

## Product Of The Month

By Michael S. Eddy

### City Theatrical SHoW DMX

Some of the SHoW DMX products including (left to right) the SHoW DMX Transmitter, Dimmer, and Receiver.



SHoW DMX™ from City Theatrical (CTI) is the newest generation of frequency-hopping spread spectrum (FHSS) wireless DMX, incorporating many features to make life easier. The 2.4GHz unlicensed area of the spectrum has become crowded, and many shows now have numerous systems operating show-critical data in the same area. The lighting, sound, and automation departments may all have wireless signals that simply must get through for the show to operate properly. To exist in the professional entertainment world, wireless DMX systems require verifiable high data fidelity, but they also must prevent any other show-critical wireless data from being disrupted. City Theatrical designed SHoW DMX specifically to address these two needs. The system has already started to rack up accolades, winning a Best Debuting Product of the Year in the lighting category at LDI 2007 and a 2007-2008 *Live Design* Lighting Product of the Year Award.

#### What It Does

“The first feature that is the heart of the product is synchronized hopping,” explains Gary Fails, president of City Theatrical. “In fact, the name of the product is an acronym for Synchronized Hopping of Wireless DMX. Most other wireless DMX radios hop randomly—relative to the DMX packet—breaking each DMX packet into pieces and stitching them back together in the receiver. Individual data bits and even entire packets are frequently dropped and lost, causing older data to be substituted for the lost data. In some situations, such as incandescent loads or static levels, this isn’t a problem, but in demanding cases, such as moving lights or LEDs, data loss can be quite obvious.”

The breakthrough of synchronized hopping is that, by timing the radio hops with the DMX packet, only full packets are transmitted, and the likelihood of achieving perfect data is increased. “Our radio is so fast that it’s able to broadcast two copies of each DMX packet on different radio channels, thereby doubling the likelihood of good data getting through,” says Larry Dunn, CTI’s head of engineering. “Our testing, both in the laboratory conducted by a nationally recognized testing lab, and outdoors under real-world conditions, confirmed SHoW DMX’s ability to broadcast perfect data. In other words, the data that was broadcast by radio was exactly the same as the data that

was transmitted by cable, with the exception of a small amount of latency created by the broadcast electronics. As with all radio systems, fidelity decreases when interference and broadcast range increases, but since SHoW DMX begins at a level of data fidelity higher than other systems, it is more likely to maintain higher data fidelity in the presence of interference.”

Early in the SHoW DMX development process, City Theatrical realized that the science of DMX transmission by radio was inexact and subjective, with no standards or methods of collecting hard data to understand fidelity. Dunn and senior engineer Paul Kleissler invented a wireless DMX tester that sends a predictable set of data—both wireless and wired—and then compares the two in a variety of ways. “This, alone, is a large advance in the science of wireless DMX and has helped raise the awareness of data fidelity in a scientific rather than a subjective way,” says Dunn.

SHoW DMX also incorporates features to allow it to “play well with others.” Although right out of the box SHoW DMX is completely plug-and-play, by utilizing its two-line display and five-button keypad, users have access to a range of features, including adjustable output power, selectable from 5mW to 125mW (FCC) or 5mW to 100mW (CE-ETSI), and adjustable hopping patterns, including full bandwidth hopping and hopping limited to one of three sub-bands, each occupying about 40% of the entire 2.4GHz band. Another feature is limited burst mode, allowing broadcast of only the number of DMX slots that are needed. Any number of slots in multiples of 32 can be broadcast. The fewer slots that are broadcast, the less interference is caused on other wireless systems in the area. This gives SHoW DMX high data fidelity with a minimally obtrusive radio footprint.

“SHoW DMX is also one of the first fully functional RDM control and proxy applications in the lighting industry and the first known wireless implementation of RDM anywhere,” says Fails. Through an embedded web server in the transmitter, accessed through a computer—although some RDM functions are accessible directly through the user interface on the transmitter—users have access to a wide variety of RDM functions in the SHoW DMX equipment or even in any other RDM gear downstream of the receivers. RDM functions built into the system include RDM discovery, the ability to change transmitter output power,

remote DMX addressing, and monitoring of receiver signal strength at each receiver in the system. SHoW DMX three-channel 10A 12-24V dimmers can also have DMX address changed via RDM, and the voltage of batteries connected to them can be measured via RDM.

CTI has conducted a 16-universe SHoW DMX test with acceptable data fidelity—less than 20% packet loss—outdoors under real-world conditions. “Utilizing our wireless DMX tester, we were able to prove perfect data transmission outdoors at a range of over 730’, and longer range tests are upcoming,” says Fails.

SHoW DMX is also a fully functional Art-Net application. ACN will be implemented as soon as the standard is finalized.

