



RADIO TEST REPORT

Test Report No. : 11347416M-A-R1

Applicant : TAIYO YUDEN CO., LTD.
Type of Equipment : Bluetooth Smart / ANT Module
Model No. : EYSHJN
FCC ID : RYHEYSHJN
Test regulation : FCC Part 15 Subpart C: 2016
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11347416M-A. 11347416M-A is replaced with this report.

Date of test: July 6 - 8, 12, 2016

**Representative
test operator:**

Kazuhiro Ando
Engineer
Consumer Technology Division

Approved by :

Masanori Nishiyama
Manager
Consumer Technology Division



CERTIFICATE 1266.01

- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation"

UL Japan, Inc.

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13-EM-F0429 2016/01/11 Issue # 11.0

REVISION HISTORY

Original Test Report No.: 11347416M-A

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SECTION 1: Customer information

Company Name	:	TAIYO YUDEN CO., LTD.
Address	:	8-1 Sakaecho, Takasaki-Shi, Gunma, 370-8522, Japan
Telephone Number	:	+81- 27-324-2313
Facsimile Number	:	+81- 27-324-2314
Contact Person	:	Mitsuo Takagi

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

2.1 Identification of E.U.T.

Type of Equipment	:	Bluetooth Smart / ANT Module
Model No.	:	EYSHJN
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3 V, 1.7-3.6 V, 0.02 A, 0.1W
Receipt Date of Sample	:	June 30, 2016
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: EYSHJN (referred to as the EUT in this report) is a Bluetooth Smart / ANT Module.

General Specification

Clock frequency(ies) in the system	:	32 MHz
------------------------------------	---	--------

Radio Specification

< Bluetooth(BT) Low Energy (LE)>

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Power Supply (radio part input)	:	DC 1.3 V
Antenna type	:	Monopole Antenna
Antenna Gain	:	-1.5 dBi

<ANT>

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Power Supply (radio part input)	:	DC 1.3 V
Antenna type	:	Monopole Antenna
Antenna Gain	:	-1.5 dBi

<Nordic Original>

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Power Supply (radio part input)	:	DC 1.3 V
Antenna type	:	Monopole Antenna
Antenna Gain	:	-1.5 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC part 15 final revised on April 6, 2016.

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	QP 17.9 dB, 11.75800 MHz, N, L AV 14.2 dB, 0.43940 MHz, L	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	3.1 dB 2274.000 MHz, AV, Vert.	Complied	Conducted (below 30 MHz) /Radiated (above 30 MHz) *1)

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

*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r05 12.2.7.

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

FCC Part 15.31 (e)

This EUT provides stable voltage (DC1.3 V) 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	IC: RSS-Gen 6.6	IC: -	N/A	-	Conducted

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

3.4 Uncertainty

EMI

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

Item	Frequency range	Uncertainty (+/-)
		No. 10 SAC
Radiated emission (Measurement distance: 3m)	30MHz - 300MHz	4.7dB
	300MHz - 1GHz	3.6dB
	1GHz - 10GHz	5.1dB
Radiated emission (Measurement distance: 1m)	10GHz - 18GHz	5.7dB
	18GHz - 26.5GHz	5.1dB

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1GHz	0.7dB
Spurious emission (Conducted) below 1GHz	1.6dB
Spurious emission (Conducted) 1GHz - 3GHz	1.4dB
Spurious emission (Conducted) 3GHz - 18GHz	2.8dB
Spurious emission (Conducted) 18GHz - 26.5GHz	2.5dB
Bandwidth Measurement	5.4%

Conducted Emission test

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

Radiated emission test

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

3.5 Test Location

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A2LA Accreditation No. 1266.01

Test site	IC Registration Number	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.2 Open site	4659A-2	4.4 x 4.4 x 2.15	18 x 20	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.2 Shielded room	4659A-2	3.6 x 2.7 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	-	4.3 x 4.4 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)	Maximum Packet Size, PRBS9
ANT	1Mbps
Nordic Original	2Mbps
*Power of the EUT was set by the software as follows; Power settings: +4dBm, -40dBm Software: BT LE: BLE_TEST_tool-52 ANT, Nordic Original: ANT_TEST_tool-52 *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, Spurious Emission (Radiated)	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
	ANT Tx Nordic Original Tx	2402 MHz 2441 MHz 2480 MHz
	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
	ANT Tx Nordic Original Tx	2402 MHz 2441 MHz 2480 MHz
Spurious Emission above 1 GHz (Radiated)	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
	ANT Tx Nordic Original Tx	2402 MHz 2441 MHz 2480 MHz
Spurious Emission below 1 GHz (Radiated)	BT LE Tx	2440 MHz *1)
	ANT Tx Nordic Original Tx	2441 MHz *1)
Spurious Emission (Conducted)	BT LE Tx	2440 MHz *1)
	ANT Tx Nordic Original Tx	2441 MHz *1)
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
	ANT Tx Nordic Original Tx	2402 MHz 2441 MHz 2480 MHz
	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
	ANT Tx Nordic Original Tx	2402 MHz 2441 MHz 2480 MHz

*1) The mode was tested as a representative, because it had the highest power at antenna terminal test.

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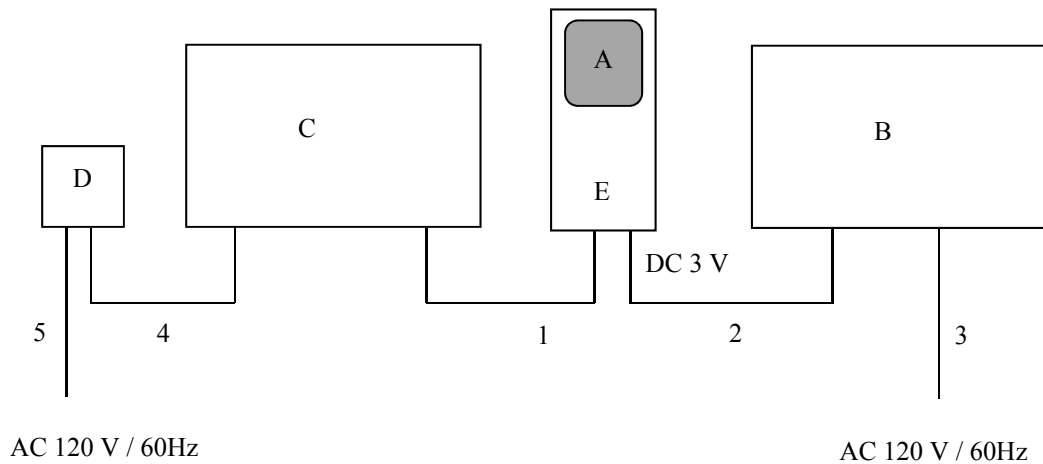
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4.2 Configuration and peripherals



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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Smart / ANT Module	EYSHJN	1 *1) 2 *2) 3 *3) 4 *4) 5 *5)	TAIYO YUDEN	EUT
B	DC Power Supply	GSV3000	1303141419	DIAMOND ANTENNA	-
C	PC	CF-T2	4CKSA46826	Panasonic	-
D	AC Adaptor	CF-AA1625A	1625AM406Z21913F	Panasonic	-
E	Evaluation Board	EBSHJNZXZ	1 *1) 2 *2) 3 *3) 4 *4) 5 *5)	TAIYO YUDEN	-

*1) Used for Antenna Terminal conducted tests (BT LE:+4dBm Setting)

*2) Used for Antenna Terminal conducted tests (ANT, Nordic Original)

*3) Used for Conducted Emission and Radiated Spurious Emission tests (BT LE)

*4) Used for Conducted Emission and Radiated Spurious Emission tests (ANT, Nordic Original)

*5) Used for Antenna Terminal conducted tests (BT LE:-40dBm Setting)

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	1.8	Shielded	Shielded	-
2	DC Cable	0.5 + 1.5	Unshielded	Unshielded	-
3	AC Cable	1.7	Unshielded	Unshielded	-
4	DC Cable	1.2	Unshielded	Unshielded	-
5	AC Cable	0.8	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a wooden table of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

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

SECTION 6: Radiated Spurious Emission

Test Procedure

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

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 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 *3)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces If duty cycle was less than 98%, a duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3.0 m	4.5 m *1) (1 GHz - 10 GHz), 1.0 m *2) (10 GHz - 26.5 GHz)		4.5 m *1) (1 GHz - 10 GHz), 1.0 m *2) (10 GHz - 26.5 GHz)

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

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

*3) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r05"

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

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

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

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor:160 MHz BW) Spectrum Analyzer *5)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				

*1) Peak hold was applied as Worst-case measurement.

*2) Reference data

*3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v03r05".

*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)

*5) The setting of spectrum Analyzer used KDB 558074 D01 DTS Meas Guidance v03r05 Section 9.2.2.4 Method AVGSA-2.

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

Test data : APPENDIX

Test result : Pass

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APPENDIX 1: Test data

Conducted Emission

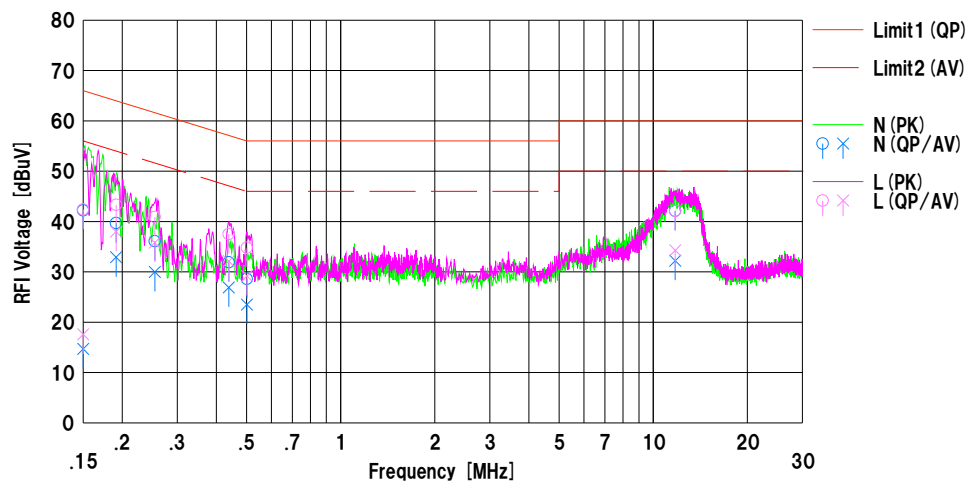
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.2 Shielded Room
Date : 2016/07/08

Mode : Tx, Bluetooth LE, 2402MHz
Order No. : 11347416M
Power : DC 3V
Temp./Humi. : 24deg.C / 53%RH

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

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<OP> [dBuV]	<AV> [dBuV]		<OP> [dBuV]	<AV> [dBuV]	<OP> [dBuV]	<AV> [dBuV]	<OP> [dB]	<AV> [dB]		
1	0.15000	32.5	5.0	9.7	42.2	14.7	66.0	56.0	23.8	41.3	N	
2	0.19120	30.0	23.2	9.7	39.7	32.9	64.0	54.0	24.3	21.1	N	
3	0.25440	26.4	20.3	9.7	36.1	30.0	61.6	51.6	25.5	21.6	N	
4	0.43850	22.2	17.2	9.7	31.9	26.9	57.1	47.1	25.2	20.2	N	
5	0.50120	18.9	13.8	9.7	28.6	23.5	56.0	46.0	27.4	22.5	N	
6	11.75800	31.9	22.0	10.2	42.1	32.2	60.0	50.0	17.9	17.8	N	
7	0.15000	32.7	7.9	9.7	42.4	17.6	66.0	56.0	23.6	38.4	L	
8	0.19120	33.6	28.3	9.7	43.3	38.0	64.0	54.0	20.7	16.0	L	
9	0.25440	31.2	26.1	9.7	40.9	35.8	61.6	51.6	20.7	15.8	L	
10	0.43850	27.8	22.4	9.7	37.5	32.1	57.1	47.1	19.6	15.0	L	
11	0.50120	25.1	19.5	9.7	34.8	29.2	56.0	46.0	21.2	16.8	L	
12	11.75800	31.9	24.1	10.2	42.1	34.3	60.0	50.0	17.9	15.7	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable) [dB]
LISN:CLS-25

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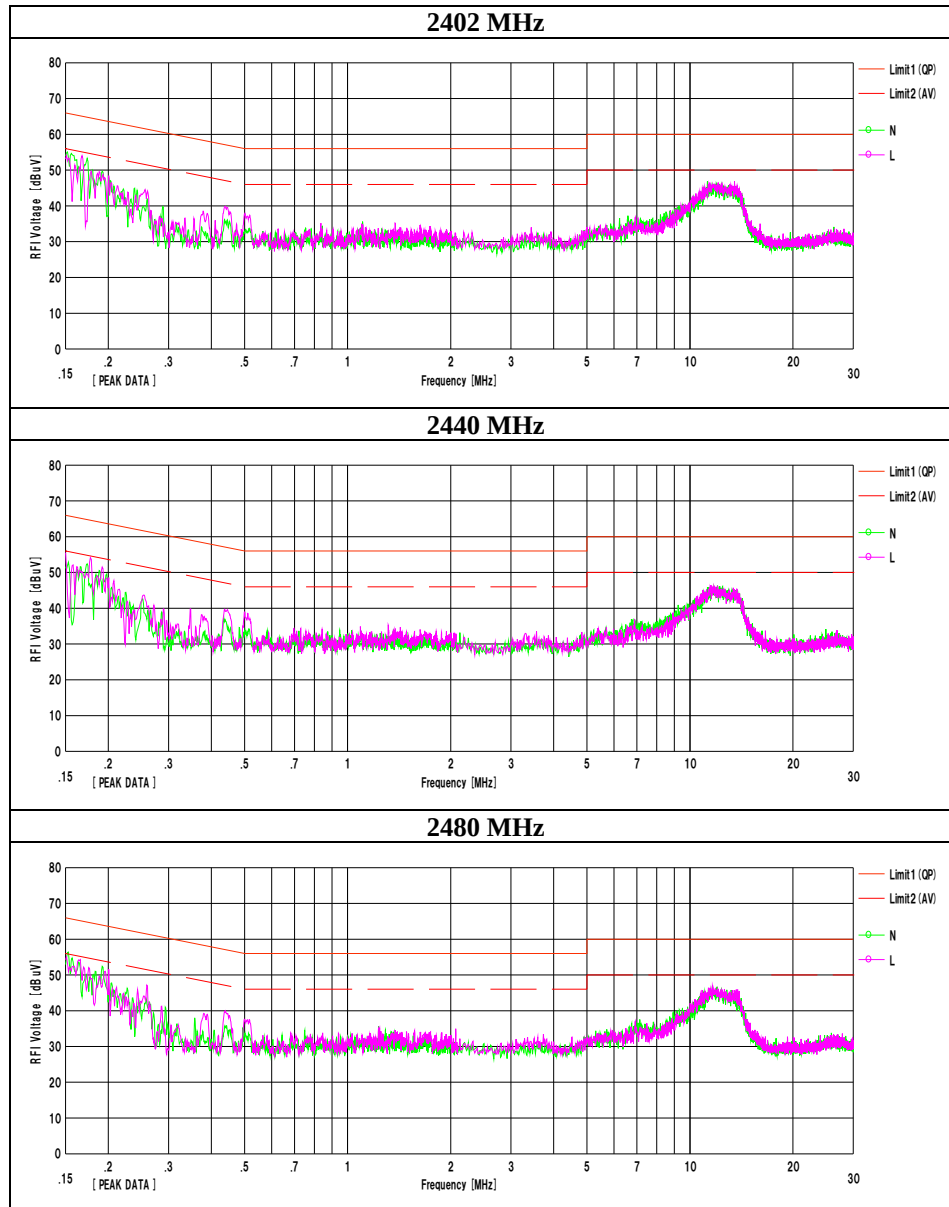
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Conducted Emission

