020	May 10, 2020
Temperature / Humidity	22 deg. C / 45 % RH	23 deg. C / 60 % RH
Engineer	Hiroyuki Furutaka	Junya Okuno
	(1 GHz - 26.5 GHz)	(Below 1 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.	196.610	QP	32.5	16.7	9.1	32.0	-	26.2	43.5	17.3	
Hori.	208.895	QP	39.1	11.2	9.2	32.0	-	27.5	43.5	16.1	
Hori.	221.182	QP	41.8	11.1	9.3	32.0	-	30.2	46.0	15.8	
Hori.	233.472	QP	38.5	11.3	9.4	32.0	-	27.2	46.0	18.8	
Hori.	276.480	QP	33.5	13.2	9.8	32.0	-	24.5	46.0	21.6	
Hori.	294.910	QP	34.0	13.4	9.9	32.0	-	25.4	46.0	20.6	
Hori.	2390.000	PK	45.0	27.7	5.3	32.7	-	45.2	73.9	28.7	
Hori.	4804.000	PK	41.0	31.6	7.4	31.7	-	48.3	73.9	25.6	Floor noise
Hori.	7206.000	PK	42.8	36.0	8.8	32.6	-	55.0	73.9	18.9	Floor noise
Hori.	9608.000	PK	42.2	38.5	9.3	33.3	-	56.7	73.9	17.2	Floor noise
Hori.	2390.000	AV	34.5	27.7	5.3	32.7	1.1	35.8	53.9	18.1	*1)
Hori.	4804.000	AV	32.5	31.6	7.4	31.7	-	39.8	53.9	14.1	Floor noise
Hori.	7206.000	AV	33.7	36.0	8.8	32.6	-	45.9	53.9	8.0	Floor noise
Hori.	9608.000	AV	33.2	38.5	9.3	33.3	-	47.7	53.9	6.2	Floor noise
Vert.	196.610	QP	36.0	16.7	9.1	32.0	-	29.7	43.5	13.8	
Vert.	221.182	QP	38.3	11.1	9.3	32.0	-	26.7	46.0	19.3	
Vert.	227.320	QP	39.1	11.1	9.4	32.0	-	27.6	46.0	18.4	
Vert.	233.473	QP	40.5	11.3	9.4	32.0	-	29.2	46.0	16.8	
Vert.	245.753	QP	37.5	11.7	9.5	32.0	-	26.7	46.0	19.3	
Vert.	294.910	QP	37.9	13.4	9.9	32.0	-	29.3	46.0	16.7	
Vert.	2390.000	PK	42.8	27.7	5.3	32.7	-	43.0	73.9	30.9	
Vert.	4804.000	PK	41.2	31.6	7.4	31.7	-	48.5	73.9	25.4	Floor noise
Vert.	7206.000	PK	41.6	36.0	8.8	32.6	-	53.8	73.9	20.1	Floor noise
Vert.	9608.000	PK	41.6	38.5	9.3	33.3	-	56.1	73.9	17.8	Floor noise
Vert.	2390.000	AV	34.2	27.7	5.3	32.7	1.1	35.5	53.9	18.4	*1)
Vert.	4804.000	AV	32.5	31.6	7.4	31.7	-	39.8	53.9	14.1	Floor noise
Vert.	7206.000	AV	33.8	36.0	8.8	32.6	-	46.0	53.9	7.9	Floor noise
Vert.	9608.000	AV	33.2	38.5	9.3	33.3	-	47.7	53.9	6.2	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 (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

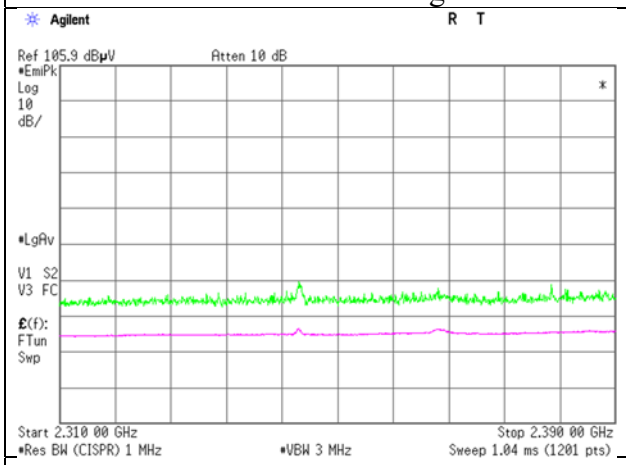
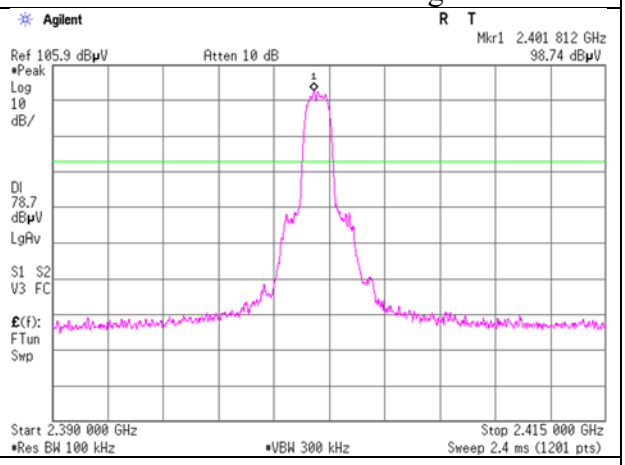
20dBc Data Sheet

