

# Oscilloscope in Medical Imaging Applications

Troubleshooting, installation, and maintenance

Measuring electrical signals is a challenge in medical applications. Users need to measure electrical signals during troubleshooting, installation and maintenance, verification of IO digital transmission, power integrity, power management and validation of DDR memory. The challenge is to find a suitable test equipment to address all these applications.

This application brief explores how Keysight oscilloscopes help technical professionals in their troubleshooting, installation and maintenance field work in the medical environment.

## Keysight oscilloscope

- Intuitive user-interface
- Masking feature for fast visual measurement
- Automated demo and training for self-learning
- Reduces out-of-service wait time



**Figure 1.** Keysight InfiniiVision 3000T X-Series Oscilloscope

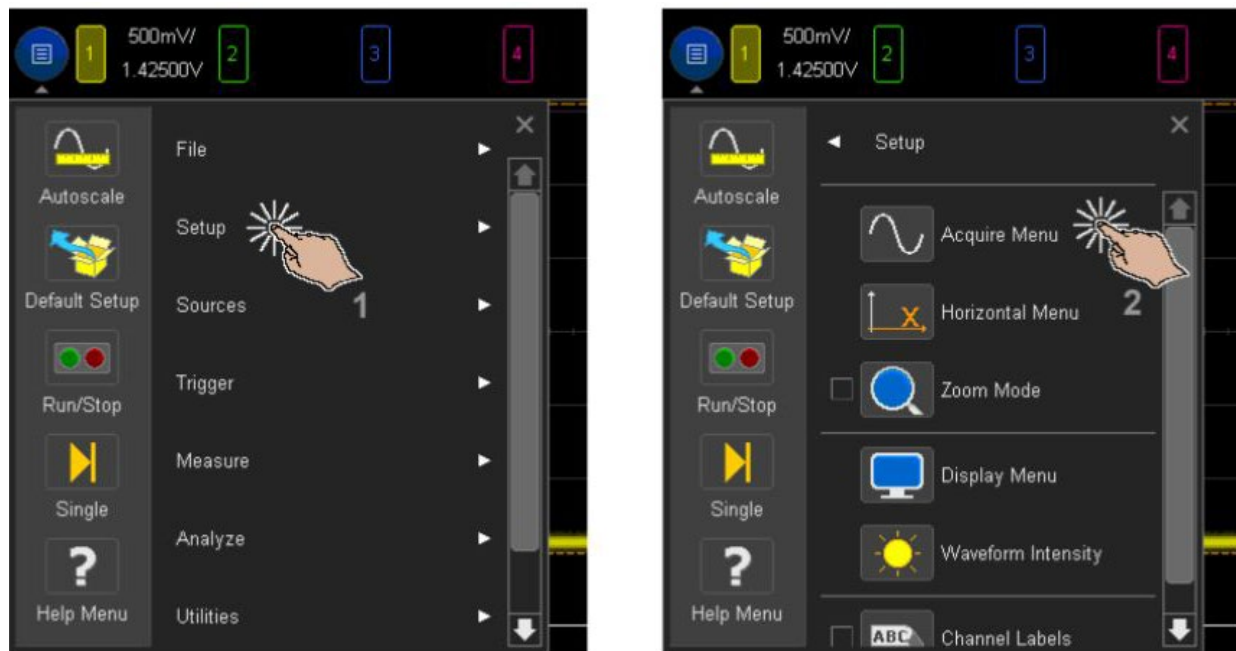
# Keysight Solutions

## Maintenance of medical imaging products

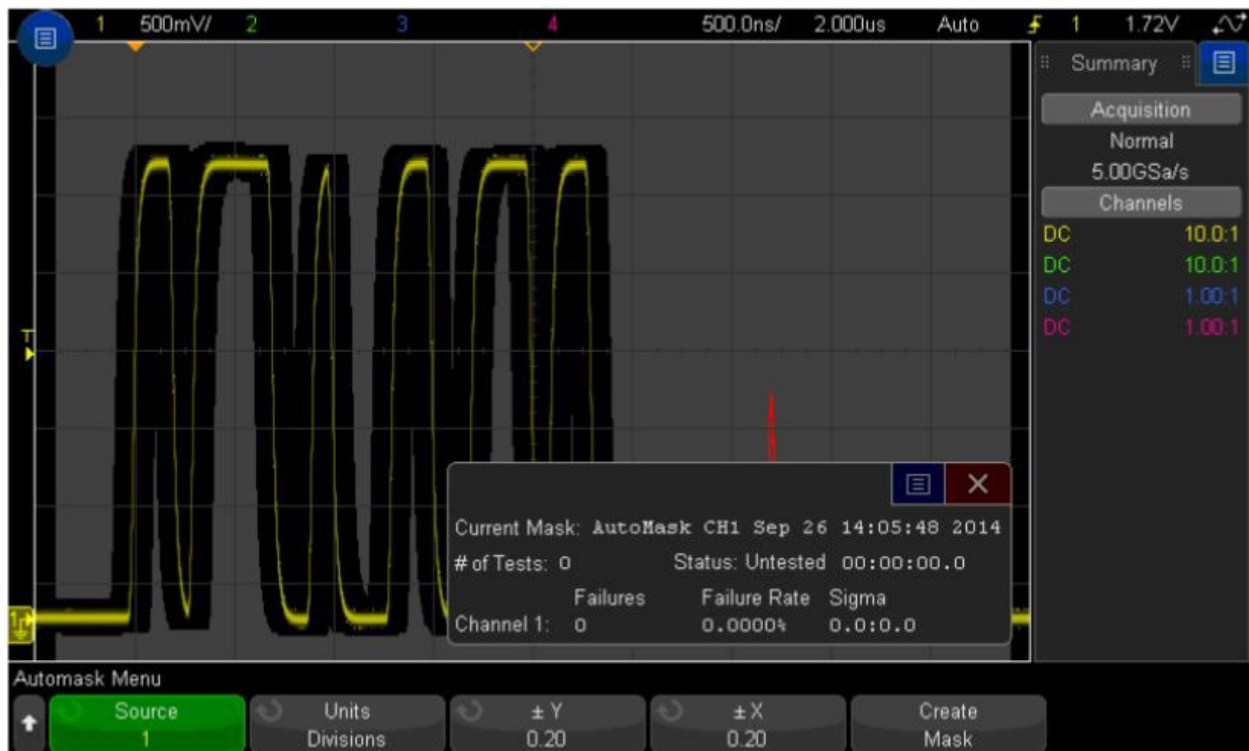
Maintenance on medical imaging products such as magnetic resonance imaging (MRI), computed tomography (CT) scan, positron emission tomography (PET) scan and X-ray machine are usually performed on-site because these machines cannot be removed from their locations. Hence, a total solution general purpose troubleshooting instrument such as the oscilloscope is the best tool for the technical personnel.

A quick fix and reducing the service down time is always the top priority for technical personnel. To address this priority, two key factors comes into play: one, how fast can you troubleshoot problems, and two, how do you know you have fixed the issue. Most technical personnel are not experts in using the oscilloscope. Because of this, an intuitive user interface is very important for the technical personnel to recall the oscilloscope's test settings and collect the data automatically.

Whenever the technical personnel replaces a component in the board or the printed circuit board (PCB), they have to compare the signal from the imaging machine to the factory preset signal to check that they match. An oscilloscope with an intuitive user interface and mask features is the key solution to ensure fast and reliable component or board replacement or repair. The mask feature is a limit testing to perform pass/fail tests on the measured waveform against the ideal waveform, giving the user instant pass/fail indication. These features reduce the service down time and allow the medical imaging product to be returned to the customer faster, and they help to reduce unnecessary parts or components replacement.



