Title: HDMI Cable Pedigree
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Introduction

HDMI seemingly came from nowhere several years ago, just appearing in our lives one day. Now in 2010 HDMI is *the* domestic AV connectivity standard, but I've observed that a majority of HDMI cables in the marketplace have evolved little, if at all, over the past few years. With the coming launch of 3-D TV & Blu-ray, the demands for reliable bandwidth delivery and quality will increase universally, and by the time the gaming sector inevitably goes 3D as well, bandwidth demands will be around double what they currently are for 1080p/60!! An installer's choice of HDMI cable is becoming ever more important.

This paper applies simple logic and a few home truths about HDMI cabling, by comparing it to the more commonly understood Category 5/6 cable (for the sake of simplicity, I'll only refer to CAT6 from here on). **My aim is to help you to better understand what goes into a good HDMI cable design, so that you can better predict the performance capabilities, longevity and future viability of the cables that you use in your installations.**

Twisted Pairs...

There's an undeniable link between HDMI and CAT6, and no, I'm not talking about HDMI transmission over CAT6 solutions – not in this document anyway. I'm referring to the fact that they both use multiple twisted pairs for primary data transmission. If you are already very familiar with CAT6 cable, then take the time apply what you understand about CAT6 cable to HDMI. It may be more simple than you think to determine good cables from, well... not so good.

CAT6 cable

- CAT6 comprises four twisted pairs, most commonly 24AWG
- Defined under standard TIA/EIA-568-B as supporting bandwidth to 250MHz
- Common application – Gigabit Ethernet (1Gbps). Can be used for more, but with greater limitations
- *Solid* core used for "horizontal" runs (e.g. in-wall). Maximum bandwidth and relatively easy to site terminate
- *Stranded* core exhibits higher attenuation rates than solid, reducing bandwidth potential. But generally more flexible than solid core, hence used for short patch cords.

Now, in case you thought CAT6 cables are pretty much all the same, as they all just carry "1"s and "0"s (how often we hear this about HDMI!), here's a couple of simple challenges for you;

Challenge #1 – Take a 1000ft/305m box of solid core CAT6 – a good unshielded variety - and cut it into 5x 200ft pieces. Terminate each length with identical RJ45 connectors at both ends, using the same crimp tools and optimum methods for each. If you then sweep tested each length for bandwidth, what do you think the chances would be of every cable performing in an identical manner? Would there likely be some variation in performance, albeit small, even though they are all seemingly identical? When I surveyed several installers, 100% said they wouldn't be surprised if there was a difference.

Expectation –This challenge outlines the very real potential for variations in performance, even where all elements appear totally consistent. **The main cause is in the integrity of each termination**, rather than variations within the cable or connectors themselves, although this is of course possible as well (especially in lower quality examples, further degrading the signal.

Challenge #2 – Put away your crimp tools, cut a 200ft piece of stranded CAT6 cable – again, the best you can find – then terminate RJ45 connectors using manual soldering methods – yup, that's right, get out your soldering iron! What do you think the bandwidth characteristics of this stranded, hand soldered cable will be in comparison to those cables in Challenge #1? Respondents to this question usually chuckled at the thought, expressing that they would definitely expect a reduction in performance, but not sure how much.

Expectation – Cable in Challenge #2 expected to be undeniably inferior to that in Challenge #1, but to varying degrees. Stranded core CAT6 exhibits inferior bandwidth to solid, and hand soldered terminations are significantly less consistent than symmetrical machine soldered connections, with inevitable variations in solder quantity, and even the heat and time of application of the soldering iron making a difference.

It's on these simple principles alone that the **real** differences between HDMI cables be easily highlighted. Let's do the physical comparison first;

HDMI cable

- 3 twisted pairs for high speed data channels – CAT6 has 4
- Bandwidth specification to 340MHz (High Speed, Cat2) – CAT6 specifies to 250Mhz
- Data rate to 10.2Gbps – CAT6 generally up to 1Gbps
- HDMI expected to perform in REAL TIME – CAT6 in Ethernet application often buffers

FACT: HDMI is expected to transmit up to **10x** the data rate of CAT6, and do so on 25% fewer conductors, and that's not even taking into account the usually smaller gauge (AWG) in many HDMI cables

FACT: Most HDMI cables (>99% est.) in the market today use *stranded* cores, including most of the biggest names in the business. *Note- be careful on this point as some brands promote the benefits of solid core on many cable types, but fail to mention it with their HDMI cables – a convenient omission.*

FACT: Most HDMI cables are terminated using *hand soldering* techniques.

Given these facts, do you think that most HDMI cables in the market are optimised for bandwidth, if you apply the same logic as with the CAT6 demonstration on the previous page? How much better would you expect of a solid core HDMI cable with optimized (aka symmetrical & automated) termination methods? Furthermore, how much more faith would you have in a cable that is actually real-world bandwidth tested at the production level, before it even leaves the factory? Kordz does all of this and more.

We use only solid cores in all GEN-4 models (2009+), terminated using an automated, machine soldering system with total control and consistency of solder quantity, with every terminal simultaneously terminated in a relatively low heat ultrasonic oven. Furthermore, every Kordz EVO, EVS and EVX cable is B.E.R. (Bit Error Rate) tested before it leaves the production line, ensuring its ability to pass a real world simulated bitstream at high bandwidth, complete with simulated source jitter.

Recommendation

New developments in the industry such as 3-D, Ethernet over HDMI, and ever evolving display resolutions and graphics capabilities, all add to the demands for connection bandwidth. **Please recognise just how crucial this is**, and how a simple choice of cable can influence long term reliability and compatibility in the rapidly advancing AV system. The cable should be the easy bit – the bit that doesn't cause you any grief or installation delays. The bit that doesn't see you cop a phone call from a bereaved customer on a Saturday night because their system has stopped working, only for you to find that they've just upgraded the firmware on their PS3 to support 3-D, and the cable you installed can't support the added bandwidth! Or even worse, the HDMI cable has come loose due to its poorly made connector!

Conclusion

CAT6 cables do vary. HDMI cables do also vary. Surprising to many, the causes of performance anomalies with these two cable types can actually be very similar! Sure, there's additional data cores for EDID, DDC, etc in HDMI, but I'm talking fundamentals here. The significant point is that HDMI performance matters **more** as it's simply being asked to do more. Yet most HDMI cables on the market are inherently inferior to the humble CAT6 in their termination methodologies, regardless of price. And we haven't even looked at raw cable construction, geometry and connector quality yet!

At Kordz, demonstrable real world performance and dependability means more to us than marketing jargon and attempting to differentiate models with varying "Gbps" speed ratings. We tell it like it is, and simply use the best design and production methods possible - from tip-to-tip in the cable - in order to deliver a reliable and long lasting product. For more details, go to http://www.kordz.com/.

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