



# Radio Star

When LumenRadio brought its new products to the PLASA Show in September 2009, it was barely a year old, and a complete unknown to most of those at the show that year. When its product, CRMX Nova - a new wireless lighting control system - collected one of the prestigious PLASA Awards for Innovation, the lighting industry began to take notice. So who are these Swedish innovators, and what did the PLASA judges find so impressive about their wireless technology? Lee Baldock visited Gothenburg to find out . . .

In 2008, a young, serial entrepreneur called Per Hulthén was looking for a fresh challenge. Having recently sold his interest in a successful computer graphics venture and dabbled in venture capital for a while, Hulthén now teamed up with Niclas Norlen - an ex-Ericsson telecoms engineer and co-founder of Swedish wireless DMX specialist Wireless Solution - who was similarly looking for something new. Hulthén focussed his entrepreneurial vision on wireless lighting control and LumenRadio was born.

Hulthén immediately set about building an R&D team of the best wireless electronics experts he could find, many of them with backgrounds as engineers at telecoms giant Ericsson. In addition to Norlen, the team also includes another ex-Wireless Solutions R&D engineer, Michael Karlsson.

Norlen explained his background thus: "I started at Ericsson in 1997 and was a co-founder of Wireless Solution in the early 2000s. In 2008 I wasn't really happy about the development of the company, business-wise and so on, and so I made the decision to sell my share of the company and move on. It was very important to me not to have a non-competitive clause in the deal. I was very open about my intentions to stay in the industry and it was agreed that I was free to continue with wireless light control, because that's what I do."

With the team in place, Hulthén set them a demanding target: to produce the first "truly reliable" wireless light control system in time for PLASA 2009. That was ambitious enough, but Hulthén also wanted to have the first example of the technology on display at Frankfurt's ProLight&Sound exhibition in the Spring of 2009 - just eight months or so away. The team met that target with the CRMX (Cognitive Radio Multiplexer) system, which was available for OEM customers and was well received. Six months later, at

PLASA09, came the Award-winning introduction of CRMX Nova - a range of wireless DMX and RDM-based tools specifically developed for the entertainment and archtainment industries. In little more than one year, LumenRadio had gone from the drawing board to Innovation Award. And there were other prizes along the way: the company also received three major Swedish business awards during 2009.

#### Aiming High

LumenRadio's aim from the outset was to create a range of tools that would "revolutionise" the wireless lighting control market. Hulthén says: "Wireless light control is a niche market . . . the majority is still wired. I saw an opportunity because wireless lighting controls were not seen as being as reliable as cables. Even though there were many benefits offered by a move to wireless, the majority of people did not because of the reliability issues, both real and perceived . . . If we could make the first generation of lighting controls that were as reliable, or even better than cables, then we could take wireless lighting control from a niche market to a mainstream concept."

(That's a big statement, which we'll come back to: the advice in using wireless light control for the entertainment market has always been 'if you can use a cable, do so'.)

By mainstream, Hulthén means just that - industrial, commercial, civic and domestic lighting are the big opportunities and the long-term goals. The company currently has various ongoing projects in these markets, the details of which are tied up by NDAs. LumenRadio could confirm that they were working with Fagerhult Lighting, one of the top five lighting companies in Europe shipping well over a million fixtures a year, but were secretive about exactly what they were developing for Fagerhult.

The LumenRadio team, L-R: Marcus Bengtsson (R&D), Anders Ardstål (VP of operations), Lennart Floreby (R&D), Jessica Björk (marketing & administration), Mette Boström (marketing & administration), Niclas Norlen (CTO), Michael Karlsson (R&D) and Per Hulthén (CEO).



However, the early focus on entertainment and archtainment lighting, which currently represents 50% of the company's business, is for clear reasons. "Entertainment is important for us because it's a reference market," says Hulthén. "It has many new and exciting projects with high visibility; there are a lot of pioneers who like to look for new things, so it's a great test market and a proving ground for our technology."

