DECEMBER 2010

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Dual feed lines require special testing

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Proper speaker placement is key to good audio

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An SD lens on an HD camera won't do

A PENTON MEDIA PUBLICATION

TABLE OF CONTENTS

VOLUME 52 | NUMBER 12 | DECEMBER 2010

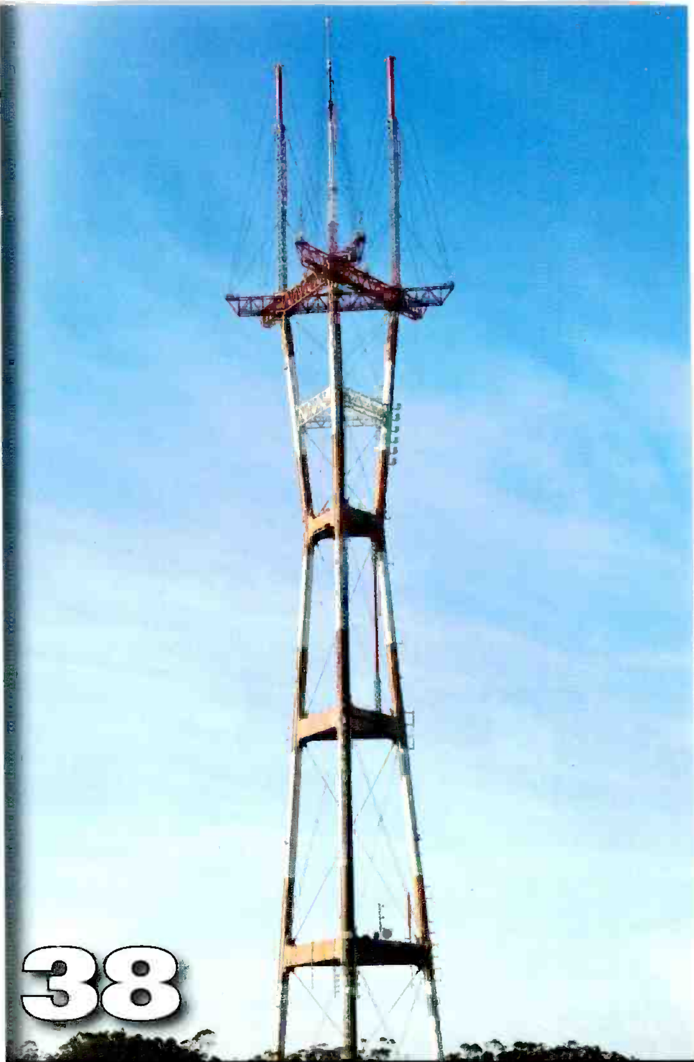
BroadcastEngineering®

FEATURES

BEYOND THE HEADLINES

DIGITAL HANDBOOK

continued on page 6



ON THE COVER:
Many broadcast systems rely on separate transmission lines to feed the upper and lower halves of the antenna. For those installations experiencing coverage issues, measuring the differential phase between the two lines can be a first step toward performance improvement. (Photo: Sutro Tower, San Francisco, CA)

TABLE OF CONTENTS (CONTINUED)

VOLUME 52 | NUMBER 12 | DECEMBER 2010

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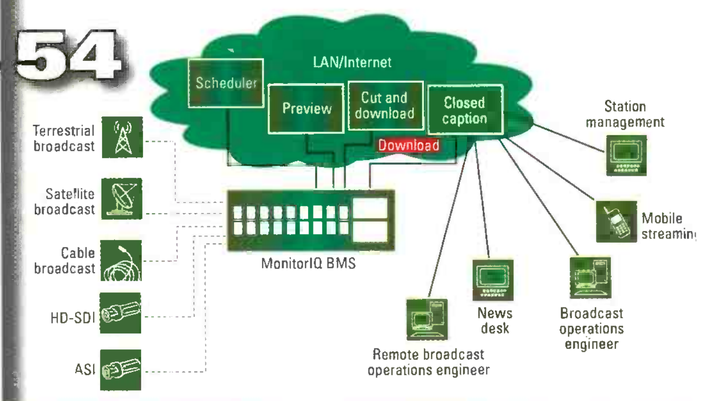
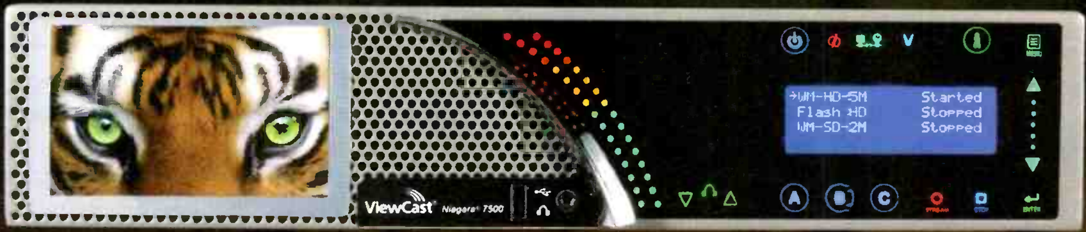


Beauty on the outside.
Beast on the inside.



It's easy to be enticed by the alluring good looks of the Niagara® 7500 – the newest HD streaming solution from ViewCast. On the outside, its sleek, innovative design and responsive touch-control interface will excite you. Its brilliant high-resolution HD display will dazzle you. But on the inside, it's a beast.

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OTT is closer than it appears

SNL Kagan says the U.S. pay-TV business lost 119,000 subscribers in Q3. Looking closer, one discovers that cable really lost 741,000 households, while satellite and telco gained 621,000 subscribers. Looking at the glass half-full, losing 119,000 paying customers is better than losing 216,000 subscribers, as was the case last quarter.

The question for content delivery networks, including cable, has to be: Is the loss caused by cord cutting? As the SNL Kagan report summarizes, "It's becoming increasingly difficult to dismiss the impact of over-the-top substitution on video subscriber performance, particularly after seeing declines during the period of the year that tends to produce the largest subscriber gains due to seasonal shifts back to television viewing and subscription packages."

Executives from two of the largest MSOs disagree, claiming their research indicates precisely the opposite. Time Warner CEO Jeff Bewkes said, "The trend, as far as we can see it, continues up … It's all good." Viacom CEO Philippe Dauman echoed this view, saying the concern about consumers cutting their cords was "much ado about nothing."

Despite those two claims, other media executives see OTT gaining ground on cable. Speaking at the Web 2.0 Summit, former News Corp President Peter Chernin said, "I think the traditional media people are nervous about both these technologies [Google TV and Apple TV]." He reminded the audience that 50 to 90 percent of the largest media companies' income comes from multichannel (cable) business. "They're nervous, not inappropriately so, about being disenfranchised from the cable model," he said.

Outgoing NBC executive Jeff Zucker concurred, saying in response to a question about programmers delivering their content directly to the Web, "You know what matters more than anything? Brand … Broadcast networks will have schedules for [the] next few years, but in an on-demand world, content matters more than schedules."

What kind of changes could OTT delivery bring to the media marketplace?

Long-form video will remain on the large screen, said Netflix CEO Reed Hastings. "There are some use cases where the kids can watch in the car or you finish a movie on mobile that you started watching on TV, [but] the big deal is watching on TV where you click and watch the movies there."

Hastings predicts that Internet-enabled TV sets will comprise a third of the sets sold this year, two-thirds next, and virtually all TV sets by 2012 will be Web-enabled. Both Hulu and Netflix now offer an $8 per month subscription plan for OTT content delivery, and never dismiss Google TV despite its ongoing battles with content owners. In late November, Verizon signed on as a Google TV partner; Verizon's 3.3 million FiOS subscribers will soon have access to more than 50 networks. In addition, the video streaming service Vudu launched on Sony's PlayStation 3 gaming console just before Thanksgiving.

Viewers can now select from more than 50 devices and software packages that deliver movies, TV shows and videos via OTT technology to a person's desktop, mobile device or TV. Viewers regularly embrace technology that provides more viewing options, and nothing is likely to diminish this trend.

A report from The Diffusion Group, "The Economics of Over-the-Top TV Delivery: How Television Networks Can Shift to Online Content Delivery," claims OTT viewership will catch up to live broadcast consumption in 2019, and then become the dominant form of delivery by 2020. The study says that while total TV viewing time remains flat, from 2008 to 2009, the amount of online video consumed increased 84 percent.

The cable industry can ignore the speeding object in the rearview mirror, but that doesn't change the reality that it's getting closer. BE

Brad Dick

EDITORIAL DIRECTOR

Send comments to: editor@broadcastengineering.com

Can you teach?

In today's fast-paced and intense production and broadcast studios, professionals usually have all they can handle just keeping up with a day's activities. And for many, by the end of the day or week, all they want is to forget where they work and all the technology.

Others, however, are invigorated by such pressure, and a few of these even want to share their skills and knowledge with others. If you consider yourself in this category, read on.

Broadcast Engineering magazine is looking for a few knowledgeable engineers, technology managers and creative video experts to help produce print, electronic and live training products. We produce a wealth of articles, webcasts, e-newsletters and blogs each month that offer unique opportunities to those who can communicate well and have the desire to share that knowledge.

A few assignments are once a month, assigned to cover specific topics. Others involve weekly assignments with strict deadlines. A few projects allow more freedom in topic selection.

Virtually 100 percent of what we print is tutorial, not opinion. If you simply want to "give others a piece of your mind," or as I call it "soapbox," this isn't the place. However, if you want to teach and share, then we have an excellent platform.

Yes, we do pay for this work, but don't expect to get rich.

If you have a solid background in any of the traditional production and broadcast technologies, can write and communicate well, and want to share that knowledge, let us know. Interested professionals should forward examples of previous presentations, papers or written articles and a brief outline of your experience and current title to: editor@broadcastengineering.com. Conclude your inquiry by reviewing current *Broadcast Engineering* products and telling us which of those you'd like to participate. If you have a new product idea, pass it on.

Who knows; exposure in *Broadcast Engineering* might be just the thing to help bring that next big promotion your way!

Brad Dick
Editorial director

Incentive auctions of broadcast spectrum

Readers had much to say regarding Michael Grotticelli's Nov. 22 online article, "FCC considers lifting restrictions to allow broadcast spectrum to be used for broadband." Here are some comments:

Dear editor:

OTA TV is the only option for the people that government is most expected to serve, but self-serving government is more concerned with profiting from the nation's resources, including the electromagnetic spectrum. We need to do a better job of educating the public not only of the advantages of OTA TV, but also of the risks of losing it.

Gary

Dear editor:

Well, here comes the attack on OTA television again, as more people are dropping cable and satellite because it's just too expensive, and using antennas to get their local television along with multiple other subchannels now with digital TV. Is FCC Chairman Julius Genachowski trying to put a stake in the heart of a new spark of life in the broadcasting industry before it goes any further? OTA is seeing an increase of popularity here in Dallas Fort Worth. We have about 50 channels now with an antenna — channels like RTV, HOT-TV, Living Well Network, etc. Plus, it works when it rains. Satellite doesn't; it just abruptly goes away.

Ed in Dallas

Google TV

Broadcast Engineering's editorial director Brad Dick's Nov. 19 blog post "Is Google TV a Yugo?" discussed how Google TV sets have yet to realize Google's promise of any content from any place at any time. Here are some responses:

Dear editor:

It seems that Google does not know "squat" about how to market tangible consumer products. Remember the Google mobile phone fiasco? Google TV is déjà vu.

Louis Carliner

Dear editor:

Google has a bigger challenge than content. Its approach to user interface has a fundamental flaw — the idea that the PC is the ideal device on which to view content. The goal of their device is to make the TV behave like a PC.

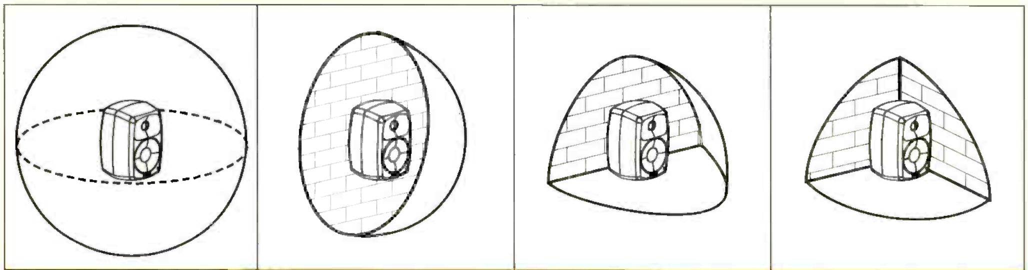
John Maxwell Hobbs

Consistent audio

Equipment selection and calibration are key.

BY CHRISTOPHE ANET

Broadcasters usually have monitoring rooms of various sizes and shapes. To achieve consistent quality in recording, live productions and on-air transmission, complete control of the audio reproduction quality in all facilities is mandatory. This requires careful installation, loudspeaker system calibration and proper system setup documentation of all production spaces. This article presents practical guidelines to achieve consistency.



Solid angle 4π	Solid angle 2π	Solid angle π	Solid angle π/2
Free space	Half space	Quarter space	One-eighth space
Freestanding	Flush-mounted or next to a wall	In a corner (limited by two walls)	In an apex (corner limited by three walls)
Theoretical amplitude gain at low frequencies (below 200Hz):			
0dB	+6dB	+12dB	+18dB

Figure 1. Shown here are solid angle values, respective amplitude gain and loudspeaker alignments.

Controlling radiation effects

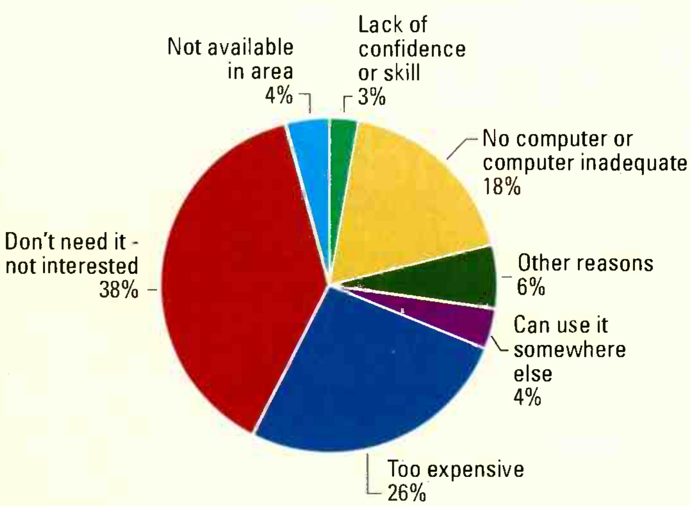
The majority of the audible problems in monitoring quality are due to effects of the control room on the sound radiated by the loudspeakers and subwoofers; therefore, their placement in the room is critical. Loudspeakers and subwoofers radiate long wavelengths at low frequencies. Several cancellation effects and standing waves (resonances) in the room can affect loudspeaker or subwoofer performance.

The radiation space is defined as the solid angle (part of a sphere) into which the loudspeaker is radiating sound. A loudspeaker or subwoofer produces a certain volume flow, which naturally spreads out in all

FRAME GRAB *A look at the issues driving today's technology*

Main reason for nonadoption of home broadband Internet

Lack of interest biggest reason U.S. households don't subscribe to broadband Internet.



Source: U.S. Census Bureau *www.esa.doc.gov/DN*

directions at low frequencies. As we limit the space, and simultaneously keep the power constant, the energy density (intensity) in the limited radiation space increases. Hence, every halving of the radiation space doubles the SPL. You can halve the radiation space of a loudspeaker by placing it at a wall. (See Figure 1 on page 12.)

At high frequencies, the loudspeaker does not radiate in all directions, and placing it on the wall does not increase the sound level. However, low frequencies are boosted and the frequency response is no longer flat, causing the loudspeaker to sound boomy. It is important to correct the response of the loudspeaker or subwoofer so the frequency response in the room remains flat.

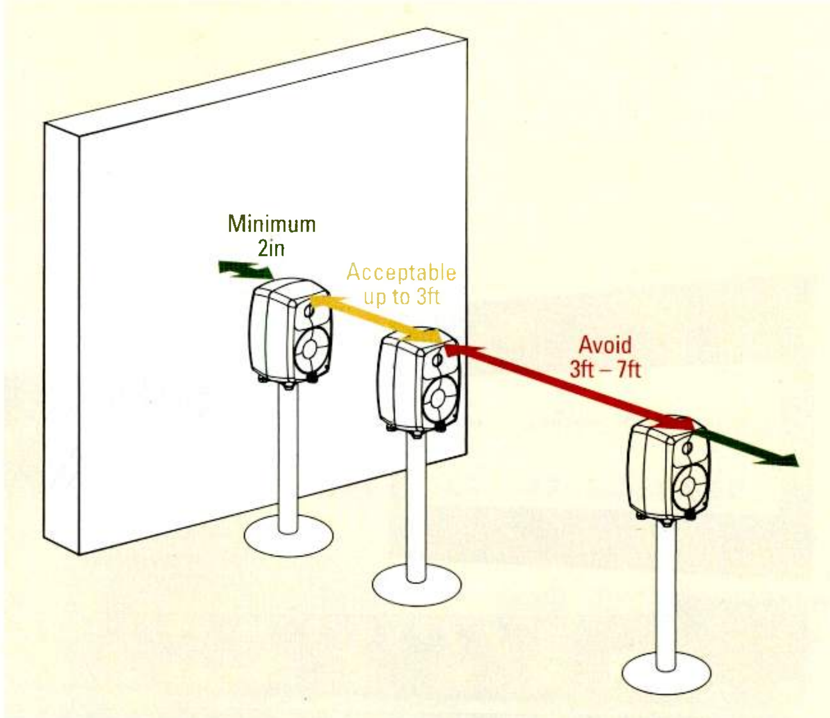


Figure 2. For two-way loudspeakers, acceptable response flatness can be achieved up to 3ft from the wall. Distances within the 3ft to 7ft range should be avoided.

Walls can cause cancellations

When two identical signals are in antiphase (180 degrees out of phase), they cancel each other, and this results in silence. If the loudspeaker is placed at a quarter sound wavelength away from a reflective wall, the wave reflected off the wall arrives back at the loudspeaker in antiphase and cancels, totally or partially, the original signal at that particular frequency. How complete the cancellation is depends on the distance and the ability of the wall to reflect the sound. This results in the sound level dipping down at the frequencies where the reflected sound is in antiphase. The depth and width of a cancellation dip varies, but in most cases it is quite audible. No loudspeaker equalization will cure this problem; increasing the level of the loudspeaker at the dip frequency also boosts the reflection, but their sum remains low, and the dip is not removed.

The best way to cure cancellations is to flush-mount the loudspeakers in a hard wall. This places the loudspeaker in an "infinite baffle" and can totally eliminate the dipping phenomena because no reflections are present.

The second best cure is to place the loudspeaker close to the wall. This raises the frequencies where the cancellations occur. With small loudspeakers inherently less directional in midfrequencies, the cancellation dips might just move to the low midband and still cause coloration. Fortunately, placing small loudspeakers close to the wall, at distances between 0in (at the wall) and up to 7.5in from the wall, renders the loudspeaker response unaffected by such cancellation dips, in most cases.

The third cure is to move the loudspeaker considerably far away from the wall; the first cancellation frequency goes down far enough below the low cutoff frequency of the loudspeaker. However, now distances to other boundaries in the room can be similar to the desired distance from the wall behind the loudspeaker, and the reflections from these other surfaces might also affect the loudspeaker frequency response in similar ways.

Nearby walls affect freestanding loudspeakers

The reflections from all boundaries strongly affect the performance of freestanding loudspeakers. In general, when positioning the loudspeaker's front baffle farther than 12in from the wall, a reflection of the sound from the wall behind the loudspeaker can cause cancellations in the low frequencies. The bass reproduction quality can be lowered. In some cases, most of the low-frequency response can be absent altogether.

