

RADIO TEST REPORT

Test Report No. : 13809761H-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
*For permissive change
Test Result : Complied (Refer to SECTION 3)
(20dB Bandwidth, 99% Occupied Bandwidth and
Carrier Frequency Separation, Radiated Spurious
Emission and Conducted Spurious Emission tests only)

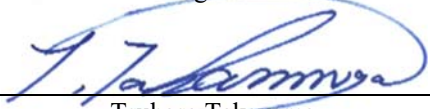
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9. The information provided from the customer for this report is identified in Section 1.

Date of test: May 12 to 20, 2021

Representative test engineer:


Takafumi Noguchi
Engineer

Approved by:


Tsubasa Takayama
Leader



CERTIFICATE 5107.02

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 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.: 13809761H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13809761H-B	June 12, 2021	-	-

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Reference: Abbreviations (Including words undescribed in this report)

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

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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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 : April 30, 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
Power Supply (inner) : DC 3.3 V, DC 1.8 V
Clock frequency(ies) : 26 MHz

	IEEE802.11b	IEEE802.11g/n (20 M band)	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 *1)
Frequency of operation	2402 MHz - 2480 MHz
Type of modulation	BT: FHSS (GFSK, $\pi/4$ -DQPSK, 8-DPSK)
Channel spacing	BT: 1 MHz
Antenna type	Surface Mountable Dielectric Chip Antenna
Antenna Connector type	-
Antenna Gain	1.6 dBi

*1) This test report applies to Bluetooth Ver.3.0 with EDR function (2402 MHz - 2480 MHz).
(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 May 3, 2021 and effective July 2, 2021

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz,
and 5725-5850 MHz

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

* 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)	4.0 dB 639.994 MHz, QP, Horizontal	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	4.0 dB 639.994 MHz, QP, Horizontal	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. Dwell time and hopping number 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.

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

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 $k=2$.
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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) (Vertical)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		4.8 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
		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

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*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967

ISED Lab Company Number: 2973C / CAB identifier: JP0002

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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.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-

* 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

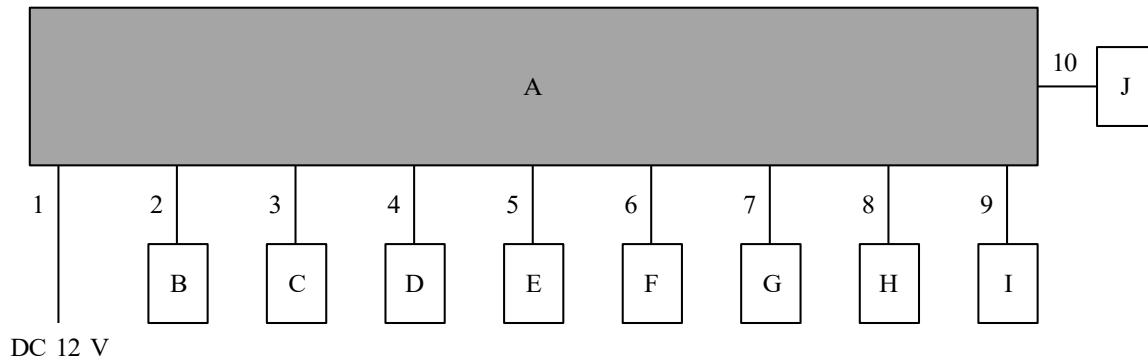
4.1 Operating Mode(s)

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
<p>*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length</p> <p>*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.</p> <p>* 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.</p> <p>*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)</p> <p>*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.</p>		

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 Navigation	FT0091A	MSC00018	DENSO TEN	EUT *1)
			MSC00044	Limited	EUT *2)
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	-
J	Jig board	-	-	DENSO TEN Limited	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.5	Unshielded	Unshielded	*2)
		2.0			*1)
2	Antenna Cable	3.6	Shielded	Shielded	-
3	Antenna Cable	0.5	Shielded	Shielded	-
4	Signal Cable	0.6	Unshielded	Unshielded	-
5	Signal Cable	0.5	Unshielded	Unshielded	-
6	Signal Cable	0.5	Unshielded	Unshielded	-
7	Signal Cable	1.0	Unshielded	Unshielded	-
8	USB Cable	1.0	Shielded	Shielded	-
9	USB Cable	1.0	Shielded	Shielded	-
10	Signal Cable	0.1	Unshielded	Unshielded	-

*1) Used only for Radiated Spurious Emission

*2) Used for Antenna Terminal Conducted Tests

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

SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]

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

[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.

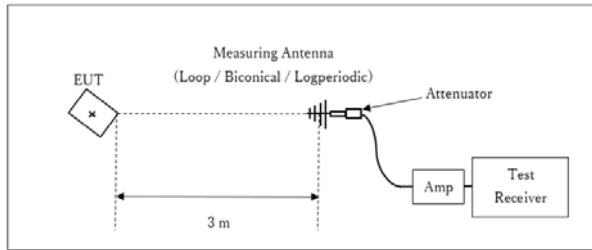
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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

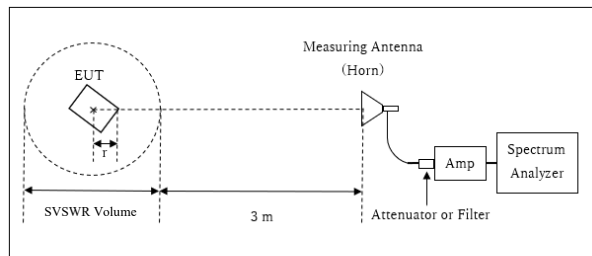
Below 1 GHz



× : 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: $20 \times \log(3.65 \text{ m} / 3.0 \text{ m}) = 1.7 \text{ dB}$

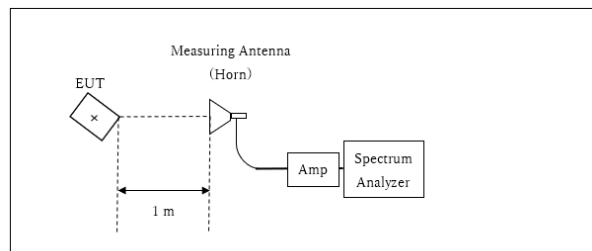
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.65 \text{ m}$

SVSWR Volume : 1.5 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: $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

*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	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
<p>*1) The measurement was performed with Max Hold since the duty cycle was not 100 %.</p> <p>*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).</p> <p>*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 Ohms. 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.</p>							

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

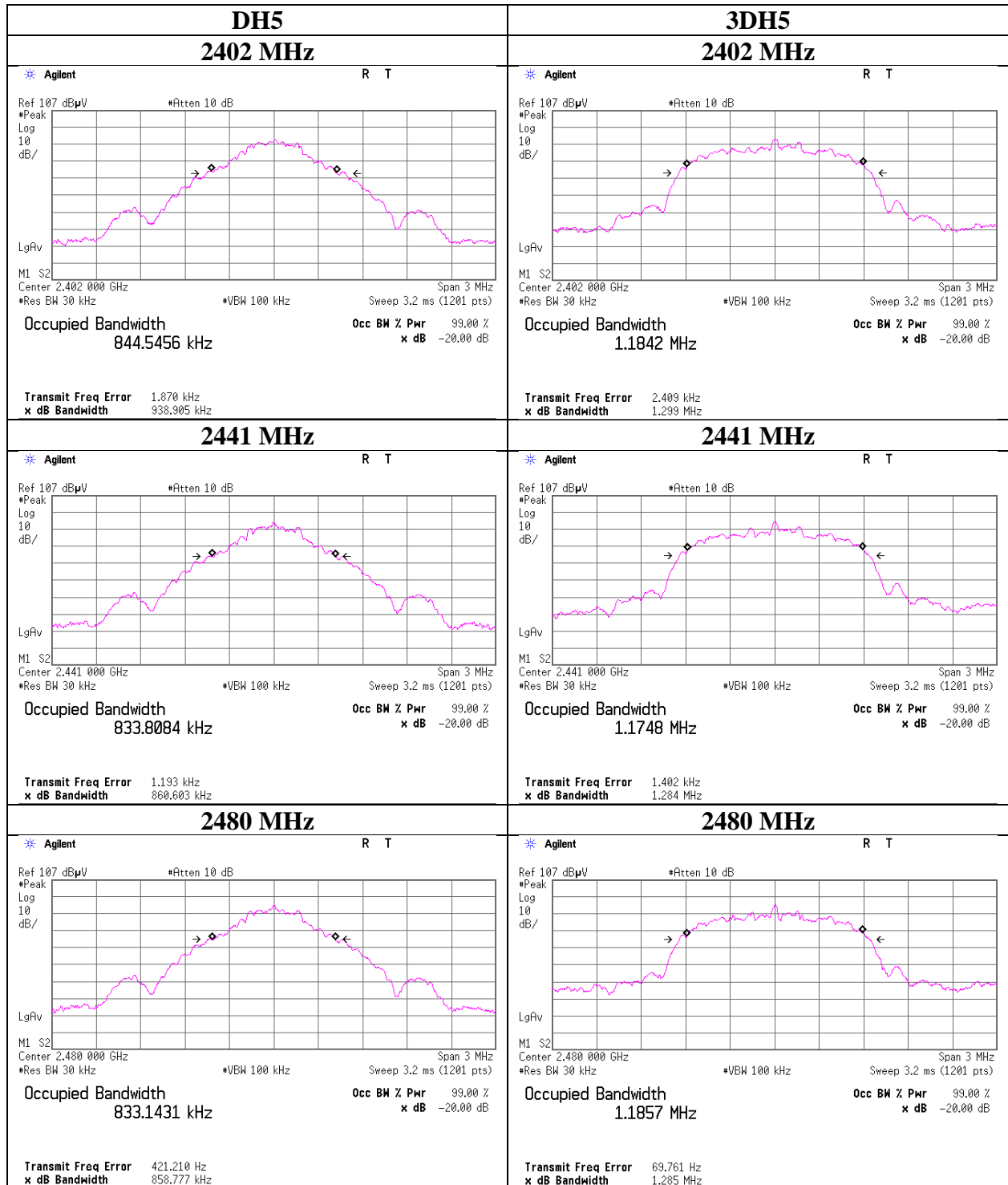
Report No. 13809761H
Test place Ise EMC Lab. No.8 Measurement Room
Date May 20, 2021
Temperature / Humidity 24 deg. C / 62 % RH
Engineer Kiyoshiro Okazaki
Mode Tx, Hopping Off, Tx, Hopping On

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.939	844.546	1.000	≥ 0.626
DH5	2441.0	0.861	833.808	1.000	≥ 0.574
DH5	2480.0	0.859	833.143	1.000	≥ 0.573
3DH5	2402.0	1.299	1184.200	1.000	≥ 0.866
3DH5	2441.0	1.284	1174.800	1.000	≥ 0.856
3DH5	2480.0	1.285	1185.700	1.000	≥ 0.857

Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

20dB Bandwidth and 99% Occupied Bandwidth



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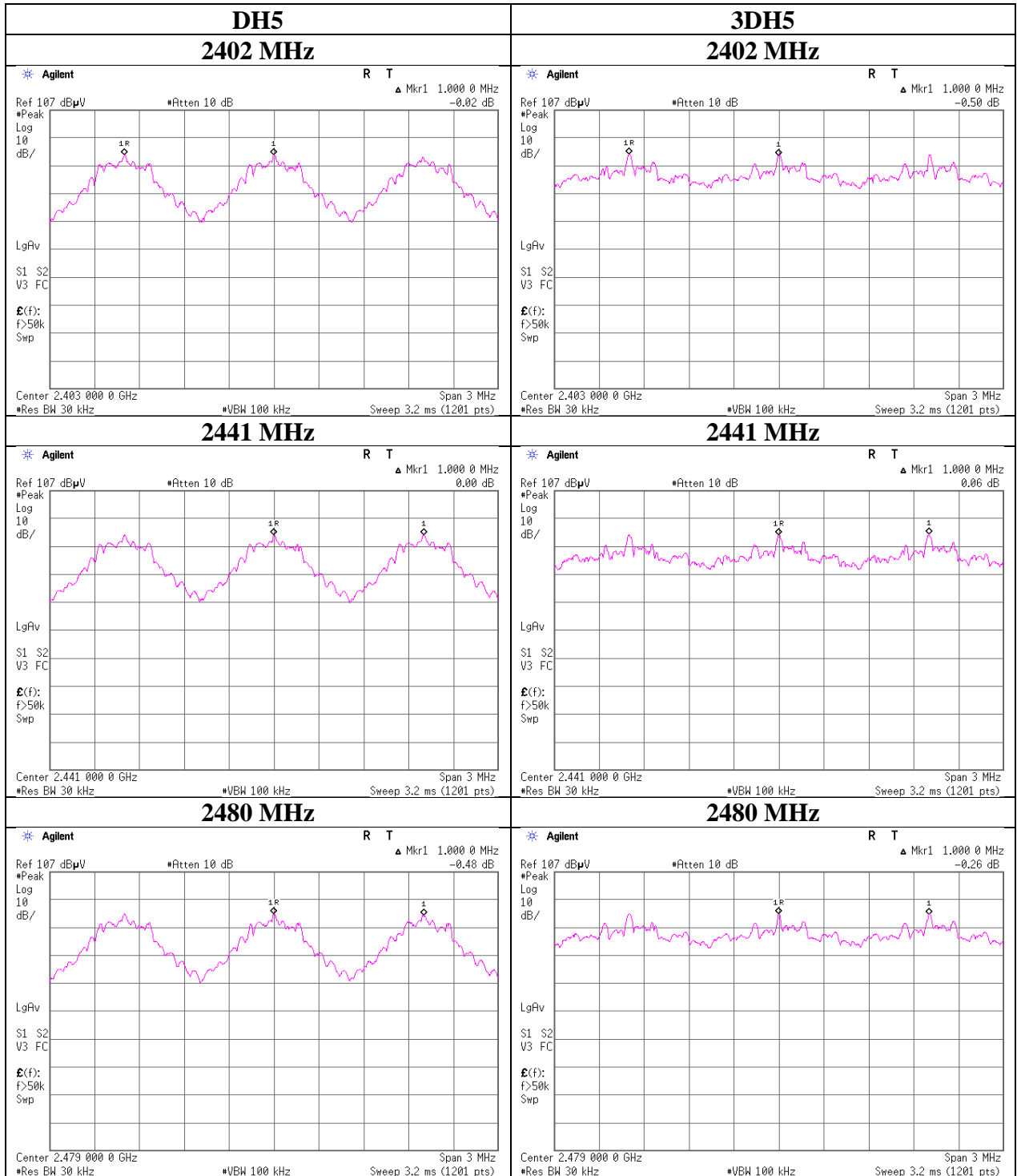
Ise EMC Lab.

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Telephone : +81 596 24 8999

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Carrier Frequency Separation



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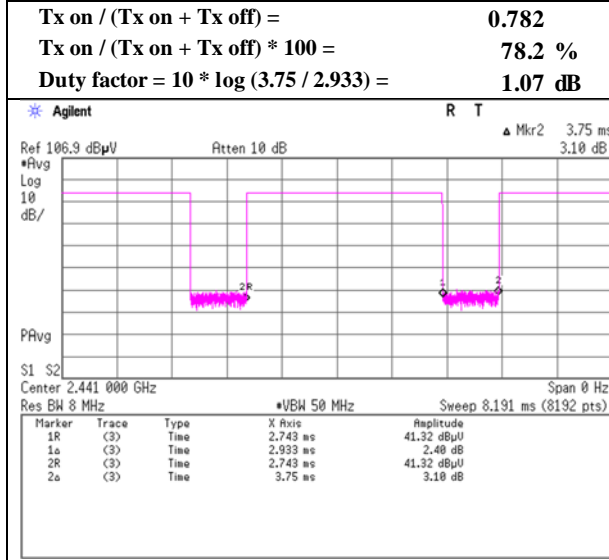
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

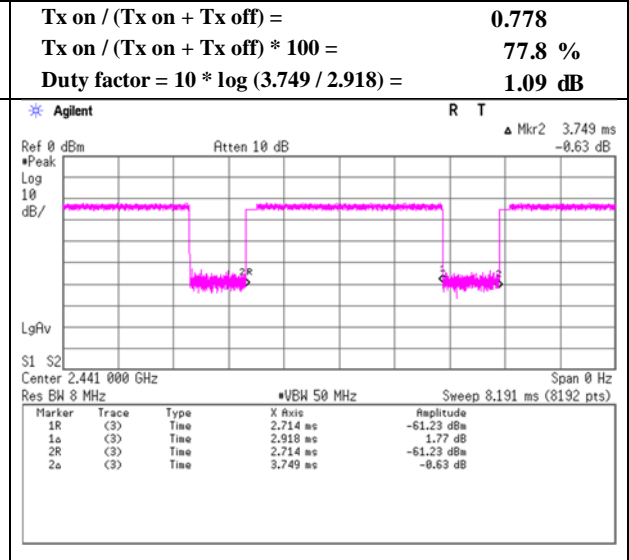
Burst Rate Confirmation

Report No. 13809761H
 Test place Ise EMC Lab. No.1 Measurement Room
 Date May 12, 2021
 Temperature / Humidity 22 deg. C / 41 % RH
 Engineer Takafumi Noguchi
 Mode Tx, Hopping Off

DH5

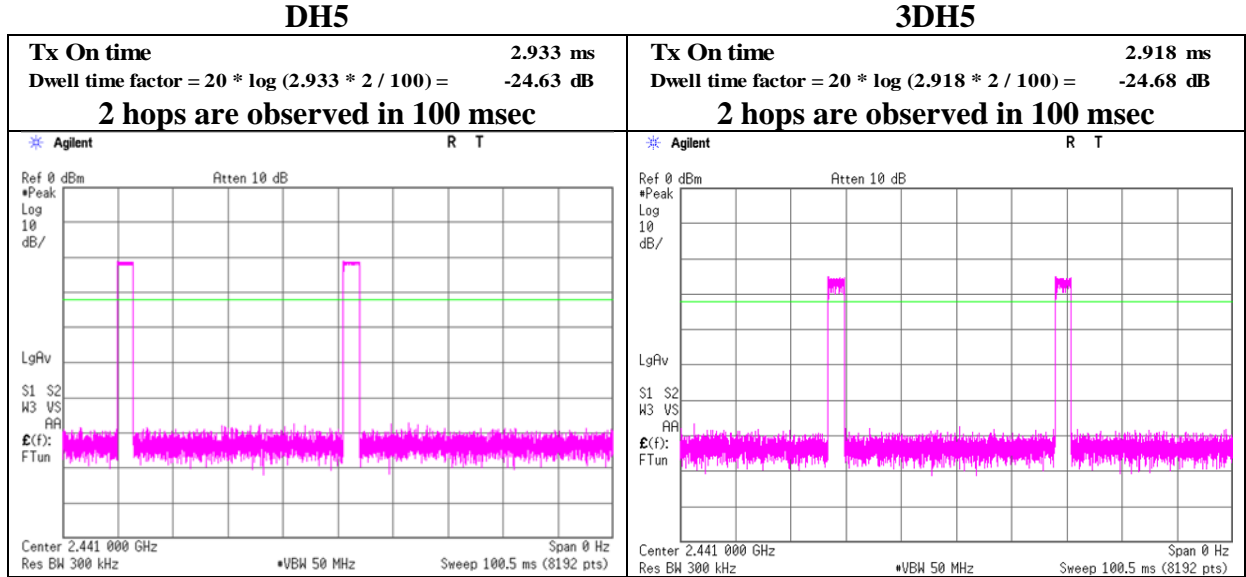


3DH5



Duty cycle correction factor

Report No. 13809761H
 Test place Ise EMC Lab. No.1 Measurement Room
 Date May 12, 2021
 Temperature / Humidity 22 deg. C / 41 % RH
 Engineer Takafumi Noguchi
 Mode Tx, Hopping Off



Radiated Spurious Emission

Report No. 13809761H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2 No.2
Date May 12, 2021 May 13, 2021 May 15, 2021
Temperature / Humidity 22 deg. C / 41 % RH 22 deg. C / 42 % RH 21 deg. C / 44 % RH
Engineer Takafumi Noguchi Takafumi Noguchi Takafumi Noguchi
(1 GHz -10 GHz) (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.	156.009	QP	33.6	14.9	7.9	28.3	-	28.1	43.5	15.4	
Hori.	187.970	QP	35.0	15.9	8.1	28.1	-	30.9	43.5	12.6	
Hori.	219.960	QP	34.1	11.2	8.3	28.0	-	25.7	46.0	20.3	
Hori.	236.000	QP	39.3	11.4	8.4	27.9	-	31.2	46.0	14.8	
Hori.	336.772	QP	31.6	14.7	9.1	28.0	-	27.4	46.0	18.6	
Hori.	577.995	QP	34.4	18.7	10.1	29.3	-	33.9	46.0	12.2	
Hori.	639.994	QP	41.4	19.3	10.4	29.3	-	41.8	46.0	4.2	
Hori.	650.226	QP	33.8	19.3	10.4	29.3	-	34.2	46.0	11.8	
Hori.	873.611	QP	33.2	21.8	11.2	29.0	-	37.3	46.0	8.7	
Hori.	2390.000	PK	44.2	27.5	4.8	35.1	-	41.4	73.9	32.5	
Hori.	4804.000	PK	41.2	31.7	7.0	34.4	-	45.5	73.9	28.4	Floor noise
Hori.	7206.000	PK	49.5	36.1	8.5	34.4	-	59.8	73.9	14.2	
Hori.	9608.000	PK	42.4	38.7	9.0	35.0	-	55.1	73.9	18.8	Floor noise
Hori.	2390.000	AV	35.5	27.5	4.8	35.1	1.1	33.8	53.9	20.1	*1)
Hori.	4804.000	AV	33.6	31.7	7.0	34.4	-	38.0	53.9	15.9	Floor noise
Hori.	9608.000	AV	35.0	38.7	9.0	35.0	-	47.7	53.9	6.2	Floor noise
Vert.	156.009	QP	30.0	14.9	7.9	28.3	-	24.6	43.5	19.0	
Vert.	187.970	QP	23.5	15.9	8.1	28.1	-	19.4	43.5	24.1	
Vert.	219.960	QP	26.0	11.2	8.3	28.0	-	17.6	46.0	28.4	
Vert.	236.000	QP	30.4	11.4	8.4	27.9	-	22.3	46.0	23.7	
Vert.	336.772	QP	34.1	14.7	9.1	28.0	-	29.9	46.0	16.1	
Vert.	577.995	QP	34.3	18.7	10.1	29.3	-	33.8	46.0	12.3	
Vert.	639.994	QP	39.6	19.3	10.4	29.3	-	40.0	46.0	6.0	
Vert.	650.226	QP	34.8	19.3	10.4	29.3	-	35.2	46.0	10.8	
Vert.	873.611	QP	32.0	21.8	11.2	29.0	-	36.1	46.0	9.9	
Vert.	2390.000	PK	44.0	27.5	4.8	35.1	-	41.3	73.9	32.6	
Vert.	4804.000	PK	41.7	31.7	7.0	34.4	-	46.0	73.9	27.9	Floor noise
Vert.	7206.000	PK	47.7	36.1	8.5	34.4	-	57.9	73.9	16.0	
Vert.	9608.000	PK	42.5	38.7	9.0	35.0	-	55.1	73.9	18.8	Floor noise
Vert.	2390.000	AV	35.7	27.5	4.8	35.1	1.1	34.0	53.9	19.9	*1)
Vert.	4804.000	AV	33.7	31.7	7.0	34.4	-	38.1	53.9	15.8	Floor noise
Vert.	9608.000	AV	34.8	38.7	9.0	35.0	-	47.5	53.9	6.4	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (3.65 m / 3.0 m) = 1.71 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	92.1	27.5	4.8	35.1	89.3	-	-	Carrier
Hori.	2400.000	PK	39.0	27.5	4.8	35.1	36.2	69.3	33.1	
Vert.	2402.000	PK	89.4	27.5	4.8	35.1	86.7	-	-	Carrier
Vert.	2400.000	PK	35.7	27.5	4.8	35.1	32.9	66.7	33.8	

