RADIO TEST REPORT

Test Report No. : 13665469H-B

Applicant	:	**DENSO TEN Limited**
Type of EUT	:	**Car Navigation**
Model Number of EUT	:	**FT0091A**
FCC ID	:	**BABFT0091A**
Test regulation	:	**FCC Part 15 Subpart C: 2021** ***Bluetooth parts** **(20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation, Duty cycle correction factor, Radiated Spurious Emission and Conducted Spurious Emission)** ***For permissive change**
Test Result	:	**Complied (Refer to SECTION 3)**

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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.
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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 and February 7, 2021

Representative test engineer:
Yuichiro Yamazaki
Engineer
Consumer Technology Division

Approved by:
Tsubasa Takayama
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".

UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

REVISION HISTORY

Original Test Report No.: 13665469H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13665469H-B	March 22, 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	:	DENSO TEN Limited
Address	:	2-28, Gosho-dori 1-Chome, Hyogo-ku, Kobe, 652-8510 JAPAN
Telephone Number	:	+81-78-682-2159
Facsimile Number	:	+81-78-671-7160
Contact Person	:	Daisuke Fukii

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 Navigation
Model Number	:	FT0091A
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 12 V
Receipt Date	:	January 15, 2021
Country of Mass-production	:	Mexico
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: FT0091A (referred to as the EUT in this report) is a Car Navigation.

Radio Specification

Radio Type : Transceiver

Clock frequency(ies) : 26 MHz

	IEEE802.11b *1)	IEEE802.11g/n (20 M band) *1)	IEEE802.11a/n (20 M band)	IEEE802.11n (40 M band)
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5700 MHz 5745 MHz - 5825 MHz	5190 MHz - 5230 MHz 5270 MHz - 5310 MHz 5510 MHz - 5670 MHz 5755 MHz - 5795 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM)	
Channel spacing	5MHz		20MHz	40MHz
Antenna type	Surface Mountable Dielectric Chip Antenna			
Antenna Connector type	-			
Antenna Gain	1.6 dBi (2.4 GHz Band), 0 dBi (5 GHz Band)			

	Bluetooth Ver.3.0 with EDR function
Frequency of operation	2402 MHz - 2480 MHz
Type of modulation	BT: FHSS (GFSK, π/4-DQPSK, 8-DPSK)
Channel spacing	1 MHz
Antenna type	Surface Mountable Dielectric Chip Antenna
Antenna Connector type	-
Antenna Gain	1.6 dBi

*1) This test report applies to Bluetooth part.
*Wireless LAN 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 * The revision does not affect the test result conducted before its effective date.
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

* This test report is due to change of the crystal in the EUT.

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	*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)		N/A	*2)
Dwell time	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 **ISED:** -	**FCC:** Section15.247(a)(1)(iii) **ISED:** RSS-247 5.1 (d)		N/A	*2)
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)		N/A	*2)
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	7.3 dB 156.002 MHz, QP, Vert.	Complied b) / c)	Conducted/ Radiated (above 30 MHz) *3)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) The test was not performed since the EUT was DC device.
*2) The purpose of this test is to verify that the degradation and performance meets the minimum adaptable requirements, therefore, only items related to the x'tal were tested. This test item is controlled by software there is no "degradation"
*3) 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 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 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) 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.

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

Conducted emission

using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.4 dB
	0.15 MHz to 30 MHz	2.9 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
Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 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 Off	2402 MHz 2441 MHz 2480 MHz

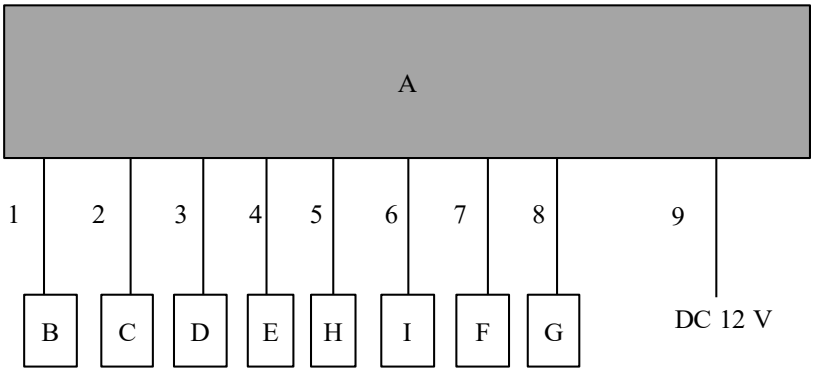
*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length
*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.
* It is considered that the non-tested 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: OX=07
EDR: OX=07
Software: Version 00.01F
(Date: January 6, 2021, 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

Radiated Spurious Emission test



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

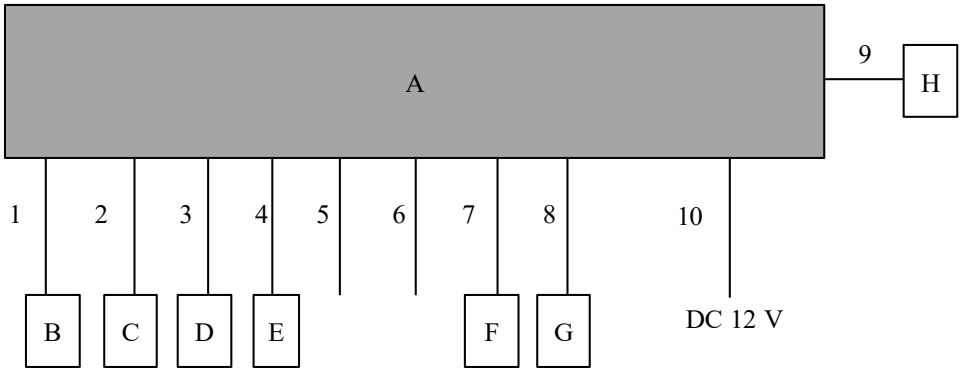
Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Car Navigation	FT0091A	MSC00010	DENSO TEN Limited	EUT
B	Antenna	16ADA	No.1	HONDA Genuine product	-
C	Radio dummy	39835-T5A-E010-M1	24D50094	-	-
D	Camera	8983980530	0000015	HONDA Genuine product	-
E	MIC ASSY	W01B-5012-D240	03U1520000026	TRANSTRON INC.	-
F	Dummy load	-	-	DENSO TEN Limited	-
G	Switch	-	-	DENSO TEN Limited	-
H	USB memory	USM4GR B	-	Sony	-
I	USB memory	USM4GR B	-	Sony	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	0.6	Shielded	Shielded	-
2	Antenna Cable	0.5	Shielded	Shielded	-
3	Signal Cable	0.6	Unshielded	Unshielded	-
4	Signal Cable	0.5	Unshielded	Unshielded	-
5	USB Cable	1.0	Shielded	Shielded	-
6	USB Cable	1.0	Shielded	Shielded	-
7	Signal Cable	0.5	Unshielded	Unshielded	-
8	Signal Cable	1.0	Unshielded	Unshielded	-
9	DC Cable	1.5	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	Car Navigation	FT0091A	MSC00011	DENSO TEN Limited	EUT
B	Antenna	16ADA	No.1	HONDA Genuine product	-
C	Radio dummy	39835-T5A-E010-M1	24D50094	-	-
D	Camera	8983980530	0000015	HONDA Genuine product	-
E	MIC ASSY	W01B-5012-D240	03U1520000026	TRANSTRON INC.	-
F	Dummy load	-	-	DENSO TEN Limited	-
G	Switch	-	-	DENSO TEN Limited	-
H	Jig board	-	-	DENSO TEN Limited	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	0.6	Shielded	Shielded	-
2	Antenna Cable	0.5	Shielded	Shielded	-
3	Signal Cable	0.6	Unshielded	Unshielded	-
4	Signal Cable	0.5	Unshielded	Unshielded	-
5	USB Cable	1.0	Shielded	Shielded	-
6	USB Cable	1.0	Shielded	Shielded	-
7	Signal Cable	0.5	Unshielded	Unshielded	-
8	Signal Cable	1.0	Unshielded	Unshielded	-
9	Signal Cable	0.1	Unshielded	Unshielded	-
10	DC Cable	0.5	Unshielded	Unshielded	-

SECTION 5: Radiated Spurious Emission

Test Procedure

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

[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.

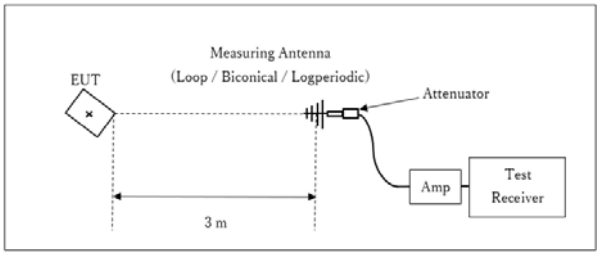
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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

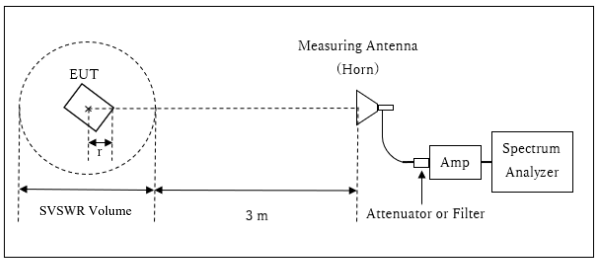
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz

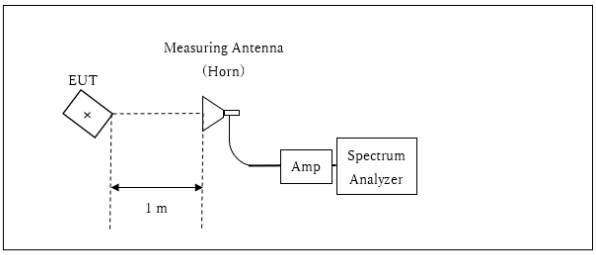


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.9 m / 3.0 m) = 2.28 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.9 m

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.1 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 test was made on EUT at the normal use position.

