



RADIO TEST REPORT

Test Report No. : 11818228M-A-R3

Applicant : TAIYO YUDEN CO., LTD.
Type of Equipment : Bluetooth Smart / ANT Module
Model No. : EYSHSN
FCC ID : RYYEYSHSN
Test regulation : FCC Part 15 Subpart C: 2017
Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
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 11818228M-A-R2.

Date of test: June 15 - July 3, 2017

Representative test operator:

Kazuhiro Ando
Engineer
Consumer Technology Division

Approved by :

Tomoyuki Yamashita
Engineer
Consumer Technology Division



- 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.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan
Telephone : +81 478 88 6500
Facsimile : +81 478 82 3373

REVISION HISTORY

Original Test Report No.: 11818228M-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11818228M-A	July 26, 2017	-	-
1	11818228M-A-R1	August 7, 2017	P.5	Modification of the operation temperature range
2	11818228M-A-R2	August 29, 2017	P.6, P.31, P.33, P.34, P.37, P.39, P.40, P.43, P.45, P.46, P.49, P.51, P.52	Modification of the data
2	11818228M-A-R2	August 29, 2017	P.31, P.33, P.34, P.37, P.39, P.40, P.43, P.45, P.46, P.49, P.51, P.52	Add the comment
3	11818228M-A-R3	August 31, 2017	P.45, P.51, P.69, P.71	Modification of the frequency of mode
3	11818228M-A-R3	August 31, 2017	P.7	Modification of the Uncertainty

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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. : EYSHSN
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 3 V, 1.7 V - 3.6 V, 0.02 A, 0.1W
Receipt Date of Sample : June 19, 2017
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: EYSHSN (referred to as the EUT in this report) is a Bluetooth Smart / ANT Module.

General Specifications

Clock frequency(ies) in the system : 32 MHz

Radio Specification

<Bluetooth(BT) Low Energy (LE) (1 Mbps)>

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 : -3.7 dBi
Operation temperature range : -40 deg. C. to +85 deg. C.

<Bluetooth(BT) Low Energy (LE) (2 Mbps)>

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 : -3.7 dBi
Operation temperature range : -40 deg. C. to +85 deg. C.

<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 : -3.7 dBi
Operation temperature range : -40 deg. C. to +85 deg. C.

<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 : -3.7 dBi
Operation temperature range : -40 deg. C. to +85 deg. C.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on June 14, 2017 and effective July 14, 2017

* The revision on June 14, 2017, does not affect the test specification applied to the EUT.

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 ----- ISED: RSS-Gen 8.8	FCC: Section 15.207 ----- ISED: RSS-Gen 8.8	QP 12.2 dB, 0.38741 MHz, N AV 15.1 dB, 0.38913 MHz, N	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- ISED: -	FCC: Section 15.247(a)(2) ----- ISED: RSS-247 5.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- ISED: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ----- ISED: RSS-247 5.4(d)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- ISED: -	FCC: Section 15.247(e) ----- ISED: RSS-247 5.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- ISED: RSS-Gen 6.13	FCC: Section15.247(d) ----- ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	4.3 dB 2488.000 MHz, AV, Hori.	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.					

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

FCC Part 15.31 (e)

This EUT provides stable voltage (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	ISED: RSS-Gen 6.6	ISED: -	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 (+/-)
Conducted emission	0.15 MHz - 30 MHz	2.4 dB

Item	Frequency range	Uncertainty (+/-)
Radiated emission (Measurement distance: 3 m)	30 MHz - 200 MHz	4.2 dB
	200 MHz - 1 GHz	5.8 dB
	1 GHz - 6 GHz	5.1 dB
	6 GHz - 18 GHz	5.4 dB
Radiated emission (Measurement distance: 1 m)	18 GHz - 26.5 GHz	5.4 dB

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1GHz	0.7 dB
Spurious emission (Conducted) below 1 GHz	0.9 dB
Spurious emission (Conducted) 1 GHz - 3 GHz	1.5 dB
Spurious emission (Conducted) 3 GHz - 18 GHz	2.2 dB
Spurious emission (Conducted) 18 GHz - 26.5 GHz	2.5 dB
Bandwidth Measurement	2.0%

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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JAB Accreditation No. : RTL02610

Test site	ISED 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) 1Mbps	Maximum Packet Size, PRBS9
Bluetooth(BT) Low Energy (LE) 2Mbps	Maximum Packet Size, PRBS9
ANT	1Mbps
Nordic Original	2Mbps
<p>*Power of the EUT was set by the software as follows; Power settings: +4dBm, -40dBm Software: Radio_test_BLE2M available Radio_test_tool_BLE2M</p> <p>*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.</p>	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission,	BT LE 1Mbps Tx	2402 MHz
Spurious Emission (Radiated)	BT LE 2Mbps Tx	2440 MHz
Spurious Emission (Conducted)		2480 MHz
6dB Bandwidth	ANT Tx	2402 MHz
Maximum Peak Output Power	Nordic Original Tx	2441 MHz
Power Density		2480 MHz
99% Occupied Bandwidth		
Spurious Emission (Radiated, Band-edge)	BT LE 1Mbps Tx	2402 MHz
	BT LE 2Mbps Tx	2480 MHz
	ANT Tx	
	Nordic Original Tx	

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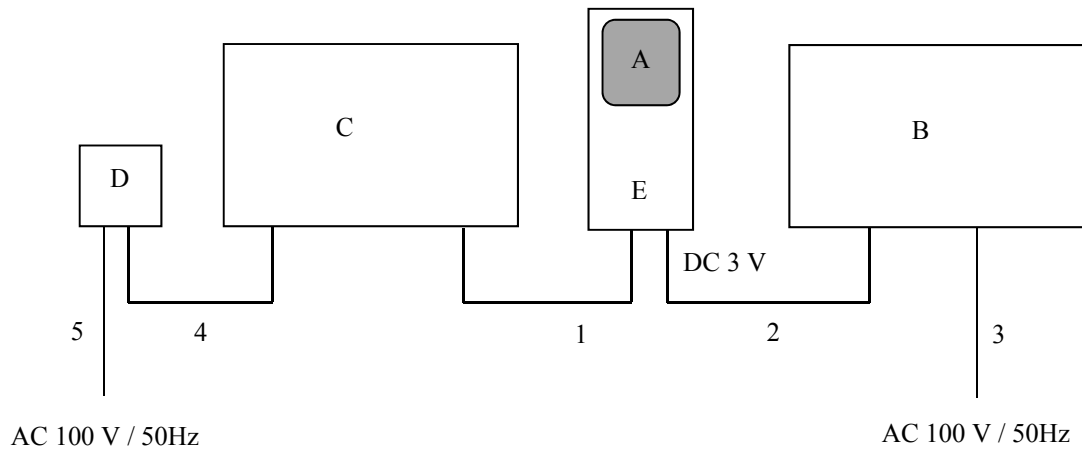
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4.2 Configuration and peripherals



* 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	EYSHSN	1	TAIYO YUDEN	EUT
B	DC Power Supply	GSV3000	1303141419	DIAMOND ANTENNA	-
C	PC	FMV-B8230	R7200268	FUJITSU	-
D	AC Adaptor	SEB55N2-16.0	08X01013A	FUJITSU	-
E	Evaluation Board	EBSHSNZWZ	1	TAIYO YUDEN	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	1.0	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	1.9	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

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SECTION 6: Radiated Spurious Emission

Test Procedure

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

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 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 v04".

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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 v04".

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

Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart.

(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 v04 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

APPENDIX 1: Test data

Conducted Emission

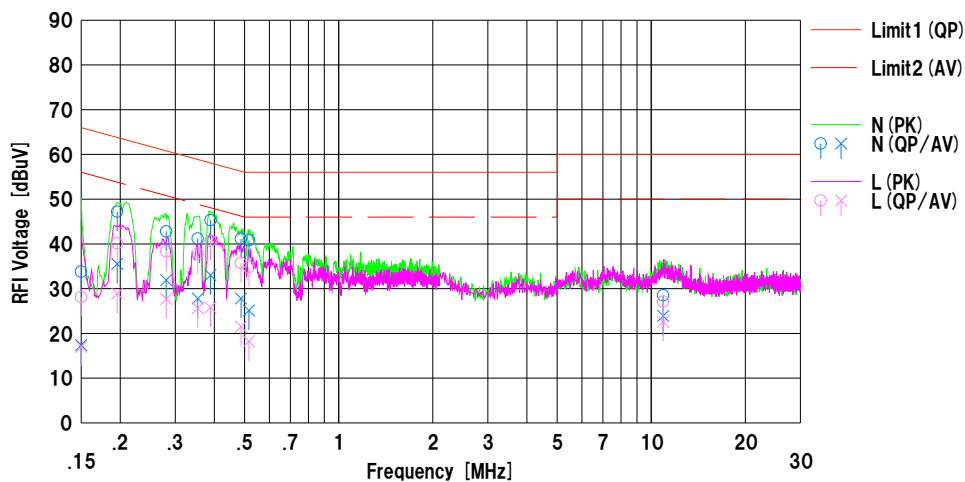
DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Kashima EMC Lab. No.5 Shielded Room
Date : 2017/06/22

Mode : Tx, BT LE 1Mbps, 2402MHz
Order No. : 11818228M
Power : DC 3V (AC 120V/60Hz)
Temp./Humi. : 24deg.C / 58%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	23.7	7.3	10.1	33.8	17.4	66.0	56.0	32.2	38.6	N	
2	0.19567	37.1	25.4	10.1	47.2	35.5	63.8	53.8	16.6	18.3	N	
3	0.28065	32.6	21.7	10.2	42.8	31.9	60.8	50.8	18.0	18.9	N	
4	0.35400	31.0	17.6	10.2	41.2	27.8	58.9	48.9	17.7	21.1	N	
5	0.38913	35.1	22.8	10.2	45.3	33.0	58.1	48.1	12.8	15.1	N	
6	0.48710	30.9	17.6	10.2	41.1	27.8	56.2	46.2	15.1	18.4	N	
7	0.51586	30.6	14.9	10.2	40.8	25.1	56.0	46.0	15.2	20.9	N	
8	10.91510	17.4	12.8	11.1	28.5	23.9	60.0	50.0	31.5	26.1	N	
9	0.15000	18.0	6.9	10.1	28.1	17.0	66.0	56.0	37.9	39.0	L	
10	0.19567	30.0	18.8	10.1	40.1	28.9	63.8	53.8	23.7	24.9	L	
11	0.28065	28.1	17.5	10.2	38.3	27.7	60.8	50.8	22.5	23.1	L	
12	0.35400	27.6	15.4	10.2	37.8	25.6	58.9	48.9	21.1	23.3	L	
13	0.38913	30.5	15.6	10.2	40.7	25.8	58.1	48.1	17.4	22.3	L	
14	0.48710	25.5	11.3	10.2	35.7	21.5	56.2	46.2	20.5	24.7	L	
15	0.51586	24.6	8.0	10.2	34.8	18.2	56.0	46.0	21.2	27.8	L	
16	10.91510	16.0	11.5	11.1	27.1	22.6	60.0	50.0	32.9	27.4	L	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable+ATT) [dB]
LISN:CLS-11

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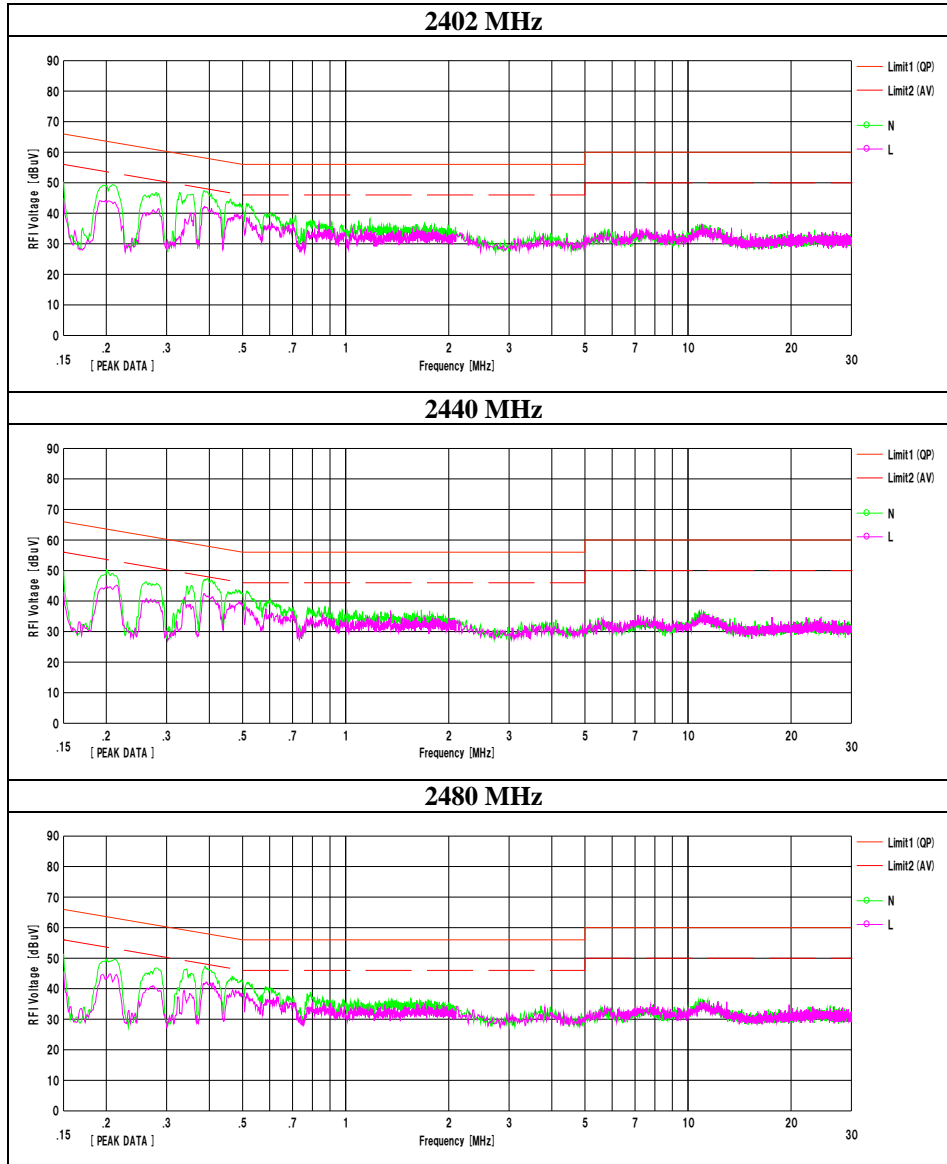
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Conducted Emission

Test place	Kashima EMC Lab. No.5 Shielded Room
Report No.	11818228M-A
Date	June 22, 2017
Temperature / Humidity	24 deg. C / 58 % RH
Engineer	Kazuhiro Ando
Mode	Tx



Conducted Emission

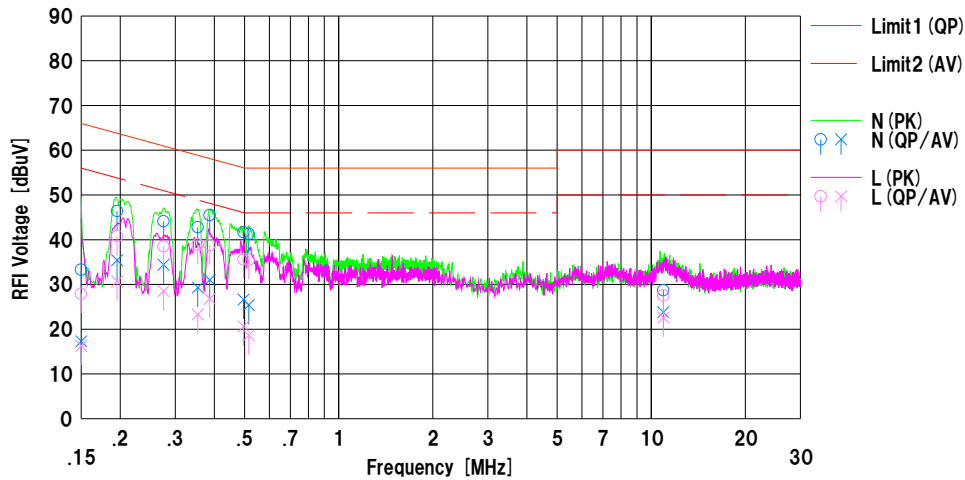
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.5 Shielded Room
Date : 2017/06/22

Mode : Tx, BT LE 2Mbps, 2402MHz
Order No. : 11818228M
Power : DC 3V (AC 120V/60Hz)
Temp./Humi. : 24deg.C / 58%RH

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

Tested by : Kazuhiro Ando

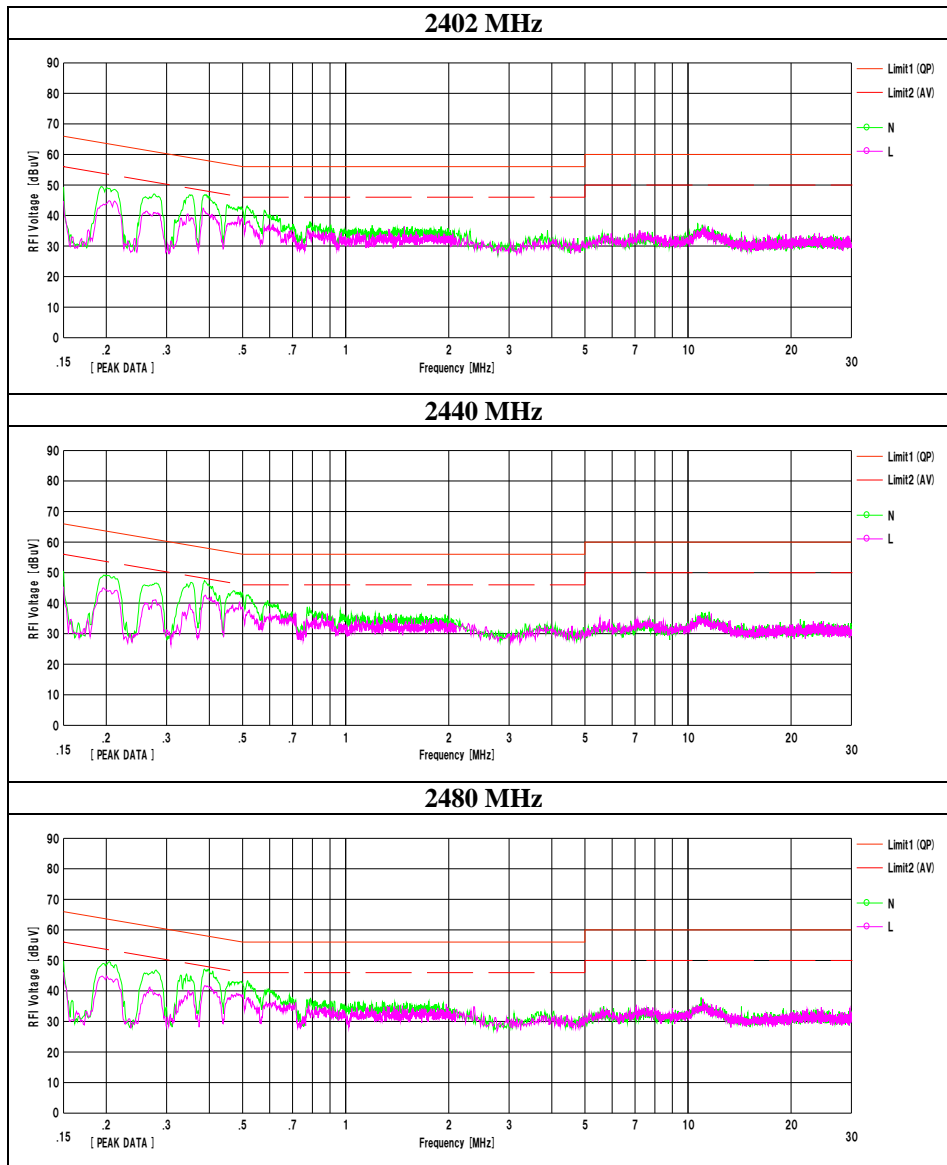


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	23.2	7.2	10.1	33.3	17.3	66.0	56.0	32.7	38.7	N	
2	0.19550	36.3	25.3	10.1	46.4	35.4	63.8	53.8	17.4	18.4	N	
3	0.27530	33.9	24.2	10.2	44.1	34.4	61.0	51.0	16.9	16.6	N	
4	0.35406	32.6	19.1	10.2	42.8	29.3	58.9	48.9	16.1	19.6	N	
5	0.38679	35.3	20.8	10.2	45.5	31.0	58.1	48.1	12.6	17.1	N	
6	0.49611	31.5	16.4	10.2	41.7	26.6	56.1	46.1	14.4	19.5	N	
7	0.51566	31.1	15.2	10.2	41.3	25.4	56.0	46.0	14.7	20.6	N	
8	10.93550	17.6	12.7	11.1	28.7	23.8	60.0	50.0	31.3	26.2	N	
9	0.15000	17.8	6.2	10.1	27.9	16.3	66.0	56.0	38.1	39.7	L	
10	0.19550	30.7	20.6	10.1	40.8	30.7	63.8	53.8	23.0	23.1	L	
11	0.27530	28.3	18.3	10.2	38.5	28.5	61.0	51.0	22.5	22.5	L	
12	0.35406	28.7	13.1	10.2	38.9	23.3	58.9	48.9	20.0	25.6	L	
13	0.38679	28.6	16.6	10.2	38.8	26.8	58.1	48.1	19.3	21.3	L	
14	0.49611	25.4	10.4	10.2	35.6	20.6	56.1	46.1	20.5	25.5	L	
15	0.51566	25.3	8.4	10.2	35.5	18.6	56.0	46.0	20.5	27.4	L	
16	10.93550	16.4	11.5	11.1	27.5	22.6	60.0	50.0	32.5	27.4	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN:CLS-11

Conducted Emission

Test place : Kashima EMC Lab. No.5 Shielded Room
Report No. : 11818228M-A
Date : June 22, 2017
Temperature / Humidity : 24 deg. C / 58 % RH
Engineer : Kazuhiro Ando
Mode : Tx BT LE (2Mbps)



Conducted Emission

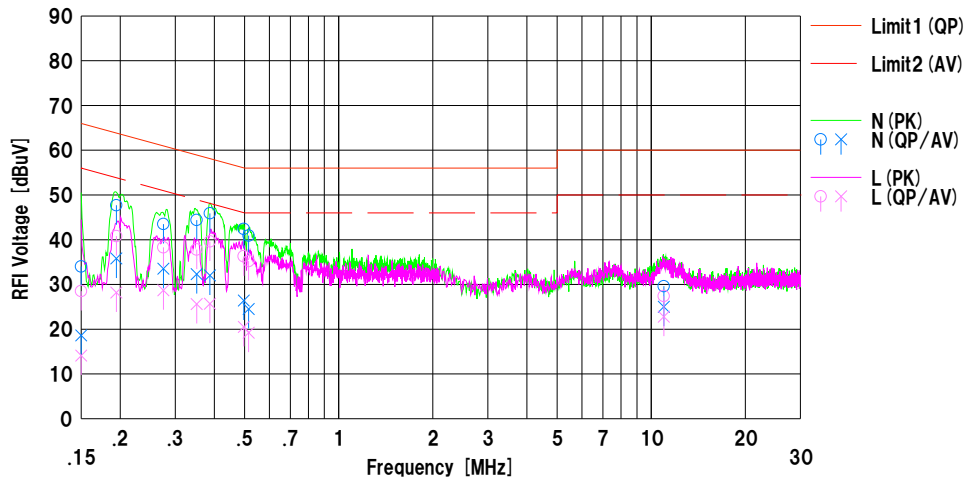
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.5 Shielded Room
Date : 2017/06/22

Mode : Tx. ANT. 2402MHz
Order No. : 11818228M
Power : DC 3V (AC 120V/60Hz)
Temp./Humi. : 24deg.C / 58%RH

