

RADIO TEST REPORT


Test Report No. : 10524935M-R1

Applicant : ALPS Electric Co., Ltd.
Type of Equipment : Bluetooth Module
Model No. : UGMZ2AA
FCC ID : CWTUGMZ2AA
Test regulation : FCC Part 15 Subpart C: 2014
Test Result : Complied

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2. The results in this report apply only to the sample tested.
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4. The test results in this report are traceable to the national or international standards.
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6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Kashima has been accredited.
7. This report is a revised version of 10524935M. 10524935M is replaced with this report.

Date of test: October 16, 20, December 15, 2014

Representative test engineer


Kazuhiro Ando
Manager of EMC Testing Sec.,
Operation Dept.

Approved by:


Go Ishiwata
Department Manager
Operation Dept.



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

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13-EM-F0429

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REVISION HISTORY

Original Test Report No. 10524935M

Revision	Test Report No.	Date	Page revised	Revision Description
00	10524935M	November 19, 2014	-	Original
01	10524935M-R1	December 15, 2014	- (Full-revision)	- Correction of antenna information - Addition of printer information - Addition of AV power data - Addition of Conducted Emission test

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SECTION 1: Customer information

Company Name : ALPS Electric Co., Ltd.
Address : 6-3-36 Furukawanakazato Osaki-city Miyagi-pref. 989-6181 Japan
Telephone Number : +81- 229-24-6341
Facsimile Number : +81- 229-24-7016
Contact Person : Yuji Ouchi

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

2.1 Identification of E.U.T.

Type of Equipment : Bluetooth Module
Model No. : UGMZ2AA
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 1.5 or 3.0 V
Receipt Date of Sample : October 11, 2014
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: UGMZ2AA (referred to as the EUT in this report) is a Bluetooth Module.

Clock frequency(ies) in the system : 16 MHz

<Radio part>

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth / Channel spacing : 1MHz / 2MHz
Type of modulation : GFSK
Antenna type / Antenna connector type : $\lambda/4$ Monopole antenna / None
Antenna gain : -5.9 dBi
ITU code : F1D
Operation temperature range : -20 to +65 deg.C

FCC 15.31 (e)

The RF Module is constantly provided voltage (DC1.41 V) through its own regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC 15.203/212

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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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2014, final revised on August 15, 2014 and effective October 14, 2014

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.209 Radiated emission limits, general requirements
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures and results

Item	Test Procedure *1)	Specification	Remarks	Deviation	Worst Margin	Results
Conducted Emission	ANSI C63.10:2009	FCC 15.207	-	N/A	7.5 dB (0.19480 MHz, QP, L) 3.1 dB (0.19480 MHz, AV, L)	Complied
6dB Bandwidth	ANSI C63.10:2009	FCC 15.247 (a)(2)	Conducted	N/A	* See data	
Maximum Peak Conducted Output Power	ANSI C63.10:2009	FCC 15.247 (b)(3)	Conducted	N/A		Complied
Out of Band Emission & Restricted Band Edges	ANSI C63.10:2009	FCC 15.109, 15.247 (d) & 15.209	Conducted / Radiated	N/A	4.6 dB Freq.: 41.495MHz Polarization: Vertical Detection:QP Mode: Tx 2440MHz	Complied
Maximum Power Spectral Density	ANSI C63.10:2009	FCC 15.247 (e)	Conducted	N/A	* See data	Complied

Note: UL Japan's EMI Work Procedures No.13-EM-W0420 and 13-EM-W0422.
*1) These tests were also referred to KDB 558074 v03r01 (FCC), "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

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3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.4:2009 13. Measurement of intentional radiators, RSS-Gen 6.6	-	Conducted	-	-

Note: UL Kashima's Work Procedures No. 13-EM-W0420 and 13-EM-W0422

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

3.4 Confirmation

UL Kashima, Inc. hereby confirms the E.U.T., in the configuration tested, complies with the specifications FCC Part 15 Subpart C: 2014.

3.5 Uncertainty

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

Item	Frequency range	
Conducted emission (AC Mains) AMN	0.15 MHz-30 MHz	2.8 dB
Radiated emission	30 MHz-1GHz	6.3 dB
	1 GHz-6 GHz	4.5 dB
	6 GHz-18 GHz	4.8 dB
	18 GHz-26.5 GHz	4.9 dB

Antenna port conducted test

Power measurement uncertainty above 1GHz for this test was: (±) 1.5dB

Spurious emission (Conducted) measurement (below 1GHz) uncertainty for this test was: (±) 1.6dB

Spurious emission (Conducted) measurement (1G-3GHz) uncertainty for this test was: (±) 1.4dB

Spurious emission (Conducted) measurement (3G-18GHz) uncertainty for this test was: (±) 2.8dB

Spurious emission (Conducted) measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.5dB

Bandwidth measurement uncertainty for this test was: (±) 5.4%

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3.6 Test Location

UL Kashima, Inc.
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Telephone number : +81 478 82 0963
Facsimile number : +81 478 82 3373
A2LA Accreditation No. : 1266-01

	FCC Registration No.	Width x Depth x Height (m)	Size of reference ground plane/horizontal conducting plane (m)	Maximum measurement distance
No.1 Open site	90558	6.0 x 5.5 x 2.5	20 x 40	10 m
No.2 Open site	510504	4.4 x 4.4 x 2.15	18 x 20	10 m
No.5 Open site	99356	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	90558	5.4 x 4.5 x 2.3		-
No.2 Shielded room	510504	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	4.2 x 3.1 x 2.5		-
No.1 Measurement room	-	5.0 x 3.7 x 2.6		-
No.6 Measurement room	-	4.3 x 4.4 x 2.7		-
No.3 Fully Anechoic Chamber	-	7.0 x 3.5 x 3.5		-
No.6 Semi-anechoic Chamber	372431	8.5 x 5.5 x 5.2		3 m
No.10 Semi-anechoic Chamber	682397	18.4 x 9.9 x 7.7		10 m
No.11 Semi-anechoic Chamber	718605	9.0 x 6.5 x 5.2		3 m

3.7 Data of tests, Test instruments, and Photographs of test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

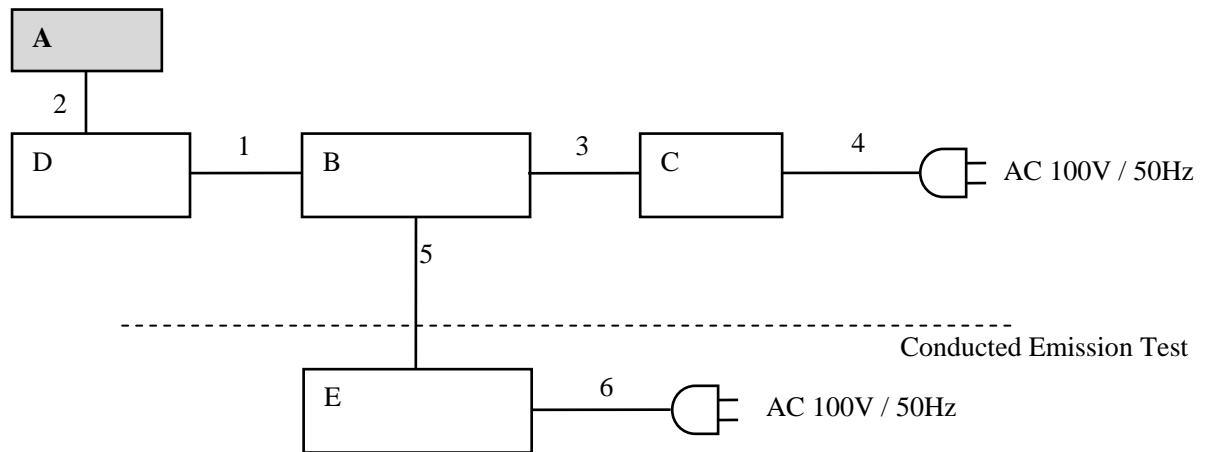
Test item	Mode	Tested frequency
All items	Transmitting (Tx), Hopping OFF Bluetooth Low Energy (LE), Payload: PRBS9	2402MHz, 2440MHz, 2480MHz

Power settings: Fixed

Test software: ALPS_Dialog_DLL

Justification: The system was configured in typical fashion (as customer would normally use it) for testing.

4.2 Configuration and peripherals



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

4.3 EUT(s) and support equipment(s)

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Bluetooth Module	UGMZ2AA	*1)	ALPS Electric	EUT
B	Laptop PC	Compaq 6710b	CNU83632JK	HP	-
C	AC Adapter	PPP014L-S	-	HP	-
D	Jig	-	-	ALPS Electric	-
E	Printer	K10220	FBNM26052	Canon	

*1) 001: Antenna port conducted tests, 002: Other tests

4.4 Cable(s) used

No.	Item	Length (m)	Shield		Remark
			Cable	Connector	
1	USB	1.9	Shielded	Shielded	-
2	Flexible	0.025	Unshielded	Unshielded	-
3	DC	1.8	Unshielded	Unshielded	-
4	AC	1.7	Unshielded	Unshielded	-
5	USB	1.8	Shielded	Shielded	
6	AC cable	1.8	Unshielded	Unshielded	

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SECTION 5: Conducted emission

5.1 Operating environment

Test place : See test data (APPENDIX 1)
Temperature : See test data (APPENDIX 1)
Humidity : See test data (APPENDIX 1)

5.2 Test configuration

EUT was placed on a platform of nominal size, 1.0m by 2.0m, raised 0.8m above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from LISN. I/O cables that were connected to the peripherals were bundled in center. They were folded back and for the forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. Each EUT current-carrying power lead was individually connected through a LISN to the input power source. Photographs of the set up are shown in Appendix 3.

