



RADIO TEST REPORT

Test Report No. : 11156274M-A-R2

Applicant : TAIYO YUDEN CO., LTD.
Type of Equipment : Bluetooth Smart / ANT Module
Model No. : EYSHCN
FCC ID : RYYEYSHCN
Test regulation : FCC Part 15 Subpart C: 2015
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11156274M-A-R1. 11156274M-A-R1 is replaced with this report.

Date of test: February 13, 16, 18, 19,
March 10, 2016

Representative test engineer: 

Kazuhiro Ando
Engineer
Consumer Technology Division

Approved by: 

Masanori Nishiyama
Manager
Consumer Technology Division



CERTIFICATE 1266.01

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

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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. : EYSHCN
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 3 V, 1.7-3.6 V, 0.02 A, 0.1W
Receipt Date of Sample : February 13, 2016
Country of Mass-production : Japan
Condition of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Model: EYSHCN (referred to as the EUT in this report) is a Bluetooth Smart / ANT Module.

General Specification

Clock frequency(ies) in the system : 32 MHz, 32.768 kHz

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Radio Specification

< Bluetooth(BT) Low Energy (LE)>

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : GFSK
Power Supply (radio part input) : DC 1.3 V
Antenna type : Monopole Antenna
Antenna Gain : +0.9 dBi

<ANT>

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : GFSK
Power Supply (radio part input) : DC 1.3 V
Antenna type : Monopole Antenna
Antenna Gain : +0.9 dBi

<Nordic Original>

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : GFSK
Power Supply (radio part input) : DC 1.3 V
Antenna type : Monopole Antenna
Antenna Gain : +0.9 dBi

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on November 23, 2015
*Some parts are effective on and after December 17, 2015 or December 23, 2015. The revision 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 IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	QP 17.3 dB, 11.11820 MHz, N, AV 12.7 dB, 0.43964 MHz, L,	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	1.8 dB 2530.000 MHz, AV, Horizontal,	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 v03r04 12.2.7.

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

FCC Part 15.31 (e)

This EUT provides stable voltage(DC 1.3 V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because it is soldered on the circuit board. Therefore the equipment complies with the requirement of 15.203/212.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	-	Conducted

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

3.4 Uncertainty

EMI

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

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Item	Frequency range	Uncertainty (+/-)
		No. 1 SAC / SR
Radiated emission (Measurement distance: 3m)	30MHz - 300MHz	4.7dB
	300MHz - 1GHz	3.6dB
	1GHz - 13GHz	5.1dB
Radiated emission (Measurement distance: 1m)	13GHz - 18GHz	5.7dB
	18GHz - 26.5GHz	5.1dB

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

Conducted Emission test

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

Radiated emission test

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

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3.5 Test Location

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 A2LA Accreditation No. 1266.01

Test site	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Open site	90558	4659A-1	6.0 x 5.5 x 2.5	20 x 40	10 m
No.2 Open site	510504	4659A-2	4.4 x 4.4 x 2.15	18 x 20	10 m
No.5 Open site	99356	4659A-5	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	90558	4659A-1	5.4 x 4.5 x 2.3	-	-
No.2 Shielded room	510504	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	99356	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	372431	4659A-6	8.5 x 5.5 x 5.2	-	3 m
No.10 Semi-anechoic Chamber	682397	4659A-10	18.4 x 9.9 x 7.7	-	10 m
No.11 Semi-anechoic Chamber	718605	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.

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

4.1 Operating Mode(s)

Mode	Remarks*
Bluetooth(BT) Low Energy (LE)	Maximum Packet Size, PRBS9
ANT	1Mbps
Nordic Original	2Mbps
*Power of the EUT was set by the software as follows; Power settings: +4dBm, -40dBm Software: BT LE: BLE_TEST_tool-52 ANT, Nordic Original: ANT_TEST_tool-52 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

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

*1) Since ANT and Nordic have the same modulation method and no differences in transmitting specification test was performed on the representative mode that had the highest peak output power.

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

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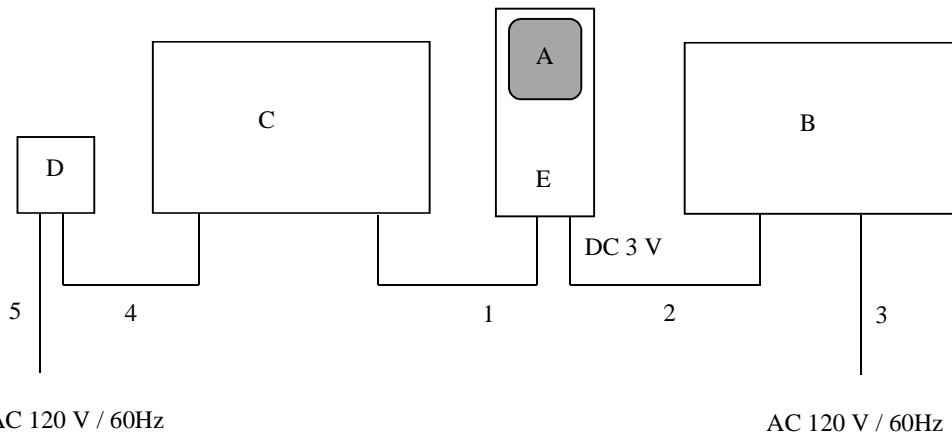
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Configuration and peripherals



* 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	EYSHCN	1 *1) 2 *2) 3 *3) 5 *4) 6 *5)	TAIYO YUDEN	EUT
B	DC Power Supply	GSV3000	60645741	DIAMOND ANTENNA	-
C	PC	CF-T2	4CKSA46826	Panasonic	-
D	AC Adaptor	CF-AA1625A	1625AM406Z21913F	Panasonic	-
E	Evaluation Board	EBSHCNZZX	1 *1) 2 *2) 3 *3) 5 *4) 6 *5)	TAIYO YUDEN	-

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

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

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

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

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

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	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	0.8	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a wooden table of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector : QP and CISPR AV
Measurement range : 0.15 MHz – 30 MHz
Test data : APPENDIX
Test result : Pass

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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 "558074 D01 DTS Meas Guidance v03r04".

[For below 1GHz]

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 1GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	30 MHz to 300 MHz	300 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: <u>12.2.5.1</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces <u>12.2.5.2</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3m	4 m*1) (below 10 GHz), 1 m *2) (above 10 GHz)		4 m *1)(below 10 GHz), 1 m *2) (above 10 GHz)

*1) Distance Factor: $20 \times \log(4.0 \text{ m} / 3.0 \text{ m}) = 2.5 \text{ dB}$

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

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

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

Measurement range : 30 M - 26 GHz
Test data : APPENDIX
Test result : Pass

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SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor:160 MHz BW) Spectrum Analyzer *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 v03r04". *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 not detected 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 v03r04 Section 9.2.2.4 Method AVGSA-2.							

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

Test data : APPENDIX
Test result : Pass

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APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

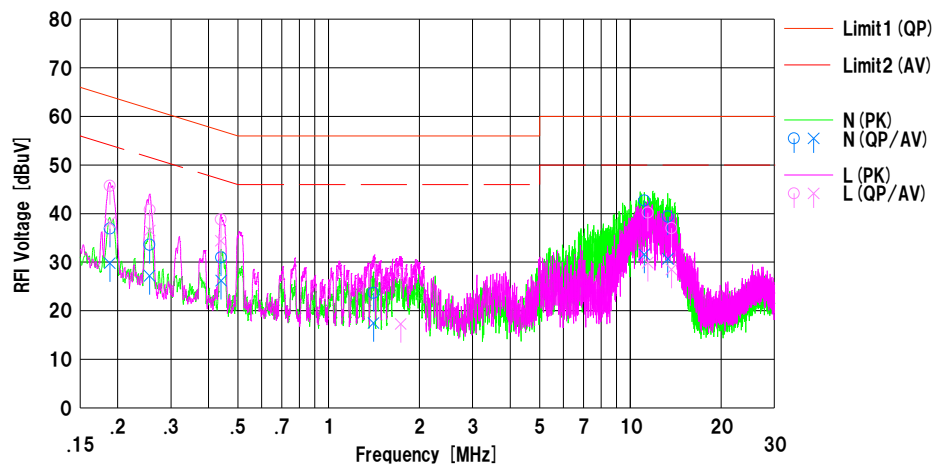
UL Japan,Inc. Kashima EMC Lab. No.5 Shielded Room
Date : 2016/02/19

Company : TAIYO YUDEN CO., LTD.
Kind of EUT : Bluetooth/ANT Module
Model No. : EYSHCN
Serial No. : 3
Remarks :

Mode : Tx, Bluetooth LE, 2402MHz
Order No. : 11156274M
Power : DC 3V (AC 120V/60Hz)
Temp./Humi. : 21deg.C / 40%RH

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

Tested by : Mitsuhiro Jitsukawa

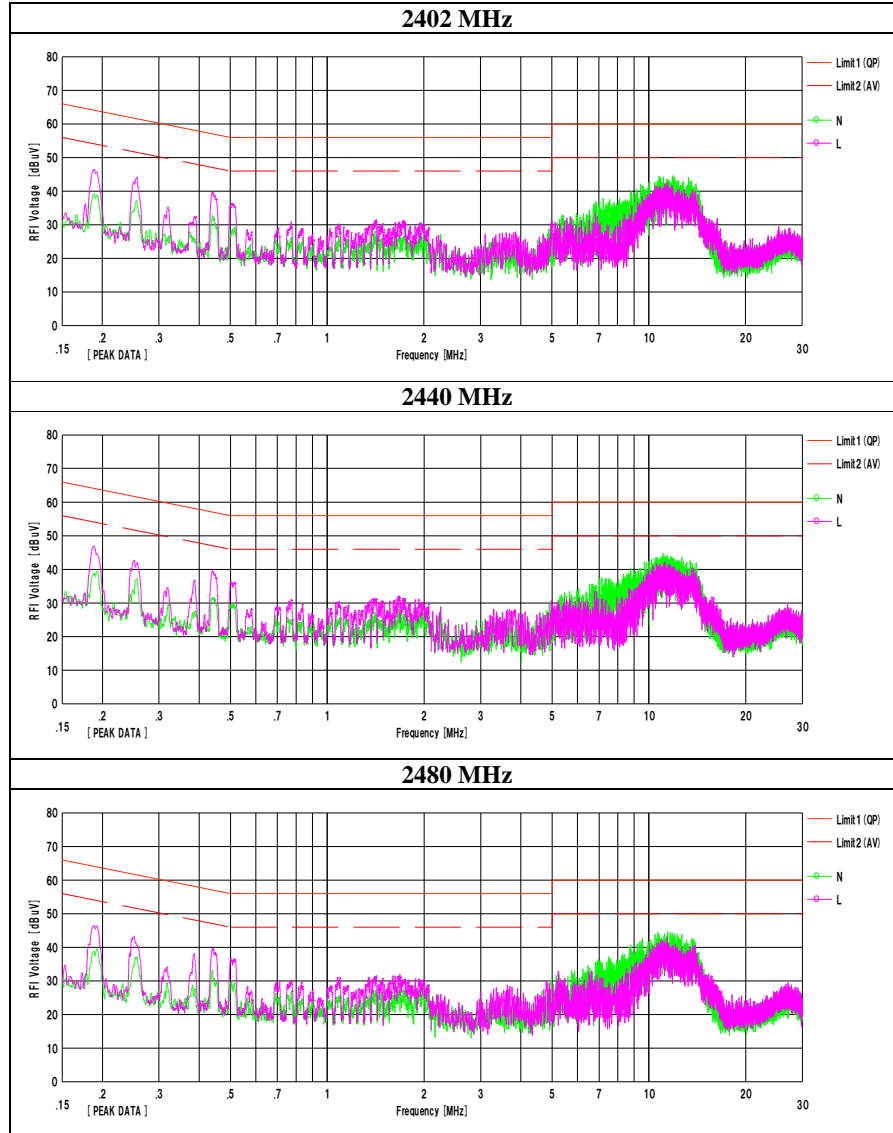


No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<OP> [dBuV]	<AV> [dBuV]		<OP> [dBuV]	<AV> [dBuV]	<OP> [dBuV]	<AV> [dBuV]	<OP> [dB]	<AV> [dB]		
1	0.18830	26.7	19.6	10.2	36.9	29.8	64.1	54.1	27.2	24.3	N	
2	0.25487	23.4	17.0	10.2	33.6	27.2	61.6	51.6	28.0	24.4	N	
3	0.43976	20.8	16.0	10.2	31.0	26.2	57.1	47.1	26.1	20.9	N	
4	1.40789	13.4	7.2	10.3	23.7	17.5	56.0	46.0	32.3	28.5	N	
5	11.11820	31.6	20.5	11.1	42.7	31.6	60.0	50.0	17.3	18.4	N	
6	13.29831	28.1	19.4	11.3	39.4	30.7	60.0	50.0	20.6	19.3	N	
7	0.18831	35.5	28.0	10.2	45.7	38.2	64.1	54.1	18.4	15.9	L	
8	0.25518	30.6	26.3	10.2	40.8	35.5	61.6	51.6	20.8	15.1	L	
9	0.43964	28.6	24.2	10.2	38.8	34.4	57.1	47.1	18.3	12.7	L	
10	1.73253	17.5	7.0	10.3	27.8	17.3	56.0	46.0	23.2	26.7	L	
11	11.41575	29.1	18.8	11.1	40.2	29.9	60.0	50.0	19.8	20.1	L	
12	13.68672	25.7	17.2	11.3	37.0	28.5	60.0	50.0	23.0	21.5	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.	11156274M
Date	February 19, 2016
Temperature / Humidity	21 deg. C / 40 % RH
Engineer	Mitsuhiro Jitsukawa
Mode	Tx BT LE



