



RADIO TEST REPORT

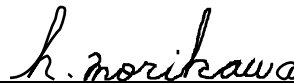
Test Report No. : 11920648S-D-R1

Applicant : Ueda Japan Radio Co., Ltd.
Type of Equipment : Telemetry Transmitter
Model No. : DTF-251
FCC ID : 2ADKK-DTF251
Test regulation : FCC Part 15 Subpart C: 2018
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)
7. This report is a revised version of 11920648S-D. 11920648S-D is replaced with this report.

Date of test: December 6 to 24, 2017
January 27, 2018

Representative test engineer:



Hiroyuki Morikawa
Engineer
Consumer Technology Division

Approved by:



Toyokazu Imamura
Leader
Consumer Technology Division



JAB
Testing
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".

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13-EM-F0429

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on February 2, 2018 and effective March 5, 2018

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

* The revision on February 2, 2018, does not affect the test specification applied to the EUT..

* Also the EUT complies with FCC Part 15 Subpart B.

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	AV 26.8 dB, 043570 MHz, N Tx. BTLE, 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	5.7 dB 9920.000 MHz, AV, Hori., 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 section 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 2.8 V) constantly to the RF part regardless of input voltage. Therefore, the EUT complies with the requirement.

FCC Part 15.203 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.

3.3 Addition to standard

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

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

3.4 Uncertainty

EMI

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

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Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	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	-	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
Radiated emission (Measurement distance: 1 m)	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.

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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

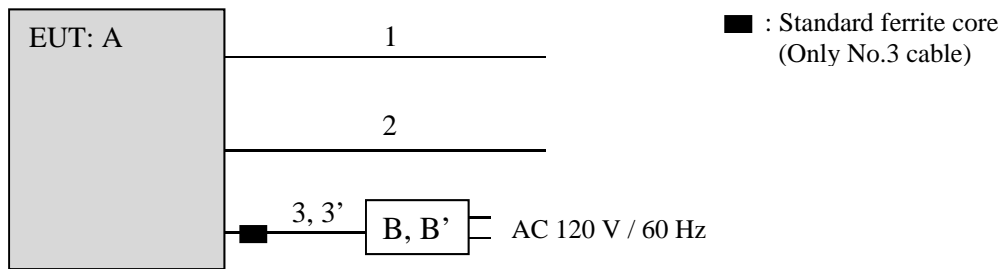
Refer to APPENDIX.

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

4.1 Operating Mode(s)

Mode	Frequency	Remarks*
Bluetooth Low Energy	2402 MHz 2440 MHz 2480 MHz	PRBS9
<p>*Power of the EUT was set by the software as follows; - Power Setting: Fixed - Software: nRFgo Studio version 1.21.2.10</p> <p>*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.</p>		

4.2 Configuration and peripherals



*Cabling and setup 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	Remark
A	Telemetry Transmitter	DTF-251	9990016	Ueda Japan Radio Co., Ltd.	EUT
B	AC Adapter	HPU15-102	S02205121747	SINPRO	*1)
B'	AC Adapter	ACM18US05	160601-00648	XP Power	*2)

*1) Used for other than Conducted Emission.

Confirmed that there is no difference in spurious emission characteristics by the differences in AC adapter.

*2) Used for Conducted Emission.

List of cable used

No.	Item	Length (m)	Shield		Remark
			Cable	Connector	
1	GND	1.0	Unshielded	Unshielded	-
2	Signal	1.4	Unshielded	Unshielded	-
3	DC	1.2	Unshielded	Unshielded	-
3'	DC	1.8	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on 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 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.

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.

For the tests on EUT itself (as a standalone equipment)

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 Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

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: <u>12.2.5.2</u> 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	3.96 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)		3.96 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: $20 \times \log(3.96 \text{ m}/3.0 \text{ m}) = 2.41 \text{ dB}$

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

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

Antenna polarization	Frequency				
	Below 1 GHz	1 GHz - 2.8 GHz	2.8 GHz - 13 GHz	13 GHz - 18 GHz	18 GHz - 26.5 GHz
Horizontal	Z	X	Z	X	X
Vertical	Z	Z	Z	X	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.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 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

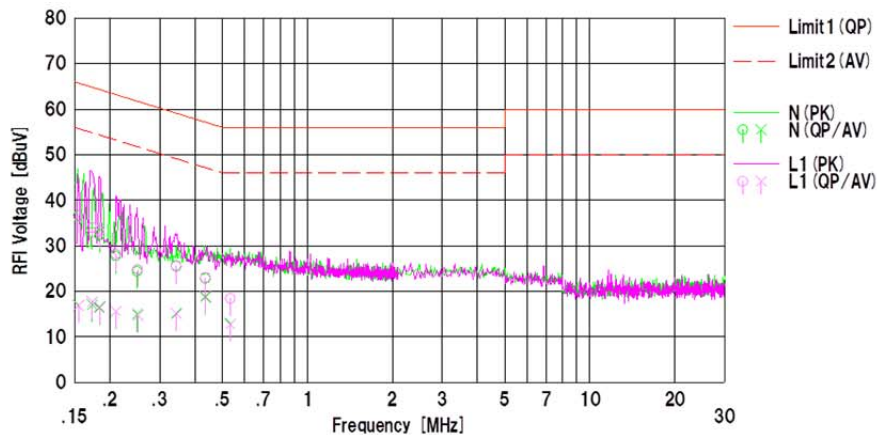
UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2018/01/27

Mode : Tx BTLE 2402 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 22 deg.C / 31 %RH

Remarks : -

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

Engineer : Takahiro Suzuki



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<OP> [dBuV]	<AV> [dBuV]		<OP> [dBuV]	<AV> [dBuV]	<OP> [dBuV]	<AV> [dBuV]	<OP> [dB]	<AV> [dB]		
1	0.15496	24.00	4.40	12.43	36.43	16.83	65.73	55.73	29.3	38.9	N	
2	0.17291	20.50	4.60	12.44	32.94	17.04	64.82	54.82	31.8	37.7	N	
3	0.18388	19.90	3.90	12.43	32.33	16.33	64.31	54.31	31.9	37.9	N	
4	0.20970	15.30	3.20	12.43	27.73	15.63	63.22	53.22	35.4	37.5	N	
5	0.25009	11.90	2.50	12.45	24.35	14.85	61.75	51.75	37.4	36.8	N	
6	0.34336	13.10	2.70	12.48	25.58	15.18	59.12	49.12	33.5	33.9	N	
7	0.43594	10.30	6.20	12.48	22.78	16.68	57.14	47.14	34.3	28.4	N	
8	0.53411	5.90	0.30	12.49	18.39	12.79	56.00	46.00	37.6	33.2	N	
9	0.15460	24.20	4.40	12.43	36.63	16.83	65.75	55.75	29.1	38.9	L1	
10	0.17287	21.50	5.20	12.44	33.94	17.64	64.82	54.82	30.8	37.1	L1	
11	0.18384	20.80	4.10	12.43	33.23	16.53	64.31	54.31	31.0	37.7	L1	
12	0.20972	15.70	3.20	12.43	28.13	15.63	63.22	53.22	35.0	37.5	L1	
13	0.25075	12.30	2.20	12.45	24.75	14.65	61.73	51.73	36.9	37.0	L1	
14	0.34368	13.00	2.50	12.48	25.48	14.98	59.11	49.11	33.6	34.1	L1	
15	0.43594	10.50	6.40	12.48	22.99	18.88	57.14	47.14	34.1	28.2	L1	
16	0.53374	5.90	0.30	12.49	18.39	12.79	56.00	46.00	37.6	33.2	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) : SLS-02

