RADIO TEST REPORT

Test Report No. : 10799281S-A

Applicant	:	**Murata Manufacturing Co., Ltd.**
Type of Equipment	:	**Communication Module**
Model No.	:	**Type1EK**
FCC ID	:	**VPYLB1EK**
Test regulation	:	**FCC Part 15 Subpart C: 2015**
Test Result	:	**Complied**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: May 27 to June 8, 2015

Representative test engineer:

Kenichi Adachi
Engineer
Consumer Technology Division

Approved by:

Toyokazu Imamura
Leader
Consumer Technology Division

RTL02610

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

REVISION HISTORY

Original Test Report No.: 10799281S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10799281S-A	June 30, 2015	-	-
1	10799281S-A	July 21, 2015	5 23	Correction of provided voltage Correction of misdescription

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SECTION 1: Customer information

Company Name	:	Murata Manufacturing Co., Ltd.
Address	:	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555 Japan
Telephone Number	:	+81-75-955-6173
Facsimile Number	:	+81-75-955-7096
Contact Person	:	Noriko Ueno

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

2.1 Identification of E.U.T.

Type of Equipment	:	Communication Module
Model No.	:	Type1EK
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.0 V
Receipt Date of Sample	:	May 17, 2015
Country of Mass-production	:	China, 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: Type1EK (referred to as the EUT in this report) is a Communication Module.

General Specification

Clock frequency(ies) in the system	:	32 MHz

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2405 MHz - 2480 MHz
Modulation	:	O-QPSK, DSSS
Antenna type	:	Monopole pattern antenna
Antenna Gain	:	+0.7 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2015, final revised on January 21, 2015
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 C63.4-2009 7. AC powerline Conducted Emission measurements	**FCC:** Section 15.207	**QP** 19.9 dB, 0.48530 MHz, L1	Complied	-
	IC: RSS-Gen 8.8	**IC:** RSS-Gen 8.8			
6 dB Bandwidth	**FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 9, 2015)"	**FCC:** Section 15.247(a)(2)	See data.	Complied	Conducted
	IC: -	**IC:** RSS-247 5.2(1)			
Maximum Peak Output Power	**FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 9, 2015)"	**FCC:** Section 15.247(b)(3)		Complied	Conducted
	IC: RSS-Gen 6.12	**IC:** RSS-247 5.4(4)			
Power Density	**FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 9, 2015)"	**FCC:** Section 15.247(e)		Complied	Conducted
	IC: -	**IC:** RSS-247 5.2(2)			
Spurious Emission Restricted Band Edges	**FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 9, 2015)"	**FCC:** Section15.247(d)	2.9 dB 2483.500 MHz, AV, Horizontal	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
	IC: RSS-Gen 6.13	**IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 12.2.7.

* In case any questions arise about test procedure, ANSI C63.4: 2009 is also referred.

FCC Part 15.31 (e)
The RF Module has its own regulator.
The RF Module is constantly provided voltage (DC 1.8 V) through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement of 15.203/212.

FCC Part 15.203/212 Antenna requirement
It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

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.

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)		
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR
Conducted emission (AC Mains) LISN	150 kHz - 30 MHz	3.6 dB	3.4 dB	3.4 dB
Radiated emission (Measurement distance: 3 m)	9 kHz - 30 MHz	3.7 dB	3.5 dB	3.5 dB
	30 MHz - 300 MHz	4.9 dB	4.9 dB	4.7 dB
	300 MHz - 1 GHz	5.0 dB	5.0 dB	4.8 dB
	1 GHz - 15 GHz	4.9 dB	4.9 dB	4.9 dB
Radiated emission (Measurement distance: 1 m)	15 GHz - 18 GHz	5.7 dB	5.7 dB	5.7 dB
	18 GHz - 40 GHz	4.5 dB	4.3 dB	4.3 dB

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz	0.68 dB
Spurious emission (Conducted) below 1 GHz	1.5 dB
Spurious emission (Conducted) 1 GHz - 3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz - 18 GHz	2.4 dB
Spurious emission (Conducted) 18 GHz - 26.5 GHz	2.5 dB
Bandwidth Measurement	0.66 %

Conducted Emission test

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

Radiated emission test

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

3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401
JAB Accreditation No. RTL02610

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

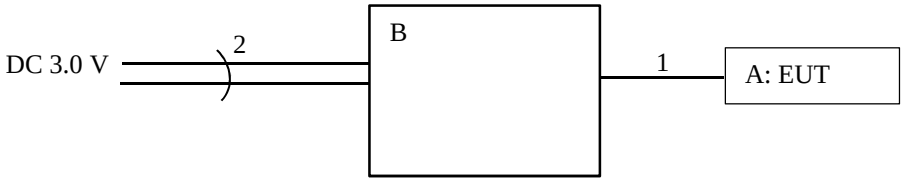
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

*The details of Operating mode(s)

Test item	Mode	Tested frequency
All items	Transmitting (Tx) IEEE 802.15.4	2405MHz, 2440MHz, 2480MHz
*1) Software: TeraTerm 4.83.0.0 *2) Power setting: F0		

4.2 Configuration and peripherals



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

*1) DC power supply (Model No.: PAN35-10A) was used for DC 3.0 V input.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Communication Module	Type 1EK	10 *3), 14 *2)	Murata Mfg. Co Ltd.	EUT
B	Jigu board	-	-	Murata Mfg. Co Ltd.	-

*2) Used for Antenna Terminal conducted tests
*3) Used for Conducted Emission test and Radiated Emission tests

List of cables used

No.	Cable name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal	0.025	Unshielded	Unshielded	-
2	DC	1.0	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform 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 80 cm 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.

1) 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 50 ohm 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 via DC power supply within the shielded room.
The EUT via DC power supply was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

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

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

SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v03r03 (Issue on June 9, 2015)".

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.
The height of the measuring antenna varied between 1 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	Below 30 MHz	30 MHz to 300 MHz	300 MHz to 1 GHz	Above 1 GHz
Antenna Type	Loop	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 *3)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: 13.3.1 RBW: 1 MHz VBW: 3 MHz Detector: Voltage Averaging Trace: 100 traces	RBW: 100 kHz VBW: 300 kHz
Test Distance	3m	3 m (below 15 GHz), 1 m *1) (above 15 GHz)		3 m (below 15 GHz), 1 m *1) (above 15 GHz)

*1) Distance Factor: 20 x log (3.0 m / 1.0 m) = 9.5 dB
*3) Average Power Measurement was performed based on 6.0 & 13.3.1 of "KDB 558074 D01 DTS Meas Guidance v03r03 (Issue on June 9, 2015)"

- 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

Frequency / Antenna polarization	Carrier *2)	Spurious			
		Below 1GHz	1-15GHz	15-18GHz	15-25GHz
Horizontal	X	X	X	X	X
Vertical	Z	X	Z	Z	Z

*2) with spurious emissions near carrier frequency.

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

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

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6 dB 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	Sample	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3) *4)
Conducted Spurious Emission *5)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				
Band Edge confirmation	100 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *2)

*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 v03r03 (Issue on June 9, 2015)"
*4) The test was not performed at RBW:3 kHz however the measurement is to be performed with RBW:3kHz in the regulation, because, the measurement value with RBW:3 kHz is less than the value of RBW:30 kHz and the test data met the limit with RBW:30 kHz.
*5) 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.

