

# EMCE Engineering

## CERTIFICATE OF COMPLIANCE

### FCC / ISSED Certification

**Applicant Name:**  
Transducers Direct**Address:**  
PO Box 162, 264 Center Street  
Miamiville, Ohio, 45147**Date of Issue:**

05/26/2018

**Test Site/Location:**

EMCE Engineering

1726 Ringwood Avenue San Jose, California USA

**Report No.:** 4378-1**EMCE FRN:** 007198120

|                  |                             |
|------------------|-----------------------------|
| <b>FCC ID</b>    | <b>: 2ACGE-TDWLBLC</b>      |
| <b>IC</b>        | <b>: 12056A-TDWLBLC</b>     |
| <b>APPLICANT</b> | <b>: Transducers Direct</b> |

**FCC Model(s):** TDWLBLC**Additional Model(s):** NONE**EUT Type:** Bluetooth LE**Max. RF Output Power:** BLE 2.91 dBm / 1.95 mW**Frequency Range:** 2402 MHz - 2480 MHz**Modulation type** GSKF**FCC Classification:** Digital Transmission System(DTS)**FCC Rule Part(s):** Part 15.247**ISED Rule Part(s):** RSS-247, Issue 2**Engineering Statement:**

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the applicable limits. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all personnel taking them.

**EMCE Engineering** Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S.C. 853(a)

**Report prepared by:**  
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**Administrative Assistant,**  
**EMCE Engineering****Approved by:**  
**Bob Cole**  
**President,**  
**EMCE Engineering**

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|                                  |                                     |                                                     |  |                                 |
|----------------------------------|-------------------------------------|-----------------------------------------------------|--|---------------------------------|
| <b>FCC PT.15.247 TEST REPORT</b> | <b>FCC CERTIFICATION REPORT</b>     |                                                     |  |                                 |
| <b>Test Report No.</b><br>4378-1 | <b>Date of Issue:</b><br>05/29/2018 | <b>EUT Type:</b> Bluetooth data transmission device |  | <b>FCC ID:</b><br>2ANB3-TDWLBLC |

# Version

| TEST REPORT NO. | DATE       | DESCRIPTION             |
|-----------------|------------|-------------------------|
| 4378-1          | 05/31/2018 | - First Approval Report |
|                 |            |                         |

|                                      |                                     |                                               |  |                                 |
|--------------------------------------|-------------------------------------|-----------------------------------------------|--|---------------------------------|
| <b>FCC PT.15.247<br/>TEST REPORT</b> | <b>FCC CERTIFICATION REPORT</b>     |                                               |  |                                 |
| <b>Test Report No.</b><br>4378-1     | <b>Date of Issue:</b><br>05/29/2018 | <b>EUT Type: BLE data transmission device</b> |  | <b>FCC ID:</b><br>2ANB3-TDWLBLC |

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## 1. GENERAL INFORMATION

**Applicant:** Transducers Direct

**Address:** PO Box 162, 264 Center Street  
Miamiville, Ohio, 45147

**FCC ID:** 2ACGE-TDWLBLC

**EUT Type:** Bluetooth LE

**Model name(s):** TDWLBLC

**Additional Model name(s):**

**Date(s) of Tests:** 05/20/2018 – 05/23/2018

**Place of Tests:** EMCE Engineering  
1726 Ringwood Ave. San Jose, CA 95131 USA  
(IC Recognition No. : 3324A)

## 2. EUT DESCRIPTION

|                                  |                           |                    |
|----------------------------------|---------------------------|--------------------|
| <b>EUT Type</b>                  | Bluetooth LE              |                    |
| <b>FCC Model Name</b>            | TDWLBLC                   |                    |
| <b>Additional FCC Model Name</b> | n/a                       |                    |
| <b>Power Supply</b>              | Battery                   |                    |
| <b>Battery type</b>              | Coin Cell                 |                    |
| <b>Frequency Range</b>           | TX                        | 2402 – 2480 MHz    |
|                                  | RX                        | 2402 – 2480 MHz    |
| <b>Max. RF Output Power</b>      | Peak                      | 2.91 dBm / 1.95 mW |
|                                  |                           |                    |
| <b>Modulation Type</b>           | GFSK                      |                    |
| <b>Antenna Specification</b>     | Antenna type: PCB trace   |                    |
|                                  | Peak Gain : 1.0 (numeric) |                    |

|                                      |                                     |                                               |                                 |
|--------------------------------------|-------------------------------------|-----------------------------------------------|---------------------------------|
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### 3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas. Guidance v4 dated April 04, 2017 entitled “Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) and the measurement procedure described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2010) Operating Under §15.247” were used in the measurement.

#### 3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

#### 3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

#### 3.3 GENERAL TEST PROCEDURES

##### Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.3.1 of ANSI C63.10 – 2010. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

##### Radiated Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane for the range of .009 – 1000 MHz, 1.5 Meters above the ground plane for measurements >1000 MHz. According to the requirements in Section 6.3.1 of ANSI C63.10 – 2010. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in ANSI C63.10. - 2010

##### Conducted Antenna Terminal

See Section from 9.1 to 9.2.(558074 D01 DTS Meas Guidance v04)

|                              |                              |                                               |                          |
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### 3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

### 4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

## 5. FACILITIES AND ACCREDITATIONS

### 5.1 FACILITIES

The SAC (Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 1726 Ringwood Ave. San Jose, CA 95131 USA. The site is constructed in conformance with the requirements of ANSI C63.4 - 2014) and CISPR Publication 22. Detailed description of test facility was submitted to the NVLAP, designated US0125.

### 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

## 6. ANTENNA REQUIREMENTS

### According to FCC 47 CFR §15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

\* The antenna of this E.U.T. is a trace antenna.

\*The E.U.T Complies with the requirement of §15.203

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## 7. SUMMARY TEST OF RESULTS

| Test Description                       | FCC / ISSED Part Section(s)                  | Test Limit                         | Test Condition | Test Result |
|----------------------------------------|----------------------------------------------|------------------------------------|----------------|-------------|
| 6 dB Bandwidth<br>99% Bandwidth        | §15.247(a)(2)<br>RSS 247 5.2(1)              | > 500 kHz<br>For Info Purpose Only | CONDUCTED      | PASS        |
| Conducted Maximum<br>Peak Output Power | §15.247(b)(3)<br>RSS 247 5.4(4)              | < 1 Watt                           |                | PASS        |
| Power Spectral Density                 | §15.247(e)<br>RSS 247 5.2(2)                 | < 8 dBm / 3 kHz Band               |                | PASS        |
| Band Edge<br>(Out of Band Emissions)   | §15.247(d)<br>RSS 247 5.5                    | Conducted < 20 dBc                 |                | PASS        |
| AC Power line<br>Conducted Emissions   | §15.207                                      | cf. Section 8.6                    |                | N/A         |
| Radiated Spurious Emissions            | §15.205, 15.209<br>RSS 247 5.5               | cf. Section 8.5.1                  | RADIATED       | PASS        |
| Radiated Restricted<br>Band Edge       | §15.247(d), 15.205,<br>15.209<br>RSS 247 5.5 | cf. Section 8.5.2                  |                | PASS        |

|                                      |                                     |                                               |  |                                 |
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## 8. TEST RESULT

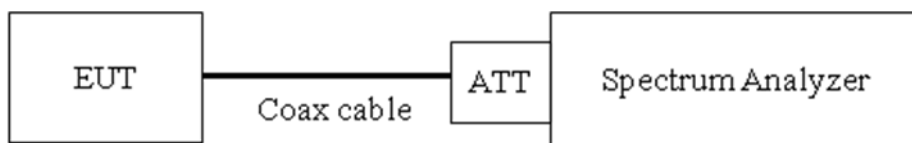
### 8.1 6dB BANDWIDTH / 99% BANDWIDTH

#### Test Requirements and limit, §15.247(a)(2)

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

**The 6dB bandwidth limit is  $\leq 500$  kHz.**

#### ■ TEST CONFIGURATION



#### ■ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to ( Page 5 in KDB 558074, issued 04/09/2013)

RBW = 100 kHz

VBW  $\geq 3 \times$  RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

Note : 6 dB bandwidth tested using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

|                              |                              |                                        |  |                          |
|------------------------------|------------------------------|----------------------------------------|--|--------------------------|
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## TEST RESULTS

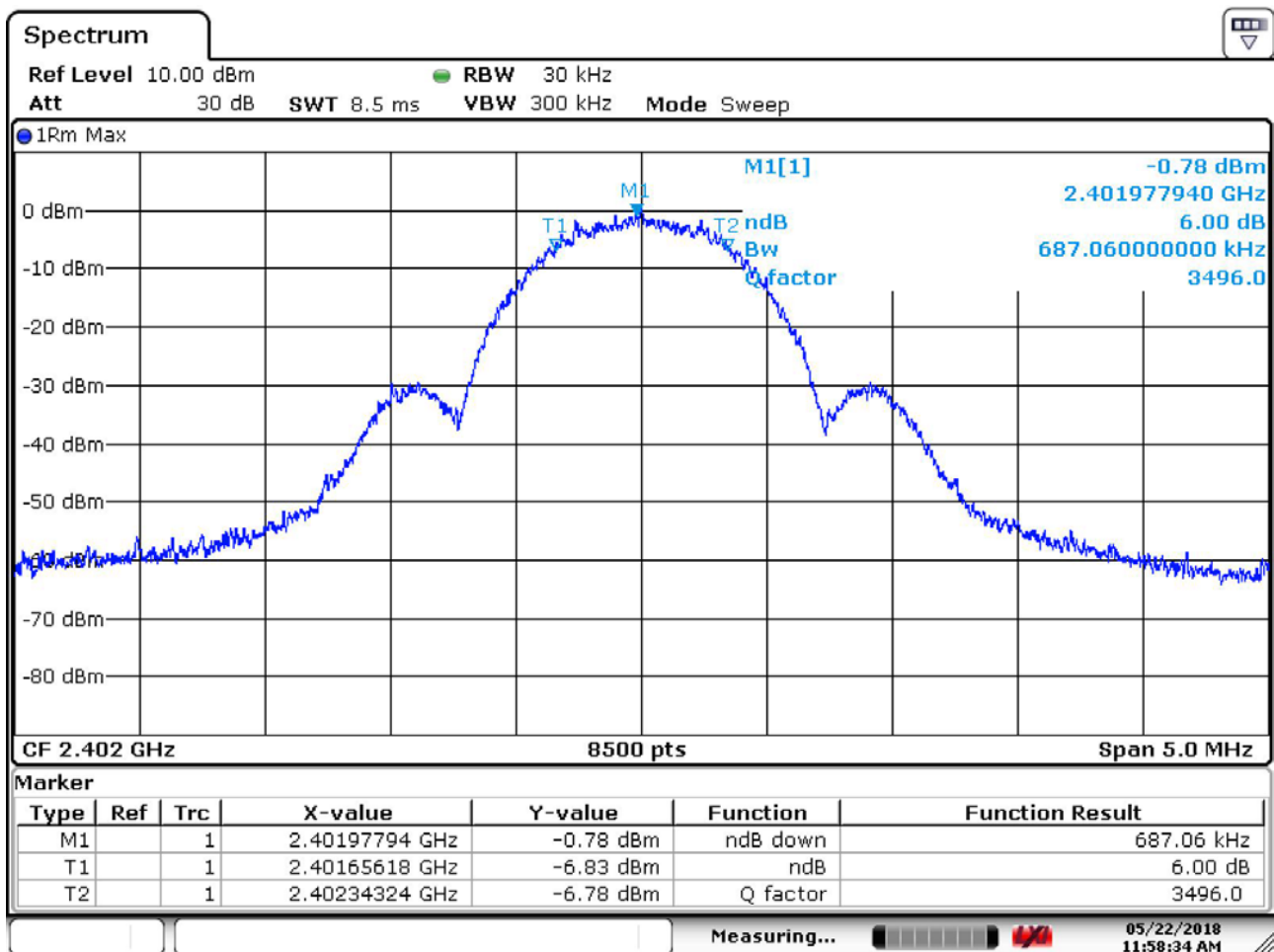
Note : In order to simplify the report, worst case plots for each mode are shown.

