# FCC Test Report

| | |
|---|---|
| Product Name | Swaive Thermometer |
| Model No. | SWT1A |
| FCC ID. | 2AEOA-SWT1A |

| | |
|---|---|
| Applicant | Swaive Corporation |
| Address | 1400 Coleman Ave, Suite A21,Santa Clara, CA 95050 USA |

| | |
|---|---|
| Date of Receipt | Apr. 04, 2015 |
| Issued Date | May 12, 2015 |
| Report No. | 1550091R-RFUSP01V00 |
| Report Version | V1.0 |

Testing Laboratory
3023

The test results relate only to the samples tested.
The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.
This report must not be used to claim product endorsement by TAF or any agency of the government.
The test report shall not be reproduced without the written approval of QuieTek Corporation.

# Test Report

Issued Date: May 12, 2015
Report No.: 1550091R-RFUSP01V00

| | |
|---|---|
| Product Name | Swaive Thermometer |
| Applicant | Swaive Corporation |
| Address | 1400 Coleman Ave, Suite A21,Santa Clara, CA 95050 USA |
| Manufacturer | E-Care Technology Co., Ltd. |
| Model No. | SWT1A |
| FCC ID. | 2AEOA-SWT1A |
| EUT Rated Voltage | DC 3V (By battery*2) |
| EUT Test Voltage | DC 3V (By battery*2) |
| Trade Name | Care |
| Applicable Standard | FCC CFR Title 47 Part 15 Subpart C: 2014<br>ANSI C63.4: 2009, ANSI C63.10: 2009<br>KDB 558074 D01 DTS Meas Guidance v03r02 |
| Test Result | Complied |

Documented By : Joanne Lin

( Senior Adm. Specialist / Joanne Lin )

Tested By : Ivan Chuang

( Assistant Engineer / Ivan Chuang )

Approved By :

( Director / Vincent Lin )

# TABLE OF CONTENTS

Description Page

**1. GENERAL INFORMATION ..... 4**
1.1. EUT Description ..... 4
1.2. Operational Description ..... 6
1.3. Tested System Details ..... 7
1.4. Configuration of Tested System ..... 7
1.5. EUT Exercise Software ..... 7
1.6. Test Facility ..... 8
**2. CONDUCTED EMISSION ..... 9**
2.1. Test Equipment ..... 9
2.2. Test Setup ..... 9
2.3. Limits ..... 10
2.4. Test Procedure ..... 10
2.5. Uncertainty ..... 10
2.6. Test Result of Conducted Emission ..... 11
**3. PEAK POWER OUTPUT ..... 12**
3.1. Test Equipment ..... 12
3.2. Test Setup ..... 12
3.3. Limit ..... 12
3.4. Test Procedure ..... 12
3.5. Uncertainty ..... 12
3.6. Test Result of Peak Power Output ..... 13
**4. RADIATED EMISSION ..... 14**
4.1. Test Equipment ..... 14
4.2. Test Setup ..... 15
4.3. Limits ..... 16
4.4. Test Procedure ..... 17
4.5. Uncertainty ..... 17
4.6. Test Result of Radiated Emission ..... 18
**5. RF ANTENNA CONDUCTED TEST ..... 22**
5.1. Test Equipment ..... 22
5.2. Test Setup ..... 22
5.3. Limits ..... 22
5.4. Test Procedure ..... 22
5.5. Uncertainty ..... 22
5.6. Test Result of RF Antenna Conducted Test ..... 23
**6. BAND EDGE ..... 24**
6.1. Test Equipment ..... 24
6.2. Test Setup ..... 25
6.3. Limit ..... 26
6.4. Test Procedure ..... 26
6.5. Uncertainty ..... 26
6.6. Test Result of Band Edge ..... 27
**7. OCCUPIED BANDWIDTH (6DB BW) ..... 31**
7.1. Test Equipment ..... 31
7.2. Test Setup ..... 31
7.3. Limits ..... 31
7.4. Test Procedure ..... 31
7.5. Uncertainty ..... 31
7.6. Test Result of Occupied Bandwidth ..... 32
**8. POWER DENSITY ..... 34**
8.1. Test Equipment ..... 34
8.2. Test Setup ..... 34
8.3. Limits ..... 34
8.4. Test Procedure ..... 34
8.5. Uncertainty ..... 34
8.6. Test Result of Power Density ..... 35
**9. EMI REDUCTION METHOD DURING COMPLIANCE TESTING ..... 37**
Attachment 1: EUT Test Photographs
Attachment 2: EUT Detailed Photographs

# 1. GENERAL INFORMATION

## 1.1. EUT Description

| | |
|---|---|
| Product Name | Swaive Thermometer |
| Trade Name | Care |
| Model No. | SWT1A |
| FCC ID. | 2AEOA-SWT1A |
| Frequency Range | 2402 – 2480MHz |
| Channel Number | V4.0: 40CH |
| Type of Modulation | V4.0: GFSK(1Mbps) |
| Antenna Type | PCB printed Antenna |
| Channel Control | Auto |
| Antenna Gain | Refer to the table “Antenna List” |

**Antenna List**

| No. | Manufacturer | Part No. | Antenna Type | Peak Gain |
|---|---|---|---|---|
| 1 | Care | N/A | PCB printed | -0.2dBi for 2.4GHz |

Note: The antenna of EUT is conforming to FCC 15.203.

Center Frequency of Each Channel: (For V4.0)

| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---|---|---|---|---|---|---|---|
| Channel 00: | 2402 MHz | Channel 01: | 2404 MHz | Channel 02: | 2406 MHz | Channel 03: | 2408 MHz |
| Channel 04: | 2410 MHz | Channel 05: | 2412 MHz | Channel 06: | 2414 MHz | Channel 07: | 2416 MHz |
| Channel 08: | 2418 MHz | Channel 09: | 2420 MHz | Channel 10: | 2422 MHz | Channel 11: | 2424 MHz |
| Channel 12: | 2426 MHz | Channel 13: | 2428 MHz | Channel 14: | 2430 MHz | Channel 15: | 2432 MHz |
| Channel 16: | 2434 MHz | Channel 17: | 2436 MHz | Channel 18: | 2438 MHz | Channel 19: | 2440 MHz |
| Channel 20: | 2442 MHz | Channel 21: | 2444 MHz | Channel 22: | 2446 MHz | Channel 23: | 2448 MHz |
| Channel 24: | 2450 MHz | Channel 25: | 2452 MHz | Channel 26: | 2454 MHz | Channel 27: | 2456 MHz |
| Channel 28: | 2458 MHz | Channel 29: | 2460 MHz | Channel 30: | 2462 MHz | Channel 31: | 2464 MHz |
| Channel 32: | 2466 MHz | Channel 33: | 2468 MHz | Channel 34: | 2470 MHz | Channel 35: | 2472 MHz |
| Channel 36: | 2474 MHz | Channel 37: | 2476 MHz | Channel 38: | 2478 MHz | Channel 39: | 2480 MHz |

Note:

1. The EUT is a Swaive Thermometer with a built-in Bluetooth V4.0 transceiver.
2. These tests were conducted on a sample for the purpose of demonstrating compliance of Bluetooth transmitter with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

| | |
|---|---|
| Test Mode | Mode 1: Transmit - BLE (GFSK) |

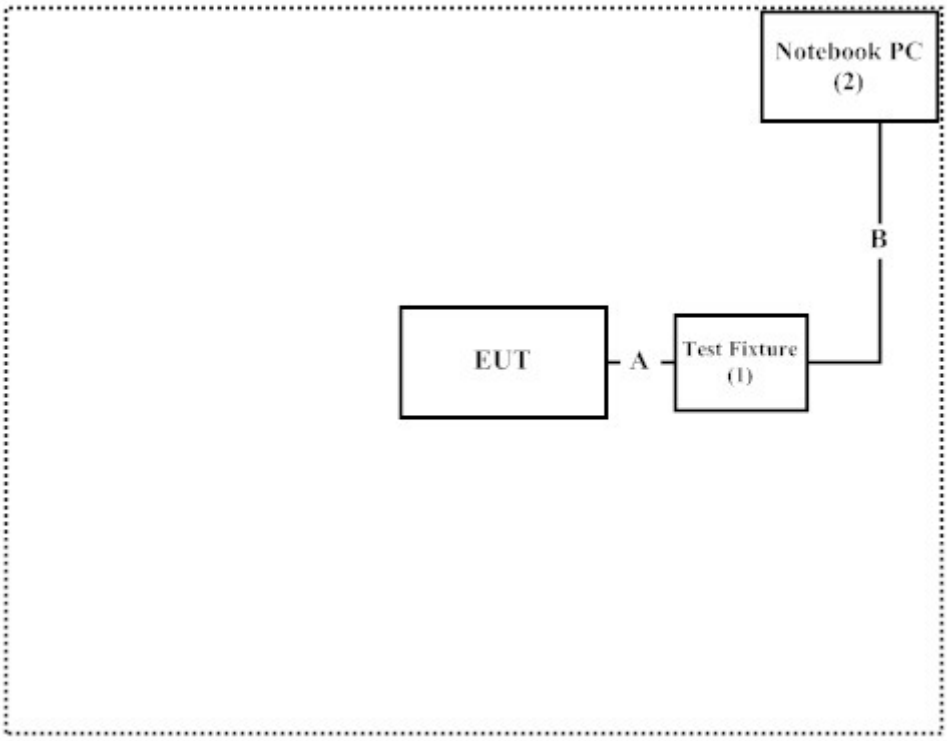
## 1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

| Product | | Manufacturer | Model No. | Serial No. | Power Cord |
|---|---|---|---|---|---|
| 1 | Test Fixture | Universal Testing Inc. | N/A | N/A | N/A |
| 2 | Notebook PC | DELL | PP18L | 36119001664 | Non-Shielded, 0.8m |

| Signal Cable Type | | Signal cable Description |
|---|---|---|
| A | Signal Cable | Non-Shielded, 0.23m |
| B | RS-232 Cable | Shielded, 1m |

## 1.4. Configuration of Tested System




## 1.5. EUT Exercise Software

1. Setup the EUT as shown in Section 1.4.
2. Execute software “MS-Dos” on the Notebook PC.
3. Configure the test mode, the test channel, and the data rate.
4. Press “OK” to start the continuous Transmit.
5. Verify that the EUT works properly.

