



RADIO TEST REPORT

Test Report No. : 12725754M-A-R2

Applicant : TAIYO YUDEN CO., LTD.
Type of Equipment : Bluetooth low energy / ANT / 802.15.4 Module
Model No. : EYSKJN
FCC ID : RYYEYSKJN
Test regulation : FCC Part 15 Subpart C: 2018
Test Result : Complied (Refer to SECTION 3.2)

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
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It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Kashima EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 12725754M-A-R1. 12725754M-A-R1 is replaced with this report.

Date of test: February 15 to March 9, 2019

Representative test operator:

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 There is no testing item of "Non-accreditation"

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REVISION HISTORY

Original Test Report No.: 12725754M-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12725754M-A	April 1, 2019	-	-
1	12725754M-A-R1	April 16, 2019	P. 9	Modification of the asterisk for the following comment. *The worst condition was determined based on the test result of Maximum Peak Output Power
1	12725754M-A-R1	April 16, 2019	P. 14	Modification of the "r" from 0.005 m to 0.0 m And add the following comment to the test set up on 1 GHz - 10 GHz. * The test was performed with r = 0.0 m since EUT is small and it was the rather conservative condition.
1	12725754M-A-R1	April 16, 2019	P. 40	Modification of the Duty factor of ANT 1 Mbps from 0.23 dB to 0.22 dB
1	12725754M-A-R1	April 16, 2019	P. 93	Fill out information to 143656 and 143654. Description: Ruler Serial: none (-)
1	12725754M-A-R1	April 16, 2019	P. 98	Add the following comment regarding a description of the chip. *The chip is mounted to the motherboard as a part of a test jig.
2	12725754M-A-R2	April 17, 2019	P. 9	Modification of the following comment from *The worst condition was determined based on the test result of Maximum Peak Output Power. to *Bluetooth (BT) Low Energy (LE) (125 kbps, 500 kbps, 1 Mbps) are the same bandwidth so that the test of 1 Mbps was performed as a representative based on the test result of Maximum Peak Output Power.
2	12725754M-A-R2	April 17, 2019	P. 98	Modification of the following comment from *The chip is mounted to the motherboard as a part of a test jig. to *The chip is mounted to the EUT as a part of a test jig. And delete the following comment. *Use the motherboard with no metal plate, therefore this motherboard does not affect the module test condition.

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SECTION 1: Customer information

Company Name : TAIYO YUDEN CO., LTD.
Address : 8-1, Sakae-cho, Takasaki-shi, Gunma 370-8522, Japan
Telephone Number : +81-27-324-2313
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Contact Person : Hideki Kato

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No. on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

* The laboratory is exempted from liability of any test results affected from the information in SECTION 2 and 4.

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

2.1 Identification of E.U.T.

Type of Equipment : Bluetooth low energy / ANT / 802.15.4 Module
Model No. : EYSKJN
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 3 V (DC 1.7 V - 3.6 V), 0.02 A
Receipt Date of Sample : February 14, 2019
(Information from test lab.)
Country of Mass-production : Japan
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: EYSKJN (referred to as the EUT in this report) is a Bluetooth low energy / ANT / 802.15.4 Module.

Radio Specification

< Bluetooth (BT) Low Energy (LE) (1 Mbps, 2 Mbps) BLE Long range (500 kbps, 125 kbps)>

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : GFSK
Antenna type : Monopole Antenna
Antenna Gain : -1.5 dBi
Clock frequency (Maximum) : 32 MHz

< ANT (1 Mbps) >

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : GFSK
Antenna type : Monopole Antenna
Antenna Gain : -1.5 dBi
Clock frequency (Maximum) : 32 MHz

< Nordic Original (2 Mbps) >

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : GFSK
Antenna type : Monopole Antenna
Antenna Gain : -1.5 dBi
Clock frequency (Maximum) : 32 MHz

< IEEE802.15.4 >

Radio Type : Transceiver
Frequency of Operation : 2405 MHz - 2475 MHz
Modulation : O-QPSK, DSSS
Antenna type : Monopole Antenna
Antenna Gain : -1.5 dBi
Clock frequency (Maximum) : 32 MHz

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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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.207	QP 10.1 dB, 0.15000 MHz, N (Nordic Original 2 Mbps) AV 14.2 dB, 12.09090 MHz, N (Nordic Original 2 Mbps)	Complied a)	-
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
6dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r01	FCC: Section 15.247(a)(2)	See data.	Complied b)	Conducted
	IC: -	IC: RSS-247 5.2(a)			
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r01	FCC: Section 15.247(b)(3)	See data.	Complied c)	Conducted
	IC: RSS-Gen 6.12	IC: RSS-247 5.4(d)			
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05r01	FCC: Section 15.247(e)	See data.	Complied d)	Conducted
	IC: -	IC: RSS-247 5.2(b)			
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r01	FCC: Section15.247(d)	1.2 dB 7206.00 MHz, AV, Vert. (ANT 1 Mbps)	Complied# e), f)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
	IC: RSS-Gen 6.13	IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

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 15.247 Meas Guidance v05r01 8.5 and 8.6.

- a) Refer to APPENDIX 1 (data of Conducted Emission)
b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)
c) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
d) Refer to APPENDIX 1 (data of Power Density)
e) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
f) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

FCC Part 15.31 (e)

This EUT provides the stable voltage constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 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 15.203/212.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	RSS-Gen 6.7	IC: -	N/A	- a)	Conducted

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

a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

3.4 Uncertainty

EMI

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Conducted emission

Frequency range	Required Uncertainty (+/-)	Uncertainty (+/-)
0.15 MHz to 30 MHz	3.4 dB	3.2dB

Radiated emission

Measurement distance	Frequency range	Required Uncertainty (+/-)	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	Not Defined	3.0 dB
	30 MHz to 200 MHz	6.3 dB	5.2 dB
	200 MHz to 1000 MHz		6.2 dB
	1 GHz to 6 GHz	5.2 dB	4.7 dB
	6 GHz to 18 GHz	5.5 dB	5.1 dB
	18 GHz to 40 GHz	Not Defined	5.4 dB
1 m	1 GHz to 18 GHz	Not Defined	5.2 dB
	18 GHz to 40 GHz		5.5 dB

Antenna Terminal test

Test Item	Required Uncertainty (+/-)	Uncertainty (+/-)
6 dB Bandwidth / 99 % Occupied Bandwidth	Not Defined	1.6 %
Maximum Peak Output Power	0.75 dB	0.74 dB
Average Output Power		0.74 dB
Burst Rate	Not Defined	0.012 %
Power Density	4 dB	2.2 dB
Conducted Spurious Emission (9 kHz to 30 MHz)	4 dB	2.2 dB

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3.5 Test Location

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JAB Accreditation No.:RTL02610 / FCC Test Firm Registration Number: 910230

Test site	ISED Assigned Code	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Open site	4659A-1	6.0 x 5.5 x 2.5	20 x 40	10 m
No.5 Open site	4659A-5	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	4659A-1	5.4 x 4.5 x 2.3	-	-
No.3 Shielded room	-	5.4 x 3.6 x 2.3	-	-
No.4 Shielded Room	-	6.1 x 6.1 x 3.1	-	-
No.5 Shielded Room	4659A-5	4.2 x 3.1 x 2.5	-	-
No.3 Fully Anechoic Chamber	-	7.0 x 3.5 x 3.5	-	-
No.6 Semi-anechoic Chamber	4659A-6	8.5 x 5.5 x 5.2	-	3 m
No.10 Semi-anechoic Chamber	4659A-10	18.4 x 9.9 x 7.7	-	10 m
No.11 Semi-anechoic Chamber	4659A-7	9.0 x 6.5 x 5.2	-	3 m
No.1 Measurement room	-	5.0 x 3.7 x 2.6	-	-
No.2 Measurement room	-	4.3 x 4.4 x 2.7	-	-
No.3 Measurement room	-	4.5 x 5.3 x 2.7	-	-

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*
Bluetooth (BT) Low Energy (LE) 1 Mbps *)	Maximum Packet Size, PRBS9
Bluetooth (BT) Low Energy (LE) 2 Mbps	Maximum Packet Size, PRBS9
ANT 1 Mbps	1 Mbps
Nordic Original 2 Mbps	2 Mbps
IEEE802.15.4	-
*Bluetooth (BT) Low Energy (LE) (125 kbps, 500 kbps, 1 Mbps) are the same bandwidth so that the test of 1 Mbps was performed as a representative based on the test result of Maximum Peak Output Power.	
Power of the EUT was set by the software as follows; -Power settings: +8 dBm,-40 dBm -Software: 10_BLE_TEST_tool-BT5.xls Radio_test_tool_20180927.xls	
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 BT LE 1 Mbps	2402 MHz, 2440 MHz, 2480 MHz
	Tx BT LE 2 Mbps	
	Tx ANT 1 Mbps	2402 MHz, 2441 MHz, 2480 MHz
	Tx Nordic Original 2 Mbps	
	Tx IEEE 802.15.4	2405 MHz, 2440 MHz, 2475 MHz
Spurious Emission	Tx BT LE 1 Mbps	2402 MHz, 2440 MHz, 2480 MHz
	Tx BT LE 2 Mbps	
	Tx ANT 1Mbps	2402 MHz, 2441 MHz, 2480 MHz
	Tx Nordic Original 2 Mbps	
	Tx IEEE 802.15.4	2405 MHz, 2440 MHz, 2475 MHz
Maximum Peak Output Power	Tx BT LE 125 kbps	2402 MHz, 2440 MHz, 2480 MHz
	Tx BT LE 500 kbps	
	Tx BT LE 1 Mbps	
	Tx BT LE 2 Mbps	2402 MHz, 2441 MHz, 2480 MHz
	Tx ANT 1Mbps	
	Tx Nordic Original 2 Mbps	
Tx IEEE 802.15.4	2405 MHz, 2440 MHz, 2475 MHz	
Power Density 6dB Bandwidth 99% Occupied Bandwidth Conducted Spurious Emission	Tx BT LE 1 Mbps	2402 MHz, 2440 MHz, 2480 MHz
	Tx BT LE 2 Mbps	
	Tx ANT 1 Mbps	2402 MHz, 2441 MHz, 2480 MHz
	Tx Nordic Original 2 Mbps	
	Tx IEEE 802.15.4	2405 MHz, 2440 MHz, 2475 MHz

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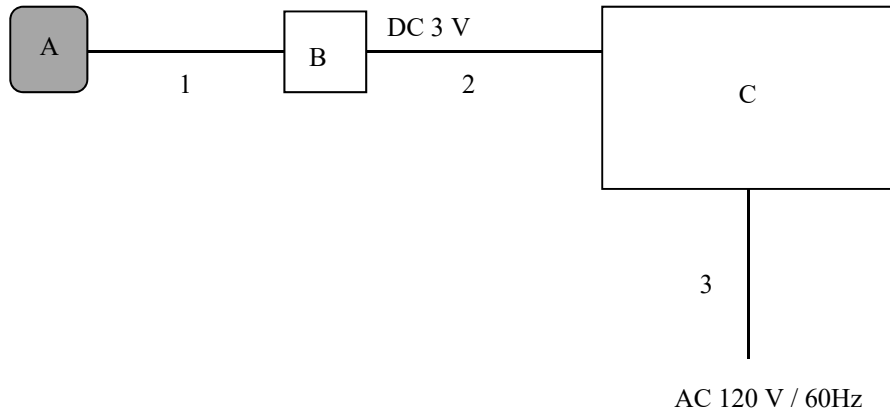
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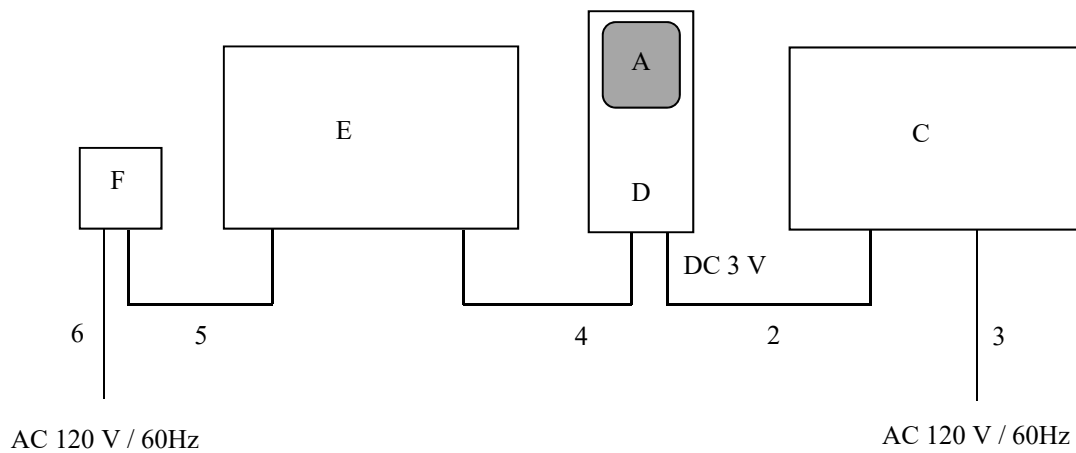
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4.2 Configuration and peripherals

Radiated Emission test



Other tests



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

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Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth low energy / ANT / 802.15.4 Module	EYSKJN	10 *1) 11 *2) 4 *3) 5 *4) 8 *5)	TAIYO YUDEN	EUT
B	Evaluation Board	TE8707	-	TAIYO YUDEN	-
C	DC Power Supply	GSV3000	60646742	DIAMOND ANTENNA	-
D	Evaluation Board	TE8926	-	TAIYO YUDEN	-
E	PC	CF-T2	T0993Z	Panasonic	-
F	AC Adaptor	CF-AA1625A	1625AM406Z21913F	Panasonic	-

*1) Used for BT LE mode (+8 dBm setting) for Radiated Emission and Conducted Emission test

*2) Used for ANT, Nordic Original mode and IEEE802.15.4 mode (+8 dBm setting) for Radiated Emission and Conducted Emission test

*3) Used for BT LE mode (+8 dBm setting) for Antenna Terminal conducted test

*4) Used for BT LE mode (-40 dBm setting) for Antenna Terminal conducted test

*5) Used for ANT, Nordic Original mode and IEEE802.15.4 mode for Antenna Terminal conducted test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.55	Shielded	Shielded	*1)
		0.45	Shielded	Shielded	*2)
2	DC Cable	0.5 + 1.2	Unshielded	Unshielded	-
3	AC Cable	1.7	Unshielded	Unshielded	-
4	USB Cable	1.8	Shielded	Shielded	-
5	DC Cable	1.2	Unshielded	Unshielded	-
6	AC Cable	0.9	Unshielded	Unshielded	-

*1) Used for BT LE mode (+8 dBm setting) for Radiated Emission and Conducted Emission test

*2) Used for ANT, Nordic Original mode and IEEE802.15.4 mode (+8 dBm setting) for Radiated Emission and Conducted Emission test

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a wooden 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.

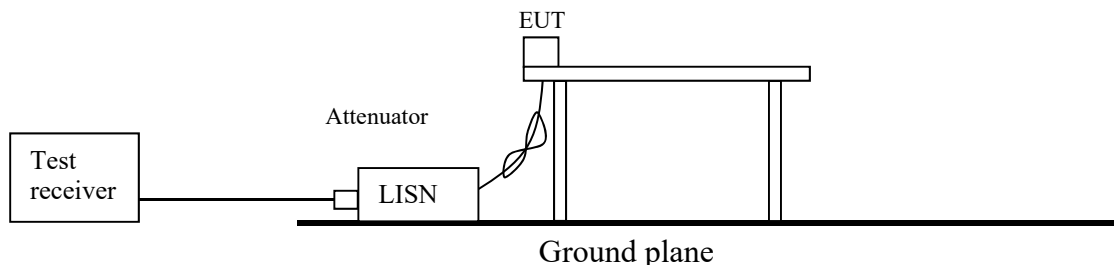
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Shielded Room. The EUT was connected to a LISN (AMN).

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

Figure 1: Test Setup



SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05r01".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 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 1 GHz	Above 1 GHz
Antenna Type	Hybrid	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	<u>11.12.2.5.1 *1)</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces <u>11.12.2.5.2 *1)</u> The duty cycle was less than 98% for detected noise, a duty factor was added to the 11.12.2.5.1 results.	RBW: 100 kHz VBW: 300 kHz

*1) Average Power Measurement was performed based on ANSI C63.10-2013.

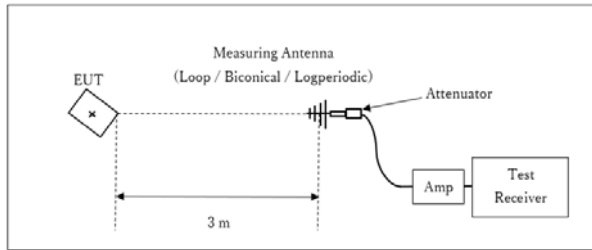
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Figure 2: Test Setup

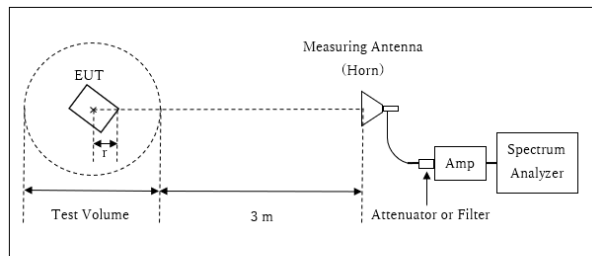
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

× : Center of turn table

Distance Factor: $20 \times \log(4.5 \text{ m} / 3.0 \text{ m}) = 3.5 \text{ dB}$

* Test Distance: $(3 + \text{Test Volume} / 2) - r = 4.5 \text{ m}$

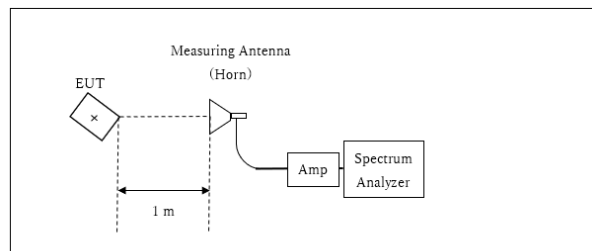
Test Volume : 3.0 m

(Test Volume has been calibrated based on CISPR 16-1-4.)

r = 0.0 m

* The test was performed with r = 0.0 m since EUT is small and it was the rather conservative condition.

10 GHz - 26.5 GHz



× : Center of turn table

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

* Test Distance: 1 m

- The 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.

Worst position:

(BT LE 1 Mbps, 2 Mbps)

	Below 1 GHz	Above 1 GHz
Horizontal	X	X
Vertical	X	Z

(ANT 1 Mbps, Nordic Original 2 Mbps, IEEE 802.15.4)

	Below 1 GHz	Above 1 GHz
Horizontal	X	X
Vertical	X	Z

Measurement range : 30 MHz - 26.5 GHz

Test data : APPENDIX

Test result : Pass

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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: 160 MHz BW) Spectrum Analyzer *3) *4)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *5)
Conducted Spurious Emission *6)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Peak Power Measurement was performed based on Section 11.9.1.1 RBW \geq DTS bandwidth of "ANSI C63.10-2013". (Power setting: -40 dBm) *4) Average Power Measurement was performed based on Section 11.9.2.2.4 Method AVGSA-2 of "ANSI C63.10-2013". (Power setting: -40 dBm) *5) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013". *6) 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 = 10 kHz)							

The test results and limit are rounded off to two decimals place, so some differences might be observed.
The equipment and cables were not used for factor 0 dB of the data sheets.

Test data : APPENDIX
Test result : Pass

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Facsimile : +81 478 82 3373

APPENDIX 1: Test data

Conducted Emission

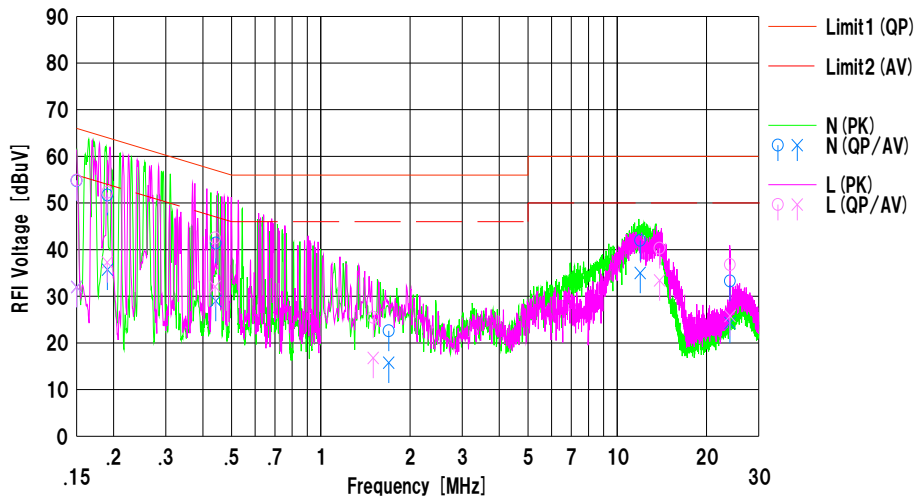
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.1 Shielded Room
Date : 2019/03/05

Company : TAIYO YUDEN CO., LTD. Mode : Tx BT LE 1 Mbps 2440MHz
Kind of EUT : Bluetooth low energy / ANT / 802.15.4 Order No. : 12725754M
Model No. : EYSKJN Power : DC 3V
Serial No. : 10 Temp./Humi. : 18deg.C. / 40%RH
Remarks : -

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Tested by : Kazuhiro Ando

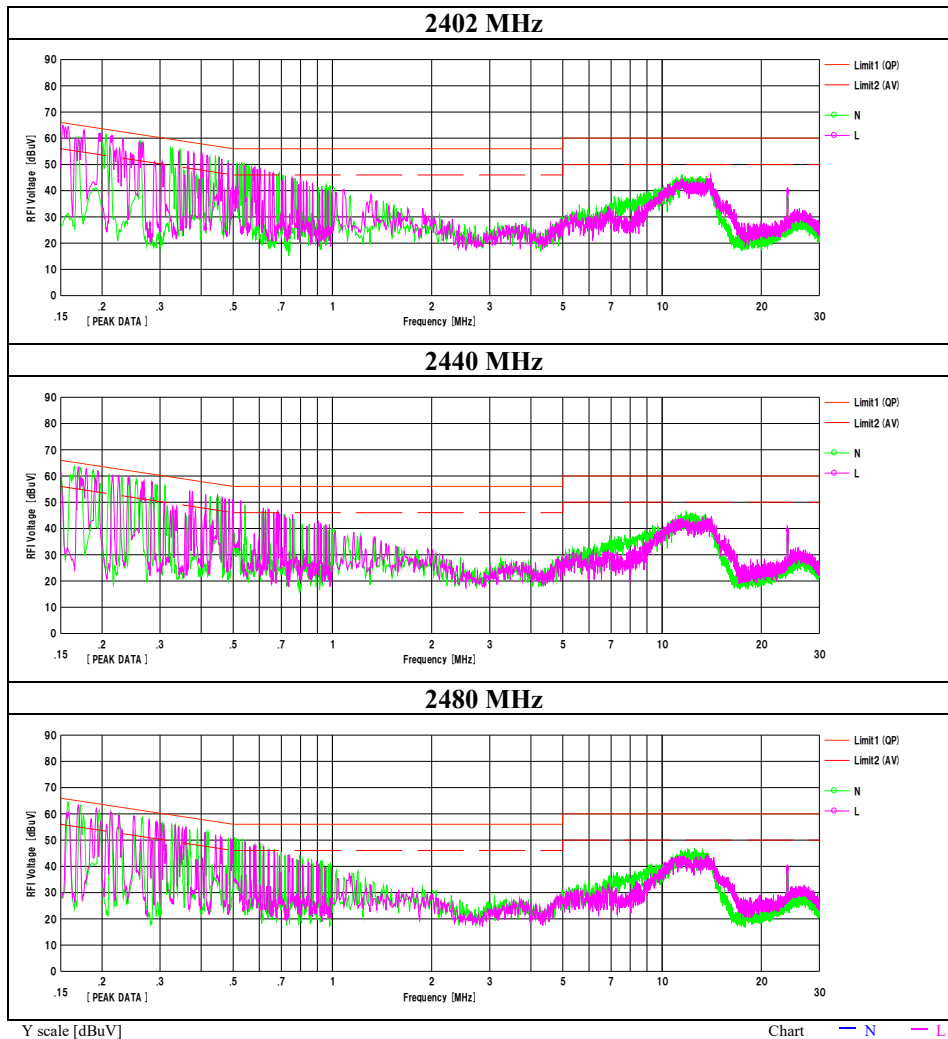


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	44.6	21.8	10.2	54.8	32.0	66.0	56.0	11.2	24.0	N	
2	0.19057	41.5	25.5	10.2	51.7	35.7	64.0	54.0	12.3	18.3	N	
3	0.44222	31.1	18.7	10.3	41.4	29.0	57.0	47.0	15.6	18.0	N	
4	1.69525	12.2	5.4	10.4	22.6	15.8	56.0	46.0	33.4	30.2	N	
5	11.95472	31.0	24.0	11.0	42.0	35.0	60.0	50.0	18.0	15.0	N	
6	24.00262	21.5	12.5	11.8	33.3	24.3	60.0	50.0	26.7	25.7	N	
7	0.15000	44.7	21.8	10.2	54.9	32.0	66.0	56.0	11.1	24.0	L	
8	0.19021	42.1	27.1	10.2	52.3	37.3	64.0	54.0	11.7	16.7	L	
9	0.43987	32.2	21.8	10.3	42.5	32.1	57.1	47.1	14.6	15.0	L	
10	1.50277	15.1	6.4	10.4	25.5	16.8	56.0	46.0	30.5	29.2	L	
11	13.89351	29.1	22.2	11.2	40.3	33.4	60.0	50.0	19.7	16.6	L	
12	24.00693	25.0	14.0	11.8	36.8	25.8	60.0	50.0	23.2	24.2	L	

Calculation:Result [dBuV]=Reading [dBuV]+C.Fac (AMN+Cable) [dB]
AMN:CLS-03

Conducted Emission

Report No.	12725754M-A-R2
Test place	Kashima EMC Lab. No.1 Shielded Room
Date	March 5, 2019
Temperature / Humidity	18 deg. C / 40 % RH
Engineer	Kazuhiro Ando
Mode	Tx BT LE 1 Mbps



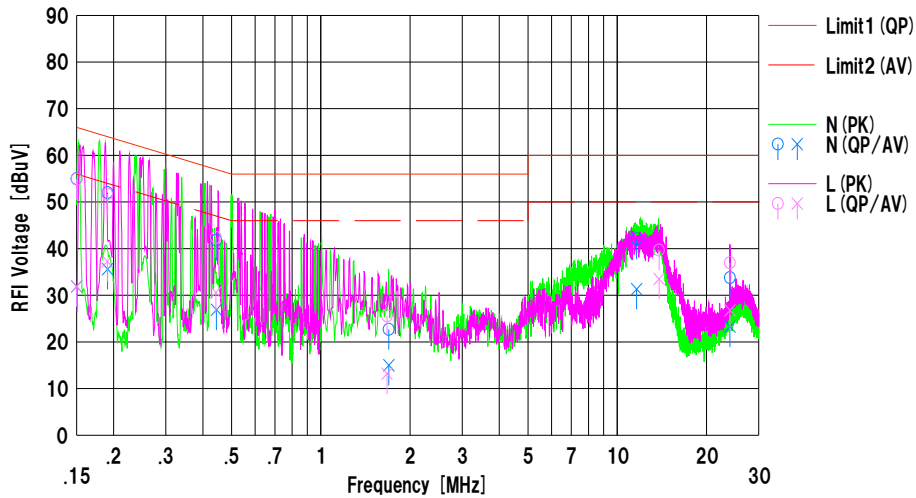
Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.1 Shielded Room
Date : 2019/03/05

Company : TAIYO YUDEN CO., LTD.	Mode : Tx BT LE 2 Mbps 2440MHz
Kind of EUT : Bluetooth low energy / ANT / 802.15.4	Order No. : 12725754M
Model No. : EYSKJN	Power : DC 3V
Serial No. : 10	Temp./Humi. : 18deg.C. / 40%RH
Remarks : -	

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV
Tested by : Kazuhiro Ando

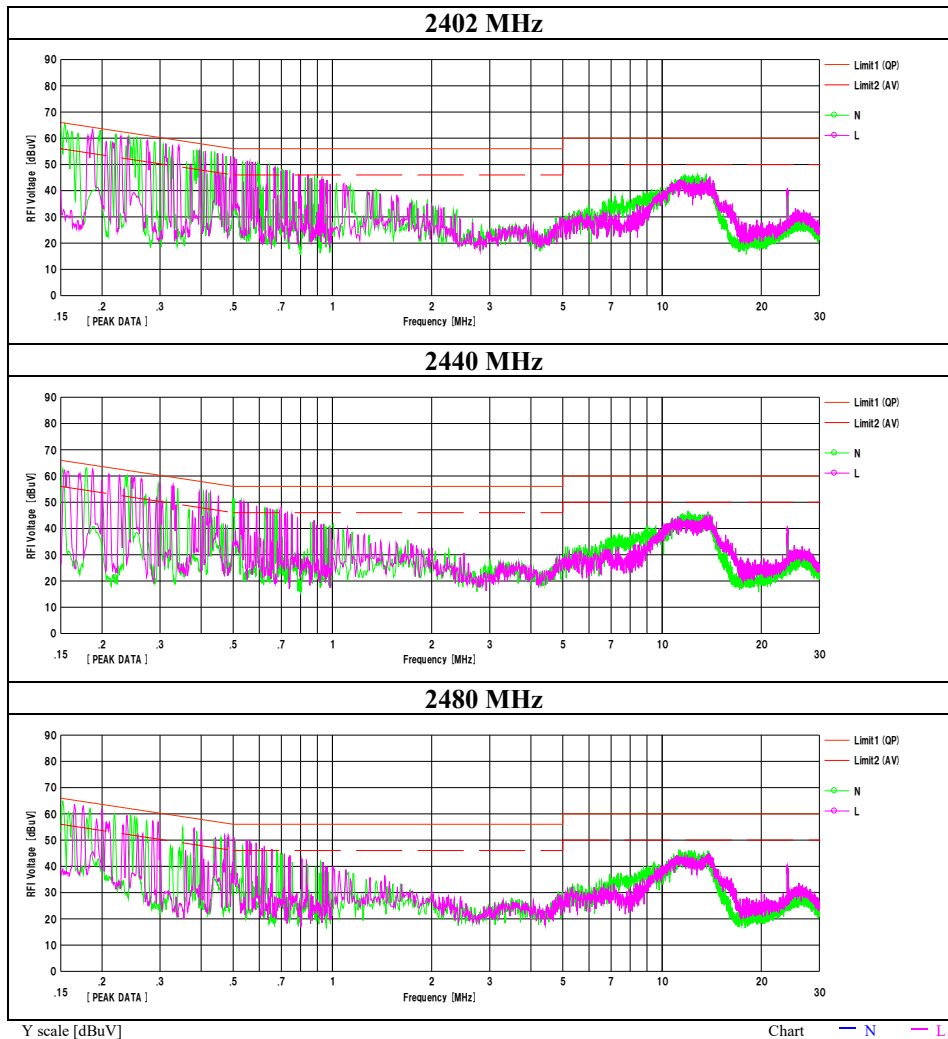


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	44.8	21.7	10.2	55.0	31.9	66.0	56.0	11.0	24.1	N	
2	0.19077	41.8	25.4	10.2	52.0	35.6	64.0	54.0	12.0	18.4	N	
3	0.44445	31.5	16.6	10.3	41.8	26.9	57.0	47.0	15.2	20.1	N	
4	1.69673	12.3	4.6	10.4	22.7	15.0	56.0	46.0	33.3	31.0	N	
5	11.62500	31.1	20.3	11.0	42.1	31.3	60.0	50.0	17.9	18.7	N	
6	24.00931	22.0	11.5	11.8	33.8	23.3	60.0	50.0	26.2	26.7	N	
7	0.15000	44.7	21.7	10.2	54.9	31.9	66.0	56.0	11.1	24.1	L	
8	0.19037	41.5	27.1	10.2	51.7	37.3	64.0	54.0	12.3	16.7	L	
9	0.44273	32.1	20.3	10.3	42.4	30.6	57.0	47.0	14.6	16.4	L	
10	1.67254	15.2	2.8	10.4	25.6	13.2	56.0	46.0	30.4	32.8	L	
11	13.83940	28.5	22.3	11.2	39.7	33.5	60.0	50.0	20.3	16.5	L	
12	24.01155	25.2	15.0	11.8	37.0	26.8	60.0	50.0	23.0	23.2	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (AMN+Cable) [dB]
AMN:CLS-03

