



RADIO TEST REPORT


Test Report No. : 12103115H-A-R1

Applicant : Roland Corporation
Type of Equipment : Wireless Transmitter
Model No. : WL-T
FCC ID : SOP420321A
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.
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4. The test results in this report are traceable to the national or international standards.
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6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 12103115H-A. 12103115H-A is replaced with this report.

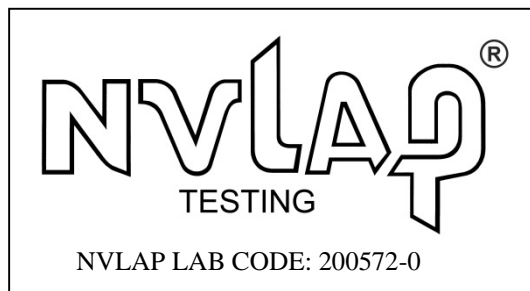
Date of test: December 19 and 20, 2017

Representative test engineer:


Tomohisa Nakagawa
Engineer
Consumer Technology Division

Approved by:


Tsubasa Takayama
Leader
Consumer Technology Division



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SECTION 1: Customer information

Company Name : Roland Corporation
Address : 1-5-3 Shinmiyakoda, Kita-ku, Hamamatsu, Shizuoka 431-1304, JAPAN
Telephone Number : +81-53-428-5095
Facsimile Number : +81-53-428-5097
Contact Person : Hisashi Ninomiya

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

2.1 Identification of E.U.T.

Type of Equipment : Wireless Transmitter
Model No. : WL-T
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 3.7 V (DC 5 V for battery charging)
Receipt Date of Sample : December 19, 2017
Country of Mass-production : China
Condition of EUT : Engineering 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: WL-T (referred to as the EUT in this report) is a Wireless Transmitter.

Radio Specification

Radio Type : Transmitter
Frequency of Operation : 2402 MHz - 2478 MHz
Modulation : GFSK
Power Supply (radio part input) : DC 3.3 V
Antenna type : Pattern Antenna
Antenna Gain : 2.51 dBi max
Clock frequency : 32 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on January 2, 2018 and effective February 1, 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 January 2, 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 22.0 dB, 0.65876 MHz, L AV 27.1 dB, 0.65876 MHz, N / L	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	2.1 dB 2350.079 MHz, Horizontal, AV	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)

This EUT provides stable voltage (DC 3.3 V) constantly to RF Module 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.

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

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.15 MHz - 30 MHz	3.4 dB

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 MHz - 200 MHz	200 MHz - 1000 MHz	30 MHz - 200 MHz	200 MHz - 1000 MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	5.0 dB	6.3 dB	4.9 dB	5.0 dB

Radiated emission (Above 1 GHz)				
	(3 m*) (+/-)	(1 m*) (+/-)		(10 m*) (+/-)
1 GHz - 6 GHz	6 GHz - 18 GHz	10 GHz - 26.5 GHz	26.5 GHz - 40 GHz	1 GHz - 18 GHz
5.0 dB	5.3 dB	5.8 dB	5.8 dB	5.2 dB

*Measurement distance

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.

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.

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

4.1 Operating Mode(s)

Mode	Remarks*
Tx GFSK	PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power. *Power of the EUT was set by the software as follows;	
*The power value of the EUT was set for testing as follows (setting value might be different from product specification value); Power settings: -4dBm Software: TX_ULJPN, 20171215_TX_ULJPN_from_1213moonpo *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 frequency
Conducted Emission	Tx GFSK	2402 MHz
6dB Bandwidth		2440 MHz
99% Occupied Bandwidth		2478 MHz
Maximum Peak Output Power		
Power Density		
Spurious Emission (Conducted/ Radiated)		

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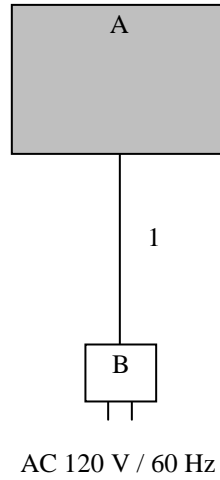
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4.2 Configuration and peripherals

<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	Wireless Transmitter	WL-T	2	Roland Corporation	EUT
B	AC Adapter	MPA-ACUCN004	7900784	ELECOM	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-

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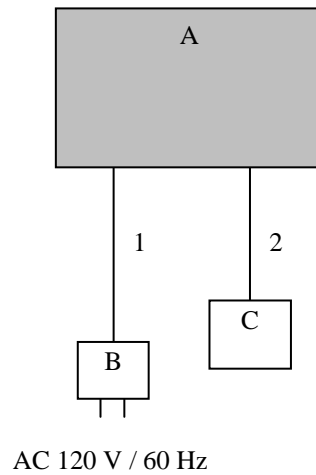
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<Other than Antenna Terminal Conducted Tests>



* 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	Wireless Transmitter	WL-T	2	Roland Corporation	EUT
B	AC Adapter	MPA-ACUCN004	7900784	ELECOM	-
C	iPod	A1367	CCQHKLMYDNQW	Apple	-

* Conducted Emission test was performed on AC power port of item No. B.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-
2	Audio Cable	0.1	Shielded	Shielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform table of nominal size, 1.0 m by 1.5 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.

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	3 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 low enough as shown in the chart.

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

Test data : APPENDIX

Test result : Pass

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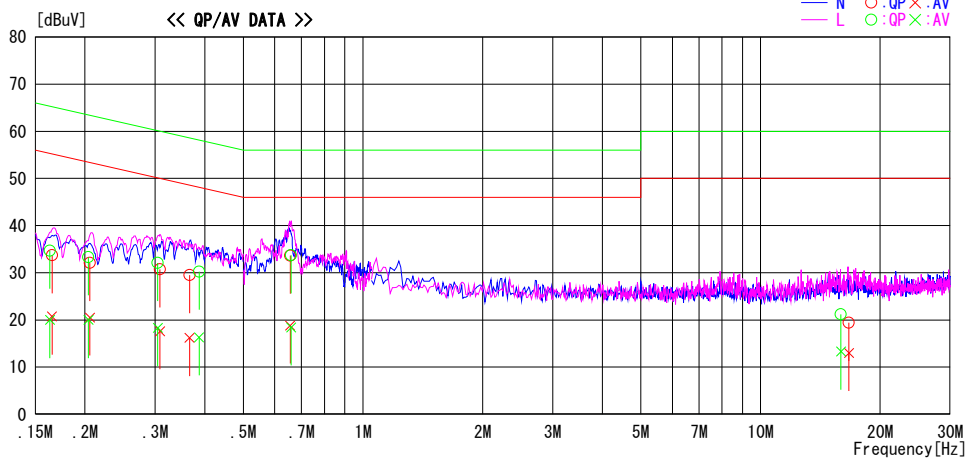
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APPENDIX 1: Test data

Conducted Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 12103115H
Date : December 20, 2017
Temperature / Humidity : 23 deg. C / 32 % RH
Engineer : Masafumi Niwa
Mode : Tx GFSK 2402 MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