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7206.000	AV	44.8	36.1	8.5	34.4	-24.6	1.1	31.5	53.9	22.4	*
Vert.	7206.000	AV	42.5	36.1	8.5	34.4	-24.6	1.1	29.2	53.9	24.7	*

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

*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log (3.65 m / 3.0 m) = 1.71 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

UL Japan, Inc.

Ise EMC Lab.

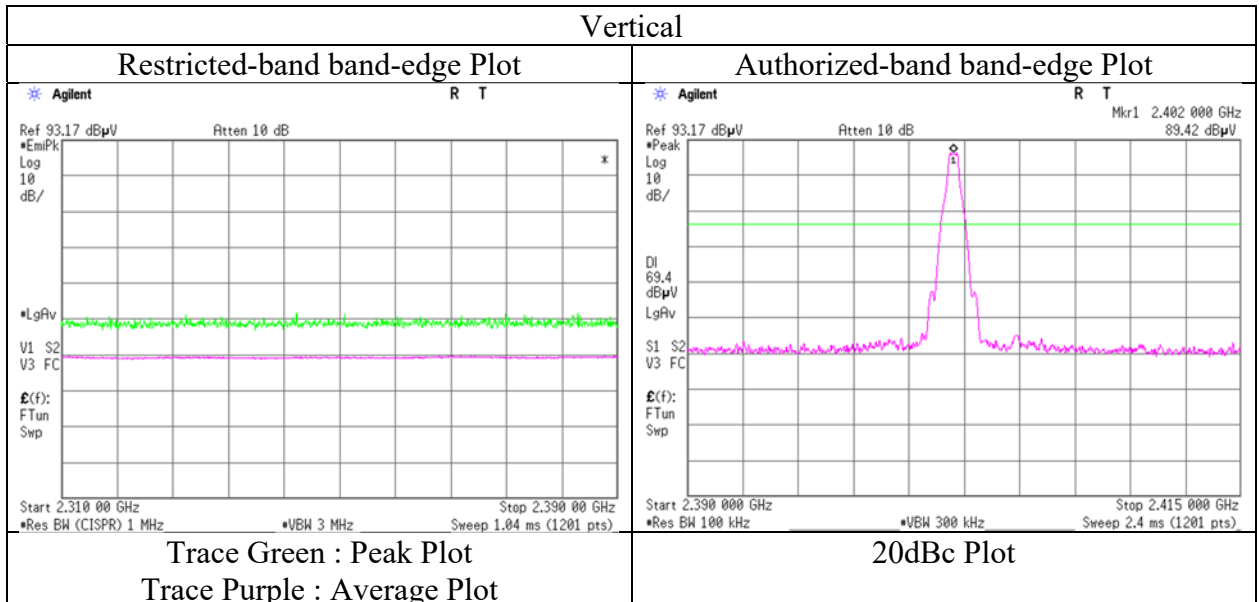
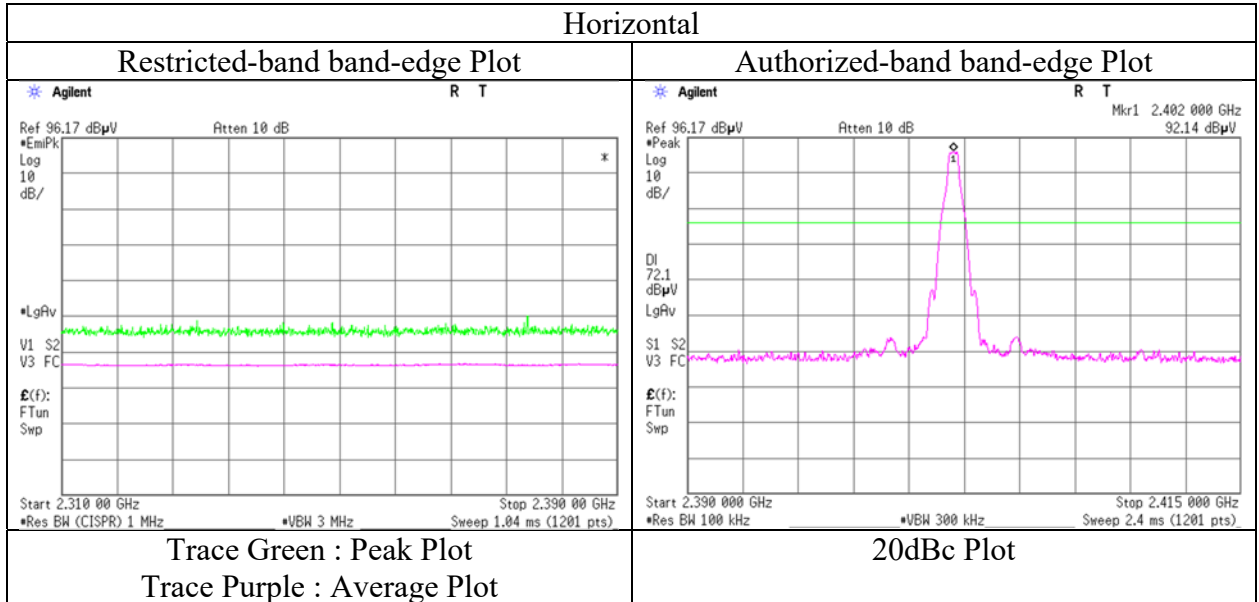
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 13809761H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date May 12, 2021
Temperature / Humidity 22 deg. C / 41 % RH
Engineer Takafumi Noguchi
(1 GHz -10 GHz)
Mode Tx, Hopping Off, DH5 2402 MHz



* 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. 13809761H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2 No.2
Date May 12, 2021 May 13, 2021 May 15, 2021
Temperature / Humidity 22 deg. C / 41 % RH 22 deg. C / 42 % RH 21 deg. C / 44 % RH
Engineer Takafumi Noguchi Takafumi Noguchi Takafumi Noguchi
(1 GHz -10 GHz) (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.	156.009	QP	33.4	14.9	7.9	28.3	-	27.9	43.5	15.6	
Hori.	187.970	QP	35.2	15.9	8.1	28.1	-	31.1	43.5	12.4	
Hori.	219.960	QP	34.5	11.2	8.3	28.0	-	26.1	46.0	19.9	
Hori.	236.000	QP	38.7	11.4	8.4	27.9	-	30.6	46.0	15.4	
Hori.	336.772	QP	31.2	14.7	9.1	28.0	-	27.0	46.0	19.0	
Hori.	577.995	QP	34.2	18.7	10.1	29.3	-	33.7	46.0	12.4	
Hori.	639.994	QP	41.3	19.3	10.4	29.3	-	41.7	46.0	4.3	
Hori.	650.226	QP	33.7	19.3	10.4	29.3	-	34.1	46.0	11.9	
Hori.	873.611	QP	33.3	21.8	11.2	29.0	-	37.4	46.0	8.6	
Hori.	4882.000	PK	42.2	31.4	7.0	34.4	-	46.3	73.9	27.6	Floor noise
Hori.	7323.000	PK	48.4	36.2	8.5	34.4	-	58.7	73.9	15.2	
Hori.	9764.000	PK	42.8	39.0	9.0	35.0	-	55.8	73.9	18.1	Floor noise
Hori.	4882.000	AV	34.0	31.4	7.0	34.4	-	38.1	53.9	15.8	Floor noise
Hori.	9764.000	AV	35.0	39.0	9.0	35.0	-	48.0	53.9	6.0	Floor noise
Vert.	156.009	QP	29.3	14.9	7.9	28.3	-	23.8	43.5	19.7	
Vert.	187.970	QP	23.3	15.9	8.1	28.1	-	19.2	43.5	24.3	
Vert.	219.960	QP	26.8	11.2	8.3	28.0	-	18.4	46.0	27.6	
Vert.	236.000	QP	28.0	11.4	8.4	27.9	-	19.9	46.0	26.1	
Vert.	336.772	QP	31.8	14.7	9.1	28.0	-	27.6	46.0	18.4	
Vert.	577.995	QP	34.1	18.7	10.1	29.3	-	33.6	46.0	12.5	
Vert.	639.994	QP	39.4	19.3	10.4	29.3	-	39.8	46.0	6.2	
Vert.	650.226	QP	34.2	19.3	10.4	29.3	-	34.6	46.0	11.4	
Vert.	873.611	QP	32.0	21.8	11.2	29.0	-	36.1	46.0	9.9	
Vert.	4882.000	PK	43.1	31.4	7.0	34.4	-	47.1	73.9	26.8	Floor noise
Vert.	7323.000	PK	48.1	36.2	8.5	34.4	-	58.4	73.9	15.5	
Vert.	9764.000	PK	42.9	39.0	9.0	35.0	-	55.8	73.9	18.1	Floor noise
Vert.	4882.000	AV	34.1	31.4	7.0	34.4	-	38.2	53.9	15.7	Floor noise
Vert.	9764.000	AV	34.6	39.0	9.0	35.0	-	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 (3.65 m / 3.0 m) = 1.71 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7323.000	AV	42.6	36.2	8.5	34.4	-24.6	1.1	29.4	53.9	24.5	*
Vert.	7323.000	AV	42.1	36.2	8.5	34.4	-24.6	1.1	28.8	53.9	25.1	*

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

Distance factor: 1 GHz - 10 GHz 20log (3.65 m / 3.0 m) = 1.71 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

