

# CASE STUDY

United States of America

Telecom/Audio

**Shure Incorporated**  
**Audio Electronics – R&D, Production Testing**

SoundCheck™, Microphones, Calibrators

*Sidney N. Shure founded the company in 1925 as a radio parts distributor. Shure began production of microphones in 1932 and has expanded to its status today as a global leader in audio electronics. Shure has a number of manufacturing plants in the USA and Mexico, with sales offices and distribution operations throughout the world. Creative and innovative product development has resulted in a wide product range, and Shure is dominant in its core markets.*

*From its humble start nearly 80 years ago, to the present day, there has always been a high focus on research and testing. Shure's relationship with Brüel & Kjær goes back more than 25 years. A wide range of Brüel & Kjær products are used including microphones, calibrators, and telecom/audio testing equipment. Twelve SoundCheck™ Electroacoustic Test Systems are used in the R&D laboratory and for production line testing.*

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*Photo by kind permission of Shure Incorporated*

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## 80 Years of Technological Innovation

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**SHURE**®

was founded by Sidney N. Shure in 1925. Originally a distributor of parts for home-built radios, when factory-made radios took over the market, Shure changed direction and began manufacturing microphones. From the very beginning, research and rigorous testing were high priorities.

Shure's first product was the innovative two-button carbon microphone, introduced in 1932. This was followed a year later by the company's first condenser microphone. The Unidyne, often referred to as "the Elvis mic" introduced in 1939, was Shure's first major success. Over the years this microphone was adopted by many famous people including Franklin D. Roosevelt, John F. Kennedy and, of course, Elvis himself.

During World War II, Shure supplied the US armed forces with microphones, including the T-30 throat microphone. In 1958, the company introduced the M3D Phonograph Cartridge, the world's first stereo cartridge that brought hi-fi sound into private homes.

In April 2003, Shure moved its headquarters to a large and impressive facility at Niles, Illinois, some 15 miles north-west of downtown Chicago. In addition to this facility, in 2004, Shure completed its new Technical Annex. This is a 55000 sq.ft. two storey building which primarily houses the company's technical lab functions. Shure is globally accredited to ISO 9000.

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## Wide Product Range

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Innovative design has continued to be a Shure hallmark. The company manufactures a wide range of state-of-the-art products and it is globally dominant in its core audio electronics markets.

**Fig. 1**  
Shure is renowned for its range of state-of-the-art microphones for use in recording studios. This picture illustrates three microphones from Shure's KSM range of condenser microphones  
Photo by kind permission of Shure Incorporated



### Microphones

With a long and illustrious history, Shure microphones are the benchmark for stage and studio sound. The range includes the world-renowned SM57 and SM58, through the highly acclaimed Beta Series, to Shure's superb KSM studio microphones.

### Wireless Systems

More than 10 years ago, Shure introduced wireless microphone systems. These products are used in schools, churches, concert halls and stadia where presenters and performers benefit from the freedom and flexibility that wireless systems provide.

Also groundbreaking were the PSM wireless in-ear monitors, which provide high-quality monitoring while also protecting hearing.

### Mixers and Audio Processors

Moving forward from its classic range of portable mixers and preamps, today's mixers and audio processors use digital technology. The latest products provide user control of high-end DSP functionality – from automated mixing and feedback control, to broadcast field production.

### Personal Monitors

Today's musicians realise how consistent and accurate their performances are when they can hear themselves better on-stage. Hardwired or wireless, Shure's PSM Personal Monitor Systems conserve hearing, provide portable and personal control, and excellent sound quality.

## Phonograph Cartridges

Shure began manufacturing phonograph cartridges in 1937. Today, all Shure cartridges employ its patented low-mass, high-output moving magnet structure. With their high tracking ability, Shure cartridges are very gentle on irreplaceable vinyl records, using polished, natural diamond-tipped styli for precise, musical signal tracing.

## QuietSpot™ Headset

**Fig. 2**  
Inside and outside views of Shure's state-of-the-art QuietSpot™ headset

Photo by kind permission of Shure Incorporated



Shure's QuietSpot™ hands-free cellular-phone headset provides superb sound quality. The NoiseBlocker earphone fits snugly and securely inside the ear and reduces background noise by 80% – roughly the difference between a busy city street corner and a quiet office. The headset utilises a directional noise-cancelling microphone. It is designed specifically to pick up the sound of the user's voice while rejecting 70% of extraneous noise.

