RADIO TEST REPORT

Test Report No. : 11489733H-C-R2

Applicant	:	**Quantum Inc.**
Type of Equipment	:	**eny button**
Model No.	:	**ENY-T1U01D**
FCC ID	:	**2AJ8N-ENY-T1U01D**
Test regulation	:	**FCC Part 15 Subpart C: 2016**
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 11489733H-C-R1. 11489733H-C-R1 is replaced with this report.

Date of test: November 1 and 4, 2016

Representative test engineer:
Keisuke Kawamura
Engineer
Consumer Technology Division

Approved by:
Takayuki Shimada
Engineer
Consumer Technology Division

NVLAP TESTING
NVLAP LAB CODE: 200572-0

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REVISION HISTORY

Original Test Report No.: 11489733H-C

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11489733H-C	November 15, 2016	-	-
1	11489733H-C-R1	November 22, 2016	P9	Addition of explanatory note under the figure of Configuration.
1	11489733H-C-R1	November 22, 2016	P9	Addition and correction of *1)
1	11489733H-C-R1	November 22, 2016	P24 - 26	Addition of explanatory note for antenna gain.
2	11489733H-C-R2	November 25, 2016	P8	Addition of power setting to “The details of Operating mode(s)”.
2	11489733H-C-R2	November 25, 2016	P9	Correction of the figure of Configuration.
2	11489733H-C-R2	November 25, 2016	P9	Correction and addition of explanatory note *1) and *2).

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SECTION 1: Customer information

Company Name	:	Panasonic Corporation Automotive & Industrial Systems Company *
Address	:	1006 Kadoma, Kadoma City, Osaka 571-8506 Japan
Telephone Number	:	+81-50-3587-3753
Facsimile Number	:	+81-6-6906-1154
Contact Person	:	HANASHIMA MASATO

*Remarks:
Quantum Inc. designates Panasonic Corporation Automotive & Industrial Systems Company as manufacturer of the product (eny button).

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

2.1 Identification of E.U.T.

Type of Equipment	:	eny button
Model No.	:	ENY-T1U01D
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	AC -50 V to AC +50 V
Receipt Date of Sample	:	November 1, 2016
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: ENY-T1U01D (referred to as the EUT in this report) is a eny button.

This system has Wireless transmitter (eny button: ENY-T1U01D) and receiver (eny receiver: ENY-R1U01W). The transmitter sends 2.4GHz band original protocol operating with vibration power generation. The receiver (shape of USB dongle) received signal from the transmitter.
Wireless transmitter has transmitting mode and Wireless receiver has receiving mode.
This test report applies to Wireless transmitter (eny button: ENY-T1U01D).

Radio Specification

Radio Type	:	Transmitter
Frequency of Operation	:	2402 MHz - 2478 MHz
Modulation	:	GFSK
Power Supply (radio part input)	:	DC 2.1 V
Antenna type	:	λ/4 mono pole Antenna
Antenna Gain	:	1.2 dBi max
Maximum Clock frequency (crystal)	:	16 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016
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 November 14, 2016, does not affect the test specification applied to the EUT.
* Also the EUT complies with FCC Part 15 Subpart B.

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	-	N/A *1)	-
6dB Bandwidth	**FCC:** KDB 558074 D01 DTS Meas Guidance v03r05 **IC:** -	**FCC:** Section 15.247(a)(2) **IC:** RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	**FCC:** KDB 558074 D01 DTS Meas Guidance v03r05 **IC:** RSS-Gen 6.12	**FCC:** Section 15.247(b)(3) **IC:** RSS-247 5.4(4)		Complied	Conducted
Power Density	**FCC:** KDB 558074 D01 DTS Meas Guidance v03r05 **IC:** -	**FCC:** Section 15.247(e) **IC:** RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 DTS Meas Guidance v03r05 **IC:** RSS-Gen 6.13	**FCC:** Section15.247(d) **IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	2.2 dB 2483.500 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) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.
*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r05 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 2.1 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.

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 $k = 2$.

Ise EMC Lab.

Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz -3 GHz	3 GHz -18 GHz	18 GHz -26.5 GHz	26.5 GHz -40 GHz	Channel power
0.9 dB	1.0 dB	1.4 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	2.6 dB

Test distance	Radiated emission (+/-) 9 kHz - 30 MHz
3m	3.8 dB
10m	3.7 dB

Polarity	Radiated emission (Below 1GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 – 200 MHz	200 – 1000MHz	30 – 200 MHz	200 – 1000MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 – 6GHz	6 – 18GHz	10 – 26.5 GHz	26.5 – 40GHz	1 -18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

*Measurement distance

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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Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

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	-	-

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)