### 2.4 GHz Band

#### Conducted 6dB Bandwidth Measurements

| GSFK            | Measured Bandwidth | Minimum Bandwidth | Pass / Fail |
|-----------------|--------------------|-------------------|-------------|
| Frequency [MHz] | [kHz]              | [kHz]             |             |
| 2402            | 687.1              | 500               | Pass        |
| 2440            | 627.6              | 500               | Pass        |
| 2480            | 649.4              | 500               | Pass        |

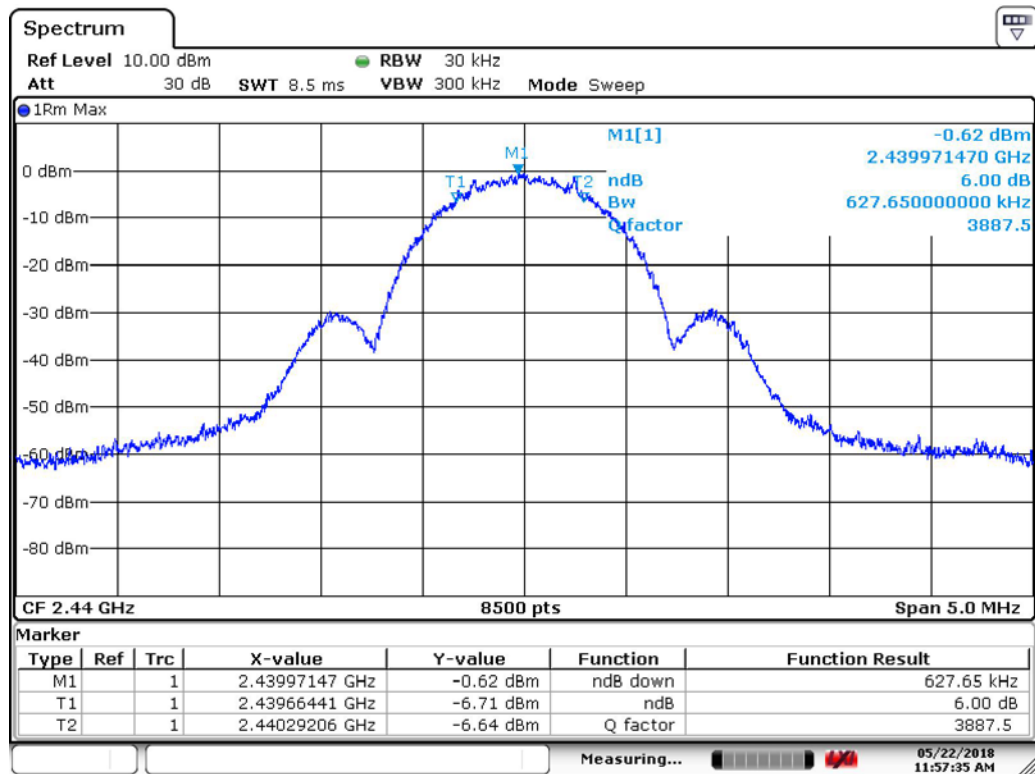
2402 MHz



Date: 22.MAY.2018 11:58:34

|                              |                              |                                        |  |                          |
|------------------------------|------------------------------|----------------------------------------|--|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |  |                          |
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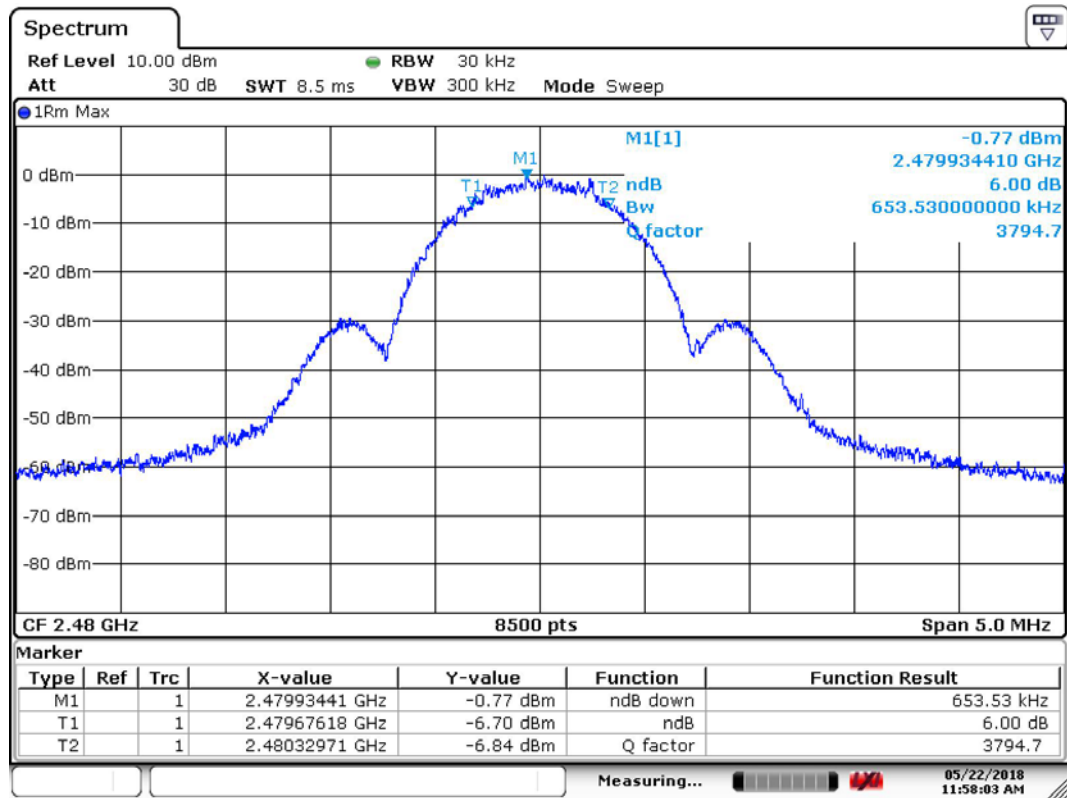
2440 MHz



Date: 22.MAY.2018 11:57:35

2480 MHz

|                              |                              |                                        |  |                          |
|------------------------------|------------------------------|----------------------------------------|--|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |  |                          |
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Date: 22.MAY.2018 11:58:03

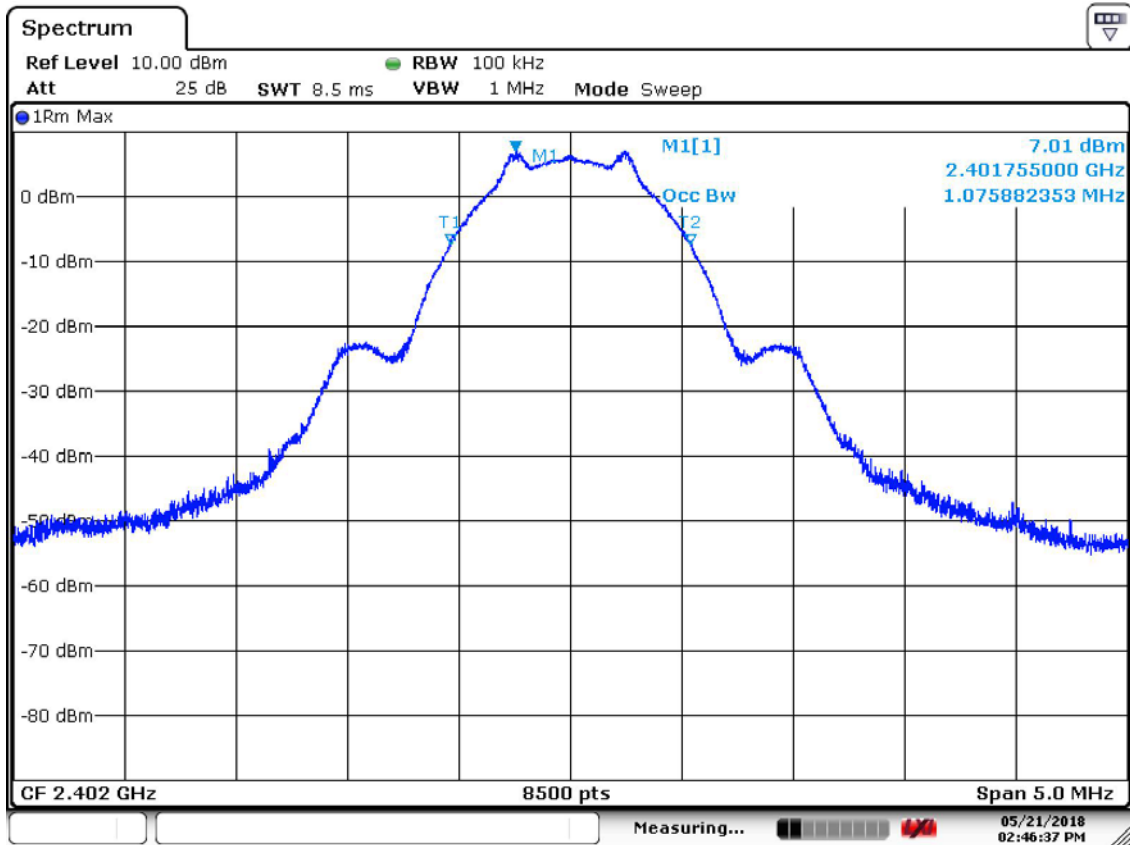
**Conducted 99% Bandwidth Measurements – For Information Purpose Only**

| GSFK            | Measured Bandwidth | Minimum Bandwidth | Pass / Fail |
|-----------------|--------------------|-------------------|-------------|
| Frequency [MHz] | [MHz]              | [MHz]             |             |
| 2402            | 1.075              | N/A               | N/A         |
| 2440            | 1.067              | N/A               | N/A         |
| 2480            | 1.072              | N/A               | N/A         |

