



# **RADIO TEST REPORT**

**Test Report No. : 11123175S-A**

**Applicant** : CITIZEN WATCH CO., LTD.  
**Type of Equipment** : Module for Wrist WATCH  
**Model No.** : W770MV  
**FCC ID** : YUQ-W770MV  
**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)

**Date of test:** January 20 to February 1, 2016

**Representative test engineer:**

*K. Adachi*

Kenichi Adachi  
Engineer  
Consumer Technology Division

**Approved by:**

*A. Hayashi*

Akio Hayashi  
Leader  
Consumer Technology Division



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

**UL Japan, Inc.**  
**Shonan EMC Lab.**

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13-EM-F0429



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## **SECTION 1: Customer information**

Company Name	:	CITIZEN WATCH CO., LTD.
Address	:	6-1-12, TANASHI-CHO, NISHI-TOKYO-SHI, TOKYO 188-8511, JAPAN
Telephone Number	:	+81-42-468-4769
Facsimile Number	:	+81-42-468-4730
Contact Person	:	Masayuki Araki

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

### **2.1 Identification of E.U.T.**

Type of Equipment	:	Module for Wrist WATCH
Model No.	:	W770MV
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 2.8 V
Receipt Date of Sample	:	January 8, 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: W770MV (referred to as the EUT in this report) is a Module for Wrist WATCH.

### **General Specification**

Clock frequency(ies) in the system	:	16 MHz
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### **Radio Specification**

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Power Supply (radio part input)	:	DC 1.41V
Antenna type	:	Monopole Antenna
Antenna Gain	:	-4 dBi

## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C: 2015, final revised on November 23, 2015  
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928 MHz,  
2400 -2483.5 MHz, and 5725-5850 MHz

\*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.

### **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 29.7 dB, 0.20000 MHz, N	Complied	-
6 dB 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: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	6.0 dB 9760.000 MHz, AV, Horizontal, Tx BT LE 2440 MHz	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. (ANSI C63.10: 2013 is non-accreditation.)

#### **FCC Part 15.31 (e)**

The EUT provides stable voltage (DC 1.41 V) constantly to RF IC regardless of input voltage. Therefore, this EUT complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement.

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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

### 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-13 GHz	4.9 dB	4.9 dB	4.9 dB
Radiated emission (Measurement distance: 1 m)	13 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 (Average Detector)_SPM-06	0.76 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.79 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.08 dB
Spurious emission (Conducted) below 1GHz	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
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.5 dB
Bandwidth Measurement	0.66 %
Duty cycle and Time Measurement	0.012 %

#### 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 test report has enough margin, more than the site margin.

### 3.5 Test Location

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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 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity. 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.

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN / (AMN) to the input power source.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT via DC power supply in a 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.

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

## **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, 0.2 m by 0.4 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 *2)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: <u>12.2.5.2</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	4.47 m *1) (below 13 GHz), 1 m *2) (above 13 GHz)		4.47 m *1) (below 13 GHz), 1 m *2) (above 13 GHz)

\*1) Distance Factor:  $20 \times \log (4.47 \text{ m} / 3.0 \text{ m}) = 3.5 \text{ dB}$

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

\*3) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r04"

- 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.

	Carrier (Band edge)	Spurious			
		30 MHz-1 GHz	1 -2.8 GHz	2.8-15 GHz	above 15 GHz
Horizontal	Y	Y	Y	Y	Y
Vertical	Z	Y	Z	Y	Y

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

**Measurement range** : 30 M - 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	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 *1)	-	Power Meter (Sensor: 160 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *2)
Conducted Spurious Emission *3)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				
*1) Reference data							
*2) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v03r04".							
*3) In the frequency range below 30 MHz, 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 = 9.1 kHz)							

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

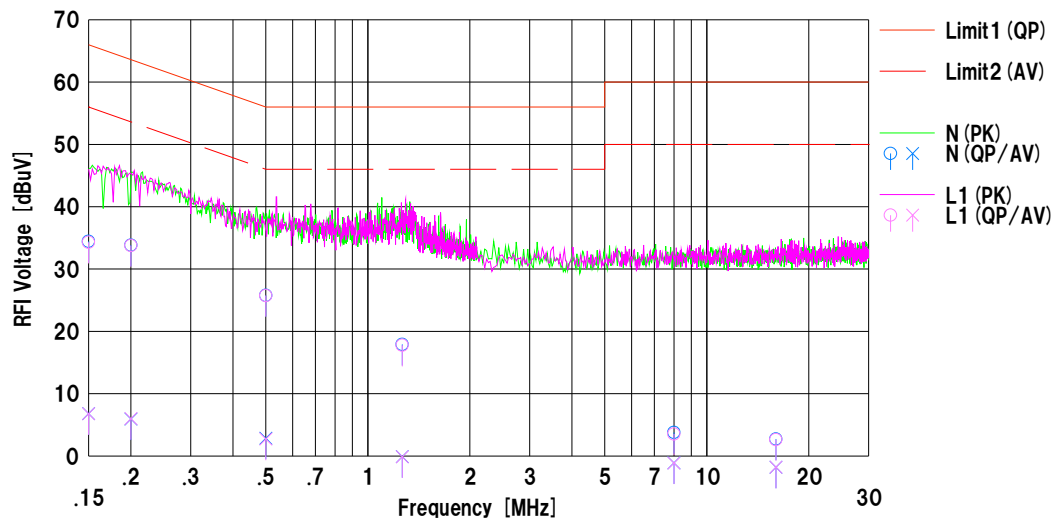
UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room  
Date : 2016/02/01

Mode : Tx BT LE 2402 MHz  
Power : DC2.8 V (DC supply input AC120V/60Hz)  
Temp./Humi. : 24 deg.C / 38 %RH

Remarks : -

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

Engineer : Kenichi Adachi



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	22.04	-5.59	12.40	34.44	6.81	66.00	56.00	31.5	49.1	N	
2	0.20000	21.46	-6.45	12.38	33.84	5.93	63.61	53.61	29.7	47.6	N	
3	0.50000	13.34	-9.58	12.43	25.77	2.85	56.00	46.00	30.2	43.1	N	
4	1.26354	5.43	-12.58	12.48	17.91	-0.10	56.00	46.00	38.0	46.1	N	
5	8.00000	-9.08	-13.97	12.87	3.79	-1.10	60.00	50.00	56.2	51.1	N	
6	16.00000	-10.49	-14.99	13.20	2.71	-1.79	60.00	50.00	57.2	51.7	N	
7	0.15000	21.89	-5.62	12.40	34.29	6.78	66.00	56.00	31.7	49.2	L1	
8	0.20000	21.39	-6.38	12.38	33.77	6.00	63.61	53.61	29.8	47.6	L1	
9	0.50000	13.31	-9.71	12.43	25.74	2.72	56.00	46.00	30.2	43.2	L1	
10	1.26354	5.28	-12.61	12.48	17.76	-0.13	56.00	46.00	38.2	46.1	L1	
11	8.00000	-9.34	-14.00	12.87	3.53	-1.13	60.00	50.00	56.4	51.1	L1	
12	16.00000	-10.56	-15.01	13.20	2.64	-1.81	60.00	50.00	57.3	51.8	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]  
LISN: SLS-01 (US)

UL Japan, Inc.