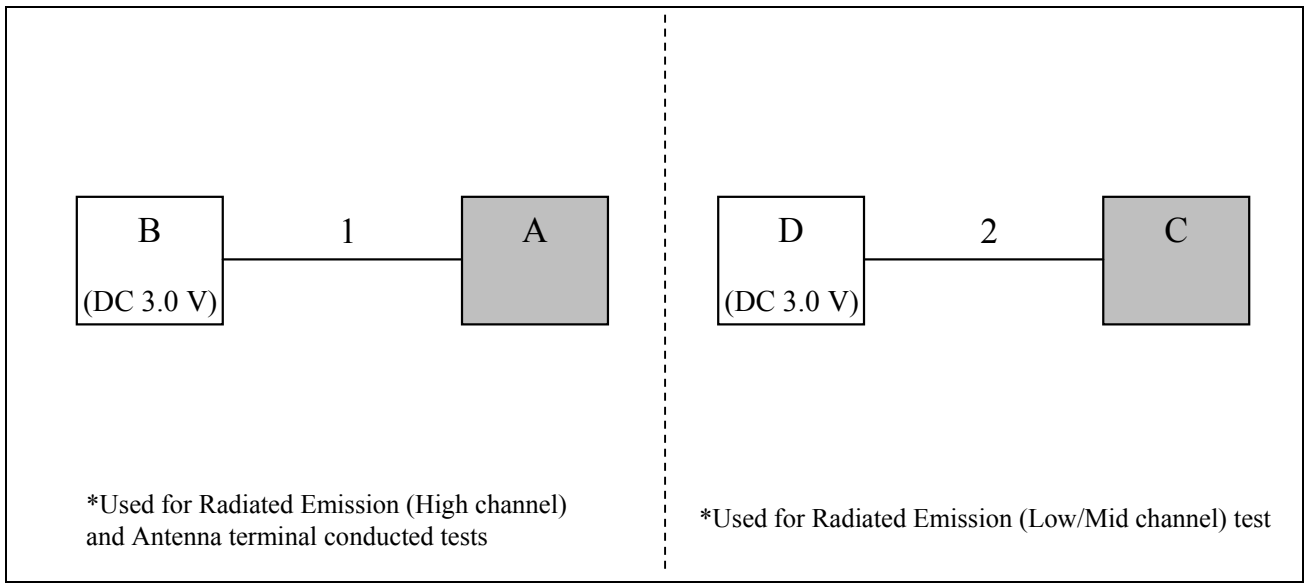
Mode	Remarks*
Transmitting (Tx) mode	-

*Power of the EUT was set by the software as follows;
Power settings: High: 0 dBm, Low: -6 dBm
Software: Same as product
*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	Power setting
6dB Bandwidth, Spurious Emission (Radiated / Conducted), Power Density, 99% Occupied Bandwidth	Tx	2402 MHz 2450 MHz 2478 MHz	High: 0 dBm
Maximum Peak Output Power	Tx	2402 MHz 2450 MHz 2478 MHz	High: 0 dBm Low: -6 dBm

4.2 Configuration and peripherals



*Cabling and setup were taken into consideration and test data was taken under worse case conditions.
*Test configuration has two patterns for the realization of test mode. The difference of configurations does not affect RF characteristic.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	eny button	ENY-T1U01D	5	Panasonic Corporation Automotive & Industrial Systems Company	EUT
B	Battery Box Jig	-	-	Panasonic Corporation Automotive & Industrial Systems Company	*1)
C	eny button	ENY-T1U01D	11	Panasonic Corporation Automotive & Industrial Systems Company	EUT
D	Battery Box Jig	-	-	Panasonic Corporation Automotive & Industrial Systems Company	*1)

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	0.05	Unshielded	Unshielded	*2)
2	DC Cable	0.1	Unshielded	Unshielded	*2)

*1) Battery Box Jig was connected to voltage input part of DC-DC converter. Because the EUT cannot input AC voltage as test mode and input voltage does not affect RF characteristic.
*2) DC Cable does not affect RF characteristic.

SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r05".

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

[For above 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 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	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Loop	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	3.75 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)		3.75 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 v03r05".
*2) Distance Factor: 20 x log (3.75 m / 3.0 m) = 1.94 dB
*3) Distance Factor: 20 x log (1.0 m / 3.0 m) = -9.5 dB

- 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 6: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
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 v03r05".
*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
① 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

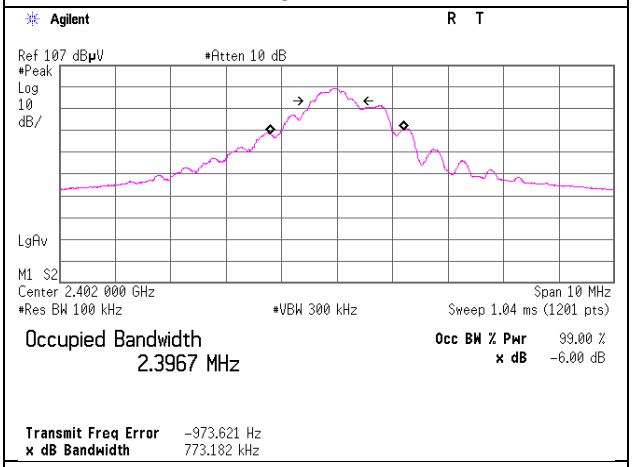
6dB Bandwidth

Report No.	11489733H	
Test place	Ise EMC Lab.	
Measurement Room	No.6	No.11
Date	November 1, 2016	November 4, 2016
Temperature / Humidity	23 deg. C / 38 % RH	20 deg. C / 36 % RH
Engineer	Masafumi Niwa (Low / Mid ch)	Takumi Shimada (High ch)
Mode	Tx	

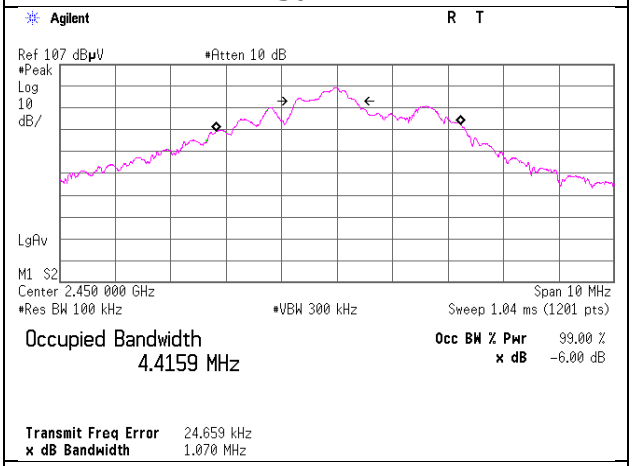
Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2402	0.773	> 500
2450	1.070	> 500
2478	0.742	> 500

6dB Bandwidth

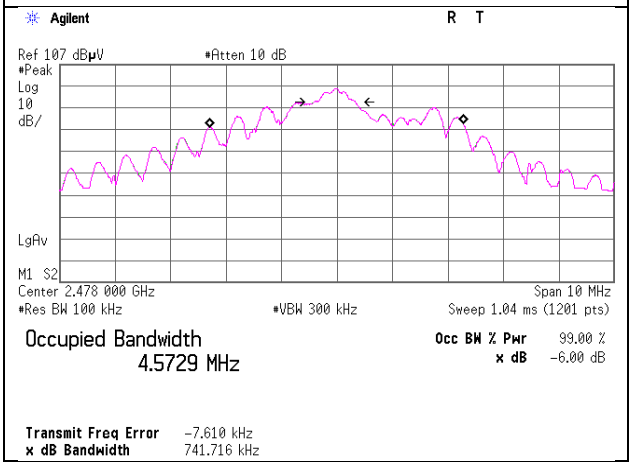
2402 MHz



2450 MHz



2478 MHz



Maximum Peak Output Power

Report No.	11489733H	
Test place	Ise EMC Lab.	
Measurement Room	No.6	No.11
Date	November 1, 2016	November 4, 2016
Temperature / Humidity	23 deg. C / 38 % RH	20 deg. C / 36 % RH
Engineer	Masafumi Niwa	Takumi Shimada
	(Low / Mid ch)	(High ch)
Mode	Tx	