Center Frequency Plot is shown as representative in order to simplify this report.

|                              |                              |                                        |                          |
|------------------------------|------------------------------|----------------------------------------|--------------------------|
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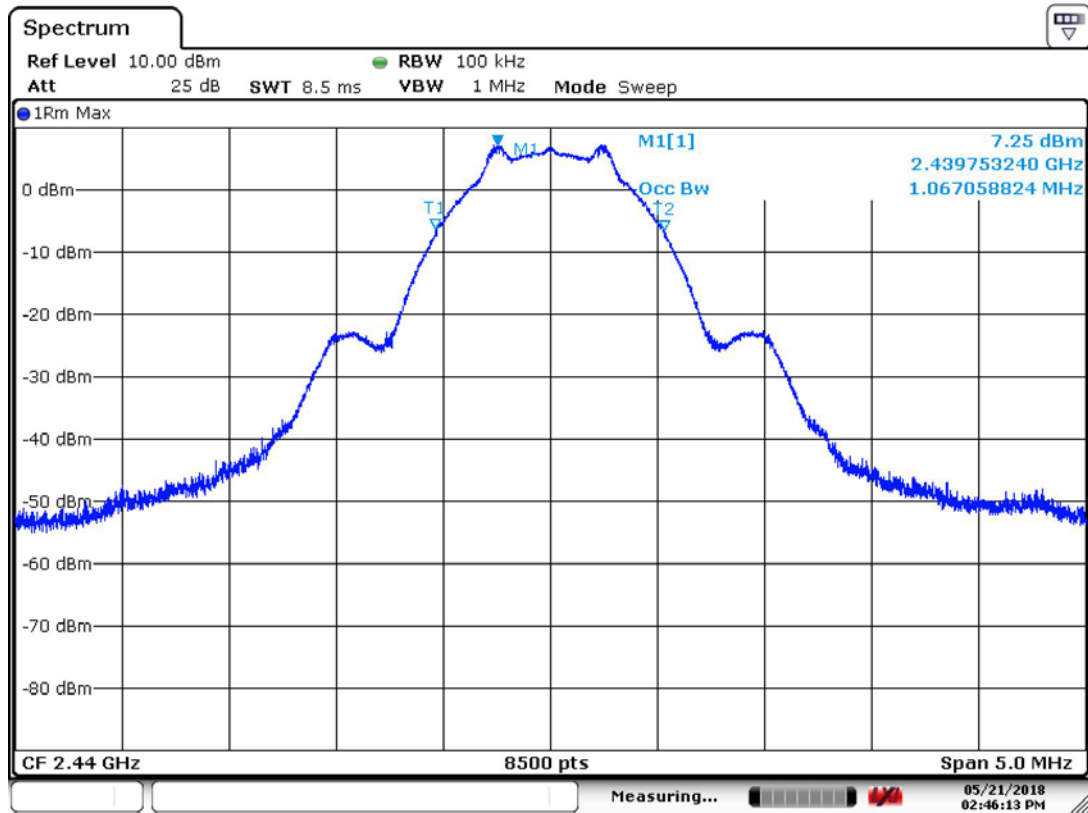
2402



Date: 21.MAY.2018 14:46:38

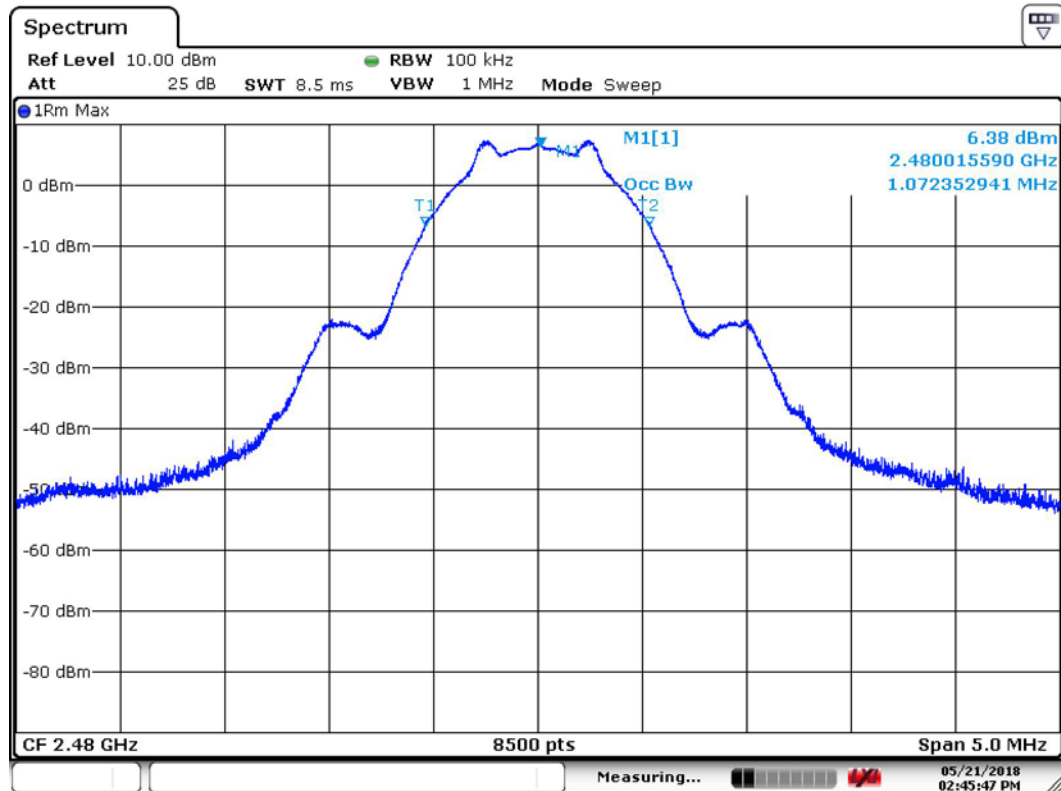
|                              |                              |                                        |                          |
|------------------------------|------------------------------|----------------------------------------|--------------------------|
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2440 MHz



Date: 21.MAY.2018 14:46:13

2480 MHz



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|                              |                              |                                        |  |                          |
|------------------------------|------------------------------|----------------------------------------|--|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |  |                          |
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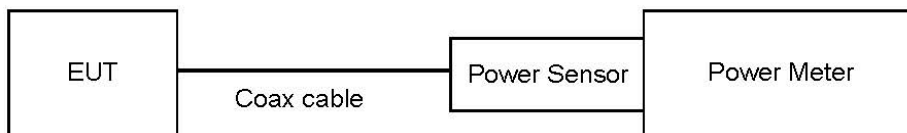
## 8.2 OUTPUT POWER

### Test Requirements and limit, §15.247(b)(3)

The transmitter output is connected to the input of an RF power sensor. Measurement is made using a broadband power meter capable of making peak and average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

**The maximum permissible conducted output power is 1 Watt.**

### ■ TEST CONFIGURATION (20 MHz BW)



### ■ TEST PROCEDURE (20 MHz BW)

- Peak Power (Procedure 9.1.3 in KDB 558074, issued 04/09/2013)
  1. Measure the peak power of the transmitter.
- Average Power (Procedure 9.2.3.1 in KDB 558074, issued 04/09/2013)
  1. Measure the duty cycle.
  2. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
  3. Add  $10 \log(1/x)$ , where  $x$  is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

### Sample Calculation

Output Power = Reading Value + ATT loss + Cable loss(1 ea)

Output Power = 10 dBm + 20 dB + 0.8 dB + 0.2 dB = 31.0 dBm

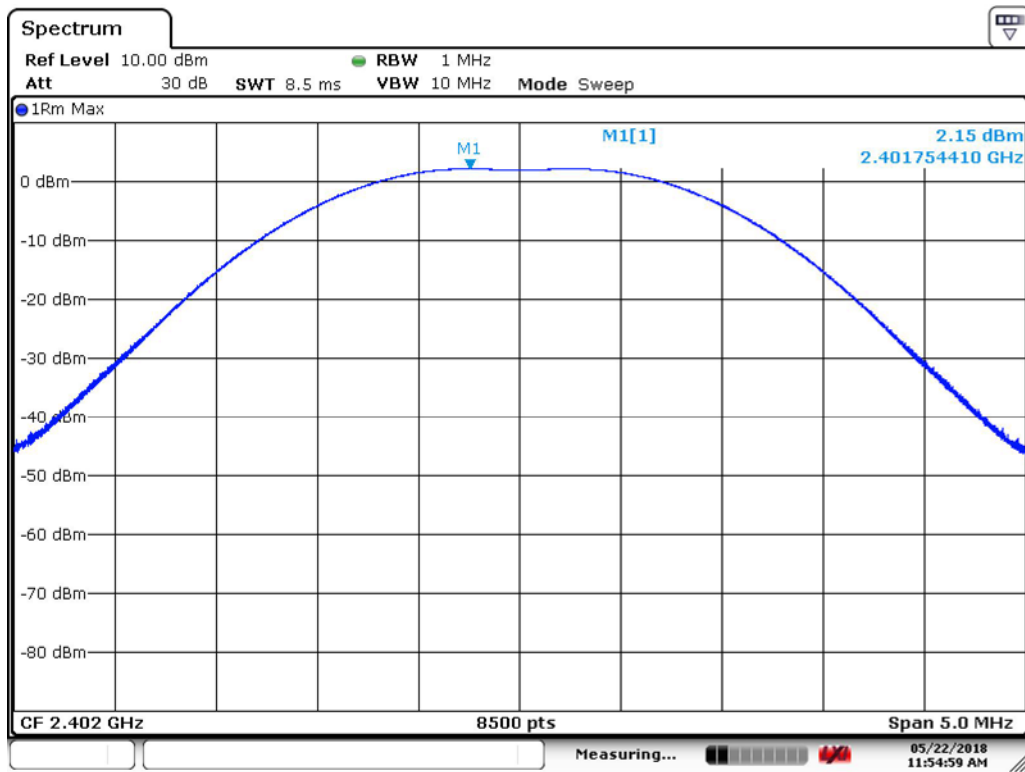
### ■ TEST RESULTS-Peak

| Mode | Channel | Power (dBm) | Power (mW) |
|------|---------|-------------|------------|
| GSFK | 2402    | 2.15        | 1.64       |
| GSFK | 2440    | 2.91        | 1.95       |
| GSFK | 2480    | 2.91        | 1.95       |

