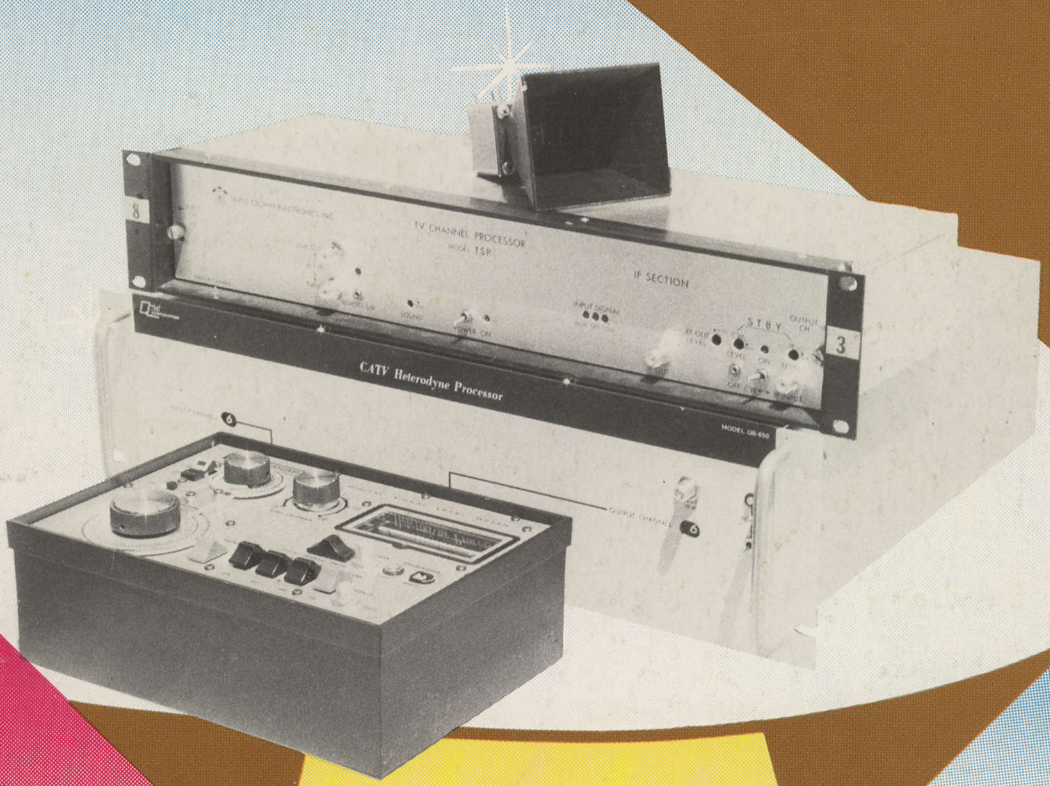
JUNE 1977

CATJ



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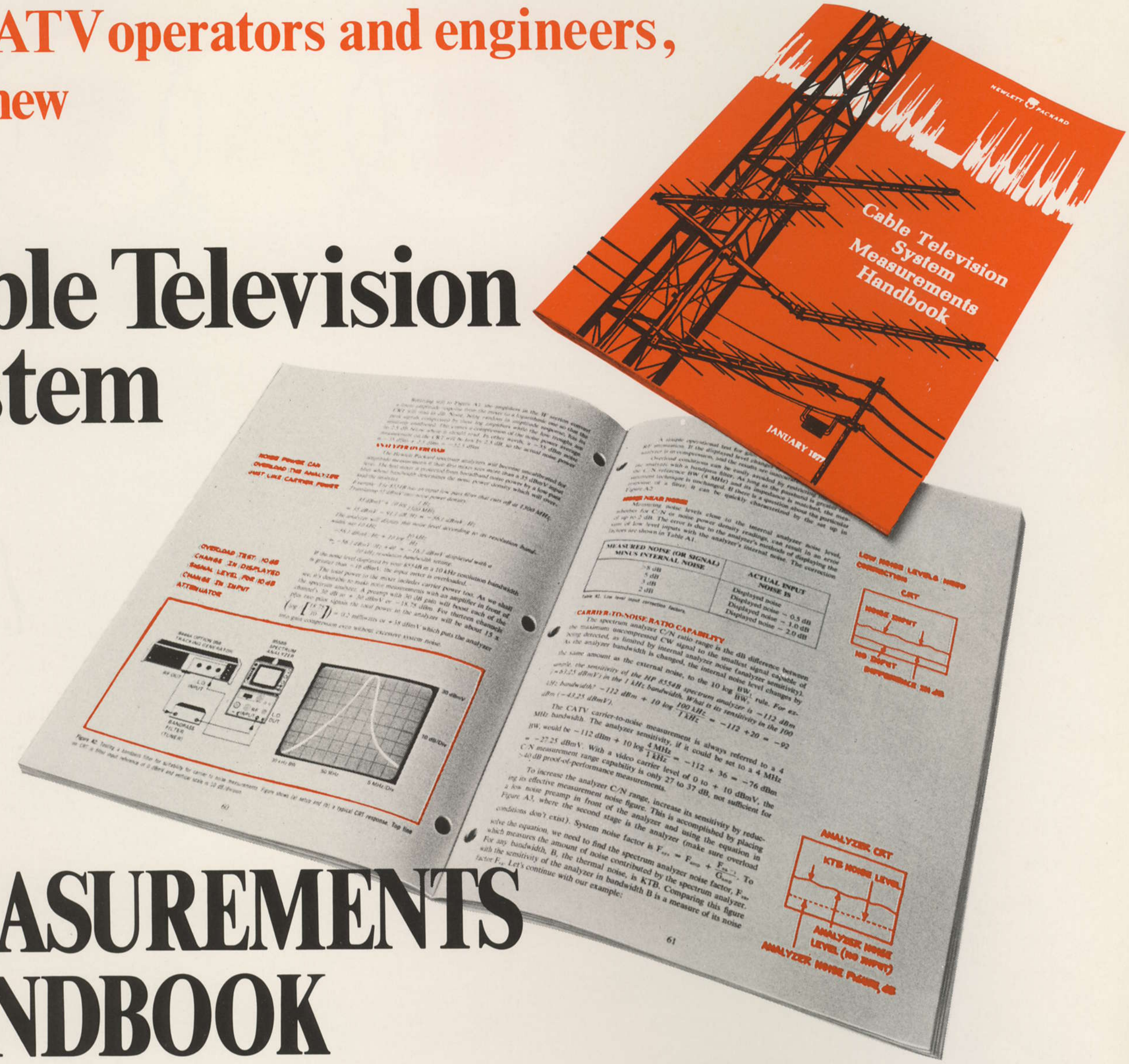

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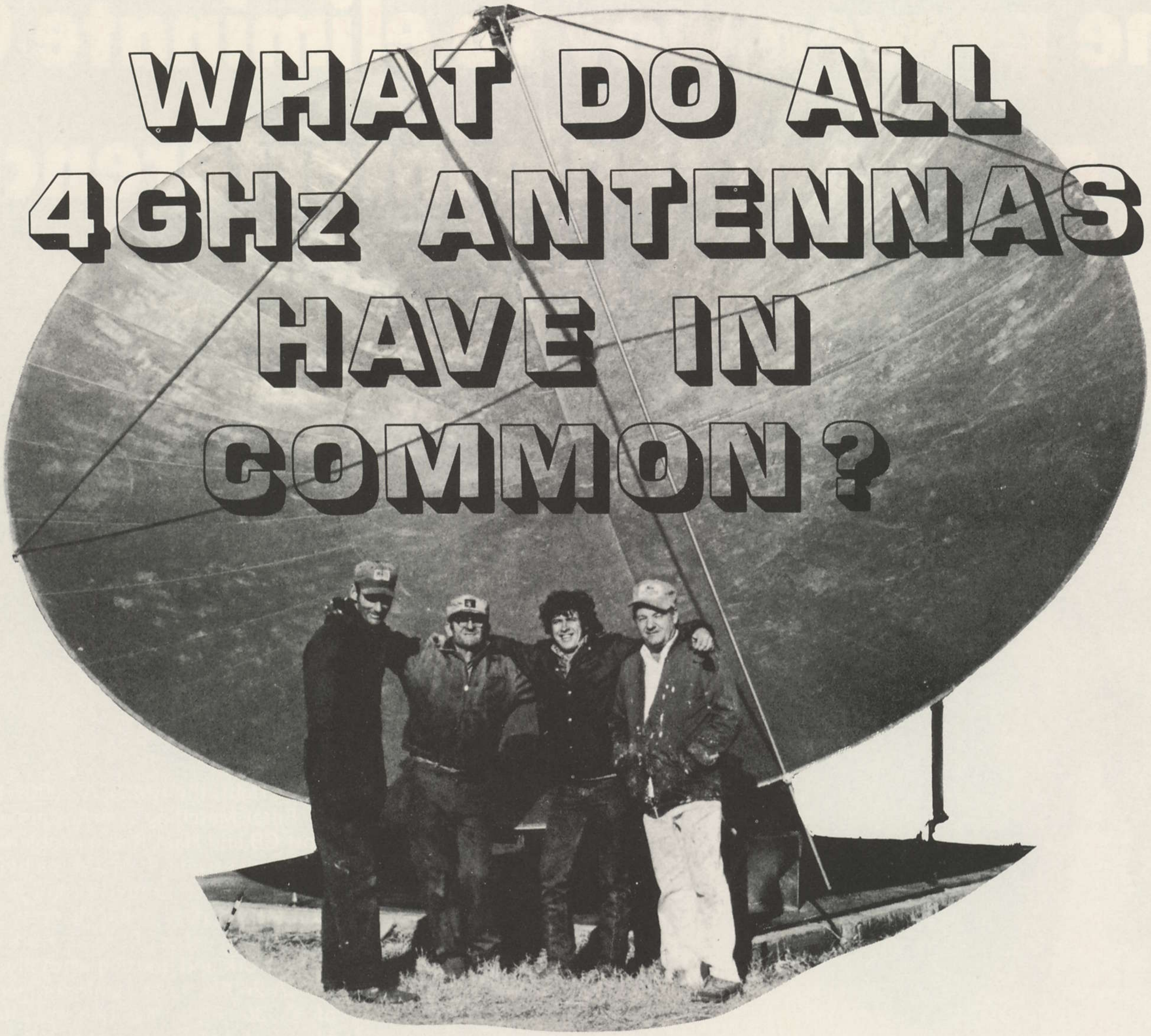

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—FEATURES—

—DEPARTMENTS—

OUR COVER

Technology moving again. That's the message throughout this issue of CATJ as we look at (1) Gunnplexer microwave (top unit on cover), (2) new headend processors and (3) the world's first digital-ized signal level meter. R and D departments are humming as CATV gets back into high**(er)** gear once more.

CATA - TORIAL

KYLE D. MOORE, President of CATA, Inc.

Canada's Problems With 'Bell'

Last fall as the then-current session of Congress wound down, there was much discussion concerning something called The Bell Bill. For those who haven't followed the exercise, the Bell telephone companies have poured (and continue to pour) massive sums of lobbying money into getting some 'sweetheart' legislation passed by the United States Congress. The bill, as introduced and supported last year, would eventually prohibit anybody **but Bell** from providing cable type communication services.

Some segments of the CATV industry saw this bill as being aimed primarily at two new upstarts in the communications world; broadband (including TV) communication systems, and, the miscellaneous common carrier people like MCI who have been giving Bell some fits with private-communication services conducted through the newly emerging private microwave networks.

Bell has always been ahead of the game, and down the road a ways they see (properly we suspect) the emergence of fiber-optic distribution plants. They see, again correctly we believe, the potential where one man with a fiber-optic distribution plant might enter into a business relationship with another man who has a private microwave carrier service (such as MCI). If there are local distribution plants **not** of the Bell design on **both ends** of a circuit, and a private microwave system inter-connecting the two local plants, who needs Bell anymore?

Those are the kind of fears Bell carries around. They fairly shake the foundations of the world's most profitable government authorized monopoly.

For the record, the 'Bell Bill' is having much tougher sledding this year. Last year there was a long list of 'sponsors' of the bill on both sides of Congress. It appeared, to the casual observer, that the bill got sponsorship simply because most Senators and Congressmen failed to look into it carefully, and Bell's profile in supporting the bill was kept low. This year, with more attention focused on the bill, it has far fewer sponsors. It also has something else; **active opposition** in Congress.

The Canadian experience with Bell, as reported by Canadian cable pioneer Ken Easton in the April issue of **Cable Communications** (a Candian journal serving all forms of cable communications, including telephone and CATV) is instructive to how Bell's mind sometimes works.

Easton traces the development of cable-telco relations in Canada, pointing out that in the early 50's in Quebec Bell would 'negotiate' with the cable company **only if** the cable company agreed to a **full** leaseback. That meant that Bell would provide the full CATV plant, leaving to the cable operator only the headend. Bell even ran the drops. Several people actually agreed to this ploy and the systems were a disaster and Bell retreated; not because it had a change of 'heart' but rather because it decided it couldn't handle the problems. The diastrous results did not escape the attention of the Canadian government however. They eventually adopted some language in their permit-process (Canadian systems have almost forever had to obtain federal government sanction to operate; long before it came up in the United States) which specified that for the CRTC permit to be 'valid' that **"the licensee** (must) **own, as a minimum, the local headend, the amplifiers, and the drops to the houses and apartment buildings".**

The addition of this "phrase" or "condition" to the CRTC "permits" became a very useful tool for the would-be CATV entrepreneur. Up to that point the cable person was at the negotiable-mercy of the local Bell facility. Long after the ill-fated Quebec experience in the early 50's, Bell had continued to provide pole attachments to Canadian CATV companies **only when** the cable company agreed, as a minimum, to Bell providing **some** portion of the cable plant. In most Canadian systems this amounts to Bell supplying the trunk and distribution cables, in place. This is the reason you see so many over-lashed CATV type cables snug down on top of lead sheathed telco cables in Canada; Bell, in providing "attachments" and cable, simply does the most expeditious thing when supplying "service" to the cable company. It lashes over itself the newly required cables. With the Canadian industry "accepting" the Bell instituted requirement that "at a minimum Bell will provide the cable in place along with the attachment to the pole" it was only a short hop, skip and jump to the next plateau of negotiation. Which was "and Bell will supply the amplifiers. . .".

Various Bell operating companies in various Canadian provinces have attempted to enlarge their "foothold" through the years. For example, in Nova Scotia inspite of the CRTC phrase previously noted, Bell through Maritime Telegraph and Telephone refused to come to the conference table unless the cable company allowed MT&T to provide full lease back services. In Newfoundland, the local Bell dominated operating company tried the same ploy. **No alternative to full lease back.** If you can't or won't accept that Bell dictum, you can't gain access to the poles. Which resulted in much teeth gnashing but no cable service in the province.

When the combined pressures of the local people who wanted CATV, and the provincial governments and the CRTC built up a head of steam in places like Nova Scotia and Newfoundland, Bell did a 180 and announced a 'new' program of **shared-structures.** This looked like a victory for cable until the details of the shared-structuring-agreements were carefully studied. Then it became apparent, as Easton points out, that what Bell had done was not disengage from the battle; they simply created a **new** battle with a whole new set of rules. The bottom line was that if Bell could not force a company into a full leaseback program, they were going to make it very-**very** expensive for the cable operator to use poles on a "shared" basis. Bell came up with a formulae only a Bell accountant could understand or love; splitting costs between strand **and** poles; the equivalent of $9.00 per pole per year if you averaged a large enough plant. And the initial first-year costs had a built-in escalation clause of 24 cents per year. The Canadian operators got downright hostile over this program since on one hand **with a Bell company suppling** dedicated in-place cable **plus** attachments the average per-pole cost was near $3.00 per year; **but then with the cable operator supplying the cable and maintenance** it became $9.00 per year. Either Bell had been 'taken' all of those years by the cable company at $3.00 typical charge per pole per year (**including** in-place cable and strand), or the cable operator was 'about to be taken' for poles and strand (but **no** cable) for $9.00 per year plus 24 cents more per pole each year thereafter.

The Canadian 'Bell Experience' is hardly over. It is a battle that continues, quietly but with great intensity, at this time. And it is instructive to those of us who operate south of the Canadian border. **Bell does not give up.** They do not want **anyone else** out there in the alleyways and along the right of ways with **any form** of 'broadband communications' capacity; unless they, Bell, own the pieces to the system. It is alot easier to shut it off, at will, when **you own** one or more critical pieces, than when you merely supply **rented space** to someone else.

In our present battles with Bell in the United States, we do wonder just a tad how the Canadian divisions of Bell have been able to supply poles **plus** strand **plus** cable to Canadian operators for the equivalency of **$3.00 per year per pole** while down here we have been averaging $3.00 **plus** per **bare** pole **per** year. What possible way can Bell accounting justify a bare-pole rental of $3.00 (and up) per year **here** when the **same** bare **pole** in Canada **loaded with** strand, hardware **and** (expensive) aluminum sheathed, jacketed cable sells for the **same $3.00** per year? We are sure that some bright, young Bell accounting executive can explain this for us. . .but we are not so sure we'd understand the explanation or agree with it.

Let's face it. Bell is out to make **our future a Bell future.** We should not be lulled into any false sense of security with Bell at any point in time. The hungry cat continues to circle, just waiting for the proper moment to strike. We had best keep our powder dry. . . for one day soon we are going to need it!

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GUNNPLEXERS FOR MICROWAVE

The 'Wave' Of The Future For CATV May Be Generated By A Gunn Diode

A Quiet Revolution. . .

A revolution is coming to rural American television. It is coming very slowly, but like the internal and external battles of just one year ago when the cable industry took on many of the giants of American communications (and won), we too will win this battle.

We beat the odds with small earth terminals. The FCC rules were against us and the established communication barons were against us. But we won anyhow.

This time the rules are again stacked against us. So too are the established media barons. It is not unlike the small earth terminal battle once again.

The new revolution is coming in the microwave marketplace.

The young lady holds in her hand a $108 package. A **complete** microwave transmitter **and** receiver, operating at 10.380 GHz (that's 10,380 megahertz). That strange fanned shaped device on the end, several times larger than the shiney metal container to the rear, is the antenna. 17 dB of antenna at 10.38 GHz. The shiney metal portion? That's the outer container of the electronics portion of the package.

Actually, it didn't cost the full $108 at all. We bought two of them, identical except they are offset from one another by 30 MHz of frequency (we'll see why later) for the unheard of total package price of $185.00. That means in each of the two transceivers (transceiver means the package transmits **and** receives) we have $92.50.

This is the new GUNNPLEXER 10 GHz package from Microwave Associates; first discussed in last month's (May) CATJ. With these packages the CATJ Lab is carrying on video paths of up to 5 miles of length with varying results. By tieing the packages to surplus 4 foot dish antennas, we have rock solid results over the ten mile paths and we believe twenty miles is within the realm of reasonable operation. We are setting up a 22 mile path as this is written.

There is more here than new technology (it is not really **all that** new) or new hardware. There is a new attitude. A new attitude that comes with the recognition that microwave hardware does not have to cost ten thousand dollars a channel or more, to purchase.

Remember the early microwave gear? It took several six foot racks of tubes and plumbing and traveling wave tubes (or magnetrons or klystrons) to generate a few hundreths **of one watt** of RF power at say 6 GHz. **Then** the tubes and TWT's (etc.) lasted for short periods of time. Maintenance was a problem, transmitters wandered off frequency and multiplier stages and modulation schemes were tricky at best and impossible at worst to adjust to proper operation. The FCC had generous amounts of "advice" from the telephone company users of microwave in the early days. The telco's considered microwave their "private preserve" and they figured **one way** to keep others from chasing after microwave allocations would be to simply establish such tough engineering requirements that only an outfit "with a guaranteed rate of return" could afford the equipment and requirements. The influence of telco engineers (**they** had **all** of the early experience and it was only 'natural' that FCC engineers, wrestling with the creation of new rules and regs for the new microwave services would go to the telco engineers for advice) on the original microwave rules and technical requirements is still apparent.

Microwave gear "must be" as close to fault-proof as electronic gear can be. That suited the telco's because they could pass the costs of such requirements along to the general public as they determine their rate making bases. But for a little fellow intent only on getting a signal from one point to another 30 miles away, the costs attendant with redundant this and failproof that are substantial. You've got to hand it to the telco's; they have held onto their microwave preserve for several decades. And most of the early rules and requirements stand pretty much as they did two decades ago.

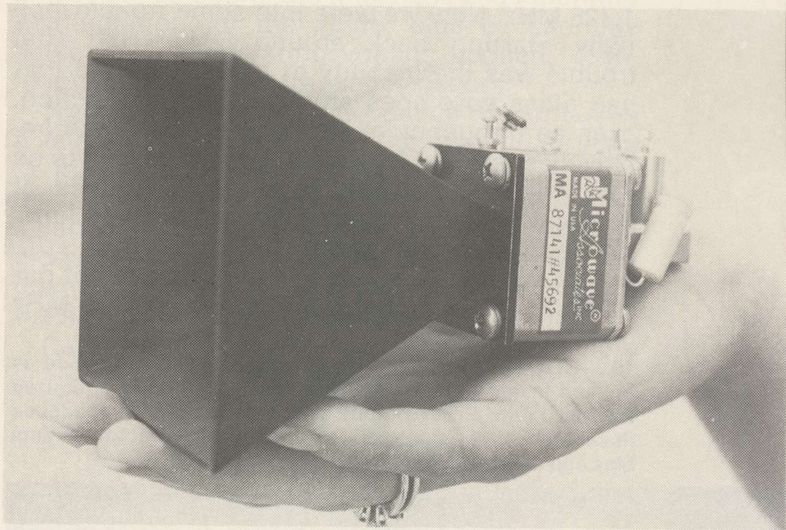
But along the way there have been advances which the telco's could **not** control. Technology is world wide, and while the U.S. microwave market has been infested with telco drawn requirements for all of these decades, **other** world markets have been freer to develop along more technology-limited lines. Gradually, not overnight certainly, the off-shore advances have filtered back into the U.S. microwave climate. In fact, many of the microwave advances have been **by** American microwave manufacturers, who have in turn been selling a large percentage (if not a majority) of their goods overseas.

The rapid development of solid-state microwave technology is an excellent example of this change. The Gunn-diode is our instant example. It is named after an engineer named John Gunn, who while conducting basic research with a material known as **gallium-arsenide** back in 1963 noted that under certain conditions of voltage (applied to a gallium-arsenide sample) the current flowing through the material became "unstable". When just the right amount of voltage was applied, IBM's John Gunn noted that the gallium-arsenide sample pulstated or cycled on and off at a very rapid rate. The rate, he determined, was so rapid that what he had created was a solid state (meaning no electron tube) oscillation **at microwave frequencies.** The point at which the current flow through the gallium-arsenide ceased to be linear or constant (as voltage was increased across the material) and at which the device began to "oscillate" was dubbed the "threshold point". In a nutshell, apply the proper amount of voltage across the material sample, and it would take off like it was a transmitter source.

The next "trick" was to **control** the frequency of oscillation. This turned out to be quite a problem, although it (obviously) **was eventually solved** by controlling the thickness of the gallium-arsenide material which in turn along with another trick or two controlled the frequency of oscillation. A wafer of gallium-arsenide 10 microns thick, for example, turns out to be fairly close to "self-oscillation-resonant" at 10 GHz. Now if the wafer is **mounted in** a high-Q tuned circuit, also resonant at about the **same** frequency, and the high-Q tuned circuit is tuneable over a "modest" frequency range, then some precise controlling can be done on the actual frequency of operation of the gunn oscillator device.

Finally, by carefully controlling the relationship **between** the actual voltage applied to the gallium-arsenide wafer **and** the design of the high-Q resonant (tuned) circuit, a fairly wide "tuning range" for the device can be achieved.

The significance of this development is difficult to properly assess unless you create some perspective.