For two-way loudspeakers, low-frequency cancellations in the frequency range of 40Hz-80Hz should definitely be avoided. Cancellations in the frequency range of 80Hz-200Hz should also be avoided where possible. If this is not possible, the overall sound quality will still remain acceptable. Acceptable response flatness can be achieved up to 3ft from the wall. Distances within the 3ft-7ft range also should be avoided.

Large loudspeakers placed at a distance more than 7ft away from the wall may suffer from a cancellation in the very low-frequency region around their low-frequency cutoff, compromising their LF extension. The loudspeaker no longer reproduces low frequencies. In practice, freestanding loudspeakers always suffer from some irregularities in their frequency responses caused by cancellations. (See Figure 2 above and Figure 3 on page 16.)

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A new situation occurs with a subwoofer that uses a crossover (85Hz) between the loudspeakers and the subwoofer. The subwoofer should be placed acoustically close to the walls to maximize its efficiency (maximum distance from a wall is 60cm). This eliminates most possible sources of cancellation dips in the subwoofer response.

High-passed main loudspeakers (satellites) do not reproduce low frequencies. They can be placed at a distance where low-frequency notching does not occur in their passbands. The guidelines for placing the satellite loudspeakers are similar to those for the freestanding loudspeakers, with the addition that satellite loudspeakers should not be placed too far from the subwoofer (maximum distance is 6.5ft). If the distances are larger, the tonal balance between the loudspeakers playing with the subwoofer may differ considerably between them due to excitation of different room modes.

Early reflections can color sound and spoil imaging

Early reflections, with high amplitude in relation to the direct sound, can color the sound, smear the coherence of sound images and compromise the localization of sources in the space between loudspeakers. To avoid this, all reflective surfaces between the loudspeakers and the listening position should be minimized.

Symmetrical positioning of the loudspeakers and all equipment reflecting sound is essential. Even after this has been done, some reflections will remain, so everything possible should be done to remove reflective surfaces from the vicinity of the acoustic path. Also note that the smaller the loudspeaker physically is, the less directional it is and the more the loudspeaker is influenced by its surroundings.

The often-compromised center loudspeaker should be placed above video screens or TV monitors. One should always ensure that the center loudspeaker does not suffer from first-order ceiling reflection. If the ceiling is low, some absorbing materials should be placed over the ceiling surface near that center loudspeaker.

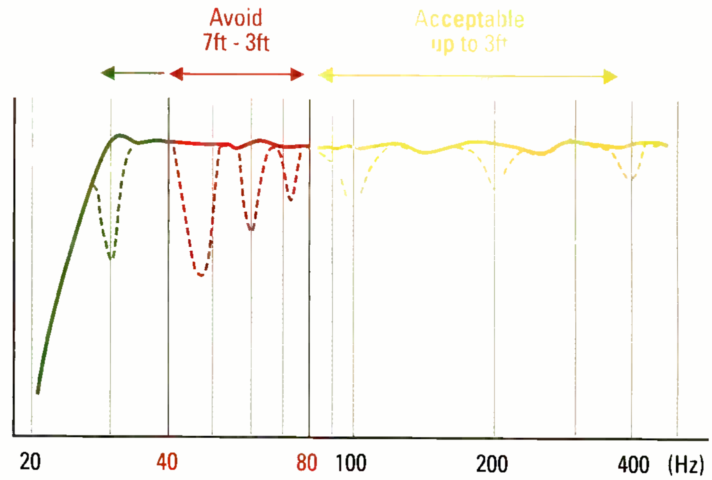

Figure 3. Freestanding loudspeakers always suffer from some irregularities in their frequency responses caused by cancellations.

Equipment placement affects sound quality

Loudspeakers should be placed as far as possible from reflective surfaces. This keeps the reflection-related problems in the frequency response to low frequencies and also improves the imaging. In the presence of many reflecting surfaces (such as tables, computer screens, etc.), loudspeakers can be placed slightly above the listening level and then tilted down (maximum 15-20 degrees) to point toward the listening position.

High-frequency response and loudspeaker orientation

Multilistener control rooms are commonplace in broadcast environments. Because several operators can be present simultaneously, the loudspeakers are frequently poorly placed and aimed.

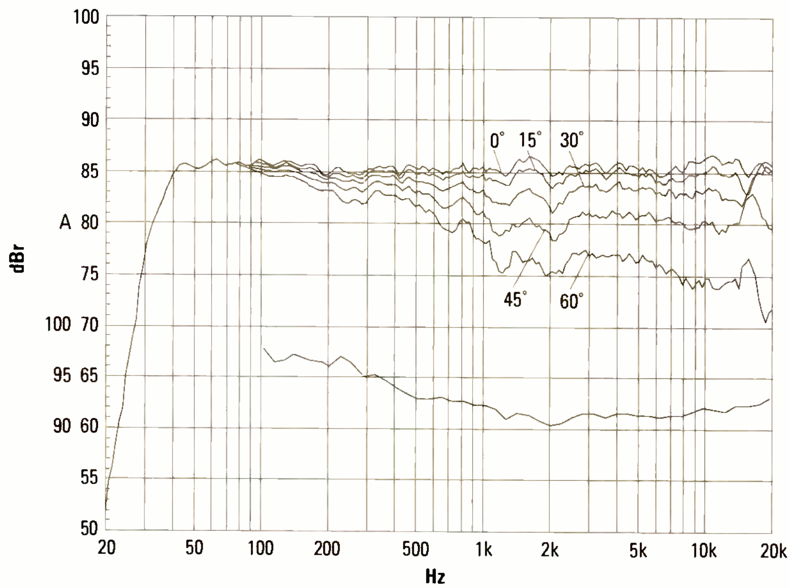

Figure 4. Illustrated here is the typical freestanding monitor frequency response featuring a directivity control waveguide and associated directivity curves (off-axis response); the lower curve is the power response of the system measured in an IEC-approved reverberant chamber.

High-frequency information is of the utmost importance for the listener to evaluate subtle movements and variations in the audio stage. If room reflections are too high compared with the direct sound, the imaging is smeared and quality is poor. Loudspeakers should have a well-controlled directivity. It leads to a high direct-to-reflected sound level ratio and reduces the effects of nearby sound-reflecting boundaries. This helps the operator to hear the actual program material content and reduces the room effects.

Loudspeaker design can control the radiation angle of the tweeter and midrange drivers such that the detrimental diffractions from the loudspeaker enclosure and room surfaces are minimized. The localization, imaging and flatness of the frequency response are then improved, irrespective of the loudspeaker location. (See Figure 4.)

Calibration improves quality and consistency

Every monitoring system should be calibrated in its final installation to provide the best possible reproduction quality and consistency across monitoring rooms. Today, DSP processing is integrated in monitoring loudspeakers. The most important benefit of such technology is the possibility for extensive automated calibration of a loudspeaker system within a given room.

An automatic calibration tool can measure and determine the system response and calculate all the correct acoustical compensations and correction parameter settings for each loudspeaker and subwoofer. The automatic system determines precise acoustical settings to give a flat frequency response at the listening position (or over an area via spatial averaging) using notch and shelving filters available in each loudspeaker and subwoofer. It also aligns loudspeakers in time for equal delay from all loudspeakers to the primary listening position, aligns output levels of loudspeakers, and sets the subwoofer crossover phase. The entire calibration process takes less than five minutes for a full 5.1 system.

More and more small rectangular rooms with strong modal resonances at low and midrange frequencies, low ceiling height and nonsymmetrical equipment layout are used as broadcast monitoring and production rooms. As a consequence, the need for proper loudspeaker placement and consistent monitoring system calibration is more essential than ever before.

A well-engineered monitoring system, containing DSP equalization and supported by a fully automated equalization method, can bring these difficult and challenging environments close to the quality of properly designed control rooms. Even then, however, correct loudspeaker and subwoofer placement is essential. BE

Christophe Anet is technical editor at Genelec Oy.

BAS policy change

Frequency coordination is required for most microwave broadcast auxiliary changes.

BY HARRY C. MARTIN

The FCC's Wireless Bureau has issued a declaratory ruling clarifying that a frequency coordination is required for Broadcast Auxiliary Service (BAS) microwave applications above 2110MHz whenever a change could affect other licensees. This requirement applies regardless of whether the change is "major" or "minor."

New BAS fixed microwave links and major changes in existing links must go through a formal frequency coordination process. This procedure allows existing licensees and applicants who may be affected to protest, before a license application is filed with the FCC.

What constitutes a major change

Major changes requiring prior coordination include changes in:

- location of more than five seconds of latitude or longitude;
- area of operation;
- frequency tolerance and transmission bandwidth;
- emission type (including conversion from analog to digital);
- EIRP (power), if increased by more than 3dB;
- antenna beam width or polarization; and
- antenna height, if increased by more than 3m.

Thus, if a change affects the extent to which a signal can cause interference to others, the change generally is major, and the applicant must always coordinate before filing for a license. Several engineering firms offer coordination services. The coordination process takes 30 days or more.

Policy for minor changes

Until the FCC's recent ruling, minor changes — which have less impact than the major change categories noted above — could be implemented as a matter of right. However, under the prior policy, if a minor change involved any change in operating parameters, the FCC had to be notified through the filing of a license application within 30 days after the change was made.

To head off interference, the engineering community asked the FCC to require coordination prior to implementation of even minor changes. The FCC agreed, but ruled that coordination of minor changes would be required only if the proposed change "could affect or be affected by" anyone else's facilities, in which case an applicant must coordinate before implementing a minor change and filing its license application.

In spite of this change in policy, the FCC is not requiring applicants for minor changes to include evidence of coordination as part of their Form 601 applications. But minor change applicants nevertheless have to complete such studies before filing if another station might be affected. In those cases where a minor change by one facility will *lessen* interference to another, the applicant must, as in the past, file a license application within 30 days after the change is made, so that the FCC can update the database used by coordinators.

New BAS fixed microwave links and major changes in existing links must go through a formal frequency coordination process.

Who is not affected

The formal coordination process, described in Section 101.103(d) of the FCC's rules, is not required for fixed or mobile stations below 2110MHz (including 2GHz ENG systems), mobile stations in higher bands, or short-term operation of 30 days or less under Section 74.24. In those situations, informal coordination is required with all licensees in the area. Informal coordination entails contacting a local frequency coordinating committee if one exists, or otherwise contacting anyone you can find who might be affected by the proposed operation. BE

Harry C. Martin is a member of Fletcher, Heald and Hildreth, PLC.

? Send questions and comments to: harry.martin@penton.com

Dateline

- Noncommercial TV stations in Arkansas, Louisiana, Mississippi, New Jersey and New York must file their biennial ownership reports by Feb. 1, 2011.
- By Feb. 1, TV and Class A TV stations in the following locations must place their EEO public file reports in their files and post them on their websites: Arkansas, Kansas, Louisiana, Mississippi, Nebraska, New Jersey, New York and Oklahoma.
- Feb. 1 is the deadline for TV stations in New Jersey and New York to electronically file their broadcast EEO midterm reports (Form 397) with the FCC.

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Multiplexing

Bandwidth is expensive, so combining multiple digital signals into a single stream is desirable, but complex.

BY ALDO CUGNINI

As its most basic function, the multiplexing operation combines several programs into one overall program. That's the simple view. In common practice, multiplexing can be quite complex, and the overall purpose is to combine separate programs — usually video, audio and data — into one logical signal entity for the sake of contribution, distribution and transmission, and often, to conserve bandwidth.

The most common methods of transmission multiplexing all involve the generation of transport streams. Within these streams, the various programs are compression encoded. Figure 1 shows this in a very simple form. Multiplexing is often done in a hierarchical manner too. In this figure, the programs could be completely unrelated entities, e.g., different entertainment programs, or they could be the interrelated video and audio components (and associated data) of a larger program. In a transmission that includes mobile service, the multiplexer (or mux) will also include an IP encapsulator, which formats the stream to allow Internet-like accessibility, and a signaling generator, which packages together the various information tables associated with the mobile broadcast.

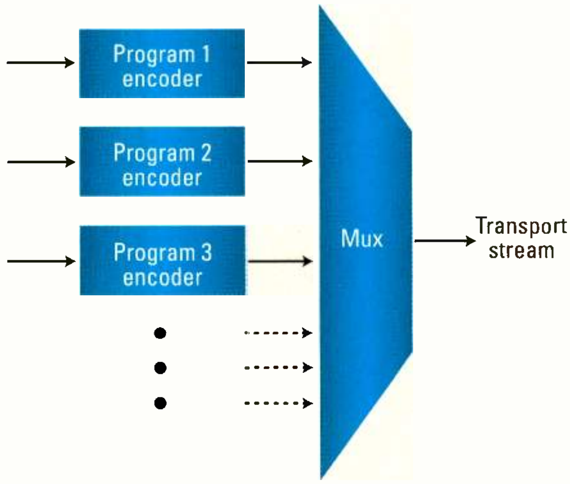


Figure 1. Transmission multiplexing involves the generation of transport streams. Within these streams, the various programs are compression encoded.

The simplest approach to multiplexing is to encode each program at a constant bit rate.

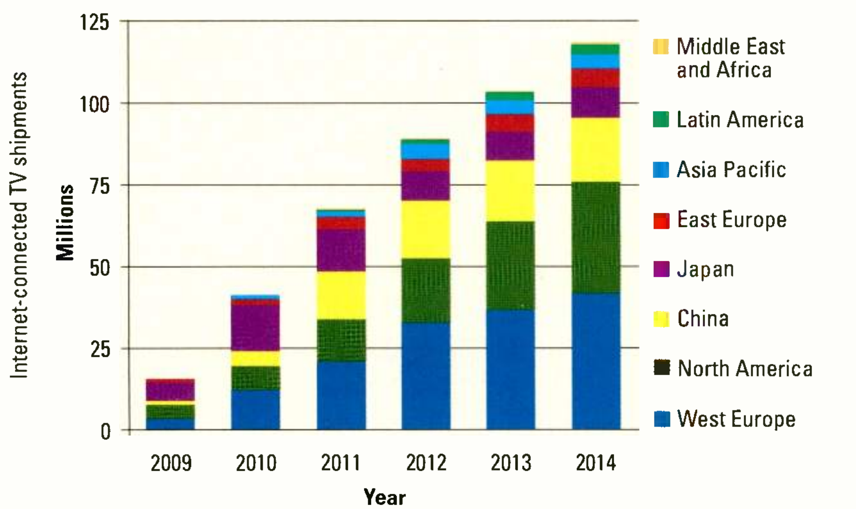
The simplest approach to multiplexing is to encode each program at a constant bit rate (CBR); the overall transport stream bit rate is thus the sum of the individual program rates, plus a small amount for transport overhead. CBR encoding works by setting a tight target on the number of bits per frame of video, without regard

FRAME GRAB

A look at tomorrow's technology

Worldwide Internet-connected TV shipments increasing

More than 40 million sets will be shipped in 2010, with 118 million shipped by 2014.



Source: DisplaySearch *www.displaysearch.com*

to the video content itself. (See the top portion of Figure 2.) While each frame type (i.e., Inter, Intra) can get a different number of bits, the ratio of bits between different frame types is kept to a relatively constant factor, as is the total number of bits in a reference time, usually one Group-of-Pictures (GOP). This often means that a more complex frame (more detail and motion) will get a lower encoded quality than a less complex one because it would require more bits to encode a more complex frame.

In order to produce a more-constant encoding quality, variable bit rate encoding (VBR) can be used. A VBR encoder sets a target number of bits depending on an analysis of the video content itself, resulting in a bit stream whose bit rate varies between a minimum and maximum level. While this bit allocation can be done on the fly, the highest efficiency can be achieved by analyzing many frames of video and then performing the bit allocation according to a calculated "schedule," as shown in the bottom portion of Figure 2. DVD encoding, as it can be done in non-real time, can actually perform this two-pass encoding by first analyzing the entire length of the program, and then going back and applying the bit allocation frame by frame. Live VBR encoding, however, must constrain itself to an acceptable latency, usually on the order of frames or even a few seconds.

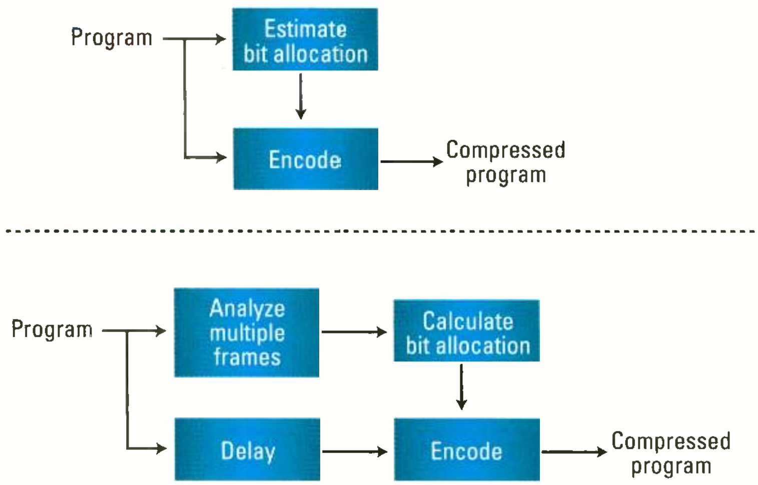


Figure 2. The top half of this figures shows how CBR encoding works by setting a tight target on the number of bits per frame of video, without regard to the video content itself. The lower half illustrates how the highest efficiency can be achieved by analyzing many frames of video and then performing the bit allocation according to a calculated "schedule."

While multiplexing with CBR encoding results in the lowest latency of the process, it is inefficient as far as bandwidth use, especially due to the fact that multiple programs do not always dynamically need all the bits allocated to them. This provided the motivation to develop statistical multiplexing (stat-mux) using VBR encoding, where each program is given a frame-by-frame bit allocation that also depends on the relative need of all the programs taken as an ensemble. With a stat-mux, the increase in efficiency can often mean adding one more channel into a mux for every three when using CBR and simple multiplexing. The cost, of course, is both latency and hardware complexity. In addition, for a mux that is heavily loaded with many programs, compression artifacts will become noticeable; "pumping" at the GOP rate can result in a periodic overall blockiness of the picture, and random blockiness can occur when the stat-mux robs bits from one channel to feed another with a higher priority.

Remultiplexing and rate control

Another variant of multiplexing is that of remultiplexing. While a mux used for transmission will typically be the last such device before the transport stream reaches a consumer's receiver, this same mux will often be preceded by a contribution or distribution mux at a site further up the signal chain. Cascaded multiplexers will, therefore, require a re-multiplexing operation, and this will often involve a partial transcoding of the streams; not only can source and destination bit rates be different, but the program manifest within the source and destination transport streams may differ as well, requiring adding or dropping programs (grooming). It should appreciated that even if a stream is already encoded and stored, it may necessitate a partial recoding when it is muxed into another stream. This can happen when there is insufficient bandwidth in the new stream, or when the playback buffer management requires a different state of what is called the Video Buffer Verifier (VBV). Either way, the instantaneous bit rate may need modification, and this requires changing the bit allocation (up or down) in an encoded stream.

With a stat-mux, the increase in efficiency can often mean adding one more channel into a mux for every three when using CBR and simple multiplexing.

Grooming can also take place as programs become active and inactive during a broadcast day, such as when a group of SD programs is replaced by an HD program. In order to ensure that receivers accurately describe the program availability, the PSIP tables must be correctly managed and updated by the final transmission mux. For this purpose, the Virtual Channel Table (VCT) of the transport stream makes use of "hidden" flags so that receivers are correctly signaled with the active content.

With a stat-mux, it is also more practical to dynamically change the channel allocation as the programming need varies. This will become more useful as non-real-time (NRT) broadcasting enables the download of data, files and programs. Because an NRT download is transferred in bursts over a long span of time, a transmission mux can opportunistically insert the data when there is space in the mux. In addition to the start time of such a transmission, a parameter file would indicate the priority and allowable duration of the transmission, ensuring that the content would be available to the consumer by a certain time.