|                              |                              |                                        |                          |
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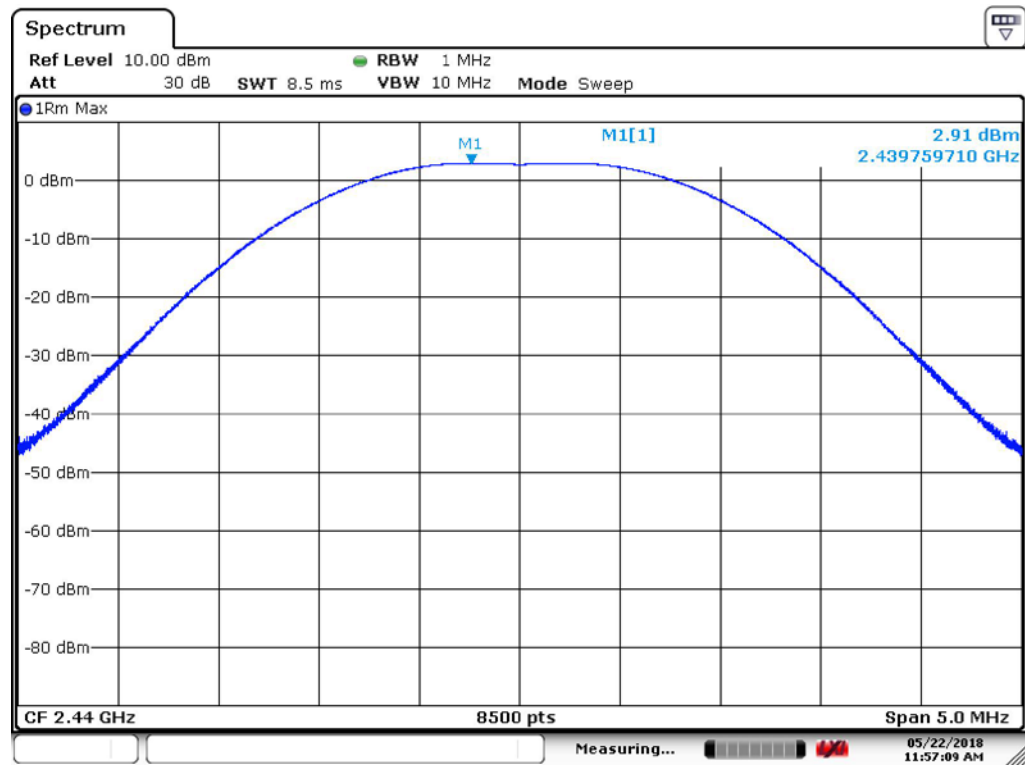
## RESULT PLOTS-Peak

2402



Date: 22.MAY.2018 11:54:59

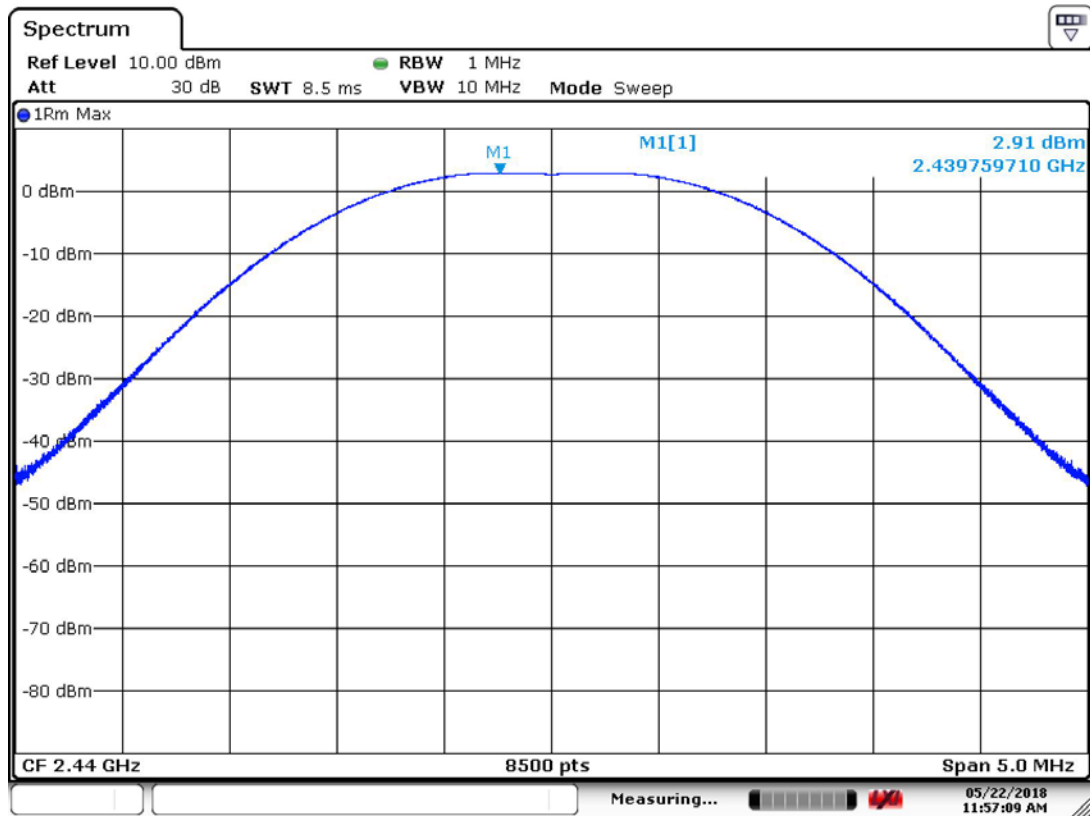
2440



Date: 22.MAY.2018 11:57:08

|                              |                              |                                        |                          |
|------------------------------|------------------------------|----------------------------------------|--------------------------|
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2480



Date: 22.MAY.2018 11:57:08

|                              |                              |                                        |                          |
|------------------------------|------------------------------|----------------------------------------|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |                          |
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: BLE data transmission device | FCC ID:<br>2ANB3-TDWLBLC |

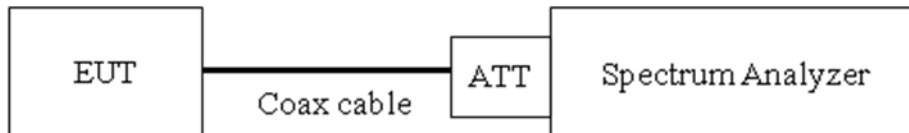
## 8.4 POWER SPECTRAL DENSITY

### Test Requirements and limit, §15.247(e)

The peak power spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

**Minimum Standard – the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.**

### ■ TEST CONFIGURATION



### ■ TEST PROCEDURE

We tested according to Procedure 10.2 in KDB 558074, issued 04/09/2013

The spectrum analyzer is set to :

Set analyzer center frequency to DTS channel center frequency.

Span = 1.5 times the DTS channel bandwidth.

RBW = 3 kHz ≤ RBW ≤ 100 kHz.

VBW ≥ 3 × RBW.

Sweep = auto couple

Detector = peak

Trace Mode = max hold

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### ■ Sample Calculation

$$\begin{aligned}
 \text{PSD} &= \text{Reading Value} + \text{ATT loss} + \text{Cable loss}(1 \text{ ea}) \\
 &= -5 \text{ dBm} + 10 \text{ dB} + 0.8 \text{ dB} = 5.8 \text{ dBm}
 \end{aligned}$$

|                              |                              |                                        |                          |
|------------------------------|------------------------------|----------------------------------------|--------------------------|
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## TEST RESULTS

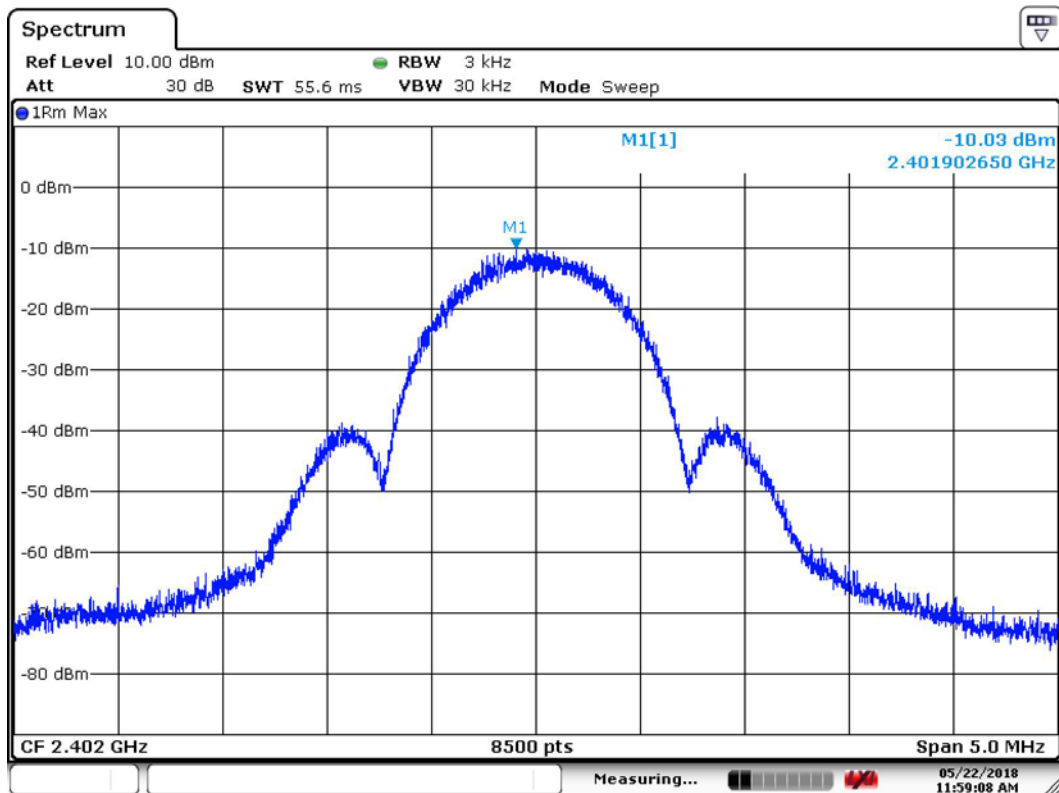
### Conducted Power Density Measurements

Note : In order to simplify the report, the attached plots are only the highest PSD channels.

| Mode | Channel | Power (dBm) |
|------|---------|-------------|
| GSFK | 2402    | -10.03      |
| GSFK | 2440    | -9.85       |
| GSFK | 2480    | -9.23       |

Center Frequency Plot is shown as representative in order to simplify this report.

