



Application

For

Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart C, paragraphs 15.207, 15.209 and 15.249

For the

Estimote Polska Sp. z. o. o.

Model: Beacon H1.7

FCC ID: 2ABP2-EST0216

UST Project: 16-0265

Issue Date: November 14, 2016

Total Pages in This Report: 38

**3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com**



Testing Tomorrow's Technology

I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: George Yang

Name: 

Title: Laboratory Manager

Date November 14, 2016



NVLAP LAB CODE 200162-0

This report shall not be reproduced except in full. This report may be copied in part only with the prior written approval of US Tech. The results contained in this report are subject to the adequacy and representative character of the sample provided. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government.

3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z. o. o.
Beacon H1.7

MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Estimote Polska Sp. z. o. o.

MODEL: Beacon H1.7

FCC ID: 2ABP2-EST0216

DATE: November 14, 2016

This report concerns (check one): Original grant ☒
Class II change

Equipment type: 2402 – 2480 MHz Transmitter Module

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No X

If yes, defer until: N/A
date

agrees to notify the Commission by N/A
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
3505 Francis Circle
Alpharetta, GA 30004
Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

Table of Contents

| <u>Paragraph</u> | <u>Title</u> | <u>Page</u> |
|-------------------------|--|--------------------|
| 1 | General Information | 7 |
| 1.1 | Purpose of this Report..... | 7 |
| 1.2 | Characterization of Test Sample | 7 |
| 1.3 | Product Description | 7 |
| 1.4 | Configuration of Tested System | 8 |
| 1.5 | Test Facility | 8 |
| 1.6 | Related Submittals | 8 |
| 2 | Tests and Measurements | 9 |
| 2.1 | Test Equipment | 9 |
| 2.2 | Modifications to EUT Hardware | 10 |
| 2.3 | Number of Measurements for Intentional Radiators (15.31(m)) | 10 |
| 2.4 | Frequency Range of Radiated Measurements (Part 15.33) | 10 |
| 2.4.1 | Intentional Radiator..... | 10 |
| 2.4.2 | Unintentional Radiator | 11 |
| 2.5 | Measurement Detector Function and Bandwidth (CFR 15.35) | 11 |
| 2.5.1 | Detector Function and Associated Bandwidth | 11 |
| 2.5.2 | Corresponding Peak and Average Requirements..... | 11 |
| 2.5.3 | Pulsed Transmitter Averaging..... | 11 |
| 2.6 | EUT Antenna Requirements (CFR 15.203) | 12 |
| 2.7 | Restricted Bands of Operation (Part 15.205)..... | 13 |
| 2.8 | Transmitter Duty Cycle (CFR 35 (c)) | 13 |
| 2.9 | Intentional Radiator, Power Line Conducted Emissions (CFR 15.207) | 15 |
| 2.10 | Intentional Radiator, Radiated Emissions (CFR 15.209, 15.249(a),(c)) (IC RSS 210, A2.9 (a)) | 15 |
| 2.11 | Band Edge Measurements – (CFR 15.249 (d)) | 23 |
| 2.12 | 99% Occupied Bandwidth (Part 2.1049) | 30 |
| 2.13 | Unintentional Radiator, Powerline Emissions (CFR 15.107) | 34 |
| 2.14 | Unintentional Radiator, Radiated Emissions (CFR 15.109)..... | 35 |
| 2.15 | Measurement Uncertainty | 38 |
| 2.15.1 | Conducted Emissions Measurement Uncertainty | 38 |
| 2.15.2 | Radiated Emissions Measurement Uncertainty | 38 |

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

List of Figures

| <u>Figures</u> | <u>Title</u> | <u>Page</u> |
|-----------------------|--|--------------------|
| Figure 1. | Block Diagram of Test Configuration | 12 |
| Figure 2. | Duty Cycle 100ms Sweep..... | 13 |
| Figure 3. | Transmitter Pulse Width..... | 14 |
| Figure 4. | Band Edge Compliance, Low Channel Delta - Peak..... | 24 |
| Figure 5. | Radiated Restricted Band 2310 MHz to 2390 MHz, Peak | 25 |
| Figure 6. | Radiated Restricted Band 2310 MHz to 2390 MHz, Average | 26 |
| Figure 7. | Band Edge Compliance, High Channel Delta – Peak | 27 |
| Figure 8. | Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak | 28 |
| Figure 9. | Radiated Restricted Band 2483.5 MHz to 2500 MHz, Average | 29 |
| Figure 10. | 99% Occupied Bandwidth – Low Channel..... | 31 |
| Figure 11. | 99% Occupied Bandwidth – Mid Channel..... | 32 |
| Figure 12. | 99% Occupied Bandwidth – High Channel | 33 |

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

List of Tables

| <u>Table</u> | <u>Title</u> | <u>Page</u> |
|---------------------|---|--------------------|
| Table 1. | EUT and Peripherals..... | 8 |
| Table 2. | Test Instruments | 9 |
| Table 3. | Number of Test Frequencies for Intentional Radiators..... | 10 |
| Table 4. | Allowed Antenna(s)..... | 12 |
| Table 5. | Spurious Radiated Emissions Below 30 MHz (X-Position)..... | 16 |
| Table 6. | Spurious Radiated Emissions Below 30 MHz (Y-Position)..... | 17 |
| Table 7. | Spurious Radiated Emissions Below 30 MHz (Z-Position)..... | 18 |
| Table 8. | Unintentional Radiator, Peak Radiated Emissions (CFR 15.209) | 19 |
| Table 9. | Fundamental Emissions (Peak & AVG) | 20 |
| Table 10. | Spurious Emissions (Peak & AVG) | 21 |
| Table 11. | Radiated Restricted Band 2310 MHz to 2390 MHz, Peak..... | 25 |
| Table 12. | Radiated Restricted Band 2310 MHz to 2390 MHz, Average | 26 |
| Table 13. | Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak..... | 28 |
| Table 14. | Radiated Restricted Band 2483.5 MHz to 2500 MHz, Average | 30 |
| Table 15. | 20 dB Bandwidth and 99% Occupied Bandwidth | 30 |
| Table 16. | Transmitter Power Line Conducted Emissions Test Data, Part 15.107 ... | 34 |
| Table 17. | Unintentional Radiator, Peak Radiated Emissions (CFR 15.109), | 36 |
| Table 18. | Unintentional Radiator, Peak Radiated Emissions (CFR 15.109), | 37 |

List of Attachments

Agency Agreement
Application Forms
Letter of Confidentiality
Equipment Label(s)
Block Diagram(s)
Schematic(s)
Test Configuration Photographs
Internal Photographs
External Photographs
Theory of Operation
User's Manual

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z. o. o.
Beacon H1.7

1 General Information

1.1 Purpose of this Report

This report is prepared as a means of conveying test results and information concerning the suitability of this exact product for public distribution according to the FCC Rules and Regulations Part 15, Section 249.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on November 7, 2016 in good operating condition.

1.3 Product Description

The Equipment Under Test (EUT) is the Estimote Polska Sp. z. o. o. Model Beacon H1.7. The Beacon H1.7 (Estimote Beacon) is a standalone Bluetooth LE Beacon. The Estimote Beacon is battery powered by three lithium ER14505 AA 3.6V batteries (LiSOCL₂). The EUT operates in the unlicensed 2.4 GHz ISM (Industrial Scientific Medical) band. The regulatory range (2.400-2.4835 GHz) is divided into 40 channels. In the advertising state the device sends data on 3 channels with the center frequencies at 2402, 2426, and 2480 MHz. In the connectivity state the device uses the remaining 37 channels in a frequency hopping scheme to reduce interference between units. The Estimote Beacon H1.7 incorporates an accelerometer which is capable of detecting and recognizing movement and orientation changes. The EUT is rated for a maximum output power of +4.0 dBm.

Radio: Bluetooth LE Standard
Range: Up to 70 Meters (230 Feet)
Modulation: GFSK (FHSS)
TX Power: -20 dBm to +4 dBm (in 4 dB steps)
Data Rate: 1 Mbps (Max)
Channels: 40

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.4:2014, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2014)*, and *ANSI C63.10.2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices*.

A list of EUT and Peripherals is found in Table 1 below. A block diagram of the tested system is shown in Figure 1. Test configuration photographs are provided in separate Appendices

1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC. Its designation number is 186022. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1.

1.6 Related Submittals

The EUT is subject to the following FCC authorizations:

- a) Certification under section 15.249 as a transmitter.
- b) Verification under 15.101 as a digital device and receiver.

The Verification requirement shares many common report elements with the Certification report. Therefore, though this report is mostly intended to provide data for the Certification process, the Verification authorization report (part 15.107 and 15.109) for the EUT is included herein.

Table 1. EUT and Peripherals

| PERIPHERAL MANUFACTURER. | MODEL NUMBER | SERIAL NUMBER | FCC ID: | CABLES P/D |
|---------------------------------|-----------------|-----------------------|--|---------------|
| Estimote Polska Sp. z. o. o. | Beacon H1.7 | Engineering Sample | FCC ID: 2ABP2- EST0216 (pending) | N/A |

U= Unshielded
S= Shielded
P= Power
D= Data

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216

16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

2 Tests and Measurements

2.1 Test Equipment

The table below lists test equipment used to evaluate this product. Model numbers, serial numbers and their calibration status are indicated.

