CED

Receivers

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85

Satellite EIRP chart
Weinhouse: signal quality
Gluyas: picture transients
Ferber: PPV technology

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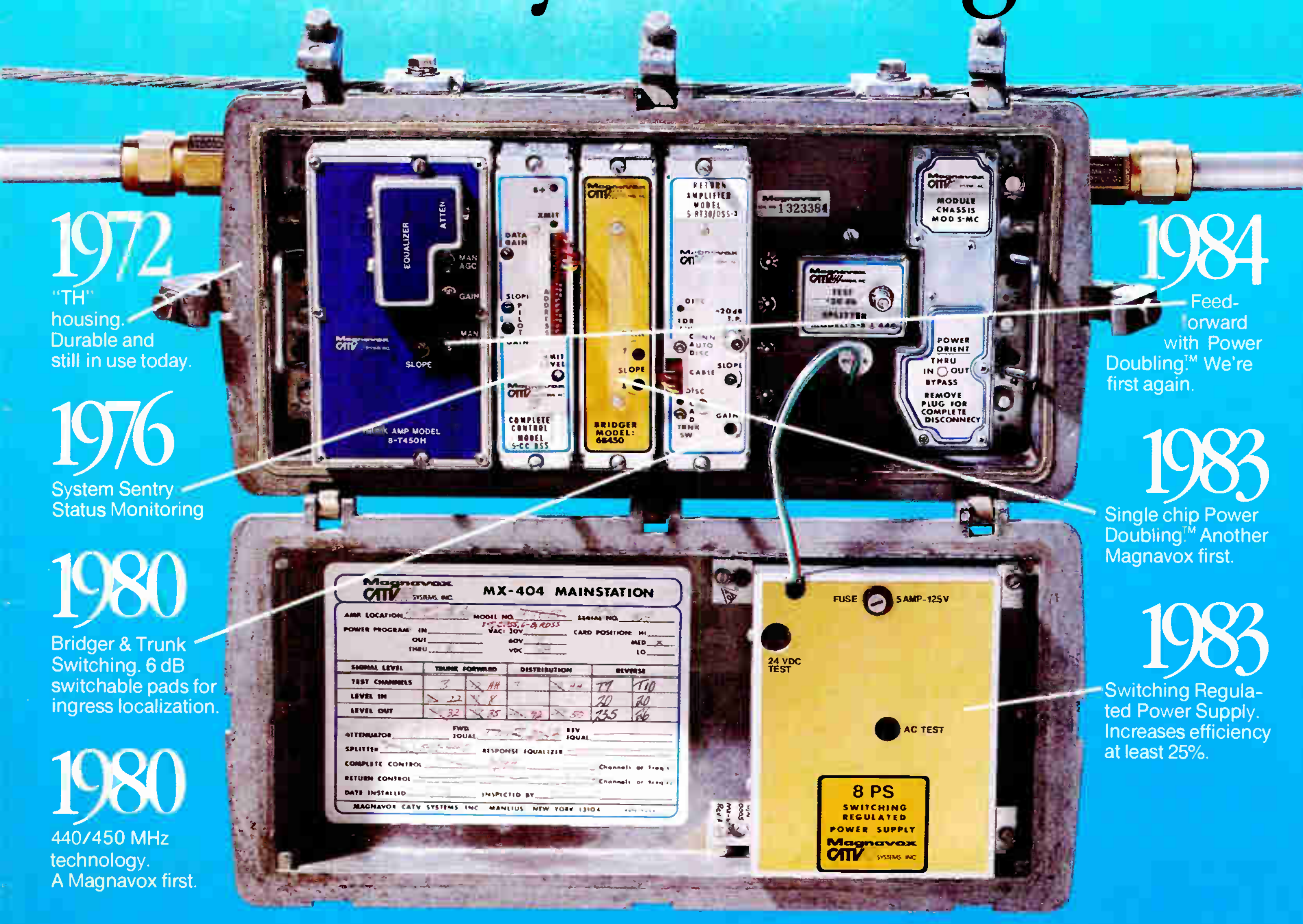

Reader Service Number 2

CED™

October 1985

About the cover
Artist's rendition of Westar IV used courtesy of the Western Union Corp.

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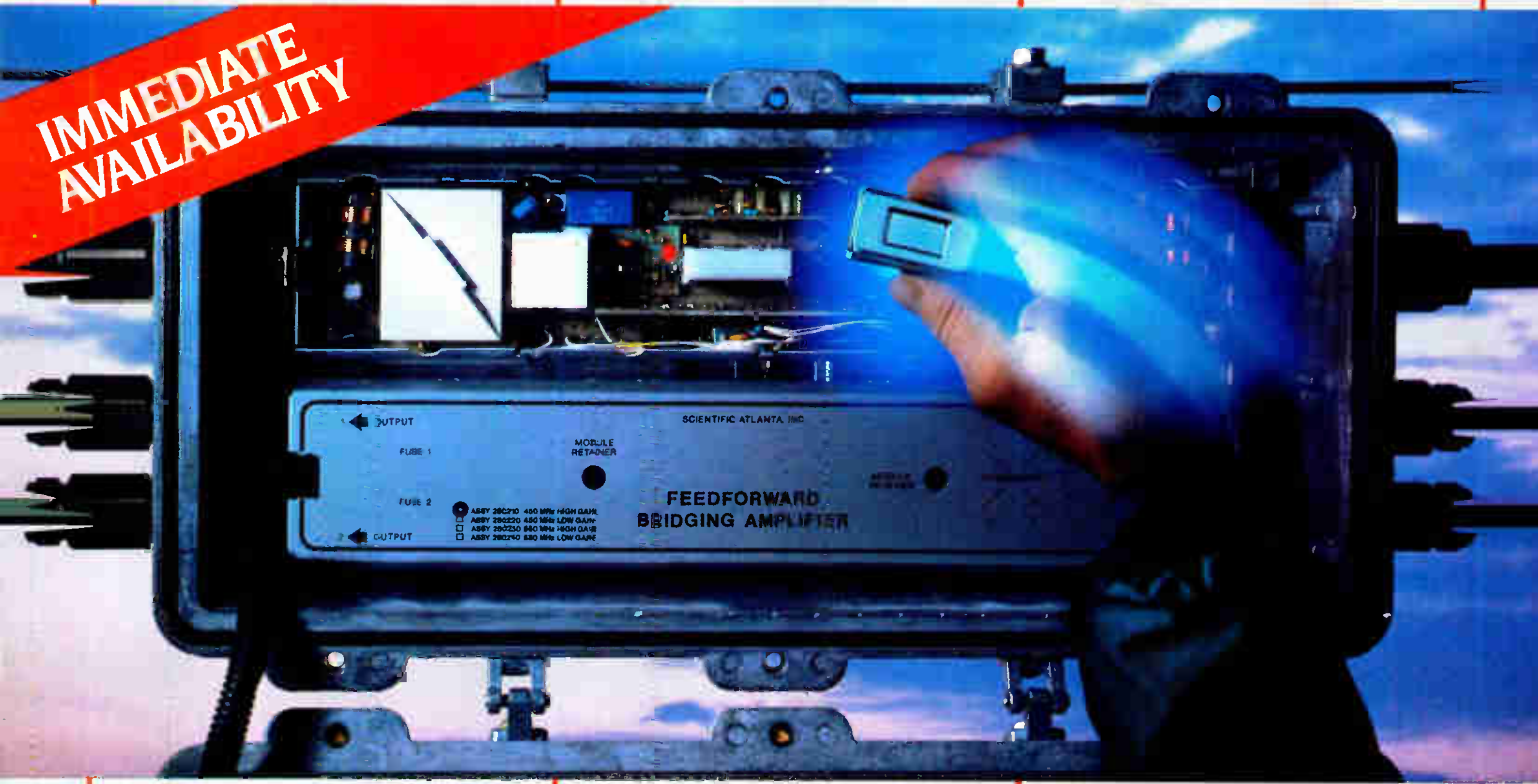

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Reader Service Number 3

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Nick Hamilton-Piercy

What is the biggest danger facing the cable industry? According to Nick Hamilton-Piercy of Rogers Cablesystems, it's forgetting why we're here. "Cable's primary purpose is to serve its subscribers. We have to listen to our customers and remember that they pay our wages. But many operators don't spend the time or money necessary to find out what their subscribers think about their cable service. And because of that, a lot of the moves made to improve customer satisfaction are off-target. System operators simply cannot rely on gut feelings or impressions about what subscribers want. They need to be doing systematic surveys of customer attitudes and then responding to them."

As vice president of engineering and technical services at Rogers, Hamilton-Piercy is ultimately responsible for getting cable to the homes of almost 2 million subscribers in the United States and Canada. And according to extensive surveys conducted by Rogers, picture quality and reliability are the number one subscriber concerns. "This satisfaction factor is deteriorating. Yet, we know our signal quality is improving every year," Hamilton-Piercy states. "The subscribers' perceived picture quality and reliability are decreasing because they now have something to compare us with—namely SMATV, TVRO and VCRs."

Another factor adding to the increasing dissatisfaction among subscribers is new television sets, which produce a much higher fidelity picture. "If there *are* any discrepancies or deficiencies in the cable plant, these new sets show them up in their glory. Our goal is to get picture quality and reliability an order of magnitude better than we are currently delivering. This is the biggest single technical challenge on the continent for any cable operator," Hamilton-Piercy insists.

The regulatory climate for cable in Canada also is of tremendous concern to Hamilton-Piercy. Cable operators in Canada are strictly limited in the number of U.S. signals they can carry, and they are forbidden to carry any U.S. premium signals. Private cable systems, on the other hand, are virtually free to carry any signal that is unscrambled on the satellite. "Obviously, we are trying to compete against someone who has a much better offering than we have. We want to compete fairly but feel we are being held back from doing so," he explains. "We want to carry these signals also. We don't believe in holding others back. All we want is an equal chance."

How long will the CRTC go on severely restricting Canadian cable systems? "Eventually, I am sure it will respond to our plight. However, right now the entire broadcasting system in Canada is under review by a special Parliament-appointed group. Its review will continue until next year, and I'm sure the CRTC will not be making any major changes until it is complete," Hamilton-Piercy cautions. "There will always be a degree of protectionism here, just because of the smaller market size and the need to allow at least some of the production houses in Canada to stay alive. But I think the protectionist attitude of the government will back off considerably."

Meanwhile, Hamilton-Piercy has his hands full overseeing the technical aspects of both the U.S. and Canadian systems owned by Rogers. Is it tough switching rulebooks every day? "No, actually I find it very refreshing to be able to have both perspectives," he says. "Canadian cable tended to focus on the urban markets first, then the suburban or rural areas. In the U.S., this order was reversed. So, with our older suburban systems in the U.S., we are trying to get them to have more of an urban mindset, while at the same time trying to develop a more suburban mindset in our older urban systems in Canada. Each side provides a contrast to the other and gives me the desire to bring them all up to the same level. Generally, though, I've found that our Canadian operations are more precise and mature on the technical side, which I find quite invigorating.

"I don't have a management goal," Hamilton-Piercy concludes, "rather—a goal of achievement. Anything I can contribute to providing our subscribers with better service is very high on my personal priority list."

If you happen to be a subscriber of a Rogers system, consider yourself lucky. There is someone at the top looking out for you.

—Lesley Dyson Camino

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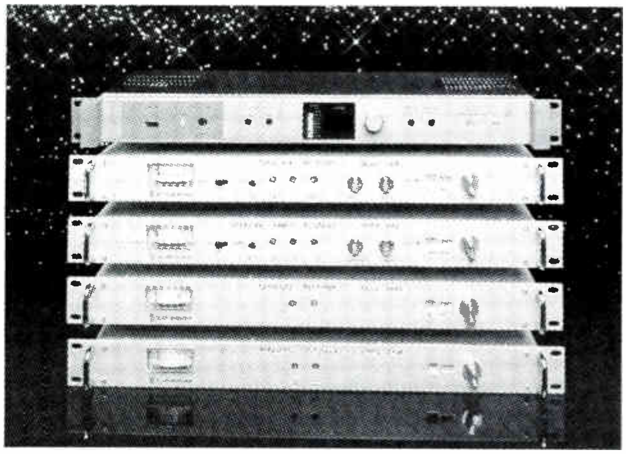

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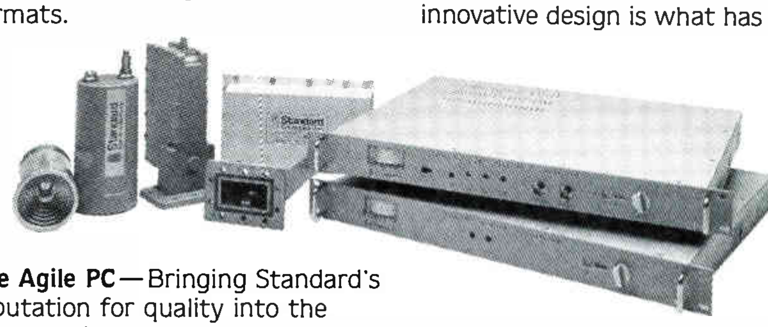

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Reader Service Number 4

dBmV, dBm & dBu

By Archer S. Taylor,
Malarkey-Taylor Associates Inc.

