



**MEASUREMENT REPORT**  
**FCC Part 15.249 Bluetooth (Low Energy)**

**Applicant Name:**  
 Saucon Technologies, Inc.  
 2455 Baglyos Circle  
 Bethlehem, PA 18020

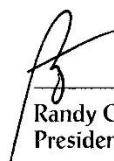
**Date of Testing:**  
 12/11/2020-12/16/2020  
**Test Site/Location:**  
 PCTEST Lab. Columbia, MD USA  
**Test Report Serial No.:**  
 1M2012080194.01.2AYQW

<b>FCC ID:</b>	<b>2AYQW-IOTTEMP</b>
<b>APPLICANT:</b>	<b>Saucon Technologies, Inc.</b>

<b>Application Type:</b>	Certification
<b>EUT Type:</b>	IoT Temperature Beacon
<b>Max. RF Output Power:</b>	0.441 mW (-3.56 dBm) Peak Conducted
<b>Frequency Range:</b>	2402 – 2480MHz
<b>FCC Classification:</b>	Part 15 Low Power Communication Device Transmitter (DXX)
<b>Test Procedure(s):</b>	ANSI C63.10-2013

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013 and KDB 558074 D01 v05r02. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

  
 Randy Ortanez  
 President


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## 1.0 INTRODUCTION

### 1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

### 1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

### 1.3 Test Facility / Accreditations

**Measurements were performed at PCTEST located in Columbia, MD 21046, U.S.A.**

- PCTEST is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

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## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Saucon Technologies IoT Temperature Beacon FCC ID: 2AYQW-IOTTEMP**. The data found in this test report was taken with the EUT operating in Bluetooth low energy mode. While in low energy mode, the Bluetooth transmitter hops pseudo-randomly between 40 channels, three of which are “advertising channels”.

**Test Device Serial No.:** 2030-0024, 2030-0005

### 2.2 Device Capabilities

This device contains the following capabilities:

BTLE

Ch.	Frequency (MHz)
0	2402
:	:
19	2440
:	:
39	2480

Table 2-1. Frequency / Channel Operations

### 2.3 Antenna Description

Following antenna was used for the testing.

Frequency [GHz]	Antenna Gain (dBi)
2.4	0

Table 2-2. Antenna Peak Gain

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## 2.4 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013 and KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing. See Sections, 3.2 for radiated emissions test setups, and 7.2 and 7.3 for antenna port conducted emissions test setups.

The EUT was connected to a laptop, via supplied diagnostic cable, to send test commands to the EUT in order for the EUT to transmit or to stop transmitting. Once the EUT was transmitting the laptop was then disconnected and placed on the test site.

The emissions below 1GHz and above 18GHz were tested with the highest transmitting power channel and the worst case configuration.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

## 2.5 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

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## 3.0 DESCRIPTION OF TESTS

### 3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

**Deviation from measurement procedure.....**None

### 3.2 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33 depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 474788 D01.

### 3.3 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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## 4.0 ANTENNA REQUIREMENTS

### Excerpt from §15.203 of the FCC Rules/Regulations:

"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(s) of the EUT are **permanently attached**.
- There are no provisions for connection to an external antenna.

### Conclusion:

The EUT complies with the requirement of §15.203.

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## 5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the  $U_{CISPR}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty ( $\pm$ dB)
Conducted Bench Top Measurements	1.13
Line Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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## 6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	WL25-1	Conducted Cable Set (25GHz)	7/2/2020	Annual	7/2/2021	WL25-1
Agilent	N9030A	PXA Signal Analyzer (44GHz)	7/17/2020	Annual	7/17/2021	MY49430494
Emco	3116	Horn Antenna (18 - 40GHz)	8/7/2018	Triennial	8/7/2021	9203-2178
Keysight Technologies	N9030A	PXA Signal Analyzer (3Hz-26.5GHz)	10/16/2020	Annual	10/16/2021	MY54490576
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	11/1/2019	Biennial	T11/1/2021	100040
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	7/15/2020	Annual	7/15/2021	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	9/9/2020	Annual	9/9/2021	100348
Rohde & Schwarz	FSV40-N	Spectrum Analyzer	12/20/2019	Annual	12/20/2020	103200
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2/10/2020	Annual	2/10/2021	102134
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2/21/2020	Annual	2/21/2021	102133
Rohde & Schwarz	TC-TA18	Vivaldi Antenna	8/13/2020	Biennial	8/13/2022	101073
Rohde & Schwarz	TC-TA18	Vivaldi Antenna	7/8/2020	Biennial	7/8/2022	101058
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	7/27/2020	Biennial	7/27/2022	A051107

**Table 6-1. Annual Test Equipment Calibration Schedule**

**Note:**

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

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## 7.0 TEST RESULTS

### 7.1 Summary

Company Name: Saucon Technologies, Inc.  
 FCC ID: 2AYQW-IOTTEMP  
 FCC Classification: Part 15 Low Power Communication Device Transmitter (DXX)  
 Number of Channels: 40

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	RSS-210	6dB Bandwidth	n/a	CONDUCTED	PASS	Section 7.2
2.1046	RSS-210	Transmitter Output Power	n/a		PASS	Section 7.3
15.249(a)	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])	RADIATED	PASS	Sections 7.4, 7.5, 7.6 , 7.7

**Table 7-1. Summary of Test Results**

**Notes:**

1. All modes of operation were investigated. The test results shown in the following sections represent the worst case emissions.
2. The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3. All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
4. For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Bluetooth LE Automation," Version 3.6.
5. For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Chamber Automation," Version 1.3.1.

