Measurement Excellence in Education

Test and Measurement Equipment Challenges and Solutions at University and College Engineering Labs

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The engineers and technicians of tomorrow must be trained with the best test and measurement equipment of today.

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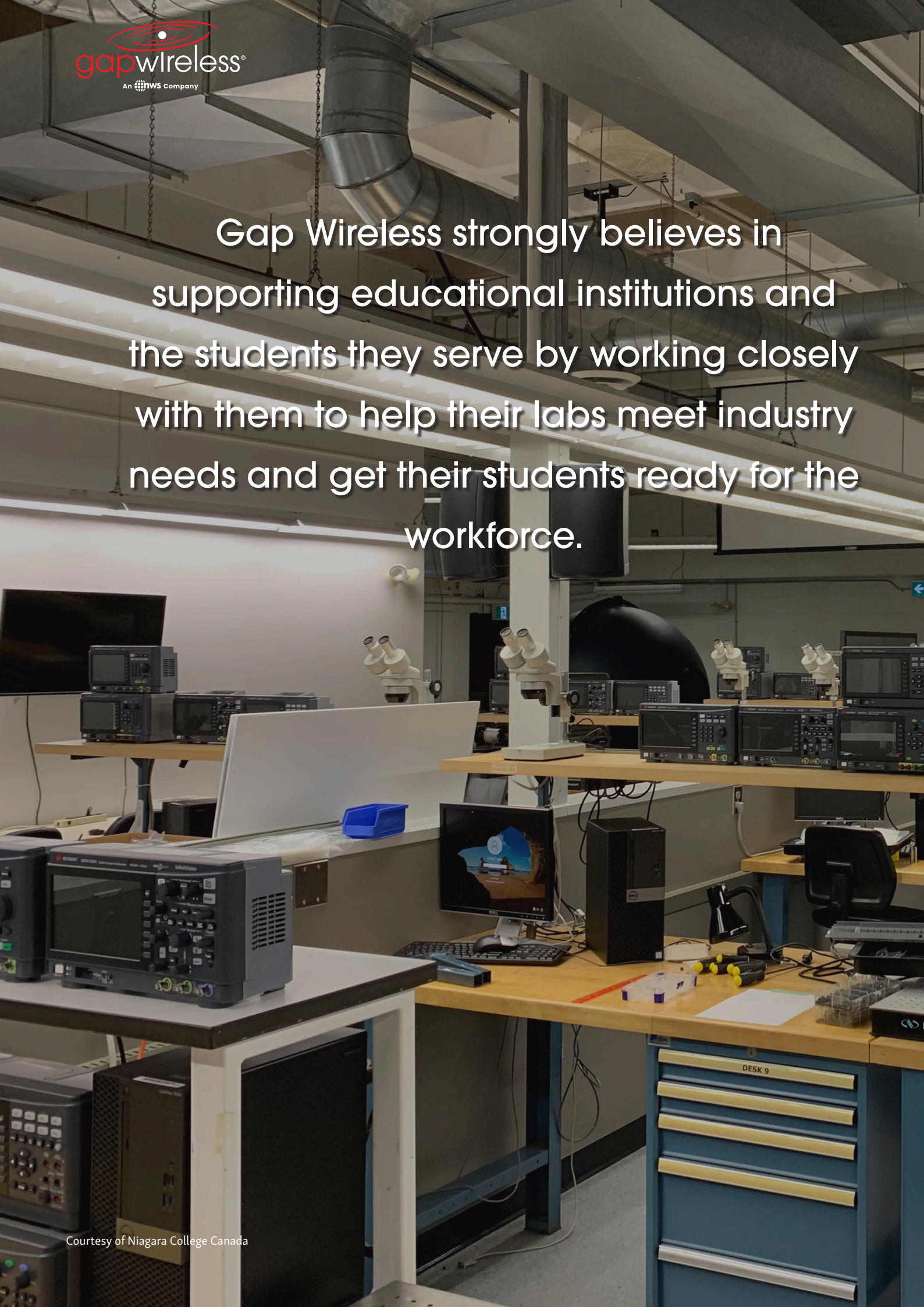


Courtesy of Niagara College Canada

Measurement Excellence in Education

The engineers and technicians of tomorrow must be trained with the best test and measurement equipment of today. Employers expect graduates to be familiar with the tools and techniques used in the industry to hit the bench running with mastery of the most popular equipment.

