

4K Testing

Crestron lab certification program is non-proprietary.

By Justin Kennington

Editor's Note: *At InfoComm in Las Vegas, we were given a brief overview of the Crestron 4K Certified program, which is non-proprietary. They test any manufacturer's products to ensure that they are truly "4K." We felt that a "tour" of this facility might give our readers a better idea of what is involved in ensuring that these new products actually work with all of the other elements in the systems. We hope you find this enlightening.*

In its earliest days, HDMI appeared as a consumer-focused offshoot of DVI, the first practical format for transmitting digital video outside of the broadcast environment. HDMI carried some advantages over DVI and analog video, but brought significant challenges, too. Suddenly, getting a picture required bidirectional communication. Poor cabling resulted in intermittent or absolute failure, rather than picture degradation. Things were OK in the mass consumer market, where a "complex" system, circa 2008, involved a TV, an AV receiver and maybe two digital sources. Expand the concepts of HDMI to the larger systems in professional AV, and these communication complexities can quickly explode into unmanageable systems. Integrators and consultants saw this, and were glad that HDMI was isolated to the mass market.

But then some CTO got a Blu-ray



Crestron engineers in the DigitalMedia Lab are taking the industry lead in 4K product testing.

player at home, and asked his AV department: "Why can't we have this in our boardroom?"

This is how HDMI got its foothold in the professional AV industry, sometime in early 2009. Perhaps you remember what an awful pain that first year was...I do. At the end of 2008, Crestron shipped the first DigitalMedia system (a new distribution platform based around HDMI signaling) to an industry that, frankly, wasn't ready for it and didn't want it: Display and source manufacturers didn't have good interoperability, integrators didn't have enough digital installation and troubleshooting knowhow, consultants didn't yet know how to design digital systems, and DigitalMedia "didn't know what it didn't know." HDMI's complexity

became the enemy.

They say that the pioneers take the arrows, and this was true for everyone who tried HDMI in the professional market in the early days. End users got mad at consultants, who got mad at integrators and they all got mad at me. It didn't matter if that display didn't work with that cable box when connected directly. The DigitalMedia switch was the most expensive component, so it took the blame.

Now it's 2014, and HDMI has become routine in commercial AV. More than 16,000 industry professionals have been through DigitalMedia Certification training. DigitalMedia has been connected to more than two million HDMI devices in real-world systems, and has made



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Engineers at the Crestron DigitalMedia Lab in the Research Center at the company's World Headquarters in Rockleigh NJ test 4K products. Crestron built its own 4K test equipment because none existed yet.



One challenge systems designers must contend with is that signal integrity requirements for 4K video are significantly higher than those of HD. Crestron uses state-of-the-art test equipment, such as Agilent 16GHz high-performance oscilloscopes, and standard commercially available sources and displays.



every one of those connections work. A wide array of manufacturers build sources, switches and displays that can accomplish the basic task of moving 1080p digital content from place to place.

In 2009, HDMI distribution systems were on the bleeding edge of technology, and their designers knew it. That's because it was easy to see that HDMI is more complex than component video. Today, 4K is the bleeding edge, but it's not as apparent because it shares so much in common with the HDMI we already know.

Four times the resolution of 1080p is the promise of 4K. This increase in detail is great for any application where lots of information has to be viewed and synthesized quickly: medical imaging, equities analysis, CAD or even movies at home. However, this level of detail comes at a price. As defined by HDMI 1.4, 4K formats consume double the data rate of their 1080p counterparts. HDMI 2.0 defines 4K formats that consume a

full four times the data rate of 1080p. AV infrastructure (HDMI cables, HDBaseT cables, sources, displays, etc.) will struggle to keep up with the increasing demand for bits. Beyond the basic strain on infrastructure, 4K brings new and unfamiliar design challenges of its own, including different 4K formats and the scarcity of 4K downscalers.

HDMI is at the core of nearly every new video system installed today. Crestron sells more than 100 times as much DigitalMedia gear now as we did in 2009. And, unlike the challenges of the transition from component video to HDMI, the challenges of the 4K transition are hidden. We are potentially headed for a repeat of 2009 that none of us can afford.

When we started building 4K products and testing with third-party gear, we noticed interoperability problems between gear from reputable manufacturers, sometimes between one manufacturer's own source and display. Many reasons for this exist, but the most critical one

is this: The HDMI Compliance Test Specification (CTS) does not require full testing at 4K resolutions. Someone needed to fill the gap between "it meets the spec" and "it's guaranteed to work." The result is the Crestron 4K Certified program, which tests and certifies third-party 4K sources and displays for use in commercial AV environments.

We'll detail here how we test displays. The testing rigor for sources is similar. Crucially, we run all protocol compliance and signal integrity tests at each resolution for which the display declares support. There are three key areas of HDMI CTS that we focus on:

- Video Protocol Compliance (HDMI CTS 8-17 through 8-20, and 8-30): This verifies that the display supports all of its advertised video resolutions, including 4K. Each resolution is tested to ensure that the display accurately represents the data. This is a basic protocol test using an ideal signal from the test generator.
- Transition Minimized Differential Signaling Integrity (HDMI CTS 8-5 through 8-7): Digital video signals are high speed and low amplitude. This makes them susceptible to noise, interference and signal loss. This test works by injecting poor signals—at the very fringes of what the spec allows—into the display. If the TV can display these signals cleanly, it meets the specification. Failure of this test indicates that the TV may work with some sources, but not others. The HDMI CTS does not require that this test be run at 4K resolutions, but the Crestron 4K Certified program does. This is the test where we most often see failures.
- EDID Structure Verification (HDMI CTS 8-1 through 8-2): This test verifies that the EDID data, packed quite compactly into 256 bytes, is structured correctly to ensure that it may be read by a source device. The test does not offer any verification that the data is correct, but merely that it is formatted in an understandable way.