5.3 Test conditions

Frequency range : 0.15 - 30MHz
EUT position : Table top

5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT in an open site. The EUT was connected to a Line Impedance Stabilization Network (LISN). An overview sweep with peak detection has been performed. The measurements had been performed with a quasi-peak detector and if required, a CISPR average detector. The conducted emission measurements were made with the following detection of the test receiver.

Detection Type : Quasi-Peak/ CISPR-Average
IF Bandwidth : 9kHz

5.5 Results

Summary of the test results : Pass

Refer to APPENDIX 1.

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SECTION 6: Radiated emission

6.1 Operating environment

Test place : See test data (APPENDIX 1)
Temperature : See test data (APPENDIX 1)
Humidity : See test data (APPENDIX 1)

6.2 Test configuration

EUT was placed on a platform of nominal size, 0.5m by 0.5m, raised 80cm above the conducting ground plane. Photographs of the set up are shown in APPENDIX 3.

6.3 Test conditions

Frequency range : 30MHz to 25GHz *)
Test distance : 3m(below 13GHz) / 1m(above13GHz)
EUT position : Table top
EUT operation mode : Refer to SECTION 4.1

*) It was not measured the radiated emissions from 9kHz to 30MHz, because it had been not detected the noise from 9kHz to 30MHz with the antenna terminal.

6.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m(below 13GHz) / 1m(above 13GHz) (Refer to Figure 1). Measurements were performed with quasi-peak, peak and average detector. The measuring antenna height was varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.

The radiated emission measurements were made with the following detection of the test receiver.

Frequency	30-1000MHz	Above 1GHz		20dBc
Detection type	Quasi-Peak	Peak	* Average *1)	Peak
IF Bandwidth	120kHz	Detector: Peak RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 3MHz Detector: Linear Voltage Averaging	RBW: 100kHz VBW: 300kHz

*1) Average Power Measurement was measured based on 13.3.2 l). 2 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

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

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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.

Combinations of the worst case

Antenna polarization \ Frequency	Carrier *2)	Spurious	
		Below 1GHz	Above 1GHz
Horizontal	Z	X	Z
Vertical	Z	X	Z

*2) with spurious emissions near carrier frequency.

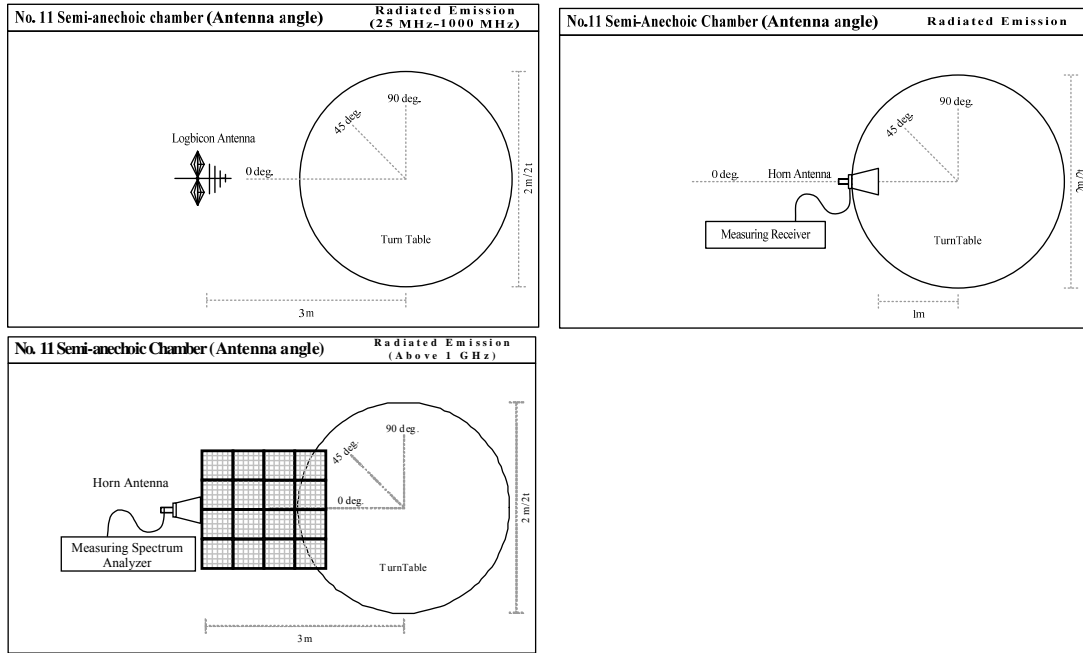


Figure 1. Antenna angle

6.5 Band edge

Band edge level at 2400MHz is less than 20dB of peak point of the carrier.
Band edge level at 2390MHz and 2483.5MHz is below the limits of FCC 15.209.
Refer to the data of Radiated emission.

6.6 Results

Summary of the test results : Pass *No noise was detected above the 3th order harmonics.
Refer to APPENDIX 1

SECTION 7: Out of band emissions (Antenna port conducted)

Test procedure

The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port. In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement. 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. (9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=10kHz)

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 8: 6dB bandwidth & Occupied bandwidth (99%)

Test procedure

The bandwidth was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 9: Maximum peak conducted output power

Test procedure

The maximum peak conducted output power was measured with a power meter connected to the antenna port. The test was measured based on Method 9.1.3, method PKPM1 of KDB 558074 (“Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247”).
Detection type: Peak / Average *1)

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 10: Maximum power spectral density

Test procedure

The maximum power spectral density was measured with a spectrum analyzer connected to the antenna port.

Instrument used : Spectrum Analyzer *1)
RBW / VBW : 3kHz / 9.1kHz

The test was measured based on Method 10.2, method PKPSD of KDB 558074 (“Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247”).

Summary of the test results: Pass
Refer to APPENDIX 1

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Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

Conducted emission
6dB bandwidth
Maximum peak output power
Conducted emission
Radiated emission
Spurious emission (Antenna port conducted)
Peak power density
Occupied bandwidth

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Conducted emission
Radiated emission
Pre-check of worst position

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DATA OF CONDUCTED EMISSION TEST

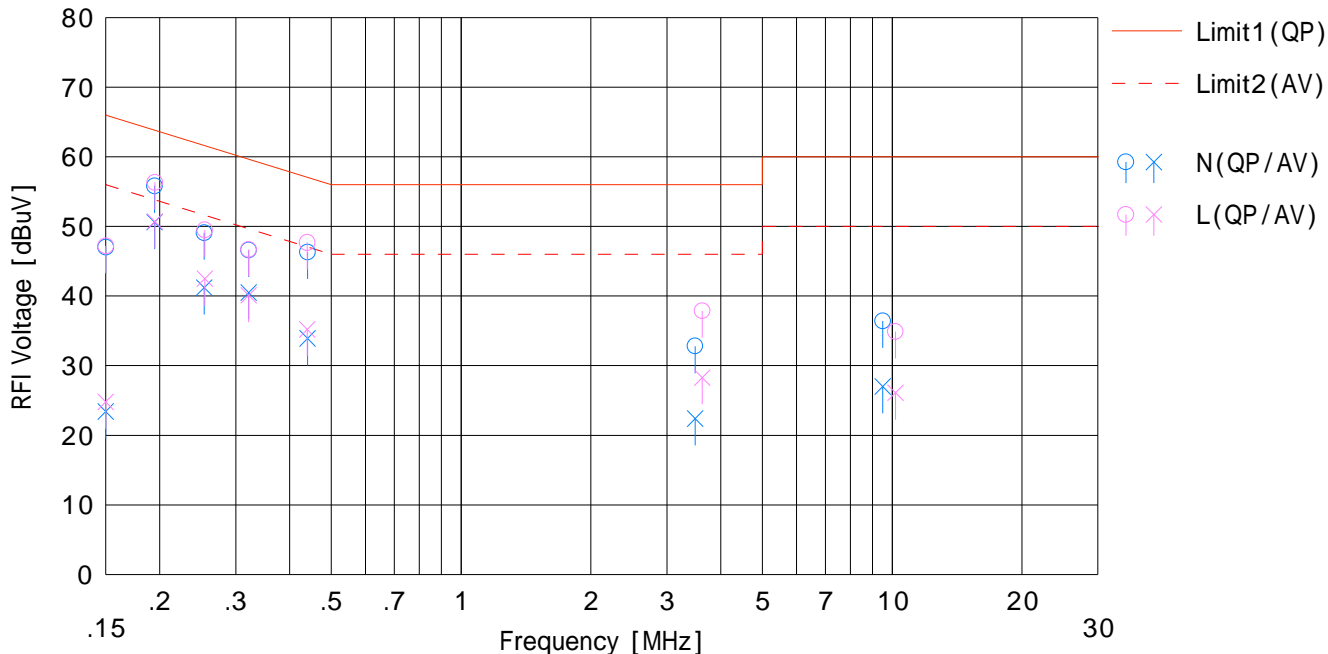
UL Kashima, Inc. No.5 Test Site
Date : 2014/12/15

Company : Alps Electric Co.,Ltd.
Kind of EUT : Bluetooth LE Module
Model No. : UGMZ2AA
Serial No. : 002
Remarks :

Mode : Tx, BT LE, 2402MHz
Order No. : 10524935S
Power : AC120V / 60Hz (AC Adapter)
Temp./Humi. : 21deg.C / 42%RH

