

Introduction to Medical Electronics Industry Test Analysis and Solution

Background and development status of the medical electronics industry

Background

As the global population ages, increasing health care costs as well as emerging developing countries' increasing demand for medical diagnosis and treatment, the worldwide demand for medical electronic products will increase. And by the recent economic development and nation-building continued emphasis on improving health care system to the whole society, the demand for worldwide medical electronics market is also showing a stage of rapid and stable development. This continued demand greatly stimulated investment in the field of medical electronics, medical electronic equipment manufacturers constantly improve the technological level and expand innovative applications which promote stable development of the global medical electronics industry.

Development Status

On current global medical electronics products constitution, United States and Europe companies' products occupy a dominant position, followed by Japan on a number of professional projects also has certain advantages. Developing countries' medical electronics industry started late because of weak foundation, their products are mainly concentrated in the low-end products and high-end equipments are seriously depend on import. But with rapid increase of R&D, as well as market focus from high-tech to universal, product competitiveness is gradually increased, there have been a number of core competitiveness companies with advantage of digital medical imaging and vitro diagnostics. With background of high investment and faster product cycle, how to improve testing efficiency and reduce test development costs also be cared at product development stage.

Testing Technology Analysis

RIGOL can provide a complete and cost-effective test measurement instruments to customers, which can meet medical electronic equipment companies' testing

requirements and lower capital investment in the early stages of pre-research to accelerate product development cycles. Here we focused on test analysis of high-frequency electric knife and breathing machines in the development stage, to help you understand the test application of RIGOL instrument products.

Product Testing Introduction

High-frequency Electric Knife Test Analysis

High frequency electric cautery knife (HF-surgical device) is a replacement for mechanical cutting scalpel organized electrosurgical instrument. Because of the high frequency electric knife can be cut and coagulation at the same time, in the mechanical scalpel surgery difficult access and implementation (such as: abdominal pipeline ligation, the prostatic urethra tumor resection) it is universally applied. Because of its high precision, and thus for power waveform, voltage, current, and other safety indicators requires rigorous testing. Power output test can be calculated by using an oscilloscope to test the output terminal voltage and output circuit current. Precision and accuracy of output power adjustment is fundamental to ensure the safety of the surgery, so accurate degree for the high-frequency electric knife adjusted output power of can be accurately measured by a differential probe and oscilloscope.

In addition, some manufacturers of high-frequency electric knife has humanized and personalized design. According to human tissue impedance monitoring and neurophysiology stimulation pattern to determine the different parts and pain, adjust the treatment mode. Thus in the testing process requires accurate simulation of human body resistance and nerve signals to test whether coagulation can output accurate treatment frequency signal mode. So can use high-precision voltmeter test simulates impedance resistance, and use waveform generator to simulate a neural signal to test whether coagulation output mode is accurate.



Figure 1 High-frequency Electric Knife Output Power Test



Figure 2 Simulate Physiological stimulation mode Ventilator Test Description

In modern clinical medicine, ventilator as an effective means of artificial alternative substitutes autonomous ventilation function in the field of modern medical science occupies a very important position. Usually in the test, the pipeline will be built in ventilation ventilator pressure transmitter, the pressure of work when the ventilator passage of gas into electrical output to an oscilloscope to display the voltage waveform changes. After a long monitoring, the conclusion that the pressure limits access by the relationship between voltage and pressure, the key parameters respiratory rate, minute ventilation, etc.



Figure 3 Ventilator Stress Test

Portable mobile medical monitoring equipment communications test introduction. With internet coverage growing, an aging population, increased health care costs, remote monitoring and other new social conditions, it will enable medical device toward portability and connectivity. Future mobile internet healthcare industry will enter a very rapid development stage.



Figure 4 Remote monitoring equipment communications test

In the mobile internet medical industry, medical device's requirement is not only to meet the normal use, but also to meet stable communication. Wi-Fi, Bluetooth and other communication module test become a key project of medical electronic equipment. Usually the test project has uploaded signal's carrier frequency offset, transmit power, receive end signal reception sensitivity and bit error rate and other parameters. Generally for above indicators test, we can provide test system includes spectrum analyzer, RF signal source and oscilloscope for accurate and efficient testing.