Levels in many communications systems are designed in terms of decibels relative to one milliwatt, expressed as "dBm," without regard to the load resistance. One milliwatt is 75,000 times as much power as one millivolt across 75 ohms.

1 millivolt across 75 ohms =
$(0.001)^2/75$ =
13.33×10^{-9} watts =

Multiply by 1,000 to get:
(0.001)/75 = 1/75,000 milliwatts
10 log 75,000
= 48.75 dB

Thus, to convert dBm to dBmV, simply add 48.75 dB.
dBmV = dBm + 48.75

For leakage field strength measurement (remember the CLI?), signal levels measured in dBmV at the 75-ohm dipole terminal must be converted to field intensity (sometimes called field strength or signal strength) measured in dBu referenced to one microvolt per meter.

dBu = dBmV + (dipole factor)

A table of dipole factors may be found in several places, one of which is Ken Simmons' *Technical Handbook for CATV Systems.* Readers desiring a better theoretical understanding of the physical principles involved may be interested in the following derivation of the dipole factor.

The maximum power that can be extracted by a half-wave dipole is given by:

$P(\text{received}) = P_O A$ Eq. 1

P_O is the power density of the radiated signal in watts per square meter, and A is the effective capture area of the antenna in square meters. Power density and antenna capture area are derived from Maxwell's equations, which in turn were based on the earlier work of Ampere and Faraday.[1,2]

$P_O = E^2/120\pi = E^2/377$ watts Eq. 2
$A = G(300/f)^2/4\pi$ square meters Eq. 3
E = field intensity in volts per meter
G = Dipole gain factor
= 1.64 re isotropic
f = frequency in MHz
300/f = wavelength in air, in meters
377 = "impedance of space" in ohms

Coverting power to milliwatts (p) and field intensity to microvolts per meter (e), and substituting Equations 2 and 3 in Equation 1:

P(received) = p(rec)/1000
$E = e/10^6$
$p(\text{rec})/1000 = (e/10^6)^2 \times 1.64 \times (300/f)^2/4\pi \times 377$ Eq. 4

Convert Equation 4 to decibels:

10 log p(rec)—30 = 20 log e—120 + 10 log 1.64 + 20 log 300 —20 log f—10 log (4π x 377) Eq. 5

Where:
10 log e (rec) = dBm
20 log e = dBu
10 log 1.64 = 2.15 dB
20 log 300 = 49.54 dB
10 log (4π x 377) = 36.76 dB

Equation 5 simplifies to:
dBm = dBu—20 log f—75.07 Eq. 6
Remember that:
dBm = dBmV—48.75
So:
dBmV—48.75 = dBu—20 log f—75.07
dBmV = dBu—20 log f—26.32
And:
dBu = dBmV + (20 log f + 26.32)
Dipole Factor = 20 log f + 26.32 dB

Example:
At 108.625 MHz, the dipole factor is 67.04 dB. A 50 microvolt per meter leak (20 log 50 = 33.98 dBu) would read 33.98—67.04 = -33.06 dBmV on a signal level meter connected to a half-wave dipole. With the 10 dB gain of the Wavetek RD-1 dipole amplifier, the SLM reading would be about -17 dBmV. A 20 microvolt per meter leak would read only -25 dBmV, even with the RD-1 amplifier gain. This explains why it is necessary to use special leakage detectors like the "Sniffer" or the "Cuckoo" that can detect smaller leaks.

CED

References:
[1] ITT *Reference Data for Radio Engineers (Sixth Edition)*; pages 27-7, 27-8, and Chapter 45; Howard W. Sams & Co., Indianapolis, Ind. 46268.
[2] Terman, Frederick E.; *Electronic and Radio Engineering (Fourth Edition)*; page 927; McGraw-Hill, New York.

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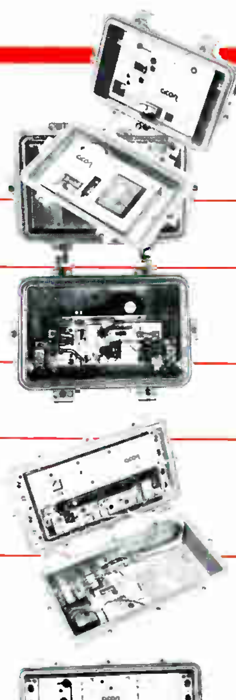

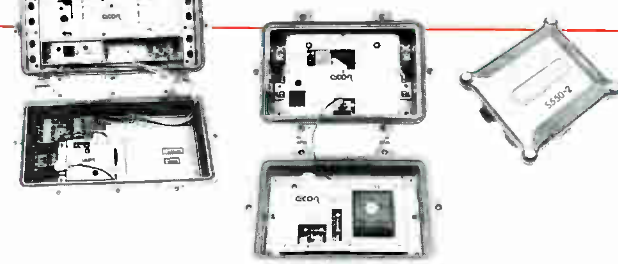

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In Perspective

BOCs and bypass

Nine to 14 billion dollars a year. That's what local Bell operating companies could lose if enough users decide to connect their voice and data circuits directly to long-distance switching centers.

A couple of things worry the BOCs. Typically, a local phone company gets something like half of its revenue from 2% to 3% of its business customers. And the costs those customers may pay to reach long-distance switches is rising.

At the same time, costs for alternative private connections are dropping. So, at some point, a company saves money by going off the local telephone network and transporting signals by leased or private twisted-pair lines, microwave radio, fiberoptic or CATV cable.

Access charges are a big factor in the cost equation. Because of the Bell system breakup, long-distance carriers now pay a fee to connect their circuits to the local loops.

AT&T's charge, for example, is somewhere in the neighborhood of $750/month to $400-$500/month. But a pair of 23 GHz microwave radios operating at 1.544 Mbps is only about $25,000. And since a single T-1 circuit carries 24 voice channels, the savings are clear.

If monthly access charges cost $315 to $750, then 24 channels would cost between $7,560 and $18,000 a month. Compare that to the $25,000 purchase price of a 23-gig microwave link. It's serious money.

So, how about CATV? Well, Contel Information Systems recently studied bypass. The objective: find the most effective way to connect 11 sites to a switch in central Manhattan (New York City).

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Fiber to ten sites: $933,600.

Manhattan Cable to all sites: $91,950.

The BOCs are painfully aware of the bypass threat and are moving vigorously to protect themselves. So losses may not amount to the worst-case $9 to $14 billion. But it will cost something. And CATV could well emerge as one of the low-cost alternatives.

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Reader Service Number 6

Television transmitter luminance transient response

Part One

By T. M. Gluyas, FELLOW, IEEE

Abstract—*Comparison between bandwidth-limited input pictures and output pictures from current generation TV transmitters show little difference except for faint edge ringing at an appropriate 1 MHz rate. This is shown to be due to lack of specification and control of transmitter and receiver lower sideband attenuation and phase characteristics in the region around 1 MHz below visual carrier. Some observed and some calculated results are presented for comparison.*

Although it is possible to adjust a transmitter system for nearly perfect 2 T sine-squared pulse and bar performance using a particular demodulator, it is concluded that it is pointless to attain performance better than K = 1 or 1.5 percent. Variations in performance as observed on different demodulators or different receivers tend to mask any further improvement in transient response. Use of a "mop-up" system equalizer preceding the transmitter is suggested.

Current generation television transmitters are capable of radiating a remarkably good picture when they have been adjusted with care and when the input picture is good. In fact, it is difficult to tell the difference between transmitter input and output pictures when the two are compared in an *A/B* test on the same monitor, provided that the input picture has been bandwidth limited to 4.2 MHz.

The residual defects most likely to be found are faint transients in the form of edge overshoots and low-frequency ringing that has the appearance of "close-in" echoes. These are most readily observed on titles of high contrast such as station call letters.

This is not to say that today's transmitted pictures are perfect in all other respects. Certainly chrominance-to-luminance crosstalk due to quadrature distortion, hue errors in color edges due to imperfect amplitude and delay response around the color subcarrier, and other defects can be identified upon supercritical inspection. But, in our opinion, luminance transient errors, although small, are the most noticeable impairment. For that reason, it has been selected as the subject of this article.

We hope to shed some light on what causes this problem, what to do about it and the practical boundaries of possible improvement.

Adjustment and measurement of transient response

To observe the transmitter transient response on the station picture and waveform monitors it is, of course, necessary to demodulate the signal. The picture quality then is determined by the combined characteristics of the transmitter and demodulator, and there is no way to separate the two.

Figure 1 is a block diagram of a monitoring arrangement for comparing the transmitter input and output signals. A 2 *T* sine-squared pulse and bar test signal is employed as the video input for quantitative measurements of transient response. This test can be supplemented by a call-letter slide or electronically generated titles for qualitative observation.

When the combined transmitter and demodulator amplitude versus frequency response and envelope delay are good, the transient response will be good. Consequently, the transmitter system can be adjusted either in the frequency domain or the time domain as implied by alternate connections shown in dashed lines in this diagram.

Figure 2 (a) and (b) shows system response to a window signal and to a 2 *T* sine-squared pulse after the transmitter system had been aligned in the frequency domain. The 2 *T* pulse is almost perfect. The *K* factor is approximately 0.3 percent—illustrating that current generation transmitters are capable of excellent transient response if carefully adjusted.