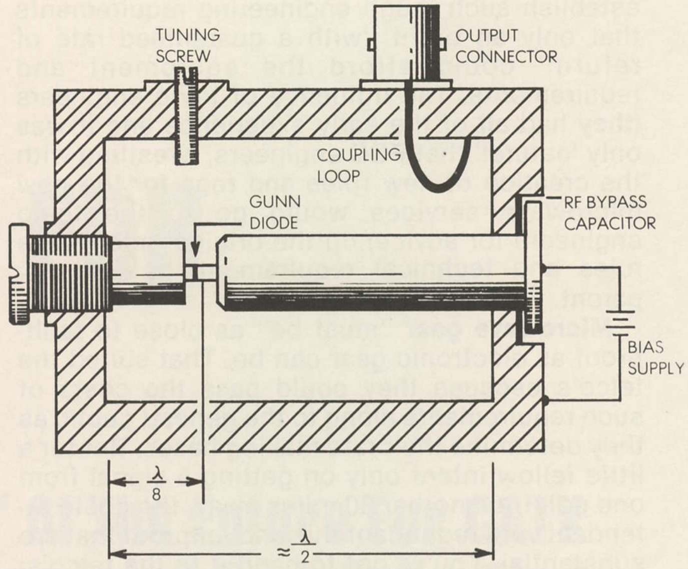
Let's go back twenty years to the point where Bell was another word for microwave. Let's say you wanted to generate a signal at 6,000 MHz or 6 gigahertz. First of all, thanks to the FCC's Bell "suggested" specs the rules said the frequency had to be pretty darned stable. OK—stable signals were **low** frequencies. For discussion let's choose 8 megahertz; a popular frequency for high stability crystals in 1957. Only 8 MHz is a long ways from 6,000 MHz (or there abouts). Here's how you got there from 8:

(1) **An oscillator worked at 8.000,000 (etc) MHz;**
(2) A frequency-tripler **multiplied** that output by selecting the third harmonic of the 8 MHz crystal and amplifying it, which got us to 24 MHz;
(3) **Another tripler got the 24 MHz signal to 72 MHz;**

This might be a good point to explain what a frequency multiplier stage was, back in those days, with a tube type circuit. First you laid out a stage that had a tuned input and a tuned output. The **input** would be tuned to (say) 24 MHz, by the careful selection of the circuit component parts. Then the **output** would be tuned to the **third harmonic of** 24 or 72 MHz. So each time you frequency-multiplied you needed a tube stage. Every now and again because the respective or successive harmonic signals got pretty weak or low in power level, you had to throw in a straight amplifier stage (called a buffer) just to bring the level up to some point where you could develop a useable harmonic signal.

Then there are some frequency multiplication "problem areas" where for one design reason or another you can't "triple" but are limited to doubling (it should go without saying that multiplication was limited in most circuits to times 3 or "3X"). So by the time you got to 6,000 MHz from our basic 8.000,000 MHz crystal we have covered 24 MHz, 72 MHz, a buffer stage, then 216 MHz, a buffer then 432 MHz, another buffer, then 864 MHz, another buffer and then 1,728 MHz. Now we were into some trouble (actually starting back around 864 MHz). That trouble was the inability of tubes (the kind that had glass envelopes around them) to function, even as frequency multipliers, at such high (relatively speaking) frequencies. So there had to be very special "ceramic construction" tubes of something called "planar" construction to function in this frequency range.

And so it went, so that by the time we got our 8.000,000 MHz signal up to the 6,000,000 MHz



Simple Gunn-diode oscillator uses a half-wavelength coaxial cavity. Impedance matching is provided by the output coupling loop. This type of circuit can be tuned over an octave or more, but difficulties with oscillation at harmonic frequencies are common, and the coaxial cavity is more sensitive to temperature changes and load mismatches than waveguide resonators.

DIAGRAM ONE

region we had typically multiplied and buffered around 13 or 14 or 15 times. Each stage took **at least one** tube or tube-type-device and each tube type stage had its backup stage and various regulator and other tube-type circuits. It was one big hairy mess, but in the 50's it **was** state of the art.

Now picture in your mind the 19 (or 22) inch wide "relay rack" filled with panels of tubes and related components just to get a "signal" from 8 MHz up to the 6-7 GHz region.

Now go back and look at the photo of the little box in the hand of the young lady at the opening of this report. And look now, fresh as it were, at the wonderful world of the Gunn-diode.

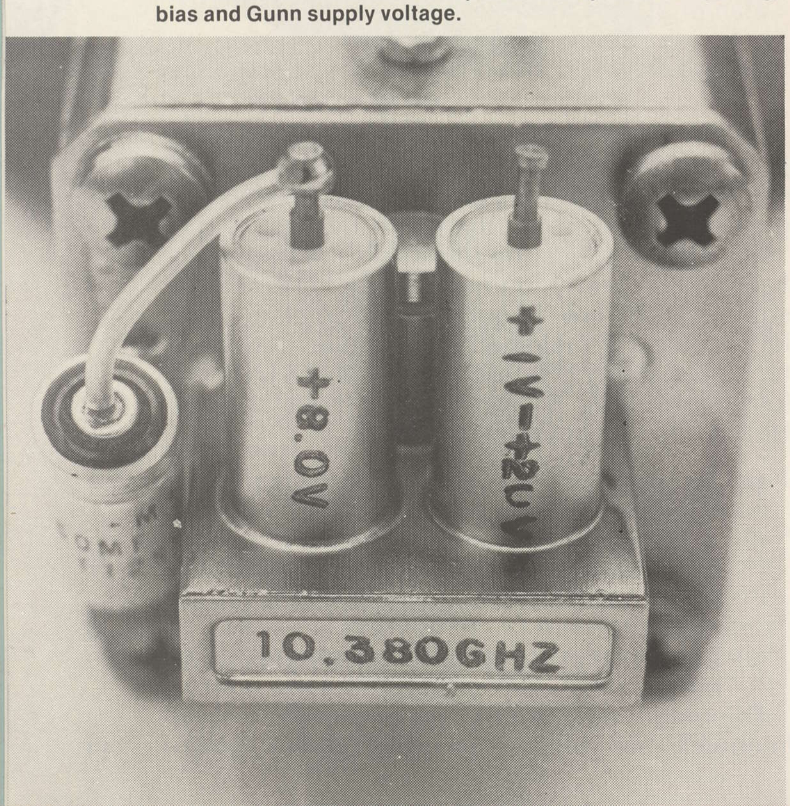
Recall that the Gunn-diode is constructed from a material known as gallium-arsenide. If you **control** the **thickness** of the material, and the **way** it is **mounted**, you can generate 6-7 GHz (or 10 or 12 or higher frequency) energy **right at the operating frequency**. No multipliers. No harmonics. No tuned circuits, except that of the small metal resonator-cavity in which the Gunn-diode rests and does its job.

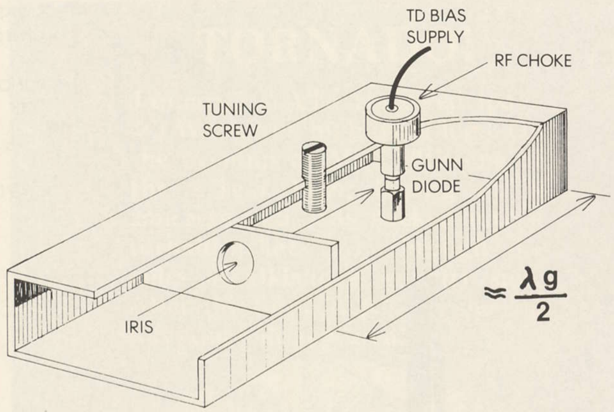
The Gunn Oscillator

The basic Gunn-diode oscillator mounts the diode at one end of a half-wavelength coaxial cavity as shown in **diagram one.** A coaxial cavity is a metal enclosure of precise length/width measurements. With all of the design elements taken into consideration, this is the size of enclosure or box which will resonate (or tune-up) on a pre-determined frequency of interest. The box, it's inside walls, is the actual tuned circuit; just as you have coils of wire with capacitors determining the tuned or resonant circuits at lower frequencies.

Note in diagram one that there is a small

10.3 GHz varactor-tuned Gunn oscillator. Gunn diode is housed inside of container and "iris" opening is optimized for maximum power output and isolation from impedance mis-matches. Terminals on top connect up varactor (tuning) bias and Gunn supply voltage.





Simple waveguide resonator for Gunn-diode oscillators. In this circuit the microwave energy from the Gunn diode is coupled into the cavity with a post mounted between the narrow dimension of the waveguide. The size of the opening (iris) is optimized for maximum power output and isolation from impedance mismatches. The rf choke requires careful design for minimum rf loss.

DIAGRAM TWO

"tuning screw" inserted down into the interior of the cavity enclosure. At the microwave frequencies, you can "tune" the resonant or operating frequency of a "cavity" such as this by simply inserting a piece of metal into the walls of the box. By adjusting the amount of metal protruding down into the box you raise or lower the operating frequency of the box by a small amount. This is similar in function to the fine tuning control on a television set. Now notice the output connector and the "coupling loop" attached thereto in diagram one. The coupling loop is a piece of wire or small diameter metal that attaches on one end to the center pin on the coaxial **output** connector, and on the opposite end it grounds or terminates on the inner shell of the coaxial cavity. The **length** of the coupling loop, and its **position** inside of the cavity box determines two things:

(1) **The amount of energy** "coupled" out of the coaxial cavity on the output frequency of the system, and,
(2) **The "load impedance"** which the Gunn-diode "sees".

This is **one way** to mount a Gunn-diode and make it generate RF signal and then to couple that RF signal out of the coaxial cavity into a piece of transmission line. But this approach, while it works and while it is relatively simple to construct, has operational problems. For one thing the "Q" or "selectivity" of the half-wavelength circuit is not very high. That means the Gunn-diode may tend to oscillate not (only) at the desired frequency, but at a harmonic frequency. You might believe you were putting out power on say 10 GHz when in fact you were really putting out power on 2X or 20 GHz. And for another thing this type of coaxial cavity is quite sensitive to temperature variations and to (antenna/transmission line) "load" mis-matches. If the environment changes, the characteristics of the cavity also change. In effect, temperature changes "tune" the box for you. And if you have something less than a proper antenna/transmission line "perfect" match (i.e. low VSWR) that too can "tune" the cavity for you. Neither is a good deal, and for stable-high reliability microwave applications, these are not acceptable operating specs.

So people like John Gunn devised a better way of getting the job done. One approach developed is shown in **diagram two** here. What we have is a modification of the 1/2 wavelength coaxial cavity; a device known as a "wavelength (rectangular) cavity" with (and this is important) a "coupling iris" mounted between the segment of the waveguide where the Gunn-diode mounts and the "output end" of the cavity box. Here is how that works and why it works better.

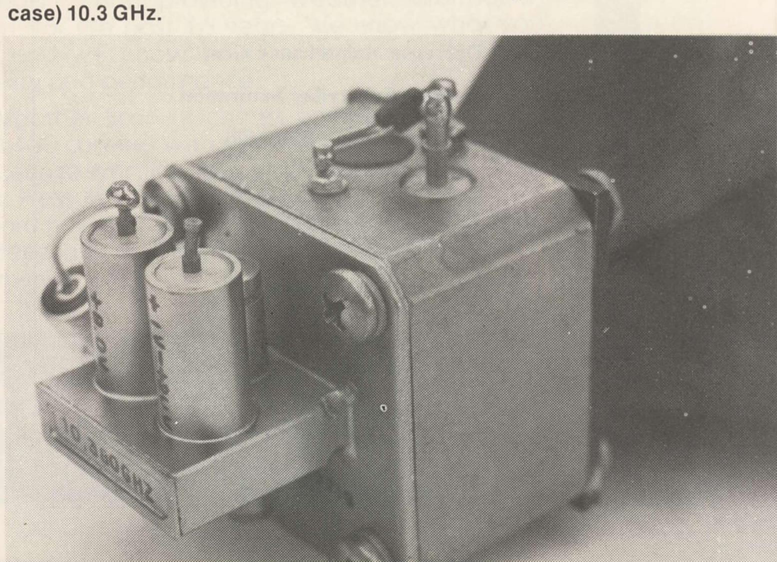
Note that the interior of the rectangular cavity, from the point where the iris mounts back to the far end (right side of drawing) where the Gunn-diode mounts is 1/2 wavelength (adjusted) long. This creates the resonant cavity we discussed for diagram one. The Gunn-diode is put into a tuned circuit (**the 1/2 wavelength resonant cavity**) and by pre-selecting the thickness and mounting configuration for the diode, plus by carefully selecting the operating voltage applied, oscillation on the desired frequency occurs.

Now the iris. The iris can best be thought of as a "simple" bandpass filter. The opening (or hole or iris) is **really** an **adjustable diaphragm.** The designer "adjusts" the opening size to allow just a certain amount of the rectangular-cavity/Gunn-diode generated energy to pass through the opening. The amount of energy allowed through the iris is a function of **balancing** two factors:

(1) The output power level (the bigger the hole the more energy escapes);
(2) The "match" or isolation of the Gunn-diode signal generating device to the load (waveguide/antenna) connected to the open (left hand side) end of the rectangular cavity.

Now take a look at diagram three. This is the complete adaptation of this Gunn-diode

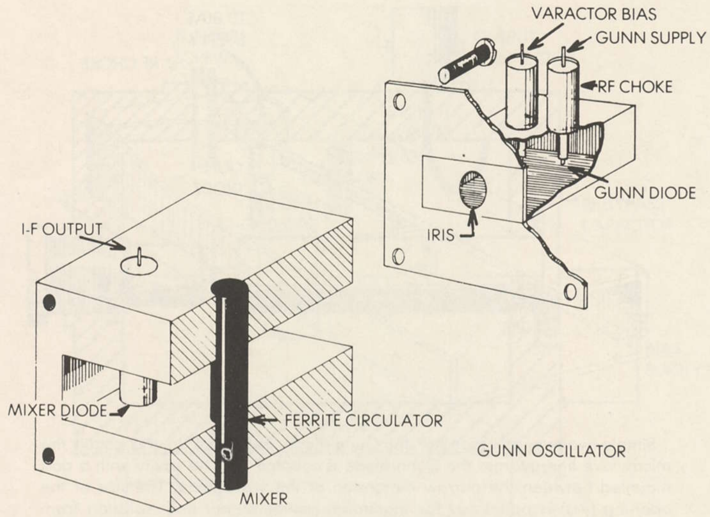
WHAT PUTS IT ON FREQUENCY? The size of the housing (diagram three) from the "iris" back to the rear wall behind the Gunn Diode mount creates a resonant cavity at (in this case) 10.3 GHz.



technology into a small (9.5 ounce with antenna) 20 milliwatt output 10 GHz transceiver. **Trans** is for **trans**mitter while **ceiver** is for **receiver.** In other words, this is a complete "two-way radio" that transmits and receives in the 10 GHz range.

In diagram three we have the basic transmitter portion, as just detailed. Note (on far right of diagram) the iris coupler that "looks into" the waveguide section that houses the receiver (we'll talk about it shortly), and further to the right the Gunn-diode (mounted under the RF choke) and a varactor-bias feed point. The operating power (9 volts at 200 mA for the package) is fed to the device where the diagram is marked "Gunn supply". Most units operate with a relatively simple 10 VDC positive supply, regulated. Then using a separate, adjustable type of "bias" supply we can vary the actual operating frequency of the Gunn-diode transmitter. For example, let's say you set the bias supply to 4 volts DC and measure the output frequency at 10.380 GHz. Now suppose you arranged for the bias supply voltage to **swing** back and forth in operating voltage, say from 3-5 volts. What do you suppose would happen to the operating frequency?

It also would swing back and forth, at the **"rate"** that the bias supply voltage "swung". Take that one step further; provide a 4 volt bias supply but "modulate" that bias supply with say



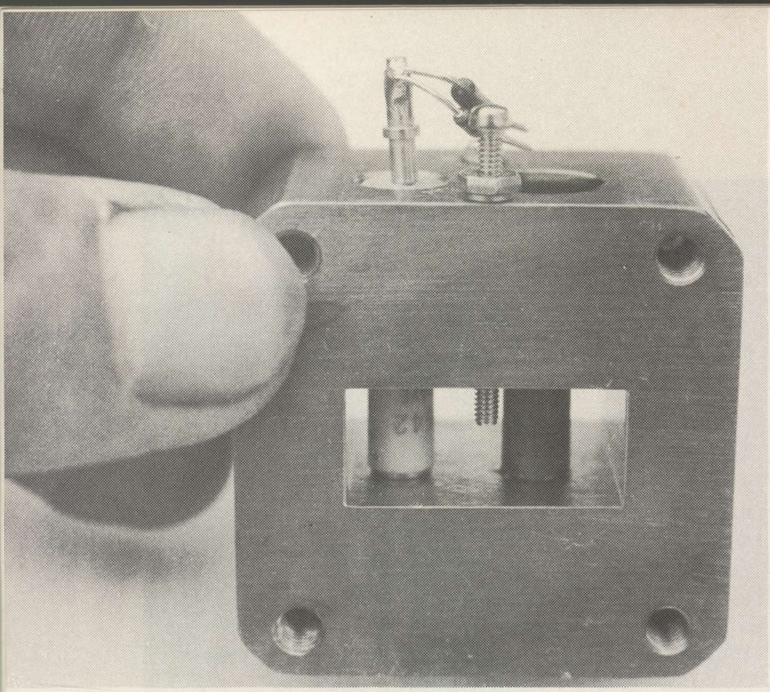
Cutaway view of the 10-GHz Microwave Associates Gunnplexer. The post-coupled Gunn diode is tuned to the desired frequency with the dielectric tuning screw, and the rf energy is coupled out through an iris. The ferrite circulator couples a small amount of energy into the Schottky mixer diode and isolates the transmit and receive functions. Mixer injection can be adjusted with the small screw mounted in front of the circulator. A horn antenna provides 17 dB gain.

DIAGRAM THREE

a 4 MHz FM deviation TV (video) signal. Now what do you suppose happens? The bias supply, modulated by the 4 MHz FM **deviating** video signal, now swings back and forth **at the modulation rate** of the FM video signal. You have just created a system to send a 4 MHz video signal through a 10.380 GHz microwave Gunn-diode transmitter. The **video** signal **modulates** the **bias** supply and the bias supply **swings** or deviates the actual output signal frequency **as a function of** the video signal information applied.

Now look at the **left hand portion** of diagram three. This is basically a 10.380 GHz microwave receiver. Well, almost.

What we have in the metal portion is a continuation of the waveguide for the operating frequency range; a piece of rectangular metal designed to transmit through or along the inner walls the energy generated back in the Gunn-diode. Now as that energy passes through the waveguide opening a very small amount of the energy is intercepted by the ferrite coupler (the black rod-like material shown in diagram three and the photos.) This small amount of 10.380 GHz energy intercepted by the ferrite coupler is **directed into** the Schottky "mixer diode"; another rather amazing type of modern day diode device. So at the Schottky diode we have the transmitter portion 10.380 GHz energy being applied as a "mixer voltage" **and** then coming back **into the opening** at the far left of diagram three (i.e. the open end of the rectangular waveguide) we have **another signal** from **another** 10 GHz range **transmitter** some distance away. This second signal is (for our example) operating on 10.350 GHz (i.e. 30 MHz removed from the frequency of the Gunn-diode unit in our diagram). The Schottky diode sees **two** signals present; **one at** 10.380 GHz and **another at** 10.350 GHz. It



FRONT END of the transceiver package includes the ferrite circulator (black rod), Schottky mixer (receiver) diode and the small tuning screw that controls mixer injection. IF Output is off of terminal (feed thru) on top of housing.

mixes the two together and creates a sum (addition of the two) frequency at 20.730 GHz and it also creates a difference (subtraction of the lower frequency of the pair from the higher frequency of the pair); **or 30 MHz**. Now if you connect a wire or cable to the top or output port pin of the Schottky mixer diode and to that cable connect a 30 MHz receiver, you would then have a way of receiving the transmissions from the other (10.350 GHz) transmitter; **at the 30 MHz IF.**

Finally, as shown in the photos here, you can take this "complex" and amazing package one step further. You can **directly attach** at the end of the waveguide section shown in diagram three (just to the left of the mixer diode) **an antenna.** In the photos here there is a "horn" antenna bolted or attached directly to the waveguide opening on the package. In the transmit mode this small horn antenna beams or directs the 10.380 GHz signal in the direction you desire. In the receive mode, by pointing the horn antenna at the other transmitter in the system, you will receive the other units transmissions, through the IF output of 30 MHz in our example.

For CATV?

If all of this is new to you, chances are excellent you are either in shock or moderate disbelief over the **simplicity of** the entire system. "It looks like a modern day crystal set" noted one CATV operator we displayed our package to.

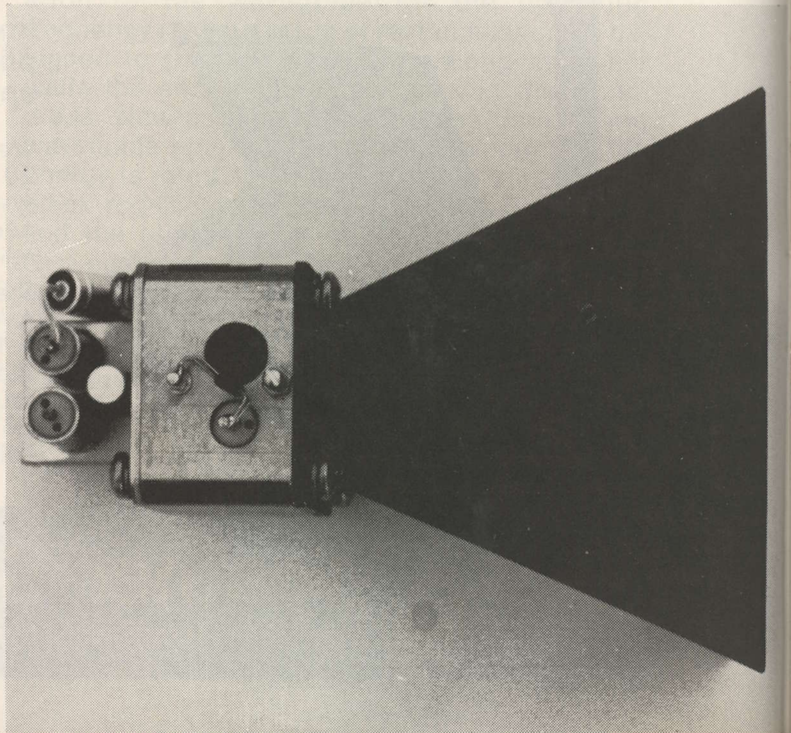
Yes, it is that. But crystal sets at 10 GHz were not **that** common. It is an amazing but true observation that in the last decade, as very high frequency (meaning **not** VHF but SHF or **super high frequency**) techniques have developed, the design of microwave range equipment has gone from the ridiculously complex to the absurdly simple. In a very real sense, as technology has advanced, the microwave world has become less (much less) complicated.

The packages shown here are **NOT** for CATV application. First of all, they are (as noted in the May **CATJ**) designed to operate in the 10 GHz region; the nearest CATV band is the CARS band, some 2.5 + GHz (that's 2,500 + MHz) **higher in** frequency. YES—this approach, perhaps even these packages, **could be made** to operate directly in the CARS (CATV assigned) bandwidth. But they would not be legal as they stand for operation there. However, as noted last month (See **$2400 Microwave?** pages 10 to 17 May 1977 **CATJ**) there is at least one company **(Microwave Associates)** that is preparing to adapt this technology **to** CARS band applications.

As things now stand, to operate **any** equipment in CARS band you need FCC approval for the equipment. **This equipment would not pass FCC approval.** And if it did, it would still not be ready for CATV applications **directly.** It **lacks** a power supply, and a modulator (for the transmit portion) and a demodulator (with perhaps an IF) for the receive portion. It would also be nice to have a weather proof housing for the package, and a way to join two or more together into a package for coupling into a singular waveguide to feed energy up to or take received energy down from a single transmit/receive (dish/parabolic) antenna. All of this, including the FCC approval, costs extra bucks. Which gets us to the $2400 package price per channel discussed last month in **CATJ.**

There would also be a stability problem. That is, in the package shown here for every drop in temperature by one degree (C) increments, this package will **increase** the operating frequency **by 350 KHz** (or downward with increased temperature). So for a **stable** operating environment, one where you **stay on frequency** at **all times,** you either need to (1) control the housing tem-

THE COMPLETE 10.3 GHz transceiver package including 17 dB gain horn antenna is less than 5 inches long, 3.65 inches wide (at front of horn) and it weighs in at 9.5 ounces.



perature, or, (2) employ some type of AFC or automatic frequency control. Of the two choices, AFC is actually far simpler but it presents a few design problems to prevent one transmitter chasing the other one up and down the "frequency band" as the temperature goes up and down.

These are not insurmountable problems, and they **have been solved** for the **commercial application** of **this** technology by Microwave Associates for CARS band use and so it turns out that in the process of generating 10.380 GHz signal (in our example package) and in the companion process of receiving that signal, we are using some machined metal housings and a **handful of** parts. In the process of **modulating** the signal, or IF amplifying and detecting the signal, we are using nearly **100 times more** component parts. **Then** in the process of **stabilizing** the operating frequency of the package, we use another fair number of descrete and IC parts. It actually turns out that microwave technology is far-far ahead of the 30 MHz (IF) technology!

The technology to place quality television signals five or ten or twenty miles away from the headend, with **low cost microwave transmitters and receivers** is now **at hand.** Lacking, at this time, is the practical application of that really low cost technology as it might apply to the expansion of rural American CATV service **IF** (and this **is** a big if) the FCC rules were **flexible** enough **to permit** such technology.

