EARLY QUAD-CASTS AND OTHER FUN

Musings by Mark Durenberger

The early 70's were a great time for a guy like me getting interested in good broadcast audio. While some of us had been doing "AM-AM" stereo on radio more than a decade earlier, FM was finally coming into its own in the 70's. Serious FM receivers were being developed, and FM audio had not yet been bastardized by the processing wars. It was even possible to transmit "barefoot" on FM, preserving the original dynamic range. (Of course when we operated "barefoot" with no compression or limiting, we weren't thinking about the listening ambience, and that problem was brought home to us dramatically, as we'll discuss in a bit.)

I had just come to WLOL from a stint in the "Big Time'". WCCO Radio was as big as you got in those days, with its 35% market share and its total dominance in the Upper Midwest radio market. 3 years in Master Control gave me a solid appreciation for the way the Pros do radio.

But audio quality was not a priority for WCCO, and that was frustrating. In 1970, assuming WCCO would continue some simulcasting with its new sister FM station, I laid on the station elders a proposal for converting their plant to stereo, naively thinking WCCO might now be interested in better audio. I shouldn't have been so clueless; they had only reluctantly turned on the FM station. (They did this at 2700 watts, minimum time, just so they wouldn't lose the license.) Turned out that at WCCO Radio in 1970, stereo was never a consideration. They were in fact doing their best to ignore FM. Even station IDs had to be separately fed during simulcasts, so no one listening to AM would hear the call "WCCO-FM".

That philosophy didn't suit my restless nature, so it was off to WLOL, to be given a free hand with a Classical-format FM operation on what was one of the earliest Twin Cities FM stations. While Minnesota Educational Radio (now MPR) was beginning to build its reputation for broadcasting quality, we started experimenting at WLOL-FM, trying to deliver better audio to the folks who had invested in decent reception equipment. Those audio experiments led to the Minneapolis market's first "Quad-casts" in, I believe, 1971 or so.

IT'S HELL TO BE A PIONEER

The initial Minneapolis Quad-casts originated at the WLOL-FM studios and were transmitted in 4 discrete channels; 2 channels on WLOL-FM and 2 channels on Minnesota Educational Radio's KSJN. Source material was 4-track ¼-inch tape, played from a consumer deck.

Our first big broadcast was promoted as "a demonstration of the awesome new Quadraphonic sound", and was presented under the auspices of local hi-fi dealers. From the get-go, we learned what to do wrong. The demonstration was

to be at a cocktail reception in a huge room. The guy in charge of the demo was the Classical Music Director of WLOL, and he insisted on choosing, of all things for a noisy cocktail party, the *Berlioz Requiem!*

At the time, you could count on either hand the number of recordings that had more dynamic range than the Requiem. Given the free drinks and the fact we were running the audio "barefoot", the public demo never had a chance over the conversation. To top it off, I learned later we had a nervous guy at the receivers who thought he could override the cocktail crowd by cranking up the speakers during soft passages. Can you *imagine* what that must have sounded like?

Your friendly chronicler was safely removed from the scene of that disaster. I was at the WLOL-FM studios, with the source gear. Pretty high tech ☺; we used a borrowed 4-track consumer deck (it was probably a Tandberg or Teac). Deck output was a typical –10db, high-impedance. So to get to line-level we had to cob up an amplifier array, using what was then a new development: the "Operational Amplifier".

These Op-Amps were entirely discrete. There wasn't an IC available in 1970 that could drive any kind of load. Our discrete Op-Amp Array was built on 8 plug-in circuit cards, ran on something like 41 volts and delivered a hefty +18 dbm to 8 low impedance outputs. (On each of the 4 channels, one output drove the VU meter; the other drove the feed to the transmitter.)

PHONE PHRUSTRATIONS

The WLOL-FM studios fed the transmitter site through a 'pair' of Class AAA equalized telephone channels. The path to the KSJN transmitter was also via telco, but this path traveled all the way across the Twin Cities metro area. Telco-STL veterans will recall how hard it was to get any kind of noise performance from such paths, even on short hauls. So it was no surprise that we encountered the usual unacceptable noise problems. The number of program amplifiers and the cable lengths in that path meant the best S/N we ever got out of the channels was a dozen db shy of acceptable.

Through a process of barter and bargain, compromise and conciliation, we stole back a half-dozen db of noise on the telco link to KSJN. The battle was fought on 3 fronts: band-pass, transmit level and noise-reference levels. The story would be hilarious if it weren't sadly true, and if you've ever had to deal with these issues you can relate to what happened next. Because of course the Bell Boys told us they were delivering "acceptable specs".
Turned out they were measuring noise using highly-weighted meters designed for message traffic (200 to 3000 "cps"). The deep breathing began when we asked if we could measure the circuits with "real" gear. Wide-band noise of course turned out to be totally unacceptable. Even using 20-15 khz weighting, the best we could measure was –48 db, below a telco "0" reference of +8 dbm.

Next, we had to argue with them about what –48 db really meant. It got somewhat silly when we attempted to explain that, if +8 dbm was the telco "0" transmit level, a reading of 48 db below that level would really be –40 dbm!

