Amateur Radio

Our 32nd year in amateur radio.

February 1977
$1.25

CQ

CARIBBEAN SEA

ATLANTIC OCEAN

PACIFIC OCEAN

TRINDADE ISLAND

Expedition to Trindade Island

...see page 16

Amateur's Journal

TS-520

As a TS-520 owner, you go on the air with a sense of pride and confidence. Thousands of these precision-built beauties are in operation all over the world . . . in ham shacks, field day sites, in DX and contest stations and in countless mobile installations. No other rig has ever offered the performance, dependability, versatility and value that is built into every KENWOOD TS-520.

It lets you go on the air almost anyplace with its built-in 110/220 VAC and 12 VDC power supply. The TS-520 employs two rugged, time-proven S-2001 (equivalent 6146A) final tubes which are known for long life and superb linearity.

You have certainly heard the TS-520's clean signal on the air and have probably heard a lot of glowing praise by other hams. So if you don't already own a 520, maybe it's time that you did.

TV-506 Subject to FCC certification **TV-502** **VFO-520** **TS-520** **SP-520**

TS-520 Specifications

MODES: USB, LSB, CW
POWER: 200 watts PEP input on SSB, 160 watts DC input on CW
ANTENNA IMPEDANCE: 50-75 Ohms, unbalanced
CARRIER SUPRESSION: Better than −45dB
UNWANTED SIDEBAND SUPPRESSION: Better than −40 dB
HARMONIC RADIATION: Better than −40 dB
AF RESPONSE: 400 to 2600 Hz (−6 dB)
AUDIO INPUT SENSITIVITY: 0.25μV for 10 dB (S+N)/N
SELECTIVITY: SSB, 2.4 kHz (−6 dB), 4.4 kHz (−60 dB). CW 0.5 kHz (−6 dB), 1.5 kHz (−60 dB) (with accessory filter)
FREQUENCY STABILITY: 100 Hz per 30 minutes after warmup
IMAGE RATIO: Better than 50 dB
IF REJECTION: Better than 50 dB
TUBE & SEMICONDUCTOR COMPLEMENT: 3 tubes (2 x S-2001, 12BY7A), 1 IC, 18 FET, 44 transistors, 84 diodes
DIMENSIONS: 13.1" W x 5.9" H x 13.2" D
WEIGHT: 35.2 lbs.

VFO-520

Provides high stability with precision gearing. Function switch provides any combination with the TS-520. Both are equipped with VFO indicators showing at a glance which VFO is being used. Connects with a single cable and obtains its power from the TS-520.

SP-520

Although the TS-520 has a built-in speaker, the addition of the SP-520 provides improved tonal quality. A perfect match in both design and performance.

TV-502

The TV-502 transverter puts you on 2-meters the easy way. Simply plug it in and you're on the air. Operates in the 144.0-145.7 MHz frequency range with a 145.0-146.0 MHz option. The TV-502 is completely compatible with the TS-520, the TS-820 and most any HF transceiver.

TV-506

The TV-506 is similar to the TV-502 except that it opens up the 6-meter band to your HF rig. It operates in the 50.0-54.0 MHz frequency range for full coverage.

TRIO-KENWOOD COMMUNICATIONS INC. 116 EAST ALONDRA/GARDENA, CA 90248

KENWOOD
. . . pacesetter in amateur radio

ANNOUNCING AN EXCITING NEW 2-METER TRANSCEIVER FROM KENWOOD

the

TR-7400A

Featuring Kenwood's New and Unique CONTINUOUS TONE CODED SQUELCH SYSTEM

4 MHz BAND COVERAGE

25 WATT OUTPUT

FULLY SYNTHESIZED

UNIQUE SQUELCH SYSTEM
The TR-7400A may be used on your favorite repeater, no matter what type of squelch system is used. The continuous tone coded squelch (CTCS) may be used for both transmit and receive or for transmit only. Tone burst operation may also be used.

SYNTHESIZED, 800 CHANNELS
The phase-locked loop (PLL) frequency synthesizer in the TR-7400A divides the 4 MHz bandwidth into 400 channels at intervals of 10 KHz. The frequency may be offset 5 KHz higher with the push of a button, thus providing 800 discrete channels.

REPEATER OFFSET
A convenient front panel switch offsets the transmit frequency of the TR-7400A up OR down 600 KHz for standard repeater operation. This offset circuit uses digital technology to provide a highly stable offset frequency without spurious response. A dual color LED indicates the direction of offset from the displayed receive frequency.

OUTSTANDING RECEIVER PERFORMANCE
Large-sized helical resonators with high Q minimize undesirable interference from outside the 2-meter band. The large helical resonators, 2-pole 10.7 MHz monolithic crystal filter, and MOSFET front-end circuitry combine to give outstanding receiver performance.

TONE PAD CAPABILITY
A jack is provided to allow convenient connection of a tone pad to the TR-7400A.

FINAL PROTECTION CIRCUIT
The final transistor in the TR-7400A is protected from antenna impedance mismatch. Excessive reflected power reduces the amount of drive to the final transistor rather than turning off the final stage. This practical feature allows continued safe operation at a reduced power level whether the antenna system becomes opened or shorted.

TRIO-KENWOOD COMMUNICATIONS INC.
116 EAST ALONDRA/GARDENA, CA 90248

KENWOOD
...pacesetter in amateur radio

Specifications TR-7400A

Range: 144.00 MHz to 147.995 MHz
Mode: FM
800 Channels: 5 KHz spaced
Sensitivity: Better than 0.4 uV for 20 dB quieting
Better than 1 uV for 30 dB S/N
Squelch Sensitivity: Better than 0.25 uV
Selectivity: 12 KHz at −6 dB down
40 KHz at −70 dB down
Image Rejection: Better than −70 dB
Spurious Interference: Better than −60 dB
Intermodulation: Better than 66 dB
Receive System: Double conversion
First IF: 10.7 MHz
Second IF: 455 KHz
Audio Output: More than 1.5 Watts (8 ohm load)
RF Output Power: 25 Watts (High)
5-15 Watts (Low-adjustable)
Antenna Impedance: 50 ohms
Frequency Deviation: ±5 KHz
Spurious Response: Better than −60 dB
Tone Pad Input Impedance: 600 ohms
Tone Burst Duration: 0.5 to 1.0 sec.
CTCS Range: 88.5 Hz to 156.7 Hz
Microphone: Dynamic, with PTT switch, 500 ohms
Voltage: 11.5 to 16.0V DC (13.8V DC nominal)
Current Drain: Less than 1A in receive (no input signal)
Current Drain: Less than 8A in transmit
Polarity: Negative ground
Temperature Range: −20 to +50 degrees C
Dimensions: 182 mm (7-3/16") wide
270 mm (10-5/8") deep
74 mm (2-7/8") high
Net Weight: Approximately 2.8 kg (6.2 lbs.)

Call toll-free 800-647-8660 for products by MFJ ENTERPRISES

400% MORE RF POWER PLUGS BETWEEN YOUR MICROPHONE AND TRANSMITTER

$49.95

LSP-520BX. 30 db dynamic range IC log amp and 3 active filters give clean audio. RF protected. 9 V battery. 3 conductor, ¼" phone jacks for input and output. 2-3/16 x 3-1/4 x 4 inches.

$59.95

LSP-520BX II. Same as LSP-520BX but in a beautiful 2-1/8 x 3-5/8 x 5-9/16 inch Ten-Tec enclosure with uncommitted 4 pin Mic jack, output cable, rotary function switch.

SUPER LOGARITHMIC SPEECH PROCESSOR

Up To 400% More RF Power is yours with this plug-in unit. Simply plug the MFJ Super Logarithmic Speech Processor between your microphone and transmitter and your voice is suddenly transformed from a whisper to a **Dynamic Output.**

Your signal is full of punch with power to slice through QRM and you go from barely readable to "solid copy OM".

$27.95

CWF-2BX Super CW Filter

By far the leader. Over 5000 in use. Razor sharp selectivity. 80 Hz bandwidth, extremely steep skirts. No ringing. Plugs between receiver and phones or connect between audio stage for speaker operation.

• Selectable BW: 80, 110, 180 Hz • 60 dB down one octave from center freq. of 750 Hz for 80 Hz BW • Reduces noise 15 dB • 9 V battery • 2-3/16 x 3-1/4 x 4 in. • CWF-2PC, wired PC board, $18.95 • CWF-2PCK, kit PC board $15.95

$49.95

CMOS-8043 Electronic Keyer

State of the art design uses CURTIS-8043 Keyer-on-a-chip.

• Built-in Key • Dot memory • Iambic operation with external squeeze key • 8 to 50 WPM • Sidetone and speaker • Speed, volume, tone, weight controls • Ultra reliable solid state keying ±300 volts max. • 4 position switch for TUNE, OFF, ON, SIDETONE OFF • Uses 4 penlight cells • 2-3/16 x 3-1/4 x 4 inches

$39.95

NEW

MFJ-16010 Antenna Tuner

Now you can operate all band — 160 thru 10 Meters — with a single random wire and run your full transceiver power output — up to 200 watts RF power OUTPUT.

• Small enough to carry in your hip pocket, 2-3/16 x 3-1/4 x 4 inches • Matches low and high impedances by interchanging input and output • SO-239 coaxial connectors • Unique wide range, high performance, 12 position tapped inductor. Uses two stacked toroid cores

$29.95

SBF-2BX SSB Filter

Dramatically improves readability.

• Optimizes your audio to reduce sideband splatter, remove low and high pitched QRM, hiss, static crashes, background noise, 60 and 120 Hz hum • Reduces fatique during contest, DX, and ragchewing • Plugs between phones and receiver or connect between audio stage for speaker operation • Selectable bandwidth IC active audio filter • Uses 9 volt battery • 2-3/16 x 3-1/4 x 4 inches

$27.95

MFJ-200BX Frequency Standard

Provides strong, precise markers every 100, 50, or 25 KHz well into VHF region.

• Exclusive circuitry suppresses all unwanted markers • Markers are **gated** for positive identification. CMOS IC's with transistor output. • No direct connection necessary • Uses 9 volt battery • Adjustable trimmer for zero beating to WWV • Switch selects 100, 50, 25 KHz or OFF • 2-3/16 x 3-1/4 x 4 inches

$49.95

MFJ-1030BX Receiver Preselector

Clearly copy weak unreadable signals (increases signal 3 to 5 "S" units).

• More than 20 dB low noise gain • Separate input and output tuning controls give maximum gain and RF selectivity to significantly reject out-of-band signals and reduce image responses • Dual gate MOS FET for low noise, strong signal handling abilities • Completely stable • Optimized for 10 thru 30 MHz • 9 V battery • 2-1/8 x 3-5/8 x 5-9/16 inches

$27.95

MFJ-40T QRP Transmitter

Work the world with 5 watts on 40 Meter CW.

• No tuning • Matches 50 ohm load • Clean output with low harmonic content • Power amplifier transistor protected against burnout • Switch selects 3 crystals or VFO input • 12 VDC • 2-3/16 x 3-1/4 x 4 inches

MFJ-40V, Companion VFO $27.95
MFJ-12DC, IC Regulated Power Supply, 1 amp, 12 VDC $27.95

$15.95

NEW

CPO-555 Code Oscillator

For the Newcomer to learn the Morse code.
For the Old Timer to polish his fist.
For the Code Instructor to teach his classes.

• Send crisp clear code with plenty of volume for classroom use • Self contained speaker, volume, tone controls, aluminum cabinet • 9 V battery • Top quality U.S. construction • Uses 555 IC timer • 2-3/16 x 3-1/4 x 4 inches

TK-555, Optional Telegraph Key $1.95

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Dear Fellow Ham,

Try any MFJ products and if you are not completely satisfied, return it within 30 days for a full prompt refund (less shipping). Call us today **toll free 800-647-8660** and charge your Bank-Americard or Master Charge, or mail your order in today with your check or money order (or use your BAC or MC). Please add $2.00 for shipping and handling.

73, Martin F. Jue, K5FLU

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FEBRUARY, 1977 VOL. 33, NO. 2

The Radio Amateur's Journal

FEATURES

DEPARTMENTS

Offices: 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050. Telephone: 516-883-6200

CQ (Title registered U.S. Post Office) is published monthly by Cowan Publishing Corp. Second Class Postage paid at Port Washington, N.Y. and other points. Subscription Prices one year, $7.50; two years $13.00. Allow six weeks for change of address. Printed in the United States of America.

Postmaster: Please send form 3579 to CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050

YAESU ELECTRONICS CORPORATION ANNOUNCES THEIR 1977

TWO METER SSB DX CONTEST

THOUSANDS OF DOLLARS IN PRIZES !

Yaesu Electronics Corporation is sponsoring a Two Meter SSB DX Contest open to all U. S. amateurs, between April 1 and April 30, 1977. Thousands of dollars in Yaesu amateur radio equipment will be given as prizes to those amateurs who garner the most points for contacts over 150 airline miles from their station or through Oscar 6 and 7 satellites !

Full details of this super contest are available at all authorized Yaesu dealers. Get your entry blank now ! If you have no two meter equipment, see your Yaesu dealer now and buy the thrilling new FT-221 all-mode full band coverage transceiver or a FT-250 transverter. Their sparkling performance will give your station an edge and you will also gain multiplier points for using Yaesu equipment. See these top performers at your **Yaesu** dealer now, and get your entry blank for full details.

You could be among the winners !

FIRST PRIZE
FT-101E

SECOND PRIZE
FR-101 DIGITAL RECEIVER

THIRD PRIZE
FL-101 TRANSMITTER

FOURTH PRIZE
FRG-7 ALL BAND RECEIVER

AND MANY MORE !

See Your Yaesu Dealer For Contest Entry Form

WIN A PRIZE - JUST FOR FUN !

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The radio.

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Zero Bias

an editorial

HI, and welcome to the world of amateur radio. It may be a new experience for some of our old time readers and for those of you who have never been exposed to amateur radio to find that starting with this the February issue, CQ is on the newsstands. Not only on the newsstands but still at major electronic distributors throughout the country.

If you are a newcomer, or just picked this issue up out of curiosity, or even got it by mistake, glance through the pages at some of the most interesting and exciting facets any pastime can give you. Get set to match the inner you with the rest of the world.

A stamp in an album can give an inner satisfaction but doesn't talk back or respond to you nor does that super new camera respond to you. It merely reflects what you see and put into it. Even most sports require that you go to some place to participate, which is sometimes inconvenient. The current CB craze is still in some ways limiting as to who you can talk to and just how far can you talk. After you've found out traffic conditions or just where the next law officer is hiding where do you go from there?

Well we're here to tell you that your next giant step is right into amateur radio. Talk To The World is not just a slogan it's a reality or just as real as you want to make it, Want to find out traffic conditions (in case you're hung up on driving) then why not ask someone on Gough Island? Like to exchange stamps? Why not swap a few this week with a new friend you've made via amateur radio in Malagasy Republic. Even snap shots take on a new meaning via one facet of amateur radio . . . Slow Scan Television. You can send and receive pictures from practically anyplace you can think of including some recent shots sent back from Mars.

What's your pleasure? Are you the sports minded, competitive hard driving type who likes a challenge and plays to win? Well amateur radio is still the place for you. Almost every week throughout the year there are contests, contests and more contests testing the spirit, endurance, stamina and equipment of everyone who enters them. There are countless Award Programs sponsored by different organizations designed to test both your patience and skill as you work for these achievements.

Perhaps you're more the retiring type who really doesn't care who wins or you haven't got a place on your mantle for a trophy that you can say with a measure of pride "The station here is homebrew". Maybe not, you say well how about seeing how far you can talk by using lower and lower and still lower power. The average CB set is only a few watts and that doesn't go too far but with that same few watts of power you can reach clear across the ocean (either one).

If you're the type who still likes the brisk challenge of the great outdoors there are always new antennas to be thought of and built as well as put up. There's always room for improvement or simply change.

What about travel? Wouldn't it be fun for a change to go to a new city or even a foreign country for the first time and actually have an old friend there to meet you and show you around. Amateur radio puts you just a switch away from anyplace.

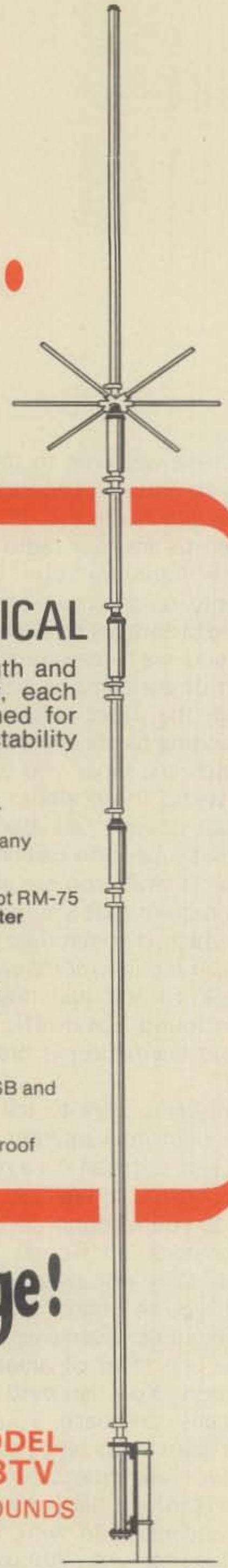
Well, you might say that's OK for someone who knows the ropes, has a lot of money and is really technically oriented. What about us, those of us who want to get our feet wet slowly and really are not in too much of a hurry to do any of those things. You can really enter amateur radio at any level or any phase. You can learn about electronics to any degree you want to find useful or helpful. What you can get out of amateur radio, like any other endeavor can only be measured by what you are willing to put into it.

Are you a chronic saver or collector? Here's a chance to start a new collection. Of what you might ask, well anything that has to do with radio, electronics, and all the rarities connected with amateur radio. In no time at all you can fill every nook and crany with terrific memorabilia from any age of radio or wireless (maybe just some of everything).

At the other edge are the folks who go all out for

(continued on page 72)

if the 4-BTV weighs 39% more... what do others leave out?



HUSTLER FIXED STATION FOUR BAND VERTICAL

The 4-BTV is longer for greater aperature, larger in diameter for strength and bandwidth, heavier traps for precision and safety factor. Individually, each subassembly weighs more to collectively give you an antenna designed for convenience of assembly and installation, a wide margin in mechanical stability and far superior electrical performance.

- **Lowest SWR**—PLUS!
- Bandwidth at its **broadest!** SWR 1.6 to 1 or better at band edges.
- Hustler exclusive trap covers **"Spritz" extruded** to otherwise unattainable close tolerances assuring accurate and permanent trap resonance.
- Solid one inch **fiberglass trap forms** for optimum electrical and mechanical stability.
- Extra heavy duty aluminum mounting bracket with **low loss—high strength** insulators.
- All sections **1¼" heavy wall,** high strength aluminum. Length 21'5".
- **Stainless steel clamps** permitting adjustment without damage to the aluminum tubing.
- Guaranteed to be **easiest assembly** of any multi-band vertical.
- Antenna has ⅜"-24 stud at top to accept RM-75 or RM-75-S Hustler resonator for **75 meter operation** when desired.
- Top loading on 75 meters for broader bandwidth and **higher radiation efficiency!**
- Feed with **any length** 50 ohm coax.
- Power capability—**full legal limit** on SSB and CW.
- Ground mount with or without radials; roof mount with radials.

one setting for total band coverage!
40 THROUGH 10 METERS

HUSTLER ANTENNA PRODUCTS—for sixteen years—original designs—created and manufactured by American ingenuity, labor and materials—used by communicators throughout the world.

Hustler designs are patented under one or more of the following assigned to New-Tronics Corporation: 3287732, 3513472, 3419869, 3873985, 3327311, 3599214, 3582951

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15 POUNDS

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brook park, ohio 44142
Exporter: Roburn Agencies, Inc., New York, N. Y.

Announcing

• **Whitewater, WI** — The Tri County ARC Hamfest will be held March 20, in the Whitewater Armory. Donation $1.50 in advance, $2.00 at the door. Reserved tables $2.00 in advance. Write Doc Walters WB9EMR, 81 N. Main St., Fort Atkinson, Wisconsin 53538

• **Columbus, GA** — The Columbus Amateur Radio Club will hold their annual hamfest at the Fine Arts Bldg (Fairgrounds) on April 2 & 3, Palm Sunday weekend. This year a ham auction has been added. Hours are 9 AM to 4 PM daily. Bring your gear to build up the flea market. The Buffet Dinner is at the Black Angus at 8 PM Saturday. For Info write K4JNL, Advance tickets: K3MTY-/4, Rt. 5, Box 750, Phenix City, AL 36867.

• **St. Clair Shores, MI** — The South Eastern Michigan Amateur Radio Association is holding its Nineteenth Annual Hamfest on April 3, 1977 from 8 am EST to 3 pm EST. It will be held at the South Lake High School, nine mile rd. and Mack Ave., For further information contact Dorothy Spilski, WB8PRJ, 11906 Riad Ave., Detroit, Mich. 48224. (313) 521-6646.

• **Tampa, FL** — The "Old fashioned Tampa Hamfest will be held on Sunday, April 17, at Lowry Park from 9:00 am till 4:00 pm. Bring the family and picnic, lunch. Refreshments available, zoo and rides for the kids! Plenty of free parking - table or trunk swapping. Due to location - no dealers please! $1 Donation. Prizes for the whole family. For info: Hillsborough Amateur Radio Society (HARS), 8835 Nautilis Drive, Tampa, Florida 33615.

Triple chrome plated hardware is one reason why A/S is number one in antennas.

We're not about to rust on our laurels.

All of a sudden, the 2-way audio world has been flooded with a bewildering assortment of antenna brands. Some of these (including some that remarkably resemble ours) do not measure up to the performance, reliability and appearance standards that have made A/S antennas number one for over 20 consecutive years.

Superficial chrome plating (or no plating at all) is one way to cut cost without being obvious – for a few months. Whips made of inferior stainless steel work perfectly – until they hit their first tree limb. And erratic coil winding you can't see can cut miles from range.

A/S has never compromised its professional standards – the hidden virtues that make a world of difference in the performance of your radio system. Look for the stripes of quality. Your best assurance that you're getting what you're seeing.

® "Stripes of Quality"

the antenna specialists co.

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GENAVE

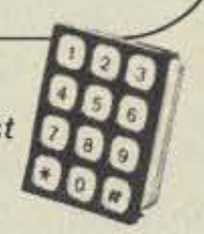
The HAM Gear for 1977

GTX-IT
Hand-Held 2-meter FM, 6-channel, 3.5 watts hand-held with factory-installed tone encoder
$299.95

GTX-I
Hand-Held 2-meter FM, 6-channel, 3.5 watts hand-held
$249.95

CHECK THESE FEATURES:
- All metal case
- American made
- Accepts standard plug-in crystals
- Features 10.7 MHz crystal filter
- Trimmer caps on TX and RX crystals
- 3.5 watts output
- Battery holder accepts AA regular, alkaline or nicad cells
- Mini hand-held measures 8" high x 2.625" wide x 1.281" deep
- Rubber ducky antenna,
- Wrist safety-carrying-strap included
- 6 channels
- Factory-direct to you!

Accessories Available
- Nicad battery pack
- Charger for GTX-1 battery pack
- Leather carrying case
- TEIII tone encoder for auto patch

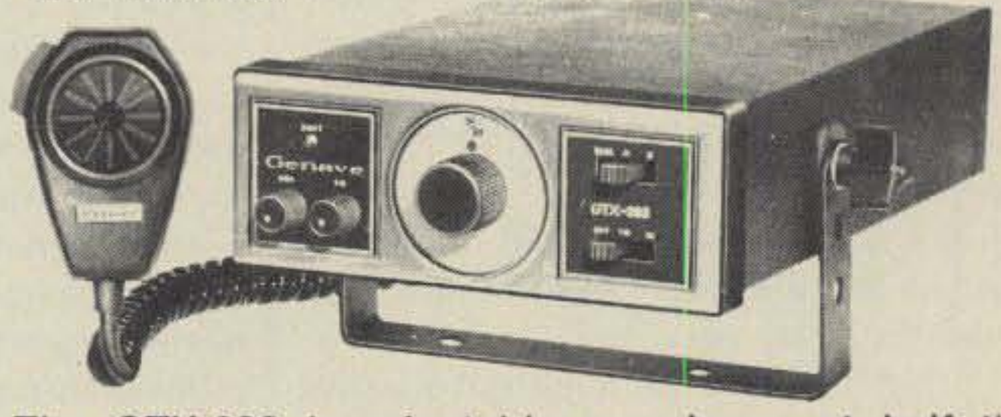


TONE ENCODER PAD
Plug-in installation on most amateur transceivers.

TE-II **$49.95** TE-I **$59.95**

GTX-202
$239.95 (Incl. 146.94 MHz)

INTERMOD? Virtually None! SELECTIVITY? Really Super NUMBER OF CHANNELS? From 1 to 22



The GTX-202 is adaptable anywhere—at half the price of synthesis—so, buy at low acquisition cost, and add crystals later as you want them.

CHECK THESE OUTSTANDING FEATURES:
- Massive heat sink to maintain power over prolonged transmissions
- 30 watts (nom.) output
- 8-pole crystal filter
- 15-pin accessory jack
- Dual-gate MOSFET front end

Same Circuitry as used in Genave's famous Land Mobile transceivers . . . Manufactured in America by the same Government-Inspected facility that produces high quality reliable communications and navigations for marine and aircraft industries.

GTX-200-T
2-meter FM, 100 channel combinations, 30 watts with factory installed tone encoder (Incl. 146.94 MHz)
$249.95

GTX-200
2-meter FM, 100 channel combinations, 30 watts (Incl. 146.94 MHz)
$199.95

GTX-10-S
2-meter FM, 10 channels, 10 watts (Xtals not included)
$149.95

GTX-2
2-meter FM, 10 channels, 30 watts with pushbutton freuency selector (Incl. 146.94 MHz)
$189.95

'HURRY! USE THIS HANDY ORDER FORM'

Genave

4141 Kingman Dr., Indianapolis, IN 46226
Phone-in orders accepted (317+546-1111)

NAME_____

ADDRESS_____ CITY_____

STATE & ZIP_____ AMATEUR CALL_____

☐ GTX-202	$239.95	☐ Ringo Ranger ARX-2 6db 2-M Base Antenna	$29.95
☐ GTX-200-T	$249.95	☐ Lambda/4 2-M and 6-M Trunk Antenna	$29.95
☐ GTX-200	$199.95	☐ TE-I Tone Encoder Pad	$59.95
☐ GTX-10-S	$149.95	☐ TE-II Tone Encoder Pad	$49.95
☐ GTX-2	$189.95	☐ PS-I AC Power Supply for use with all makes of transceivers 14 VDC—6 amp	$69.95
☐ GTX-1	$249.95	and the following **standard** crystals @ $4.50 each ..... $_____	
☐ GTX-IT	$299.95	**Non-standard** crystals @ $6.50 each: ..... $_____	

Add $4 per Radio for Shipping, Handling, and Crystal Netting. C2

ACCESSORIES FOR GTX-1 and GTX-1T

☐ **PSI-18** Optional Nicad battery pack	$29.95
☐ **PS-2** Charger for GTX-1(T) battery pack	$39.95
☐ **GLC-1** Leather carrying case	$12.95
☐ **TE-III** Tone Encoder (for use with GTX-1)	$49.95

Payment by:
☐ Certified Check/Money Order ☐ Personal Check
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20% Down Payment Enclosed. Charge Balance To:

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IN residents add 4% sales tax:
CA residents add 6% sales tax: $_____

All orders shipped post-paid within continental U.S.

Our Readers Say

Zero Bias Revisited

Editor, CQ:

Was very pleased when your August issue arrived a few weeks back. Being a little different from many magazine readers, I started this issue just behind the front cover (HI!). I looked for the inspiration usually contained in "Zero Bias". What a surprise I was in for! When a notice to renew my subscription arrived three days later, the first thought was, "I'll drop that EEK a note and tell him where he can put . . ." But, since I seldom act on ideas like that, here I am sending out a check and some unbiased thoughts of my own.

"God grant me the serenity to accept the things I cannot change, courage to change the things I can, and wisdom to know the difference."

I know, as do all of your regualr reders, that you and your staff are doing everything in your power to make up for the delays of a year ago. As soon as possible, I know the date on your mag will match that on the calendar in the shack. As for the post office, I don't think anybody really knows how to help them, so I certainly don't lose any brass pounding time on raillery against them. There are some things in this world which I do feel capable of changing. Even though I'm only one, I have put my time, energy, and enthusiam to the tasks and found that once I was underway there were others following. I found that by joining a fraternal organization for a little fun, I was also able to help others, the young and the old. By being active in the organization I joined, I added not only numerical support, but physical support to the ideas, and the legislation espoused by that organization.

In your article you mentioned the two conventions in Phily last July and made some unfortunate, and inaccurate, comparisons. It is truly unfortunate that convention planners and those people providing the facilities don't try to avoid conflicts of interest. As a Legionnaire, and an amateur, I know of some strong similarities involved in our conventions. I'll not waste your time by dwelling on the psychology of a convention where leaders (and those aspiring to be), workers, and a whole string of support units get together to solve problems and plan for the future. Let it be sufficient to say that without the eating, drinking, parades, and competition, how many people like you and me would bother to attend another?

Just to set the record straight, let me say, in my eight years with the American Legion I have told and heard a FEW war stories. Being an organization of veterans who served honorably during war time, it is to be expected, however these tales in no way dominate the conversations between Legionnaires. If you had sat in on the convention sessions that weekend, you would likely have been exposed to some long debates, endless caucuses, and a long line of committee reports. You would have heard reports on how the Legion has involved over a million kids in a program known around the country as Boy's and Girl's State. You would have heard how the Legion fights to keep God and Country in our schools and drugs out, and resolutions to prevent cuts in pensions received by the older or disabled men and women who stood up for our country. You certainly would have heard something about the maintenance of peace through strength. If you had looked a little deeper into this organization, you would have found that the young veterans are active, and those of the Vietnam period make up a large percentage of the newer memberships and are responsible for many of the new programs the organization is involved in. (During the last five years the average age of it's members has actually decreased by five years.) They have been appointed to positions from the local to national levels and have been elected to positions as high as State Commander. This is hardly an organization which exist "to relive WW II and the good old days".

This year, 42% of the nation's Legion Posts participated in a new reporting system. Here are some of the totals from the summary of those 7,000 reports: Presentation of 20,000 school awards (cost 220,000), 2 million manhours donated to community service, donations to charitable campaigns such as the Red Cross and United Way accounted for $1.6 million with another $4 million for childrens services and charities and direct aid to 190,000 kids, and more than $300,000 support to the scouting program. That's the count for 42% of the posts representing about half of the Legion's members! (Though not close to the other veteran's organizations, I know that most stand for similar purposes, and I believe that most have had some success recruiting the younger veterans.)

I have written this letter because in your attempt to put a spark under amateurs, I think you have accidently hurt others. I would hope that any of your readers looking for an opportunity to do something for their community, state, or nation will have a chance to read this. Incidently, I am a Vietnam veteran. Three years ago I commanded a local Legion Post and I now hold an elected district (county) position.

Gary Lee Williams, AB8MWR
Milford, MI

"More Gottlieb . . . Please"

Editor, CQ:

I was just about to write to you inquiring why an Irving Gottlieb, W6HDM article hadn't appeared in CQ for sometime when I discovered in the August '76 issue his latest masterpiece, Relativity in the Hamshack.

I have read each of his previous articles with great interest, but I must say his latest one deserves a prize.

Here's hoping that Mr. Gottlieb continues to write his "mind joggling" articles and you continue to publish them.

Louis Facto, WAØQDB
Iowa City, IA

Thanks CQ

Editor, CQ:

We wish to express our gratitude and sincerest "THANKS" to your fine Journal in assisting us in making our "Aruba Salutes America" activity a success.

As a matter of fact it was so succesful that many stateside Hams requested a prolongation in order to give them a better chance at obtaining the "Aruba Salutes America" award.

Please if space permitting, could you publish this in your journal as we are paying tribute to a great Country and it's great people in the only way possible to us, and that is through Ham radio.

Aruba Amateur Radio Club
R.A. Richardson, Secretary

(continued on page 79)

DenTron amateur radio products have always been strikingly individual. This is the result, not of a compulsion to be different, but of a dedication to excellence in American craftsmanship. This dedication now extends to one of the worlds finest high performance military amateur amplifiers.

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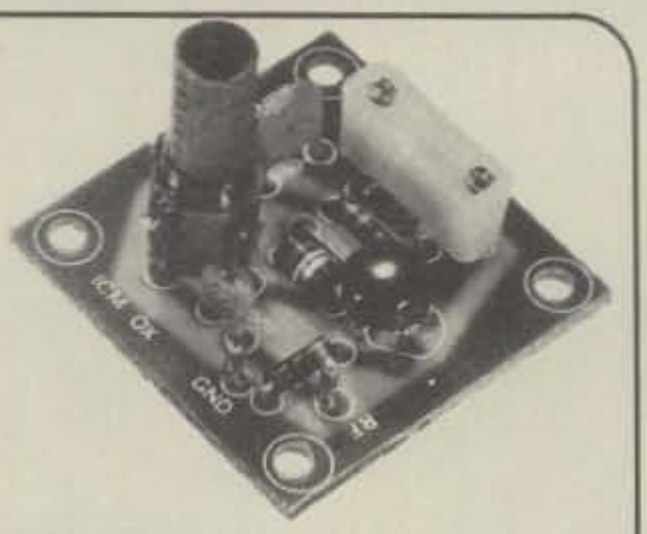

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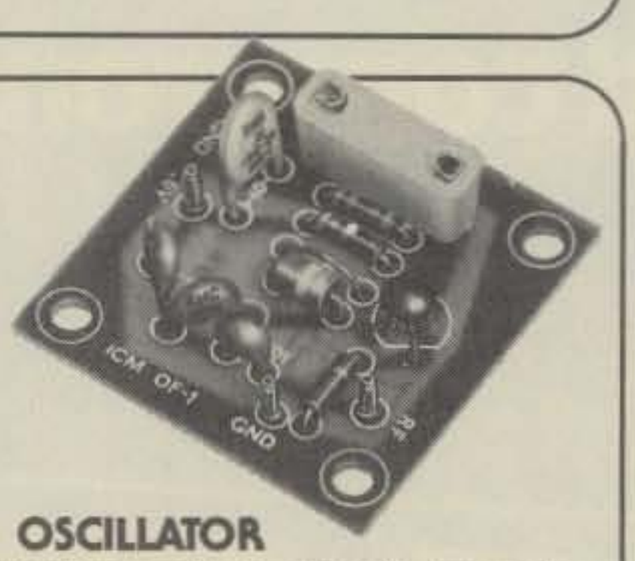

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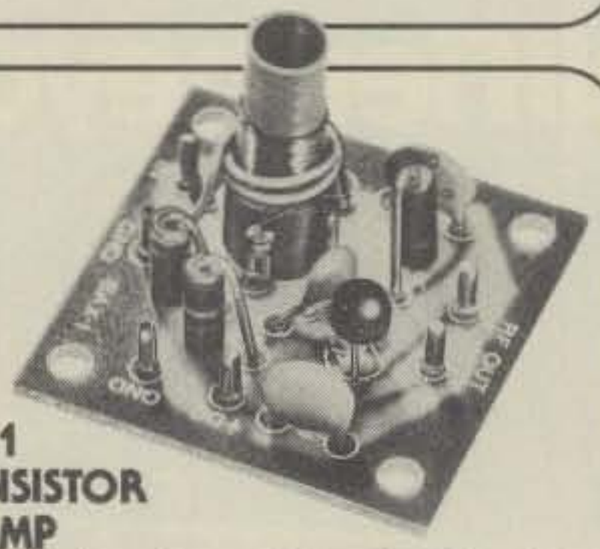

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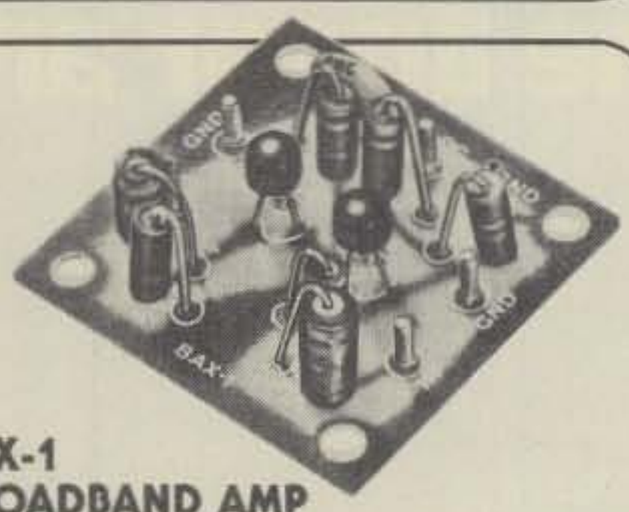

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VSWR	2:1 or less	2:1 or less	2:1 or less	2:1 or less	2:1 or less
Impedance	50 ohms	50 ohms	50 ohms	50 ohms	50 ohms
Mechanical					
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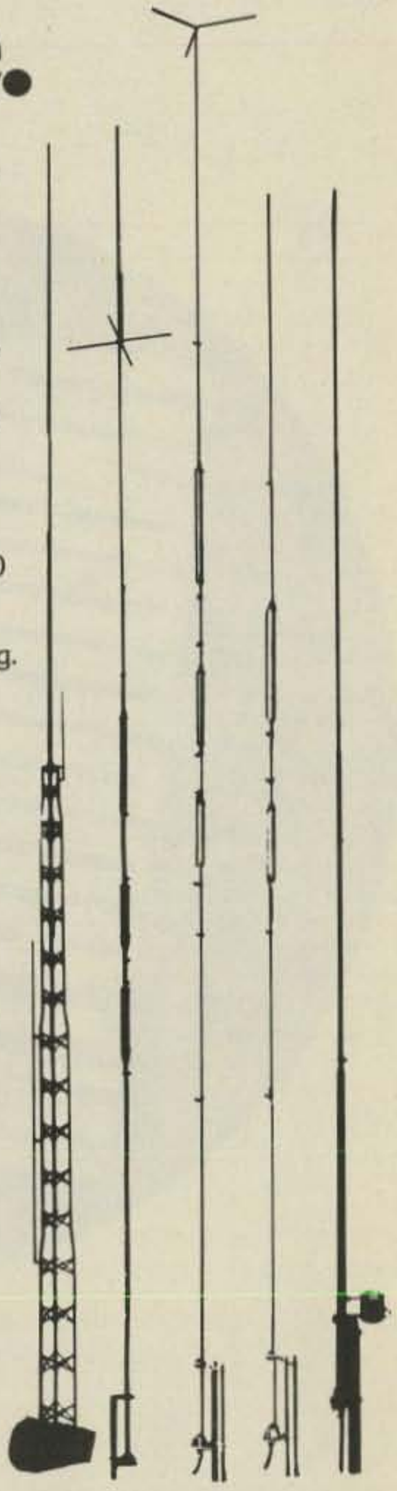

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No it's not a misspelling. Trindade is not another form of Trinidad nor is it even close. Follow Carl and Rolf through a rather short but exotic Dxpedition they took several years ago.

A DXpedition To TRINDADE ISLAND

BY CARL KRATZER*, WA3HRV/LU3AU

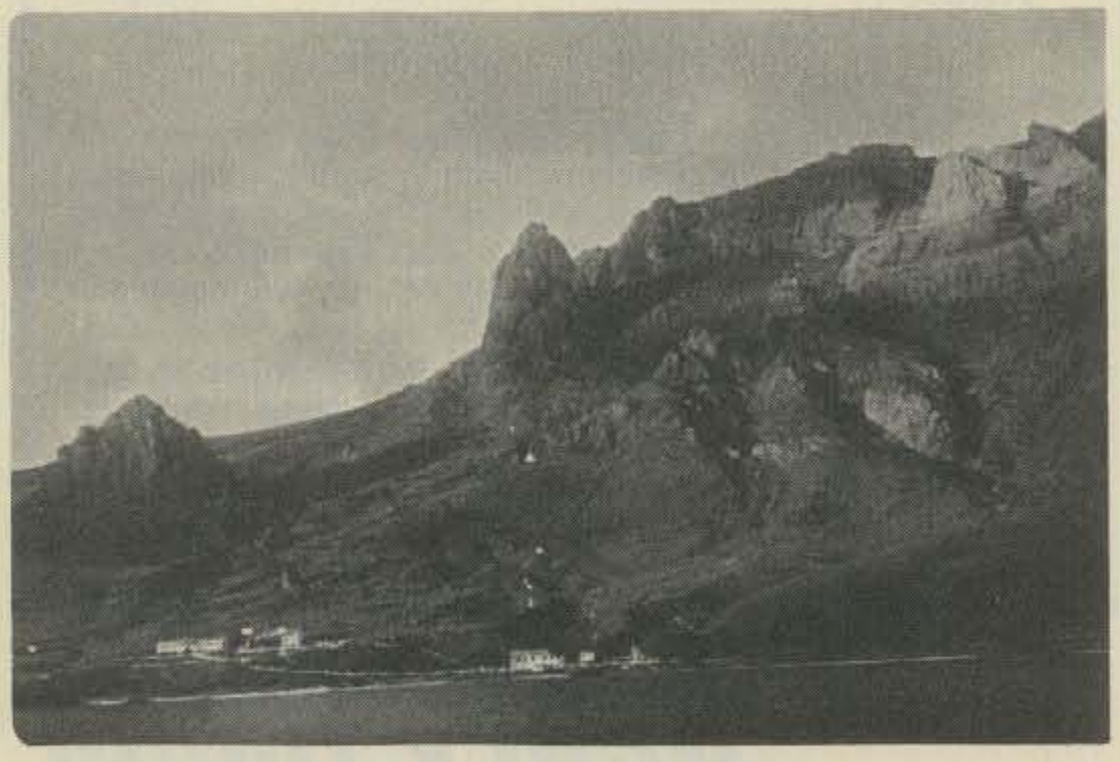
Destination Unknown

Planning for the DXpedition to Trindade Island began in early 1972. Since I would be spending a few months in Argentina later that year, the opportunity to make an expedition was clear. The destination, however, was not. The airline stopover privilege would make it possible to stop nearly anywhere in South or Central America without any additional fare.

Armed with an atlas and a DXCC Countries List, I searched carefully for an appealing target. Nearly every nation, island, rock, reef, and sand bar in the Americas had hosted a substantial radio operation in past years. Even such rarely activated spots as San Felix, Bajo Nuevo, and Serrana Bank had been "turned on." Furthermore, all of the Caribbean islands had been worked "dry" by visiting amateurs. I finally narrowed my selection to the three Brazilian island territories: Fernando de Noronha, Saint Peter and Paul's Rocks, and Trindade Island.

Because of a massive multi-transmitter operation from "the rocks" in 1968 and the frequent activity from "Fernando" by PYØAD and others, I began to focus my attention on Trindade. Discussions with other DXers confirmed this choice.

*11827 New Hampshire Ave., Silver Spring MD 20904



The rocky island of Trindade rises nearly 2000 feet above sea level and is located about 600 miles east of Brazil. The Brazilian Naval station is situated near the shoreline.

Getting There is Half the Fun

Throughout the planning stage of the operation my outlook wavered between highly pessimistic and guardedly optimistic. I had several obstacles to contend with. First, I was a foreigner to Brazil. Second, I did not know a word of Portuguese. Third, I was confined to a shoestring budget. And fourth, I knew absolutely nothing about the island. Hoping to tackle the fourth problem first, I went to the library at Cornell University. At the time, Trindade meant nothing more to me than a speck of ink on a map. My research yielded little information aside from the exact position of this speck in degrees, minutes, and seconds. It is, by the way, 20°30′32″ South latitude by 29°50′ West longitude.

Finally, I recalled that one member of the radio club at Cornell was from Brazil. She taught Portuguese at the university and, although not a licensed amateur herself, her father and brother are both amateurs. Lucia told me that Trindade was administered by the Brazilian Navy and that an oceanographic station was maintained on the island. She

volunteered to translate letters between English and Portuguese for me, thus solving the language barrier. Lucia also contacted her brother, a navy officer in Rio, who told us that a supply ship went to the island every two months and stayed for about two days. He began to secure the necessary applications that would be needed to request permission to visit the island.

Most DXpeditions last at least four days, providing most active DXers with a good opportunity to contact the expedition station. Since I could not afford the luxury of private transportation to the island, the expedition (if it was to take place) would be limited to about two days of operation. Such a short operation as this, I thought, would be just like Field Day. Clearly, more contacts could be made if more operators were on the island. Another operator would also be able to help with the numerous and laborious preparations.

Rolph, PY1DVG, on the left, and the author on the deck of the Baependi.

At the end of May I met with Rolf, PY1DVG, in Rio de Janeiro. Rolf became immediately interested in the expedition so we were now two. We decided not to recruit more operators because we were not certain how many visitors could be accommodated on the ship or the island and we did not wish to impose further on the generosity of the Brazilian Navy. Rolf continued making the arrangements with the navy and telecommunications authorities while I concentrated on publicity.

Equipment was not a major problem. Rolf decided to bring his Drake equipment and we borrowed a Galaxy transceiver with remote v.f.o. from PY1DMQ. We wanted to bring a linear amplifier but decided against it because of the unwieldy size and weight of Rolf's amplifier and because of our lack of information about the capacity of the generator on the island. We were told that 110 volt power would be available on the island at all times. We hoped so.

Passengers and cargo disembark from the raft at the shore of Trindade Island.