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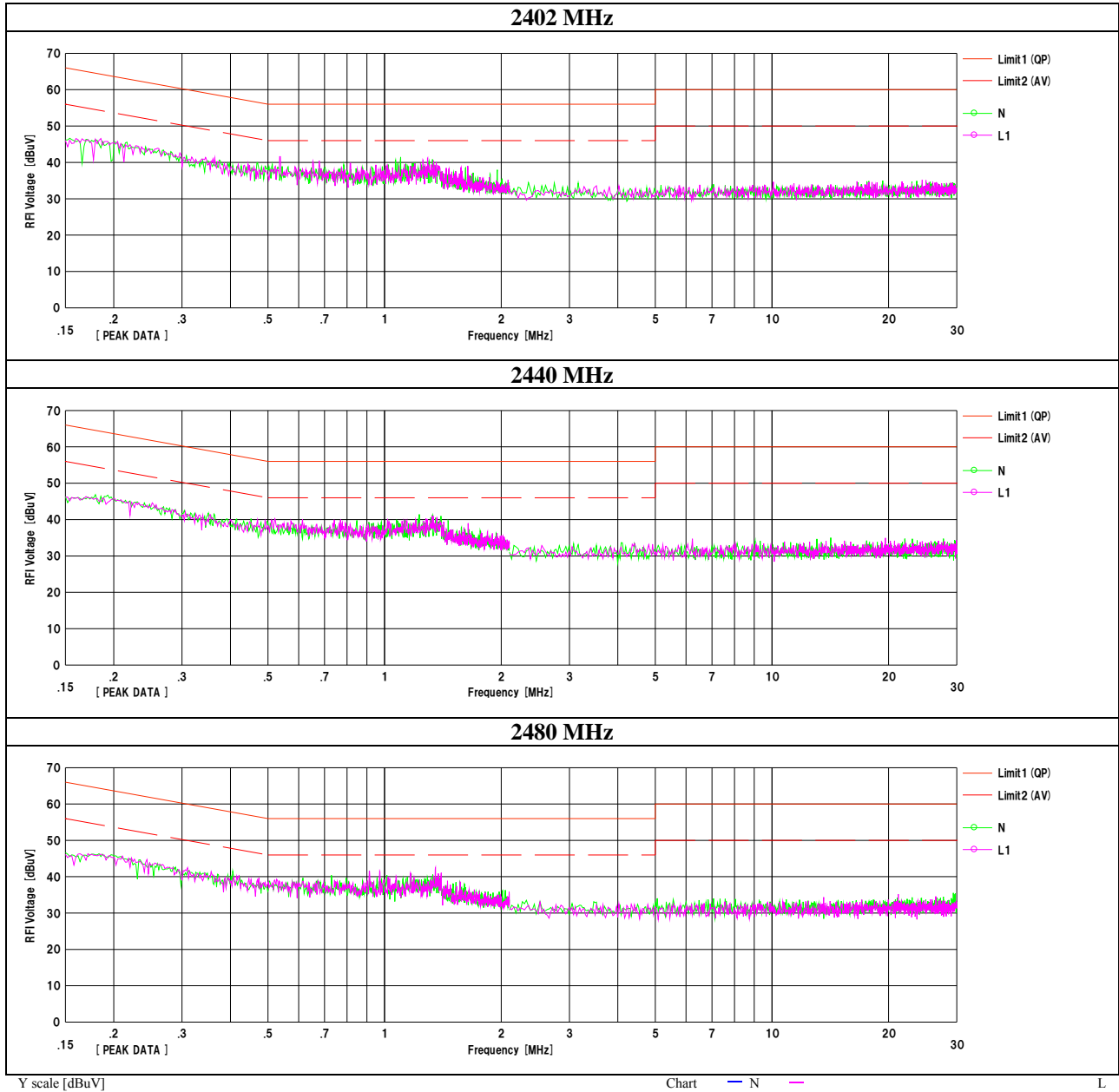
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## Conducted Emission

Test place	Shonan EMC Lab. No.5 Shielded room
Report No.	11123175S-A
Date	February 1, 2016
Temperature / Humidity	24 deg. C / 38 % RH
Engineer	Kenichi Adachi
Mode	Tx BT LE



### **6 dB Bandwidth**

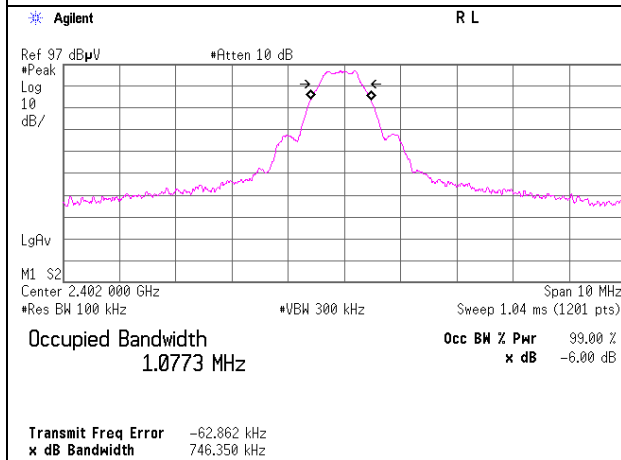
Test place                      Shonan EMC Lab. No.5 Shielded Room  
Report No.                    11123175S-A  
Date                            January 22, 2016  
Temperature / Humidity    22 deg. C / 28 % RH  
Engineer                      Yosuke Ishikawa  
Mode                            Tx BT LE

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
BT LE	2402	0.746	> 500
	2440	0.743	> 500
	2480	0.731	> 500

