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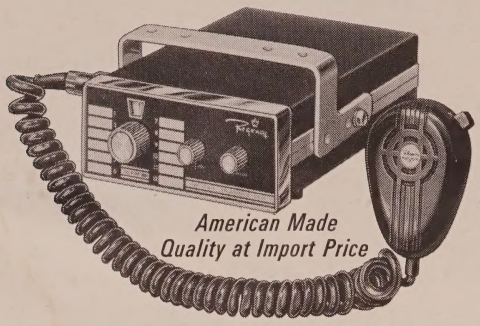
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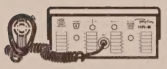
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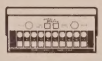
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OUR READERS SAY

20282

Editor, *CQ*:

The Federal Register for Monday, March 24, 1975, announced that the FCC has made several new call sign blocks available for assignment to the Amateur Service. Part 2, para. 2.302 and Part 97, para. 97.51 have been amended accordingly.

The accompanying table shows what various letter-digit combinations the Commission may now use in assigning amateur calls. Tabulated with the table are the maximum number of possible combinations in each of the 21 blocks, for a single call-number district. The letter "X" cannot follow the digit immediately, and those combinations have not been counted. ("X" is reserved for experimental stations.)

Effective April 25, 1975, each of ten call-number districts (1 through 0) has a potential of 1,634,475 different call sign combinations for assignment to US hams.

A tabulation from the FCC Annual Report for fiscal year 1973 shows that the Commission has slightly over 1.8 million outstanding station authorizations in all their services combined.

Who would ever suspect that so many possible combinations will ever be needed in the Amateur Service in this country? Perhaps a close examination of FCC Docket 20282 on restructuring the Amateur Service could shed some light on the subject. Only time will tell.

Loren E. "Bud" Thompson, Jr., W0LRN
Littleton, Colorado

	Call sign block	
1 x 1	K1A through K0Z	25
	N1A through N0Z	25
	W1A through W0Z	25
1 x 2	K1AA through K0ZZ	650
	N1AA through N0ZZ	650
	W1AA through W0ZZ	650
1 x 3	K1AAA through K0ZZZ	16,900
	N1AAA through N0ZZZ	16,900
	W1AAA through W0ZZZ	16,900
2 x 1	AA1A through AL0Z	300
	KA1A through KZ0Z	650
	NA1A through NZ0Z	650
	WA1A through WZ0Z	650
2 x 2	AA1AA through AL0ZZ	7,800
	KA1AA through KZ0ZZ	16,900
	NA1AA through NZ0ZZ	16,900
	WA1AA through WZ0ZZ	16,900
2 x 3	AA1AAA through AL0ZZZ	202,800
	KA1AAA through KZ0ZZZ	439,400
	NA1AAA through NZ0ZZZ	439,400
	WA1AAA through WZ0ZZZ	439,400
		1,634,475

Editor, *CQ*:

This letter is in regard to the new rule changes mentioned in Zero Bias in January, 1975 *CQ*. I only have a few comments to make and I am wondering if there is anyone who can put them before the FCC and the amateur fraternity better than people in your position. In order to qualify my position, let me tell you that I hava a vague feeling that something is going to happen that is again going to restrict my rights and privileges as an amateur and I am going to wake up too late to do anything about it.

If I understand the proposed changes as they appear in Docket 20282, the General class license holder is the guy who is going to get cut down to size again. As a holder of a General class license for over twenty years, I feel that any chopping done at this time should be at the other ends of the licensing structure, not in my turf. If someone wants to be a glorified CB operator, let his privileges be designed to allow him, but without restricting mine. If another fellow wants to approach the realms of the electronic engineer, let his privileges be designed to allow him his full expression, but without restricting mine.

I am a brass pounder by avocation, and I probably will spend most of my operating time on the 40 and 15 meter bands, but I do not want to have the v.h.f. or u.h.f. portions of the spectrum closed to me by arbitrary decisions that seem to be related mainly to future sales of commercial amateur gear.

I don't care too much about power restrictions based on class of license, but I do resent the limitations on spectrum use and emission type that will come as part of these changes. A General licensee should have access to all areas without limits except power input. The license was meant to be used by the "average" amateur, and that may be the class that represents the silent majority. Everyone knows what happens to the silent majority.

R.E. Brossman, W8PMS
Wheeling, West Virginia

Editor, *CQ*:

Could it be that we are finally going to find our way out of the incentive licensing wilderness? Since it's adoption in 1968, we have seen the erosion of amateurs at the rate of 350 per month. Any net benefit gained by the present incentive licensing structure has been totally wiped out. The 350 per month loss has even made it a negative procedure. Now we have FCC Docket 20282 on restructuring before us to hopefully resurrect our decaying hobby.

At the present rate of negative growth in our ranks, we will have the fight of our lives to just maintain what we now have when that ITU frequency conference comes around in 1979. We have got to turn this trend around and start growing. The people in amateur radio who are educated beyond their capacity have had their chance since 1968. It has been an unprecedented disaster for amateur radio. The humanistic side of our hobby was never figured into their equation of incentives. Technical knowledge was going to better our ranks, but in effect it has just thinned them.

At least the FCC has recognized something is drastically wrong in amateur radio. It should have been the ARRL that made some far-reaching proposals to correct the situation. But no, they have missed the boat again, as they did in 1968. However, this time it is my hope that every amateur radio operator in the U.S. will write directly to the

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FCC to express their constructive thoughts on this vitally essential proposal. Some parts of Docket 20282 are excellent, some need modification. But the FCC is asking for guidance in this endeavor. Do not remain silent and only complain about bureaucracy in Washington. Let them know where you stand.

David J. Church, WA2HZR
Amber, New York

Editor, *CQ*:

As to the latest brainstorm from the FCC I would like to voice my opinion against it. Nowhere in the United States Constitution is a whiz kid given more privileges than the average citizen.

This docket is the worst piece of discrimination that ever came out of Washington to hit the presses. Take a general ham who has held a ticket for twenty or thirty years and now he can't get his code speed up or learn his theory, so he is penalized.

I am only a Conditional class but I worked hard and I know I got my ticket legit, so why must I go through this again. But if need be, I'll be ready.

Robert M Bosch
Pennsburg, PA

Super Power

Editor, *CQ*:

I've been reading with great interest the comments of my fellow hams about the illegal operations of some of us. My first point is: You oughta view it from the other side! Of the ocean, that is, I was fortunate enough to operate overseas for several years and it was a real eye-opening experience.

When the conditions are good and the little guys are getting through pretty good, the big guns knock you right off your stool. When conditions are bad, their brute force power still knocks you off your stool. I can never be convinced that they were legal.

Now I'm back in the states and it's the same drill. I'm sitting there waiting for my schedule which is about all the operating I do - and blap!!! I'm knocked off my stool by a 25 kHz - wide signal that almost melted my speaker. You know the type, he's not concerned with who may be using the frequency, he just starts pumping out the r.f. 'cause he knows he's swamping everyone anywhere close. My first impression is wrong, he's not a local, he's halfway accross the U.S. from me.

Well, okay, most of us say, and have said for years, so what? We gripe about the CB'ers, we gripe about these illegal types, we gripe about this and that, but the fundamental question is, what can we do about it?

Let's first ask ourselves these questions:

– Is the fact that we hold ham radio licenses public information?

—Do we feel that FCC enforcement of the regulations are virtually nil?

– Are the pitifully few FCC actions against violators also public information?

– If the above are true, why dosen't someone like *CQ* Magazine obtain from the FCC a list of actions against whom, for what reason, since it is public information?

Perhaps just perhaps, if the non-action of the FCC in these areas were made more public, and the public (in this case, the hams), made their displeasure known to the FCC or their Congressmen & Senators, perhaps, just perhaps pressure could be brought in the right places to increase the FCC budget to include a massive increase in bird dogs to police our bands and enforce the law!!!

Even without publishing this information on FCC actions, can you imagine the impact if all of us wrote just one letter to Washington? Gee Whiz, I'm so fired up I'm gonna write my Congressman and Senators, right after I build a back support for my stool.

Seriously fellows, we can bitch and raise dust all we want but political pressure is the only thing they understand, so let's use it.

Jerry Shields, W5SRN
Austin, Texas

Editor, *CQ*:

Re: Mr. Harts(W0IBZ), Mr. Backys(K9QN), Mr. Cothran(WN8PBN) letters (Our Readers Say) Feb.

After reading these letters I must reluctantly agree with some of the points raised. It is possible that there are certain members of the DXCC Honor Roll that do run "super power" but if so I feel that they are in the minority. Several times in the past few years the DX Advisory Committee of ARRL has considered the problem of excessive power but have come up with no workable solution. The DXAC would appreciate any input from concerned amateurs on correcting this problem. Personally, however, I feel the solution must come from within the 'self policing activity' of Amateur Radio.

The DXCC award and the Honor Roll are personal achievements and if obtained by 'illegal' means or methods they tend to lose much of their significance. It is however interesting to note that some of the "super signals" on the DX bands are calls which never appear in the DXCC or Honor Roll listings.

It is unfortunate but I must state that I personally feel that there is more abuse of the power limit within the ranks of DXers than within the ranks of the large, active contest stations. I do not feel that any of the top 10 multi-multi, multi-single, or single operator contest stations in the USA run illegal power. Granted, most of these stations have tremendous antenna setups and good locations but do not use, nor do they need to use super power.

In the large multi-multi stations there are enough problems with 'interstation interference' running legal power and the use of 'super power' would make the efficient operation of 5 stations at the same time impossible.

So in closing I would offer this suggestion. If any one has a good suggestion for cleaning up the problem of 'super power' drop a note to the ARRL DX Advisory Committee or the CQ DX Advisory Committee, or if the individual is a contestor, write the respective Contest Advisory Committee. Perhaps the best solution would be to contact the amateur involved and discuss the problem with him.

Dr. J.R. Sheller, WA8ZDF
Chairman, ARRL DX Advisory Committee
4925 Hamilton Rd.,
Groveport, Ohio 43125

Correction

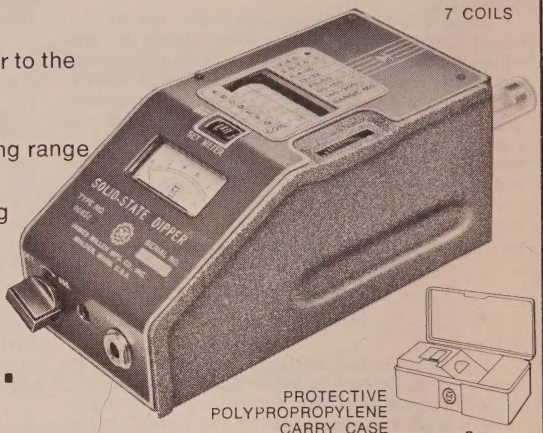
As happens from time to time, we do make a mistake. In preparing the Hamtronics ad for April (page 51) we left out one very important detail. In order to get the SRC-146A as a free item, you have to buy the SRC 851T-00. The combination of the transceiver and walkie/talkie sells for $659.00. We apologize both to Hamtronics and their customers for any inconveince this might have caused.

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Announcements

Foundation for Amateur Radio, Inc.

The Foundation for Amateur Radio, Inc., an nounces its intent to award three scholarships for the academic year 1975-76. All amateurs, wherever resident in the U.S. and holding an FCC license of at least General class, can compete for one or more of the awards if they are now enrolled or have been accepted for enrollment in a full-time course of studies beyond high school.

Application forms can be requested from the Chairman, Scholarship Committee, 8101 Hampden Lane, Bethesda, MD 20014. Area preference is the same as the Gore Scholarship.

Cardenden, Fife, Scotland

Father Stan Smith, GM4DNM is in the process of organizing a Net for members of the Knights of St. Columba in the United Kingdom, Knights of Columbus in the United States and Canada, and New Zealand.

Members of these organizations who are "hams" and interested in this project can get more details by writing the Rev. S.J. Smith, GM4DNM, 6 Derran Drive, Cardenden, Fife, KY5 OJG, Scotland.

Birmingham, Michigan

The Catalpa Amateur Radio Society will celebrate Michigan Week, May 20th through 26th, 1975, by contacting out-of-state foreign hams, using their call, WM8ICH, Certificates will be awarded to those sending a QSL card and large SASE to: Operator,--------Station, WM8ICH, American Red Cross, 100 E. Mack Ave., Detroit, MI 48201.

HAMFESTS

● **Lake Delton, Wisconsin** — The fifth annual Yellow Thunder Hamfest will be held in the Dellview Hotel at Lake Delton, WI, on May 17, 1975. Registration will begin at 10:00 am. For further information contact Kenneth A. Ebneter, K9GSC, 822 Wauona Trail, Portage, WI 53901. ● **Wabash, Indiana** — This year the Wabash County Indiana Amateur Radio Club is sponsoring it's Seventh Annual Hamfest to be held on Sunday May 18th, 1975. It will be at the 4-H Fairgrounds, admission $1.50 at the gate. For more information contact: Bob Mitting,- WB9DKH, 663 N. Spring Street, Wabash, IN 46992.

● **West Liberty, Ohio** — The Champaign Logan Amateur Radio Club will hold their Annual Fleamarket & Auction on May 18, 1975 at 12pm. It will be in the West Liberty Lions Park; for more information contact: John L. Wentz, Box 102, West Liberty, OH 43357. ● **Pittsburgh, PA** — The 21st Annual Breeze Shooters Hamfest is Sunday, May 18th at White Swan Park (Parkway West, 4 miles east of the Pittsburgh International Airport). No fees and free parking. Amusement Park adjacent to hamfest. For further information contact: Herb Heller, K3DE, 2873 Beechwood, Blvd., PA 15217. ● **Bronx, New York** — The Bronx County Historical Society will sponsor a special events stations on Bronx Bicentennial Day, Sunday May 18th, 1975. The call requested is KT2BBC.

[*Continued on page 65*]

new

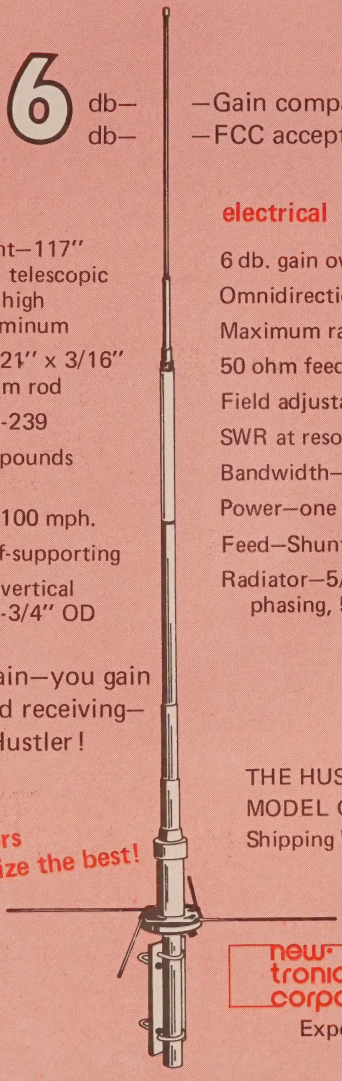
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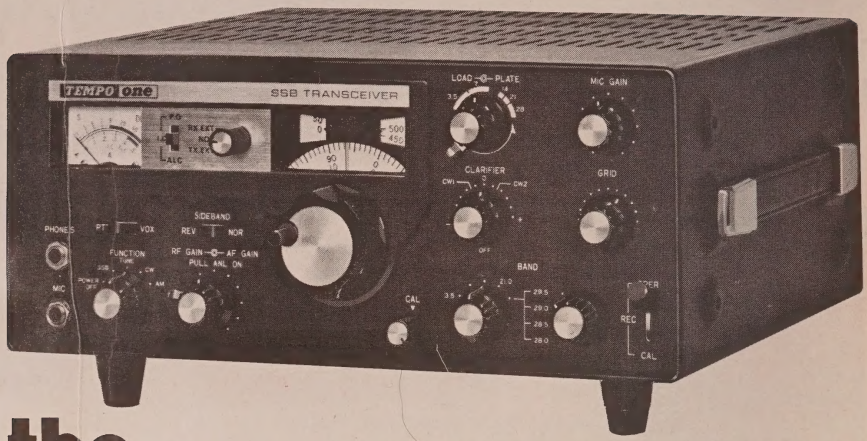
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MODES OF OPERATION: SSB upper and lower sideband, CW and AM.

