Low power RF
Vital-sign wireless monitoring
LifeSignals: technology background

About LifeSignals
LifeSignals Group Inc, is a venture and private-equity backed company which is led by its co-Founder and CEO, Surendar Magar, Ph.D., who started LifeSignals in 2008 to develop a purpose-built semiconductor platform that would enable high reliability, disposable, low cost, clinical-grade wireless biosensors that would transform healthcare by bringing clinical-grade monitoring and diagnostics out of expensive hospitals, and into homes and remote villages globally.

Technology Foundation
LifeSignals has developed world's first and only single-chip Life Signal Processor (LSP) silicon chip platform solely to enable high volume biosensor patches that are clinical grade, wireless, fully disposable, lightweight, comfortable and showerproof which accurately and reliably capture, record and stream vital signs to the cloud.

LifeSignals intellectual property on multiple fronts is covered by over 20 patents.

About LifeSignals LSP Platform
More than 10,000 people have worn the LifeSignals patch for multiple days for remote and ambulatory cardiac monitoring. Patch based on LifeSignals LSP platform that continuously monitors multi-channel ECG and is cleared by FDA, CE (EU) and HSA (Singapore).

These patches save lives and enable 7x24 health monitoring while avoiding undue hospitalizations.
LifeSignals and ST

ST has been working with LifeSignals to **develop** and **industrialize** their innovative multi-radio architecture and to **bring it to the market** in **high volumes** while meeting **clinical-grade** requirements.

The Live Signal Processor (LSP) is the perfect example of the benefits delivered by the complex combination of ultra-low-power **wireless connectivity**, highly **accurate sensor interfaces**, advanced **analog features**, and an ultra-efficient **processing** platform.
LC1100: Single-Chip Solution with AFE + Processing + Radio link

Developed for medical grade – Key patented IP

The world’s first battery operated, ultra-high reliable, disposable wireless System-on-Chip (SoC) solution

On-Chip Sensor Processors
- Physiological
  - Multilead ECG
  - Heart rate
  - Respiration
  - SpO2
  - Temperature
  - Hydration
- Others
  - Motion
  - Pressure
  - Humidity
  - Microphone
  - Audio

802.11 MAC
- WiFi (2.4 GHz)
- UWB (3-10 GHz)
- MBAN (2.38 GHz)

Multiple Radios

Actuator Interfaces

Multiple Digital Buses

µC and RAM

Power Management

Coin Battery Operation
- No other Wi-Fi chip

Purposely built for mission critical vital-sign wireless monitoring
Life Signal Processor – LC1100

- Dual 32-bit Cortex-M0 Processor
  - 128KB RAM (Radio)
  - 192KB RAM (Application)
- 2Kbit OTP memory
- QSPI, SPI, I2C, I2S, PDM
- EMMC and JTAG

- ECG
- SpO2
- TTI based respiration
- RDL amplifier
- Lead off detection
- Digital pacemaker pulse detection
- Low battery indication

Disposible Wireless Patch
for remote vital-sign monitoring
LifeSignals provides disposable wireless patch to allow more accurate screening.

LifeSignals has ground-breaking technology that allows remote monitoring of all key vital signs currently monitored in hospitals.

LifeSignals technology can assist government officials and the medical community to respond to the Coronavirus outbreak at two critical steps:

**PRE-diagnosis: Screening**

**POST-diagnosis: Monitoring**

LifeSignals wireless patches:
- Transmission to cloud
- Disposable afterward
- 5 days of continuous operation

Real-time critical vital sign monitoring, alerting and reporting @ scale
LSP-based personal symptom monitoring

**Patch-S – Symptomatic monitoring**
- 2-channel ECG, heart rate, respiration rate, skin temperature, cough frequency

**Patch-M – Clinical monitoring**
- SpO2, 2-channel ECG, heart rate, respiration rate, Skin Temperature, cough frequency, heart sound, Bluetooth Low Energy

**Example of COVID-19 monitoring**

For the many people who are currently self-isolating at home, continuous monitoring of COVID-19 symptoms is not possible. With the Patch-S and Symptom Tracking App, key COVID-19 symptoms can be continually monitored, providing individuals with detailed health trends and alerts.

There is currently a shortage of Intensive Care Unit (ICU) and high dependency beds in hospitals. Recovering patients can return to the comfort of their own homes or low dependence setting while still being monitored remotely, releasing scarce bed space in the hospital.
Life Signal Processor – Wireless wearable patches

**LSP1210: LIFESIGNALS BIOSENSOR 1A**
Multi-Parameter Disposable Patch

2-channel ECG, Heart rate, FDA/CE approved on FEBRUARY 2020
In production

**LSP1250: LIFESIGNALS BIOSENSOR 1AX**
Patch-S: symptomatic monitoring

2-channel ECG, heart rate, respiration rate, skin temperature, cough frequency
Sampling NOW

**LSP1250: LIFESIGNALS BIOSENSOR 2A**
Patch-M: clinical monitoring

SpO2, 2-channel ECG, heart rate, respiration rate, skin temperature, cough frequency, heart sound, Bluetooth LE
Sampling e/o APRIL 2020

POWERED BY LC1100 LSP (LIFE SIGNAL PROCESSOR)
Scalable remote monitoring solution

Ready to build E2E ecosystem with LifeSignals patches

Patches easily worn and changed by Patients

Infrastructure to monitor Millions and Millions

Examples
1. Holter
2. In-Patient Monitoring
3. Remote Monitoring
4. Disease Management
Thank you