



RADIO TEST REPORT

Test Report No. : 12206316H-A-R1

Applicant : **HERUTU ELECTRONICS CORPORATION**
Type of Equipment : **2.4GHz Wireless Module**
Model No. : **HRF-2402**
FCC ID : **T82-HRF2402**
Test regulation : **FCC Part 15 Subpart C: 2018**
Test Result : **Complied**

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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 above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 12206316H-A. 12206316H-A is replaced with this report.

Date of test: March 16 to 23, 2018

Representative test engineer:

K. Yamamoto

Koji Yamamoto
Engineer

Consumer Technology Division

Approved by:

S. Miyazono

Shinichi Miyazono
Engineer

Consumer Technology Division



NVLAP LAB CODE: 200572-0

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*As for the range of Accreditation in NVLAP, you may refer to the WEB address,

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12206316H-A

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CONTENTS	PAGE
SECTION 1: Customer information.....	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results.....	5
SECTION 4: Operation of E.U.T. during testing.....	8
SECTION 5: Conducted Emission.....	11
SECTION 6: Radiated Spurious Emission	12
SECTION 7: Antenna Terminal Conducted Tests.....	13
APPENDIX 1: Test data	14
Conducted Emission	14
6 dB Bandwidth and 99 % Occupied Bandwidth.....	20
Maximum Peak Output Power	22
Average Output Power	23
Radiated Spurious Emission	25
Conducted Spurious Emission	41
Power Density	44
APPENDIX 2: Test instruments	46
APPENDIX 3: Photographs of test setup	47
Conducted Emission	47
Radiated Spurious Emission	50
Worst Case Position	53

SECTION 1: Customer information

Company Name	:	HERUTU ELECTRONICS CORPORATION
Address	:	62-1 TOYOOKA-CHO KITA-KU, HAMAMATSU-SHI SHIZUOKA-KEN JAPAN
Telephone Number	:	+81-53-438-3511
Facsimile Number	:	+81-53-438-3411
Contact Person	:	YOSHIYASU UEDA

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	2.4GHz Wireless Module
Model No.	:	HRF-2402
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.0 V
Receipt Date of Sample	:	March 15, 2018
Country of Mass-production	:	Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: HRF-2402 (referred to as the EUT in this report) is a 2.4GHz Wireless Module.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2403 MHz - 2478 MHz
Modulation	:	GFSK
Antenna type	:	1) 1/4λ Dipole antenna (chip antenna) 2) 1/2λ Dipole antenna (SMB Male connector) 3) 1/2λ Dipole antenna (SMB Male connector) Magnet Base Cable :RG174-1.5m
Antenna Gain	:	3.0 dBi (max)
Clock frequency (Maximum)	:	16 MHz (crystal)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

* The revision on March 12, 2018, does not affect the test specification applied to 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 IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	QP 30.5 dB, 0.15000 MHz, L AV 31.3 dB, 0.51653 MHz, N 1.62507 MHz, N	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(d)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	4.1 dB 4806.000 MHz, AV, Horizontal	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.

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

FCC Part 15.31 (e)

The RF Module has its own regulator.

The RF Module is constantly provided voltage through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

[1/4λ Dipole antenna]

It is impossible for end users to replace the antenna, because it is soldered on the circuit board. Therefore the equipment complies with the requirement of 15.203/212.

[1/2λ Dipole antenna]

The EUT has a unique coupling/antenna connector (SMB Male connector). Therefore the equipment complies with the requirement of 15.203.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	-	Conducted

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

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 (+/-)
RF output power	1.3 dB
Antenna terminal conducted emission / Power density /	2.7 dB
Adjacent channel power / Channel power	
Below 3GHz	1.9 dB
3 GHz or 6 GHz	2.1 dB

Conducted emission

using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.8 dB
	0.15 MHz to 30 MHz	3.4 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)	4.9 dB
	200 MHz to 1000 MHz (Horizontal)	5.0 dB
	(Vertical)	5.0 dB
3 m	1 GHz to 6 GHz	5.0 dB
	6 GHz to 18 GHz	5.3 dB
1 m	10 GHz to 26.5 GHz	5.8 dB
	26.5 GHz to 40 GHz	5.8 dB
10 m	1 GHz to 18 GHz	5.2 dB

Conducted Emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

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3.5 Test Location

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NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	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	2973C-1	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	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	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	2973C-4	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.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	N/A	-	-
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 m x 2.0m 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.

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SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

Mode	Remarks*
Tx	PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 1.5 mW (The same power as the product) Software: hrf_2402_test V1.01 *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.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested Antenna	Tested frequency
Conducted Emission	Tx	1/4λ Dipole antenna 1/2λ Dipole Antenna 1/2λ Dipole Antenna with Magnetic Base	2403 MHz 2441 MHz 2478 MHz
Spurious Emission	Tx	1/4λ Dipole antenna 1/2λ Dipole Antenna 1/2λ Dipole Antenna with Magnetic Base	2403 MHz 2441 MHz 2478 MHz
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	Tx	-	2403 MHz 2441 MHz 2478 MHz

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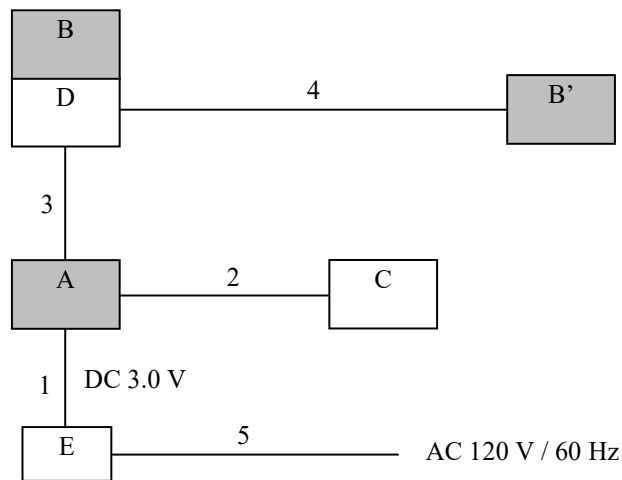
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4.2 Configuration and peripherals

[Conducted emission and Radiated emission 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	2.4 GHz Wireless Module	HRF-2402	A900001	Herutu Electronics Corporation	EUT
B	1/2λ Dipole Antenna	GRF1696	001	VSO Electronics Co., Ltd.	EUT *1)
B'	1/2λ Dipole Antenna with Magnetic Base	MB-13F-2	001	Tekfun Co., Ltd.	EUT *2)
C	Jig	-	-	-	-
D	Antenna Connector	-	-	-	*1) *2)
E	DC Power Supply	PMC35-2A	13090501	Kikusui Electronics Corp.	*CE only

*1) Used for 1/2λ Dipole Antenna

*2) Used for Dipole Antenna with Magnetic Base

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.00 for RE 0.20 for CE	Unshielded	Unshielded	-
2	Signal Cable	0.15	Unshielded	Unshielded	-
3	Antenna Cable	0.10	Shielded	Shielded	*1) *2)
4	RG174 Coaxial Cable	1.50	Shielded	Shielded	*2)
5	AC Cable	1.50	Unshielded	Unshielded	*CE only

*1) Used for 1/2λ Dipole Antenna

*2) Used for Dipole Antenna with Magnetic Base

* CE: Conducted emission test
RE: Radiated emission test

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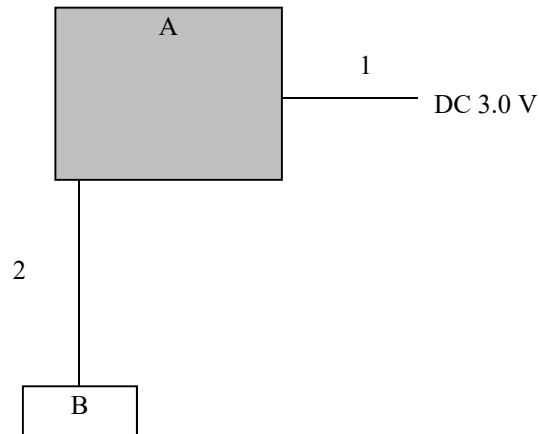
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[Antenna Terminal Conducted Tests]



* 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	Module	HRF-2402	A900001	HERUTU ELECTRONICS CORPORATION	EUT
B	Jig	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC cable	1.0	Unshielded	Unshielded	-
2	Signal Cable	0.2	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

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 rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

1) For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector	: QP and CISPR AV
Measurement range	: 0.15 MHz - 30 MHz
Test data	: APPENDIX
Test result	: Pass

SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v04".

[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 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

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(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

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	Average Power Method: RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces If duty cycle was less than 98%, a duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3 m	4 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)		4 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

*2) Distance Factor: $20 \times \log(4.0 \text{ m} / 3.0 \text{ m}) = 2.5 \text{ dB}$

*3) Distance Factor: $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

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

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

Measurement range : 30 MHz - 26.5 GHz
 Test data : APPENDIX
 Test result : Pass

SECTION 7: 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
6dB Bandwidth	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04". *4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)							

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

Test data : APPENDIX
 Test result : Pass

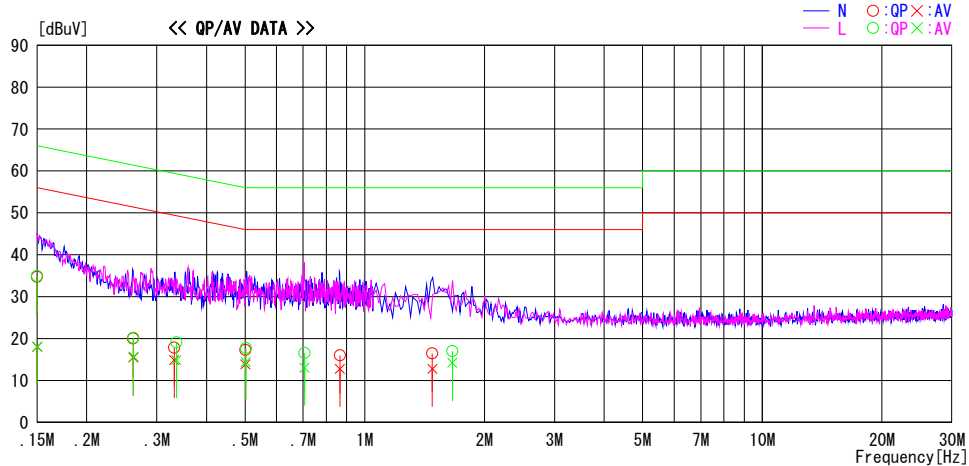
APPENDIX 1: Test data

Conducted Emission

1/4λ Dipole antenna

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 12206316H
Date : March 23, 2018
Temperature / Humidity : 23 deg. C / 33 % RH
Engineer : Koji Yamamoto
Mode : Tx 2441 MHz

LIMIT : FCC15.107(a) QP ClassB
FCC15.107(a) AV ClassB



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	21.5	4.9	13.2	34.7	18.1	66.0	56.0	31.3	37.9	N	
0.26175	6.8	2.3	13.2	20.0	15.5	61.4	51.4	41.4	35.9	N	
0.33167	4.6	1.7	13.2	17.8	14.9	59.4	49.4	41.6	34.5	N	
0.50132	4.1	0.7	13.2	17.3	13.9	56.0	46.0	38.7	32.1	N	
0.86586	2.7	-0.5	13.3	16.0	12.8	56.0	46.0	40.0	33.2	N	
1.47869	3.1	-0.6	13.4	16.5	12.8	56.0	46.0	39.5	33.2	N	
0.15000	21.7	4.9	13.2	34.9	18.1	66.0	56.0	31.1	37.9	L	
0.26232	7.0	2.5	13.2	20.2	15.7	61.4	51.4	41.2	35.7	L	
0.33620	5.9	1.7	13.2	19.1	14.9	59.3	49.3	40.2	34.4	L	
0.50215	4.5	1.2	13.2	17.7	14.4	56.0	46.0	38.3	31.6	L	
0.70523	3.3	-0.2	13.3	16.6	13.1	56.0	46.0	39.4	32.9	L	
1.66163	3.6	0.8	13.4	17.0	14.2	56.0	46.0	39.0	31.8	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

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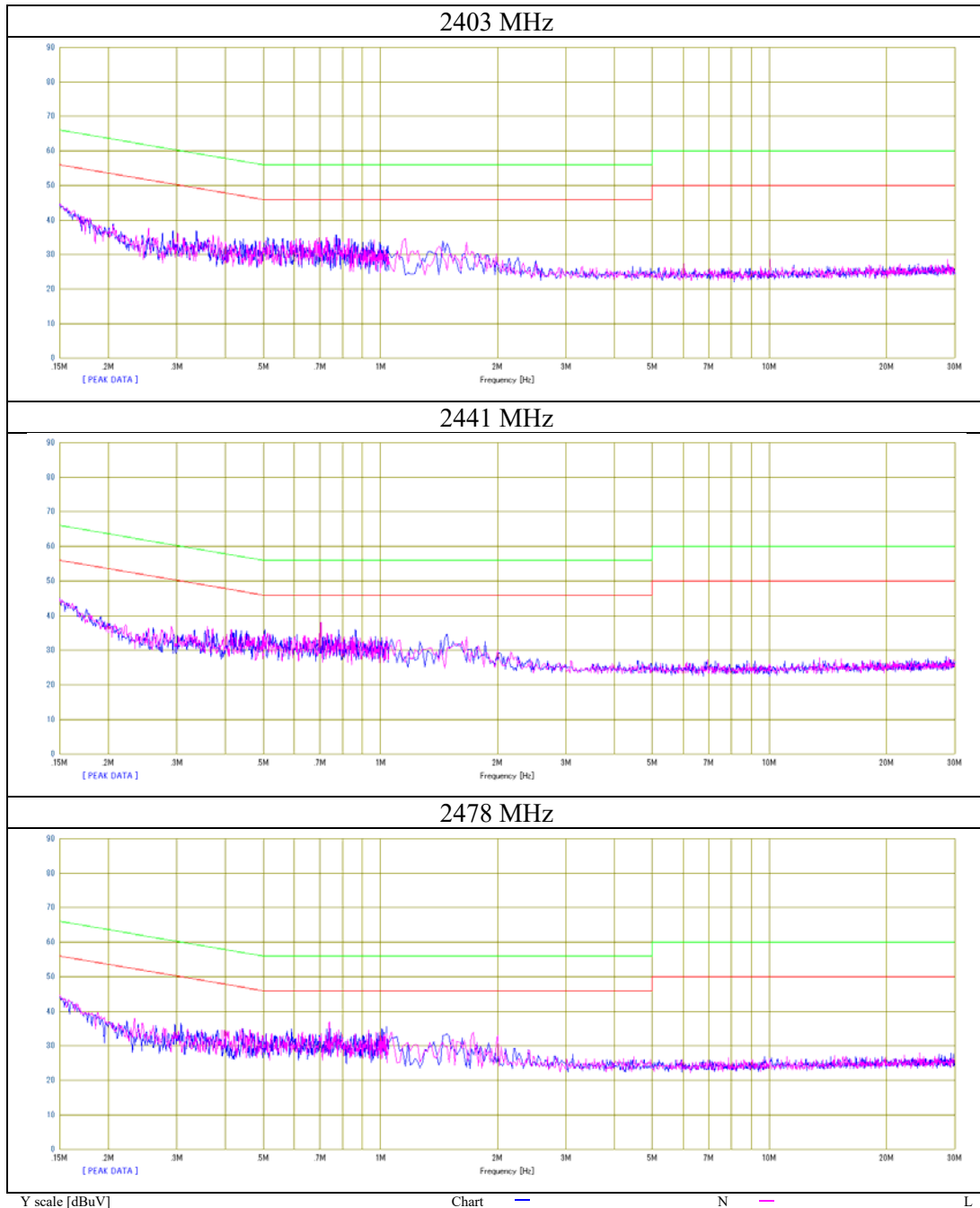
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Conducted Emission