Test place	Kashima EMC Lab. No.2 Shielded Room
Report No.	11347416M
Date	July 8, 2016
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuhiro Ando
Mode	Tx BT LE



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Conducted Emission

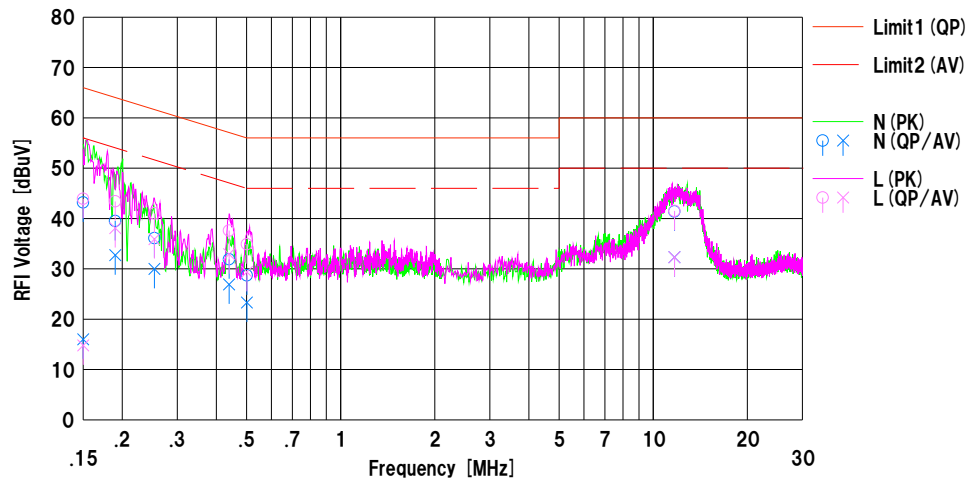
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.2 Shielded Room
Date : 2016/07/08

Mode : Tx, ANT, 2402MHz
Order No. : 11347416M
Power : DC 3V
Temp./Humi. : 24deg.C / 53%RH

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

Tested by : Kazuhiro Ando

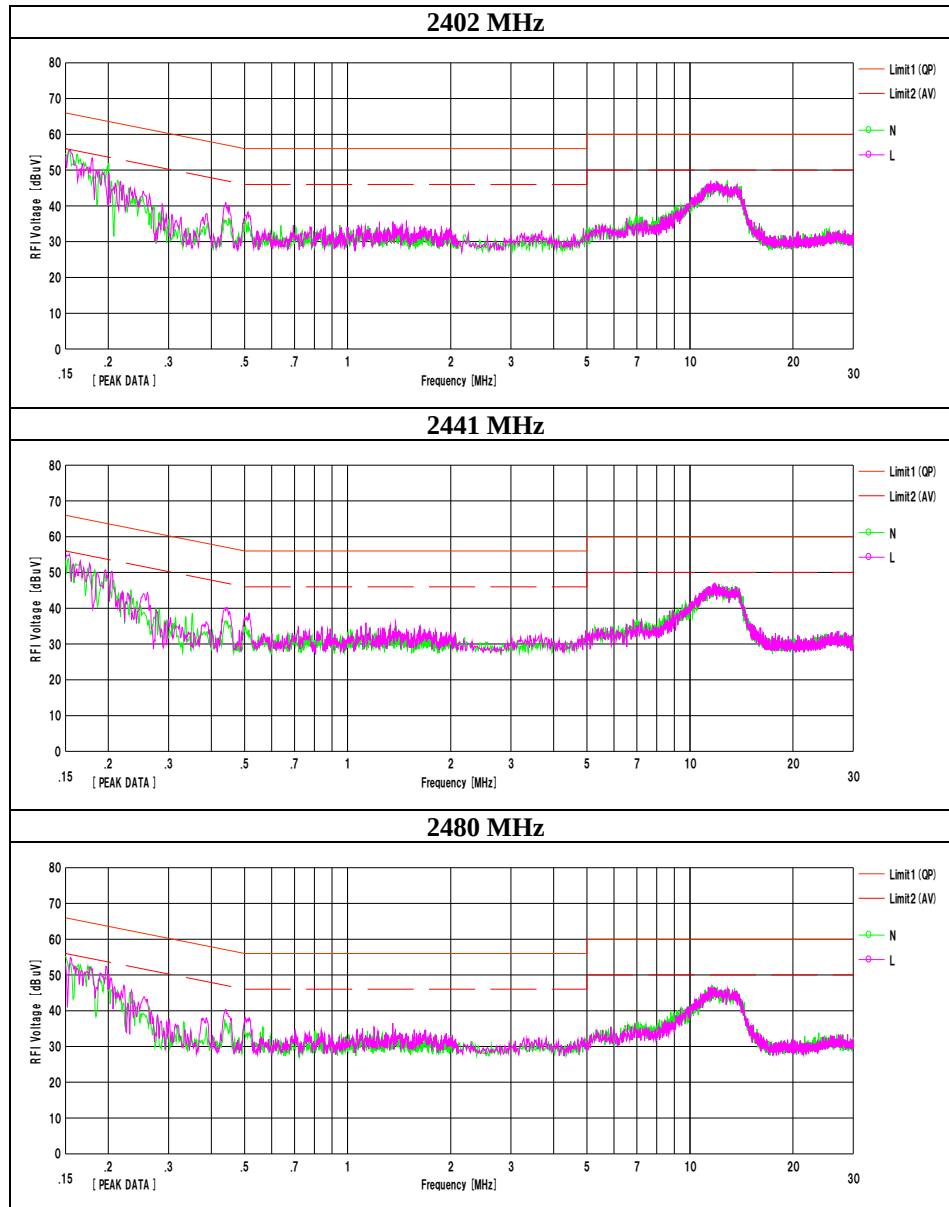


No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	33.5	6.3	9.7	43.2	16.0	66.0	56.0	22.8	40.0	N	
2	0.19000	29.8	23.0	9.7	39.5	32.7	64.0	54.0	24.5	21.3	N	
3	0.25360	26.4	20.3	9.7	36.1	30.0	61.6	51.6	25.5	21.6	N	
4	0.43940	22.2	17.2	9.7	31.9	26.9	57.1	47.1	25.2	20.2	N	
5	0.50100	19.0	13.6	9.7	28.7	23.3	56.0	46.0	27.3	22.7	N	
6	11.69070	31.2	22.1	10.2	41.4	32.3	60.0	50.0	18.6	17.7	N	
7	0.15000	34.2	5.1	9.7	43.9	14.8	66.0	56.0	22.1	41.2	L	
8	0.19000	33.7	28.4	9.7	43.4	38.1	64.0	54.0	20.6	15.9	L	
9	0.25360	31.3	26.2	9.7	41.0	35.9	61.6	51.6	20.6	15.7	L	
10	0.43940	27.9	23.2	9.7	37.6	32.9	57.1	47.1	19.5	14.2	L	
11	0.50100	25.2	19.7	9.7	34.9	29.4	56.0	46.0	21.1	16.6	L	
12	11.69070	31.3	22.1	10.2	41.5	32.3	60.0	50.0	18.5	17.7	L	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable) [dB]
LISN:CLS-25

Conducted Emission

Test place	Kashima EMC Lab. No.2 Shielded Room
Report No.	11347416M
Date	July 8, 2016
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuhiro Ando
Mode	Tx ANT



UL Japan, Inc.

Kashima EMC Lab.

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Conducted Emission

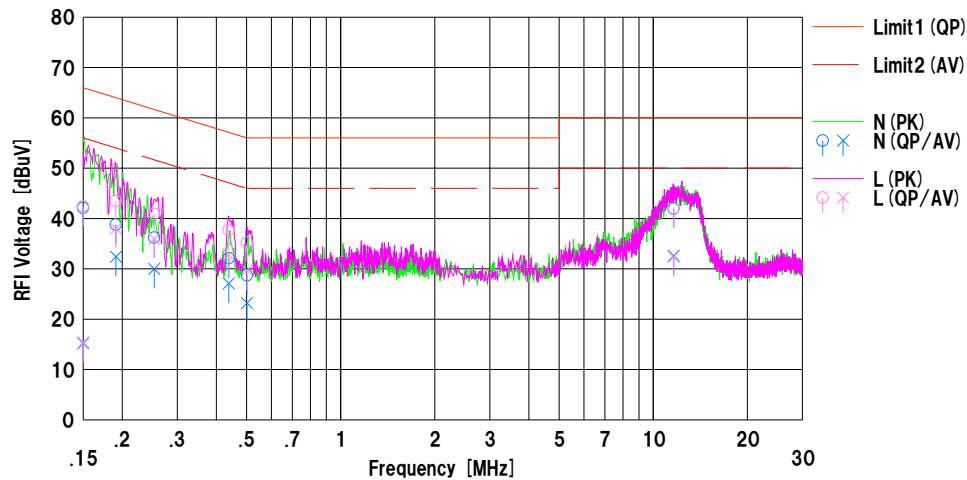
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.2 Shielded Room
Date : 2016/07/08

Mode : Tx, Nordic, 2402MHz
Order No. : 11347416M
Power : DC 3V
Temp./Humi. : 24deg.C / 53%RH

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

Tested by : Kazuhiro Ando

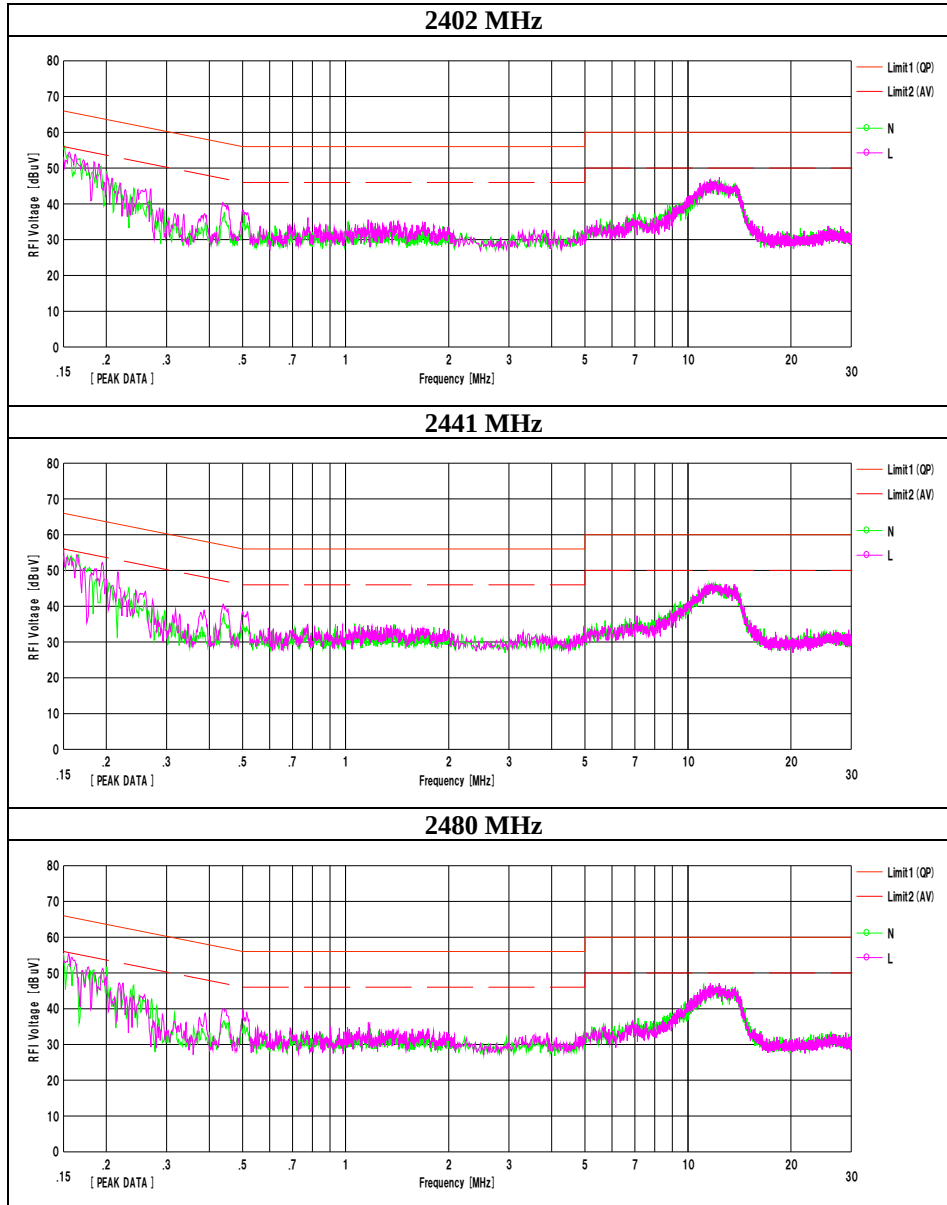


No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	32.4	5.5	9.7	42.1	15.2	66.0	56.0	23.9	40.8	N	
2	0.19100	29.1	22.7	9.7	38.8	32.4	64.0	54.0	25.2	21.6	N	
3	0.25320	26.5	20.3	9.7	36.2	30.0	61.7	51.7	25.5	21.7	N	
4	0.43870	22.4	17.4	9.7	32.1	27.1	57.1	47.1	25.0	20.0	N	
5	0.50150	19.0	13.5	9.7	28.7	23.2	56.0	46.0	27.3	22.8	N	
6	11.62860	31.8	22.4	10.2	42.0	32.6	60.0	50.0	18.0	17.4	N	
7	0.15000	32.7	5.7	9.7	42.4	15.4	66.0	56.0	23.6	40.6	L	
8	0.19100	33.8	28.3	9.7	43.5	38.0	64.0	54.0	20.5	16.0	L	
9	0.25320	31.2	26.2	9.7	40.9	35.9	61.7	51.7	20.8	15.8	L	
10	0.43870	28.0	23.1	9.7	37.7	32.8	57.1	47.1	19.4	14.3	L	
11	0.50150	25.5	20.0	9.7	35.2	29.7	56.0	46.0	20.8	16.3	L	
12	11.62860	31.7	22.2	10.2	41.9	32.4	60.0	50.0	18.1	17.6	L	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable) [dB]
LISN:CLS-25

Conducted Emission

Test place	Kashima EMC Lab. No.2 Shielded Room
Report No.	11347416M
Date	July 8, 2016
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuhiro Ando
Mode	Tx Nordic



UL Japan, Inc.