Thankfully, with all this complexity comes better management tools. In the end, we are balancing bandwidth and quality, so we must ensure that our playout systems have in place adequate tools to predict, monitor and control this trade-off. BE

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Backup and disaster recovery

Careful planning can keep your facility on the air.

BY BRAD GILMER

It is an engineer's worst nightmare — a backup plan that fails. Whether the initiating event is a complete on-air server failure, an infection of master control computers by a virus or a late-night fire that destroys the entire facility, we try hard to anticipate the worst. But sometimes backup plans fail. Here are some suggestions that will help you avoid a failed disaster recovery plan.

As you dust off your backup and disaster recovery plans, it may help to first think about the sorts of things you are trying to recover from. Here are some possibilities:

- Loss of facilities, which could be the result of tornado, fire, hurricane, etc.
- Loss of key equipment, including failure of servers, automation, traffic, power systems, HVAC, etc.
- Loss of personnel.
- Environmental disaster, such as a gas leak or chemical spill.
- Virus or other computer attack due to infection of critical systems, Denial of Service attack on WAN feed, etc.
- Physical attack, for example, the Discovery Networks attack earlier this year.

The typical large diesel generator is a key part of any disaster plan. But it is important to think through disaster scenarios. Do you have a contract with a fuel supplier if the outage lasts longer than your fuel supply? Does that contract give you priority over other customers during a prolonged outage? A good disaster plan should take these sorts of issues into account.

Boxing your recovery plans

Recovery plans can cover a broad range of issues, and these different issues may require completely different responses. This brings me to the first key point about recovery plans: Recovery plans should be developed by a multidisciplinary group with diverse skill sets, having good knowledge of the company.

As you consider different types of events that could negatively affect your facility, put a box around your recovery plans. In other words, for some facilities, being off the air is absolutely not an option. Fox Television, for example, has facilities in Los Angeles and Houston. The broadcaster has made substantial investments to ensure that its operations can continue, even in the event of a major earthquake or hurricane. Other companies may decide that, for some events, there is a point at which the costs are too great and the risks too remote to justify a recovery plan that covers the most extreme events. These companies may plan for a loss of servers, but not for a loss of the entire facility. Boxing your recovery plans is critical, but it is absolutely vital that affected departments are involved in making decisions about what is in the box and what is out. Communicating the plan and working as a team is vital. If the plan ever gets put into place, you want those affected by the plan to have participated in the decisions that will now be put into effect. When developing recovery plans, communications is critical; those affected by the plans must be involved in the process of developing them.

Recovery plans can be expensive to develop and expensive to deploy. Top management must buy into these plans, and they must participate in development of these plans, at least at a high level. In many cases, recovery plans involve basic business decisions. Top management must buy into recovery plans because they involve basic decisions about the business.

Testing the recovery plans

When thinking about recovery plans, consider what can be done as a part of normal operations to contribute to recovery activities. For example, if you have an ingest process for the on-air content, think about what it would cost to have that ingest create another copy that is stored at a remote location as part of the normal workflow.

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If you are thinking about building a remote news studio in another part of town, consider what it would take to do a minimal newscast entirely from that remote studio, assuming that the main studio was completely inaccessible. Remember that steps in a recovery plan that become a normal part of everyday workflows will get done. Processes that require attention outside of normal operations will get missed over time, especially processes that are automated and unattended. To the greatest extent possible, activities that are part of recovery plans should be part of normal operations.

I know of a number of companies that have put a lot of effort into recovery plans, only to find out that these plans were incomplete; the plans would not work after they were put into effect. This is actually a common problem. People develop elaborate plans, but they are hesitant to test them because there might be something wrong with the plan that would result in lost airtime during a simulated emergency. This fear is well founded; people who think hard about recovery plans quickly realize that it would be easy to miss a critical item. It can be frightening to pull that critical circuit breaker to test whether the backup systems work, but you have to do it. Otherwise, all the planning will have been wasted. That is not to say that every possible scenario must be played out; common sense must be your guide. However, if none of the recovery plans are tested, then how will you know whether they're adequate? Simulated tests must not be superficial.

Another key point is that recovery plans must be retested periodically. When I worked at Turner, we had an elaborate power distribution system that put two separate power feeds into all critical racks. But over time, someone doing maintenance would plug both power cords of a redundant power supply into the same mains source. It is critical to test recovery plans. Top management must support

Over time, your business changes. When your plan was created, the part of the facility that created iPhone feeds was an experiment. This year it is a critical part of your business.

these tests, with the understanding that it is possible the tests will reveal a problem that affects air.

Over time, your business changes. This certainly has been the case in the media industry. When your plan was created, the part of your facility that created iPhone feeds was an experiment. This year it is a critical part of your business. Recovery plans must be reevaluated.

Thinking through all aspects of a recovery plan can be challenging. That is why it is good to get a group of people with different skill sets together and tackle this activity as a team. As an example, when you plan for a loss of power, how long do you plan for power to be off? A relatively short power outage — say one or two hours, is not really a problem. What about a power outage that is so long that you use up all the diesel fuel? Do you have a contract with a fuel delivery company? What if a significant part of the city is without power? Does your contract guarantee delivery within a certain period of time, regardless of how many other customers are calling for fuel? How hot or cold is it when the power goes out? Do your plans include running the HVAC units at full capacity? Partial capacity? At partial capacity, what equipment would you have to turn off in order to keep your facility from overheating? Is this enough to keep you on the air?

If you back up all the content to a remote facility, are the software systems also backed up so that you have the metadata at the remote location to find the content on a server? Involving people from many different departments in your facility will help you to think more completely about all aspects of your recovery plan and may help you avoid missing something critical.

Conclusion

I want to leave you with one last thought. A great German military leader, Helmuth von Moltke, said, "No plan survives first contact with the enemy." We all know this to be true. But this should not keep us from planning. Many aspects of a recovery plan will work perfectly. But since we can anticipate that some aspects of the recovery plan will not work, remaining agile and flexible in our recovery planning will be critical to success. Recovery plans must be well thought out, but they should also be flexible and adaptable to allow for unforeseen events. BE

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Handling 5.1 audio

How 5.1 audio is recorded, downmixed, upmixed and made compatible presents a set of challenges.

BY RUSSELL BROWN

Consumers have come to expect surround sound from their entertainment sources such as movies and now television shows. Toward this end, the ATSC standard incorporated multichannel sound into the DTV specification. How to record, mix, playout and monitor multichannel sound is the focus of this article.

Recording 5.1 audio

Out in the field, many videographers just record two-channel stereo sound and sometimes record extra channels to catch the ambient sound. Then back in post, they mix a 5.1 surround output for the final cut.

There are several 5.1 microphones that will supply you with six channels of sound, but most of today's camcorders only come with two to four audio channels. To really record six channels of audio, you would need a professional multichannel audio recorder with SMPTE time code locked to your camcorder.

5.1 audio signals

Professionally, it's called 5.1 audio, and it consists of six separate audio channels — Left (L), Right (R), Center (C), Left surround (Ls), Right surround (Rs) and the Low Frequency Effects (LFE) channel. (See Figure 1.) These six audio channels are used for DVD, cable, satellite and broadcast DTV audio.

One of the problems with using three separate AES3 cables to transport 5.1 audio is keeping them all synchronized together and with the video, as well as routing all three around the plant. Because AES3's data frames are not synchronized with video, it's easy enough for one to slip out of sync, let alone three. Today, there are better options, including Multichannel Audio Digital Interface (MADI), Dolby E and embedded audio within SDI.

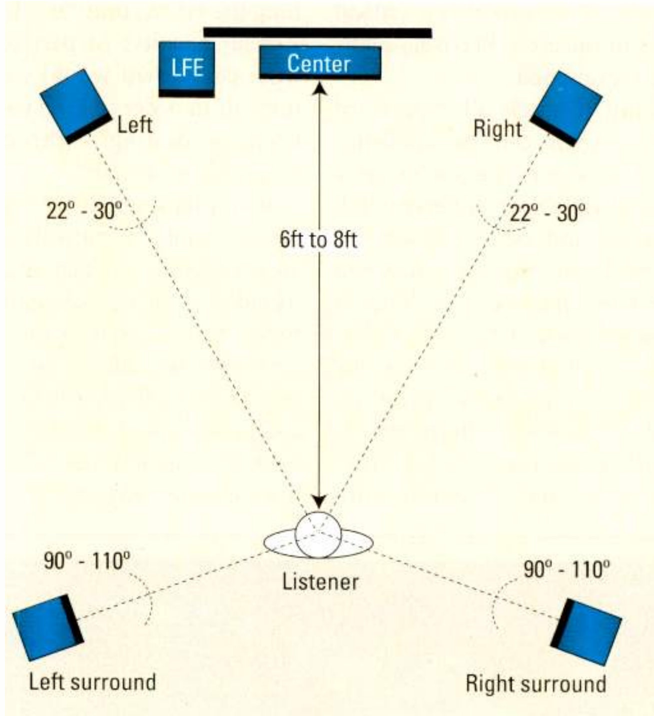


Figure 1. Shown here is the speaker placement for 5.1 audio.

Embedded audio

SDI video can handle up to 16 channels of digital audio or eight AES3 audio feeds. Thus, 5.1 audio can easily be accommodated by embedding it within the associated SDI video. For SD-SDI, the standard is SMPTE 272M. For HD-SDI, it is SMPTE 299M. The audio data is transmitted during the horizontal blanking period that is not used.

MADI

MADI is capable of transporting up to 64 separate digital audio channels over a single 75Ω coax cable or fiber-optic cable. MADI is basically a high-speed AES3 transport. Where AES3 will handle just two channels compared with MADI's 64 channels, its official designation is AES10-2003. While MADI has been mostly found in recording studios to connect mixing consoles to multitrack recorders, it has now found use in television production studios and broadcast facilities.

AES50

AES50 is another standard for transporting multichannel audio around a facility. It uses IP packets and Cat 5 cabling. Each channel is assigned 1Mb to assure a very high level of quality. AES50 will handle up to 16 channels of 192Kb digital audio or more channels at lower bit rates.

It's meant as a point-to-point system even though it uses Ethernet cable and IP packets. Trying to pass it

Downmixing 5.1 audio

There are two types of downmixes that can be performed on 5.1 audio: L/R total downmix and L/R only downmix.

L/R total downmix:
Lt = L + [-3dB center] + -3dB [Ls + Rs]
Rt = R + [-3dB center] + -3dB [Ls + Rs]

L/R only downmix:
Lo = L + [-3dB center] plus
[Ls maybe be added at a higher attenuation]

Ro = R + [-3dB center] plus
[Rs may be added at a higher attenuation]

** Ls = left surround; Rs = right surround*

through a network can cause a high degree of latency. AES50 has not found widespread acceptance or use.

Dolby E

Dolby E is a proprietary system developed by Dolby Labs. It was designed to overcome many of the issues that engineers face when trying to use any of the above systems for broadcasting multichannel audio. Dolby E is an encode/decode system for transporting up to eight channels of digital audio over any two-channel digital link of 16-bit depth for 5.1 audio and 20 bits for the full eight channels. Besides the audio channels, it also carries metadata and time code.

Once a program is finished, its surround sound 5.1 mix is encoded to Dolby E along with metadata about the audio tracks, including Dialnorm, dynamic control and downmixing. With a complete broadcast audio chain, this metadata will be passed through to the audio processor and to the home DTV receiver. By encoding every program with Dolby E, each one would have its own audio parameters adjusted in the audio chain whenever it played on-air.

Monitoring 5.1 audio can be problematic within a control room environment, and two speakers and an amplifier will not suffice.

Monitoring/metering

Monitoring 5.1 audio can be problematic within a control room environment, and two speakers and an amplifier will not suffice. Special 5.1 audio monitoring consoles have been developed to address this issue. Being able to solo the front or rear (surround) as well as the center and LFE channels is very important to being able to isolate problems in the audio. So is the ability to perform a downmix to two-channel stereo. Because many viewers are only listening in stereo audio, it's important to monitor it.

Most of the time, being able to look at a level meter or, better yet, a graphic display of the surround-sound environment is the way most engineers will monitor 5.1 audio. Several manufactures make such instruments that display a roughly circular pattern showing that all channels are present and that there are no phase problems. This display is usually accompanied by six bar graph meters. This type of monitoring is essential when trying to monitor 5.1 audio in a television facility.

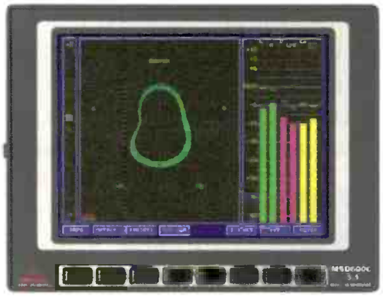
Converting to two channels

Normally, all six channels are transmitted, received and played back on the viewer's surround-sound audio system. But, there are many cases where viewers have only the two stereo speakers to listen to. What happens then? All ATSC receivers have the capability of downmixing the 5.1 surround sound down to two channels. There are two ways they can do this: The first is called L/R Total, and the other is L/R Only. (See the "Downmixing 5.1 audio" sidebar.)

Converting to six channels

If most of your programming is in 5.1 surround sound, then switching to spots and other programming that is in stereo-only may not be what you want, jarring your viewers when switching between the two. In that case, you can upmix — take a stereo audio feed and convert it to 5.1 surround. There are several processors on the market that will do this for you. These can be added to your audio chain with some master control switchers capable of being programmed to switch in the 5.1 converter as needed for stereo-only sources.

Even though 5.1 audio has been around for several years, many stations have not embraced adding it to local productions. To do so means changing audio boards as well as control room monitoring and even signal routing. But with proper planning and installing the right equipment, it does not have to be as big of a problem as it first appears. **BE**



Most engineers monitor 5.1 audio by looking at a level meter or graphical display of the surround-sound environment.

Russell Brown is chief engineer at KMTP-TV in San Francisco and writer of Broadcast Engineering's "Transition to Digital" e-newsletter.

The state of Web video

Adaptive streaming tailors quality to the viewer's bandwidth.

BY DAVID SAYED

Web video has grown up fast. Ten years ago, quality and capacity problems plagued attempts at putting video online. Today, Internet users can experience watching video online at up to 720p with adaptive streaming so they never suffer from buffering or stuttering, and they can use advanced interactive features that traditional TV can only dream about. According to eMarketer, more people are watching online than ever before: More than 60 percent of the U.S. Internet population watches video content online at least once per month. Major events boost online viewership and keep users engaged with the content longer.

Norwegian broadcaster NRK found that more than one in four Norwegians watched parts of the Winter Olympics online.

Impact on broadcasters

For broadcasters, the Web is both a challenge and an opportunity. A recent Nielsen study showed that first, TV viewers who also use the Internet are spending more time online, which means less time watching TV, decreasing the value of the broadcast channel. Secondly, 18- to 24-year-olds watch the most online video. Today's younger audience is tomorrow's mainstream audience and is a leading indicator of the future. Finally, online viewers prefer free content but will pay for certain types of content and for instant gratification. However, according to comScore, they are also more engaged with the advertising they watch.

Reinventing broadcast for the Web

It seems obvious, but if the desire is to use the Web as a vehicle to augment an audience, putting online exactly the same content as what is on-air is self-defeating. Can Web video augment a broadcast viewer's experience? The answer is yes.

Consider the Winter Olympics, a unique event that happens once every four years. With 300 events, athletes from 82 countries, expert commentary and 15 sports, the Olympics are an incredibly complex event for broadcasters to cover. NBC, Canada's CTV and Norway's NRK worked together to create an enhanced 2010 Olympics experience that enabled their national viewers to watch all aspects of the games, engage more deeply with content that interested them and ultimately drive larger overall audiences. More than one in four Norwegians watched online with an average viewing time of 77 minutes per viewer, setting a new record for NRK.

Rather than replacing the broadcast channel, this was "TV 2.0," where a Web-based HD player with digital video recorder capabilities and layered content augmented the broadcast experience and enabled viewers to go deeper than is possible within the broadcast medium.

These types of enhanced experiences are not limited to sporting events. News and current affairs programming can benefit as well. France 24, the international French news channel, has a website that streams its news programming live and adds transcription, an interactive program guide, statistics and social media elements into the player.

Another way to approach the Web is to offer unique content. This is effective for programming that has an active fan base. In some cases, this content may be offered through a mobile device, perhaps made exclusive to a particular operator. Such Web-only episodes frequently feature extensive support from a sponsor. For example, *New York Magazine* created a series of Web-only videos that used time-coded product placement that triggered external advertising.

Cost considerations

Today, there are four main broadcast models:

- *Free.* Very popular with viewers for obvious reasons and may not apply to all programming from a broadcaster.

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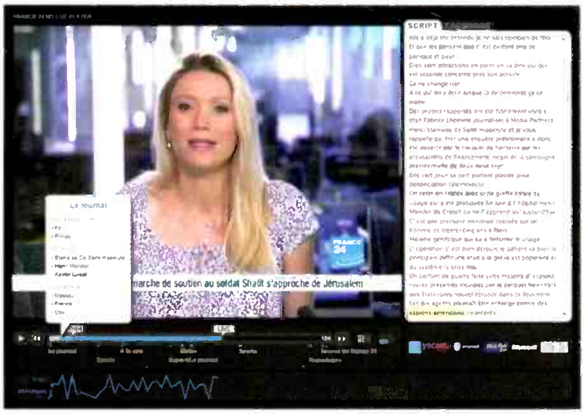


French news broadcaster France 24's live player features a synchronized script, integrated program grid and viewer statistics.

- *Advertising-supported.* Familiar to commercial broadcasters, advertising in this situation could be preroll, in-stream advertising or nonvideo advertising around the video player on the Web page.
- *Subscription.* This model is popular for movie streaming services such as Netflix. For a monthly fee, viewers can stream movies from the service provider's website.
- *Pay-per-view.* Popular for niche content, this model requires a transaction before the content can be played.

In addition, content is often blocked geographically so it can only be accessed within a broadcaster's national boundaries.

Regardless of the business model, the costs involved in actually getting content from source to viewer include website design, coding and management, digital rights management, encoding, storage, and bandwidth. Some of these are fixed, but the data transfer cost is variable; the more content that is transferred, the greater the cost. When the number of viewers or resolution of the content goes up, so does the cost of delivery.

Adaptive streaming

A recent comScore study found that consumers prefer the picture and sound quality of broadcast TV to Web video. Historically, picture quality has not been a strong point of Web video, but this has changed over the past two years. Now, anyone with a broadband connection and a capable computer can watch Web video that exceeds the quality of SD broadcast TV. The technology that makes this possible is HTTP-based adaptive streaming, and it promises to bring together broadcast-quality video with the transformative power of the Web.

Popular video sites like YouTube do not actually stream video. When a user plays a video, it is progressively downloaded to his computer like a file transfer. As soon as the user's computer starts to download the content, it starts to play it back. The benefits of progressive download are that it is easy and works with any Web server. The disadvantages are that different viewers can get wildly varying playback experiences; some of the content that the broadcaster is paying to transfer may be wasted if it is not watched, which is akin to burning money, and it does not work for live content.