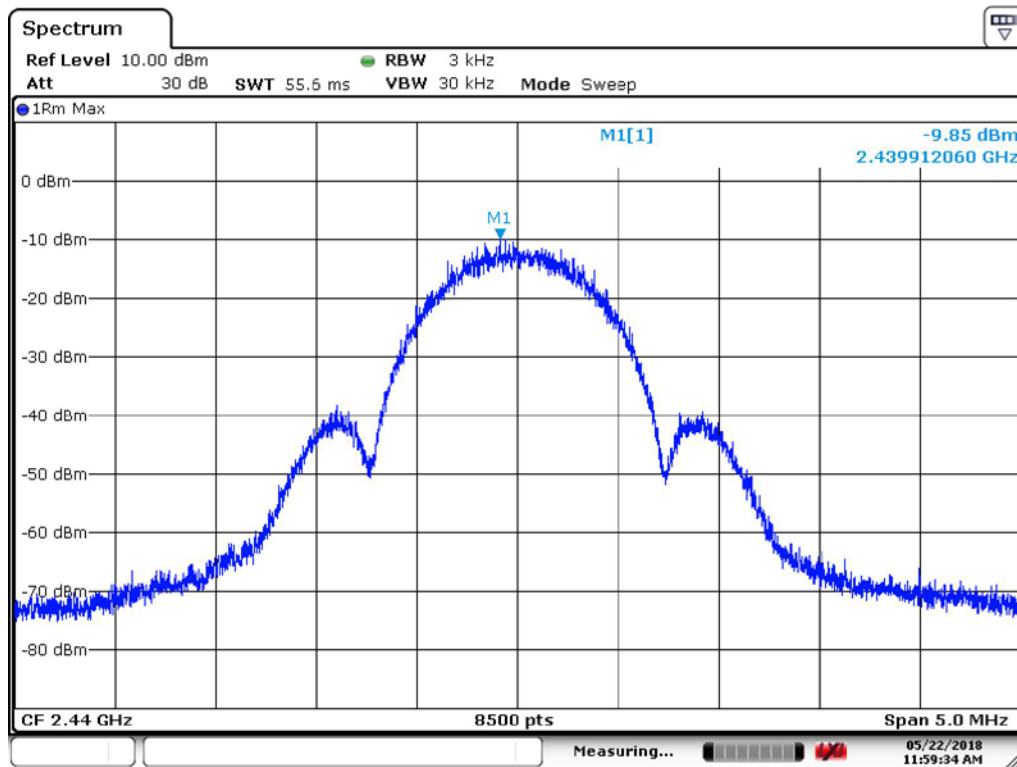
2402



Date: 22.MAY.2018 11:59:08

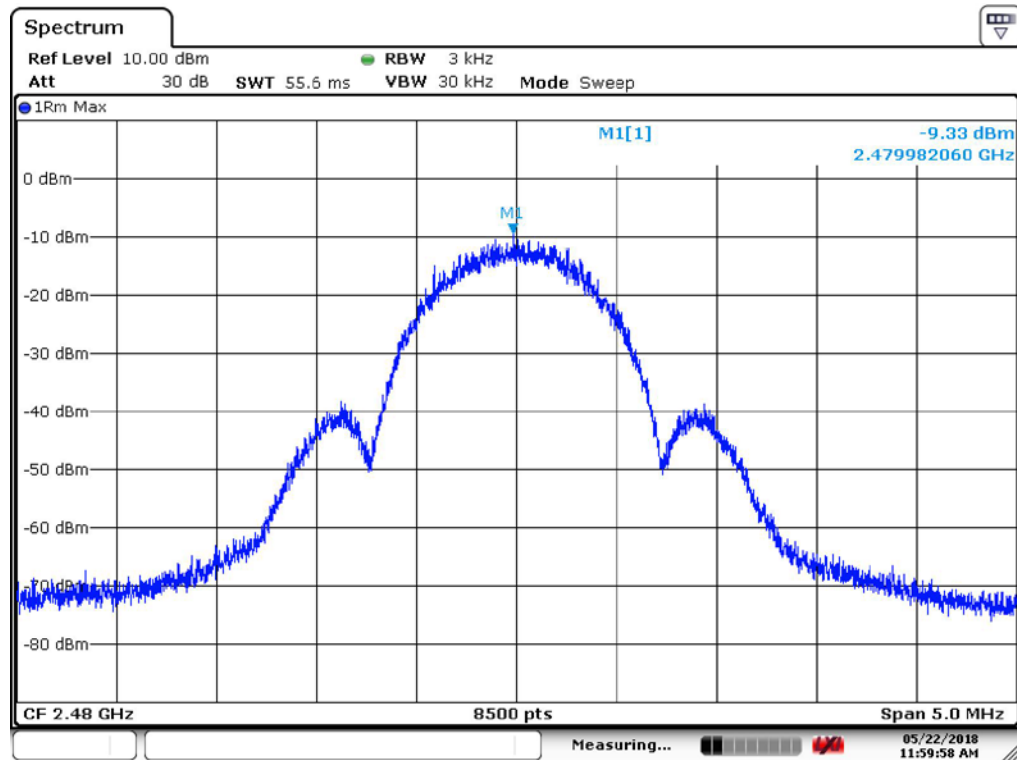
|                              |                              |                                        |                          |
|------------------------------|------------------------------|----------------------------------------|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |                          |
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: BLE data transmission device | FCC ID:<br>2ANB3-TDWLBLC |

2440 MHz



Date: 22.MAY.2018 11:59:34

2480 MHz



Date: 22.MAY.2018 11:59:58

|                              |                              |                                        |  |                          |
|------------------------------|------------------------------|----------------------------------------|--|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |  |                          |
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: BLE data transmission device |  | FCC ID:<br>2ANB3-TDWLBLC |

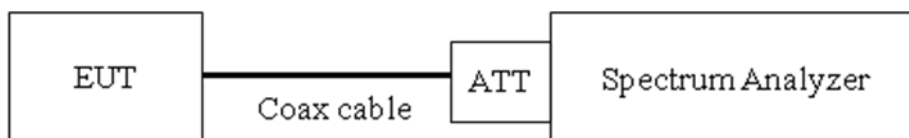
## 8.5 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

### Test Requirements and limit, §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 a radiated 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

**Limit : 20 dBc**

#### ■ TEST CONFIGURATION



#### ■ TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. (Procedure 11.0 in KDB 558074, issued 04/09/2013)

RBW = 100 kHz

VBW  $\geq 3 \times$  RBW

Set span to encompass the spectrum to be examined

Detector = Peak

Trace Mode = max hold

Sweep time = auto couple

Ensure that the number of measurement points  $\geq 2 \times \text{Span} / \text{RBW}$

Allow trace to fully stabilize.

Use peak marker function to determine the maximum amplitude level.

Measurements are made over the 30 MHz to 10<sup>th</sup> harmonic range with the transmitter set to the lowest, middle, and highest channels.

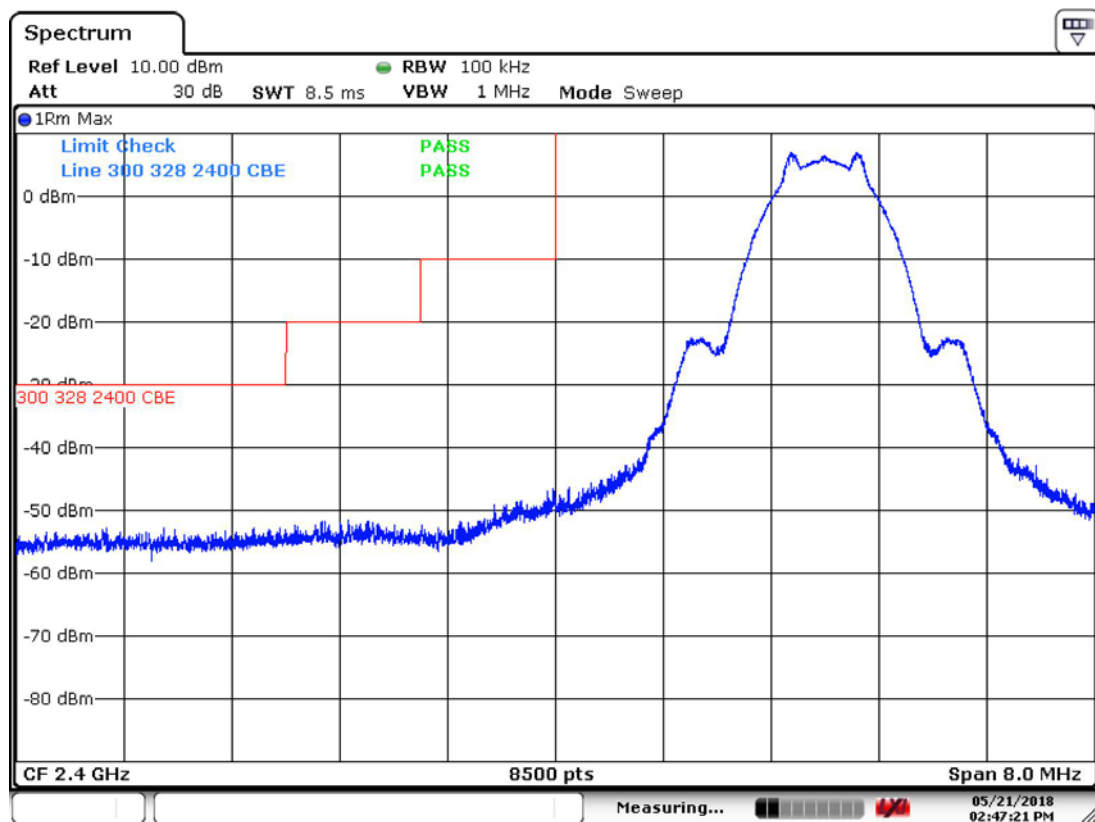
|                              |                              |                                               |                          |
|------------------------------|------------------------------|-----------------------------------------------|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                               |                          |
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: <b>BLE data transmission device</b> | FCC ID:<br>2ANB3-TDWLBLC |

### CONDUCTED BAND EDGE DATA

| Mode    | Frequency | Delta Measured | Delta Limit (dB) |
|---------|-----------|----------------|------------------|
| 2.4 GHz |           |                |                  |
| GSFK    | 2400      | 44.37          | >20              |
|         | 2483.5    | 43.03          | >20              |