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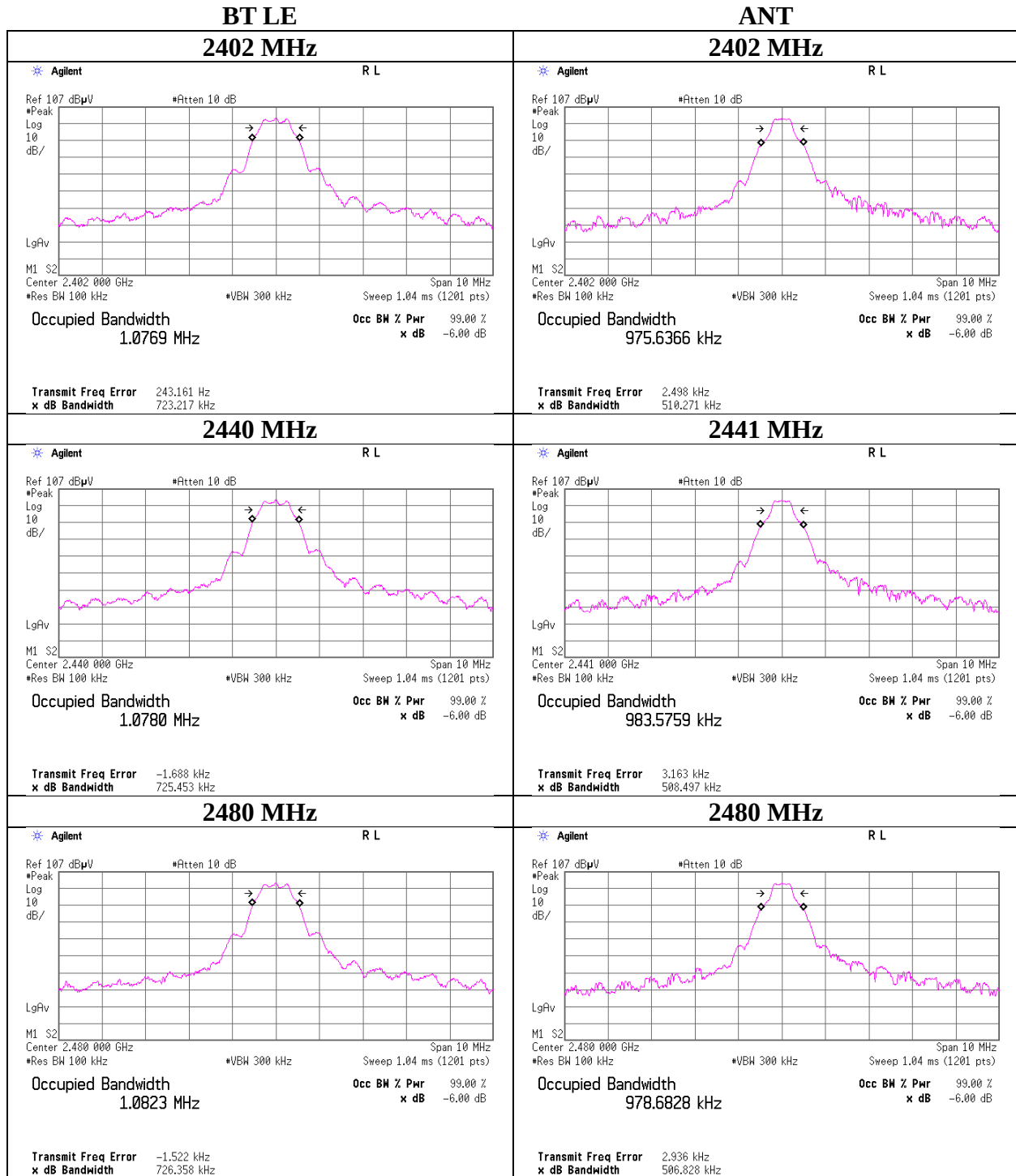
Facsimile : +81 478 82 3373

6dB Bandwidth

Test place Kashima EMC Lab. No. No.2 Measurement Room
Report No. 11347416M
Date July 6, 2016
Temperature / Humidity 23 deg. C / 54 % RH
Engineer Kazuhiro Ando
Mode Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
BT LE	2402	0.723	> 500
	2440	0.725	> 500
	2480	0.726	> 500
ANT	2402	0.510	> 500
	2441	0.508	> 500
	2480	0.507	> 500
Nordic Original	2402	0.845	> 500
	2441	0.830	> 500
	2480	0.837	> 500

6dB Bandwidth



UL Japan, Inc.

Kashima EMC Lab.

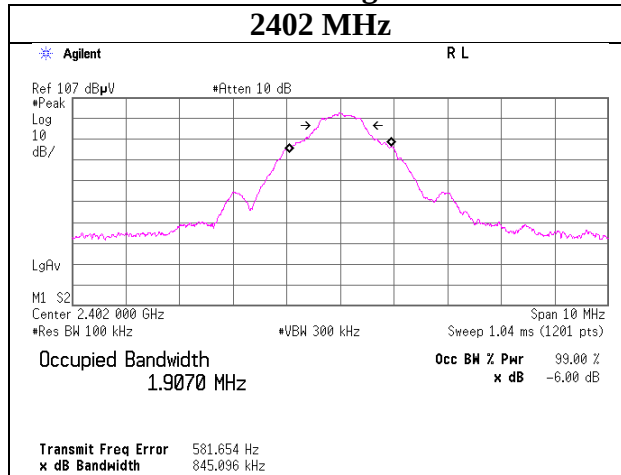
1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

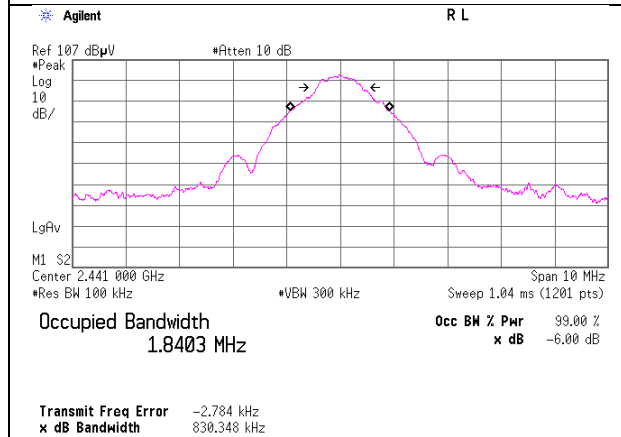
Facsimile : +81 478 82 3373

6dB Bandwidth

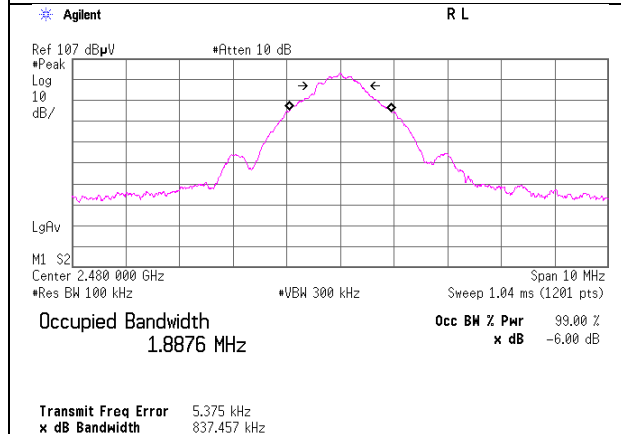
Nordic Original 2402 MHz



2441 MHz



2480 MHz



Maximum Peak Output Power

Test place : Kashima EMC Lab. No. No.2 Measurement Room
Report No. : 11347416M
Date : July 6, 2016
Temperature / Humidity : 23 deg. C / 54 % RH
Engineer : Kazuhiro Ando
Mode : Tx (+4dBm setting)

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-6.65	1.51	10.04	4.90	3.09	30.00	1000	25.10
2440	-6.62	1.51	10.04	4.93	3.11	30.00	1000	25.07
2480	-6.74	1.52	10.04	4.82	3.03	30.00	1000	25.18

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-6.93	1.51	10.04	4.62	2.90	30.00	1000	25.38
2441	-6.89	1.51	10.04	4.66	2.92	30.00	1000	25.34
2480	-6.99	1.52	10.04	4.57	2.86	30.00	1000	25.43

Nordic Original

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-6.93	1.51	10.04	4.62	2.90	30.00	1000	25.38
2441	-6.90	1.51	10.04	4.65	2.92	30.00	1000	25.35
2480	-7.00	1.52	10.04	4.56	2.86	30.00	1000	25.44

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.

Maximum Peak Output Power

Test place : Kashima EMC Lab. No. No.2 Measurement Room
Report No. : 11347416M
Date : July 6, 2016
Temperature / Humidity : 23 deg. C / 54 % RH
Engineer : Kazuhiro Ando
Mode : Tx (-40dBm setting)

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-51.09	1.51	10.04	-39.54	0.00011	30.00	1000	69.54
2440	-50.91	1.51	10.04	-39.36	0.00012	30.00	1000	69.36
2480	-50.65	1.52	10.04	-39.09	0.00012	30.00	1000	69.09

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-50.67	1.51	10.04	-39.12	0.00012	30.00	1000	69.12
2441	-50.65	1.51	10.04	-39.10	0.00012	30.00	1000	69.10
2480	-50.38	1.52	10.04	-38.82	0.00013	30.00	1000	68.82

Nordic Original

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-50.90	1.51	10.04	-39.35	0.00012	30.00	1000	69.35
2441	-50.68	1.51	10.04	-39.13	0.00012	30.00	1000	69.13
2480	-50.32	1.52	10.04	-38.76	0.00013	30.00	1000	68.76

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.

Average Output Power (Reference data for)

Test place : Kashima EMC Lab. No. No.2 Measurement Room
Report No. : 11347416M
Date : July 6, 2016
Temperature / Humidity : 23 deg. C / 54 % RH
Engineer : Kazuhiro Ando
Mode : Tx (+4dBm setting)

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-8.89	1.51	10.04	2.66	1.85	1.97	4.63	2.90
2440	-8.85	1.51	10.04	2.70	1.86	1.97	4.67	2.93
2480	-8.97	1.52	10.04	2.59	1.82	1.97	4.56	2.86

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-7.41	1.51	10.04	4.14	2.59	0.23	4.37	2.74
2441	-7.37	1.51	10.04	4.18	2.62	0.23	4.41	2.76
2480	-7.49	1.52	10.04	4.07	2.55	0.23	4.30	2.69

Nordic Original

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-7.65	1.51	10.04	3.90	2.45	0.45	4.35	2.72
2441	-7.61	1.51	10.04	3.94	2.48	0.45	4.39	2.75
2480	-7.71	1.52	10.04	3.85	2.43	0.45	4.30	2.69

Sample Calculation:

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

Result (Burst power) = Frame power + Duty factor

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

Average Output Power (Reference data for)

Test place : Kashima EMC Lab. No. No.2 Measurement Room
Report No. : 11347416M
Date : July 6, 2016
Temperature / Humidity : 23 deg. C / 54 % RH
Engineer : Kazuhiro Ando
Mode : Tx (-40dBm setting)

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-53.79	1.51	10.04	-42.24	0.00006	1.97	-40.27	0.00009
2440	-53.65	1.51	10.04	-42.10	0.00006	1.97	-40.13	0.00010
2480	-53.35	1.52	10.04	-41.79	0.00007	1.97	-39.82	0.00010

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-51.77	1.51	10.04	-40.22	0.00010	0.23	-39.99	0.00010
2441	-51.66	1.51	10.04	-40.11	0.00010	0.23	-39.88	0.00010
2480	-51.39	1.52	10.04	-39.83	0.00010	0.23	-39.60	0.00011

Nordic Original

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-52.00	1.51	10.04	-40.45	0.00009	0.45	-40.00	0.00010
2441	-51.87	1.51	10.04	-40.32	0.00009	0.45	-39.87	0.00010
2480	-51.52	1.52	10.04	-39.96	0.00010	0.45	-39.51	0.00011

Sample Calculation:

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

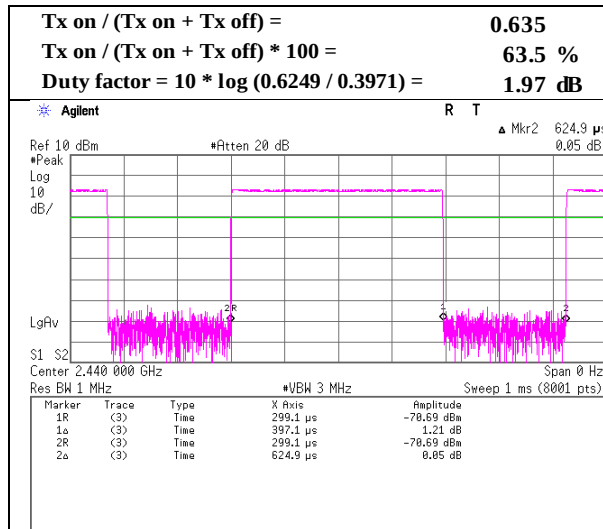
Result (Burst power) = Frame power + Duty factor

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

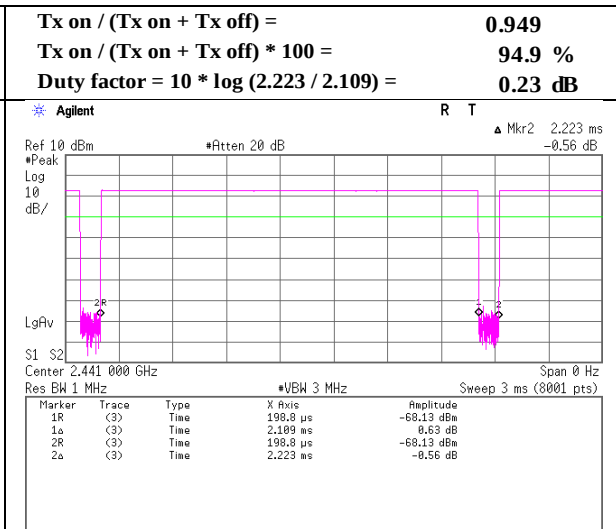
Burst rate confirmation

Test place : Kashima EMC Lab. No. No.2 Measurement Room
Report No. : 11347416M
Date : July 6, 2016
Temperature / Humidity : 23 deg. C / 54 % RH
Engineer : Kazuhiro Ando
Mode : Tx

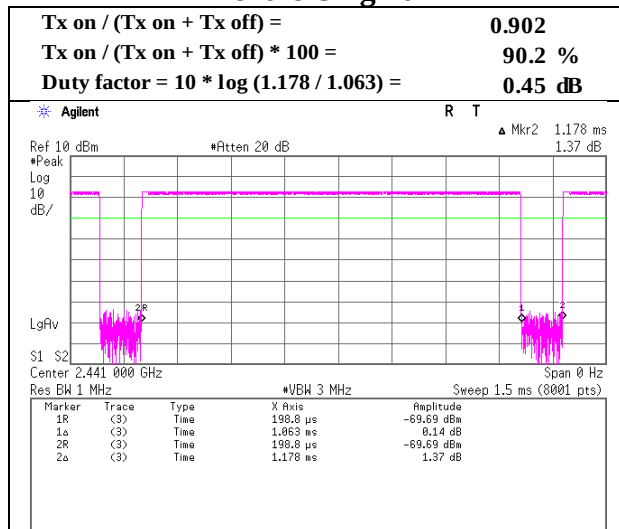
BT LE



ANT



Nordic Original



UL Japan, Inc.