Power setting 0 dBm

Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-10.94	0.73	10.09	-0.12	0.97	30.00	1000	30.12
2450	-11.00	0.74	10.09	-0.17	0.96	30.00	1000	30.17
2478	-11.30	0.74	10.09	-0.47	0.90	30.00	1000	30.47

Power setting -6 dBm

Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-14.61	0.73	10.09	-3.79362	0.42	30.00	1000	33.79
2450	-14.44	0.74	10.09	-3.6145	0.44	30.00	1000	33.61
2478	-14.80	0.74	10.09	-3.96918	0.40	30.00	1000	33.97

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

Average Output Power
(Reference data for RF Exposure)

Report No.	11489733H	
Test place	Ise EMC Lab.	
Measurement Room	No.6	No.11
Date	November 1, 2016	November 4, 2016
Temperature / Humidity	23 deg. C / 38 % RH	20 deg. C / 36 % RH
Engineer	Masafumi Niwa (Low / Mid ch)	Takumi Shimada (High ch)
Mode	Tx	

Power setting 0 dBm

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2402	-13.40	0.73	10.09	-2.58	0.55	1.10	-1.48	0.71
2450	-13.47	0.74	10.09	-2.64	0.54	1.10	-1.54	0.70
2478	-13.20	0.74	10.09	-2.37	0.58	1.10	-1.27	0.75

Power setting -6dBm

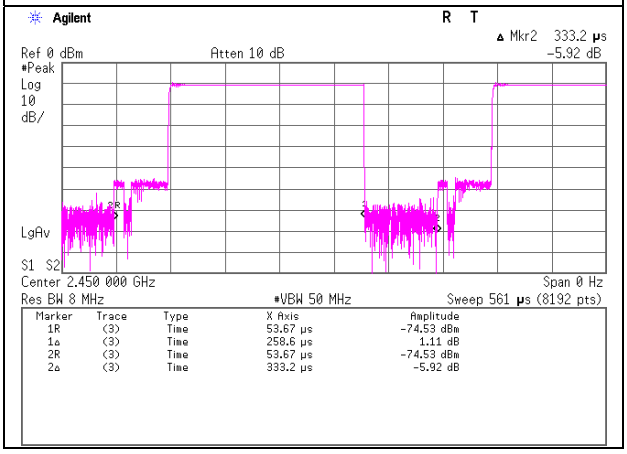
Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2402	-17.43	0.73	10.09	-6.61	0.22	1.10	-5.51	0.28
2450	-17.28	0.74	10.09	-6.45	0.23	1.10	-5.35	0.29
2478	-17.06	0.74	10.09	-6.23	0.24	1.10	-5.13	0.31

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

Report No.	11489733H
Test place	Ise EMC Lab.
Measurement Room	No.6
Date	November 1, 2016
Temperature / Humidity	23 deg. C / 38 % RH
Engineer	Masafumi Niwa
Mode	Tx

Tx on / (Tx on + Tx off) =	**0.776**
Tx on / (Tx on + Tx off) * 100 =	**77.6 %**
Duty factor = 10 * log (333.2 / 258.6) =	**1.10 dB**



Radiated Spurious Emission

Report No.	11489733H	
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber	
Date	November 1, 2016	November 1, 2016
Temperature / Humidity	21 deg. C / 41 % RH	23 deg. C / 42 % RH
Engineer	Takumi Shimada	Keisuke Kawamura
	(Above 1 GHz)	(Below 1 GHz)
Mode	Tx 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	43.883	QP	23.1	12.8	6.9	28.1	-	14.7	40.0	25.3	
Hori	113.583	QP	22.1	12.0	7.5	27.9	-	13.7	43.5	29.8	
Hori	321.334	QP	21.5	14.0	8.9	27.3	-	17.1	46.0	28.9	
Hori	402.314	QP	22.0	15.6	9.4	27.8	-	19.2	46.0	26.8	
Hori	564.001	QP	22.0	18.4	9.9	28.0	-	22.3	46.0	23.7	
Hori	610.234	QP	22.0	18.9	10.1	28.0	-	23.0	46.0	23.0	
Hori	2390.000	PK	43.7	27.6	4.3	34.8	-	40.8	73.9	33.1	
Hori	4804.000	PK	45.3	31.5	6.2	34.1	-	48.9	73.9	25.0	
Hori	7206.000	PK	41.2	36.1	7.0	34.1	-	50.2	73.9	23.7	Floor noise
Hori	9608.000	PK	43.4	38.5	7.6	34.8	-	54.7	73.9	19.2	Floor noise
Hori	2390.000	AV	35.4	27.6	4.3	34.8	1.1	33.6	53.9	20.3	*1)
Hori	4804.000	AV	37.4	31.5	6.2	34.1	1.1	42.1	53.9	11.8	
Hori	7206.000	AV	33.2	36.1	7.0	34.1	-	42.2	53.9	11.7	Floor noise
Hori	9608.000	AV	35.3	38.5	7.6	34.8	-	46.6	53.9	7.3	Floor noise
Vert	43.883	QP	23.1	12.8	6.9	28.1	-	14.7	40.0	25.3	
Vert	113.583	QP	22.5	12.0	7.5	27.9	-	14.1	43.5	29.4	
Vert	321.334	QP	21.5	14.0	8.9	27.3	-	17.1	46.0	28.9	
Vert	402.314	QP	22.0	15.6	9.4	27.8	-	19.2	46.0	26.8	
Vert	564.001	QP	22.3	18.4	9.9	28.0	-	22.6	46.0	23.4	
Vert	610.234	QP	22.2	18.9	10.1	28.0	-	23.2	46.0	22.8	
Vert	2390.000	PK	44.7	27.6	4.3	34.8	-	41.8	73.9	32.1	
Vert	4804.000	PK	45.5	31.5	6.2	34.1	-	49.1	73.9	24.8	
Vert	7206.000	PK	41.1	36.1	7.0	34.1	-	50.1	73.9	23.8	Floor noise
Vert	9608.000	PK	43.1	38.5	7.6	34.8	-	54.4	73.9	19.5	Floor noise
Vert	2390.000	AV	35.9	27.6	4.3	34.8	1.1	34.1	53.9	19.8	*1)
Vert	4804.000	AV	37.3	31.5	6.2	34.1	1.1	42.0	53.9	11.9	
Vert	7206.000	AV	33.2	36.1	7.0	34.1	-	42.2	53.9	11.7	Floor noise
Vert	9608.000	AV	35.3	38.5	7.6	34.8	-	46.6	53.9	7.3	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 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

