




# RADIO TEST REPORT


Test Report No. : 11701947H-A

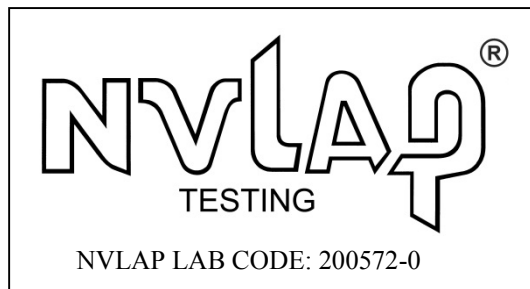
**Applicant** : **Hosiden Corporation**  
**Type of Equipment** : **Sensor Beacon**  
**Model No.** : **TMX-CB10**  
**FCC ID** : **VIYHRM5087**  
**Test regulation** : **FCC Part 15 Subpart C: 2016**  
**\*Antenna Terminal Conducted Tests only**  
**Test Result** : **Complied**

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. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
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:** February 16, 2017

**Representative test engineer:**   
Yuta Moriya  
Engineer  
Consumer Technology Division

**Approved by:**   
Takayuki Shimada  
Engineer  
Consumer Technology Division



This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.  
\*As for the range of Accreditation in NVLAP, you may refer to the WEB address,  
[http://japan.ul.com/resources/emc\\_accredited/](http://japan.ul.com/resources/emc_accredited/)



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## **SECTION 1: Customer information**

Company Name : Hosiden Corporation  
Address : 4-33, Kitakyuhoji 1 chome, Yao-city, Osaka, 581-0071  
Telephone Number : +81-72-924-1153  
Facsimile Number : +81-72-996-4672  
Contact Person : Tomoki Umeda

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

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

Type of Equipment : Sensor Beacon  
Model No. : TMX-CB10  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : ACC12V: Typ: DC 14.4 V (DC 10.8 V - 15.1 V)  
ACC24V: Typ: DC 28.0 V (DC 21.0 V - 30.0 V)  
Receipt Date of Sample : February 16, 2017  
Country of Mass-production : China  
Condition of EUT : Production 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: TMX-CB10 (referred to as the EUT in this report) is a Sensor Beacon.

### **General Specification**

Clock frequency(ies) in the system : Main: 32 MHz, Sub: 32.768 kHz

### **Radio Specification**

#### **Bluetooth Low Energy**

Radio Type : Transmitter  
Frequency of Operation : 2402 MHz - 2480 MHz  
Modulation : GFSK  
Power Supply (radio part input) : DC 1.29 V  
Antenna type :  $\lambda/4$  inverted-Fantenna  
Antenna Gain : 0.5 dBi

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

#### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016

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

#### **3.2 Procedures and results**

Item	Test Procedure	Specification	Worst margin	Results	Remarks
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 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 v03r05 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 v03r05 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 v03r05 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10		-	Complied

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

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

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

The test was performed with the New Battery (DC 1.29 V) and the stable voltage was supplied to the EUT during the tests. 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  $k = 2$ .  
Ise EMC Lab.

Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz -3 GHz	3 GHz -18 GHz	18 GHz -26.5 GHz	26.5 GHz -40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.5 dB	2.8 dB	2.8 dB	2.9 dB	2.6 dB

### 3.5 Test Location

UL Japan, Inc. Ise EMC Lab. \*NVLAP Lab. code: 200572-0  
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN  
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

\* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

### 3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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Facsimile : +81 596 24 8124