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

Tested by : Kazuhiro Ando

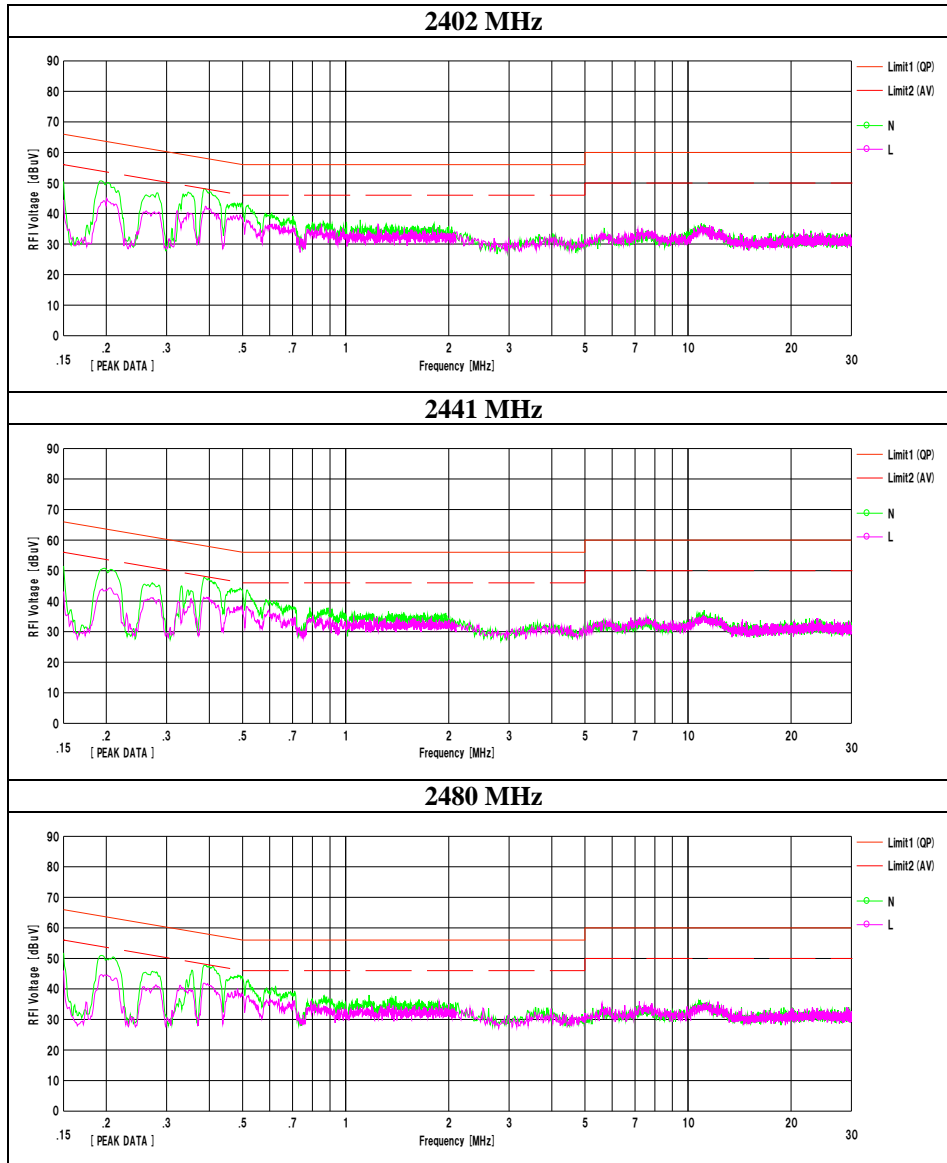


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	23.9	8.5	10.1	34.0	18.6	66.0	56.0	32.0	37.4	N	
2	0.19435	37.6	25.7	10.1	47.7	35.8	63.8	53.8	16.1	18.0	N	
3	0.27484	33.3	23.3	10.2	43.5	33.5	61.0	51.0	17.5	17.5	N	
4	0.35130	34.2	22.1	10.2	44.4	32.3	58.9	48.9	14.5	16.6	N	
5	0.38741	35.7	21.8	10.2	45.9	32.0	58.1	48.1	12.2	16.1	N	
6	0.49705	32.2	16.2	10.2	42.4	26.4	56.0	46.0	13.6	19.6	N	
7	0.51513	30.7	14.3	10.2	40.9	24.5	56.0	46.0	15.1	21.5	N	
8	10.97410	18.5	13.9	11.1	29.6	25.0	60.0	50.0	30.4	25.0	N	
9	0.15000	18.4	4.0	10.1	28.5	14.1	66.0	56.0	37.5	41.9	L	
10	0.19435	30.7	18.1	10.1	40.8	28.2	63.8	53.8	23.0	25.6	L	
11	0.27484	28.1	18.5	10.2	38.3	26.7	61.0	51.0	22.7	22.3	L	
12	0.35130	27.6	15.4	10.2	37.8	25.6	58.9	48.9	21.1	23.3	L	
13	0.38741	29.4	15.5	10.2	39.6	25.7	58.1	48.1	18.5	22.4	L	
14	0.49705	26.1	10.3	10.2	36.3	20.5	56.0	46.0	19.7	25.5	L	
15	0.51513	25.0	9.0	10.2	35.2	19.2	56.0	46.0	20.8	26.8	L	
16	10.97410	16.3	11.7	11.1	27.4	22.8	60.0	50.0	32.6	27.2	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN:CLS-11

Conducted Emission

Test place : Kashima EMC Lab. No.5 Shielded Room
Report No. : 11818228M-A
Date : June 22, 2017
Temperature / Humidity : 24 deg. C / 58 % RH
Engineer : Kazuhiro Ando
Mode : Tx ANT



Conducted Emission

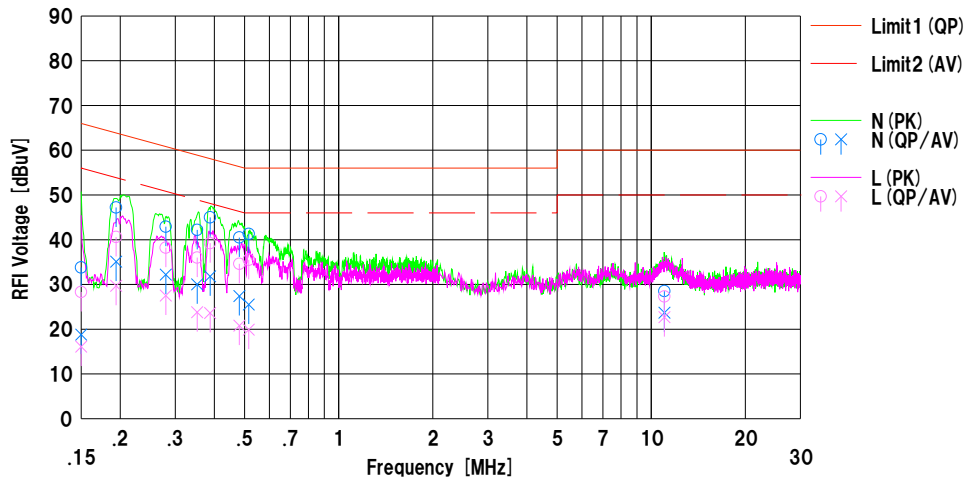
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.5 Shielded Room
Date : 2017/06/22

Mode : Tx, Nordic, 2480MHz
Order No. : 11818228M
Power : DC 3V (AC 120V/60Hz)
Temp./Humi. : 24deg.C / 58%RH

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

Tested by : Kazuhiro Ando

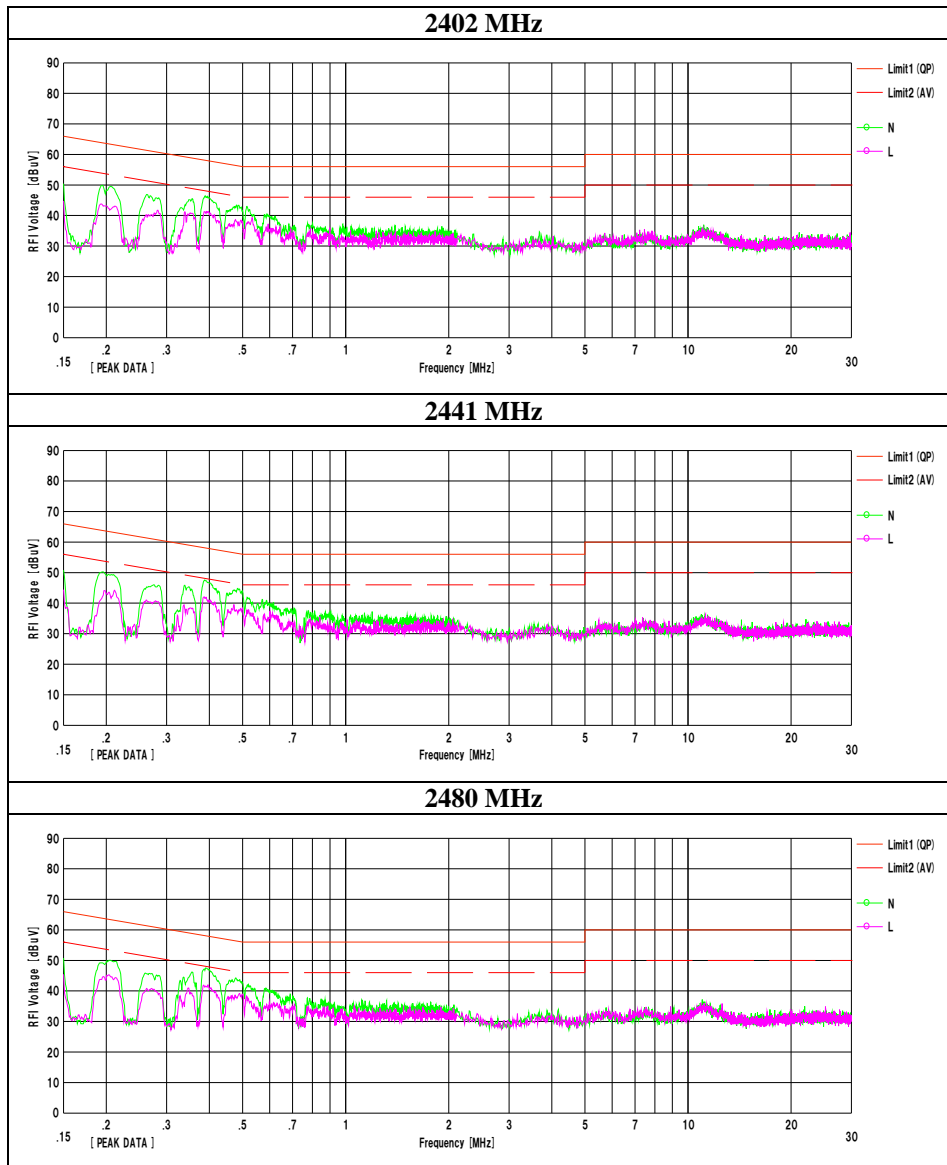


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	23.7	8.7	10.1	33.8	18.8	66.0	56.0	32.2	37.2	N	
2	0.19406	37.1	25.0	10.1	47.2	35.1	63.9	53.9	16.7	18.8	N	
3	0.27987	32.7	22.0	10.2	42.9	32.2	60.8	50.8	17.9	18.6	N	
4	0.35268	32.0	19.8	10.2	42.2	30.0	58.9	48.9	16.7	18.9	N	
5	0.38806	34.8	21.6	10.2	45.0	31.8	58.1	48.1	13.1	16.3	N	
6	0.48116	30.3	17.2	10.2	40.5	27.4	56.3	46.3	15.8	18.9	N	
7	0.51575	31.1	15.3	10.2	41.3	25.5	56.0	46.0	14.7	20.5	N	
8	11.02100	17.4	12.6	11.1	28.5	23.7	60.0	50.0	31.5	26.3	N	
9	0.15000	18.2	6.0	10.1	28.3	16.1	66.0	56.0	37.7	39.9	L	
10	0.19406	30.5	19.6	10.1	40.6	29.7	63.9	53.9	23.3	24.2	L	
11	0.27987	28.0	17.3	10.2	38.2	27.5	60.8	50.8	22.6	23.3	L	
12	0.35268	25.8	13.6	10.2	36.0	23.8	58.9	48.9	22.9	25.1	L	
13	0.38806	29.0	13.4	10.2	39.2	23.6	58.1	48.1	18.9	24.5	L	
14	0.48116	24.4	10.6	10.2	34.6	20.8	56.3	46.3	21.7	25.5	L	
15	0.51575	25.3	9.7	10.2	35.5	19.9	56.0	46.0	20.5	26.1	L	
16	11.02100	16.2	11.6	11.1	27.3	22.7	60.0	50.0	32.7	27.3	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN:CLS-11

Conducted Emission

Test place : Kashima EMC Lab. No.5 Shielded Room
Report No. : 11818228M-A
Date : June 22, 2017
Temperature / Humidity : 24 deg. C / 58 % RH
Engineer : Kazuhiro Ando
Mode : Tx Nordic Original

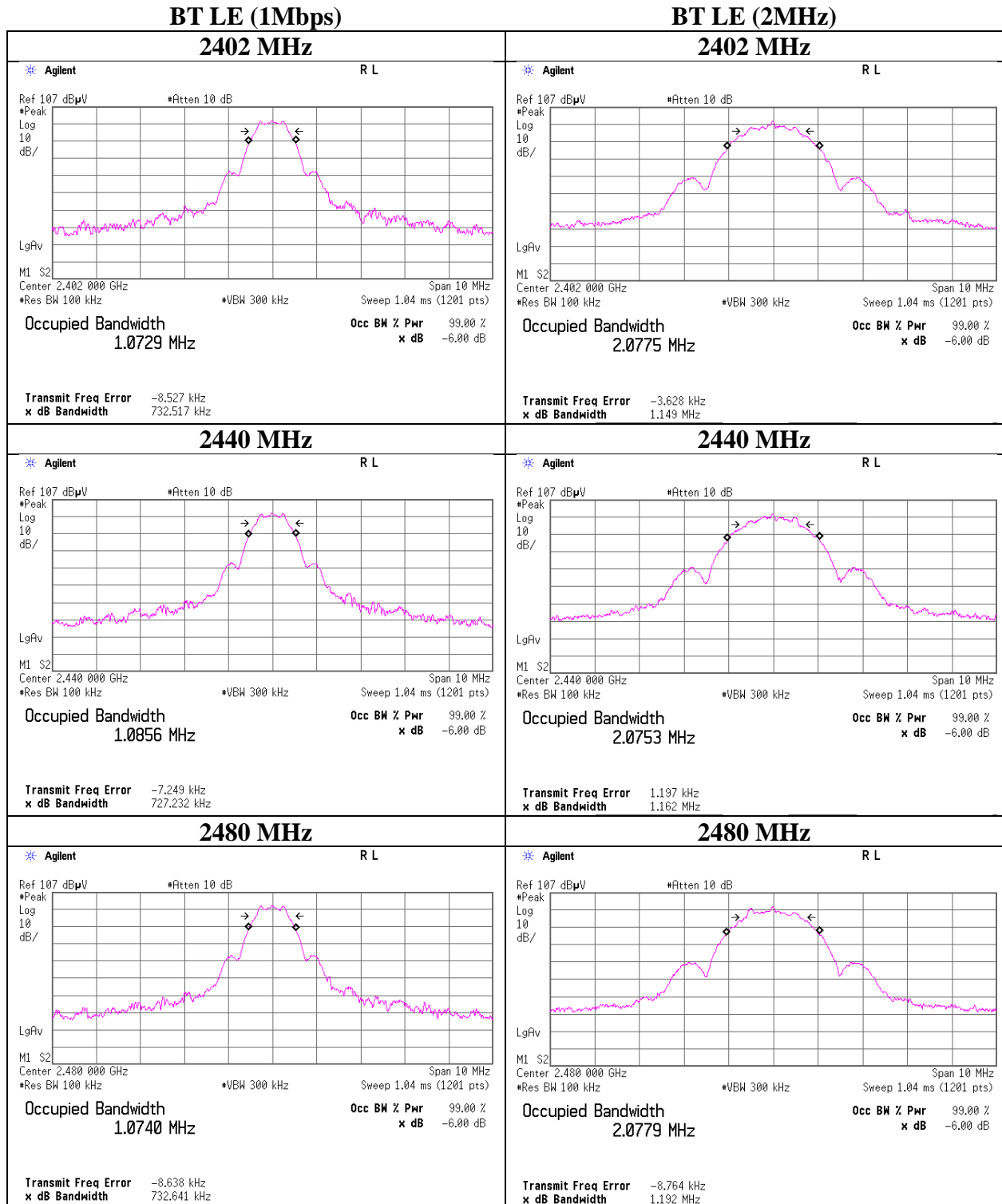


6dB Bandwidth

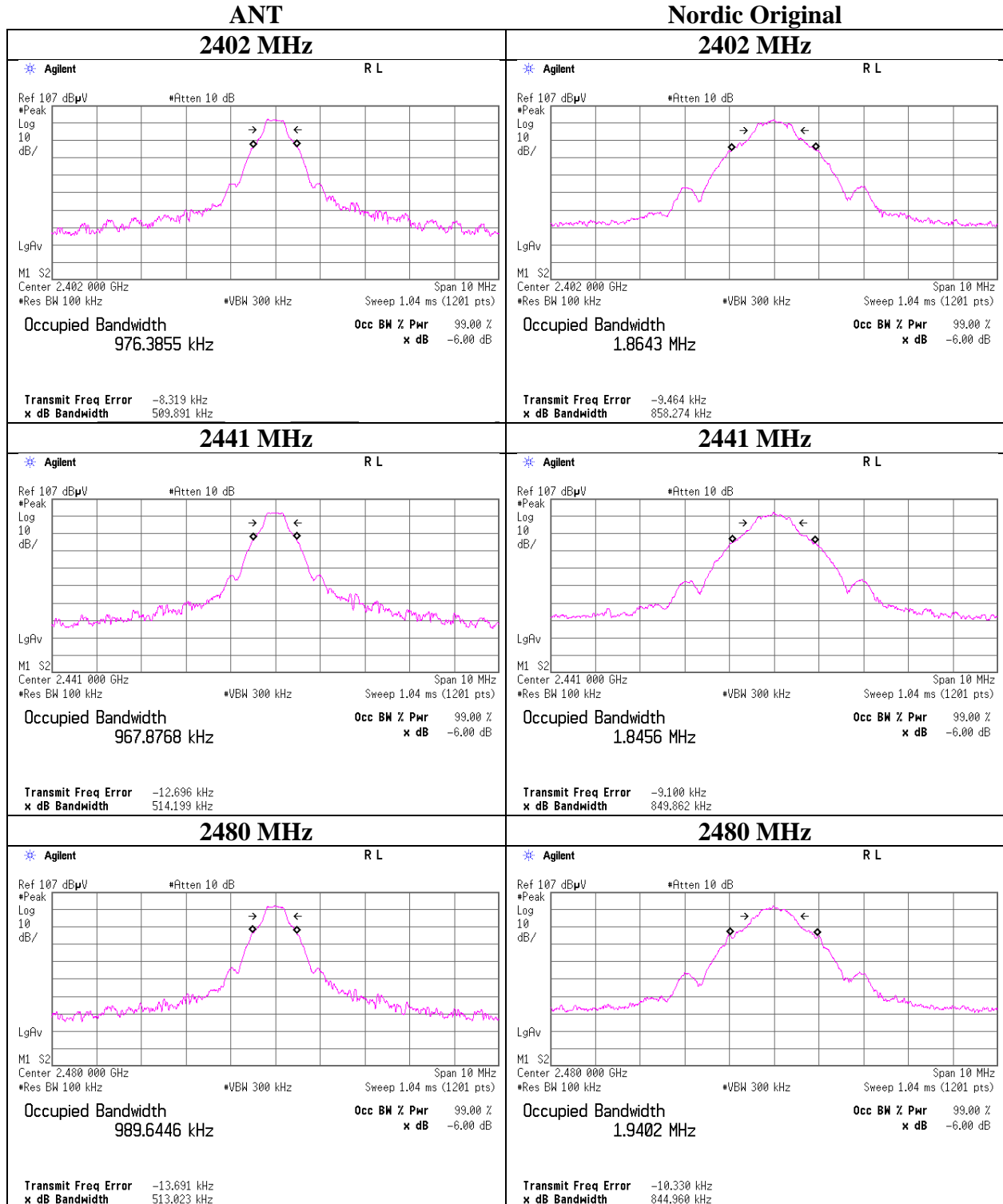
Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
BT LE (1Mbps)	2402	0.733	> 500
	2440	0.727	> 500
	2480	0.733	> 500
BT LE (2Mbps)	2402	1.149	> 500
	2440	1.162	> 500
	2480	1.192	> 500
ANT	2402	0.510	> 500
	2441	0.514	> 500
	2480	0.513	> 500
Nordic Original	2402	0.858	> 500
	2441	0.850	> 500
	2480	0.845	> 500

6dB Bandwidth



6dB Bandwidth



Maximum Peak Output Power

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx (+4dBm setting)

BT LE (1Mbps)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-7.66	1.06	10.04	3.44	2.21	30.00	1000	26.56
2440	-7.57	1.07	10.04	3.54	2.26	30.00	1000	26.46
2480	-7.59	1.08	10.04	3.53	2.25	30.00	1000	26.47

BT LE (2Mbps)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-7.67	1.06	10.04	3.43	2.20	30.00	1000	26.57
2440	-7.59	1.07	10.04	3.52	2.25	30.00	1000	26.48
2480	-7.59	1.08	10.04	3.53	2.25	30.00	1000	26.47

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-7.66	1.06	10.04	3.44	2.21	30.00	1000	26.56
2441	-7.56	1.07	10.04	3.55	2.26	30.00	1000	26.45
2480	-7.59	1.08	10.04	3.53	2.25	30.00	1000	26.47

Nordic Original

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-7.67	1.06	10.04	3.43	2.20	30.00	1000	26.57
2441	-7.57	1.07	10.04	3.54	2.26	30.00	1000	26.46
2480	-7.58	1.08	10.04	3.54	2.26	30.00	1000	26.46

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.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx (-40dBm setting)

BT LE (1Mbps)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-51.46	1.06	10.04	-40.36	0.00009	30.00	1000	70.36
2440	-51.36	1.07	10.04	-40.25	0.00009	30.00	1000	70.25
2480	-51.17	1.08	10.04	-40.05	0.00010	30.00	1000	70.05

BT LE (2Mbps)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-51.46	1.06	10.04	-40.36	0.00009	30.00	1000	70.36
2440	-51.24	1.07	10.04	-40.13	0.00010	30.00	1000	70.13
2480	-51.16	1.08	10.04	-40.04	0.00010	30.00	1000	70.04

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-51.44	1.06	10.04	-40.34	0.00009	30.00	1000	70.34
2441	-51.37	1.07	10.04	-40.26	0.00009	30.00	1000	70.26
2480	-51.16	1.08	10.04	-40.04	0.00010	30.00	1000	70.04

Nordic Original

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-51.37	1.06	10.04	-40.27	0.00009	30.00	1000	70.27
2441	-51.32	1.07	10.04	-40.21	0.00010	30.00	1000	70.21
2480	-51.23	1.08	10.04	-40.11	0.00010	30.00	1000	70.11

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)

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx (+4dBm setting)

BT LE (1Mbps)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-8.16	1.06	10.04	2.94	1.97	0.23	3.17	2.07
2440	-8.08	1.07	10.04	3.03	2.01	0.23	3.26	2.12
2480	-8.09	1.08	10.04	3.03	2.01	0.23	3.26	2.12

BT LE (2Mbps)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-8.39	1.06	10.04	2.71	1.87	0.44	3.15	2.07
2440	-8.30	1.07	10.04	2.81	1.91	0.44	3.25	2.11
2480	-8.31	1.08	10.04	2.81	1.91	0.44	3.25	2.11

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	-8.16	1.06	10.04	2.94	1.97	0.23	3.17	2.07
2441	-8.07	1.07	10.04	3.04	2.01	0.23	3.27	2.12
2480	-8.08	1.08	10.04	3.04	2.01	0.23	3.27	2.12

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	-8.39	1.06	10.04	2.71	1.87	0.44	3.15	2.07
2441	-8.30	1.07	10.04	2.81	1.91	0.44	3.25	2.11
2480	-8.31	1.08	10.04	2.81	1.91	0.44	3.25	2.11

Sample Calculation:

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

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx (-40dBm setting)

BT LE (1Mbps)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-52.50	1.06	10.04	-41.40	0.00007	0.23	-41.17	0.00
2440	-52.41	1.07	10.04	-41.30	0.00007	0.23	-41.07	0.00
2480	-52.13	1.08	10.04	-41.01	0.00008	0.23	-40.78	0.00

BT LE (2Mbps)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-52.75	1.06	10.04	-41.65	0.00007	0.44	-41.21	0.00
2440	-52.56	1.07	10.04	-41.45	0.00007	0.44	-41.01	0.00
2480	-52.47	1.08	10.04	-41.35	0.00007	0.44	-40.91	0.00

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	-52.53	1.06	10.04	-41.43	0.00007	0.23	-41.20	0.00
2441	-52.42	1.07	10.04	-41.31	0.00007	0.23	-41.08	0.00
2480	-52.29	1.08	10.04	-41.17	0.00008	0.23	-40.94	0.00

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	-52.92	1.06	10.04	-41.82	0.00007	0.44	-41.38	0.00
2441	-52.65	1.07	10.04	-41.54	0.00007	0.44	-41.10	0.00
2480	-52.50	1.08	10.04	-41.38	0.00007	0.44	-40.94	0.00

Sample Calculation:

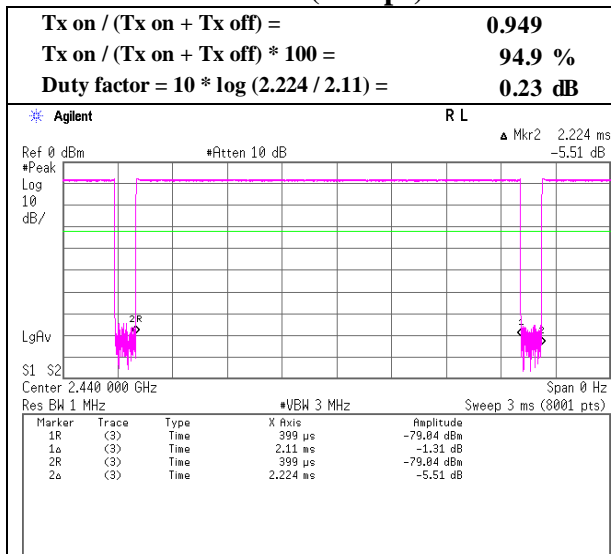
Result (Frame power) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator
Result (Burst power) = Frame power + Duty factor

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

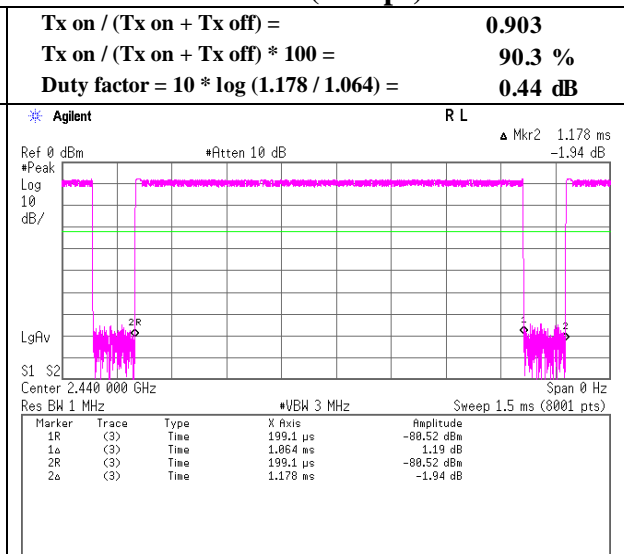
Burst rate confirmation

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11818228M-A
Date	June 15, 2017
Temperature / Humidity	22 deg. C / 54 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx

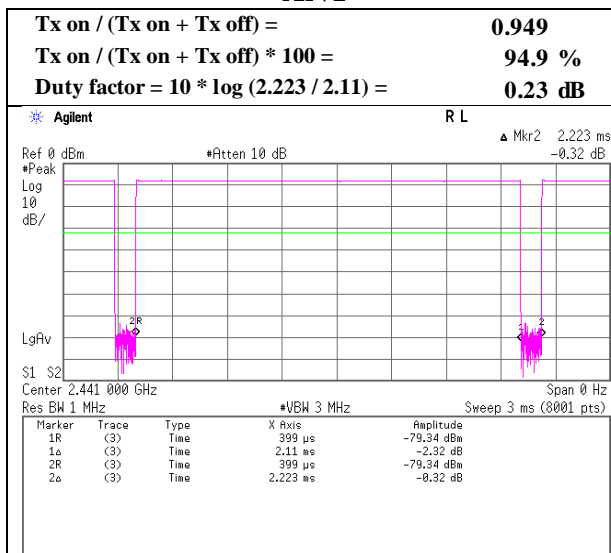
BT LE (1Mbps)



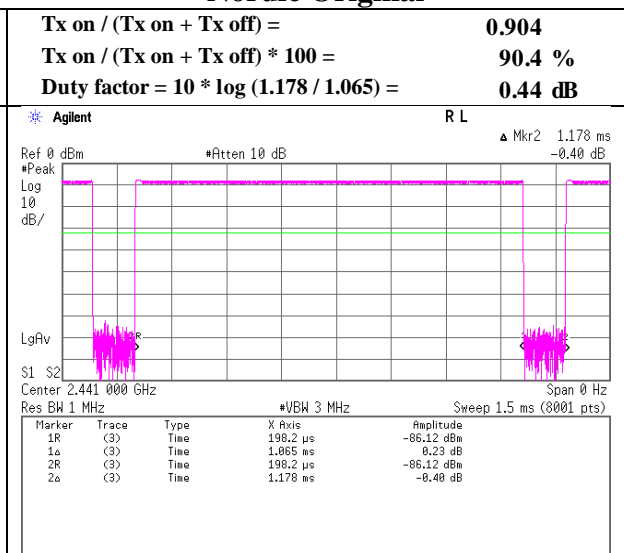
BT LE (2Mbps)



ANT



Nordic Original



Radiated Spurious Emission

Test place Kashima EMC Lab. No.10 Semi Anechoic Chamber (1-26GHz)
 Kashima EMC Lab. No.11 Semi Anechoic Chamber (30-1000MHz)
Report No. 11818228M-A
Date July 3, 2017 June 28, 2017 July 2, 2017
Temperature / Humidity 22 deg. C / 59 % RH 20 deg. C / 58 % RH 22 deg. C / 45 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
 (30-1000MHz) (1-10GHz) (10-26GHz)
Mode Tx BT LE (1Mbps), 2402MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	128.000	QP	33.00	12.00	4.80	32.20	0.00	17.60	43.50	25.9	215	191	
Hori.	204.518	QP	27.50	9.70	5.40	32.10	0.00	10.50	43.50	33.0	180	280	
Hori.	2390.000	PK	49.20	27.60	13.50	42.10	3.50	51.70	73.90	22.2	187	291	
Hori.	4804.000	PK	46.10	31.30	5.60	41.90	3.50	44.60	73.90	29.3	125	25	
Hori.	7206.000	PK	45.80	36.30	7.00	40.90	3.50	51.70	73.90	22.2	125	235	
Hori.	9608.000	PK	44.30	38.60	7.80	39.90	3.50	54.30	73.90	19.6	100	0	Floor Noise
Vert.	80.000	QP	32.60	9.00	4.40	32.20	0.00	13.80	40.00	26.2	100	0	
Vert.	137.284	QP	42.40	12.90	4.90	32.20	0.00	28.00	43.50	15.5	100	0	
Vert.	204.518	QP	37.70	9.70	5.40	32.10	0.00	20.70	43.50	22.8	100	322	
Vert.	2390.000	PK	50.00	27.60	13.50	42.10	3.50	52.50	73.90	21.4	100	161	
Vert.	4804.000	PK	47.30	31.30	5.60	41.90	3.50	45.80	73.90	28.1	148	339	
Vert.	7206.000	PK	46.60	36.30	7.00	40.90	3.50	52.50	73.90	21.4	127	338	
Vert.	9608.000	PK	44.70	38.60	7.80	39.90	3.50	54.70	73.90	19.2	100	0	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	38.60	27.60	13.50	42.10	0.23	3.50	41.33	53.90	12.6	*1)
Hori.	4804.000	AV	37.30	31.30	5.60	41.90	0.23	3.50	36.03	53.90	17.9	
Hori.	7206.000	AV	37.50	36.30	7.00	40.90	0.23	3.50	43.63	53.90	10.3	
Hori.	9608.000	AV	35.10	38.60	7.80	39.90	0.23	3.50	45.33	53.90	8.6	Floor Noise
Vert.	2390.000	AV	38.80	27.60	13.50	42.10	0.23	3.50	41.53	53.90	12.4	*1)
Vert.	4804.000	AV	38.10	31.30	5.60	41.90	0.23	3.50	36.83	53.90	17.1	
Vert.	7206.000	AV	37.50	36.30	7.00	40.90	0.23	3.50	43.63	53.90	10.3	
Vert.	9608.000	AV	35.50	38.60	7.80	39.90	0.23	3.50	45.73	53.90	8.2	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	92.60	27.60	13.50	42.10	3.50	95.10	-	-	Carrier
Hori.	2394.000	PK	47.20	27.60	13.50	42.10	3.50	49.70	75.10	25.4	
Hori.	2400.000	PK	44.80	27.60	13.50	42.10	3.50	47.30	75.10	27.8	
Vert.	2402.000	PK	92.80	27.60	13.50	42.10	3.50	95.30	-	-	Carrier
Vert.	2394.000	PK	48.00	27.60	13.50	42.10	3.50	50.50	75.30	24.8	
Vert.	2400.000	PK	44.50	27.60	13.50	42.10	3.50	47.00	75.30	28.3	

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

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Kashima EMC Lab.

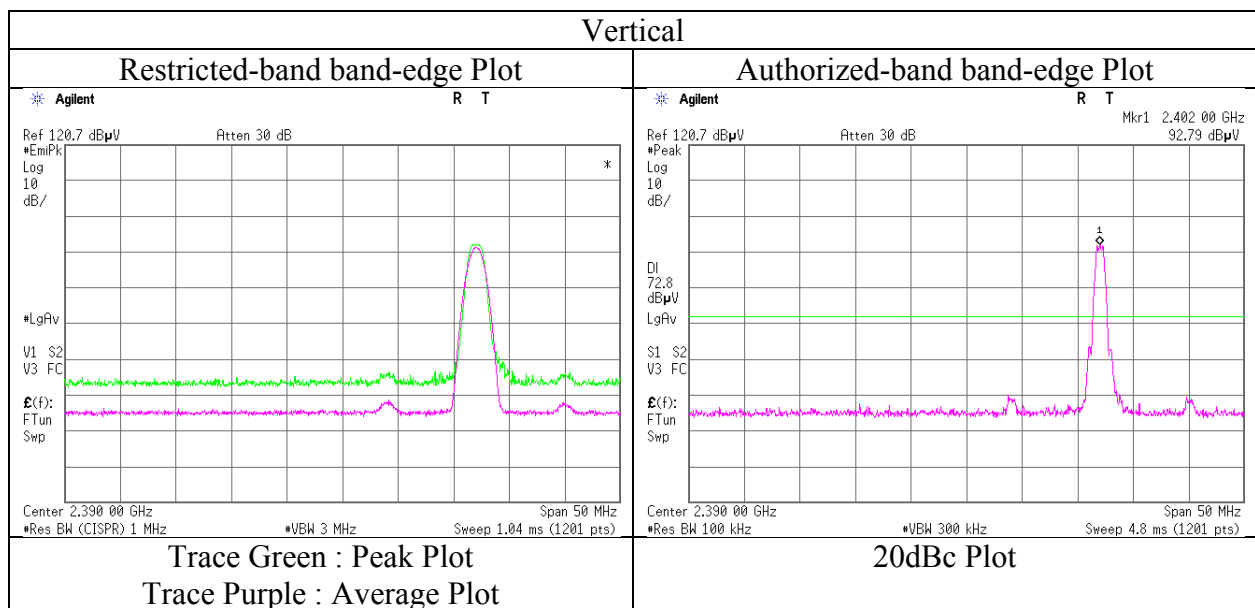
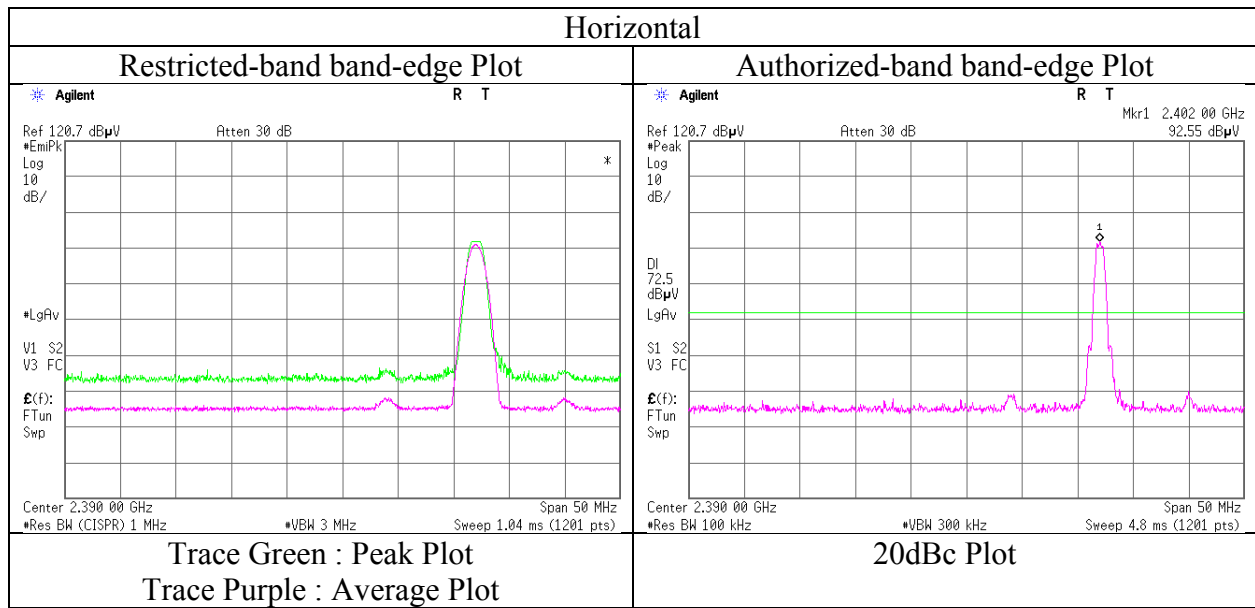
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11818228M-A
Date	June 28, 2017
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx BT LE (1Mbps), 2402MHz



* 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. : 11818228M-A
Date : June 28, 2017 July 2, 2017
Temperature / Humidity : 20 deg. C / 58 % RH 22 deg. C / 45 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando
(1-10GHz) (10-26GHz)
Mode : Tx BT LE (1Mbps), 2440MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4880.000	PK	46.50	31.20	5.70	41.90	3.50	45.00	73.90	28.9	110	20	
Hori.	7320.000	PK	46.80	36.20	7.10	40.90	3.50	52.70	73.90	21.2	115	80	
Hori.	9760.000	PK	43.00	39.30	7.90	39.80	3.50	53.90	73.90	20.0	100	0	Floor Noise
Vert.	4880.000	PK	47.10	31.20	5.70	41.90	3.50	45.60	73.90	28.3	143	342	
Vert.	7320.000	PK	47.50	36.20	7.10	40.90	3.50	53.40	73.90	20.5	186	197	
Vert.	9760.000	PK	43.60	39.30	7.90	39.80	3.50	54.50	73.90	19.4	100	0	Floor Noise

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

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

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	37.70	31.20	5.70	41.90	0.23	3.50	36.43	53.90	17.5	
Hori.	7320.000	AV	38.00	36.20	7.10	40.90	0.23	3.50	44.13	53.90	9.8	
Hori.	9760.000	AV	34.00	39.30	7.90	39.80	0.23	3.50	45.13	53.90	8.8	Floor Noise
Vert.	4880.000	AV	38.40	31.20	5.70	41.90	0.23	3.50	37.13	53.90	16.8	
Vert.	7320.000	AV	38.90	36.20	7.10	40.90	0.23	3.50	45.03	53.90	8.9	
Vert.	9760.000	AV	34.50	39.30	7.90	39.80	0.23	3.50	45.63	53.90	8.3	Floor Noise

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

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

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

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No. : 11818228M-A
Date : June 28, 2017 July 2, 2017
Temperature / Humidity : 20 deg. C / 58 % RH 22 deg. C / 45 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando
(1-10GHz) (10-26GHz)
Mode : Tx BT LE (1Mbps), 2480MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	53.90	27.50	13.60	42.10	3.50	56.40	73.90	17.5	154	301	
Hori.	2488.000	PK	51.70	27.50	13.60	42.10	3.50	54.20	73.90	19.7	154	301	
Hori.	4960.000	PK	46.90	31.30	5.70	41.90	3.50	45.50	73.90	28.4	150	5	
Hori.	7440.000	PK	47.20	36.60	7.10	40.90	3.50	53.50	73.90	20.4	105	40	
Hori.	9920.000	PK	43.60	39.40	8.00	39.60	3.50	54.90	73.90	19.0	100	0	Floor Noise
Vert.	2483.500	PK	52.90	27.50	13.60	42.10	3.50	55.40	73.90	18.5	155	288	
Vert.	2488.000	PK	53.40	27.50	13.60	42.10	3.50	55.90	73.90	18.0	155	288	
Vert.	4960.000	PK	47.80	31.30	5.70	41.90	3.50	46.40	73.90	27.5	151	335	
Vert.	7440.000	PK	47.00	36.60	7.10	40.90	3.50	53.30	73.90	20.6	183	178	
Vert.	9920.000	PK	44.00	39.40	8.00	39.60	3.50	55.30	73.90	18.6	100	0	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	39.40	27.50	13.60	42.10	0.23	3.50	42.13	53.90	11.8	*1)
Hori.	2488.000	AV	45.70	27.50	13.60	42.10	0.23	3.50	48.43	53.90	5.5	
Hori.	4960.000	AV	38.00	31.30	5.70	41.90	0.23	3.50	36.83	53.90	17.1	
Hori.	7440.000	AV	38.00	36.60	7.10	40.90	0.23	3.50	44.53	53.90	9.4	
Hori.	9920.000	AV	34.20	39.40	8.00	39.60	0.23	3.50	45.73	53.90	8.2	Floor Noise
Vert.	2483.500	AV	39.70	27.50	13.60	42.10	0.23	3.50	42.43	53.90	11.5	*1)
Vert.	2488.000	AV	45.60	27.50	13.60	42.10	0.23	3.50	48.33	53.90	5.6	
Vert.	4960.000	AV	39.00	31.30	5.70	41.90	0.23	3.50	37.83	53.90	16.1	
Vert.	7440.000	AV	38.80	36.60	7.10	40.90	0.23	3.50	45.33	53.90	8.6	
Vert.	9920.000	AV	34.00	39.40	8.00	39.60	0.23	3.50	45.53	53.90	8.4	Floor Noise

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

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

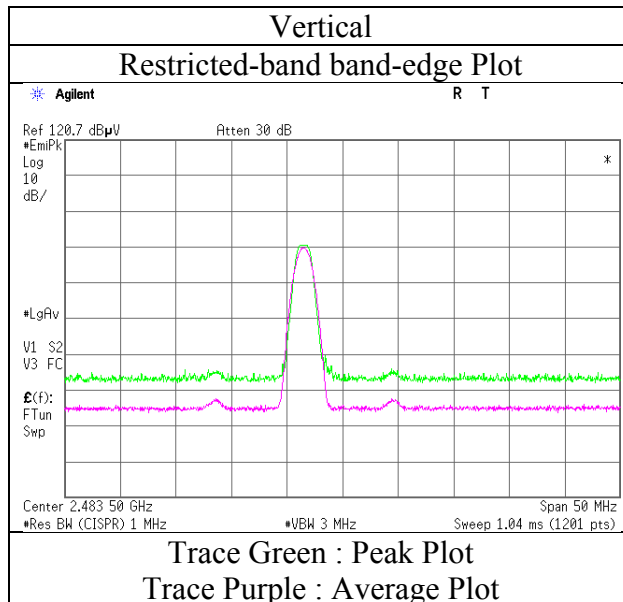
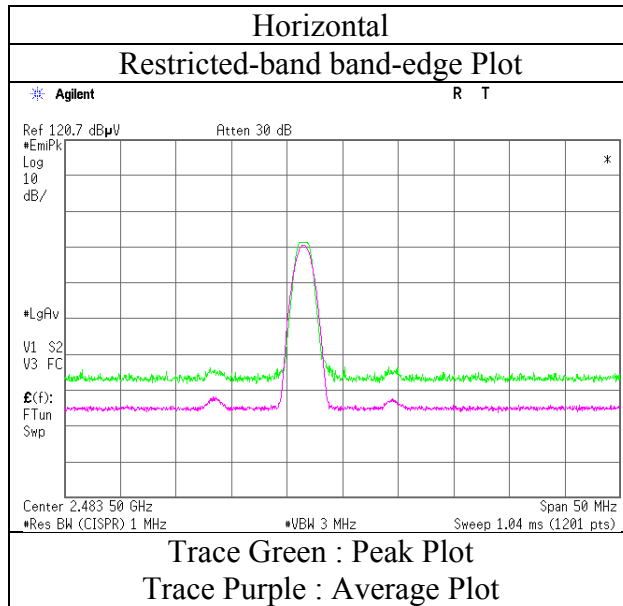
10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

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

Radiated Spurious Emission
(Reference Plot for band-edge)

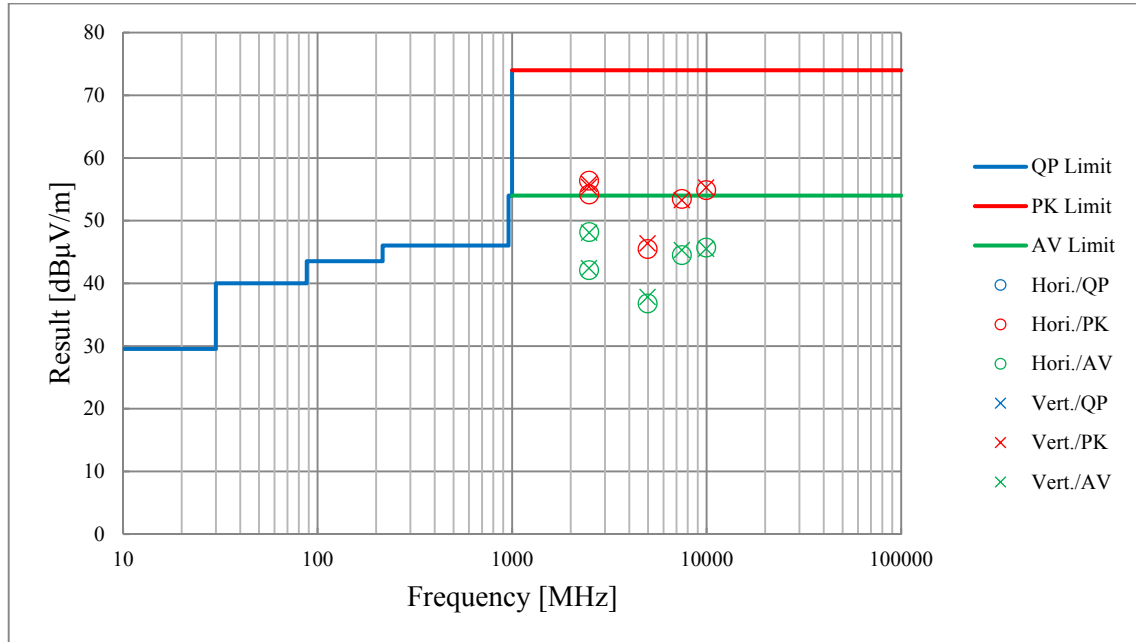
Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11818228M-A
Date	June 28, 2017
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx BT LE (1Mbps), 2480MHz



* 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. 11818228M-A
Date June 28, 2017 July 2, 2017
Temperature / Humidity 20 deg. C / 58 % RH 22 deg. C / 45 % RH
Engineer Kazuhiro Ando Kazuhiro Ando
 (1-10GHz) (10-26GHz)
Mode Tx BT LE (1Mbps), 2480MHz



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

Radiated Spurious Emission

Test place Kashima EMC Lab. No.10 Semi Anechoic Chamber (1-26GHz)
 Kashima EMC Lab. No.11 Semi Anechoic Chamber (30-1000MHz)
Report No. 11818228M-A
Date July 3, 2017 June 28, 2017 July 2, 2017
Temperature / Humidity 22 deg. C / 59 % RH 20 deg. C / 58 % RH 22 deg. C / 45 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
 (30-1000MHz) (1-10GHz) (10-26GHz)
Mode Tx BT LE (2Mbps), 2402MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	128.000	QP	33.70	12.00	4.80	32.20	0.00	18.30	43.50	25.2	230	170	
Hori.	205.018	QP	26.80	9.70	5.40	32.10	0.00	9.80	43.50	33.7	181	278	
Hori.	2390.000	PK	49.90	27.60	13.50	42.10	3.50	52.40	73.90	21.5	132	300	
Hori.	4804.000	PK	46.60	31.30	5.60	41.90	3.50	45.10	73.90	28.8	145	235	
Hori.	7206.000	PK	45.50	36.30	7.00	40.90	3.50	51.40	73.90	22.5	105	235	
Hori.	9608.000	PK	44.10	38.60	7.80	39.90	3.50	54.10	73.90	19.8	100	0	Floor Noise
Vert.	80.000	QP	32.50	9.00	4.40	32.20	0.00	13.70	40.00	26.3	100	0	
Vert.	135.900	QP	43.20	12.80	4.90	32.20	0.00	28.70	43.50	14.8	100	178	
Vert.	205.018	QP	37.00	9.70	5.40	32.10	0.00	20.00	43.50	23.5	100	331	
Vert.	2390.000	PK	49.80	27.60	13.50	42.10	3.50	52.30	73.90	21.6	165	355	
Vert.	4804.000	PK	47.30	31.30	5.60	41.90	3.50	45.80	73.90	28.1	148	323	
Vert.	7206.000	PK	45.40	36.30	7.00	40.90	3.50	51.30	73.90	22.6	125	356	
Vert.	9608.000	PK	44.80	38.60	7.80	39.90	3.50	54.80	73.90	19.1	100	0	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	38.70	27.60	13.50	42.10	0.44	3.50	41.64	53.90	12.3	*1)
Hori.	4804.000	AV	37.00	31.30	5.60	41.90	0.44	3.50	35.94	53.90	18.0	
Hori.	7206.000	AV	36.30	36.30	7.00	40.90	0.44	3.50	42.64	53.90	11.3	
Hori.	9608.000	AV	34.60	38.60	7.80	39.90	0.44	3.50	45.04	53.90	8.9	Floor Noise
Vert.	2390.000	AV	38.90	27.60	13.50	42.10	0.44	3.50	41.84	53.90	12.1	*1)
Vert.	4804.000	AV	38.20	31.30	5.60	41.90	0.44	3.50	37.14	53.90	16.8	
Vert.	7206.000	AV	36.40	36.30	7.00	40.90	0.44	3.50	42.74	53.90	11.2	
Vert.	9608.000	AV	35.70	38.60	7.80	39.90	0.44	3.50	46.14	53.90	7.8	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	93.00	27.60	13.50	42.10	3.50	95.50	-	-	Carrier
Hori.	2394.000	PK	48.50	27.60	13.50	42.10	3.50	51.00	75.50	24.5	
Hori.	2400.000	PK	59.00	27.60	13.50	42.10	3.50	61.50	75.50	14.0	
Vert.	2402.000	PK	91.40	27.60	13.50	42.10	3.50	93.90	-	-	Carrier
Vert.	2394.000	PK	46.10	27.60	13.50	42.10	3.50	48.60	73.90	25.3	
Vert.	2400.000	PK	58.10	27.60	13.50	42.10	3.50	60.60	73.90	13.3	

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

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Kashima EMC Lab.