1/4 λ Dipole antenna

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	12206316H
Date	March 23, 2018
Temperature / Humidity	23 deg. C / 33 % RH
Engineer	Koji Yamamoto
Mode	Tx



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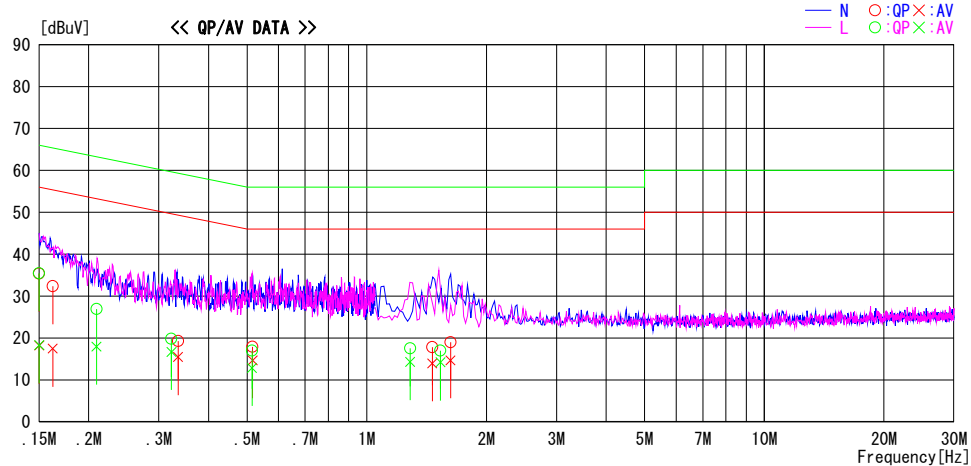
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Conducted Emission

1/2λ Dipole Antenna

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 12206316H
Date : March 23, 2018
Temperature / Humidity : 23 deg. C / 33 % RH
Engineer : Koji Yamamoto
Mode : Tx 2441 MHz

LIMIT : FCC15.107(a) QP ClassB
FCC15.107(a) AV ClassB



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	22.2	5.0	13.2	35.4	18.2	66.0	56.0	30.6	37.8	N	
0.16235	19.2	4.3	13.2	32.4	17.5	65.3	55.3	32.9	37.8	N	
0.33526	6.1	2.3	13.2	19.3	15.5	59.3	49.3	40.0	33.8	N	
0.51653	4.7	1.5	13.2	17.9	14.7	56.0	46.0	38.1	31.3	N	
1.46179	4.4	0.6	13.4	17.8	14.0	56.0	46.0	38.2	32.0	N	
1.62507	5.6	1.3	13.4	19.0	14.7	56.0	46.0	37.0	31.3	N	
0.15000	22.3	5.1	13.2	35.5	18.3	66.0	56.0	30.5	37.7	L	
0.20912	13.7	4.8	13.2	26.9	18.0	63.2	53.2	36.3	35.2	L	
0.32261	6.6	3.5	13.2	19.8	16.7	59.6	49.6	39.8	32.9	L	
0.51433	3.8	-0.3	13.2	17.0	12.9	56.0	46.0	39.0	33.1	L	
1.28518	4.2	0.9	13.4	17.6	14.3	56.0	46.0	38.4	31.7	L	
1.53186	3.6	0.8	13.4	17.0	14.2	56.0	46.0	39.0	31.8	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

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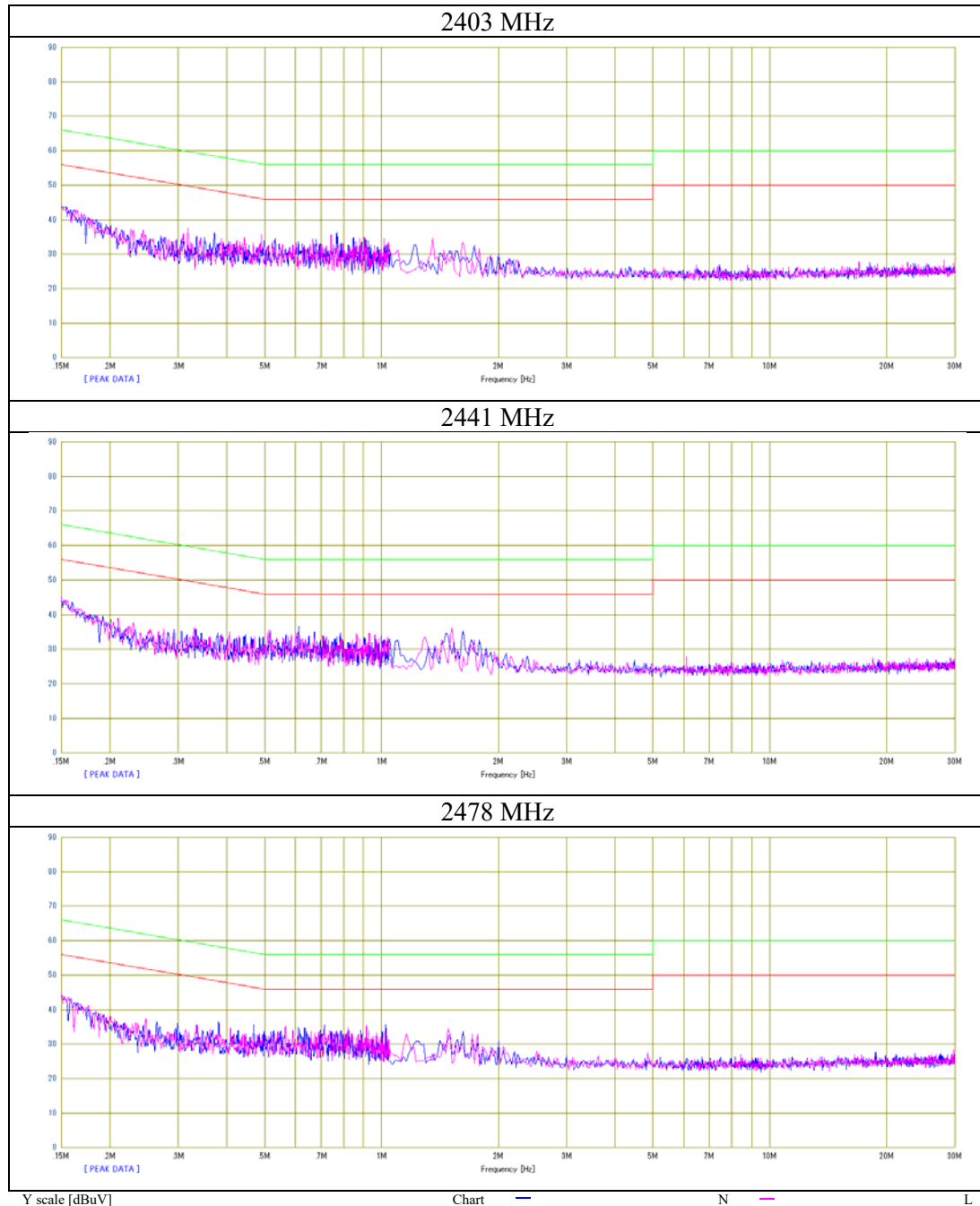
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Emission

1/2λ Dipole Antenna

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	12206316H
Date	March 23, 2018
Temperature / Humidity	23 deg. C / 33 % RH
Engineer	Koji Yamamoto
Mode	Tx



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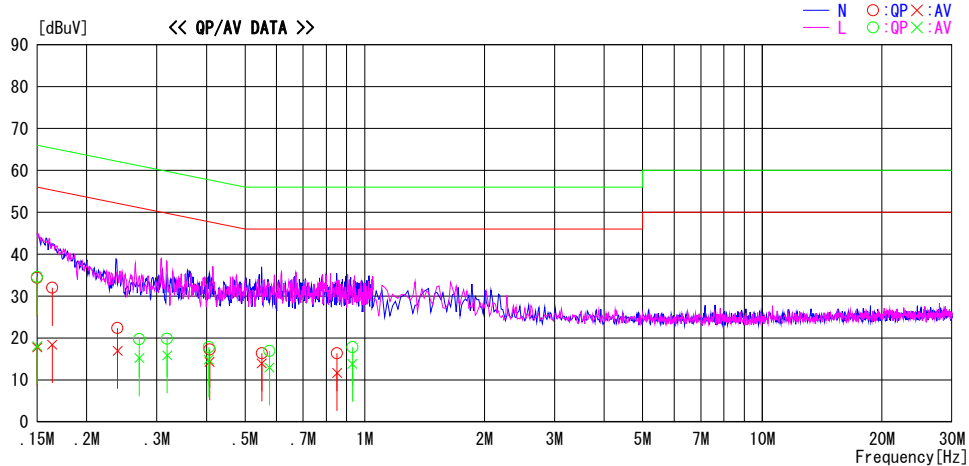
Facsimile : +81 596 24 8124

Conducted Emission

1/2λ Dipole Antenna with Magnetic Base

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 12206316H
Date : March 23, 2018
Temperature / Humidity : 23 deg. C / 33 % RH
Engineer : Koji Yamamoto
Mode : Tx 2441 MHz

LIMIT : FCC15.107(a) QP ClassB
FCC15.107(a) AV ClassB



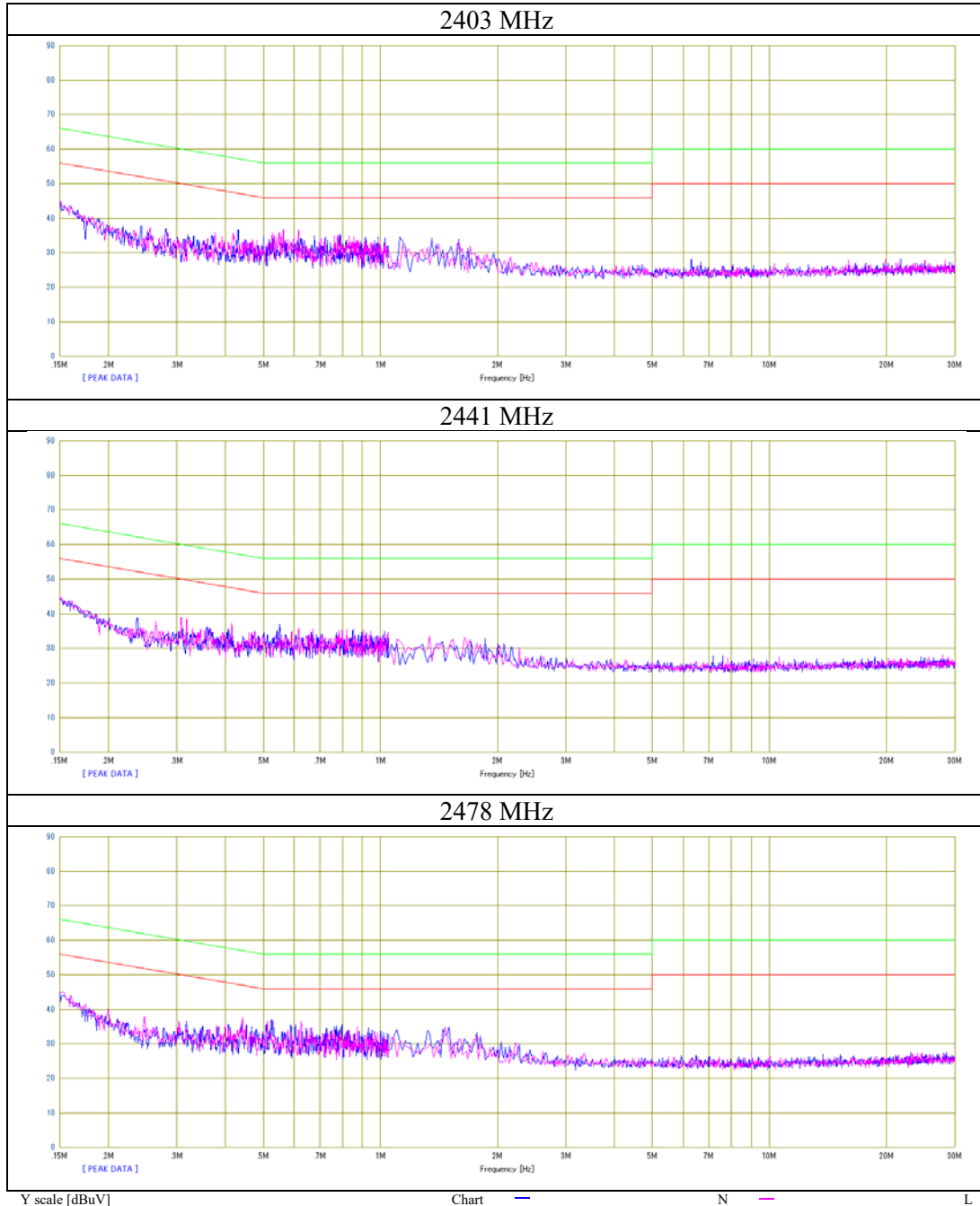
Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	21.2	4.6	13.2	34.4	17.8	66.0	56.0	31.6	38.2	N	
0.16375	18.8	5.2	13.2	32.0	18.4	65.3	55.3	33.3	36.9	N	
0.23912	9.2	3.8	13.2	22.4	17.0	62.1	52.1	39.7	35.1	N	
0.40726	4.1	1.1	13.2	17.3	14.3	57.7	47.7	40.4	33.4	N	
0.55077	3.2	0.8	13.2	16.4	14.0	56.0	46.0	39.6	32.0	N	
0.85217	3.1	-1.6	13.3	16.4	11.7	56.0	46.0	39.6	34.3	N	
0.15000	21.4	4.9	13.2	34.6	18.1	66.0	56.0	31.4	37.9	L	
0.27096	6.5	2.0	13.2	19.7	15.2	61.1	51.1	41.4	35.9	L	
0.31832	6.6	2.7	13.2	19.8	15.9	59.8	49.8	40.0	33.9	L	
0.40557	4.6	1.7	13.2	17.8	14.9	57.7	47.7	39.9	32.8	L	
0.57612	3.7	-0.2	13.2	16.9	13.0	56.0	46.0	39.1	33.0	L	
0.93162	4.5	0.6	13.3	17.8	13.9	56.0	46.0	38.2	32.1	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission

1/2λ Dipole Antenna with Magnetic Base

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	12206316H
Date	March 23, 2018
Temperature / Humidity	23 deg. C / 33 % RH
Engineer	Koji Yamamoto
Mode	Tx



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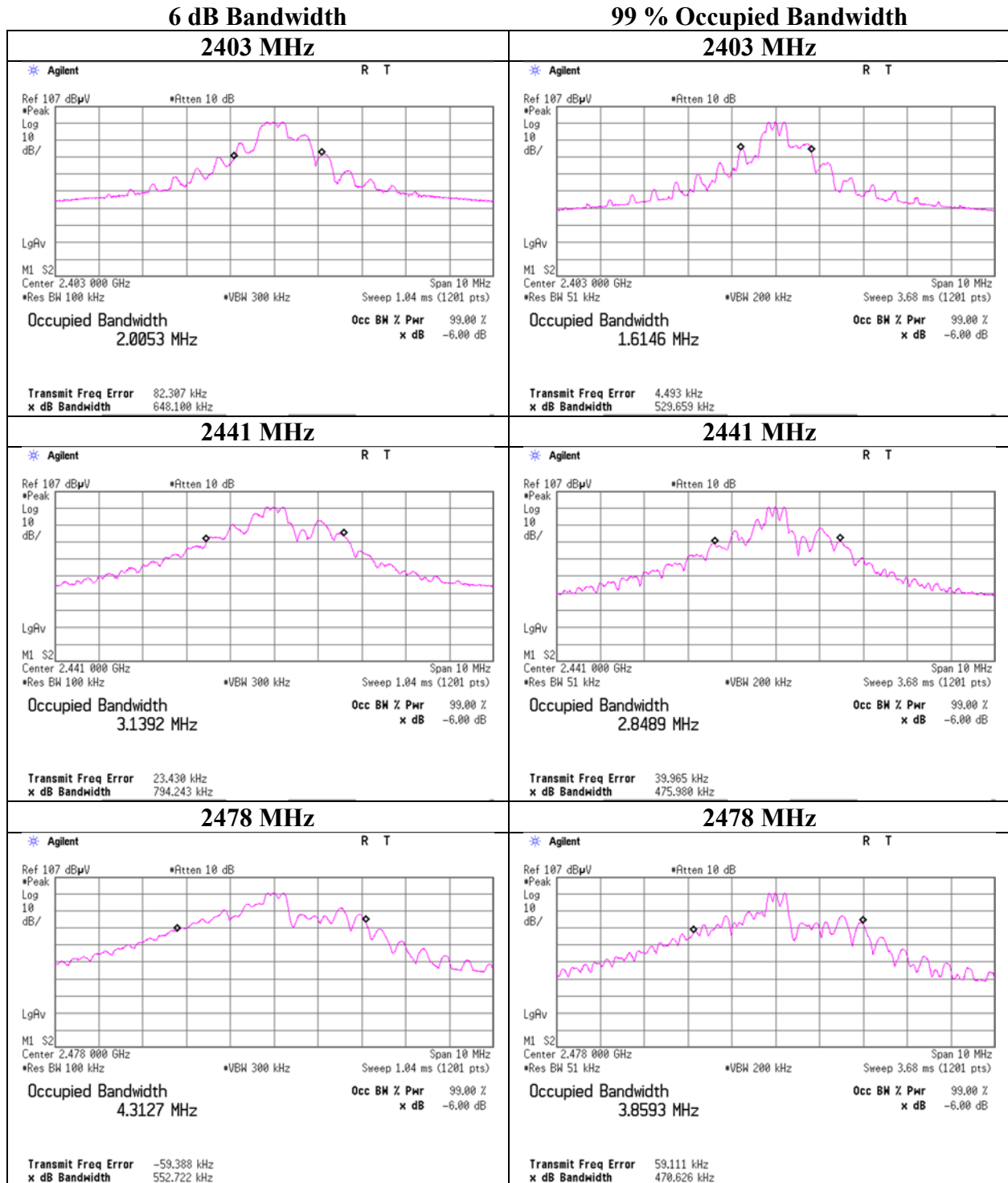
Facsimile : +81 596 24 8124

6 dB Bandwidth and 99 % Occupied Bandwidth

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 12206316H
Date March 16, 2018
Temperature / Humidity 22 deg. C / 51 % RH
Engineer Masafumi Niwa
Mode Tx

Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
2403	1614.6	0.6481	> 0.5000
2441	2848.9	0.7942	> 0.5000
2478	3859.3	0.5527	> 0.5000

6 dB Bandwidth and 99 % Occupied Bandwidth



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Maximum Peak Output Power

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 12206316H
Date March 16, 2018
Temperature / Humidity 22 deg. C / 51 % RH
Engineer Masafumi Niwa
Mode Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2403	-9.61	1.20	10.04	1.63	1.46	30.00	1000	28.37
2441	-9.57	1.20	10.04	1.67	1.47	30.00	1000	28.33
2478	-9.69	1.20	10.04	1.55	1.43	30.00	1000	28.45

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

Average Output Power
(Reference data for RF Exposure)

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	12206316H
Date	March 16, 2018
Temperature / Humidity	22 deg. C / 51 % RH
Engineer	Masafumi Niwa
Mode	Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2403	-10.12	1.20	10.04	1.12	1.29	0.13	1.25	1.33
2441	-10.06	1.20	10.04	1.18	1.31	0.13	1.31	1.35
2478	-10.20	1.20	10.04	1.04	1.27	0.13	1.17	1.31

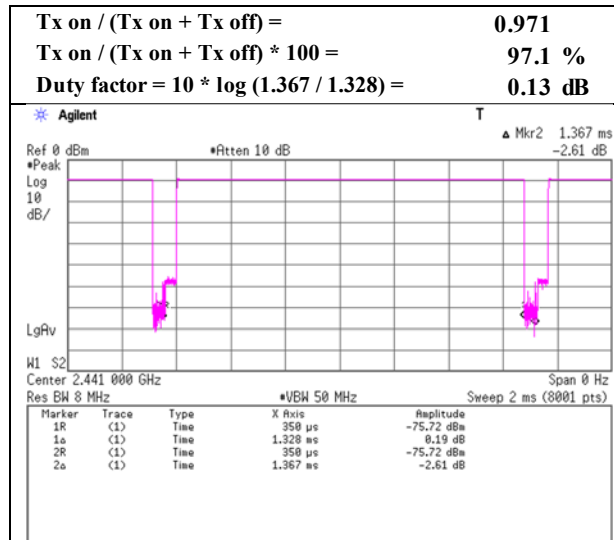
Sample Calculation:

Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

Result (Burst power average) = Time average + Duty factor

Burst rate confirmation

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 12206316H
Date March 16, 2018
Temperature / Humidity 22 deg. C / 51 % RH
Engineer Masafumi Niwa
Mode Tx 2441 MHz



* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Radiated Spurious Emission

1/4λ Dipole antenna

Report No.	12206316H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.2
Date	March 21, 2018	March 22, 2018	March 23, 2018
Temperature / Humidity	21 deg. C / 38 % RH	20 deg. C / 40 % RH	22 deg. C / 35 % RH
Engineer	Koji Yamamoto (1 GHz - 10 GHz)	Tomoki Matsui (Above 10 GHz)	Koji Yamamoto (Below 1 GHz)
Mode	Tx 2403 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	96.000	QP	26.2	9.5	7.4	30.3	-	12.8	43.5	30.7	
Hori	128.000	QP	28.2	13.4	7.7	30.1	-	19.2	43.5	24.3	
Hori	160.000	QP	34.5	15.4	7.9	29.9	-	27.9	43.5	15.6	
Hori	208.008	QP	29.6	11.5	8.2	29.6	-	19.7	43.5	23.8	
Hori	256.005	QP	32.6	11.9	8.5	29.3	-	23.7	46.0	22.3	
Hori	304.005	QP	31.0	13.5	8.9	29.2	-	24.2	46.0	21.8	
Hori	2390.000	PK	49.8	27.4	5.9	32.1	-	51.0	73.9	22.9	
Hori	4806.000	PK	44.1	31.7	8.1	31.3	-	52.6	73.9	21.3	
Hori	7209.000	PK	42.6	36.5	9.5	32.4	-	56.2	73.9	17.7	Floor noise
Hori	9612.000	PK	42.5	38.0	10.2	32.6	-	58.1	73.9	15.8	Floor noise
Hori	2390.000	AV	33.2	27.4	5.9	32.1	0.1	34.5	53.9	19.4	*1)
Hori	4806.000	AV	37.8	31.7	8.1	31.3	0.1	46.4	53.9	7.5	
Hori	7209.000	AV	33.6	36.5	9.5	32.4	-	47.2	53.9	6.7	Floor noise
Hori	9612.000	AV	32.2	38.0	10.2	32.6	-	47.8	53.9	6.1	Floor noise
Vert	96.000	QP	27.5	9.5	7.4	30.3	-	14.1	43.5	29.4	
Vert	128.000	QP	29.9	13.4	7.7	30.1	-	20.9	43.5	22.6	
Vert	160.000	QP	28.3	15.4	7.9	29.9	-	21.7	43.5	21.8	
Vert	208.008	QP	31.1	11.5	8.2	29.6	-	21.2	43.5	22.3	
Vert	256.005	QP	30.6	11.9	8.5	29.3	-	21.7	46.0	24.3	
Vert	304.005	QP	35.5	13.5	8.9	29.2	-	28.7	46.0	17.3	
Vert	2390.000	PK	50.0	27.4	5.9	32.1	-	51.2	73.9	22.7	
Vert	4806.000	PK	45.2	31.7	8.1	31.3	-	53.7	73.9	20.2	
Vert	7209.000	PK	42.6	36.5	9.5	32.4	-	56.2	73.9	17.7	Floor noise
Vert	9612.000	PK	42.5	38.0	10.2	32.6	-	58.1	73.9	15.8	Floor noise
Vert	2390.000	AV	33.2	27.4	5.9	32.1	0.1	34.5	53.9	19.4	*1)
Vert	4806.000	AV	40.0	31.7	8.1	31.3	0.1	48.6	53.9	5.3	
Vert	7209.000	AV	33.6	36.5	9.5	32.4	-	47.2	53.9	6.7	Floor noise
Vert	9612.000	AV	32.2	38.0	10.2	32.6	-	47.8	53.9	6.1	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 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	2403.000	PK	88.2	27.4	5.9	32.1	89.4	-	-	Carrier
Hori	2400.000	PK	53.4	27.4	5.9	32.1	54.6	69.4	14.8	
Vert	2403.000	PK	86.8	27.4	5.9	32.1	88.0	-	-	Carrier
Vert	2400.000	PK	52.3	27.4	5.9	32.1	53.5	68.0	14.5	

