

Tektronix Signal Generators Offer Sophistication Without Complication to Mississippi State University Students



Solution Summary

Challenge	Enable electrical engineering students to learn the intricacies of modern circuitry – through the construction and testing of an AM/FM radio receiver – with minimal direct supervision.
Solution	Tektronix AFG3102 Arbitrary/Function Generators, featuring two channels and the ability to generate up to 100 MHz sine waveforms and arbitrary waveforms at 2 GS/s.
Benefits	The AFG3102 delivers advanced performance and signal generation capabilities, including 12 standard waveforms and arbitrary waveforms up to 128 K in length, and ease-of-use.

The Department of Electrical and Computer Engineering is the largest and one of the oldest academic units within the Bagley College of Engineering at Mississippi State University (MSU). Housed in the 95,000 square foot Simrall Building, the department includes several hundred undergraduate and graduate students, approximately thirty faculty members and a newly refurbished lab with state-of-the-art test equipment.

Department leaders recently established three new electrical engineering courses, which are designed to better integrate the theory and application of electrical circuits and electronics. The progressive and interwoven curriculum offers two of the first formal laboratory experiences MSU's electrical engineering students encounter within the department.

“In developing the new curriculum and modernizing the lab, we wanted to give students as much real-world experience as possible without overwhelming them,” said Dr. Marion Hagler, a former professor at MSU and current advisor to the university's Department of Electrical and Computer Engineering.

Whereas the first course of the series has students building simple circuits as homework, the second course has them developing and analyzing more advanced systems. In fact, MSU engineering students enrolled in the second course work with a component kit to build their own AM/FM radio receiver in a laboratory environment.

To facilitate this curriculum, the university implemented advanced instrumentation within the revamped first formal lab that enables students to test, measure, characterize and troubleshoot their receivers.

“We needed test equipment that operated at higher frequencies, offered flexible modulation capabilities and settings and was easy to understand and use,” Dr. Hagler noted. “After considering a number of alternatives, Tektronix signal generators were clearly the best solutions for our requirements.”

“No other signal source instrument offers a perfect blend of capability and ease-of-use like the Tektronix AFG3102.”

-Dr. Marion Hagler, Mississippi State University

AFG3102 Delivers 100 MHz Performance

MSU is now utilizing several Tektronix AFG3102 Arbitrary/Function Generators in its refurbished first formal lab. With two channels and the ability to generate up to 100 MHz sine waveforms and arbitrary waveforms at 2 GS/s, the AFG3102 delivers performance comparable to what MSU students will encounter when they embark upon careers in the engineering industry.

“These are advanced instruments for young undergraduates,” Dr. Hagler commented. “But they allow our students to build and work with an actual product while helping our faculty better align the classroom and lab portions of the curriculum.”

The AFG3102’s operating specifications and depth of signal generation capabilities enable MSU students to create a stimulus and characterize their receivers, align and tune the receivers for proper operation and test the entire system through analysis and simulations. According to Dr. Hagler, the instrument’s dual channel support and exceptional frequency range are necessary for conducting high-frequency and advanced measurements.

“Anyone can build a radio, but the AFG3102 enables us to go much further in our instruction and allows our students to go much further in their understanding of electrical circuitry,” he said. “Our students are making sophisticated bandwidth and modulation measurements, solving problems, conducting theoretical analysis and performing numerical simulations, all with the AFG3102, a Tektronix oscilloscope, and their personal laptops.”

Using the AFG3102, MSU students can choose from 12 different standard waveforms. Arbitrary waveforms can be generated up to 128 K in length at high sampling rates. On pulse waveforms, leading and trailing edge time can be set

independently. External signals can be connected and added to the output signal. And since the AFG3102 offers dual channels, it can generate two identical or completely different signals.

Sophistication without Complication

The AFG3102’s unique combination of advanced signal generation capabilities and ease-of-use has been a key benefit to MSU’s Department of Electrical and Computer Engineering, Dr. Hagler notes. Students now spend more time on their lab work – analyzing and troubleshooting their AM/FM radio receivers – than they do learning how to operate and understand the test instrumentation. Furthermore, most of the testing and analysis is conducted away from professors and teaching assistants.

“We believe most learning occurs beyond the classroom. Therefore, we purposely reduced the direct supervision of our students to develop a more real-world environment,” explained Dr. Hagler. “The lab is open 24 hours a day, 7 days a week. Students conduct their work on their own time and use official lab time primarily to verify their work.”

Dr. Hagler believes the accessibility and usability of the AFG3102 have been key factors in enabling this level of independent learning and problem solving. “No other signal source instrument offers a perfect blend of capability and ease-of-use like the Tektronix AFG3102,” he said.

The instruments have also proven valuable beyond the lab. A USB port on the AFG3102 enables MSU engineering students to easily save and transfer waveforms and settings from and to their laptops. The waveforms are often inserted into reports and other homework assignments, and the saved settings are useful for replicating previously generated waveforms.

“Student evaluations have been very, very positive,” Dr. Hagler concludes. “They enjoy the lab experience and they like building and testing their own radios. Neither would have been possible without the AFG3102.”