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January 2003
Volume 11 Issue 1

Few people have been building broadcast audio processors as long as Bob Orban. What is it that he has learned in almost 40 years of "pumping up" the audio?

Wanna Take a Ride?

This month, *Radio Road Trip* takes us to Orban, in San Leandro, Calif. Ride along on page 4, as Barry takes us on the first of many interesting visits.

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Radio Guide

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Columns & Articles

Radio Guide

Volume 11 Issue 1
January 2003

Audio Processing

Orban: The Quest for Loud & Clean

Page 4 – Barry makes the journey to San Leandro, California, and reveals the interesting story of Orban, and its founder Bob Orban.

This is the first, in a series of Radio Road Trips, that we'll take you on throughout the year. We'll give you an inside look at some of radio's manufacturers and suppliers – with a bit of their history as well.

Rolling Your Own Audio Processor

Page 8 – Have you ever thought about building your own audio processor? Where would you start? Perhaps it seems like something impossible to do, or maybe it's still a project floating in your mind.

Let's find out what set Cornelius Gould on his audio processor project, and how he managed to put it together.

Crafting Good SCA Audio

Page 12 – Lyle Henry help us to understand the value and the effects of good SCA audio processing and adjustments. Lyle gives us his "Top-10 Tips for Happier SCAs." If you have questions about SCA, the answers are here.

We Are Broadcasting

Broadcast engineering is a curious combination of education, experience, and "feel." More than just a profession, our work and our hobbies seem to come together to create a special sort of craftsmen.

A lot of folks who see this often end up suggesting that in some ways our craft is an art. It is this combination that really ends up defining a lot of what broadcasters do. It is what we are.

I suppose just sending audio through the air, and having it come out the other side – so people can listen in their homes, offices, and in all sorts of mobile situations – is just a tiny bit magical.

It may sound silly, but early in the last century people were actually afraid of radios. Those disembodied voices were hard to explain. When you get down to it, most of the pioneers in the industry really had no concept of what radio would become.

Certainly Audio Processing can be counted as much art as science. Broadcast audio processors have taken stations from an average 30% modulation to where modulation monitor needles seem to be "glued" to 100%. Yet, the clarity and fidelity have improved measurably. And with digital processors driving the new IBOC transmitters, a whole new level of "magic" can be heard.

This issue of Radio Guide has a lot of emphasis on Audio Processing. Pick an aspect, pull up a chair, and enjoy reading about one of the passions that drive your fellow broadcasters to do what we do.

What did you like? What can we do better? Email can go to: radio@broadcast.net. Or send standard mail to P.O. Box 20975, Sedona, AZ 86341 We'd like to hear from you! **Barry M.**

Orban - The Quest for Loud and Clean

by Barry Mishkind

The Optimod 8000A

Bob Orban and the Optimod: From college radio to IBOC.

[Tucson, Arizona - January 2003] From FM college stations, to Internet streaming, to the new IBOC digital broadcasting plans, Orban has been a major force in the broadcasting industry for over 30 years, ever since the Optimod 8000 turned FM processing on its head.

All Bob Orban started out to do was help improve his college station's sound. Since then, it has been a nearly 40 year run of testing, refining and innovation. And the ride still isn't over. As the age of digital audio transmission dawns, Bob Orban and his audio processors continue to focus on refinements to facilitate getting the cleanest audio from studio to listener.

So, how was it an audio purist with 24 patents and an Academy Award to his name – a man who has spent the last four decades building ever more sophisticated audio processors, and who's signature product, Optimod, is known around the world – how did Bob Orban find himself in the middle of Modulation Wars and Digital Shoot-outs? It might well seem to be a contradictory situation.

It was 1963 when Bob Orban was a freshman at WPRB in Princeton. The 17 kW station had no audio processing at all, and consequently, listeners could hear not only the full dynamic range of the music, but also the over modulation light relay clicking away behind the announcer. (This was not uncommon then. Many stations used AM limiters, including the Collins 26U1, well into the 70s.)

Trying out different state-of-the-art processors of the time, such as the Gates "Top Level" and the Fairchild "Conax," it quickly became clear that processing audio on FM – with it's 75 micro-second (μS) pre-emphasis curve – was going to require a different approach.

Using available technology, Orban himself built a self-described "contraption," with a compander and filter that would present a reasonably decent output. Far from what we would call great audio today, it still stood out in those days of minimal processing.

From Research Project to Reality

A couple of years later, now at Stanford, Orban used a class design project to build an FET Limiter with a multiple time constant side chain. Five of these units were built and found their way on the air in diverse places.

The next step was pre-emphasized clipping, which Orban included in a unit designed for a college friend who had bought a local Class A FM station.

The Orban Overload Protection System

Feeding a Collins stereo generator, the OPS was clean, but there was a noticeable overshoot problem which would require some effort to overcome.

At this point in history, AM radio was still getting the majority of attention from most people in the processing field. Indeed, it seemed like engineers were working overtime blowing up transmitters as they brought average levels from 30% up to the 80% range. Manufacturers soon saw they needed beefed up transformers for their transmitters.

CBS Laboratory's Audiomax and Volumax combination (often "sped up") were common in many stations, and a pre-emphasis FM Volumax was produced for FM stations. As the 1970s dawned, Mike Dorrough designed an AM and FM version of a processor called the "Discriminate Audio Processor." The DAP, which broke the audio into three bands, demonstrated that high levels of compression need not result in the "pumping" sound so prevalent on AM radio at the time. Still, FM processors needed to deal with that 75 μS pre-emphasis issue.

Over the next few years, Orban and some friends worked on dealing with the overshoot problem. Eventually, the idea came along to build a complete system which included the stereo generator. By doing this, it was possible to match the high-frequency limiter, clipper, 15 kHz non-linear low pass filters and stereo generator in one box, thus simplifying the setup and adjustment of the entire chain. Using his father's factory resources, Orban produced the prototype unit, and the Optimod 8000 was born!

Optimod 8000 Prototype

Orban showed the unit to Eric Small, who was active in consulting stations, especially in New York City, where the Loudness Wars were starting to heat up on FM. Small's test bench analysis showed the Optimod would give at least a 3 dB gain in average modulation. His response to this was so positive Small wanted to enter into a agreement with Orban to market the Optimod to the broadcast industry.

Production Models Emerge

At this time, it was necessary to bring a more structured entity to control the production. Buying out his father's interest, Orban and partner John Delantoni founded Orban Associates in 1975. Small arranged for the unit to be shown at the Belar booth at the 1975 NAB Convention. The combination worked well. Quite a few folks noticed Orban's product and orders started coming in right away.

The cleanness of the sound and stereo generator were obvious to those that listened to the unit. With CBS Labs being sold and essentially leaving the processing field, the Optimod 8000A was the right product at the right time. They started showing up in stations everywhere. Orban Associates business grew 20-fold in short order, and required a move to larger quarters.

In fact, so great was the acceptance of the Optimod 8000A that the name "Optimod" itself became virtually synonymous with FM processing. Few leading stations would operate without an Optimod on line. Bob's place in broadcast history was assured. There are literally thousands of Optimods on the air throughout the world. It is hard to visit an FM facility anywhere that doesn't have at least one Optimod in the rack.

As the Optimod proliferated, stations tried various combinations to get an advantage over the competition, most of whom were also using Optimods. Various pre-processors were adapted to provide multiband processing and leveling. Orban would incorporate many of these ideas in the trail of improvements that would continue over the years, with the 8100, 8200 and the current 8400 providing leadership in the broadcast audio industry.

Rumblings on AM

While Bob Orban's focus had been largely on FM audio, and how to make his favorite music more enjoyable, the AM stations had not lacked for attention. Dorrough, Circuit Research Labs, and others were building ever louder boxes, seemingly trying to get the modulation monitor need to "stay" at 99% while still having at least more than a "hint" of dynamic range.

Into this fray came Greg Ogonowski. Greg grew up on Detroit radio, especially the audio war between CKLW and WJR. The sound was, as he describes it, "Hi Fi on AM." Over the years, as Ogonowski moved to Dallas, Seattle, and finally Los Angeles, he was aghast at how bad so many of the stations sounded. Building the "better mousetrap" was his goal; improving on the processors at his stations.

1975 was Ogonowski's first NAB Convention. It would have a lasting effect. As the show was drawing to a close, Ogonowski came upon the Belar booth, and remembers clearly to this day how he met Bob Orban, and saw the Optimod for the first time. Their mutual interests proved to begin a long running friendship. It changed his life course.

Starting with the concept that AM had some problems that were very different from FM, Greg focused on how to bring back that "Hi Fi on AM" that had been knocking around in his head all those years. Shortly after arriving in LA in 1977, Ogonowski started Gregg Labs, and began building processing gear, as well as modifying transmission and monitoring gear to reduce transmission overshoot and monitoring errors, among other things.

Greg Ogonowski

Although AM was transmitted without a pre-emphasis curve as FM was, the state of AM had effectively brought about the need for frequency shaping. Ogonowski worked on a five band processor, giving special attention to the low end, as well as the upper range. The result was a crisp sound with a low end that didn't stop.