Conducted Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.1 Shielded Room
Date March 5, 2019
Temperature / Humidity 18 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx BT LE 2 Mbps



Conducted Emission

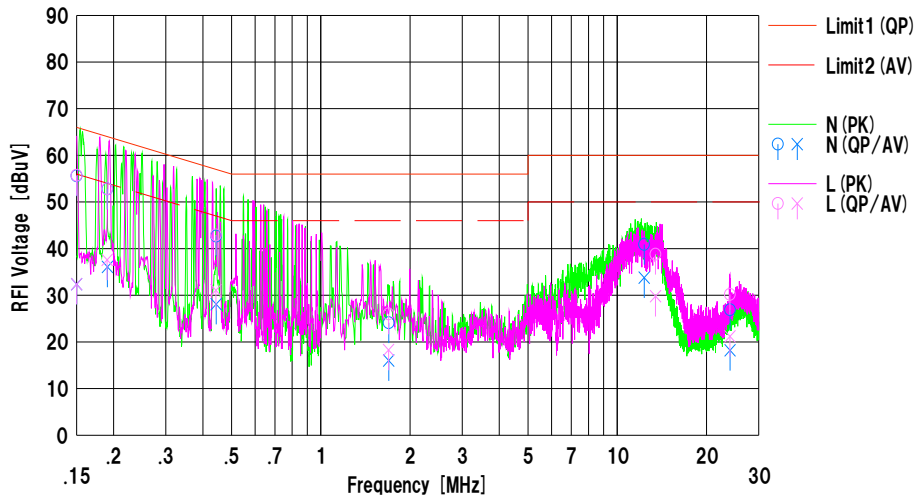
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.1 Shielded Room
Date : 2019/03/05

Company : TAIYO YUDEN CO., LTD.	Mode : Tx ANT 1 Mbps 2441MHz
Kind of EUT : Bluetooth low energy / ANT / 802.15.4	Order No. : 12725754M
Model No. : EYSKJN	Power : DC 3V
Serial No. : 11	Temp./Humi. : 18deg.C. / 40%RH
Remarks : -	

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Tested by : Kazuhiro Ando

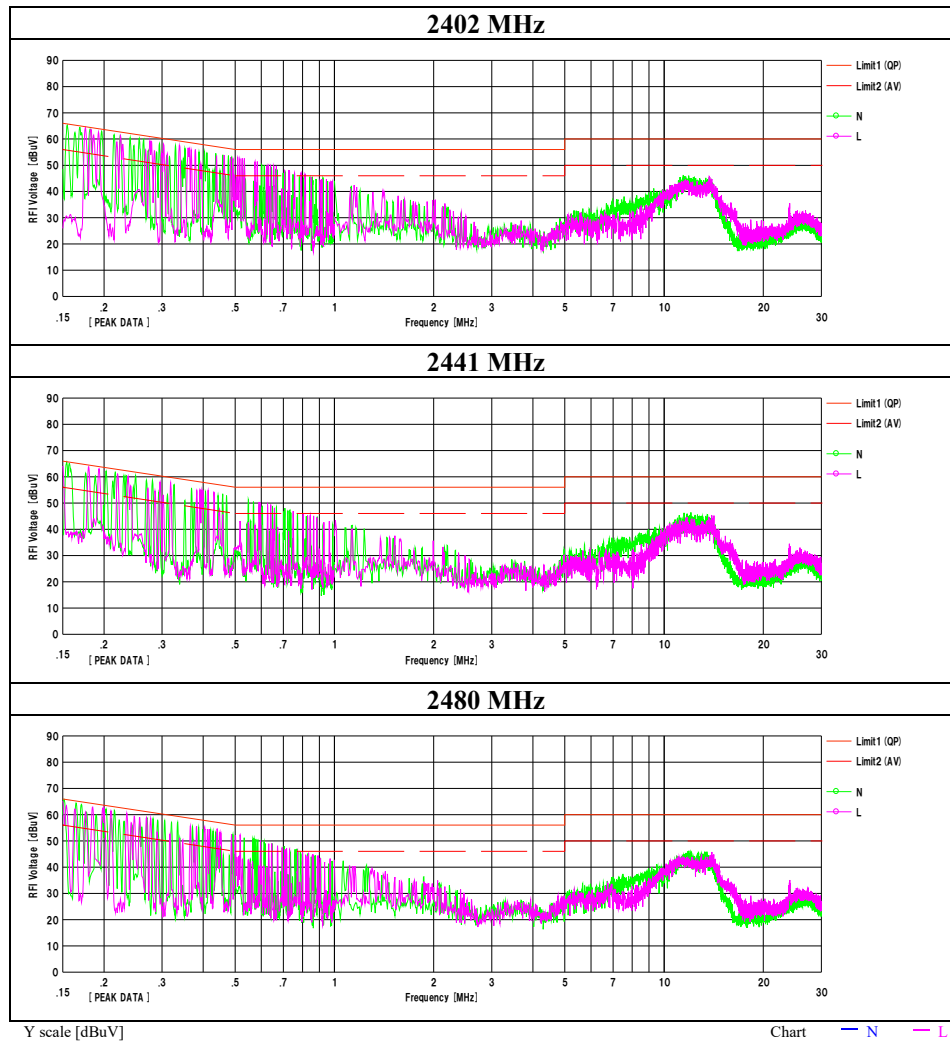


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	45.4	22.2	10.2	55.6	32.4	66.0	56.0	10.4	23.6	N	
2	0.19052	42.6	25.9	10.2	52.8	36.1	64.0	54.0	11.2	17.9	N	
3	0.44365	32.4	17.8	10.3	42.7	28.1	57.0	47.0	14.3	18.9	N	
4	1.69485	13.7	5.6	10.4	24.1	16.0	56.0	46.0	31.9	30.0	N	
5	12.33375	29.9	22.8	11.0	40.9	33.8	60.0	50.0	19.1	16.2	N	
6	24.02540	15.1	6.4	11.8	26.9	18.2	60.0	50.0	33.1	31.8	N	
7	0.15000	45.5	22.2	10.2	55.7	32.4	66.0	56.0	10.3	23.6	L	
8	0.19011	42.6	27.4	10.2	52.9	37.6	64.0	54.0	11.2	16.4	L	
9	0.44267	32.6	20.8	10.3	42.9	31.1	57.0	47.0	14.1	15.9	L	
10	1.69253	15.6	7.9	10.4	26.0	18.3	56.0	46.0	30.0	27.7	L	
11	13.46450	27.7	18.7	11.1	38.8	29.8	60.0	50.0	21.2	20.2	L	
12	24.00864	18.4	9.4	11.8	30.2	21.2	60.0	50.0	29.8	28.8	L	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (AMN+Cable) [dB]
AMN:CLS-03

Conducted Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.1 Shielded Room
Date March 5, 2019
Temperature / Humidity 18 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx ANT 1 Mbps



Y scale [dBuV]

Chart — N — L

UL Japan, Inc.

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Conducted Emission

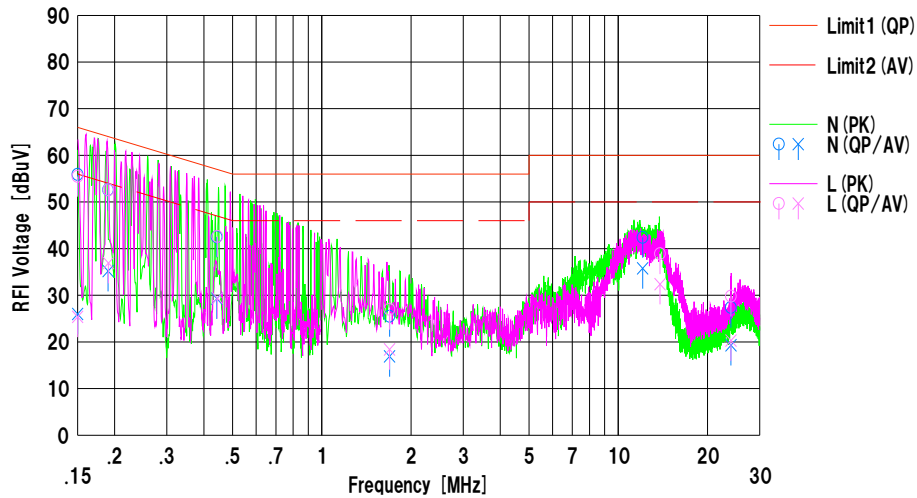
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.1 Shielded Room
Date : 2019/03/05

Company : TAIYO YUDEN CO., LTD.	Mode : Tx Nordic 2 Mbps 2441MHz
Kind of EUT : Bluetooth low energy / ANT / 802.15.4	Order No. : 12725754M
Model No. : EYSKJN	Power : DC 3V
Serial No. : 11	Temp./Humi. : 18deg.C. / 40%RH
Remarks : -	

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Tested by : Kazuhiro Ando

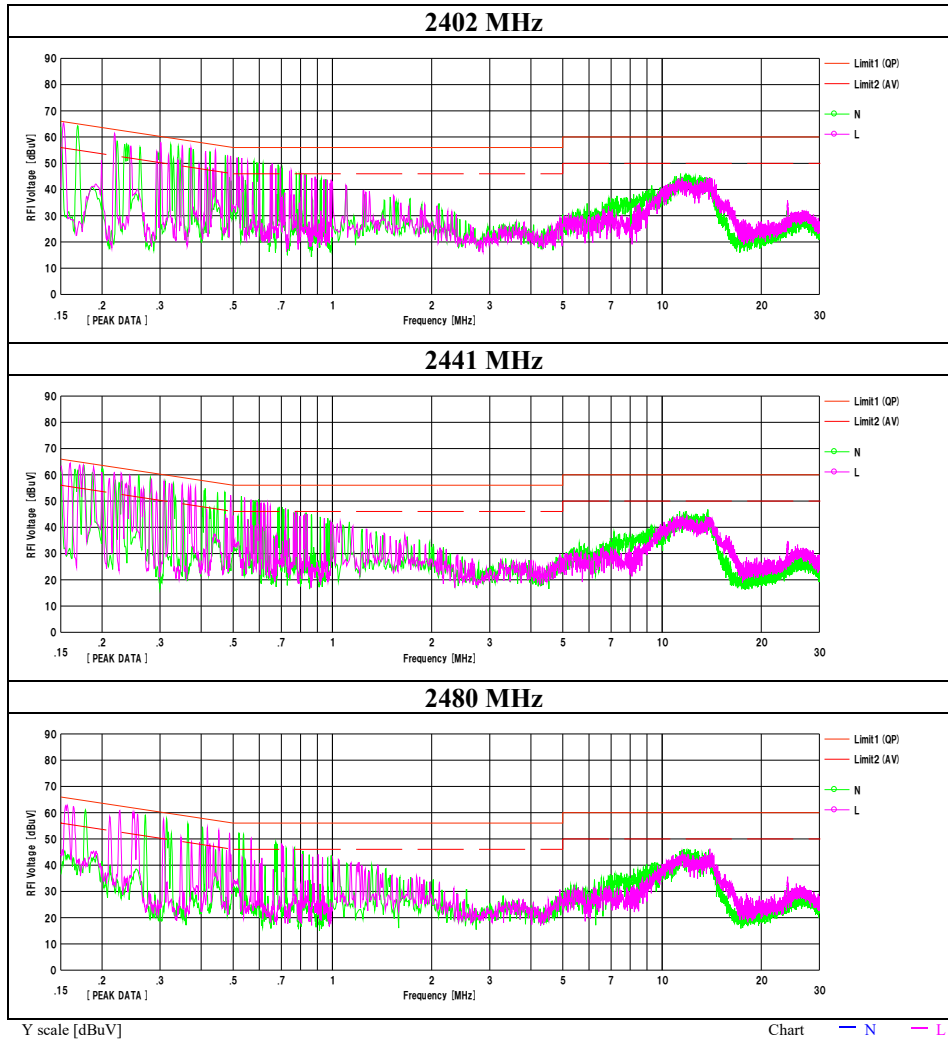


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	45.7	15.8	10.2	55.9	26.0	66.0	56.0	10.1	30.0	N	
2	0.19013	42.4	25.0	10.2	52.6	35.2	64.0	54.0	11.4	18.8	N	
3	0.44225	32.2	19.0	10.3	42.5	29.3	57.0	47.0	14.5	17.7	N	
4	1.69332	15.1	6.5	10.4	25.5	16.9	56.0	46.0	30.5	29.1	N	
5	12.09090	31.4	24.8	11.0	42.4	35.8	60.0	50.0	17.6	14.2	N	
6	24.00525	15.6	7.5	11.8	27.4	19.3	60.0	50.0	32.6	30.7	N	
7	0.15000	45.3	15.2	10.2	55.5	25.4	66.0	56.0	10.5	30.6	L	
8	0.19057	42.4	26.7	10.2	52.6	36.9	64.0	54.0	11.4	17.1	L	
9	0.44467	32.3	19.1	10.3	42.6	29.4	57.0	47.0	14.4	17.6	L	
10	1.69111	16.6	8.0	10.4	27.0	18.4	56.0	46.0	29.0	27.6	L	
11	13.83630	27.7	21.2	11.2	38.9	32.4	60.0	50.0	21.1	17.6	L	
12	24.00310	18.0	8.5	11.8	29.8	20.3	60.0	50.0	30.2	29.7	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (AMN+Cable) [dB]
AMN:CLS-03

Conducted Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.1 Shielded Room
Date March 5, 2019
Temperature / Humidity 18 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx Nordic Original 2 Mbps



Conducted Emission

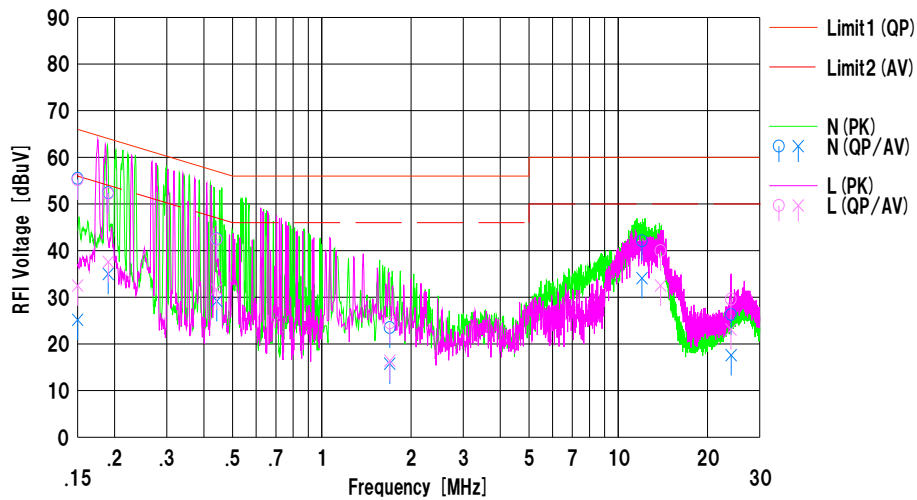
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.1 Shielded Room
Date : 2019/03/05

Company : TAIYO YUDEN CO., LTD.	Mode : Tx IEEE 802.13.4 250 kbps 2440MHz
Kind of EUT : Bluetooth low energy / ANT / 802.15.4	Order No. : 12725754M
Model No. : EYSKJN	Power : DC 3V
Serial No. : 11	Temp./Humi. : 18deg.C. / 40%RH
Remarks : -	

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Tested by : Kazuhiro Ando

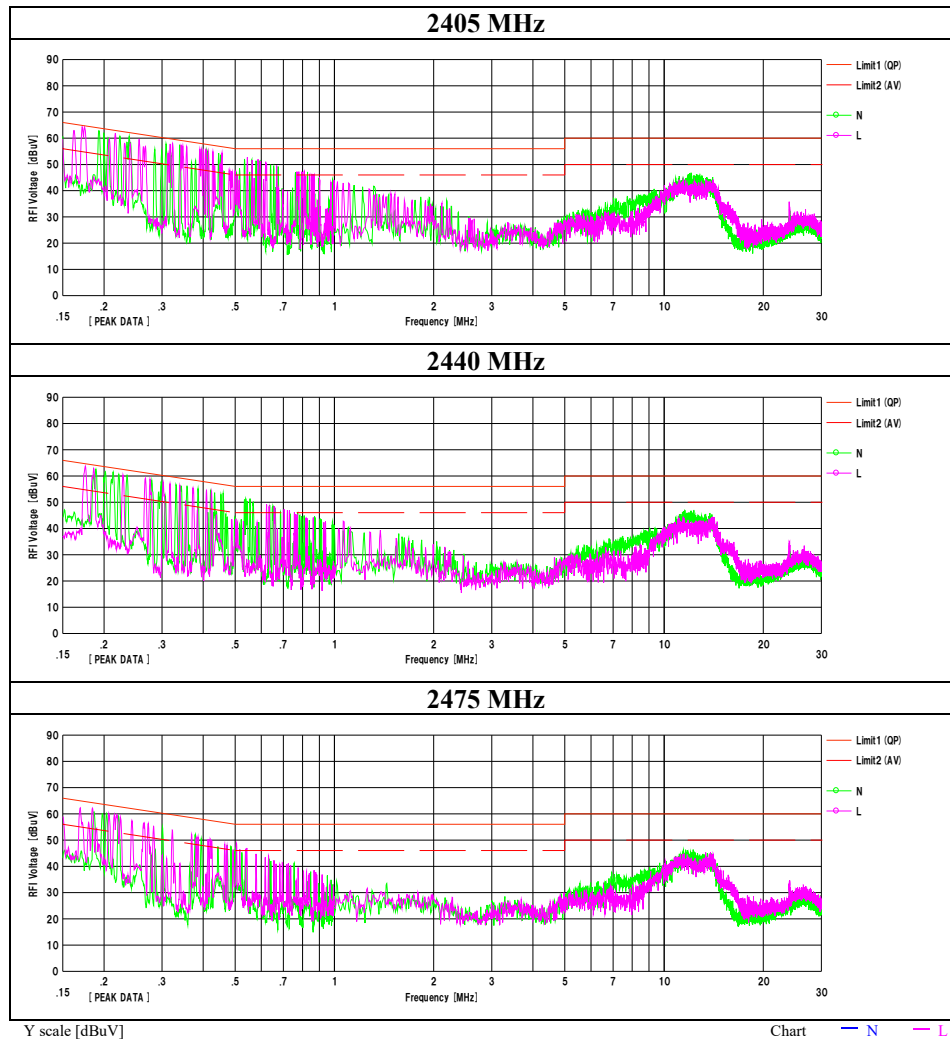


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	45.3	15.0	10.2	55.5	25.2	66.0	56.0	10.5	30.8	N	
2	0.19032	42.2	24.8	10.2	52.4	35.0	64.0	54.0	11.6	19.0	N	
3	0.44217	32.2	18.9	10.3	42.5	29.2	57.0	47.0	14.5	17.8	N	
4	1.69545	13.1	5.4	10.4	23.5	15.8	56.0	46.0	32.5	30.2	N	
5	12.02356	31.1	23.1	11.0	42.1	34.1	60.0	50.0	17.9	15.9	N	
6	24.03970	14.5	5.8	11.8	26.3	17.6	60.0	50.0	33.7	32.4	N	
7	0.15000	45.0	22.3	10.2	55.2	32.5	66.0	56.0	10.8	23.5	L	
8	0.19042	42.0	27.4	10.2	52.2	37.6	64.0	54.0	11.8	16.4	L	
9	0.44152	32.1	21.4	10.3	42.4	31.7	57.0	47.0	14.6	15.3	L	
10	1.69678	14.1	6.0	10.4	24.5	16.4	56.0	46.0	31.5	29.6	L	
11	13.89311	28.8	21.3	11.2	40.0	32.5	60.0	50.0	20.0	17.5	L	
12	24.01112	17.8	11.3	11.8	29.6	23.1	60.0	50.0	30.4	26.9	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (AMN+Cable) [dB]
AMN:CLS-03

Conducted Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.1 Shielded Room
Date March 5, 2019
Temperature / Humidity 18 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx IEEE 802.15.4

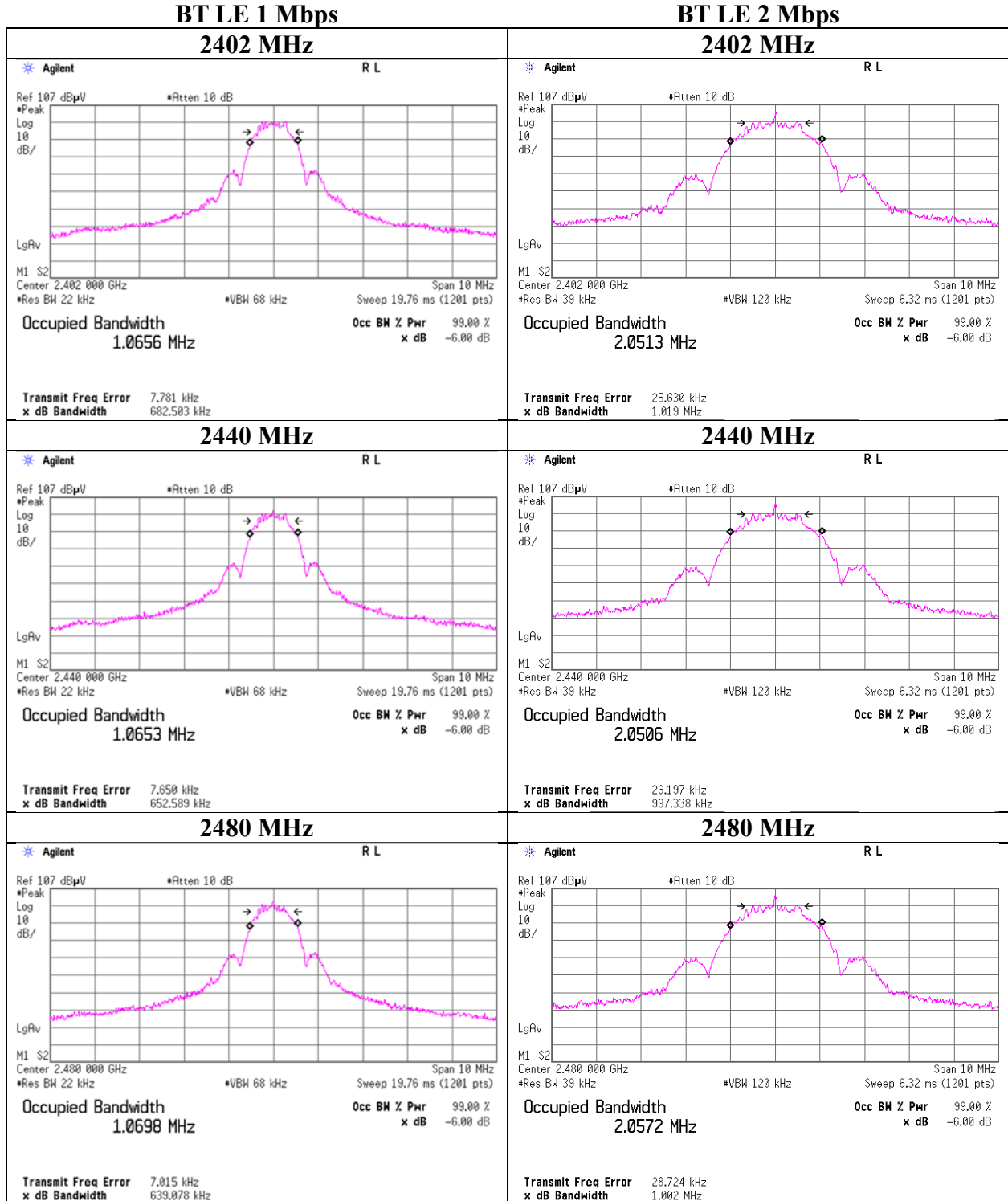


6 dB Bandwidth and 99 % Occupied Bandwidth

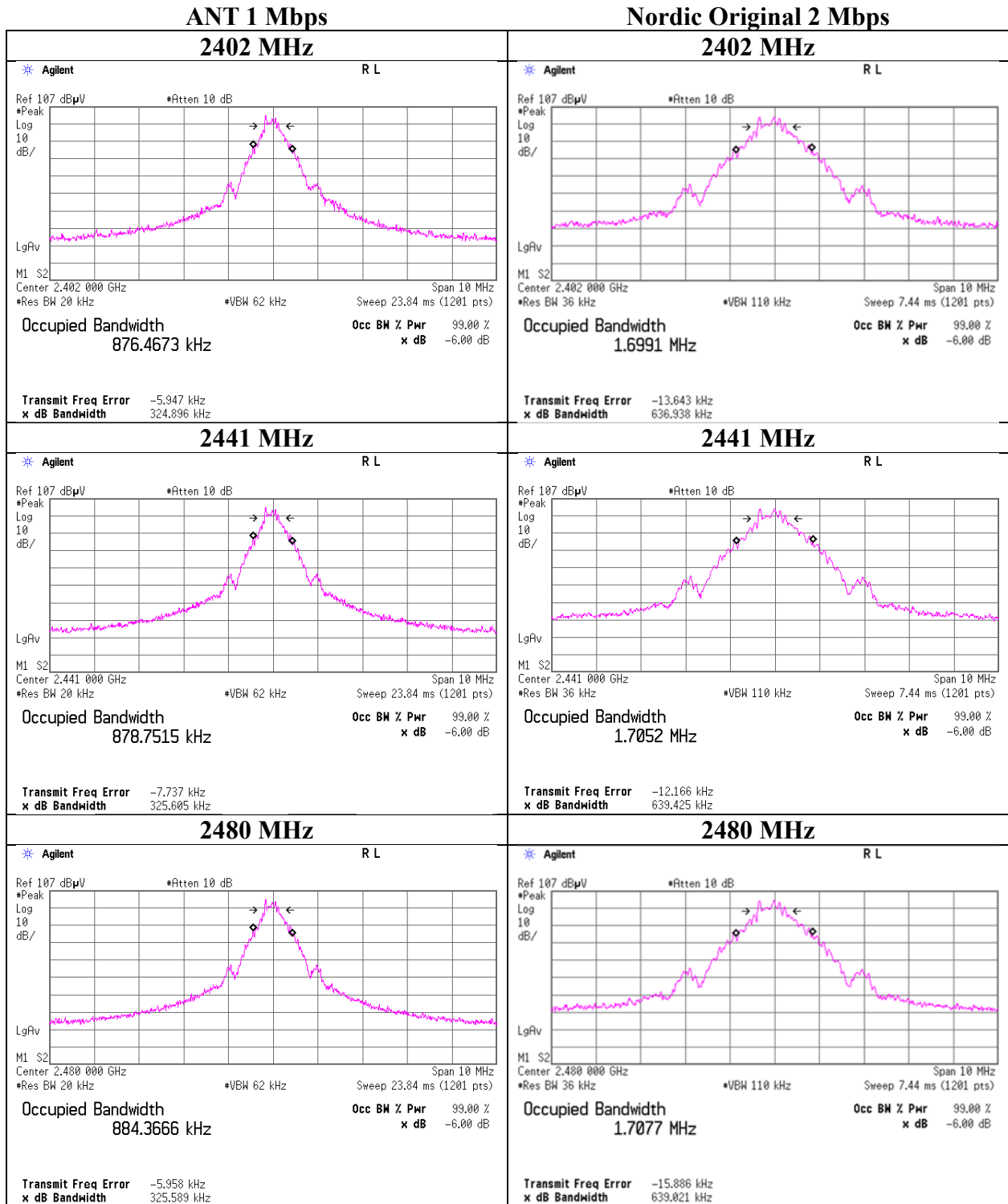
Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 25, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
BT LE 1 Mbps	2402	1065.6	0.742	> 0.5000
	2440	1065.3	0.736	> 0.5000
	2480	1069.8	0.741	> 0.5000
BT LE 2 Mbps	2402	2051.3	1.167	> 0.5000
	2440	2050.6	1.162	> 0.5000
	2480	2057.2	1.166	> 0.5000
ANT 1 Mbps	2402	876.5	0.506	> 0.5000
	2441	878.8	0.506	> 0.5000
	2480	884.4	0.505	> 0.5000
Nordic Original 2 Mbps	2402	1699.1	0.850	> 0.5000
	2441	1705.2	0.852	> 0.5000
	2480	1707.7	0.857	> 0.5000
IEEE802.15.4	2405	2242.1	1.119	> 0.5000
	2440	2246.2	1.142	> 0.5000
	2475	2237.9	1.120	> 0.5000

99%Occupied Bandwidth

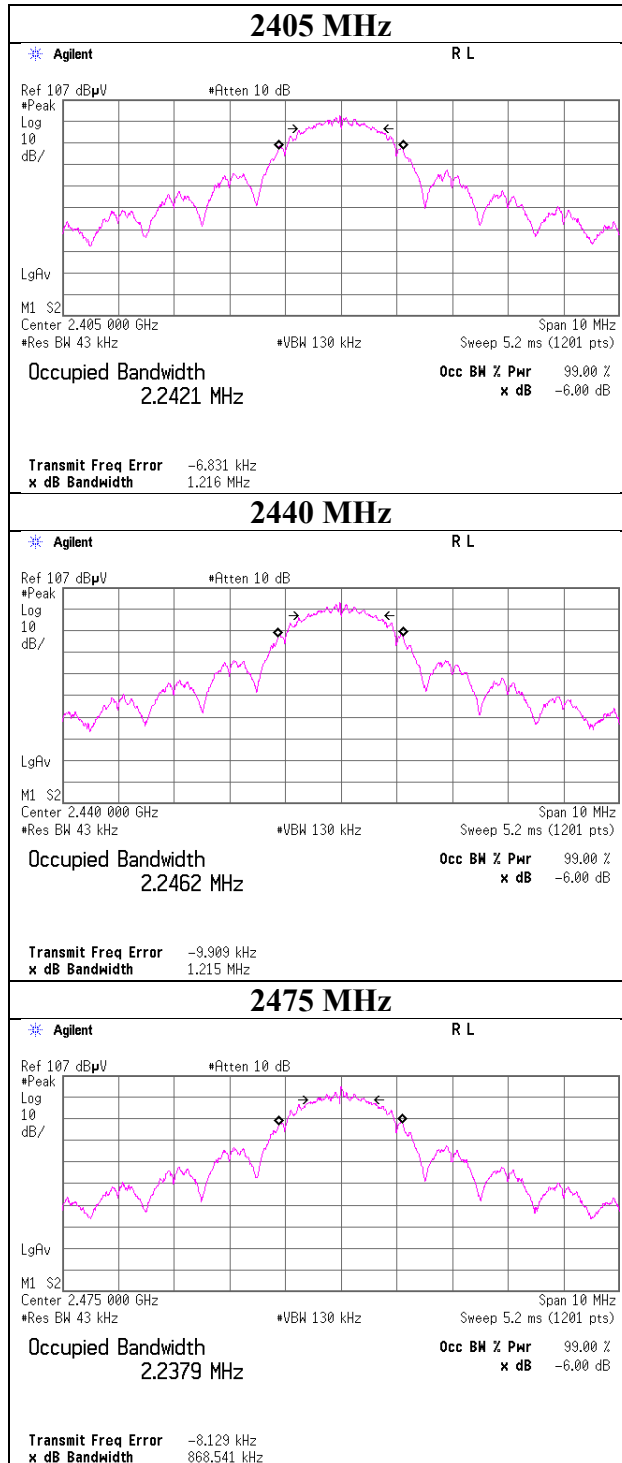


99% Occupied Bandwidth



99% Occupied Bandwidth

IEEE802.15.4



UL Japan, Inc.