INPUT POWER: 300 watts PEP, 240 watts CW

ANTENNA IMPEDANCE: 50-75 ohms

CARRIER SUPPRESSION: -40 dB or better

SIDEBAND SUPPRESSION: -50 dB at 1000 CPS

THIRD ORDER INTERMODULATION PRODUCTS: -30 dB (PEP)

AF BANDWIDTH: 300-2700 cps

RECEIVER SENSITIVITY: 1/2 μv input S/N 10 dB

AGC: Fast attack slow decay for SSB and CW.

SELECTIVITY: 2.3 khz. (-6 dB), 4 khz. (-60 dB)

IMAGE REJECTION: More than 50 dB.

AUDIO OUTPUT: 1 watt at 10% distortion.

AUDIO OUTPUT IMPEDANCE: 8 ohms and 600 ohms

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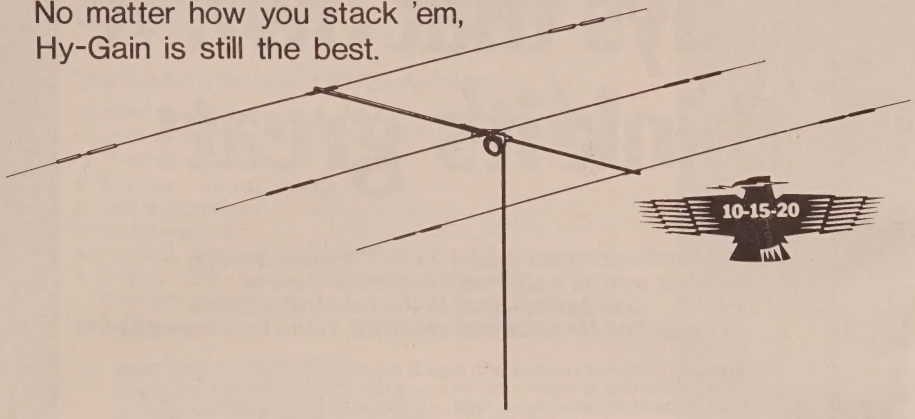
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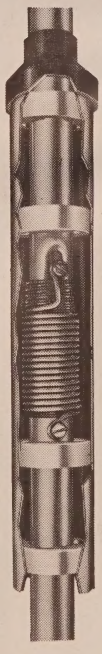
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- Up to 8 db gain.
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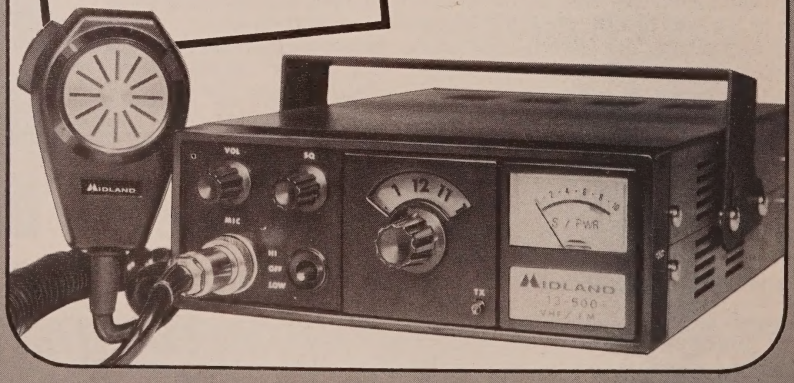
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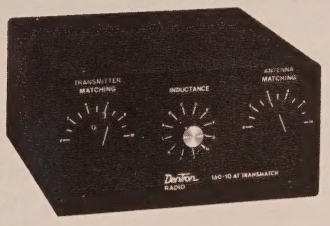
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160-40V Antenna ..... $79.50 ppd. USA



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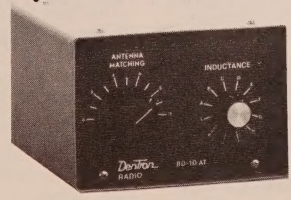
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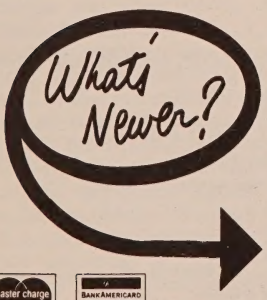
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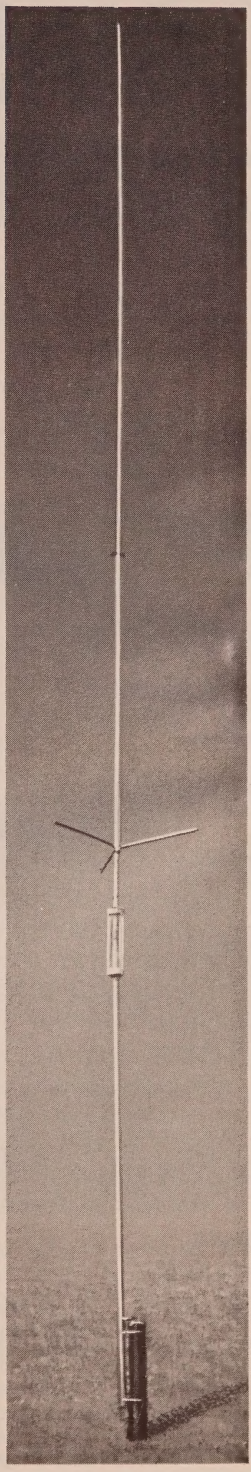
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Sub-Total $_____ Ind. residents add 4% sales tax: Cal. residents add 6% sales tax:_____ **TOTAL:** $_____

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The Golden Years

The Wonderful HRO Receiver

or, "They Don't Build Them Like They Used To"

BY WILLIAM I. ORR,* W6SAI

ONCE in a blue moon a product appears that becomes a legend. A bottle of 1926 *Chateau Haut Brion,* the original *Ford V-8,* or the classic *Atwater-Kent* "breadboard" receiver. Connoisseurs of the finer things of life remember such outstanding examples of man's ingenuity with nostalgia and bemoan the day when honest wine, metal and polished wood gave way to the screw-top bottle of pop wine, the veneer coating and the nondisposable plastic container. In retrospect, this is the story of such a classic—a legendary radio receiver that set the pace for two decades and bought about a revolution in radio communication. The HRO receiver is fondly remembered today as an outstanding example of equipment design and a receiver that was the standard of comparison for many famous DX operators.

* * * * *

The story began in the early "thirties" in the golden days of radio, the dark days of the depression and the uneasy days of commercial aviation. The time was ripe for aviation to take a giant step forward and it would do it, aided by radio amateurs and experimenters, in a style that is unknown today.

Most commercial flying during this early period was done during daylight hours and night navigation—when it was done at all—was by revolving light beacons located on high hills and mountain tops. Radio, if used, was not considered reliable enough for consistent ground-to-air communication (fig. 1). Worst of all, the existing radio equipment was heavy and ignition noise in the plane drowned out all but the loudest signals. The ground equipment, moreover, consisted largely of regenerative receivers well-suited for c.w. reception but useless for telephony. This threw the burden of communication on an extra radio operator in the aircraft who knew the Morse Code. Could not the communication be handled by voice, by the pilot, so that an extra radio operator would not be required, it

*48 Campbell Lane, Menlo Park, CA 94025.



Fig. 1—Flying was a chancy thing in the early "thirties" and aircraft radio was unreliable and heavy. Most airways relied upon beacon lights, placed atop high hills, for navigation. Only two frequencies (3105 kHz and 6120 kHz) were used for aircraft communication in the United States. Here, a ground engineer for United Airlines adjusts a radio transmitter in a mail plane prior to takeoff. The mail compartment is directly above engineer's head.

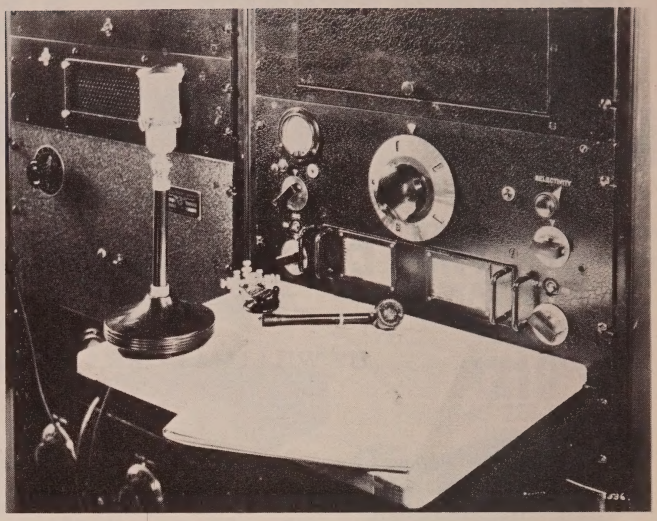


Fig. 2—The Godfather. The original HRO installed at the station of Jim Millen, W1HRX. That great boon to appliance operators, the S-meter (originally called an R-meter) was calibrated from R1 to R5, R5 being the loudest signal received! The revolutionary epicyclic dial is at the center of the receiver, with the crystal filter controls to the right. Below the main dial is the plug-in coil catacomb. Sharp-eyed old-timers will also notice the Collins speech amplifier mounted to the left of the receiver and the Brush multi-cell crystal microphone in the foreground. The power supply for the HRO is directly above the Collins amplifier, and the coil box for the many catacombs is above the receiver. Note that the operating "desk" is a genuine breadboard!

was asked? If so, a whole new aviation radio concept was required, and quickly.

Early Beginnings

About 1930 the Department of Commerce (which installed and maintained the light beacons) proposed the development of a nation-wide radio range, a multitude of radio beacons used in conjunction with voice ground-to-air communication. The chief engineer of the DOC was a radio amateur named Bill Jackson who coordinated the efforts of the manufacturers working on this unique undertaking. The General Electric Company was selected to make most of the special ground station transmitting equipment. Aircraft Radio Corporation was chosen to make much of the airborne equipment and the relatively obscure National Company of Malden, Mass. was chosen to make the ground station receivers, mainly because of their outstanding work on the famous Browning-Drake broadcast receivers (a household word in the early golden years of radio).

Working on the DOC project, the first communications superheterodyne receiver developed by National, (under the direction of James Millen, 2BYP, later W1HRX) was the *AGS* (Aviation Ground Station) receiver, a single conversion superhet, using three plug-in coils. Some of the airlines used the AGS but others, such as Transcontinental and Western Airlines (the predecessor for TWA and United) felt the need for a more sophisticated receiver than the AGS to replace the SW3s they were using for c.w. communication, and to work along with the newly-acquired Western Electric phone transmitters. The coordination job for a new receiver was turned over to Herbert Hoover, Jr., W6ZH, past President of the ARRL, who was living in Pasadena, California, working with T & WA and also teaching part-time at Cal. Tech. Herb contacted Jim Millen of the National Company, who had interesting ideas on the project, and the new airlines receiver concept was hurried into development.

The Birth of the HRO

W6ZH set up an experimental laboratory in his garage under the direction of Howard Morgan of Western Electric Co. Howard and a few technicians went to work on circuit development based upon experience gained with the AGS and the demands of the airlines.

The specifications were laid down to meet the state-of-the art: The receiver would have superior image rejection. That called for two stages of tuned r.f. amplification. Superior selectivity called for the new Lamb crystal filter. The read-out would be excellent, and Jim Millen had a radical new epicyclic dial design for that, readable to one part in 500! In addition, the receiver would have good a.v.c. and an S-meter (fig. 2).

Because the designers believed in the efficiency of plug-in coils over bandswitching, the receiver would have a new three-bank plug-in coil catacomb, each coil deck having its own calibration chart. To reduce hum, the power

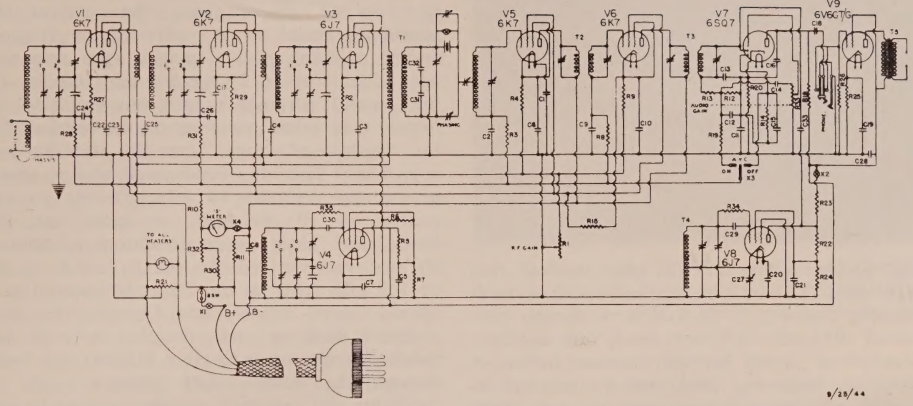


Fig. 3—Circuit of the HRO. The early HRO used 2.5 volt glass tubes and a later version switched to 6.3 volt glass tubes. The post-war HRO-5 (built in quantities during the war under various nomenclatures) used metal tubes. The receiver used an external power supply—a good idea in the early days when the owner of the receiver could build his own supply, or use the supply of the HRO for another purpose. However, in post-war years, the receiver power supply became an integral part of the receiver, leaving the HRO with its bulky, external supply as an oddity. Classic in design, the 40-year old circuit still represents good engineering design for a single conversion receiver.

supply would be separate from the receiver (a design goof that was to plague the company at a later date).

Taken as a whole, the receiver was years ahead of its time. Viewing those days from these days, the project was one of the very first examples of system-designed equipment, an art well-known today, but unknown before World War II. Consider the state of the radio art in late 1933 and early 1934: The great majority of radio amateurs had home-made regenerative receivers or SW3s. The superheterodyne receiver was thought useless for c.w. reception and was suspected of inferior performance for general short wave work. The more affluent and sophisticated radio amateurs boasted a Hammarlund *"Comet Pro"* superhet, an elementary receiver without preselection, a.v.c. or crystal filter. Since it was considered more or less a feat of great dexterity to receive *anything* on a shortwave superhet, the problem of interference and image signals never seemed to enter the picture. No standard of comparison existed with which to judge the new receiver design!

Slowly, a prototype receiver took form. And what a receiver! The cost of duplicating it today would be out of the question. Special dies for punch-presses were used for the chassis and coil assembly. Castings for the dial and mechanism were designed and molds built. National Company built the i.f. transformers, the coils, the various forms and insulators and even some minor hardware, specifically designed for the new set. The design was full of knotty problems, having no precedent, compounded by the miles separating the mechanical and electrical design teams, one on the east coast and one on the west coast!

"A Hell Of A Rush"

Finally, in early 1934, Jim Millen completed a mechanical mock-up of the receiver, complete with the new, revolutionary dial mechanism and the unusual plug-in coil assembly. Herb Hoover reported good progress on the electrical design, although problems still remained with the a.v.c. system and the second detector. It was decided, however, that the time was ripe to combine the mechanical and electrical systems into a working model of the new receiver.

Using much overtime, the National Company rushed the assembly of several prototypes. The toolmakers working on the various dies and castings required a job number for their overtime slips and, as none had been assigned for the rush work, took it upon themselves to use the initials *HOR*, as an abbreviation for "Hell of a Rush," since that was the state of affairs for the new project thrust upon them.