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Facsimile : +81 478 82 3373

Radiated Spurious Emission

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber		
Report No.	11347416M		
Date	July 7, 2016	July 8, 2016	July 12, 2016
Temperature / Humidity	23 deg. C / 56 % RH	23 deg. C / 56 % RH	22 deg. C / 54 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(1-10GHz)	(10-18GHz)	(18-26.5GHz)
Mode	Tx BT LE 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.	2390.000	PK	49.7	27.6	14.5	44.4	3.5	50.9	73.9	23.0	162	304	
Hori.	4804.000	PK	52.5	31.3	6.7	46.1	3.5	47.9	73.9	26.0	192	65	
Hori.	7206.000	PK	52.1	36.3	8.1	44.7	3.5	55.3	73.9	18.6	220	129	
Vert.	2390.000	PK	50.2	27.6	14.5	44.4	3.5	51.4	73.9	22.5	147	174	
Vert.	4804.000	PK	53.0	31.3	6.7	46.1	3.5	48.4	73.9	25.5	174	285	
Vert.	7206.000	PK	52.3	36.3	8.1	44.7	3.5	55.5	73.9	18.4	197	149	

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 - 26.5 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	41.0	27.6	14.5	44.4	2.0	3.5	44.2	53.9	9.7	*1)
Hori.	4804.000	AV	41.9	31.3	6.7	46.1	2.0	3.5	39.3	53.9	14.6	
Hori.	7206.000	AV	43.4	36.3	8.1	44.7	2.0	3.5	48.6	53.9	5.3	
Vert.	2390.000	AV	41.5	27.6	14.5	44.4	2.0	3.5	44.7	53.9	9.2	*1)
Vert.	4804.000	AV	44.8	31.3	6.7	46.1	2.0	3.5	42.2	53.9	11.7	
Vert.	7206.000	AV	43.5	36.3	8.1	44.7	2.0	3.5	48.7	53.9	5.2	

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 - 26.5 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	93.2	27.6	14.5	44.4	3.5	94.4	-	-	Carrier
Hori.	2400.000	PK	48.6	27.6	14.5	44.4	3.5	49.8	74.4	24.6	
Vert.	2402.000	PK	92.4	27.6	14.5	44.4	3.5	93.6	-	-	Carrier
Vert.	2400.000	PK	46.3	27.6	14.5	44.4	3.5	47.5	73.6	26.1	

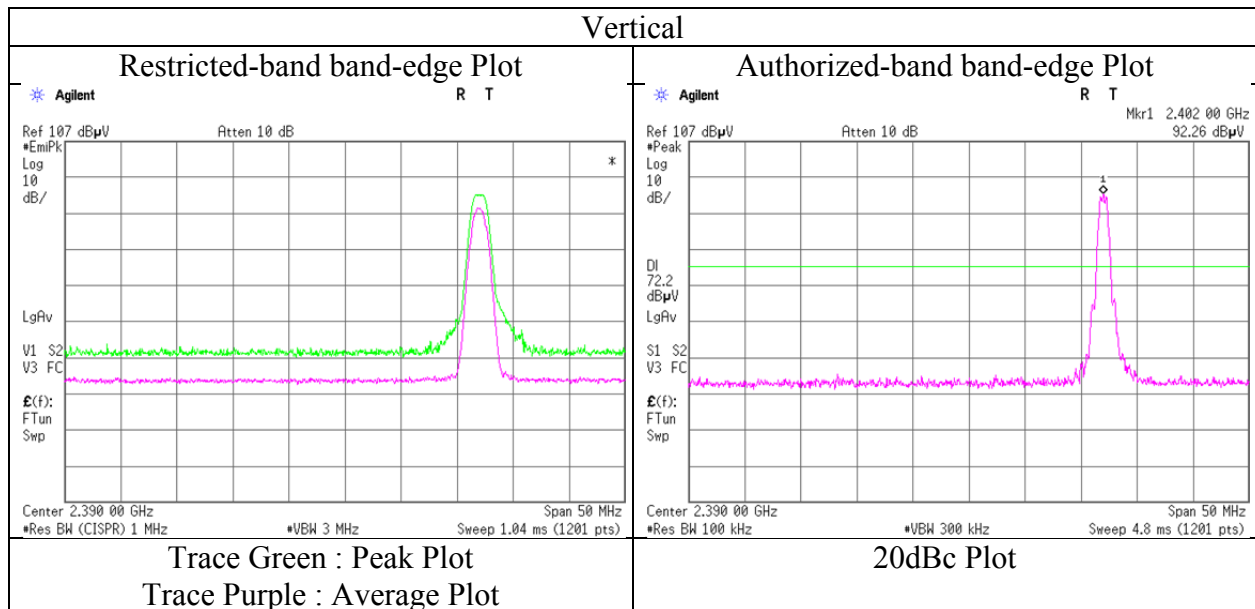
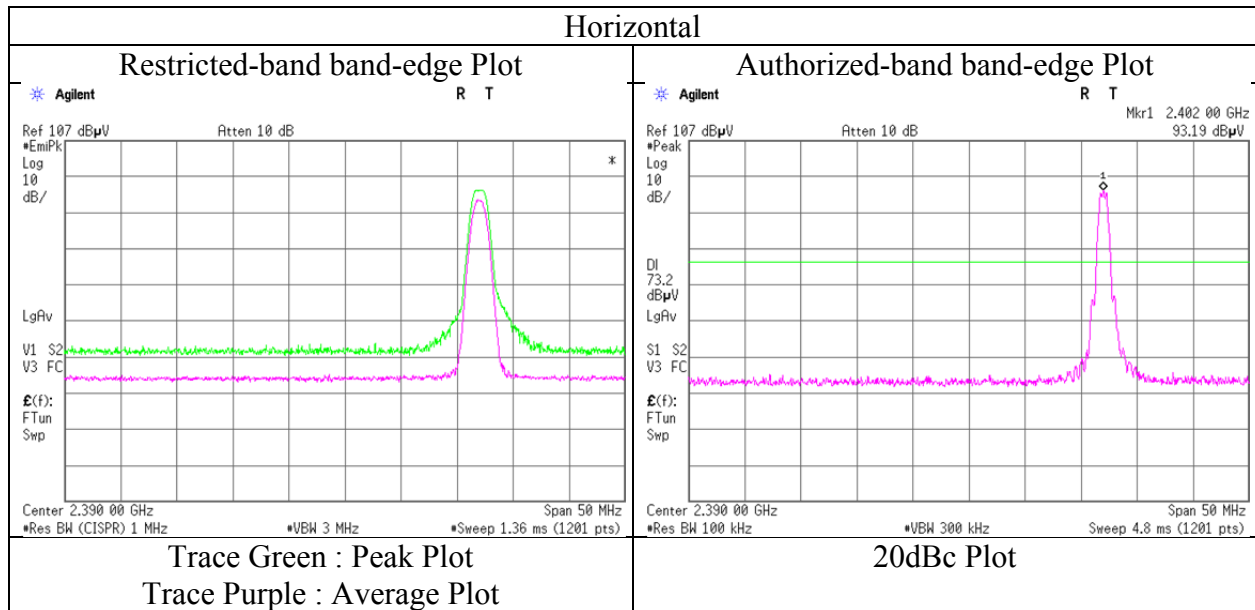
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

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

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

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11347416M
Date	July 7, 2016
Temperature / Humidity	23 deg. C / 56 % RH
Engineer	Kazuhiro Ando
	(1-10GHz)
Mode	Tx BT LE 2402 MHz



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

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No. : 11347416M
Date : July 12, 2016 July 7, 2016 July 8, 2016 July 12, 2016
Temperature / Humidity : 22 deg. C / 54 % RH 23 deg. C / 56 % RH 23 deg. C / 56 % RH 22 deg. C / 54 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30-1000MHz) (1-10GHz) (10-18GHz) (18-26.5GHz)
Mode : Tx BT LE 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.	86.017	QP	46.0	7.9	5.1	26.7	0.0	32.3	40.0	7.7	230	260	
Hori.	110.594	QP	40.5	10.6	5.4	26.6	0.0	29.9	43.5	13.6	290	240	
Hori.	4880.000	PK	52.7	31.2	6.8	46.1	3.5	48.1	73.9	25.8	100	33	
Hori.	7320.000	PK	49.9	36.4	8.2	44.4	3.5	53.6	73.9	20.3	100	253	
Vert.	61.441	QP	39.2	12.9	4.7	26.8	0.0	30.0	40.0	10.0	100	180	
Vert.	86.017	QP	48.3	7.9	5.1	26.7	0.0	34.6	40.0	5.4	100	200	
Vert.	168.287	QP	40.5	13.2	6.0	26.4	0.0	33.3	43.5	10.2	100	180	
Vert.	390.919	QP	36.2	15.4	8.2	26.7	0.0	33.1	46.0	12.9	100	280	
Vert.	4880.000	PK	52.2	31.2	6.8	46.1	3.5	47.6	73.9	26.3	176	241	
Vert.	7320.000	PK	51.7	36.4	8.2	44.4	3.5	55.4	73.9	18.5	203	151	

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

Distance factor : 1 GHz - 10 GHz : 20log(4.5 m / 3.0 m) = 3.5 dB

10 GHz - 26.5 GHz : 20log(1.0 m / 3.0 m) = -9.5 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	43.4	31.2	6.8	46.1	2.0	3.5	40.8	53.9	13.1	
Hori.	7320.000	AV	41.2	36.4	8.2	44.4	2.0	3.5	46.9	53.9	7.0	
Vert.	4880.000	AV	43.5	31.2	6.8	46.1	2.0	3.5	40.9	53.9	13.0	
Vert.	7320.000	AV	41.7	36.4	8.2	44.4	2.0	3.5	47.4	53.9	6.5	

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

Distance factor : 1 GHz - 10 GHz : 20log(4.5 m / 3.0 m) = 3.5 dB

10 GHz - 26.5 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

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

Radiated Spurious Emission

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber		
Report No.	11347416M		
Date	July 7, 2016	July 8, 2016	July 12, 2016
Temperature / Humidity	23 deg. C / 56 % RH	23 deg. C / 56 % RH	22 deg. C / 54 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(1-10GHz)	(10-18GHz)	(18-26.5GHz)
Mode	Tx BT LE 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.	2483.500	PK	59.3	27.5	14.5	44.3	3.5	60.5	73.9	13.4	180	296	
Hori.	4960.000	PK	52.8	31.4	6.8	46.1	3.5	48.4	73.9	25.5	172	47	
Hori.	7440.000	PK	50.9	36.7	8.2	44.2	3.5	55.1	73.9	18.8	154	30	
Vert.	2483.500	PK	55.1	27.5	14.5	44.3	3.5	56.3	73.9	17.6	167	34	
Vert.	4960.000	PK	52.9	31.4	6.8	46.1	3.5	48.5	73.9	25.4	164	311	
Vert.	7440.000	PK	51.2	36.7	8.2	44.2	3.5	55.4	73.9	18.5	178	165	

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 - 26.5 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	42.9	27.5	14.5	44.3	2.0	3.5	46.1	53.9	7.8	*1)
Hori.	4960.000	AV	43.8	31.4	6.8	46.1	2.0	3.5	41.4	53.9	12.5	
Hori.	7440.000	AV	40.7	36.7	8.2	44.2	2.0	3.5	46.9	53.9	7.0	
Vert.	2483.500	AV	41.3	27.5	14.5	44.3	2.0	3.5	44.5	53.9	9.4	*1)
Vert.	4960.000	AV	43.6	31.4	6.8	46.1	2.0	3.5	41.2	53.9	12.7	
Vert.	7440.000	AV	42.3	36.7	8.2	44.2	2.0	3.5	48.5	53.9	5.4	

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

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

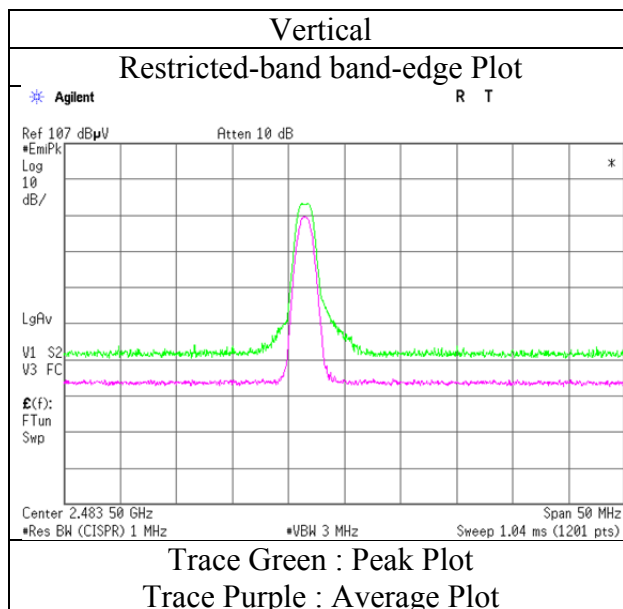
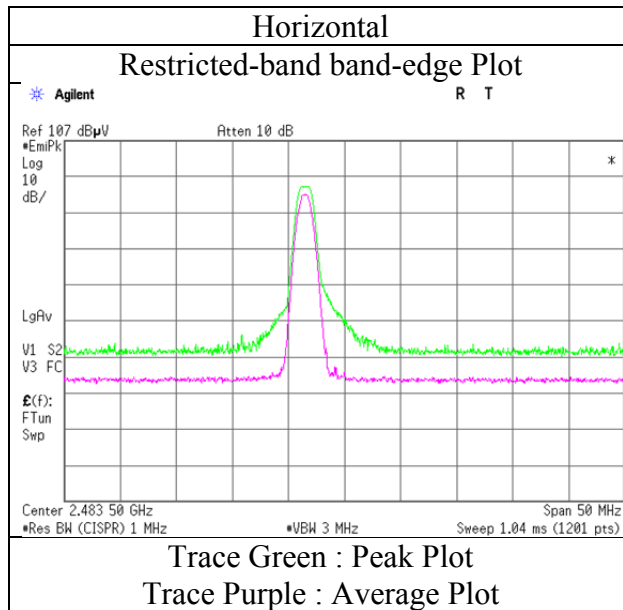
10 GHz - 26.5 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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)

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11347416M
Date	July 7, 2016
Temperature / Humidity	23 deg. C / 56 % RH
Engineer	Kazuhiro Ando
	(1-10GHz)
Mode	Tx BT LE 2480 MHz



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

Radiated Spurious Emission

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber		
Report No.	11347416M		
Date	July 7, 2016	July 8, 2016	July 12, 2016
Temperature / Humidity	23 deg. C / 56 % RH	23 deg. C / 56 % RH	22 deg. C / 54 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(1-10GHz)	(10-18GHz)	(18-26.5GHz)
Mode	Tx ANT 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.	2274.000	PK	51.9	28.0	14.3	44.4	3.5	53.3	73.9	20.6	165	245	
Hori.	2390.000	PK	48.8	27.6	14.5	44.4	3.5	50.0	73.9	23.9	160	293	
Hori.	2530.000	PK	53.7	27.5	14.6	44.3	3.5	55.0	73.9	18.9	173	289	
Hori.	4804.000	PK	53.5	31.3	6.7	46.1	3.5	48.9	73.9	25.0	198	84	
Hori.	7206.000	PK	51.7	36.3	8.1	44.7	3.5	54.9	73.9	19.0	171	268	
Hori.	2274.000	AV	46.7	28.0	14.3	44.4	3.5	48.1	53.9	5.8	165	245	
Hori.	2530.000	AV	47.1	27.5	14.6	44.3	3.5	48.4	53.9	5.5	173	289	
Vert.	2274.000	PK	55.0	28.0	14.3	44.4	3.5	56.4	73.9	17.5	145	240	
Vert.	2390.000	PK	49.9	27.6	14.5	44.4	3.5	51.1	73.9	22.8	146	337	
Vert.	2530.000	PK	54.0	27.5	14.6	44.3	3.5	55.3	73.9	18.6	145	136	
Vert.	4804.000	PK	53.5	31.3	6.7	46.1	3.5	48.9	73.9	25.0	147	247	
Vert.	7206.000	PK	51.4	36.3	8.1	44.7	3.5	54.6	73.9	19.3	141	127	
Vert.	2274.000	AV	49.4	28.0	14.3	44.4	3.5	50.8	53.9	3.1	145	240	
Vert.	2530.000	AV	48.2	27.5	14.6	44.3	3.5	49.5	53.9	4.4	145	136	

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 - 26.5 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	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	40.8	27.6	14.5	44.4	0.2	3.5	42.2	53.9	11.7	*1)
Hori.	4804.000	AV	41.9	31.3	6.7	46.1	0.2	3.5	37.5	53.9	16.4	
Hori.	7206.000	AV	41.2	36.3	8.1	44.7	0.2	3.5	44.6	53.9	9.3	
Vert.	2390.000	AV	41.0	27.6	14.5	44.4	0.2	3.5	42.4	53.9	11.5	*1)
Vert.	4804.000	AV	44.9	31.3	6.7	46.1	0.2	3.5	40.5	53.9	13.4	
Vert.	7206.000	AV	43.5	36.3	8.1	44.7	0.2	3.5	46.9	53.9	7.0	

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 - 26.5 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	93.2	27.6	14.5	44.4	3.5	94.4	-	-	Carrier
Hori.	2400.000	PK	46.5	27.6	14.5	44.4	3.5	47.7	74.4	26.7	
Vert.	2402.000	PK	92.9	27.6	14.5	44.4	3.5	94.1	-	-	Carrier
Vert.	2400.000	PK	47.0	27.6	14.5	44.4	3.5	48.2	74.1	25.9	

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

UL Japan, Inc.