OPERATING CHARACTERISTICS
Microwave Associates MA-87127 Series 10 GHz Gunnplexers

RF center frequency -	10,250 MHz (10.25 GHz) with 4 volts of varactor bias applied
RF output power -	20 mW (milliwatts)
Tuning:	
Mechanical -	+/- 100 MHz
Electronic -	60 MHz minimum
Frequency stability -	350 kHz variation per degree C maximum
Noise figure -	12 dB maximum (mixer diode)
Input Voltages	
Gunn voltage -	+ 10 Vdc typical
Gunn current -	500 mA maximum
Tuning voltage -	+1 to +20 Vdc
Operating Temp -	-30 to +70 degrees C
Operating Range (*)	
17 dB horn antenna	
a) 240 kHz IF bandwidth	15-20 miles
b) 4 MHz IF bandwidth	3.6-5 miles
12" parabolic dish	
a) 240 kHz IF bandwidth	150-200 miles
b) 4 MHz IF bandwidth	24-48 miles
24" parabolic dish	
a) 240 kHz IF bandwidth	600-800 miles
b) 4 MHz IF bandwidth	150-200 miles

* - **NOTE:** Operating range is **line of sight range,** such as you might encounter **IF** you pointed **straight up** through space. This assumes a minimal type 6 dB signal to noise ratio **(far from adequate for CATV applications)** with an AFC system and a low noise (1 dB) IF system noise figure.

OFF-AIR PROCESSING. . .

Two Recent Entrants To The Heterodyne Processor Marketplace *(Triple Crown and Q-Bit)* Have Interesting New Technology At Work

"Head" Technology

The CATV signal processor has always held a particular fascination for most cable system operators and technical types who make the cable delivery systems function. As almost everyone is well aware, if you cannot clean up the interference and degradation on an off-air signal at or within the headend, there is no way to make the cable plant pictures look decent or adequate.

The whole process starts when the signal is taken off the air by the off-air antennas. Any limitation of the antennas is reflected in the quality of the signal that is subsequently passed on to the followup equipment. The same "limitation" is reflected in the other "pre" processing equipment; the downline (seldom a problem unless there is poor antenna/equipment match to the line), the pre-amplifier (often a problem when there is a poor match between the antenna **and the input** to the pre-amp or when the output of the pre-amp does not see a good "match"-load at the base of the transmission line), and any external-to-processor filters and traps. These system design problems have been well covered in **CATJ** in past issues (see **October** 1975, page 42; **May** 1976, page 12; **August** 1976, page 10; **September** 1976, page 40; and **November** 1976, page 45).

Whatever the accumulated "problems" from the antenna to the processor input, the headend is supposed to be a **magical** cure-all for all that ails the poor off-air signal. It may well be a great deal to ask of a (generally speaking) "relatively simple" piece of equipment.

In this two-part series we will be looking at the accumulated "technology" exhibited in two new (one is brand-new) signal processors; units developed recently enough that the latest state-of-the-art processing technology, and descrete and IC technology should be represented therein. Both units are from CATV "specialty houses" which means they come **not from** large, corporate operations where headend processors are "merely" another entry line in a large catalog of CATV "goodies", but rather they come from smaller suppliers where the success or failure of the new processors can and might have a substantial impact on the CATV marketing of the respective firms.

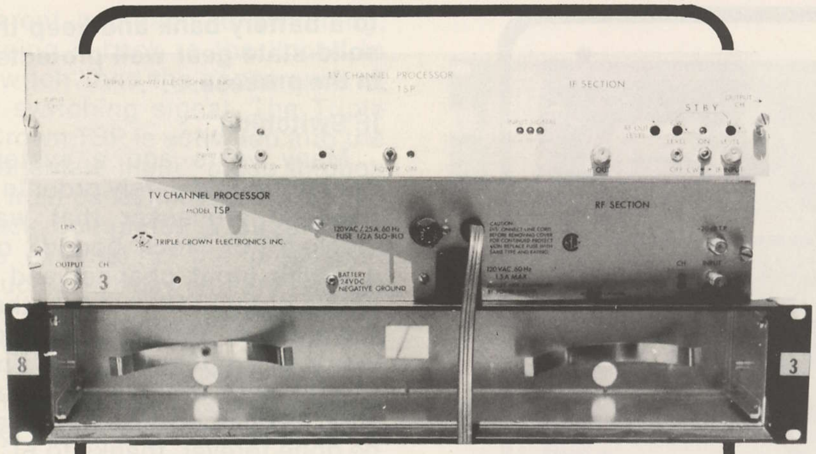
Modular Is In

Modular (i.e. compartmentalized sub-sections, each devoted to a specific function) are hardly new in CATV nor in CATV headend signal processing. Both of the units to be discussed in this series however have taken a distinct approach to creating modules for the processing application.

Triple Crown Electronics (42 Racine Road, Rexdale, Ontario, Canada M9W 2Z3; see Associate roster listing page 47 here) has done a very unique and frankly very clever thing with their modules. First they provide a rack mounting "frame". The frame is 3.5 inches high, 9 inches deep and standard rack width. It is broken into a **pair of separate** and equal compartments with a long-ways divider that creates a pair of 3.5 inch tall by 4.5 inches deep (by 18 inches wide) inner "wells". Access to the two "wells" is from the front of the rack (one well) and from the rear of the rack (second well).

By exerting gentle pressure on a pair of retaining screws (they operate latches or catches) the electronics which fits into the two wells slides out of the respective compartments. A spring clip keeps the section under pressure when it is in the well, and mating plugs join the two front and back electronic segments.

The wall dividing the main frame into two identical compartments is for both strength and shielding. Now if you have to do work on the



RACK MOUNTING MAIN FRAME (bottom), RF section (middle) and IF section (top) make up "snap-in" packaging for TSP processor.

whole processor, you simply remove the two (front and rear) compartments by moving the four retaining screw-latches and take the two sections from the housing. Then you can plug them back together on the workbench in front of you. This makes processor testing very convenient indeed.

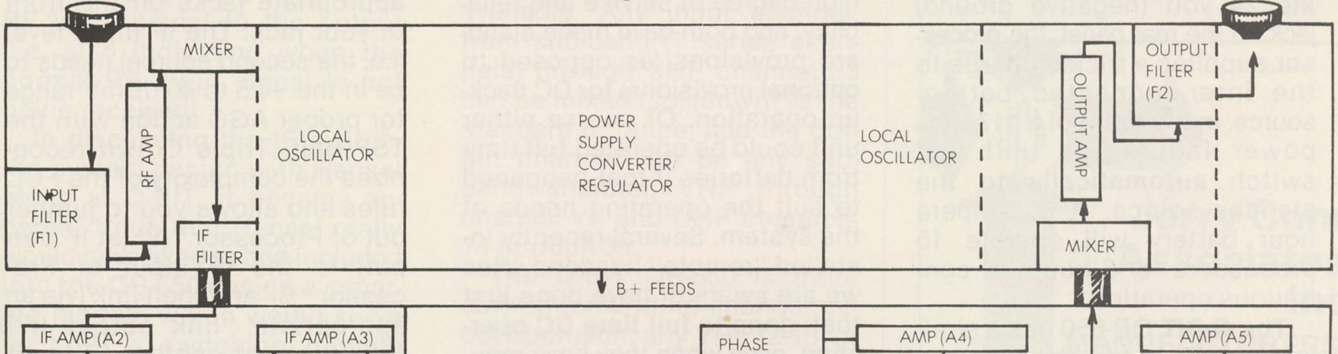
As shown in the diagram here, the two front and rear compartments are respectively the "RF Section" (rear of main frame) and the "IF Section" (front of main frame). We'll get into the electronics and operation at a later point; pointing out here only that the RF input and RF output are on F fittings to the rear of the unit; while various IF switching options are handled with front-of-rack F fittings.

The second "new" unit is from **Q-BIT Corporation** (P.O. Box 2208, Melbourne, Fl. 32901). It takes a different approach to "modules" as shown in the photo here. Q-BIT's QB-650 processor has a solid metal top plate which "clips" into place with slide in/out metal fasteners. In other words, you get inside to the modules without having to use a screwdriver. The unit is hefty, although light weight; measuring standard rack width by 5.25 inches tall by 15 inches deep. Rack mounting **"slide rails"** are available so you get a **"works in the drawer"** approach if that is what you want.

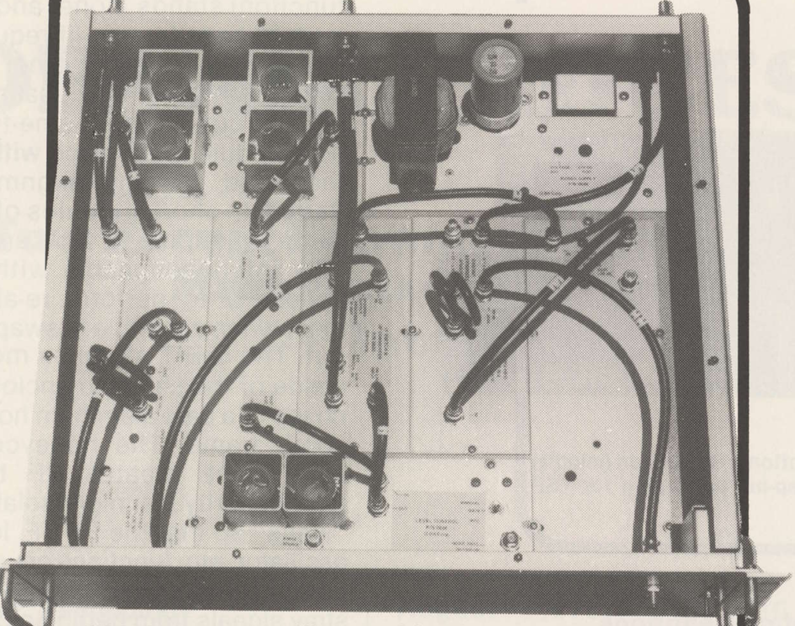
Q-BIT has approached the modular design with one paramount thought in mind; that being that each module (i.e. function) stands alone, and the system operator can (if required for service or test or other reason) remove any individual module and put another same-function module in its place **without** the need for **any** alignment. **Period.** In short, modules of the same function and type are totally inter-changeable with no necessity to perform re-alignment when a module is swapped out. The Q-BIT modules mount inside of the shielded enclosure on top of a cast aluminum honeycomb frame. The honeycomb cast frame creates RF tight high integrity (i.e. high isolation) "wells" so that the RF, IF, local oscillator, etc. functions are each compartmentalized to prevent stray signals from getting around and about the package in undesireable places or ways.

So both of the new units have approached the ease-of-service aspect of their processor designs with some special care for the user. Neither approach is **totally** innovative, but both indicate that service-ability for headend processing units is uppermost on the minds of processor design engineers these days.

Of the two, the Triple Crown unit is going to be easiest to take out of the rack and onto the bench for work; but the Q-BIT unit is possibly going to be easier to work on, and substitute modules in and with, after a defective section is found (the QB-650 modules remove from



TRIPLE CROWN TSP PROCESSOR



QB-650 processor utilizes modules for each function in the package; flat-plate modules rests atop cast-aluminum "well" of honeycombed sections.

the cast aluminum well-frame with four screws).

Powering

Both of the new units recognize that not every headend "shack" has reliable 117 VAC juice available. So both have built-in operational capability for a DC voltage source, such as you might provide for your headend from a standby battery bank.

Triple Crown's TSP processor will function in a "standby mode" from a 24 volt DC supply source (0.5 amp drain). By connecting a 24 volt source to the appropriate 24 volt (negative ground) jack on the rear panel, the **processor** supplies a trickle charge to the inter-connected battery source. In the event of a 117 VAC power failure the unit will switch **automatically** to the standby source. A 60 ampere hour battery will operate 15 processors for 8 hours of continuous operation.

The Q-BIT QB-650 has a similar approach to standby powering. When the line voltage drops below 85 VAC (the point at which the internal processor operating voltage is **close to** the +21 VDC cut-off **after** regulation), switching takes place and the processor switches to an external +24 to 30 VDC source. This external "reserve" source can be a battery bank or other type of standby powering source. Rather than build trickle charging into **each** processor, Q-BIT offers an optional standby battery charging system (model 651) which with two automotive batteries supplies operating power for a **complete** headend. Battery drain at 24 VDC varies from 0.6 to 1.0 amp, depending upon the options chosen for the processor.

Both units, then, recognize that the modern cable system of the late 70's must provide a high degree of service and reliability; and both have made **standard** provisions (as opposed to **optional** provisions) for DC backup operation. Of course either unit could be operated **full** time from batteries if that happened to suit the operating needs of the system. Several recently installed "remote" headend sites we are aware of have done just that; gone to **full time DC operation,** even when they have regular 117 VAC operation available. As one operator employing this approach notes **"that battery bank provides an excellent** 'filter capacitor' **against line surges knocking out solid state power supply components; you can** 'dump' **a whole lot of surge in- to a battery bank and keep the solid state gear well protected in the process. . .".**

IF Switching. . .

Many years ago a system operator could safely order in a headend processor that was "locked" or "rock bound" on **a single** input channel and **a single** output channel (whether the same or different); and not worry too much about getting caught with inadequate operating flexibility. Those days may be gone forever, thanks to FCC rules regarding duplication, signal carriage and other programming restrictions and options.

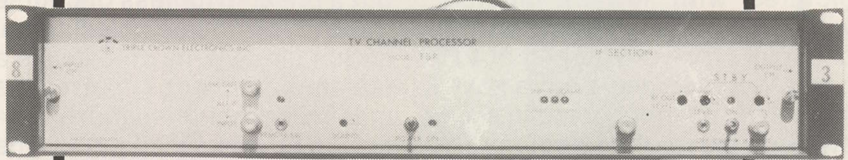
With heterodyne signal processing, about the best place to do switching of input/output channels is at **IF.** If your RF front end processes a signal and then converts it down to IF for additional processing, adjacent channel shaping and AGC action, **and** all IF frequency ranges within a processor are identical for **all other** processors in the headend, it makes excellent sense to do your channel-hopping at the IF point.

Triple Crown provides front panel location for an "alternate" or "standby" (or switched-in) IF source. The front panel also has an "IF OUT" jack which means you can manually connect up the appropriate IF output processor to the appropriate IF (alternate) input point on a second (or third) processor by simply employing RG-59/U "jumpers" between the appropriate jacks on the front of your rack. The IF input level (i.e. the second source) needs to be in the +25 to 40 dBmV range for proper AGC action with the TSP unit. Triple Crown recognizes the complexity of the FCC rules and allows you to jumper out of Processor "A" (at IF output) to the IF input of Processor "B" and then link (via an appropriate "link output IF" fitting) to yet another IF input of Processor "C" (etc.). **Theoretically** you **could** switch or link **all 12** (30, etc.) channels to a single channel in this procedure if you wanted a dial full of the **same** program at the **same** time!

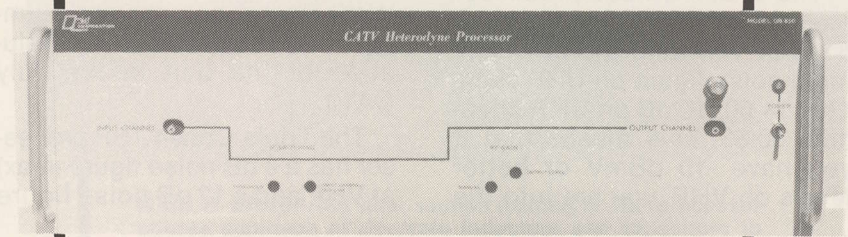
The Q-BIT QB-650 takes a different approach to switching, tieing it back to the "need to switch" and the appearance of a switching signal. The Triple Crown TSP is activated into the "alternate input" mode through a front panel miniature jack. The jack completes a circuit that is external to the processor; such as a relay closure located on a switching module (timer or non-dup switcher). The QB-650 uses something called "OR TIE" in digital logic terminology. A set of rear panel contacts cause a transistor switch internal to the processor to move from the internal IF to an external IF input jack (also on the rear panel) anytime the "OR TIE" line contact on the rear panel is taken to a common ground. In other words, simply provide a DC path to ground for the tie point on the back panel, and operate that path through a relay that is controlled by a timer or non-dup switcher, and when the tie point goes to ground the alternate IF input signal fed into the unit is picked up and the internal IF signal is switched out. This eliminates switching voltages per se, for the processor.

Both processors have front panel lights that indicate when the normal input signal (i.e. normal **off-air** signal) has been **replaced** with another signal source. The TSP unit light indicates when an **alternate IF source** is being programmed, while the QB-650 light indicates **anytime** there is no routing of an RF input signal to the output (i.e. also indicating when the normal RF input signal is not being received).

In discussing the IF switching system design with Hansel Mead at Q-BIT, it became apparent to us that Hansel really would have **liked** to had included into the QB-650 design a separate module which would serve as both a switching module and a non-dup programming module. **"It would have been possible to simply allow the system to order up a non-dup module for the channel in question I suppose"** noted Mead **"but the number of systems having to have the ability on all channels**



TRIPLE CROWN TSP processor takes input and output fittings to rear; locates IF and switching connections and controls on front.



Q-BIT QB-650 VHF heterodyne signal processor rack mounts on "rails" for "works in a drawer" servicing approach.

is so fluid that it seemed a shame to saddle the basic processor buyer with any additional cost (such as the extra space and hard wiring for the module if selected as an option)".

The RF level in the QB-650 to drive the unit to proper output is +25 dBmV; the same level out of the IF "out" (i.e. to drive a separate processor at IF, that is the level present).

Input/Output Channels. . .

The Triple Crown TSP unit is one of (if not **the**. . .) most versatile input/output processors available. Any input channel, from sub-band (T series channels) through UHF channel 83 can be mixed (up) (down) to the standard IF range; and the output channel can be any subband channel, VHF through channel W, **and** UHF channels 14 through 35.

The Q-BIT QB-650 is more conventional in its channel in/-out approach; any VHF (2-13) or UHF (14-83) **input** channel can be accomodated. **Output** channels are VHF 2-13 with midband available on special order.

Input Level Ranging. . .

For years and years the input noise figure of processors has been sufficiently high that for input RF levels below say 0 to -5 dBmV it was almost **mandatory** that the system **precede** the processor with a low(er) noise pre-amplifier. Recent improvements in front end noise figures in processors has changed or reduced this requirement for many installations.

The name of the game is quality television pictures. If the processor can produce quality pictures with low(er) inputs, with**out** a pre-amplifier, that is one less piece of equipment to have "on line" and both a savings to the operator going in and one less piece of equipment to blow up when there is foul weather around. Systems that have lost and continue to lose tower mounted pre-amplifiers to nasty weather shouid take note.

The Q-BIT QB-650 processor has a maximum noise figure of 6 dB at VHF and a 9 dB maximum noise figure on UHF channels 14-50; 10 dB on UHF channels 50-83. This means that if you have -10 dBmV **or better levels** on VHF, you are into the sparkle-free picture region with**out** a pre-amp (unless of course there is man-made noise degradation present, in which case a pre-amplifier won't solve the man-made noise sparkles anyhow). The specifications for the QB-650 for the AGC range tells the balance of the weak-signal-end story; the AGC will hold the output level constant for input levels that range as low as -20 dBmV (and up to +30 dBmV). We'll look at how the real numbers play in our CATJ Lab evaluation of the unit in the July CATJ.

The Triple Crown TSP processor has a 8 dB noise figure (max) at VHF and a 12 dB noise figure on UHF. The AGC range is 40 dB (-15 dBmV to +25 dBmV) on VHF, and 35 dB (-15 dBmV to +20 dBmV) on UHF.

The relationship between noise figure, and signal to noise ratio is rather exact of course. The **lower** the input noise figure, the **better** the signal to noise ratio; assuming a couple of other factors are equivalent. For example, match between the processor (tuner) input and the transmission line is important; since a poor or inadequate match results in poor power transfer between the downline signal and the input to the tuner/processor. Getting 1,000 microvolts (0 dBmV) **into** the input "F" fitting doesn't do much good in the impedance match on the **inner side** of the fitting (or inside the tuner) is so poor that only half of the power is accepted. That's a good way to give away 3 dB of signal. Another important factor is the amount of man-made noise present with the signal at the input to the tuner/processor. There is not much a processor **(any processor)** can do if there is 0 dBmV of signal (typically adequate for a mid to high 40's signal to noise) **and** -20 dBmV of man made noise present. In this case, the worst case becomes the best case; i.e. the signal to noise ratio cannot be any better than the 20 dB difference between the man-made noise and the signal voltage present.

Of these two "variable" factors the input (tuner/processor) match is the only one of the pair which the manufacturer has any control over. Through the years there have been processors on the market which exhibited decidely poor matches. A poor match at the input to the tuner/processor actually does a pair of things; it results in a lower-than-need-be energy transfer efficiency (i.e. voltage is lost in the transfer from the relatively pure 75 ohm input line and the not so pure "75 ohm" input connector), and, if there happens to be a poor match **and** a fair amount of input signal present, standing waves created by the mis-match travel back to the antenna or equipment ahead of the processor, and then may come back to the processor as delayed or ghosting signals.

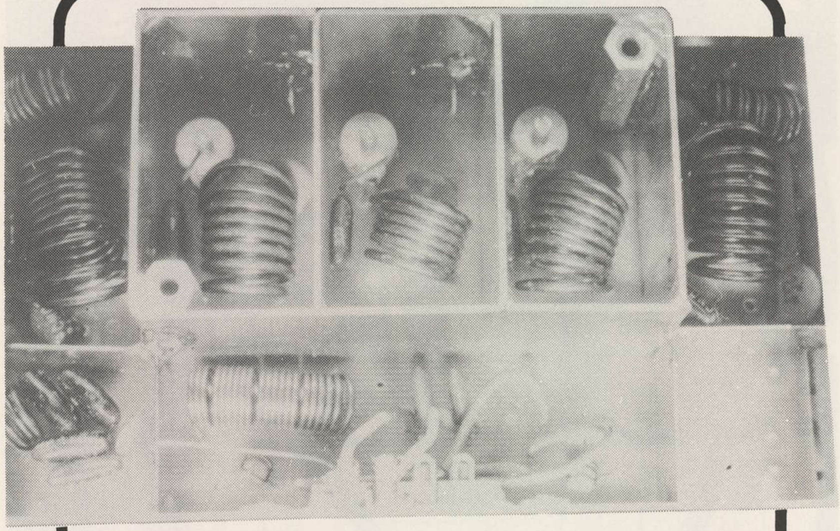
Both the TSP and the QB-650 processors have an input match spec of 16 dB rtl (return loss); or a "voltage error" (i.e. loss) of about 16%. This is about as good as state of the art allows and for most applications it is quite adequate.

Circuit Description—TSP Processor

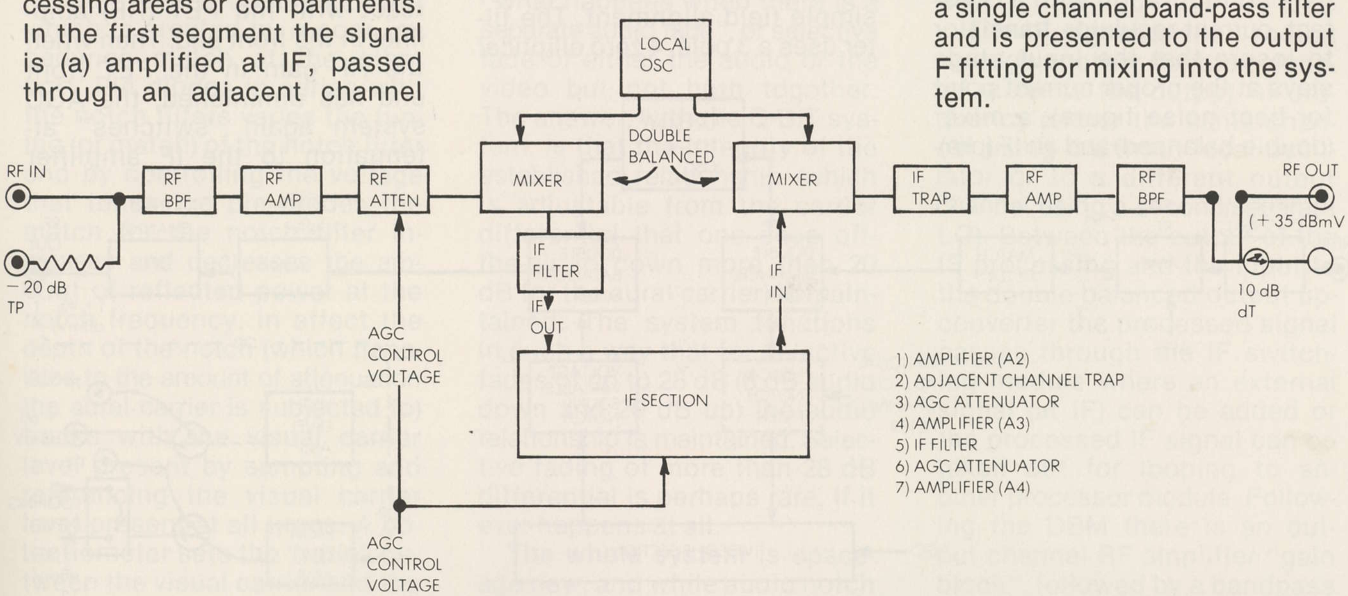
The RF input signal is applied to the processor through a single channel input filter and then to a low noise RF amplifier stage. The output of the RF amplifier goes through a pin diode attenuator which is connected to the AGC line; loss of the attenuator is controlled from the AGC voltage derived in the IF section. Following the AGC'd pin diode attenuator network, the RF signal is fed into a double balanced mixer. The DBM is also driven from a crystal controlled local oscillator signal source; the input or down converter utilizes the **same** LO signal for up conversion to the output RF channel if the input and output channels **are identical.** Where they differ, the local oscillator for the input converter operates separate from the local oscillator for the after-IF up converter

The IF segment of the system is broken into three distinct processing areas or compartments. In the first segment the signal is (a) amplified at IF, passed through an adjacent channel trapping network, an AGC'd pin diode attenuator network, and a second stage of IF amplification. IF amplifiers are descrete bi-polar transistor stages. In the second IF segment of the IF housing the signal is passed through a "master" IF (bandpass) filter, another AGC'd pin diode attenuator and a phase equalizer network. In the third and final IF section segment, the signal is passed through a final stage of IF amplification and then through a network which derives the AGC voltage through a detector network. A (CW) standby carrier system operating at IF is housed in the same compartment.

