

# Perform systematic testing of HDMI EDID

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Modern audio/video (A/V) devices rely on HDMI Extended Display Identification Data (EDID) to communicate with other devices in an A/V system. If a device is sending incorrect EDID values or if the receiving device does not have adequate error-handling, significant audio and video errors can occur. This article looks at the risks inherent in an ad hoc approach to testing EDID with a selection of random HDMI sources and sinks, and advocates a more systematic approach to HDMI test.

There's no doubt that HDMI, whatever its relative merits and demerits, is here to stay as the A/V interface of the foreseeable future. And as the number of consumer and professional devices using HDMI to deliver audio and HD video grows, so pressure is increasing on A/V manufacturers to ensure that their devices' Extended Display Identification Data (EDID) is accurate.

The idea of EDID is a powerful one, analogous to the spec sheet of an HDMI device in electronic form. Contained in one simple ROM, and in typically just a couple of hundred bytes of data, is all of the information about the video and audio formats the device can receive and do business with. In the world of broadcast manufacturing and test, it's a welcome innovation, because if you want to know what formats a certain piece of hardware can cope with over HDMI, all you have to do is read its EDID. Or that's the theory. In practice, there seems to be quite a lot of equipment out there with EDID that doesn't accurately describe the device's capabilities—a frustrating state of affairs for manufacturers and end-users alike.



Figure 1: If written such that it correctly describes its parent device, this unfriendly looking hex readout—the code at the heart of the EDID—can make HDMI equipment testing and troubleshooting much easier.



Figure 2: Like EDID, HDMI is a great idea in principle—a high-bandwidth format capable of carrying audio and video through a single connector.

## Labeling is everything

Generally speaking, the specification of HD AV equipment is not always as clearly expressed as it could be, especially in the consumer domain, where labeling is everything. In the United States and Europe, for example, if you buy a TV that says 1,080p in large letters on the box, it's not always a guarantee that the screen can show video with a vertical resolution of 1,080 progressively updated lines. Sometimes all the label does is indicate that the device can receive incoming video in the 1,080p format, which it then decimates before displaying it at a lower resolution.

There are similar ambiguities with EDID information, as EDID is concerned only with describing the formats that a device can successfully recognize and receive, and contains no information about how a particular format will be reproduced. If the EDID says a device will accept audio at a sample rate of 96kHz, and it plays the audio back correctly, the EDID is accurate, even if the device actually achieves playback by sample-rate converting the audio down to 48kHz internally beforehand. However, can it honestly be said that the EDID is accurate if the 96kHz audio is received by the device, but is reproduced full

of dropouts and pops, as was the case with an HDTV Audio Precision's engineers were testing recently?

It's not clear what causes the mistakes in HDMI EDID, but it's possible to speculate, based on some of the errors that crop up regularly. Some manufacturers seem to be uncertain how to write the required information in accordance with the EDID specification. Some appear to be using off-the-shelf EDID information produced by third parties, which doesn't correctly describe their product. This might be due to oversight; perhaps the companies concerned have bought the third-