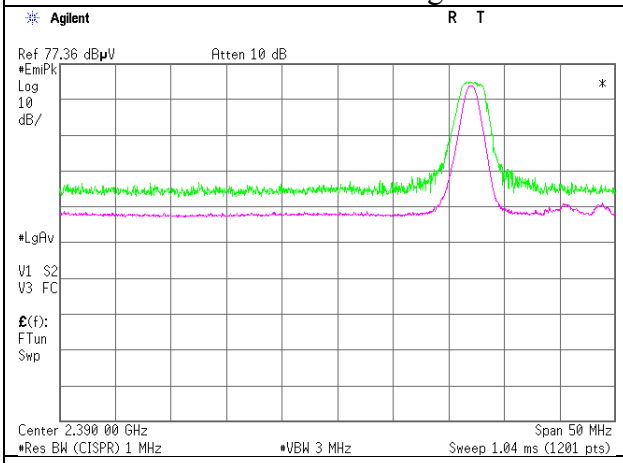
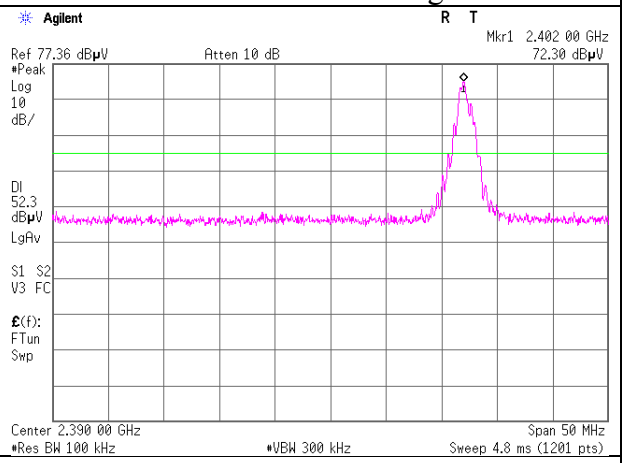
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	72.3	27.6	4.4	34.8	69.5	-	-	Carrier
Hori	2400.000	PK	43.6	27.6	4.4	34.8	40.8	49.5	8.7	
Vert	2402.000	PK	74.7	27.6	4.4	34.8	71.9	-	-	Carrier
Vert	2400.000	PK	43.1	27.6	4.4	34.8	40.3	51.9	11.6	

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

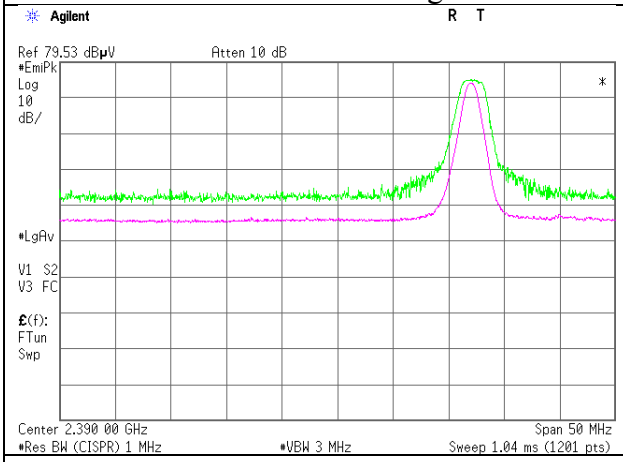
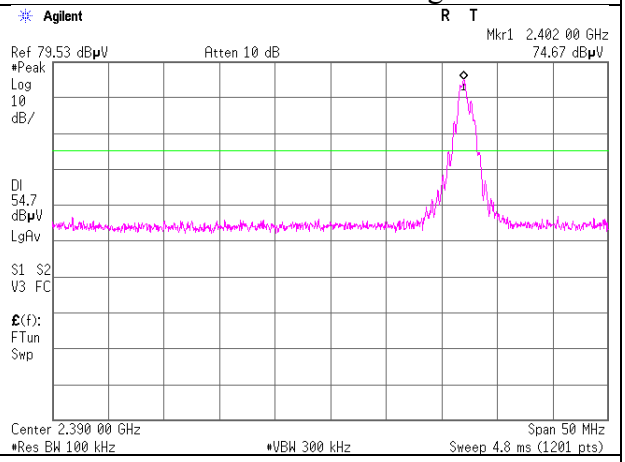
Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	11489733H
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Date	November 1, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Takumi Shimada
	(Above 1 GHz)
Mode	Tx 2402 MHz