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

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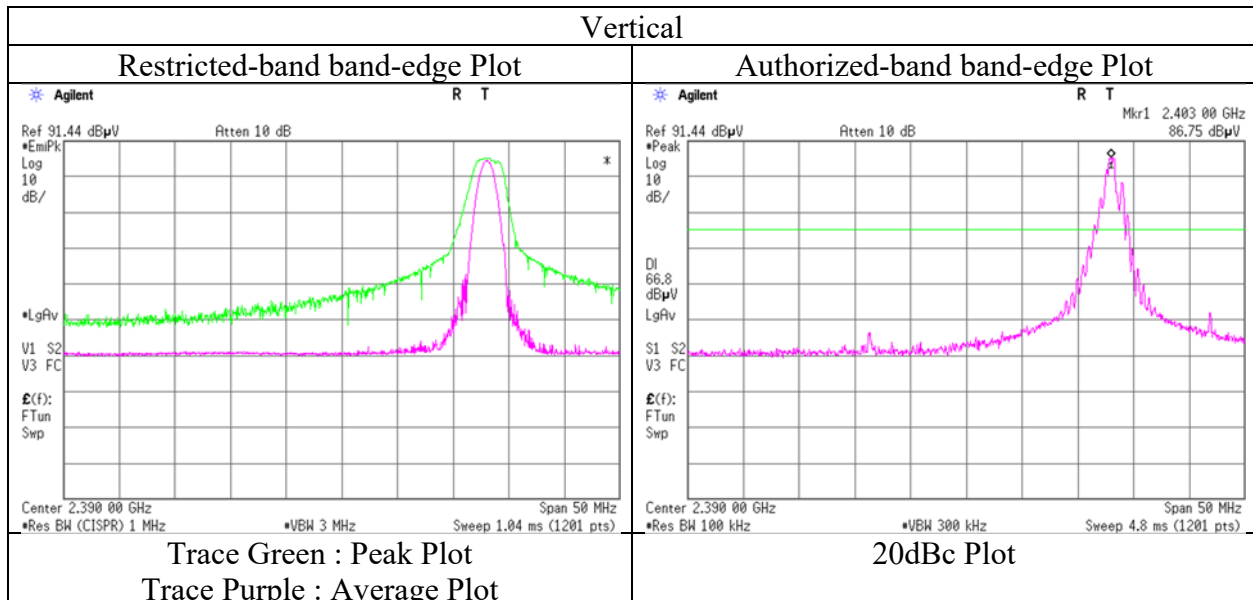
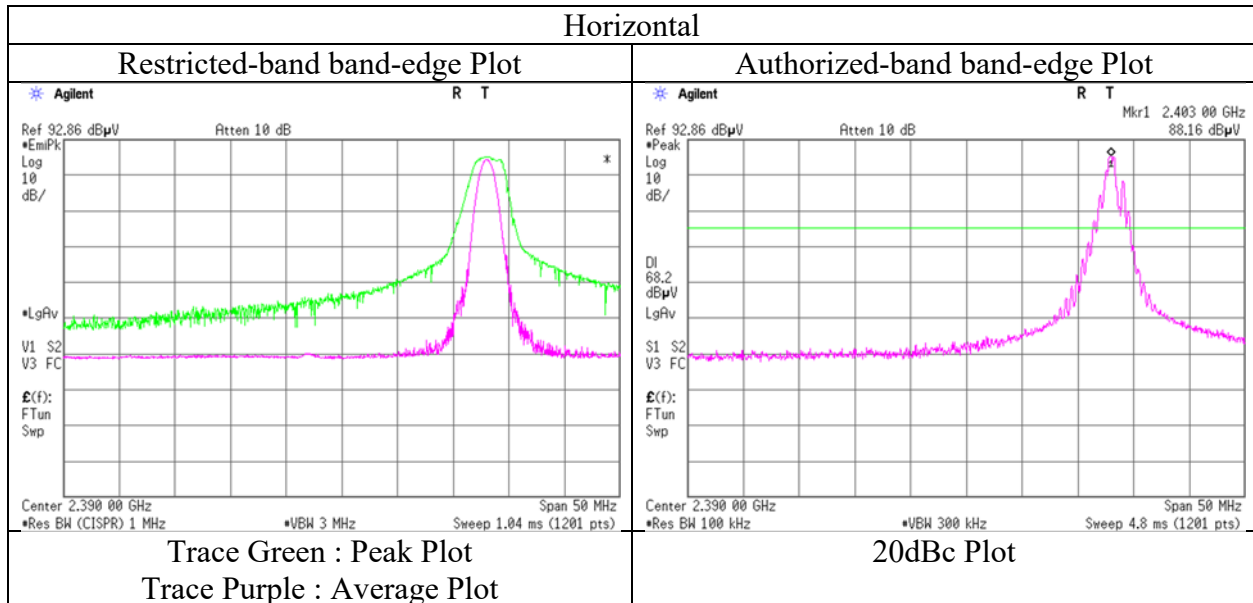
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Radiated Spurious Emission
(Reference Plot for band-edge)
1/4λ Dipole antenna

Report No.	12206316H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	March 21, 2018
Temperature / Humidity	21 deg. C / 38 % RH
Engineer	Koji Yamamoto
	(1 GHz - 10 GHz)
Mode	Tx 2403 MHz



* Final result of restricted band edge was shown in tabular data.

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Radiated Spurious Emission

1/4λ Dipole antenna

Report No.	12206316H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.2
Date	March 21, 2018	March 22, 2018	March 23, 2018
Temperature / Humidity	21 deg. C / 38 % RH	20 deg. C / 40 % RH	22 deg. C / 35 % RH
Engineer	Koji Yamamoto (1 GHz - 10 GHz)	Tomoki Matsui (Above 10 GHz)	Koji Yamamoto (Below 1 GHz)
Mode	Tx 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	96.000	QP	26.8	9.5	7.4	30.3	-	13.4	43.5	30.1	
Hori	128.000	QP	28.5	13.4	7.7	30.1	-	19.5	43.5	24.0	
Hori	160.000	QP	34.2	15.4	7.9	29.9	-	27.6	43.5	15.9	
Hori	208.008	QP	32.2	11.5	8.2	29.6	-	22.3	43.5	21.2	
Hori	256.005	QP	31.8	11.9	8.5	29.3	-	22.9	46.0	23.1	
Hori	304.005	QP	31.5	13.5	8.9	29.2	-	24.7	46.0	21.3	
Hori	4882.000	PK	42.5	31.9	8.2	31.2	-	51.4	73.9	22.5	
Hori	7323.000	PK	42.3	36.6	9.5	32.4	-	56.0	73.9	17.9	Floor noise
Hori	9764.000	PK	42.2	38.1	10.2	32.7	-	57.8	73.9	16.1	Floor noise
Hori	4882.000	AV	35.3	31.9	8.2	31.2	0.1	44.3	53.9	9.6	
Hori	7323.000	AV	33.0	36.6	9.5	32.4	-	46.7	53.9	7.2	Floor noise
Hori	9764.000	AV	32.2	38.1	10.2	32.7	-	47.8	53.9	6.1	Floor noise
Vert	96.000	QP	27.8	9.5	7.4	30.3	-	14.4	43.5	29.1	
Vert	128.000	QP	30.9	13.4	7.7	30.1	-	21.9	43.5	21.6	
Vert	160.000	QP	28.6	15.4	7.9	29.9	-	22.0	43.5	21.5	
Vert	208.008	QP	30.9	11.5	8.2	29.6	-	21.0	43.5	22.5	
Vert	256.005	QP	31.2	11.9	8.5	29.3	-	22.3	46.0	23.7	
Vert	304.005	QP	34.6	13.5	8.9	29.2	-	27.8	46.0	18.2	
Vert	4882.000	PK	43.7	31.9	8.2	31.2	-	52.6	73.9	21.3	
Vert	7323.000	PK	42.3	36.6	9.5	32.4	-	56.0	73.9	17.9	Floor noise
Vert	9764.000	PK	42.2	38.1	10.2	32.7	-	57.8	73.9	16.1	Floor noise
Vert	4882.000	AV	38.2	31.9	8.2	31.2	0.1	47.2	53.9	6.7	
Vert	7323.000	AV	33.0	36.6	9.5	32.4	-	46.7	53.9	7.2	Floor noise
Vert	9764.000	AV	32.2	38.1	10.2	32.7	-	47.8	53.9	6.1	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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Radiated Spurious Emission

1/4λ Dipole antenna

Report No.	12206316H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.2
Date	March 21, 2018	March 22, 2018	March 23, 2018
Temperature / Humidity	21 deg. C / 38 % RH	20 deg. C / 40 % RH	22 deg. C / 35 % RH
Engineer	Koji Yamamoto (1 GHz - 10 GHz)	Tomoki Matsui (Above 10 GHz)	Koji Yamamoto (Below 1 GHz)
Mode	Tx 2478 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	96.000	QP	26.5	9.5	7.4	30.3	-	13.1	43.5	30.4	
Hori	128.000	QP	27.9	13.4	7.7	30.1	-	18.9	43.5	24.6	
Hori	160.000	QP	33.6	15.4	7.9	29.9	-	27.0	43.5	16.5	
Hori	208.008	QP	29.5	11.5	8.2	29.6	-	19.6	43.5	23.9	
Hori	256.005	QP	30.0	11.9	8.5	29.3	-	21.1	46.0	24.9	
Hori	304.005	QP	31.3	13.5	8.9	29.2	-	24.5	46.0	21.5	
Hori	2483.500	PK	61.5	27.5	5.9	32.0	-	62.9	73.9	11.0	
Hori	4956.000	PK	42.6	32.2	8.2	31.2	-	51.8	73.9	22.1	
Hori	7434.000	PK	41.6	36.7	9.5	32.5	-	55.3	73.9	18.6	Floor noise
Hori	9912.000	PK	42.1	38.1	10.2	32.8	-	57.6	73.9	16.3	Floor noise
Hori	2483.500	AV	42.1	27.5	5.9	32.0	0.1	43.6	53.9	10.3	*1)
Hori	4956.000	AV	36.2	32.2	8.2	31.2	0.1	45.5	53.9	8.4	
Hori	7434.000	AV	32.5	36.7	9.5	32.5	-	46.2	53.9	7.7	Floor noise
Hori	9912.000	AV	32.3	38.1	10.2	32.8	-	47.8	53.9	6.1	Floor noise
Vert	96.000	QP	27.9	9.5	7.4	30.3	-	14.5	43.5	29.0	
Vert	128.000	QP	30.3	13.4	7.7	30.1	-	21.3	43.5	22.2	
Vert	160.000	QP	28.8	15.4	7.9	29.9	-	22.2	43.5	21.3	
Vert	208.008	QP	31.2	11.5	8.2	29.6	-	21.3	43.5	22.2	
Vert	256.005	QP	30.6	11.9	8.5	29.3	-	21.7	46.0	24.3	
Vert	304.005	QP	35.5	13.5	8.9	29.2	-	28.7	46.0	17.3	
Vert	2483.500	PK	60.7	27.5	5.9	32.0	-	62.1	73.9	11.8	
Vert	4956.000	PK	42.8	32.2	8.2	31.2	-	52.0	73.9	21.9	
Vert	7434.000	PK	41.6	36.7	9.5	32.5	-	55.3	73.9	18.6	Floor noise
Vert	9912.000	PK	42.1	38.1	10.2	32.8	-	57.6	73.9	16.3	Floor noise
Vert	2483.500	AV	39.8	27.5	5.9	32.0	0.1	41.3	53.9	12.6	*1)
Vert	4956.000	AV	37.3	32.2	8.2	31.2	0.1	46.6	53.9	7.3	
Vert	7434.000	AV	32.5	36.7	9.5	32.5	-	46.2	53.9	7.7	Floor noise
Vert	9912.000	AV	32.3	38.1	10.2	32.8	-	47.8	53.9	6.1	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

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Ise EMC Lab.

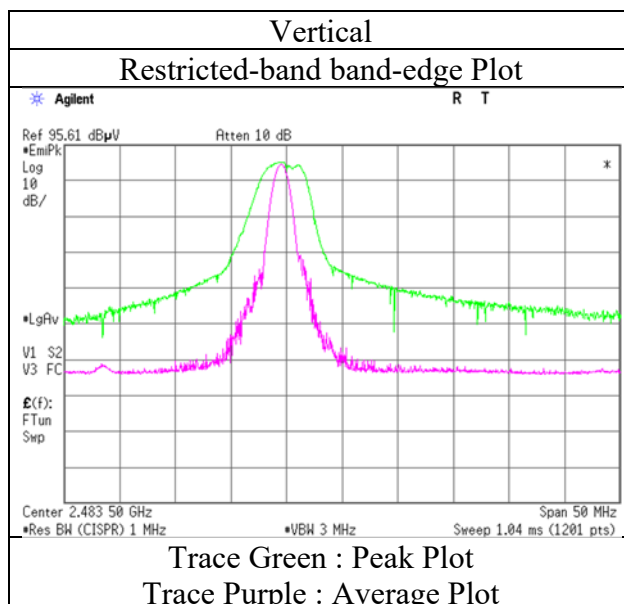
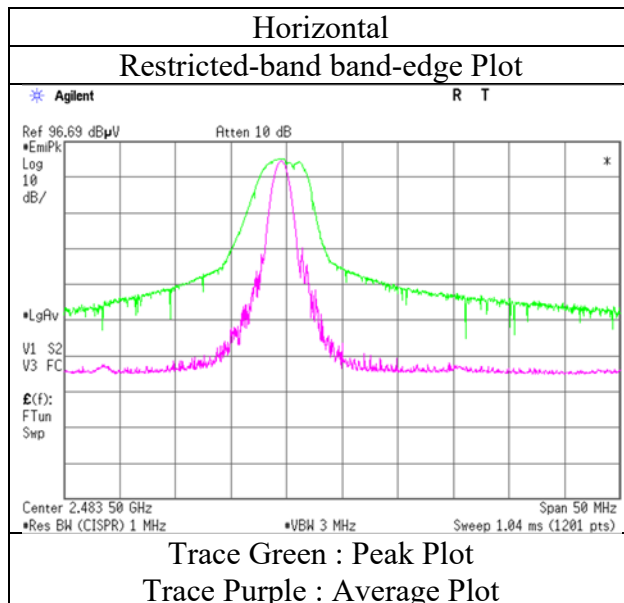
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Radiated Spurious Emission
(Reference Plot for band-edge)
 1/4λ Dipole antenna

Report No.	12206316H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	March 21, 2018
Temperature / Humidity	21 deg. C / 38 % RH
Engineer	Koji Yamamoto (1 GHz - 10 GHz)
Mode	Tx 2478 MHz



* Final result of restricted band edge was shown in tabular data.