## RESULT PLOTS

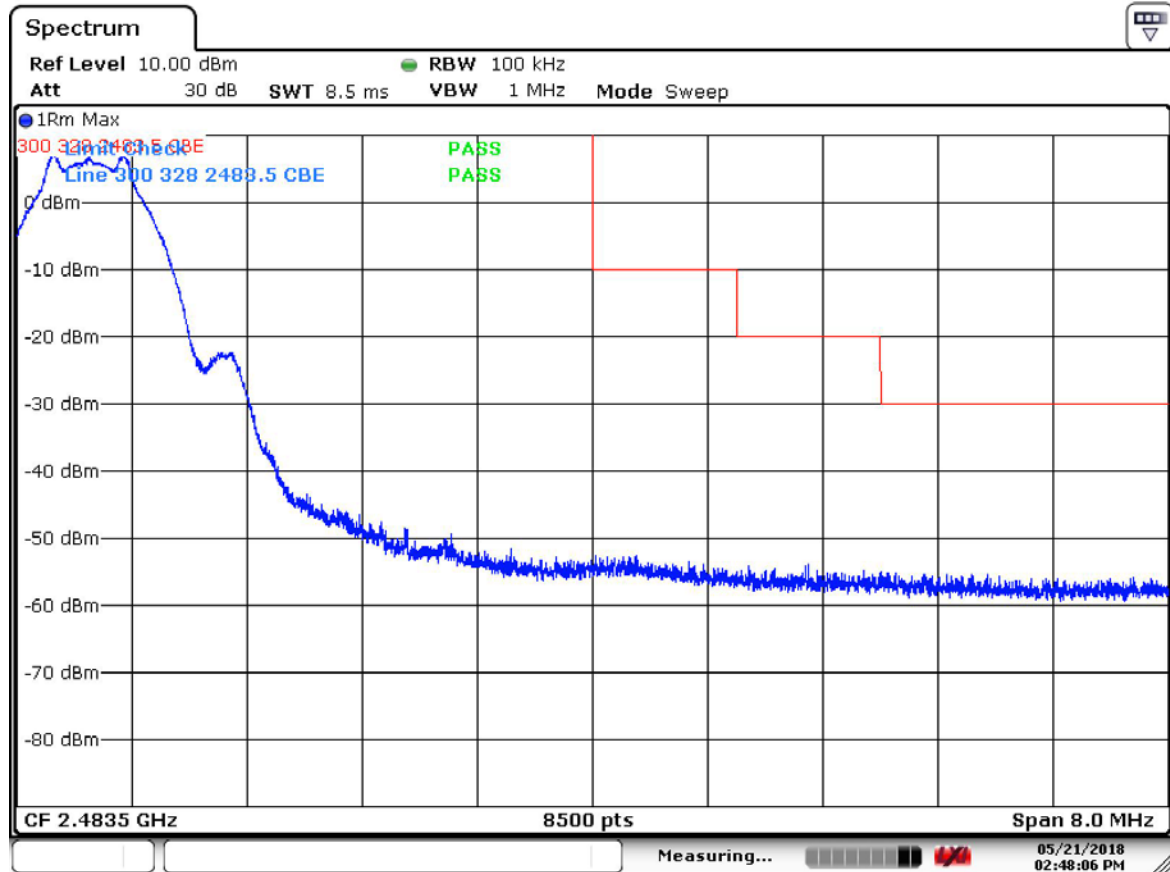
### 2400 MHz Band Edge



Date: 21.MAY.2018 14:47:21

|                              |                              |                                        |                          |
|------------------------------|------------------------------|----------------------------------------|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |                          |
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: BLE data transmission device | FCC ID:<br>2ANB3-TDWLBLC |

## 2483.5 MHz Band Edge



Date: 21.MAY.2018 14:48:06

## Conducted Spurious Emissions

9 kHz – 30MHz

Operation Mode: Normal Mode

| Frequency                  | Reading | Cable loss | Total | Limit | Margin |
|----------------------------|---------|------------|-------|-------|--------|
| MHz                        | dBm     | dBm        | dBm   | dBm   | dB     |
| No Critical Peaks Detected |         |            |       |       |        |

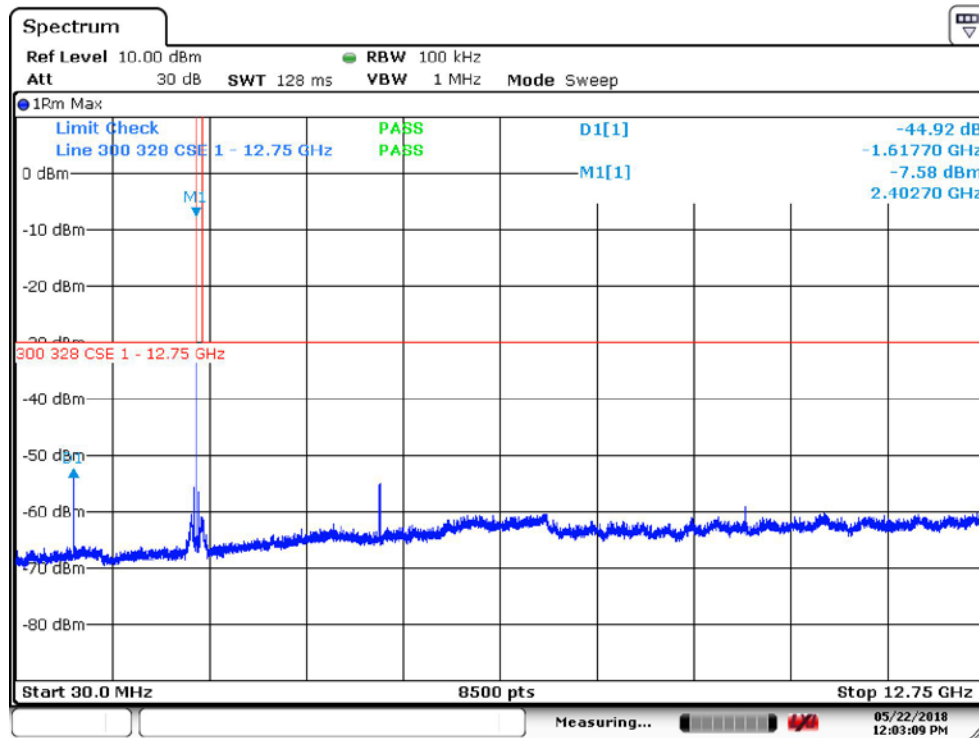
30 MHz – 1.0 GHz

| Frequency                  | Reading | Cable loss | Total | Limit | Margin |
|----------------------------|---------|------------|-------|-------|--------|
| MHz                        | dBm     | dBm        | dBm   | dBm   | dB     |
| No Critical Peaks Detected |         |            |       |       |        |

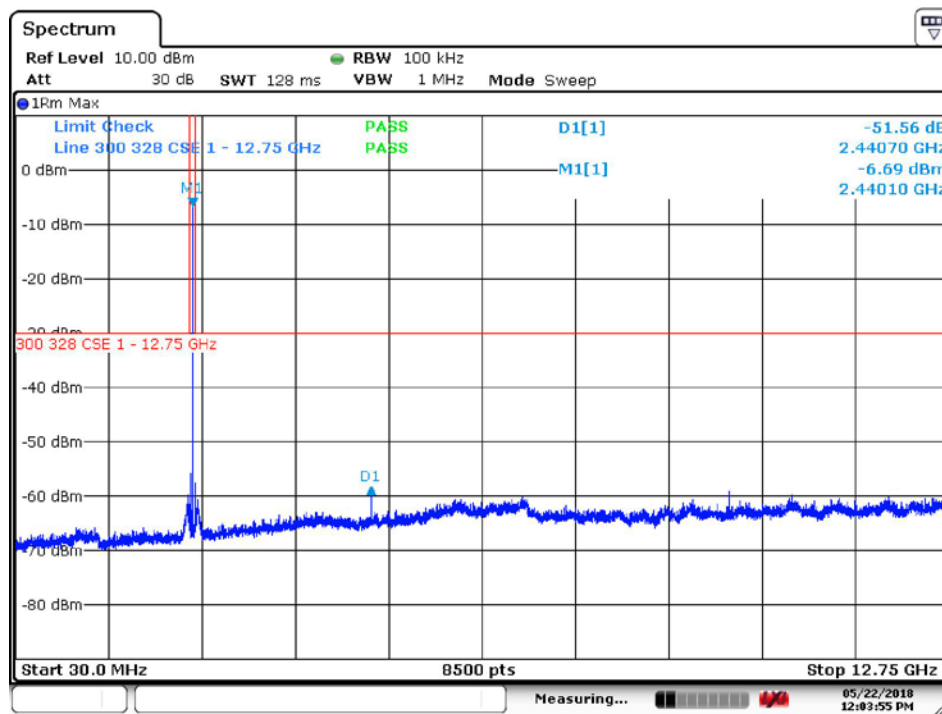
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |  |                          |
|------------------------------|------------------------------|----------------------------------------|--|--------------------------|
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: BLE data transmission device |  | FCC ID:<br>2ANB3-TDWLBLC |

1.0 – 18 GHz

2402 Xmit

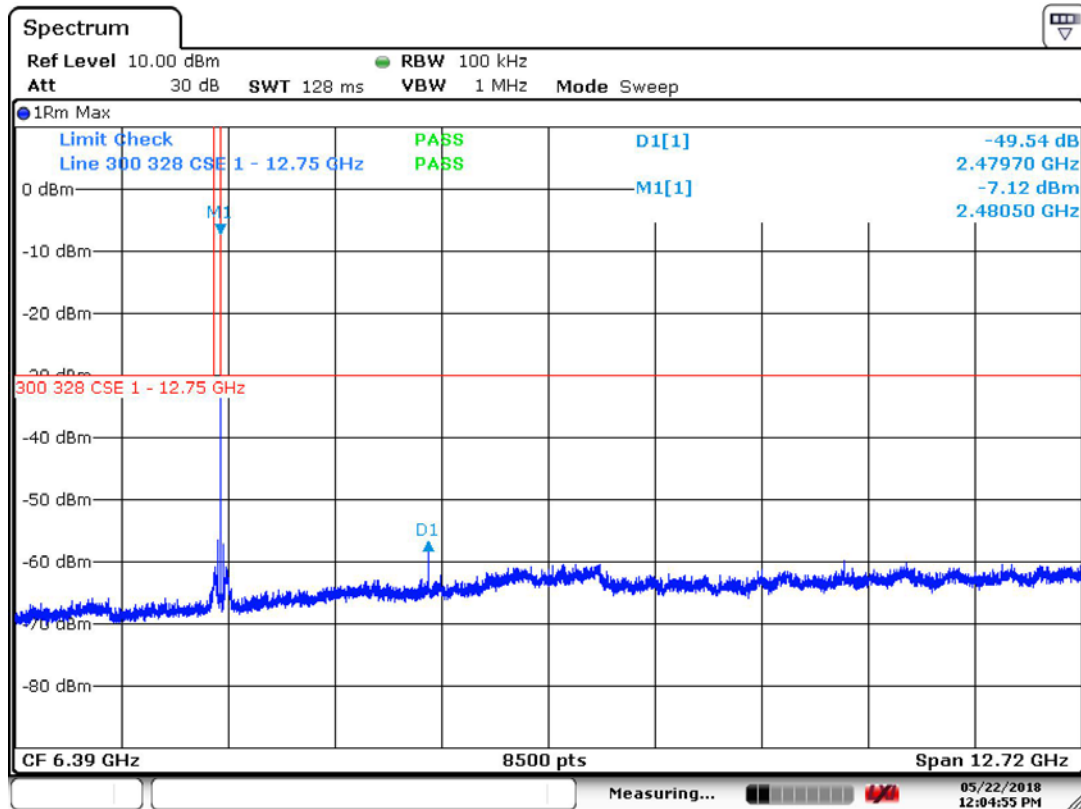


2440 Xmit



| FCC CERTIFICATION REPORT     |                              |                                        |                          |
|------------------------------|------------------------------|----------------------------------------|--------------------------|
| FCC PT.15.247<br>TEST REPORT |                              |                                        |                          |
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: BLE data transmission device | FCC ID:<br>2ANB3-TDWLBLC |

