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## Medical wearables: the convergence of two worlds, medical-grade devices vs. consumer wearables

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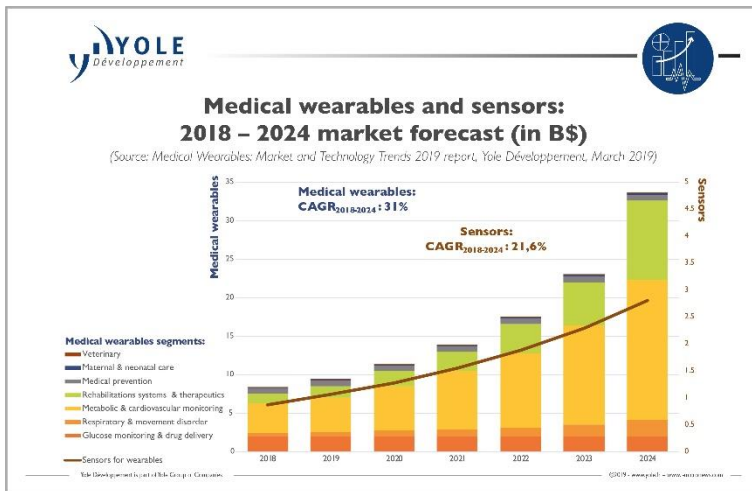
- Apple Watch 4's PPG and ECG Health Sensors report, System Plus Consulting, 2019
- Medical Wearables: Market and Technology Trends report, Yole Développement, 2019

**LYON, France – June 27, 2019:** “In today’s wearable technology market, the vast majority of growth has been in consumer sports, fitness, and wellness,” announces **Jérôme Mouly, Senior Technology & Market Analyst at Yole Développement (Yole)**. “However, wearable devices are rapidly expanding for health and medical uses. At Yole, we think, this market should reach US\$32 billion by 2024 with a year-to-year 31% growth between 2018 and 2024. In the meantime, the global sensor market for medical wearables, including CGM<sup>1</sup>, is expected to reach

US\$2.8 billion in 2024, with a 21.6% CAGR<sup>2</sup> during the same period.”

Smartphone ubiquity, sensor miniaturization, and ease of integration have increased the number of wearable products on the market, to the point where such products are now achieving performance levels suitable for medical use-cases.

But how will medical wearables make patients healthier – and why now?

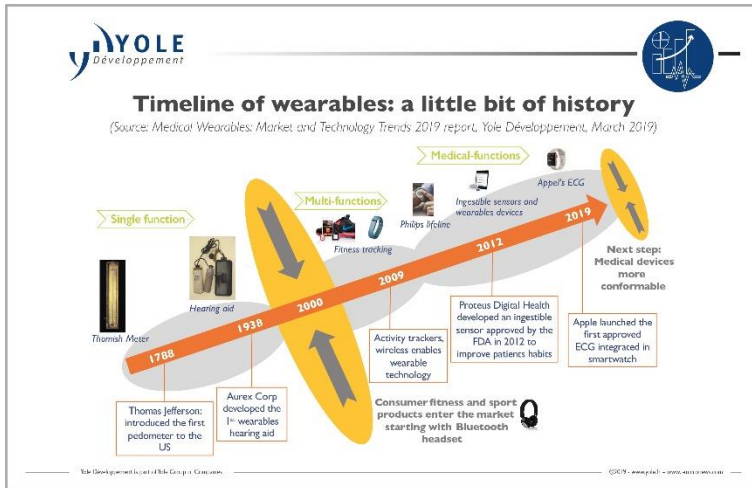


Yole Group of Companies including Yole Développement and [System Plus Consulting](#) investigate the world of medical wearables, existing and emerging technologies to propose today two dedicated analyses, [Apple Watch 4's PPG and ECG Health Sensors report](#) and [Medical Wearables: Market and Technology Trends](#).

Yole’s analysts explore the medical wearable technologies used across different market segments and point out the technical choices made by the companies and possible evolutions.

<sup>1</sup> CGM : Continuous Glucose Monitoring

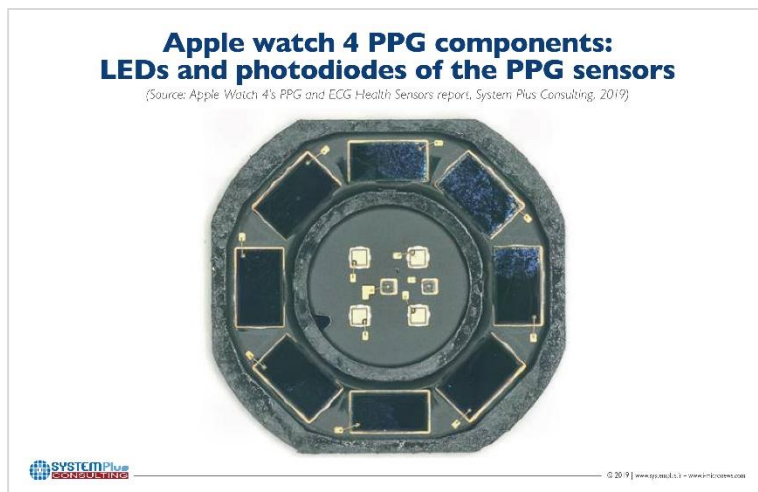
<sup>2</sup> CAGR : Compound Annual Growth Rate