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

Tested by : Mitsuhiro Jitsukawa



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	36.9	13.3	10.1	47.0	23.4	66.0	56.0	19.0	32.6	N	
2	0.19450	45.7	40.5	10.1	55.8	50.6	63.8	53.8	8.0	3.2	N	
3	0.25360	39.0	31.1	10.1	49.1	41.2	61.6	51.6	12.5	10.4	N	
4	0.32150	36.5	30.4	10.1	46.6	40.5	59.7	49.7	13.1	9.2	N	
5	0.44050	36.2	23.8	10.1	46.3	33.9	57.1	47.1	10.8	13.2	N	
6	3.48800	22.4	12.0	10.4	32.8	22.4	56.0	46.0	23.2	23.6	N	
7	9.51400	25.6	16.2	10.8	36.4	27.0	60.0	50.0	23.6	23.0	N	
8	0.15000	37.1	14.7	10.1	47.2	24.8	66.0	56.0	18.8	31.2	L	
9	0.19480	46.2	40.6	10.1	56.3	50.7	63.8	53.8	7.5	3.1	L	
10	0.25460	39.4	32.4	10.1	49.5	42.5	61.6	51.6	12.1	9.1	L	
11	0.32150	36.6	30.0	10.1	46.7	40.1	59.7	49.7	13.0	9.6	L	
12	0.43980	37.6	25.1	10.1	47.7	35.2	57.1	47.1	9.4	11.9	L	
13	3.62400	27.5	17.9	10.4	37.9	28.3	56.0	46.0	18.1	17.7	L	
14	10.17200	23.9	15.1	11.0	34.9	26.1	60.0	50.0	25.1	23.9	L	

DATA OF CONDUCTED EMISSION TEST

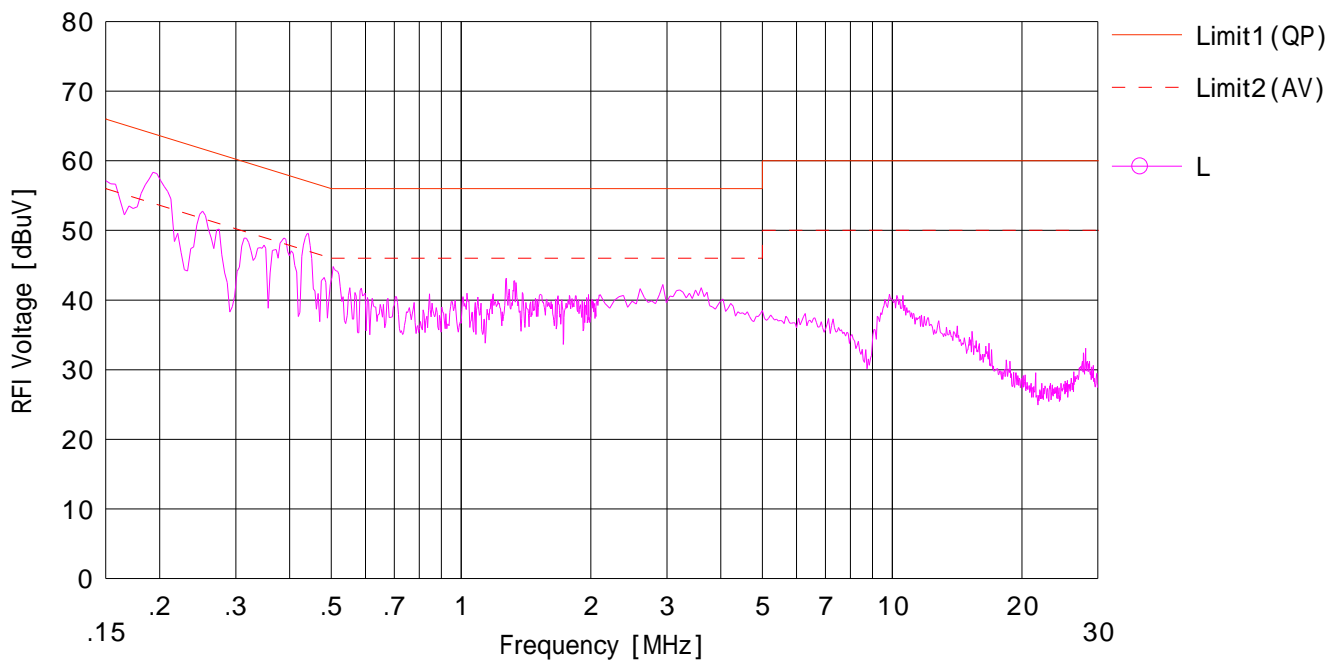
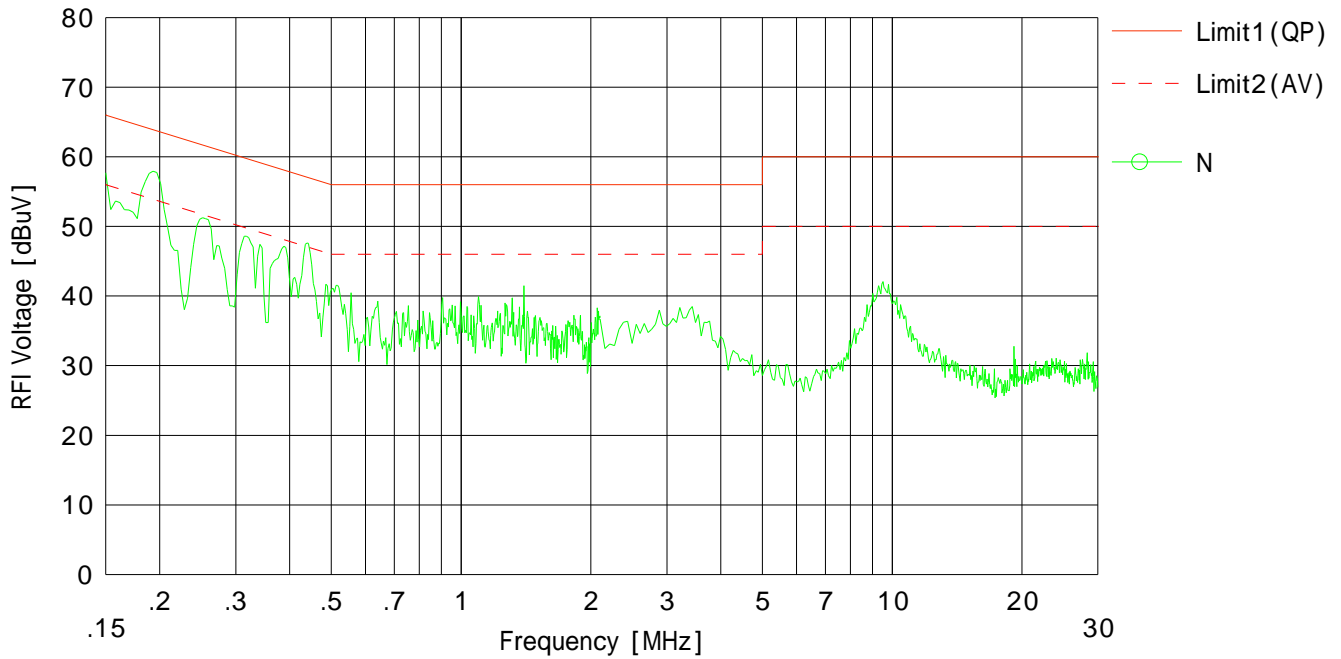
UL Kashima, Inc. No.5 Test Site
Date : 2014/12/15

Company : Alps Electric Co.,Ltd.
Kind of EUT : Bluetooth LE Module
Model No. : UGMZ2AA
Serial No. : 002
Remarks :

Mode : Tx 2402MHz
Order No. : 10524935S
Power : AC120V / 60Hz
Temp./Humi. : 21deg.C / 42%RH