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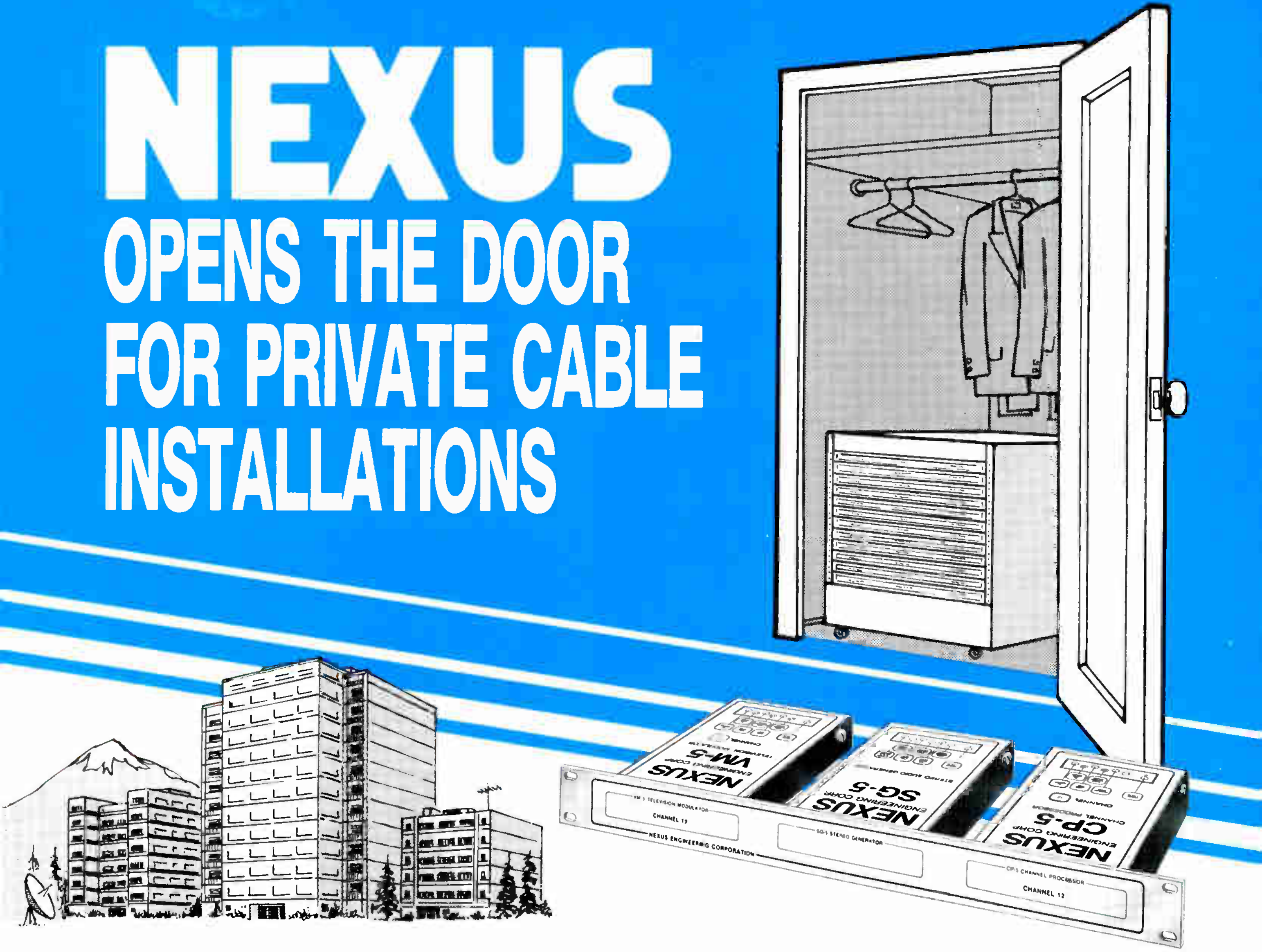
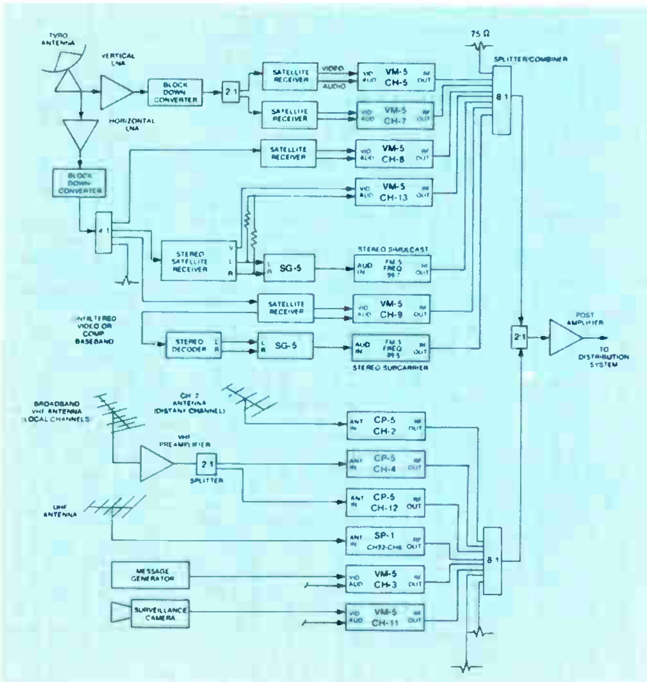


TYPICAL SMATV HEADEND



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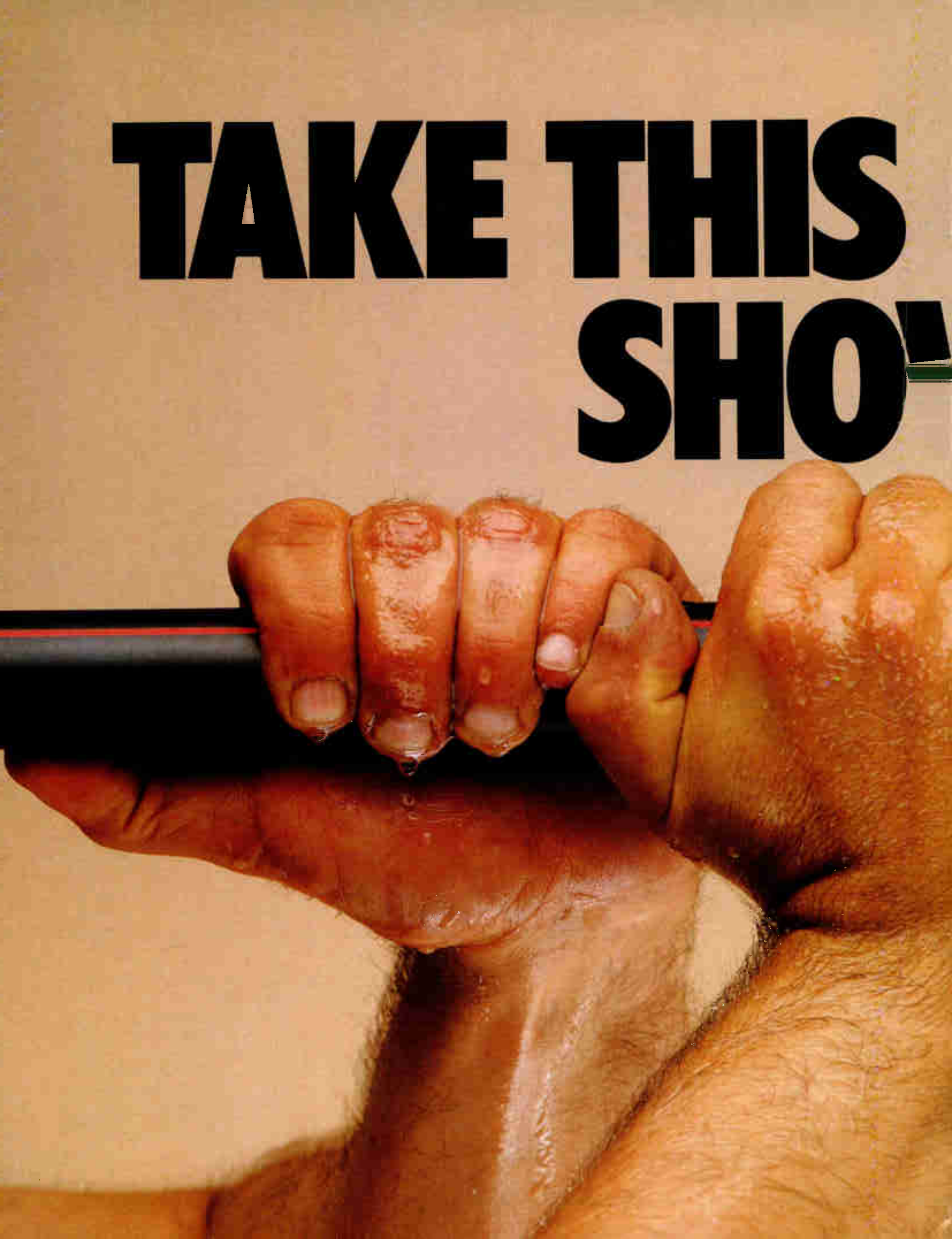
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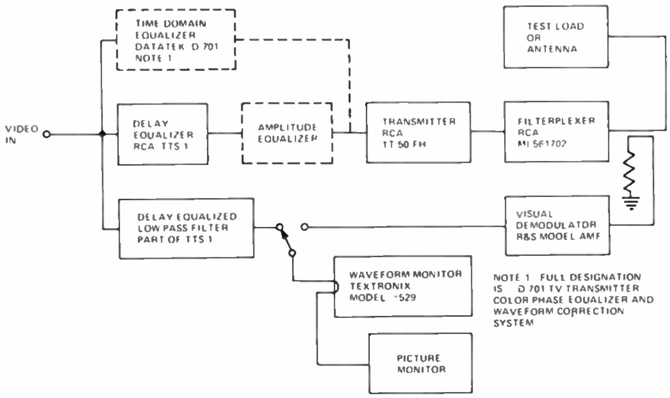


Figure 1 Block diagram of arrangement for evaluating TV transmitter transient response.

Figure 3 shows the transmitter sideband response. The 4.2 MHz low-pass filter was switched out, but it was switched in for the transient response photographs.The unnecessarily strong market is at 4.2 MHz. The filterplexer sound notch is obvious. The corresponding overall system video response, measured at the output of the Rohde & Schwarz (R&S) demodulator is shown in Figure 4. The dark spaces are 2 and 4 MHz markers. The dip at 0.3 MHz was caused in a curious way by a defective electrolytic capacitor in the transmitter. It was repaired before the 2 *T* pulse photograph of Figure 2 was made. The waveform distortion at 2.2 MHz is caused by quadrature distortion and the effect of the sound notch on the second harmonic of 2.2 MHz. It disappears when the demodulator sound notch is switched out.

Based on somewhat limited experience, we judge that overall results of transient response improvement are equally satisfactory, whether the transmitter is equalized in the time domain or in the frequency domain. We are speaking of luminance transient response only—not chrominance transient response. The final result of adjustment in the time domain is shown in Figure 5.

Variations of implied transmitter transient response when using different demodulators

Figure 6 compares the 2 *T* sine-squared pulse performance of the transmitter monitored with an R&S AMF demodulator and a Telemet 4501 demodulator after the transmitter was adjusted using the R&S demodulator. The *K* factor measures approximately 0.3 percent using the R&S demodulator and approximately 2.1 percent using the Telemet demodulator.

In order to dispel any notion that this simply compares the quality of the demodulators, we hasten to call attention to Figure 7 which is the output of the Telemet demodulator after the transmitter amplitude and delay were optimized with that demodulator. *K* measures approximately 0.5 percent and no doubt could have been trimmed to the same degree of perfection as with the R&S demodulator, given enough time and patience.

What causes the substantial difference in 2 *T* pulse shape between the outputs of the two demodulators? It is mainly due to different weighting of the lower sideband of the transmitter by the responses of the demodulators. Then, when the upper and lower sidebands are combined in the detector, they do not yield a flat video frequency response and constant time delay in the critical region 0.2 to 1.5 MHz.

Figure 8 shows the amplitude versus frequency and delay versus frequency of the output of the Telemet demodulator, corresponding to a transient response of $K = 2.1$ percent. There is a broad 1.2 dip in the response and a corresponding 100 ns step in delay at 1.1 MHz.

The transmitter system then was equalized by peaking 1.2 dB at 1.1 MHz—selecting the peaking circuit Q to smoothly fill the observed dip in response. The resulting amplitude and delay responses are shown in Figure 9. The system video-in to video-out amplitude response is now ±0.2 dB and the delay is approximately ±22 ns from 0.2 to 3.58 MHz. This relates to the 2 T sine-squared pulse K factor of approximately 0.5 percent. (Figure 7)

It is worth noting that when the amplitude response was corrected, the delay response was either automatically corrected or fell into place with a minimum of adjustment. This relationship has been noticed on more than one occasion and suggests that if adjustments are carried out in the frequency domain, it is best to adjust the amplitude response first—then the delay.

The transmitter vestigal sideband demodulators most widely used in the United States are the RCA BW-4, the Telemet 4501 and the R&S AMF. Although the RCA BW-4 is capable of excellent performance, it uses vacuum tubes and cannot be regarded as a modern product. Therefore, we are mainly concerned with the characteristics of the Telemet 4501 and the R&S AMF as they influence the *apparent* transmitter system performance. We are even more concerned with which characteristic most resembles that of a typical home receiver.

Figure 10 is required for the discussion that follows. It includes the following:

1) The standard (idealized) transmitter attenuation (TA) characteristic.

2) The standard (idealized) receiver attenuation (RA) characteristic.

3) Tolerance on attenuation characteristic of R&S AMF and Telemet 4501 visual demodulators.

4) A measured response of one RCA BW-4.

