



RADIO TEST REPORT

Test Report No. : 11825847S-A-R2

Applicant : CITIZEN WATCH CO., LTD.
Type of Equipment : Module for Wrist WATCH
Model No. : W410MV
FCC ID : YUQ-W410MV
Test regulation : FCC Part 15 Subpart C: 2018
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11825847S-A-R1. 11825847S-A-R1 is replaced with this report.

Date of test: December 13 to 18, 2017

Representative test engineer:

Shiro Kobayashi
Engineer
Consumer Technology Division

Approved by:

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".

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11825847S-A

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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.	:	W410MV
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 2.8 V
Receipt Date of Sample	:	October 23, 2017
Country of Mass-production	:	Japan
Condition of EUT	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: W410MV (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

Equipment Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Type of Modulation	:	GFSK
Channel spacing	:	2 MHz
Antenna Type	:	Monopole Antenna
Antenna Gain	:	-11 dBi
Operating Temperature	:	-10 deg. C - +60 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on January 2, 2018 and effective February 1, 2018

Title : FCC 47 CFR 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

* The revision on January 2, 2018, 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	29.4 dB 0.20078 MHz, N, QP Tx BLE 2440 MHz 0.20096 MHz, N, QP Tx BLE 2480 MHz 0.20161 MHz, L1, QP Tx BLE 2480 MHz	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(d)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	7.7 dB 4804 MHz, AV, Vert. Tx BT LE 2402 MHz 7440 MHz, AV, Hori. & Vert. Tx BT LE 2480 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 FCC 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.

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

FCC Part 15.31 (e)

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 $k=2$.
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Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR	No. 5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.5 dB	2.5 dB	2.5 dB	2.6 dB	2.6 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.2 dB	3.2 dB	3.3 dB	-	-
	30 MHz-200 MHz	4.3 dB	4.3 dB	4.3 dB	-	-
	200 MHz-1 GHz	5.9 dB	5.9 dB	5.9 dB	-	-
	1 GHz-6 GHz	4.7 dB	4.7 dB	4.7 dB	-	-
	6 GHz-18 GHz	5.3 dB	5.3 dB	5.3 dB	-	-
Radiated emission (Measurement distance: 1 m)	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	1 GHz-18 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 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	0.48 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.66 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.47 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.64 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.5 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.7 dB
Bandwidth Measurement	1.01 %
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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 Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401
 JAB Accreditation No. RTL02610
 FCC Test Firm Registration Number: 839876

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

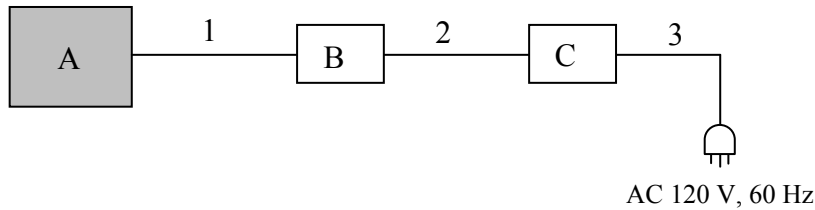
4.1 Operating Mode(s)

Mode	Remarks*
Bluetooth Low Energy (BT LE)	PRBS9
*Power of the EUT was set by the software as follows; Power settings: Fixed Software: Smart Snippets Studio Version 1.6.3.918 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission	BT LE Tx	2402 MHz
Spurious Emission		2440 MHz
6dB Bandwidth		2480 MHz
Maximum Peak Output Power		
Power Density		
99% Occupied Bandwidth		

Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Module for Wrist WATCH	W410MV	20171208_11825847S-A	Citizen Watch	EUT
B	Jig Board	-	-	Citizen Watch	-
C	Regulated DC Power supply	PAN35-10A	DE001677	Kikusui	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.3+0.8	Unshielded	Unshielded	-
2	DC	1.5	Unshielded	Unshielded	-
3	AC	2.0	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a 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 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

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 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.

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 v04".

[For below 1 GHz]

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.

[For above 1 GHz]

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

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

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

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

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

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

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

Test Antennas are used as below;

Frequency	30 MHz to 200 MHz	200 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 *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: 12.2.5.2 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	3.99 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)		3.99 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

*2) Distance Factor: $20 \times \log(3.99 \text{ m} / 3.0 \text{ m}) = 2.48 \text{ dB}$

*3) Distance Factor: $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

- 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.

Antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz -13 GHz)	Spurious (13 GHz -26.5 GHz)
Horizontal	Z	X	Z	X
Vertical	X	X	Z	X

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

Measurement range : 30 MHz - 26.5 GHz

Test data : APPENDIX

Test result : Pass

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04". *4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was 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

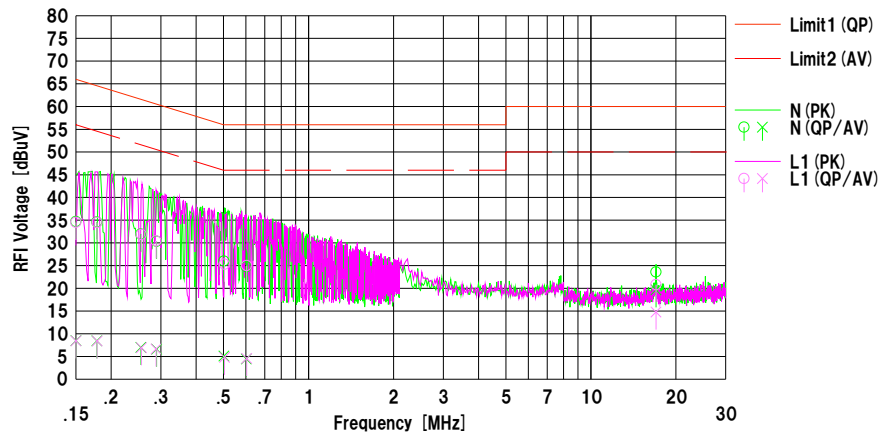
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2017/12/13

Mode : Tx_BLE_2402 MHz
Power : AC 120 V, 60 Hz
Temp./Humi. : 24 deg.C. / 30 %RH

Remarks : -

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

Engineer : Shiro Kobayashi



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	22.31	-3.88	12.39	34.70	8.51	66.00	56.00	31.3	47.4	N	
2	0.17790	22.22	-3.94	12.38	34.60	8.44	64.58	54.58	29.9	46.1	N	
3	0.25474	19.54	-5.38	12.39	31.93	7.01	61.60	51.60	29.6	44.5	N	
4	0.28963	17.96	-5.77	12.39	30.35	6.62	60.54	50.54	30.1	43.9	N	
5	0.50132	13.61	-7.29	12.41	26.02	5.12	56.00	46.00	29.9	40.8	N	
6	0.60194	12.34	-7.95	12.42	24.76	4.47	56.00	46.00	31.2	41.5	N	
7	16.99995	10.52	6.62	13.07	23.59	19.69	60.00	50.00	36.4	30.3	N	
8	0.15000	22.13	-3.93	12.39	34.52	8.46	66.00	56.00	31.4	47.5	L1	
9	0.17832	22.10	-3.95	12.38	34.48	8.43	64.56	54.56	30.0	46.1	L1	
10	0.25579	19.45	-5.46	12.39	31.84	6.93	61.57	51.57	29.7	44.6	L1	
11	0.28844	18.05	-5.72	12.39	30.44	6.67	60.57	50.57	30.1	43.9	L1	
12	0.50403	12.90	-7.59	12.41	25.31	4.82	56.00	46.00	30.6	41.1	L1	
13	0.60393	12.61	-7.82	12.42	25.03	4.60	56.00	46.00	30.9	41.4	L1	
14	16.99995	7.74	1.73	13.07	20.81	14.80	60.00	50.00	39.1	35.2	L1	