Streaming overcomes some of the limitations of progressive download. A streaming server will deliver the exact portion of content that the user wants to play, so no data transfer is wasted. Streaming also handles live and on-demand content. However, traditional streaming has some important limitations:

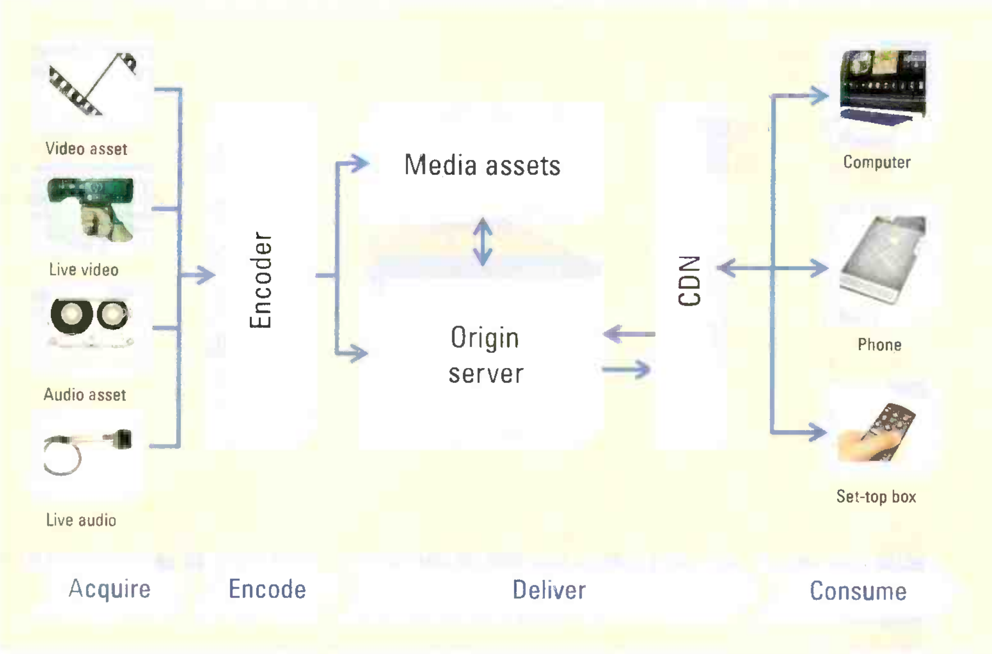


Figure 1. A basic streaming workflow includes acquisition, encoding, delivery and consumption.

- Broadcasters providing a stream with a single bit rate need to accommodate the bandwidth constraints of their viewers, which could be anything from a 3G cellular connection to fiber. This one-size-fits-all approach means that some users will not be able to stream the content

Figure 2. Microsoft IIS Smooth Streaming can adapt to changing network conditions by varying the quality of the stream.

well because the bit rate chosen by the broadcaster is too high, and users with greater bandwidth than the streaming bit rate will not enjoy the highest possible quality.

- Broadcasters providing a choice of streams will either confuse or disappoint users who try to stream at the highest bit rate even if their bandwidth is insufficient to do so reliably.
- Streaming protocols are frequently blocked by firewalls, which the user may not have control over.
- Many dedicated streaming servers are required to scale content distribution to thousands of geographically dispersed viewers.
- Building out and managing a separate streaming server infrastructure can be expensive.

HTTP-based adaptive streaming is a better way to deliver content to viewers. The goals of HTTP-based adaptive streaming are to efficiently deliver high-quality video to any viewer and scale using standard Internet infrastructure. HTTP-based adaptive streaming is not one technology; rather, it encompasses a set of concepts related to the encoding, preparation and transmission of Web video.

These concepts have implemented it in different ways and are called different names. Fundamentally, they offer:

- *More efficient data transfer.* As soon as a viewer stops watching, the data transfer stops, saving transmission costs.
- *Multiple bit rates.* The content is encoded at multiple bit rates, which enables different bit rates to be delivered to a viewer depending on their bandwidth, delivering the best possible picture quality for that situation.
- *Adaptive bit rates.* The stream can be switched to an appropriate bit rate for the viewer's bandwidth and other conditions, so he always sees video that does not stutter.
- *HTTP transfer.* The content is delivered over HTTP, the lingua franca of the Internet. The content scales better because it takes advantage of existing Web infrastructure and guarantees access to a viewer because it traverses Internet firewalls with no reconfiguration.

All current approaches rely on encoding streams at different bit rates and breaking them into stream fragments at regular intervals. These fragments are stored on a server and delivered to a user's Web browser over HTTP. The differences in vendor implementation come up when one considers supported codecs, transport wrappers, the chunking process and player heuristics (how the stream is switched).

The basic workflow consists of four main steps: acquire, encode, deliver and consume. (See Figure 1 on page 35.) For example, the server receives VC-1 or H.264 streams at different bit rates from a hardware or software encoder, creates stream fragments and delivers them to Web caches (edge servers), which are typically part of a CDN. When a viewer watches the video on his computer through the media plug-in in the Web browser, the edge server delivers the most appropriate stream fragment to the viewer. Which bit rate is actually sent depends on both the network and the user's computer performance and is continually evaluated by player heuristics. This enables the quality of the stream to adapt in real time to changing network and local performance conditions, resulting in seamless and optimal video playback. The scalability to handle millions of concurrent users comes from the use of standard Internet protocols, which Internet caches know how to handle. As a result, the load on the streaming server is low. (See Figure 2.) This dramatically reduces the number of servers needed even for a large event such as the Winter Olympics, which had more than 20 million unique viewers.

This same approach can be expanded beyond Web browsers to work with set-top boxes and mobile devices.

Finally, HTTP-based adaptive streaming enables the use of Web analytics tools to provide real-time monitoring from encode to viewer experience. This actually exceeds what is available in the broadcast realm because visibility into individual viewer metrics is possible.

Summary

The Web has forever changed the way that viewers consume short-form, long-form, live and on-demand content. To preserve, grow and be relevant to their audiences, broadcasters need to develop Web experiences that are differentiated from their traditional broadcast output. HTTP-based adaptive streaming enables broadcasters to deliver content on the Web that looks and sounds great, thereby increasing the time that a viewer spends on their Web property, which translates into a higher-value viewer to the broadcaster. BE

David Sayed is responsible for Silverlight media marketing at Microsoft.

Making differential phase measurements

BY DEAN W. SARGENT

In both VHF and UHF single-station and multistation antennas, the use of two transmission lines for feeding the upper and lower halves of the antenna is common. While most of these systems work well, some experience coverage issues caused, in most cases, by an incorrect differential phase.

A mistake that broadcasters often make is to assume that if the two transmission lines are installed with the same overall lengths, then they must be in phase. Physical measurements will not necessarily provide confirmation of the relative phase between the lines. An electrical measurement is the only accurate method for confirming the relative phase.

In some cases, electrical measurements are made by using a network analyzer and installing a short at the top of the transmission lines. This is a reflected system, in which the phase of one line is subtracted from the other and divided by two to determine the differential phase.

There are two main concerns with this type of system. First, the type of short used is typically a Type N coax screwed onto a reducer-mounted N coax connector. Ideally, the short should instead be bolted to the transmission line and consist of a flat slab with an inner connector bolted to it. Second, the reflected signal may see a different phase going down than it does going up to the short, particularly if the measurement includes several elbows.

A more accurate procedure, a "direct" or "through" measurement system, involves feeding a signal from a signal generator to both transmission lines, in phase, at the antenna end. A network analyzer is connected to the two transmission lines at the transmitter end. The analyzer is operated in the external source auto mode. In this mode, the analyzer locks to the received signal from the signal generator. The analyzer is in phase format, and the zero degree reference line is the middle of the display.

A more accurate procedure involves feeding a signal from a signal generator to both transmission lines, in phase, at the antenna end.

The frequency of the signal is displayed in megahertz on the analyzer display, allowing the user at the transmitter end to verify that the correct frequency is being used at the antenna end. This is important in multistation systems where several frequencies are used.

Regardless of the process used, it is necessary to know if there is one or more multiples of a wavelength in either transmission line referenced to the other. Time domain measurements of each transmission line can be used to initially determine the approximate physical lengths of the lines.

The measuring system

The basics of a through measuring system include a signal generator,

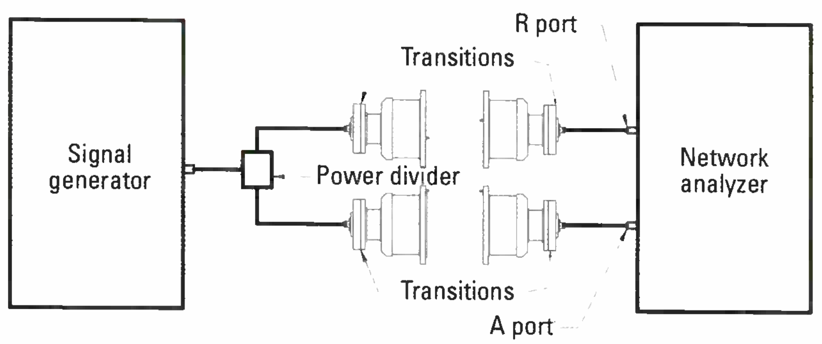


Figure 1. A basic through measurement configuration includes a signal generator, power divider, transitions from N female connectors to the correct transmission line size and impedance, and a network analyzer.

Sutro Tower, a large TV tower in the San Francisco Bay Area, is an example of a transmission site that could benefit from a "through" differential phase measurement system.

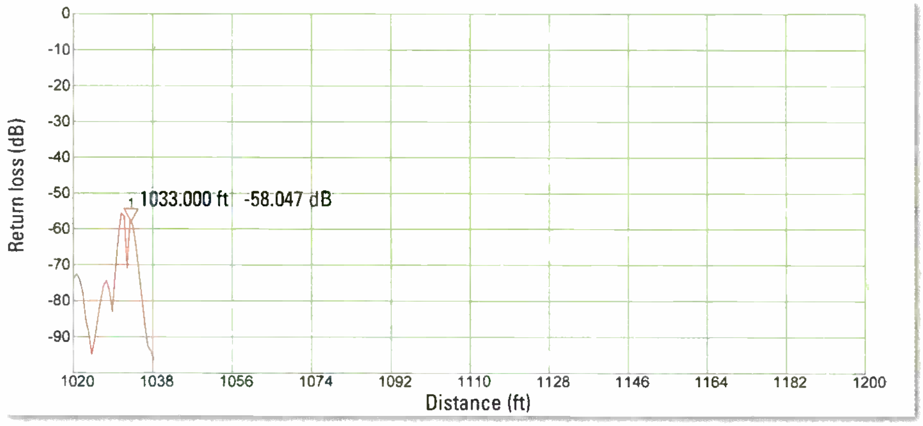


Figure 2. Initial measured time domain length difference for lower transmission line

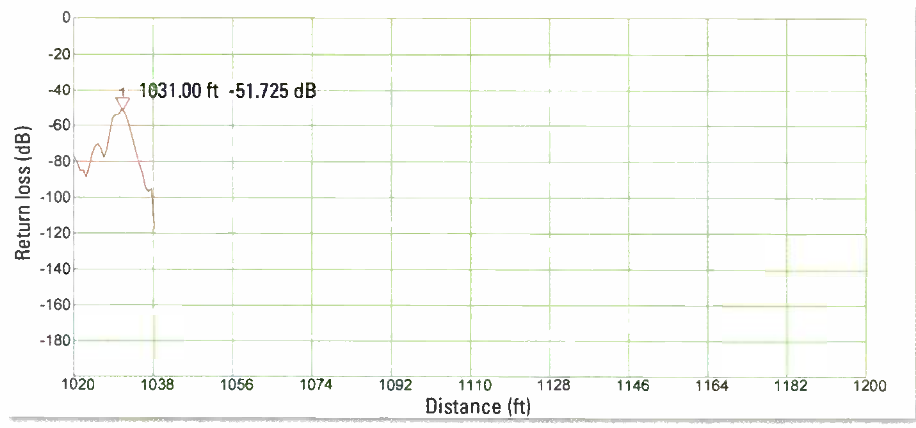


Figure 3. Initial measured time domain length difference for upper transmission line

power divider, transitions from N female connectors to the correct transmission line size and impedance, and a network analyzer. A UPS power source is used to power the generator if 110V is unavailable. A battery-powered signal generator is also an option. A block diagram of the basic system is shown in Figure 1 on page 38.

Having the smaller, lightweight signal generator at the antenna end of the line and the network analyzer at the transmitter end makes it easier to work with. The UPS supply at the antenna end can be smaller due to lower power requirements. Because a signal generator takes less expertise to operate than a network analyzer, it's more suited for the antenna end, where a nontechnical person is likely to be doing the work.

Any signal generator capable of generating a CW signal and output of 3dBm is all that is required. When measuring a multistation antenna, however, it is nice to be able to set up and store the required frequencies when calibrating the system on the ground. This allows the tower worker to choose preset buttons to change frequency — a much easier process than setting each frequency via a knob on the tower's signal generator.

Example measurement

The following description walks you through an actual measurement on a three-station DTV antenna system.

The two transmission lines are measured using time domain measurements to determine the length in feet of each line. Figures 2 and 3 are expanded plots of these measurements. Note that the lower transmission line is 24in longer than the upper transmission line. This data will determine how many degrees longer, at each of the three frequencies, the lower transmission line is compared with the upper transmission line.

The measuring system was set up on the ground and calibrated at the three station center frequencies. The measuring system consists of an Agilent N9310A signal generator with a Type N power divider connected to the signal generator output, four transitions from the transmission lines to N connectors, and an Agilent 8753ES Option 10 and 11 network analyzer. A notebook computer, connected to the analyzer, stores the measurement data.

Having a smaller, lightweight signal generator at the antenna end of the line and the network analyzer at the transmitter end makes it easier to work with.

The transitions, cables and instruments have been match-marked in such a manner that the system could be connected on the tower and at the transmitter end in the same manner as when calibrated on the ground. The transitions are labeled upper transmission line and lower transmission. Figure 4 displays the signal generator with the power

Figure 4. The signal generator displays the three stored station frequencies.

divider and two cables installed. Also note the display showing the three stored station frequencies.

The upper and lower transitions were connected together for calibration. The signal generator had the three frequencies stored, and the network analyzer was set up in phase format and external generator auto. The system was calibrated at all three frequencies, and this information was stored in the analyzer.

At this time, the individual who was going to be on the tower went through the selection of the frequencies as he would when on the tower. Once everyone understood the process, the system was disassembled and taken to the tower. In this sample case, 110V was available on the tower, so the UPS supply was not required.

The two transitions at the input of the two transmission lines were installed, and the network analyzer was connected to them. With the signal generator powered up on the tower,

Ideally, the differential phase should be zero degrees at each channel.

the engineer on the ground directed the tower worker to select a frequency. This frequency was also selected from the calibration file in the network analyzer. The differential phase then appeared on the network analyzer display. This procedure was repeated for the other two channels. The measurement data was stored in the computer and labeled differential phase as found. (See Figures 5, 6 and 7.)

The time domain measurements indicated that there was an extra wavelength in the lower transmission line at all channels. Knowing this and the differential phase, we calculated the need for a 22.6in section of transmission line in the upper line. Once this was installed, we repeated the differential phase measurements on each channel.

Ideally, the differential phase should be zero degrees at each channel. However, due to the number of frequency-sensitive components (such as tuned

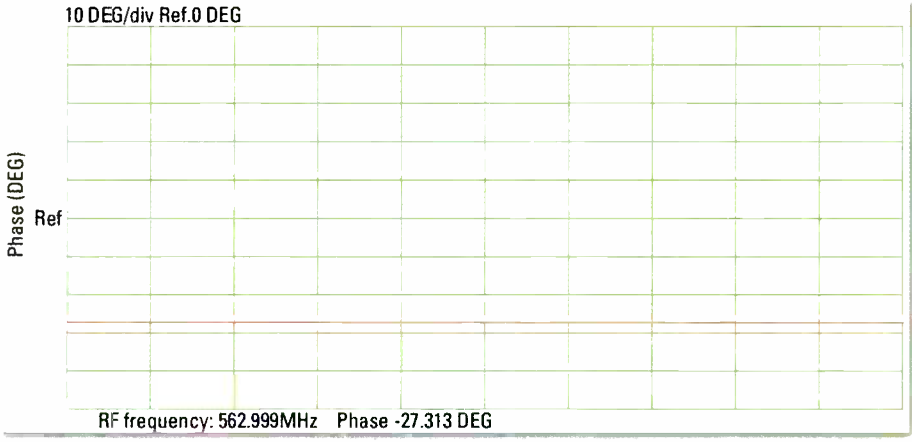


Figure 5. Initial measured phase difference at midband Channel 29

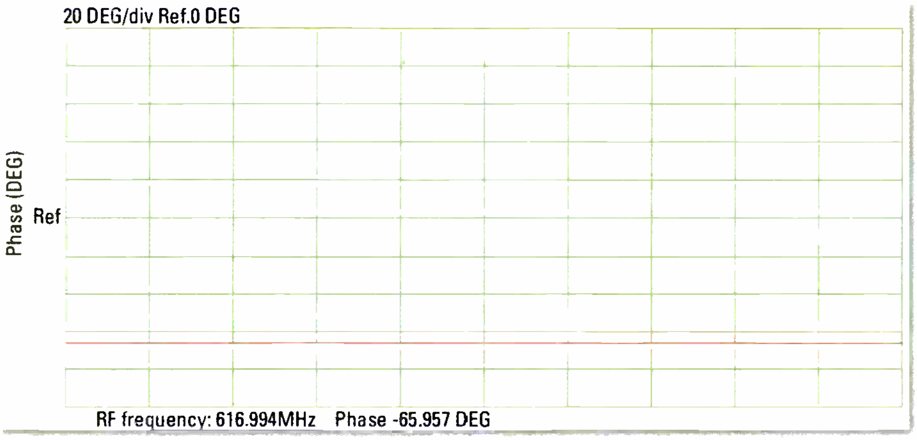


Figure 6. Initial measured phase difference at midband Channel 38

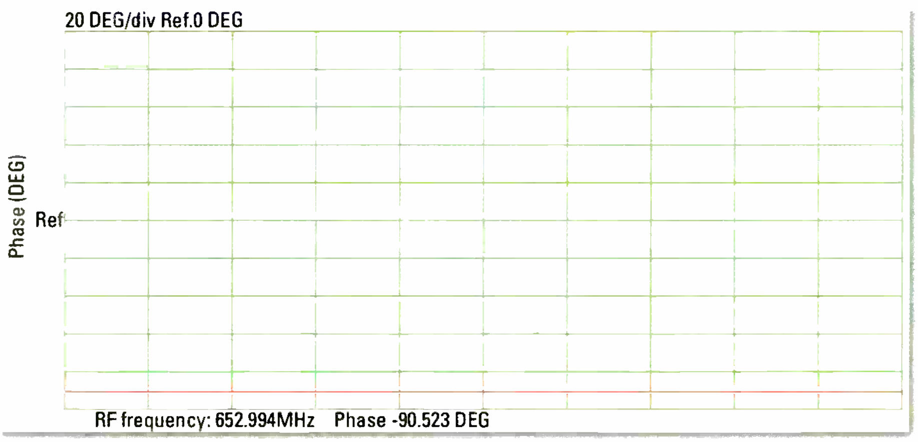


Figure 7. Initial measured phase difference at midband Channel 44

elbows), the variation was not unexpected and, when compared with calculated plots of the antenna patterns using these phase differences, the variation was negligible and acceptable. (See Figures 8, 9 and 10.)