This testing is performed with state-of-the-art measurement equip-

ment from Keysight Technologies and Quantum Data. There are only 10 labs in the world authorized to perform HDMI testing, and Crestron has built up the same capabilities as those labs to support our certification program.

The HDMI specification is the critical foundation to ensure that all system components basically work together, but other data is required for seamless and consistent 4K implementation, especially in large matrix designs.

After a device has passed the HDMI portion of our certification testing, it is handed over to the Quality Engineering (QE) lab, where the display is connected to real-world DigitalMedia systems and tested for user-experience quality. This entails using the display as a typical end user would, and noting any

anomalies or problems that wouldn't be caught by HDMI testing. For example, we would note slow or unclean switching, intermittent HDCP failures or audio distortions.

Many of the details checked in user-experience testing do not have designated pass/fail criteria. For

example, one display targeted at the digital signage market exhibits switching lock times of upwards of 10 seconds. In your presentation room, this might not be acceptable, but in the digital signage environment, it's no big deal. In our certification report, we disclose the actual measured switching lock time, as well as any notes on performance when locking onto a new signal.

Crestron wants our certification database to be a go-to reference for system designers. For years,

designers have asked for certain third-party performance details, and this program has finally given us the opportunity to provide the data, including:

- a detailed description of the device's EDID, including supported

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This shows a clean 4K eye diagram; The eye is wide open because the system under test has more than enough bandwidth to support 4K.

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Acoustic Performance Center Gets Amplified

Since opening in 2005, the Holland Performing Arts Center in Omaha NE has been celebrated as a world-class concert hall. Originally designed to enrich live acoustic performances, the 2000-seat, shoebox-style space hosts a variety of performers, and is home to the Omaha Symphony Orchestra. After almost a decade, however, the venue noticed an increase in the number of amplified shows it hosts. Omaha Performing Arts Production Manager Kate Williams explained that, "Although the room is ideal for acoustic or lightly amplified performances, our old audio system was aging and becoming no longer competitive in the entertainment market."

The HPAC decided to upgrade to an amplified system that would match and preserve the acoustic audio quality of the auditorium, and enlisted Threshold Acoustics (Chicago IL) led by Jonathan Laney, as well as integrator Audio Logic Systems (Waconia MN), to provide a solution. "The long, shoebox design made it challenging, as we needed a loudspeaker that would focus energy on the audience and off the walls," explained Williams. "Our biggest struggle was finding a solution that wouldn't slam the front of the room or create shadows in the back."

With the use of d&b audiotechnik's ArrayCalc simulation software, the new audio design took careful consideration of each loudspeaker selection, coverage and placement. From the Qi10s



employed in the center cluster, to the E8 under-balcony delay system, each element addressed a specific venue need. Both J-SUBs and B4-SUBs are also used in the room, all running from D6 and D12 amplifiers. The T10s selected for the front-fills have been left as portable components, so they can be redeployed for use in the main entrance, as well as the rehearsal and conference rooms. "It's a warm, lovely room," said Williams, "and we've finally found a solution to highlight its full glory, regardless of performance type." ■

INDUSTRY POV: 4K TESTING

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video resolutions, preferred timing, allowable colorspace and supported audio formats.

- CEC compatibility report, not only whether or not the display supports CEC, but which of the critical CEC commands it responds to.

The average system designer or integrator has no way to gather this information without the huge cost and time of buying lots of TVs and testing for themselves.

Finally, any other unique behaviors—good or bad—are noted. The purpose is to never call out another manufacturer for a glitch or a bug, but to help system designers have as much knowledge as possible in order to design the most reliable system for their customers.

In addition to helping designers, there is a second and, perhaps more important function, to the Crestron 4K Certified program. When a device fails to meet one of our criteria, we do not publish a "failed

device" report. Instead, we contact the manufacturer and offer our help to its engineering group to fix the problem. Once fixed, we can certify the device.

Because of our extensive experience with fixing HDMI interoperability issues, rather than keeping that knowledge strictly to ourselves, we share it with our partner manufacturers to help them improve their products alongside ours.

The program represents an incredible investment on behalf of Crestron: more than \$500,000 in test equipment and hundreds of hours from the DigitalMedia engineering team. We feel that this investment is worth it to ensure the continued success of DigitalMedia, our customer base and the professional AV market. The ultimate goal of the program is to create a world where all 4K devices interoperate as a matter of course, and 4K certification is no longer required.

To learn about the Crestron 4K

Certified program, and to see the list of certified devices and their detailed test reports, go to crestron.com/4k. ■

INDUSTRY POV: GOLDEN

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and when your systems are delivered, they're made your way, exactly as you want them configured; they really are plug and play.

Because the process is so efficient, the costs are minimal compared to the expenditures in time you would traditionally spend. The image is set once, and repeated in each device. And when you have updates or changes, you simply update the golden image with any new requirements you might have, and then any additional computers are preconfigured exactly as you choose. It's your choice and not your computer vendor's choice. It's simple, fast, efficient and effective. It's the best way to do more with less. ■