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Conducted Emission

DATA OF CONDUCTED EMISSION TEST

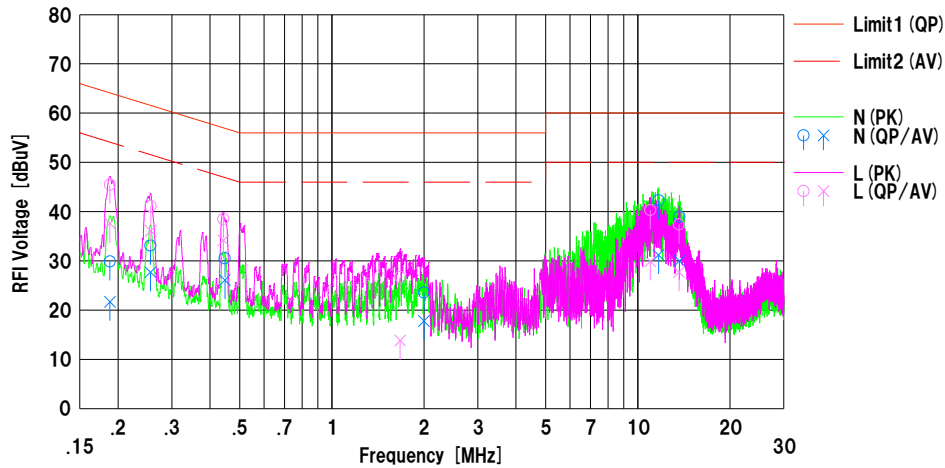
UL Japan.Inc. Kashima EMC Lab, No.5 Shielded Room
Date : 2016/02/19

Company : TAIYO YUDEN CO., LTD.
Kind of EUT : Bluetooth/ANT Module
Model No. : EYSHCN
Serial No. : 5
Remarks :

Mode : Tx, ANT, 2402MHz
Order No. : 11156274M
Power : DC 3V (AC 120V/60Hz)
Temp./Humi. : 21deg.C / 40%RH

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

Tested by : Mitsuhiro Jitsukawa

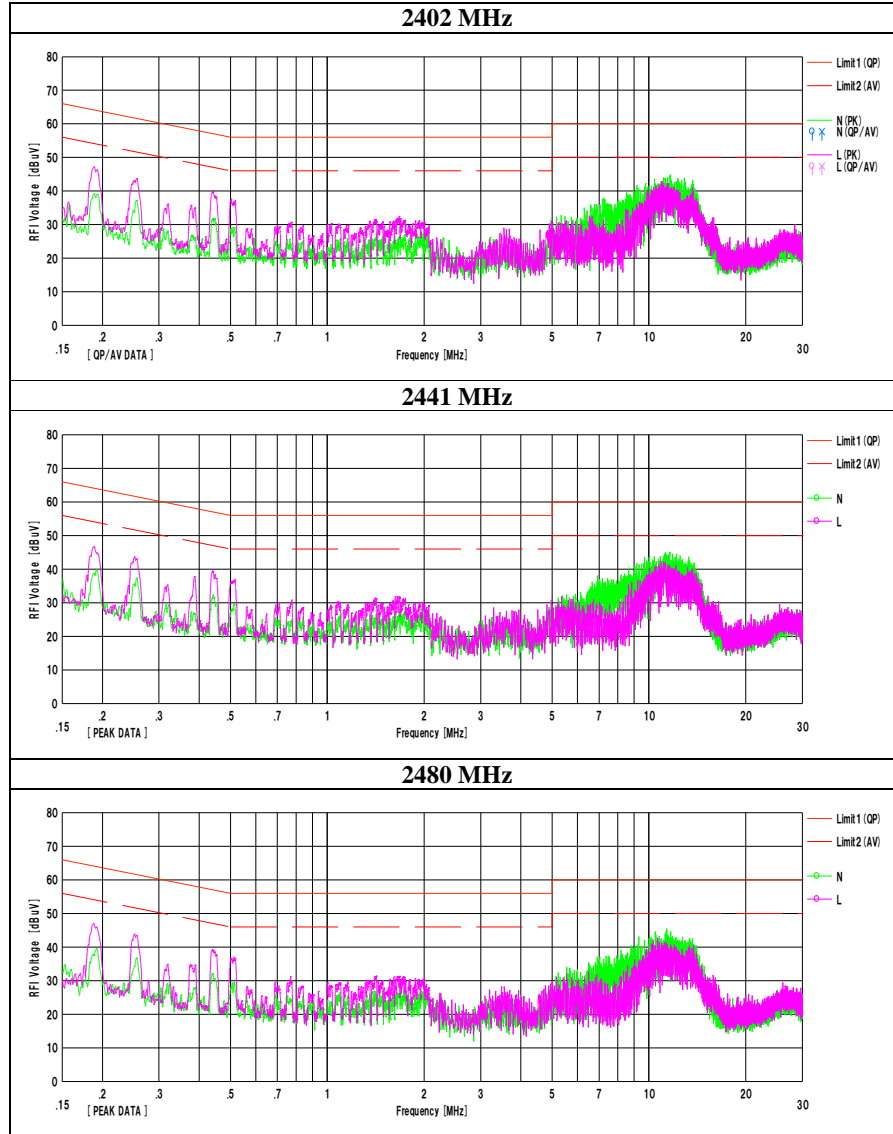


No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<OP> [dBuV]	<AV> [dBuV]	<OP> [dBuV]	<AV> [dBuV]	<OP> [dB]	<AV> [dB]		
1	0.18831	19.7	11.5	10.2	29.9	21.7	64.1	54.1	34.2	32.4	N	
2	0.25536	22.9	17.5	10.2	33.1	27.7	61.6	51.6	28.5	23.9	N	
3	0.44704	20.3	15.9	10.2	30.5	26.1	56.9	46.9	26.4	20.8	N	
4	1.99944	13.3	7.5	10.3	23.6	17.8	56.0	46.0	32.4	28.2	N	
5	11.68973	31.2	20.1	11.1	42.3	31.2	60.0	50.0	17.7	18.8	N	
6	13.69087	27.7	18.7	11.3	39.0	30.0	60.0	50.0	21.0	20.0	N	
7	0.18822	35.3	27.4	10.2	45.5	37.6	64.1	54.1	18.6	16.5	L	
8	0.25580	30.9	25.9	10.2	41.1	36.1	61.6	51.6	20.5	15.5	L	
9	0.44191	28.3	24.0	10.2	38.5	34.2	57.0	47.0	18.5	12.8	L	
10	1.67262	16.4	3.5	10.3	26.7	13.8	56.0	46.0	29.3	32.2	L	
11	10.98806	29.2	18.8	11.1	40.3	29.9	60.0	50.0	19.7	20.1	L	
12	13.63945	26.1	16.4	11.3	37.4	27.7	60.0	50.0	22.6	22.3	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.	11156274M
Date	February 19, 2016
Temperature / Humidity	21 deg. C / 40 % RH
Engineer	Mitsuhiro Jitsukawa
Mode	Tx, ANT



UL Japan, Inc.

Kashima EMC Lab.

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Facsimile : +81-478-82-3373

6dB Bandwidth

Test place Kashima EMC Lab. No.2 Measurement Room
Report No. 11156274M
Date February 18, 2016
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Kazuhiro Ando
Mode Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
BT LE	2402	0.733	> 500
	2440	0.739	> 500
	2480	0.739	> 500
ANT	2402	0.515	> 500
	2441	0.514	> 500
	2480	0.516	> 500
Nordic Original	2402	0.850	> 500
	2441	0.850	> 500
	2480	0.864	> 500

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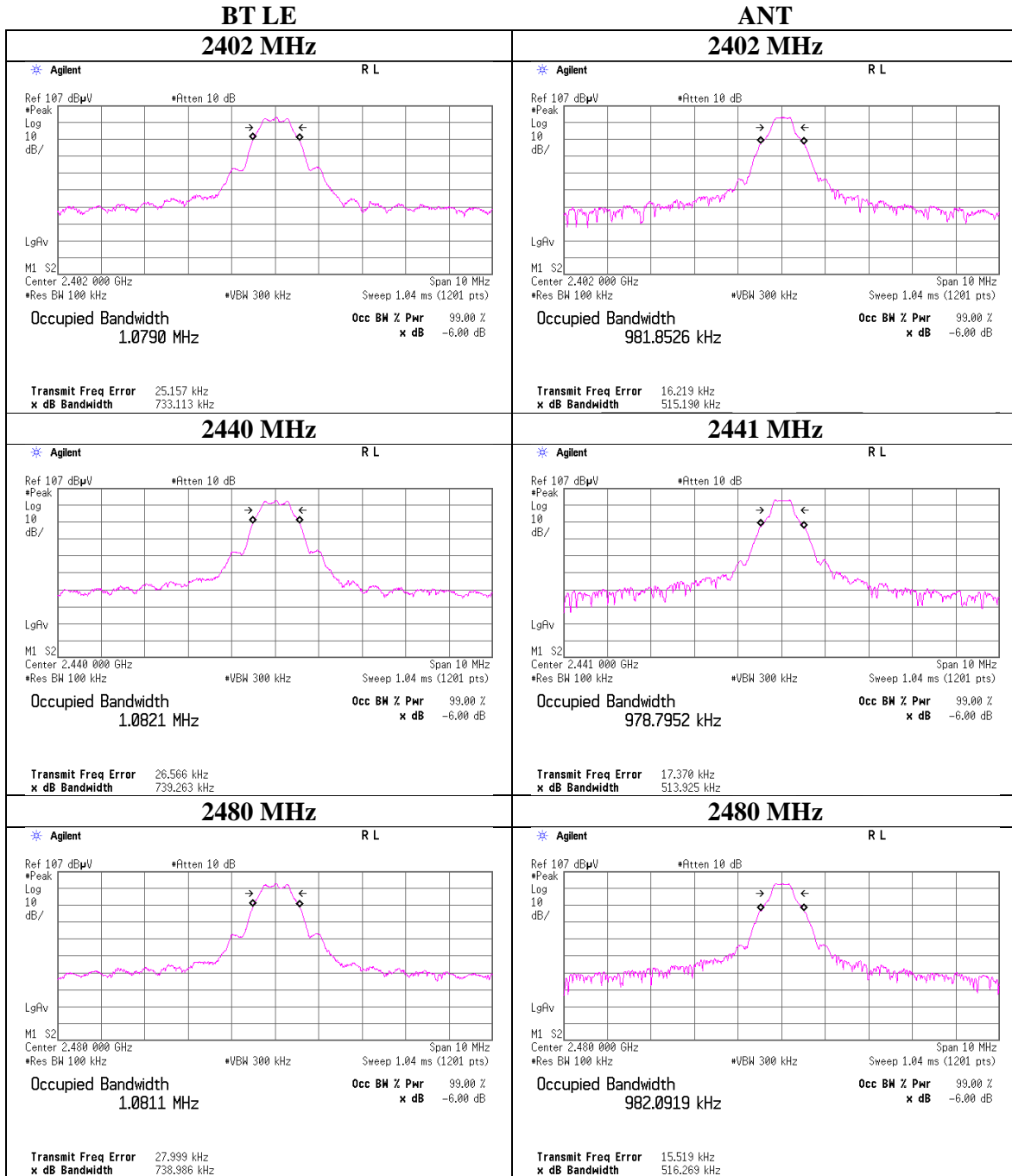
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Telephone : +81-478-88-6500