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

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

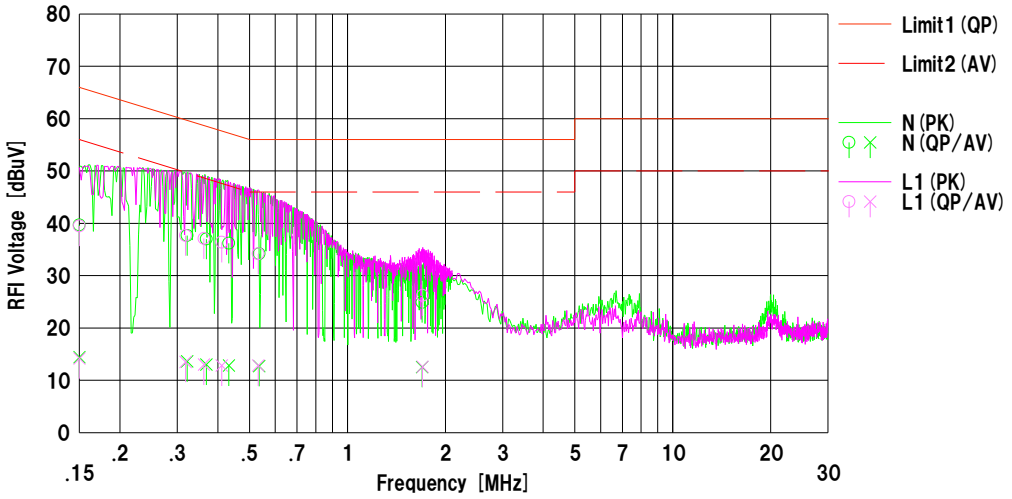
UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2015/05/29

Mode : Transmitting 2405 MHz

Power : DC 3 V / AC 120V 60Hz
Temp./Humi. : 24 deg.C / 55 %RH

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

Engineer : Kenichi Adachi



No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP>	<AV>		<QP>	<AV>	<QP>	<AV>	<QP>	<AV>		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	27.3	2.0	12.4	39.7	14.4	66.0	56.0	26.3	41.6	N	
2	0.32150	25.3	1.2	12.4	37.7	13.6	59.6	49.6	21.9	36.0	N	
3	0.36830	24.6	0.6	12.4	37.0	13.0	58.5	48.5	21.5	35.5	N	
4	0.43220	23.8	0.4	12.4	36.2	12.8	57.2	47.2	21.0	34.4	N	
5	0.53600	21.7	0.2	12.5	34.2	12.7	56.0	46.0	21.8	33.3	N	
6	1.69790	12.4	0.0	12.5	24.9	12.5	56.0	46.0	31.1	33.5	N	
7	0.15000	27.1	1.8	12.4	39.5	14.2	66.0	56.0	26.5	41.8	L1	
8	0.31790	25.3	1.1	12.4	37.7	13.5	59.7	49.7	22.0	36.2	L1	
9	0.36230	24.7	0.6	12.4	37.1	13.0	58.6	48.6	21.5	35.6	L1	
10	0.41110	24.0	0.4	12.4	36.4	12.8	57.6	47.6	21.2	34.8	L1	
11	0.53230	21.7	0.3	12.5	34.2	12.8	56.0	46.0	21.8	33.2	L1	
12	1.70270	13.7	0.1	12.5	26.2	12.6	56.0	46.0	29.8	33.4	L1	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-05

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

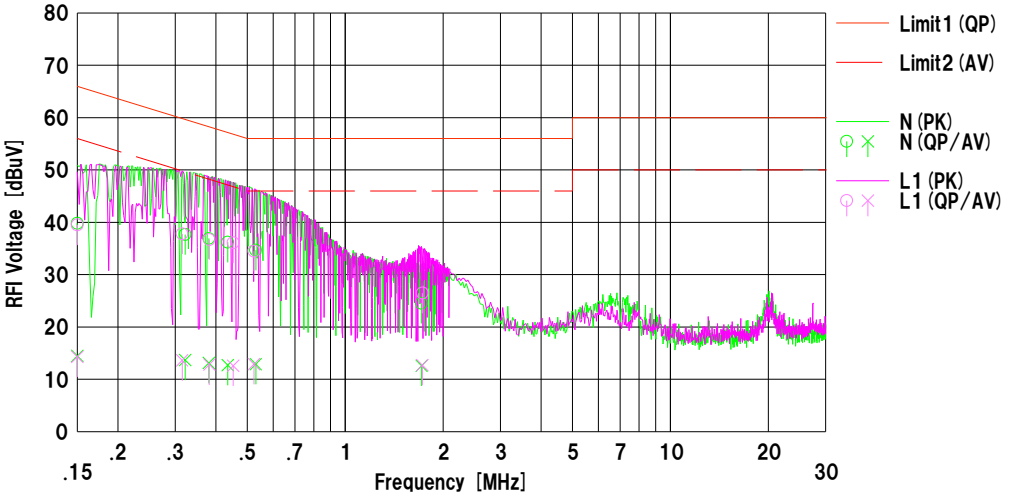
UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2015/05/29

Mode : Transmitting 2440 MHz

Power : DC 3 V / AC 120V 60Hz
Temp./Humi. : 24 deg.C / 55 %RH

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

Engineer : Kenichi Adachi



No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP>	<AV>		<QP>	<AV>	<QP>	<AV>	<QP>	<AV>		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	27.4	2.1	12.4	39.8	14.5	66.0	56.0	26.2	41.5	N	
2	0.32200	25.3	1.3	12.4	37.7	13.7	59.6	49.6	21.9	35.9	N	
3	0.38060	24.5	0.7	12.4	36.9	13.1	58.2	48.2	21.3	35.1	N	
4	0.43475	23.8	0.3	12.4	36.2	12.7	57.1	47.1	20.9	34.4	N	
5	0.53040	22.2	0.4	12.5	34.7	12.9	56.0	46.0	21.3	33.1	N	
6	1.71590	12.0	0.1	12.5	24.5	12.6	56.0	46.0	31.5	33.4	N	
7	0.15000	27.1	1.9	12.4	39.5	14.3	66.0	56.0	26.5	41.7	L1	
8	0.31510	25.4	1.2	12.4	37.8	13.6	59.8	49.8	22.0	36.2	L1	
9	0.38190	24.3	0.4	12.4	36.7	12.8	58.2	48.2	21.5	35.4	L1	
10	0.45250	23.7	0.2	12.4	36.1	12.6	56.8	46.8	20.7	34.2	L1	
11	0.52370	22.0	0.4	12.5	34.5	12.9	56.0	46.0	21.5	33.1	L1	
12	1.72700	14.0	0.2	12.5	26.5	12.7	56.0	46.0	29.5	33.3	L1	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-05

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

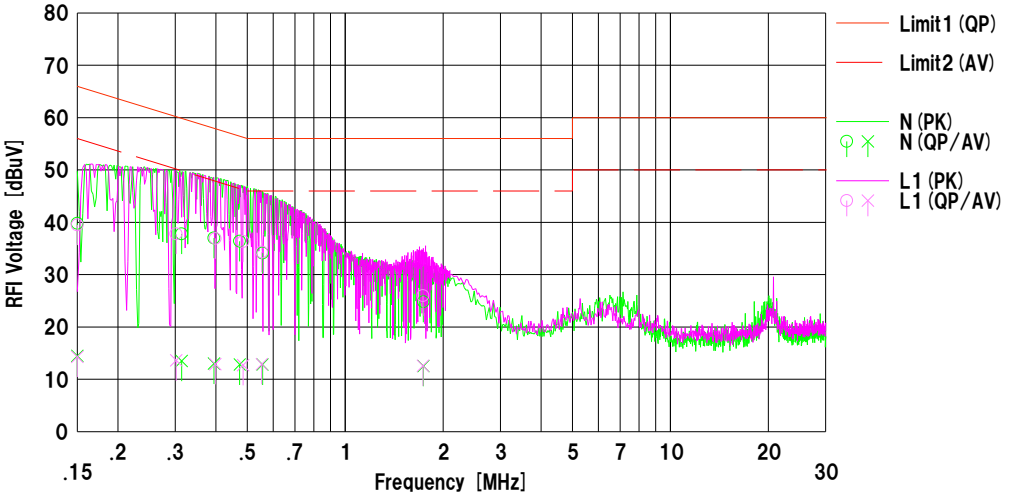
UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2015/05/29