We also knew they measured noise against –90db, using their "dbrN" weighted scale. In dbrN measurements they SUBTRACTED from –90, so a –48 db noise floor was actually "42 dbrN" to them. Yet they couldn't understand why, if we were trying to LOWER the noise, we would want to go UP, from their measured 42 dbrN to a 30 dbrN. Readers who've been there will empathize….

The paths suffered not only from wide-band hiss but also had a lot of impulse noise; particularly from nasty DC transients generated because the telco guys used the same cable to transmit make-and-break DC teletype circuits. The wide-band noise got a bit better with 15 khz band-pass filters on the receive end, but the only way we could hope to overcome the impulse noise was to push the operating level. And that led to our third difference with Mother Bell; what constituted operating level and clipping level. We gave up on trying to translate, and after they threw down their tools and departed, we looked for the "crash" point, backed off 14 db for headroom, and called it a poor compromise.

We also knew that there was a lot of loop between the studios and the first repeater, so we were able to do some pre-emphasis as we hit the lines. The complementary de-emphasis on the receive end also helped noise performance.

MEANWHILE…

If you're with us so far, we're in the middle of setting up for this highly-publicized demonstration. We're using ¼-inch consumer tape and playback gear with no noise-reduction. We'll be demo-ing in a cocktail-party atmosphere using 4 speakers placed incorrectly, and a nervous guy with his hand on the volume control. Anything else to worry about?

PHASE COHERENCY !!!

We had a long way to go to reach phase similarity among all 4 channels. Assuming the two stereo equalized pairs were somewhat phase-coherent with respect to each other, there was still the matter of the FM stations' transmitting equipment. Different stereo generators, different exciters and RF chains. Turned out that wasn't as relevant as we thought.
We found the audio buffs who followed our broadcasts at home were of a mixed discipline; more often than not the two stereo receivers they lashed up weren't anywhere near a match, and usually the speakers were whatever was at hand. So phase-coherency wasn't the most important concern. But noise was an issue. And from a distance of 30 years, I'm not sure whether our biggest noise concerns were about the source material, the tape equipment or the phone lines.

I do suspect that, with the Requiem in play, in those days before Dolby “A”, all the quieting advantages gained by careful installation of the FM receivers were easily offset by the tape noise, and anyone looking for serious quieting would have been sadly disappointed.

So what was the at-home audience response? Overwhelmingly *favorable* as I recall. I suppose folks hearing a musical instrument localized from a specific speaker in a 4-channel array may have felt the same excitement we experienced when we first heard the early “ping-pong” stereo.

Which brings us to a short time-out, to weigh in about “Quad” content; then we’ll tell you about the second Minneapolis demo, which was a whole lot more fun and certainly more satisfying.

QUAD NEVER HAD A CHANCE

In my opinion, one of the main reasons Quadraphonic Sound never took off in the popular marketplace was the lack of content and the way it was produced to tape and disc. Much of the material was simply 4-channel mix-downs of multi-track recordings. The result of course, to the listener situated among 4 speakers, was that he was placed right in the middle of the band. And that was really a confusing place to be, to anyone looking for “natural” perspective.

The folks who got better at this quickly learned that real “ambience” or “surround” sound required one to stay true to the concept of using the 3rd and 4th channels for ambience pickup, not mix-down tracks. The most successful ambient-sound pickups were delivered by a stereo pickup in the front and two “rear” mikes in the back of the hall. This same Minnesota Public Radio became quite accomplished at these pickups over the next few years.

Even if there had been a choice of real Quad product, there was another reason it never caught on. In the midst of the Hi-Fi/Stereo craze, there was never developed a really useful transmission medium for the analog Quad world. Discrete 4-channel tape didn’t do well in the consumer market because there were few players. And “Matrix Quad” as a “2-channel” solution never had a chance; a universal/compatible approach was never accepted.

As for the LP as a Quad delivery medium, I recall being at a Broadcasters' show in the early 70's and listening to the RCA matrix disc. It sounded horrible! They offered as demo content some multi-channel mix-downs. They encoded it onto "stereo" LPs; then asked you to judge the effect by listening on HEADPHONES! No wonder Quad never had a chance ☺

THE SECOND TIME AROUND

We learned a lot from the first Minneapolis Quad-cast. The second time we laid Quad-casting on an unsuspecting public, we totally eliminated the telco-provided "terrestrial-transport interference mechanism". The tape decks were installed at the WLOL-FM transmitter site; co-located with KEEY-FM's transmitter. That made things a LOT more coherent (and quiet).

For the second set of demos we played some serious 4-channel tapes, including some 4-track work produced especially for the Guthrie Theater by Sound 80 studios of Minneapolis. The main musical presentations escape my memory, but I know we included not only 4-channel mix-downs for effect but added recordings properly made with mikes in the rear of the room. Those demonstrations were an unqualified success. And from our own tests, we were able to affirm that for true ambient broadcasting, phase consistency AMONG the 4 channels was not nearly as important as ensuring that each PAIR of channels was matched.