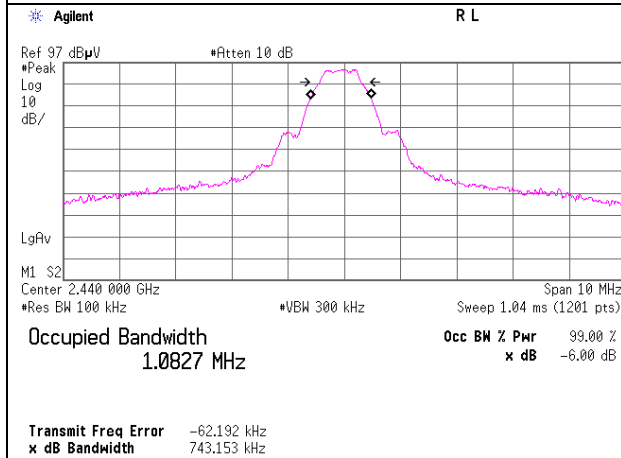
## 6 dB Bandwidth

### BT LE

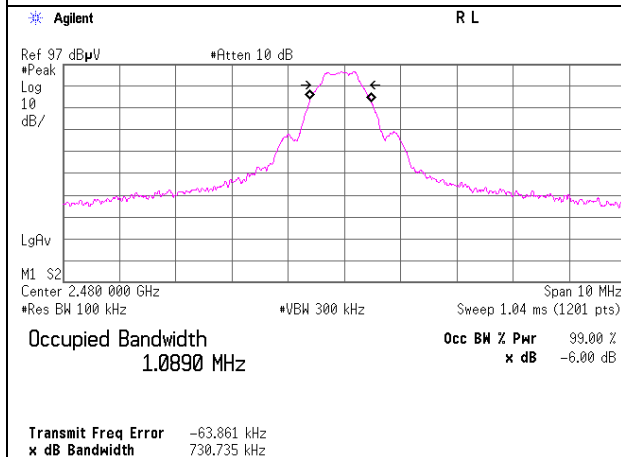
#### 2402 MHz



#### 2440 MHz



#### 2480 MHz





### **Maximum Peak Output Power**

Test place Shonan EMC Lab. No.5 Shielded Room  
Report No. 11123175S-A  
Date January 22, 2016  
Temperature / Humidity 22 deg. C / 28 % RH  
Engineer Yosuke Ishikawa  
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-11.88	1.44	9.93	-0.51	0.89	30.00	1000	30.51
2440	-12.06	1.45	9.93	-0.68	0.86	30.00	1000	30.68
2480	-12.25	1.47	9.93	-0.85	0.82	30.00	1000	30.85

Sample Calculation:

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

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

**Average Output Power**  
**(Reference data)**

Test place                      Shonan EMC Lab. No.5 Shielded Room  
Report No.                    11123175S-A  
Date                            January 22, 2016  
Temperature / Humidity    22 deg. C / 28 % RH  
Engineer                      Yosuke Ishikawa  
Mode                            Tx 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	-12.41	1.44	9.93	-1.04	0.79	0.00	-1.04	0.79
2440	-12.61	1.45	9.93	-1.23	0.75	0.00	-1.23	0.75
2480	-12.81	1.47	9.93	-1.41	0.72	0.00	-1.41	0.72

Sample Calculation:

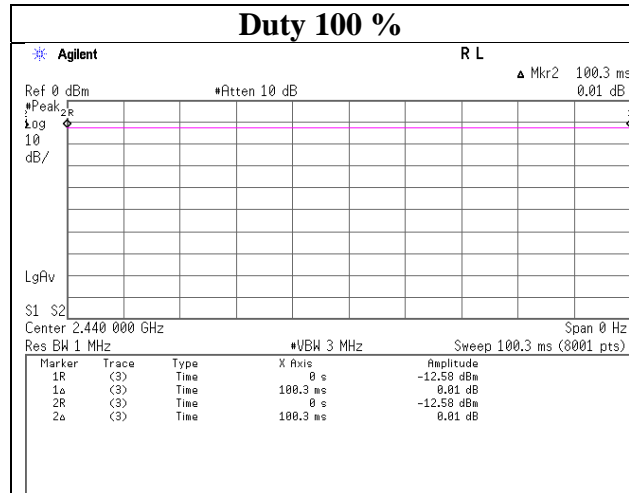
Result (Frame power) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

Result (Burst power) = Frame power + Duty factor

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

### Burst rate confirmation

Test place Shonan EMC Lab. No.5 Shielded Room  
Report No. 11123175S-A  
Date January 22, 2016  
Temperature / Humidity 22 deg. C / 28 % RH  
Engineer Yosuke Ishikawa  
Mode Tx BT LE



## Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11123175S-A  
Date : January 20, 2016  
Temperature / Humidity : 21 deg. C / 30 % RH  
Engineer : Hikaru Shirasawa  
  
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.	224.994	QP	28.7	16.7	8.3	32.0	0.0	21.7	46.0	24.3	300	109	
Hori.	725.379	QP	21.4	20.4	10.4	31.7	0.0	20.5	46.0	25.5	150	0	
Hori.	2390.000	PK	46.4	27.8	13.7	41.0	3.5	50.4	73.9	23.5	222	4	
Hori.	4804.000	PK	45.0	31.4	5.8	39.6	3.5	46.1	73.9	27.8	149	316	
Hori.	7206.000	PK	45.5	36.9	7.2	40.1	3.5	53.0	73.9	20.9	158	359	
Hori.	9608.000	PK	45.9	38.5	8.2	39.6	3.5	56.5	73.9	17.4	150	0	
Hori.	2390.000	AV	36.4	27.8	13.7	41.0	3.5	40.4	53.9	13.5	222	4	
Hori.	4804.000	AV	36.6	31.4	5.8	39.6	3.5	37.7	53.9	16.2	149	316	
Hori.	7206.000	AV	36.4	36.9	7.2	40.1	3.5	43.9	53.9	10.0	158	359	
Hori.	9608.000	AV	36.4	38.5	8.2	39.6	3.5	47.0	53.9	<b>6.9</b>	150	0	
Vert.	59.000	QP	39.2	7.6	6.7	32.1	0.0	21.4	40.0	18.6	100	307	
Vert.	67.002	QP	43.0	6.3	6.8	32.1	0.0	24.0	40.0	16.0	100	134	
Vert.	145.999	QP	36.1	14.4	7.8	32.1	0.0	26.2	43.5	17.3	100	294	
Vert.	192.997	QP	32.5	16.1	8.0	32.0	0.0	24.6	43.5	18.9	100	174	
Vert.	944.684	QP	20.0	22.6	11.1	30.6	0.0	23.1	46.0	22.9	100	0	
Vert.	2390.000	PK	45.7	27.8	13.7	41.0	3.5	49.7	73.9	24.2	147	356	
Vert.	4804.000	PK	45.3	31.4	5.8	39.6	3.5	46.4	73.9	27.5	150	0	
Vert.	7206.000	PK	44.9	36.9	7.2	40.1	3.5	52.4	73.9	21.5	150	359	
Vert.	9608.000	PK	45.7	38.5	8.2	39.6	3.5	56.3	73.9	17.6	100	0	
Vert.	2390.000	AV	36.8	27.8	13.7	41.0	3.5	40.8	53.9	13.1	147	356	
Vert.	4804.000	AV	36.0	31.4	5.8	39.6	3.5	37.1	53.9	16.8	150	0	
Vert.	7206.000	AV	36.2	36.9	7.2	40.1	3.5	43.7	53.9	10.2	150	359	
Vert.	9608.000	AV	36.4	38.5	8.2	39.6	3.5	47.0	53.9	<b>6.9</b>	100	0	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(4.47\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

