# CHARLIE AND THE CHOCOLATE FACTORY

# SHoW DMX NEO®

*Charlie And The Chocolate Factory* Uses City Theatrical's Wireless DMX

**Lighting Credits for** *Charlie And The Chocolate Factory*:

**Lighting Designer:** Paul Pyant
**Associate Lighting Designer:** David Howe
**Assistant Lighting Designer:** Derek Anderson
**Programmer:** Jim Beagley
**Senior Production Electrician:** Gerry Amies
**Production Electricians:** Martin Chisnall, Chris Dunford, Sam Floyd, James Leatherby
**Theatre Chief Electrician:** Steve McAndrew
**Lighting equipment supplied by:** White Light
**Specialized Lighting Contractor:** Howard Eaton Lighting

The new musical *Charlie and the Chocolate Factory* at the Theatre Royal, Drury Lane, has been the most eagerly anticipated opening in London's West End this year. With direction by Sam Mendes, set and costume design by Mark Thompson, and Lighting Design by Paul Pyant, it is this summer's golden ticket. Watch the official trailer here.


*Photograph: Helen Maybanks*

City Theatrical worked closely with UK specialist lighting contractor Howard Eaton to realize the demanding wireless DMX requirements. As well as using SHoW DMX Neo® Transceivers and Receivers, the production marked the first use of the new D2 and D4 Dimmers.

Martin Chisnall, as well as being one of the show's production electricians, took on the role of wireless DMX consultant, and was brought on board by Howard Eaton Lighting to oversee the design and installation of the SHoW DMX Neo wireless DMX system. Because of previous bad experiences with wireless DMX, the theatre had gained a reputation as a hostile environment in which to use radio DMX.

Because of this, Martin's work began even before the theatre's previous show *Shrek* had closed. He conducted a 2.4GHz WiSpy survey onstage to discover what other competing wireless networks existed, and if there were any particular causes for concern. The survey results revealed