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 *1)	Spectrum Analyzer
Carrier Frequency Separation	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Conducted Spurious Emission *2) *3)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	9.1 kHz	27 kHz				
	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) The measurement was performed with Max Hold since the duty cycle was not 100 %.
*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 low enough 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

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

Report No.	13665469H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 18, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping Off,

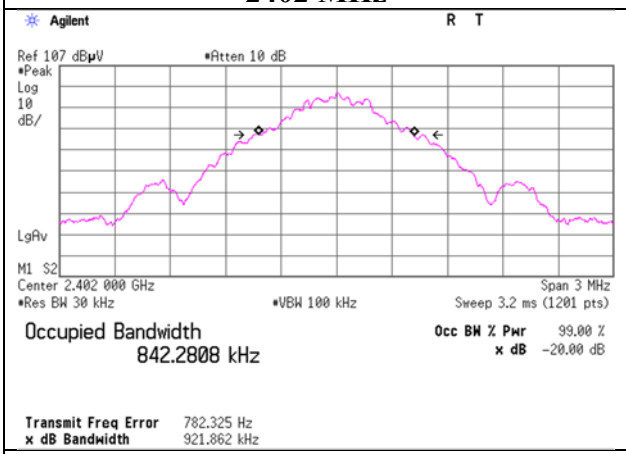
Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.922	842.281	1.000	>= 0.615
DH5	2441.0	0.840	834.373	1.000	>= 0.560
DH5	2480.0	0.844	833.446	1.000	>= 0.563
3DH5	2402.0	1.282	1174.4	1.000	>= 0.855
3DH5	2441.0	1.281	1174.8	1.000	>= 0.854
3DH5	2480.0	1.281	1175.1	1.000	>= 0.854

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

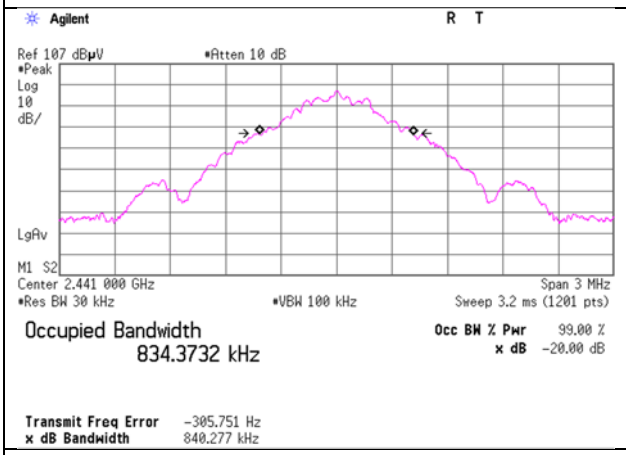
20dB Bandwidth and 99% Occupied Bandwidth

DH5

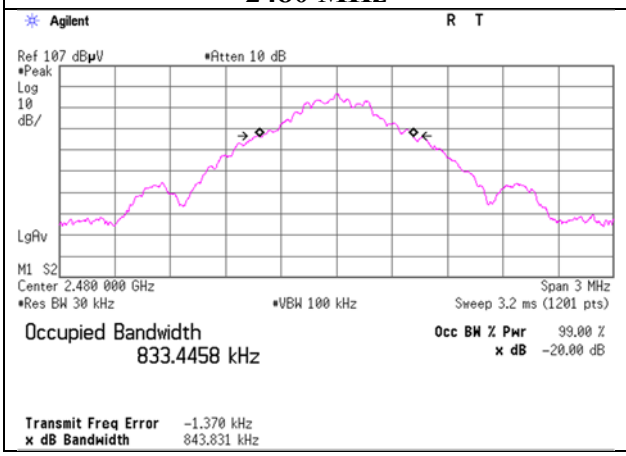
2402 MHz



2441 MHz

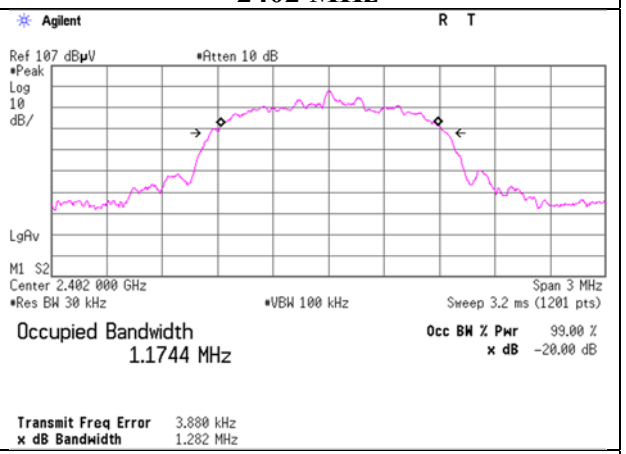


2480 MHz

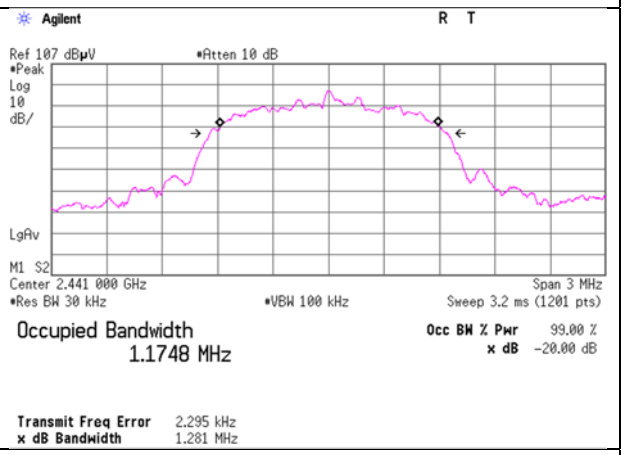


3DH5

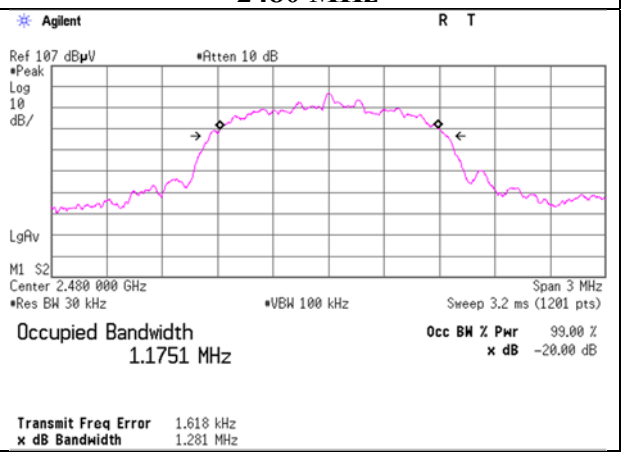
2402 MHz



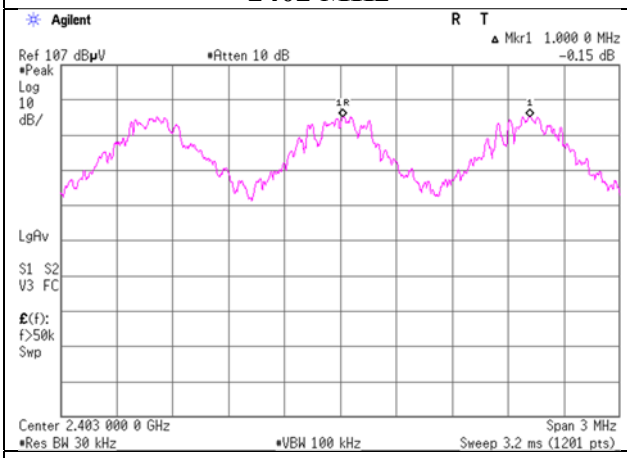
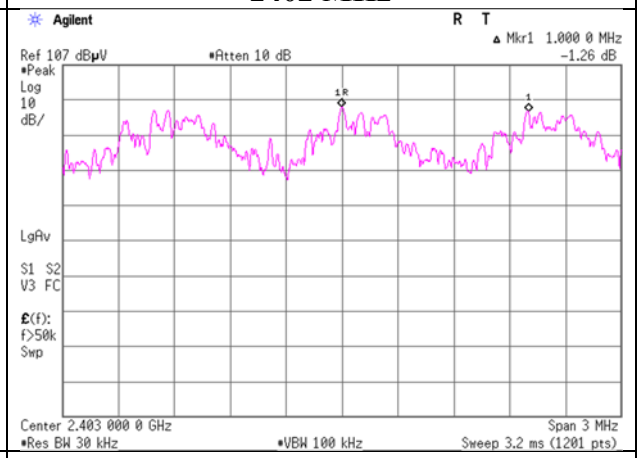
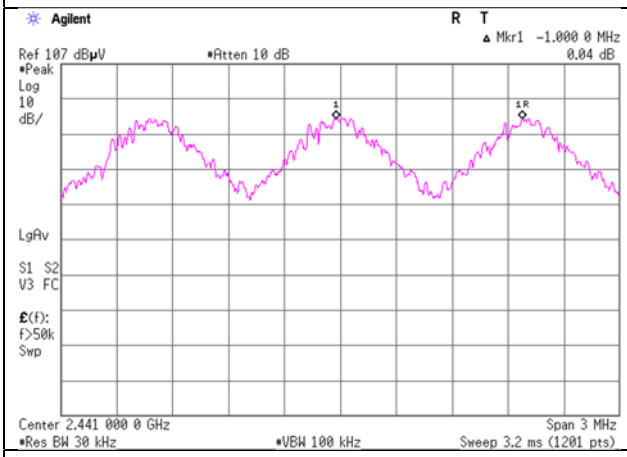
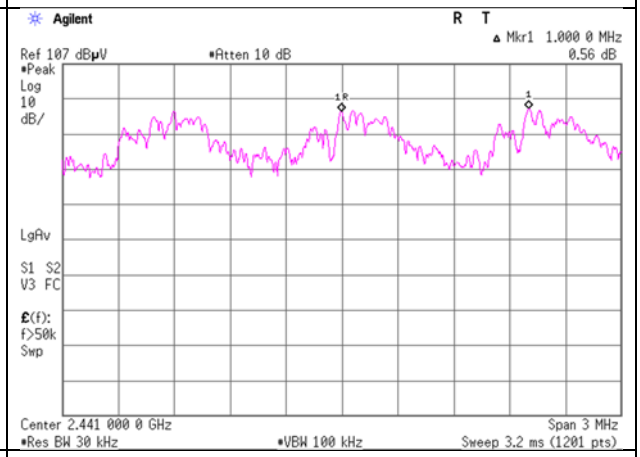
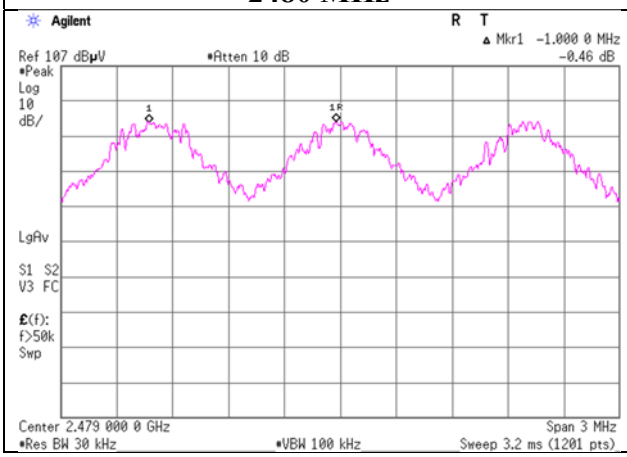
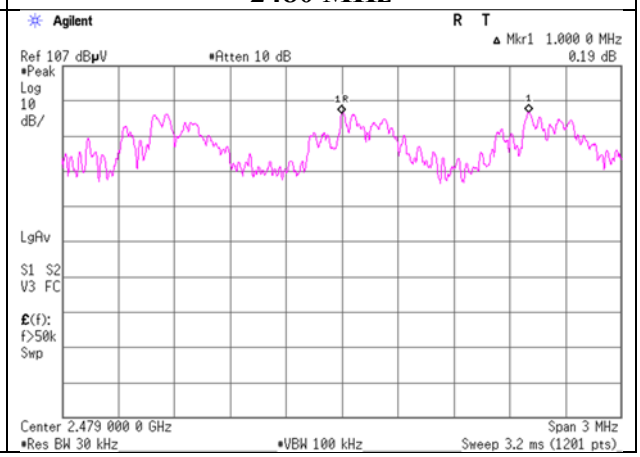
2441 MHz



2480 MHz



Carrier Frequency Separation

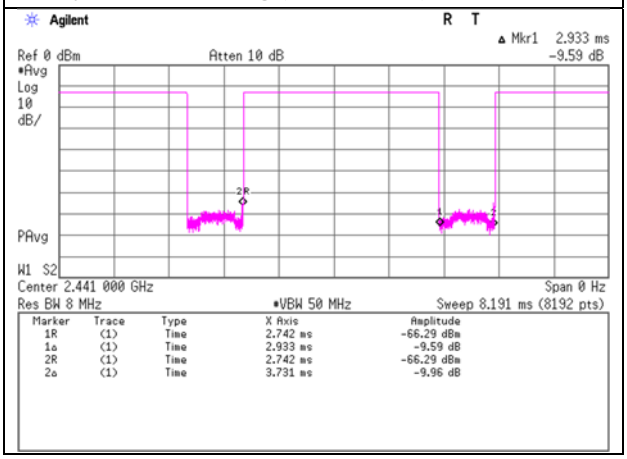
DH5	3DH5
2402 MHz	2402 MHz
	
2441 MHz	2441 MHz
	
2480 MHz	2480 MHz
	

Burst Rate Confirmation

Report No.	13665469H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 18, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping Off