Horizontal

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

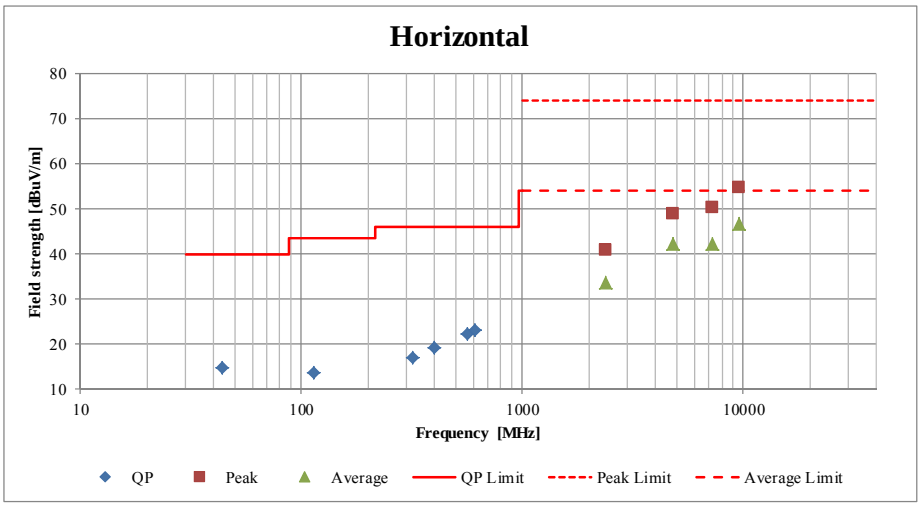
Vertical

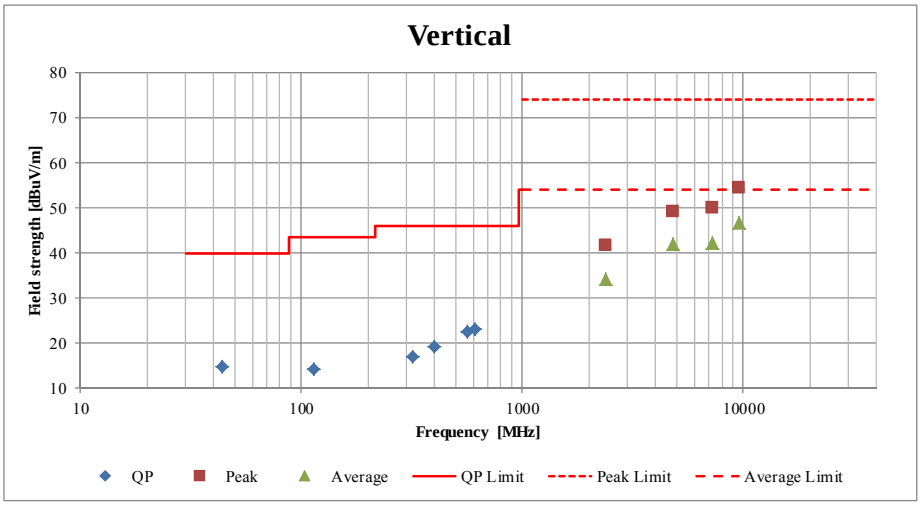
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	11489733H	
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber	
Date	November 1, 2016	November 1, 2016
Temperature / Humidity	21 deg. C / 41 % RH	23 deg. C / 42 % RH
Engineer	Takumi Shimada	Keisuke Kawamura
	(Above 1 GHz)	(Below 1 GHz)
Mode	Tx 2402 MHz	





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

Radiated Spurious Emission

Report No.	11489733H	
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber	
Date	November 1, 2016	November 1, 2016
Temperature / Humidity	21 deg. C / 41 % RH	23 deg. C / 42 % RH
Engineer	Takumi Shimada (Above 1 GHz)	Keisuke Kawamura (Below 1 GHz)
Mode	Tx 2450MHz	

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	43.883	QP	23.1	12.8	6.9	28.1	-	14.7	40.0	25.3	
Hori	113.583	QP	22.1	12.0	7.5	27.9	-	13.7	43.5	29.8	
Hori	321.334	QP	21.5	14.0	8.9	27.3	-	17.1	46.0	28.9	
Hori	402.314	QP	22.0	15.6	9.4	27.8	-	19.2	46.0	26.8	
Hori	564.001	QP	22.0	18.4	9.9	28.0	-	22.3	46.0	23.7	
Hori	610.234	QP	22.0	18.9	10.1	28.0	-	23.0	46.0	23.0	
Hori	4900.000	PK	43.6	31.8	6.2	34.1	-	47.5	73.9	26.4	
Hori	7350.000	PK	41.7	36.3	7.1	34.1	-	51.0	73.9	22.9	Floor noise
Hori	9800.000	PK	42.0	38.5	7.6	34.9	-	53.2	73.9	20.7	Floor noise
Hori	4900.000	AV	35.1	31.8	6.2	34.1	1.1	40.1	53.9	13.8	
Hori	7350.000	AV	33.3	36.3	7.1	34.1	-	42.6	53.9	11.3	Floor noise
Hori	9800.000	AV	33.7	38.5	7.6	34.9	-	44.9	53.9	9.0	Floor noise
Vert	43.883	QP	23.1	12.8	6.9	28.1	-	14.7	40.0	25.3	
Vert	113.583	QP	22.5	12.0	7.5	27.9	-	14.1	43.5	29.4	
Vert	321.334	QP	21.5	14.0	8.9	27.3	-	17.1	46.0	28.9	
Vert	402.314	QP	22.0	15.6	9.4	27.8	-	19.2	46.0	26.8	
Vert	564.001	QP	22.3	18.4	9.9	28.0	-	22.6	46.0	23.4	
Vert	610.234	QP	22.2	18.9	10.1	28.0	-	23.2	46.0	22.8	
Vert	4900.000	PK	45.3	31.8	6.2	34.1	-	49.2	73.9	24.7	
Vert	7350.000	PK	42.4	36.3	7.1	34.1	-	51.7	73.9	22.2	Floor noise
Vert	9800.000	PK	42.5	38.5	7.6	34.9	-	53.7	73.9	20.2	Floor noise
Vert	4900.000	AV	36.4	31.8	6.2	34.1	1.1	41.4	53.9	12.5	
Vert	7350.000	AV	33.5	36.3	7.1	34.1	-	42.8	53.9	11.1	Floor noise
Vert	9800.000	AV	33.9	38.5	7.6	34.9	-	45.1	53.9	8.8	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	11489733H
Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Date	November 4, 2016
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Takumi Shimada
Mode	Tx 2478MHz