### 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	80.6	27.8	13.7	41.0	3.5	84.6	-	-	
Hori.	2400.000	PK	38.3	27.8	13.7	41.0	3.5	42.3	64.6	22.3	
Vert.	2402.000	PK	80.4	27.8	13.7	41.0	3.5	84.4	-	-	
Vert.	2400.000	PK	37.5	27.8	13.7	41.0	3.5	41.5	64.4	22.9	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(4.47\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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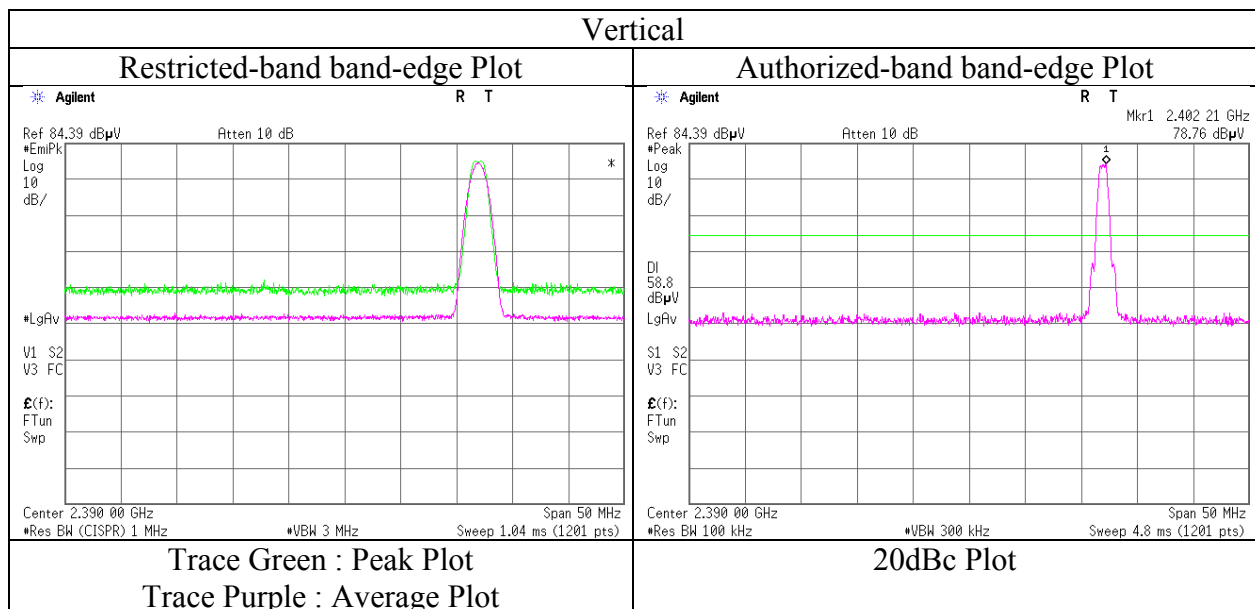
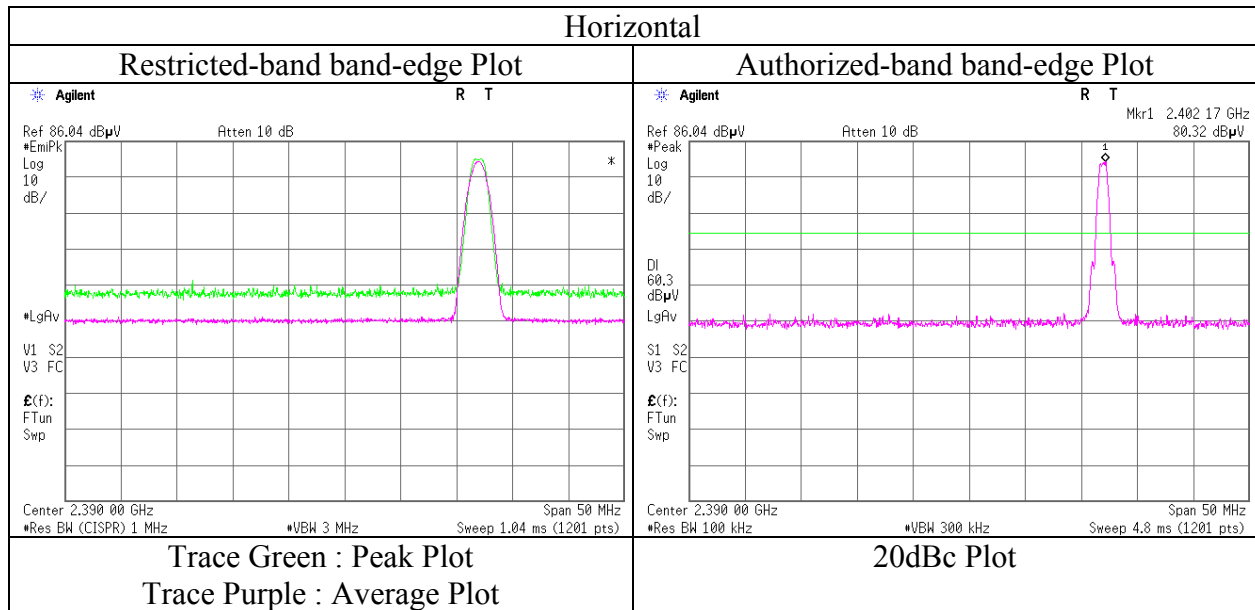
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11123175S-A
Date	January 20, 2016
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Hikaru Shirasawa
Mode	Tx BT LE 2402 MHz