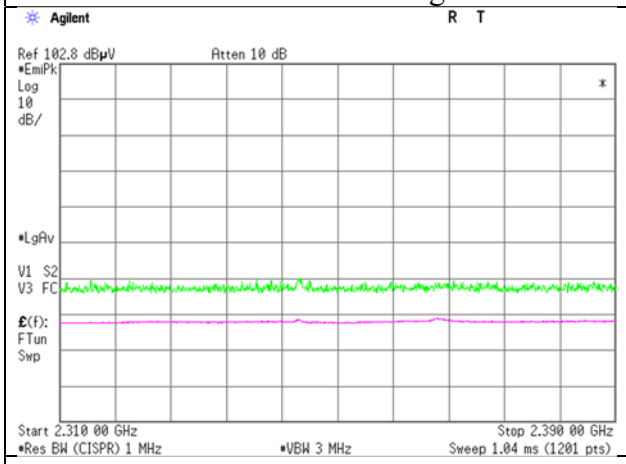
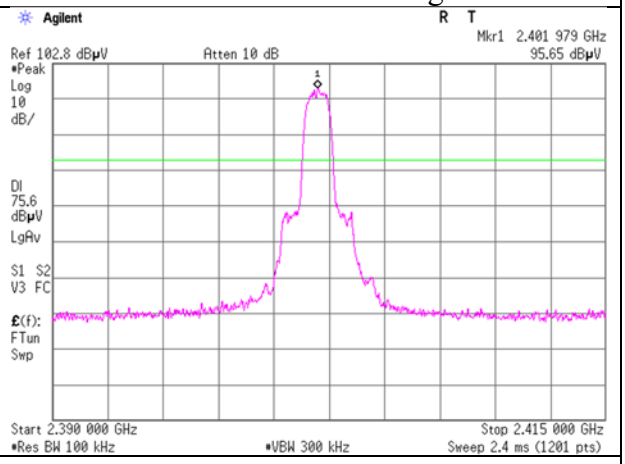
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	98.7	27.7	5.3	32.7	99.0	-	-	Carrier
Hori.	2400.000	PK	46.8	27.7	5.3	32.7	47.0	79.0	31.9	
Vert.	2402.000	PK	95.7	27.7	5.3	32.7	95.9	-	-	Carrier
Vert.	2400.000	PK	43.7	27.7	5.3	32.7	43.9	75.9	31.9	

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13329061H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 5, 2020
Temperature / Humidity	22 deg. C / 45 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz

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

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

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

Radiated Spurious Emission

Report No.	13329061H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 5, 2020	May 10, 2020
Temperature / Humidity	22 deg. C / 45 % RH	23 deg. C / 60 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 26.5 GHz)	Junya Okuno (Below 1 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.	196.610	QP	32.6	16.7	9.1	32.0	-	26.3	43.5	17.2	
Hori.	208.895	QP	39.3	11.2	9.2	32.0	-	27.7	43.5	15.9	
Hori.	221.182	QP	41.5	11.1	9.3	32.0	-	29.9	46.0	16.1	
Hori.	233.472	QP	38.5	11.3	9.4	32.0	-	27.2	46.0	18.8	
Hori.	276.480	QP	33.3	13.2	9.8	32.0	-	24.3	46.0	21.8	
Hori.	294.910	QP	34.1	13.4	9.9	32.0	-	25.5	46.0	20.5	
Hori.	4882.000	PK	40.2	31.5	7.4	31.6	-	47.5	73.9	26.4	Floor noise
Hori.	7323.000	PK	42.6	36.2	8.8	32.6	-	54.9	73.9	19.0	Floor noise
Hori.	9764.000	PK	42.0	38.8	9.3	33.4	-	56.7	73.9	17.2	Floor noise
Hori.	4882.000	AV	32.0	31.5	7.4	31.6	-	39.3	53.9	14.6	Floor noise
Hori.	7323.000	AV	33.6	36.2	8.8	32.6	-	45.9	53.9	8.0	Floor noise
Hori.	9764.000	AV	33.2	38.8	9.3	33.4	-	47.9	53.9	6.0	Floor noise
Vert.	196.610	QP	36.3	16.7	9.1	32.0	-	30.0	43.5	13.5	
Vert.	221.182	QP	38.5	11.1	9.3	32.0	-	26.9	46.0	19.1	
Vert.	227.320	QP	39.9	11.1	9.4	32.0	-	28.4	46.0	17.6	
Vert.	233.473	QP	40.8	11.3	9.4	32.0	-	29.5	46.0	16.5	
Vert.	245.753	QP	37.7	11.7	9.5	32.0	-	26.9	46.0	19.1	
Vert.	294.910	QP	37.8	13.4	9.9	32.0	-	29.2	46.0	16.8	
Vert.	4882.000	PK	41.3	31.5	7.4	31.6	-	48.6	73.9	25.3	Floor noise
Vert.	7323.000	PK	42.4	36.2	8.8	32.6	-	54.7	73.9	19.2	Floor noise
Vert.	9764.000	PK	42.2	38.8	9.3	33.4	-	56.9	73.9	17.0	Floor noise
Vert.	4882.000	AV	32.1	31.5	7.4	31.6	-	39.4	53.9	14.5	Floor noise
Vert.	7323.000	AV	33.5	36.2	8.8	32.6	-	45.8	53.9	8.1	Floor noise
Vert.	9764.000	AV	33.2	38.8	9.3	33.4	-	47.9	53.9	6.0	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 (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13329061H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 5, 2020	May 10, 2020
Temperature / Humidity	22 deg. C / 45 % RH	23 deg. C / 60 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 26.5 GHz)	Junya Okuno (Below 1 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.	196.610	QP	32.7	16.7	9.1	32.0	-	26.4	43.5	17.1	
Hori.	208.895	QP	40.0	11.2	9.2	32.0	-	28.4	43.5	15.2	
Hori.	221.182	QP	41.8	11.1	9.3	32.0	-	30.2	46.0	15.8	
Hori.	233.472	QP	38.7	11.3	9.4	32.0	-	27.4	46.0	18.6	
Hori.	276.480	QP	33.0	13.2	9.8	32.0	-	24.0	46.0	22.1	
Hori.	294.910	QP	34.5	13.4	9.9	32.0	-	25.9	46.0	20.1	
Hori.	2483.500	PK	50.6	27.5	5.3	32.7	-	50.7	73.9	23.3	
Hori.	4960.000	PK	40.7	31.6	7.4	31.6	-	48.0	73.9	25.9	Floor noise
Hori.	7440.000	PK	43.1	36.3	8.8	32.7	-	55.5	73.9	18.4	Floor noise
Hori.	9920.000	PK	41.5	38.9	8.8	33.5	-	55.8	73.9	18.1	Floor noise
Hori.	2483.500	AV	39.2	27.5	5.3	32.7	1.1	40.4	53.9	13.5	*1)
Hori.	4960.000	AV	32.0	31.6	7.4	31.6	-	39.3	53.9	14.6	Floor noise
Hori.	7440.000	AV	34.3	36.3	8.8	32.7	-	46.7	53.9	7.2	Floor noise
Hori.	9920.000	AV	33.5	38.9	8.8	33.5	-	47.8	53.9	6.1	Floor noise
Vert.	196.610	QP	36.1	16.7	9.1	32.0	-	29.8	43.5	13.7	
Vert.	221.182	QP	38.6	11.1	9.3	32.0	-	27.0	46.0	19.0	
Vert.	227.320	QP	39.9	11.1	9.4	32.0	-	28.4	46.0	17.6	
Vert.	233.473	QP	41.0	11.3	9.4	32.0	-	29.7	46.0	16.3	
Vert.	245.753	QP	38.2	11.7	9.5	32.0	-	27.4	46.0	18.6	
Vert.	294.910	QP	37.8	13.4	9.9	32.0	-	29.2	46.0	16.8	
Vert.	2483.500	PK	47.2	27.5	5.3	32.7	-	47.3	73.9	26.6	
Vert.	4960.000	PK	41.3	31.6	7.4	31.6	-	48.6	73.9	25.3	Floor noise
Vert.	7440.000	PK	42.3	36.3	8.8	32.7	-	54.7	73.9	19.2	Floor noise
Vert.	9920.000	PK	42.3	38.9	8.8	33.5	-	56.6	73.9	17.3	Floor noise
Vert.	2483.500	AV	36.5	27.5	5.3	32.7	1.1	37.7	53.9	16.2	*1)
Vert.	4960.000	AV	32.1	31.6	7.4	31.6	-	39.4	53.9	14.5	Floor noise
Vert.	7440.000	AV	34.1	36.3	8.8	32.7	-	46.5	53.9	7.4	Floor noise
Vert.	9920.000	AV	33.6	38.9	8.8	33.5	-	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 (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