## 1.6. Test Facility

Ambient conditions in the laboratory:

| Items | Required (IEC 68-1) | Actual |
|---|---|---|
| Temperature (°C) | 15-35 | 20-35 |
| Humidity (%RH) | 25-75 | 30-65 |
| Barometric pressure (mbar) | 860-1060 | 950-1000 |

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site: http://www.quietek.com/chinese/about/certificates.aspx?bval=5

The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site: http://www.quietek.com/

Site Description: File on
Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Registration Number: 92195

Site Name: Quietek Corporation
Site Address: No.5-22, Ruishukeng,
Linkou Dist. New Taipei City 24451,
Taiwan, R.O.C.
TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com

FCC Accreditation Number: TW1014

# 2. Conducted Emission

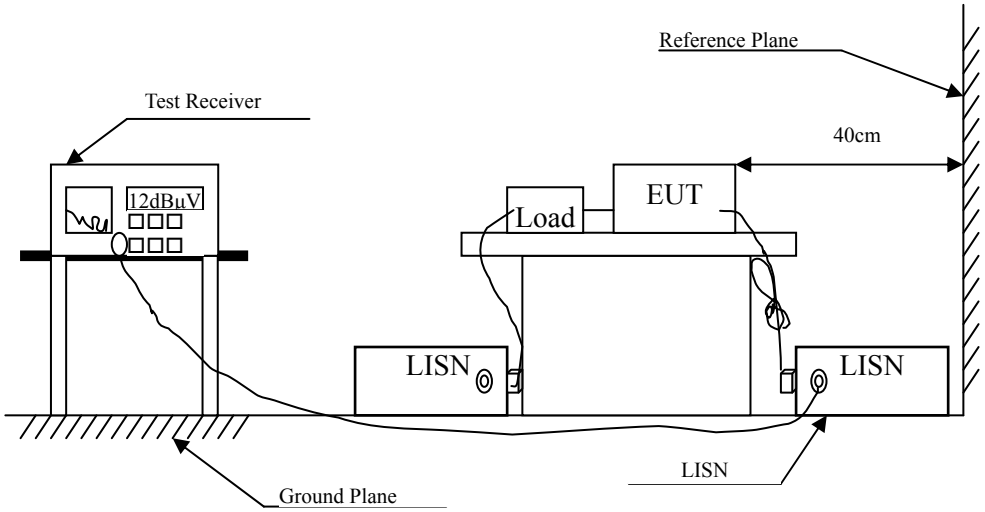
## 2.1. Test Equipment

| | Equipment | Manufacturer | Model No. / Serial No. | Last Cal. | Remark |
|---|---|---|---|---|---|
| X | Test Receiver | R & S | ESCS 30 / 825442/018 | Sep., 2014 | |
| X | Artificial Mains Network | R & S | ENV4200 / 848411/10 | Feb., 2015 | Peripherals |
| X | LISN | R & S | ESH3-Z5 / 825562/002 | Feb., 2015 | EUT |
| | DC LISN | Schwarzbeck | 8226 / 176 | Mar., 2015 | EUT |
| X | Pulse Limiter | R & S | ESH3-Z2 / 357.8810.52 | Feb., 2015 | |
| | No.1 Shielded Room | | | | |

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked by "X" are used to measure the final test results.

## 2.2. Test Setup



## 2.3. Limits

| FCC Part 15 Subpart C Paragraph 15.207 (dBμV) Limit | | |
|---|---|---|
| Frequency MHz | Limits | |
| | QP | AV |
| 0.15 - 0.50 | 66-56 | 56-46 |
| 0.50-5.0 | 56 | 46 |
| 5.0 - 30 | 60 | 50 |

Remarks: In the above table, the tighter limit applies at the band edges.

## 2.4. Test Procedure

The EUT and Peripherals are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.4: 2009 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

The EUT was setup according to ANSI C63.10: 2009 for compliance to FCC 47CFR 15.247 requirements.

## 2.5. Uncertainty

± 2.26 dB

## 2.6. Test Result of Conducted Emission

Owing to the EUT use battery supply voltage, this test item is not performed.

# 3. Peak Power Output

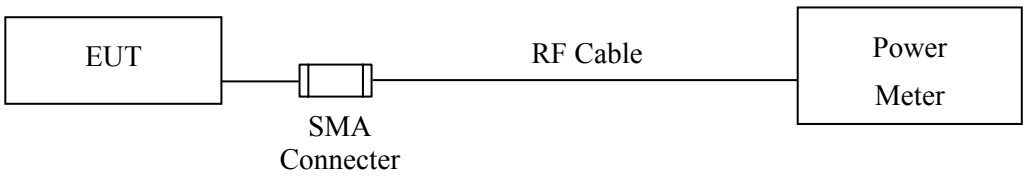
## 3.1. Test Equipment

| | Equipment | Manufacturer | Model No./Serial No. | Last Cal. |
|---|---|---|---|---|
| X | Power Meter | Anritsu | ML2495A/6K00003357 | May, 2015 |
| X | Power Sensor | Anritsu | MA2411B/0738448 | Jun., 2014 |

Note: 1. All equipments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

## 3.2. Test Setup




## 3.3. Limit

The maximum peak power shall be less 1Watt.

## 3.4. Test Procedure

Tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements. The maximum peak conducted output power using KDB 558074 section 9.1.2 PKPM1 Peak power meter method.

## 3.5. Uncertainty

± 1.27 dB

## 3.6. Test Result of Peak Power Output

Product : Swaive Thermometer
Test Item : Peak Power Output
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK)

| Channel No. | Frequency (MHz) | Measurement (dBm) | Required Limit | Result |
|---|---|---|---|---|
| Channel 00 | 2402.00 | 2.19 | 1 Watt= 30 dBm | Pass |
| Channel 19 | 2440.00 | 2.25 | 1 Watt= 30 dBm | Pass |
| Channel 39 | 2480.00 | 2.23 | 1 Watt= 30 dBm | Pass |

# 4. Radiated Emission

## 4.1. Test Equipment

The following test equipments are used during the radiated emission test:

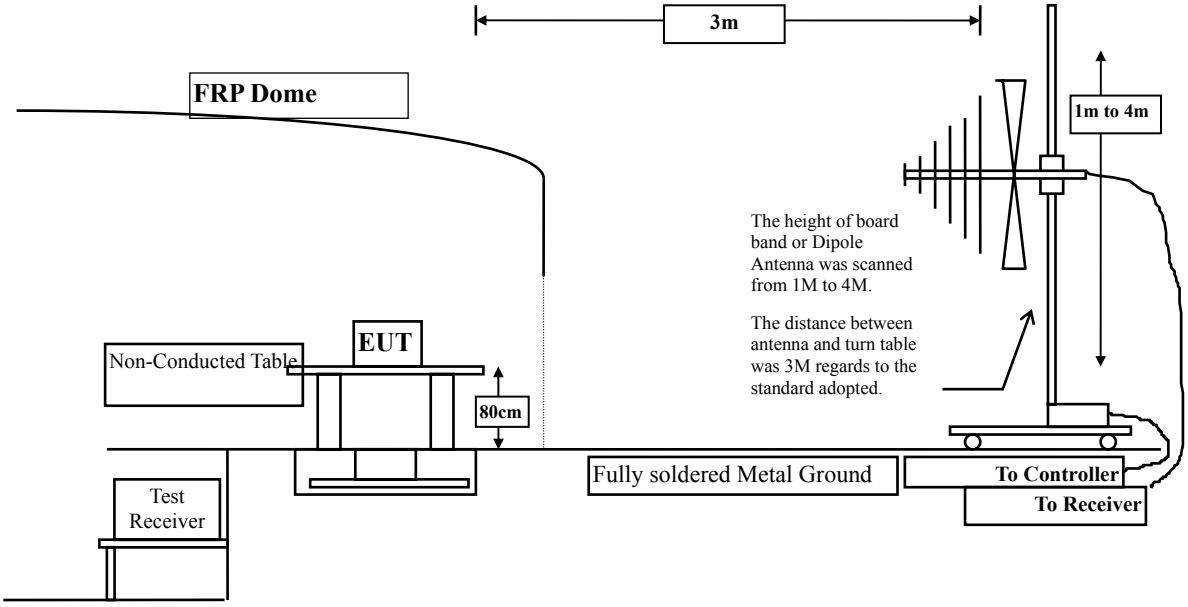
| Test Site | | Equipment | Manufacturer | Model No./Serial No. | Last Cal. |
|---|---|---|---|---|---|
| ☒Site # 3 | X | Loop Antenna | Teseq | HLA6120 / 26739 | Jul., 2014 |
| | X | Bilog Antenna | Schaffner Chase | CBL6112B/2673 | Sep., 2014 |
| | X | Horn Antenna | Schwarzbeck | BBHA9120D/D305 | Sep., 2014 |
| | X | Horn Antenna | Schwarzbeck | BBHA9170/208 | Jul., 2014 |
| | X | Pre-Amplifier | Agilent | 8447D/2944A09549 | Sep., 2014 |
| | X | Spectrum Analyzer | Agilent | E4407B / US39440758 | May, 2015 |
| | X | Test Receiver | R & S | ESCS 30/ 825442/018 | Sep., 2014 |
| | X | Coaxial Cable | QuieTek | QTK-CABLE/ CAB5 | Feb., 2015 |
| | X | Controller | QuieTek | QTK-CONTROLLER/ CTRL3 | N/A |
| | X | Coaxial Switch | Anritsu | MP59B/6200265729 | N/A |

| Test Site | | Equipment | Manufacturer | Model No./Serial No. | Last Cal. |
|---|---|---|---|---|---|
| ☒CB # 8 | X | Spectrum Analyzer | R&S | FSP40/ 100339 | Oct., 2014 |
| | X | Horn Antenna | ETS-Lindgren | 3117/ 35205 | Mar., 2015 |
| | X | Horn Antenna | Schwarzbeck | BBHA9170/209 | Jan., 2015 |
| | X | Horn Antenna | TRC | AH-0801/95051 | Aug., 2014 |
| | X | Pre-Amplifier | EMCI | EMC012630SE/980210 | Jan., 2015 |
| | X | Pre-Amplifier | MITEQ | JS41-001040000-58-5P/153945 | Jul., 2014 |
| | X | Pre-Amplifier | NARDA | DBL-1840N506/013 | Jul., 2014 |