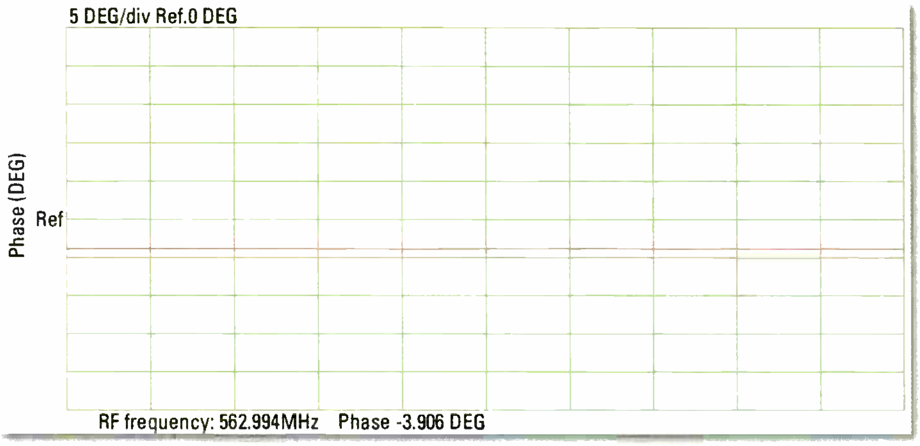


Figure 8. Final measured phase difference at midband Channel 29

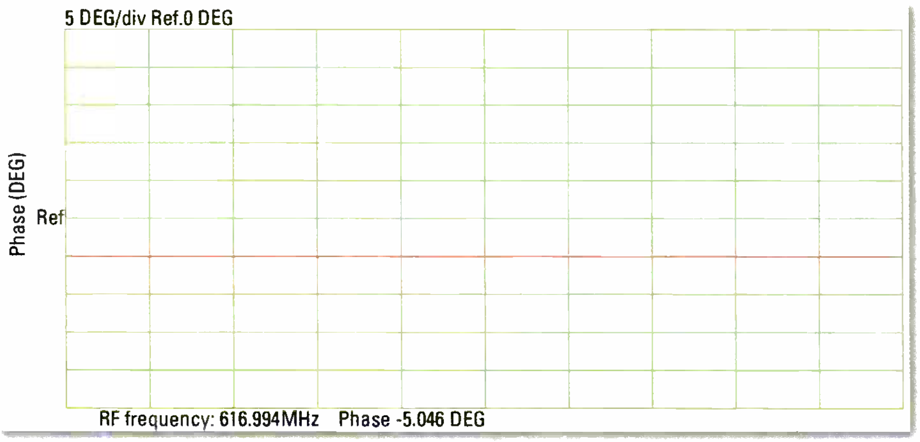


Figure 9. Final measured phase difference at midband Channel 38

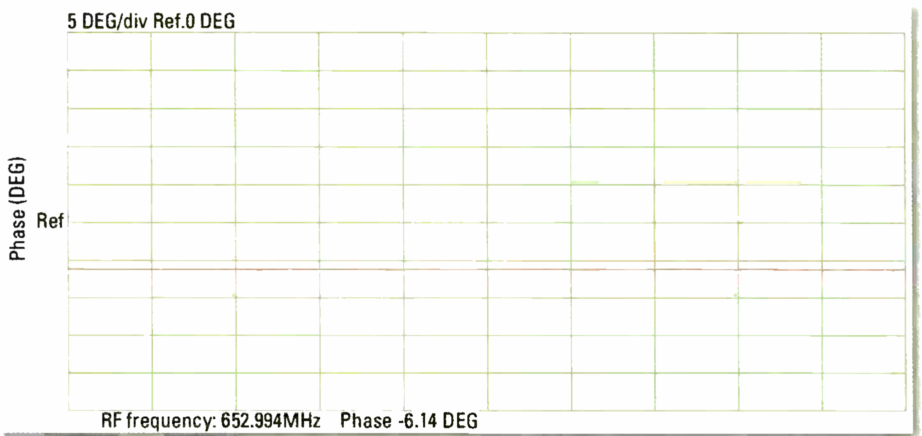


Figure 10. Final measured phase difference at midband Channel 44

When to make measurements

Since the through measurement system displays the differential phase in real time, any change is immediately reflected on the network analyzer display. When making the measurements in the example measurement above, a drift in the differential phase over time was noted. Investigation revealed that the sun exposure was on the transmission line feeding the lower antenna half, while the upper half of the transmission line was shielded. (See Figure 11.) As the sun moved across the sky, the phase increased 20 degrees and then gradually returned to normal.

Since the through measurement system displays the differential phase in real time, any change is immediately reflected on the network analyzer display.

Because the sun cannot be turned off like a light bulb, the only other option was to make the measurements on a cloudy day or at night. The effect of this condition on signal strength can be calculated. This was done in our case, and it was determined that it was not a problem, as shown in Figure 12.

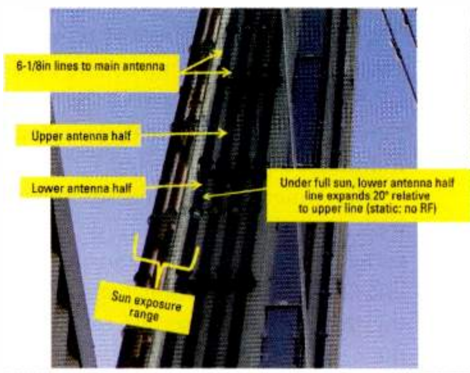


Figure 11. Transmission line configuration on tower

Each situation can be different, so it is recommended that the measurements be made at night or on a cloudy day so that the "as found" measurements and "final" measurements are done at the same temperature.

In the example measurement above, the sun affected the lower transmission line due to the shielding on the tower legs. This resulted in downward beam tilt. In other systems, the same scenario could have caused upper line expansion and upward beam tilt. In other systems it could affect both transmission lines, causing the beam tilt to swing up and down.

Regardless of the environmental circumstances of an antenna installation, the through measurement system provides more accurate measurements than other measuring systems that use shorts, line stretchers and physical measurements. **BE**

Dean W. Sargent is president of D W Sargent Broadcast Service.

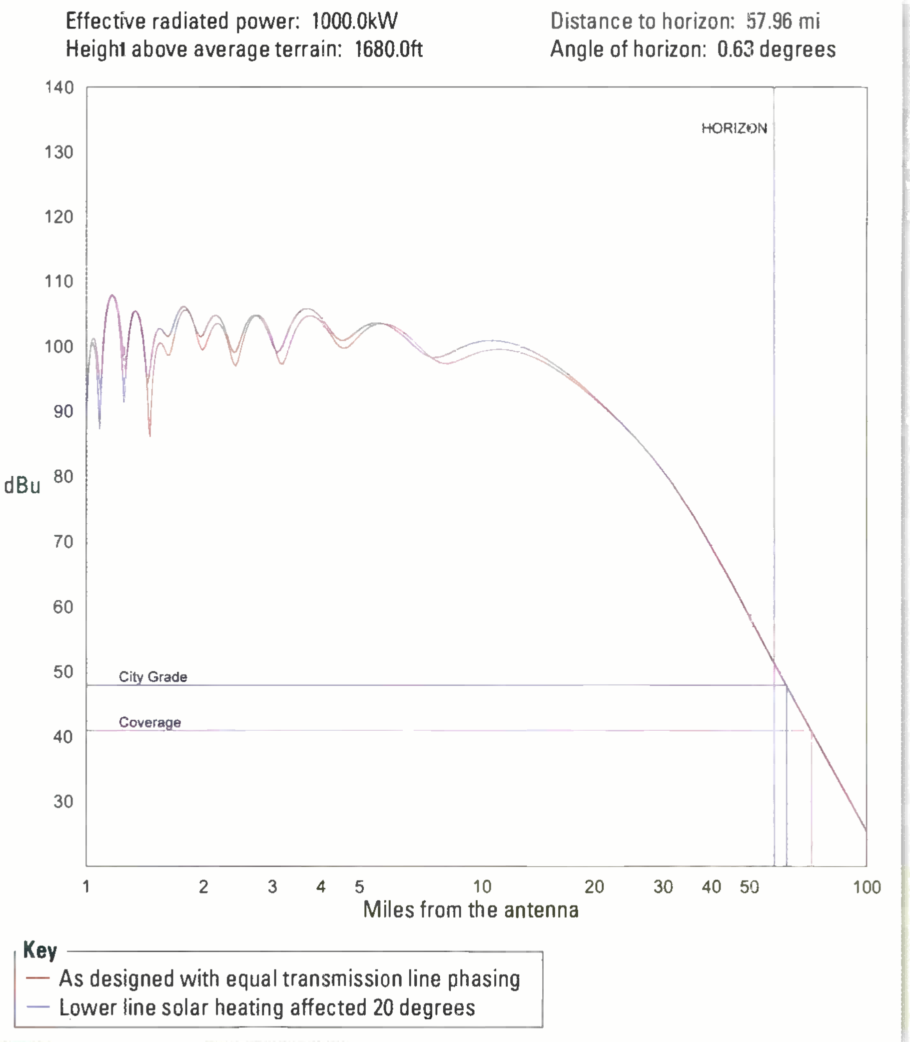


Figure 12. Effect of phase difference due to solar heating of transmission line feeding lower half of antenna

Outdoor enclosures

Custom prebuilt enclosures provide diverse options for RF installations.

BY STEVE ROSSITER

The ongoing spectrum debate has shed new light on a fact that the broadcast industry has always known: The terrestrial broadcast model provides the most efficient means of delivering broadcast and multimedia content from one site to many consumers.

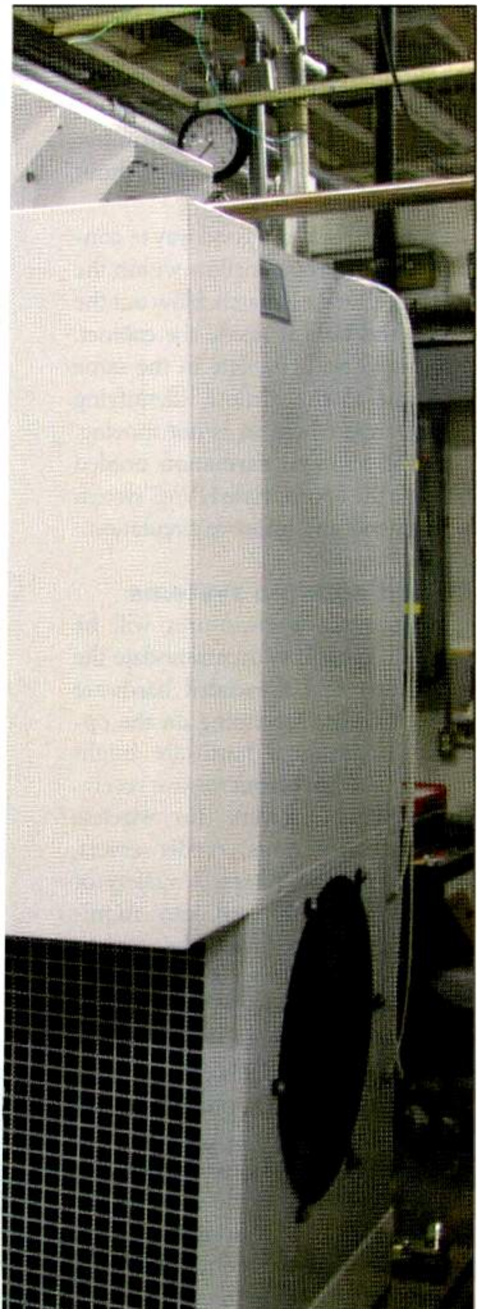
The increasing number of terrestrial multichannel DTV and mobile television broadcasts means that most local viewers of free over-the-air television can receive more content today than ever before. This proves that local broadcasters are recognizing and taking advantage of their most prized commodities — their wireless transmission capabilities and allotted spectrum — in new and innovative ways.

Broadcasters are also exploring and deploying new ways to transmit content. More high-power broadcasters today are adding repeater sites to effectively blanket their markets following the digital transition. Meanwhile, low-power and mobile broadcasters may rely on shared sites or single-frequency networks with multiple transmitters.

All of these factors have influenced a growing number — and diverse array — of broadcasters to explore new locations not traditionally used for terrestrial broadcast services. Such locations, including rooftops and shared cellular towers, offer a variety of benefits, including easy deployments and open real estate. However, cost of deployment remains a drawback.

Custom-built outdoor enclosures, constructed of steel or aluminum, offer a cost-effective and technically-sound alternative for broadcasting from nontraditional locations. Prebuilt enclosures vastly reduce the square footage compared with traditional structures. Installation costs are also minimized: Enclosures are transported to the site and dropped onto a small concrete foundation.

From a technical standpoint, properly designed enclosures also offer everything required to support terrestrial transmissions. This includes HVAC and electrical systems, the transmitter and associated hardware, filtering, and antenna systems. Quality enclosures also implement design characteristics that meet the most pertinent industry standards for construction and equipment protection, ensuring that the broadcaster's investment in technology is secure and well-protected.



Protection from external elements, including dirt, moisture and corrosive materials, is pertinent for ensuring long life and continued operation of the many components that ultimately generate the terrestrial signal.

Design specifications

The choice of steel or aluminum will mainly align with the size and application of the enclosure. Steel is thinner but far heavier, rendering rooftop installations difficult at best. Cost is also an issue, making ground-level installations at cell sites expensive. Steel enclosures make more sense for pole-mount installations on towers housing very small, low-power transmitters. These are more common for low-power gap fillers in multisite transmission systems. Stainless steel enclosures can also be used in highly corrosive environments.

Building out the infrastructure begins with identifying electrical requirements and ensuring compliance to various safety and construction standards. Electrical systems are specified for single-phase, split-phase or three-phase depending on availability; single- and split-phase are most common given the site seclusion of most enclosure installations.

The electrical system is often built out within a small cabinet or AC distribution box affixed to the side of the enclosure. The AC distribution panel lives within the cabinet to accommodate the appropriate breakers. The electrical system is then specified and built to meet the appropriate UL standards, typically UL60950, an American National Standard detailing Safety of Information Technology.

Protection from outside elements is another critical design consideration. Transmitter outdoor enclosures should meet NEMA 4X-rating, UL508A listings and partial Telcordia specifications. Outdoor enclosures protect equipment from external dirt, moisture and corrosive materials. NEMA 4X and UL508A standards represent compliance for the construction of industrial control panel enclosures built for installations in hazardous and environmentally-diverse locations.

The air-conditioning system should be a closed loop system that is not open or vented to the outside. This keeps external moisture, dust and dirt ingression out of the enclosure. Watertight and airtight seals around entry points for transmission line and other cables will further assist in keeping dirt and moisture outside.

Telcordia GR-487-CORE specifications should be met to support noise pollution standards as well as specifications for wind resistance, and more specifically, to prevent significant leakage from wind-driven rain. This standard provides criteria for analyzing electronic equipment cabinets used in outside plant environments and applications, noting acoustic noise and environmental vibrations. It ensures that transmission systems outfitted within compliant enclosures in urban or congested areas, like suburban neighborhoods, will pass noise tests with the neighbors. Enclosures built off-site and delivered by vehicle should also pass Telcordia standards such as GR-63-CORE, which addresses transportation vibration and shock — ensuring the enclosure reaches the site in one piece.

Equipment cooling

Proper insulation, typically an R rating of 6.5 or better, will keep heat from the sun and ambient sources to a minimum. R6.5 insulation is a 1in, foam-based, rigid foil-faced insulation that protects equipment from external heat sources. Still, even with modern advancements in cooling efficiency, transmission systems will require environmental control. An efficient HVAC system and airflow strategy is required to keep equipment at the proper operating temperature and costs low. Heating the enclosure may also be required for cold environments, and cold startup of electrical equipment, transmitters and RF components.

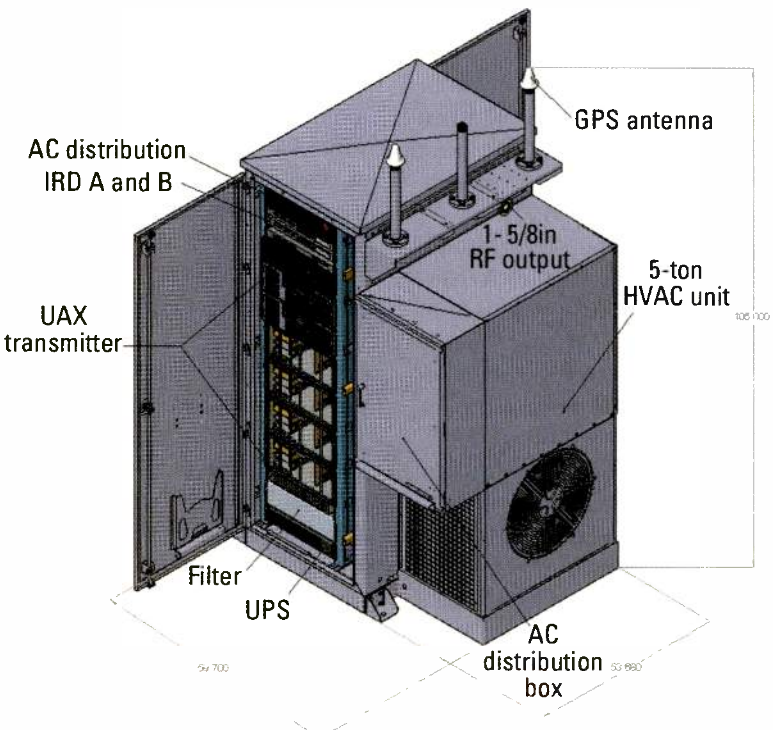
HVAC is perhaps the most challenging requirement. The first step is to ensure compliance with EPA standards for environmentally safe refrigerants as mandated by U.S. EPA Title VI of the Clean Air Act, governmental regulations. The mandate, as of Jan. 1, 2010, states:

The Montreal Protocol requires the U.S. to reduce its consumption of HCFCs by 75% below the U.S. baseline. Allowance holders may only produce or import HCFC-22 (R22) to service existing equipment. Virgin R-22 may not be used in new equipment. As a result, heating, ventilation and air-conditioning (HVAC) system manufacturers may not produce new air conditioners and heat pumps containing R-22 after Jan. 1, 2010.

With the differences in the types of refrigerants, there are differences in the way HVAC systems react in adverse environments. This requires changes in the way systems are designed. Newer environmentally-friendly refrigerants such as 407C have replaced older R22 refrigerants that had adverse effects on the ozone layer. These newer refrigerants are also adequate for use in enclosures shipped overseas.

The size of the cooling system is based on the size of the structure and its estimated heat load. This will help to determine the appropriate airflow based on the directed airflow of the equipment going inside. Most of the hot air from the transmitter is expelled at the rear of the transmitter and remains in the enclosure; this is because air is moving through the front to the back. Directing a portion of the cool air from the HVAC system to the rear of the transmitter will create an appropriate cold and hot air mixture. Turbulence in that area mixes the hot and cold air that is pertinent to maintaining an efficient and reliable transmission system.

The movement of air inside the enclosure should be in a circular pattern. The HVAC unit pulls air from the top of the enclosure and blows cool air into the center. An air deflector will keep the cool air from going directly back into the HVAC unit and also direct the airflow to the bottom front of the enclosure. This creates a circulation pattern from bottom front to top front and onto the top back of the enclosure. The large circular direction eliminates hot spots in the enclosure (good point).



This diagram breaks down the design of an outdoor enclosure featuring a Harris Maxiva UAX air-cooled transmitter. Note the antenna mounting options on the roof and how the AC distribution cycle pulls air from the top of the enclosure, creating a continuous airflow pattern that maintains operational efficiency.

Note that efficient transmitter designs will reduce heat load. Transmitter cooling with internal fan systems that direct airflow in one direction, from the front of the enclosure across the PA modules and through to the rear of the transmitter cabinet, helps the circulation of the air in the enclosure. Fans moving in multiple directions within the transmitter will upset the airflow throughout the enclosure.

A "smoke test" is a good way to confirm there is proper airflow within the enclosure. Strike a match, blow out the flame, and hold it inside the cabinet. The smoke will circulate in the same direction as the airflow, identifying "dead" areas where air is not moving. This will supply information needed to make the appropriate HVAC system adjustments and improve circulation.

RF and antenna systems

Most outdoor enclosures will be spacious enough to accommodate the transmitter and associated hardware without issue. Depending on the operation, additional hardware might include satellite or microwave receivers, wireless receivers (for wireless network connections), media servers, routers and computers. A variety of monitoring equipment can monitor temperatures inside the cabinet and alert engineering staff of open doors or intrusions. A UPS system is also necessary, often coupled with an IP-controlled power distribution unit to remotely cycle power on specific components.

Digital broadcasts today require a mask filter to minimize out-of-band interference. In UHF systems, ceramic 12-pole filters are commonly used to minimize the system footprint. This design features ceramic resonators with small cavities on the inside of the filter as opposed to using traditional, larger air cavities. VHF applications will require traditional air cavity mask filters, making outdoor enclosure systems for VHF broadcasts far more challenging in terms of cost and footprint.