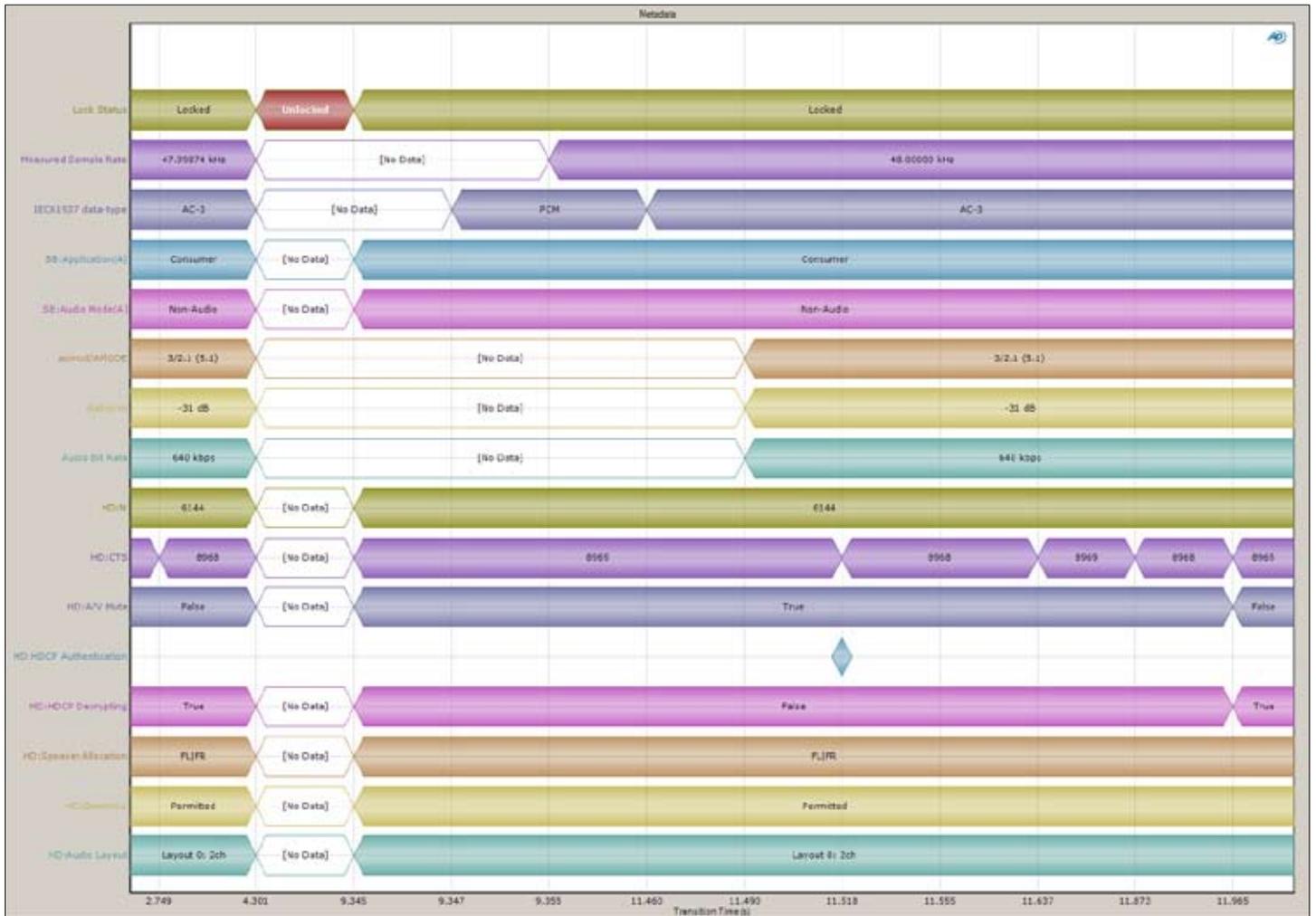


Figure 3: A cable has been unexpectedly disconnected, as you can see from the interruption in the data flow at around the four-second mark.

party EDID as a starting point to describe their product, but they never get around to adapting it for their device. Others may be producing EDID information for a top-of-the-range product, and then using that same data for all of the products in the range, without considering that the EDID is inaccurate for the entry-level product in the same range.

### The problem

Producing accurate HDMI EDID definitely requires care, and as the number of available formats for HD video and audio delivery has grown, the task has become more complex. It could be that the situation will both improve and worsen over time: Manufacturers may become more appreciative of the importance of producing accurate EDID information, and also more accustomed to the task, as time goes by.

However, new formats will con-

tinue to develop, which means it won't be easy to stay on top of the situation. It's been interesting to watch the growing popularity of the now-regular PlugFest events organized by HDMI manufacturers; this can be interpreted as a measure of just how difficult it can be in this digital, metadata-driven age to create products that are compatible with a wide range of industry hardware.