Table 2. Test Instruments

| TEST INSTRUMENT | MODEL NUMBER | MANUFACTURER | SERIAL NUMBER | CALIBRATION DUE DATE |
|----------------------|--------------|-----------------|---------------|----------------------|
| SPECTRUM ANALYZER | E4407B | AGILENT | US41442935 | 2/11/2017 |
| LOOP ANTENNA | SAS-200/562 | A.H. Systems | 142 | 9/28/2017 2 yr |
| BICONICAL ANTENNA | 3110B | EMCO | 9307-1431 | 8/25/2017 2 yr |
| LOG PERIODIC ANTENNA | 3146 | EMCO | 9305-3600 | 9/21/2018 2 yr |
| HORN ANTENNA | 3115 | EMCO | 9107-3723 | 9/22/2018 2 yr |
| PRE-AMPLIFIER | 8449B | HEWLETT-PACKARD | 3008A00480 | 12/1/2016 |
| PRE-AMPLIFIER | 8477D | HEWLETT-PACKARD | 1937A02980 | 12/2/2016 |

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.2 Modifications to EUT Hardware

No physical modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements.

2.3 Number of Measurements for Intentional Radiators (15.31(m))

Measurements of intentional radiators or receivers shall be performed and reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in Table 3 below.

Table 3. Number of Test Frequencies for Intentional Radiators

| Frequency Range over which the device operates | Number of Frequencies | Location in the Range of operation |
|--|-----------------------|--|
| 1 MHz or less | 1 | Middle |
| 1 to 10 MHz | 2 | 1 near the top 1 near the bottom |
| Greater than 10 MHz | 3 | 1 near top 1 near middle 1 near bottom |

Because the EUT operates at 2402 MHz to 2480 MHz, 3 test frequencies were used.

2.4 Frequency Range of Radiated Measurements (Part 15.33)

2.4.1 Intentional Radiator

The spectrum was investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 10th harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

2.4.2 Unintentional Radiator

For the digital device, an unintentional radiator, the frequency range tested was 30 MHz to 1000 MHz, or to 5 times the highest internal clock frequency.

2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

The radiated and conducted emissions limits shown herein are based on the following:

2.5.1 Detector Function and Associated Bandwidth

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the Quasi-peak device are used.

2.5.2 Corresponding Peak and Average Requirements

Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

2.5.3 Pulsed Transmitter Averaging

When the radiated emissions limit is expressed as an average value, and the transmitter is pulsed, the measured field strength shall be determined by applying a Duty Cycle Correction Factor based upon dividing the total ON time during the first 100 ms period by 100 ms (or by the period if less than 100 ms). The duty cycle may be expressed logarithmically in dB.

NOTE: If the transmitter was programmed to transmit at >98% duty cycle, then, wherever applicable (where the detection mode was AVG), the duty cycle factor calculated will be applied.

2.6 EUT Antenna Requirements (CFR 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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. Only the antenna(s) listed in Table 4 will be used with this module.

Table 4. Allowed Antenna(s)

| REPORT REFERENCE | MANUFACTURER | TYPE OF ANTENNA | MODEL | GAIN dB _i | TYPE OF CONNECTOR |
|---------------------|-----------------|---------------------------------|-----------------------|-------------------------|----------------------|
| Antenna | Estimote Polska | 2.4 Bluetooth LE Standard | Engineering Sample | 0.0 | Trace antenna |

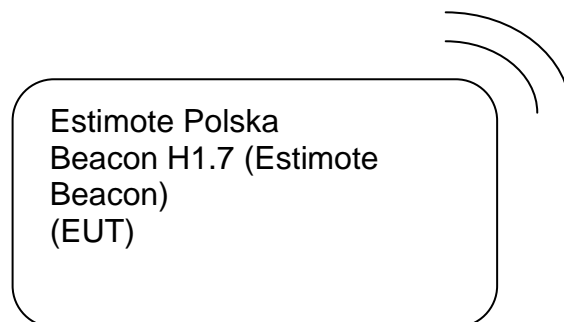


Figure 1. Block Diagram of Test Configuration

2.7 Restricted Bands of Operation (Part 15.205)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious cannot exceed the limits of 15.209. Radiated harmonics and other Spurious are examined for this requirement see paragraph 2.1

2.8 Transmitter Duty Cycle (CFR 35 (c))

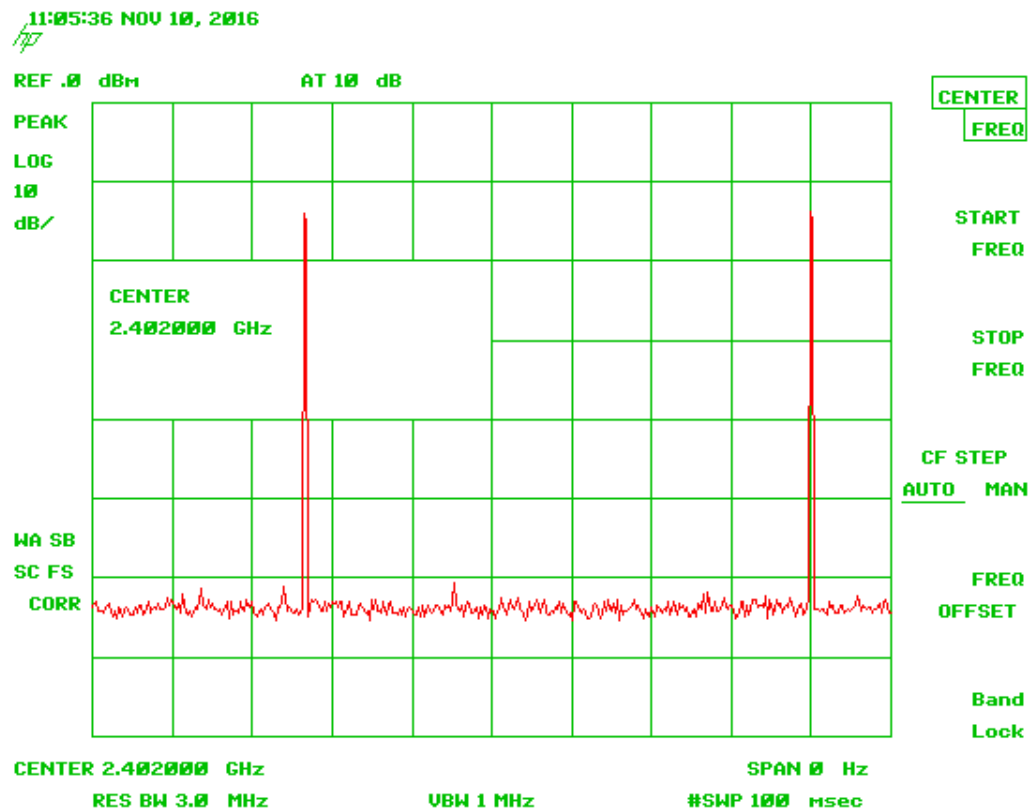


Figure 2. Duty Cycle 100ms Sweep

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z o. o.
 Beacon H1.7

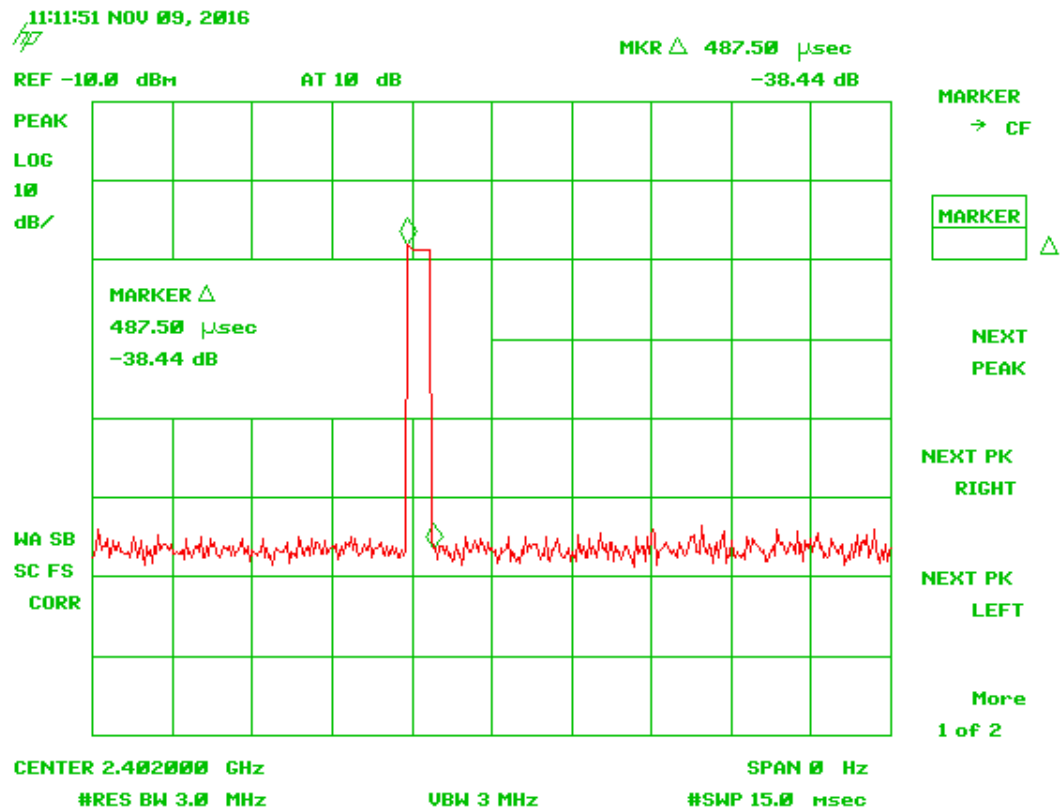


Figure 3. Transmitter Pulse Width

Total Pulse Train from Figure 3 = 1.0 ms (Pulse Train)

$$(1.0 \text{ ms Total Time On}) / (100 \text{ ms Total Pulse Train}) = .01 \text{ Numeric Duty Cycle}$$

$$\text{Duty Cycle} = 20 \text{ Log } (.01) = \boxed{-40.0 \text{ dB}}$$

Since the Duty Cycle is less than -20 dB, only a -20 dB Duty Cycle correction factor will be applied in this test report.