AC line filtering is also useful. This removes conducted AC emissions such as harmonics and other undesirable artifacts from the AC line — a requirement for minimizing interference with nearby consumer radios and TV sets. Surge suppressors will minimize electrical spikes for lines coming in the enclosure. Examples include GPS and satellite antenna cables.

Transmission line out to the antenna and tower will usually be of the 1-5/8in to 3in variety, in rigid or flexible style. Rigid line is best used up to the point it leaves the enclosure given the limited space inside. Attaching a standard rigid EIA flange at the exit point will give broadcasters the option of continuing with rigid line or switching to a flexible-style solution. Dehydrators for transmission line and antenna pressurization can assist inside the enclosure.

Antenna mounting systems vary, so it's best to provide a few options atop the enclosure. An ideal mounting system includes three separate pipes, about 18in long and 1in in diameter to support antennas in the range of 5lbs to 6lbs. An antenna shelf provides enough space for comfortable separation between GPS, Yagi, wireless WAN/LAN and other antenna choices.

GPS-capable antennas are especially ideal for single-frequency networks, effectively locking in exciters across multiple enclosures in the same market and allowing for a perfectly timed, synchronized transmission network. Small wireless antennas, such as G3-style models, can also assist with monitoring procedures over cellular communications — especially useful if a local T1 line is not available to the site.

The antenna shelf provides mounting for an ice bridge to protect the antenna systems' associated transmission line and cabling. Multiple predrilled holes into the antenna shelf will support multiple ice bridge mounting options, designed to protect both the antennas and the associated transmission line from snow, ice and other elements that can settle on top of the systems or fall from the tower, potentially causing service problems.

It should be noted that transmission systems for virtually any standard can live inside these enclosures. It doesn't matter if the system is ATSC, ATSC-MDTV, DVB-T, DVB-H, ISDB-T, FM or DAB/DMB; these enclosures are perfectly capable of supporting mobile and terrestrial broadcasts for main and repeater systems at the site of your choosing. BE

Steve Rossiter is mobile applications engineer for Harris Broadcast Communications.

SYSTEM DESIGN
SHOWCASE

Griffin Communications

BY MICHAEL GROTTICELLI

For many, the migration of a television station from analog to digital and then HD operations is a complex challenge that takes a bit of planning and careful technology choices to get right. Multiply that by three, and you get some idea of what the Griffin Communications design team and station personnel faced when they implemented the comprehensive simultaneous switchover at three Oklahoma stations in October.

To implement the move in a timely manner, Griffin Communications decided to convert the entire station group of KWTV, KOTV and KQCW at one time. So, on Oct. 24, KWTV, the CBS affiliate in Oklahoma City, debuted HDTV studio production, as well as HD spot playback, in its 10 p.m. news. Griffin's two stations in Tulsa, OK — KOTV and KQCW — went 16:9 with HD spot playback at 9 p.m. for the CW-affiliated television station KQCW, followed an hour later by CBS affiliate KOTV (a duopoly arrangement whereby the two stations share a single facility in Tulsa).

Setting a master plan

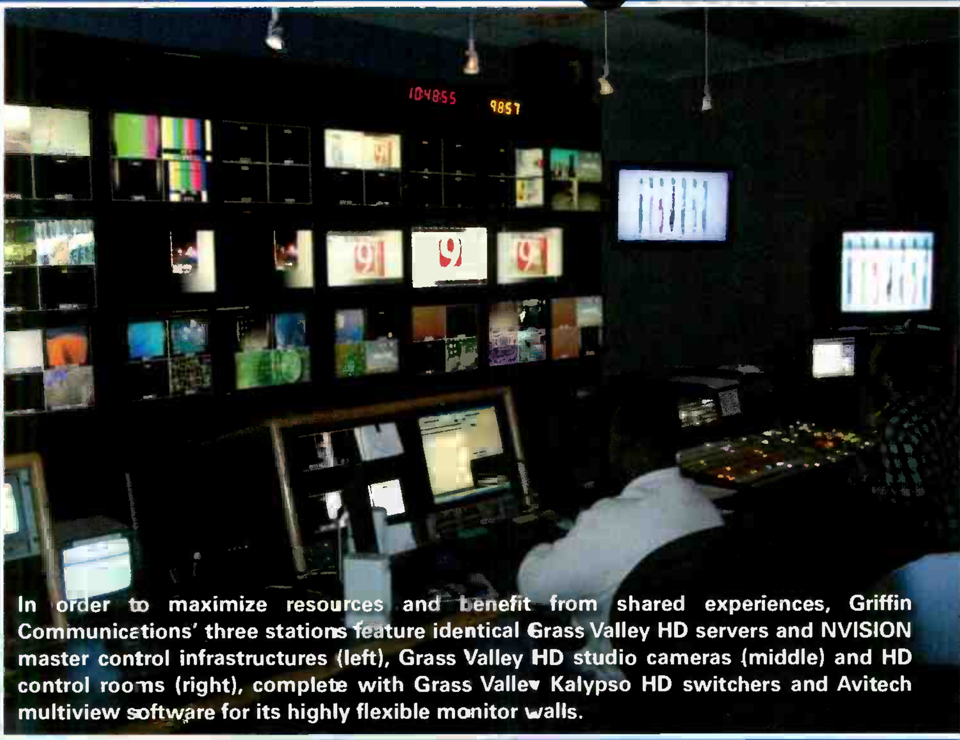
Although it had been discussed for about three years prior, the huge undertaking of physically getting it done began in earnest in January 2010, when the technology team sat down with systems integrator Beck Associates (whom they had worked with in the past) to devise a plan. Remember that all three stations were already on the air with daily newscasts and had to remain that way. There could be no interruption in service for their viewers, and failure was not an option.

The general idea was to replicate all of the technology implementation at all three stations. Equipment was purchased and delivered in June, and the next few months saw a reconfiguring of existing control rooms with multiscreen flat-screen displays running Avitech multiview software, and a spruced up production studio to accommodate the new gear.

To implement the move to HD in a timely manner, Griffin Communications decided to convert the entire station group at one time.

In Oklahoma City, the master control suite was expanded to fit a new virtual monitor wall running Miranda X-16

migrates stations together



In order to maximize resources and benefit from shared experiences, Griffin Communications' three stations feature identical Grass Valley HD servers and NVISION master control infrastructures (left), Grass Valley HD studio cameras (middle) and HD control rooms (right), complete with Grass Valley Kalypso HD switchers and Avitech multiview software for its highly flexible monitor walls.

multiviewer software and hardware. Likewise, in Tulsa, additions were made to the already existing monitor wall for 16:9 digital.

The staff was also busy training to use a revised file-based workflow that includes Avid Nitris Media Composer edit workstations and three Grass Valley HD K2 media servers (12 channels) in a storage area network (SAN) configuration at each location. Each SAN is fully loaded with 5.3TB of storage capacity.

Ensuring a smooth transition

Much of the transition was made easier by staying with the vendors originally used for the company's earlier "HD ready" SD-SDI conversion. For example, the Grass Valley K2 media servers now in place were a simple upgrade of existing Profile servers. They also implemented new Grass Valley K2 Summit and K2 Solo servers to handle ingest and file conversion, in tandem with Telestream FlipFactory transcoding software. In the production control rooms, servers are operated in multichannel "ChannelFlex" mode, whereby key with fill clips are combined into one server channel and fed to the Kalypso switchers.

The company's existing Grass Valley Kalypso Duo switcher in Oklahoma City was easily upgraded from SD to HD capability, as was the Grass Valley Trinix NXT 512 x 512 routing switcher, which was initially populated with both SD and HD material. This made it easy to work with the Avid Unity systems at each location, maintaining mezzanine level and lower level compressed versions of their news content. The Kalypso Classic in Tulsa was switched to 16:9 SD mode, with the station's 7500 router already capable of handling 16:9 SD.

KOTV now operates two control systems for playout of clips from its K2 servers involved in newscasts — the Avid Command and the Advanced Media Protocol (AMP). The AMP specification allows production staff playout of two channels of key/fill wipe transitions, controlled directly by the Kalypso from the switcher panel. The same holds true with Command for two channels controlled by iNEWS rundowns with MOS for opens and mini-opens. There's an Avid Unity storage system and Nitris Media Composer edit station at each facility, as well as an NVISION master control switcher. KWTV had also installed an Avid ISIS storage system a year ago. Program and commercial elements are created on Avid Nitris for HD and Adrenaline for SD, and then converted with FlipFactory before going to the K2 Summit or K2 media servers for playout to air or preproduction. In Tulsa, newscast opens and mini-opens are created and stored as HD, but played out in SD via an automatic transcoding feature of the K2 server. The K2 SAN is also used to play commercial and syndicated content to air at all stations, with Harris automation systems used for all three channels.

Working out the kinks

In all locations, one of the more challenging aspects was moving the correct file format in a timely manner between the Grass Valley K2 Summit server, the FlipFactory software and a craft editor's workstation. Both stations had used a file-based workflow for several years, but the move to HD and SD 16:9 brought challenges. Both stations debuted new station logos and a shared station graphics package, using Adobe After Effects and Vizrt. Getting all the graphical templates operational and the Vizrt systems at each station fully interfaced also presented challenges.

To this end, the set at KWTV (designed by FX Design in 2007) was built before the transition but had been designed for future HD use. At KOTV, small cosmetic changes were made for widescreen. Studio camera operators at all three stations were trained to shoot 16:9, but protect for 4:3 audiences (with seven Grass Valley LDK 4000 HD cameras in the group). News photographers began shooting 16:9 SD footage, with 4:3 protect, in early 2010 to build up a library of 16:9 file footage.

Training on the Grass Valley Kalypso Duo switcher was accomplished during downtime and after hours in many cases, when the newscasts were finished. The flexibility of the Kalypso switcher is such that the crew could use it in SD mode and then easily reconfigure it for HD operation for rehearsal. They did this for about three weeks before launch and could not have accomplished the migration as quickly as they did any other way. Likewise, Tulsa was able to switch its Kalypso Classic between 4:3 and 16:9 modes for training and preparation.

Sharing graphics production

Another element that helped with the transition is graphics production. All three TV stations are using Vizrt's full suite of graphics systems and platforms, so content could be shared seamlessly. Graphics can be created in Oklahoma City and Tulsa and then sent to the other station as needed. However, there are times when the staffs create their own local elements when a breaking story arises. Viz Ticker3D was also a critical part in the sharing of graphics and tying the on-air look together using crawls, logos, time and temperature during local broadcast.

Planning the journey brings successful results

The project was a success because Griffin Communications laid the groundwork several years earlier, and the current station design teams worked closely together to exchange information and thoughts about workflows, equipment placement and many other details. All company personnel embraced the opportunity to launch out into a new arena of broadcasting by contributing to the development of the many changes that affected workflows.

In the end, the move to HD was all about delivering a better product to its viewers in the most cost-effective way. And viewers have responded positively. One commented on the new on-air look by stating, "You really knocked one out of the park." BE

Michael Grotticelli regularly reports on the professional video and broadcast technology industries.

Design team

Griffin Communications
Sue Bergherr, statewide IT director
Randy Cassimus, KWTV production director
John Quesnel, KOTV/KQCW production director
Gerald Weaver, statewide director of engineering
Houston Hunt, director of marketing services
Jenny Monroe, director of PM content
Ron Harig, director of PM content
Steve Schroeder, statewide news operations
Jachin Merrill, director of AM content
Nikki Howell, director of operations for Griffin New Media
Barbara Merckx, director of sports content

Beck Associates
Bill McKenna, project manager

Production consultation
Mike Krim

Technology at work

- Avid
  - ISIS storage system
  - Media Composer Nitris
- Avitech multiview software
- Miranda
  - Signal processing gear
  - X-16 multiviewer
- Grass Valley
  - GeckoFlex signal processing system
  - K2 media servers
  - Kalypso Classic production switcher
  - Kalypso Duo HD production switcher
  - LDK 4000 HD cameras
  - Trinix routing switcher
- NVISION master control switcher
- Telestream FlipFactory video transcoding software
- Vizrt graphics platform

Apple iPad

Find out your best option when encoding for the iPad.

BY JAN OZER

There are three ways of transferring video to the iPad: the physical cable, Wi-Fi and 3G. If high-quality video is your goal, the best scenario is transferring the video to the iPad via direct cable, since bandwidth restrictions don't apply. This would be the case if you're encoding your own demo materials for a pitch meeting or encoding HD content for upload to iTunes. In these instances, I'll assume that the video is targeted for full-screen playback on the iPad, as opposed to video in a window. That being the case, what encoding parameters should you use to produce your video?

Starting with resolution, if you're producing for double-duty viewing on both the iPad and general-purpose computers, 720p (1280 x 720) is a good choice. It plays well on the iPad and is the overwhelming choice of producers distributing HD TV shows on iTunes. On the other hand, if you're primarily producing podcasts for mobile viewing, consider at least three other options: two high resolution and one low resolution.

Remember that the iPad's screen is 1024 x 768. When playing 720p video, the iPad scales it down to 1024 x 576 and displays black bars on the top and bottom, so any horizontal pixels beyond the 1024 are essentially a waste. This is shown in Figure 1, a 720p podcast from the hit show "Glee."

So the first option is encoding your videos at 1024 x 576, which has 36 percent fewer pixels than 720p. This should translate to identical quality at 64 percent of the file size, and 64 percent of the download time for files downloaded from iTunes. The second option is 960 x 540, which is the resolution that iTunes uses if you choose a video and click Advanced > Create iPad or AppleTV version.

The third option is 640 x 360, which came into the picture courtesy of an e-mail I received from a buddy who went to the 2010 NAB Show. A few days earlier, I had asked his advice about encoding for the iPad. While at NAB, he met with Apple's technical marketing manager, Mac OS X - QuickTime, who pointed him to a new technical note that he just published on encoding content for distribution to the iPhone and iPad. He said the iPad scaler is so good that sending content at higher res than 640 x 360 just isn't worth the bandwidth. In addition to saving space and download time, a 640 x 360 video will also play in the iPhone and iPod touch, as well as many older iPods, as long as you encode using the Baseline profile.

Grading the options

So what resolution makes the most sense? My first thought was to check iTunes and see what resolution most producers were using. I quickly saw that while 720p predominated, 960 x 540 was used by about 10 percent of the videos that I checked. I found no videos produced at 1024 x 576; this is not shocking since the iPad is so new, but clearly not a mandate. There were a several videos produced at 640 x 360, though obviously none were the HD section that I was checking.

Next I decided to run some visual tests: first with a general-purpose test video, and second with a news video that included scanned newspaper text. Specifically, starting with the same source video, I produced three iPad versions at the three resolutions, encoding at a data rate sufficient to ensure the lack of encoding artifacts in all of them. Then I played the videos back on the iPad, paused the video on the same frame and shot a picture of the video with a digital camera. This is definitely not the most sophisticated of tests, but the results were illuminating.

With the first video, I found that the Apple marketing manager was right: The lower-resolution video scaled to full-screen playback was almost indistinguishable from the high-resolution video. On the other hand, the newspaper text was a different story, as you can see in Figure 2 on page 52.

As expected, the biggest difference is between the 640 x 360 video and the other two. If your videos contain significant fine detail, you need to encode at one of the two HD resolutions. The 1024 x 576 version is slightly more crisp than the 960 x 540 — again expected because the larger version is displayed at its native resolution, while the 960 x 540 version is scaled slightly. The iPad's scaling capabilities may be awesome, but scaling always degrades quality to some degree.

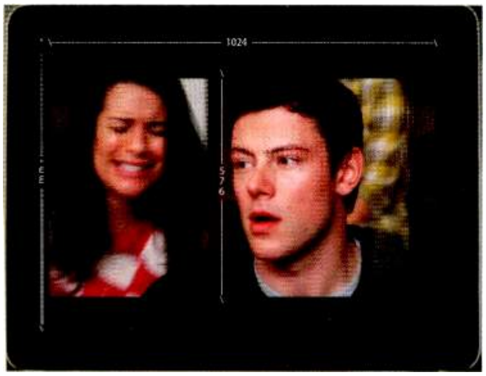


Figure 1. A 720p video played on an Apple iPad is scaled down to 1024 x 576 with letterboxes on top and bottom.

So, if you're producing for joint playback on the iPad and computer, encode at 720p. Going forward, when I'm producing podcasts or video bound for playback on the iPad, I'll produce at 1024 x 576, though the more conventional path is 960 x 540.

If your source video is a talking head or similar footage with very little detail, you might try producing at 640 x 360 and comparing that quality to either of the HD encoding resolutions; you'll be surprised at how little difference you'll notice, you'll cut your encoding and administrative load, and you'll save download time and disc space for your viewers. On the other hand, if there is a lot of text or other fine detail, it's going to look pretty mangled if you encode at 640 x 360 and display at 1024 x 576 display on the iPad.

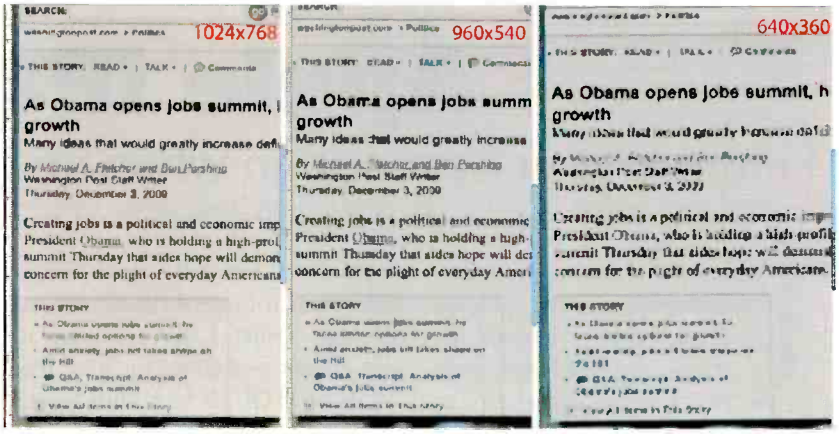


Figure 2. Shown here is video encoded at 1024 x 576, 960 x 540 and 640 x 360, and then played on the iPad.

Other encoding parameters

Because Apple iTunes encoded the 960 x 540 file specifically for the iPad, that's the best indicator of what Apple thinks are the ideal iPad encoding parameters, so let's start there. Note that I collect all encoding options in Table 1, so don't feel that you need to take notes along the way.

I should also say that all encoding tools present these parameters in a slightly different way, and some present some parameters and not others. If you're familiar with your encoding tool, you should be able to figure things out.

To identify the parameters used by Apple, I analyzed the iTunes-created file in MediaInfo, a free video-analysis utility, and show the money screen in Figure 3. First up is the Profile and Level, which should be the Main Profile at no higher than Level 3.1. The Advanced Video Codec is another name for the prescribed H.264; no problem there.

The next option is format settings, context-adaptive binary arithmetic coding (CABAC). It's no surprise that iTunes didn't enable CABAC entropy encoding, since it's not an option on any Apple encoding tool, but I use CABAC encoding for all my H.264 encodes that aren't bound for the iPod (which uses the Baseline profile that doesn't offer CABAC entropy encoding). During the course of my testing, I loaded CABAC encoded test files on the iPad, and they loaded and played with no problem.

In theory, CABAC delivers about 15 percent higher quality than the alternative, context-adaptive variable-length coding (CAVLC), but at these high data rates, you probably wouldn't notice the difference. If you're a conformist, go with CABAC off (or choose the CAVLC option); if you're seeking the very best quality at the selected file size, enable CABAC.

MediaInfo also shows iTunes encoded with variable-bit-rate (VBR) encoding rather than constant bit rate (CBR), which makes sense for a file transferred via cable rather than via wireless. If you're encoding for iTunes or your own use, use VBR.