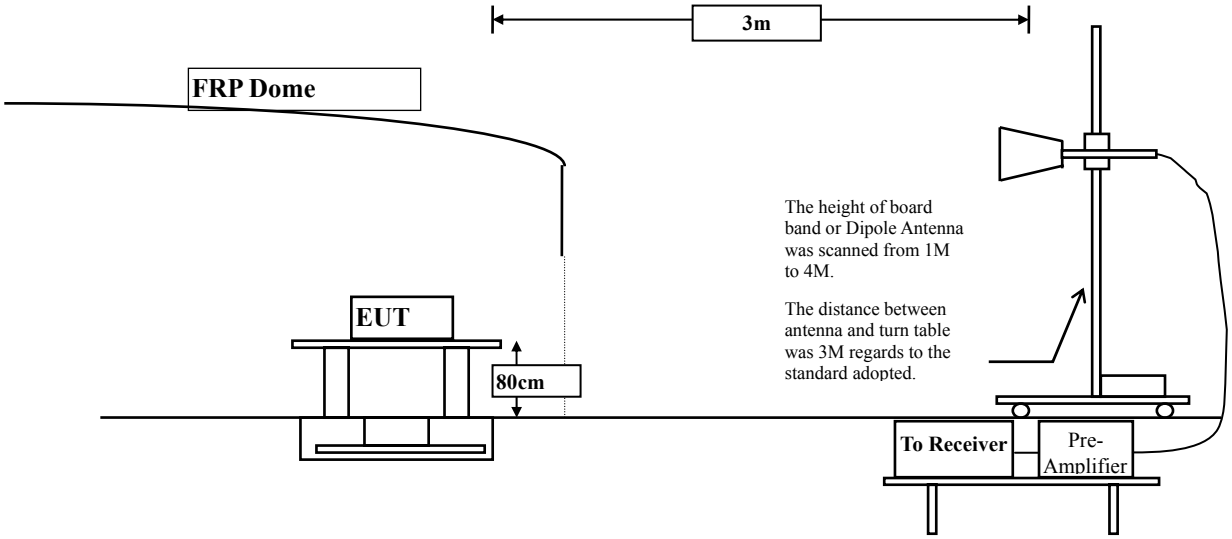
Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

## 4.2. Test Setup

Below 1GHz




Above 1GHz



## 4.3. Limits

➢ **General Radiated Emission Limits**

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

| **FCC Part 15 Subpart C Paragraph 15.209 Limits** | | |
|---|---|---|
| Frequency MHz | Field strength (microvolts/meter) | Measurement distance (meter) |
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

Remarks: 1. RF Voltage (dBμV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

## 4.4. Test Procedure

The EUT was setup according to ANSI C63.10: 2009 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground, the antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2009 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured on the Final Measurement.

The measurement frequency range form 9kHz - 10th Harmonic of fundamental was investigated.

## 4.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

## 4.6. Test Result of Radiated Emission

Product : Swaive Thermometer
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK)(2402MHz)

| Frequency | Correct Factor | Reading Level | Measurement Level | Margin | Limit |
|---|---|---|---|---|---|
| MHz | dB | dBμV | dBμV/m | dB | dBμV/m |
| **Horizontal** | | | | | |
| **Peak Detector:** | | | | | |
| 4804.000 | 3.327 | 42.330 | 45.657 | -28.343 | 74.000 |
| 7206.000 | 10.136 | 40.800 | 50.936 | -23.064 | 74.000 |
| 9608.000 | 13.706 | 40.300 | 54.006 | -19.994 | 74.000 |
| **Average** | | | | | |
| **Detector:** | | | | | |
| 9608.000 | 13.706 | 26.500 | 40.206 | -13.794 | 54.000 |
| **Vertical** | | | | | |
| **Peak Detector:** | | | | | |
| 4804.000 | 6.638 | 42.380 | 49.017 | -24.983 | 74.000 |
| 7206.000 | 11.005 | 41.800 | 52.805 | -21.195 | 74.000 |
| 9608.000 | 14.103 | 40.810 | 54.913 | -19.087 | 74.000 |
| **Average** | | | | | |
| **Detector:** | | | | | |
| 9608.000 | 14.103 | 27.190 | 41.293 | -12.707 | 54.000 |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Swaive Thermometer
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

| Frequency | Correct Factor | Reading Level | Measurement Level | Margin | Limit |
|---|---|---|---|---|---|
| MHz | dB | dBμV | dBμV/m | dB | dBμV/m |
| **Horizontal** | | | | | |
| **Peak Detector:** | | | | | |
| 4880.000 | 3.010 | 42.780 | 45.790 | -28.210 | 74.000 |
| 7320.000 | 11.833 | 39.310 | 51.144 | -22.856 | 74.000 |
| 9760.000 | 12.580 | 39.260 | 51.841 | -22.159 | 74.000 |
| **Average Detector:** | | | | | |
| -- | | | | | |
| **Vertical** | | | | | |
| **Peak Detector:** | | | | | |
| 4880.000 | 5.738 | 44.850 | 50.588 | -23.412 | 74.000 |
| 7320.000 | 12.703 | 39.440 | 52.143 | -21.857 | 74.000 |
| 9760.000 | 13.052 | 39.930 | 52.982 | -21.018 | 74.000 |
| **Average Detector:** | | | | | |
| -- | | | | | |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Swaive Thermometer
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

| Frequency | Correct Factor | Reading Level | Measurement Level | Margin | Limit |
|---|---|---|---|---|---|
| MHz | dB | dBμV | dBμV/m | dB | dBμV/m |
| **Horizontal** | | | | | |
| **Peak Detector:** | | | | | |
| 4960.000 | 2.760 | 42.000 | 44.760 | -29.240 | 74.000 |
| 7440.000 | 12.567 | 39.500 | 52.066 | -21.934 | 74.000 |
| 9920.000 | 13.456 | 39.640 | 53.096 | -20.904 | 74.000 |
| **Average** | | | | | |
| **Detector:** | | | | | |
| -- | | | | | |
| **Vertical** | | | | | |
| **Peak Detector:** | | | | | |
| 4960.000 | 5.557 | 43.270 | 48.827 | -25.173 | 74.000 |
| 7440.000 | 13.426 | 39.720 | 53.145 | -20.855 | 74.000 |
| 9920.000 | 13.958 | 39.790 | 53.748 | -20.252 | 74.000 |
| **Average** | | | | | |
| **Detector:** | | | | | |
| -- | | | | | |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Swaive Thermometer
Test Item : General Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

| Frequency | Correct Factor | Reading Level | Measurement Level | Margin | Limit |
|---|---|---|---|---|---|
| MHz | dB | dBμV | dBμV/m | dB | dBμV/m |
| **Horizontal** | | | | | |
| 121.180 | 2.113 | 30.344 | 32.457 | -11.043 | 43.500 |
| 237.580 | 2.547 | 30.030 | 32.577 | -13.423 | 46.000 |
| 383.080 | 3.033 | 29.717 | 32.750 | -13.250 | 46.000 |
| 456.800 | 3.210 | 33.071 | 36.281 | -9.719 | 46.000 |
| 600.360 | 3.534 | 29.027 | 32.561 | -13.439 | 46.000 |
| 774.960 | 3.914 | 27.301 | 31.215 | -14.785 | 46.000 |
| **Vertical** | | | | | |
| 136.700 | 5.627 | 30.415 | 36.042 | -7.458 | 43.500 |
| 251.160 | 6.025 | 29.240 | 35.265 | -10.735 | 46.000 |
| 437.400 | 6.560 | 29.683 | 36.243 | -9.757 | 46.000 |
| 559.620 | 6.844 | 28.267 | 35.111 | -10.889 | 46.000 |
| 639.160 | 7.062 | 29.562 | 36.624 | -9.376 | 46.000 |
| 740.040 | 7.283 | 29.050 | 36.333 | -9.667 | 46.000 |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

# 5. RF Antenna Conducted Test

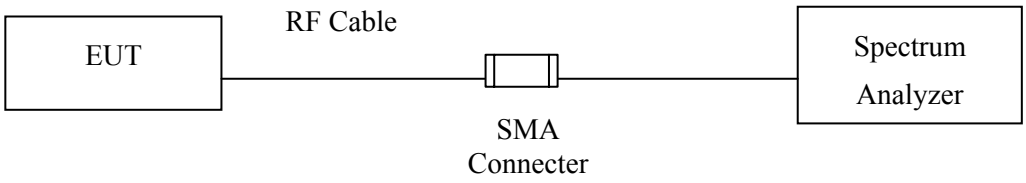
## 5.1. Test Equipment

| | Equipment | Manufacturer | Model No./Serial No. | Last Cal. |
|---|---|---|---|---|
| | Spectrum Analyzer | R&S | FSP40 / 100170 | Jun., 2014 |
| | Spectrum Analyzer | Agilent | E4407B / US39440758 | Jun., 2014 |
| X | Spectrum Analyzer | Agilent | N9010A / MY48030495 | Apr., 2015 |

Note: 1. All equipments are calibrated every one year.