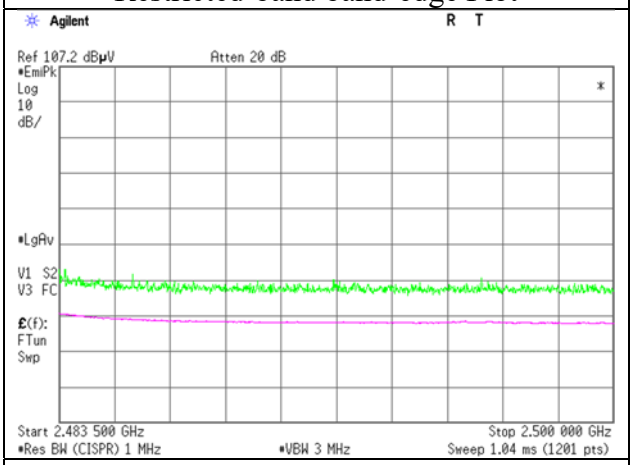
*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13329061H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 5, 2020
Temperature / Humidity	22 deg. C / 45 % RH
Engineer	Hiroyuki Furutaka (1 GHz – 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz

Horizontal

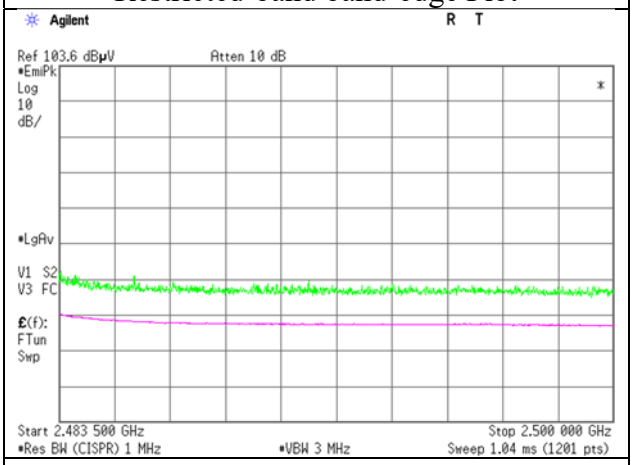
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