Next up is the video data rate of 3627kb/s, which is almost certainly higher than you need. At 960 x 540, I would start at 2500kb/s, which should produce very high-quality video, and only increase the data rate if quality is subpar. Since 1024 x 576 is about 14 percent larger than 960 x 540, I would start at 2.8Mb/s.

I'll note for the record that iTunes didn't change the frame rate of my test file to 24fps; it left it at 29.97fps. For this type of encode, I would always use the native frame rate of the video.

The frame-rate graph from Inlet Technologies Semaphore, shown in Figure 4, illustrates the VBR encoding discussed above. It shows lower data

	iTunes (High-res)	iTunes (Low-res)	720p
	Video		
Resolution	960 x 540/1024 x 576	640 x 360	1280 x 720
Frame rate	29.97fps (same as original)	29.97fps (same as original)	23.976fps
Profile/level	Main/3.1	Baseline	Main
VBR/CBR	VBR	VBR	VBR
CABAC/CAVLC	CABAC	NA	No
Video data rate	2.5Mb/s / 2.8Mb/s	1.4Mb/s	4.1Mb/s
Keyframe interval	3 seconds (90 frames)	3 seconds (90 frames)	Unavailable
B-frame interval	1	NA	Unavailable
Reference frames	2	NA	Unavailable
	Audio		
Codec	AAC-LC	AAC-LC	AAC-LC
Data rate	128kb/s	128kb/s	160kb/s
Channels	Stereo	Stereo	Stereo
Sample rate	44.1kHz	44.1kHz	44.1kHz
VBR/CBR	CBR	CBR	CBR

Table 1. Producing podcasts for iPad viewing

General

Complete name:	/Users/apple/Desktop/HD_Compressor.m4v
Format:	MPEG-4
Format profile:	Apple TV
Codec ID:	M4VH
File size:	41.6 MiB
Duration:	1mn 32s
Overall bit rate:	3 760 Kbps
Movie name:	HD_Compressor - ipad
Encoded date:	UTC 2010-04-14 16:54:11
Tagged date:	UTC 2010-04-14 16:54:12

Video

ID:	2
Format:	AVC
Format/Info:	Advanced Video Codec
Format profile:	Main@L3.1
Format settings, CABAC:	No
Format settings, ReFrames:	2 frames
Codec ID:	avc1
Codec ID/Info:	Advanced Video Coding
Duration:	1 mn 32s
Bit rate mode:	Variable
Bit rate:	3 627 Kbps
Width:	960 pixels
Height:	540 pixels
Display aspect ration:	16:9
Frame rate mode:	Constant
Frame rate:	29.970 fps
Resolutions:	8 bits
Colorimetry:	4:2:0
Scan type:	Progressive
*Bits/(Pixel*Frame):*	0.233
Stream size:	40.1 MiB (96%)

Audio

ID:	1
Format:	AAC
Format/Info:	Advanced Audio Codec
Format version:	Version 4
Format profile:	LC
Format settings, SBR:	No
Codec ID:	40
Duration:	1 mn 32s
Bit rate mode:	Constant
Bit rate:	128 Kbps
Channel(s):	2 channels
Channel positions:	L R
Sampling rate:	44.1 KHz
Stream size:	1.41 MiB (3%)
Language:	English
Econded date:	UTC 2010-04-14 16:48:29
Tagged date:	UTC 2010-04-14 16:54:12

Figure 3. Shown here is the file iTunes rendered when the author clicked Advanced > Create iPad or Apple TV version.

rates during the start of this test clip, which begins with 30 seconds of low-motion talking head footage, and then higher data rates for the higher-motion content that follows. The graph also reveals that key frames, which are those red vertical lines beneath the time scale, are spaced about one per every three seconds (or every 90 frames in this 29.97fps video). The irregular keyframes are those inserted at scene changes, a technique that improves overall quality. To enable this in your encoding tool, make sure that the "Insert keyframe at scene change" option, or "Natural" keyframe option, is checked or otherwise enabled.

Paging through the file in Semaphore revealed that Apple inserts one B frame between P and I frames, so set your B frame interval to 1, with two reference frames, a parameter revealed in both MediaInfo and Semaphore.

For audio, iTunes produced stereo audio using the Advanced Audio Codec (AAC) Low Complexity (LC) profile, with a data rate of 128kb/s and a sampling rate of 44.1kHz. Most encoding tools don't let you choose between VBR and CBR for audio, but if they do, note that iTunes used CBR.

If you chose the 640 x 360 option, I would start at around 1.4Mb/s, which should produce pristine quality. Use the Baseline profile if you want the file to run on other devices like the iPhone and iPod Touch, which takes CABAC and B-frames out of the picture because they're not supported under the Baseline profile. Otherwise, follow the recommendations in the table.

The third column shows the collective stats from the 720p files that I downloaded from iTunes for your reference. Note that I couldn't load any of the files into Semaphore, probably because they were encoded with the Apple digital-rights-management technology. Note also that MediaInfo reported that all the TV shows were produced using the High Profile, but I'm guessing that this relates to the DRM as well.

As a final thought, after producing your files, test, test and then test again. It's a new platform for all of us, and we're bound to collectively make some mistakes. **BE**

Jan Ozer is owner of Doceo Publishing and a contributor to Broadcast Engineering's *sister website,* Digital Content Producer.

Figure 4. This frame-rate graph from Inlet Technologies Semaphore shows lower data rates during the start of the test clip, which begins with 30 seconds of low-motion talking head footage, and then higher data rates for the higher-motion content that follows.

Digital Nirvana MonitorIQ

The broadcast monitoring solution streamlines content monitoring and delivery across multiple platforms.

BY NED CHINI

Today, broadcasters are being challenged to do more with less. New regulations such as the pending C.A.L.M. Act will necessitate broadcasters to stay within certain volume levels, which requires constant monitoring. In addition, the multimedia age requires broadcasters to have content-repurposing workflows in place that ensure the seamless delivery of content to various locations in different formats. Broadcasters must also quickly supply up-to-date air logs to their advertisers — all with a smaller staff.

One way they can address these challenges is with a software-based broadcast monitoring solution (BMS), which provides multiple tasks such as efficient transmission troubleshooting, intelligent search and retrieval, streamlined content repurposing, and archiving capabilities. These systems can make the job of managing media in the era of multimedia less harried for broadcasters. Digital Nirvana has such a solution, the MonitorIQ.

Scalable Web-based system

MonitorIQ is an easy-to-use, scalable networked appliance with multichannel tuner/recorder capabilities. (See Figure 1.) The application is browser-based, so it is familiar to operators. It can be accessed from the office, on-site and virtually anywhere else it may be needed. Its modular architecture makes it highly scalable, so that new modules can be added to enhance an existing feature or add new features. The system is equipped with up to four built-in intelligent tuners and customizable storage for air-check logging. ATSC, DVB-C/T, QAM, NTSC/PAL and HD-SDI inputs are supported.

There are no license limits on the number of clients supported by the system, so all staff members have access to scheduling functions and recordings at any time, from any location, along with trouble-free user management with AD/LDAP integration.

Signal monitoring

MonitorIQ incorporates an intelligent agent to send customized e-mail or messenger alerts to staff in the event of a signal problem, such as loss of audio or video, black or static screen, encoding, loss of closed captions, processor load, free disk space or free memory/swap space. Alerts are also automatically logged to make it easy to locate and review the broadcast during the affected time period. By having alerts sent via e-mail, a staff member can handle other items until there is an issue instead of standing by the monitors, waiting for an issue.

The system also includes adapters for most traffic logging systems, incorporating ad schedules for automated cross-checking with transmission exception logs. Sales staff can easily identify local ads affected by transmission

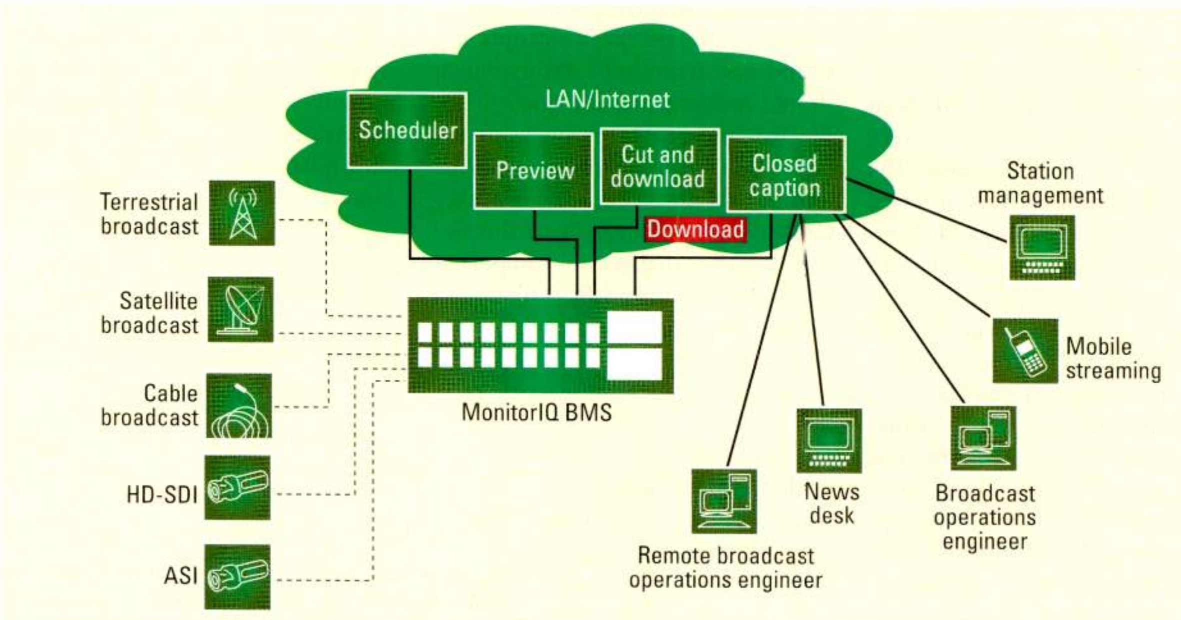


Figure 1. Digital Nirvana's MonitorIQ BMS integrates with other broadcast operations systems. Staff can access the BMS using any Web-enabled device from any location.

problems and retrieve the affected content by timestamp or spot ID to see if a "make good" will be required. Customized adapters are also available. An intuitive, easy-to-use Web-based interface enables staff to schedule, monitor or retrieve from any device in any location.

Repurposing content

Repurposed content can add value to a broadcaster's bottom line, but only if it can be generated and delivered across multiple platforms quickly and frequently. The content must be delivered in different formats to various locations, which is why the system supports most known formats, including several clip/export ones such as MPEG-1, MPEG-2 and H.263/4, as well as formats supported by nonlinear editors for professional users.

One can also retrieve, repurpose, clip and share full broadcast bit-rate resolution, full-HD/SD or FLV content with MonitorIQ. Output formats include Flash, MPEG-1/2, MPEG-4, XDCAM and H.263/4, so content can be repurposed for use on websites, portable media players and mobile Internet devices. Broadcasters can automate their repurposing workflow by specifying names to clips and upload to a preconfigured/defined FTP location for publishing, making it possible to streamline the entire process down to a few clicks of a button daily.

An intelligent search and retrieval system is a major component of the system. Searches can be performed by channel name, broadcast time, program title, description and captions, enabling users to identify content more quickly and efficiently. Users can also employ the search system to identify content such as news segments and programs for repurposing over the Web or for mobile media.

To help manage content retrieval and storage, the system has auto-expire and archiving features, allowing content to be offloaded to existing NAS systems, but still keeping it accessible. Depending on one's needs, full bit rate recordings or just low-resolution proxies can be stored externally.

MonitorIQ also handles content recording, scheduling the recordings according to the broadcaster's priorities. Intelligent, built-in tuners with an RF, SDI, ASI input facilitate recording of up to four channels 24/7 or specific programs based on prefed/notified recording schedules. The tuners switch to channels based on the recording schedules. To stay on top of any potential problem with the broadcast, a logging and alerting system continuously monitors each scheduled recording.

Proof of broadcast

Low-resolution Flash proxies of all recorded content are made continuously to allow painless air-check logging from any Web browser with a Flash plug-in. An ad tracking module provides for competitive analysis of advertisers and frequency of placements. Users can import as-run, traffic and other custom logs to verify a scheduled ad run.

Multitasking is key when responsibilities are growing and staff is shrinking. Technologies are not an exception. Having an intelligent system in place for signal monitoring, broadcast logging repurposing and archiving as well as for proof of broadcast will allow broadcasters to reap the rewards of a multimedia world. Using the system's monitoring features will help to quickly resolve issues associated with volume levels, transmission and closed captioning, freeing up staff while still ensuring that the station is meeting new transmission standards.

Multimedia content stands to be a great advantage for broadcasters, but only if they can develop a fast, efficient way to deliver error-free repurposed content across different platforms. **BE**

Ned Chini is vice president, business development and sales, for Digital Nirvana.

Broadcast Videohub

ProShow used the SDI routers from Blackmagic Design for coverage of the 2010 Winter Olympics.

BY TIM LEWIS

Every two years, thousands of broadcasters descend on an Olympic host city like a horde of media-ravenous carnivores. In addition to the International Broadcast Center (IBC) provided for the rights holder broadcasters, the host city also provides a second media center handles the 24x7 needs of the non-rights holder broadcasters. At the 2010 Winter Games in Vancouver, this facility was put in place by the Province of British Columbia at Robson Square in downtown Vancouver, and was called the BC Media Centre (BCMC).

Broadcasters needed easy and immediate access to all of the audio and video available to them through the BCMC. To get the feeds to them, we here at ProShow, a Western Canada-based provider of broadcast mobiles, flypacks, engineering and corporate audiovisual services, pulled together a routing network based around the Blackmagic Design Broadcast Videohub router and its Smart Control Panel software.

ProShow installed a 72 x 144 Broadcast Videohub as well as two 16 x 32 Studio Videohubs at the BCMC in the weeks prior to the opening ceremony, and maintained that network well after the last event was held. Throughout, we were able to route all of the feeds coming in from various sources through the Studio Videohub and give any broadcaster access to those feeds.

Installation

Installing and configuring the routers was simple. The routers come with SDI reclocking features, which allowed us to connect to long-distance equipment, as well as redundant power supplies and power fail protection, so we were ensured the system would be reliable. And we were able to connect to different formats on the same router because the routers are able to handle mixed SD, HD and 3Gb/s SDI connections.

After we had gone through the initial connections, we moved onto configuration. The routers have the ability to configure and change connections right from our desktop. We had more than 60 sources coming in to the system, including the BCMC press theatre, bookable and unilateral stand-up locations, multicamera feeds of Robson Square's live entertainment, remote feeds from the media center in Whistler, backhaul feeds from broadcasters, and, the most popular item, multiple "beauty cam" shots in and around Robson Square from HD cameras placed around the two-block area. Router destinations included all of the HD LCD screens placed throughout the BCMC facility, the three giant LED walls for public viewing, and, of course, outgoing feeds to broadcasters' control rooms and edit suites both in the BCMC and via fiber back to their home stations.

Software control

We had to have total flexibility to manage the routers — in addition to giving broadcasters complete access.

Blackmagic Design's Broadcast Videohub routers come with SDI reclocking features, allowing ProShow to connect to long-distance equipment, as well as redundant power supplies and power fail protection.

That is where software control was invaluable. Some workstations like our Master Control Operator or Press Theatre Technician needed to control multiple destinations; others like a simple edit suite or outgoing feed to a broadcaster only had a single destination assigned. The Smart Control Panel software allowed us to create customized control panels for each user that gave them full access to what they needed, without the visual clutter of things they didn't need.

We also used the router's Pushbutton View feature. This let us build an interface that allows users to easily navigate pages of buttons with concise and easy to understand descriptions. The Software Control Panel already came with a library of icon buttons and gave us the ability to customize the descriptions even more.

As an IP-based system, the Software Control Panel users were not limited just to those broadcasters that maintained edit suites and control rooms within the BCMC. We were able to give each of our broadcasters an IP address that they could connect into and grab the feeds they needed from anywhere. As long as they could get Internet access, they could access the routers. With a simple software app installed back at the station across the city, or across the continent, a news program could take an event in our Press Theatre live, switch to a beauty cam shot for the bumper to commercial, then switch to a unilateral camera on a stand-up riser and come back for a live interview, followed by a different beauty cam shot into the next break. This level of control and ease of use made the BCMC routing network really stand out.

And although they were located blocks away in the IBC, many of the rights holding broadcasters got in on the act and made use of the Software Control Panel to access our Press Theatre and beauty cams throughout the games.

By the end of the games, more than 3800 members of the media made use of the BCMC, and images taken from our network were used in nearly every country with a broadcast presence at the games.

What we accomplished and the ease with which our audience was able to use the routing infrastructure really could not have been made possible without software control. And it can be done at a fraction of the cost of the old hardware-based control. The Broadcast Videohub that was at the center of it all has now been installed in one of our HD broadcast trucks, where it continues to provide exceptional performance and flexibility. **BE**

Tim Lewis is founder of ProShow AudioVisual/Broadcast.

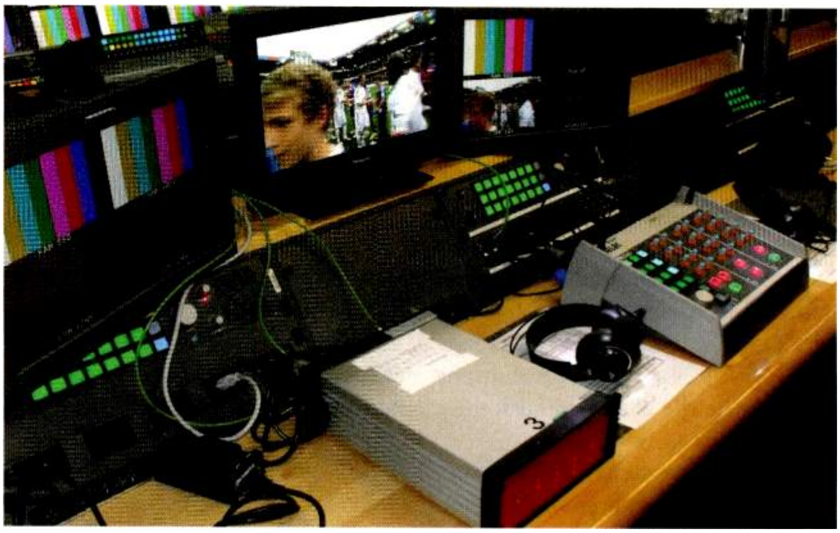
Nevion's FlashCase

The portable housing meets tpc's need for a small water-resistant box with up to five cards for different signals.

BY HEINZ KOHLER

Much like other broadcasting centers, tv production center zürich (tpc) has been working through the implications of migrating from SD to HD. In 2008, as part of our HD rollout, we began development on a new HD OB truck. But with the distance limitations of coaxial cable and the needs of often complex, live, OB applications, we needed a new solution. We needed a box that combines all the necessary signals (video, audio, RS-422, GPI and Ethernet) in a single multifiber cable feeding a remote box.

Having used Nevion Flashlink fiber transport and signal processing systems for the past eight years without any problems, we decided to contact AVC-Systems, its dealer in Switzerland, about the idea for a simple but robust application: a small water-resistant box with up to five cards for different signals with BNC and XLR connectors on the back plate. We took some drawings and blueprints to Nevion, and the company came back with fully executed drawings and design solutions. After making some refinements in a second meeting, the new solution was born. The process took less than four months, and in October 2009, we had our first two boxes in hand to test with our new OB truck.



Nevion's FlashCase portable housing connects camera sites to production trucks or other facilities through a lightweight optical fiber cable.

FlashCase portable housing is designed to be used with up to five standard Flashlink fiber transport or signal processing modules, connecting camera sites to production trucks or other facilities through a lightweight optical fiber cable. Using optical fiber rather than triax cable substantially increases distance capabilities and eliminates ground current loops, while provisioning for multiple signals in the same cable simplifies cabling infrastructure and reduces setup time.