Mode : Transmitting 2480 MHz

Power : DC 3 V / AC 120V 60Hz
Temp./Humi. : 24 deg.C / 55 %RH

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

Engineer : Kenichi Adachi



No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP>	<AV>		<QP>	<AV>	<QP>	<AV>	<QP>	<AV>		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	27.4	2.1	12.4	39.8	14.5	66.0	56.0	26.2	41.5	N	
2	0.31400	25.4	1.1	12.4	37.8	13.5	59.8	49.8	22.0	36.3	N	
3	0.39450	24.6	0.6	12.4	37.0	13.0	57.9	47.9	20.9	34.9	N	
4	0.47380	24.0	0.4	12.4	36.4	12.8	56.4	46.4	20.0	33.6	N	
5	0.55660	21.6	0.3	12.5	34.1	12.8	56.0	46.0	21.9	33.2	N	
6	1.73960	12.3	0.0	12.5	24.8	12.5	56.0	46.0	31.2	33.5	N	
7	0.15000	27.1	1.9	12.4	39.5	14.3	66.0	56.0	26.5	41.7	L1	
8	0.30190	25.4	1.2	12.4	37.8	13.6	60.1	50.1	22.3	36.5	L1	
9	0.39850	24.5	0.5	12.4	36.9	12.9	57.8	47.8	20.9	34.9	L1	
10	0.48530	23.9	0.3	12.4	36.3	12.7	56.2	46.2	19.9	33.5	L1	
11	0.55370	21.8	0.4	12.5	34.3	12.9	56.0	46.0	21.7	33.1	L1	
12	1.73350	13.5	0.1	12.5	26.0	12.6	56.0	46.0	30.0	33.4	L1	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-05

6 dB Bandwidth

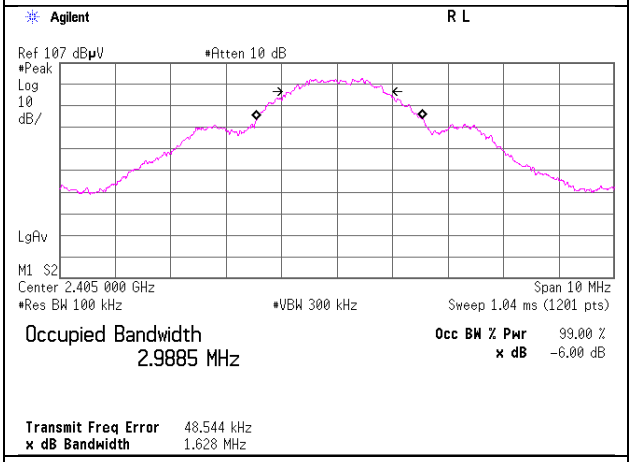
Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
2405	1.628	> 0.500
2440	1.606	> 0.500
2480	1.641	> 0.500

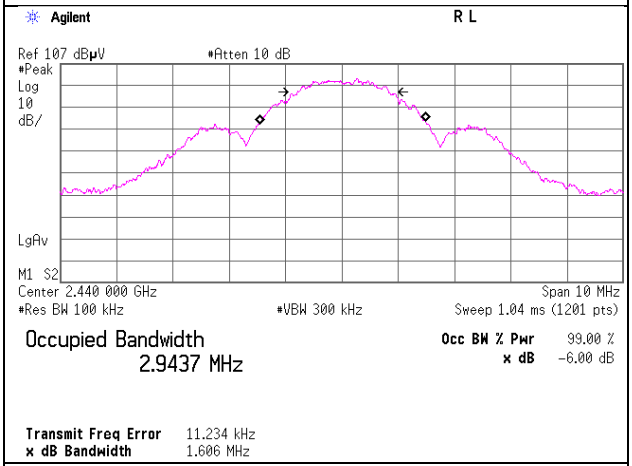
6 dB Bandwidth

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

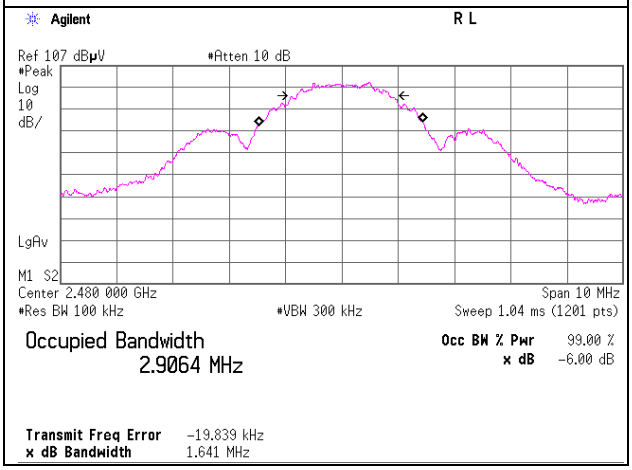
2405 MHz



2440 MHz



2480 MHz



Maximum Peak Output Power

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

Freq.	Reading (Peak)	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2405.0	-3.24	1.84	9.93	8.53	7.13	30.00	1000	21.47
2440.0	-2.95	1.85	9.93	8.83	7.64	30.00	1000	21.17
2480.0	-3.47	1.86	9.93	8.32	6.79	30.00	1000	21.68

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

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

Average Output Power
(Reference data for RF Exposure)

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

Freq.	Reading	Cable Loss	Atten. Loss	Result (Burst power)		Duty factor	Result (Frame power)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2405.0	-3.84	1.84	9.93	7.93	6.21	-4.57	3.36	2.17
2440.0	-3.57	1.85	9.93	8.21	6.62	-4.57	3.64	2.31
2480.0	-4.14	1.86	9.93	7.65	5.82	-4.57	3.08	2.03

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

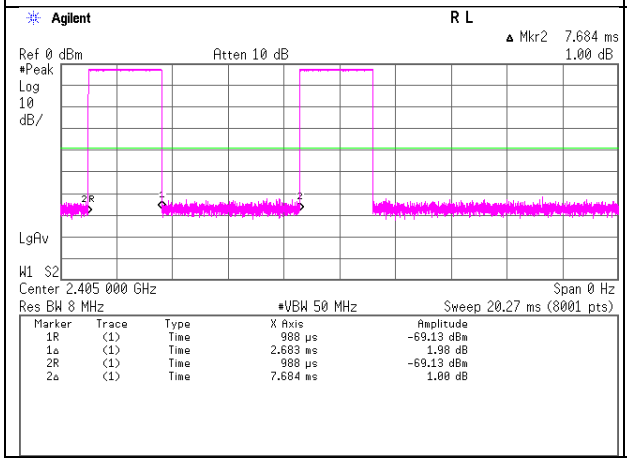
*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst rate confirmation

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

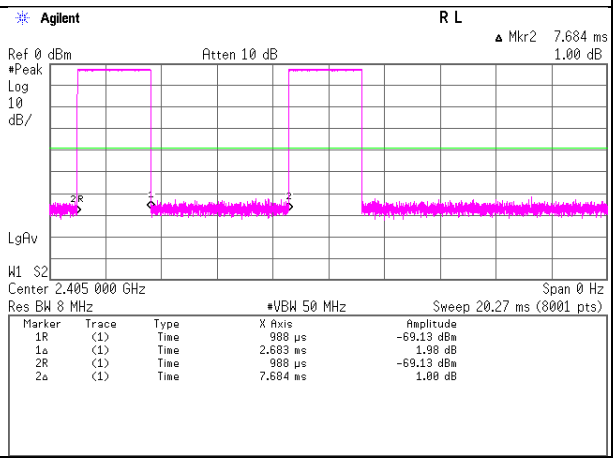
(for Average Output Power)

Tx on / (Tx on + Tx off) = 0.349
Tx on / (Tx on + Tx off) * 100 = 34.9 %
Duty factor = 10 * log (2.683 / 7.684) = -4.57 dB



(for Spurious emissions)

Tx on / (Tx on + Tx off) = 0.349
Tx on / (Tx on + Tx off) * 100 = 34.9 %
Duty factor = 20 * log (2.683 / 7.684) = -9.14 dB



* When testing (Average output power, Spurious emissions), it measured by the signal of duty 100 %, and it was corrected measuring value the duty of normal operation.