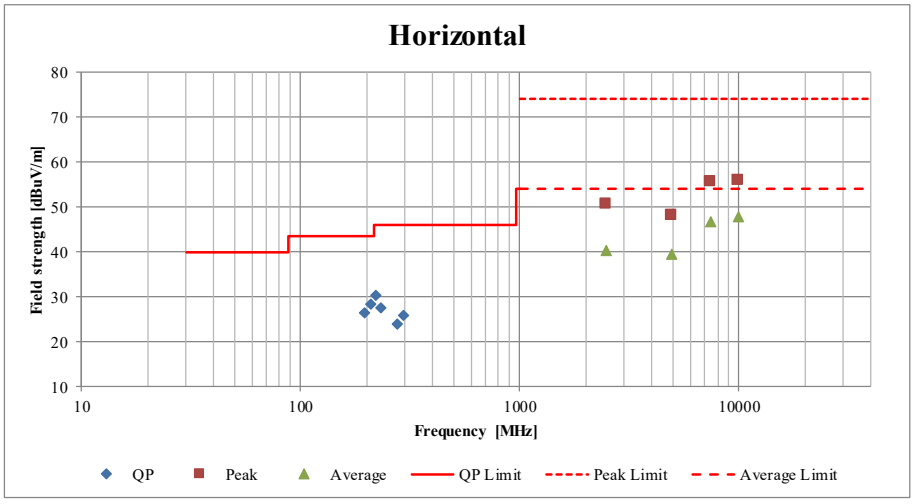


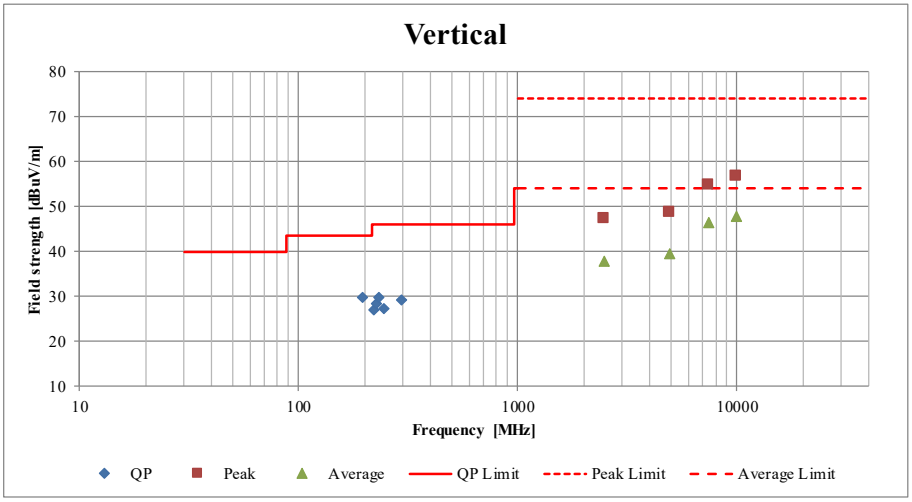
Trace Green : Peak Plot
Trace Purple : Average Plot

* 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.	13329061H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 5, 2020	May 10, 2020
Temperature / Humidity	22 deg. C / 45 % RH	23 deg. C / 60 % RH
Engineer	Hiroyuki Furutaka (1 GHz - 26.5 GHz)	Junya Okuno (Below 1 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz	





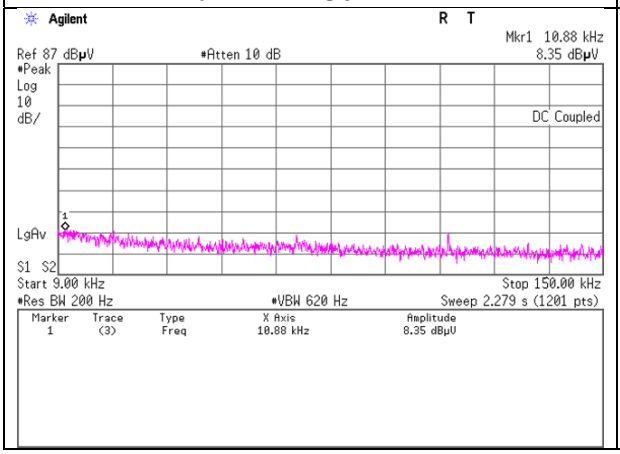
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

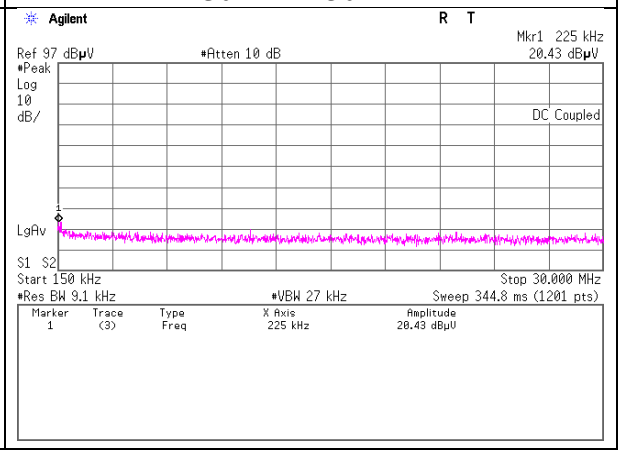
Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx, Hopping Off, DH5

2402 MHz

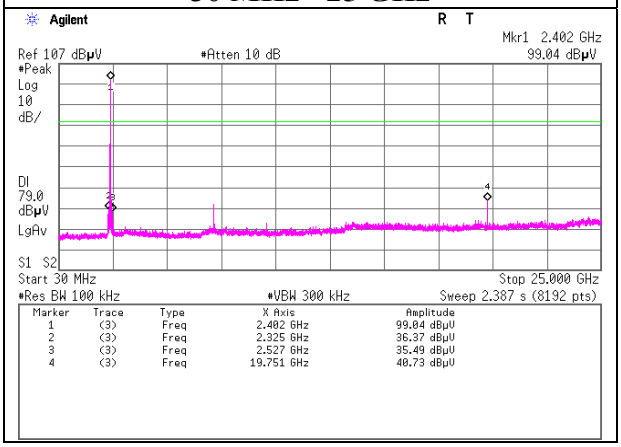
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

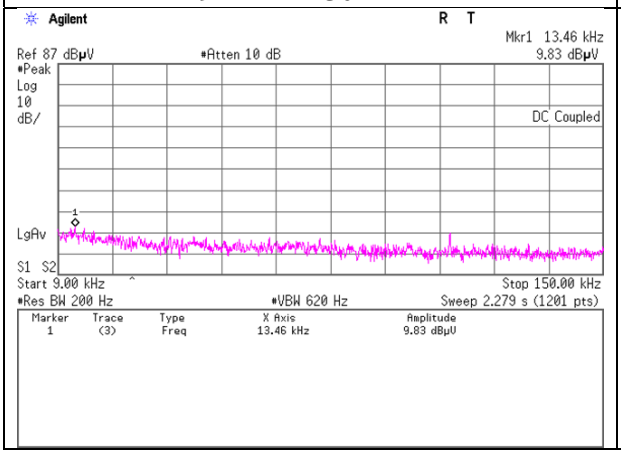


Conducted Spurious Emission

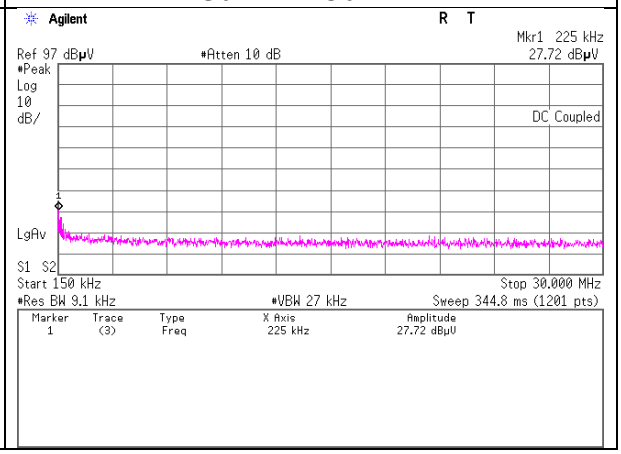
Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx, Hopping Off, DH5

