Ensuring Medical Alert Pendants are Accurate and Reliable with Modular Functional Test

Keysight Technologies and Circuit Check, Inc.

Learn why Circuit Check, a Keysight Solution Partner, selected Keysight’s 34980A multi-function switch measurement as part of a system used to ensure the accuracy and reliability of medical alert devices.
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While we view retirement as the golden years of life, age comes with added risks. Seniors face the threat of accidents that can take away the freedom and joy that retirement offers. Timely responses to falls and other emergencies reduce the possibility of serious injuries and preserve self-reliance. Personal medical alert systems offer help at the touch of a button, creating a layer of protection for seniors when human helpers cannot be around, so accuracy and reliable performance is crucial.

Wireless medical alert systems typically have two simple components: a console and a pendant with a button, worn around the user’s neck. In the case of a fall or other emergency, the user can summon help with the touch of a button. This sends a call over phone lines or the internet to a service representative who can call the user’s emergency contacts and/or emergency medical responders, depending on the situation. Because the pendants are worn, they offer a more reliable resource than a cellular phone which may not be readily available when needed.

A downfall of traditional medical alert systems is that it requires a phone or internet connection for the base station unit. Another is that many systems’ pendants only operate within a specific distance from the base station. More advanced systems are just now becoming readily available, with base stations that are wireless via cellular, and pendants that support GPS and WiFi as well as traditional methods, but with these advances come design validation and functional test challenges.

The addition of wireless base station functionality increases the complexity of the technology involved and the range and depth of testing that needs to take place. Because the system is only as reliable as the design and components it is built upon and the quality of wireless communication between the base station and service center, the ability to conduct thorough testing throughout the system is critical to its success.

The test challenge

Device manufacturers must verify that their assembled products will accommodate the rigors of daily use. This requires medical alert systems to define a detailed Equipment Requirements Specification covering a detailed list of test requirements for equipment related to the next generation, wireless, medical alert pendent system. New systems include wireless, Wifi, GPS and traditional low frequency communications capabilities, all of which must be tested and verified during the production process. Manufacturing test requires the ability to test populated boards during initial production and retest refurbished units.

Circuit Check, a Keysight Solution partner, worked with medical alert system suppliers to design and deploy manufacturing test systems that ensure the accuracy and reliability of the medical alert system before leaving the production factory.

The test systems were configured into two core platforms:
– Final PCA Tester: For board test early in the production process.
– Final Functional Tester: For final, finished product test.
Circuit Check selected Keysight's 34980A multi-function switch/measurement unit to provide test system integration for its ease of use and flexible configurations. The 34980A offers a built-in 6.5 digit DMM for basic measurements, a large selection of re-configurable switch and measurement plug-in modules and provides a wide range of source and measurement options to address challenging manufacturing test needs. The Keysight 34980A was selected because of its software driver is easy to use, and the switch measurement unit is easy to configure and wire up due to its standard DSUB-type connectors. The ability to easily connect to and program the 34980A contributed to the fast and reliable development of the manufacturing test systems.

System perspective

Designing a test system capable of addressing all the technical needs for the medical alert device was a challenge mainly due to the need to test its multiple features. The new, innovative design of the medical alert system includes a working help button, even when it is not in the range of the communicator. It also has an audio system which allows the subscriber to communicate directly with the Call Center. It contains a PCBA, battery, enclosure, speaker, microphone, neck cord and antenna. Besides Wifi, GSM and GPS, the pendant includes LEDs, pressure sensors and an accelerometer. A large button enables operation via a microphone. Battery power is provided by a Lithium-Ion rechargeable battery. All of these features require testing to verify proper operation and to assure that the manufacturing process results in a high quality product.