In essence, PlugFests are opportunities for manufacturers to meet, and bring along their hardware and software. Sometimes, they are still at an early stage in the development of a new product, so that they can try connecting it to other manufacturers' equipment.

At this year's PlugFest, the Audio Precision team was able to observe what was happening down at the metadata level when some of the HDMI devices at the show were connected

together, thanks to a recently added feature in our APx analyzer that presents metadata in a view like a logic analyzer. To take one example we observed, when two HDCP content-protected devices are hooked together, they have to decide whether they're going to allow digitally protected content to pass from one to the other. They're supposed to have a short "digital handshake," authenticate each other, and if successful, exchange encryption keys and begin encrypted transfer. But some of the hardware doing this was authenticating, starting encryption, de-authenticating, re-authenticating and starting again. The devices took a lot longer to settle down and get on with the transfer than they should have. With consumer equipment pairings like HDMI-equipped Blu-ray players and TVs, authentication errors like this could lead to a noticeable delay of several seconds

between a consumer pressing Play and playback beginning on screen. That's the kind of thing consumers would notice, which would compare unfavorably to old home video systems, even analog ones like VHS.

### Consumer pressure

Some companies argue that it's to pick up these kinds of problems that they attend PlugFest, and that further action is unnecessary. It's true to say that some consumers will never encounter problems, depending on the devices they hook up via HDMI and the formats they use, and certainly, none of this is likely to matter if a manufacturer of broadcast technology produces devices that respond to well-established standard audio and video formats, and correctly flag this fact in their EDID.

However, if the EDID incorrectly says the device will receive

(say) compressed formats, like Dolby's AC-3, and this fact has not been tested or brought up at a PlugFest, the first people to find out might be the manufacturer's customers. These days, when a disgruntled user can rapidly make their displeasure regarding an apparently dysfunctional machine heard around the world via consumer forums, it's much better for manufacturers if such problems never make their way into the public domain. Ideally, HDMI and EDID-related problems should be picked up at the R&D stage of the product's development, rather than at a PlugFest, before the scrutiny of the world's HDMI manufacturers or when the device is already on the production line.

There's sense in using PlugFests in addition to a carefully designed in-house program

of rigorous product testing, but a few ad hoc interconnection tests performed on some pre-production hardware at a PlugFest cannot be considered a replacement for proper product testing programs. The use of accurate EDID information, and a thorough programme of audio and video testing at the design stage can nip these problems in the bud.

### **Recommendations**

In short, manufacturer-led support for accurate EDID is good news for both customers and manufacturers. Use of off-the-shelf EDIDs should be avoided. The product design team needs to be trained properly in the art of writing properly specified EDID information and should create it such that it properly describes the capabilities of the specific

product—and not just one in that range. The device should then be given to an EDID-conversant test engineer, ideally someone not involved with the product design, who should decompile the EDID. This is not as hard as it sounds—several companies, Audio Precision included, make devices capable of reading and editing EDID.

But just reading the EDID isn't enough; the engineer also needs to test the device's ability to cope with the media formats that the onboard EDID says it can handle. Again, this isn't difficult: It's simply a matter of constructing a systematic test program that involves firing these media types—including obscure HD video and compressed audio formats where necessary—at the DUT and evaluating the results.

Error handling should also be tested by sending deliberately corrupted information, and seeing exactly how the device handles data its EDID says it can't cope with.

With modern video and audio test hardware, the process of testing, analysis and results reporting can be automated and integrated into a software-based process control environment. In this way, any problems with the EDID or with the device's ability to behave according to its advertised specification could be picked up long before the product reaches end users. None of this needs replace testing sessions at the likes of PlugFest, but it might make for more reliable HDMI equipment at both the broadcast and consumer level, which has to be a good thing for all of us.