Radiated Spurious Emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	10799281S-A	
Date	May 27, 2015	May 28. 2015
Temperature / Humidity	24 deg. C / 55 % RH	23 deg.C / 58 %RH
Engineer	Kenichi Adachi	Kenichi Adachi
	(1 GHz-15 GHz)	(above 15 GHz, below 1 GHz)
Mode	Tx 2405 MHz	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	30.774	QP	23.0	17.1	6.7	32.1	0.0	14.7	40.0	25.3	150	185	
Hori.	194.597	QP	22.8	16.2	8.0	32.0	0.0	15.0	43.5	28.5	200	338	
Hori.	916.873	QP	22.2	22.7	11.1	30.8	0.0	25.2	46.0	20.8	150	352	
Vert.	30.293	QP	23.2	17.3	6.7	32.1	0.0	15.1	40.0	24.9	100	42	
Vert.	163.990	QP	23.6	15.3	8.0	32.0	0.0	14.9	43.5	28.6	100	1	
Vert.	879.250	QP	21.8	22.2	10.9	31.1	0.0	23.8	46.0	22.2	100	292	
Hori.	2390.000	PK	43.0	26.4	13.7	41.1	3.5	45.5	73.9	28.4	100	130	
Hori.	4809.062	PK	61.3	30.7	5.8	39.8	3.5	61.5	73.9	**12.4**	113	6	
Hori.	4810.000	PK	56.1	30.7	5.8	39.8	3.5	56.3	73.9	17.6	113	6	
Hori.	4811.002	PK	61.3	30.7	5.8	39.8	3.5	61.5	73.9	**12.4**	113	6	
Hori.	7214.000	PK	45.2	36.7	7.2	40.2	3.5	52.4	73.9	21.5	100	354	
Hori.	7215.000	PK	42.0	36.7	7.2	40.2	3.5	49.2	73.9	24.7	100	354	
Hori.	7216.727	PK	45.0	36.7	7.2	40.2	3.5	52.2	73.9	21.7	100	354	
Hori.	9620.000	PK	41.3	38.5	8.2	40.1	3.5	51.4	73.9	22.5	100	0	
Hori.	12025.000	PK	40.9	39.5	9.3	39.6	3.5	53.6	73.9	20.3	100	0	
Vert.	2390.000	PK	44.1	26.4	13.7	41.1	3.5	46.6	73.9	27.3	100	172	
Vert.	4809.238	PK	53.5	30.7	5.8	39.8	3.5	53.7	73.9	20.2	129	101	
Vert.	4810.000	PK	49.4	30.7	5.8	39.8	3.5	49.6	73.9	24.3	129	101	
Vert.	4811.158	PK	53.8	30.7	5.8	39.8	3.5	54.0	73.9	19.9	129	101	
Vert.	7213.683	PK	46.1	36.7	7.2	40.2	3.5	53.3	73.9	20.6	100	2	
Vert.	7215.000	PK	43.8	36.7	7.2	40.2	3.5	51.0	73.9	22.9	100	2	
Vert.	7216.525	PK	47.1	36.7	7.2	40.2	3.5	54.3	73.9	19.6	100	2	
Vert.	9620.000	PK	40.4	38.5	8.2	40.1	3.5	50.5	73.9	23.4	100	0	
Vert.	12025.000	PK	41.6	39.5	9.3	39.6	3.5	54.3	73.9	19.6	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 15 GHz : 20log (4.5 m / 3.0 m) = 3.5 dB
15 GHz - 40 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	36.7	26.4	13.7	41.1	-9.1	3.5	30.1	53.9	23.8	*1)
Hori.	4809.062	AV	57.1	30.7	5.8	39.8	-9.1	3.5	48.2	53.9	**5.7**	
Hori.	4810.000	AV	51.2	30.7	5.8	39.8	-9.1	3.5	42.3	53.9	11.6	
Hori.	4811.002	AV	57.0	30.7	5.8	39.8	-9.1	3.5	48.1	53.9	5.8	
Hori.	7214.000	AV	35.5	36.7	7.2	40.2	-9.1	3.5	33.6	53.9	20.3	
Hori.	7215.000	AV	34.7	36.7	7.2	40.2	-9.1	3.5	32.8	53.9	21.1	
Hori.	7216.727	AV	35.6	36.7	7.2	40.2	-9.1	3.5	33.7	53.9	20.2	
Hori.	9620.000	AV	34.5	38.5	8.2	40.1	-9.1	3.5	35.5	53.9	18.4	
Hori.	12025.000	AV	34.0	39.5	9.3	39.6	-9.1	3.5	37.6	53.9	16.3	
Vert.	2390.000	AV	35.2	26.4	13.7	41.1	-9.1	3.5	28.6	53.9	25.3	*1)
Vert.	4809.238	AV	48.1	30.7	5.8	39.8	-9.1	3.5	39.2	53.9	14.7	
Vert.	4810.000	AV	42.4	30.7	5.8	39.8	-9.1	3.5	33.5	53.9	20.4	
Vert.	4811.158	AV	47.6	30.7	5.8	39.8	-9.1	3.5	38.7	53.9	15.2	
Vert.	7213.683	AV	38.0	36.7	7.2	40.2	-9.1	3.5	36.1	53.9	17.8	
Vert.	7215.000	AV	35.4	36.7	7.2	40.2	-9.1	3.5	33.5	53.9	20.4	
Vert.	7216.525	AV	36.2	36.7	7.2	40.2	-9.1	3.5	34.3	53.9	19.6	
Vert.	9620.000	AV	33.2	38.5	8.2	40.1	-9.1	3.5	34.2	53.9	19.7	
Vert.	12025.000	AV	32.8	39.5	9.3	39.6	-9.1	3.5	36.4	53.9	17.5	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 15 GHz : 20log (4.5 m / 3.0 m) = 3.5 dB
15 GHz - 40 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.	2405.000	PK	87.0	26.4	13.7	41.1	3.5	89.5	-	-	Carrier
Hori.	2400.000	PK	41.0	26.4	13.7	41.1	3.5	43.5	69.5	26.0	
Vert.	2405.000	PK	86.8	26.4	13.7	41.1	3.5	89.3	-	-	Carrier
Vert.	2400.000	PK	39.7	26.4	13.7	41.1	3.5	42.2	69.3	27.1	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 15 GHz : 20log (4.5 m / 3.0 m) = 3.5 dB
15 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.5 dB

* It measured the near frequency of the second high harmonic and the near frequency of third high harmonic by the addition, because there was envelope curve of the noise of the same pattern as high harmonic frequency. (And,it had applied duty factor.)

