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WHAT A RIDE

Guy Wire on how far down corporate radio could go.

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Radio World

ENGINEERING EXTRA

December 10, 2008

RW-EE: A Deep Technology Read for Engineers

NewBay Media

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WHITE PAPER

Minimal Interference to Analog Seen in Power Hike

A Study of a 10 dB Power Increase in Digital Carrier Level For HD Radio Transmissions in the FM Broadcast Band

by Steve Densmore and Russ Mundschenk

Steve Densmore is broadcast technology manager at iBiquity Digital Corp. Russ Mundschenk is field implementation manager at iBiquity.

As many Radio World readers know, iBiquity Digital Corp. has developed a system for radio broadcasting in the digital domain alongside a station's existing analog signal.

Using a method called in-band, on-channel (IBOC) under the brand name "HD Radio," broadcast radio stations in the FM band transmit identical upper and lower digital sidebands adjacent to their conventional analog signals. Using Orthogonal Frequency Division Multiplexing (OFDM), these digital sidebands can carry audio and data information at a rate of up to 145 kbps. Depending on the hybrid service mode employed, these sidebands extend from

SEE 10 DB, PAGE 4

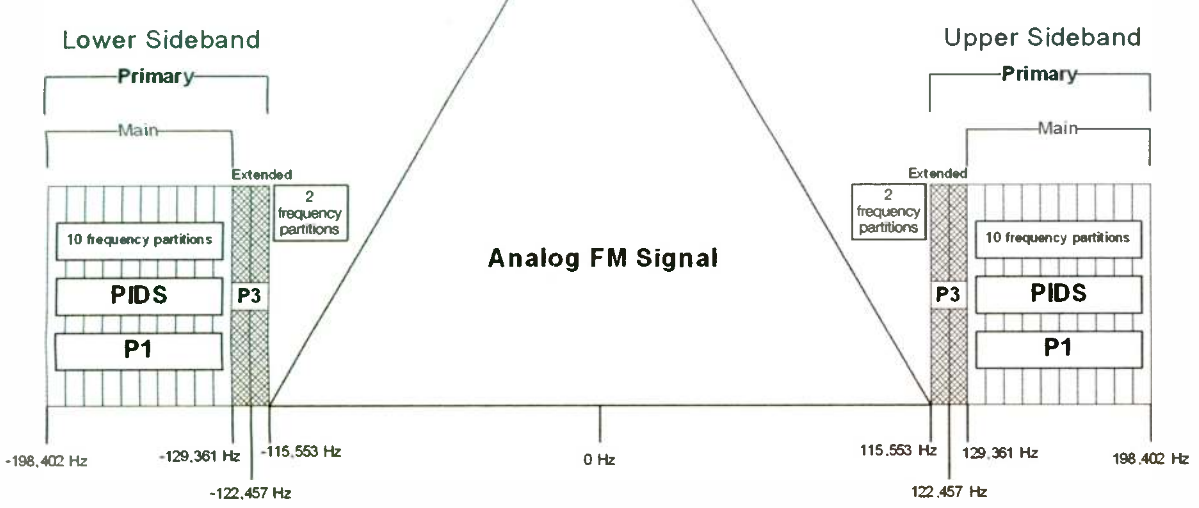


Fig. 1: Spectral diagram of an FM IBOC signal in service mode MP3. There are 191 OFDM sub-carriers grouped into 10 Primary Main Partitions as well as 39 additional subcarriers in four Primary Extended Partitions.

WHITE PAPER

FM Boosters & SFNs: The 'Synchronize Everything' Approach

Research Shows Getting the Details Right Improves Performance

by Tim Bealor

The author is vice president RF systems for Broadcast Electronics in Quincy, Ill.

With broadcast frequencies hard to come by in many markets, and populations expanding into areas not accessible by a single FM signal, new techniques for synchronizing the RF as well as audio waveforms overcome most of the interference issues that have prevented many broadcasters from establishing boosters and single-frequency networks in the past.

The philosophy of accurately aligning all aspects of the FM signal significantly improves the listener's experience in the overlap or interference zone, which is the key to good system performance. The result: RF sites that were marginal before because of interference issues now become viable options for extending programming into new population corridors or to fill-in areas underserved by a main FM signal.

WHY A SFN OR BOOSTER?

Single-frequency networks and related boosters are defined as two or more broadcasts from different locations that share a

SEE SYNCHRONIZE, PAGE 18

WINNING THE RATINGS WAR VORSIS: THE TECHNICAL STUFF

The loudness wars are over. The winner? Nobody. Why? Because when everyone became as loud as possible, using the same limited tools, the personality of every station got lost. We call it "the sameness syndrome."

We hate the sameness syndrome and believe it's a good part of the reason ears are turning to alternate sources. They are just plain tired. Fatigued.

Imagine, then, scanning a radio dial and finding an aural oasis – sound that's breathtaking in its natural quality, but loud and still retaining a sense of dynamic range. Impossible? If you think so, you haven't heard Vorsis.

Vorsis is the first line of air-chain processors designed for today's 21st century radio listener. It's a complete ground-up rethinking of the tired and traditional approach that is inescapable with those well-known processors. Here we talk about a few of the innovations that make the flagship AP-2000 Spectral Dynamics Processor the incredible tool that it is. Many of these advances are shared among the entire range of Vorsis solutions.

Intuitive Interface and Operation

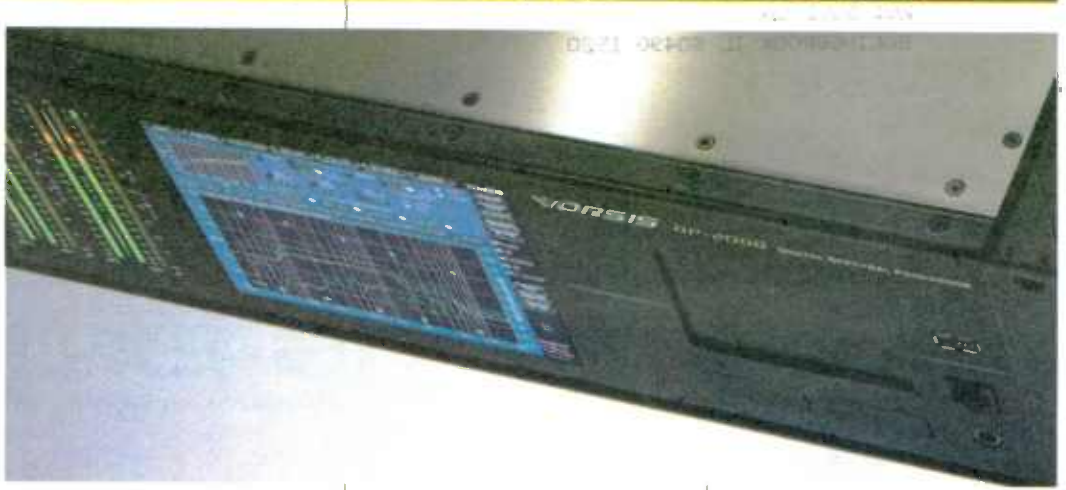
No processor can meet its full potential if it's not something that's easy to use or if the full palette of controls are not accessible. The Vorsis GUI is designed for intuitive operation, from the front panel or remotely on your PC. No control is more than two clicks of the mouse away. The screens offer a logical layout with a virtual control surface above and monitoring graphs and meters below. You can see and hear the results instantly. Nothing is easier.

Think about having the full engineering control you've always dreamed of – being able to find the whispers as well as the screams in your station's sound, crafting an aural signature that's so good, so transparent, you will have people calling to find out how you do it.

Vorsis Dynamics Control

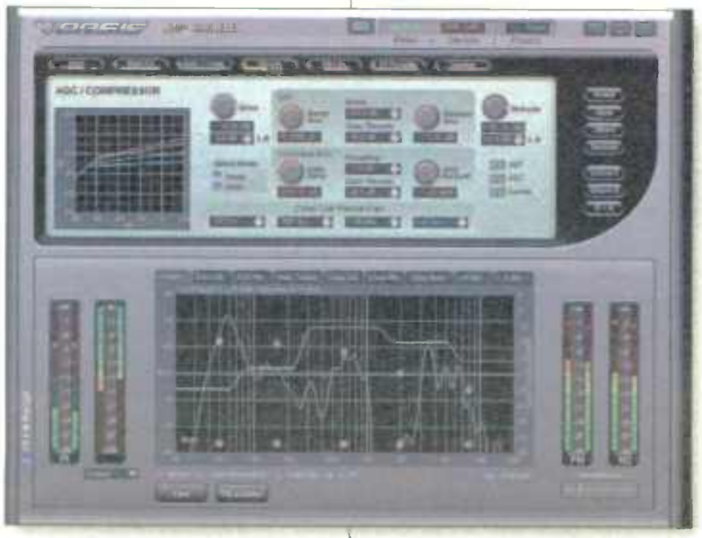
Vorsis completely rethought dynamics control – AGC and compression – and came up with a design that's intelligent AND amazingly flexible to control and shape your station's "sound."

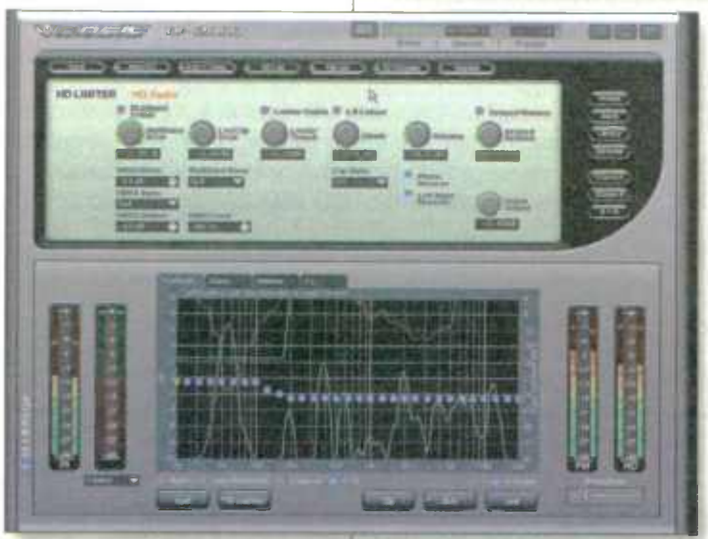
Five-band AGC (four-band in the VP-8) ensures a consistent spectral balance. Vorsis' exclusive SST™ Sweet Spot Technology manages the behavior of the AGC in real-time so that it always operates in its "sweet spot." The multi-band compressor, operating in concert with the AGC, provides unprecedented dynamics control. All operate in sum and difference – the highest signal controls the amount of processing. This is a completely new way to manage multiband dynamics to maximize the consistency of your station's on-air presentation – no matter what the incoming level or era of the music.



Powerful Bass, Incredibly Clean Voice

Vorsis Bass Management System extracts and reveals the nuances in the program that are simply not heard in any other radio processor. It puts deep pristine bass on the air without the distortions of common bass clipper technologies. VoiceMaster is a special Vorsis clipper management tool that has its own automatic processing chain dedicated to detecting and specially processing live speech signals, giving you the loudest and cleanest on-air voices ever.





Superior Stereo Enhancement

In rethinking Vorsis, it became clear that stereo enhancement HAS to be integral to the processing. It is, after all, a manipulation of the amplitude of the L/R difference signal that creates the perception of a wider sound field. With Vorsis, you'll get smear-free enhancement of the stereo image that can be as wide as you desire. But that's only the beginning – you can also control the stereo image width on a frequency-conscious basis and use L+R to L-R signal ganging to prevent the image from wandering uncontrolled. It's already field-proven to manage wide discrepancies between the recording techniques of various eras (oldies to the over-mastered music of today) and even reduce multipath interference.

Surgical Limiting and Clipping

To some the idea of 31 bands is scary. Not to us. It's simply amazing what can be done with it. Limiting and clipping's primary purpose is peak control to increase loudness; the less audible in its action, the better. 31 bands allow surgical limiting – its dynamic operation is nearly inaudible to the ear so the resulting sound is louder AND cleaner. It also provides unprecedented opportunity to further fine-tune the sound. FM and HD/DAB have entirely different transmission characteristics, so Vorsis processors have completely separate limiting and final peak control sections for analog and digital broadcast.

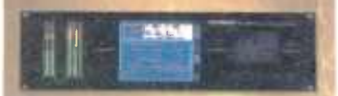
Welcome to the 21st Century

Vorsis is the first processor designed for the needs of a modern radio station and its listeners. Visit the web to learn more and read our application notes and white papers. Call us to set up a demo today.

It'll make a HUGE difference in your station's sound AND your bottom line.

The Vorsis Lineup

AP-2000
Digital Spectral Processor for FM analog and HD/DAB
· 5-band dynamics controller
· 31-band limiter/clipper

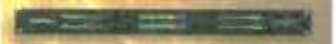


FM-2000
AP-2000 without HD/DAB section

AM-10HD
Digital Audio Processor for AM analog and HD
· 5-band dynamics controller
· 10-band limiter/clipper

FM-10HD
Digital Audio Processor for FM analog and HD/DAB
· 5-band dynamics controller
· 10-band limiter/clipper

VP-8
Multi-Mode Processor for FM, AM, FM-HD/DAB, AM HD, MP3/AAC
· 4-band dynamics controller
· 8-band limiter/clipper



HD-P3
Production, HD, STL Processor
· 3-band AGC

M-1
Digital Mic Processor

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ENGINEERING EXTRA

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FROM THE TECH EDITOR

by Michael LeClair

A Conventional Road Trip

Two Weeks of Broadcasting Live from the Presidential Race

In the Oct. 15 issue, I talked about planning for live coverage at the national political conventions. I promised to come back with more from those two weeks and some tips on handling a "super remote" like these.

Our broadcast team added up to 15 total. The technical support crew consisted of me and my colleague Karl Voelker. My responsibilities included all of the audio systems while Karl handled the IT systems. There were also two audio engineers to run mixers for the live broadcast and assist with audio production.

The first of the national conventions began with the Democrats in Denver on August 25. Our plan was to arrive on the 23rd to set up and test equipment preparing for news pre-production to begin on Sunday evening the 24th. Equipment cases were pre-shipped to the site and then delivered to our workspaces by the general services contractor. It was a real time-saver not to have to carry 400 pounds of equipment through security from a remote parking lot at the Pepsi Center with just the two of us — this easily could have taken half a day.

SWEPT AWAY

The immediate goal when we arrived in Denver was to get site access passes, which must be picked up in person. Then we proceeded to the Pepsi Center to check out the sites we would be using for the next six days.

It was a good surprise to see that all our road cases had arrived intact at their proper location on Radio Row. I also checked that all the specified furniture and accessories ordered for our eight-person workspace had arrived at the large air-conditioned tent known as Media Pavilion Two.

We were even more pleased to find that all of the requested telecommunications services, including two ISDNs, two 10 Mbps Internet connections and a total of four business phone lines were in place and working. We got remarkably good service on these crucial broadcast links from Qwest Communications at both the Democratic and Republican conventions. Not only did they provide reliable connections, they staffed a help desk on-site in the Pepsi Center from early in the morning until after midnight each day. This was the best service I have received from a telecommunications provider, ever.

Within an hour or so we knew that we had everything we needed for our broadcasts. Then we had to evacuate the site for the required security sweep. During the sweep, which usually begins at night and runs until the next morning, everyone must leave the building except security personnel. Afterwards security rules become much tighter so it is usually a good idea to get all your equipment in place before.

With the benefit of hindsight, it would have made sense to arrive one day earlier to allow us to complete our final audio and computer setups before the sweep. This would have made the next day much shorter.

We returned on Sunday morning to complete the equipment setup and spent the day resolving a few minor issues with the phone service and furniture at both our broadcast and work sites. We took an hour to show staff the basics of operating the broadcast and computer equipment. I find it helps to take 30 minutes to post notes with important phone numbers at the broadcast site; having a small labeler on site is a good idea.

Sunday afternoon and all is well at our booth in Radio Row before the start of the Republican National Convention.

By the end of the day (and until about midnight) we were feeding production audio back to Boston to be mixed into stories for use on our early Monday news shows.

SECURITY

It quickly became apparent that the most difficult aspect of working at the Pepsi Center would be the security arrangements. A number of protest groups had declared publicly their intentions to disrupt the Denver area and potentially make a dangerous assault on convention attendees.

It was necessary to have a pass to get beyond what I dubbed "Checkpoint Charlie," a portable tent with armed guards about a quarter-mile from the center. The actual security tent at the center included metal detectors and bomb-sniffing dogs for any equipment cases. Then there was a third checkpoint to enter the arena and a fourth checkpoint to gain entrance to the inner seating area. A lot of our time and energy was spent working around these security arrangements.

Oddly, the security procedures seemed to change on a daily basis. At one point on Sunday, guards would not allow any passes and part of our staff was left outside the Pepsi Center making frantic phone calls to our contacts at the DNC. On Monday, all laptop computers had to be opened and turned on while standing in line at the main security tent. Later in the week this requirement was dropped (probably after many laptops were too).

Particularly frustrating was the lack of parking near the Pepsi Center. It is surrounded by dozens of acres of parking, none of which was available. In one lot across the street a group of security officials set up lawn furniture in the shade to watch all of us walk through the open asphalt that had been cordoned off with concrete barriers. Comfortable shoes were a must and woe to anyone who left their pass back at the hotel.

THE BIG SHOW

Just when we began to get comfortable doing live shows from our temporary digs at Pepsi Center we had to prepare for the big curveball: Barack Obama would be making his acceptance speech in the Invesco Field football stadium about two miles away.

We needed to set up yet a third site for live broadcast and work through all the same issues of security, telecommunications, furniture and transportation again.

Invesco Field holds about 80,000 people so it was clear that unless we were inside early to set up it would not be possible to even get in the door due to the

SEE REMOTE, PAGE 4

IN THIS ISSUE

10 dB

CONTINUED FROM PAGE 1

100 kHz to 200 kHz above and below the station's center frequency (see Fig. 1).

The system was originally tested with digital carriers at a total integrated power 20 dB below the analog (–20 dBc). Extensive testing demonstrated this power level could be implemented without any adjacent or host interference [see reference 1, page 10].

Because the digital sidebands extend to the center frequency of the first adjacent channel, steps were taken to minimize the impact to existing analog FM stations. Prior to the development of HD Radio technology, the FCC had established an analog spectral mask in order to prevent spurious emissions. During the development of HD Radio technology, iBiquity tightened this criterion [2] to ensure that IBOC stations would exceed compliance with the FCC's restrictions (see Fig. 2).

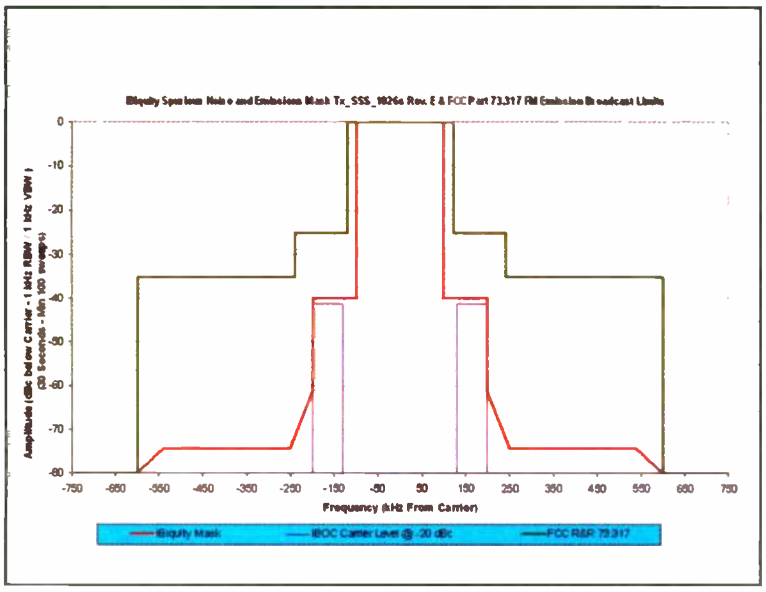

Fig. 2: Spectral plot of an IBOC signal compliant with the FCC mask (green) and the iBiquity mask (red).