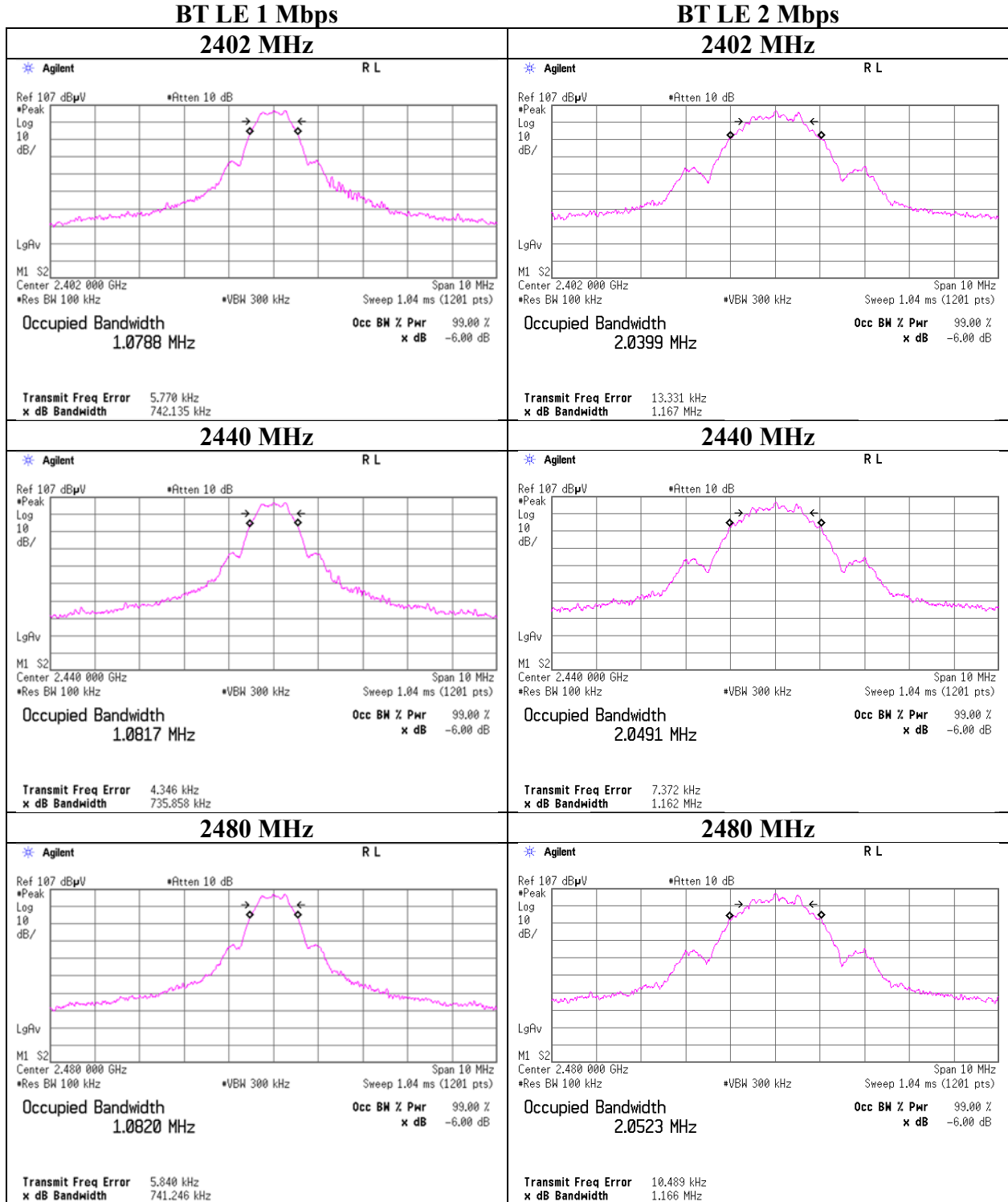
Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

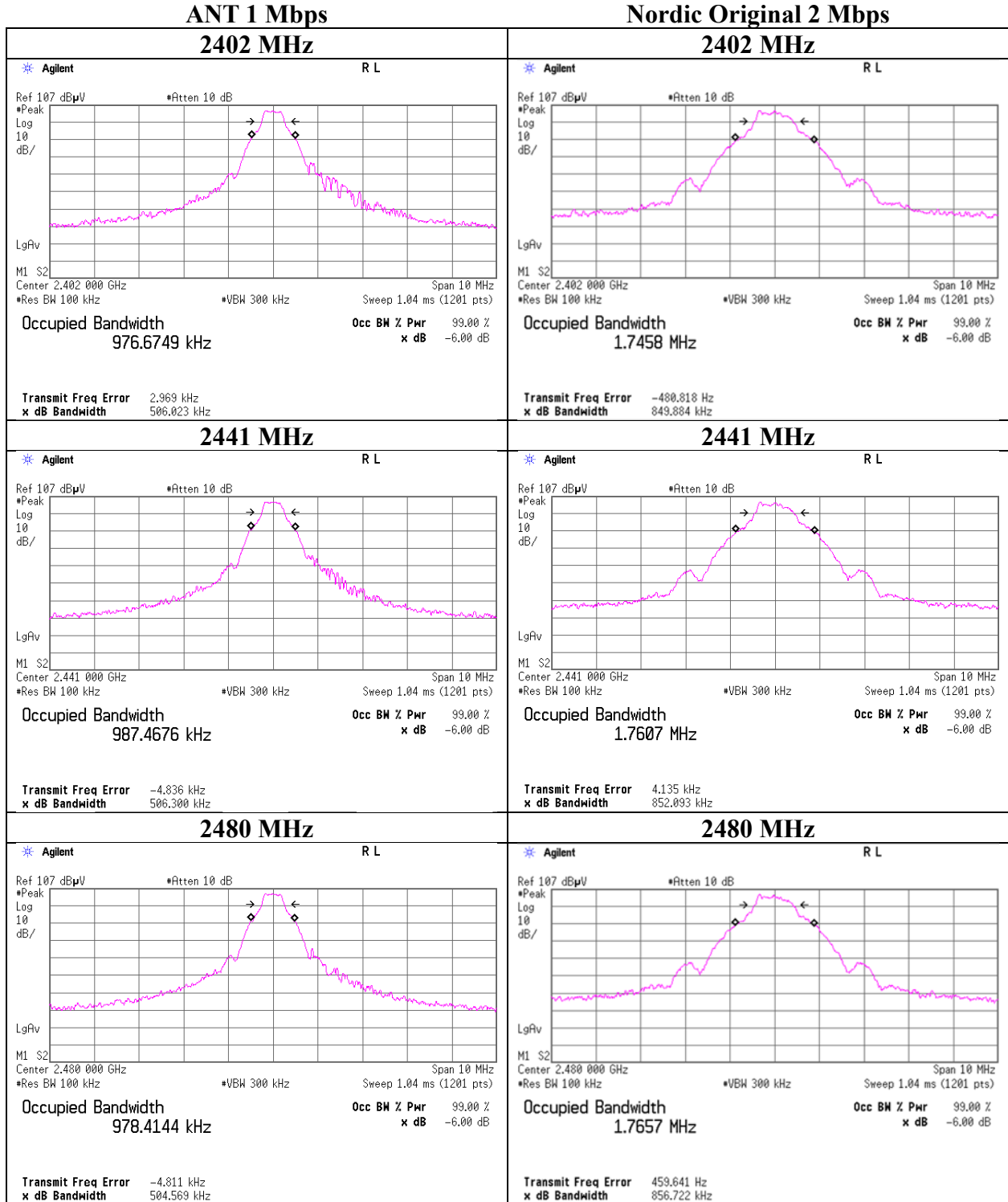
Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

6dB Bandwidth



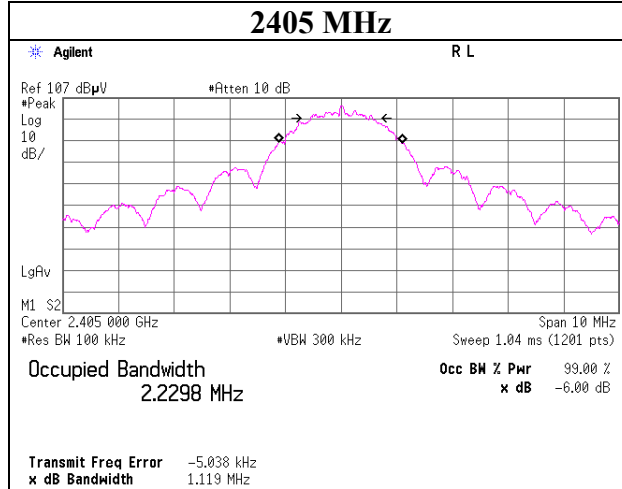
6dB Bandwidth



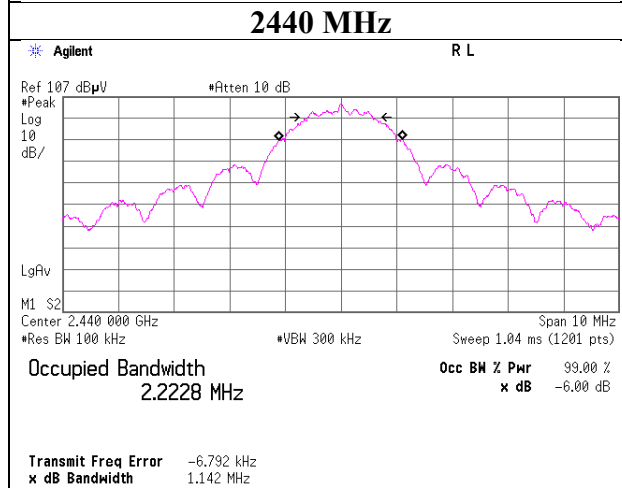
6dB Bandwidth

IEEE802.15.4

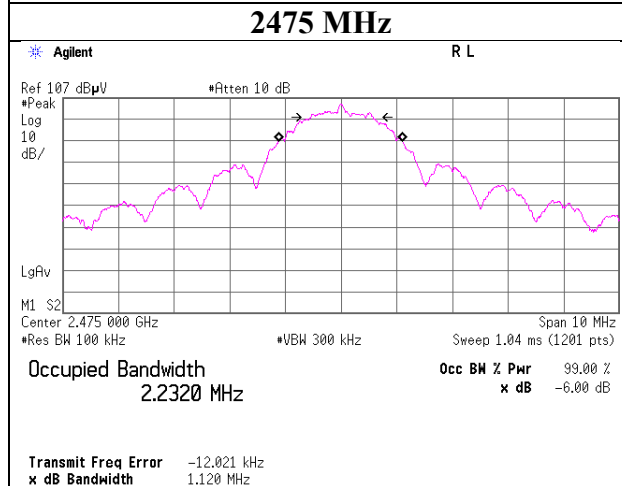
2405 MHz



2440 MHz



2475 MHz



UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Maximum Peak Output Power

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx (+8dBm Setting)

BT LE 1 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-3.31	1.63	10.04	8.36	6.85	30.00	1000	21.64	-1.50	6.86	4.85	36.02	4000	29.16
2440	-3.18	1.64	10.05	8.51	7.10	30.00	1000	21.49	-1.50	7.01	5.02	36.02	4000	29.01
2480	-3.10	1.65	10.05	8.60	7.24	30.00	1000	21.40	-1.50	7.10	5.13	36.02	4000	28.92

BT LE 125 kbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-3.33	1.63	10.04	8.34	6.82	30.00	1000	21.66	-1.50	6.84	4.83	36.02	4000	29.18
2440	-3.20	1.64	10.05	8.49	7.06	30.00	1000	21.51	-1.50	6.99	5.00	36.02	4000	29.03
2480	-3.13	1.65	10.05	8.57	7.19	30.00	1000	21.43	-1.50	7.07	5.09	36.02	4000	28.95

BT LE 500 kbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-3.33	1.63	10.04	8.34	6.82	30.00	1000	21.66	-1.50	6.84	4.83	36.02	4000	29.18
2440	-3.19	1.64	10.05	8.50	7.08	30.00	1000	21.50	-1.50	7.00	5.01	36.02	4000	29.02
2480	-3.11	1.65	10.05	8.59	7.23	30.00	1000	21.41	-1.50	7.09	5.12	36.02	4000	28.93

BT LE 2 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-3.31	1.63	10.04	8.36	6.85	30.00	1000	21.64	-1.50	6.86	4.85	36.02	4000	29.16
2440	-3.18	1.64	10.05	8.51	7.10	30.00	1000	21.49	-1.50	7.01	5.02	36.02	4000	29.01
2480	-3.09	1.65	10.05	8.61	7.26	30.00	1000	21.39	-1.50	7.11	5.14	36.02	4000	28.91

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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Maximum Peak Output Power

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx (+8dBm Setting)

ANT 1 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-3.35	1.63	10.04	8.32	6.79	30.00	1000	21.68	-1.50	6.82	4.81	36.02	4000	29.20
2441	-3.25	1.64	10.05	8.44	6.98	30.00	1000	21.56	-1.50	6.94	4.94	36.02	4000	29.08
2480	-3.13	1.65	10.05	8.57	7.19	30.00	1000	21.43	-1.50	7.07	5.09	36.02	4000	28.95

Nordic Original 2 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-3.40	1.63	10.04	8.27	6.71	30.00	1000	21.73	-1.50	6.77	4.75	36.02	4000	29.25
2441	-3.31	1.64	10.05	8.38	6.89	30.00	1000	21.62	-1.50	6.88	4.88	36.02	4000	29.14
2480	-3.20	1.65	10.05	8.50	7.08	30.00	1000	21.50	-1.50	7.00	5.01	36.02	4000	29.02

IEEE802.15.4				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2405	-3.47	1.63	10.04	8.20	6.61	30.00	1000	21.80	-1.50	6.70	4.68	36.02	4000	29.32
2440	-3.42	1.64	10.05	8.27	6.71	30.00	1000	21.73	-1.50	6.77	4.75	36.02	4000	29.25
2475	-3.34	1.65	10.05	8.36	6.85	30.00	1000	21.64	-1.50	6.86	4.85	36.02	4000	29.16

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

Maximum Peak Output Power

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx (-40dBm Setting)

BT LE 1 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-49.61	1.63	10.04	-37.94	0.00016	30.00	1000	67.94	-1.50	-39.44	0.00011	36.02	4000	75.46
2440	-49.84	1.64	10.05	-38.15	0.00015	30.00	1000	68.15	-1.50	-39.65	0.00011	36.02	4000	75.67
2480	-50.37	1.65	10.05	-38.67	0.00014	30.00	1000	68.67	-1.50	-40.17	0.00010	36.02	4000	76.19

BT LE 125 kbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-49.49	1.63	10.04	-37.82	0.00017	30.00	1000	67.82	-1.50	-39.32	0.00012	36.02	4000	75.34
2440	-49.87	1.64	10.05	-38.18	0.00015	30.00	1000	68.18	-1.50	-39.68	0.00011	36.02	4000	75.70
2480	-50.14	1.65	10.05	-38.44	0.00014	30.00	1000	68.44	-1.50	-39.94	0.00010	36.02	4000	75.96

BT LE 500 kbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-49.56	1.63	10.04	-37.89	0.00016	30.00	1000	67.89	-1.50	-39.39	0.00012	36.02	4000	75.41
2440	-49.93	1.64	10.05	-38.24	0.00015	30.00	1000	68.24	-1.50	-39.74	0.00011	36.02	4000	75.76
2480	-50.29	1.65	10.05	-38.59	0.00014	30.00	1000	68.59	-1.50	-40.09	0.00010	36.02	4000	76.11

BT LE 2 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-49.31	1.63	10.04	-37.64	0.00017	30.00	1000	67.64	-1.50	-39.14	0.00012	36.02	4000	75.16
2440	-49.63	1.64	10.05	-37.94	0.00016	30.00	1000	67.94	-1.50	-39.44	0.00011	36.02	4000	75.46
2480	-50.03	1.65	10.05	-38.33	0.00015	30.00	1000	68.33	-1.50	-39.83	0.00010	36.02	4000	75.85

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

*The equipment and cables were not used for factor 0 dB of the data sheets.

Maximum Peak Output Power

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx (-40dBm Setting)

ANT 1 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-49.44	1.63	10.04	-37.77	0.00017	30.00	1000	67.77	-1.50	-39.27	0.00012	36.02	4000	75.29
2441	-49.96	1.64	10.05	-38.27	0.00015	30.00	1000	68.27	-1.50	-39.77	0.00011	36.02	4000	75.79
2480	-50.23	1.65	10.05	-38.53	0.00014	30.00	1000	68.53	-1.50	-40.03	0.00010	36.02	4000	76.05

Nordic Original 2 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-49.32	1.63	10.04	-37.65	0.00017	30.00	1000	67.65	-1.50	-39.15	0.00012	36.02	4000	75.17
2441	-49.65	1.64	10.05	-37.96	0.00016	30.00	1000	67.96	-1.50	-39.46	0.00011	36.02	4000	75.48
2480	-49.94	1.65	10.05	-38.24	0.00015	30.00	1000	68.24	-1.50	-39.74	0.00011	36.02	4000	75.76

IEEE802.15.4				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2405	-49.39	1.63	10.04	-37.72	0.00017	30.00	1000	67.72	-1.50	-39.22	0.00012	36.02	4000	75.24
2440	-49.63	1.64	10.05	-37.94	0.00016	30.00	1000	67.94	-1.50	-39.44	0.00011	36.02	4000	75.46
2475	-49.92	1.65	10.05	-38.22	0.00015	30.00	1000	68.22	-1.50	-39.72	0.00011	36.02	4000	75.74

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

*The equipment and cables were not used for factor 0 dB of the data sheets.

Average Output Power
(Reference data for RF Exposure)

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx (+8dBm Setting)

BT LE 1 Mbps

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	-4.11	1.63	10.04	7.56	5.70	0.67	8.23	6.65
2440	-3.98	1.64	10.05	7.71	5.90	0.67	8.38	6.89
2480	-3.89	1.65	10.05	7.81	6.04	0.67	8.48	7.05

BT LE 125 kbps

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	-3.56	1.63	10.04	8.11	6.47	0.11	8.22	6.64
2440	-3.43	1.64	10.05	8.26	6.70	0.11	8.37	6.87
2480	-3.34	1.65	10.05	8.36	6.85	0.11	8.47	7.03

BT LE 500 kbps

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	-3.83	1.63	10.04	7.84	6.08	0.39	8.23	6.65
2440	-3.70	1.64	10.05	7.99	6.30	0.39	8.38	6.89
2480	-3.61	1.65	10.05	8.09	6.44	0.39	8.48	7.05

BT LE 2 Mbps

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	-5.83	1.63	10.04	5.84	3.84	2.38	8.22	6.64
2440	-5.69	1.64	10.05	6.00	3.98	2.38	8.38	6.89
2480	-5.60	1.65	10.05	6.10	4.07	2.38	8.48	7.05

Sample Calculation:

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

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Average Output Power
(Reference data for RF Exposure)

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx (+8dBm Setting)

ANT 1 Mbps

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	-3.69	1.63	10.04	7.98	6.28	0.22	8.20	6.61
2441	-3.59	1.64	10.05	8.10	6.46	0.22	8.32	6.79
2480	-3.48	1.65	10.05	8.22	6.64	0.22	8.44	6.98

Nordic Original 2 Mbps

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	-3.97	1.63	10.04	7.70	5.89	0.44	8.14	6.52
2441	-3.88	1.64	10.05	7.81	6.04	0.44	8.25	6.68
2480	-3.78	1.65	10.05	7.92	6.19	0.44	8.36	6.85

IEEE802.15.4

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2405	-3.65	1.63	10.04	8.02	6.34	0.06	8.08	6.43
2440	-3.60	1.64	10.05	8.09	6.44	0.06	8.15	6.53
2475	-3.51	1.65	10.05	8.19	6.59	0.06	8.25	6.68

Sample Calculation:

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

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Average Output Power
(Reference data for RF Exposure)

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx (-40dBm Setting)

BT LE 1 Mbps

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	-51.13	1.63	10.04	-39.46	0.00011	0.67	-38.79	0.00013
2440	-50.90	1.64	10.05	-39.21	0.00012	0.67	-38.54	0.00014
2480	-51.73	1.65	10.05	-40.03	0.00010	0.67	-39.36	0.00012

BT LE 125 kbps

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	-50.73	1.63	10.04	-39.06	0.00012	0.11	-38.95	0.00013
2440	-50.39	1.64	10.05	-38.70	0.00013	0.11	-38.59	0.00014
2480	-50.75	1.65	10.05	-39.05	0.00012	0.11	-38.94	0.00013

BT LE 500 kbps

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	-50.96	1.63	10.04	-39.29	0.00012	0.39	-38.90	0.00013
2440	-51.40	1.64	10.05	-39.71	0.00011	0.39	-39.32	0.00012
2480	-51.83	1.65	10.05	-40.13	0.00010	0.39	-39.74	0.00011

BT LE 2 Mbps

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	-53.57	1.63	10.04	-41.90	0.00006	2.38	-39.52	0.00011
2440	-52.51	1.64	10.05	-40.82	0.00008	2.38	-38.44	0.00014
2480	-53.47	1.65	10.05	-41.77	0.00007	2.38	-39.39	0.00012

Sample Calculation:

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

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Average Output Power
(Reference data for RF Exposure)

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx (-40dBm Setting)

ANT 1 Mbps

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	-50.51	1.63	10.04	-38.84	0.00013	0.22	-38.62	0.00014
2441	-50.90	1.64	10.05	-39.21	0.00012	0.22	-38.99	0.00013
2480	-51.23	1.65	10.05	-39.53	0.00011	0.22	-39.31	0.00012

Nordic Original 2 Mbps

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	-50.73	1.63	10.04	-39.06	0.00012	0.44	-38.62	0.00014
2441	-51.05	1.64	10.05	-39.36	0.00012	0.44	-38.92	0.00013
2480	-51.42	1.65	10.05	-39.72	0.00011	0.44	-39.28	0.00012

IEEE802.15.4

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2405	-50.45	1.63	10.04	-38.78	0.00013	0.06	-38.72	0.00013
2440	-50.70	1.64	10.05	-39.01	0.00013	0.06	-38.95	0.00013
2475	-50.99	1.65	10.05	-39.29	0.00012	0.06	-39.23	0.00012

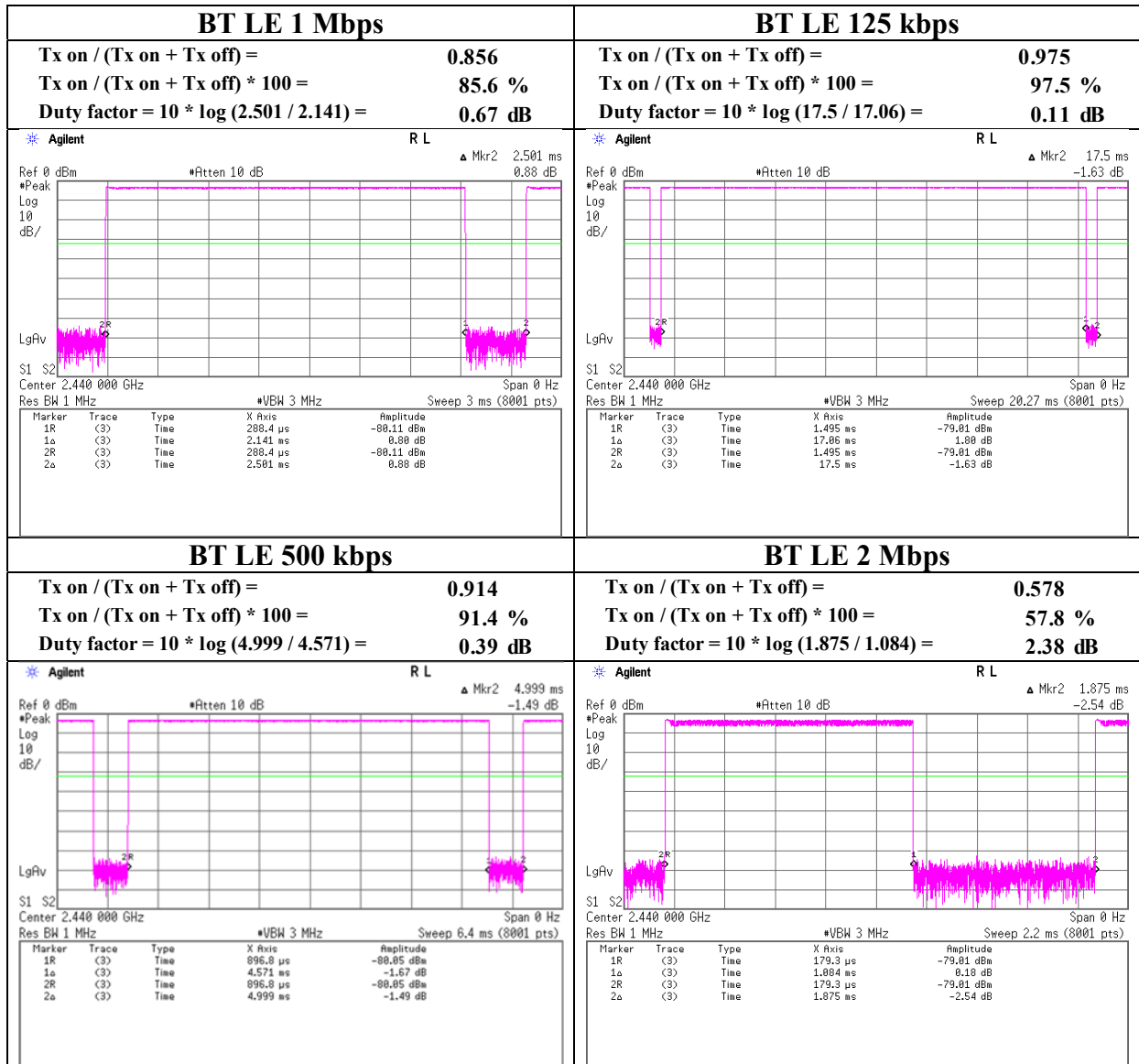
Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst rate confirmation

Report No. 12725754M-A-R2
 Test place Kashima EMC Lab. No.2 Measurement Room
 Date February 15, 2019
 Temperature / Humidity 20 deg. C / 40 % RH
 Engineer Kazuhiro Ando
 Mode Tx