2480 MHz



Date: 22.MAY.2018 12:04:55

18 – 25 GHz

| Frequency                  | Reading | Cable loss | Total | Limit | Margin |
|----------------------------|---------|------------|-------|-------|--------|
| MHz                        | dBm     | dBm        | dBm   | dBm   | dB     |
| No Critical Peaks Detected |         |            |       |       |        |

|                              |                              |                                        |  |                          |
|------------------------------|------------------------------|----------------------------------------|--|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |  |                          |
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: BLE data transmission device |  | FCC ID:<br>2ANB3-TDWLBLC |

## 8.6 RADIATED MEASUREMENT

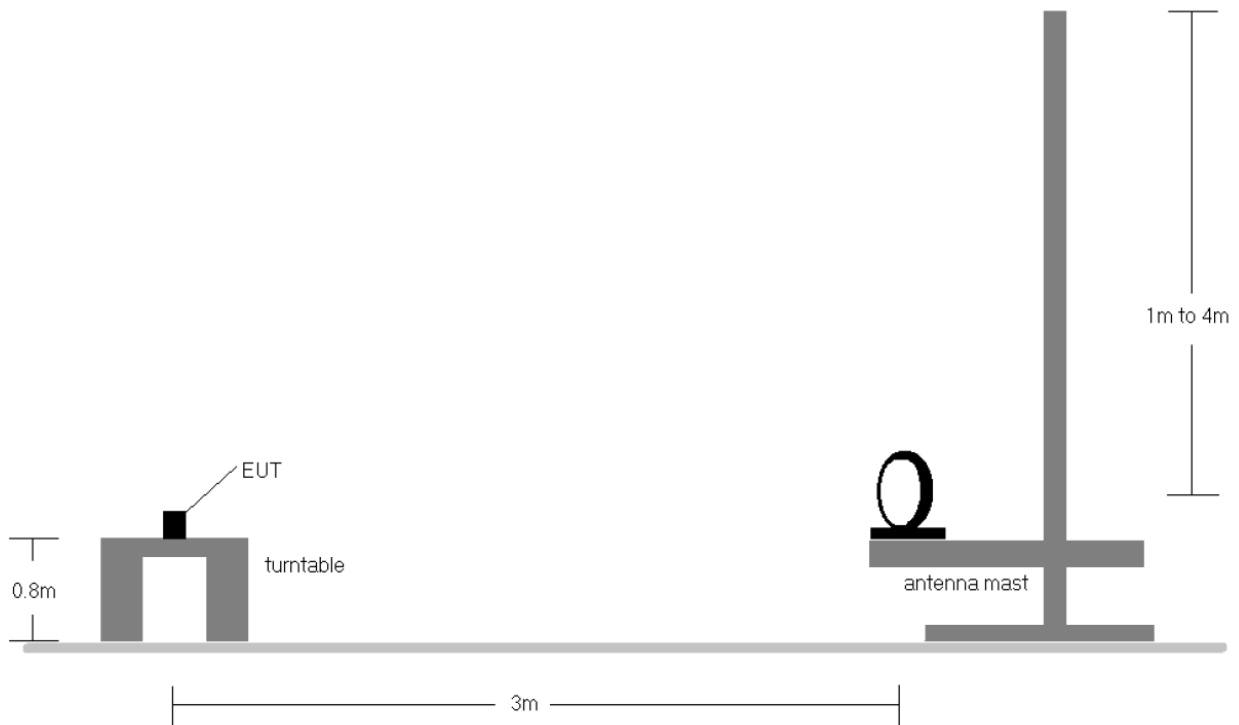
### 8.6.1 RADIATED SPURIOUS EMISSIONS.

Test Requirements and limit, §15.205, §15.209

| Frequency (MHz) | Field Strength (uV/m) | Measurement Distance (m) |
|-----------------|-----------------------|--------------------------|
| 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                        |

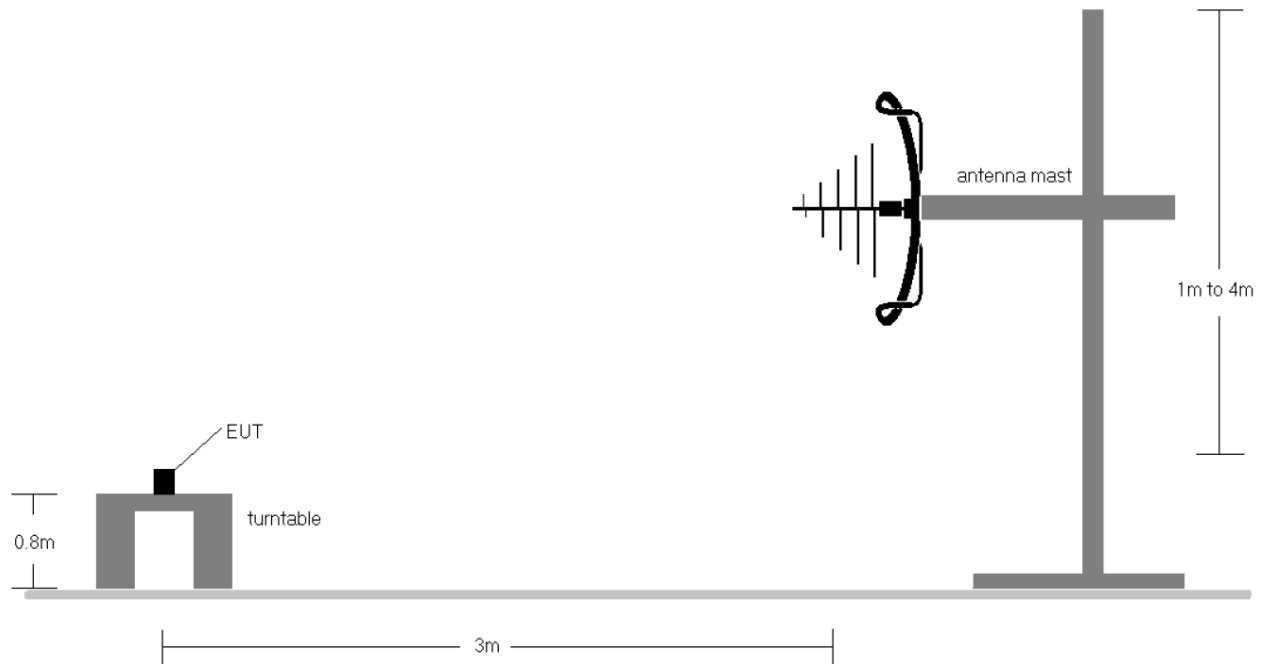
#### Test Configuration

##### Below 30 MHz

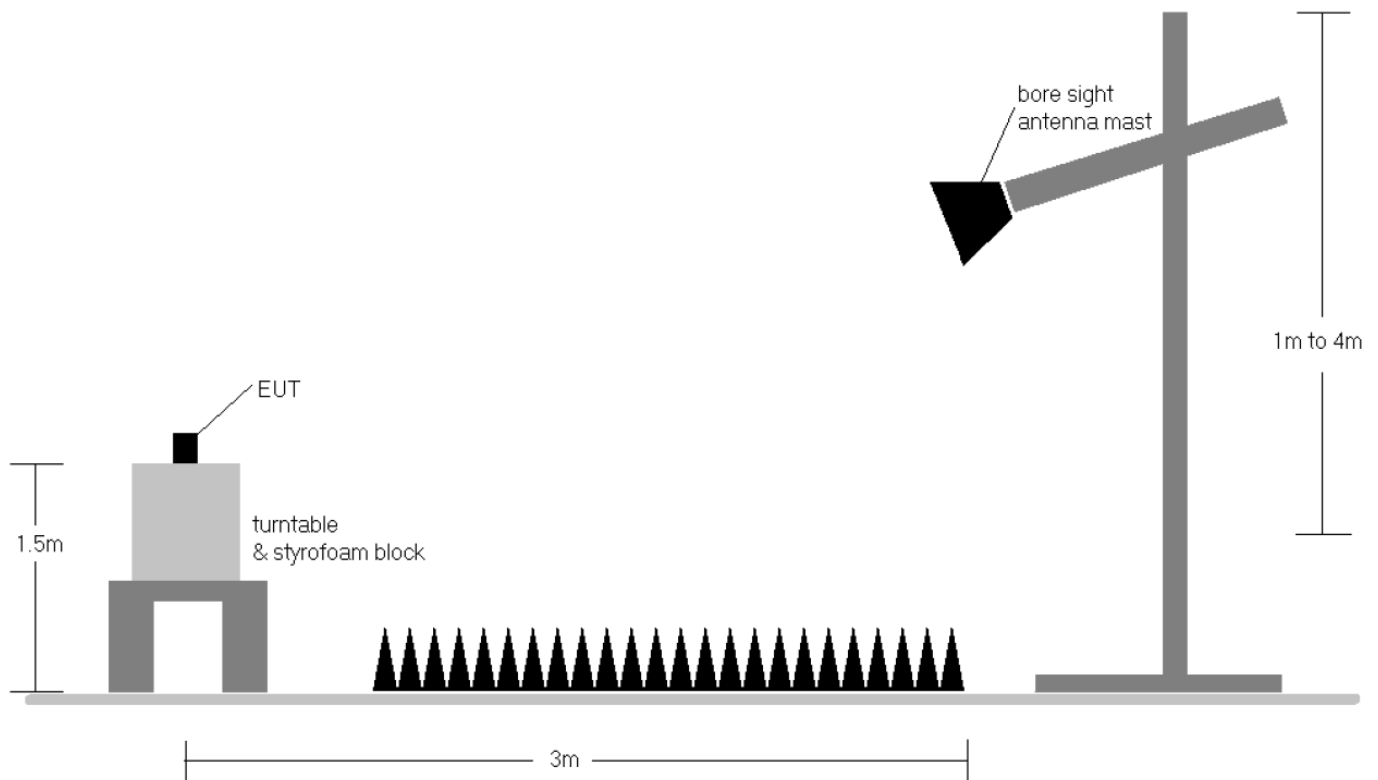


|                                      |                                     |                                               |                                 |
|--------------------------------------|-------------------------------------|-----------------------------------------------|---------------------------------|
| <b>FCC PT.15.247<br/>TEST REPORT</b> | <b>FCC CERTIFICATION REPORT</b>     |                                               |                                 |
| <b>Test Report No.</b><br>4378-1     | <b>Date of Issue:</b><br>05/29/2018 | <b>EUT Type:</b> BLE data transmission device | <b>FCC ID:</b><br>2ANB3-TDWLBLC |