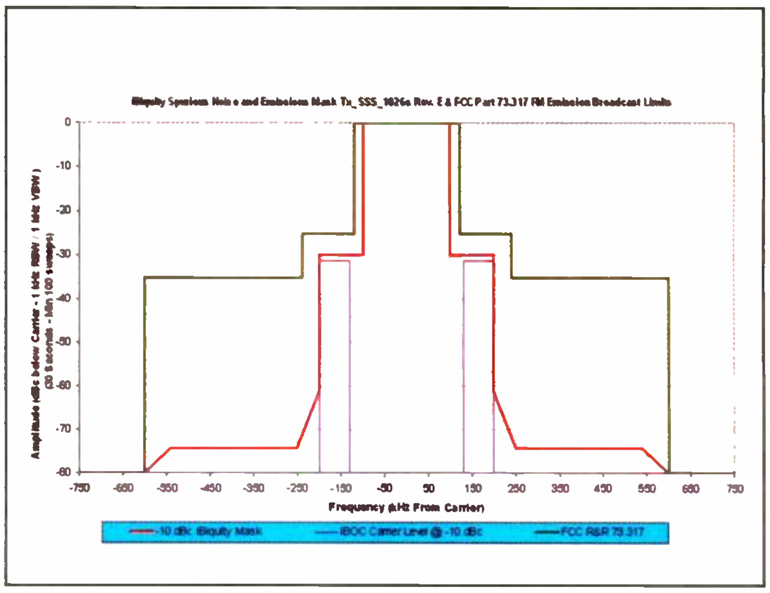

Fig. 3: The FCC and iBiquity masks with IBOC carriers increased in power by 10 dB. It is evident that the sidebands will exceed the iBiquity mask by about 8-1/2 dB, but are still under the FCC part 73.317 mask

PROPOSAL

The HD Radio transmission mask has been extremely successful in limiting interference between stations. Since its implementation, however, state-of-the-art adaptive pre-correction techniques allow broadcasters to transmit with higher digital power while maintaining compliance with the HD Radio mask's out-of-band emissions specification.

Recent propagation prediction studies showed that 10 dB additional digital power will improve HD Radio signal coverage, putting it on par with analog and improving building penetration. At the same time those studies showed that, even with the higher digital power, digital interference to first-adjacent analog signals was in nearly all cases below a level that would adversely affect analog signal quality [3] (see Fig. 3).

STUDY METHOD

IBiquity Digital Corp., in conjunction with Clear Channel Radio, CBS Radio and Greater Media, planned a series of surveys to study the feasibility of increasing digital power by 10 dB.

The coverage study would be done empirically by driving a route within a station's coverage area and comparing the analog to digital coverage. There were two criteria to be considered:

- Performance — the expected benefit of increased digital power and
- Compatibility — anticipated harm to first-adjacent analog signals.

STATION SELECTION

The stations to be studied for performance characteristics and adjacent-channel interference were selected on the basis of "worst case" and "typical" scenarios.

Stations were selected to test a range of geographic terrain conditions and the interference potential of different classes of stations, and to look specifically at short-spaced allocations.

The sample stations were selected to measure the impact between first-adjacent stations of identical classes, i.e. Class B to Class B or Class A to Class A allocations.

For example, station WKCI, Connecticut, was chosen to represent fringe reception conditions with terrain shielding. Station WCSX in Detroit was chosen to measure the effects of first-adjacent interference in the absence of other signal impairments. In Los Angeles, station KOST was selected to characterize first-adjacent interference effects from grandfathered, high-power class B stations in the western desert (Super B class stations). The test group included examples of first-adjacent stations with both proper spacing and short spacing (worst case).

Table 1 summarizes the conditions for comparing different classes of stations.

In addition to the above criteria, three Class A stations were selected for performance testing:

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Remote

CONTINUED FROM PAGE 3

overwhelming crowds. I chose to bring a much smaller sports style mixer, the Musicam USA Road Warrior, for our ISDN link to Boston instead of our large Mackie. The extra gear was in separate road cases so that we could keep the Pepsi Center remote site alive and working while we set up Invesco.

One bonus of the large stadium was that my basic security pass allowed me to go inside the stadium bowl. Barack Obama's speech was the only time during the entire two weeks that I was able to see one of the actual events.

TIME TO MOVE

After the acceptance speech the convention in Denver was basically over. But coming right on its heels was the Republican National Convention in St. Paul.

Karl and I were tasked with striking the Denver site, transporting the equipment and starting the whole process over again.

This is where the road trip comes in. It's about 900 miles from Denver to St. Paul. We rented a Penske truck, loaded up our cases and drove. We took turns driving the truck through the empty plains between $75 stops to fill the gas tank. Even considering the cost of the truck, we saved about $2,000 compared to overnight shipping from Denver, plus the airline tickets.

By next afternoon, Saturday, we were in St. Paul just in time to pick up a new set of security passes but not in time to make it to the Excel Center before the security sweep closed everything down at 4 p.m.

Happily, security arrangements were much smoother and easier in St. Paul. Other team members flew in before us and helped out with car rentals and equipment dropoff. This gave us extra time to set up our broadcast and work spaces quickly so that pre-production work could begin on Sunday night. Once again the general services contractors and telecommunications providers were extremely helpful and prepared for our arrival so installation could proceed quickly. It also helped that by now we were old hands at doing this setup and we could put it together in our sleep.

WRAP IT UP

The week in St. Paul went by with few hitches. This was a simpler remote because we didn't have to plan to set up a third site for the acceptance speech by John McCain. In general the crowds were smaller. Although there were some protest marches that turned violent nearby, we fortunately avoided getting caught up in them.

On the final night of the broadcast, we packed everything up again around midnight. Early the next day, we handed the road cases to UPS. Given the size, weight and number of these cases, it made no sense to try to bring them to the airport, especially with the luggage surcharges that are routine now on domestic flights.

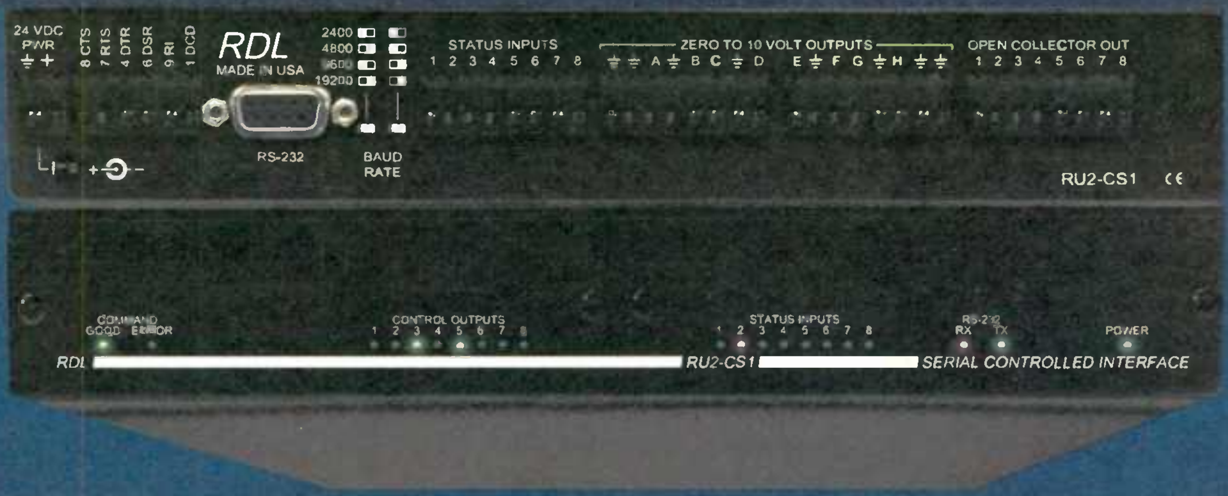
I was very ready to head home after that much time on the road and pleased with how successful the entire operation had been.

LAST TIP

As engineers, we tend to focus on equipment and logistics. No one else will take care of these things if we don't. But it is important to remember that the essential success of a remote depends on the people on the team. Take extra time to make talent and producers comfortable; your effort will help them perform their best. Keep your temper in check at all times even if someone is being unreasonable; the good ones will apologize later. Be the competent center of calm in the middle of the storm and earn everyone's respect. You will get credit after the remote comes to a successful end.

Do you have a story to tell about a tough remote? Write me at *rwee@nbmedia.com* and tell me how you handled it. ■

GET EVERYTHING UNDER CONTROL



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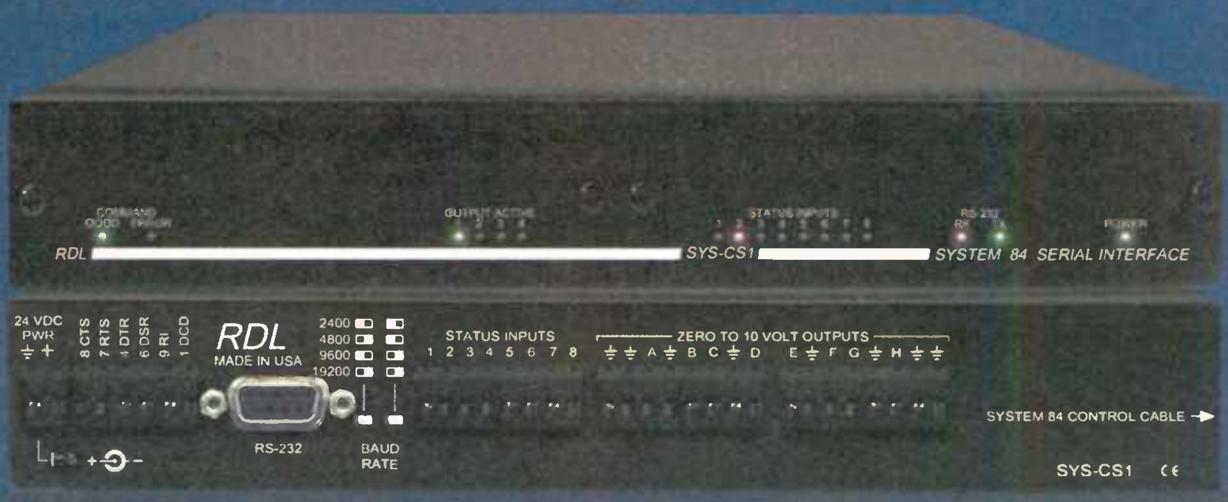
  Examples include sensing contact closures from satellite receivers or from RDL audio or video detection modules.
- •Rack mountable using RDL RU-RA3HD



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10 dB

CONTINUED FROM PAGE 4

- WDHA, northern New Jersey, characterizing Class A performance with terrain shielding.
- WJRZ and WRAT, Jersey shore, characterizing Class A performance with no terrain shielding.
- One Class B station, KROQ, Los Angeles, was also selected to measure the improvements in digital coverage for performance evaluation.

In all cases the area of maximum interference impacts a very small percentage of the desired station's coverage area. The field intensity of the first-adjacent interference at this location will be less than 6 dB below that of the desired station in 50 percent of the locations, 90 percent of the time by the F50/10 definition. Therefore, a dB D/U value should be considered a worst-case profile, localized to a point in line with the two transmitters at the desired station's protected contour and occurring only 10 percent of the time.

OPERATING POWER

For these tests, iBiquity chose to operate each transmitting facility at total power levels of 20 dB and 10 dB below that of the reference analog carrier. The digital to analog power ratio was verified with spectrum analysis in the field as shown in Fig. 4.

The digital to analog ratio was calculated from two spectral shots: One at 300 kHz resolution bandwidth and video bandwidth (for analog power) and one at 1 kHz RBW/VBW, with the noise marker turned on (dBm/Hz for digital power). See Figs. 5 and 6. The value of the noise marker was multiplied out as a voltage to 70 kHz for each sideband and the log or the product taken. These two values were added in the same way and the total power in 140 kHz was obtained. The analog power was then subtracted from this value to obtain the ratio in dB.

MEASURING PERFORMANCE

The typical HD Radio receiver is an ideal instrument to compare analog vs. digital coverage. A primary feature of the HD Radio system is the "blend" feature: When the robustness of the digital signal falls below a certain pre-determined point, the radio will seamlessly switch or "blend" to the analog signal. The blend point is available parametrically on the receiver's I^2C bus.

Condition	Host (Digital) Station	First-Adjacent (Analog) Station
"B" to "B"	WKCI	WWBB and WCBS
"B" to "B" short spaced	WCSX	WXKR
"Super B" to "B"	KOST	KSCF
"Super B" to "Super B"	KOST	KVYB

Table 1: Conditions Used for Comparing Classes of Stations

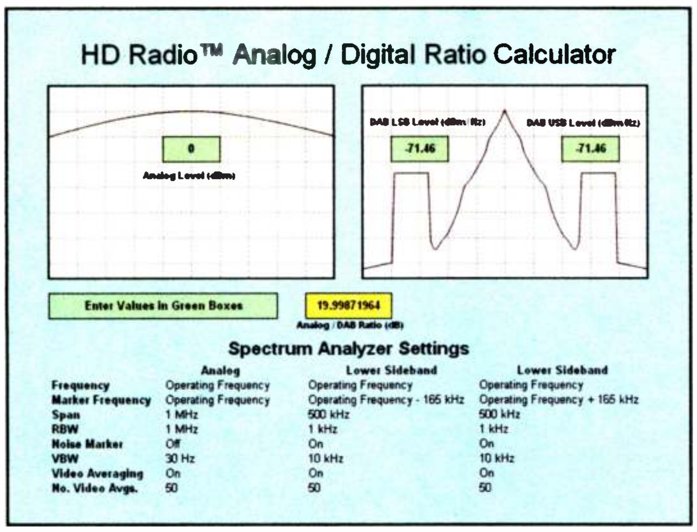

Fig. 4: Operating Power Calculation

By correlating the blend data to GPS data, digital vs. analog coverage may be mapped.

MEASURING COMPATIBILITY

In order to predict the signal level of first-adjacent digital interference, the field intensity of the desired and undesired stations must be characterized at the desired station's protected contour, usually at the point of intersection of a line connecting the two transmitter sites. The field strength is defined in dBu (dB µV/m). FCC R&R 47CFR 73.215 defines the maximum allowable F50/10 field intensity of any first-adjacent interferer to be 6dB below the protected F50/50 field intensity for the desired station's class of operation.

The compatibility test program was conducted in two phases. In the first phase, analog audio was collected with a digital broadcast operating at the existing –20 dB power level and then with the same station operating at the higher –10 dB power level. In both cases, the analog audio was collected from first-adjacent stations that were predicted to be most vulnerable to interference from the digital signal. At each power level, audio was collected at (i) approximately +6 dB D/U ratio representing the protected contour of the desired analog station and (ii) approximately 0 dB D/U ratio representing an area outside the station's protected contour and at the edge of reliable analog reception (see Fig. 7). Either identical or similar programming was broadcast at the two power levels to facilitate comparison of the impact of the digital signals. In the second phase, the audio samples were sent to Salisbury University for formal subjective evaluation of the audio using general population listeners.

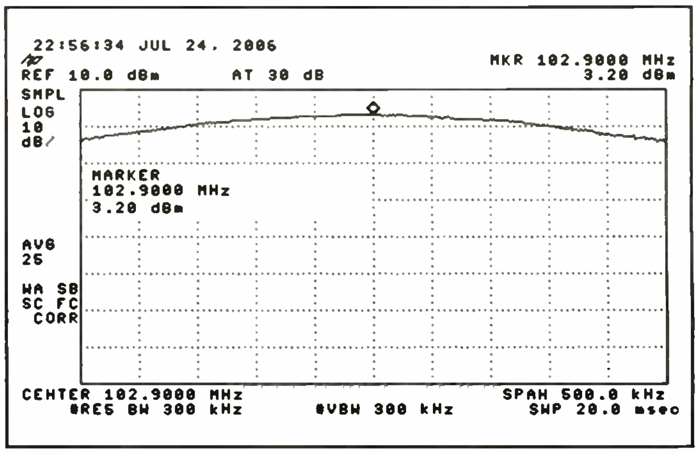

Fig. 5: Spectral shot at 300 kHz RBW/VBW

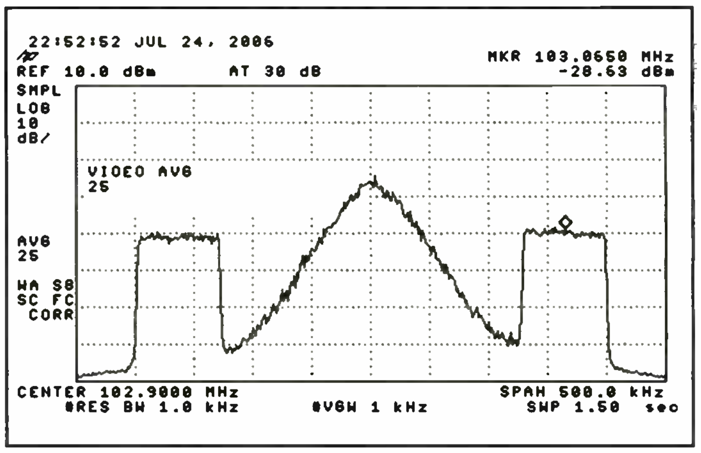

Fig. 6: Spectral shot at 1 kHz RBW/VBW

THE IBIQUITY DIGITAL TEST BED

Fig. 8 shows the iBiquity test van configured to split a single 31 inch vertical whip

SEE 10 DB, PAGE 8

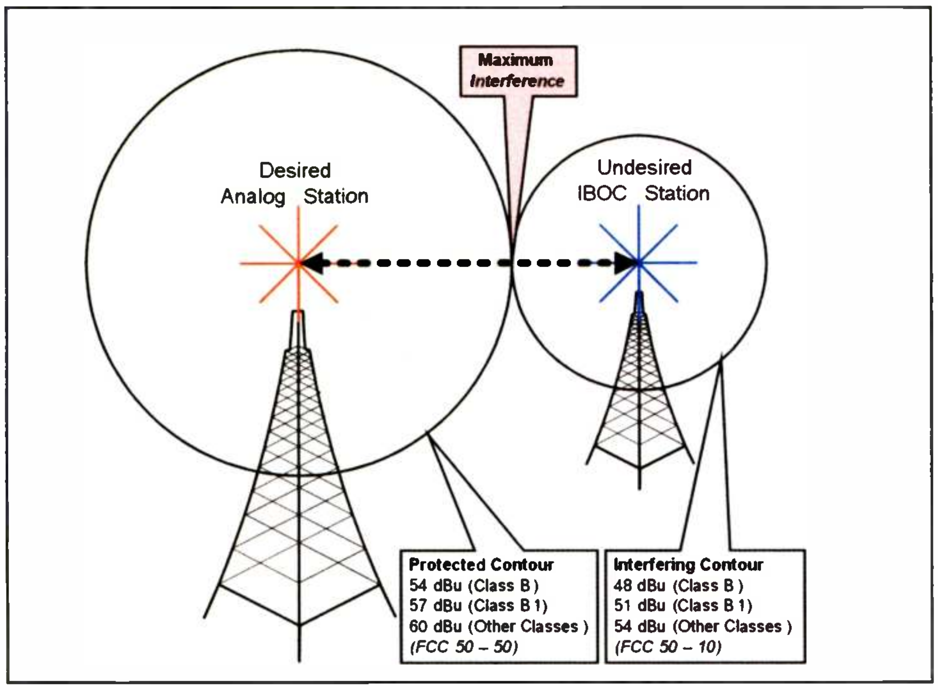

Fig. 7: The relationship between a desired and undesired station's coverage contours at a D/U of 6 dB

