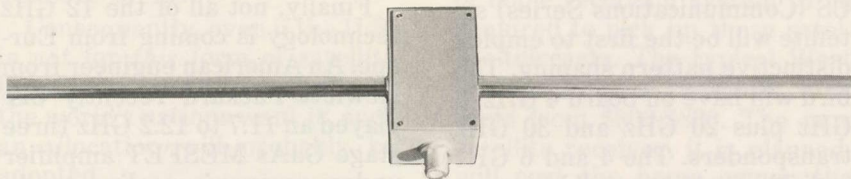


RICHEY ON RADIATION TESTS

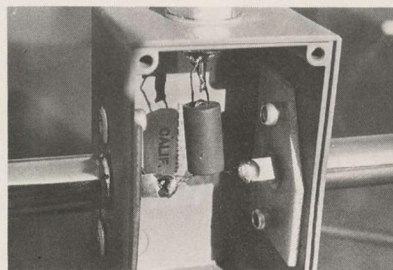
Steve Richey Describes A Do-It-Yourself Radiation Test Dipole/Amplifier Rig



In previous months this series of CATJ do-it-yourself construction article projects have covered (1) stripper for driving a frequency counter (September), (2) broadband noise generator (October) and (3) marker/signal generator for locating precise frequencies (November). This month we will deal with the construction of a home-built adjustable radiation (or signal strength measurement) dipole with a 15 dB gain flat broadband amplifier. The primary intent of this segment of the do-it-yourself test equipment package is to provide you with a way, with your trusty (if not trusted) calibration-referenced FSM/SLM, to make the devilish radiation tests. If you also utilize this system as a "Calibrate-able" package for making off-air field strength measurements, so much better for your package.

The package is two parts: an adjustable dipole constructed with a matching transformer (75 ohm balanced to 75 ohms un-balanced), and

a flat broadband amplifier. We make no suggestions as to a "mounting technique" for the radiation dipole. You should be clever enough on your own to figure out how to mount the unit to an expandable fiberglass or plastic pole-section array to allow you to raise the antenna to the proper height above ground (see box construction here). The antenna is constructed utilizing two readily available rod-section antennas which are found at your neighborhood Radio Shack store (Radio Shack part number 21-1156). The transformer is a two turn, to two turn unit wound on virtually any CATV type 2 hole ferrite core (such as you will find inside of a two-way splitter). The antenna elements screw attach into mounts installed on a piece of G-10 or phenolic board, pop-riveted into the box as shown in diagram two and in the photo. The antenna rods must of course be insulated from the metal of the box (a Pomona Electronics 2417 box).



Because the signal levels are very weak, even when you are radiating more signal than the rules allow (see box material here), the typical (read any) FSM/SLM cannot detect accurately such weak levels,

so we need some extra "measurement gain" between the dipole and the SLM/FSM to make the system play. This is the function of the 15 dB gain flat or broadband amplifier. It raises the detected levels by 15 dB, which is enough to make your 727 or SLIM or FSM-2 (or whatever) meter read the radiated level (s) present. To determine whether you "comply" or not,

PREPARATION OF POMONA BOX

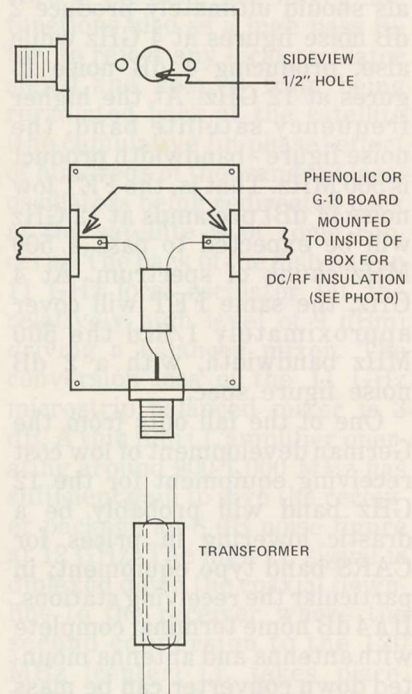
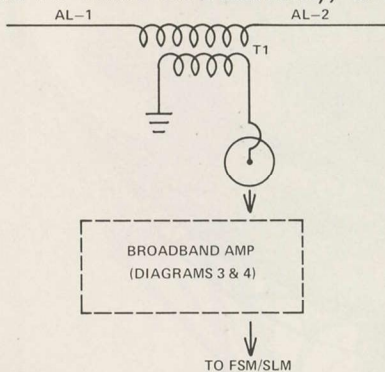


DIAGRAM 2

RADIATION LEVELS

Levels given below are "at" the properly-adjusted radiation-dipole terminals as measured at 75 ohms unbalanced. To these levels, adjust upward by the gain of the in-line broadband amplifier and downward by the known loss of the interconnecting downline cable to the SLM. Levels are absolute, and proper testing requires a freshly calibrated SLM/FSM.