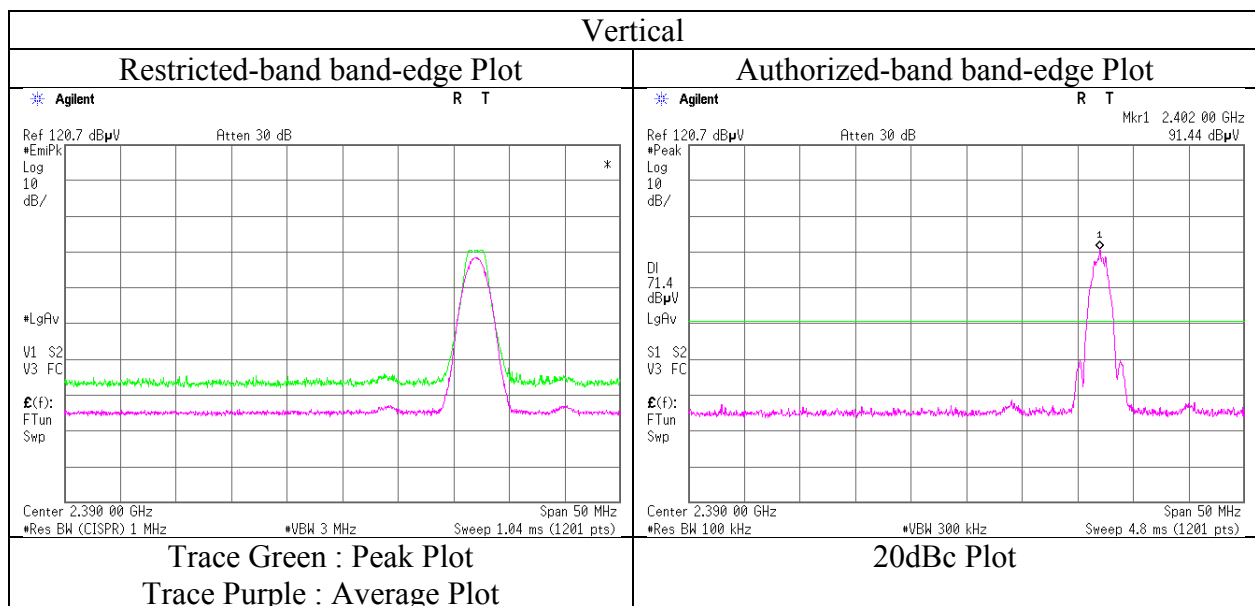
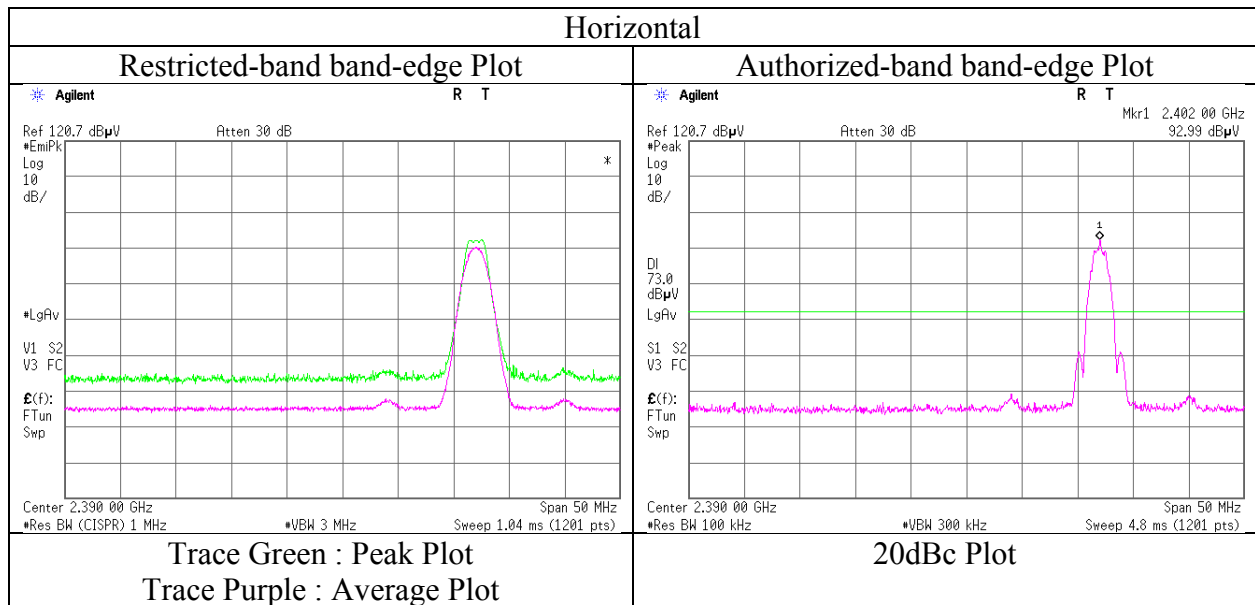
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Facsimile : +81 478 82 3373

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11818228M-A
Date	June 28, 2017
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx BT LE (2Mbps), 2402MHz



* 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. : 11818228M-A
Date : June 28, 2017 July 2, 2017
Temperature / Humidity : 20 deg. C / 58 % RH 22 deg. C / 45 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando
(1-10GHz) (10-26GHz)
Mode : Tx BT LE (2Mbps), 2440MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4880.000	PK	46.30	31.20	5.70	41.90	3.50	44.80	73.90	29.1	112	20	
Hori.	7320.000	PK	46.80	36.20	7.10	40.90	3.50	52.70	73.90	21.2	110	65	
Hori.	9760.000	PK	43.20	39.30	7.90	39.80	3.50	54.10	73.90	19.8	100	0	Floor Noise
Vert.	4880.000	PK	47.20	31.20	5.70	41.90	3.50	45.70	73.90	28.2	145	341	
Vert.	7320.000	PK	46.60	36.20	7.10	40.90	3.50	52.50	73.90	21.4	197	180	
Vert.	9760.000	PK	44.10	39.30	7.90	39.80	3.50	55.00	73.90	18.9	100	0	Floor Noise

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

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

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	37.10	31.20	5.70	41.90	0.44	3.50	36.04	53.90	17.9	
Hori.	7320.000	AV	37.40	36.20	7.10	40.90	0.44	3.50	43.74	53.90	10.2	
Hori.	9760.000	AV	33.60	39.30	7.90	39.80	0.44	3.50	44.94	53.90	9.0	Floor Noise
Vert.	4880.000	AV	38.00	31.20	5.70	41.90	0.44	3.50	36.94	53.90	17.0	
Vert.	7320.000	AV	37.80	36.20	7.10	40.90	0.44	3.50	44.14	53.90	9.8	
Vert.	9760.000	AV	34.50	39.30	7.90	39.80	0.44	3.50	45.84	53.90	8.1	Floor Noise

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

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

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

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No. : 11818228M-A
Date : June 28, 2017 July 2, 2017
Temperature / Humidity : 20 deg. C / 58 % RH 22 deg. C / 45 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando
(1-10GHz) (10-26GHz)
Mode : Tx BT LE (2Mbps), 2480MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	53.70	27.50	13.60	42.10	3.50	56.20	73.90	17.7	153	298	
Hori.	2488.000	PK	52.90	27.50	13.60	42.10	3.50	55.40	73.90	18.5	153	298	
Hori.	4960.000	PK	47.00	31.30	5.70	41.90	3.50	45.60	73.90	28.3	150	12	
Hori.	7440.000	PK	45.80	36.60	7.10	40.90	3.50	52.10	73.90	21.8	105	45	
Hori.	9920.000	PK	43.90	39.40	8.00	39.60	3.50	55.20	73.90	18.7	100	0	Floor Noise
Vert.	2483.500	PK	52.40	27.50	13.60	42.10	3.50	54.90	73.90	19.0	113	215	
Vert.	2488.000	PK	51.90	27.50	13.60	42.10	3.50	54.40	73.90	19.5	113	215	
Vert.	4960.000	PK	47.90	31.30	5.70	41.90	3.50	46.50	73.90	27.4	114	337	
Vert.	7440.000	PK	47.10	36.60	7.10	40.90	3.50	53.40	73.90	20.5	162	185	
Vert.	9920.000	PK	43.20	39.40	8.00	39.60	3.50	54.50	73.90	19.4	100	0	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	40.90	27.50	13.60	42.10	0.44	3.50	43.84	53.90	10.1	*1)
Hori.	2488.000	AV	44.70	27.50	13.60	42.10	0.44	3.50	47.64	53.90	6.3	
Hori.	4960.000	AV	37.20	31.30	5.70	41.90	0.44	3.50	36.24	53.90	17.7	
Hori.	7440.000	AV	36.20	36.60	7.10	40.90	0.44	3.50	42.94	53.90	11.0	
Hori.	9920.000	AV	34.20	39.40	8.00	39.60	0.44	3.50	45.94	53.90	8.0	Floor Noise
Vert.	2483.500	AV	40.30	27.50	13.60	42.10	0.44	3.50	43.24	53.90	10.7	*1)
Vert.	2488.000	AV	43.20	27.50	13.60	42.10	0.44	3.50	46.14	53.90	7.8	
Vert.	4960.000	AV	38.70	31.30	5.70	41.90	0.44	3.50	37.74	53.90	16.2	
Vert.	7440.000	AV	38.10	36.60	7.10	40.90	0.44	3.50	44.84	53.90	9.1	
Vert.	9920.000	AV	34.30	39.40	8.00	39.60	0.44	3.50	46.04	53.90	7.9	Floor Noise

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

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

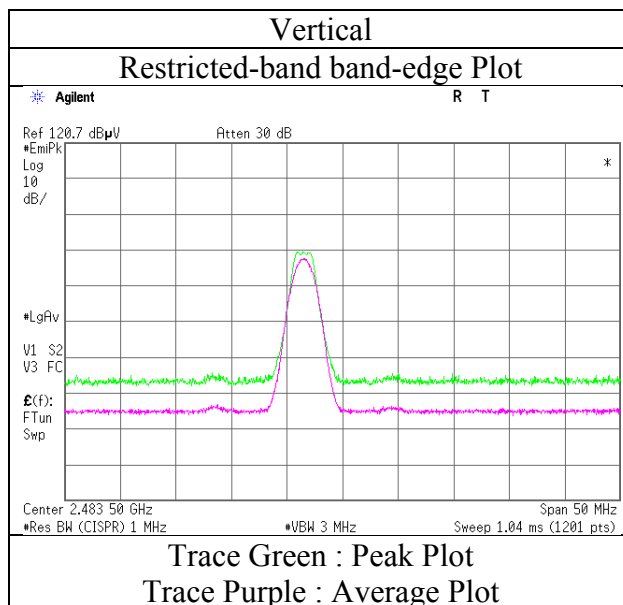
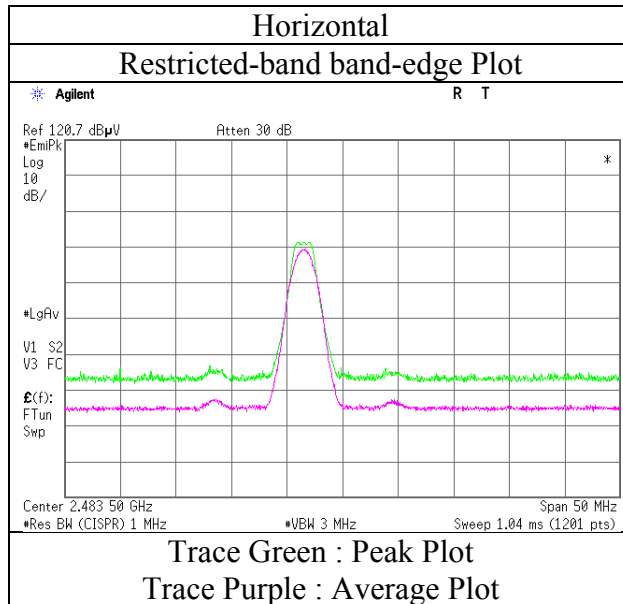
10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

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

Radiated Spurious Emission
(Reference Plot for band-edge)

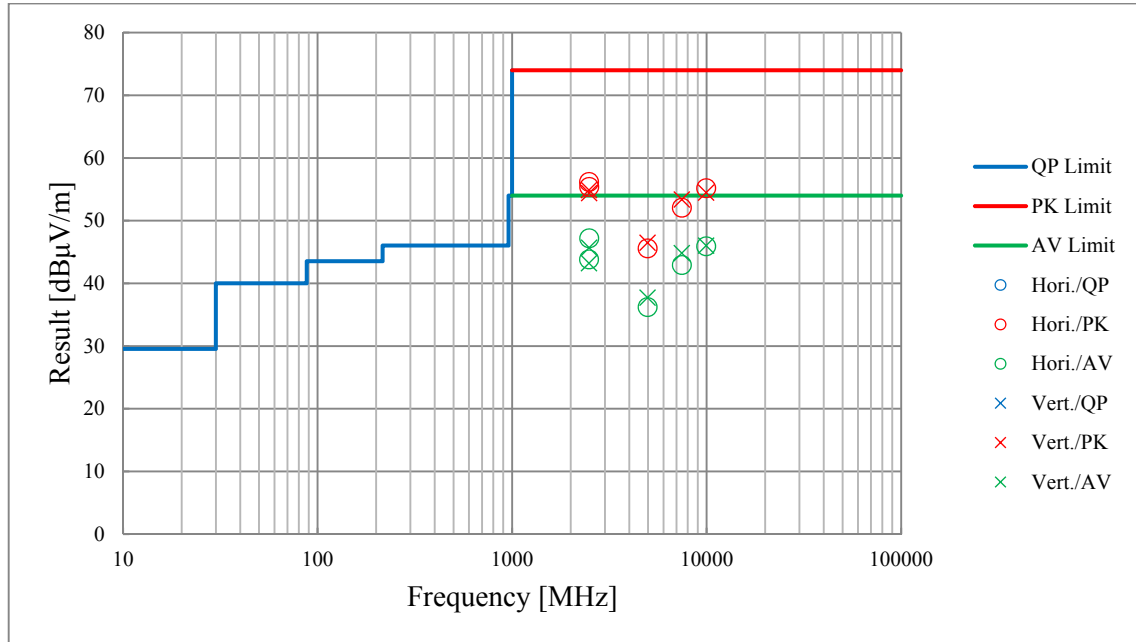
Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11818228M-A
Date	June 28, 2017
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx BT LE (2Mbps), 2480MHz



* 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.	11818228M-A	
Date	June 28, 2017	July 2, 2017
Temperature / Humidity	20 deg. C / 58 % RH	22 deg. C / 45 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando
	(1-10GHz)	(10-26GHz)
Mode	Tx BT LE (2Mbps), 2480MHz	



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

Radiated Spurious Emission

Test place Kashima EMC Lab. No.10 Semi Anechoic Chamber (1-26GHz)
 Kashima EMC Lab. No.11 Semi Anechoic Chamber (30-1000MHz)
Report No. 11818228M-A
Date July 3, 2017 June 22, 2017 July 2, 2017
Temperature / Humidity 22 deg. C / 59 % RH 23 deg. C / 43 % RH 22 deg. C / 45 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
 (30-1000MHz) (1-10GHz) (10-26GHz)
Mode Tx ANT, 2402MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	128.000	QP	32.70	12.00	4.80	32.20	0.00	17.30	43.50	26.2	212	191	
Hori.	206.484	QP	27.00	9.70	5.40	32.10	0.00	10.00	43.50	33.5	183	288	
Hori.	2390.000	PK	49.60	27.60	13.50	42.10	3.50	52.10	73.90	21.8	154	293	
Hori.	4804.000	PK	46.40	31.30	5.60	41.90	3.50	44.90	73.90	29.0	152	220	
Hori.	7206.000	PK	46.60	36.30	7.00	40.90	3.50	52.50	73.90	21.4	107	234	
Hori.	9608.000	PK	44.10	38.60	7.80	39.90	3.50	54.10	73.90	19.8	100	0	Floor Noise
Vert.	80.000	QP	32.80	9.00	4.40	32.20	0.00	14.00	40.00	26.0	100	0	
Vert.	136.423	QP	42.10	12.80	4.90	32.20	0.00	27.60	43.50	15.9	100	0	
Vert.	206.484	QP	37.90	9.70	5.40	32.10	0.00	20.90	43.50	22.6	100	335	
Vert.	2390.000	PK	49.70	27.60	13.50	42.10	3.50	52.20	73.90	21.7	127	352	
Vert.	4804.000	PK	47.00	31.30	5.60	41.90	3.50	45.50	73.90	28.4	133	351	
Vert.	7206.000	PK	45.60	36.30	7.00	40.90	3.50	51.50	73.90	22.4	117	54	
Vert.	9608.000	PK	44.30	38.60	7.80	39.90	3.50	54.30	73.90	19.6	100	0	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	38.80	27.60	13.50	42.10	0.23	3.50	41.53	53.90	12.4	*1)
Hori.	4804.000	AV	37.50	31.30	5.60	41.90	0.23	3.50	36.23	53.90	17.7	
Hori.	7206.000	AV	38.50	36.30	7.00	40.90	0.23	3.50	44.63	53.90	9.3	
Hori.	9608.000	AV	35.30	38.60	7.80	39.90	0.23	3.50	45.53	53.90	8.4	Floor Noise
Vert.	2390.000	AV	39.10	27.60	13.50	42.10	0.23	3.50	41.83	53.90	12.1	*1)
Vert.	4804.000	AV	38.30	31.30	5.60	41.90	0.23	3.50	37.03	53.90	16.9	
Vert.	7206.000	AV	37.70	36.30	7.00	40.90	0.23	3.50	43.83	53.90	10.1	
Vert.	9608.000	AV	35.30	38.60	7.80	39.90	0.23	3.50	45.53	53.90	8.4	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	93.10	27.60	13.50	42.10	3.50	95.60	-	-	Carrier
Hori.	2394.000	PK	48.00	27.60	13.50	42.10	3.50	50.50	75.60	25.1	
Hori.	2400.000	PK	44.30	27.60	13.50	42.10	3.50	46.80	75.60	28.8	
Vert.	2402.000	PK	92.20	27.60	13.50	42.10	3.50	94.70	-	-	Carrier
Vert.	2394.000	PK	47.80	27.60	13.50	42.10	3.50	50.30	74.70	24.4	
Vert.	2400.000	PK	44.10	27.60	13.50	42.10	3.50	46.60	74.70	28.1	

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

UL Japan, Inc.

Kashima EMC Lab.

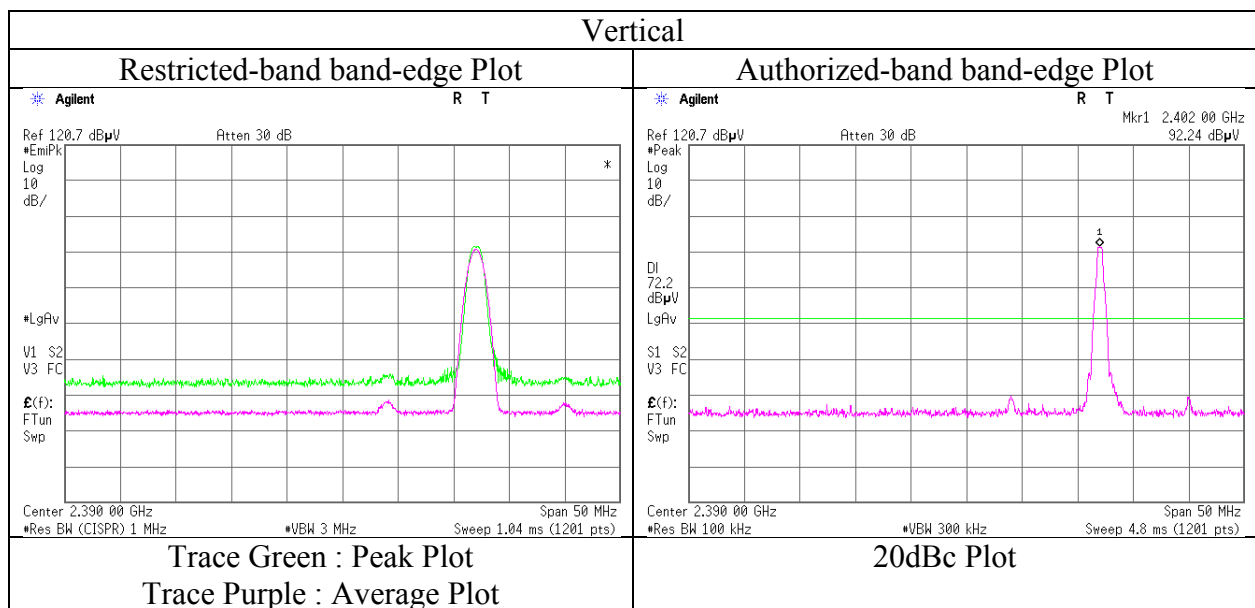
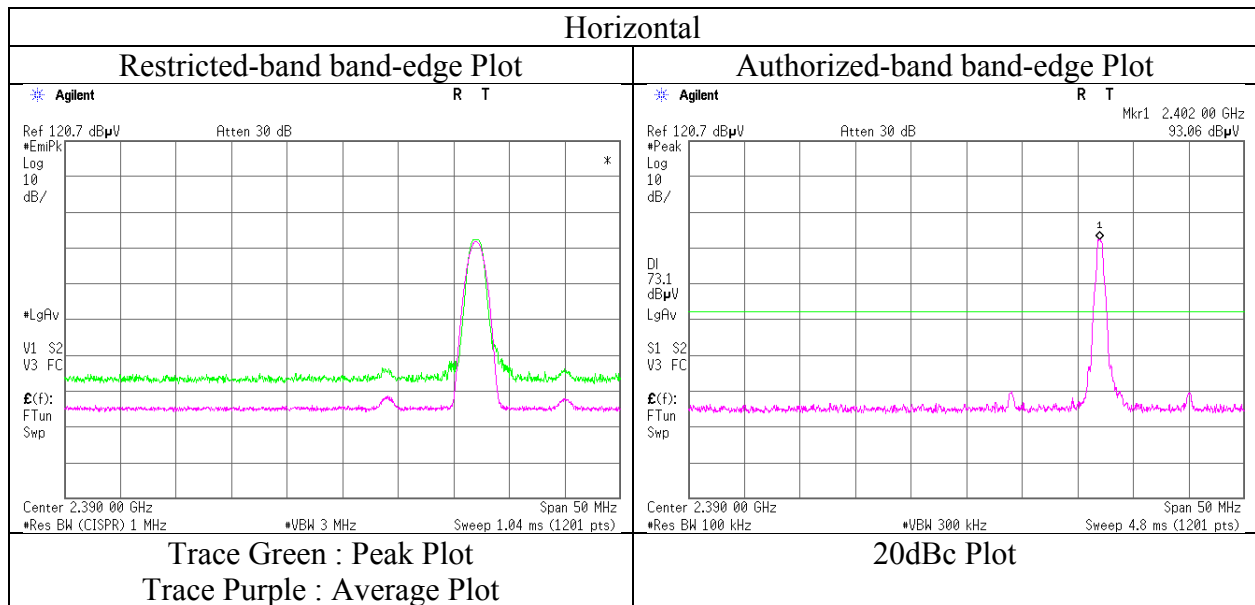
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11818228M-A
Date	June 22, 2017
Temperature / Humidity	23 deg. C / 43 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx ANT, 2402MHz



