

"A UHD Standard Will Replace HD ... in about 30 years."

Widescreen Review[®]

The Essential Home Theatre Resource™

LG 65-Inch
4K 3D LCD

Building
High-Performing
Audio Servers

THE MONUMENTS MEN



\$5.99 US \$7.99 Canada
Volume 23, Number 4
Issue 186, April/May 2014
www.WidescreenReview.com



17 Blu-ray Discs
Reviewed



Amplifier Technologies Incorporated

"American Muscle" Part II

Gary Reber

...Continued from Issue 185, March 2014, Page 53.

Gary Reber, *Widescreen Review*: What is the anatomy of an ATI amplifier? What's it made up of? What are all these components?

Morris Kessler: Well, the anatomy is the quality of the components. Good components can be more expensive. In the case of the Signature amplifiers, the input capacitors are special Muse capacitors. The mylar capacitors that are used throughout, the circuit topology is different than most. I'm doing a lot of this now, where we're using smaller banks of capacitors for the power supply because you get a lower ESR, I should say, lower ESR series resistance. There are just a lot of little things, and of course, just the materials, the circuit boards, of using heavy copper glass circuit boards. Transistors have improved a lot. These two inside transistors that you alluded to are called thermal traks from ON-Semiconductor. They finally decided after 100 years that the bias-sensing device should actually be inside the transistor. With their Thermal-trak design, optimizing amplifier bias, which has to track the temperature of the amplifier, is now an easy job and very, very, very accurate. So with our newest amps, essentially there is no bias sensor at all. It's inside the transistor.

Jeff Hipps: When I look at one of your amplifiers, what I see is a cleanliness to the design, and when I talk about them, I say, where did the wires go? When did you start doing that?

Kessler: When we started putting multi-channels into a box. As soon as you have a bunch of wires, they start talking. The first thing you have to do is get rid of all the wires.

Hipps: Well that seems to me to be the number one hallmark of one of your amplifiers, is the cleanliness of the layout.

Kessler: Here's the output right here, this is the output, just two wires, and the input plugs in here, and the AC power from the transformer plugs in here, and that's all there is. The power supply is all integrated into the amplifier, and like I said, as soon as you have wires running around and then you put

the wires from whatever it be, five channels or seven channels, and all these wires are running around, it's the wires that talk to each other most. And by putting everything on the circuit board, once you establish a pattern of the circuit, it's 100 percent repeatable. Wires, even if you dress them, have a tendency to fall where they may. And you can literally move, you can ask Dave, you can literally move a wire from here to there and make a difference, a huge difference. Where here there's no crosstalk or distortion, here you've got distortion and crosstalk.

WSR Reber: You then minimize that in the circuit layout design.

Hipps: In the circuit layout and the circuit to some extent. This is a fully balanced amplifier, from input to output.

WSR Reber: I want to go back to, what is amplifier topology before we address fully balanced. What is amplifier topology? What does that mean?

Kessler: Well, there are different things. The class is part of the topology, and the topology is what you do in that class.

Hipps: How many stages, is it AC or DC coupled, different philosophies in the capacitors, as he was mentioning.

Kessler: Zero feedback versus a nominal feedback, or some feedback, or a lot of feedback, or whatever. It's just the way, within that Class AB there are a million designs.

WSR Reber: But some of those topology approaches are better than others.

Kessler: Oh, absolutely.

WSR Reber: You mentioned that Datasat, you thought, represented the cream of the crop.

Kessler: Well, you know, like anything else, you can't take a whole bunch of new ideas and put it in one thing because you'll never get it to work. You've got to kind of sneak up on things. You've got to say, okay, you've got this working really well, I'm going to try this. No that didn't work, take that back out. I'm going to try arranging this differently. That worked. So it's kind of—that's why, from our standpoint, we've made so many designs. God, I can't even count how many.

Dave Reich: The experience is invaluable. Like you said, you go and pick the best

parts you can find of everything, an exotic crazy-costing thing and put it together, it's going to sound like shit. It might not even work. Compatibility is key between the components, between the stages, that's all part of it.

Kessler: It's like baking a cake, right? You can put one wrong thing in the cake and it's ruined.

WSR Reber: Because you've had this extensive experience at ATI building different designs, you've gained all this experience in what works the best or combinations of components that work the best, and that's what you're putting into your own product.

Kessler: I put everything I know into everybody's product, I really do. I don't shortchange anybody. I think everybody knows that.

Hipps: From my experience, Morris tries to make every amplifier he's designed better than the previous one.