Norlen adds: "There are also special requirements in the entertainment market; you cannot compare a high profile show with lighting an office, for example; the technology *must* work - *all* the time."

Although Hulthén has his eye on bigger fish, all the products the company is developing are aimed at entertainment and archtainment: once proven in those demanding environments they can be adapted for other, less critical markets. Hulthén says, "We're not an entertainment company that dabbles in wireless - we're a wireless company that dabbles in entertainment."

That's not to say there isn't a good degree of lighting business knowledge in the team: both Norlen and Karlsson have considerable experience of the professional lighting market. Even so, the implication here is that wireless light control is just the first stage in a much broader long-term strategy for LumenRadio's technology.

#### Cognitive Radio

When Hulthén uses phrases like "the first truly reliable" wireless system, or says that he wanted to create lighting controls that were "as reliable, or even better than cables", you can almost hear the howls of protest from his competitors in the market. While wireless data technology has seen some big improvements in the past five years,

no-one has ever been brave or foolish enough to claim that their RF transmissions are as good as a length of copper. It's a paradigm that requires closer examination. But then, according to Hulthén, what LumenRadio is doing has more in common with the technology of GSM cellphones than with that of its competitors in the field of wireless light control.

Hulthén says: "We set out from the very beginning to develop an entire new system; it was not an incremental change, it was more revolutionary, developing these technologies into a new generation that didn't just improve on the old systems, but came to a completely new integrated solution that solved all of the big problems at once. I have trouble seeing that you could incrementally come to where we are now."

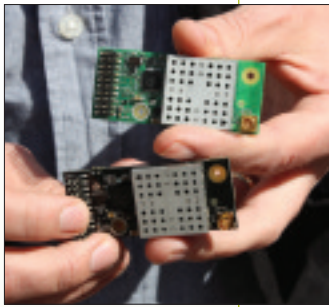
In defining their goal, Hulthén and his team outlined four main 'requirements' that their technology would have to meet. The first concerned the reliability or integrity of the data; the second concerned its speed (latency); the third was that it had to be securely encrypted; and the fourth, crucially, was that it had to co-exist with other devices using the spectrum.

Let's look at integrity first. As Hulthén says, ideally you have to know not just that you're transmitting the data, but that it is arriving intact at the other end. To achieve this, LumenRadio employs a clever technique from high-tech GSM telecoms called Forward Error Correction (FEC). In this method, the transmitter includes with each message some data known as error-correction code. This allows the receiver to automatically detect and correct errors or omissions in the transmitted data (within reason), without communicating back to the transmitter, or waiting for another transmission. "We can lose up to 30% of the DMX sub-frames and recreate that in the receiver maintaining 100% data integrity and fidelity," says Norlen.

## The Products

### CRMX for OEM

The company's OEM modules are available in a number of versions, identifiable by their colour-coded PCBs: Green signifies the 2.4GHz DMX receiver, which is also available in a 'Flex' version, meaning it can be configured as either a Transmitter or a Receiver. Black PCBs signify RDM capability, and can be the straightforward RDM & DMX receiver, or a Flex model which can be configured as Transmitter, Receiver or Repeater, again in the 2.4GHz band. Mounted on a white PCB, and available as of this summer, is the company's new dual-band enabler, which brings Black and Green OEM cards the capability to use 5.8GHz and 2.4GHz dual-band communications, bringing yet another layer of assurance to the CRMX platform. All are fully compatible with other CRMX products.



### CRMX Nova

Housed in sturdy aluminium extrusions designed to take the knocks of live entertainment, the boxed sales range begins with CRMX Nova TX, a single-universe DMX transmitter. The CRMX Nova TX2 is an ethernet-enabled dual-universe DMX transmitter which brings wired network support to the range, handling DMX512 and DMX512-A, Streaming ACN, Art-Net I and Art-Net II, ETCNet 2 and 3, Strand ShowNet and Pathport. The CRMX Nova TX2 RDM is a dual universe RDM transmitter (controller & proxy) with ethernet. It supports RDM, DMX512 and DMX512-A, Streaming ACN, Art-Net I and II, ETCNet 2 and 3, Strand ShowNet and Pathport. Then there are the CRMX Nova RX, a single-universe receiver - and the RDM version, the CRMX Nova RX RDM.