DATA OF CONDUCTED EMISSION TEST

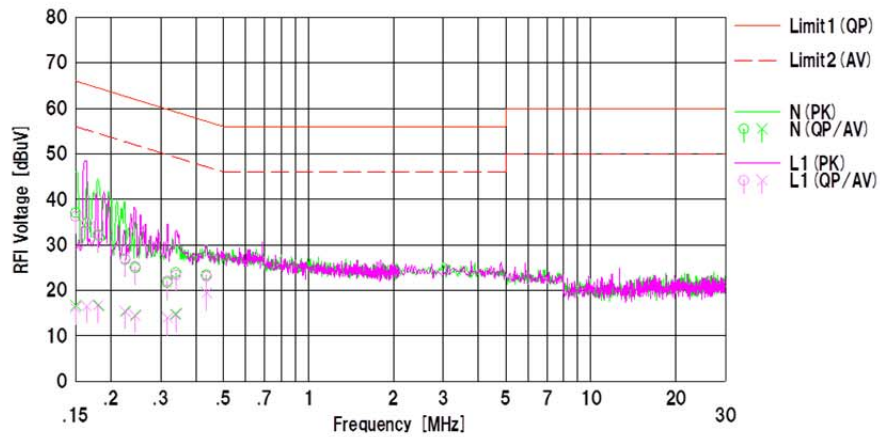
UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2018/01/27

Mode : Tx BTLE 2440 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 22 deg.C / 31 %RH

Remarks : -

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

Engineer : Takahiro Suzuki



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]				
1	0.15008	24.60	4.20	12.43	37.03	16.63	66.00	56.00	28.9	39.3	N	
2	0.16426	22.40	4.10	12.44	34.84	16.54	65.25	55.25	30.4	38.7	N	
3	0.18029	19.60	4.30	12.43	32.03	16.73	64.47	54.47	32.4	37.7	N	
4	0.22468	14.30	2.90	12.44	26.74	15.34	62.64	52.64	35.9	37.3	N	
5	0.24404	12.50	2.00	12.45	24.95	14.45	61.96	51.96	37.0	37.5	N	
6	0.31732	9.20	1.50	12.47	21.67	13.97	59.78	49.78	38.1	35.8	N	
7	0.33980	11.40	2.30	12.48	23.88	14.78	59.21	49.21	35.3	34.4	N	
8	0.43590	10.90	7.00	12.48	23.38	19.48	57.14	47.14	33.7	27.6	N	
9	0.15000	23.80	3.70	12.43	36.23	16.13	66.00	56.00	29.7	39.8	L1	
10	0.16442	22.20	4.10	12.44	34.64	16.54	65.24	55.24	30.6	38.7	L1	
11	0.18013	19.90	4.20	12.43	32.33	16.63	64.48	54.48	32.1	37.8	L1	
12	0.22442	14.50	2.80	12.44	26.94	15.24	62.65	52.65	35.7	37.4	L1	
13	0.24429	12.80	2.00	12.45	25.25	14.45	61.95	51.95	36.7	37.5	L1	
14	0.31702	8.60	1.40	12.47	22.07	13.87	59.78	49.78	37.7	35.9	L1	
15	0.33944	10.90	2.10	12.48	23.38	14.58	59.22	49.22	35.8	34.6	L1	
16	0.43677	10.60	6.90	12.48	23.08	19.38	57.12	47.12	34.0	27.7	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) : SLS-02

DATA OF CONDUCTED EMISSION TEST

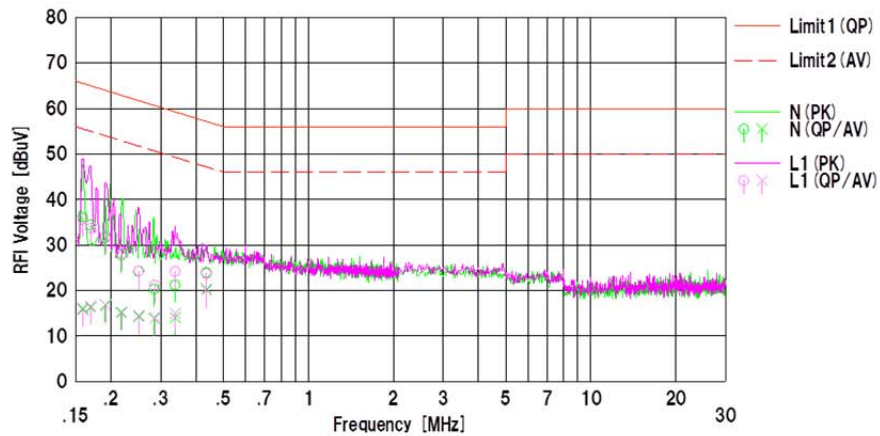
UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2018/01/27

Mode : Tx BTLE 2480 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 22 deg.C / 31 %RH

Remarks : -

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

Engineer : Takahiro Suzuki



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]				
1	0.15896	23.70	3.50	12.43	36.13	15.93	65.52	55.52	29.3	39.5	N	
2	0.16971	21.90	3.90	12.44	34.34	16.34	64.97	54.97	30.6	38.6	N	
3	0.19097	19.20	4.40	12.44	31.64	16.64	63.99	53.99	32.3	37.1	N	
4	0.21780	15.30	2.70	12.44	27.74	15.14	62.90	52.90	35.1	37.7	N	
5	0.25074	11.70	1.80	12.45	24.15	14.25	61.73	51.73	37.5	37.4	N	
6	0.28464	7.80	1.30	12.47	20.27	13.77	60.68	50.68	40.4	36.9	N	
7	0.33784	8.70	1.50	12.48	21.18	13.98	59.26	49.26	38.0	35.2	N	
8	0.43570	11.40	7.90	12.48	23.88	20.28	57.14	47.14	33.2	26.8	N	
9	0.15896	23.20	3.30	12.43	35.63	15.73	65.52	55.52	29.8	39.7	L1	
10	0.16946	21.20	4.10	12.44	33.64	16.54	64.99	54.99	31.3	38.4	L1	
11	0.19164	19.50	4.20	12.44	31.94	16.64	63.97	53.97	32.0	37.3	L1	
12	0.21873	15.60	2.70	12.44	28.04	15.14	62.87	52.87	34.8	37.7	L1	
13	0.25135	11.80	2.00	12.45	24.25	14.25	61.71	51.71	37.4	37.2	L1	
14	0.28584	8.60	1.60	12.47	21.07	14.07	60.64	50.64	39.5	36.5	L1	
15	0.33784	11.70	2.40	12.48	24.18	14.88	59.26	49.26	35.0	34.3	L1	
16	0.43569	11.20	7.50	12.48	23.68	19.98	57.14	47.14	33.4	27.1	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) : SLS-02