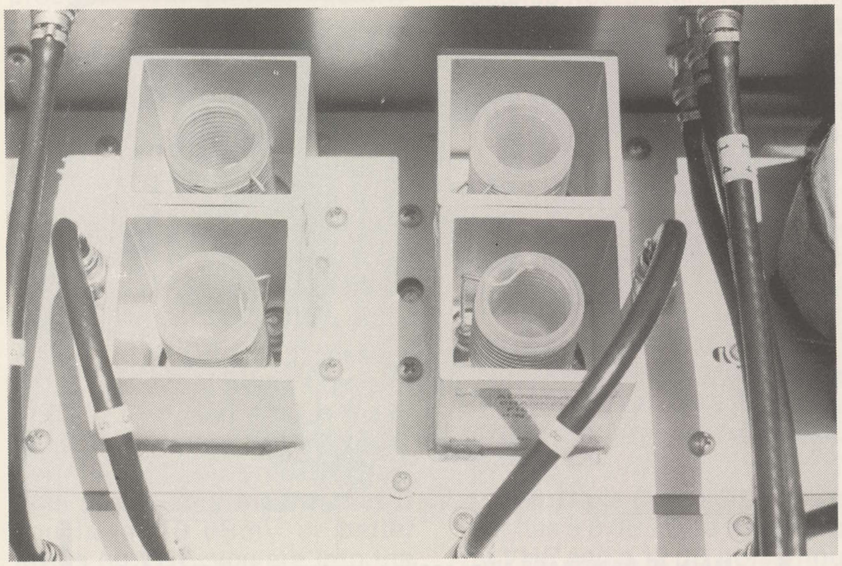
Finally the filtered, amplified and AGC'd IF signal is coupled into an upconverter section of the processor where either the local oscillator signal from the up converter is shared with the down converter or a second local oscillator (for different output than input cable carriage channel selection) mixes in another double balanced mixer to reach the appropriate output channel frequency. The on-channel signal is then amplified in a straight forward bi-polar RF amplifier stage, is fed through a single channel band-pass filter and is presented to the output F fitting for mixing into the system.



MAIN IF BANDPASS filter section (center) in TSP processor utilizes approach of descrete inductors and capacitors to create single channel bandpass.



TRIPLE CROWN TSP PROCESSOR



ADJACENT CHANNEL (nearest carriers) helical resonator filter section produces high-Q, stable trapping action.

We'll look at its actual operation in part two, in July.

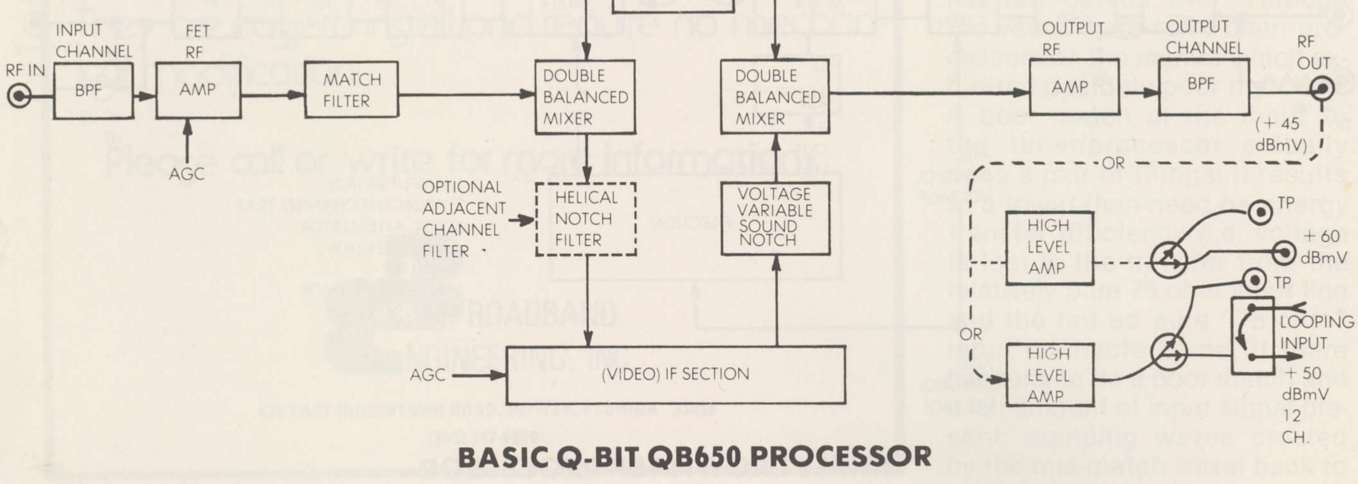
Circuit Design—QB-650 Processor

The QB-650 is apt to confuse many (if not most) people because it strikes out in a fair amount of new or virgin territory. Q-BIT comes by it honestly however, coming out of the 50 ohm space communications world.

The input to the QB-650 is through a single channel "VHF head"; a small printed circuit "card" which includes the input filter (3 pole, 2 zero elliptical design), an RF amplifier (a cascode design FET in grounded gate configuration with a constant current-regulator transistor to insure that the input stage stays at the proper current point for best noise figure), a mixer (double balanced) and an IF (pre)-amplifier (low noise design with its own bias transistor).

Output of the mixer/IF post amplifier is to the helical notch (adjacent channel) filter. The use of high Q helical resonators is not unknown in CATV gear, but they are not all that common either. The helical filter offers several design advantages which normal lumped-constant (capacitors and small inductors) do not; including very good phase linearity (resulting in very low delay distortion), a flat passband and perhaps most important to anyone who has tried to align adjacent channel (IF) filters in the field; (relatively) simple field alignment. The filter uses a 3 pole, 4 zero elliptical design with two notches (or zeroes) at or on each of the two **adjacent** carriers. One set is on 39.75 MHz (upper video carrier) while the other set is on 47.25 MHz (lower aural carrier). The large helical coils are wound on polystyrene forms and tuning capacitors are of the (expensive but stable) Johanson variety. The helical resonators have a Q greater than 500 and a notch depth in excess of 42 dB.

The video IF accomplishes 45-50 dB of gain in two "stages." The first stage is a 10 dB gain broadband descrete transistor stage that serves as a "buffer" between the adjacent channel filter (preceding) and the main IF gain stage; a Motorola MC 1349P integrated circuit amplifier. The MC 1349P is AGC'd and this particular IC has the ability to maintain the same match (i.e. impedances) regardless of the gain "setting" of the device. An IF interstage filter sits between the descrete transistor gain stage and the input to the IC; it has 3 poles and 2 zeroes (another elliptical filter) with trapping at 35.25/51.75 MHz (upper adjacent aural and lower adjacent visual respectively). A word about the AGC "sequence" is in order here. The first 30 dB of gain reduction for the processor takes place in the IF amplifier segment of the package. At this point the AGC voltage present begins to interreact with the FET (RF) amplifier in the front end. Then when the RF gain in the FET front end has diminished, the AGC system again "switches" attenuation to the IF amplifier

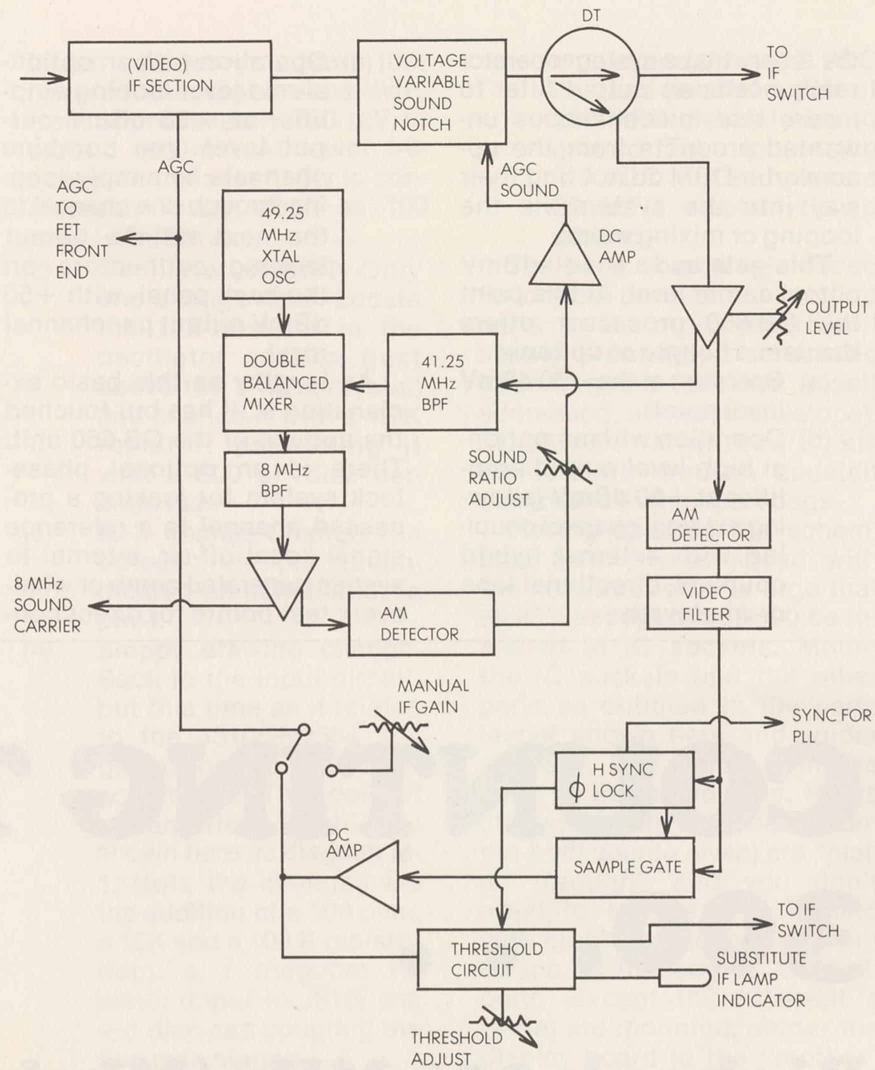


BASIC Q-BIT QB650 PROCESSOR

segment where another 15 dB of gain reduction remains. When all of the AGC range has "expired" a total of 85 dB of gain reduction has taken place.

The AGC system is a keyed (or delayed) AGC system. The keyed AGC "samples" the horizontal blanking pulse of the carrier being processed to derive the AGC reference. All of the keyed AGC circuits use COS/MOS IC devices. The primary advantage to the keyed AGC approach is that noise spikes and pulses do not "false" or "fool" the AGC detector circuit into thinking that a sudden increase in signal level has taken place. In the detection system the horizontal sync pulses are phase locked and the peak DC level of the detected (sync) pulses is sampled. A more detailed discussion of the keyed AGC system and the COS/MOS technology involved will be included in next month's Lab evaluation report on the unit.

The sound notch filter is another interesting approach to audio carrier control. At least two other headend signal processing packages on the market are now utilizing similar (but not identical or necessarily comparable) approaches. The concept is that a 90° hybrid splitter (also known as a **quadrature coupler**) is used as a two-port coupler that drives notch filters. One of the two ports is isolated and it absorbs power which is created by a poor impedance match at the other port. Pin diodes in series with the notch filters varies the tuning (or match) of the notch filter and by controlling the voltage that tunes the pin diodes the match for the notch filter increases and decreases the amount of reflected power at the notch frequency. In effect the depth of the notch (which translates to the amount of attenuation the aural carrier is subjected to) tracks with the visual carrier level present by sampling and referencing the visual carrier level present at all times. A potentiometer sets the "ratio" between the visual carrier and the aural carrier and once set the quadrature coupler/notch filter sees that this relationship (say "down 15 dB") is maintained.



Q-BIT QB650 VIDEO/SOUND LEVEL CONTROL

The question often asked about sound notch filters is "what happens when there is a separate audio fade", or selective fade of either the audio or the video but not both together. The answer, with the Q-BIT system, is that the integrity of the established relationship (which is adjustable from the carrier differential that one sees off-the-air to down more than 20 dB for the aural carrier) **is** maintained. The system functions in such a way that for selective fades of up to 28 dB (8 dB audio down and 20 dB up) the audio relationship is maintained. Selective fading of more than 28 dB differential is perhaps rare, if it ever happens at all.

The whole system is space-age new, and while audio notch filters have been employed before, we believe Q-BIT's use of the 90° quad coupler and pin diodes to absorb unwanted audio carrier level power is a first-timer application and rather neat.

The IF signal is then routed through another double balanced mixer to the output RF frequency (either the same channel using the input local oscillator or to a different output channel using a second/separate LO). Between the output of the IF processing and the input to the double balanced output up-converter the processed signal passes through the IF switching module where an external signal (at IF) can be added or the processed IF signal can be taken out for looping to another processor module. Following the DBM there is an output channel RF amplifier "gain block", followed by a bandpass filter. Q-BIT has chosen to build the output BPF into the unit on the theory that a system operator really needs an output filter to insure that miscellaneous unwanted products from the upconverter DBM do not find their way into the system via the looping or mixing mode.

This gets us to a +40 dBmV output carrier level. At this point the QB-650 processor offers the user a couple of **options:**

(a) Operation at the **+40 dBmV** level point;

(b) Operation with an optional high level output amplifier at **+60 dBmV** (allowing external channel coupling with external hybrid couplers, directional taps or whatever);

(c) Operation with an optional mid-level looping amplifier at **+50 dBmV** output level (you combine channels by simply looping through one channel to the next via the output looping connectors on the back panel, with +50 dBmV output per channel max).

As lengthy as this basic explanation is, it has but touched the surface of the QB-650 unit. There is an optional phaselock system for locking a processed channel to a reference signal (local off-air, internal to system generated comb or whatever); test points for direct connection of a garden variety VHF frequency counter to measure the (unmodulated) carrier frequencies in the processor; **optional** use of the helical resonator adjacent channel filter (if you **don't** have strong adjacents—such as UHF input—the cost of the hi-Q adjacent channel filter is eliminated); pre-amplifier powering from the processor and so on.

Both the Triple Crown TSP processor (operating on 8 in, 3 out) and the QB-650 processor (operating 6 in, 6 out) are now undergoing extensive tests at the **CATJ** Lab and this report will continue in the July issue.

COUNTING TO 300. . .

Richey's 300 MHz 'Mini-Freq' Counter Can Be Assembled In Your Spare Time

CATV's "MINI-FREQ" counter developed by Steve Richey and described in text.

Editor's Note:

The reader is referenced to pages 31 to 34 in the April (1977) issue of CATJ for part one of this two-part series. In the April issue Steve Richey describes a very newly developed, state-of-the-art frequency counter for CATV applications. Included in that first installment is a schematic of the unit.

Richey's intent with this unit is to make possible the home or system construction of a counter which is uniquely tailored to serve CATV frequency measurement needs. The unit is described with a parts list in April (see modifications to the parts list here) and certain perhaps hard-to-find-everywhere component parts are sourced in part one.

A complete kit of parts for construction of this frequency counter at this July's CCOS-77 (see separate preview **May**) will be available for CCOS-attendees. Richey advises that in about 2-3 hours time a person should be able to take a complete set of parts and have the counter "up and working"; allowing another hour's time for installing the unit into the metal case and getting the minor adjustments and debugging done.

Modifications To April

Sufficient additional experience with the "Mini-Freq" counter has been achieved since our April CATJ report that the first order of business is to **update** a couple of changes. The changes result in improved performance.

(1) **Input sensitivity**-Reference is made to the schematic diagram on page 34 for April (1977). **Remove** the two 1N914 diodes between the 1K input resistor and the SD-1006 first stage. **Next,** remove the 68 ohm resistor from the B plus to the collector of the SD1006 and replace it with a 6 turn choke on a 4B bead. **Third,** in series with the 68 ohm resistor appearing on the base of the SD-1006 add another 6 turn choke on a 4B bead. **Fourth,** place a 10 ohm resistor in series with the .01 disc cap on the emitter of the SD1006. **Fifth,** place a 22 pF ceramic disc cap from the emitter to ground of the SD1006. **Sixth** and lastly, place a 1K resistor from pin 1 of the 7490 IC (center, near top of diagram) to ground.

By making these modifications, the overall sensitivity of the "Mini-Freq" is improved across the spectrum. To a considerable extent, sensitivity is a function of input frequency with virtually any counter. In real hard numbers, at the 300 MHz upper limit of this particular counter you have just lowered the input sensitivity from approximately 700 mV to around 300 mV. At lower frequencies the sensitivity is considerably lower, such as 100 mV (+40 dBmV).

(2) **Oscillator stability**-Only one change here. Locate the 10K resistor in the oscillator section (just above the 1 MHz crystal) and change it with a 4.7K resistor, **paralleling it** with a 500 pF disc ceramic cap.

(3) **IC-3 change**-Change the output from pin 12 (indicated on schematic) **to** pin 4.

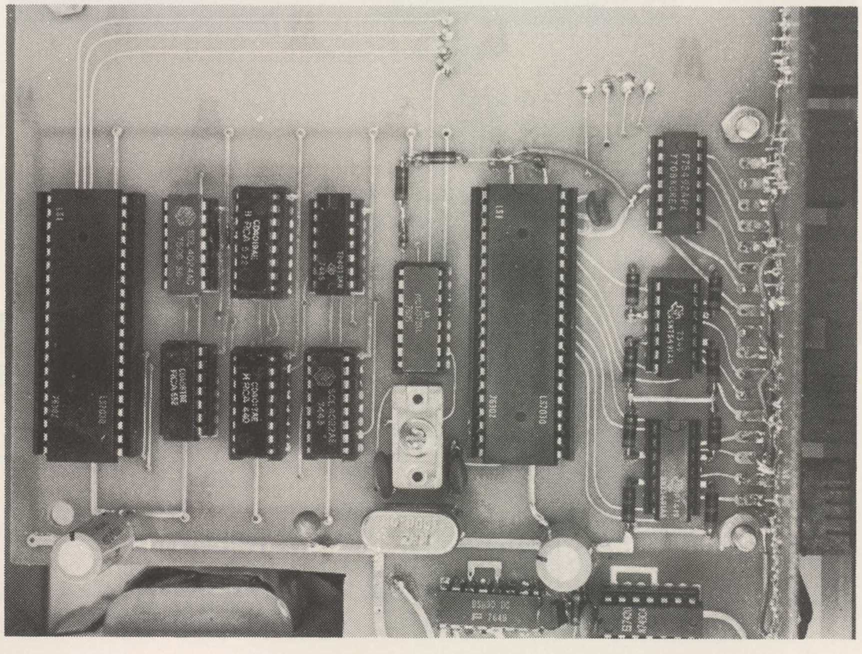
(4) **Sloppy drawing change**-Back to the input circuit, but this time as it relates to the J310/2N3564 stages at the top left of the schematic. The **correct** schematic for this is shown here as **diagram M-1.** Note the changes are the **addition of** a 100 ohm, a 10K and a 100 K resistor (top), a 1 megohm resistor (input to J310) and a .1 disc cap coupling the two gain stages.

(5) **Power supply glitches**-A more stable DC source for the IC's is the result when you do the following: locate the +12 VDC line and **parallel** a **pair** of 100 MFD electrolytics to ground. Then locate the +5 VDC line and **place** a 25 MFD electrolytic to ground.

The parts source referenced for critical parts or hard to find parts in the April report will supply a **corrected schematic** upon request (**enclose** a self addressed, stamped envelope). CCOS-77 "Mini-Freq" kit builders will find an updated schematic in their part bags.

Having updated the schematic, let's charge ahead with the construction. We urge that all IC's **except** the 95H90 be installed **in IC sockets.** Mount the IC sockets and the other parts as outlined in the parts layout shown here and solder all parts into place from the **back of the board only.** Holes (if you obtain the board from the April source given) are "plated through" and you don't need to be messing around with globby solder on the front or top of the board! After all parts (except the IC's-**wait** a while) are mounted, solder the display board to the "mother" (that's respectful) board. Using great care with heat (keep it around 25 watts and keep the soldering tip on the pin only

FND500 LED DISPLAYS mount on right-angle mounted sub-board that attaches to the main "mother board" and places displays directly behind cut out in cabinet.



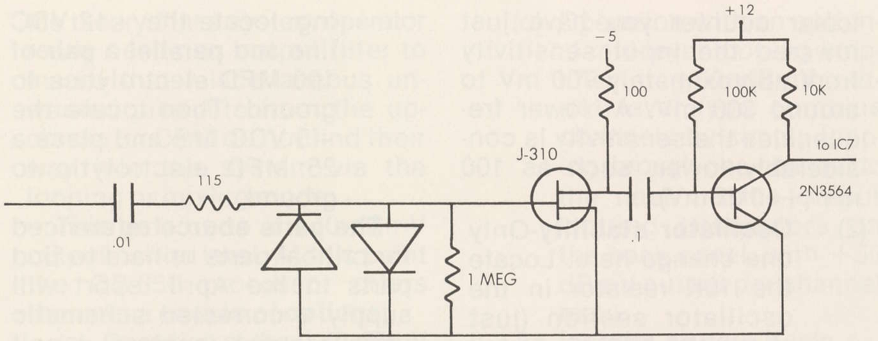
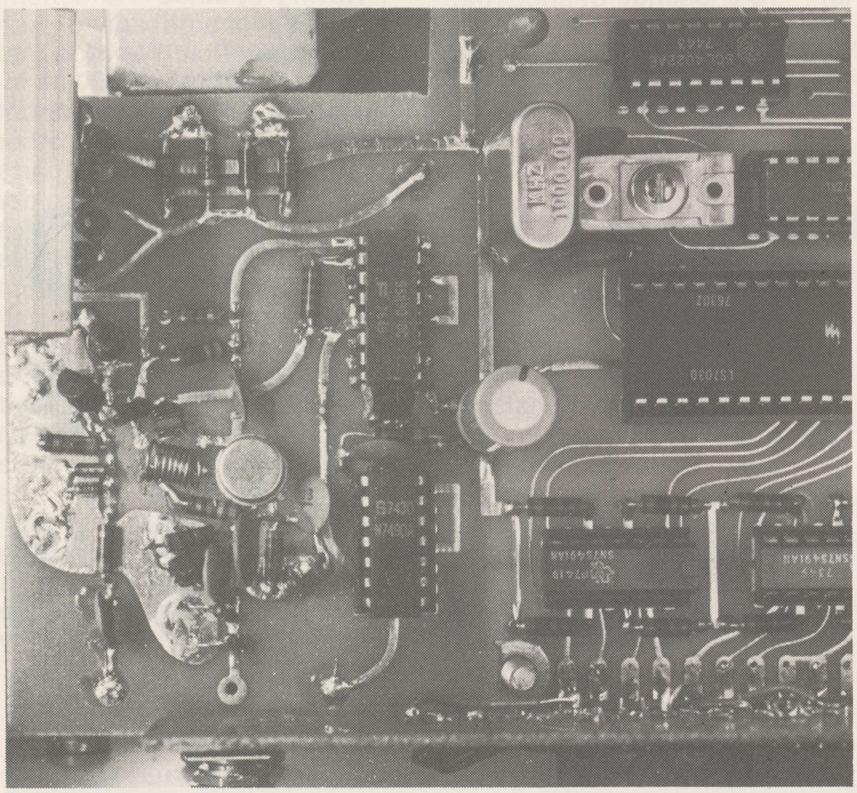


DIAGRAM M-1



long enough to flow-solder) connect up the 95H90. Now put the board into the case (see photos) and connect the input "F" fitting and the 2 pole, 3 position switch. **Note:** Use **very short** leads (as short as practical) in wiring up the switch and the input fitting.