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## 7.2 6dB Bandwidth Measurement – Bluetooth (LE)

§2.1049; RSS-210

### Test Overview and Limit

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the transmitter antenna terminal of the EUT while the EUT is operating at maximum power and at the appropriate frequencies. All modes of operation were investigated and the worst case configuration results are reported in this section.

***The minimum permissible 6dB bandwidth is 500 kHz.***

### Test Procedure Used

ANSI C63.10-2013 – Section 11.8.2 Option 2

### Test Settings

1. The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 100kHz
3. VBW  $\geq 3 \times$  RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize

### Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



**Figure 7-1. Test Instrument & Measurement Setup**

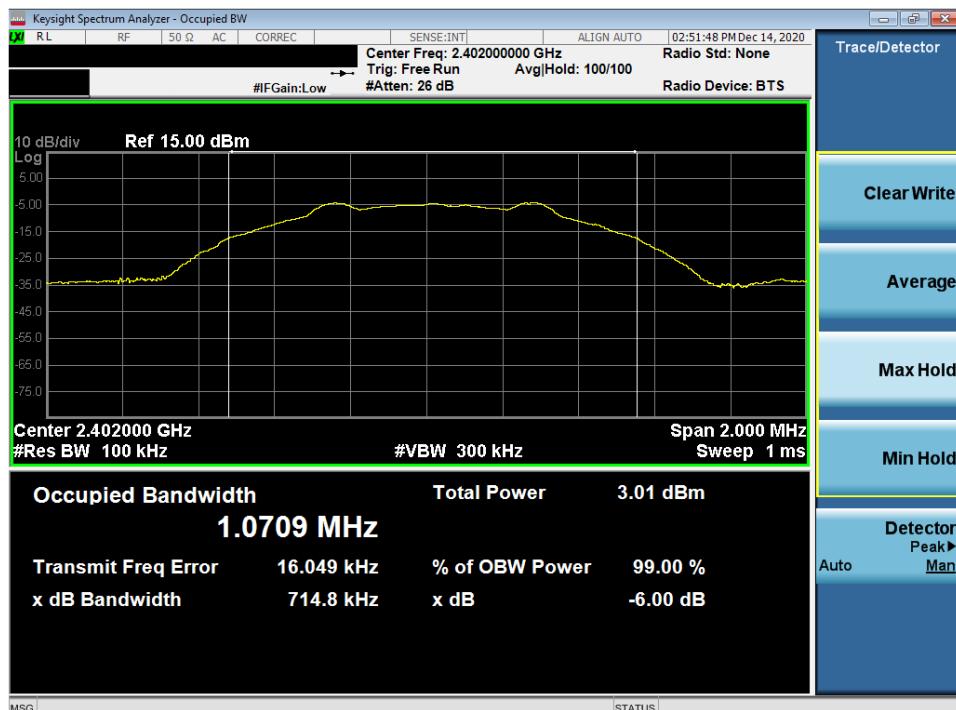
### Test Notes

None

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Frequency [MHz]	Data Rate	Channel No.	Bluetooth Mode	Measured Bandwidth [kHz]
2402	1 Mbps	0	LE	714.8
2440	1 Mbps	19	LE	727.2
2480	1 Mbps	39	LE	729.5
2402	2 Mbps	0	LE	1260
2440	2 Mbps	19	LE	1286
2480	2 Mbps	39	LE	1359

**Table 7-2. Conducted Bandwidth Measurements**



**Plot 7-1. 6dB Bandwidth Plot (Bluetooth (LE), 1Mbps – Ch. 0)**

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Plot 7-2. 6dB Bandwidth Plot (Bluetooth (LE), 1Mbps – Ch. 19)



Plot 7-3. 6dB Bandwidth Plot (Bluetooth (LE), 1Mbps – Ch. 39)

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Plot 7-4. 6dB Bandwidth Plot (Bluetooth (LE), 2Mbps – Ch. 0)



Plot 7-5. 6dB Bandwidth Plot (Bluetooth (LE), 2Mbps – Ch. 19)

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Plot 7-6. 6dB Bandwidth Plot (Bluetooth (LE), 2Mbps – Ch. 39)

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## 7.3 Output Power Measurement – Bluetooth (LE)

§2.1046; RSS-210

### Test Overview and Limits

The transmitter antenna terminal of the EUT is connected to the input of a spectrum analyzer. Measurements are made while the EUT is operating at maximum power and at the appropriate frequencies.

### Test Procedure Used

ANSI C63.10-2013 – Section 11.9.1.1

### Test Settings

1. RBW = 3MHz
2. VBW = 50MHz
3. Span  $\geq$  3 x RBW
4. Sweep = auto couple
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

### Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



**Figure 7-2. Test Instrument & Measurement Setup**

### Test Notes

None

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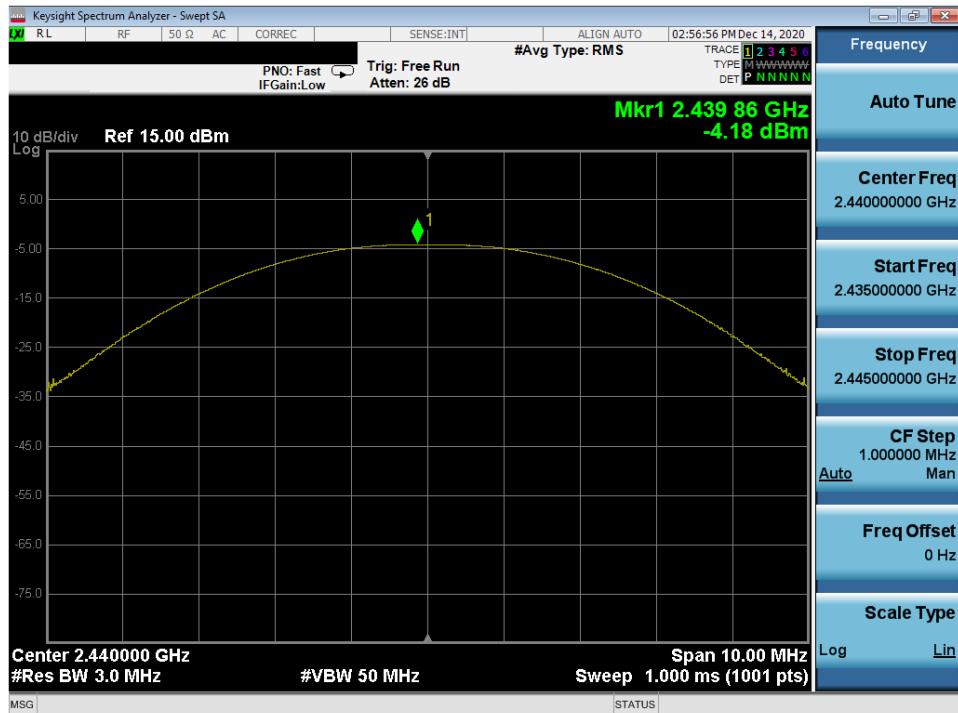
Frequency [MHz]	Data Rate [Mbps]	Channel No.	Bluetooth Mode	Peak Conducted Power [dBm]
2402	1 Mbps	0	LE	-3.64
2440	1 Mbps	19	LE	-4.18
2480	1 Mbps	39	LE	-4.30
2402	2 Mbps	0	LE	-3.56
2440	2 Mbps	19	LE	-4.10
2480	2 Mbps	39	LE	-4.31

**Table 7-3. Conducted Output Power Measurements (Bluetooth (LE))**

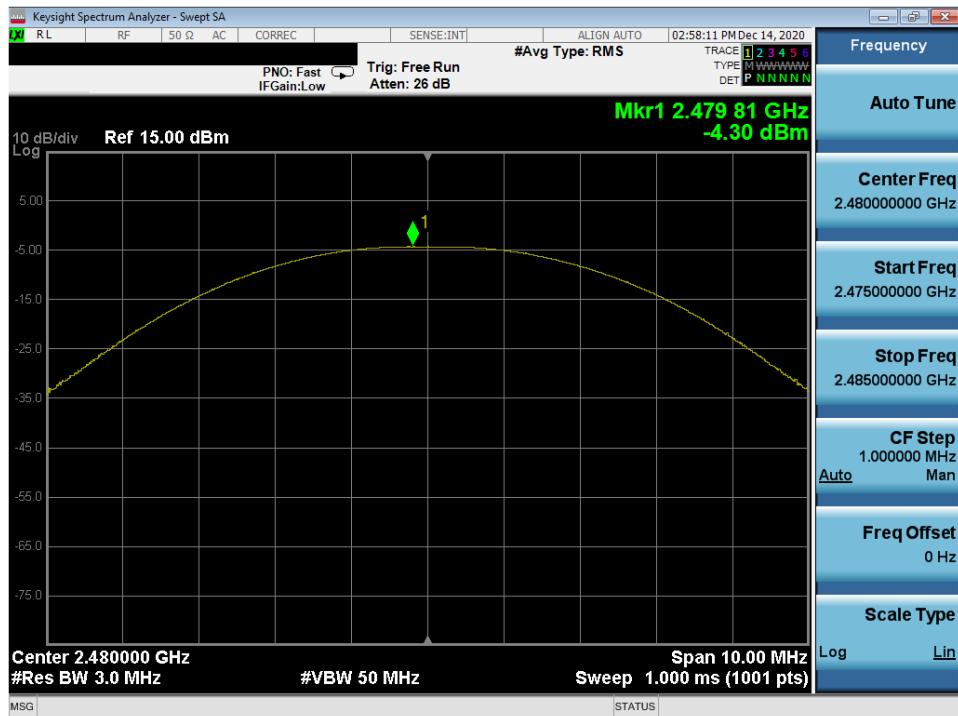


**Plot 7-7. Peak Power Plot (Bluetooth (LE), 1Mbps – Ch. 0)**

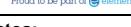
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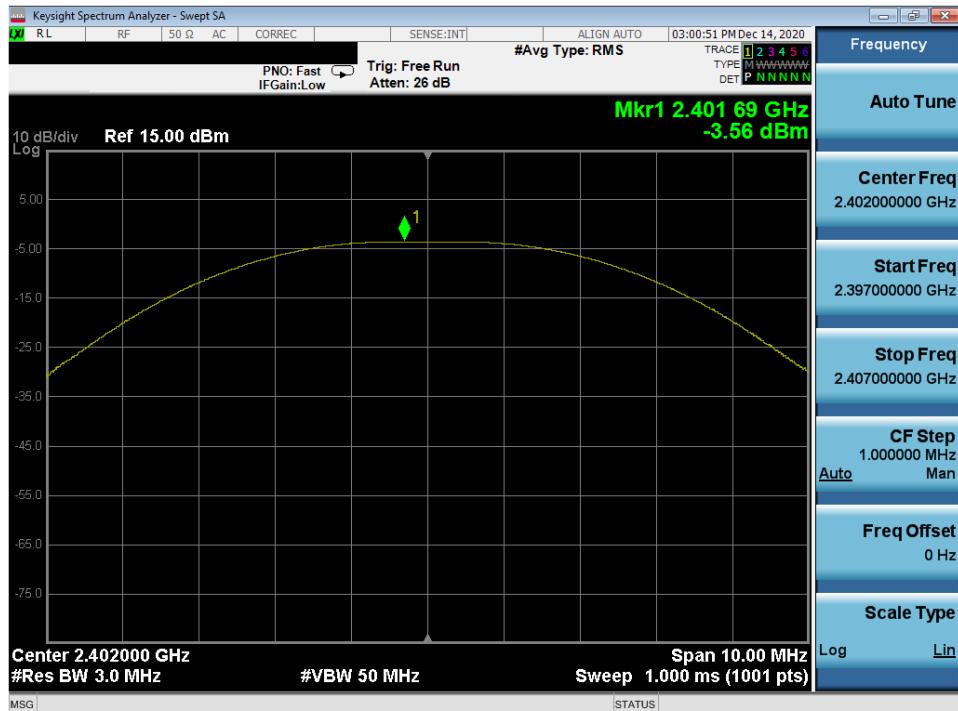