2. The test instruments Marked "X" are used to measure the final test results.

## 5.2. Test Setup




## 5.3. Limits

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

## 5.4. Test Procedure

The EUT was tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

## 5.5. Uncertainty

± 150Hz

## 5.6. Test Result of RF Antenna Conducted Test

Product : Swaive Thermometer
Test Item : RF Antenna Conducted Test
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK)

**Figure Channel 00:**

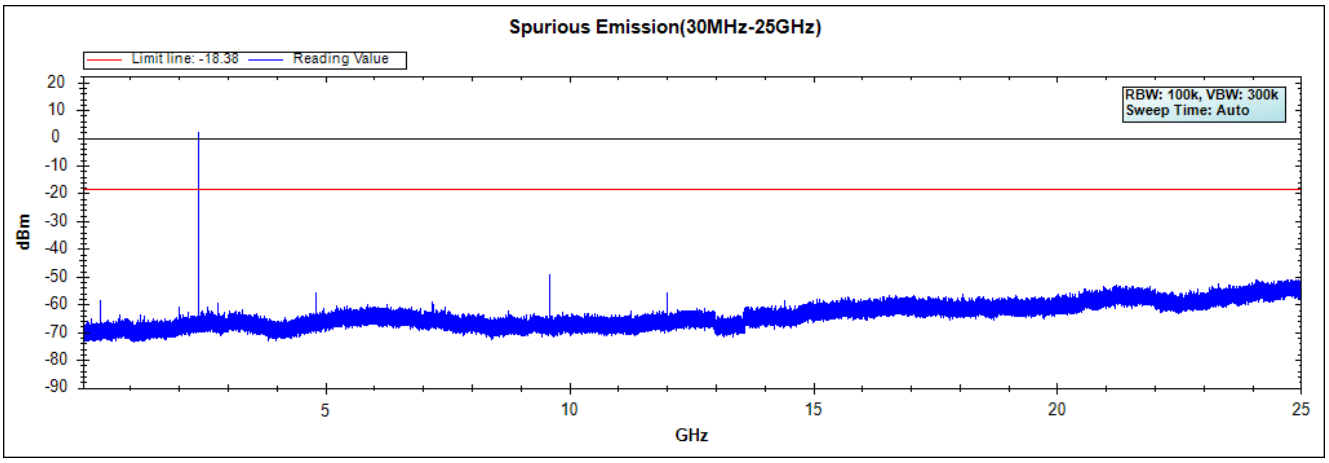



**Figure Channel 19:**

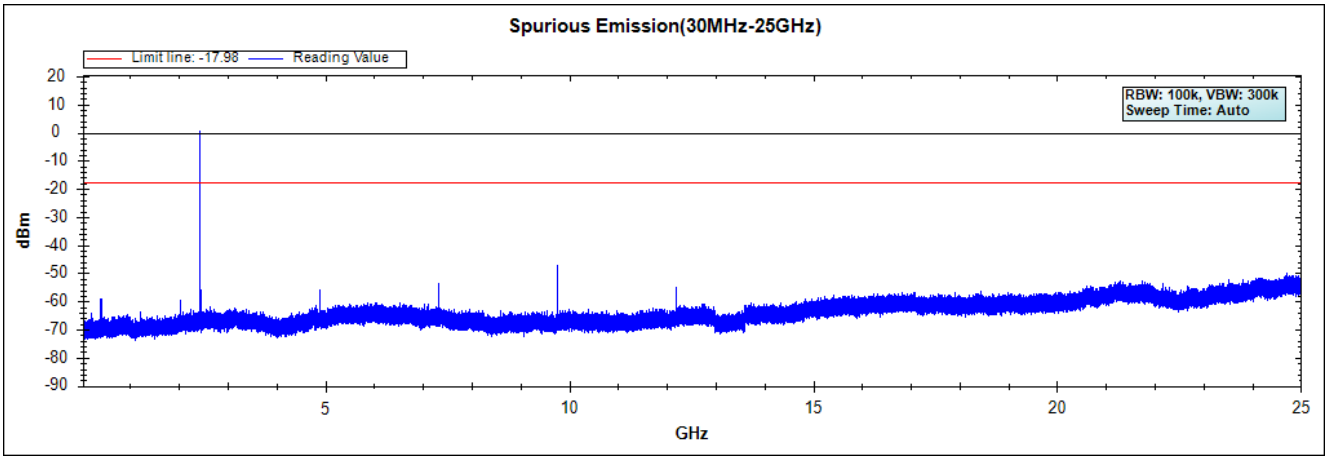
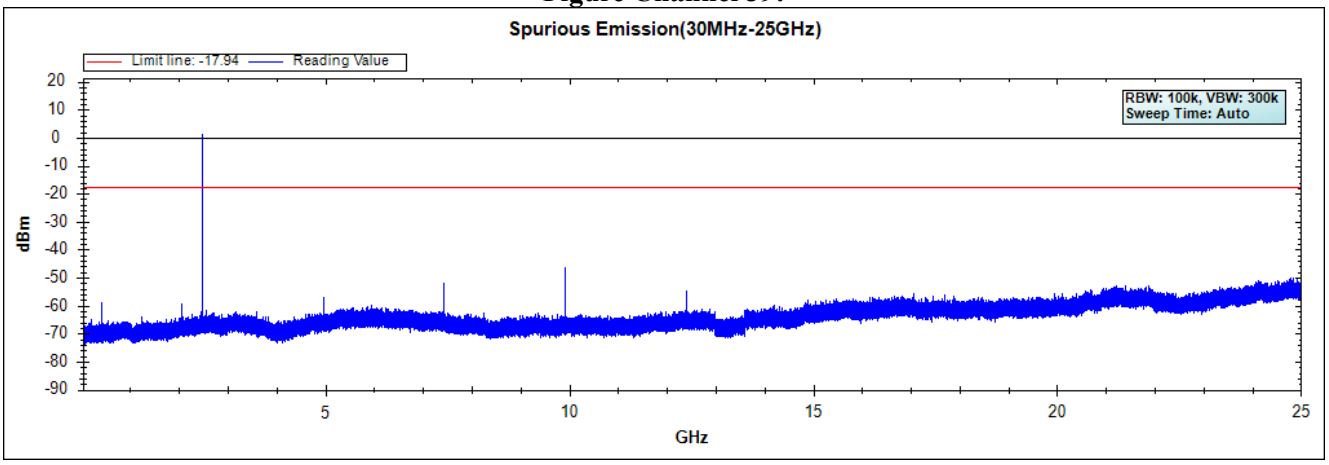



**Figure Channel 39:**



# 6. Band Edge

## 6.1. Test Equipment

### RF Conducted Measurement

The following test equipments are used during the band edge tests:

| | Equipment | Manufacturer | Model No./Serial No. | Last Cal. |
|---|---|---|---|---|
| | Spectrum Analyzer | R&S | FSP40 / 100170 | Jun., 2014 |
| | Spectrum Analyzer | Agilent | E4407B / US39440758 | Jun., 2014 |
| X | Spectrum Analyzer | Agilent | N9010A / MY48030495 | Apr., 2015 |

### RF Radiated Measurement:

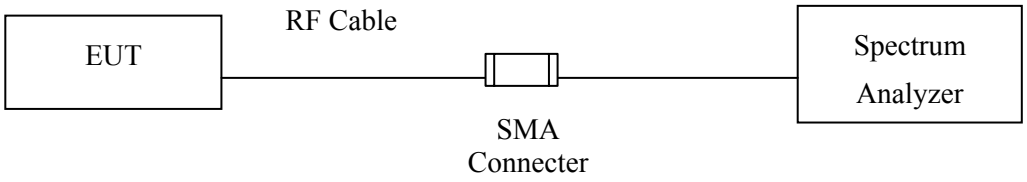
The following test equipments are used during the band edge tests:

| Test Site | | Equipment | Manufacturer | Model No./Serial No. | Last Cal. |
|---|---|---|---|---|---|
| ☒Site # 3 | | Bilog Antenna | Schaffner Chase | CBL6112B/2673 | Sep., 2014 |
| | X | Horn Antenna | Schwarzbeck | BBHA9120D/D305 | Sep., 2014 |
| | | Horn Antenna | Schwarzbeck | BBHA9170/208 | Jul., 2014 |
| | X | Pre-Amplifier | Agilent | 8447D/2944A09549 | Sep., 2014 |
| | X | Spectrum Analyzer | Agilent | E4407B / US39440758 | Jul., 2014 |
| | | Test Receiver | R & S | ESCS 30/ 825442/018 | Sep., 2014 |
| | X | Coaxial Cable | QuieTek | QTK-CABLE/ CAB5 | Feb., 2015 |
| | X | Controller | QuieTek | QTK-CONTROLLER/ CTRL3 | N/A |
| | X | Coaxial Switch | Anritsu | MP59B/6200265729 | N/A |

Note: 1. All equipments are calibrated every one year.
2. The test instruments marked by "X" are used to measure the final test results.