2441 MHz

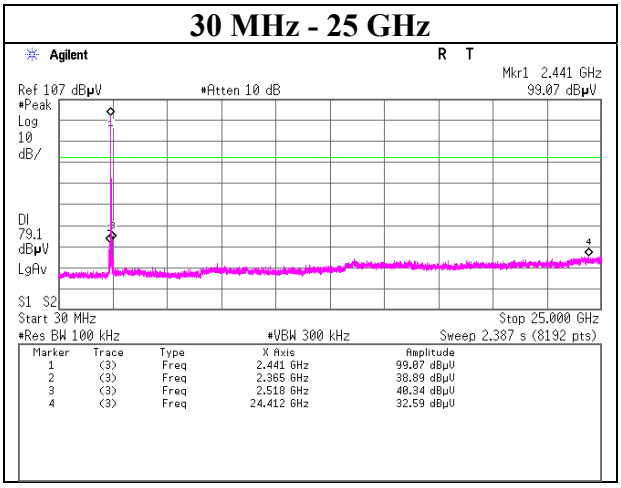
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

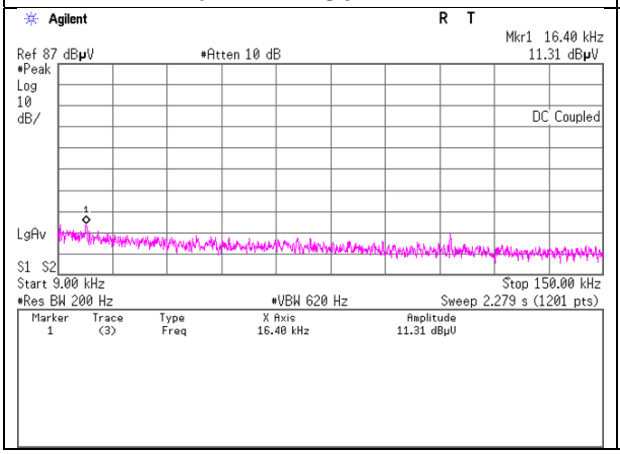


Conducted Spurious Emission

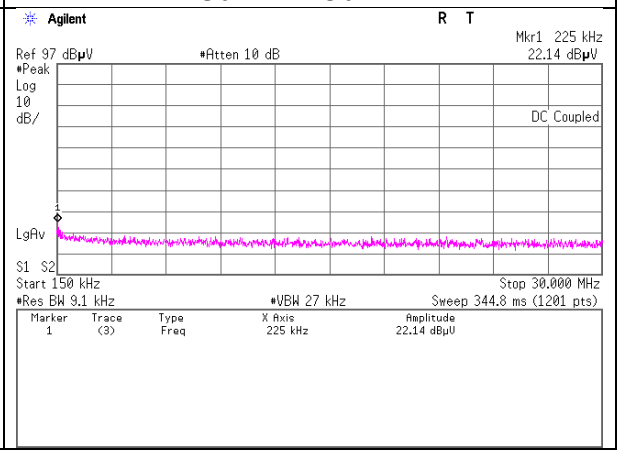
Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx, Hopping Off, DH5

2480 MHz

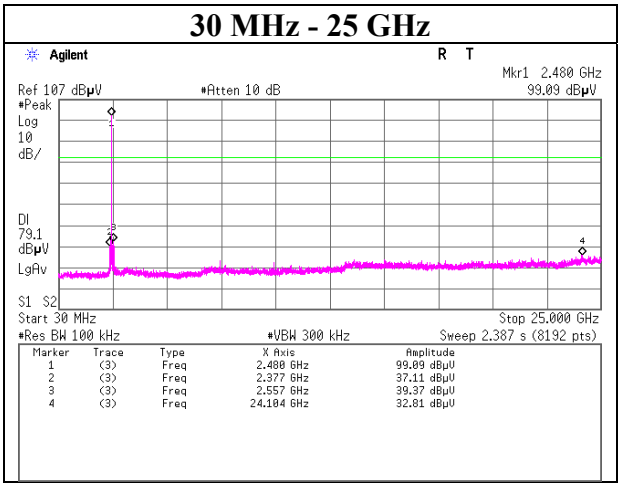
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

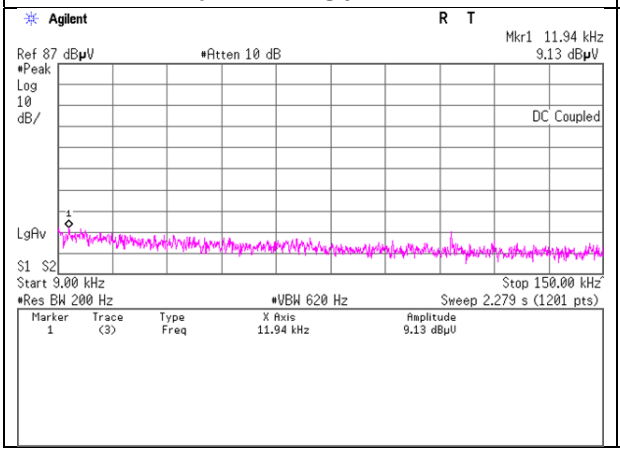


Conducted Spurious Emission

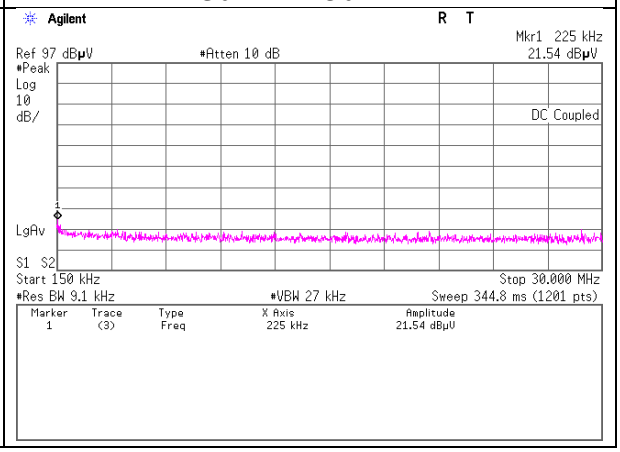
Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx, Hopping Off, 3DH5