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

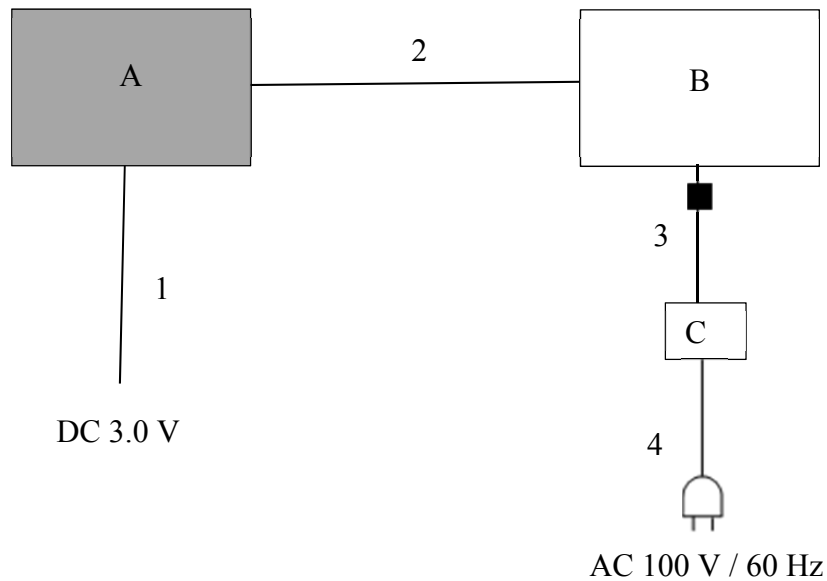
### **4.1 Operating Mode(s)**

<b>Mode</b>	<b>Remarks*</b>
Bluetooth Low Energy (BT LE)	Maximum Packet Size, PRBS9
*Power of the EUT was set by the software as follows; Power settings: 4 dBm Software: HRM5087_RadioTest_NoSoftDevice_161026.hex *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)

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested frequency</b>
Spurious Emission (Conducted), 6dB Bandwidth, Maximum Peak Output Power, Power Density, 99% Occupied Bandwidth	BT LE Tx	2402 MHz 2440 MHz 2480 MHz

## 4.2 Configuration and peripherals



■ : Standard Ferrite Core

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

### Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Sensor Beacon	TMX-CB10	1	Hosiden Corporation	EUT
B	Laptop PC	CF-N8HWCDPS	OBKSA08702	Panasonic	-
C	AC Adapter	CF-AA6373B M4	6372BM409X21200B	Panasonic	-

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.5	Unshielded	Unshielded	-
2	USB Cable	1.8	Shielded	Shielded	-
3	DC Cable	0.9	Unshielded	Unshielded	-
4	AC Cable	0.8	Unshielded	Unshielded	-

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## **SECTION 5: 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	3 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	10 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	9.1 kHz	27 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 v03r05".

\*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 = 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**

**6dB Bandwidth**

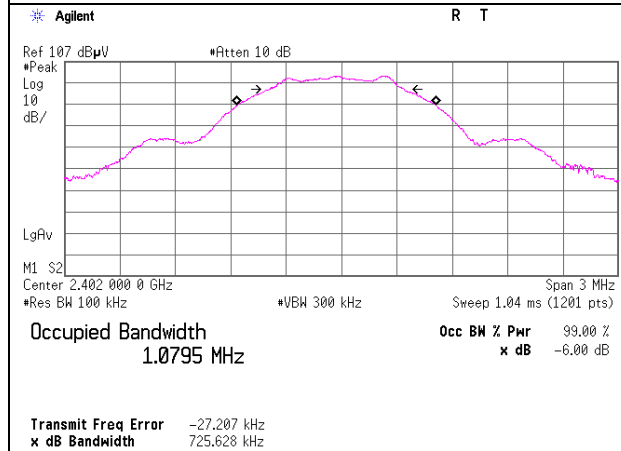
Test place Ise EMC Lab. No.3 Measurement Room  
Report No. 11701947H  
Date February 16, 2017  
Temperature / Humidity 23 deg. C / 36 % RH  
Engineer Yuta Moriya  
Mode Tx BT LE

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
BTLE	2402	0.726	> 500
	2440	0.693	> 500
	2480	0.701	> 500