Gap Wireless strongly believes in supporting educational institutions and the students they serve by working closely with them to help their labs meet industry needs and get their students ready for the workforce. By using better tools, students can learn to be the best engineers and technicians they possibly can be.

In this report, we'll look at benchtop and RF test equipment, fiber optics equipment, and courseware challenges at university and college labs from coast to coast, and the solutions we proposed and successfully implemented. In some cases, we've even provided students and educators with hands-on training for their new equipment so that they can maximise the time they spend doing what's most important: learning, teaching, and developing the skills needed to stay ahead in a fast-paced and increasingly vital industry.

Here are just some of the many educational institutions we're proud to have partnered with and the solutions they successfully deployed.

Courtesy of University of California, Davis

Benchtop and RF Test Equipment

The beating heart of every engineering laboratory is benchtop test and measurement equipment. These fundamental devices—including power supplies, function generators, oscilloscopes, and multimeters—are among the most familiar and essential tools for engineers and technicians. To get a leg up in their career, every aspiring engineer or technician needs to learn the ropes with good, reliable equipment.

In the following case studies, we'll see how Keysight's industry-renowned test and measurement equipment serves that need—especially the Keysight Smart Bench Essentials (SBE) bundle for education, which offers high-quality benchtop essentials in one affordable and powerful package.

Humber College Institute of Technology and Advanced Learning

As one of Canada's largest college, Humber College offers the most electronics programs and enrollment in the country. For the Faculty of Applied Sciences and Technology, there is a need for lots of reliable test and measurement equipment.

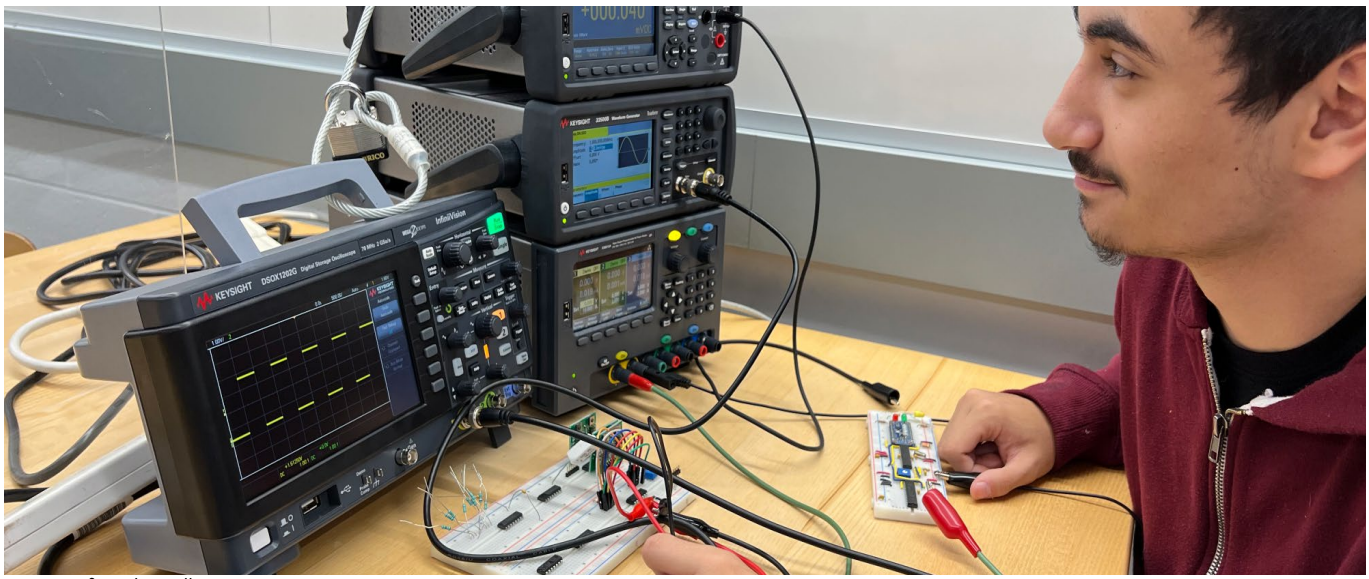
Unfortunately, that lesson was hard-won. A decade ago, the Faculty of Applied Sciences and Technology used low-quality test and measurement equipment in their electronics and electrical labs. It was a decision based on the sticker price, bbut the equipment failed to meet the demands. Worse, it hindered the student learning experience. Knobs would fall off oscilloscopes; function generators wouldn't function. The students ended up paying the price in frustration and wasted time.