When everything is mounted into place, including the 5 volt regulator mounted on the case itself, turn the unit on and measure the voltage at the 5 and 12 volt regulators. Make sure they are working properly, then **turn off the unit** and insert the 7490 IC. (Note: Never-ever-plug in and take out IC's with the voltage on the unit).

Input with your sweep generator and check the flatness of the input amplifier section. The spec should be flat to within +/- 1 dB from 5 through 300 MHz (pin 12 on the 7490, tieing back to the 2 pole 3 position switch is the output and that's where you sample the sweep after amplification). Now switch your generator to the CW mode and input at 100 MHz or thereabouts. Look at the output with a spectrum analyzer or with a scope (and detector) at TP1 (see lower left, diagram M-2). You should have a square wave output at 1 MHz or 1 cycle per microsecond on your scope. If you do not have these results, back up to your pin 1 input on the 7490 and look for 10 cycles at the input.

When you have completed this step, insert the 4572 (IC6) and hook up your scope to test point 2 (TP2). TP2 is located

POWER SUPPLY

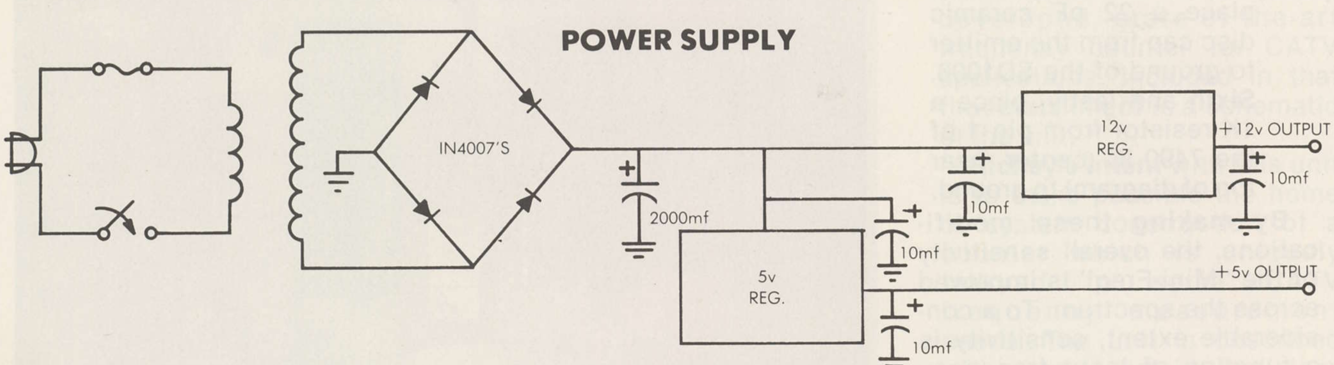


DIAGRAM M-3

just to the left of the 5K resistor at the upper left hand corner of IC1 (7030) near the center of the board (diagram M-2). Adjust your scope for a display of 1 cycle per microsecond or 1 MHz. With power off, insert the balance of the IC's.

When power is re-applied, the display's should light, briefly, and then go to a single zero. By changing the rotary switch (S1A/B) the decimal point location should shift about (from far left to 3 places right of far left).

PARTS LIST ADDENDUM

The following parts have been added, or replace an earlier designated part, or were inadvertently left off the April edition parts list for the "Mini-Freq" counter.

Qty.	Item	Note
1	**4019**	**(IC-5) (a)**
5	10 MFD tantalum caps	
2	100 MFD electrolytic caps	
1	25 MFD electrolytic cap	
1	500 pF disc ceramic	
1	10 ohm resistor	
1	100 ohm resistor	
1	1K resistor	
1	10K resistor	
1	100K resistor	
1	1 Meg-ohm resistor	
1	4.7K resistor	
1	.1 MFD disc ceramic	
1	22 pF disc ceramic	
1	F-61 chassis connector	
1	Radio Shack RS 270-299 enclosure	
3	2" stud spacers, 10-32	
3	10-32 x 2.25" bolts	
3	10-32 nuts	

(a-a source for hard to find parts in bold face [including those listed in April] is: **Electronic Research & Development, 5611 NW 37th, Oklahoma City, Ok. 73122.**)

Temporarily remove the jumper from the right hand side of IC1 (diagram M-2) and apply 12 VDC to the "A" point where the jumper came off. All of the digits should turn to "8". If they do, dis-connect the 12 volts and replace the jumper.

Now apply a 100 MHz signal (from signal generator, sweep in CW mode, or some other source of suitable input voltage) and the unit should indicate, in the .01 position, 100.XXX. In the .1 position it should indicate 00.XXXX and in the 1 second division it should read direct.

Trouble?

If there are problems not discussed here, in the alignment procedure and fire-up steps, check the following:

(1) There should be approximately 10 kHz of signal present on pin 39 of IC1. If not, check for a bum solder connection and check the 100 pF capacitor.

(2) Check for signal presence on pins 21 and 22 of IC1. If none is present, IC9 or IC8 may be on the fritz.

(3) Check for signal of one cycle per second or 10 Hz or 100 Hz (varies with position of time-select switch) at pin 6 of IC7. If none is present, go back to pin 3 of IC1. IC-7 or IC-4 can cause this problem.

(4) When all else fails, you might call Mark Miller at (405) 681-5343 and ask for help!

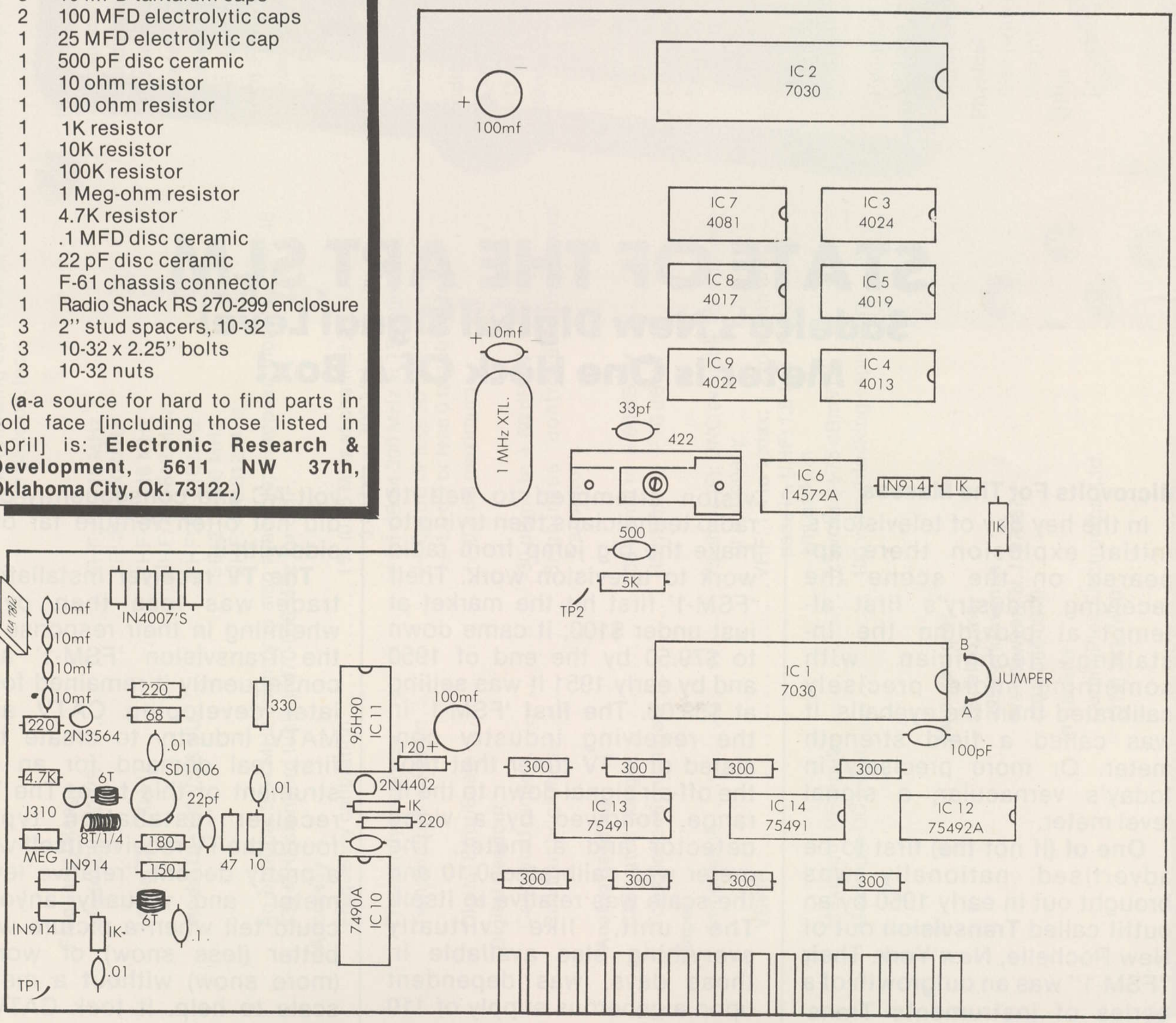
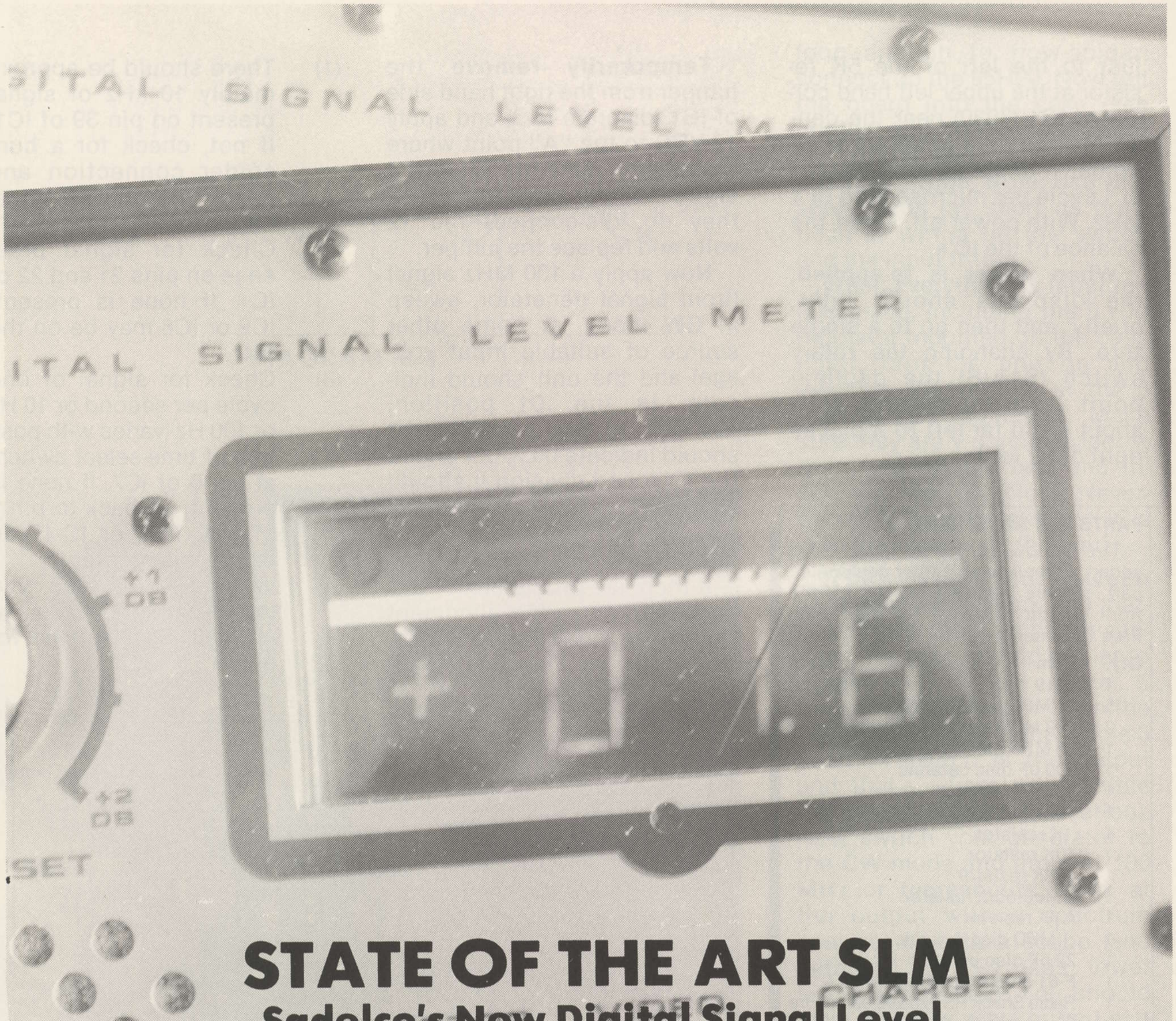


DIAGRAM M-2



STATE OF THE ART SLM

Sadelco's New Digital Signal Level Meter Is One Heck Of A Box!

Microvolts For The Masses

In the hey day of television's initial explosion there appeared on the scene the receiving industry's first attempt at providing the installing technician with something more precisely calibrated than the eyeballs. It was called a field strength meter. Or more precisely in today's vernacular, a signal level meter.

One of (if not **the**) first to be advertised nationally was brought out in early 1950 by an outfit called **Transvision** out of New Rochelle, New York. Their "FSM-1" was an outgrowth of a series of instruments Transvision attempted to sell to radio technicians then trying to make the big jump from radio work to television work. Their 'FSM-1' first hit the market at just under $100; it came down to $79.50 by the end of 1950 and by early 1951 it was selling at $59.00. The **first** 'FSM-1' in the receiving industry consisted of a TV tuner that took the off-air signal down to the IF range, followed by a video detector and a meter. The meter was calibrated 0-10 and the scale was relative to itself. The unit, like virtually everything else available in those days, was dependent upon a generous supply of 110 volt AC and consequently one did not often venture far outside with it.

The TV receiver installation trade was less than overwhelming in their response to the Transvision 'FSM-1' and consequently it remained for a later developing CATV and MATV industry to create the first real demand for an instrument of this type. The TV receiver installation types found the TV receiver **itself** was a pretty decent "relative level meter" and virtually anyone could tell when a picture was better (less snow) or worse (more snow) with**out** a meter scale to help. It took CATV's

SADELCO DL-100 FAMILY METER SPECIFICATIONS

The following **abbreviated specs** pertain to the DL-100 series of instruments ′rom Sadelco, Inc.

Frequency Range

Model DL-100-VS	VHF: 54-216 MHz SB: 216-300 MHz
Model DL-100-VU	VHF: 54-216 MHz UHF: 470-812 MHz
Model DL-100 VS & VU	VHF: 54-216 MHz SB: 216-300 MHz UHF: 470-812 MHz

An optional 5-54 MHz adaptor is also available; European models cover 48-230 MHz standard tuning, 470-856 MHz for UHF.

Accuracy

Frequency calibration	1% (0.55 MHz at channel 2; 3.0 MHz at 300 MHz)
Frequency response	+/- 1 dB 54-300 MHz at 75 degrees F
Temperature variation	+/- 0.5 dB or less 30 to 90 degrees F +/- 1.0 dB or less 0 to 100 degrees F
Digital Error/Scale	+/- 0.3 dB maximum

Digital Readout

Calibrated range	-30 dBmV to + 60 dBmV
Readout brightness	Brightness controlled by photo transistor

Analog Readout

Calibrated Range	-30 dBmV to + 60 dBmV
Total deflection range	-40 dBmV to + 70 dBmV

Input

Impedance	75 ohms (F); BNC available for Europe or optionally
VSWR	VHF: 1.4 to 1 max; 1.2 to 1 with any pads in. UHF: 1.8 to 1; 1.4 to 1 with any pads in
Maximum RF input	5.5 volts (+75 dBmV)
Maximum DC input	100 volts (blocking capacitor)

Manufacturer

Sadelco, Inc.
299 Park Avenue
Weehawken, N.J. 07087
(201) 866-0912

In Canada

Comm-Plex Electronics, Ltd.
(514) 341-7440

IF

Frequency	42.5 MHz
Bandwidth	0.5 MHz at 3 dB points, typical
Adjacent channel reject	33 dB nearest carrier

Detector

Pulse peak mode

(a) Sound carrier (CW)	reads RMS
(b) Picture carrier	reads RMS of horizontal sync pulse

Quasi-peak mode

(a) Sound carrier (CW)	reads RMS
(b) Picture carrier	response slopes from sync pulse by 0.7 dB +/- 0.2 dB at full scale to 1.3 dB +/- 0.3 dB at bottom of scale
Signal/noise mode	reads RMS value at 4 MHz bandwidth white noise (5 MHz for Europe)

Audio

Display	front panel speaker
Operation	slide switch on/off

Video Output Jack

Purpose	for scope, recorder, summation receiver drive
Signal present	0.36 millivolts positive polarity at full scale of meter display

X-Y Recorder Jack

Purpose	Analog meter voltage take-off for recording, external meter monitoring
Signal present	+0.65 volts at full scale, into 100K ohms

Power

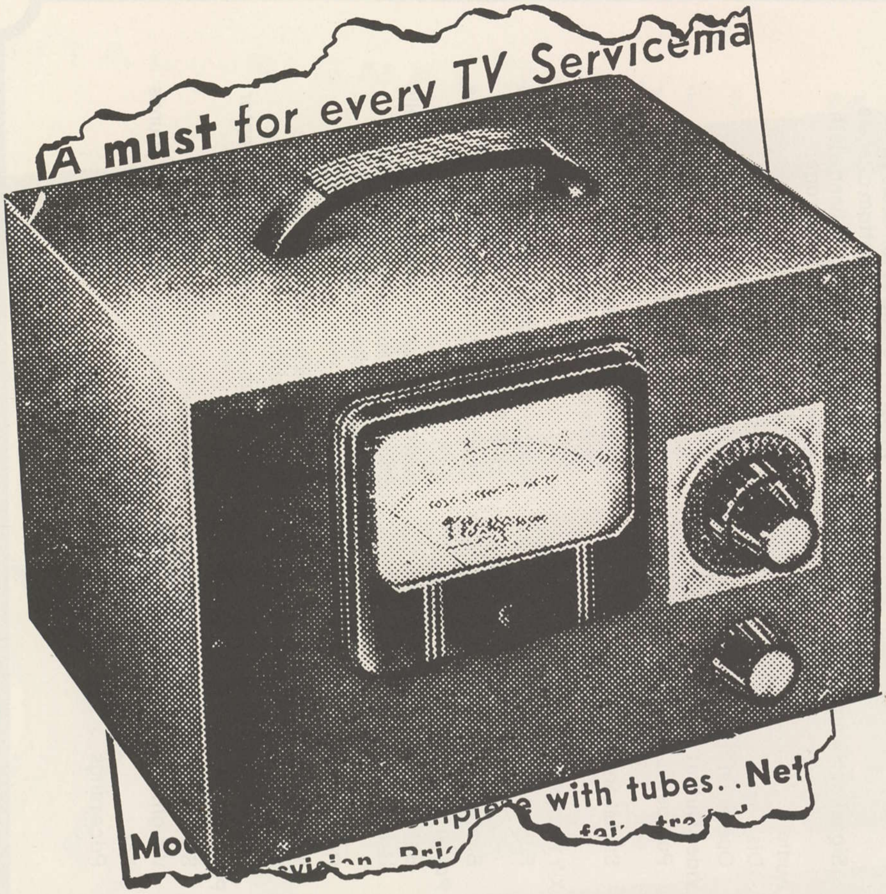
Battery	five internal sub-C nickel-cadmium cells
Use period	4 hours continuous at 70 degrees F before recharging required
Recharge cycle period	12 hours
Voltage indicator display	LED flashes twenty minutes before voltage drop
AC operation	continuous with trickle charge adaptor

Physical

Size (with carrying case)	4-1/4 x 8 x 12 inches
Weight	with batteries, case, AC adaptor 8 pounds

Other

Price range	$900 region



POSSIBLY THE FIRST—the 'Transvision' FSM-1 meter was offered to the television receiver installation industry in 1950.

cascading demands (i.e. amplifiers in series) with relatively precise demands for minimum and maximum signal level voltages to create a need for an instrument that read real-world microvolts or millivolts. But even these first-for-CATV instruments found the Transvision approach (a TV tuner with a detector and a meter scale) adequate for early system demands. If there was a technical advance in **CATV** meters of the early era, it was the ability to operate a meter from a portable (i.e. battery) supply that had the most far ranging effects on the way America received television. For with battery operation came the ability for early CATV pioneers to seek out remote antenna sites; locations where television signals were stronger, or more stable, or less riddled with interference . . .or all three. And from whence remotely located home viewers would receive better signals, and for which such viewers would be willing to cough up regular monthly fees for "antenna service". The "batteryization" of signal level meters was an important step for CATV and the industry that has grown up around the concept.

For all practical purposes, that single development was one of the last **major** developments for FSM/SLM instruments for nearly 25 years. To be sure, there came better meters, more refined meters, easier to operate meters and eventually even transistorized meters. But none of the later developments changed the **basic concept** all that very much and the changes that did come were largely dictated by the parallel evolution of the CATV plant itself. The most recent series of SLM/FSM instruments pretty much follow the same basic 'Transvision' approach to signal measurements:

(1) **Select** the channel or signal you want (a tuner),
(2) **Amplify** the signal (in an RF or, RF and IF, or IF alone format),
(3) **Detect** it for meter scale reading purposes,
(4) And, **display** it on an analog meter.

Because there has in reality been very little change in the instruments that have followed the 'Transvision' unit, there has also been only minor changes in the way we as an industry **use** the instrument. We read:

(1) Relative signal levels;
(2) In some instruments, absolute signal levels;
(3) Gain blocks;
(4) Loss blocks;
(5) And time spatial variations in relative or absolute signal levels.

Beyond these applications, the basic SLM/FSM has seen few if any **major** attempts at expansion of the utility of the instrument. Until quite recently, that is.

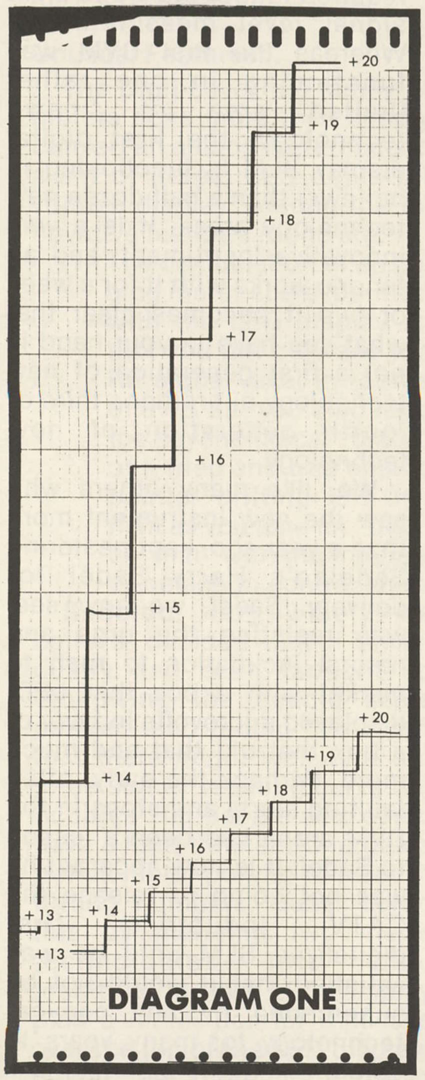
To be sure, there have been instruments brought to the market which combined the signal level meter with a small portable television receiver (this was done most recently by an Alabama firm in 1972) and there has been the development of the visual signal level meter or spectrum analyzer at relatively speaking 'low prices' (i.e. the VSM-1).

Two recently announced signal level meters **may** signal the first real departure from a tradition established (if not successfully at the time) back in 1950 by 'Transvision'. We'll look at one of these here this month; the Sadelco Digit Level 100. We'll also take a brief look at the other new approach to SLM's; the Avantek SL-300.

Digits Are In. . .