NOTE: The transmitter was programmed to transmit at >98% duty cycle, therefore wherever applicable (where the detection mode was AVG) the duty cycle factor calculated above will be applied.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

2.9 Intentional Radiator, Power Line Conducted Emissions (CFR 15.207)

Since the EUT is battery powered, this test was not applied. The EUT is powered by three AA 3.6V Lithium Primary Cell type batteries.

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.249(a),(c)) (IC RSS 210, A2.9 (a))

Radiated Spurious measurements: the EUT was placed into a continuous transmit mode of operation (>98% duty cycle) and tested per FCC KDB Publication 558074 and ANSI C63.10:2013. A preliminary scan was performed on the EUT to find signal frequencies that were caused by the transmitter part of the device. To obtain worse case results the EUT was tested in X, Y and Z axes or in the orientation of normal operation if the device is designed to operation in a fixed position.

Radiated measurements were then conducted between the frequency range of 9 KHz (or lowest frequency used/generated by the device) up to the tenth harmonic of the device (no greater than 40 GHz). In the band below 30 MHz a resolution bandwidth (RBW) of 9 kHz was used; emissions below 1 GHz were tested with a RBW of 120 KHz and emissions above 1 GHz were tested with a RBW of 1 MHz. All video bandwidth settings were at least three times the RBW value.

The EUT was investigated to CFR 15.209, General requirements for unwanted spurious emissions.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z. o. o.
 Beacon H1.7

Table 5. Spurious Radiated Emissions Below 30 MHz (X-Position)

| 9 kHz to 30 MHz, 15.209 limits | | | | | | | |
|--------------------------------|------------------|------------------|------------------|--------------------------------------|--------------------------------|-------------|---------------------|
| Test: Radiated Emissions | | | | Client: Estimote Polska Sp. z. o. o. | | | |
| Project: 16-0265 | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | AF+CA-AMP (dB/m) | Results (dBuV/m) | QP Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector PK, or AVG |
| 0.07 | 34.93 | 62.40 | 97.33 | 111.1 | m./meters. | 13.8 | PK |
| 0.16 | 26.47 | 57.54 | 84.01 | 103.7 | m./meters. | 19.7 | PK |
| 0.68 | 20.71 | 42.32 | 63.03 | 71.0 | m./meters. | 7.9 | PK |
| 1.55 | 18.55 | 38.27 | 56.82 | 63.8 | m./meters. | 7.0 | PK |
| 5.13 | 18.47 | 24.09 | 42.56 | 69.5 | m./meters. | 26.9 | PK |
| 15.45 | 25.12 | 5.22 | 30.34 | 69.5 | m./meters. | 39.2 | PK |
| 20.18 | 24.89 | 1.96 | 26.85 | 69.5 | m./meters. | 42.7 | PK |

Sample Calculation at 0.07 MHz:

| | | |
|---|-------|--------|
| Magnitude of Measured Frequency | 34.93 | dBuV |
| +Antenna Factor + Cable Loss - Amplifier Gain | 62.40 | dB/m |
| Corrected Result | 97.33 | dBuV/m |

Test Date: November 10, 2016
 Tested By

Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z o. o.
 Beacon H1.7

Table 6. Spurious Radiated Emissions Below 30 MHz (Y-Position)

| 9 kHz to 30 MHz, 15.209 limits | | | | | | | |
|--------------------------------|------------------|------------------|------------------|-------------------------------------|--------------------------------|-------------|---------------------|
| Test: Radiated Emissions | | | | Client: Estimote Polska Sp. z o. o. | | | |
| Project: 16-0265 | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | AF+CA-AMP (dB/m) | Results (dBuV/m) | QP Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector PK, or AVG |
| 0.07 | 34.54 | 62.40 | 96.94 | 111.1 | m./meters. | 14.2 | PK |
| 0.15 | 25.63 | 57.54 | 83.17 | 104.0 | m./meters. | 20.8 | PK |
| 0.68 | 20.07 | 42.32 | 62.39 | 71.0 | m./meters. | 8.6 | PK |
| 1.78 | 18.47 | 38.27 | 56.74 | 69.5 | m./meters. | 12.8 | PK |
| 5.83 | 18.44 | 24.09 | 42.53 | 69.5 | m./meters. | 27.0 | PK |
| 16.85 | 60.68 | 1.52 | 62.20 | 69.5 | m./meters. | 7.3 | PK |
| 20.03 | 24.41 | 1.96 | 26.37 | 69.5 | m./meters. | 43.1 | PK |

Sample Calculation at 0.07 MHz:

| | | |
|---|-------|--------|
| Magnitude of Measured Frequency | 34.54 | dBuV |
| +Antenna Factor + Cable Loss - Amplifier Gain | 62.40 | dB/m |
| Corrected Result | 96.94 | dBuV/m |

Test Date: November 10, 2016

Tested By

Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z o. o.
 Beacon H1.7

Table 7. Spurious Radiated Emissions Below 30 MHz (Z-Position)

| 9 kHz to 30 MHz, 15.209 limits | | | | | | | |
|--------------------------------|------------------|------------------|------------------|-------------------------------------|--------------------------------|-------------|---------------------|
| Test: Radiated Emissions | | | | Client: Estimote Polska Sp. z o. o. | | | |
| Project: 16-0265 | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | AF+CA-AMP (dB/m) | Results (dBuV/m) | QP Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector PK, or AVG |
| 0.07 | 35.29 | 62.40 | 97.69 | 111.1 | m./meters. | 13.4 | PK |
| 0.15 | 26.29 | 57.54 | 83.83 | 104.0 | m./meters. | 20.2 | PK |
| 0.68 | 20.17 | 42.32 | 62.49 | 71.0 | m./meters. | 8.5 | PK |
| 1.51 | 18.21 | 38.27 | 56.48 | 64.0 | m./meters. | 7.5 | PK |
| 9.96 | 18.42 | 24.09 | 35.61 | 69.5 | m./meters. | 33.9 | PK |
| 15.96 | 25.43 | 1.52 | 30.65 | 69.5 | m./meters. | 38.9 | PK |
| 20.10 | 23.79 | 1.96 | 25.75 | 69.5 | m./meters. | 43.8 | PK |

Sample Calculation at 0.07 MHz:

| | | |
|---|-------|--------|
| Magnitude of Measured Frequency | 35.29 | dBuV |
| +Antenna Factor + Cable Loss - Amplifier Gain | 62.40 | dB/m |
| Corrected Result | 97.69 | dBuV/m |

Test Date: November 10, 2016

Tested By

Signature: 

Name: Robert K. Mills

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z. o. o.
Beacon H1.7

Table 8. Unintentional Radiator, Peak Radiated Emissions (CFR 15.209)

| 30 MHz to 1000 MHz | | | | | | | |
|--|------------------------|-------------------------|---------------------|--------------------------------------|--------------------------------------|----------------|--------------------------|
| Test: Radiated Emissions | | | | Client: Estimote Polska Sp. z. o. o. | | | |
| Project: 16-0265 | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | AF+CA- AMP (dB/m) | Results (dBuV/m) | QP Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector PK, or QP |
| All emissions seen were greater than 20 dB below the applicable limit. | | | | | | | |

Sample Calculation at N/A MHz:

Test Date: November 8, 2016

Tested By

Signature:  Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216

16-0265
 November 14, 2016
 Estimote Polska Sp. z. o. o.
 Beacon H1.7

Table 9. Fundamental Emissions (Peak & AVG)

| Test: FCC Part 15, Para 15.209, 15.249(a) | | | | | Client: Estimote Polska Sp. z. o. o. | | | |
|---|------------------|-------------|-------------------|------------------|--------------------------------------|--------------------------------|-------------|---------------|
| Project: 16-0265 | | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | Factor (dB) | AF+CA -AMP (dB/m) | Results (dBuV/m) | Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector Mode |
| Low - Channel | | | | | | | | |
| 2401.85 | 63.89 | - | 30.16 | 94.05 | 114.0 | 3.0m./HORZ | 19.9 | PK |
| 2401.85 | 62.20 | | 30.16 | 92.36 | 94.0 | 3.0m./HORZ | 1.6 | AVG |
| Mid - Channel | | | | | | | | |
| 2442.33 | 62.72 | - | 30.13 | 92.85 | 114.0 | 3.0m./HORZ | 21.1 | PK |
| 2442.33 | 60.03 | - | 30.13 | 90.16 | 94.0 | 3.0m./HORZ | 3.8 | AVG |
| High - Channel | | | | | | | | |
| 2480.35 | 61.27 | - | 30.13 | 91.40 | 114.0 | 3.0m./HORZ | 22.6 | PK |
| 2480.35 | 59.17 | - | 30.13 | 89.30 | 94.0 | 3.0m./HORZ | 4.7 | AVG |

Notes:

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. (-) Measurements taken at 1 meter were extrapolated to 3 meters using a factor of (-9.5 dB).
4. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 2401.85 MHz:

| | | |
|---|-------|--------|
| Magnitude of Measured Frequency | 63.89 | dBuV |
| +Antenna Factor + Cable Loss - Amplifier Gain | 30.16 | dB/m |
| Corrected Result | 94.05 | dBuV/m |