Now, known as the *HOR*, the new prototype was carried by Jim Millen to Pasadena for final circuit revisions and tests. The bugs were worked out and the new receiver seemed an unqualified success. By this time, however, some of the partcipants in the project had doubts about the name of the new receiver, at least from the social aspect, so the receiver

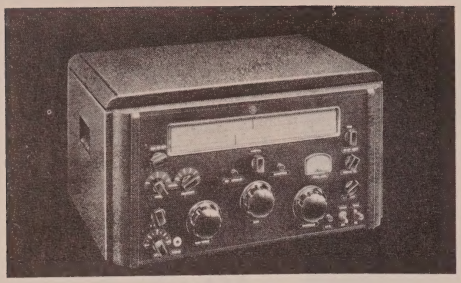


Fig. 4—The Millen DPF-201—the receiver that never was! This was a double conversion receiver covering 550 kHz to 31.5 MHz. A directly calibrated slide rule dial was used, with auxiliary bandspread tuning for all amateur bands. A 6AK5 r.f. stage was used, and the receiver included an antenna compensator for exact alignment of the r.f. stage. The DPF-201 employed a sliding coil catacomb mounted beneath the chassis and weighed 80 pounds.

was rechristened the *HRO*, the name change being made just in time to catch the first advertisement of the receiver in the December, 1934 issue of *QST*.

The HRO Circuitry

The HRO circuit is an outstanding example of receiver design, when it is remembered the primitive state of affairs that existed in the early "thirties." Classic in its simplicity, the HRO employed two r.f. stages (fig. 3), a crystal filter, two i.f. stages, full a.v.c. and a b.f.o. for code reception. Most startling of all, the HRO could be adapted for full 450 degree bandspread on any amateur band! This was accomplished by a switching system built into the coil catacombs whereby, with the aid of a screwdriver, the user could interchange connecting links to shift from general coverage to bandspread.

To obtain the utmost mechanical stability the receiver was built on a welded steel chassis and all components were firmly fixed in place with a number of tie-point strips. Lock washers were liberally used at all joints and all wiring was laced in position.

While all of this sounds like no big deal today, the HRO, as far as is known, was the *first* receiver to employ all of these practices. The vaunted Hammarlund Super-Pro, for example, had helter-skelter wiring beneath the chassis that looked like a rat's nest with resistors and other components hanging by their leads in mid-air. And the other receivers of that time weren't much better. The HRO, on the other hand, was built to last!

The First HRO

The first HRO receivers met with instant acclaim. The performance was sensational, the two r.f. stages giving the receiver the sensitivity equal to the ears of an Iriquois Indian scouting party. Images were nonexistant, at least up to 20 meters, and stability on the general coverage ranges was equal to, or better, than other receivers on the market. On the bandspread range, however, stability was a problem. Since the bandspread was so great, a warmup drift of 10 kilocycles or so appeared as 10 divisions, or more, on the tuning dial. Under some conditions of humidity, the receiver would drift as much as 50 or 100 kilocycles on the 20 or 10 meter bandspread ranges! The National Company met this problem head-on and struggled with it for years. Owners of successive HRO's note with interest the many small changes made in oscillator coil material, padding capacitors and coil placement within the catacomb in an effort to lick the problem of drift. Unfortunately, a good deal of frequency drift was inherent in the oscillator tube itself and throughout the life of the HRO, until the very latest post-war models, the drift problem was never entirely conquered.

It must be remembered, on the other hand, that while amateurs measure frequency in *Hertz* today, frequency measurement was a chancy thing in the "thirties." While crystal control was popular in transmitting equipment, the crystals used and the circuitry of the oscillators was such that transmitter stability was poor, even under the best circumstances. And those hams using self-excited oscillators tended to drift all over the place. Thus, it was common practice to "chase" the received signal over the dial of the receiver, and very few amateurs worried much about receiver stability. So while the National Company worried about receiver drift, the problem was not great enough to cause any dimunition in receiver sales until single sideband came along in the post-war years.

The Success of the HRO

Early models of the HRO went to a number of prominent amateurs who were friends of Herb and Jim: Percy Spencer, Thorne Donnelly, Ross Hull and K. B. Warner. Another early owner of the HRO was Charlie Kolster, the Radio Inspector in the Boston office, Charlie was quite impressed with the receiver and when Jim Millen wished to replace his old 2BYP call with a first district call, Charlie confided that Jim could have W1HRO, in honor of the new receiver. Alas! The fledgling FCC goofed and instead Jim ended up with the call W1HRX!

In spite of the call letter mixup, the HRO receiver was an instant success. The first large order came from Braniff Airways who bought

a quantity and installed them in boxes on telephone poles, every 50 miles or so along their main route. The HROs ran continuously, tuned to the 3105 kHz aircraft channel, and the outputs were patched into a special land line which could be monitored in Kansas City, Dallas, Tulsa and Oklahoma City. This scheme provided Braniff with continuous voice reception of their planes on that route. When operated in this fashion, the HRO proved to have excellent reliability and stability.

Amateurs, in larger numbers, bought the receiver, too. Sales got an impetus when the two ground stations for Howard Hughes' famous flight around the world—both operated by radio amateurs—used two HROs apiece. And by 1940, the HRO was well established as the unexcelled DX operator's receiver on the amateur bands.

World War II and the HRO

At the outbreak of World War II, the HRO was in full production. The British Government ordered a number of the receivers for the Royal Navy. The U.S. Navy, too, bought hundreds of HROs for base and shipboard communications. The Australians, on the waiting list for HROs, made copies of the receiver for use in their country. The Germans and Japanese, not to be outdone, also made carbon-copies of the HRO. It is estimated that over 10,000 HROs were put to use by various countries as a general purpose communication receiver during World War II.

The HRO succeded in such a spectacular fashion because it was custom-designed to do a job well and no corners had been cut. Ironically, it was this concept of system-engineering that finally brought about the downfall of the great receiver as the winds of change swept across the communication world in the decade follow-the World War II.

To be sure, minor modifications were made to adapt the receiver to wartime conditions. Better and more reliable fixed capacitors were incorporated, along with improved wiring insulation. The high frequency oscillator was temperature stabilized to cut down drift. A change was made from glass to metal tubes. But the overall receiver was so well designed, so compact, and so well laid out for the specific circuit that any major changes in the receiver became a formidable task. The addition of a simple noise limiter, for example, was an engineering change of the first magnitude. Where, for example, would the panel control potentiometer for the limiter be put? The only available space was above the coil catacomb, across the panel from the dial lamp. But when finally placed here, the potentiometer partially blocked the alignment holes for the r.f. coils! There really wasn't any room in the "perfect" design for another tube and its components! However, the National Company knew a good thing when they had it, and stubbornly clung to the original design, which by then, had nearly become the trade-mark of the company.

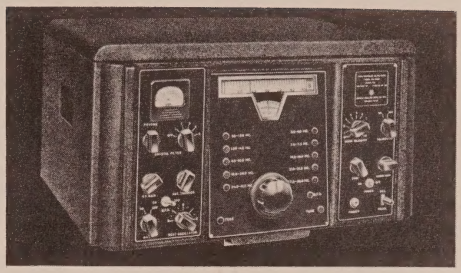


Fig. 5—The Millen DPF-501—the deluxe receiver that never left the drawing board. Weighing 107 pounds and having direct dial calibration and general coverage to 41.5 MHz, this receiver was the result of years of design work by Jim Millen. Unfortunately the advent of s.s.b. and soaring production costs doomed the DPF-501 and it never was built in quantity.

The HRO-5 and Eclipse

The post-war HRO-5 represented the apex of HRO popularity. Already the bell of history had sounded and new, improved receiver designs were on the drawing boards of several companies. Out west Mike Villard, W6QYT, was running experimental s.s.b. transmissions from Stanford University that excited great comment on the ham bands and which pointed up the drastic improvement required in receiver stability and selectivity to make the new system practical for general amateur use. And in Cedar Rapids, Iowa, Art Collins, WØCXX approved the final design for a revolutionary new receiver, the Collins 75A-1, having a new order of frequency stability and readout. Clearly, the days of the famous old HRO were numbered.

But Jim Millen, the Godfather of the HRO had left the National Company before the war to start his own company. The spark was gone. The HRO would go through several convolutions and modifications, but the famous receiver died a slow death shortly after the birth of s.s.b.

The Unlucky DPF Receivers

Jim Millen, meanwhile, was letting no grass grow under his feet. The James Millen Company prospered and always, in the back of Jim's mind, was the wish to bring out a truly modern, post-war communication receiver. The embryo Millen receiver was designated the DPF (*Designed for Performance*) and took

[*Continued on page 64*]



Front view of the Atlas 210 solid state transceiver. Despite the small size of the unit, all controls are full size and easily manipulated.

CQ Reviews: The Atlas 210 and 215 SSB Transceivers

BY JOHN SCHULTZ,* W2EEY

ANYBODY who happened to see W6QKI at the ARRL Convention in New York City last year operating the Atlas 180 transceiver from a portable battery pack must surely have been impressed. The day of a fully solid-state, portable h.f. rig of reasonable power had arrived. Both the Atlas 180 and the battery pack could be taken under one arm and one would have a completely portable station running 180 watts PEP input on 160, 80, 40, and 20 meters!

Herb Johnson, W6QKI, the President of Atlas Radio, is not new to introducing exciting products to amateur radio. He was one of the founders of Swan Radio and active in developing its product line for many years.

The 180 was the first Atlas product to come on the market and it, as well as the current 210/215 models, borrows heavily from circuitry developed for military/industrial communications applications. Most of the circuitry used was developed by SouthCom International for use in their military transceiver AN/URC-78.

General Specs

Perhaps the first impression one gets about the 210 or 215 is that it is small. As can be seen in the photograph, it is easily held in one hand. The dimensions are 9¼" wide, 3½" high and 9¼" deep overall. The weight is 8 lbs. Contained inside this little package is a complete transceiver of exceptional performance.

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, NY 11050.

The major specs as Atlas claims them for the 210 and 215 are as follows:

Band Coverage: 210 model: 3700-4050, 7000-7350, 14,000-14,350, 21,100-21,450 and 28,400-29,100 kHz. The 215 deletes 10 meters but adds 1800-2000 kHz. The restricted coverage of some bands is due only to the basic 350 kHz v.f.o. used. Full coverage of 80, 15 and 10 is possible with an external v.f.o. without any other modifications.

Modes of Operation: U.s.b., l.s.b. and c.w.

Power Input/Output: 200 watts PEP or c.w. input and minimum of 80-100 watts PEP or c.w. output on all bands (except 120 watts input on 10 meters for the 210). RTTY and SSTV modes are not specified.

Load Impedance: 50 ohms resistive for rated power output. Infinite v.s.w.r. protection for output transistors.

Carrier and Sideband Suppression: 50-60 db at 1000 Hz.

Harmonic Suppression: 35 db below peak output.

Receiver Sensitivity: 0.3 μv for 10 db signal/noise ratio.

Selectivity: Crystal lattice filter at 5520 kHz i.f., 8 pole.

Image Rejection: 60 db or better.

Audio Output: 2 watts max. into built-in speaker.

Metering: Reads S units on receive, amplifier collector current (0-16 amps) on transmit.

Power Requirements: 12-14 v.d.c. Draws 0.2

to 0.4 amps in receive mode and 16 amps *peak* in transmit mode.

The above specs are not all there is to the 210/215, but are presented mainly to illustrate that the 210/215 claims to be much more than just a compromise type transceiver. Except for band coverage, the 210/215 claims to be as good or better than the 25-60 lb. tube-type transceivers most of us have on our operating tables.

Being completely solid-state, the 210/215 makes use of broadband tuning circuits for both the receiver and transmitter functions. There are no tuning controls except for the v.f.o. In spite of the broadband tuning of the receiver input circuits, a claimed design feature is "exceptional" immunity to overload and cross modulation which matches or exceeds the best tube-type designs. Obviously, Atlas was willing to stand by its claim since the usual "fudge-factor" input attenuator common to solid-state receiver designs is not present.

The 210/215 emphasizes modular design. Not all of the PC boards are plug-in, however, only the main ones which contain active devices, except for the power amplifier stages. The controls visible on the front panel photo are all there are. No hidden controls or switches are on the back panel which contains only the various connectors for microphone, antenna, key and accessory items.

Basic Circuitry

Figure 1 shows a block diagram of the stage arrangement. The heart of the circuitry is the dual use of the i.f. amplifier/mixer chain in both the receive and transmit modes. In the receive mode, the 210/215 performs as a single conversion receiver with an i.f. of 5,520 kHz. The signal is introduced via a set of bandswitched low pass filters to a set of bandswitched 4 pole bandpass receiver input filters and then directly to the first balanced diode mixer *without* r.f. preamplification. The v.f.o. signal, which operates 5520 above the i.f. on 160, 80 and 40 and 5520 kHz below it on other bands, is also injected into the mixer The resultant i.f. signal travels through Q_{101}, a low noise amplifier stage, and thence via the i.f. filter and IC i.f. amplifier to the second balanced diode mixer, injected with the crystal controlled carrier oscillator signal, acts as a product detector. Normal a.f. amplification follows via two IC stages.

In the transmit mode, the first balanced diode mixer serves as the usual diode ring modulator being fed with the transmitter audio and carrier oscillator signals. Sideboard selection is accomplished by the i.f. filter plus use of the desired carrier oscillator frequency for u.s.b. or l.s.b. The second mixer serves as a frequency conversion stage and with injection of the v.f.o. signal and i.f. signal produces a signal output

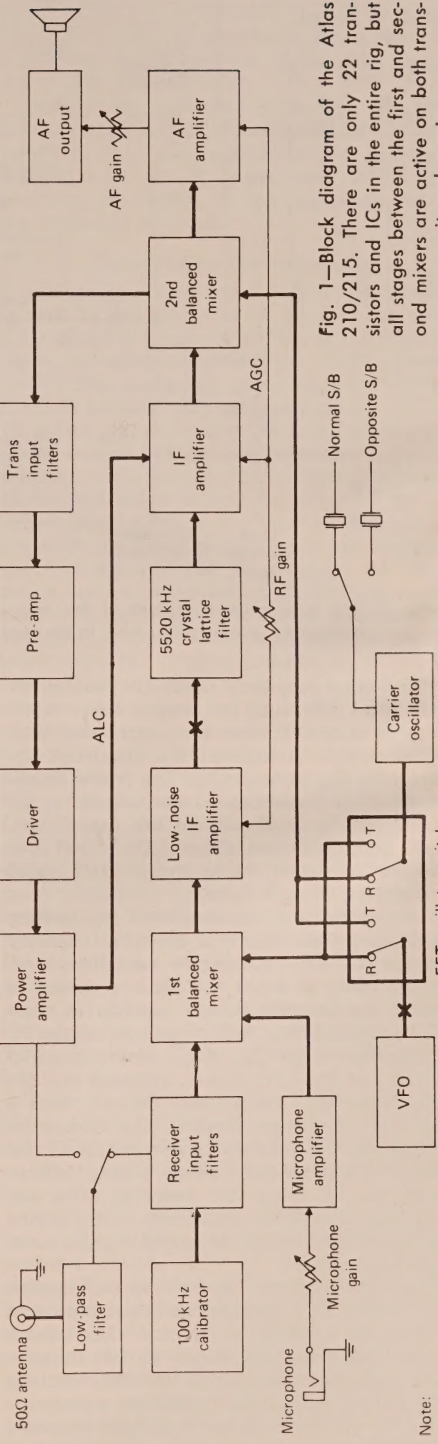


Fig. 1—Block diagram of the Atlas 210/215. There are only 22 transistors and ICs in the entire rig, but all stages between the first and second mixers are active on both transmit and receive.