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

## Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11123175S-A  
Date : January 20, 2016  
Temperature / Humidity : 21 deg. C / 30 % RH  
Engineer : Hikaru Shirasawa  
  
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.	271.645	QP	27.8	18.0	8.5	32.0	0.0	22.3	46.0	23.7	294	123	
Hori.	754.871	QP	20.9	20.6	10.5	31.7	0.0	20.3	46.0	25.7	154	316	
Hori.	4880.000	PK	44.9	31.7	5.9	39.5	3.5	46.5	73.9	27.4	247	334	
Hori.	7320.000	PK	45.8	36.9	7.3	40.2	3.5	53.3	73.9	20.6	150	0	
Hori.	9760.000	PK	45.1	38.5	8.3	39.5	3.5	55.9	73.9	18.0	150	0	
Hori.	4880.000	AV	37.1	31.7	5.9	39.5	3.5	38.7	53.9	15.2	247	334	
Hori.	7320.000	AV	36.1	36.9	7.3	40.2	3.5	43.6	53.9	10.3	150	0	
Hori.	9760.000	AV	37.1	38.5	8.3	39.5	3.5	47.9	53.9	6.0	150	0	
Vert.	58.997	QP	38.8	7.6	6.7	32.1	0.0	21.0	40.0	19.0	100	283	
Vert.	67.000	QP	40.9	6.3	6.8	32.1	0.0	21.9	40.0	18.1	100	182	
Vert.	149.000	QP	33.5	14.6	7.9	32.1	0.0	23.9	43.5	19.6	100	278	
Vert.	165.329	QP	32.9	15.3	8.0	32.0	0.0	24.2	43.5	19.3	100	359	
Vert.	200.995	QP	33.8	16.3	8.1	32.0	0.0	26.2	43.5	17.3	100	179	
Vert.	833.535	QP	20.8	21.4	10.8	31.3	0.0	21.7	46.0	24.3	100	0	
Vert.	4880.000	PK	46.2	31.7	5.9	39.5	3.5	47.8	73.9	26.1	100	65	
Vert.	7320.000	PK	45.6	36.9	7.3	40.2	3.5	53.1	73.9	20.8	150	359	
Vert.	9760.000	PK	45.6	38.5	8.3	39.5	3.5	56.4	73.9	17.5	100	0	
Vert.	4880.000	AV	37.6	31.7	5.9	39.5	3.5	39.2	53.9	14.7	100	65	
Vert.	7320.000	AV	35.9	36.9	7.3	40.2	3.5	43.4	53.9	10.5	150	359	
Vert.	9760.000	AV	36.0	38.5	8.3	39.5	3.5	46.8	53.9	7.1	100	0	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(4.47\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

## Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11123175S-A  
Date : January 20, 2016  
Temperature / Humidity : 21 deg. C / 30 % RH  
Engineer : Hikaru Shirasawa  
  
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.	272.318	QP	27.6	18.1	8.5	32.0	0.0	22.2	46.0	23.8	301	119	
Hori.	767.203	QP	21.3	20.7	10.5	31.6	0.0	20.9	46.0	25.1	153	358	
Hori.	2483.500	PK	45.9	27.9	13.8	41.0	3.5	50.1	73.9	23.8	146	345	
Hori.	4960.000	PK	47.0	32.0	6.0	39.4	3.5	49.1	73.9	24.8	155	294	
Hori.	7440.000	PK	45.8	37.0	7.5	40.4	3.5	53.4	73.9	20.5	150	0	
Hori.	9920.000	PK	45.3	38.4	8.4	39.4	3.5	56.2	73.9	17.7	150	359	
Hori.	2483.500	AV	36.0	27.9	13.8	41.0	3.5	40.2	53.9	13.7	146	345	
Hori.	4960.000	AV	37.5	32.0	6.0	39.4	3.5	39.6	53.9	14.3	155	294	
Hori.	7440.000	AV	35.5	37.0	7.5	40.4	3.5	43.1	53.9	10.8	150	0	
Hori.	9920.000	AV	35.0	38.4	8.4	39.4	3.5	45.9	53.9	8.0	150	359	
Vert.	59.001	QP	38.6	7.6	6.7	32.1	0.0	20.8	40.0	19.2	100	167	
Vert.	66.998	QP	40.8	6.3	6.8	32.1	0.0	21.8	40.0	18.2	100	177	
Vert.	149.329	QP	35.6	14.6	7.9	32.1	0.0	26.0	43.5	17.5	100	276	
Vert.	200.994	QP	32.7	16.3	8.1	32.0	0.0	25.1	43.5	18.4	100	176	
Vert.	920.761	QP	20.4	22.5	11.0	30.8	0.0	23.1	46.0	22.9	100	0	
Vert.	2483.500	PK	45.8	27.9	13.8	41.0	3.5	50.0	73.9	23.9	102	22	
Vert.	4960.000	PK	45.7	32.0	6.0	39.4	3.5	47.8	73.9	26.1	100	65	
Vert.	7440.000	PK	45.1	37.0	7.5	40.4	3.5	52.7	73.9	21.2	150	359	
Vert.	9920.000	PK	44.3	38.4	8.4	39.4	3.5	55.2	73.9	18.7	100	0	
Vert.	2483.500	AV	36.4	27.9	13.8	41.0	3.5	40.6	53.9	13.3	102	22	
Vert.	4960.000	AV	35.9	32.0	6.0	39.4	3.5	38.0	53.9	15.9	100	65	
Vert.	7440.000	AV	35.7	37.0	7.5	40.4	3.5	43.3	53.9	10.6	150	359	
Vert.	9920.000	AV	35.1	38.4	8.4	39.4	3.5	46.0	53.9	<b>7.9</b>	100	0	