6 dB Bandwidth and 99 % Occupied Bandwidth

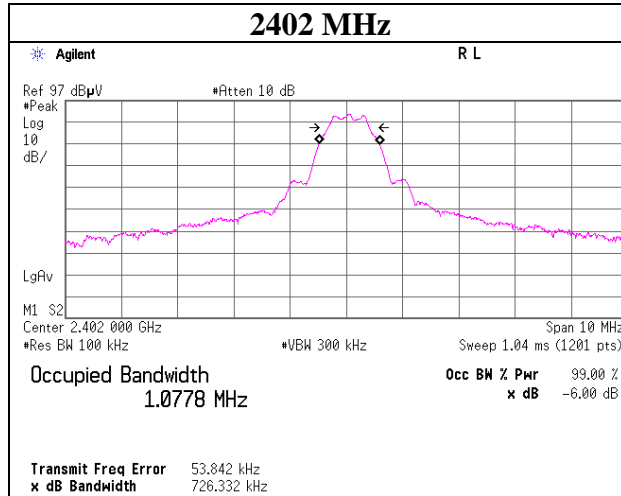
Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11920648S-D-R1
Date December 6, 2017
Temperature / Humidity 20 deg. C / 37 % RH
Engineer Hiroyuki Morikawa
Mode Tx BT LE

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Limit for 6dB Bandwidth [kHz]
BTLE	2402	0.726	1045.8	> 500
	2440	0.731	1047.1	> 500
	2480	0.732	1049.9	> 500

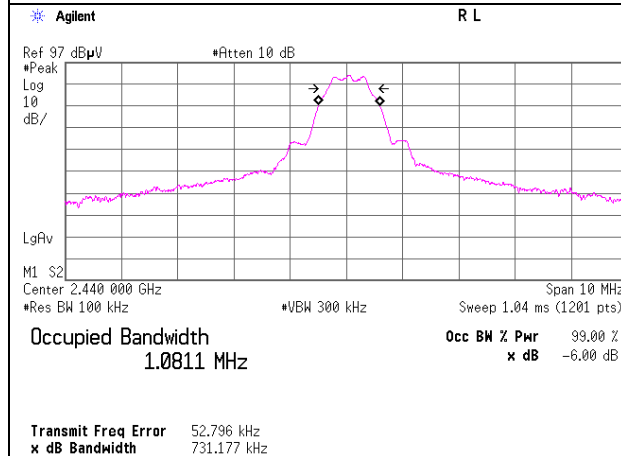
6dB Bandwidth

BTLE

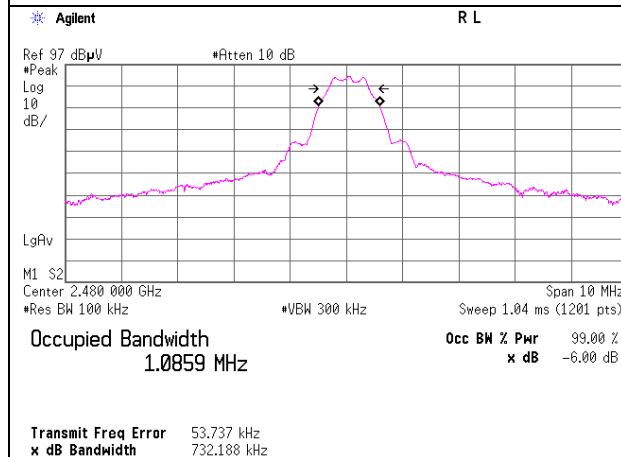
2402 MHz



2440 MHz



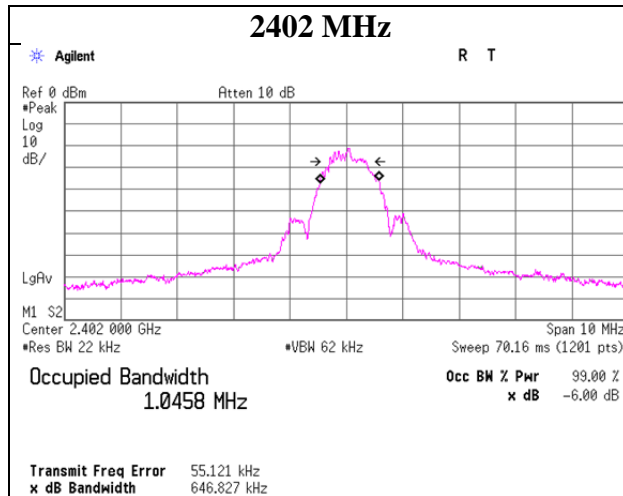
2480 MHz



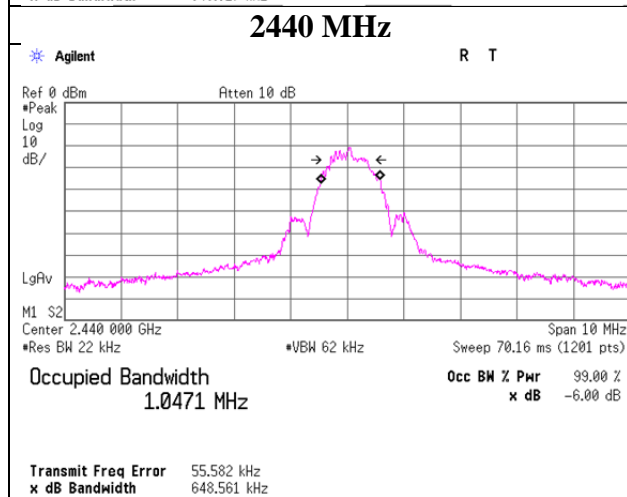
99%Occupied Bandwidth

BTLE

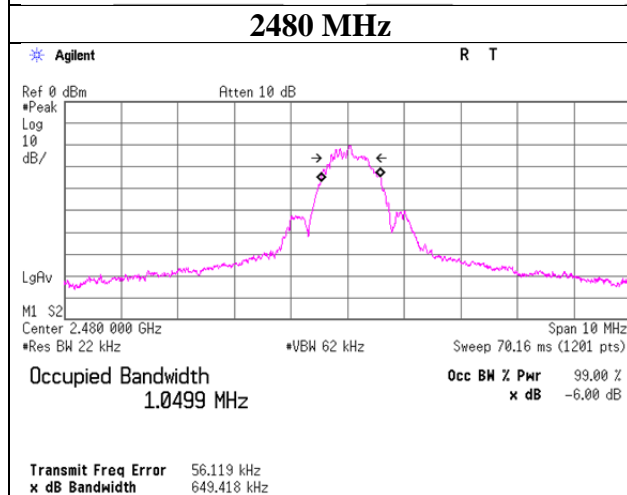
2402 MHz



2440 MHz



2480 MHz



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Maximum Peak Output Power

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11920648S-D-R1
Date December 6, 2017
Temperature / Humidity 20 deg. C / 37 % RH
Engineer Hiroyuki Morikawa
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-15.15	2.02	9.68	-3.45	0.45	30.00	1000	33.45
2440	-14.89	2.03	9.67	-3.19	0.48	30.00	1000	33.19
2480	-14.53	2.04	9.67	-2.82	0.52	30.00	1000	32.82

Sample Calculation:

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

Average Output Power
(Reference data for RF Exposure)

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11920648S-D-R1
Date December 6, 2017
Temperature / Humidity 20 deg. C / 37 % RH
Engineer Hiroyuki Morikawa
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	-18.57	2.02	9.68	-6.87	0.21	1.96	-4.91	0.32
2440	-18.12	2.03	9.67	-6.42	0.23	1.96	-4.46	0.36
2480	-17.68	2.04	9.67	-5.97	0.25	1.96	-4.01	0.40