Radiated Spurious Emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	10799281S-A	
Date	May 27, 2015	May 28. 2015
Temperature / Humidity	24 deg. C / 55 % RH	23 deg.C / 58 %RH
Engineer	Kenichi Adachi	Kenichi Adachi
	(1 GHz-15 GHz)	(above 15 GHz, below 1 GHz)
Mode	Tx 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.	31.495	QP	23.0	16.9	6.7	32.1	0.0	14.5	40.0	25.5	150	113	
Hori.	192.201	QP	22.9	16.2	8.0	32.0	0.0	15.1	43.5	28.4	200	198	
Hori.	919.994	QP	22.3	22.7	11.1	30.8	0.0	25.3	46.0	20.7	150	359	
Vert.	30.971	QP	23.3	17.1	6.7	32.1	0.0	15.0	40.0	25.0	100	50	
Vert.	188.919	QP	23.3	16.2	7.9	32.0	0.0	15.4	43.5	28.1	100	358	
Vert.	880.283	QP	21.9	22.2	10.9	31.1	0.0	23.9	46.0	22.1	100	233	
Hori.	4879.105	PK	62.6	30.9	5.8	39.7	3.5	63.1	73.9	**10.8**	135	154	
Hori.	4880.000	PK	56.8	30.9	5.8	39.7	3.5	57.3	73.9	16.6	135	154	
Hori.	4881.018	PK	62.5	30.9	5.8	39.7	3.5	63.0	73.9	10.9	135	154	
Hori.	7318.708	PK	50.0	36.8	7.2	40.3	3.5	57.2	73.9	16.7	135	143	
Hori.	7320.000	PK	44.0	36.8	7.2	40.3	3.5	51.2	73.9	22.7	135	143	
Hori.	7321.559	PK	50.4	36.8	7.2	40.3	3.5	57.6	73.9	16.3	135	143	
Hori.	9760.000	PK	41.7	38.6	8.3	40.0	3.5	52.1	73.9	21.8	100	0	
Hori.	12200.000	PK	41.6	39.4	9.4	39.8	3.5	54.1	73.9	19.8	100	0	
Vert.	4879.045	PK	54.0	30.9	5.8	39.7	3.5	54.5	73.9	19.4	153	12	
Vert.	4880.000	PK	49.0	30.9	5.8	39.7	3.5	49.5	73.9	24.4	153	12	
Vert.	4881.073	PK	53.7	30.9	5.8	39.7	3.5	54.2	73.9	19.7	153	12	
Vert.	7318.686	PK	50.4	36.8	7.2	40.3	3.5	57.6	73.9	16.3	129	189	
Vert.	7320.000	PK	44.4	36.8	7.2	40.3	3.5	51.6	73.9	22.3	129	189	
Vert.	7321.625	PK	50.1	36.8	7.2	40.3	3.5	57.3	73.9	16.6	129	189	
Vert.	9760.000	PK	42.7	38.6	8.3	40.0	3.5	53.1	73.9	20.8	100	0	
Vert.	12200.000	PK	42.2	39.4	9.4	39.8	3.5	54.7	73.9	19.2	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 15 GHz : 20log (4.5 m / 3.0 m) = 3.5 dB
15 GHz - 40 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.	4879.105	AV	57.0	30.9	5.8	39.7	-9.1	3.5	48.4	53.9	**5.5**	
Hori.	4880.000	AV	53.3	30.9	5.8	39.7	-9.1	3.5	44.7	53.9	9.2	
Hori.	4881.018	AV	56.8	30.9	5.8	39.7	-9.1	3.5	48.2	53.9	5.7	
Hori.	7318.708	AV	41.1	36.8	7.2	40.3	-9.1	3.5	39.2	53.9	14.7	
Hori.	7320.000	AV	36.6	36.8	7.2	40.3	-9.1	3.5	34.7	53.9	19.2	
Hori.	7321.559	AV	41.0	36.8	7.2	40.3	-9.1	3.5	39.1	53.9	14.8	
Hori.	9760.000	AV	34.6	38.6	8.3	40.0	-9.1	3.5	35.9	53.9	18.0	
Hori.	12200.000	AV	34.2	39.4	9.4	39.8	-9.1	3.5	37.6	53.9	16.3	
Vert.	4879.045	AV	47.1	30.9	5.8	39.7	-9.1	3.5	38.5	53.9	15.4	
Vert.	4880.000	AV	43.6	30.9	5.8	39.7	-9.1	3.5	35.0	53.9	18.9	
Vert.	4881.073	AV	46.7	30.9	5.8	39.7	-9.1	3.5	38.1	53.9	15.8	
Vert.	7318.686	AV	41.3	36.8	7.2	40.3	-9.1	3.5	39.4	53.9	14.5	
Vert.	7320.000	AV	36.5	36.8	7.2	40.3	-9.1	3.5	34.6	53.9	19.3	
Vert.	7321.625	AV	41.0	36.8	7.2	40.3	-9.1	3.5	39.1	53.9	14.8	
Vert.	9760.000	AV	35.6	38.6	8.3	40.0	-9.1	3.5	36.9	53.9	17.0	
Vert.	12200.000	AV	33.6	39.4	9.4	39.8	-9.1	3.5	37.0	53.9	16.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 15 GHz : 20log (4.5 m / 3.0 m) = 3.5 dB
15 GHz - 40 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)

* It measured the near frequency of the second high harmonic and the near frequency of third high harmonic by the addition, because there was envelope curve of the noise of the same pattern as high harmonic frequency. (And,it had applied duty factor.)

Radiated Spurious Emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	10799281S-A	
Date	May 27, 2015	May 28. 2015
Temperature / Humidity	24 deg. C / 55 % RH	23 deg.C / 58 %RH
Engineer	Kenichi Adachi	Kenichi Adachi
	(1 GHz-15 GHz)	(above 15 GHz, below 1 GHz)
Mode	Tx 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.	30.598	QP	22.6	17.2	6.7	32.1	0.0	14.4	40.0	25.6	150	332	
Hori.	194.606	QP	22.8	16.2	8.0	32.0	0.0	15.0	43.5	28.5	200	99	
Hori.	932.866	QP	22.5	22.8	11.1	30.7	0.0	25.7	46.0	20.3	150	359	
Vert.	31.656	QP	22.9	16.9	6.7	32.1	0.0	14.4	40.0	25.6	100	86	
Vert.	188.761	QP	23.2	16.2	7.9	32.0	0.0	15.3	43.5	28.2	100	357	
Vert.	917.836	QP	22.1	22.7	11.1	30.8	0.0	25.1	46.0	20.9	100	59	
Hori.	2483.500	PK	58.1	26.6	13.7	41.1	3.5	60.8	73.9	13.1	100	129	
Hori.	4959.068	PK	61.8	31.2	5.9	39.6	3.5	62.8	73.9	**11.1**	144	157	
Hori.	4960.000	PK	56.2	31.2	5.9	39.6	3.5	57.2	73.9	16.7	144	157	
Hori.	4961.052	PK	61.2	31.2	5.9	39.6	3.5	62.2	73.9	11.7	144	157	
Hori.	7438.666	PK	51.2	37.0	7.2	40.4	3.5	58.5	73.9	15.4	151	147	
Hori.	7440.000	PK	45.0	37.0	7.2	40.4	3.5	52.3	73.9	21.6	151	147	
Hori.	7441.603	PK	50.5	37.0	7.2	40.4	3.5	57.8	73.9	16.1	151	147	
Hori.	9920.000	PK	42.0	38.6	8.2	39.9	3.5	52.4	73.9	21.5	100	0	
Hori.	12400.000	PK	41.8	39.3	9.5	40.0	3.5	54.1	73.9	19.8	100	0	
Vert.	2483.500	PK	55.2	26.6	13.7	41.1	3.5	57.9	73.9	16.0	100	331	
Vert.	4959.108	PK	55.3	31.2	5.9	39.6	3.5	56.3	73.9	17.6	130	156	
Vert.	4960.000	PK	51.0	31.2	5.9	39.6	3.5	52.0	73.9	21.9	130	156	
Vert.	4961.104	PK	56.1	31.2	5.9	39.6	3.5	57.1	73.9	16.8	130	156	
Vert.	7438.676	PK	50.6	37.0	7.2	40.4	3.5	57.9	73.9	16.0	106	205	
Vert.	7440.000	PK	45.9	37.0	7.2	40.4	3.5	53.2	73.9	20.7	106	205	
Vert.	7441.546	PK	51.0	37.0	7.2	40.4	3.5	58.3	73.9	15.6	106	205	
Vert.	9920.000	PK	42.8	38.6	8.2	39.9	3.5	53.2	73.9	20.7	100	0	
Vert.	12400.000	PK	41.8	39.3	9.5	40.0	3.5	54.1	73.9	19.8	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 15 GHz : 20log (4.5 m / 3.0 m) = 3.5 dB
15 GHz - 40 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	57.4	26.6	13.7	41.1	-9.1	3.5	51.0	53.9	**2.9**	*1)
Hori.	4959.068	AV	57.1	31.2	5.9	39.6	-9.1	3.5	49.0	53.9	4.9	
Hori.	4960.000	AV	51.9	31.2	5.9	39.6	-9.1	3.5	43.8	53.9	10.1	
Hori.	4961.052	AV	56.6	31.2	5.9	39.6	-9.1	3.5	48.5	53.9	5.4	
Hori.	7438.666	AV	43.1	37.0	7.2	40.4	-9.1	3.5	41.3	53.9	12.6	
Hori.	7440.000	AV	37.7	37.0	7.2	40.4	-9.1	3.5	35.9	53.9	18.0	
Hori.	7441.603	AV	42.7	37.0	7.2	40.4	-9.1	3.5	40.9	53.9	13.0	
Hori.	9920.000	AV	35.4	38.6	8.2	39.9	-9.1	3.5	36.7	53.9	17.2	
Hori.	12400.000	AV	33.8	39.3	9.5	40.0	-9.1	3.5	37.0	53.9	16.9	
Vert.	2483.500	AV	53.6	26.6	13.7	41.1	-9.1	3.5	47.2	53.9	6.7	*1)
Vert.	4959.108	AV	48.7	31.2	5.9	39.6	-9.1	3.5	40.6	53.9	13.3	
Vert.	4960.000	AV	45.3	31.2	5.9	39.6	-9.1	3.5	37.2	53.9	16.7	
Vert.	4961.104	AV	49.2	31.2	5.9	39.6	-9.1	3.5	41.1	53.9	12.8	
Vert.	7438.676	AV	41.2	37.0	7.2	40.4	-9.1	3.5	39.4	53.9	14.5	
Vert.	7440.000	AV	36.4	37.0	7.2	40.4	-9.1	3.5	34.6	53.9	19.3	
Vert.	7441.546	AV	42.8	37.0	7.2	40.4	-9.1	3.5	41.0	53.9	12.9	
Vert.	9920.000	AV	36.0	38.6	8.2	39.9	-9.1	3.5	37.3	53.9	16.6	
Vert.	12400.000	AV	34.2	39.3	9.5	40.0	-9.1	3.5	37.4	53.9	16.5	