### 30 MHz - 1 GHz



### Above 1 GHz



| FCC CERTIFICATION REPORT             |                                     |                                               |                                 |
|--------------------------------------|-------------------------------------|-----------------------------------------------|---------------------------------|
| <b>FCC PT.15.247<br/>TEST REPORT</b> |                                     |                                               |                                 |
| <b>Test Report No.</b><br>4378-1     | <b>Date of Issue:</b><br>05/29/2018 | <b>EUT Type:</b> BLE data transmission device | <b>FCC ID:</b><br>2ANB3-TDWLBLC |

## TEST PROCEDURE – Signal Identification

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. Spectrum Setting
  - a. Peak Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 MHz.
  - b. AV Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 kHz  $\geq 1/\tau$  Hz, where  $\tau$  = pulse width in seconds.

**Table 1 —RBW as a function of frequency**

| Frequency   | RBW         |
|-------------|-------------|
| 9-150 kHz   | 200-300 Hz  |
| 0.15-30 MHz | 9-10 kHz    |
| 30-1000 MHz | 100-120 kHz |
| > 1000 MHz  | 1 MHz       |

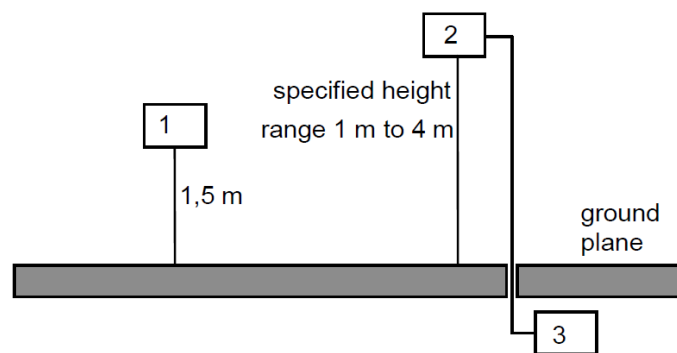
|                              |                              |                                               |                          |
|------------------------------|------------------------------|-----------------------------------------------|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                               |                          |
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: <b>BLE data transmission device</b> | FCC ID:<br>2ANB3-TDWLBLC |

## TEST PROCEDURE – Final Measurements

### Radiated measurements in an OATS or SAR

Radiated measurements shall be performed with the aid of a measurement antenna and a substitution antenna in test sites described in annex B. The measurement set-up shall be calibrated according to the procedure defined in this annex. The UUT and the measurement antenna shall be oriented such as to obtain the maximum emitted power level. This position shall be recorded in the test report.

- a) The measurement antenna (device 2 in figure C.1) shall be oriented initially for vertical antenna polarization unless otherwise stated and the UUT (device 1 in figure C.1) shall be placed on the support in its normal position and switched on.
- b) The measurement equipment (device 3 in figure C.1) shall be connected to the measurement antenna (device 2 in figure C.1) as shown in figure C.1.



- c) UUT
- d) Measurement antenna
- e) Measurement equipment

**Figure C.1: Measurement arrangement No.1**

- c) The UUT shall be rotated through 360° around its azimuth until the maximum signal level is received.
- d) The measurement antenna shall be raised or lowered over the specified height range until the maximum signal level is received. This level shall be recorded.
- e) This measurement shall be repeated for horizontal measurement antenna polarization.

|                              |                              |                                               |                          |
|------------------------------|------------------------------|-----------------------------------------------|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                               |                          |
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## TEST RESULTS

9 kHz – 30MHz

Operation Mode: Normal Mode

| Frequency               | Reading      | Ant. factor | Cable loss | Ant. POL | Total        | Limit        | Margin |
|-------------------------|--------------|-------------|------------|----------|--------------|--------------|--------|
| MHz                     | dB $\mu$ V/m | dBm /m      | dBm        | (H/V)    | dB $\mu$ V/m | dB $\mu$ V/m | dB     |
| No Critical peaks found |              |             |            |          |              |              |        |

### Notes:

1. Measuring frequencies from 9 kHz to the 30MHz.
2. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
3. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
4. Limit line = specific Limits (dBuV) + Distance extrapolation factor
5. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

|                              |                              |                                        |  |                          |
|------------------------------|------------------------------|----------------------------------------|--|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |  |                          |
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## TEST RESULTS

### 30 MHz - 1 GHz

**Operation Mode:** Normal Mode

| Freq in MHz | Meter<br>dBμV/m | Factors | Corr   | Spec | Margin | Table | Antenna | Polarity | Test Dist |
|-------------|-----------------|---------|--------|------|--------|-------|---------|----------|-----------|
| 219.4421    | -64.11          | -14.01  | -78.12 | -54  | -24.12 | 109   | 110     | V        | 3 Meters  |
| 494.1185    | -68.4862        | -6.59   | -75.07 | -54  | -21.07 | 293   | 125     | V        | 3 Meters  |
| 792.3397    | -70.5501        | -1.40   | -71.95 | -54  | -17.95 | 201   | 255     | V        | 3 Meters  |

#### Notes:

1. Measuring frequencies from 30 MHz to the 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

## TEST RESULTS

### 1 - 25 GHz

| Freq in MHz | Meter<br>dBμV/m | Factors | Corr  | Spec  | Margin | Antenna | Polarity | Test<br>Dist |
|-------------|-----------------|---------|-------|-------|--------|---------|----------|--------------|
| 4804.2091   | 35.60           | 9.00    | 44.60 | 74.00 | -29.40 | 133.40  | V - PK   | 3<br>Meters  |
| 4804.3230   | 27.7            | 9.00    | 36.70 | 54.00 | -17.30 | 145.10  | H - AV   | 3<br>Meters  |

#### Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or fewer if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain
5. Worst case data is shown from x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna

|                              |                              |                                        |  |                          |
|------------------------------|------------------------------|----------------------------------------|--|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |  |                          |
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: BLE data transmission device |  | FCC ID:<br>2ANB3-TDWLBLC |

## 8.6.2 RADIATED RESTRICTED BAND EDGES

### Test Requirements and limit, §15.247(d) §15.205, §15.209

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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)).

| Frequency<br>(MHz) | Meter<br>dBμV/m | Corr.<br>Factor | Corr.<br>Reading | Spec | Margin | Detector<br>Type | Polarity | Test<br>Distance |
|--------------------|-----------------|-----------------|------------------|------|--------|------------------|----------|------------------|
| 2402 Tx            |                 |                 |                  |      |        |                  |          |                  |
| 2390               | 37.11           | 10.37           | 47.48            | 74   | -26.52 | PK               | V        | 3 Meters         |
| 2390               | 29.18           | 10.37           | 39.55            | 54   | -14.45 | AVE              | V        | 3 Meters         |
| 2390               | 37.59           | 10.37           | 47.96            | 74   | -26.04 | PK               | H        | 3 Meters         |
| 2390               | 29.44           | 10.37           | 39.81            | 54   | -14.19 | AVE              | H        | 3 Meters         |
| 2480 Tx            |                 |                 |                  |      |        |                  |          |                  |
| 2483.5             | 37.52           | 10.5            | 48.02            | 74   | -25.98 | PK               | V        | 3 Meters         |
| 2483.5             | 30.85           | 10.5            | 41.35            | 54   | -12.65 | AVE              | V        | 3 Meters         |
| 2483.5             | 39.09           | 10.5            | 49.59            | 74   | -24.41 | PK               | H        | 3 Meters         |
| 2483.5             | 27.68           | 10.5            | 38.18            | 54   | -15.82 | AVE              | H        | 3 Meters         |

|                              |                              |                                        |  |                          |
|------------------------------|------------------------------|----------------------------------------|--|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |  |                          |
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## 8.7 POWERLINE CONDUCTED EMISSIONS

### Test Requirements and limit, §15.207

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

| Frequency Range (MHz) | Limits (dBµV) |          |
|-----------------------|---------------|----------|
|                       | Quasi-peak    | Average  |
| 0.15 to 0.50          | 66 to 56      | 56 to 46 |
| 0.50 to 5             | 56            | 46       |
| 5 to 30               | 60            | 50       |

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

### Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

### TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.
5. We are performed the AC Power Line Conducted Emission test for 13 Mbps, Ch.6 and 802.11n\_20 MHz BW. Because 802.11n\_20 MHz BW mode is worst case.

### Test Results:

*Not Applicable – Battery Powered*

|                              |                              |                                        |                          |
|------------------------------|------------------------------|----------------------------------------|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                        |                          |
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## 1. LIST OF TEST EQUIPMENT

| Equipment                                   | Serial Number   | Last Calibration Date | Calibration Due |
|---------------------------------------------|-----------------|-----------------------|-----------------|
| Omega-IBTHXBP<br>Temp / Humidity Meter      | 14490199        | 7/8/2016              | 7/8/2018        |
| ETS – EmPower<br>Power Sensor               | 141000-48SNO051 | 6/9/2017              | 6/9/2018        |
| Fluke-87 DMM                                | 64920001        | 6/28/2016             | 6/28/2018       |
| EMCO-3816-2 LISN                            | 9809-1089       | 6/12/2017             | 6/12/2018       |
| Rohde & Schwarz- FSV40<br>Spectrum Analyzer | 101424          | 6/20/2016             | 6/20/2018       |
| Sunol Sciences-JB6<br>BiConilog Antenna     | A042610         | 6/8/2017              | 6/8/2018        |
| A.H. Systems-SAS- 571<br>Horn Antenna       | 236             | 6/13/2017             | 6/13/2018       |

END OF REPORT

|                              |                              |                                               |                          |
|------------------------------|------------------------------|-----------------------------------------------|--------------------------|
| FCC PT.15.247<br>TEST REPORT | FCC CERTIFICATION REPORT     |                                               |                          |
| Test Report No.<br>4378-1    | Date of Issue:<br>05/29/2018 | EUT Type: <b>BLE data transmission device</b> | FCC ID:<br>2ANB3-TDWLBLC |