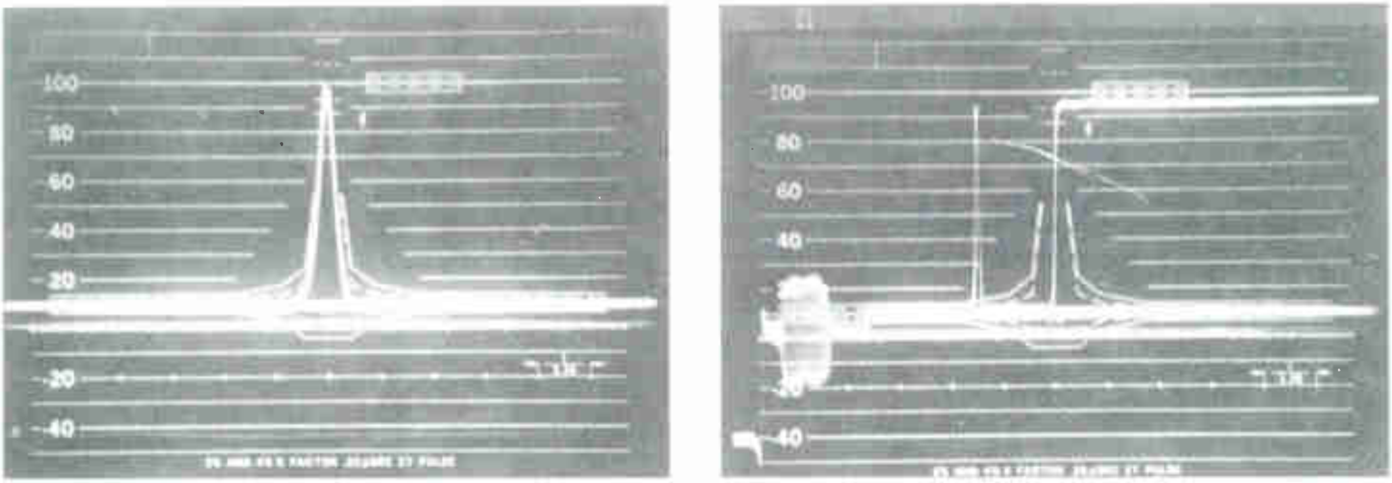
5) A measured response of one R&S AMF.

Fortunately, the R&S AMF and Telemet 4501 visual demodulators have the same limits on amplitude response, but not necessarily the same limits on envelope delay, throughout the frequency band of major concern. Unfortunately, the tolerances are wide enough to permit appreciable variation between demodulators. Furthermore, the characteristics are seldom checked in the field to assure that equipments are within tolerance at the time of use.

The RCA BW-4 comes closer to the idealized RA response than do the more modern demodulators, and superfically it would appear that this is better than the 20 percent response (compared to visual carrier level) at —1 MHz permitted by the tolerances of the other demodulators. However, when we consider data on characteristics of modern receivers, it may be good, either by design or by fortunate circumstance, that visual demodulator lower sideband response is as high as it is.

When a vestigal sideband system was selected for the United States domestic television service, standard (idealized) TA and RA curves were specified. The intent was that the transmitter should provide full response throughout the frequency region in which a properly designed receiver would have appreciable response and then cutoff sharply at the channel edge. By avoiding an overlap region in which transmitter and receiver each had unspecified partial response, receivers that produced good pictures on a double sideband signal generator could be expected to produce reasonably good pictures on a delay equalized vestigial sideband transmitter.

The full intent of the TA and RA characteristics was never quite realized in



(a) (b)

Figure 2 System response to sine-squared pulse and bar. Transmitter aligned in frequency domain. (a) 2 *T* sine-squared pulse. (b) 20-μs white bar.

practice. Until recently, transmitters tended to roll off on the lower sideband to approximately —3.0 dB, or sometimes more, at —0.75 MHz below visual carrier. Correspondingly, and for valid reasons, receivers do not attenuate sufficiently to have insignificant response below —0.75 MHz. Consequently, there *is* overlap in lower sideband attenuation and, owing to the lack of standards in this region, all good receivers do not have good transient response on all good transmitters.

Published information on receiver attenuation characteristics is scanty, but inferences from observed transient response lend credence to the general characteristics of published data such as that reproduced in Figure 11. The data for these figures were extracted from the supplemental comments of the National Cable Television Association (NCTA) before the FCC in connection with a proposed rulemaking.[1] Since the main concern of that report was adjacent channel selectivity, it is not certain that the inband data were precisely plotted. Also, as pointed out in the reference, each curve was from one sample only of the designated model and is not necessarily representative of the norm of that model.

Data from the NCTA report has been redrawn in Figure 11 on a linear scale with visual carrier at 100 percent as an aid in estimating video response at the output of the second detector. Video amplifier response is not included.

Figure 12 is a composite curve of one each of several gener-

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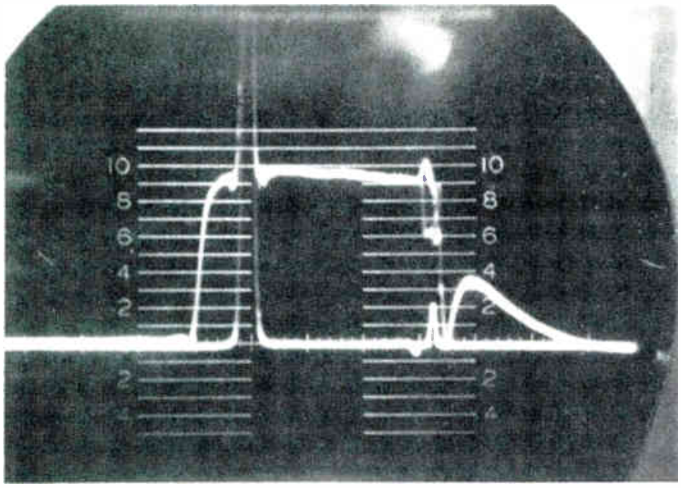
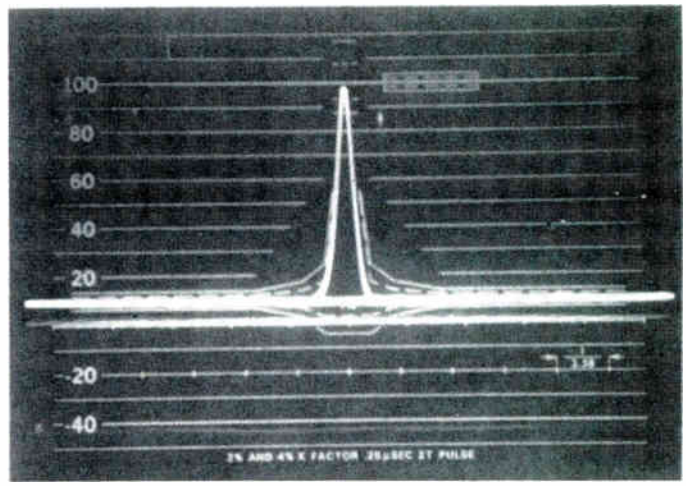


Figure 3 Transmitter sideband response associated with waveforms of Figure 2(a) and (b). Marker at 4.2 MHz. Notch at 4.5 MHz.



(a)

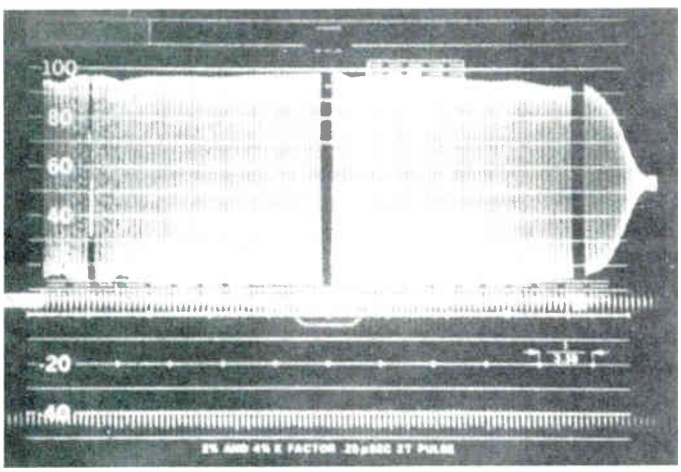
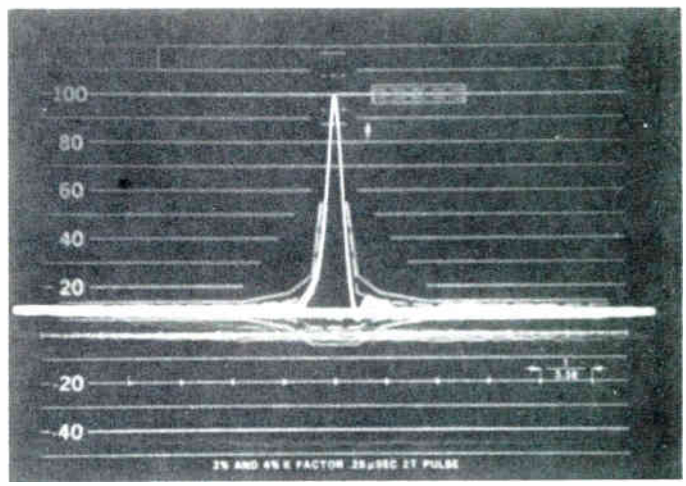


Figure 4 System overall video response: transmitter in to demodulator out. This response relates to waveforms of Figure 2(a) and (b). Dark bands are 2-MHz markers.



(b)

Figure 6 2 *T* sine-squared pulse response of system. Transmitter equalized in frequency domain using AMF demodulator. (a) Output of R&S AMF demodulator. (b) Output of Telemet 4501 demodulator.

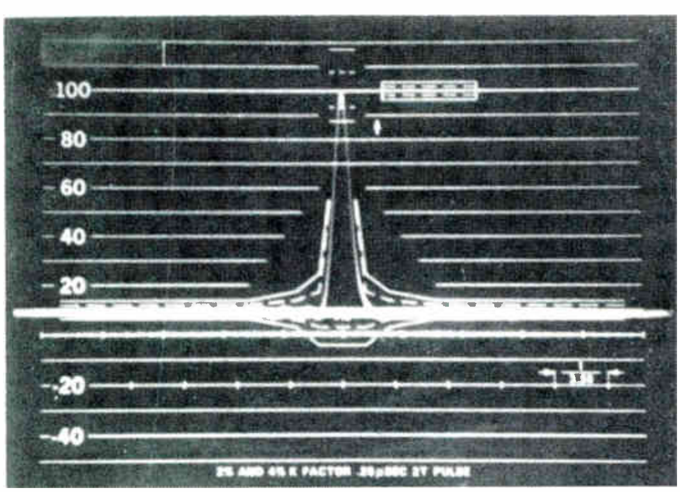


Figure 5 System response to 2 *T* sine-squared pulse. Transmitter adjusted in the time domain. Compare to Figure 2(a).