Sample Calculation:

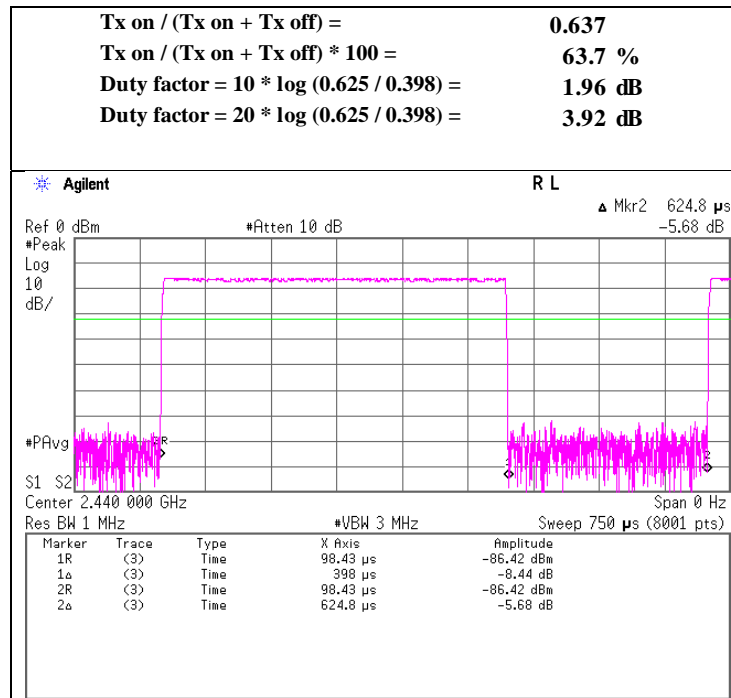
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

Burst rate confirmation

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11920648S-D-R1
Date : December 6, 2017
Temperature / Humidity : 20 deg. C / 37 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx BT LE

BTLE



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

Radiated Spurious Emission

Report No. 11920648S-D-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3AC
Date December 23, 2017 December 24, 2017
Temperature / Humidity 22 deg.C / 24 %RH 21 deg.C / 31 %RH
Engineer Kazuya Noda Kazutaka Takeyama
(30 MHz - 1 GHz) (1 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.	70.201	QP	38.27	6.21	6.96	32.10	0.00	19.34	40.00	20.6	290	89	
Hori.	81.170	QP	31.46	6.45	7.74	32.10	0.00	13.55	40.00	26.4	223	294	
Hori.	128.574	QP	26.81	13.55	7.53	32.05	0.00	15.84	43.50	27.6	227	78	
Hori.	799.199	QP	21.64	20.56	10.71	31.47	0.00	21.44	46.00	24.5	100	1	
Hori.	2390.000	PK	49.02	27.26	13.56	44.13	2.41	48.12	73.90	25.7	130	288	
Hori.	4804.000	PK	51.64	31.40	5.61	44.45	2.41	46.61	73.90	27.2	134	34	
Hori.	7206.000	PK	46.13	36.56	6.86	43.99	2.41	47.97	73.90	25.9	150	0	
Hori.	9608.000	PK	47.81	38.61	7.84	43.83	2.41	52.84	73.90	21.0	150	0	
Vert.	36.542	QP	24.89	15.41	6.76	32.13	0.00	14.93	40.00	25.0	100	183	
Vert.	47.987	QP	24.94	11.35	6.94	32.12	0.00	11.11	40.00	28.8	100	228	
Vert.	71.246	QP	38.51	6.21	7.05	32.10	0.00	19.67	40.00	20.3	107	195	
Vert.	87.198	QP	34.47	7.62	7.74	32.09	0.00	17.74	40.00	22.2	100	198	
Vert.	176.669	QP	21.82	15.92	7.98	32.01	0.00	13.71	43.50	29.7	100	1	
Vert.	920.301	QP	21.59	22.01	11.12	30.74	0.00	23.98	46.00	22.0	100	1	
Vert.	2390.000	PK	49.90	27.26	13.56	44.13	2.41	49.00	73.90	24.9	156	22	
Vert.	4804.000	PK	51.13	31.40	5.61	44.45	2.41	46.10	73.90	27.8	179	236	
Vert.	7206.000	PK	46.20	36.56	6.86	43.99	2.41	48.04	73.90	25.8	150	0	
Vert.	9608.000	PK	48.67	38.61	7.84	43.83	2.41	53.70	73.90	20.2	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 (3.96 m / 3.0 m) = 2.41 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.	2390.000	AV	39.58	27.26	13.56	44.13	3.92	2.41	42.60	53.90	11.3	*1)
Hori.	4804.000	AV	43.69	31.40	5.61	44.45	3.92	2.41	42.58	53.90	11.3	
Hori.	7206.000	AV	37.09	36.56	6.86	43.99	3.92	2.41	42.85	53.90	11.1	
Hori.	9608.000	AV	38.89	38.61	7.84	43.83	3.92	2.41	47.84	53.90	6.1	
Vert.	2390.000	AV	39.80	27.26	13.56	44.13	3.92	2.41	42.82	53.90	11.1	*1)
Vert.	4804.000	AV	42.14	31.40	5.61	44.45	3.92	2.41	41.03	53.90	12.9	
Vert.	7206.000	AV	36.81	36.56	6.86	43.99	3.92	2.41	42.57	53.90	11.3	
Vert.	9608.000	AV	38.68	38.61	7.84	43.83	3.92	2.41	47.63	53.90	6.3	

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 (3.96 m / 3.0 m) = 2.41 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.	2402.000	PK	92.12	27.29	13.57	44.14	2.41	91.25	-	-	Carrier
Hori.	2400.000	PK	46.51	27.29	13.57	44.14	2.41	45.64	71.25	25.6	
Vert.	2402.000	PK	93.00	27.29	13.57	44.14	2.41	92.13	-	-	Carrier
Vert.	2400.000	PK	47.44	27.29	13.57	44.14	2.41	46.57	72.13	25.6	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.41 dB

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

UL Japan, Inc.

Shonan EMC Lab.