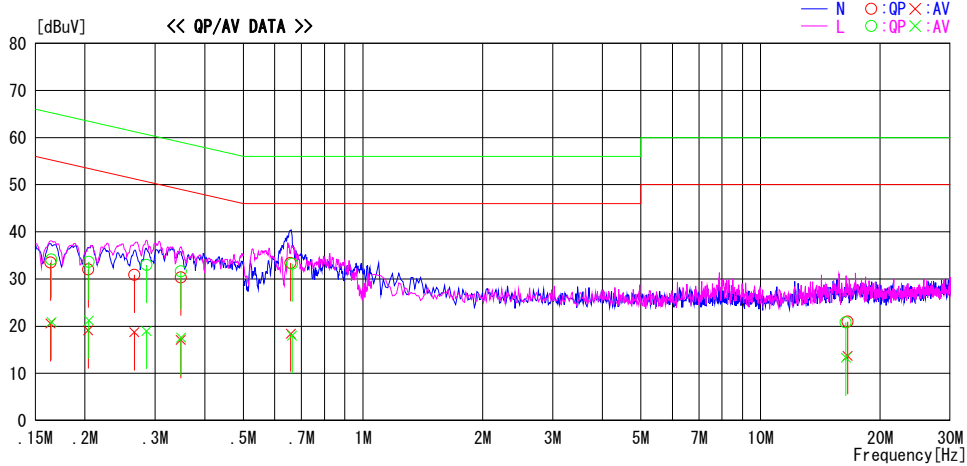
Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.16517	20.4	7.4	13.3	33.7	20.7	65.2	55.2	31.5	34.5	N	
0.20571	18.8	7.2	13.3	32.1	20.5	63.4	53.4	31.3	32.9	N	
0.30876	17.4	4.3	13.3	30.7	17.6	60.0	50.0	29.3	32.4	N	
0.36624	16.2	2.9	13.3	29.5	16.2	58.6	48.6	29.1	32.4	N	
0.65588	20.2	5.4	13.4	33.6	18.8	56.0	46.0	22.4	27.2	N	
16.69245	3.5	-2.9	15.9	19.4	13.0	60.0	50.0	40.6	37.0	N	
0.16322	21.4	6.7	13.3	34.7	20.0	65.3	55.3	30.6	35.3	L	
0.20383	20.0	6.7	13.3	33.3	20.0	63.5	53.5	30.2	33.5	L	
0.30468	18.8	5.0	13.3	32.1	18.3	60.1	50.1	28.0	31.8	L	
0.38711	16.9	3.0	13.3	30.2	16.3	58.1	48.1	27.9	31.8	L	
0.65982	20.3	5.0	13.4	33.7	18.4	56.0	46.0	22.3	27.6	L	
15.93540	5.3	-2.6	15.9	21.2	13.3	60.0	50.0	38.8	36.7	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

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 12103115H
Date : December 20, 2017
Temperature / Humidity : 23 deg. C / 32 % RH
Engineer : Masafumi Niwa
Mode : Tx GFSK 2440 MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



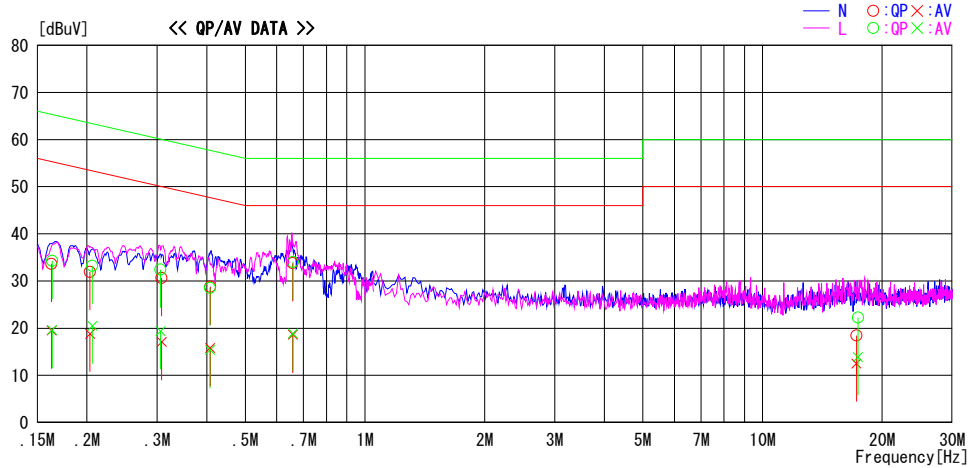
Frequency [MHz]	Reading		Level [dBuV]	Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]			QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.16375	20.2	7.3	13.3	33.5	20.6	65.3	55.3	31.8	34.7	N		
0.20359	18.7	5.8	13.3	32.0	19.1	63.5	53.5	31.5	34.4	N		
0.26606	17.6	5.4	13.3	30.9	18.7	61.2	51.2	30.3	32.5	N		
0.34836	17.0	3.8	13.3	30.3	17.1	59.0	49.0	28.7	31.9	N		
0.65814	20.0	5.0	13.4	33.4	18.4	56.0	46.0	22.6	27.6	N		
16.55436	5.0	-2.2	15.9	20.9	13.7	60.0	50.0	39.1	36.3	N		
0.16463	20.8	7.6	13.3	34.1	20.9	65.2	55.2	31.1	34.3	L		
0.20434	20.3	7.9	13.3	33.6	21.2	63.4	53.4	29.8	32.2	L		
0.28538	19.7	5.7	13.3	33.0	19.0	60.7	50.7	27.7	31.7	L		
0.34843	18.3	4.3	13.3	31.6	17.6	59.0	49.0	27.4	31.4	L		
0.66295	19.8	4.6	13.4	33.2	18.0	56.0	46.0	22.8	28.0	L		
16.38745	4.9	-2.6	15.9	20.8	13.3	60.0	50.0	39.2	36.7	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

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 12103115H
Date : December 20, 2017
Temperature / Humidity : 23 deg. C / 32 % RH
Engineer : Masafumi Niwa
Mode : Tx GFSK 2478 MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



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]		
0.16273	20.3	6.2	13.3	33.6	19.5	65.3	55.3	31.7	35.8	N	
0.20348	18.6	5.5	13.3	31.9	18.8	63.5	53.5	31.6	34.7	N	
0.30796	17.3	3.8	13.3	30.6	17.1	60.0	50.0	29.4	32.9	N	
0.40812	15.5	2.5	13.3	28.8	15.8	57.7	47.7	28.9	31.9	N	
0.65784	20.4	5.2	13.4	33.8	18.6	56.0	46.0	22.2	27.4	N	
17.22158	2.4	-3.5	16.0	18.4	12.5	60.0	50.0	41.6	37.5	N	
0.16342	21.0	6.3	13.3	34.3	19.6	65.3	55.3	31.0	35.7	L	
0.20625	19.9	7.2	13.3	33.2	20.5	63.4	53.4	30.2	32.9	L	
0.30590	19.1	6.1	13.3	32.4	19.4	60.1	50.1	27.7	30.7	L	
0.40756	15.2	2.1	13.3	28.5	15.4	57.7	47.7	29.2	32.3	L	
0.65876	20.6	5.5	13.4	34.0	18.9	56.0	46.0	22.0	27.1	L	
17.37625	6.2	-2.1	16.0	22.2	13.9	60.0	50.0	37.8	36.1	L	