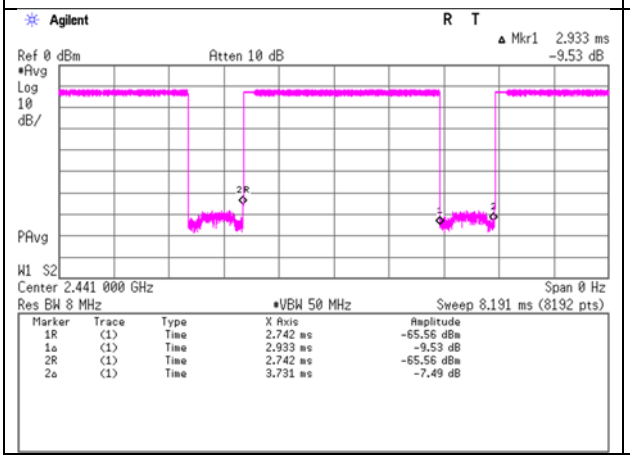
DH5

Tx on / (Tx on + Tx off) =	**0.786**
Tx on / (Tx on + Tx off) * 100 =	**78.6 %**
Duty factor = 10 * log (3.731 / 2.933) =	**1.05 dB**



2DH5

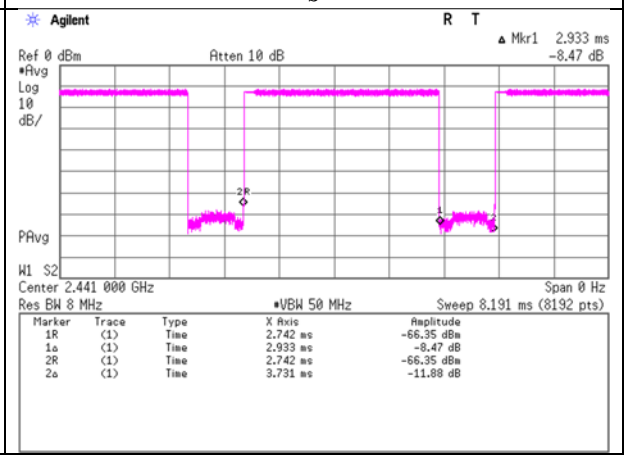
Tx on / (Tx on + Tx off) =	**0.786**
Tx on / (Tx on + Tx off) * 100 =	**78.6 %**
Duty factor = 10 * log (3.731 / 2.933) =	**1.05 dB**



3DH5

Tx on / (Tx on + Tx off) =	**0.786**
Tx on / (Tx on + Tx off) * 100 =	**78.6 %**
Duty factor = 10 * log (3.731 / 2.933) =	**1.05 dB**

s



Duty cycle correction factor

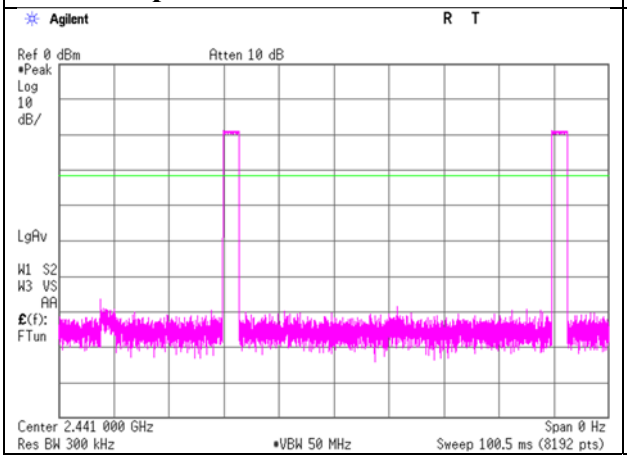
Report No.	13665469H
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Date	February 7, 2021
Temperature / Humidity	20 deg. C / 34 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping On

DH5

Tx On time 2.933 ms

Dwell time factor = 20 * log (2.933 * 2 / 100) = -24.63 dB

2 hops are observed in 100 msec

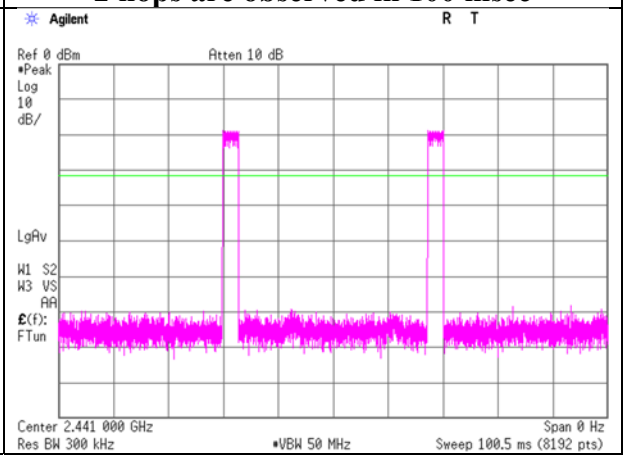


3DH5

Tx On time 2.933 ms

Dwell time factor = 20 * log (2.933 * 2 / 100) = -24.63 dB

2 hops are observed in 100 msec



Radiated Spurious Emission

Report No.	13665469H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	February 7, 2021 (Day)	February 7, 2021 (Night)
Temperature / Humidity	20 deg. C / 34 % RH	22 deg. C / 28 % RH
Engineer	Tomohisa Nakagawa (1 GHz -10 GHz)	Yuichiro Yamazaki (Above 10 GHz) (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.	156.002	QP	43.0	15.2	8.5	32.0	-	34.7	43.5	8.8	
Hori.	188.003	QP	41.9	16.2	8.7	31.9	-	34.9	43.5	8.6	
Hori.	577.998	QP	33.6	18.6	11.1	32.1	-	31.2	46.0	14.8	
Hori.	650.248	QP	34.6	19.2	11.4	32.1	-	33.1	46.0	12.9	
Hori.	791.349	QP	32.0	20.6	11.9	31.7	-	32.9	46.0	13.2	
Hori.	873.616	QP	30.9	21.8	12.3	31.3	-	33.7	46.0	12.3	
Hori.	2390.000	PK	42.6	27.8	5.3	31.8	-	43.8	73.9	30.1	
Hori.	4804.000	PK	40.2	31.6	7.5	31.2	-	48.1	73.9	25.9	Floor noise
Hori.	7206.000	PK	48.2	36.5	8.7	32.4	-	61.0	73.9	12.9	
Hori.	9608.000	PK	41.0	38.0	9.4	32.6	-	55.9	73.9	18.1	Floor noise
Hori.	2390.000	AV	33.8	27.8	5.3	31.8	1.1	36.1	53.9	17.8	*1)
Hori.	4804.000	AV	32.9	31.6	7.5	31.2	-	40.7	53.9	13.2	Floor noise
Hori.	9608.000	AV	33.3	38.0	9.4	32.6	-	48.1	53.9	***5.8***	Floor noise
Vert.	156.002	QP	44.4	15.2	8.5	32.0	-	36.1	43.5	7.4	
Vert.	171.996	QP	33.2	15.7	8.6	31.9	-	25.6	43.5	17.9	
Vert.	577.998	QP	36.5	18.6	11.1	32.1	-	34.1	46.0	11.9	
Vert.	650.248	QP	36.6	19.2	11.4	32.1	-	35.1	46.0	10.9	
Vert.	722.498	QP	36.0	20.0	11.7	32.1	-	35.7	46.0	10.3	
Vert.	873.616	QP	31.7	21.8	12.3	31.3	-	34.5	46.0	11.5	
Vert.	2390.000	PK	41.9	27.8	5.3	31.8	-	43.1	73.9	30.8	
Vert.	4804.000	PK	41.2	31.6	7.5	31.2	-	49.1	73.9	24.8	Floor noise
Vert.	7206.000	PK	48.4	36.5	8.7	32.4	-	61.2	73.9	12.7	
Vert.	9608.000	PK	41.4	38.0	9.4	32.6	-	56.2	73.9	17.7	Floor noise
Vert.	2390.000	AV	33.7	27.8	5.3	31.8	1.1	36.0	53.9	17.9	*1)
Vert.	4804.000	AV	31.4	31.6	7.5	31.2	-	39.3	53.9	14.6	Floor noise
Vert.	9608.000	AV	31.9	38.0	9.4	32.6	-	46.7	53.9	7.2	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 (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

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

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	PK	88.2	27.83	5.29	31.84	89.5	-	-	Carrier
Hori.	2400	PK	35.2	27.83	5.29	31.84	36.5	69.5	33.0	
Vert.	2402	PK	84.8	27.83	5.29	31.84	86.1	-	-	Carrier
Vert.	2400	PK	34.9	27.83	5.29	31.84	36.2	66.1	29.9	

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7206.000	AV	42.7	36.5	8.7	32.4	-24.6	30.9	53.9	23.0	*
Vert.	7206.000	AV	40.6	36.5	8.7	32.4	-24.6	28.8	53.9	25.1	*

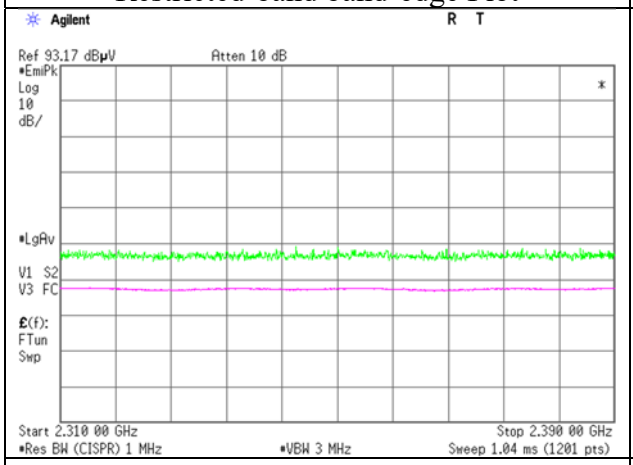
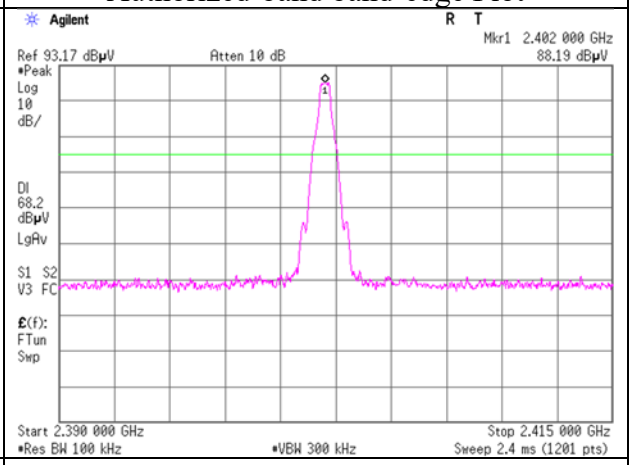
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))
- Gain(Amprifier) + Dwell time factor (Refer to dwell time data sheet)