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

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Conducted Emission

DATA OF CONDUCTED EMISSION TEST

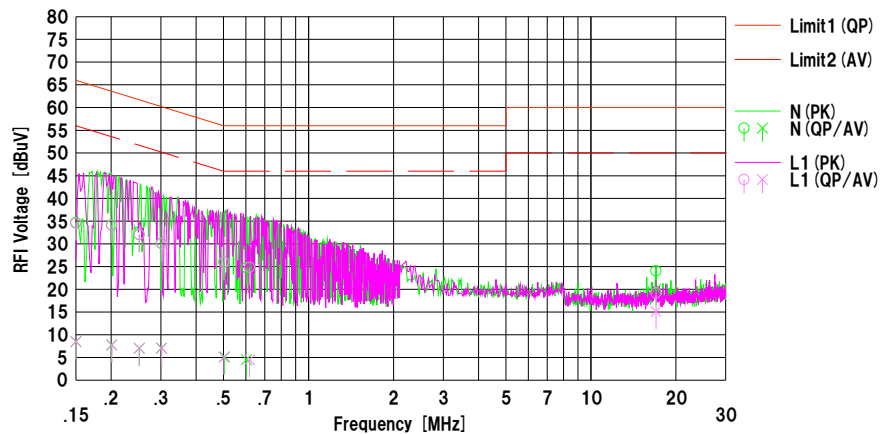
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2017/12/13

Mode : Tx_BLE_2440 MHz
Power : AC 120 V. 60 Hz
Temp./Humi. : 24 deg.C. / 30 %RH

Remarks : -

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

Engineer : Shiro Kobayashi



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	22.32	-3.89	12.39	34.71	8.50	66.00	56.00	31.2	47.5	N	
2	0.20078	21.78	-4.62	12.37	34.15	7.75	63.58	53.58	29.4	45.8	N	
3	0.25161	19.63	-5.36	12.39	32.02	7.03	61.70	51.70	29.6	44.6	N	
4	0.30112	17.73	-5.29	12.39	30.12	7.10	60.21	50.21	30.0	43.1	N	
5	0.50451	13.56	-7.28	12.41	25.97	5.13	56.00	46.00	30.0	40.8	N	
6	0.60319	12.35	-7.89	12.42	24.77	4.53	56.00	46.00	31.2	41.4	N	
7	17.00002	10.99	7.02	13.07	24.06	20.09	60.00	50.00	35.9	29.9	N	
8	0.15000	22.16	-3.89	12.39	34.55	8.50	66.00	56.00	31.4	47.5	L1	
9	0.20112	21.69	-4.59	12.37	34.06	7.76	63.56	53.56	29.5	45.7	L1	
10	0.25128	19.66	-5.37	12.39	32.05	7.02	61.71	51.71	29.6	44.6	L1	
11	0.30207	17.71	-5.35	12.39	30.10	7.04	60.19	50.19	30.0	43.1	L1	
12	0.50098	13.56	-7.36	12.41	25.97	5.05	56.00	46.00	30.0	40.9	L1	
13	0.61839	12.44	-7.92	12.42	24.86	4.50	56.00	46.00	31.1	41.5	L1	
14	17.00002	6.16	2.09	13.07	19.23	15.16	60.00	50.00	40.7	34.8	L1	

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

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

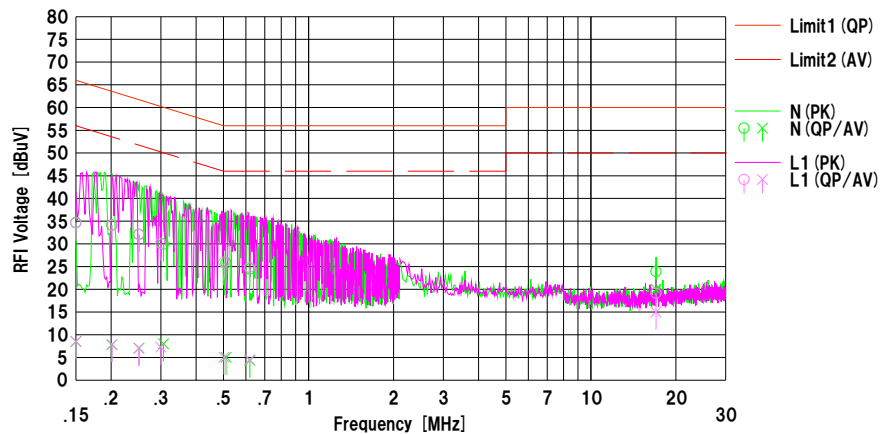
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2017/12/13

Mode : Tx_BLE_2480 MHz
Power : AC 120 V. 60 Hz
Temp./Humi. : 24 deg.C. / 30 %RH

Remarks : -

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

Engineer : Shiro Kobayashi



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	22.33	-3.87	12.39	34.72	8.52	66.00	56.00	31.2	47.4	N	
2	0.20096	21.78	-4.56	12.37	34.15	7.81	63.57	53.57	29.4	45.7	N	
3	0.25105	19.69	-5.31	12.39	32.08	7.08	61.72	51.72	29.6	44.6	N	
4	0.30647	17.56	-4.35	12.39	29.95	8.04	60.07	50.07	30.1	42.0	N	
5	0.51021	13.41	-7.36	12.41	25.82	5.05	56.00	46.00	30.1	40.9	N	
6	0.62040	12.07	-8.04	12.42	24.49	4.38	56.00	46.00	31.5	41.6	N	
7	17.00001	10.85	6.94	13.07	23.92	20.01	60.00	50.00	36.0	29.9	N	
8	0.15000	22.19	-3.85	12.39	34.58	8.54	66.00	56.00	31.4	47.4	L1	
9	0.20161	21.69	-4.52	12.37	34.06	7.85	63.54	53.54	29.4	45.6	L1	
10	0.25030	19.69	-5.35	12.39	32.08	7.04	61.75	51.75	29.6	44.7	L1	
11	0.29985	17.74	-5.11	12.39	30.13	7.26	60.25	50.25	30.1	42.9	L1	
12	0.50195	13.55	-7.35	12.41	25.96	5.06	56.00	46.00	30.0	40.9	L1	
13	0.61826	12.43	-7.93	12.42	24.85	4.49	56.00	46.00	31.1	41.5	L1	
14	17.00001	6.07	1.96	13.07	19.14	15.03	60.00	50.00	40.8	34.9	L1	