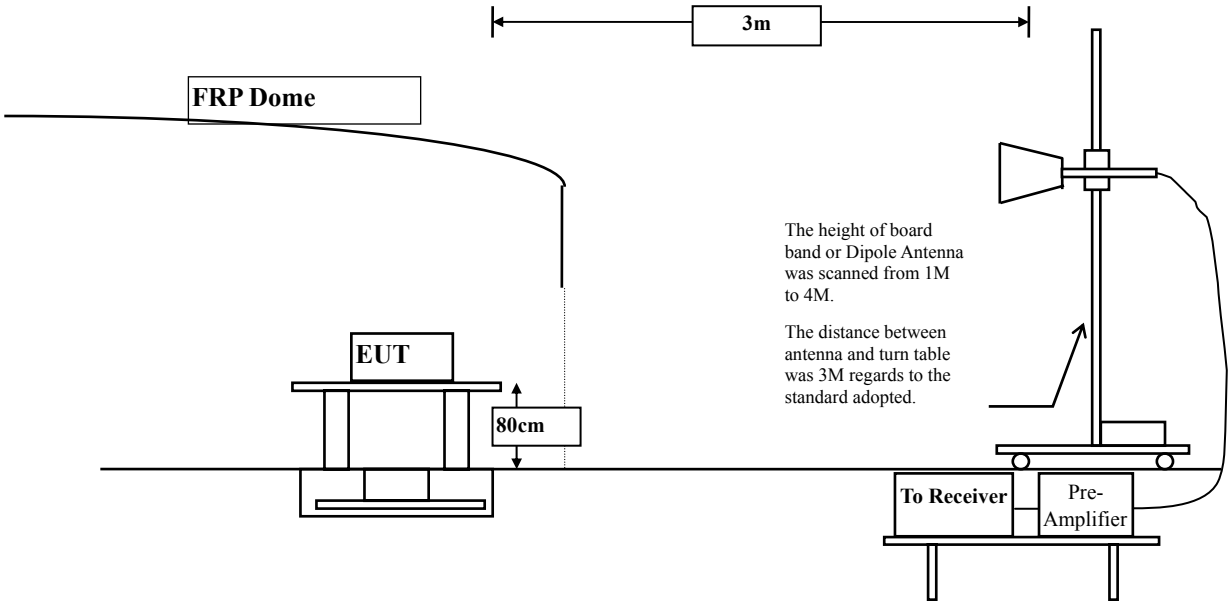
## 6.2. Test Setup

**RF Conducted Measurement**




**RF Radiated Measurement:**

Above 1GHz



## 6.3. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

## 6.4. Test Procedure

The EUT is placed on a turn table which is 0.8 meter above ground. the antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2009 on radiated measurement.
The bandwidth below 1GHz setting on the field strength meter is 120 kHz, above 1GHz are 1 MHz.
The EUT was setup to ANSI C63.10: 2009.

## 6.5. Uncertainty

± 3.9 dB above 1GHz
± 3.8 dB below 1GHz

## 6.6. Test Result of Band Edge

Product : Swaive Thermometer
Test Item : Band Edge
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

**RF Radiated Measurement (Horizontal):**

| Channel No. | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Peak Limit (dBμV/m) | Arerage Limit (dBμV/m) | Result |
|---|---|---|---|---|---|---|---|
| 00 (Peak) | 2382.200 | -1.162 | 42.471 | 41.310 | 74.00 | 54.00 | Pass |
| 00 (Peak) | 2390.000 | -1.131 | 40.062 | 38.931 | 74.00 | 54.00 | Pass |
| 00 (Peak) | 2400.000 | -1.084 | 52.620 | 51.537 | -- | -- | -- |
| 00 (Peak) | 2401.800 | -1.074 | 82.833 | 81.759 | -- | -- | -- |
| 00 (Average) | 2390.000 | -1.131 | 28.639 | 27.508 | 74.00 | 54.00 | Pass |
| 00 (Average) | 2400.000 | -1.084 | 34.914 | 33.831 | -- | -- | -- |
| 00 (Average) | 2402.000 | -1.073 | 63.655 | 62.583 | -- | -- | -- |

**Figure Channel 00: Horizontal (Peak)**

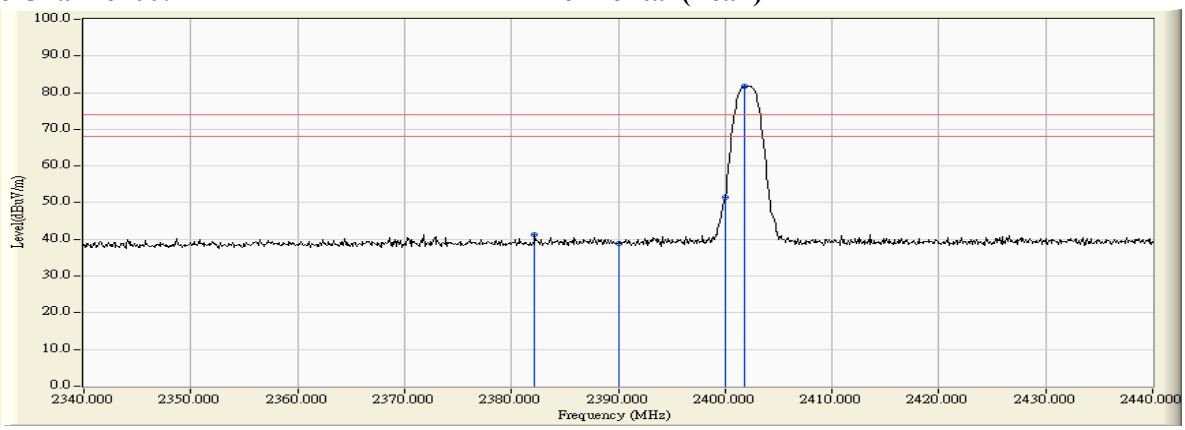
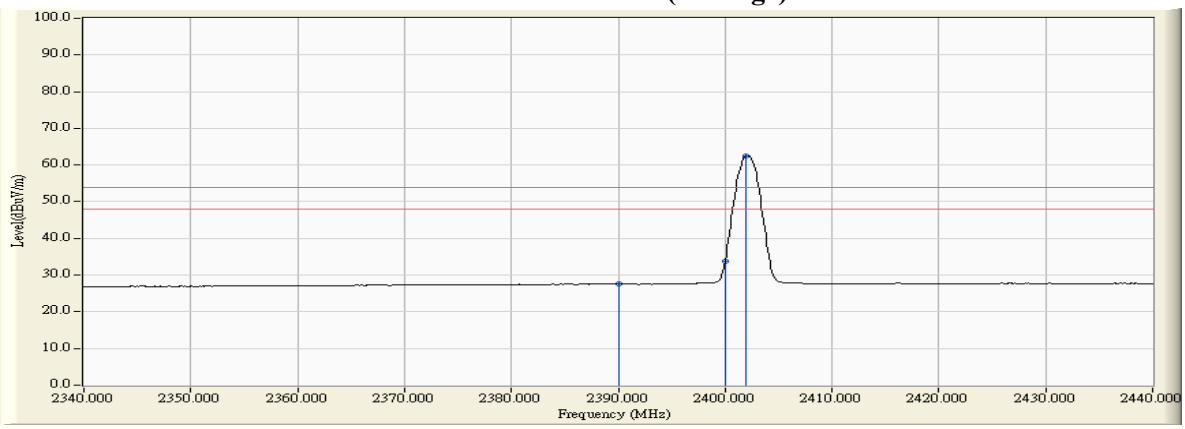



**Figure Channel 00: Horizontal (Average)**




Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Swaive Thermometer
Test Item : Band Edge
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

**RF Radiated Measurement (Vertical):**

| Channel No. | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Peak Limit (dBμV/m) | Arerage Limit (dBμV/m) | Result |
|---|---|---|---|---|---|---|---|
| 00 (Peak) | 2388.600 | -1.718 | 41.947 | 40.229 | 74.00 | 54.00 | Pass |
| 00 (Peak) | 2390.000 | -1.725 | 40.589 | 38.864 | 74.00 | 54.00 | Pass |
| 00 (Peak) | 2400.000 | -1.733 | 54.339 | 52.607 | -- | -- | -- |
| 00 (Peak) | 2402.200 | -1.729 | 84.388 | 82.660 | -- | -- | -- |
| 00 (Average) | 2390.000 | -1.725 | 28.658 | 26.933 | 74.00 | 54.00 | Pass |
| 00 (Average) | 2400.000 | -1.733 | 35.698 | 33.966 | -- | -- | -- |
| 00 (Average) | 2402.100 | -1.729 | 64.765 | 63.036 | -- | -- | -- |

**Figure Channel 00: Vertical (Peak)**

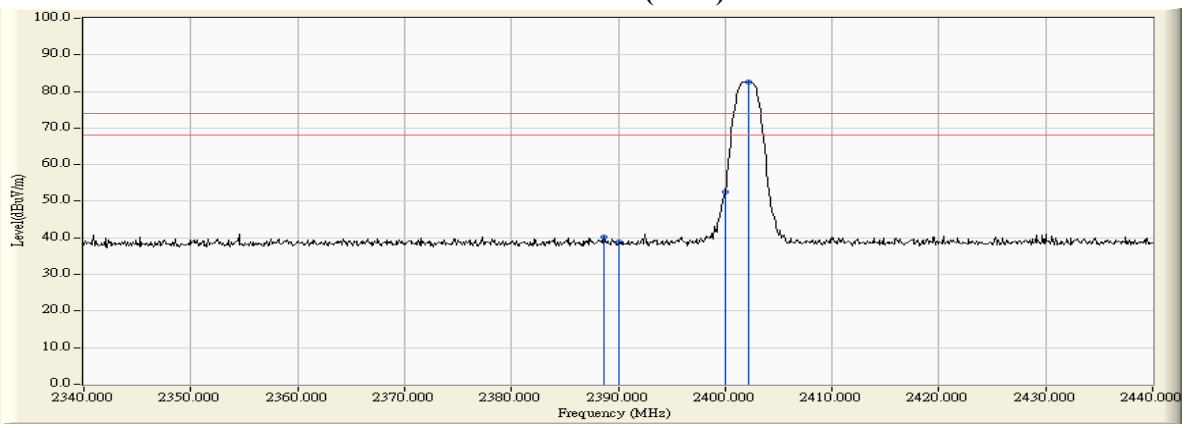
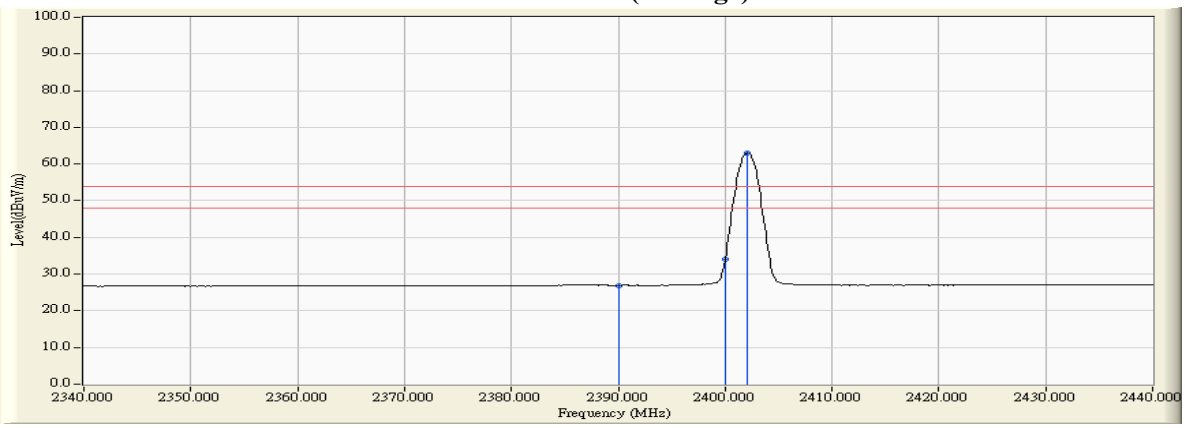