Plot 7-8. Peak Power Plot (Bluetooth (LE), 1Mbps – Ch. 19)

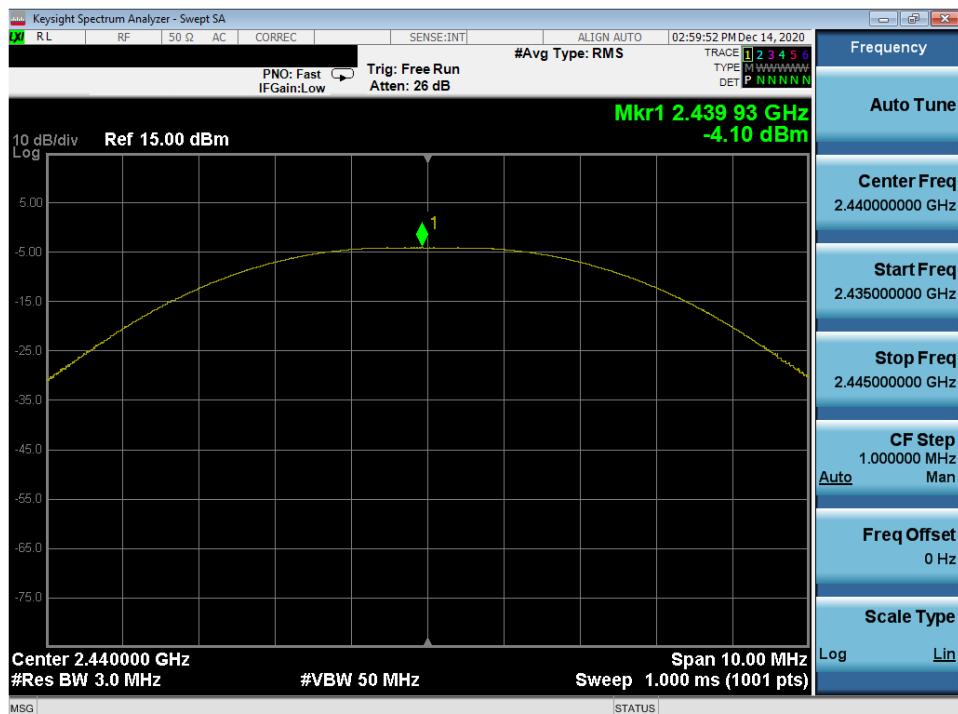


Plot 7-9. Peak Power Plot (Bluetooth (LE), 1Mbps – Ch. 39)

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Plot 7-10. Peak Power Plot (Bluetooth (LE), 2Mbps – Ch. 0)



Plot 7-11. Peak Power Plot (Bluetooth (LE), 2Mbps – Ch. 19)

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Plot 7-12. Peak Power Plot (Bluetooth (LE), 2Mbps – Ch. 39)

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## 7.4 Radiated Spurious Emission Measurements

§15.249(a); RSS-Gen [8.9]

### Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at maximum power and at the appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

***All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 6 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-4 per Section 15.209 and RSS-Gen (8.9).***

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

**Table 7-4. Radiated Limits**

### Test Procedures Used

ANSI C63.10-2013 – Section 6.6.4.3

### Test Settings

#### Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3kHz > 1/T
4. Averaging type was set to RMS to ensure that video filtering was applied in the power domain
5. Detector = peak
6. Sweep time = auto
7. Trace mode = max hold
8. Trace was allowed to run for at least 50 times (1/duty cycle) traces

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## Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW is set depending on measurement frequency, as specified in Table 7-5 below
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