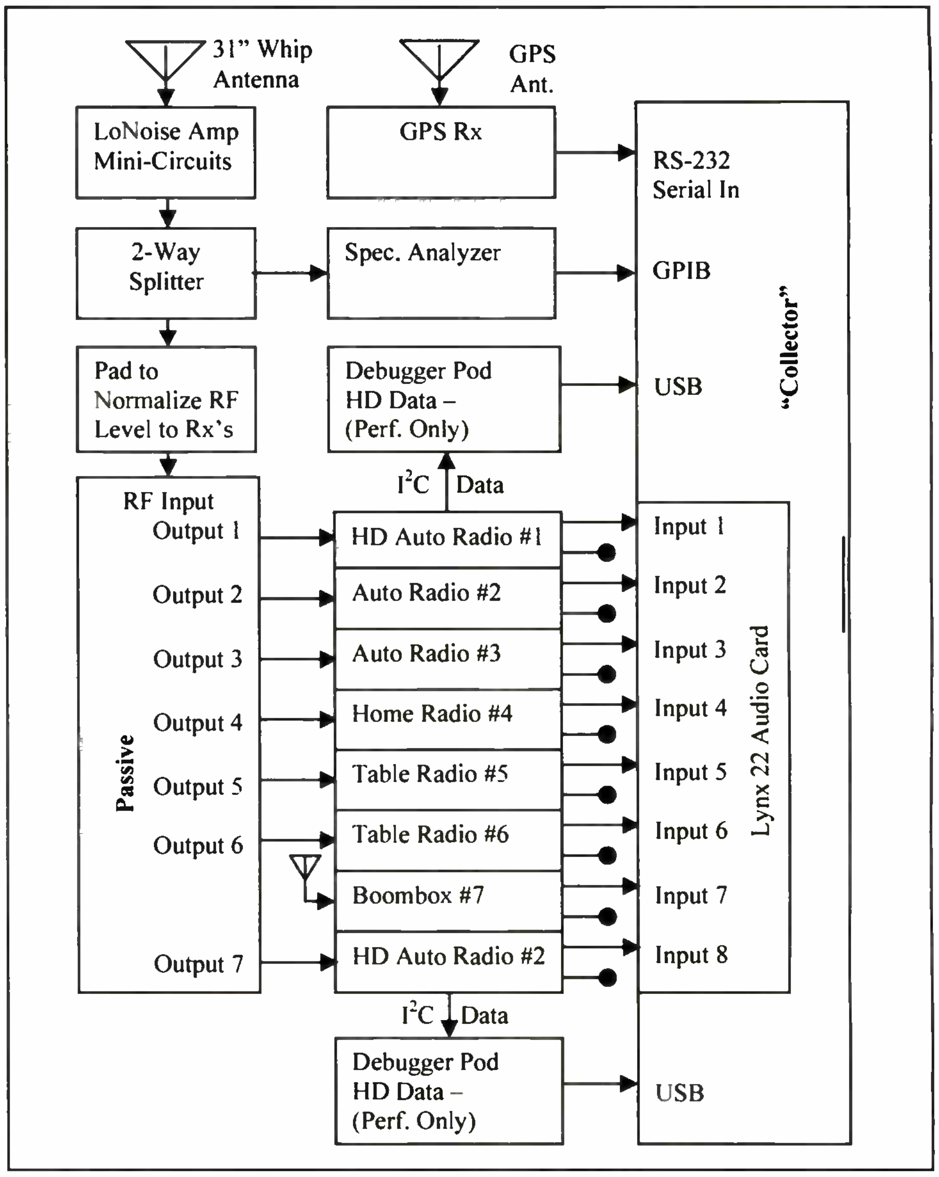

Fig. 8: Block diagram of the test van used for field measurements

Analog Rx	Radio #	Make	Model Type
1 (HD Auto)	JVC	HDR-1	HD Auto
2 (Auto)	Pioneer	DEH-1800	Auto
3 (Auto)	Delphi	28061577	Auto
4 (Home)	Onkyo	TX-SR504	Home
5 (Table)	Bose	WRCC1	Table Top
6 (Table)	Tivoli	Model 2	Table Top
7 (Boombox)	Sony	ZX-H10CP	Boombox
8 (HD Auto)*	JVC	HDR-1	HD Auto

* (2nd HD Radio receiver use for performance measurements)

Table 2: Receivers Used for Compatibility and Performance Measurements

Call Sign	Freq (MHz)	City	Solid HD Radius @-20 dBc (KM)	Solid HD Radius @-10 dBc (KM)	Area Gain -20 to -10 dBc (KM²)	Area Gain -20 to -10 dBc (Percent)
WCSX	94.7	Detroit	47	62	5062	74
WKCI	101.3	New Haven	51	65	5100	62
KOST	103.5	Los Angeles	39	49	2763	58
KROQ	106.7	Los Angeles	51	58	2396	29
	Averages		47	59	3830	56

Table 3: Class B Performance Measured

Call Sign	Freq (MHz)	City	Solid HD Radius @-20 dBc (KM)	Solid HD Radius @-10 dBc (KM)	Area Gain -20 to -10 dBc (KM²)	Area Gain -20 to -10 dBc (Percent)
WDHA	94.7	Dover	15	17	200	28
WJRZ	101.3	Manahawkin	23	33	1758	105
WRAT	106.7	Pt. Pleasant	24	31	1209	67
	Averages		21	27	1056	67

Table 4: Class A Performance Measured

10 dB

CONTINUED FROM PAGE 6

antenna to a spectrum analyzer and six typical consumer receivers. One additional portable "boombox" receiver used its own antenna for the compatibility tests. The left channel of each receiver feeds an input of a multitrack PC-based audio recorder. GPS position and spectrum analyzer data are also recorded by the software application "The Collector." This software was also used to record position, spectral and digital receiver status for the performance tests.

TEST RECEIVERS

Six analog-only receivers and one HD Radio receiver set in analog mode were used for the compatibility tests. One HD Radio receiver in blending mode was used for the performance tests. These radios are typical of those available after-market and from OEMs. The specific models used are listed in Table 2.

TEST DATA COLLECTION HARDWARE AND SOFTWARE

The data collection computer consists of a PC running the Software Audio Workshop (SAW) multitrack audio recording application and custom iBiquity "The Collector" software. The Collector is capable of recording GPS location, spectrum analyzer data (a 400 point capture), and information from the I²C bus with of specifically configured HD Radio receivers. Mode (analog/digital) and other parameters from the receiver(s) are captured every second.

The SAW application correlates the data with up to eight tracks of recorded audio by feeding SMPTE timecode to the Collector. This synchronization allows the reviewer to attribute any audio anomalies to external influences, such as waveform disturbances or low signal level. This audio will later be subjectively evaluated.

For compatibility testing, the RF spectral record ensures that specific audio cuts are recorded at precise desired to undesired field intensity ratios. For performance characterization, the receiver mode and GPS position data captured every second can be translated into a digital/analog multicolor "bread crumb" trail, for map overlays.

FINDINGS

For the coverage tests, a series of radials were run from each station at the existing digital power level and at the higher digital power level. From these tests, maps were produced showing existing digital coverage in each market and the digital coverage attained at the higher power level. Fig. 9 shows the difference in coverage for WJRZ in New Jersey operating at the normal -20 dBc and then at the elevated power of -10 dBc.

SEE 10 DB, PAGE 10

The results of all the performance runs were tabulated and by averaging the data we were able to quantify the results. See Tables 3 and 4.

Although this sample of seven stations is a small representation of the more than

SEE 10 DB, PAGE 10

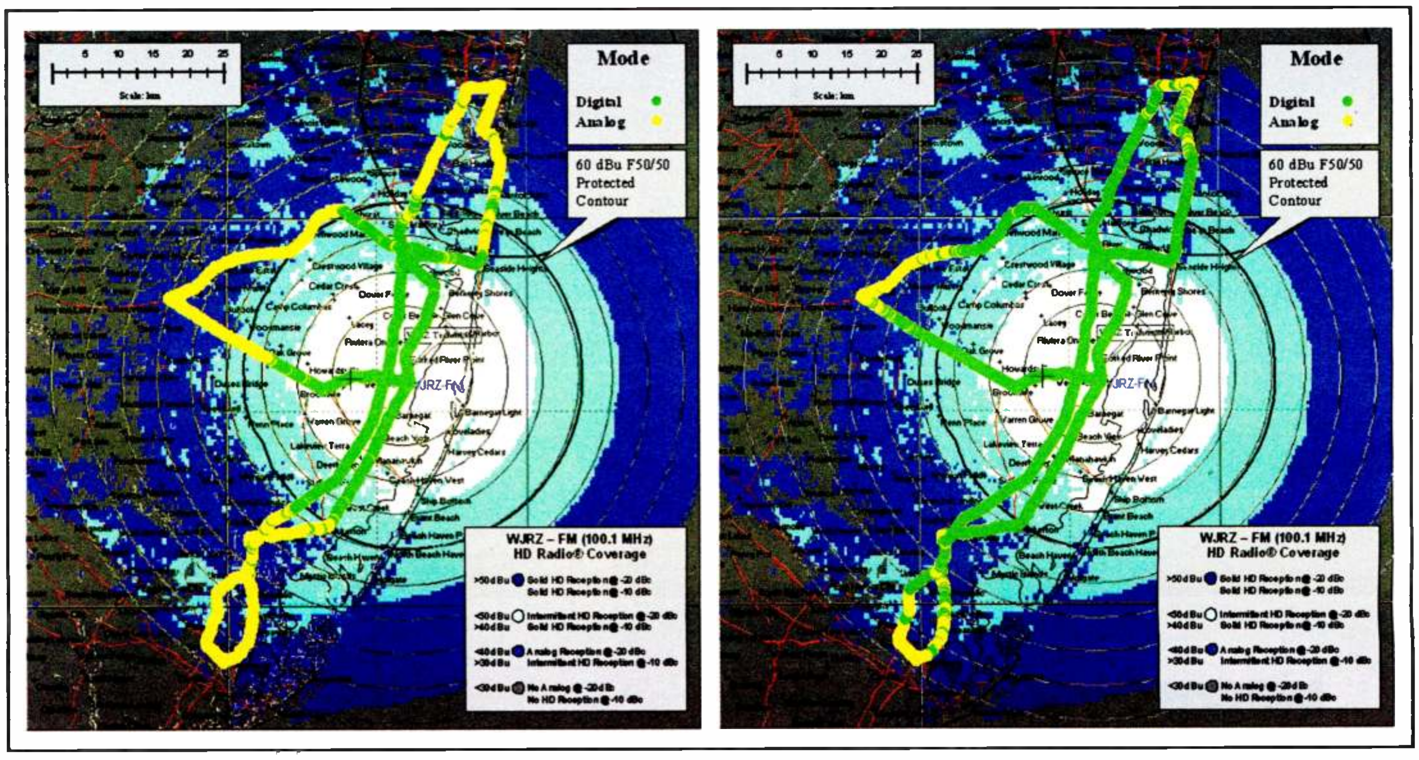

Fig. 9: WJRZ HD Radio coverage at -20 dBc and -10 dBc digital to analog power ratio

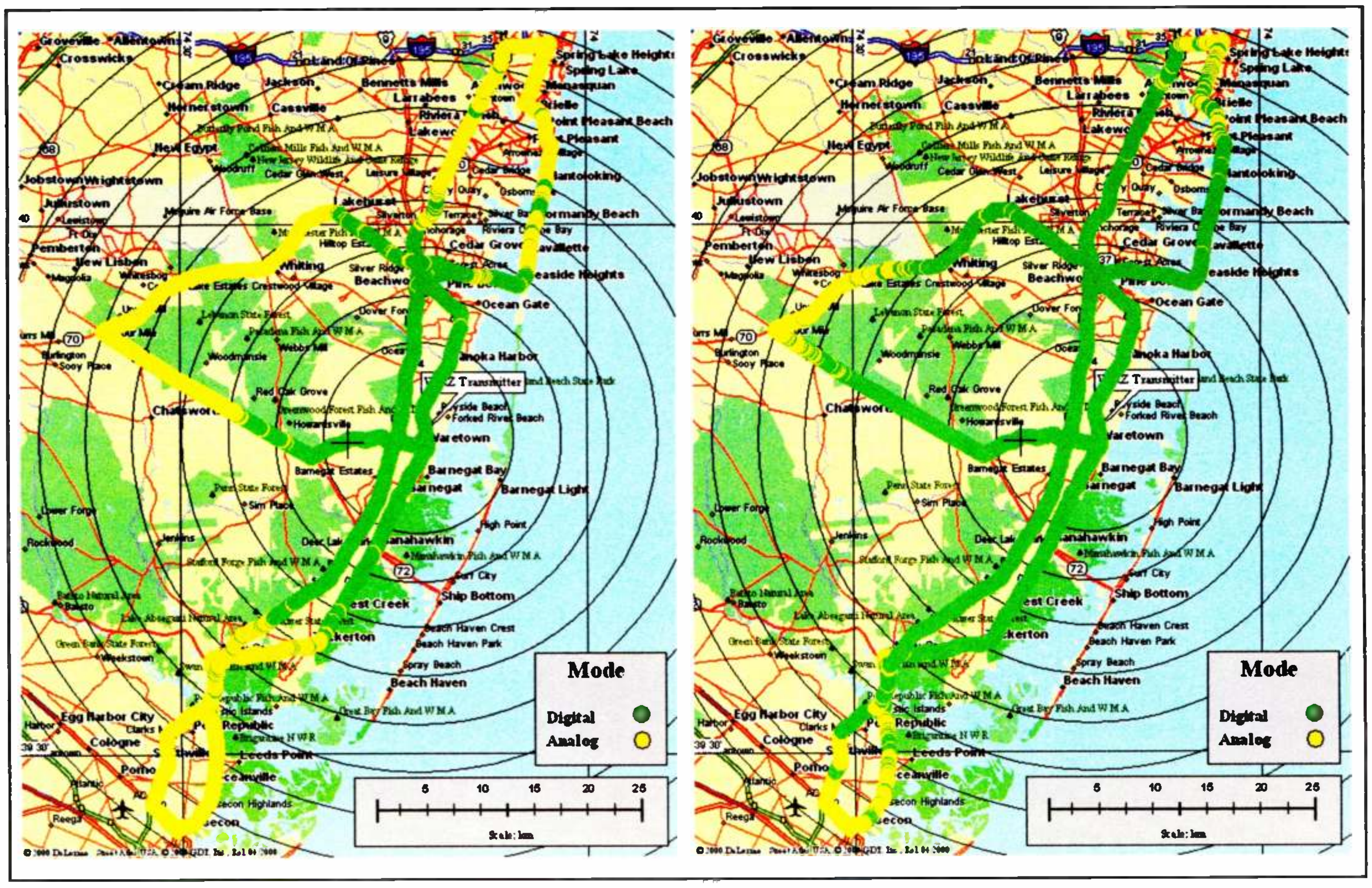

Fig. 10: Examples of map plots showing digital signal coverage (green) vs. analog signal coverage (yellow) at -20 dBc and -10 dBc power levels.

Can do.

CODECS

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by Charles S. "Buc" Fitch

Keep a Close Eye on Tower Documents

Question posed in the last issue
(Exam level: CBRE)

At a minimum, what documents should your station engineering records have for the 400-foot tall, company-owned FM antenna tower in the studio parking lot?

a. Only the FAA "Determination of No Hazard"
b. The FAA "Determination of No Hazard" and the FCC "Antenna Structure Registration"
c. The FAA "Determination of No Hazard," the FCC "Antenna Structure Registration" and the latest (last) license on the tower with lighting/marking directives
d. The FAA "Determination of No Hazard," the FCC "Antenna Structure Registration," the latest (last) license on the tower with lighting/marking directives and at least the last two years of quarterly inspections of the tower lighting, marking and structural integrity.
e. No documentation is required

SBE certification is the emblem of professionalism in broadcast engineering. To help you get in the certification exam frame of mind, Radio World Engineering Extra poses a typical question in each edition. Although similar in style and content to exam questions, these examples are not from past exams nor will they be on future exams in this exact form.

The correct answer is to the question in the box is **d**.

In a strange twist of regulations, the Federal Aviation Administration can only *recommend* tower lighting and marking (L&M). However, the Federal Communications Commission can *require* it from radio stations. Installation and maintenance of the dictated L&M usually is a condition of the station license grant.

The first stage of the tower permitting process on the federal level is FAA review, which you hope concludes in a "Determination of No Hazard."

You should think of this as a determination that "no hazard *if* the following is accomplished," and that "if" usually is the L&M.

(In a case in which I was involved, the "marking" requirement included installation of a non-directional VLF radio beacon to allow aircraft to navigate around the tower. Be happy if all you need do is light and paint your tower.)

All that follows stems from the FAA review, so keep a complete copy of that document.

The Antenna Structure Registration (ASR) program now allows the FCC to keep track of the existence and construction status of support structures that fall into the serious, coordinated category.

All structures that require lighting and marking must be registered. In general, this covers structures with height more than 199 feet above ground level, which includes short towers on top of tall buildings that top out over 199 feet AGL, and even some shorter structures near airports.

The majority of applications for transmission sites are processed using the site's ASR number; and if the site requires ASR status, no grant will be issued until registration is accomplished. Site owners must issue a copy of the ASR to tenants for their records as soon as their presence at the site is formalized, such as when they file an FCC application for the site or sign their lease. (We may get a rule change after which owners would be required only to supply the Web location of the ASR record.)

If your station is a tenant and you do not have a copy of the ASR, request a copy of the original. If the owners do not furnish a copy, print the record off of the Wireless Branch ASR Web site just to CYA.

The last license issued for a site dictates

SEE TOWER, PAGE 12

10 dB

CONTINUED FROM PAGE 8

1,800 HD Radio stations, they are representative of typical types of terrain. A larger sampling of stations would presumably show a broader range of data. What we can see from this study is that a 10 dB increase in the digital power results in significant increases in coverage.

COMPATIBILITY

Recordings were made of analog stations in the study with first-adjacent digital stations broadcasting with no digital carriers, carriers set at the licensed level of –20 dBc, and carriers set at the test level of –10 dBc. The recordings were sent to Salisbury University for formal subjective evaluation by general population listeners.

Forty-six female and 42 male consumers were individually tested. Participants ranged in age from 18–70 years, and were recruited from both Salisbury University and the local community. Of the 88 consumers tested, eight did not pass the screening test. Therefore only 80 participants were included in the final results. Table 5 shows the categorization of the test population.

Age	Male	Female
18–29	11	10
30–32	10	10
40–49	9	9
50+	10	11

Table 5: Breakdown of Test Audience By Age and Gender

The results of the listening tests were compiled and are presented here in bar graph form. Fig. 11 shows the overall results in terms of Mean Opinion Scores for various interference scenarios and various programming formats. In this set of scores, listeners were judging the impact of first-adjacent IBOC interference at a +6 dB D/U, in other words at the desired stations protected contour. The greatest potential impact was seen when a short-spaced "B" interferes with another "B" when the programming was speech. For the other scenarios, the potential impact was judged to be minimal by the test group. Fig. 12 shows the percentage of people who would continue to listen to the program material, given the audio quality [4].

Distilling the results presented in Figs. 11 and 12, the B-to-B short-spaced scenario is the only situation where increased digital power has the potential of having an impact on first-adjacent analog signals. Methods of mitigating this impact might include reduced power levels in the digital sidebands, directional antenna arrays, and the use of on-frequency boosters to more accurately define a station's coverage area.

ACKNOWLEDGEMENTS

The authors wish to thank the staff of iBiquity Digital Corp., Columbia, Md., for their support and assistance is preparing this paper. Special mention is given to General Counsel Al Shuldiner, Vice President for Commercial Applications Ashruf El-Dinary, Director of Broadcast Business Development Jeff Detweiler and Broadcast Technologist Pat Malley for their invaluable help.