The two of us discussed operating details at great length. In this age, when more and more DXpeditions confine their activity to s.s.b., I was rather startled when Rolf asked whether we ought to operate phone *and* c.w. or *only* c.w.! Although we both favor code, we decided to use both modes for the sake of those DXers who do not (or perhaps cannot) operate c.w. Rolf said he would get on s.s.b. at least long enough to work the PY gang on the mainland. This struck us as a good idea. How would you like it if a Brazilian amateur who spoke only Portuguese operated from Navassa Island? Since Rolf was particularly interested in 160 meters, we decided to make this DXpedition a six-band affair.

Later, Rolf had the rare opportunity to speak to two amateurs who had previously operated from Trindade, PY1CK and PY2BZD. They provided us with some dated but useful information about accommodations on the island.

As our departure date grew closer, the permission from the navy arrived. The license had not. From my station in Buenos Aires I kept frequent schedules with Rolf on 40 meters. We were getting

Amateur radio equipment being wheeled toward the radio shack.

This radio shack houses the naval station, PWH3, and was also used by the PYØDVG group.

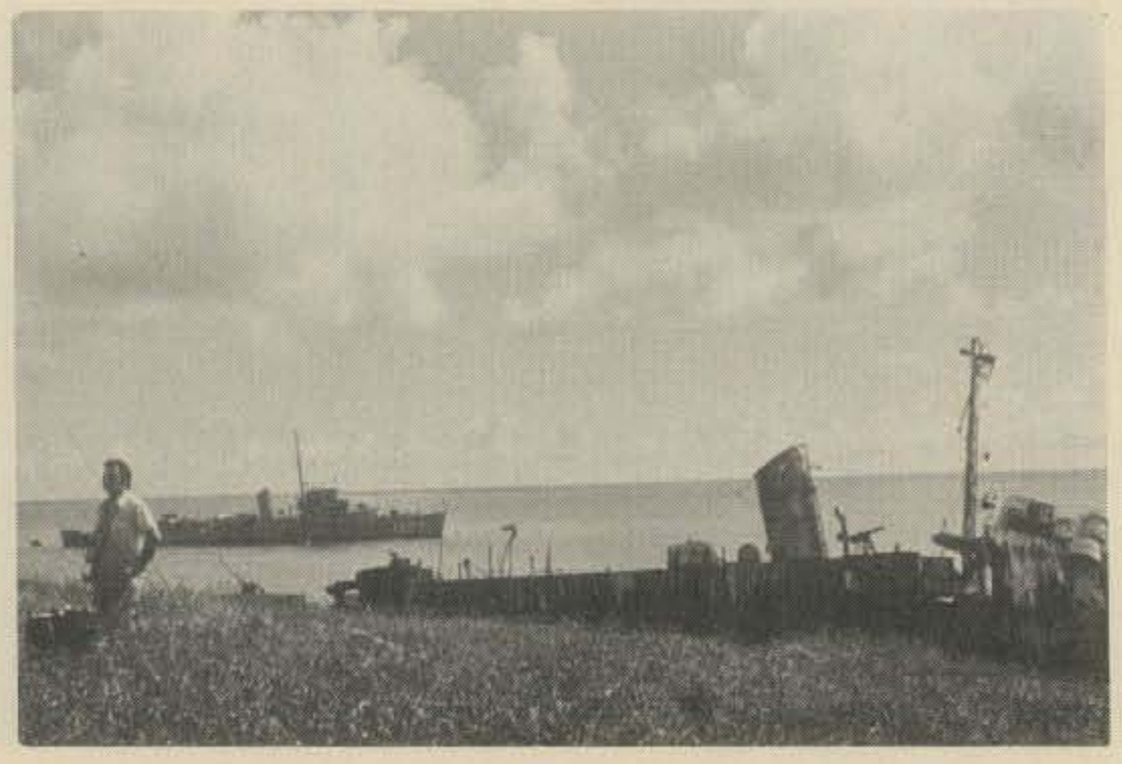
increasingly worried about the license when finally, one week before our planned departure, we learned via PY2PE and PT2MI that we had been issued the callsign PYØDVG.

During the weeks preceeding the operation we publicized the expedition by announcements in the major DX bulletins and through contacts on the air. As usual, the DX "grapevine" also helped spread the word. One evening, while tuning across 20 meters, I encountered UW1CX in Leningrad passing the information about the DXpedition to UKØKAA in Siberia.

Field Day, My Foot

The ship was to leave the harbor in Rio between August 8th and 10th. I arrived at the airport in Rio on the evening of the 7th, where Rolf told me that we were leaving the next morning. Rolf had already packed the equipment into wooden crates and delivered them to the ship.

The Aviso Oceanico **Baependi** is a World War II surplus U.S. Navy destroyer, converted for peacetime use by the Brazilian Navy. Traveling as guests of the navy, we were greeted by the officers of the ship. Before putting to sea we had a small banquet after which we viewed maps and photographs of Trindade and toured the ship.



PY1DVG and the wrecked ship in the foreground; the Baependi is in the background.

We could hardly believe we were on the way to Trindade, a small volcanic island more than 600 miles from civilization. The trip would take three days each way—if the weather was good. The sea was indeed calm and so were our stomachs. We spent most of the time on the journey relaxing and planning final details of the big event. We also talked with the officers, all of whom could speak some English. We learned that there was a chance that the ship would remain at the island for an extra day or two; we were certainly agreeable to that idea. We also discovered that there was a Swan 350 already on the island. Though we now had more rigs than operators, we could use the Swan in case one of the other rigs failed. We wanted to test our equipment aboard ship and received permission to erect a 20 meter dipole between the mast and bow of the ship. Our brief operation as WA3HRV/MM pointed out a few bugs in our setup (which we corrected) and also gave us a chance to alert the DX fraternity of our expected date of arrival on Trindade. We also learned that a large solar flare had just occurred.

We were awoken at 4 a.m. Trindade Standard Time on August 11th to watch our final approach to the island from the ship's bridge. The **Baependi** dropped anchor to the north of Trindade in the Enseada dos Portugueses (Cove of the Portuguese). Because of the sharp coral near the shore it is not possible to land on the island with a small motor launch. Landing was accomplished with a small flat-bottomed raft pulled by a rope between the ship and the island. Even the raft cannot reach dry land; the last fifty feet through the water are made on foot. We were provided with special shoes to protect our feet from the sharp coral. We saw a few fish in the water. They were sharks, so we were told.

As we approached the island we could see very little vegetation—only a few palm trees, two of which were painted with red and white stripes. When we and our equipment landed we were greeted by the naval commander of Trindade and the other islanders. After joining the officers to a drink of some tropical beverage whose name I can't remember, we walked up the hill toward those colorful trees. To our surprise and delight, they were antenna towers! Near the towers was the building which housed PWH3, a *radio shack* in the most literal sense. PWH3 was the naval communications station on Trindade. It was equipped with 110 and 220 volt power, spare receivers, a well-stocked workbench, and some military transmitters. The antenna farm included several long-wires, a 20 meter dipole, a multi-band vertical, and a conical monopole. The towers, which did not support any

antennas, were already fitted with ropes and pulleys. We were overjoyed when we were told that this shack would house the PY0DVG operation and that we could use the towers to support our antennas.

We were on the air in less than an hour. We had hoisted up dipoles for 160 through 15 meters and a portable 10 meter deltaloop antenna of our own design. The first contact took place at 1700 GMT on August 11th with EA8GZ on 10 meters. From then on we operated frantically, non-stop. Band conditions were mediocre and contacts were scarce during daylight hours.

Trindade had many of the comforts of home including sidewalks, telephones, running water, and even flush toilets. It also had few discomforts of home such as mosquitos. There was one discomfort there which one does not usually find at home. This one was discovered by Rolf when he left the shack late at night to change the taps on the 80 meter dipole between phone and c.w. There were crabs, thousands of them, creeping through the grass. These peculiar crabs remain hidden during the day and emerge at night. Luckily, the crabs were as fearful of us as we were of them.

The Party's Over

We continued operating through the night. Band conditions became very poor at about 4 a.m. The large solar flares were probably responsible for the weak signal strengths and high noise levels we encountered. The going was particularly rough on 80 and 160 meters where static bursts were much stronger than the signals we tried to copy.

Shortly after dawn we were told that the ship would leave at noon. We were disappointed, of course, but not surprised. Although we had expected to stay at least two days, we were aware that the stay could be shorter—especially if the weather was unfavorable. It was. Though the sky was clear and the sea was calm on the day of our arrival, the weather quickly worsened overnight. Reports from the mainland informed us that a large storm was approaching us.

We operated for as long as we could before it became necessary to pack the rigs into their crates. Having a few minutes remaining, we decided to fire up the station's Swan 350. It didn't work. After a final toast with the officers we left the island.

The ride on the raft back to the *Baependi* was an exciting experience in itself. Holding down a crate of radio gear with one hand and holding on to the raft with the other, we bobbed unsteadily back to the ship. The sea was much more choppy than it had been when we landed. The captain's decision to get under way before the storm arrived was partly prompted by the conspicuous view of the twisted, rusty remains of another ship (of the same type as the *Baependi*) on the rocky shore of the

Rolf, PY1DVG, at the key of PYØDVG. The islands spare Swan 350 lies under the table.

island. The captain of that ship had overstayed his welcome.

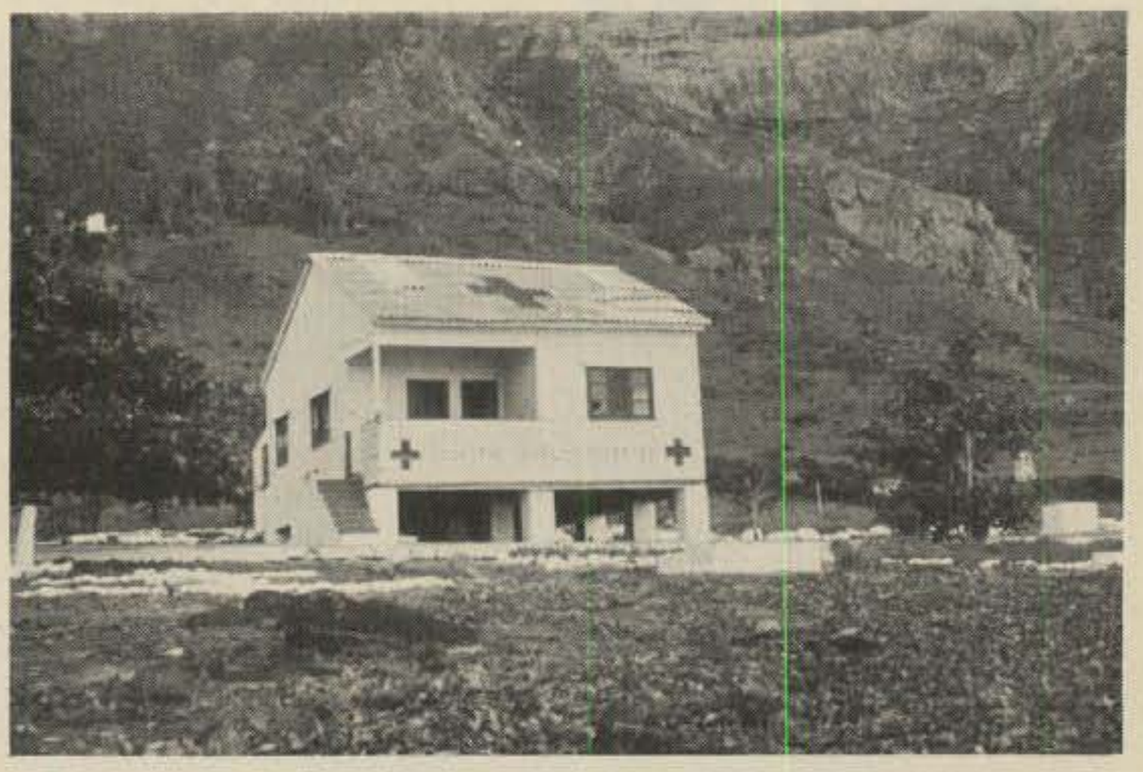
That evening, as we made our way back to the mainland, the storm came. The ship was rolling so violently that anything which could move had to be tied down. Many of the crew became seasick. We were so tired and exhausted that we hardly felt seasick, though I must confess we took anti-seasickness pills. We soon discovered that the most effective way to combat seasickness was to remain horizontal; this also proved to be the most stable position.

Three days later, we finally arrived at the harbor in Rio at about midnight. We were tired, ragged, and bearded. And it was still raining.

Aftermath

After reviewing our logs we counted 1340 contacts with stations in 63 countries during fewer than 16 hours of operation. Four stations; EIØREI, OZ8KR, VP2AAA, and WA2DHS; succeeded in working us on five bands. Trindade was worked on 160 meters for the first time ever by three stations: EL2CB, W1HGT, and W4EX. We could not copy any other stations on this band due to the excruciating

(Continued on page 74)



"Hospital Naval da Trindade" was used as guest quarters.

a monthly feature by

ADRIAN WEISS, K8EEG

QRP

The art of very low power operating

Operating Reports and Miscellaneous

Operating Reports

Believe it or not, QRPp does get out remarkably well in mobile operation! Would have never believed it myself until I tried it. At any rate, because of various moves occasioned by divorce hassles etc, I haven't had a station setup for about a year. When I picked up a car that would permit mobile operation, just had to try it out to see what it was all about. I figured: "mobile QRPp is better than no QRPp at all!" So far, I've only run 20m c.w. with the Argonaut and Hustler, but I'm really impressed. Seems that it is as easy as it used to be with the Gem-Quad at 40ft. During the SS, for example, I ran QSO's as fast as I could keep up with the pace. There is something intriguing about QRPp, and doubly so when I'm tooling along the interstate chatting with fellows all over the country. So far AJ4AA (KV4AA) is the only DX QSO, and that was rough, but for stateside work, very successful. The next step is to acquire a PTT mike, rewire the mike plug of the Argo so that it can sit on its back on the front seat, and give s.s.b. a try.

I guess I'm like the rest of the ordinary amateur fraternity—I'll read someone else's comment that he's been doing this or that with QRPp, half-believe it, but never expect it to work for me. Actually, I have no reason to be surprised that moblie QRPp is very effective. It's been about four years now since I first learned about K4FS—perhaps the "grandaddy of mobile QRPp." It's been four years since I first worked K4FS's 40 milliwatt *input* mobile signal. Only about a month ago, I was trying to snag AJ4AA when lo' and behold, he responds to K4FS/m! I couldn't hear or raise Don, sad to say. I was more interested in doing a two-way QRPp mobile than making my first DX QSO! To start off this month's operating report, I'd like to reprint a note by K4FS about his mobile operations that appeared in the December, 1972, issue of *The Milliwatt*. Don wrote:

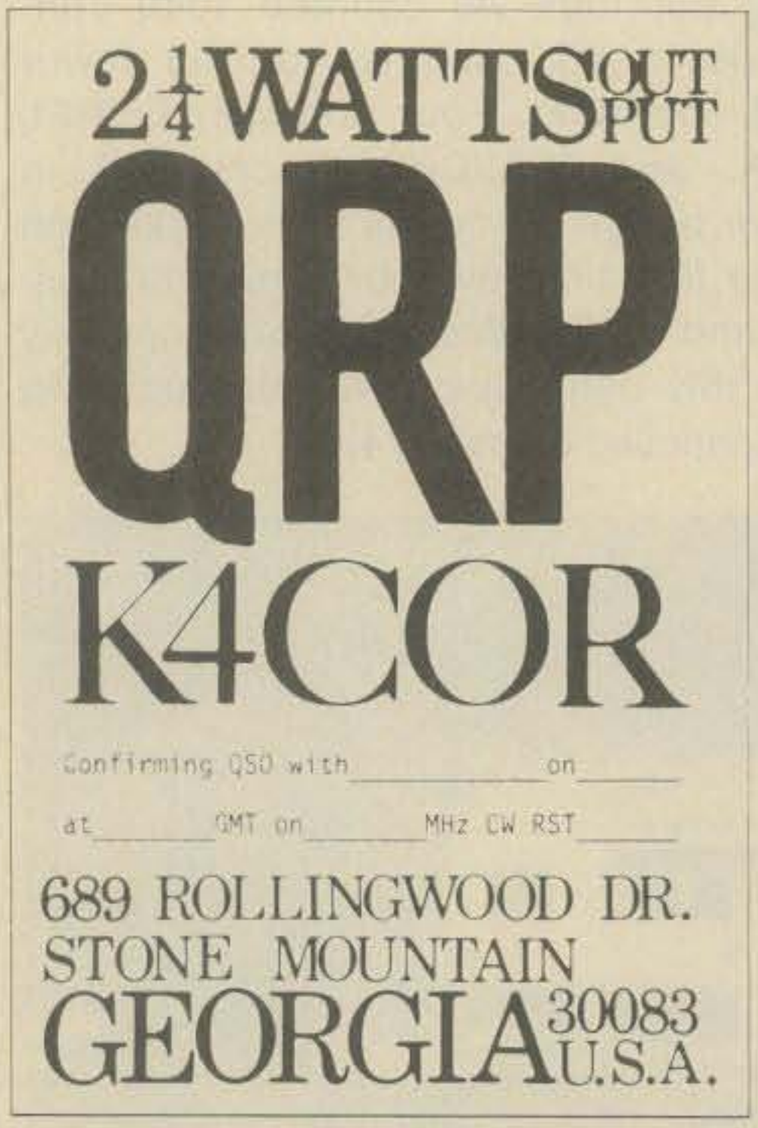
"QRPp activities here consist mostly of mobile c.w. operating, with an occasional QSO with a solid state rig at the home QTH. I am employed by Pan American World Airways and have a long haul by auto between home and the office, thus the many hours spent on the air with mobile c.w. A few bits of information on my activities follow.

I first tried mobile c.w. in September, 1949—worked a VE3 on the first attempt while running 10 watts input to a homebuilt rig and I was incurably "hooked." I had been a War Dept. c.w. operator during WWII and have done some sea-going duty as a ship's "sparks," so I found operating from a car really not very difficult. I used this same 10 watt rig in different cars, making a total of 3,075 QSO's by July, 1965. I then picked up a 12V powered car and had to discard the old 6V vibrator supply, but used the same old rig, operating at a lower voltage (120V on the plates) and running just under five watts input. I now have over 5,000 QSO's with this setup, and the same car. In July, 1972, I tried putting the car's 12.6 v.d.c. right on the B+ line of the old faithful rig and started making a few contracts running 40 milliwatts *input*. (Ed. Note: K8EEG/Ø worked K4FS, 40mw mobile, a month later on 20m during the 1972 QRP QSO Party. Solid, but rough copy!)

Since 1949, I have driven just over 500,000 *operating* miles, have made WAC with the 10 watts and again with the 5 watt setup; I've worked *a total of 102 countries* with the two power levels. I have also completed WAS with the same combination, using, by the way, the same 8ft. whip tuned with a homebuilt base loading coil. Operation has been almost entirely on 20 meters, but a few contacts were made on 15 and 10 meters. With the 40 milliwatt rig just on 20 meters I have a current total of 19 states, 6 countries, and 2 continents. Best DX with the 5 watt rig was VK and ZL via long path; best DX with the 40 milliwatt rig so far was a 10 minute QSO with XE1DE. Low power operation has been one of the most fascinating facets of ham radio for me and I've had a lot of fun with it.

It is interesting to see the boost in QRPp activity which is resulting from the TenTec and Heathkit solid state rigs becoming available. There was a similar increase in low power interest before WWII when the Meiss-

*83 Suburban Estates. Vermillion, SD 57069.



K4COR has come up with this eye-catching design to reward those who put up with his QRPp signal. Neat! Any other interesting QRPp QSLs floating around out there?

ner Signal Shifter, a commercial v.f.o. with about 7.5 watts output, appeared on the scene. Many present day operators who are interested in QRPp are missing out on a lot of fun because they feel that they have to have a whole new rig to operate at really low, low power levels. Almost any transmitter can be operated at a reduced plate voltage, and with a few silicon diodes, an external power supply of the right voltages can power the rig without any internal circuit changes. Or there are other approaches—an ARC-5 surplus transmitter operating with 22.5 or 24 v.d.c. on the B+ line puts out an amazingly clean, stable signal. I have converted one for 20 meters and it is a pleasure to operate.

Thanks again for your patience in copying my 40 milliwatt signal during the QSO party . . . I hope that you will ride and chat with us again (and so we have several times—Ed.). (*K4FS, Don Compton, 1712 Merritt Park Drive, Orlando, FLA 32803*)"

We'd like to hear from other amateurs who have operated mobile QRPp. I really don't believe that six foot hunk of metal on my rear bumper is netting all those QSO's with 5 watts! Let's hear how the rest of you are doing.

The reason for devoting this entire column to operator reports is quite simple. I'd been looking over the columns from the past year and suddenly realised that I'd gotten into the rut of writing all that technical, boring stuff without letting a breath of fresh air into these pages in the form of letters from the QRPp fraternity. So, let's see what's happening in the world of QRPp!

Operating Reports

de . . . W3AZR (Ike Kerschner, RD1 Box 181, Kunkletown, PA 18058): You're doing a fine job with the QRPp column in *CQ*. I am truly sorry about *The Milliwatt* and the problems that you are having. I wanted to tell you about the fantastic HW-8. I ordered mine as soon as they were announced last Xmas and finally received it in March! I got it on the air March 29th and to date (6/1/76) I have 15 countries worked and 20 states. It is difficult to believe how easy it is to work a station with the HW-8. QSO's are nearly as easy as when using my Viking Ranger. I worked three VP9's during the Bermuda Contest with excellent reports and I frequently get thru some pretty large pile-ups on DX stations. I installed the rig in the car using a Swan mobile antenna and the first evening on 40 c.w. I worked ILL, IA, and KP4 with 3 watts input. At home

What do QRPp operators look like? Dan Lewis, WA6GSS, is the interesting personality for this month. Dan happens to be a banjo-picker from what is locally claimed to be "the banjo-picking capitol of north-western San Luis Obispo county." His pride 'n' joy is leaning against the rear fender of his restored rumble-seat Lizzie. The HW-7 and antenna coupler sit unobtrusively on the running board. It goes to show that QRPp is one of the "finer things" in life, along with banjo-pickin' and tin Lizzies!

I use a folded dipole on 80, a dipole on 40, and a 2 element yagi on 20 and 15 meters. I highly recommend the HW-8 for anyone interested in QRPp. Hope to see you on the air this year."

de . . . K3NLT (Russ Mumaw, RD1 Box 65, Hatfield, PA 19440): "My QRPp activity started in 1959 with a 3A5 watt transmitter and regenerative receiver. I had several good contacts with it both fixed and mobile. Interest lagged and I went the QRO-to-kw route until 1972 when I purchased a TenTec PM2B and found QRPp very exciting again. I still operate the PM2B and have added the Argonaut for QRPp s.s.b. I find that in turning the drive back on the Yaesu FT-101, I can operate c.w. at 2 watts output and have a better receiver at the cost of efficiency for more difficult copy conditions. Presently I am trying to build a very compact portable rig and so have read with great interest what you did with the MFJ v.f.o. and TX boards on 7 MHz. I don't have much to show for my activity except a lot of good ragchews in the logbook. I don't chase wallpaper and records don't make any difference to me. Keep up the good work."

de . . . W2CRS (Douglass Allen, Hilltop Rd. RD1, Pattersonville, NY 12137): "The day before yesterday I completed *WAS QRPP SSB* with the Argonaut. The accomplishment was one of those feast-or-famine situations. I needed KL7 and hadn't heard it during my few hours of operation during the previous two months. This past week I have had more time and Sunday I hit the jackpot, working three KL7's on 20 meters s.s.b.! By the way, I have never used any other rig except the Argonaut barefoot to initiate or complete contacts. In fact, my Drake Line is at the local ham store where it is for sale, dust included! My antennas remain the same—a TA-33Jr at 50ft, and an 18AVT/WB plus dipoles. However, my 40m dipole fell down this winter so the other day I erected a 40m "ZL Special" in its place. It is only 35ft high, but is superior to the vertical in its favored direction—South. I had called a few DX stations on 40 before without much luck, but in the last three nights I have worked VP9, KP4, VP2V, TI2 on c.w., and KZ5 on s.s.b. with the "ZL Special." Yesterday I even received an answer to my 40 m c.w. CQ! My QRPp DXCC score has improved a bit since I wrote you last December at the 52 country mark. Since then I've added 5L2, KL7, CN8, VP2V, HAØ, HP1, LA9, OK3, 4X4, VP2A, HKØ, HB9, CT1, and FY7."

de . . . K4COR (Alan Pike, 689 Rollingwood Dr., Stone Mountain, GA 30083): "Just thought that you'd be interested in an unsolicited appraisal of the MFJ-40T QRPp transmitter. After about a month's wait, the UPS truck rolled into the drive and an incredibly small package was handed to me. I wasted no time in unwrapping it, hooking up two 6V lantern batteries, and an antenna. I stuck in a 7040 kHz crystal and sent "TEST DE K4COR QRP K." I could hear WB2TEN, Tom in NJ, coming back with a 569. Work beckoned, so I

didn't get back on till 2100 that night and worked WØBQH in Lennox, SD, with another 569 report. The next day was a Saturday, and I knocked out 14 QSO's with mostly 569 reports —FLA to NY with 8 states in all. Only one/two-way QRPp QSO was had with K3OKC in MD. None of the QRO stations could believe that 5 watts input could accomplish so much, and there were lots of compliments on the tone. The following day, I worked a bewildered WBØMAO in MN. I sensed that he doubted my QRPp claim and gave me a 589 anyway—not bad for a CD Party weekend with QRM galore and poor conditions to boot. Many memorable QSO's have since followed— a 45 minute ragchew with WØUZS in MN, the Saturday QRPp Net with WB2TEN and WA2TDL etc. The MFJ-40T is a simple, uncomplicated unit that's a real thrill to operate. I'm making good use of all those 40 meter crystals I've collected over the years. Being rockbound is a bother, but not the immense handicap that I expected. Even at the new price, the MFJ-40T is a steal. A companion receiver by MFJ would round out a neat little package—I hope MFJ is working on it." (Ed. Note: As of April, 1976, MFJ has been working on a QRPp transceiver, but R&D work has had to take a backseat to production, which is good for MFJ, but no so good for the QRPp fraternity!)

de . . . DJ5QK (Otto A. Wiesner, Feudenheimer St. 14, D-69 Heidelberg 1, W. Germany): "I am the chief of the Activity Group-C.W. (AGCW) in Germany. In this work, I conduct the "CW Ecke" (CW Corner) in the German equivalent of the ARRL's *QST—QRV* (Ed. Note: excellent job on the "CW Ecke). For our purposes, we understand as QRPp all levels below *10 watts input* to the final stage. In my station, an Argonaut is in use for QRPp purposes, with 12 volts from a power supply or lantern batteries for emergency service. I also have the TenTec 405 linear for more power. My antenna is a dipole in the attic for multiband operation. 90% of my work is done on c.w., the remaining part on 10m local and 2 meter f.m."

de . . . WNØLFM (Arnie Timm, 3207 Fourth St. N., Minneapolis, MN 55412): "I listened to the QRPp Net on 80 meters when I was able to stay awake or if my workday hadn't been too haggard. QRM frequently covered it and my rooming house setup leaves much to be desired on an HA-800B receiver. If all goes well, an end-fed 75ft wire/tuner will be up for 3.725 kHz and my 8 watt homebrew transmitter by this summer, and then, I'll turn to strengthening my c.w. "headcopy" for 15 w.p.m. and hopefully WBØ???. I purchased MFJ's 40-T/v.f.o. package last year. Took quite a while to secure it, but, I enjoy the 1 watt output for a local sked. I backpack occasionally during the summer and the MFJ 40-T's housing is a mite sturdier than Ten-Tec's PM3A. PM3A's are bulky in a backpack and the little extras keep operating time down. MFJ has my money if the planned $150 transceiver ever gets into production. I think that communications should be kept within a compact, portable arrangement."

Well gang, that's space for this month. If you've enjoyed reading the above operator reports, take the time to fill us in on your activities and experiences. There's something to learn in just about every letter that I get. I am puzzled, however, over the apparent bashfulness of QRPp operators—don't you guys have any pictures that you can send in? I know that none of us want to be famous and draw attention to ourselves, but a picture won't hurt! It's time to get your DXCC and WAS QRPp listings in now! Until next month,

73's, Ade, K8EEG/Ø

CQ Reviews:

The Kenwood TS-820 Transceiver

BY HUGH R. PAUL*, W6POK

When Kenwood first announced the new TS-820 transceiver, response from the amateur community was immediate. Dealers were reporting extensive back orders and this author was receiving calls asking if I had completed testing of the TS-820. It was obvious Kenwood had built a solid reputation over the past couple of years with their TS-520.

The TS-820 is a new design, incorporating a number of features not found on the TS-520. Top band operators will be pleased to learn that the 160 meter band is standard with the TS-820. Digital readout is an option that can be installed anytime at a cost of $170. Installation is simple and does not affect the analog frequency readout dial system. Blue LEDs provide an easy-on-the-eyes display of frequency. Accuracy of the digital readout is to within 100 Hertz and proved to be very stable. A digital hold feature may be actuated by a push button on the front panel. This provides constant display of the selected frequency while tuning the transceiver to other areas of the band.

The analog system reads out to 1 kHz accuracy with the skirt located behind the panel rather than directly behind the tuning knob as on the TS-520.

Other new features include a switch selected 20 db of front end attenuation, r.f. speech processing, and an i.f. Shift control that allows the operator to move the received signal across the passband of the i.f. This latter feature is an old idea, well worth resurrecting. RTTY operators will be pleased to find that an FSK keying circuit is included and either narrow or wide shift may be selected by merely repositioning a jumper plug on the carrier sub-assembly. When FSK is selected, input power is reduced to about 100 watts input. The FSK, c.w., external speaker, and phone patch jacks are located on the rear panel.

Standard items such as 25 kHz calibrator, noise blanker, WWV reception, audio monitor, receiver incremental tuning, and VOX have been retained on the TS-820. VOX controls are now on the front panel, below the main tuning dial—a nice convenience for those operators who prefer VOX over push to talk.

A fan for cooling of the final tubes is included, but the 12 v.d.c. power supply is now an extra cost option, as is the 500 Hz c.w. filter.

The receiver is a single conversion design, with an i.f. frequency of 8.83 MHz. This approach yields a receiver with high sensitivity and good strong signal handling characteristics. Sensitivity on all bands was less than .2 microvolt for 10 db signals plus noise to noise ratio in the s.s.b. mode.

Crossmodulation and intermodulation are not a problem with the TS-820, except under extreme conditions. This is due in part to the balanced type mixer employing dual gate MOSFETs. My neighbor did give me some difficulty with his TS-520 when we were both operating 40 meter s.s.b. I was able to cure the problem by inserting the 20 db attenuator pad. With my neighbor on s.s.b. and I on c.w. with the TS-820, absolutely no problems were encountered with the 20 db attenuator out of the circuit. My TS-520 will react rather strongly under this same situation. I mention this only because com-

Front view of the Kenwood TS-820 s.s.b. transceiver. (Photo by Sandra K. Paul.)

*291 Macalester Drive, Walnut, CA 91789

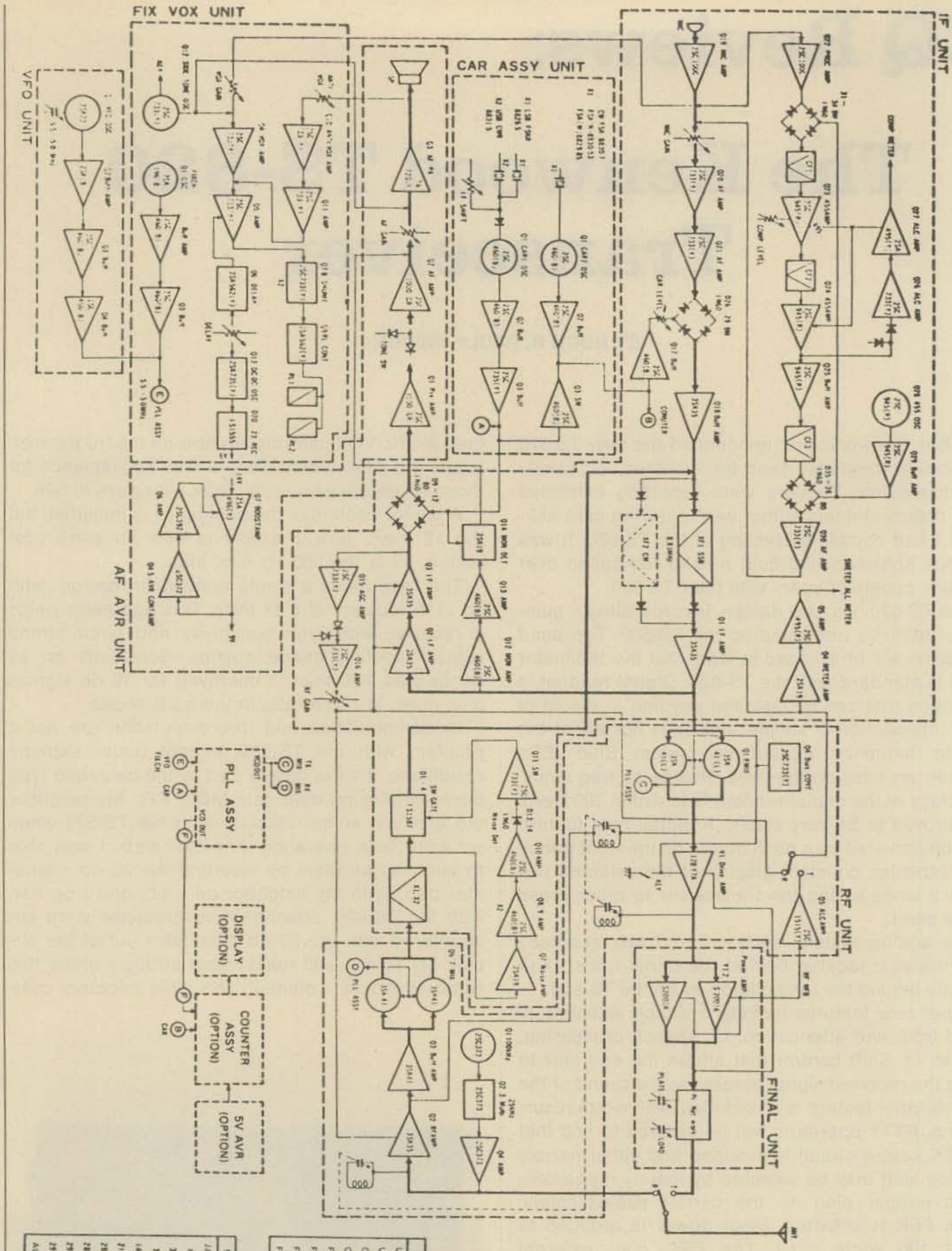


Fig. 1- Block diagram of the Kenwood TS-820 transceiver.

parison between the TS-520 and TS-820 is inevitable.

Rejection of signals at the i.f. frequency is rated at better than 80 db down from the desired output signal. Bench tests verified this figure. Image rejection is rated at better than 60 db down from the desired output signal and again this figure was verified. On two occasions while operating on 14 MHz images of S8 to S9 were received. The source of the interference was the same in both instances, a high power coastal communication station. In over two months of operating no other image reception was noted.

A phase locked loop system is employed as the local oscillator. The result is extremely good frequency stability on both transmit and receive. Drift is just not worth noting. An additional benefit derived is that the receive frequency remains constant when switching between upper and lower s.s.b. or c.w., thus eliminating the need for re-calibration of the dial for each mode.

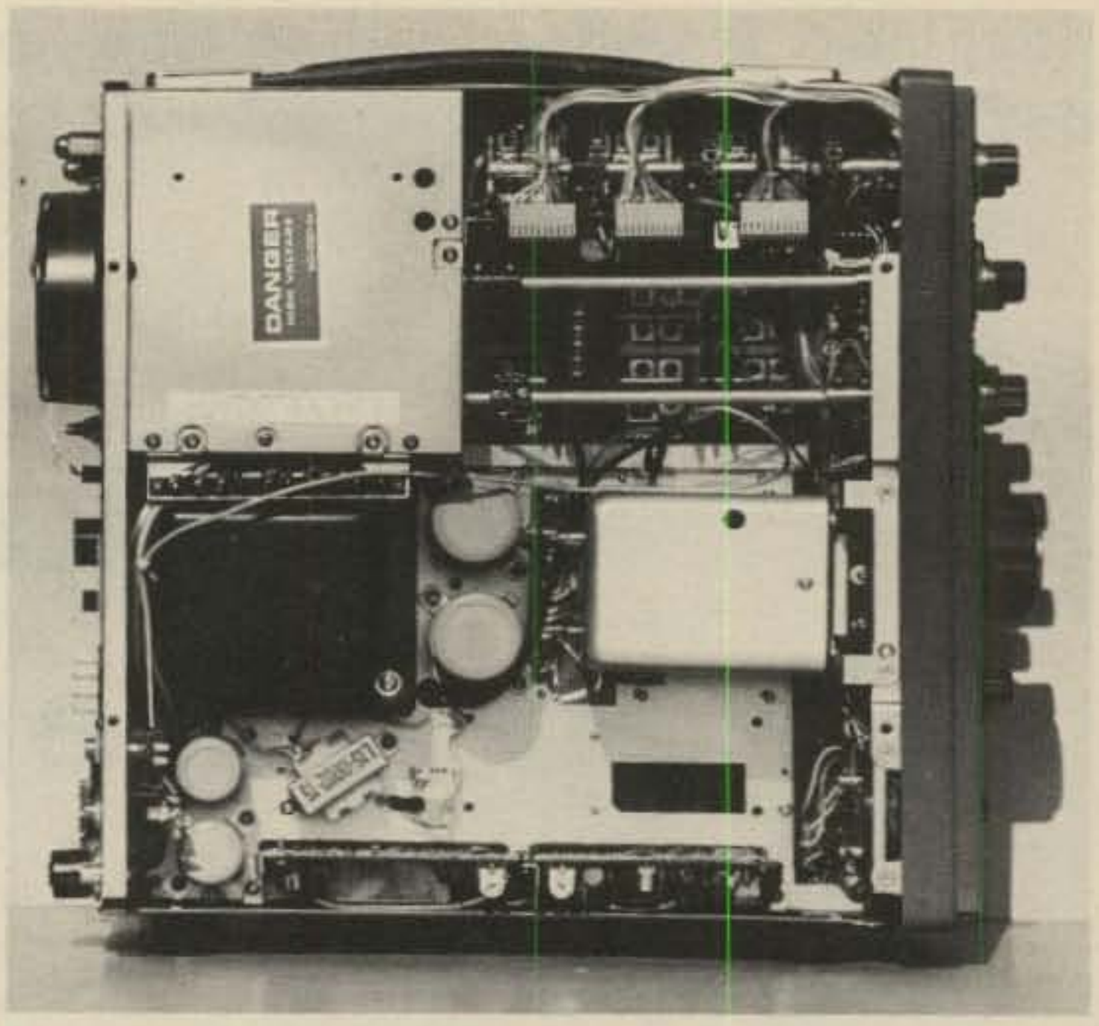
Shape factor of the s.s.b. crystal filter is 2.4 kHz at −6 db and 4.4 kHz at −60 db. The c.w. filter is rated .5 kHz at −6 db and 1.8 kHz at −60 db. On c.w. extensive use was made of the i.f. shift feature. By being able to move the desired signal across the passband of the i.f. it was possible to effectively null many an interfering signal. You will especially appreciate this feature if you are a casual c.w. operator and don't wish to spend the additional $45 for the 500 Hertz crystal filter.

The receiver incremental tuning control is smooth and precise in operation and provides a shift of approximately plus or minus 3 kHz. I did not have the 820 external v.f.o. while testing the TS-520, but have seen the unit and was surprised to note that it too has an r.i.t. control.

Audio output of the unit is better than 1.5 watts at less than 10% distortion. Impedance output is from 4 to 16 ohms for both speaker and headphones. Performance of the noise blanker was directly comparable to the one in the TS-520—very effective on short duration impulse type ignition noise with no degredation of audio quality. One of the best available. What more can be said?

The transmitter section of the TS-820 is a winner. Lots of audio amplification allows the use of very low output microphones. The balanced modulator is of the diode ring type. The mixer stage is balanced and employs dual gate MOSFETs of the same type as the receiver mixer. It's all solid state up to the 12BY7 driver and the dual 614B amplifier stages.

Linearity of the final amplifier is extremely good. Negative r.f. feedback from the 6146Bs to the driver stage results in a third order product figure of 32 db below a single tone of a two tone test. This would be equivalent to 38 db below full output of the amplifier. I apologize for the lack of photographs demonstrating this fact, but under the expanded

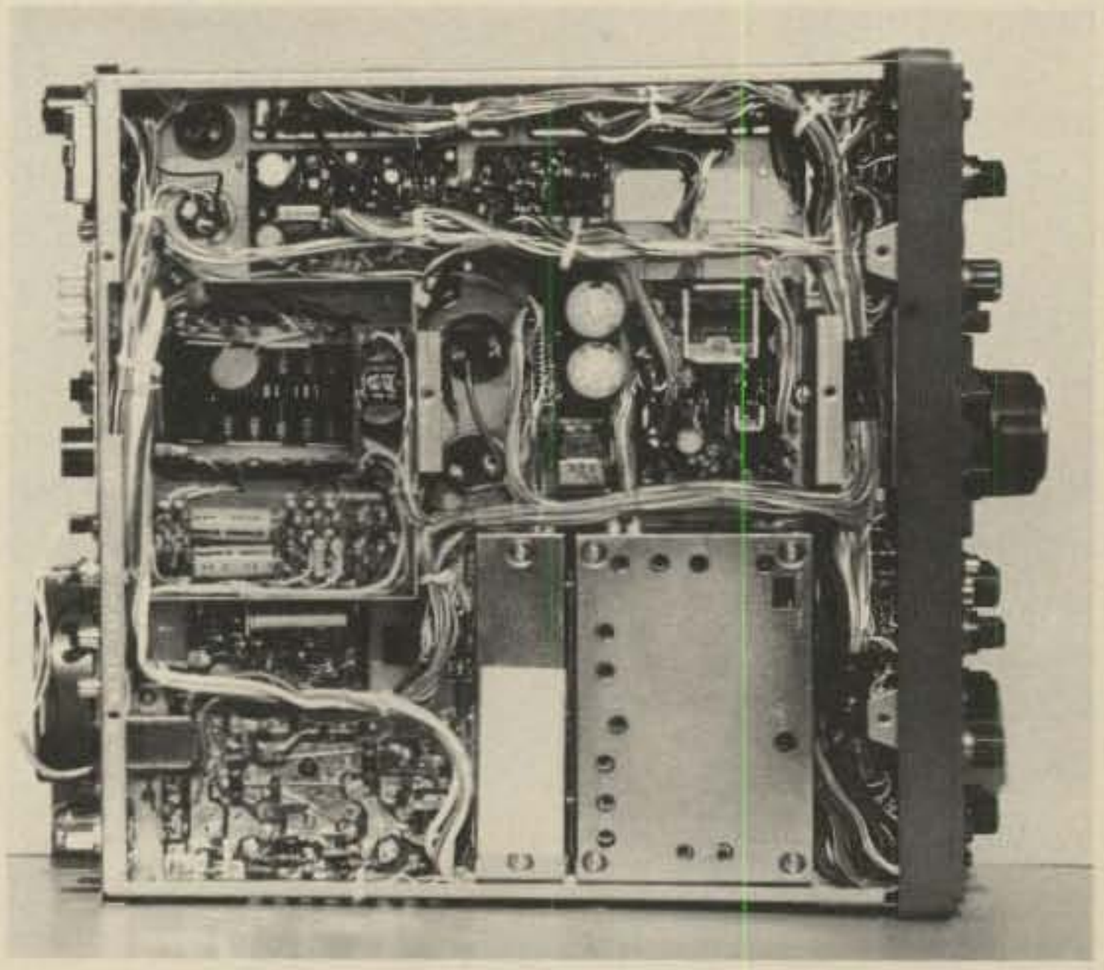


Top view of the TS-820 transceiver. (Photo by Sandra K. Paul.)

display condition our Tektronix Analyzer was acting up a bit in the stability department. The photographs looked like I had taken them while suffering the morning after a very late evening. Hopefully we can rectify this situation in the near future.

Transmitter power is rated at 160 watts input for c.w. and 200 watts p.e.p. for s.s.b. At 160 watts input on c.w., the output measured from 94 to 96 watts on all bands. This appears to be a bit low compared to that reported by owners and Kenwood. After tuning for maximum output as the manual suggests for s.s.b. operation, output measured between 115 and 120 watts for c.w. on all bands. The final tubes were not groaning under this condition,

(Continued on page 74)



Bottom view of the TS-820. (Photo by Sandra K. Paul.)

Happiness is understanding trap-antenna design, and whether to make or buy.

The Multi-Band Trap Antenna — Part I

BY JOSEPH M. BOYER*, W6UYH

For one reason or another I have had occasion to mention to a number of amateur friends that the familiar multi-band "trap" antenna was invented by a clever radio engineer named Howard Morgan[1] just before the onset of WW II. Most of them were quite surprised to learn that the concept was that old. However, one friend burst out laughing and said, "Invented! What was there to invent?" I asked what he meant. "Why I didn't know you could get a patent on anything that simple," he said. It's just a colinear collection of half wave doublets or grounded monopole antennas, each cut to work in a different band and all *insulated* from one another by parallel resonant circuits!"