Recognizing the need for better lab equipment, Humber College turned to Gap Wireless. They ultimately standardized on Keysight lab equipment, a brand known for high quality and reliable technical support. The school outfitted its benchtops with hundreds of Keysight power supplies, digital multimeters, oscilloscopes, and function generators.

For network analysis, Humber College chose the Keysight FieldFox handheld analyzers—as they are the most trusted in the industry for routine maintenance, in-depth troubleshooting, and anything in between. With frequency coverage up to 54 GHz with precision comparable to benchtop results. Another educational advantage is the ability of the FieldFox to be configured as a cable and antenna analyzer (CAT), vector network analyzer (VNA), spectrum analyzer, or an all-in-one combination analyzer.

Humber also chose Keysight's PathWave Vector Signal Analysis software for evaluating wireless signals.

The switch to Keysight paid off for Humber College. Not only does Keysight have more reliable test and measurement equipment, but Humber is now training its students on industry-standard tools and setting them up for career success. Gap Wireless has provided a great partner for Humber to connect with industry partners that also use Keysight equipment. Working with Gap Wireless has helped Humber to stay in contact with the industry to keep their programs more relevant to students and the current workforce needs.



Courtesy of Humber College

University of Toronto

The University of Toronto is one of the most esteemed universities in Canada, and the Edward S. Rogers Sr. Department of Electrical and Computer Engineering is among the best in the country. When the U of T launched a new second-year engineering course for Hardware Design and Communication, the school knew it needed to find the right lab equipment. Since students would be learning how to design, build, and test a complete electronic system from the ground up, they needed tools that were both reliable and easy to use.

There were four key pieces of equipment that each bench would need: a digital storage oscilloscope, waveform generator, digital multimeter, and power supply. As the faculty was putting together a shopping list, Gap Wireless presented them with a revolutionary design solution for modern test workbenches in teaching labs and aspiring new product development electronic engineers called the Keysight Smart Bench Essentials (SBE) Series. It harnesses the power of four unique test instruments through one powerful graphical interface with integrated data management and analysis. It includes a Keysight InfiniiVision oscilloscope with a 50 MHz bandwidth, a waveform function generator with up to 20 MHz frequency range, a triple-output DC power supply with 90 W of total power, and a digital multimeter with 5.5 digits of resolution. With this new complete portfolio of instruments, plus powerful software. Students and general electronic test engineers will have a truly connected, modern design solution for their lab or test workbenches.

The SBE Series was everything the University of Toronto needed and at a significantly lower price than the four separate test instruments the faculty would otherwise have purchased. Despite being less expensive, the Keysight test equipment provided equivalent or greater functionality than the faculty's initial picks. The Keysight waveform generator, for example, offers two channels, while the original selection offers only one.

The new Hardware Design and Communication program was a smashing success, with U of T students building over 50 printed circuit boards and producing a fully functional digital radio transceiver. Unit and system-level testing was a significant part of the course, and the students benefitted from using modern test equipment with a unified interface to learn the tricks of the trade.

Courtesy of University of Toronto

University of California

The University of California (UC), Davis is near the heart of the tech industry, perfectly placed to serve engineering graduates in some of the most exciting and valuable careers. To ensure its students have the skills they need to thrive in those careers, the University of California, Davis's Electrical Engineering Department has outfitted its laboratory benchtops with the Keysight Smart Bench Essentials Series to replace outdated lab equipment at an affordable price. Deciding factors for the University of California were Gap Wireless's ability to provide equipment training and the SBE Series ability to test, analyze, and share results collaboratively across the room or the world. During the Pandemic, and still to this day, teaching, learning, or working on a design, from a classroom or your home with full access to configure and test using your connected instruments is a huge advantage.