Test Date: November 8, 2016

Tested By

Signature:  Name: Robert K. Mills

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216

16-0265
November 14, 2016
Estimote Polska Sp. z. o. o.
Beacon H1.7

Table 10. Spurious Emissions (Peak & AVG)

| Test: FCC Part 15, Para 15.209, 15.249(a) | | | | | Client: Estimote Polska Sp. z. o. o. | | | |
|---|------------------|-------------|-------------------|------------------|--------------------------------------|--------------------------------|-------------|---------------|
| Project: 16-0265 | | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | Factor (dB) | AF+CA -AMP (dB/m) | Results (dBuV/m) | Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector Mode |
| Low - Channel | | | | | | | | |
| 4804.60 | 51.95 | - | 1.97 | 53.92 | 74.0 | 3.0m./HORZ | 20.1 | PK |
| 4804.60 | 45.70 | - | 1.97 | 47.67 | 54.0 | 3.0m./HORZ | 6.3 | AVG |
| 7205.45 | 60.74 | -9.5 | 6.82 | 58.06 | 74.0 | 3.0m./HORZ | 15.9 | PK |
| 7205.45 | 54.79 | -9.5 | 6.82 | 52.11 | 54.0 | 3.0m./HORZ | 1.9 | AVG |
| 9608.00 | 45.34 | -9.5 | 6.41 | 42.25 | 74.0 | 3.0m./HORZ | 31.8 | PK |
| 9608.00 | 30.81 | -9.5 | 6.41 | 27.72 | 54.0 | 3.0m./HORZ | 26.3 | AVG |
| Mid - Channel | | | | | | | | |
| 4884.65 | 52.09 | - | 2.26 | 54.35 | 74.0 | 3.0m./HORZ | 19.7 | PK |
| 4884.65 | 45.99 | - | 2.26 | 48.25 | 54.0 | 3.0m./HORZ | 5.8 | AVG |
| 7325.45 | 54.71 | -9.5 | 7.35 | 52.56 | 74.0 | 3.0m./HORZ | 21.4 | PK |
| 7325.45 | 47.82 | -9.5 | 7.35 | 45.67 | 54.0 | 3.0m./HORZ | 8.3 | AVG |
| 9768.00 | 45.34 | -9.5 | 8.70 | 44.54 | 74.0 | 3.0m./HORZ | 29.5 | PK |
| 9768.00 | 30.78 | -9.5 | 8.70 | 29.98 | 54.0 | 3.0m./HORZ | 24.0 | AVG |
| High - Channel | | | | | | | | |
| 4960.65 | 51.04 | - | 1.32 | 52.36 | 74.0 | 3.0m./HORZ | 21.6 | PK |
| 4960.65 | 43.83 | - | 1.32 | 45.15 | 54.0 | 3.0m./HORZ | 8.8 | AVG |
| 7439.40 | 51.66 | -9.5 | 6.48 | 48.64 | 74.0 | 3.0m./HORZ | 25.4 | PK |
| 7439.40 | 44.62 | -9.5 | 6.48 | 41.60 | 54.0 | 3.0m./HORZ | 12.4 | AVG |
| 9912.10 | 46.28 | -9.5 | 9.04 | 45.82 | 74.0 | 3.0m./HORZ | 28.2 | PK |
| 9912.10 | 31.27 | -9.5 | 9.04 | 30.81 | 54.0 | 3.0m./HORZ | 23.2 | AVG |

Notes:

- (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
- No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
- (-) Measurements taken at 1 meter were extrapolated to 3 meters using a factor of (-9.5 dB).
- The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

Sample Calculation at 4804.60 MHz:

| | | |
|---|-------|--------|
| Magnitude of Measured Frequency | 51.95 | dBuV |
| +Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle | 1.97 | dB/m |
| Duty Cycle Correction Factor | N/A | dB |
| Corrected Result | 53.92 | dBuV/m |

Test Date: November 8, 2016

Tested By

Signature:  Name: Robert K. Mills

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

2.11 Band Edge Measurements – (CFR 15.249 (d))

Band Edge measurements are made following the guidelines in FCC KDB Publication No. 558074 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Radiated measurements are performed to demonstrate compliance with the requirement of 15.249(d) that all emissions outside of the band edges be attenuated by at least 50 dB or 15.209 limits, when compared to its highest in-band value (contained in a 100 kHz band).

To capture the band edge, set the Spectrum Analyzer frequency span set to 2 MHz to capture the peak level of the emission operating on the channel closest to the band edge as well as any modulation products falling outside of the authorized band of operation. See figure and calculations following for more detail.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z o. o.
 Beacon H1.7

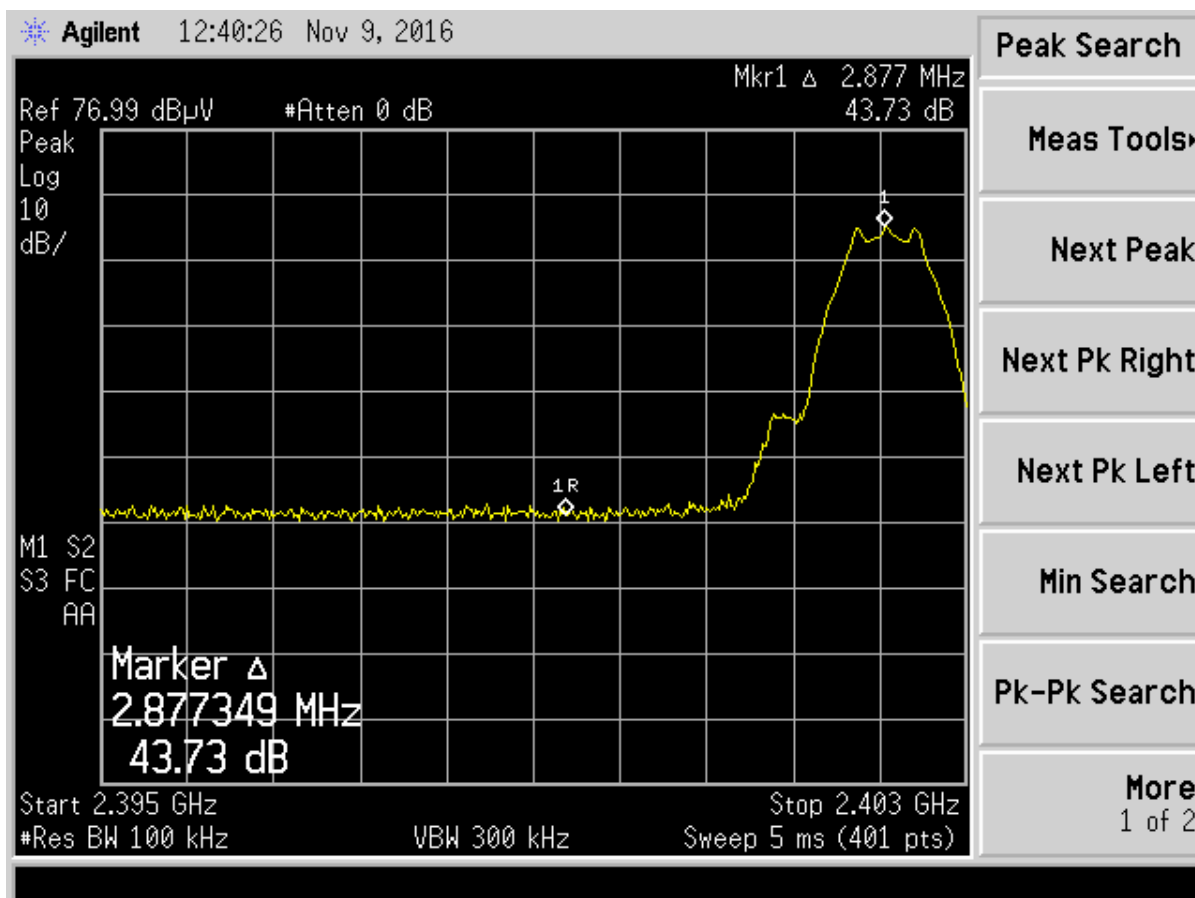


Figure 4. Band Edge Compliance, Low Channel Delta - Peak

| | | |
|---|-------|--------|
| Low Channel Corrected Measured Value from Table 7 | 94.05 | dBuV |
| Low Channel Band Edge Delta from Figure 4 | 43.73 | dB |
| Calculated Result | 50.32 | dBuV/m |
| Band Edge Limit | 54.00 | dBuV/m |
| Calculated Result | 50.32 | dBuV/m |
| Band Edge Margin | 3.68 | dBuV/m |