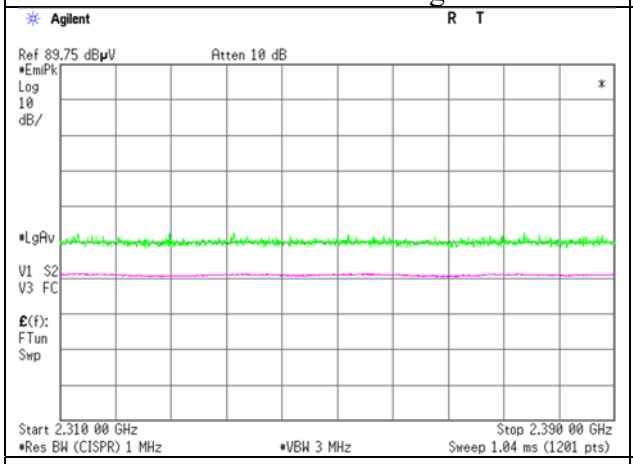
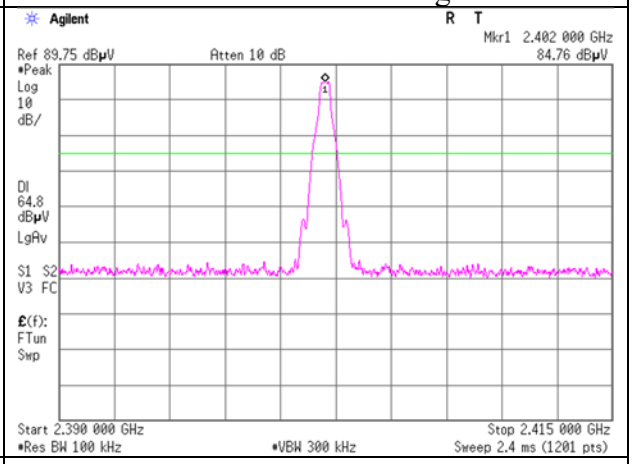
*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13665469H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 7, 2021 (Day)
Temperature / Humidity	20 deg. C / 34 % RH
Engineer	Tomohisa Nakagawa (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.	13665469H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	February 7, 2021 (Day)	February 7, 2021 (Night)
Temperature / Humidity	20 deg. C / 34 % RH	22 deg. C / 28 % RH
Engineer	Tomohisa Nakagawa (1 GHz -10 GHz)	Yuichiro Yamazaki (Above 10 GHz) (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.	156.002	QP	42.5	15.2	8.5	32.0	-	34.2	43.5	9.3	
Hori.	188.003	QP	42.0	16.2	8.7	31.9	-	35.0	43.5	8.5	
Hori.	577.998	QP	35.3	18.6	11.1	32.1	-	32.9	46.0	13.1	
Hori.	650.248	QP	34.4	19.2	11.4	32.1	-	32.9	46.0	13.1	
Hori.	791.349	QP	32.1	20.6	11.9	31.7	-	33.0	46.0	13.1	
Hori.	873.616	QP	30.7	21.8	12.3	31.3	-	33.5	46.0	12.5	
Hori.	4882.000	PK	41.7	31.6	7.5	31.2	-	49.6	73.9	24.3	Floor noise
Hori.	7323.000	PK	45.0	36.6	8.7	32.4	-	57.8	73.9	16.1	
Hori.	9764.000	PK	40.6	38.4	9.4	32.7	-	55.7	73.9	18.2	Floor noise
Hori.	4882.000	AV	40.0	31.6	7.5	31.2	-	47.8	53.9	6.1	Floor noise
Hori.	9764.000	AV	32.9	38.4	9.4	32.7	-	48.0	53.9	5.9	Floor noise
Vert.	156.002	QP	44.2	15.2	8.5	32.0	-	35.9	43.5	7.6	
Vert.	171.996	QP	33.5	15.7	8.6	31.9	-	25.9	43.5	17.6	
Vert.	577.998	QP	36.5	18.6	11.1	32.1	-	34.1	46.0	11.9	
Vert.	650.248	QP	36.5	19.2	11.4	32.1	-	35.0	46.0	11.0	
Vert.	722.498	QP	36.0	20.0	11.7	32.1	-	35.7	46.0	10.3	
Vert.	873.616	QP	31.7	21.8	12.3	31.3	-	34.5	46.0	11.5	
Vert.	4882.000	PK	41.2	31.6	7.5	31.2	-	49.1	73.9	24.9	Floor noise
Vert.	7323.000	PK	47.1	36.6	8.7	32.4	-	59.9	73.9	14.0	
Vert.	9764.000	PK	41.0	38.4	9.4	32.7	-	56.2	73.9	17.7	Floor noise
Vert.	4882.000	AV	32.4	31.6	7.5	31.2	-	40.3	53.9	13.6	Floor noise
Vert.	9764.000	AV	33.7	38.4	9.4	32.7	-	48.9	53.9	***5.0***	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 (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7323.000	AV	39.0	36.6	8.7	32.4	-24.6	27.3	53.9	26.6	*
Vert.	7323.000	AV	41.6	36.6	8.7	32.4	-24.6	29.8	53.9	24.1	*

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))
- Gain(Amprifier) + Dwell time factor (Refer to dwell time data sheet)
*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

Radiated Spurious Emission

Report No.	13665469H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	February 7, 2021 (Day)	February 7, 2021 (Night)
Temperature / Humidity	20 deg. C / 34 % RH	22 deg. C / 28 % RH
Engineer	Tomohisa Nakagawa (1 GHz -10 GHz)	Yuichiro Yamazaki (Above 10 GHz) (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.	156.002	QP	42.5	15.2	8.5	32.0	-	34.2	43.5	9.3	
Hori.	188.003	QP	41.9	16.2	8.7	31.9	-	34.9	43.5	8.6	
Hori.	577.998	QP	35.4	18.6	11.1	32.1	-	33.0	46.0	13.0	
Hori.	650.248	QP	34.6	19.2	11.4	32.1	-	33.1	46.0	12.9	
Hori.	791.349	QP	32.2	20.6	11.9	31.7	-	33.1	46.0	13.0	
Hori.	873.616	QP	30.8	21.8	12.3	31.3	-	33.6	46.0	12.4	
Hori.	2483.500	PK	42.9	27.7	5.4	31.8	-	44.1	73.9	29.8	
Hori.	4960.000	PK	40.1	31.6	7.5	31.2	-	48.0	73.9	25.9	Floor noise
Hori.	7440.000	PK	44.5	36.7	8.7	32.5	-	57.5	73.9	16.4	
Hori.	9920.000	PK	40.9	38.6	9.5	32.7	-	56.2	73.9	17.7	Floor noise
Hori.	2483.500	AV	31.4	27.7	5.4	31.8	1.1	33.7	53.9	20.2	*1)
Hori.	4960.000	AV	29.7	31.6	7.5	31.2	-	37.6	53.9	16.3	Floor noise
Hori.	9920.000	AV	31.5	38.6	9.5	32.7	-	46.8	53.9	***7.1***	Floor noise
Vert.	156.002	QP	44.5	15.2	8.5	32.0	-	36.2	43.5	7.3	
Vert.	171.996	QP	33.6	15.7	8.6	31.9	-	26.0	43.5	17.5	
Vert.	577.998	QP	36.8	18.6	11.1	32.1	-	34.4	46.0	11.6	
Vert.	650.248	QP	36.6	19.2	11.4	32.1	-	35.1	46.0	10.9	
Vert.	722.498	QP	36.3	20.0	11.7	32.1	-	36.0	46.0	10.0	
Vert.	873.616	QP	31.5	21.8	12.3	31.3	-	34.3	46.0	11.7	
Vert.	2483.500	PK	42.7	27.7	5.4	31.8	-	43.9	73.9	30.0	
Vert.	4960.000	PK	39.9	31.6	7.5	31.2	-	47.8	73.9	26.1	Floor noise
Vert.	7440.000	PK	45.0	36.7	8.7	32.5	-	57.9	73.9	16.0	
Vert.	9920.000	PK	41.0	38.6	9.5	32.7	-	56.3	73.9	17.6	Floor noise
Vert.	2483.500	AV	32.2	27.7	5.4	31.8	1.1	34.5	53.9	19.4	*1)
Vert.	4960.000	AV	29.9	31.6	7.5	31.2	-	37.9	53.9	16.1	Floor noise
Vert.	9920.000	AV	31.1	38.6	9.5	32.7	-	46.5	53.9	7.4	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 (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
*1) Not Out of Band emission(Leakage Power)

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7440.000	AV	35.5	36.7	8.7	32.5	-24.6	23.8	53.9	30.1	*
Vert.	7440.000	AV	37.0	36.7	8.7	32.5	-24.6	25.3	53.9	28.6	*

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))
- Gain(Amprifier) + Dwell time factor (Refer to dwell time data sheet)
*Above noise was synchronized with carrier frequency.

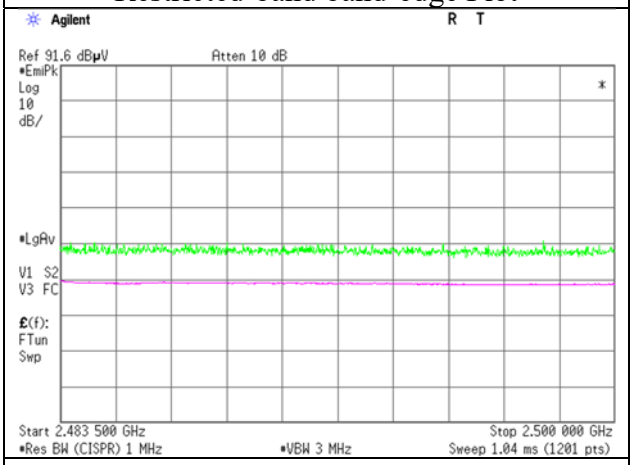
Distance factor: 1 GHz - 10 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13665469H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 7, 2021 (Day)
Temperature / Humidity	20 deg. C / 34 % RH
Engineer	Tomohisa Nakagawa (1 GHz -10 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz

Horizontal

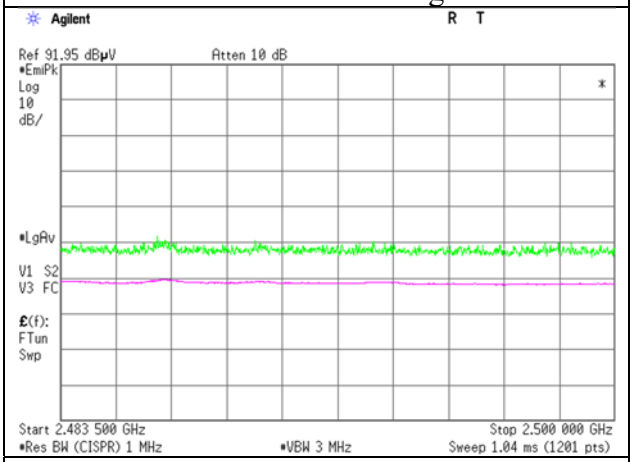
Restricted-band band-edge Plot



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.	13665469H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	February 7, 2021 (Day)	February 7, 2021 (Night)
Temperature / Humidity	20 deg. C / 34 % RH	22 deg. C / 28 % RH
Engineer	Tomohisa Nakagawa (1 GHz -10 GHz)	Yuichiro Yamazaki (Above 10 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.	156.002	QP	40.9	15.2	8.5	32.0	-	32.6	43.5	10.9	
Hori.	188.003	QP	41.5	16.2	8.7	31.9	-	34.5	43.5	9.0	
Hori.	577.998	QP	35.4	18.6	11.1	32.1	-	33.0	46.0	13.0	
Hori.	650.248	QP	34.7	19.2	11.4	32.1	-	33.2	46.0	12.8	
Hori.	791.349	QP	32.0	20.6	11.9	31.7	-	32.9	46.0	13.2	
Hori.	873.616	QP	30.6	21.8	12.3	31.3	-	33.4	46.0	12.6	
Hori.	2390.000	PK	42.8	27.8	5.3	31.8	-	44.1	73.9	29.8	
Hori.	4804.000	PK	40.8	31.6	7.5	31.2	-	48.7	73.9	25.2	Floor noise
Hori.	7206.000	PK	47.5	36.5	8.7	32.4	-	60.3	73.9	13.6	
Hori.	9608.000	PK	41.9	38.0	9.4	32.6	-	56.8	73.9	17.2	Floor noise
Hori.	2390.000	AV	31.3	27.8	5.3	31.8	1.1	33.7	53.9	20.3	*1)
Hori.	4804.000	AV	30.2	31.6	7.5	31.2	-	38.1	53.9	15.9	Floor noise
Hori.	9608.000	AV	31.2	38.0	9.4	32.6	-	46.0	53.9	7.9	Floor noise
Vert.	156.002	QP	44.0	15.2	8.5	32.0	-	35.7	43.5	7.8	
Vert.	171.996	QP	33.4	15.7	8.6	31.9	-	25.8	43.5	17.7	
Vert.	577.998	QP	36.8	18.6	11.1	32.1	-	34.4	46.0	11.6	
Vert.	650.248	QP	36.5	19.2	11.4	32.1	-	35.0	46.0	11.0	
Vert.	722.498	QP	36.2	20.0	11.7	32.1	-	35.9	46.0	10.1	
Vert.	873.616	QP	31.7	21.8	12.3	31.3	-	34.5	46.0	11.5	
Vert.	2390.000	PK	46.3	27.8	5.3	31.8	-	47.5	73.9	26.4	
Vert.	4804.000	PK	40.4	31.6	7.5	31.2	-	48.2	73.9	25.7	Floor noise
Vert.	7206.000	PK	47.4	36.5	8.7	32.4	-	60.2	73.9	13.8	
Vert.	9608.000	PK	41.6	38.0	9.4	32.6	-	56.4	73.9	17.5	Floor noise
Vert.	2390.000	AV	43.7	27.8	5.3	31.8	1.1	46.0	53.9	7.9	*1)
Vert.	4804.000	AV	30.0	31.6	7.5	31.2	-	37.8	53.9	16.1	Floor noise
Vert.	9608.000	AV	31.7	38.0	9.4	32.6	-	46.5	53.9	***7.4***	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 (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

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

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	PK	87.4	27.83	5.29	31.84	88.7	-	-	Carrier
Hori.	2400	PK	36.8	27.83	5.29	31.84	38.1	68.7	30.6	
Vert.	2402	PK	84.8	27.83	5.29	31.84	86.1	-	-	Carrier
Vert.	2400	PK	35.2	27.83	5.29	31.84	36.5	66.1	29.6	

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7206.000	AV	37.9	36.5	8.7	32.4	-24.6	26.1	53.9	27.8	*
Vert.	7206.000	AV	38.1	36.5	8.7	32.4	-24.6	26.3	53.9	27.6	*

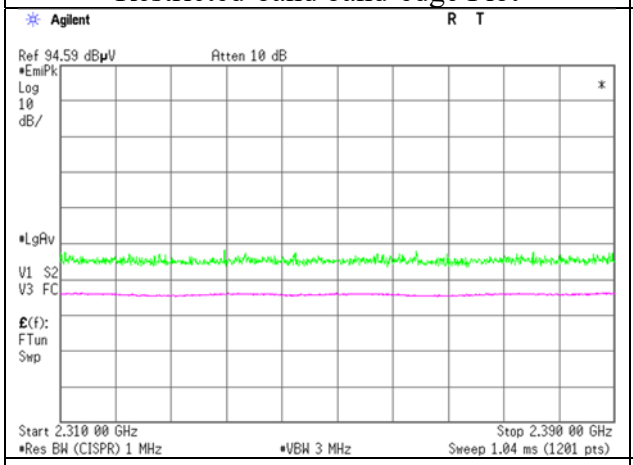
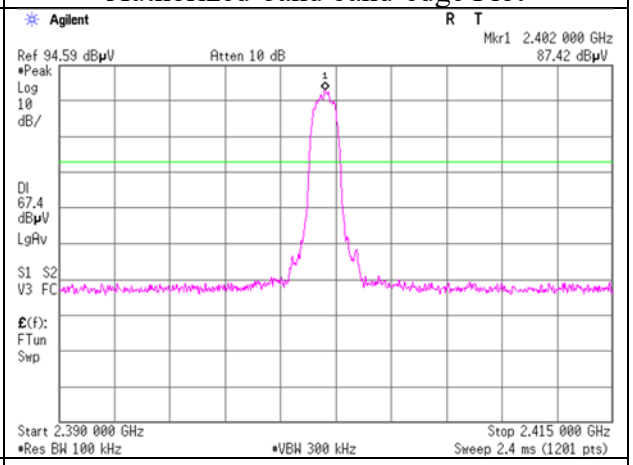
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))
- Gain(Amprifier) + Dwell time factor (Refer to dwell time data sheet)

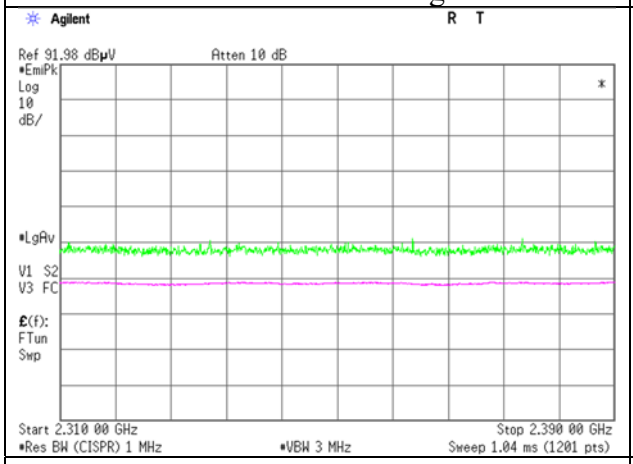
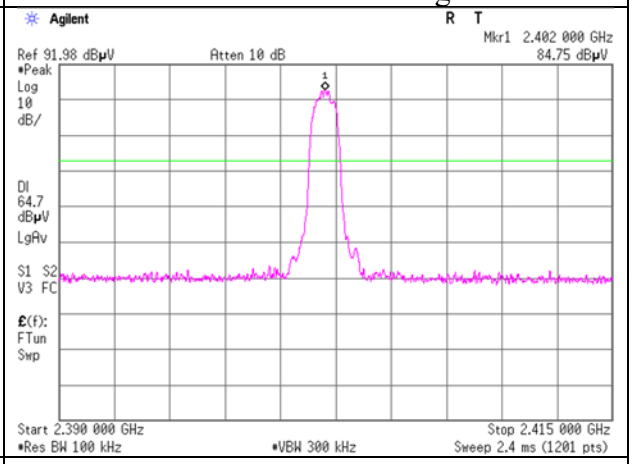
*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13665469H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 7, 2021 (Day)
Temperature / Humidity	20 deg. C / 34 % RH
Engineer	Tomohisa Nakagawa (1 GHz -10 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.	13665469H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	February 7, 2021 (Day)	February 7, 2021 (Night)
Temperature / Humidity	20 deg. C / 34 % RH	22 deg. C / 28 % RH
Engineer	Tomohisa Nakagawa (1 GHz -10 GHz)	Yuichiro Yamazaki (Above 10 GHz) (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.	156.002	QP	41.1	15.2	8.5	32.0	-	32.8	43.5	10.7	
Hori.	188.003	QP	41.6	16.2	8.7	31.9	-	34.6	43.5	8.9	
Hori.	577.998	QP	35.4	18.6	11.1	32.1	-	33.0	46.0	13.0	
Hori.	650.248	QP	34.8	19.2	11.4	32.1	-	33.3	46.0	12.7	
Hori.	791.349	QP	32.2	20.6	11.9	31.7	-	33.1	46.0	13.0	
Hori.	873.616	QP	30.9	21.8	12.3	31.3	-	33.7	46.0	12.3	
Hori.	4882.000	PK	40.4	31.6	7.5	31.2	-	48.2	73.9	25.7	Floor noise
Hori.	7323.000	PK	45.5	36.6	8.7	32.4	-	58.4	73.9	15.5	
Hori.	9764.000	PK	41.0	38.4	9.4	32.7	-	56.2	73.9	17.7	Floor noise
Hori.	4882.000	AV	32.4	31.6	7.5	31.2	-	40.3	53.9	13.6	Floor noise
Hori.	9764.000	AV	32.9	38.4	9.4	32.7	-	48.1	53.9	5.8	Floor noise
Vert.	156.002	QP	44.0	15.2	8.5	32.0	-	35.7	43.5	7.8	
Vert.	171.996	QP	33.3	15.7	8.6	31.9	-	25.7	43.5	17.8	
Vert.	577.998	QP	36.8	18.6	11.1	32.1	-	34.4	46.0	11.6	
Vert.	650.248	QP	36.5	19.2	11.4	32.1	-	35.0	46.0	11.0	
Vert.	722.498	QP	36.3	20.0	11.7	32.1	-	36.0	46.0	10.0	
Vert.	873.616	QP	31.0	21.8	12.3	31.3	-	33.8	46.0	12.2	
Vert.	4882.000	PK	40.5	31.6	7.5	31.2	-	48.4	73.9	25.5	Floor noise
Vert.	7323.000	PK	45.8	36.6	8.7	32.4	-	58.7	73.9	15.2	
Vert.	9764.000	PK	40.5	38.4	9.4	32.7	-	55.7	73.9	18.2	Floor noise
Vert.	4882.000	AV	32.0	31.6	7.5	31.2	-	39.8	53.9	14.1	Floor noise
Vert.	9764.000	AV	33.1	38.4	9.4	32.7	-	48.3	53.9	***5.6***	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 (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7323.000	AV	38.8	36.6	8.7	32.4	-24.6	27.1	53.9	26.8	*
Vert.	7323.000	AV	38.6	36.6	8.7	32.4	-24.6	26.9	53.9	27.0	*

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))
- Gain(Amprifier) + Dwell time factor (Refer to dwell time data sheet)

*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

Radiated Spurious Emission

Report No.	13665469H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	February 7, 2021 (Day)	February 7, 2021 (Night)
Temperature / Humidity	20 deg. C / 34 % RH	22 deg. C / 28 % RH
Engineer	Tomohisa Nakagawa (1 GHz -10 GHz)	Yuichiro Yamazaki (Above 10 GHz) (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.	156.002	QP	40.3	15.2	8.5	32.0	-	32.0	43.5	11.5	
Hori.	188.003	QP	41.3	16.2	8.7	31.9	-	34.3	43.5	9.2	
Hori.	577.998	QP	35.5	18.6	11.1	32.1	-	33.1	46.0	12.9	
Hori.	650.248	QP	34.2	19.2	11.4	32.1	-	32.7	46.0	13.3	
Hori.	791.349	QP	32.5	20.6	11.9	31.7	-	33.4	46.0	12.7	
Hori.	873.616	QP	30.5	21.8	12.3	31.3	-	33.3	46.0	12.7	
Hori.	2483.500	PK	44.6	27.7	5.4	31.8	-	45.8	73.9	28.1	
Hori.	4960.000	PK	40.1	31.6	7.5	31.2	-	48.0	73.9	25.9	Floor noise
Hori.	7440.000	PK	44.7	36.7	8.7	32.5	-	57.6	73.9	16.3	
Hori.	9920.000	PK	40.9	38.6	9.5	32.7	-	56.3	73.9	17.7	Floor noise
Hori.	2483.500	AV	31.9	27.7	5.4	31.8	1.1	34.1	53.9	19.8	*1)
Hori.	4960.000	AV	29.8	31.6	7.5	31.2	-	37.7	53.9	16.2	Floor noise
Hori.	9920.000	AV	30.9	38.6	9.5	32.7	-	46.2	53.9	7.7	Floor noise
Vert.	156.002	QP	43.4	15.2	8.5	32.0	-	35.1	43.5	8.4	
Vert.	171.996	QP	33.2	15.7	8.6	31.9	-	25.6	43.5	17.9	
Vert.	577.998	QP	36.9	18.6	11.1	32.1	-	34.5	46.0	11.5	
Vert.	650.248	QP	36.5	19.2	11.4	32.1	-	35.0	46.0	11.0	
Vert.	722.498	QP	36.1	20.0	11.7	32.1	-	35.8	46.0	10.2	
Vert.	873.616	QP	31.8	21.8	12.3	31.3	-	34.6	46.0	11.4	
Vert.	2483.500	PK	43.9	27.7	5.4	31.8	-	45.1	73.9	28.8	
Vert.	4960.000	PK	40.2	31.6	7.5	31.2	-	48.1	73.9	25.8	Floor noise
Vert.	7440.000	PK	45.4	36.7	8.7	32.5	-	58.4	73.9	15.6	
Vert.	9920.000	PK	41.5	38.6	9.5	32.7	-	56.9	73.9	17.1	Floor noise
Vert.	2483.500	AV	34.7	27.7	5.4	31.8	1.1	36.9	53.9	17.0	*1)
Vert.	4960.000	AV	30.3	31.6	7.5	31.2	-	38.2	53.9	15.7	Floor noise
Vert.	9920.000	AV	31.2	38.6	9.5	32.7	-	46.5	53.9	***7.4***	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 (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
*1) Not Out of Band emission(Leakage Power)