Kessler: No matter who it's for.

Hipps: And some companies might focus on one area more than another.

Kessler: Yeah, they want certain features and certain ideas and stuff. Basically, the deal is that you can tell me what you want it to look like, you can tell me the power you want, the features you want, but I do the design. I've found from experience, especially doing some of Adcom's, they've fiddled a lot, and the more they fiddled, the worse the product got. So I've kind of learned from that, even the stuff we do for Harman, for JBL. They leave me alone. They've just said, make it look like this. And as long as they don't produce problems and it works good and customers are happy and raving about it, just make more. They never tell me they want the circuit like this or they want this like that, never, ever. And that works the best. And I give them the best I can, whether it be them, or Datasat, or anybody else.

WSR Reber: I'm curious, you mentioned features. What features are there in an amplifier other than, some of them have...

Hipps: Can I answer for a second? When we sat down with one of these customers, Morris said, "The fundamental thing you have to decide is, are these going in a rack



ON SCREEN

or are they going to be freestanding?"

Kessler: Well that determines whether you have active cooling or passive cooling. If you're going to have a convection-cooled amplifier like this, you can't put it really in a tight rack. Because you've got to have good airflow from the top and good airflow from the bottom and out the top. If you're going to put amplifiers into a rack system, we have to have some sort of active fan cooling system. And I spent a lot of time coming up with a cooling system that would give the maximum amount of cooling and the least amount of noise.

Reich: I'm also witness to some of the other design decisions. Morris is involved in a project now in which we recognize that movie theatres are going to have unprecedented channel density and the projection room and the rack space isn't getting any bigger. So there's the fundamental decision now, can we put more channels, maintain the appropriate performance, in the same space? Because if you suddenly have a 23-channel Atmos system and you're only set up for 5.1 now, where do you put the extra amplifiers? And that's the fundamental design decision.

Kessler: We're making audiophile-type amplifiers this big. We're making a stereo version this big, it's not in here right now, and then we're taking 16 of those and putting them in one chassis. We're working on a high-power, 16-channel amp...the Crestron was a 60-watt amplifier. Basically, the new amp is the same physical size as the Crestron, but now it's an AB amplifier that delivers 200 watts a channel. That's a big jump, over three times the power in the same space.

Hipps: Another design decision, some of the amplifiers he designs have got built-in compressors, input limiters, power...

Kessler: Well that's for commercial.

Hipps: But not only is it a fundamental decision, now you're spending time refining the circuit. You have to have perfect clip-level detection so you know when to implement the compressor. Otherwise, you're sacrificing power or you're adding distortion. Then you have to have a very sophisticated circuit, which will maintain the output without having it be distorted.

Kessler: You know, the cinema, which you're involved in a lot, is moving slowly but surely, maybe even faster than slowly, into big multiple-channel systems like Atmos, or Aurosound 3D, and the amplifiers required—even our own—required two or three racks of amplifiers. The biggest Atmos system right now is 64 channels. In stereo amplifiers, you'd need 32 amplifiers. Movie theatres aren't going to go for that. But if we have a 16-channel design, now obviously they need

different powers, but we can do a 64-channel Atmos system with only four amplifiers.

Hipps: But set up so that even if the projectionist has got a heavy thumb, he can't distort the output.

Kessler: There's that and also we're doing all kinds of telemetry, where they'll be able in a movie theatre to look at their iPad and see every channel; like you could have a 14-plex with five amplifiers, what's that, 70 amplifiers. You could look at each IP address, see what every channel is doing, whether it's playing, whether it's not playing, whether it's clipping, whether it's in thermal mode, everything, all from an iPad—which has nothing to do with this. But that's the other thing that's being added to amplifiers is all this peripheral stuff.

WSR Reber: Let's talk about your latest Signature 6000 Series amplifiers, which utilize current feedback instead of the more commonly used voltage feedback. What performance difference does that make?

Kessler: Our first balanced amplifiers—bridged amplifiers—were essentially taking the idea of two channels and bridging them. Two channels of an amplifier, a stereo amplifier, for years has been common knowledge and common to bridge amplifiers. The only problem with that is it's very difficult to take two separate amplifiers and bridge them and keep them perfectly symmetrical and perfectly balanced. Balance is a relative word. It's balanced to what, to one percent? To 10 percent? To .000001? I mean, where do you stop, there's balanced here and there's balanced there. With two separate channels we could get a lot better balance by incorporating both those channels on one board, which we've done. Essentially it's a mirror image; one side would be a mirror image. But you still get some—it's made a big improvement but you still get some imbalance with that. This new circuit, which is an evolution of that bridged/balanced design, is kind of the same thing—two separate output stages, and it's still balanced, but it's driven from one single input stage, which improves the balance significantly because obviously the input stage is in balance, which is where all the gain is done; where most of your imbalance would be. The output stages have zero gain. But there's a big problem with doing that. A common differential circuit only has two ports (inputs), and if you want to do balanced in and balanced out, or balanced feedback, you need four ports.