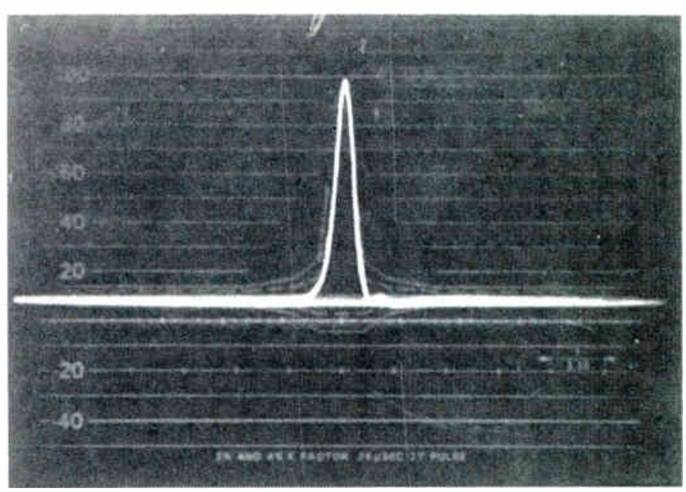
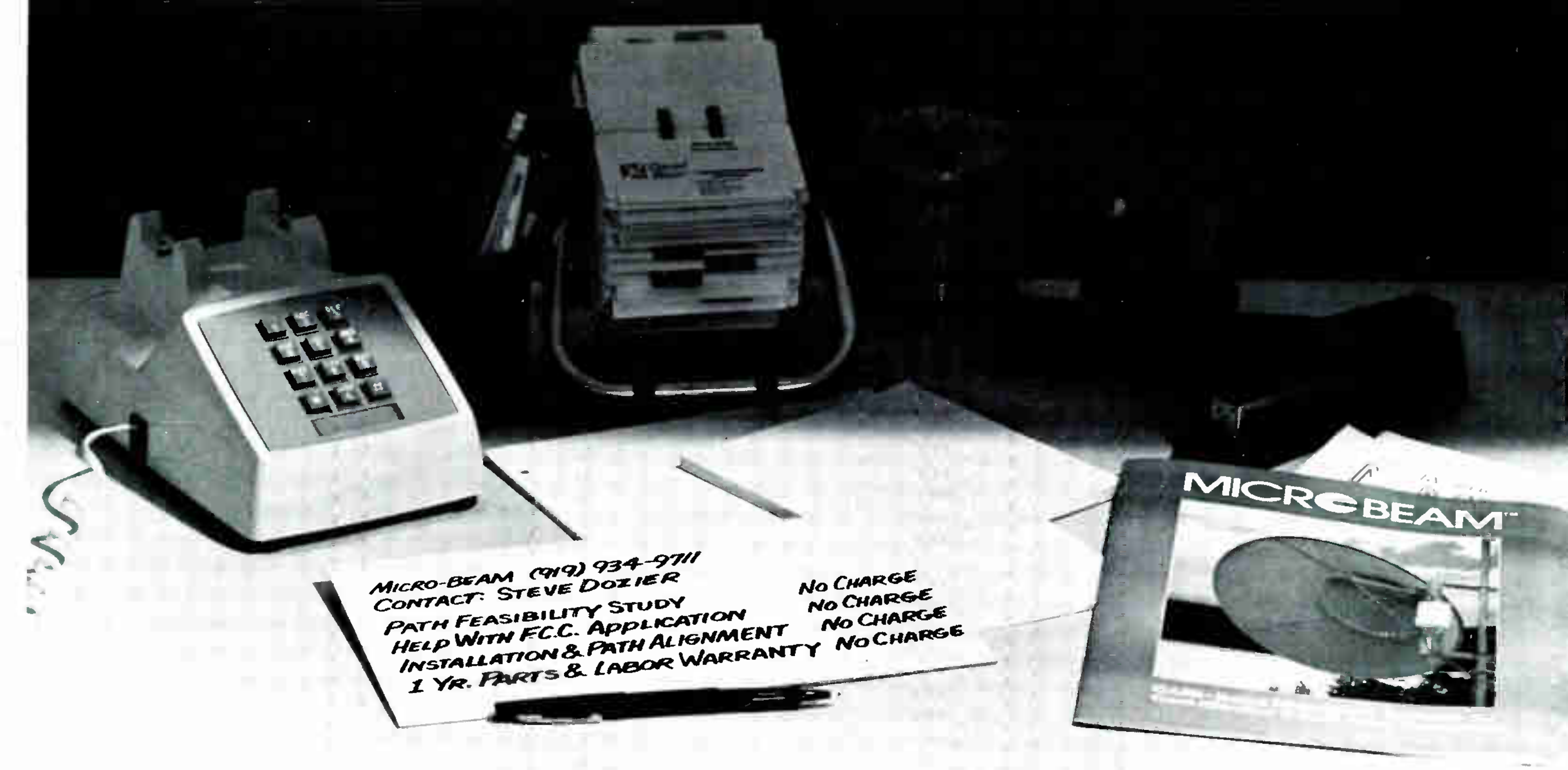


Figure 7 2 *T* sine-squared pulse response of system. Transmitter equalizer in frequency domain with Telemet 4501 demodulator.



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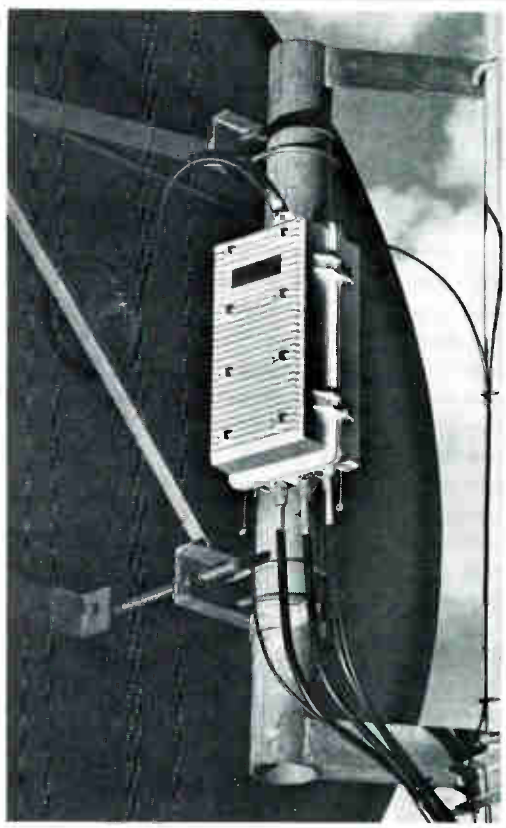

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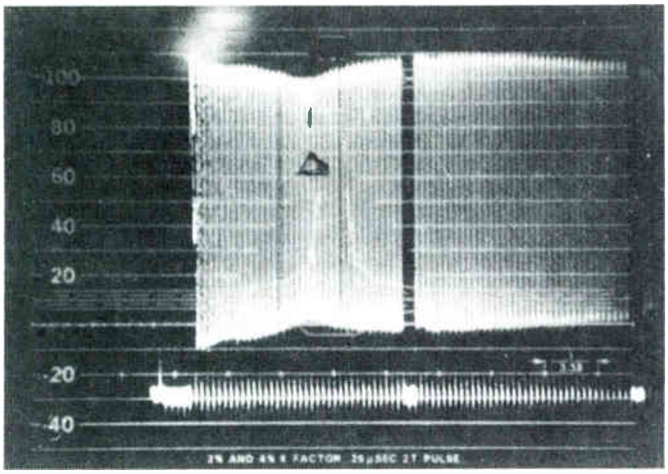

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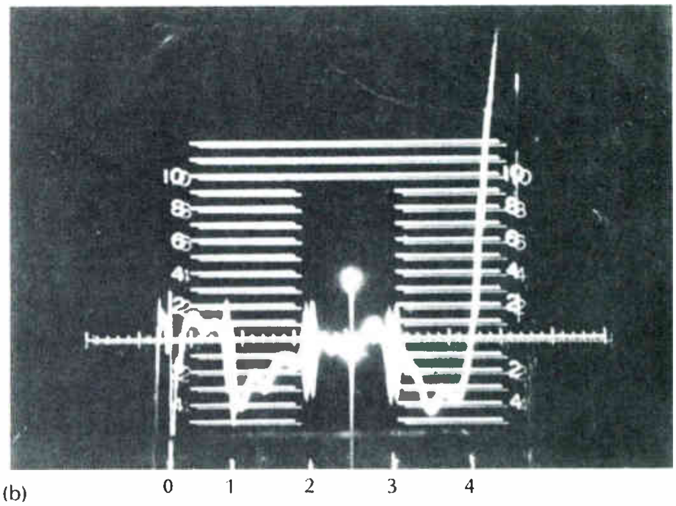

(b)

Figure 8 System response, transmitter input to demodulator output, corresponding to pulse response Figure 6(b). (a) Amplitude versus frequency response. Note dip in response at 1.1 MHz. (b) Envelope delay. Beats are 1 MHz interval markers. Bright dots are 100-ns calibration marks. Note 100 ns step at 1.1 MHz.

ations of RCA color sets. It is not an accurate mean curve. The measurements were made by different engineers, using different techniques, in different locations, at different times, for different purposes. Relative to visual carrier, the response at —1 MHz for all the data shown in Figures 11 and 12 ranged from 6 to 30 percent. In keeping with the spirit of the standard RA response, it should have been nearly 0 percent (say less than 2 percent).

We looked at the transmitter transient response on a Sony receiver coupled to the antenna transmission line at a transmitter site. The Sony receiver had a convenient video output connection and worked well in the transmitter room environment.

The 2 *T* sine-squared pulse and bar response are shown in Figure 13. The transmitter had been adjusted for excellent transient response as displayed on the station monitor using an R&S demodulator.

Next, the transmitter system was adjusted (predistorted) using a Datatek time-domain equalizer to optimize the transient response at the output of the Sony receiver. Now, except for the poorly equalized 4.2 MHz system cutoff ringing, the transient response is good. (Figure 14)

We have not attempted to experimentally compare the tran-

Continued on page 52

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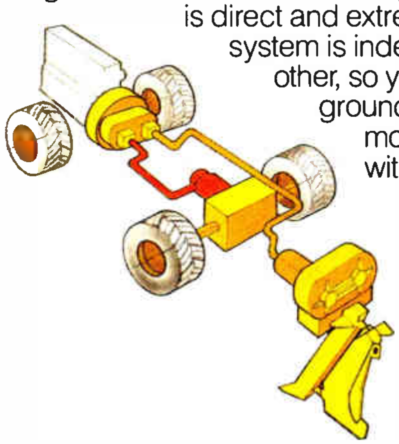

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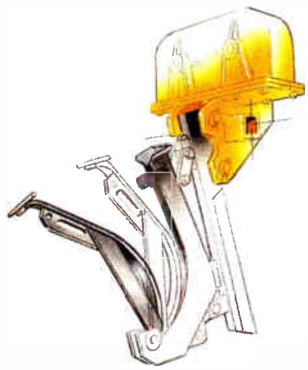

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Reader Service Number 17

TV signal quality

By Norman Weinhouse, Norman Weinhouse Associates

The cable industry is one whose origins include risk-taking entrepreneurs who were not thwarted by the combined efforts of giants such as the broadcast, utility and telephone industries. It now has reached the point where cable passes about 70% of all television households in the United States; and it is estimated that by 1990, 87% will be passed by cable.[1] The pioneers' faith seems to have been rewarded, and the future looks good for the industry.

However, there is one area where the cable industry too often has been negligent: quality. Why for example, do the modern urban systems have only 20% to 30% penetration, rendering them of questionable financial viability? Part of the reason is the quality provided. Furthermore, I don't detect forward looking activity in the industry to make a meaningful improvement in quality in order to differentiate cable from other delivery technologies. It appears that some of our original pioneering spirit is needed. The means currently exist and cable is a natural medium to provide a truly enhanced television experience.

The word "quality" is so highly subjective as to be virtually meaningless. Unfortunately, in the cable industry there exists a situation which, for want of a better term, I call the "Good Enough Syndrome." This syndrome pervades, and it is usually (too often) exercised by non-technical managers. However, even sharp technical people also suffer from it. It has its roots in the old "Mom and Pop" days when cable started as primarily a quasi-rural service to people that were ill served or had no television at all. In those days it made sense. At a recent convention, one highly respected cable engineer told me: "I can rest easy because all of the technical problems in cable have been solved. The remaining problems are marketing and financially related." This attitude seems to me to be ostrich-like and, if continued, will lead cable to doom.

We are not talking here about quality as a mere "cleaning up" of cable systems. Cable engineers know how to do this. Some systems are clean. In fact, many are clean and provide a signal that would look better if better TV sets were used in the home. However, the current "Good Enough Syndrome" is applied to the lowest grade of home receivers. The up-scale models, defined as 25-inch or larger CRTs or projection types, show up cable system deficiencies dramatically. Models with comb filters and/or digital video circuits are, in general, not well served by cable. In fact, these up-scale models also reveal deficiencies in the current TV standards.

Resolution

Fortunately, television imaging quality can be defined quasi-objectively. In the absence of anomalies (such as ghosts or beats caused by transmission) and artifacts (inherent in format), quality can be defined in terms of "lines of resolution." The present 525 line, interlaced NTSC signal with 4.2 MHz bandwidth ideally can produce about 280 effective lines of both horizontal and vertical resolution. Anyone who has seen European television (625 line interlaced; 5 MHz bandwidth) knows what a dramatic improvement in visual satisfaction comes from even a 20% increase in resolution. The standards we live with today were developed back in the 1930s, and compatible color standards were adopted in the early 1950s.

There is a general recognition in the television infrastructure that new standards are needed and that the public will be well served by doing so. The Advanced Television Standards Committee (ATSC) was started in September 1983. This effort is sponsored by 1) National Association of Broadcasters (NAB), 2) National Cable Television Association (NCTA), 3) Electronic Industries Association (EIA), 4) Society of Motion Picture and Television Engineers (SMPTE)and 5) Institute of Electronic and Electrical Engineers (IEEE). It is funded by corporations and other entities interested in television. NAB is the driving force, and the ATSC staff is housed at NAB headquarters in Washington, D.C. Meetings of the board of ATSC and main committee meetings are at the NAB offices. The goal of ATSC is the promulgation of new voluntary standards.

Cable participation in ATSC has been minimal. Vendors (equipment and programs) are participants, but operators are not too active. Because of current shortages in technical staff,

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Reader Service Number 28

NCTA has not been as active as it would like. It would appear prudent for cable to take a more active role in this effort which could affect cable's future.