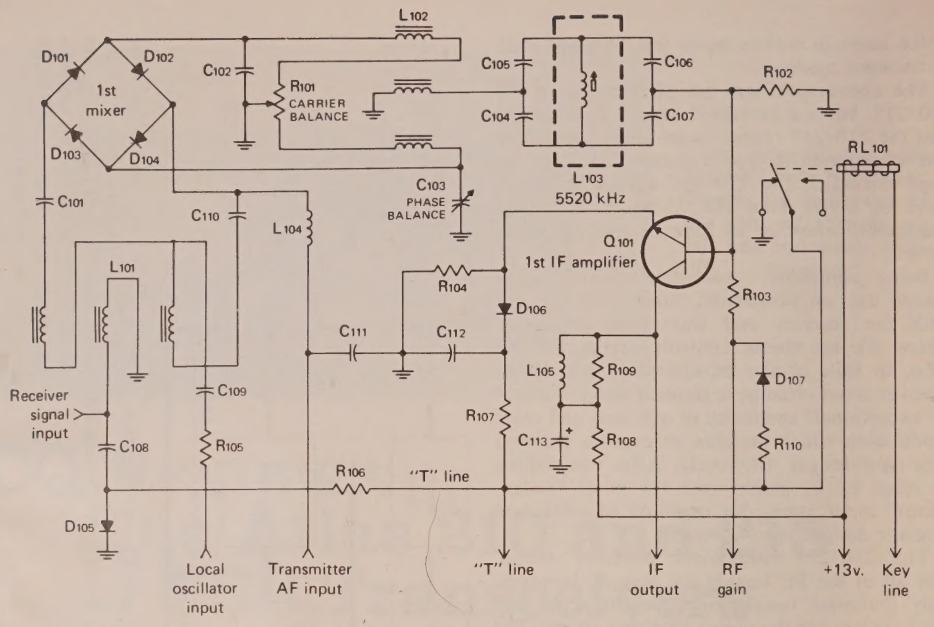


Fig. 2—The most unusual feature of the Atlas 210/215 is the use of a diode balanced mixer, without r.f. pre-amplification, in the receiver, followed by a low-noise i.f. amplifier.

on the desired frequency band. The transmitter input filters following the second mixer select the mixer output. Further s.s.b. signal amplification is straight-through at the operating frequency via Q_{501} through Q_{504}. The power amplifier stages are broad-banded and coupled to the antenna via the bandswitched low pass fiilters. These dual half-wave filters have cutoff frequencies from about ½ to several MHz above the high end of each band.

C.w. operation is accomplished by shifting one of the carrier oscillator crystal's frequency into the i.f. filter passband by capacitive loading. An offset of about 600 Hz is provided to prevent leap-frogging on c.w. contacts. A combined amplified a.g.c./a.l.c. line acts on the IC i.f. amplifier stage Q_{201}. A.g.c. action is audio derived and the a.l.c. action, although not obvious from fig. 1, is actually derived from a built-in s.w.r. bridge. Normal a.l.c. voltage is detected by the forward power pickup of the bridge. Excess reflected power pickup acts to cut-off the i.f. chain thus reducing drive and protecting the power transistors. C.w. keying is performed by the i.f. to cut-off via this same a.g.c./a.l.c. chain.

The "device count" doesn't appear impressive—only 4 IC's and 17 transistors! But, most of them are working *all* the time! The success of the scheme depends mainly on two things—those balanced diode mixers and the switching of the v.f.o. and carrier oscillator signals between the mixers. Both techniques are discussed later in some detail.

Receiver Performance

Input signals from the antenna are first routed through the bandswitched low pass filters which always remain in the antenna line, then via the bandswitched receiver input bandpass filters and finally to the double balanced first mixer (fig. 2).

The first mixer is similar to the second one in the use of 1N4148 diodes and trifilar wound toroid transformers for input and output coupling. Interestingly enough, the diodes are not some super-sophisticated types but silicon types selling at about 30 cents each from G.E. The first mixer output goes to a 5520 kHz i.f. transformer and then to the first amplifying device in the receive chain—a 2N3866. Manual r.f. gain control is applied to this stage via a potentiometer which varies the forward bias. The output of this stage goes first to the 8 pole crystal i.f. filter and then to a conventional MC1350C second i.f. amplifier which has a.g.c. applied. With all the passive components on the input of the receive line one might imagine that the sensitivity would be rather less than spectacular. Atlas claims a minimum sensitivity of 0.3 μv for 10 db signal/noise ratio. The measured results were:

160 — .25 μv	15 — .28 μv
80 — .20 μv	10 — .33 μv
40 — .15 μv	
20 — .15 μv	

One can convert the μv figures for a 20 db signal/noise ratio by multiplying them by ap-

proximately 3 times. The 210 or 215 appears as sensitive or more sensitive than most transceivers on the market which do have an r.f. preamplifier stage.

The general impression that one gets when operating the 210 or 215 in receive is how similar the bands sound as to when using a direct conversion receiver. The main impression is the remarkable lack of signal "garbage" and clutter generated usually by front end overload and poor image rejection. Signals seem to pop out of a quiet background.

The 8 pole filter is extremely effective. Numbers and measurement figures on such things as front-end overload and filter bandwidth are certainly interesting, and if everyone were consistent in measurement, useful for comparison purposes. But, they can also rapidly loose meaning when trying to describe actual operating experiences. The 210/215 was tried extensively in the Saturday/Sunday morning mayhem which exists on the phone bands on the East coast. Probably no receiver in this world will ever be able to offer enough selectivity, sensitivity and overload protection to separate all the DX from the locals and unscramble all the W's from each other. But, the 210/215 performed as well as an expensive communications receiver using mechanical filters and costing several times the price of a 210 or 215.

For c.w. reception under extreme QRM, additional selectivity is undoubtedly desirable. Atlas at the moment does not provide a c.w. filter. However, they did bring the leads from the installed s.s.b. filter to an accessory socket on the rear of the 210/215. So, one could break the i.f. chain at this point and insert additional selectivity. A 2 pole crystal filter with 100-200 Hz bandwidth can be worked in series with the s.s.b. filter. This should provide excellent c.w. selectivity at low cost.

The audio derived a.g.c. used works very well. A signal input range of from 5 μv to 3 volts produces only a 4 db change in the audio output level. The only thing in the audio chain that might deserve a bit of criticism is the built-in 3" speaker. On the units tested, it had a slightly tinny ring to it. There is a provision for the plug-in of an external speaker. The 2 watts of audio output is more than sufficient, even for mobile use.

The "feel" of the tuning on a transceiver is another one of those things which defies definition by a set of numbers but yet determines very much over a period of time whether one is going to enjoy using the unit. The feel of the tuning on the 210/215 is very good. Smooth and with no backlash. The tuning rate on all bands is 15 kHz/revolution except on 160 where it is about 9 kHz and on 10 where it is 30 kHz/rev.

For c.w. and with a sharp c.w. i.f. filter installed, the tuning rate would be excellent. The main dial is calibrated every 5 kHz. With the slow tuning rate one can easily count down to 1 kHz and spaced markers on the main tuning knob make the job easier.

A 100 kHz calibrator is built-in and produces strong markers. Why 50 cents or so more wasn't spent to include an IC divider to obtain markers every 25 kHz is not clear. It is a simple thing, of course, to add such a divider to the calibrator if desired.

Transmitter Performance

The same i.f. chain used in the receive mode is used to develop the s.s.b. signal. The basic d.s.b. signal is generated in the first low-noise, diode, balanced mixer at either 5520 kHz or 5523.3 kHz, depending on the sideband chosen. U.s.b. is automatically produced on 20, 15 and 10 meters and l.s.b. on 40, 80 and 160. A front panel switch allows for opposite sideband selection when desired. The "switching around" of the first mixer to function either as the receiver input mixer in the receive mode or as the d.s.b. balanced modulator in the transmit mode is accomplished in a simple but ingenuous fashion. Referring to fig. 2 which shows the first mixer in detail, it can be seen how the switching of inputs is accomplished. In the receive mode, the "T" line going to R_{106} is at zero volts. Diode switch D_{105} is open and allows receiver input signal to go to L_{101}. The local oscillator (v.f.o.) signal is routed to L_{101} via C_{109} and R_{105}. The transmitter a.f. input coupled via r.f. choke L_{104} has been grounded via a diode switch similar to D_{105} on another PC board. On transmit, the "T" line is at +13 volts and diode switch D_{105} shorts out the receive input signal. The local oscillator input becomes the carrier oscillator input (via another switching arrangement described later). The transmitter a.f. input is fed to the diode modulator from the microphone amplifier. A similar type of switching arrangement converts the second mixer to either a product detector on receive or mixer for the purpose of translating the 5520 kHz s.s.b. signal to the desired output band on transmit.

The v.f.o. is a three stage affair with two buffer stages. Its frequency range is switched depending upon the band in use. Stability is excellent, being in the order of 100 Hz per hour after warmup.

The 8-pole crystal filter following Q_{101} performs the single side-band selection. Atlas makes a definite point of the fact that they chose a filter with a 6 db bandwidth of 2.7 kHz to handle an audio response of 300 to 3000 Hz rather than a 2.4 or 2.1 kHz wide filter. They point out that "it has been convincingly proven that transmission and reception of the audio frequencies between 2400 and 3000 Hz provides a substantial improvement in real signal readability." There might be some argument

on this point. All that can be said here is that reports of excellent audio quality and signal punch were received. Atlas recommends the use of a quality microphone with a smooth response from 300 to 3000 Hz, one example of which might be the Shure 404 C.

The second mixer converts the 5520 kHz s.s.b. signal to the output band frequency. It might be interesting to see at this point how the v.f.o. and carrier oscillator signals are switched back and forth to either the first or second mixer.

The diagram of the "switch" is shown in fig. 3. Essentially, it is a solid-state equivalent of a d.p.d.t. switch using FET's as the switching elements. The transmitter "key line" is at +13 volts on receive and at 0 volts on transmit. The opposite is true for the "T" line shown. On receive, Q_{304} and Q_{305} are pinched off by about +10 volts. Q_{303} and Q_{306} are conducting with only about +0.7 volts on their gates. Thus the v.f.o. signal flows to mixer #1 and the carrier oscillator signal to mixer #2. On transmit, the opposite happens with Q_{303} and Q_{306} pinched off, etc. It's a handy circuit to remember for use as a solid-state low-level switch.

Following translation to the output frequency, the real power buildup comes in the stages contained in a separate power amplifier module (really a large heat sink enclosure) mounted on the rear of the transceiver. The r.f. buildup is via a 40446 as a preamplifier, a 2N5490 as driver and two 2N6459's as finals. All stages are coupled by broad-band transformers. The nominal 12 volt input power line to the transceiver is permanently connected to the latter two stages. Only the low-level 12 volt circuits are affected by the front-panel on-off switch. A bias switching transistor associated with the driver and final stages assures that they draw no significant current unless the low-level 12 volt circuits are activated. The final stage is rated as 200 watts input (except on 10) on s.s.b. and c.w. and a minimum output of 80 watts. Measurements made showed the following for output at 13.6 v.d.c.:[1]

160 — 93 watts	15 — 90 watts
80 — 102 watts	10 — 42 watts
40 — 90 watts	
20 — 84 watts	

RTTY and SSTV modes were not tested but it would appear that the 210 or 215 could run at a reduced power input of around 100 on these modes.

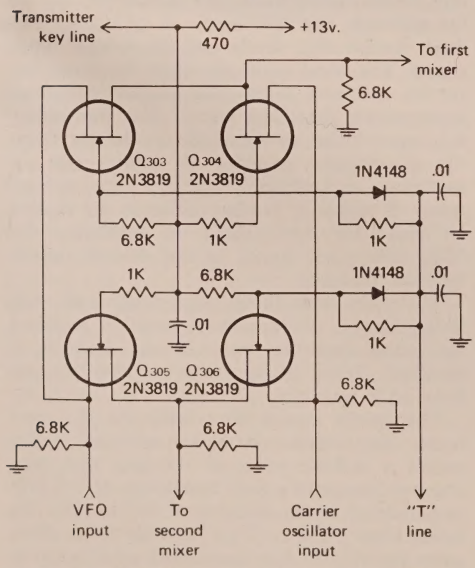


Fig. 3—FET switch used to transfer v.f.o. and carrier oscillator signals between the first and second mixers. Functionally, it is the equivalent of a d.p.d.t. relay.

Those who have seen solid-state 2 watt transmitters completely ruin nearby TV reception because of their high harmonic collector currents and output, may wonder what 200 watts of solid-state can do. Not much in this case. Through the shielding provided by the completely enclosed power amplifier module and the use of bandswitched low-pass filters harmonic radiation is 35 db down from peak output. This is sufficient for mobile use but for home use in fringe area more harmonic attenuation will probably be necessary, the same as with almost any transceiver on the market today.

A far more significant item to watch when using the 210/215 (or any new solid-state, broad-band transmitter) is that of having an *exact* antenna/transmission line match to the output of the transmitter. A tube type rig with an adjustable pi-network output can match a small but definite range of impedances. However, with a broadband, solid-state rig there is no adjustable pi-network and fig. 4 shows what happens to the output power of a rig such as the 210/215.

Most mobile antennas on the market today do not provide a non-reactive load of 50 ohms at their resonant frequency. They may provide a "nominal" 50 ohm load but that won't do for solid-state rigs. Therefore, when using a rig such as the 210/215 for mobile applications, it must be matched far more closely to the antenna used. Atlas markets a toroid, broadband matching transformer (the MT-1) which converts from 50 ohms to selectable impedances of 13, 18 or 23 ohms. These impedances are closer to the "real" ones presented by most center loaded mobile antennas. The taps may have to be changed when bands are switched.

[1] Values shown are worst-case figures for two units tested where both units cover the same band. Same as for receiver sensitivity.

S.W.R.	Nominal Power Output (*Watts*)
1.0	100
1.1	98
1.2	95
1.3	90
1.5	80
2.0	50
3.0	20

Fig. 4—Output power vs. s.w.r. for the Atlas 210/215 transceiver. Note the particularly sharp decrease in output power when s.w.r. rises above 1.5:1. This characteristic is common to broadband solid-state transceivers using high-s.w.r. protective circuitry.

For home station operation, the amateur using a simple dipole or beam will almost certainly require a matching network between the barefoot 210/215 and his antenna on 20, 40 or 80 meters to achieve maximum power output over the entire band. Working into a linear generally will present no problem if it has the usual input broadband Pi or L network, although these networks may have to be optimized for 50 ohms instead of the usual sloppy tolerances which tube-type transceivers can accommodate.

Excessive s.w.r. protection and a.l.c. operation in the 210/215 is provided by a built-in reflectometer or s.w.r. bridge using a toroidial transformer as the pickup element on the transmitter output line. Voltage pickup proportional to the reflected power level is used to reduce i.f. drive via the a.g.c./a.l.c. loop. Several tests confirmed the effectiveness of this circuit involving no-load conditions.

Tune-up is normally accomplished in the c.w. mode and in this mode the front-panel microphone gain control is automatically switched to function as a carrier level insertion control. The a.l.c. control is brought out as a front panel control as a dual potentiometer arrangement with the microphone gain potentiometer. This arrangement allows an optimum setting of the a.l.c. level to be achieved for each band.

S.s.b. signal reports confirmed clean and articulate modulation. Higher order distortion products are at least 30-35 db down. C.w. keying, which is accomplished by means of cut-off of the i.f. chain, shows no sign of clicks. No c.w. monitor is built in although one can be easily added.

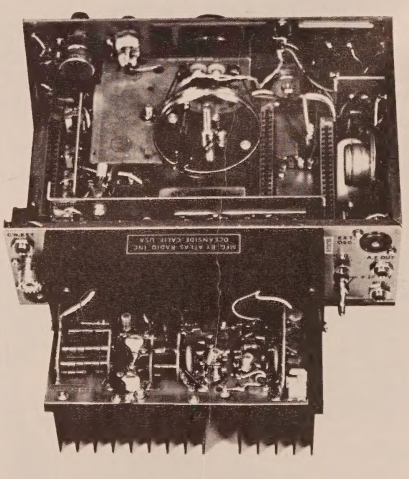
Switching between receive and transmit modes on s.s.b. is conventional. Either a PTT button on a microphone, or the front panel function switch can be used. Unfortunately, things are not so simple of c.w. Using the same front panel switch one would have to go from REC through TRANS and to CW and then back each time the receive/transmit function is performed. This arrangement is certainly not acceptable for a lot of c.w. activity. Fortunately, all the lines which have to be switched are terminated also as points on the accessory sockets on the rear of the transceiver. Semi-break-in, for instance, could be achieved by an external keyer which activated a time delay circuit and relay which accomplished the necessary switching or one could run a line to a miniature d.p.d.t. toggle switch set next to or on the base of the key to use for manual receive/transmit switching.