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

Tested by : Mitsuhiro Jitsukawa



DATA OF CONDUCTED EMISSION TEST

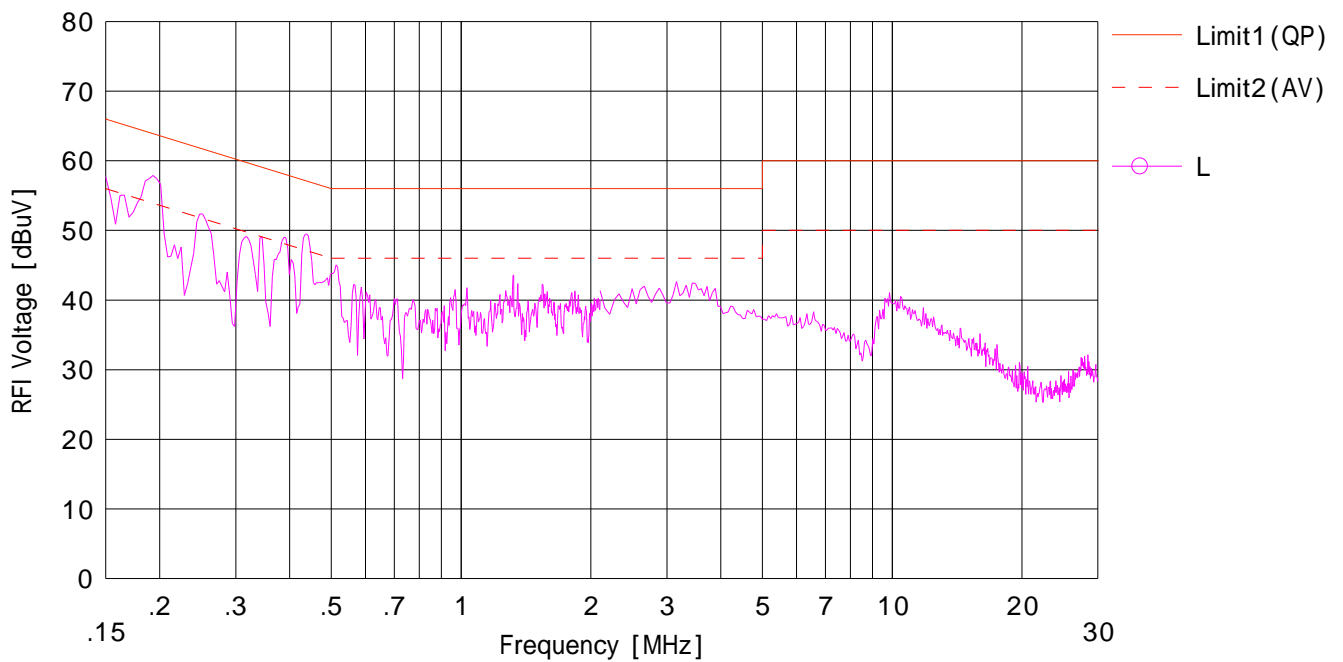
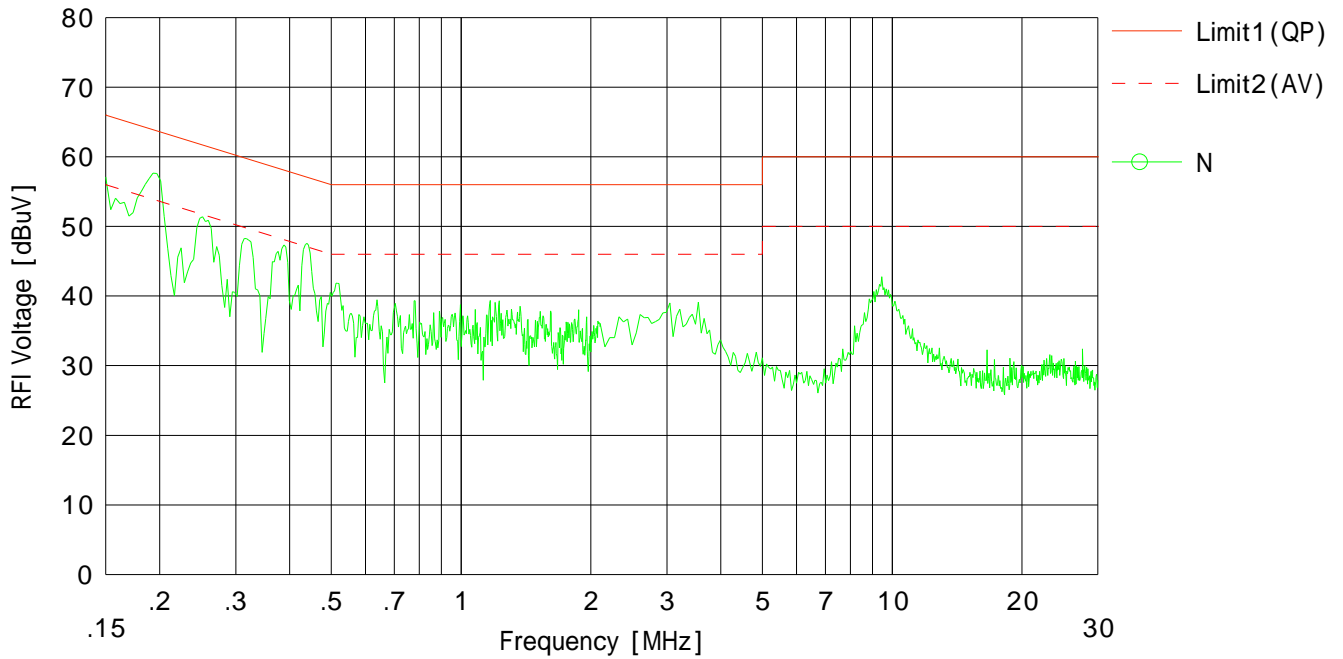
UL Kashima, Inc. No.5 Test Site
Date : 2014/12/15

Company : Alps Electric Co.,Ltd.
Kind of EUT : Bluetooth LE Module
Model No. : UGMZ2AA
Serial No. : 002
Remarks :

Mode : Tx 2440MHz
Order No. : 10524935S
Power : AC120V / 60Hz
Temp./Humi. : 21deg.C / 42%RH

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

Tested by : Mitsuhiro Jitsukawa



DATA OF CONDUCTED EMISSION TEST

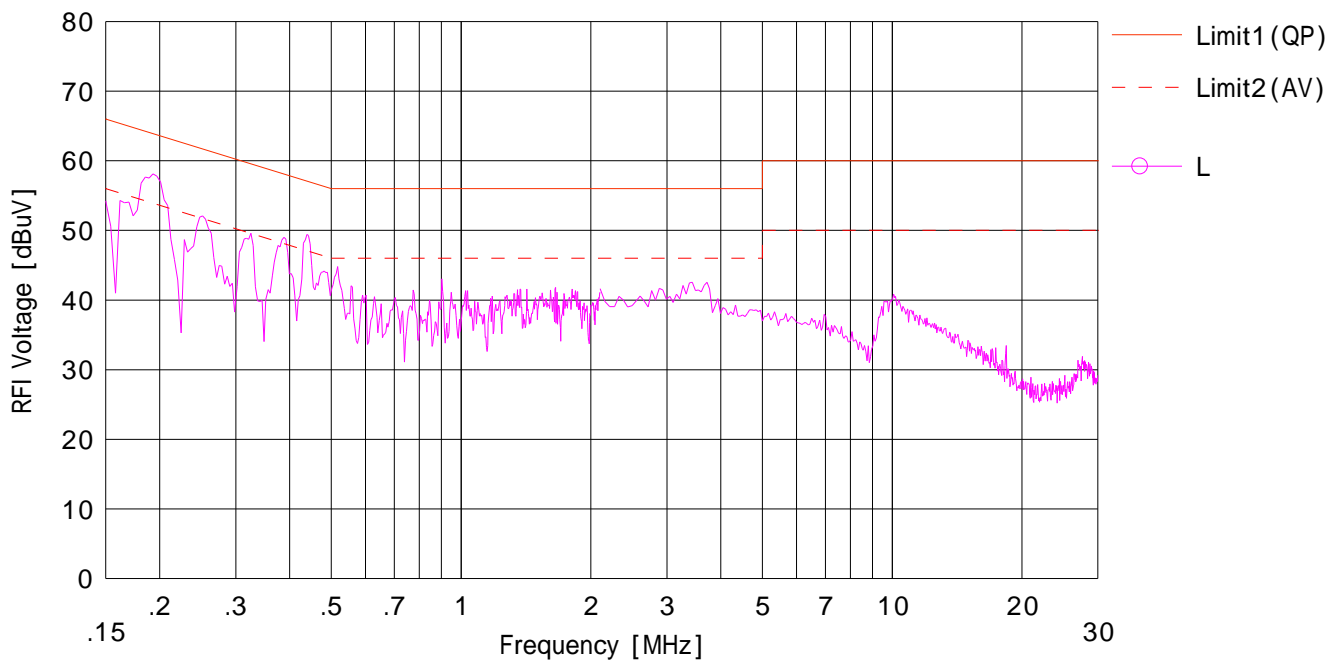
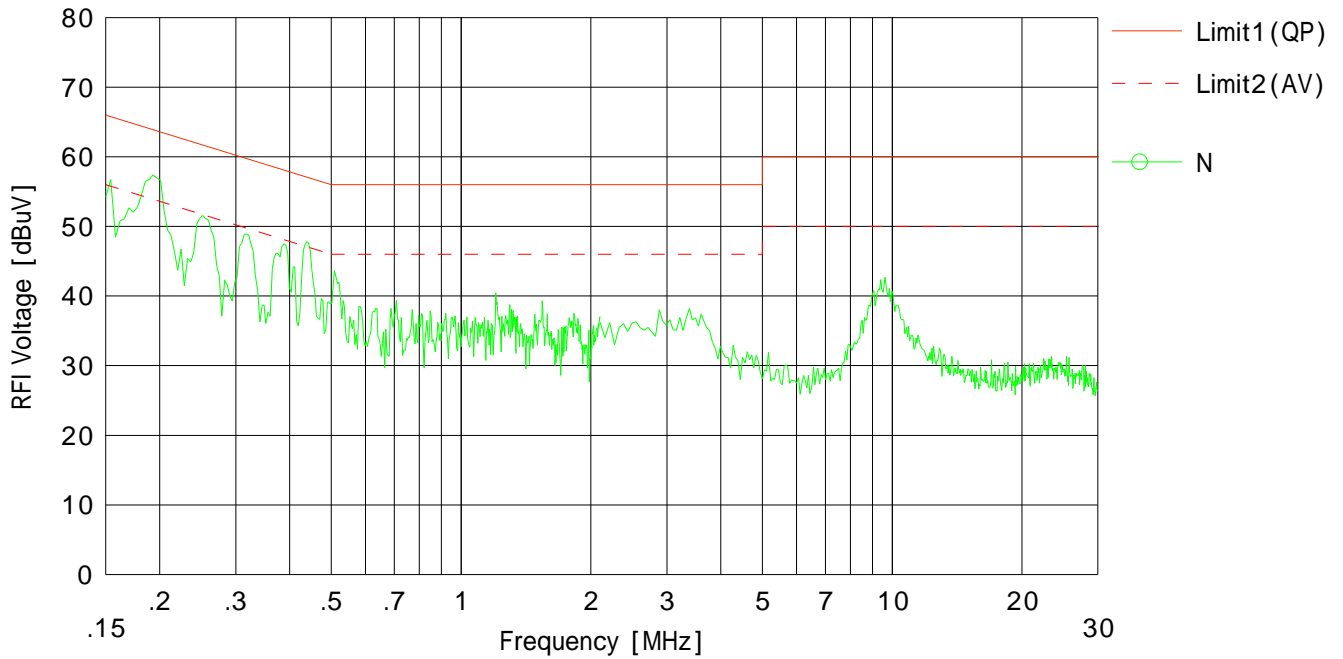
UL Kashima, Inc. No.5 Test Site
Date : 2014/12/15