REFERENCES

[1] USA Digital Radio, *Petition for Rulemaking to the United States Federal Communications Commission for In-Band On-Channel Digital Audio Broadcasting*, October 1998
[2] National Radio Systems Committee, *NRSC-5-A, In-Band/On-Channel Digital Radio Broadcasting Standard*, September 2005
[3] *FM HD Radio System Performance at Elevated Carrier Levels*, iBiquity Digital Corp., December 2007
[4] Ellyn G. Sheffield, Jason McCartney, Daniel Schwab, *Consumer Testing HD Radio System Testing at Increased Power Levels*, August 2007

This paper originally was presented at the 58th Annual IEEE Broadcast Symposium, Oct. 15–17, 2008. ■

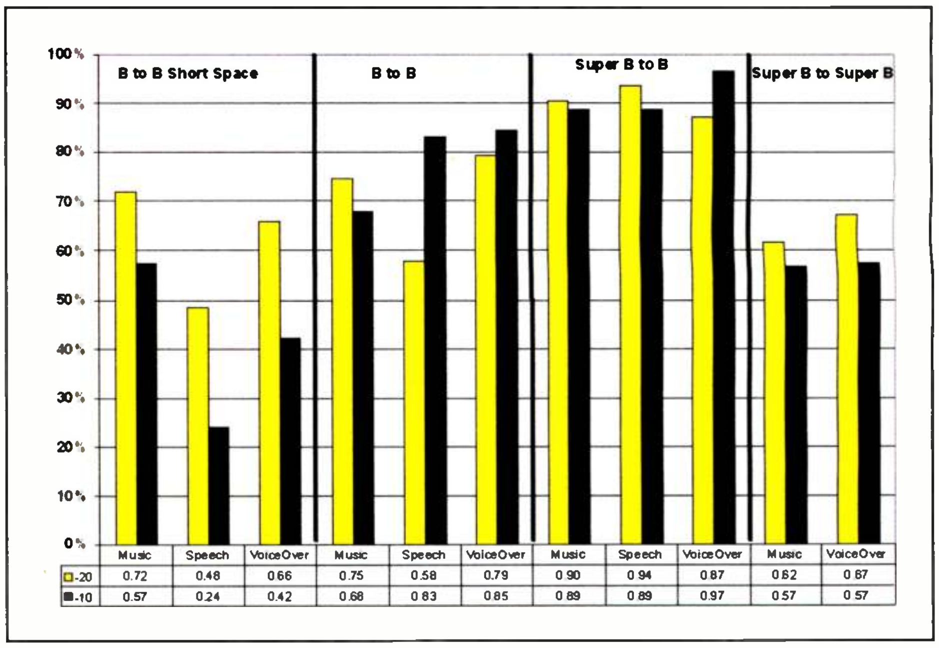

Fig. 11: All Scenarios at +6 dB D/U

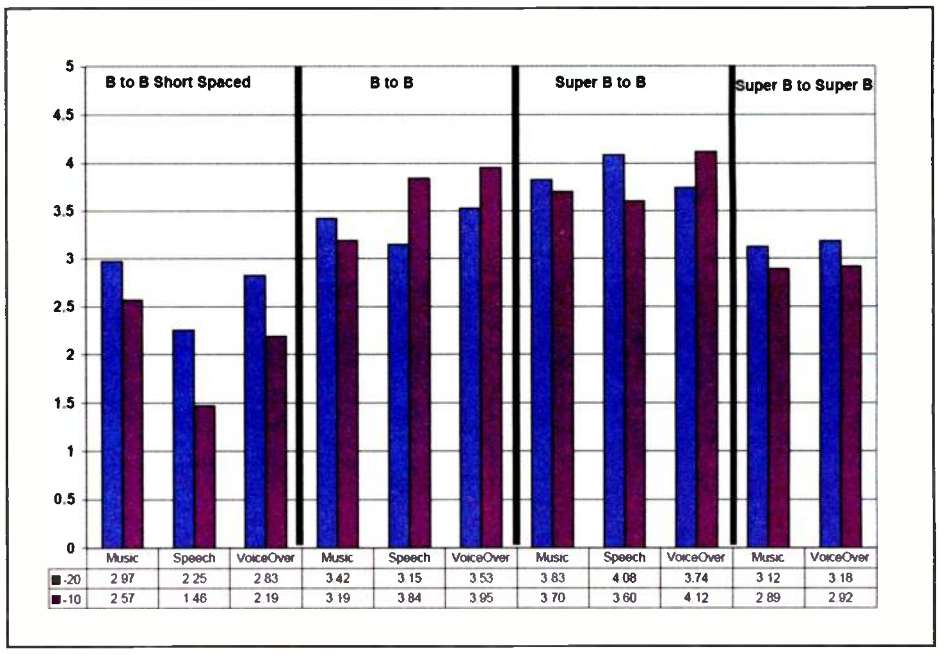

Fig. 12: All Scenarios at +6 dB D/U
Percentage of Participants Continuing to Listen

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Tower

CONTINUED FROM PAGE 10

the Lighting and Marking, so check whenever a new "instrument" is issued. If the L&M requirement does not match your existing installation — such as specifying day and night strobes instead of medium strobes by day and reds at night — these changes must be made or a petition initiated for them to be corrected to the existing L&M circumstances.

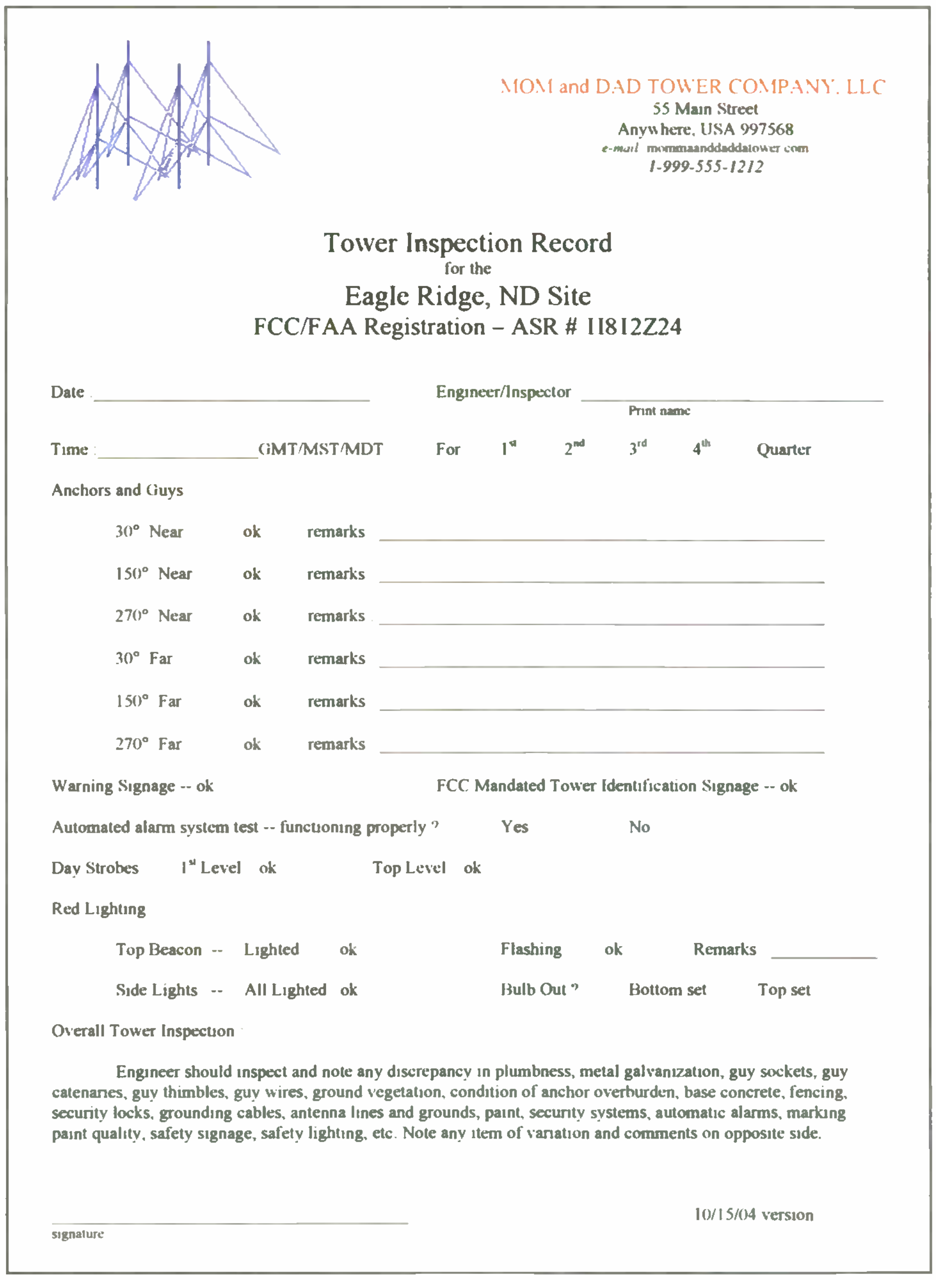
Ignore this at your own jeopardy. No matter what, changes in L&M must be reflected in all licenses to the current, annotated requirements. Having a copy of the last license issued with L&M requirements on it clarifies the issue and demonstrates that you are in compliance.

Since most of these L&M directives are issued automatically based on computer reviewed criterion, most often the computer attaches the normal and current regulation based directives for L&M to match the elevation and location of your support structure. These directives quite often are not the L&M arrangements that you might actually have as a function of operating an older, grandfathered installation or allowed under special circumstances. A few towers require no L&M as they are surrounded by higher hills or in the midst of tall, brilliantly lighted buildings.

There is a legendary story of the Empire State Building being given a marking requirement of alternating bands of international orange and white courtesy of an erroneous key stroke. Check the Lighting and Marking requirements. If they are wrong, persevere until you get them corrected; otherwise you may be installing strobes in January to take the place of those red lights you've been running for 50 years in addition to receiving a healthy Notice of Apparent Liability (read: an FCC fine).

Towers are required to be inspected physically every quarter *and at intervals no more then five months apart* unless you enjoy one of those infamous individual special ruling exceptions; see section 17.47(b) of the FCC Rules.

On the federal level, maintenance and confirmation of the operation of the Lighting and Marking are paramount, but for Building Officials Code Authority, OSHA, insurance and CYA, the structure needs to be structurally inspected as well. You don't need to bring in the outside engineers, but you do need to check for loose guys, deteriorated or missing ground wires, rust, obvious vertical distortion and such, logging your observations and corrections.



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1-999-555-1212

Tower Inspection Record
for the
Eagle Ridge, ND Site
FCC/FAA Registration – ASR # 11812Z24

Date ________________ Engineer/Inspector ________________
Print name

Time ________________ GMT/MST/MDT For 1st 2nd 3rd 4th Quarter

Anchors and Guys

30° Near ok remarks ________________
150° Near ok remarks ________________
270° Near ok remarks ________________
30° Far ok remarks ________________
150° Far ok remarks ________________
270° Far ok remarks ________________

Warning Signage -- ok FCC Mandated Tower Identification Signage -- ok

Automated alarm system test -- functioning properly ? Yes No

Day Strobes 1st Level ok Top Level ok

Red Lighting

Top Beacon -- Lighted ok Flashing ok Remarks ________

Side Lights -- All Lighted ok Bulb Out ? Bottom set Top set

Overall Tower Inspection

Engineer should inspect and note any discrepancy in plumbness, metal galvanization, guy sockets, guy catenaries, guy thimbles, guy wires, ground vegetation, condition of anchor overburden, base concrete, fencing, security locks, grounding cables, antenna lines and grounds, paint, security systems, automatic alarms, marking paint quality, safety signage, safety lighting, etc. Note any item of variation and comments on opposite side.

____
signature

10/15/04 version

Sample Inspection Form

If you have automatic lighting failure warning systems, operation must be checked and confirmed as part of the 90-day inspections. Although there is no specific requirement for preservation of these inspections, I suggest you keep the last two years of original inspections on file, based on guidelines we find at the federal level.

The graphic shown here is a typical tower inspection form; if you'd like a more detailed one, check out one that the state of Maryland uses (this is a PDF download) at *http://tinyurl.com/inspectionRW*.

A note about coordinates on documents: FCC licenses under Part 73 most likely will be in the North American Datum of 1927. ASR and Part 74 licenses will be in NAD-83. Remarkably, I often find that somehow the coordinates have become confused.

If you have not checked that the real and accurate coordinates have been used uniformly in all your paperwork, do so. And check new paperwork when it arrives so the integrity of your numbers is maintained. This includes the licenses that your tenants maintain as well.

As a side note and by way of a reminder, all towers that have an ASR number are required to have it posted visibly on or near the tower. Additionally the FCC has "clarified" this rule that the number should also be posted at the nearest point that the general public can approach the tower. So if you can see the tower at the end of the driveway and that's as close as the public can come, the ASR number has to be posted there as well. In extreme cases — say, your tower is out on a private island — the ASR number has to be posted at the nearest public point as well as the private island buoy sign or at the nearest public pier.

If all of the above is not enough, most sites require an "RF Plan" a directive from another corner of the federal government that addresses mainly non-ionizing RF radiation. Since this document is more closely coupled with OSHA, we'll address this separately in a future column.

Don't forget, the deadline to sign up for the next SBE certificate exams at the local chapter level is Dec. 31. Details at *www.sbe.org*. Good luck!

★ ★ ★

A CBRE-level question for the February issue: *You have installed a new solid-state transmitter in place of your old tube rig using the same power connections. On cold start the supply panel circuit breaker trips but if you reset the CB fast enough and restart, the rig will run without a trip. What is the most likely cause?*

a. When running, solid-state transmitters intrinsically consume more current then comparable tube rigs.

b. You have reversed the phase and neutral wires.

c. The current inrush caused by the highly reactive input of switching supplies used in most solid-state transmitters exceeds the current "trip curve" of the circuit breaker.

d. You have forgotten to install utility power line surge protection.

e. You cannot start up a solid-state transmitter with modulation applied.

Buc Fitch, P.E., CPBE, AMD is a frequent contributor to Radio World. Miss one of his certification columns? They are archived at radioworld.com. ■

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Support

A DAY IN THE LIFE

by Cris Alexander

Misconceptions About Computer Modeling of AM Directional Arrays

Back in September, after a 19-year wait, the FCC approved the much-anticipated rules that will permit computer modeling of AM directional arrays as a means of directional antenna performance verification. The NPRM came out early last spring and generated a lot of hubbub at the NAB spring show and through the summer. Now, the rules have been approved by the FCC and are slated to become effective in February.

This is a very good thing for AM broadcasters, and yet there is much misunderstanding and misinformation out there.

One misconception is that all directional AM stations will have to model their arrays. Not true.

Antenna modeling simply represents an *option* for broadcasters. Stations can continue operating under the terms of their existing licenses as before. But if there is a condition at a station (such as an out-of-tolerance monitor point or tower work above the base insulator) that would otherwise require pattern adjustment and either a full or partial proof of the array, the *option* now exists to instead construct a model of the array, calibrate the sample system and adjust the array to the model-indicated parameters.

In my view, that beats the heck out of walking and driving all over the countryside making proof measurements! But if a traditional proof is a more comfortable way to go for a particular station owner or engineer, that remains an option as well.

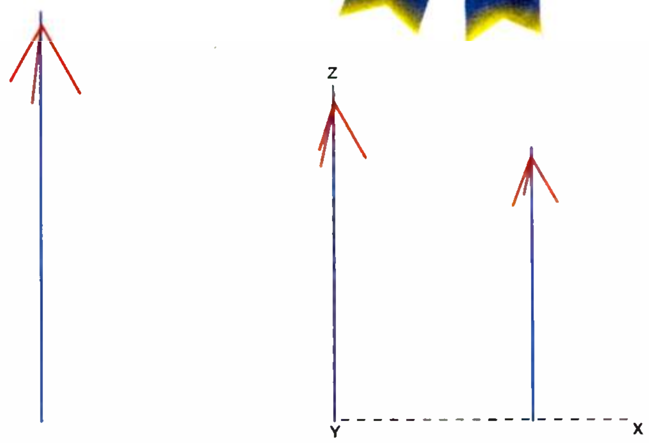
Another misconception is that arrays with unequal height towers are not eligible for the modeling option. The new rules provide for modeling of arrays with unequal height towers, provided that they are series fed.

GO FOR THE SERIES

I should note here that *only* series-fed (i.e. insulated-base) towers are eligible for the modeling option. This rules out skirt-fed ("folded unipole") elements and shunt-fed towers using a slant wire. Arrays using other than insulated-base series-fed towers will have to stick with the old proof method.

Still another bit of misinformation that I have heard from several places is that arrays using top-loaded towers cannot be modeled. Untrue.

SEE ARRAYS, PAGE 18



X-Y-Z Graphical Display of a Three-tower Top-loaded Antenna Model Using the MBPRO Modeling Program. Top-loaded arrays are eligible for modeling under the new FCC rules.

FUN WITH TRANSMISSION LINES

In the last few issues of RWEE, I have left you with some little tidbit that you may find useful someday, something that you really can't get anywhere else.

Let's face it, radio engineering textbooks, particularly those that cover some of the "legacy" theory, aren't easy to come by these days. One of my primary reference books, Terman's "Radio Engineering," has been out of print longer than I have been alive!

But that doesn't mean that we don't need to know this stuff. We need these techniques, equations and constants to do our jobs. So I'll continue to provide you with these interesting tidbits.

UPSTREAM IMPEDANCE

What is the input impedance of a transmission line? There can be a lot of correct answers to that question. Out here in the real world, it depends on a lot of things.

In a properly engineered AM transmission system, we would set up the antenna tuning unit network so that the input impedance is equal to the characteristic impedance of the transmission line being used, 50 ohms for modern coaxial lines. Looking into that transmission line from the transmitter end, you're going to see 50 ohms. So what else do we need to know?

Out here in the real world, our load may be 50 j0 ohms on the carrier frequency, but it's something else on all other frequencies. Because our transmissions occupy a band of frequencies rather than a single frequency, it matters what the impedances are on all the frequencies within that occupied bandwidth (and more importantly, it's the slope of those impedances that matters).

Let's take a theoretical case where at the ATU input on carrier frequency we have an impedance of 50 j0 ohms, but on the 15 kHz lower sideband frequency we have an impedance of 37.5 +j4.5 ohms and 39.4 –j17.5 ohms on the upper. A Smith chart plot of these impedances and the 5 kHz points in between is shown in Fig. 1.

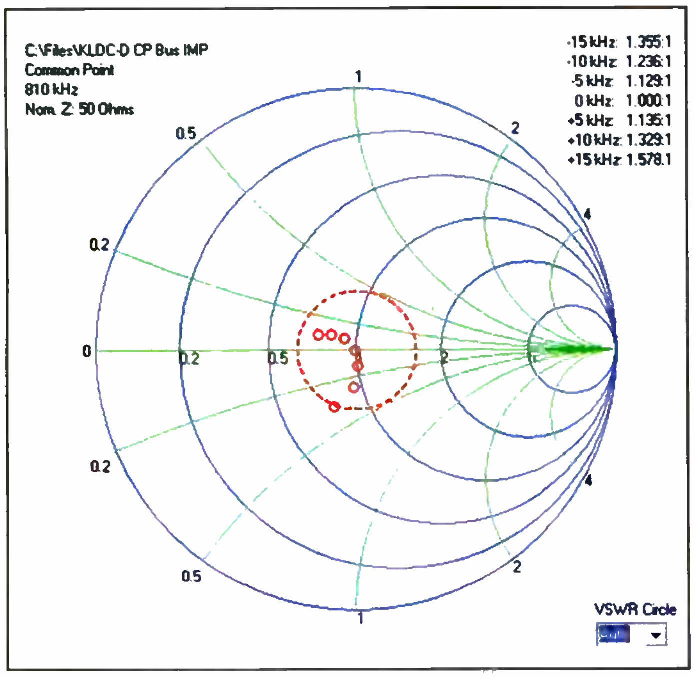


Fig. 1: Smith chart plot of the ATU input.