Hipps: So the two ports are what, inverting and non-inverting? Is that right?

Kessler: Yeah, it's the basis of your input. When you do two separate amplifiers you end up with four ports because you have two separate differential inputs. But when you combine them into one, with four ports of

output, that wasn't a problem. The problem is so you use your high-impedance ports on the input and that's okay, but now what do you do with feedback? You have no place to put it. The only way to put it, which kind of, things have to fall into place like any other kind of puzzle, so voltage feedback, which is the typical amplifier feedback, and works and works fine, but would not work in a single input because you have no place to connect it. It's high impedance. Basically, the difference between voltage feedback and current feedback is the impedance that you're driving the feedback into. So the solution was to run the feedback back into the balanced emitters of all four differential input transistors. And you have to do that in a balanced way, and that was the trick. And then what happens is you lose control of the DC offset. So then you need a servo. I'm getting too complicated now. So, essentially everything's a little bit of a tradeoff, but if you find the solution to the tradeoff you really end up with something good. The advantage, by the way, of current feedback is it has a very high slew rate, which is the ability of the amplifier to respond to high frequencies, the speed of the amplifier, if you will. It's almost unlimited with current feedback. It just eliminates that problem. The old amplifiers with slow transistors, you'd look at a sine wave and when they would clip they would lean over, they'd keel over, and they'd keel over because not only were they clipping, they were slewing—what was called slewing—at the same time. That was pretty much eliminated due to the availability of faster, better transistors. Now when an amplifier clips, a good one, you get just a flat line. It doesn't start leaning over. Meaning that clipping causes distortion but the actual signal, the whole signal, isn't distorted.

In the old days you'd clip an amplifier and the distortion would go like straight up right at clipping. Now it kind of sort of goes up and doesn't get into the 20 and 30 percent region. You can't make an amplifier get into 20 or 30 percent, no matter how much you clip it, because most of the signal is still intact because the slew rate's so good. A current feedback amplifier is even better.

And the other thing it improves is you get perfect cancellation of the noise, which you can't get out of even a bridge. You get some noise cancellation but not anywhere near what this can do. This new design is a good 6 dB better.

So there are advantages, but the trick is overcoming—and this is a discussion we had with audio journalist and engineer David Rich—about the advantages of this circuit. We're probably at the limit. I don't know where an AB amplifier can go from here. It's pretty close to the capabilities of the amplifier. But

a Class D amplifier isn't even that close. They may sound good, they may sound okay, but from a real performance standpoint, when you start talking about 20 or 30 dB better single noise ratio that's significant.

WSR Reber: On a lot of amplifier spec sheets you'll see RMS power or it'll be omitted and never mentioned. What is RMS power? And secondly, dynamic power, sometimes they'll say dynamic power. What do those things really mean?

Kessler: They mean a lot. That's another problem with switching amplifiers because they don't work right with high-storage capacitance because they're working at such high speeds. I'm not saying this quite right, but what I'm trying to say is that the dynamic power of a switching amplifier is not anywhere near as high as an AB amplifier. That's number one, basically, and especially the ones that have regulated power supplies because regulating the power supply makes a switching amplifier a little better, but when it hits the rail it just stops.

WSR Reber: So what is dynamic power?

Kessler: Dynamic power is the ability of an amplifier, basically, to reach a much higher power level undistorted, unclipped, for a very small time.

Hipps: Could you say it's the ability to use the power stored in the filter capacitors from...

Kessler: Do you have Jordan's (one of ATI's engineers) measured test results? I don't have them handy, but the AP (Audio Precision) is a real tool because the AP has the ability to measure power in every different kind of way, and I think on the BGW amplifier we were getting 200 watts into 8 ohms RMS. We were getting 260 something

at one percent, at 1 kHz, and then we were getting some ridiculous number, 600 and some watts instantaneously. Basically, it would put out, the AP would put out a pulse and measure the distortion, it's so fast, measure the distortion when it reached one percent and tell you how much power that was. So you can really measure dynamic power accurately. It was huge. But on a switching amplifier it's only a little bit more, it's not a lot.