Figure 5 Wireless receiving end sensitivity and bit error rate testing

ECG Test Introduction

The electrocardiograph is an instrument to record ECG. It can automatically record biological signals (ECG) produced by myocardial excitement of cardiac activity. It's a common medical electronic equipment for clinical diagnosis and research. ECG machine test usually needs mV level signal so we can use arbitrary waveform generator to generate low amplitude ECG signal to test instrument.

Electromagnetic compatibility pre-test of medical electronic products

With the development of medical electronic equipment technology, resulting in increasingly complex electromagnetic compatibility environment, such as improper EMC performance design of medical devices, it is easy to cause malfunction of equipment, loss of control and failure, endangers the health of patients and medical staff.

With more stringent EMC standards, all medical electronic equipment manufacturers need to think electromagnetic radiation indicators at research and design stage, or improve product under Electromagnetic compatibility test at medical devices inspection institute in order to improve the product through rate. Based on this, RIGOL can provide customers with a spectrum analyzer with EMI filter and quasi-peak detector function, and is equipped with near field probe to ensure electromagnetic radiation pre-test, it can accurately locate the source of interference and debug. All test results are automatically generated via software.

Summary
Toward the medical electronics industry is now highly competitive and faster new product development cycles and faster product release, Rigol can provide more cost-effective test equipment to help you launch products earlier in market.



Figure 6 Arbitrary waveform generator generate low amplitude ECG signal



Figure 7 Arbitrary waveform generator built-in multiple arbitrary waveform

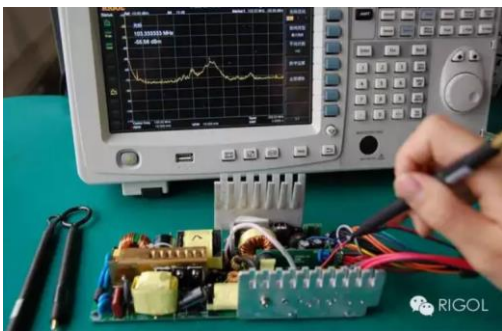


Figure 8 Near-field radiation test to determine the source of interference device

Product Configuration

Basis Test Instrument		
Model	Basic Specification	List Price
DS4000 Digital Oscilloscope	100MHz/200MHz/350MHz/500 MHz Bandwidth 4GSa/s Sample Rate 140Mpts Memory Depth 2/4 Channels	Starting from 2099.0USD
DG5000 Arbitrary/Function Generator	70MHz/100MHz/250MHz/350MHz Max Sine Waveform output AM/FM/PM/ASK/FSK/PSK/PWM Modulations Minimum pulse signal 4ns Max voltage output 20Vpp	Starting from 2058.0USD
DM3068 Digital Multimeter	6 ½ digits Voltage, Current, Capacitance, Resistance, Sensor and other test functions. Histogram Display and Mathematical Analysis	882.0USD
DP800 Programmable DC Power Supply	Max 3 channel output 60V one channel output 2mVpp Ripple	Starting from 472.0USD

RF communications, EMC pre-testing recommended Instruments		
Model	Basic Specification	List Price
DSA800 Spectrum Analyzer	9kHz-1.5GHz/3.2GHz/7.5GHz Phase Noise -98dBc/Hz @10KHz offset DANL -161dBm	Starting from 1428.0USD
DSA1000 Spectrum Analyzer	9kHz-3GHz Min Phase Noise -88dBc/Hz @10KHz offset Min DANL -148dBm	Starting from 3149.0USD
DSG3000 RF Signal Generator	9kHz-3GHz/6GHz Level uncertainty <0.5dB Output -130dBm-13dBm Max 5ppb clock stability Support IQ modulation	Starting from 7581.0USD