### CRMX Nova Outdoor

The latest additions to LumenRadio's range, available from May 2020, are built to last, both electronically and mechanically. They include the CRMX Outdoor receiver unit, which comes in an IP67-rated vandal-proof housing. In its 'Flex' version it is user-configurable (via SuperNova) as a single universe DMX/RDM transmitter, repeater or receiver. It supports RDM, DMX512 and DMX512-A, DALI and DSI, plus Streaming ACN, ArtNet, ETCNet 2 and 3, Strand ShowNet and Pathport. CRMX Outdoor Slim is an IP65-rated single universe DMX/RDM receiver which supports RDM, DMX512 and DMX512-A, DALI and DSI.



*(NB. None of LumenRadio's RDM-enabled products are currently available for sale in the United States)*

For the next aim, low latency, Hulthén set his team a characteristically demanding target. To be sure that the eye would never notice a discrepancy in the performance of lighting, in even the most complex applications, he set a maximum latency threshold of just five milliseconds - even for a big multi-universe control system. Norlen says: "Some people claim to be able to 'see' a 20ms latency; I'm not sure that they can, but we decided that if that's what is being claimed, then we need to set a target well below that." "We aimed below 10, and achieved 5", says Hulthén.

Traditionally, in data transmission there exists a balancing act between how robust the data is, and how quickly it can be sent. Doesn't a system achieving such low latency and such high integrity at the same time seem a little like having your cake and eating it?

"A lot of people claim that what we are doing is impossible," agrees Hulthén. However, the key to the conundrum, he claims, is the much greater efficiency of the system. Because CRMX utilises the available free spectrum in such a 'smart' way, integrity and low latency can be jointly achieved.

The third point, encryption, may not have been a major concern for manufacturers until now, but as Hulthén rightly says, if wireless control is to become mainstream, the data has to be protected. Disrupting the lighting of a stage musical might not be high on many people's agendas, but when it comes to commercial and industrial applications, the stakes can rise for different reasons.

And now for that crucial fourth aim, co-existence. This, says Hulthén, was the hardest technical challenge to overcome. "Since the open bands are becoming more and more crowded, there are more collisions, and a lot of the space available is wasted, because the systems on the market are not using it in a smart way. And that was one of the key innovations in our technology - Cognitive Radio Multiplexing."

CRMX is what Hulthén calls "smart radio" - a system which listens continuously to the surrounding spectrum activity, and every millisecond adapts its transmission to use the available frequencies in the most efficient manner possible. This approach minimises interference and maximises the chance of getting the data across successfully. And perhaps more importantly in our RF-rich entertainment environments, it also minimises the risk of upsetting other systems that happen to be in use. Where some previous systems had used signal strength as a weapon to ensure data delivery - with all the consequent problems where other RF systems are being used - the CRMX approach is far more considerate to other users and far more efficient in its use of the finite resource that is our RF spectrum. Beating competing wireless signals into submission has become too wasteful a practice for the 21st century.

### SuperNova



A fifth requirement was also identified - not an enormous technical hurdle, but a fundamental requirement - and that was bi-directional communication via RDM. "You have to have feedback, you have to know what's going on at the other end, and that was also a big part of making it useful," says Hulthén.

Norlen says: "It's important that we see the technology not just as wireless light control but also how it fits in with the entire system on a show - what do you need to do this? We developed SuperNova so the user could monitor the system and be sure that everything is working out there. This is very appealing to me and to the rest of the team, as it allows you to see how our technology fits in with the rest of the system, not just the wireless devices but the total network."

CRMX SuperNova is LumenRadio's cross-platform RDM monitoring and management tool. It allows the discovery of all connected RDM devices, wired or wireless, and automatically reports the type of equipment and features. "It started out as an RDM controller, but it is evolving into something much more than that," says Hulthén, "because RDM is now only a portion of the feedback you are getting."