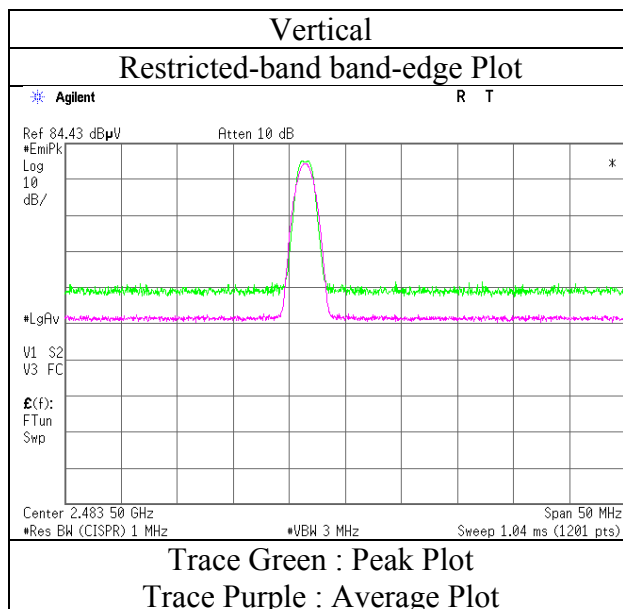
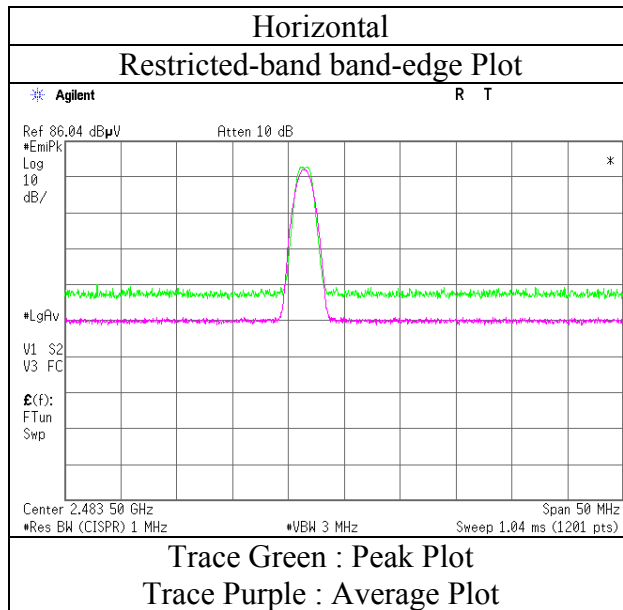
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(4.47\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

## Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11123175S-A
Date	January 20, 2016
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Hikaru Shirasawa
Mode	Tx BT LE 2480 MHz

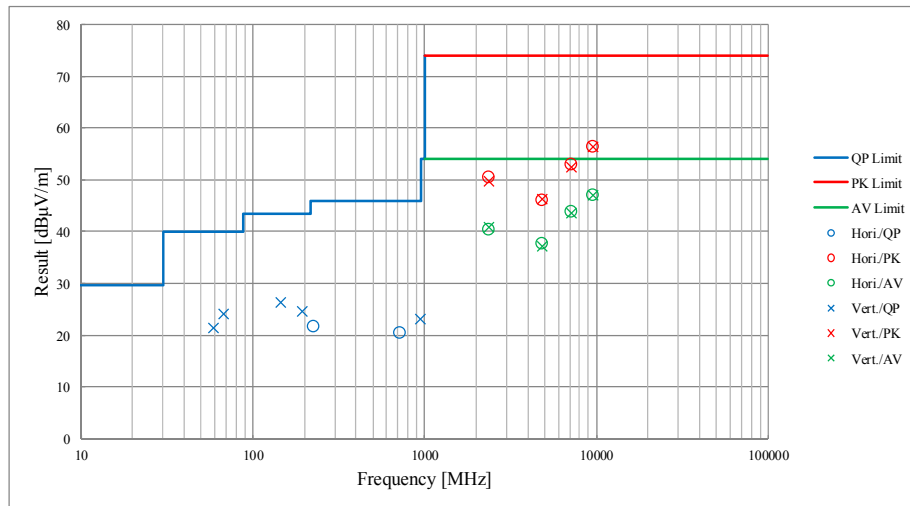


\* Final result of restricted band edge was shown in tabular data.



**Radiated Spurious Emission**  
**(Plot data, Worst case)**

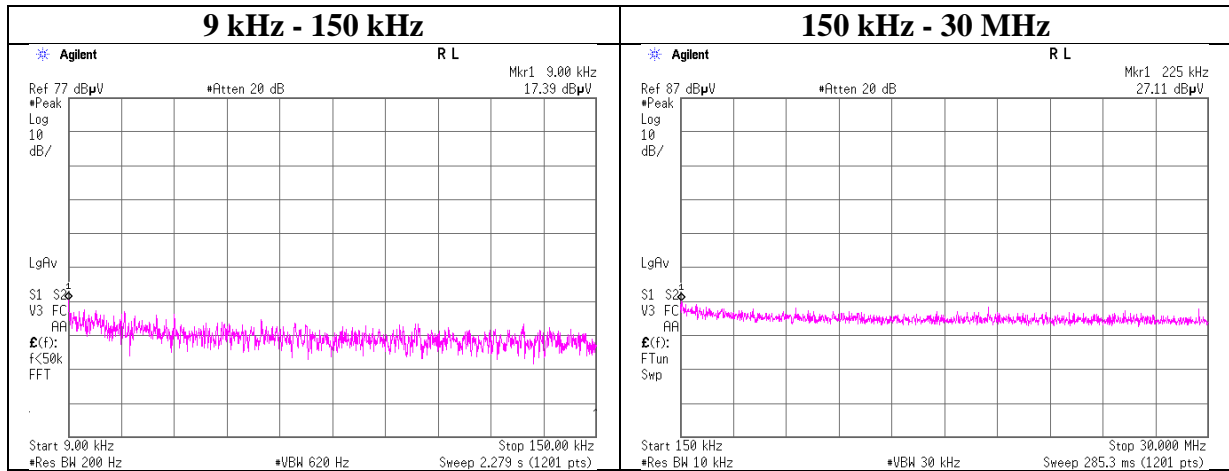
Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11123175S-A  
Date : January 20, 2016  
Temperature / Humidity : 21 deg. C / 30 % RH  
Engineer : Hikaru Shirasawa  
  
Mode : Tx BT LE 2402 MHz



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

## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11123175S-A
Date	January 22, 2016
Temperature / Humidity	22 deg. C / 28 % RH
Engineer	Yosuke Ishikawa
Mode	Tx BT LE 2402 MHz