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

Table 7-5. RBW as a Function of Frequency

## Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

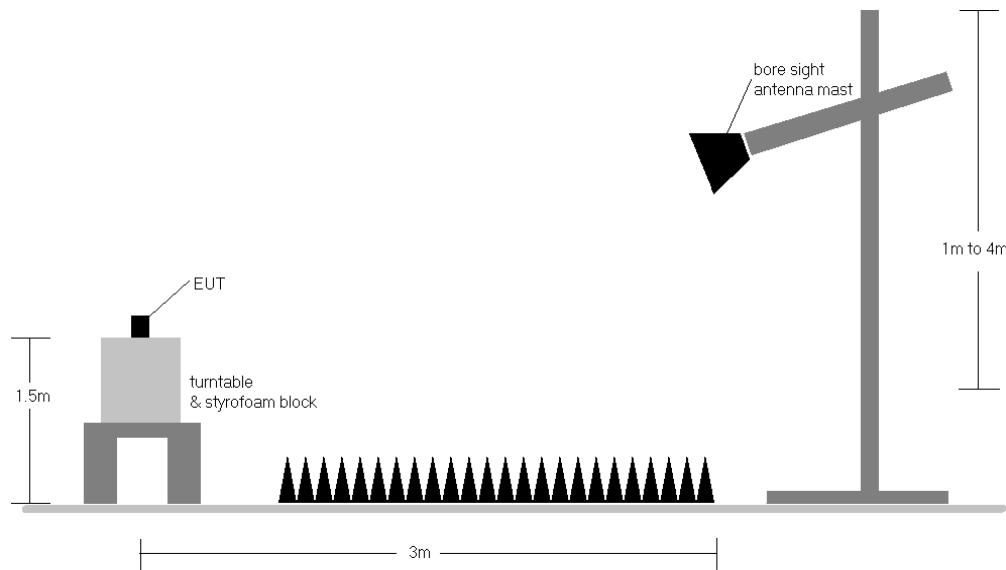


Figure 7-3. Radiated Test Setup >1GHz

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## Test Notes

1. All emissions lying in restricted bands specified in §15.205 and Section 8.10 of RSS-Gen are below the limit shown in Table 7-4.
2. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested with its standard battery.
4. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
5. Average measurements were recorded using a VBW of 3kHz, per Section 4.1.4.2.3 of ANSI C63.10-2013, since 1/T is equal to just under 3kHz. This method was used because the EUT could not be configured to operate with a duty cycle > 98%. Both average and peak measurements were made using a peak detector
6. Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. No significant radiated band edge emissions were found in the 2310 – 2390MHz restricted band.
8. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

## Sample Calculations

### Determining Spurious Emissions Levels

- Field Strength Level [ $\text{dB}_{\mu\text{V/m}}$ ] = Analyzer Level [ $\text{dBm}$ ] + 107 + AFCL [ $\text{dB/m}$ ]
- AFCL [ $\text{dB/m}$ ] = Antenna Factor [ $\text{dB/m}$ ] + Cable Loss [ $\text{dB}$ ]
- Margin [ $\text{dB}$ ] = Field Strength Level [ $\text{dB}_{\mu\text{V/m}}$ ] – Limit [ $\text{dB}_{\mu\text{V/m}}$ ]

### Radiated Band Edge Measurement Offset

- The amplitude offset shown in the radiated restricted band edge plots in Section 7.6 was calculated using the formula:  

$$\text{Offset (dB)} = (\text{Antenna Factor} + \text{Cable Loss} + \text{Attenuator}) - \text{Preamplifier Gain}$$

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## Radiated Field Strength of Fundamental Measurements

§15.249(a); RSS-Gen [8.9]

Bluetooth Mode: LE  
 Distance of Measurements: 3 Meters  
 Data Rate: 1Mbps

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
2402.00	Peak	H	133	45	-25.04	11.89	93.85	113.98	-20.13
2402.00	Average	H	133	45	-25.66	11.89	93.23	93.98	-0.75
2440.00	Peak	H	125	47	-26.34	12.02	92.68	113.98	-21.30
2440.00	Average	H	125	47	-27.09	12.02	91.93	93.98	-2.05
2480.00	Peak	H	123	51	-25.95	12.26	93.31	113.98	-20.67
2480.00	Average	H	123	51	-27.18	12.26	92.08	93.98	-1.90

Table 7-6. Radiated Fundamental Measurements @ 3 meters

Bluetooth Mode: LE  
 Distance of Measurements: 3 Meters  
 Data Rate: 2Mbps

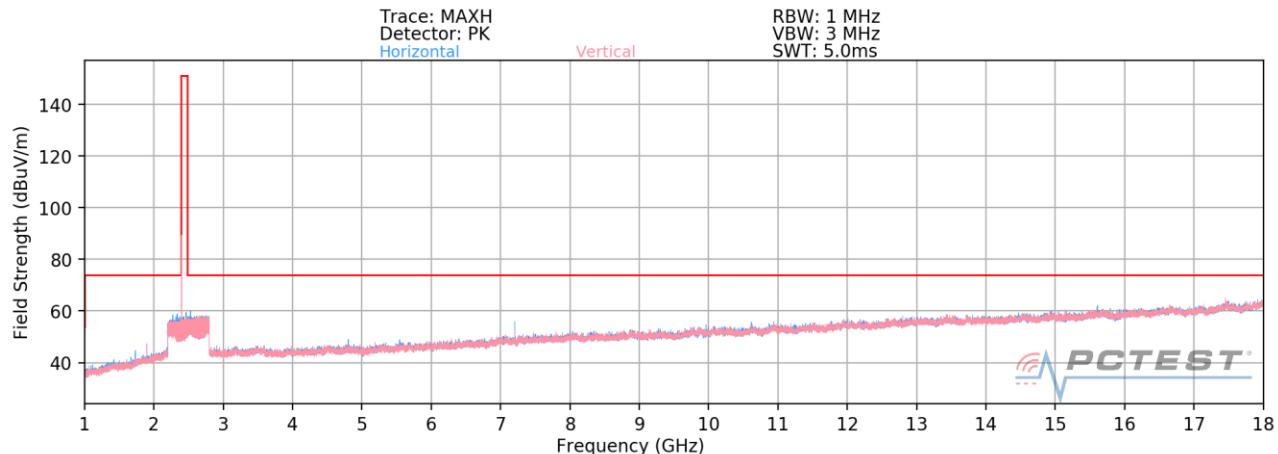
Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
2402.00	Peak	H	139	41	-25.17	11.89	93.72	113.98	-20.26
2402.00	Average	H	139	41	-26.76	11.89	92.13	93.98	-1.85
2440.00	Peak	H	104	9	-25.55	12.02	93.47	113.98	-20.51
2440.00	Average	H	104	9	-28.55	12.02	90.47	93.98	-3.51
2480.00	Peak	H	123	48	-26.19	12.26	93.07	113.98	-20.91
2480.00	Average	H	123	48	-27.80	12.26	91.46	93.98	-2.52