The box is designed for maximum portability. Fully loaded, it weighs about 11lb, and at 9.5in x 14in x 4in, it's small enough for easy storage and OB van deployment. Because it's populated with Flashlink modules, it's power-efficient, with no fans to clean or replace. It's also highly resistant to the elements, and it features rugged design and materials.

The Flashlink modules support a wide variety of system configurations, including embedding, signal processing, format conversion, synchronization, WDM/CWDM/DWDM optical multiplexing and TDM electrical multiplexing applications. Any audio, video, data or fiber connector can be used through optional customized back plates. It also offers full monitoring and control capabilities.

Flashlink is ideal for scalable system designs, allowing additional services to be added on-site. It enables optical multiplexing of several broadcast signals, including bidirectional HD-SDI video with audio embedding, intercom and remote camera control through standard RS communication, and GPI for use with multiple fibers or on a single fiber using CWDM optical multiplexing. A separate Ethernet connection can also be added.

The unit's portability and feature set make it highly versatile and suitable for a range of applications, such as fiber-optic extension or connection for production trucks; audio, video and data transport; video trunking or return video; or as a studio/event relay box or stage box.

Using fiber-optic cables allows us to transport a range of signals, from audio, RS-422, GPI and Ethernet in addition to video, all with a common fiber cable and over long distances. It's a multifunctional tool that we can use for day-to-day applications such as live HD productions, but we expect the functionality and versatility to grow according to our production needs. BE

Heinz Kohler is video engineer, outside broadcast, at tpc.

Camera lens guidelines

Application is key; using an SD lens with a new HD camera just won't cut it.

BY JOHN LUFF

These days we are often focused on technically esoteric topics like file-based workflow, video-over-IP standards and stereoscopic imaging. It might seem hard to grasp, but modern optics are perhaps more difficult to design than most of the electronic infrastructure we have to deal with every day.

The complexity of today's optics

Think for a moment about the level of precision that is necessary in both the mechanics and the optical surfaces. With lenses extending out to 101X, it is clear that mechanical tolerances must improve to maintain image stability as the optical elements move to make the lens zoom. At the long end of the zoom range, such a lens (900mm) has a field of view of less than a half degree, less than the width of the full moon. The same lens at the wide end has a field of view of a whopping 52 degrees (horizontally).

When one looks at a cutaway of a lens, it is clear that a lot is happening! To control focal length and focus, and to minimize aberrations, the moving elements are controlled with high precision and move in both directions. Also, the considerable weight of a field lens places a bending moment on the barrel, or frame, of the optical system. Gravity is the law. To avoid image deflection, the system must hold the optical center precisely in alignment with the optical axis of the camera. Since modern field lenses can weigh upwards of 55lbs, the design of the lens must also use modern mechanical engineering tools to predict and control mechanical forces without jeopardizing the precision of the placement and movement of the optical elements.

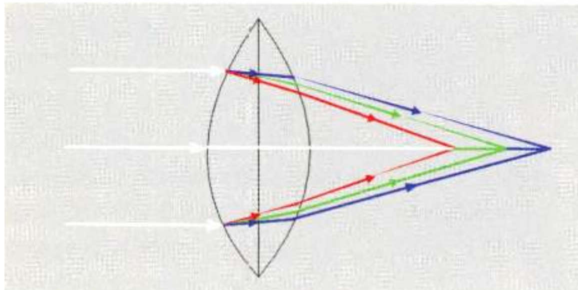


Figure 1. If chromatic abberation exists, meaning all three images do not converge in the same plane, adjustments could be made. But new modern lenses have fixed imagers, so the lens must provide precise focus.

With SD cameras, the demands on the optical system were already considerable, but with HD imagers, those demands become much more critical. For instance, with tube cameras, one could adjust size and center for all three image tubes at the time the camera was set up for each production. Optical back focus for each could be moved as well. Thus, if longitudinal chromatic aberration is present (i.e., all three images do not converge in the same plane), adjustments could be made. (See Figure 1.) With modern fixed imagers, often permanently aligned on the prism assembly at the time of manufacturing, the lens must of necessity provide precise focus across the entire zoom range for all colors.

With lenses extending out to 101X, it is clear that mechanical tolerances must improve to maintain image stability as the optical elements move to make the lens zoom.

With the number of pixels in a 1080p image being 6X higher than a 480 image, it is clear the image must converge to better than 6X the specs that worked for SD television.

All optical aberrations contribute to degradation of the sharpness, color

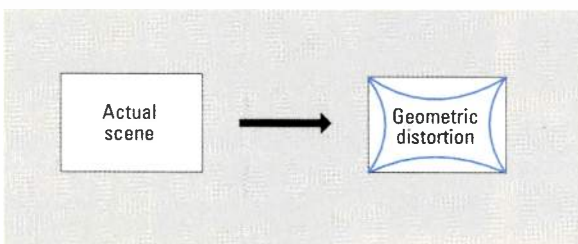


Figure 2. Geometric distortion occurs when a three-dimensional object is projected on a plane.

accuracy, image contrast and geometry of the image. There is no perfect lens, so it is a matter of controlling the cumulative effect of all image defects for the purpose of making superior images. Some aberrations are easier to spot than others.

For instance, geometric distortion is relatively easy to spot. (See Figure 2.) Think of the wide-angle lens on your SLR and the distortion it creates on objects with vertical or horizontal edges. The further out toward the corners of the image generally the larger the amount of distortion.

One might, correctly, surmise that lenses without extreme wide angles should not exhibit excessive geometric distortion. But keep in mind that lenses are sometimes designed in a series with more than one target for delivery. For instance, a series of lenses may share common design elements for imagers of both 1/2in and 2/3in. The net effect is that the same lens would have a considerably different angle of view on the two different images, which is adjusted by elements added to the path. It might be that a lens with moderate geometric distortion would produce a fine image on a smaller sensor. This effect is also seen on SLRs where the "C size" sensors produce a longer effective focal length, but less distortion with lenses designed for full frame, 35mm imagers because the corners of the image are not used in the smaller format.

Cost is related to performance

There is a direct correlation between the cost of optics and their performance. Buying a less expensive lens for HD applications will likely result in lower performance, particularly in the areas of sharpness, ramping (increase in f-stop at longer focal lengths) and maximum aperture, which will affect low light results. It follows necessarily that less expensive consumer crossover cameras that cost as low as $1000 will have lower performance optics and produce marginal results when compared with cameras that have three larger imagers and more sophisticated optics.

There will be declining performance with any optical system as the size of the imager reduces. This is not only a cost factor, but assuming a 1/3in sensor is built with superior specs, the optics have to produce much higher resolution to achieve the same result at the camera output. A 2/3in sensor is actually only 11mm diagonally, and a 1/3in sensor is about 6mm diagonally. But in both cases, the output resolution would ideally be the same, the modulation transfer function (MTF) providing about 50 percent contrast at 872 TV lines per picture height (TVL/ph). To get that much resolution from a smaller sensor, the lens must increase from about 80 lines per millimeter (LP/mm) at the sensor to about 150LP/mm. By contrast, on an SD camera, the lens would only need to produce about 32LP/mm to get full performance from the camera (in 16:9).

Thus, it is obvious that there are huge benefits to using optics chosen specifically for the application. It is tempting to use existing SD lenses on new cameras. The capital saved is enormous, but so is the reduction in performance. Similarly, choosing low-cost, low-performance cameras and lenses and then intercutting the resulting images with the output from high-end studio cameras and appropriate lenses will produce a result that is quite obvious. It's sad to say, but as in all things, there is no free lunch.

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Yamaha Commercial Audio Systems — M7CL v3.5

Latest firmware release contains numerous new functions to further enhance operation and efficiency of the M7CL console; features new alternate functions for the selected channel that can be assigned to user-defined keys for greater efficiency; when using HA remote signal output from Slot 1 on an M7CL-48ES, up to three additional SB168-ES stage box units can be connected via MY16-ES64 and MY16-EX cards installed in the expansion slots, allowing for six stage box unit connectivity.

714-522-9011; www.yamahaca.com

Monroe Electronics — R-189 One-Net SE

Analog/digital EAS encoder/decoder gives cable providers an all-in-one system for ensuring compliance with FCC guidelines; features a built-in CG and optional integrated MPEG encoding; includes nonvolatile memory for EAS alert storage, integrated support for MPEG-2 and MPEG-4 formats, and optional support for up to four Ethernet ports; can hold up to three internal AM/FM/NOAA radios; available with one of two CAP-EAS software packages.

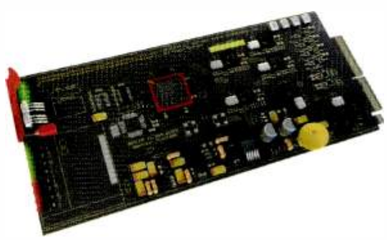
800-821-6001; www.monroe-electronics.com

Ikegami — GFCAM HDS-V10 Flash-RAM

Advanced 3-CCD ENG camera features 1080i or 720p HDTV format support, 480i SD support, Avid NLE compatibility and advanced features such as Bluetooth for instant export of thumbnail clips directly to laptops; records to GFPAK removable cartridge that provides a capacity of up to 128GB and includes a USB port; employs MPEG-2 compression and MXF file format for an open-codec HD/SD recording architecture.

201-368-9171; www.ikegami.com

Wohler Technologies — HDCC-200A-OP47



Three new subtitling cards allow users to handle transmission and monitoring of WST- and OP47-based subtitles; XCODE is a dual-channel WST/OP-47 subtitle inserter that encodes subtitle streams onto two separate SD/HD-SDI video signals, can bridge subtitles from one channel to the other, transcoding the subtitle data from WST (SD) to OP-47 (HD) or vice versa as required, and supports encoding and decoding for as many as four GPI inputs; DUALMON card provides dual-channel WST and OP-47 subtitle monitoring and generates burned-in subtitle display on two dedicated SDI outputs; LOGGER is a dual-channel data extractor that outputs full WST/OP-47 subtitle data from SD/HD-SDI video signals to serial and/or Ethernet ports for logging, external monitoring and regeneration of subtitle files; FULL HDCC200A card incorporates combined functionality of all three cards.

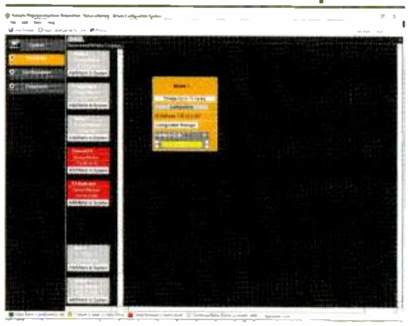
510-870-0810; www.wohler.com

Axon Digital — Cortex

Monitoring and control software provides comprehensive tools to configure, monitor and maintain Synapse products as well as other devices; delivers the common control and monitoring interface using SNMP; allows users to remotely configure a complex workflow in a short amount of time, manage and report events using hierarchical system status, control devices using an intuitive and user-friendly GUI, and maintain a workflow over its lifetime; employs Ethernet communication to each device in the chosen workflow; uses an SQL database to record, view and archive historical workflow events as well as store the user-definable aspects of each device's configuration; available free to existing customers.

212-683-6724; www.axon.tv

Clear-Com — Eclipse v5.2



Digital matrix intercom system features enhanced Eclipse Configuration Software with a simplified GUI that facilitates ease of configuration and management as well as a faster and more efficient communications workflow; includes auto-detection of matrices and networks, load or change pre-established configurations, auto-default to a factory configuration, and on-screen assistance.

510-337-6600; www.clearcom.com

Autoscript — LED17TFT-BLW

Wide-angle, on-camera, 17in prompter features a TFT LED system that offers instant warm-up to full brightness; comes with a wide-angle hood and Eco +Plus+ feature that saves power when no active video is present; includes a preset low-consumption mode feature for use with camera utility power outlets, dimmable tally light with opto sensor input and repeat output, illuminated control panel for easy visibility in dark studio conditions, and optional HD-SDI input.

203-926-2400; www.autoscript.tv

Barco RLM-W8

Three-chip DLP, 8000-lumen projector supports WUXGA (1920 x 1200) resolution; offers low power consumption and decreased noise levels; features geometry correction and edge-blending capabilities, picture in picture, P7 color processing, horizontal and vertical keystone correction, a Web browser and inputs for HDMI, 3G/HD-SDI/SDI, YUV1, composite video, S-video and RGBHV/YUV2.

678-475-8000; www.barco.com

Front Porch Digital DIVApublish

Cloud-based service for automated frame-based metadata creation and integrated online video publishing; enables users to delve deep into their content using facial recognition, scene detection, speech recognition, natural language processing, ad-break detection and closed-captioning time alignment; manages the distribution of this content to a wide variety of destinations, devices and partners.

303-440-7930; www.fpdigital.com

Sony PMW-500

Shoulder-mount professional camcorder is equipped with three 2/3in Power HAD FX CCD image sensors and can record both 1080 and 720 HD pictures at 50Mb/s; comes with two slots for recording onto SxS memory cards; features the XDCAM HD422 codec, toggle between MXF and MP4, option to record MPEG IMX and DVCAM material, interoperability with major NLE systems, lower power consumption and four channels of uncompressed 48kHz digital audio.

212-833-6800; pro.sony.com

Linear Acoustic UPMAX II

Reference upmixer produces stable 5.1-channel version of two-channel inputs; audio elements are extracted using frequency domain filtering and time domain amplitude techniques; bass enhancement signal for LFE channel is derived from the left, center and right channels for quick creation of subwoofer channel elements without compromising full-range consumer playback systems; surround field can be infinitely adjusted via the center channel width control and surround channel depth controls; features a full-color OLED display, rotary encoder, four control keys, auto-ranging power supply with an option for a second redundant power supply and bypass relays; accepts three AES pairs of audio; optional HD/SD-SDI I/O is available for access to all 16 embedded audio channels.

**717-735-3611
www.linearacoustic.com**

Omneon ProXchange 1.6

Grid-based transcode application adds support for the Apple ProRes 422 media format; can perform faster-than-real-time content transcoding between ProRes and mezzanine production formats such as DNxHD; converts media in the ProRes format to broadcast transmission formats such as MPEG-2, as well as low-bit-rate distribution formats such as Flash, WM9 and H.264.

408-542-2500; www.omneon.com

Sencore CMA 1820

Compressed media analyzer supports in-depth analysis of video encoding in almost any format, including H.264, MPEG-2 and VC-1, in container files such as Transport Stream, 3GP, ASF, Flash, MP4, Smooth Streaming and QuickTime; decodes pictures from video elementary streams and displays the information using picture overlays and data boxes, giving key information on coding parameters — including slice and macroblock-level data; syntax view provides values and descriptions of all syntax elements down to the header level; analyzer includes dynamic buffer analysis for H.264 that tests the compliance of the bit stream.

605-978-4600; www.sencore.com

Streambox StreamboxME

Smart phone streaming application is available on iPhone 4 as well as iPhone 3GS phones that have been upgraded to the iOS 4 operating system; enables iPhone users to stream high-quality video via the Streambox Live broadband video contribution service; based on the ACT-L3 codec, which offers low latency, high video quality and reliable transport at any data rate; features a many-to-many video rights management system, video geotagging and text-based IFB talkback; available for free download from the iTunes App Store.

206-956-0544; www.streambox.com

Integrated Microwave Technologies RF Central microLite HD

Compact, mountable COFDM SD/HD digital transmitter designed for the next generation of professional lightweight cameras featuring full HD-SDI capabilities; occupies less than 6in^3; features MPEG-4 encoding/decoding in HD/SD; can be operated in 20mW or 100mW output power modes.

908-852-3700; www.rfcentral.com

Telecast Fiber Systems CopperHead 3400

Fiber-optic video transceiver mounts directly onto a dual-camera 3-D rig; transports all of the signals to and from two HD cameras, as well as the 3-D rig's control system, to the control room or truck and carries a return 3-D HD-SDI signal back to the camera operator; enables full control of both cameras from the base station as well as control of the 3-D rig's interocular convergence; works with any rig using virtually any HD-SDI camera system; transports two uncompressed 1.5Gb/s HD-SDI streams and uncompressed 3Gb/s signals from 3-D or high-speed HD-SDI cameras.

508-754-4858; www.telecast-fiber.com

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Mobile DTV lessons

Consumer fatigue with subscription fees may have contributed to the demise of FLO TV.

BY ANTHONY R. GARGANO

It's time to make some room on that dusty shelf collecting antique tech gadgets. Among the items on the shelf are an eight-track stereo player, your battery-operated portable NTSC TV receiver and that old vinyl record turntable. Now you can add your FLO TV receiver to that junk pile.

Having announced in October the decision to pull the plug on its FLO TV service, Qualcomm will actually discontinue delivery of content to FLO TV receivers in the spring. In the announcement, the company was very careful to indicate that it was the direct-to-consumer service that was being affected and that its white label service "was not affected at this time." White label service is what is currently provided to Verizon and AT&T, who market the content as a subscription-based mobile television add-on service to special mobile phone models that include a 700MHz MediaFLO receiver. MediaFLO is the name Qualcomm uses for the technology delivery vehicle while FLO-TV is the name used for the actual service.

Given the data rate and bandwidth requirements for streaming video, the concept of a network-efficient hybrid — a handset with both a cellular transceiver for voice and data, and a 700MHz MediaFLO receiver for video — seemed an ideal concept. In practice, however, the cellular providers' high monthly subscription fees for the TV service and lack of any real marketing push has led to minimal consumer penetration.

To implement its concept for a portable TV subscription service, Qualcomm originally invested $683 million for the acquisition of spectrum space from the circa 2005 FCC series of auctions for 700MHz range frequencies. Once the auctions were complete, delays and inconsistencies in spectrum availability on a market-by-market basis precluded Qualcomm from quickly rolling out a nationwide service — one of the first nails in the coffin of FLO TV's nascent service.

Other nails in the form of an economic downturn and a flawed business model quickly followed. In making the announcement, Qualcomm CEO Paul Jacobs expressed disappointment in the failure of the FLO TV service business but in a classic example of turning lemons into lemonade; he went on to say that the good news was that based on current valuations, the company's original investment in spectrum is now worth some $2 billion. While that might be good news for shareholders, it is probably not the kind of statement that would inspire signing up for the remaining MediaFLO service that is being delivered by the cellular phone companies. Perhaps it was those spectrum dollar signs that prompted the lukewarm commitment regarding the white label service not being "afffected at this time."

Why'd FLO TV bite the dust?

There are a variety of factors that contributed to the failure of FLO TV. During last summer's ATSC M/H tests in the Washington, D.C., market, the Open Mobile Video Coalition (OMVC) reported that local news was far and away the most frequently viewed content by consumers participating in the test. FLO TV's business model precluded the offering of local content — a lesson that should have been learned from the early experiences of Dish Network and DIRECTV and the negative impact on subscriber growth that they suffered until coming up with a way to deliver local channels. But perhaps the overarching reason for the lack of success, particularly in today's economy, was consumer fatigue with facing yet one more monthly subscription fee, one more hand reaching into a pocket that increasingly contains more lint than cash.

Market research firm SNL Kagan reported in August that subscription TV service providers actually lost subscribers in the previous quarter — the first quarterly decline ever reported. In its October quarterly earnings report, Comcast reported the continuing loss of subscribers, with 275,000 disconnecting in the previous quarter alone. Subscribers are finding that with a combination of Internet-provided services and over-the-air signals, they can dramatically reduce viewing entertainment monthly costs.

As the TV broadcast community begins to ramp up for mobile/handheld-delivered TV services, the highly positive results reported by the OMVC regarding the Washington tests are very welcome. With the exit of FLO TV, certainly opportune as well, comes the demise of a competing service. But there are key lessons to be learned regarding that demise, and they should not be overlooked. They are prescient and critically important as broadcasters are formulating business models today for their new mobile service. To paraphrase George Santayana: heed the past or be condemned to repeat it. BE

Anthony R. Gargano is a consultant and former industry executive.

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