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Radiated Spurious Emission

1/2λ Dipole Antenna

Report No.	12206316H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.2
Date	March 22, 2018	March 23, 2018
Temperature / Humidity	20 deg. C / 40 % RH	22 deg. C / 35 % RH
Engineer	Tomoki Matsui (Above 1 GHz)	Koji Yamamoto (Below 1 GHz)
Mode	Tx 2403 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	96.000	QP	29.3	9.5	7.4	30.3	-	15.9	43.5	27.6	
Hori	128.000	QP	28.6	13.4	7.7	30.1	-	19.6	43.5	23.9	
Hori	160.000	QP	33.9	15.4	7.9	29.9	-	27.3	43.5	16.2	
Hori	208.008	QP	30.2	11.5	8.2	29.6	-	20.3	43.5	23.2	
Hori	256.005	QP	32.0	11.9	8.5	29.3	-	23.1	46.0	22.9	
Hori	304.005	QP	31.0	13.5	8.9	29.2	-	24.2	46.0	21.8	
Hori	1201.537	PK	48.6	25.0	4.9	34.2	-	44.3	73.9	29.6	
Hori	2390.000	PK	61.1	27.4	5.9	32.1	-	62.3	73.9	11.6	
Hori	4806.000	PK	43.8	31.7	8.1	31.3	-	52.3	73.9	21.6	
Hori	7209.000	PK	41.9	36.5	9.5	32.4	-	55.5	73.9	18.4	Floor noise
Hori	1201.537	AV	44.0	25.0	4.9	34.2	0.1	39.8	53.9	14.1	
Hori	2390.000	AV	39.3	27.4	5.9	32.1	0.1	40.6	53.9	13.3	*1)
Hori	4806.000	AV	37.9	31.7	8.1	31.3	0.1	46.5	53.9	7.4	
Hori	7209.000	AV	32.1	36.5	9.5	32.4	-	45.7	53.9	8.2	Floor noise
Vert	96.000	QP	30.1	9.5	7.4	30.3	-	16.7	43.5	26.8	
Vert	128.000	QP	28.8	13.4	7.7	30.1	-	19.8	43.5	23.7	
Vert	160.000	QP	32.1	15.4	7.9	29.9	-	25.5	43.5	18.0	
Vert	208.008	QP	31.5	11.5	8.2	29.6	-	21.6	43.5	21.9	
Vert	256.005	QP	29.7	11.9	8.5	29.3	-	20.8	46.0	25.2	
Vert	304.005	QP	34.1	13.5	8.9	29.2	-	27.3	46.0	18.7	
Vert	1201.537	PK	49.2	25.0	4.9	34.2	-	44.9	73.9	29.0	
Vert	2390.000	PK	57.7	27.4	5.9	32.1	-	58.9	73.9	15.0	
Vert	4806.000	PK	44.0	31.7	8.1	31.3	-	52.5	73.9	21.4	
Vert	7209.000	PK	41.9	36.5	9.5	32.4	-	55.5	73.9	18.4	Floor noise
Vert	1201.537	AV	44.8	25.0	4.9	34.2	0.1	40.6	53.9	13.3	
Vert	2390.000	AV	37.0	27.4	5.9	32.1	0.1	38.3	53.9	15.6	*1)
Vert	4806.000	AV	37.2	31.7	8.1	31.3	0.1	45.8	53.9	8.1	
Vert	7209.000	AV	32.1	36.5	9.5	32.4	-	45.7	53.9	8.2	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 (4.0 m / 3.0 m) = 2.5 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	2403.000	PK	97.8	27.4	5.9	32.1	99.0	-	-	Carrier
Hori	2400.000	PK	57.6	27.4	5.9	32.1	58.8	79.0	20.2	
Hori	9612.000	PK	36.0	38.0	10.2	32.6	51.6	79.0	27.4	
Vert	2403.000	PK	98.2	27.4	5.9	32.1	99.4	-	-	Carrier
Vert	2400.000	PK	56.3	27.4	5.9	32.1	57.5	79.4	21.9	
Vert	9612.000	PK	37.0	38.0	9.5	32.6	51.9	79.4	27.5	

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

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Ise EMC Lab.

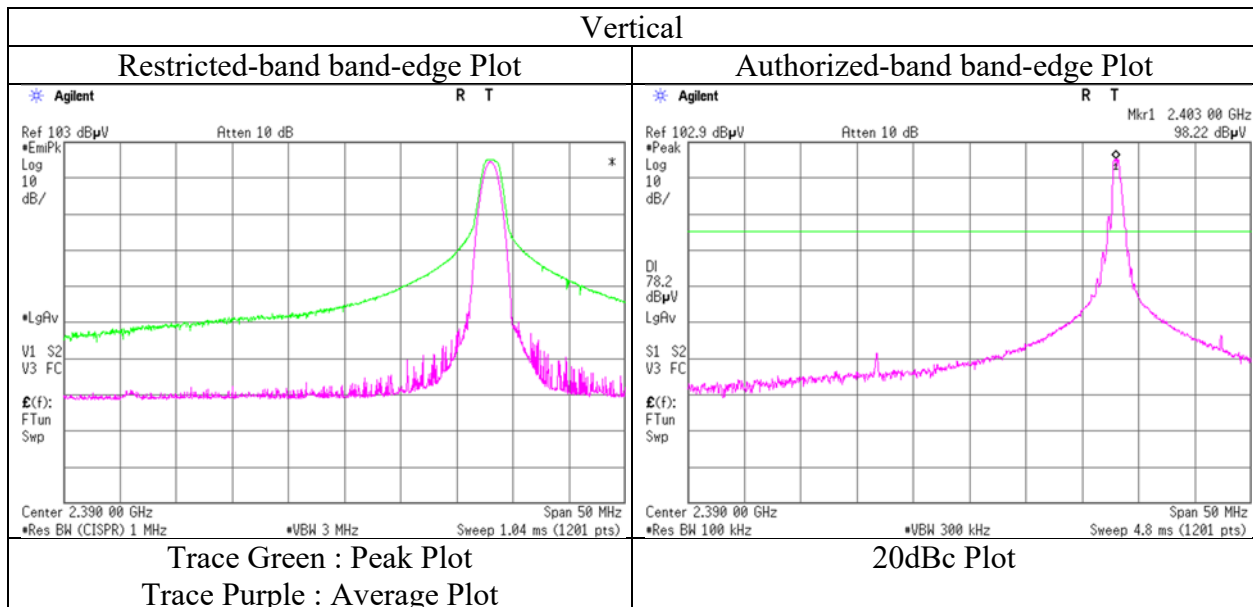
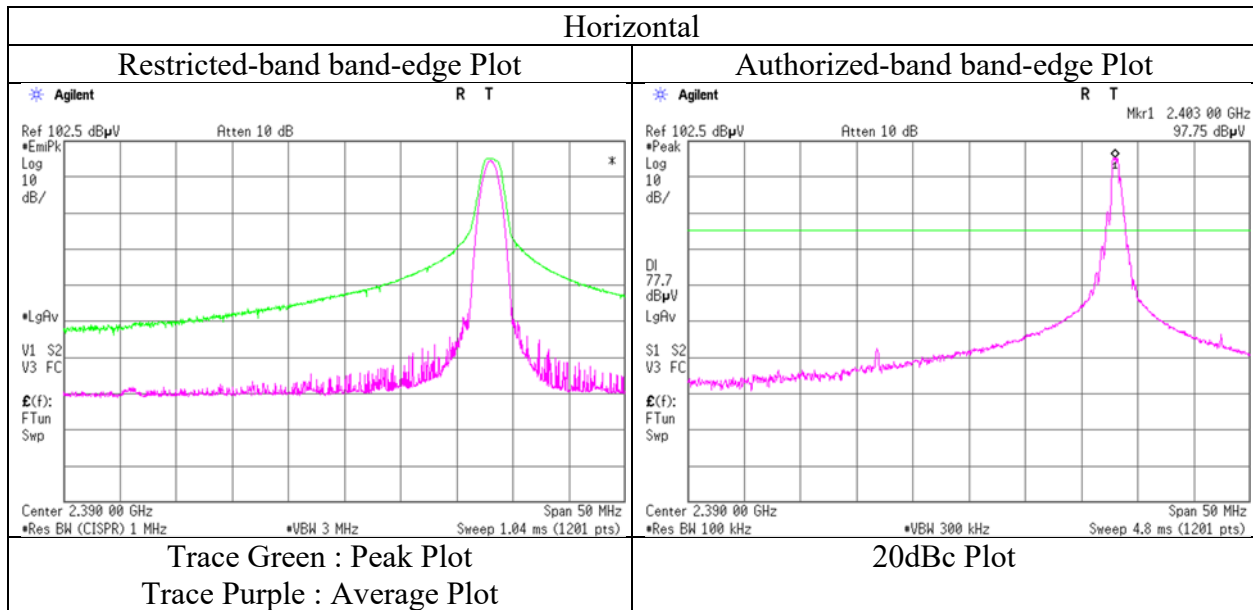
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Radiated Spurious Emission
(Reference Plot for band-edge)
1/2λ Dipole Antenna

Report No.	12206316H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	March 22, 2018
Temperature / Humidity	20 deg. C / 40 % RH
Engineer	Tomoki Matsui (Above 1 GHz)
Mode	Tx 2403 MHz



* Final result of restricted band edge was shown in tabular data.

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Radiated Spurious Emission

1/2λ Dipole Antenna

Report No.	12206316H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.2
Date	March 21, 2018	March 23, 2018
Temperature / Humidity	20 deg. C / 40 % RH	23 deg. C / 32 % RH
Engineer	Tomoki Matsui (Above 1 GHz)	Koji Yamamoto (Below 1 GHz)
Mode	Tx 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	96.000	QP	29.0	9.5	7.4	30.3	-	15.6	43.5	27.9	
Hori	128.000	QP	29.3	13.4	7.7	30.1	-	20.3	43.5	23.2	
Hori	160.000	QP	34.5	15.4	7.9	29.9	-	27.9	43.5	15.6	
Hori	208.008	QP	32.1	11.5	8.2	29.6	-	22.2	43.5	21.3	
Hori	256.005	QP	31.8	11.9	8.5	29.3	-	22.9	46.0	23.1	
Hori	304.005	QP	32.6	13.5	8.9	29.2	-	25.8	46.0	20.2	
Hori	1220.510	PK	48.2	25.0	4.9	34.1	-	44.0	73.9	29.9	
Hori	4882.000	PK	42.1	31.9	7.4	31.2	-	50.2	73.9	23.7	
Hori	7323.000	PK	42.2	36.6	9.5	32.4	-	55.9	73.9	18.0	Floor noise
Hori	1220.510	AV	43.6	25.0	4.9	34.1	0.1	39.5	53.9	14.4	
Hori	4882.000	AV	35.0	31.9	7.4	31.2	0.1	43.2	53.9	10.7	
Hori	7323.000	AV	32.3	36.6	9.5	32.4	-	46.0	53.9	7.9	Floor noise
Vert	96.000	QP	29.6	9.5	7.4	30.3	-	16.2	43.5	27.3	
Vert	128.000	QP	28.7	13.4	7.7	30.1	-	19.7	43.5	23.8	
Vert	160.000	QP	30.6	15.4	7.9	29.9	-	24.0	43.5	19.5	
Vert	208.008	QP	30.3	11.5	8.2	29.6	-	20.4	43.5	23.1	
Vert	256.005	QP	31.1	11.9	8.5	29.3	-	22.2	46.0	23.8	
Vert	304.005	QP	33.8	13.5	8.9	29.2	-	27.0	46.0	19.0	
Vert	1220.510	PK	47.9	25.0	4.9	34.1	-	43.7	73.9	30.2	
Vert	4882.000	PK	41.7	31.9	7.4	31.2	-	49.8	73.9	24.1	
Vert	7323.000	PK	42.2	36.6	9.5	32.4	-	55.9	73.9	18.0	Floor noise
Vert	1220.510	AV	43.3	25.0	4.9	34.1	0.1	39.2	53.9	14.7	
Vert	4882.000	AV	34.3	31.9	7.4	31.2	0.1	42.5	53.9	11.4	
Vert	7323.000	AV	32.3	36.6	9.5	32.4	-	46.0	53.9	7.9	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 $20\log(4.0\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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	2441.000	PK	98.7	27.4	5.9	32.1	99.9	-	-	Carrier
Hori	9764.000	PK	36.6	38.1	10.2	32.7	52.2	79.9	27.7	
Vert	2441.000	PK	97.1	27.4	5.9	32.1	98.3	-	-	Carrier
Vert	9764.000	PK	37.6	38.1	10.2	32.7	53.2	78.3	25.1	

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

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Radiated Spurious Emission

1/2λ Dipole Antenna

Report No.	12206316H	No.2
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	
Date	March 22, 2018	March 23, 2018
Temperature / Humidity	20 deg. C / 40 % RH	22 deg. C / 35 % RH
Engineer	Tomoki Matsui (Above 1 GHz)	Koji Yamamoto (Below 1 GHz)
Mode	Tx 2478 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	96.000	QP	28.8	9.5	7.4	30.3	-	15.4	43.5	28.1	
Hori	128.000	QP	28.9	13.4	7.7	30.1	-	19.9	43.5	23.6	
Hori	160.000	QP	33.8	15.4	7.9	29.9	-	27.2	43.5	16.3	
Hori	208.008	QP	30.3	11.5	8.2	29.6	-	20.4	43.5	23.1	
Hori	256.005	QP	31.3	11.9	8.5	29.3	-	22.4	46.0	23.6	
Hori	304.005	QP	31.6	13.5	8.9	29.2	-	24.8	46.0	21.2	
Hori	1239.980	PK	50.0	25.0	4.9	34.1	-	45.8	73.9	28.1	
Hori	2483.500	PK	63.2	27.5	5.9	32.0	-	64.6	73.9	9.3	
Hori	4956.000	PK	42.6	32.2	8.2	31.2	-	51.8	73.9	22.1	
Hori	7434.000	PK	42.6	36.7	9.5	32.5	-	56.3	73.9	17.6	
Hori	1239.980	AV	46.6	25.0	4.9	34.1	0.1	42.5	53.9	11.4	
Hori	2483.500	AV	41.3	27.5	5.9	32.0	0.1	42.8	53.9	11.1	*1)
Hori	4956.000	AV	33.8	32.2	8.2	31.2	0.1	43.1	53.9	10.8	
Hori	7434.000	AV	32.7	36.7	9.5	32.5	0.1	46.5	53.9	7.4	
Vert	96.000	QP	30.2	9.5	7.4	30.3	-	16.8	43.5	26.7	
Vert	128.000	QP	31.0	13.4	7.7	30.1	-	22.0	43.5	21.5	
Vert	160.000	QP	29.7	15.4	7.9	29.9	-	23.1	43.5	20.4	
Vert	208.008	QP	29.6	11.5	8.2	29.6	-	19.7	43.5	23.8	
Vert	256.005	QP	30.8	11.9	8.5	29.3	-	21.9	46.0	24.1	
Vert	304.005	QP	34.7	13.5	8.9	29.2	-	27.9	46.0	18.1	
Vert	1239.980	PK	48.4	25.0	4.9	34.1	-	44.2	73.9	29.7	
Vert	2483.500	PK	65.3	27.5	5.9	32.0	-	66.7	73.9	7.2	
Vert	4956.000	PK	43.6	32.2	8.2	31.2	-	52.8	73.9	21.1	
Vert	7434.000	PK	41.9	36.7	9.5	32.5	-	55.6	73.9	18.3	
Vert	1239.980	AV	42.4	25.0	4.9	34.1	0.1	38.3	53.9	15.6	
Vert	2483.500	AV	33.4	27.5	5.9	32.0	0.1	34.9	53.9	19.0	*1)
Vert	4956.000	AV	35.8	32.2	8.2	31.2	0.1	45.1	53.9	8.8	
Vert	7434.000	AV	31.9	36.7	9.5	32.5	0.1	45.7	53.9	8.2	

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 (4.0 m / 3.0 m) = 2.5 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	2478.000	PK	96.2	27.5	5.9	32.0	97.6	-	-	Carrier
Hori	9912.000	PK	35.3	38.1	10.2	32.8	50.8	77.6	26.8	
Vert	2478.000	PK	96.1	27.5	5.9	32.0	97.5	-	-	Carrier
Vert	9912.000	PK	34.5	38.1	10.2	32.8	50.0	77.5	27.5	

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

UL Japan, Inc.