Frequent reference has been made to the various sockets on the rear of the 210/215. Specifically, there are sockets for r.f. output, external speaker/headphones, microphone, c.w. key, external oscillator and another simply marked "accessory socket." It accesses linear amplifier switching, a.l.c. input from a linear, provision for c.w. filter insertion in the i.f. chain and just about every operating voltage and switching function.

Wiring and Construction

The construction and wiring can be rated as excellent. The wiring was examined carefully and no trace of poor workmanship could be found. The plug-in boards are held tightly in place by brackets or other support means. A nice feature about all of the controls, switches and sockets is that they are screw mounted instead of riveted. Therefore even if something

[*continued on page 65*]



At the rear of the Atlas 210/215, the broad-band power amplifier hinges down to provide access to PA wiring. The toroid-stack-cores for the broad-band transformers are visable towards the left. Missing from this view are the plug-in PC boards and the drum dial which sits above the dial cord pulley at the top center.

1974 CQ WORLD-WIDE DX CONTEST PHONE RESULTS

BY FRED CAPOSSELA,* K6SSS, ex-W2IWC/6

How would you like to make almost 6½ million points—break the world's record by 1,000,000—and still come in second!

That's exactly what happened to 4M6AW.

The man who beat him was ZD3X, Martin Laine, OH2BH, who piled up 6.6 million from Gambia to take Single Op/All Band honors. Congratulations, Marty!

To give you an idea of the competition, Ron, F5QQ, at FY0BHI broke the existing record by ½ million—and had to settle for third.

But that's the kind of contest it was.

Remember the call, PJ9JR, you heard all over the place?

Everybody else did too. Because the PVRC Multi-Multi talked their way to the largest score ever made in the history of the DX contest—a whopping 19 million plus.

Speaking of smashing records, the gang at PY2CAB also gave us a new Multi-Single mark to shoot for—just under 7 million.

Those weren't the only records to fall. Congratulations to brand-new record holders 4X4-UR, EA8CR, 4W1GM, CR6WW, OD5HC, XU-1DX, PA0HIP, VP2MSU, WB8APH, W1EBC and W3WJD.

Hats off also to WB8APH who knocked off 9 zones and 20 countries from West Virginia on 160 meter SSB. That's right, on 160! And to three stations who cracked the 100-country mark on 40 Phone—EA8CR, SM6CKU and W3AZD at PJ9JR. And to Marion, ZL1BKL, and Carol, ZL1AJL, for the first YL DXpedition—ZL1-AA/C Chatham Island.

Tuning around the bands, I noticed that an increasing number of DX stations are resisting the temptation to work W/K's transceive on 80 meters. Instead, they are going below the U.S. band between 3.750 and 3.775 KHz and announcing a listening frequency higher in the band. It really speeds up things. Because of generally weak signal levels and murderous Stateside QRM, transceive operation on 80 usually results in frustration on both ends.

This year's write-up contains some new features I hope you'll enjoy. To begin with, there's a new listing of high W/K's called "USA TOP

USA TOP SCORES

Single-Op All Band

W6RR	1,346,880	W6MAR	1,182,352
W3AU	1,326,240	W3GRF	1,143,205
W3LPL	1,324,078	K4VX	883,872
K6UA	1,265,232	W3BGN	880,149
W7JST	1,229,440	W2GXD	841,338

Single-Op Single Band

28 MHz		7 MHz	
K4JRB	51,300	W3PHL	82,485
W4LBP	42,456	W4QCW	73,332
K4KJN	35,478	WA6IQM	36,704
W8WPC	35,022	W6PXG	32,964
WA1HFN	31,339	K8LUU	32,370
WB6PXP	26,796	WA3TLR	26,950
21 MHz		**3.8 MHz**	
K6SDR	345,874	W1EBC	44,540
WA6EKL	292,866	K6ERT	43,392
W6HX	210,600	K8INX	35,332
WA5RXT	167,442	W4CRW	33,129
W2NIN	154,572	W5LUJ	26,411
K1IMP	134,664	W6NLZ	23,832
14 MHz		**1.8 MHz**	
K2KUR/2	281,808	WB8APH	2,175
K4IRQ	260,601	K1PBW/1	1,175
W2GRR	259,160	WIBB	494
W8AHB	218,854	W2BP	228
WA1NKK/1	193,595		
W9YRA	153,120		

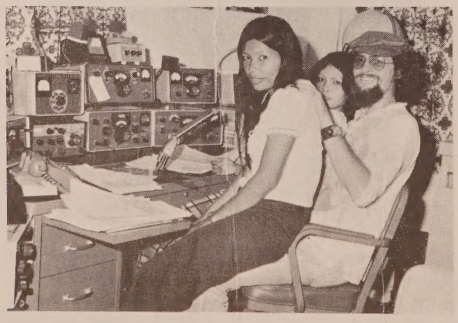
Multi-Op Single Trans.

W3WJD	2,440,167	W9LT	1,119,180
W6ONV	1,277,586	K6CQF	1,030,428
W4FDA	1,217,920	W6YRA	883,353

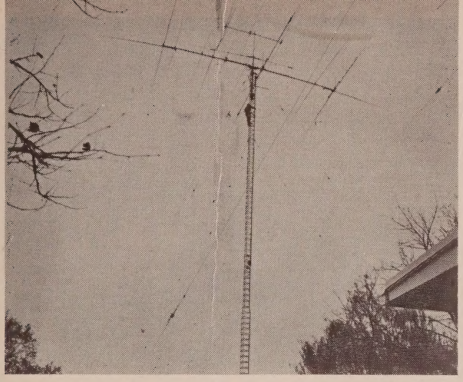
Multi-Op Multi-Trans.

W2PV	3,859,185	WA8ZDF	2,889,048
W3GPE	3,091,770	WB5DTX	2,559,972
W4BVV	2,889,254	W1ZM	2,491,061

* Director, *CQ* DX Contest Committee.



XU1DX Top Asian scorer. Didn't you say you were Single Op, Don? It's refreshing to see he doesn't limit himself to one hobby.



The 100-footer at W9LT. That's the OM himself inching his way to the top.

SCORES". And, from the "Remarks" section of your summary sheets, we've assembled a new column of comments entitled "QRM". It's the first time I can say I actually enjoyed QRM (the inquiry from WB4KTR/8 and UP20X's imaginative solution to TVI are classics).

Don't know if this will become a regular feature, but in the "Don't-you-wish-you-had-his-callsign" department, I'd like to nominate TA2SC, FRØBCS, XUIDX, 7P8AT, WB4KSE/KW6 and OE2NWL/YK.

And in the "Your-secret-is-safe-with-me" corner, I promise not to reveal the callsign of a contestant with the last name of Yagi who ran up a quarter of a million points using a 4 el. —Quad. Or the WB6 who wrote his call incorrectly on his summary sheet.

A lot of fine people worked very hard to help me with my first attempt at putting the Results together. And I'd like to give them the credit they deserve. First, the Old Master, Frank Anzalone, W1WY, the Chairman. Our Regular DX Committee members, Gene Walsh, K2KUR; Bo Cox, K3EST; Bernie Welch, W8IMZ; Dave Donnelly, WB2SQN, and Dick Norton, W6DGH. And a warm welcome to new Committee members who joined us in 1975: Larry Weaver, W6JPH; Glen Rattmann, W6MAR; Jim Neiger, W6BHY; Phil Goetz, W6DQX; Larry Brockman, WA6EPQ, and Fred Laun, W9SZR. Thank you, gentlemen, I couldn't have done it without you. And, last but not least, to the one who made sure all the logs got to California from *CQ*, Marguerite Fagella.

The expanded Committee is planning a number of new projects to make the Contest better and more enjoyable. As always, we'd like to hear from you—both pro and con. We've got a lot of energy and manpower, but we can always use more input. So, drop us a card c/o *CQ*.

That's it for now. Coming up next month, the C.W. Results. And coming up the weekend of October 25 & 26, the 1975 *CQ* WW Phone Contest.

73, Fred, K6SSS ex-W2IWC/6

TROPHY WINNERS

Single-Operator Single Band

Julio Manuel da Costa Morais CR6WW (14 MHz)
World Phone Trophy
K2HLB Memorial Trophy (NJDXA)

Paul Hicks, VE3BBH
Canadian Phone Trophy
Donor: Gene Krehbiel, VE6TP

Dieter Spieth, HT1ØAA (28 MHz)
Carib./C.A. Phone Trophy
Donor: G. Keuther, HR2GK

Rafael Ponce de Leon Zas, CX7B (14 MHz)
So. American Phone Trophy
Donors: Brazil DXers

Single-Operator All Band

Martin Laine, ZD3X
World Phone Trophy
Donor: Bill Leonard, W2SKE

W3AU (Opr. Alfred A. Laun, III, W9SZR)
USA Phone Trophy
Donor: Potomac Valley Radio Club

Garry V. Hammond, VE3GCO
Canadian Phone Trophy
Donor: Jack Baldwin, VE3BS

Antonio Cardelli, I6FLD
European Phone Trophy
Donor: W4BVV Operators

Chester H. Moore, KP4EAJ
Carib./C.A. Phone Trophy
Donor: Harold Fox, W3AA

Jerome Trousdale, 9L1JT
African Phone Trophy
Donor: Gordon Marshall, W6RR

Donald R. Riebhoff, XU1DX
Asian Phone Trophy
Donor: Japan CQ Magazine

Joseph A. Locascio, KH6IGJ
Oceania Phone Trophy
Donor: Northern California DX Club

Multi-Operator Single Transmitter

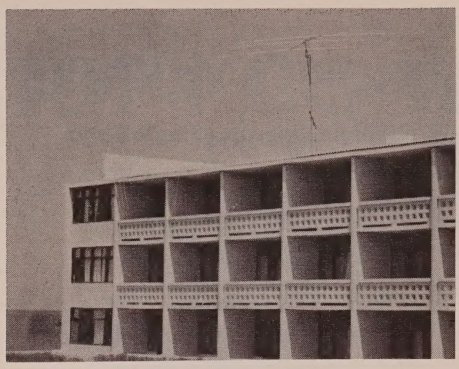
PY2CAB (Oprs. PY2CAB, PY2DYI, PY2ELV, PY2EGM, PY2BU)
World Phone Trophy
Donor: John Knight, W6YY

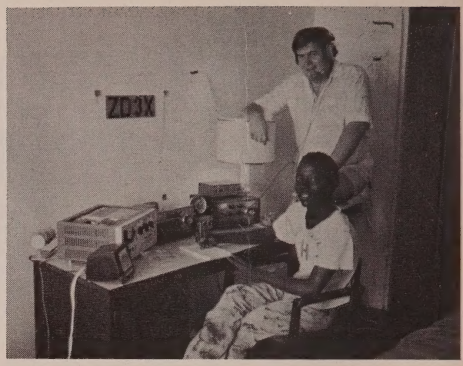
Multi-Operator Multi-Transmitter

PJ9JR (Oprs. K3EST, W3ZKH, WA3IAQ, W3AZD, W4WSF, W3IN, W6UM)
World Phone Trophy
Donor: Radio Club Venezolano

Expedition Trophy

PJ9JR (Oprs. K3EST, W3ZKH, WA3IAQ, W3AZD, W4WSF, W3IN, W6UM)
Donor: Stuart Meyer, W2GHK





World Champion ZD3X and his oceanside "antenna farm"—TH3, 14AVQ, dipoles. Imagine how many more QSOs he could have made if he had a digital clock. Fellow in the operating position is Sheriff who kept Marty supplied with ice water.

DX QRM

"To break the world record by 1 million points and lose? I'm crying . . . *4M6AW*. Must have had banana-shape polarization due to high winds . . . *GM3ASY*. This is the best contest for me because I always work new countries . . . *EA3NA*. Last year I got a very bad cold. This year condx went bad due to auroral activity. What will happen next year? . . . *SM5GZ*. Friendship among men brings peace among nations . . . *YO2AFB*. At 0820Z worked JA1AFI long path (10m.) . . .*YU3EJ*. Many USA stations did not listen on EU band (below 3.7 KHz) . . . *YU3TXT*. Too much QRM from Tirana broadcasts (40m.) . . . *SP9DH*. Biggest thrill when the DU called us in a pileup . . . *EI0GRC*. Where have all the DX gone? . . . *GM3ZRC*. Sorry, TVI didn't allow me to operate most part of the contest. Will hide in a forest next year . . . *UP2OX*. To give as many stations as possible Chathams, we decided to go multi-multi . . . *ZL1AA/C*. When are we going to be given the chance to compete with South America (PJ/9Y4)? It is next to impossible for us to rig-up a group and operate in the Caribbean . . . *TI1K*. Being a surgeon, I unfortunately had to operate at the hospital in addition to the contest . . . *FO8EE*. Only equipment to fail was a ballpoint pen I got from W7RM . . . *XU1DX*. A capacitor exploding in the SB-220 during the 21st hour helped keep me awake . . . *4W1GM*. Broken quad, power failures and power line noise . . . *VU7GV*. Ten meters very poor here . . . *FO8DF*. Great condx on 10 meters . . . *9L1JT*. My first contest ever . . . *6W8FP, VU2OO, KH6IJA, EL0REI*. It was impossible to work with W/K's whenever I came on the air . . . *TA2SC*. Sorry for the very bad propagation . . . *FR0BCS*. Biggest thrill—assisting the ZL1AA/C operators to catch new multipliers . . . *ZL4BO*. Three different transmitters at our multiplier pick-up point failed to operate properly . . . *OD5HC*. Why don't contacts between UA9 and JA count as 2 points? . . . *UK9AAN*. This was my last contest from UA0-land, will try it from Moscow next year as UV3GM . . . *UA0FGM*. Always enjoy working stations in the contest with low power . . . *JA2ZAP*. Got very tired . . . *JR1BRV*. What about all the double and triple calls this year? . . . *YV1AC/5*. Please examine overpower station JH3---, he is 2nd class op so output 100W. only, but his xmtr 1.4kw input . . . *Osaka Over Power Examiner*. You guessed it! Who else but poor stupid old Gene would wait a year and travel so far just to listen to QRN? . . . *9Y4GS/VP7*. On the 21 Mcs band a number of USA chaps were well below 21.250. Have also noted that below 14200, USA hams often call a DX station requesting they look above 14200 for a QSO. This is also illegal, but not too often is the call sign given but some "minds" still think this is cricket . . . *VE1EK*. Surprised how well my "antenna farm" got out. (10 meter dipole, 15 feet high). Also lots of confusion with KP4s EAK, EAJ, EAM & ME . . . *KP4EAS*. Fue un magnifico contest como todos los anteriores, lamentablemente los premios llegaran tarde . . . *LU8AJG*.

0200 Final amplifier blew up. No tube on hand. Have to call all friends.
0530 Very low line voltage. Have to QRT.
0555 Low line voltage again. QRT.
0650 Speech amplifier goes microphonic. Have to tear shack apart to find another 12AX7.
0950 The 2-el beam crashed down on the roof. Have to raise an inverted-V dipole.
0300 Have a short in the coax. Where?
0712 Power supply blows fuses. Why?
0732 Can't load the dipole. Back to the roof.
0832 Smell something burning in the transmitter . . . *LU1ADI*.

I shall soon be CP1AT! Waiting for my new ticket . . . *CP3BY/CP1*. My first contest. Must get antenna rotator next time—had to climb tower to turn antenna; Lost some pounds, but good exercise . . . *PY2GNR*. Nice contest once more. Worked 4 new countries . . .*CE5GO*. This is the first time I have actively participated and submitted a log. I found lots of courtesy displayed in the contest and it was a pleasure to participate. After more than 3 years, I finally caught up with 3D2CC and worked him on 2 bands . . . *HC2YL*. I made the enormous mistake to think that multipliers would come just like that and I never looked for them. Although I think I have the biggest number of QSOs in the category, my multiplier is pitiful and that certainly teaches me a lesson. I learn every time! I fell asleep for 6 hours after the first 24 hours after making such a big effort, mentally and physically, to be ready in time for the contest. ZD3X and 4M6AW are tough competition! . . . *FY0BHI*. Better condx than I expected. Bettered my last year's all band score by a lot . . . *OA4AIW*. Really enjoyed the contest . . . *YV4TI*. We all enjoyed the contest, sure wish the W's would understand that we need multipliers also!! . . . *VP7BC*. Blew a resistor with 4 hours left in the contest. Was most distressed to hear so many W/Ks operating outside their legal operating limits . . . *HI8XAW*. Lost the generator during a great run for 45 minutes Saturday morning. Stateside operators were great during the contest. Where were the Africans? . . . *VP5WW*. What started out as a fairly good set up fell apart within the first hour. In that time we lost a rig, a KW, the big beam and a rotator. The remainder of the contest we used a TA33 Jr with no indicator. Aw well, next year?? . . . *VE3EDC*. It was a nice experience. Not prepared with enough time. Much local QRM . . . *LU2AFH*.