Kashima EMC Lab.

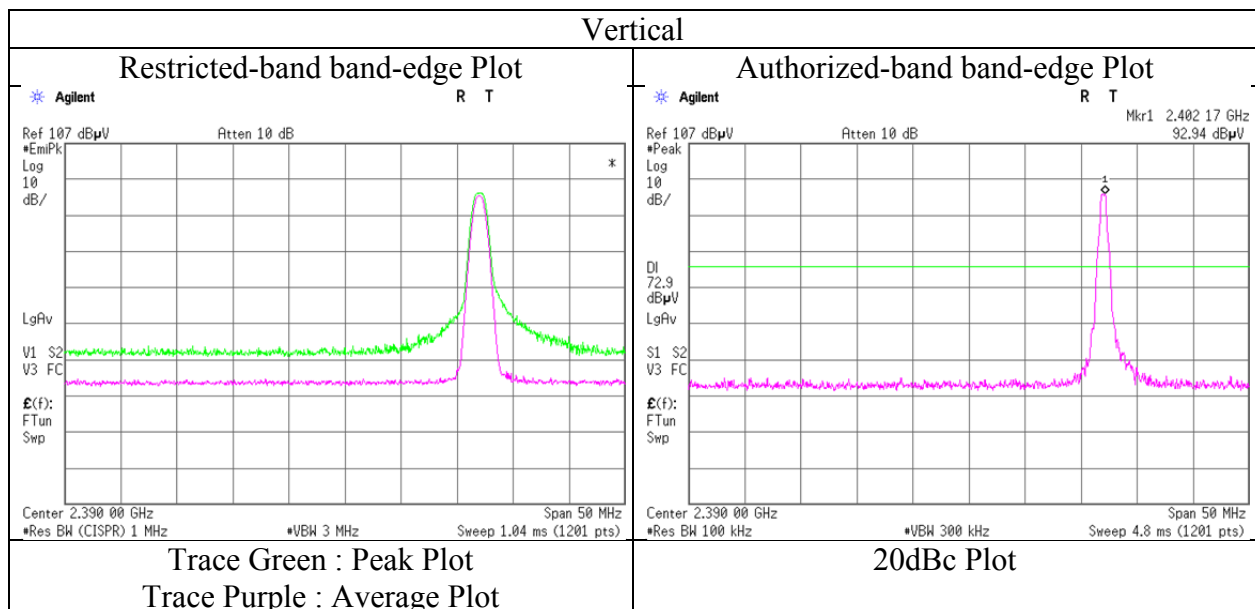
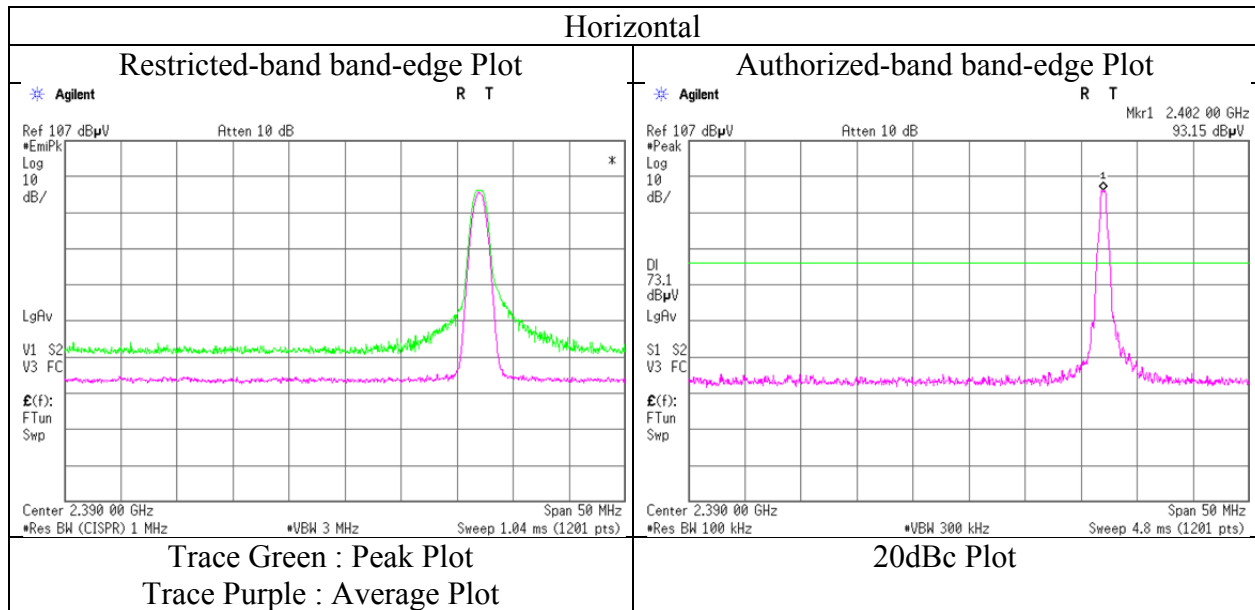
1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

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Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11347416M
Date	July 7, 2016
Temperature / Humidity	23 deg. C / 56 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx ANT 2402 MHz



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

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No. : 11347416M
Date : July 12, 2016 July 7, 2016 July 8, 2016 July 12, 2016
Temperature / Humidity : 22 deg. C / 54 % RH 23 deg. C / 56 % RH 23 deg. C / 56 % RH 22 deg. C / 54 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30-1000MHz) (1-10GHz) (10-18GHz) (18-26.5GHz)
Mode : Tx ANT 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.	86.017	QP	45.4	7.9	5.1	26.7	0.0	31.7	40.0	8.3	290	240	
Hori.	110.594	QP	39.9	10.6	5.4	26.6	0.0	29.3	43.5	14.2	290	250	
Hori.	2313.000	PK	53.4	27.9	14.4	44.4	3.5	54.8	73.9	19.1	160	234	
Hori.	2569.000	PK	53.6	27.6	14.6	44.3	3.5	55.0	73.9	18.9	170	291	
Hori.	4882.000	PK	51.8	31.2	6.8	46.1	3.5	47.2	73.9	26.7	145	65	
Hori.	7323.000	PK	50.0	36.5	8.2	44.4	3.5	53.8	73.9	20.1	170	259	
Hori.	2313.000	AV	47.8	27.9	14.4	44.4	3.5	49.2	53.9	4.7	160	234	
Hori.	2569.000	AV	46.8	27.6	14.6	44.3	3.5	48.2	53.9	5.7	170	291	
Vert.	61.441	QP	38.0	12.9	4.7	26.8	0.0	28.8	40.0	11.2	100	190	
Vert.	86.017	QP	46.7	7.9	5.1	26.7	0.0	33.0	40.0	7.0	100	150	
Vert.	390.919	QP	37.1	15.4	8.2	26.7	0.0	34.0	46.0	12.0	100	280	
Vert.	456.072	QP	34.8	17.1	8.8	27.2	0.0	33.5	46.0	12.5	100	280	
Vert.	2313.000	PK	53.1	27.9	14.4	44.4	3.5	54.5	73.9	19.4	156	353	
Vert.	2569.000	PK	50.0	27.6	14.6	44.3	3.5	51.4	73.9	22.5	152	73	
Vert.	4882.000	PK	51.8	31.2	6.8	46.1	3.5	47.2	73.9	26.7	149	255	
Vert.	7323.000	PK	50.7	36.5	8.2	44.4	3.5	54.5	73.9	19.4	100	135	
Vert.	2313.000	AV	46.5	27.9	14.4	44.4	3.5	47.9	53.9	6.0	156	353	
Vert.	2569.000	AV	45.5	27.6	14.6	44.3	3.5	46.9	53.9	7.0	152	73	

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 - 26.5 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	42.7	31.2	6.8	46.1	0.2	3.5	38.3	53.9	15.6	
Hori.	7323.000	AV	39.0	36.5	8.2	44.4	0.2	3.5	43.0	53.9	10.9	
Vert.	4882.000	AV	43.6	31.2	6.8	46.1	0.2	3.5	39.2	53.9	14.7	
Vert.	7323.000	AV	42.7	36.5	8.2	44.4	0.2	3.5	46.7	53.9	7.2	

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

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

Radiated Spurious Emission

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber		
Report No.	11347416M		
Date	July 7, 2016	July 8, 2016	July 12, 2016
Temperature / Humidity	23 deg. C / 56 % RH	23 deg. C / 56 % RH	22 deg. C / 54 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(1-10GHz)	(10-18GHz)	(18-26.5GHz)
Mode	Tx ANT 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.	2352.000	PK	54.7	27.7	14.4	44.4	3.5	55.9	73.9	18.0	232	293	
Hori.	2483.500	PK	51.2	27.5	14.5	44.3	3.5	52.4	73.9	21.5	153	262	
Hori.	2608.000	PK	52.7	27.6	14.6	44.3	3.5	54.1	73.9	19.8	156	295	
Hori.	4960.000	PK	53.5	31.4	6.8	46.1	3.5	49.1	73.9	24.8	177	53	
Hori.	7440.000	PK	50.2	36.7	8.2	44.2	3.5	54.4	73.9	19.5	153	186	
Hori.	2352.000	AV	48.8	27.7	14.4	44.4	3.5	50.0	53.9	3.9	232	293	
Hori.	2608.000	AV	45.5	27.6	14.6	44.3	3.5	46.9	53.9	7.0	156	295	
Vert.	2352.000	PK	54.3	27.7	14.4	44.4	3.5	55.5	73.9	18.4	149	349	
Vert.	2483.500	PK	56.3	27.5	14.5	44.3	3.5	57.5	73.9	16.4	149	139	
Vert.	2608.000	PK	52.3	27.6	14.6	44.3	3.5	53.7	73.9	20.2	116	297	
Vert.	4960.000	PK	50.9	31.4	6.8	46.1	3.5	46.5	73.9	27.4	153	58	
Vert.	7440.000	PK	51.1	36.7	8.2	44.2	3.5	55.3	73.9	18.6	117	166	
Vert.	2352.000	AV	48.7	27.7	14.4	44.4	3.5	49.9	53.9	4.0	149	349	
Vert.	2608.000	AV	46.1	27.6	14.6	44.3	3.5	47.5	53.9	6.4	116	297	

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

Distance factor : 1 GHz - 10 GHz : 20log(4.5 m / 3.0 m) = 3.5 dB

10 GHz - 26.5 GHz : 20log(1.0 m / 3.0 m) = -9.5 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	38.0	27.5	14.5	44.3	0.2	3.5	39.4	53.9	14.5	*1)
Hori.	4960.000	AV	44.0	31.4	6.8	46.1	0.2	3.5	39.8	53.9	14.1	
Hori.	7440.000	AV	40.1	36.7	8.2	44.2	0.2	3.5	44.5	53.9	9.4	
Vert.	2483.500	AV	42.3	27.5	14.5	44.3	0.2	3.5	43.7	53.9	10.2	*1)
Vert.	4960.000	AV	41.3	31.4	6.8	46.1	0.2	3.5	37.1	53.9	16.8	
Vert.	7440.000	AV	42.8	36.7	8.2	44.2	0.2	3.5	47.2	53.9	6.7	

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

Distance factor : 1 GHz - 10 GHz : 20log(4.5 m / 3.0 m) = 3.5 dB

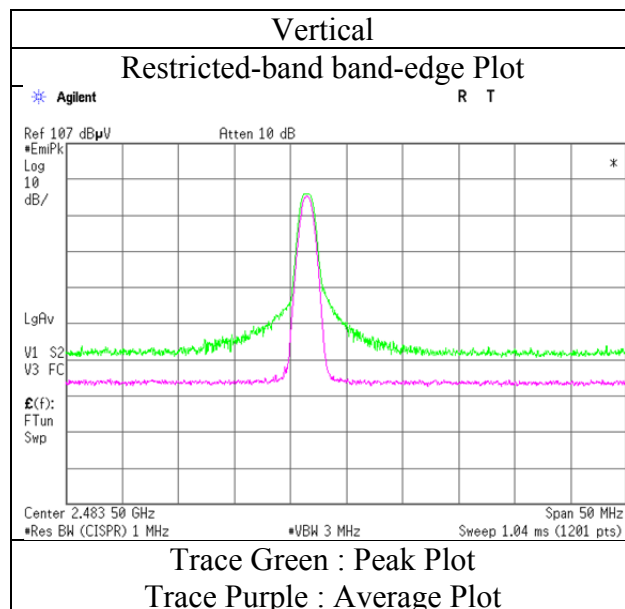
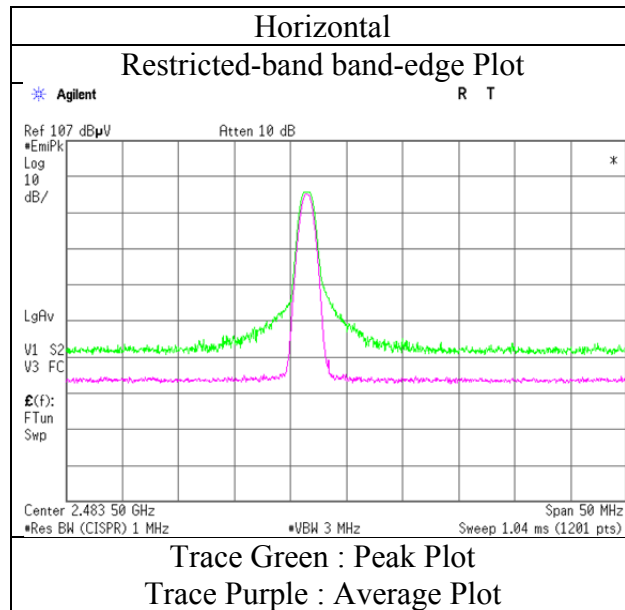
10 GHz - 26.5 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

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)

