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SOUND PROCESSING

A History of Audio Processing

Part 3 – The Era of Multiband Processing Begins

by Jim Somich
with Barry Mishkind

[September 2018] Before his untimely death, Jim Somich and I had a number of conversations by phone and email as we discussed the history of broadcast audio processing and laid the basis for these articles.

We were both involved with the multiband processors that gave radio a loud, clean voice in the 70s and 80s, and we had watched the changes over the years. As before, Jim Somich took the lead on this guided tour. I get to help finish it off as a tribute to a great radio engineer.

On one hand, audio processing can be contrary to the way artists would like to see their music presented. The dynamic range is purposely reduced and peaks are clipped off, losing much of the "openness" and detail of a work.

At the same time, audio processing can make stations much louder – and the reduced dynamic range makes it easier to listen in cars. That makes program directors happy.

Unfortunately, the bargain was audio sounding somewhat flat and subject to nasty side-effects from the processor. For years, artists had to be content that their songs were being played – and hoped they sold well in the record stores.

But a change was coming.

A NEW PLAYER: MULTIBAND AUDIO

Before the 1970s, most audio limiters and processors came from the big companies: RCA, Western Electric, General Electric, and CBS.

However, that began to change, rapidly – and in a big way.

Radio is an exciting business. It is live. It is right now. And stations work hard to grab the attention of their listeners, using jingles, sounders, and a distinctive sound. The pioneers who have led the way were usually an engineer or programmer seeking a different sound – to the point of obsession.

Perhaps you, dear reader, are one of those.

FIRST TAKES

Early experimentation started in the recording industry.

As rock and roll – and 45 rpm discs – took over record companies had a problem. As they tried to make the loudest record in the juke boxes, they needed some way to reduce the excursions from the base line that made it hard to control the cutting lathe. Cutting for too much loudness resulted in either the record would skip or run out of playing time.

Interestingly, broadcasters used at least two other efforts at creating loudness: introducing a peak at 2.5 kHz (or thereabout) – and various methods of speeding up the turntables (did you ever wonder why you kept finding bottles of liquid paper in the Control Room)! None really required actual processors.

WHY MULTIBAND WORKS

The greatest problem with broadband compression is inter-modulation, caused, for example, when a heavy bass line modulates the middle and upper frequencies.

Listeners could literally hear audio "pumping." Abrupt audio spikes can cause the whole audio package to "duck" – or worse – as instruments (violins, for example) would disappear and reappear in time with the beat.

Altec-Lansing built a dual-band compressor in the 1960s that provided the key concept to cure the inter-modulation problem: It split the audio into two bands and processed them separately. The results were far superior to any broadband designs

Altec 9473A Limiting Amplifier

Broadcasters engineers caught on quickly. Split-frequency and sped-up compressors soon followed – with each engineer having his personal "take" on the best attack and release times, as well as crossover networks.

At KDAY in Santa Monica, CA, Andy Laird constructed his own custom two-band audio processor, according to Jim Stanley, who used similar techniques using Audimax III's to build a processor for KEZY in Anaheim, CA.

Lindy Williams' idea was to use dual limiters with different release times, but in his words, "… it was nowhere near as dense and loud as the DAP would be."

MULTIBAND

Real multiband came in 1971.

Mike Dorrough was a young recording studio engineer turned broadcast engineer who was not a great fan of the famous "Maxx Brothers." He especially disliked the way many engineers had been developing Audimax modifications left and right simply for loudness.

Dorrough disliked the severe sonic limitations of broadband audio processing. His passion was to make radio sound better. Not just louder, but better. He achieved success

I (Jim Somich) first met Dorrough in the early 1970s, as he wandered around the country selling his DAP (Discriminate Audio Processor) or trading it for old gear. His business partner, Barry Mishkind (Editor's Note: Thanks, Jim for the hat tip!), held down the fort in LA. Little did I know how his idea would revolutionize the sound of broadcasting.

Even Dorrough could not imagine back then how far we would come in forty years. There is no question that we have better processing tools today than ever before. Yet, in many ways, we are still learning how to use them.

THE DAP

Basically, the Altec compressor from the 1960s provided the idea for the Discriminate Audio Processor (DAP).

Dorrough's first prototype split the audio into eight bands with passive filters, processing the individual bands with SpectraSonics modules. "The Monolith," as this monster was dubbed, was put on the air at KRLA in Los Angeles and the results were spectacular. This 50 kW AM flamethrower instantly became the most distinctive sound on the LA radio dial!

Unfortunately, the box was extremely tweaky, with each song sounding quite different from the one preceding it. They learned two things from this prototype: Eight bands were just too many, and the filter slopes had to be much gentler, allowing the individual band control to be much broader.

And so the three-band DAP 310 was born.

The DAP310

The Model 310 was a three-band processor with FET gain-control elements. The included limiter was little more than a diode clipper. But as the three bands acted independently on the audio, the RMS level was greatly increased, while the dynamic range seemed to stay wide and open. It just sounded good.

Then came a unique marketing campaign. Dorrough drove around the country.

SPREADING THE WORD

Instead of just sending out the processor as CBS did with the Audimax/Volumax, by visiting markets, large and small, Dorrough would not only demonstrate the processor, he would leave it behind so the stations could carefully compare the sound.

In the series of one-on-one, personal visits to scores of engineers and program directors, he would install a DAP in their air chain and let them play with it.

As with the "Maxx Brothers" before, few stations returned the DAPs, and the Model 310 became one of the most popular broadcast processors of its time – with thou-sands sold.

DAPs became an open-secret processing weapon, with different engineers using their own set of special tweaks – chasing it with more sophisticated limiters, adjusting the attack and release, or even running a pair of DAPs in parallel, to smooth the amount of processing on different frequencies.