Company : Alps Electric Co.,Ltd.
Kind of EUT : Bluetooth LE Module
Model No. : UGMZ2AA
Serial No. : 002
Remarks :

Mode : Tx 2480MHz
Order No. : 10524935S
Power : AC120V / 60Hz
Temp./Humi. : 21deg.C / 42%RH

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

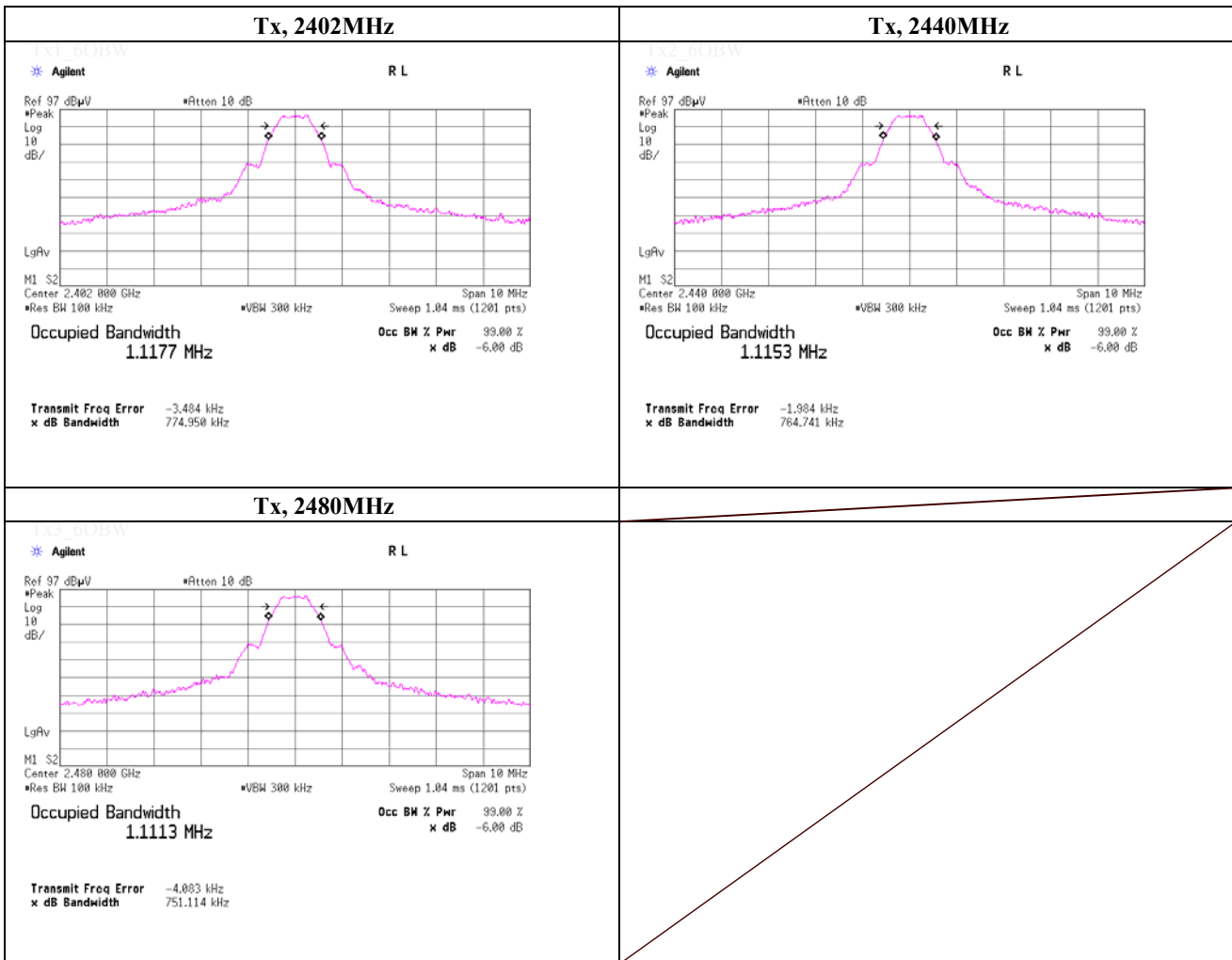
Tested by : Mitsuhiro Jitsukawa



-6dB Bandwidth

Test place	UL Kashima, Inc.	No.1 Measurement Room
Date	October 16, 2014	
Temperature / Humidity	23deg.C , 47%RH	
Engineer	Kazuhiro Ando	
Mode	Tx, Bluetooth LE, PRBS9	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2402.0000	0.775	> 0.500
2440.0000	0.765	> 0.500
2480.0000	0.751	> 0.500



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Maximum Peak Conducted Output Power

(PKPM1)

Test place UL Kashima, Inc. No.1 Measurement Room
 Date October 16, 2014
 Temperature / Humidity 23deg.C , 47%RH
 Engineer Kazuhiro Ando
 Mode Tx, Bluetooth LE, ,

(* P/M: Power Meter with power sensor)

Ch	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
Low	2402.0	-12.16	1.17	10.07	-0.92	0.81	30.00	1000	30.92
Mid	2440.0	-12.22	1.18	10.07	-0.97	0.80	30.00	1000	30.97
High	2480.0	-12.63	1.18	10.07	-1.38	0.73	30.00	1000	31.38

Sample Calculation:

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

Maximum Average Conducted Output Power (Reference data for SAR test)

(AVGPM)

(* P/M: Power Meter with power sensor, AV: Average)

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result	
					[dBm]	[mW]
Low	2402.0	-12.78	1.17	10.07	-1.54	0.70
Mid	2440.0	-12.86	1.18	10.07	-1.61	0.69
High	2480.0	-13.36	1.18	10.07	-2.11	0.62

Sample Calculation:

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

UL Kashima, Inc.

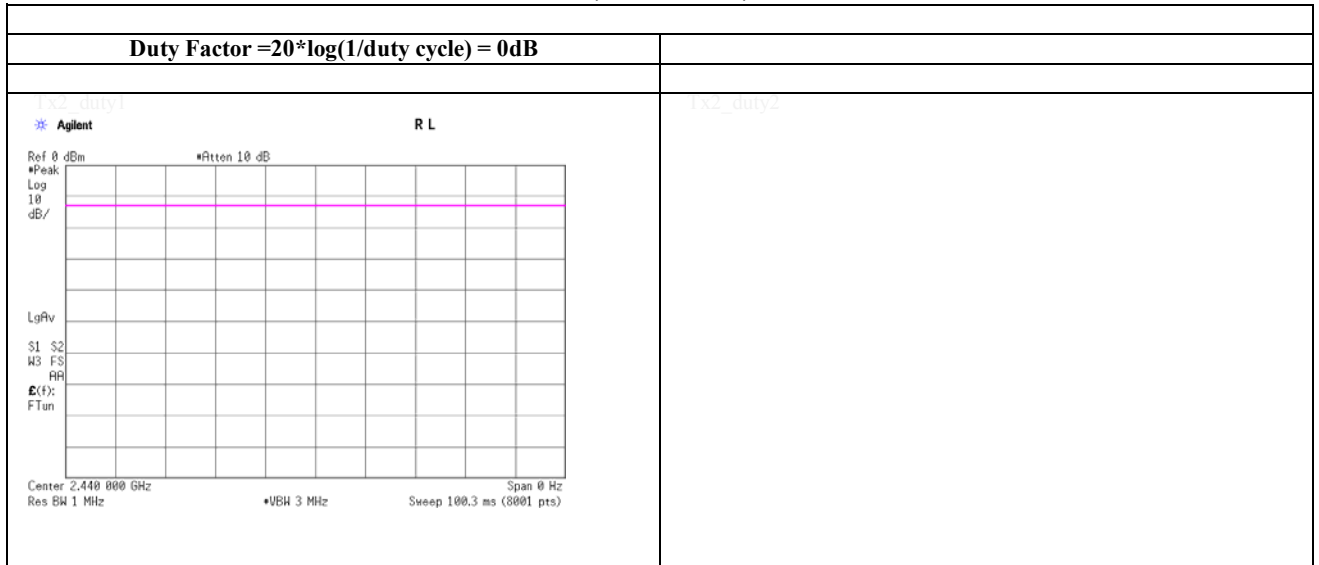
1614 Mushihata, Katori-shi, Chiba-ken 289-0341 JAPAN