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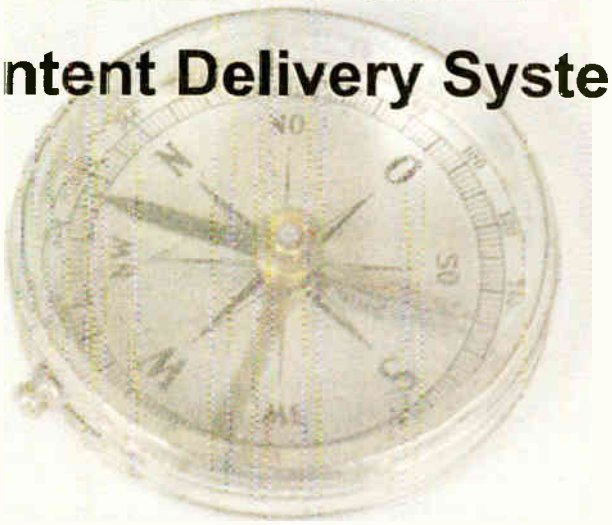

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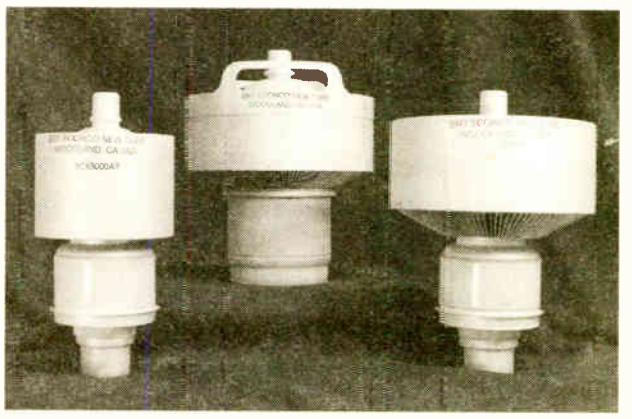

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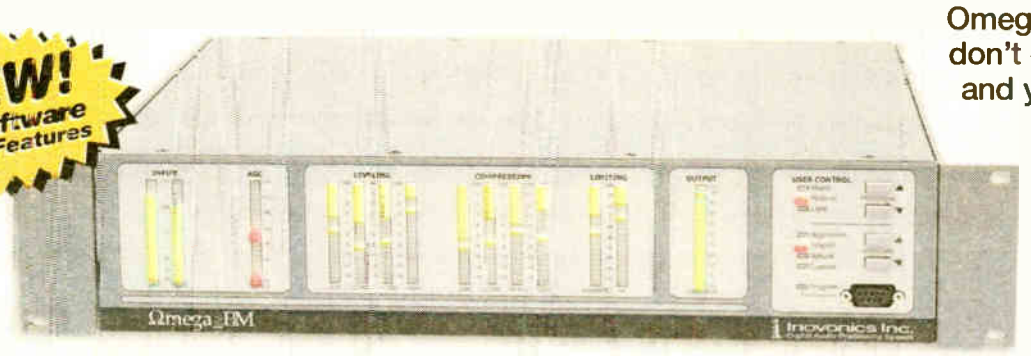

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Orban - The Quest

Continued from page 4.

Car radio manufacturers, however, were moving in the opposite direction, rolling off both the highs and the lows. As modern processors continued to improve their capabilities and boost the high end, the car radios seemed designed to counter the processors. It was almost a standoff.

Ogonowski decided to "take it to the manufacturers," and went off to Delco to discuss not only "détente" between the processors and car radios, but actually how to improve things. These discussions, along with consultation with Bob Orban, led to a paper presented to the Detroit companies, and later on, with Orban, to the NRSC curves that would set a standard for both radio stations and radio manufacturers.

NRSC-1 and NRSC-2 stopped a lot of the endless narrowing of car radios, as well as station processors being set so hot on the high end that audio would "sizzle" onto adjacent channels.

With the NRSC project, Orban and Ogonowski continued talking and consulting each other. Orban brought out the Optimod AM in 1978, and by 1982 had incorporated a number of Ogonowski's ideas in the Optimod 9100. In return, Ogonowski offered his suggestions for the Optimod FM, leading to the "0" card for the 8100, and a number of features in the model 8200.

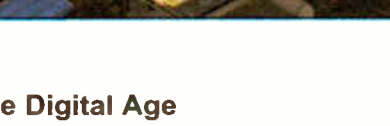
Meanwhile Greg's company, Gregg Labs, was running into a number of difficulties, including the inability to build an FM processor without stepping on patents belonging to Bob Orban and Dave Hershberger. Suffering from financial hassles, and despite developing consoles as well as processors, Gregg Labs eventually closed. It wasn't all a loss, as Ogonowski joined Orban in 1990.

Combined Forces

In 1989, for a number of reasons, including his desire to stay on the engineering side, Bob Orban and John Delantoni sold Orban Associates to AKG. This brought some benefits, as Bob didn't have to give his attention to the business side, although there were also some of the usual corporate inanities that one might expect.

At the factory in San Leandro, CA (near Oakland), Orban continue to produce their lines of processors, and incorporated the DSE 7000 digital audio work station from AKG, and later the Audicy in 1997. In 1993, the company shifted from AKG ownership to Harmon, and then in June 2000, CRL bought Orban. Nevertheless, Orban continues as a separate division, with its own manufacturing plant.

Orban has a full factory manufacturing plant, with machines to load/solder/trim/test/control each part of the process in making each product



Opticodec 7400

Over the years, Bob Orban has continued the progression of improved features in the Optimods, both for AM and for FM. Some of the ideas come from Orban's desire for "purity" of audio, others come from carefully watching the competition. Although having a large market share of operating processors, Orban knows he is not alone in the industry, and with the change to digital signal processing, it is imperative that the Optimods stay on the "cutting edge" of technology.

Optimod 8400

With digital signal processing (DSP), and especially the current Optimod 8400, the customer has a whole lot greater control and more choices to make in setting up the processing. Software downloads can update the processor without having to buy a new box. Orban has several programmers working on the software code, and continues to upgrade it. The Optimod 8400 sports version 3.0 of the software, available on the Orban web site for download.

How do Bob and Greg feel about IBOC? They are solidly in favor of digital transmission, for its ability to put cleaner audio on the air, with less multipathing. They would have liked to see the Eureka system at 128 kb adopted here, which would provide the "next level of audio quality." But, they definitely are supporters for some form of IBOC. On FM, for example it removes pre-emphasis based artifacts

Into the Digital Age

In 1992 Bob Orban suggested that the analog audio processing methods were "mature" and any real major steps ahead would have to come from digital methods. This has proven not only true from the feature standpoint, but as we move toward adoption of IBOC (In Band, On Channel) digital transmission, extremely valuable.

Orban notes that digital processing is a wonderful way to "provide repeatability of settings and performance. With something of the complexity of the 9100 there are already 60 or 70 "tweaks" in order to make it work consistently as expected. The moment you go digital, you solve all those problems." Ogonowski adds, "There are no tweaks, no tight component tolerance problems."

That said, Orban and Ogonowski both point out it also makes it easier for a station to destroy the audio. From their standpoint as "purists," sometimes it seems "the congregation not only ignores the sermon, but goes out to sin again."

This, of course, doesn't stop Orban from building processors with wide capabilities. Clearly, to a large extent, the market is customer driven, as often by programming as by the engineering department. The Optimod 8400 was designed to please both sides of the station.

allows more transparent audio. The Optimod 8400HD is ready for IBOC now, and on the air in Los Angeles. Plug-ins will allow standard 8400s to be upgraded. Nevertheless, Orban expects it to be a tough sell in the marketplace.

After some 40 years of efforts toward providing broadcasters with the tools to make loud and clean audio, Bob Orban is not discouraged that so many stations push the level closer to loud than clean. He just keeps trying to find ways to "narrow the gap" between those two seemingly conflicting goals.

Finally, I asked what Bob's favorite "tweak" to his processor might be, hoping he'd give me a "secret" to pass on. His reply? "Since I designed all the stock settings to make myself happy, I really recommend the defaults!" Ogonowski echos that, since "all the tweaks are now incorporated in the latest models and versions, the best tweak is version 3.0 software."

Processor manufacturers have come and gone. Concepts and ideas have been improved upon, so that broadcasters today can transmit higher fidelity and cleaner audio quality than ever before. As Bob Orban and his crew power ahead into more digital signal processing and IBOC, we can be sure the Optimod will continue to be a driving innovator in broadcast audio.

– Radio Guide –

Rolling Your Own Audio Processing

by Cornelius Gould – *Senior Staff Engineer, Infinity Broadcasting Cleveland*

A 1982 electronics kit, long afternoons playing DJ, and the evolution of a processor.

Have you ever thought about building your own audio processor? Where would you start? Perhaps it seems like something impossible to do, or maybe it's still a project floating in your mind.

Recently, while browsing the Internet, I came across an audio processor built by Cornelius Gould. It occurred to me that it might be interesting to learn what set Cornelius on this project, and how he managed to put it together.

While his processor is not quite the same level of complexity as the digital units found in some stations, the thought processes and considerations that went into construction certainly should be useful in your understanding of what goes into processing audio for broadcast. [Ed.]

[Cleveland, OH - January 2003] Hello! We hope this discussion will grab your interest, as I explain what possessed me to build an audio processor in the first place.

To start off, let me say that I think of myself as more of a never-ending researcher of Audio Processing and audio processing technology rather than a manufacturer. At one point in my life, I looked into marketing audio processors of my own, but dismissed that fairly early on, as it is too far outside my interests as a "researcher." I seem to work best when my interests are in the research and exploration arena.

My processors are always in a continuous state of evolution, never really existing as a 'finished product.' As you can imagine, each developed idea branches into 14 new ones, and each of those takes me to new "levels" ... and so on.

Occasionally some idea of mine ends up in use at one of my radio stations, in the form of a modification of some kind, or even as a black box that sits in the rack and does its thing. Some of my research and exploration does end up being used in commercial processors ... not in some grandiose scheme, but in the form of some little algorithm that is used to create some effect.

The Quest Begins ...

Well, it all started back in 1982. I was one of the lucky kids to get one of those "120 electronic projects in one" kits from my Dad for Christmas. It had lots of circuits, and I played with some, learning how transistors, capacitors and resistors worked. Then I discovered the "Mini AM Broadcast station," and that was the last project the kit ever got configured into.

From there, I started clipping in all sorts of parts to "improve" the performance of that AM transmitter. One day, I made a mistake, and thought I broke it. Since I didn't write things down as I went, I had no idea what the configuration was before. All I knew is that it didn't work. I just walked away to do something else.

When I came back into the room, I went to listen to the radio to see what exciting new songs the FM radio DJ's of 1983 were playing. While dialing through the radio band, I came across a radio station that was broadcasting nothing. I kept it on to see how long it would take the DJ to do something. At the same time, I noticed that I left my AM transmitter on, and went to shut it off. The station on the radio went to static. It was my ... umm ... AM transmitter ... only it was putting out a radio wave on the FM band!

I went to play audio through it, and guess what! It worked. After playing with it a few weeks, marveling at the fact I was on FM radio, I went to intentionally build an FM transmitter, and I learned a *lot* about transmitters during this time.

After my new (intentional) little FM transmitter was up and running, I routinely took it to my friends' houses, where we'd spend long afternoons playing radio DJ's. Not long after, the future step-dad of one of my friends was listening to what we were doing, and came to me and said "You know what you need?" he continued. "You need this thing called an audio processor."

He explained "It automatically controls your levels, and it can make your station sound louder than it really is. A friend of mine is a DJ at a radio station. He showed me one a couple weeks ago. It's really neat. When I saw it, I thought of you."