over 25 competing Wi-Fi networks.
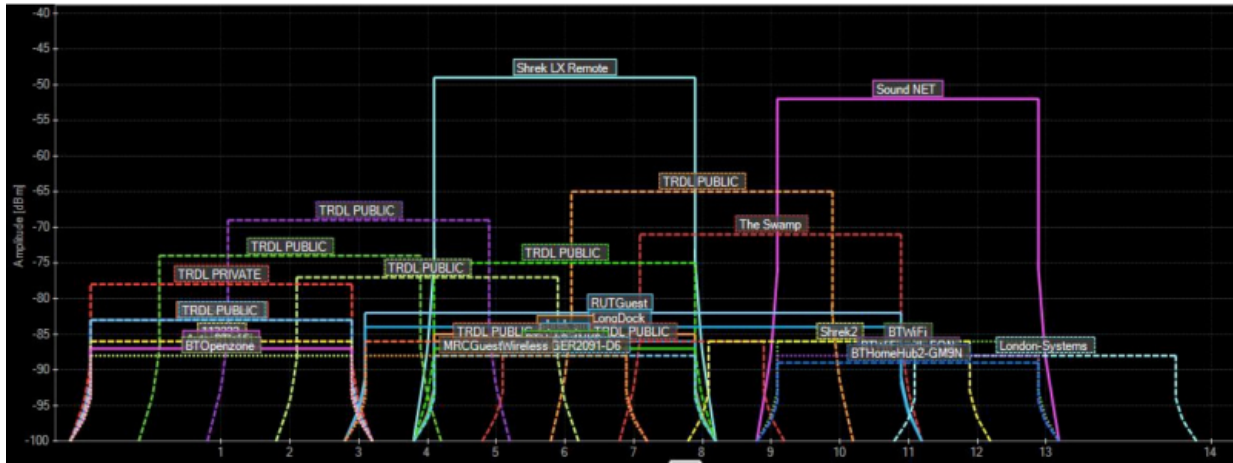


*Site Survey: 2.4GHz Wi-Fi Broadcasting SSID's*
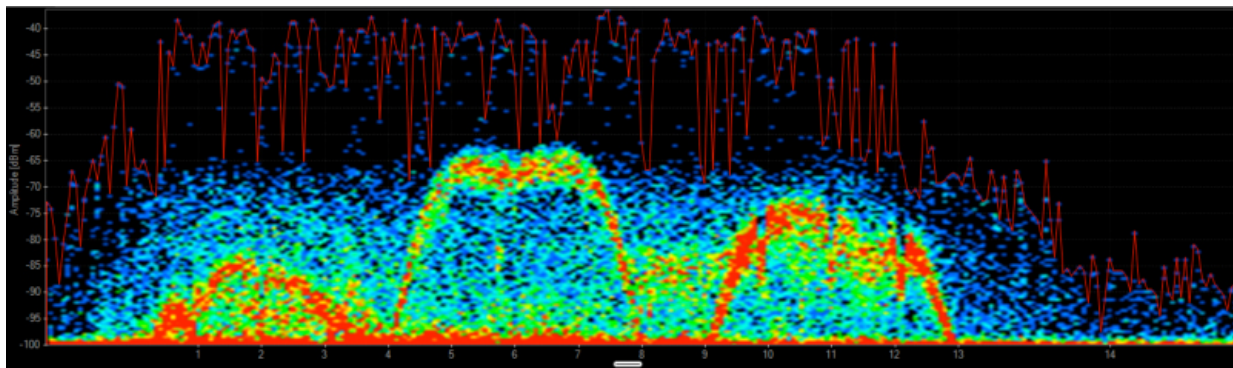


*Site Survey: RF Energy Levels*

By far the two strongest networks were '*Shrek* LX Remote', a Wi-Fi network for the incumbent show's lighting console remote, and 'Sound NET', a personal network installed by the sound department for private web surfing. Other frivolous uses of the spectrum were noted. 'The Swamp' transpired to be a wireless network connecting the stage manager's computer to his printer, both adjacent to each other on the same desk!

Because of the noisy wireless environment Radio Frequency Management was implemented, limiting the use of personal, non-show critical wireless networks, and gathering information on other departments' show critical wireless needs.

Although SHoW DMX is not a Wi-Fi system, and does not use Wi-Fi to transmit the DMX signal, it does operate in the same frequencies as Wi-Fi. The 'frequency hopping' nature of SHoW DMX usually ensures the DMX signal will get through in the presence of Wi-Fi activity, but it stands to reason that the less competing radio signals there are, the less potential interference there will be, and the higher quality the DMX data link will be.

*Charlie and the Chocolate Factory* uses a total of four wireless DMX universes.  For the majority of the show the wireless elements all fit in to one universe, but for one scene in Act II, Willy Wonka's Inventing Room, another three universes are required simultaneously. These drive two arrays of Color Kinetics RGB LED nodes, through which chase sequences are run. This is always a tough test for any wireless DMX system, with the LED arrays mercilessly revealing any errors in the DMX data. The Neo system performed perfectly.

Because of the need to have four universes broadcast simultaneously, care was taken in the choice of frequency bandwidths and hopping patterns to ensure the four transmitters did not interfere with each other. Two of the transmitters were set to broadcast in the lower end of the available frequency spectrum, while the other two were set to broadcast in the upper end of the spectrum.  Furthermore, within each pair of transmitters, one was set to an odd numbered hopping pattern, while the other was set to an even numbered hopping pattern to ensure the transmitters could never clash.

Directional panel antennas were used on the transmitters to ensure maximum signal was directed towards the stage, and to help reduce spurious interfering radio reflections from around the theatre auditorium. The transmitters and associated antennas were mounted on the circle front lighting position, providing an elevated and uninterrupted view of the stage.

*Transmitters and Panel Antennas on Circle Front*

The panel antennas had the added advantage of directing signal away from the multitude of production desks in the rear of the stalls, and lessening interference to the production wireless internet. It is a fact that no big production can be staged today without constant access to the internet, and how productions were ever staged before the internet is one of life's great mysteries!