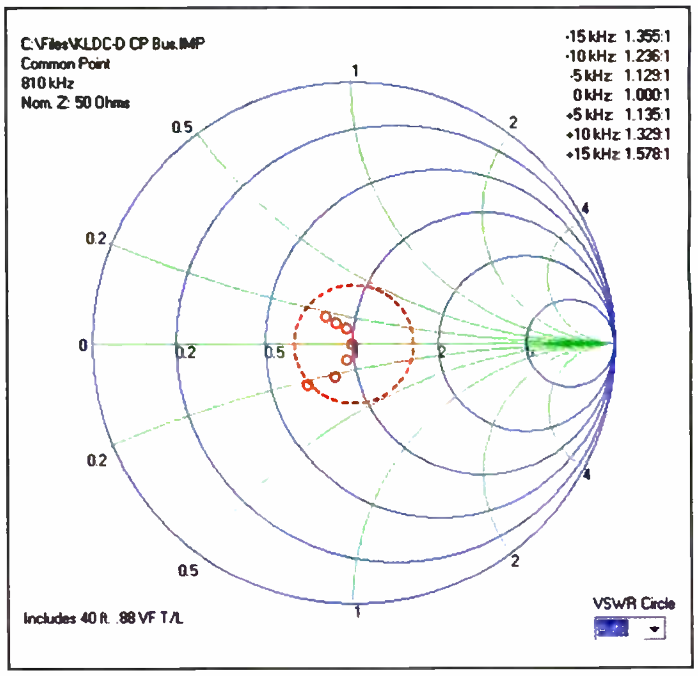


Fig. 2: Smith chart plot of the transmission line input — note the rotation of the plot compared to Fig. 3.

But what will this look like at the other end of the transmission line? Let's assume for a moment that we have 40 feet of 7/8-inch air dielectric transmission line between our transmitter and the ATU. What will the load look like at that point?

There is a way to calculate the input impedance of a piece of transmission line for a given termination impedance. That equation set is shown below. Don't worry — it's not as scary as it looks.

$$R_{IN} = R_1 Z_O$$

$$X_{IN} = X_1 Z_O$$

Where:

$$R_1 = \frac{R(1+T^2)}{D_1}$$

$$X_1 = \frac{[T(1 - X^2 - XT - R^2)] + X}{D_1}$$

Z_O = Characteristic Z of the line

Where:

$$R = \frac{R_{OUT}}{Z_O}$$

$$X = \frac{X_{OUT}}{Z_O}$$

$$T = \tan(T_1 F)$$

$$D_1 = [1 - (TX)]^2 + (RT)^2$$

$$T_1 = 1.2 L_1$$

F = Frequency (MHz)

L_1 = Line length in meters

Let's take that lower sideband impedance of 37.5 +j4.5 ohms and run it through this equation set. Assume a carrier frequency of 810 kHz, which would make the actual frequency 795 kHz. Crunching those numbers through the equation set, we find that this impedance is transformed to 40 +j9.4 ohms on the other end of the transmission line.

We can do the same thing with all the other impedance numbers (except the one on carrier, which won't change if it is, in fact, 50 j0) to see what happens with them on the other side. If we then plot these impedance values on the Smith chart, we get the plot shown in Fig. 2. Note that the cusp has rotated exactly twice the electrical length of the line in degrees.

Now you can amaze your friends with this little bit of knowledge, but more importantly you are equipped to calculate the effect that a length of transmission line will have on an impedance other than the characteristic impedance of the line. That just might come in handy someday.

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Synchronize

CONTINUED FROM PAGE 1

common frequency. Applications range from a network of low-powered FMs covering a region, province or state, to a booster signal transmitting into an area overshadowed by a mountain or tall building.

Through synchronized broadcasts spaced at geographic intervals, commuters can continue to receive a program while driving along an extended stretch of highway, and without changing the dial position on their radios.

Similarly, a network of synchronized FMs enables broadcasters to expand program coverage across a larger region not possible with just one broadcast tower.

In addition, a booster signal synchronized to the main signal is an increasingly popular option for reaching populations within a station's 1 mVm contour but otherwise unreachable by the main signal due to mountains or buildings shielding the signal.

Frequency preservation, cost savings and continuity of service are the main advantages of SFN and booster applications.

Allocating one frequency for a network of synchronized FMs is more band-efficient than broadcasting on a succession of frequencies, especially if a single frequency

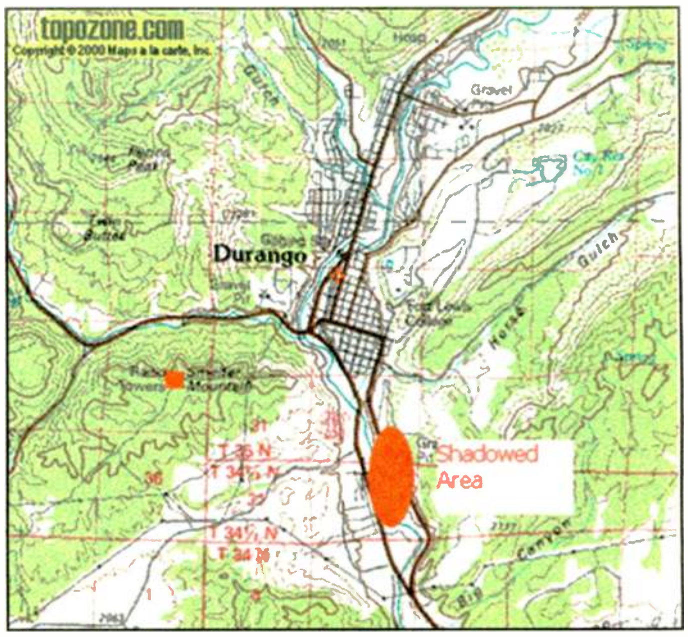

Fig. 1: Dead zones within the primary coverage area are good candidates for fill-in boosters, as this map of a Durango station's coverage area shows.

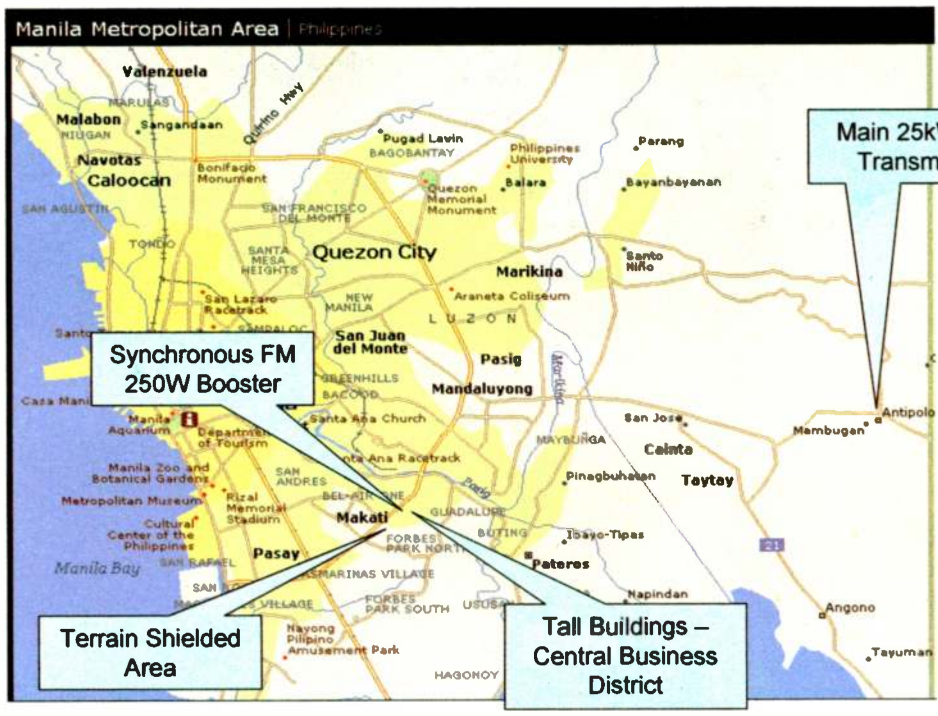

Fig. 2: Listener gaps in areas shielded from the main signal by buildings are also good candidates for fill-in boosters.

Arrays

CONTINUED FROM PAGE 14

Top-loaded towers are very much eligible for the modeling option, again provided that they are series fed.

The new rules require reference field intensity measurements at three points on each of the null and lobe radials. Some have misunderstood this to mean that arrays licensed pursuant to the modeling option will still have monitor points. Again, not true. Monitor points will be a thing of the past for such stations. The reference field intensity measurements are filed along with the model, but they do not have licensed maximum values as monitor points do.

A requirement of the new rules is that modeled arrays have their sample systems recertified every 24 months. This requirement has produced no little angst among those who do not have a good understanding of what it entails.

A network analyzer, while a handy (and way cool) tool to use for this purpose, is not required. All you have to do is check the current/voltage/phase linearity of the base sample devices (TCTs) or the consistency of the impedance of the sample loops, and then check the sample lines for electrical length and loss. All that can be done with a bridge, oscillator and detector. Also once every 24 months, the reference field strength measurements must be repeated. Again, these aren't monitor points, so a higher field strength at a point than one filed with the license application does not constitute a "violation."

And you don't have to file an FCC Form 301 to employ the modeling option in most cases. The station license can be modified for eligible stations with a Form 302-AM.

Besides doing away with monitor points, perhaps the biggest advantage of the modeling option for AM station owners and engineers is the cost savings that this option represents.

Most if not all the variables associated with the old way of doing things can be eliminated, leaving a fast, fixed-cost means of tuning up and "proofing" a directional array. Rather than days, weeks or even months of trial and error adjustments and measurements, the modeling and adjustment process can be completed in a couple of days. Instead of days or weeks of walking and driving radials and making field measurements, and instead of countless hours documenting the measurements, with the modeling option as soon as the array is adjusted to the model parameters and three field measurements are made on each pattern minima and maxima radial, you're done. You can file the 302-AM and go home.

The new modeling option also does away with most of the excuses for having an out-of-adjustment array. For a fixed sum, most arrays can be retuned using a model, eliminating the likelihood of a big FCC fine and clearing up interference caused by the out-of-adjustment directional pattern. With a low-cost way to make their out-of-adjustment arrays compliant and clean up interference, I believe that a lot of AM station owners will be willing to make the relatively small investment to model and retune. This, I think, will make the AM band a much better place to be.

Cris Alexander is the director of engineering at Crawford Broadcasting Company and the SBE's Broadcast Engineer of the Year. ■

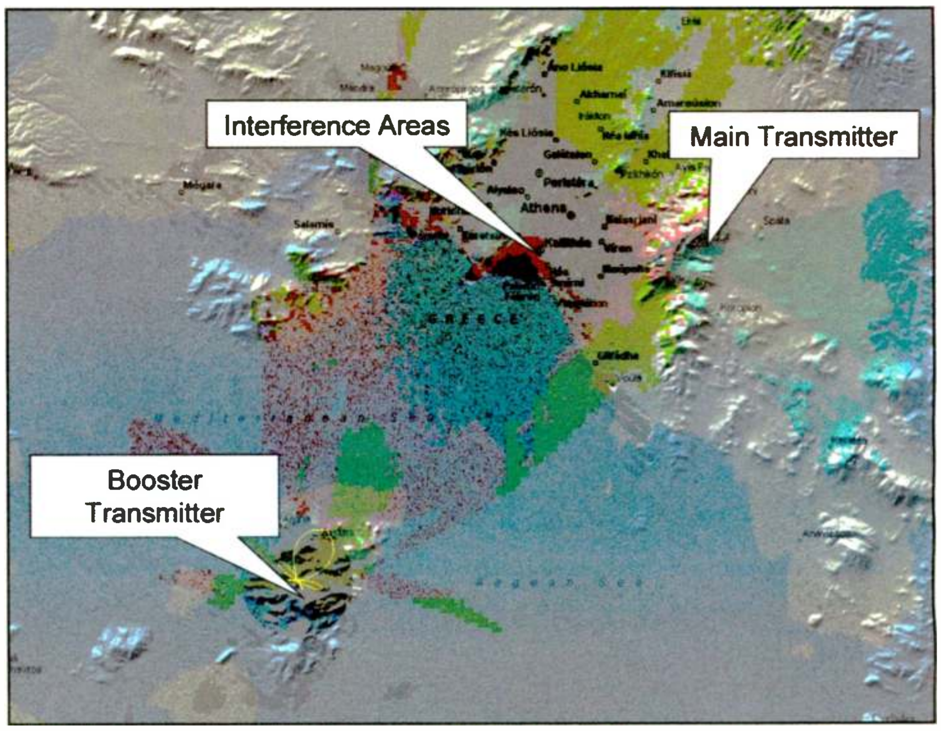

Fig. 3: This map of a single-frequency network and added booster shows how one broadcaster in Athens was able to cover a large geographic area with one broadcast frequency.

has been established already in a mature market and the remaining frequencies available present a possibility of adjacent-channel interference. Costs across the board, from capital expenditure to operating expenses, also may be comparatively less for SFN or booster applications, depending on the extent and location of broadcasts.

Just as important, the SFN and booster application is largely seamless to the listener; he or she can continue to listen to the same broadcast over a wider region without changing frequencies. For many broadcasters, this application offers a way to extend and expand programming coverage without listener loss.

EXAMPLE INSTALLATIONS

The following are just a few examples of the dozens of synchronous FM applications BE has been involved in over the years.

The topographic map in Fig. 1 illustrates a booster installation successfully completed near Durango, Colo. The shaded area shown is representative of the dead spots within the primary coverage area that are out of the line-of-sight of the main broadcast signal and filled in by a booster signal. A properly conducted and executed engineering study identified the ideal location for the booster site in order to maximize population penetration and minimize interference to the listener.

Natural terrain as well as large buildings in the central downtown business district shielded the main 25 kW broadcast originating some distance from downtown Quezon City, Manila, shown in Fig. 2. A 250 watt booster signal supplied by BE and synchronized to the main FM filled in the listenership gaps in this downtown area.

The topographical map of Fig. 3 shows a single-frequency network along with a booster application implemented near Athens, Greece, by Broadcast Electronics engineers. Initially broadcasting on two separate frequencies in the region, the broadcaster synchronized both its stations to cover the same regional area using one frequency, and returned one frequency to the communication authority for reallocation to other public services.

Also, notice the blue shaded area along the Mediterranean Sea. A booster tower was installed on the adjacent island with the signal aimed at the city so listeners could continue to receive the broadcast uninterrupted as they drove along the highway below the bluff overlooking the sea.

Long, well-traveled highways are good candidates for low-powered synchronized FM networks, as shown in Fig. 4. This map represents a SFN in Malaysia. The circles in red are representative of the coverage patterns of 12 low-powered transmitters making up a single-frequency network

SEE SYNCHRONIZE, PAGE 20

RoadWarrior LC is a new full-duplex, two channel (Program & talkback) audio codec. Its new design, robust, compact and with a flat control surface, prevents accidental damage to the controls and makes it easier to use. It is a portable audio codec with all Suprima functionality built in.

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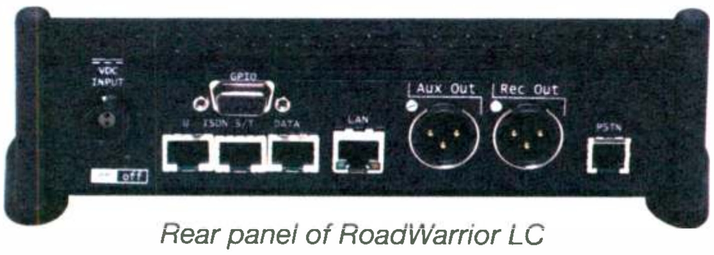

Rear panel of RoadWarrior LC

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Synchronize

CONTINUED FROM PAGE 18

synchronized to provide unbroken service one end of the highway to the other.

Several high-powered stations synchronized on one broadcast frequency efficiently cover a large area while preserving the frequency band in that region or country. Fig. 5 shows how BE's "synchronize everything" approach enabled this India broadcaster to air programming to a large region using one frequency, instead of four, five or more frequencies.

Fig. 4: Several low-powered transmitters broadcasting on the same frequency can provide unbroken service from one end of the highway to the other.

INTERFERENCE ZONES

In theory, the SFN and booster application provides new and rich opportunities for reaching out to new listeners. In practice, however, the application has seen limited success because of "interference" zones, where overlapping signals of equal strength from two broadcasts on the same frequency can cause audible distortion and dramatically increased noise.

Interference happens when two signals broadcasting on the same frequency arrive at the receiver within 3 dB of each other in signal strength. These interference zones are the area where one transmitter hands off coverage to another. If one signal is weaker by more than about 3 dB, the receiver captures the stronger signal and completely ignores the weaker one, resulting in adequate reception. The problem arises when both signals are of near equal signal strength and are combined within the receiver.

If both signals are coming into the receiver at the same signal strength, the receiver cannot separate one from the other and it reproduces the resulting difference as noise. The resulting audible distortion and noise sound similar to multipath.

ISSUES AFFECTING INTERFERENCE

Several key issues affect the degree and severity of noise and distortion in the overlap zone. As mentioned, we have been able to mitigate some distortion in the interference zone by synchronizing the RF carrier frequencies of both transmissions. As early as 1988, BE began aligning the carrier frequencies by synchronizing the booster exciter to a reference frequency generated in the main exciter. This lessened the disparity between the two signals coming into the receiver, and reduced the affect of one cause of distortion.

Fig. 5: This map shows how synchronizing several transmissions can make it possible to broadcast to a wide geographic region using one frequency, instead of several.

However, early field experiments proved that it's not enough to just align carrier frequencies. Audio level differences from both broadcasts potentially increase the noise floor, causing varying degrees of white noise. In addition, audio arriving at the interference zone at different intervals results in an out-of-phase condition, causing even more noise.

What's more, if the two stereo pilots are out of phase, noise will show up in the stereo signal as the receiver switches between the two pilots trying to lock onto a signal.

What is needed is a way to precisely lock the carrier and the pilot in frequency and in phase, and to synchronize audio levels as well as delay the audio at one of the transmitters so that it arrives at the interference zone exactly at the same time as the audio coming from the other transmitter.

If everything — audio, pilot and carrier — is synchronized, the signal will be optimized within the targeted portion of the overlap zone.

THE POWER OF GPS

The advent of GPS technology along with BE's introduction of the FXi exciter in 2002 allowed the next step to be taken in improving overall booster performance.

The FXi exciter was the first to employ direct-to-channel carrier synthesis based on the GPS external 10 MHz reference. The GPS reference was used to synchronize not only the carrier but the pilot as well. In addition, with the use of a pilot sync option and the external 1 pulse per second capability of later GPS receivers, the phase of the pilot signal could also be locked to a common reference. The use of an extremely accurate modulation adjustment of the AES/EBU input also helped align the resultant modulation levels of multiple exciters.

BE has since refined the application of synchronous technology with the introduction of its next-generation FXi 60/250esp digital FM exciter in April 2008, which now includes built-in synchronous features ideal for this application. Prior to the FXi 60/250esp exciter, external GPS and delay units were needed to perform the synchronization.

SYNCHRONIZE EVERYTHING

BE's "synchronize everything" approach requires several components.

First, an uncompressed digital AES/EBU studio-to-transmitter link is recommended. This makes it possible to synchronize audio accurately using the AES/EBU input on the exciter. BE's FXi exciter, for example, has the ability to adjust input levels to within 0.1 dB for accuracy purposes.