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11347416M
Date	July 7, 2016
Temperature / Humidity	23 deg. C / 56 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx ANT 2480 MHz



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

Radiated Spurious Emission

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber		
Report No.	11347416M		
Date	July 7, 2016	July 8, 2016	July 12, 2016
Temperature / Humidity	23 deg. C / 56 % RH	23 deg. C / 56 % RH	22 deg. C / 54 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(1-10GHz)	(10-18GHz)	(18-26.5GHz)
Mode	Tx Nordic 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.	2274.000	PK	53.7	28.0	14.3	44.4	3.5	55.1	73.9	18.8	194	303	
Hori.	2390.000	PK	49.0	27.6	14.5	44.4	3.5	50.2	73.9	23.7	192	296	
Hori.	2530.000	PK	53.5	27.5	14.6	44.3	3.5	54.8	73.9	19.1	174	298	
Hori.	4804.000	PK	53.1	31.3	6.7	46.1	3.5	48.5	73.9	25.4	154	43	
Hori.	7206.000	PK	51.0	36.3	8.1	44.7	3.5	54.2	73.9	19.7	175	136	
Hori.	2274.000	AV	46.1	28.0	14.3	44.4	3.5	47.5	53.9	6.4	194	303	
Hori.	2530.000	AV	46.6	27.5	14.6	44.3	3.5	47.9	53.9	6.0	174	298	
Vert.	2274.000	PK	54.5	28.0	14.3	44.4	3.5	55.9	73.9	18.0	100	336	
Vert.	2390.000	PK	50.4	27.6	14.5	44.4	3.5	51.6	73.9	22.3	147	237	
Vert.	2530.000	PK	53.4	27.5	14.6	44.3	3.5	54.7	73.9	19.2	111	137	
Vert.	4804.000	PK	53.5	31.3	6.7	46.1	3.5	48.9	73.9	25.0	133	248	
Vert.	7206.000	PK	50.9	36.3	8.1	44.7	3.5	54.1	73.9	19.8	147	112	
Vert.	2274.000	AV	48.6	28.0	14.3	44.4	3.5	50.0	53.9	3.9	100	336	
Vert.	2530.000	AV	47.3	27.5	14.6	44.3	3.5	48.6	53.9	5.3	111	137	

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 - 26.5 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	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	40.9	27.6	14.5	44.4	0.5	3.5	42.6	53.9	11.4	*1)
Hori.	4804.000	AV	41.2	31.3	6.7	46.1	0.5	3.5	37.1	53.9	16.9	
Hori.	7206.000	AV	40.0	36.3	8.1	44.7	0.5	3.5	43.7	53.9	10.3	
Vert.	2390.000	AV	41.2	27.6	14.5	44.4	0.5	3.5	42.9	53.9	11.1	*1)
Vert.	4804.000	AV	44.8	31.3	6.7	46.1	0.5	3.5	40.7	53.9	13.3	
Vert.	7206.000	AV	41.9	36.3	8.1	44.7	0.5	3.5	45.6	53.9	8.4	

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 - 26.5 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	93.6	27.6	14.5	44.4	3.5	94.8	-	-	Carrier
Hori.	2400.000	PK	53.7	27.6	14.5	44.4	3.5	54.9	74.8	19.9	
Vert.	2402.000	PK	92.6	27.6	14.5	44.4	3.5	93.8	-	-	Carrier
Vert.	2400.000	PK	54.5	27.6	14.5	44.4	3.5	55.7	73.8	18.1	

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

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Kashima EMC Lab.

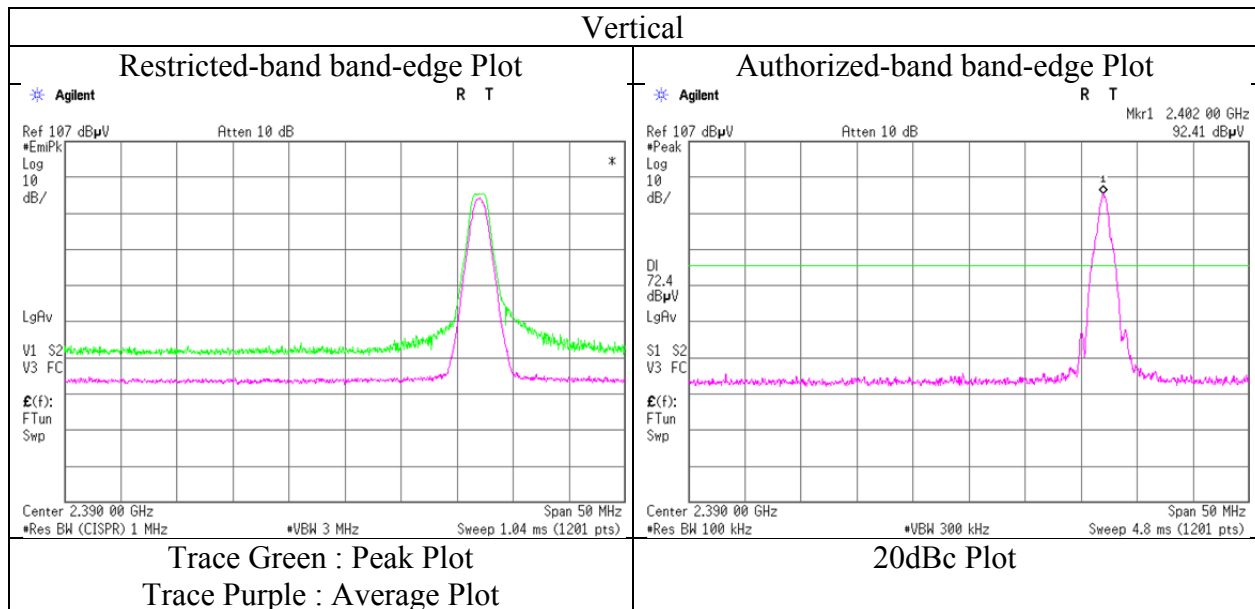
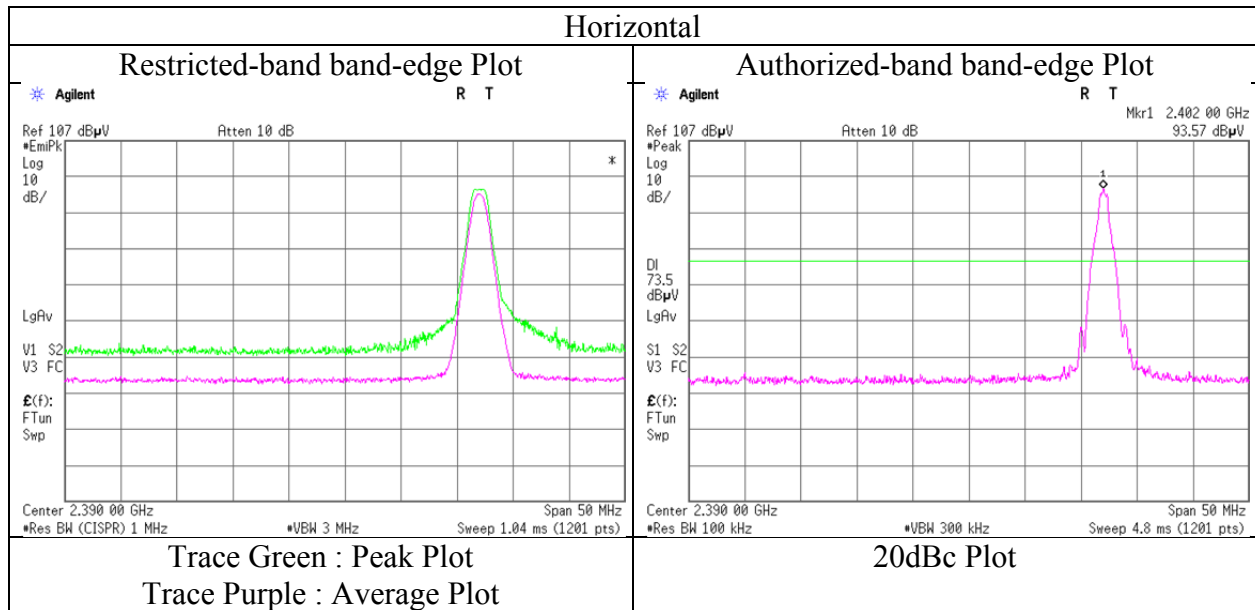
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Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11347416M
Date	July 7, 2016
Temperature / Humidity	23 deg. C / 56 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx Nordic 2402 MHz



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

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No. : 11347416M
Date : July 12, 2016 July 7, 2016 July 8, 2016 July 12, 2016
Temperature / Humidity : 22 deg. C / 54 % RH 23 deg. C / 56 % RH 23 deg. C / 56 % RH 22 deg. C / 54 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30-1000MHz) (1-10GHz) (10-18GHz) (18-26.5GHz)
Mode : Tx Nordic 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.	86.017	QP	43.0	7.9	5.1	26.7	0.0	29.3	40.0	10.7	230	240	
Hori.	110.594	QP	38.0	10.6	5.4	26.6	0.0	27.4	43.5	16.1	290	250	
Hori.	2313.000	PK	53.5	27.9	14.4	44.4	3.5	54.9	73.9	19.0	176	302	
Hori.	2569.000	PK	53.4	27.6	14.6	44.3	3.5	54.8	73.9	19.1	168	292	
Hori.	4882.000	PK	52.4	31.2	6.8	46.1	3.5	47.8	73.9	26.1	142	53	
Hori.	7323.000	PK	50.0	36.5	8.2	44.4	3.5	53.8	73.9	20.1	148	140	
Hori.	2313.000	AV	47.3	27.9	14.4	44.4	3.5	48.7	53.9	5.2	176	302	
Hori.	2569.000	AV	46.0	27.6	14.6	44.3	3.5	47.4	53.9	6.5	168	292	
Vert.	61.441	QP	40.9	12.9	4.7	26.8	0.0	31.7	40.0	8.3	100	165	
Vert.	86.017	QP	47.1	7.9	5.1	26.7	0.0	33.4	40.0	6.6	100	180	
Vert.	110.594	QP	40.0	10.6	5.4	26.6	0.0	29.4	43.5	14.1	100	155	
Vert.	500.833	QP	34.3	17.8	8.8	27.4	0.0	33.5	46.0	12.5	100	260	
Vert.	2313.000	PK	53.3	27.9	14.4	44.4	3.5	54.7	73.9	19.2	176	315	
Vert.	2569.000	PK	53.9	27.6	14.6	44.3	3.5	55.3	73.9	18.6	15	330	
Vert.	4882.000	PK	52.8	31.2	6.8	46.1	3.5	48.2	73.9	25.7	146	197	
Vert.	7323.000	PK	49.9	36.5	8.2	44.4	3.5	53.7	73.9	20.2	146	148	
Vert.	2313.000	AV	47.4	27.9	14.4	44.4	3.5	48.8	53.9	5.1	176	315	
Vert.	2569.000	AV	46.8	27.6	14.6	44.3	3.5	48.2	53.9	5.7	15	330	

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

Distance factor : 1 GHz - 10 GHz : 20log(4.5 m / 3.0 m) = 3.5 dB

10 GHz - 26.5 GHz : 20log(1.0 m / 3.0 m) = -9.5 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	41.4	31.2	6.8	46.1	0.5	3.5	37.3	53.9	16.7	
Hori.	7323.000	AV	38.3	36.5	8.2	44.4	0.5	3.5	42.6	53.9	11.4	
Vert.	4882.000	AV	43.3	31.2	6.8	46.1	0.5	3.5	39.2	53.9	14.8	
Vert.	7323.000	AV	41.4	36.5	8.2	44.4	0.5	3.5	45.7	53.9	8.2	

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

Distance factor : 1 GHz - 10 GHz : 20log(4.5 m / 3.0 m) = 3.5 dB

10 GHz - 26.5 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

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

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Radiated Spurious Emission

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber		
Report No.	11347416M		
Date	July 7, 2016	July 8, 2016	July 12, 2016
Temperature / Humidity	23 deg. C / 56 % RH	23 deg. C / 56 % RH	22 deg. C / 54 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(1-10GHz)	(10-18GHz)	(18-26.5GHz)
Mode	Tx Nordic 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.	2352.000	PK	54.0	27.7	14.4	44.4	3.5	55.2	73.9	18.7	232	290	
Hori.	2483.500	PK	57.1	27.5	14.5	44.3	3.5	58.3	73.9	15.6	214	284	
Hori.	2608.000	PK	52.0	27.6	14.6	44.3	3.5	53.4	73.9	20.5	160	294	
Hori.	4960.000	PK	53.5	31.4	6.8	46.1	3.5	49.1	73.9	24.8	135	61	
Hori.	7440.000	PK	49.2	36.7	8.2	44.2	3.5	53.4	73.9	20.5	148	66	
Hori.	2352.000	AV	47.4	27.7	14.4	44.4	3.5	48.6	53.9	5.3	232	290	
Hori.	2608.000	AV	44.8	27.6	14.6	44.3	3.5	46.2	53.9	7.7	160	294	
Vert.	2352.000	PK	54.9	27.7	14.4	44.4	3.5	56.1	73.9	17.8	158	333	
Vert.	2483.500	PK	57.5	27.5	14.5	44.3	3.5	58.7	73.9	15.2	121	135	
Vert.	2608.000	PK	51.5	27.6	14.6	44.3	3.5	52.9	73.9	21.0	103	154	
Vert.	4960.000	PK	51.9	31.4	6.8	46.1	3.5	47.5	73.9	26.4	135	244	
Vert.	7440.000	PK	49.9	36.7	8.2	44.2	3.5	54.1	73.9	19.8	182	154	
Vert.	2352.000	AV	49.2	27.7	14.4	44.4	3.5	50.4	53.9	3.5	158	333	
Vert.	2608.000	AV	44.4	27.6	14.6	44.3	3.5	45.8	53.9	8.1	103	154	

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 - 26.5 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	39.0	27.5	14.5	44.3	0.5	3.5	40.7	53.9	13.3	*1)
Hori.	4960.000	AV	43.1	31.4	6.8	46.1	0.5	3.5	39.2	53.9	14.8	
Hori.	7440.000	AV	38.1	36.7	8.2	44.2	0.5	3.5	42.8	53.9	11.2	
Vert.	2483.500	AV	43.1	27.5	14.5	44.3	0.5	3.5	44.8	53.9	9.2	*1)
Vert.	4960.000	AV	44.7	31.4	6.8	46.1	0.5	3.5	40.8	53.9	13.2	
Vert.	7440.000	AV	41.9	36.7	8.2	44.2	0.5	3.5	46.6	53.9	7.4	