Ise EMC Lab.

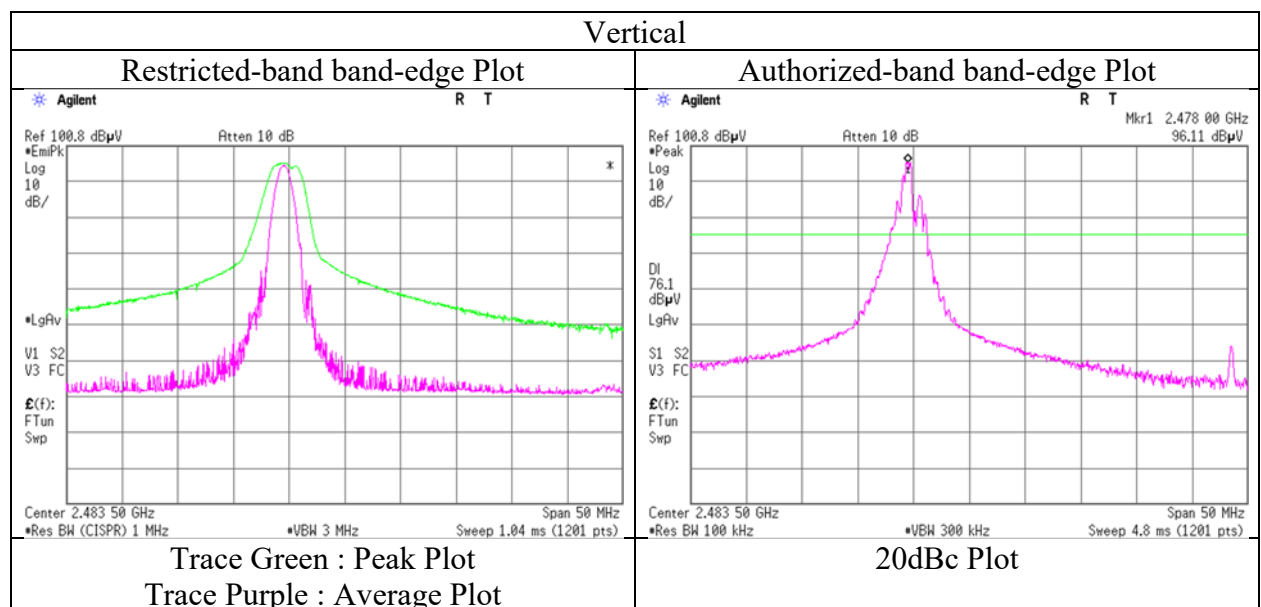
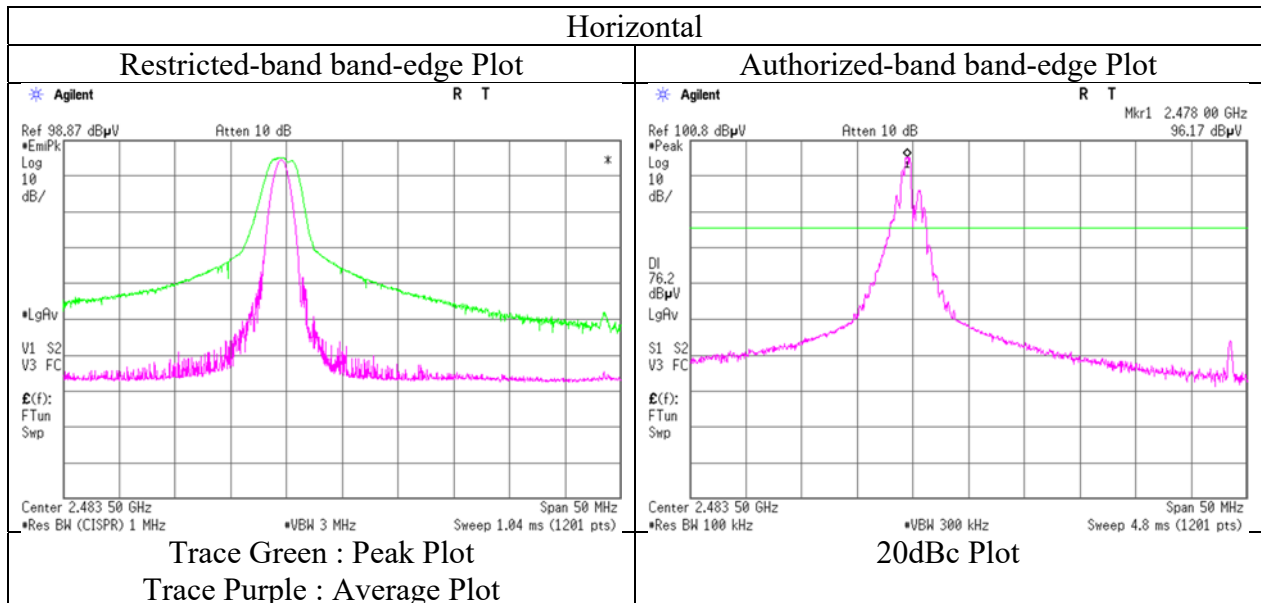
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Radiated Spurious Emission
(Reference Plot for band-edge)
1/2λ Dipole Antenna

Report No.	12206316H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	March 22, 2018
Temperature / Humidity	20 deg. C / 40 % RH
Engineer	Tomoki Matsui
	(1 GHz - 10 GHz)
Mode	Tx 2478 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

1/2λ Dipole Antenna with Magnetic Base

Report No.	12206316H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.2
Date	March 21, 2018	March 22, 2018	March 23, 2018
Temperature / Humidity	21 deg. C / 37 % RH	20 deg. C / 40 % RH	22 deg. C / 35 % RH
Engineer	Koji Yamamoto (1 GHz - 10 GHz)	Tomoki Matsui (Above 10 GHz)	Koji Yamamoto (Below 1 GHz)
Mode	Tx 2403 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	79.998	QP	28.6	6.7	7.3	30.4	-	12.2	40.0	27.8	
Hori	208.008	QP	29.2	11.5	8.2	29.6	-	19.3	43.5	24.2	
Hori	256.005	QP	30.9	11.9	8.5	29.3	-	22.0	46.0	24.0	
Hori	304.005	QP	30.6	13.5	8.9	29.2	-	23.8	46.0	22.2	
Hori	528.006	QP	31.5	18.1	9.9	29.9	-	29.6	46.0	16.4	
Hori	600.004	QP	26.3	19.1	10.2	29.7	-	25.9	46.0	20.1	
Hori	1201.493	PK	54.1	25.0	4.9	34.2	-	49.8	73.9	24.1	
Hori	2390.000	PK	56.4	27.4	5.9	32.1	-	57.6	73.9	16.3	
Hori	4806.000	PK	46.1	31.7	8.1	31.3	-	54.6	73.9	19.3	
Hori	7209.000	PK	42.6	36.5	9.5	32.4	-	56.2	73.9	17.7	Floor noise
Hori	9612.000	PK	42.5	38.0	10.2	32.6	-	58.1	73.9	15.8	Floor noise
Hori	1201.493	AV	51.4	25.0	4.9	34.2	0.1	47.2	53.9	6.7	
Hori	2390.000	AV	36.7	27.4	5.9	32.1	0.1	38.0	53.9	15.9	*1)
Hori	4806.000	AV	41.2	31.7	8.1	31.3	0.1	49.8	53.9	4.1	
Hori	7209.000	AV	32.7	36.5	9.5	32.4	-	46.3	53.9	7.6	Floor noise
Hori	9612.000	AV	32.1	38.0	10.2	32.6	-	47.7	53.9	6.2	Floor noise
Vert	79.998	QP	31.0	6.7	7.3	30.4	-	14.6	40.0	25.4	
Vert	208.008	QP	29.8	11.5	8.2	29.6	-	19.9	43.5	23.6	
Vert	256.005	QP	31.3	11.9	8.5	29.3	-	22.4	46.0	23.6	
Vert	304.005	QP	32.5	13.5	8.9	29.2	-	25.7	46.0	20.3	
Vert	528.006	QP	29.2	18.1	9.9	29.9	-	27.3	46.0	18.7	
Vert	600.004	QP	29.8	19.1	10.2	29.7	-	29.4	46.0	16.6	
Vert	1201.493	PK	49.9	25.0	4.9	34.2	-	45.6	73.9	28.3	
Vert	2390.000	PK	59.4	27.4	5.9	32.1	-	60.6	73.9	13.3	
Vert	4806.000	PK	44.5	31.7	8.1	31.3	-	53.0	73.9	20.9	
Vert	7209.000	PK	42.6	36.5	9.5	32.4	-	56.2	73.9	17.7	Floor noise
Vert	9612.000	PK	42.5	38.0	10.2	32.6	-	58.1	73.9	15.8	Floor noise
Vert	1201.493	AV	45.4	25.0	4.9	34.2	0.1	41.2	53.9	12.7	
Vert	2390.000	AV	39.3	27.4	5.9	32.1	0.1	40.6	53.9	13.3	*1)
Vert	4806.000	AV	39.2	31.7	8.1	31.3	0.1	47.8	53.9	6.1	
Vert	7209.000	AV	32.7	36.5	9.5	32.4	-	46.3	53.9	7.6	Floor noise
Vert	9612.000	AV	32.1	38.0	10.2	32.6	-	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 (4.0 m / 3.0 m) = 2.5 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	2403.000	PK	95.7	27.4	5.9	32.1	96.9	-	-	Carrier
Hori	2400.000	PK	54.2	27.4	5.9	32.1	55.4	76.9	21.5	
Vert	2403.000	PK	96.2	27.4	5.9	32.1	97.4	-	-	Carrier
Vert	2400.000	PK	55.5	27.4	5.9	32.1	56.7	77.4	20.7	

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

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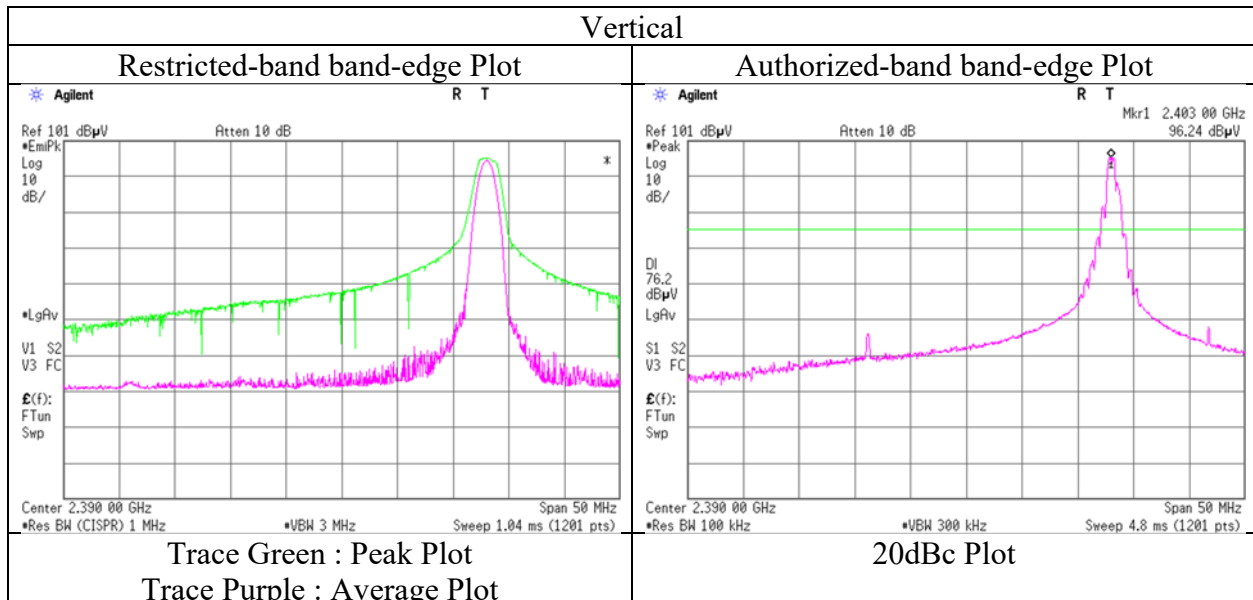
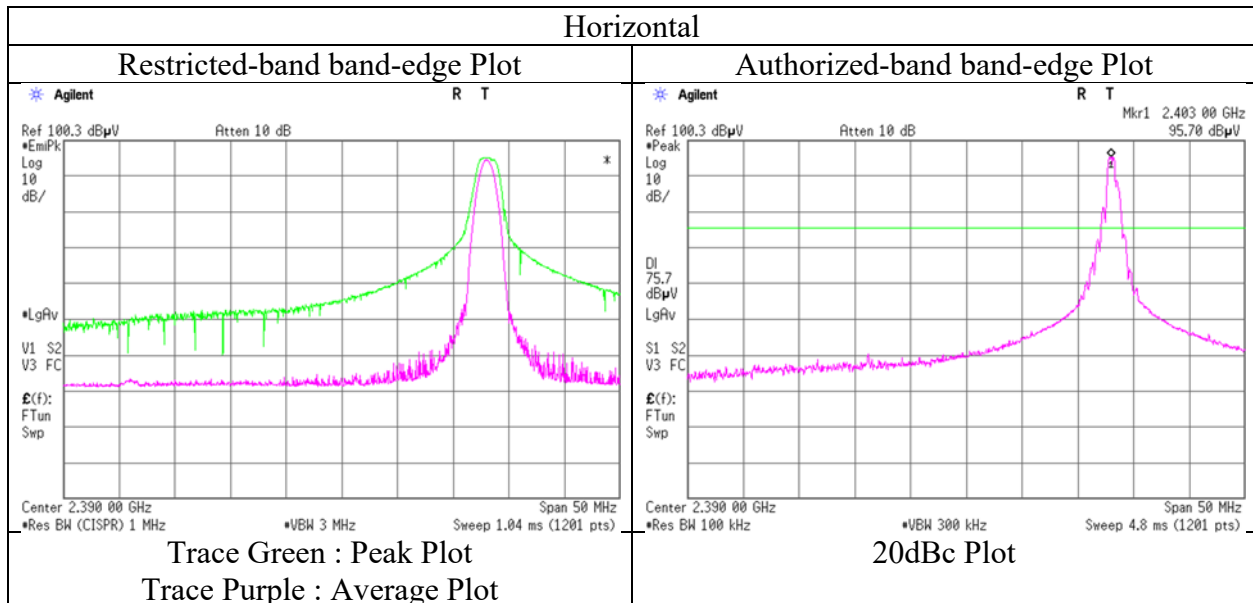
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Radiated Spurious Emission
(Reference Plot for band-edge)
1/2λ Dipole Antenna with Magnetic Base