Auburn University, Texas A&M, and Weber State University, Utah

Auburn University, Texas A&M, and Weber State University are three more examples of schools that have revitalized their laboratories with modern Keysight equipment, namely, Smart Bench Essentials Series and basic spectrum analyzers. They all praise the reliability and affordability of Keysight educational equipment and the convenient ability to "rack and stack" the instruments.

Professors at these Universities also praised the accompanying Keysight PathWave BenchVue software for its ability to allow students to control and gather their data easily. Especially for students whose primary language isn't English since the interface can be easily adjusted to several language settings.

Professors also love that when the PathWave test software is paired with the SBE Series, you can configure, control, and monitor multiple bench instruments from a single screen. Automate workflows from test set up to report generation. Lastly, access lab instruments remotely to ensure students get the most out of their lab experience.

Courtesy of University of Toronto

Seneca College

At Seneca College in Canada, the Electronics Engineering Technology and Computer Engineering Technology programs are structured for students to gain the foundation for a career in technology. But to learn about technology effectively, they must use effective technology—which means reliable test and measurement equipment in Seneca's eight electronics laboratories.

The Electronics Engineering Technology program requires students to design and print microstrip directional couplers, which they test with the Keysight Network Analyzer E5070B. In the Computer Engineering Technology program, students are asked to build Internet of Things (IoT) applications with Raspberry Pis and wireless sensors, ensuring they operate correctly through the use of Keysight spectrum analyzers and vector signal analysis software.

The Keysight benchtop equipment provided by Gap Wireless has been a hit with Seneca students, who praise its intuitive interface that allows them to focus on the task at hand rather than wasting time setting up their instruments. The students also appreciate Keysight vector signal analysis software for its automated measurement and documentation.

McMaster University

Canada's McMaster University has a reputation for research excellence, and its engineering faculty aids that reputation by providing its students with top-notch lab equipment from Keysight. For over a decade, Gap Wireless has provided McMaster's electrical, computer, and biomedical engineering programs with Keysight test and measurement equipment. Students have gotten hands-on with Keysight's InfiniiVision 1000 X-Series oscilloscopes, 2000 X-Series oscilloscopes, and Keysight digital multimeters with a 4.5-digit dual display.

The Keysight equipment has been instrumental in teaching McMaster students the foundations of analog and digital electronics, digital signal processing, electromagnetics, transmission lines, power electronics, electric motor drives, and fiber optics. Students have successfully used the instruments in second- and third-year project courses and final-year capstone projects.

McMaster University chose Keysight for the brand's stellar reputation and versatile, intuitive equipment that helps students succeed sooner. And the University chose Gap Wireless for our excellent technical support and valuable connections to Keysight—meaning less downtime and more learning.

Courtesy of Seneca College

University of Waterloo

The University of Waterloo is regarded as one of the finest engineering schools in all of Canada, and its students have gone on to produce some of the country's most notable innovations. That mastery is thanks, in part, to Waterloo's exemplary engineering labs.

Gap Wireless helped the University of Waterloo outfit those labs with Keysight test and measurement equipment, including Keysight InfiniiVision 1000 X-Series entry-level oscilloscopes and Keysight 5.5-digit digital multimeters. As part of the Smart Bench Essentials Series, these instruments offer an intuitive and unified interface in a sleek and affordable package.
The University of Waterloo integrated this equipment into its Systems Design Engineering and Biomedical Engineering programs, where it formed the foundation of several lab courses dedicated to analog and digital electronics and electromechanical prototyping. By learning with industry-standard test and measurement equipment, Waterloo engineering students enjoy a leg up in their careers while honing their engineering skills.

California State University, Chico

One of the oldest campuses in the California State University system, Chico State's College of Engineering, Computer Science, and Construction Management has a long-standing reputation to live up to. That means its undergraduate teaching labs are again equipped with the best core electronics test and measurement instruments available—the Keysight Smart Bench Essentials Series.

Gap Wireless supplied California State University, Chico, with a large quantity of the SBE Series to update its undergraduate electronics labs. The equipment has been a resounding success with students and faculty alike.