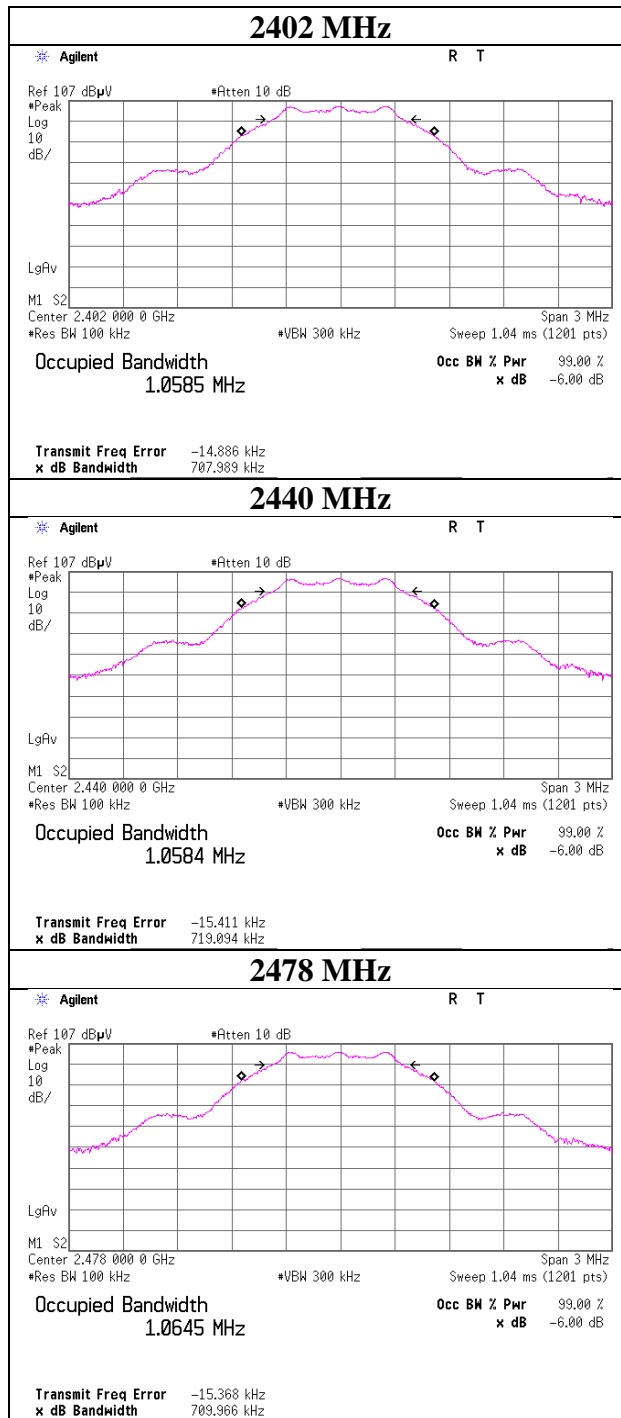
CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

6 dB Bandwidth and 99 % Occupied Bandwidth

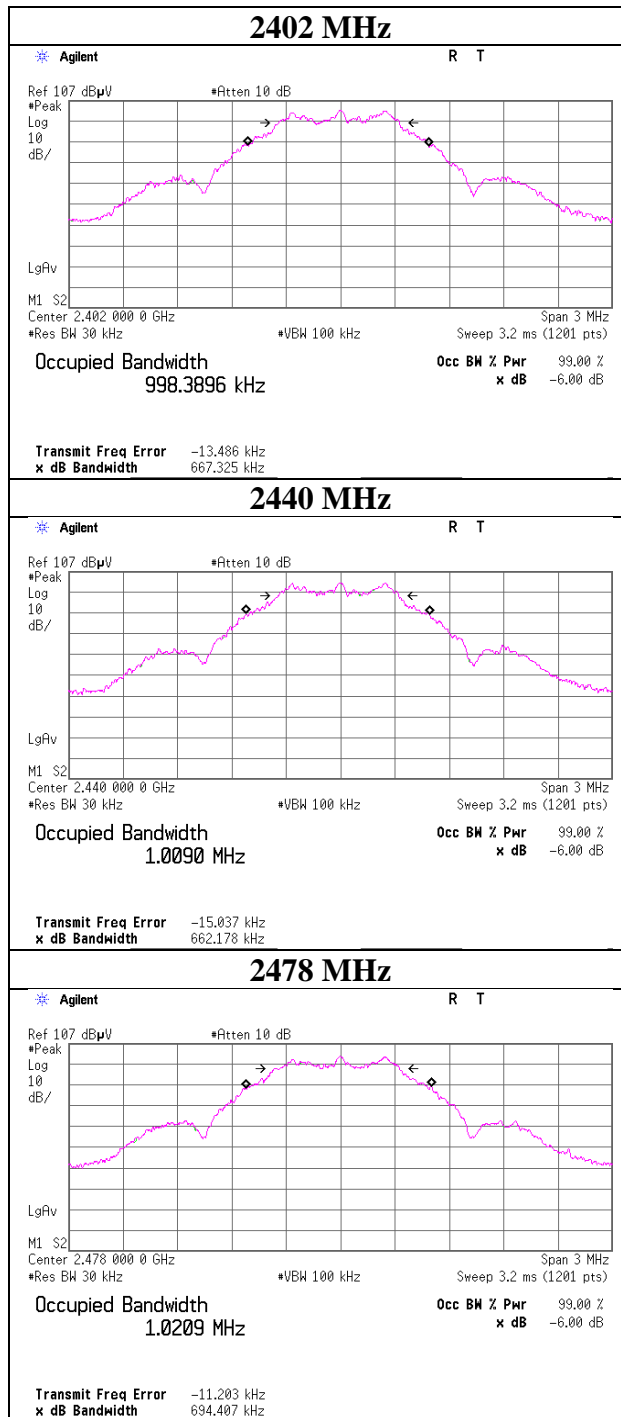
Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 12103115H
Date : December 19, 2017
Temperature / Humidity : 22 deg. C / 27 % RH
Engineer : Tomohisa Nakagawa
Mode : Tx

Frequency [MHz]	6dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Limit for 6dB Bandwidth [kHz]
2402	0.708	998.4	> 500
2440	0.719	1009.0	> 500
2478	0.710	1020.9	> 500

6dB Bandwidth



99% Occupied Bandwidth



Maximum Peak Output Power

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 12103115H
Date December 19, 2017
Temperature / Humidity 22 deg. C / 27 % RH
Engineer Tomohisa Nakagawa
Mode Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-3.05	1.29	10.03	8.27	6.71	30.00	1000	21.74
2440	-3.65	1.32	10.03	7.70	5.89	30.00	1000	22.30
2478	-4.38	1.34	10.03	6.99	5.00	30.00	1000	23.01

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. : 12103115H
Date : December 19, 2017
Temperature / Humidity : 22 deg. C / 27 % RH
Engineer : Tomohisa Nakagawa
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]
2402	-3.71	1.29	10.03	7.61	5.76	0.53	8.14	6.51
2440	-4.32	1.32	10.03	7.03	5.05	0.53	7.56	5.70
2478	-5.07	1.34	10.03	6.30	4.27	0.53	6.83	4.82