### How It Came To Be

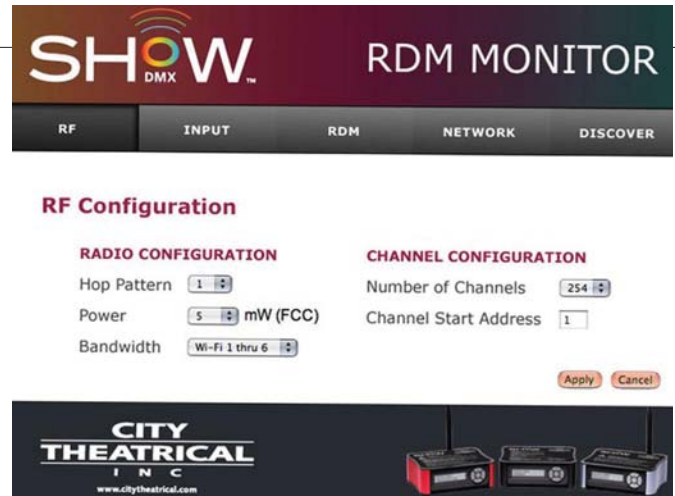
Dunn and Kleissler have a strong background with wireless systems. Prior to coming to City Theatrical, Kleissler co-developed the Logical Lighting Interface, a wireless dimming system that was the *de facto* standard for Broadway use. In 2002, Dunn and Kleissler were co-inventors of City Theatrical’s WDS Wireless Data System™, which CTI has supplied to nearly every Broadway show, tour, and many Las Vegas and West End productions.

In the early days of wireless DMX, the name of the game was power and the ability to cut through any interference on site. With the fast growth of the 802.11b protocol, other show-critical wireless applications appeared on productions. The stronger frequency-hopping wireless DMX systems tended to obliterate the weaker WiFi signals. CTI began crafting custom firmware solutions for Broadway shows to reduce interference with WiFi and to limit the output power. It soon became clear that the future of wireless DMX in live entertainment would involve working closely with a growing amount of WiFi gear on shows. From their years of working on the largest professional shows, Dunn and Kleissler started to envision a system that would have improved data fidelity and still be able to peacefully coexist with WiFi. They began the early stages of design for the system that would eventually become SHoW DMX.

“Whereas the WDS system used a purchased radio reconfigured for DMX broadcast, for SHoW DMX, Larry and Paul designed and developed a purpose-built radio optimized for DMX,” comments Fails. “This not only required a completely new radio design and submittal for FCC approval, but we also implemented automated, lead-free, surface-mount printed circuit-board assembly to enable complete process and cost control over the manufacturing process. Besides having designed the entire system, we manufacture all parts, including all metalwork and circuit boards.”

### What’s Next

CTI’s relationships on Broadway, in Las Vegas, and on London’s West End, as well as the unique product development and manufacturing relationship the company has with Philips Solid-State Lighting Solutions (formerly Color Kinetics) has fueled the popularity of SHoW DMX. “We will shortly receive full FCC certification for a range of antennas to enable users to achieve long distance performance,” says Fails. “Our full access to the Color Kinetics patent portfolio also allows



The RDM monitor for SHoW DMX.

our engineers to create customized wireless Color Kinetics products. We also look forward to growing a range of OEM partners who choose to have SHoW DMX implemented in their DMX equipment.”

### What End Users Have To Say

Production electrician Tom Blancato used the SHoW DMX system at Yankee Stadium for the Pope’s recent mass. Working with lighting designer Alan Adelman, Blancato used the wireless system to get to the upper deck “because there was no way to run cable there,” he says. “I had absolutely no issues with it whatsoever. I turned it on, and it worked, and I never thought about it again until we had to pack it up. There was wireless audio, wireless video, Secret Service was there, and there are other permanent wireless systems in the stadium.”

David Empey, system sales with Barbizon Phoenix, and Mike Riordan, manager of system sales, have tested SHoW DMX thoroughly. They drove around Barbizon’s industrial complex and tested the system’s different settings. “We passed the signal through 12 brick walls with steel reinforcement and two WiFi networks, all without reading the manual,” says Empey. “Initially, we only got a couple of hundred feet before it cut out. Then I opened the manual and saw how to boost it to a higher signal, and then it was great. We had no issues with all of the walls and WiFi networks. It was awesome.”

Based on that experience, Riordan and Empey specified SHoW DMX on a job “where a church called us at the last moment and needed to do a whole lot of wall wash units quickly,” says Empey. “It was going to cost a lot for the electrical contractor to come in and do it. This was the first wireless product that we have found that we trusted in a permanent installation.”

Empey particularly likes its ease of use out of the box. “You really do unpack it, plug it in, and it works,” he says. For improvements, Empey has requested CTI add some basic presets. “I want nine presets that are easy to activate and just be able to say, ‘This is my environment,’ or ‘Oh, that one isn’t working, so now I am going to push button two,’” he says. “Right now, in a crazy radio environment, you have to tune three or four different things. I would rather just push one button. But we really feel that we can specify the SHoW DMX system in a show-critical situation and have confidence it will work.”

For further information, visit [www.citytheatrical.com](http://www.citytheatrical.com). LD