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216

16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

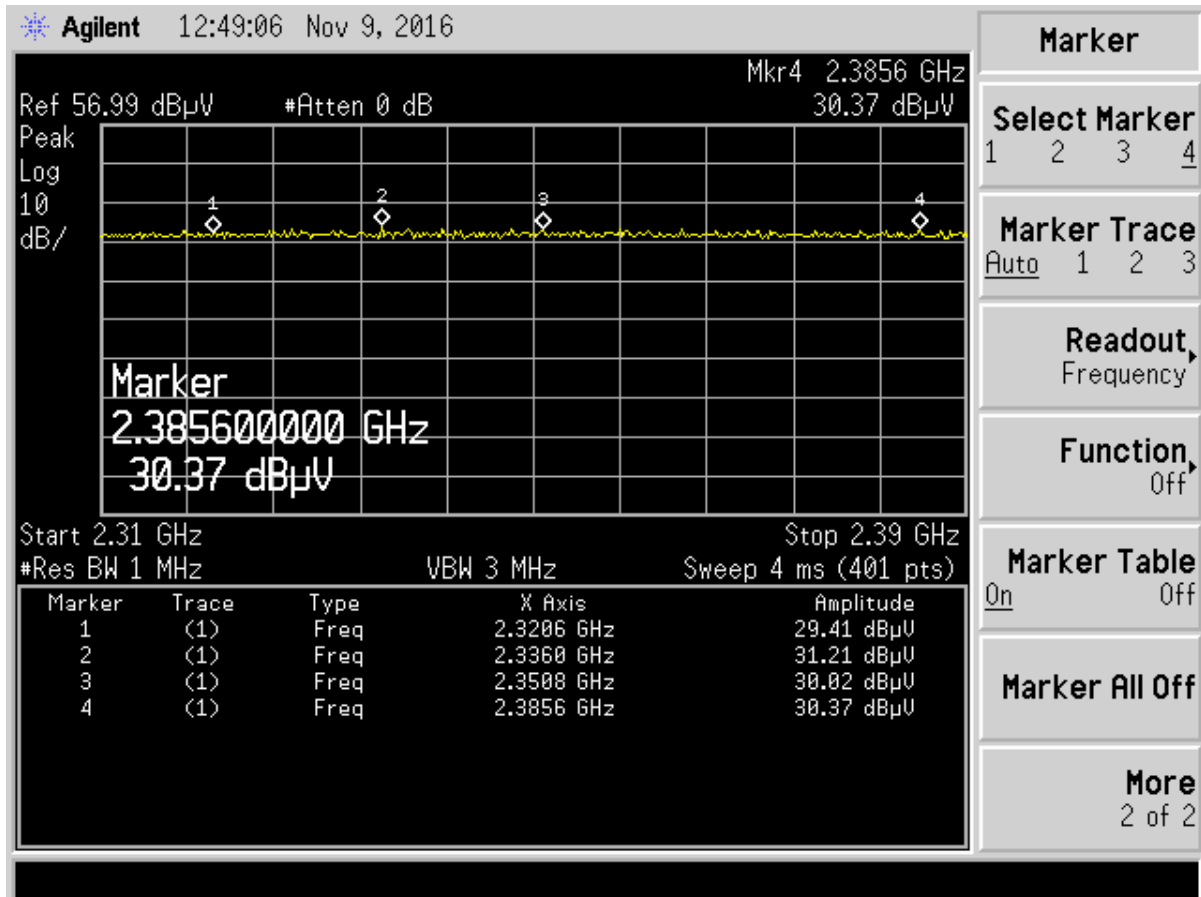


Figure 5. Radiated Restricted Band 2310 MHz to 2390 MHz, Peak

Table 11. Radiated Restricted Band 2310 MHz to 2390 MHz, Peak

| 2310 MHz to 2390 MHz Restricted Band Peak Measurements | | | | | | | |
|--|------------------|------------------|------------------|-----------------------------------|--------------------------------|-------------|---------------------|
| Test: Radiated Emissions | | | | Client: Estimote Polska Sp.z.o.o. | | | |
| Project: 16-0265 | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | AF+CA-AMP (dB/m) | Results (dBuV/m) | PK Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector PK, or AVG |
| 2320.6 | 29.41 | 29.49 | 58.90 | 74.0 | 3.0m./HORZ | 15.1 | PK |
| 2336.0 | 31.21 | 28.02 | 59.23 | 74.0 | 3.0m./HORZ | 14.8 | PK |
| 2350.8 | 30.02 | 28.02 | 58.04 | 74.0 | 3.0m./HORZ | 16.0 | PK |
| 2385.6 | 30.37 | 28.02 | 58.39 | 74.0 | 3.0m./HORZ | 15.6 | PK |

Test Date: November 9, 2016

Tested By
Signature: Robert K. Mills Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z o. o.
 Beacon H1.7

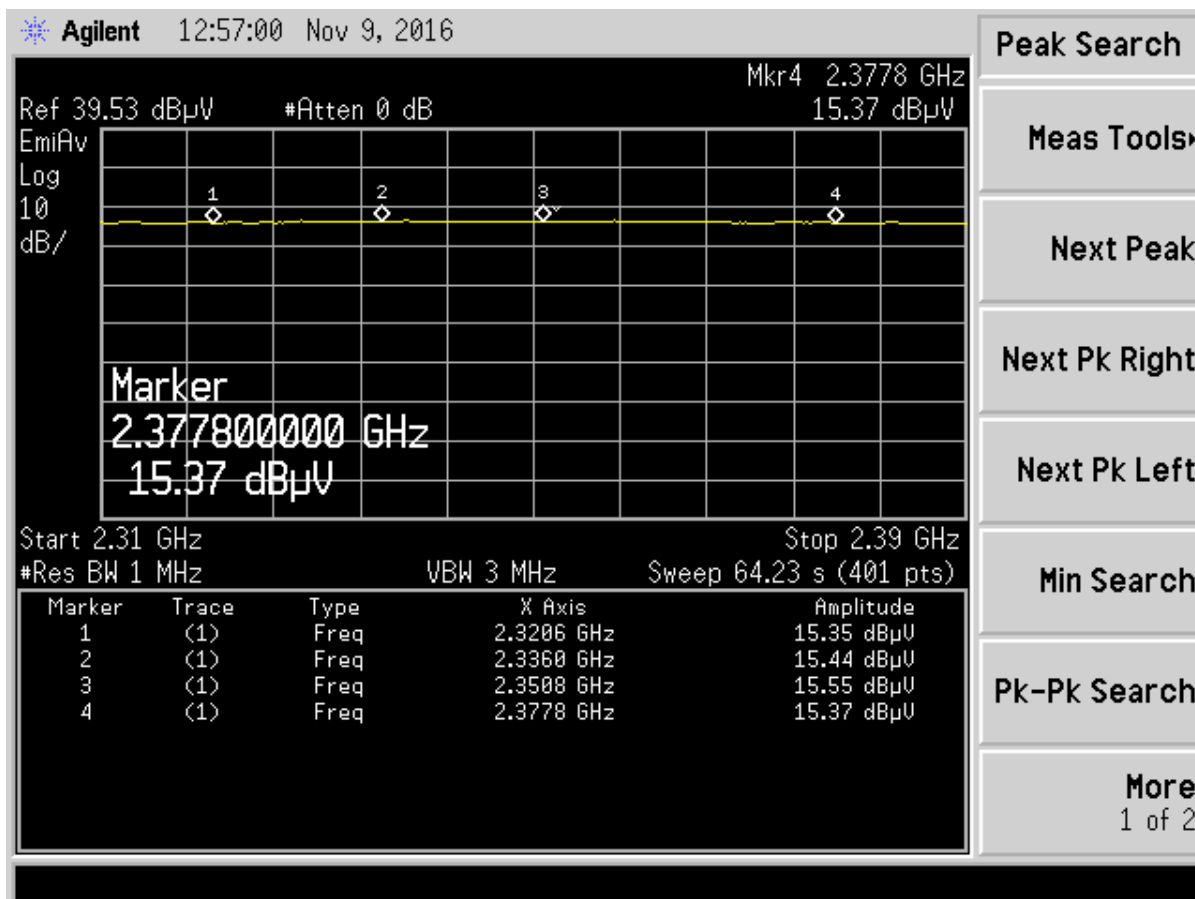


Figure 6. Radiated Restricted Band 2310 MHz to 2390 MHz, Average

Table 12. Radiated Restricted Band 2310 MHz to 2390 MHz, Average

| 2310 MHz to 2390 MHz Restricted Band Peak Measurements | | | | | | | |
|--|------------------|------------------|------------------|-----------------------------------|--------------------------------|-------------|---------------------|
| Test: Radiated Emissions | | | | Client: Estimote Polska Sp.z.o.o. | | | |
| Project: 16-0265 | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | AF+CA-AMP (dB/m) | Results (dBuV/m) | PK Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector PK, or AVG |
| 2320.6 | 15.35 | 29.49 | 44.84 | 54.0 | 3.0m./HORZ | 9.2 | AVG |
| 2336.0 | 15.44 | 28.02 | 43.46 | 54.0 | 3.0m./HORZ | 10.5 | AVG |
| 2350.8 | 15.55 | 28.02 | 43.57 | 54.0 | 3.0m./HORZ | 10.4 | AVG |
| 2377.8 | 15.37 | 28.02 | 43.39 | 54.0 | 3.0m./HORZ | 10.6 | AVG |

Test Date: November 9, 2016

Tested By

Signature:  Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z o. o.
 Beacon H1.7