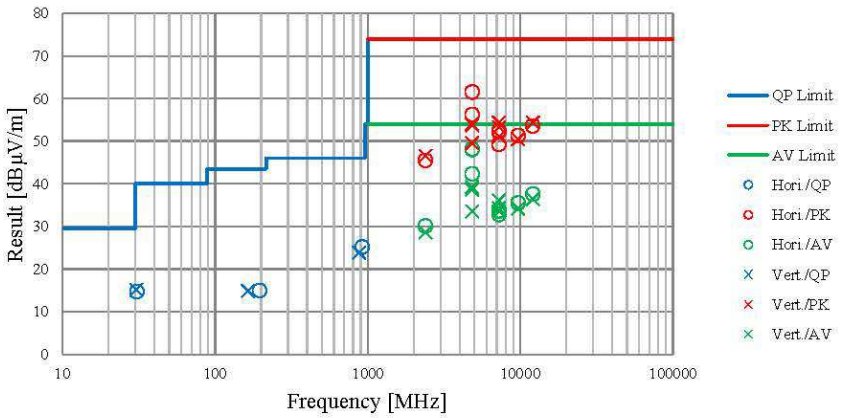
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 15 GHz : 20log (4.5 m / 3.0 m) = 3.5 dB
15 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.5 dB
Duty factor refer to "Duty factor Calculation chart" sheet.
*1) Not out of band emission (Leakage Power)

* It measured the near frequency of the second high harmonic and the near frequency of third high harmonic by the addition, because there was envelope curve of the noise of the same pattern as high harmonic frequency. (And,it had applied duty factor.)

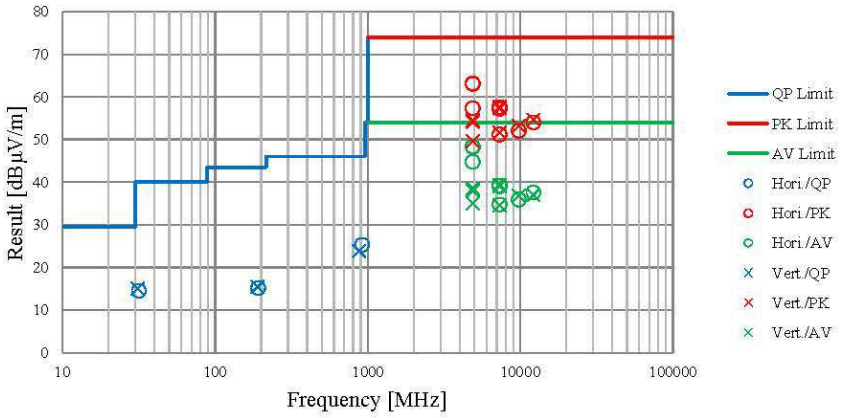
Radiated Spurious Emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	10799281S-A	
Date	May 27, 2015	May 28. 2015
Temperature / Humidity	24 deg. C / 55 % RH	23 deg.C / 58 %RH
Engineer	Kenichi Adachi	Kenichi Adachi
	(1 GHz-15 GHz)	(above 15 GHz, below 1 GHz)
Mode	Tx, 2405 MHz, 2440 MHz, 2480 MHz	

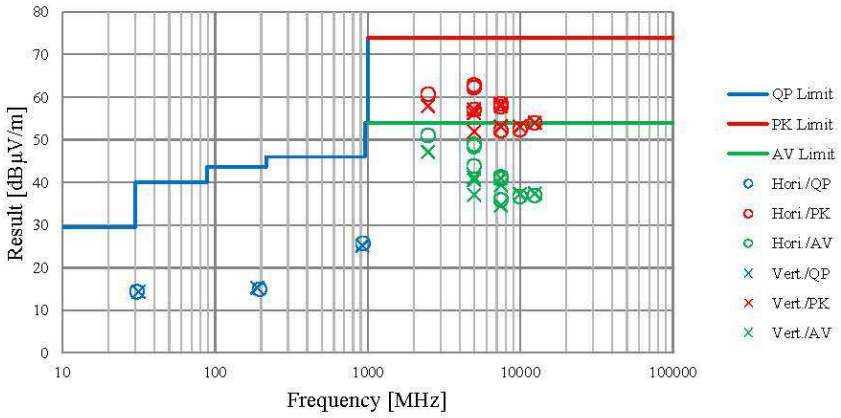
Tx, 2405 MHz



Tx, 2440 MHz



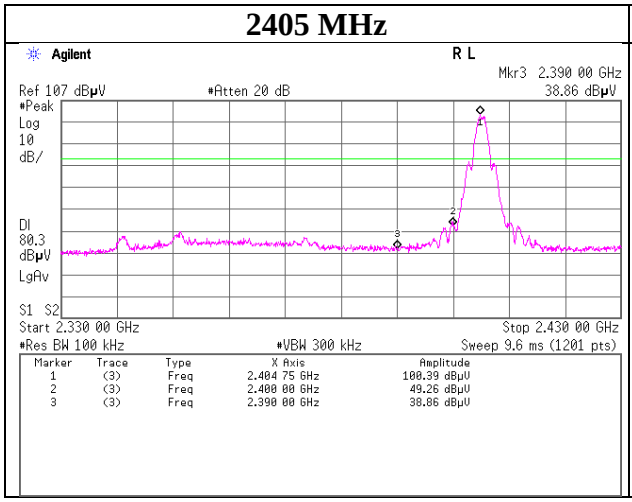
Tx, 2480 MHz



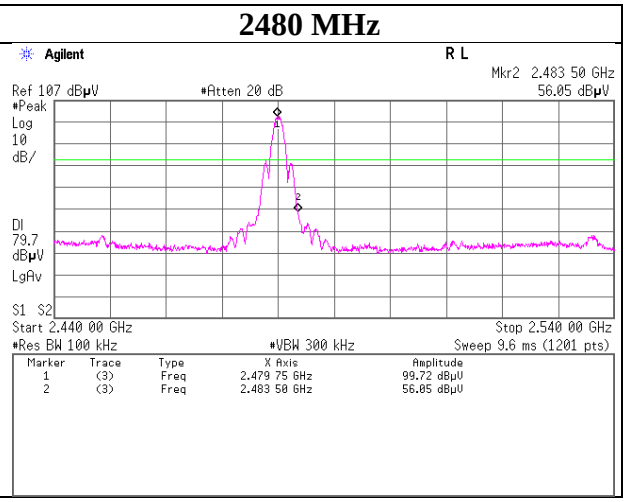
Band Edge confirmation

Test place	Shonan EMC Lab. No.1 Measurement room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx 2405 MHz / 2480 MHz