WSR Reber: And what does RMS mean?

Kessler: "Root Mean Square." It just means continuous power, and then of course the FTC threw in 20 to 20, forty years ago, thirty-some years ago.

WSR Reber: And then all channels driven. That's another spec on a sheet. What does that mean to the consumer?

Kessler: I try to get the maximum efficiency out of whatever amplifier I'm making.

Hipps: But you've got a power supply with every channel.

Kessler: I have a separate DC conversion at every channel. I have a separate secondary winding on the main power transformer for every channel. The only thing that's common is the primary. So there is some sharing. In other words, meaning that if you run all three channels you're going to get a little less power, but not as much in our amplifiers as you would if you only had a single power supply. Obviously, this is more expensive to do. Every module has its own onboard power supply right here on the end, whereas it is possible to make a multichannel amplifier and share the power supply. They turned that, which I consider a negative, into a positive saying, well, by sharing

you're getting the max amount of current to one channel if that channel needs it, which is true to some extent. You're still sharing because the primary is sharing. With this topology, if you will, you get the best of both worlds. You get the isolation of a power supply for each channel, but you do get some sharing from the transformer. Does that make sense?

WSR Reber: And the transformer, what type is the transformer?

Kessler: We use Toroid's.

WSR Reber: And what's the advantage of that? That's the circular type?

Kessler: There are several advantages to a Toroid other than it's trying to put a round peg in a square hole. They're about 40 percent more efficient by weight and size generally, current wise. It's what they call VA ratings. It's about 40 percent more efficient, and also they're a little bit quieter. They have a couple of negatives. They're more sensitive to AC line noise and DC noise because since they're more efficient, any disturbance that comes through the AC line is passed through the transformer at the same efficiency as the transformer is. Sometimes you'll get a noise that comes in on the AC line to an EI transformer and someone will say, "Gee, I have this receiver and it doesn't bother it but I have this high-end amplifier and the transformer's buzzing." Because it takes that little bit of distortion or DC that's in the AC and it can actually be sensitive to that, where an EI is not efficient enough to react. So there are some disadvantages from that standpoint, but overall it's a huge advantage, and we use only Toroid's. And then of course it's the quality of the Toroid, the steel





ON SCREEN

grade that you use, the winding technique, there are a lot of little tricks to everything. Transformers are a whole science in itself.

Hipps: How many transformers have you wound in your career?

Kessler: Making them ourselves? I don't know.

Hipps: Certainly well into the six figures.

Kessler: In audio, audio is definitely a specific transformer. You have to design the transformer for an amplifier; it's a different transformer. My best analogy is a battery charger. Have you ever used a battery charger?

WSR Reber: Yeah.

Kessler: Have you ever listened to one? They just sit there and buzz away. Bzzzzzzz. Well, if you're charging a battery, you don't really care that the charger is buzzing away. And the reason it's buzzing away is because they're running the transformer at its absolute peak efficiency, right before total saturation of that transformer. Well if you do that in an audio amplifier, the first thing the customer is going to do is return it, because my transformer is making more noise than the music. So it's a whole art to make a transformer...

Hipps: It is an art, it really is, there are so many parameters, it's unbelievable.

Reich: Experience counts.

Kessler: ...to make a transformer that gives you the highest efficiency as possible without any noise. It's truly impossible but you walk a tightrope to make that transformer, and any imbalance or problem that comes out of the AC line will cause the transformer to go off the deep end because it's so close. That's why AC power is important. Not all the things that are being sold as improving AC power do improve the AC power, but the AC power is important.

WSR Reber: I know, I use Equi=Tech balanced power systems and, man, what a difference that made. I mean, I can go right up to my loudspeaker, put my ear right next to the drivers and I don't hear anything at the full-reference-level setting with no signal.

Kessler: I'm not that familiar, is it the Plitron thing? Is it a transformer?

WSR Reber: It's a big transformer.

Kessler: It's a big transformer. Well, Plitron is a big transformer.

WSR Reber: Equi=Tech makes professional studio power products.

Kessler: Well, what it's doing, basically, is isolating the crap that comes out of the AC. It's an isolation transformer. And the second thing is it's taking the crap that's coming out of the AC, depending on where you live and how it's generated. Essentially they're not passing it through. But it has losses too. It's costing you some electricity to use that, and that Equi=Tech thing, even if you had nothing plugged into it would cost you your electric bill. You said there's a

switch on there.

WSR Reber: Yeah, power on and off.

Kessler: It's possible that your power bill was more the Equi=Tech than it was your amplifiers.