Next, GPS receivers are needed to synchronize carrier and pilot, both in frequency and phase. BE's FXi 60/250 exciter has a GPS receiver built-in; all that is required is an external antenna.

Finally, a delay function is also needed to accurately synchronize programming in the selected region of the interference zone. An internal delay in the BE FXi exciter accurately adjusts the delay with a resolution of 1 microsecond along with the capability to adjust the minimum delay to approximately 1 microsecond; another cost savings. This is essential when the difference in distances between the two sites and the interference zone is small and a small amount of delay is required.

SEE SYNCHRONIZE, PAGE 22

Sychronize

CONTINUED FROM PAGE 20

What happens when audio levels from separate sites differ?

The following graphs show what happens when variations in audio modulation levels take place between two transmitters, similar to what happens in the interference zone as programming coming from two separate broadcasts on the same frequency conflict with each other in the receiver.

These plots were created by feeding the two signals into a combiner and viewing the resultant output.

Small variations in modulation levels can affect reception quality. Shown here in Fig. 7 is a quarter of a decibel variation in modulation between the two broadcasts, resulting in an increased noise floor from –90 dB to –70 dB.

If we increase the modulation variation, the noise floor is even more pronounced (see Fig. 8). Shown is a modulation deviation of a half a decibel, resulting in a rising noise floor approaching –50 dB.

Finally, if we increase the modulation variation between the two signals to a full decibel, the signal becomes largely unlistenable (Fig. 9).

What happens when signals transmitted from separate sites arrive at the overlap zone at different intervals?

The following plots show what happens when signals from each transmitter arrive at the receiver at different time intervals, where one signal is delayed or out of phase with the other. These plots were created by feeding the two signals into a combiner and viewing the resultant output.

Shown in Fig. 10 is the resulting noise when signals from two sources are shifted 90 degrees out of phase. Note the noise in the –80 to –100 dB range as a result of one signal arriving at a 90 degree time delay.

Here is the resulting noise, between –60 and –80 dB, when the two signals are shifted 180 degrees out of phase (see Fig. 11).

BUILDING BLOCKS TO THE 'SYNCHRONIZE EVERYTHING' APPROACH

In the late '80s and the early '90s, at Broadcast Electronics we focused primarily on syncing the carrier and pilot frequencies

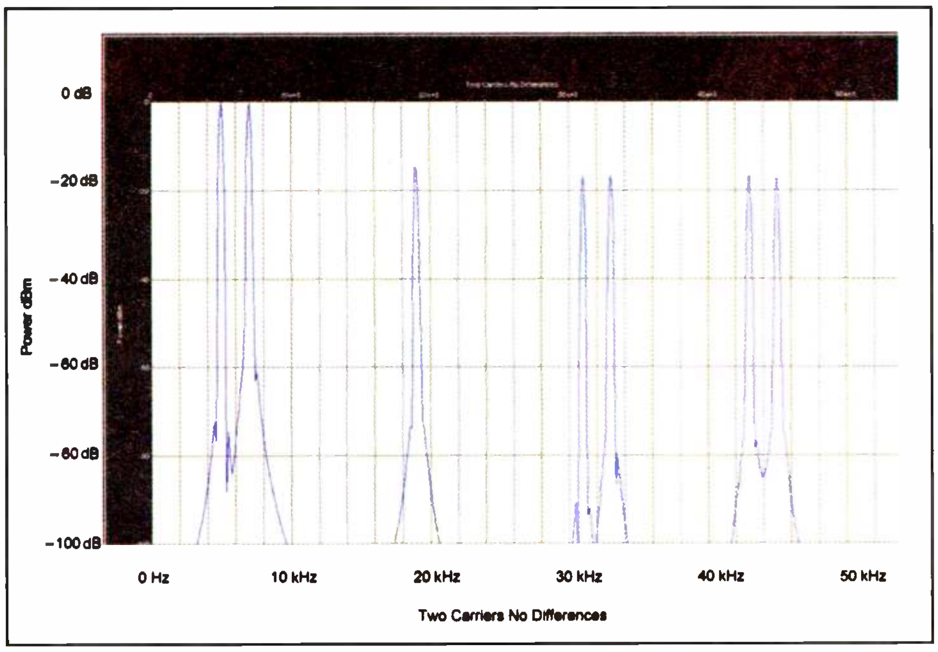

Fig. 6: The composite baseband of two carriers in phase alignment. Notice the relative absence of noise.

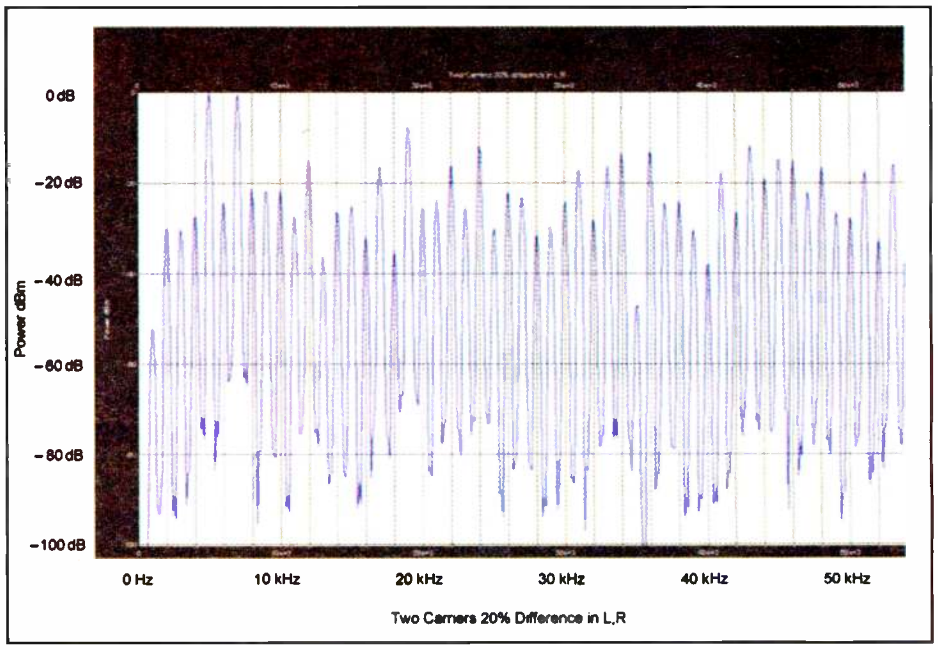

Fig. 9: Two carriers — 1 dB deviation difference.

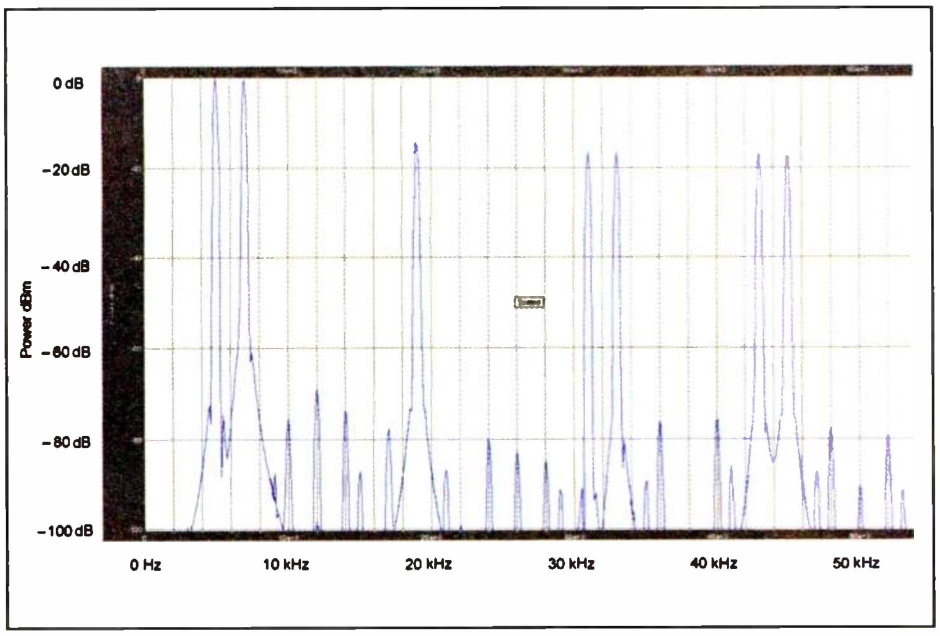

Fig. 7: Two carriers — 1/4 dB deviation difference.

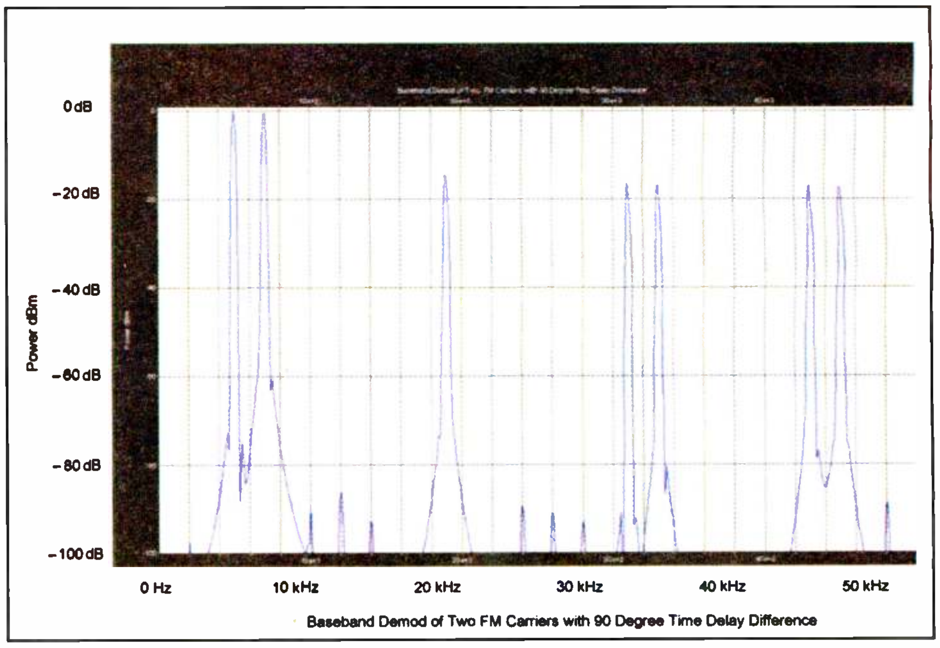

Fig.10: Two carriers 90 degree time delay

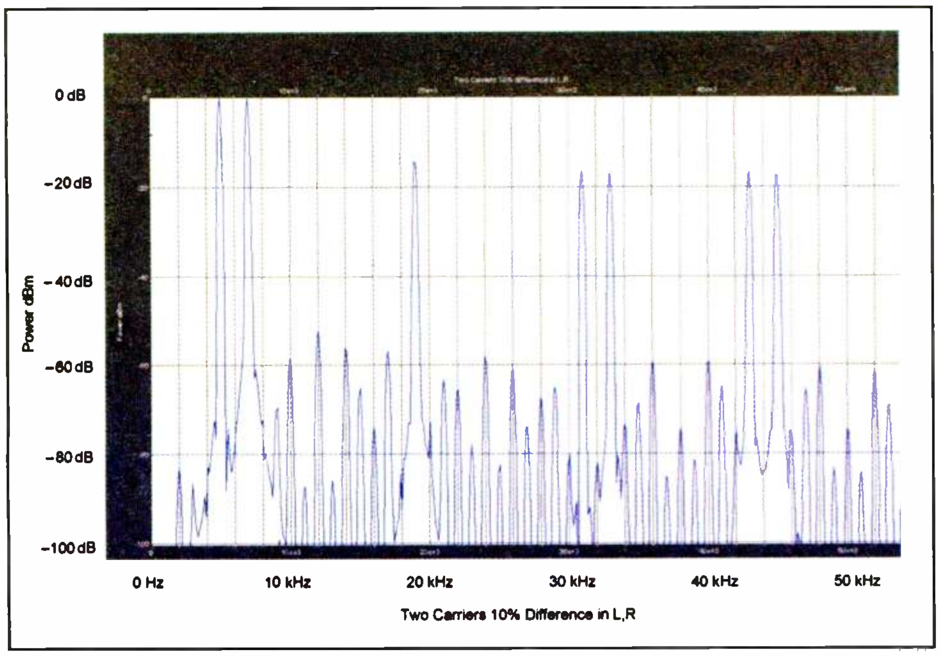

Fig. 8: Two carriers — 1/2 dB deviation difference.

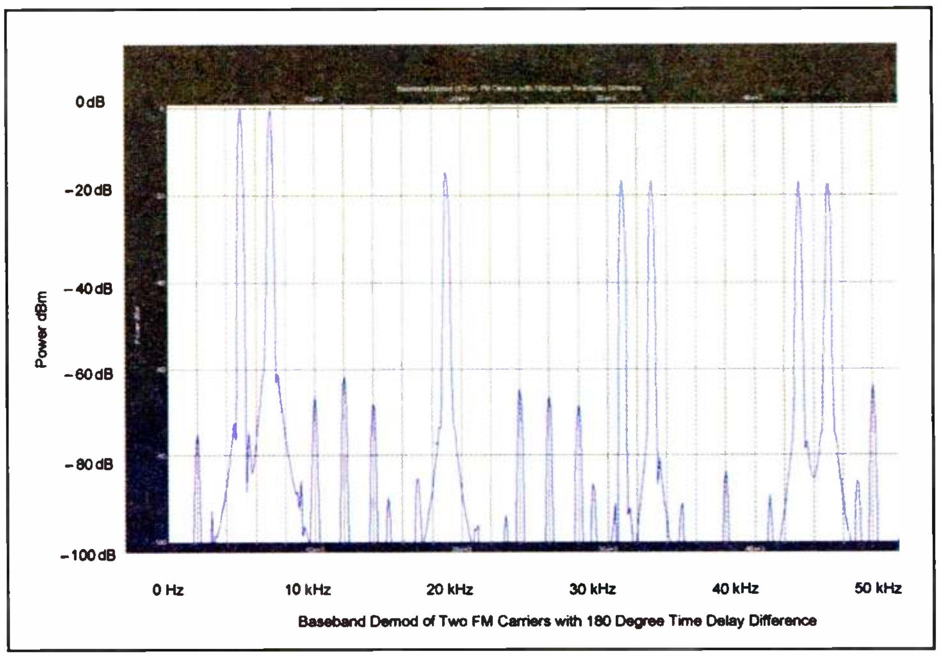

Fig.11: Two carriers 180 degree time delay

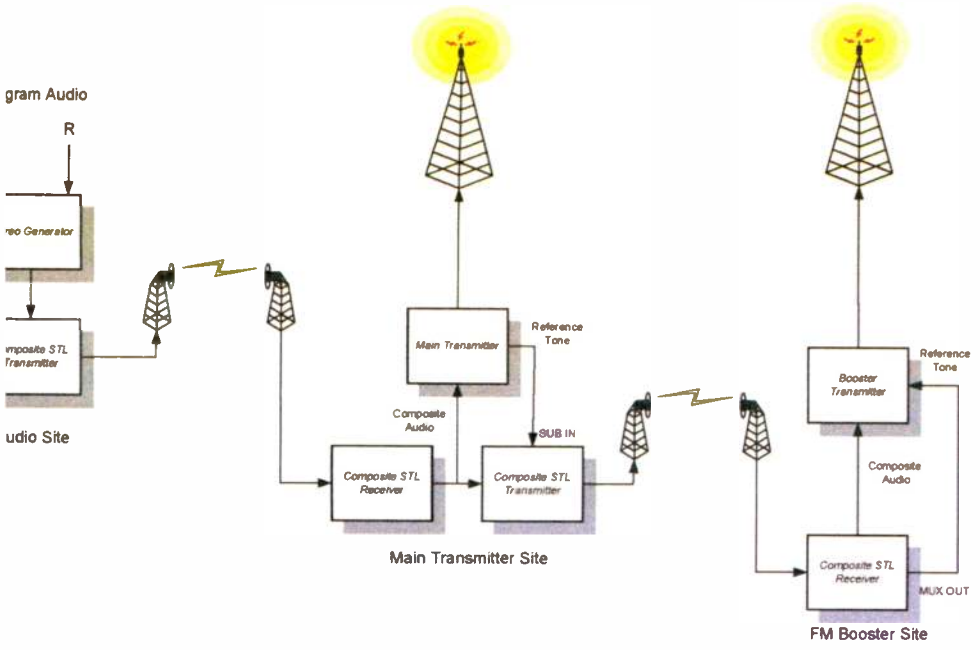

Fig.12: Previous System Block Diagram

in an attempt to reduce the interference in the overlap zones. And, to some extent, we were successful. We found that by setting up a secondary booster exciter as a slave to the main exciter, we could reduce the interference noise to a level much lower than is possible without this synchronization.

Fig. 12 is a typical block diagram of the master/slave synchronous configuration.

As GPS devices became available, we moved away from the master/slave configuration and started adding GPS receivers at each transmitter site as a more accurate common reference for synchronizing the carrier and pilot frequencies, as well as the phase of the pilot.

We designed our first-generation FXi exciter to accept an external digital carrier reference, which enabled two FXi exciters to be synchronized to a common carrier frequency as referenced to a 10 MHz GPS outputs. Then, as time went on and we recognized the importance of synchronizing the phase of the pilot as well, we added a 1 pulse-per-second (PPS) reference from the GPS to create a reference to which each pilot frequency can be phase locked.

By doing so, we virtually eliminated the noise created when the receiver switches between the pilots of the two carriers.

Yet, we continually ran into program timing problems that caused another source of noise in the overlap zones. Audio arriving from each tower at different intervals resulted in audio phase issues; the more the two audio sources were out of phase with one another, the more distortion showed up in the interference zone. As our previous plot graphs indicate, two signals shifted at 180 degrees out-of-phase can create distortion on the order of –70dB.

To correct for this, an extremely accurate delay unit with a very low minimum delay is required.

The resolution of the delay unit is of critical importance in order to precisely correct for any phase variation between the two broadcasts. This type of unit was difficult to find and quite expensive, and added a level of complexity that could be avoided by including the delay in the exciter.

In Fig. 13 the delay unit is eliminated from the configuration block diagram because this function is designed into the FXi 60/250esp digital FM exciter.

Setting delay in the unit can be done in 1 microsecond increments, starting at zero and going up to several seconds' delay in order to cover any parameters that might be needed in the field. In addition to delay functions, the FXi 60/250esp has fine calibration of the AES/EBU inputs to align the modulation levels of two or more exciters within 0.1 dB deviation accuracy. As mentioned, if modulation levels from two exciters are not exactly the same, the resulting effect is noise in the interference zone.

SEE SYNCHRONIZE, PAGE 29

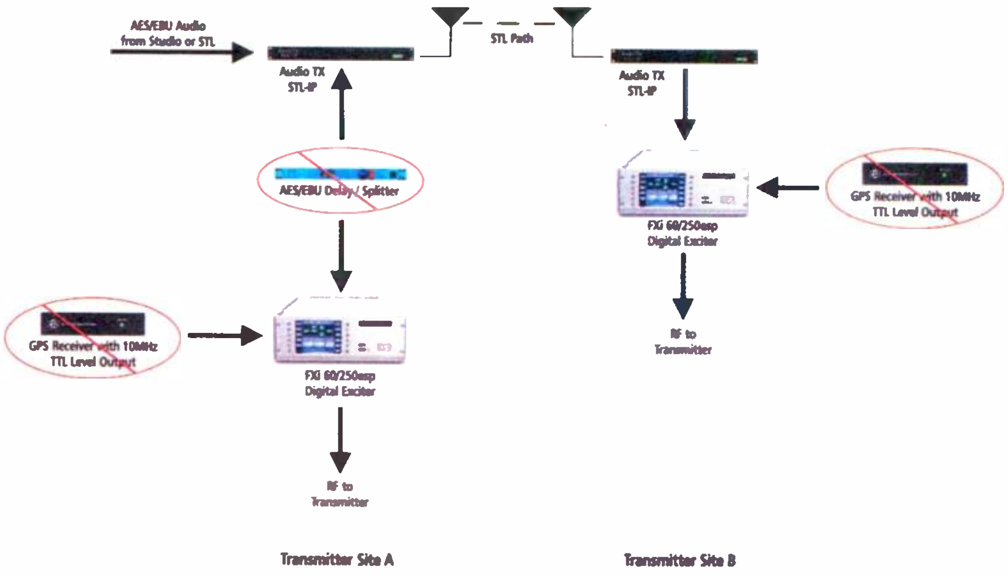

Fig.13: Current System Block Diagram

GUY WIRE

Coping with the Meltdown

How Far Down Will Corporate Radio Go?

