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## EXHIBIT 2002

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# PERFORMANCE OF LEADING OPTICAL HEART RATE MONITORS DURING INTERVAL EXERCISE CONDITIONS

Valencell Biometrics Lab  
January 2017





## Why we test

As a developer of optical heart rate monitor (OHRM) technology, Valencell has a critical need to objectively understand how all OHRM technologies in the market, not just Valencell's, perform in all conditions. We want to know how these technologies perform, why they perform the way they do, how they work, and under what conditions they don't work. If our technology is not performing to our customers' high standards for accuracy, our business will suffer. Period.

As you will see from the results in this report, Valencell technology is performing at the highest levels in the industry.

## Valencell Biometrics Lab

We created the [Valencell Biometrics Lab](#) to serve not only as a testing ground for the latest in biometric wearable technology, but as a check & balance on our product development teams to ensure the highest standards. The lab is run by Dr. Chris Eschbach, PhD exercise physiologist, and operated by a team of exercise scientists who have tested thousands of devices of all types on thousands of test subjects over the years.

### Valencell Biometrics Lab

- Tests over 450 devices per year from leading wearable tech and medical device companies
- Conducts over 36,000 different device tests
- Analyzes over 50 million biometric data points
- Measures over 2,000 hours of testing & validation per year

The Lab maintains a rotating pool of nearly 100 volunteers who visit the lab every week to participate in testing. The volunteer pool consists of a broad range of ages, weights, fitness levels, skin tones, and physiological habitus, which enables Valencell to test how devices work across a diverse population of users.

## Testing methodology

This particular investigation involved testing several different devices and two of those devices in multiple positions on the arm. Subjects included 30 healthy adults (15 males and 15 females), ranging in age from 21 to 68. At most 4 devices under test were worn by the subject at one time – one on each wrist and arm (forearm or upper arm), respectively. All data was compared to the Polar H7 BLE chest strap heart rate monitor as a benchmark. Devices were always worn according to the



manufacturer's directions, and there was never more than one wrist device worn on the same wrist. All subjects performed the same test with all devices: an 8-minute indoor dynamic treadmill test, commonly known as the "Valencell Test":

Elapsed Time	Activity Time	Activity
0-0:30	0:30	Stand
0:30-1:15	0:45	3.4 mph Walk
1:15-4:30	3:15	Self-selected run speed (generally between 5 and 9 mph)
4:30-5:30	1:00	3.0 mph Walk
5:30-6:30	1:00	Self-selected run speed (generally between 6 and 9 mph, but greater than 1:15-4:30 run)
6:30-7:00	0:30	2.2 mph Walk
7:00-8:00	1:00	Stand

Over years of testing, the Valencell Test has been shown to identify weaknesses in OHRM devices, particularly in tracking changes in heart rate and other biometrics caused by varying activity intensity in different intervals.

### Devices tested

The following devices were tested:

- Valencell's reference design
- Valencell's partners' wrist/arm products
- Leading competitor products

### Device Placement, Recording & Data Extraction

#### *Wrist Devices*

Subjects wore one wrist device on each arm during testing, and the devices were assigned at random to the subject's dominant and non-dominant sides. All devices were put on by the tester to ensure consistency. Placement was approximately one finger proximal to the ulnar styloid process. The device was tightened to the point where it would not slide when the subject shook their wrist but was not uncomfortable or squeezing the arm.

#### *Forearm Devices*

Subjects wore one forearm device on each arm during testing, and the devices were assigned at random to the subject's dominant and non-dominant sides. All



devices were put on by the tester to ensure consistency. Placement was approximately two fingers distal to the elbow crease and aligned with the radial artery. The straps were tightened snugly to prevent sliding.

#### *Upper Arm Devices*

Subjects wore only one upper arm device at a time because they wore an armband with an iPod Touch on the other arm. Devices were assigned at random to the subject's dominant and non-dominant sides. All devices were put on by the tester to ensure consistency. Placement was approximately four fingers distal to the shoulder joint on the lateral side of the arm, directly on top of the deltoid muscle. The straps were tightened snugly to prevent sliding.

#### **Sources of Error**

- Sweat occasionally caused the devices to slide, even when the test started with the proper tightness and fit.
- Due to arm and/or wrist circumference, the devices were in a slightly different location and tightness on some participants.
- The Valencell Reference Design at the upper arm had to be lower on the arm for several participants.

It is also important to note that it is common for the benchmark chest straps to experience errors. Valencell has done simultaneous testing with multiple CSHRM devices and found that they typically produce results within +/-5% of each other anywhere from 95-98% of the time.

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