Radiated Spurious Emission

Report No. 13809761H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2 No.2
Date May 12, 2021 May 13, 2021 May 15, 2021
Temperature / Humidity 22 deg. C / 41 % RH 22 deg. C / 42 % RH 21 deg. C / 44 % RH
Engineer Takafumi Noguchi Takafumi Noguchi Takafumi Noguchi
(1 GHz -10 GHz) (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.	156.009	QP	33.8	14.9	7.9	28.3	-	28.3	43.5	15.2	
Hori.	187.970	QP	35.0	15.9	8.1	28.1	-	30.9	43.5	12.6	
Hori.	219.960	QP	34.5	11.2	8.3	28.0	-	26.1	46.0	19.9	
Hori.	236.000	QP	38.5	11.4	8.4	27.9	-	30.4	46.0	15.6	
Hori.	336.772	QP	31.0	14.7	9.1	28.0	-	26.8	46.0	19.2	
Hori.	577.995	QP	34.3	18.7	10.1	29.3	-	33.8	46.0	12.3	
Hori.	639.994	QP	41.4	19.3	10.4	29.3	-	41.8	46.0	4.2	
Hori.	650.226	QP	33.4	19.3	10.4	29.3	-	33.8	46.0	12.2	
Hori.	873.611	QP	33.1	21.8	11.2	29.0	-	37.2	46.0	8.8	
Hori.	2483.500	PK	45.8	27.3	4.9	35.0	-	43.0	73.9	31.0	
Hori.	4960.000	PK	42.4	31.5	7.0	34.4	-	46.4	73.9	27.5	Floor noise
Hori.	7440.000	PK	46.7	36.3	8.5	34.4	-	57.0	73.9	16.9	
Hori.	9920.000	PK	43.3	38.8	9.0	35.1	-	56.1	73.9	17.8	Floor noise
Hori.	2483.500	AV	36.9	27.3	4.9	35.0	1.1	35.1	53.9	18.8	*1)
Hori.	4960.000	AV	33.4	31.5	7.0	34.4	-	37.5	53.9	16.4	Floor noise
Hori.	9920.000	AV	34.7	38.8	9.0	35.1	-	47.5	53.9	6.4	Floor noise
Vert.	156.009	QP	29.6	14.9	7.9	28.3	-	24.1	43.5	19.4	
Vert.	187.970	QP	23.2	15.9	8.1	28.1	-	19.1	43.5	24.4	
Vert.	219.960	QP	26.5	11.2	8.3	28.0	-	18.1	46.0	27.9	
Vert.	236.000	QP	28.2	11.4	8.4	27.9	-	20.1	46.0	25.9	
Vert.	336.772	QP	32.0	14.7	9.1	28.0	-	27.8	46.0	18.2	
Vert.	577.995	QP	34.2	18.7	10.1	29.3	-	33.7	46.0	12.4	
Vert.	639.994	QP	40.0	19.3	10.4	29.3	-	40.4	46.0	5.6	
Vert.	650.226	QP	34.0	19.3	10.4	29.3	-	34.4	46.0	11.6	
Vert.	873.611	QP	31.8	21.8	11.2	29.0	-	35.9	46.0	10.1	
Vert.	2483.500	PK	45.9	27.3	4.9	35.0	-	43.1	73.9	30.9	
Vert.	4960.000	PK	41.5	31.5	7.0	34.4	-	45.6	73.9	28.3	Floor noise
Vert.	7440.000	PK	45.5	36.3	8.5	34.4	-	55.8	73.9	18.1	
Vert.	9920.000	PK	43.8	38.8	9.0	35.1	-	56.5	73.9	17.4	Floor noise
Vert.	2483.500	AV	36.6	27.3	4.9	35.0	1.1	34.9	53.9	19.0	*1)
Vert.	4960.000	AV	33.6	31.5	7.0	34.4	-	37.7	53.9	16.2	Floor noise
Vert.	9920.000	AV	34.8	38.8	9.0	35.1	-	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 $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*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]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7440.000	AV	40.5	36.3	8.5	34.4	-24.6	1.1	27.3	53.9	26.6	*
Vert.	7440.000	AV	39.0	36.3	8.5	34.4	-24.6	1.1	25.8	53.9	28.1	*

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

*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Ise EMC Lab.

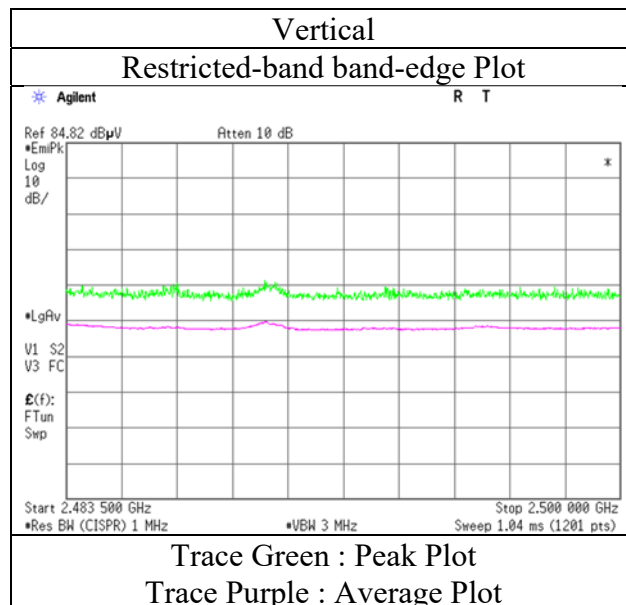
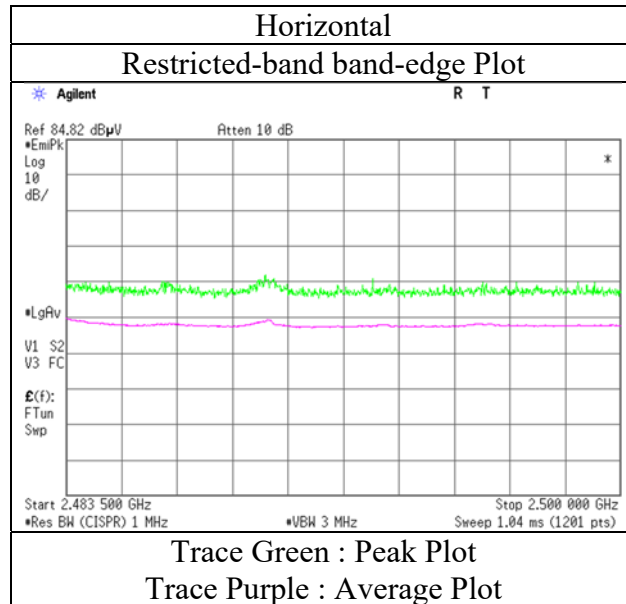
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 13809761H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date May 12, 2021
Temperature / Humidity 22 deg. C / 41 % RH
Engineer Takafumi Noguchi
(1 GHz - 10 GHz)
Mode Tx, Hopping Off, DH5 2480 MHz



* 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. 13809761H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2 No.2
Date May 12, 2021 May 13, 2021 May 15, 2021
Temperature / Humidity 22 deg. C / 41 % RH 22 deg. C / 42 % RH 21 deg. C / 44 % RH
Engineer Takafumi Noguchi Takafumi Noguchi Takafumi Noguchi
(1 GHz - 10 GHz) (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.	156.009	QP	33.8	14.9	7.9	28.3	-	28.3	43.5	15.2	
Hori.	187.970	QP	35.0	15.9	8.1	28.1	-	30.9	43.5	12.6	
Hori.	219.960	QP	34.2	11.2	8.3	28.0	-	25.8	46.0	20.2	
Hori.	236.000	QP	39.0	11.4	8.4	27.9	-	30.9	46.0	15.1	
Hori.	336.772	QP	31.3	14.7	9.1	28.0	-	27.1	46.0	18.9	
Hori.	577.995	QP	34.1	18.7	10.1	29.3	-	33.6	46.0	12.5	
Hori.	639.994	QP	41.6	19.3	10.4	29.3	-	42.0	46.0	4.0	
Hori.	650.226	QP	33.1	19.3	10.4	29.3	-	33.5	46.0	12.5	
Hori.	873.611	QP	33.3	21.8	11.2	29.0	-	37.4	46.0	8.6	
Hori.	2390.000	PK	45.2	27.5	4.8	35.1	-	42.5	73.9	31.4	
Hori.	4804.000	PK	41.3	31.7	7.0	34.4	-	45.7	73.9	28.2	Floor noise
Hori.	7206.000	PK	49.6	36.1	8.5	34.4	-	59.8	73.9	14.1	
Hori.	9608.000	PK	42.5	38.7	9.0	35.0	-	55.2	73.9	18.7	Floor noise
Hori.	2390.000	AV	36.2	27.5	4.8	35.1	1.1	34.5	53.9	19.4	*1)
Hori.	4804.000	AV	33.5	31.7	7.0	34.4	-	37.8	53.9	16.1	Floor noise
Hori.	9608.000	AV	35.0	38.7	9.0	35.0	-	47.6	53.9	6.3	Floor noise
Vert.	156.009	QP	30.0	14.9	7.9	28.3	-	24.6	43.5	18.9	
Vert.	187.970	QP	24.4	15.9	8.1	28.1	-	20.3	43.5	23.2	
Vert.	219.960	QP	26.6	11.2	8.3	28.0	-	18.2	46.0	27.8	
Vert.	236.000	QP	29.2	11.4	8.4	27.9	-	21.1	46.0	24.9	
Vert.	336.772	QP	31.8	14.7	9.1	28.0	-	27.6	46.0	18.4	
Vert.	577.995	QP	35.0	18.7	10.1	29.3	-	34.5	46.0	11.6	
Vert.	639.994	QP	40.0	19.3	10.4	29.3	-	40.4	46.0	5.6	
Vert.	650.226	QP	34.2	19.3	10.4	29.3	-	34.6	46.0	11.4	
Vert.	873.611	QP	31.6	21.8	11.2	29.0	-	35.7	46.0	10.3	
Vert.	2390.000	PK	45.7	27.5	4.8	35.1	-	43.0	73.9	31.0	
Vert.	4804.000	PK	41.9	31.7	7.0	34.4	-	46.2	73.9	27.7	Floor noise
Vert.	7206.000	PK	48.5	36.1	8.5	34.4	-	58.8	73.9	15.1	
Vert.	9608.000	PK	42.3	38.7	9.0	35.0	-	55.0	73.9	18.9	Floor noise
Vert.	2390.000	AV	35.8	27.5	4.8	35.1	1.1	34.2	53.9	19.8	*1)
Vert.	4804.000	AV	33.6	31.7	7.0	34.4	-	37.9	53.9	16.0	Floor noise
Vert.	9608.000	AV	35.0	38.7	9.0	35.0	-	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(3.65 m / 3.0 m) = 1.71 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	92.9	27.5	4.8	35.1	90.1	-	-	Carrier
Hori.	2400.000	PK	39.9	27.5	4.8	35.1	37.1	70.1	33.0	
Vert.	2402.000	PK	90.9	27.5	4.8	35.1	88.1	-	-	Carrier
Vert.	2400.000	PK	39.6	27.5	4.8	35.1	36.8	68.1	31.3	