The basic analog (meaning meter-scale-face-display) meter has been with us since long before 'Transvision' brought out their 'FSM-1'. The shortcomings of analog displays are well known (see **CATJ** for October, November, December 1974 and January 1975). The meter movement **itself** is not exactly linear in its display range, and this non-linear problem becomes more pronounced when the non-linear detector(s) that create the display voltage are added to the equation. This has always resulted in **"absolute** level **accuracy"** errors; errors independent of frequency (i.e. tuner) errors. The display meter movement has its own "tracking" errors which tend to magnify as the voltage it is displaying is stepped in 1 dB voltage steps up and down the scale. **Diagram one** illustrates. This is a chart recording created by applying a constant-level signal calibrator signal source to the input jack on a popular brand FSM/SLM. Then the voltage that drives the display meter was "borrowed"

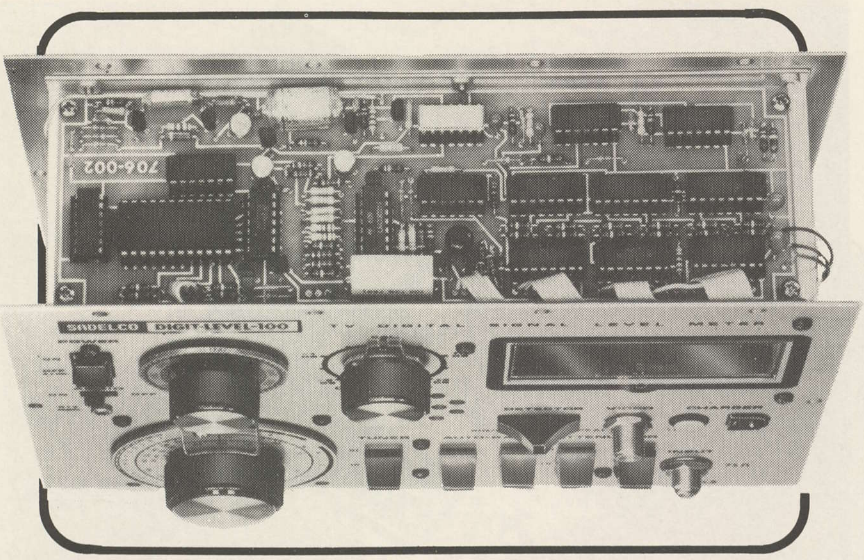
Uneven detector efficiency is illustrated by recording output of X-Y type recorder jack on popular brand FSM/SLM on Heath SR-206 dual channel chart recorder (top/left stair-step recording). Voltage output from detector driving X-Y drive jack varies over 233% range for same 1 dB step equivilents (between + 15/ + 14 1 dB step).



to drive the recording head on the Heath SR-206 recorder. The recorder paper-records what it sees, on the linear chart paper roll. In this case the RF signal voltage was stepped down in precision 1 dB levels at the signal generator source but as you can see the resulting drive voltage to the FSM/SLM display meter was anything but in equal-steps. It **is** a linear/log type of stepping (i.e. if plotted it does fit a reasonably linear 'curved line' but the steps are far from equi-distant apart when recorded in this manner). This is not an important exercise for the present, except that it illustrates rather graphically the type of detector-originated voltage steps the poor FSM/SLM meter designer must contend with when he is attempting to create a display-meter-scale with an analog meter display device. Given this illustration, you can visualize on your own the *typical CATV FSM/SLM meter* with a gradual bunching of the analog display scale divisions at one end of the scale (typically at the low end of the 15-20 dB analog meter face).

Given this difficulty with **any** analog display scale device, it is not any particular wonder that the people who design and build signal level meter reading devices would be very interested in getting away from this stumbling block to design perfection, if there happened to be a way to do so. The wonderful world of digital electronics seems to offer such an opportunity, to correct at least part of the problem.

We say "part of the problem" because as you will recall the display accuracy for any FSM/SLM device is largely a **combination** of problems. The analog meter **display** is but a part of that problem. The **detector** device, and its own linearity shortcomings, is another almost equal in magnitude problem. We'll *come back to that portion of* the equation shortly.



Anyone who has been shopping for a "simple" volt meter or current meter or multi-tester of late is well aware that LED type digital displays are "in". It is not simply a rush to a new display technology that is causing all of the basic service shop instruments to abandon the time-honored analog format. The two new meters for CATV, the Sadelco Digit Level 100 and the Avantek SL-300 are into LED digits as well. Neither is first in this area, nor do the digits do the same thing in both meters.

Phillips tried a digital RF level indicator system in an European meter some years ago. It was a complex system with servo motors and between the ill-advised marriage of electronics (digital display) and mechanics (servo motors) the Phillips meter failed rather badly and was subsequently taken off the market in Europe. Lugging around enough battery supply to make the servo motors perform was another problem; the state of the art went backward into the 'Transvision' era with the **need** for a handy 110 VAC output (or in the case of Europe, a 220/240 VAC outlet!).

Sadelco made it work, as we shall see. This would be a good point to note that whereas the Sadelco DL-100 meter uses digital displays to 'announce' the RF **signal levels** present, the Avantek SL-300 uses (three) digits to 'announce' the **frequency** of the meter. The SL-300 still relies on the analog meter for signal level measurements; the digits replace the channel or frequency meter display portion of the instrument. The SL-300 displays the frequency you are tuned to with 1 MHz accuracy, making it sort of a poor man's frequency counter. Even here, this innovation is not entirely unique. Another European manufacturer (Wisi) offers a digital frequency readout like the SL-300, and they also offer a digital front-end-attenuator readout as well (thereby telling you the amount of attenuation you have ahead of the unit).

Digital displays abound in the world these days and **if** there was **once** a **uniqueness** in electronic measurements with digital displays, it is an era that has passed by for the most part. For a digital-approach meter to be revolutionary these days the digits really need to do something that analog displays cannot do; either better, or faster, or more accurately. The DVM (or digital volt meter) is an excellent case in point. If you are into IC devices and you have precise voltage requirements (as many IC devices do have) whereby the difference between 4.7 and 4.8 volts applied makes a bunch of difference in whether the IC works properly or not, the DVM is almost a necessity. It is some mean trick to make a typical analog volt meter accurately display the difference between 4.7 and 4.8 volts; it is no trick at all with a DVM.

DVM Is Not SLM. . .

Getting an LED to properly "count", "latch" and "display" with a straight AC or DC voltage is not much of a problem anymore; but you can bet for the **first guy** to perfect the scheme it took some ingenious application of new technology. The "first-timer" problem for the first truly digital signal level meter for the measurement of RF carrier levels in the 5-300 and 470-812 MHz ranges was also something else again.

The first "showing" of this meter was in Dallas at the industry's annual clambake in 1976. First deliveries were more than nine months later; an indication of the nearly two years of constant, dedicated raw engineering that was required to turn the digits on in signal level measurements. Whereas the first DVM was functioning in one rather limited area of "new" technology, the first digital display SLM is functioning in no fewer than a half dozen new technology areas. It is a very innovative instrument, and after one works with it for a week or two it becomes clear that what you have in your hand is not a first generation of new technology but rather a third or fourth generation of new technology.

We, like many others who saw the new instrument more than a year ago, kept pestering Sadelco's Harry Sadel for delivery. Sadel, we now see, was resisting the urge and natural inclination to **rush to market** with a box that LED-displayed microvolts in favor of a box that did that **and** much more. Perhaps the early, often faulting starts and stops in the DVM arena had been a lesson to Sadel; it is now apparent he was not going to release the CATV industry's first digitalized SLM until he was satisfied that it would not be superceded by any copycat technology for many years to come.

Sadel was apparently not going to be satisfied with the release of any instrument that traded off digital display technology for some new burden; such as excess battery drain (resulting in another trade off. . .either short use cycles or a bigger, heavier, battery supply), or, complex operating procedures. Consequently what you have in the DL-100 family of SLMs is an extremely well thought out instrument that should offer Sadelco's meter building competition few opportunities for major improvements for many years to come. The DL-100 instruments are, as we shall now see, a major change in the methodology of measuring voltage levels with a frequency selective RF voltmeter and it offers the user the opportunity to change (and improve) the way he sets up and maintains his CATV headend, or plant.

Unusual Features. . .

The Digit-Level 100 family of meters does more than simply convert an analog meter face to a set of (three) LED digits for voltage display. Among the innovative features found are:

(1) **The combination of** an analog meter scale (pointer) **with** the LED display so that you not only see the RF signal level in tenths of a dB but you also have the psychological "brace" of a tried and true analog pointer drifting left and right as you tune for "max" or "min" with the frequency selection control knob.

Sadelco, very wisely we believe, decided that if an industry had been brought up "following the needle scale pointer" and tuning "for max" that there might well turn out to be some "learning curve difficulties" for people who could have a hard time shifting gears from a meter pointer to a set of flitting numbers. Sadel cured this by **marrying** two meter technologies into one; resulting in the LED display **plus** a meter pointer that lays over the top of the LED display. If **you** feel more comfortable tuning for maximum "right-hand-side" deflection of an analog scale pointer, you've still got **that** crutch. Then you simply look "through" the pointer and there is your actual level displayed on the LED's.

(2) **An "under range" and an "over range" scale display system.**

Let's say you plug in an unknown signal and with the particular attenuator settings you have slid into place there is no LED display or movement of the analog pointer scale. Now you could simply glance at the analog pointer and if the pointer was resting far to the left you would know instinctively that you had too much attenuator (i.e. not enough signal) to make the meter display. And take the appropriate amount of attenuation out of the meter front end. Or vice-versa if the analog display pointer was resting against the peg to the right. Sadelco updated this process by building into the meter display a **pair** of LED lights; one is an **"under range"** light and the other is an **"over range"** light. If the signal level is too low to fit the particular signal reading range chosen by the attenuators, the "under range" LED flashes on and off. And the same with the "over range" light. This instantly alerts the meter user that he must take out or put in additional front end attenuation.

(3) **LED Indication of picture carrier tuning.**

Once you are into LED displays it is hard to stop being imaginative! How many times have you tuned in say channel 3 aural and because of the narrowly-spaced 1.5 MHz frequency difference between 3A and the intended 4 visual made a reading of 3A when you really wanted 4V all along? That can't happen with the DL-100 units because there is another LED that lights with the letter "P" whenever you are tuned into a video modulated carrier.

(4) **LED Indication of low-battery condition.**

There are many other battery-status indicators in the marketplace. So the uniqueness of this feature might be argued, but it is in place none the less. When the battery supply voltage reaches a "trigger point" a fourth front panel LED begins to flash. It is imprinted with the letter "B" and that means that your battery is reaching the point where a fresh (re) charge is required.

(5) **It is possibly redundant to make note of the 0.1 dB readout display steps of the DL-100 units.**

The LED display is complete with three digits, a period or decimal point between the second from the left and third from the left number displayed, and a "+" or "-" indicator. The actual level present is in tenths of a decibel (dB).

(6) **There are three (switch selectable) detector "schemes" built into the instrument.**

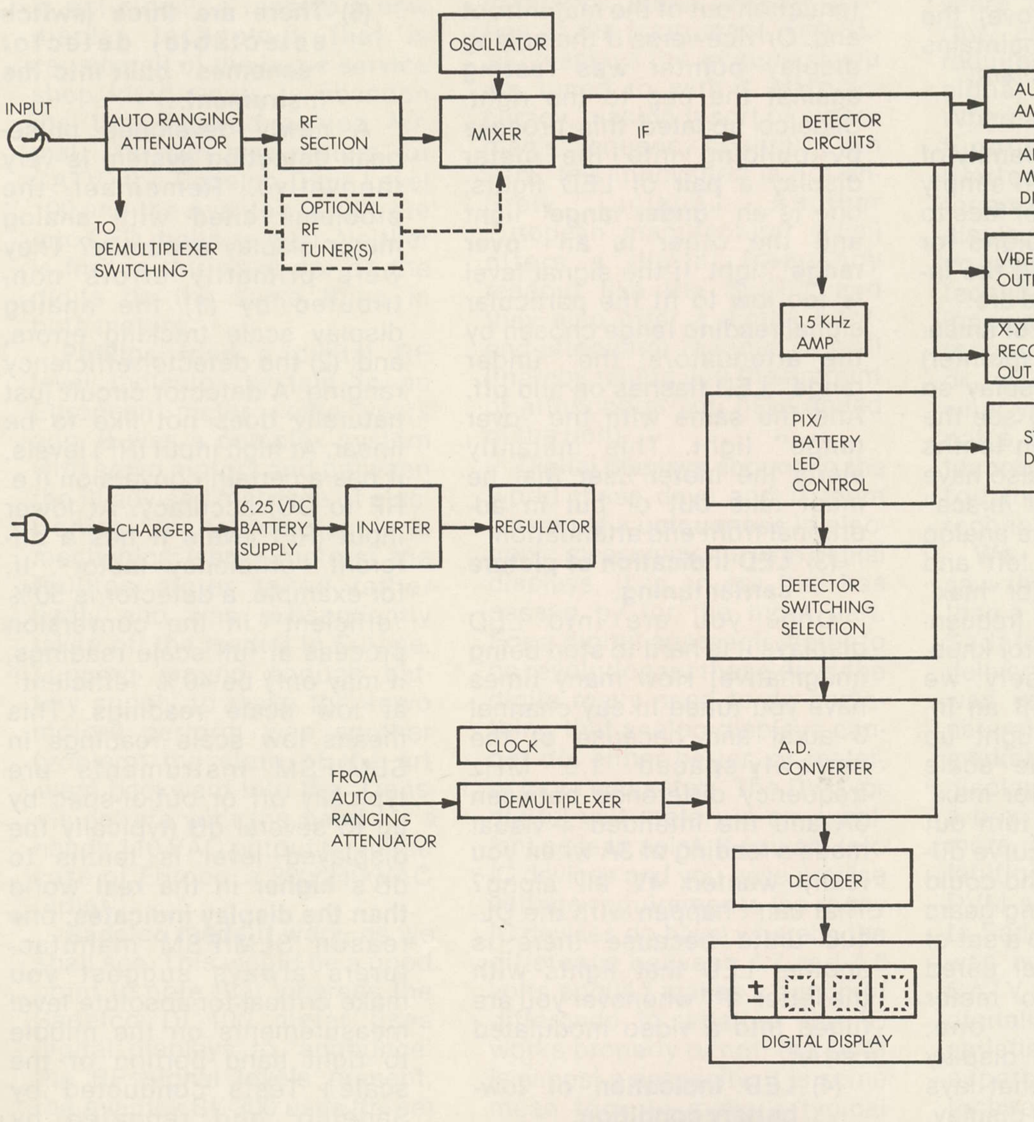
A newly developed pulse-peak detection system is very innovative. Remember the problems cited with analog meter display accuracy? They were primarily errors contributed by (1) the analog display scale tracking errors, and, (2) the detector efficiency ranging. A detector circuit just naturally does not like to be linear. At high input (RF) levels, it has a certain conversion (i.e. RF to DC) accuracy. At lower input (RF) levels it has a different "efficiency factor". If, for example, a detector is 50% "efficient" in the conversion process at full scale readings, it may only be 40% "efficient" at low scale readings. This means low scale readings in SLM/FSM instruments are typically off or out-of-spec by up to several dB (typically the displayed level is tenths to dB's **higher** in the **real** world **than the display indicates;** one reason SLM/FSM manufacturers always suggest you make critical-for-absolute level measurements on the middle to right hand portion of the scale.) Tests conducted by Sadelco, and repeated by CATJ's Lab indicates that when the DL-100 unit is operating in the "pulse peak detection" mode the amount of absolute-level **error** contributed **by the detector** is never over 0.1 dB across the 20 dB display "window" of a particular attenuator setting. By comparison, other units often have detector efficiency fall-off of 2.5 dB or greater on the low end of a display scale.

The middle or second position for the multi-mode detector is a "quasi-peak" detection system; the same circuit found in the Sadelco FS-3SC SLM (see **CATJ** for January 1975). It was, when first announced by Sadelco, an apparent improvement in the "peak reading" detection systems found in most CATV SLM meters and by including it in the DL-100 units the system operator can **switch** back and forth with the new pulse peak detection system to ascertain just how far out of spec he may **have been** setting his amplifiers **in the past**.

The third or far left position for the multi-mode detector is a "noise detection" scheme. This allows you to make quick and accurate to within 0.5 dB signal-to-noise readings with**out** the need to apply any correction factor for the 4 MHz noise product bandwidth. A similar scheme is found in the Mid State SLIM meter.

First Timer Impressions. . .

It does take a little bit of time to get used to the "flitting digits". The first impression is "gee, that is neat" as you watch the LED display do its thing. But as we tuned for max we found (after twenty-five years of tuning for max with an analog meter pointer) that our eyes were glued to the analog pointer, **not** the LEDs, during the tuning process. This mental procedure lasted for a few hours of initial use, and **then** we found ourselves using the analog pointer less and less; to the eventual point that we simply ignored its presence. We suspect others with a long history of analog meters will do the same thing. We also suspect that somebody who has never been exposed to an analog meter will never even notice the analog pointer on the face. If you start out with**out** any bad "analog" habits the LED displayed num-



bers are certainly quicker and more accurate to read.

Hooking up the Lab's Heath SR-206 chart recorder to the X-Y recorder output jack (this provides +0.65 volts DC to drive a recorder with a full scale reading) we ran through our "stair-step" 1 dB detector check-out test shown in diagram one. This is reshown here in **diagram three.** A constant level signal source is externally stepped from a full scale reading (+20 dBmV in our case) down some 34 dB in 1 dB steps. The external attenuator was a $200 type laboratory model attenuator. By monitoring and recording the X-Y recorder output voltage with the SR-206, we could monitor the actual **detector efficiency** in the pulse peak mode (or any of the three modes). Note two things in diagram three. Each time we reach a "9 dB attenuation" point with the external 10 dB (1 dB step) attenuator, there is a **"glitch"** or out-of-spec error. This (it turned out) was **not** a problem within the DL-100 but a problem built into our $200 attenuator(!). We've since returned it to the respective manufacturer for repair.

(There is a message here; perhaps a pair of messages. This particular attenuator was far too expensive to have this type of "glitch". We doubt we would have caught the problem, at least as quickly as we did, without the tenths of a dB accuracy or display ranging the DL-100 offers.)

As you can see in diagram three, for the first 20 dB of display the detector is exceedingly accurate. For the next 14 dB of output "range" the detector efficiency falls off on a curve that indicates lower and lower detector efficiency.

The LED display range for any particular attenuator setting is the typical 20 dB range. For example, if you are measuring between 0 dBmV and +20 dBmV, the **under range** flashing LED **begins to flash** when the level indicated falls below -0.2 to 0.3 dBmV. On the opposite end of the scale the **over range** LED **begins**

Chart illustrates measurements made with Sadelco DL-100 meter by measuring the voltage output at the X-Y recorder jack (after detector) and recording same on Heath SR-206 chart recorder. Signal source was stepped downwards in 1 dB level while X-Y recorder voltage output was recorded. Note appearance of noise in X-Y recorder voltage in lower steps. "9 dB attenuator" step error is explained in text.

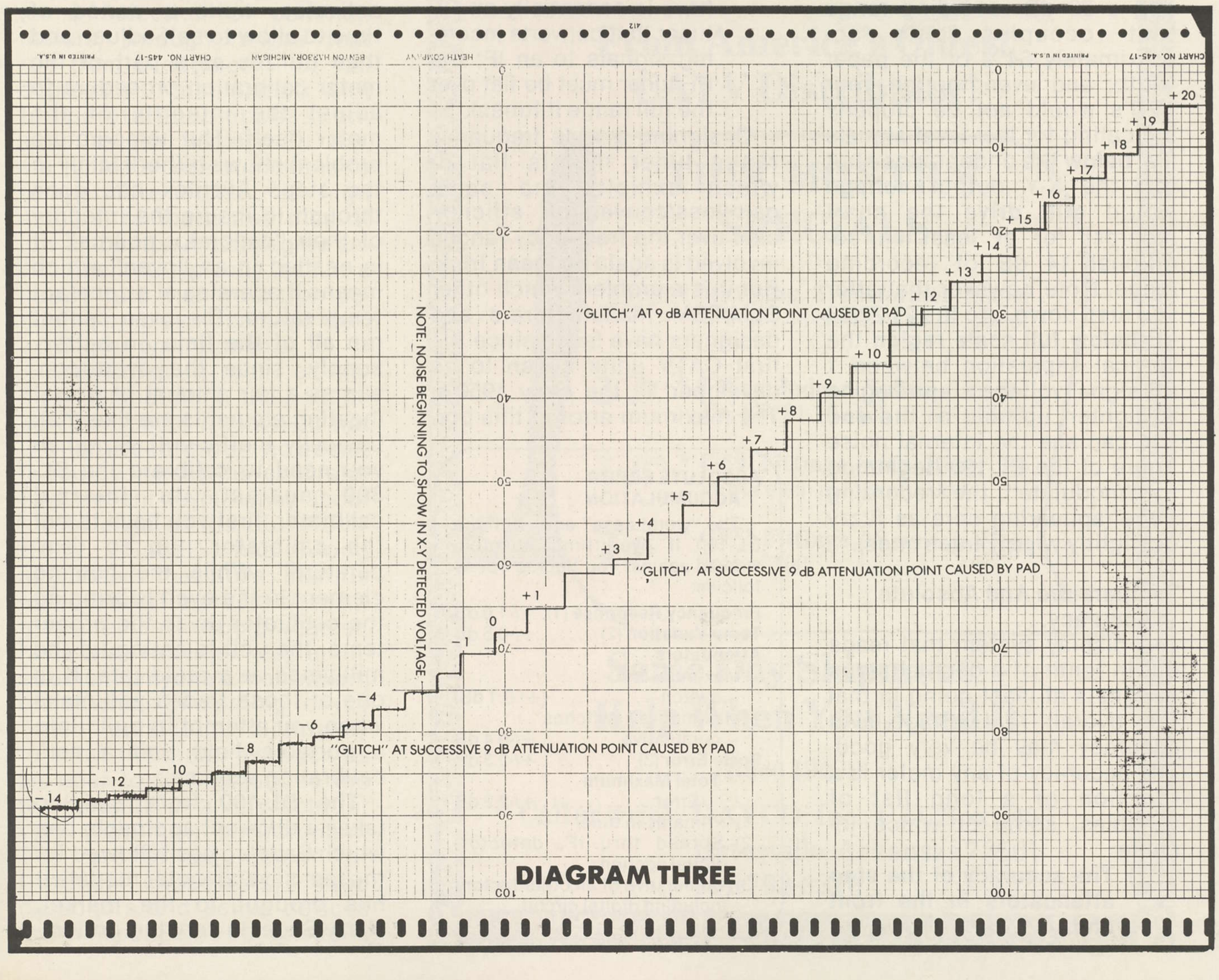


DIAGRAM THREE

flashing when you hit +20.2 or 20.3 dBmV. There are still useful readings (meaning accurately displayed LED Indications of the signal voltage present) down to -1.0 dBmV and on the high end up to +23.5 dBmV. If the signal goes above or below the end-of-accurate display points, the LEDs **shut down** and the under or over range LED continues to flash. This "LED shut down" is purposeful; **it saves LED drain** on the battery supply.

Now back to diagram three. The highly accurate **region** of the detector is **within** the 20 dB range. In our particular stair-step test we did not happen to check the detector efficiency above the full scale (or +20 dBmV in our test) point with the external chart recorder system. It is worth noting if you were driving a chart recorder with the DL-100 that you have (on a Heath SR-206 type recorder) a 20 dB recording **range** that occupies only approximately 64% of the paper width; and even though your LED's would not be properly indicating for low level signals (i.e. **below** the under range shut off) the X-Y output **voltage** would **still drive** the chart recorder for **at least** an additional 14 dB of recording range. Note however that after you step down into the 21/22/23 dB **below full scale region** the vertical separation between 1 dB signal voltage steps begins to tighten up, and at the end you can see the internal noise figure of the DL-100 beginning to "modulate" the recording trace (appearing here as fuzzy or slightly wiggly trace lines).

Temperature And Absolute Accuracy. . .

A display system that reads out in tenth of a decibel steps suggests at least going in that the overall real-voltage-level accuracy may be very good. The accuracy of any meter is a function of a long list of variables, some of which include:

(1) **The accuracy of the step attenuators in the front end.**

The attenuators must be accurate over not only a wide range of inputs (there is some small concern here at low and high power input levels) but more important over a wide range of input frequencies. With the various optional tuner heads available, the attenuators in the front of the DL-100 must be good over the range 5 to 812 MHz; no small trick, when you have tenth of a dB steps in the display system. The attenuators thru 300 MHz have individual accuracies of 0.1 dB and for high level signals when **all four** attenuators are switched in the **cumulative error** is 0.4 dB maximum (the minimum is theoretically 0.0 dB). In the UHF range the attenuator pads are 0.5 dB worst case accurate for a cumulative error of 1.5 dB maximum.

(2) **The accuracy of the RF tuning system** (what you have is essentially an RF tuner that converts incoming signals to an IF; the RF tuner must be flat over the full range it tunes).

Designing a wide frequency range tuner that is flat or which exhibits the same gain/loss/conversion efficiencies over the frequency ranges involved is again **no mean trick.** But it is a problem which other SLM/FSM manufacturers and designers have faced since the first CATV units began to be developed in the early 1950's. The maximum error in this portion of the system is +/- 1.0 dB.