Channel/ Frequency	Microvolts	[dBmV]
2	15.65	-36
3	14.20	-37
4	12.90	-38
74 MHz	11.70	-39
5	11.20	-39
6	10.40	-40
100 MHz	8.65	-41
108 MHz	8.05	-42
165 MHz	5.25	-46
7	4.95	-46
8	4.80	-46
9	4.65	-47
10	4.50	-47
11	4.35	-47
12	4.22	-48
13	4.10	-48



AL 1,2 - RADIO SHACK # 21-1156
BOX - POMONA #2417
F61A
T1 - SEE TEXT

DIAGRAM 1

you back-off the noted measurements by the 15 dB gain of the amplifier. If you are still below the FCC specified maximum levels, you are (almost) home free.

The amplifier section can be built into a secondary housing, and it can be attached directly to the output F61A on the dipole head. The amplifier is DC operated (i.e. with its own internal battery supply) and there is an LED circuit which keeps the LED glowing as long as you are above the 12 volt (regulated) level. When the LED goes out, either the LED went west or your voltage is now below the "Threshold" point, and you need to replace the batteries because the 15 dB gain amplifier will no longer have the intended gain.

The amplifier itself is very similar to the amplifier described in the October CATJ segment on the broadband noise generator (see page 29, October). The transistors are of the TO-39 type (metal can) and they can be anyone of a number of commonly avail-

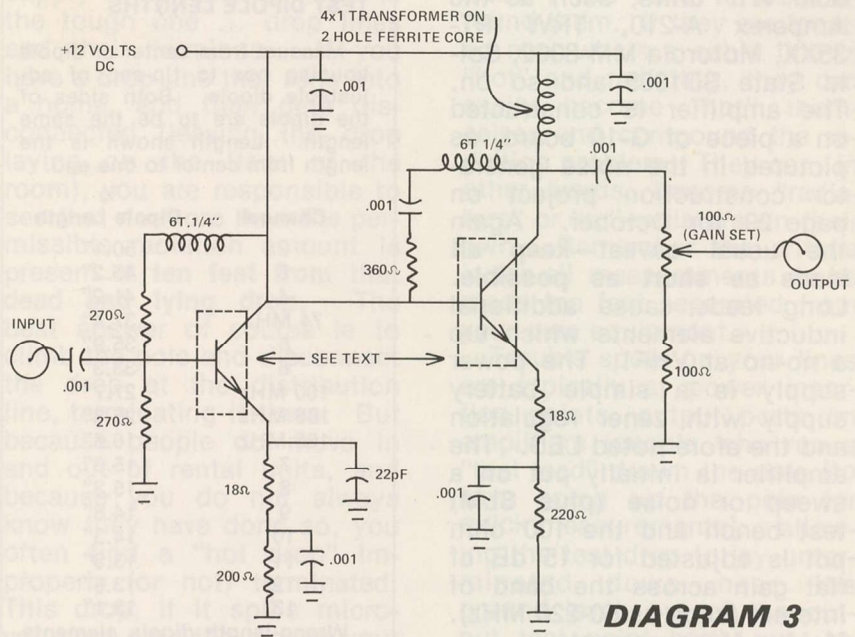


DIAGRAM 3

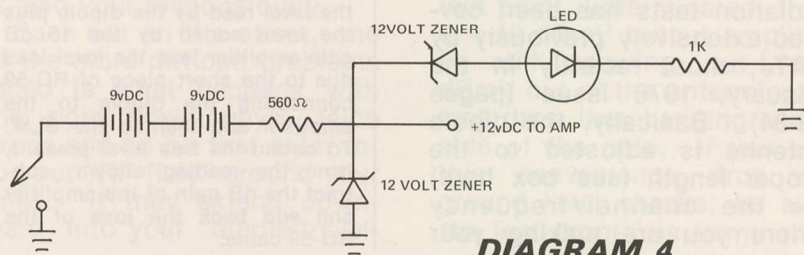


DIAGRAM 4

NEW FROM GILBERT ENGINEERING



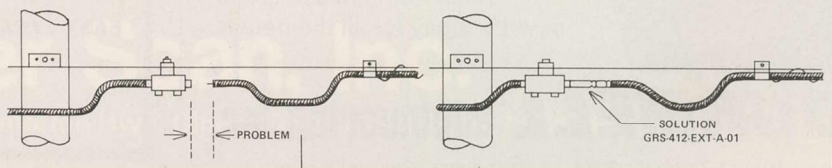
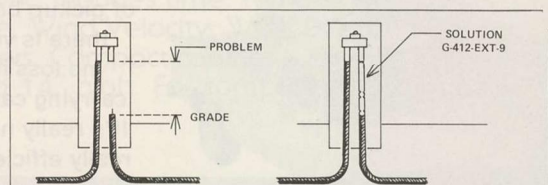
PATENT PENDING