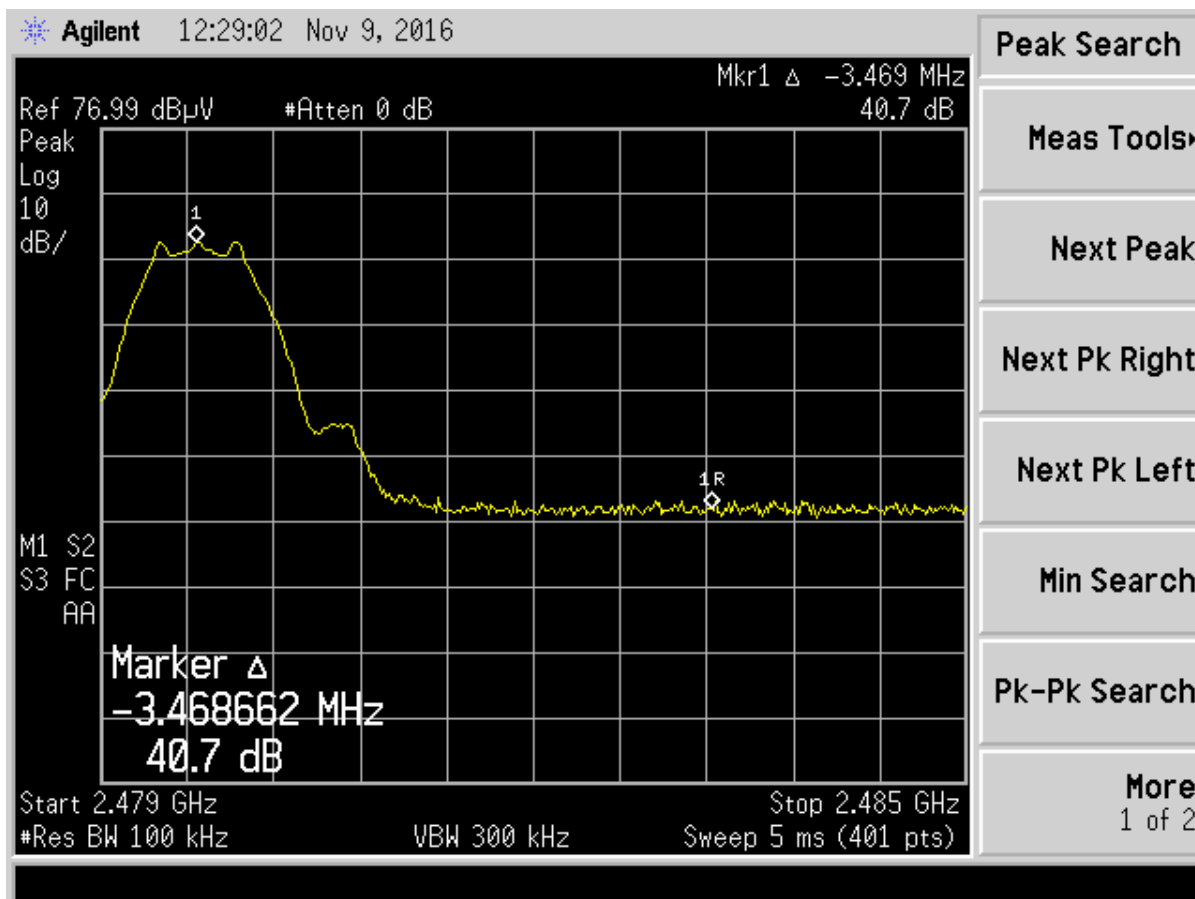


Figure 7. Band Edge Compliance, High Channel Delta – Peak

| | | |
|--|-------|--------|
| High Channel Corrected Measured Value from Table 8 | 91.40 | dBuV |
| High Channel Band Edge Delta from Figure 6 | 40.70 | dB |
| Calculated Result | 50.70 | dBuV/m |
| Band Edge Limit | 54.00 | dBuV/m |
| Calculated Result | 50.70 | dBuV/m |
| Band Edge Margin | 3.30 | dBuV/m |

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216

16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

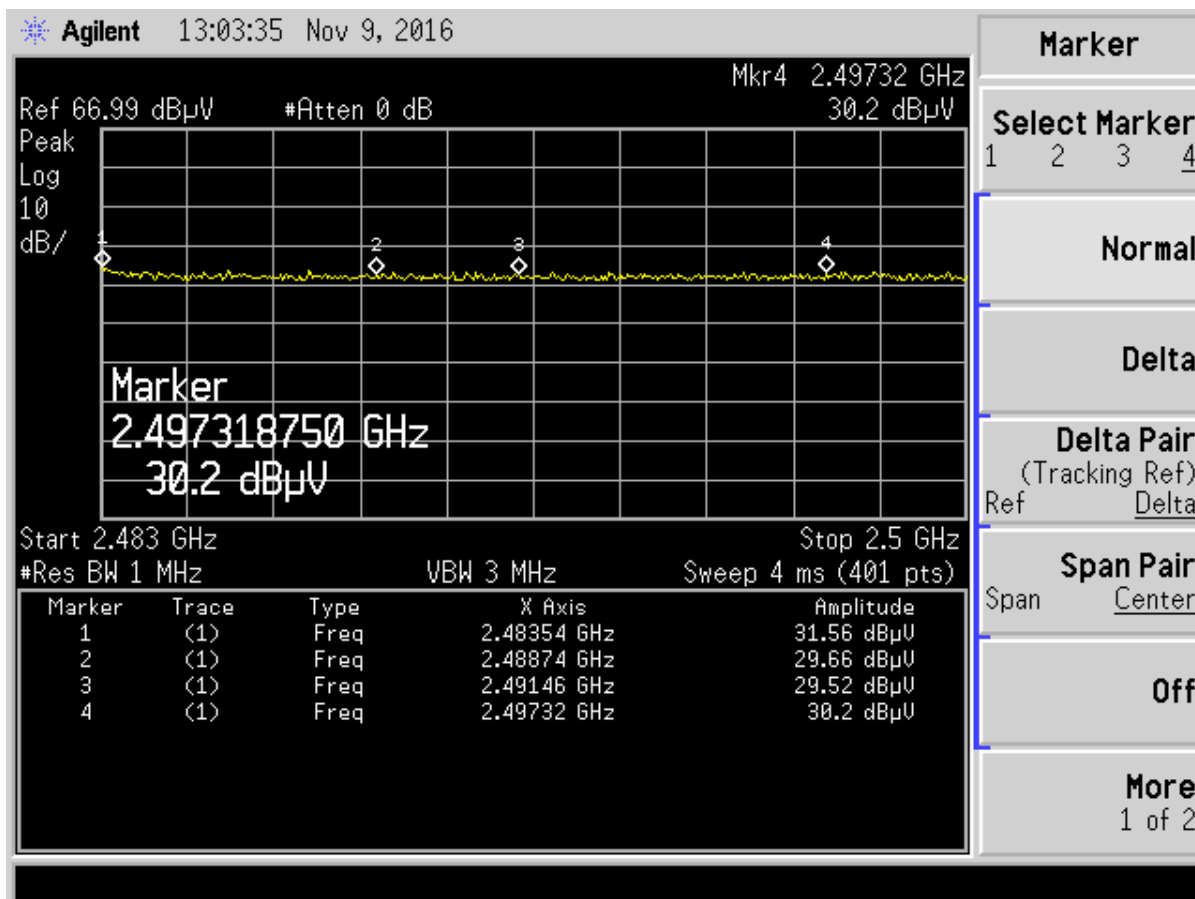


Figure 8. Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak

Table 13. Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak

| 2483.5 MHz to 2500 MHz Restricted Band Peak Measurements | | | | | | | |
|--|------------------|------------------|------------------|-----------------------------------|--------------------------------|-------------|---------------------|
| Test: Radiated Emissions | | | | Client: Estimote Polska Sp.z.o.o. | | | |
| Project: 16-0265 | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | AF+CA-AMP (dB/m) | Results (dBuV/m) | PK Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector PK, or AVG |
| 2483.54 | 31.56 | 30.13 | 61.69 | 74.0 | 3.0m./HORZ | 12.3 | PK |
| 2488.74 | 29.66 | 28.18 | 57.84 | 74.0 | 3.0m./HORZ | 16.2 | PK |
| 2491.46 | 29.52 | 28.18 | 57.70 | 74.0 | 3.0m./HORZ | 16.3 | PK |
| 2497.32 | 30.20 | 28.18 | 58.38 | 74.0 | 3.0m./HORZ | 15.6 | PK |

Test Date: November 9, 2016

Tested By

Signature: 