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

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

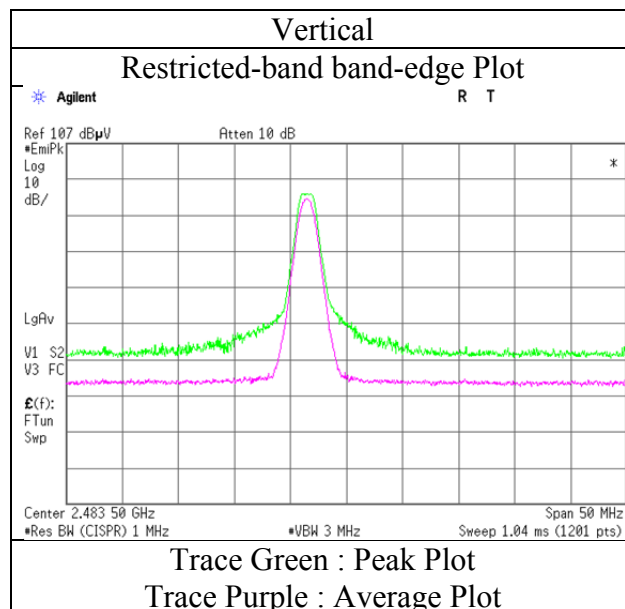
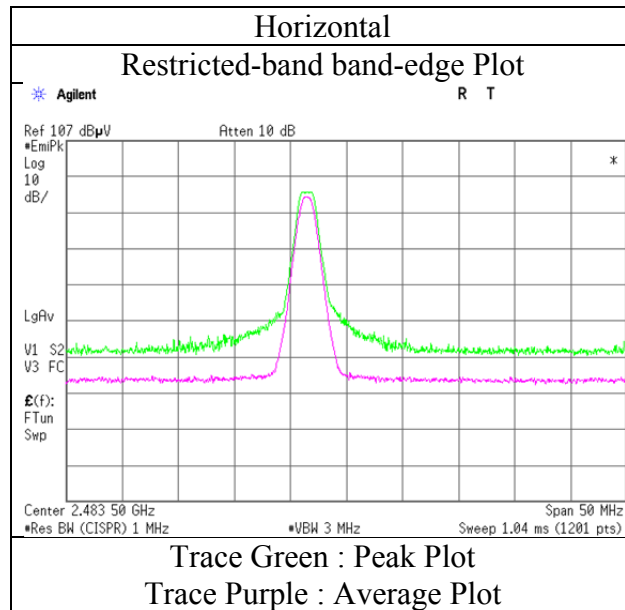
10 GHz - 26.5 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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)

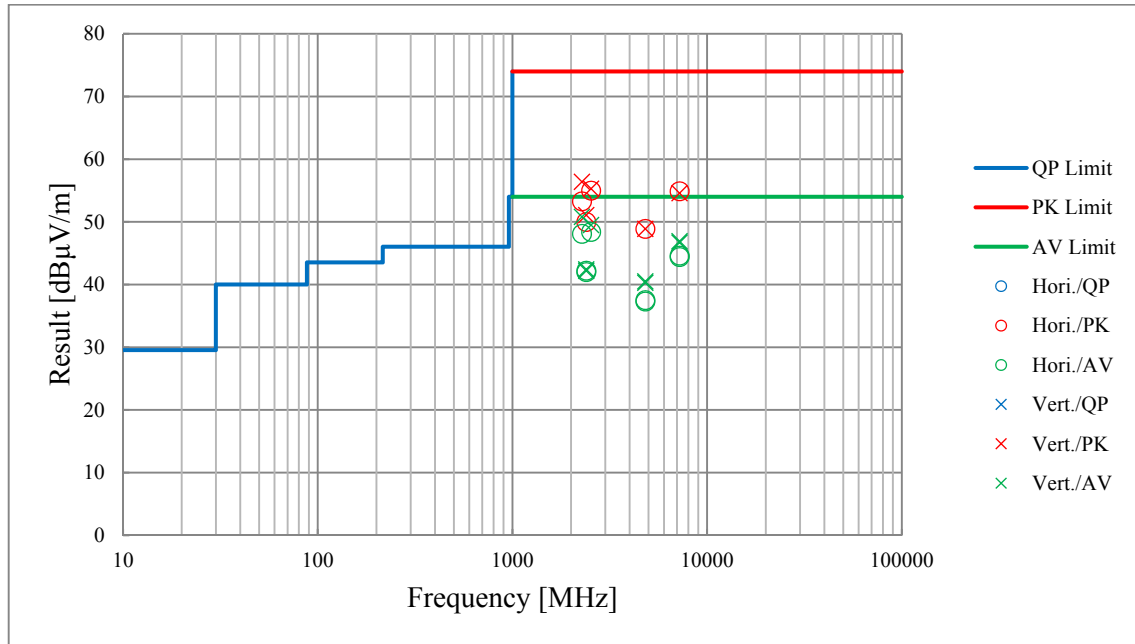
Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11347416M
Date	July 7, 2016
Temperature / Humidity	23 deg. C / 56 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx Nordic 2480 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

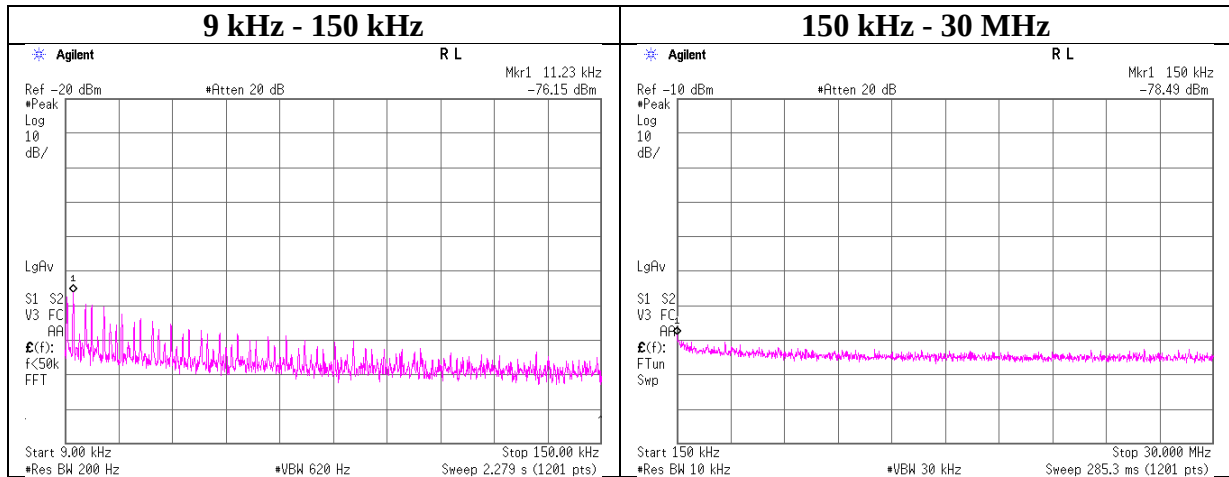
Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber		
Report No.	11347416M		
Date	July 7, 2016	July 8, 2016	July 12, 2016
Temperature / Humidity	23 deg. C / 56 % RH	23 deg. C / 56 % RH	22 deg. C / 54 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(1-10GHz)	(10-18GHz)	(18-26.5GHz)
Mode	Tx ANT 2402 MHz		



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

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11347416M
Date : July 6, 2016
Temperature / Humidity : 23 deg. C / 54 % RH
Engineer : Kazuhiro Ando
Mode : Tx BT LE 2440 MHz



Frequency	Reading	Cable Loss	Attenuator Loss	Antenna Gain	N	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]	(Number of Output)	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
11.23	-76.2	0.01	9.95	2.0	1	-64.2	300	6.0	-2.9	46.5	49.4	
150.00	-78.5	0.01	9.94	2.0	1	-66.5	300	6.0	-5.3	24.0	29.3	

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

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

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Kashima EMC Lab.

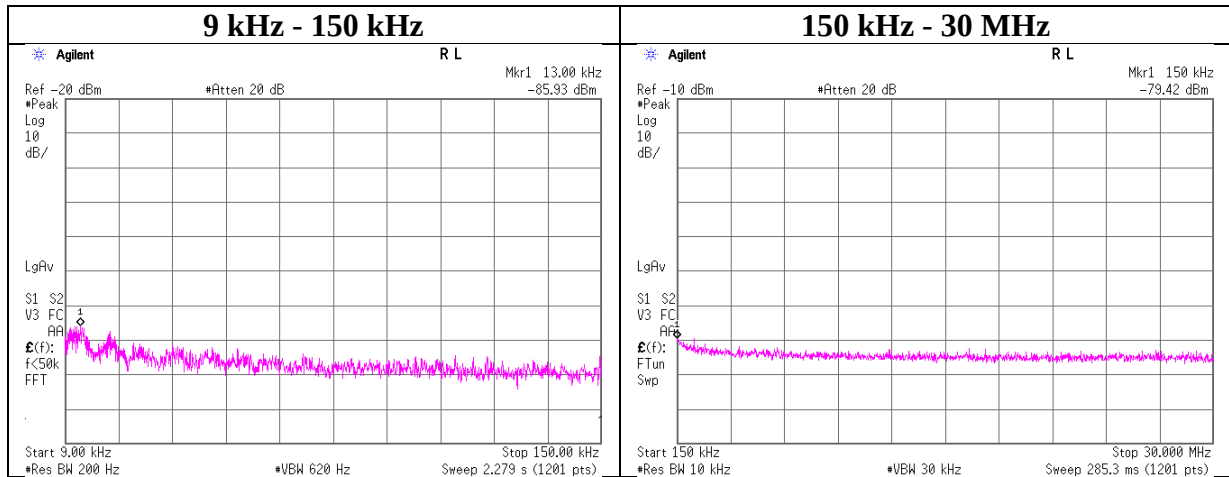
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11347416M
Date : July 6, 2016
Temperature / Humidity : 23 deg. C / 54 % RH
Engineer : Kazuhiro Ando
Mode : Tx ANT 2441 MHz



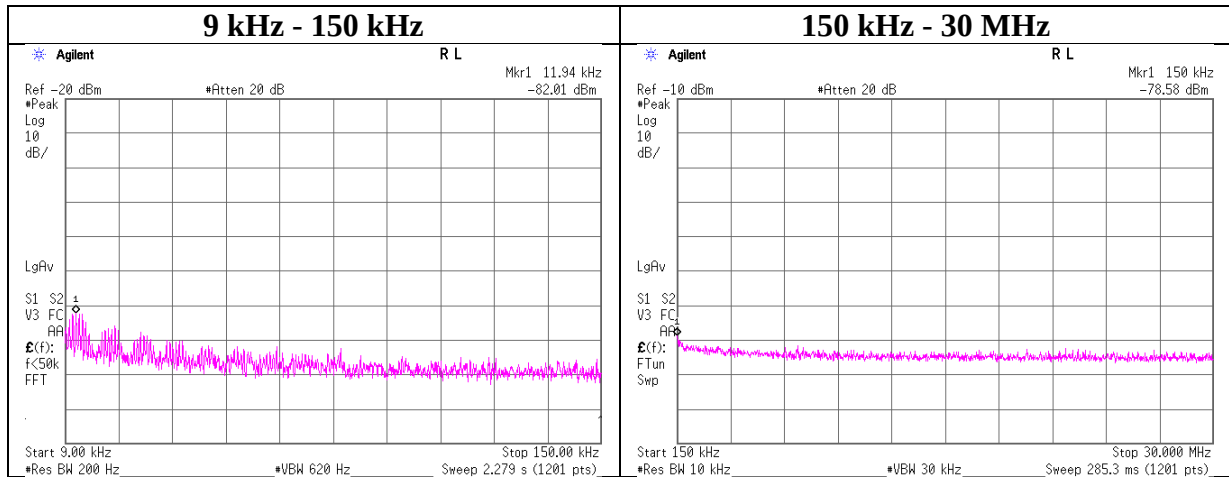
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
13.00	-85.9	0.01	10.0	2.0	1	-74.0	300	6.0	-12.7	45.3	58.0	
150.00	-79.4	0.01	9.9	2.0	1	-67.5	300	6.0	-6.2	24.0	30.2	

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

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11347416M
Date : July 6, 2016
Temperature / Humidity : 23 deg. C / 54 % RH
Engineer : Kazuhiro Ando
Mode : Tx Nordic 2441 MHz



Frequency	Reading	Cable Loss	Attenuator Loss	Antenna Gain	N	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]	(Number of Output)	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
11.94	-82.0	0.01	9.95	2.0	1	-70.1	300	6.0	-8.8	46.0	54.8	
150.00	-78.6	0.01	9.94	2.0	1	-66.6	300	6.0	-5.4	24.0	29.4	

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

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

Power Density

Test place Kashima EMC Lab. No.2 Measurement Room
Report No. 11347416M
Date July 6, 2016
Temperature / Humidity 23 deg. C / 54 % RH
Engineer Kazuhiro Ando
Mode Tx

BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-22.19	1.51	10.04	-10.64	8.00	18.64
2440.00	-22.17	1.51	10.04	-10.62	8.00	18.62
2480.00	-22.20	1.52	10.04	-10.64	8.00	18.64

ANT

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-16.80	1.51	10.04	-5.25	8.00	13.25
2441.00	-17.03	1.51	10.04	-5.48	8.00	13.48
2480.00	-16.56	1.52	10.04	-5.00	8.00	13.00

Nordic Original

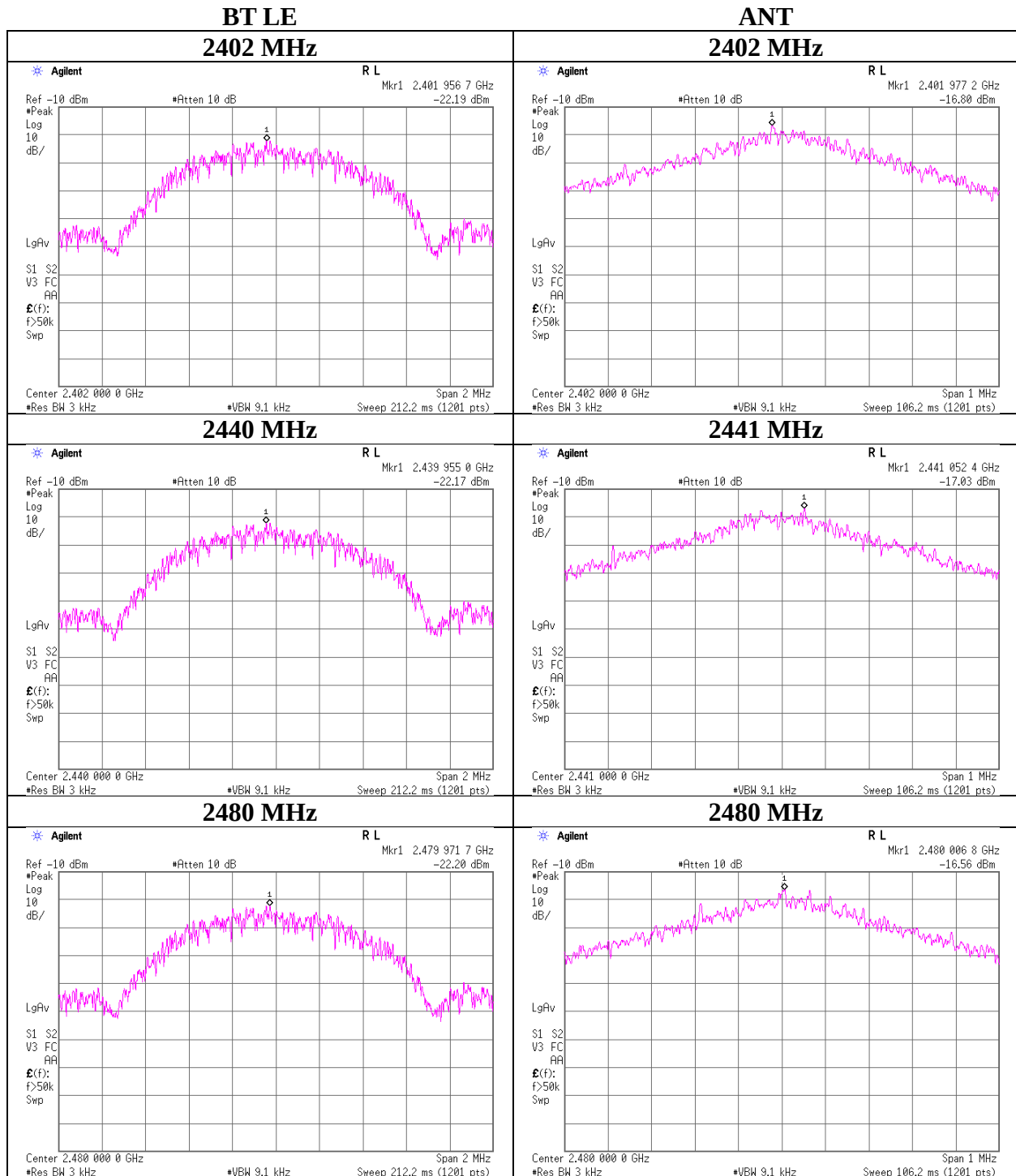
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-20.41	1.51	10.04	-8.86	8.00	16.86
2441.00	-20.61	1.51	10.04	-9.06	8.00	17.06
2480.00	-20.41	1.52	10.04	-8.85	8.00	16.85