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

6 dB Bandwidth and 99 % Occupied Bandwidth

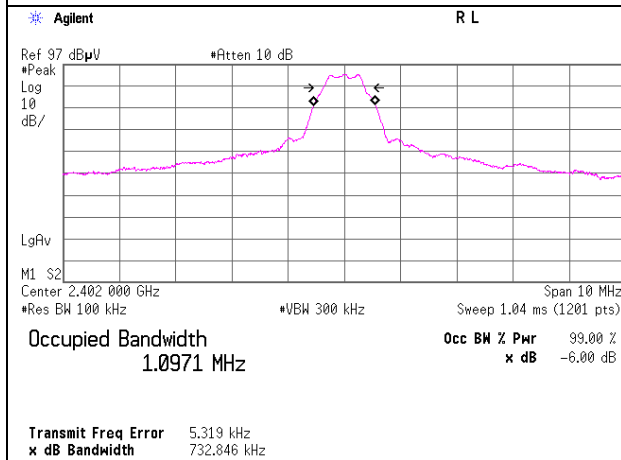
Test place Shonan EMC Lab. No.1 Measurement Room
Report No. 11825847S-A-R2
Date December 14, 2017
Temperature / Humidity 22 deg. C / 31 % RH
Engineer Kazuya Noda
Mode Tx BT LE

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
BT LE	2402	1072.6	0.733	> 0.5000
	2440	1079.6	0.736	> 0.5000
	2480	1077.6	0.740	> 0.5000

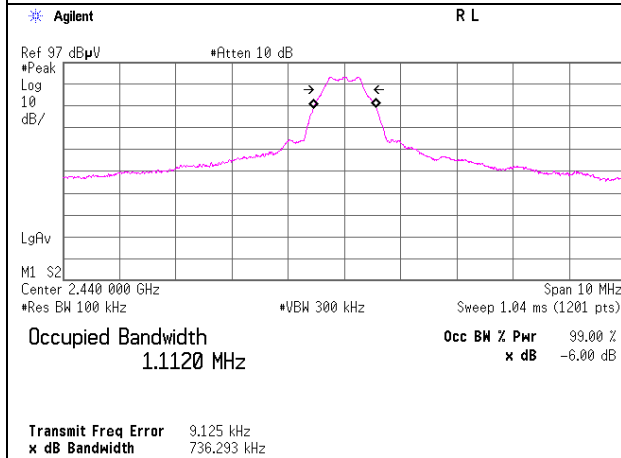
6dB Bandwidth

BT LE

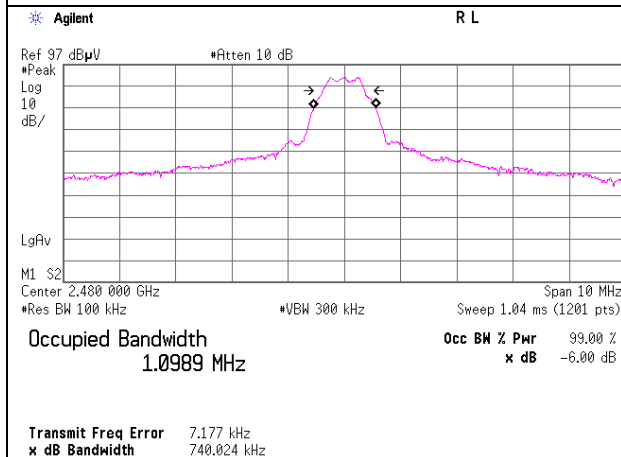
2402 MHz



2440 MHz



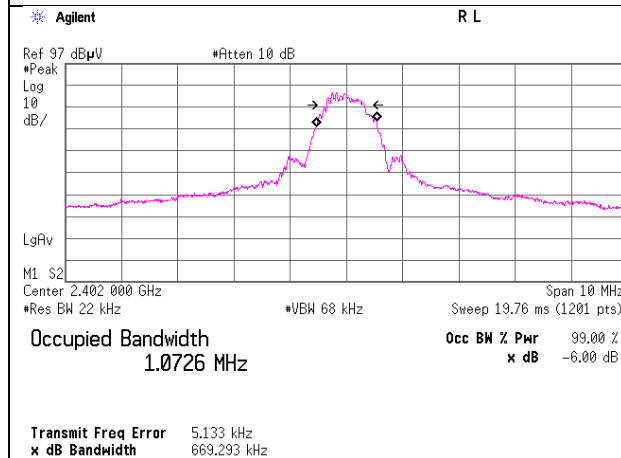
2480 MHz



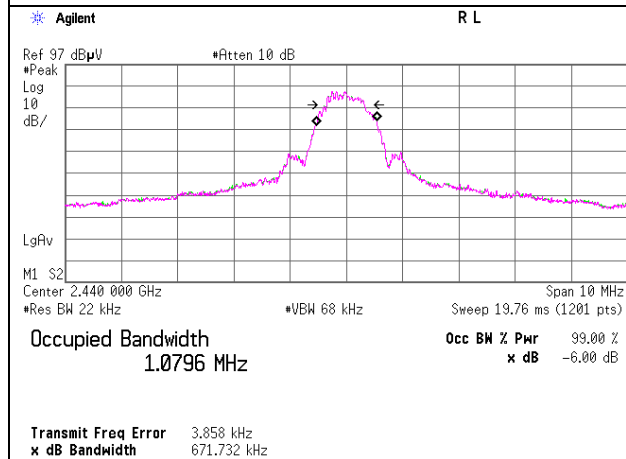
99% Occupied Bandwidth

BT LE

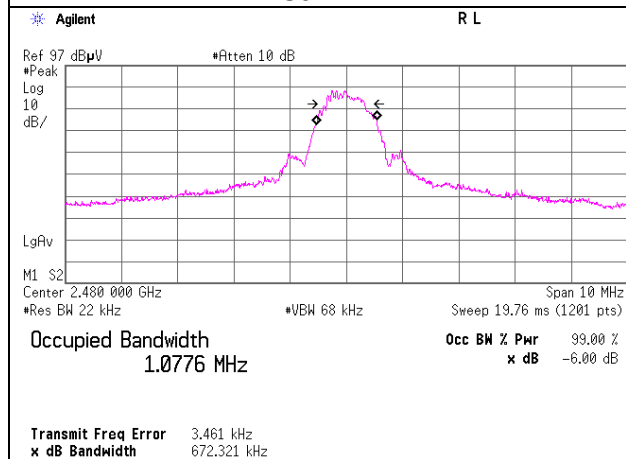
2402 MHz



2440 MHz



2480 MHz



Maximum Peak Output Power

Test place Shonan EMC Lab. No.1 Measurement Room
Report No. 11825847S-A-R2
Date December 14, 2017
Temperature / Humidity 22 deg. C / 31 % RH
Engineer Kazuya Noda
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-7.26	0.72	0.00	-6.54	0.22	30.00	1000	36.54
2440	-6.32	0.72	0.00	-5.60	0.28	30.00	1000	35.60
2480	-5.61	0.73	0.00	-4.88	0.33	30.00	1000	34.88

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

Average Output Power
(Reference data for SAR testing)

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11825847S-A-R2
Date	December 14, 2017
Temperature / Humidity	22 deg. C / 31 % RH
Engineer	Kazuya Noda
Mode	Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-9.52	0.72	0.00	-8.80	0.13	2.00	-6.80	0.21
2440	-8.53	0.72	0.00	-7.81	0.17	2.00	-5.81	0.26
2480	-7.83	0.73	0.00	-7.10	0.19	2.00	-5.10	0.31