Of the 525 lines in NTSC, 481 are active. At optimum viewing distance, the interlace creates a subjective (Kell) factor of about 0.6, which gives an effective resolution of about 280 lines in vertical space. In the horizontal space, resolution is determined by the luminance bandwidth. Most TV sets have only 3 MHz of bandwidth in the luminance (Y) channel to eliminate cross color artifacts. Those sets with comb filters theoretically can improve the resolution. The range is about 200 to 300 effective lines in the horizontal. This is what we are living with today.

The broadcasting authority of Japan (NHK) developed a high definition television (HDTV) system in the late 1970s and started to demonstrate it in 1979. This system is totally non-compatible with NTSC and has resolution of about 650 effective lines, both horizontal and vertical, with a screen aspect ratio of 5:3 as opposed to NTSC's 4:3. Those who have seen these demonstrations generally agree that the quality is equivalent to 35 mm film. In fact, this was recently verified by a CBS experiment where 35 mm theatrical film was defined in terms of lines of resolution.[2]

Once the public is exposed to a truly high-quality television signal, even the so-called "low-end" customer will upgrade to this visual experience.

The price paid for this resolution in the Japanese system in horrendous in terms of studio equipment to generate the 1125 line interlace and in bandwidth (for transmission). The luminance bandwidth is 20 MHz and the chrominance bandwidth is 10 MHz. However, there are some interesting things coming out of ATSC.

ATSC is organized with three major subcommittees. They are:

- ♦ Improved compatible 525-line NTSC
- ♦ Enhanced 525-line systems
- ♦ HDTV

For the improved NTSC, proposed enhancements involve: a) TV sets with frame store and motion compensation to allow progressive scan in the set from an input which is interlaced. Demonstrations have shown a remarkable improvement in vertical resolution; and b) horizontal resolution improvements usually are accompanied by some sort of augmentation channel, either in band or out of band. These improvements have not yet been demonstrated.

In the area of enhanced 525-line systems, the main thrust has been in applications involving Direct Broadcast by Satellite (DBS). The viable proponent systems in this area are Time Multiplexed Component (TMC), sometimes called MAC.

In the HDTV area, a digital studio standard has been decided on, and several compatible and non-compatible systems are being proposed.

ATSC expects to continue its work for another three years, at which time some new, voluntary standards will emerge.

Recommendations

The time is right for a cable company to step forward in the pioneering spirit formerly exhibited by the industry and announce an enhanced or high-definition service directed to the up-scale customer. Pick a system that most closely fits a cable plant. TV set manufacturers soon will have an appropriate set to fit the system. Likewise, some premium programmer(s) will rise to the occasion.

It also is my judgment that once the public is exposed to a truly high quality television signal, even the so-called "low-end" customer will upgrade to this visual experience. Cable has the clout to determine what the TV standards will be for the next 30 to 50 years. CED

References

[1] "Cable Stats," *CableVision*, August 12, 1985, p. 48.
[2] Kaiser, Mahler and McMann, *SMPTE Journal*, June 1985, p. 4.

Correction

In the August issue of *CED*, the model name for Jerrold's modulator was incorrectly listed as C4MS/C4MPS. The correct identification is C4APC. The output channels for the H-band should read 2-86H instead of 2-69H. Also listed incorrectly was the RF output level. The correct level is +60 dBmV and the spurious output is −60 dB at +60 dBmV output. *CED* apologizes for any inconvenience or confusion this may have caused.

Voice response IPPV

By Leon Ferber,
Perception Technology

The cable television industry has long recognized the profitability of impulse pay-per-view (PPV). This innovative service creates a challenging environment for cable TV operators who seek to seize the unpredictable pay-per-view market segment while maintaining a high level of customer satisfaction.

Increasingly, voice response is sparking interest with cable television system operators and vendors as an effective and economical way to cash in on the revenue opportunities of PPV. Voice response satisfies the impulse viewing nature of the subscriber by letting her select a special program right up until airtime, simply by using the touch-tone phone. At the same time, it significantly reduces the staffing requirements for cable operators by automating the entire order transaction. Certain voice response systems even have the ability to automatically transfer the hesitant user to a live operator.

Along the spectrum of impulse PPV systems and technologies, voice response lies midway between hybrid telephone-cable systems and ANI (Automatic Number Identification) systems. Similar to a hybrid system, voice response uses a cable operator's existing broadband coaxial cable for downstream communication and uses the telephone company's lines for the return link to the office.

Unlike a hybrid system, a voice response system is online and fully interactive with an in-house computer billing system. The order, fulfillment and account adjustment are processed in real time. Essentially, a voice response system, sitting between the computer and the phone lines, eliminates the bottlenecks associated with PPV order entry by enabling the subscriber to interact directly with the cable office's in-house computer via any touch-tone phone.

Perception Technology manufactures voice response peripherals used by such cable system operators as Cox Cable and Group W Cable to provide PPV services to their subscribers. PTC's voice response systems fully automate PPV order entry and, in conjunction with an in-house billing system, authorize the service, keep track of the activity on the subscriber's file, arrange for proper billing and signal the addressable converter to activate the transmission to the proper home at the proper time.

PTC's voice response products, the BT-II, VOCOM I and AudioText 1, consist of proprietary software, hardware and digitized speech designed around a super-minicomputer. The systems use a common data entry/voice response engine to translate dual-tone multifrequency (DTMF) signals into ASCII character stream, and multiplex from 8 to 32 telephone lines into a single data terminal line. All PTC systems interface with telephone lines through an FCC-approved coupler plugged into a standard phone jack.

The systems also enhance the functioning of PBXs because they model all the standard features of a single-line analog telephone. When connected to a PBX or central office with custom calling features, a voice response system can provide call transfer and live agent transfer capabilities. This means unattended 24-hour operation, with incoming calls being dispersed intelligently. Joint testing has certified the compatibility of PTC voice response systems with the telephone switching equipment from AT&T. PTC also has installed its equipment to work with Rolm, Northern Telecom, Rockwell and many other PBX manufacturers. A voice response system can reduce dedicated line requirements and increase utilization by consolidating departments and multiple applications on a common WATS line.

The cable that connects the voice response system to the host computer is an RS-232C null modem cable, so the system communicates with the cable operator's host computer by emulating a standard data terminal connected to an ordinary terminal line. The system communicates to the external world via a serial line unit on a module meeting RS-423 specs, and it is RS-232C compatible.

The main elements of the voice response system are the voice board, the phone board and the operating software program. The voice board is at the heart of the system. It functions to retrieve the digitally encoded vocabulary from a disk drive at system boot and store it in RAM. During normal operation, the voice board decodes and outputs the vocabulary.

The phone board enables realtime database interaction through DTMF coding and decoding which is passed on to the host computer as a data stream. The phone board interfaces the voice response system to the data access arrangements which then connect to the telephone lines. Speech output from the voice board is processed by the phone board and spoken to the user over the telephone line in a natural-sounding, digitized voice.

The voice of the system is produced by a combination of hardware and operating software. The vocabulary of a voice response system is made up of a recorded human voice that is digitized and stored in small units of words and phrases. These atoms, as they are called, then are combined, on command from the host-resident application program, to form specific word sequences and sentence formations. The application program may be written in virtually any programming language. Currently, programs exist in C, Basic, Cobol, Dibol and Fortran.

Customized script preparation entails a thorough study of actual live agent order entry interaction so as to emulate the interaction on paper. PTC works with a customer throughout the vocabulary recording process to ensure the pronunciations and inflections of the vocabulary are to customer satis-

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Panasonic
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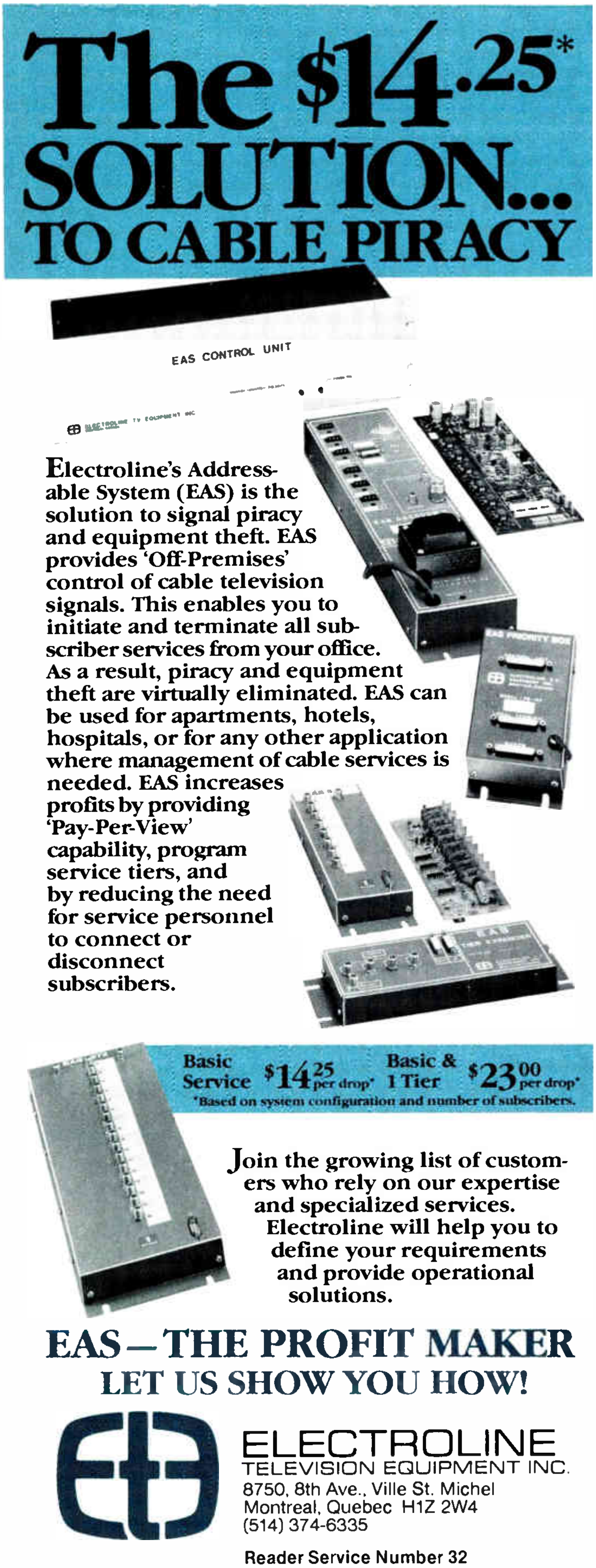
Reader Service Number 31



faction. The original vocabulary and one subsequent change are included in the system purchase price, and future changes are provided by PTC for $500. Independently, cable companies are able to change and generate new vocabulary through the purchase of a speech development package (SDP).

Business Systems Inc., application specialist to the cable television industry, integrates PTC's voice response peripherals with their computerized management system to offer cable operators a totally interactive system. BSI provides a total turnkey PPV system including a super-minicomputer that gathers all the necessary billing information from the order entry and generates timely invoices. BSI also provides the software and hardware interface to the voice response system and the headend processor.

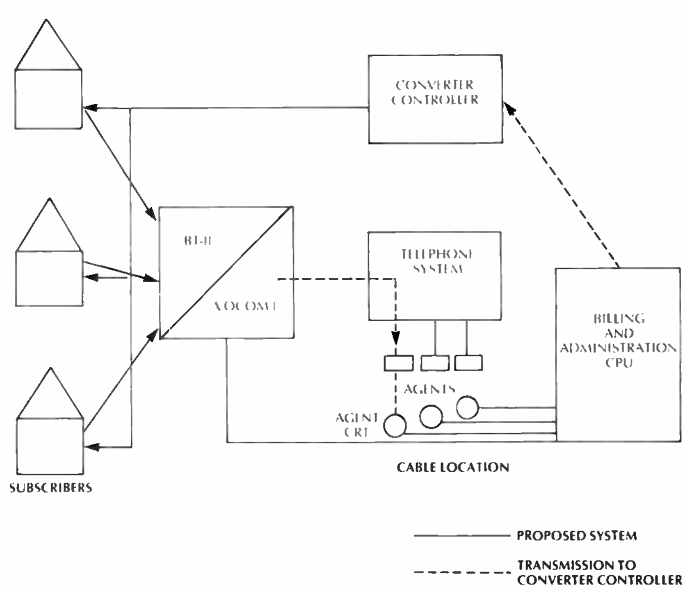
Application

In a typical application, a subscriber dials the designated order number and is greeted by the voice response system. After asking the caller to enter an authorization code and an account number, voice response lists the services offered together with their corresponding touch-tone key. For example: "To view *The Return of the Jedi*, press 1 followed by the star key; to view the Holmes-Cooney rematch, press 2 followed by the star key; to speak to a customer service representative, press 3 followed by the star key; to check your account balance, press 7 followed by the star key; to place an equipment service request, press 5 followed by the star key."