USA QRM

"Getting old . . . *WA3ATP*. Too long for OM. Crapped out and let Junior take over . . . *W8GIO*. We missed our tennis game because of your dumb contest . . . *W6BVN*. From the Midwest, it's fight the East Coast all morning, both coasts all afternoon, and the West Coast all evening . . . *W0EEE*. Antenna wouldn't rotate Friday, receiver broke Saturday, power shut off Sunday morning, but it was still fun . . . *W6YRA*. Had a good time in the Virginia mountains . . . *W4JVN/4*. Assumed I had worked ZD3X and VP2MSU on 40 when I didn't. Never worked them . . . *WA5RTG*. Request Rules Committee to dis-allow the use of tape recorders . . . *K8INX*. Friday morning we discovered that operating the 20 meter station produced a broad band noise on 15 that made the position unusable. We began adding filters, matchboxes, changing exciters, linears, fittings, grounds, etc. By 5 P.M. we had run out of ideas. Suddenly, half an hour before the contest, I remembered I had added a 2 meter ground plane to the 15m. tower since the last contest. We

disconnected the coax and shorted it to ground. Shazam! No more noise on 15 . . . *WA8ZDF*. Win or lose, working XU1DX on 7MHz long path made it all worthwhile . . . *W4QCW*. Forgot to work USA! XU1DX 58 on 40 here Sunday morning. What a pileup . . . WA4APG. Had to work 6:30 A.M.-4 P.M. Sat. and Sunday . . . *WA8ZDT/4*. The East Coast has Europe, the West Coast has Japan and we have S.A. But only 12% of QSOs were with S.A. We need more S.A. activity and a limit on JA's . . . *K5FKD*. Enjoyed this year's *CQ* WW better than 1973 . . . *WB5FKX*. Discovered that I had left all the cables connecting the rig, linear amplifier and antenna 125 miles away at my portable five QTH. This was 3 minutes before the contest! . . . *WA5VDH*. Hard to believe I worked a CR6 right under a pileup on a South American station . . . *WB6PXP*. Worked YJ8 while repairing equipment . . . *WA6EKL*. Thanks to VK5MF for my only zone 30, long path, late in the contest . . . *WA1NKK/1*. Didn't have time off this year for the phone weekend . . . *WØDAD/1*. European ops weren't listening in US (40m.) phone band . . . *WA1FBX*. Suggest creating special multiplier for DX on 160 to boost contest activity on 160 . . . *K1PBW/1*. Heard a JA1 work G2 at 1538Z on Oct. 27. Heard both ends on long path (10 meters) . . . *WA2IFS*. Sorry I had to work on my job Sat. and Sun. . . . *WB2AQC*. Always enjoy *CQ WW*. It's the best contest in ham radio . . . *W3KDD*. Wow! Who said 15 was dead. Hi. Got 5 new countries . . . *WA3DMH*. Working Canada to get QSO points is more like Sweepstakes than DX contest. Maximum contacts per country should be incorporated . . . *WA3TLR*. I must have worked every LU station on SSB . . . *K4JRB*. Finally bagged SV1GA. Had a ball in first try at contesting. See you next year . . . *WA4CFI*. Heard XU1DX and VS5MC on 40. XU1DX on the long path at that. Now to work them . . . *WAØCPX*. 203 JA stations in one continuous unbroken run with no other countries (15 meters) . . . *W7TML*. Am I the highest scoring 25-year-old rock musician? . » . *WB4KTR/8*. Feel earlier date might be better—too close to SS . . . *WØIUB*. Missed 7P8AT again—No UK's this time . . . *W8KOD*. If the operator (me) was as ready as the station I might have placed first . . . *WA8ZAN*. Enjoyed getting through the pileup to get 3A2GX, 5W1AV and others . . . *WB8NVD*. My score is inversely proportional to my efforts— tried harder this year and had a lower score than last year . . . *WA8VZO*. QRM seems to get worse as conditions on 15 and 10 deteriorate . . . *WA8YVR*. First contest—great fun. Will be back again with the hope that (multi/multi) will not be as unprofessional and discourteous as he was this year . . . *K8LUU*. Copied UK4WAC, UK9AAN but could not catch them listening in US band (40m) . . . *WA8LXJ*. Enjoyed working first JA on 75 . . . *K8INX*. I'm greatly impressed over the increased 160 activity this year as compared to last. I think *CQ* Manager's increased publicity towards 160 is a big factor . . . *WB8APH*. Miss my old pal W9ICE now /6 as we did much multi-op together . . . *W9RX*. In general condx poor—country mult best ever—115 on 14 mc! . . . *W9YRA*. Happy to work XU1DX for #313 during contest . . . *W9ZRX*. WB9HAK is an M.D. who invariably has to deliver a baby during contests, so he had to get a guest operator . . . *WA9QAL* (Opr. of WB9HAK). Condx poor . . . *K9CLO*. USA stations still violating 97,87 by not giving both calls during exchange . . . *K9UQN*. Suggest do away with giving points for working VE's . . . *W9DUB*. Thought conditions were reasonable . . . *WB9MOG*. 10 meters sounded good! Just like the old days—But no Europe . . . *KØGVG*. There should be a rule to prevent W's calling CQ DX. They were not getting the results that would justify the mass of interference that was caused . . . *KØSGJ*. Where was the ZM7? . . . W3GID. Really enjoyed my first contest even though I goofed on the GMT conversion and began about 21 hours late . . . *WA3RRS*. Fifteen meters was wild on Saturday! . . . *K4VX*. Ten meters was great on the second day . . . *W4QQN*. Biggest thrill working ZL1AA/C on 40 . . . *W4UPJ*. Still the best DX contest . . . *W4YWX*. Great fun, but better to be DX . . . *K4LSD* (ex-HS5AFJ.) The DXpedition boys are to be congratulated on their fine work! . . . *W4BAA*. Had bad case of laryngitis the whole weekend. Had to stop occasionally and let voice come back . . . *K4TBN*. Phone is *such* hard work! . . . *W4KFC*. Hard to get through East Coast but good contest . . . *WA6RFX*. First contest. It was the biggest opening to South America I ever heard . . . *WA6PAQ*. Let's have a multiplier for those over 65. Hi . . . *W6OK*. Propagation excellent, but thunderstorm first evening made QRN unbelievable! Great contest, biggest thrill was working Europe (SM6CKU) first time on 40 . . . *W6PXG*. No Europe short path here, but heard so many long path!! But no Europe long path listening up! (Above 7.15) . . . *WA6KAC*. Lots of fun as usual . . . *K6NA*. I was really thrilled to receive the nice certificate for the 1973 phone test on 14 mc phone . . . *WA7BPS*. Portable operation utilizing a gasoline generator . . . *WØSII/7*. Where was Europe? . . . *W8WPC*. After two hours of calling VQ9D in a pileup, 1 gave up. Returned 30 minutes later and got him on the first call! . . . *WA4TLB*. Got to get that beam up! . . . *W4ZTB*. It surely was a challenge working from stateside after leaving KP4DJI . . . *WB4FOT*. Wish you guys would move the contest so it doesn't interfere with bird season. Hi! . . . *K4JYM*. Super stations/multi-op and single-op who run another hams super station are ruining this test. . . . *W5LPO*. Shameful pileup on 15 meters for 7P8AT. We don't need that sort of thing for these contests . . . *WB5KWU*. Tough going in New Mexico . . . *WB5HAE*. My linear ties in with the stove 220 v. line and my XYL had me QRT several times during the contest so she could cook her meals—but she never cooked me anything. Hi! . . . *WA4IRE/4*. Nice VP2 turn out . . . *K4HWW*. My advanced ticket arrived week after test . . . *K4WVT*. Worked a new country on phone ZM7 for #290 . . . *W4HOS*. Excellent conditions for a great contest . . . *K4ISV*. I would have been honored to work just one—honorable station in zone 25! ! ! . . . *WA4OSM*. Terrible head cold and linear went up in smoke at start of test . . . *K4PHY*. Very few stations in the general part of the band . . . *WA4FOJ*. After operating this contest from overseas for many years found it a whole different ball game from this side . . . *K4IRQ* (ex KH6HCM). Suggest that contests be held prior to Monday holidays so one can recover . . . *WA4HPF*. How about giving DX stations extra QSO points for U.S. contacts on 40 and 80 meters? . . . *W2EHB*. Hardest contest I ever operated . . . *WA2DHF*. First time in contest—Fun? . . . *W2RFL*. Wish 40 and 80 were transceive! . . . *WA2AUB*. Too many stateside stations and not enough DX to go around . . . . *W2LEJ*. I had the best time ever, including all my XE and CX operations . . . *W3GRF* (Opr. KØDQI, ex-XE1JIJ). DX stations should identify more often . . . *W3BGN*. Started out just to get a few points for

[*continued on page 66 . . . Scores overleaf*]

WORLD TOP SCORES

Single-Op All Band	ZD3X	6,653,881	9Y4VU	2,522,532
	4M6AW	6,428,946	HC2YL	2,316,953
	FYØBHI	5,956,416	9L1JT	2,267,406
	KH6RS	3,337,005	DJ6QT/	
	XU1DX	2,607,750	CT3	2,109,952
			KP4EAJ	2,094,736
Single-Op Single Band	**28 MHz**		**7 MHz**	
	CR6NO	634,490	EA8CR	253,528
	CR6CN	586,432	EA4LH	164,952
	LU8FEU	488,488	VE3BMV	130,286
	HT1ØAA	484,770	SM6CKU	110,922
	CE6EZ	424,212	OH2QV	95,584
	YV1AQE	399,504	YU3DBC	87,890
	21 MHz		**3.8 MHz**	
	CR6OZ	638,810	EIØREI	68,112
	CR6OR	592,478	IT9ZGY	66,360
	F2SI	392,931	I3MAU	46,588
	4WIED	364,764	W1EBC	44,540
	EA8JJ	352,584	OH1XX	43,435
	K6SDR	345,874	K6ERT	43,392
	14 MHz		**1.8 MHz**	
	CR6WW	1,058,446	PAØHIP	5,200
	CX7B	967,050	9Y4GS/VP7	3,822
	4W1GM	705,602	GM4ASY	2,244
	4X4NJ	653,535	WB8APH	2,175
	YV4TI	579,020	4X4UR	1,188
	I5BPD	551,040	KIPBW/1	1,175
Multi-Op Single Trans.	PY2CAB	6,959,474	CV4C	4,959,474
	VP2MSU	5,512,584	OD5HC	4,606,547
	VP2GMB	5,077,140	UK9ABA	4,033,024
Multi-Op Multi-Trans.	PJ9JR	19,469,094	4Z4EU	3,968,844
	TI1K	6,833,020	W2PV	3,859,185
	DLØPG	4,280,214	VU2CBE	3,205,488

Number groups after call letters denotes following: Band, (A-all) Final Score, Number of QSOs, Zones and Countries. Certificae winners are listed Bold Face.

PHONE RESULTS SINGLE OPERATOR NORTH AMERICA

United States

K1CSJ A 648,174 676 94 260
W1CMH " 431,844 545 79 212
W1BIH " 86,483 167 60 137
WA1MCY " 76,012 220 35 89
WA1RGW " 68,252 221 42 71
W1WY* " 59,124 158 54 102
K1GAX " 41,745 121 40 81
W1JDE " 28,483 103 28 63
W1HWM " 23,370 95 31 64
VE2CK/W1 16,456 82 29 59
W1VV " 11,808 74 23 49
W1GPK " 11,025 56 25 50
K1IIK " 9,405 61 19 38
W1PLJ " 6,820 47 18 37
WA1HFN 28 31,339 151 19 58
K1LWI " 9,636 87 15 29
K1IMP 21 134,664 388 28 96
W1PIV " 69,264 221 27 84
WA1NKK/1 14
193,595 437 32 123
WA1SKV " 91,242 288 22 89
WA1JMP " 39,618 162 21 72
W5TTV/1 " 38,311 153 23 68
K1KNQ " 20,196 109 16 50
WØDAD/1 6,943 51 15 37
W1BPW 7 5,550 43 20 30
WA1FBX " 5,170 45 13 34
W1EBC 3.8 44,540 225 20 65
K1PBW/1 1.8 1,175 22 9 16
W1BB " 494 14 8 11
W2GXD A 841,338 790 100 287
W2EHB " 370,622 430 89 233
K2FL " 341,784 434 84 219
WA2DHF " 322,816 463 71 185
K2BQO " 238,124 368 76 160
W2RFL " 234,240 376 73 171
W2HNO " 203,889 355 58 161
WA2AUB " 186,676 304 71 165
WB2JJN " 157,092 288 65 147
W2DT " 156,800 283 53 147
W2UI " 105,794 237 51 118
W2LEJ " 96,900 219 54 116
WA2DLV " 95,830 207 60 125
WA2LVV " 81,289 185 50 119
W2HAE " 66,360 154 54 114
WA2ZWH " 60,781 173 43 90
K2PZF " 50,052 142 37 92
W2FGY " 42,028 129 45 88
WB2NDR " 32,940 119 44 78
K2SNK " 24,831 100 32 61
K2BK " 24,402 102 33 65
K2QIL " 21,669 86 31 62
K2GI " 17,775 84 22 57
K2MFY " 9,306 51 26 40
WA2JZX " 3,854 34 15 26
WA2IFS 28 12,862 87 16 43
K2OLG " 10,788 76 15 43
WB2FJX " 4,674 47 15 26
W2NIN 21 154,572 413 28 104
WB2ZGI " 62,348 210 24 85
W2AZO " 9,720 66 16 38
K2FE " 6,600 52 18 32
K2KUR/2*
14 281,808 686 34 118
W2GRR " 259,160 578 35 120
K2EVW " 38,528 161 23 63
(Opr. W2HBT)
WB2GXW " 12,792 89 13 39
WB2AQC " 6,615 57 13 32
W2MB " 520 14 6 7
K2TXC 3.8 21,420 132 17 53
WA2UJM " 20,130 129 16 50
W2BP 1.8 228 10 4 8
W3AU A
1,326,240 1092 111 321
(Op. W9SZR/3)
W3LPL "
1,324,078 1042 114 344
(Opr. WA3HRV)

*Committee Member. Ineligible for Award.