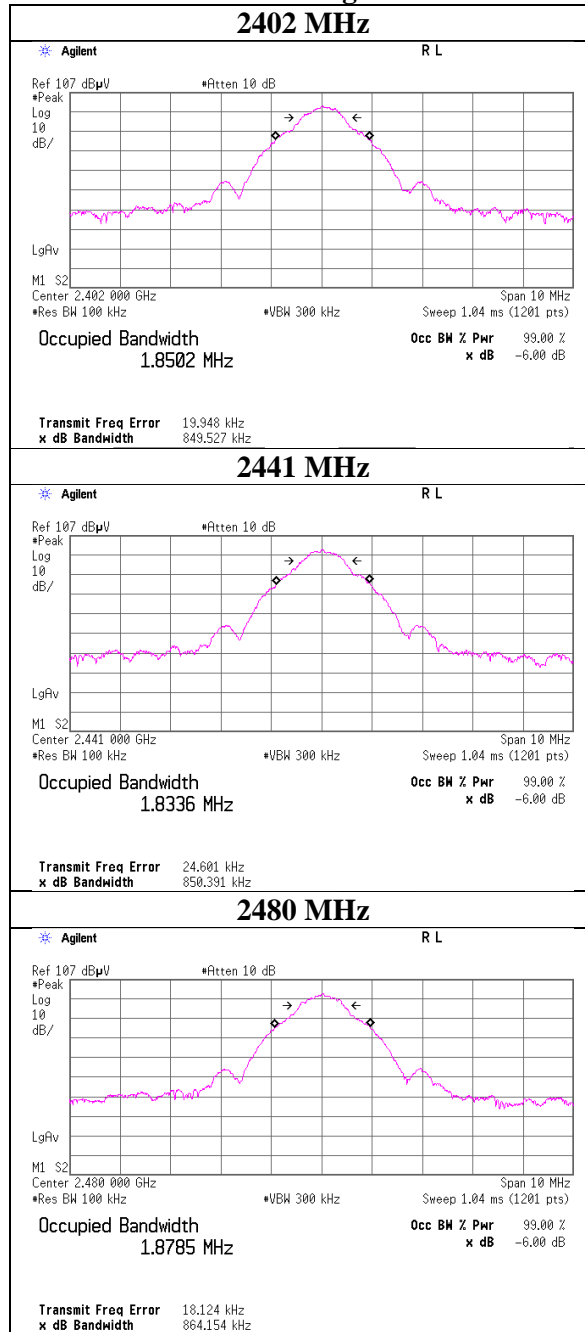
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6dB Bandwidth



6dB Bandwidth

Nordic Original



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Maximum Peak Output Power

Test place : Kashima EMC Lab. No.2 Measurement Room
 Report No. : 11156274M
 Date : February 13, 2016
 Temperature / Humidity : 21 deg. C / 39 % RH
 Engineer : Kazuhiro Ando
 Mode : Tx (+4dBm setting)

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-6.89	1.62	10.03	4.76	2.99	30.00	1000	25.24
2440	-6.95	1.63	10.03	4.71	2.96	30.00	1000	25.29
2480	-7.07	1.63	10.03	4.59	2.88	30.00	1000	25.41

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-6.80	1.62	10.03	4.85	3.05	30.00	1000	25.15
2441	-6.90	1.63	10.03	4.76	2.99	30.00	1000	25.24
2480	-6.98	1.63	10.03	4.68	2.94	30.00	1000	25.32

Nordic Original

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-6.81	1.62	10.03	4.84	3.05	30.00	1000	25.16
2441	-6.90	1.63	10.03	4.76	2.99	30.00	1000	25.24
2480	-6.99	1.63	10.03	4.67	2.93	30.00	1000	25.33

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.

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Maximum Peak Output Power

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11156274M
Date : February 18, 2016
Temperature / Humidity : 23 deg. C / 35 % RH
Engineer : Kazuhiro Ando
Mode : Tx (-40dBm setting)

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-50.57	1.62	10.03	-38.92	0.00013	30.00	1000	68.92
2440	-50.66	1.63	10.03	-39.00	0.00013	30.00	1000	69.00
2480	-50.83	1.63	10.03	-39.17	0.00012	30.00	1000	69.17

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-50.23	1.62	10.03	-38.58	0.00014	30.00	1000	68.58
2441	-50.38	1.63	10.03	-38.72	0.00013	30.00	1000	68.72
2480	-50.53	1.63	10.03	-38.87	0.00013	30.00	1000	68.87

Nordic Original

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-50.30	1.62	10.03	-38.65	0.00014	30.00	1000	68.65
2441	-50.41	1.63	10.03	-38.75	0.00013	30.00	1000	68.75
2480	-50.64	1.63	10.03	-38.98	0.00013	30.00	1000	68.98

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.

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Average Output Power (Reference data)

Test place : Kashima EMC Lab. No.2 Measurement Room
 Report No. : 11156274M
 Date : February 13, 2016
 Temperature / Humidity : 21 deg. C / 39 % RH
 Engineer : Kazuhiro Ando
 Mode : Tx (+4dBm setting)

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-9.14	1.62	10.03	2.51	1.78	1.97	4.48	2.81
2440	-9.19	1.63	10.03	2.47	1.77	1.97	4.44	2.78
2480	-9.32	1.63	10.03	2.34	1.71	1.97	4.31	2.70

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-7.29	1.62	10.03	4.36	2.73	0.23	4.59	2.88
2441	-7.38	1.63	10.03	4.28	2.68	0.23	4.51	2.82
2480	-7.47	1.63	10.03	4.19	2.62	0.23	4.42	2.77

Nordic Original

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-7.51	1.62	10.03	4.14	2.59	0.45	4.59	2.88
2441	-7.60	1.63	10.03	4.06	2.55	0.45	4.51	2.82
2480	-7.69	1.63	10.03	3.97	2.49	0.45	4.42	2.77

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.

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Average Output Power (Reference data)

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11156274M
Date : February 18, 2016
Temperature / Humidity : 23 deg. C / 35 % RH
Engineer : Kazuhiro Ando
Mode : Tx (-40dBm setting)

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-53.55	1.62	10.03	-41.90	0.00006	1.97	-39.93	0.00010
2440	-53.02	1.63	10.03	-41.36	0.00007	1.97	-39.39	0.00012
2480	-53.52	1.63	10.03	-41.86	0.00007	1.97	-39.89	0.00010

ANT

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-51.09	1.62	10.03	-39.44	0.00011	0.23	-39.21	0.00012
2441	-51.39	1.63	10.03	-39.73	0.00011	0.23	-39.50	0.00011
2480	-51.62	1.63	10.03	-39.96	0.00010	0.23	-39.73	0.00011

Nordic Original

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-51.31	1.62	10.03	-39.66	0.00011	0.45	-39.21	0.00012
2441	-51.57	1.63	10.03	-39.91	0.00010	0.45	-39.46	0.00011
2480	-51.76	1.63	10.03	-40.10	0.00010	0.45	-39.65	0.00011

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.

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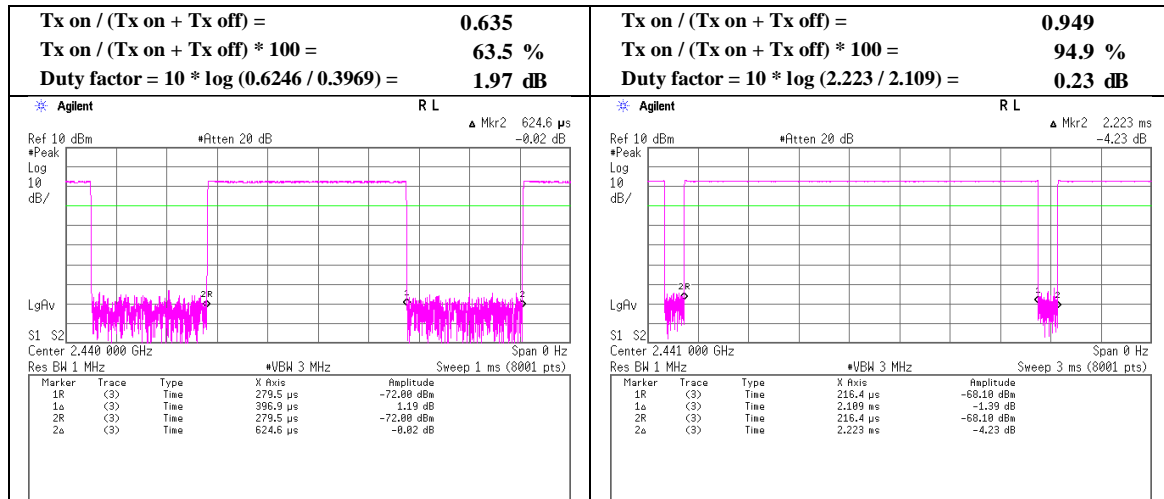
Facsimile : +81-478-82-3373

Burst rate confirmation

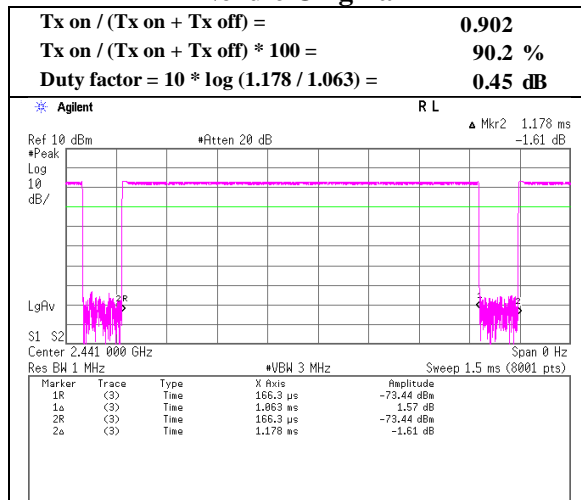
Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11156274M
Date	February 13, 2016
Temperature / Humidity	21 deg. C / 39 % RH
Engineer	Kazuhiro Ando
Mode	Tx

BT LE

ANT



Nordic Original



Radiated Spurious Emission

Test place : Kashima EMC Lab. No.6 Semi Anechoic Chamber (1-26GHz)
Kashima EMC Lab. No.10 Semi Anechoic Chamber (30-1000MHz)
Report No. : 11156274M
Date : February 14, 2016 February 16, 2016 February 17, 2016
Temperature / Humidity : 21 deg. C / 47 % RH 21 deg. C / 36 % RH 22 deg. C / 35 % RH
Engineer : Mitsuhiro Jitsukawa Kazuhiro Ando Kazuhiro Ando
(30-1000MHz) (1-10GHz) (10-26GHz)
Mode : Tx, BT LE, 2402 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	144.181	QP	35.7	13.3	5.8	26.5	0.0	28.3	43.5	15.2	215	0	
Hori.	168.076	QP	26.5	13.2	6.0	26.4	0.0	19.3	43.5	24.2	181	0	
Hori.	263.910	QP	28.5	12.2	7.0	26.0	0.0	21.7	46.0	24.3	135	329	
Hori.	2390.000	PK	43.8	27.6	14.0	38.3	2.5	49.6	73.9	24.3	167	240	
Hori.	4804.000	PK	46.7	31.3	6.1	39.3	2.5	47.3	73.9	26.6	106	336	
Hori.	7206.000	PK	46.8	36.3	7.5	38.4	2.5	54.7	73.9	19.2	127	139	
Hori.	9608.000	PK	40.6	39.0	8.6	37.0	2.5	53.7	73.9	20.2	100	0	Floor Noise
Vert.	95.962	QP	33.1	8.4	5.2	26.7	0.0	20.0	43.5	23.5	100	118	
Vert.	120.228	QP	35.4	11.5	5.5	26.6	0.0	25.8	43.5	17.7	100	143	
Vert.	144.275	QP	37.0	13.3	5.8	26.5	0.0	29.6	43.5	13.9	100	327	
Vert.	264.126	QP	32.0	12.2	7.0	26.0	0.0	25.2	46.0	20.8	100	198	
Vert.	408.031	QP	29.2	15.7	8.3	26.8	0.0	26.4	46.0	19.6	100	211	
Vert.	504.521	QP	26.4	17.9	8.8	27.4	0.0	25.7	46.0	20.3	100	0	
Vert.	2390.000	PK	43.6	27.6	14.0	38.3	2.5	49.4	73.9	24.5	173	273	
Vert.	4804.000	PK	49.5	31.3	6.1	39.3	2.5	50.1	73.9	23.8	153	25	
Vert.	7206.000	PK	47.0	36.3	7.5	38.4	2.5	54.9	73.9	19.0	100	26	
Vert.	9608.000	PK	40.5	39.0	8.6	37.0	2.5	53.6	73.9	20.3	100	0	Floor Noise

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

Distance factor : 1 GHz - 10 GHz : 20log(4.0 m / 3.0 m) = 2.5 dB

10 GHz - 26 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	33.4	27.6	14.0	38.3	1.97	2.5	41.2	53.9	12.7	*1)
Hori.	4804.000	AV	36.7	31.3	6.1	39.3	1.97	2.5	39.3	53.9	14.6	
Hori.	7206.000	AV	37.1	36.3	7.5	38.4	1.97	2.5	47.0	53.9	6.9	
Hori.	9608.000	AV	30.6	39.0	8.6	37.0	1.97	2.5	45.7	53.9	8.2	Floor Noise
Vert.	2390.000	AV	33.2	27.6	14.0	38.3	1.97	2.5	41.0	53.9	12.9	*1)
Vert.	4804.000	AV	40.0	31.3	6.1	39.3	1.97	2.5	42.6	53.9	11.3	
Vert.	7206.000	AV	37.6	36.3	7.5	38.4	1.97	2.5	47.5	53.9	6.4	
Vert.	9608.000	AV	30.6	39.0	8.6	37.0	1.97	2.5	45.7	53.9	8.2	Floor Noise

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

Distance factor : 1 GHz - 10 GHz : 20log(4.0 m / 3.0 m) = 2.5 dB

10 GHz - 26 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	87.5	27.6	14.0	38.3	2.5	93.3	-	-	Carrier
Hori.	2400.000	PK	38.4	27.6	14.0	38.3	2.5	44.2	73.3	29.1	
Vert.	2402.000	PK	86.5	27.6	14.0	38.3	2.5	92.3	-	-	Carrier
Vert.	2400.000	PK	37.8	27.6	14.0	38.3	2.5	43.6	72.3	28.7	

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

Distance factor : 1 GHz - 10 GHz : 20log(4.0 m / 3.0 m) = 2.5 dB

10 GHz - 26 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

UL Japan, Inc.