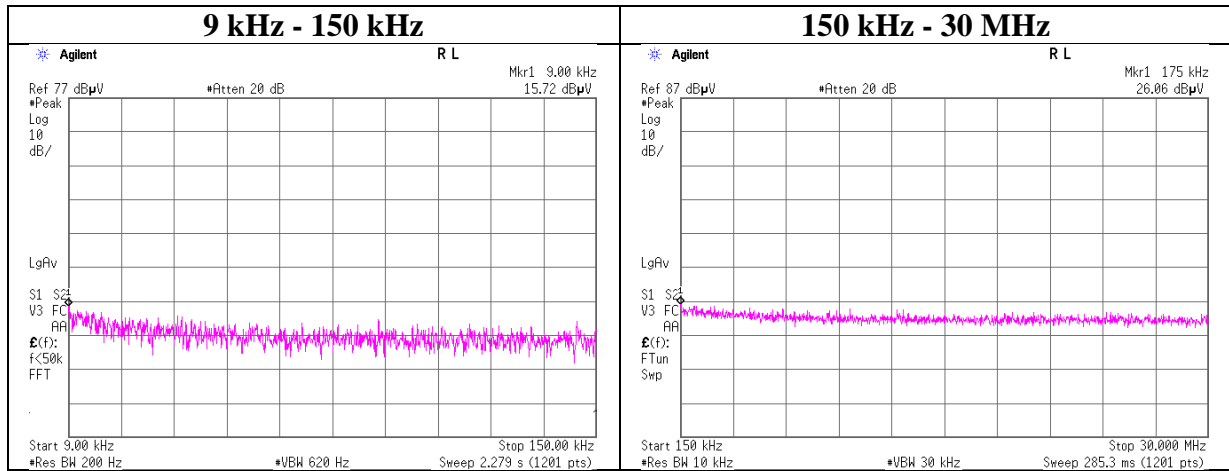
Frequency	Reading	Cable Loss	Attenuator Loss	Antenna Gain	N (Number of Output)	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]		[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
9.00	-89.6	0.15	9.8	-4.0	1	-83.6	300	6.0	-22.4	48.5	70.9	
225.00	-79.9	0.15	9.8	-4.0	1	-73.9	300	6.0	-12.6	20.5	33.1	

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

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

## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11123175S-A
Date	January 22, 2016
Temperature / Humidity	22 deg. C / 28 % RH
Engineer	Yosuke Ishikawa
Mode	Tx BT LE 2440 MHz



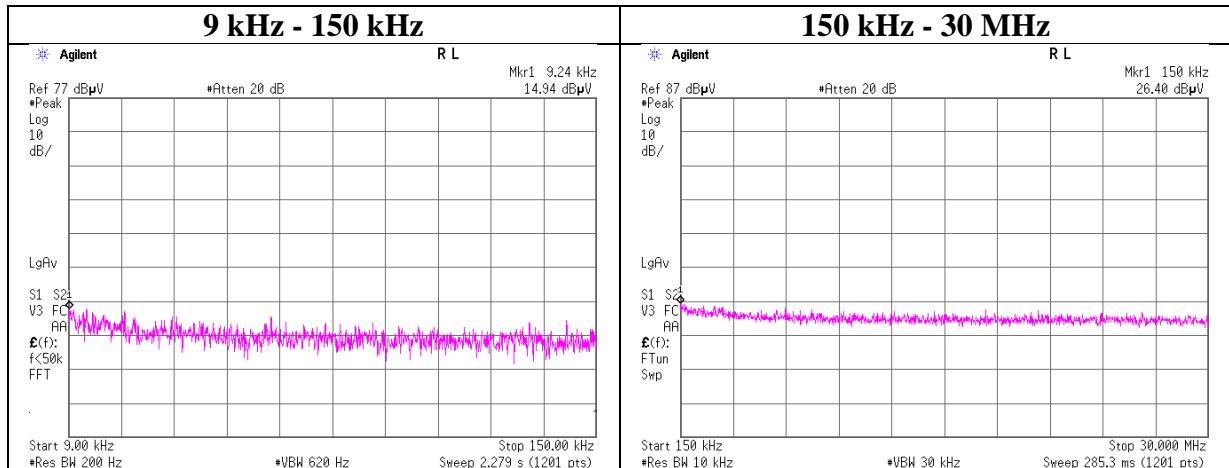
Frequency	Reading	Cable Loss	Attenuator Loss	Antenna Gain	N (Number of Output)	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]		[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
9.00	-91.3	0.15	9.8	-4.0	1	-85.3	300	6.0	-24.1	48.5	72.6	
175.00	-80.9	0.15	9.8	-4.0	1	-75.0	300	6.0	-13.7	22.7	36.4	

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

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

## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11123175S-A
Date	January 22, 2016
Temperature / Humidity	22 deg. C / 28 % RH
Engineer	Yosuke Ishikawa
Mode	Tx BT LE 2480 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.24	-92.1	0.15	9.8	-4.0	1	-86.1	300	6.0	-24.9	48.2	73.1	
150.00	-80.6	0.15	9.8	-4.0	1	-74.7	300	6.0	-13.4	24.0	37.4	

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

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

### **Power Density**

Test place                      Shonan EMC Lab. No.5 Shielded Room  
Report No.                     11123175S-A  
Date                             January 22, 2016  
Temperature / Humidity      22 deg. C / 28 % RH  
Engineer                        Yosuke Ishikawa  
Mode                             Tx BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-28.53	1.44	9.93	-17.16	8.00	25.16
2440.00	-28.76	1.45	9.93	-17.38	8.00	25.38
2480.00	-29.05	1.47	9.93	-17.65	8.00	25.65

Sample Calculation:

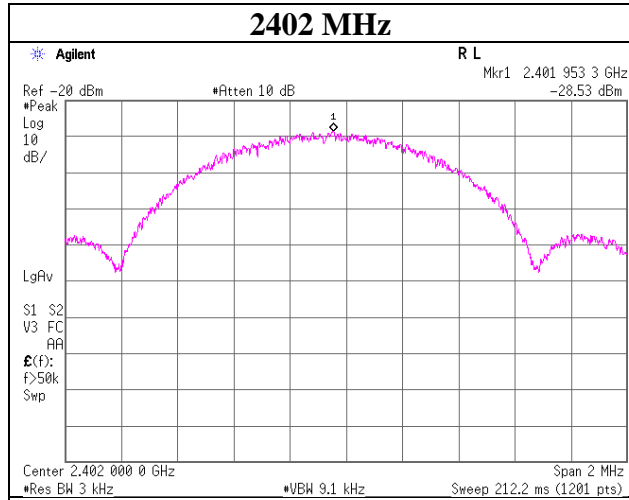
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