Because the voice response system is tied to the billing computer by a direct line interface, the system is able to check the billing file to ensure current payment. If the subscriber does not have a good credit rating, the system can be programmed to respond with the message, "I'm sorry; we are unable to authorize your service at this time. Please call during normal business hours." Or the call can be transferred to a live customer service agent for credit follow-up. If the subscriber's account is current, the service is authorized. The account is adjusted to reflect the pay service, and the signal is sent to the headend which activates the transmission to the subscriber.

If an error is made or if, after a predetermined length of

PAY-PER-VIEW ORDER FLOW



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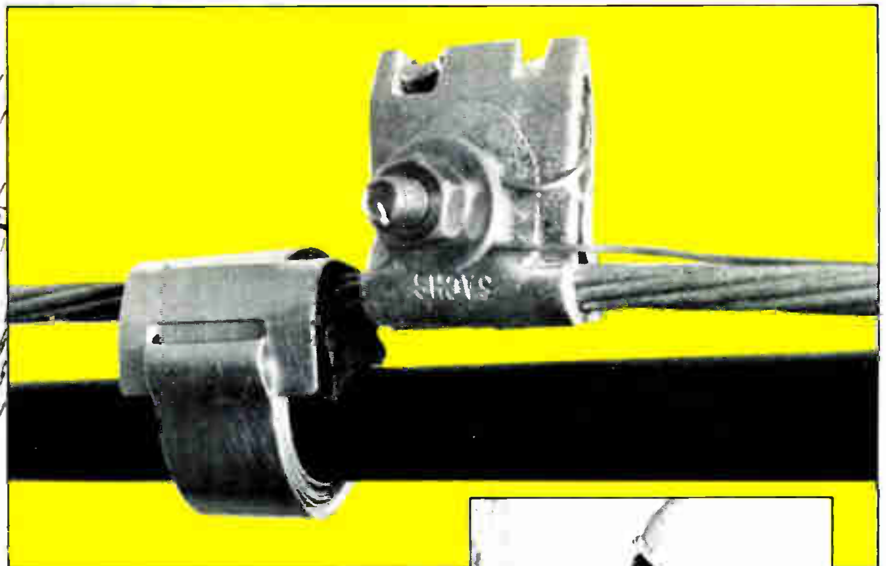

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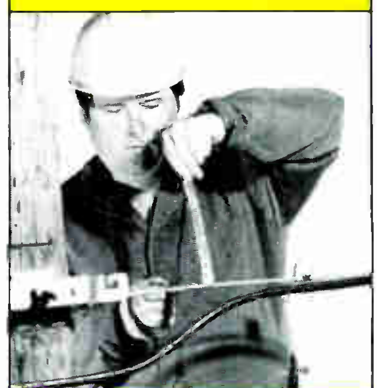
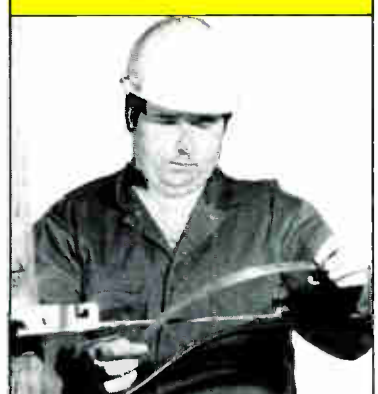


Straighten on strand.



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Reader Service Number 33

Voice response satisfies the impulse viewing nature of the subscriber by letting her select a special program right up until airtime, simply by using the touch-tone phone.

time (for example, five seconds), a caller hasn't used the touch-tone keys in response to a prompt, the system can reissue the prompt, deliver an error message or automatically transfer the call to a live agent to complete the transaction. This function usually is programmed on the host by means of a time-out option that alerts the host of the need to prompt for input or to dial a live agent.

Benefits and costs

The benefits to a cable operator are evident. Pay-per-view with voice response helps optimize the performance of customer service representatives by improving response time and productivity, while simultaneously allowing for increased call volume from subscribers without the need for an agent. In this way, voice response complements an existing subscriber network by automating the communication between subscribers and the cable operator. Customer service is improved, as is overall system management and the administration of accounts. Viewer selectivity is heightened and refined, providing MSOs with programming preference. Revenue opportunities are multiplied and productivity is increased while labor costs go down. The system is on-line, so information is accurate and current and, because only one port is tied, the strain on the CPU is minimal.

The cost of a voice response system is contingent upon the number of telephone lines required to handle the call volume and the amount of vocabulary needed to create the script. Costs for a cable company may range substantially dependent also upon existing computer capabilities. For a cable company with its own billing system and headend interface, a minimum system cost might be close to $40,000. For a more complicated and complete system, including a super-minicomputer, custom software and speech development package, the cost might reach $150,000. CED

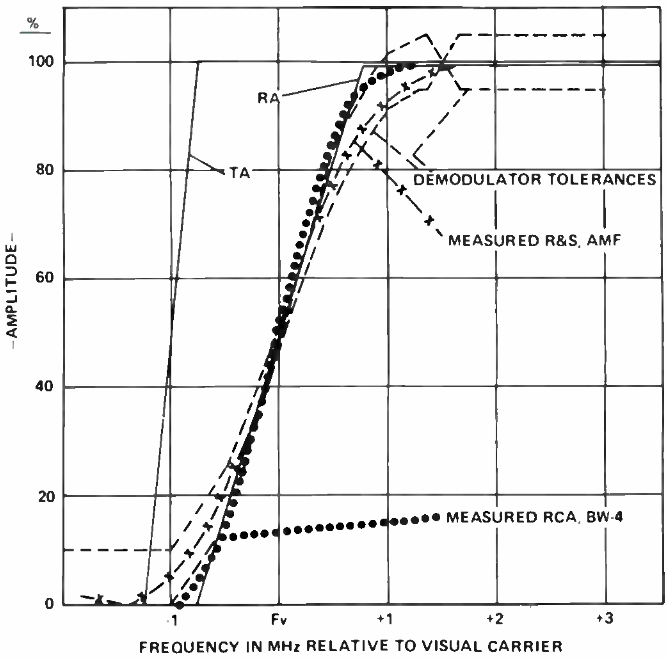

Figure 10 Standard (idealized) RA and TA characteristics, compared to demodulator attenuation tolerances and sample measurements.

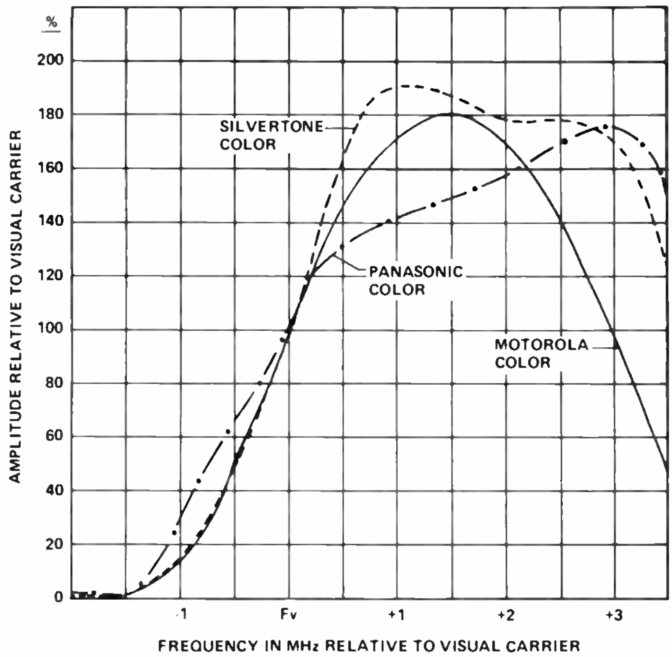

Figure 11a RF-IF attenuation characteristics of sample TV receivers[1].

Continued on page 64

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Electrohome also offers the SR24 receiver without a built-in modulator.

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Reader Service Number 41

Satellite receivers

Company/ Model	Input freq. (MHz)	Input sens. (dBm)	IF freq. (MHz)	Loop avail	Bandwidth (MHz)	Stability method	Input connection	110 VAC auxiliary outlet	C/N threshold (dB)
Avantek AR-2000	940-1440	-65	300	No	30	Stable oscillator	Dual polarity	No	8
AVCOM Com-66T	3.7-4.2 GHz	-70 to -25	70	Opt.	30	Highly stabilized ceramic resonator	Dual or single polarity	Yes	Approx. 7
Blonder-Tongue DSA-643A	900-1400	-50	130	Yes	30	PPL	Single	Yes	8
Channel Master 6121	950-1450	-65	134	Yes	30 SAW filter	Synthesized	Single	Yes	8
Conifer XT-200	950-1450	-60 to -25	385	No	25	PLL	Dual or single polarity	No	7
DX Communications DSB-700A	900-1400	-60	510	Yes	27	Crystal oscillator	Single	No	dBC-N static
R.L. Drake ESR-2240	950-1450	-70	600	Yes	30 SAW filter	Fully synthesized	Dual polarity	Yes	7
Electrohome SR-24	950-1450	-65	134	Yes	30 SAW filter	Digitally synthesized	Active loop	Yes	8
ICM SR-4650P	950-1450	-65	70	Yes	30	DSO/ AFC	Single	No	8
ISS GL-5000	430-930	-60	70	Yes	28	PLL	Dual polarity	Yes	7
Jerrold C4R	950-1450	-60	70	No	30	PLL	Single	No	7
M/A COM CSR-8001	950-1450	-60	140	Opt.	27	Volt synthesized	Dual polarity	No	8
Macom CR-1000	950-1450	-60	70	Yes	27	PLL	Single	Yes	7
McCullough KB24	950-1450	N/A	No	Yes	30	Dielectric resonator control, AFC	Single	Yes	8
Microdyne 1100 LPR	3700-4200 (4 GHz)	-65	600	No	30	PPL	Single-standard Dual-optional	N/A	8
Precise 1300	270-770	-75	70	Yes-2	30	Synthesized oscillator	Single	No	7
Scientific-Atlanta 6680	270-770	-75 to -35	230	Yes	32	Crystal-controlled PLL	Dual polarity	No	8
Standard Agile Omni	950-1450 (C-or Ku-band)	-70 to + 10	610	Yes	30	PLL synthesized w/AFC	Dual polarity	No	6.5
TL Systems 7682	440-940	-65	70	Yes	27	DSO/AFC	Single	No	8
Triple Crown CVR-B	950-1450	-70	70	Yes	28	Linear variable resister	Single	No	7

Descrambler compatible	Audio channels		Diff. gain		VH—switch or control	Internal microprocessor	Dimensions (H" x W" x D")	For more info. contact
	No.	Type	%	Phase deg.				
Yes	2	1-var. 1-opt.	2	1	Automatic	No RS-422 compatible	6¾" 2¼" 12¼"	408/943-7803
Yes	1	Tunable 4-8 MHz	N/A	N/A	Control	No	3½" 19" 14"	804/794-2500
Yes	6	1-opt.	4	3	Switch	No	3½" 19" 12"	201/679-4000
Yes	1	Synth.	3	2	Control	Yes	3½" 19" 14"	919/934-9711
Baseband video output	2	Matrix & direct variable	5	5	Control	Yes	45 mm 430 mm 350 mm	319/752-3607
Yes	1	1-var.	-1 -3	N/A N/A	Switch	Yes	2½" 12" 10"	914/347-4040
Yes	5-8.99 MHz in 10 kHz steps	Tunable	2 10-90 APL	1	Switch	Yes	3½" 19" 12½"	513/866-2421
Yes	1	1-var. synthesized	3	2	No	Yes	7" 21" 15"	519/744-7111
Yes	1	Var. linear	2	1.5	Both	No	1¾" 17" 12"	800/426-9825
Yes	1	Var.	3	2	Built-in IF switch	Yes	1¾" 16¾" 11¾"	800/227-6288
Yes	2	1-stand 1-opt.	3	2	Switch	Yes	1¾" 19" 17"	215/674-4800
Yes	2	Var.	5	3	Switch	Yes	3½" 19" 11-4/5"	704/324-2200
Yes	2	Var. digital	4	2	Control	Yes	2½" 13⅓" 10¼"	800/421-6511
Yes	1-stand 2-opt.	N/A	4	3	N/A	No	1¾" 19" 10"	501/895-3624
Yes	1	Fixed	3	1	Automatic	Yes	1¾" 19" 10"	904/687-4633
Yes	1-stand 2-opt.	Fixed	2	1	No	Yes	1¾" 19" 14"	602/968-8523 800/821-0862
Yes	2	Var.	±3	±1.5	Switch	No	5¼" 8¼" 13½"	800/241-5909
Yes	2	Var. (PLL synthesized)	3	2	Switch relay	Yes	3½" 14" 19"	800/243-1357
Yes	1	1-fixed 1-opt.	3	2	Switch	No	3½" 19" 11"	619/320-8006
Yes	1	Fixed	3	3	No	No	N/A	416/629-1111