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	43.883	QP	22.3	12.9	7.3	32.2	-	10.3	40.0	29.7	
Hori	113.583	QP	22.4	11.9	8.2	32.2	-	10.3	43.5	33.2	
Hori	321.334	QP	21.8	14.0	10.1	31.9	-	14.0	46.0	32.0	
Hori	402.314	QP	21.8	15.6	10.6	31.9	-	16.1	46.0	29.9	
Hori	564.001	QP	22.0	18.6	11.7	32.0	-	20.3	46.0	25.7	
Hori	610.234	QP	21.9	19.2	12.0	32.1	-	21.0	46.0	25.0	
Hori	2483.500	PK	63.9	26.8	7.0	32.6	-	65.1	73.9	8.8	
Hori	4956.000	PK	42.4	31.5	9.1	31.7	-	51.3	73.9	22.6	
Hori	7434.000	PK	42.8	35.5	10.4	32.7	-	56.0	73.9	17.9	Floor noise
Hori	9912.000	PK	43.9	37.2	11.1	33.4	-	58.8	73.9	15.1	Floor noise
Hori	2483.500	AV	49.4	26.8	7.0	32.6	1.1	51.7	53.9	2.2	*1)
Hori	4956.000	AV	33.7	31.5	9.1	31.7	1.1	43.7	53.9	10.2	
Hori	7434.000	AV	32.4	35.5	10.4	32.7	-	45.6	53.9	8.3	Floor noise
Hori	9912.000	AV	34.0	37.2	11.1	33.4	-	48.9	53.9	5.0	Floor noise
Vert	43.883	QP	22.5	12.9	7.3	32.2	-	10.5	40.0	29.5	
Vert	113.583	QP	22.4	11.9	8.2	32.2	-	10.3	43.5	33.2	
Vert	321.334	QP	21.9	14.0	10.1	31.9	-	14.1	46.0	31.9	
Vert	402.314	QP	21.8	15.6	10.6	31.9	-	16.1	46.0	29.9	
Vert	564.001	QP	22.0	18.6	11.7	32.0	-	20.3	46.0	25.7	
Vert	610.234	QP	21.9	19.2	12.0	32.1	-	21.0	46.0	25.0	
Vert	2483.500	PK	60.0	26.8	7.0	32.6	-	61.2	73.9	12.7	
Vert	4956.000	PK	41.6	31.5	9.1	31.7	-	50.5	73.9	23.4	
Vert	7434.000	PK	42.1	35.5	10.4	32.7	-	55.3	73.9	18.6	Floor noise
Vert	9912.000	PK	43.6	37.2	11.1	33.4	-	58.5	73.9	15.4	Floor noise
Vert	2483.500	AV	47.5	26.8	7.0	32.6	1.1	49.8	53.9	4.1	*1)
Vert	4956.000	AV	32.5	31.5	9.1	31.7	1.1	42.5	53.9	11.4	
Vert	7434.000	AV	31.9	35.5	10.4	32.7	-	45.1	53.9	8.8	Floor noise
Vert	9912.000	AV	33.5	37.2	11.1	33.4	-	48.4	53.9	5.5	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 (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

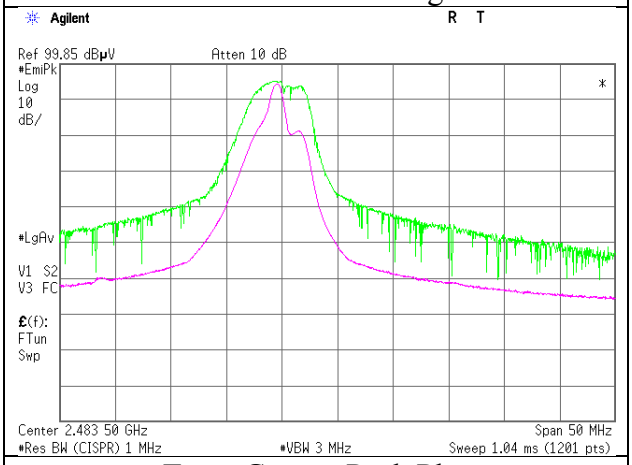
*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	11489733H
Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Date	November 4, 2016
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Takumi Shimada
Mode	Tx 2478 MHz

Horizontal

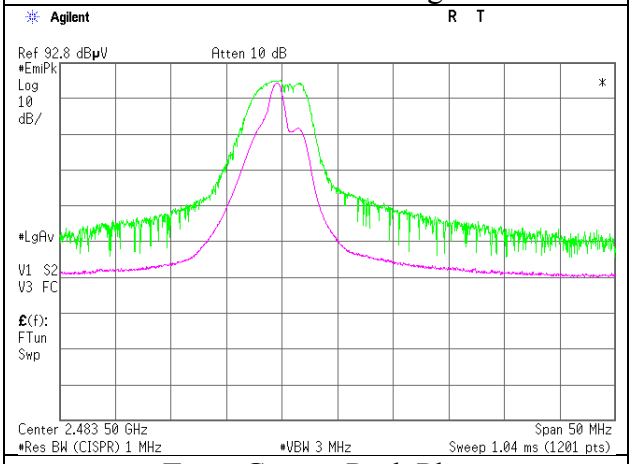
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



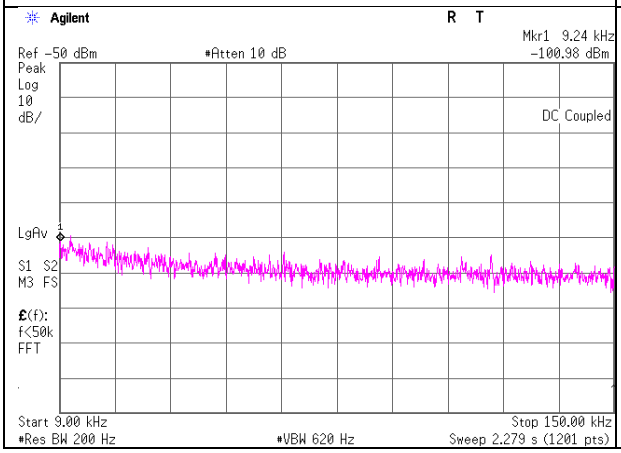
Trace Green : Peak Plot
Trace Purple : Average Plot

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

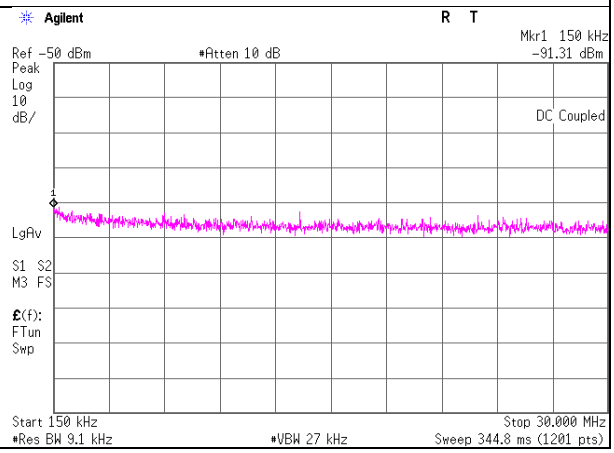
Conducted Spurious Emission

Report No.	11489733H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	November 1, 2016
Temperature / Humidity	23 deg. C / 38 % RH
Engineer	Masafumi Niwa
Mode	Tx 2402 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator 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	-101.0	0.01	9.8	2.0	1	-89.2	300	6.0	-27.9	48.2	76.1	
150.00	-91.3	0.01	9.8	2.0	1	-79.5	300	6.0	-18.2	24.0	42.2	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