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## Technical GRAMMY® Award – 2003

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Shure has long been a supporter of the National Academy of Recording Arts and Sciences in its mission to honour and support the music industry. Shure was awarded the academy's 2003 Technical GRAMMY®. This honour is bestowed on individuals or companies that have made outstanding contributions of technical significance to the recording industry – an industry that Shure proudly serves.

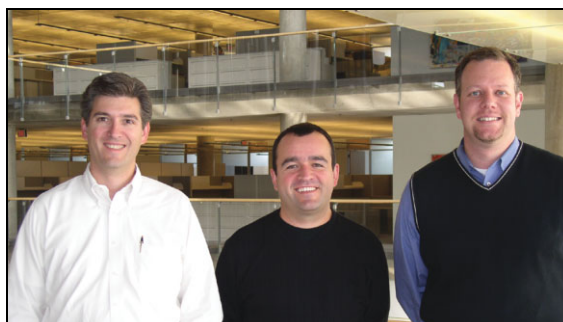
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## Experience and Expertise

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**Fig. 3**  
From left to right:  
Chris Lyons  
Rick Santiago  
Scott Grinker

Photo by kind permission of Shure Incorporated



Shure's Niles headquarters has a mid-size staff. It is the location of the company's marketing, finance, administration and project teams. The new Technical Annex houses Shure's R&D functions, microphone development, ECM chamber, quality, tool rooms and service.

Production of Shure products is carried out at plants in the US and Mexico.

Scott Grinker is Project Engineer, Electroacoustics, Personal Communications. He has a B.Sc in Acoustical Engineering from Purdue University and is completing his M.Eng degree in the same discipline with Pennsylvania State University. He also has an MBA. Scott has worked at Shure for over two years. Prior to this he worked for seven years in NVH (noise vibration harshness) testing in the automotive industry. Scott says, “I am involved in the measurement and analysis of our products from design and development, through to production testing and quality control. I also assist in developing the manufacturing processes and specifying the test procedures for production line testing. We continually make substantial investments and always aim to use the latest technologies”.

Rick Santiago is Shure’s Director of Engineering, Personal Communications. He has worked at Shure for 13 years. Rick has a B.Sc. in Electrical Engineering from Marquette University and an M.Sc., also from Marquette University, in Digital Signal Processing. Rick explains, “I work on the road maps and strategies for engineering Shure’s personal communications products”.

Chris Lyons majored in marketing at North Central College, Chicago and has worked at Shure for 18 years. Chris says, “I have always worked in marketing and am Shure’s Portfolio Planning Manager for Personal Audio. We are all passionate about sound, and about audio products – it’s a super environment to work in, to work for a company with such a reputation as we have, and we attract some of the best talents”.

Chris adds, “Although we manufacture microphones, of course we don’t compete with Brüel & Kjær as our products are entirely different. As the world leader in audio electronics, it is natural for us to work with the world leader in sound and vibration measurement. Using their equipment adds legitimacy and gives us complete confidence in the accuracy of our testing. We frequently recommend Brüel & Kjær as the industry benchmark to third parties. In fact, we don’t consider them as a supplier but as a partner”.

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## R&D

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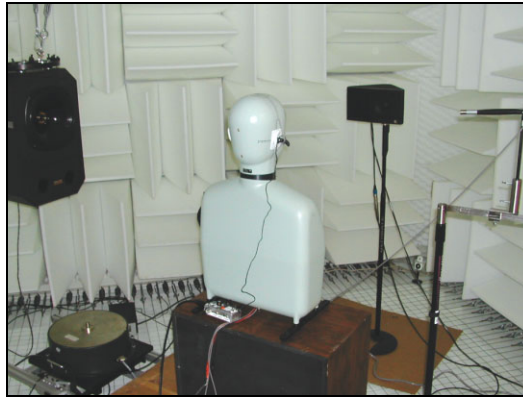
**Fig. 4**  
Left: AU1000  
Automotive Noise  
Compensation  
Microphone – ideal  
for automotive  
noise sensing  
Right: HF2000  
Hands-free Cellular  
Microphone  
Photos by kind  
permission of Shure  
Incorporated



Shure’s R&D facilities are impressive. Currently, there are two full anechoic rooms, with space for a third. The cut-off frequency of each is 90 Hz, due to some advanced engineering. Rick explains, “There is a railroad close by which required special architectural design of the engineering annex to reduce the noise and vibration to the low levels we need in the lab”.