**Figure 2.** Intuitive user interface displays menu and submenu items.



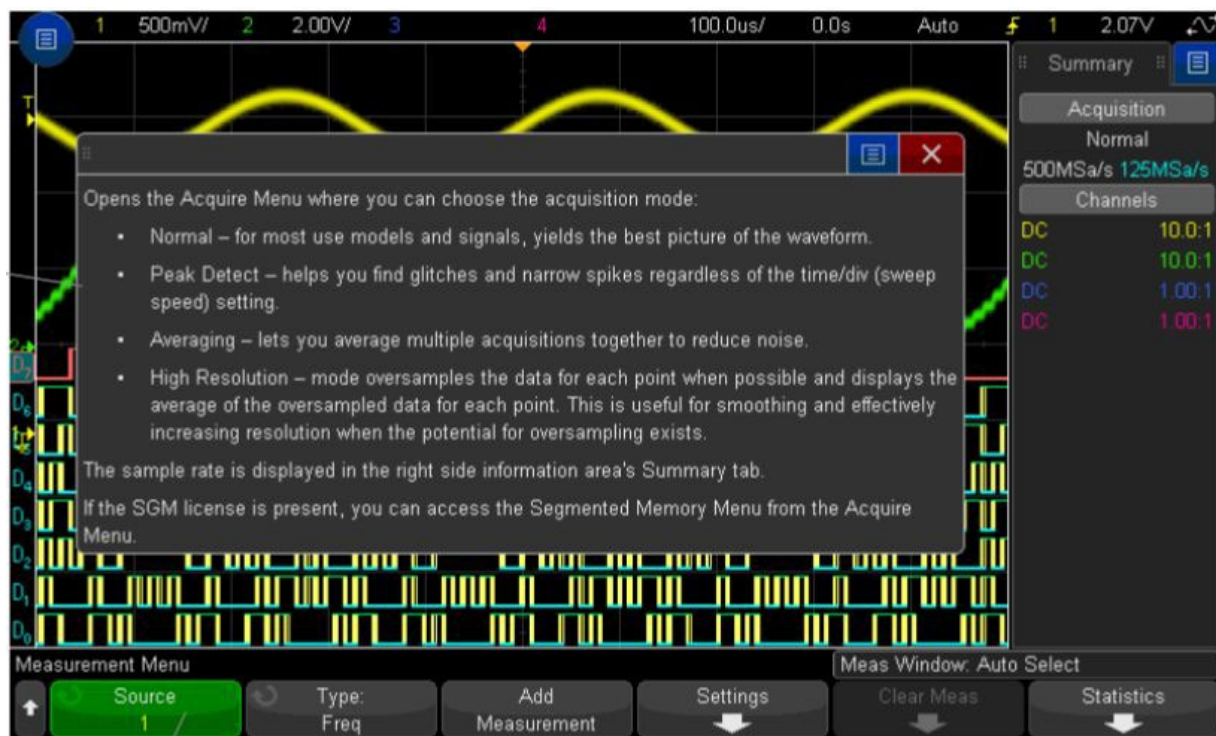
**Figure 3.** The mask test runs continuously to accumulate valid pass/fail statistics. After running the test for just a few seconds, the mask test statistics show that the oscilloscope performed the pass/fail mask test on more than 1,000,000 waveforms.