It's now grown into a 1,000-pound gorilla staring at everybody in the room. Nobody can ignore it anymore.

What is it, you ask? To quote the politicians, "It's the economy, stupid." More precisely, it's the very bad economy. And it's affecting everyone.

While I'd prefer to be writing about the HD digital power increase or about online radio streaming making giant strides, those topics pale when compared to the drastic economic downturn and how it's affecting our business and our people. There is an unrelenting downsizing going on that's becoming downright scary.

Less than a year ago, few in our industry saw this coming.

For instance, since January, we've locally lost about a quarter of our entire major-market staff through attrition and layoffs. I just worked up enough courage to walk into the GM's office and ask if my job was "safe."

He looked at me and said, "I'd like to assure you we couldn't run this cluster without you, but truthfully, nobody's job here is ultimately safe, especially mine." He advised me to keep working hard and go the extra mile, but that I should probably figure out a good "Plan B" ... just in case.

Plan B means going out and looking for another job. That's not going to be easy for anyone in the present environment. You may have to seriously consider pursuing another career. If you've been in the business for a considerable length of time, that's going to be anything but easy.

THE PARTY'S OVER

We're witnessing the worst business recession since the Great Depression. Few who were working in radio back then are still around.

Those who remember those days have told me radio actually fared pretty well through the 1930s. FDR spoke to the nation regularly throughout his presidency with the famous fireside chats. Entire families everywhere stayed glued to their radios. There were lots of trade-outs going on since cash was scarce. For some stations, that practice is still alive and well.

But make no mistake; the long party of rising revenue growth year after year for radio is over. It ended in 2006 and will not likely return anytime soon, if ever.

Our business is being transformed into a smaller and potentially less effective medium that will have to be satisfied with reduced earnings, profit and growth. We'll have to be very smart in figuring out ways to successfully compete with alternative media in the years to come.

I FEEL YOUR PAIN

How did we get here and why do the waves of layoffs at many public companies keep happening every few months?

When I wrote about the deteriorating market conditions and layoffs in April, we were hoping most of the pain had already been absorbed. Instead, it's only getting worse. The worldwide financial meltdown in October made sure of that.

Most stations have been operating very lean and mean already. The fat is gone and much of the muscle has withered. We're now literally removing bones from the beast ... the very structure upon which successful stations have depended for many years.

The companies most acutely affected are publicly held. If you work for a privately owned station or group with little debt, or an NCE public radio station, you probably haven't seen or felt these layoffs. But as the economic tide goes out, boats of all stripes will be tougher to navigate and will carry fewer passengers.

THE WALL STREET BLUES

Stock prices of most all media companies have fallen to ridiculously low levels. The trend-lines had been dropping steadily since early 2007. Few financial experts were predicting that they would continue to slide downward and then fall precipitously in late September. A lot of this is symptomatic of the entire market sell-off of course.

As of this writing and from the peaks, Entercom has nosedived from $66.56 to 78 cents a share; Citadel from $22.08 to 25 cents; Emmis from $58.09 to 50 cents; Cumulus from $53 to $1.28; Spanish Broadcasting from $40.25 to 19 cents; Salem from $33.08 to 88 cents; Cox from $35.31 to $6.19; CBS from $35 to $7.79; Saga from $29 to $4.18.

Sirius Satellite has almost disintegrated from a high of $65.06 to 25 cents. Mel got his Christmas present from the FCC early this year with the approved XM/Sirius merger. But now he gets to play the role of executioner as I suspect perhaps a third of the inherited staff will likely be terminated. Mel may have to watch a lot of Harry Houdini movies to figure out a saving strategy for his new company during this financial debacle.

Clear Channel execs no doubt feel very lucky they were able to finalize taking the company private just a few months before the meltdown. At least the Mays family and their banker friends don't have Wall Street to answer to anymore. But even many of the privately held outfits are struggling with large debt-to-asset ratios as market values continue to drop. When the balance sheet turns completely upside down and balloon payments come due, there are few escape routes.

Stock prices are only part of the story dogging the beleaguered broadcast industry. They merely tell us that the market has heavily devalued radio company stocks as a function of how they are expected to perform in the future in terms of debt service, revenue growth and profitability.

Most of the devaluation is based on the notion that radio became entirely too over-leveraged in debt from equity market-fed financing over the past 15 years. The cumulative debt of many companies that grew quickly and paid too much will be very difficult if not impossible to pay off. Radio is no longer perceived as a growth industry, and will have a hard time holding onto its share of advertising market revenues competing against new media and the Internet.

When the overall market falls significantly, there is often a disconnect between the stock price and the real value of any company. With prices dropping so far, profit opportunities emerge for buy-outs to break up and resell their component pieces. We will likely see such activity in the very near future. The buyers this time around may not only be corporate raiders or healthier broadcast companies. They very well might be new media competitors who have managed their assets and debt much better.

NUMBER CRUNCH

Radio has been losing its share of ad revenue as the Internet has grown its share. All media companies appear to be under the same gun during this meltdown and will generally suffer the same pain. Layoffs and budget cuts are hitting other media. Most financial trade journals are predicting that media and entertainment, along with automobiles, food retailers, restaurants and the leisure industry, are the most vulnerable as the recession deepens. The high tech and software industries could follow.

This is an equal opportunity recession.

Advertising revenues are down significantly for most all stations in many markets for the second half of this year.

There are exceptions, of course, mostly in the smaller markets. Christmas is shaping up to deliver many lumps of coal into radio's revenue stockings. Ad bookings for the first quarter of 2009 are way down to historic lows. The business that is out there is mostly coming in at the last minute as sales managers struggle to hold rates and fill avails. Talk to any GSM and they will tell you they have never seen it this bad.

When group stations aren't making their budgets and revenues are falling, corporate managers look at the projected shortfalls against expected performance benchmarks. They then have to determine how much cost savings must be extracted to maintain acceptable profit margins for the CEO and the board of directors, who ultimately have to answer to their major stockholders.

Each market manager is given two numbers when crafting next year's budget. The first is the annual total revenue increase (or decrease) the market is expected to deliver. The second is the overall percentage of cost reductions that must be made for the upcoming fiscal year. Every market manager must decide where and how the cuts will be made. That mostly involves determining who will stay and who will go.

Employees who have shown the readiness and willingness to take on more work will be the lucky ones still employed, as less-essential workers are laid off and positions are eliminated. Those who have learned how to work smarter rather than merely harder will be among the survivors.

YET MORE PAIN

Beyond staff cuts and beating out all other possible operating cost savings, owners and managers are invoking other painful take-aways that especially affect vested employees — those who have shown a measure of loyalty and have been around the longest.

Many have built up at least something of value in their 401(k) plans, before they became 201(k) or even 101(k) plans. Entercom, for example, announced in October they are no longer doing any stock matching for their 401(k) program.

Others are sure to follow that lead. Media companies tend to do the monkey-see, monkey-do routine when these kinds of crises unfold.

Another maneuver some of the bolder and more desperate companies may implement is an across-the-board pay cut for all employees, or perhaps a modified version that applies the cuts to only the higher-salaried employees. Emmis did that a few years ago and is doing it again.

Such a scorched earth move is considered by many as potentially lethal as it sends the message that a complete financial breakdown or fire sale may not be far behind. The more valuable and talented employees will formulate

SEE GUY, PAGE 29

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by Charles S. "Buc" Fitch

Don't Wait for February to See If Deicers Are Working

Easy-to-Build Controller Saves Money, Adds Reliability

The bane of FM broadcast transmit antennas has to be the element deicers. To quote one major manufacturer, "I hate deicers. They are the source of almost all my FM antenna customers' dissatisfaction."

Since element icing changes the antenna's impedance (usually for the worse), causing VSWR problems, adequate deicing in cold weather is important for staying on the air with a quality signal. If anything, the problems engendered are worse when the station operates in FM IBOC with digital sidebands.

All FM deicer systems are electrically powered. Two schemes are most often encountered: strip heater units inside the elements and utilizing the elements themselves as heaters.

The former variety — the most common — has insulated coil-type heaters inside each metallic element. Sometimes heaters are integrated into the matching components as well. The heaters warm up the antenna enough to keep ice from forming directly on the antenna element.

The latter scheme steps down the normal utility power line voltage to a very low voltage (something like 3 volts) and allows this voltage to travel through the low resistance of the antenna element(s) creating a large current flow, which even in this tiny resistance generates heat. This scheme is enhanced when the designer uses a higher resistance metal (such as stainless steel) to form the element, covered with a lower resistance coating (such as copper) on the outside to direct a larger proportion of current through the skin, maximizing the heat on the outside of the element.

Radomes are sometimes used to eliminate almost all icing on the antenna elements. But ice can damage radomes and, if the ice is bad enough, it will still produce some signal problems in spite of the radome. In really hostile environments, hot air is introduced into the radomes to minimize icing. Since these phenomena are even more notable at satellite frequencies many, if not most, satellite dishes have some form of deicing.

As we often mention in these pages when discussing electrical power systems, high manufacturing standards and processes have produced electrical components that require little maintenance. But they are not maintenance-free.

Deicers are no exception. When deicers are new and known to be perfectly functional, take the time to record the current the system consumes when operating normally. No other piece of information will be as helpful in evaluation or troubleshooting when you need to perform maintenance. An accurate current probe is the best device for this measurement. A good probe that is immune to strong RF fields is essential when measurements are taken at the transmitter. Cheaper units often display some of the induced site RF as line current.

A part of your site preparation for winter should always be a check of the deicers, including a confirmation that the system is drawing the proper current. A lower current always indicates an open heater or even multiple open heaters.

UNDER CONTROL

A deicer is an electrical device, and thus a potential point of failure. The potential of failure is heightened by use, so it's best to use them *only when needed*.

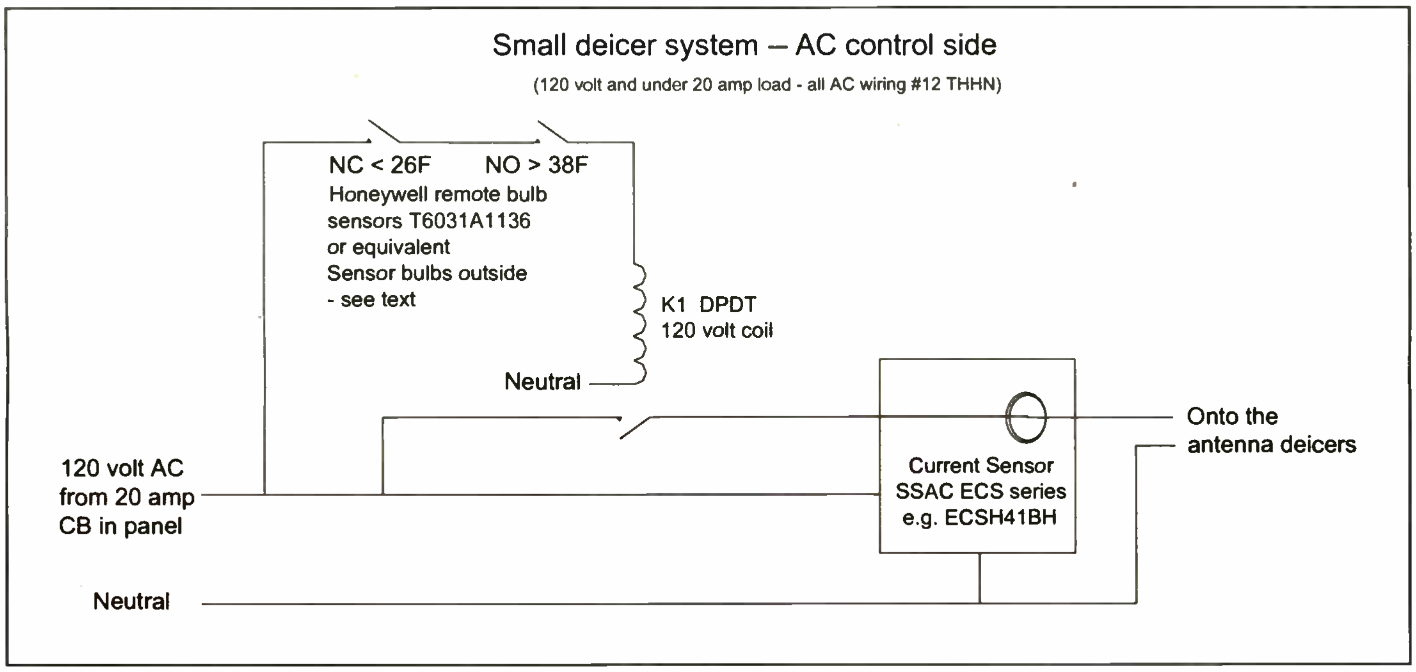
In its simplest form, manual deicer control varies from turning them on only when the transmitter kicks out from ice VSWRs to leaving them on all the time. The first method is problematic as it might take hours of heating to get the ice off when the elements are already encased in ice. The continuous concept will just about guarantee that you will have non-functional heater elements when you really need to deice. As a bonus, selective operation drastically cuts the power bill. Some lower powered stations with multi-bay antennas sometimes consume more power in the deicers than in the transmitter.

Automatic deicer controls vary in sophistication, with some even using exotic capacitor-based ice sensing schemes. You could use the VSWR sensor on the transmitter to activate the heaters. Or there is the pragmatic, reliable controller that my cohorts and I have used with great success (see schematic 1).

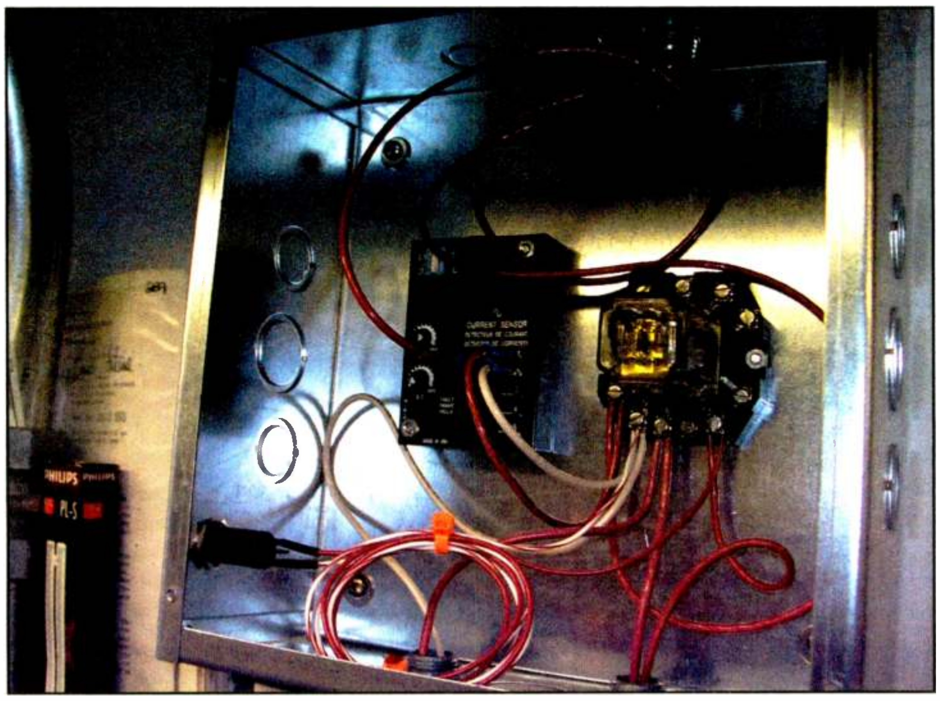
If your antenna is very high, it's somewhat difficult on the ground to determine exactly what's going on up there. However, atmospheric physics does provide one absolute: Near the earth, temperature only drops three degrees for every 1,000 feet AGL, so that is a definite value. Even on the tallest towers we

High and low remote temperature sensing bulbs mounted on the wooden frame of a fresh air input vent on the north side of the transmitter building. The wood conducts less of any ambient heat to the sensors and the shroud shields the sensors from rain and ice.

Interior mounted temperature sensor controls with high on top (set at 38° F) and low on bottom (set at 20° F). This station wanted absolutely no possibility of icing (a big biller) and so set a wide window. Since these two units create essentially a single-pole switch, only two wires are needed to interconnect with the main control assembly on the other side of the room near the electrical equipment.

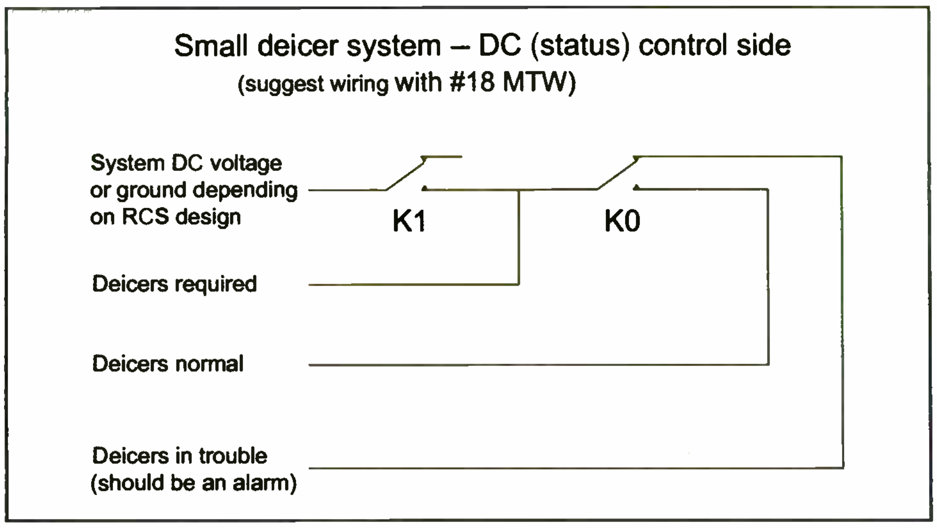


Schematic 1: The AC (power) side of a simple 120 volt deicer. Larger antennas with corresponding larger current demand usually are supplied in 240 volts or 208 volts three phase. The power relay would then be a DPST or 3PST relay with auxiliary contact respectively.



Interior view showing the power relay and current sensor. This installation has a useful option on the left end of the unit, a neon telltale light connected to the output contact of the power relay. This provides a local visual indication that the deicers are operating.

A consolidated control system with temperature controls and an off-the-shelf electrical enclosure for the relay and current sensor mounted on the electrical power wall. The sensing bulb is slightly larger than the capillary tube, so an oversized hole to clear the bulb was drilled for each sensor to pass these through the plywood wall and then onto the outside. Caulk was used to fill the excess space in the holes as well as to stabilize the position of the tubes.



Schematic 2: The DC (status/alarm) section of the deicer controller. Of the three outputs created for your remote control system, the most useful and telling is the Deicers in trouble. If you have just one open channel, this is the one to wire and list as an alarm.

know what the temperature should be around the antenna.

(Footnote: The lowest layer of the earth's atmosphere is the troposphere, and its boundaries are described by the lapse rate, in this case the uniform decrease in temperature as we go higher. The troposphere extends from the surface to about 11 miles up and contains about 4/5 of the total volume of the gases that encircles the earth. At the point where the lapse rate becomes nonlinear you have entered the stratosphere where they filmed "Zombies of the Stratosphere" with Leonard Nimoy.)