I pressed for more information. He had me fascinated at this point. He couldn't answer much more except that it split the audio into three bands, controlled the levels of each band, and put it back together again. By doing that, it made the station sound louder. Looking back (this was 1983), what he was describing was a Dorrough DAP-310.

Dorrough DAP 310

At this point, I suddenly knew why my station sounded so wimpy and thin, and was on a mission to somehow get one. After all, how much could one of those cost? Fifty bucks?

My First Compressor

After about a year or so, I found out what these devices cost. Yikes!! "OK, how do they work?" I asked. It looked like I'd have to build one. I started the research, and discovered the concept behind all AGC's – a device called a Voltage Controlled Amplifier (or a collection of circuits that behave like one).

"Cool! But how can I build one?" I wondered. It took a while to figure out how to make a voltage control the volume of an amplifier ... but I did it. That first compressor set me on the path of sounding like the big boys. Almost immediately, I noticed the pumping sound of that basic compressor, so it led to another design involving multiple time constants (keep mind I never saw a schematic, or was even aware this was the holy grail of a good broadcast processor).

All I knew was that mine sort of sounded like other stations, but it was "jumping" much more with gain reduction, and after wrecking my brain for weeks on the issue, the thought of multiple time constants came to mind.

The first successful processor (when I was happy with my multiple time constants) – and the last version in this line – was developed in 1986 as the "AC 302." "AC" stood for "Audio Compressor."

At the same time (about spring of 1985), I wanted my station to be in Stereo, so that was being developed along side the audio compressor project. The first stereo generator I built was a *literal* double sideband, suppressed carrier system, using two tunable transformers and a diode modulator to create a 38 kHz DSB modulator.

I later read, in a library book, the concept of the switching type FM stereo multiplexer, and went to that design as it was simpler and much more stable.

After getting the basic building blocks to the processor up and running, it was time to build a multi-band unit. I was aware that most of the stations I was listening to were using 4 or more bands of processing.

Because of space considerations, a three band design was made. I had these space limitations because the processor AGC's and limiters were all of discrete transistor design. (For some reason, I had trouble getting op-amps to work right, and I dismissed it for the transistorized topology I was more familiar with.)

This tri-band unit was essentially made up of my "AC-300 series" compressors (like the AC-302C I mentioned earlier) slightly changed for multi-band use. I dubbed it the "AC 600" series. It was also used to do "over the top" processing on the liners used for the High School PA based "radio station" of which I was a member.

In 1987, my first Op-Amp based processor was built, and called the AC 700. It was not too good, and was shelved.

No Longer A Home Project

The transistorized AC-302C wideband AGC fed into the three band AC 600, and my switching stereo generator with integrated composite clipping was still my standard setup when, back in 1988, I stumbled across some of the DJ's at WNCX radio here in town.

I decided to let them listen to tapes of my little neighborhood blaster station. I was more interested in their thoughts on my programming, but much to my surprise, they were very impressed with the technical quality of the station they heard in these recordings. The first thing they noticed was the multi-band processing sound.

Continued on page 10.

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Rolling Your Own Audio Processing

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"Are you using multi-band processing?!!?" they asked. "Yes," I answered. They then went "Damn!! That sounds almost better than the stations in town here!" and they pulled in more of the on-air staff to hear the quality of my pirate station.

Shortly after, I was hired onto the staff of the WNCX programming department. Slowly, I realized the things I developed in the basement of my mom's house were very much like the same units in use in the radio station.

The DJ's were encouraging both the General Manager and Sam Cappas, the new Chief Engineer, that I should be in the Engineering Department. Eventually I had my chance, and I was hired on as the new Engineering Kid; they all watched to see how I would do.

At this time, I was routinely building things with op-amps, and decided to build a new op-amp based version of the tri-band. It was a success, and with all the space savings, I decided to finally make it the four band unit I wanted. The multiple time constants got better, and I started experimenting with better crossover networks, as I realized that is where the power lies.

In 1989, my second attempt at an op-amp based processor proved much better, and I gave it a new series number, and it was the first of my processors to carry a name. APS 1000 was the model designation – the name was the "Audio Chameleon." "APS" stood for "Audio Processing System."

During this particular time, I got to play with a few of the processors sitting on a shelf in the engineering shop, and kept commenting aloud why you couldn't do this or that with it, and comparing it with my own. Sam commented, "Then why don't you just sell yours?" It was a radical idea to me when he mentioned it, and I said to myself, "I guess it's good enough for that ... hmmm."

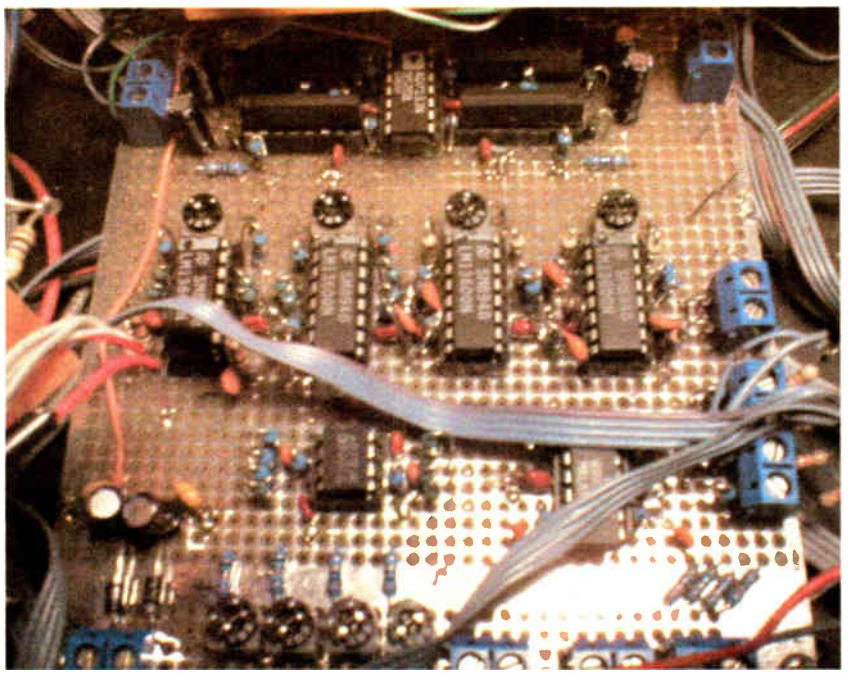
Real World Test

At this point, they allowed me to take over the audio processing on the 5kW AM sister station, WERE. The station needed help in that area and they figured the worst I could do was to make it sound better. Indeed, they were impressed, and within a year I was allowed to make changes on the FM sister station, WNCX. I was now playing the audio processing game with the big boys.

Over the course of that year, my processing construction didn't slow down one bit. I was busily working on a mating multi-band limiter design with a "distortion controlled" clipper and 19 kHz pilot protection filtering for the APS 1000. In 1990 the first successful version was used on a local College Station, WUJC 88.7 FM.

In 1991, I picked up the part time job of Chief engineer for WUJC (now WJCU), and with that achievement, I gained the perfect FM station to test out these processor designs. The APS-1000 was used as the WUJC main processor until 1993.

In 1993, the second generation processor in this new series rolled out of my "kitchen table shop" the APS 1020 "FM Audio Chameleon". It performed AGC, Limiting and distortion controlled clipping in two different boxes. The limiter designs were much improved, with a much better distortion controlled clipper, and excellent 15 kHz pilot protection filtering with minimal overshoots – which allowed for greater loudness, and



The APS-1020, FM Audio Chameleon

a brand new multi-band crossover design gave it a "slick" sound.

There are other controls on the inside of the APS 1020 upon which I exercise my "tweaker".

The APS 1020 saw "off and on" use on WUJC, while the design was being tweaked, before being moved to a bigger station. This is the processor that I used as the "secret weapon" on WENZ 107.9 FM against rival WMMS during the time of the Modern rock format "The End."

I didn't really talk about it much, outside the station, so if you know me and wondered how we got that sound, now you know.

The word did kind of spread about it, and I actually got calls, from inquiring minds, wondering if I was going to sell this processor.

After looking into what it would take to market one of these things, I dropped the idea of selling processors, and concentrated on what I do best... research.

Using The Concepts On A New Level

The APS 1020 was in use on WENZ until October 1996, when I left to work at Telos/ Cutting Edge. I had a lot of fun there, and it was neat to be a part of the team that created the processor that everyone now knows as "The Omnia." The first Omnia featured a couple things that I worked on; one came directly from the APS 1020! But I can't talk about any of those secrets, or Frank will have me silenced! I was at Telos/ Cutting Edge until 1999, when I left to work on a few Internet Radio related projects.

In 2000, the third iteration was developed (the APS 1050 – The Internet Chameleon) specifically for the Internet Radio station my family and I were running at the time. It was later used in front of an Omnia 3.net processor. This was one of the most intense learning experiences I've had since I started out on this journey. Processing into perceptual codecs taught me *tons* of things that, as luck would have it, will be invaluable to me as IBOC rolls out.

The APS 1050 is essentially an APS 1020 with newer VCA's, a much better crossover design, and timing circuits designed to be "perceptual codec friendly." It makes a kick-butt audio production processor, and it sees use mostly in that function today.

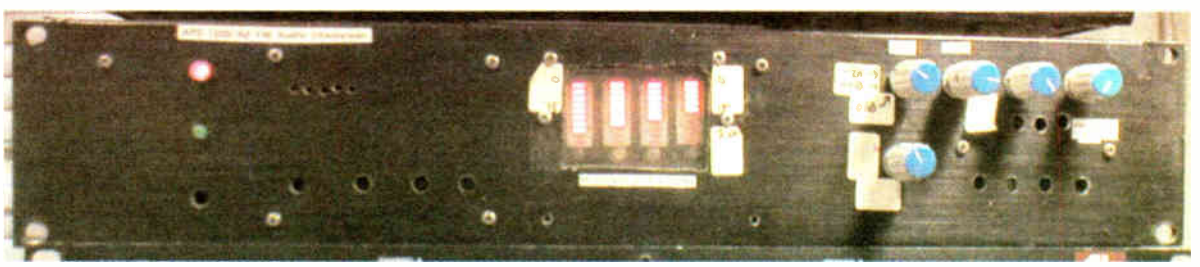
So, there you have the basic map of how I got from "there" to "here." But there is so much about processing to talk about! Over the next months, the plan is to use all my varied experiences to write a series of articles digging down into the why's and how's of Audio Processing.