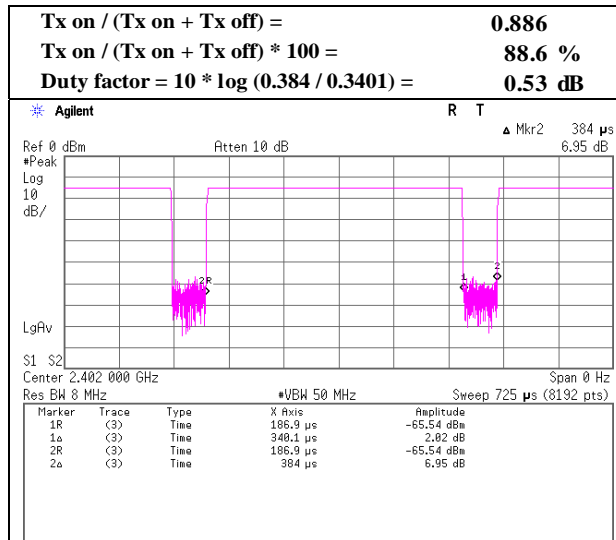
Sample Calculation:

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.4 Semi Anechoic Chamber
Report No.	12103115H
Date	December 19, 2017
Temperature / Humidity	20 deg. C / 33 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx



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

Radiated Spurious Emission

Report No. 12103115H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4 No.2
Date December 19, 2017 December 20, 2017
Temperature / Humidity 25 deg. C / 31 % RH 20 deg. C / 33 % RH
Engineer Tomoki Matsui Tomohisa Nakagawa
(Above 1 GHz) (Below 1 GHz)
Mode Tx GFSK 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	47.567	QP	25.5	11.7	6.9	30.4	-	13.7	40.0	26.3	
Hori	52.000	QP	25.1	10.3	7.0	30.4	-	12.0	40.0	28.0	
Hori	79.300	QP	26.0	6.2	7.3	30.4	-	9.1	40.0	30.9	
Hori	250.000	QP	23.6	11.7	8.5	29.3	-	14.5	46.0	31.5	
Hori	330.000	QP	23.0	14.1	9.1	29.4	-	16.8	46.0	29.2	
Hori	405.000	QP	23.3	15.7	9.4	29.7	-	18.7	46.0	27.3	
Hori	2338.037	PK	49.4	27.4	5.8	32.1	-	50.5	73.9	23.4	
Hori	2390.000	PK	43.5	27.4	5.9	32.1	-	44.7	73.9	29.2	
Hori	2530.033	PK	50.2	27.5	6.0	32.0	-	51.7	73.9	22.2	
Hori	4804.000	PK	44.5	31.7	8.1	31.3	-	53.0	73.9	20.9	
Hori	9608.000	PK	40.8	38.0	10.2	32.6	-	56.4	73.9	17.5	Floor noise
Hori	2338.037	AV	44.4	27.4	5.8	32.1	0.5	46.0	53.9	7.9	
Hori	2390.000	AV	34.5	27.4	5.9	32.1	0.5	36.2	53.9	17.7	*1)
Hori	2530.033	AV	45.5	27.5	6.0	32.0	0.5	47.5	53.9	6.4	
Hori	4804.000	AV	38.1	31.7	8.1	31.3	0.5	47.1	53.9	6.8	
Hori	9608.000	AV	32.0	38.0	10.2	32.6	-	47.6	53.9	6.3	Floor noise
Vert	47.567	QP	36.5	11.7	6.9	30.4	-	24.7	40.0	15.3	
Vert	52.292	QP	31.0	10.2	7.0	30.4	-	17.8	40.0	22.2	
Vert	79.300	QP	31.4	6.2	7.3	30.4	-	14.5	40.0	25.5	
Vert	250.000	QP	23.3	11.7	8.5	29.3	-	14.2	46.0	31.8	
Vert	330.000	QP	23.0	14.1	9.1	29.4	-	16.8	46.0	29.2	
Vert	405.000	QP	23.3	15.7	9.4	29.7	-	18.7	46.0	27.3	
Vert	2338.037	PK	50.2	27.4	5.8	32.1	-	51.3	73.9	22.6	
Vert	2390.000	PK	44.6	27.4	5.9	32.1	-	45.8	73.9	28.1	
Vert	2530.033	PK	52.0	27.5	6.0	32.0	-	53.5	73.9	20.4	
Vert	4804.000	PK	45.0	31.7	8.1	31.3	-	53.5	73.9	20.4	
Vert	9608.000	PK	40.8	38.0	10.2	32.6	-	56.4	73.9	17.5	Floor noise
Vert	2338.037	AV	45.4	27.4	5.8	32.1	0.5	47.0	53.9	6.9	
Vert	2390.000	AV	34.7	27.4	5.9	32.1	0.5	36.4	53.9	17.5	*1)
Vert	2530.033	AV	47.8	27.5	6.0	32.0	0.5	49.8	53.9	4.1	
Vert	4804.000	AV	38.6	31.7	8.1	31.3	0.5	47.6	53.9	6.3	
Vert	9608.000	AV	32.0	38.0	10.2	32.6	-	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 (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	2402.000	PK	99.8	27.4	5.9	32.1	101.0	-	-	Carrier
Hori	2400.000	PK	51.0	27.4	5.9	32.1	52.2	81.0	28.8	
Hori	7206.000	PK	41.6	36.4	9.5	32.4	55.1	81.0	25.9	
Vert	2402.000	PK	99.8	27.4	5.9	32.1	101.0	-	-	Carrier
Vert	2400.000	PK	51.2	27.4	5.9	32.1	52.4	81.0	28.6	
Vert	7206.000	PK	41.5	36.4	9.5	32.4	55.0	81.0	26.0	

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

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) = -9.5dB

UL Japan, Inc.

Ise EMC Lab.