Continued from page 54

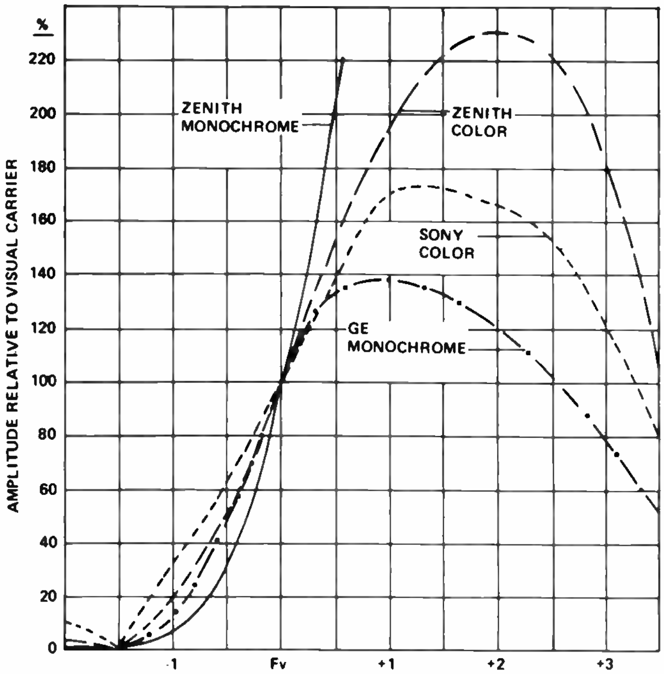


Figure 11b RF-IF attenuation characteristics of sample TV receivers[1].

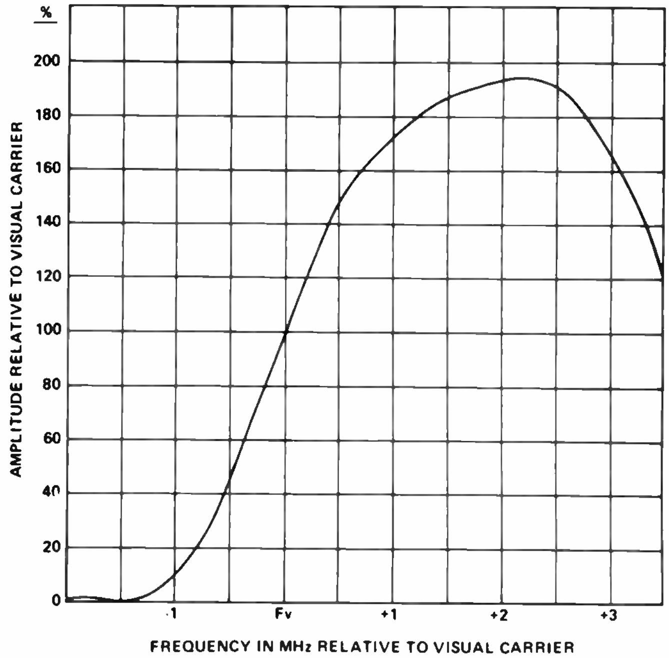


Figure 12 RCA color receiver RF-IF attenuation characteristic. Composite of one sample each of models: CTC-12, CTC-17, CTC-25, CTC-39, CTC-49 and CTC-60.

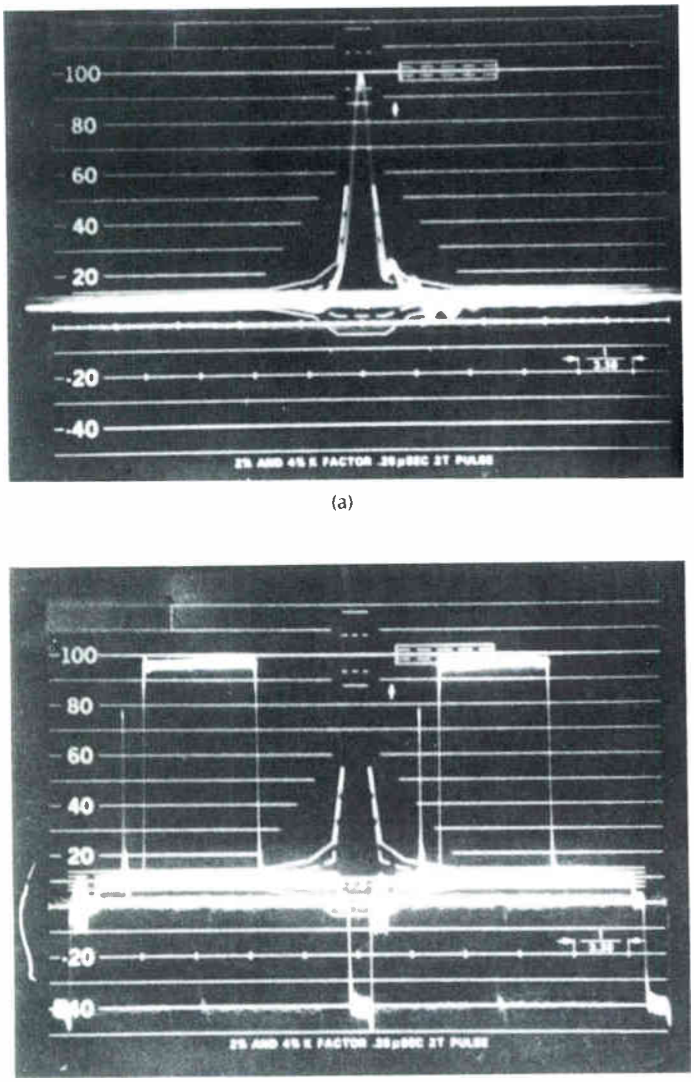
be like on home receivers?

4) What is the spread in performance among receivers?

The first question is easy. The answer has been carefully researched by the British Post Office and the BBC[2, 4] and further interpreted by Siocos[5].

From a review of these reports, we arrive at a conclusion that most viewers rate pictures either good or excellent when K = 2 percent, and half vote excellent when K = 3 percent.

Reader Service Number 13



(a)

(b)

Figure 13 Sine-squared pulse and bar on Sony receiver when transmitter has been equalized for good results on R&S AMF demodulator. (a) 2 T sine-squared pulse. (b) 20-μs white bar.

A Bell Telephone study[6] on echo visibility helps provide an answer to question 2. Based on observation of still pictures, and equating echo visibility to transient response distortion, we conclude that 90 percent of the viewers would either barely perceive or would not perceive distortion where K = 1.5 percent.

It has been widely reported elsewhere that 1 percent echoes under laboratory conditions are at the threshold of visibility. While this is probably true for ordinary picture material, echoes from high-contrast titles against a uniform background are easier to see. We have observed that, when critically viewing titles, is it possible to detect 1μs echoes or 1 MHz ringing of 0.5 percent, especially if picture controls are manipulated to block highlights and change blacks into greys.

Question 3 and 4 will be dealt with jointly. The approach to this question is to evaluate distortions in the frequency domain and then show what spread in corresponding transient response can be expected with different receivers.

We saw in previous slides that 2 T sine-squared pulse ringing was associated with a dip in frequency response at approximately 1 MHz. This can be analytically simulated with a 1 MHz video trap circuit. We let the trap circuit damping factor be K = 0.2 (Q = 2.5).

CED

Please see page 66 for Figure 14. Look for the conclusion of Gluyas' article in the November issue of CED.

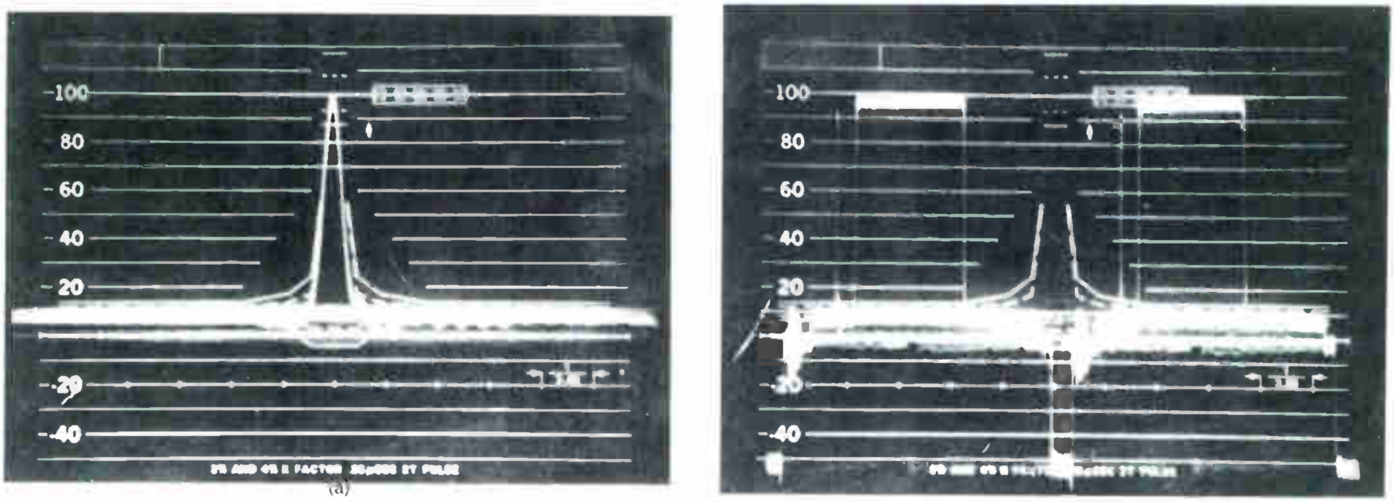


Figure 14 Sine-squared pulse and bar on Sony receiver when transmitter has been adjusted for best Sony receiver response using a time-domain equalizer. (a) 2 T sine-squared pulse. (b) 20-μs white bar.

References

1 Malarkey, Taylor and Associates, Inc. (for NCTA), "Supplemental comments of National Cable Television Association, Inc." presented before the FCC, Docket No. 18894 (RM-1530), Jan. 8, 1971.

2 Lewis, N.W., "Waveform responses of television links,"*Proc. Inst. Elec. Eng.*, vol. 101, pt. III, July 1954.

3 Allnatt, J.W. and J.D. Prosser, "Subjective quality of television pictures impaired by long delayed echoes," *Proc. Inst. Elec. Eng.*, vol. 112, no. 3, pp. 487-492, 1965.

4 Weaver, L.E., "The quality rating of color television pictures," *J. Soc. Motion Pict. Telev. Eng.*, vol. 77, pp. 610-612, June 1968.

5 Siocos, C.A., "Numerical values for subjective picture quality in television," *J. Soc. Motion Pict. Telev. Eng.*, vol. 80, pp. 958-962. Dec. 1971.

6 Lessman, A.M., "The subjective effects of echoes in 525-line monochrome and NTSC color television and the resulting echo time weighting," *J. Soc. Motion Pict. Telev. Eng.*, vol. 81, pp. 907-916, Dec. 1972.

7 Millman, J. and H. Taub, *Pulse Digital and Switching Waveforms*, New York, McGraw-Hill, 1965, sec. 2-10, p. 59.

8 Behrend, W.L. "TV transmitter monitoring problems," *RCA Eng.*, vol. 14 pp. 32-38, June-July 1968.

9 Wolf, P., "Modification of the pulse- and bar-test signal with special reference to application in color television," *J. Soc. Motion Pict. Telev. Eng.*, vol. 25, pp. 15-19, Jan. 1966.

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