**Figure Channel 00: Vertical (Average)**




Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Swaive Thermometer
Test Item : Band Edge
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

**RF Radiated Measurement (Horizontal):**

| Channel No. | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Peak Limit (dBμV/m) | Arerage Limit (dBμV/m) | Result |
|---|---|---|---|---|---|---|---|
| 39 (Peak) | 2480.300 | -0.579 | 86.317 | 85.738 | -- | -- | -- |
| 39 (Peak) | 2483.500 | -0.558 | 41.732 | 41.174 | 74.00 | 54.00 | Pass |
| 39 (Average) | 2480.100 | -0.580 | 66.154 | 65.574 | -- | -- | -- |
| 39 (Average) | 2483.500 | -0.558 | 29.294 | 28.736 | 74.00 | 54.00 | Pass |

**Figure Channel 39: Horizontal (Peak)**

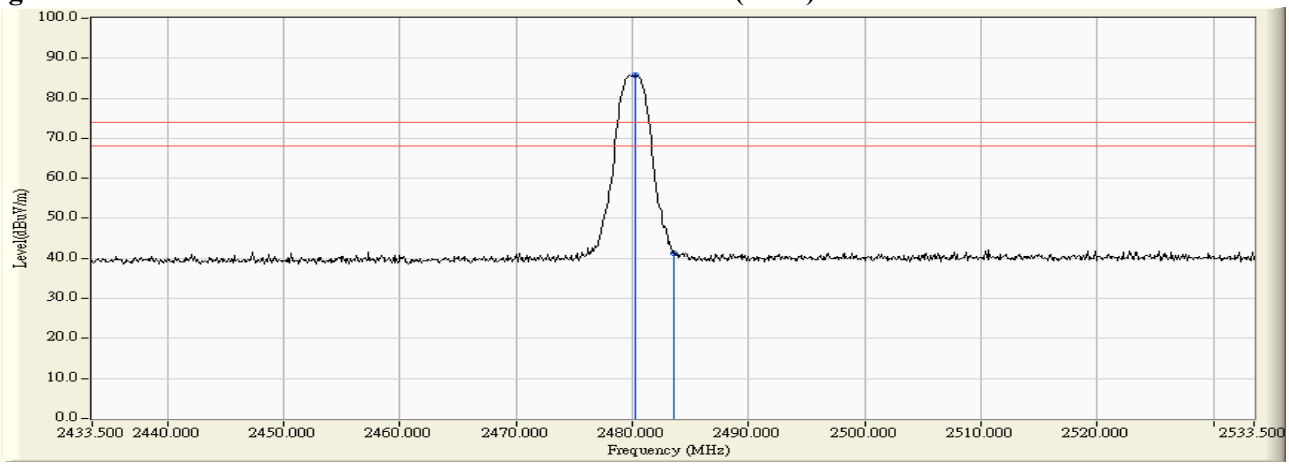
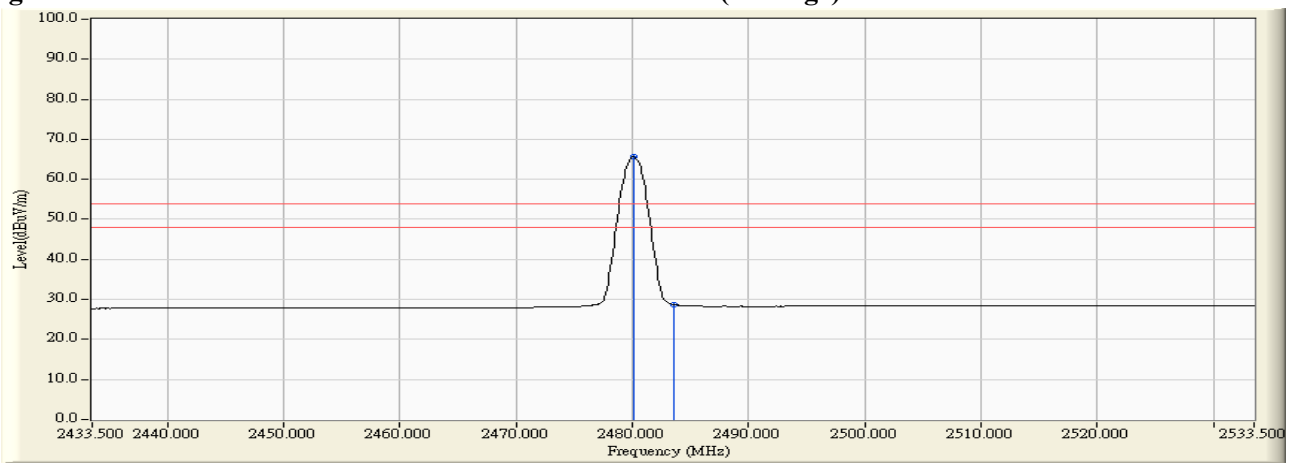



**Figure Channel 39: Horizontal (Average)**




Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Swaive Thermometer
Test Item : Band Edge
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

**RF Radiated Measurement (Vertical):**

| Channel No. | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Peak Limit (dBμV/m) | Arerage Limit (dBμV/m) | Result |
|---|---|---|---|---|---|---|---|
| 39 (Peak) | 2479.900 | 30.281 | 88.940 | 87.615 | -- | -- | -- |
| 39 (Peak) | 2483.500 | 30.303 | 44.420 | 43.115 | 74.00 | 54.00 | Pass |
| 39 (Average) | 2480.100 | -1.324 | 68.088 | 66.764 | -- | -- | -- |
| 39 (Average) | 2483.500 | -1.305 | 29.787 | 28.482 | 74.00 | 54.00 | Pass |

**Figure Channel 39: Vertical (Peak)**

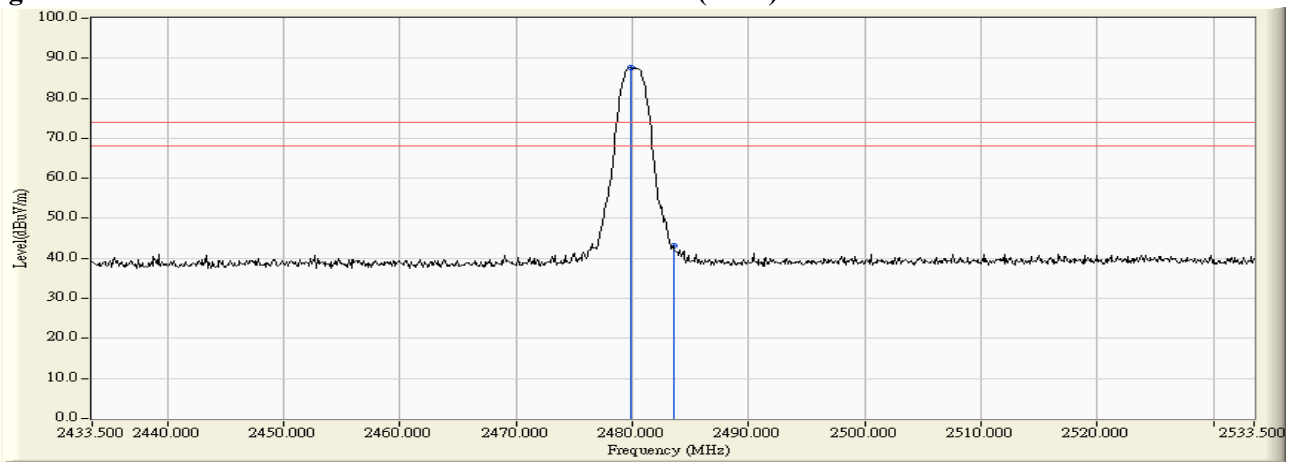
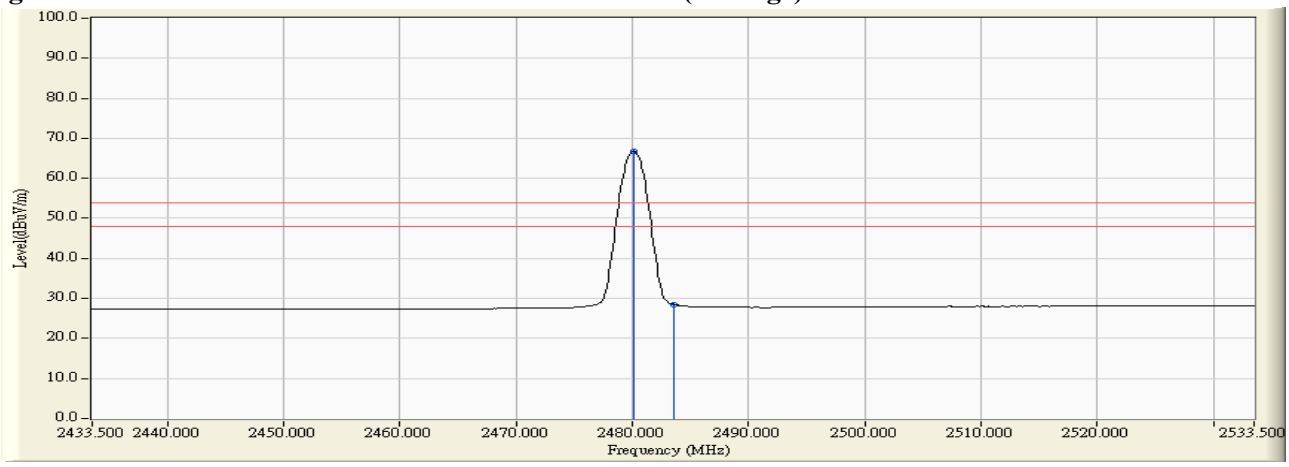