WSR Reber: It could be, I don't know how to determine that.

Kessler: Well, it's easy because you said you were turning off the amplifiers and your power bill still didn't go down.

WSR Reber: In other words, there's a 30-amp circuit coming in from the street and that's what the Equi=Tech plugs into and then it turns everything into 20-amp circuits and I plug everything into that, and then the power switch is on the front.

Kessler: What you'd have to do...but the power switch on the front is turning off that transformer, turning off the whole thing. Whereas unplugging everything and leaving the power switch on, you probably will still have a fairly high electrical bill, possibly, I don't know.

WSR Reber: I get what you're saying.

Kessler: Because the transformer's still running, even if nothing's plugged into it. It's running at a point of excitation current, which is the amount of magnetism going into the core, that is just before the knee in, and once that core saturates your current, even though nothing's plugged into it, skyrockets, goes straight up. It's basically at that curve, and the problem with that is the voltage is going up and down, which means the excitation current is going up and down. Anyhow, that's a whole other...

WSR Reber: ...different thing. Summarize for me, again, the point-by-point performance benefits of balanced design.

Kessler: With balanced design in general you get double the slew rate.

WSR Reber: And the slew rate is the speed of reaction to a transient?

Kessler: Right. Well, the speed of the amplifiers, per se, so many volts per microsecond. And there is a limit to that. You need a certain amount of speed, where you can do a 20 kHz signal without seeing slewing.

WSR Reber: Please summarize the balanced power approach. Why do it that way?

Kessler: There are a lot of advantages; some are little, some are big. The output stages run at half the voltage, which makes the output devices more reliable because their current capacity is logarithmic to their voltage. You get extremely good reliability by reducing the voltage and you get more power. Nothing's for free, it's all physics, and certainly more complicated. It requires more parts. It requires two output stages. It requires a well-balanced power supply. Everything has to be matched very closely because any imbalance shows up as a problem, so there's a lot to deal with. To control

the DC offset you have to have a servo. The servo has to be designed right—if it's not designed right it pumps, and it causes other issues. This is the servo right here, this whole section here.

Protection circuits have to be doubled up because you've got two outputs just to protect, and the protection circuits that I use...the basic topology for this circuit was developed by Jim Bongorno, but I would say I pretty much completely redesigned it.

Hipps: You also made it practical.

Kessler: I made it practical, more practical to build, I made it more straightforward, and I fixed some issues that it had.

Hipps: It's quieter now too than it was when Jim did it.

Kessler: Jim had it pretty quiet, this is even quieter. There are some trick parts on here. I don't know if you can even see them. These are some special surface-mount differential transistors, which are made in one chip, so the matching is like perfect. If you try to do this circuit with individual transistors that aren't perfectly matched, it probably wouldn't even work, or close to not working. So component selection is critical, and those components had to be made. These chips didn't even exist five, ten years ago. And we're using some old standards, these are the—what do you call these resistors? There's a name for them.

Hipps: Metal film?

Kessler: Well, they're metal film but they're the low- and super-low-noise metal film resistors.

Hipps: Vishay?

Kessler: Well, Vishay is one, but they were originally...what was the original brand? Anyway, part selection is critical. The other thing that this circuit had, which was a real problem, it has just the opposite problem. You know, an amplifier that has a balanced input—what started this whole situation of balanced amplifiers, for me anyway, was the fact that people wanted to use a balanced wire to go from Point A to Point B. They wanted to use XLR connectors because that was considered the best way to get from the preamp to the amplifier. There's one big problem. You're taking a preamplifier, and let's assume for arguments sake not the Theta Casablanca, which is a balanced preamplifier, but everything else out there that I know of, or most everything, is a single-ended preamp. To have a balanced output you have to have a single-ended circuit convert to a balanced circuit, which to me is an issue because you're introducing noise and distortion in this conversion.

Reich: It can only add problems, it can't solve any.

Kessler: Yeah, it doesn't really solve any problems, and you're going from Point A to

Point B, which could be maybe a three-foot cable. And then when you get to the amplifier, assuming it's a single-ended amplifier, you have to convert from balanced back to single-ended right at the input, and we actually make some amplifiers like that.