Kashima EMC Lab.

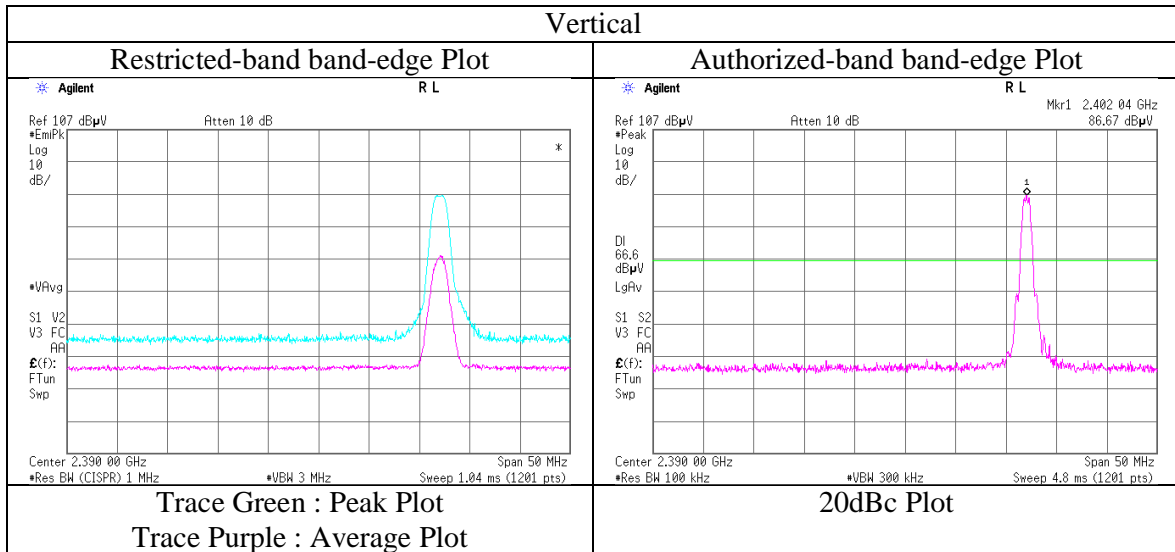
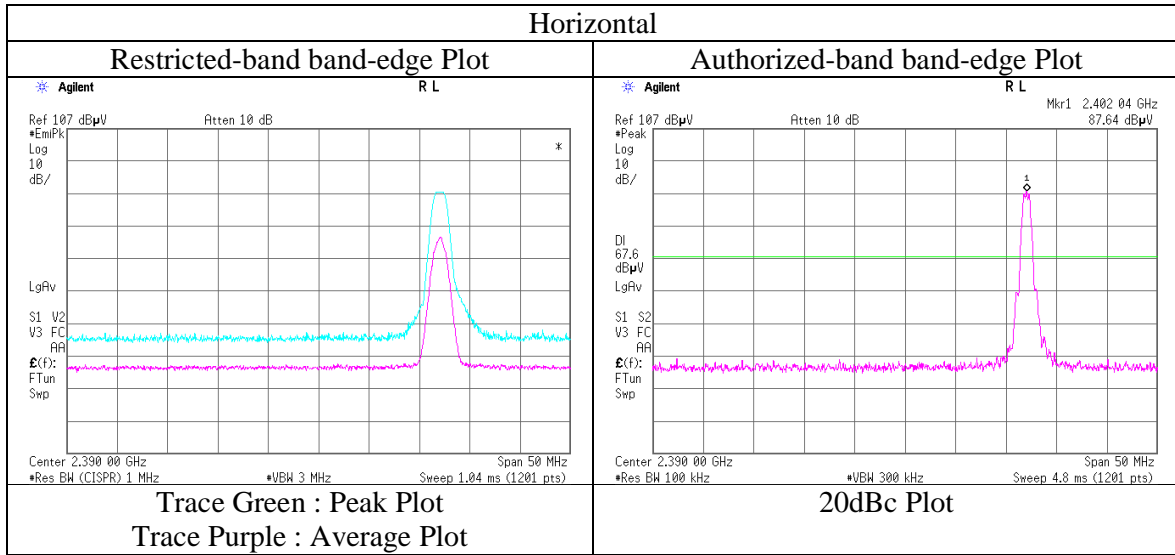
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

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Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No.	11156274M
Date	February 16, 2016
Temperature / Humidity	21 deg. C / 36 % RH
Engineer	Kazuhiro Ando
Mode	Tx, BT LE, 2402 MHz



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

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.6 Semi Anechoic Chamber
 Report No. : 11156274M
 Date : February 16, 2016 February 17, 2016
 Temperature / Humidity : 21 deg. C / 36 % RH 22 deg. C / 35 % RH
 Engineer : Kazuhiro Ando Kazuhiro Ando
 (1-10GHz) (10-26GHz)
 Mode : Tx, BT LE, 2440 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4880.000	PK	46.4	31.2	6.2	39.3	2.5	47.0	73.9	26.9	112	23	
Hori.	7320.000	PK	47.0	36.4	7.8	38.4	2.5	55.3	73.9	18.6	100	331	
Hori.	9760.000	PK	41.7	39.5	8.7	36.9	2.5	55.5	73.9	18.4	100	0	Floor Noise
Vert.	4880.000	PK	46.5	31.2	6.2	39.3	2.5	47.1	73.9	26.8	141	0	
Vert.	7320.000	PK	47.1	36.4	7.8	38.4	2.5	55.4	73.9	18.5	118	20	
Vert.	9760.000	PK	41.6	39.5	8.7	36.9	2.5	55.4	73.9	18.5	100	0	Floor Noise

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

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

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4880.000	AV	35.1	31.2	6.2	39.3	1.97	2.5	37.7	53.9	16.2	
Hori.	7320.000	AV	37.6	36.4	7.8	38.4	1.97	2.5	47.9	53.9	6.0	
Hori.	9760.000	AV	30.9	39.5	8.7	36.9	1.97	2.5	46.7	53.9	7.2	Floor Noise
Vert.	4880.000	AV	37.0	31.2	6.2	39.3	1.97	2.5	39.6	53.9	14.3	
Vert.	7320.000	AV	38.1	36.4	7.8	38.4	1.97	2.5	48.4	53.9	5.5	
Vert.	9760.000	AV	30.9	39.5	8.7	36.9	1.97	2.5	46.7	53.9	7.2	Floor Noise

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

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

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

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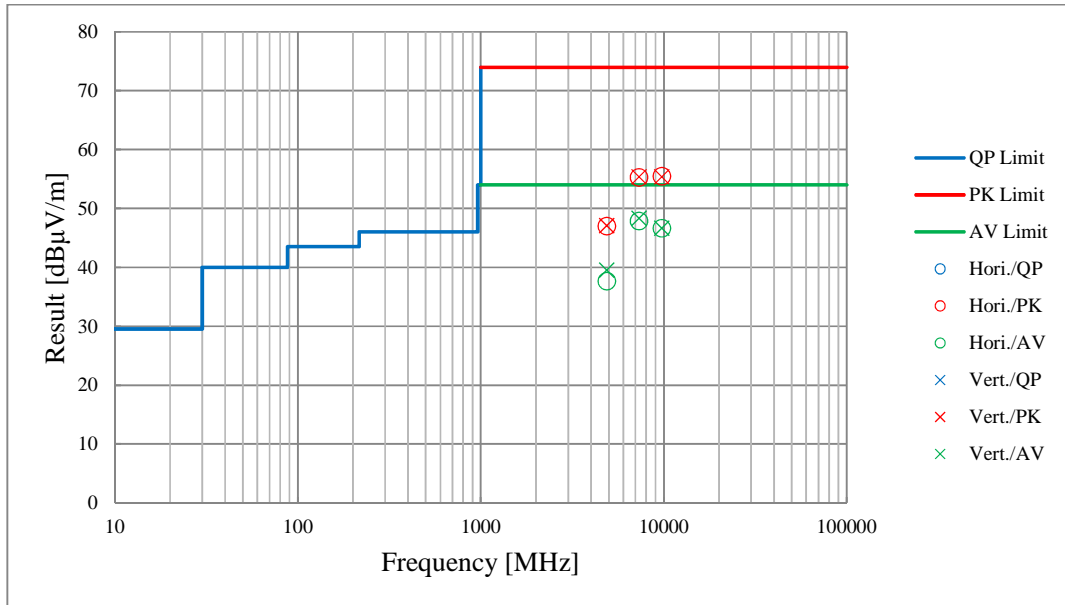
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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Facsimile : +81-478-82-3373

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber	
Report No.	11156274M	
Date	February 16, 2016	February 17, 2016
Temperature / Humidity	21 deg. C / 36 % RH	22 deg. C / 35 % RH
Engineer	Kazuhiro Ando (1-10GHz)	Kazuhiro Ando (10-26GHz)
Mode	Tx, BT LE, 2440 MHz	



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

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Radiated Spurious Emission

Test place : Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No. : 11156274M
Date : February 16, 2016 February 17, 2016
Temperature / Humidity : 21 deg. C / 36 % RH 22 deg. C / 35 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando
 (1-10GHz) (10-26GHz)
Mode : Tx, BT LE, 2480 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	51.0	27.5	14.1	38.4	2.5	56.7	73.9	17.2	152	298	
Hori.	4960.000	PK	45.7	31.4	6.2	39.3	2.5	46.5	73.9	27.4	121	151	
Hori.	7440.000	PK	45.6	36.7	7.7	38.3	2.5	54.2	73.9	19.7	105	318	
Hori.	9920.000	PK	41.7	39.5	8.7	36.8	2.5	55.6	73.9	18.3	100	0	Floor Noise
Vert.	2483.500	PK	48.9	27.5	14.1	38.4	2.5	54.6	73.9	19.3	140	332	
Vert.	4960.000	PK	46.5	31.4	6.2	39.3	2.5	47.3	73.9	26.6	114	0	
Vert.	7440.000	PK	46.7	36.7	7.7	38.3	2.5	55.3	73.9	18.6	137	147	
Vert.	9920.000	PK	41.9	39.5	8.7	36.8	2.5	55.8	73.9	18.1	100	0	Floor Noise

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

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

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	35.3	27.5	14.1	38.4	1.97	2.5	43.0	53.9	10.9	*1)
Hori.	4960.000	AV	35.5	31.4	6.2	39.3	1.97	2.5	38.3	53.9	15.6	
Hori.	7440.000	AV	34.5	36.7	7.7	38.3	1.97	2.5	45.1	53.9	8.8	
Hori.	9920.000	AV	30.9	39.5	8.7	36.8	1.97	2.5	46.8	53.9	7.1	Floor Noise
Vert.	2483.500	AV	34.2	27.5	14.1	38.4	1.97	2.5	41.9	53.9	12.0	*1)
Vert.	4960.000	AV	36.1	31.4	6.2	39.3	1.97	2.5	38.9	53.9	15.0	
Vert.	7440.000	AV	35.8	36.7	7.7	38.3	1.97	2.5	46.4	53.9	7.5	
Vert.	9920.000	AV	30.9	39.5	8.7	36.8	1.97	2.5	46.8	53.9	7.1	Floor Noise

