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Jeff Keith: Create Algorithms That 'You Can't Hear Work'

Jeff Keith is senior product development engineer at Wheatstone Corp.

In the big scheme of radio broadcast audio processing, is there anywhere to go beyond the current state of the art; or have we already made the dramatic improvements that can be achieved without harming listenability? What's the next frontier?

Keith: As we see it, the next frontier in on-air processing is being able to produce the robust on-air sound that PDs and station owners want at even lower perceived distortion.

This means, or at least implies, that some new psychoacoustic tricks will be required, and that's where we'll tap further into how human hearing works. By "tap further into," I'm referring back to our original foray into that frontier, when we introduced our revolutionary 31-band limiter design at NAB 2006. Rather than relying on the oft-used tricks of gating limiter releases and other things to make the action of the limiters less audible, we tapped into human psychoacoustics to create a superior method of controlling audio energy where it is impossible to hear the individual limiter bands of the 31-band limiter work.

Granted, some scoffed at this idea when they first heard about it, but then they discovered that it didn't do what they expected it to do: create squashed, dense and lifeless sound. In fact they found quite the opposite; the audio just opens up and remains louder, clearer and much more detailed.

At one point in recent history we would have said that radio processing was in an "era of loudness." What era are we in now in radio processing, and what does that mean for processor design?

Keith: I think we're still in that era, at least for now. Whatever a station's on-air processor can't deliver in loudness, stations create what they want by goosing up their overall modulation. I've seen stations in the field running 140 percent or higher and crushing the audio at the

> "Two-hundred percent modulation and smashed-to-death audio isn't going to make people listen to a station when it's the programming that sucks."

VORSIS TECHNOLOGY:

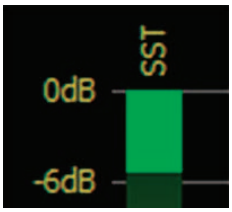
Ultra High Resolution Processing for Competitive Clean (and Loud) Modern Radio

Modern Ears Want Modern Audio:

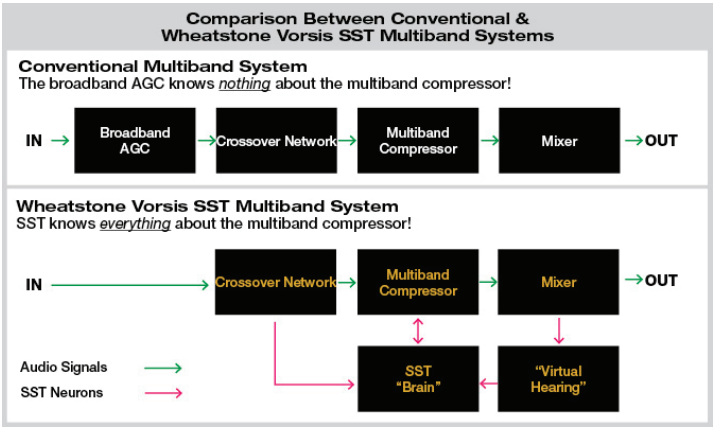
It's no secret that radio has sounded tired for a very long time now. With modern delivery options, exciting new technology and our brains buzzing with fresh ideas about how to use it, Wheatstone thinks it's time to for processors that work in unique new ways to make radio sound better than ever – WAY better. Wheatstone's Vorsis tools help you get the most out of your content, whether it's a minor bass adjustment or a format change requiring an entirely new sound.

There is a Wheatstone Audio Processor for every processing application in a broadcast facility and each has unique Vorsis Processing Tools to help you get the most out of your content - whatever it is. It's a new audience and Vorsis gives today's engineers a modern audio toolbox (a treasure chest, actually) for great sound. Contact Wheatstone for a free in-station demo – listen and see if you don't agree that it's a hugely positive difference whose time has come.

SST:

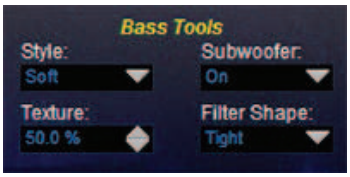


SST, which stands for Sweet Spot Technology, is a different approach to audio level control in an audio processor. SST operates through a proprietary technique called Density Compensation™. This algorithm utilizes real-time analysis of the pre and post-processed audio, and data from the processing controls as the user has adjusted them, to invisibly manage the user set spectral balance and program density. The result is the replacement of the traditional wideband AGC with a device that is smart and truly sentient about audio management. SST can be found in our flagship AirAura X3 FM & HD audio processor and in our FM-531HD audio processor.