CABLE EXTENDERS

THE MOST CONVENIENT WAY TO "BUY" 3 INCHES OF CABLE. SAVE THE COST AND LABOR OF INSTALLING SPLICES OR NEW CABLE.

NEW FAMILY OF CABLE/CONNECTOR EXTENSIONS

How many times have you incurred extra cost and time loss because the cable was a few inches too short or done less than a professional job when the necessary materials were not available? Gilbert can now help solve this problem from a stock of either prestige center seized or integral mandrell GRS series cable extender connectors.



GILBERT ENGINEERING CO.

3700 N. 36th AVENUE
PHOENIX, ARIZONA 85019
602-272-6871

TOLL FREE
800-528-5567

able VHF units, such as the Amperex A-210, TRW PT-35XX, Motorola MM 8002, Solid State SD1005 and so on. The amplifier is constructed on a piece of G-10 board, as pictured in the noise generator construction project on page 29 for October. Again the usual caveat—**keep all leads as short as possible.** Long leads cause additional inductive elements which are a no-no at VHF! The power supply is a simple battery supply with zener regulation and the afore noted LED. The amplifier is initially put on a sweep or noise (plus SLM) test bench and the 100 ohm pot is adjusted for 15 dB of flat gain across the band of interest (such as 50-220 MHz).

Making Measurements

The technique for making radiation tests has been covered extensively previously by CATJ, most recently in the January, 1976 issue (pages 32-34). Basically, the dipole antenna is adjusted to the proper length (see box here) for the channel/frequency where you are making your

TEST DIPOLE LENGTHS

Measure from center of dipole housing box to tip-end of adjustable dipole. Both sides of the dipole are to be the same length. Length shown is the length from center to **one** end.

Channel	$\frac{1}{2}$ Dipole Length
2	50.1"
3	45.2"
4	41.2"
74 MHz	37.4"
5	35.9"
6	33.3"
100 MHz	27.7"
108 MHz	25.6"
165 MHz	16.8"
7	15.8"
8	15.3"
9	14.8"
10	14.3"
11	13.9"
12	13.5"
13	13.1"

Wrong-length dipole elements will register incorrect readings. Your **total** SLM indicated level is the level read by the dipole **plus** the level added by the 15 dB gain amplifier **less** the level loss due to the short piece of RG-59 connecting the dipole to the amplifier and then to the SLM. To obtain the **true** level present, from the reading shown, **subtract** the dB gain of the amplifier and **add back** the loss of the RG-59 cable.

radiation test/checks. **Note:** When adjusting the length of the dipole, start from the **center** of the Pomona housing and measurement **outward** to both end-tips. Do **not** start at the edge of the box and measure outward. The overall length of the dipole is from tip to tip, in two equal segments starting at the center of the box. The inaccuracy of starting at box-edge for low band VHF will be minimal, but at high band VHF you will have a slightly off-resonant dipole (i.e. resonating lower in frequency than the intended frequency) if you start at the edge of the box and work outward.

Then, based upon 76.605 (a) (12) measurement requirements, you elevate the reference dipole to the point where you are (as close as possible) **10 feet removed** from the cable lines and the dipole is facing **parallel** to the cable line run. All FCC-measurement-permissible levels are based upon a ten foot separation between the test dipole and the cable lines. If you go back

IT'S UP, UP and AWAY with all new telescoping

DURA-LIFT®



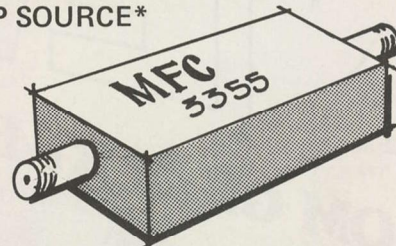
Now you can have a telescoping one man aerial bucket lift that mounts in a pickup! New PT-30 has nominal 30' working height with 15' reach over side. Mounts at front of pickup body, so there is virtually no loss in load-carrying capacity. It's really new . . . really efficient . . . really economical! Phone or write today for all the details.