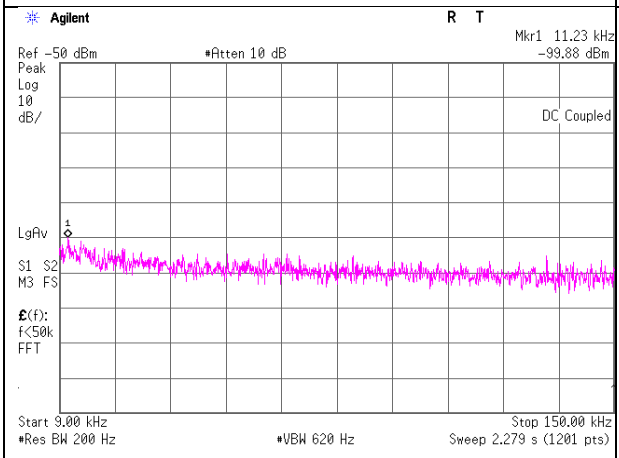
EIRP = Reading + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

*If antenna gain is less than 2.0 dBi, 2.0 dBi is applied to the test result based on KDB 558074 12.2.6.

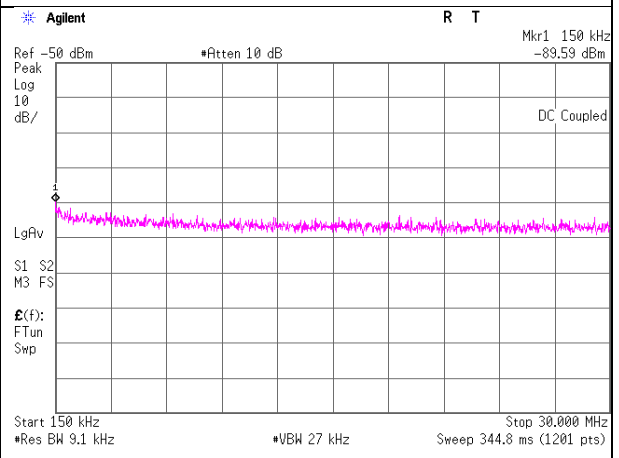
Conducted Spurious Emission

Report No.	11489733H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	November 1, 2016
Temperature / Humidity	23 deg. C / 38 % RH
Engineer	Masafumi Niwa
Mode	Tx 2450 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



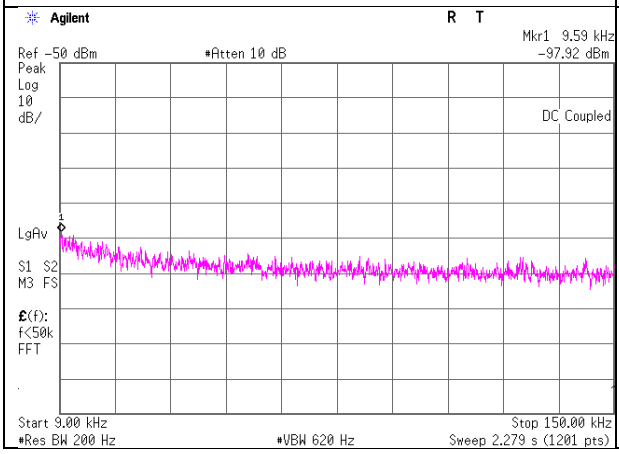
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.23	-99.9	0.01	9.8	2.0	1	-88.1	300	6.0	-26.8	46.5	73.3	
150.00	-89.6	0.01	9.8	2.0	1	-77.8	300	6.0	-16.5	24.0	40.5	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]
EIRP = Reading + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)
*If antenna gain is less than 2.0 dBi, 2.0 dBi is applied to the test result based on KDB 558074 12.2.6.

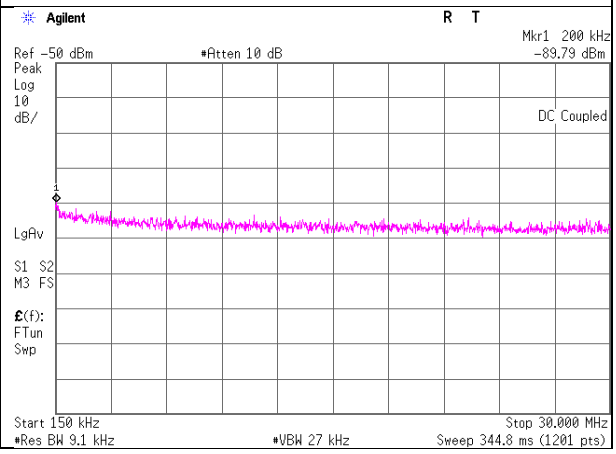
Conducted Spurious Emission

Report No.	11489733H
Test place	Ise EMC Lab. No.11 Measurement Room
Date	November 4, 2016
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Takumi Shimada
Mode	Tx 2478 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator 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
9.59	-97.9	0.01	9.8	2.0	1	-86.1	300	6.0	-24.9	47.9	72.8	
200.00	-89.8	0.01	9.8	2.0	1	-78.0	300	6.0	-16.7	21.5	38.2	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]
EIRP = Reading + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)
*If antenna gain is less than 2.0 dBi, 2.0 dBi is applied to the test result based on KDB 558074 12.2.6.

Power Density

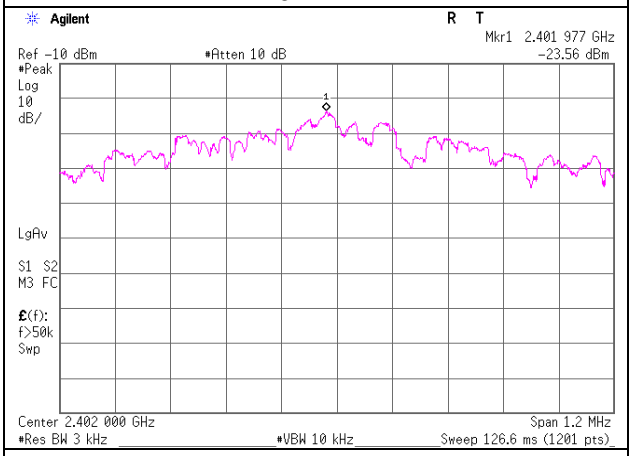
Report No.	11489733H	
Test place	Ise EMC Lab.	
Measurement Room	No.6	No.11
Date	November 1, 2016	November 4, 2016
Temperature / Humidity	23 deg. C / 38 % RH	20 deg. C / 36 % RH
Engineer	Masafumi Niwa	Takumi Shimada
	(Low / Mid ch)	(High ch)
Mode	Tx	