Telephone : +81 478 82 0963

Facsimile : +81 478 82 3373

Burst rate confirmation

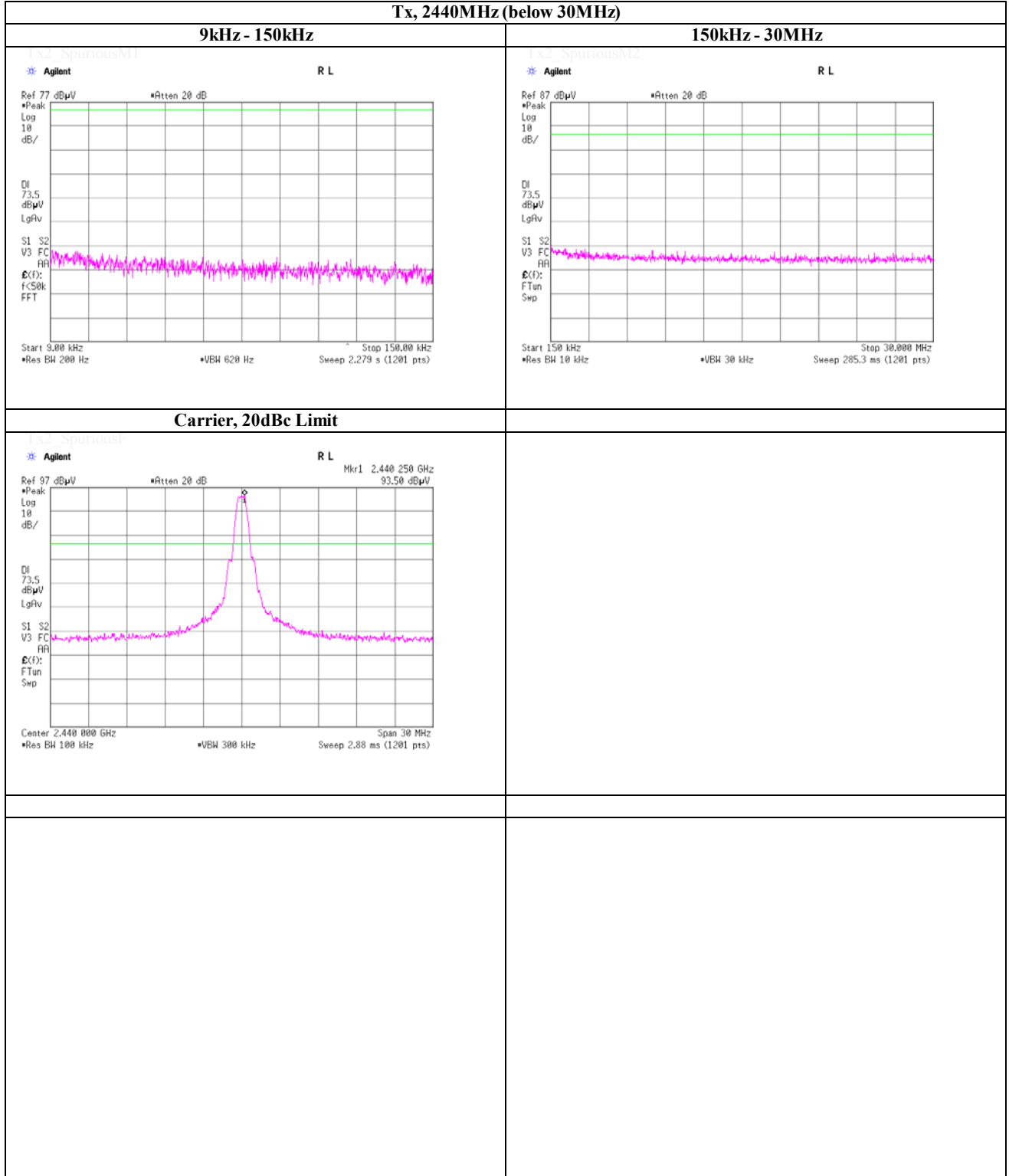
Tx, Bluetooth LE, PRBS9



Spurious emission (Conducted)

Tx, Bluetooth LE, PRBS9

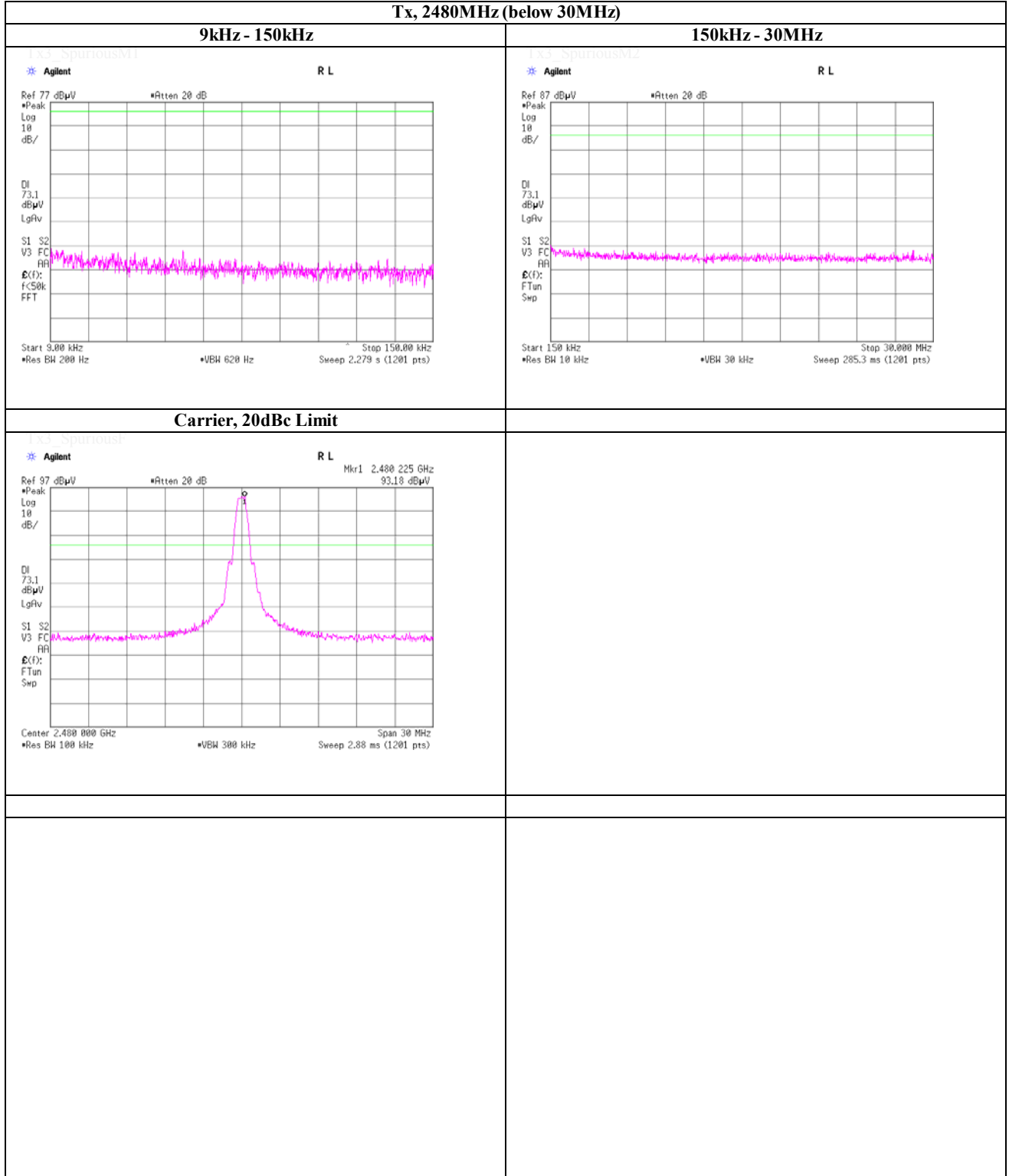
Tx, 2440MHz (below 30MHz)



Spurious emission (Conducted)

Tx, Bluetooth LE, PRBS9

Tx, 2480MHz (below 30MHz)



Radiated Emission

Test place No.11 Semi Anechoic Chamber
 Date October 20, 2014
 Temperature / Humidity 23 deg.C, 51 %RH
 Engineer S.Arai
 Mode Tx, 2402 MHz
 Tx, Bluetooth, Low energy, PRBS9

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	143.996	QP	43.4	13.2	8.0	32.1	32.5	43.5	11.0	196	87	
Hori.	191.997	QP	44.7	10.5	8.3	32.1	31.4	43.5	12.1	116	265	
Hori.	250.065	QP	37.9	11.7	8.7	32.0	26.3	46.0	19.7	122	244	
Hori.	2390.000	PK	40.4	27.6	14.0	38.5	43.5	73.9	30.4	100	0	
Hori.	4804.000	PK	49.9	31.3	6.0	39.6	47.6	73.9	26.3	100	330	
Hori.	7206.000	PK	43.1	36.0	7.5	38.7	47.9	73.9	26.0	100	0	
Hori.	9608.000	PK	41.5	38.5	8.6	37.2	51.4	73.9	22.5	100	0	
Hori.	2390.000	AV	31.6	27.6	14.0	38.5	34.7	53.9	19.2	100	0	
Hori.	4804.000	AV	42.6	31.3	6.0	39.6	40.3	53.9	13.6	100	330	
Hori.	7206.000	AV	31.8	36.0	7.5	38.7	36.6	53.9	17.3	100	0	
Hori.	9608.000	AV	29.9	38.5	8.6	37.2	39.8	53.9	14.1	100	0	
Vert.	42.022	QP	47.4	13.0	7.1	32.2	35.3	40.0	4.7	100	0	
Vert.	72.001	QP	48.6	10.9	7.3	32.2	34.6	40.0	5.4	100	60	
Vert.	144.009	QP	42.4	13.2	8.1	32.1	31.6	43.5	11.9	100	0	
Vert.	191.987	QP	43.7	10.5	8.3	32.1	30.4	43.5	13.1	100	125	
Vert.	249.910	QP	38.3	11.7	8.7	32.0	26.7	46.0	19.3	100	328	
Vert.	2390.000	PK	43.4	27.6	14.0	38.5	46.5	73.9	27.4	100	0	
Vert.	4804.000	PK	48.6	31.3	6.0	39.6	46.3	73.9	27.6	100	33	
Vert.	7206.000	PK	44.7	36.0	7.5	38.7	49.5	73.9	24.4	100	0	
Vert.	9608.000	PK	42.3	38.5	8.6	37.2	52.2	73.9	21.7	100	0	
Vert.	2390.000	AV	31.4	27.6	14.0	38.5	34.5	53.9	19.4	100	0	
Vert.	4804.000	AV	39.5	31.3	6.0	39.6	37.2	53.9	16.7	100	33	
Vert.	7206.000	AV	31.5	36.0	7.5	38.7	36.3	53.9	17.6	100	0	
Vert.	9608.000	AV	31.7	38.5	8.6	37.2	41.6	53.9	12.3	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 13GHz)) - Gain(Amplifier)