W3GRF "
1,143,205 932 113 332
Opr. K0DQI)
W3BGN " 880,149 803 100 297
K3GJD " 692,384 719 102 250
W3CRE " 684,738 726 92 257
K3YUA " 499,328 552 90 242
W3DBT " 420,912 577 78 218
W3ZSR " 404,217 519 85 212
W3VT " 366,865 455 85 222
K3KNH " 332,408 407 82 214
W3AXW " 278,163 382 80 199
K3AWZ " 258,129 373 78 183
K3DPQ " 228,042 369 69 177
W3KT " 210,589 316 72 179
K3CY " 202,125 335 67 164
K3TGM " 197,664 318 63 169
W3KFQ " 193,022 336 55 151
W3GRS " 160,688 255 73 169
WA3AFQ " 160,460 282 68 158
W3GID " 113,315 234 49 124
W3GHM " 113,128 227 60 119
K3JGI " 108,920 281 42 98
W3FA " 108,864 226 62 130
W3MFJ " 107,880 262 46 109
W3OV " 104,328 214 67 122
K3BNS " 103,016 239 48 110
WA3NNA " 97,053 203 62 125
W3HVM " 86,337 202 50 109
W3KV " 68,880 163 53 111
W3YHR " 51,800 134 49 99
W3EVW " 49,911 147 41 90
W3ZJ " 43,757 143 49 84
K3KHL " 42,210 123 45 81
W3HYJ " 41,406 151 33 70
W3CGS " 30,200 111 32 68
W3BB " 23,296 96 36 55
K3IMC " 21,018 91 30 63
WA3RRS " 15,252 79 29 53
WA3UHJ " 14,040 71 35 55
W3DRD " 4,386 35 19 32
W3KDD 28 16,380 91 20 50
WA3OSJ " 1,972 28 8 21
WA3VBU " 595 15 6 11
WA3DMH 21 3,827 32 16 27
W3EZT 14 113,316 292 31 111
WA3SWF " 93,483 282 29 88
W3KHB " 32,038 139 20 63
K3AV " 8,957 62 14 39
W3PHL 7 82,485 281 30 87
WA3TLR " 26,950 153 23 54
W3OOR " 6,540 44 18 42
K4VX A 883,872 789 103 293
W4QQN " 640,800 716 104 252
W4UPJ " 614,725 687 89 246
W4YWX " 570,489 550 108 289
W9MIJ/4 " 505,284 582 80 236
W4MCM " 491,232 455 101 307
K4JWD " 408,366 509 81 213
K4LSD " 405,620 455 94 246
W4MYA " 369,340 490 79 216
K4KZZ " 350,873 432 87 226
WA6CXK/4 329,376 449 85 207
K4PQL " 328,944 442 73 194
WB4OSS " 309,455 399 86 209
K4YFQ " 303,225 375 87 224
W4QAW " 249,824 321 77 219
WB4TBO " 244,110 385 64 173
WA4GQJ " 221,704 337 79 180
K4AUL " 220,500 321 64 184
W4WRY " 218,095 317 79 186
K0CMF/4 202,800 301 77 183
W4BAA " 191,774 292 79 174
W4PRO " 185,673 368 44 133
K4ZRX " 176,220 302 63 157
K4TBN " 169,120 294 69 155
W4ZSH " 147,312 252 66 150
WA4EWX " 126,763 252 65 134
K4GGJ " 123,579 227 65 142
WB4SGV " 115,042 236 61 133
W4JHK " 112,833 213 64 135
W4KFC " 110,048 229 54 127
WA4TLB " 107,300 223 55 130
K4DJC " 104,535 204 61 146
W4UYC " 84,160 207 47 113
WA4SVH " 81,445 165 59 120
WB4OGW " 78,030 167 54 116
W4DSW " 77,916 175 42 109
K4GFH " 76,254 206 44 98
WB4OXD " 50,820 131 47 93
W4KXV " 43,680 132 44 86
K4JRF " 39,262 125 47 87
K4BAI " 30,747 110 44 67
W4ZTB " 27,830 97 37 73
WB4FOT " 23,275 89 33 62
K4ZA " 22,386 97 27 64
K4JYM " 21,049 83 37 60
K4RD " 19,875 89 23 52
WB4AEX " 18,270 75 30 57
W4DS " 18,096 82 24 54
W4WHK " 16,468 71 33 59
W4TMN " 13,950 67 27 48
K4OD " 12,900 75 28 47
WB4EMF " 9,577 54 21 40
W4GF " 4,558 38 20 33
K4AUN " 3,239 34 14 27
K4KA " 1,887 28 16 21
WA4GKQ " 1,122 17 6 16
K4JRB 28 51,300 215 22 68
W4LBP " 42,456 194 21 66
K4KJN " 35,478 169 20 61
WB4IIP " 23,904 129 18 54
WA4CFI " 21,371 133 19 52
K4GRD " 17,963 100 19 52
WA4IRE/4 11,286 86 19 35
K4HWW " 10,808 76 19 37
K4WVT " 4,551 46 16 25
W4EEO " 3,840 35 14 26
W4HOS " 2,432 29 14 18
WB4TPU 21 129,280 371 25 103
K4ISV " 95,760 265 28 105
WA4OSM " 91,378 265 26 96
K4PHY " 91,000 265 25 100
W4UGE " 70,140 246 27 78
W4UPV " 48,140 168 26 79
W4ZTW " 41,492 164 23 69
WA4FOJ " 17,940 93 22 47
K4IRQ 14 260,601 620 32 117
WA4HPF " 68,985 243 23 82
K4HAV " 39,904 162 23 63
W4JAT " 26,013 145 18 51
WB4NRI " 3,034 32 15 26
W4JUK " 1,100 23 8 14
W4QCW 7 73,332 286 26 82
WB4SIJ " 18,865 100 20 57
WA4APG " 10,080 65 18 42
W4CRW 3.8 33,129 182 20 61
WA8ZDT/4 18,772 101 27 49
W4COP " 14,706 114 15 42
(Opr. WB4UKA)
K5PFL A 532,856 611 102 242
W5NMA " 368,440 481 94 211
W5RTQ " 342,738 452 95 202
W5TMN " 301,623 423 77 194
(Opr. WB5JJE)
K5YMY " 238,500 385 75 175
W5KKZ " 202,686 360 79 170
WB5EWH " 197,280 329 72 168
W5TWI " 171,288 284 67 167
WB5DDI " 149,766 270 70 148
W5OSJ " 146,944 271 74 150
VE6BU/W5 143,352 281 59 139
W5PAQ " 121,444 238 65 129
WA5STI " 108,400 231 66 134
W5BE " 91,296 234 52 92
W5LPO " 91,224 209 59 109
W5WG " 69,768 181 46 106
W5KCR " 66,420 157 57 107
W5OB " 47,158 141 49 97
K5TSR " 43,320 146 43 71
W5AE " 39,852 128 43 80
W5ORX " 37,466 123 52 79
WB5KWU " 27,090 103 39 66
WB5HOD " 26,912 108 45 71
K5SOR " 25,688 98 37 67
WB5HAE " 24,158 95 31 63
WA5YFQ " 15,741 73 41 58
W5EDX " 13,578 66 34 59
W5NVU " 13,430 73 25 54
K5FVA " 12,282 72 19 50
K5DEC " 9,996 65 29 39
WA7LKI/5 7,688 56 24 38
WB5CJE " 4,700 41 17 30
W5HIC " 3,380 33 22 30
WA5WEY " 3,168 39 18 26
W5ZWQ " 1,107 16 11 16
W5SOD " 378 11 8 10
WB5HIH 28 13,281 93 16 41
W5QF " 1,764 26 10 18
WB5HVY " 1,705 21 12 19
WA5RXT 21 167,442 466 29 100
K5FKD " 101,135 336 28 85
WB5FKX " 28,182 152 21 56
WA5VDH 14 97,586 342 29 89
WA5LES " 55,794 208 27 75
K5PFE 7 300 12 7 8
W5LUJ 3.8 26,411 147 21 56

W6RR A
1,346,880 1304 108 260
K6UA
1,265,232 1311 114 230
W6MAR
1,182,360 1245 104 230
K6OVJ " 638,352 803 92 194
(Opr. W6DSQ)
W6PLH " 484,832 762 81 137
WA6EPQ " 302,500 414 87 188
K6UJS " 261,508 446 77 137
W6EYY " 250,170 498 68 118
K6QW " 239,616 369 87 169
K6QPH " 235,936 433 69 133
W6HJP " 204,612 371 66 138
WB6NHF " 191,296 381 70 126
W6OAU " 151,179 259 58 103
W6CPL " 150,336 317 74 118
K6SSJ " 125,643 246 68 125
W6DKQ " 116,081 266 55 106
W6YVK " 100,104 287 50 79
W6HXW " 99,964 262 49 85
W6ANB " 90,090 253 47 79
W6BJB " 81,120 213 49 81
W6VPZ " 66,220 228 40 70
(Opr. W6CFM)
W6PRP " 59,364 149 55 98
K6AO " 54,778 172 49 73
WA6AHF " 52,326 172 46 68
K6PO " 42,120 139 39 69
W6KYA " 39,372 139 39 63
W6CHV " 37,960 111 44 86
W6EJ " 36,360 113 45 75
W6OAT " 33,796 114 43 76
WA6OWM " 33,152 118 45 67
W6ZWK " 29,532 103 41 66
W6KHI " 28,968 150 33 38
WA6LBP " 23,000 90 40 60
W6SC " 15,552 77 30 51
W6HJ " 15,390 76 34 47
WA6TKT " 14,980 78 32 38
W6RNF " 14,820 78 34 42
WA3VHB/6 8,496 55 31 24
WA6WUI " 4,370 41 20 26
WA6UFY " 3,800 43 20 18
WØLBP/6 " 3,280 32 16 24
WB6PXP 28 26,796 165 18 48
W6MI " 968 16 8 14
K6SDR 21 345,874 1152 28 75
WA6EKL " 292,866 933 28 86
W6HX " 210,600 695 26 78
K0GJD/6 " 135,736 501 24 70
WB6PNB " 114,950 416 27 68
WA6NGG " 86,975 421 20 51
W6AM " 15,732 103 19 33
W6ID " 13,896 80 19 40
WB6FDD 14 123,342 396 30 92
WB6FZC " 99,120 333 30 75
WA6RFX " 95,687 328 26 77
WA6PAQ " 56,628 211 25 74
W6OK " 43,924 203 23 56
W6FF " 8,532 60 19 35
WA6IQM 7 36,704 191 22 52
W6PXG " 32,964 188 24 43
WA6KAC " 23,488 176 22 42
K5AM/6 " 320 11 4 6
K6ERT 3.8 43,392 306 21 43
W6NLZ " 23,832 131 22 50
W6ITY " 11,110 83 17 38
K6NA " 8,900 82 16 34
W6QJW " 8,648 206 16 30
W7JST A
1,229,440 1373 95 225
K3MNT/7 422,100 675 79 146
W7TML " 419,060 681 75 155
K7RSC " 406,350 649 78 147
W9IRH/7 391,020 587 80 165
W7HXG " 231,137 450 57 124
W7BSU/7 103,768 336 49 70
(Opr. WB7UQV)
WA7JCB " 89,640 352 34 56
W7GYP " 86,730 206 48 99
K7GEX " 82,308 243 46 68
W7NP " 70,924 219 44 75
WA7OBL " 70,680 224 48 72
W7LZF " 63,474 170 53 96
W7BCT " 55,481 182 41 68
W7WOX " 35,861 124 47 62
W7RIR " 26,329 102 47 66
W7MCU " 23,968 95 45 67
WA7OBH " 20,895 96 41 64
K7RSB " 16,643 84 41 48
WA7YRP " 15,836 94 29 45
W7APN " 14,784 88 26 40

BAND-BY-BAND BREAKDOWN — TOP ALL BAND SCORES

Number groups indicate: QSO's/Zones/Countries on each band.

WORLD TOP SINGLE OPERATOR — ALL BAND

Station	1.8	3.8	7	14	21	28
ZD3X	10/5/5	225/12/34	288/19/57	1184/27/96	1771/26/89	1133/26/91
4M6AW		359/15/48	481/18/56	1256/30/99	1562/26/82	1083/23/64
FXØBHI		196/9/23	487/20/68	1517/28/96	1785/24/73	786/25/66
KH6RS	9/3/2	224/14/19	539/17/34	901/28/56	1415/27/45	644/20/40
XU1DX		33/14/14	353/29/65	853/34/102	906/30/88	566/26/73
9Y4VU		272/15/38	292/19/53	612/24/77	395/17/49	760/21/59
HC2YL		49/7/8	81/16/30	470/24/51	1051/27/79	864/19/56
9L1JT	1/1/1	49/11/29	104/17/28	711/25/94	539/20/65	545/25/82
DJ6QT/CT3		62/9/33	158/15/52	412/26/92	985/27/98	144/18/46
KP4EAJ	11/5/6	293/11/34	182/5/5	1153/22/80	798/20/64	695/16/49

WORLD TOP MULTI-OPERATOR — SINGLE TRANSMITTER

PY2CAB		13/5/7	48/18/23	1535/39/154	1993/36/127	906/32/86
VP2MSU	13/4/7	395/15/48	565/22/70	1862/28/96	1421/23/84	1096/20/45
VP2GMB		†	629/22/70	1481/29/99	1495/27/96	1470/24/77
CV4C		19/11/17	171/22/45	1085/32/75	1394/28/85	1248/28/93
OD5HC	2/2/2	157/9/40	376/19/69	1181/33/111	1237/22/70	422/24/72
UK9ABA		472/19/62	517/26/69	1031/34/95	691/27/94	99/23/63

WORLD TOP MULTI-OPERATOR — MULTI-TRANSMITTER

PJ9JR	36/7/15	663/18/63	1104/26/102	3804/35/157	2032/31/109	2404/25/73
TI1K	26/5/8	288/14/41	369/20/64	1917/30/123	1795/27/105	1278/24/74
DLØPG	205/3/15	523/16/72	522/22/82	1554/38/142	410/32/133	198/19/68
4Z4EU		217/9/38	206/14/46	1214/27/91	1258/22/78	417/24/79
W2PV	43/10/17	458/20/69	304/28/80	878/34/131	537/30/125	177/18/65
VU2CBE		25/9/18	277/26/62	1029/35/110	1315/31/84	444/27/65

† 80 meter score deleted. See disqualification note.

USA TOP SINGLE OPERATOR — ALL BAND

Station	1.8	3.8	7	14	21	28
W6RR		51/12/26	146/22/43	282/28/77	231/25/60	144/21/54
W3AU	2/2/2	63/16/40	88/23/56	318/29/89	543/27/93	78/14/41
W3LPL	7/3/4	73/17/46	98/22/60	272/25/86	513/28/104	79/19/44
K6UA	8/5/3	49/17/30	103/21/34	333/27/62	706/25/65	112/19/36
W7JST	1/1/1	15/7/9	193/17/39	357/29/69	710/24/62	89/17/45
W6MAR	3/3/2	41/14/27	224/23/44	180/23/57	705/22/56	92/19/44
W3GRF	1/1/1	69/16/46	68/21/53	314/30/95	411/26/94	69/19/43
K4VX		48/12/31	55/20/40	246/29/91	348/24/83	92/18/48
W3BGN	1/1/1	59/15/35	64/19/46	326/24/89	281/24/84	72/17/42
W2GXD		49/13/32	69/21/49	257/25/82	339/25/83	76/16/41

USA TOP MULTI-OPERATOR — SINGLE TRANSMITTER

W3WJD		192/20/66	84/24/58	794/36/132	414/29/109	85/18/55
W6ONV	5/3/2	58/16/28	212/24/46	324/30/77	634/25/57	50/14/32
W4FDA	5/4/4	77/13/40	79/20/58	329/25/94	463/24/93	69/19/46
W9LT	10/5/5	120/20/48	113/22/56	336/29/99	275/25/89	84/16/46
K6COF		78/18/32	176/25 49	275/27/74	480/20/53	97/17/33
W6YRA	2/2/2	27/11/15	173/16/31	119/24/46	751/23/60	53/15/32

USA TOP MULTI-OPERATOR — MULTI-TRANSMITTER

W2PV	43/10/17	458/20/69	304/28/80	878/34/131	537/30/125	177/18/65
W3GPE		201/21/72	134/25/74	677/35/132	694/30/123	174/19/63
W4BVV	9/3/7	253/21/60	171/25/74	717/33/122	672/28/111	123/17/46
WA8ZDF	46/7/12	165/21/64	261/27/77	840/35/130	377/28/111	162/17/55
WB5DTX	16/6/8	152/22/58	303/29/73	494/32/105	597/29/105	195/22/68
W1ZM	42/3/7	319/21/76	138/23/58	855/33/125	300/26/91	129/16/49