The SuperNova interface shows a visual representation of the entire system setup, including an indication of signal strength for all RF devices. Configuration tools allow you to link transmitters and receivers, adjust output power, and set Art-Net and other ethernet protocols within the same user interface. DMX addressing and equipment management is made easy, while the 'Coexistence View' lets you see the spectrum in real-time and identify your own and external radio traffic. Error messages, alerts, operational status, temperatures and fan speed can also be logged, while warnings can be e-mailed to the user.

Hulthén continues: "We're extremely customer focussed. We don't develop anything without consulting very closely with our customers, so we have a very clear picture of where we're

  
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 Per Hulthén  


going before we've started. All through the development process, with every iteration, we show it to customers and get feedback so that we can fine-tune it to their specific demands. Technology is only worth as much as it is useful to the customer."

**Quietly Confident**

LumenRadio will make further product announcements at this year's PLASA Show, but we'll have to wait and see what form they take. They are not the most vocal company, which is partly through being incredibly focussed on the job in hand, but is also to some extent a reaction against what Hulthén sees as the "culture of boastfulness" in manufacturing. He says: "We have a policy that we don't discuss what we are going to release until we release it. There is a tendency among some companies to promise a lot, but not to deliver until quite some time later . . . we want to prove our point that we are reliable. What we promise, we deliver on. It's how we build credibility."

Hulthén adds: "We're probably a bit Swedish in our minimalistic ways . . . it's not so much a strategy as the direct result of our personalities."



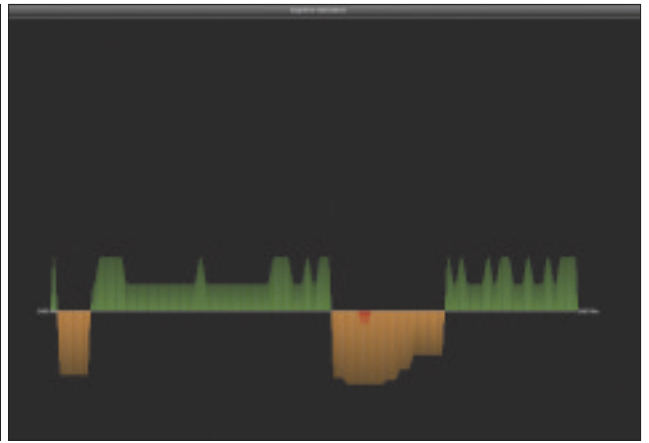
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SuperNova: a Network view (left) and the Coexistence view, showing CRMX transmissions (in green) filling the spaces between the external RF traffic.

By the same token, you might also note that it is unusual for a winner of a PLASA Award for Innovation to make so little mention of it on its website, but LumenRadio hasn't done much about that yet. That's not to say the PLASA Award was unimportant, says Hulthén. "It was the very best type of recognition that we could get," he says, "being a new company, at our first fair, showing our first product, and receiving the biggest award you can in this industry. It was a great recognition of our efforts, but it also had a significant impact on the attention that the market paid to us."

Despite the reticence, you can be assured that there is plenty of interest going on with LumenRadio: they're just not fond of shouting about it. Hulthén says: "For example, right now we are doing wireless light controls for live television in several countries across Scandinavia."

Television studio environments heavy with wireless communications and even wireless camera operation, this is indeed an impressive testing ground - particularly for live broadcast - and a real sign of user confidence in the system.

"That was one of the goals we set ourselves; it's probably the hardest target market because you are talking about an audience of several million. We're pushing our technology into the hardest environments we can to get the best references, proving our reliability."