Some of the topics we can discuss include the tools of the audio processor trade: what the potential audio processing "tweaker person" should have and why. Have you even wondered what is the idea behind the various parts of a modern audio processor? What do we need to know to choose a good one?

As we detail each part of a modern audio processor, and some things you need to know about before adjusting them, we'll answer the question: How does mis-adjusting the AGC's, limiters, and clippers contribute to listener fatigue?

What's the difference between processors for AM, FM, TV? And now, what do we need to know about processing audio for IBOC?

By the time we're done, the goal is to help you understand your processors better, and be able to use the knowledge to better adjust your processing chain so it works the best possible for your format and target audience.



A front panel view of the APS 1050 (a modified APS 1020).
There are some controls on the front panel, drilled in place, in typical prototype fashion.

Questions? Comments? Sure. Let's hear your thoughts, too. I love audio processing, and am always on the prowl for new ideas to try.

Cornelius Gould no longer needs to use his home radio station to experiment with audio processing.

He is the Senior Staff Engineer for Infinity Broadcasting in Cleveland, Ohio as well as Chief Engineer for WJCU 88.7 FM in Cleveland. You can reach him at: ***cg@radiocleveland.com***

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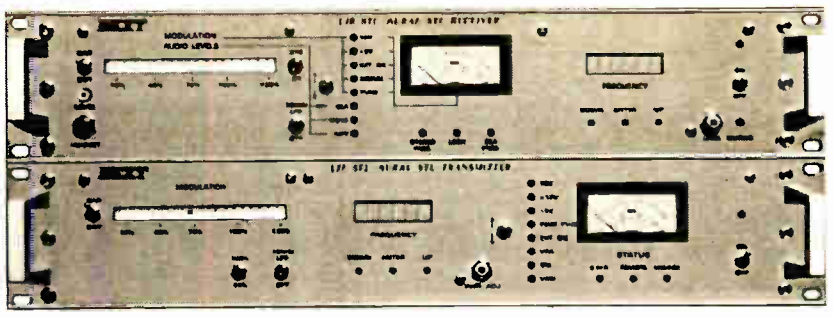

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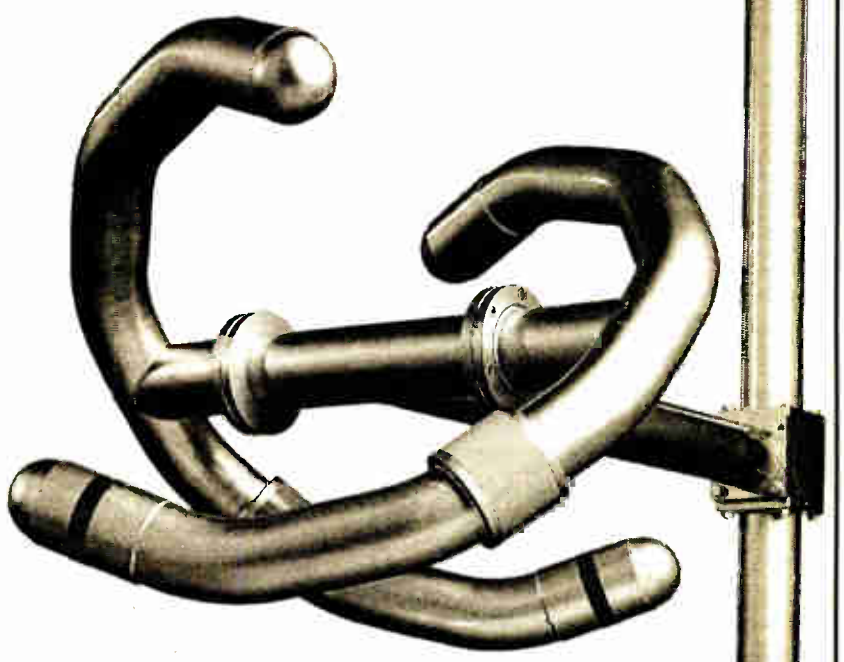

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Crafting Good SCA Audio

by Lyle Henry – *THE RADIO DOCTOR, Los Angeles, Calif.*

Quick SCA Primer & 10 Tips for Happier SCA's

[Los Angeles, CA - January 2003] The process of getting good, clean analog SCA audio processing seems to have some mystery attached to it. Perhaps someone stuck a retired Volumax ahead of an old 67 kHz McMartin SCA generator and the SCA signal sounded lousy, wasn't loud, and got into the stereo or the other SCA channel.

So what went wrong? The SCA signal is FM, after all, but the low deviation, relatively poor signal to noise ratio, and limited RF bandwidth in the SCA spectrum do affect how we process.

A Quick SCA Primer for Broadcasters

The available bandwidth at 67 or 92 kHz on an FM station is only about 20 kHz, and the FCC limits the highest main channel modulating frequency to 99 kHz. These constraints mean we can't deviate a 92 kHz SCA more than 7 kHz (92+7=99), or a 67 kHz SCA to more than 6 kHz, if we want to keep its sidebands out of the stereo, or not trash any RDS or other signal at 57 kHz. Sidebands extending a bit above 99 kHz appear to be OK.

Of course, an FM signal is really infinitely wide, but we can keep most of the energy within a reasonable occupied bandwidth by limiting the highest modulating frequency. For SCA purposes, 5 kHz is the standard cut-off point. This provides adequate audio quality and helps maintain a better Signal to Noise Ratio (SNR).

SNR can also be improved by using steep pre-emphasis of the SCA audio. Standard pre-emphasis for FM is 75 micro-second (μS) in the U.S. (50 μS in much of the rest of the world), but 150 μS has become standard for SCA.

So what we want in our audio processor is a filter to limit the audio bandwidth to 5 kHz along with 150 μS pre-emphasis ahead of the peak limiter. The 5 kHz filtering must be done ahead of the pre-emphasis and ahead of the peak limiting, to ensure that audio frequencies which will not be transmitted do not affect the processor control circuits.

It is best if the 5 kHz filter is even ahead of any wideband leveling (AGC) device – again to avoid any effect on the AGC by intense high frequency information such as snare drums. However, I have used wideband leveling circuits without significant ill effect, where the leveling was at the studio and the 5 kHz filter and peak limiter were at the transmitter or composite STL location.

By far the most popular SCA generator is the Modulation Sciences Sidekick which combines leveling, filtering, and peak control in one unit. It is installed at the transmitter/STL and deserves its wide acceptance and excellent reputation.

The CRL SCA-300 is a filter and peak limiter which can also be installed at the transmitter/STL location, but should be preceded by an AGC at the studio of the SCA client. Aphex Compellors, Orban Co-Operators, CRL Preparation Processors, or any other mono or stereo AGC should be fine for gain riding.

Other combinations of older equipment can be used to good effect as well. Various manufacturers have made SCA generators, but they have no built-in peak limiters. An old CBS Volumax or Moseley TFL-280 can be set for 150 μS pre-emphasis and make good peak limiters.

Since SCA clients typically send their audio to the radio station by a phone line, they should order only a 5 kHz equalized circuit. This is a cheap and acceptable way of creating the 5 kHz filtering needed ahead of the peak limiters so long as the last phone company amplifier is not overdriven causing harmonics to be generated by clipping the audio. Alternatively, an old mono equalizer can often be pressed into service.

Some even have filters built-in, but if not, the higher frequency bands can be set to minimum.

A word about pre-emphasis. The best practice is to have pre-emphasis only in the peak limiter. Turn off its de-emphasis and any pre-emphasis in the SCA generator. Doing pre-, de-, and another pre- is just asking for the circuits not to track and the peak control to be less accurate.

Content, Content, Content

Of course, now that you have nice clean SCA audio, the question becomes – what can you do with it? There has been a huge drop in interest in leasing SCA space in the last couple of years. The prices stations can get are therefore also down.

Foreign language broadcasters are still interested from time to time, but the ones who used to use the most SCAs have been able to lease or buy AM or FM stations. For example; the Chinese, Vietnamese, Korean, and Persians here in Los Angeles. The Spanish speaking community never has used SCA here, but in markets where they do not have a large presence they may be candidates, as would other minority groups.

Sometimes a data application comes along, but most have failed. Seiko's Message Watch service is defunct, and Clariti's digital VOCA Wireless Messaging failed, among others.

Paging never worked that well on SCA because of the tiny antennas that had to be used in the pagers, the RF noise created by the digital electronics right next to the antenna, and the serious effects of multipath on digital SCA transmission causing packet loss as people moved about.

Some services, such as Muzak essentially have gone to satellite delivery. Command Audio (a digital service) also changed its delivery from SCA to satellite.

Modulation Sciences SCA-186

Tips for Happier SCAs

All that being said, here are my Top Ten suggestions about SCA channel usage:

1. Put analog on 92 kHz and digital on/near 67 kHz when possible. 57 kHz RDS is close enough to 67 to be annoying in analog receivers. Digital signals on 57 and 67 coexist nicely.

2. Give SCA clients the injection they need to do the job. You'll just lose them if it doesn't work well. 10% is normal and generally necessary, particularly for analog. Remember that you get to increase your modulation 0.5% for every 1.0% used by SCA services. There's no point in limiting them to say 8% (a 20% drop for them) when it's only an undetectable 1% for you. Neither is there need to save injection for RDS. Since it's phase-locked to the pilot, it does not really add to your modulation unless you run way more RDS injection than you need. 0.5 to 1% seems to be plenty.

3. Run analog SCAs at 6 kHz deviation on 67 kHz and 7 kHz deviation on 92 kHz. This is a win-win. The more that SCA signal is spread out, the less likely that it will show up as a birdie (whistle) in your main channel in areas where you have multipath.

Most car radios blend to mono where there is multipath, anyway, so this is not much of an issue nowadays and does not happen on mono stations. Even in stereo, it's almost a non-issue when analog is on 92 kHz. Stories of SCA birdies mostly come from years ago, are related to 67 kHz, and were sometimes caused and/or aggravated by transmitter mistuning.

4. You should own the analog SCA generators or ensure that the clients use high quality generators such as the Modulations Sciences Sidekick or the CRL SCA-300B. These have excellent peak limiters built in. The CRL needs an AGC in front of it, typically at the client's studio end. Other SCA generators can be used if a good peak limiter is placed in front of them. It should have 150 μS pre-emphasis and the audio input should be band limited to 5 kHz. Modified Moseley TFL-280 peak limiters work well.