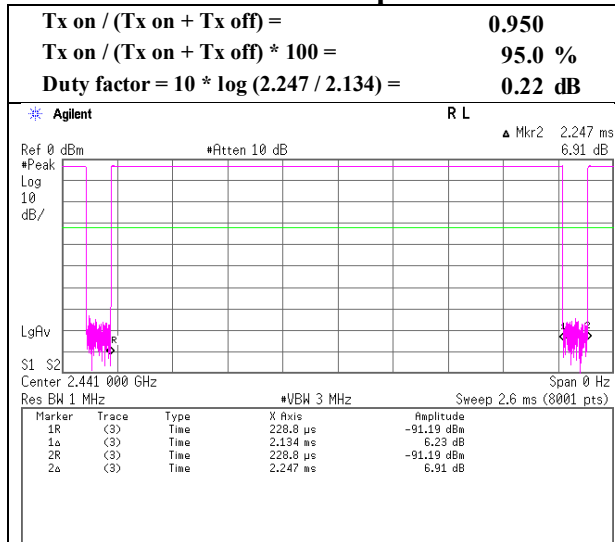


* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

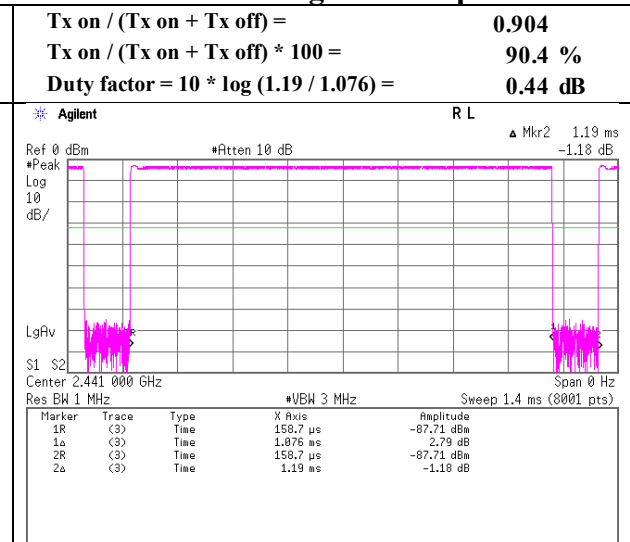
Burst rate confirmation

Report No. 12725754M-A-R2
 Test place Kashima EMC Lab. No.2 Measurement Room
 Date February 15, 2019
 Temperature / Humidity 20 deg. C / 40 % RH
 Engineer Kazuhiro Ando
 Mode Tx

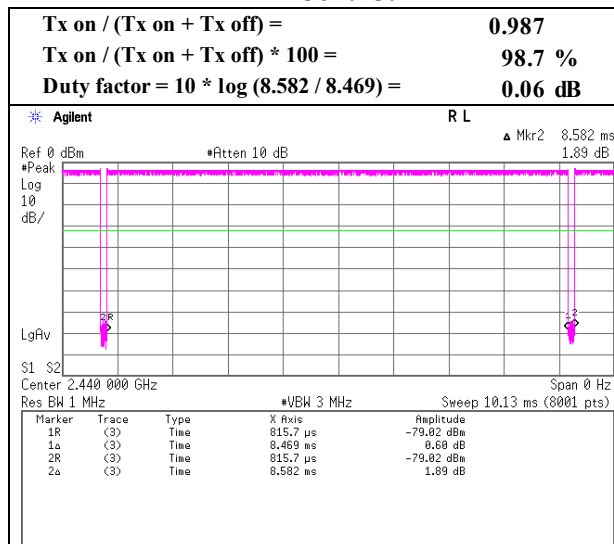
ANT 1 Mbps



Nordic Original 2 Mbps



IEEE802.15.4



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

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 6, 2019 February 27, 2019 March 8, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 45 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 1Mbps 2402 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.80	12.60	4.20	26.90	0.00	10.70	40.00	29.3	100	0	
Hori.	64.000	QP	20.80	12.60	4.80	26.80	0.00	11.40	40.00	28.6	100	0	
Hori.	96.000	QP	20.10	8.40	5.20	26.70	0.00	7.00	43.50	36.5	100	0	
Hori.	2390.000	PK	50.30	27.60	13.70	44.30	3.50	50.80	73.90	23.1	160	125	
Hori.	4804.000	PK	53.40	32.60	5.70	45.70	3.50	49.50	73.90	24.4	150	110	
Hori.	7206.000	PK	53.90	37.20	7.00	44.70	3.50	56.90	73.90	17.0	160	110	
Hori.	9608.000	PK	47.70	38.20	8.00	42.30	3.50	55.10	73.90	18.8	100	0	Floor noise
Hori.	12010.000	PK	53.70	38.70	9.10	43.80	-9.50	48.20	73.90	25.7	163	199	
Vert.	32.000	QP	20.80	12.60	4.20	26.90	0.00	10.70	40.00	29.3	100	0	
Vert.	64.000	QP	23.80	12.60	4.80	26.80	0.00	14.40	40.00	25.6	100	105	
Vert.	96.000	QP	20.50	8.40	5.20	26.70	0.00	7.40	43.50	36.1	100	0	
Vert.	2390.000	PK	48.50	27.60	13.70	44.30	3.50	49.00	73.90	24.9	150	295	
Vert.	4804.000	PK	52.70	32.60	5.70	45.70	3.50	48.80	73.90	25.1	155	125	
Vert.	7206.000	PK	52.70	37.20	7.00	44.70	3.50	55.70	73.90	18.2	145	200	
Vert.	9608.000	PK	47.60	38.20	8.00	42.30	3.50	55.00	73.90	18.9	100	0	Floor noise
Vert.	12010.000	PK	53.70	38.70	9.10	43.80	-9.50	48.20	73.90	25.7	128	353	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	40.80	27.60	13.70	44.30	0.67	3.50	41.97	53.90	11.9	*1)
Hori.	4804.000	AV	46.20	32.60	5.70	45.70	0.67	3.50	42.97	53.90	10.9	
Hori.	7206.000	AV	46.20	37.20	7.00	44.70	0.67	3.50	49.87	53.90	4.0	
Hori.	9608.000	AV	38.70	38.20	8.00	42.30	0.67	3.50	46.77	53.90	7.1	
Hori.	12010.000	AV	46.20	38.70	9.10	43.80	0.67	-9.50	41.37	53.90	12.5	
Vert.	2390.000	AV	41.70	27.60	13.70	44.30	0.67	3.50	42.87	53.90	11.0	*1)
Vert.	4804.000	AV	44.00	32.60	5.70	45.70	0.67	3.50	40.77	53.90	13.1	
Vert.	7206.000	AV	44.70	37.20	7.00	44.70	0.67	3.50	48.37	53.90	5.5	
Vert.	9608.000	AV	38.80	38.20	8.00	42.30	0.67	3.50	46.87	53.90	7.0	
Vert.	12010.000	AV	46.80	38.70	9.10	43.80	0.67	-9.50	41.97	53.90	11.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	101.70	27.60	13.80	44.30	3.50	102.30	-	-	Carrier
Hori.	2400.000	PK	51.70	27.60	13.80	44.30	3.50	52.30	82.30	30.0	
Vert.	2402.000	PK	95.30	27.60	13.80	44.30	3.50	95.90	-	-	Carrier
Vert.	2400.000	PK	46.90	27.60	13.80	44.30	3.50	47.50	75.90	28.4	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

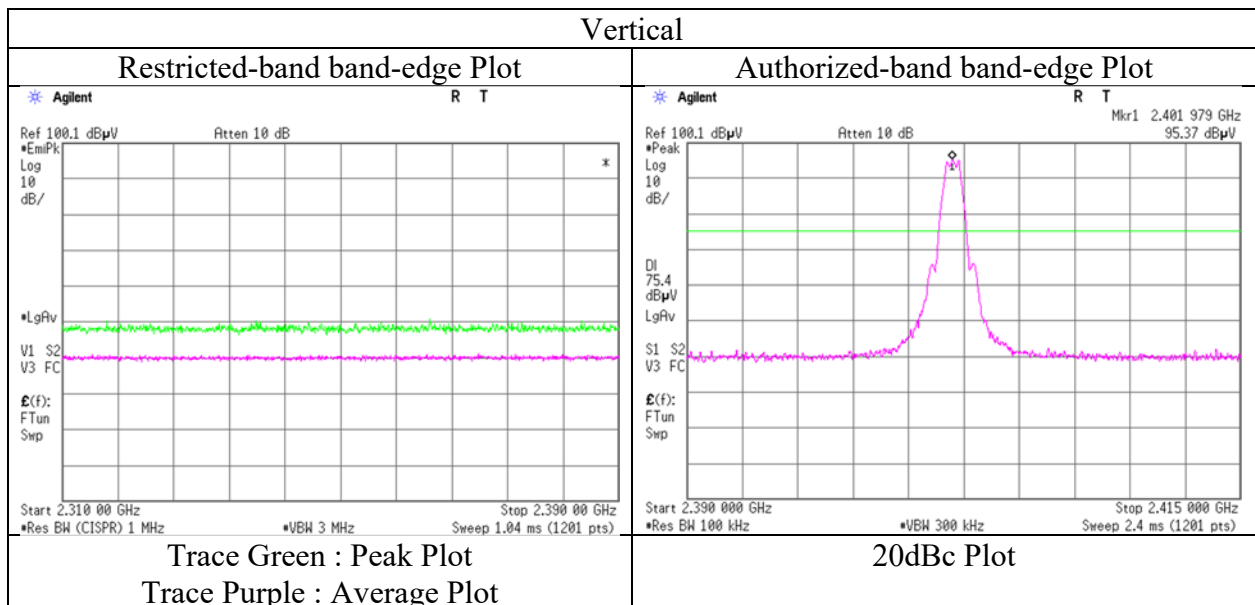
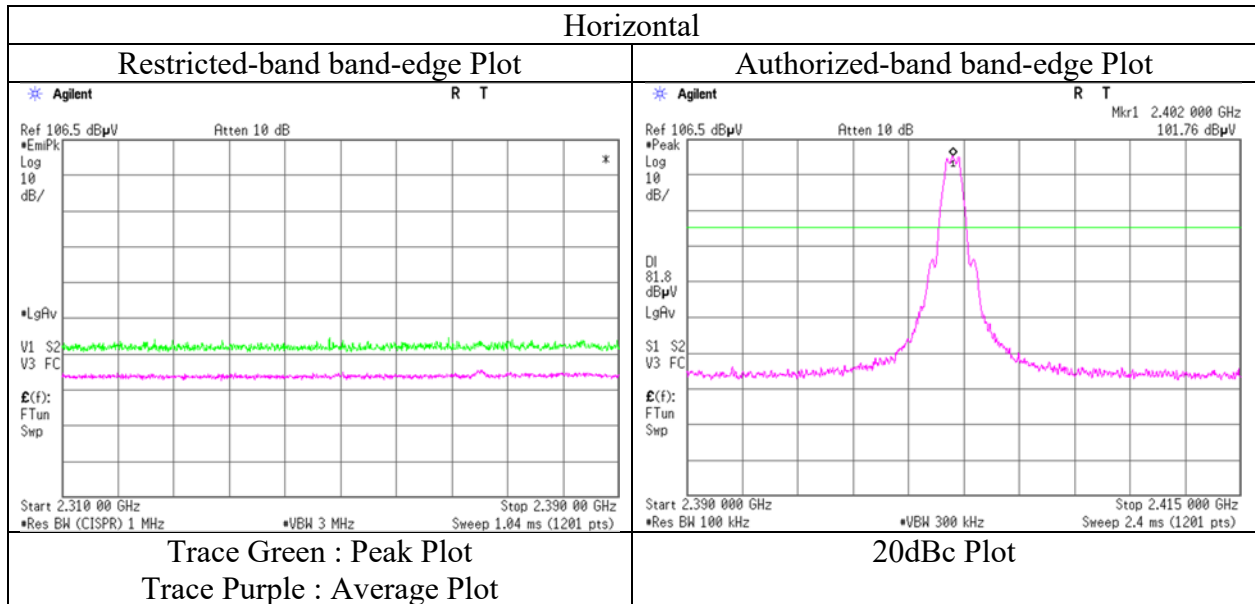
1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date February 27, 2019
Temperature / Humidity 20 deg. C / 45 % RH
Engineer Kazuhiro Ando
(1 GHz - 10 GHz)
Mode Tx BT LE 1Mbps 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 6, 2019 February 27, 2019 March 8, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 45 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 1Mbps 2440 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Hori.	64.000	QP	20.80	12.60	4.80	26.80	0.00	11.40	40.00	28.6	100	0	
Hori.	96.000	QP	20.10	8.40	5.20	26.70	0.00	7.00	43.50	36.5	100	0	
Hori.	4880.000	PK	56.00	32.50	5.70	45.70	3.50	52.00	73.90	21.9	130	110	
Hori.	7320.000	PK	52.10	37.30	7.10	44.40	3.50	55.60	73.90	18.3	155	110	
Hori.	9760.000	PK	46.30	38.10	8.00	42.20	3.50	53.70	73.90	20.2	100	0	Floor noise
Hori.	12200.000	PK	52.80	38.50	9.10	44.00	-9.50	46.90	73.90	27.0	151	196	
Vert.	32.000	QP	20.80	12.60	4.20	26.90	0.00	10.70	40.00	29.3	100	0	
Vert.	64.000	QP	23.90	12.60	4.80	26.80	0.00	14.50	40.00	25.5	100	105	
Vert.	96.000	QP	20.60	8.40	5.20	26.70	0.00	7.50	43.50	36.0	100	0	
Vert.	4880.000	PK	53.50	32.50	5.70	45.70	3.50	49.50	73.90	24.4	155	145	
Vert.	7320.000	PK	51.80	37.30	7.10	44.40	3.50	55.30	73.90	18.6	200	195	
Vert.	9760.000	PK	46.40	38.10	8.00	42.20	3.50	53.80	73.90	20.1	100	0	Floor noise
Vert.	12200.000	PK	52.70	38.50	9.10	44.00	-9.50	46.80	73.90	27.1	132	354	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4880.000	AV	50.33	32.50	5.70	45.70	0.67	3.50	47.00	53.90	6.9	
Hori.	7320.000	AV	45.70	37.30	7.10	44.40	0.67	3.50	49.87	53.90	4.0	
Hori.	9760.000	AV	37.60	38.10	8.00	42.20	0.67	3.50	45.67	53.90	8.2	
Hori.	12200.000	AV	45.20	38.50	9.10	44.00	0.67	-9.50	39.97	53.90	13.9	
Vert.	4880.000	AV	45.40	32.50	5.70	45.70	0.67	3.50	42.07	53.90	11.8	
Vert.	7320.000	AV	44.10	37.30	7.10	44.40	0.67	3.50	48.27	53.90	5.6	
Vert.	9760.000	AV	37.60	38.10	8.00	42.20	0.67	3.50	45.67	53.90	8.2	
Vert.	12200.000	AV	45.10	38.50	9.10	44.00	0.67	-9.50	39.87	53.90	14.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

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Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 6, 2019 February 27, 2019 March 8, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 45 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 1Mbps 2480 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.80	12.60	4.20	26.90	0.00	10.70	40.00	29.3	100	0	
Hori.	64.000	QP	20.80	12.60	4.80	26.80	0.00	11.40	40.00	28.6	100	0	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	2483.500	PK	54.00	27.80	13.80	44.30	3.50	54.80	73.90	19.1	180	120	
Hori.	4960.000	PK	56.80	32.60	5.80	45.80	3.50	52.90	73.90	21.0	125	110	
Hori.	7440.000	PK	54.50	37.40	7.10	44.10	3.50	58.40	73.90	15.5	145	105	
Hori.	9920.000	PK	46.90	38.20	8.10	42.20	3.50	54.50	73.90	19.4	100	0	Floor noise
Hori.	12400.000	PK	52.00	38.60	9.20	44.20	-9.50	46.10	73.90	27.8	150	194	
Vert.	32.000	QP	20.80	12.60	4.20	26.90	0.00	10.70	40.00	29.3	100	0	
Vert.	64.000	QP	24.00	12.60	4.80	26.80	0.00	14.60	40.00	25.4	100	105	
Vert.	96.000	QP	20.60	8.40	5.20	26.70	0.00	7.50	43.50	36.0	100	0	
Vert.	2483.500	PK	51.50	27.80	13.80	44.30	3.50	52.30	73.90	21.6	110	325	
Vert.	4960.000	PK	53.70	32.60	5.80	45.80	3.50	49.80	73.90	24.1	145	165	
Vert.	7440.000	PK	51.90	37.40	7.10	44.10	3.50	55.80	73.90	18.1	165	135	
Vert.	9920.000	PK	47.40	38.20	8.10	42.20	3.50	55.00	73.90	18.9	100	0	Floor noise
Vert.	12400.000	PK	52.70	38.60	9.20	44.20	-9.50	46.80	73.90	27.1	130	345	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	44.10	27.80	13.80	44.30	0.67	3.50	45.57	53.90	8.3	*1)
Hori.	4960.000	AV	50.70	32.60	5.80	45.80	0.67	3.50	47.47	53.90	6.4	
Hori.	7440.000	AV	45.40	37.40	7.10	44.10	0.67	3.50	49.97	53.90	3.9	
Hori.	9920.000	AV	38.20	38.20	8.10	42.20	0.67	3.50	46.47	53.90	7.4	
Hori.	12400.000	AV	43.90	38.60	9.20	44.20	0.67	-9.50	38.67	53.90	15.2	
Vert.	2483.500	AV	41.10	27.80	13.80	44.30	0.67	3.50	42.57	53.90	11.3	*1)
Vert.	4960.000	AV	45.90	32.60	5.80	45.80	0.67	3.50	42.67	53.90	11.2	
Vert.	7440.000	AV	44.20	37.40	7.10	44.10	0.67	3.50	48.77	53.90	5.1	
Vert.	9920.000	AV	38.40	38.20	8.10	42.20	0.67	3.50	46.67	53.90	7.2	
Vert.	12400.000	AV	43.40	38.60	9.20	44.20	0.67	-9.50	38.17	53.90	15.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

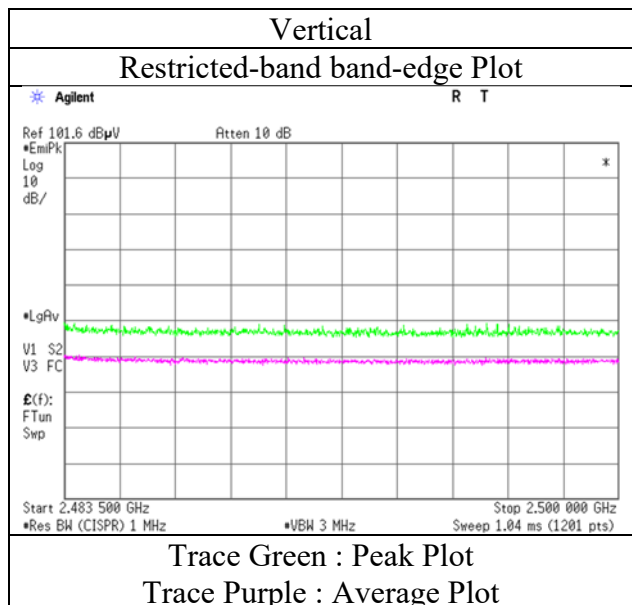
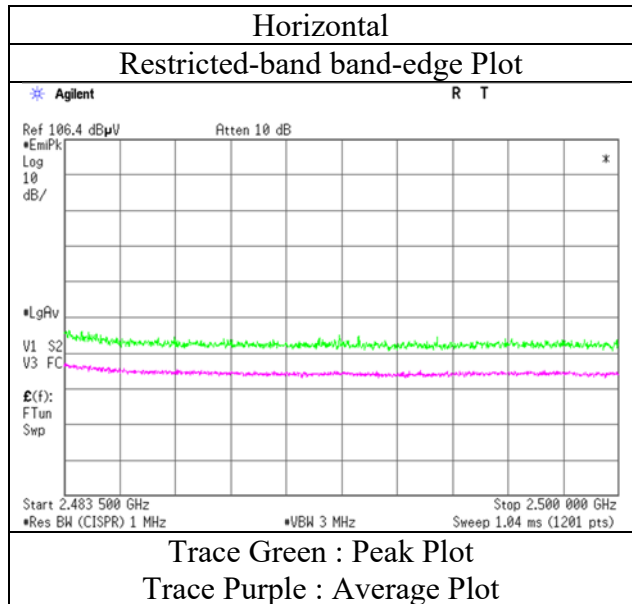
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

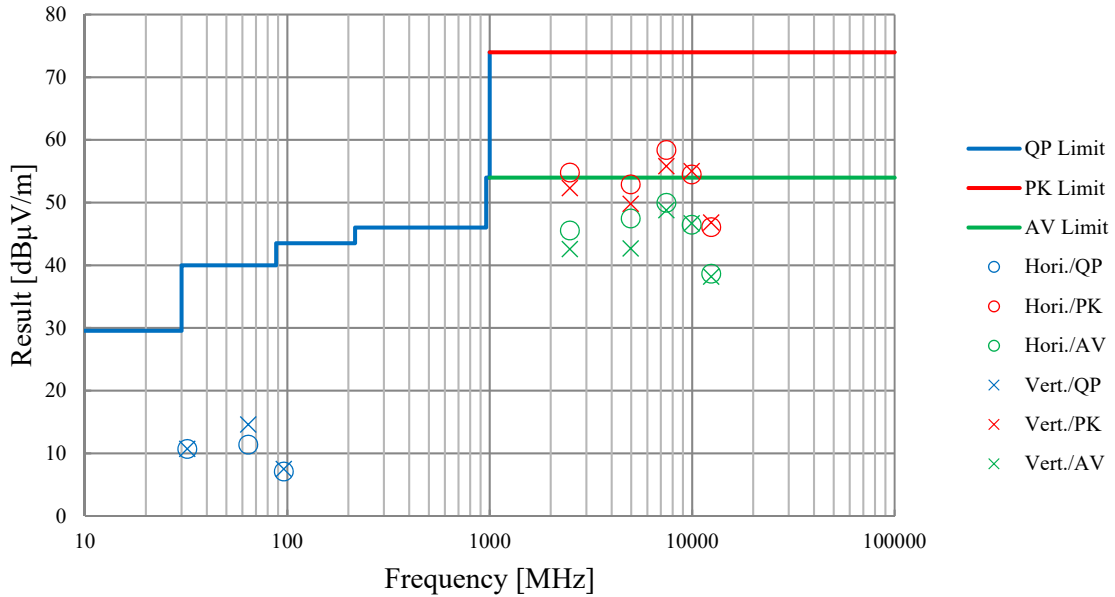
Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date February 27, 2019
Temperature / Humidity 20 deg. C / 45 % RH
Engineer Kazuhiro Ando
(1 GHz - 10 GHz)
Mode Tx BT LE 1Mbps 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12725754M-A-R2			
Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.10			
Date	March 6, 2019	February 27, 2019	March 8, 2019	March 9, 2019
Temperature / Humidity	22 deg. C / 40 % RH	20 deg. C / 45 % RH	22 deg. C / 40 % RH	19 deg. C / 40 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(30 MHz - 1000 MHz)	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Mode	Tx BT LE 1Mbps 2480 MHz			



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

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 6, 2019 February 27, 2019 March 8, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 45 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 2Mbps 2402 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Hori.	64.000	QP	20.80	12.60	4.80	26.80	0.00	11.40	40.00	28.6	100	0	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	2390.000	PK	50.70	27.60	13.70	44.30	3.50	51.20	73.90	22.7	160	125	
Hori.	4804.000	PK	52.80	32.60	5.70	45.70	3.50	48.90	73.90	25.0	140	110	
Hori.	7206.000	PK	52.60	37.20	7.00	44.70	3.50	55.60	73.90	18.3	110	105	
Hori.	9608.000	PK	46.80	38.20	8.00	42.30	3.50	54.20	73.90	19.7	100	0	
Hori.	12010.000	PK	53.00	38.70	9.10	43.80	-9.50	47.50	73.90	26.4	155	198	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	23.90	12.60	4.80	26.80	0.00	14.50	40.00	25.5	100	105	
Vert.	96.000	QP	20.60	8.40	5.20	26.70	0.00	7.50	43.50	36.0	100	0	
Vert.	2390.000	PK	49.00	27.60	13.70	44.30	3.50	49.50	73.90	24.4	150	295	
Vert.	4804.000	PK	52.00	32.60	5.70	45.70	3.50	48.10	73.90	25.8	155	120	
Vert.	7206.000	PK	52.20	37.20	7.00	44.70	3.50	55.20	73.90	18.7	200	175	
Vert.	9608.000	PK	47.10	38.20	8.00	42.30	3.50	54.50	73.90	19.4	100	0	
Vert.	12010.000	PK	53.70	38.70	9.10	43.80	-9.50	48.20	73.90	25.7	130	343	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	40.90	27.60	13.70	44.30	2.38	3.50	43.78	53.90	10.1	*1)
Hori.	4804.000	AV	43.60	32.60	5.70	45.70	2.38	3.50	42.08	53.90	11.8	
Hori.	7206.000	AV	44.50	37.20	7.00	44.70	2.38	3.50	49.88	53.90	4.0	
Hori.	9608.000	AV	38.70	38.20	8.00	42.30	2.38	3.50	48.48	53.90	5.4	
Hori.	12010.000	AV	44.10	38.70	9.10	43.80	2.38	-9.50	40.98	53.90	12.9	
Vert.	2390.000	AV	41.20	27.60	13.70	44.30	2.38	3.50	44.08	53.90	9.8	*1)
Vert.	4804.000	AV	42.00	32.60	5.70	45.70	2.38	3.50	40.48	53.90	13.4	
Vert.	7206.000	AV	43.20	37.20	7.00	44.70	2.38	3.50	48.58	53.90	5.3	
Vert.	9608.000	AV	38.90	38.20	8.00	42.30	2.38	3.50	48.68	53.90	5.2	
Vert.	12010.000	AV	45.20	38.70	9.10	43.80	2.38	-9.50	42.08	53.90	11.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	101.20	27.60	13.80	44.30	3.50	101.80	-	-	Carrier
Hori.	2400.000	PK	68.10	27.60	13.80	44.30	3.50	68.70	81.80	13.1	
Vert.	2402.000	PK	94.10	27.60	13.80	44.30	3.50	94.70	-	-	Carrier
Vert.	2400.000	PK	61.50	27.60	13.80	44.30	3.50	62.10	74.70	12.6	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

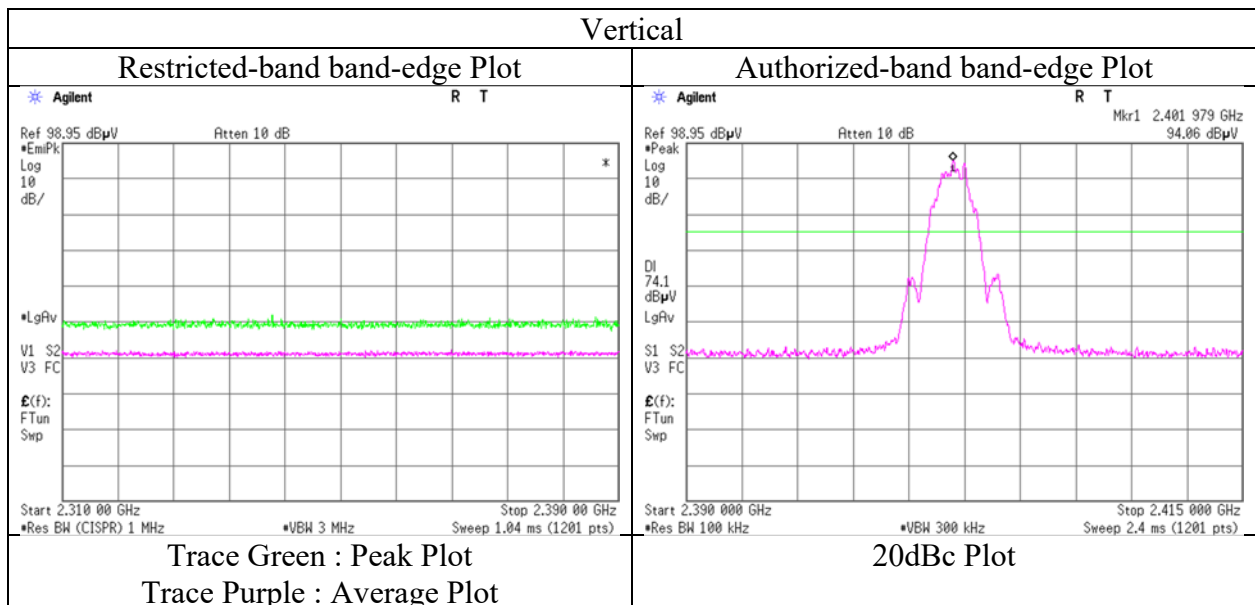
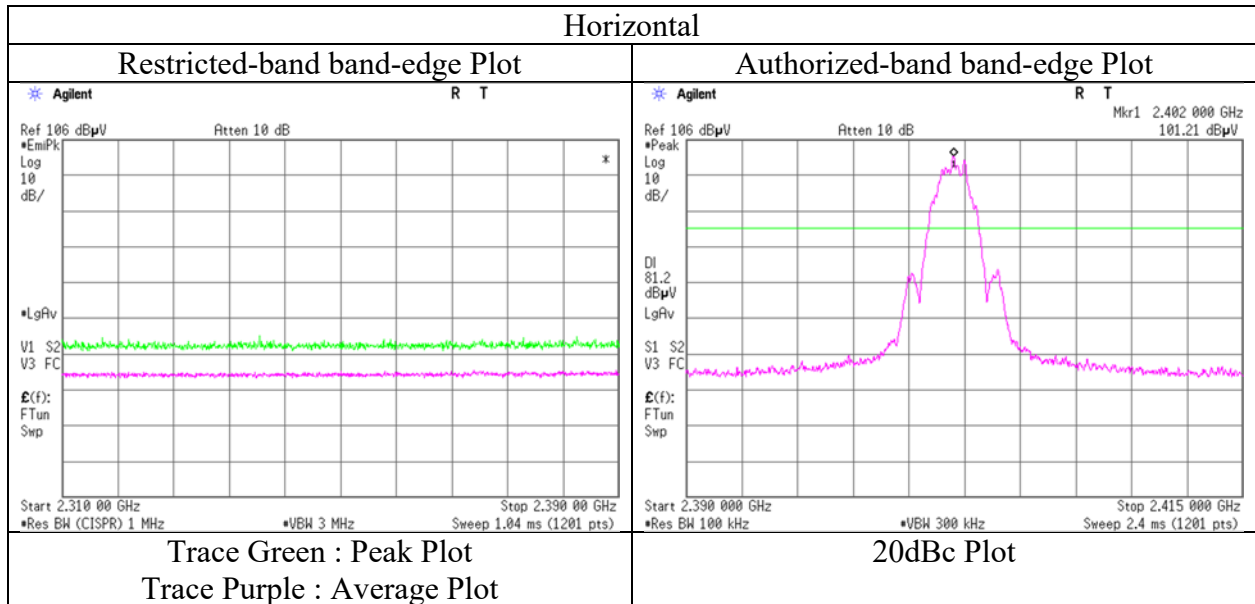
1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date February 27, 2019
Temperature / Humidity 20 deg. C / 45 % RH
Engineer Kazuhiro Ando
(1 GHz - 10 GHz)
Mode Tx BT LE 2Mbps 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 6, 2019 February 27, 2019 March 8, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 45 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 2Mbps 2440 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Hori.	64.000	QP	20.80	12.60	4.80	26.80	0.00	11.40	40.00	28.6	100	0	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	4880.000	PK	55.50	32.50	5.70	45.70	3.50	51.50	73.90	22.4	130	110	
Hori.	7320.000	PK	52.10	37.30	7.10	44.40	3.50	55.60	73.90	18.3	155	105	
Hori.	9760.000	PK	46.50	38.10	8.00	42.20	3.50	53.90	73.90	20.0	100	0	
Hori.	12200.000	PK	52.20	38.50	9.10	44.00	-9.50	46.30	73.90	27.6	154	195	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	24.00	12.60	4.80	26.80	0.00	14.60	40.00	25.4	100	105	
Vert.	96.000	QP	20.60	8.40	5.20	26.70	0.00	7.50	43.50	36.0	100	0	
Vert.	4880.000	PK	52.70	32.50	5.70	45.70	3.50	48.70	73.90	25.2	235	145	
Vert.	7320.000	PK	50.50	37.30	7.10	44.40	3.50	54.00	73.90	19.9	205	220	
Vert.	9760.000	PK	46.10	38.10	8.00	42.20	3.50	53.50	73.90	20.4	100	0	
Vert.	12200.000	PK	52.30	38.50	9.10	44.00	-9.50	46.40	73.90	27.5	132	349	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4880.000	AV	47.20	32.50	5.70	45.70	2.38	3.50	45.58	53.90	8.3	
Hori.	7320.000	AV	43.50	37.30	7.10	44.40	2.38	3.50	49.38	53.90	4.5	
Hori.	9760.000	AV	37.40	38.10	8.00	42.20	2.38	3.50	47.18	53.90	6.7	
Hori.	12200.000	AV	43.70	38.50	9.10	44.00	2.38	-9.50	40.18	53.90	13.7	
Vert.	4880.000	AV	44.10	32.50	5.70	45.70	2.38	3.50	42.48	53.90	11.4	
Vert.	7320.000	AV	41.90	37.30	7.10	44.40	2.38	3.50	47.78	53.90	6.1	
Vert.	9760.000	AV	37.30	38.10	8.00	42.20	2.38	3.50	47.08	53.90	6.8	
Vert.	12200.000	AV	43.70	38.50	9.10	44.00	2.38	-9.50	40.18	53.90	13.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

UL Japan, Inc.