* 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. : 11818228M-A
Date : June 22, 2017 July 2, 2017
Temperature / Humidity : 23 deg. C / 43 % RH 22 deg. C / 45 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando
(1-10GHz) (10-26GHz)
Mode : Tx ANT, 2441MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4882.000	PK	46.80	31.20	5.70	41.90	3.50	45.30	73.90	28.6	156	9	
Hori.	7323.000	PK	46.90	36.20	7.10	40.90	3.50	52.80	73.90	21.1	100	79	
Hori.	9764.000	PK	43.10	39.30	7.90	39.80	3.50	54.00	73.90	19.9	100	0	Floor Noise
Vert.	4882.000	PK	47.10	31.20	5.70	41.90	3.50	45.60	73.90	28.3	110	0	
Vert.	7323.000	PK	46.70	36.20	7.10	40.90	3.50	52.60	73.90	21.3	192	212	
Vert.	9764.000	PK	43.50	39.30	7.90	39.80	3.50	54.40	73.90	19.5	100	0	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	38.10	31.20	5.70	41.90	0.23	3.50	36.83	53.90	17.1	
Hori.	7323.000	AV	39.20	36.20	7.10	40.90	0.23	3.50	45.33	53.90	8.6	
Hori.	9764.000	AV	34.30	39.30	7.90	39.80	0.23	3.50	45.43	53.90	8.5	Floor Noise
Vert.	4882.000	AV	38.30	31.20	5.70	41.90	0.23	3.50	37.03	53.90	16.9	
Vert.	7323.000	AV	39.30	36.20	7.10	40.90	0.23	3.50	45.43	53.90	8.5	
Vert.	9764.000	AV	34.30	39.30	7.90	39.80	0.23	3.50	45.43	53.90	8.5	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No. : 11818228M-A
Date : June 22, 2017 July 2, 2017
Temperature / Humidity : 23 deg. C / 43 % RH 22 deg. C / 45 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando
(1-10GHz) (10-26GHz)
Mode : Tx ANT, 2480MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	53.30	27.50	13.60	42.10	3.50	55.80	73.90	18.1	174	291	
Hori.	2488.000	PK	53.60	27.50	13.60	42.10	3.50	56.10	73.90	17.8	174	291	
Hori.	4960.000	PK	47.30	31.30	5.70	41.90	3.50	45.90	73.90	28.0	149	223	
Hori.	7440.000	PK	46.50	36.60	7.10	40.90	3.50	52.80	73.90	21.1	148	49	
Hori.	9920.000	PK	43.20	39.40	8.00	39.60	3.50	54.50	73.90	19.4	100	0	Floor Noise
Vert.	2483.500	PK	53.40	27.50	13.60	42.10	3.50	55.90	73.90	18.0	150	317	
Vert.	2488.000	PK	51.70	27.50	13.60	42.10	3.50	54.20	73.90	19.7	150	317	
Vert.	4960.000	PK	47.80	31.30	5.70	41.90	3.50	46.40	73.90	27.5	146	28	
Vert.	7440.000	PK	48.30	36.60	7.10	40.90	3.50	54.60	73.90	19.3	286	204	
Vert.	9920.000	PK	43.10	39.40	8.00	39.60	3.50	54.40	73.90	19.5	100	0	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	39.10	27.50	13.60	42.10	0.23	3.50	41.83	53.90	12.1	*1)
Hori.	2488.000	AV	46.90	27.50	13.60	42.10	0.23	3.50	49.63	53.90	4.3	
Hori.	4960.000	AV	38.80	31.30	5.70	41.90	0.23	3.50	37.63	53.90	16.3	
Hori.	7440.000	AV	39.00	36.60	7.10	40.90	0.23	3.50	45.53	53.90	8.4	
Hori.	9920.000	AV	33.90	39.40	8.00	39.60	0.23	3.50	45.43	53.90	8.5	Floor Noise
Vert.	2483.500	AV	39.70	27.50	13.60	42.10	0.23	3.50	42.43	53.90	11.5	*1)
Vert.	2488.000	AV	46.10	27.50	13.60	42.10	0.23	3.50	48.83	53.90	5.1	
Vert.	4960.000	AV	39.10	31.30	5.70	41.90	0.23	3.50	37.93	53.90	16.0	
Vert.	7440.000	AV	40.90	36.60	7.10	40.90	0.23	3.50	47.43	53.90	6.5	
Vert.	9920.000	AV	33.90	39.40	8.00	39.60	0.23	3.50	45.43	53.90	8.5	Floor Noise

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

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

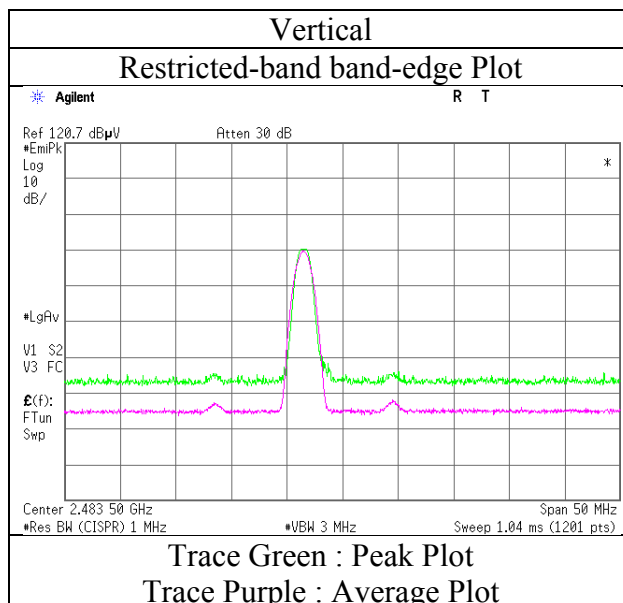
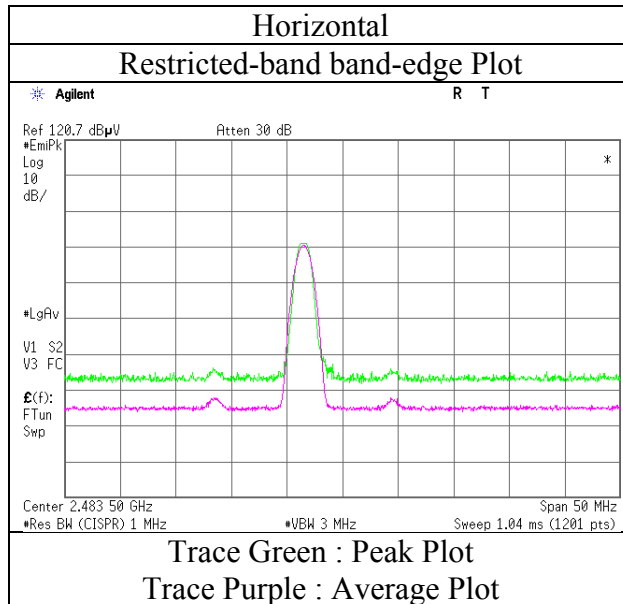
10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

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

Radiated Spurious Emission
(Reference Plot for band-edge)

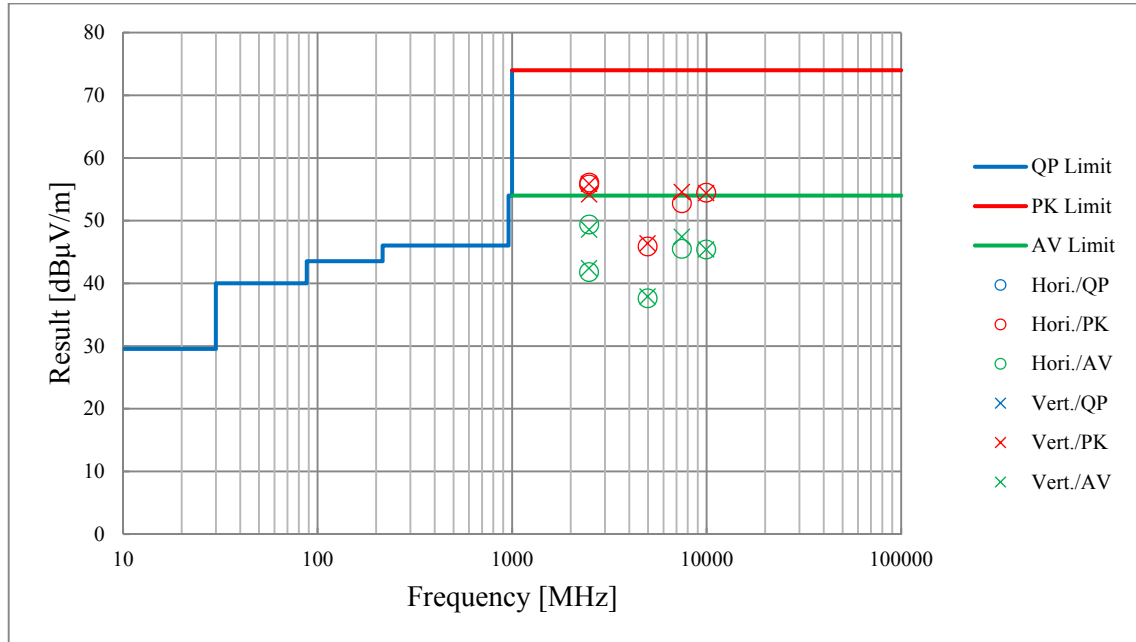
Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11818228M-A
Date	June 22, 2017
Temperature / Humidity	23 deg. C / 43 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx ANT, 2480MHz



* 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.	11818228M-A	
Date	June 22, 2017	July 2, 2017
Temperature / Humidity	23 deg. C / 43 % RH	22 deg. C / 45 % RH
Engineer	Kazuhiro Ando (1-10GHz)	Kazuhiro Ando (10-26GHz)
Mode	Tx ANT, 2480MHz	



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

Radiated Spurious Emission

Test place Kashima EMC Lab. No.10 Semi Anechoic Chamber (1-26GHz)
 Kashima EMC Lab. No.11 Semi Anechoic Chamber (30-1000MHz)
Report No. 11818228M-A
Date July 3, 2017 June 22, 2017 July 2, 2017
Temperature / Humidity 22 deg. C / 59 % RH 23 deg. C / 43 % RH 22 deg. C / 45 % RH
Engineer Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
 (30-1000MHz) (1-10GHz) (10-26GHz)
Mode Tx Nordic Original, 2402MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	128.000	QP	32.90	12.00	4.80	32.20	0.00	17.50	43.50	26.0	224	187	
Hori.	204.663	QP	27.00	9.70	5.40	32.10	0.00	10.00	43.50	33.5	175	282	
Hori.	2390.000	PK	50.00	27.60	13.50	42.10	3.50	52.50	73.90	21.4	134	301	
Hori.	4804.000	PK	46.30	31.30	5.60	41.90	3.50	44.80	73.90	29.1	147	106	
Hori.	7206.000	PK	46.70	36.30	7.00	40.90	3.50	52.60	73.90	21.3	107	341	
Hori.	9608.000	PK	44.70	38.60	7.80	39.90	3.50	54.70	73.90	19.2	100	0	Floor Noise
Vert.	80.000	QP	32.60	9.00	4.40	32.20	0.00	13.80	40.00	26.2	100	0	
Vert.	135.789	QP	42.30	12.80	4.90	32.20	0.00	27.80	43.50	15.7	100	0	
Vert.	204.663	QP	37.50	9.70	5.40	32.10	0.00	20.50	43.50	23.0	100	330	
Vert.	2390.000	PK	50.50	27.60	13.50	42.10	3.50	53.00	73.90	20.9	135	160	
Vert.	4804.000	PK	47.50	31.30	5.60	41.90	3.50	46.00	73.90	27.9	133	299	
Vert.	7206.000	PK	46.10	36.30	7.00	40.90	3.50	52.00	73.90	21.9	125	53	
Vert.	9608.000	PK	44.20	38.60	7.80	39.90	3.50	54.20	73.90	19.7	100	0	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	38.80	27.60	13.50	42.10	0.44	3.50	41.74	53.90	12.2	*1)
Hori.	4804.000	AV	37.50	31.30	5.60	41.90	0.44	3.50	36.44	53.90	17.5	
Hori.	7206.000	AV	38.10	36.30	7.00	40.90	0.44	3.50	44.44	53.90	9.5	
Hori.	9608.000	AV	35.40	38.60	7.80	39.90	0.44	3.50	45.84	53.90	8.1	Floor Noise
Vert.	2390.000	AV	39.10	27.60	13.50	42.10	0.44	3.50	42.04	53.90	11.9	*1)
Vert.	4804.000	AV	38.50	31.30	5.60	41.90	0.44	3.50	37.44	53.90	16.5	
Vert.	7206.000	AV	37.40	36.30	7.00	40.90	0.44	3.50	43.74	53.90	10.2	
Vert.	9608.000	AV	35.40	38.60	7.80	39.90	0.44	3.50	45.84	53.90	8.1	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	93.10	27.60	13.50	42.10	3.50	95.60	-	-	Carrier
Hori.	2394.000	PK	47.60	27.60	13.50	42.10	3.50	50.10	75.60	25.5	
Hori.	2400.000	PK	54.10	27.60	13.50	42.10	3.50	56.60	75.60	19.0	
Vert.	2402.000	PK	92.60	27.60	13.50	42.10	3.50	95.10	-	-	Carrier
Vert.	2394.000	PK	47.80	27.60	13.50	42.10	3.50	50.30	75.10	24.8	
Vert.	2400.000	PK	54.40	27.60	13.50	42.10	3.50	56.90	75.10	18.2	

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

UL Japan, Inc.

Kashima EMC Lab.

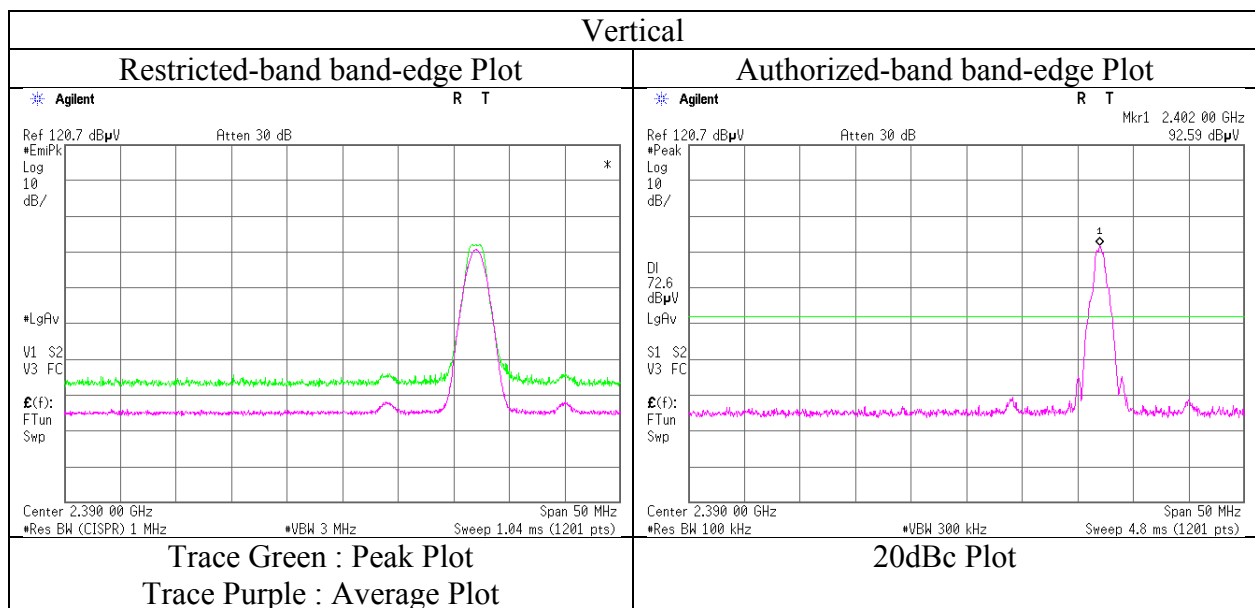
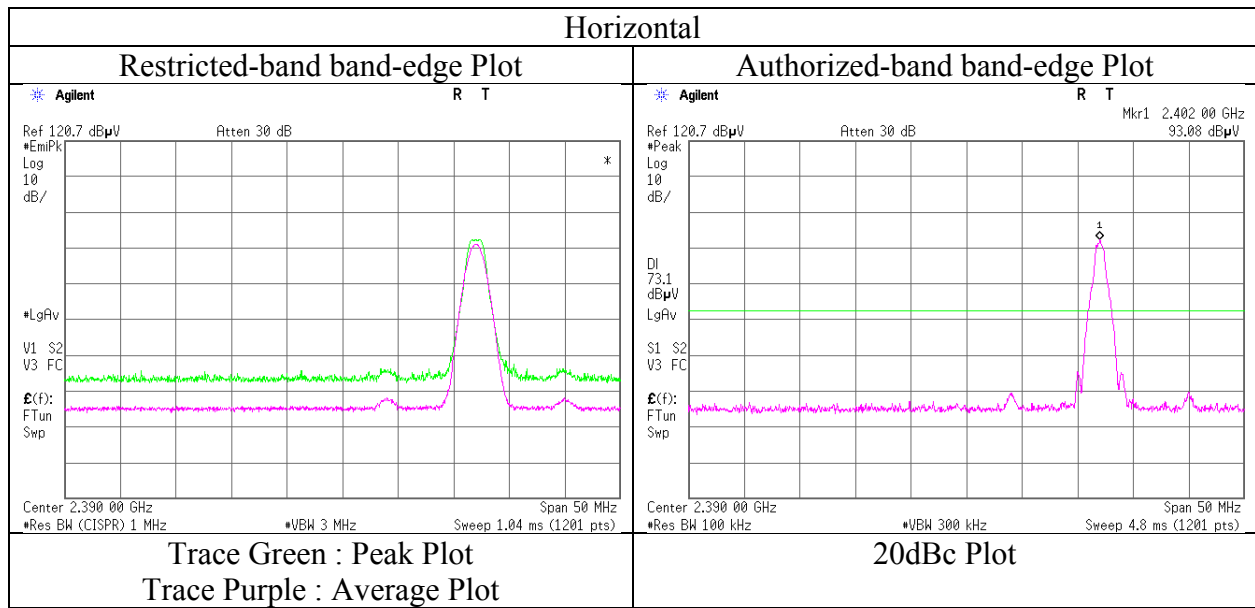
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11818228M-A
Date	June 22, 2017
Temperature / Humidity	23 deg. C / 43 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx Nordic Original, 2402MHz



* 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. : 11818228M-A
Date : June 22, 2017 July 2, 2017
Temperature / Humidity : 23 deg. C / 43 % RH 22 deg. C / 45 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando
(1-10GHz) (10-26GHz)
Mode : Tx Nordic Original, 2441MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4882.000	PK	46.20	31.20	5.70	41.90	3.50	44.70	73.90	29.2	122	227	
Hori.	7323.000	PK	46.60	36.20	7.10	40.90	3.50	52.50	73.90	21.4	189	133	
Hori.	9764.000	PK	42.70	39.30	7.90	39.80	3.50	53.60	73.90	20.3	100	0	Floor Noise
Vert.	4882.000	PK	47.10	31.20	5.70	41.90	3.50	45.60	73.90	28.3	155	343	
Vert.	7323.000	PK	47.40	36.20	7.10	40.90	3.50	53.30	73.90	20.6	188	195	
Vert.	9764.000	PK	43.00	39.30	7.90	39.80	3.50	53.90	73.90	20.0	100	0	Floor Noise

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

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

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	37.60	31.20	5.70	41.90	0.44	3.50	36.54	53.90	17.4	
Hori.	7323.000	AV	37.30	36.20	7.10	40.90	0.44	3.50	43.64	53.90	10.3	
Hori.	9764.000	AV	34.10	39.30	7.90	39.80	0.44	3.50	45.44	53.90	8.5	Floor Noise
Vert.	4882.000	AV	38.00	31.20	5.70	41.90	0.44	3.50	36.94	53.90	17.0	
Vert.	7323.000	AV	38.00	36.20	7.10	40.90	0.44	3.50	44.34	53.90	9.6	
Vert.	9764.000	AV	34.00	39.30	7.90	39.80	0.44	3.50	45.34	53.90	8.6	Floor Noise

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

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

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

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No. : 11818228M-A
Date : June 22, 2017 July 2, 2017
Temperature / Humidity : 23 deg. C / 43 % RH 22 deg. C / 45 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando
(1-10GHz) (10-26GHz)
Mode : Tx Nordic Original, 2480MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	53.60	27.50	13.60	42.10	3.50	56.10	73.90	17.8	153	299	
Hori.	2488.000	PK	53.00	27.50	13.60	42.10	3.50	55.50	73.90	18.4	153	299	
Hori.	4960.000	PK	46.90	31.30	5.70	41.90	3.50	45.50	73.90	28.4	166	223	
Hori.	7440.000	PK	46.10	36.60	7.10	40.90	3.50	52.40	73.90	21.5	190	141	
Hori.	9920.000	PK	43.30	39.40	8.00	39.60	3.50	54.60	73.90	19.3	100	0	Floor Noise
Vert.	2483.500	PK	53.40	27.50	13.60	42.10	3.50	55.90	73.90	18.0	151	335	
Vert.	2488.000	PK	53.50	27.50	13.60	42.10	3.50	56.00	73.90	17.9	151	335	
Vert.	4960.000	PK	47.50	31.30	5.70	41.90	3.50	46.10	73.90	27.8	152	26	
Vert.	7440.000	PK	47.60	36.60	7.10	40.90	3.50	53.90	73.90	20.0	151	201	
Vert.	9920.000	PK	43.10	39.40	8.00	39.60	3.50	54.40	73.90	19.5	100	0	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Antenna Factor [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	40.70	27.50	13.60	42.10	0.44	3.50	43.64	53.90	10.3	*1)
Hori.	2488.000	AV	45.60	27.50	13.60	42.10	0.44	3.50	48.54	53.90	5.4	
Hori.	4960.000	AV	38.20	31.30	5.70	41.90	0.44	3.50	37.24	53.90	16.7	
Hori.	7440.000	AV	37.90	36.60	7.10	40.90	0.44	3.50	44.64	53.90	9.3	
Hori.	9920.000	AV	34.10	39.40	8.00	39.60	0.44	3.50	45.84	53.90	8.1	Floor Noise
Vert.	2483.500	AV	40.50	27.50	13.60	42.10	0.44	3.50	43.44	53.90	10.5	*1)
Vert.	2488.000	AV	45.90	27.50	13.60	42.10	0.44	3.50	48.84	53.90	5.1	
Vert.	4960.000	AV	38.60	31.30	5.70	41.90	0.44	3.50	37.64	53.90	16.3	
Vert.	7440.000	AV	38.70	36.60	7.10	40.90	0.44	3.50	45.44	53.90	8.5	
Vert.	9920.000	AV	34.30	39.40	8.00	39.60	0.44	3.50	46.04	53.90	7.9	Floor Noise

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

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

10GHz - 40GHz : 20log(1.0m / 3.0m)= -9.5dB

Duty factor refer to "Duty factor Calculation chart" sheet. All the detected noises had duty synchronized with the carrier.