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

Dwell time factor relaxation

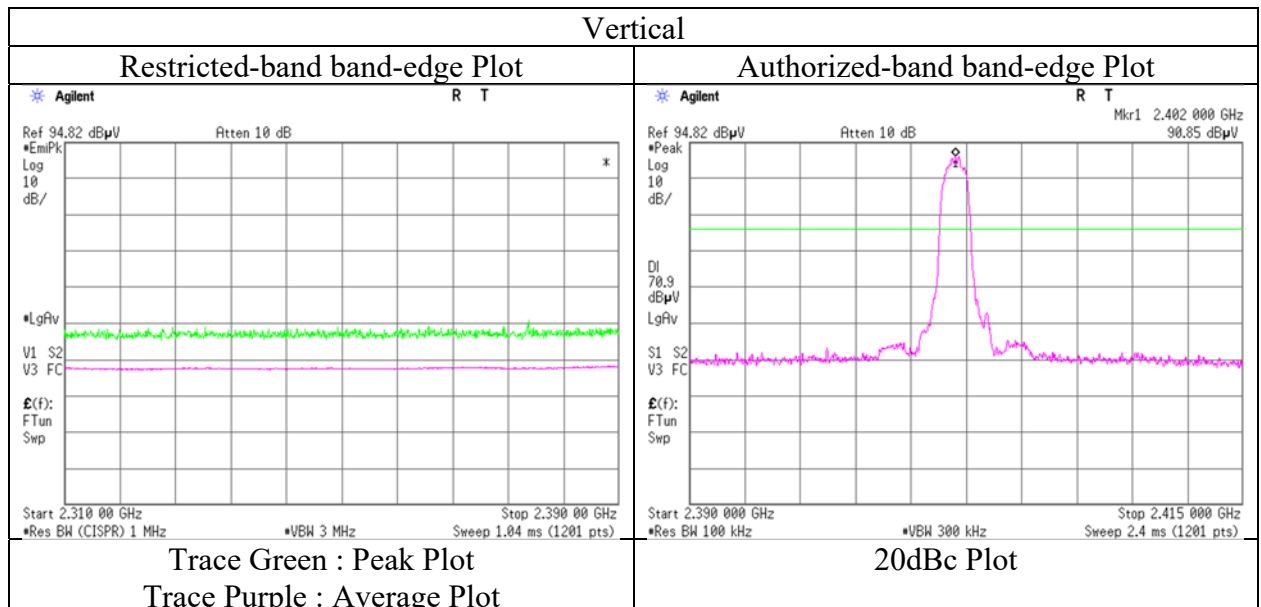
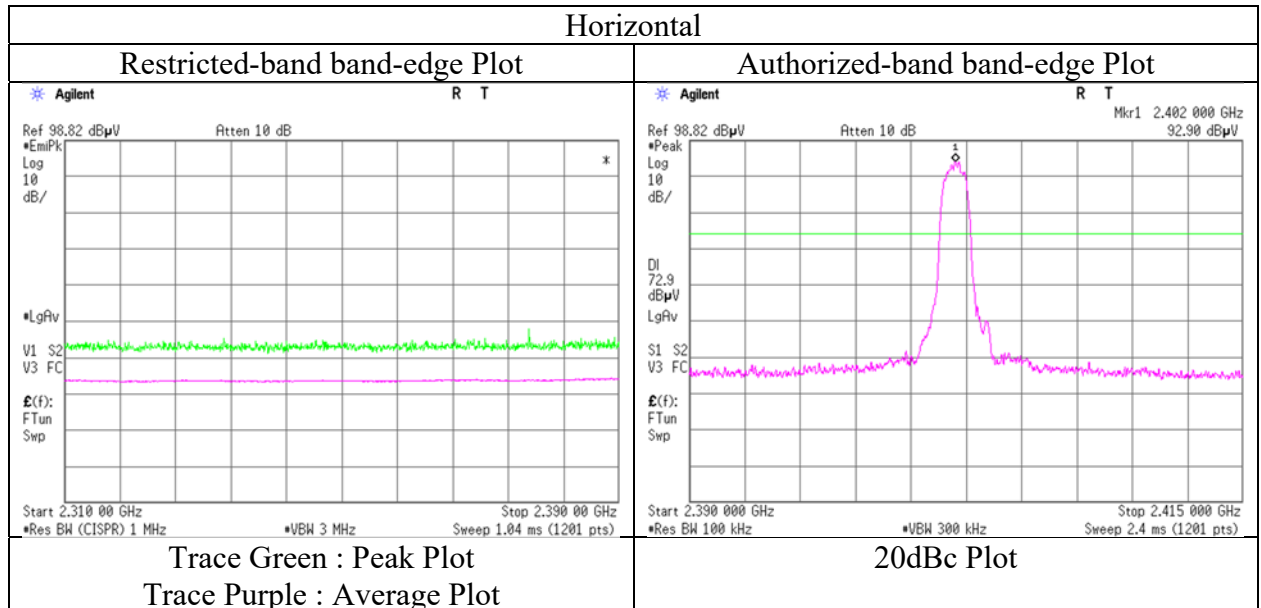
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7206.000	AV	43.9	36.1	8.5	34.4	-24.7	1.1	30.5	53.9	23.4	*
Vert.	7206.000	AV	42.4	36.1	8.5	34.4	-24.7	1.1	29.1	53.9	24.9	*

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

Distance factor: 1 GHz - 10 GHz 20log(3.65 m / 3.0 m) = 1.71 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. 13809761H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date May 12, 2021
Temperature / Humidity 22 deg. C / 41 % RH
Engineer Takafumi Noguchi
(1 GHz -10 GHz)
Mode Tx, Hopping Off, 3DH5 2402 MHz



* 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.	13809761H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	May 12, 2021	May 13, 2021	May 15, 2021
Temperature / Humidity	21 deg. C / 41 % RH	22 deg. C / 42 % RH	21 deg. C / 44 % RH
Engineer	Hiroki Numata	Takafumi Noguchi	Takafumi Noguchi
	(1 GHz - 10 GHz)	(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.	156.009	QP	33.8	14.9	7.9	28.3	-	28.3	43.5	15.2	
Hori.	187.970	QP	35.1	15.9	8.1	28.1	-	31.0	43.5	12.5	
Hori.	219.960	QP	34.2	11.2	8.3	28.0	-	25.7	46.0	20.3	
Hori.	236.000	QP	39.2	11.4	8.4	27.9	-	31.1	46.0	14.9	
Hori.	336.772	QP	31.5	14.7	9.1	28.0	-	27.3	46.0	18.7	
Hori.	577.995	QP	34.4	18.7	10.1	29.3	-	33.9	46.0	12.2	
Hori.	639.994	QP	41.5	19.3	10.4	29.3	-	41.9	46.0	4.1	
Hori.	650.226	QP	33.1	19.3	10.4	29.3	-	33.5	46.0	12.5	
Hori.	873.611	QP	33.4	21.8	11.2	29.0	-	37.5	46.0	8.5	
Hori.	4882.000	PK	41.4	31.4	7.0	34.4	-	45.5	73.9	28.4	Floor noise
Hori.	7323.000	PK	47.3	36.2	8.5	34.4	-	57.6	73.9	16.3	
Hori.	9764.000	PK	43.3	39.0	9.0	35.0	-	56.2	73.9	17.7	Floor noise
Hori.	4882.000	AV	33.8	31.4	7.0	34.4	-	37.9	53.9	16.0	Floor noise
Hori.	9764.000	AV	34.2	39.0	9.0	35.0	-	47.2	53.9	6.7	Floor noise
Vert.	156.009	QP	30.0	14.9	7.9	28.3	-	24.6	43.5	19.0	
Vert.	187.970	QP	23.2	15.9	8.1	28.1	-	19.1	43.5	24.4	
Vert.	219.960	QP	26.6	11.2	8.3	28.0	-	18.2	46.0	27.8	
Vert.	236.000	QP	30.0	11.4	8.4	27.9	-	21.9	46.0	24.1	
Vert.	336.772	QP	31.8	14.7	9.1	28.0	-	27.6	46.0	18.4	
Vert.	577.995	QP	35.4	18.7	10.1	29.3	-	34.9	46.0	11.2	
Vert.	639.994	QP	39.9	19.3	10.4	29.3	-	40.3	46.0	5.7	
Vert.	650.226	QP	34.1	19.3	10.4	29.3	-	34.5	46.0	11.5	
Vert.	873.611	QP	31.8	21.8	11.2	29.0	-	35.9	46.0	10.1	
Vert.	4882.000	PK	42.7	31.4	7.0	34.4	-	46.8	73.9	27.1	Floor noise
Vert.	7323.000	PK	48.8	36.2	8.5	34.4	-	59.1	73.9	14.8	
Vert.	9764.000	PK	43.3	39.0	9.0	35.0	-	56.2	73.9	17.7	Floor noise
Vert.	4882.000	AV	34.2	31.4	7.0	34.4	-	38.2	53.9	15.7	Floor noise
Vert.	9764.000	AV	34.1	39.0	9.0	35.0	-	47.0	53.9	6.9	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 $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7323.000	AV	41.1	36.2	8.5	34.4	-24.7	1.1	27.8	53.9	26.1	*
Vert.	7323.000	AV	42.0	36.2	8.5	34.4	-24.7	1.1	28.8	53.9	25.1	*

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

Distance factor: 1 GHz - 10 GHz $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No. 13809761H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2 No.2
Date May 12, 2021 May 13, 2021 May 15, 2021
Temperature / Humidity 21 deg. C / 41 % RH 22 deg. C / 42 % RH 21 deg. C / 44 % RH
Engineer Hiroki Numata Takafumi Noguchi Takafumi Noguchi
(1 GHz -10 GHz) (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.	156.009	QP	33.8	14.9	7.9	28.3	-	28.3	43.5	15.2	
Hori.	187.970	QP	35.0	15.9	8.1	28.1	-	30.9	43.5	12.6	
Hori.	219.960	QP	34.2	11.2	8.3	28.0	-	25.8	46.0	20.2	
Hori.	236.000	QP	39.1	11.4	8.4	27.9	-	31.0	46.0	15.0	
Hori.	336.772	QP	31.3	14.7	9.1	28.0	-	27.1	46.0	18.9	
Hori.	577.995	QP	34.5	18.7	10.1	29.3	-	34.0	46.0	12.1	
Hori.	639.994	QP	41.6	19.3	10.4	29.3	-	42.0	46.0	4.0	
Hori.	650.226	QP	33.0	19.3	10.4	29.3	-	33.4	46.0	12.6	
Hori.	873.611	QP	33.4	21.8	11.2	29.0	-	37.5	46.0	8.5	
Hori.	2483.500	PK	47.8	27.3	4.9	35.0	-	45.0	73.9	28.9	
Hori.	4960.000	PK	41.8	31.5	7.0	34.4	-	45.9	73.9	28.0	Floor noise
Hori.	7440.000	PK	45.8	36.3	8.5	34.4	-	56.2	73.9	17.8	
Hori.	9920.000	PK	43.0	38.8	9.0	35.1	-	55.8	73.9	18.2	Floor noise
Hori.	2483.500	AV	37.0	27.3	4.9	35.0	1.1	35.3	53.9	18.6	*1)
Hori.	4960.000	AV	34.0	31.5	7.0	34.4	-	38.1	53.9	15.9	Floor noise
Hori.	9920.000	AV	34.1	38.8	9.0	35.1	-	46.9	53.9	7.0	Floor noise
Vert.	156.009	QP	30.0	14.9	7.9	28.3	-	24.5	43.5	19.0	
Vert.	187.970	QP	23.4	15.9	8.1	28.1	-	19.3	43.5	24.2	
Vert.	219.960	QP	26.4	11.2	8.3	28.0	-	18.0	46.0	28.0	
Vert.	236.000	QP	30.1	11.4	8.4	27.9	-	22.0	46.0	24.0	
Vert.	336.772	QP	31.6	14.7	9.1	28.0	-	27.4	46.0	18.6	
Vert.	577.995	QP	35.5	18.7	10.1	29.3	-	35.0	46.0	11.1	
Vert.	639.994	QP	40.1	19.3	10.4	29.3	-	40.5	46.0	5.5	
Vert.	650.226	QP	34.0	19.3	10.4	29.3	-	34.4	46.0	11.6	
Vert.	873.611	QP	31.9	21.8	11.2	29.0	-	36.0	46.0	10.0	
Vert.	2483.500	PK	45.8	27.3	4.9	35.0	-	43.0	73.9	30.9	
Vert.	4960.000	PK	42.8	31.5	7.0	34.4	-	46.9	73.9	27.0	Floor noise
Vert.	7440.000	PK	46.2	36.3	8.5	34.4	-	56.5	73.9	17.4	
Vert.	9920.000	PK	43.3	38.8	9.0	35.1	-	56.1	73.9	17.8	Floor noise
Vert.	2483.500	AV	37.8	27.3	4.9	35.0	1.1	36.1	53.9	17.8	*1)
Vert.	4960.000	AV	34.2	31.5	7.0	34.4	-	38.3	53.9	15.6	Floor noise
Vert.	9920.000	AV	34.8	38.8	9.0	35.1	-	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 $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*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]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7440.000	AV	39.3	36.3	8.5	34.4	-24.7	1.1	25.0	53.9	28.9	*
Vert.	7440.000	AV	38.6	36.3	8.5	34.4	-24.7	1.1	24.2	53.9	29.7	*

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

*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Ise EMC Lab.