Sample Calculation:

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

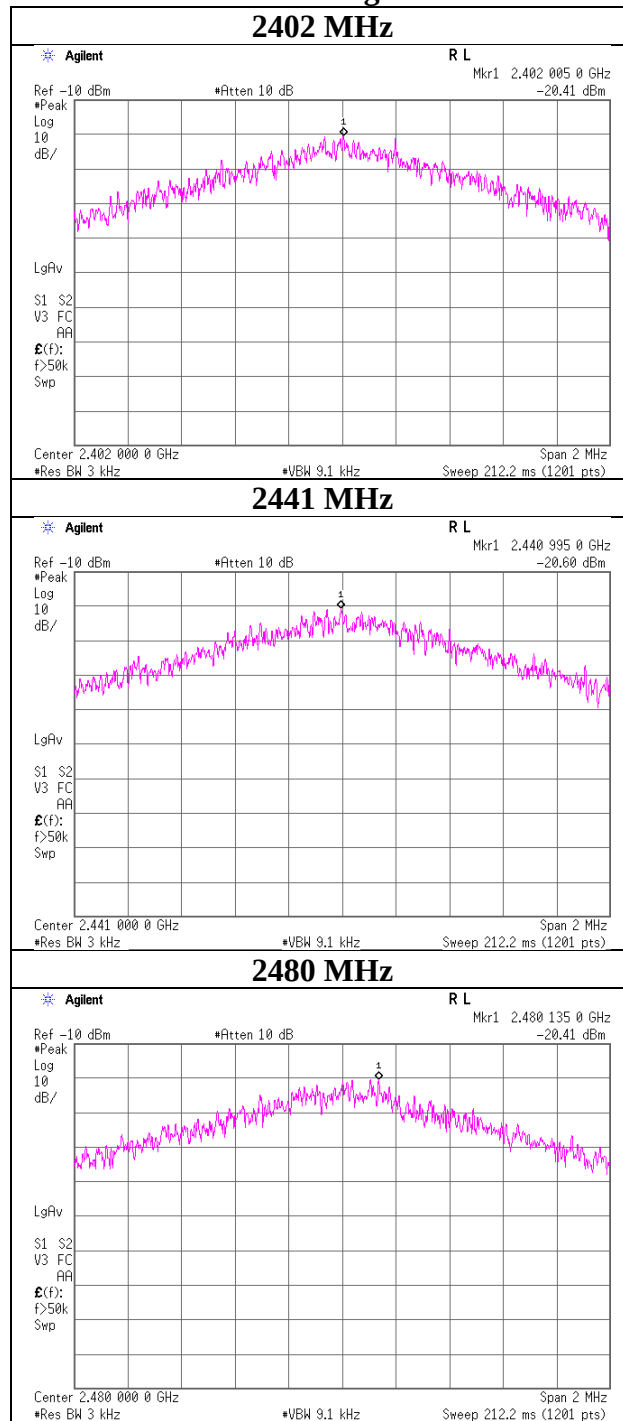
*The equipment and cables were not used for factor 0 dB of the data sheets.

Power Density



Power Density

Nordic Original



UL Japan, Inc.

Kashima EMC Lab.

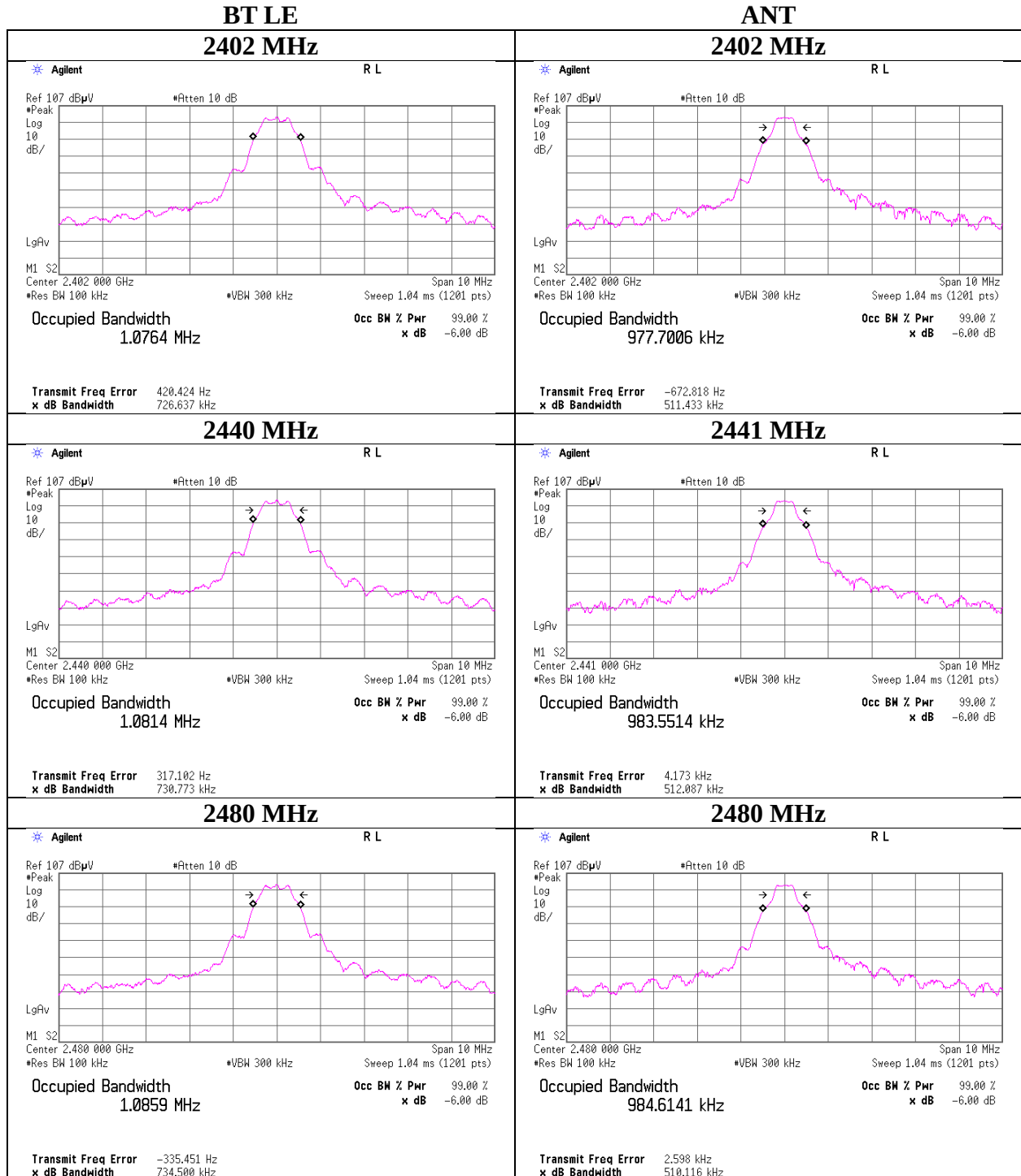
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

99% Occupied Bandwidth

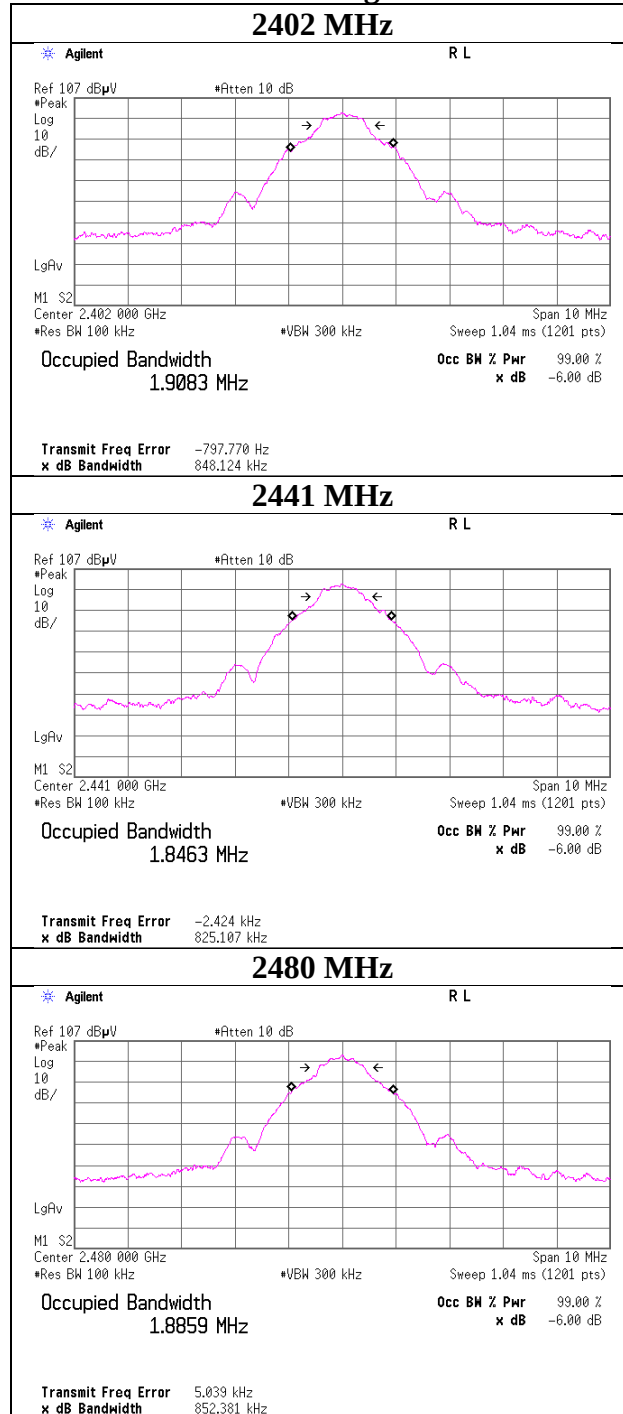
Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11347416M
Date : July 6, 2016
Temperature / Humidity : 23 deg. C / 54 % RH
Engineer : Kazuhiro Ando
Mode : Tx



99% Occupied Bandwidth

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11347416M
Date : July 6, 2016
Temperature / Humidity : 23 deg. C / 54 % RH
Engineer : Kazuhiro Ando
Mode : Tx

Nordic Original



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
CLS-25	A.M.N.	Rohde & Schwarz	ENV216	101042	CE	2015/08/06 * 12
CCC-S2-C(2/6 /7/8)	Coaxial Cable	Fujikura,Fujikura,Fujikura,Fujikura	5D-2W,5D-2W,5D-2W,5D-2W	-	CE	2015/07/14 * 12
CTR-05	Test Receiver	Rohde & Schwarz	ESCI	100608 Rev 4.32	CE	2015/09/24 * 12
COS-02	Temperature & Humidity Indicator	A&D	AD-5681	6878345	CE	2015/07/13 * 12
CTS-06	Digital Multimeter	FLUKE	112	89790159	CE	2015/09/08 * 12
COTS-CEMI-02	EMI Software	TSJ	TEPTO-DV(RE,CE, MF,PE)	Ver, RE: 2.5.0131, CE: 2.5.0131	CE/RE	-
CTR-09	Test Receiver	Agilent	N9038A	MY53290016 Version A.14.03	RE	2016/06/19 * 12
CBL-08	LOGBICON	Schwarzbeck	VULB 9168	343	RE	2015/11/15 * 12
CAT3-04	3dB Fixed Atten.	TAMAGAWA	UFA-01	none	RE	2015/09/03 * 12
CCC-S10-R(2/ 4/CATS-11/5/ 6/7/8/11/12)	Coaxial Cable	Fujikura,Fujikura,Agilent,Fujikura,Fujikura,Fujikura,Fujikura,Fujikura	5D-2W,5D-2W,8494A,5D-2W,5D-2W,5D-2W,5D-2W,5D-2W	MY41110200(Step Att)	RE	2015/08/11 * 12
CAF-08	Pre-Amplifier	Hewlett Packard	8447D	2944A09041	RE	2015/08/11 * 12
CSCL-13	Ruler	Tajima	L19-55	none	RE	2016/02/22 * 12
COS-10	Temperature & Humidity Indicator	HIOKI	3641/9680-50	090999895/090905406	RE	2016/05/24 * 12
CTS-14	Digital Multimeter	FLUKE	115	994460954	RE	2015/10/01 * 12
CSA-06	Spectrum Analyzer	Agilent	N9030A	MY53310670 Version A.13.12	RE	2016/05/26 * 12
CSA-07	Spectrum Analyzer	Agilent	E4448A	MY52490024 Version A.11.21	RE/AT	2016/05/11 * 12
CHA-20	Broad Band Horn	Schwarzbeck	BBHA 9120D	9120D-1270	RE	2015/07/31 * 12
CHA-07	Double Ridged Horn	ETS-Lindgren	3160-09	00166043	RE	2016/06/24 * 12
CAF-19	Pre-Amplifier	TOYO	HAP18-26W	00000035	RE	2016/06/30 * 12
CAF-21	Pre-Amplifier	Micro Wave Factory	MPR-1G26.5-35	161398	RE	2016/05/06 * 12
CAT10-16	10dB Fixed Atten.	Weinschel	54A-10	56246	RE	2016/05/13 * 12
CHF-03	HPF	Micro-Tronics	HPM50111-02	008	RE	2016/05/13 * 12
CCC-W03	Micro Wave Cable	SUHNER	SUCOFLEX102	MY3772/2	RE	2016/05/12 * 12
CCC-W05	Micro Wave Cable	Junkosha	MWX241	MRA-12-14-145	RE	2016/05/13 * 12
CCC-W09	Micro Wave Cable	SUHNER	SUCOFLEX104	MY588/4	RE	2015/07/13 * 12

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
CAT10-17	10dB Fixed Atten.	Weinschel	54A-10	56251	AT	2016/05/13 * 12
CCC-W01	Micro Wave Cable	SUHNER	SUCOFLEX102	MY3662/2	AT	2016/05/13 * 12
CPM-16	Peak Power Analyzer	Agilent	8990B	MY51000276	AT	2016/06/01 * 12
CPSO-24	Power Sensor	Agilent	N1923A	MY54070024	AT	2016/06/01 * 12
COS-12	Temperature & Humidity Indicator	A&D	AD-5681	6876017	AT	2015/07/13 * 12

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

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

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

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