Report No.	12206316H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	March 21, 2018
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Koji Yamamoto
	(1 GHz - 10 GHz)
Mode	Tx 2403 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
1/2λ Dipole Antenna with Magnetic Base

Report No.	12206316H	No.4	No.2
Test place	Ise EMC Lab.	March 22, 2018	March 23, 2018
Semi Anechoic Chamber	No.4	20 deg. C / 40 % RH	22 deg. C / 35 % RH
Date	March 21, 2018		
Temperature / Humidity	21 deg. C / 37 % RH		
Engineer	Koji Yamamoto	Tomoki Matsui	Koji Yamamoto
	(1 GHz - 10 GHz)	(Above 10 GHz)	(Below 1 GHz)
Mode	Tx 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	79.998	QP	28.6	6.7	7.3	30.4	-	12.2	40.0	27.8	
Hori	160.000	QP	34.6	15.4	7.9	29.9	-	28.0	43.5	15.5	
Hori	208.008	QP	29.1	11.5	8.2	29.6	-	19.2	43.5	24.3	
Hori	256.005	QP	30.7	11.9	8.5	29.3	-	21.8	46.0	24.2	
Hori	304.005	QP	33.2	13.5	8.9	29.2	-	26.4	46.0	19.6	
Hori	528.006	QP	29.1	18.1	9.9	29.9	-	27.2	46.0	18.8	
Hori	1220.510	PK	50.8	25.0	4.9	34.1	-	46.6	73.9	27.3	
Hori	4882.000	PK	43.7	31.9	8.2	31.2	-	52.6	73.9	21.3	
Hori	7323.000	PK	41.8	36.6	9.5	32.4	-	55.5	73.9	18.4	Floor noise
Hori	9764.000	PK	42.0	38.1	10.2	32.7	-	57.6	73.9	16.3	Floor noise
Hori	1220.510	AV	46.3	25.0	4.9	34.1	0.1	42.2	53.9	11.7	
Hori	4882.000	AV	38.0	31.9	8.2	31.2	0.1	47.0	53.9	6.9	
Hori	7323.000	AV	32.6	36.6	9.5	32.4	-	46.3	53.9	7.6	Floor noise
Hori	9764.000	AV	32.2	38.1	10.2	32.7	-	47.8	53.9	6.1	Floor noise
Vert	79.998	QP	33.2	6.7	7.3	30.4	-	16.8	40.0	23.2	
Vert	160.000	QP	29.7	15.4	7.9	29.9	-	23.1	43.5	20.4	
Vert	208.008	QP	30.7	11.5	8.2	29.6	-	20.8	43.5	22.7	
Vert	256.005	QP	31.1	11.9	8.5	29.3	-	22.2	46.0	23.8	
Vert	304.005	QP	34.8	13.5	8.9	29.2	-	28.0	46.0	18.0	
Vert	528.006	QP	29.2	18.1	9.9	29.9	-	27.3	46.0	18.7	
Vert	1220.510	PK	48.2	25.0	4.9	34.1	-	44.0	73.9	29.9	
Vert	4882.000	PK	42.3	31.9	8.2	31.2	-	51.2	73.9	22.7	
Vert	7323.000	PK	41.8	36.6	9.5	32.4	-	55.5	73.9	18.4	Floor noise
Vert	9764.000	PK	42.0	38.1	10.2	32.7	-	57.6	73.9	16.3	Floor noise
Vert	1220.510	AV	42.1	25.0	4.9	34.1	0.1	38.0	53.9	15.9	
Vert	4882.000	AV	35.9	31.9	8.2	31.2	0.1	44.9	53.9	9.0	
Vert	7323.000	AV	32.6	36.6	9.5	32.4	-	46.3	53.9	7.6	Floor noise
Vert	9764.000	AV	32.2	38.1	10.2	32.7	-	47.8	53.9	6.1	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

1/2λ Dipole Antenna with Magnetic Base

Report No.	12206316H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.2
Date	March 21, 2018	March 22, 2018	March 23, 2018
Temperature / Humidity	21 deg. C / 37 % RH	20 deg. C / 40 % RH	22 deg. C / 35 % RH
Engineer	Koji Yamamoto (1 GHz - 10 GHz)	Tomoki Matsui (Above 10 GHz)	Koji Yamamoto (Below 1 GHz)
Mode	Tx 2478 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	80.000	QP	28.5	6.7	7.3	30.4	-	12.1	40.0	27.9	
Hori	160.000	QP	33.8	15.4	7.9	29.9	-	27.2	43.5	16.3	
Hori	208.008	QP	29.6	11.5	8.2	29.6	-	19.7	43.5	23.8	
Hori	256.005	QP	31.6	11.9	8.5	29.3	-	22.7	46.0	23.3	
Hori	304.005	QP	30.8	13.5	8.9	29.2	-	24.0	46.0	22.0	
Hori	528.006	QP	29.3	18.1	9.9	29.9	-	27.4	46.0	18.6	
Hori	1239.000	PK	55.3	25.0	4.9	34.1	-	51.1	73.9	22.8	
Hori	2483.500	PK	59.7	27.5	5.9	32.0	-	61.1	73.9	12.8	
Hori	4956.000	PK	42.9	32.2	8.2	31.2	-	52.1	73.9	21.8	
Hori	7434.000	PK	41.3	36.7	9.5	32.5	-	55.0	73.9	18.9	Floor noise
Hori	9912.000	PK	42.2	38.1	10.2	32.8	-	57.7	73.9	16.2	Floor noise
Hori	1239.000	AV	53.0	25.0	4.9	34.1	0.1	48.9	53.9	5.0	
Hori	2483.500	AV	39.3	27.5	5.9	32.0	0.1	40.8	53.9	13.1	*1)
Hori	4956.000	AV	35.1	32.2	8.2	31.2	0.1	44.4	53.9	9.5	
Hori	7434.000	AV	31.2	36.7	9.5	32.5	-	44.9	53.9	9.0	Floor noise
Hori	9912.000	AV	31.9	38.1	10.2	32.8	-	47.4	53.9	6.5	Floor noise
Vert	80.000	QP	33.5	6.7	7.3	30.4	-	17.1	40.0	22.9	
Vert	160.000	QP	29.7	15.4	7.9	29.9	-	23.1	43.5	20.4	
Vert	208.008	QP	30.5	11.5	8.2	29.6	-	20.6	43.5	22.9	
Vert	256.005	QP	33.1	11.9	8.5	29.3	-	24.2	46.0	21.8	
Vert	304.005	QP	33.9	13.5	8.9	29.2	-	27.1	46.0	18.9	
Vert	528.006	QP	29.3	18.1	9.9	29.9	-	27.4	46.0	18.6	
Vert	1239.000	PK	49.2	25.0	4.9	34.1	-	45.0	73.9	28.9	
Vert	2483.500	PK	62.0	27.5	5.9	32.0	-	63.4	73.9	10.5	
Vert	4956.000	PK	42.5	32.2	8.2	31.2	-	51.7	73.9	22.2	
Vert	7434.000	PK	41.3	36.7	9.5	32.5	-	55.0	73.9	18.9	Floor noise
Vert	9912.000	PK	42.2	38.1	10.2	32.8	-	57.7	73.9	16.2	Floor noise
Vert	1239.000	AV	45.6	25.0	4.9	34.1	0.1	41.5	53.9	12.4	
Vert	2483.500	AV	41.3	27.5	5.9	32.0	0.1	42.8	53.9	11.1	*1)
Vert	4956.000	AV	33.7	32.2	8.2	31.2	0.1	43.0	53.9	10.9	
Vert	7434.000	AV	31.2	36.7	9.5	32.5	-	44.9	53.9	9.0	Floor noise
Vert	9912.000	AV	31.9	38.1	10.2	32.8	-	47.4	53.9	6.5	Floor noise

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

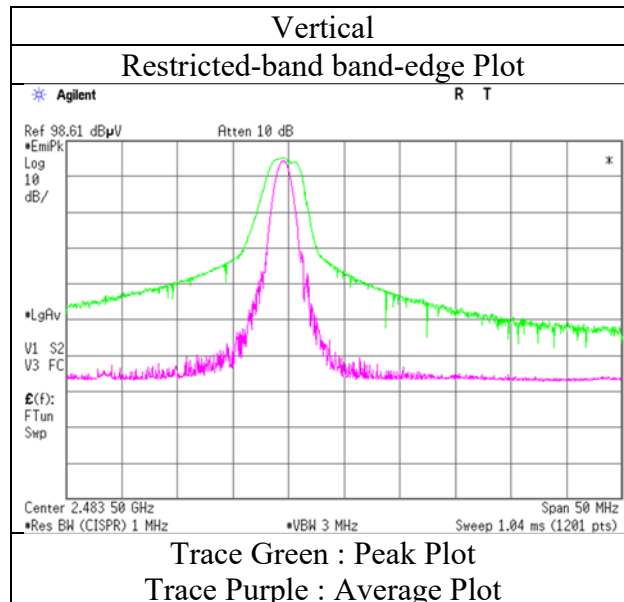
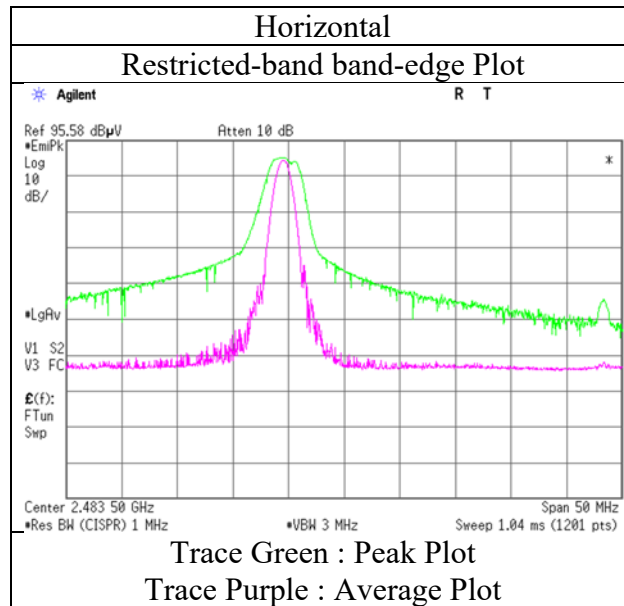
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

Radiated Spurious Emission
(Reference Plot for band-edge)
1/2λ Dipole Antenna with Magnetic Base

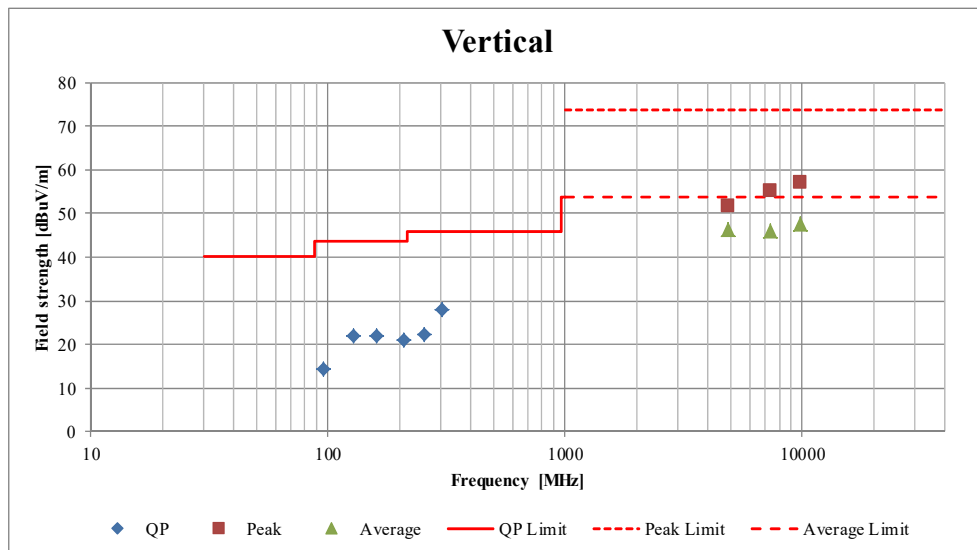
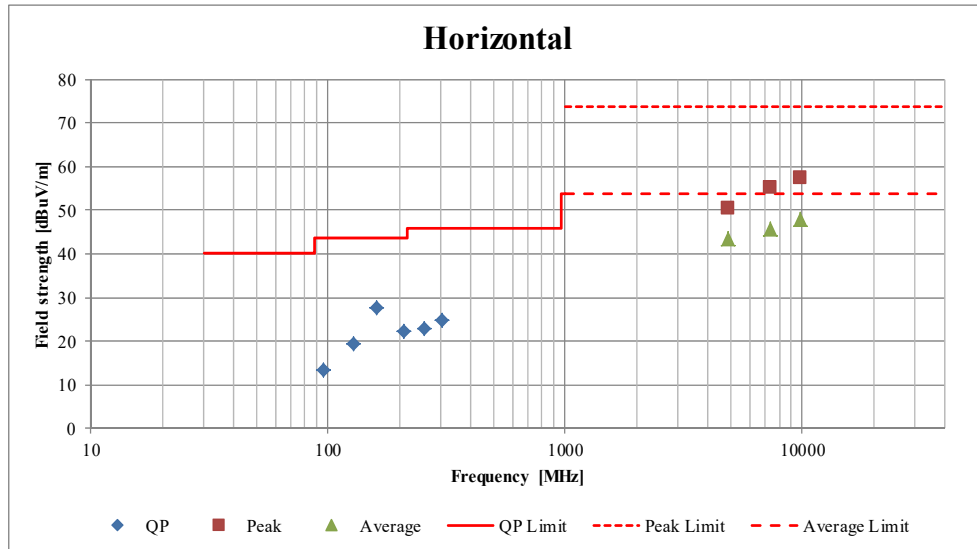
Report No.	12206316H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	March 21, 2018
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Koji Yamamoto (1 GHz - 10 GHz)
Mode	Tx 2478 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12206316H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.2
Date	March 21, 2018	March 22, 2018	March 23, 2018
Temperature / Humidity	21 deg. C / 38 % RH	20 deg. C / 40 % RH	22 deg. C / 35 % RH
Engineer	Koji Yamamoto	Tomoki Matsui	Koji Yamamoto
	(1 GHz - 10 GHz)	(Above 10 GHz)	(Below 1 GHz)
Mode	Tx 2441 MHz (1/4λ Dipole antenna)		