Table 7-7. Radiated Fundamental Measurements @ 3 meters

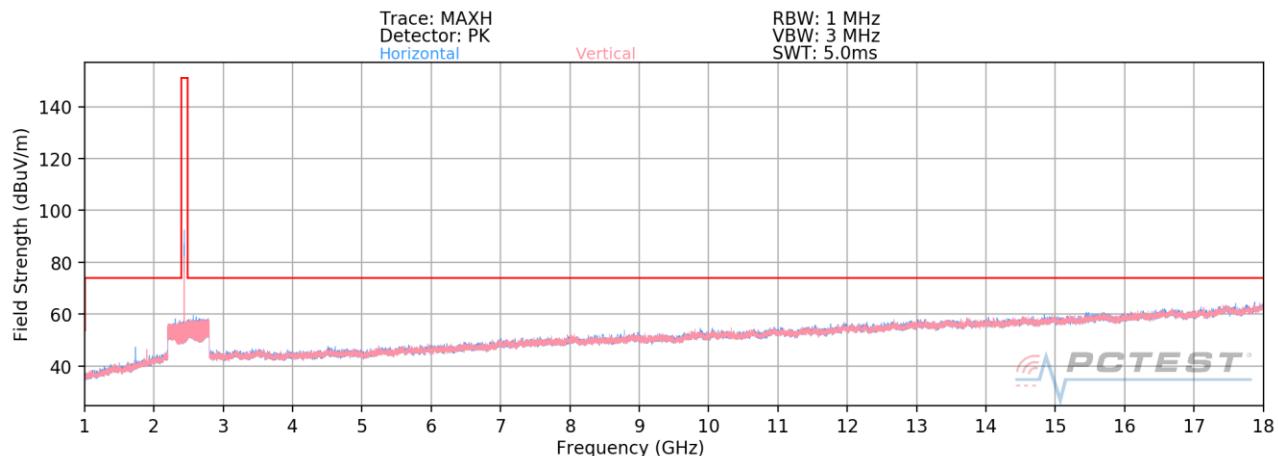
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## 7.5 Radiated Spurious Emission Measurements

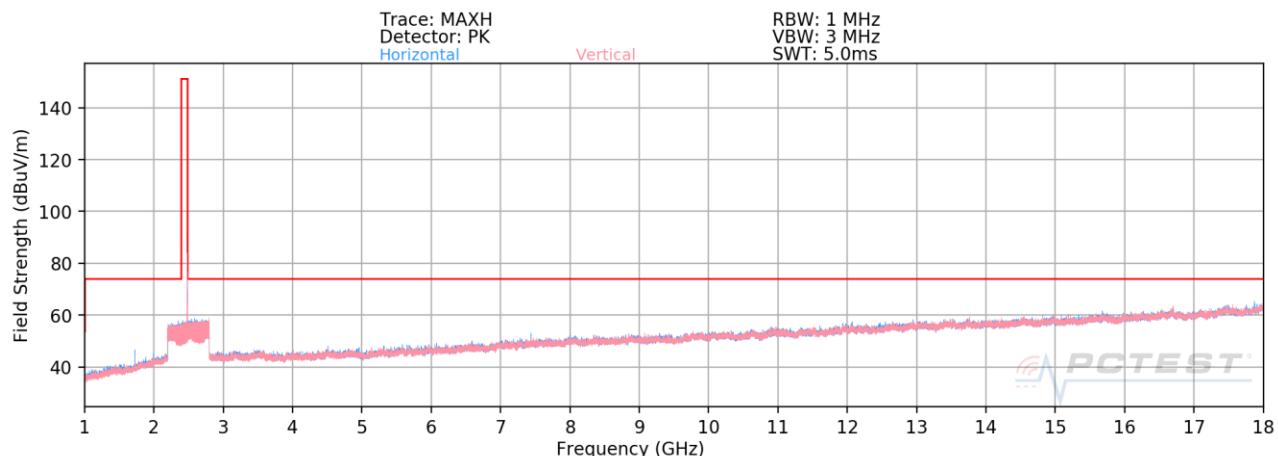
§15.249(a); RSS-Gen [8.9]