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7440.000	AV	34.6	36.7	8.7	32.5	-24.6	22.9	53.9	31.0	*
Vert.	7440.000	AV	36.5	36.7	8.7	32.5	-24.6	24.8	53.9	29.1	*

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))
- Gain(Amprifier) + Dwell time factor (Refer to dwell time data sheet)
*Above noise was synchronized with carrier frequency.

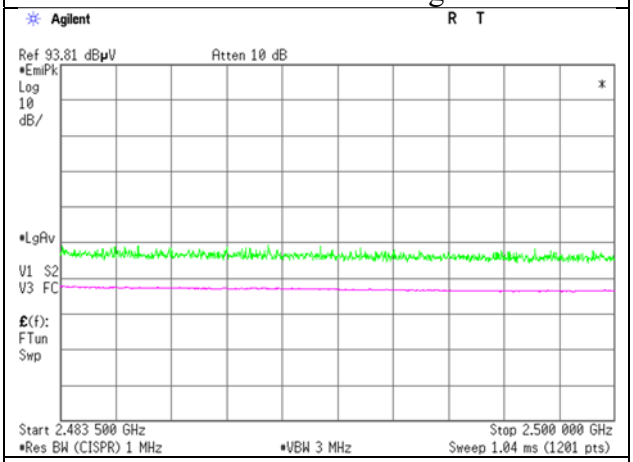
Distance factor: 1 GHz - 10 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13665469H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 7, 2021 (Day)
Temperature / Humidity	20 deg. C / 34 % RH
Engineer	Tomohisa Nakagawa (1 GHz - 10 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz

Horizontal

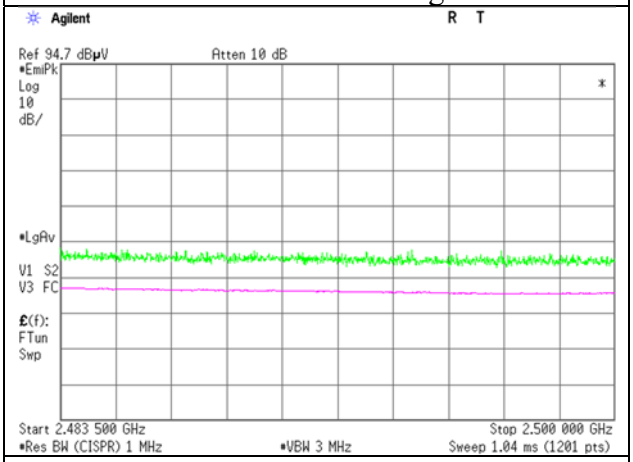
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

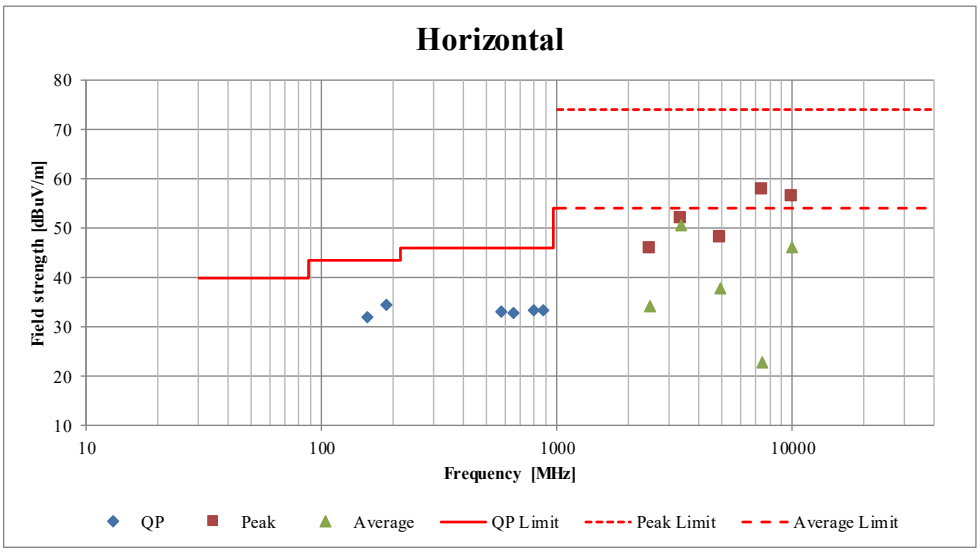


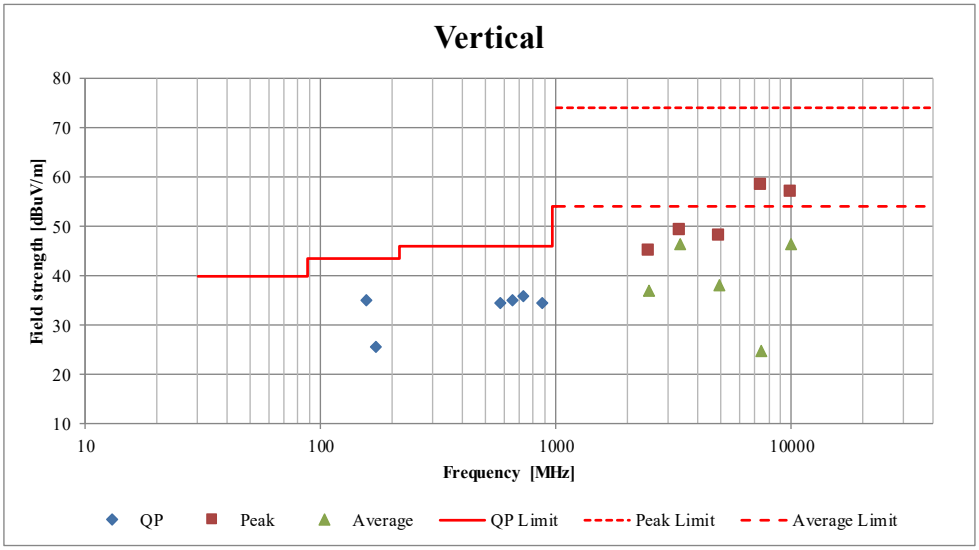
Trace Green : Peak Plot
Trace Purple : Average Plot

* 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.	13665469H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	February 7, 2021 (Day)	February 7, 2021 (Night)
Temperature / Humidity	20 deg. C / 34 % RH	22 deg. C / 28 % RH
Engineer	Tomohisa Nakagawa (1 GHz -10 GHz)	Yuichiro Yamazaki (Above 10 GHz) (Below 1 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz	





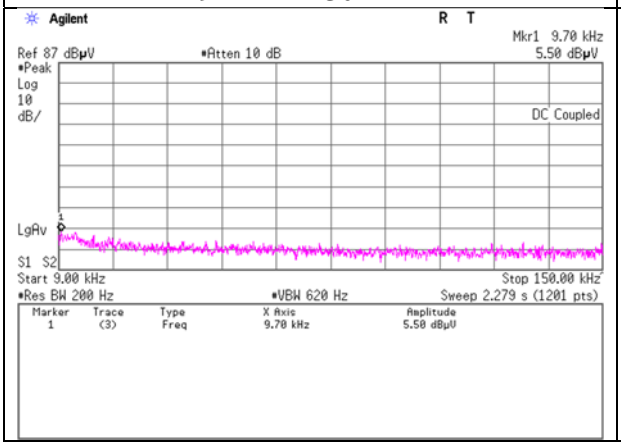
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

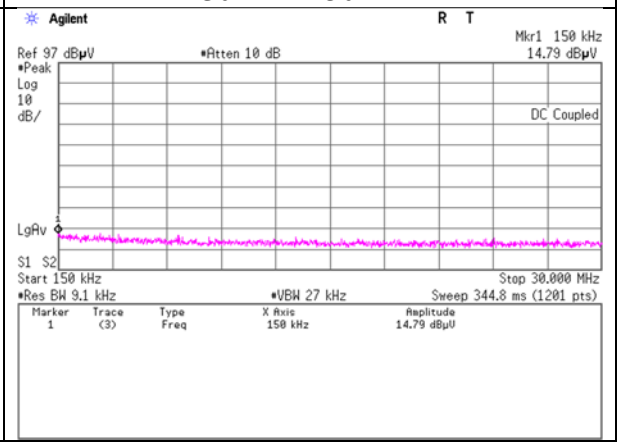
Report No.	13665469H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 18, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping Off, DH5

2402 MHz

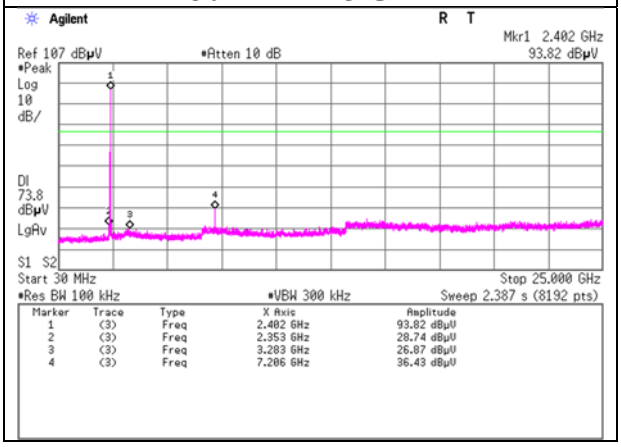
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