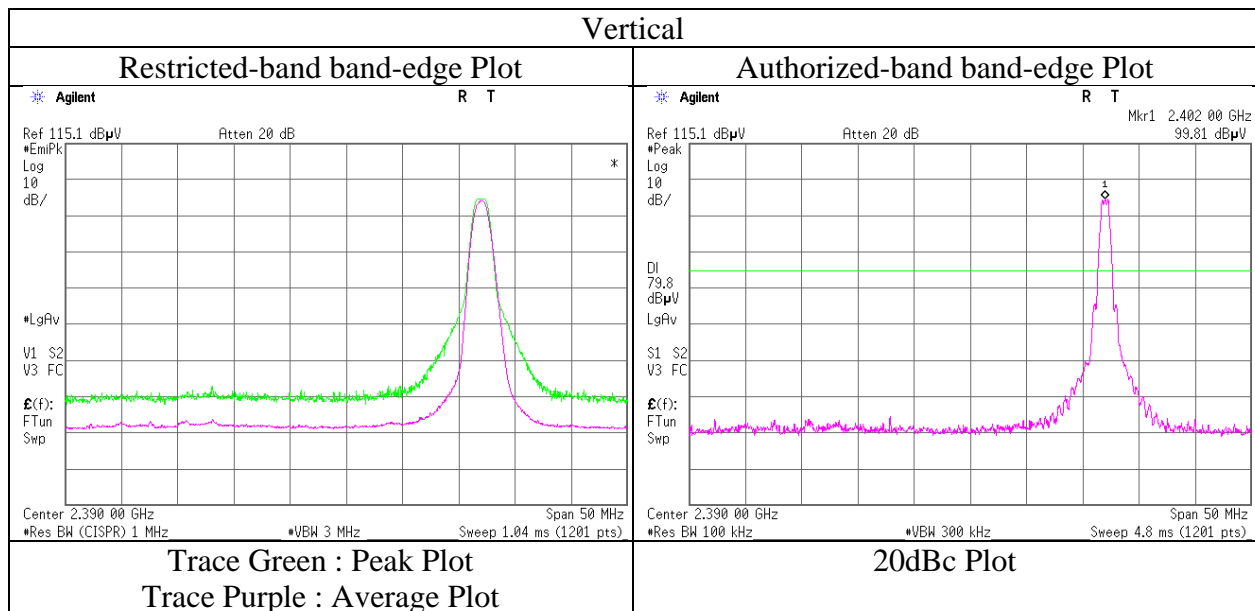
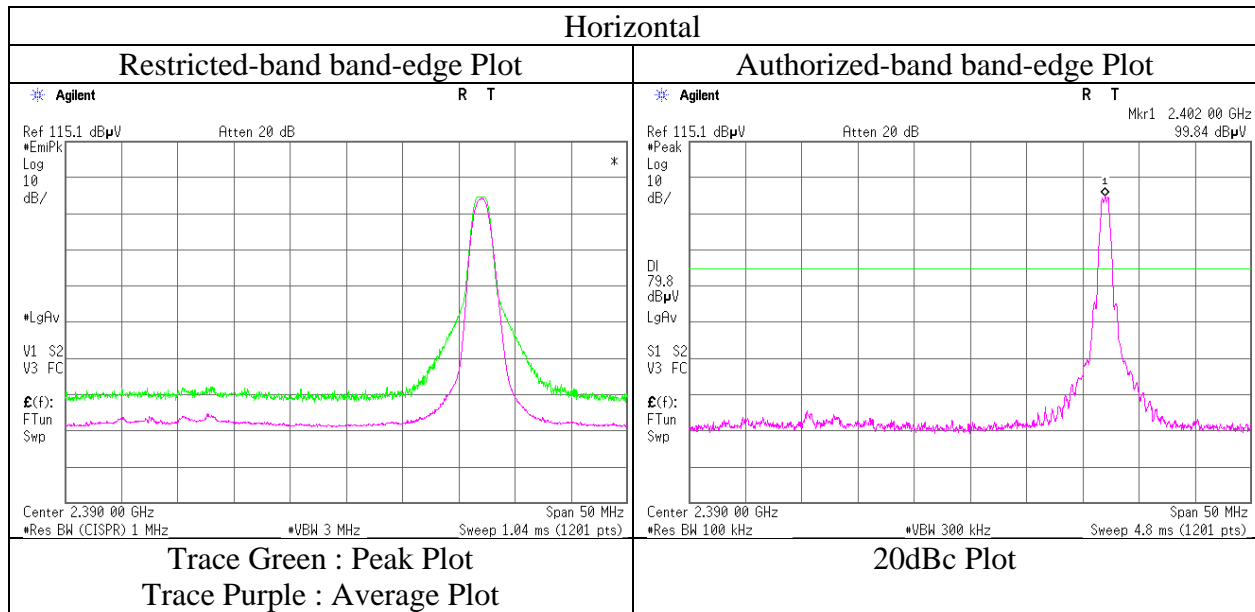
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12103115H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	December 19, 2017
Temperature / Humidity	25 deg. C / 31 % RH
Engineer	Tomoki Matsui
Mode	Tx GFSK 2402 MHz



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

Radiated Spurious Emission

Report No.	12103115H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.2
Date	December 19, 2017	December 20, 2017
Temperature / Humidity	25 deg. C / 31 % RH	20 deg. C / 33 % RH
Engineer	Tomoki Matsui (Above 1 GHz)	Tomohisa Nakagawa (Below 1 GHz)
Mode	Tx GFSK 2440 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	47.567	QP	25.5	11.7	6.9	30.4	-	13.7	40.0	26.3	
Hori	52.000	QP	25.1	10.3	7.0	30.4	-	12.0	40.0	28.0	
Hori	79.300	QP	25.9	6.2	7.3	30.4	-	9.0	40.0	31.0	
Hori	250.000	QP	23.6	11.7	8.5	29.3	-	14.5	46.0	31.5	
Hori	330.000	QP	23.0	14.1	9.1	29.4	-	16.8	46.0	29.2	
Hori	405.000	QP	23.3	15.7	9.4	29.7	-	18.7	46.0	27.3	
Hori	2312.204	PK	51.5	27.4	5.8	32.1	-	52.6	73.9	21.3	
Hori	2568.108	PK	50.3	27.6	6.0	32.0	-	51.9	73.9	22.0	
Hori	4880.000	PK	45.6	31.9	8.2	31.2	-	54.5	73.9	19.4	
Hori	7320.000	PK	43.2	36.6	9.5	32.4	-	56.9	73.9	17.0	
Hori	9760.000	PK	40.4	38.1	10.2	32.7	-	56.0	73.9	17.9	Floor noise
Hori	2312.204	AV	46.8	27.4	5.8	32.1	0.5	48.4	53.9	5.5	
Hori	2568.108	AV	45.7	27.6	6.0	32.0	0.5	47.8	53.9	6.1	
Hori	4880.000	AV	39.0	31.9	8.2	31.2	0.5	48.4	53.9	5.5	
Hori	7320.000	AV	34.7	36.6	9.5	32.4	0.5	48.9	53.9	5.0	
Hori	9760.000	AV	32.0	38.1	10.2	32.7	-	47.6	53.9	6.3	Floor noise
Vert	47.207	QP	36.3	11.8	6.9	30.5	-	24.5	40.0	15.5	
Vert	52.524	QP	30.9	10.1	7.0	30.4	-	17.6	40.0	22.4	
Vert	79.300	QP	30.7	6.2	7.3	30.4	-	13.8	40.0	26.2	
Vert	250.000	QP	23.3	11.7	8.5	29.3	-	14.2	46.0	31.8	
Vert	330.000	QP	23.0	14.1	9.1	29.4	-	16.8	46.0	29.2	
Vert	405.000	QP	23.3	15.7	9.4	29.7	-	18.7	46.0	27.3	
Vert	2312.204	PK	49.6	27.4	5.8	32.1	-	50.7	73.9	23.2	
Vert	2568.108	PK	51.1	27.6	6.0	32.0	-	52.7	73.9	21.2	
Vert	4880.000	PK	44.5	31.9	8.2	31.2	-	53.4	73.9	20.5	
Vert	7320.000	PK	43.7	36.6	9.5	32.4	-	57.4	73.9	16.5	
Vert	9760.000	PK	40.4	38.1	10.2	32.7	-	56.0	73.9	17.9	Floor noise
Vert	2312.204	AV	45.2	27.4	5.8	32.1	0.5	46.8	53.9	7.1	
Vert	2568.108	AV	47.1	27.6	6.0	32.0	0.5	49.2	53.9	4.7	
Vert	4880.000	AV	37.0	31.9	8.2	31.2	0.5	46.4	53.9	7.5	
Vert	7320.000	AV	35.4	36.6	9.5	32.4	0.5	49.6	53.9	4.3	
Vert	9760.000	AV	32.0	38.1	10.2	32.7	-	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 (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