Kashima EMC Lab.

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Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 6, 2019 February 28, 2019 March 8, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 45 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 2Mbps 2480 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.80	12.60	4.20	26.90	0.00	10.70	40.00	29.3	100	0	
Hori.	64.000	QP	20.80	12.60	4.80	26.80	0.00	11.40	40.00	28.6	100	0	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	2483.500	PK	55.50	27.80	13.80	44.30	3.50	56.30	73.90	17.6	145	60	
Hori.	4960.000	PK	56.00	32.60	5.80	45.80	3.50	52.10	73.90	21.8	125	112	
Hori.	7440.000	PK	52.00	37.40	7.10	44.10	3.50	55.90	73.90	18.0	145	105	
Hori.	9920.000	PK	47.00	38.20	8.10	42.20	3.50	54.60	73.90	19.3	100	0	
Hori.	12400.000	PK	51.20	38.60	9.20	44.20	-9.50	45.30	73.90	28.6	152	199	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	24.10	12.60	4.80	26.80	0.00	14.70	40.00	25.3	105	0	
Vert.	96.000	QP	20.60	8.40	5.20	26.70	0.00	7.50	43.50	36.0	100	0	
Vert.	2483.500	PK	51.70	27.80	13.80	44.30	3.50	52.50	73.90	21.4	110	325	
Vert.	4960.000	PK	52.90	32.60	5.80	45.80	3.50	49.00	73.90	24.9	230	145	
Vert.	7440.000	PK	50.50	37.40	7.10	44.10	3.50	54.40	73.90	19.5	160	140	
Vert.	9920.000	PK	47.10	38.20	8.10	42.20	3.50	54.70	73.90	19.2	100	0	
Vert.	12400.000	PK	50.70	38.60	9.20	44.20	-9.50	44.80	73.90	29.1	133	345	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	46.00	27.80	13.80	44.30	2.38	3.50	49.18	53.90	4.7	*1)
Hori.	4960.000	AV	48.80	32.60	5.80	45.80	2.38	3.50	47.28	53.90	6.6	
Hori.	7440.000	AV	43.80	37.40	7.10	44.10	2.38	3.50	50.08	53.90	3.8	
Hori.	9920.000	AV	38.30	38.20	8.10	42.20	2.38	3.50	48.28	53.90	5.6	
Hori.	12400.000	AV	42.70	38.60	9.20	44.20	2.38	-9.50	39.18	53.90	14.7	
Vert.	2483.500	AV	42.70	27.80	13.80	44.30	2.38	3.50	45.88	53.90	8.0	*1)
Vert.	4960.000	AV	44.40	32.60	5.80	45.80	2.38	3.50	42.88	53.90	11.0	
Vert.	7440.000	AV	42.90	37.40	7.10	44.10	2.38	3.50	49.18	53.90	4.7	
Vert.	9920.000	AV	38.10	38.20	8.10	42.20	2.38	3.50	48.08	53.90	5.8	
Vert.	12400.000	AV	42.40	38.60	9.20	44.20	2.38	-9.50	38.88	53.90	15.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

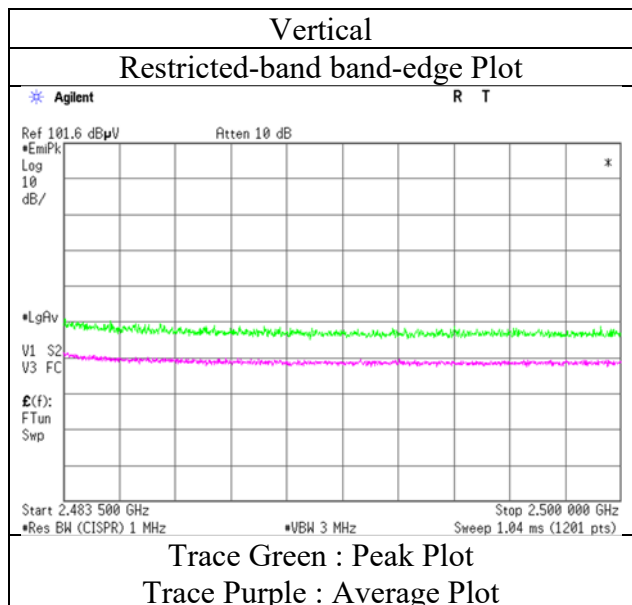
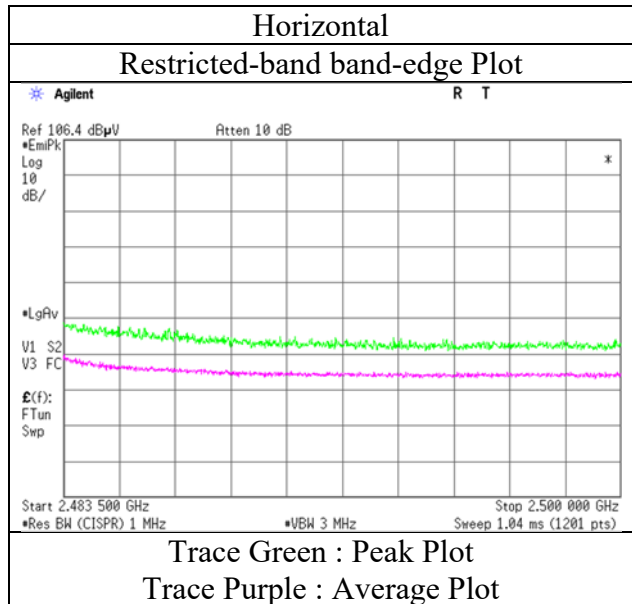
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

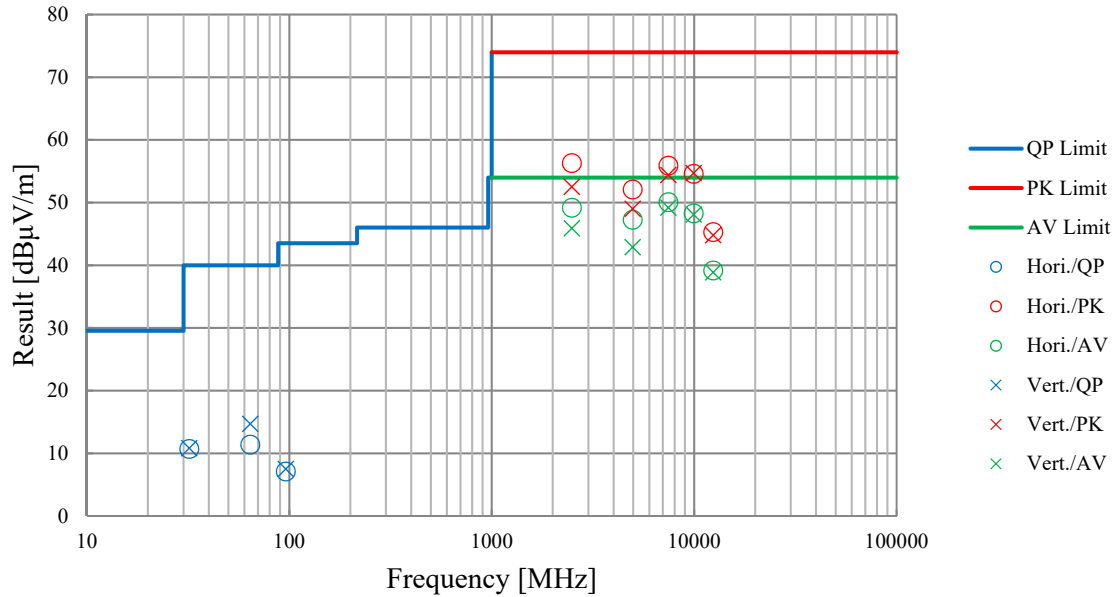
Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date February 28, 2019
Temperature / Humidity 20 deg. C / 45 % RH
Engineer Kazuhiro Ando
(1 GHz - 10 GHz)
Mode Tx BT LE 2Mbps 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12725754M-A-R2			
Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.10			
Date	March 6, 2019	February 27, 2019	March 8, 2019	March 9, 2019
Temperature / Humidity	22 deg. C / 40 % RH	20 deg. C / 45 % RH	22 deg. C / 40 % RH	19 deg. C / 40 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(30 MHz - 1000 MHz)	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Mode	Tx BT LE 1Mbps 2480 MHz			



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

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 7, 2019 February 28, 2019 March 7, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 48 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx ANT 1 Mbps 2402 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Hori.	64.000	QP	20.70	12.60	4.80	26.80	0.00	11.30	40.00	28.7	100	0	
Hori.	80.000	QP	21.50	9.00	5.00	26.80	0.00	8.70	40.00	31.3	170	180	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	2390.000	PK	48.60	27.60	13.70	44.30	3.50	49.10	73.90	24.8	100	115	
Hori.	4804.000	PK	52.50	32.60	5.70	45.70	3.50	48.60	73.90	25.3	160	65	
Hori.	7206.000	PK	53.50	37.20	7.00	44.70	3.50	56.50	73.90	17.4	160	45	
Hori.	9608.000	PK	47.00	38.20	8.00	42.30	3.50	54.40	73.90	19.5	100	0	
Hori.	12010.000	PK	54.50	38.70	9.10	43.80	-9.50	49.00	73.90	24.9	150	203	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	23.30	12.60	4.80	26.80	0.00	13.90	40.00	26.1	100	105	
Vert.	80.000	QP	27.20	9.00	5.00	26.80	0.00	14.40	40.00	25.6	100	100	
Vert.	96.000	QP	20.50	8.40	5.20	26.70	0.00	7.40	43.50	36.1	100	0	
Vert.	2390.000	PK	47.70	27.60	13.70	44.30	3.50	48.20	73.90	25.7	150	140	
Vert.	4804.000	PK	52.40	32.60	5.70	45.70	3.50	48.50	73.90	25.4	150	290	
Vert.	7206.000	PK	54.80	37.20	7.00	44.70	3.50	57.80	73.90	16.1	125	290	
Vert.	9608.000	PK	47.50	38.20	8.00	42.30	3.50	54.90	73.90	19.0	100	0	
Vert.	12010.000	PK	57.50	38.70	9.10	43.80	-9.50	52.00	73.90	21.9	134	24	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	40.00	27.60	13.70	44.30	0.22	3.50	40.72	53.90	13.2	*1)
Hori.	4804.000	AV	45.10	32.60	5.70	45.70	0.22	3.50	41.42	53.90	12.5	
Hori.	7206.000	AV	48.20	37.20	7.00	44.70	0.22	3.50	51.42	53.90	2.5	
Hori.	9608.000	AV	38.00	38.20	8.00	42.30	0.22	3.50	45.62	53.90	8.3	
Hori.	12010.000	AV	47.90	38.70	9.10	43.80	0.22	-9.50	42.62	53.90	11.3	
Vert.	2390.000	AV	40.20	27.60	13.70	44.30	0.22	3.50	40.92	53.90	13.0	*1)
Vert.	4804.000	AV	43.90	32.60	5.70	45.70	0.22	3.50	40.22	53.90	13.7	
Vert.	7206.000	AV	49.50	37.20	7.00	44.70	0.22	3.50	52.72	53.90	1.2	
Vert.	9608.000	AV	38.00	38.20	8.00	42.30	0.22	3.50	45.62	53.90	8.3	
Vert.	12010.000	AV	52.60	38.70	9.10	43.80	0.22	-9.50	47.32	53.90	6.6	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	100.70	27.60	13.80	44.30	3.50	101.30	-	-	Carrier
Hori.	2400.000	PK	51.00	27.60	13.80	44.30	3.50	51.60	81.30	29.7	
Vert.	2402.000	PK	97.10	27.60	13.80	44.30	3.50	97.70	-	-	Carrier
Vert.	2400.000	PK	48.00	27.60	13.80	44.30	3.50	48.60	77.70	29.1	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

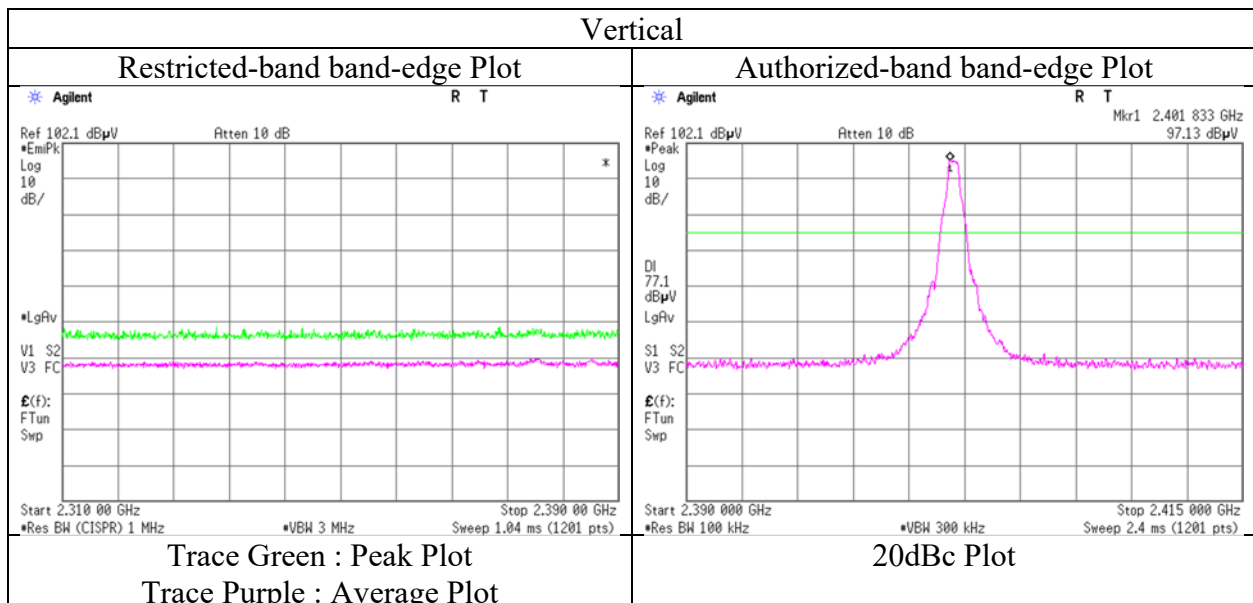
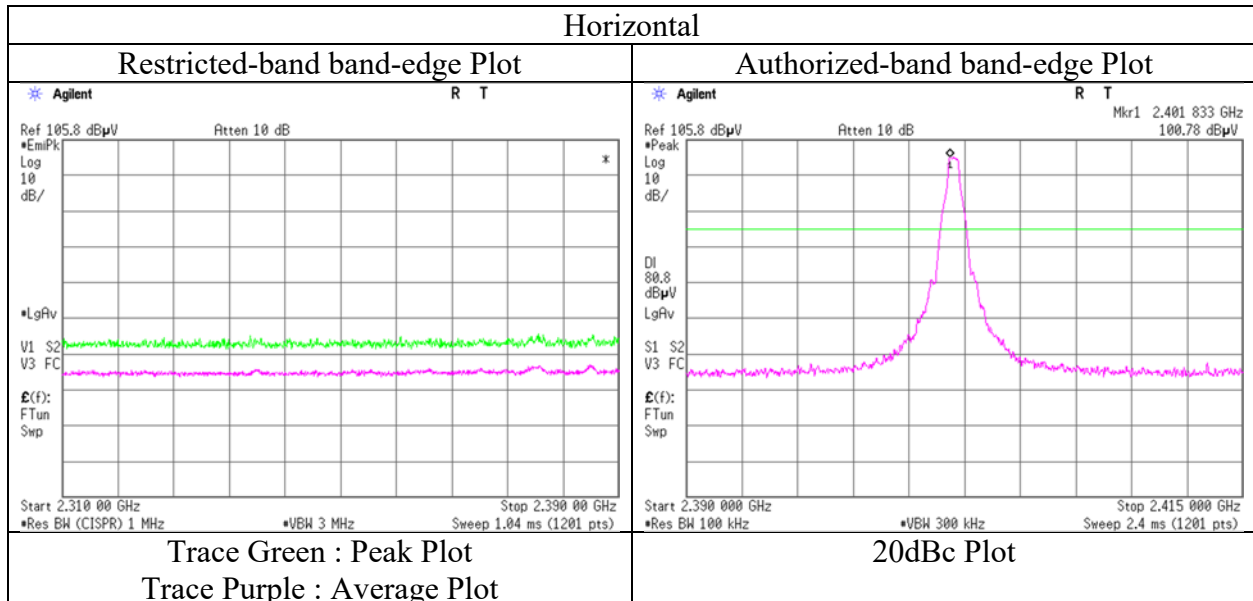
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12725754M-A-R2
Test place	Kashima EMC Lab.
Semi Anechoic Chamber	No.10
Date	February 28, 2019
Temperature / Humidity	20 deg. C / 48 % RH
Engineer	Kazuhiro Ando
	(1 GHz - 10 GHz)
Mode	Tx ANT 1 Mbps 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 7, 2019 February 28, 2019 March 7, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 48 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx ANT 1 Mbps 2441 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Hori.	64.000	QP	20.70	12.60	4.80	26.80	0.00	11.30	40.00	28.7	100	0	
Hori.	80.000	QP	21.40	9.00	5.00	26.80	0.00	8.60	40.00	31.4	170	180	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	4882.000	PK	53.30	32.50	5.70	45.70	3.50	49.30	73.90	24.6	155	70	
Hori.	7323.000	PK	53.40	37.30	7.10	44.40	3.50	56.90	73.90	17.0	150	55	
Hori.	9764.000	PK	45.90	38.10	8.00	42.20	3.50	53.30	73.90	20.6	100	0	
Hori.	12205.000	PK	53.30	38.50	9.10	44.00	-9.50	47.40	73.90	26.5	150	190	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	23.30	12.60	4.80	26.80	0.00	13.90	40.00	26.1	100	110	
Vert.	80.000	QP	27.30	9.00	5.00	26.80	0.00	14.50	40.00	25.5	100	100	
Vert.	96.000	QP	20.30	8.40	5.20	26.70	0.00	7.20	43.50	36.3	100	0	
Vert.	4882.000	PK	52.00	32.50	5.70	45.70	3.50	48.00	73.90	25.9	150	277	
Vert.	7323.000	PK	53.70	37.30	7.10	44.40	3.50	57.20	73.90	16.7	112	283	
Vert.	9764.000	PK	45.50	38.10	8.00	42.20	3.50	52.90	73.90	21.0	100	0	
Vert.	12205.000	PK	56.30	38.50	9.10	44.00	-9.50	50.40	73.90	23.5	134	24	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	46.20	32.50	5.70	45.70	0.22	3.50	42.42	53.90	11.5	
Hori.	7323.000	AV	46.60	37.30	7.10	44.40	0.22	3.50	50.32	53.90	3.6	
Hori.	9764.000	AV	37.00	38.10	8.00	42.20	0.22	3.50	44.62	53.90	9.3	
Hori.	12205.000	AV	46.40	38.50	9.10	44.00	0.22	-9.50	40.72	53.90	13.2	
Vert.	4882.000	AV	43.50	32.50	5.70	45.70	0.22	3.50	39.72	53.90	14.2	
Vert.	7323.000	AV	47.60	37.30	7.10	44.40	0.22	3.50	51.32	53.90	2.6	
Vert.	9764.000	AV	37.10	38.10	8.00	42.20	0.22	3.50	44.72	53.90	9.2	
Vert.	12205.000	AV	51.00	38.50	9.10	44.00	0.22	-9.50	45.32	53.90	8.6	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 7, 2019 February 28, 2019 March 7, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 48 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx ANT 1 Mbps 2480 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Hori.	64.000	QP	20.70	12.60	4.80	26.80	0.00	11.30	40.00	28.7	100	0	
Hori.	80.000	QP	21.40	9.00	5.00	26.80	0.00	8.60	40.00	31.4	170	180	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	2483.500	PK	51.20	27.80	13.80	44.30	3.50	52.00	73.90	21.9	180	65	
Hori.	4960.000	PK	55.00	32.60	5.80	45.80	3.50	51.10	73.90	22.8	150	70	
Hori.	7440.000	PK	52.40	37.40	7.10	44.10	3.50	56.30	73.90	17.6	150	75	
Hori.	9920.000	PK	47.20	38.20	8.10	42.20	3.50	54.80	73.90	19.1	100	0	
Hori.	12400.000	PK	52.40	38.60	9.20	44.20	-9.50	46.50	73.90	27.4	150	188	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	23.30	12.60	4.80	26.80	0.00	13.90	40.00	26.1	100	110	
Vert.	80.000	QP	27.20	9.00	5.00	26.80	0.00	14.40	40.00	25.6	100	100	
Vert.	96.000	QP	20.30	8.40	5.20	26.70	0.00	7.20	43.50	36.3	100	0	
Vert.	2483.500	PK	51.10	27.80	13.80	44.30	3.50	51.90	73.90	22.0	155	297	
Vert.	4960.000	PK	52.60	32.60	5.80	45.80	3.50	48.70	73.90	25.2	235	225	
Vert.	7440.000	PK	53.40	37.40	7.10	44.10	3.50	57.30	73.90	16.6	185	260	
Vert.	9920.000	PK	46.40	38.20	8.10	42.20	3.50	54.00	73.90	19.9	100	0	
Vert.	12400.000	PK	55.00	38.60	9.20	44.20	-9.50	49.10	73.90	24.8	132	24	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	42.90	27.80	13.80	44.30	0.22	3.50	43.92	53.90	10.0	*1)
Hori.	4960.000	AV	49.20	32.60	5.80	45.80	0.22	3.50	45.52	53.90	8.4	
Hori.	7440.000	AV	45.90	37.40	7.10	44.10	0.22	3.50	50.02	53.90	3.9	
Hori.	9920.000	AV	38.30	38.20	8.10	42.20	0.22	3.50	46.12	53.90	7.8	
Hori.	12400.000	AV	44.70	38.60	9.20	44.20	0.22	-9.50	39.02	53.90	14.9	
Vert.	2483.500	AV	42.40	27.80	13.80	44.30	0.22	3.50	43.42	53.90	10.5	*1)
Vert.	4960.000	AV	44.60	32.60	5.80	45.80	0.22	3.50	40.92	53.90	13.0	
Vert.	7440.000	AV	47.20	37.40	7.10	44.10	0.22	3.50	51.32	53.90	2.6	
Vert.	9920.000	AV	38.50	38.20	8.10	42.20	0.22	3.50	46.32	53.90	7.6	
Vert.	12400.000	AV	48.50	38.60	9.20	44.20	0.22	-9.50	42.82	53.90	11.1	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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Kashima EMC Lab.

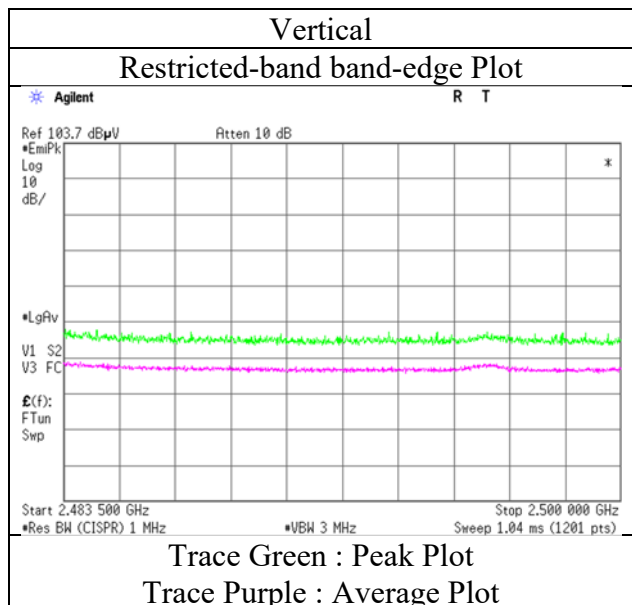
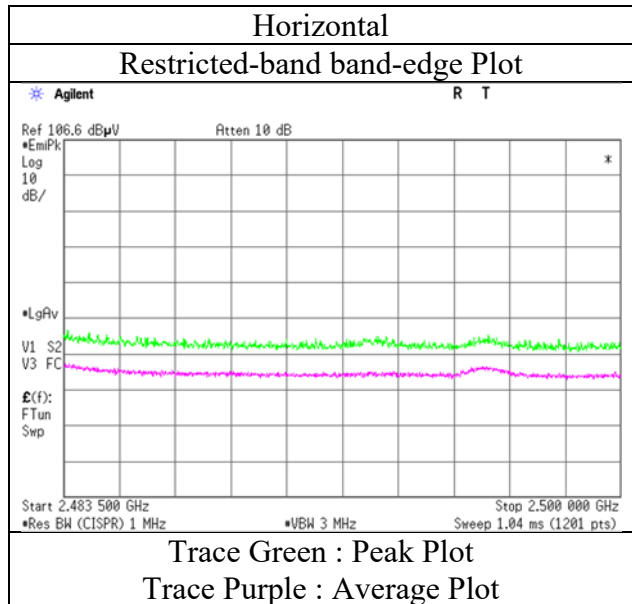
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Radiated Spurious Emission
(Reference Plot for band-edge)

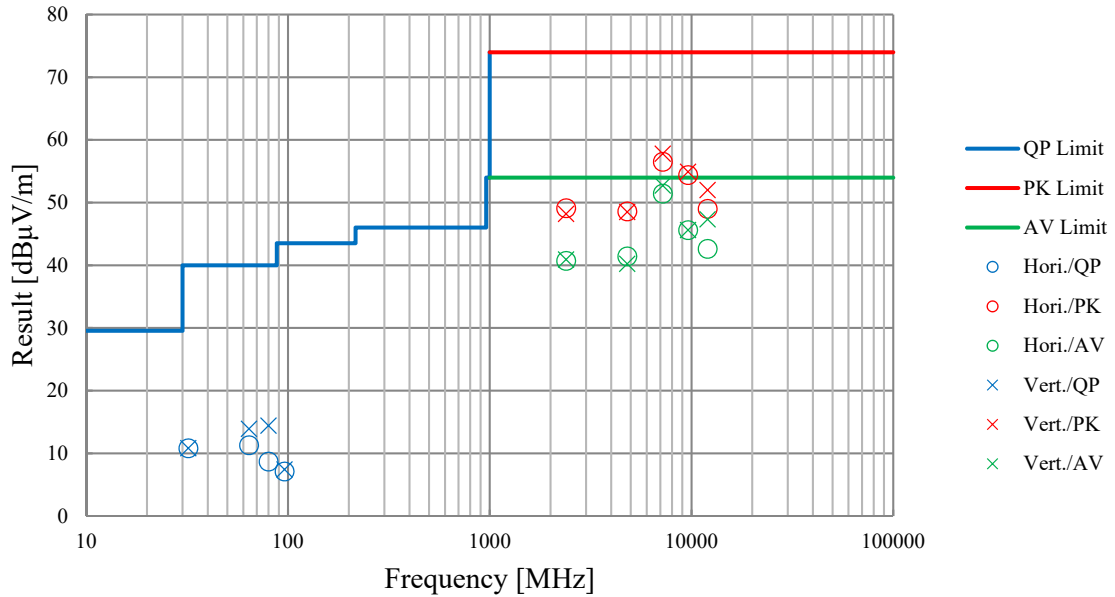
Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date February 28, 2019
Temperature / Humidity 20 deg. C / 48 % RH
Engineer Kazuhiro Ando
(1 GHz - 10 GHz)
Mode Tx ANT 1 Mbps 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12725754M-A-R2			
Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.10			
Date	March 7, 2019	February 27, 2019	March 8, 2019	March 9, 2019
Temperature / Humidity	22 deg. C / 40 % RH	20 deg. C / 45 % RH	22 deg. C / 40 % RH	19 deg. C / 40 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(30 MHz - 1000 MHz)	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Mode	Tx ANT 1 Mbps 2402 MHz			