A WiSpy survey conducted during rehearsals shows the results of the frequency management scheme. The SHoW DMX signal can clearly be seen in the upper (right hand side) and lower (left hand side) areas of spectrum, with a 'guard band' separating the two. The individual 'channel hops' of the Neo transmitters are also evident. Many of the spurious Wi-Fi networks have been removed, with only the production Wi-Fi on channel 6 remaining, positioned to sit largely 'in between' the SHoW DMX broadcasts. (This network is switched off during public shows.)
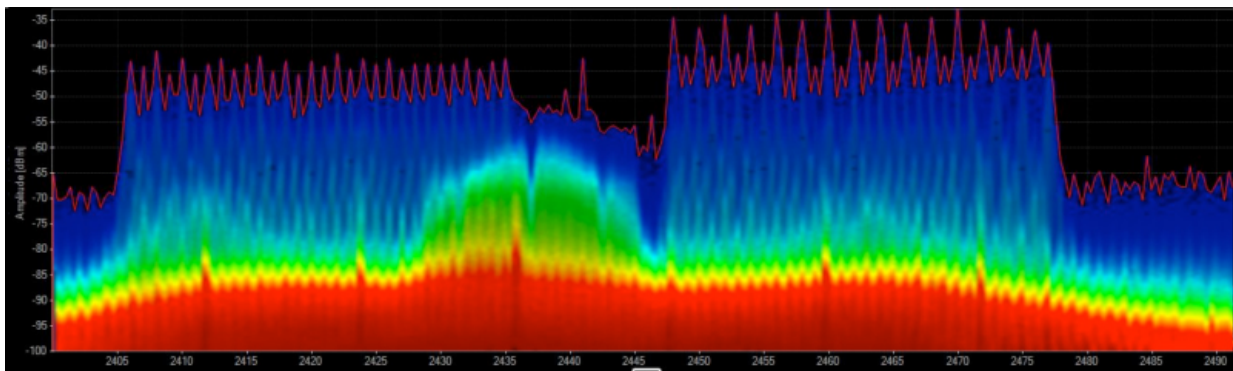


*2.4GHz spectrum use*

At the receiving end of all this wireless DMX is a wide variety of scenic elements and costumes. The majority of pieces are trucks, either in floor tracks, or free roving. Because of the impracticality of getting cables to them, they have to be battery powered and wirelessly controlled. In a couple of cases pieces could conceivably have been cabled, but the inconvenience of having trailing cables across the floor meant that wireless control was the preferred option.

Light sources controlled include low voltage incandescent lamps, along with reams of the now obligatory LED tape, in white, RGB, and RGBW varieties. Dimming was provided either by City Theatrical low voltage dimmers or Howard Eaton 'XT cards' and 600 watt high power dimmers.

Special mention should be made of the City Theatrical D2 and D4 Dimmers. These units are very small but manage to pack a lot of functionality into their diminutive size. As their names suggest, they are either two or four channel low voltage dimmers with inbuilt SHoW DMX Neo receivers. Settings are adjusted by what must surely be the world's smallest ever DIP switches, so small in fact that a magnifying glass had to be purchased in order to set them! Luckily the units are also entirely configurable via RDM (Remote Device Management), and this rapidly became the preferred means of setting them up.

This ability really paid dividends in the case of 10 light up costumes used in one scene. The costumes use Electroluminescent ('EL') tube sewn into the fabric and accessories. Each costume includes a small Lithium Ion battery pack and a D2 dimmer to take care of the wireless DMX reception and EL dimming.
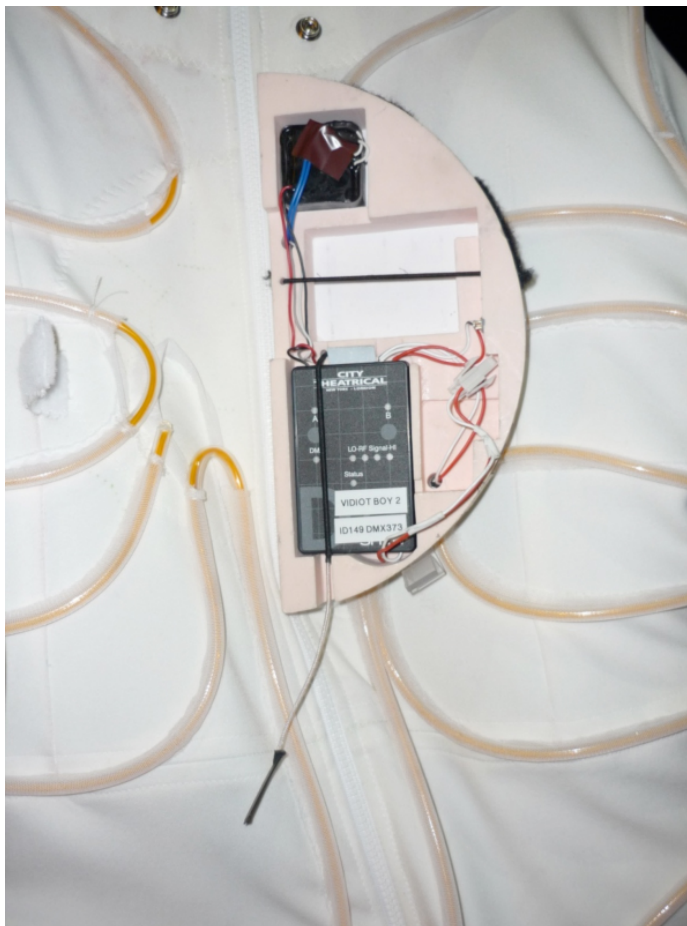