Is Morgan's electromagnetic brain child really all that simple in concept? Are each of its radiating sections just self resonant antennas, oscillating naturally on their respective frequency bands? Do those lumped LC parallel resonant traps actually *open* and *close* like frequency controlled *switches* along the antenna as you flip the rig from one band to another? The truth of the matter is that the Morgan trap antenna is better described by the words of the old song which tells how "the foot bone's connected to the ankle bone, and the ankle bone's connected to the leg bone . . .". If its design is approached by conventional methods of antenna analysis, it can give a headache even to a trained professional. This is unfortunate, because the trap multi-band antenna is extremely convenient to use in a cramped space QTH for all-band h.f. operation. Newcomers to amateur radio wish to understand at least its key features in order to intelligently compare the merits of several commercially available models on the market; experienced amateurs may want to apply certain of its basic theory principles to a special radiator of their own conception. Rather than let its true mode of operation remain a matter of doubt in amateur circles and its design a thing of exhausting cut-and-try while sweltering out in the hot sun, it might be interesting and useful to reduce the trap antenna design to clear cut simplicity.

Not only that, but while we are at it let's not make this a matter of following some other fellow's step-by-step blue print description of the DX Band Hopping Skyhook; instead let's use a general design approach so we can juggle our own available capacitor sizes, our own conductor stock to end up with a radiator which fits our own particular needs. Finally, let us do the job in such way that while its design is still on paper—long before we feed it r.f. power—we will know how the antenna is going to perform; what its inherent performance limitations are, and why things turned out that way.

Polarization—Horizontal Or Vertical

Right at the start we have a choice of using a horizontal trap doublet antenna or a trap vertical monopole working against its electrical image or ground. The choice we make really doesn't matter technically; any grounded monopole antenna of

*Antenna Consultant
17302 Yukon, Suite 63, Torrance, CA 90504

[1]H. K. Morgan, "A Multi-frequency Tuned Antenna System," *Electronics* vol. 13, page 42, August, 1940

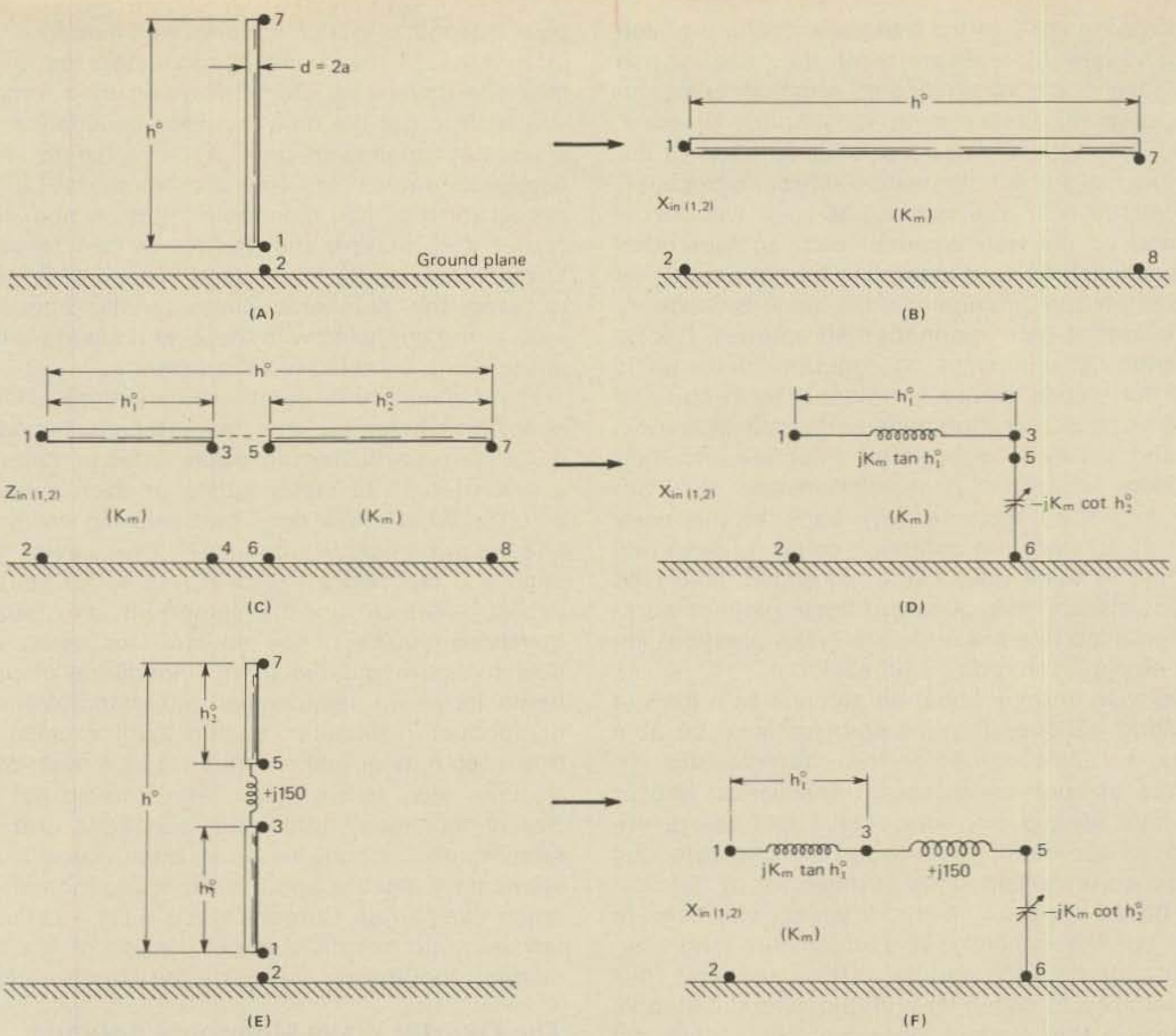


Fig. 1—(A) Naturally resonant λ/4 monopole antenna and (B) its analogue r.f. transmission line. (C) R.f. transmission line stub broken into two sections and (D) its equivalent "circuit". (E) Morgan two-band trap monopole series loaded with out-of-resonance trap operating on a lower frequency band. (F) Analogue r.f. transmission line representation of same Morgan trap antenna.

length h is merely one half of the equivalent doublet form having a total length 2h and located high above the earth. Therefore, when we go through the process of finishing the design of a multi-band trap monopole of length h and conductor radius "a", all we need do to convert it into its equivalent free space doublet is to build another duplicate monopole—complete with identical traps—and connect the two "half elements" on each side of the center insulator. Here, we will use the vertical monopole only because it makes our discussion and the drawings related to it easier to follow.

Now, of course, if we contemplate going the whole route and including coverage of all h.f. amateur bands from eighty to ten meters, well then we might have good reason to think about polarization choice for a moment. Any good antenna handbook has diagrams showing the radiation patterns in the elevation plane of horizontal doublet antennas at various heights above ground. Inspection of such radiation patterns quickly shows that amateurs at least face a real world problem in using horizontal h.f. antennas. Only at heights of about 0.5 λ or more above ground does the maximum amplitude response point on the major radiation pattern lobes of the horizontal doublet get near enough to the horizon to consistently produce decent DX performance. At eighty meters that 0.5λ height means about 130 feet. Few urban amateurs have available the space, facilities, and freedom from local height ordinances to erect an eighty meter doublet that high in the air. Conversely, a grounded vertical λ/4 monopole on any ham band produces (a) omnidirectional response in the horizon plane and (b) its elevation plane pattern yields maximum gain quite close to (but never right on) the horizon. Now let's turn to the receiving noise problem in terms of antenna polarization...oops, sorry! That is an entirely different subject; another time, perhaps.

Pulling The Fangs Of The Beast

Our first move in the design game we are to play is

to remove the *teeth* of the general antenna problem so it can't bite. By *teeth* we mean the need for use of the advanced mathematics on which antenna and electromagnetic theory are quite properly founded. Luckily, we can make a great simplification in the math used in a practical design approach because, at about the time that Howard Morgan was nicely wrapping up his trap antenna idea, another good man was finishing an outstanding job on an elegant theory related to *all* antennas; his name is Sergei A. Schelkunoff of Bell Telephone Laboratories. Doctor Schelkunoff's significant contribution to us all is called the "mode theory of antennas"[2]. In carrying out his work, Schelkunoff pulled off a neat side trick: he found a way to convert *all* antennas into their equivalent form of *r.f. transmission line*. Now antenna engineers working way back in the early 1900's suspected that antennas could be regarded as acting in some ways like open ended, stub type r.f. transmission lines. A few of these pioneer workers even used this basic idea to make practical antenna design in that day a bit easier.

If we wish to think about an antenna as a form of oscillating transmission line stub we must be able to plug in some value for the *characteristic impedance* of such an antenna/transmission line or the whole idea is not very useful. Old timers obtained an approximate value for the characteristic impedance of certain kinds of antennas by calculations based on a d.c. method, which was used to figure out the capacity of a one-meter long conductor section in the middle of their antennas; this d.c. method was called logarithmic potential theory[3]. Not only is this method laborious, but it does not account for all types of r.f. waves which really exist on antennas, just the d.c. or static mode. Still, the idea was very helpful.

Schelkunoff, however, found a way to get an *average* value of characteristic impedance representing *all* the wave modes existing on various types of antennas. Not only that, but the formulas derived by this most eminent theoretician are expressed in ordinary, every day mathematics familiar to us all, not just people with a Ph.D in physics. Although Schelkunoff worked out formulas for the characteristic impedance of antennas having many different kinds of cross sectional conductor geometry, his formula for a monopole antenna made from a conductor having a uniform radius "a" and length h is just,

$$K_m = 60 \left[2.306 \log_{10} \frac{2(h)}{(a)} - 1 \right] \text{ OHMS} \quad (1.0\text{-}1.)$$

The above formula gives the average characteristic impedance K_m for a grounded cylindrical monopole antenna, although it works well also for square or triangular cross section conductors as long as they are *uniform* in diameter along their length. If you wish to get the characteristic impedance K_a of a doublet antenna in free space of length 2h and conductor radius "a" you use equation (1.0-1.) to get K_m for the "half monopole" part on one side of center and multiply the answer by two to get K_a. The notation K_m (or K_a) is used instead of Z_o merely to keep the antenna's characteristic impedance from being confused with the Z_o of a standard transmission line used to feed the antenna.

Right about here someone may think, "Ok, so now I can calculate the characteristic impedance K_m of some particular monopole antenna made from a given length of metal tubing or even a hunk of wire. So what? How does that help me design and understand amateur antennas?" The answer is that once you can find a K_m (or K_a) value for your *particular* antenna, all the important and puzzling questions you've asked yourself for years about how to figure out the input impedance of an antenna, its v.s.w.r. response as you change frequency or conductor diameter, or add loading coils, band traps, top hats or make it perform as a multi-bander become easy to work out. And you do not need Bessel functions, differential equations and other super-math cannons to do it, either. Just a bit of elementary algebra and a dash of trigonometry. It's much like "Brain Surgery Made Easy." Let's try a few *warm up* exercises to get the feel of this handy antenna tool before we tackle the Morgan antenna.

The Quarter Wave Monopole Antenna As An R.F. Transmission Line

The naturally resonant quarter wave vertical monopole antenna working against ground forms an ideal *launching pad* for our design attack on the multi-band trap antenna. A monopole which is naturally resonant attains this freely oscillating state solely by means of its shunt capacity distributed along its conductor to the ground plane and the distributed series inductance of the conductor. (In doublets, this distributed shunt capacity is from one doublet conductor half to the other.) A typical amateur problem related to the $\lambda/4$ monopole can be stated in two related parts as follows:

(1) We wish to operate a $\lambda/4$ vertical monopole across the entire frequency width of the eighty meter band, which means an upper frequency band limit f_{high} of 4.000 MHz, a band center frequency f_o of 3.750 MHz, and a low band limit of 3.500 MHz. If such monopole is naturally resonant at f_o, what v.s.w.r. will the monopole's input impedance produce in a fifty-ohm coaxial cable at f_o, f_{low} and f_{high}?

(2) How will the cross section diameter d=2a of the conductor used in such monopole influence v.s.w.r. at the stated frequencies?

We can start by choosing monopole conductors

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[2] S. A. Schelkunoff, "Theory of Antennas of Arbitrary Size and Shape," IRE Proc., 29, pp. 493-521, September, 1941

[3] Edmund A. Laport, "Radio Antenna Engineering," page 28 and chapter 6, McGraw-Hill Book Company, Inc. First Edition.

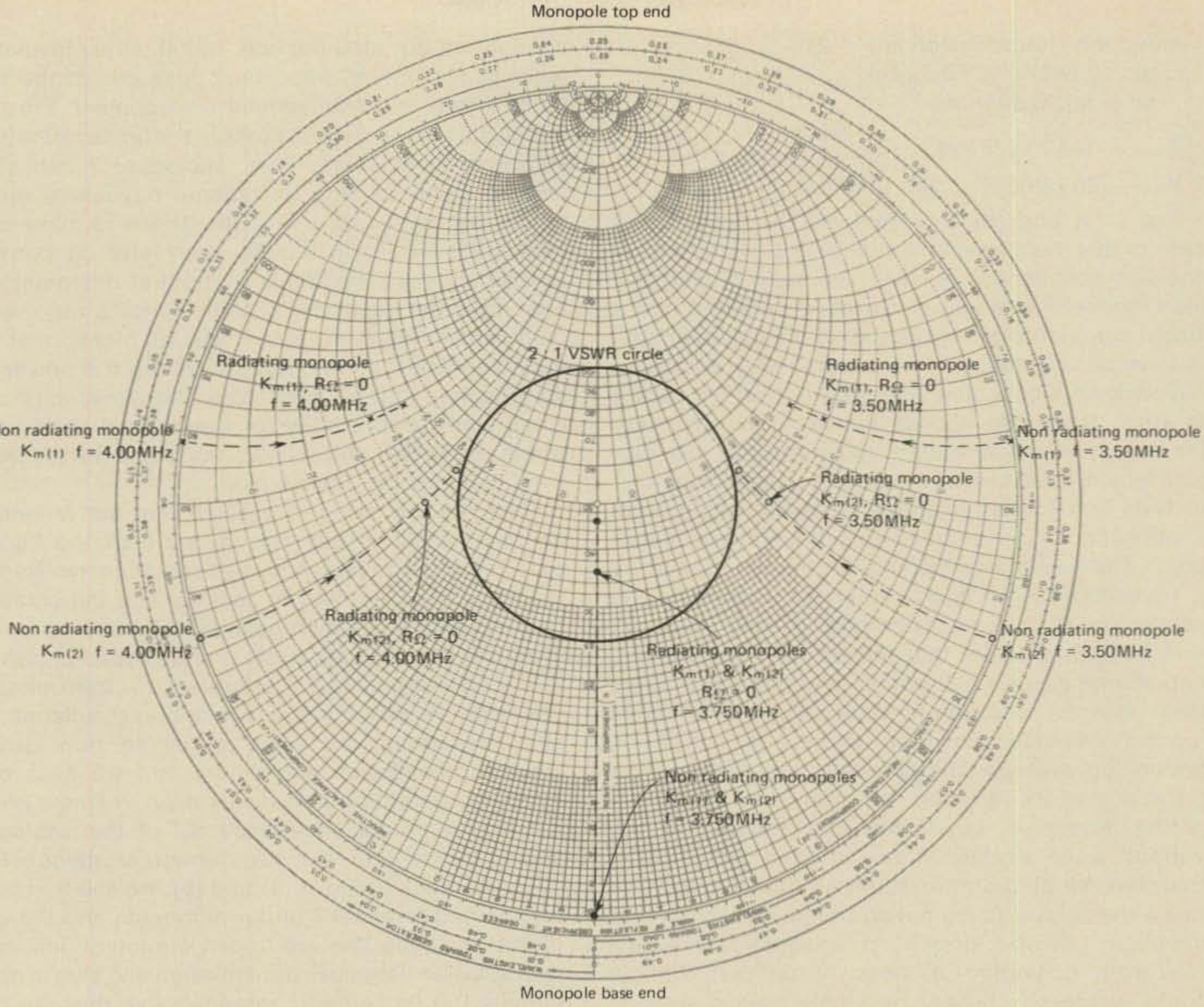


Fig. 2—Calculated input impedances for each of two naturally resonant λ4 monopole antennas plotted on Smith chart representing fifty-ohm coaxial cable feed. Monopole $K_{m(1)}$ conductor is #10 gauge wire; Monopole $Km_{m(2)}$ conductor is 4.0 inch diameter tubing. End input impedances are those for each monopole radiating as well as operating in a $R\Omega = 10$-ohm lossy r.f. environment.

of widely different radii, a. For one monopole let's use a number 10 gauge copper wire having a radius a_1'' of 0.0510 inches or 4.246×10^{-3} feet. For our second conductor choice we will go all out and use aluminum tubing having a radius a_2'' equal to 2.0 inches or 1.667×10^{-1} feet.

In stating our problem, we said the λ/4 monopole would be naturally resonant at f_o; by definition, this sets the monopole *electrical* length h° to be equal to 90 degrees, regardless of the conductor radius, a, at 3.750 MHz. By giving the length h° of the antenna in electrical degrees at f_o instead of in feet, meters, or some other units we must then convert our selected conductor radii into degrees at the operating frequency to avoid having a case of apples and oranges. This is easy to do. At the frequency of 3.750 MHz, the wavelength λ in *free space* is just 984.00/3.750 MHz equals 262.400 feet; this wavelength dimension of 262.400 feet also represents 360 electrical degrees in *free* space at our f_o. The two selected monopole conductors at 3.750 MHz then have radii in degrees respectively of,

$a_1° = (4.246 \times 10^{-3}$ ft./262.400 ft.) $\times 360°$
$= 5.825 \times 10^{-3}$ degrees.

$a_2° = (1.667 \times 10^{-1}$ ft./262.400 ft.) $\times 360°$
$= 2.287 \times 10^{-1}$ degrees.

This data immediately "arms us for bear." We now know radii a° and electrical length h° for these two particular monopoles. To handle them as simple *lossless* r.f. transmission line stubs from here on, we convert both monopoles into their analogue lines by finding the value for $K_{m(1)}$ and $K_{m(2)}$ using Schelkunoff's formula (1.0-1.):

Monopole/transmission line #1:

$a_1° = 5.825 \times 10^{-3}$ degrees;

$h° = 90.00$ degrees.

$$K_{m(1)} = 60\ [2.3026 \log_{10} \frac{2\ (90)°}{(5.825 \times 10^{-3})°} - 1]$$

$K_{m(1)} = 60\ [2.3026 \log_{10} 3.090 \times 10^{4} - 1]$

$K_{m(1)} = 60\ [9.339] = 560.31$ ohms

Monopole/transmission line # 2:

$a_2^\circ = 2.287 \times 10^{-1}$ degrees

$h^\circ = 90.00$ degrees.

$$K_{m(2)} = 60\ [2.3026 \log_{10} \frac{2\ (90)^\circ}{(2.287 \times 10^{-1})^\circ} - 1]$$

$K_{m(2)} = 60\ [5.668] = 340.10$ ohms

Fig. 1 (a) and (b) represent the general picture case of this monopole antenna-into-r.f. transmission line stub conversion we have just made. Notice that the *monopole* antenna over ground converts into a single conductor laying parallel to the ground plane to form an *unbalanced* transmission line. We could have shown a coax line also, except that it's harder to draw. (If we had wanted to make our conversion for a doublet antenna high above ground, our picture would have shown a two wire, *balanced* transmission line floating in space.) One more thing: the shunt capacity to ground in an actual vertical monopole varies with height points on the monopole. As a transmission line's characteristic impedance is related to *distributed* conductor L and C as $Z_o = \sqrt{L/C}$, this means that the actual characteristic impedance K_m of a cylindrical conductor monopole also changes to different values as height above ground changes. Equation (1.0-1.) is based on taking the *average* characteristic impedance over the range of its variation from the base to the top of the monopole, but taking into account all the various wave modes on an antenna while doing that. We are glad that in doing all this, Schelkunoff made the answer come out so simple for us, but that simplicity covers a lot of electromagnetic "muscle". His work converted a mess of difficult "jungle trails" ventured on only by highly trained experts into a nice clean "freeway" which any of us can travel over to solve our problems quite easily. Now, back to fig. 1 (a) and (b).

On the left hand end of the line stub section, the "hot" or base end of the monopole or its analogue line has an input terminal labeled 1; the ground input terminal is labeled 2. Then at the far opposite end of the stub line conductor, a terminal is located there labeled 7; the "ground" for the top end of the monopole or analogue line end point is shown marked 8. Finally, the length h° of the analogue line is the same as the electrical height h° of the monopole antenna it represents, and the label K_m is shown representing the characteristic impedance of the line, but now viewed as if it were a *constant* value which does not change with analogue line length.

To be able to calculate the v.s.w.r. in a fifty-ohm feed line connected either to the monopole or to the analogue line, we have to find the total input impedance,

$$Z_{in(1\ 2)} = R_r + R\Omega + jX \quad , \quad \text{OHMS}, \qquad (1.0\text{-}2.)$$

where the R_r resistive part is the radiation resistance of the monopole. The $R\Omega$ resistive part is the ohmic, non-radiating loss of not only the antenna conductors but also the soil, radial wires, insulator leakage resistance, trap ohmic loss etc. of the antenna's *total electromagnetic environment*. Finally, the jX part is the antenna input reactance; although shown as a plus inductive reactance, it can also take on a minus sign to indicate capacitive reactance. We must now pull a few tricks to make our next steps easier to handle, then later on correct for this sneaky simplification. Right at this point we also must depart from Dr. Schelkunoff's more elegant mode theory to avoid use of higher mathematics in what follows, but still retain the power of his equation (1.0-1.). Therefore, the writer must assume sole responsibility for the method used here which, however, still follows the same wide "freeway" built by Dr. Schelkunoff.

First, we are going to assume that our antennas *do not radiate at all!* This gets rid of the "good part" of input impedance, the radiation resistance R_r. Then, we are going to assume that the antenna as well as its total environmental QTH has no ohmic loss; that discards the nasty and unloved $R\Omega$ part of $Z_{in(1\ 2)}$. All we have left is a *lossless* r.f. transmission line stub representing our monopole antenna. It certainly should be easy to handle now, using simple transmission line theory; but we have one tremendous thing going for us now: *We now know the characteristic impedance* K_m *of the analogue lines representing our two particular monopoles.* Glancing gack to Fig. 1 (a) and (b), we see that both the top end terminal 7 of our monopole and the end of the analogue line are "open circuited" into free space. When a lossless transmission line stub is open circuited at its "output" terminals like that, we can find its input reactance from the easy formula,[4]

$$jX_{in(1\ 2)} = -jK_m \text{ cotan } h^\circ \qquad \text{OHMS} \qquad (1.0\text{-}3.)$$

Because we already know all the values to plug into equation (1.0-3.) at the band center frequency 3.750 MHz, we will start there. We defined h° as being exactly 90 electrical degrees long at that frequency. Therefore,

$jX_{in(1\ 2)}\ f_o = -jK_m \text{ cotan } 90^\circ = -jK_m\ (0.000)$

$= -j0$ ohms

Naturally we expected all along to get that kind of answer at the monopole's resonant frequency. With that 0.000 multiplier, there is no need for us to insert the actual values of $K_{m(1)}$ or $K_{m(2)}$ at f_o. But we suspect that things won't continue like this when we move over to f_{low} or f_{high} in the band. Take the low band limit of 3.500 MHz; Here, the frequency proportionality is 3.500 MHz/3.750 MHz equals 0.933. Our total electrical line length h° now shrinks to $90.000^\circ \times 0.933$, or 84.00 degrees. Equation (1.0-3.) now tells us,

(Continued on page 73)

[4] If a reader is a trifle rusty in trig or aigebra, the author recommends "Basic Mathematics for Electronics," by M. Cooke and H. Adams, McGraw-Hill Book Company, Inc. New York.

a monthly feature by

BILL DEWITT, W2DD

In Focus

Television on the Amateur bands

The Outstanding Amateur Radio Public Relations of 1976. N6V SSTV Pictures of Mars

Millions of people viewing the NBC Today Show were given an extremely favorable example of amateur radio and SSTV last October when it was demonstrated that pictures of Mars could be transmitted by SSTV from one amateur station to another. No doubt about it, the N6V/WB5SAJ contact seen and heard all over the USA was tops in PR for '76!

Congratulations to the Jet Propulsion Laboratory ARC for an outstanding job! Robot Research deserves a pat on the back too for their loan (and subsequent gift!) of a Robot Model 300 Scan Converter to the JPL club.

While pictures and information are exchanged by hundreds of slow scanners all over the world at all hours of every day, it is the unusual application of our picture transmission capability that sparks the interest of John Q. Public! You can tell your friends over and over again about SSTV and what it can do, but when pictures of MARS are transmitted from one amateur station to another, the public is really impressed—especially if the whole scene is demonstrated on network television!

*2112 Turk Hill Road, Fairport, N.Y. 14450.

Stan Brokl, K6YYQ adjusts the Robot 300 during the NBC Today Show telecast.

Jim Lumsden, WA6MYJ, says that he was just getting acquainted with the SSTV gear when this picture was taken. There is a 700 foot long nitrogen-filled coax line connecting those gray boxes to the N6V antenna! Not shown is a 30S-1 linear.

It's always difficult to be sure that all contributors to the success of any project are included in a list, but Mel Shavelson, W6VLH, Stan Brokl, K6YYQ, Jim Lumsden, WA6MYJ, and Robot's Dave Smith, WB6ZFT were some of the main "movers" on this project. Newsman Roy Neal of NBC, also an amateur, did a terrific job on all the network arrangements. For once, amateur procedures and the description of what was being shown didn't get all fouled up!

For a look at Stan (who is the JPL club president) and Jim, see the accompanying photos.

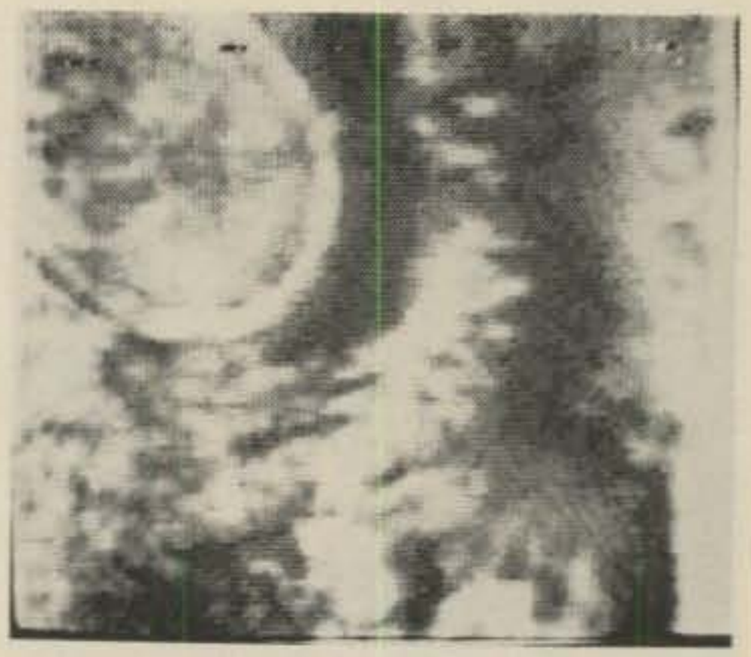
W.A.S.—SSTV, An Unofficial List

From time to time yours truly has been requested to publish a list of stations who have Worked All States on SSTV. The following list was supplied by Bob Howell, WA7QBV, of Tucson, Ariz. If you have additional calls for this list, please write. And No. 19, wherever you are, please come forward!

1. WB4OVX
2. W8YEK
3. W4MS
4. W6EYY
5. WA7QBV
6. W8ATK
7. W7NEQ
8. WA9USE
9. WB4ECE
10. WA1NXR
11. W9ZVT
12. K4PRT
13. WB5IXK
14. K0ALL
15. K4IRQ
16. K9ZUH
17. W8KZM
18. G3IAD
19. ??
20. W8QZ

Required Reading: "SSTV Image Processing" By Dr. Geo. R. Steber

WB9LVI has done it again! Last November's *QST* carries another excellent article by Dr. George Steber. The advantage to be gained by frame averaging is described and shown in a graphic picture series. Diagrammatic information is also included for the benefit of those who have built the famous WB9LVI digital scan converter. Don't miss this important contribution from George.



A view of the crater South Spot from orbit by Viking 1. The crater shown is about 62 miles in diameter.

Here's Dave Smith, WB6ZFT, taped by N6V and photographed from the tape by W2DD via Robot 400 Display.

More On Image Processing, Photographic That Is—

If you have any doubts about the advantage of using frame averaging, let me assure you that it is REAL. I have used this technique in two ways, photographically, and with a storage tube scan converter. Let's review the photographic angle first.

In exchanging color SSTV pictures with ZS6PP, VK3LM, and others, it became apparent that QRM had some damaging effect on almost every frame. For this reason, a technique of transmitting 10 or 12 frames of each color was used. This was described in detail in the article "Slow Scanning Color" by W2DD which appeared in *CQ* for September, 1972.

To secure a color picture, several frames of "red-green-blue information" were exposed onto film using appropriate color filters. This constitutes a means of Image Processing/ Frame Averaging which I chose to call Signal Integration in the article.

The accompanying photos show one frame each of the heavily QRMed Green and Red information that were used with many other frames to produce the reasonably acceptable final picture. (Which was in color.) No one single frame used was without some disruption.

A little comic relief between Mars pictures. This is W5GZR's "station ID" as received by N6V.

Still More On Image Processing— Via Storage Tube Scan Conversion

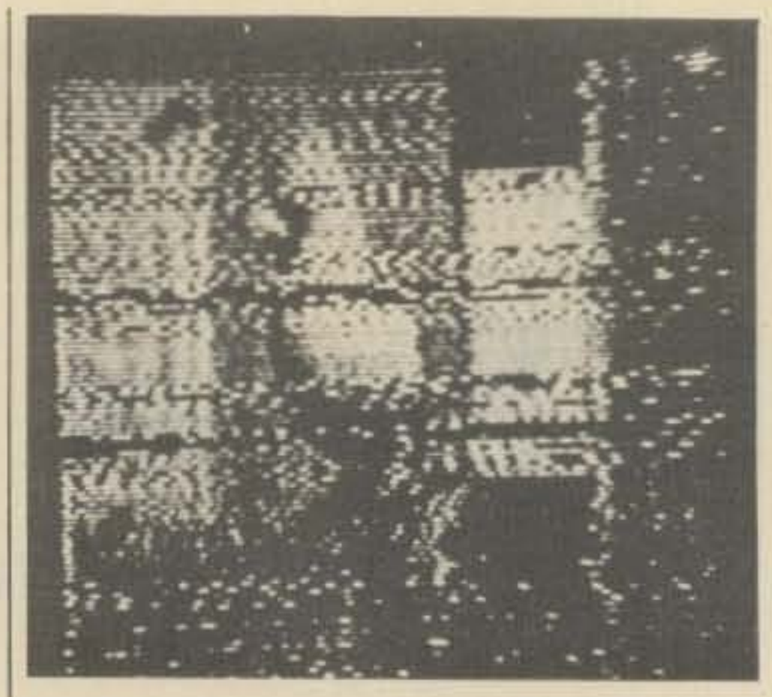
During a period of three and one-half years' use of the Hughes MSC-1 Storage Tube Scan Converter, I found that frame averaging (2 or 3 frames) frequently enhanced the quality of the displayed image enormously. The use of this method was directly related to my experience with color SSTV as mentioned above. Mention was made of this technique in the article, "Storage Tube Scan Conversion" by W2DD, which appeared in *CQ* for October, 1973. Again, it was

Mel Shavelson, W6VLH, homebrewed a "Mars Moon" picture to send back to N6V!

referred to as "Signal Integration". (Whatever you call it, it works!)

The method used with the storage tube scan converter involved "writing" several frames over each other at a low level of writing current and without interspersed erasure. The net result was generally an improvement over what would have been obtained with a single frame. I say "generally" because one cannot always anticipate when a cataclysmic disruption will occur in say, the second and third frames, after a reasonably good first frame! (In the photographic use of this system, I selected frames out of taped sequences.)

A further demonstration of the advantage of this interesting method was shown in this column for September, 1975. Pictures received from W9NTP/HK0 through deliberate QRM



Note the disruptions in this single frame of "red information" received by ZS6PP from W2DD during 1972 color SSTV tests. This frame was averaged with 10 others to provide the complete red exposure onto color film.

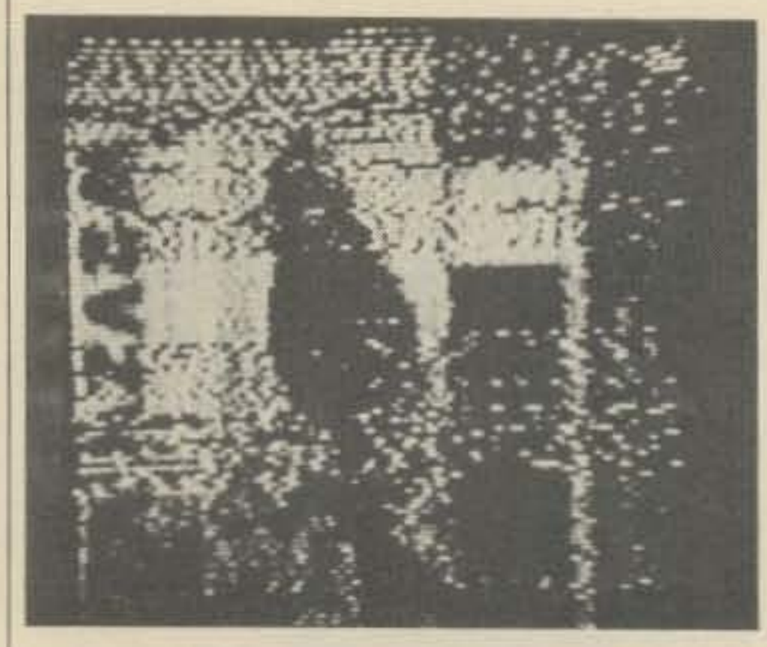
showed what can be done by frame averaging with a scan converter.

Frame Averaging With The Robot 300?

I tried to get Joe Hawkins interested in a "frame averaging MOD" for the 300 soon after it hit the market. With 16 controls on the 300, Joe was understandably unenthusiastic about this idea—but it can be done. I believe that if provision were made to reduce the erase current, "overwriting" could be done to achieve frame averaging. It would require a switchable change in a resistor value (now a "pot" setting). So, 300 owners, get out your blow-torch and fire away! Meantime, any mods for the 400, Joe?

A Comment

I hope that owners of WB9LVI scan converters will make use of the frame averaging technique described by its designer. It is hard to describe how fascinating (and rewarding!) the use of frame averaging can be.



An equally disrupted frame of "green information" received by ZS6PP. This frame was also averaged onto color film.

Wouldn't It Be Wonderful Department

I've just been reading about Satellite Business Systems' proposed satellite communications networks. SBS is a partnership of Comsat General Business Communications, Inc., Information Satellite Corp., and Aetna Satellite Communications, Inc. These partners are in turn wholly owned subsidiaries of the sponsors, Comsat General Corp., IBM Corp., and the Aetna Casualty and Surety Co.

SBS proposes to provide communications networks via a "stationary" satellite at an altitude of 22,300 miles over the equator. The beam of the satellite will be focused on the mainland of the United States.

An organization requiring communications among say, twelve major locations would use twelve earth stations connectable to each other via the satellite. There would be on site receivers, transmitters, and antennas at each station. (Are you beginning to get any ideas?)

The SBS approach is to use digital handling of all information. Their proposal includes two satellites in orbit (one spare), and one ground spare. Each satellite would carry eight transponder channels with a power output of 20 watts each. Relay capability would be up to 54 MILLION BITS PER SECOND.

Facsimile, SSTV, or full-motion digital television can be used separately or together between two or more locations. I can well imagine that the cost of facilities as described here would be horrendous—but certainly it could be balanced off against reductions in other costs such as having company representatives rushing from one plant to another to discuss and review matters that could be handled virtually from desk-to-desk by satellite communications with a resultant elimination of travel costs!

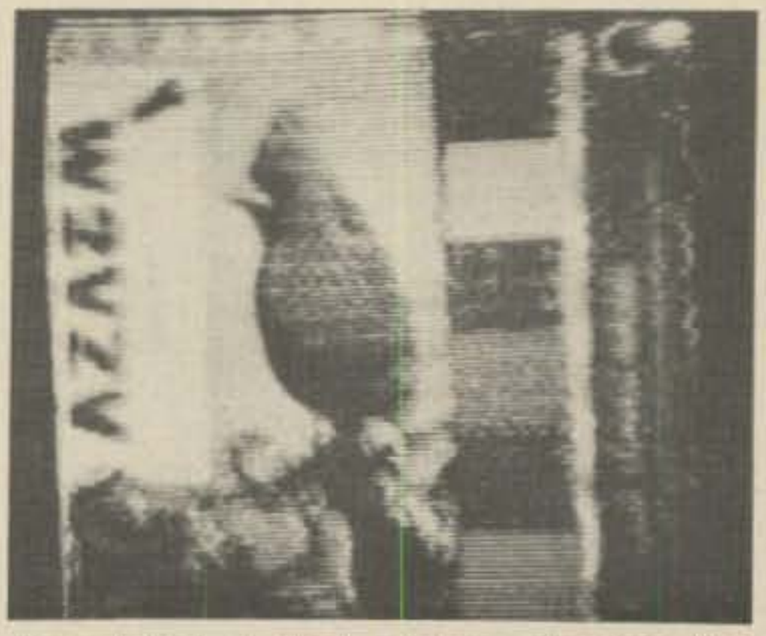
Wouldn't it be wonderful if we slow scanners had a nice little "stationary" satellite of our own hanging up there? The Oscar gang are working on this general problem (I've heard) with a little different approach—an elliptical orbiting satellite that would stay in (and out of) range for longer periods than the satellites now in use.

The problem of QRM on a stationary satellite over the USA might be just too much, but one can dream! Maybe SBS will have an "off peak" period with a few little ol' channels available for picture swapping. If they want to find out where the problems are before going commercial, we amateurs sure could help them!

Final-Final

Don't forget to make your reservations for the Dayton Hamvention! And please don't forget to send your pictures and reports on YOUR SSTV activities to Bill DeWitt, W2DD, at the same old place, 2112 Turk Hill Road, Fairport, N.Y. 14450.

73, Bill, W2DD



Completed (color) picture showing the quality improvement obtainable by photographic frame averaging. Individually unsatisfactory frames of red, green, and blue information were used to make a reasonably satisfactory picture. The same principle can be applied to storage tube and digital scan conversion displays of SSTV pictures as described in the text.

a monthly feature by

WILLIAM I. ORR, W6SAI

Antennas

Design, construction, fact, and even some fiction

Transmitters I Wish I Had Owned
The Gross CW-25

"Darn it all," exclaimed Pendergast. "There must be some cross-over point in life, but I can't find it! When I was a kid I had plenty of time and enthusiasm, but no money. Now, I'm a lot older, and have some money but no time and less enthusiasm. When did I go through the cross-over point?"

"I know what you mean", I replied. "When I was a kid I wanted so badly to buy a *National HRO*, or a *Collins* transmitter or something like that. But I didn't have the money! Now I have the money, but all of those great pieces of amateur equipment are gone with the wind. They are collector's items. I never had the joy of QSOs with that glorious gear *when I really wanted them*. I must admit, however, it is a lot of fun to find the old equipment, clean it up, repair it and get it on the air. *That's a real thrill!* And a challenge, too."

"Right", laughed Pendergast. "I'll never forget the W6 I worked on 80 meter c.w. last winter. He nearly dropped dead when I told him I was using a pair of 852s in the transmitter and a *Breting 12* receiver!"

"More and more amateurs—including a lot of newcomers—are interested in the old gear", I said. "It represents an art that is rapidly vanishing from the scene. Today the vacuum tube and tomorrow the transistor! Transistor production is already on the decline as more and more equipment reverts to integrated circuits. One day soon, transistorized equipment will join the vacuum tube equipment on the museum shelf."

"That means the old-time collector and conoisseur will have a long and healthy life ahead of him, doesn't it?", asked my friend.

*48 Campbell Lane, Menlo Park, CA 94025.

"Radio Row" in New York

Do you remember "Radio Row"?

Every city had one. But the most famous one was located in New York City during the "twenties, thirties and early forties". The area encompassed a few city blocks, the main thoroughfares were Vesey, Cortlandt and Dey Streets and the main products for sale were radios, radio components and radio hardware. Nearly a hundred shops clustered together, providing a happy hunting ground for radio fans and radio amateurs. This is the story of one shop, and a particular piece of equipment in it.

It was very easy to get there in 1934 and it only cost a nickle. By a combination of subways any radio amateur could emerge from the downtown station of the IRT (*Independent Rapid Transit*) subway system into the grimy world of "radio row". And the Mecca of the visitor was a small enclave of stores bounded by Cortlandt and Vesey streets.

The young radio amateur, with a dollar or two in his pocket, could spend an entire Saturday looking into dusty window displays of enticing radio equipment, falsely marked down for imaginary sales and wander the aisles of long-forgotten purveyors or radio junk and exotica, such as the establishment of "Blan, the Radio Man".

By far the most popular of these radio emporiums was the famous *Gross Radio Company* at 51 Vesey Street. Owned and operated by Jerry Gross, W2AAE, the tiny shop featured a dazzling display of amateur equipment for the beginner and old-timer alike. And one of the most famous pieces of equipment on display was the "Gross CW-25 beginner's transmitter", faithfully advertised each month in *QST* magazine as a kit for $13.95, or fully wired for $14.95 (Fig. 1).

In those dark days of the depression, however, this sum was equal to a week's wages to some and was only a theoretical concept to the many unemployed. As a result, most amateurs spent their time in Jerry's store examining the model transmitter carefuly set atop a counter, and copying its circuit so that they could build the equipment out of scrap parts salvaged from a defunct broadcast receiver!

Armed with a pencil and a school notebook, the author of this article was a copier, not a buyer. But what a *great* transmitter bargain Jerry Gross offered to the radio world! Running 50 watts input, the CW-25 delivered about half that power on the 160 and 80 meter bands, and somewhat less on 40 and 20 meters. Equipped with a set of three plug-in coils for one band operation, extra coil sets for the transmitter were available from genial Jerry for only 75 cents per coil. A 50 watt power supply kit was available for $8.75 (fifty cents extra wired), and a set of tubes for the transmitter was only $3.50. If you bought the complete package, and if Jerry liked you he'd throw in a free crystal holder (worth one dollar) when you bought your crystal blank for 99 cents.

So for a total expenditure of $27.19 (no sales tax in those days) you had a complete transmitter kit, ready to assemble for single band operation. What red-blooded, active amateur could resist such a deal?

The Transmitter Circuit

Plenty of amateurs could, and did, resist the tempting offer. Economics was the main reason. And while scores of CW-25 transmitters were on the air, more home-built versions were constructed by visitors to Jerry's store than were bought over the counter. Jerry didn't seem to mind and he spent many hours working with the kids, drawing schematics and giving them advice. He probably sold as many components for the homebuilt rigs as he used himself in

Fig. 1—The Gross CW-25 transmitter. Sold as a kit for $13.95, this simple 50 watt transmitter was used by many beginners and Old Timers alike during the 1933-1934 years of the Great Depression. The transmitter used a 247 crystal oscillator, a 46 buffer or doubler and two 46s in the final amplifier stage. With a 500 volt supply the transmitter ran 50 watts input and delivered about half that power on 160, 80 or 40 meters. On 20 meters, output was down to about 15 watts. One set of plug-in coils came with the transmitter kit, other coils and the crystal were extra. No meters were provided but four panel jacks allowed the operator to measure plate and grid currents. The jacks were insulated from the chassis as they were "hot". Considered very dangerous today, the "hot" meter jack was just one of the hazards of the game in 1934! Antenna connections were left to the ingenuity of the owner, as only a link-coupled winding was supplied for the output circuit. Most amateurs either keyed the B-plus of the buffer stage, or else placed the key in the grid meter jack, J3 of the amplifier to achieve blocked-grid keying.

building his little transmitters. Never mind.

I never had enough money to buy one of the CW-25 transmitters, but I looked at it long enough to burn a clear memory of it in my mind's eye over forty years ago.

The CW-25 was sturdily built upon a heavy steel chassis that was copper plated and then painted with a baked crackle finish. The components were impressive: *General Radio* variable condensers and dials, good quality mica capacitors and heavy, insulated wiring. The total cost of the components, if bought separately, was well over thirty dollars. How did Jerry sell the transmitter kit for under fourteen dollars? That was a secret he would never reveal to the eager amateurs, with thin wallets, who poured over the assembled model of the transmitter in the Vesey street store.

The circuit of the CW-25 was the popular "46 job" that could be built up by any beginner who was reasonably adept with a soldering iron and pliers (fig. 3). Many of today's amateurs can still draw the circuit from memory. It consisted of a 47 crystal oscillator that would work with 160, 80 or 40 meter crystals, a 46 neutralized buffer stage and two parallel-connected 46's as a class C amplifier. The 47 was an audio pentode that provided reasonable r.f. output with minimum crystal current when run at about 300 volts. The 46 was a dual grid tube that could either be connected as a tetrode (with 100 volts on the grid #2) or as a high-mu, zero-bias triode (by connecting the two grids together). It was in the latter mode that the 46 proved to be an inexpensive and good tube, capable of about 25 watts input.

The 46 had to be handled with kid gloves, however. If it was overdriven, or if the grid was heated in any manner, serious grid-emission problems would result. This was caused by a gradual deposit of filament oxide on the #1 grid of the 46. When enough oxide had boiled off the filament, the #1 grid proved to be an efficient emitter of electrons if its temperature was high enough! When this phenomena took place, and it eventually did, the 46 "ran away" and drew increasingly heavy plate current until the tube destroyed itself. The operating trick then, was to use the tube as long as possible and then get it out of the rig before things blew up! In most cases the 46 lasted for a year or two of everyday operation, so a lot of time passed before the problem came up.