Our Sales staff couldn't sell this specialized programming as an ongoing series on these two stations because the amount of material available was limited and the two stations' formats were so wildly diverse that finding common time when an audience could be expected was a major problem. We had to limit our work (play) time to Sunday evenings.

Over the next couple of years we watched what the market was doing with "SQ" and "QS" matrixes and kept an eye on Columbia and Sony and RCA and the other folks trying to push acceptance. But from what I could tell, the dearth of true Quad content and the absence of an acceptable 4-channel media doomed it to failure. Progressive broadcasters like Jim Gabbert at K101 in San Francisco promoted Quad very heavily; they too saw the potential and must have been disappointed when the music folks and the consumer electronics industries didn't get behind it. In our region, a few broadcasters tried to make a hit with one of the matrix systems but, like Dolby FM, "Quad" mercifully faded into the background noise.

There may have been other, marketplace reasons Quad didn't catch on. Good two-channel stereo product was becoming a lot more plentiful, thanks in great part to the terrific promotional campaign Columbia and others put forth, to bring to market on the new stereo LP the mix-downs of all those 3-track ½-inch masters they had been building. At the same time FM was coming into its own, and broadcast audio quality was getting better.

KIDS' TOYS

The idea of "stereo" is ageless, whether aural or visual. Being able to transmit accompanying perspective is what made multi-channel audio a hit. And in a practical sense, the timing for true 2-channel stereo was just about right. The "Hi-Fi" developments of the late 40's and 50's were putting serious audio equipment in the hands of consumers, and those folks were hungry for the next advances. From my own experience at that time, I can tell you that it was little wonder that early stereo, no matter how bad it was, was considered infinitely superior to the best mono hi-fi rig. To prove my point let me digress for a moment, then we'll shut down this journal.

I'm a fortunate fellow, lucky enough to be at the phase of "maximum curiosity" at the time these new audio toys were being wrung out. I was doubly fortunate for being bitten by the Broadcasting bug at age 14. The true "Broadcaster" just had to share what he was experiencing, and a lot of us started "broadcasting" with a phonograph in the back yard, blasting across the fences and no doubt irritating the neighbors (though we were sure they appreciated what we were "sharing"). By the time I got behind a real mike, it seemed natural to want to "share" new audio toys with those souls not fortunate enough to have a "stereo player", even when in the pre-LP days, "stereo player" mean "tape deck".

I cut my teeth on the ¼-inch "staggered head" tape format. The early staggered-head tapes were quite good but of course editing was almost impossible. The two playback heads were a serious distance apart; presumably because no one was yet able to build a good inline stereo head.

So here I was, buying all these stereo demo tapes with my lunch money, and I just had to share them with *somebody*. At the same time, we're building carrier-current radio stations at St. John's Prep School and St. John's University in Minnesota. When I was in high school we went on the air as "KSJP" on 870 kcs (khz came later). The college station, KSJU, was at 660. Since there was literally nothing in my life but radio, of course I had to combine the two efforts, and to this day I don't know how I got through school, because my entire college life was "KSJU, the Stereophonic Voice of St. John's University".

In those days before stereo LPs and FM stereo, we broadcast “AM-AM” stereo on 660 and 870 kc. We played those staggered-track (and later, inline) stereo tapes from my VM ¼-inch machine, encouraging students to “take two radios, place them across the room from each other, and tune one to each signal”. I don’t know whether we accomplished any “firsts” back there in ‘57 or so, but the project was certainly a whole lot more fun than studying Calculus or History.

About the time the stereo LP hit the market, I had a “real” gig at KFAM in St. Cloud, and we started doing “AM-FM” stereo shows, with one channel on the AM and one on the (mono) FM. Again, folks thought it was great, and what the hell did we know (or care) about phase coherency?

Doing a live show from the KFAM studios was always fun since the two control rooms faced a common studio, and it was easy to do live 2-channel AM-FM broadcasts. The ultimate fun at KFAM had to be the summer we did “stereo” for the local drive-in theater. The FM signal was piped into the drive-in window speakers for the left channel, and patrons tuned their car radios to 1450 AM for the right channel. Now honestly…doesn’t that sound like a whole lot more fun than having to work for a living?

Thanks for sitting through this chronicle. Early stereo was a lot of fun. Quad was a whole lot more challenging, though it may have been set up to fail. It may have been that the industry had too much invested in 2-channel discrete stereo product to push another format. I just don’t know. But every once in a while I wonder what might have happened, if the producers had built up a library of true Quad music; if the promoters if the audio guys had educated the consumer on what to expect from true Quad, and if manufacturers had been willing to take a risk in developing 4-channel transport media.

In my imagination, I still find myself cruising down the highway, behind the wheel of what would have been an *ideal* Quad playback environment. And I suppose somewhere, some nut like me modified an 8-track cassette player to work as a Quadraphonic car playback system.

If so, like me, from time to time he probably pulls out his invention (or his other audio-toy ideas), stares at them, and wonders: “what if…..”

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May, 1999