Dorrough fiddled with the technology, but never achieved another processor that matched the DAP 310.

MORE VOICES HEARD

Spurred on by the success of the DAP, engineers from New York to Canada produced various boxes to compliment or replace some of the DAP's functions. Williams notes, "It was a time when everyone was playing with limiters and were caught up in the loudness game."

Indeed, the real Loudness Wars of the 1980s and 1990s were right around the corner. First, something had to be done about the peak limiters, especially on FM.

THE ORBAN OPTIMOD

While still a freshman at Princeton, Bob Orban decided to do something about how FM stations were processed.

The Stanford engineering graduate had started a small company to build equipment for recording studios, but was dissatisfied with the state of radio audio – FM radio audio in particular.

Up until that time, most FM processors really were AM processors. The result was a low average modulation and a lot of peaks – it was not uncommon to hear an overmod light relay clicking away behind an announcer. Modifications to handle the 75 uS pre-emphasis curve employed on FM were the first thing needed..

In 1972, after experimentation with different products and approaches, including FET gain control, program-controlled time constants, nonlinear smoothing, and a pre-emphasized clipper, Orban built a self-described "contrap-tion," the "Overload Protection System."

Although not yet a complete processsing solution, it definitely stood out on the FM dial when unveiled on KPEN in Los Altos, California.

The Orban Overload Protection System

The big hurdle to overcome in achieving a major advance in FM processing was figuring out how to resolve the significant overshoot caused by the 15 kHz low-pass filters required to protect the 19 kHz stereo pilot region. This had required stations to back down the modulation significantly.

Orban's breakthrough came when he realized that by integrating the FM processor *and* the stereo generator "under one roof" he could effectively control this overshoot, resulting in as much as 6 dB greater loudness on the dial *without overmodulation.*

The whole package came together in 1974 with the prototype: Model 8000.

The Optimod 8000 was the first FM processor with a built-in Stereo Generator

The next year, the Optimod 8000A was released for production. To say it was an instant hit is an under-statement. A radio legend was born! In fact, to this day for many broadcasters the name "Optimod" has become synonymous with FM processing.

The Optimod 8000A

The Optimod 8000A easily made stations louder than anything that had come before with substantially less distortion than the Audimax/Volumax combos. It is a tribute to Orban that there are many 8000A's still running on the air today – over 40 years later.

Orban ended the 1970s by bringing his processsing philosophy to the AM band, with the Model 9000A.

SOUTHERN CALIFORNIA ROCKS

While Bob Orban was making history in Northern California, the tech gurus of Southern California were also hard at work.

SOUTHERN CALIFORNIA ROCKS

While Bob Orban was making history in Northern California, the tech gurus of Southern California were also hard at work.

We have mentioned Stanley. Laird, and Williams. Also active was Greg Ogonowski, who grew up in Detroit in the shadow of great radio stations like CKLW. No other single radio station influenced the way his processors sounded than CKLW.

Ogonowski says “that radio station had a sound that "meant business" and it enjoyed the success that came with it.”

His career took him to the West Coast and some of the biggest stations in Los Angeles – his work included "touching" most radio stations in the LA area. Finding no station in LA sounded as good as CKLW back in his home market did, Ogonowski was inspired to design his own processor.

Gregg Labs began selling the 2510 Broadcast AM Audio Processing System in 1978 – and it quickly became a favorite of stations that wanted their signature sound to include that wonderful bass-end sound that made the music of the time so popular.

The first unit made its radio debut on 94 Fox FM CFXX-FM/CKLW-FM – the first of many stations which rode the processor to Number 1. The low-pass filter became the Orban Optimod-FM 8100 "0" Card. The crossover filter, AGC and compressor time-constants, and low-pass filter designs were then converted to DSP and used for the first time in the Orban Optimod-FM 8200, which made its radio debut on KBIG Los Angeles – and are still in use in all current Optimod products today.

Ogonowski’s major achievement, the 2540, was a five-band AM processor with a novel third-order, time-aligned crossover.

Gregg Labs 2540

It instantly got the attention of the engineering community for its smooth sound, especially on the crisp and clear low end, where many processors simply got "muddy" when doing more than minimal processing.

In short order, Ogonowski's processor design led to many transmitter and STL improvements, because in order to transmit competitive audio, accurate transmission paths are very necessary.

THE AM STEREO CHALLENGE

Because there were five AM Stereo systems competing for pre-eminence, audio processing had to accommodate everything from the Kahn dual sideband (“put two radios six feet apart and tune each to one of the sidebands) to phase modulated L-R to the Harris sliding pilot tone.

The Gregg Labs 2540 processed in both the L and R domains, so that each channel’s output would never reach the -75% threshold that was required by Motorola’s specifications for C-QUAM audio.

The added benefit was a cleaner sound than the matrix processors most of the other manufacturers were producing because the inverse modulator in the receiver’s stereo decoder would not be stressed as hard.

Part of the untold story of how Gregg Labs shaped and molded broadcast audio forever includes how, when WFAN, New York City, was sold, the only piece of transmission equipment specified in the purchase agreement was the Gregg Laboratories audio processor.

EAST COST ACTIVITY

No, we have not forgotten the East Coast advances.

When we return with the next article in this series, we will address what was happening on the East side of the country – and other places – and how the Loudness Wars reached their peak with processors made to squeeze out that last dB of loudness.

Jim Somich passed away early in 2007 at the age of 65. He was actively interested in audio processing, always pushing the envelope at his company, Micro-Com Systems. He also served as Director of Radio Engineering at Malrite Communications, as well as such major stations as KFI, KMET, WMMS, WHK, WHTZ, WJW.

Jim was also very generous with his time, making room to help a number of broadcast engineers to get started.

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