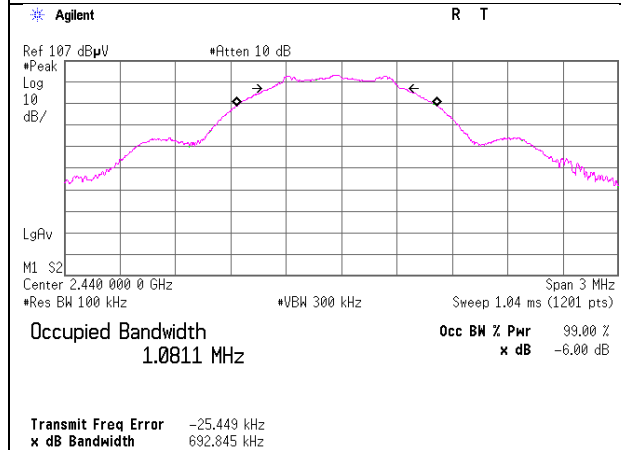
## 6dB Bandwidth

### BTLE

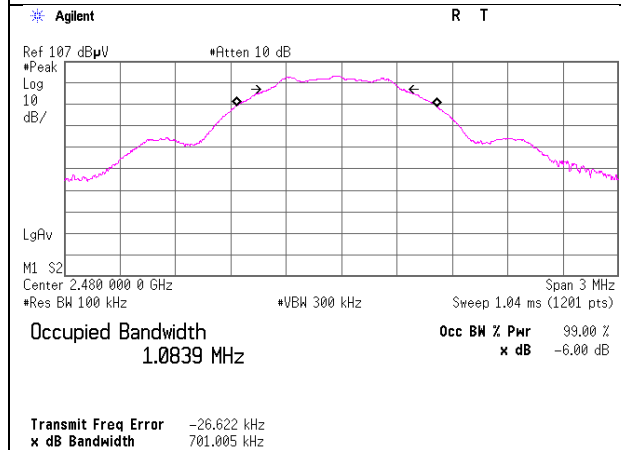
#### 2402 MHz



#### 2440 MHz



#### 2480 MHz



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### Maximum Peak Output Power

Test place Ise EMC Lab. No.3 Measurement Room  
Report No. 11701947H  
Date February 16, 2017  
Temperature / Humidity 23 deg. C / 36 % RH  
Engineer Yuta Moriya  
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-6.67	1.39	10.05	4.76	2.99	30.00	1000	25.24
2440	-6.74	1.39	10.05	4.70	2.95	30.00	1000	25.30
2480	-6.86	1.40	10.05	4.60	2.88	30.00	1000	25.40

Sample Calculation:

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

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

**Average Output Power**  
**(Reference data for RF Exposure / SAR testing)**

Test place : Ise EMC Lab. No.3 Measurement Room  
Report No. : 11701947H  
Date : February 16, 2017  
Temperature / Humidity : 23 deg. C / 36 % RH  
Engineer : Yuta Moriya  
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	-7.07	1.39	10.05	4.36	2.73	0.23	4.59	2.88
2440	-7.14	1.39	10.05	4.30	2.69	0.23	4.53	2.84
2480	-7.19	1.40	10.05	4.27	2.67	0.23	4.50	2.82

Sample Calculation:

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

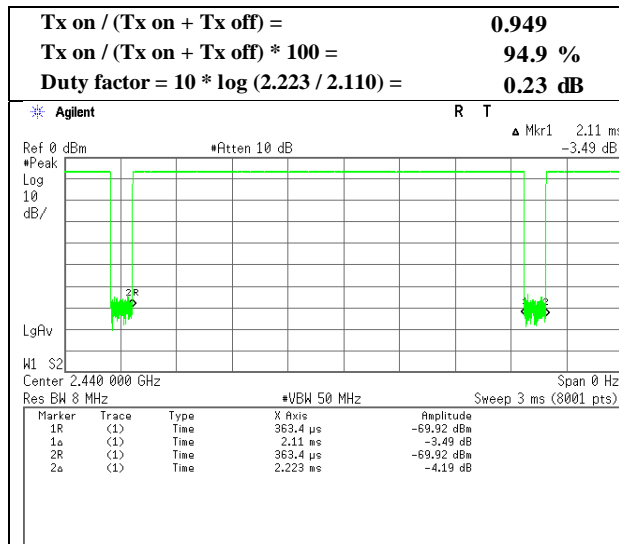
Result (Burst power average) = Time average + Duty factor