Most amateurs were aware of the shortcomings of the 46 and divided into two schools of thought about the

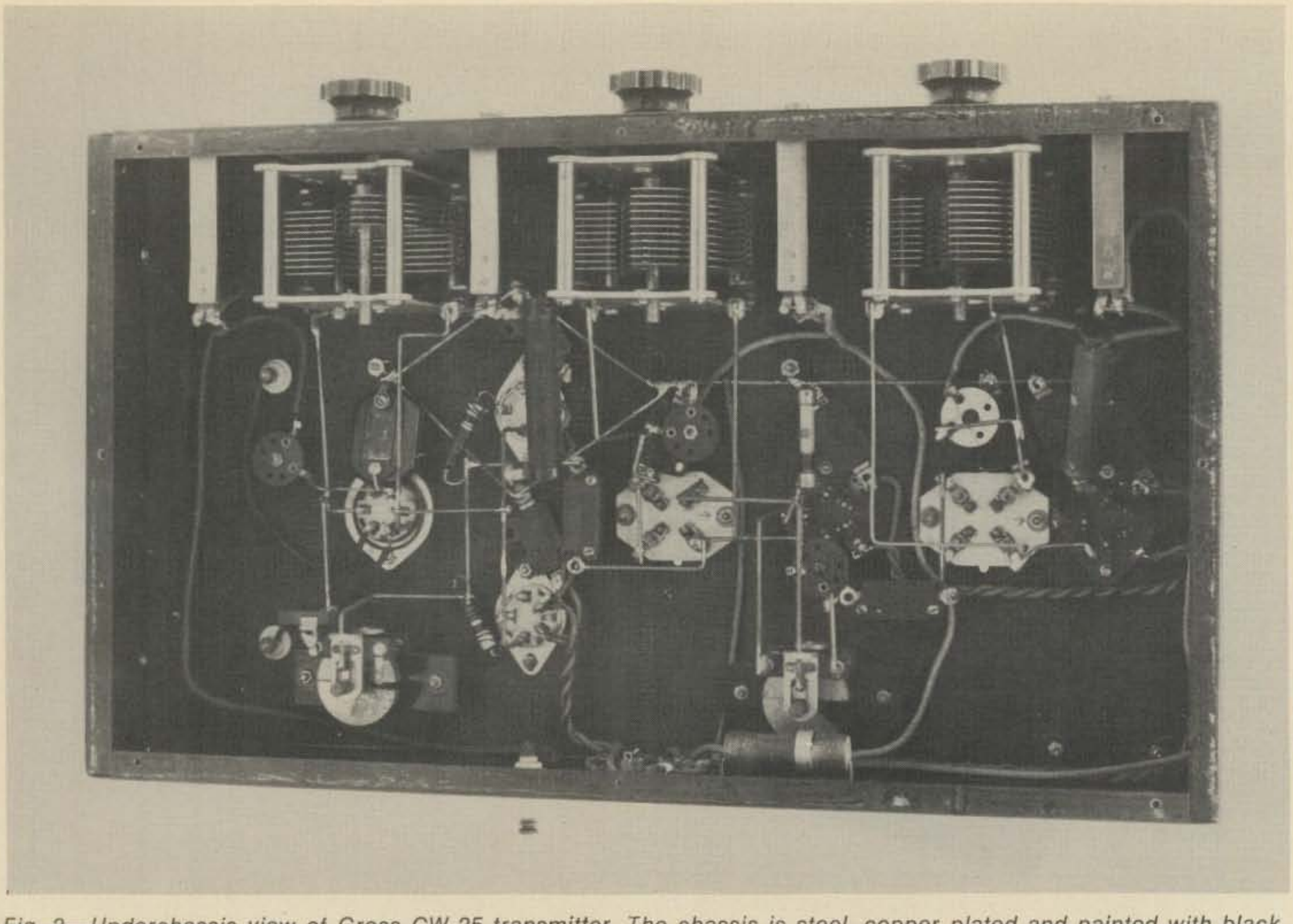


Fig. 2—Underchassis view of Gross CW-25 transmitter. The chassis is steel, copper plated and painted with black crackle paint. Bus-bar wiring is used for the r.f. circuits and rubber covered wire for the d.c. circuits. The three tuning controls are across the front edge of the chassis. Note that half the plates in the amplifier tuning capacitor have been deftly cut out. The two neutralizing capacitors are mounted on the chassis and are visible at the bottom of the photograph. Containing well over thirty dollars worth of parts, it is a mystery how Jerry Gross sold the transmitter kit for under fifteen dollars!

tube. The first group swore by the *RCA* 46, as it was believed to have a better life and less grid emission than the inferior competitors. The opposite school believed the *National Union* and *Sylvania* 46s were superior to the inferior *RCA* tubes and look down their respective noses at the dolts who preferred the *RCA* bottles. Today, it is generally known that "double branding" of tubes was common in those days and manufacturers gladly made tubes for the competitors so that the label on the tube had very little to do with the actual manufacturer! So much for the competing 46 tubes and their admirers! (Author's note: actually, the *National Union* 46 was better than the RCA 46. HI).

The Power Supply and the Antenna

All the eager amateur required was a power supply and an antenna and he was on the air. If he didn't want to spend $8.75 for a power supply kit, *Gross Radio* would sell a rugged power transformer capable of delivering 500 volts at 350 milliamperes, plus filament windings that would run the whole transmitter. The price of this beauty was only $3.45. Another 65 cents for an 83 mercury vapor rectifier, plus other components filched from a defunct broadcast receiver and the power supply was ready to throw together on a breadboard.

Most of the CW-25s ended up on 160 or 80 meters and a simple Marconi did the job as an antenna. Well-heeled amateurs could buy an "Antenna Meter" for $2.95 that would indicate antenna current. This device, obsolete today, was a *hot-wire* ammeter that indicated the expansion built up in an iron wire when current flowed through it.

The CW-25 Phone Transmitter

The CW-25 transmitter, when combined with a modulator and meter panel formed a simple phone transmitter that was mounted in a two-foot high metal rack assembly. The cost of this transmitter kit was only $66. For another ten dollars, you could get it wired and tested. Type 46 tubes were used as modulators and as a driver-amplifier, with a 57 pentode as a speech amplifier. I only knew one amateur who was rich enough to own a CW-25 phone transmitter and he was the envy of fellow amateurs on 160 meters within a hundred mile radius.

The CW-25 transmitter was quickly obsoleted by more modern equipment and soon faded into the recesses of my mind. A year or so ago, however, I was browsing in a flea market and to my astonishment found a mint condition CW-25 transmitter for sale or trade at a modest price (fig. 2). So with sweaty palms and a trembling voice I bargained with the owner, trying not to let my excitement betray my eagerness to get the little transmitter. Soon it was mine and I rushed home with it, to gloat over my purchase, much as I might have done 40 years ago when my desire had exceeded my finances.

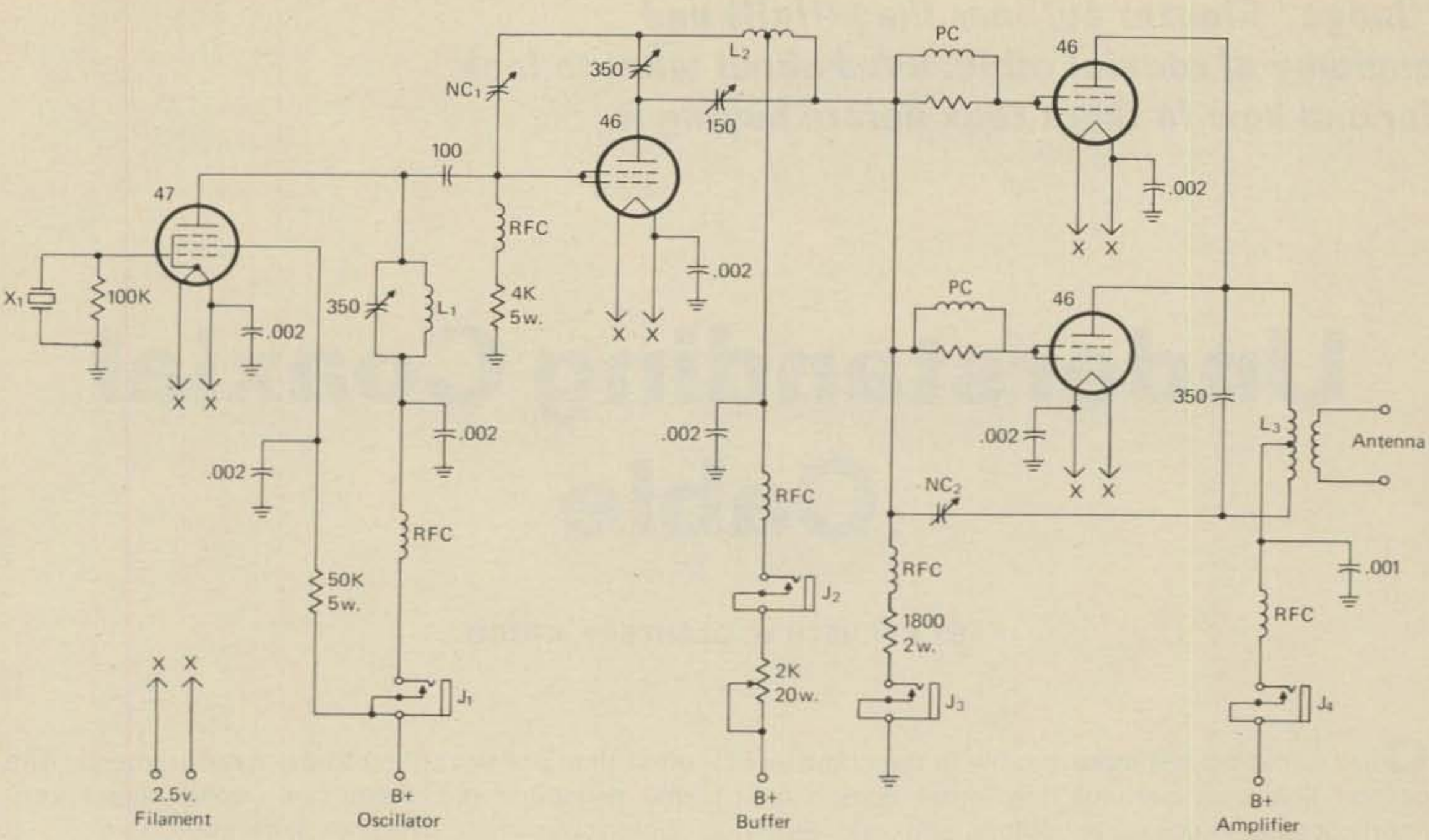


Fig. 3—Schematic of the CW-25 transmitter. The 47 functioned as a fundamental frequency crystal oscillator using 160, 80 or 40 meter crystals. The 46 buffer had the two grids tied together to act as a high-mu triode. Resistance bias was used. A split-coil plate circuit provided out-of-phase neutralizing voltage, fed back to the grid circuit via capacitor NC[1]. The buffer was capacitively coupled to the final amplifier, which consisted of two 46 tubes connected in parallel. The parasitic chokes (PC) in the grid circuit are a 1977 modification to suppress a v.h.f. parasitic oscillation that showed up in the little transmitter. No parasitic suppressor seemed necessary in the buffer stage. A split-coil plate circuit is used for neutralization. Recommended operating voltages are: Oscillator, 300 volts; buffer 300 to 400 volts and amplifier, 400 to 500 volts.

The CW-25 Transmitter Today

Time had dealt kindly with the little transmitter. Most of the commercially built amateur transmitters are junk today. Amateurs tore them apart for their components or vainly tried to de-TVI them enough to get them on the air. Consequently, the pre-war transmitters are few and far between and most of them are in poor shape. Not so this little CW-25. It took only a short time to trace out the circuitry, clean the chassis with a stiff brush and liquid *trisodium phosphate* (a *great* cleaner for old metal). A few soldered joints that had come apart over the years were resoldered and the transmitter was ready to put on the air. A genuine pre-war Bliley crystal was used, the antenna connected and *away we go!* It worked like a charm until it was noticed that once in a while the meters would give an odd jump and bands of light and dark would flash across the screen of the nearby television receiver. It was but the work of a few moments to find that the parallel-connected 46 tubes in the final amplifier had a robust parasitic oscillation at about 70 MHz that would show up whenever the transmitter was keyed. How the owners of the CW-25 must have scratched their heads over this problem in 1934! Even though TVI was no problem, the parasitic oscillation was a function of tuning and neutralization and could appear and disappear with perplexing rapidity. Applying today's solution to yesterday's problem, parasitic chokes were added to the grid circuit of the final amplifier and the problem was solved. No choke seemed to be necessary in the buffer stage of this particular transmitter. A few on-the-air checks proved the worth of the transmitter and its rugged design.

Cleaned up, re-tubed and adjusted the *Gross* CW-25 is a collector's item worthy of space in any ham's shack. In addition to looking *great*, and being a superlative example of transmitting art in the "thirties", it *works*. It can be put on the air for a QSO and always arouses interest among the amateurs that hear it.

The next project is to clean up and get working a genuine *Gross* modulator and power supply that good fortune led me to find in an out-of-the way radio shop. Shortly the complete *Gross Radiophone* will be working. And won't that be the day! But, as Pendergast said, "a little late. The cross-over point had been passed years ago."

* * *

The writer will be pleased to hear from any amateurs who own a *Gross* CW-25 transmitter, or any working pre-war transmitter, for that matter. Write care of *CQ* magazine, or via the callbook QTH. ■

CQ's Ham Shop is a good source of antique and hard to get items. It's a free service for CQ subscribers. Why not start collecting now?

"Judge" Glanzer outlines the pitfalls and anatomy of coaxial cable. Read about what to look for and how to check coax before buying it.

Understanding Coaxial Cable

BY KENNETH W. GLANZER*, K7GCO

Coax cable causes more trouble in the communications link than perhaps any other component. Poorly installed coax connectors and rain easily gaining entry are the most common problems even though the cable itself may be OK. The new foam dielectric coax has *not* proven to be as useful as you might have been led to believe except that it is lighter and more flexible. There are, however, some exceptions. Its loss at 28 MHz is about 0.8 dB /100 ft. as compared to about 1 dB/100 ft. for the regular solid dielectric. The claimed 0.2 dB lower loss has turned out to be closer to 0.1 dB more often than not according to my measurements. The one exception has been some solid center conductor coax made by Times Wire and Cable.

*202 S. 124th St., Seattle, WA 98168

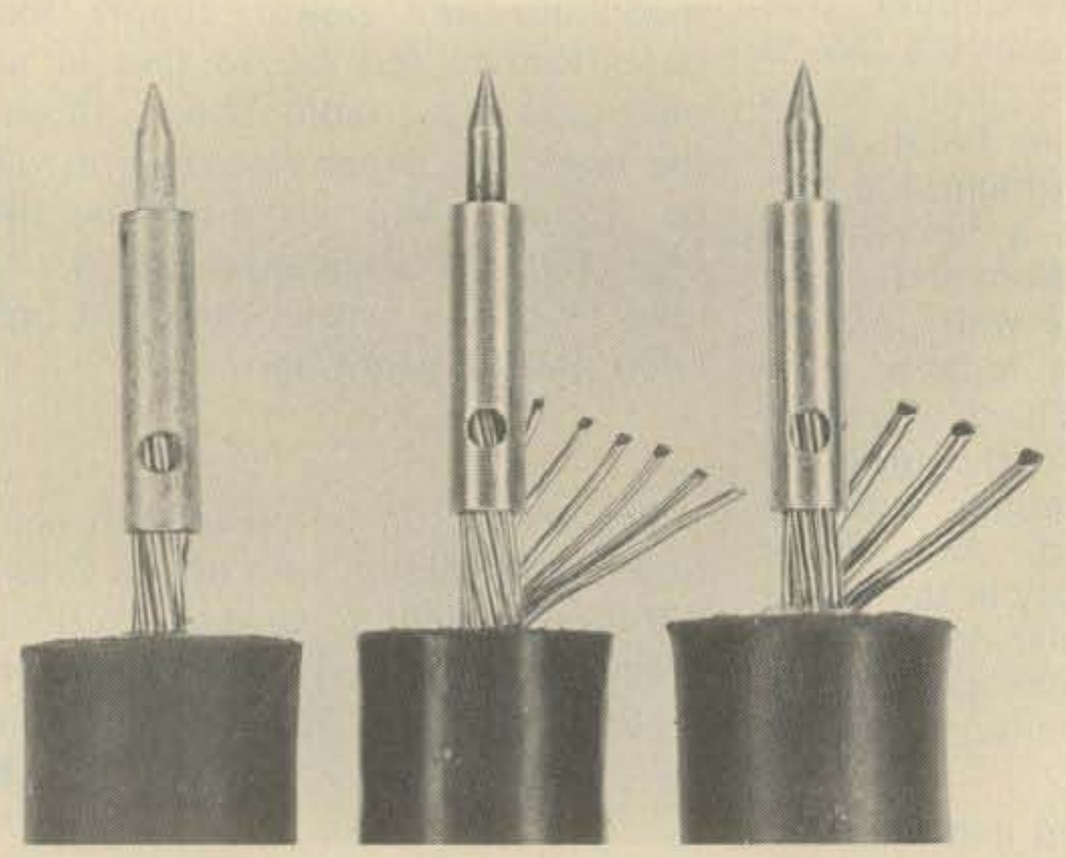


Fig. 1—A test for poor quality foam coax due to a small center conductor is to try to slip the center tip of an N-type connector over the wire. The wire on the left accepts the tip and is thus unsatisfactory. The center and right coax do not accept the tip without peeling off strands of the center conductor. These two are Columbia Superflex and Belden 8214.

In solid dielectric coax at frequencies up to 100 MHz about 80% of the loss is in the center conductor. The shield accounts for 19% and 1% is lost in the dielectric. So why change the dielectric if so little loss is caused by it? If the 0.66 velocity factor is increased to say 0.75 by a foaming action by mixing yeast with the material (actually done with nitrogen) it becomes part air and part dielectric. The dielectric constant (K) for the solid is 2.3 and about 1.5 for the foam.

The formula for the impedance of coax with spaced bead support is

$$Z = 138 \log_{10} \frac{D}{d}$$

where D = outside shield diameter
d = center conductor diameter.

For solid or foam dielectric coax the formula is modified to take into account the change in velocity factor.

$$Z = 138 \log_{10} \frac{D}{d} (1/\sqrt{K})$$

where K = the velocity factor determined by the insulating material used. Examination of the above formula will show that if K is lowered (2.3 to 1.5) the value of $1/\sqrt{K}$ gets larger. Since the outside shield diameter, D, is to be kept the same and therefore constant, the only other factor that can change in the formula in order to retain 50 ohm impedance is the center conductor diameter, d. Since the factor $1/\sqrt{K}$ is larger, the quantity, 138 $\text{Log}_{10} \frac{D}{d}$, must be smaller. Making d larger will balance the equation. This is just what is wanted, increased center conductor diameter, and therefore lower re-

sistance. The conductor with the greatest loss was increased in diameter and this is why a larger center conductor is a *must* in foam coax. When foam coax first came out, one company just changed the dielectric and did not increase the center conductor size. This coax turned out to have a 60 ohm impedance which is great for matching 50 to 72 ohm loads with quarter wave stubs. Several outfits are still selling coax *without* the larger center conductor to save copper costs and the average customer doesn't seem to know the difference.

The larger center conductor in the good foam coax requires that 6 of the 19 strands (Columbia Superflex) be cut when trying to slip the center tip of a Type N conductor over the wire (3 of 7 must be cut on Beldon 8214). The regular center conductor of solid dielectric coax (and the 60 ohm foam coax) will just fit in this center tip of the N connector (see fig. 1).

One other way some outfits are cutting cost is reducing the percent of braid and this doesn't affect loss too much other than through leakage. So check for complete and partial braids also. There is no cheap but good coax.

Foam Problems

When you foam any material, it gets weaker and it is harder to control the density. Variations in density will cause variation in impedance and velocity factor. The former causes incorrect s.w.r. readings and the latter is of no problem except when lines are cut to a certain electrical length by formula rather than by grid dipping them.[1] I have an antenna that requires two feedlines of equal electrical length. In the past, with solid dielectric coax, I'd cut one to length by formula and then do a quick check with the grid dipper and then cut the other the same physical length with no problems. With the foam coax the velocity factor is higher and varies from manufacturer to manufacturer and from lot to lot. Not grid dipping the second length of foam coax turned out to be a disaster with this phased beam. Since the coax was the last thing I suspected, it took a systematic step by step check to isolate the problem. Upon grid dipping the other coax, I found it to be electrically longer and had to cut three feet off or 3% of the length. Upon checking the other double coax lengths, cut from the same 1500 foot batch, I found, in every case, one to be 3% to 4% longer. You would think that the law of averages would have two come out the same but didn't. It is kind of hard to tell a customer that they are really the same length. Even when cut to the right lengths, this coax gave phony s.w.r. values. I just replaced it with solid dielectric coax and had no more problems. It was a very costly lesson.

[1]Glanzer, Kenneth W., "Determining Resonant Lengths Of Transmission Lines," *CQ*, May 1974, p. 37.

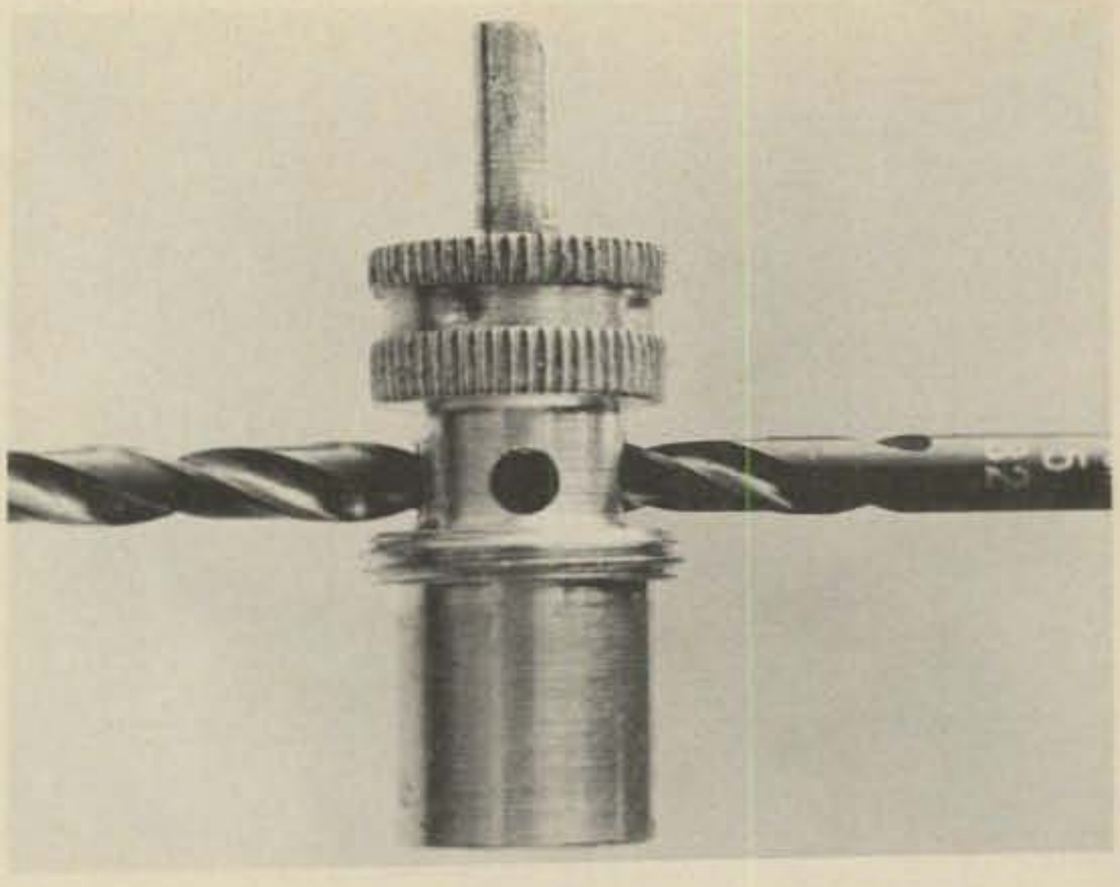


Fig. 2—Enlarging the holes on the PL-259 male connector with a 5/32 drill makes it easier to solder to the shield and thus provides improved contact.

When checking foam coax made by other manufacturers it was found that Belden 8214 and Essex 623-111 foam coax were stable and the impedance was 50 ohms. Apparently Belden and Essex know how to mix up the yeast in the dielectric.

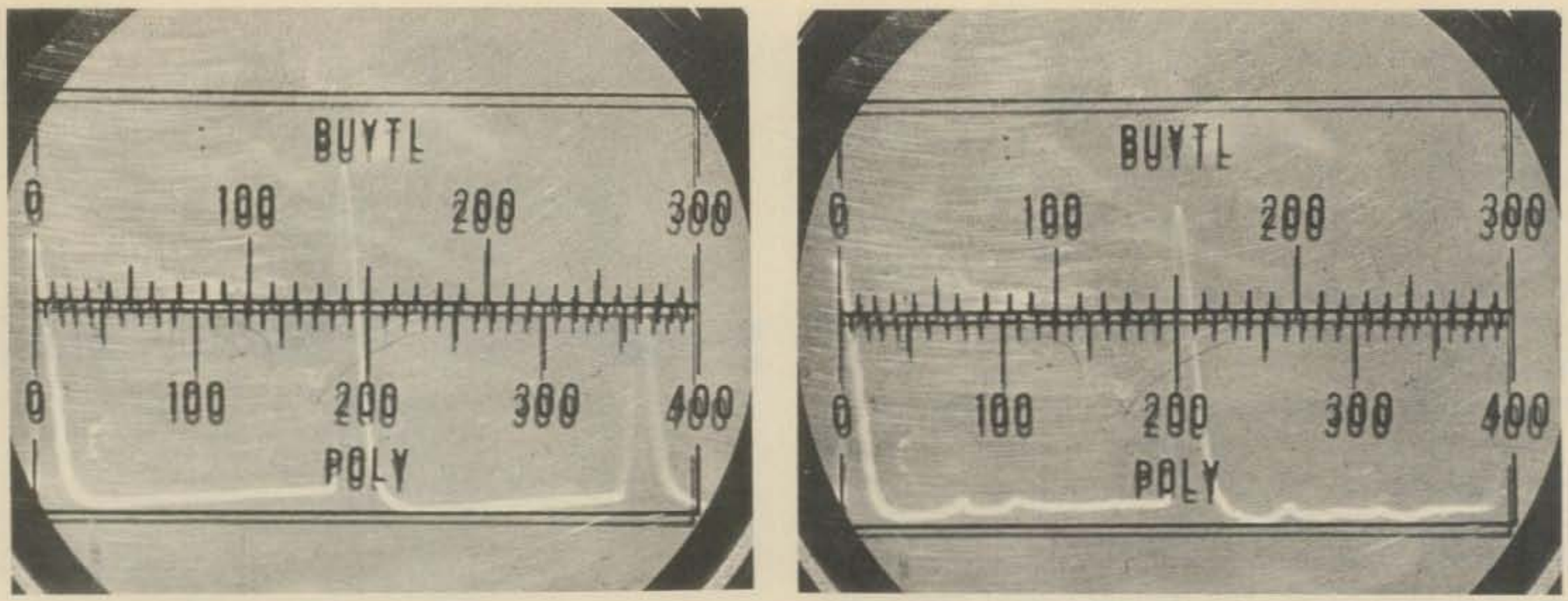
Connector Problems

Installing u.h.f. connectors is a problem for most. It is difficult to solder through the four small holes and if the heat is applied to the connector too long, the foam oozes out of the holes and prevents the solder from flowing. I drill these holes larger to aid in soldering (fig. 2) and prefer the heavy tipped irons that can deliver heat rather than the soldering gun types because the soldering should be done as quickly as possible. These larger holes give more area for the solder to grab the shield making a stronger connection.

Coax Testing

The best way to test coax is to what is called "impulsing." This is a technique of sending a video pulse down the cable and observing it on a scope on its way back. You can see "impedance bumps" and other discontinuities and their exact location. This technique was first used to check out underwater cables and the first patent was issued to Bell Telephone Labs in 1924. The old Tobe Capacitor Co. made the first Time Domain Reflectometer and it sold for $7000. Old telegraphers could tell if a line was shortened or open and about how many miles away by the echo. Back in 1946 a local professional engineer by the name of Bill Harrold, who had worked on radar at MIT, was asked to make an inexpensive Reflectometer, which he did. It is presently marketed by Radar Engineers, 4654 N.E. Columbia Blvd., Portland, Oregon 97218.

I borrowed this "Fault-Finder (fig. 3) to check out my *questionable* coax and found just about

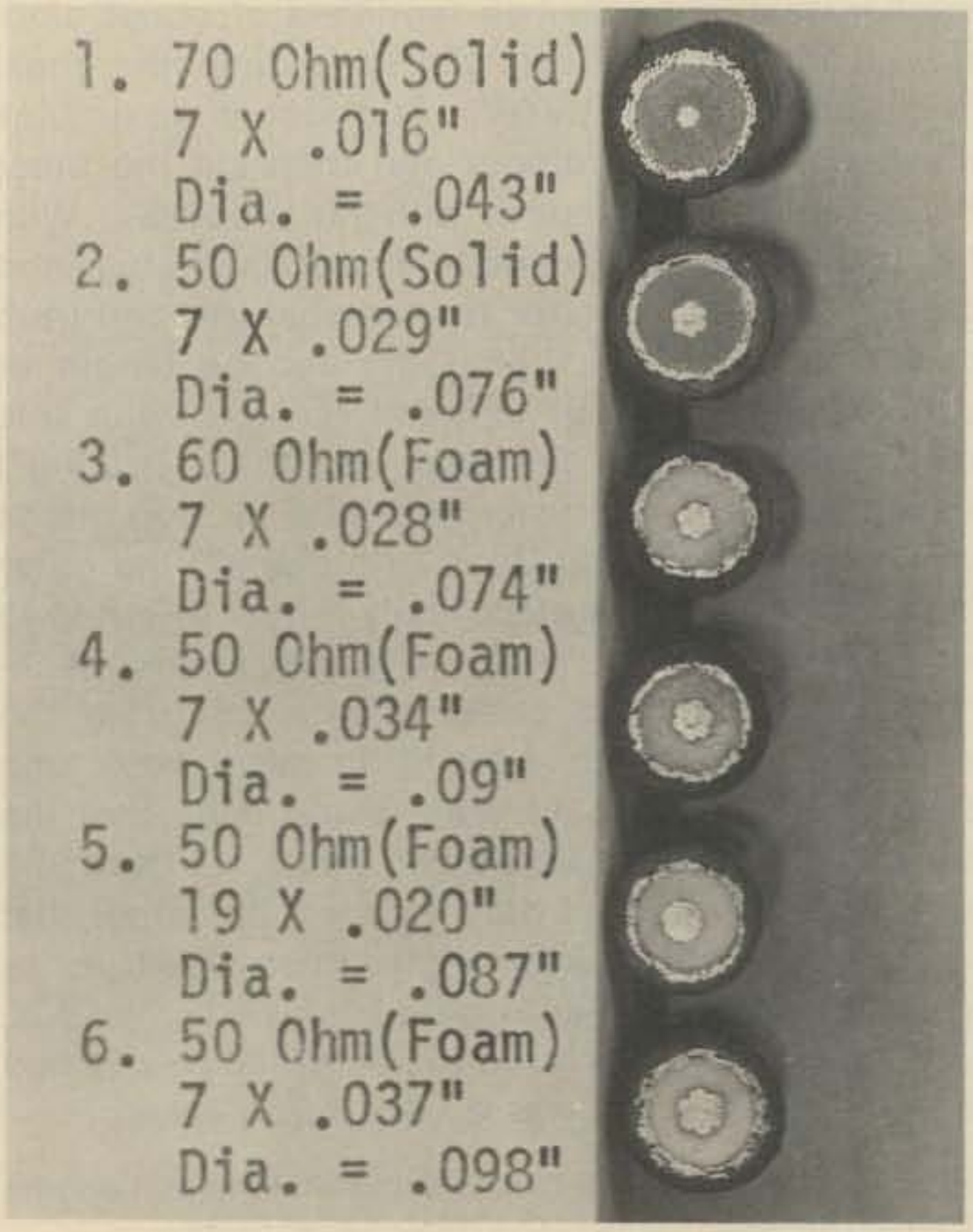


(A) (B)

Fig. 3—(A) Belden and Essex foam coax tested with an open load showed perfect response on the "Fault Finder". (B) Some other brand of coax showed impedance "bumps" in the line when tested open.

what I had expected: 1. The impedance of the coax varied due to highly irregular density of the foam (on the particular piece under test.) 2. The Velocity Factor varied up to 3%. 3. Foam coax with "normal" center conductor diameter give about 60 ohm feedline impedance. 4. Solid dielectric coax velocity factor is fixed and I've yet to see any variations in impedance in any length tested (unless externally damaged.) The exceptions to the impedance bump and variations in "foam" coax was Belden 8214 and Essex 621-111 (fig. 3). You get just what you pay for and there is no "inexpensive" good coax. Whatever you buy, be sure to examine the braid density (fig. 4) before you buy either type coax and if you purchase foam coax, be sure that the center conductor is larger than that in solid dielectric coax. So take your calipers to the radio store when you buy foam coax. Make sure that the center conductor sizes are as shown in examples 4, 5, & 6 of the coax cross-sections pictured. ■

Fig. 4—Make certain that any coax purchased has a tight shield as shown above. Cheap coax often has 70 or 80% as much braid and will leak at the higher frequencies. Cross-sectional views of various brands of coax shows the relative sizes of their center conductors.



A simplified introduction to s.s.b. theory for the beginner

Single Sideband Theory for People Who Don't Understand Single Sideband Theory

BY JOSEPH L. SHEFFER*, WA7LSI

For many years, single sideband has been playing a more and more important part in amateur radio. It is, now, the most widely used form of voice communication we have.

Some amateurs do not look upon this as an improvement, however. They say that perfectly good equipment has become obsolete, new techniques must be learned, s.s.b. equipment is more expensive, and perhaps worst of all, the FCC is putting more and more single sideband theory in their tests. To make things still worse, single sideband theory is sometimes hard to understand for those of us who are familar, mainly, with "conventional a.m." radio theory.

Basic A.M.

Many of us, I think, learned that the "carrier" carries the audio frequency signal, stored in the sidebands, from the transmitter to the receiver. Therefore, it's confusing when we learn that s.s.b. transmission not only does without one sideband, but also without the carrier. It seems like trying to carry passengers across an ocean without a ship and leaving half the passengers behind, besides.

Obviously something's wrong. But when a person without a strong radio background tries to study it further, he sometimes becomes more confused, either coming across explanations that make little sense or explanations that assume he knows more than he does.

The problem, as I see it, is a basic misconception which many of us learn when we first start studying radio, which stays with us after that. Without this misconception, single sideband theory can be easily understood and, perhaps, even become obvious. Around the turn of the centry, when radio telephony communications first came into use, a popular explanation for its operation would run something like this: An audio signal and a radio frequency signal combine in a modulator. The radio wave, called a "carrier", carries the audio signal from the transmitter to the receiver. There the radio wave is stripped away, leaving only the audio frequency signal.

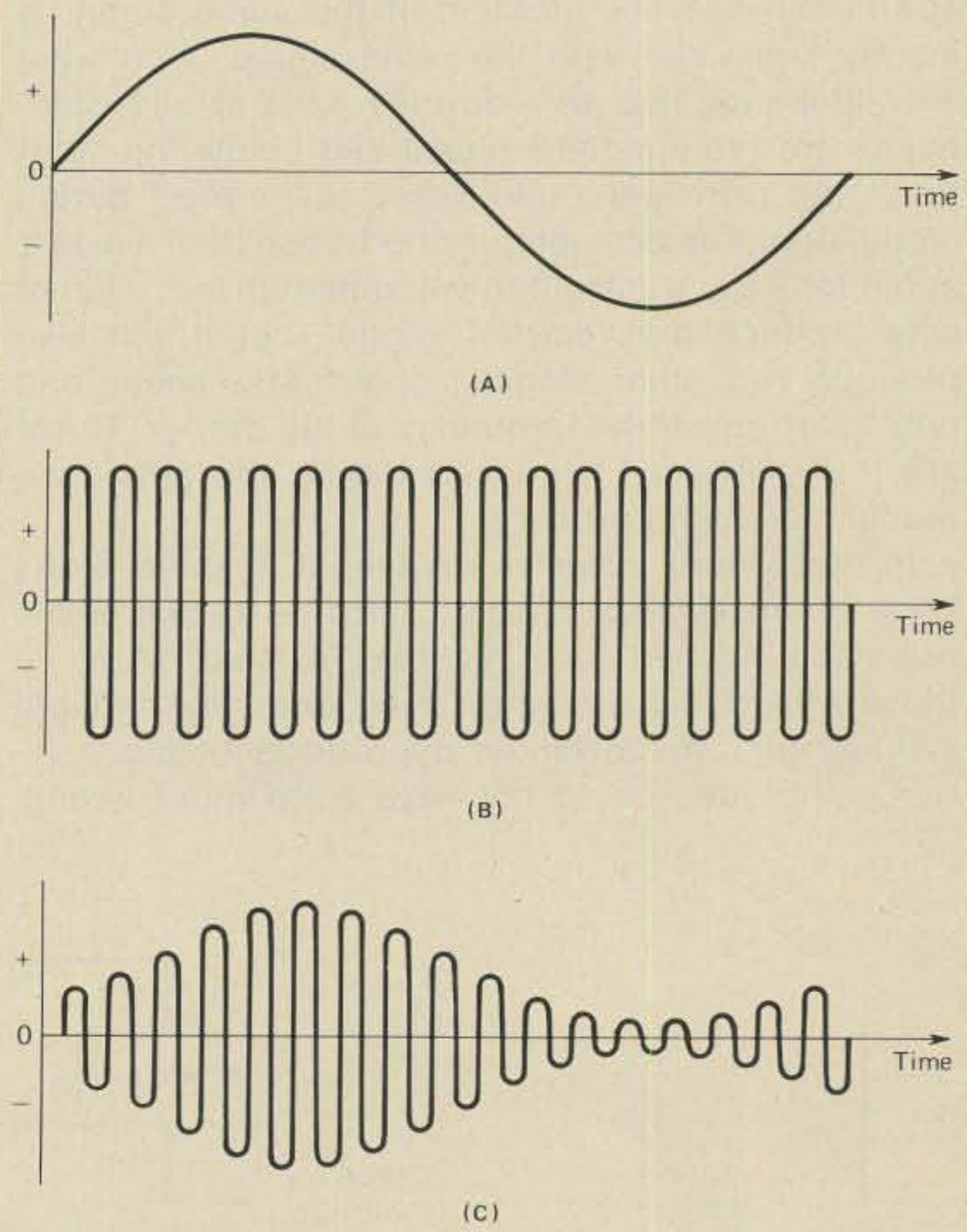


Fig. 1—Waveforms involved in amplitude modulation. (A) represents the audio signal, the intelligence to be transmitted. (B) represents the radio frequency wave and (C) represents the result when (A) and (B) are combined in a modular circuit.

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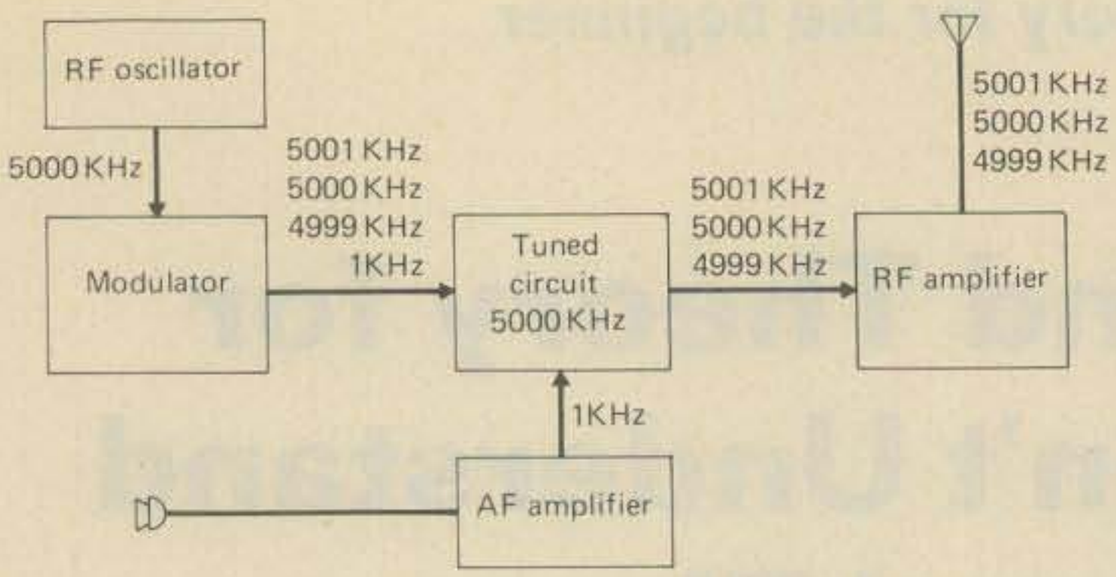

Fig. 2—Block diagram of the basic a.m. transmitter described in the text.

Fig. 1 illustrates this explanation. Part (A) shows the graph of an audio frequency wave. Part (B) shows the graph of a radio frequency wave. When they are combined in a modulator, we have a wave pattern something like part (C). This is nice, straight forward explanation and it is essentially true. If one were to combine an audio signal and a radio signal and read out the result on an oscilloscope, the pattern would look like part (C).

Sidebands

But this simple theory doesn't tell the whole story and herein lies our problem. If the audio signal is merely combined with the radio signal, then what are sidebands and why do they exist at all? Sidebands are radio signals above and below the "carrier," the principal radio signal generated during modulaton. For example, if one transmitter a 1 kHz audio tone the transmitter, when modulated, will not only produce the "carrier" signal, but it will also produce two other signals, one 1 kHz below and one 1 kHz above the frequency of the carrier. These are the sidebands produced during the amplitude modulation (a.m.) process.

In those early days, most people in radio didn't know about sidebands. Even into the 1920's, some radiomen refused to admit they existed. Many of those who would recognize their existence thought of them only as unwanted byproducts of the "carrier". This idea could not have been more wrong. To explain the fact that sidebands are necessary for for radio telephone communications, the theory was revised. The sidebands contained the information, but the "carrier" still carried everything along.

This explanation is still used today, with variations, in basic radio textbooks, because it is relatively easy to understand and seems to make sense until one considers single sideband transmission.

Beat Frequencies

Let me offer, instead, a different explanation which may shed some light on the subject. I am not saying that this explanation is any more correct than the one I gave previously, but it may make single sideband theory easier to understand what beat frequencies are. The reader may already be familiar with beat frequency effect in regards to frequency converters and the such. When two a.c. signals are combined in a mixer or modulator, two new signals are produced along with the two original signals. One of these new signals will be the sum of the two original signals and the other new signal will be the difference between them.

For example, suppose a 5000 kHz signal and a 1 kHz signal are combined in a modulator. The original 5000 kHz and 1 kHz signals will, of course, appear in the output, but there also will be a 5001 kHz signal (5000 kHz + 1 kHz) and a 4999 kHz signal (5000 — 1 kHz). These signals, the sum and difference are called the beat frequencies and are the sidebands. The beat frequency effect present in almost all areas of radio, but it is particularly important in s.s.b. theory.

The A.M. Transmitter

Consider fig. 2, the block diagram of a radio transmitter. A 1 kHz tone is converted by the mike to an electrical signal and fed to the audio amplifier and from the amplifier to the modulator, where it is mixed with the 5000 kHz signal coming from the r.f. oscillator.

The output of the modulator contains the 1 kHz signal and the 5000 kHz signal, along with the beat frequencies, 5001 and 4999 kHz. These four signals must be thought of as being completely independent of each other. Once they have been produced, each can exist without the others. In fact, the tuned circuit gets rid of the 1 kHz signal on the way to the next stage. The stage then amplifies the remaining three signals and sends them on their merry way. The 5000 kHz signal is the "carrier" and the 5001 and 4999 kHz signals are the sideband frequencies.

The A.M. Receiver

Now, consider fig. 3, a block diagram of an a.m. radio receiver. The "carrier" and the sidebands are received through the antenna and the tuned circuit gets rid of all but the wanted signals (which consists of the "carrier" and two sidebands). These

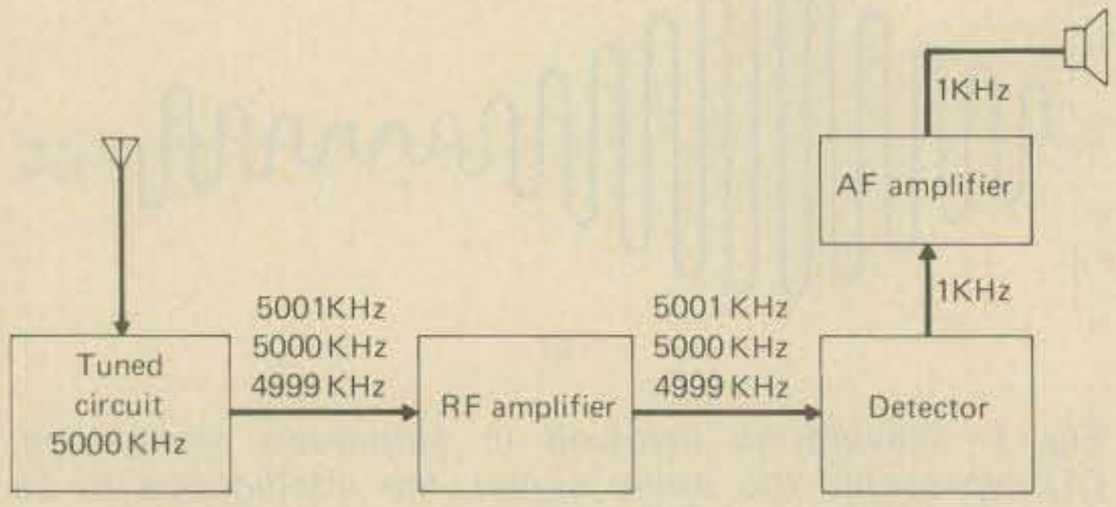

Fig. 3—Block diagram of the basic a.m. receiver described in the text.

are strengthened in the r.f. amplifier stage.