Sample Calculation:

Result (Time average) = Reading + Cable Loss + Attenuator Loss

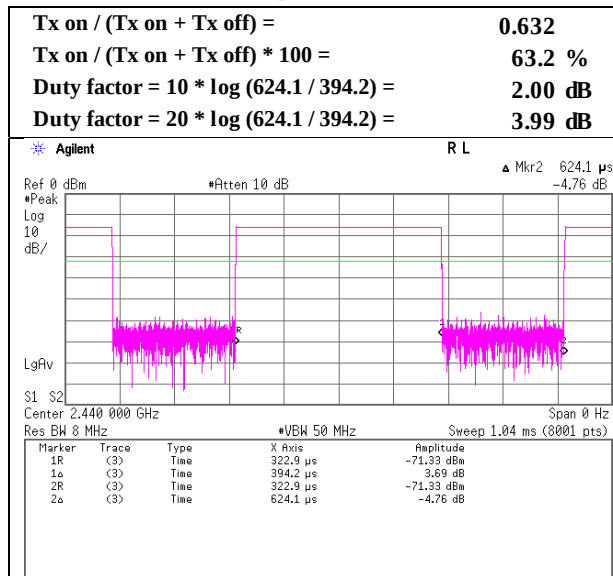
Result (Burst power average) = Time average + Duty factor

*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.	11825847S-A-R2
Date	December 14, 2017
Temperature / Humidity	22 deg. C / 31 % RH
Engineer	Kazuya Noda
Mode	Tx BT LE

BT LE



* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Radiated Spurious Emission

Report No. 11825847S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date December 18, 2017 December 13, 2017
Temperature / Humidity 21 deg. C / 36 % RH 26 deg. C / 31 % RH
Engineer Yosuke Ishikawa Shiro Kobayashi
(30 MHz – 1000 MHz) (1 GHz -18 GHz)
(18 GHz -26.5 GHz)
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.	177.779	QP	21.70	15.96	7.98	32.01	0.00	13.63	43.50	29.8	302	355	
Hori.	719.886	QP	21.30	19.78	10.45	31.71	0.00	19.82	46.00	26.1	100	351	
Hori.	926.046	QP	20.60	22.02	11.13	30.69	0.00	23.06	46.00	22.9	100	352	
Hori.	2390.000	PK	50.12	27.26	14.00	44.13	2.48	49.73	73.90	24.1	217	332	
Hori.	4804.000	PK	53.25	31.40	6.34	44.45	2.48	49.02	73.90	24.8	205	299	
Hori.	7206.000	PK	47.73	36.56	7.82	43.99	2.48	50.60	73.90	23.3	150	0	
Vert.	32.003	QP	28.30	16.83	6.67	32.13	0.00	19.67	40.00	20.3	100	175	
Vert.	73.893	QP	39.60	6.21	7.27	32.10	0.00	20.98	40.00	19.0	100	120	
Vert.	80.001	QP	41.50	6.22	7.73	32.10	0.00	23.35	40.00	16.6	108	288	
Vert.	150.006	QP	35.10	14.76	7.94	32.03	0.00	25.77	43.50	17.7	100	292	
Vert.	153.501	QP	36.60	14.91	7.97	32.03	0.00	27.45	43.50	16.0	100	302	
Vert.	172.999	QP	32.90	15.76	8.00	32.01	0.00	24.65	43.50	18.8	100	286	
Vert.	948.942	QP	20.40	22.09	11.20	30.48	0.00	23.21	46.00	22.7	100	23	
Vert.	2390.000	PK	49.70	27.26	14.00	44.13	2.48	49.31	73.90	24.5	241	145	
Vert.	4804.000	PK	53.36	31.40	6.34	44.45	2.48	49.13	73.90	24.7	101	232	
Vert.	7206.000	PK	47.62	36.56	7.82	43.99	2.48	50.49	73.90	23.4	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	39.09	27.26	14.00	44.13	3.99	2.48	42.69	53.90	11.2	*1)
Hori.	4804.000	AV	46.33	31.40	6.34	44.45	3.99	2.48	46.09	53.90	7.8	
Hori.	7206.000	AV	39.20	36.56	7.82	43.99	3.99	2.48	46.06	53.90	7.8	
Vert.	2390.000	AV	39.56	27.26	14.00	44.13	3.99	2.48	43.16	53.90	10.7	*1)
Vert.	4804.000	AV	46.47	31.40	6.34	44.45	3.99	2.48	46.23	53.90	7.7	
Vert.	7206.000	AV	39.13	36.56	7.82	43.99	3.99	2.48	45.99	53.90	7.9	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	80.73	27.29	14.01	44.14	2.48	80.37	-	-	Carrier
Hori.	2400.000	PK	45.89	27.29	14.01	44.14	2.48	45.53	60.37	14.8	
Hori.	9608.000	PK	39.97	38.61	8.80	43.83	2.48	46.03	60.37	14.3	
Vert.	2402.000	PK	81.92	27.29	14.01	44.14	2.48	81.56	-	-	Carrier
Vert.	2400.000	PK	46.29	27.29	14.01	44.14	2.48	45.93	61.56	15.6	
Vert.	9608.000	PK	39.67	38.61	8.80	43.83	2.48	45.73	61.56	15.8	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

UL Japan, Inc.

Shonan EMC Lab.