2402 MHz

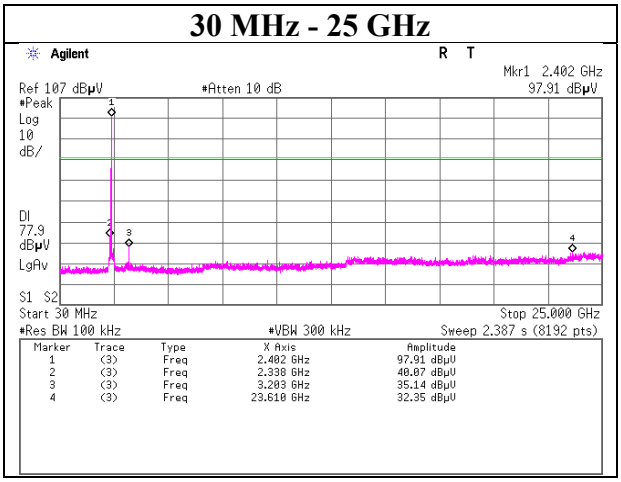
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

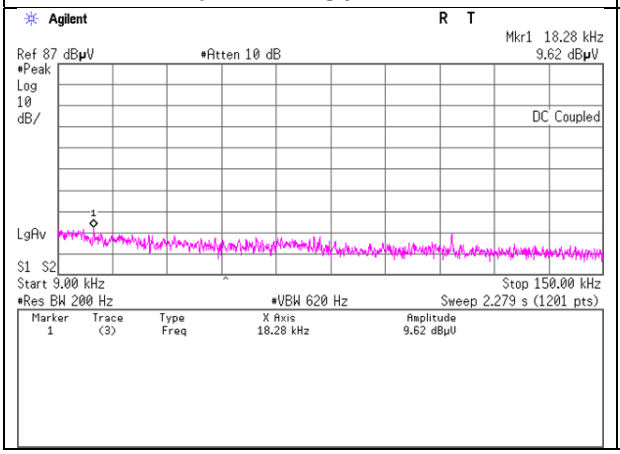


Conducted Spurious Emission

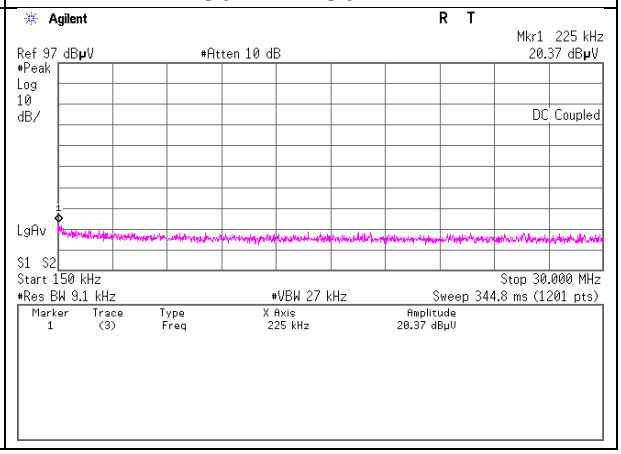
Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx, Hopping Off, 3DH5

2441 MHz

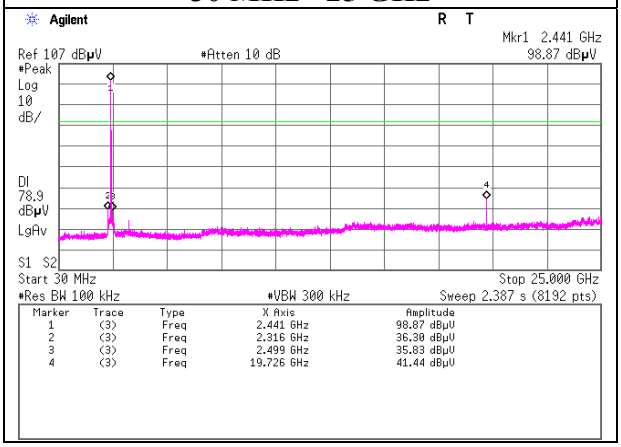
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

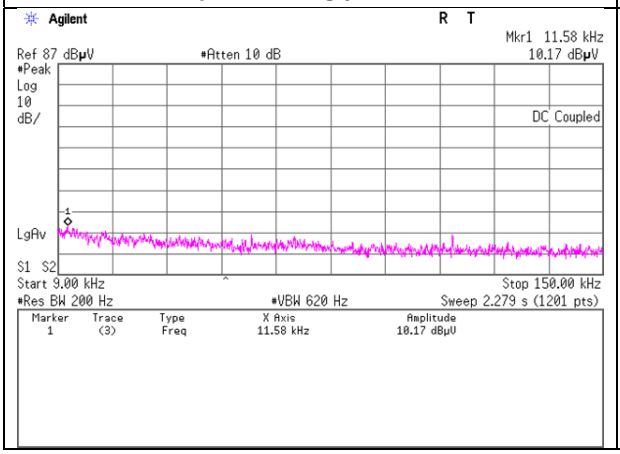


Conducted Spurious Emission

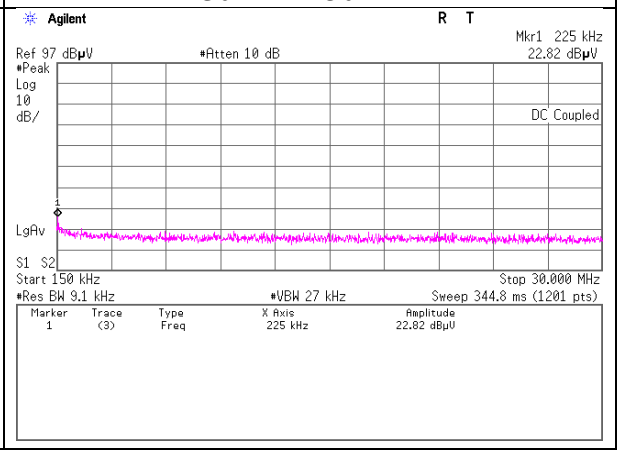
Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx, Hopping Off, 3DH5