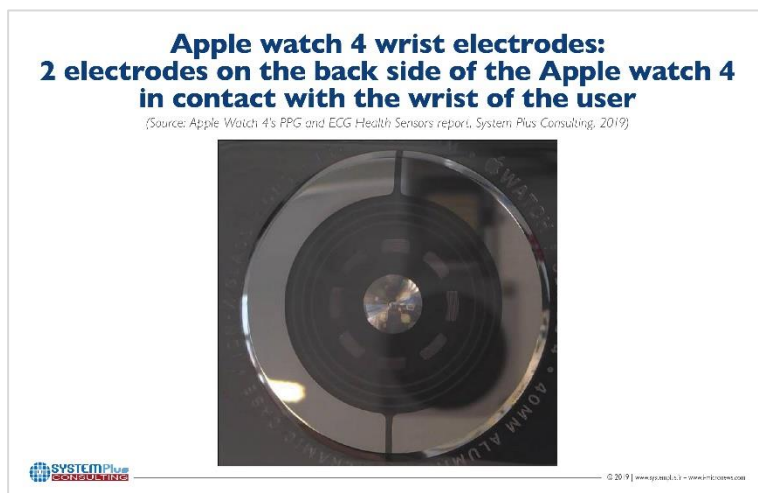
From its side, System Plus Consulting, goes deeply inside the technology with the reverse engineering & costing of the two main health sensors embedded in the Apple Watch series 4: an enhanced PPG and ECG, a medical sensor approved by FDA for the first time in an Apple Watch..

“The PPG is the core of the continuous heart beat sensor,” explains **Sylvain Hallereau, Project Manager at System Plus Consulting**. “A new,

and more compact design reduces the surface area by 30%, while the number of components increases from six to 14. This enhances heartbeat measures. In parallel, the ECG electrically measures very small currents using three electrodes. Two wrist electrodes are integrated on the back side of the Apple’s watch. The third electrode is in the digital crown. The signals are captured and amplified by Analog Devices circuits...”



A myriad of advanced technologies are under development to solve the current issues. But what is exactly the status of this medical wearable industry? Does it offer lot of business opportunities? What could be the key enabling technologies?... Yole Group of companies presents you the status of medical wearables with a special case study, a deep analysis of the technologies selected by Apple for its Apple Watch 4.



Medical wearables are the convergence of two worlds: the world of medical-grade devices and the world of consumer wearables. Medical wearables also feature two major player types: medical device manufacturers willing to reach consumer healthcare with the promise of higher volumes, and consumer device companies willing to reach the high-value healthcare market. Medical wearables development is quickening and competition is intensifying, prompting players to ensure a high

level of quality as well as medical-grade accuracy for the generated data.

Apple made the choice to dramatically increase the number of LED and photodiodes to reach higher heart rate measurement accuracy with higher sensitivity. The LEDs emit light through the skin to the blood vessels, and the photodiode receives the unabsorbed portion of light. On the other hand, sensor designers are developing sensor modules that integrate LEDs and photodiode with the right packaging and electronic architecture, ensuring accuracy of measurement with miniaturized, low-power devices. These turnkey solutions contribute to a faster time-to-market for medical wearable makers and help sensor makers move up the value chain with high-value solutions.

Led by the Apple Watch Series 4, there is increasingly strong interest to add ECG capability in a smartwatch so that doctors and hospitals can get accurate information on a patient's cardiac status. At sensor level, increasing complexity of medical wearables turns electronic companies to medical grade sensor experts, like AMS, Maxim Integrated or Valencell developing dedicated platforms. It enables an optimized integration (in terms of footprint and power consumption) while reducing development time with the guarantee of measurement accuracy.

To better understand the challenges linked to non-invasive sensors in the medical sector, Yole had the opportunity to debate with Valencell ([Valencell's interview](#)) and Ava ([Ava's interview](#)), both players strongly involved in the development of sensor solutions and medical wearables.

*"I am convinced that medical wearables are more than a hype," asserts **Pascal Koenig, CEO of Ava.** "However, having been in this space for more than 15 years I am deeply aware that building successful medical wearables takes time and is complex. Having said this, I am convinced that a number of highly successful companies will emerge in this space over the coming years..."*

*"Wearable device makers are continually adding new capabilities, which mean there is less real estate and power budget to go around for each sensor and or function," comments **Ryan Kraudel, VP Marketing at Valencell.** "So, device makers always want the sensors to be smaller, more power efficient, but also more capable. Much of our R&D effort is in meeting those demands and we've been able to drastically shrink the size of our sensors while increasing our levels of accuracy and the number of biometric we can measure."*

Since 2014, the market research and strategy consulting company Yole has identified more than US\$550 million raised by medical device and diagnostic companies, and the pace at which new medical wearable products are being commercialized is accelerating. Moreover, at the beginning of the year Apple has announced a collaboration with Janssen Pharmaceutical, a Johnson & Johnson company to perform a research

study to help Atrial Fibrillation outcomes, including stroke prevention. It shows one of the first medical application of the Apple Watch series 4 in a dedicated use case.... All these movements confirm the attractiveness of the sector.