## Automated demo and training for self learning

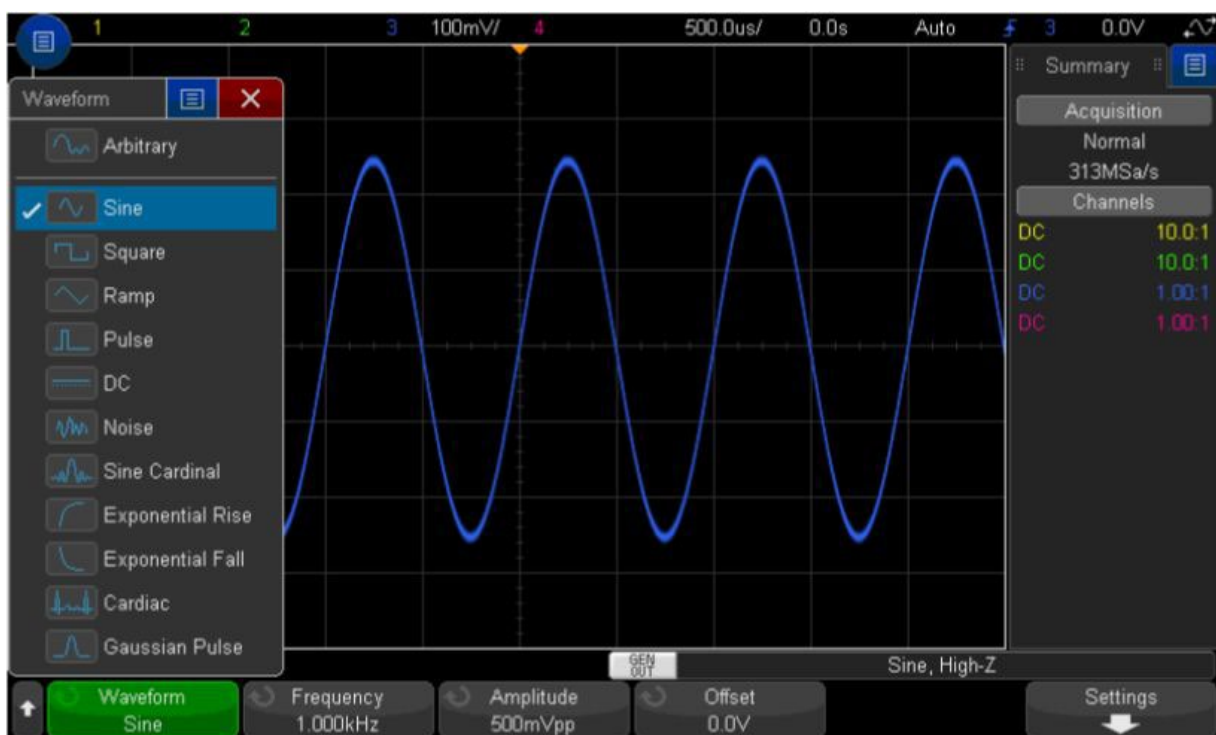
Medical imaging equipment is too expensive to have a dedicated unit to train new engineers or technicians and most of the time they don't have a chance to try testing on the equipment itself. Therefore, the new technical personnel must go to the hospital without practical experience on how to use the oscilloscope to test medical imaging equipment.

Automated demo features and built-in help and training signal would help the new technical personnel in self-paced training. This allows them to understand the oscilloscope's capability and usage based on their own diagnosis and repair procedure.

In addition, the built-in function generator software allows the oscilloscope to generate emulated waveforms of medical equipment. These emulated waveforms can be added to the existing automated demo to help the new technical personnel understand the medical equipment signal profile better.



**Figure 4.** Built-in Quick Help together with built-in demo with training signals assist users during self-paced training.



**Figure 5.** The built-in waveform generator software gives users an easy way to provide input signals when testing circuitry with the oscilloscope.

# Specification at a Glance

Features	Keysight InfiniiVision 3000T X-Series Oscilloscopes
Bandwidth	100, 200, 350, 500 MHz, 1 GHz
Channels	2 or 4 analog channels (DSO) + 16 digital channels (MSO)
Max sample rate	5 GSa/s
Max memory	4 Mpts
Display	8.5 inch capacitive touch display
Wfm update rate	> 1,000, 000 waveforms per second
Connectivity	USB2.0 (mouse & keyboard support), optional LAN, video, GPIB
Upgradeability	Bandwidth, MSO, WaveGen, serial protocol trigger and decode, DVM, 8-digit counter and other applications
Analysis	Segmented memory, search/navigate, advanced math functions, limit/mask test (option), gated FFT
<b>Mask/Waveform limit testing Characteristic</b>	
Mask test source	Analog channels 1, 2, 3, or 4
Maximum test rate	Up to 270, 000 waveforms tested per second
Acquisition modes	Real-time sampling-non-averaged, real-time sampling-averaged
Statistics display	Number of tests, number of failures (for each channel tested), failure rate (for each channel tested), test time (hours—minutes—seconds), sigma (actual versus maximum without failures)

## Literature

Managing Wireless Medical Applications	Publication number
<i>InfiniiVision 3000T X-Series Oscilloscope Data Sheet</i>	5992-0140EN
<i>Mask/Waveform Limit Testing for InfiniiVision Series Oscilloscope Data Sheet</i>	5990-3269EN

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