There are quality labs, and a special 3 metre EMC lab with copper-lined walls. Additionally, there are two ‘critical listening’ rooms for jury testing. An auditorium for demonstration of products is being constructed.

**Fig. 5**  
*Inside the R&D lab’s anechoic room, Brüel & Kjær Head and Torso Simulator Type 4128 C evaluates the performance of microphones under various conditions  
Photo by kind permission of Shure Incorporated*



Chris continues, “There is a strong focus on new product development. We are driven by our markets and our customers, by our own innovative ideas and, to some extent by legislation, for example, F.C.C regulations. Most of our R&D work is with Shure’s standard range but we also make special products, for example, for use in the communications industry”.

“With consumer products the end user has strong and clear ideas of the expected performance from a product and our goal is to transform these expectations

into products that satisfy our customers – and quality gives us our competitive edge – it is the key product differentiator. The Shure brand is the premium, in all our markets.”

Shure currently has twelve SoundCheck™ Electroacoustic Test Systems. Three systems are used for new product development in R&D at the Niles HQ facility. Typical measured parameters include frequency response, sensitivity, self noise, dynamic range, etc. The tests are made using a variety of sound sources including pink noise, swept sine and stepped sine wave. Benchmark testing is also made on the products marketed by Shure’s competitors.

Scott says, “We have a Brüel & Kjær HATS (Head and Torso Simulator Type 4128 C). This is used inside the R&D lab’s anechoic and reverberant rooms. The HATS evaluates the performance of microphones under simulated real operating conditions. The loudspeakers are used to play back previously recorded noise, such as car and street noise, to analyse the sensitivity and directivity of the microphone being tested. Several Brüel & Kjær measurement microphones are used to determine the reference levels and the noise field. The HATS test setup was a major key in developing our QuietSpot™ hands-free cellular-phone headset”.

**Fig. 6**  
*Inside a small anechoic chamber in the R&D lab, a Brüel & Kjær Mouth Simulator Type 4227 is connected to SoundCheck™, via an amplifier. This setup is used to test the response of the microphone  
Photo by kind permission of Shure Incorporated*



He continues, “In fact, we use Brüel & Kjær equipment for almost all our acoustic measurement and analysis. Our relationship goes back more than 25 years. For example, inside a small anechoic chamber in the R&D lab, we use a Brüel & Kjær Mouth Simulator Type 4227. This is connected to SoundCheck™ via an amplifier. This setup is used to test the response of the microphone. Brüel & Kjær’s Artificial Ear Type 4152 can be used in a similar way to measure the acoustic parameters of the earpiece. We also use Brüel & Kjær Microphones Types 4190 and 4192 for free-field and pressure-field calibration. The microphones are themselves calibrated using Sound Level Calibrator Type 4231”.

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## Production Line Testing

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**Fig. 7**  
Shure's KSM  
Cardioid  
microphones are  
specially designed  
to record sounds  
from musical  
instruments – from  
acoustic guitars  
and cymbals to a  
full orchestra  
Photo by kind permission  
of Shure Incorporated



Rick explains, “Shure has often supplied products to the military. During World War II, the company not only learned about new materials and new technologies, but it brought about new quality testing procedures. In these circumstances, a faulty product could make the difference between life and death”.

“Today, we 100% test the critical factors on all our products at the end of the production line. We also 100% test all critical purchased components to ensure conformity to the laid down specifications. Production testing enables us to live up to Shure’s reputation for ultimate quality and reliability”.

Six SoundCheck™ Electroacoustic Test Systems are used in production line testing at Shure’s manufacturing sites. Typical production tests check the frequency response and sensitivity. The SoundCheck™ user interface provides a clear PASS/FAIL indication, thus speeding the process for operators and providing better error proofing in quality control. The user interface also displays the tested parameters and upper and lower limits in graphical format. All SoundCheck™ production line test data is stored on a central database for future analysis. The data can be exported to Excel to compile printed reports.