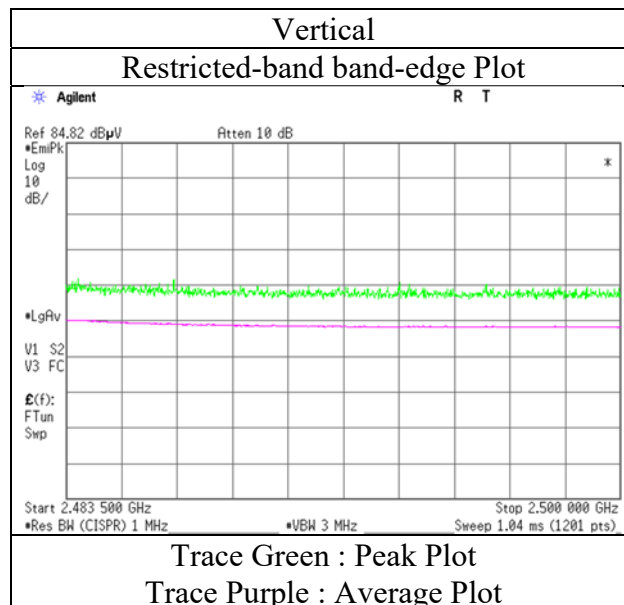
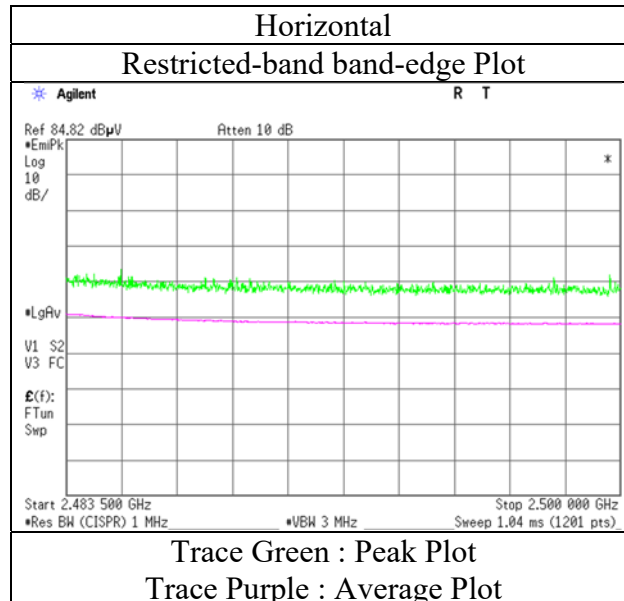
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission
(Reference Plot for band-edge)

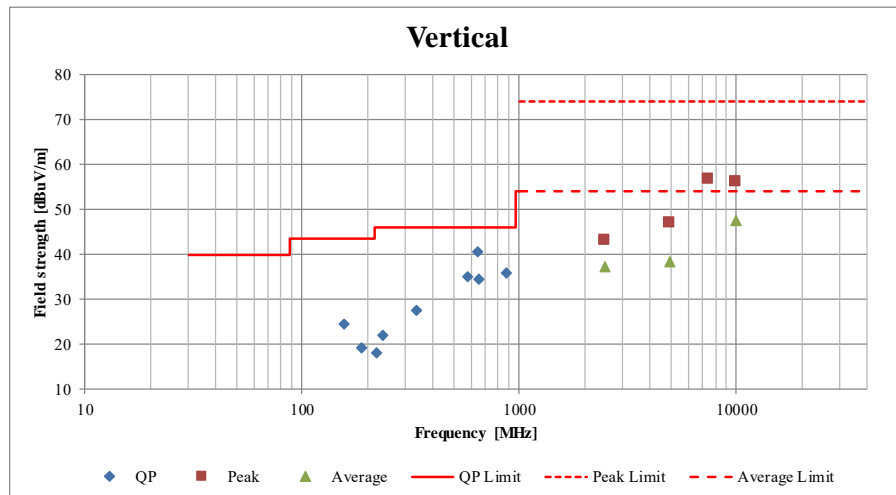
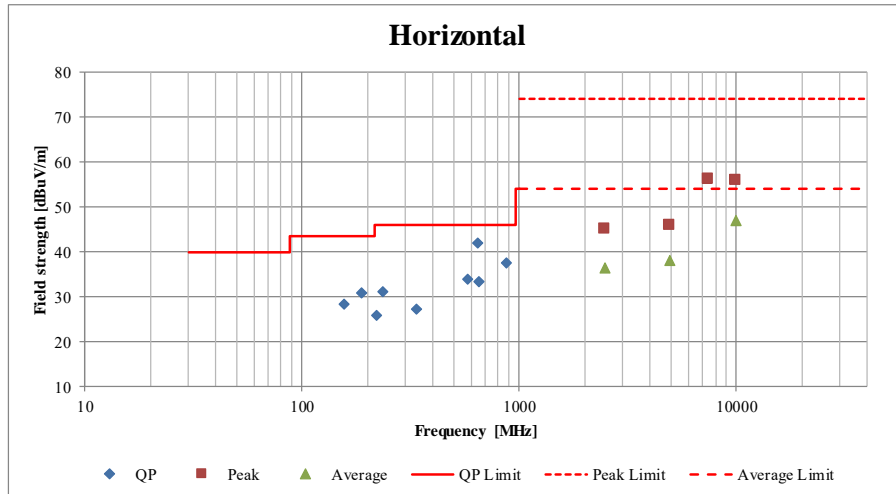
Report No. 13809761H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date May 12, 2021
Temperature / Humidity 21 deg. C / 41 % RH
Engineer Hiroki Numata
(1 GHz - 10 GHz)
Mode Tx, Hopping Off, 3DH5 2480 MHz



* 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.	13809761H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	May 12, 2021	May 13, 2021	May 15, 2021
Temperature / Humidity	21 deg. C / 41 % RH	22 deg. C / 42 % RH	21 deg. C / 44 % RH
Engineer	Hiroki Numata (1 GHz - 10 GHz)	Takafumi Noguchi (Above 10 GHz)	Takafumi Noguchi (Below 1 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz		

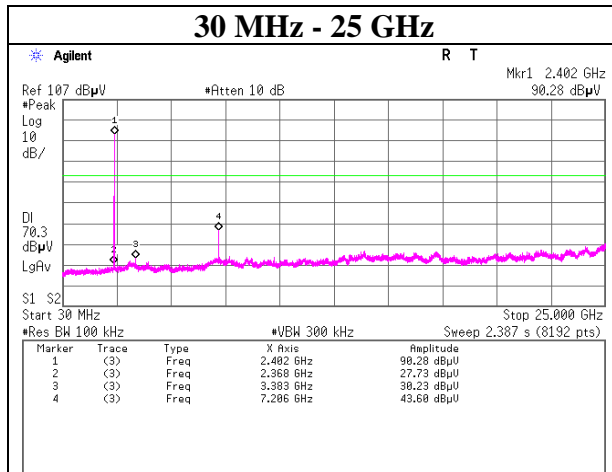
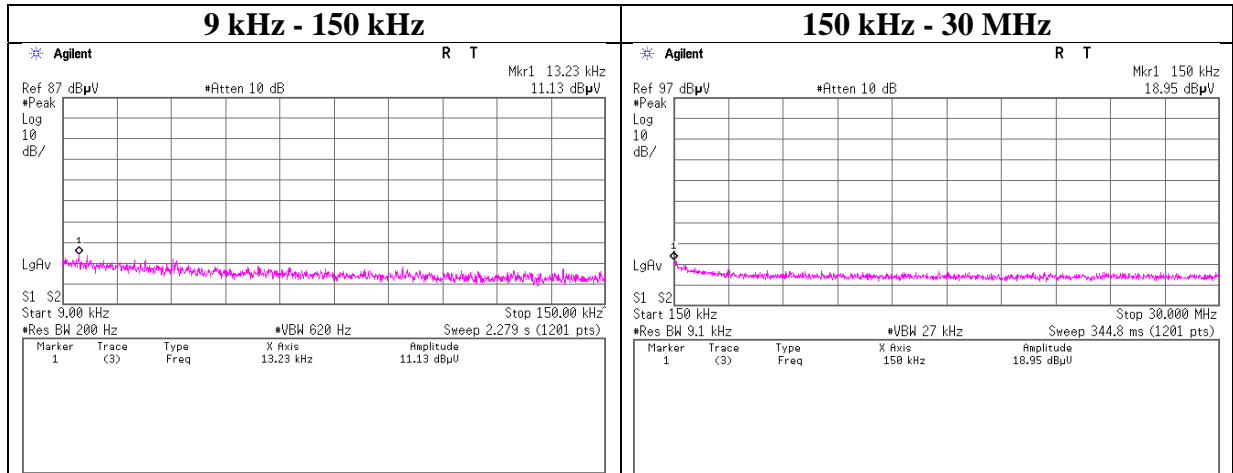


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Report No.	13809761H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 20, 2021
Temperature / Humidity	24 deg. C / 62 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx, Hopping Off, DH5

2402 MHz



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Ise EMC Lab.