**Figure Channel 39: Vertical (Average)**




Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

# 7. Occupied Bandwidth (6dB BW)

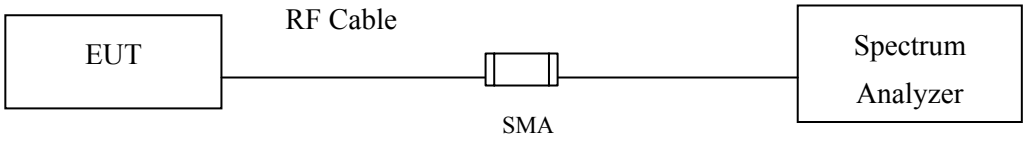
## 7.1. Test Equipment

| | Equipment | Manufacturer | Model No./Serial No. | Last Cal. |
|---|---|---|---|---|
| | Spectrum Analyzer | R&S | FSP40 / 100170 | Jun., 2014 |
| | Spectrum Analyzer | Agilent | E4407B / US39440758 | Jun., 2014 |
| X | Spectrum Analyzer | Agilent | N9010A / MY48030495 | Apr., 2015 |

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

## 7.2. Test Setup




## 7.3. Limits

The minimum bandwidth shall be at least 500 kHz.

## 7.4. Test Procedure

The EUT was setup according to ANSI C63.10: 2009; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 1-5% of the emission bandwidth, VBW≥3*RBW

## 7.5. Uncertainty

± 150Hz

## 7.6. Test Result of Occupied Bandwidth

Product : Swaive Thermometer
Test Item : Occupied Bandwidth Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

| Channel No. | Frequency (MHz) | Measurement Level (kHz) | Required Limit (kHz) | Result |
|---|---|---|---|---|
| 00 | 2402 | 800.0 | >500 | Pass |
| 19 | 2440 | 790.0 | >500 | Pass |
| 39 | 2480 | 790.0 | >500 | Pass |

**Figure Channel 00:**

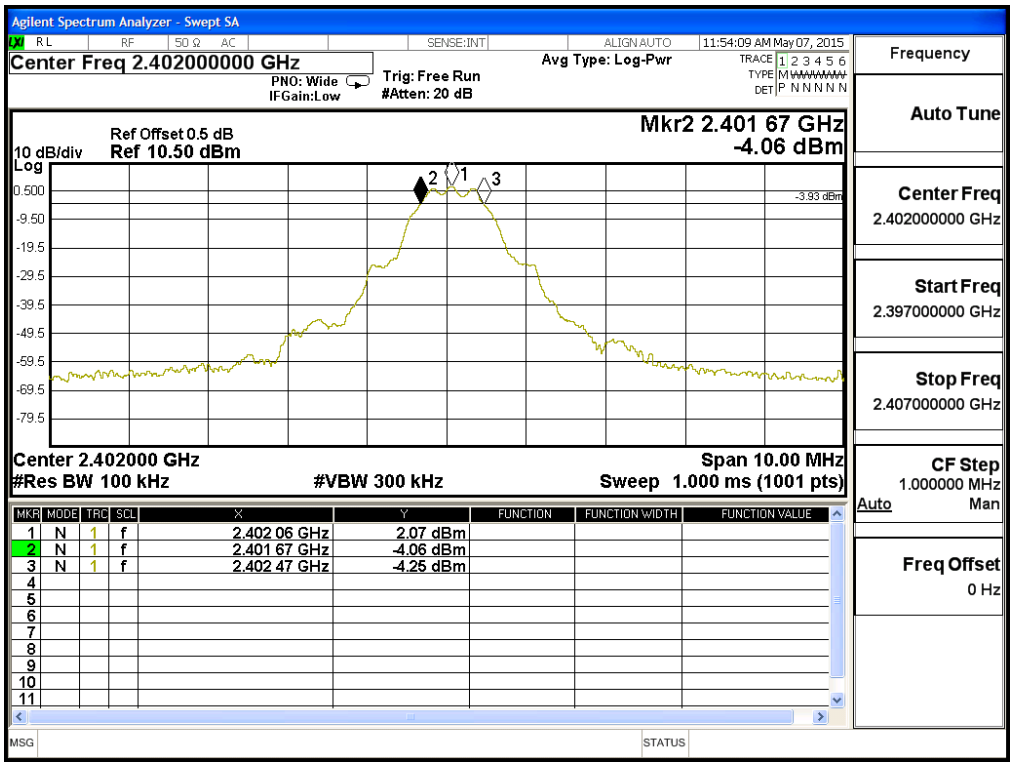


**Figure Channel 19:**

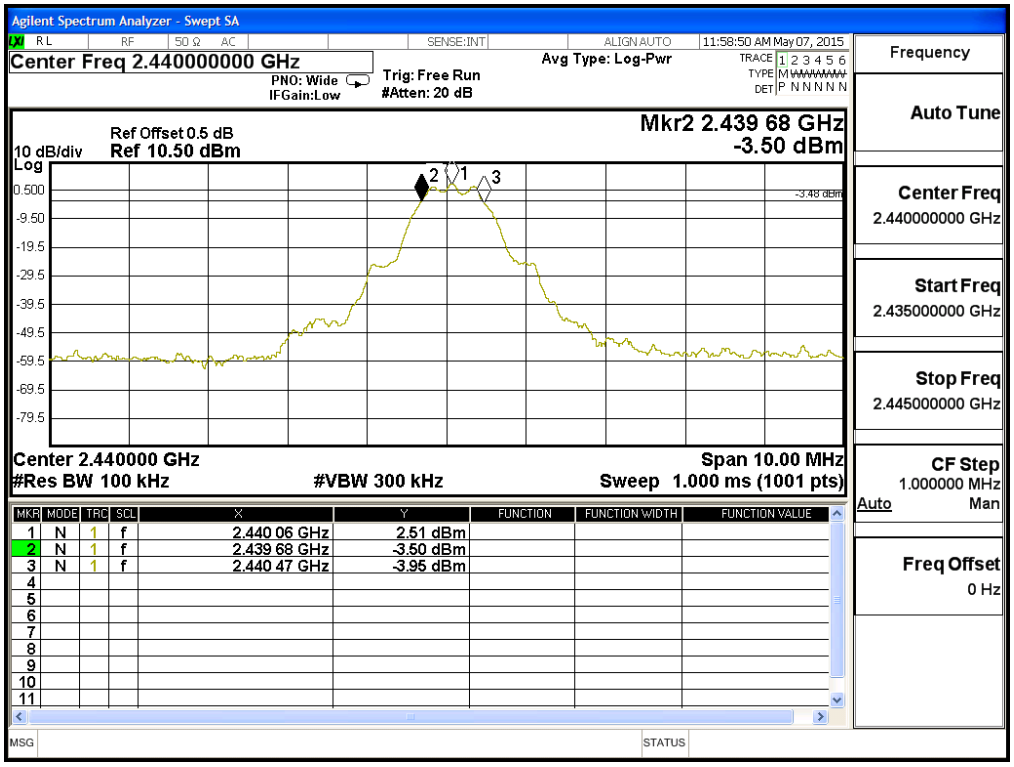
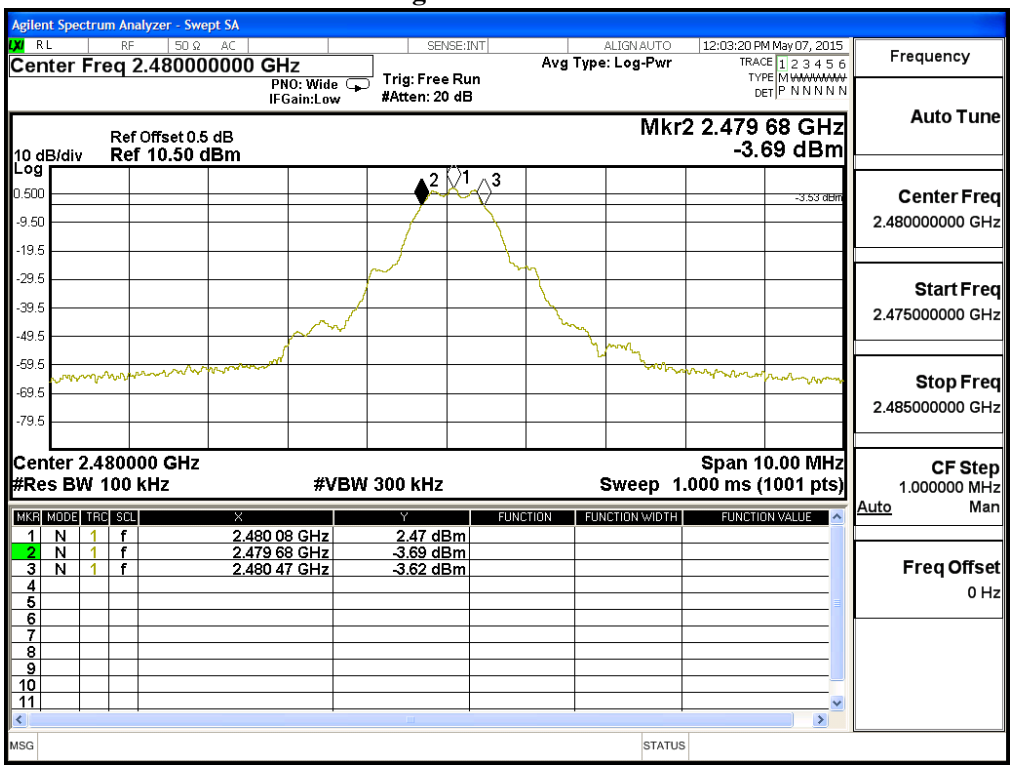