Distance factor : 13GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	79.7	27.5	14.0	38.5	82.7	-	-	
Hori.	2400.000	PK	35.3	27.5	14.0	38.5	38.3	62.7	24.4	
Vert.	2402.000	PK	80.3	27.5	14.0	38.5	83.3	-	-	
Vert.	2400.000	PK	35.5	27.5	14.0	38.5	38.5	63.3	24.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 13GHz)) - Gain(Amplifier)

Distance factor : 13GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Radiated Emission

Test place No.11 Semi Anechoic Chamber
 Date October 20, 2014
 Temperature / Humidity 23 deg.C, 51 %RH
 Engineer S.Arai
 Mode Tx, 2440 MHz
 Tx, Bluetooth, Low energy, PRBS9

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	41.197	QP	35.2	13.0	6.9	32.2	22.9	40.0	17.1	234	102	
Hori.	191.994	QP	39.5	10.5	8.3	32.1	26.2	43.5	17.3	183	189	
Hori.	360.003	QP	35.8	14.6	9.3	32.0	27.7	46.0	18.3	121	0	
Hori.	2880.000	PK	49.4	28.3	5.7	38.7	44.7	73.9	29.2	100	119	
Hori.	7320.000	PK	43.6	36.2	7.6	38.7	48.7	73.9	25.2	100	0	
Hori.	9760.000	PK	42.6	39.0	8.6	37.2	53.0	73.9	20.9	100	0	
Hori.	2880.000	AV	44.1	28.3	5.7	38.7	39.4	53.9	14.5	100	119	
Hori.	7320.000	AV	31.3	36.2	7.6	38.7	36.4	53.9	17.5	100	0	
Hori.	9760.000	AV	29.9	39.0	8.6	37.2	40.3	53.9	13.6	100	0	
Vert.	41.495	QP	47.6	13.0	7.0	32.2	35.4	40.0	4.6	100	25	
Vert.	71.996	QP	48.3	11.0	7.3	32.2	34.4	40.0	5.6	100	235	
Vert.	143.995	QP	41.7	13.2	8.0	32.1	30.8	43.5	12.7	100	5	
Vert.	191.986	QP	40.3	10.5	8.3	32.1	27.0	43.5	16.5	100	95	
Vert.	244.897	QP	34.7	11.5	8.7	32.0	22.9	46.0	23.1	100	67	
Vert.	2880.000	PK	50.1	28.3	5.7	38.7	45.4	73.9	28.5	100	33	
Vert.	7320.000	PK	43.6	36.2	7.6	38.7	48.7	73.9	25.2	100	0	
Vert.	9760.000	PK	42.1	39.0	8.6	37.2	52.5	73.9	21.4	100	0	
Vert.	2880.000	AV	45.7	28.3	5.7	38.7	41.0	53.9	12.9	100	33	
Vert.	7320.000	AV	31.8	36.2	7.6	38.7	36.9	53.9	17.0	100	0	
Vert.	9760.000	AV	29.8	39.0	8.6	37.2	40.2	53.9	13.7	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 13GHz)) - Gain(Ampriifier)

Distance factor : 13GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Radiated Emission

Test place No.11 Semi Anechoic Chamber
 Date October 20, 2014
 Temperature / Humidity 23 deg.C, 51 %RH
 Engineer S.Arai
 Mode Tx, 2480 MHz
 Tx, Bluetooth, Low energy, PRBS9

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	143.962	QP	43.3	13.2	8.0	32.1	32.4	43.5	11.1	203	79	
Hori.	191.988	QP	45.7	10.5	8.3	32.1	32.4	43.5	11.1	115	237	
Hori.	250.265	QP	37.1	11.7	8.7	32.0	25.5	46.0	20.5	120	266	
Hori.	2483.500	PK	43.7	27.5	14.1	38.5	46.8	73.9	27.1	100	0	
Hori.	4960.000	PK	51.2	31.5	6.1	39.6	49.2	73.9	24.7	100	165	
Hori.	7440.000	PK	44.3	36.3	7.6	38.6	49.6	73.9	24.3	100	0	
Hori.	9920.000	PK	42.3	39.0	8.7	37.1	52.9	73.9	21.0	100	0	
Hori.	2483.500	AV	31.7	27.5	14.1	38.5	34.8	53.9	19.1	100	0	
Hori.	4960.000	AV	47.1	31.5	6.1	39.6	45.1	53.9	8.8	100	165	
Hori.	7440.000	AV	31.9	36.3	7.6	38.6	37.2	53.9	16.7	100	0	
Hori.	9920.000	AV	29.4	39.0	8.7	37.1	40.0	53.9	13.9	100	0	
Vert.	42.096	QP	46.8	13.0	7.1	32.2	34.7	40.0	5.3	100	0	
Vert.	72.012	QP	46.9	10.9	7.3	32.2	32.9	40.0	7.1	100	45	
Vert.	144.008	QP	40.1	13.2	8.1	32.1	29.3	43.5	14.2	100	21	
Vert.	191.989	QP	43.0	10.5	8.3	32.1	29.7	43.5	13.8	100	78	
Vert.	249.212	QP	39.2	11.6	8.7	32.0	27.5	46.0	18.5	100	302	
Vert.	2483.500	PK	43.2	27.5	14.1	38.5	46.3	73.9	27.6	100	0	
Vert.	4960.000	PK	51.2	31.5	6.1	39.6	49.2	73.9	24.7	100	22	
Vert.	7440.000	PK	43.5	36.3	7.6	38.6	48.8	73.9	25.1	100	0	
Vert.	9920.000	PK	42.9	39.0	8.7	37.1	53.5	73.9	20.4	100	0	
Vert.	2483.500	AV	31.8	27.5	14.1	38.5	34.9	53.9	19.0	100	0	
Vert.	4960.000	AV	47.1	31.5	6.1	39.6	45.1	53.9	8.8	100	22	
Vert.	7440.000	AV	32.3	36.3	7.6	38.6	37.6	53.9	16.3	100	0	
Vert.	9920.000	AV	29.5	39.0	8.7	37.1	40.1	53.9	13.8	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 13GHz)) - Gain(Ampriifier)

Distance factor : 13GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Maximum Power Spectral Density

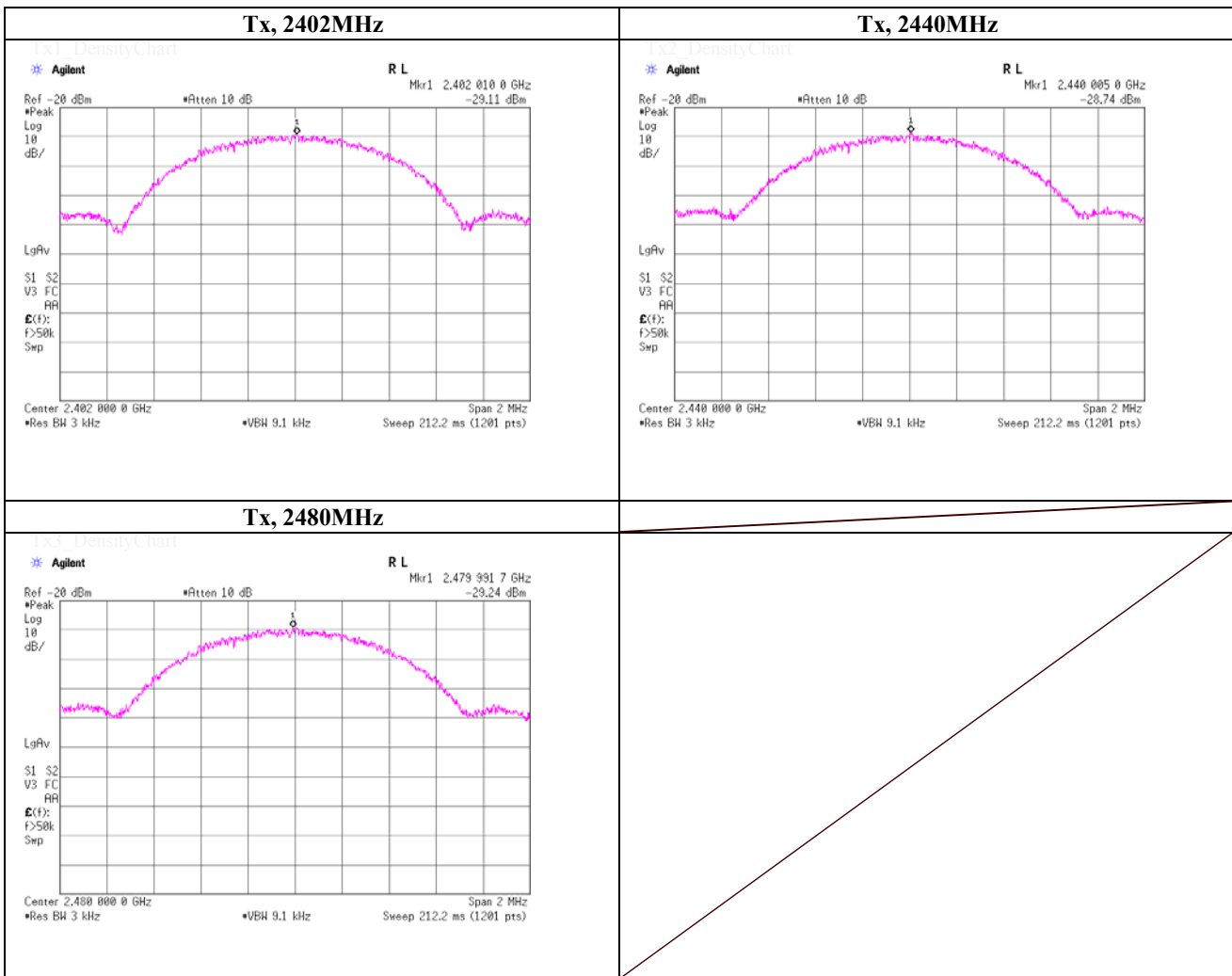
(PKPSD)