Courtesy of University of Waterloo

Fiber Optics Equipment

Fiber optics is playing an increasingly important role in telecommunications systems, and that puts increased pressure on educators looking to train the next generation of Fiber optics engineers and technicians. Fortunately, these educators don't have to sacrifice test and measurement functionality for affordability.

Our array of fiber optics equipment includes optical power meters, all-in-one fusion splicers, and network analyzers from respected brands like VeEX, UCL Swift, and Keysight. In the following case studies, we'll see how educators are successfully using these products in the lab.

Niagara College

The Niagara College of Applied Arts and Technology in Canada is minutes away from one of the world's grandest waterfalls, emulating that downpour in the form of knowledge. Niagara College partnered with Gap Wireless to equip those budding technicians with modern, state-of-the-art equipment to ensure its students in the Photonics Engineering Technology and Technician programs are prepared for the dynamic industries they'll serve.

Niagara College has integrated the Gap Wireless supplied VeEX FX40 Optical Power Meter, VeEX FX40 Optical Light Source, and UCL Swift K4A All-in-One Fusion Splicer into Fiber optics technology courses and beyond. The VeEX FX40 Series offers single and multimode testing, high accuracy and wide dynamic range, a built-in universal 2.5 mm tip sleeve, and software compatibility with all major desktop and mobile platforms. The All-in-One UCL Swift K4A cladding alignment fusion splicer performs five major functions, including stripping, cleaning, cleaving, splicing and protecting, making it a convenient and reliable tool for fusion splicing and fusion splice-on connectors (SOC) of FTTx network applications.

In partnership with Gap Wireless, Niagara College used this fiber optics field equipment in remote classes and a webcast to demonstrate industry best practices in Fiber optic testing and splicing. Ultimately, that's what the school appreciates most about the equipment: it provides students with industry-standard equipment that prepares them for the skills they'll need.

Courtesy of Niagara College Canada

Humber College Institute of Technology and Advanced Learning

The Faculty of Applied Sciences and Technology at the Humber Institute of Technology and Advanced Learning has high expectations of its students. The students have high expectations, too—they need an education that sets them up for career success.

For Humber's Computer Engineering Technology and Technician programs, students can rest easy knowing that their school is equipped with UCL Swift K4A All-in-One Fusion Splicers provided by Gap Wireless. This is the same equipment favoured in the industry for its five-in-one functionality that provides stripping, cleaning, cleaving, splicing and protecting. Learning with this device means that Humber students receive field-like hands-on training, conditioning them for a proliferating industry and ensuring that tomorrow's telecommunications infrastructure is in capable hands.

TelecomTRAIN

An expert in training telecom experts, TelecomTRAIN is a unique hands-on skills training company that empowers engineers and technicians to test and troubleshoot telecommunication systems. To provide effective, realistic training, TelecomTRAIN partnered with Gap Wireless to equip its instructors with a wide range of test and measurement equipment.

Gap Wireless provided TelecomTRAIN with modern equipment, including network and spectrum analyzers such as the Keysight FieldFox, RF and fiber cabling and connectors, UCL Swift K4A All-in-One Fusion Splicers, VeEX Optical Time Domain Reflectometers (OTDRs) and Fiber test equipment, and Wirewerks Fiber optic splice trays. These industry-standard products provide beginner and expert students with hands-on training in the latest telecom test and measurement technology.

Using equipment relied on by industry; students can easily transfer their newfound skills into the field and adapt them to their specific requirements. TelecomTRAIN's equipment has proven successful in a variety of student use cases. For instance, the company incorporated the equipment in a custom one-day training course on the basics of cable and antenna test and measurement for distributed antenna systems.

Courtesy of TelecomTRAIN

Courseware Kits

Educating the next generation of telecommunications engineers and technicians is no easy job—but with world-class training kits from DreamCatcher, that job is a little easier. In the following case studies, we'll see how two universities successfully deployed DreamCatcher programs for RF circuit design and electromagnetic theory.