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

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 7, 2019 February 28, 2019 March 8, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 48 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx Nordic Original 2 Mbps 2402 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Hori.	64.000	QP	20.70	12.60	4.80	26.80	0.00	11.30	40.00	28.7	100	0	
Hori.	80.000	QP	21.40	9.00	5.00	26.80	0.00	8.60	40.00	31.4	170	180	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	2390.000	PK	48.60	27.60	13.70	44.30	3.50	49.10	73.90	24.8	100	115	
Hori.	4804.000	PK	52.00	32.60	5.70	45.70	3.50	48.10	73.90	25.8	165	70	
Hori.	7206.000	PK	53.20	37.20	7.00	44.70	3.50	56.20	73.90	17.7	145	55	
Hori.	9608.000	PK	46.30	38.20	8.00	42.30	3.50	53.70	73.90	20.2	100	0	
Hori.	12010.000	PK	54.30	38.70	9.10	43.80	-9.50	48.80	73.90	25.1	150	187	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	23.40	12.60	4.80	26.80	0.00	14.00	40.00	26.0	100	110	
Vert.	80.000	QP	27.40	9.00	5.00	26.80	0.00	14.60	40.00	25.4	100	100	
Vert.	96.000	QP	20.40	8.40	5.20	26.70	0.00	7.30	43.50	36.2	100	0	
Vert.	2390.000	PK	50.10	27.60	13.70	44.30	3.50	50.60	73.90	23.3	150	140	
Vert.	4804.000	PK	52.00	32.60	5.70	45.70	3.50	48.10	73.90	25.8	155	293	
Vert.	7206.000	PK	54.20	37.20	7.00	44.70	3.50	57.20	73.90	16.7	112	290	
Vert.	9608.000	PK	46.90	38.20	8.00	42.30	3.50	54.30	73.90	19.6	100	0	
Vert.	12010.000	PK	57.60	38.70	9.10	43.80	-9.50	52.10	73.90	21.8	128	24	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	39.90	27.60	13.70	44.30	0.44	3.50	40.84	53.90	13.1	*1)
Hori.	4804.000	AV	43.90	32.60	5.70	45.70	0.44	3.50	40.44	53.90	13.5	
Hori.	7206.000	AV	46.00	37.20	7.00	44.70	0.44	3.50	49.44	53.90	4.5	
Hori.	9608.000	AV	38.20	38.20	8.00	42.30	0.44	3.50	46.04	53.90	7.9	
Hori.	12010.000	AV	47.20	38.70	9.10	43.80	0.44	-9.50	42.14	53.90	11.8	
Vert.	2390.000	AV	39.50	27.60	13.70	44.30	0.44	3.50	40.44	53.90	13.5	*1)
Vert.	4804.000	AV	43.20	32.60	5.70	45.70	0.44	3.50	39.74	53.90	14.2	
Vert.	7206.000	AV	46.90	37.20	7.00	44.70	0.44	3.50	50.34	53.90	3.6	
Vert.	9608.000	AV	38.00	38.20	8.00	42.30	0.44	3.50	45.84	53.90	8.1	
Vert.	12010.000	AV	51.50	38.70	9.10	43.80	0.44	-9.50	46.44	53.90	7.5	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	100.30	27.60	13.80	44.30	3.50	100.90	-	-	Carrier
Hori.	2400.000	PK	60.10	27.60	13.80	44.30	3.50	60.70	80.90	20.2	
Vert.	2402.000	PK	97.60	27.60	13.80	44.30	3.50	98.20	-	-	Carrier
Vert.	2400.000	PK	57.30	27.60	13.80	44.30	3.50	57.90	78.20	20.3	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

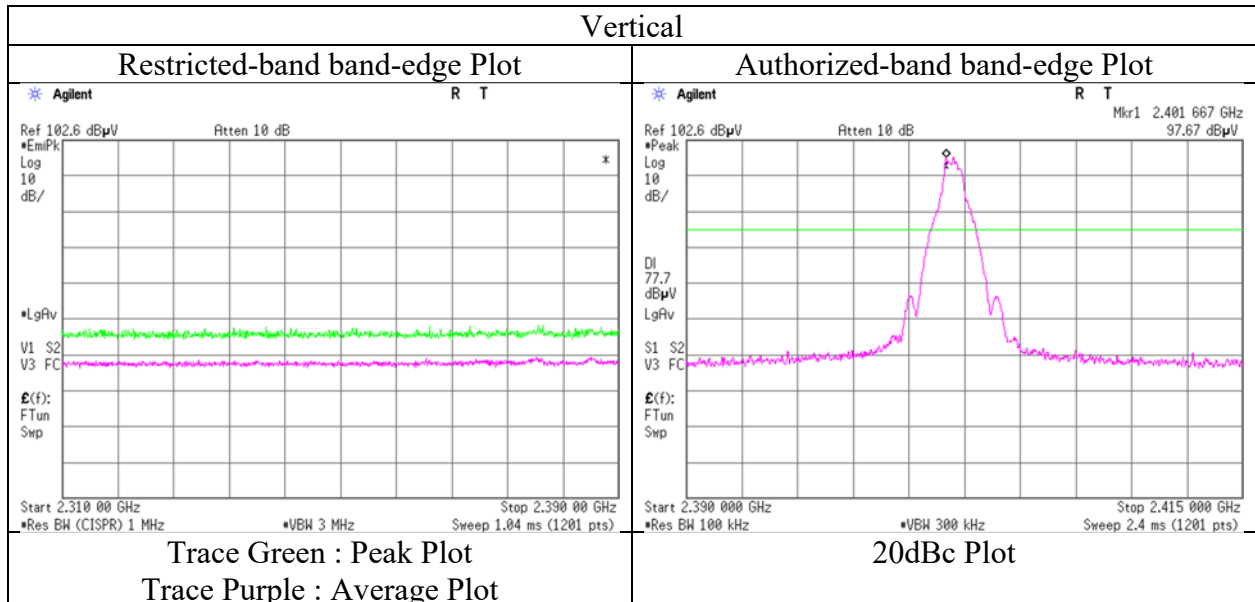
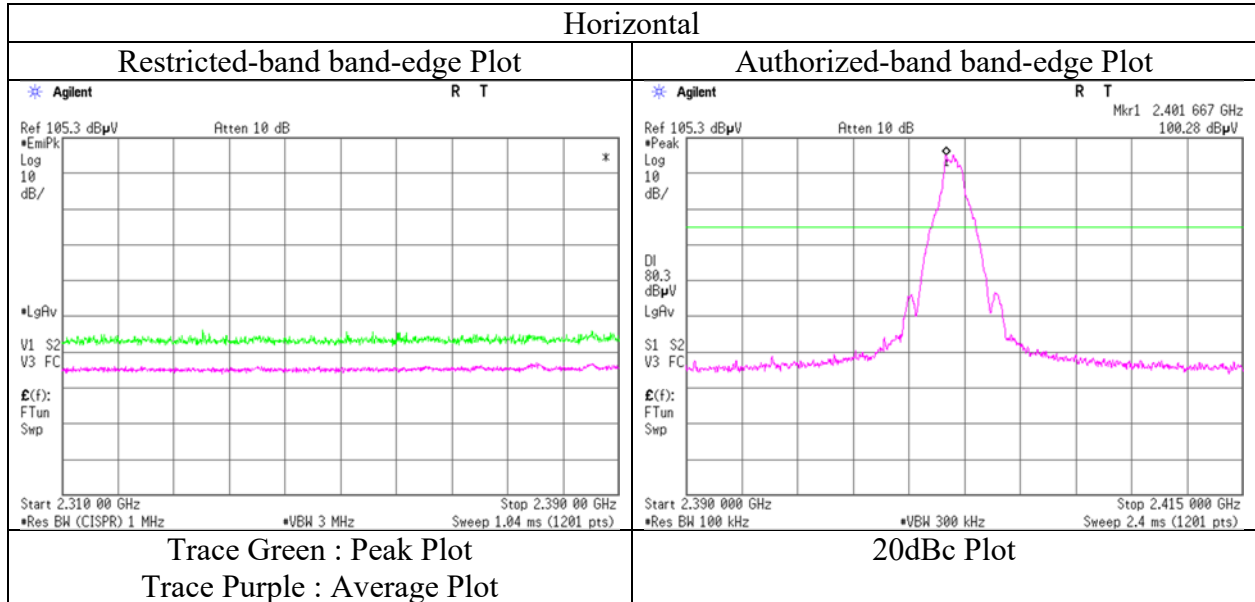
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date February 28, 2019
Temperature / Humidity 20 deg. C / 48 % RH
Engineer Kazuhiro Ando
(1 GHz - 10 GHz)
Mode Tx Nordic Original 2 Mbps 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 7, 2019 February 28, 2019 March 8, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 48 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx Nordic Original 2 Mbps 2441 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Hori.	64.000	QP	20.70	12.60	4.80	26.80	0.00	11.30	40.00	28.7	100	0	
Hori.	80.000	QP	21.40	9.00	5.00	26.80	0.00	8.60	40.00	31.4	170	180	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	4882.000	PK	53.00	32.50	5.70	45.70	3.50	49.00	73.90	24.9	160	70	
Hori.	7323.000	PK	52.30	37.30	7.10	44.40	3.50	55.80	73.90	18.1	150	57	
Hori.	9764.000	PK	45.80	38.10	8.00	42.20	3.50	53.20	73.90	20.7	100	0	
Hori.	12205.000	PK	53.10	38.50	9.10	44.00	-9.50	47.20	73.90	26.7	150	184	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	23.40	12.60	4.80	26.80	0.00	14.00	40.00	26.0	100	110	
Vert.	80.000	QP	27.30	9.00	5.00	26.80	0.00	14.50	40.00	25.5	100	100	
Vert.	96.000	QP	20.30	8.40	5.20	26.70	0.00	7.20	43.50	36.3	100	0	
Vert.	4882.000	PK	50.90	32.50	5.70	45.70	3.50	46.90	73.90	27.0	150	280	
Vert.	7323.000	PK	53.80	37.30	7.10	44.40	3.50	57.30	73.90	16.6	113	283	
Vert.	9764.000	PK	45.20	38.10	8.00	42.20	3.50	52.60	73.90	21.3	100	0	
Vert.	12205.000	PK	56.00	38.50	9.10	44.00	-9.50	50.10	73.90	23.8	133	24	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	45.10	32.50	5.70	45.70	0.44	3.50	41.54	53.90	12.4	
Hori.	7323.000	AV	44.50	37.30	7.10	44.40	0.44	3.50	48.44	53.90	5.5	
Hori.	9764.000	AV	37.00	38.10	8.00	42.20	0.44	3.50	44.84	53.90	9.1	
Hori.	12205.000	AV	45.40	38.50	9.10	44.00	0.44	-9.50	39.94	53.90	14.0	
Vert.	4882.000	AV	43.10	32.50	5.70	45.70	0.44	3.50	39.54	53.90	14.4	
Vert.	7323.000	AV	46.30	37.30	7.10	44.40	0.44	3.50	50.24	53.90	3.7	
Vert.	9764.000	AV	37.10	38.10	8.00	42.20	0.44	3.50	44.94	53.90	9.0	
Vert.	12205.000	AV	49.40	38.50	9.10	44.00	0.44	-9.50	43.94	53.90	10.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 7, 2019 February 28, 2019 March 8, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 48 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx Nordic Original 2 Mbps 2480 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Hori.	64.000	QP	20.70	12.60	4.80	26.80	0.00	11.30	40.00	28.7	100	0	
Hori.	80.000	QP	21.40	9.00	5.00	26.80	0.00	8.60	40.00	31.4	170	180	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	2483.500	PK	54.70	27.80	13.80	44.30	3.50	55.50	73.90	18.4	180	60	
Hori.	4960.000	PK	55.00	32.60	5.80	45.80	3.50	51.10	73.90	22.8	160	70	
Hori.	7440.000	PK	52.80	37.40	7.10	44.10	3.50	56.70	73.90	17.2	140	47	
Hori.	9920.000	PK	46.90	38.20	8.10	42.20	3.50	54.50	73.90	19.4	100	0	
Hori.	12400.000	PK	51.80	38.60	9.20	44.20	-9.50	45.90	73.90	28.0	150	188	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	23.40	12.60	4.80	26.80	0.00	14.00	40.00	26.0	100	110	
Vert.	80.000	QP	27.50	9.00	5.00	26.80	0.00	14.70	40.00	25.3	100	100	
Vert.	96.000	QP	20.30	8.40	5.20	26.70	0.00	7.20	43.50	36.3	100	0	
Vert.	2483.500	PK	54.90	27.80	13.80	44.30	3.50	55.70	73.90	18.2	155	295	
Vert.	4960.000	PK	50.90	32.60	5.80	45.80	3.50	47.00	73.90	26.9	145	313	
Vert.	7440.000	PK	53.20	37.40	7.10	44.10	3.50	57.10	73.90	16.8	225	280	
Vert.	9920.000	PK	46.80	38.20	8.10	42.20	3.50	54.40	73.90	19.5	100	0	
Vert.	12400.000	PK	54.60	38.60	9.20	44.20	-9.50	48.70	73.90	25.2	130	24	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	46.10	27.80	13.80	44.30	0.44	3.50	47.34	53.90	6.6	*1)
Hori.	4960.000	AV	47.80	32.60	5.80	45.80	0.44	3.50	44.34	53.90	9.6	
Hori.	7440.000	AV	44.80	37.40	7.10	44.10	0.44	3.50	49.14	53.90	4.8	
Hori.	9920.000	AV	38.40	38.20	8.10	42.20	0.44	3.50	46.44	53.90	7.5	
Hori.	12400.000	AV	43.80	38.60	9.20	44.20	0.44	-9.50	38.34	53.90	15.6	
Vert.	2483.500	AV	45.40	27.80	13.80	44.30	0.44	3.50	46.64	53.90	7.3	*1)
Vert.	4960.000	AV	43.60	32.60	5.80	45.80	0.44	3.50	40.14	53.90	13.8	
Vert.	7440.000	AV	45.60	37.40	7.10	44.10	0.44	3.50	49.94	53.90	4.0	
Vert.	9920.000	AV	38.30	38.20	8.10	42.20	0.44	3.50	46.34	53.90	7.6	
Vert.	12400.000	AV	47.70	38.60	9.20	44.20	0.44	-9.50	42.24	53.90	11.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

UL Japan, Inc.

Kashima EMC Lab.

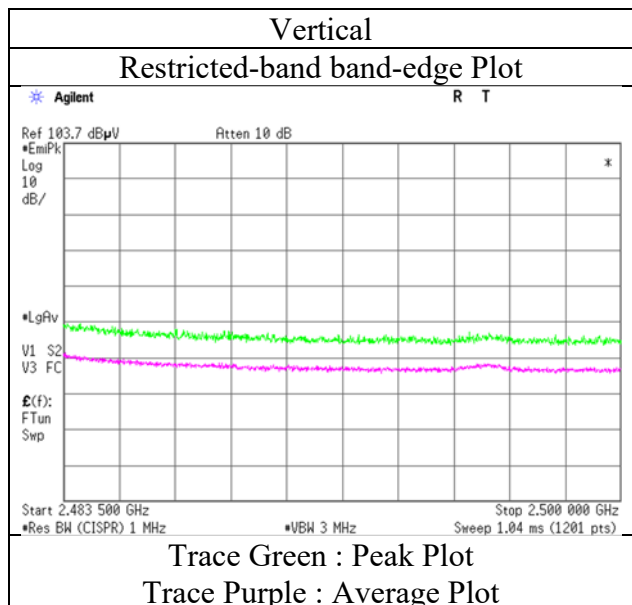
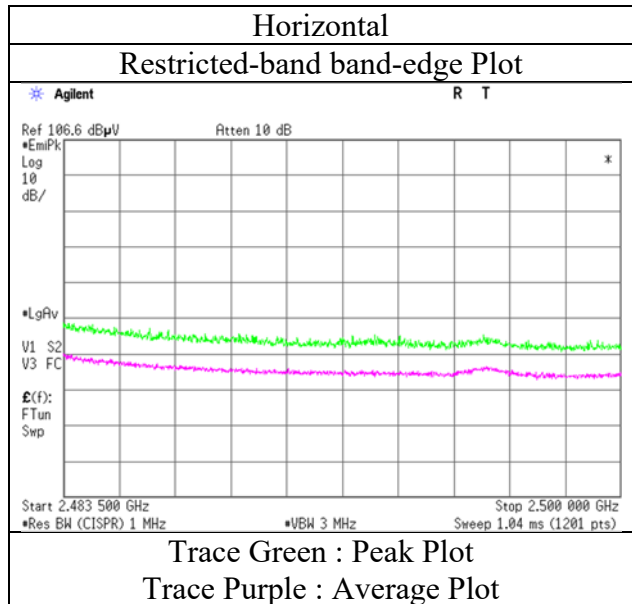
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Radiated Spurious Emission
(Reference Plot for band-edge)

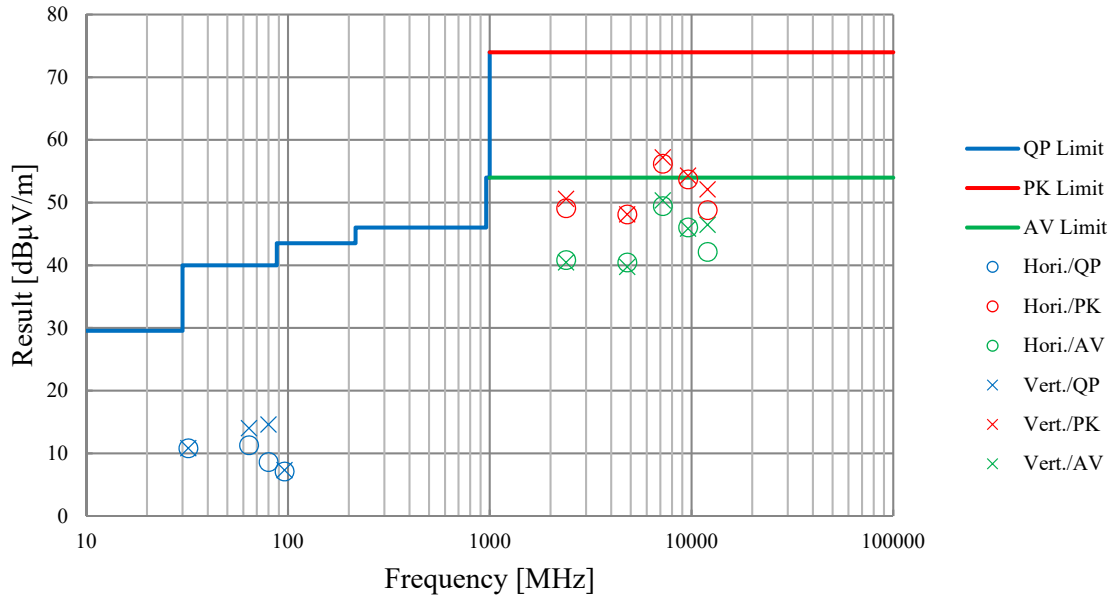
Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date February 28, 2019
Temperature / Humidity 20 deg. C / 48 % RH
Engineer Kazuhiro Ando
(1 GHz - 10 GHz)
Mode Tx Nordic Original 2 Mbps 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12725754M-A-R2			
Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.10			
Date	March 7, 2019	February 28, 2019	March 8, 2019	March 9, 2019
Temperature / Humidity	22 deg. C / 40 % RH	20 deg. C / 48 % RH	22 deg. C / 40 % RH	19 deg. C / 40 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(30 MHz - 1000 MHz)	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Mode	Tx Nordic Original 2 Mbps 2402 MHz			



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

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 7, 2019 February 28, 2019 March 7, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 48 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx IEEE 802.15.4 2405 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.80	12.60	4.20	26.90	0.00	10.70	40.00	29.3	100	0	
Hori.	64.000	QP	20.80	12.60	4.80	26.80	0.00	11.40	40.00	28.6	100	0	
Hori.	80.000	QP	21.20	9.00	5.00	26.80	0.00	8.40	40.00	31.6	170	180	
Hori.	96.000	QP	20.30	8.40	5.20	26.70	0.00	7.20	43.50	36.3	100	0	
Hori.	2390.000	PK	48.40	27.60	13.70	44.30	3.50	48.90	73.90	25.0	100	115	
Hori.	4810.000	PK	51.70	32.60	5.70	45.70	3.50	47.80	73.90	26.1	170	70	
Hori.	7215.000	PK	53.20	37.20	7.00	44.60	3.50	56.30	73.90	17.6	145	55	
Hori.	9620.000	PK	45.40	38.20	8.00	42.30	3.50	52.80	73.90	21.1	100	0	
Hori.	12025.000	PK	54.20	38.70	9.10	43.80	-9.50	48.70	73.90	25.2	150	186	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	23.70	12.60	4.80	26.80	0.00	14.30	40.00	25.7	100	110	
Vert.	80.000	QP	27.50	9.00	5.00	26.80	0.00	14.70	40.00	25.3	100	100	
Vert.	96.000	QP	20.40	8.40	5.20	26.70	0.00	7.30	43.50	36.2	100	0	
Vert.	2390.000	PK	49.70	27.60	13.70	44.30	3.50	50.20	73.90	23.7	150	140	
Vert.	4810.000	PK	50.80	32.60	5.70	45.70	3.50	46.90	73.90	27.0	150	292	
Vert.	7215.000	PK	54.10	37.20	7.00	44.60	3.50	57.20	73.90	16.7	120	285	
Vert.	9620.000	PK	46.30	38.20	8.00	42.30	3.50	53.70	73.90	20.2	100	0	
Vert.	12025.000	PK	57.20	38.70	9.10	43.80	-9.50	51.70	73.90	22.2	135	24	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	40.20	27.60	13.70	44.30	0.00	3.50	40.70	53.90	13.2	*1)
Hori.	4810.000	AV	43.60	32.60	5.70	45.70	0.00	3.50	39.70	53.90	14.2	
Hori.	7215.000	AV	45.80	37.20	7.00	44.60	0.00	3.50	48.90	53.90	5.0	
Hori.	9620.000	AV	38.10	38.20	8.00	42.30	0.00	3.50	45.50	53.90	8.4	
Hori.	12025.000	AV	47.60	38.70	9.10	43.80	0.00	-9.50	42.10	53.90	11.8	
Vert.	2390.000	AV	40.00	27.60	13.70	44.30	0.00	3.50	40.50	53.90	13.4	*1)
Vert.	4810.000	AV	42.80	32.60	5.70	45.70	0.00	3.50	38.90	53.90	15.0	
Vert.	7215.000	AV	47.10	37.20	7.00	44.60	0.00	3.50	50.20	53.90	3.7	
Vert.	9620.000	AV	38.30	38.20	8.00	42.30	0.00	3.50	45.70	53.90	8.2	
Vert.	12025.000	AV	51.50	38.70	9.10	43.80	0.00	-9.50	46.00	53.90	7.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2405.000	PK	97.60	27.60	13.80	44.30	3.50	98.20	-	-	Carrier
Hori.	2400.000	PK	48.70	27.60	13.80	44.30	3.50	49.30	78.20	28.9	
Vert.	2405.000	PK	97.30	27.60	13.80	44.30	3.50	97.90	-	-	Carrier
Vert.	2400.000	PK	45.20	27.60	13.80	44.30	3.50	45.80	77.90	32.1	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

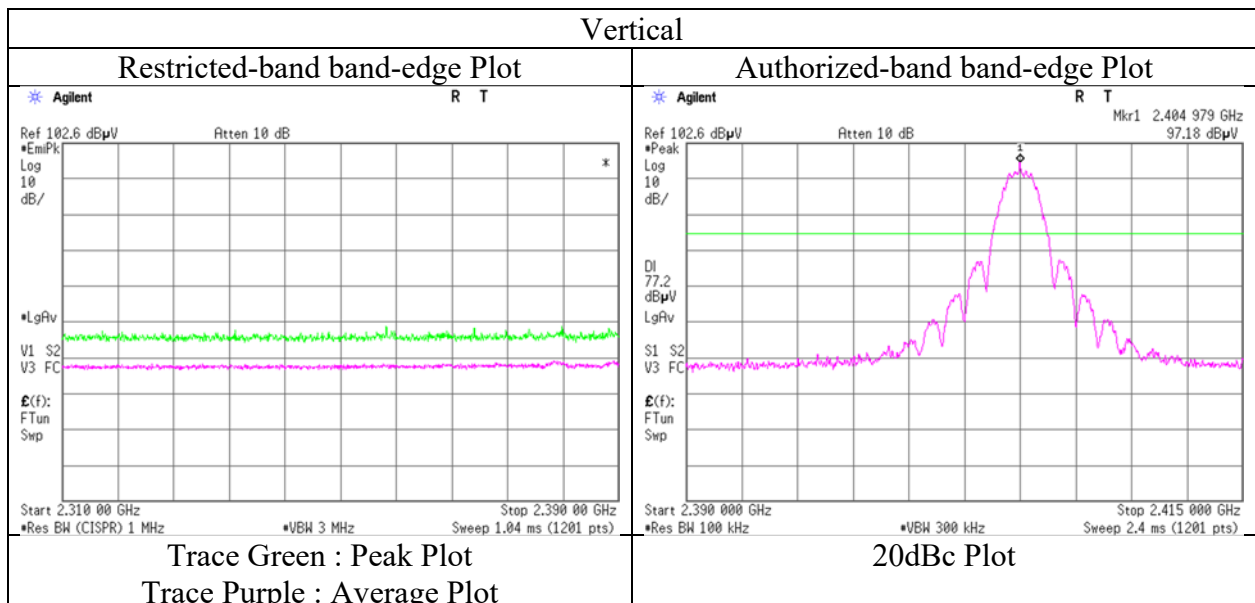
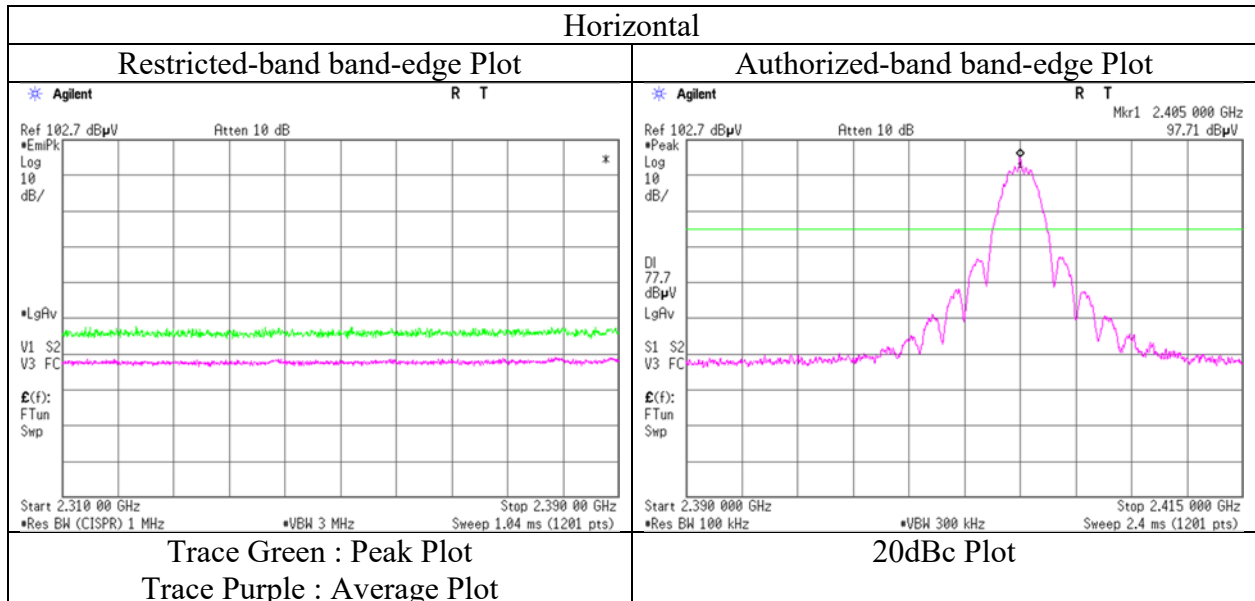
1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12725754M-A-R2
Test place	Kashima EMC Lab.
Semi Anechoic Chamber	No.10
Date	February 28, 2019
Temperature / Humidity	20 deg. C / 48 % RH
Engineer	Kazuhiro Ando
	(1 GHz - 10 GHz)
Mode	Tx IEEE 802.15.4 2405 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 7, 2019 February 28, 2019 March 7, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 48 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx IEEE 802.15.4 2440 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Hori.	64.000	QP	20.70	12.60	4.80	26.80	0.00	11.30	40.00	28.7	100	0	
Hori.	80.000	QP	21.20	9.00	5.00	26.80	0.00	8.40	40.00	31.6	170	180	
Hori.	96.000	QP	20.30	8.40	5.20	26.70	0.00	7.20	43.50	36.3	100	0	
Hori.	4880.000	PK	52.60	32.50	5.70	45.70	3.50	48.60	73.90	25.3	165	70	
Hori.	7320.000	PK	52.50	37.30	7.10	44.40	3.50	56.00	73.90	17.9	155	80	
Hori.	9760.000	PK	48.20	38.10	8.00	42.20	3.50	55.60	73.90	18.3	100	0	
Hori.	12200.000	PK	52.50	38.50	9.10	44.00	-9.50	46.60	73.90	27.3	150	178	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	23.70	12.60	4.80	26.80	0.00	14.30	40.00	25.7	100	110	
Vert.	80.000	QP	27.60	9.00	5.00	26.80	0.00	14.80	40.00	25.2	100	100	
Vert.	96.000	QP	20.50	8.40	5.20	26.70	0.00	7.40	43.50	36.1	100	0	
Vert.	4880.000	PK	51.50	32.50	5.70	45.70	3.50	47.50	73.90	26.4	150	275	
Vert.	7320.000	PK	54.00	37.30	7.10	44.40	3.50	57.50	73.90	16.4	110	282	
Vert.	9760.000	PK	46.50	38.10	8.00	42.20	3.50	53.90	73.90	20.0	100	0	
Vert.	12200.000	PK	56.00	38.50	9.10	44.00	-9.50	50.10	73.90	23.8	133	24	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4880.000	AV	44.40	32.50	5.70	45.70	0.00	3.50	40.40	53.90	13.5	
Hori.	7320.000	AV	44.90	37.30	7.10	44.40	0.00	3.50	48.40	53.90	5.5	
Hori.	9760.000	AV	37.10	38.10	8.00	42.20	0.00	3.50	44.50	53.90	9.4	
Hori.	12200.000	AV	45.90	38.50	9.10	44.00	0.00	-9.50	40.00	53.90	13.9	
Vert.	4880.000	AV	42.40	32.50	5.70	45.70	0.00	3.50	38.40	53.90	15.5	
Vert.	7320.000	AV	47.40	37.30	7.10	44.40	0.00	3.50	50.90	53.90	3.0	
Vert.	9760.000	AV	37.10	38.10	8.00	42.20	0.00	3.50	44.50	53.90	9.4	
Vert.	12200.000	AV	50.20	38.50	9.10	44.00	0.00	-9.50	44.30	53.90	9.6	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date March 7, 2019 February 28, 2019 March 7, 2019 March 9, 2019
Temperature / Humidity 22 deg. C / 40 % RH 20 deg. C / 48 % RH 22 deg. C / 40 % RH 19 deg. C / 40 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 MHz - 1000 MHz) (1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx IEEE 802.15.4 2475 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	32.000	QP	20.80	12.60	4.20	26.90	0.00	10.70	40.00	29.3	100	0	
Hori.	64.000	QP	20.70	12.60	4.80	26.80	0.00	11.30	40.00	28.7	100	0	
Hori.	80.000	QP	21.20	9.00	5.00	26.80	0.00	8.40	40.00	31.6	170	180	
Hori.	96.000	QP	20.20	8.40	5.20	26.70	0.00	7.10	43.50	36.4	100	0	
Hori.	2483.500	PK	51.00	27.80	13.80	44.30	3.50	51.80	73.90	22.1	180	60	
Hori.	4950.000	PK	54.10	32.60	5.80	45.80	3.50	50.20	73.90	23.7	160	70	
Hori.	7425.000	PK	52.70	37.40	7.10	44.10	3.50	56.60	73.90	17.3	135	45	
Hori.	9900.000	PK	46.70	38.20	8.10	42.20	3.50	54.30	73.90	19.6	100	0	
Hori.	12375.000	PK	51.30	38.60	9.20	44.20	-9.50	45.40	73.90	28.5	150	176	
Vert.	32.000	QP	20.90	12.60	4.20	26.90	0.00	10.80	40.00	29.2	100	0	
Vert.	64.000	QP	23.70	12.60	4.80	26.80	0.00	14.30	40.00	25.7	100	110	
Vert.	80.000	QP	27.50	9.00	5.00	26.80	0.00	14.70	40.00	25.3	100	100	
Vert.	96.000	QP	20.50	8.40	5.20	26.70	0.00	7.40	43.50	36.1	100	0	
Vert.	2483.500	PK	49.50	27.80	13.80	44.30	3.50	50.30	73.90	23.6	160	280	
Vert.	4950.000	PK	51.80	32.60	5.80	45.80	3.50	47.90	73.90	26.0	145	295	
Vert.	7425.000	PK	53.60	37.40	7.10	44.10	3.50	57.50	73.90	16.4	105	275	
Vert.	9900.000	PK	47.00	38.20	8.10	42.20	3.50	54.60	73.90	19.3	100	0	
Vert.	12375.000	PK	54.40	38.60	9.20	44.20	-9.50	48.50	73.90	25.4	133	24	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	42.60	27.80	13.80	44.30	0.00	3.50	43.40	53.90	10.5	*1)
Hori.	4950.000	AV	46.90	32.60	5.80	45.80	0.00	3.50	43.00	53.90	10.9	
Hori.	7425.000	AV	45.00	37.40	7.10	44.10	0.00	3.50	48.90	53.90	5.0	
Hori.	9900.000	AV	38.50	38.20	8.10	42.20	0.00	3.50	46.10	53.90	7.8	
Hori.	12375.000	AV	44.20	38.60	9.20	44.20	0.00	-9.50	38.30	53.90	15.6	
Vert.	2483.500	AV	41.50	27.80	13.80	44.30	0.00	3.50	42.30	53.90	11.6	*1)
Vert.	4950.000	AV	43.30	32.60	5.80	45.80	0.00	3.50	39.40	53.90	14.5	
Vert.	7425.000	AV	45.70	37.40	7.10	44.10	0.00	3.50	49.60	53.90	4.3	
Vert.	9900.000	AV	38.10	38.20	8.10	42.20	0.00	3.50	45.70	53.90	8.2	
Vert.	12375.000	AV	48.30	38.60	9.20	44.20	0.00	-9.50	42.40	53.90	11.5	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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Kashima EMC Lab.