Test place	UL Kashima, Inc.	No.1 Measurement Room
Date	October 16, 2014	
Temperature / Humidity	23deg.C , 47%RH	
Engineer	Kazuhiro Ando	
Mode	Tx, Bluetooth LE, PRBS9	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.0000	2402.01	-29.11	1.17	10.07	-17.87	8.00	25.87
2440.0000	2440.01	-28.74	1.18	10.07	-17.49	8.00	25.49
2480.0000	2479.99	-29.24	1.18	10.07	-17.99	8.00	25.99

Sample Calculation:

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



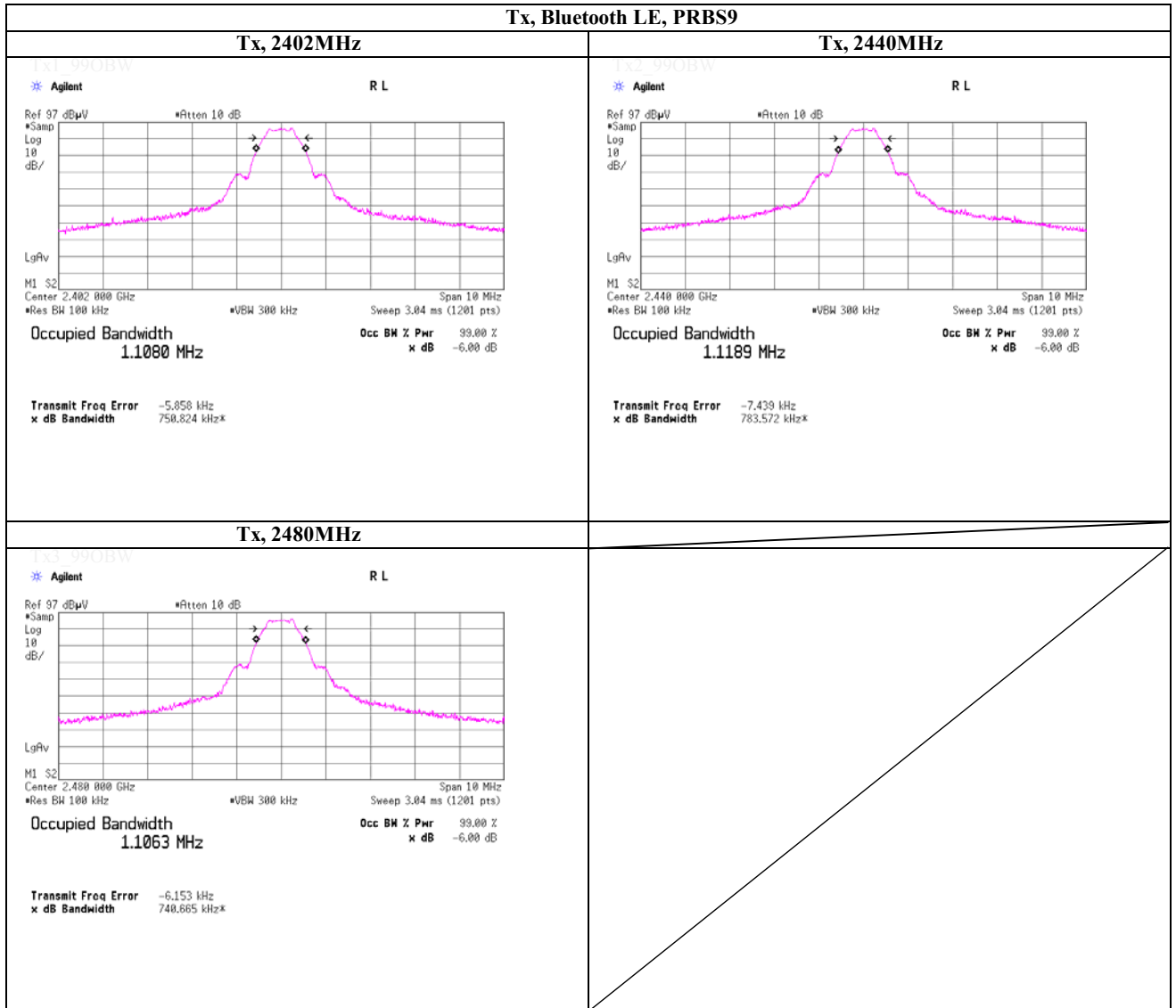
UL Kashima, Inc.

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

Telephone : +81 478 82 0963

Facsimile : +81 478 82 3373

99% Occupied Bandwidth



Test Report No.: 10524935M-R1

APPENDIX 2 Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
CSA-07	Spectrum Analyzer	Agilent	E4448A	MY52490024	AT	2014/05/19 * 12
CAT10-17	10dB Fixed Atten.	Weinschel	54A-10	56251	AT	2014/05/23 * 12
CCC-W06	Micro Wave Cable	Junkosha	MWX241	MRA-12-14-14 6	AT	2014/05/23 * 12
CCH-04	Temperature and Humidity Chamber	ESPEC	PL-1J	15004059	AT	2014/06/03 * 12
CPM-16	Peak Power Analyzer	Agilent	8990B	MY51000276	AT	2014/06/26 * 12
CPSO-24	Power Sensor	Agilent	N1923A	MY54070024	AT	2014/06/26 * 12
COS-11	Temperature, Humidity & Atmospheric Logger	T&D	TR-73U	F8060468	AT	2014/05/07 * 12
CTR-06	Test Receiver	Rohde & Schwarz	ESCI	100107 Rev 4.32	RE	2014/09/03 * 12
GBL-09	LOGBICON	Schwarzbeck	VULB 9168	508	RE	2014/04/25 * 12
CAF-16	Pre-Amplifier	Sonoma Instrument	310N	325015	RE	2014/05/23 * 12
CSCL-16	Ruler	Tajima	G3 gold	none	RE	2014/02/03 * 12
COS-11	Temperature, Humidity & Atmospheric Logger	T&D	TR-73U	F8060468	RE	2014/05/07 * 12
COTS-CEMI-02	EMI Software	T SJ	TEPTO-DV(RE,CE, MF,PE)	Ver.2.5.0128	CE/RE	-
CSA-06	Spectrum Analyzer	Agilent	N9030A	MY53310670	RE	2014/05/20 * 12
CHA-20	Broad Band Horn	Schwarzbeck	BBHA 9120D	9120D-1270	RE	2014/07/12 * 12
CHA-07	Double Ridged Horn	TOYO	HAP18-26W	00000035	RE	2014/06/26 * 12
CAF-18	Pre-Amplifier	TOYO	TPA0118-36	A-1001	RE	2014/07/14 * 12
CAT10-16	10dB Fixed Atten.	Weinschel	54A-10	56246	RE	2014/05/23 * 12
CHF-02	HPF	Micro-Tronics	HPM50115-02	002	RE	2014/05/23 * 12
CCC-W05	Micro Wave Cable	Junkosha	MWX241	MRA-12-14-14 5	RE	2014/05/23 * 12
CCC-W07	Micro Wave Cable	Junkosha	MWX221	MRA-12-14-14 8	RE	2014/05/23 * 12
CCC-W09	Micro Wave Cable	SUHNER	SUCOFLEX104	MY588/4	RE	2014/07/17 * 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	2014/11/09 * 12
CTR-05	Test Receiver	Rohde & Schwarz	ESCI	100608 Rev 4.32	CE	2014/09/02 * 12
CCC-S5-C(2/9/10/11)	Coaxial Cable	Fujikura,Fujikura,Fujikura, Fujikura	5D-2W,5D-2W,5D-2W,5D-2W	-	CE	2014/07/09 * 12
CLS-11	A.M.N.	Rohde & Schwarz	ESH3-Z5	835239/022	CE	2014/07/09 * 12
CLS-08	A.M.N.	Rohde & Schwarz	ESH3-Z5	847265/011	CE	2014/07/09 * 12
CSCL-06	Ruler	Tajima	L19-55S	none	CE	2014/02/03 * 12
COS-05	Temperature & Humidity Indicator	A&D	AD-5681	6975761	CE	2014/07/01 * 12

The expiration date of the calibration is the end of the expired month .
As for some calibrations performed after the tested dates , those test equipment have been controlled by means of an unbroken chains of calibrations .

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