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

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

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

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

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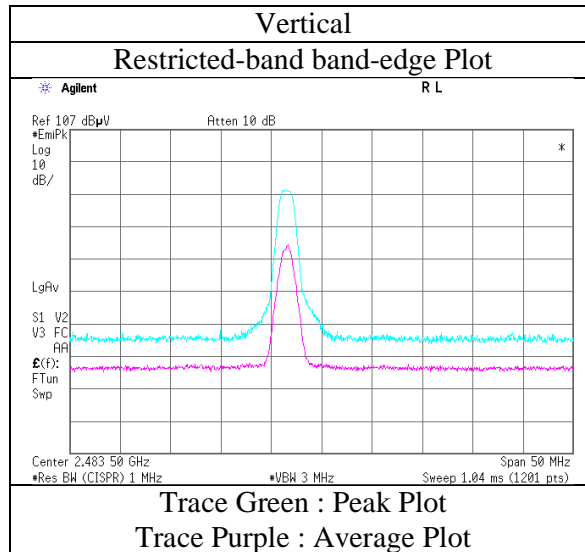
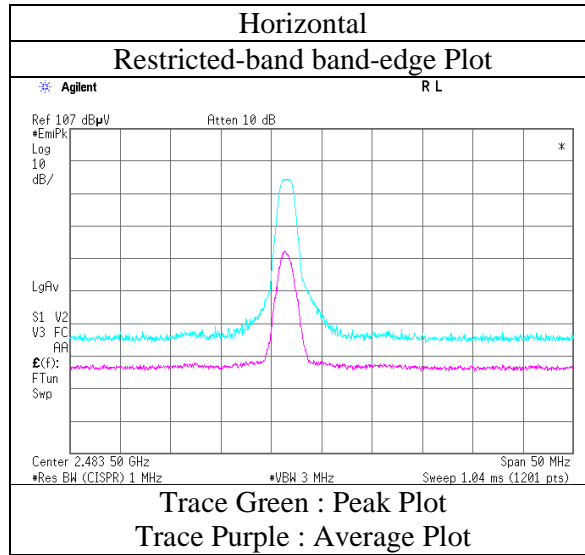
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Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No.	11156274M
Date	February 16, 2016
Temperature / Humidity	21 deg. C / 36 % RH
Engineer	Kazuhiro Ando
Mode	Tx, BT LE, 2480 MHz



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

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.6 Semi Anechoic Chamber (1-26GHz)
Kashima EMC Lab. No.10 Semi Anechoic Chamber (30-1000MHz)
Report No. : 11156274M
Date : February 19, 2016 February 17, 2016
Temperature / Humidity : 21 deg. C / 42 % RH 22 deg. C / 35 % RH
Engineer : Mitsuhiro Jitsukawa Kazuhiro Ando
(30-1000MHz) (1-26GHz)
Mode : Tx, ANT, 2402 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	168.073	QP	35.6	13.2	6.0	26.4	0.0	28.4	43.5	15.1	155	179	
Hori.	359.919	QP	27.8	14.6	7.9	26.4	0.0	23.9	46.0	22.1	100	191	
Hori.	384.413	QP	25.5	15.3	8.1	26.6	0.0	22.3	46.0	23.7	100	174	
Hori.	2274.000	PK	46.7	28.0	14.0	38.3	2.5	52.9	73.9	21.0	100	300	
Hori.	2390.000	PK	44.8	27.6	14.0	38.3	2.5	50.6	73.9	23.3	169	301	
Hori.	2530.000	PK	49.8	27.5	14.1	38.4	2.5	55.5	73.9	18.4	100	296	
Hori.	4804.000	PK	47.2	31.3	6.1	39.3	2.5	47.8	73.9	26.1	100	311	
Hori.	7206.000	PK	47.5	36.3	7.5	38.4	2.5	55.4	73.9	18.5	131	142	
Hori.	9608.000	PK	41.3	39.0	8.6	37.0	2.5	54.4	73.9	19.5	100	0	Floor Noise
Hori.	2274.000	AV	39.2	28.0	14.0	38.3	2.5	45.4	53.9	8.5	100	300	
Hori.	2530.000	AV	46.4	27.5	14.1	38.4	2.5	52.1	53.9	1.8	100	296	
Vert.	86.017	QP	49.1	7.9	5.1	26.7	0.0	35.4	40.0	4.6	100	237	
Vert.	96.108	QP	44.7	8.4	5.2	26.7	0.0	31.6	43.5	11.9	100	152	
Vert.	110.628	QP	35.9	10.6	5.4	26.6	0.0	25.3	43.5	18.2	100	215	
Vert.	168.034	QP	36.0	13.2	6.0	26.4	0.0	28.8	43.5	14.7	100	308	
Vert.	216.417	QP	35.5	9.8	6.5	26.1	0.0	25.7	46.0	20.3	100	139	
Vert.	384.418	QP	28.7	15.3	8.1	26.6	0.0	25.5	46.0	20.5	100	202	
Vert.	2274.000	PK	46.1	28.0	14.0	38.3	2.5	52.3	73.9	21.6	108	50	
Vert.	2390.000	PK	45.5	27.6	14.0	38.3	2.5	51.3	73.9	22.6	124	59	
Vert.	2530.000	PK	47.8	27.5	14.1	38.4	2.5	53.5	73.9	20.4	170	10	
Vert.	4804.000	PK	46.7	31.3	6.1	39.3	2.5	47.3	73.9	26.6	166	227	
Vert.	7206.000	PK	46.5	36.3	7.5	38.4	2.5	54.4	73.9	19.5	178	239	
Vert.	9608.000	PK	40.8	39.0	8.6	37.0	2.5	53.9	73.9	20.0	100	0	Floor Noise
Vert.	2274.000	AV	38.1	28.0	14.0	38.3	2.5	44.3	53.9	9.6	108	50	
Vert.	2530.000	AV	41.6	27.5	14.1	38.4	2.5	47.3	53.9	6.6	170	10	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26 GHz : 20log (1.0 m / 3.0 m) = -9.5 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	33.4	27.6	14.0	38.3	0.23	2.5	39.4	53.9	14.5	*1)
Hori.	4804.000	AV	38.4	31.3	6.1	39.3	0.23	2.5	39.2	53.9	14.7	
Hori.	7206.000	AV	39.1	36.3	7.5	38.4	0.23	2.5	47.2	53.9	6.7	
Hori.	9608.000	AV	30.9	39.0	8.6	37.0	0.23	2.5	44.2	53.9	9.7	Floor Noise
Vert.	2390.000	AV	33.2	27.6	14.0	38.3	0.23	2.5	39.2	53.9	14.7	*1)
Vert.	4804.000	AV	37.1	31.3	6.1	39.3	0.23	2.5	37.9	53.9	16.0	
Vert.	7206.000	AV	37.9	36.3	7.5	38.4	0.23	2.5	46.0	53.9	7.9	
Vert.	9608.000	AV	30.8	39.0	8.6	37.0	0.23	2.5	44.1	53.9	9.8	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26 GHz : 20log (1.0 m / 3.0 m) = -9.5 dB

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	89.8	27.6	14.0	38.3	2.5	95.6	-	-	Carrier
Hori.	2400.000	PK	42.5	27.6	14.0	38.3	2.5	48.3	75.6	27.3	
Vert.	2402.000	PK	86.9	27.6	14.0	38.3	2.5	92.7	-	-	Carrier
Vert.	2400.000	PK	40.1	27.6	14.0	38.3	2.5	45.9	72.7	26.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26 GHz : 20log (1.0 m / 3.0 m) = -9.5 dB

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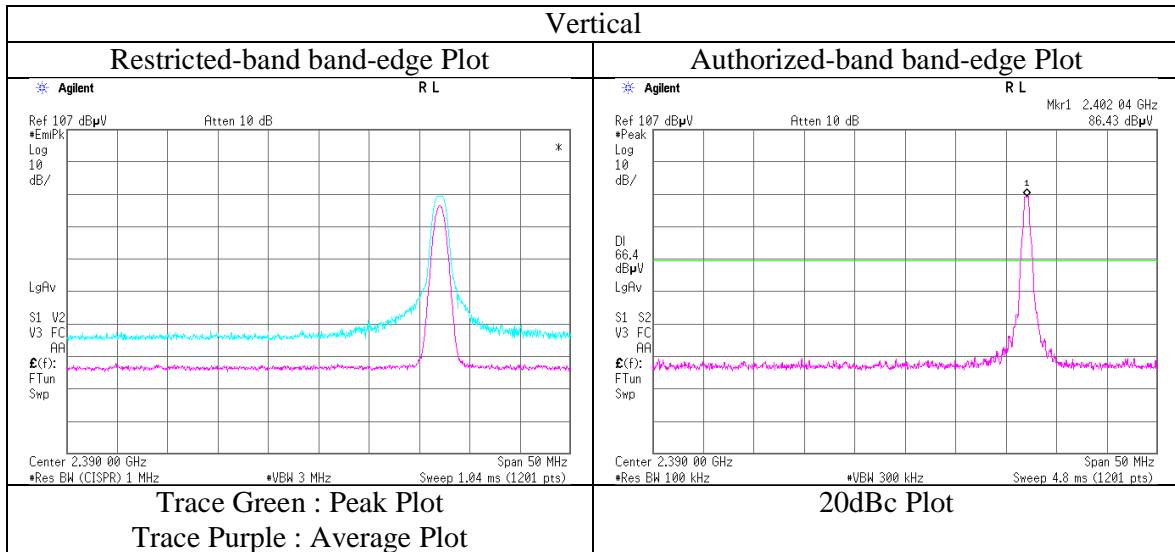
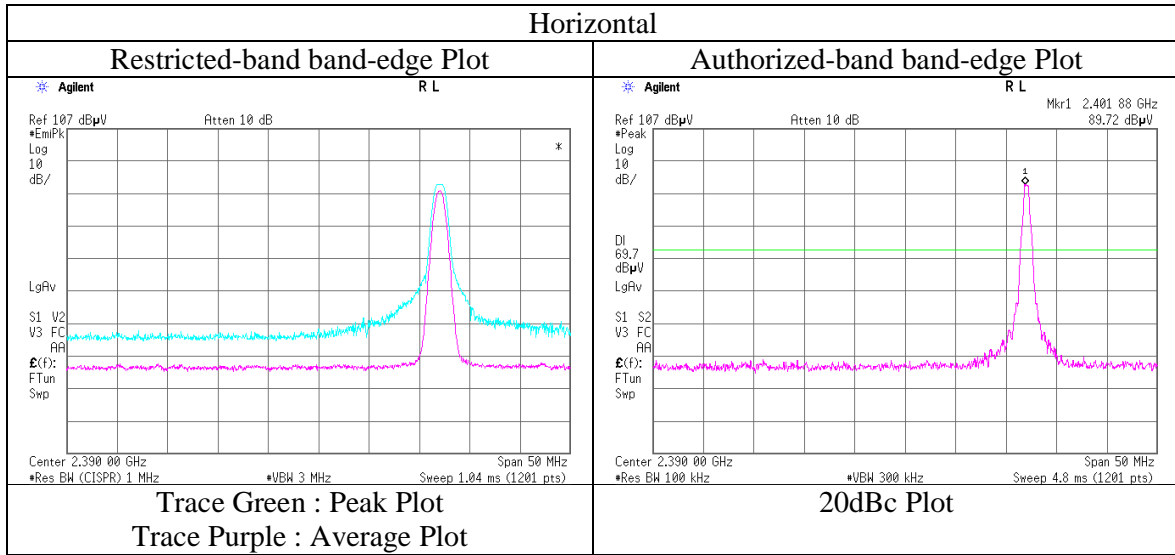
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Radiated Spurious Emission
(Reference Plot for band-edge)