5. Be aware of the 'sound' of the digital stream that a digital SCA client will use if you are a talk, classical music, or other format stereo station running light audio processing and have multipath problems. The best digital data stream sounds like white noise, but there are some that are very raucous. RDS itself is a noisy one. When the data stream is essentially white noise, it is unnoticeable in multipath conditions.

6. Have an accurate SCA monitor at your transmitter and another one at your studio. Use a good directional antenna at the studio end or you probably will get inaccurate readings, typically higher than reality. The receive-only Scala log-periodic and the Radio Shack 6-element antennas are good choices. The latest Belar monitors are digitally based and very accurate. Do not depend on older SCA monitors to set digital injection. I've never seen one read correctly.

7. Particularly for analog services, have a decent SCA radio you can use to hear what the signal sounds like. Have one of the client's radios, too. One of their most common complaints is cross-talk from your main channel. The audio output from your SCA modulation monitor may not be the best source to listen to because it may not be band-limited and you'll hear high frequency cross-talk from your main channel that is not audible on normal SCA radios.

8. Keep your AM noise low, but even more important, keep your group delay low through your transmitter. This is mainly an issue with tube type transmitters. The input and IPA tuning will have the most effect. Poor group delay can destroy a digital SCA and increase crosstalk on both digital and analog SCAs. You may not think you hear any effect of poor group delay when listening to your own audio, but get it right and your separation will improve. This is another win-win.

If a high-speed digital SCA client installs equipment at your transmitter which can show raw data errors, you can just tune your transmitter for minimum errors and your group delay will be right.

You can also tune for minimum group delay by removing all modulation from your transmitter. Remember to disconnect the stereo and SCA generators, too. Then use a low distortion audio oscillator and set it to exactly 9,500 Hz. Connect it to the composite input and modulate the transmitter to about 100%. Use your stereo monitor to monitor pilot injection. Tune your transmitter for minimum indicated pilot (which is the second harmonic of your audio oscillator.

9. Be aware that the maximum total SCA injection is 30% for mono FM stations and 20% for stereo stations. The limit above 75 kHz is 10%, so while you may run a 57 or 67 kHz SCA at 20% on a stereo station, you may run a 92 at no more than 10%. Incidentally, a 39 or 41 kHz SCA at 30% is one honking signal on a mono station. Great coverage.

10. Note that some older composite STL receivers have an 85 kHz lowpass filter and therefore will not pass 92 kHz. For 92, they should have a 110 kHz lowpass filter. Older units can be modified, of course. It is normally preferable to inject SCAs at the transmitter, anyway, to keep crosstalk to a minimum and many clients will prefer to not be at the mercy of your STL in case of failure, its being hit by radar or other interference, etc.

Lyle Henry, THE RADIO DOCTOR, in Los Angeles specializes in SCA issues. He can be reached at 323-660-4690 or email at: lylehenry@fastmail.fm

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And You thought Radio was just another job?

Radio War Stories

Attack of the Antenna

by Tom Bosscher

I've heard of transmitter fires, but how many folks have been attacked by their antennas?

Pull up a chair and let grandpa tell you this story. It was around 1977, or so. The station, WLAV-FM. Grandpa Tom had installed a new 400 foot tower, with a brand new McMartin BF-25 transmitter and a brand new 5 bay antenna in them fancy white radomes.

Now keep in mind that the owner had ordered the equipment first, *then* hired the engineer. Grandpa Tom would have preferred other equipment. (In fact, I begged to get a yet then still-called Collins transmitter.)

Everything was fine for a few months. Then I got a call from the friendly neighbor that the top tower light was all white – no red. Great, someone had shot out the lens. Back in those days, the FCC actually mattered so I drove out to the site. From 3 miles away I could see the white light from the tower. But it was on all the time! Great Guns, the flasher had shorted out!

I got to the bottom of the road leading to the tower, and walked to the gate to unlock it, and then it struck me. I *could* see a flashing red globe, maybe 20 feet above the white spot! When I got to the building, it was obvious that I had one bay that was arcing.

The transmitter showed 1.2 VSWR, up from the dead flat. I turned the transmitter off, then back on. The arc stopped. VSWR was normal. I stuck around for a while, and then left.

Next day, the transmitter dumped, and stayed down. I went to the site, and found the VSWR lamp tripped. I reset it, and fired up the transmitter. I figured, I'm going to sit around for a bit and watch this. So I started some needed house cleaning.

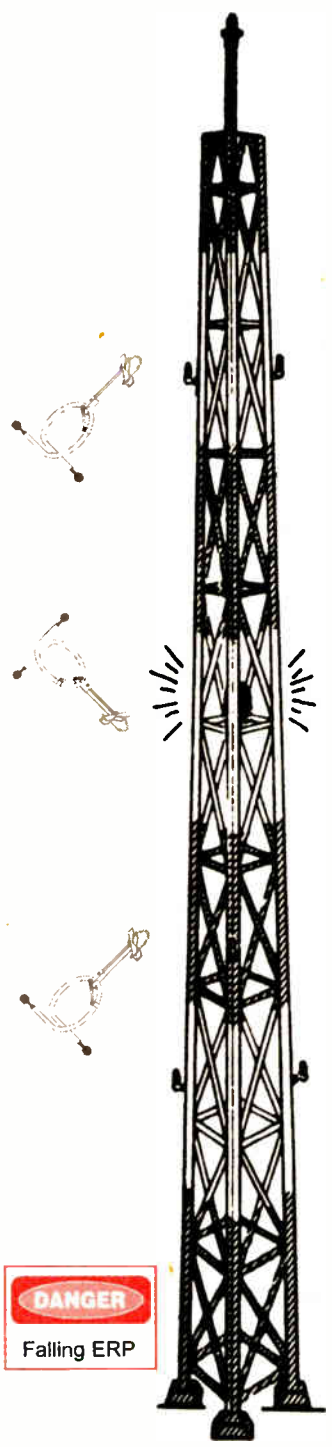
30 minutes later, as I was sweeping dust out the door, I heard the transmitter cycle on and off. A quick glance across the room showed the VSWR lamp lit up, but the last recycle held the transmitter on the air.

I started walking out the door, when I heard a whining, shrieking sound. 10 feet from me, landed a smoking piece of brass and copper. I glanced up, and I saw not one, but two white radomes ON FIRE floating down!

I was under attack from my antenna! I dove back into the "thank God it's concrete"; building, and waited. 2 bays worth of copper and brass, and two burned up radomes were sitting just a few feet from my truck. I waited – I waited some more – I waited even longer. With my eyes up towards heaven, I walked out of the building.

I ordered out an exact replacement antenna, except that I specified no radomes. When the replacement arrived, it's helix spacing was twice that of the burned up antenna.

I'm convinced that I had originally been shipped a low power antenna, and had been running my 21 KW TPO into it. The replacement antenna held up.



Tom Bosschler is Director of Broadcast Engineering Services and Technology at Cornerstone University in Grand Rapids, Michigan, which includes WCSG, WAYK, and KTEO.

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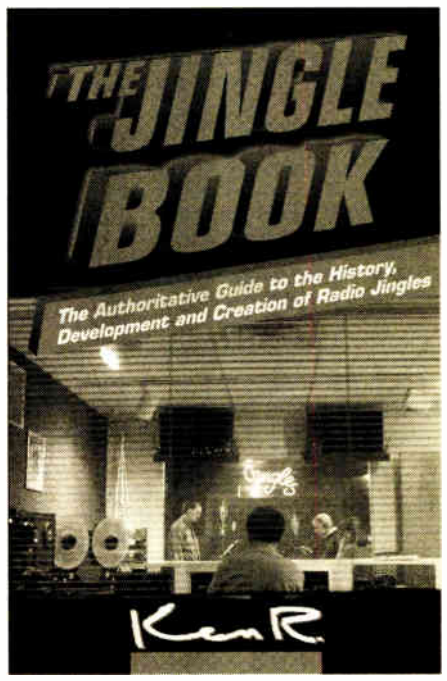
RADIO THAT SINGS

They range from short "shouts" of barely a second ("More Music," "Yesterday") to phrases you can't get out of your head ("All hits all the time," "Radio a go go!") to literally "song length" of several minutes, but radio jingles not only identify the station, but give it a definite personality. An outgrowth of commercial music, radio jingles have a lore of their own, as well as aficionados and collectors. They include names broadcasters will long remember, like Pepper-Tanner, Johnny Mann, TM, Heller, JAM, Anita Kerr and PAMS.

Recently the current owner of PAMS, Ken R., published a book that details the history of the radio jingle industry, as well as lot of the story behind how some of the most famous jingle packages were created.

The Jingle Book takes you back to the days in 1963 when Ken R. began collecting jingles. Ken talks about how his life was molded by his passion for jingles, leading to his eventual purchasing of JAMS from bankruptcy in 1980. Using those 5,500 tapes and tracks, Ken spent 20 years selling "re-voiced" jingle packages, and even now has a brisk business selling CD compilations to collectors and jingle enthusiasts around the world.



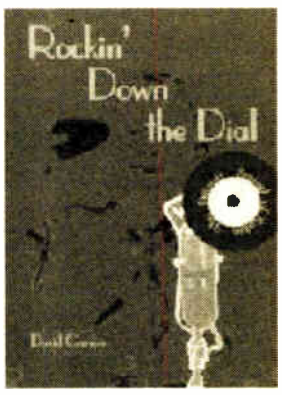
In the book, you'll learn about the radio jingle industry from its beginning. Ken R. profiles and interviewed many of the folks who had an important part in the process, and describes in detail the process of creating and producing the jingles themselves. Included is a CD full of jingles from over the past 40 years.

Even better, there are many stories told in the book about the folks that used the jingles, the successful packages, and the bombs. There is even a lot of jingle trivia sprinkled throughout the book, and you'll learn things with which you can stump all but the most obsessive PD. When was the first radio jingle produced? And, did you know the famous Johnny Mann a capella jingles were not planned that way, until a musician's union strike intervened. There's a lot more waiting for you to find in The Jingle Book.

The Jingle Book was produced by Ken R. and is available on his web site: **http://www.kenr.com/book.html**

MOTOWN RADIO ROCKS

If you have jingles, can disc jockeys be very far behind? David Carson's book, Rockin' Down the Dial, published by Momentum Books, takes you into the studios of the big stations in Detroit. Just like Motown Records produced a clearly identifiable sound, the radio stations of the Motor City had their sound, too. Dick Purtan, Ed McKenzie, Casey Kasem, and many memorable people sat behind the microphones of the Detroit stations.