Sonoma State University

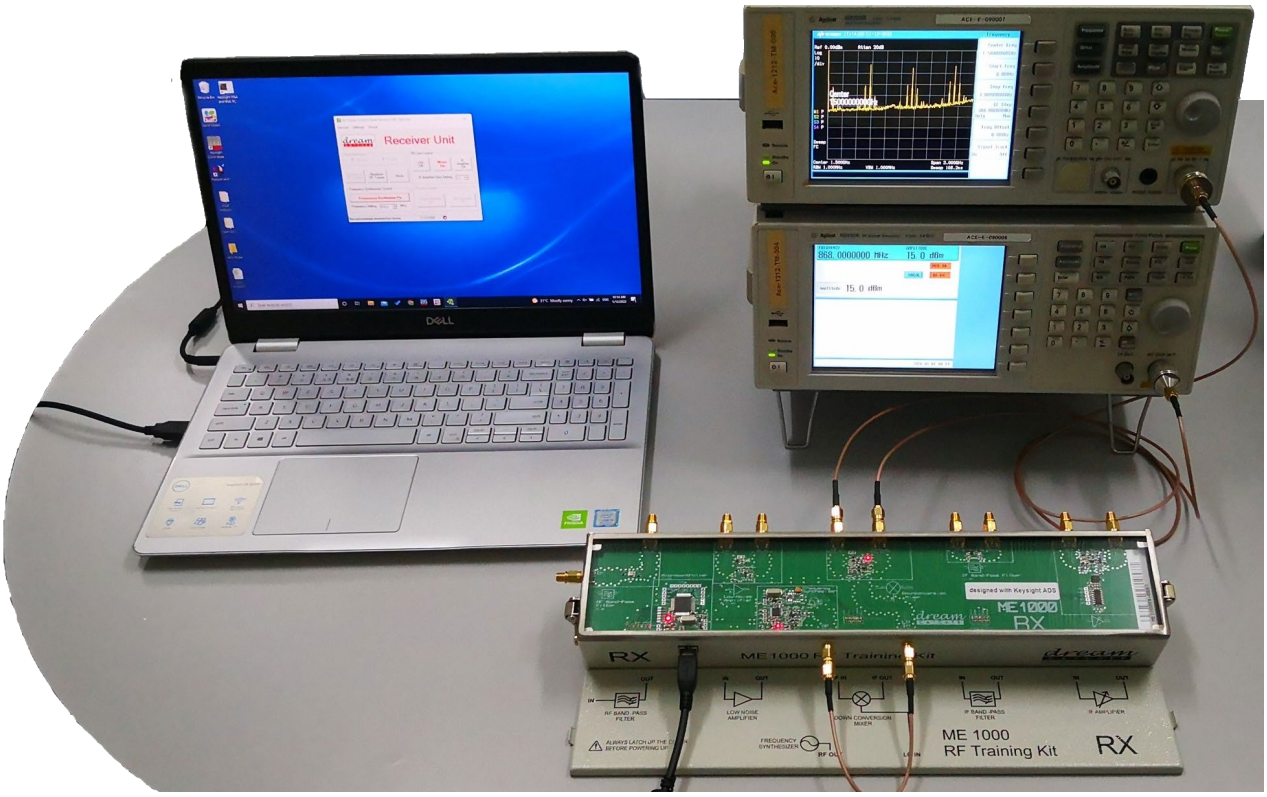
Six years ago, Sonoma State University in Rohnert Park, California, instituted an interesting new lab for the Department of Engineering Science senior students. The "RF Test" lab is a one-semester program that provides students with hands-on learning using DreamCatcher RF Training Kits and Keysight FieldFox handheld RF and microwave analyzers.

Under the guidance of Gap Wireless Senior Account Manager Rob Rowlands, Sonoma State students learned the basics of RF circuit design, simulation, measurement, and much more. DreamCatcher's ME1000 RF Circuit Design training kits are a ready-to-teach lecture resource for wireless communications students, complete with teaching slides, training kits, lab sheets, and problem-based assignments. The lab has been a hit with students who appreciate the opportunity to learn with industry-standard Keysight FieldFox network analyzers. In fact, some graduates of the course have even gone on to be hired by Keysight's Santa Rosa intellectual center.

University of Nevada, Reno

For the University of Nevada, Reno's Department of Electrical and Biomedical Engineering, the microwave lab is a prime spot for learning. That's because UNR students can access top-of-the-line test equipment and training resources from Keysight and DreamCatcher.