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

## Burst rate confirmation

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11701947H
Date	February 16, 2017
Temperature / Humidity	23 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Tx BT LE

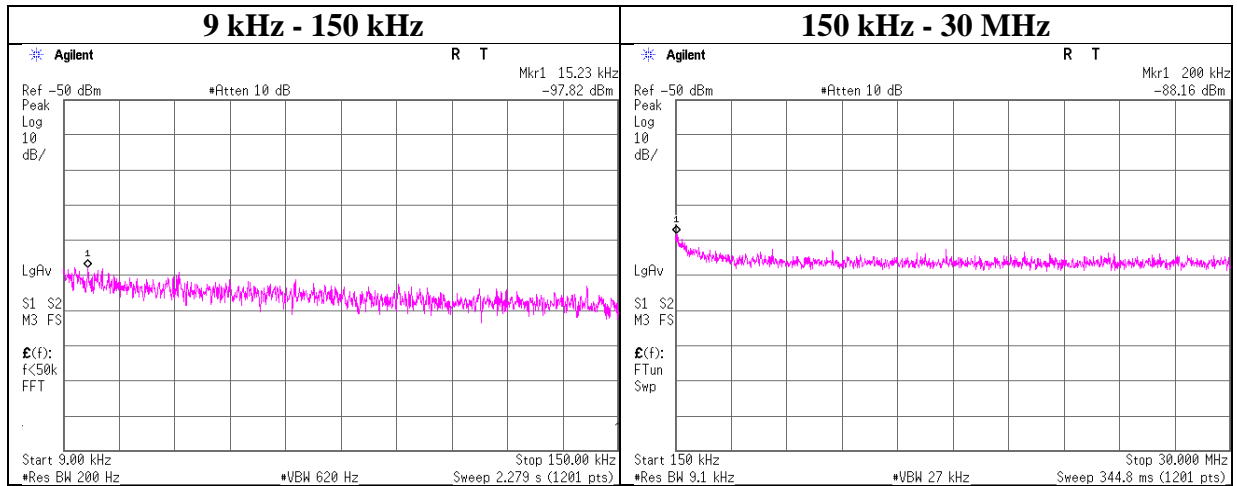
### BTLE



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

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11701947H
Date	February 16, 2017
Temperature / Humidity	23 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Tx BT LE 2402MHz



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
15.23	-97.8	0.07	9.9	2.0	1	-85.9	300	6.0	-24.6	43.9	68.5	
200.00	-88.2	0.31	9.9	2.0	1	-76.0	300	6.0	-14.7	21.5	36.2	