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

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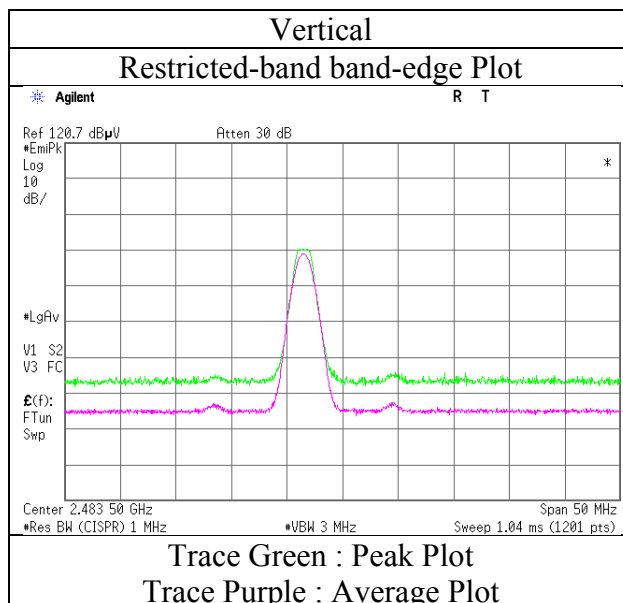
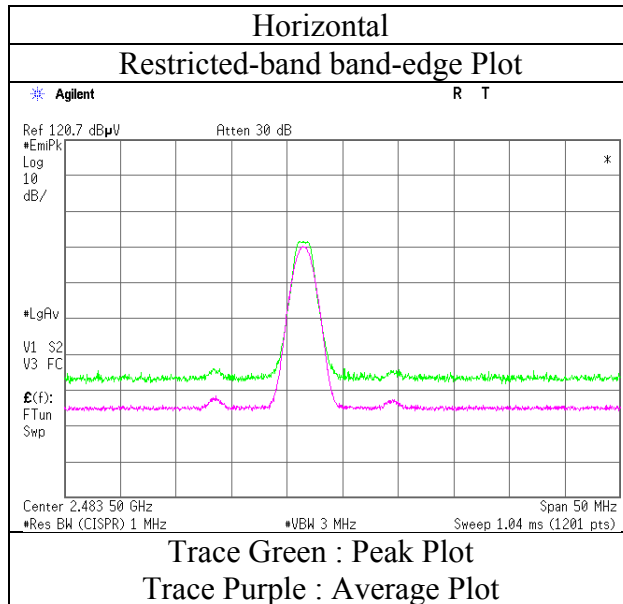
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Radiated Spurious Emission
(Reference Plot for band-edge)

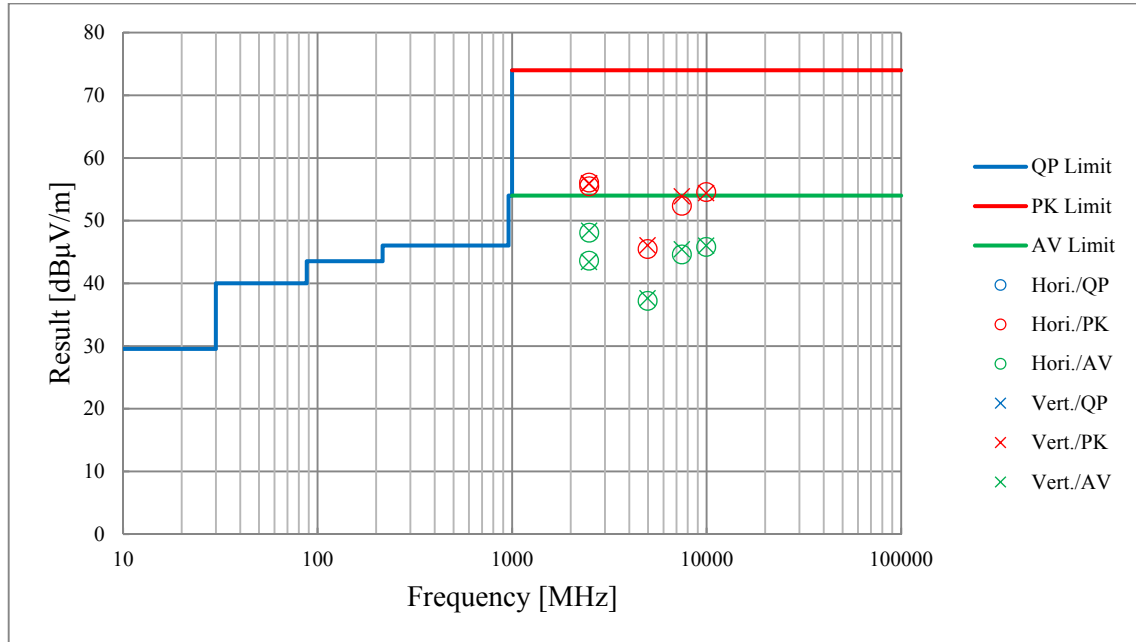
Test place	Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No.	11818228M-A
Date	June 22, 2017
Temperature / Humidity	23 deg. C / 43 % RH
Engineer	Kazuhiro Ando (1-10GHz)
Mode	Tx Nordic Original, 2480MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

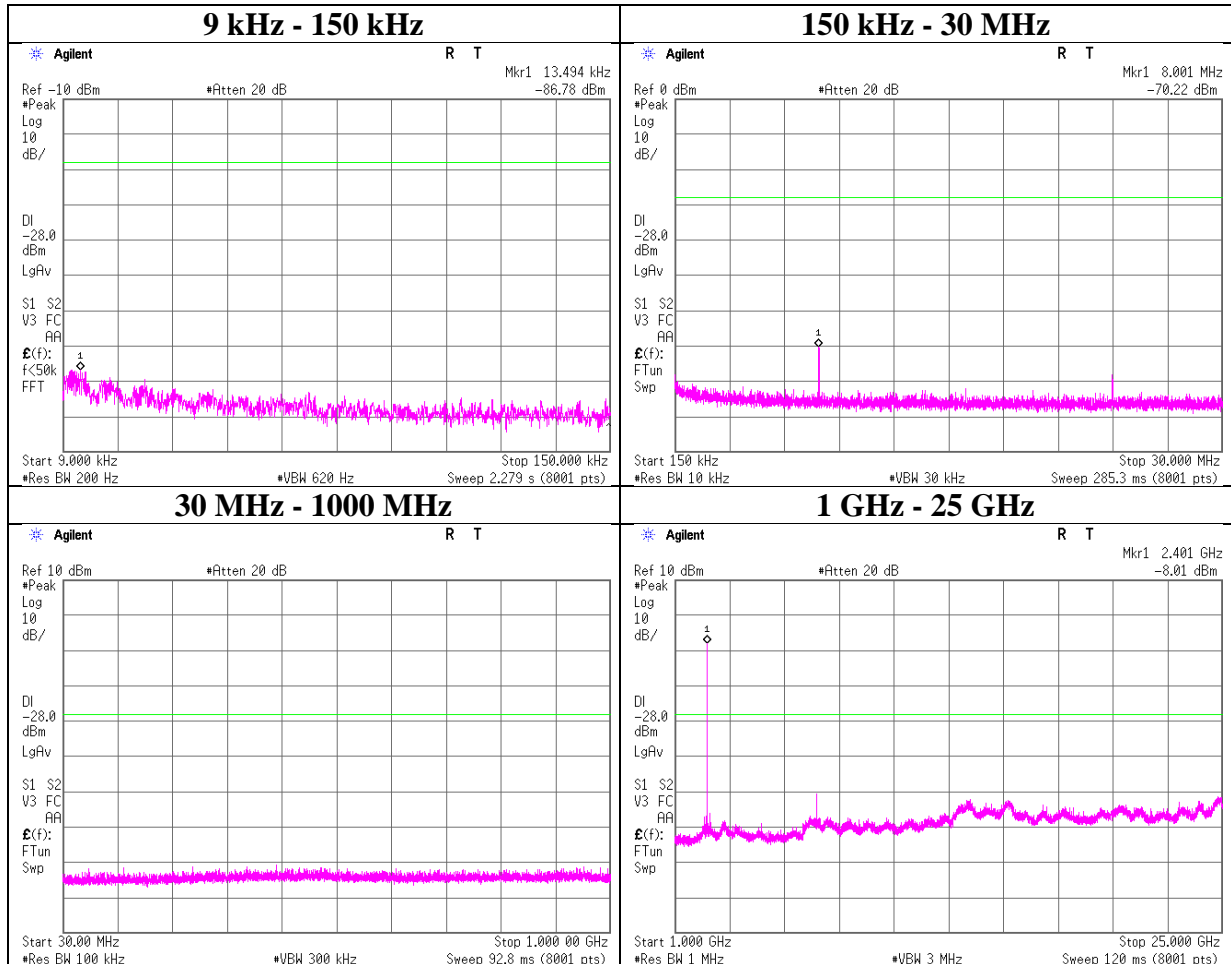
Test place Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No. 11818228M-A
Date June 22, 2017 July 2, 2017
Temperature / Humidity 23 deg. C / 43 % RH 22 deg. C / 45 % RH
Engineer Kazuhiro Ando Kazuhiro Ando
 (1-10GHz) (10-26GHz)
Mode Tx Nordic Original, 2480MHz



*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. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx BT LE (1Mbps), 2402MHz



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
13.49	-86.8	0.01	9.95	2.0	1	-74.8	300	6.0	-13.6	45.0	58.6	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.22	0.03	9.95	-60.2	-16.9	43.3	*1)
2402.00	-8.01	1.06	10.04	3.1	-	-	- Carrier

$Result [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB]$

*1) The frequency does not include the Restricted bands of operation.

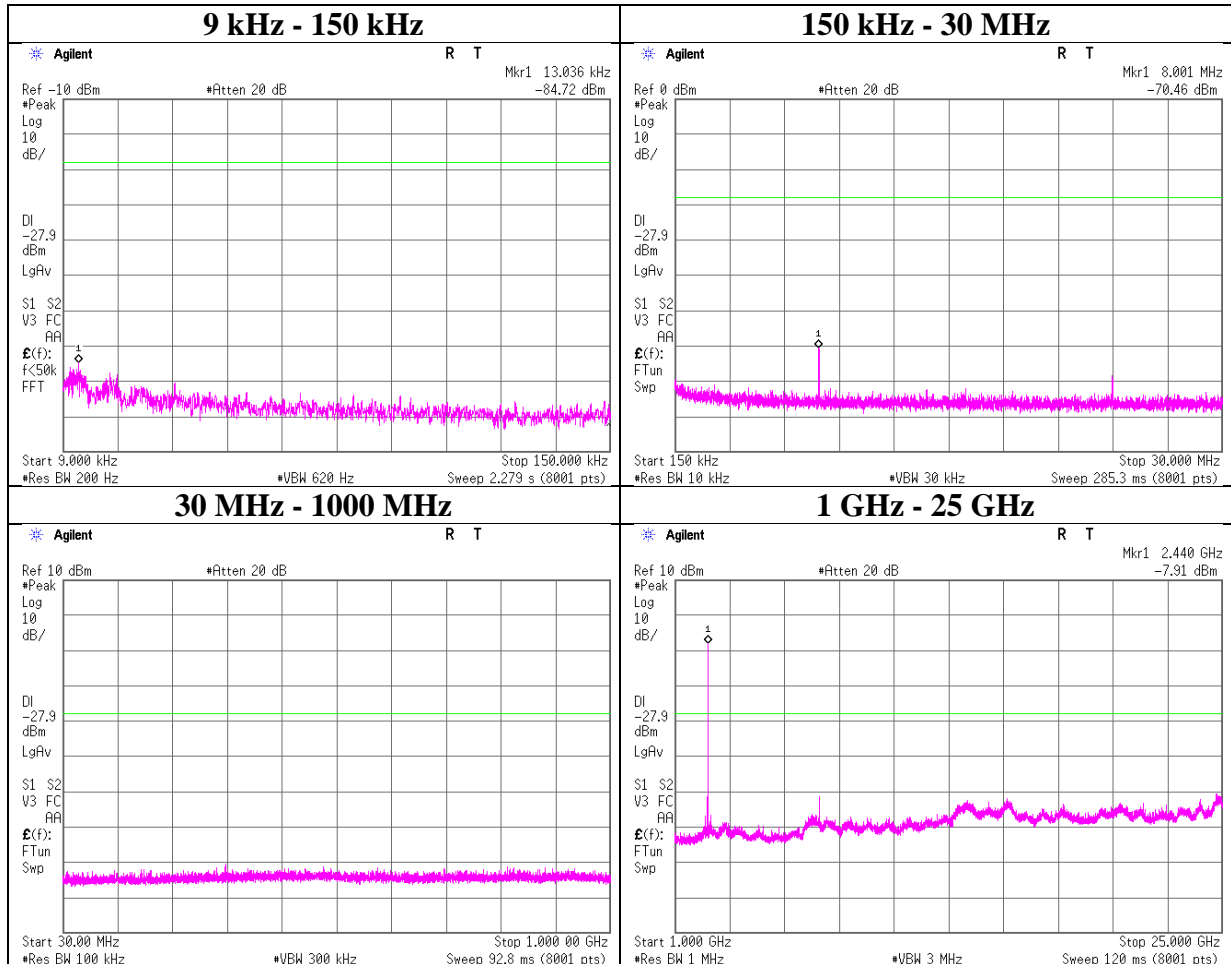
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Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan
Telephone : +81 478 88 6500
Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx BT LE (1Mbps), 2440MHz



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
13.04	-84.7	0.01	9.95	2.0	1	-72.8	300	6.0	-11.5	45.3	56.8	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.46	0.03	9.95	-60.5	-16.8	43.7	*1)
2440.00	-7.91	1.07	10.04	3.2	-	-	Carrier

$\text{Result[dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]}$

*1) The frequency does not include the Restricted bands of operation.

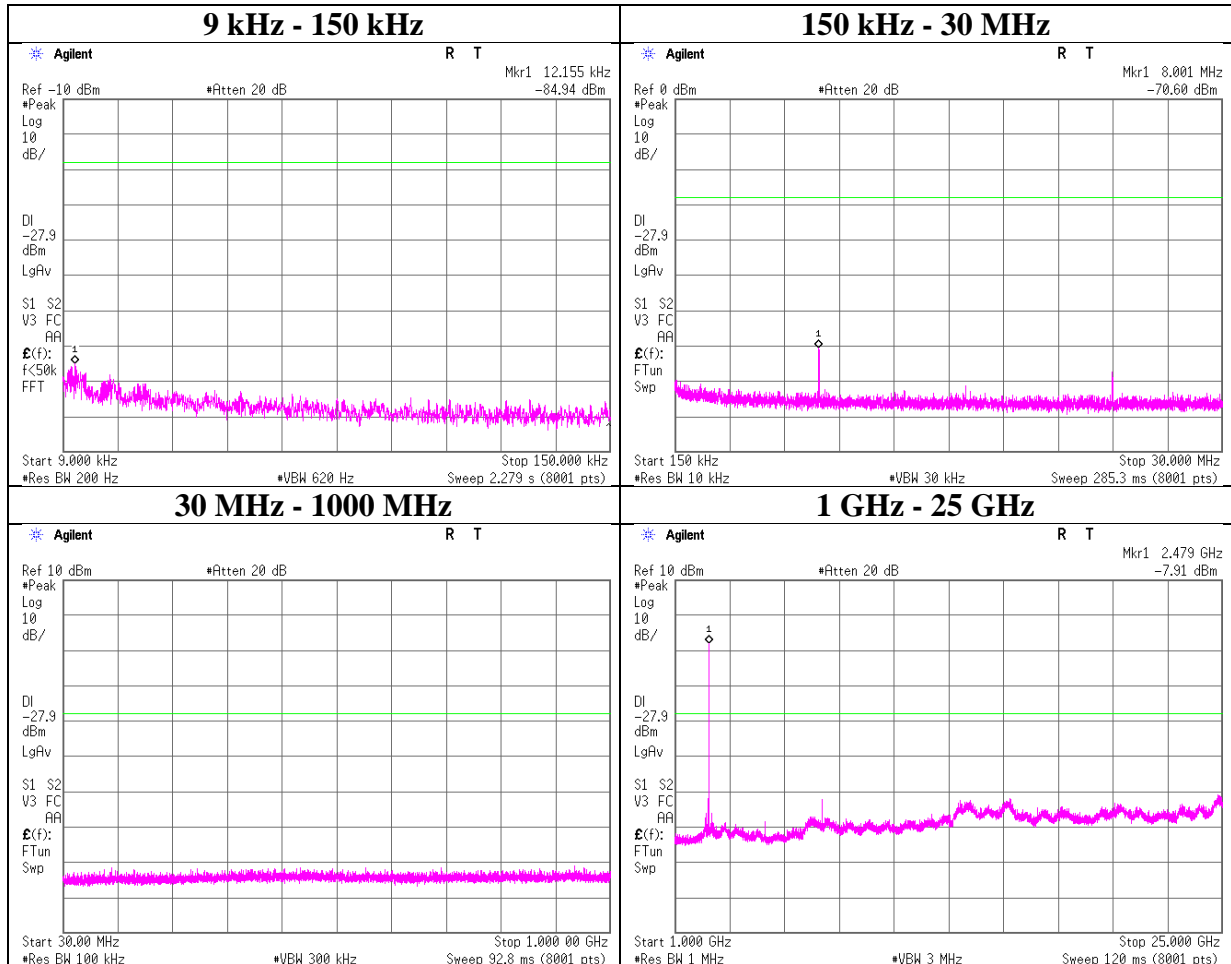
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Kashima EMC Lab.

1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan
Telephone : +81 478 88 6500
Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx BT LE (1Mbps), 2480MHz



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
12.12	-84.9	0.01	9.95	2.0	1	-73.0	300	6.0	-11.7	45.9	57.6	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.60	0.03	9.95	-60.6	-16.8	43.8	*1)
2480.00	-7.91	1.08	10.04	-	-	-	Carrier

$\text{Result [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]}$

*1) The frequency does not include the Restricted bands of operation.

UL Japan, Inc.

Kashima EMC Lab.

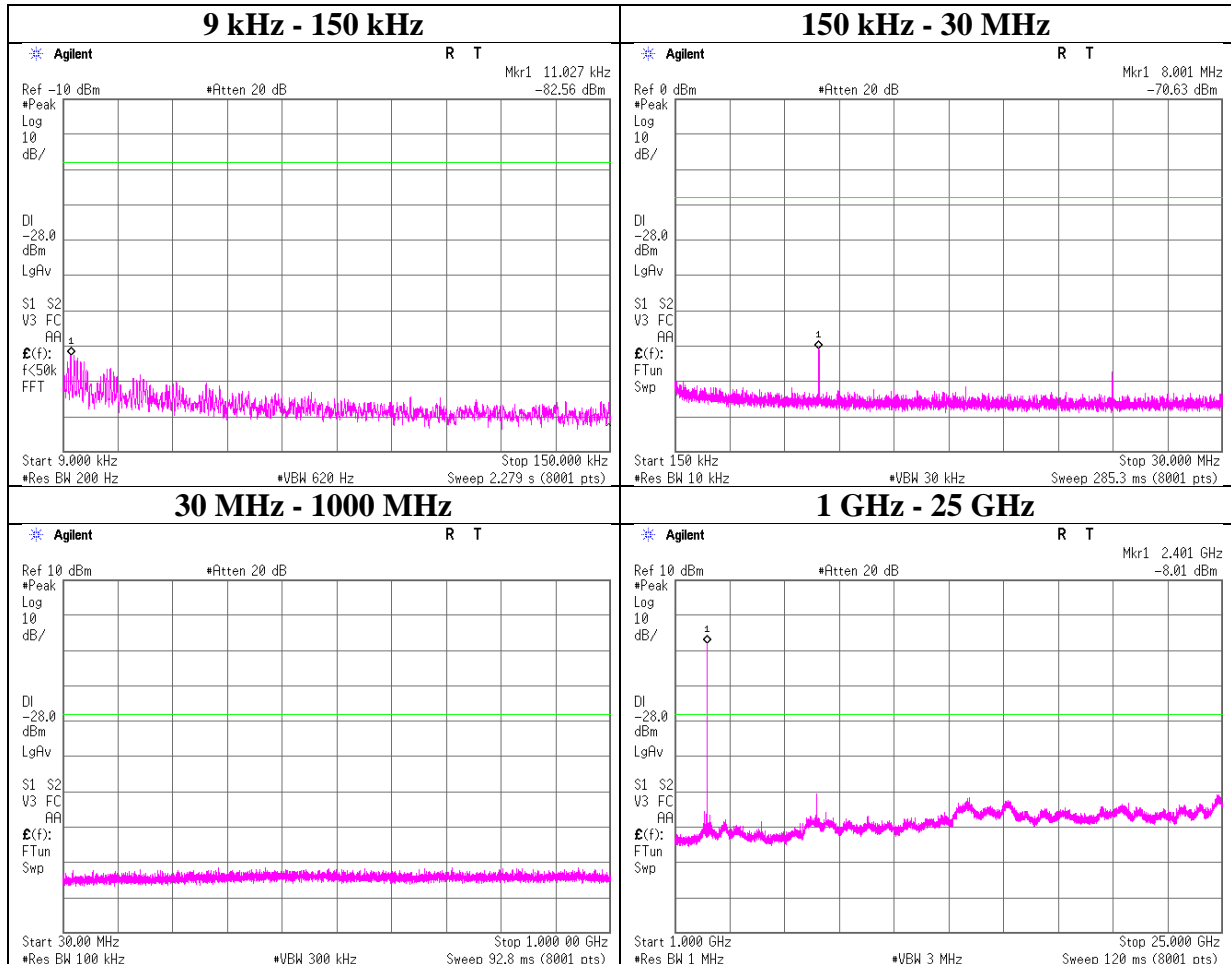
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx BT LE (2Mbps), 2402MHz



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
11.03	-82.6	0.01	9.95	2.0	1	-70.6	300	6.0	-9.3	46.7	56.0	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.63	0.03	9.95	-60.7	-16.9	43.7	*1)
2402.00	-8.01	1.06	10.04	3.1	-	-	Carrier

$$\text{Result [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]}$$

*1) The frequency does not include the Restricted bands of operation.

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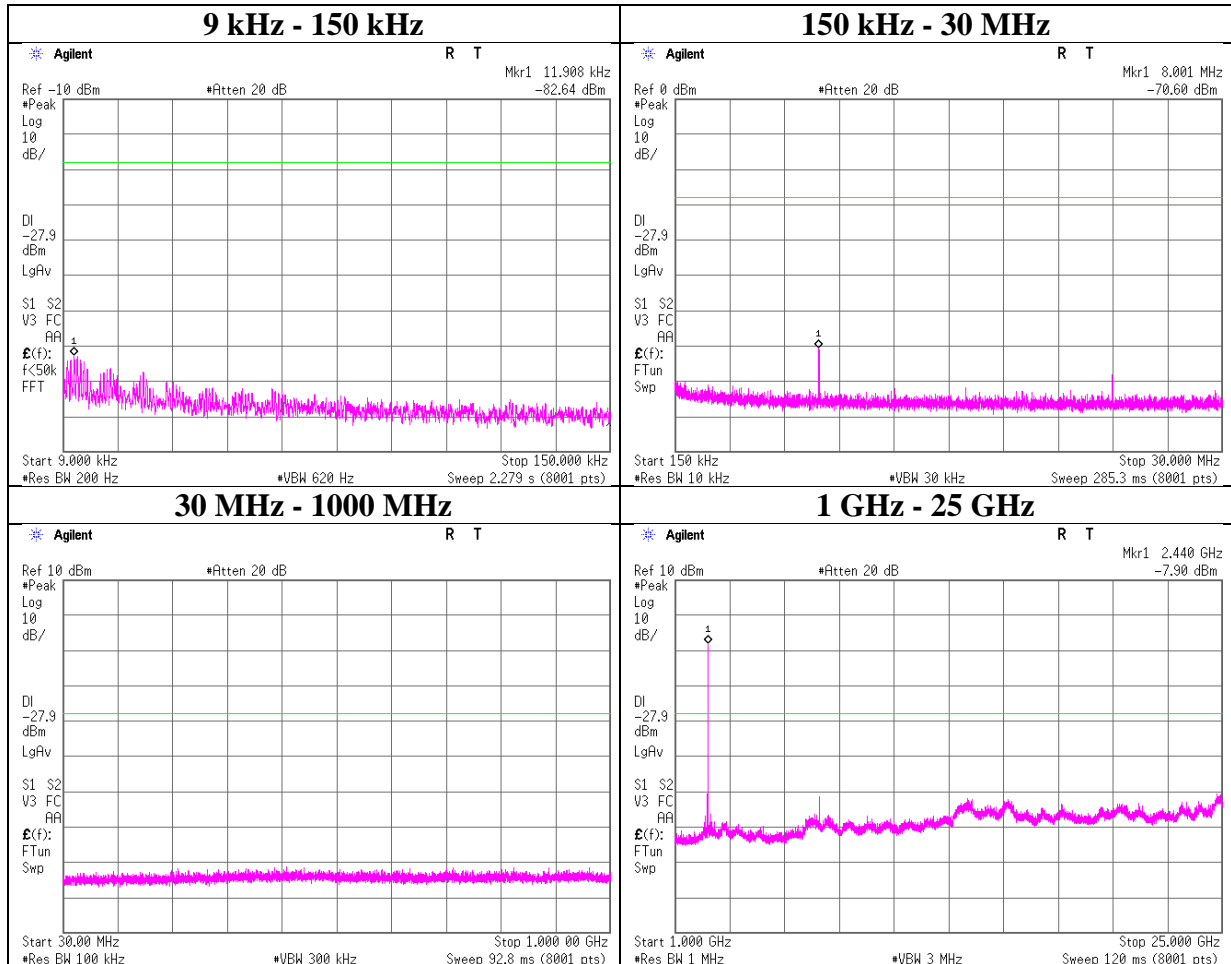
1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11818228M-A
Date	June 15, 2017
Temperature / Humidity	22 deg. C / 54 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx BT LE (2Mbps), 2440MHz



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
11.91	-82.6	0.01	9.95	2.0	1	-70.7	300	6.0	-9.4	46.0	55.4	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.60	0.03	9.95	-60.6	-16.8	43.8	*1)
2440.00	-7.90	1.07	10.04	3.2	-	-	Carrier

$\text{Result [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]}$

*1) The frequency does not include the Restricted bands of operation.

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Kashima EMC Lab.