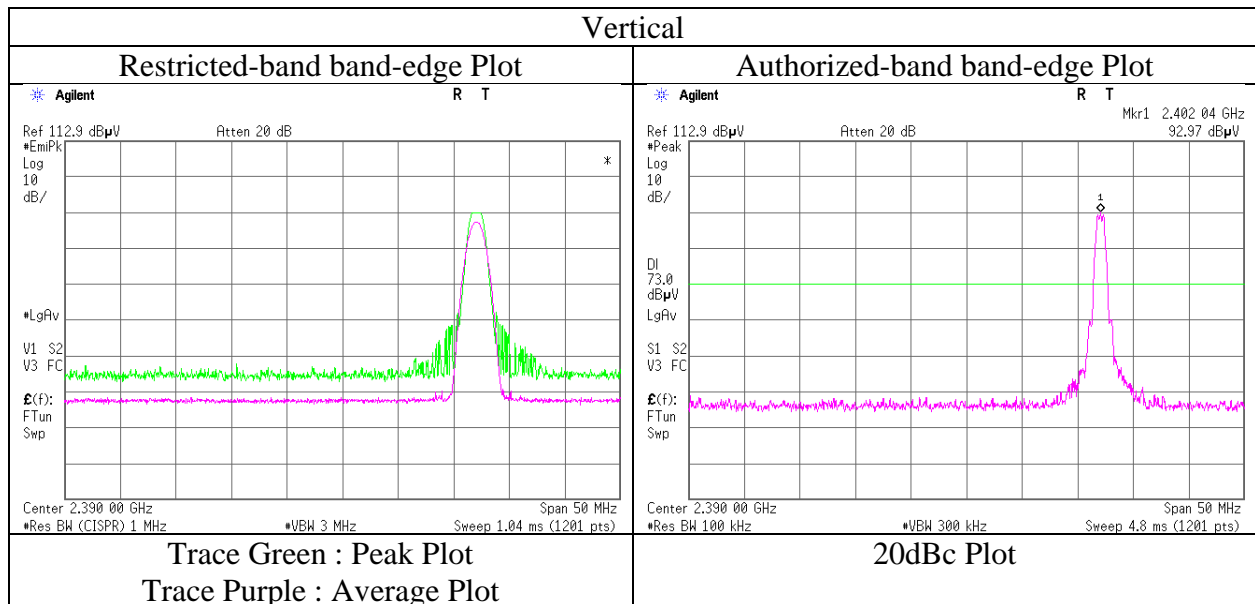
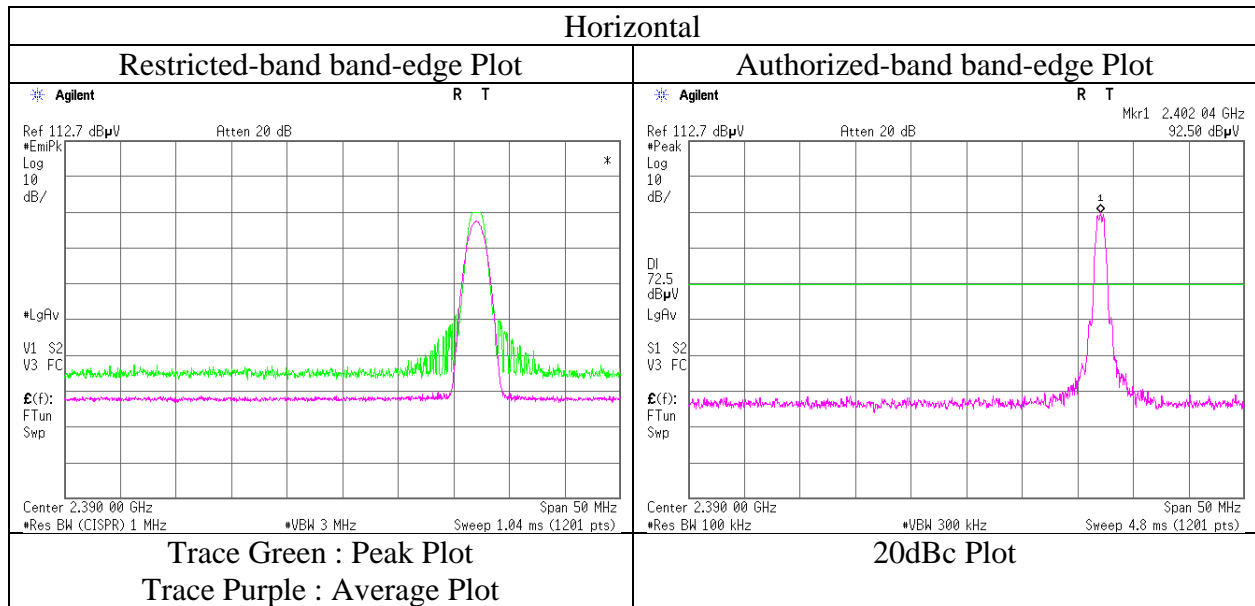
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Facsimile : +81 463 50 6401

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 11920648S-D-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3AC
Date December 24, 2017
Temperature / Humidity 21 deg.C / 31 %RH
Engineer Kazutaka Takeyama
Mode Tx BT LE 2402 MHz



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

Radiated Spurious Emission

Report No.	11920648S-D-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	3AC	3AC
Date	December 23, 2017	December 24, 2017
Temperature / Humidity	22 deg.C / 24 %RH	21 deg.C / 31 %RH
Engineer	Kazuya Noda	Kazutaka Takeyama
	(30 MHz - 1 GHz)	(1 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.	62.504	QP	26.31	7.39	6.68	32.11	0.00	8.27	40.00	31.7	342	247	
Hori.	75.279	QP	32.22	6.22	7.39	32.10	0.00	13.73	40.00	26.2	348	84	
Hori.	93.980	QP	28.28	8.91	7.64	32.08	0.00	12.75	43.50	30.7	231	262	
Hori.	121.579	QP	27.56	13.08	7.43	32.06	0.00	16.01	43.50	27.4	299	102	
Hori.	135.640	QP	27.77	14.03	7.66	32.04	0.00	17.42	43.50	26.0	218	273	
Hori.	841.087	QP	21.67	21.14	10.85	31.27	0.00	22.39	46.00	23.6	100	1	
Hori.	4880.000	PK	51.96	31.61	5.59	44.48	2.41	47.09	73.90	26.8	100	24	
Hori.	7320.000	PK	47.36	36.76	6.89	44.03	2.41	49.39	73.90	24.5	150	0	
Hori.	9760.000	PK	47.36	38.79	7.94	43.85	2.41	52.65	73.90	21.2	150	0	
Vert.	30.440	QP	31.05	17.31	6.64	32.13	0.00	22.87	40.00	17.1	102	242	
Vert.	46.768	QP	23.65	11.73	6.93	32.12	0.00	10.19	40.00	29.8	100	151	
Vert.	76.001	QP	33.61	6.22	7.44	32.10	0.00	15.17	40.00	24.8	100	195	
Vert.	677.728	QP	21.74	19.44	10.31	31.79	0.00	19.70	46.00	26.3	100	1	
Vert.	4880.000	PK	51.05	31.61	5.59	44.48	2.41	46.18	73.90	27.7	249	72	
Vert.	7320.000	PK	46.54	36.76	6.89	44.03	2.41	48.57	73.90	25.3	150	0	
Vert.	9760.000	PK	47.14	38.79	7.94	43.85	2.41	52.43	73.90	21.4	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.41 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.	4880.000	AV	44.90	31.61	5.59	44.48	3.92	2.41	43.95	53.90	9.9	
Hori.	7320.000	AV	38.26	36.76	6.89	44.03	3.92	2.41	44.21	53.90	9.7	
Hori.	9760.000	AV	38.55	38.79	7.94	43.85	3.92	2.41	47.76	53.90	6.1	
Vert.	4880.000	AV	43.25	31.61	5.59	44.48	3.92	2.41	42.30	53.90	11.6	
Vert.	7320.000	AV	38.44	36.76	6.89	44.03	3.92	2.41	44.39	53.90	9.5	
Vert.	9760.000	AV	38.63	38.79	7.94	43.85	3.92	2.41	47.84	53.90	6.1	

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 (3.96 m / 3.0 m) = 2.41 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)