Report No.	12103115H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.2
Date	December 19, 2017	December 20, 2017
Temperature / Humidity	25 deg. C / 31 % RH	20 deg. C / 33 % RH
Engineer	Tomoki Matsui (Above 1 GHz)	Tomohisa Nakagawa (Below 1 GHz)
Mode	Tx GFSK 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	47.567	QP	25.5	11.7	6.9	30.4	-	13.7	40.0	26.3	
Hori	52.000	QP	25.0	10.3	7.0	30.4	-	11.9	40.0	28.1	
Hori	79.300	QP	25.9	6.2	7.3	30.4	-	9.0	40.0	31.0	
Hori	250.000	QP	23.6	11.7	8.5	29.3	-	14.5	46.0	31.5	
Hori	330.000	QP	23.0	14.1	9.1	29.4	-	16.8	46.0	29.2	
Hori	405.000	QP	23.3	15.7	9.4	29.7	-	18.7	46.0	27.3	
Hori	2350.079	PK	53.7	27.4	5.9	32.1	-	54.9	73.9	19.0	
Hori	2483.500	PK	48.0	27.5	5.9	32.0	-	49.4	73.9	24.5	
Hori	2606.032	PK	51.4	27.7	6.0	32.0	-	53.1	73.9	20.8	
Hori	4956.000	PK	43.9	32.2	8.2	31.2	-	53.1	73.9	20.8	
Hori	7434.000	PK	43.2	36.7	9.5	32.5	-	56.9	73.9	17.0	
Hori	9912.000	PK	40.9	38.1	10.2	32.8	-	56.4	73.9	17.5	Floor noise
Hori	2350.079	AV	50.1	27.4	5.9	32.1	0.5	51.8	53.9	2.1	
Hori	2483.500	AV	37.4	27.5	5.9	32.0	0.5	39.3	53.9	14.6	*1)
Hori	2606.032	AV	46.9	27.7	6.0	32.0	0.5	49.1	53.9	4.8	
Hori	4956.000	AV	36.9	32.2	8.2	31.2	0.5	46.6	53.9	7.3	
Hori	7434.000	AV	33.9	36.7	9.5	32.5	0.5	48.1	53.9	5.8	
Hori	9912.000	AV	32.0	38.1	10.2	32.8	-	47.5	53.9	6.4	Floor noise
Vert	47.407	QP	36.4	11.8	6.9	30.4	-	24.7	40.0	15.3	
Vert	52.696	QP	30.6	10.1	7.0	30.4	-	17.3	40.0	22.7	
Vert	79.300	QP	31.1	6.2	7.3	30.4	-	14.2	40.0	25.8	
Vert	250.000	QP	23.3	11.7	8.5	29.3	-	14.2	46.0	31.8	
Vert	330.000	QP	23.1	14.1	9.1	29.4	-	16.9	46.0	29.1	
Vert	405.000	QP	23.3	15.7	9.4	29.7	-	18.7	46.0	27.3	
Vert	2350.079	PK	53.6	27.4	5.9	32.1	-	54.8	73.9	19.1	
Vert	2483.500	PK	48.7	27.5	5.9	32.0	-	50.1	73.9	23.8	
Vert	2606.032	PK	51.7	27.7	6.0	32.0	-	53.4	73.9	20.5	
Vert	4956.000	PK	43.9	32.2	8.2	31.2	-	53.1	73.9	20.8	
Vert	7434.000	PK	43.6	36.7	9.5	32.5	-	57.3	73.9	16.6	
Vert	9912.000	PK	40.9	38.1	10.2	32.8	-	56.4	73.9	17.5	Floor noise
Vert	2350.079	AV	50.0	27.4	5.9	32.1	0.5	51.7	53.9	2.2	
Vert	2483.500	AV	38.2	27.5	5.9	32.0	0.5	40.1	53.9	13.8	*1)
Vert	2606.032	AV	47.4	27.7	6.0	32.0	0.5	49.6	53.9	4.3	
Vert	4956.000	AV	35.6	32.2	8.2	31.2	0.5	45.3	53.9	8.6	
Vert	7434.000	AV	35.1	36.7	9.5	32.5	0.5	49.3	53.9	4.6	
Vert	9912.000	AV	32.0	38.1	10.2	32.8	-	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).

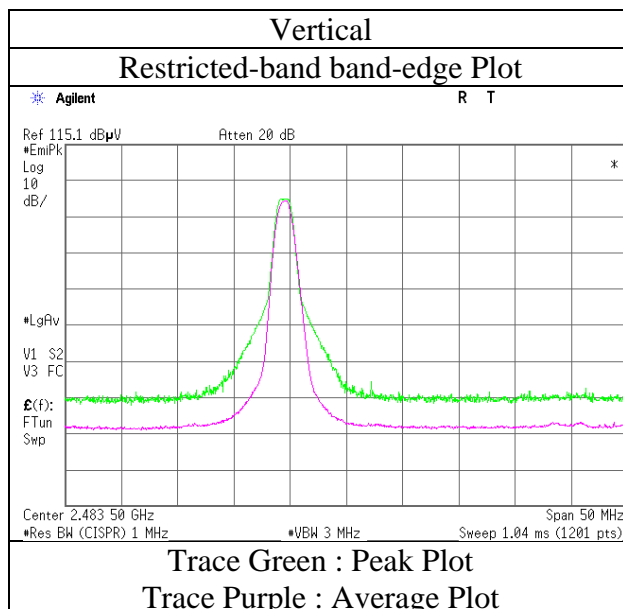
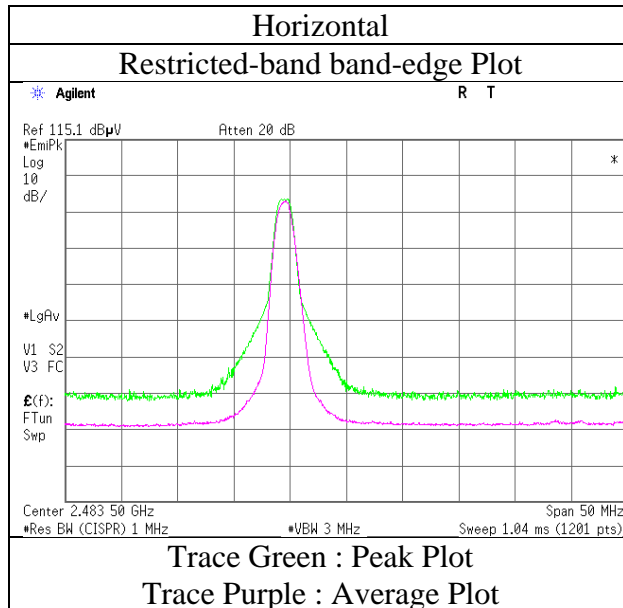
Distance factor: 1 GHz - 10 GHz $20\log(4.0\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12103115H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date December 19, 2017
Temperature / Humidity 25 deg. C / 31 % RH
Engineer Tomoki Matsui