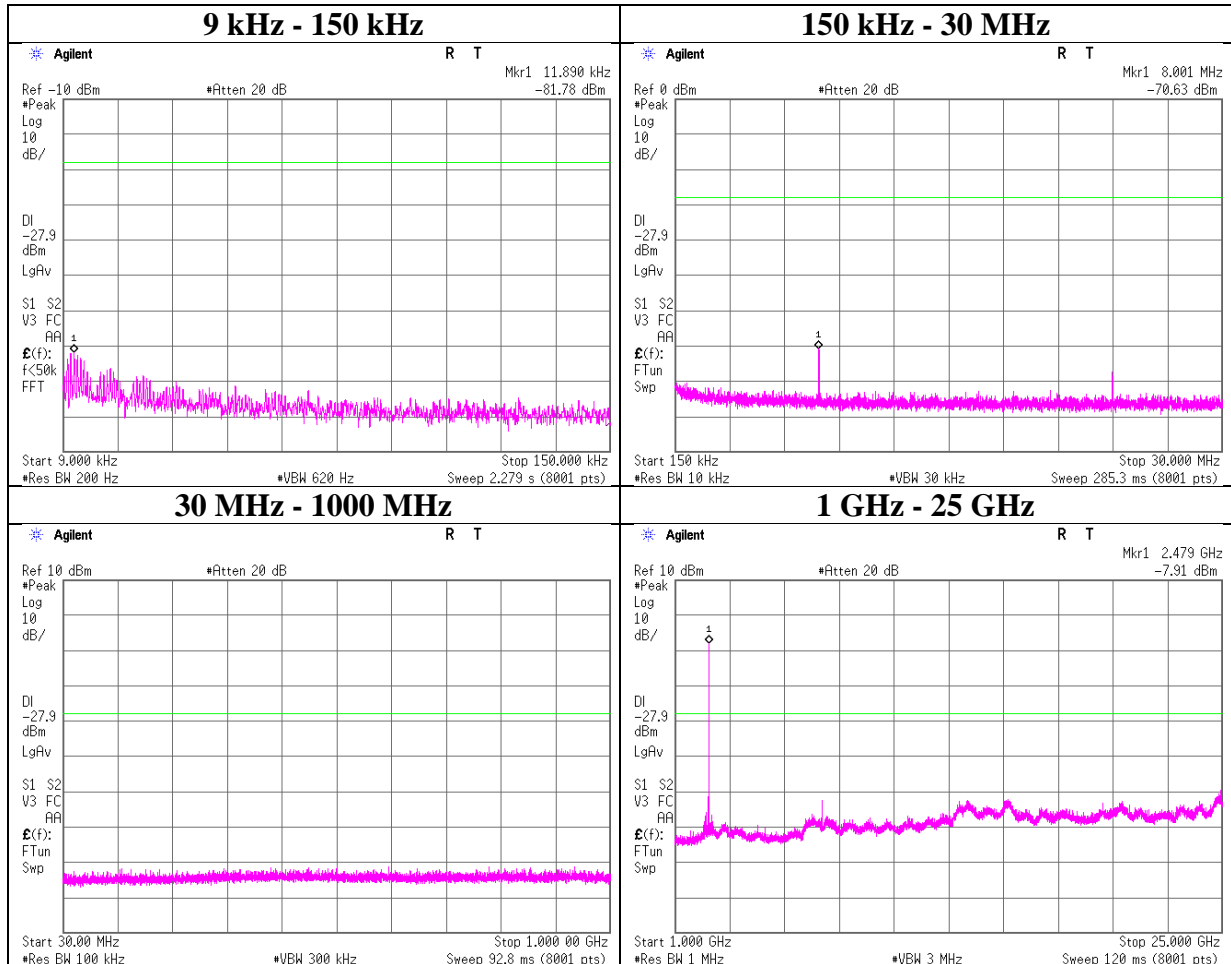
1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11818228M-A
Date	June 15, 2017
Temperature / Humidity	22 deg. C / 54 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx BT LE (2Mbps), 2480MHz



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
11.89	-81.8	0.01	9.95	2.0	1	-69.8	300	6.0	-8.6	46.1	54.7	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.63	0.03	9.95	-60.7	-16.8	43.9	*1)
2480.00	-7.91	1.08	10.04	3.2	-	-	Carrier

$$\text{Result [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]}$$

*1) The frequency does not include the Restricted bands of operation.

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Kashima EMC Lab.

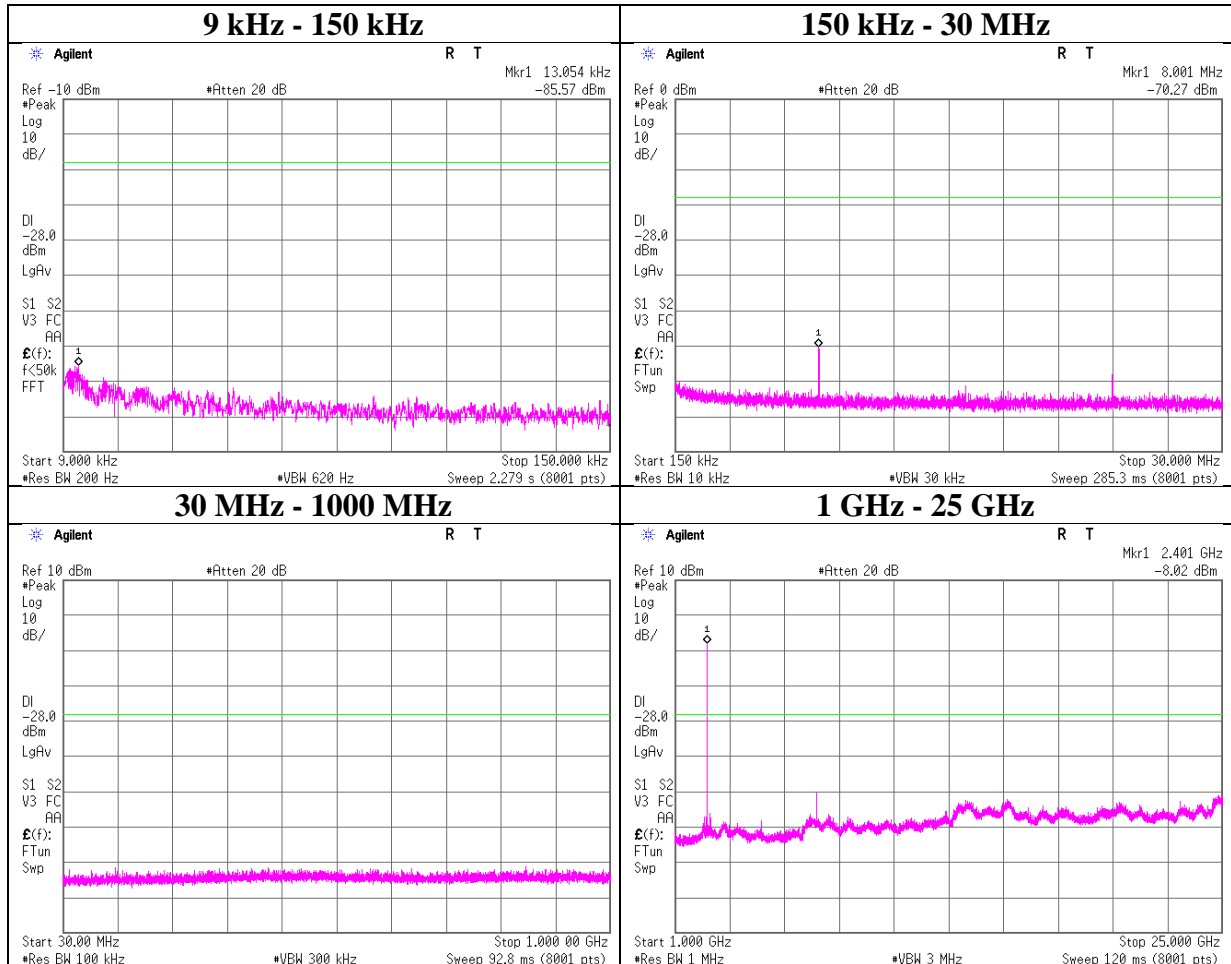
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx ANT, 2402MHz



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
13.05	-85.6	0.01	9.95	2.0	1	-73.6	300	6.0	-12.4	45.2	57.6	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.27	0.03	9.95	-60.3	-16.9	43.4	*1)
2402.00	-8.02	1.06	10.04	3.1	-	-	Carrier

$\text{Result [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]}$

*1) The frequency does not include the Restricted bands of operation.

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Kashima EMC Lab.

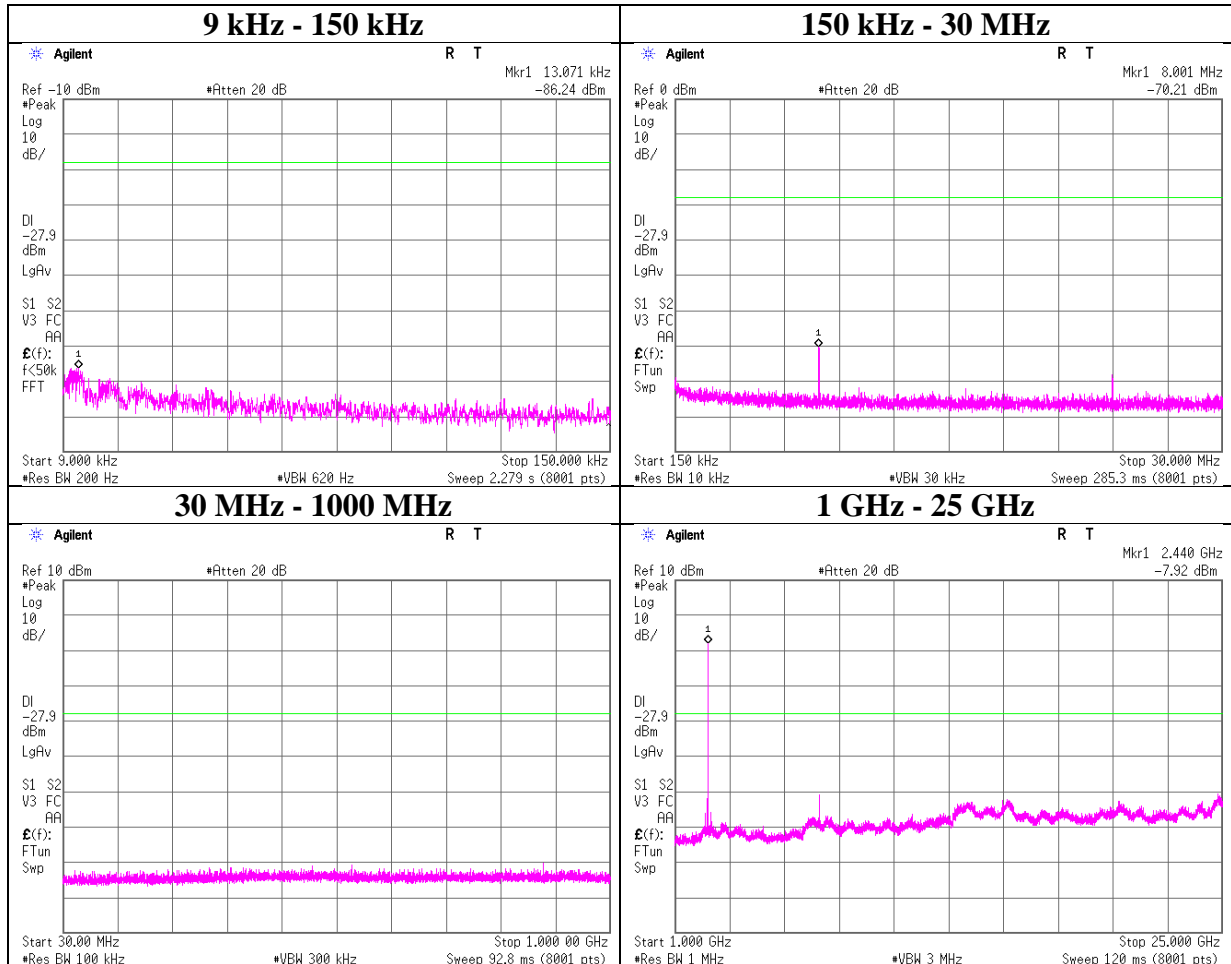
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx ANT, 2441MHz



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
13.07	-86.2	0.01	9.95	2.0	1	-74.3	300	6.0	-13.0	45.2	58.2	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.21	0.03	9.95	-60.2	-16.8	43.4	*1)
2441.00	-7.92	1.07	10.04	3.2	-	-	Carrier

Result[dBm] = Reading [dBm] + Cable loss [dB] + Attenuator Loss [dB]

*1) The frequency does not include the Restricted bands of operation.

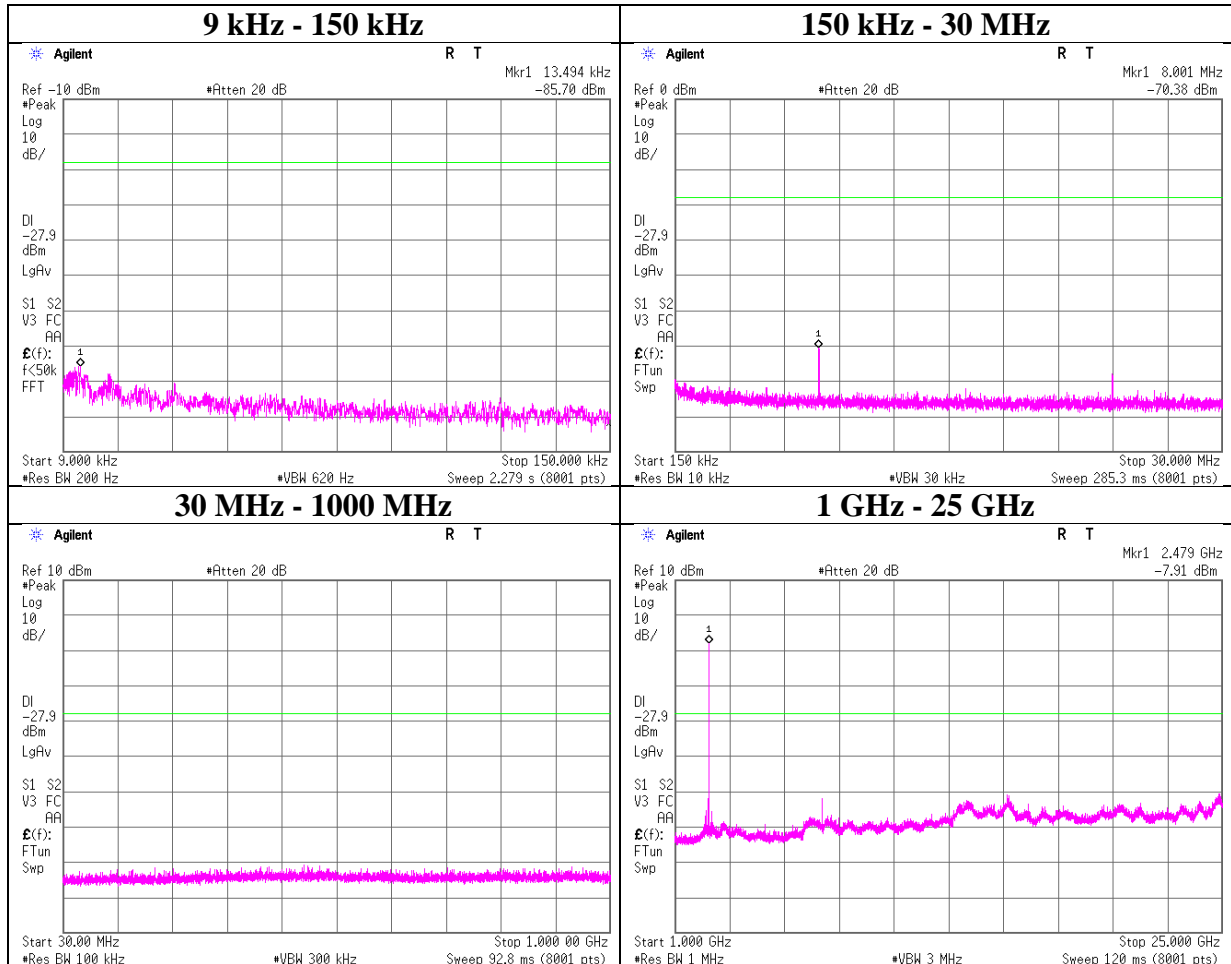
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Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan
Telephone : +81 478 88 6500
Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx ANT, 2480MHz



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
13.49	-85.7	0.01	9.95	2.0	1	-73.7	300	6.0	-12.5	45.0	57.5	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.38	0.03	9.95	-60.4	-16.8	43.6	*1)
2480.00	-7.91	1.08	10.04	3.2	-	-	-Carrier

$\text{Result [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]}$

*1) The frequency does not include the Restricted bands of operation.

UL Japan, Inc.

Kashima EMC Lab.

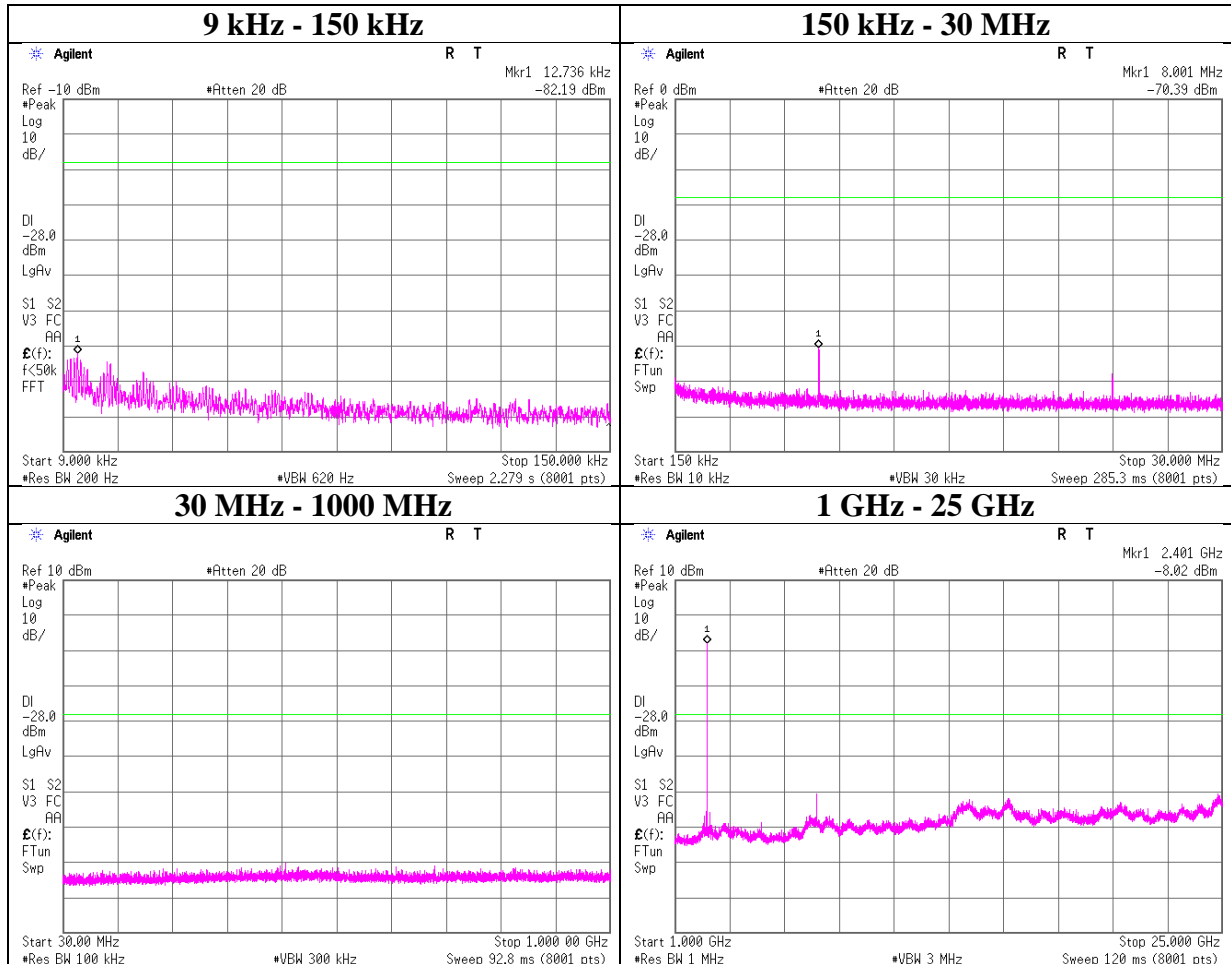
1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx Nordic Original, 2402MHz



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
12.74	-82.2	0.01	9.95	2.0	1	-70.2	300	6.0	-9.0	45.5	54.5	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.39	0.03	9.95	-60.4	-16.9	43.5	*1)
2402.00	-8.02	1.06	10.04	3.1	-	-	Carrier

$\text{Result [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]}$

*1) The frequency does not include the Restricted bands of operation.

UL Japan, Inc.

Kashima EMC Lab.

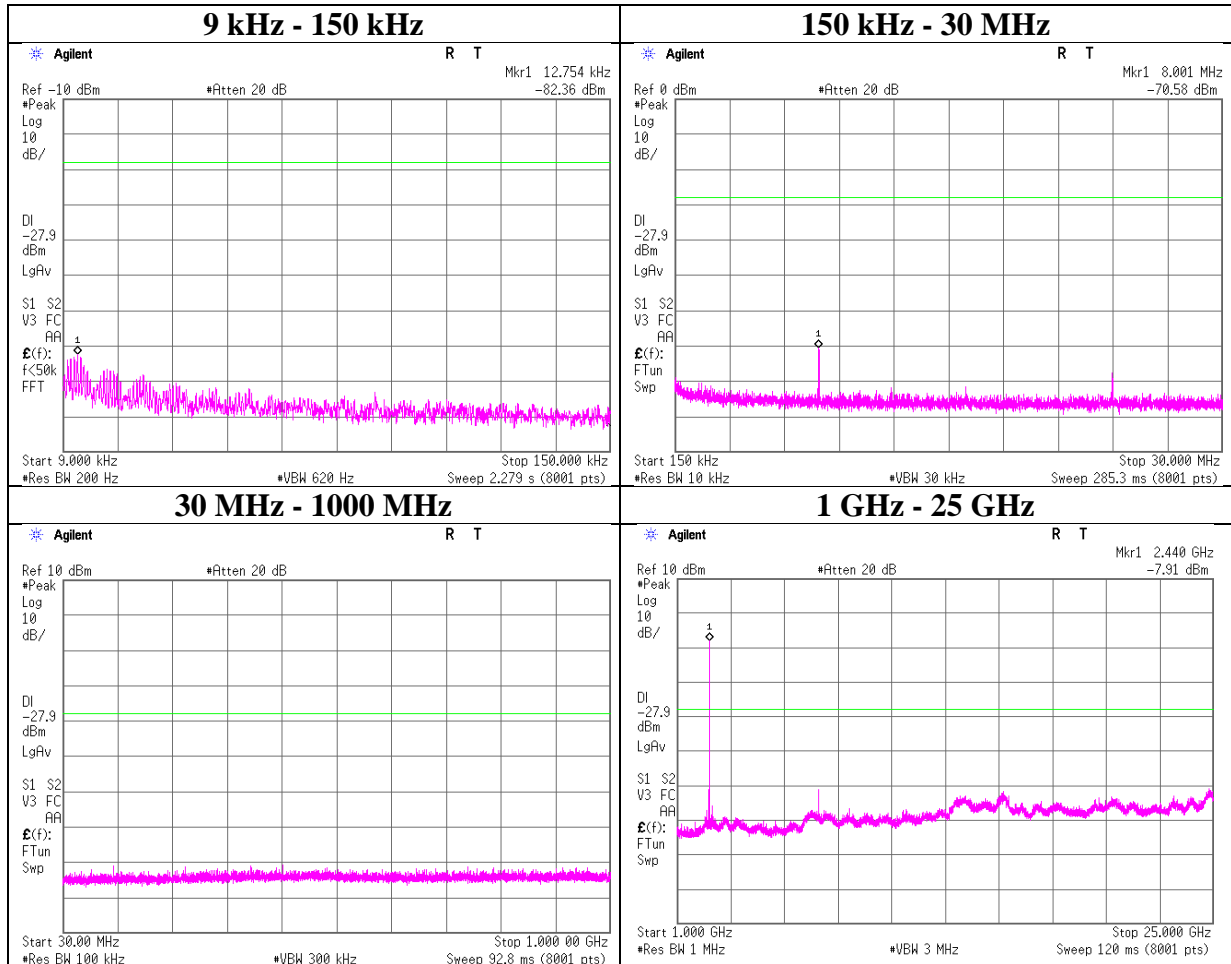
1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx Nordic Original, 2441MHz



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
12.75	-82.4	0.01	9.95	2.0	1	-70.4	300	6.0	-9.1	45.4	54.5	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.58	0.03	9.95	-60.6	-16.8	43.8	*1)
2441.00	-7.91	1.07	10.04	3.2	-	-	Carrier

$$\text{Result [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]}$$

*1) The frequency does not include the Restricted bands of operation.

UL Japan, Inc.

Kashima EMC Lab.