The company has also notched up a suite of high-profile installations in Stockholm which testify further to the high level of trust which is being placed in its technology. CRMX Nova can now be found operating in Stockholm's leading 'spoken drama' venue,

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in theatre technology

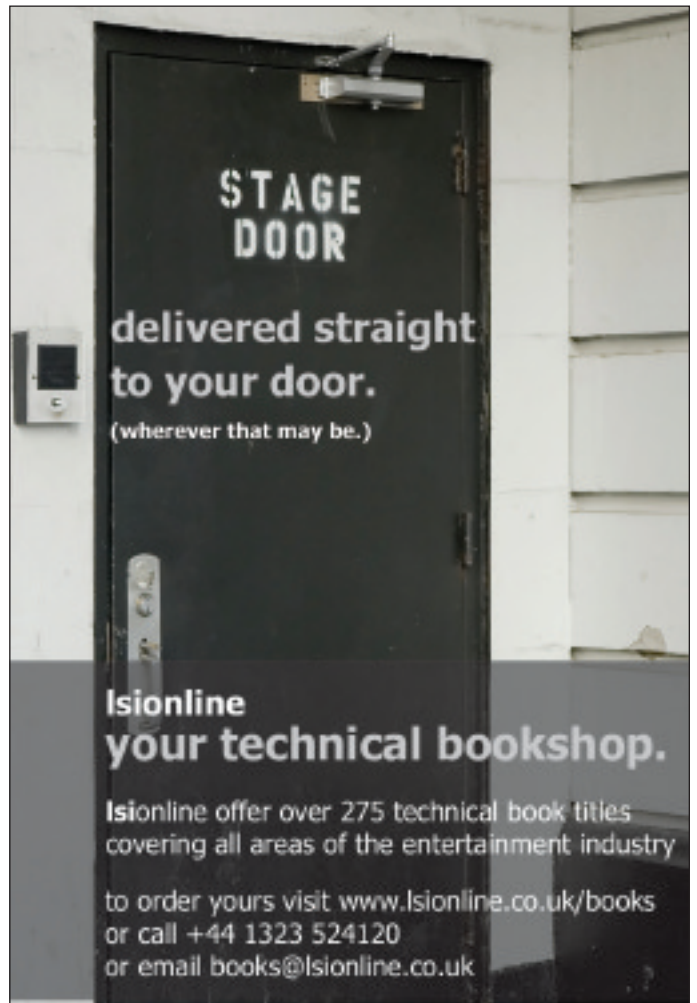
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the Royal Dramatic Theatre, as well as in Stockholm Opera House and the iconic City Hall - famous for being the host venue of the Nobel Prize Banquet.

For the coming months and years, Hulthén forecasts a rapid uptake of LumenRadio's technology, with the targeted 'mainstream' markets really coming to the fore during 2011, and OEM activity in the entertainment and archtainment markets beginning to take off in the very near future. He explains: "The vast majority of what we do currently is boxed sales; OEM follows boxes. OEM users are more conservative in their outlook, as incorporating technology into your own product is a much bigger commitment than simply buying a system. We have had a couple of dozen companies tracking our progress for quite some time, and I think they are now coming to see that, firstly, the technology is as good as we promised, and secondly that customers are buying into it. So OEM is something that we are moving heavily into right now."

**Culture of Technology**

LumenRadio has its base at Chalmers University of Technology in Gothenburg. The top technology university in Sweden, it supports a number of high-tech start-up businesses on its campus. This, combined with the vast presence of Ericsson and its resources and facilities within the city, creates an environment in which there is a "culture of pride" in technological development, says Hulthén. "We fit right in," he says.

He adds: "Giving talented people a challenge that no-one has overcome, and giving them the resources to meet that challenge, is the key . . . That kind of dare-devil attitude to developing new technology is something that we still have. We've pushed out 13 new products in nine months, and we're still only getting started."



Pictured on the Chalmers University campus, Niclas Norlen (left) with the new CRMX Outdoor Slim, and Per Hulthén with the CRMX Outdoor.

Finally, at the end of our discussion, I asked Per Hulthén if he was now happy to say that the CRMX Nova system really is as reliable as wire? After some considerable thought, he answered: "I would say that in *most* applications, it is."

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