Radiated Spurious Emission

Report No.	11920648S-D-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	3AC	3AC
Date	December 23, 2017	December 24, 2017
Temperature / Humidity	22 deg.C / 24 %RH	21 deg.C / 31 %RH
Engineer	Kazuya Noda	Kazutaka Takeyama
	(30 MHz - 1 GHz)	(1 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.	62.504	QP	26.31	7.39	6.68	32.11	0.00	8.27	40.00	31.7	342	247	
Hori.	75.279	QP	32.22	6.22	7.39	32.10	0.00	13.73	40.00	26.2	348	84	
Hori.	93.980	QP	28.28	8.91	7.64	32.08	0.00	12.75	43.50	30.7	231	262	
Hori.	121.579	QP	27.56	13.08	7.43	32.06	0.00	16.01	43.50	27.4	299	102	
Hori.	135.640	QP	27.77	14.03	7.66	32.04	0.00	17.42	43.50	26.0	218	273	
Hori.	841.087	QP	21.67	21.14	10.85	31.27	0.00	22.39	46.00	23.6	100	1	
Hori.	2352.031	PK	52.04	27.14	13.53	44.12	2.41	51.00	73.90	22.9	134	249	
Hori.	2483.500	PK	57.26	27.55	13.65	44.16	2.41	56.71	73.90	17.1	150	241	
Hori.	4960.000	PK	52.16	31.83	5.59	44.51	2.41	47.48	73.90	26.4	197	29	
Hori.	7440.000	PK	48.15	36.97	6.92	44.08	2.41	50.37	73.90	23.5	150	0	
Hori.	9920.000	PK	48.13	38.98	8.04	43.87	2.41	53.69	73.90	20.2	150	0	
Vert.	30.440	QP	31.05	17.31	6.64	32.13	0.00	22.87	40.00	17.1	102	242	
Vert.	46.768	QP	23.65	11.73	6.93	32.12	0.00	10.19	40.00	29.8	100	151	
Vert.	76.001	QP	33.61	6.22	7.44	32.10	0.00	15.17	40.00	24.8	100	195	
Vert.	677.728	QP	21.74	19.44	10.31	31.79	0.00	19.70	46.00	26.3	100	1	
Vert.	2483.500	PK	56.39	27.55	13.65	44.16	2.41	55.84	73.90	18.0	216	30	
Vert.	4960.000	PK	51.26	31.83	5.59	44.51	2.41	46.58	73.90	27.3	256	69	
Vert.	7440.000	PK	48.44	36.97	6.92	44.08	2.41	50.66	73.90	23.2	150	0	
Vert.	9920.000	PK	48.76	38.98	8.04	43.87	2.41	54.32	73.90	19.5	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(3.96 m / 3.0 m) = 2.41 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.	2352.031	AV	43.10	27.14	13.53	44.12	3.92	2.41	45.98	53.90	7.9	
Hori.	2483.500	AV	40.46	27.55	13.65	44.16	3.92	2.41	43.83	53.90	10.1	*1)
Hori.	4960.000	AV	44.44	31.83	5.59	44.51	3.92	2.41	43.68	53.90	10.2	
Hori.	7440.000	AV	38.55	36.97	6.92	44.08	3.92	2.41	44.69	53.90	9.2	
Hori.	9920.000	AV	38.71	38.98	8.04	43.87	3.92	2.41	48.19	53.90	5.7	
Vert.	2483.500	AV	40.49	27.55	13.65	44.16	3.92	2.41	43.86	53.90	10.0	*1)
Vert.	4960.000	AV	42.43	31.83	5.59	44.51	3.92	2.41	41.67	53.90	12.2	
Vert.	7440.000	AV	37.98	36.97	6.92	44.08	3.92	2.41	44.12	53.90	9.8	
Vert.	9920.000	AV	38.20	38.98	8.04	43.87	3.92	2.41	47.68	53.90	6.2	

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(3.96 m / 3.0 m) = 2.41 dB

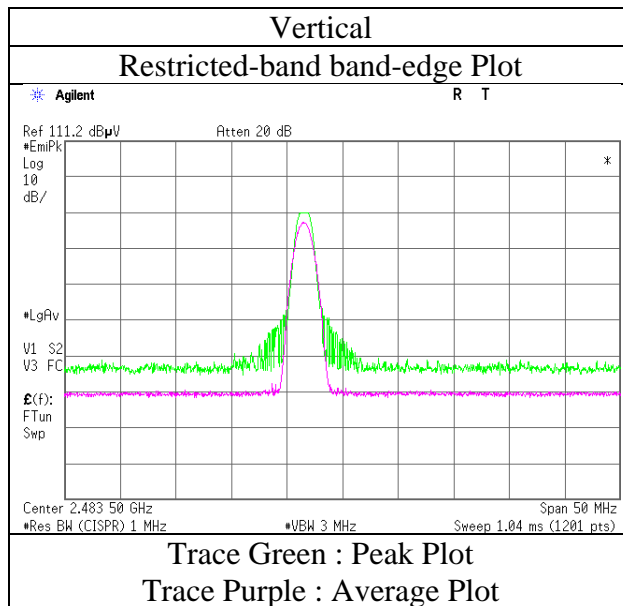
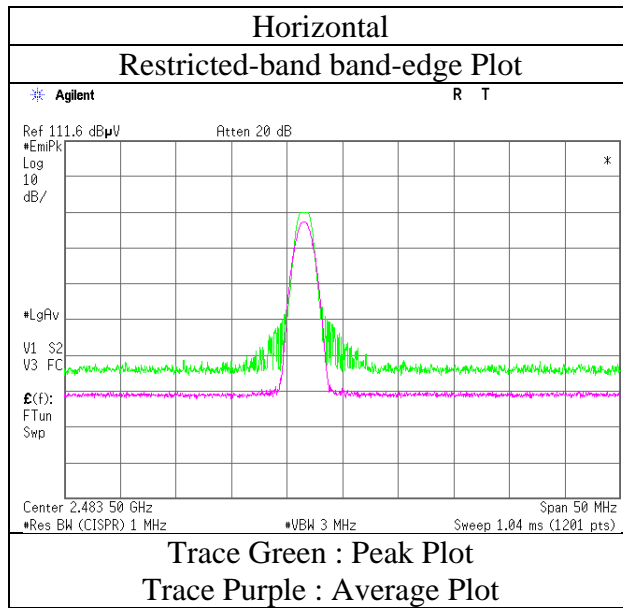
13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

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

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

Radiated Spurious Emission
(Reference Plot for band-edge)