**Plot 7-13. Radiated Spurious Plot Above 1GHz (Bluetooth (LE), 1Mbps – Ch. 0)**



**Plot 7-14. Radiated Spurious Plot Above 1GHz (Bluetooth (LE), 1Mbps – Ch. 19)**

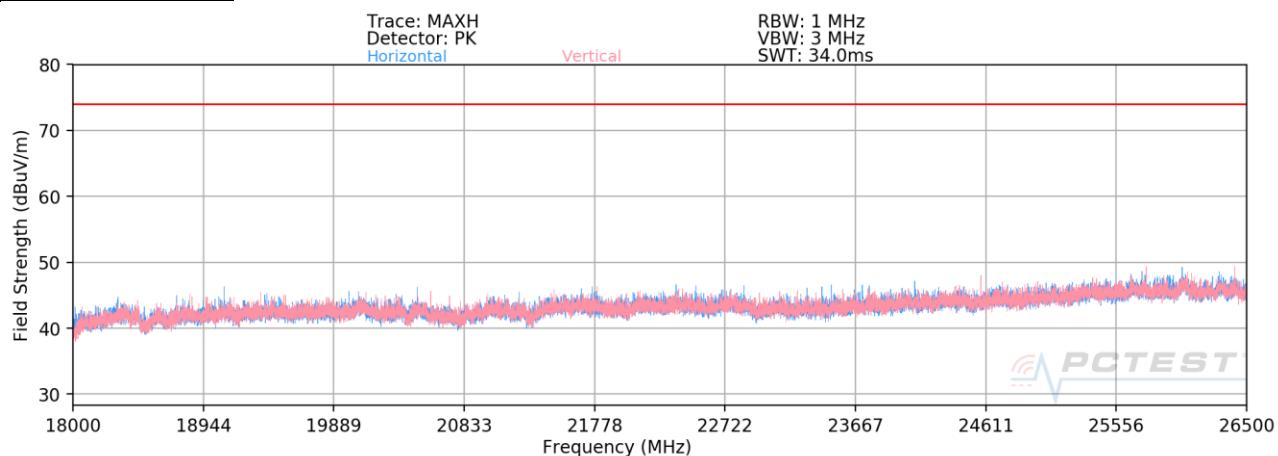


**Plot 7-15. Radiated Spurious Plot Above 1GHz (Bluetooth (LE), 1Mbps – Ch. 39)**

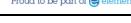
FCC ID: 2AYQW-IOTTEMP	 Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
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## Radiated Spurious Emission Measurements (Above 18GHz)

§15.249; RSS-Gen [8.9]



**Plot 7-16. Radiated Spurious Plot Above 18GHz (Bluetooth (LE), 1Mbps)**

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## Radiated Spurious Emission Measurements

§15.249; RSS-Gen [8.9]

Bluetooth Mode: LE  
 Distance of Measurements: 3 Meters  
 Operating Frequency: 2402MHz  
 Channel: 0

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
4804.00	Avg	H	-	-	-79.53	6.53	34.00	53.98	-19.97
4804.00	Peak	H	-	-	-65.90	6.53	47.63	73.98	-26.34
12010.00	Avg	H	-	-	-82.26	17.66	42.40	53.98	-11.58
12010.00	Peak	H	-	-	-67.75	17.66	56.91	73.98	-17.07

**Table 7-8. Radiated Measurements @ 3 meters**

Bluetooth Mode: LE  
 Distance of Measurements: 3 Meters  
 Operating Frequency: 2440MHz  
 Channel: 19

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
4880.00	Avg	H	-	-	-79.59	6.89	34.30	53.98	-19.68
4880.00	Peak	H	-	-	-66.71	6.89	47.18	73.98	-26.80
7320.00	Avg	H	-	-	-81.38	12.42	38.04	53.98	-15.94
7320.00	Peak	H	-	-	-68.41	12.42	51.01	73.98	-22.97
12200.00	Avg	H	-	-	-82.49	18.47	42.98	53.98	-11.00
12200.00	Peak	H	-	-	-69.53	18.47	55.94	73.98	-18.04

**Table 7-9. Radiated Measurements @ 3 meters**

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## Radiated Spurious Emission Measurements

§15.249; RSS-Gen [8.9]

Bluetooth Mode: LE  
 Distance of Measurements: 3 Meters  
 Operating Frequency: 2480MHz  
 Channel: 39

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
4960.00	Avg	H	-	-	-79.83	6.79	33.96	53.98	-20.02
4960.00	Peak	H	-	-	-68.19	6.79	45.60	73.98	-28.38
7440.00	Avg	H	-	-	-81.68	12.48	37.80	53.98	-16.18
7440.00	Peak	H	-	-	-66.79	12.48	52.69	73.98	-21.29
12400.00	Avg	H	-	-	-83.08	18.31	42.23	53.98	-11.75
12400.00	Peak	H	-	-	-69.92	18.31	55.39	73.98	-18.59

Table 7-10. Radiated Measurements @ 3 meters

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## 7.6 Radiated Restricted Band Edge Measurements

§15.249; RSS-Gen [8.9]

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting.

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

$$\text{Offset (dB)} = (\text{Antenna Factor} + \text{Cable Loss} + \text{Attenuator}) - \text{Preamplifier Gain}$$

Bluetooth Mode:

LE

Measurement Distance:

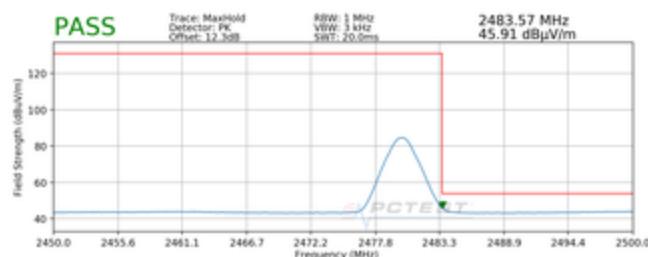
3 Meters

Operating Frequency:

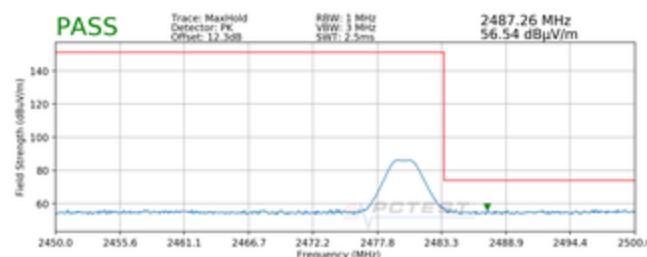
2480MHz

Channel:

39



**Plot 7-17. Radiated Restricted Upper Band Edge Measurement (Average)**



**Plot 7-18. Radiated Restricted Upper Band Edge Measurement (Peak)**

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## 7.7 Radiated Spurious Emissions Measurements – Below 1GHz

§15.209; RSS-Gen [8.9]

### Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

***All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 6 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-11 per Section 15.209 and RSS-Gen (8.9).***