2405 MHz



2480 MHz



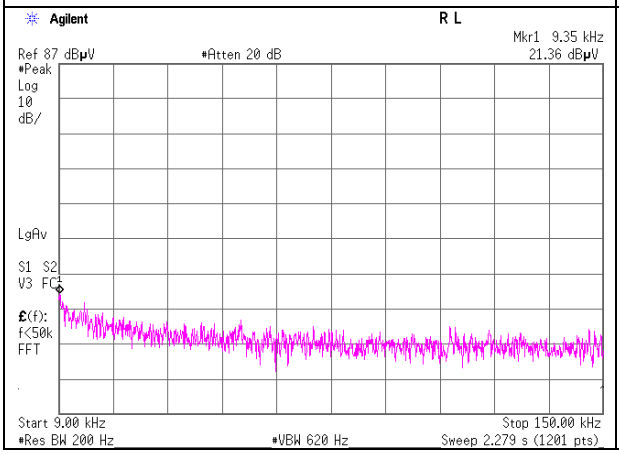
* Final result of band edge was measured as radiated spurious emission. Refer to Radiated Spurious Emission's pages.

Conducted Spurious Emission

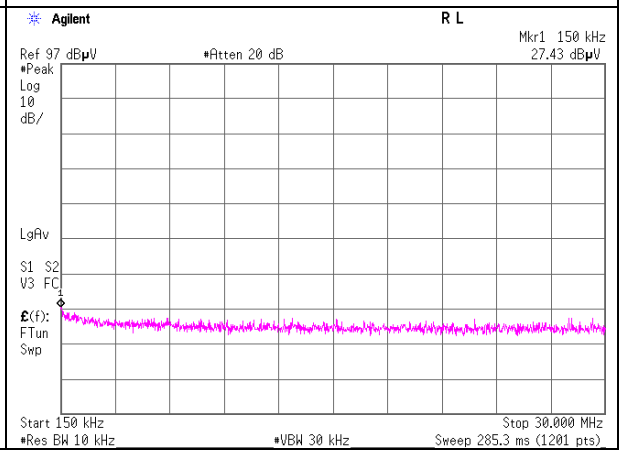
Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

(Tx, 2405 MHz)

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBuV]	Cable Loss [dB]	Attenator Loss [dB]	Antenna Gain [dBi]	N (Number of Output	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.35	21.4	0.01	9.8	0.7	1	-75.1	300	6.0	-13.8	48.1	61.9	
150.00	27.4	0.02	9.8	0.7	1	-69.0	300	6.0	-7.8	24.0	31.8	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

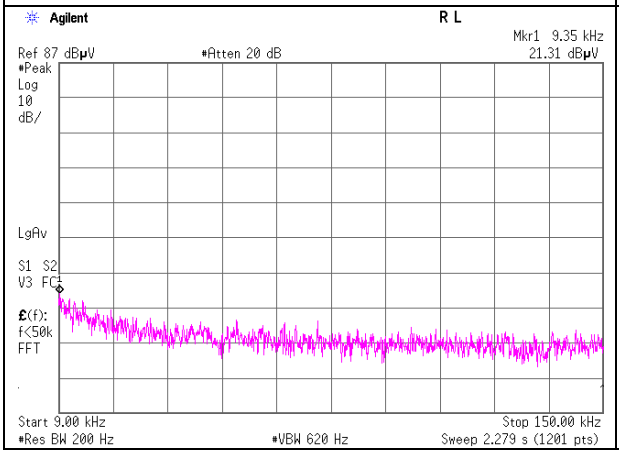
EIRP = (Reading - 107) + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

Conducted Spurious Emission

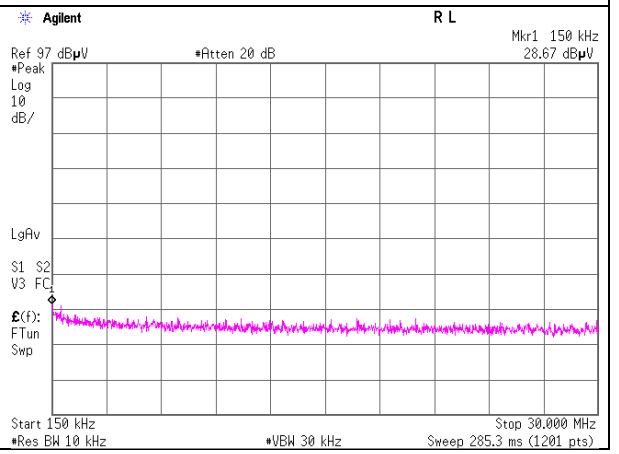
Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

(Tx, 2440 MHz)

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBuV]	Cable Loss [dB]	Attenator Loss [dB]	Antenna Gain [dBi]	N (Number of Output	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.35	21.3	0.01	9.8	0.7	1	-75.1	300	6.0	-13.9	48.1	62.0	
150.00	28.7	0.02	9.8	0.7	1	-67.8	300	6.0	-6.5	24.0	30.5	

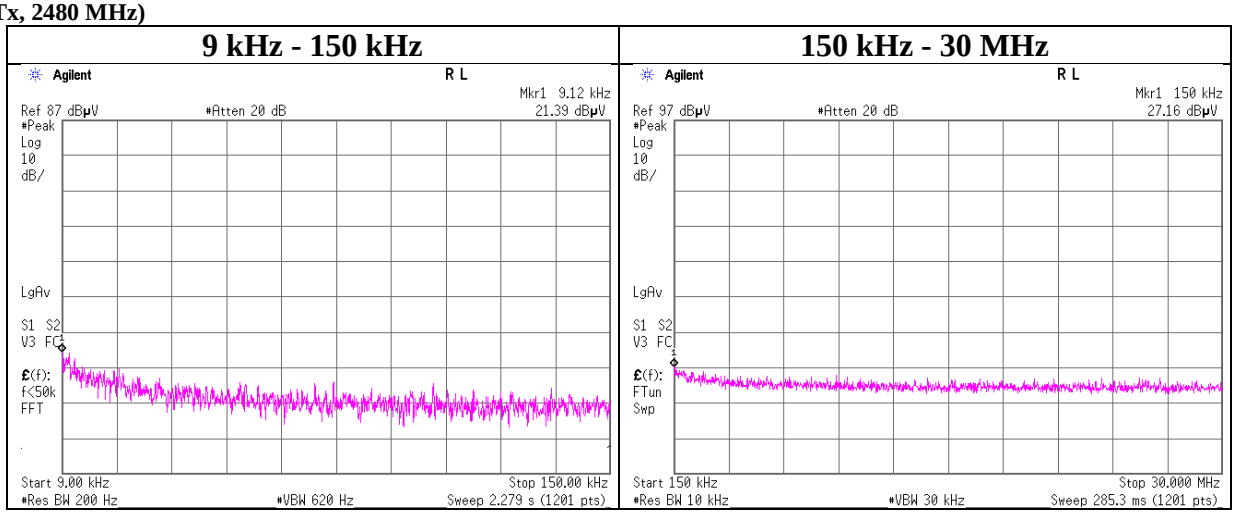
E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

EIRP = (Reading - 107) + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

Conducted Spurious Emission

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

(Tx, 2480 MHz)