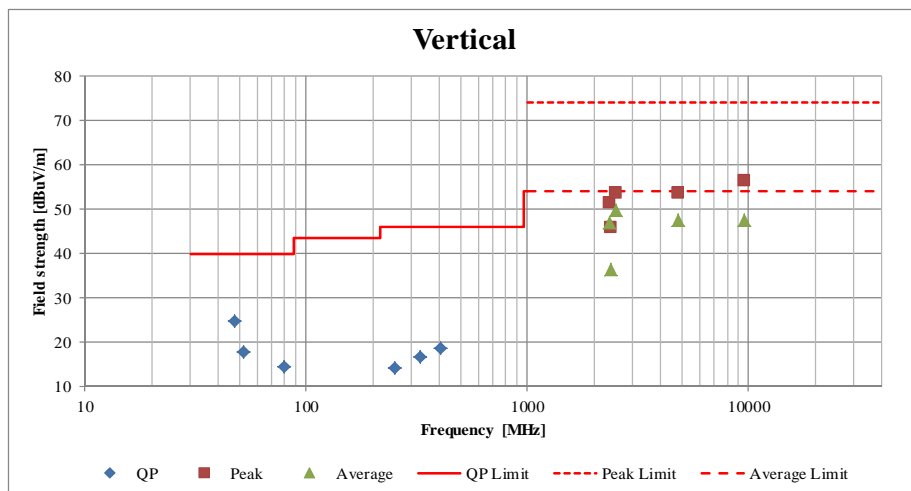
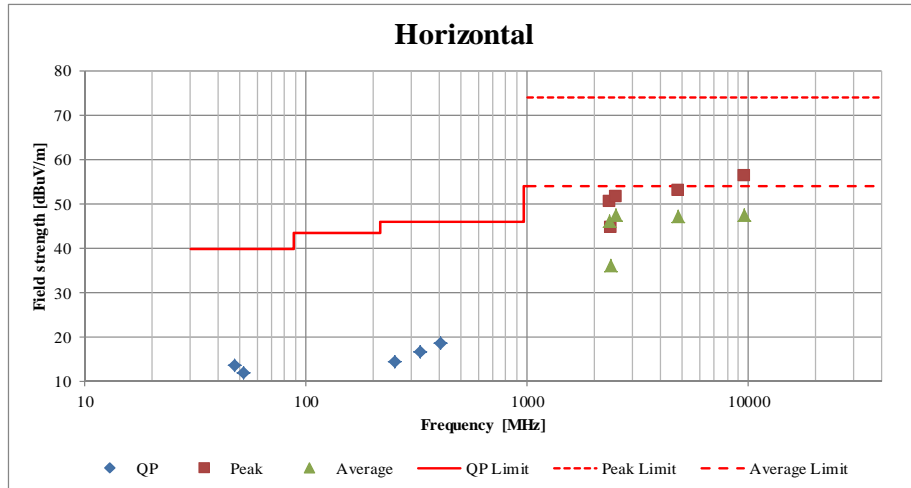
Mode Tx GFSK 2478 MHz



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

Radiated Spurious Emission (Plot data, Worst case)

Report No.	12103115H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.2
Date	December 19, 2017	December 20, 2017
Temperature / Humidity	25 deg. C / 31 % RH	20 deg. C / 33 % RH
Engineer	Tomoki Matsui (Above 1 GHz)	Tomohisa Nakagawa (Below 1 GHz)
Mode	Tx 2402 MHz	



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

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Ise EMC Lab.

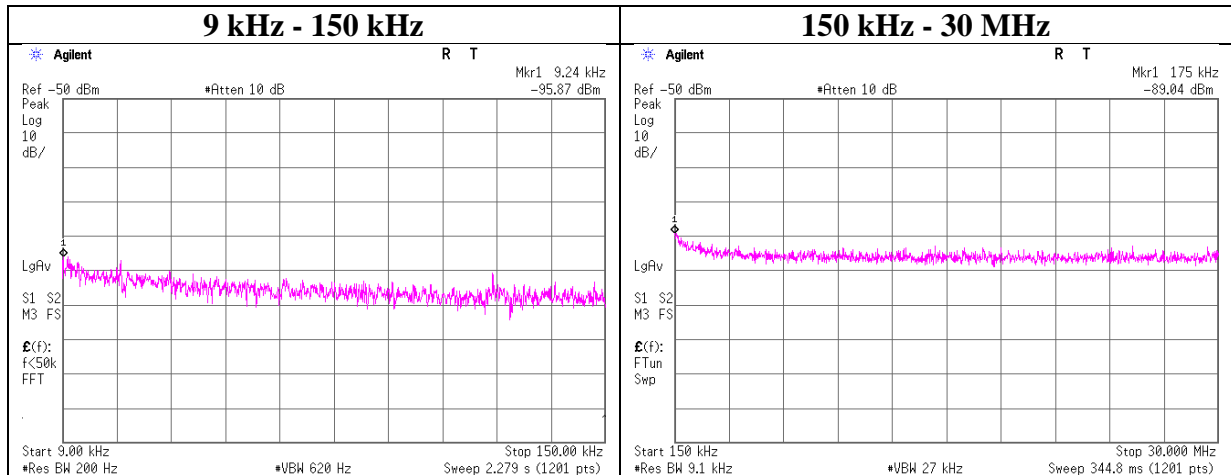
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Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	12103115H
Date	December 19, 2017
Temperature / Humidity	22 deg. C / 27 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx 2402 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
9.24	-95.9	0.40	9.8	2.5	1	-83.1	300	6.0	-21.9	48.2	70.1	
175.00	-89.0	0.40	9.8	2.5	1	-76.3	300	6.0	-15.0	22.7	37.7	

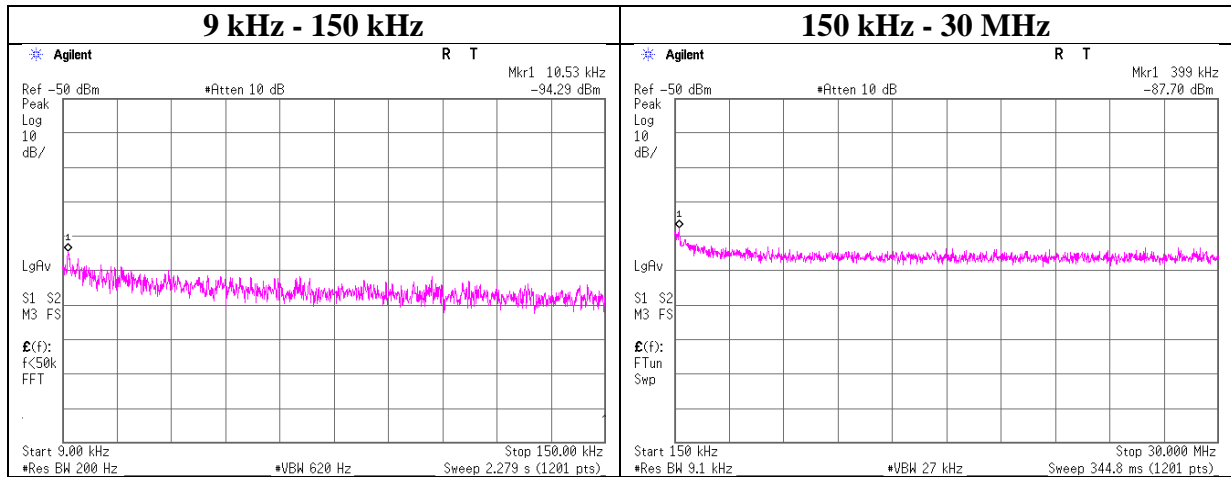
$$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$$

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

N: Number of output

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	12103115H
Date	December 19, 2017
Temperature / Humidity	22 deg. C / 27 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx 2440 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
10.53	-94.3	0.42	9.8	2.5	1	-81.5	300	6.0	-20.3	47.1	67.4	
399.00	-87.7	0.42	9.8	2.5	1	-74.9	300	6.0	-13.7	15.5	29.2	

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

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

N: Number of output

UL Japan, Inc.