In addition to the Keysight 34980A multi-function switch measure unit, the optional 6.5 digit DMM and 34921A, a 40 channel armature multiplexer module were used to measure pressure sensors and accelerometers within the device. The 34941A, a Quad 1x4 50 Ohm 3 GHz multiplexer module was also used to switch in various RF signals, such as Wifi, GSM and GPS, to simulate communications sent to the product. The test system software, developed by Circuit Check, allows for more than one device to be tested at a time, so the same test station can be used for both the base station unit and the wearable communicator pendant device.

The test solution

The 34980A multifunction switch/measure unit is a valued addition to the Circuit Check manufacturing test systems because of its compact size, economical price, and a one-box solution for medium to high-density switch and measure applications. Keysight’s 34980-based system enabled Circuit Check to assemble the tester in various configurations based on its customers’ needs. As show in Figure 2, the PCBA testers included several Keysight instruments matched to product-specific fixtures designed and produced by Circuit Check. Keysight’s 34980A’s 8-slot mainframe supports up to 21 mix-and-match plug-in modules and up to 560 2-wire multiplexer channels or 4096 matrix cross-points.

A key reason the 34980A was selected is because the number of channels needed for device testing in a manufacturing test system will never be a limiting factor due to its high maximum number of channels. Another core 34980A value to Circuit Check, as a system integrator, was that the switch connectors consist of known industry standards, rather than custom I/O connectors like the ones provided by other suppliers. This allowed Circuit Check to quickly acquire the needed connectors and create Device Unit Test (DUT) interface cables to speed deployment. Another advantage the 34980 offers is the ability to be reconfigured by changing or adding new plug-in modules or simply changing the measurement connections for various test system needs. The PCBA and Final Test systems used for the medical alert device were easily modified and four test systems were used for specific sections of the assembly test.
Test goals

This test system is designed to provide a means for both pass/fail and specific measurement limit testing in order to ensure reliable performance of the medical alert device.

The test process

The test system, consisting mainly of the 34980A with plug-in modules controlled by the test system software, first tests the product as a printed circuit board assembly (PCBA) to verify the power, voltage and current levels and then provide product identification and configuration. More advanced testing is then conducted to verify the accuracy of the microprocessor oscillator, RF current measurements and multiple voltage measurements. Once the device is assembled, the functionality of the battery, pressure sensor, acceleration sensor, temperature sensor, LEDs, and communications completes the series of product tests. Final configuration including country specifics and calibration are verified and communication of the medical alert device is thoroughly tested by activating the cellular connection, paring the device with a base station, and testing cellular connectivity with a PC and a connection to an active cellular network.

The DUT fixture allows for product modification in case new versions of the product need to be deployed.

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<tr>
<td>Keysight 34980A</td>
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<td>Keysight 34921A</td>
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<td>Keysight 34941A</td>
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<td>Keysight Y1130A</td>
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<td>Keysight N5181A (with options)</td>
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<td>Keysight N5181A-1CM</td>
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Figure 2. PCBA tester with a CCI board test fixture.

Figure 3. Circuit Check’s modular DUT test fixture.
Summary

Electronic products contain many components, each of which is a critical link in the chain which must be relied upon to perform as expected. The failure rate of a product is equal to the sum of the failure rates of its components. For a product to be reliable, defects or weaknesses in any of the various components must be detected in the manufacturing process. This is accomplished through functional testing based upon detailed processes and procedures followed carefully in the factory. Keysight’s modular test equipment, along with Circuit Check’s expertise in designing, producing and deploying validated testing solutions applied to the Medical Alert Pendants ensures that the elderly have a continuous communication channel so that they can continue to live an independent lifestyle.

Related Literature

- 34980A Multifunction Switch/Measure Unit, Product Fact Sheet, literature part number 5990-7238EN
- 34980A Multifunction Switch/Measure Unit, Data Sheet, literature part number 5989-1437EN
- 34980A Measurements Made Easy, Application Note, literature part number 5991-1464EN
- Accelerate the deployment of your production test strategy with a modular approach to functional test, Solution Brief, literature part number 5991-0510EN
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