ABSOLUTE ERROR ACCUMULATION

The "worst case" error with the DL-100 **if** everything possible worked against you figures out as follows:

Frequency Response (1)	+/-1.0 dB
Temp Variation (2)	+/-0.5 dB
Attenuators	
Maximum one switch	(+/-0.1 dB)
Maximum all switches cumulative	+/-0.4 dB
Scale Error (3)	+/-0.3 dB
Total Maximum Error	**+/-2.2 dB**

1) Primarily in tuner
2) Spread thru IF, detector, digital section
3) Cumulative of all other factors including digital circuit

(3) **The accuracy of the scale itself.**

In an analog meter display the **scale** error is considerable, although predictable in the sense that it **can be plotted once** and then a correction factor used from that point forward (assuming no **mechanical** problems develop with the meter movement). In digital system the scale error is more complex, but also much lower as a rule. The cumulative scale error, worse case, is 0.3 dB with the DL-100 series units.

(4) **And the temperature problem.**

Temperature has been an enemy of precision measurements for as long as there has been the precision measurement requirement. The SL-300 meter, new from Avantek, **for example,** includes a built-in meter **calibrator.** This is a signal source that the user activates, waits a period of time to allow to self-adjust, and then utilizes as a part of the meter calibration procedure to adjust the integrity of the meter itself. The temperature problem shows rather plainly in the steps Avantek has gone through to insure the integrity of their "calibrator source". It is nestled in an "oven" which means it operates at a constant temperature. The oven cannot run **all of the time** on battery supply, since the oven consumes a fair amount of power (heating elements are like that; basically inefficient). So when you need to calibrate the SL-300 against its internal calibrator, first you have to get the calibrator "up to temperature". **While** the heating element in the oven **is** bringing the calibrator up to the proper temp, the unit is eating up the milliamps at a rapid rate. It is one of those trades you make when you attempt to build into a portable field unit a self-calibration scheme.

The DL-100 from Sadelco takes a different approach; one which Sadelco has followed for the last several meter models it has brought to the market. Harry Sadel is very big on temperature compensating component parts; temperature correcting capacitors, for example, are found throughout the unit (in fairness, others do the same thing, although perhaps not to the extent that Sadelco does). Then when all is done that can be done in the temperature compensating department, the final results are plotted and a temperature stability curve is plotted.

The temperature problem **is** a stinker. Avantek didn't go to all of the trouble of sticking their calibrator into an oven just for the innovation and added battery drain the approach presents. They recognized, wisely we believe, that under different operating temperatures the meter has different operating characteristics. A useful exercise, one planned for later this year in the CATJ Lab, would be the temperature cycling of a meter (or a selection of common meters) through ranges that run from 0 degrees F to 120 degrees F. Most meters with temperature compensation, such as the Sadelco DL-100, are typically less vulnerable to temperature "drift" at high ambient temperatures than at low ambients. A 120 degree environment is **typically** less of a hazard to a man intent on obtaining precision readings than a 0 degree environment.

Stabilizing, in room or ambient temperature, the calibration portion of a meter is **not** the **entire** answer however. If you oven-heat the **calibrator** to a decent level, what about the **balance** of the SLM/FSM? Harry Sadel has long suggested that if a man is responsible for precision plant measurements in cold weather, he is wise to either keep an instrument (**anyone's** instrument) under wraps in clothing for the "dash" outside, or, alternately to allow the meter as much as an hour to fully adjust to the temperature in a very cold (or very warm/hot) environment. The rate of adjustment for trimmer capacitors, fixed capacitors and active devices is not fixed. Some components adjust to sudden changes in environment quickly, others take a gradual period "of up to an hour" notes Sadel. With his experience in temperature compensation, one is bound to listen to his advice.

AUTO RANGING ATTENUATOR

Think back to the way you utilize your present SLM/FSM. Each time you add or subtract a 10 or 20 dB pad, you have to either mentally adjust the scale in use, or visually look at the scale on the meter and trace with your eyes the proper scale as a function of the attenuation selected.

The digital scale is programmed, with the attenuators, so that as you switch in or out attenuators (remember the over and under range LED's) the digital display scale "tracks" automatically. In other words, if you have a full scale read-out capability of +10 dBmV (chosen by dropping in 20 dB of attenuation) and the signal you are reading is +18 dBmV, by switching in an additional (10 dB) pad the scale **automatically switches** to the **next higher decade** range (+20 dBmV maximum display read out).

By juggling the 10 and 20 dB slide switch step attenuators, you can place the mid-range of the scale so your signal is in the top of the analog (and digital display) region or in the top portion.

Accuracy And Operation. . .

As a table here indicates, the worst-case factory-allowable error for the DL-100 is 2.2 dB. This assumes everything that could possibly happen against accuracy has happened, and it has **all** been **worst case** and in opposing directions that add to **maximum** cumulative error. This includes attenuator error, frequency response error, temperature error and scale error. In the real world, the typical operating error as measured in the CATJ Lab under room environment was under 0.5 dB cumulative. That was close enough to **our** laboratory standards that we can**not** honestly call it error at all; that is, our own standards are not good enough to insure that we are not that far out with our own reference system. We noted with considerable interest the Sadelco statement in literature and advertising that "...**Calibration standards are NBS traceable".** To the best of our knowledge, that is the first time **this** statement has appeared on literature describing **CATV** signal level meters.

After our experience in the Lab with the precision two hundred dollar 1 dB step attenuator we got the bright idea (with the 0.1 dB readout display definition) that it might be instructive to run through a bunch of common CATV passive "appliances" just to see how they measured up. We warn you in advance this can be a very habit-forming exercise.

(1) **Push-on connectors** - without mentioning a brand name, the type you screw an F fitting into and then use to push on and pull off of a chassis connector. We "tested" 25 of the units fresh out of a factory bag at channels 2 and 13 and found they averaged 0.15 dB "loss" at channel 2 and almost 0.2 dB loss at channel 13.

(2) **Barrel splices** - again, without mentioning a brand name, we found they were (of 15 sampled) in the under 0.1 dB loss range at channel 2 (but **not** unity loss) and up to 0.15 dB loss at channel 13.

(3) **A handful of fixed in-line pads,** where we found:

(A) **Of eight 3 dB** units checked, they ranged from 2.5 dB loss to 3.2 dB loss;

(B) **Of six 6 dB** units checked, they ranged from 5.7 dB loss to 6.4 dB loss;

(C) **Of a dozen 10 dB** units checked, they ranged from 8.9 dB loss to 10.4 dB loss;

(D) **Of five 20 dB** units checked, they ranged from 19.1 dB loss to 21.1 dB loss.

So much for passives. A fellow can grade his passives with the DL-100 and if enough people start doing it on their own it **might** not be long before the passive suppliers start doing it themselves(!).

We ran into one problem that had us confused for awhile. We were demonstrating the DL-100 at a system that has something less than good looking pictures and we noticed that when we tuned in the aural carriers on some channels the "P" lit up indicating we were tuned to a visual carrier. We checked with Harry Sadel for an answer. **"Did you check the amount of cross-mod on the system"** asked Sadel. We noted that we had not measured it, but the pictures suggested the system had some. **"The 'P' light glows when there is a 15.75 KHz sync signal on the carrier tuned in. When you have a system that has cross mod, the horizontal sync is 'humming away' on the aural carrier and this lights up the 'P' LED"** noted Sadel. Gee whiz. . .now **if** Sadelco could "calibrate" that 'P' LED so that it winked at you on an aural carrier **only when** cross mod was say worse than -57 dB you would really have a useful tool there. Sort of a "go" and "no go" situation for testing for cross mod!

The pulse peak detection system is perhaps as innovative to the meter and meter technology as the LED system. We fear it won't get near the mention or comment however because it is not as "flashy" as the LED feature. Sadelco says you can accurately read to within 0.1 dB **between** the aural and visual levels **on a channel,** independent of the errors we have come to expect or accept with other detector circuits. The DL-100 in the quasi-peak detection mode has a .6 to .8 dB error factor between the aural and visual carriers. We wondered about **other** "peak reading" detector circuits and after doing some digging we determined that anyplace between 0.5 and 1.0 dB correlation between visual and aural carriers is standard; it pretty much depends upon the individual diode characteristics in typical "peak" detector circuits, and the time constant built into the detector charging or holding capacitor network.

Finally the powering system. One would naturally suspect that with the LED digital displays, the flashing and winking and on and off of four indicator LED's that the operating time would be lower (perhaps substantially) than say a standard analog meter. The DL-100 utilizes five of the sub-C size nickel-cadmium cells. This provides **4 hours of continuous** operation; comparable to most meters available. The re-charge cycle period is 12 hours, using a charger supplied. You can use the instrument on the bench, with the charger, and trickle charge at the same time. Incidentially, one of the larger battery companies recently issued the advice that if you use an instrument with rechargeable batteries on the bench through a trickle charger it is smart to allow the unit to go into a state of **almost total dis-charge** say every six months or so. This gives the batteries an opportunity to recycle chemically and it prolongs their useful life by "refreshing" the Nicad's "memory".

Summary. . .

The 4-1/4" x 8" x 12" (including case) DL-100 SLM/FSM weighs in at 8 pounds. It is as small as many of the installer type meters available to the CATV industry. At the risk of alienating the balance of the meter producing industry (which we **probably** managed to do several pages ago) it is our studied opinion that the new Sadelco meter series is going to turn a few heads and establish several new standards for both comparison and operational accuracy in the SLM/FSM marketplace. Nearly a quarter of century has elapsed since the first 'Transvision' meter appeared in the TV receiving industry. Hopefully, spirited on by the appearance of the DL-100 family of units, it will not take another quarter of a century for the next innovative family of meters to appear.

TECHNICAL TOPICS

FCC Piqued?

"It has come to our attention that statements made in your magazine may be causing some confusion in the cable television industry with respect to FCC requirements for proof of performance testing. In your April, 1977 issue, for example, the unnumbered page facing page 49 states that **"FCC rules require tests to be completed by March 31, 1977,** for current year." You further state that ". . .systems signed up for the CATA Test Program are allowed **later completion** dates provided they are signed up and scheduled for tests sometime in 1977." (Emphasis in original copy.) Both statements are incorrect.

Concerning the first statement, Section 76.601(c) of the Commission's Rules and Regulations says that performance tests are to be made at least once each calendar year, at intervals not to exceed 14 months. There is no reference to a particular date within the year, other than that the **initial** tests for systems in operation before March 31, 1972 had to be completed by March 31, 1976. Thus, a cable system which had performed its 1976 tests on March 15, 1976, would have until May 15, 1977, to perform its 1977 tests. A system may have performed its 1976 tests on May 1, 1976, for example, under the CATA test program approved by David D. Kinley, former Chief of the Cable Television Bureau. In that case, the system would have until July 1 to perform its 1977 tests. Of course, a system performing 1976 tests on December 31, 1976, would have only until December 31, 1977, to make its 1977 tests since the tests must be performed once each **calendar** year.

Concerning your second statement, the letter from Mr. Kinley to your General Counsel Richard Brown, dated December 31, 1975, does not imply any relaxation of the within-14-months requirement for the 1977 performance tests. That letter referred only to the time for making 1976 measurements. The 14 month period would, however, begin on the date the 1976 tests were actually performed, not necessarily on March 31, 1976.

As you are aware, the Commission has recently relieved operators of systems having fewer than 500 subscribers from most of the requirements for making annual proof of performance tests. Signal leakage testing is still required for systems using frequencies outside the FM and TV broadcast bands for any purpose (including pilot carriers), and the Commission reserves the right to require specific tests in the case of complaints or disputes. We sincerely hope that this relief will not mean that small system operators will stop making measurements—regular testing is clearly essential to good subscriber service. The relaxation of requirements is merely intended to leave to the operator the judgement of which tests should be made and how often.

We would appreciate your passing this information along to your readers. I hope that it will clarify the situation.

James R. Hobson
Chief, Cable Television Bureau
FCC
Washington, D.C. 20554

Mr. Hobson—

Somehow the reason for former FCC Cable Bureau Chief David Kinley's agreement of extended deadlines for systems conducting their tests utilizing the CATA test equipment package seems to have been lost with the transition from Kinley to yourself. Kinley agreed with us that (1) it was highly desireable for all systems required to make the tests to do so, (2) if the CATA test equipment program resulted in systems making the tests that might otherwise not make the tests, that this should be encouraged, and (3) if it was impossible for all systems to receive the equipment on a 'bicycle basis' prior to the end of a 14 month period since last they made the tests, that the FCC would be happy to extend that 14 month period provided the systems had indeed signed up for the tests, and, provided the only thing holding back their completion of the tests was the scheduling of the test equipment to their system.

Now you are suggesting that none of this is true. It appears you are hung up on a strict interpretation of the rules in 76.601(c), regardless of what that may mean to the smallish system operator. Let's review the facts. There were 47 systems using the CATA test package in 1976. Only one of these had EVER made FCC tests previously. Most were older (meaning grandfathered) systems. They had gone years and years without making tests (a few of the systems were built after 3-31-72) and would have gone on forever without making them, or until 'caught' had CATA not put together the test program that made possible relatively low-cost testing equipment. Now this year, because of the recent FCC decision (which you reference) regarding systems of under 500 subscribers, a great many of the systems that tested with the CATA package last year are no longer obligated to make annual tests. However, replacing in number those who tested last year but who do not need to do so, this, year are numerous additional systems (with 500 or more subscribers) who have signed up for the test package. Some are scheduled to be taking the tests through September or even later, again, depending upon when the equipment can be bicycled to them. The systems using the test equipment this year are (1) newer systems making their first tests, and, (2) systems that made tests last year (some one whom—but not all of whom—will be within the magic bureaucratic 14 month figure), and (3) systems that ignored the tests every year to date, but who finally **decided that this year they had better make them.** That's the real world. **So what would you rather have? Strict interpretation of 76.601(c) and most of these systems not making tests, or, a more realistic approach to the rules and your support for an honest effort on the part of CATA to get the tests done?** The ball, sir, is in your court.

Can't Find Parts?

"In your March 1977 issue there is a series of articles, starting on page 10, that describes how to build your own CATV system equipment. I am a person who builds and experiments on new circuits and designs and I often need parts such as teflon or ceramic Hi-Q, low-loss capacitors. Since Allied merged with Radio Shack, I have lost contact with firms that sell variables, pistons and other much needed parts for construction. It would be a great service to all like me if CATJ could list some firms that supply small parts. It has become increasingly more difficult to locate parts, especially in small quantities. About the best I've been able to do is to rob parts out of MATV or CATV gear that is no longer in service."

Joseph D. Burgess
Allentown Cable TV
Wellsville, New York

Joseph -

As long as the pile lasts, taking parts out of salvaged MATV and CATV gear is not a bad approach. There are a few sources which may be helpful. The best catalog around these days is from Newark Electronics, 500 N. Pulaski Road, Chicago, Illinois 60624. Ask for catalog 102 (Industrial). Newark has branch-offices in around 30 locations from coast to coast, including one in Rochester (716-473-6600), the nearest to you. We've found their service medium to good, prices higher than what we think we should by paying, but considering how hard it is to find parts, we guess that it is understandable. For specialized VHF-UHF parts (including capacitors as you note) try Hamtronics, 182 Belmont Road, Rochester, New York 14612; they also have a modest catalog. Other mail order sources include (1) James Electronics **(1021 Howard Ave., San Carlos, California**

94070—a catalog for 24 cents in stamps (2) NuData Electronics **(104 N. Emerson Street, Mt. Prospect, Illinois 60056—a catalog for a SASE);** (3) MHz Electronics **(2543 N. 32nd Street, Phoenix, Az. 85008 / lots of VHF-UHF goodies);** (4) M. Weinschenker **(Box 353, Irwin, Pa. 15642—SASE for 'bargain list'); (5)** Poly Paks **(P.O. Box 942, Lynnfield, Ma. 01940—free catalog with bunches of surplus goodies).**

Rural Cable?

"I am in the process of trying to absorb the April 25th issue of **Cablevision,** having completed an article on rural cable quoting a Mr. Don Mackin who testified before the Senate subcommittee on communications on behalf on NCTA. Mr. Mackin is apparently attempting to wipe out small rural cable systems in favor of either translators or telephone company operated CATV systems. He states that private cable companies cannot survive with fewer than 25 homes per mile.

I take strong exception to this statement and I am sure many others do also. Anyone who is half-smart can take a community of say 300 homes, install a cable system, and then proceed to branch out into the surrounding countryside with home densities as low as 8 to 10 per mile. In Oregon, for example, the cost of installing a relatively simple home antenna in a fringe area is about $175. That will get you 1 to 3 channels, reception quality being generally so poor that people accept it only because that is all they can get.

On the other side is the fact that a low-band only cable system, providing five channels of quality television, can be constructed for $2700 per mile or less. This assumes that you do most of the work either yourself or with locally acquired labor, and that you bury the cable distribution plant to stay off of expensive poles and away from the maintenance that goes with such pole or above ground installations. Divide this by ten homes and you have $270 per home investment. So far this year I have extended my very small system by three miles, added new subscribers in those three miles, and the financial return was immediate.

Small systems, left alone, can survive with far fewer subscribers per mile because we are not faced with the very-very expensive 'cost of regulation'. Left in the open and free marketplace, there are many things we can and do manage to do to keep our costs down; while still providing quality service. With testimony from people like Mr. Mackin I believe we will see the telephone companies getting back into cable TV once again and you will find yourself competing with Bell dollars. It doesn't take much insight to see that the telephone companies can arrange their books to provide "cable TV" service "for free", or at best provide cable service as a part of a "package" which cable companies would find impossible to live with. Let's not get so involved with 'Pay TV' and other 'blue-sky' areas (blue-sky as far as the rural folks are concerned. . . when they have yet to see their first regular good-quality TV signal!) that we forget about the country people. Oliver Swan (March CATJ) has the right idea. Let's see more of this!

Steve Streeter
Storm Antenna Service
Siletz, Oregon

Steve-

In reading Don Mackin's testimony, it appears he was asking the Senate subcommittee to not relax translator rules, but rather make them at least as restrictive as cable rules are (vis-a-vis signal carriage, non-duplication, and so on). We were particularily galled when the translators snuck through the copyright bill without having to pay. We know of numerous translator system operators who make a very nice living from their translators and if that is not "television for pay", we'll eat the next ten watt Adler unit we come across! As for allowing the telco's back into cable, that is a different can of worms. There are some telco operated small systems in some areas that do an excellent job and charge a fair price for what they sell. Others tend to use the cable operation as a form of 'compensating balance' for their telco operation. If Congress through REA or some other agency does agree to fund long term loans for telco operated rural cable, we believe the very least that should also be done is to allow rural

cable not owned by telco's to have the same long term, low interest rate money available.

TVRO Financing

"The industry may be interested to know that we are able to arrange financing for earth receiving terminals on a favorable basis. We represent the Sullivan State Bank in Sullivan, Indiana and we are most interested in assisting small systems. This includes earth receiving terminals for smaller communities.

It is possible that small systems will have some difficulty getting local banks to go along with 'space age technology funding'. If that is the case, having a bank like Sullivan available with a demonstrated interest in making cable TV related loans might be very useful; and we can assist cable operators in this position."

J. Patrick Michaels
Communications Equity
Associates
8200 Normandale Blvd., Suite 323
Bloomington, Mn. 55437

Rick-

We have heard from some systems contemplating a TVRO installation who are having some difficulty convincing their local bank that a 15 foot terminal is just what they need. In addition to your offer, we also suggest systems in the southwest contact Mr. Clark Bass at First National Bank and Trust Company in McAlester, Oklahoma (918-426-0211). **Mr Bass has been financing CATV systems for more than a decade and recently financed a TVRO terminal for a small system in Texas.**

Swan Feedback

Oliver Swan **(see CATJ for March 1977)** has pointed out a drafting error in our report on his do-it-yourself amplifiers. Reference is made to **diagram N-A,** appearing on **page 24** for March.

The 16 volt zener should have a 300 ohm resistor ahead of the zener, as indicated here. Failure to have this hunk of carbon in place will result in popping the zener.

Several readers, especially those who manufacture or sell 1/2 inch jacketed cable, wonder how Oliver Swan can construct his plants for "$500.00 per mile. . .". Anyone who has recently priced half-inch jacketed cable, flooded, knows that the $140-$150 per thousand price range is about as good as you are going to do. That does NOT translate into $500. per mile total plant costs; not when the cable alone may be as much as $700.00.

The $500. figure was not intended to be Oliver Swan's actual cost per mile; it was a number which appeared in print in this report usually with a question mark **(?)** following it; **asking the question** of 'Can it be done for this' more than making the flat statement that indeed it can be done for this.

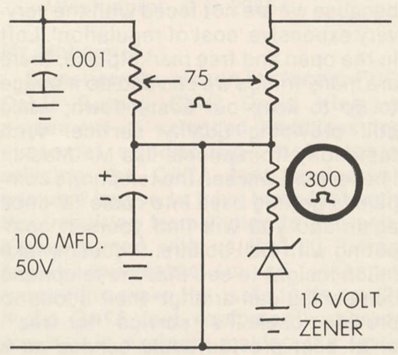


DIAGRAM N-A

There **are** broadband CATV plants operating with that kind of cost per mile installation figures. They are either (1) open line systems (not suggested here), or (2) they are .412 systems where the system operator has taken advantage of special buys in .412 cable (i.e. perhaps cable that has 24-26 dB return loss spec) offered from time to time by the cable suppliers. This is not jacketed cable, so you can't bury it; but you might "string it up" along fence posts if that was your style. We'll have a more detailed look at the "cable equation" for rural systems in a future issue.

Construction Project Comments

After three years of reading CATJ, I finally had to write to express several thoughts I've had regarding your magazine. The catalyst was the 300 MHz counter article by Steve Richey in the April '77 issue.

First, the counter article. Another fine construction piece by Richey. They've all been great. But I must correct Steve on one point that I feel should be made clear to the many technicians who are getting much of their basic electronic knowledge from CATJ. In the article Steve goes into a lengthy explanation about how the counter counts events, or "cycles" or "Hertz". He uses the term "Hertz" interchangeably with "cycles", and then says that in order for the counter to count frequency, these "cycles" or "Hertz" must be referenced to time, so we may count how many cycles or Hertz occur each second. Steve has apparently failed to realize that "Hertz" by definition is referenced to time. One "Hertz" is equal to one "cycle per second". The electronics world changed to this term because all too often the "per second" would be left out when talking about frequency. For example, the video carrier frequency of Channel 2 would be referred to as "55.25 Megacycles" rather than the proper "55.25 Megacycles **per second**". Even though we all knew the "per second" was understood, purists felt a new term was needed to encompass the "per second" as well as the "cycles". Hence the term "Hertz" which means "cycles per second".

Now a comment about your great little analyzer. This comment also includes a concern about the general emphasis CATJ seems to have on the 12 channel system, or in any event, on systems of less than 35 channels, the current "state of the art". Maybe it's because the CATA caters mainly to the classic type system, but rarely is it acknowledged in CATJ that many systems are built today with a 300 MHz. top end. (**Finally** the "300MHz Counter"!) The analyzer may be built with the Jerrold RSX or Hamlin MCC-2000, thus providing coverage to 300 MHz. With no other charges. The newest RSC converters, built in late '76, would also provide 300 MHz coverage.

Now about the A-1 and A-2 question. A-1 is generally understood to mean Channel A (120-126 MHz) minus 6 MHz, and A-2 to be Channel A minus 12 MHz. The "-1" and "-2" mean to subtract that number of 6 MHz channels. Hence, A-1 is 114 - 120 MHz. and A-2 is 108 - 114 MHz. Now to further complicate the matter we have "A-2-2" which means "Channel A minus 12 MHz minus 2 MHz". I guess this discussion will go on a while longer, unless the FAA has it's way, in which case any discussion of these channels is academic.

Finally, I think CATJ is much needed in the industry, and regret that I am missing two issues from the early days. I would greatly appreciate help obtaining the May and July 1974 issues to complete my library. I do have dups of several other issues if any readers would like to trade, they are more than welcome to contact me.

Keep up the good work.

George Fenwick
Vice President
Katek, Inc.
Bound Brook. N.J. 08805

George-

You're correct . . . "Hertz per second" is redundant. We'll tell Richey to clean up his 'count" in the future. Does anyone out there have 'spare copies' of Volume One, numbers 1 and 2 (May and June of 1974) which they'd like to trade or sell to Mr. Fenwick? His

address in Bound Brook is P.O. Box 83. Katek, for those who are not aware, is deeply involved in the business of repairing CATV converters (Hamlin, Oak, Jerrold).

A Better LNA?

"I read with great interest your excellent survey of the TVRO industry in the February issue of the Journal. The issue was well written and put together in a most interesting format.

May I call your attention to what I think may be an omission? Scientific Communications has an LNA, their GASFET Model 395-505 which for $2800 is a much more cost-effective LNA than the NEC unit your study mentioned twice. I am enclosing some data for your consideration.