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

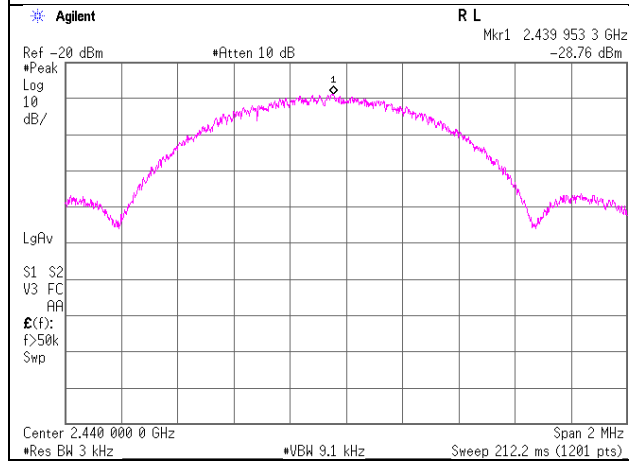
## Power Density

### BT LE

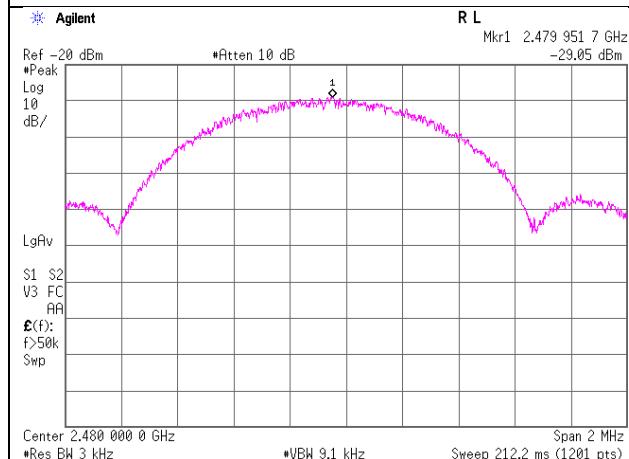
#### 2402 MHz



#### 2440 MHz



#### 2480 MHz



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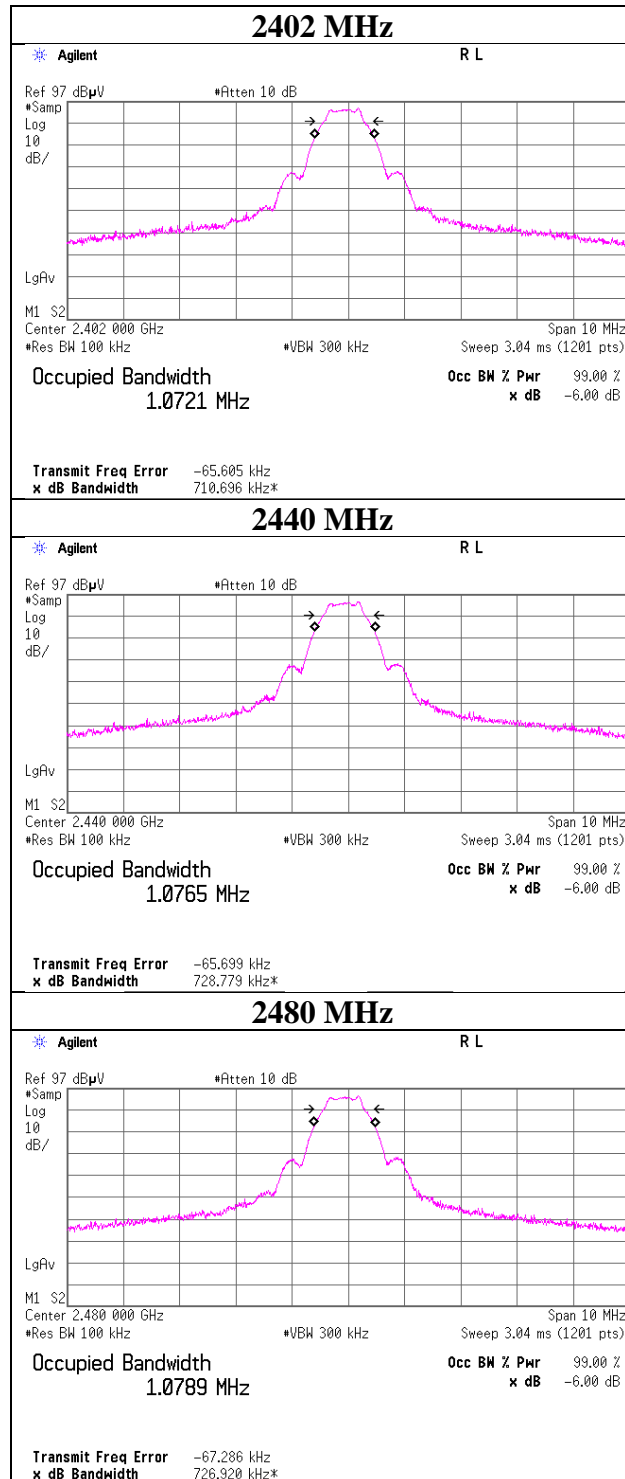
Telephone : +81 463 50 6400

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## 99 % Occupied Bandwidth

Test place Shonan EMC Lab. No.5 Shielded Room  
Report No. 11123175S-A  
Date January 22, 2016  
Temperature / Humidity 22 deg. C / 28 % RH  
Engineer Yosuke Ishikawa  
Mode Tx

### BT LE



**UL Japan, Inc.**

**Shonan EMC Lab.**

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## APPENDIX 2: Test instruments

### Test equipment (1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2015/07/16 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2015/10/11 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2015/10/11 * 12
SAT6-08	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	RE	2015/08/31 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	2015/04/17 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2015/02/18 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2015/03/24 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	RE, CE	-
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2015/10/22 * 12
SJM-15	Measure	ASKUL	-	-	RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2015/11/18 * 12
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	2015/08/11 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2015/03/26 * 12
SAEC-03(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	RE	2015/08/28 * 12
SAT10-05	Attenuator(above1GHz)	Agilent	8493C-010	74864	RE	2015/11/04 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2015/11/16 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2015/03/17 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2015/03/23 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2015/03/11 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000KMSKMS	-	RE	2015/04/09 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT	2015/03/23 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2015/04/02 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2015/04/02 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2015/04/09 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2015/03/11 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT, CE	2015/12/07 * 12

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

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

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

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

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**Test equipment (2/2)**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
STR-02	Test Receiver	Rohde & Schwarz	ESCI	100575	CE	2015/09/11 * 12
SCC-05	Coaxial Cable	Fujikura	5D2W	-	CE	2015/04/17 * 12
SLS-01	LISN	Rohde & Schwarz	ENV216	100511	CE	2015/02/24 * 12
SAT3-10	Attenuator	JFW	50HF-003N	-	CE	2015/08/31 * 12
SJM-17	Measure	ASKUL	-	-	CE	-
STS-05	Digital Hitester	Hioki	3805-50	080997828	CE	2015/11/18 * 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**  
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