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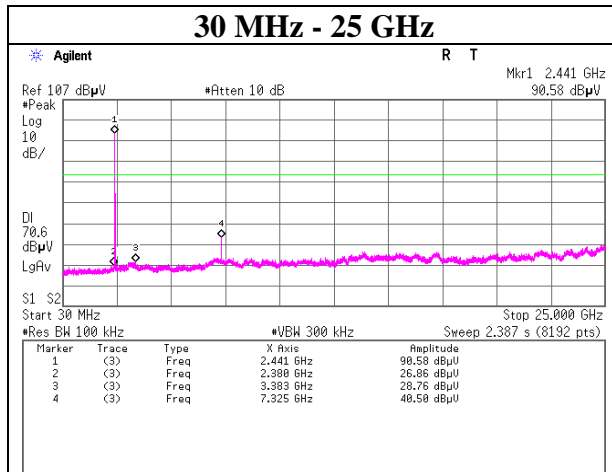
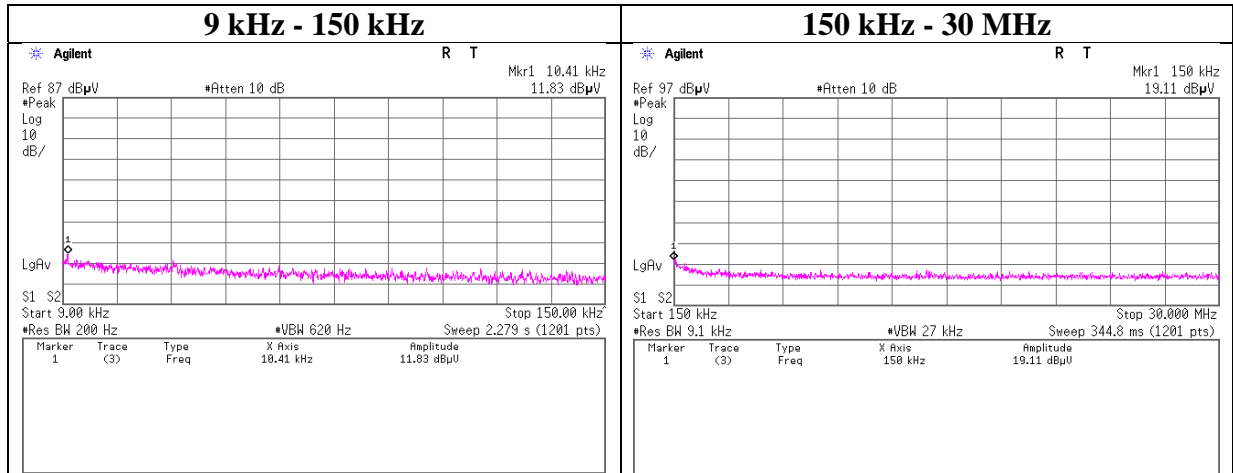
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No.	13809761H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 20, 2021
Temperature / Humidity	24 deg. C / 62 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx, Hopping Off, DH5

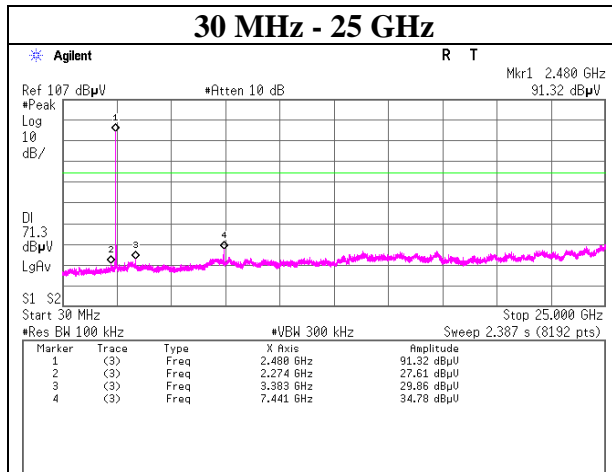
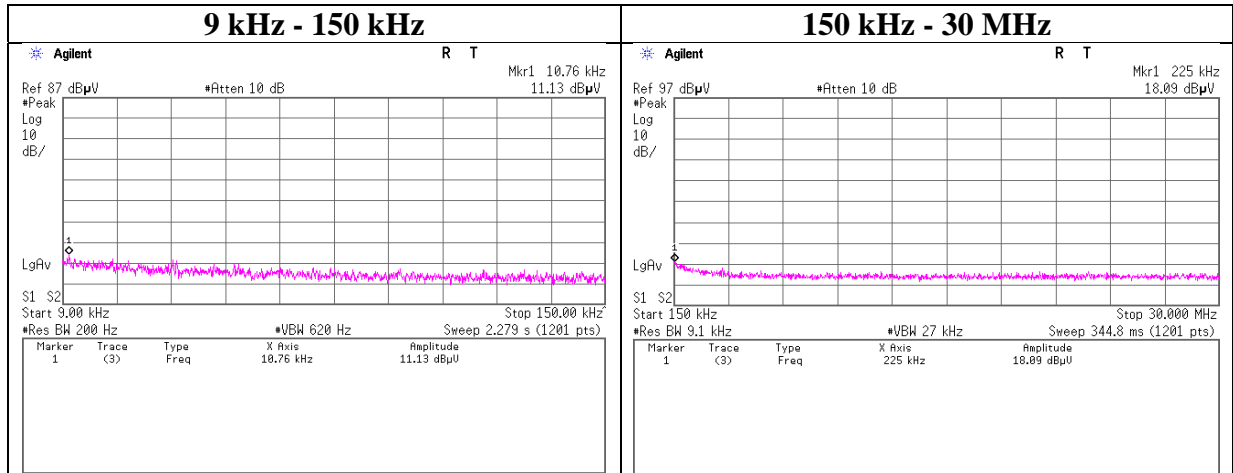
2441 MHz



Conducted Spurious Emission

Report No.	13809761H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 20, 2021
Temperature / Humidity	24 deg. C / 62 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx, Hopping Off, DH5

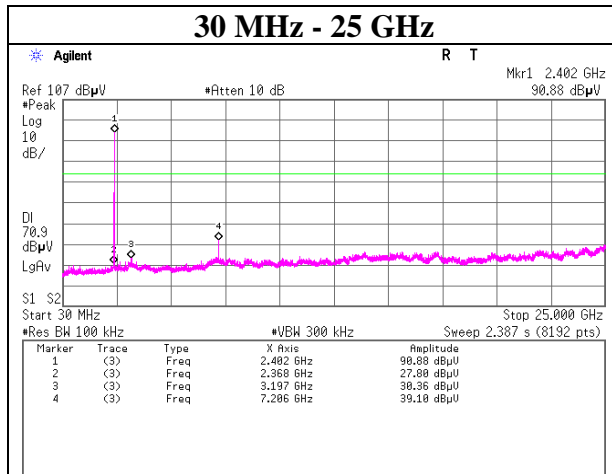
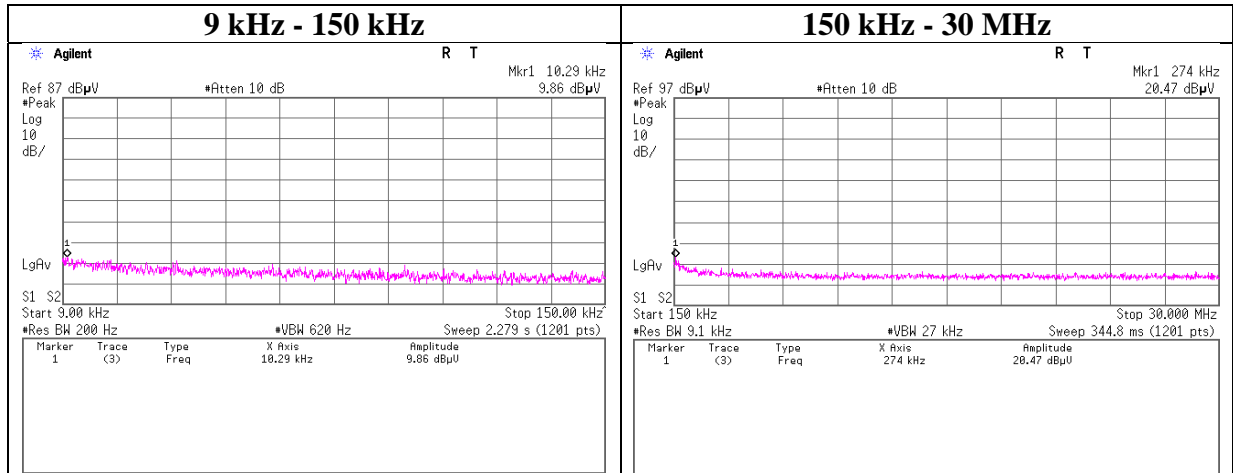
2480 MHz



Conducted Spurious Emission

Report No.	13809761H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 20, 2021
Temperature / Humidity	24 deg. C / 62 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx, Hopping Off, 3DH5

2402 MHz



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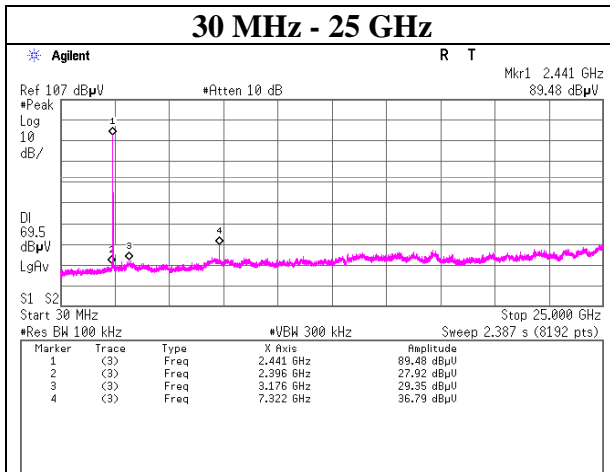
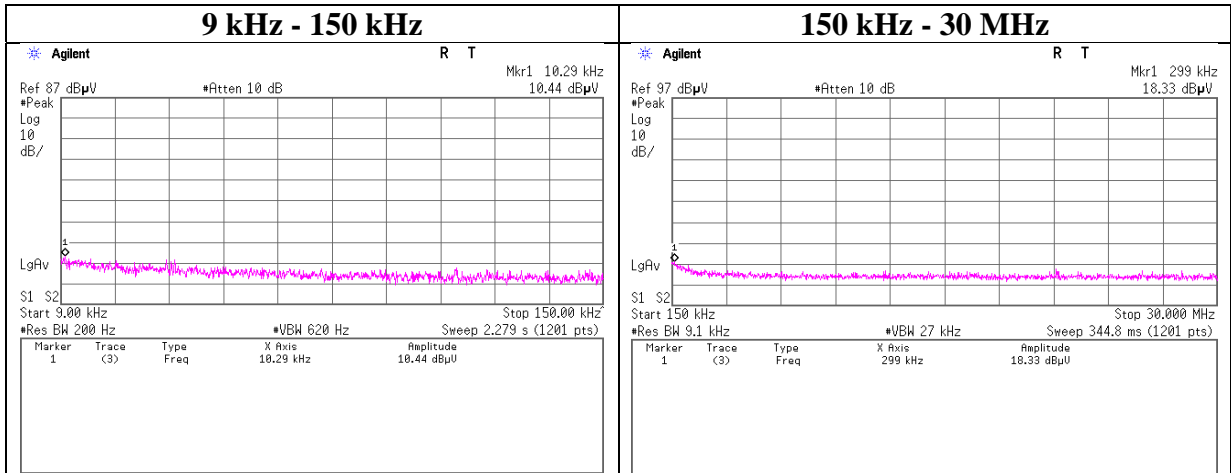
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No.	13809761H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 20, 2021
Temperature / Humidity	24 deg. C / 62 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx, Hopping Off, 3DH5