The output of the amplifier is then fed to the detector where the signals are combined; beat frequencies are developed again. The difference between 5000 and 5001 kHz is 1 kHz, the audio output signal. The 4999 kHz sideband also beats with the 5000 kHz "carrier" and produces another 1 kHz signal that combines with the first 1 kHz audio signal to produce the total output of the detector stage. This signal is then strengthened in the audio amplifier and drives the speaker.

The "carrier" was used by the modulator at the transmitter to generate the sidebands. At the receiver the "carrier" is used in the detector to permit the beat frequency process to occur. Realize then, that the "carrier" did not carry anything. In fact, once produced, the sidebands can get along quite well without the "carrier". The "carrier" is completely misnamed and this is why I have placed it in quotation marks.

Developing The S.S.B. Signal

To send the useless "carrier" along with the sidebands is a waste of power that can be used for the sidebands instead. Why not get rid of the "carrier" once it has done its job at the transmitter? But that's not all we can get rid of. Only one sideband is necessary for the receiver to detect the audio signal, so we can also eliminate the other side-band.

Now we have fig. 4 a block diagram of a simplified transmitter revised for s.s.b. transmission. Everything is the same as the a.m. transmitter up to the tuned circuit. After that, there is a filter, which removes the "carrier" and one sideband. The amplifier need amplify only the remaining sideband and, therefore, does a better job of it in that all the transmitted power is in that one sideband.

The S.S.B. Receiver

Fig. 5 is a block diagram of a receiver revised for s.s.b. reception. This is the same as the a.m. receiver of fig. 3, except that the beat frequency oscillator introduces a 5000 kHz signal to the detector as a replacement for the "carrier". The "carrier" taken away at the transmitter, is put back in the receiver by a small low power oscillator, the b.f.o., and power doesn't need to be wasted by transmitting it. Also, just one sideband takes up less room on our crowded bands than two sidebands and a "carrier".

The Simplifications

I must confess I have simplified the situation a little. In actual practice, the filter in the transmitter is rarely used to get rid of both the "carrier" and the sideband. More commonly, a balanced modulator is used, which mixes the audio signal and the radio signal in such a way that the "carrier" is eliminated. The filter then gets rid of one sideband.

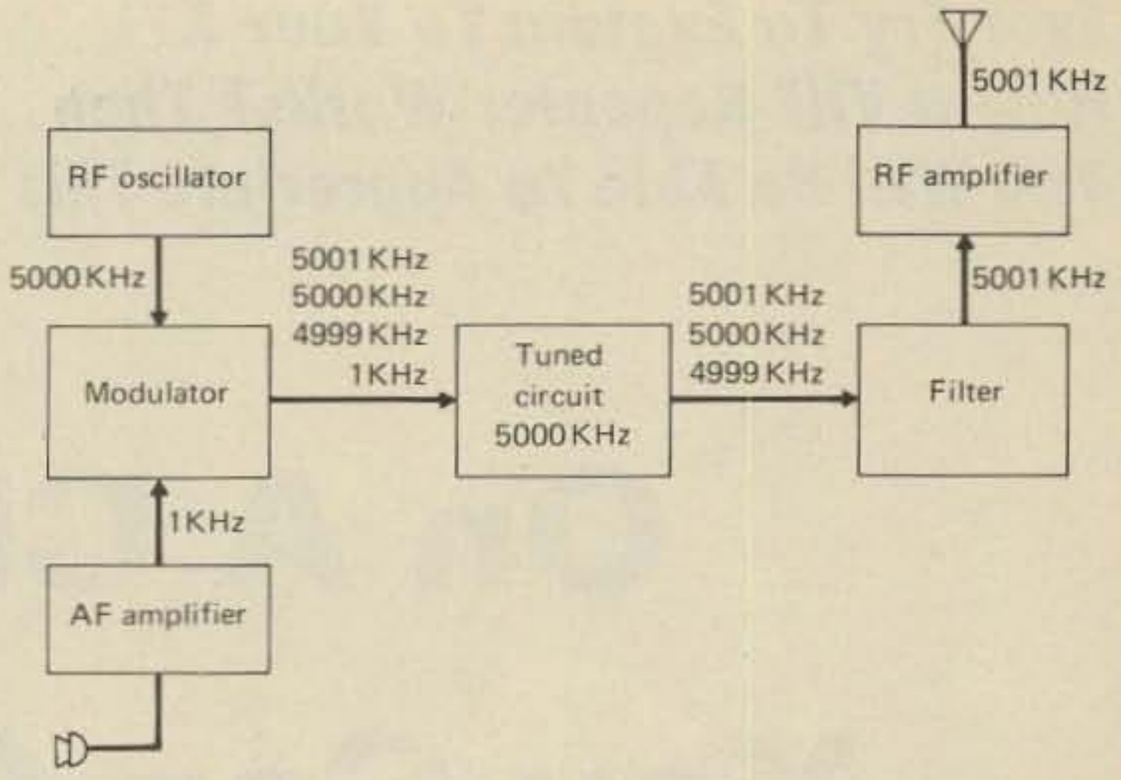

Fig. 4—Block diagram of the basic transmitter revised for s.s.b. operation. As noted in the text, the diagram is an over-simplification.

Another method of developing a s.s.b. signal in common use, employs two modulators and some phasing tricks. The result is, again, no "carrier" and one sideband.

I have, also, simplified the description by just using one tone. The human voice conveys information by many constantly changing tones and amplitudes. Therefore, the sideband signals must also change frequency and amplitude in a like manner.

If a 2 kHz signal were transmitted along with a 1 kHz signal, the two sidebands would not only contain the sum and difference of 1 kHz and the "carrier" frequency, but would also contain the sum and difference of 2 kHz and the "carrier" frequency. In other words, if one transmits two sounds of different tones, each sideband will contain two frequencies.

The filters used are not perfect. "Carriers" and the second sideband are never completely eliminated (at least at our state of the art). The term "carrier and unwanted sideband suppression" refers

(Continued on page 73)

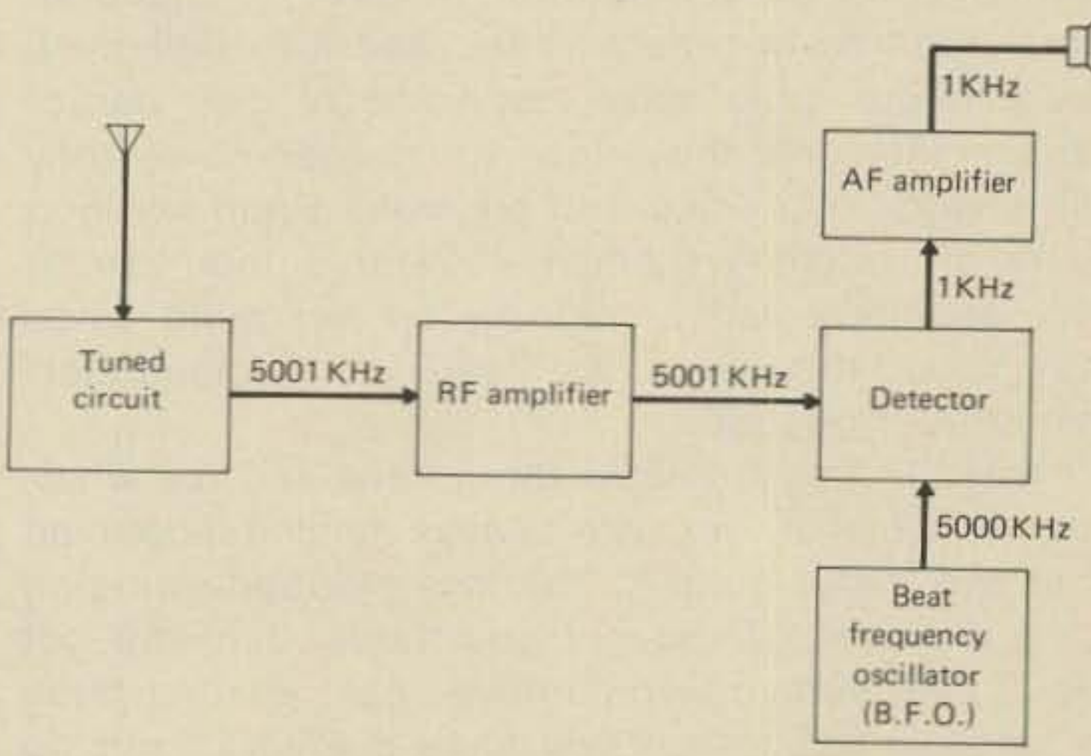

Fig. 5—Block diagram of a basic s.s.b. receiver.

Ever Try To Explain To Your XYL How a VHF Repeater Works? Then You Will Be Able To Appreciate This

On A Clear Day You Can CFAR Ever

BY PAUL C. CRUM*, W9LC

My XYL — who has achieved a certain degree of distinction among our amateur friends for having "helped" me shoot TVI, and for her culinary capabilities — was sitting on the tall bench in front of the electric organ. Although I will readily confess that this has nothing to do with amateur radio, that I can think of, she swung over the edge of the bench a pair of gams that a number of years ago used to cause stirs of excitement in me when I looked at them. They terminated, as those things very comminly do, in feet. Even though there is a callus or two on them now, that won't keep me from remembering them when they—and we—were young, and they were white and slender and when they pounded across the tennis court, returning my serve, or sliced through the water as I chased her across the pool. She swung them pretty much as she used to, although they have changed in minor regards in recent years, and although they, like amateur radio, have lost some of their earlier excitement—and they, too, are larger now—they still provide many hours of pleasure. From my long years of watching them, I knew that their owner very definitely had something on her mind when they moved thus. Probably, I was in for some determined interrogation.

"What is this *repeater* thing, 'see far,' or whatever you call it, you are always talking about on your two meter outfit?" The legs stopped swinging for a moment. "I thought you said when you got that S Line that you would never want another thing in amateur radio. Now you have this v.h.f. stuff up on the shelf above the desk, and keep getting on there and talking on it."

"First, to settle the identity matter, our repeater is known as CFAR—which we call 'see far'—and the letters stand for Chicago F.M. Amateur Radio. The repeater is probably the outstanding development in amateur radio in recent years." I began, thinking a declarative sentence was the best way for me to begin my defense of the challenge. "It has made possible communication over much greater distances than were previously possible. It has greatly extended . . ."

"You call Hammond, Indiana, greater *distance?* You were just bragging that you called CQ on forty and a ZL or something, came back to you. Is Napeville farther than New Zealand?"

"Now that is pretty much in the way you look at it. You see v.h.f. is generally limited in its range. V.h.f. is for *local* contacts. The repeater greatly extends this range."

"From what I've heard of some of the things it has on it, I'd *want* to extend it. Very far. I don't know what you see in this v.h.f., as you call it. When you were on the other outfit, I think you had some interesting contacts. There was this fellow on the ship out in the gulf. Then talking to those fellows in Antartica, and taking messages to their wives. I can think of a lot of them."

"How about that woman preacher in Manuelito, New Mexico? This kid was the only amateur in town, and she was Mayor, too."

"With a population of fifteen, I imagine she was pretty busy. I bet she had a real job at town council

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meetings. Seriously, though . . . if one *can* be serious about such an outfit, how does the 'repeater' work that is different from just talking to them the other way?"

"V.h.f. isn't like the low frequencies." I began, "It isn't so much the power one uses, it's the height. The receiver and transmitter are located on some high spot — our CFAR transmitter is on top of the Civic Center. Since the coverage is substantially line-of-sight, and you can see farther up there, the range is much greater through the repeater. The repeater is a sort of *relay* station to send my message to some one too far away to hear me direct. You see I transmit on one frequency; the receiver picks this up and sends it out on another frequency."

"Why don't they use the *same* frequency? Wouldn't it be a lot simpler, and doesn't it take up a lot more room in the bands they could use for something important like Citizen's Band, or something?"

"They can't do that. It won't work."

"Why don't they *make* it work? If this fat guy, Gil, who you said was the brains — if you will excuse the expression — of the outfit, if he's so smart, why doesn't he make it work?"

"There are things that take even great minds time to work out. Even Edison didn't get everything just like he wanted it the first time."

"Did Gil try it the way Edison did?"

"Well yes, he did. But he said he couldn't figure out how Thomas Alva did it. He said he tried that getting just four hours sleep a night routine, and said they had to wake him up every afternoon at work, so he could go home when it was time to quit."

"Oh well, let it go. I can see I won't get any place trying to get an intelligent answer out of you. Now regardless of what frequency they use, how is it again, this repeater works?"

"Well you see I put my signal into this repeater, then it passes through it, and on out to the other station."

"Oh. It's kind of like a recorder then . . . you play yours into it, and it plays it back?"

"That's not it at all! I don't play anything into it. It is *not* a recorder."

"Well it certainly *sounds* like one. You say 'this is W9LC calling WA9WUT;" then he comes back and says the same thing, practically. He says 'this is WA9WUT,' or whatever his call is, 'calling W9LC.' Then another thing that has to be the silliest thing anyone ever heard on amateur radio . . . some girl comes on there and sounds like she's trying to be the most seductive-sounding thing on the air, and says, 'This is CFAR, WR9ABZ, Chicago,' and then 'the time is one ten p.m.,' or whatever it happens to be. I don't know why they want her to give the time every ten minutes. You have the clock right at the left of your desk." Then reflectively, "We have two in our big bedroom right next door. I think women sound silly on ham radio things."

"I don't know why you complain about *her*. You listen to that soprano 'co-anchorwoman,' or whatever they call her, on the ten o'clock news. Our girl sounds better than she does."

"Who pays to keep up this outfit? It must cost a lot of money to keep it going. The things on top of the Center, and all."

"The Club runs it. But it doesn't actually pay for all of it. A lot of guys subscribe and they put all the money together and come up with enough. All the labor is donated, of course."

"I can understand that. From the 'labor' I've seen, I don't know why anyone would pay for it."

There was a brief pause in the interrogation as my prosecuting attorney slid down off the bench and into her favorite easy chair. More at ease, she was ready to continue.

"What about that silly club? They have these Fox Hunts, or whatever they call them. They must be stupid. All of the fox hunts I've ever heard of, have dogs. They 'run to the hounds,' as they say. You took our *cat* to that one a few weeks ago."

"Now you know I didn't have our cat chasing the fox. I had been telling Tom, 'A9CIO, and Mit, about her being different, and having five toes on each front foot, instead of four like other cats. I explained that these looked like thumbs on people's hands, and that we called her Thumbs because of that. They said they'd like to see her, so I took her over and left her with Tom's cat, while we were on the fox hunt. W9AVP brought his over, too. He has a Persian. Big fellow. Fuzzy all over. The cats got along fine!"

I guess they had plenty of time to get acquainted. It took you 'til one o'clock to find the fox."

"Now it didn't really take us that long to find the fox. I'll come right out and tell you. One of the fellows in the Club is a, well *publican,* and although of course, I didn't want anything myself, two of the men in our group wanted to stop at his place for a while, when we got through.

"Did you use that silly 'ten code' or whatever you call it, where you say 'ten four,' then the next one comes on right away and says 'ten eight,' then someone after that will say 'ten twenty,' or something?"

"Although we didn't use it in the fox hunt, this code is very useful. Instead of coming on the air and saying a lot of words to tell someone one operator wants to talk to another, a fellow just comes on and says 'ten eight.' It is more convenient and saves a lot of time."

"I suppose it's like a lot of other abbreviations you use, then. Some of them aren't too bad, but when you get on the radio and start talking about me and calling me your *'hexed* YL,' or whatever it

is, I don't like that."

"It's not *hexed* YL. It's *X* YL. That means that where once you were a YL (young lady) you have since stumbled or been dragged through the gates of solemn matrimony, so you are now an *X* YL."

"I still don't like it, but I guess if you want to talk on that repeater, it's all right. But the fellows in that club . . . I don't know."

"It's a sort of *diverse* group, I guess. With very limited verbal capabilities, I should of course, have trouble describing them. Basically, I'm prejudiced in their favor. Except for two that I can't stand, I find them friendly, congenial, accomplished, and witty. Unfortunately, I am not prepared to explore the demography of the group, and since by nature I am an egalitarian, I wish that I had words to describe fairly each and every one of my brethern."

"From the bunch I've seen, I don't think that group needs fairness as much as a distinct leaning toward mercy."

"I'm sorry that I can't defend these fine gentlemen better than I can, but my knowledge of the English language, and my vocabulary are so limited, that I cannot do them justice. As you so often remind me, I'm probably the only one in the Club who was so stinking in grammar that I had to take 'dumb bell English' in college. Because of this, I must muddle along with monosylabic simplicity in my attempts. Not inclined to paucity, I may take rather longer than others might, to defend my friends. Also, I am admittedly quite intransigent in my appraisals of them."

"What do these kooks do? That is, how do they earn a living?"

"Now, as in other regards, their occupations vary. Some are engineers."

"Like you? Do any of them earn an honest living?"

"One member of the club is in the legal profession."

"Then you have your share of crooks in the club, too? Well, the way you grown men carry on on that radio is disgraceful. When that girl you all talk to so much, comes on . . . she gives just one call and you'd think the first one to answer her would get a big prize, or something. And you call her 'America's cutest operator.' I bet she's, she's . . . just . . . oh let it go!"

"Ellen is a very fine girl. She is educated, sensitive and a credit to amateur radio.".

"Speaking of being sensitive, this guy Art you had over here, I'd think he'd be a bit sensitive about some of the blubber he's carrying around."

"Now Art is just plump. You know that. It's men like Art who make things move at meetings. He's jolly, and . . . well, he's *jolly!*"

"Then this W9RKU, or something. When you and he get on the radio, you'd think you two invented the airplane. Because at one time you could get a contraption with a tail skid on it, out of a cow pasture, and he's doing something for some airplane at O'Hare, you think you are the Wright Brothers."

"Pat is very competent in avionics."

"Well he may be, but if he fixed the 'avionics' on that airplane we came back from Miami on last fall, he'd better work on trucks. When I saw us circling that truck load of pigs outside of Nashville, and heard the Flight Engineer talking to the driver on channel nineteen and asking him the way to Chicago, I knew that had to be Pat's airplane."

"Would there be any *constructive* comments about any of our group?"

"We saw one pretty normal-looking fellow at the hamfest at Princeton, that you talk to sometimes . . . Phil something or other. What is he doing in a bunch like that?"

"Frankly, I think he's often wondered that himself. But it it *his* job. He represents the League here."

"Kind of like you having to listen to that Rock and Roll down at the station, is it?"

The XYL has a finely-honed awareness of when our associations have reached the point where they should leave the verbal, and become gastronomic. She had just gotten one of her peach pies out of the oven, and was letting a piece of it begin to soothe my somewhat abraided nerves. Feeling that one more positive statement should be made about our members before we closed the discussion, I washed down the last piece of my pie and stated, "you can say what you want to about the fellows, but they are a great bunch of guys. For one thing, I feel right at home with them."

"You should. From what I've seen of them, they don't have any more hair than you do. Are there any *young* men in the club, or are they all like you . . . a sort of 'other side of the mountain' type?"

"We have a *lot* of young men. They're all great material, too. Someday, they will take over and the club will be theirs."

"It must be awfully depressing for them to look at you old guys and think someday they'll be like you."

She got up and took the pie plates to the kitchen. I went up to the den and got on the repeater with W9RW and W9APH. She was in the basement for quite a while, then when I finished giving a new station the dope on CFAR's receiver and transmitter sites, she came upstairs. From the years of common occupancy of our marital state, I knew by her air that she was the bearer of news of great importance. I also knew that she would not give up this news easily. She would dangle it, tantalizing me, hopeful that I would ask her for it. I obliged. "From our years of close association," I began, "and knowing you to be a bit surreptitious — make

(Continued on page 73)

This simple device will monitor your power line and give immediate audible warning of a power failure.

THE POWERLARM

BY CALVIN R. GRAF*, W5LFM

The Powerlarm is an a.c. line voltage monitor and will indicate the status of the power line coming into your home or apartment. In the event there is a power interruption, a buzzer will sound to alert you to that fact.

With the impending power shortage in the country, brown outs and power interruptions will become more frequent and commonplace. The power interruptions may be intentional on the part of the power company (conservation, equipment repair, etc.) or they may be unintentional (storms, severe weather, lightning strikes, etc.).

How a power failure affects you depends a lot on what time it is and what you are doing at the time. If you use an electric alarm clock to awaken you in the morning, a 5 or 10 minute power failure may not affect you much as you will be only 5 to 10 minutes behind your regular schedule. However, if the power failure lasts 1 to 2 hours, you are definitely behind in your start on the day.

The Powerlarm operates in the following manner. When the unit is plugged into a 115 volt a.c. power outlet, the 115 v.a.c. relay is held closed. The green light emitting diode (LED) remains lighted due to the current drawn by the relay coil and lets you know the Powerlarm is plugged in. The relay coil acts as a current limiter for the green LED and the current should not exceed 20 mA. A diode is connected in reverse polarity parallel with the LED in order to protect the LED when the line voltage reverses polarity. During a power interruption or failure lasting longer than about 0.2 seconds, the relay will de-energize. The buzzer will be switched on, energized by the two size AA cells, which are capable of supplying power to the buzzer for a number of hours.

Powerlarm Applications

The Powerlarm finds its greatest potential at night time as its buzzer will awaken a sleeper. The red LED will glow so that the Powerlarm can be located in the dark next to the night stand or on a nearby shelf. The buzzer can then be switched off and the red LED will continue to glow. Once awake, you may decide to set a manual alarm clock and go back to sleep or you may call a friend by phone who belongs to your car pool so that he may also take action. If you are catching an early airplane flight, you certainly don't want to miss it due to a power failure.

There are several other areas where the Power-

(continued on page 73)

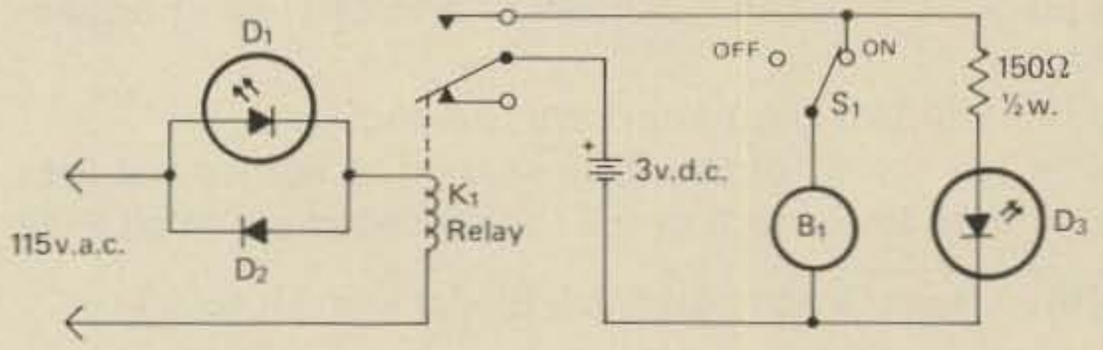


Fig. 1—Circuit diagram for the Powerlarm which will sound a buzzer when there is a power failure.

B1—Buzzer, 1.5 6 v.d.c. Radio Shack # 273-004 or equiv.
D1—Green LED, Radio Shack # 276-043 or equiv.
D2—Silicon Diode, Radio Shack # 276-1103 or equiv.
D3—Red LED, Radio Shack # 276-041 or equiv.
K1—S.P.D.T. 117 v.a.c. Relay, Radio Shack # 275-211 or equiv.
R1—150 ohm ½ watt resistor.
S1—S.P.D.T. slide switch, Radio Shack # 275-407 or equiv.
Utility Case, 4" × 2¼ × 2¼, Radio Shack # 270-231 or equiv.
Battery Holder, for 2 AA cells, Radio Shack # 270-382 or equiv.
AC line cord and plug.
Grommet for line cord.

*207 Zorina, San Antonio, TX 78213

Here's an interesting project that will add hours of fun to your operating time.

A Log-Periodic Quad Array

BY JAMES W. FISHER*, W8KJN

While I was designing a fixed-direction log-periodic array for receiving Arabic-language broadcasts from the Middle East, it occurred to me that a quad configuration might be substituted for the opposed bays of a conventional log-periodic. Gain should be greater than that of a log-periodic dipole array (LPDA) of the same boom length, and only slightly less than that of a two-bay conventional log-periodic of the same boom length. The idea appeared to offer mechanical and operating advantages.

- Only two high supports are required
- The width of the largest loop is somewhat less than the length of the longest element in a LPDA
- The quad is widely regarded as a good performer under marginal band conditions

While I have seen two-element quad arrays with both elements driven, I have not found any literature describing multi-element driven quad arrays in a log-periodic configuration. After doing some thinking about the position of the current loops on the elements fore and aft of the phase center, and the effect on current distribution of the lower Q of the loop, I decided that such an array was worth a try.

Initially, I constructed a four-element array with a frequency coverage of approximately 6-10 MHz. The primary objectives were to provide an antenna for regular listening to and recording of Middle Eastern broadcasts and to provide for on-the-air trials of the antenna in the 4-meter amateur band. The initial number of elements was kept to four

*6100 Upper Straits Blvd., W. Bloomfield, MI 48033

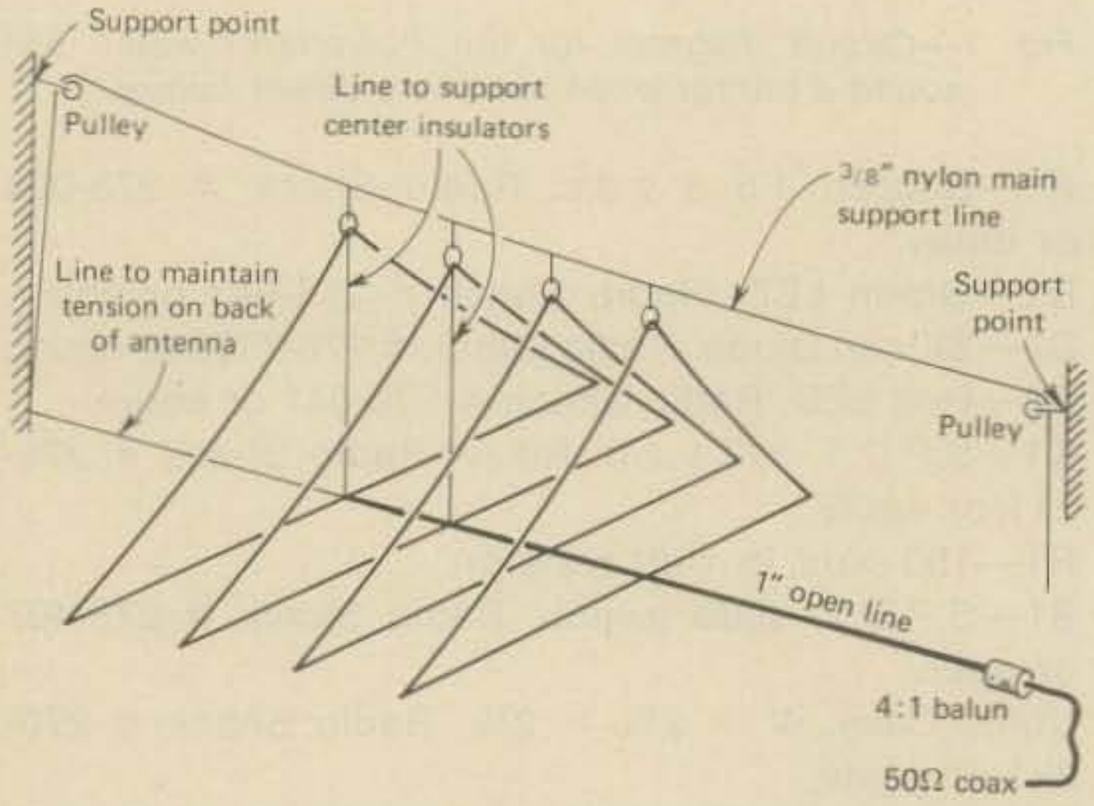
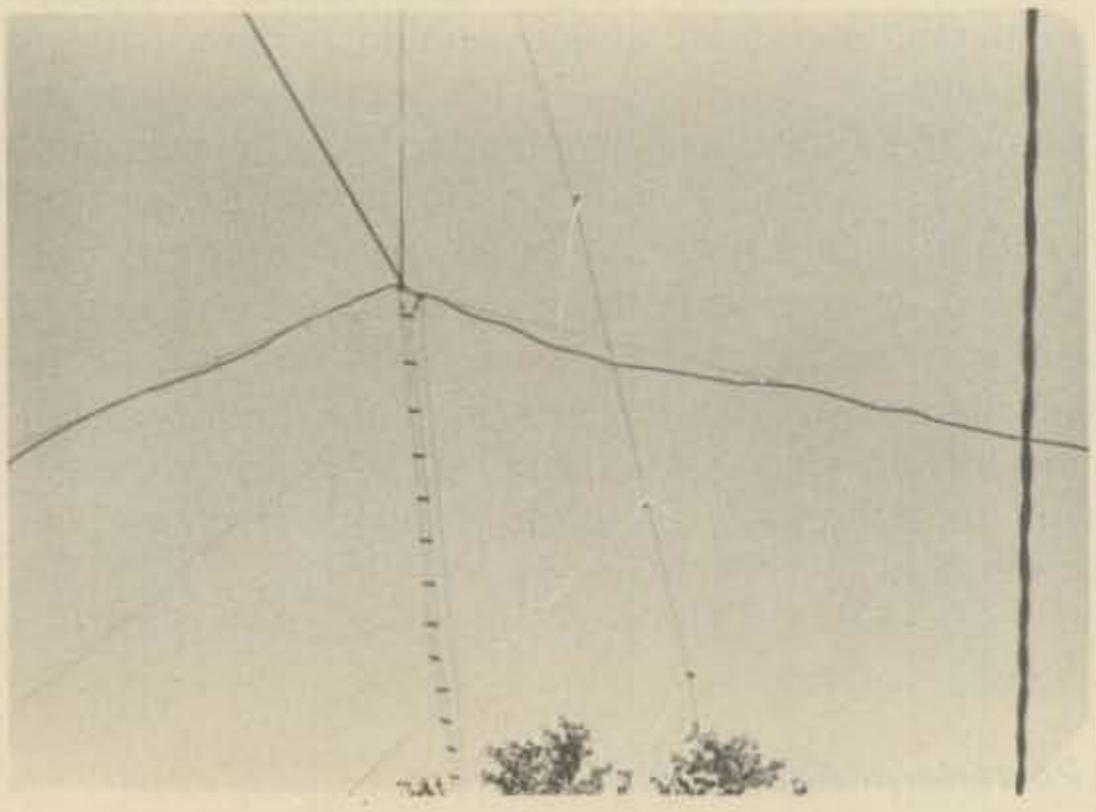


Fig. 1—General layout of the author's log-periodic dipole array. A pulley system is used to permit easy raising and lowering. Although the array was designed for only 6-10 MHz, construction parameters are provided for 2-32 MHz.

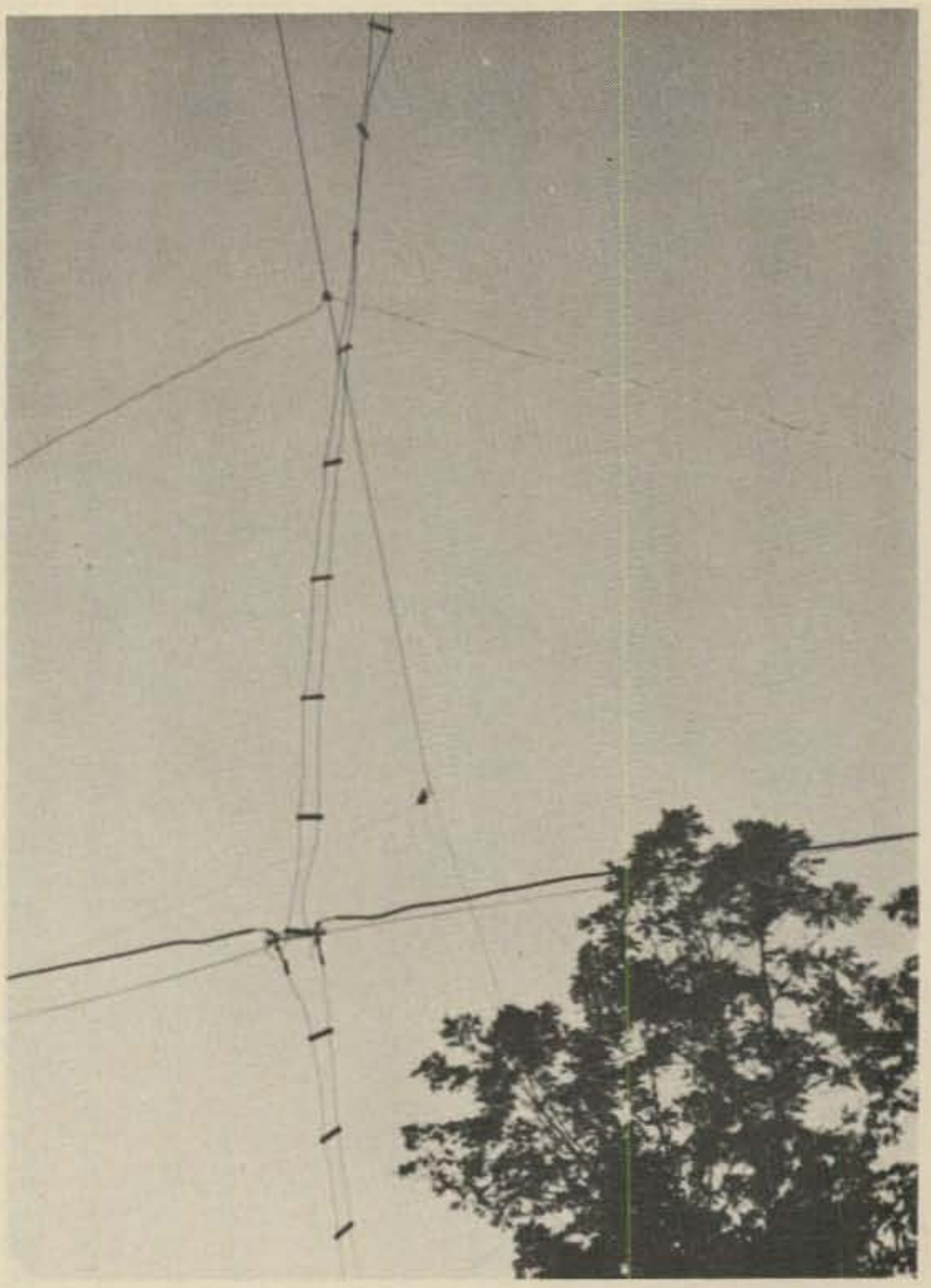


Looking Northeast. The feedpoint of L1, the support and back tension lines of L1 are in the foreground.

TABLE I. Array Dimensions

Element	Length	Length/2	Length/6	Spacing
1	167'6"	83'9"	27'11"	
1-2				10'0"
2	142'6"	71'3"	23'9"	
2-3				8'6"
3	121'0"	60'6"	20'2"	
3-4				7'3"
4	103'0"	51'6"	17'2"	
4-5				6'2"
5	87'6"	43'9"	14'7"	
5-6				5'3"
6	74'6"	37'3"	12'5"	
6-7				4'5"
7	63'6"	31'9"	10'7"	
7-8				3'9"
8	54'0"	27'0"	9'0"	
8-9				3'2"
9	46'0"	23'0"	7'8"	
9-10				2'9"
10	39'0"	19'6"	6'6"	
10-11				2'4"
11	33'0"	16'6"	5'5"	

To date, only elements 1 through 4 have been constructed and tested. Dimensions *length/2* and *length/6* are for constructing a LPDL. *Length/2* gives the length from the feedline to the low insulators.



Looking southwest. The feedpoint for L3 is in the foreground.

partly to facilitate measurement of resistance and reactance at the fundamental, and harmonic and subharmonic frequencies, and partly because the four-element array has performed so well that I haven't had much incentive to expand it.

Design Considerations

For the experimental antenna, the following parameters were chosen:[1]

f_1 (lowest frequency): 6MHz

Circumference of largest elements: 1005'/6=167.5' (quad driven-element formula)

Spacing of two largest elements: 10 feet (chosen to keep array length reasonable)

(Ratio of spacing and element size): .85

Boom length to theoretical apex: approximately 64'

Table I shows the calculated dimensions for eleven elements, corresponding approximately to 6-30 MHz; however, only the four largest elements have been constructed to date.

Construction of the four largest elements of this array results in a boom length of 25'9". Open-wire feed with 1" spacing is used for the feedline, and is cut to the full theoretical length of the array, from the longest element through the apex, to maintain the periodicity of antenna impedance throughout the full operating range of the antenna. Additional elements could be added with little difficulty. The open feedline is terminated at the array apex with a 4:1 balun, and a 5-ohm coax is used from there to the operating position.

As quad performance is very similar whether the loop is square or triangular, the triangular shape was chosen for mechanical convenience. An appropriate generic name for the antenna is log-periodic quad array (LPQA); since the antenna as I have constructed features triangular elements suspended from the element apex, it can be described as a log-periodic delta loop (LPDL); with the horizontal run at the top, it could be called a periodic delta quad (PDQ).

The polarization of the array is determined by the feed point. I feed it at the bottom; fed there or at the top, it is horizontally polarized. Fed from the side, it would be vertically polarized. Also, if the elements are fed at corners, one insulator per element could be spared; this could be done with an LPDL by feeding it at the top of each element.

If the array is designed for as much as a 2:1 frequency range, individual elements will show multiple resonances within the operating frequency

[1]see Rhodes, "The Log-Periodic Dipole Array," *QST*, November 1973, for terminology and formulas for standard LPDA's.

TABLE II. RESISTANCE AND REACTANCE OF ARRAY, 2-32 MHz

MHz	R	Xc	X_L	MHz	R	Xc	X_L	MHz	R	Xc	X_L	MHz	R	Xc	X_L	MHz	R	Xc	X_L
2.0	low	—	10	8.0	70	—	—	14.0	20	15	—	20.0	30	—	—	26.0	30	—	—
2.1	low	—	5	8.1	75	—	—	14.1	20	10	—	20.1	40	—	—	26.1	35	—	—
2.2	low	—	10	8.2	100	—	—	14.2	20	10	—	20.2	45	—	—	26.2	35	—	—
2.3	low	—	10	8.3	100	10	—	14.3	25	5	—	20.3	55	10	—	26.3	35	—	—
2.4	5	—	10	8.4	90	15	—	14.4	30	5	—	20.4	50	15	—	26.4	35	—	—
2.5	5	—	15	8.5	75	15	—	14.5	30	—	—	20.5	40	20	—	26.5	35	—	—
2.6	15	—	20	8.6	45	15	—	14.6	50	—	—	20.6	35	20	—	26.6	40	—	—
2.7	25	—	25	8.7	40	15	—	14.7	95	5	—	20.7	25	20	—	26.7	40	—	—
2.8	40	—	45	8.8	35	15	—	14.8	70	20	—	20.8	15	20	—	26.8	45	—	—
2.9	250	—	70+	8.9	30	15	—	14.9	30	20	—	20.9	15	10	—	26.9	45	5	—
3.0	250	30	—	9.0	30	10	—	15.0	30	20	—	21.0	20	10	—	27.0	40	10	—
3.1	40	15	—	9.1	25	10	—	15.1	35	10	—	21.1	15	10	—	27.1	40	15	—
3.2	20	10	—	9.2	20	10	—	15.2	40	10	—	21.2	15	10	—	27.2	40	15	—
3.3	15	5	—	9.3	20	10	—	15.3	50	15	—	21.3	20	10	—	27.3	40	15	—
3.4	5	—	—	9.4	20	10	—	15.4	55	15	—	21.4	20	10	—	27.4	30	15	—
3.5	5	—	—	9.5	15	5	—	15.5	45	20	—	21.5	20	5	—	27.5	30	15	—
3.6	low	—	—	9.6	15	10	—	15.6	40	20	—	21.6	25	5	—	27.6	25	20	—
3.7	low	—	5	9.7	10	10	—	15.7	30	20	—	21.7	25	5	—	27.7	25	20	—
3.8	low	—	5	9.8	10	5	—	15.8	20	20	—	21.8	25	5	—	27.8	25	10	—
3.9	low	—	10	9.9	low	5	—	15.9	25	20	—	21.9	30	—	—	27.9	20	15	—
4.0	10	—	10	10.0	10	—	—	16.0	20	15	—	22.0	25	—	—	28.0	20	10	—
4.1	15	—	10	10.1	15	—	—	16.1	20	10	—	22.1	30	5	—	28.1	25	15	—
4.2	low	—	15	10.2	10	—	—	16.2	20	10	—	22.2	30	5	—	28.2	20	15	—
4.3	15	—	15	10.3	15	—	—	16.3	20	10	—	22.3	30	5	—	28.3	20	10	—
4.4	25	—	20	10.4	20	—	—	16.4	20	10	—	22.4	30	5	—	28.4	20	10	—
4.5	25	—	30	10.5	20	—	5	16.5	25	5	—	22.5	30	5	—	28.5	15	10	—
4.6	35	—	40	10.6	20	—	5	16.6	25	5	—	22.6	35	5	—	28.6	15	10	—
4.7	50	—	55	10.7	20	—	10	16.7	30	—	—	22.7	35	10	—	28.7	15	10	—
4.8	90	—	70+	10.8	20	—	15	16.8	30	—	—	22.8	35	10	—	28.8	10	10	—
4.9	250+	—	70+	10.9	35	—	10	16.9	40	—	—	22.9	35	10	—	28.9	10	5	—
5.0	250+	—	70+	11.0	40	—	30	17.0	50	—	—	23.0	30	10	—	29.0	15	10	—
5.1	250+	20	—	11.1	40	—	45	17.1	70	5	—	23.1	35	10	—	29.1	10	5	—
5.2	250+	20	—	11.2	80	—	70+	17.2	65	10	—	23.2	30	10	—	29.2	10	5	—
5.3	190	15	—	11.3	135	—	70+	17.3	50	15	—	23.3	30	10	—	29.3	10	5	—
5.4	140	10	—	11.4	250+	—	50	17.4	40	15	—	23.4	30	10	—	29.4	10	5	—
5.5	110	5	—	11.5	250+	—	25	17.5	40	15	—	23.5	25	10	—	29.5	10	5	—
5.6	120	—	—	11.6	100	30	—	17.6	40	15	—	23.6	25	10	—	29.6	10	5	—
5.7	130	—	—	11.7	50	25	—	17.7	40	15	—	23.7	25	10	—	29.7	10	5	—
5.8	150	—	5	11.8	35	15	—	17.8	40	15	—	23.8	20	10	—	29.8	5	5	—
5.9	250+	—	5	11.9	25	10	—	17.9	35	15	—	23.9	20	5	—	29.9	5	—	—
6.0	250+	—	—	12.0	30	10	—	18.0	40	20	—	24.0	25	10	—	30.0	5	—	—
6.1	250+	15	—	12.1	30	5	—	18.1	35	15	—	24.1	25	10	—	30.1	10	—	—
6.2	250+	20	—	12.2	30	—	—	18.2	35	20	—	24.2	25	10	—	30.2	10	—	—
6.3	145	20	—	12.3	35	—	5	18.3	30	15	—	24.3	25	10	—	30.3	10	—	—
6.4	90	20	—	12.4	45	—	15	18.4	25	15	—	24.4	25	5	—	30.4	10	—	—
6.5	75	20	—	12.5	60	—	30	18.5	25	15	—	24.5	20	5	—	30.5	10	—	—
6.6	60	15	—	12.6	95	—	50	18.6	25	15	—	24.6	20	5	—	30.6	10	—	—
6.7	50	15	—	12.7	170	—	55	18.7	20	15	—	24.7	20	5	—	30.7	10	—	—
6.8	50	10	—	12.8	250+	—	—	18.8	20	15	—	24.8	20	—	—	30.8	10	—	10
6.9	50	5	—	12.9	250+	25	—	18.9	15	10	—	24.9	20	—	—	30.9	15	—	10
7.0	70	10	—	13.0	140	30	—	19.0	15	10	—	25.0	20	—	—	31.0	15	—	5
7.1	80	10	—	13.1	90	30	—	19.1	20	10	—	25.1	25	—	—	31.1	20	—	10
7.2	75	10	—	13.2	50	30	—	19.2	15	10	—	25.2	25	—	—	31.2	20	—	10
7.3	70	15	—	13.3	40	25	—	19.3	20	10	—	25.3	25	—	—	31.3	20	—	10
7.4	50	15	—	13.4	30	25	—	19.4	20	10	—	25.4	25	—	—	31.4	20	—	10
7.5	45	10	—	13.5	25	20	—	19.5	20	10	—	25.5	25	—	—	31.5	25	—	10
7.6	40	10	—	13.6	25	20	—	19.6	20	5	—	25.6	25	—	—	31.6	25	—	10
7.7	40	10	—	13.7	25	20	—	19.7	20	5	—	25.7	30	—	—	31.7	25	—	10
7.8	40	5	—	13.8	15	15	—	19.8	25	—	—	25.8	30	—	—	31.8	30	—	10
7.9	40	—	—	13.9	20	15	—	19.9	30	—	—	25.9	35	—	—	31.9	25	—	10
																32.0	30	—	10

NOTE: R indicates measured resistance in ohms. *Xc* indicates measured capacitive reactance in pF. X_L readings indicate that the array displays inductive reactance; the X_L shown is the approximate pf by which the cariable capacitor in the bridge is less than the fixed capacitor. The readings should not be considered exact, but do provide useful general indications. Some of the measured reactance may be due to the few inches of coax used to connect the balun to the bridge.