Covering the period from the mid-1940's through the 1970's, Rockin' Down the Dial takes a look at the people and their relationship with the market. From the payola scandal to the days of the programming consultants, Carson tries to explain how the formats came about, and why some of the announcers resonated so well with the people of Detroit. (A curious example, Dick Purtan, a longtime Detroit "star," was completely unwelcome in Baltimore, and was asked to leave. Back in Detroit, he was a hero.)

Those who traveled around the country in those days could describe the sound – the people, the jingles, the reverb, the contests – all things that marked Detroit radio. Of course, there was also the "Big 8" from across the lake ... but wasn't CKLW as much Detroit as the WXYZ, WJBK, and WKNR?

Rockin' Down the Dial isn't the story of all the Motown stations like WWJ and WJR. Focused more on the music and personalities of rock and roll radio, the book gives a good flavor of what it took to win the market, taking no prisoners, as they say.

You can order Rockin' Down the Dial, from Momentum Books at 1-800-758-1870, or online at: **http://www.momentumbooks.com/**

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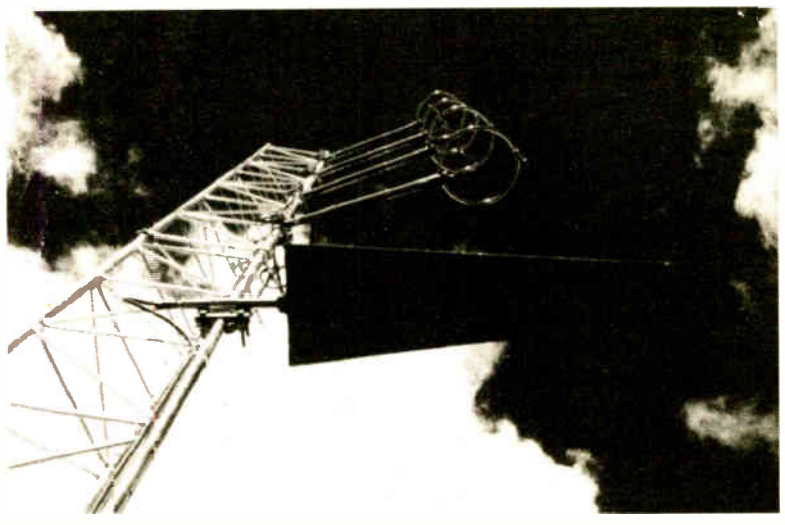

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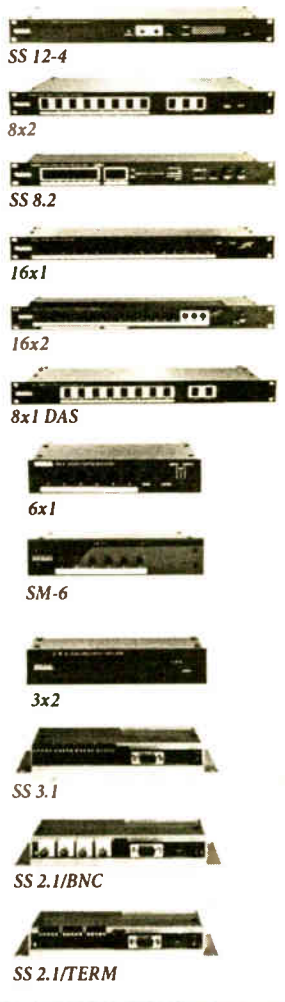

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The Business of Contract Engineering *by Bill Bordeaux*

Contract Engineer

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Like most full time chief engineers, the stations I worked for depended on me to keep their technical plant, and sometimes their toilets, running smoothly. As much as I disliked it, I was the "go-to guy" around the station when an electrical or mechanical thing wasn't working. And who better to get to put the lights on the Christmas parade float?

Later, when I transitioned to a contract engineer and was paid by the hour for my technical expertise, the station management went though the roof when they saw my bill and the items listed on it. From that date forward, no more remotes, changing light bulbs, or unplugging toilets. Turns out the local plumber likes to trade out his services for a little airtime! Imagine that.

While some of these activities may not be the best use of your skills as a broadcast engineer, they may offer opportunities for expanding your business base. I'm not suggesting offering plumbing services, but there are quite a few areas that overlap the true engineering services you offer as a contract engineering business.

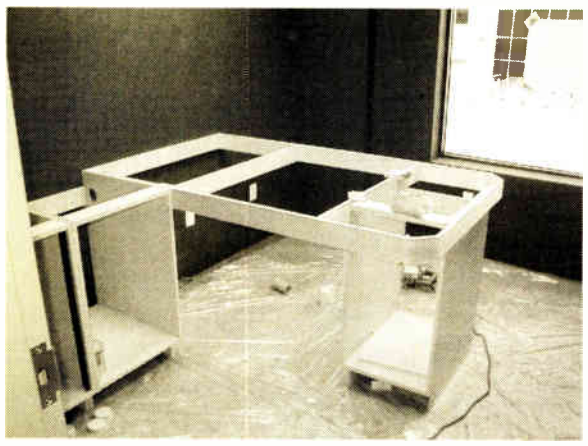
Before we kick around some ideas for sources of revenue beyond transmitters and studios, it's important to remember that if you are working on a contract for a fixed monthly or yearly amount, these "extra" services will be just that.

If your contract calls for you to bill your client on an hourly basis then these services can be wrapped into your regular bill. This isn't to say that you can go about tacking on extra items without the consent of your client, but if a need arises, your client may appreciate your ability to be a "one-stop" shop to solve his technical problems.

Project Management

Construction projects involving broadcast stations are always strange ducks. There are a lot of little items that most architects and construction contractors have never seen or heard of. A contract engineer is in a unique position to be the facilitator between the client and a construction project.

Even something a simple as moving a wall, or adding a window to a studio can be full of problems for the contractor. He may not know or understand the needs for insulation and isolation, or "what's this conduit with all the big fat wire in it?"



To stay on time and on budget, we designed and built these studio tables using off the shelf components from a local home improvement store. A local cabinetmaker completed them by installing solid surface material on the top of our completed tables.

We recently managed a project for a client to be sure that their wishes were fully realized by the contractor. We initially spent quite a bit of time with the client to be sure we understood the scope of the project and all of the details involved. We then were the single point of contact with the contractor, which allowed our client to focus on running their radio stations.

We would meet occasionally to offer updates on progress and get clarification on issues, but for the most part we followed the contractor around to be sure they were doing their job properly. At the completion of the project, the client was happy with the results and we were happy to be compensated for our expertise.

Light Construction

Sometimes, by the time you get done explaining how you want a small project done, you could have done it yourself. We're lucky to have employees that have a wide range of skills beyond that necessary for broadcast work. Often, we'll take advantage of that talent pool by doing some of the light construction that is necessary to complete a project.

Installing a new tube in a transmitter one day and pouring concrete the next. A talented work force will always stay busy.

We've dug holes for satellite dishes, built and poured pads for generators, built studio cabinetry, built studio partitions and installed air conditioning systems. Of course you need to stay within the limits of your expertise and take care of the proper permitting on any job. In many cases we found ourselves up against deadlines that couldn't be met by contractors and ended up doing the work ourselves.

The results were on time and on budget and frankly were much easier to manage since we understood all of the special requirements of a broadcast facility. I can't tell you how many times, over the years, I've had to intercept an electrician as he's flipping breakers off trying to locate a circuit.

Remotes

Most of our clients have trained promotion staff to handle remotes so we don't have a lot of business in that area. From time to time, when a client has a very high visibility remote, they will ask us to be present at the remote to be *sure* it goes properly.

Depending on your location and number of clients, expanding into offering remote setups might bring in extra revenue. Maybe extra headaches too. Remember that many remotes are on weekends or nights, and you may need to hire extra part time help to take care of set ups.

I'm always concerned about spreading my resources too thin. There's nothing worse then being out late at a remote and have a transmitter go off the following morning.

Equipment Rental

Clients are always strapped for cash and on limited capital budgets. When the latest, greatest piece of processing or remote gear is introduced it may take a year or more to work it into the budget. In the mean time a competitor my have coughed up the cash and is already taking advantage of the new gear. Here's where your friendly contract engineer may be able to help.

By maintaining a line of credit with your local bank, you will have the opportunity to buy a piece of equipment and lease or rent it to your client.

Nothing's more fun than installing a new transmitter that you're leasing to a client!

There will be a little bit of legal work for your business attorney to do but in the end, you get to install some new equipment and make some money off it as well.

Information Technology

Many contract engineers are already offering IT services – sort of by default. With some clients they are only to happy to trust their IT problems to someone they already know and trust. In our experience, it makes our jobs easier to be able to offer IT services along with broadcast engineering. We don't have to wait for the IT guy to show up to get a job done, and since we've configured the networks and computers troubleshooting is much faster.

If your business can support it, an IT guy with an interest in broadcast can quickly be brought up to speed on the broadcast end of things. Or, if not, consider sending your existing engineers to a local course on IT and head them down the road of certification.

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Answers to the EAS *by Clay Frienwald with Barry Mishkind*

EAS Q&A

EAS Procedures and Paperwork

As we move into the new year, this might well be a good time to take a few minutes (or more) to review each station's EAS procedures and paperwork, to ensure they are kept up to date and complete. As has been noted in the past, proper EAS operation and logs are primary concerns the FCC looks at when they come knocking. They are also proving to be a big money maker for the FCC – and a big money loser for those broadcasters that continue to be caught 'sleeping at the switch.'

Let's take a few moments together to review the essentials, and make corrections where necessary.

Barry: Clay, in a nutshell, what are the RI's looking for when they come to the station?

Clay: This one is hard to answer, as each inspector operates a bit differently with various levels of 'EAS Savvy.' You can be assured of one thing: EAS *really* is near the top of the list of things that the inspector will be dealing with. One look at a recent listing of station NAL's should quickly demonstrate that fact.

Here's a quick checklist of some items and procedures I think a station would be wise to ensure the staff fully understands and complies with:

1. Logging

I recommend each station have an EAS log that records all the station's EAS activity, in particular:

RWT's (the Required Weekly Tests). Ensure there is a log entry that you transmitted the test. It's a good idea to make sure the tests occur at different times and days ... so these tests are indeed "random" within the week.

Receipt of RWT's. Since each station is responsible for monitoring two 'sources,' this means there should be – at least – TWO RWT's logged as being received each week.

RMT's (the Required Monthly Test). Log who you received it from, and when it was re-transmitted.