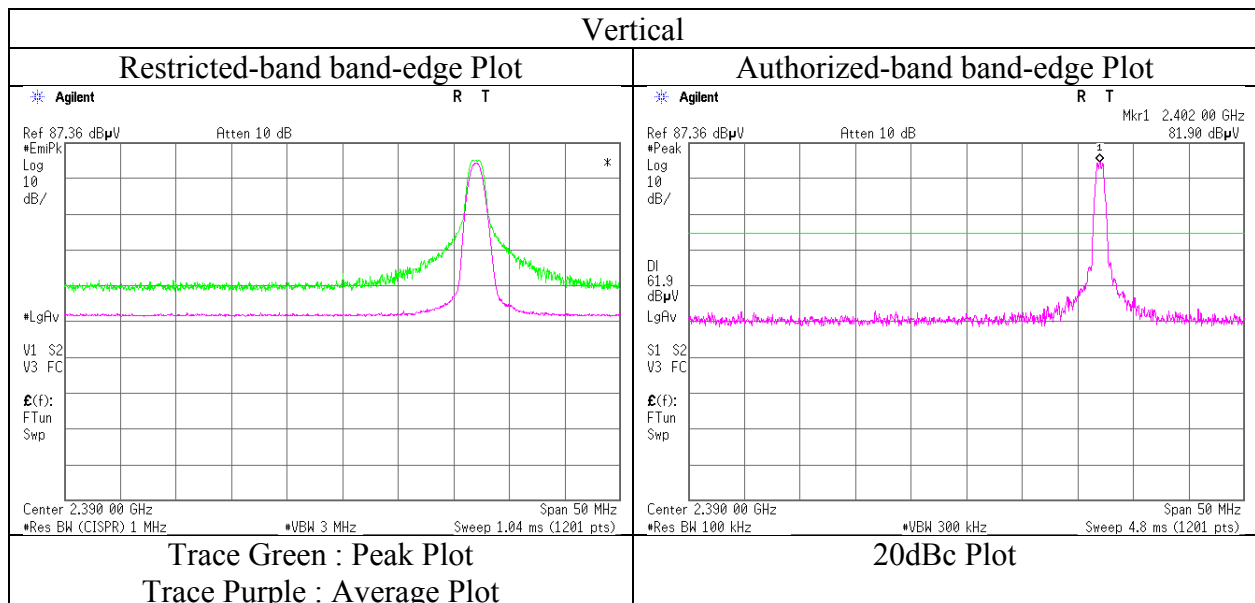
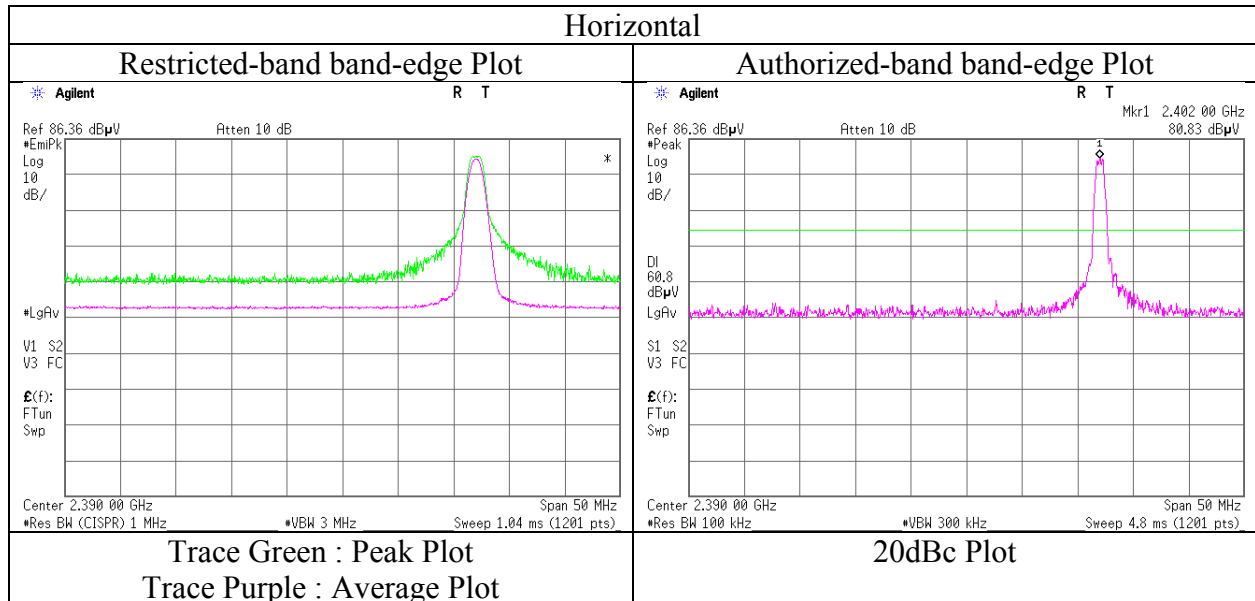
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11825847S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	December 13, 2017
Temperature / Humidity	26 deg. C / 31 % RH
Engineer	Shiro Kobayashi (1 GHz -18 GHz)
Mode	Tx BT LE 2402 MHz



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

Radiated Spurious Emission

Report No. 11825847S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3
Date December 18, 2017 December 13, 2017
Temperature / Humidity 21 deg. C / 36 % RH 26 deg. C / 31 % RH
Engineer Yosuke Ishikawa Shiro Kobayashi
(30 MHz – 1000 MHz) (1 GHz -18 GHz)
(18 GHz -26.5 GHz)
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.	167.584	QP	22.10	15.53	8.02	32.02	0.00	13.63	43.50	29.8	295	312	
Hori.	714.719	QP	21.30	19.73	10.43	31.72	0.00	19.74	46.00	26.2	100	356	
Hori.	924.821	QP	20.50	22.02	11.13	30.70	0.00	22.95	46.00	23.0	100	51	
Hori.	4880.000	PK	53.09	31.61	6.40	44.48	2.48	49.10	73.90	24.8	169	278	
Hori.	7320.000	PK	48.12	36.76	7.93	44.03	2.48	51.26	73.90	22.6	150	0	
Vert.	32.974	QP	25.40	16.53	6.68	32.13	0.00	16.48	40.00	23.5	100	344	
Vert.	73.892	QP	39.30	6.21	7.27	32.10	0.00	20.68	40.00	19.3	100	140	
Vert.	80.003	QP	41.00	6.22	7.73	32.10	0.00	22.85	40.00	17.1	116	256	
Vert.	150.003	QP	34.90	14.76	7.94	32.03	0.00	25.57	43.50	17.9	100	298	
Vert.	153.504	QP	36.30	14.91	7.97	32.03	0.00	27.15	43.50	16.3	100	308	
Vert.	173.002	QP	32.20	15.76	8.00	32.01	0.00	23.95	43.50	19.5	100	300	
Vert.	917.709	QP	20.80	22.00	11.11	30.77	0.00	23.14	46.00	22.8	100	335	
Vert.	4880.000	PK	53.56	31.61	6.40	44.48	2.48	49.57	73.90	24.3	102	217	
Vert.	7320.000	PK	48.03	36.76	7.93	44.03	2.48	51.17	73.90	22.7	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4880.000	AV	45.12	31.61	6.40	44.48	3.99	2.48	45.12	53.90	8.8	
Hori.	7320.000	AV	38.71	36.76	7.93	44.03	3.99	2.48	45.84	53.90	8.1	
Vert.	4880.000	AV	45.38	31.61	6.40	44.48	3.99	2.48	45.38	53.90	8.5	
Vert.	7320.000	AV	38.91	36.76	7.93	44.03	3.99	2.48	46.04	53.90	7.9	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2440.000	PK	82.00	27.41	14.05	44.15	2.48	81.79	-	-	Carrier
Hori.	9760.000	PK	39.03	38.79	8.95	43.85	2.48	45.40	61.79	16.4	
Vert.	2440.000	PK	82.85	27.41	14.05	44.15	2.48	82.64	-	-	Carrier
Vert.	9760.000	PK	39.95	38.79	8.95	43.85	2.48	46.32	62.64	16.3	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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Radiated Spurious Emission