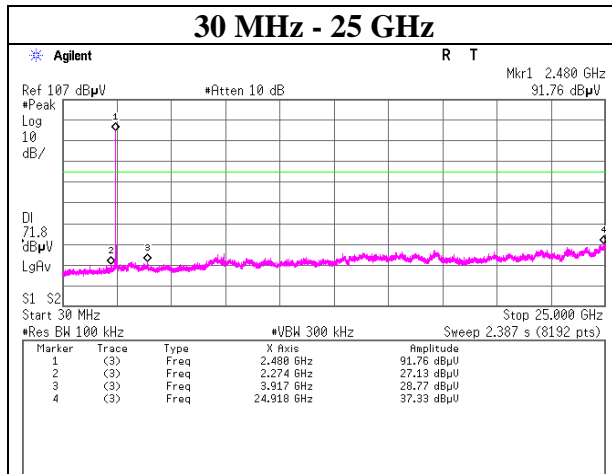
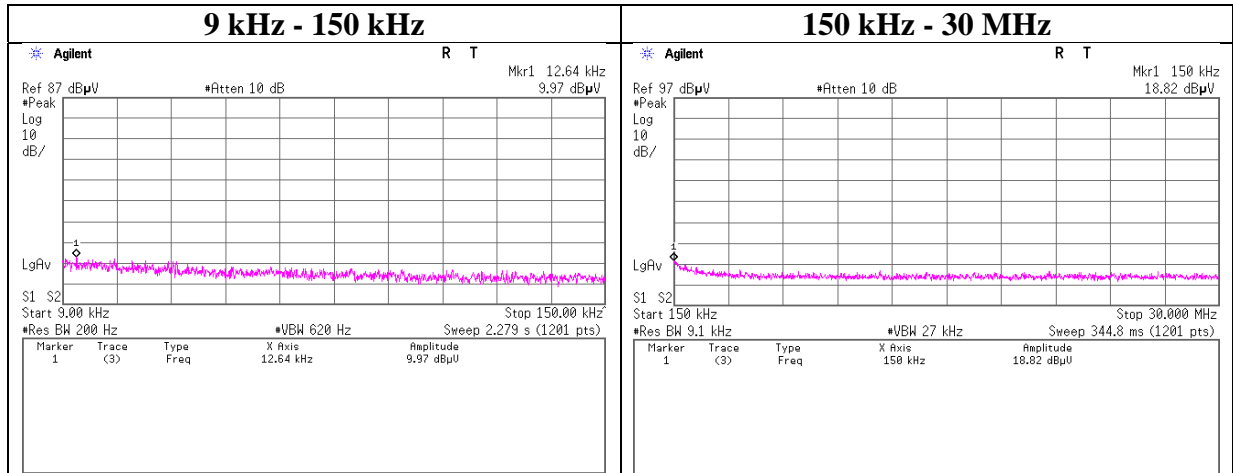
2441 MHz



Conducted Spurious Emission

Report No.	13809761H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 20, 2021
Temperature / Humidity	24 deg. C / 62 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx, Hopping Off, 3DH5

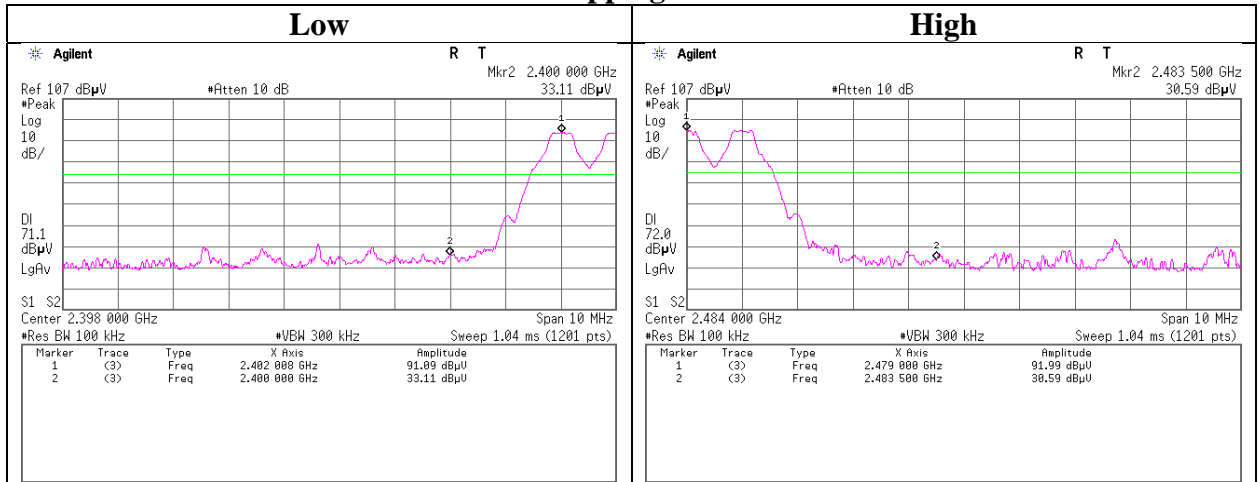
2480 MHz



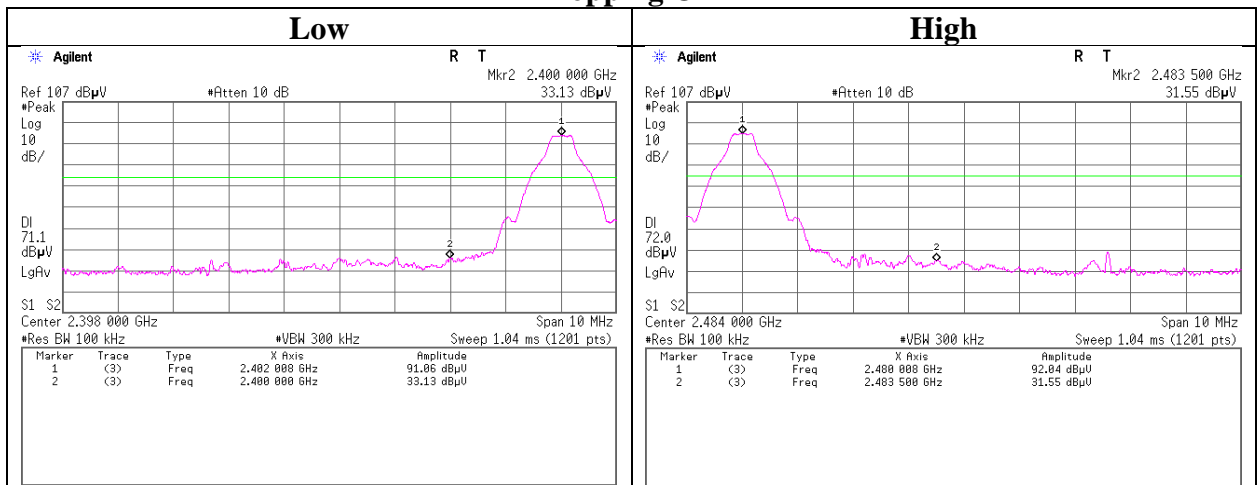
Conducted Emission Band Edge compliance

Report No.	13809761H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 20, 2021
Temperature / Humidity	24 deg. C / 62 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx DH5

Hopping On



Hopping Off



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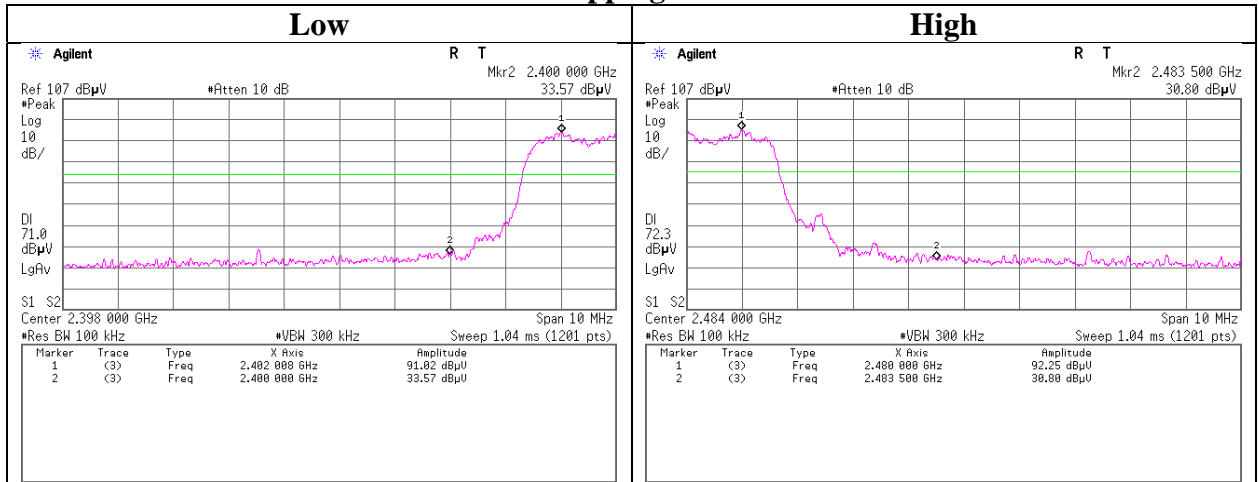
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

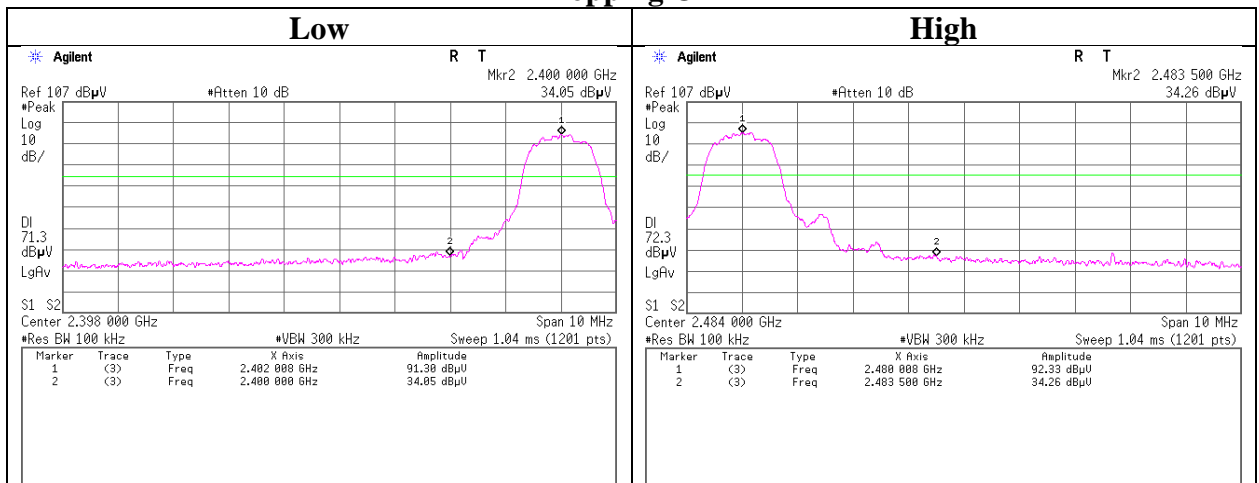
Conducted Emission Band Edge compliance

Report No.	13809761H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 20, 2021
Temperature / Humidity	24 deg. C / 62 % RH
Engineer	Kiyoshiro Okazaki
Mode	Tx 3DH5

Hopping On



Hopping Off



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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MRENT-130	141855	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187750	11/18/2020	12
RE	MHF-25	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/23/2020	12
RE	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	02/18/2021	12
RE	MCC-231	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/1902S579(5m)	03/04/2021	12
RE	MHA-20	141507	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	258	10/01/2020	12
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/26/2020	24
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/06/2020	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/18/2020	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEM1-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MHA-02	141503	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	06/15/2020	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/18/2020	12
RE	MCC-12	141317	Coaxial Cable	UL Japan Inc.	-	-	09/25/2020	12
RE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	02/18/2021	12
RE	MBA-08	141427	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103B+BBA9106	8031	07/29/2020	12
RE	MLA-21	141265	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-190	07/29/2020	12
RE	MAT-07	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	11/13/2020	12
RE	MAEC-02-S VSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/09/2021	24
AT	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/10/2021	12
AT	MCC-92	141398	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	30813/2	05/11/2021	12
AT	MAT-57	141333	Attenuator(10dB)	Suhner	6810.19.A	-	12/07/2020	12
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	MOS-28	141567	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0008	01/15/2021	12
AT	MMM-17	141557	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	70900530	01/07/2021	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

UL Japan, Inc.

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124