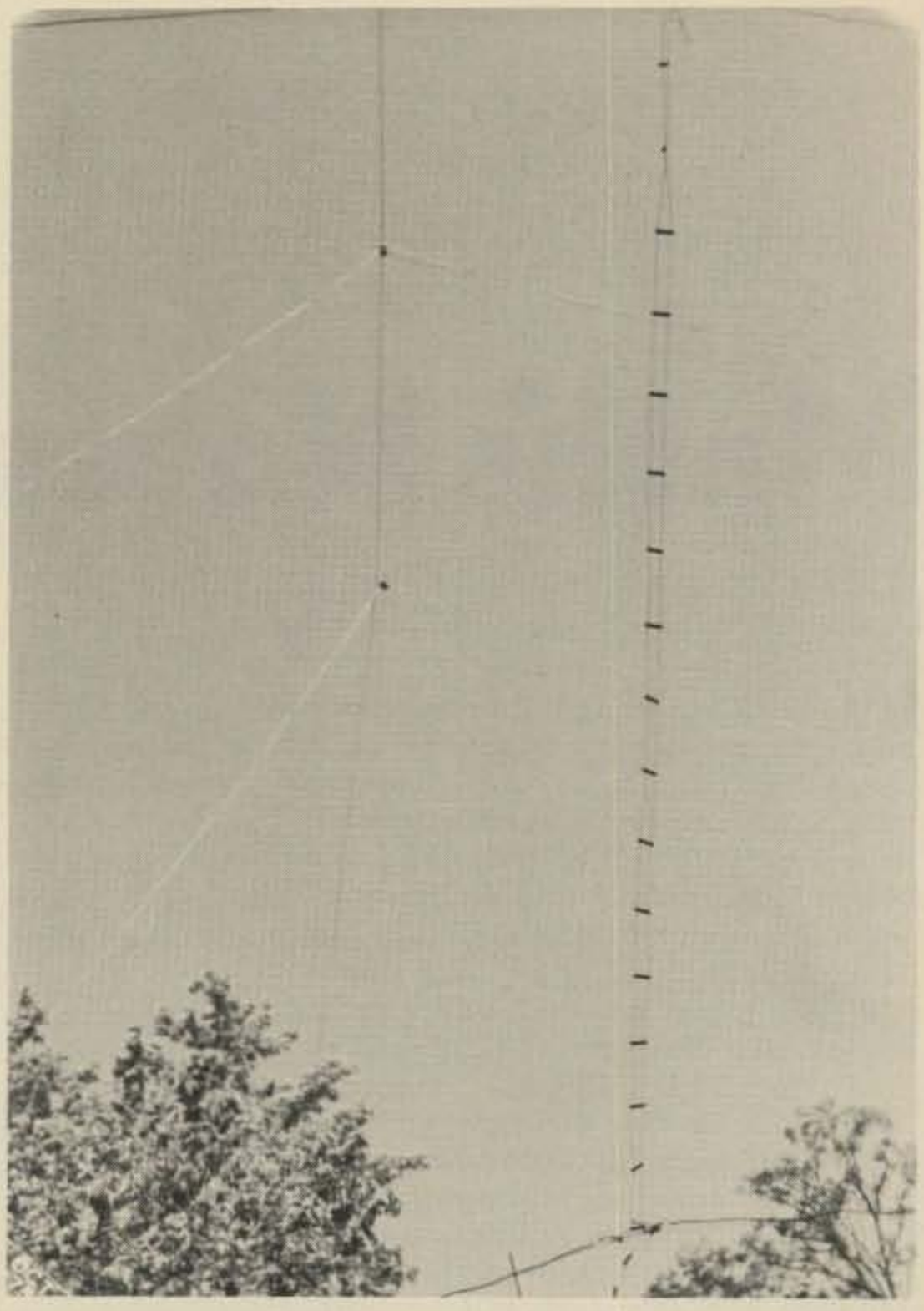
range. This is an important consideration, as the figures for resistance and reactance for 2-32 MHz show definite resonances at half the fundamental frequency and at harmonics. Several approaches could be taken:

- High-pass or low-pass filters could be used in the transmission line or elements;
- The transmission line and element impedance could be chosen to minimize power transfer at undesired resonant areas;
- The relative spacing constant and could be chosen so that radiation from the various parts of the array would combine to reinforce desired patterns;
- The frequency range of individual arrays could be kept under 2:1, and separately-fed higher-frequency arrays could be interlaced within lower-frequency arrays, just as 10- and 15-meter quad arrays are interlaced with 20-meter arrays. As an alternative to separate feeding, the interlaced elements could be brought to a common feedline;
- The frequency range of individual arrays could be kept under 2:1, and each "element" could be composed of open-wire twinlead with one loop complete and the other broken directly opposite the feedpoint, essentially combining two arrays on the same feedline.

Mechanical Considerations

Fishing lines were lofted over the two trees by a friend using a bow and a flu-flu arrow (the flu-flu has a high-drag "feather" area and provides adequate initial speed and distance without traveling long distances on the other side). The fishing lines were used to pull up the ⅜" nylon lines which support the array. As shown in fig. 1, a pulley system is used to permit easy raising and lowering of the array without scraping the end ropes back and forth over the support-point tree. The pulley system has been a success, but for maximum height, the pulley must be near the point where the line passes over the tree, or the pulley and the whole array can end up considerably lower than the highest point in the line passing over the tree.

In general, it will be necessary to suspend the top insulators from the nylon rope by varying lengths of light line, in order to keep the array shape linear. While designing the antenna, I calculated the lengths of line necessary to connect the corners of adjacent elements together, in order to simplify the job of keeping the whole array in shape. However, with only four elements, it has been just as easy to attach individual lines from the ends of the elements to the house, trees, etc. Also, array elevation problems have prevented me from using equilateral triangles for the elements, so the calculations would have been inaccurate.



The feedline is in the foreground. The apexes of L3 and L4 are above, looking up.

Having had some earlier problems with aluminum-wire connections in various other arrays, I decided to use copper-clad wire throughout the elements and feedline, and to solder all connections using a propane torch. The commercial open-wire twinlead used has a spacing of 1" and is relatively light, but the middle of the base of each element tends to sag unless considerable tension was placed on the corner insulators, putting the whole array under considerable strain. Therefore, a line was run from the top insulator down to the feedpoint insulator of the longer elements. Doing this alleviated the problem. The line currently used on the largest element is unnecessarily short and probably plays a large role in the high resistance noted at the array apex around 6MHz.

Resistance and Reactance of Experimental Four-Element Array

Table II shows the resistance and reactance of the array from 2 through 32 MHz, as measured just after the 4:1 balun with a Palomar RX Noise Bridge. The reactance is predominantly capacitive from 5

(continued on page 72)

a monthly feature by

IRWIN MATH, WA2NDM

Math's Notes

A look at the technical side of things

With more and more repeaters going on the air or changing their operating frequencies, the 2 meter band is getting harder and harder to keep up with. The only solution seems to be the use of a synthesizer. Unfortunately up to now such devices have usually been complex, tricky and hard to get going. A new circuit by Dale Heatherington WA4DSY, 3126 Flamingo Drive, Decatur, Georgia 30033, may change this however and this is the topic for December.

Dale has come up with a simplified synthesizer originally intended for Motorola HT-220's that covers 146 to 148 MHz in 5 kHz steps with full provision for simplex operation and ± 600 kHz offset operation within this entire range.

The unit is quite small, the P/C board being only 2½" × 4½" overall and it will mount inside an HT-220. The circuit uses only 3 RCA CMOS integrated circuits and conventional components. Although originally intended for use with a 16.8 MHz i.f. (that of the HT-220) changing one crystal will allow 10.7 MHz i.f. equipment to be used if so desired. Before proceeding further there are several important points you should be aware of:

1. On "transmit" the unit *will* produce two major spurious outputs that are only — 45 db down from the desired carrier. These frequencies can be calculated and when used with a transmitter of 1-2 watts output like the HT-220 will not cause any problems. If you run higher power however be very careful. At 10 watts output your "spurs" will be at a level of ½ milliwatt and at 100 watts, 5 milliwatts. These levels could key repeaters without your knowledge.

2. The output of the synthesizer is 16.222 MHz to 16.444 MHz for transmit (× 9 to get to the 2 meter band) and 14.3555 to 14.5777 MHz for 16.38 MHz, i.f.'s, or when modified 15.0333 to 15.2555 MHz for 10.7 MHz i.f.'s during receiving (also × 9 to get the proper local oscillator injection). If your equipments multiplier chain cannot accommodate these frequencies you may have some major work.

3. A frequency counter *is* necessary for alignment and anyone attempting to use this unit for other than HT-220 operation should be experienced in building, testing and troubleshooting synthesizing equipment.

Now that the bad news is over, let me relate a bit of the good. Power drain is only 30 milliamperes from 12 volts making it a light load in battery operated equipment. Dale will supply detailed assembly and alignment instructions (with waveshapes) and a very well made, high quality G-10, double-sided P/C board for only $15.00. Considering the work that went into the design and P/C artwork this is certainly an excellent value. Another $20-50, depending on your junk box, will put you in business. Alternately, this unit is the perfect building block for a synthesizer for just about any 2 meter gear.

Fig. 2 is a schematic diagram of the entire synthesizer and fig. 1 is a block diagram of the synthesizing scheme used. A 16 MHz VCO Q8 is mixed with one of 4 individual crystal generated offset frequencies depending on the mode of operation desired. This signal is then divided by an RCA CD 4059, CMOS programmable di-

*5 Melville Lane, Great Neck, NY 11020.

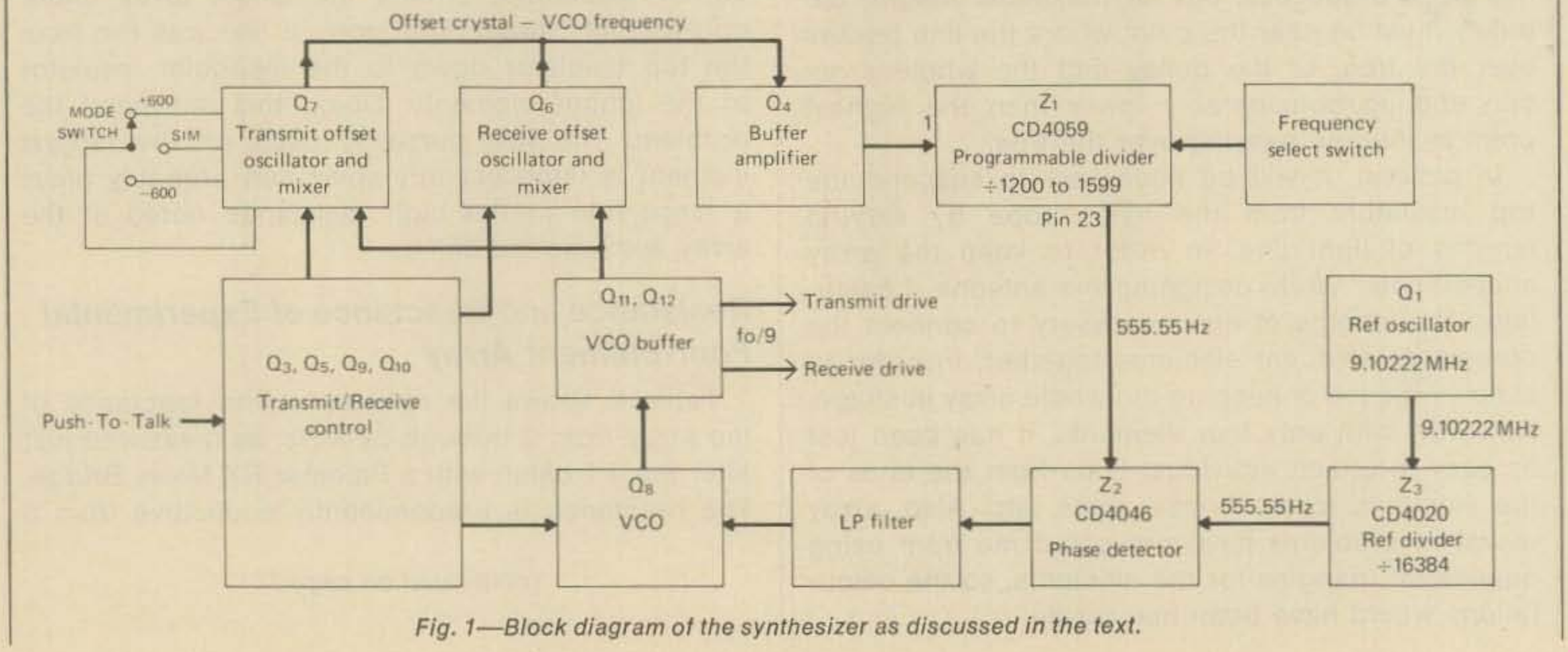


Fig. 1—Block diagram of the synthesizer as discussed in the text.

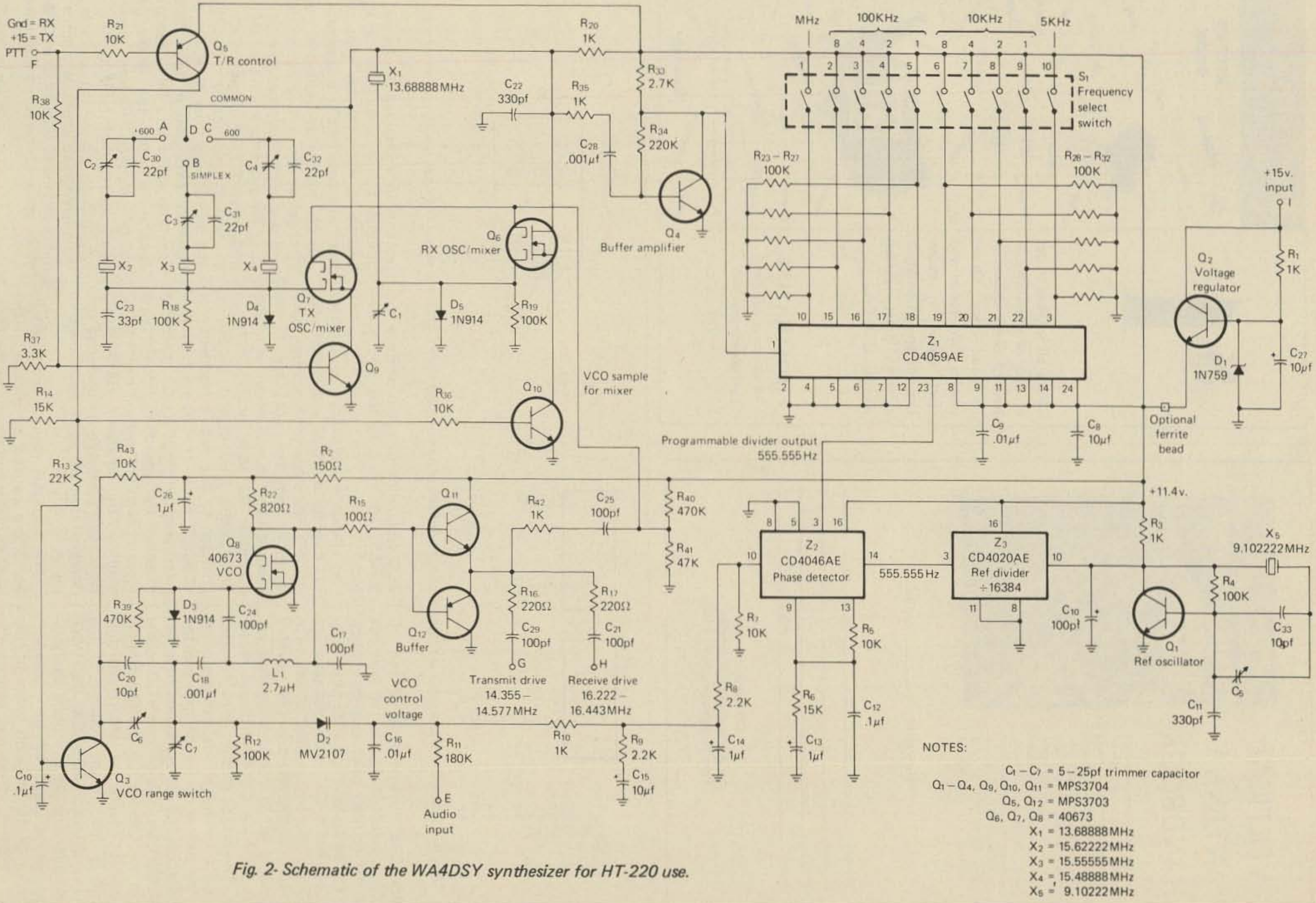


Fig. 2- Schematic of the WA4DSY synthesizer for HT-220 use.

NOTES:

$C_1 - C_7$ = 5–25pf trimmer capacitor
$Q_1 - Q_4$, Q_9, Q_{10}, Q_{11} = MPS3704
Q_5, Q_{12} = MPS3703
Q_6, Q_7, Q_8 = 40673
X_1 = 13.68888MHz
X_2 = 15.62222MHz
X_3 = 15.55555MHz
X_4 = 15.48888MHz
X_5 = 9.10222MHz

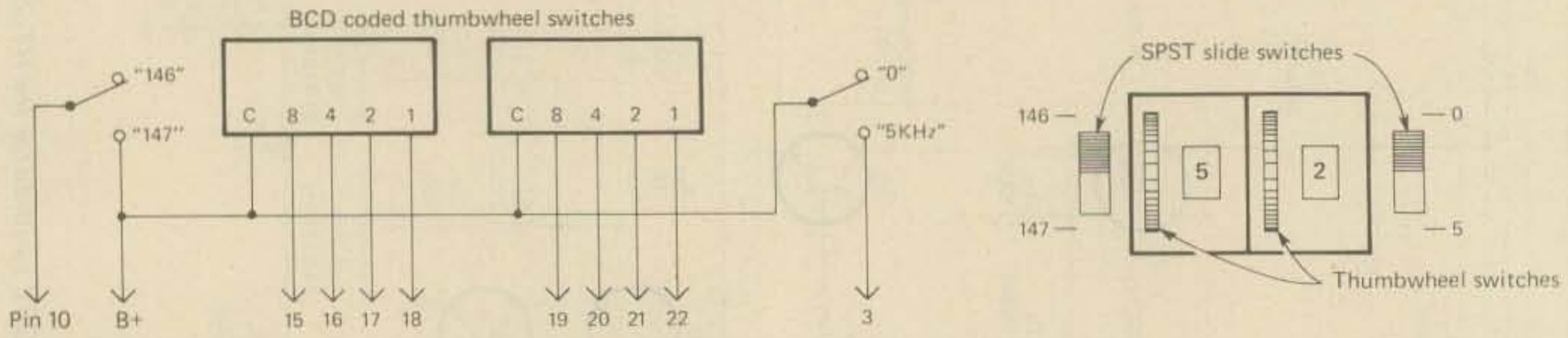


Fig. 3—Schematic and suggested layout for the synthesizer panel using slide and thumb wheel switches to change frequency.

vider. The division ratio of the CD 4059 is selected by external switches for the desired operating frequency. At the same time a 9.1022 MHz crystal oscillator, Q1, is divided down to 555.555 Hz by means of an RCA CD4020 CMOS divider. This divided signal is fed to a third integrated circuit, an RCA CD 4046 phase detector. The output of the phase detector is a d.c. voltage which is proportional to the phase difference between the reference 555.555 Hz signal from the CD 4020 and the divided VCO signal from the CD 4059. If the two signals are not exactly at the same frequency, the output voltage of the phase detector pulls Q8, the VCO, until they are. At this point the synthesizer is said to be "locked." Changing the division ratio of the CD 4059 will, of course, change the VCO frequency to again achieve the 555.555 Hz input to the phase detector.

As shown the WA4DSY synthesizer will directly interface with a Motorola HT-220. For other units several modifications may be necessary. If you wish to use the unit with equipment having a 10.7 MHz receiver first i.f., the 13.6888 MHz crystal should be changed to one with a frequency of 14.36666 MHz. The original synthesizer also employs s.p.s.t. switches to select the operating frequency. A more convenient method might be to employ thumbwheel BCD-coded switches to achieve an easier to understand format such as shown in fig. 3.

The spurious signals produced in fig. 3 are caused by pickup in the VCO circuitry and mounting the components in a shielded enclosure, additional buffer amplifiers or better bypassing will probably give significant improvement in this area.

If you have ever wanted to have a synthesizer for your 2 meter station and are technically capable of realizing the pro's and con's of this unit and solving them, I would strongly suggest that you order a P/C board and instructions from WA4DSY. It will certainly save you a good deal of time and effort and be a rewarding experience when you finally get it going properly. Please, however, don't forget that running this unit into a high power rig as it is will definitely cause spurious outputs that many produce undesirable QRM to other users of the two meter band.

73, Irwin, WA2NDM

a monthly feature by

HERBERT S. BRIER, W9EGQ

Novice

"How to" for the newcomer to Amateur radio

Power, Peak Envelope Power, And S.S.B.

In a previous column, we learned that on c.w. approximately 60 per cent of the d.c. power fed to the output amplifier tubes or transistors from the power supply in a modern amateur s.s.b./c.w. transmitter is delivered as useful r.f. power to its output terminal. This estimate is based on class-AB or class-B operation of the output amplifier tubes or transistors and normal losses in the coupling circuits. Of course, how skillfully the equipment is adjusted also affects power output. And power output—not input—determines the strength of the transmitted signal. On balance, rating c.w. transmitter power in terms of input is reasonably satisfactory, because they operate either full input and output (key down) or zero input and output (key up). But the method is less satisfactory in single-sideband (s.s.b.) operation, in which instantaneous power input and output are constantly changing. Although Novices are not immediately concerned with phone operation, there is phone in the future of all who plan to get a higher class license. The FCC insists on asking questions about phone operation in all amateur license exams above the Novice class.

*409 So. 14th St., Chesterton, Ind. 46304.

Looking at The Output Signal on an Oscilloscope

If you tune up your c.w. transmitter to a load and look at its r.f. envelope on a monitorscope, every time you press the transmitter key, you will see a wide bar across the scope tube which will reduce to a narrow line when the key is released. Whether you send a dot or a dash, fast or slow, the scope pattern will extend to the same height unless the power output or the load has changed. Assuming 250 watts input, an efficiency of 60 per cent, and 50-ohm resistive load, the voltage across the resistor will be 86 volts for 150 watts output.

By keying the transmitter with high-speed dots and dashes with an electronic keyer and advancing the sweep-frequency control of the scope, individual dots and dashes will be displayed side by side on the scope tube (Fig. 1B), rather than having one long bar of light filling the screen from left to right. It is then possible to view the r.f. envelope of the individual characters. A "good" dot or dash will have straight vertical sides and horizontal tops with somewhat rounded corners. Too sharp corners signal key clicks that annoy operators on adjacent frequencies on the air, especially if there is a sharp spur at the beginning or end of the characters. Also, if the power supply does not have good voltage regulation, the tops of the characters will slope down from left to right. A slope of a few degrees is not serious, but if it is too acute, check for a burned-out bleeder resistor across the power supply or dried out filter capacitors.

As noted, all dots and dashes have the same height on the screen, but watch the transmitter final amplifier milliameter during keying. On long individual dashes, the meter will swing up to its maximum value and stay there until the key is released. But on a string of high-speed dots, the meter pointer will hover around half of its maximum steady value. Similarly, a string of high-speed dashes will hold the meter pointer near the three-quarter maximum value. The milliameter is actually measuring the duty cycle of keyed stages on dots and dashes.

D.S.B. And S.S.B. Phone Signals

The simplest method of generating an amplitude-modulated phone signal is to run the plate or collector current of an r.f. amplifier through a secondary winding of the output transformer of a speech amplifier. The audio signal varies the d.c. input to the r.f. amplifier and generates upper and lower sidebands around the carrier frequency. Each sideband is a mirror image of the other and is wide as the highest modulating frequency, making the total signal two times as wide as the highest modulating frequency. At 100 per cent modulation, the peak power in a double sideband

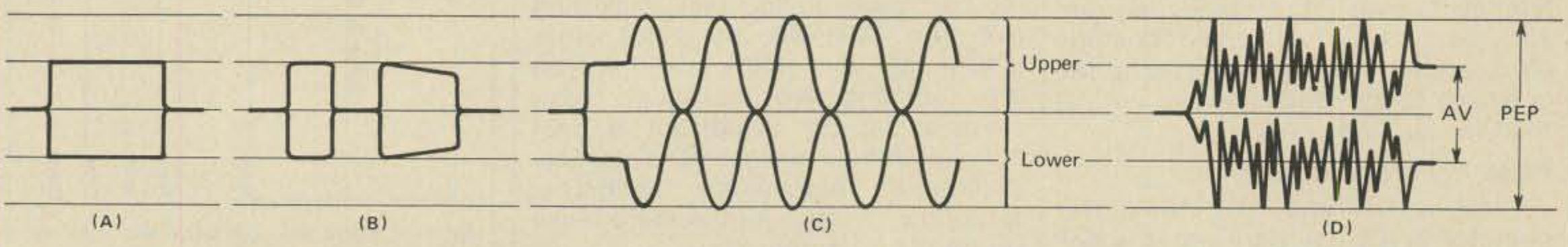


Fig. 1—Sketches of oscilloscope wave-form patterns on amateur signals. (A) Steady r.f. carrier. (B) dot and dash. Power supply voltage regulation fairly good. (C) 100 per cent sine-wave modulated double-sideband phone signal. In s.s.b., the carrier and one sideband are eliminated before transmission. (D) Approximate voice pattern of a s.s.b. phone signal

Ken Haller, WN9LIP, Baraboo, Wisconsin, is not really posing to show how to manipulate a code key if you want to send good code! Push the key back so that your forearm is resting on the table. Ken's receiver (bottom) is National NC-303, and the transmitter is a Hallicrafters HT-37 c.w. and phasing-type s.s.b. using a pair of 6146's. Antenna a "trap" dipole. Photo by K9PKQ.

signal with carrier is four times the unmodulated carrier power. Except for broadcast service and its use in the Citizens Radio Service, d.s.b. a.m. is obsolete, because it occupies over twice the spectrum space as equivalent s.s.b. signals and suffers a 9-db power handicap.

In the filter method of generating single-sideband signals, the steady r.f. carrier and the audio-frequency signals are fed to a balanced modulator which eliminates the steady r.f. signal from its output while mixing the audio and r.f. signals to produce upper and lower sideband signals. The output of the balanced modulator is fed through a sharp filter to slice off one of the sidebands. It is not needed, because both sidebands are saying the same thing. The remaining sideband is then amplified and then fed to the antenna to be radiated.

In the phasing method of s.s.b. signal generation, the audio and r.f. signals are each divided into components 90 degrees apart and fed to separate balanced modulators. The resulting two sets of sidebands are then combined to cancel one of the sidebands and to re-create the other with the proper phase relationships.

At the receiver, the sideband components are combined with a local steady signal equivalent to the original carrier in a product detector. The detector in turn senses the difference between the steady carrier and the received sideband components and delivers the difference fre quencies to the loudspeakers via the receiver audio amplifier.

Peak Envelope Power

Referring to figure 1D, when the operator of a s.s.b. transmitter is not speaking into the microphone, there is zero height on the scope display. As he talks, some voice peaks reach a maximum amplitude but most of them reach lower values. If we draw an imaginary line connecting all peaks during a time interval, we have drawn a peak envelope pattern for that interval. It has been found that for the average voice, the instantaneous peak envelope power (p.e.p.) to the average power in a s.s.b. signal is 2:1 but may vary from under 2:1 to over 3:1, depending on individual voices. On the other hand, the maximum permissible power input to any amateur transmitter is 1000 watts, d.c., measured by standard instruments. Thus, if the transmitter is properly adjusted so that the indicated power does not exceed 1000 watts on any voice peak, the transmitter is operating legally, no matter what the p.e.p. may be measured by other standards.

One problem in tuning a maximum-power for this performance is how to do it without exceeding 1000 watts input. If you tune up to a radiating antenna at full voltage and drive, the steady input is 2000 watts or more. Tuning to a dummy antenna makes it legal, at least; and a Heath Cantenna and other 1000-watt loads stand the overload for short periods of time, if plenty of cooling time is allowed between hot runs. Better is to tune up at 70 per cent of the normal operating voltage. The power input then doubles when the tune switch is set to the operating point.

Another expedient is to key the transmitter with continuous high-speed dots and tune for half the desired d.c. plate milliamperes. Possibly the FCC would frown on you for doing this on the air, but it would have to applaud you for doing it on a dummy antenna. Your equipment will be happier, too.

Whatever tune-up method you use, with a monitorscope you can verify what d.c. power input actually results in maximum transmitter output without exceeding the maximum rated d.c. input by measuring the height of the scope display. Finally, when operating s.s.b., adjust the transmitter microphone gain control so that highest speech-peaks just reach the maximum height without flattening on peaks ("flat-topping") or the plate milliameter flickering over the 1000-watt point (or other limit), and you will know that you are radiating the maximum p.e.p. s.s.b. signal the equipment is capable of without excessive distortion. In fact, to improve the Signal/Distortion (S/D) ratio a little more, ease up on the gain control.

News And Views

John T. Salyer, K3DPQ/ZF1WW, 45 Briar Road, Wayne, Pa. 19087, reports that he and **Tony, K3JGI/ZF1TD,** operated the "CQWW DX" contest on Grand Cayman Island on phone in 1975. They had several free hours when the contest was not on and worked over 400 Novices from Grand Cayman, all on 15 meters "cross-mode" their phone to Novice c.w. John planned to go back to Grand Cayman again in October, 1976, but his letter arrived far too late to alert you of his operation there. John had a suggestion that Novices might look for U.S. amateurs who go to neighboring "DX" countries to work the annual *CQ* and *QST* DX contests as "DX." During the actual contest, they are much too busy exchanging numbers to work crossband with Novice, but in the hours before and after the contest, a number of them actively look for Novice contacts. If you work one of them, keep the contact short and send your QSL card and addressed return envelope to the QSL Manager for the DX-pedition.

As always, we are waiting for your views, pictures, and suggestions for the column. Mail them to: Herbert S. Brier, W9AD, Novice Editor, CQ Magazine, 409 So. 14 St., Chesterton, Ind. 46304.

73, *Herb, W9AD*

Part II of this series continues the discussion of SSTV equipment. In Part III we will finally get to get our hot little hands on the gear and look in on the world.

Slow Scan Television, Overview '77

Part II

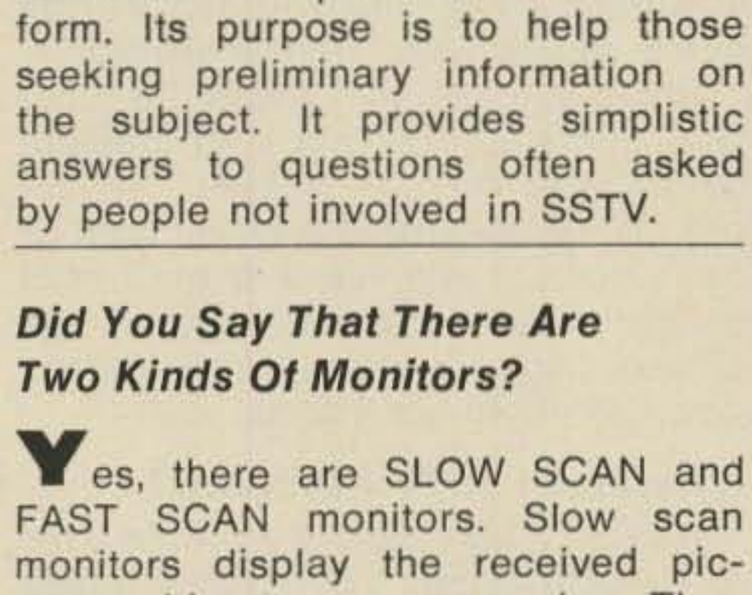
BY BILL DEWITT*, W2DD

Author's Note: This article presents a generalized overview of slow scan television in question and answer form. Its purpose is to help those seeking preliminary information on the subject. It provides simplistic answers to questions often asked by people not involved in SSTV.

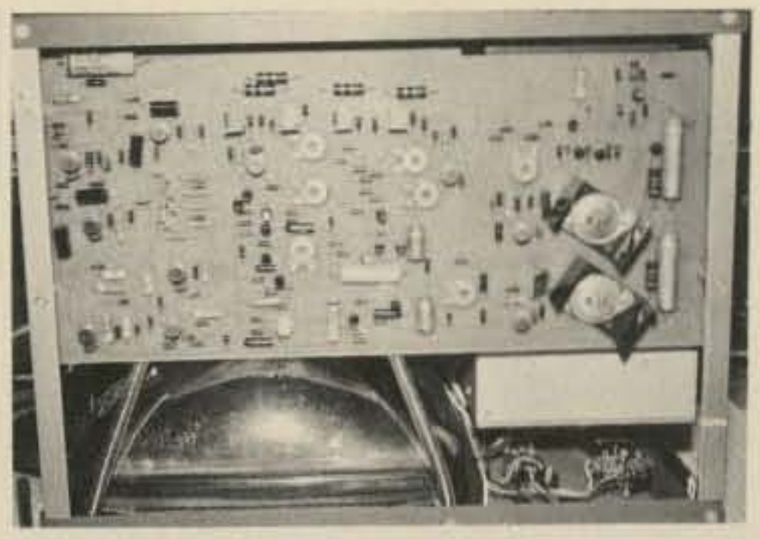
Did You Say That There Are Two Kinds Of Monitors?

Yes, there are SLOW SCAN and FAST SCAN monitors. Slow scan monitors display the received pictures without scan conversion. They are referred to as P-7 monitors. The term P-7 relates to the long-persistence phosphor needed for this kind of image display and viewing.

*2112 Turk Hill Road, Fairport, N.Y. 14450



The Robot Model 70 monitor. Without a doubt the most popular and widely used P-7 monitor ever made.



The Robot 70 series monitors all used a single circuit board like this one.

MOST fast scan monitors use a conventional "black and white TV set" cathode ray tube. They are essentially a TV set without the r.f. section. However, some monitors include an r.f. section and are switchable from broadcast TV reception to monitor use. And, almost any TV set can be converted for use as a monitor by feeding fast scan video in at the video amplifier input stage.

I said "MOST" fast scan monitors use the B&W set tubes (in the paragraph above) because Robot Research did make a fast scan "Viewfinder" monitor called the Model 61 employing a P-7 CRT, which was used to monitor the non-standard fast scan video output of the Model 80 series Robot cameras. This particular monitor was used for setting up one's camera, not for viewing received pictures. Frame rate was 15 frames per second.

As is obvious from earlier comments, when fast scan monitors are used to view received SSTV pictures, a scan converter is needed.

How Much Does A Monitor Cost? What Do They Look Like?

At this writing, Robot Model 70 series, Venus SS-2, SBE, and SEEC monitors are available "used" here in the U.S. for $125 up, depending upon the make and condition. (These are all P-7 monitors.)

The Venus SS-2 is still available new at $189, kit form, and $225 completely wired (from the manufacturer). I believe that there are still some SBE monitors available, new, from dealers. With the trend of SSTVers to scan conversion, there are many P-7

Robot's Model 61 Viewfinder appears at the lower right of this picture. It employs a P-7 phosphor CRT for viewing the 15 frames per second output of the Robot Model 80 series cameras.

A typical fast scan monitor. This 9 inch diagonal Panasonic Model TR920M is an excellent size for viewing scan converted SSTV.

monitors becoming available at attractive prices.

Robot Research's 70 series P-7 monitors dominated the SSTV field during their period of manufacture. Figures 1 and 2 will give you an idea of what the Robot 70s look like. They're about the same size as a KWM-2, but not as wide. Just about everything but the power supply, switches, and the CRT is included on one circuit board. These monitors have an excellent record of stability and generally trouble-free performance. I know of no glaring problems relative to the other commercial monitors mentioned. They are all good "buys" second hand unless they have been mis-treated.

Something to look for in buying a second hand slow scan monitor is the "fast scan viewfinder and waveform display" which was incorporated in later models of the Robot 70 series. Venus also incorporated a waveform display, useful in making video adjustments. A Robot Model 61 Viewfinder is shown in fig. 3.

Front view of a Robot Research Model 80 camera showing the brightness and contrast controls.

Pictured in fig. 4 is a typical small sized commercial fast scan monitor, the Panasonic TR920M. It costs about $150, has a so-called 9 inch screen. It's an excellent size for SSTV pictures. There are several other makes available in the same size. Don't go any bigger than this for SSTV unless you're going to be watching from across the room! Good viewing distance for a 9 incher is at least FOUR FEET.

Do SSTV Cameras Operate At A 120 Line/8 Second Frame Rate?

Very few cameras of this nature have been built. The general practice is to use a faster scan rate (conventional TV or an intermediate line and frame rate) and then "SAMPLE" the video signals. By taking out a point of video information every so often and then assembling that point with others at the right rate, and THEN adding some synch pulses—you can assemble a new picure having lesser total information—but with the desired standard of SSTV, 120 lines in 8 seconds.

Who Makes SSTV Cameras, And What Do They Cost?

There are probably more Robot Model 80 series cameras available "used" than any other make. Figures 5, 6 and 7 show the front and interior views of a Model 80 camera. All solid state except the vidicon, practically all parts are mounted on a single circuit board. The camera case is about 5 in. wide by 7¾ in. high by 12¾ in. long. Other makes are close to this size. Warning: If you buy ANY camera, BE SURE to get the connecting cable!

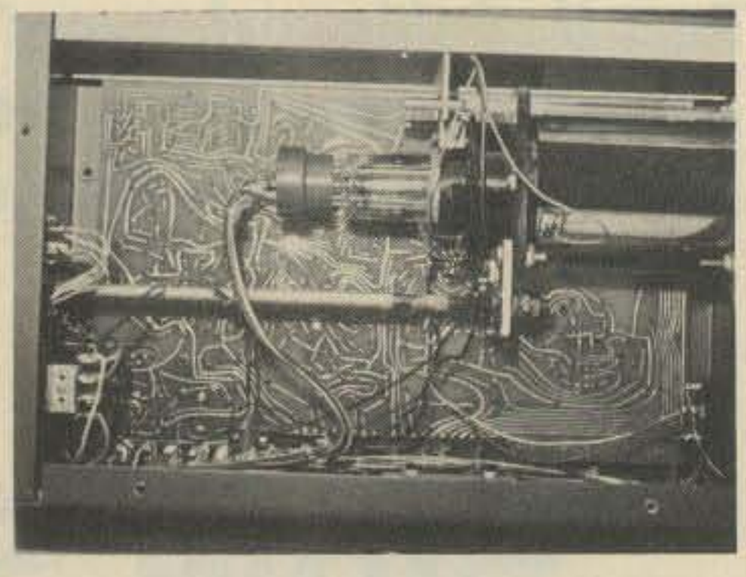
Fig. 8 shows an overall view of an "Italian copy" of a Robot camera beautifully constructed by I5FLN.

Can Standard TV Cameras Be Used For SSTV?

Yes. But some means of converting the standard TV video output signals must be provided. Two conventional approaches to this problem are: use a "sampling converter" as mentioned a few paragraphs earlier, or; use a scan converter to sample and store the fast scan camera video for "read out" at the SSTV frame rate.

The use of a standard TV camera is desirable because its output can be viewed directly as "live" video on a fast scan monitor. Scan converter owners find that this is a BIG advantage when making camera and lighting adjustments.

Standard or closed circuit TV cameras operate on their own internal power supply powered by 110



An interior view of a Robot Model 80 camera showing the position of the vidicon. The horizontal shaft extending from the vidicon mounting to the left was installed by the author using materials and instructions supplied by W3LY. Its purpose is to permit focusing adjustments for extreme close-ups. More about this in Part 3 of this article.

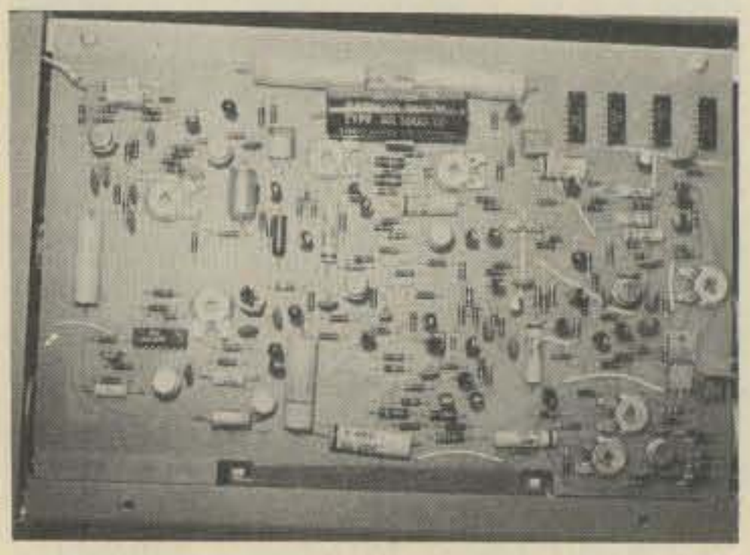
or 220v. mains depending upon country of origin. Video output is generally brought out to a coax fitting on the back of the camera. Some cameras have an extra fitting to permit the use of synch pulses from a source other than the camera's internal circuitry. Fig. 9 shows a typical moderately priced CCTV camera. You can find used cameras in good condition at reputable dealers for about $100 up. New cameras start at around $175, and you can pay as much as you want, from there up!

Some suggestions: Avoid old tube-type cameras; Try out ANY camera before you buy it; NEVER, NEVER point a TV camera at a bright light or flash bulb. It will leave a burn spot on the vidicon that will show on the screen. Look for a lens that will focus down to about six inches.

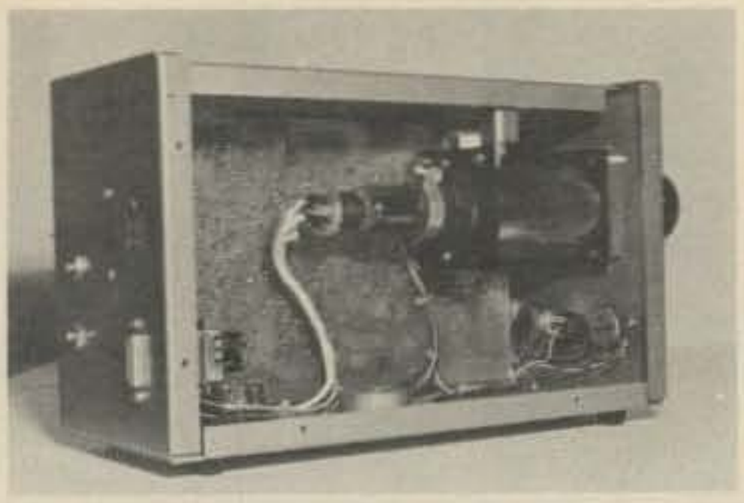
What Is An SSTV Keyboard?

An SSTV keyboard is a device used to electronically generate letters and numbers. It's a very useful (but not a necessary) item for the slow scan operator. It has an arrangement of keys similar to a typewriter.

For a brief period of time, Sumner Electronics and Engrg. made the HCV-3KB SSTV keyboard shown in



A single circuit board carries virtually all electronic parts of the Model 80 camera.



An "Italian copy" of the Robot 80 camera constructed by I5FLN.

fig. 10. The cost of this unit, new, was $455. It is not currently manufactured.

The principal use of keyboards is to produce alpha-numeric information such as signal reports, names, locations, etc. for SSTV transmission without the use of a camera. It eliminates the need for handlettered signs or the use of a "menu-board" as shown in fig. 11. In my opinion, its best application is for adding titles to pictures. This can be done by a variety of techniques depending upon whether a scan converter is being used or not.

The heart of the keyboard is an IC chip called a character generator. When a particular key is depressed, the keyboard circuitry causes the character generator to produce output signals (that are converted to the audio tones representing absolute blacks and whites)—at just the right intervals to form the desired letter or numeral. The size of the letters is determined by timing circuits.

Many keyboards have been constructed by hams following the excellent constructional article by W0LMD which appeared in the Sept. 1974 issue of *CQ*.

What Kind Of A Tape Recorder Can Be Used For SSTV?

Either reel-to-reel or casette tape recorders can be used to record and playback slow scan video because in reality, it is just an audio tone of variable frequency. For best performance it is important that wow and flutter be less than 0.2% RMS. Cassette machines are preferred because of the ease of changing tapes and the availability of endless cassettes (of 1, 3, and 6 minutes duration).

Two excellent cassette recorder/players that I have used for SSTV are the Sony TC-129, and the Superscope C-104. The C-104 by the way, has a "pause" control on it, very useful in the preparation of tapes for transmission.

Machines that do not meet the wow and flutter requirements will produce diagonal patterns and/or jagged edges on vertical lines.

If you're wondering if your tape recorder is good enough for SSTV, zero in on the voice of an SSTV station, record his video and play it back to him. If it jitters, he'll let you know. You don't even have to own a monitor!