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

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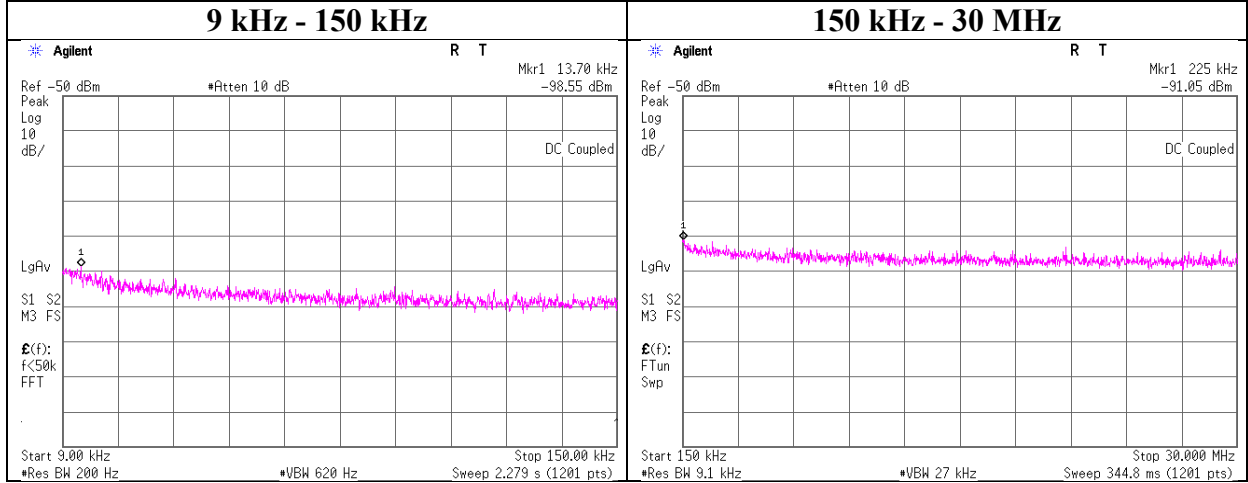
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	12206316H
Date	March 16, 2018
Temperature / Humidity	22 deg. C / 51 % RH
Engineer	Masafumi Niwa
Mode	Tx 2403 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
13.70	-98.6	1.20	9.8	3.0	1	-84.5	300	6.0	-23.3	44.8	68.1	
225.00	-91.1	1.20	9.8	3.0	1	-77.0	300	6.0	-15.8	20.5	36.3	

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

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

N: Number of output

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Ise EMC Lab.

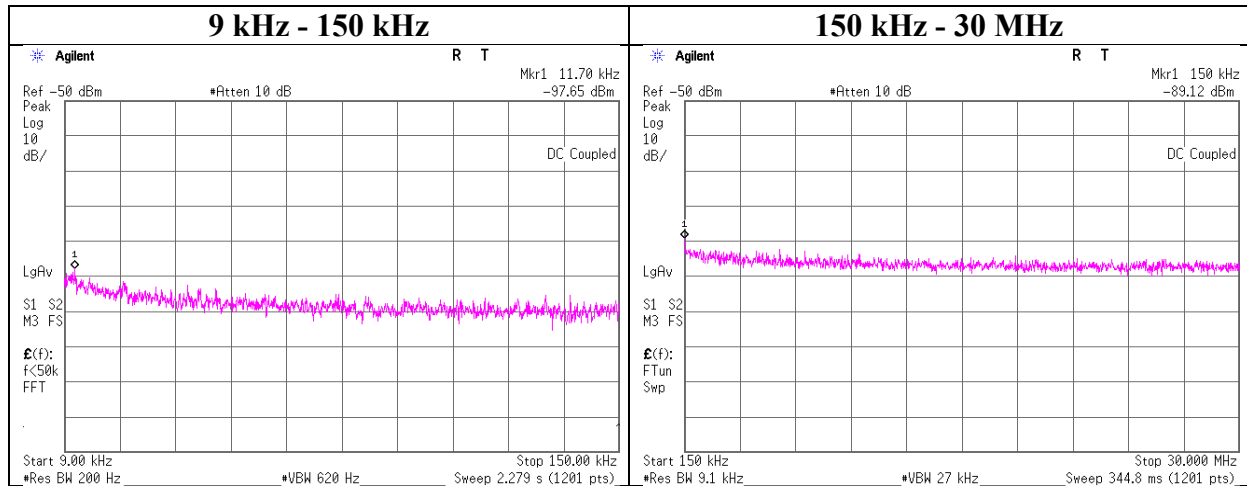
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	12206316H
Date	March 16, 2018
Temperature / Humidity	22 deg. C / 51 % RH
Engineer	Masafumi Niwa
Mode	Tx 2441 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.70	-97.7	1.20	9.8	3.0	1	-83.6	300	6.0	-22.4	46.2	68.6	
150.00	-89.1	1.20	9.8	3.0	1	-75.1	300	6.0	-13.8	24.0	37.8	

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

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

N: Number of output

UL Japan, Inc.

Ise EMC Lab.

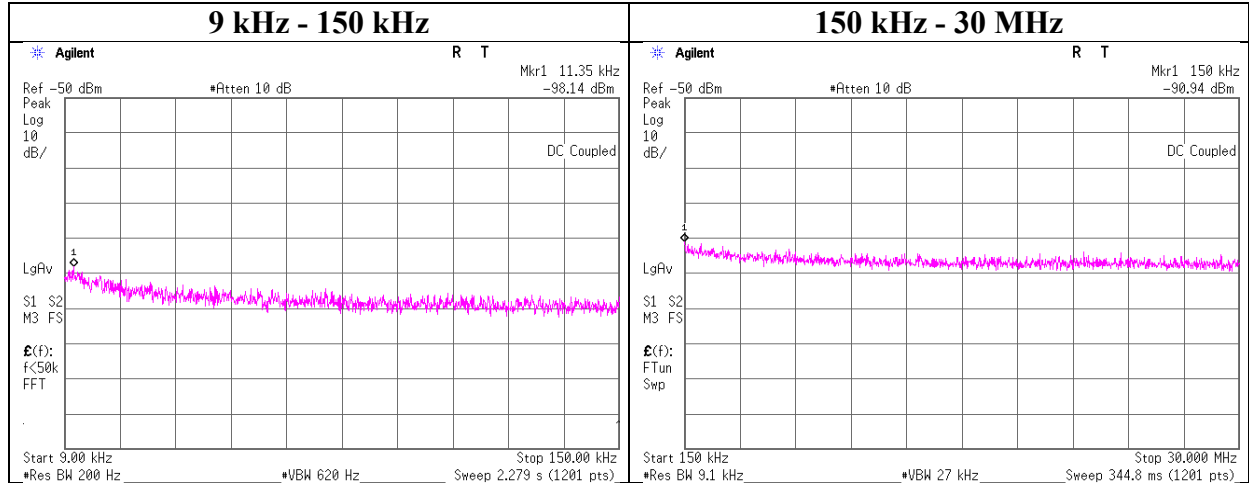
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	12206316H
Date	March 16, 2018
Temperature / Humidity	22 deg. C / 51 % RH
Engineer	Masafumi Niwa
Mode	Tx 2478 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.35	-98.1	1.20	9.8	3.0	1	-84.1	300	6.0	-22.9	46.5	69.4	
150.00	-90.9	1.20	9.8	3.0	1	-76.9	300	6.0	-15.7	24.0	39.7	

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

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

N: Number of output

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Power Density

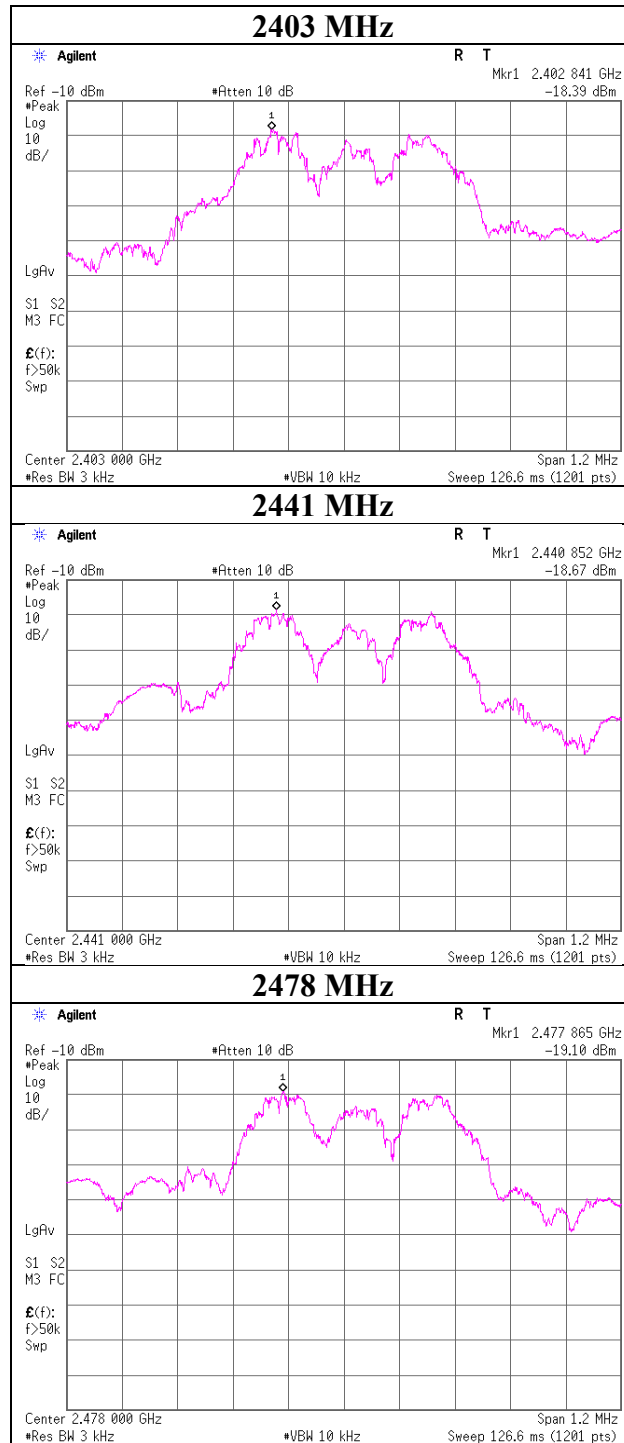
Test place Ise EMC Lab. No.6 Measurement Room
Report No. 12206316H
Date March 16, 2018
Temperature / Humidity 22 deg. C / 51 % RH
Engineer Masafumi Niwa
Mode Tx

Freq.	Reading	Cable	Atten.	Result	Limit	Margin
[MHz]	[dBm]	Loss	Loss	[dBm]	[dBm]	[dB]
		[dB]	[dB]			
2403.00	-18.39	1.20	10.04	-7.15	8.00	15.15
2441.00	-18.67	1.20	10.04	-7.43	8.00	15.43
2478.00	-19.10	1.20	10.04	-7.86	8.00	15.86

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

Power Density



UL Japan, Inc.

Ise EMC Lab.

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APPENDIX 2: Test instruments

Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2017/10/30 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2018/01/24 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MRENT-130	Spectrum Analyzer	Agilent	E4440A	MY46187750	RE	2017/11/17 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2017/09/15 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2017/06/23 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2017/10/06 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2017/09/11 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2018/01/09 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2017/06/30 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE/CE	2017/08/31 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/CE	2017/12/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE/CE	-
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	RE/CE	2017/09/20 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE/CE	2017/08/21 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2017/07/24 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/ 5D-2W(5m)/ 5D-2W(0.8m)/ 5D-2W(1m)	-	CE	2018/02/23 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2017/12/19 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE/CE	2017/08/07 * 12
MBA-08	Biconical Antenna	Schwarzbeck	VHA9103B	08031	RE	2017/09/13 * 12
MLA-21	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2017/12/10 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2018/02/23 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2017/11/14 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2017/09/27 * 12
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	AT	2017/11/16 * 12
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2017/11/16 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2017/11/16 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2018/03/12 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2017/11/14 * 12
MMM-12	DIGITAL HiTESTER	Hioki	3805	060500120	AT	2018/02/07 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2018/01/24 * 12

The expiration date of the calibration is the end of the expired month.

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

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test item: CE: Conducted Emission test
RE: Radiated Emission test
AT: Antenna Terminal Conducted test

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