It seemed totally ridiculous to me that you would convert to balanced, go three feet, and convert back again, you know, with all the issues. Using a regular single-ended RCA to go from Point A to Point B, which for, maybe let's say three feet or even five feet, will introduce virtually zero noise. But the high-end world decided that's the way they want to go. So my argument was, well, okay, it's bad enough you're doing a conversion from single-ended to balanced, but it should stop there. The balanced wires, basically, what you have is a positive signal and a negative signal and you're amplifying the difference, so anything that's introduced to the wire, like hum, would be introduced together to both wires so that cancels out. That's how balanced works. Now, obviously, the longer the wire the more things that are going to be, let's say, have 100 foot—it was invented for telephones, it was invented for microphones. It wasn't invented to go from a preamp to an amplifier because that's only a few feet. But, anyway, if they insist upon doing that, I wanted to keep the balanced mode in a balanced mode all the way to the loudspeaker. That's the whole premise of this. That was more important to me than the fact that, you

know, bridging an amplifier you get more power and all this other stuff, which was maybe good and maybe bad, some of it's bad. But the fact that you're not converting back again to single-ended, you're taking that balance all the way to the loudspeaker, was the only way to go, so we created a new oxymoron. This amplifier, when you do a balanced amplifier, the problem, of course, is, well, what if I want to use an unbalanced input? Then you have to convert from an unbalanced input, you have to convert to a balanced drive, which was really not something I wanted to do.

What you normally do with a balanced drive is you ground the negative signal, and you just use the positive in ground. But that doesn't work on this so I have to include this little relay and a circuit to re-balance the amplifier after the unbalanced screws it up.

WSR Reber: So when you're using a Signature Series amplifier with a Casablanca preamp/controller, you don't have that problem?

Kessler: Yeah, balanced, straight balanced all the way through.

WSR Reber: But you have to come out of the XLRs or the RCAs?

Kessler: No, no, the XLRs are already balanced.

WSR Reber: So you have to come out of the XLR outputs.

Kessler: And you go balanced into the amplifier's XLR inputs and you're balanced all the way to the loudspeaker.

WSR Reber: The ideal connection is XLR to XLR, isn't it?

Kessler: Except when the amplifier really isn't a balanced amplifier. Ninety-five percent of the amplifiers that are out there are single-ended amplifiers trying to live in a balanced world, and you'd be better off—if you have a single-ended amplifier, honestly...

WSR Reber: Just go RCA.

Kessler: RCA out.

WSR Reber: RCA in to RCA out. So you've got to determine that. How do you determine that? Because that's not stated in any specs.

Hipps: You'd have to call the manufacturer and find out.

Kessler: We make amplifiers for other people that are single-ended amplifiers, but they want balanced inputs because that's what the world wants. I have to make an active board on the input that converts the balanced input back down to single output, which is an oxymoron. You're going against the idea, but I have no choice.

WSR Reber: The other thing I picked up on was the power rating. For example, the Classé amplifiers I'm using right now—I use many amplifiers—are spec'd at 300 watts RMS 8 ohms, 600 RMS 4 ohms. What's that all about? The notion is that a really good amplifier will always double the rated power.

Kessler: Well, they won't always double, there are losses. The question is how close you can get to double, and the losses are in two places. They're in the power supply—





ON SCREEN

look it's all Ohm's law, everything is Ohm's law. When you get double the power, you have to double the current. If you get double the current, you're putting double the demand on the power supply. The power supply is going to sag.

In a perfect world, if the power supply was perfect and the output stage was perfect, you'd get a perfect double the power into 4 ohms. So it depends on the amplifier design. The better the amplifier, meaning that it has a bigger power supply, and the better the amplifier has a big enough output stage, yes, you'll get close to double the power. Not exactly double the power, you could get 90 percent of it, you could get 80 percent of it, you'll never get 100 percent on anybody's amplifier.

Hipps: It can also be a numbers game. You can have one that doesn't double down very well, but if its 8-ohm power is a lot higher, you can call it 300 and 600. It might be doing 500 into 8 and 250 into, you know...

WSR Reber: I see, they just don't state it.

Hipps: The marketing guy in the room says the easiest way to double down is to understate the 8-ohm power.

Kessler: To make up that loss, whatever that loss may be.

WSR Reber: So your spec is more true, conservative.

Kessler: Conservative. I like to use 1-1/2 times. That's my standard scenario, which means you're getting full performance at 8 ohms, you're going to get at a minimum of 1-1/2 times to double, somewhere in that range. And that even depends on what's coming out of the wall. If your power's voltage is low, you're going to get less power. That's my argument with these magazines—no offense—that test amplifiers, they don't regulate the AC power, which makes no sense to me. If you're testing an amplifier, and they say, well, it's got 120 volts coming out of the wall, and when they turn the amplifier—especially big amplifiers—and they're measuring at 500 watts, they don't regulate the AC power. The AC power could be 100 volts. And so what they're saying is, well, the amplifier didn't put out enough power, it didn't put out the spec, it didn't make its spec. Well, the only thing that didn't make spec was the plug in the wall. That didn't make spec. The amplifier may have made the spec. And that's a constant argument; I don't understand why they don't get that. You must test an amplifier with a very large variac and monitoring the AC voltage, so if you're testing at 500 watts, you have to bring that AC voltage—presumably undistorted—up to 120, whatever the rated AC is. I don't know a single magazine that does that, and it's so simple.