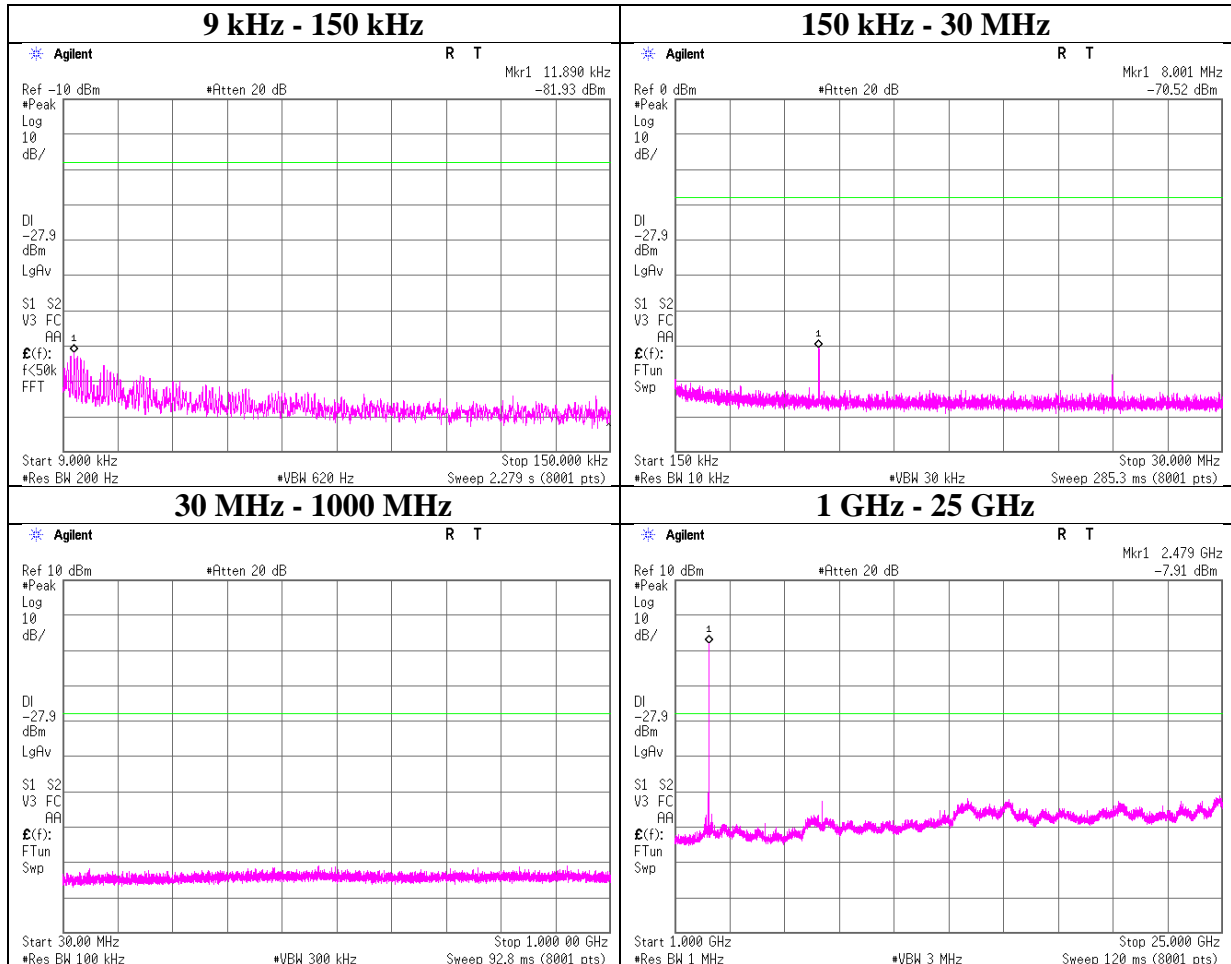
1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11818228M-A
Date : June 15, 2017
Temperature / Humidity : 22 deg. C / 54 % RH
Engineer : Hiromitsu Tanabe
Mode : Tx Nordic Original, 2480MHz



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
11.89	-81.9	0.01	9.95	2.0	1	-70.0	300	6.0	-8.7	46.1	54.8	

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

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

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.

20dBc Data Sheet

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
8.00	-70.52	0.03	9.95	-60.5	-16.8	43.7	*1)
2480.00	-7.91	1.06	10.04	3.2	-	-	Carrier

$$\text{Result [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]}$$

*1) The frequency does not include the Restricted bands of operation.

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

Power Density

Test place Kashima EMC Lab. No.2 Measurement Room
Report No. 11818228M-A
Date June 15, 2017
Temperature / Humidity 22 deg. C / 54 % RH
Engineer Hiromitsu Tanabe
Mode Tx

BT LE (1Mbps)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-21.38	1.06	10.04	-10.28	8.00	18.28
2440.00	-20.45	1.07	10.04	-9.34	8.00	17.34
2480.00	-21.00	1.08	10.04	-9.88	8.00	17.88

BT LE (2Mbps)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-23.23	1.06	10.04	-12.13	8.00	20.13
2440.00	-23.62	1.07	10.04	-12.51	8.00	20.51
2480.00	-24.51	1.08	10.04	-13.39	8.00	21.39

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-18.39	1.06	10.04	-7.29	8.00	15.29
2441.00	-17.40	1.07	10.04	-6.29	8.00	14.29
2480.00	-18.59	1.08	10.04	-7.47	8.00	15.47

Nordic Original

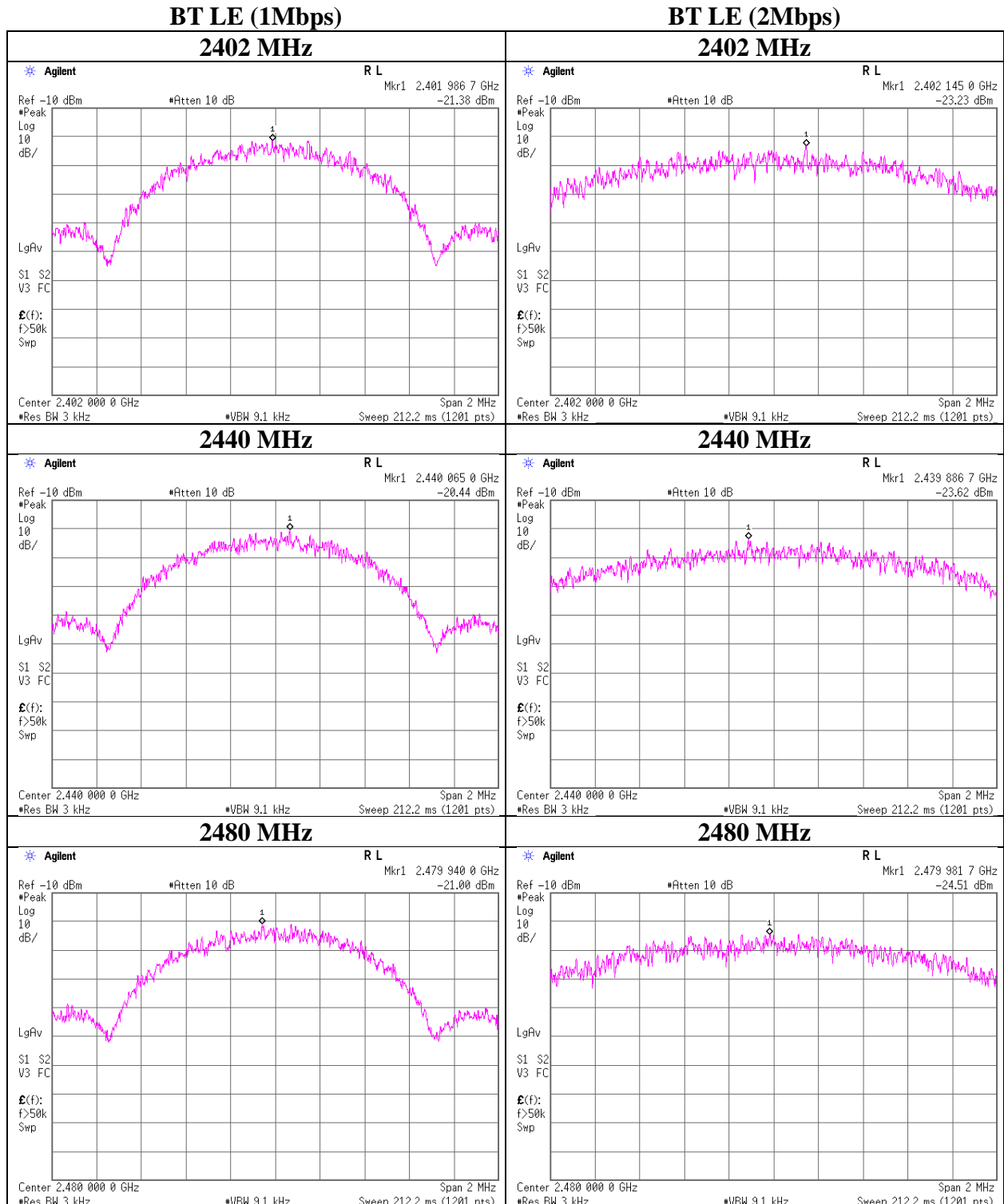
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-21.12	1.06	10.04	-10.02	8.00	18.02
2441.00	-21.38	1.07	10.04	-10.27	8.00	18.27
2480.00	-20.81	1.08	10.04	-9.69	8.00	17.69

Sample Calculation:

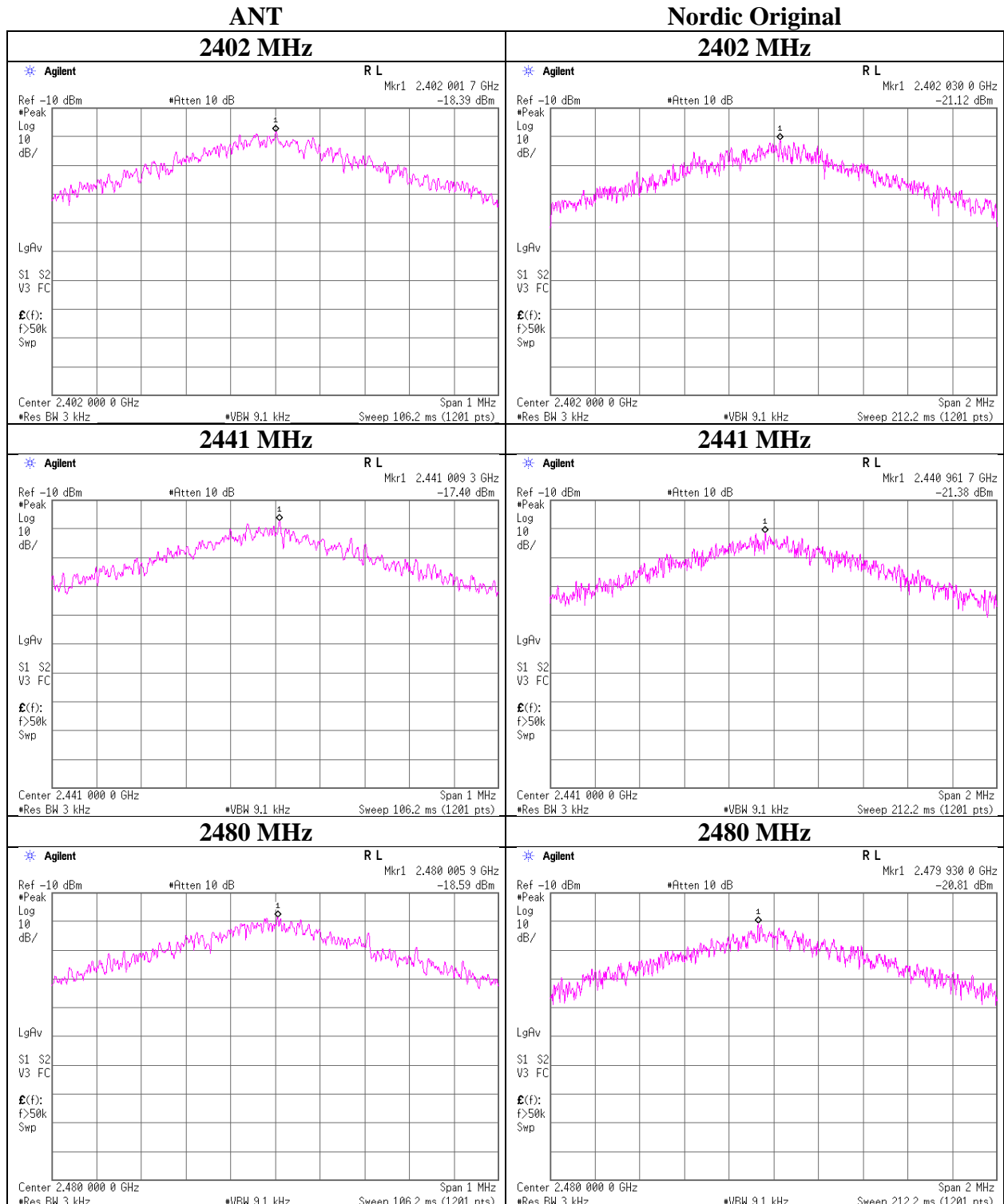
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten

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

Power Density

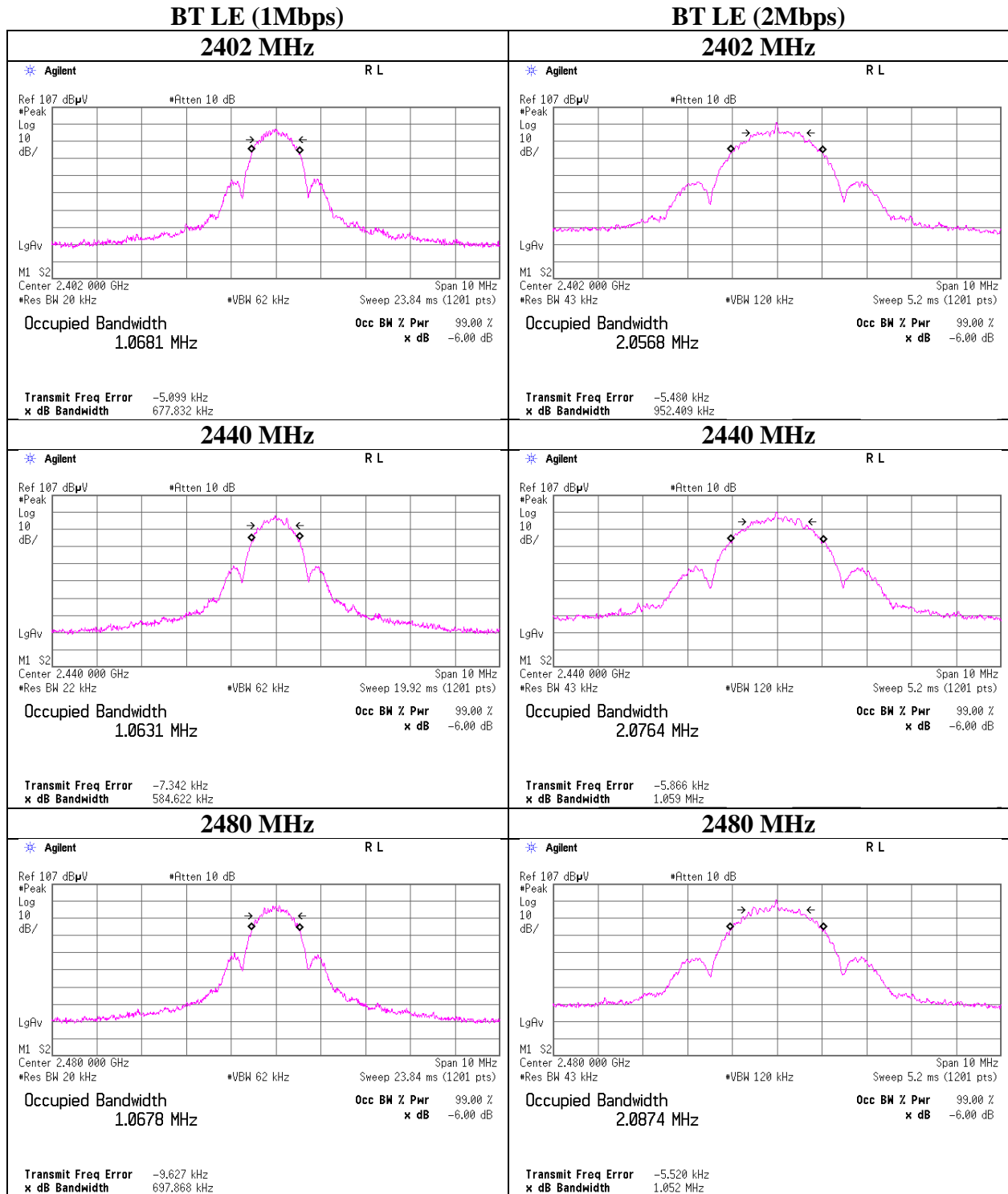


Power Density



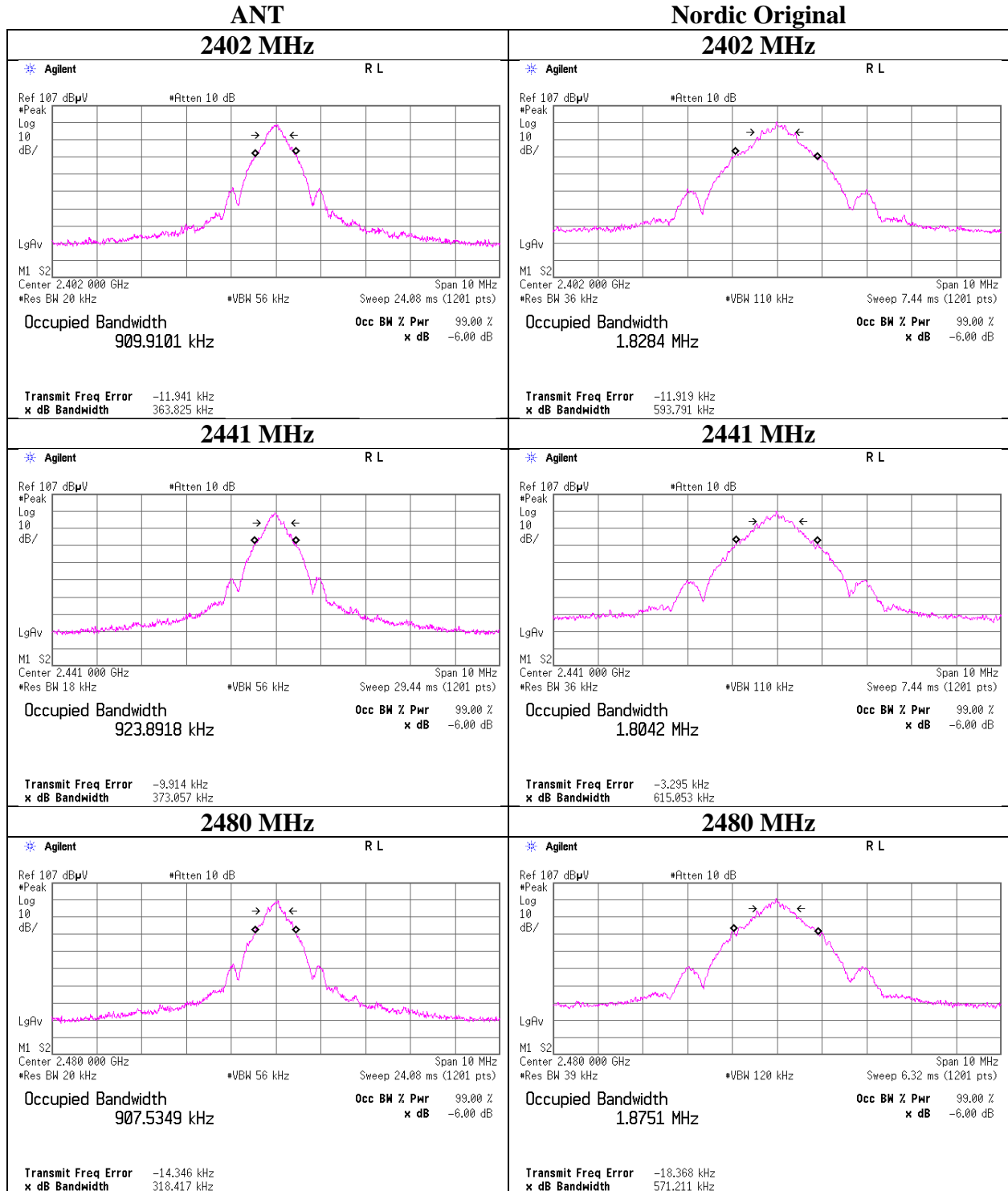
99% Occupied Bandwidth

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11818228M-A
Date	June 15, 2017
Temperature / Humidity	22 deg. C / 54 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx



99% Occupied Bandwidth

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11818228M-A
Date	June 15, 2017
Temperature / Humidity	22 deg. C / 54 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
CLS-08	A.M.N.	Rohde & Schwarz	ESH3-Z5	847265/011	CE	2016/07/22 * 12
CLS-11	A.M.N.	Rohde & Schwarz	ESH3-Z5	835239/022	CE	2016/07/22 * 12
CAT10-25	10dB Fixed Atten.	Suhner	6810.01.A	none	CE	2016/07/01 * 12
CTM-31	Terminator	Suhner	65_BNC-50-0-2/133_NE	none	CE	2016/11/01 * 12
CCC-S5-C(2/9/10/11)	Coaxial Cable	Fujikura,Fujikura,Fujikura,Fujikura	5D-2W,5D-2W,5D-2W,5D-2W	-	CE	2016/07/09 * 12
CTR-06	Test Receiver	Rohde & Schwarz	ESCI	100107 Rev 4.32	CE	2016/09/26 * 12
CSCL-06	Ruler	Tajima	L19-55S	none	CE	-
COS-05	Temperature & Humidity Indicator	A&D	AD-5681	6975761	CE	2016/07/21 * 12
CTS-09	Digital Multimeter	FLUKE	112	89790194	CE	2016/10/04 * 12
COTS-CE MI-02	EMI Software	TSJ	TEPTO-DV(RE,C E,MF,PE)	Ver, RE: 2.5.0131, CE: 2.5.0131, ME: 2.5.0129, PE: 2.5.0129	CE/RE	-
CHA-21	Broad Band Horn	Schwarzbeck	BBHA 9120D	9120D-1271	RE	2016/07/03 * 12
CTR-09	Test Receiver	Agilent	N9038A	MY53290016 Version A.14.03	RE	2017/06/27 * 12
CAF-18	Pre-Amplifier	TOYO	TPA0118-36	A-1001	RE	2016/11/07 * 12
CCC-G09	Micro Wave Cable	Junkosha	MWX221	1407S222	RE	2016/11/25 * 12
CCC-G10	Micro Wave Cable	Junkosha	MWX221	J12J102343-00	RE	2016/11/25 * 12
CAT10-17	10dB Fixed Atten.	Weinschel	54A-10	56251	RE/A T	2017/05/19 * 12
CHF-04	HPF	Micro-Tronics	HPM50111-02	009	RE	2017/05/19 * 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	2017/06/28 * 12
CCC-W09	Micro Wave Cable	SUHNER	SUCOFLEX104	MY588/4	RE	2016/07/19 * 12
CCC-S11-R(1/4/5/CATS12-13/6/7/8/10)	Coaxial Cable	Fujikura,Suhner,Suhner,Agilent,Suhner,-,Suhner	5D-2W,SF106,SF104,8496B+8494B,SF106,-,SF106	MY42143380,US00431042(Step Att)	RE	2016/11/10 * 12
CTR-01	Test Receiver	Rohde & Schwarz	ESU40	100426 Version 4.73 SP1	RE	2017/04/27 * 12
CAT3-06	3dB Fixed Atten.	TAMAGAWA	UFA-01	none	RE	2017/04/03 * 12
CBL-09	LOGBICON	Schwarzbeck	VULB 9168	508	RE	2017/04/10 * 12
CAF-16	Pre-Amplifier	Sonoma Instrument	310N	325015	RE	2017/05/19 * 12
COS-11	Temperature, Humidity & Atmospheric Logger	T&D	TR-73U	F8060468	RE	2017/05/16 * 12
CTS-13	Digital Multimeter	FLUKE	FLK-83-V	14610320	RE	2016/09/14 * 12

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Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
CSA-07	Spectrum Analyzer	Agilent	E4448A	MY52490024 Version A.11.21	RE/ AT	2017/05/31 * 12
CPM-16	Peak Power Analyzer	Agilent	8990B	MY51000276	AT	2017/06/09 * 12
CPSO-24	Power Sensor	Agilent	N1923A	MY54070024	AT	2017/06/09 * 12
CCC-W01	Micro Wave Cable	SUHNER	SUCOFLEX102	MY3662/2	AT	2017/05/19 * 12
CTS-18	Digital Multimeter	FLUKE	87-3	85220051	AT	2016/09/26 * 12
COS-05	Temperature & Humidity Indicator	A&D	AD-5681	6975761	AT	2016/07/21 * 12

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

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

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

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

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