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

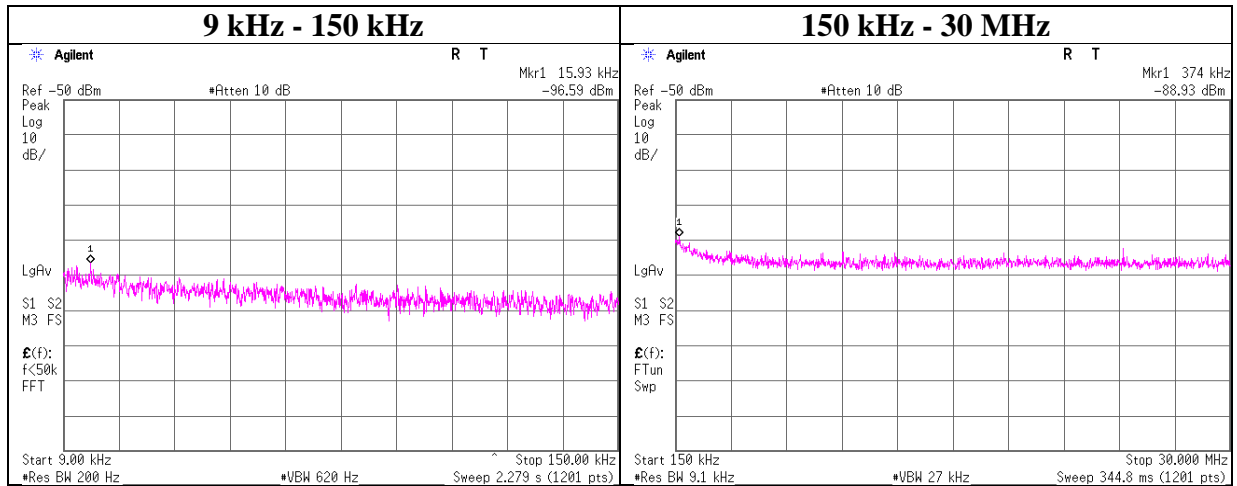
$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$$

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	Ise EMC Lab. No.3 Measurement Room
Report No.	11701947H
Date	February 16, 2017
Temperature / Humidity	23 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Tx BT LE 2440MHz



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
15.93	-96.6	0.07	9.9	2.0	1	-84.7	300	6.0	-23.4	43.5	66.9	
374.00	-88.9	0.53	9.9	2.0	1	-76.5	300	6.0	-15.2	16.1	31.3	

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

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

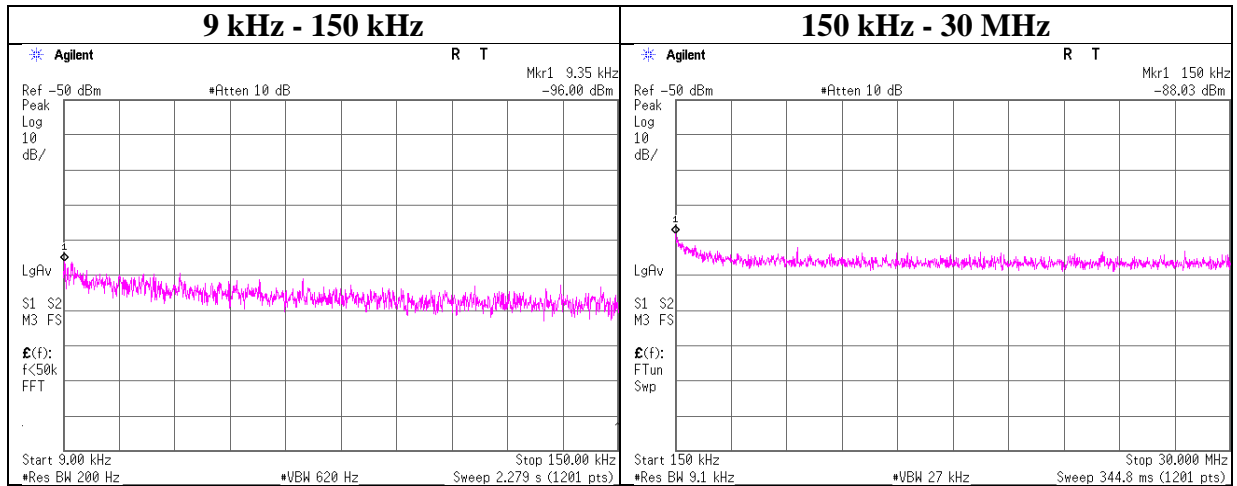
N: Number of output

\*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	Ise EMC Lab. No.3 Measurement Room
Report No.	11701947H
Date	February 16, 2017
Temperature / Humidity	23 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Tx BT LE 2480MHz



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
9.35	-96.0	0.06	9.8	2.0	1	-84.1	300	6.0	-22.8	48.1	70.9	
150.00	-88.0	0.26	9.9	2.0	1	-75.9	300	6.0	-14.6	24.0	38.6	

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

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

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.