Name: Robert K. Mills

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216

16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

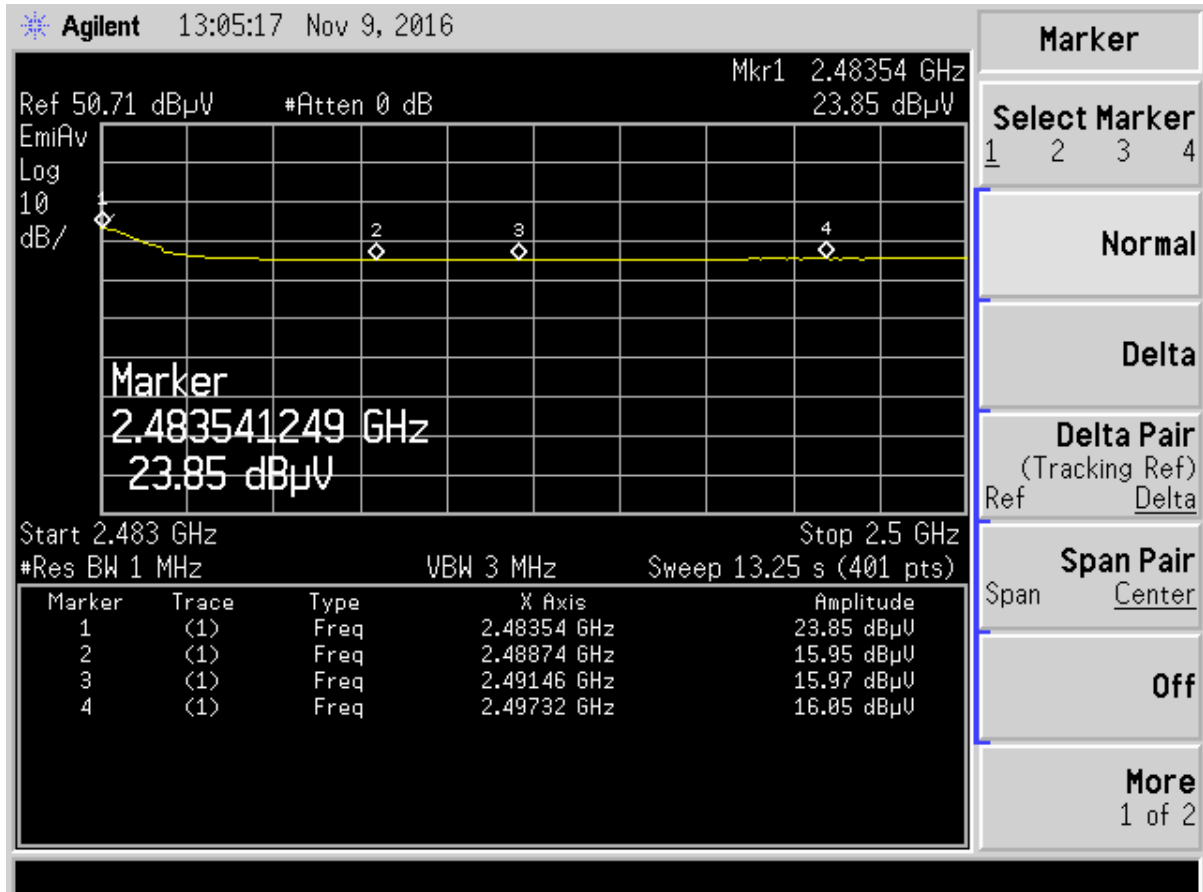


Figure 9. Radiated Restricted Band 2483.5 MHz to 2500 MHz, Average

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z o. o.
 Beacon H1.7

Table 14. Radiated Restricted Band 2483.5 MHz to 2500 MHz, Average

| 2483.5 MHz to 2500 MHz Restricted Band Average Measurements | | | | | | | |
|---|------------------|-----------------------------|------------------|-----------------------------------|--------------------------------|-------------|---------------------|
| Test: Radiated Emissions | | | | Client: Estimote Polska Sp.z.o.o. | | | |
| Project: 16-0265 | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | AF+CA-AMP+Duty Cycle (dB/m) | Results (dBuV/m) | AVG Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector PK, or AVG |
| 2483.54 | 23.85 | 10.13* | 33.98 | 54.0 | 3.0m./HORZ | 20.0 | AVG |
| 2488.74 | 15.95 | 28.18 | 44.13 | 54.0 | 3.0m./HORZ | 9.9 | AVG |
| 2491.46 | 15.97 | 28.18 | 44.15 | 54.0 | 3.0m./HORZ | 9.9 | AVG |
| 2497.32 | 16.05 | 28.18 | 44.23 | 54.0 | 3.0m./HORZ | 9.8 | AVG |

(*)= Duty cycle factor of -20 dB applied to the correction factors.

Test Date: November 9, 2016

Tested By

Signature: 

Name: Robert K. Mills

2.12 99% Occupied Bandwidth (Part 2.1049)


These measurements were performed while the EUT was in a constant transmit mode. A method similar to the marker delta method was used to capture the points. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW \geq RBW. The results of this test are given in Table 12 and Figures 10-12.

Table 15. 20 dB Bandwidth and 99% Occupied Bandwidth

| Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
|-----------------|------------------------------|
| 2402 | 1.0502 |
| 2442 | 1.0734 |
| 2480 | 1.0652 |

Test Date: November 9, 2016

Tested By

Signature: 