Under this context, Yole and System Plus Consulting invite you to discover the collection of Life Science & Healthcare reports on [i-  
micronews.com](https://micronews.com).

## ABOUT THE REPORTS:

- [Medical Wearables: Market and Technology Trends 2019](#)

*New technologies and faster market launches are driving the medical wearables market – A technology & market report performed by Yole Développement (Yole)*

### List of companies

3M, AAC Technologies, Abbott, Alertgy, AliveCor, Amazon, Amphenol, AMS, Analog Devices, Apple, Artefact, Ava, BACtrack, Biogen, Biolinq, Biometrics, Bittium, Bioserenity, Bloomlife, Bonbouton, Capsule, Cardionet, CarePredict, CareWear Corp, CEA Léti, Cefaly Technology, Chrono Therapeutics, Chronolife, Comepa, Covestro, Dakota, Delsys, Dexcom, D Free, Ectosens, Elvie, Empatica, Excelitas Technologies, Exosystems, Feel, Feetme and more.

- [Apple Watch 4's PPG and ECG Health Sensors](#)

*The first FDA approved multi-million produced Smart Watch for consumer market. – Performed by System Plus Consulting, this report also analyzes the complete health sensor system, including a full analysis of the infrared LED from Epistar, green LEDs from OSRAM and the photodiodes from OSRAM for the PPG. For the ECG sensor, the integrated circuits and the three electrodes are also studied in the report. Moreover, the back window's specific lenses, optical system and electrodes are analyzed.*

## About the authors

- **Sylvain Hallereau** serves as a Senior Technology and Costing analyst in charge of IC, LED, MEMS and Photonic. He has more than 15 years of experience in semiconductor device manufacturing cost analysis and has studied a wide range of technologies. He holds a Master degree in Microelectronics from the University of Nantes.
- **Véronique Le Troadec** has joined System Plus Consulting as a laboratory engineer. Coming from Atmel Nantes, she has more than 30 years of experience in failure analysis of components and extensive knowledge in deprocessing of integrated circuits, MEMS, LED, Compound Devices, Advanced Package.
- **Jérôme Mouly** serves as a Senior Technology & Market Analyst & Business Developer specialized in microtechnologies for inkjet & bioMEMS sensors at Yole Développement (Yole). Jérôme is supporting the development of strategic projects, following leading customers of the company, within the Life Sciences & Healthcare division. Since 2000, he is also engaged in more than 100 marketing and technological analyses for industrial groups, start-ups and institutes related to semiconductor & medical technologies industry, in the field of inkjet functional printing, wearable sensors and connected medical devices. Jérôme is also regularly involved in international conferences, giving presentations and delivering keynotes. Jérôme Mouly holds a Master of Physics from the University of Lyon (France).
- As a Technology & Market Analyst, Biotechnologies & Molecular Innovations, Medical Technologies in the Life Sciences & Healthcare division at Yole Développement (Yole), **Asma Siari** is involved in the development of technology & market reports as well as the production of custom consulting projects. After a Master's degree in Biotechnologies, Diagnostic Therapeutics & Management, Asma served as Research Assistant at the Moores Cancer Center (San Diego, CA). She is a coauthor in three scientific publications published in the Molecular Cancer Research Journal. Asma Siari graduated with an Advanced Master's degree in International Strategy & Marketing BtoB from EM Lyon Business School (France).

## ABOUT YOLE GROUP OF COMPANIES



**System Plus Consulting** specializes in the cost analysis of electronics, from semiconductor devices to electronic systems. Created more than 20 years ago, System Plus Consulting has developed a complete range of services, costing tools and reports to deliver in-depth production cost studies and estimate the objective selling price of a product.

System Plus Consulting engineers are experts in Integrated Circuits - Power Devices & Modules - MEMS & Sensors - Photonics – LED - Imaging – Display - Packaging - Electronic Boards & Systems. Through hundreds of analyses performed each year, System Plus Consulting offers deep added-value reports to help its customers



understand their production processes and determine production costs. Based on System Plus Consulting's results, manufacturers are able to compare their production costs to those of competitors. System Plus Consulting is a sister company of Yole Développement. More info on [www.systemplus.fr](http://www.systemplus.fr) and on [LinkedIn](#) and [Twitter](#).

Founded in 1998, **Yole Développement (Yole)** has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide covering MEMS & Sensors - Imaging - Medical Technologies - Compound Semiconductors - RF Electronics - Solid State Lighting - Displays - Photonics - Power Electronics - Batteries & Energy Management - Advanced Packaging - Semiconductor Manufacturing - Software & Computing - Memory and more...

The "More than Moore" market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and KnowMade, support industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business. . For more information, visit [www.yole.fr](http://www.yole.fr) and follow Yole on [LinkedIn](#) and [Twitter](#).

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