Report No. 11825847S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3
Date December 18, 2017 December 13, 2017
Temperature / Humidity 21 deg. C / 36 % RH 26 deg. C / 31 % RH
Engineer Yosuke Ishikawa Shiro Kobayashi
(30 MHz – 1000 MHz) (1 GHz -18 GHz)
(18 GHz -26.5 GHz)
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.	187.648	QP	22.30	16.13	7.96	32.00	0.00	14.39	43.50	29.1	306	347	
Hori.	887.911	QP	20.90	21.78	11.01	31.00	0.00	22.69	46.00	23.3	100	341	
Hori.	946.700	QP	20.40	22.08	11.19	30.50	0.00	23.17	46.00	22.8	100	358	
Hori.	2483.500	PK	56.85	27.55	14.09	44.16	2.48	56.81	73.90	17.0	221	351	
Hori.	4960.000	PK	51.69	31.83	6.46	44.51	2.48	47.95	73.90	25.9	110	271	
Hori.	7440.000	PK	47.34	36.97	8.06	44.08	2.48	50.77	73.90	23.1	150	0	
Vert.	73.896	QP	39.90	6.21	7.27	32.10	0.00	21.28	40.00	18.7	100	133	
Vert.	79.034	QP	38.70	6.22	7.66	32.10	0.00	20.48	40.00	19.5	120	201	
Vert.	80.000	QP	41.70	6.22	7.73	32.10	0.00	23.55	40.00	16.4	111	246	
Vert.	150.002	QP	35.10	14.76	7.94	32.03	0.00	25.77	43.50	17.7	100	292	
Vert.	153.504	QP	36.70	14.91	7.97	32.03	0.00	27.55	43.50	15.9	100	314	
Vert.	173.002	QP	32.80	15.76	8.00	32.01	0.00	24.55	43.50	18.9	100	301	
Vert.	896.893	QP	20.80	21.91	11.04	30.95	0.00	22.80	46.00	23.2	100	12	
Vert.	2483.500	PK	56.81	27.55	14.09	44.16	2.48	56.77	73.90	17.1	179	133	
Vert.	4960.000	PK	51.71	31.83	6.46	44.51	2.48	47.97	73.90	25.9	140	230	
Vert.	7440.000	PK	47.65	36.97	8.06	44.08	2.48	51.08	73.90	22.8	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.48 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 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	40.30	27.55	14.09	44.16	3.99	2.48	44.25	53.90	9.7	*1)
Hori.	4960.000	AV	43.56	31.83	6.46	44.51	3.99	2.48	43.81	53.90	10.1	
Hori.	7440.000	AV	38.81	36.97	8.06	44.08	3.99	2.48	46.23	53.90	7.7	
Vert.	2483.500	AV	40.52	27.55	14.09	44.16	3.99	2.48	44.47	53.90	9.4	*1)
Vert.	4960.000	AV	44.37	31.83	6.46	44.51	3.99	2.48	44.62	53.90	9.3	
Vert.	7440.000	AV	38.77	36.97	8.06	44.08	3.99	2.48	46.19	53.90	7.7	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.48 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 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.	2480.000	PK	82.30	27.54	14.08	44.16	2.48	82.24	-	-	Carrier
Hori.	9920.000	PK	38.01	38.98	9.10	43.87	2.48	44.70	62.24	17.5	
Vert.	2480.000	PK	82.48	27.54	14.08	44.16	2.48	82.42	-	-	Carrier
Vert.	9920.000	PK	37.95	38.98	9.10	43.87	2.48	44.64	62.42	17.8	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.48 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

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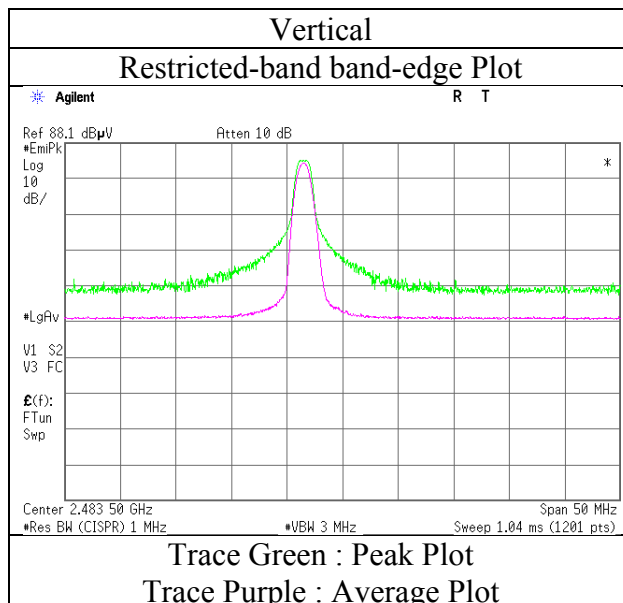
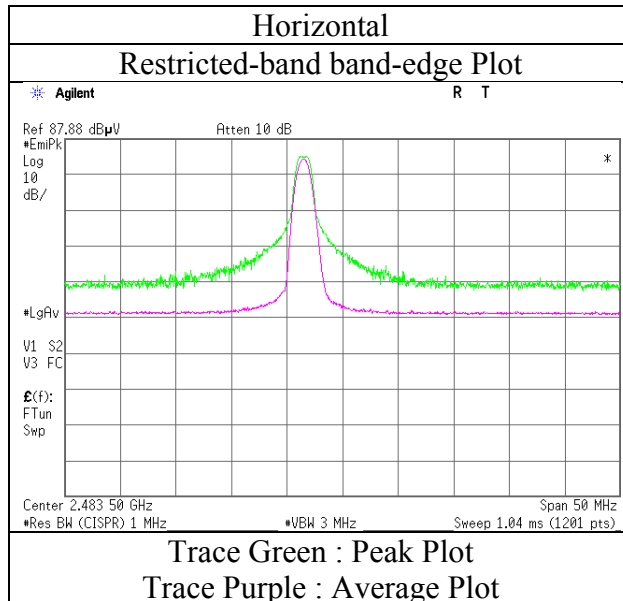
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Radiated Spurious Emission (Reference Plot for band-edge)

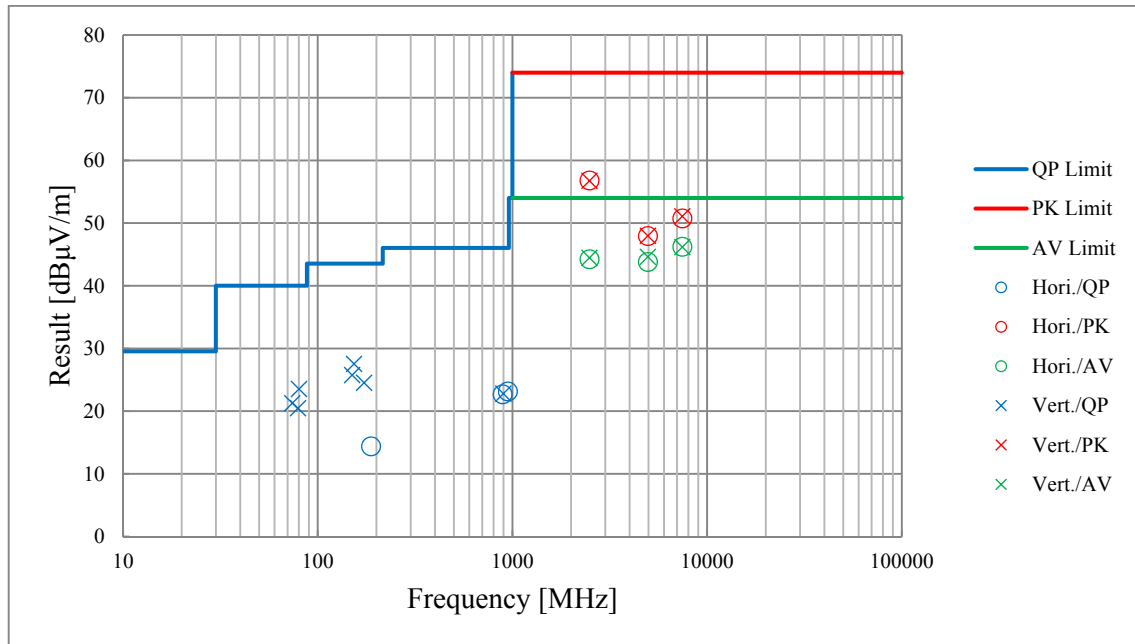
Report No.	11825847S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	December 13, 2017
Temperature / Humidity	26 deg. C / 31 % RH
Engineer	Shiro Kobayashi (1 GHz -18 GHz)
Mode	Tx BT LE 2402 MHz