Because icing can only occur in a relatively narrow range of temperature — too far above freezing and you have rain, too far below freezing and you have snow — our automatic controller can make sensible decisions when to turn on and off the deicers. With this in mind, you will notice that the two series temperature sensors in the system diagram have set point of 38° F to close and 26° F to open.

The antenna associated with this controller has a center of radiation 390 feet above ground level. These particular thermostat units are Honeywells with remote sensor bulbs, so the switches are inside and the bulbs are usually placed outside on the north side of the building (to avoid being tricked by solar heating) and away from heat sources. You can adjust the set points tighter or looser for temperatures that make sense for your tower height and experience. Setting the dead band around the selected action temperature for just a few degrees usually provides enough hysteresis to avoid control jittering.

Some 99.9% of the time, this control system in a simple manner will reliably anticipate any icing condition, reduce heater operation (cut the electric bill) and extend heater life.

On the remote control side, the current sensor in conjunction with the auxiliary contacts on the AC power control relay provides three status outputs for the remote control (see schematic 2). These are useful in avoiding having to drive out to the transmitter in icy, dangerous weather to find out what's what. The three status conditions are:

1. Deicers required
2. Deicers normal
3. Deicers in trouble

The *Deicers required* status is operated by the closure of the auxiliary contacts on the deicer power relay, which supplies a voltage or a ground, whatever your remote control system needs. This voltage or ground is then connected to the current sense alarm relay and if the over-current NO contacts close, the *Deicers normal* status should come on. If the current is lower than the set point, the sense relay will drop out of alarm and make the *Deicers in trouble* contacts close, turning on this alarm condition.

On the power side, as I often mention when working with line level AC power: Be careful and never work alone. These are lethal voltages. If you are not completely comfortable working with AC power, bring in your usual electricians and let them do the AC while you have the fun on the DC side. ■

How to Set Up the Current Sensor Alarm

The heart of our status/alarm section is an SSAC current sensor. The wire carrying the current to the deicer(s) is passed through a small current transformer, and the voltage analog created is used to make either an over- or under-current alarm closing an onboard relay. For our purposes we will select the *alarm on over-current*.

To adjust, begin with the deicers consuming normal current, setting the alarm adjust pot just *beyond* the trip point when an over-current alarm appears such that the sensor will drop out of alarm when the current is low. Using this arrangement will provide an alarm to the remote control system when the current consumed drops below normal as well as on the odd occasion that the sensor has failed.

Occasionally, in a small antenna with modest heaters, the current consumed will be small and the pot for the alarm set point a little critical or at an extreme. In this case loop the wire that passes through the current sensing transformer two or three times to get the adjustment into the center of the pot's range for better vernierity.

(This is a great word. The lexicon of engineering sometimes co-ops or creates a term known only to us. Vernierity means "adjustments in very small increments." One definition of a vernier is a small auxiliary device used with a main device to obtain fine adjustment, such as those on a surveying transit or the turns counter on your FM transmitter final amplifier. The word honors French mathematician Pierre Vernier, who died in 1637.)

Guy

CONTINUED FROM PAGE 24

their own Plan B employment options and look elsewhere.

Unfortunately most of the best-paid engineering positions in our business have been with the high-flying public companies over the past 15 years. With many of those now under the cost-cutting knife, engineering budgets and staffs are being carved up and the salary levels of those who remain could be moving backwards. Sadly this will hollow out the engineering community a great deal.

WINNERS AND LOSERS

With so much bad news swirling around, it's hard to even think about what positives might come out of all of this. There will be more losers than winners, but the winners stand to profit very nicely if they play their cards right.

We talked here in June about outsourcing and the impact that it's having on engineering and IT support for radio. Many general managers and CEOs view these areas as necessary, but only as support functions that have less impact on profitability and that can be outsourced easily.

Station sales, consolidation and buy-outs can quickly erase what you may have thought was a secure position with a supportive manager. We all know ex-chief engineers who decided that being tethered to one owner for a paycheck had become entirely too limiting and too vulnerable. They started their own contracting businesses and became able to diversify their employment activities and income sources.

Doing this successfully entails lots of caveats and risks. If you are well-organized and efficient, have a good business head and are willing to work lots of overtime, you may be able to do very well as an independent contractor during the present downturn. Existing broadcast contracting companies that offer wide-ranging services including studio construction, RF construction and IT support stand to do well as outsourcing gains more traction.

The other winners will be the privately held companies like Greater Media and Bonneville that have little debt and are looking to expand their holdings. And then there are those new media giants that have been playing on the periphery of broadcasting for a while. Microsoft or Google could decide now is the time to take an active ownership stake in our business.

Station multiples are still falling. During the heyday of the mid '90s to about 2006, sale prices commanded price multiples of up to 15 times earnings. That number is now about 9 and continues to fall. Until credit frees up and dependable valuations return to the market, there should be very attractive fire sale deals breaking soon. Many stations will be sold to independent and privately owned companies as the excesses of Wall Street unwind. Cash will be king.

DEAR MR. PRESIDENT

Our new president, Barack Obama, obviously has enormous challenges to get this derailed economic train back on the tracks. Here's hoping he can do this fairly quickly and that we may all survive whatever bad news continues to threaten our own job security and well-being.

I do have one request of Mr. Obama: While you've been quoted as being opposed to reinstating the Fairness Doctrine, many on your Democratic congressional leadership team want very badly to bring it back. Don't let them change your mind like others who got you to refuse public campaign financing. A return to the Fairness Doctrine would deliver a crippling blow to talk radio, one of the few bright spots and growth formats this business has left. ■

Synchronize

CONTINUED FROM PAGE 23

Even level differences of 0.3 to 0.5 dB can result in poor audio reception.

Also absent from Fig. 13 are the two rack-mount GPS receivers previously needed. This function is also now built into BE's FXi 60/250esp digital FM exciter, so an external GPS receiver is no longer required to create the 10 MHz output reference needed for locking the pilot and carrier frequencies to a shared frequency. The internal GPS, which is fed by an antenna connection on the rear panel of the FXi 60/250 exciter, also supplies the 1 PPS reference for aligning the pilots in phase. The 1 PPS triggers the pilot every second, effectively re-aligning the pilots in proper phase with each other.

BE's FXi 60/250esp comes standard with these synchronous features, saving broadcasters the cost of an external audio delay unit and GPS receiver.

ENGINEERING CONSIDERATIONS

Antenna patterns and site locations are outside the scope of this paper, except to say that we cannot stress enough the importance of an accurate and comprehensive engineering study before attempting the SFN or booster application.

A comprehensive engineering study by a qualified engineer will identify the most ideal transmitter location(s), taking advantage of natural terrain when possible to isolate the booster signal from the main signal, for example.

One important issue that must be considered when starting this study is the size of the interference zone. The interference zone should be as small as possible while still accomplishing the coverage expansion required. It is simply not possible effectively to align the two signals over a large area. It may be possible to have the interference zone occur in a location that is not a critical part of your desired coverage area. In this case, the alignment may not be as critical over a larger area. This, and many other issues, will need to be addressed by a comprehensive engineering study by a qualified engineer.

CONCLUSION

BE's "synchronize everything" approach is by no means the final word on SFN and booster applications. But for the properly designed and implemented system, this approach can solve many of the interference issues and significantly improve the success and viability of a marginal site for extending programming into new population growth areas or for reaching areas underserved by a main FM signal.

REFERENCES

Anthony, Edward, "*Implementation of a Reliable Synchronous FM Booster*"

Kelly, Charles, "*Synchronous FM: A New Approach*"

Salek, Stanley, "*Opportunities and Challenges of FM Boosters*"

Tim Bealor can be contacted via e-mail to tbealor@bdcast.com. ■

Cultures

CONTINUED FROM PAGE 30

you too will consider the cultural match as a criterion for making an offer.

LIFE CYCLES

While I appear to be arguing that culture is frozen, there is always a dynamic change taking place, even though it is not under the conscious control of individuals. Organizations, both big and small, have a life cycle in the same sense that all of us progress from infancy, to child, to teenager, to young adult, to maturity, to senior citizen and eventually to death.

In his book "*Emergence: The Connected Lives of Ants, Brains, Cities, and Software*," Steven Johnson described the life cycle of an ant hill, which took 10 years from birth to death, even though the life span of each individual ant was only one year. Each generation of ants was born into a different stage of the ant hill. The ants of the first year behaved differently from the ants of the 10th year. Each generation of ants brought the hill to the next stage of its life cycle.

Startup companies are like infants; large companies that have been around for decades are like senior citizens. And just as a young adult has physical stamina, the elderly have trouble walking to the store. The culture of broadcasting companies in the 1930s is very different from their counterparts in the 21st century.

The proverbial generation gap between young and old, which was first reported in ancient Greece, is nothing more than a reflection of the fact that young people mature within a different culture than that of their parents.

I started my career in the 1960s, a decade whose culture was dominated by the Cold War and Russian advances in the space race. Moreover, that culture was controlled by personalities that were formed during the economic depression and World War II. I had great opportunities for professional advancement in that culture, which I falsely attributed to my brilliance. Years later, I realized that my success was the result of the culture of that particular decade.

External forces can also change cultures, such as the introduction of personal computers and the Internet. The current global financial mess is changing cultures in all organizations as you are reading this article. Everyone is reexamining the relationships among risk, reward and survival. Attitudes towards tradition and innovation are not consistent from decade to decade. While you can pick the organization (if you are lucky), none of us picks the decade in which we live.

We now understand why the radio industry is having such trouble adapting to the 21st century. It was born in a world with different values and rules. And those individuals who created radio in the 1930s would be out of place in our world today. Conversely, if any of us were thrown back a century, we, too, would experience culture shock. When culture makes rapid changes, individuals and organizations suddenly find themselves in a foreign country.

Take an objective look at the broadcast culture in which you live. How has it changed since you joined it?

Dr. Barry Blesser is the director of engineering for 25-Seven Systems. ■

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by Barry Blesser

The Hidden and Diffuse Power Of Corporate Cultures

Workplace Communities Have Personalities Too

As social animals, we all exist within groups and organizations, and most of us spend more time with our colleagues at work than we do with our families and friends. As a result, the work culture can have a profound influence on our sense of well-being; the corporate culture is one of the biggest influences on our day-to-day behavior.

Moreover, there is some truth to the notion that after a few decades, our personalities become infused with our professional culture, hence the jokes about engineers, doctors, lawyers, economists and politicians. We become how we live. And how we live is strongly influenced by the culture of our communities.

Every profession has its own unique culture. If you want to understand the culture of surgeons, read "The Scalpel's Edge, The Culture of Surgeons" by Paul Katz; for high-voltage physicists, read "Beamtimes and Lifetimes: The World of High Energy Physicists" by Sharon Traweek; for electronic musicians, read "Rationalizing Culture: IRCAM, Boulez, and the Institutionalization of the Musical Avant-Garde" by Georgina Born; for scientists, read "Laboratory Life: The Social Construction of Scientific Facts" by Bruno Latour.

Even though anthropologists have not yet studied broadcasters and audio engineers, they too have a culture that is different from that of other professions.

TOO BIG TO IGNORE

In previous *Last Word* articles, I explored decision-making from the perspective of an individual without acknowledging the influence of the organization's culture. It now time to look at the elephant in the room that nobody mentions.

But that brings us to the question of *what is culture*? One definition states that culture is the composite of social relationships and practices within which people and activities are embedded. Patterns of human interactions acquire symbolic meanings that give those interactions significance and importance. Such definitions are wonderfully abstract and fitting for academic researchers, but almost meaningless for the rest of us.

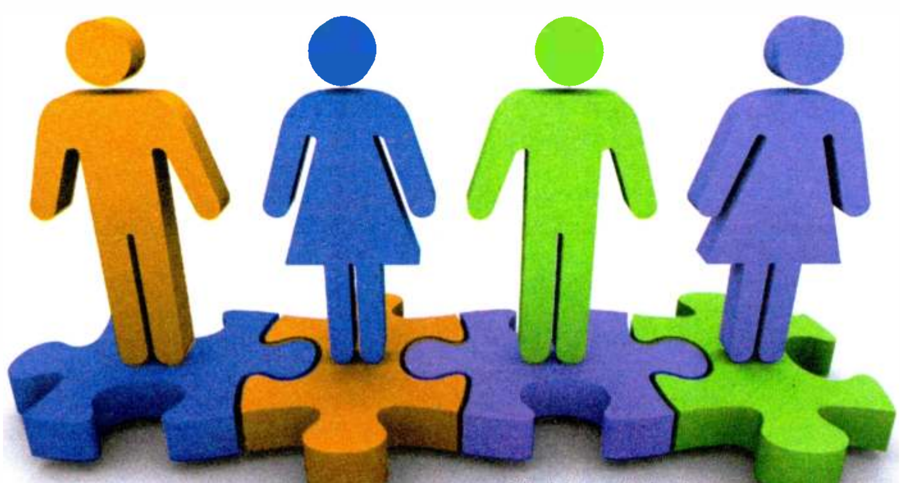
How can we recognize the properties of a corporate culture? Here are some examples.

At one time, GE managers were required to fire the weakest 10 percent of the staff and to promote the strongest 10 percent. This was a Darwinian culture where everyone was in competition with everyone else for survival. At the other extreme, 25-Seven, a start-up company where I work, has a culture based on mutual support and cooperation.

Many Japanese companies have a culture of consensus and harmony that trumps individuality. Google has a culture that provides all the amenities of life (high-quality food, exercise facilities, cleaning services and so on), which makes the work place your home, and colleagues your family. It is a culture that deliberately fuses work and play. Apple loves secrecy.

Some cultures are based on fear; some cultures value loyalty above performance; some cultures are based on who plays golf with the president; some companies value engineering above marketing; some cultures are based on dreams of infinite wealth. Some companies value tradition and consistency as being more important than innovative creativity. In some companies, politics is more important than reality.

Because of their public prominence, the cultures of major companies often are described in popular and business publications. Clear Channel, Apple, Google, Microsoft and GE have unique cultures. But even the smallest insignificant organization has a culture. Have you tried to describe the culture of your organization? It is worth doing.



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CAN'T TOUCH THIS

Culture is not found within a single person or document, but rather it is the social air that we breathe. Everyone contributes to creating the corporate culture and everyone is influenced by it.

Regardless of his power, a CEO cannot easily change an entrenched culture. He cannot readily convert an organization into an aggressive company if employees had self-selected themselves over decades to be gentle and altruistic. Conversely, an organization that promises great wealth in exchange for 70-hour work weeks is unlikely to tolerate those who place family values above the needs of the company.

Logical and rational arguments are no match for the power of culture. Ignore culture at your own peril.

Having worked for over 45 years as a professional consultant in many companies, I quickly learned to recognize the unique culture of every client company. Chatting with those employees having low status usually reveals the organization's culture because these people often are comfortable talking freely. Given the opportunity, I always try to become friends with janitors and administrators. They are the windows into corporate culture.

Culture strongly influences behavior because every decision is subject to some kind of reward and punishment, which can be as explicit as receiving a promotion, or as implicit as being ostracized from sources of information.

Gradually, those individuals who stay in a group do so by adapting to the culture, and they in turn enforce the culture on those who join the group. A personality that is mismatched to the culture is well-advised to join another organization that is a better match. This process continues indefinitely though each generation as each new employee joins the group. The original creators of the culture can be long retired, yet their values remain.

Culture is transmitted to each new generation through subtle process. When you interviewed for your current position, you no doubt considered its job description, responsibilities and compensation. And the manager that hired you considered your skills and professional experience. But both you and the interviewers unconsciously were considering if there was a cultural match in terms of values, personality, lifestyle and psychology.

This is the self-selection process of cultural transmission. Errors are corrected by resignations and dismissals.

Once you join an organization, your colleagues will provide you with the unwritten rules for success. If you can flexibly adapt to these rules, and if you choose to do so, you are joining the culture. Years later, when you interview a new prospective employee,

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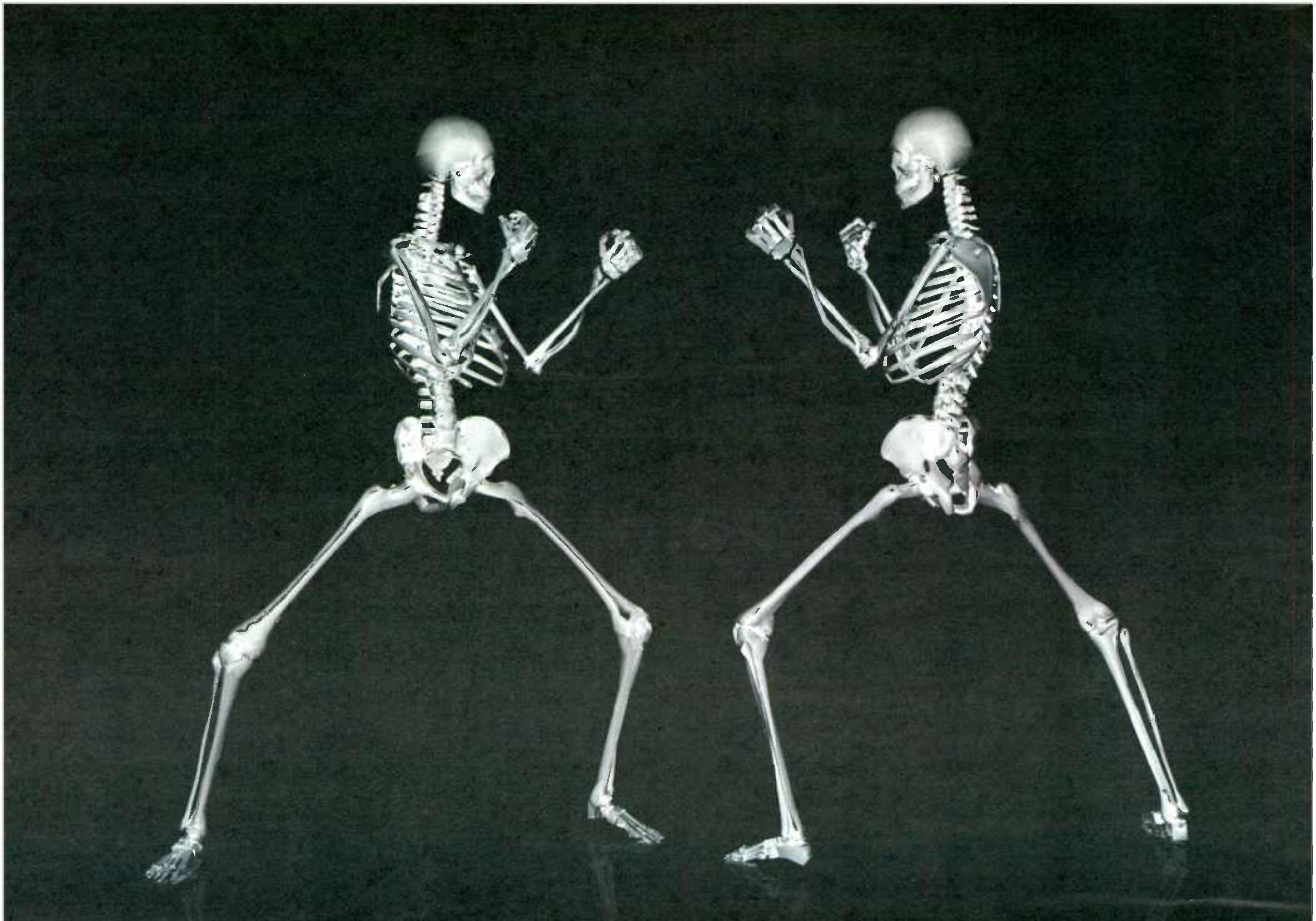

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