Name: Robert K. Mills

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216

16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

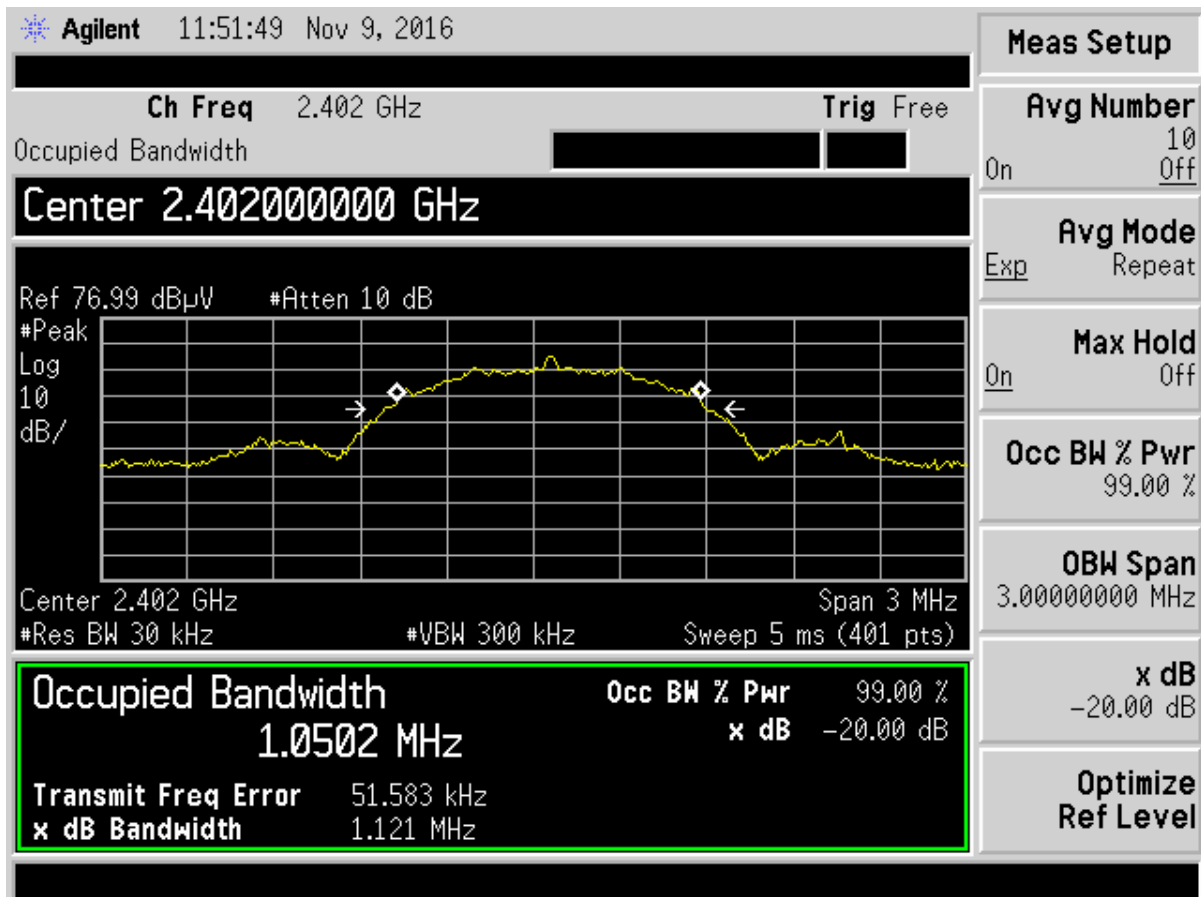


Figure 10. 99% Occupied Bandwidth – Low Channel

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z o. o.
 Beacon H1.7

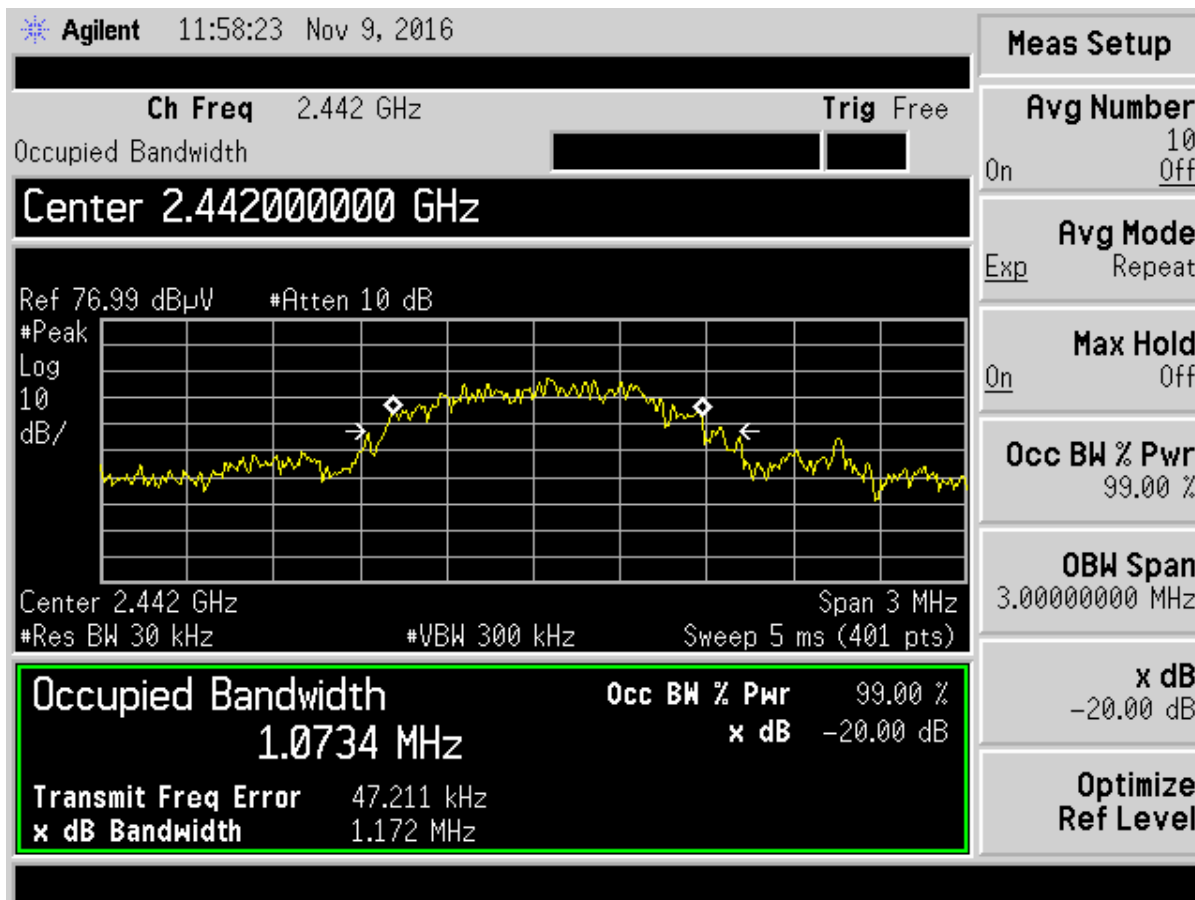
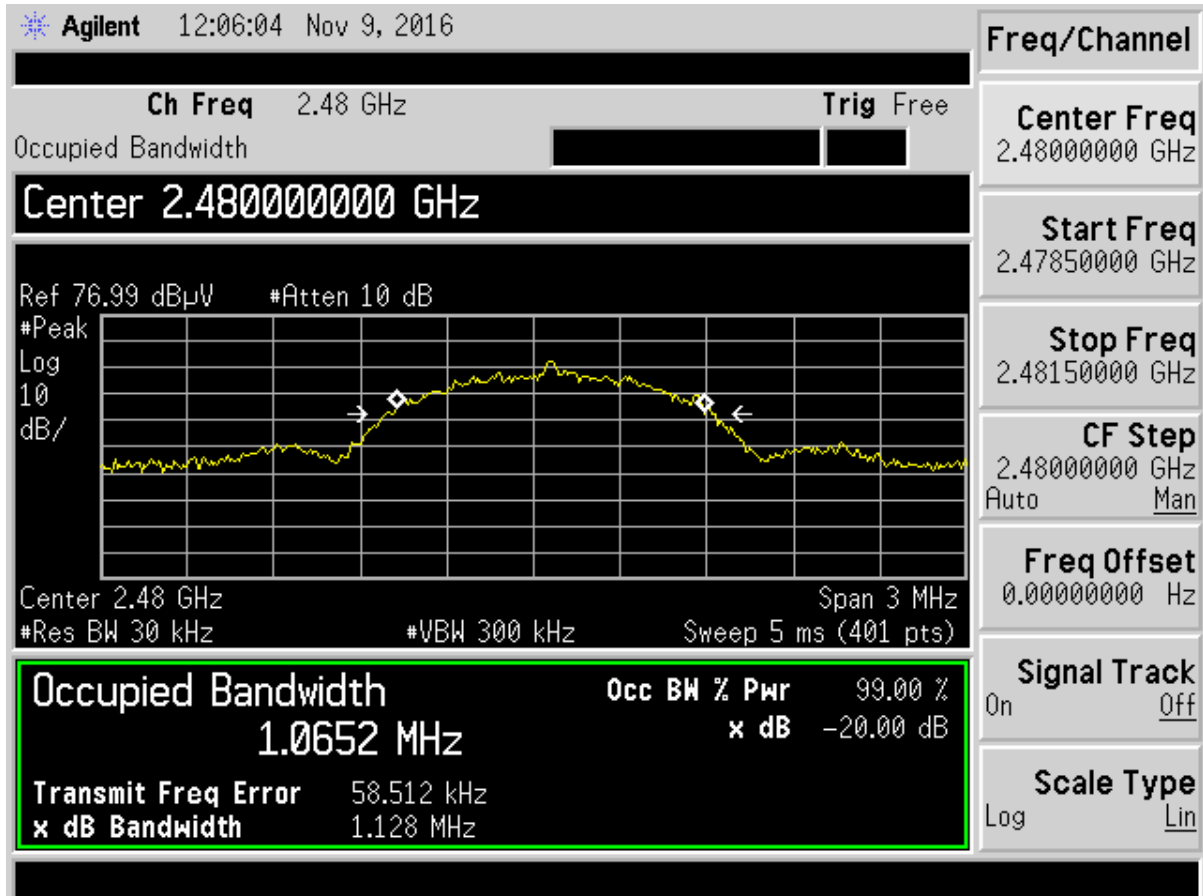


Figure 11. 99% Occupied Bandwidth – Mid Channel

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7



US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z. o. o.
Beacon H1.7

2.13 Unintentional Radiator, Powerline Emissions (CFR 15.107)

Since the EUT is battery powered, this test was not applied. The EUT is powered by three AA ER14505 3.6V LiSOCL₂ Lithium Primary Cell type batteries.


NOTE: The test data provided in this section is to support the Verification and co-location requirement for the digital apparatus and the radios within.

Table 16. Transmitter Power Line Conducted Emissions Test Data, Part 15.107

| 150KHz to 30 MHz with Class B Limits | | | | | | |
|--|------------------|-----------------|----------------|--------------------------------------|-------------|-------------------------|
| Test: Power Line Conducted Emissions | | | | Client: Estimote Polska Sp. z. o. o. | | |
| Project: 16-0265 | | | | Model: Beacon H1.7 | | |
| Frequency (MHz) | Test Data (dBuV) | LISN+CL-PA (dB) | Results (dBuV) | AVG Limits (dBuV) | Margin (dB) | Detector PK, QP, or AVG |
| The EUT is battery powered: therefore this test is not applicable. | | | | | | |

SAMPLE CALCULATION: N/A

Test Date: November 14, 2016

Tested By
Signature:  Name: Robert K. Mills

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

2.14 Unintentional Radiator, Radiated Emissions (CFR 15.109)

Radiated emissions disturbance Measurements were performed with an instrument having both peak and quasi-peak detectors over the frequency range of 30 MHz to 12.5 GHz. Measurements of the radiated emissions were made with the receiver antenna at a distance of 3 m from the boundary of the test unit.

The test antenna was varied from 1 m to 4 m in height while watching the analyzers' display for the maximum magnitude of the signal at the test frequency. The antenna polarization (horizontal or vertical) and test sample azimuth were varied during the measurements to find the maximum field strength readings to record.

The worst-case radiated emissions in the range of 30 MHz to 12.5 GHz are more than 20 dB below the limit.

NOTE: The test data provided in this section is to support the Verification and co-location requirement for the digital apparatus and the radios within.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z. o. o.
 Beacon H1.7

Table 17. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109),

| 30 MHz to 1000 MHz with Class B Limits | | | | | | | |
|--|------------------|------------------|------------------|---|--------------------------------|-------------|--------------------|
| Test: Radiated Emissions | | | | Client: Estimote Polska Sp. z. o. o. | | | |
| Project: 16-0265 | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | AF+CA-AMP (dB/m) | Results (dBuV/m) | QP Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector PK, or QP |
| 92.05 | 43.76 | -17.23 | 26.53 | 43.5 | 3m./HORZ | 17.0 | PK |
| 128.18 | 46.01 | -14.38 | 31.63 | 43.5 | 3m./VERT | 11.9 | PK |
| 202.00 | 34.57 | -13.34 | 21.23 | 43.5 | 3m./HORZ | 22.3 | PK |
| 926.00 | 34.51 | 0.69 | 35.20 | 46.0 | 3m./VERT | 10.8 | PK |

Sample Calculation at 92.05 MHz:

| | | |
|---|--------|--------|
| Magnitude of Measured Frequency | 43.76 | dBuV |
| +Antenna Factor + Cable Loss - Amplifier Gain | -17.23 | dB/m |
| Corrected Result | 26.53 | dBuV/m |

Test Date: November 8, 2016

Tested By

Signature:  Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 2ABP2-EST0216
 16-0265
 November 14, 2016
 Estimote Polska Sp. z. o. o.
 Beacon H1.7

Table 18. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109),

| 1 GHz to 15.5 GHz with Class B Limits | | | | | | | | |
|---------------------------------------|------------------|-------------|------------------|------------------|---|--------------------------------|-------------|--------------------|
| Test: Radiated Emissions | | | | | Client: Estimote Polska Sp. z. o. o. | | | |
| Project: 16-0265 | | | | | Model: Beacon H1.7 | | | |
| Frequency (MHz) | Test Data (dBuV) | Factor (dB) | AF+CA-AMP (dB/m) | Results (dBuV/m) | QP Limits (dBuV/m) | Antenna Distance/ Polarization | Margin (dB) | Detector PK, or QP |
| 1760.00 | 68.55 | 0.0 | -8.38 | 60.17 | 74.0 | 3m./VERT | 13.8 | PK |
| 1760.00 | 40.79 | 0.0 | -8.38 | 32.41 | 54.0 | 3m./VERT | 21.59 | AVG |

Sample Calculation at 1760.00 MHz:

| | | |
|---|-------|--------|
| Magnitude of Measured Frequency | 68.55 | dBuV |
| +Antenna Factor + Cable Loss - Amplifier Gain | -8.38 | dB/m |
| Corrected Result | 60.17 | dBuV/m |

Test Date: November 8, 2016

Tested By

Signature:  Name: Robert K. Mills

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
2ABP2-EST0216
16-0265
November 14, 2016
Estimote Polska Sp. z o. o.
Beacon H1.7

2.15 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4. A coverage factor of $k=2$ was used to give a level of confidence of approximately 95%.

2.15.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.78 dB.

This EUT is battery powered; therefore this tested was deemed not applicable.

2.15.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ± 5.39 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ± 5.18 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.21 dB.

The data listed in this test report does not have sufficient margin to negate the effects of uncertainty. Therefore, the EUT conditionally meets this requirement.