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

Radiated Spurious Emission (Plot data, Worst case)

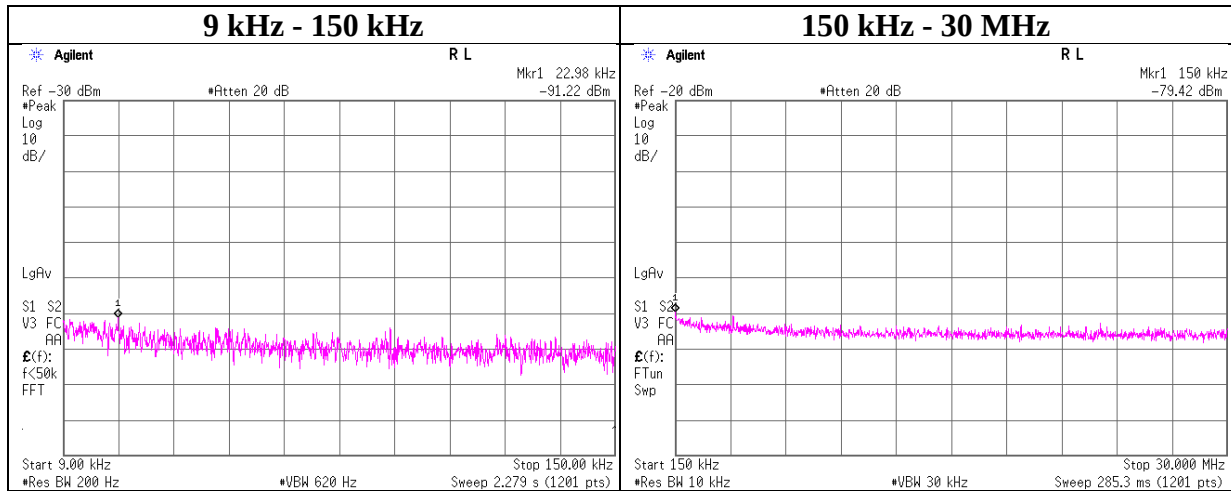
Report No.	11825847S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	3	3
Date	December 18, 2017	December 13, 2017
Temperature / Humidity	21 deg. C / 36 % RH	26 deg. C / 31 % RH
Engineer	Yosuke Ishikawa (30 MHz – 1000 MHz) (18 GHz -26.5 GHz)	Shiro Kobayashi (1 GHz -18 GHz)
Mode	Tx BT LE 2480 MHz	



*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.	11825847S-A-R2
Date	December 14, 2017
Temperature / Humidity	26 deg. C / 41 % RH
Engineer	Kazuya Noda
Mode	Tx BT LE 2402 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
22.98	-91.2	0.01	9.8	2.0	1	-79.4	300	6.0	-18.1	40.3	58.4	
150.00	-79.4	0.01	9.8	2.0	1	-67.6	300	6.0	-6.3	24.0	30.3	

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

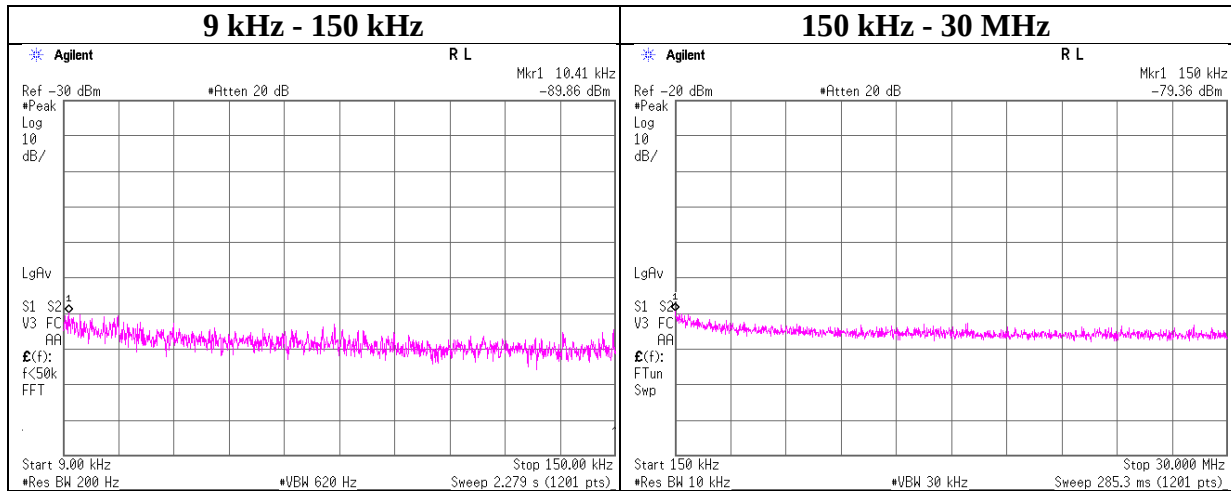
$EIRP[dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11825847S-A-R2
Date : December 14, 2017
Temperature / Humidity : 26 deg. C / 41 % RH
Engineer : Kazuya Noda
Mode : Tx BT LE 2440 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
10.41	-89.9	0.01	9.8	2.0	1	-78.0	300	6.0	-16.8	47.2	64.0	
150.00	-79.4	0.01	9.8	2.0	1	-67.5	300	6.0	-6.3	24.0	30.3	

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

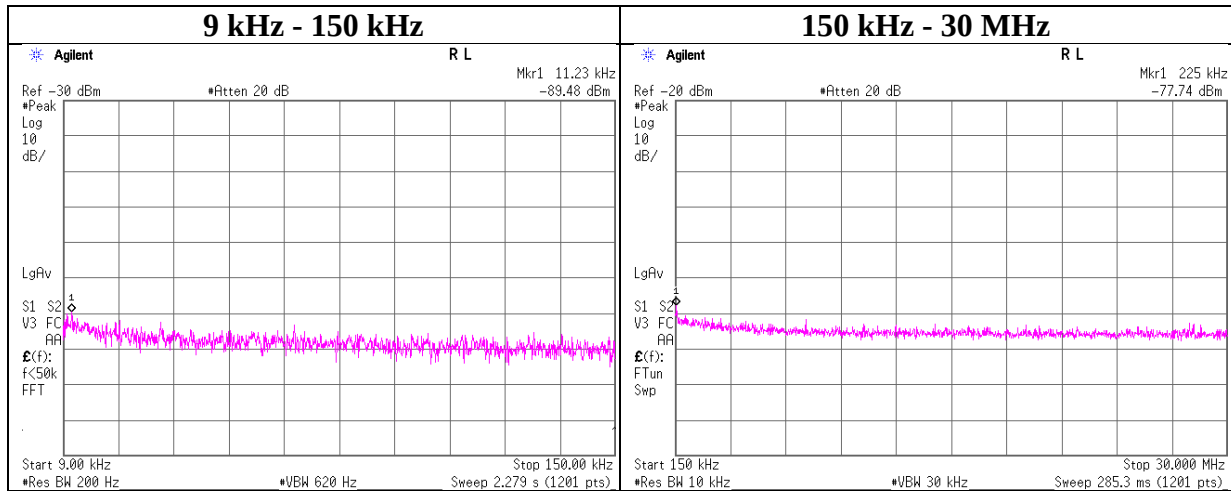
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11825847S-A-R2
Date : December 14, 2017
Temperature / Humidity : 26 deg. C / 41 % RH
Engineer : Kazuya Noda
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
11.23	-89.5	0.01	9.8	2.0	1	-77.7	300	6.0	-16.4	46.5	62.9	
225.00	-77.7	0.01	9.8	2.0	1	-65.9	300	6.0	-4.7	20.5	25.2	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Power Density