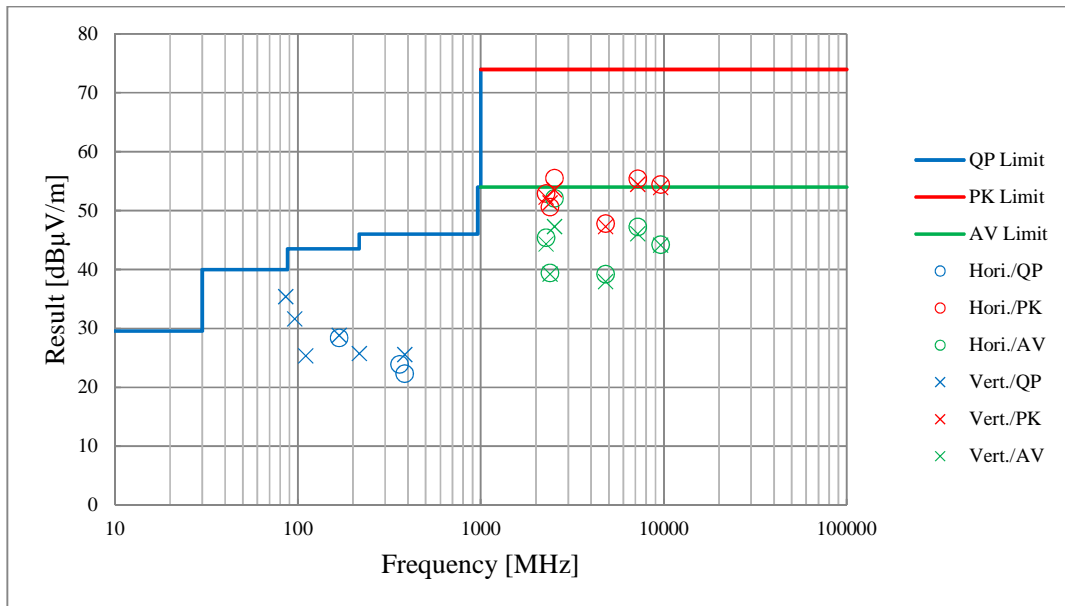
Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No.	11156274M
Date	February 17, 2016
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Kazuhiro Ando
Mode	Tx, ANT, 2402 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber (1-26GHz)	
	Kashima EMC Lab. No.10 Semi Anechoic Chamber (30-1000MHz)	
Report No.	11156274M	
Date	February 19, 2016	February 17, 2016
Temperature / Humidity	21 deg. C / 42 % RH	22 deg. C / 35 % RH
Engineer	Mitsuhiro Jitsukawa (30-1000MHz)	Kazuhiro Ando (1-26GHz)
Mode	Tx, ANT, 2402 MHz	



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

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No. : 11156274M
Date : February 17, 2016
Temperature / Humidity : 22 deg. C / 35 % RH
Engineer : Kazuhiro Ando
(1-26GHz)
Mode : Tx, ANT, 2441 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2313.000	PK	47.5	27.9	14.0	38.3	2.5	53.6	73.9	20.3	120	306	
Hori.	2569.000	PK	48.0	27.6	14.2	38.4	2.5	53.9	73.9	20.0	114	305	
Hori.	4882.000	PK	45.9	31.2	6.2	39.3	2.5	46.5	73.9	27.4	157	315	
Hori.	7323.000	PK	45.2	36.5	7.8	38.4	2.5	53.6	73.9	20.3	136	168	
Hori.	9764.000	PK	41.2	39.5	8.7	36.9	2.5	55.0	73.9	18.9	100	0	Floor Noise
Hori.	2313.000	AV	40.0	27.9	14.0	38.3	2.5	46.1	53.9	7.8	120	306	
Hori.	2569.000	AV	41.6	27.6	14.2	38.4	2.5	47.5	53.9	6.4	114	305	
Vert.	2313.000	PK	46.1	27.9	14.0	38.3	2.5	52.2	73.9	21.7	131	48	
Vert.	2569.000	PK	46.8	27.6	14.2	38.4	2.5	52.7	73.9	21.2	125	237	
Vert.	4882.000	PK	45.0	31.2	6.2	39.3	2.5	45.6	73.9	28.3	142	167	
Vert.	7323.000	PK	45.5	36.5	7.8	38.4	2.5	53.9	73.9	20.0	175	36	
Vert.	9764.000	PK	41.4	39.5	8.7	36.9	2.5	55.2	73.9	18.7	100	0	Floor Noise
Vert.	2313.000	AV	38.0	27.9	14.0	38.3	2.5	44.1	53.9	9.8	131	48	
Vert.	2569.000	AV	40.1	27.6	14.2	38.4	2.5	46.0	53.9	7.9	125	237	

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

Distance factor : 1 GHz - 10 GHz : 20log(4.0 m / 3.0 m) = 2.5 dB

10 GHz - 26 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	36.6	31.2	6.2	39.3	0.23	2.5	37.4	53.9	16.5	
Hori.	7323.000	AV	36.2	36.5	7.8	38.4	0.23	2.5	44.8	53.9	9.1	
Hori.	9764.000	AV	30.9	39.5	8.7	36.9	0.23	2.5	44.9	53.9	9.0	Floor Noise
Vert.	4882.000	AV	35.4	31.2	6.2	39.3	0.23	2.5	36.2	53.9	17.7	
Vert.	7323.000	AV	36.5	36.5	7.8	38.4	0.23	2.5	45.1	53.9	8.8	
Vert.	9764.000	AV	30.7	39.5	8.7	36.9	0.23	2.5	44.7	53.9	9.2	Floor Noise

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

Distance factor : 1 GHz - 10 GHz : 20log(4.0 m / 3.0 m) = 2.5 dB

10 GHz - 26 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

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

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Radiated Spurious Emission

Test place : Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No. : 11156274M
Date : February 17, 2016
Temperature / Humidity : 22 deg. C / 35 % RH
Engineer : Kazuhiro Ando
(1-26GHz)
Mode : Tx, ANT, 2480 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2352.000	PK	47.1	27.7	14.0	38.3	2.5	53.0	73.9	20.9	100	210	
Hori.	2483.500	PK	55.0	27.5	14.1	38.4	2.5	60.7	73.9	13.2	154	300	
Hori.	2608.000	PK	46.8	27.6	14.2	38.4	2.5	52.7	73.9	21.2	136	333	
Hori.	4960.000	PK	46.3	31.4	6.2	39.3	2.5	47.1	73.9	26.8	180	156	
Hori.	7440.000	PK	44.5	36.7	7.7	38.3	2.5	53.1	73.9	20.8	100	330	
Hori.	9920.000	PK	41.5	39.5	8.7	36.8	2.5	55.4	73.9	18.5	100	0	Floor Noise
Hori.	2352.000	AV	40.3	27.7	14.0	38.3	2.5	46.2	53.9	7.7	100	210	
Hori.	2608.000	AV	40.5	27.6	14.2	38.4	2.5	46.4	53.9	7.5	136	333	
Vert.	2352.000	PK	45.8	27.7	14.0	38.3	2.5	51.7	73.9	22.2	136	5	
Vert.	2483.500	PK	52.3	27.5	14.1	38.4	2.5	58.0	73.9	15.9	100	44	
Vert.	2608.000	PK	45.7	27.6	14.2	38.4	2.5	51.6	73.9	22.3	113	239	
Vert.	4960.000	PK	44.5	31.4	6.2	39.3	2.5	45.3	73.9	28.6	167	194	
Vert.	7440.000	PK	44.3	36.7	7.7	38.3	2.5	52.9	73.9	21.0	140	51	
Vert.	9920.000	PK	41.2	39.5	8.7	36.8	2.5	55.1	73.9	18.8	100	0	Floor Noise
Vert.	2352.000	AV	37.7	27.7	14.0	38.3	2.5	43.6	53.9	10.3	136	5	
Vert.	2608.000	AV	38.9	27.6	14.2	38.4	2.5	44.8	53.9	9.1	113	239	

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

Distance factor : 1 GHz - 10 GHz : 20log(4.0 m / 3.0 m) = 2.5 dB

10 GHz - 26 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	37.1	27.5	14.1	38.4	0.23	2.5	43.0	53.9	10.9	*1)
Hori.	4960.000	AV	36.9	31.4	6.2	39.3	0.23	2.5	37.9	53.9	16.0	
Hori.	7440.000	AV	35.2	36.7	7.7	38.3	0.23	2.5	44.0	53.9	9.9	
Hori.	9920.000	AV	30.7	39.5	8.7	36.8	0.23	2.5	44.8	53.9	9.1	Floor Noise
Vert.	2483.500	AV	35.2	27.5	14.1	38.4	0.23	2.5	41.1	53.9	12.8	*1)
Vert.	4960.000	AV	35.0	31.4	6.2	39.3	0.23	2.5	36.0	53.9	17.9	
Vert.	7440.000	AV	33.8	36.7	7.7	38.3	0.23	2.5	42.6	53.9	11.3	
Vert.	9920.000	AV	30.6	39.5	8.7	36.8	0.23	2.5	44.7	53.9	9.2	Floor Noise

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

Distance factor : 1 GHz - 10 GHz : 20log(4.0 m / 3.0 m) = 2.5 dB

10 GHz - 26 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

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

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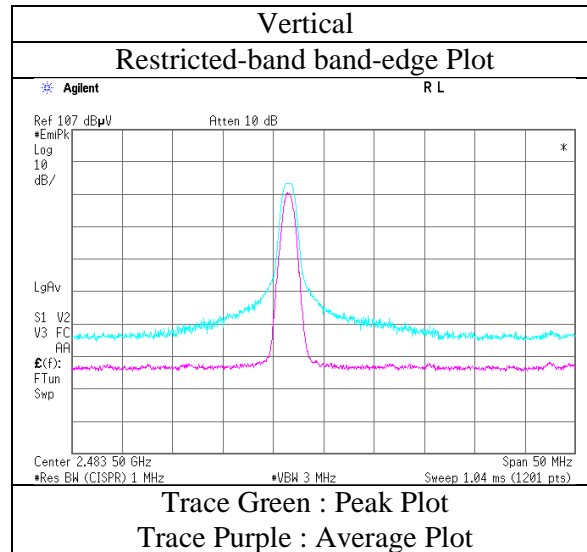
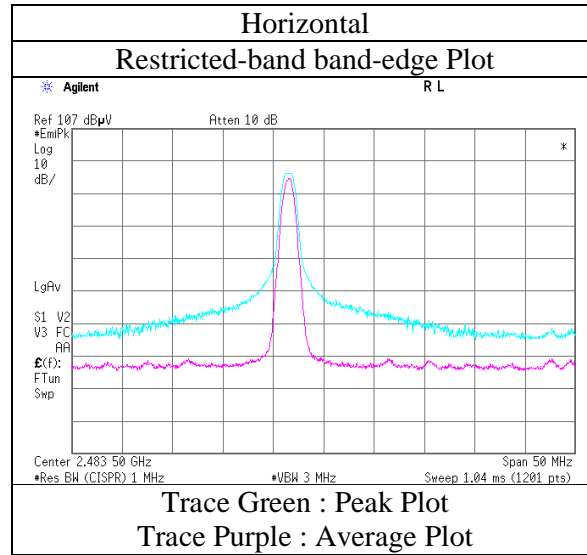
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Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No.	11156274M
Date	February 17, 2016
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Kazuhiro Ando
Mode	Tx, ANT, 2480 MHz



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

Radiated Spurious Emission (Band-edge)

Test place : Kashima EMC Lab. No.10 Semi Anechoic Chamber
Report No. : 11156274M
Date : March 10, 2016
Temperature / Humidity : 21 deg. C / 38 % RH
Engineer : Kazuhiro Ando
Mode : Tx, Nordic Original, 2402 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	45.0	27.6	14.0	38.3	3.5	51.8	73.9	22.1	113	302	
Vert.	2390.000	PK	44.6	27.6	14.0	38.3	3.5	51.4	73.9	22.5	100	52	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	33.0	27.6	14.0	38.3	0.45	3.5	40.3	53.9	13.7	*1)
Vert.	2390.000	AV	33.0	27.6	14.0	38.3	0.45	3.5	40.3	53.9	13.7	*1)

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	88.5	27.6	14.0	38.3	3.5	95.3	-	-	Carrier
Hori.	2400.000	PK	48.8	27.6	14.0	38.3	3.5	55.6	75.3	19.7	
Vert.	2402.000	PK	86.0	27.6	14.0	38.3	3.5	92.8	-	-	Carrier
Vert.	2400.000	PK	46.9	27.6	14.0	38.3	3.5	53.7	72.8	19.1	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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Radiated Spurious Emission (Band-edge)

Test place : Kashima EMC Lab. No.10 Semi Anechoic Chamber
 Report No. : 11156274M
 Date : March 10, 2016
 Temperature / Humidity : 21 deg. C / 38 % RH
 Engineer : Kazuhiro Ando
 Mode : Tx, Nordic Original, 2480 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	54.3	27.5	14.1	38.4	3.5	61.0	73.9	12.9	193	296	
Vert.	2483.500	PK	54.1	27.5	14.1	38.4	3.5	60.8	73.9	13.1	111	18	

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

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

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	37.2	27.5	14.1	38.4	0.45	3.5	44.4	53.9	9.6	*1)
Vert.	2483.500	AV	37.1	27.5	14.1	38.4	0.45	3.5	44.3	53.9	9.7	*1)