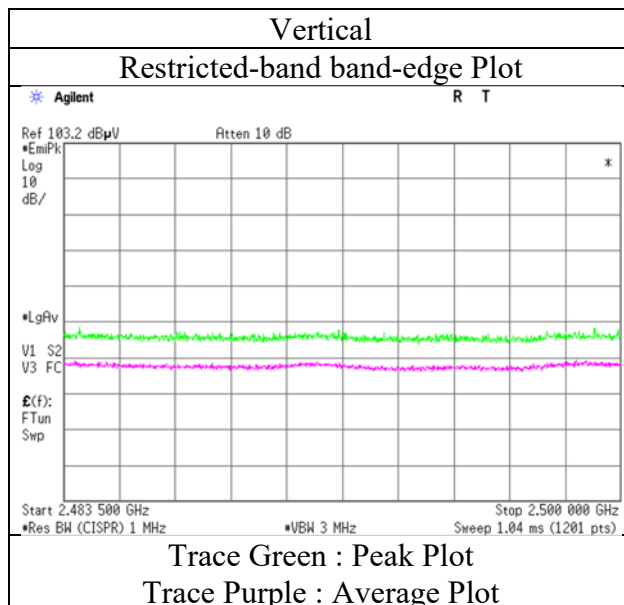
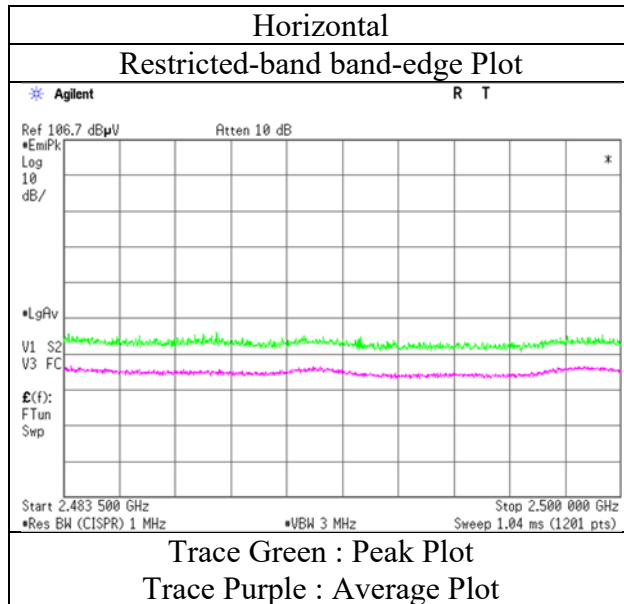
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Radiated Spurious Emission
(Reference Plot for band-edge)

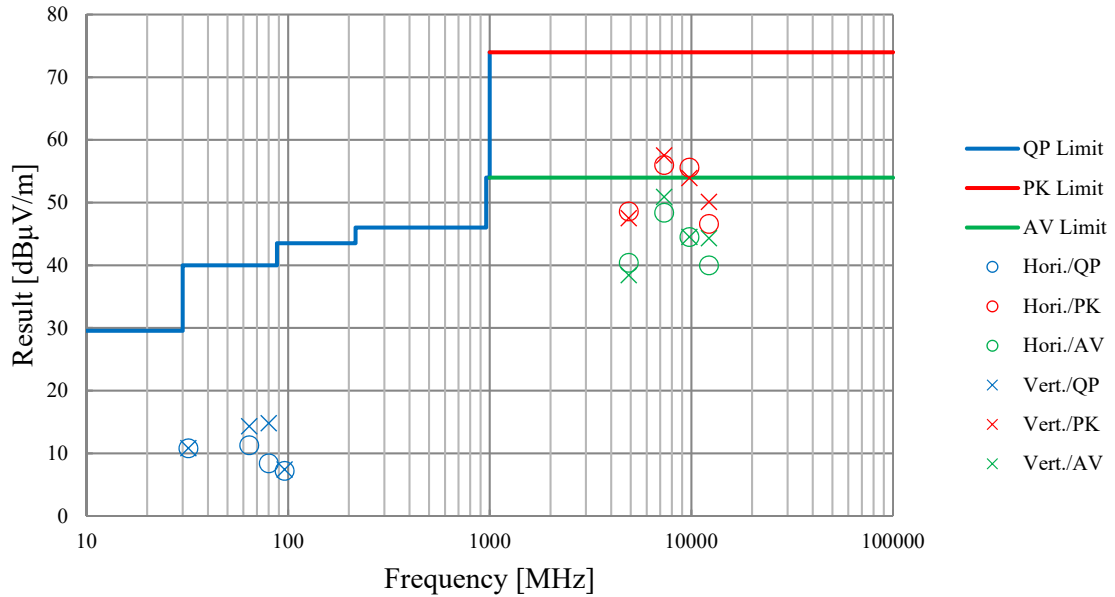
Report No. 12725754M-A-R2
Test place Kashima EMC Lab.
Semi Anechoic Chamber No.10
Date February 28, 2019
Temperature / Humidity 20 deg. C / 48 % RH
Engineer Kazuhiro Ando
(1 GHz - 10 GHz)
Mode Tx IEEE 802.15.4 2475 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

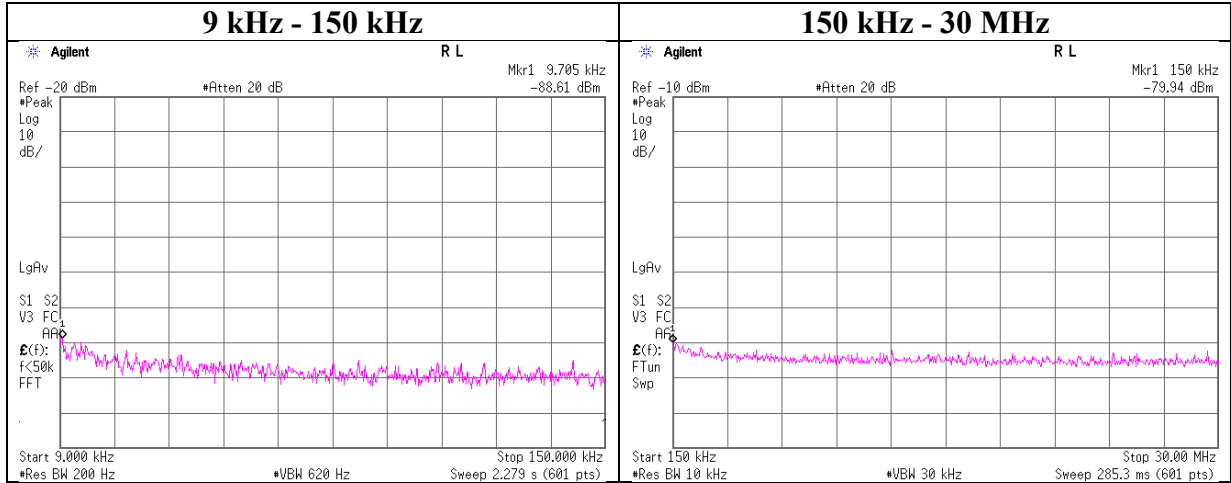
Report No.	12725754M-A-R2			
Test place	Kashima EMC Lab.			
Semi Anechoic Chamber	No.10			
Date	March 7, 2019	February 28, 2019	March 7, 2019	March 9, 2019
Temperature / Humidity	22 deg. C / 40 % RH	20 deg. C / 48 % RH	22 deg. C / 40 % RH	19 deg. C / 40 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
Mode	(30 MHz - 1000 MHz) Tx Nordic Original 2 Mbps 2440 MHz	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)



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

Conducted Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx BT LE 1 Mbps 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
9.71	-88.6	0.01	9.9	2.0	1	-76.7	300	6.0	-15.4	47.8	63.2	
150.00	-79.9	0.01	9.9	2.0	1	-68.0	300	6.0	-6.7	24.0	30.7	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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Kashima EMC Lab.

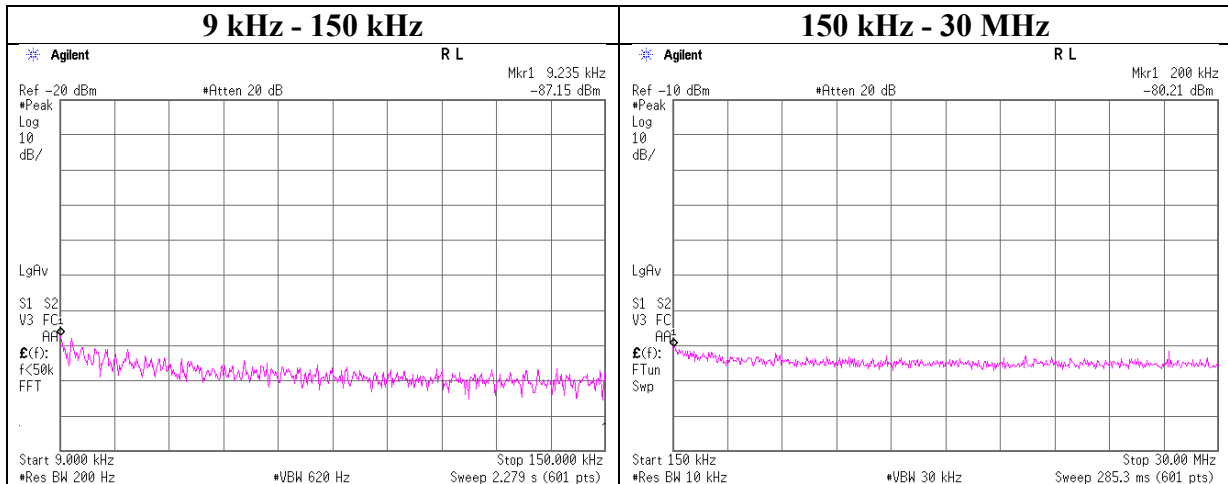
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Conducted Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx BT LE 1 Mbps 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
9.24	-87.2	0.01	9.9	2.0	1	-75.2	300	6.0	-14.0	48.2	62.2	
200.00	-80.2	0.01	9.9	2.0	1	-68.2	300	6.0	-7.0	21.5	28.5	

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

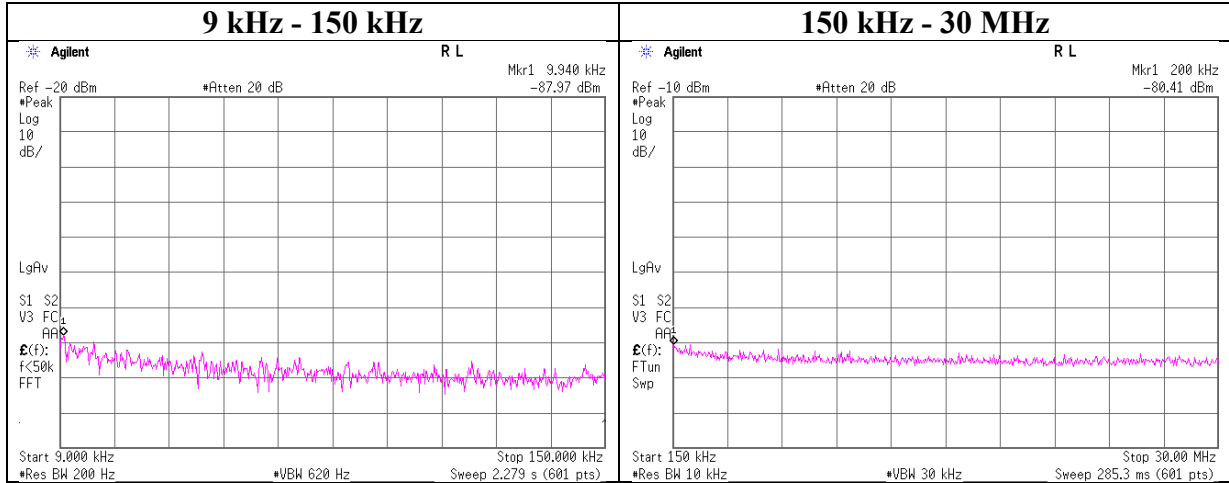
$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Report No. 12725754M-A-R2
 Test place Kashima EMC Lab. No.2 Measurement Room
 Date February 15, 2019
 Temperature / Humidity 20 deg. C / 40 % RH
 Engineer Kazuhiro Ando
 Mode Tx BT LE 1 Mbps 2480 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
9.94	-88.0	0.01	9.9	2.0	1	-76.0	300	6.0	-14.8	47.6	62.4	
200.00	-80.4	0.01	9.9	2.0	1	-68.4	300	6.0	-7.2	21.5	28.7	

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

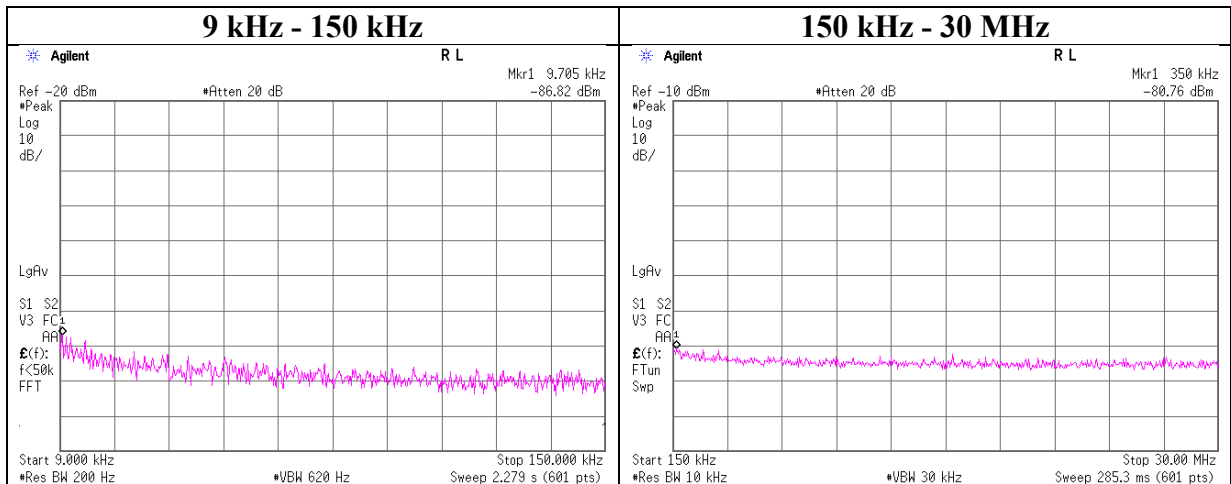
$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Report No. 12725754M-A-R2
 Test place Kashima EMC Lab. No.2 Measurement Room
 Date February 15, 2019
 Temperature / Humidity 20 deg. C / 40 % RH
 Engineer Kazuhiro Ando
 Mode Tx BT LE 2 Mbps 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
9.71	-86.8	0.01	9.9	2.0	1	-74.8	300	6.0	-13.6	47.8	61.4	
350.00	-80.8	0.01	9.9	2.0	1	-68.8	300	6.0	-7.6	16.7	24.3	

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

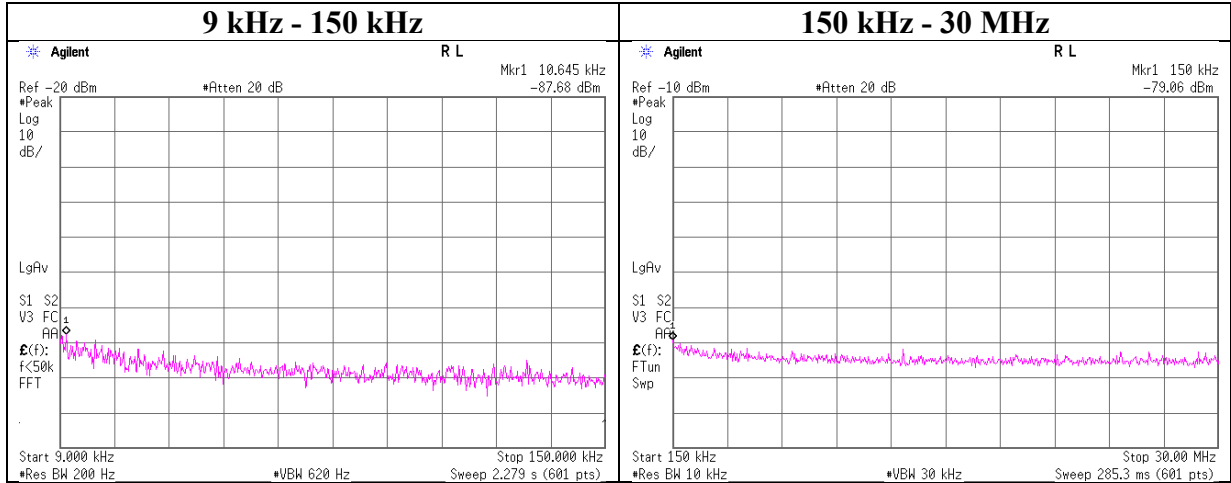
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Report No. 12725754M-A-R2
 Test place Kashima EMC Lab. No.2 Measurement Room
 Date February 15, 2019
 Temperature / Humidity 20 deg. C / 40 % RH
 Engineer Kazuhiro Ando
 Mode Tx BT LE 2 Mbps 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
10.65	-87.7	0.01	9.9	2.0	1	-75.7	300	6.0	-14.5	47.0	61.5	
150.00	-79.1	0.01	9.9	2.0	1	-67.1	300	6.0	-5.8	24.0	29.8	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

UL Japan, Inc.

Kashima EMC Lab.

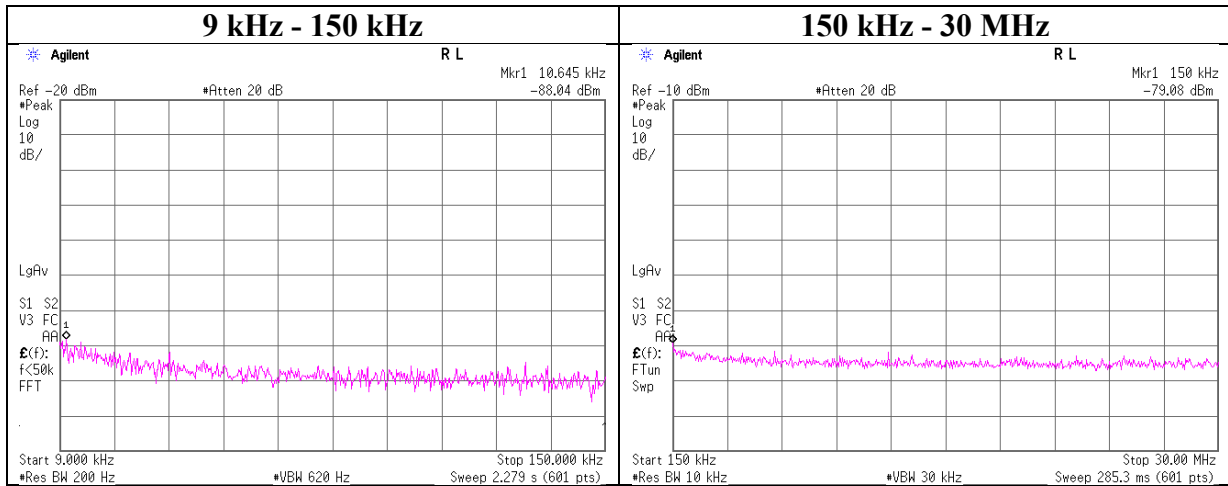
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Conducted Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx BT LE 2 Mbps 2480 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
10.65	-88.0	0.01	9.9	2.0	1	-76.0	300	6.0	-14.8	47.0	61.8	
150.00	-79.1	0.01	9.9	2.0	1	-67.1	300	6.0	-5.9	24.0	29.9	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

UL Japan, Inc.

Kashima EMC Lab.

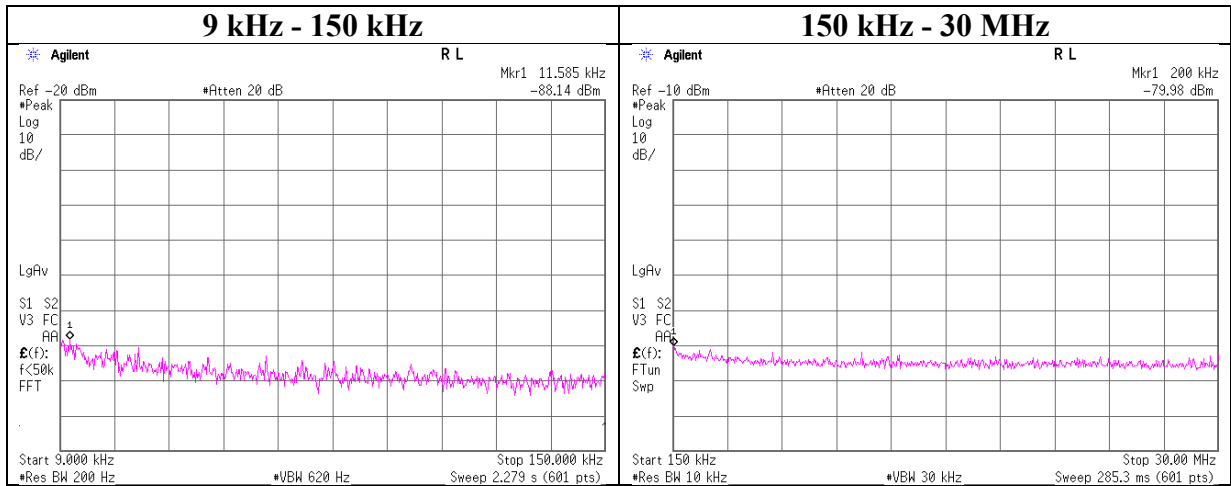
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Conducted Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx ANT 1 Mbps 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
11.59	-88.1	0.01	9.9	2.0	1	-76.1	300	6.0	-14.9	46.3	61.2	
200.00	-80.0	0.01	9.9	2.0	1	-68.0	300	6.0	-6.8	21.5	28.3	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

UL Japan, Inc.

Kashima EMC Lab.

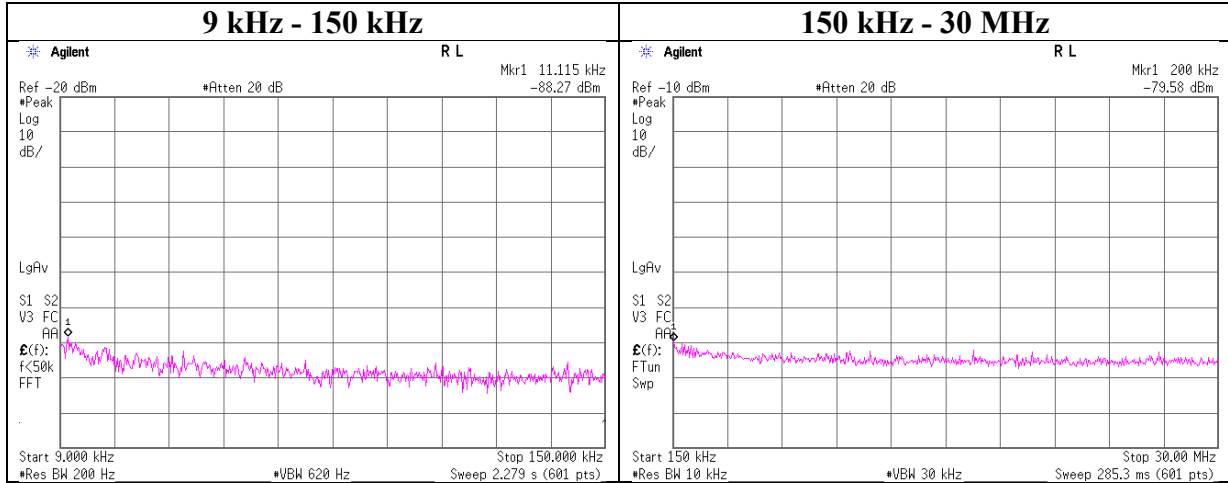
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Conducted Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx ANT 1 Mbps 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
11.12	-88.3	0.01	9.9	2.0	1	-76.3	300	6.0	-15.1	46.6	61.7	
200.00	-79.6	0.01	9.9	2.0	1	-67.6	300	6.0	-6.4	21.5	27.9	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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Kashima EMC Lab.

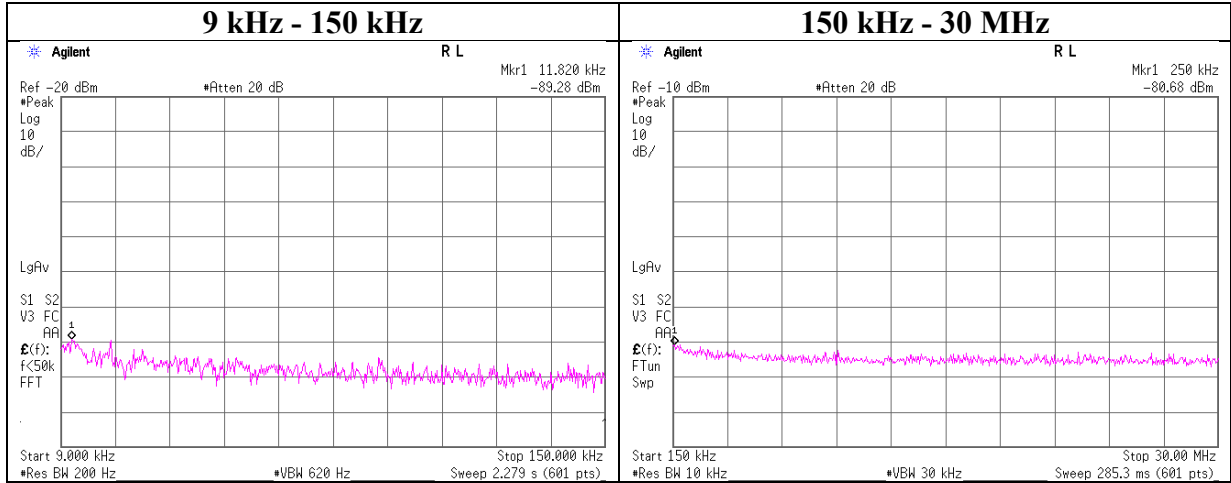
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Conducted Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx ANT 1 Mbps 2480 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
11.82	-89.3	0.01	9.9	2.0	1	-77.3	300	6.0	-16.1	46.1	62.2	
250.00	-80.7	0.01	9.9	2.0	1	-68.7	300	6.0	-7.5	19.6	27.1	

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

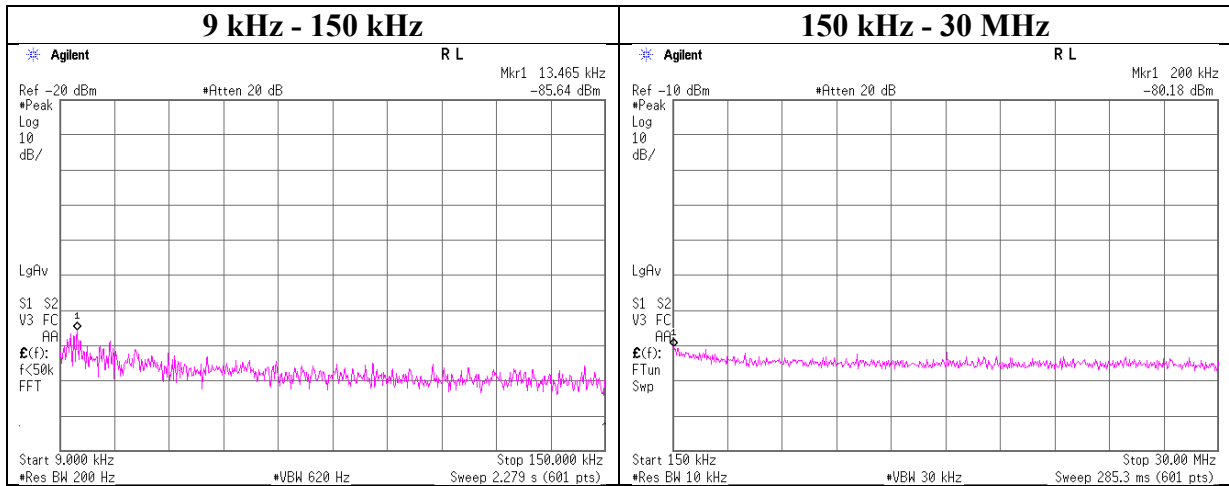
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Report No. 12725754M-A-R2
 Test place Kashima EMC Lab. No.2 Measurement Room
 Date February 15, 2019
 Temperature / Humidity 20 deg. C / 40 % RH
 Engineer Kazuhiro Ando
 Mode Tx Nordic Original 2 Mbps 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
13.47	-85.6	0.01	9.9	2.0	1	-73.7	300	6.0	-12.4	45.0	57.4	
200.00	-80.2	0.01	9.9	2.0	1	-68.2	300	6.0	-7.0	21.5	28.5	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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Kashima EMC Lab.