Test place Shonan EMC Lab. No.1 Measurement Room
Report No. 11825847S-A-R2
Date December 14, 2017
Temperature / Humidity 22 deg. C / 31 % RH
Engineer Kazuya Noda
Mode Tx BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-32.36	0.72	9.96	-21.68	8.00	29.68
2440.00	-31.03	0.72	9.97	-20.34	8.00	28.34
2480.00	-30.28	0.73	9.97	-19.58	8.00	27.58

Sample Calculation:

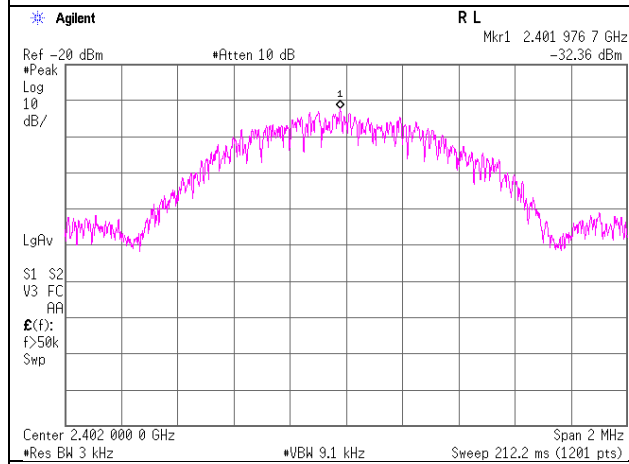
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

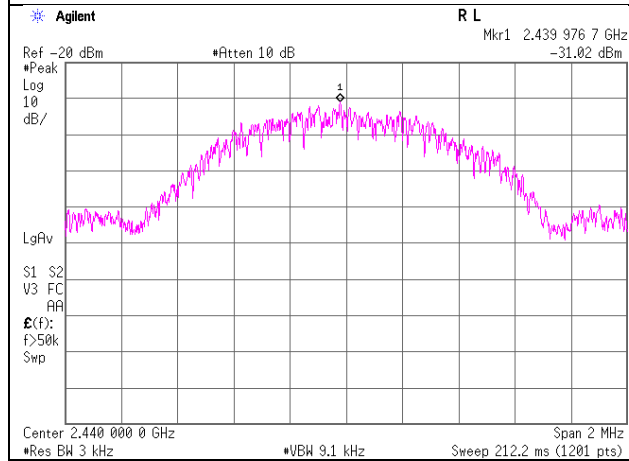
Power Density

BT LE

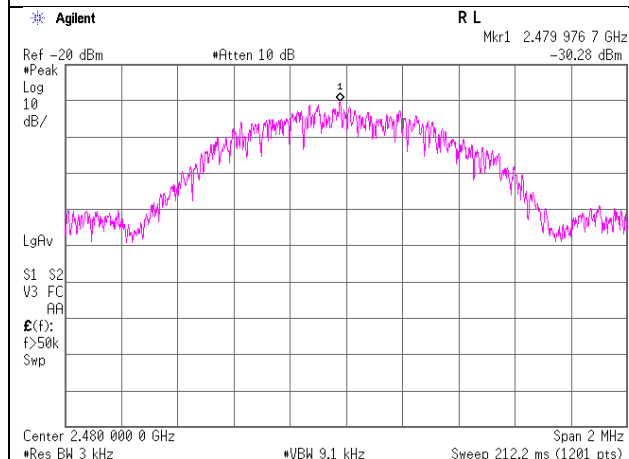
2402 MHz



2440 MHz



2480 MHz



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APPENDIX 2: Test instruments

Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2016/12/13 * 12
STS-05	Digital Hitester	Hioki	3805-50	080997828	AT	2017/10/16 * 12
SRENT-09	Spectrum Analyzer	Agilent	E4440A	MY46186392	AT	2017/11/08 * 12
SAT10-13	Attenuator	Weinschel Corp.	54A-10	81626	AT	2017/03/23 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2017/03/23 * 12
SPSS-05	Power sensor	Agilent	N1923A	MY5349008	AT	2017/05/01 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2017/05/01 * 12
SOS-13	Humidity Indicator	Custom	CTH-202	Q.C.17	AT	2016/12/13 * 12
SCC-C9	Coaxial Cable	Suhner	RG223U	-	CE	2017/04/07 * 12
SLS-05	LISN	Rohde & Schwarz	ENV216	100516	CE	2017/02/27 * 12
SAT3-10	Attenuator	JFW	50HF-003N	-	CE	2017/05/01 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2016/12/13 * 12
STR-02	Test Receiver	Rohde & Schwarz	ESCI	100575	CE	2017/09/07 * 12
SJM-02	Measure	KOMELON	KMC-36	-	CE, RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFL,MF)	-	CE, RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	CE, RE	2017/10/16 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	2046104	RE	2017/09/22 * 12
SCC-G07	Coaxial Cable	Junkosha	J12J103316-00-R	OCT-12-17-054	RE	2017/10/23 * 12
SCC-G43	Coaxial Cable	HUBER+SUHNER	SUCOFLEX_104_E	SN MY 13406/4E	RE	2017/07/10 * 12
SCC-G41	Coaxial Cable	Junkosha	MWX221-01000NFS NMS/B	1612S006	RE	2017/01/08 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2017/08/23 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2017/10/30 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2017/03/07 * 12
SAEC-03(SVS WR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	RE	2017/07/17 * 12
SAT10-05	Attenuator(above 1 GHz)	Agilent	8493C-010	74864	RE	2017/11/22 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2017/11/16 * 12
SSA-01	Spectrum Analyzer	Agilent	N9010A-526	MY48031482	RE	2017/04/14 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2017/06/11 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2017/10/02 * 12
SLA-07	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	196	RE	2017/01/26 * 12
SAT6-08	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	RE	2017/08/24 * 12
SCC-C1/C2/C3/C4/C5/C10/SRS E-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	2017/04/07 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2017/02/09 * 12
STR-08	Test Receiver	Rohde & Schwarz	ESW44	101581	RE	2017/11/24 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2017/03/15 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2017/09/22 * 12
SCC-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2017/03/23 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000KM SKMS	-	RE	2017/04/20 * 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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