This amplifier is now 'on stream' at RCA Americon and performing beautifully in service with a six foot antenna. It happens to be advertised in the same issue of the Journal on page one. Perhaps you might wish to give SCI some editorial coverage on this GASFET. It is quite an amplifier. They will guarantee 100 degrees Kelvin across any 200 MHz segment of the 3.7-4.2 GHz band."

Bertram D. Aaron, P.E.
President
Bertram D. Aaron & Co., Inc.
Greenvale, New York

Bertram-

Sometimes the most obvious information right under our nose escapes our notice! It happens, in this case, that (1) as is our 'rule', we try very hard not to mix 'advertising' with editorial material and in this case our editorial department worked totally independent of our advertising space sales department; and, (2), as we were putting together the editorial material (some weeks before the advertising deadline closed) we knew that Scientific Communications, Inc. had a new LNA they were very proud of, but it was not at that time available. The data sheet Mr. Aaron provided shows the 395-505 LNA has 50 dB minimum gain, 120 degree kelvin noise temp across the whole 3.7-4.2 GHz region, with optimized noise temp under 100 degrees K over a 200 MHz wide segment. It should be quite a shot in the arm for low EIRP areas!

SCTE Activities

Upcoming SCTE (Society of Cable Television Engineers) meetings are scheduled as follows:

(1) **Albany, New York**—Third Annual Technical Seminar, hosted by the New York State Commission on Cable Television and New York State CATV Association, June 16-17. For information contact Bob Levy at (518) 474-4992.

(2) **Palm Beach, Florida**—Florida State CATV Association holding meeting June 26-28 at Breakers in Palm Beach; SCTE member and CATA Director Ralph Haimowitz looking for gathering of fellow technical types. Contact Ralphie-Poo at (305) 589-3846.

(3) **Atlanta, Georgia**—(17th) Annual Southern Cable Television Association Convention, August 21-24 at which Guy Lee of Georgia Cablevision will oversee 'extensive' technical sessions. Contact Guy at (405) 892-2288.

PSST-WANNA BUY A PAY TV CORD?

Recently while visiting in Washington, D.C. and staying at one of the numerous Holiday Inns there, we happened into the motel bar for a short one. A traveling type engaged us in conversation.

"You travel much?" he asked. We answered with an affirmative.

"Stay in many Holiday Inns?" We again answered to the positive.

"Have you tried their Marquee Pay TV?" We said that no, we had not. "Kind of steep for someone not on an expense account," we offered.

"Let me show you something" said he, reaching into his sport coat pocket.

Out came around four feet of RG 59 with an F-61 connector on both ends. In his other pocket he discovered a popular brand locking terminator removal tool.

"See this?" We did see it, but pretended not to recognize the package for what it was.

"With this you can watch pay TV at any hotel or motel that uses these key lock systems and all it costs you is a one time charge. Come up to my room and I'll show you." He was smaller than we are, so we went along.

Inside the room he used the locking terminator removal tool to disarm the connector on the wall plate of the MATV system. The normal drop line ran from the wall plate to the key locked housing that Coral had produced (inside was a channel 2 visual carrier trap) and then through a second jumper of 59 to the 75 ohm fitting on the back of the TV set. With the connector dis-abled at the wall plate he undid the connector on the back of the receiver (which someone had forgotten or never intended to put a locking terminator on) and substituted the 4 foot jumper. Switching to channel 2 there was the Marquee Entertainment Network in perfect living color. Obviously, Washington's MDS fed system was alive and well that night.

"Tell you what I'll do" offered the gent. **"For $10.00 bucks you can have this special jumper cable and the connector-tool."** We hesitated, still somewhat dumbfounded by the scene. He mistook our hesitancy for uncertainty about the price. **"Oh hell, give me $7.00 and the package is yours. This is a hell of a deal, for the price of two movies you can have free movies wherever you go!"**. That was a bit of overselling but we got the message.

We didn't buy, but we did offer to buy the fellow a drink. It turns out he is a salesman for a popular line of drug store items, and he makes it into Washington about four days a month. During a recent stop in Philadelphia he met another traveling type who sold something other than electronics, and out of the back of the second fellow's car came a box of 50 sets of "Pay TV Cords" and the companion tools. He had bought the set of 50 as a "traveling distributor" for $4.00 each. 200 small ones, cash, on the spot. In about a month he had sold all but five and he was ready to buy some more.

"Who normally buys these things?" we asked.

"People who travel alot. If you are on the road just a night a week, it pays for itself in just a few weeks".

"But not all motels and hotels use this type of pay TV. Some have those 'converter box things'," said we, trying to sound not very knowledgeable. "How do you get around those?"

"That's a different problem. I've got a unit in the car if you are interested, but it costs. . .say $60.".

We said we weren't interested, but he wasn't giving up on the $7 sale yet. **"Look, I've even got a list of all of the motels and hotels on the east coast that use this system of pay TV,"** said he. **"With this list, you can always find a motel or hotel that has a system that this cord works on. I normally get a couple of bucks for the list, but I'll throw it in for free. . .sort of a bonus."**

We thanked the man, said we'd think about it, and headed for our room. Imagine that, ripping off the pay cable and MDS people right there in the nation's capital, only blocks from the White House. We wondered how that would set with President Carter.

☆☆☆☆ SHOWCASE ☆☆☆☆

Microwave Filter Additions

Microwave Filter Company (6743 Kinne Street, East Syracuse, N.Y. 13057) has announced several new products of interest to the cable world:

(1) **Model 3278/3445** is a newly developed adjacent channel filter for the **UHF** television band. Specifications are attenuation on the adjacent carriers (lower sound, upper picture) of 25 dB with a passband loss of 4.0 dB maximum. Pricing is $555 and delivery is 4 weeks.

(2) **Model 3271A (VAC)** is a "Channel Notcher" for insertion in a trunk or feeder line so that a single channel of information (all of the 4.5 MHz passband) can be attenuated or notched by 50 dB minimum. The unit is available on any standard VHF channel with pricing of $555 for high band VHF and $300 for low band VHF. The unit is temperature compensated for stability under environmental changes.

(3) **Model 3355CBL** is a CB transceiver filter (trap) which attaches to the RF output connector on the CB transceiver. Attenuation of CB harmonic energy has been measured as 65 dB or higher on TV channels 2, 5-6, 9 and 13. Price is $11.95 which includes a pigtail coaxial lead to jumper between the CB transceiver and the CB base or mobile antenna coaxial lead.

RMS Product Additions

RMS Electronics, Inc. (50 Antin Place Bronx, New York 10462) has announced a number of new products for the CATV industry:

cata

ASSOCIATE MEMBER ROSTER

In recognition of the untiring support given to the nation's CATV operators, and their never-ending quest for advancement of the CATV art, the COMMUNITY ANTENNA TELEVISION ASSOCIATION recognizes with gratitude the efforts of the following equipment and service suppliers to the cable television industry, who have been accorded ASSOCIATE MEMBER STATUS in CATA, INC.

Andrew Corp., 10500 W. 153rd St., Orland Park, IL. 60462 (**M2, M3, M9** Satellite Terminals) 312—349-3300
Anixter-Pruzan, Inc., 1963 First Ave. S., Seattle, WA. 98134 (**D1**) 206—624-0505
Avantek, Inc., 3175 Bowers Avenue, Santa Clara, CA. 95051 (**M8**) 408—249-0700
Belden Corp., Electronic Division, Box 1327, Richmond, IN. 47374 (**M3**) 317—966-6661
BESTON ELECTRONICS, INC. 903 South Kansas Ave., Olathe, KS. 66061 (**M9**) Character Generators-913-764-1900
BLONDER-TONGUE LABORATORIES, One Jake Brown Rd., Old Bridge, N.J. 08857 (**M1, M2, M4, M5, M6, M7**) 201—679-4000
BROADBAND ENGINEERING, INC., 535 E. Indiantown Td., Jupiter, FL. 33458 (**D9, replacement parts**) 305-747-5000
FRANK L. CROSS & ASSOCIATES, INC., 5134 Melboune Dr., Cypress, CA 90630, (**M9**) 714-827-0868
CALIFORNIA MICROWAVE, INC., 455 West Maude Ave., Sunnyvale, CA. 94086 (**M9 Satellite Terminals**) 408—732-4000
CATEL, 1400-D Stierlin Road, Mt. View, CA. 94043 (**M4, M9**) 415—965-9003
CCS HATFIELD/CATV DIV. 5707 W. Buckeye Rd., Phoenix, AZ. 85063 (**M3**) 201—272-3850
C-COR ELECTRONICS, Inc., 60 Decibel Rd., State College, PA. 16801 (**M1, M4, M5, S1, S2, S8**) 814—238-2461
COMMUNICATION EQUITY ASSOCIATES, 8200 Normandale Blvd., Suite 323, Bloomington, MN. 55435 (**S3**) 612—831-4522
COMM/SCOPE COMPANY, P.O. Box 2406, Hickory, N.C. 28601 (**M3**) 704—328-5271
ComSonics, Inc., P.O. Box 1106, Harrisonburg, VA. 22801 (**M8, M9, S8, S9**) 703—434-5965
DAVCO, INC., P.O. Box 861, Batesville, AR. 72501 (**D1, S1, S2, S8**) 501—793-3816
EAGLE COM-TRONICS, INC., 8016 Chatham Dr., Manlius, N.Y. 13104 (**M9 Pay TV Delivery systems & products**) 315—682-2650
FARINON ELECTRIC, 1691 Bayport, San Carlos, CA. 94070 (**M9, S9**) 415—592-4120
FEDERAL BROADCASTING CO. 600 Fire Rd. Box 679 Pleasantville, N.J. 08232 (**D9, S9**)
FERGUSON COMMUNICATIONS CORP., P.O. Drawer 871, Henderson, TX. 75652 (**S1, S2, S7, S8, S9**) 214—854-2405
GILBERT ENGINEERING CO., P.O. Box 14149, Phoenix, AZ. 85063 (**M7**) 602—272-6871
HOME BOX OFFICE, INC., 7839 Churchill Way—Suite 133, Box 63, Dallas, TX 75251 (**S4**) 214—387-8557
ITT SPACE COMMUNICATIONS, INC., 69 Spring St., Ramsey, N.J. 07446 (**M9**) 201—825-1600
JERRY CONN ASSOCIATES, INC., P.O. Box 444, Chambersburg, PA 17201 (**D3, D4, D5, D6, D7, D8**) 717-263-8258
JERROLD Electronics Corp., 200 Witner Road, Horsham, PA. 19044 (**M1, M2, M4, M5, M6, M7, D3, D8, S1, S2, S3, S8**) 215—674-4800
LARSON ELECTRONICS, 311 S. Locust St., Denton, TX. 76201 (**M9 Standby Power**) 817—387-0002
LRC Electronics, Inc., 901 South Ave., Horseheads, N.Y. 14845 (**M7**) 607—739-3844
Magnavox CATV Division, 133 West Seneca St., Manlius, N.Y. 13104 (**M1**) 315—682-9105

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

(1) **Model CA-2600F** is a combination high-pass filter (passes 50 MHz and above to 300 MHz with an insertion loss of 0.7 dB including matching loss) **plus** a 300 ohm to 75 ohm matching transformer. The unit is designed to install on the back of a television receiver to not only make the impedance transformation to 300 ohms at the receiver, but to also eliminate (by 40 dB minimum) the 5-50 MHz range of the spectrum. The unit also has applications in systems carrying sub-band signals in the below 50 MHz spectrum as a means of keeping these sub-band signals out of the TV receiver.

(2) **Model CA-2700F** is a 75 ohm to 75 ohm high pass filter (non-power passing) with similar specifications to the filter portion of the CA-2600F. It has an insertion loss of 0.5 dB with a rejection of 25 dB for the frequency range 5-50 MHz. It has F-61A (female) type connectors on both ends and inserts into the CATV line (i.e. into a drop, antenna downlead, etc.) as a means of controlling 27 MHz and other annoying signals that happen to wander into a system.

(3) **Model CA-3500/3501 FBP** is a Universal Splice Box that can be utilized for either aerial or underground installations. Typical applications include mating different sized cables at a junction point where outdoor splicing and jury-rigged jumper cables are unwise or impractical; as a "dummy-tap" for prededicating new system construction; allowing for coaxial cable drip-loop installations; as a "test point box" for providing access to cable voltages. The unit can also be converted into a multi-tap by removing the die-cast bottom plate and the companion RF feed-through printed circuit board and inserting into the housing the UNITAP bottom plate series unit(s).

(4) **Model CA-3006** is a non-corroding stainless steel indoor and outdoor six-way hybrid splitter (non power-passing). The stainless approach to the housing is particularily applicable to coastal areas and other regions where in-air pollutants cause life-serviceability problems with standard housings. The F-61A terminals are silver plated, for the same reason.

(5) **Model CA-1160** and model **CA-1161** are two new grounding blocks for single coaxial cables (60) and dual cables (61). Both units are 1/4 inch wide, extruded aluminum, with a chromate treated finish for corrosion resistance. The F-81A feed-through connectors are brass with a brite-acid tin plating process. A ground wire screw plus two mounting screws are included.

CATEL Has IF Modulator

Catel (1400-D Stierlin Road, Mountain View, Ca. 94043) has a new intermediate frequency modulator which the company reports "sells for under $900". The **Model TM-2400** covers all standard VHF television channels as well as special channels of 6 MHz bandwidth located between 6 and 270 MHz.

A second version, designed for microwave applications (**TM-2400B**) has a composite video plus 4.5 MHz input. A third model, for European PAL applications, is also available.

MICROWAVE ASSOCIATES, INC. 10920 Ambassador Drive-Suite 119 Kansas City, MO. 64153 (**M9**) Microwave Radio Systems-816-891-8895
Microwave Filter Co., 6743 Kinne St., Box 103, E. Syracuse, N.Y. 13057 (**M5, bandpass filters**) 315—437-4529
MID STATE Communication, Inc. P.O. Box 203, Beech Grove, IN. 46107 (**M8**) 317-787-9426
MSI TELEVISION, 4788 South State St., Salt Lake City, UT 84107 (**M9 Digital Video Equip.**) 801—262-8475
OAK INDUSTRIES INC./CATV DIV., Crystal Lake, IL. 60014 (**M1, M9 Converters, S3**) 815—459-5000
PRODELIN, INC., 1350 Duane Avenue, Santa Clara, CA. 95050 (**M2, M3, M7, S2**) 408—244-4720
Q-BIT Corporation, P.O. Box 2208, Melbourne, FL. 32901 (**M4**) 305—727-1838
RADIO MECHANICAL STRUCTURES, INC., P.O. Box 1277, Kilgore, TX 75662 (**M2, M9, S2**) 214-984-0555
RICHEY DEVELOPMENT CORP., 1436 S.W. 44th, Oklahoma City, OK. 73119 (**M1, M4, M8, S8**) 405—681-5343
RMS CATV Division, 50 Antin Place, Bronx, N.Y. 10462 (**M5, M7**) 212—892-1000
Sadelco, Inc., 299 Park Avenue, Weehawken, N.J. 07087 (**M8**) 201—866-0912
Scientific Atlanta Inc., 3845 Pleasantdale Rd., Atlanta, GA. 30340 (**M1, M2, M4, M8, S1, S2, S3, S8**) 404—449-2000
SITCO Antennas, P.O. Box 20456, Portland, OR. 97220 (**D2, D3, D4, D5, D6, D7, D9, M2, M4, M5, M6, M9**) 503—253-2000
Systems Wire and Cable, Inc., P.O. Box 21007, Phoenix, AZ. 85036 (**M3**) 602—268-8744
TEXSCAN Corp., 2446 N. Shadeland Ave., Indianapolis, IN. 46219 (**M8, bandpass filters**) 317—357-8781
Theta-Com, P.O. Box 9728, Phoenix, AZ. 85068 (**M1, M4, M5, M7, M8, S1, S2, S3, S8, AML MICROWAVE**) 602—944-4411
TIMES WIRE & CABLE CO., 358 Hall Avenue, Wallingford, CT. 06492 (**M3**) 203—265-2361
Titsch Publishing, Inc., P.O. Box 4305, Denver, CO. 80204 (**S6**) 303—573-1433
Tocom, Inc., P.O. Box 47066, Dallas, TX. 75247 (**M1, M4, M5, Converters**) 214—438-7691
TOMCO COMMUNICATIONS, INC., 1077 Independence Ave., Mtn. View, CA 94043 (**M4, M5, M9**) 415-969-3042
Toner Cable Equipment, Inc., 418 Caredean Drive, Horsham, PA. 19044 (**D2, D3, D4, D5, D6, D7**) 215—675-2053
Triple Crown Electronics Inc., 42 Racine Rd., Rexdale, Ontario, Canada M9W2Z3 (**M4,M8**) 416 743-1481
UNITED PRESS INTERNATIONAL, 220 East 42nd St., New York, N.Y. 10017, (**S9**) (Automated News Svc.) 212-682-0400
UNITED STATES TOWER & FAB. CO. P.O. Drawer "S", Afton, OK 74331 (**M2,M9**) 918-257-4257
Van Ladder, Inc., P.O. Box 709, Spencer, Iowa 51301 (**M9, automated ladder equipment**) 712—262-5810
VIDEO DATA SYSTEMS, 40 Oser Avenue, Hauppauge, N.Y. 11787 (M9) 516-231-4400
VITEK ELECTRONICS, INC., 200 Wood Ave., Middlesex, N.J. 201—469-9400
WAVETEK Indiana, 66 N. First Ave., Beech Grove, IN. 46107 (**M8**) 317—783-3221
WEATHERSCAN, Loop 132 - Throckmorton Hwy., Olney, TX. 76374 (**D9, Sony Equip. Dist., M9 Weather Channel Displays**) 817—564-5688
Western Communication Service, Box 347, San Angelo, TX. 76901 (**M2, Towers**) 915—655-6262/653-3363

NOTE: Associates listed in bold face are Charter Members

Distributors:
D1—Full CATV equipment line
D2—CATV antennas
D3—CATV cable
D4—CATV amplifiers
D5—CATV passives
D6—CATV hardware
D7—CATV connectors
D8—CATV test equipment

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Service Firms:
S1—CATV contracting
S2—CATV construction
S3—CATV financing
S4—CATV software
S5—CATV billing services
S6—CATV publishing
S7—CATV drop installation
S8—CATV engineering

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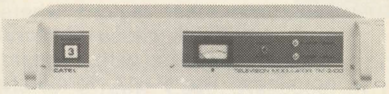


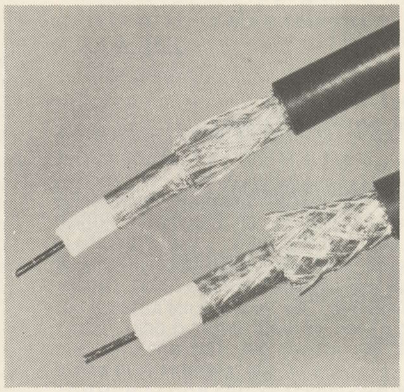
Catel points out that one of the innovations of the modulator is the ability to change out a PC board in the field and thereby change the operating (output) frequency of the unit. The modulation is applied at the IF range, thereby allowing output frequency change without impact upon the vestigal sideband filters. Maximum output available is +54 dBmV in the standard model; a +60 dBmV output is also available.

Belden Has New Cables

Belden Corporation (200 S. Batavia Avenue, Geneva, Illinois 60134) has several new cable products which should be of interest to the CATV community:

(1) Two new cables designed for remote control channel selection devices (i.e. converters) are available. **Model 9198** is a two-conductor poly jacketed cable with a conductive poly shield for 100% coverage. **Model 9199** is a three conductor cable. Both cables have been extensively tested for high flex life and limpness; and are available in a standard 1,000 foot "Unreel® " dispenser carton.

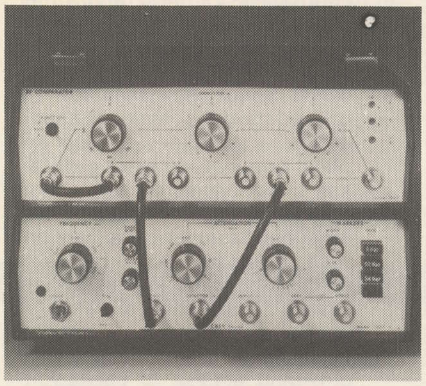
(2) Two new flooded CATV drop cables, for direct burial, have also been announced. **Model 9856** is an RG-6/U type cable while **9859** is an RG-59/U type cable. Flooding is done with a low molecular weight poly grease.



Wavetek Expands Test Gear Line

Wavetek Indiana (66 North First Avenue, Beech Grove, In. 46107) has two new test equipment additions which should make system maintenance and operation easier:

(1) **Model 3001** is a new programmable signal generator that covers the frequency range 1-520 MHz in synthesized steps. The instrument has CW, AM or FM modulation internally selectable at 400 or 1000 Hz. Frequency accuracy is .001% and the stability is 0.2 parts per million per hour. The output power is adjustable over a wide range and is monitored by a front panel meter. Pricing is $2,600 and delivery is 30 days.



(2) **Model 1067/75** "CATV Test Set" allows the user to make 'measurement by comparison' tests with electronic compensation between known and unknown ports. The 1067 sweeper is a 1-400 MHz machine with a flatness accuracy of 0.25 dB or better. Output level is variable from -33 to + 57 dBmV. The sweep rate is variable from 1 to 60 cycles per second and the sweep section provides the reference timing signal for the comparator in the companion 1075 unit. "F" connectors, RF dectector, and AC-DC blocks are standard. Optional extras include plug-in single or multiple frequency or harmonic (comb) markers, crystal controlled 'birdy' markers, tilt control of the RF output to compensate for cable losses. The 1075 Comparator-Attenuator operates as a companion piece, taking its operating power from the 1067 sweeper (or a similar unit). It "time-shares" a 0-20 dB PIN diode attenuator in the 1067 and this allows:

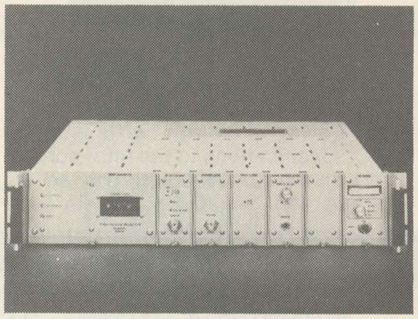
a) 1 dB calibrated continuous control of RF output in a 20 dB range;
b) Tilt of the RF output from plus or minus 20 dB;
c) Individual tilt on both gain and loss channels to compensate for cable, connectors and what have you;
d) Level control on the loss channel only to match the signal level on the gain channel;
e) Electronic PIN diode control, in 0.1 dB steps, on the gain channel, for high accuracy measurements.

Pricing on the 1067 is $745 and the 1075 is $495; a complete CATV test set up less only the display scope (which Wavetek can also supply!).

S/A Has New Demodulator

Scientific-Atlanta has a new model **6250** television demodulator with some very unusual detection systems and envelope processing circuits. The unit has user-selection of either synchronous or envelope detection. Both detection systems provide the operator with a choice of selecting how the 4.5 MHz aural sub-carrier is generated. Either intercarrier or direct mode is available with a front panel switch. The direct mode mixes the phase-locked synchronous oscillator with the sound IF which results in a higher audio signal-to-noise ratio.

The 6250 has had a 'zero-chopper' network that allows the operator to measure and monitor the depth of modulation of the received video carrier. A network of all-pass delay equalizers processes the video signal so that the received demodulated signal is the "compliment" of the original transmitter delay networks. Tne unit has an "input sensitivity of −20 dBmV or 100 microvolts.



Full information is available from Scientific-Atlanta at 3845 Pleasantdale Road, Atlanta, Georgia 30340.

Texscan Expands Rotaries

Texscan Corporation (2446 N. Shadeland Ave., Indianapolis, In. 46219) has announced a new set of microwave useable rotary attenuators that are good to 12.4 GHz. **Model RA-80** is a 1 dB step unit that goes from 0 to 10 dB while model **RA-81** is a 10 dB step unit that covers 0 to 60 dB.

AML In Canada

Hughes Aircraft Company has announced the appointment of **Micro-Sat Communications Limited** of Pickering, Ontario, Canada as distributor for the Hughes AML video relay systems throughout Canada.

Micro-Sat is a full-service distributor with CATV veteran Mark Beggs at the helm. Micro-Sat will provide in and out of warranty technical backup for the Hughes AML line throughout Canada, as well as distributing the AML gear.

An AML system was recently purchased by Cape Breton Cablevision, Limited of Sydney, Nova Scotia. The Cape Breton system is the first to install the AML package in the Atlantic provinces of Canada and it will provide Cablevision's channels throughout the Sydney and Sydney Mines regions.

AND ONLY $7.25 (5.50*)

No other tap provides this protection:

● Baked-on, Polyurethane Finish plus a Totally Water Sealed Assembly ● Patented Non-Shearing Center Seizure Mechanism ● Eye-level Center Seizure Connections ● Modular ● 5-300 MHz ●* With a standard irridite finish

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