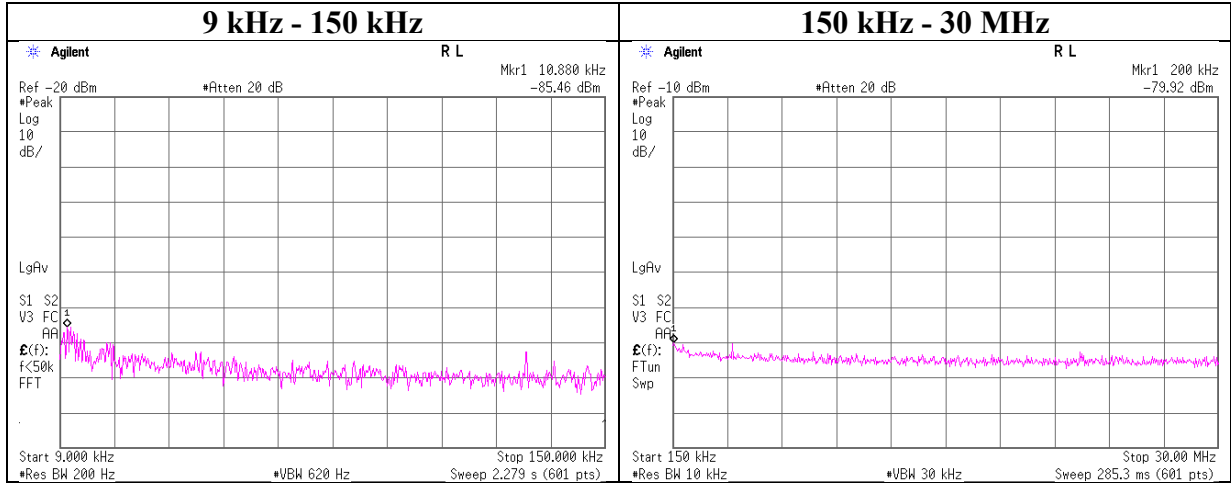
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Facsimile : +81 478 82 3373

Conducted Spurious Emission

Report No. 12725754M-A-R2
 Test place Kashima EMC Lab. No.2 Measurement Room
 Date February 15, 2019
 Temperature / Humidity 20 deg. C / 40 % RH
 Engineer Kazuhiro Ando
 Mode Tx Nordic Original 2 Mbps 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
10.88	-85.5	0.01	9.9	2.0	1	-73.5	300	6.0	-12.2	46.8	59.0	
200.00	-79.9	0.01	9.9	2.0	1	-68.0	300	6.0	-6.7	21.5	28.2	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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Kashima EMC Lab.

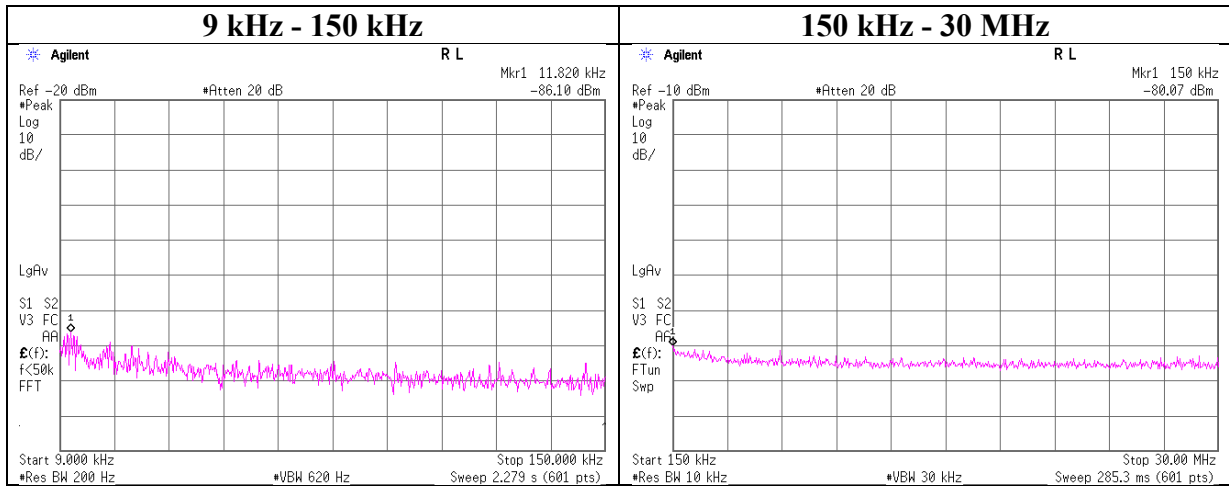
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Facsimile : +81 478 82 3373

Conducted Spurious Emission

Report No. 12725754M-A-R2
 Test place Kashima EMC Lab. No.2 Measurement Room
 Date February 15, 2019
 Temperature / Humidity 20 deg. C / 40 % RH
 Engineer Kazuhiro Ando
 Mode Tx Nordic Original 2 Mbps 2480 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
11.82	-86.1	0.01	9.9	2.0	1	-74.1	300	6.0	-12.9	46.1	59.0	
150.00	-80.1	0.01	9.9	2.0	1	-68.1	300	6.0	-6.9	24.0	30.9	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

UL Japan, Inc.

Kashima EMC Lab.

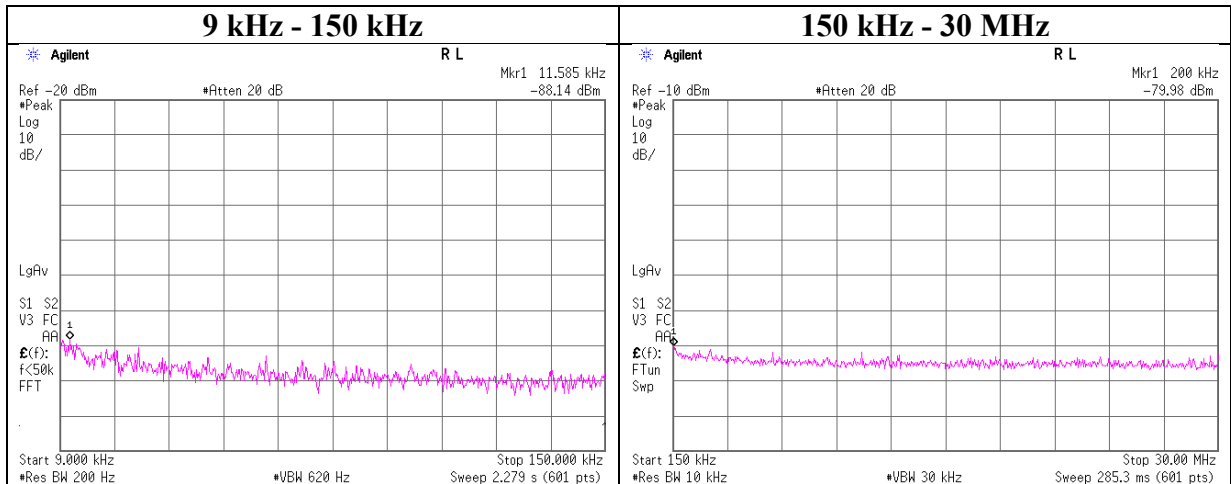
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Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Conducted Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx IEEE802.15.4 2405 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
11.59	-88.1	0.01	9.9	2.0	1	-76.2	300	6.0	-14.9	46.3	61.2	
200.00	-80.0	0.01	9.9	2.0	1	-68.0	300	6.0	-6.8	21.5	28.3	

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

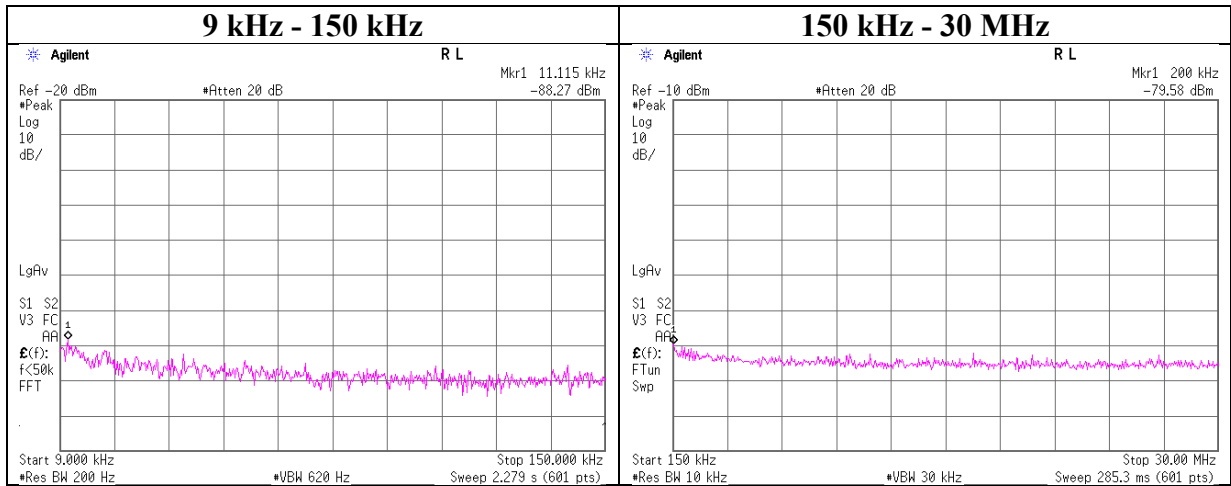
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx IEEE802.15.4 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
11.12	-88.3	0.01	9.9	2.0	1	-76.3	300	6.0	-15.1	46.6	61.7	
200.00	-79.6	0.01	9.9	2.0	1	-67.6	300	6.0	-6.4	21.5	27.9	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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Kashima EMC Lab.

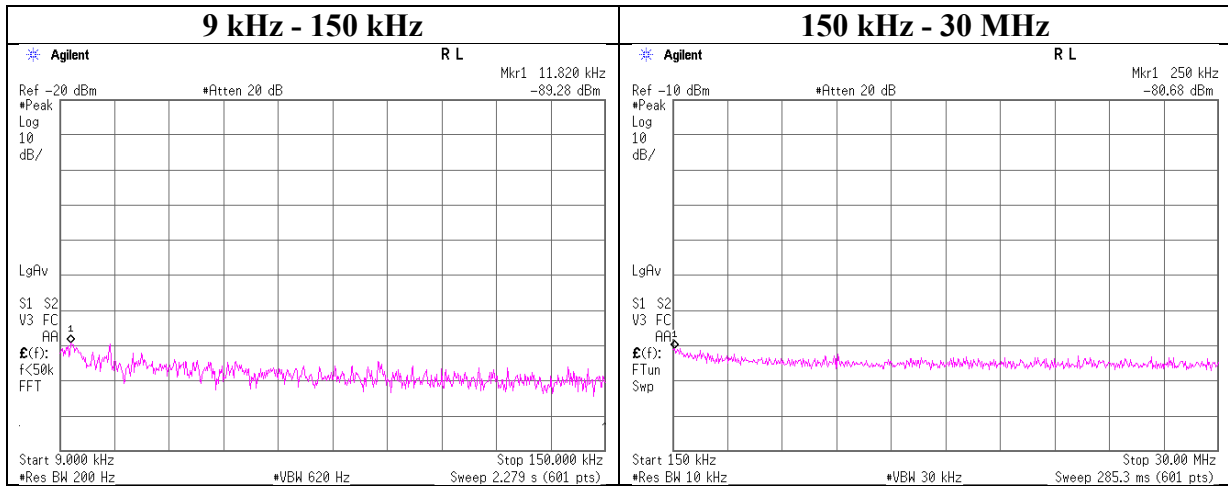
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Conducted Spurious Emission

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 15, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx IEEE802.15.4 2475 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
11.82	-89.3	0.01	9.9	2.0	1	-77.3	300	6.0	-16.1	46.1	62.2	
250.00	-80.7	0.01	9.9	2.0	1	-68.7	300	6.0	-7.5	19.6	27.1	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Power Density

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 25, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx

BT LE 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-18.87	1.63	10.04	-7.20	8.00	15.20
2440.00	-18.77	1.64	10.05	-7.08	8.00	15.08
2480.00	-18.62	1.65	10.05	-6.92	8.00	14.92

BT LE 2 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-20.87	1.63	10.04	-9.20	8.00	17.20
2440.00	-20.88	1.64	10.05	-9.19	8.00	17.19
2480.00	-20.53	1.65	10.05	-8.83	8.00	16.83

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Power Density

Report No. 12725754M-A-R2
Test place Kashima EMC Lab. No.2 Measurement Room
Date February 25, 2019
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Kazuhiro Ando
Mode Tx

ANT 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-15.19	1.63	10.04	-3.52	8.00	11.52
2441.00	-15.07	1.64	10.05	-3.38	8.00	11.38
2480.00	-14.91	1.65	10.05	-3.21	8.00	11.21

Nordic Original 2 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-17.68	1.63	10.04	-6.01	8.00	14.01
2441.00	-17.52	1.64	10.05	-5.83	8.00	13.83
2480.00	-17.37	1.65	10.05	-5.67	8.00	13.67

IEEE802.15.4

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2405.00	-17.24	1.63	10.04	-5.57	8.00	13.57
2440.00	-16.87	1.64	10.05	-5.18	8.00	13.18
2475.00	-16.85	1.65	10.05	-5.15	8.00	13.15

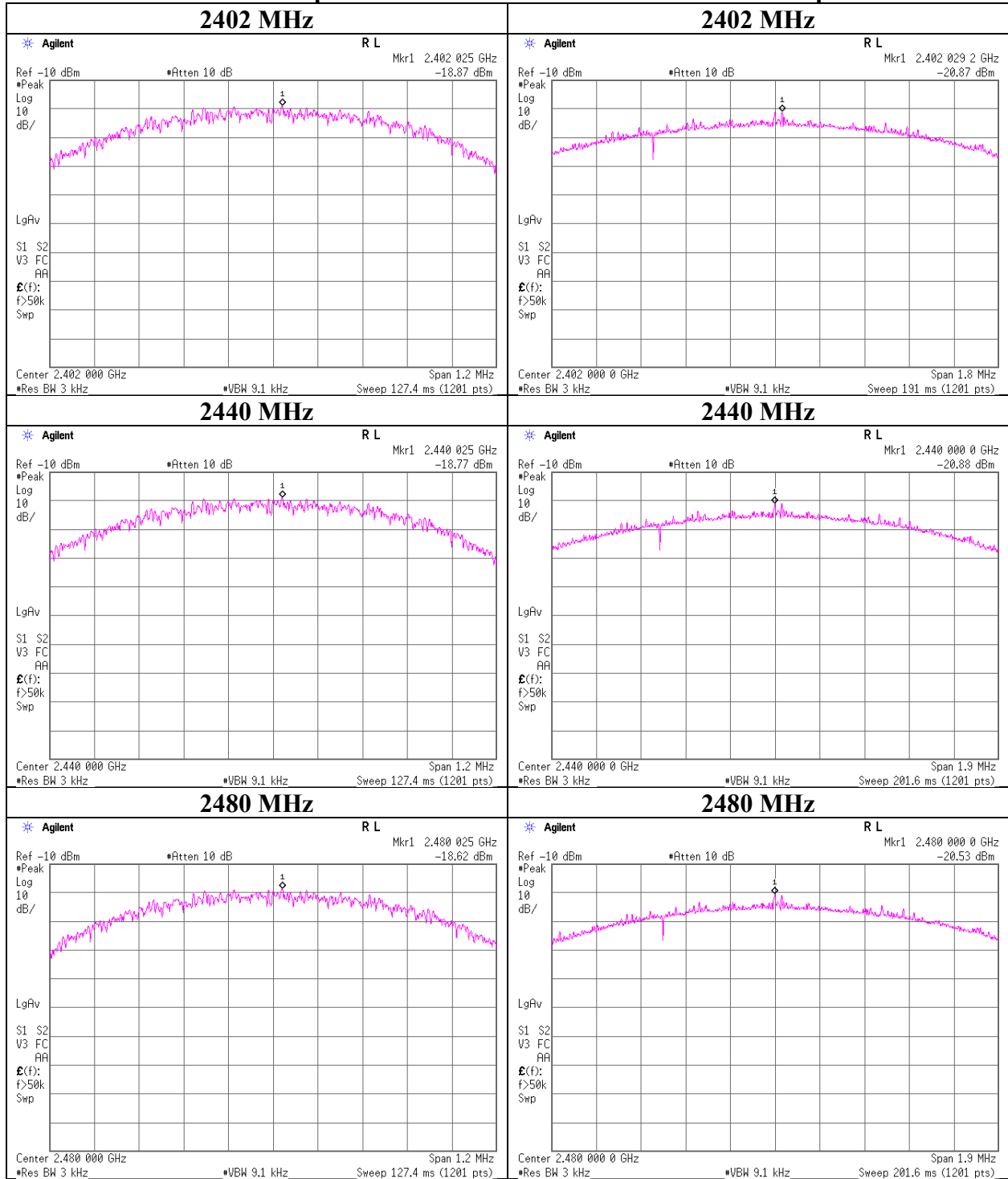
Sample Calculation:

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

Power Density

BT LE 1 Mbps

BT LE 2 Mbps



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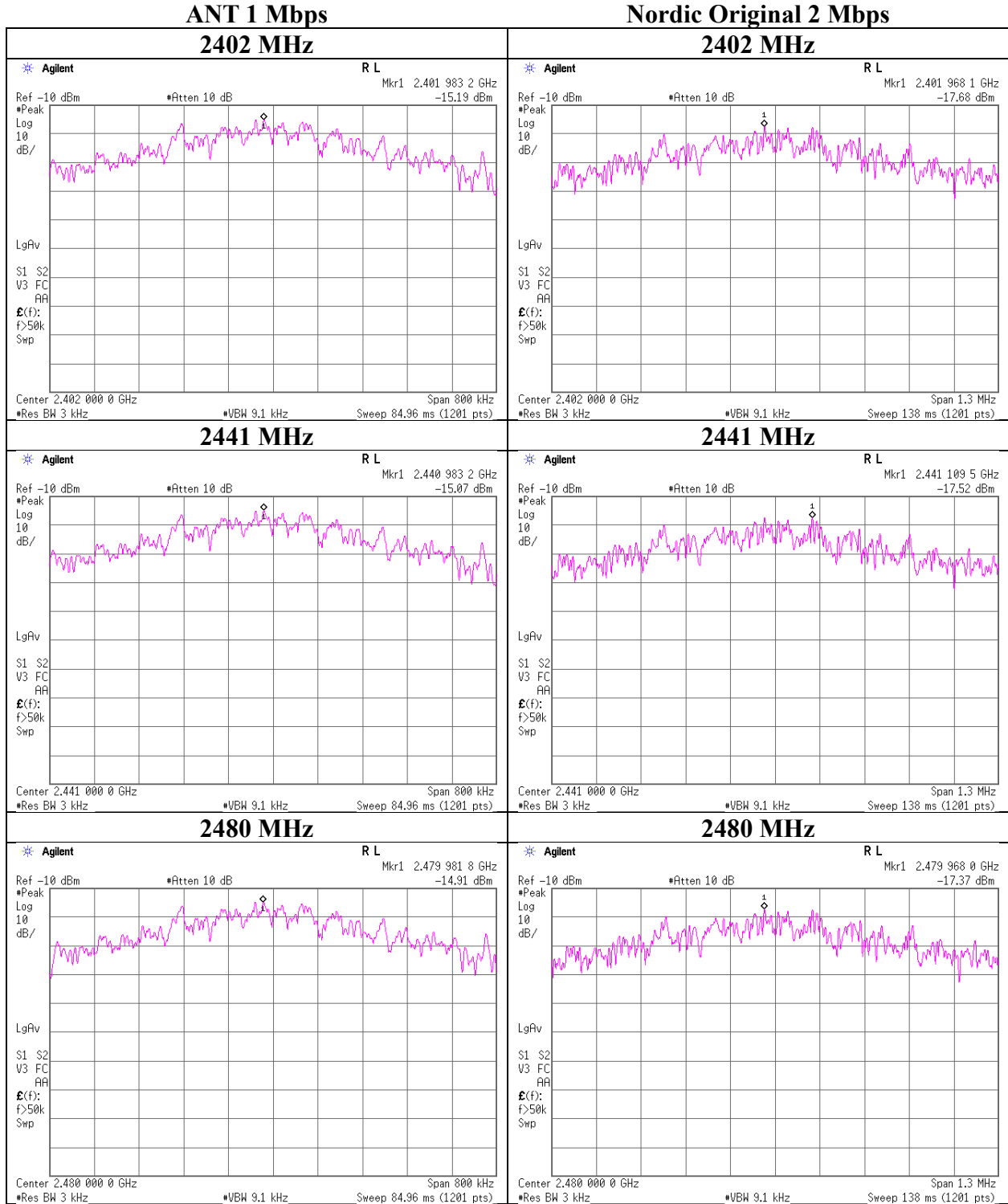
Kashima EMC Lab.

1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

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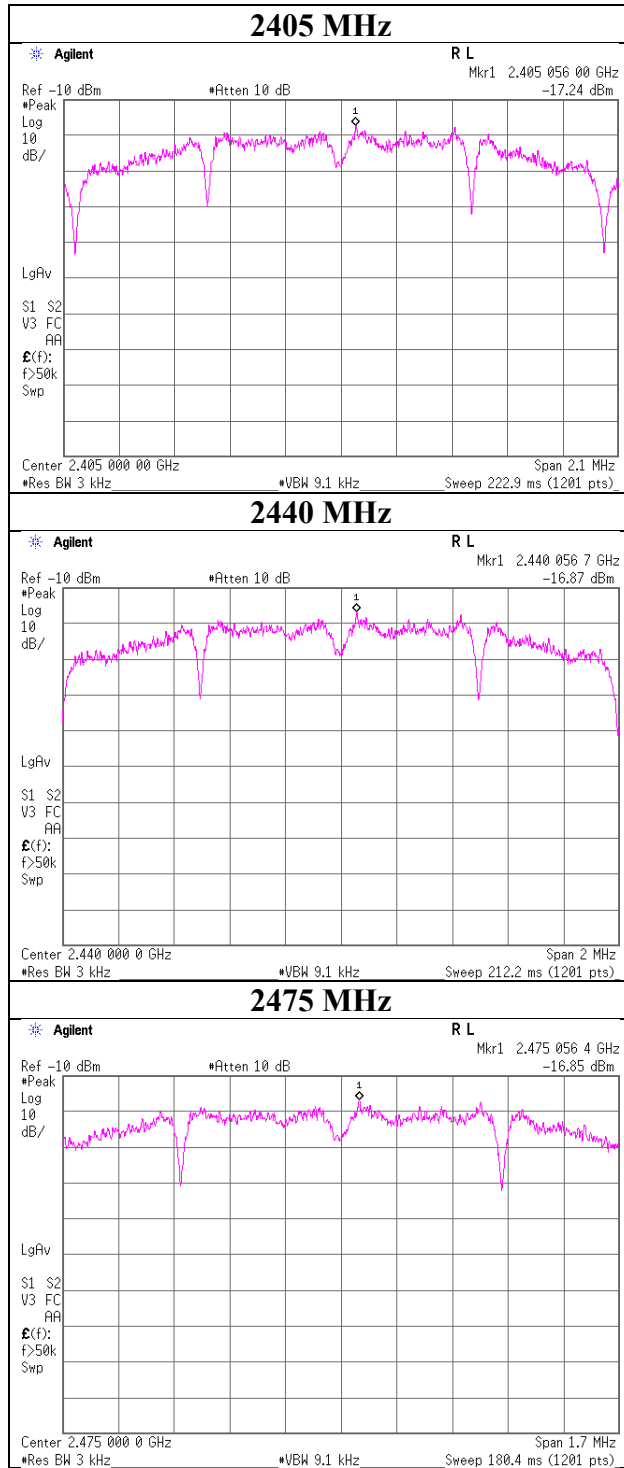
Facsimile : +81 478 82 3373

Power Density



Power Density

IEEE.802.15.4



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APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
CE	143498	A.M.N.	Rohde & Schwarz	ESH3-Z5	828874/019	2018/07/10	2019/07/31	12
CE	143499	A.M.N.	Rohde & Schwarz	ESH3-Z5	829567/010	2018/07/10	2019/07/31	12
CE	143703	Terminator	Suhner	65_BNC-50-0-2/133_NE	none	2018/11/28	2019/11/30	12
CE	143155	Coaxial Cable	Fujikura,Fujikura,Fujikura,Fujikura	5D-2W,5D-2W,5D-2W,5D-2W	-	2018/07/25	2019/07/31	12
CE	144195	Test Receiver	Rohde & Schwarz	ESCI	100053	2018/09/28	2019/09/30	12
CE	143656	Ruler	TAJIMA	L19-55	-	-	-	-
CE	143533	Temperature & Humidity Indicator	A&D	AD-5681	6877919	2018/07/18	2019/07/31	12
CE	143123	Barometer	OTA	No.11	14886	2018/11/25	2021/11/29	36
CE	144207	Digital Multimeter	Fluke Corporation	112	89790157	2018/10/09	2019/10/31	12
RE	143654	Ruler	TAJIMA	L19-55	-	-	-	-
RE	143542	Temperature & Humidity Indicator	HIOKI	3641/9680-50	090999895/090905406	2018/05/30	2019/05/31	12
RE	143133	Barometer	Sunoh	SBR-151	'001439	2018/11/25	2021/11/29	36
RE	144216	Digital Multimeter	Fluke Corporation	115	994460954	2018/10/09	2019/10/31	12
RE	143121	LOGBICON	Schwarzbeck	VULB 9168	343	2018/04/05	2019/04/30	12
RE	143050	3dB Fixed Atten.	TAMAGAWA	UFA-01	none	2018/09/12	2019/09/30	12
RE	143165	Coaxial Cable	Fujikura,Fujikura,Agilent,Fujikura,Fujikura,Fujikura,Fujikura,Fujikura,Fujikura	5D-2W,5D-2W,8494A,5D-2W,5D-2W,5D-2	MY41110200(Step Att)	2018/08/29	2019/08/30	12
RE	142930	Pre-Amplifier	HEWLETT PACKARD	8447D	2944A09041	2018/08/30	2019/08/31	12
RE	144199	Test Receiver	AGILENT	N9038A	MY53290016	2018/07/10	2019/07/31	12
RE(GHz)	144199	Test Receiver	AGILENT	N9038A	MY53290016	2018/07/10	2019/07/31	12
RE(GHz)	142940	Pre-Amplifier	Micro Wave Factory	MPR-1G26.5-35	161399	2018/06/21	2019/06/30	12
RE(GHz)	143140	Micro Wave Cable	Junkosha	MWX221	1407S222	2018/11/15	2019/11/30	12
RE(GHz)	143149	Micro Wave Cable	Junkosha	MWX221	J12J102343-00	2018/11/15	2019/11/30	12
RE(GHz)	143438	Double Ridged Horn	ETS-Lindgren	3160-09	00166043	2018/06/26	2019/06/30	12
RE(GHz)	142937	Pre-Amplifier	TOYO	HAP18-26W	00000035	2018/06/26	2019/06/30	12
RE(GHz)	143113	Micro Wave Cable	Suhner	SUCOFLEX104	MY588/4	2018/07/10	2019/07/31	12
RE(GHz)	143016	10dB Fixed Atten.	WEINSCHTEL	54A-10	56246	2018/05/21	2019/05/31	12
RE(GHz)	143459	HPF	MICRO-TRONICS	HPM50111-02	'008	2018/05/22	2019/05/31	12
RE(GHz)	143455	Double Ridged Wave Guide	ETS-Lindgren	3115	00204569	2019/02/04	2020/02/29	12
AT	143537	Temperature & Humidity Indicator	A&D	AD-5681	6975761	2018/07/18	2019/07/31	12
AT	143110	Micro Wave Cable	Suhner	SUCOFLEX102	MY3773/2	2018/05/25	2019/05/31	12
AT	143023	10dB Fixed Atten.	WEINSCHTEL	54A-10	56251	2018/05/21	2019/05/31	12
AT	143588	Peak Power Analyzer	AGILENT	8990B	MY51000276	2018/06/20	2019/06/30	12
AT	143606	Power Sensor	AGILENT	N1923A	MY54070024	2018/06/20	2019/06/30	12
AT	143643	Spectrum Analyzer	AGILENT	E4448A	MY52490024	2018/05/23	2019/05/31	12
AT	144220	Digital Multimeter	Fluke Corporation	87-3	85220051	2018/10/01	2019/10/31	12
EMI	142901	EMI Software	TSJ	TEPTO-DV(RE,CE, MF,PE)	Ver.3.3	-	-	-

*Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

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

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

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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