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

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

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

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

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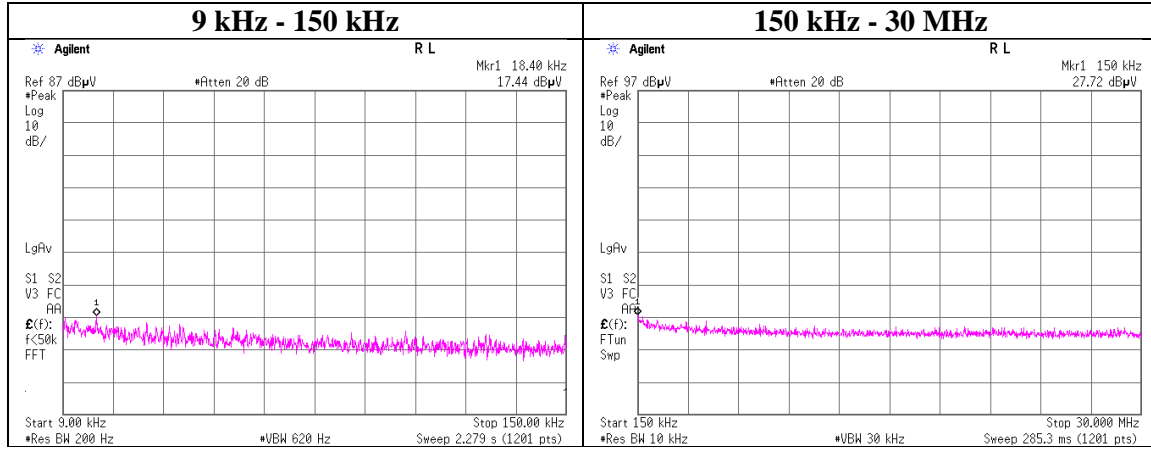
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Facsimile : +81-478-82-3373

Conducted Spurious Emission

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11156274M
Date	February 18, 2016
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Kazuhiro Ando
Mode	Tx, BT LE, 2402 MHz



Frequency [kHz]	Reading [dBuV]	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
18.84	17.44	0.19	9.97	0.9	1	-78.5	300	6.0	-17.2	42.1	59.3	
150.00	27.72	0.19	9.97	0.9	1	-68.2	300	6.0	-7.0	24.0	31.0	

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

$\text{EIRP} = (\text{Reading} - 107) + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

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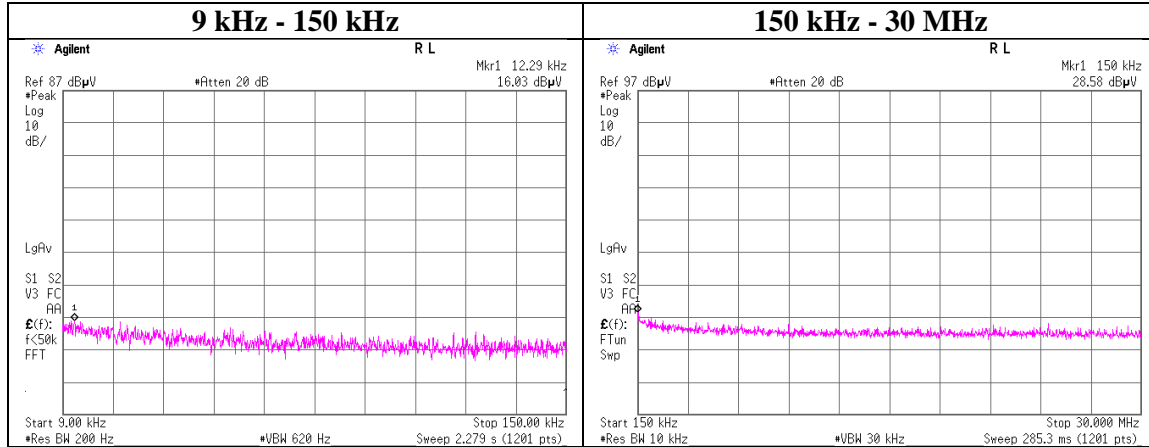
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Conducted Spurious Emission

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11156274M
Date	February 18, 2016
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Kazuhiro Ando
Mode	Tx, ANT, 2402 MHz



Frequency [kHz]	Reading [dBuV]	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
12.29	16.03	0.19	9.97	0.9	1	-79.9	300	6.0	-18.7	45.8	64.5	
150.00	28.58	0.19	9.97	0.9	1	-67.4	300	6.0	-6.1	24.0	30.1	

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

$\text{EIRP} = (\text{Reading} - 107) + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

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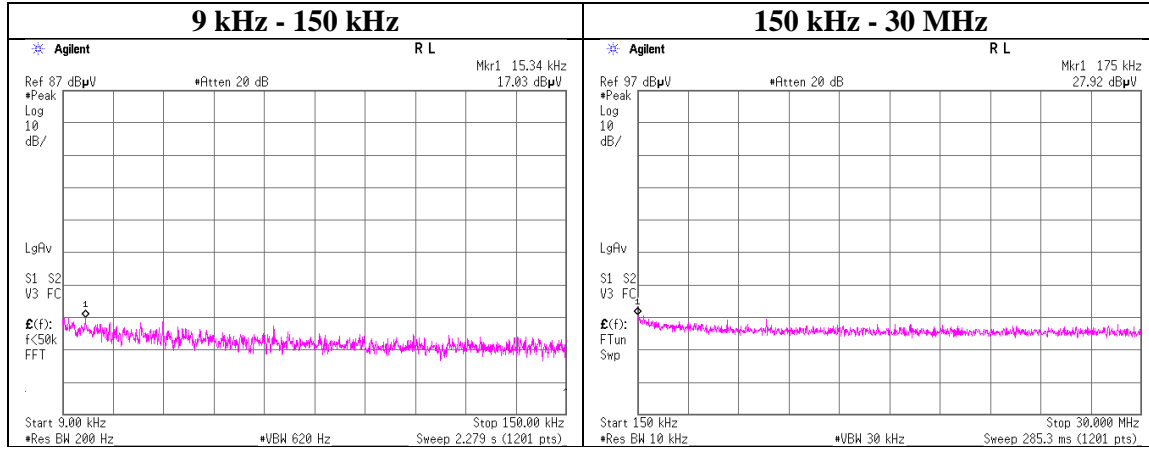
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Conducted Spurious Emission

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11156274M
Date	February 18, 2016
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Kazuhiro Ando
Mode	Tx, Nordic Original, 2402 MHz



Frequency [kHz]	Reading [dBuV]	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
15.34	17.03	0.19	9.97	0.9	1	-78.9	300	6.0	-17.7	43.8	61.5	
175.00	27.92	0.19	9.97	0.9	1	-68.0	300	6.0	-6.8	22.7	29.5	

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

$\text{EIRP} = (\text{Reading} - 107) + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

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Power Density

Test place : Kashima EMC Lab. No.2 Measurement Room
 Report No. : 11156274M
 Date : February 18, 2016
 Temperature / Humidity : 23 deg. C / 35 % RH
 Engineer : Kazuhiro Ando
 Mode : Tx

BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-22.16	1.62	10.03	-10.51	8.00	18.51
2440.00	-22.37	1.63	10.03	-10.71	8.00	18.71
2480.00	-22.20	1.63	10.03	-10.54	8.00	18.54

ANT

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-16.41	1.62	10.03	-4.76	8.00	12.76
2441.00	-17.65	1.63	10.03	-5.99	8.00	13.99
2480.00	-17.85	1.63	10.03	-6.19	8.00	14.19

Nordic Original

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-20.99	1.62	10.03	-9.34	8.00	17.34
2441.00	-20.66	1.63	10.03	-9.00	8.00	17.00
2480.00	-20.34	1.63	10.03	-8.68	8.00	16.68

Sample Calculation:

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

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

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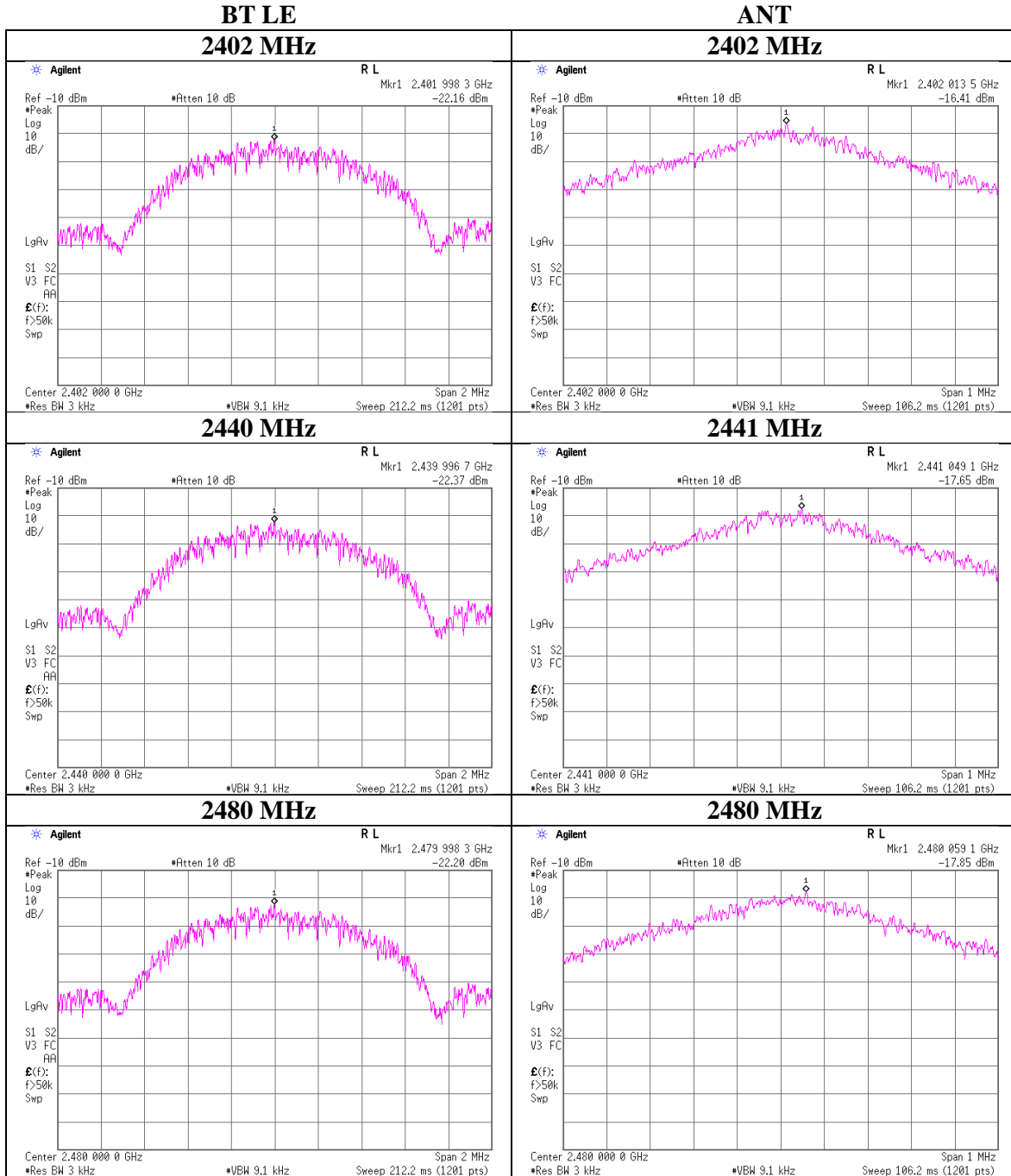
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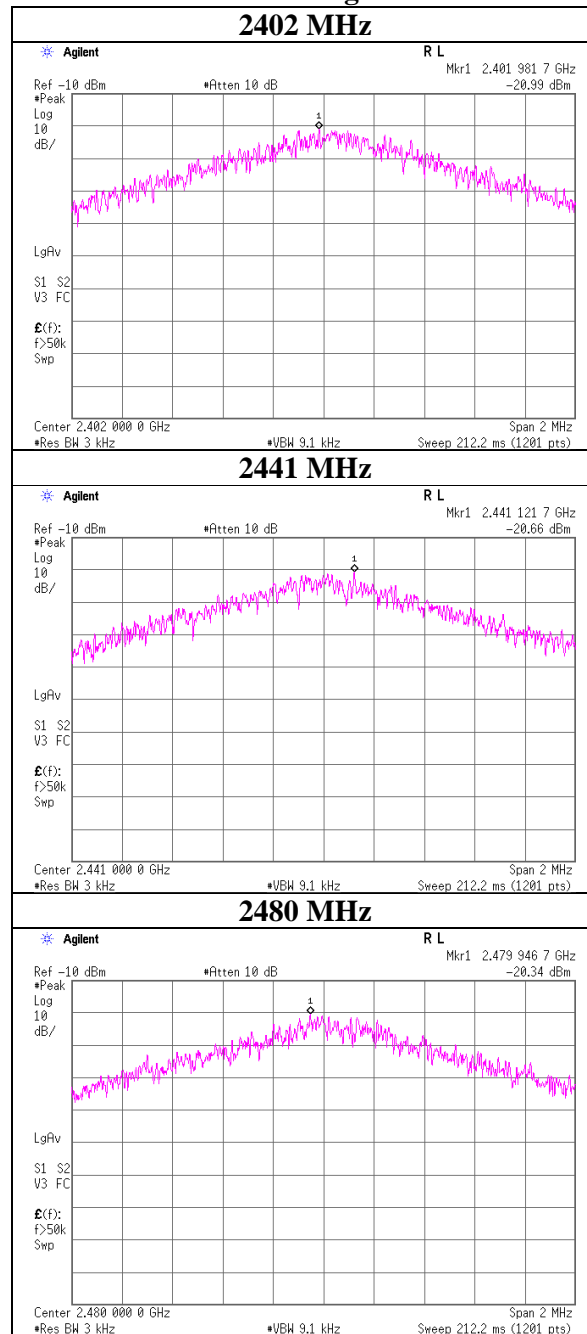
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Power Density