### Power Density

Test place Ise EMC Lab. No.3 Measurement Room  
Report No. 11701947H  
Date February 16, 2017  
Temperature / Humidity 23 deg. C / 36 % RH  
Engineer Yuta Moriya  
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-18.45	1.39	10.05	-7.02	8.00	15.02
2440.00	-19.40	1.39	10.05	-7.96	8.00	15.96
2480.00	-20.14	1.40	10.05	-8.68	8.00	16.68

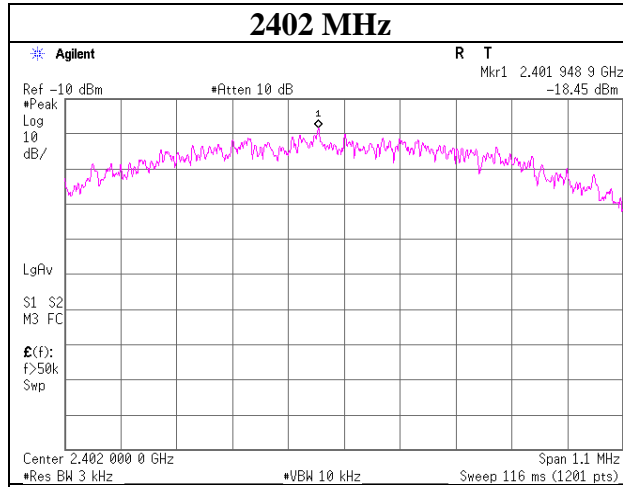
Sample Calculation:

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

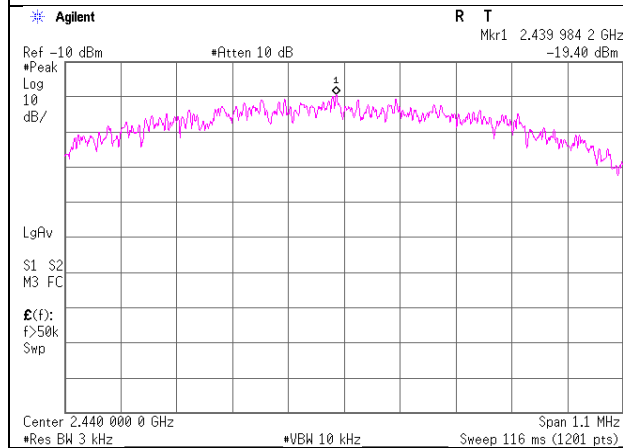
**Power Density**

**BTLE**

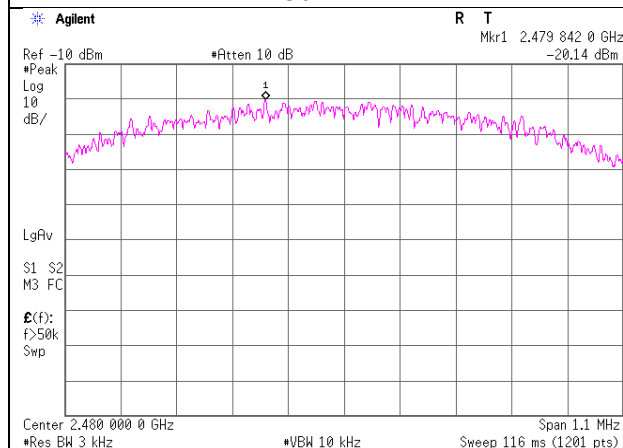
**2402 MHz**



**2440 MHz**



**2480 MHz**



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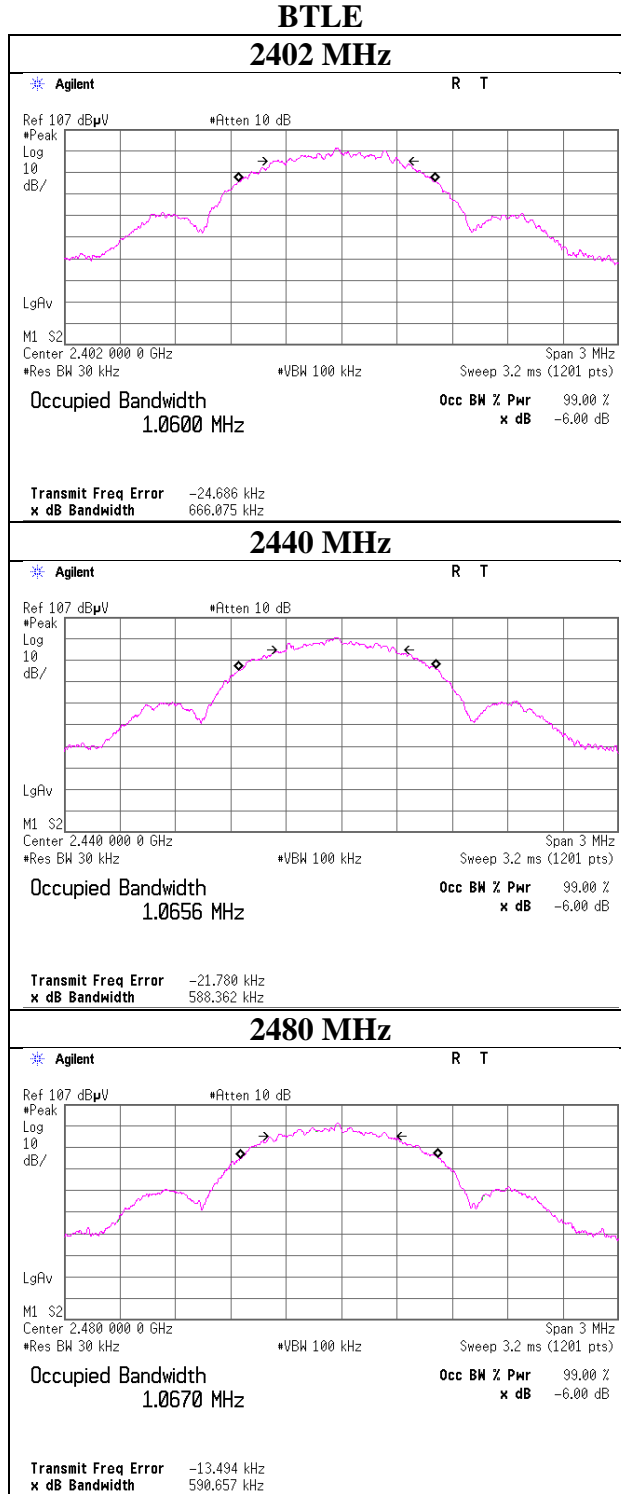
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## 99% Occupied Bandwidth

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11701947H
Date	February 16, 2017
Temperature / Humidity	23 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Tx BT LE



**UL Japan, Inc.**

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## **APPENDIX 2: Test instruments**

### **Test equipment**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	AT	2016/05/19 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2016/10/17 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2016/10/17 * 12
MCC-67	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	AT	2016/04/18 * 12
MAT-57	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2016/12/15 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	AT	2016/03/10 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2016/11/28 * 12
MOS-29	Thermo-Hygrometer	Custom	CTH-201	2901	AT	2017/01/20 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	AT	2017/01/19 * 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: AT: Antenna Terminal Conducted test**

**End of Report**

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**Ise EMC Lab.**

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