WSR Reber: You know, my Equi=Tech's

balanced power units have voltage meters, which always show what that voltage is.

Kessler: Does it have taps? Can you change the voltage?

WSR Reber: I never have tried.

Kessler: Does it have a switch?

Hipps: It's not adjustable, though, right?

WSR Reber: I just haven't fooled with it but it's reading out constantly.

Kessler: I'll go online and look it up. You may have good power where you live, but a lot of places don't. We sell amplifiers all over the world—Australia is making me nuts. They have power range from 200 to 260 at any given time.

WSR Reber: Wow.

Hipps: Yeah, it's horrible there.

WSR Reber: All right, well we're getting close to the conclusion here. Are there any other performance features in the 6000 Series that we haven't covered?

Kessler: It's super-low distortion; super-low noise; it's very, very listenable; I mean, the people that have heard it...

Hipps: We've talked about the speed, we've talked about the servo, we've talked about the current feedback, we've talked about the thermaltrak transistors, we've talked about the optically coupled protection circuitry, the only thing you haven't mentioned is no current limiting in any ATI amplifier.

Kessler: Yeah, well, I sort of mentioned, the amplifier runs full, there's no current limiting in any of the amplifiers. There are a handful of ways of protecting an amplifier and all amplifiers have to be protected. Current limiting basically says that you're going to limit the current electronically so that if it ever gets close to or exceeds the safe operating area of the transistor, you're going to just cut the current back. The negative to that is some of these current limiting circuits cause distortion, cause noise, some of them even cause weird oscillations, depending on how they're designed. And the other thing it does, depending on their design, the dynamic power of the amplifier is cut because it's limiting. In all my amplifiers I use an optical coupler. I monitor the output's current optically but I don't limit it. What I do is I treat the output transistor almost like a fuse, meaning a transistor, if you look at a safe operating area, it's based on time, part of it's based on time. It can stand, let's say, for one millisecond, 20 amps. For a half a millisecond, maybe even 40 amps. And for a quarter of a millisecond, maybe even 80 amps. So what I do is, basically, let you exceed the absolute maximum safe operating area but within its time frame. If you exceed that time frame, the amplifier shuts off for 10 seconds and then automatically recycles. So you can actually put a short circuit on the amplifier—try that on some other

amplifiers and see what happens—put a short circuit and leave it there. You can just leave it there all day. So, basically, the transistor turns on for literally a split few microseconds, tremendous current, and then it shuts off. It doesn't burn out the transistor because it's such a short time. Its off time is 10 seconds. Its on time is maybe 100 microseconds, or 50 microseconds. That allows you to give it a lot of dynamic range without current limiting in any way.

WSR Reber: Do you measure each amplifier's performance coming out of the factory here?

Kessler: Oh, absolutely. We measure each module. We don't listen to each amplifier, there are too many of them, too many channels. This is a complete amplifier. All you need to do is plug in the transformer and plug in the load and an input signal. Every one of these go through a whole bank of AP tests, the complete test, before...

WSR Reber: What's AP?

Kessler: Audio Precision. Audio Precision is automated industry-standard test equipment. Especially now, it can test the entire amplifier for every parameter, signal-noise ratio and power, and all those kinds of things, in seconds. So this amplifier, this module is completely tested as a perfect amplifier before it even goes in the chassis. We don't put modules in there and then find out that it isn't working right. We know if there's a problem, we know there's a problem before it even gets to the floor. Then they get put into a chassis, it's connected to its permanent power supply and input connections and output connections, then the whole amplifier is tested on AP again. So they're double tested.

WSR Reber: What's the best way for an enthusiast to approach evaluating an amplifier? Are specifications to be trusted?

Kessler: Well, first of all, the only way is to listen to it, from an enthusiast standpoint. That's the only option they have. That's why there are a million colors. One person will like one color and another person likes another color. The same with amplifiers. We're not going to be able to make an amplifier that pleases everybody. That's why there's still tube amplifiers around and all kinds of things.