From a practical standpoint it's desirable to tape record your call sign, location, and other frequently used information on an endless one minute cassette. Remember that cheap tape will ruin the heads in your recorder.

What Else Do I Need To Know About Scan Converters?

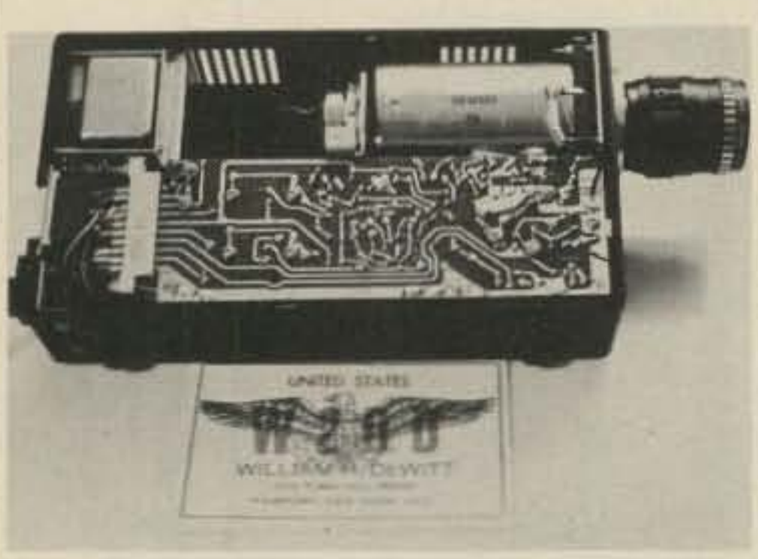
The only commercially built scan converters aimed at the amateur market have been built by Robot Research Inc. of San Diego, Ca. Their first scan converter, the Model 300, used a storage tube to store and convert slow scan video to fast scan and vice versa. It cost $995. See fig. 12.

Robot has recently switched to a digital, all solid state design with its Model 400 Scan Converter. The 400 is much smaller, has fewer controls, and is easier to operate. It is priced at $695. See figs. 13 and 14.

What Is A Storage Tube And Why Did Robot Switch To A Digital System?

For a detailed description of how storage tubes operate, see "Storage Tube Scan Conversion" by W2DD in the October 1973 issue of *CQ*.

A storage tube can be thought of as sort of an electronic blackboard. It contains a "target" that is written on by an electron beam. Video information can be "written" on the target and "read" out of the target at fast or slow rates, hence providing scan conversion capability. Storage tubes are expensive ($200



A standard television camera of the type frequently found in commercial/industrial/educational use. This is a "Roberts" camera, made by Akai. It's all solid state. Compact size can be noted by comparison to the QSL card shown.

The HCV-3KB all solid state SSTV keyboard. No longer manufactured, but a good buy if you can find one. It has provision for "writing" five lines of characters, six characters to a line. Can be modified for larger characters. It can write black on white, or vice versa.

up depending upon make and quantity), and they generally have a life of several thousand hours. I used one for scan conversion for about three years with no noticeable change in performance.

Robot Research made the switch to a digital system because of the availability of memory and other needed chips at relatively low prices. In addition, the digital approach eliminates one set of critical adjustments related to the use of the storage tube. The Robot Model 400 has fewer controls than the Model 300 and is easier to adjust for correct performance.

How Can I Get Started In SSTV With A Minimum Outlay of Money?

The absolute minimal approach to SSTV would be to get a P-7 monitor and just LOOK at the SSTV transmissions of others. However, if you have a tape recorder, you can join in the fun of two-way SSTV exchanges and see if you want to take the next step.

It's no problem to find a fellow slow scanner who'll set up your call letters, name, etc., and transmit them to you for your recording on tape. As an alternative, you can mail a few pictures and other info to a camera-

A Typical "menu board" set up for alphanumeric SSTV transmissions. The onerous task of forming words etc. with hand set letters is completely out of phase with television communications! NOT RECOMMENDED, PERIOD!

The Robot Model 300 Scan Converter, first scan converter ever designed for the amateur market. A beautifully designed and versatile unit employing a storage tube to produce either 128 or 256 line pictures. An excellent scan converter for the experienced slow scan operator.

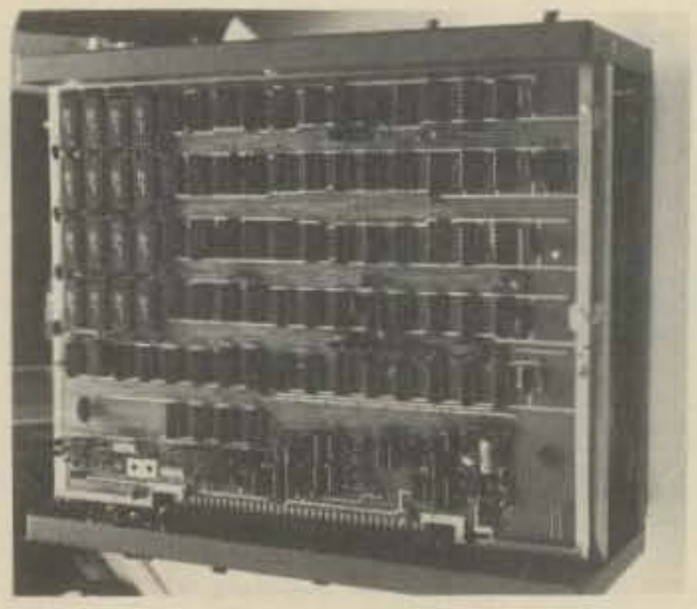
equipped friend who can make up a short tape for you. In this way you can have some good transmission material to use until you get a camera of your own.

What Would You Recommend For A Complete SSTV Station?

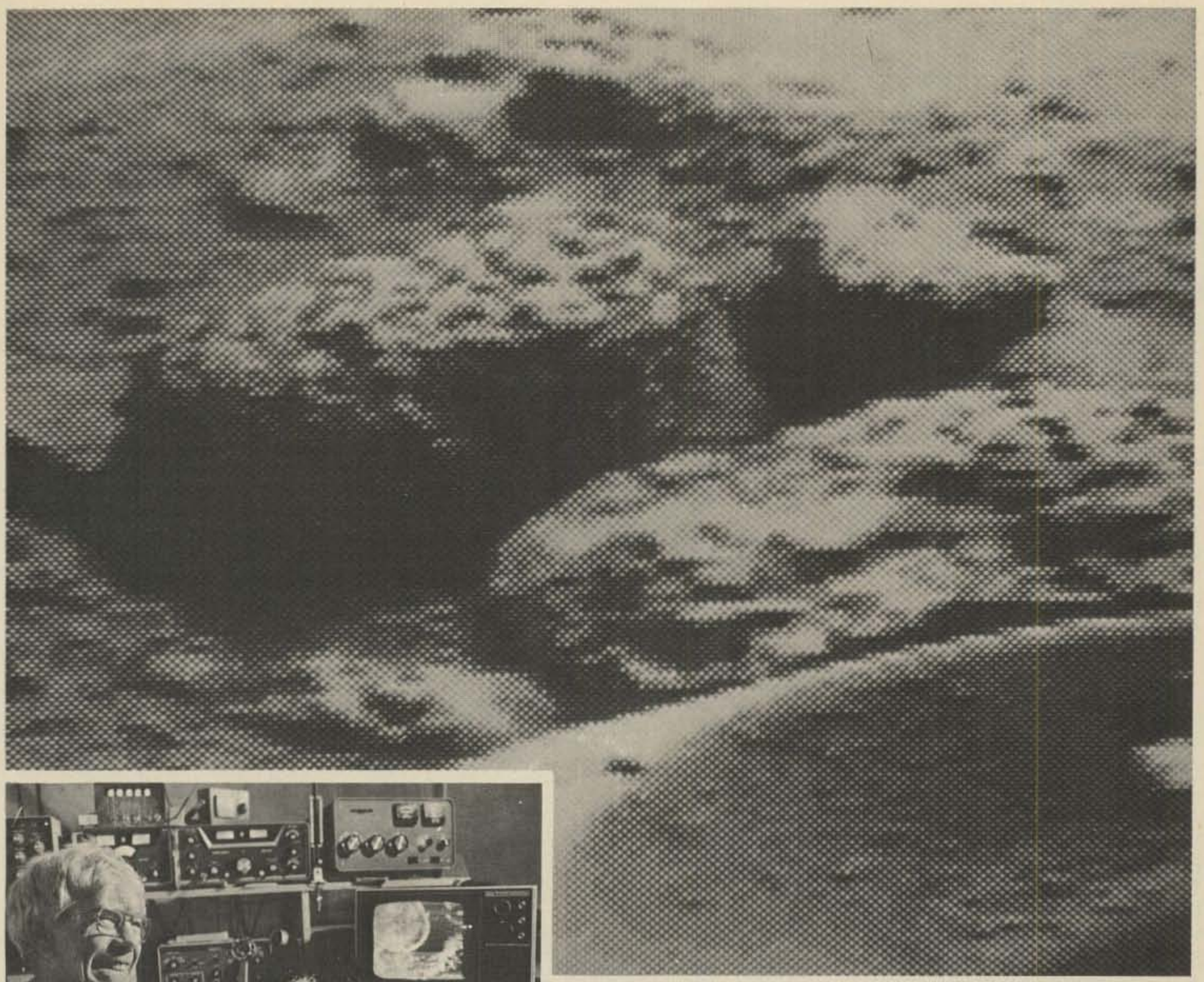
First, let's assume that you have a well-equipped s.s.b. station with a transceiver or transmitter capable of reasonable power ouput at the 100% duty cycle of SSTV.

Beyond the minimal approach, one must decide how far he wants to go and what he can afford! You don't have to go all out for the most expensive EVERYTHING to have fun

(Continued on page 75)



The Robot Model 400 Scan Converter. The first digital scan converter to hit the U.S. market. Lower-priced and easier to operate than the Model 300, it has found quick acceptance on a world-wide basis.



Bob Walton WBØJGJ Works Mars on SSTV

During the recent Viking I and Viking II Mars Operation, pictures of Mars received by NASA's Jet Propulsion Lab were relayed via SSTV to the ham bands by off-duty personnel.

Bob Walton, WBØJGJ was among the SSTV'rs fortunate enough to receive and record on tape, these historic pictures. The photo above shows the Martian landscape taken by Viking II. Bob used a Robot Model 400 SSTV converter, an audio tape recorder, and an old TV set to receive these pictures off his receiver. His total investment to view and record the most momentous event to date in man's history: $700.

SSTV is the most exciting development in amateur radio since single sideband! For complete information on SSTV and Robot equipment, write or call us and we'll send you our special SSTV Fact Pack!

ATTENTION SSTV'rs

NASA's Jet Propulsion Laboratory has made souvenir audio tape cassettes with highlights of all video transmissions from Viking I & II. For your copy send $3.75 to:

Dick Piety
Mail Station 158-205
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91103

a monthly feature by
JOHN A. ATTAWAY, K4IIF

DX

News of communications around the world

Looking back at a year just ended we see many successes. The Bicentennial prefixes, and *CQ's* Bicentennial Prefix Award, were well-received and gave a spark to WPX'ers the world over. If you hadn't worked AA, AD, AC etc. from all 10 call areas, you just couldn't of been on the air. In a September QSO, Dick Spenceley, AJ3AA (KV4AA) indicated that he had just logged contact number 23,800 with his AJ3 prefix and was shooting for 30,000 before the year ended.

It had also been a very good year for the CQ DX Awards Program. In past years the monthly listing of WAZ, WPX and CQ C.W. and S.S.B. DX Awards frequently totalled only 30 certificates, but at the close of 1976 we saw more than double that number, and in some months we almost tripled it. Soon we hope to pass the 100 certificates per month level. This is all the more remarkable as DX interest is traditionally at a low ebb at the bottom of a sunspot cycle. Much of the credit must go to the sound long-range suggestions of the CQ DX Award's Advisory Committee composed of VE3GMT, W1AM, W1WY, W2GT, K2EEK, K2FL, W4WSF, W4NJF, K4AEB, K5YMY, WA5ZNY, K6AHV, W6EJJ, W6TCQ, W7YBX, WA8TDY, W8IMZ, W9DWQ and WØSFU. The Committee has seen to it that there is always something new and interesting for everyone in the DX award's slate. The new Slow Scan TV DX Award is their latest innovation.

*P.O. Box 205, Winter Haven, FL 33880.

The big signals from JA2 land. Chip, K7-VPF aermobile R3; Haru, JA2BY; Hide, JA2BAY and Yoh, JA2JW (left to right).

The WAZ Program

Single Band WAZ

20 Meter Phone

32...JH1EIG
33...HB9AQW
34...IT9WGI

S.S.B. WAZ

1344...DJ9UM
1345...DL8OH
1346...IT9UVA
1347...JH1VRQ
1348...F8OX

C.W.—Phone WAZ

4019...WA2EJS
4020...DK1EI
4021...DM2CCM
4022...DM2CZM
4023...F6DBX
4024...YU1ODS

Phone WAZ

524...VE3AER
525...F8YO

The complete rules for all WAZ awards are found in the May, 1976 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a business-size, self-addressed, stamped envelope to the DX Editor, P.O. Box 205, Winter Haven, FL 33880.

So we bid a fond farewell to the Bicentennial Calls. Auf wiedersehen, AC8IMZ, hello W8IMZ! Right Bernie? We also bid an affectionate au revoir to the characteristic WN calls for U.S. novices. Its bleak tuning across the Novice bands and no WN prefixes, though the Novice accents certainly remain.

A small milestone among ourselves is a new Assistant DX Editor, Rod Linkous, W7YBX, who started the new year off with a bang by authoring the DX column in the January, 1977 issue. We hope this was the first of many column's by Rod. Also, we have a new WPX Manager this year, Bob, W6TCQ, and he is doing a great job wading thru those long applications from Box 88.

DX Hall of Fame

The *CQ* DX Awards Advisory Committee and the *CQ* DX Department are pleased to announce that on November 12, 1976, Lloyd Colvin, W6KG, and Iris Colvin, W6QL (ex-W6DOD), were inducted into the DX Hall of Fame.

It would not be possible to find DXer's anywhere in the world who come nearer to the ideal expressed in the DX Hall of Fame than Lloyd and Iris Colvin. The single, over-riding qualification for all members of the DX Hall of Fame is to have rendered service to the DX fraternity over a long period of time, service which goes far beyond any conceivable call of duty and which frequently requires great personal sacrifice. Anyone who has followed and observed the Colvins on their great DXpeditions is aware that this "Dynamic Duo of DX" has met this requirement many times over.

During the past 20+ years, Lloyd and Iris have personally QSOed at

The above photo shows DX Hall of Famers Lloyd (W6KG) and Iris (W6QL) Colvin while visiting John, KS6EZ, in the center of the picture. During their recent South Pacific trip the Colvins operated from VR1Z, VR8B, 3D2KG, C21NI, FKØKG and YJ8KG. All QSLs go to the YASME Foundation, P.O. Box 2025, Castro Valley, California 94546.

The WPX Program

Mixed

551...IT9LMK
552...HI8MOG

SSB

940...A9XBD
941...YS1JWD
942...WB2JJN
943...DJ9UI

CW

1538...UZ3ER
1539...JA8CFR
1540...W7ISY
1541...DJ2GW
1542...JH1VRQ

Endorsements

Mixed: 1300 W4WSF, 1298 W3GJY, 1049 K2AAC, 698 IT9LMK, 608 JH1VRQ, 550 I4BFY, 453 WA4-BSV, 450 HI8MOG.
SSB: 380 WB2JJN, 352 YS1JWD, 325 DJ9UI, 300 A9BXD.
CW: 908 OK2QX, 870 K2AAC, 800 W9WCE, 550 G3HB, 500 JA2IU, 442 DJ2GW, 338 JA8CFR, 300 JH1VRQ, 300 W7ISY.
Africa: OK2QX
Europe: HAØHW, VE3HLC, A9XBD, HI8MOG.
No. America: OK2QX, HI8MOG.

Complete rules for the WPX Program are found in the May, ,1976 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to the WPX Awards Manager, Mr. Bob Huntington, W6TCQ, 5014 Mindora Drive, Torrence, CA 90505.

least half of the active radio amateurs of the entire world. Their travels have taken them to 126 countries from which they have made over 350,000 contacts in working amateurs in 350 DX countries, and have received and alphabetically filed 200,000 QSL cards. They have held 56 different calls, and have worked DXCC under 20 of these calls.

From 1965-1968, W6KG and W6DOD carried out a series of DXpeditions to Europe, Africa and the Pacific under the auspices of the YASME Foundation. They used 21 callsigns including KG6SZ, W6KG/KG6, KC6SZ, KG6SZ/KC6, VR1Z, GD5ACH/W6KG, GD5ACI/WB6QEP, ZB2AX, GC5ACI/WB6QEP, GC5ACH/W6KG, CT3AU, CT2AY, 6W8CD, 5T5KG, ZD3I, 9L1KG, 5L2KG, 9G1KG, TU2CA, 5V1KG and TY2KG.

Resuming their DXpedition in 1976, again under the YASME banner, Lloyd and Iris operated VR1Z, VR8B, 3D2KG, C21NI, FKØKG and YJ8KG from the Pacific before returning to W6-land on R and R. In a letter dated Sept. 20, 1976, they indicate that they will be underway again shortly, and a reliable source informs us that the Colvin gear has arrived in the West Indies. It is a logical guess that they will soon add many of the Caribbean islands to the already impressive list of countries from which they have operated. QSL's for all their YASME trips go to P.O. Box 2025, Castro Valley, California 94546.

Congratulations to Lloyd and Iris Colvin, DX HALL OF FAME!

One of the leading DXers of the Pacific northwest, Robert Nesbitt, WA7UVO. Bob's motto: "I reached ino the sky and found a friend."

The DX Hall of Fame

Gus M. Browning, W4BPD
Nov. 1, 1967
John M. Cummings, W2CTN
March 23, 1968
Stewart S. Perry, W1BB
Aug. 16, 1968
Richard C. Spenceley, KV4AA
March 1, 1969
Danny Weil, VP2VB
Sept. 15, 1969
H. Dale Strieter, W4DQS
May 23, 1970
Stuart Meyer, W2GHK
Oct. 31, 1970
Martin Laine, OH2BH
Jan. 22, 1972
C. J. (Joe) Hiller, W4OPM
March 30, 1973
Ernst Krenkel, RAEM
April 14, 1974
Frank Anzalone, W1WY
June 19, 1976
Lloyd and Iris Colvin,
W6KG and W6QL
Nov. 12, 1976

De Extra

Sable and St. Paul Islands—Why Are They Separate Countries?—In response to questions raised regarding the decision to grant separate country status to Sable and St. Paul Islands, Mort Wolfson, VE3MJ, of the Canadian DX Association prepared a detailed explanation for the Association's publication, *Long Skip*. As Mort was a member of the group who prepared the application for separate country status and operated on the first DXpedition to these islands, he is an authority in the matter.

Mort points out that these islands were judged to be separate from Canada, for DXCC purposes, on the basis of point 1 of the country list criteria. Point 1 addresses the situation where "an area by reason of government or a distinctly separate administration constitutes a separate entity." He indicates that a separate administration is established under the Canadian Shipping Act which provides that the Governor in Council and the Minister of Transport are responsible for all aspects of the governing of the 2 islands such as maintenance of buoys and lighthouses, rules and regulations, management and the granting of permission as to who may visit or reside on the islands. These 2 officers are agents of the Federal Government of Canada rather than the Government of Nova Scotia, thus bringing point 1 into play. He compares this to the situation of Kingman Reef which was judged to be a separate country from Palmyra Island because it is administered by the Department of the Interior and Palmyra by the Department of the Navy, separate agencies of the U.S. government.

VE3MJ goes on to point out that the reason Sable and St. Paul are separate countries, one from the other, is based on point 3 of the country criteria which concerns itself with entities separated by foreign land. Having established that Sable and St. Paul Islands are separate from Canada under the country-list standards, then any part of Canada

Joe Monego, W2OFB/VP2MFB, operates from Spanish Pointe, Montserrat, making 1700+ contacts with 68 countries and 40 states during his stay on the island. Joe operated from the Beverstein house which is available to DXers on a rental basis. If interested, contact Dr. Beverstein at 60 Amsterdam Ave., Toronto, Canada M4B 2C2.

Ken Palmer, K2FJ, VP2VAN, PJ8DX, etc. is personally acquainted with most islands of the Caribbean. In the above photo, Ken is operating his Bicentennial Station, PJØUSA, from St. Eustatius.

Chuck Stuart, K5FKD, of Dallas, Texas recently added WAZ to his list of awards which includes WPX, the CQ SSB DX Award, WAS, WAC and DXCC-300. He finds WAZ to be the most difficult and is now working on his 15 and 20 meter Single Band WAZ awards. Chuck is 32 years of age and became interested in DX after an accident confined him to a wheelchair.

which geographically separates Sable and St. Paul would be considered separation by foreign land and would qualify the 2 islands for separate country status. Reference to a map shows that a line drawn between the 2 islands would pass through the Cape Breton Island section of Nova Scotia, roughly at the city of Sydney, thus establishing the necessary separation for point 3.

DX News-Sheet To Ceace Publication

Since 1962, Geoff Watt's *DX News-Sheet* has been one of the most accurate and reliable sources of information available to DXers, and it is with a keen sense of loss that we report Geoff's plans to discontinue publication.

In issue No. 745, dated Sept. 28, 1976, Mr. Watts advises his 1250 readers in over 100 countries, that due to health problems his physician has strongly advised him to drop the paper which takes 80 hours a week to prepare and mail. The alternative is a possible complete loss of eyesight.

The problems of coping with over 20 different foreign currencies, with currency fluctuations and with deteriorating mail service only aggravated the problem. Geoff had hoped that the Radio Society of Great Britain (RSGB) would continue to publish the *News-Sheet*, but this was not possible because of the enormous amount of work involved. However, RSGB will sponsor IOTA, the Islands-on-the-Air Award feature of the *DX News-Sheet*.

Geoff will continue to print and mail his Radio Amateur Prefix-Country-Zone list which gives the following information for each country: a. DXCC status, b. the normal prefix, c. special prefixes, d. ITU callsign block allocation, e. continent, f. *CQ* Zone and g. ITU Zone, all arranged alphabetically. At $1.00 and an s.a.e. this is the greatest bargain in amateur radio and all DXers should have one by the rig. Orders go to Geoff at 62 Belmore Rd., Norwich, Norfolk, England.

Good luck Geoff!!! Your efforts will long be appreciated by DXers everywhere.

JA6RIL, Kiyohiko Okazaki, qualified for s.s.b. WAZ No. 1326. His FB rig includes an FT-101E, a 2-element quad, an FT-401D and a TS-700 for 2 meters.

News of Rare and Special Prefixes

KC9—KC9WD was QRV during the Knoxville, Illinois Civil War Days celebration, Sept. 17-19. QSL to WB9DDF.

KX8—KX8BCF was a special events station at the Belmont County Ohio Fair. QSL to W8BQV.

N4—N4SCI operated from the Sister Cities International conference in Mobile, Alabama from August 25-28.

N6—N6V cards go via W6VIO.

NB6—Cards for NB6AFC go to WA6-PDE.

NC6—NC6CC confirmations originate with WA6VEF.

NJ2—Sends QSLs for NJ2MAP care of K2JOX.

NT7—NT7HEL operated Oct. 15-17 in celebration of Tombstone, Arizona's Helldorado Days. QSL to AA7NEV, P.O. Box 73, Tombstone, AZ 85638.

R5—R5TV was operated from the Ukraine by Yuri, UY5OO, to commemorate the first anniversary of Soviet amateur television.

S7—S7A—S7Z is the new ITU prefix block for independent Seychelles Islands.

TD76—This was the special prefix for the Guatemala City, Guatemala Centennial celebration. For WPX it counts as TD7. QSL TD76GI to Box 762, Guatemala City.

WN, KN—We hope you confirmed all the former U.S. novice prefixes as they have been discontinued by FCC and probably will never be heard again.

WT4—Send cards for WT4AAK to Route 1, Box 409, Monroe, GA 30655.

WT8—WT8AAF cards go via P.O. Box 505, Xenia, Ohio 45385.

WW9—Wonderful Wisconsin Week was celebrated again this year by WW9WWW. QSL to WA9UEK.

YD2—QSL YD2VV via K2VV.

7X4—This rare prefix was activated as 7X4MD by Driss Bendani, 7X2-MD. QSL to 23 Rue Oueld Aissa Belkacem, Mostaganem, Oran, Algeria, c/o 7X2MD.

8P7—During October and November, amateurs in Barbados used this special prefix to celebrate the 10th anniversary of the Radio Society of Barbados.

The Tough Zones

Zone 23—No. 23 is still the kingpin of the tough zones. If you need it for 80 meter c.w. WAZ, be on the lookout for JTØOAQ between 3501 and 3510 kHz right at or just after sunrise east coast time. This station is also active on 20 meter c.w. as are JT1AM, JT1AN, JT1AO, JT1AT and JT1KAA. Stations UAØYAD and UAØ-YAE are in the Soviet portion of Zone 23, Tanna-Tuva, and have been

(Continued on page 80)

The CQ DX Awards Program

S.S.B.

459...UL7NW
460...UA9EU
461...UA3ZD
462...K4LRO

C.W.

229...UV3GE
230...UF6FN
231...UA6LAH
232...UA3TAM
233...UB5GBD
234...UA3HE
235...UA9NN
236...UA4LM
237...UKØLAK
238...K4LRO
239...WB2CST

S.S.B. Endorsements

150...UA9EU, UV3DU, WB5HVY

Complete rules and application forms for the CQ DX Awards program can be obtained by sending a business size, No. 10, envelope, self-addressed and stamped to: "CQ DX Awards." 5632 47th Avenue S.W., Seattle, Washington 98136.

Japanese DXer, Masami Yamada, JA1UQP, has qualified for 20 Meter Single Band WAZ on both c.w. and phone, as well as regular WAZ on s.s.b.

a monthly feature by

GEORGE JACOBS, W3ASK

Propagation

The science of predicting radio conditions

The sunspot dilemma continues. The Swiss Federal Solar Observatory at Zurich reports a monthly mean number of 22 for this past October. The highest level recorded during the month was a count of 36 on October 17. There were only three days during the month when the count was zero.

October's mean level of solar activity results in a smoothed sunspot number, upon which the cycle is based, of 13 centered on April, 1976. This is an *increase* of one point over September's level.

Although the latest smoothed sunspot numbers indicate the cycle may be entering another plateau period, and that the beginning of a new cycle may not have yet occurred, at least two authoritative sources have recently expressed opinions concerning a new solar cycle.

Professor Waldmeier, director of the Swiss Federal Observatory has announced his opinion that a new sunspot cycle probably began during *December, 1976* and that solar activity is now increasing.

The Space Environment Laboratory of the National Oceanic and Atmospheric Administration announced recently that according to their observations, a new cycle began during *July, 1976.*

Professor Waldmeier predicts a smoothed sunspot number of 10 for February, 1977, while NOAA is predicting a level of approximately 12. The validity of this month's *CQ* propagation forecasts will hold for any level between 7 and 12.

Low solar activity coupled with seasonal changes in h.f. propagation conditions are expected to result in few *10* meter DX openings during February. The band should, however, occasionally open towards southern and tropical areas during the daytime when conditions are HIGH NORMAL or better. There's a considerably better chance for *15* meter DX openings to many parts of the world during the daylight hours, particularly when conditions are HIGH NORMAL or better.

Twenty meters should continue to be the best band for DX propagation during February. Expect a window of an hour or two duration, beginning just after sunrise, during which the band should open to most areas of the world. DX should be possible throughout the day, with another peak in conditions occurring during the early afternoon. When conditions are HIGH NORMAL or better, *20* meters may remain open towards the south and the west well past sundown and into the hours of darkness.

Somewhat improved, and often good nighttime DX propagation conditions are expected on *40* meters during February. The band should open towards Europe and the east an hour or two before sundown, peaking during the early evening. South America should be within range from about an hour or so after sundown, through the hours of darkness, and until sunrise. Openings towards the Caribbean area should be possible for an hour or more before sundown and until an hour after sunrise. Look for openings towards the South Pacific, Asia and the Far East from about an hour or two *before* to about an hour *after* local sunrise. Good *80* meter openings are also forecast to most areas of the world during the hours of darkness. Be sure to also check *160* meters between sundown and sunrise for some fairly good DX openings to some areas of the world.

A seasonal increase in static levels may begin to be noticeable on the h.f. bands during February.

Short-Skip Conditions

On *160* meters, no significant skip is expected during the daylight hours, but groundwave openings over several dozen miles should be possible. During the hours of darkness expect fairly good openings over distances up to 1300 miles and beyond. On *80* meters, look for openings up to about 250 miles during most of the daylight hours, with the skip lengthening to between 400 and 1300 miles just after sundown, and up to between 800 and 2300 miles by Midnight. On *40* meters, daytime openings should be possible between distances of approximately 200 and 750 miles, extending to between 750 miles and 2300 miles during the early evening. During the hours of darkness *40* meters should be optimum for openings between approximately 1500 and 2300 miles. Daytime skip on *20* meters should range between 750 and 2300 miles through the late afternoon, when it should lengthen

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For Feb., 1977

Propagation Index ..... Date	Expected Signal Quality (4)	(3)	(2)	(1)
Above Normal: 10, 23	A	A	B	C
High Normal: 7, 17, 22	A	B	C	C-D
Low Normal: 5-6, 8-9, 11-12, 15-16, 18, 24	B	C	D	D-E
Below Normal: 1, 4, 13-14, 19-20, 25, 28	C	D	D-E	E
Disturbed: 2-3, 26-27	C-E	D-E	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals greater than S9+30 dB.

B—Good opening, moderately strong signals varying between S9 and S9+30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.
2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, a path shown in the charts with a propagation index of (3) will be fair to poor (C-D) on Feb. 1, Poor to not possible (D-E) on the 2nd and 3rd, Fair to Poor (C-D), on the 4th, Fair (C) on the 5th and 6th, etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, subscribe to bi-weekly MAIL-A-PROP, P.O. Box 86, Northport, NY 11768.

*11307 Clara St., Silver Spring, MD 20902.

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (15 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. A ** indicates the best time to listen for 10 meter openings; * best times for 160 meter openings.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this Propagation column for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

4. Time shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M., 13 is 1 P.M., etc. Appropriate *standard* time is used, *not* GMT. To convert to GMT, add to the times shown in the appropriate Chart 8 hours in PST Zone, 7 hours in MST Zone, 6 hours in CST Zone, and 5 hours in EST Zone. For example, 14 in Washington, D.C. is 19 GMT. When it is 20 in Los Angeles it is 04 GMT, etc.

5. The charts are based upon a transmitter power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level: for each 10 db loss, it will lower by one level.

6. Propagation data, contained in the Charts has been prepared from basic data published by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

to between 1500 and 2300 miles. The band should be out for short-skip by about 8 p.m. on most nights. On *15* meters, skip should range between 1300 and 2300 miles during most of the daylight hours, with the band going dead for short-skip about an hour or so after local sundown on most nights. Occasional short-skip openings may also be possible on *10* meters during the daytime hours. Unusual sporadic-type short-skip openings may also be possible on *20, 15* and *10* meters during periods of radio storminess.

V.H.F. Ionospheric Openings

Best chance for unusual ionospheric openings should be during periods of radio storminess on the h.f. bands. Check the "Last Minute Forecast" at the beginning of this column for days during February that are likely to be BELOW NORMAL or DISTURBED. Be sure to check the v.h.f. bands and *20, 15* and *10* meters for unusual auroral-type and sporadic-E short-skip openings on these days.

No significant meteor showers are expected during February.

This month's *Propagation Charts* contain band opening predictions for the major DX paths for the period February 15 through April 15, 1977. A short-skip propagation forecast for February appeared in last month's column. Instructions for the proper use of these Charts appear elsewhere in this column.

73, George, W3ASK

February 15-April 15, 1977
Time Zone: EST (24-Hour Time)
EASTERN USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Central Europe & North Africa	10-12 (1)** 08-10 (1) 10-12 (2) 12-13 (1)	06-08 (1) 08-11 (2) 11-12 (3) 12-13 (4) 13-14 (3) 14-15 (2) 15-17 (1)	16-17 (1) 17-19 (2) 19-20 (3) 20-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	18-20 (1) 20-21 (2) 21-01 (3) 01-02 (2) 02-03 (1) 20-22 (1)* 22-01 (2)* 01-02 (1)*
Northern Europe & European USSR	09-12 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-14 (2) 14-16 (1)	17-19 (1) 19-02 (2) 02-03 (1)	20-22 (1) 22-00 (2) 00-02 (1) 20-00 (1)*
Eastern Mediterranean & Middle East	09-11 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-13 (2) 13-14 (3) 14-15 (2) 15-17 (1)	18-20 (1) 20-23 (2) 23-01 (1)	19-23 (1) 20-22 (1)*
Western Africa	10-13 (1)** 09-10 (1) 10-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-19 (1)	18-19 (1) 19-00 (2) 00-02 (1)	19-21 (1) 21-23 (2) 23-01 (1) 21-01 (1)*
Eastern & Central Africa	11-13 (1)** 09-11 (1) 11-14 (2) 14-15 (1)	13-15 (1) 15-18 (2) 18-19 (1)	19-22 (1) 22-00 (2) 00-01 (1)	20-00 (1)
Southern Africa	10-13 (1)** 09-10 (1) 10-12 (2) 12-13 (3) 13-14 (2) 14-15 (1)	07-14 (1) 14-16 (2) 16-17 (3) 17-18 (2) 18-20 (1)	18-20 (1) 20-22 (2) 22-00 (1)	21-23 (1) 21-23 (1)*
Central & South Asia	09-11 (1) 16-18 (1)	06-07 (1) 07-09 (2) 09-11 (1) 18-21 (1)	04-07 (1) 17-21 (1)	04-07 (1) 18-20 (1)
Southeast Asia	17-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 19-21 (1)	05-08 (1) 19-21 (1)	06-07 (1) 19-21 (1)
Far East	16-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-20 (1)	05-08 (1) 17-19 (1)	06-07 (1) 17-18 (1) 06-07 (1)*
South Pacific & New Zealand	14-16 (1)** 12-15 (1) 15-18 (2) 18-19 (1)	15-19 (1) 19-22 (2) 22-07 (1) 07-09 (2) 09-11 (1)	00-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1)	02-03 (1) 03-06 (2) 06-07 (1) 02-07 (1)*
Australasia	15-17 (1)** 09-11 (1) 12-16 (1) 16-18 (2) 18-20 (1)	06-07 (1) 07-09 (2) 09-15 (1) 15-17 (2) 17-18 (1) 18-20 (2) 20-22 (1)	03-05 (1) 05-07 (2) 07-08 (1)	04-05 (1) 05-06 (2) 06-07 (1) 04-07 (1)*
Caribbean, Central America & Northern Countries of South America	11-16 (1)** 07-08 (1) 08-09 (2) 09-11 (4) 11-13 (2) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	05-06 (1) 06-07 (2) 07-09 (4) 09-10 (3) 10-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-21 (2) 21-23 (1)	18-19 (1) 19-20 (2) 20-03 (3) 03-05 (2) 05-07 (1)	19-21 (1) 21-04 (2) 04-06 (1) 20-02 (1)* 02-04 (2)* 04-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	12-15 (1)** 08-09 (1) 09-11 (2) 11-13 (1) 13-14 (2) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-10 (2) 10-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-20 (2) 20-22 (1) 22-23 (2) 23-00 (1)	19-21 (1) 21-04 (2) 04-07 (1)	21-06 (1) 01-05 (1)*
McMurdo Sound, Antarctica	15-17 (1)	17-19 (1) 19-22 (2) 22-00 (1) 07-09 (1)	22-00 (1) 00-04 (2) 04-06 (1)	00-04 (1)

*Indicates Best Time For 160 Meter Openings.
**Indicates Best Time For 10 Meter Openings.

Time Zones: CST & MST
(24-Hour Time)
CENTRAL USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Southern Europe & North Africa	08-09 (1) 09-12 (2) 12-13 (1)	06-08 (1) 08-12 (2) 12-14 (3) 14-15 (2) 15-17 (1)	16-18 (1) 18-21 (2) 21-00 (1) 00-02 (2) 02-03 (1)	18-20 (1) 20-00 (2) 00-01 (1) 20-00 (1)*
Northern & Central Europe & European USSR	08-11 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-13 (2) 13-15 (1)	19-22 (1) 22-00 (2) 00-02 (1)	20-01 (1) 21-01 (1)*
Eastern Mediterranean & Middle East	08-11 (1)	07-11 (1) 11-14 (2) 14-16 (1) 22-00 (1)	19-20 (1) 20-22 (2) 22-23 (1)	20-22 (1)
Western Africa	09-12 (1)** 08-10 (1) 10-13 (2) 13-15 (1)	07-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	18-20 (1) 20-22 (2) 22-01 (1)	21-00 (1) 21-23 (1)*
Eastern & Central Africa	08-11 (1) 11-13 (2) 13-14 (1)	07-12 (1) 12-14 (2) 14-15 (3) 15-16 (2) 16-18 (1)	19-23 (1)	19-22 (1)
Southern Africa	10-12 (1)** 08-10 (1) 10-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	07-13 (1) 13-15 (2) 15-16 (3) 16-17 (2) 17-19 (1) 22-00 (1)	18-20 (1) 20-23 (2) 23-00 (1)	19-22 (1) 20-22 (1)*
Central & South Asia	09-11 (1)	06-07 (1) 07-09 (2) 09-11 (1) 19-21 (1)	04-08 (1) 17-21 (1)	05-07 (1) 17-19 (1)
Southeast Asia	10-13 (1) 17-19 (1)	06-07 (1) 07-10 (2) 10-12 (1) 17-21 (1)	04-08 (1) 17-19 (1)	05-07 (1) 17-18 (1)
Far East	16-18 (1)** 16-17 (1) 17-18 (2) 18-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-20 (2) 20-22 (1)	02-04 (1) 04-07 (2) 07-08 (1)	04-07 (1) 05-07 (1)*
South Pacific & New Zealand	14-17 (1)** 11-16 (1) 16-18 (2) 18-20 (1)	06-07 (1) 07-10 (2) 10-18 (1) 18-19 (2) 19-21 (3) 21-23 (2) 23-02 (1)	22-00 (1) 00-01 (2) 01-06 (3) 06-07 (2) 07-08 (1)	00-02 (1) 02-06 (2) 06-07 (1) 03-07 (1)*
Australasia	14-17 (1)** 12-16 (1) 16-18 (2) 18-20 (1)	06-07 (1) 07-09 (3) 09-12 (2) 12-15 (1) 15-17 (2) 17-19 (1) 19-21 (2) 21-00 (1)	01-04 (1) 04-06 (3) 06-07 (2) 07-08 (1)	04-05 (1) 05-06 (2) 06-07 (1) 05-07 (1)*
Caribbean, Central America & Northern Countries of South America	11-15 (1)** 07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	05-06 (1) 06-07 (2) 07-09 (4) 09-10 (3) 10-15 (2) 15-16 (3) 16-18 (4) 18-20 (3) 20-22 (2) 22-02 (1)	18-19 (1) 19-20 (2) 20-02 (3) 02-05 (2) 05-07 (1)	19-21 (1) 21-04 (2) 04-06 (1) 20-02 (1)* 02-04 (2)* 04-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	12-14 (1)** 07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	05-07 (1) 07-09 (2) 09-12 (1) 12-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 22-00 (2) 00-01 (1)	19-20 (1) 20-04 (2) 04-06 (1)	21-05 (1) 01-04 (1)*
McMurdo Sound, Antarctica	15-17 (1)	16-19 (1) 19-22 (2) 22-00 (1) 07-10 (1)	22-01 (1) 01-04 (2) 04-06 (1)	01-04 (1)

Time Zone: PST (24-Hour Time)
WESTERN USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Southern Europe & North Africa	08-11 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-12 (2) 12-14 (1) 22-00 (1)	19-22 (1) 22-00 (2) 00-01 (1)	19-22 (1) 20-22 (1)*

(Continued on page 80)

a monthly feature by

A. EDWARD HOPPER, W2GT

Awards

News of certificate and award collecting

The February "Story of The Month", as told by Lou:

Louis F. Wenisch, W9ZHD

All Counties #126, 4-19-75

Born in Newark, N.J. on July 16, 1929, Lou spent his early years in Union, N.J., and graduated from Newark College of Engineering in 1950 with a BSME.

Two years were spent in the Army, mostly at Fort Knox, Kentucky. That was where he got started in amateur radio, while attending the Radio Repair School. Daughter Karen was born in Fort Knox (and she is still a little gold brick, HA!!).

Lou enjoyed the electronics part of the world, so he put them together, mechanical and electrical, when he joined the Delco Radio Division of General Motors in Kokomo in 1953. While at Fort Knox he got the call of W4UUW and then got W9ZHD when he went to Kokomo.

In 1961 a move to Springfield, N.J. as he became a semiconductor sales engineer for Delco, and became WB2AHB for 7 years. It was during his sales calls that he met Bob, W2OST, and got hooked on County Hunting. Shortly after that, he got a TR-4 and a Hustler antenna, built his own power supply (using Delco transistors, naturally) and started giving out all the Counties as he drove through the Eastern States.

In 1969, he was transferred back to the home office in Kokomo, and was able to get the old call, W9ZHD, back (for $20.00).

They have a son, born in Kokomo in 1955, but he has no interest in ham radio (presumably familiarity breeds contempt), but Evelyn, the XYL, decided not to fight it, so she enjoys all their travels and does all the logging. Lou is afraid to let her get a license, as then he probably would be unable to get near the rig.

*P.O. Box 73, Rochell Park, N.J. 07662.

Special Honor Roll
All Counties

#157—Ed. Schellenberg, VE4EL 9-22-76
#158—Paul J. Kollar, W8CXS 9-27-76

He taught her how to bowl, and now she beats him.

As the last few Counties were being worked, he had help from Evelyn, who monitored the bands while he was at work. She would call him at work and he would rush to the mobile in the parking lot, and make the needed contact. Also, Don, WB9DCZ, during the daylight hours (he works nights) would keep track of the different mobiles for Lou. Finally, LeRoy, WAØLMK got the last one for Lou, Stevens, Minnesota, one Saturday morning on 40.

They went to their first convention in Knoxville, and haven't missed any since. Lou had the pleasure of MCing two conventions, and he feels that he enjoys the conventions each year about as much as the County Expeditions he has been on with such fellows as Jack, W9CNG and Bill, WA4LSU. Lou has given out several hundred Counties in 25 different States.

Collecting has slowed down quite a bit since he made them ALL, but he has another TR-4C and with his "double take" antenna bracket, Evelyn and Lou manage to give out a few Counties each vacation trip, which keeps them in contact with the finest bunch of individuals they ever had the pleasure to be associated with.

USA-CA Honor Roll

3000	2000	1000
VE4EL ..180	VE4EL ..264	WA5TPO 414
	KØITP ..265	VE4EL ..415
		KØITP ..416
2500	**1500**	**500**
VE4EL ..226	VE4EL ..310	CT1RM 1130
KØITP ..227	KØITP ..311	WB7AYN 1131
		VE4EL .1132
		W2MIG 1133

Awards Issued

Ed. Schellenberg, VE4EL, waited until he had them *all*, and then collected USA-CA-500 through USA-CA-2000 endorsed All S.S.B., All Mobiles, All 14 MHz; USA-CA-2500 *All* S.S.B.; and USA-CA-3000 and *All Counties* endorsed Mixed. The 4th *All Counties* to Canada, the others being VE3CBY #83, VE4QZ #143 and VE7ATI #133.

Paul Kollar, W8CXS after giving out so many Counties on his special Mobile trips and his QSO Party portable operations—found time to catch *All Counties,* endorsed Mixed. As you know, Paul does a lot of operating on c.w. as well as s.s.b. and has USA-CA-2000 endorsed All 2 Way C.W.

Bertha Swenson, KØITP added to her collection, USA-CA-1000 through USA-CA-2000 endorsed All S.S.B.,

Lou Wenisch, W9ZHD about to log some mobile contacts.

Carlos Orlando Rodrigues Almeida, better known as "Charlie", CT1BY and his nice set-up.

and USA-CA-2500 endorsed All A-3.

Bob Robertson, WA5TPO claimed USA-CA-1000 endorsed Mixed.

Adilio Fernando Conde De Pinno La-Salette, better known as "AD", CT1RM was issued USA-CA-500 endorsed All S.S.B. This is #6 certificate to Portugal.

Mixed USA-CA-500 Certificates went to:

Ed. Berzin, W2MIG. (Thanks for helping with my St. Vincent Award —data page 61, *CQ* September 1976).

Larry Sitton, WB7AYN (He is in Davis County, Utah).

Awards

The Mobile Amateur Radio Awards Club, Inc: As promised, here is data on more of their fine Awards. Their *Awards Custodian* is Jack Scroggin, W0SJE, 602 Jefferson Street, Lee's Summit, MO. 64063—also send *News-Letter Material* to Jack. *New membership applications* and *dues* go to Bob Dyson, K0AYO, Rt. 1, Box 230M, Desoto, Kansas 66018 (Dues is $4.00 per year which includes monthly *News-Letter).* MARAC Information HQ/QTH changes to Bertha Eggart, WA4BMC, P. O. Box 6811 Southboro Station, West Palm Beach, Florida 33405. For some genuine important data (big batch) send business size SASE with 35¢ postage

MARAC 50 Mobile Award

on it.