**Figure Channel 39:**



# 8. Power Density

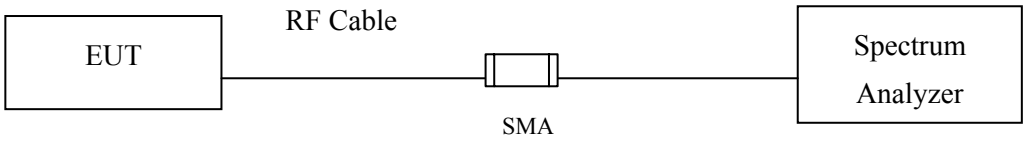
## 8.1. Test Equipment

| | Equipment | Manufacturer | Model No./Serial No. | Last Cal. |
|---|---|---|---|---|
| | Spectrum Analyzer | R&S | FSP40 / 100170 | Jun., 2014 |
| | Spectrum Analyzer | Agilent | E4407B / US39440758 | Jun., 2014 |
| X | Spectrum Analyzer | Agilent | N9010A / MY48030495 | Apr., 2015 |

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

## 8.2. Test Setup




## 8.3. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

## 8.4. Test Procedure

The EUT was setup according to ANSI C63.10: 2009, the maximum power spectral density using KDB 558074 section 10.2 PKPSD (peak PSD) method.

## 8.5. Uncertainty

± 1.27 dB

## 8.6. Test Result of Power Density

Product : Swaive Thermometer
Test Item : Power Density Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

| Channel No. | Frequency (MHz) | Measure Level (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|
| 00 | 2402 | 1.620 | < 8dBm | Pass |
| 19 | 2440 | 2.020 | < 8dBm | Pass |
| 39 | 2480 | 2.060 | < 8dBm | Pass |

**Figure Channel 00:**

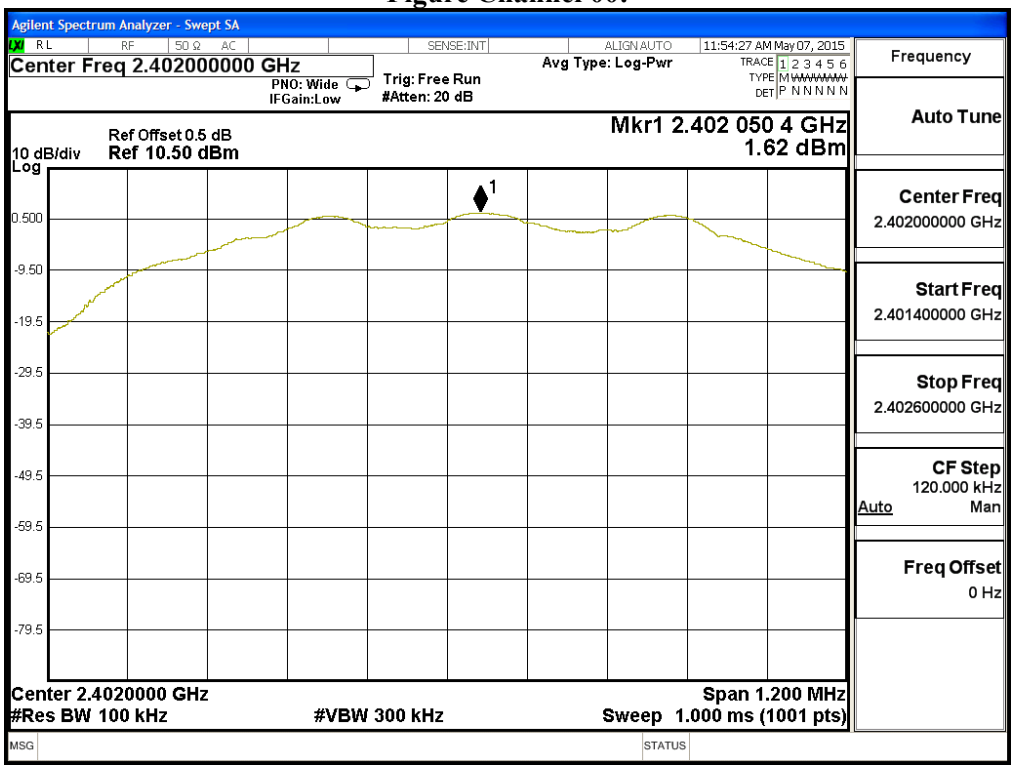


**Figure Channel 19:**

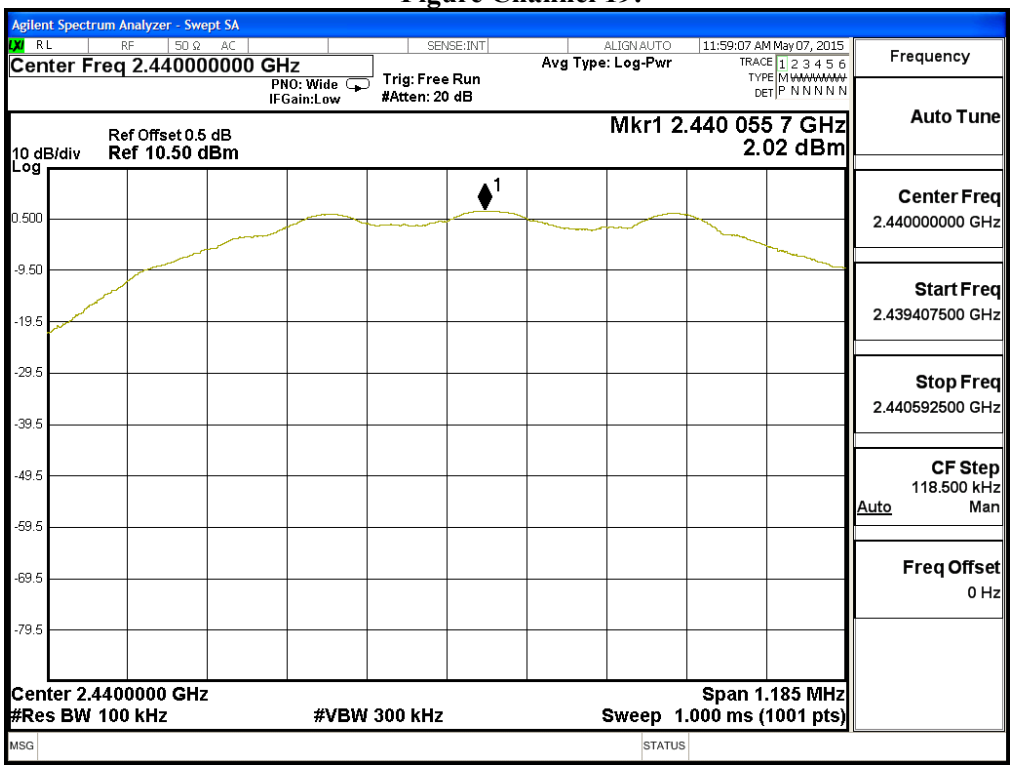
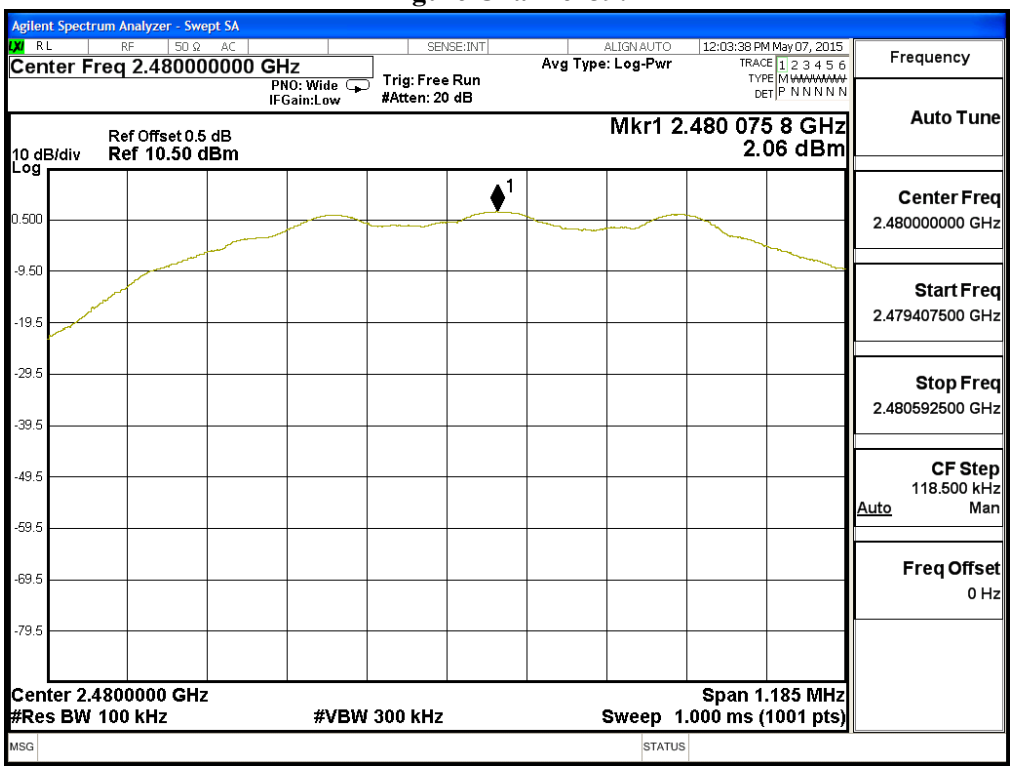



**Figure Channel 39:**



## 9. EMI Reduction Method During Compliance Testing

No modification was made during testing.

# Attachment 1: EUT Test Photographs

# Attachment 2: EUT Detailed Photographs