Actual EAS message transmissions. These are the real "events." And, don't forget, real event use of the EAS counts as a test, and may replace the RWT during that week.

Trouble reports. In the event you do not receive the RMT or RWT's, you *must* have a log entry stating why you failed to receive it! This means you are obligated to do some investigating to determine what the reason is – the more details the better. Don't just leave the line blank. Call upstream and find out. It could be you will help another station isolate a problem there.

In the evet your EAS box is out of service, your log should have lots of details about this. When was it removed? For what reason? When was it returned to service?

The RI will likely be impressed with a complete set of instructions.

2. Staff Procedures

It is one thing to have told the station's operators about EAS procedures, but it is quite another to supply them with well organized, informative and easy to understand instructions how to handle EAS testing, as well as what to do in the event of actual use of the system. It would be a good idea to have separate sections dealing with EAN and the other required stuff, as well as other voluntary aspects of the stations involvement, that is Weather, State and Local use of EAS. The RI would likely be impressed to find a rather complete set of instructions.

3. Monitoring

Many stations are not aware of the fact that either the State EAS Committee (SECC) or the Local EAS Committee (LECC) are the source of monitoring assignments. Those groups determine what you are to monitor. These assignments are usually found in one of these plans.

The FCC will want to know that you are indeed monitoring the correct sources. I recommend these assignments be posted at the control point, or on the face of your EAS decoder for all to see. In many cases I have asked a station who they are monitoring, in my work as State Chairman, just to discover that no one in the plant has a clue.

So, to summarize, the station should have at the control position:

1. Station's EAS procedures for handling tests & alerts.
2. A copy of the FCC's EAS Handbook .
3. A copies of the State Plan.
4. A copy of the Local Area Plan.
5. A notation of the sources being monitored.

While we are at it, it should be noted these monitoring assignments are enforced by the FCC ... and they expect you to be in compliance. For example, if you are assigned to monitor NWS and discover the little telescopic antenna on the top of the weather radio will not pull in a decent signal, and you are missing tests from NWS, expect to pay the consequences.

Stations have been 'nailed' by the FCC for failing to install an outside antenna. The FCC assumes you are working with these EAS Committees to the degree that the monitoring assignments are being complied with. Further, they rightly assume reception problems have been ironed out long before the inspector crosses the threshold.

EAS procedures should be treated very much like other situations that are not encountered very often, perhaps like tower light monitoring and reporting procedures. Ignorance of the rules, or failure to obey them, can cost the station plenty.

In other words, repeated training and testing may be necessary.

4. Installation Issue

The EAS 'box' should always be installed in the program line, ahead of the audio processing equipment and *NEVER* connected to an input on the stations audio console.

If the station operates un-attended, this is a given, but for those that are normally manned, I maintain you are not in compliance unless the unit can function automatically. The rules require that should an EAN be received all participating stations are to immediately stop normal broadcasting and start airing the feed following the receipt of the EAN. If the station's control operator is out of the studio taking a smoke, or answering the call of nature when the EAN is received, the station is in violation of the Rules.

Barry: And it also prevents another really annoying situation: the one with the RMT or EAS message that fails to include the EOM because the DJ potted the EAS machine down, "locking up" the other stations, forcing them to rebroadcast the originator. This situation has made more than one Program Director angry enough to contemplate ending his voluntary participation in the system.

Clay: That's true. And, while each time it is truly an "accident," it can really weaken the EAS's value in a market.

Barry: Well, it would seem that following the checklist you outlined will prevent a lot of problems.

One more operational question: if a station is automated, who is responsible for running a test if the RI comes in and asks to observe a test of the system?

Clay: The licensee of a station is always responsible for their ability to demonstrate compliance with FCC rules. The FCC has said there should be at least one management level employee and a support employee at all stations during normal business hours. Anyone in charge of the station when the RI arrives should be able to run tests, have knowledge of monitoring assignments and whereabouts of logs and other requirements on the EAS self-inspection checklist. For those automated stations, this means more than just the DJ's must receive EAS training.

Barry: Speaking of understanding the system, which version of the EAS Handbook should be in the control room? Have there been any recent updates to the FCC EAS Handbooks?

Clay: Barry, at any given moment, this is a 'relative' question, as updates can and do occur. The latest version of the AM/FM Handbook at **http://www.fcc.gov/eb/eas/** is currently labeled "2001." I'd advise any station to periodically go to the FCC's web site and download the latest version in order to *make sure* that the version they have is up-to-date. After all, it's better to be safe than sorry.

Barry: Should each station in a cluster have a separate copy?

Clay: This is my recommendation. However, it has a lot to do with the way a facility is laid out. What you want to avoid is having the instructions for dealing with EAS 'somewhere else.' Not only does this create an operational problem for the operators, but could create a serious problem for the station when the inspector starts asking questions and the answers are not 'at hand.'

Barry: I also notice the FCC EAS web page contains a link to a number of state and local plans.

Clay: That's right. This makes it very convenient to get the latest version of your state and local plan, if the link is there. The FCC will add links for any state or local EAS committee sending the information to the FCC.

Barry: The FCC released a Report and Order on October 24th that all LPFM stations should take special note of. What is the import of this R&O?

Clay: The FCC has determined Low Power FM's really have no need to initiate EAS messages. Therefore, they are permitted to install a decoder only, as opposed to the conventional EAS Encoder-Decoder that is the norm in most stations today.

Barry: So, if they won't originate alerts, it makes sense the LPFM's will not have to send the RMT and RWT's. This should save the station some money, as opposed to installing a standard EAS machine, right?

Clay: For the LPFM station, this is usually the case. Theory says that if an EAS unit does not have to contain message origination ability it should cost less. I have no idea of the pricing of these units, but there should be some savings.

Barry: What if an LPFM wants to be an LP-1 or LP-2 in an area? Is this possible?

Clay: Due to the low power status, it is going to be hard for an LPFM to "reach" other stations in an EAS area. So, they can't really serve as an LP-1 or LP-2 unless they have installed a full featured EAS unit and are vital to the success of EAS in that area.

Barry: Any final words for those who will take the opportunity to check their EAS system and ensure it is operating properly?

Clay: Barry, in thinking about your questions this month an old saying comes to mind: "It's better to be safe that sorry." The FCC has recently moved beyond 'hand-slapping,' as the increasing number of reports about NAL's underscores.

I encourage stations to go the extra mile in their efforts at EAS compliance. Unfortunately, there will always be some stations that can never find the time or money to do it right ... but in the end, they can always find the money to pay the fine.

Clay Freinwald, Senior Facilities Engineer for Entercom in Seattle, is Chairman of the SBE's EAS Committee as well as chair of the Washington State SECC. Please feel free to address your questions about EAS to Clay at radio@broadcast.net.

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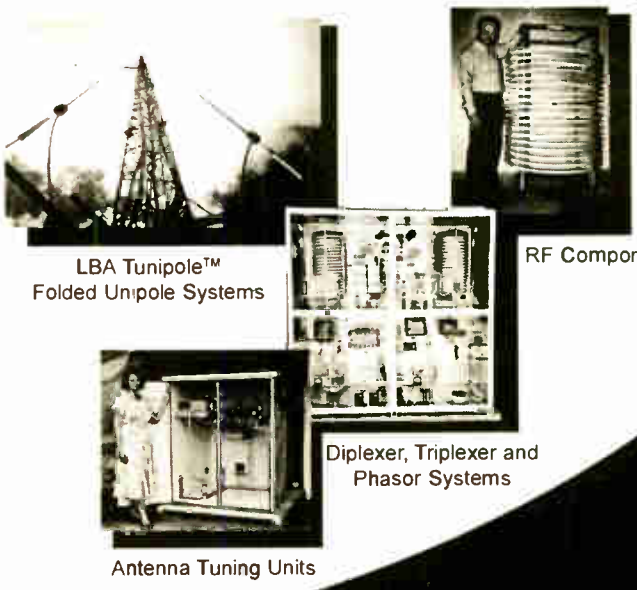

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KISSing with the Omnia-6FM

A user report by Mike Callaghan

[Los Angeles, CA - January 2003] Frank Foti and his crew haven't been lazy in addressing the improvements Bob Orban's made to the Optimod. The latest version of the Telos Omnia, the 6FM, brings a new set of features and flexibility to FM Audio Processing.

Telos Omnia-6FM

Two display screens monitor the settings and performance. Setup is easy and intuitive, and Telos has even licensed the Dorrough Peak Meter algorithm to help in making adjustments.

The venerable Jogwheel was retained from earlier versions, to set the unit up. Among the improvements to the design, the Omnia-6FM now has 5 bands of compression and 6 bands of limiting. Each parameter is adjustable, and while a series of presets set up some starting points, you're encouraged to experiment from there.

Unlike some processors that limit the range of controls to avoid producing 'bad audio,' the Omnia-6FM will let you get into serious trouble. However, even if you make a wrong turn, the presets will quickly get you back on safe ground.

A Processing Education

The manual provides detailed information not only about each of the settings, but it also tells you how to combine multiple changes to obtain an overall effect. Detailed instructions explain how to interpret the different metering options, and help you to understand what's being done on a moment-by-moment basis. An important point is emphasized – make your changes in small steps and evaluate each of them over time, as opposed to just cranking away after the installation, and hoping for the best. You have the never-ending choice to make between Loudness and Quality, so it is best to read the manual and move slowly.

Many multiband processors use phase-offsets in the crossovers to provide flat response when the outputs are summed, but the Omnia uses phase linear, time aligned crossovers to retain flatness across the band. This reduces losses in phase linearity and "smearing." The result is better clarity on the air. A built-in, multi-stage phase rotator maximizes using the symmetrical limitations of FM. It can be switched out if you don't mind potentially increased distortion on certain vocals. The Omnia-6FM also includes a Schedule menu which allows for varying presets for different parts of the day.

The peak limiting and clipping algorithms will keep your modulation monitor from moving very much, but the result, off the air, is loud and full, with surprising dynamics considering the constant high level on the meter. This unit really packs a lot into 75 kHz!