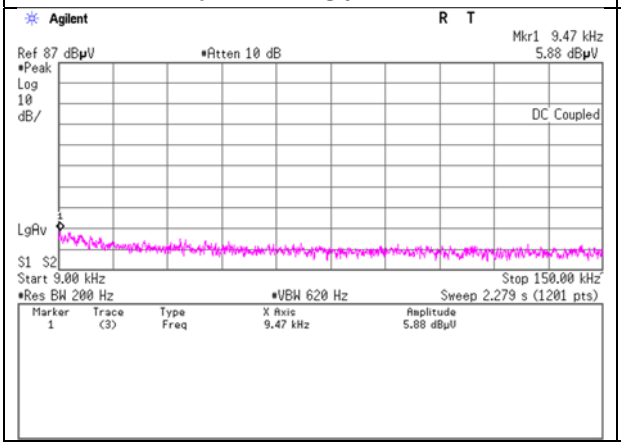


Conducted Spurious Emission

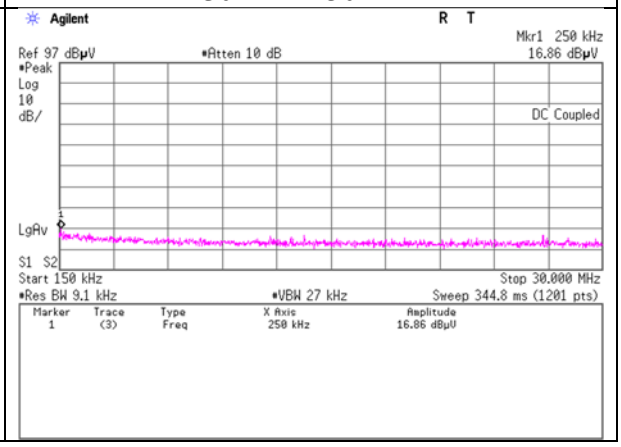
Report No.	13665469H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 18, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping Off, DH5

2441 MHz

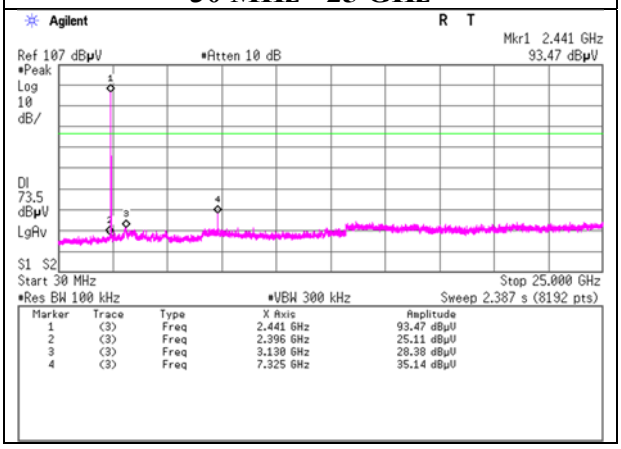
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

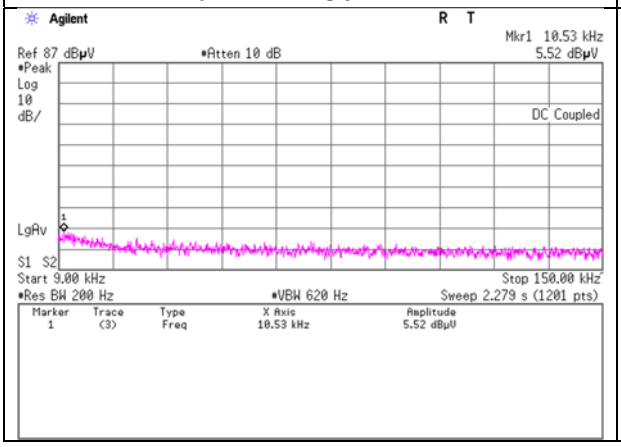


Conducted Spurious Emission

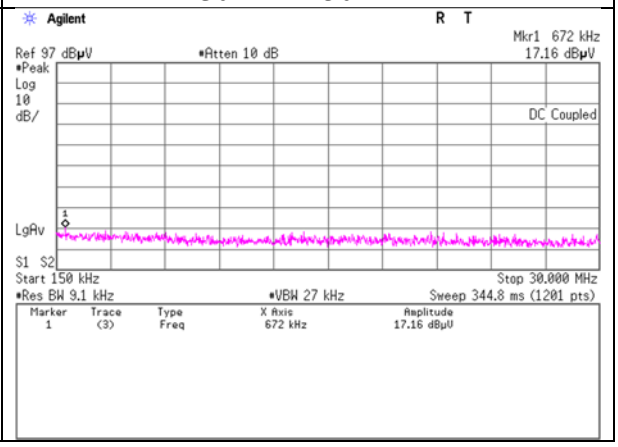
Report No.	13665469H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 18, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping Off, DH5

2480 MHz

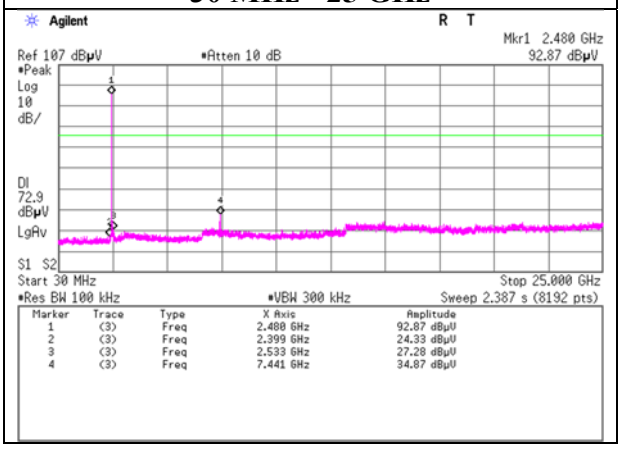
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

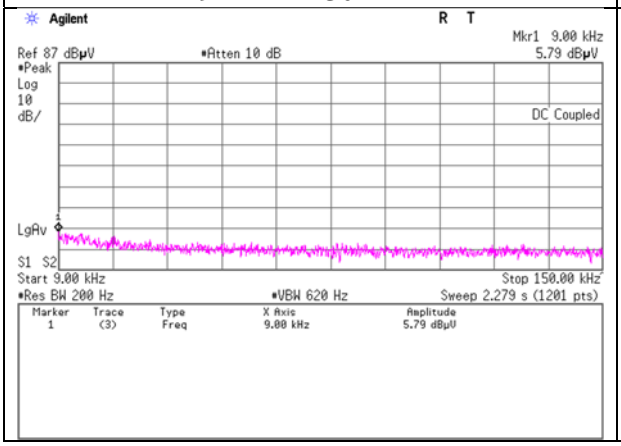


Conducted Spurious Emission

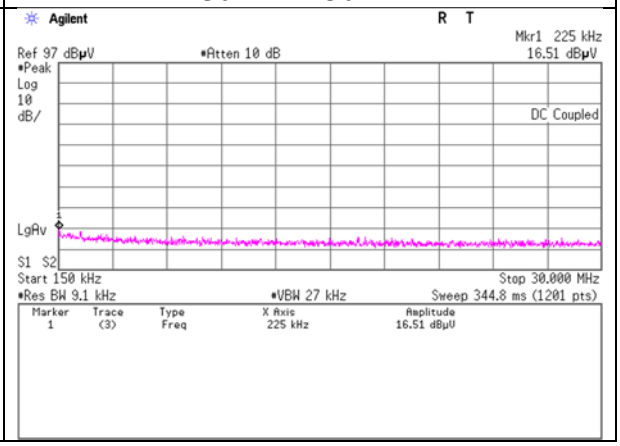
Report No.	13665469H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 18, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping Off, 3DH5

2402 MHz

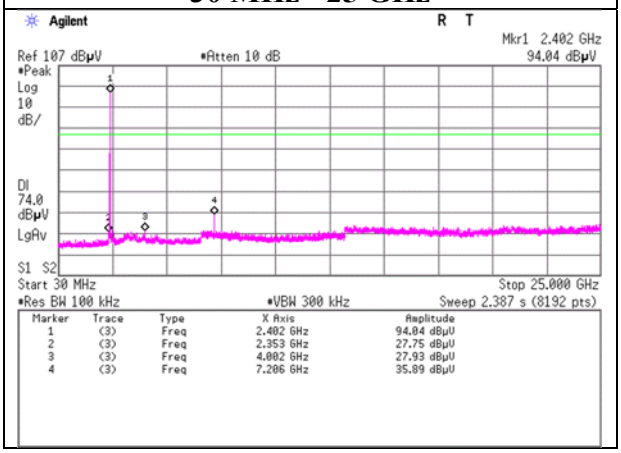
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

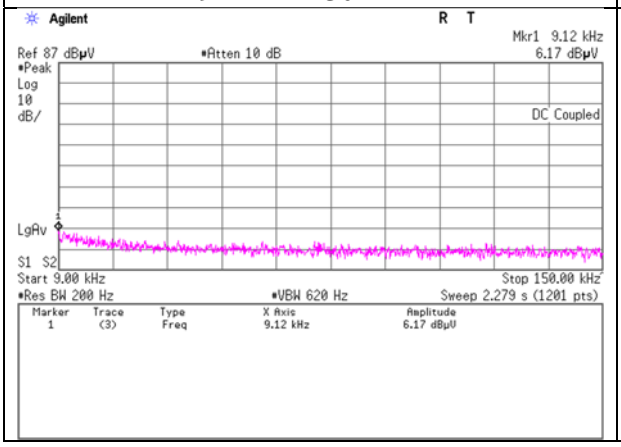


Conducted Spurious Emission

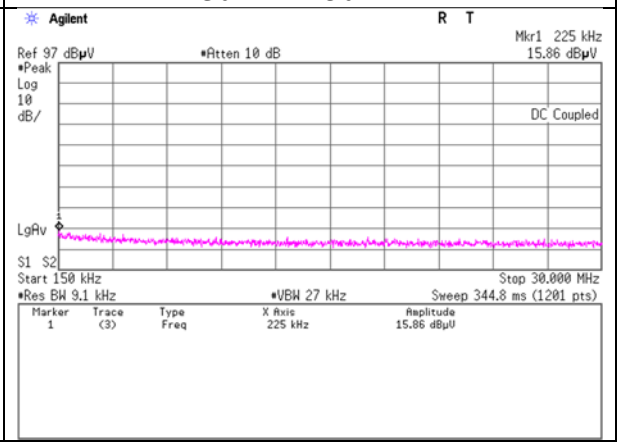
Report No.	13665469H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 18, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping Off, 3DH5

2441 MHz

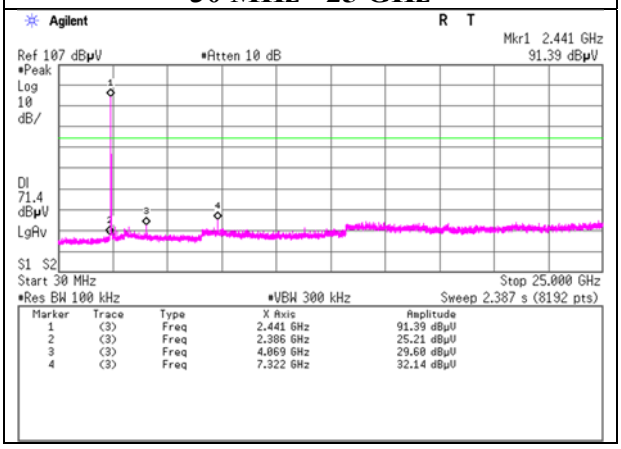
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