Ise EMC Lab.

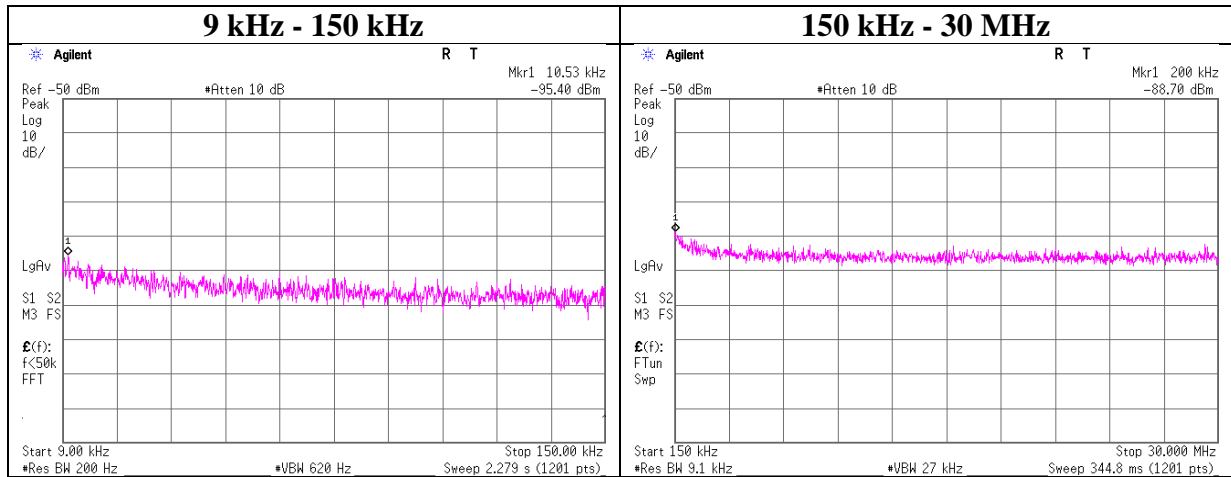
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Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	12103115H
Date	December 19, 2017
Temperature / Humidity	22 deg. C / 27 % RH
Engineer	Tomohisa Nakagawa
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
10.53	-95.4	0.43	9.8	2.5	1	-82.6	300	6.0	-21.4	47.1	68.5	
200.00	-88.7	0.43	9.8	2.5	1	-75.9	300	6.0	-14.7	21.5	36.2	

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

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

N: Number of output

Power Density

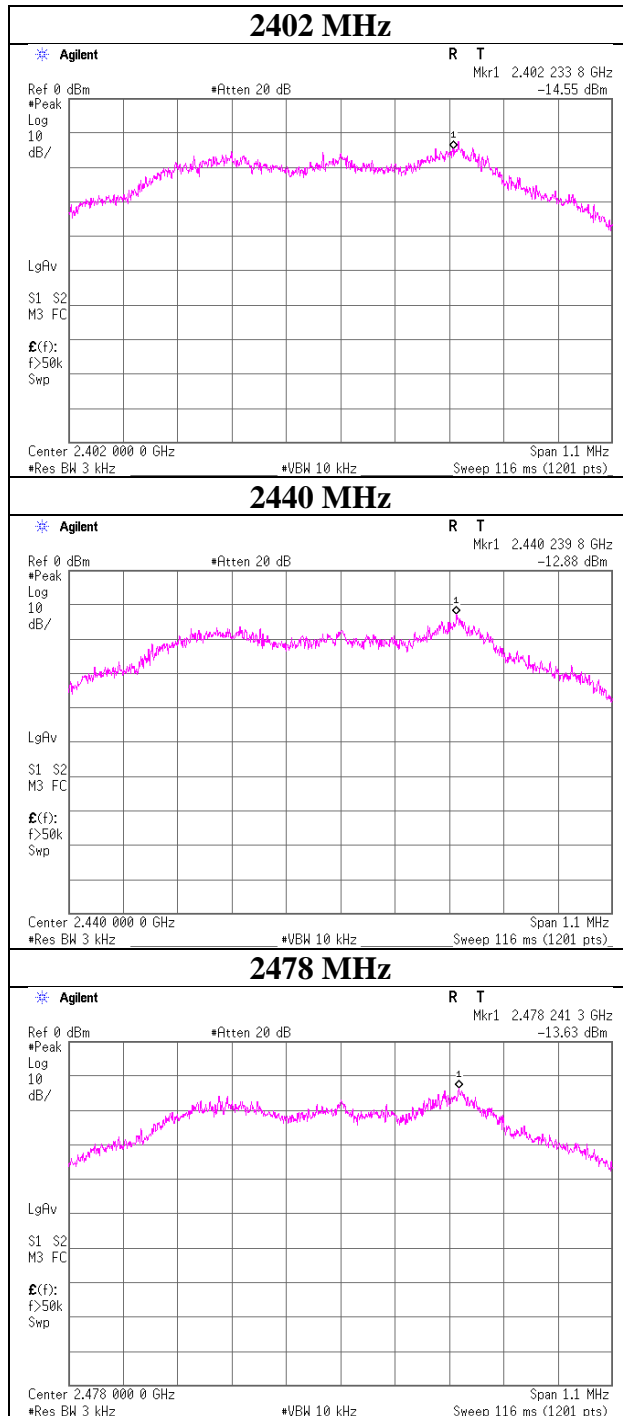
Test place Ise EMC Lab. No.6 Measurement Room
Report No. 12103115H
Date December 19, 2017
Temperature / Humidity 22 deg. C / 27 % RH
Engineer Tomohisa Nakagawa
Mode Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-14.55	1.29	10.03	-3.24	8.00	11.24
2440.00	-12.88	1.32	10.03	-1.53	8.00	9.53
2478.00	-13.63	1.34	10.03	-2.26	8.00	10.26

Sample Calculation:

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

Power Density



APPENDIX 2: Test instruments

Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	AT	2017/11/14 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2017/10/13 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2017/10/13 * 12
MAT-57	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2017/12/04 * 12
MCC-170	Microwave Cable	Junkosha	MWX221	1409S493	AT	2017/03/13 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2017/01/20 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2017/11/14 * 12
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	2017/01/20 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	CE/RE	-
MSA-15	Spectrum Analyzer	Agilent	E4440A	MY46187105	RE	2017/10/16 * 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
MMM-10	DIGITAL HITESTER	Hioki	3805	051201148	RE	2017/01/19 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2017/09/11 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	CE	2017/08/31 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	CE/RE	2016/12/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	CE/RE	-
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE/RE	2017/08/21 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE	2017/07/24 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/ 5D-2W(5m)/ 5D-2W(0.8m)/ 5D-2W(1m)	-	CE	2017/02/24 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/12/21 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	CE/RE	2017/08/07 * 12
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	CE/RE	2017/09/20 * 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	2017/02/24 * 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

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

UL Japan, Inc.

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