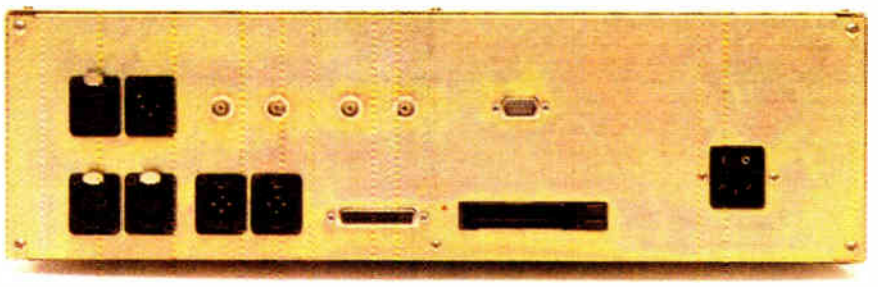
KIIS-FM in Los Angeles has been using the Omnia-6FM for just over a year, and we are very happy with the results. We did find that some CD's recorded with large amounts of inherent distortion (i.e. Creed's "My Sacrifice") could come out sounding worse than what went in, but a slight tweaking of the drive to the upper limiter bands made both input and output sound equally distorted.

Nearly Ready for IBOC

Going IBOC will involve a second Omnia at present, the Omnia-6dab, but Telos is planning a retrofit that will also provide a HD output around the time of the NAB. It's supposed to sell for less than $ 2,000.

Analog and AES/EBU inputs and outputs are provided. Either input will produce both styles of output. Bootup requires about 30 seconds, so some form of UPS is absolutely mandatory. The two composite outputs are individually controlled through the menus.

With its digital coding based on 96 kHz sampling and 24 bit resolution, the Omnia-6FM and its parameters can be controlled though either an RS-232 or Ethernet connection. The unit comes with a modem to provide dial-up access that fills one of two PCMCIA slots on the rear. A memory card holding the DSP code occupies the other. This can be changed to upgrade the firmware as newer and better algorithms are developed.



Omnia-6FM Backpanel

The Omnia-6FM fills three rack units itself, and as it needs ventilation both above and below, a total of five rack units of space are required. An input for an external SCA generator is provided, which mixes with the composite outputs. A 19 kHz clock output is provided if the SCA generator needs to be synced with the pilot.

The Omnia-6FM represents a solid value in maintaining quality and loudness on the air. Its inherent flexibility provides the best options in personalizing your sound to just what it takes to conquer the competition.

Learn More About It:

Further information on the Omnia-6FM, including a series of Frequently Asked Questions, Brochures and Manuals, can be found on the Omnia website: http://www.omniaaudio.com/o6fm/

Mike Callaghan is the Chief Engineer for KIIS-FM, the Market Engineering Co-Manager for Clear Channel Radio Los Angeles, and a long time Southern California Radio Geek.

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Equipment User Reports

The Gear Guide

If you have an equipment report that you would like to have published, please contact us at: **radio@broadcast.net** or you can give us a call at: **928-284-3700**.

Inovonics Omega – Affordable Digital Processing

A user report by Randy Pugsley

[Sacramento, CA - January 2003] As a Contract Engineer, my primary role is to utilize cost-effective solutions to meet the Audio and RF challenges at each client. Over the years, I have found Inovonics products have been the answer many times.

My first experience with Inovonics equipment dates back to the 1970's. It was then that I had the pleasure of replacing noisy Ampex tape recorder electronics with the Inovonics clean and quiet ones. These record amps extended the life off those venerable decks for many years.

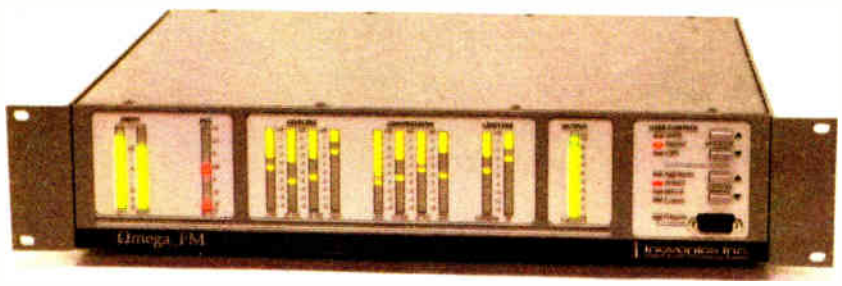
It was also in the '70s that I first encountered Inovonics audio processing gear, including the Inovonics 220's, which they called the "Audio Level Optimizer." Eventually, I put together a complex multi-band processor based on several of the Inovonic's 220's. Later on, I worked with the Inovonics "Map-II," their 8-band audio processor for AM.

Over the years, there have been many innovative Inovonics products available for broadcasting, recording, and even high-speed tape duplication. So it came as no surprise to me that Inovonics had come up with yet another intriguing audio product in their line: the Omega_FM digital audio processor and stereo encoder.

Choosing A Processor

Last February, one of my clients, Educational Media Foundation, put together an audio processor 'shoot-out.' The major brands were represented by their high-end digital processor/encoders as well as their medium priced offerings. Inovonics was represented by its brand new, all-digital processor, the Omega_FM, at a price around half that of some of the other models. People from E.M.F.'s Programming, General Management, and Engineering areas attended the shoot-out. A major vendor representative was also in attendance.

It would be no revelation that one of the big-ticket processors came in number one. However, what was startling to us was that the modestly priced Omega_FM came in a close second. The Omega_FM showed off great loudness with clarity and punch!



Inovonics Omega_FM Digital Audio Processor

Since that time, I have come to know the Omega_FM even better. I have installed several in the field, in a variety of environments ranging from air-conditioned studios to 'Nema Cans' on poles in the middle of nowhere. The Omega_FM hasn't missed a beat.

As with any of the current state-of-the-art units, the Omega_FM has provisions for analog ins and outs, including the composite/MPX signal, as well as for AES/EBU digital program lines. It has proved very versatile, and measurements reveal the Omega to be as clean as any of its high priced counterparts.

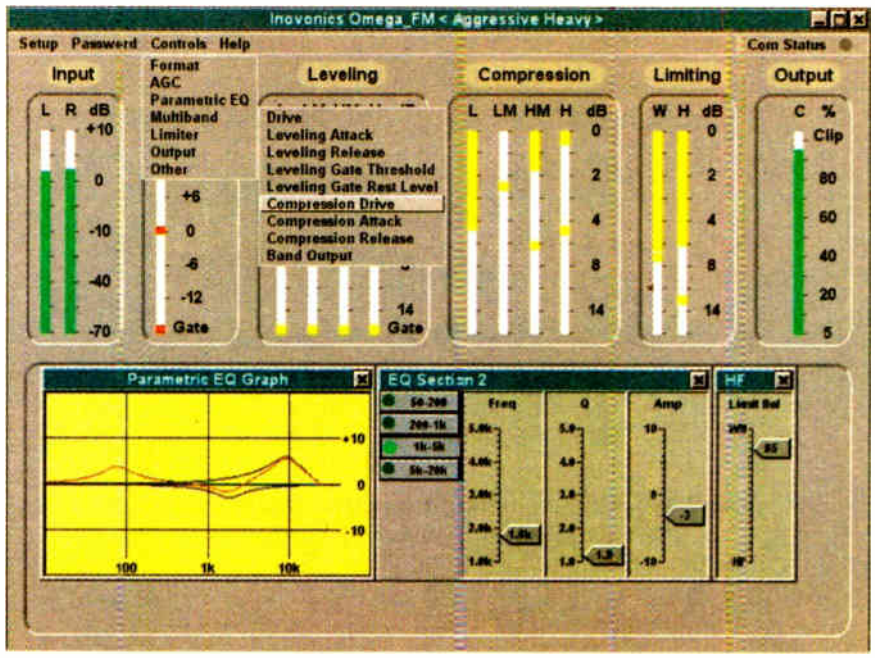
Ease of Adjustment

Setup is easy. If you're in a rush to get the Omega_FM on the air, you can go with factory presets and front panel adjustments. It plays quite well, right out of the box. Or, you can take "full control."

After installing the Inovonics software on my laptop, I merely connect the Omega_FM's serial cable from the laptop COM port to a convenient front-panel 'D' connector, and I am off to the races!

So far I've developed several 'custom' presets, capable of everything from processing a variety of music formats to handling gentle up-link protection. I save the presets in my laptop and make copies to floppy disc for distribution; I have even e-mailed setups to distant users.

The Omega_FM software is easy to comprehend and manage. Every processing nuance is adjustable; the parameters are graphically displayed and adjusted right at your fingertips. Software is periodically updated, at no charge, by Inovonics, and security is no problem as everything is password-protected, so the weekend crew is not able to "experiment" while you are not around.



Interactive Setup for the Omega_FM

Making it Better

When I have questions and suggestions, the product support staff at Inovonics has been right there to interact with me, and they have been both receptive and very helpful.

The bottom line is performance. Regardless of price, if the unit doesn't sound right, no one will be happy. With the Omega_FM, we were able to get exactly the sound we craved, from fine and subtle "hi-fi," to bass-induced, bone-jarring density. It has proved to be a real PD-pleaser that doesn't burden the bean counters. If you're in the market for processing, you owe it to yourself and to your comrades-in-arms to give the Omega_FM digital processor/encoder a spin.

Learn More About It:

More information on the Inovonics Omega_FM can be found at their website:

http://www.inovon.com/inovomeg.htm

Randy Pugsley is a contract engineer based in Sacramento, CA. He has worked in radio from the early 1960's, beginning as a small-market on-air personality, then with staff- and chief-engineering positions in the Pacific Northwest and in the San Francisco Bay Area. One of Randy's current clients is Educational Media Foundation, a nationwide broadcast group that originates the "AIR-ONE" and "K-LOVE" contemporary Christian music formats.

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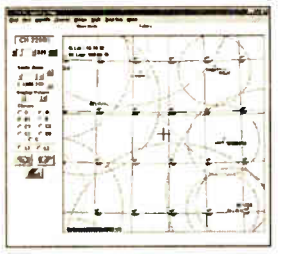

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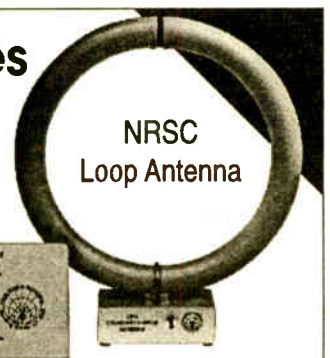

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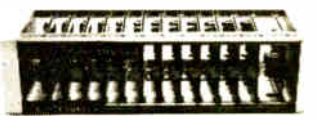

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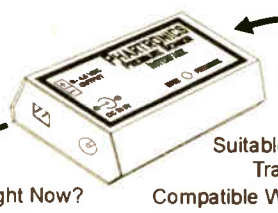

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