The University of Nevada, Reno, has successfully implemented the DreamCatcher ME1000 RF Circuit Design and ME1200 Electromagnetic Theory training kits for its engineering students. These ready-to-teach packages comprise all the resources lecturers need to teach the fundamentals of electromagnetism and RF circuit design and measurement. Complementing these training kits, Keysight FieldFox handheld RF and microwave analyzers allow students to learn the essentials of the industry with tools that have become essential to the industry.



How Gap Wireless Partners With Institutions

Gap Wireless' partnership with institutions goes beyond cutting-edge test equipment from Keysight, UCL Swift, and VeEX. We strive to help institutions fulfil their mission to attract students, develop their skills to meet industry requirements, and connect them with the industry through networking events, webinars, and training seminars. Here are just a select few.

Humber College

One of our first partnerships was with Humber College on a Fiber event. We helped attract 64 companies in the Fiber Industry to the event, drove demand for their graduates, and even a research project for their Applied Research Center from BLiNQ Networks.

Ontario Tech

Other notable partnerships include multiple events on Vehicle-to-Vehicle Communications with Ontario Tech. The automotive companies we brought to the event loved the content, and Ontario Tech researchers established further connections to top-tier automotive companies. In addition, Keysight invited the Dean of Research at Ontario Tech to be a guest speaker at the Keysight Automotive Center of Excellence in Michigan, leading to further networking about Ontario Tech's climatic chamber and test capabilities.

Niagara College

Most recently, we have partnered with Niagara College on Fiber Measurement and Splicing events to increase the visibility of their course offering within the industry. As Niagara College embarks on a new RF/Semiconductor Test program, we've set up several days of visiting our customers in the Ottawa area to establish relationships with the College.

Courtesy of Centennial College

Work Seamlessly & Productively with Modern Test Workbenches

Remote learning technology spending has experienced double-digit percentage growth, year-over-year. The COVID-19 pandemic helped catalyze that growth, as universities and colleges realized the importance of having a remote learning infrastructure to adapt to this new environment.

Transformation is underway. According to a recent survey by Ipsos for the World Economic Forum, 72% of respondents from 29 countries expect a hybrid model of higher education, with both in-person and online learning, by 2025. Even in electronics teaching labs, a real need exists for technology that requires students and educators to test, analyze, and share results collaboratively.

The Keysight Solution

Keysight's new Smart Bench Essential Series teaching lab equipment is affordable and modern. It works seamlessly with Keysight PathWave software, allowing you to test, analyze, and share results collaboratively, across the room or around the world.

The differentiated Keysight Lab Manager software allows you to configure your lab with the click of a button and manage all your lab assets effortlessly. With remote learning becoming the new normal, Keysight Remote Access Lab software allows you to access your lab equipment, even from home.

access to technical experts from Keysight and 24/7 knowledge center to help you get up to speed in the shortest time.

Keysight Smart Bench Essential Series

Many test equipment vendors do not have a complete portfolio of products for their teaching lab solutions. They mix and match models with an inconsistent look and feel, graphical user interface, and connectivity. Keysight Smart Bench Essential Series is a modern design solution for test workbenches in teaching labs, as well as for aspiring new product development electronics engineers. When testing your device, you need a complete portfolio of test instruments to perform specific functions:

- The power supply should provide the exact DC biasing power to your device under test (DUT). Otherwise, it will not operate properly.
- The function generator should provide the various test input signals for your DUT to respond. The output signals from your DUT are the responses to your stimulated test input signals.
- The oscilloscope measures the dynamic responses of your DUT output signals. The digital multimeter measures various parametric responses from the DUT, directly or indirectly. Those responses include DC voltage or current consumed by the DUT and temperature changes of the DUT.

Learn more about the Keysight SBE Series by contacting Gap Wireless quotes@gapwireless.com

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Gap Wireless is a leading distributor of products and services for the mobile broadband and wireless markets, serving carriers and contractors throughout North America.

The company works with industry-recognized vendors to stock and distribute thousands of wireless infrastructure and Test & Measurement products and offers a suite of hardware and value-added services. Gap Wireless headquarters is in Mississauga, Ontario. Other Canadian locations include Calgary and Montreal.

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