Frequency	Field Strength [ $\mu$ V/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

**Table 7-11. Radiated Limits**

### Test Procedures Used

ANSI C63.10-2013

### Test Settings

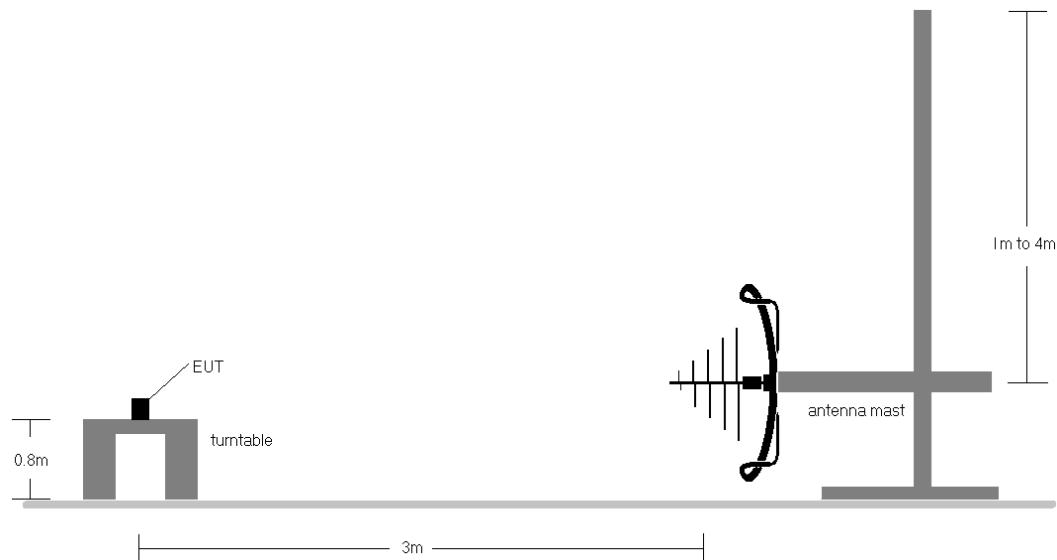
#### Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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## Test Setup

The EUT and measurement equipment were set up as shown in the diagrams below.



**Figure 7-4. Radiated Test Setup < 1GHz**

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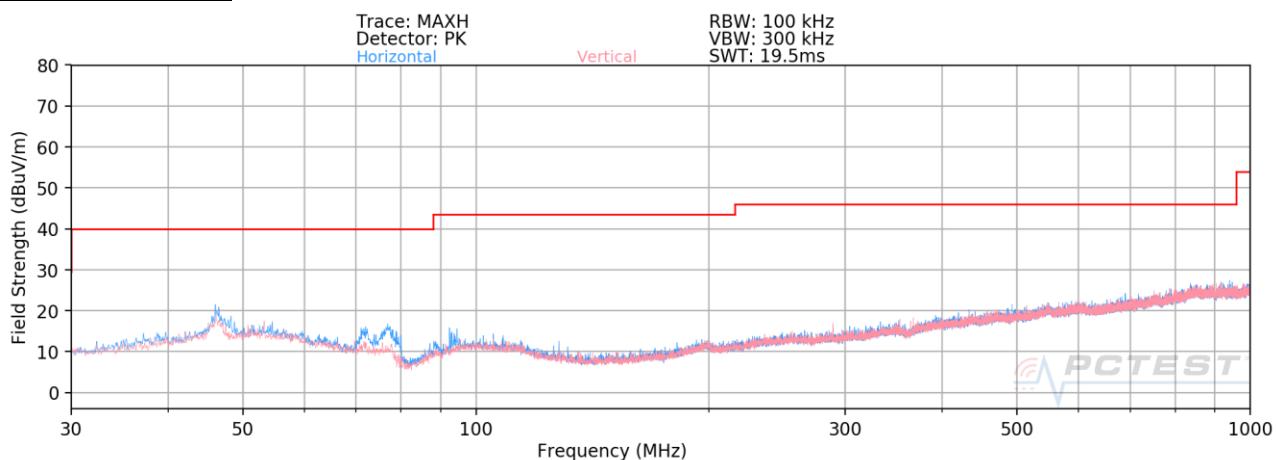
## Test Notes

1. All emissions lying in restricted bands specified in §15.205 and RSS-Gen(8.10) are below the limit shown in Table 7-11.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested with its standard battery.
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
5. Emissions were measured at a 3 meter test distance.
6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
7. No spurious emissions were detected within 20dB of the limit below 30MHz.
8. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.
9. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. There were no emissions detected in the 30MHz – 1GHz frequency range, as shown in the subsequent plots.

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## Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209; RSS-Gen [8.9]



Plot 7-19. Radiated Spurious Plot below 1GHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
46.00	Quasi-Peak	H	-	-	-70.24	-13.96	22.80	40.00	-17.20
78.80	Quasi-Peak	H	-	-	-77.36	-21.13	8.51	40.00	-31.49
92.42	Quasi-Peak	H	-	-	-78.19	-17.33	11.48	43.52	-32.04
128.00	Quasi-Peak	H	-	-	-79.66	-18.78	8.56	43.52	-34.96
497.00	Quasi-Peak	H	-	-	-80.38	-9.07	17.55	46.02	-28.47
911.00	Quasi-Peak	H	-	-	-81.22	-2.83	22.95	46.02	-23.07

Table 7-122. Radiated Measurements @ 3meters (Below 1GHz)

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## 8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Saucon Technologies IoT Temperature Beacon** FCC ID: **2AYQW-IOTTEMP** is in compliance with Part 15 Subpart C (15.249) of the FCC Rules.

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