Power Density

Nordic Original



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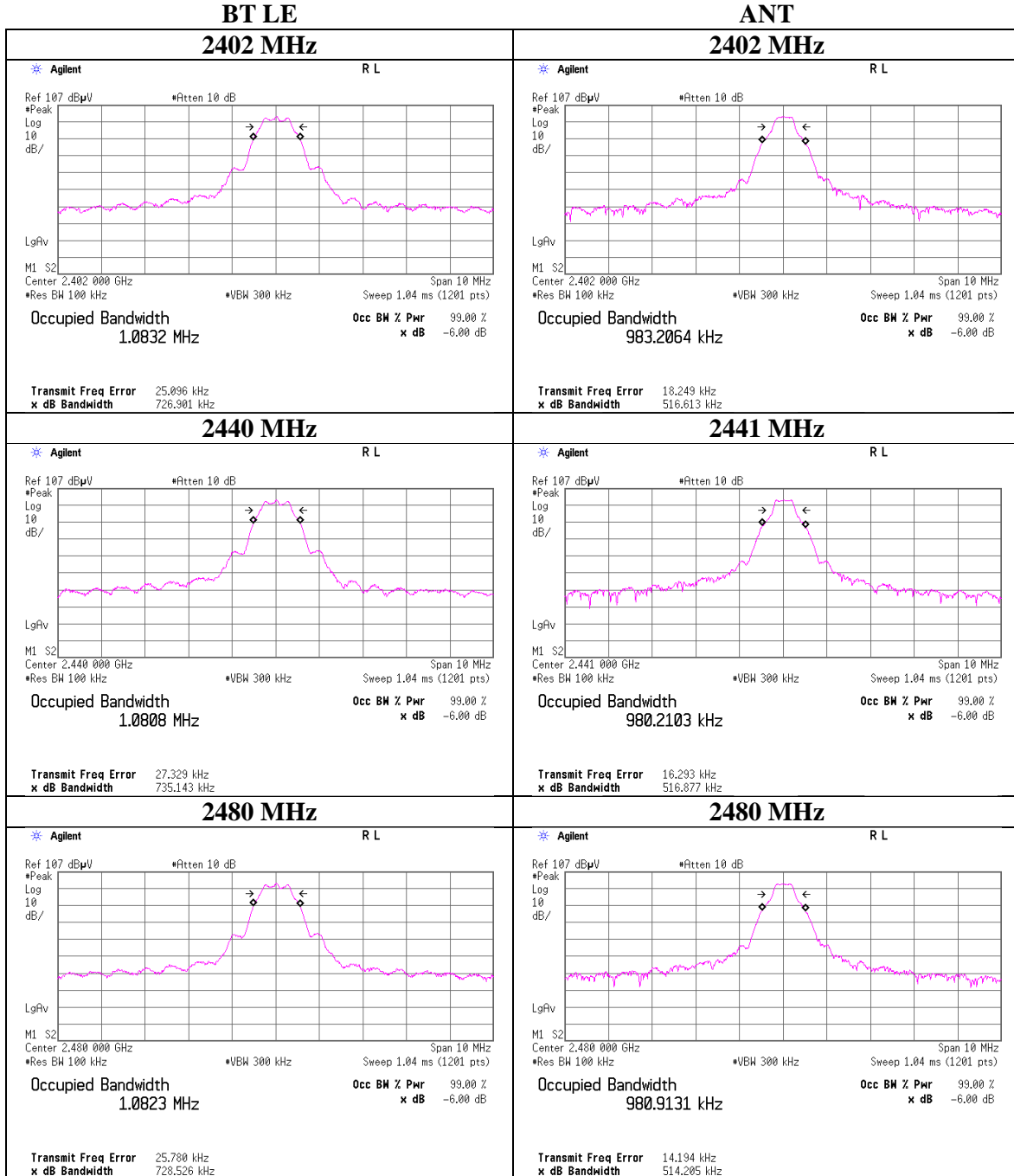
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99% Occupied Bandwidth

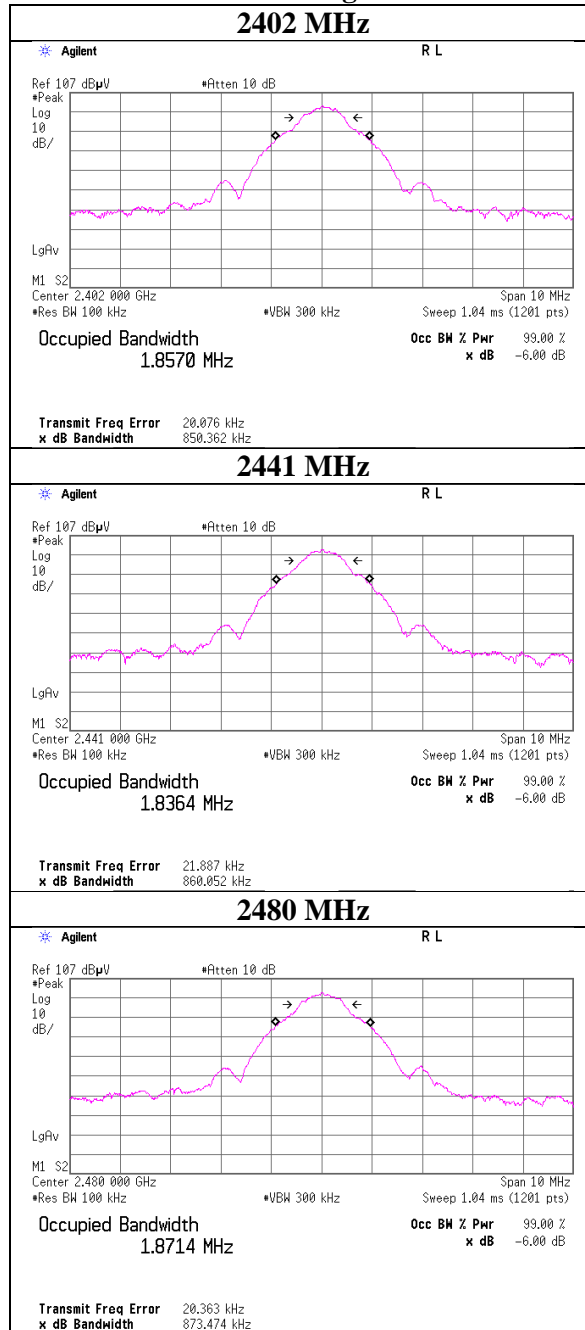
Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11156274M
Date	February 18, 2016
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Kazuhiro Ando
Mode	Tx



99% Occupied Bandwidth

Test place : Kashima EMC Lab. No.2 Measurement Room
 Report No. : 11156274M
 Date : February 18, 2016
 Temperature / Humidity : 23 deg. C / 35 % RH
 Engineer : Kazuhiro Ando
 Mode : Tx

Nordic Original



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
CLS-08	A.M.N.	Rohde & Schwarz	ESH3-Z5	847265/011	CE	2015/07/31 * 12
CLS-11	A.M.N.	Rohde & Schwarz	ESH3-Z5	835239/022	CE	2015/07/17 * 12
CAT10-25	10dB Fixed Atten.	Suhner	6810.01.A	none	CE	2015/07/17 * 12
CTM-28	Terminator	Suhner	65_BNC-50-0-2/13 3_NE	none	CE	2015/11/19 * 12
CCC-S5-C(2/9/10/11)	Coaxial Cable	Fujikura,Fujikura,Fujikura,Fujikura	5D-2W,5D-2W,5D-2W,5D-2W	-	CE	2015/07/14 * 12
CSCL-06	Ruler	Tajima	L19-55S	none	CE	2015/02/18 * 12
COS-05	Temperature & Humidity Indicator	A&D	AD-5681	6975761	CE/AT	2015/07/13 * 12
CTS-09	Digital Multimeter	FLUKE	112	89790194	CE/AT	2015/10/01 * 12
CTR-09	Test Receiver	Agilent	N9038A	MY53290016 Version A.14.03	CE/RE	2015/06/28 * 12
CBL-08	LOGBICON	Schwarzbeck	VULB 9168	343	RE	2015/11/15 * 12
CAT3-04	3dB Fixed Atten.	TAMAGAWA	UFA-01	none	RE	2015/09/03 * 12
CCC-S10-R(1/4/CATS-11/5/6/7/8/11/12)	Coaxial Cable	Junkosha,Fujikura,Agilent,Fujikura,Fujikura,Fujikura,Fujikura,Fujikura,Fujikura	MWX315,5D-2W,8494A,5D-2W,5D-2W,5D-2W,5D-2W,5D-2W,5D-2W	MY41110200(Step Att)	RE	2015/08/11 * 12
CCC-S10-R(2/4/CATS-11/5/6/7/8/11/12)	Coaxial Cable	Fujikura,Fujikura,Agilent,Fujikura,Fujikura,Fujikura,Fujikura,Fujikura,Fujikura	5D-2W,5D-2W,8494A,5D-2W,5D-2W,5D-2W,5D-2W,5D-2W	MY41110200(Step Att)	RE	2015/08/11 * 12
CAF-08	Pre-Amplifier	Hewlett Packard	8447D	2944A09041	RE	2015/08/11 * 12
CSCL-13	Ruler	Tajima	L19-55	none	RE	2015/02/18 * 12
COS-10	Temperature & Humidity Indicator	HIOKI	3641/9680-50	090999895/090905406	RE	2015/05/17 * 12
CTS-14	Digital Multimeter	FLUKE	115	994460954	RE	2015/10/01 * 12
COTS-CEM1-02	EMI Software	TSJ	TEPTO-DV(RE,CE, MF,PE)	Ver, RE: 2.5.0131, CE: 2.5.0131	CE/RE	-
CSA-06	Spectrum Analyzer	Agilent	N9030A	MY53310670 Version A.13.12	RE	2015/05/28 * 12
CHA-20	Broad Band Horn	Schwarzbeck	BBHA 9120D	9120D-1270	RE	2015/07/31 * 12
CHA-07	Double Ridged Horn	ETS-Lindgren	3160-09	00166043	RE	2015/06/28 * 12
CAF-19	Pre-Amplifier	TOYO	HAP18-26W	00000035	RE	2015/06/28 * 12
CHA-08	Double Ridged Horn	ETS-Lindgren	3160-10	00165191	RE	2015/06/28 * 12
CAF-20	Pre-Amplifier	TOYO	HAP26-40W	00000005	RE	2015/06/28 * 12
CAF-18	Pre-Amplifier	TOYO	TPA0118-36	A-1001	RE	2015/07/15 * 12
CAT10-16	10dB Fixed Atten.	Weinschel	54A-10	56246	RE	2015/05/26 * 12
CHF-03	HPF	Micro-Tronics	HPM50111-02	008	RE	2015/05/25 * 12
CCC-W05	Micro Wave Cable	Junkosha	MWX241	MRA-12-14-145	RE	2015/05/26 * 12
CCC-W07	Micro Wave Cable	Junkosha	MWX221	MRA-12-14-148	RE	2015/05/26 * 12
CCC-W09	Micro Wave Cable	SUHNER	SUCOFLEX104	MY588/4	RE	2015/07/13 * 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	AT	2015/05/28 * 12
CAT10-17	10dB Fixed Atten.	Weinschel	54A-10	56251	AT	2015/05/26 * 12
CCC-W06	Micro Wave Cable	Junkosha	MWX241	MRA-12-14-146	AT	2015/05/26 * 12
CPM-16	Peak Power Analyzer	Agilent	8990B	MY51000276	AT	2015/06/16 * 12
CPSO-24	Power Sensor	Agilent	N1923A	MY54070024	AT	2015/06/16 * 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 tes

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