DURNELL engineering, inc.

CATJ

PAY TRAPS

THE ONLY EVERY CHANNEL TRAP SOURCE*



*WRITE FOR "THE COMPLETE TRAPPER" CATALOG OF "HOW TO" AND HARDWARE.

Channel	Price	Delivery
2 & 5	\$3.75	same day
Others	\$5.50	2 weeks

MICROWAVE FILTER FCC COMPANY, INC.

6743 KINNE STREET.
EAST SYRACUSE, NEW YORK 13057

Tele: (315) 437-4529
Twx.: 710-541-0493
Cable: MICROFILCO

100 feet, you are allowed (for example) 10 dB less signal (which will be too weak to read accurately). The dipole moves along the cable lines until a "hot spot" is found. Then the dipole, still maintaining the ten foot separation, is rotated in axis and azimuth until the detected radiation is peaked. This is the level of signal you must contend with, and if it exceeds the permissible level for that channel or frequency, you have a fix-it problem on your hands. Many systems move along the line at say five foot separation, and **when** they spot a hot spot, **then they back up to the ten foot specified distance** and perform the azimuth and axis checks to peak the response. If it stays below the permissible level for the channel, you are home free. If not ... well, that is what this exercise is all about.

Many people tend to "overlook" the fact that a cable system is responsible for radiation from **any** of its equipment. Any includes power

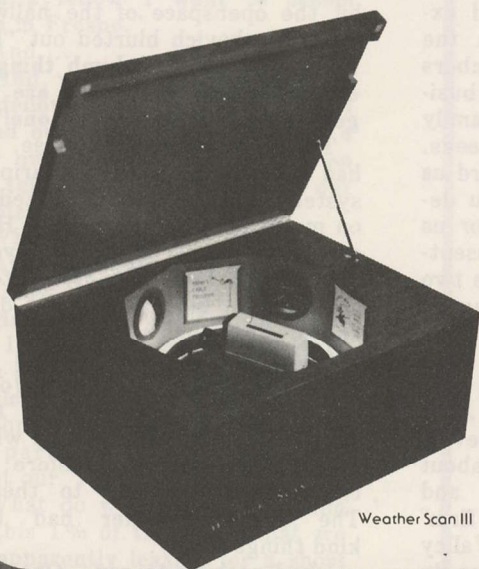
supply lines, and ... this is the tough one ... drop lines and their terminus. If you have a drop line that runs into a home, and then gets disconnected (leaving the drop laying on the floor of the room), you are responsible to see that no more than the permissible radiation amount is present **at ten feet from that dead and lying drop**. The best answer of course is to climb the pole and disconnect the drop at the distribution line, terminating it there. But because people do move in and out of rental units, and because you do not always know they have done so, you often find a "hot drop" improperly (or not) terminated. This drop, if it spills microvolts out onto the rug, is your responsibility. Probing for it is also your responsibility.

Back out on the street, one of the more difficult problems faced is what happens with the pole down guys, telco drops and so on that enter into your "RF field" around your lines. If they extend downward, into your "dipole-travel-

plane", you have to work around them. If they are located near where a cable line is "hot" and radiating, they can easily become "hot" themselves and compound the radiation problem. They can, in other words, become "radiators" or "re"-radiators on their own. Remember the criteria is for all measurements to be made ten feet separated from **your own equipment**.

Trouble spots on your lines are typically at power insertion points, output ports on amplifiers (people who run a "test lead" down the pole [to save going up the pole for quick measurements], allowing the test drop to lay unterminated down near the ground level, out of the output test point port), may be asking for trouble. A -20 dB test point, unterminated, from a +40 dBmV output amplifier is still spewing out +20 dBmV out of the unterminated test drop line hanging along side of the pole. If you use this convenience drop for ground level checks, be sure the test drop(s) is terminated.

First In Reliability



Weather Scan III

Impressive quality...surprisingly low price. Just \$1995 for the most reliable unit available (at any price!).

We have been in the cable television business for 23 years...and providing weather information systems for the past 16 years. We know what you need and we know how to manufacture it. For reliability and performance.

The Weather Scan III comes complete with Sony AVC-1400 camera with separate mesh vidicon and 2:1 interlace sync. Includes Time, Temperature, Barometric Pressure, Wind Velocity, Wind Direction, plus four card holders. Compact cabinet is just 38" wide, 23" deep and 14" high. For complete information call or write.



Weather Scan, Inc.

An R.H. Tyler Enterprise

Loop 132 and Throckmorton Hwy. Olney, Texas 76374 Ph. 817-564-5688