Brüel & Kjær’s Mouth Simulator Type 4227, connected to SoundCheck™ via an amplifier, is also used for production line testing.

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## SoundCheck™

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Shure uses the SoundCheck™ Electroacoustic Test System in R&D, for bench testing and for production line testing.

Rick explains, “Production testing enables us to live up to Shure’s reputation for ultimate quality. It’s a great benefit to use the same test platform for all three types of testing and we can correlate test data and results at all stages of advanced development, product design, and production. It’s easy and intuitive to use but flexible enough to do everything we want”.

“The key with SoundCheck™ was to build a library of customised sequences which precisely fitted our needs. We can easily modify and adapt for new models and testing demands. Our relationship with Steve Temme at Listen Inc. is outstanding and we get tremendous support from Steve and his team.”

SoundCheck™ was developed, exactly for this type of application, in the US by Listen Inc., formed by Steve Temme. Steve has been associated with Brüel & Kjær for many years, and has developed this versatile, software-based system for the production line testing of electroacoustic devices. SoundCheck™ runs under Windows® and comprises a series of ‘Virtual Instruments’.

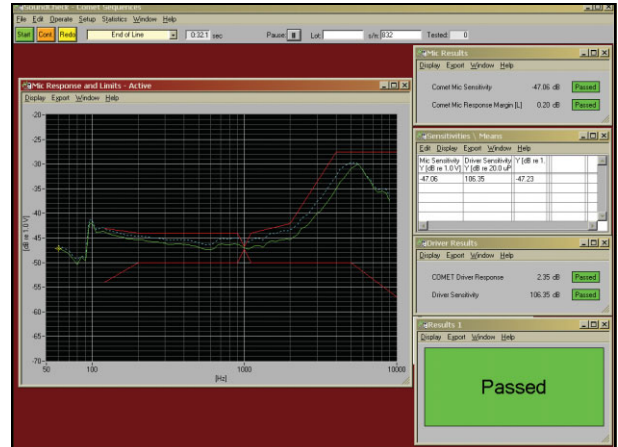
This means that no special hardware is required as the system operates using a standard professional sound card and a PC equipped with a Pentium® processor. SoundCheck™

performs very rapid frequency and phase response, impedance and distortion tests, typically in less than five seconds.

**Fig. 8**  
Typical SoundCheck™ user interface showing simple pass/fail indication and graphs showing the parameters of the item under test. The data is saved to a database for analysis and future reference

### Customisation

SoundCheck™ is easily programmed and is delivered with a range of options that automate testing. The operation sequences required by each customer, for example, user prompts, conditional branching, and non-keyboard commands, are easily accomplished using the Sequence Editor Module. All the accessories necessary for on-line production control, such as foot-switches, buzzers and bar-code readers, are supported and can be easily installed.



SoundCheck™ was widely used in the development of the QuietSpot™ headset.

## Benefits

Rick says, “SoundCheck™ has provided us with a superb measurement system. The correlation between our lab facility in Niles and our production lines in Mexico has helped tremendously in tracking down production issues quickly before product launch. SoundCheck™ is changing and improving our complete range of testing systems and procedures”.

Scott concludes, “It gives us and our customers confidence that all our R&D and production test systems are from Brüel & Kjær as they have the finest reputation”.

## Key Facts

- Sidney N. Shure founded the company in 1925
- From the very beginning, research and rigorous testing were high priorities
- In April 2003, Shure moved its headquarters to a new facility at Niles, Illinois. In 2004, its new Technical Annex was completed
- Shure is globally accredited to ISO 9000
- “We use Brüel & Kjær equipment for almost all our acoustic measurement and analysis. Our relationship goes back more than 25 years”
- Shure currently has twelve SoundCheck™ Electroacoustic Test Systems
- “We 100% test the critical factors on all our products at the end of the production line”
- “Production testing enables us to live up to Shure’s reputation for ultimate quality”
- “It gives us and our customers confidence that all our R&D and production test systems are from Brüel & Kjær as they have the finest reputation”
- “It’s a great benefit to use the same test platform for all types of testing and we can correlate test data and results at all stages of advanced development, product design, and production. It’s easy and intuitive to use but flexible enough to do everything we want”