Bass Tools/VBMS:

Bass Tools is another Wheatstone Processing exclusive designed to achieve a level of smoothness in bass not possible with other bass enhancement systems. Enhancement is done in conjunction with our 31 band limiter system. The Bass Tools platform is side-chained so you can easily create the type of bass you want and then mix it back into the main program signal. This way, the bass is accurate and consistent, and since it is well controlled, does not add any amplitude to the overall signal. Available as VBMS in the FM-4, VP-8IP and AM-10HD. Available as Bass Tools in the FM-531HD and AirAura X3.



SQ (Super Quiet) Mic Preamps:

Found in our M1, M2 and the new M4-IP Microphone Processing BLADE, our SQ mic preamps ensure that the audio of your talent begins its journey to your listeners in the cleanest environment available. Wheatstone has taken its 30 year history of clean console microphone preamps and married it with Vorsis Processing Tools for EQ, Expansion, Compression and De-Essing for mic processors that have quickly become the industry standard.

Adaptive Filter Banks:

An exclusive to our AM-10HD audio processor, this Vorsis Processing tool automatically rescales the multiband limiter in the AM-10HD based on the bandwidth setting you select for transmission. No longer do you need to "throw away" 2 or 3 bands of a processor when you choose a lower bandwidth; the AM-10HD ensures you get the maximum benefit of our multiband limiter regardless of the bandwidth needed.

31 Band Limiter:

Another exclusive to Wheatstone Audio Processing is our 31 band limiter, found in our AirAura X3 FM and HD audio processor and our FM-531HD audio processor. Championed in our legacy AP2000 processor, the 31 band limiter takes advantage of the way humans hear to limit audio in very few bands at a time. The result? Pinpoint accuracy, audio limiting focused only where needed and an overall audio signal that, at any given time, actually has LESS limiting going on than any other processor on the market. Other cool features? The 31 band limiter can be run in Wide (10 band mode) or Wide & Timbral (where the limiters auto-adjust between 5 and 10 band mode depending on content) or Timbral (where the limiters will adjust to deal with harmonics in the limiter and not in the clipper).

Multipath Limiter:

The Multipath Limiter is a feature designed to create predictable stereo enhancement from source to source and avoid excessive L-R (difference) transmission. Used in our FM processors (FM-4 excluded), the Multipath Limiter allows the end user to limit the maximum amplitude of the L-R signal as a percentage of the L+R signal. The end result helps reduce multipath blend (think car stereos).

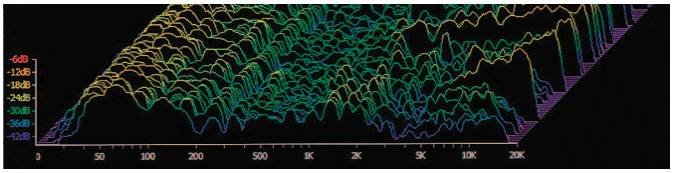
WheatNet-IP:

Every time you turn around, another Wheatstone Audio Processor is streaming audio using WheatNet-IP. First available in the AirAura2.0, Wheatstone Audio Processors using WheatNet-IP now include AirAura X3, FM-531HD, VP-8IP, Aura8-IP Audio Processing BLADE and the M4-IP Microphone Processing BLADE. WheatNet-IP allows you to easily manage audio to and from your processors, adding the power of Vorsis Processing Tools to your entire IP audio network and making them just as flexible as your WheatNet-IP surfaces and controllers!

WHEATNET
THE INTELLIGENT NETWORK

Analysis Tools:

Now it's easy to SEE what you're hearing. Vorsis Analysis Tools give you the ability to visualize the audio created in your processor. For the FM-531HD, these tools include an FFT display as well as our popular 3D Time v Frequency v Amplitude display and many others. For AirAura X3, these displays are expanded upon to show MPX analysis of your AirAura processing as well as giving you the option of inserting an external source to display.



GUI Guru:

Each Wheatstone broadcast audio processor comes packaged with our powerful GUI Guru software. It's as if we sent a processing expert with each box! GUI Guru makes the tough behind-the-scenes decisions based on the simple to use controls supplied for AGC, Compression, Density, Loudness and Bass and Treble controls. Available for the FM-4, VP-8IP (all modes), FM-531HD and AirAura X3 audio processors.

it always starts out as music...

only Wheatstone makes sure it ends up that way.

AIRAURA X3

PROCESSING LIKE YOU'VE NEVER HEARD

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same time. Combine this with lousy-sounding source material (MP3s etc.) and you have a sound that, in my view, does nothing to retain listeners.

Somewhere along the way we seem to have forgotten that it isn't loudness that attracts listeners, it's programming. Give them what they want to hear and they will be your loyal listeners. In other words, 200 percent modulation and smashed-to-death audio isn't going to make people listen to a station when it's the programming that sucks.

How has streaming changed the landscape; and how has your company responded? What makes for a great streamed or digital channel?