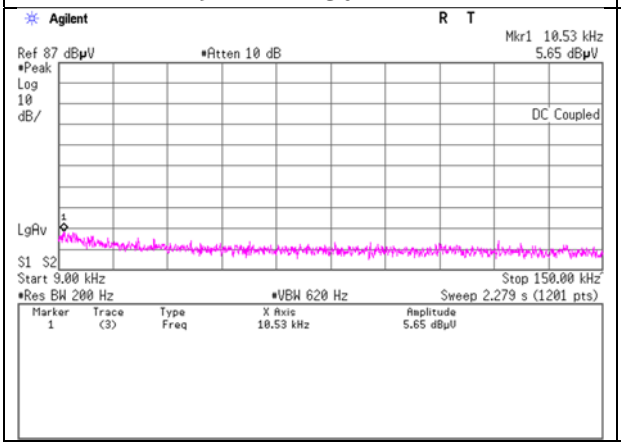


Conducted Spurious Emission

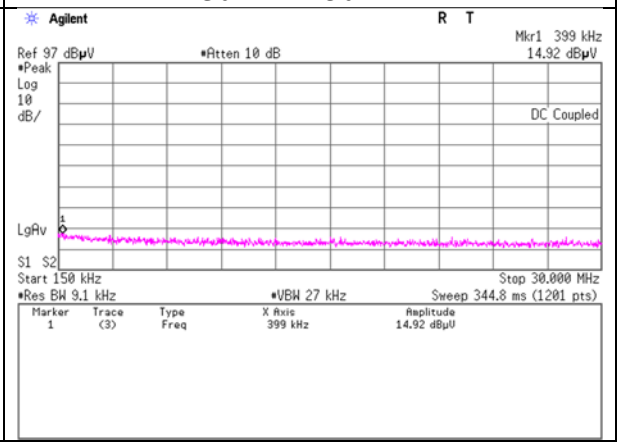
Report No.	13665469H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 18, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping Off, 3DH5

2480 MHz

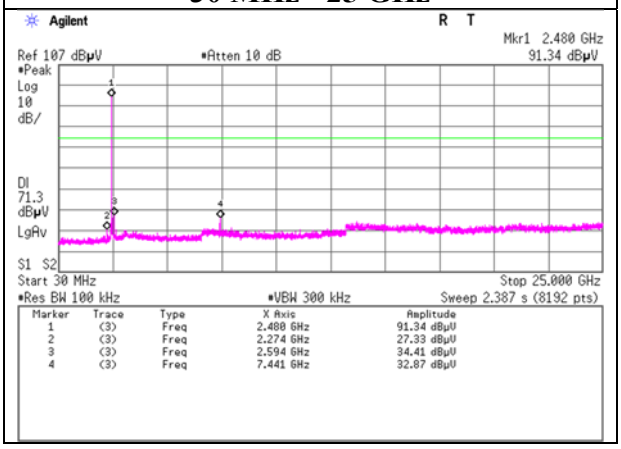
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

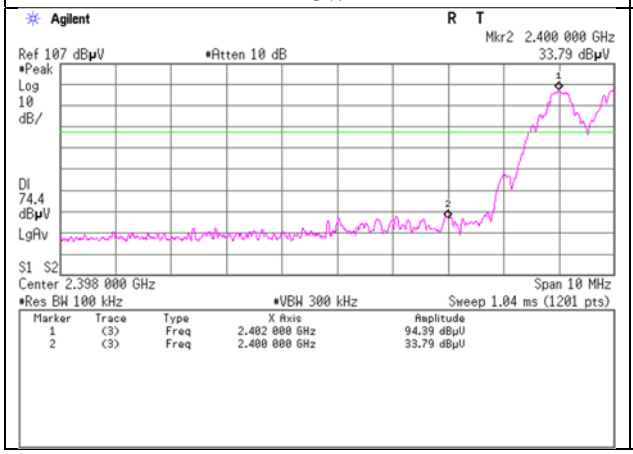


Conducted Emission Band Edge compliance

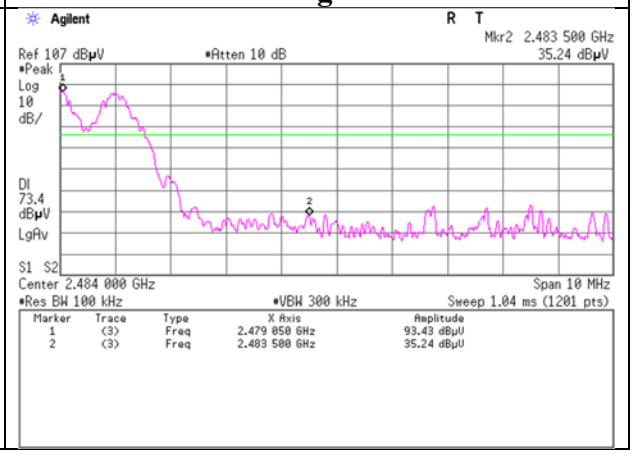
Report No.	13665469H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 18, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping Off, DH5 Tx, Hopping On, DH5

Hopping On

Low

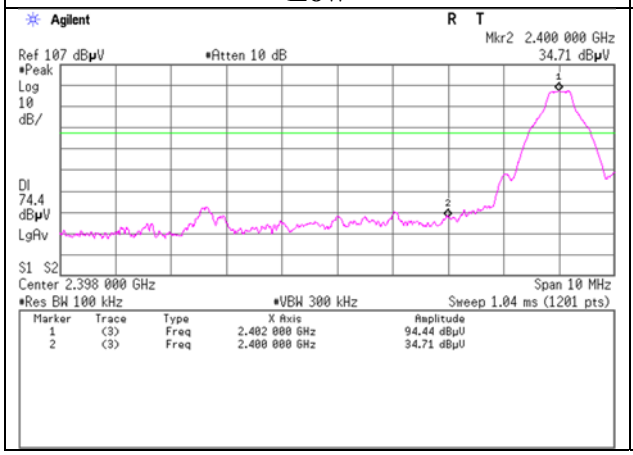


High

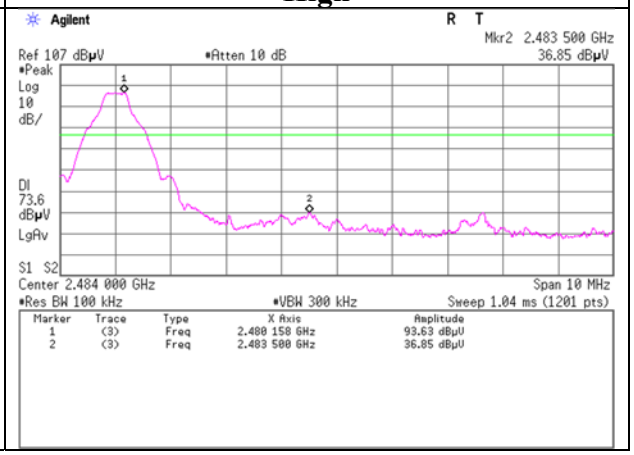


Hopping Off

Low



High

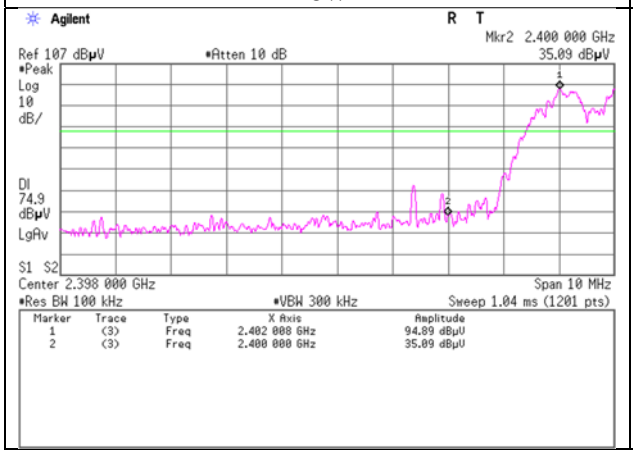


Conducted Emission Band Edge compliance

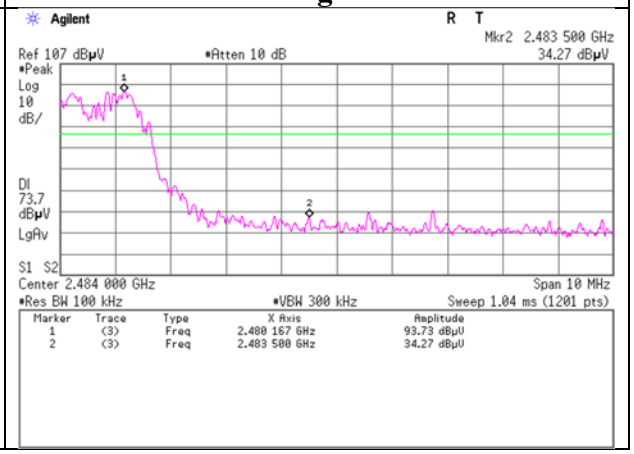
Report No.	13665469H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	January 18, 2021
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, Hopping Off, 3DH5 Tx, Hopping On, 3DH5

Hopping On

Low

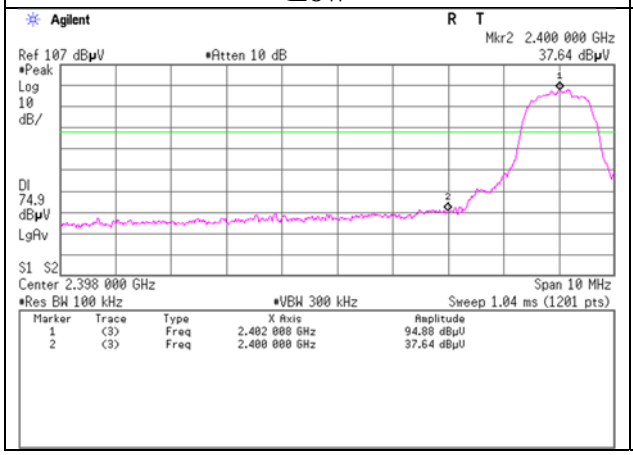


High

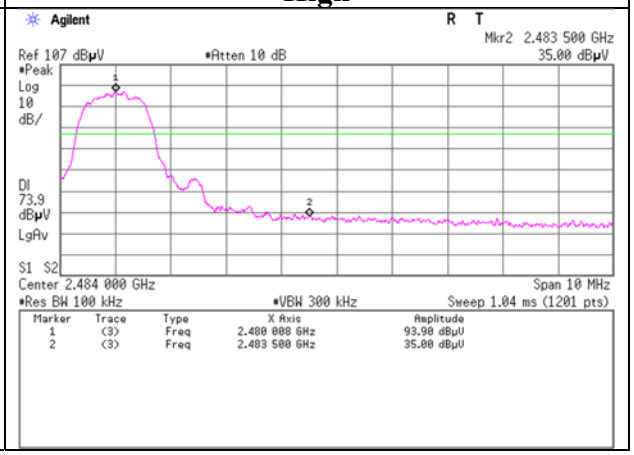


Hopping Off

Low



High



APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/15/2021	12
AT	MMM-12	141547	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	60500120	02/03/2020	12
AT	MJM-24	142225	Measure	ASKUL	-	-	-	-
AT	MCC-64	141327	Coaxial Cable	UL Japan	-	-	02/03/2021	12
AT	MAT-10	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/13/2020	12
AT	MSA-14	141901	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250080	12/18/2020	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	MCC-245	197220	Microwave cable	Huber+Suhner	SF126E/11PC35/ 11PC35/2000MM	537003/126E	03/23/2020	12
AT	MAT-23	141361	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	04/21/2020	12
RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/15/2021	12
RE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/07/2021	12
RE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-ME MI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-04-SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/04/2019	24
RE	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	557	05/22/2020	12
RE	MPA-12	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	10/19/2020	12
RE	MCC-141	141412	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	-	-
RE	MHF-26	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	09/23/2020	12
RE	MHA-17	141506	Horn Antenna 15-40GHz	Schwarzbeck Mess - Elektronik	BBHA9170	BBHA9170307	07/16/2020	12
RE	MCC-246	199563	Microwave Cable	Huber+Suhner	SF126E/11PC35/ 11PC35/1000M, 5000M	537061/126E / 537072/126E	06/11/2020	12
RE	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/04/2020	12
RE	MTR-09	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	06/03/2020	12
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/02/2021	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA910 6	VHA 91031302	08/31/2020	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	11/06/2020	12
RE	MLA-23	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-192	09/02/2020	12
RE	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/03/2021	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