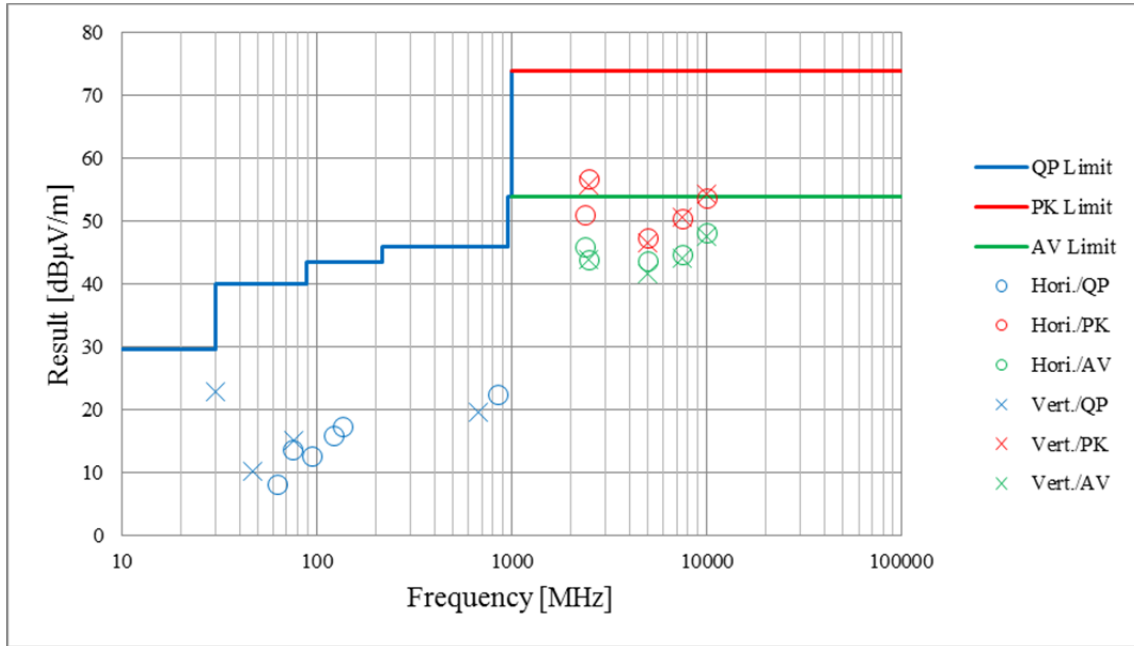
Report No.	11920648S-D-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3AC
Date	December 24, 2017
Temperature / Humidity	21 deg.C / 31 %RH
Engineer	Kazutaka Takeyama
Mode	Tx BT LE 2480 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

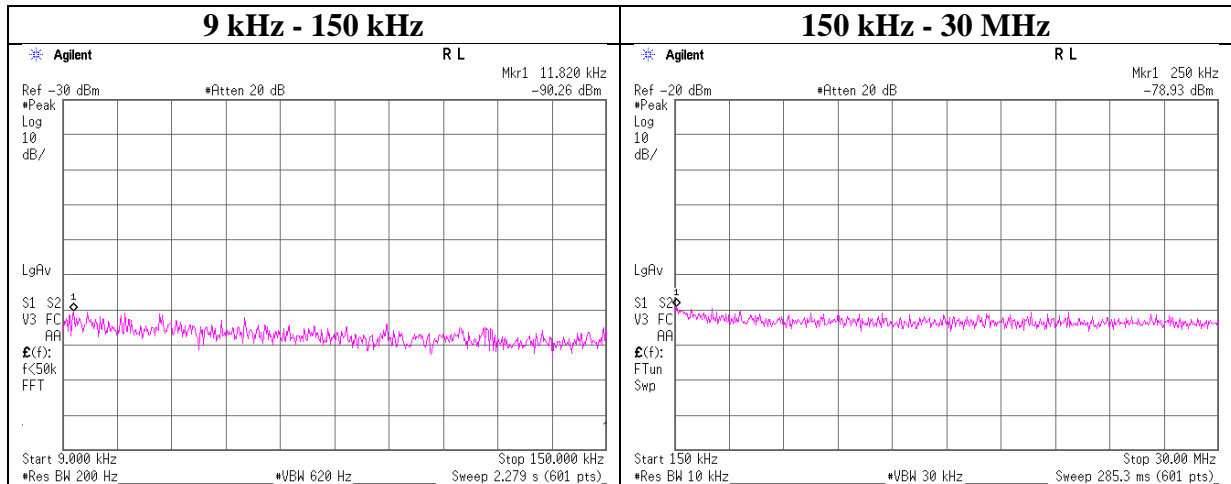
Report No.	11920648S-D-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	3AC	3AC
Date	December 23, 2017	December 24, 2017
Temperature / Humidity	22 deg.C / 24 %RH	21 deg.C / 31 %RH
Engineer	Kazuya Noda	Kazutaka Takeyama
	(30 MHz - 1 GHz)	(1 GHz - 26.5 GHz)
Mode	Tx BT LE 2480 MHz	



*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.	11920648S-D-R1
Date	December 6, 2017
Temperature / Humidity	20 deg. C / 37 % RH
Engineer	Hiroyuki Morikawa
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
11.82	-90.3	0.01	9.5	2.7	1	-78.0	300	6.0	-16.8	46.1	62.9	
250.00	-78.9	0.02	9.5	2.7	1	-66.7	300	6.0	-5.4	19.6	25.0	

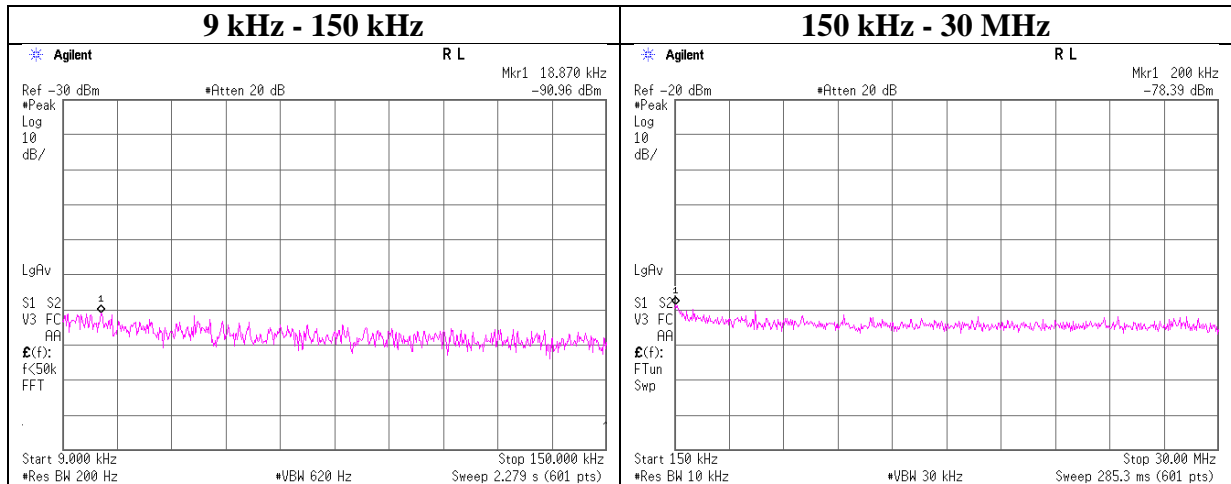
$$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$$

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

N: Number of output

Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11920648S-D-R1
Date	December 6, 2017
Temperature / Humidity	20 deg. C / 37 % RH
Engineer	Hiroyuki Morikawa
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
18.87	-91.0	0.01	9.5	2.7	1	-78.7	300	6.0	-17.5	42.0	59.5	
200.00	-78.4	0.02	9.5	2.7	1	-66.1	300	6.0	-4.9	21.5	26.4	