Keith: A great-sounding stream requires applying a different strategy than one might use for on-air processing. Because there is a codec involved, and one that's probably running at a lower bitrate than it should be, the audio going into the codec needs to be squeaky clean and well-controlled without the use of clipping. Because of the longish buffering times at the listener's end, "loudness wars" should not be an issue. The use of tastefully done multiband leveling and compression can go a long way towards making a great-sounding stream and one that can be listened to at lower levels (like in an office environment) without the listener missing important content.

What is your latest audio processor introduction, and why is it notable? Is there one feature or processor section that you most want to call attention to, and why?

Keith: Our latest offering is our top-of-the-line AirAura X3. With a completely new low-distortion back-end clipper system and a plethora of other improvements, customers are finding that it's effortless to get the on-air sound they want. Being loud and clean at the same time is easy with AirAura X3; in fact it has surprised quite a few folks when they demo it against top-shelf offerings from other manufacturers. It is very reassuring when someone asks if they can trade in their recently purchased on-air processor of another brand for AirAura X3.

Though not the latest product, one of our most popular models is the Aura8IP we introduced at least year's NAB. Eight independent stereo multiband processors wrapped around a 1RU Wheatstone WheatNet-IP Blade offer a level of performance and signal routing flexibility that cannot be found in any other product.

How would you describe your personal processing philosophy, distinct from others in this field?

Keith: When I first got into radio in 1969 and probably up until sometime in the 1990s, the goals of most radio stations was "great content combined with great audio." I'm not sure what happened, but in my view radio today has morphed into something with a lot less of both to offer to the average listener.

When I visit radio stations wanting to demo our products, I often run into situations where the audio quality coming out of the studio is awful. During one memorable trip where I could tell the audio chain was in gross disarray, I politely asked the engineer, "When was the last time the station ran an audio proof?" His reply was "Oh, we haven't done that in years. The FCC says we don't have to do those anymore." Well, I may be getting old, but to me and as much of a pain as they could sometimes be, audio proofs were how you discovered weaknesses in your air chain before they screwed up your on-air sound. Stepping down off the soapbox now. …

"Our user manuals contain the gory technical details of course; but they also reveal the philosophies of the design and the thought behind and the function of each of the algorithms."

Users are hungry for techniques and best practices. This could fill a college course, but what advice would you offer users who have already chosen your box but want to get the most out of it?

Keith: I know time is short and there is a lot to do in a radio station today, but please find time to read the manual! In those manuals are all kinds of tidbits that may not be discovered by just twisting the knobs (and that goes for every manufacturer's product, not just ours). Our user manuals contain the gory technical details of course; but they also reveal the philosophies of the design and the thought behind and the function of each of the algorithms. Reading the manual will never make you an expert on anyone's box, but it will sure give you better insight into the power hidden inside it than the user across town who has the same product but hasn't read the manual!

Audio quality and distribution formats seem to be all over the place, given our consumption of broadcast radio here,

Pandora there, satellite radio over there, iTunes on a smartphone and high-end theater systems at home. What represents "good" audio anymore?

Keith: What makes and is good audio will always be subjective. I sometimes find myself explaining audio nuances to customers using food metaphors like "what brand of ketchup do you like and why?" "What are your favorite and least favorite spices and why doesn't everyone feel the same way about them?"

Good sound is a personal thing. Knowing what good sound is? That's even more personal. I was fortunate to have been taught good audio by my grandfather at an early age and I continue to appreciate it today.

Ironically, even though I design audio processors and have done so for a long time, I actually don't like "processed" audio. In fact my professional goal has always been the creation of algorithms that "you can't hear work." To me, when that goal is reached we've perfectly matched the necessary mechanics of audio processing to the expectations of the human auditory system, and that's when listeners can listen to processed audio for a very long time without either noticing the processing or becoming "tired" of listening.

I carry that goal forward in every processor that we develop, and if you've ever listened to my factory presets you'll discover what I mean; competitively loud yet without a trace of "processing." That's my favorite sound, and over the years (and at quite a few #1 radio stations) it's served me and the program directors that I've worked with very well.

Can you identify one special station, engineer or programmer who you think is doing a particularly notable job of using audio processing creatively and intelligently? What makes their approach to processing notable?

Keith: I admire the thought, creativity and insight that went into the design of KRTH's (K-Earth, Los Angeles) custom analog air chain. It delivers a unique and smooth sound not found anywhere else that I know of. In my view KRTH's sound perfectly fits their format, target audience and time spent listening goals.

The thought behind it reminds me of the custom air chains that I built over the years where our station needed to create a unique on-air sound that was impossible for others in the market to match. And you know, I think this is what good radio and good audio is all about; it's about giving listeners the content they crave and delivered to them in a way that makes it easy to tune in and then listen forever. ■