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-23.56	0.73	10.09	-12.74	8.00	20.74
2450.00	-22.85	0.74	10.09	-12.02	8.00	20.02
2478.00	-23.82	0.74	10.09	-12.99	8.00	20.99

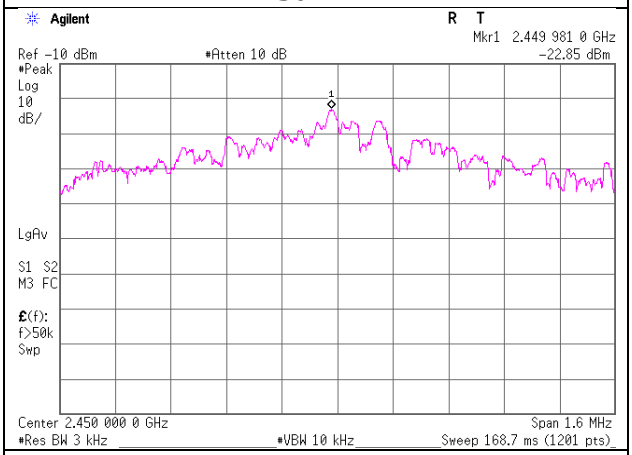
Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

Power Density

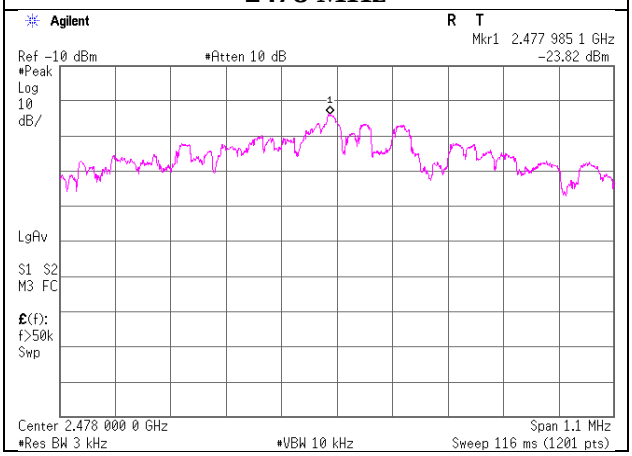
2402 MHz



2450 MHz



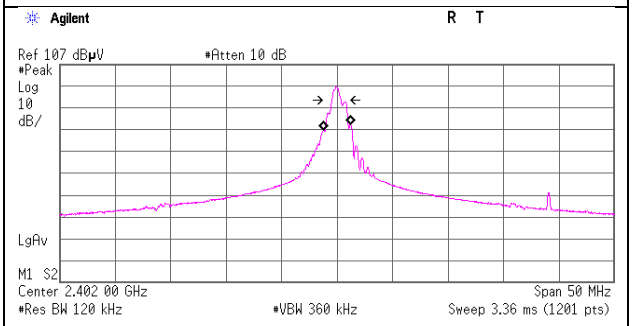
2478 MHz



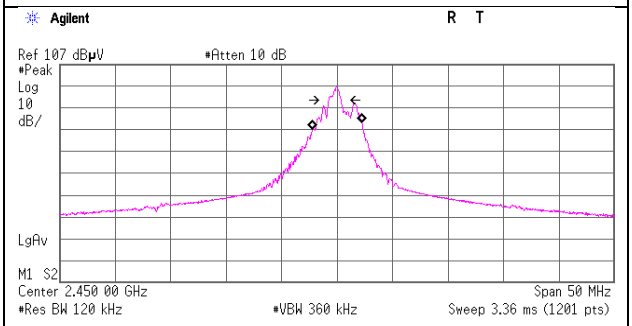
99%Occupied Bandwidth

Report No.	11489733H	
Test place	Ise EMC Lab.	
Measurement Room	No.6	No.11
Date	November 1, 2016	November 4, 2016
Temperature / Humidity	23 deg. C / 38 % RH	20 deg. C / 36 % RH
Engineer	Masafumi Niwa (Low / Mid ch)	Takumi Shimada (High ch)
Mode	Tx	

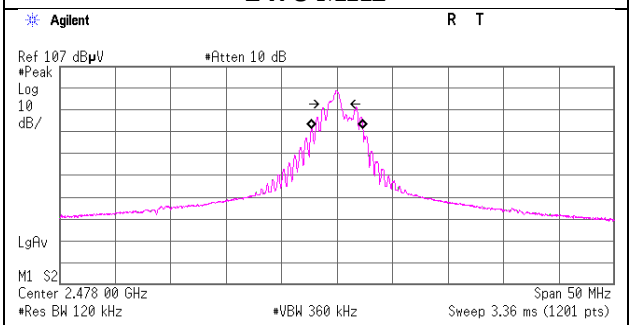
2402 MHz



2450 MHz



2478 MHz



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2016/08/02 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2016/01/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2016/05/19 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2016/02/29 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2016/08/29 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2016/01/19 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2016/02/29 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2016/08/23 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2016/05/16 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2016/01/21 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2016/10/07 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2016/10/07 * 12
MRENT-130	Spectrum Analyzer	Agilent	E4440A	MY46187750	AT	2016/06/03 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2016/03/18 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	AT	2016/03/10 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2015/11/10 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2016/10/21 * 12
MBA-08	Biconical Antenna	Schwarzbeck	VHA9103B	08031	RE	2016/09/29 * 12
MLA-21	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2016/01/30 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2016/02/08 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2015/11/10 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2016/09/13 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2016/10/20 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2016/01/21 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2015/11/06 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2016/09/15 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2016/10/15 * 12
MLA-22	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	RE	2016/01/30 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2016/07/26 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2016/04/05 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2016/03/24 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2016/01/13 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2016/05/29 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2016/05/20 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2016/03/24 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2016/05/29 * 12
MBM-12	Barometer	Sunoh	SBR121	873	AT	2015/02/04 * 36
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2015/12/08 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2016/10/17 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2016/10/17 * 12
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	AT	2016/06/17 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2016/09/21 * 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: **RE: Radiated Emission test**
AT: Antenna Terminal Conducted test