2480 MHz

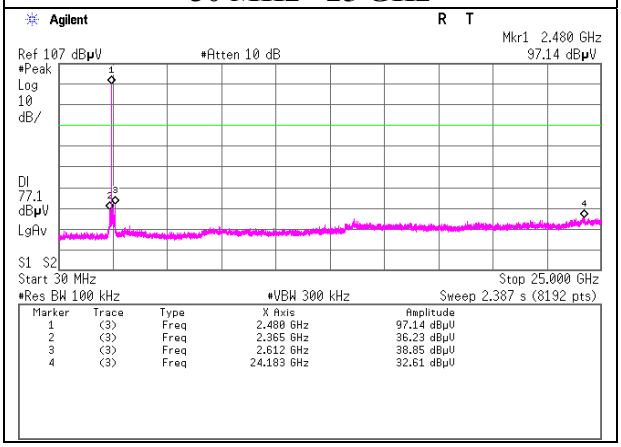
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

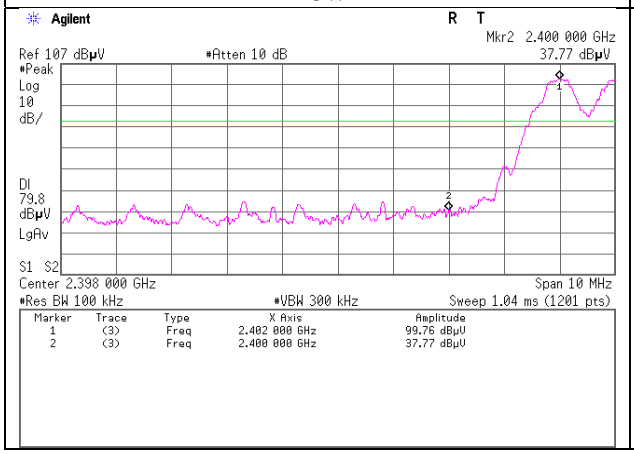


Conducted Emission Band Edge compliance

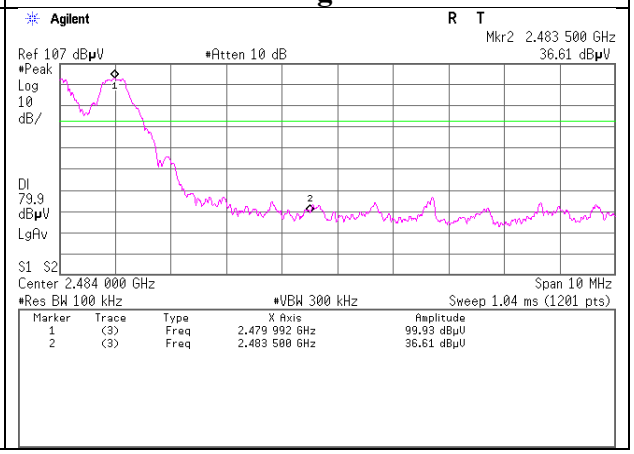
Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx DH5