*A D2 Dimmer fitted into one of the 10 light up costumes. The electroluminescent piping is clearly visible. The EL inverter is at the top of the picture. (Battery pack removed)*

The costumes were very late being delivered from the makers and arrived in the theatre only just in time to go straight on to stage for the technical rehearsals. Faced with 10 unconfigured D2's being worn in costumes by dancers onstage, and everyone clamouring to see them light up for the first time, wireless RDM proved its worth as we were able to identify each costume using the RDM Identify function, and then set the DMX address for the D2 Dimmers, even as the performers were rehearsing their choreography.

The wireless DMX is not limited to just controlling lighting effects. Without giving too much away, smoke machines are triggered, bingo machine balls blown, satellite dishes rotated, pop out hands popped, and entire inventing machines wobbled.

And finally, of course, no trip to The Chocolate Factory is complete without a ride in the glass elevator. Here to SHoW DMX Neo plays its part in driving 48 circuits of Howard Eaton XT dimming and RGB tape, giving an ethereal glow to Willy Wonka and Charlie as they appear to fly magically around the stage.

*The Great Glass Elevator.*
*Photograph: Helen Maybanks*
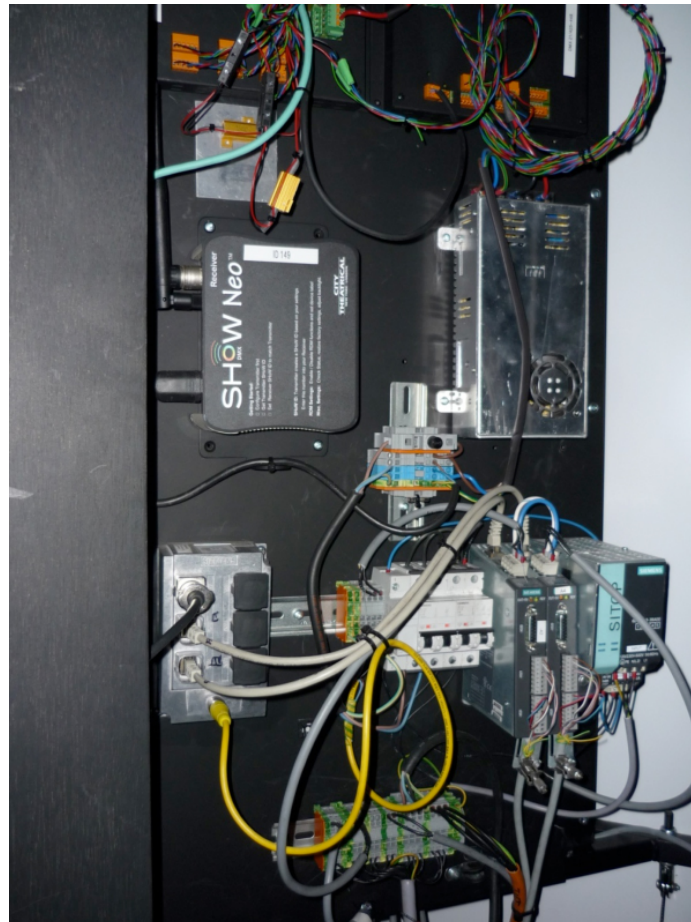


*The rear of the Great Glass Elevator with the SHoW DMX Neo receiver clearly in view.*

As the show tag line says, 'It has to be believed to be seen'. Alternatively, watch the official trailer (some would say 'spoiler') for the show, featuring some of the wirelessly controlled elements, here.



*Beds sitting sub-stage waiting to make their appearance. Each bedside light is controlled by a D2 Dimmer powered from a 12 volt battery.*



*Photograph: Brinkhoff/Moegenburg*

**City Theatrical Wireless Equipment List:**

  4   SHoW DMX Neo Transceivers as transmitters
  4   Panel antenna
10   Neo Receivers
  5   D4 Dimmers
18   D2 Dimmers
  3   D1 Dimmers