Worked All Counties USA Second Time: This special plaque available to all licensed amateurs everywhere in the world and is issued to them as individuals regardless of calls held or operating QTHs. All County contacts must be dated after the completion date of first time worked. Available to s.w.l. on heard basis. All contacts must be confirmed by QSL and QSLs must be in your possession. Any QSLs altered in anyway will disqualify the applicant. Independent cities, parks or reservations not acceptable for adjoining counties. There is no basic certificate, different classes, special seals or special endorsements. The walnut plaque, measuring 9 × 12 inches, will have the MARAC Mobile Car mounted on the bottom portion of the plaque. The plate on the mobile car will have the wording (In silk screen process) "Worked All Counties Second Time". A special en-

MARAC Merit Award

graved plate mounted top center of plaque will display the number of award, operators full name, call letters at time of application and the date of the achievement. Applications must be submitted in organized book form, showing states alphabetically and counties alphabetically under each state. Each county worked shall show call letters of station worked and date station was worked. Complete applications, certified by two (General Class or higher) amateurs, or by an official of your Radio Club, should be submitted to MARAC Awards Chairman, with a fee of $15.00 to cover cost. All MARAC Awards issued no charge to B/P.

Regular Members: Regular members of MARAC are issued billfold size membership cards. They may use the letters MARAC R followed by their issued number on their QSL cards. This counts 2 points for anyone working for the **Associate Membership Award.** If you are a regular member and have the Associate Award, use the Regular membership number on QSL cards.

Associate Award: Issued to any radio amateur (s.w.l. on heard basis) for working Charter, Regular, or Associate Members for a total of 100 points. Red Seal and ribbons for 250. Blue Seal and ribbons for 500. Gold Seal and ribbons for 1000. Use the letters MARAC A followed by issued number on your QSL cards. This counts 1 point to any amateur or s.w.l. working for the Associate Award. Fee $1.00.

M-50-M Award: Issued to any amateur (s.w.l. on heard basis). Work mobiles in all 50 States, from fixed, mobile, portable or combination of such. Original Award for 48 States. Red Seal and ribbons for 49. Blue Seal and ribbons for 50. Gold Seal and ribbons for working all States mobile to mobile. Fee $1.00

YL Mobile Award: Issued to any amateur (s.w.l. on heard basis). Work 5 or more YLs or XYLs or combination of such while they are operating mobile in a total of 50 different counties. They may be worked from mobile, fixed, portable or combination of such. Red Seal and ribbons for 100 countries. Blue Seal and ribbons for 200. Gold Seal and ribbons for 500. MARAC Plaque for 1000. Fee $1.00. Be sure to list alphabetically by States and Counties.

MARAC DX Mobile Award: Issued for working 25 DX countries while operating mobile. Red Seal and ribbons for 50 DX countries. Blue Seal and ribbons for 75, Gold Seal and ribbons and MARAC Plaque for 100. Fee $1.00, Plaque compliments of MARAC. Current ARRL countries list honored. Contacts will be accepted while DX station is operating fixed, mobile or portable. Mobiles working for this award may be operating from any location or with any assigned call. Aeronautical or maritime should be within the territorial limit of country given.

MARAC Last County Award: (1st Category) Basic Award issued to any station giving last county to finish a particular State. Red Seal and ribbons second time. Blue Seal and ribbons third time. Gold Seal and ribbons fourth time. Same county and State may be given each time. Send application and mobile reply card signed by recipient stating facts for verification. Award can be repeated. Basic fee $1.00

MARAC Last County Award: (2nd Category) Basic Award with all seals and ribbons, plus MARAC Mobile Plaque issued any station giving last

(continued on page 75)

a monthly feature by

FRANK ANZALONE, W1WY

Contest Calendar

News/views of on-the-air competition

From the activity heard during our phone contest last October I would venture to say that we have another record breaker. This in spite of the spotty conditions, fair on Saturday, not so good Sunday.

It seemed that almost every island in the Carribbean had a Contest Expedition station going full blast, especially the multi-operator groups. There was activity on every band, 10 thru 160. There were expeditions out of other areas too of course but operating in the Caribbean seems to be the thing.

I am critical of one thing however, the infrequent identification by some of the more active stations who ran off a dozen or more contacts without once signing their call. I heard many instances of "what's ur call?" from stations waiting to find out, not knowing if they had already worked the guy or not.

It not only adds more confusion to the already out-of-control pileup but makes for a questionable type of operating.

My operating time was limited and my signal not competitive but I got a big charge from the many "Hi Frank" greetings I received from stations I did manage to raise. My apologies for not remembering your names, but your calls were familiar. Good to run across you each year.

73 for now, Frank, W1WY

ARRL DX Contest

Phone: Feb. 5-6 and March 5-6
C.W.: Feb. 19-20 and March 19-20
Starts: 0001 GMT Saturday
Ends: 2359 GMT Sunday

This will be the 43rd year for this event making it the granddaddy of all contests.

DX stations will be working the W/K and VE/VO on all bands, who in turn will be digging for DX.

The modified rules used the previous two years have worked out so well that the same format will be used in this year's competition.

Single operator stations will now compete in one of three catagories: All Band, High-Band (10, 15 & 20) and Low-Band. (40, 80 & 160) Multi-operator stations, single and multi transmitter, All Band only. Phone and c.w. are separate contests.

Exchange: RS(T) plus state or province for W/K and VE/VO. RS(T) plus 3 figures indicating power input for DX stations. (KH6 & KL7 considered DX)

Scoring: Three points for each completed QSO on each band. W/VE multiply total by the number of DX countries worked on each band for their final score. DX stations use the 48 continental states and VO, VE1-VE8 for their multiplier. A possible 57 per band.

Awards: Certificates to the top scoring single operator station in each category, in each country and each U.S. and VE ARRL section. Awards to multi-operator stations, single and multi, will be made in each W/VE call area and DX country. In addition, DX stations making 1000 or more QSOs will also receive a certificate. Plaques to continental single operator leaders.

There is also a Club competition. Better check QST for details on this and the disqualification criteria.

Log forms and check sheets are available from ARRL, include a large s.a.s.e. for fast delivery.

Mailing deadline for your contest entries is April 18th to: ARRL Communications Dept., Newington, Conn. 06111.

QCWA QSO Party

Starts: 2300 GMT Friday, February 11
Ends: 2300 GMT Sunday, February 13

The 20th Annual Qso Party will be

The other side of Sam Edelman, UA9AN. Sam has always been identified as the guiding light of the super multi-operator stations UK9AAN and UK9ADT of the Chelyabinsk Politechnical Institute, winners of several world trophies. Sam is an instructor at the institute, here however we see him in the unfamilar surroundings of a childrens playground with his one year old son Maxim.

Calendar of Events

*Jan.	8-9	YU 80 Meter Contest
Jan.	8-9	ARRL VHF Sweepstakes
*Jan.	15	"Hunting Lions" Party
*Jan.	15-16	DL QRP C.W. Contest
*Jan.	15 & 23	RTTY Flash Contest
Jan.	15-16	ARRL CD C.W. Party
Jan.	22-23	ARRL CD Phone Party
***Jan.**	**28-30**	**CQ WW DX 160 Contest**
*Jan.	29-30	French C.W. Contest
*Jan.	29-30	Classic Radio Exchange
Feb.	5-6	ARRL DX Phone Contest
Feb.	5-13	ARRL Novice Roundup
Feb.	11-13	QCWA QSO Party
Feb.	12-13	10-10 Net QSO Party
Feb.	12-13	New Hampshire QSO Party
Feb.	19-20	ARRL DX C.W. Contest
Feb.	19-20	YL—OM Phone Contest
Feb.	26-27	French Phone Contest
Mar.	5-6	ARRL DX Phone Contest
Mar.	5-6	YL—OM C.W. Contest
Mar.	19-20	ARRL DX C.W. Contest
Mar.	**26-27**	**CQ WW WPX SSB Contest**
Mar.	26-27	BARTG Spring RTTY
Apr.	12-13	DX-YL to W/VE-YL C.W.
Apr.	16-17	ARRL CD C.W. Party
Apr.	23-24	ARRL CD Phone Party
Apr.	26-27	DX-YL to W/VE-YL Phone

*Covered last month.

*14 Sherwood Rd., Stamford, Conn. 06905.

sponsored by the So. California Chapter this year. The rules have been streamlined by this year's chairman, W6IL.

Only contacts between members have any point value and contacts with nets are invalid. The same station may be worked once only, c.w. or s.s.b., regardless of band.

Exchange: QSO no., QTH (state, province or country), name and QCWA membership number.

Scoring: One QSO point for contacts between members in Canada, Mexico and U.S. and possessions. (KP4, KV4, KZ5) Two points if its with QCWA Memorial station W2MM/6. Foreign members will get 5 points for contacts outside own country, including W2MM/6.

Multiplier: One for each state, province, U.S. possession, DX country and VK call area worked.

Final Score: Total QSO points × sum of the above multiplier.

Frequencies: C.W.—1815, 3550, 7050, 14050, 21050, 28050. Phone—1815, 3950, 7250, 14250, 14290, 21350, 28650. (plus or minus 10 kHz)

Logs: Log sheets should be columned as follows: QSO no. exchanged, date/time in GMT, station worked, QTH, Band, Name, QCWA membership no. and two columns for QSO and multiplier points.

Awards: There are two plaques. The winner will be awarded a plaque, in addition to having his name and call inscribed on the former rotating plaque, which Headquarters will display at Conventions. The Top Ten scorers will receive certificates. And of course the "Worked 100 Members" and other QCWA certificates are always available.

Logs go to: Ralph Cabanillas, Jr. W6IL, 2359 Creston Drive, Hollywood, Calif. 90068. Entries should be mailed as soon as possible as the deadline for mailing is February 20th.

Ten-Ten Net QSO Party

Starts: 0000 GMT Saturday, February 12
Ends: 2400 GMT Sunday, February 13

This is the Winter QSO Party of the Ten-Ten International Net of Southern California. Its open to all amateurs but non-members are not eligible for awards. However they are encouraged to submit a log and apply for membership. Details can be had from K5MRU.

Activity is on 10 meters only, use any mode but one contact only with the same station.

Exchange: Name, QTH, and 10-10 membership number if a member. Include chapter name to credit score to your chapter.

Scoring: For members, 1 point for each QSO, add another point if its with a 10-10 member. (max. of 2 points)

Awards: 1st and 2nd place certificates in each U.S. call area, KH6 & KL7, and each VE province. Also to 11 continental and sub-continental areas over the world.

Complete results will be published in the *10-10 Net Bulletin.*

Logs and application for membership go to: Grace Dunlap, K5MRU, Box 445, La Feria, TX 78559. Mailing deadline March 31st.

New Hampshire QSO Party

Two Periods GMT
2000 Sat. Feb. 12 to 0500 Sun. Feb. 13
1400 Sun. Feb. 13 to 0200 Mon. Feb. 14

Sponsored by the Concord Brasspounders, W1OC, this one was organized to promote the Worked New Hampshire Award.

The same station may be worked once on each band and mode, and New Hampshire stations may work each other.

Exchange: RS(T) and QTH, county for N.H. stations, ARRL section or country for others.

Scoring: N.H. stations score 1 point per QSO, times the number of (ARRL sections + DX countries + N.H. counties) worked.

Others score 5 points per N.H. QSO, times the number of N.H. counties. (max. of 10)

Frequencies: C.W.—1810, 3555, 7055, 14055, 21055, 28130. Phone—1820, 3935, 7235, 14280, 21380, 28575. Novice—3730, 7130, 21130, 28130. v.h.f.—50.115, 145.015 Simplex.

Awards: Certificates to the Top scorers in each N.H. county, state, VE province and DX country. (min. of 50 points) And the WNHA certificate if all 10 counties are worked.

Mailing deadline is March 14th to: Concord Brasspounders, Inc. Att: C. Halloway, 9 Via Tranquilla, Concord, N.H. 03301. Include a s.a.s.e. for results and/or an award.

French Phone Contest

Starts: 0000 GMT Saturday, February 26
Ends: 2400 GMT Sunday, February 27

Some changes have been made in the original copy of the rules (January Calendar) but received much to late for the announcement of the c.w. section of the contest.

Note the new starting and ending times. The contest has been extended to 48 hours, however only 36 hours of operating time is allowed during the 48 hour contest period. No mention was made as to how the off periods are to be taken.

The multiplier remains the same for contacts made on 80, 40 and 20 meters, 1 point for each French Dept. and etc. worked on each band. However on 15 meters your multiplier is now worth 3 points, and on 10 meters it is now worth 5 points. (F6REF and F8REF also count as a multiplier)

You add the total scores from each band for your Final Score.

Everything else remains essentially the same.

(I think the REF was ill advised to make major changes after the original rules had been released. They should have used better judgement.)

Logs go to: REF Traffic Mgr., Lucien Aubry, F8TM, 53 rue Marceau, 91120 Palaiseau, France.

YL-OM Contest

Phone: Feb. 19-20 C.W.: Mar. 5-6
Starts: 1800 GMT Saturday
Ends: 1800 GMT Sunday

Its the YLs working the OMs in this annual contest organized by the YLRL. All bands may be used but cross-band or Net contacts do not count.

Exchange: QSO no., RS(T) and ARRL section or country. (See QST for section list)

Scoring: One point per QSO. Multiply total by number of ARRL sections and countries worked for your final score. The same station may be worked once only regardless of band.

There is also a power multiplier of 1.25 for stations running 150 watts or less input on c.w., 300 watts p.e.p. if on s.s.b. Multiply your final score by above factor.

Phone and c.w. are separate contests and require separate logs.

Awards: Certificates to the highest scoring YL and OM in each U.S. and VE call area and in each country. There are also 4 Trophies for the top YL and top OM in each contest. And 2nd and 3rd place certificates for the runner-ups.

Logs must be mailed by March 24th and received no later than April 18th. This year they go to: Carol Bourne, WA9NEJ, 362 Hawthorne, GlenEllyn, Ill. 60137

(It is interesting to note that the dates of this activity are on the same week-ends as the ARRL DX contests, same as last year. Evidently this arrangement worked out OK and sets an example for future activities where different modes are used for contests on the same dates. Ed.)

Winners in the 1976 YLRL "Howdy Days" Party are WA6WZN (member) and LX1TL (non-member) ■

Zero Bias (continued from page 5)

computers and the like. They're the first on the block with all the latest jargon and equipment that literally astounds and confuses their family and friends. They may be looked on as sort of odd by some people but still within the ranks of amateur radio they can find a "home and friends" who speak their language.

Then again, suppose you're not interested in world affairs or what's going on today on Mars. There are modes and aspects of amateur radio that are tailor made for your interests. The wonderful part of amateur radio is that you're not stuck with just so many channels, a few types of film, or only a copy of the inverted airmail stamp. It's all out there and more for as much or as little as you want.

I Think We've Made It

Some of you might also experience something new receiving your monthly copy of CQ. The February issue is likely to be available slightly before or around the same time as the January issue. Before you sit down and write irate letters or reach for the phone let me explain.

The January issue and the February issue were printed by two different printers with two different schedules. The February issue is on an earlier schedule to allow for newsstand distribution during the month of January. This meant that here at CQ we all went crazy trying to put out two issues at the same time with the February issue just a little ahead of January.

Editorial Responses

I've begun to receive some responses to my editorials which were aimed at calling both the FCC and the ARRL to task. Although so far they range about 50/50 for and against, I am heartened by the response. The anti letters seem to be a little strange in that they call me to account for fighting the best thing to happen to amateur radio since Mr. Maxim. Well, all I tried to do and will continue to do is speak out and fight against getting ripped off. There aren't too many people who seem to like getting ripped off by either government or private enterprise but if you are one of them . . . enjoy. I don't, and judging by my mail, many of you don't.

I can't promise to answer your letters, but I do like to receive them. So if you have anything to say about what I have written, either for or against, let me know.

73,

Alan, K2EEK

LPQA *(from page 51)*

MHz through 30 MHz, and is typically about 10 pF. A small neutralizing reactance would facilitate achieving a low s.w.r. against 50-ohm coax throughout the normal operating range (6-10 mHz) and at higher frequencies through 30mHz. The figures show resonance at 16 different frequencies, ranging from 2.95 MHz through 30.3 MHz, plus a near-resonant condition around 6.9 MHz.

In using these findings to design other versions of the LPQA, the impedances could be "managed" in several different ways:

- The impedance of the open-wire line could be varied;
- The array could be fed from a point other than the theoretical apex;
- The impedance of individual elements could be varied by using multiple conductors;
- A 1:1 or even 1:4 balun could be used in place of the 4:1 balun;
- An open-wire feed could be used with an antenna coupler;
- Operation could be based on loops open, opposite the feedpoint, as is the case with some quad arrays.

The broad resonances above 24.7 MHz show the possibility of broadband arrays using elements which have a full-wave resonance at a subharmonic of the operating frequency.

The comparitively broad and noncritical tuning of the LPQA lends itself to the design of a wide variety of broadband directional arrays with good matches to readily available transmission lines.

Results

The array has been used for the past six months in monitoring SWBC transmissions from the Middle East. My receiver and tape recorder are operated by a timer, and I later remove the tapes and listen to them while commuting. This array has been far superior to the ones I had previously used—including a sloper and a bobtail bidirectional broadside curtain—in providing a strong, steady signal for tape recording.

On 40 meters, good results have been obtained in working European stations. I seem to be one of the earliest stations west of the Eastern seaboard to hear and work Europe. North American QRM, other than from VE1-VE2 and W1-W2 areas, appears to be attenuated to a worthwhile degree.

The design parameters chosen for this array were conservative. By increasing the and/or spacing, considerably higher gain can be achieved. Although the array is not small, it has not turned out to be troublesome to raise and maintain, except for getting the main support lines up and clear. Similar arrays for 80 or even 160 meters would not be unreasonable. For MARS use, or if additional hambands become available, the LPQA's broadband characteristics offer many advantages.

I would appreciate hearing from others who construct LPQA's. ■

The Powerlarm *(from page 47)*

larm is most useful. An intruder may pull the main switch to your house so that he can disconnect power being supplied to lights or various security guards which do not have a no-break power supply. A glance out the bedroom window to see if any other lights are visible will help establish whether the power outage is local or covers a neighborhood area. At any rate, you are forewarned.

The Powerlarm also serves a useful function when trying to locate a circuit breaker or fuse which controls a specific outlet you wish to disconnect in order to work on it. Plug the Powerlarm into the outlet and switch off the circuit breakers one by one until you hear the buzzer sound off. And if you plug the Powerlarm into the same receptacle as your deep freeze, you'll be able to tell when you've lost power to that unit. You may not notice for days that the external freezer panel light has gone out and that could mean the possible loss of all your frozen food and meats as the temperature rises above the safe deep freeze point.

The Powerlarm can be left plugged in permanently and dissipates about 3 watts power, the same as an electric clock. The Powerlarm can be easily assembled in an evening for a total cost of under $6.00. It only has to work once to pay for itself many times over. ■

On A Clear Day *(from page 46)*

that 'sneaky' — in your actions, I should say that you have been where things of great interest and dramatic impact have been occurring. Would you care to tell me what they were?"

"I guess you might say that I have been at the site of our newest 'repeater.' Now speaking of repeaters . . . we have a pretty active one in the basement. You might tell Thumbs what you told me about having to be up high to really produce, though. She doesn't know that."

"You mean she's . . . ?"

"Yes, she's! I have just come from the OB Ward. Several little feline offsprings have begun to appear there. There are certain traditional results from over-socializing on fox hunts, you know. You might say it was 'CFAR' all the way, too . . . Cute Felines Arriving Rapidly, Get it? When I left, things were what you in that 'Q Code' would call about 'ten four.' But things were happening pretty fast. She had an awful lot of help on that Fox Hunt. From what I saw, I think you'll be able to get on that other repeater and tell them that it looks like W9LC will soon be up to Ten *Twenty!*" ■

S.S.B. Theory *(from page 43)*

to the transmitter's abilities to reduce the carrier and unwanted sideband. Also, the terms "upper sideband transmission" and "lower sideband transmission" refer to which sideband the transmitter does not reject.

It is, however, not my purpose in writing this article to go into great detail about the actual makeup of single sideband systems. I do hope that, in presenting this alternate explanation, I may have shown that single sideband theory isn't completely senseless. ■

Multi-Band Traps *(from page 30)*

$jX_{in\ (1\ 2)}\ f_{low} = -jK_m \text{ cotan } 84° = -jK_m\ (+0.105)$ ohms

Plugging in our respective K_m's for the two monopoles, we get,

$jX_{in\ (1\ 2)}\ f_{low} = -j560.32(+0.105) = -j58.834$ ohms

$jX_{in\ (1\ 2)}\ f_{low} = -j340.10(+0.105) = -j35.710$ ohms

Recalling that a linear antenna seems to act, at least in terms of its impedance behavior with frequency within a *single ham band,* like a series LC circuit, we see that we indeed obtain a capacitive reactance on the low frequency side of resonance like that predicted for such "circuit." At the high frequency band limit of 4.000 MHz, the frequency proportionality is now 4.000 MHz/3.750 MHz, so our analogue line length h° becomes 1.067 × 90°, or 96.000 electrical degrees. Now equation (1.0-3.) tells us,

$jX_{in\ (1\ 2)}\ f_{high} = -jK_m \text{ cotan } 96.000°$

$= -jK_m\ (-0.105)$ ohms

On the high frequency band limit the sign of

cotangent 96.000 degrees flipped sign on us in the trig tables, so that minus times minus operation gets us,

$jK_{m\ (1\ 2)}\ f_{high} = -j560.32(-0.105) = +j58.834$ ohms

$jK_{m\ (1\ 2)}\ f_{high} = -j340.10(-0.105) = +j35.710$ ohms

Again, these inductive input reactances at the high frequency band edge look broadly ok as predicted from the series LC circuit idea. But notice a funny thing: the fat conductor monopole of $K_{m\ (2)}$ equal to 340.10 ohms gives us less input reactance at either band edge than that obtained for the skinny wire conductor monopole. Let's see what this means in terms of v.s.w.r. in the fifty ohm coax feeding our two monopoles on Eighty meters.

Oh oh! One reader just shouted, "Wait a darn minute there, OM! Those pure reactive impedance answers will give a v.s.w.r. ratio of infinity-to-one in that feed coax!" That reader is so right, but it was said we were being sneaky here. When we started out we just threw away the radiation resistance R_r of the monopole, and the ohmic QTH loss $R\Omega$. How could we get away with such a high-handed trick? Well, over the total frequency width f_{high}, f_{low} of any assigned h.f. amateur band, the radiation resistance R_r and ohmic loss $R\Omega$ change so little in value that we can regard them from a *practical* viewpoint as constants. It is only the jX_{in} reactive part of the antenna's complex input impedance which flies all over the place, madly changing value if we change r.f. frequency, change antenna conductor diameter, change guy wires, etc. You name it! It is the reactive part which we have to be mighty careful about in our antenna design in order to make our sky wires put out optimum strength signals on the air.

(To Be Continued)

CQ Reviews *(from page 25)*

but no doubt their life would be extended by keeping the input to no higher than 160 watts on c.w.

Keying characteristics are very much to my liking —just hard enough to make for good copying without any key clicks being evident. A.l.c. action on s.s.b. is effective, requiring considerable carelessness to splatter one's neighbors.

Harmonic radiation is rated by Kenwood at better than 40 db down from the output signal. Measured harmonic levels varied from 47 db down to 52 db down, depending on band. Carrier suppression was 48 db down and sideband suppression was 56 db down. Pretty good figures in anyone's book.

The r.f. speech processor operates at a frequency of 455 kHz. It is definitely effective, and can make the difference between solid and partial copy under crowded band conditions. Kenwood claims a low distortion level for this system, which is true. They also claim that it will not deteriorate the tonal quality of the voice. This claim is also true up to about 10 db of compression level.

Beyond that level, tonal quality changes drastically. Friends with whom you communicate regularly may find the change so drastic that they will ask you to turn off the processor. I have not found any r.f. processor unit that I did not find objectional as regards tonal quality at the higher compression levels. I say this so that you won't think I'm picking on Kenwood. If you are using some r.f. processing now, it may explain why your friends think someone is bootlegging your call.

Is the TS-820 worth the money? Yes, indeed, comparing features versus price, it's a good value in today's market. Would it be worth my trading in a TS-520 to get it? Yes and no, depending on your style of operating. I personally have a love affair with my TS-520. While some of its shortcomings have been eliminated in the design of the TS-820 and the latter has some luxury features that are not available with my TS-520, the TS-520 is more than adequate for my operating habits. A little s.s.b. and a little c.w. in moments of relaxation is my style. If I were an ardent DXer or contest operator the extra edge afforded by the TS-820 design would be worth every dime. If you choose the TS-820, rest assured you will not come up a loser. ■

Trindade Island *(from page 19)*

noise; even our frequent schedules with PY2FIQ in Sãn Paulo were unsuccessful. Our maximum hourly contact rate on 20 meters reached 200 QSOs per hour on voice and 150 contacts per hour on code.

Band openings to certain regions, notably the Western United States and Oceania, were severely limited. Nevertheless, a moderate number of contacts were made with stations in these areas. Unfortunately, because of our unexpectedly early arrival and departure, many DXers "missed the boat." Our abrupt disappearance caused considerable concern and speculation about our fate amongst DXers. The rumors, we are told, ran the gamut from rig failure to a shipwreck and similar catastrophies.

In addition to the aforementioned accomplishments of the DXpedition, I should point out a few of our more dubious distinctions. We spent more than six days on a ship for less than one day of operation. We both acquired mild sunburns *and* mild colds. I learned three words of Portuguese: *obrigado* (thank you) and *cinco-nove* (five-nine). And finally, we have gained enough memories to last a lifetime.

In concluding, we would like to say *obrigado* to the following people for their valuable assistance: PY1CGM, PY2QY, PY1AFA, PY1DMQ, Lucia Alves, the Brazilian Navy, the Commander of Trindade, the authorities of Dentel, and Rolf's XYL, Kitty. We are both eager to return to Trindade for an encore. ■

SSTV Overview *(from page 60)*

with SSTV. However, if you can afford it, I would recommend getting a Robot Model 400 Scan Converter, a fast scan camera, and a fast scan monitor. A "used" Robot Model 300 Scan Converter would be another good possibility. There is essentially no difference between the 300s and 400s so far as receiving adjustments are concerned. However, the 400 is definitely easier to adjust for picture TRANSMISSION.

Any Other Comments?

Yes, this winds up my description of SSTV in general, and the commercially built equipment available in the United States today.

If you have any questions that you would like answered, please send them along with an SASE to 2112 Turk Hill Road, Fairport, N.Y. 14450.

This article will conclude in an early issue with Part 3, dealing with operational procedures.

Awards *(from page 68)*

county to finish All States. Application with mobile reply card signed by recipient for verification. Fee $7.50. As an expression of his gratitude, recipient should apply for the award and plaque for the station.

Merit Award: This award with Gold Seal issued free to any amateur upon recommendation of any MARAC member. If in your opinion any amateur has contributed some outstanding service to amateur radio, write to Awards Chairman, stating facts. The information will be presented to MARAC Executive Board for action. This award also issued each year to 1st and 2nd runners-up for "Best Net Control" and "Best Mobile" of the year.

MARAC Mobile Plaques: This is a three dimensional walnut auto plaque with Hustler type antenna. Two plaques are issued free each year. One for "Best Net Control", one for "Best Mobile". Selection is made by a MARAC Membership vote. The "Best Net Control" and the "Best Mobile" can be won only once by the same amateur. Pertinent information is engraved on plate mounting on side of plaque. Remember, Awards Custodian is Jack Scroggin, WØSJE.

Notes

January began my 13th year with *CQ*, million thanks to *ALL* of *YOU* for your fine support. It has been fun and I hope you can put up with me for a long time, yet!

In my "Story" about Lou, W9ZHD, I failed to mention that Bill, WA4LSU became a Silent Key August 24, 1976.

73, Ed., W2GT.

HAM SHOP

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THE BOOK "CQ YL" has been updated again with a new supplement bringing the YLRL Officers section up to date through 1977, plus a report on the 7th International YLRL Convention held in Houston in June '76. If you have a copy of "CQ YL" and would like to add the new supplement (the pages are "slotted" so they can be inserted directly into the book's spiral backbone), drop a note with your request to author/publisher W5RZJ, Louisa Sando, 9412 Rio Grande Blvd., N.W., Albuquerque, N.M. 87114. Please enclose $1.00 to cover cost of printing and mailing. The one and only book about YLs in ham radio, "CQ YL" contains 23 chapters, over 600 photographs. Order your autographed copy, or a gift copy, from W5RZJ, $3.50, postpaid.

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SELL OR TRADE original Marconi wireless drawings 1899-1920, Works of art. 213/472-2444. L. C. Silvern, K6RXU, Box 49899, Los Angeles, CA 90049.

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HEATH SB303/401, SB600, SB630 Station Console, $675 You Ship or I Deliver w/in 100 miles. (414) 255-2291. W.T. Free, W9NDS, W168 N9241 Grand, Mendmonee Falls, WI, 53051.

MANUALS WANTED for Knight T-150A, Hammarlund HQ-110C, and Heath HW-30 (Twoer) to buy or photocopy. WD8BRF, Bob Hajdak, 1834 Paisley St., Apt. 12, Youngstown, OH 44511. (216)792-1860.

HELP - Need Manual on Heathkit RF Signal Generator Model no. SG8, John Dyrek, RR1 Box 406, Monon, IND 47959.

WANTED: Knight TR-168 2M Xceiver W/FM Converter, C. Huth, 1233 1/2 W. State, Fremont, OH 43420.

WANTED: Will pay $25 for Autek QF-1 audio filter. Don Erickson, 6059 Essex, Riverside, CA 92504. (714) 687-5910.

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HALLICRAFTERS S20R Rec $35, Heath AF-1 Audio Frequency Meter $20, 30-50 mc FM Motorcycle radio $10, HP-525B 100-220 mc $35. K6KZT, 2255 Alexander Ave., Los Osos, CA 93402.

SWAN FM-1012-A with Swan Supply, Load with Xtal combinations $175.00, WB6VNR, 213-346-5871.

HALLICRAFTER 101-A, $100 and S95 Civic Patrol $18.00. National 188 Gen. Rec. $75.00 Deliver within 100 miles. Hamilton, 6050 North Oakley, Chicago, IL 60659.

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ADVERTISER'S INDEX

Our Readers Say (from page 10)

UA FAX PICS

Editor, CQ:

Since the time of publication of my article entitled "Sleuthing the Russian Weather Satelite" (Oct/Nov. '76) there have been significant developments. I feel that this makes appropriate the enclosed Postscript to the article and the enclosed satellite print. I trust that you too will be glad for the addition which makes the article currently meaningful.

POSTSCRIPT

In early July the satellite thought to be Meteor 23 apparently started rolling in orbit and was turned off. Also in early July Ken got two negative pictures (off an unmodified surplus RD-92 fax) from a 240 line satellite on 137.165 MHz but it was heard only twice despite intensive monitoring by all three of us so no other parameters were obtained.

It seems most probable that this too is a Russian satellite but for the present we designate it as UFO-16 - Unidentified Flying Object with a 16 line sync train.

The negative "burn-off" print outs Ken sent were photographed with Agfachrome to make negative transparencies, which in turn were used as negatives in an enlarger to produce positive prints, one of which is shown in the enclosed picture. The digital telemetry readout to the left of the picture, i terspersed with greyscale indicates something of the degree of sophistication of the satellite design. We can only hope that this or a similar satellite will soon be activated for worldwide operation.

Lindsay R. Winkler, W7AVE
Walla Walla, WA

Point, Counterpoint

Editor, CQ:

I could not help but think that one of the popular manufacturers of VHF antennas has finally fooled someone into believing that a vertical dipole has more gain than a vertical "groundplane" Mr. Cogburn, K5VKQ, states that his coaxial vertical dipole has 3 dB gain over a quarter wave vertical with radials in a recent CQ article. Perhaps he is confusing the fact that a half wave vertical worked against an image plane has about 2 dB of gain with reference to a quarterwave vertical worked against the same image plane.

When the feedpoint of a vertical dpole (half-wave) and a quarterwave groundplane are at the same height above RF ground, their gains are exactly the same. In practice, this might need to be modified by possible feedline radiation, but either antenna might be the benefactor of this problem.

The series of articles by Lee which appreared in CQ a few years ago (and now available as a book) are recommended for anyone contemplating the mysteries of vertical antennas.

Terry Conboy, WB6GRZ/WA7DOX
Redwood City, CA

LETTER FROM AUTHOR

Although rigid treatment of antenna radiation patterns require considerable mathematical expertise, some aspects of similar antennas can be discussed using proportions. The vertical quarter wave radiator operating over an infinite ground with its image system is similar to the half wave antenna in free space with one exception. The impedance of the half wave (at it's center) is 72Ω and the impedance of the quarter wave antenna (between one end and ground-the systems hypothetical center) is 36Ω . Since the field intensity of an antenna is proportional to the antenna current and since the power radiated by the antenna is $P = I^2 R$, for two antennas of equal power differing by an impedance of 2 to 1, the relationship between antenna currents will be $\sqrt{2}$ to 1. Since the field strength is proportional to the antenna current and since the quarter wave radiator over ground is a half wave antenna, (with its image system) differing from the half wave antenna in free space by input impedance, the gain relationship between the two antennas is found as:

$$db=20 \log \frac{E_1}{E_2} \text{ or}$$

$$db= 20 \log \sqrt{2}=3.$$

The quarter wave vertical over an infinite ground produces a 3 db gain over that of a dipole in free space (Theory and Design of Directional Antennas by Carl E. Smith).

But now consider the comparison between a quarter wave vertical antenna above an infinite ground and a quarter wave radiator above a small ground surface such as that of a ground plane antenna operating in free space. Since the infinite ground is necessary to generate the image system, the field intensity for the ground plane antenna in free space is half of that of a quarter wave vertical radiator over an infinite ground (Antenna Theory and Practice by Friis and Schelkunoff). This can be more easily understood by considering the area of influence for the two antennas. The area of influence for the quarter wave radiator in free space is a sphere and the area of influence for the quarter wave vertical radiator over ground is a hemisphere. Since the area of influence for the antenna over ground is half of that in free space the field intensity would be doubled. Then:

$$db=20 \log \frac{E_1}{E_2} = 20 \log 2=6.$$

The quarter wave vertical radiator over ground has a 6 db gain over that of a same length antenna in free space. Comparison between the half wave antenna in free space and the quarter wave radiator in free space now shows that the half wave radiator exhibits a 3 db gain over the quarter wave radiator. Note that the ground plane for the quarter wave in free space does not affect the radiation pattern except in very near proximity to the antenna since an infinite ground plane is necessary to generate the image system.

In a similar manner, since the effect of ground on the impedance of the vertical half wave antenna is negligible for distances greater than one quarter wavelength (Antenna Theory and Practice by Friis and Schelkunoff), the vertical half wave antenna over an infinite ground will exhibit a 6 db gain over the half wave antenna in free space giving the vertical half antenna over ground a 3 db gain over the quarter wave vertical over ground.

The half wave vertical antenna using either center feed (dipole), shunt feed or series feed and the 5/8 wavelength radiator have both been used to obtain a gain over the quarter wave vertical by reduction of the angle of radiation. The optimum is just short of 5/8 wavelength (actually .622 λ). Some manufactors advertise 3.4 db gain for their 5/8 wavelength antennas. Although vertical dipoles have not experienced appreciable interest in the amateur ranks, they have been used sucessfully for many years by the two way communications industry.

Onis Cogburn
Bryan, TX

A.M. Anyone?

Editor, *CQ*:

Having recently passed my General Exam I want to do some phone work. Although I do not own any s.s.b. equipment I do have a good 90 watt c.w./a.m. set. I would like to hear from anyone wanting to work some a.m. Perhaps an a.m. net?

Richard A. Schmidt
1290 H3E
Mountain Home, Idaho 83647

DX *(from page 64)*

active near 14030 around 0100-0200 GMT.

Zones 18 and 19—Both are fairly rare. On c.w., UA9UF, 14031 at 0235 GMT, passes out Zone 18 contacts while Zone 19 is activated by UAØ-ZBT, UKØCBE, UKØFAA and UKØZAF on the low end of 20 meters. On s.s.b., Zone 19 stations UAØKAH and UVØEX have been heard in the 14200-220 band segment.

Zone 34—Stations in Egypt and the Sudan are still the best bet, but it is rumored that an Argentine DXer will operate from 5A-Libya in December. Libya has been a very rare country for DXers since Wheelus Air Force Base was closed several years ago.

QSL Information

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FL8JC—To P.O. Box 1205, Djibouti, Fr. Somaliland
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FO8EX—To F6AUZ
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FW6CO—Via Michel Pierron, c/o Hihifo Airport, Wallis Island, Pacific Ocean
GC5BTN—To F6DLA
HM2JN—c/o P.O. Box 3481, Seoul, Korea
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HZ1AB—To WA4OQO
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JTØOAQ—Via UY5LK, P.O. Box 88, Moscow, U.S.S.R.
JY9AD—To P.O. Box 3101, Amman, Jordan
JY9CR—c/o P.O. Box 2788, Amman, Jordan
K4IIF/C6A—Via W4KA, 1044 Southeast 43rd St., Cape Coral, FL 33904
KA6AM—To P.O. Box 22427, APO San Francisco, CA 96230
KCºWD—c/o WB9DDF
KG6SZ—Via JA1MEX
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6W8FP—To WA3NCP
7X2EPM—c/o P.O. Box 200, Algiers, Algeria
8J2HAM—Via Japan Amateur Radio League, P.O. Box 377, Tokyo Central, Tokyo, Japan
8P6BN—To VE3GMT
8R1CB—c/o W2MIG
8R1J—Via P.O. Box 557, Georgetown, Guyana
9G1KL—To P.O. Box 1332, Kumasi, Ghana
9H1EL—c/o P.O. Box 575, Valletta, Malta
9J2LC—Via I4UVA
9K3TC—To P.O. Box 71, W.I., CH-9500, Switzerland
9L1BH—c/o SM3CXS
9L1JM—Via W4BAA
9N1MM—To W3KVQ, 539 Fairhill Drive, Churchville, PA 18966
9Q5DM—c/o WB5OAV 73, John, K4IIF

Propagation *(from page 66)*

Northern & Central Europe & European USSR	08-10 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-12 (2) 12-13 (1) 22-00 (1)	19-21 (1) 21-22 (2) 22-23 (1)	19-22 (1) 20-22 (1)*
Eastern Mediter-ranean & Middle East	08-10 (1)	07-10 (1) 10-11 (2) 11-13 (1) 22-00 (1)	18-21 (1)	18-20 (1)
Western Africa	09-10 (1)** 08-09 (1) 09-12 (2) 12-14 (1)	05-07 (1) 07-08 (2) 08-11 (1) 11-13 (2) 13-15 (3) 15-16 (2) 16-18 (1)	18-22 (1)	19-21 (1) 19-21 (1)*
Eastern & Central Africa	09-11 (1)	06-08 (1) 11-13 (1) 13-15 (2) 15-16 (1)	18-21 (1)	18-20 (1)
Southern Africa	09-11 (1)** 08-10 (1) 10-13 (2) 13-14 (1)	05-06 (1) 06-08 (2) 08-13 (1) 13-17 (2) 17-18 (1) 23-01 (1)	18-22 (1)	19-21 (1) 19-21 (1)*
Central & South Asia	08-10 (1) 18-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-20 (2) 20-21 (1)	05-08 (1) 17-19 (1)	05-07 (1) 17-18 (1)
South-east	16-18 (1)** 08-10 (1) 16-17 (1) 17-18 (2) 18-19 (1)	02-07 (1) 07-09 (2) 09-11 (1) 16-17 (1) 17-19 (2) 19-20 (1)	02-04 (1) 04-06 (2) 06-08 (1)	05-07 (1)
Far East	14-16 (1) 16-18 (2) 18-19 (1)	06-07 (1) 07-09 (2) 09-14 (1) 14-16 (2) 16-19 (3) 19-20 (2) 20-22 (1)	01-02 (1) 02-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	02-03 (1) 03-06 (2) 06-07 (1) 03-06 (1)*
South Pacific & New Zealand	15-17 (1)** 11-14 (1) 14-15 (2) 15-17 (3) 17-18 (2) 18-20 (1)	06-09 (1) 09-11 (2) 11-16 (1) 16-18 (2) 18-19 (3) 19-21 (4) 21-22 (3) 22-00 (2) 00-04 (1)	21-22 (1) 22-06 (3) 06-08 (2) 08-09 (1)	22-00 (1) 00-06 (2) 06-07 (1) 22-00 (1)* 00-06 (2)* 06-07 (1)*
Austral-asia	15-17 (1)** 14-16 (1) 16-19 (2) 19-20 (1)	07-08 (1) 08-11 (2) 11-17 (1) 17-18 (2) 18-20 (3) 20-21 (2) 21-23 (1)	00-02 (1) 02-03 (2) 03-06 (3) 06-07 (2) 07-08 (1)	02-03 (1) 03-06 (2) 06-07 (1) 03-06 (1)*
Carib-bean, Central America & Northern Countries of South America	10-14 (1)** 07-08 (1) 08-12 (2) 12-14 (3) 14-16 (2) 16-17 (1)	05-06 (1) 06-07 (2) 07-09 (4) 09-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-22 (2) 22-02 (1)	18-19 (1) 19-20 (2) 20-01 (3) 01-04 (2) 04-06 (1)	19-20 (1) 20-03 (2) 03-04 (1) 20-01 (1)* 01-03 (2)* 03-04 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argen-tina & Uruguay	10-15 (1)** 07-08 (1) 08-10 (2) 10-12 (3) 12-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-21 (2) 21-23 (1)	18-20 (1) 20-03 (2) 03-05 (1)	20-04 (1) 22-03 (1)*
McMurdo Sound, Antarctica	13-15 (1) 15-17 (2) 17-18 (1)	16-19 (1) 19-22 (2) 22-02 (1) 06-07 (1) 07-09 (2) 09-11 (1)	22-02 (1) 02-05 (2) 05-06 (1)	02-05 (1)

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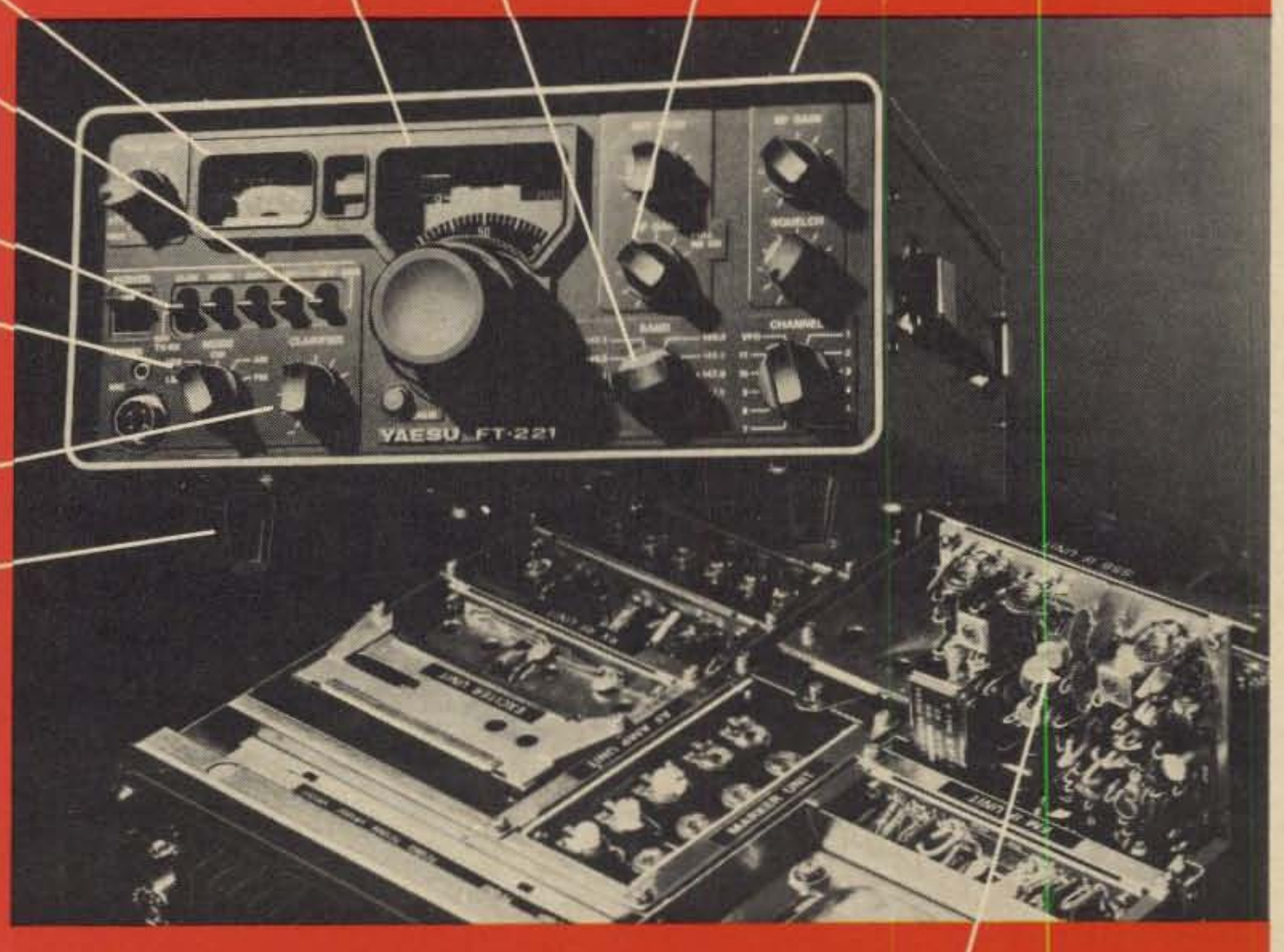

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