As far as trusting specifications, it depends on who wrote them. Most amplifiers—that's why the government got involved. In the '70s the problem was people were building really high-end, beautiful amplifiers and rating them at 50 watts and then you had the Zenith console that was rated at 1,000 watts. You would go into a TV store and say, "I could pay less for this 1,000-watt-per-channel Zenith console with a TV and everything than your amplifier, and

it's got 1,000 watts." Well, finally, the FTC came in and said, "Where did you get 1,000 watts?" "Well, we made that up." Some of them were actually rating the power they were getting out of the wall. They would come up with whatever excuse they could to do that, and that's when the FTC created—you had to list the power from 20 to 20 at a specific distortion measurement. They actually were pretty good with that until multi-channel amplifiers came around because that was no longer a requirement—now they have one channel at full power, the rest at an eighth power.

Hipps: But that's not an FTC standard, it's only a voluntary industry standard. I sat with the FTC when I was chairman of the CEA Audio Division, and they said, "We hear everything you're saying but the problem we have is nobody's complaining."

Kessler: Yeah, so someone has to complain first. But I think they did change the FTC eventually. I'll look it up. A few years ago they made some changes for multichannel amplifiers. I got a letter asking for an industry standard.

WSR Reber: There was one spec I forgot to ask about—damping factor. What does that mean?

Kessler: The damping factor is basically the ratio of the output impedance of the amplifier to the load. Honestly, it's how well the amplifier controls the woofer. It's all about the woofer, in other words, how fast the amplifier will get the woofer back to its

neutral starting point because, basically, resistance acts like a spring. That's a whole thing that Bob Carver did. Do you remember when Bob Carver did this, "I can make my solid-state amplifier sound like a tube amp"?

WSR Reber: I remember that challenge.

Kessler: Tube amplifiers have a very poor damping factor because they're transformer coupled. So, basically, it means that when you play bass and things like that, the woofer's just sort of flopping around, and to some people that sounds good, you know, it's got a lot of bass. Bob Carver took his amplifier, put a resistor, like a 2-ohm resistor insert, which reduced the damping factor to like 2, from 200 down to 2, and the woofer starts going like this, just like the tube amp, and he won that challenge as far as I know.

WSR Reber: Yes, at the time he did.

Kessler: He won that challenge that people couldn't tell the difference of a poorly designed solid-state amplifier and the basic design of a good tube amplifier.

Hipps: Then he had the temerity to come up with an amplifier with that switch.

Kessler: With a switch. He actually said, "You know, I'll make everybody happy. There's a switch on the back of my amplifier," he did it for a few years.

Hipps: The current source.

Kessler: Well, exactly. That's the difference between a current source and a voltage source. He added like a 2-ohm resistor, 1 ohm, whatever it was. You could switch this switch, and if you want to listen to your

tube sound you can listen to a tube sound. It kind of went away.

WSR Reber: You said the best way to evaluate an amplifier is for the consumer to listen.

Kessler: Which is hard to do today.

WSR Reber: I agree. How are they going to do that and what material do they use to really evaluate an amplifier?

Kessler: Well, the material is different for different people.

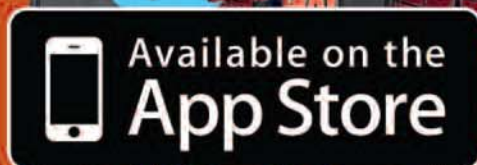
WSR Reber: Morris, do you have any concluding remarks you want to convey to our readers?

Kessler: I've been designing and manufacturing solid state amplifiers since 1962—that's over 50 years. During that time, I've seen the technology move full cycle—from experimental to mature. Today's best solid-state amplifiers, like our new ATI Signature series, exhibit performance one could not have imagined when I started. Distortion at normal listening levels is down 90 dB—less than 0.003 percent. Signal-to-noise approaches 130 dB. And we're doing it with designs that support 5, 7, and soon even 16 output channels on a single chassis. Did I ever think we'd have amplifiers this good? Not when I started. But I'm grateful for the improvements in semiconductors during my working lifetime and proud for the small part I've been able to play in helping perfect amplifier design, performance, and reliability.

WSR Reber: Thank you Morris for a most enlightening and informative conversation. **WSR**

It's Here!

Widescreen Review is now available on your Amazon Kindle, iPhone, iPad, and iPod Touch!



NOTE: iOS subscriptions do not include webzine full-access passes and are completely separate from web and print subscriptions. Subscribe to the print edition for full web-access passes by calling 877 398 3367

Powered by

pixelmags