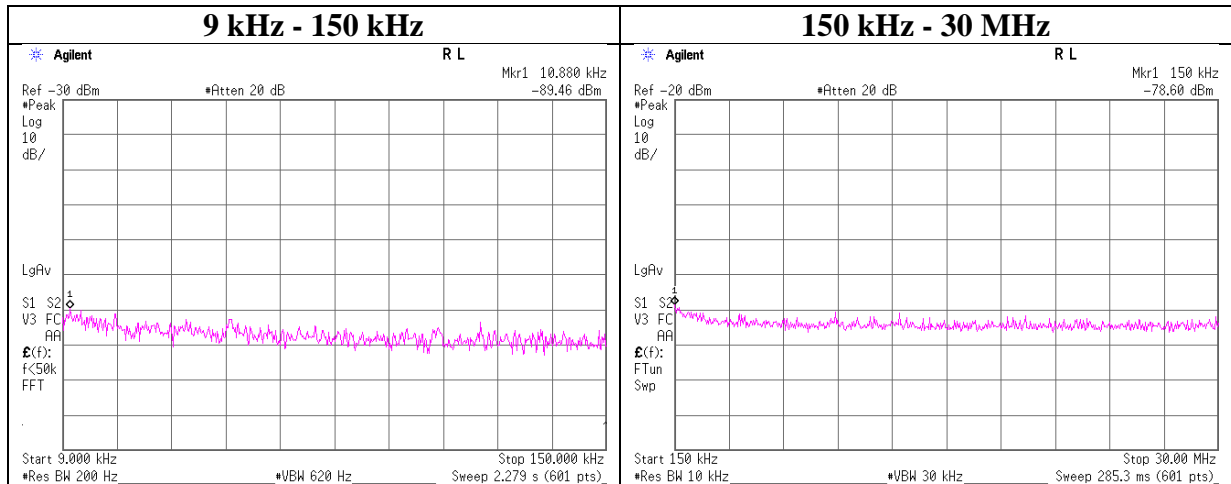
$$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$$

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

N: Number of output

Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11920648S-D-R1
Date	December 6, 2017
Temperature / Humidity	20 deg. C / 37 % RH
Engineer	Hiroyuki Morikawa
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
10.88	-89.5	0.01	9.5	2.7	1	-77.2	300	6.0	-16.0	46.8	62.8	
150.00	-78.6	0.02	9.5	2.7	1	-66.3	300	6.0	-5.1	24.0	29.1	

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

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

N: Number of output

Power Density

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11920648S-D-R1
Date December 6, 2017
Temperature / Humidity 20 deg. C / 37 % RH
Engineer Hiroyuki Morikawa
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-31.78	2.02	9.68	-20.08	8.00	28.08
2440.00	-31.38	2.03	9.67	-19.68	8.00	27.68
2480.00	-30.80	2.04	9.67	-19.09	8.00	27.09

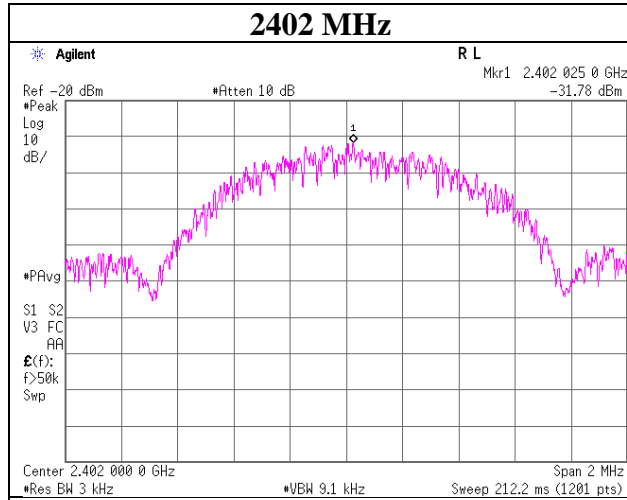
Sample Calculation:

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

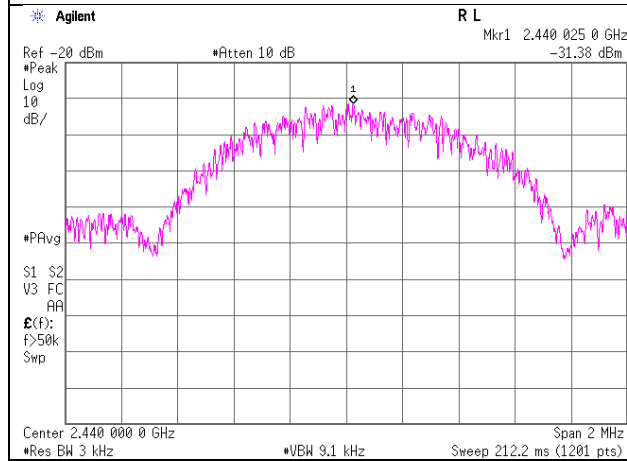
Power Density

BTLE

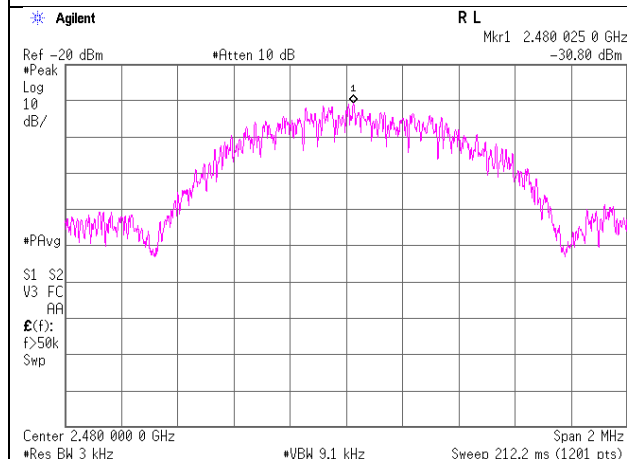
2402 MHz



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)
SRENT-08	Spectrum Analyzer	Agilent	E4448A	MY50180019	AT	2017/10/12 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2017/05/01 * 12
SPSS-05	Power sensor	Agilent	N1923A	MY5349008	AT	2017/05/01 * 12
SCC-G14	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	AT	2017/03/23 * 12
SAT10-09	Attenuator	Weinschel Corp.	54A-10	W5692	AT	2017/11/22 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2016/12/13 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2017/03/23 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000 KM SKMS	-	RE	2017/04/20 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM9861	RE	2017/07/11 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26 W	00000019	RE	2017/03/17 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2017/06/11 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2017/10/30 * 12
STR-08	Test Receiver	Rohde & Schwarz	ESW44	101581	RE	2017/11/24 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFI,MF)	-	RE,CE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2017/10/16 * 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/SRSE-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
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	2046104	RE	2017/09/22 * 12
SCC-G05	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	RE	2017/01/08 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2017/05/08 * 12
SCC-G40	Coaxial Cable	Junkosha	MWX221-01000 NF SNMS/B	1612S005	RE	2017/01/08 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2017/08/23 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2017/10/10 * 12
SAEC-03(SVSW R)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	RE	2017/07/17 * 12
SAT10-05	Attenuator (above 1GHz)	Agilent	8493C-010	74864	RE	2017/11/22 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2017/11/16 * 12
SCC-A12/A13/SRSE-01	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-269(RF Selector)	CE	2017/04/07 * 12
SLS-02	LISN	Rohde & Schwarz	ENV216	100512	CE	2017/02/10 * 12
SAT3-07	Attenuator	JFW	50HF-003N	-	CE	2017/09/08 * 12
SOS-15	Humidity Indicator	A&D	AD-5681	7478311	CE	2017/02/21 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	CE	2017/04/12 * 12
KJM-09	Measure	KOMELON	KMC-36	-	CE	-
STS-01	Digital Hitester	Hioki	3805-50	080997812	CE	2017/10/16 * 12

*Hyphens for Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

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.

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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