Hopping On

Low

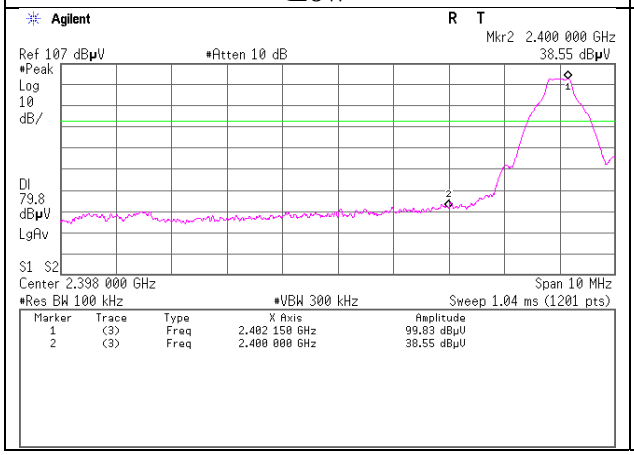


High

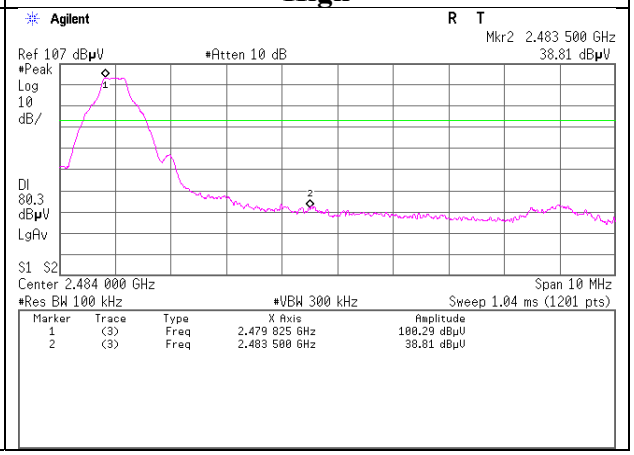


Hopping Off

Low



High

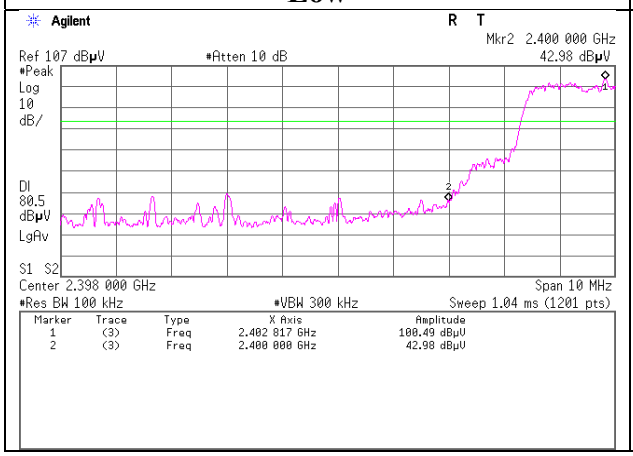


Conducted Emission Band Edge compliance

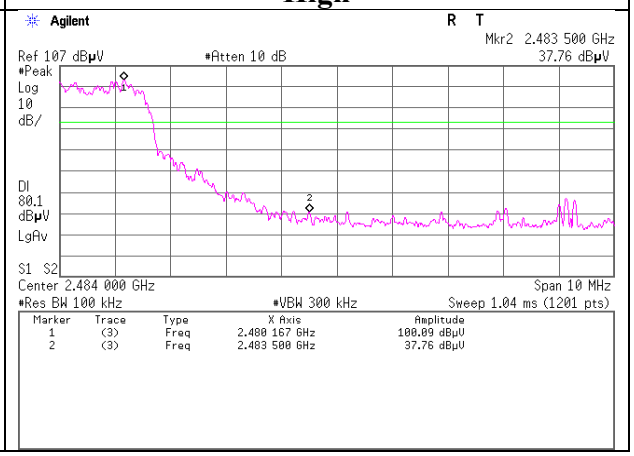
Report No.	13329061H
Test place	Ise EMC Lab. No.4 Measurement Room
Date	May 8, 2020
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Tx 3DH5

Hopping On

Low

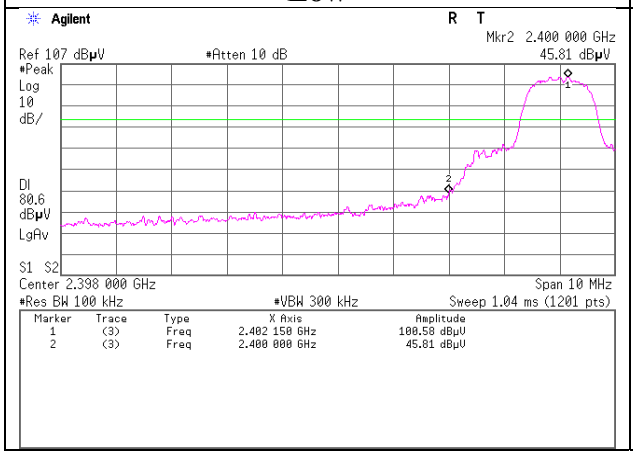


High



Hopping Off

Low



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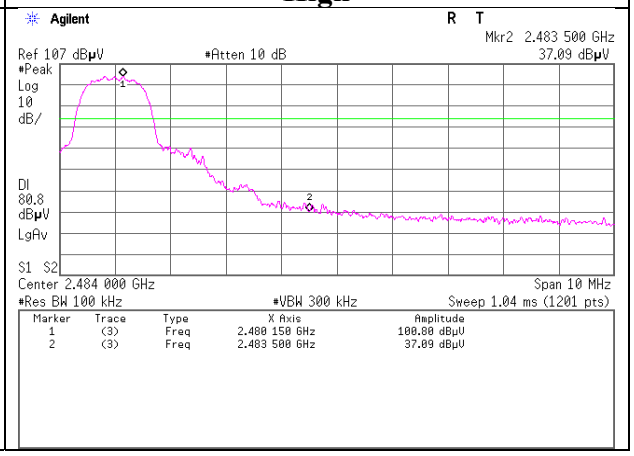

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT/RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM	CTH-201	1301	01/07/2020	12
AT/RE	MMM-08	141532	DIGITAL HiTESTER	Hioki	3805	51201197	01/06/2020	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
AT	MAT-56	141214	Attenuator(10dB)	Suhner	6810.19.A	-	-	-
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	24
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-M EMI-02	178648	EMI measurement program	TSJ	TEPTO-DV	-	-	-
RE	MAEC-03 -SVSWR	142013	AC3_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/08/2019	24
RE	MHA-20	141507	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	258	09/26/2019	12
RE	MPA-11	141580	MicroWave System Amplifier	Keysight Technologies Inc	83017A	MY39500779	03/24/2020	12
RE	MCC-231	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/ 1902S579(5m)	03/02/2020	12
RE	MHA-16	141513	Horn Antenna 15-40GHz	Schwarzbeck Mess - Elektronik	BBHA9170	BBHA9170306	10/08/2019	12
RE	MHF-25	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/11/2019	12
RE	MSA-10	141899	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180655	08/07/2019	12
AT	MOS-15	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/07/2020	12
AT	MMM-10	141545	DIGITAL HiTESTER	Hioki	3805	51201148	01/06/2020	12
AT	MJM-26	142227	Measure	KOMELON	KMC-36	-	-	-
AT	MSA-15	141902	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187105	10/09/2019	12
AT	MCC-178	141227	Microwave Cable	Junkosha	MMX221-00500DMS DMS	1502S305	03/18/2020	12
AT	MAT-21	141174	Attenuator(20dB) (above1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-120	901247	01/07/2020	12
AT	MCC-64	141327	Coaxial Cable	UL Japan	-	-	02/04/2020	12
AT	MAT-10	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/07/2019	12
RE	MAT-95	142314	Attenuator	Pasternack	PE7390-6	D/C 1504	06/11/2019	12
RE	MBA-03	141424	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	1915	08/24/2019	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	07/02/2019	12
RE	MLA-22	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-191	08/24/2019	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/10/2020	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/02/2019	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 test