Frequency [kHz]	Reading [dBuV]	Cable Loss [dB]	Attenator Loss [dB]	Antenna Gain [dBi]	N (Number of Output	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.12	21.4	0.01	9.8	0.7	1	-75.1	300	6.0	-13.8	48.4	62.2	
150.00	27.2	0.02	9.8	0.7	1	-69.3	300	6.0	-8.0	24.0	32.0	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

EIRP = (Reading - 107) + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

Power Density

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2405.46	-18.76	1.84	9.93	-6.99	8.00	14.99
2440.40	-18.67	1.85	9.93	-6.89	8.00	14.89
2480.40	-18.95	1.86	9.93	-7.16	8.00	15.16

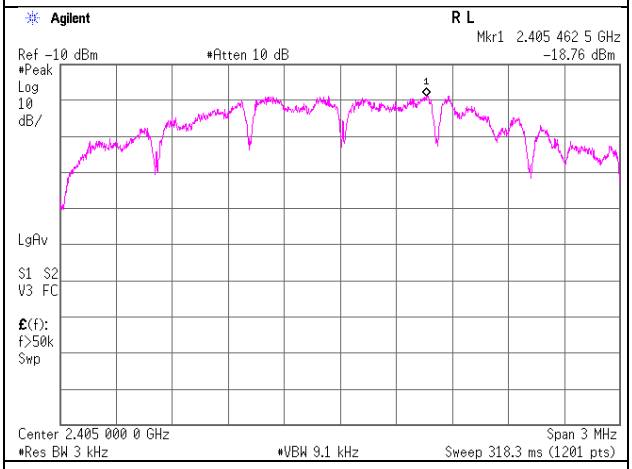
Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

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

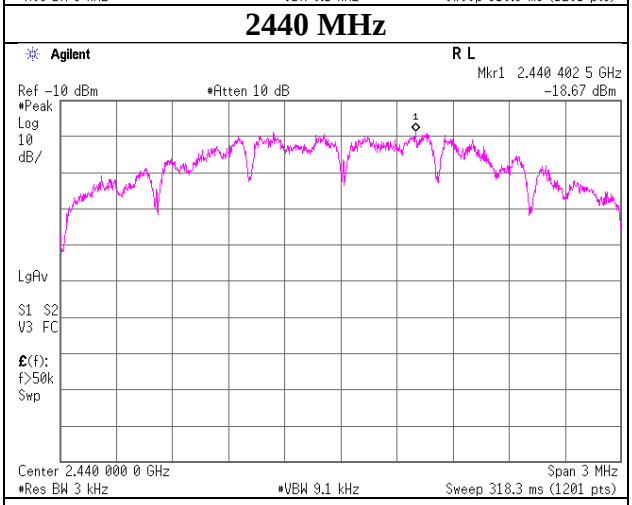
Power Density

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

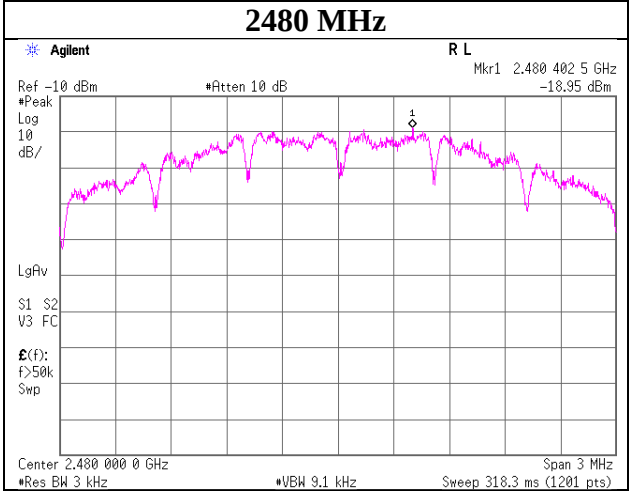
2405 MHz



2440 MHz



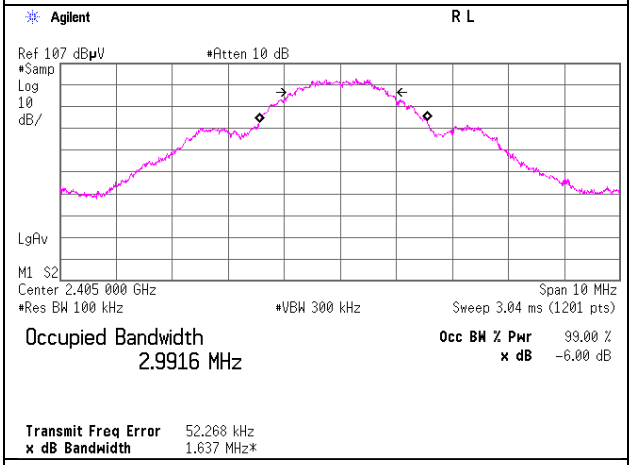
2480 MHz



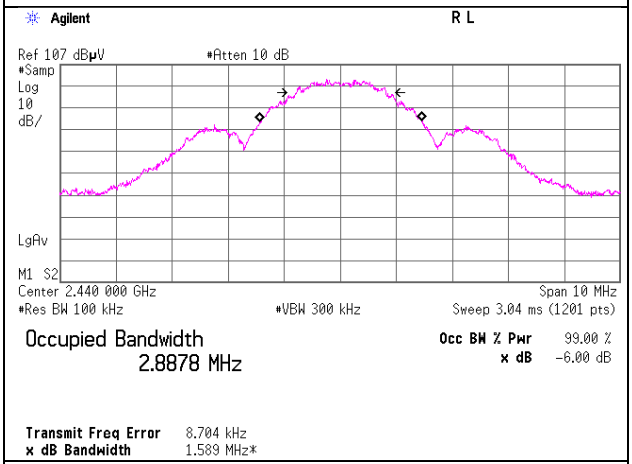
99 % Occupied Bandwidth

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10799281S-A
Date	June 8, 2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Kenichi Adachi
Mode	Tx

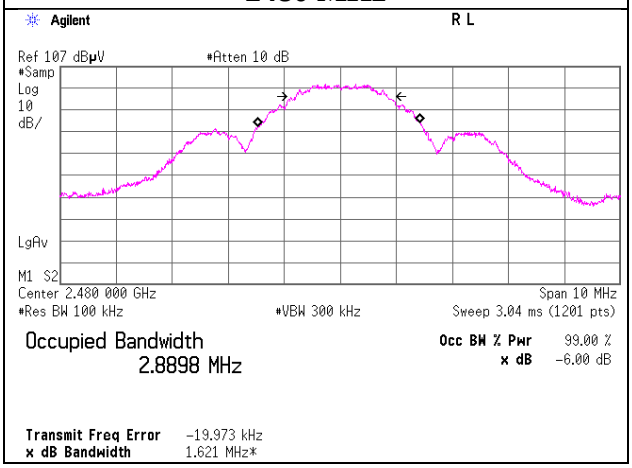
2405 MHz



2440 MHz



2480 MHz



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2015/05/27 * 12
SCC-G04	Coaxial Cable	Junkosha	J12J102207-00	JUN-12-14-018	RE	2015/06/08 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2015/05/19 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2014/08/12 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2014/10/30 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2015/03/23 * 12
SJM-15	Measure	ASKUL	-	-	RE,CE	-
SAEC-03(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	RE	2015/03/11 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV (RE,CE,RFI, MF)	-	RE,CE	-
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2014/11/21 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2014/11/21 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2015/03/23 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2015/03/17 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2015/03/11 * 12
SCC-C9/C10/SRSE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-271(RF Selector)	CE	2015/04/17 * 12
SLS-05	LISN	Rohde & Schwarz	ENV216	100516	CE	2015/02/24 * 12
SAT3-07	Attenuator	JFW	50HF-003N	-	CE	2014/09/02 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2014/12/24 * 12
STM-05	Terminator	TME	CT-01 BP	-	CE	2014/12/19 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	CE	2015/03/24 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2015/04/07 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2015/04/07 * 12
CSA-07	Spectrum Analyzer	Agilent	E4448A	MY52490024	AT	2015/05/28 * 12

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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

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