LU6DAZ/W7 9,045 78 20 25
K7LAY " 8,308 50 27 40
WA7RUY " 5,472 98 9 10
W7JUO " 4,692 40 18 28
W7BQG " 4,346 40 19 22
W7OJJ " 1,800 24 11 19
W7MH " 385 13 4 7
K7MOK " 315 9 7 8
W7AYY 28 4,095 47 12 23
K7MKS " 1,300 23 11 14
WA7LRK 21 20,586 168 18 29
WA7UZU " 3,500 45 13 22
W7KHS 14 107,738 365 29 74
W7JEG/7 " 82,800 322 24 66
WA7PEZ " 70,210 287 25 60
WA7BPS " 63,252 268 29 55
K7YDO " 13,161 116 16 25
W7YTN 3.8 22,382 165 21 41
WØSII/7 " 4,107 71 15 22
W7WMY " 2,064 42 9 15
W8TWA A 349,414 450 83 219
WA8UUQ " 237,237 380 68 163
W8LHE " 147,392 258 66 158
WB4KTR/8 145,107 265 61 146
WB8MMF " 106,488 229 46 128
WB8IAY " 100,636 235 63 118
WB8EUN " 95,040 199 66 132
WA8UUY/8 87,552 189 64 128
W8CFG " 86,457 188 53 126
WB8IOT " 79,050 195 46 109
W8FJS " 48,508 143 45 89
K8NGR " 29,640 109 41 73
W8TBZ " 10,540 69 18 44
K8PYD " 5,394 40 22 36
K8PXD " 994 9 5 9
W8WPC 28 35,022 176 17 61
WA8ZAN " 19,695 126 17 48
WA8QIY " 15,694 109 15 44
K8CFU " 5,715 53 13 32
WB8NVD " 3,822 46 13 29
K8IFF 21 72,352 237 25 87
W8KOD " 33,088 138 22 66
WA8VZO " 6,030 50 14 31
WB8ULI " 1,711 23 10 19
W8AHB 14 218,854 533 33 113
(Opr. WA8YVR)
WA8DXG " 131,220 353 31 104
W8JGU " 91,980 237 35 105
WA8QOY " 127,500 377 30 95
K8DYZ " 114,480 302 30 105
K8LUU 7 32,370 177 21 51
WA8LXJ " 13,144 84 18 44
K8INX 3.8 35,332 221 21 52
WB8APH 1.8 2,175 91 9 20
WA9BWY A 495,516 561 92 255

K9HDP " 254,997 378 76 185
WB9EBO " 226,941 342 70 183
WB9CEP " 224,339 328 80 183
W9ZTD " 193,602 306 76 170
WA9UEK " 164,880 278 69 171
K9EGA " 126,441 269 56 133
K9OTB " 106,330 190 67 150
K9ARZ " 59,503 155 54 103
WB9HZD " 45,758 137 46 91
W9LF " 43,659 113 52 95
W9MCR " 40,293 116 35 86
W9LQO " 40,221 126 39 84
W9DWQ " 39,884 123 40 78
W9RER " 36,079 122 33 76
W9QWM " 27,888 113 40 72
WB9IYO " 25,956 84 37 66
K9BQL " 21,840 93 28 63
W9MLF " 20,196 75 42 66
W9WYB " 18,564 83 31 60
WB9MYN " 14,774 73 31 58
W9DY " 14,580 72 23 58
W9LO " 14,359 61 29 54
W9SFR " 13,770 97 29 61
W9LVH " 5,989 46 19 34
W9RQM " 3,872 36 15 29
W9OHH 28 22,644 137 16 52
W9LKI " 14,500 102 15 42
W9YYG " 2,958 37 11 23
WA9LMY 21 65,408 214 27 85
WB9HAD " 52,452 209 22 72
WB9GVW " 20,100 108 22 53
WA9HPS " 18,177 87 25 58
W9RX " 15,688 75 21 53
W9YRA 14 153,120 378 30 115
W9ZRX " 102,258 269 31 107
WB9HAK " 64,584 229 25 79
(Opr. WA9QAL)
K9CLO " 42,891 192 22 65
K9UON " 5,412 49 12 32
WB9PLM " 390 8 6 5
WA9HEU 7 26,136 130 20 52
K9HMB " 23,655 114 24 59
W9DUB " 18,924 119 22 54
W9NZM " 15,624 87 22 50
WB9BWU " 12,032 91 20 44
(Opr. WA8RYM)
WB9MOG " 11,956 79 17 44
K9PQG 3.8 10,400 91 16 34
W9VIN " 4,060 52 10 25
W2GUH/Ø A 533,420 603 90 268
WA2WMT/Ø 366,560 452 101 215
KØLUZ " 184,642 314 72 154
WØIUB " 171,532 292 71 173
WØLJF " 115,434 223 68 130
(Opr. WAØEGZ)

WØFHE " 89,610 195 54 120
KØCML " 51,324 138 55 101
WAØYJL " 40,446 117 48 78
WAØTAS " 37,324 125 40 84
WØERQ " 35,076 120 35 76
WØLYI " 34,713 111 49 84
WBØIKT " 33,984 118 40 78
WØNAR " 22,944 93 30 66
WBØHPB " 22,900 95 36 64
WØUCK " 22,770 94 34 65
WØBWJ " 21,630 81 36 67
WAØAGN " 20,188 89 39 64
WBØISW " 19,796 87 18 39
WØHBH " 15,520 74 30 50
WBØGZR " 14,800 77 28 52
WBØIEL " 7,992 76 24 48
WØQYG " 3,960 40 18 27
WAØBWF " 3,666 34 21 26
WØMHK 28 11,395 85 14 39
KØGVG " 9,334 76 14 37
WØPAH " 6,450 57 13 30
WAØMOJ " 4,332 40 13 25
WBØLTD " 4,294 41 12 26
WBØKWI " 1,710 22 12 17
WBØHAI 21 23,652 111 23 58
WAØVDX " 22,599 109 26 55
WØPCO 14 130,013 351 29 108
KØSGJ " 53,126 197 25 76
WAØAWH " 43,065 162 24 75
WAØVCQ " 800 16 8 12
(Opr. WAØCGV)
WAØCPX 7 16,629 96 21 48
KØCVA " 2,997 34 11 26
Alaska
KL7HRP A 44,311 235 31 42
KL7JDO " 2,688 55 12 12
KL7ICL 14 10,368 432 11 13
KL7EWP " 3,096 48 10 14
Bahamas
9Y4GS/VP7
1.8 3,822 91 6 15
Bermuda
VP9AD A 342,540 797 63 135
Canada
VE1EK A 10,519 68 20 47
VE1AIH/1
3.8 23,688 169 14 49
VE2AYU A 263,304 548 57 155
VE2DIN " 25,795 119 23 54
VE2WA " 18,693 77 32 61
VE2AFC 21 5,029 45 14 33
VE3GCO A 606,132 848 74 224
VE3BVD " 239,538 500 70 152
VE3AXO " 86,800 308 26 74
VE3EJK " 17,862 113 24 54

VE3BS 28 5,412 48 13 28
VE3BFK " 2,128 30 10 18
VE3FFA 21 173,160 524 27 84
VE3BBH 14 265,350 746 32 113
VE3GFY " 260,253 627 23 119
VE3FLE " 165,760 645 28 84
VE3BMV 7 130,286 671 23 71
VE3BBN 3.8 23,932 190 17 45
VE3NCT/3
1.8 520 69 2 2
(Opr. VE3ECP)
VE4RP A 90,034 358 42 76
VE5XU 28 1,272 21 11 13
VE5RA 14 45,595 319 21 44
VE5NW 3.8 26,455 357 13 24
VE6MP A 318,060 822 62 118
VE6AGV " 51,051 284 29 48
VE6MC " 17,051 126 26 33
VE6LB 14 8,712 113 15 21
VE6CEC " 2,492 39 12 16
VE6TK " 2,117 28 12 17
VA7WJ A 630,420 1,353 71 139
(Opr. VE7AON)
VE7AZG A 76,000 366 40 55
VE7AJ " 17,633 92 31 46
VE7BD 3.8 9,184 163 11 21
VE8NS 21 9,240 252 8 12
VE8OO 14 111,000 454 29 71
Canal Zone
KZ5BC A
1,241,283 2,146 74 193
KZ5AA 1.8 429 19 5 6
Cayman Islands
ZF1SV 21 270,810 1,447 24 66
ZF1WE 7 42,763 514 13 28
Cuba
CM2GB A 5,724 100 11 16
CO2DC 7 15,550 145 15 35
Dominica
VP2DA A
1,107,351 2,437 69 148
Dominican Republic
HI8XKP A
1,093,950 1,627 78 208
HI8LC 7 51,192 299 21 58
Guantanamo
KG4NY 28 41,280 322 19 41
Mexico
XE3EB A 341,013 750 71 142
XE1YK " 95,472 689 31 37
XG1J 28 286,580 1,440 25 67
XE1LLS 7 29,341 396 14 23
Nicaragua
YN1FWN A 300,506 1,535 39 58
HT1ØAA 28 484,770 2,095 25 85
(Opr. YN1DS)

Panama

HP1AC	A	100,188	354	46	86

Puerto Rico

KP4EAJ	A	2,094,736	3,132	79	238
KP4EAS	28	59,556	695	18	24

St. Kitts

VP2KJ	A	1,131,027	2,640	56	145
VP2KF	21	92,015	520	20	57

AFRICA

Angola

CR6NO	28	634,490	1,599	30	104
CR6CN	"	586,432	1,451	31	105
CR6II	"	247,536	773	29	79
CR6FW	"	158,700	540	27	73
CR6WT	"	62,812	271	25	57
CR6OZ	21	638,810	1,703	27	100
CR6OR	"	592,478	1,692	28	90
CR6WW	14	1,058,446	2,152	35	132
CR6UE	7	44,196	264	20	38
CR6OT	3.5	78	5	3	3

Canary Islands

EA8KX	A	6,708	60	12	27
EA8JJ	21	352,584	1,004	28	90
EA8FS	14	95,836	424	19	57
EA8CR	7	253,528	639	31	103

Cape Verde Islands

CR4BC	A	131,648	271	55	121

Cueta

EA9ET	A	103,170	370	19	76

Ethiopia

ET3FF	A	34,710	103	50	80

Gabon

TR8DG	A	807,875	1,021	82	199

Gambia

ZD3X	A	6,653,881	4,611	115	372

Kenya

5Z4LW	A	12,626	75	27	32

Lesotho

7P8AT	21	87,561	429	21	48

Liberia

EL2FN	A	764,700	896	85	215
EL4D	14	231,168	705	29	83
EL2FP	"	9,307	82	14	27

Madeira Is.

DJ6QT/CT3	A	2,109,952	1,761	95	321

Mauritania

5T5CJ	A	162,692	324	55	123

Reunion I.

FR0BCS	A	141,900	389	36	93

Rhodesia

ZE1JV	A	111,510	281	37	98
ZE3JO	28	8,712	84	9	27
ZE1CW	14	234,315	635	31	96

Senegal

6W8FP	A	1,941,632	2,182	79	229

Sierra Leone

9L1JT	A	2,267,406	1,949	99	299

South Africa

ZS6ZE	A	1,413,468	1,526	95	221
ZS1XG	"	179,014	590	23	80

Zambia

9J10EP	A	3,480	42	14	16

ASIA

Andaman Is.

VU7GV	14	10,385	80	20	47

Hong Kong

VS6DO	A	731,038	1,104	110	219

(Opr. K3NEZ)

VS6BL	"	43,560	121	44	66
VS6DD	14	11,020	121	21	37

India

VU2DK	A	1,805,752	1,744	91	297
VU2ABC		395,556	635	77	200
VU2OO	14	88,515	373	28	77

Iran

EP2SN	A	252,730	457	57	142

Israel

4X4NJ	14	653,535	1,590	34	107
4X4UR	1.8	1,188	35	3	9

(Opr. VE3MR)

Japan

JA1ELY	A	396,032	594	89	149
JA2KFO	"	303,936	562	70	122
JA1GDN	"	220,599	438	78	115
JA1PUK	"	92,344	242	55	81
JA4BBN	"	79,804	209	55	87
JA6CNL	"	72,380	201	51	81
JA8FBM	"	71,858	214	46	76
JG1CDM	"	71,548	216	52	72
JA4BKL	"	55,650	204	45	60
JA0CZJ	"	32,334	126	44	58
JA2HGA	"	32,000	123	39	61
JA1CFJ	"	28,475	122	41	44
JH3XCU	"	26,316	125	35	50
JH2RVP	"	25,125	138	30	37
JA1OHZ	"	11,703	104	19	28
JA7EUK	"	6,612	68	19	19
JA7NY	"	5,700	51	23	26
JA0FMB	"	5,120	56	17	23
JA6JRI	"	2,555	27	17	18
JG1REA	"	2,294	34	12	19
JA9YE	"	1,632	27	15	17
JA1FIJ	"	1,564	25	11	12
JA9CWJ	"	1,159	23	9	10
JA9LVD	"	896	21	8	8
JH1LKH	"	840	15	11	13
JA1JIX	"	544	13	8	9
JA3ELU	"	450	11	9	9
JA1LB	"	56	4	4	4
JH3DPB/1	28	20,790	134	25	41
JA2DYI	"	14,136	95	25	37
JA8CSG	"	8,350	69	21	29
JA1RUJ	"	7,050	62	21	29
JA1ETO	"	7,038	61	22	29
JA7EID	"	6,972	67	19	23
JA1NB	"	6,808	57	18	28
JH3GCN	"	5,781	50	20	27
JA3XRC	"	5,040	55	18	24
JH2NWF	"	4,428	47	18	23
JA6EFT	"	4,059	48	17	24
JH1CXE	"	3,625	41	15	22
JA7CUK	"	3,584	44	13	19
JH3AKD	"	2,904	36	14	19
JA2UYS	"	2,736	33	15	21
JH2IXQ	"	2,409	36	14	19
JH3XGD	"	1,674	25	14	17
JA8GO	"	1,176	21	11	13
JA9BOH	"	1,122	25	8	9
JF1KFW	"	836	17	8	11
JF1NCT	"	494	14	8	11
JA0URR	"	399	15	9	10
JA1AAT	"	374	11	8	9
JH3EXI	21	160,378	536	32	74
JH1BBT	"	117,606	413	31	71
JA1RRF	"	116,550	395	33	72
JR1BRV	"	113,724	349	34	83
JH2MYN	"	60,987	262	30	57
JH1PZN	"	60,458	300	26	48
JH6CAW	"	25,080	143	23	43
JF1BJD	"	21,900	113	28	47
JA0QXQ	"	16,960	107	22	42
JE1RAM	"	14,350	129	18	23
JA1OLT	"	10,105	80	19	28
JR1LEV	"	8,858	78	20	23
JA9CVY	"	5,600	71	14	18
JH3FYW	"	5,565	61	17	18
JH4FYE	"	4,522	57	16	18
JA7JGD	"	3,915	53	13	16
JA3BUB	"	3,186	45	12	15
JA0NTZ	"	2,175	34	14	15
JG1JRQ	"	1,920	34	12	12
JA5IUQ	"	1,584	29	11	13
JA1BBZ	"	1,020	22	7	10
JA2YDU	"	880	17	10	12

(Opr. JR2AFF)

JA3YJQ	"	792	16	10	12
JA0UKP	"	726	15	10	12
JA6MNY	"	612	14	7	10
JA3WKG	"	455	14	6	7
JA9LX	"	72	4	3	3
JE1RLP	"	30	5	1	1
JG1JFP	"	6	1	1	1
JA2AAQ	14	300,288	765	35	101
JA1PCY	"	204,000	593	34	86
JA9AG	"	152,680	492	32	78
JA2JSF	"	57,150	235	30	60
JA2INS	"	42,000	151	32	68
JA0SC	"	37,370	188	25	48
JA7JW	"	36,675	192	28	47
JA3IBU	"	32,184	179	25	47
JG1RVR	"	27,840	125	25	55
JH2EVL	"	20,160	104	25	44
JA6CM	"	18,906	114	25	44
JA2ADH	"	15,232	98	22	34
JA3BLN	"	7,497	56	23	26
JA0AIE	"	7,095	63	20	23
JA1BUI	"	6,846	60	20	22
JA2QVQ	"	6,407	53	17	26
JA6YY	"	4,698	58	13	16
JA5CEK/3	"	3,968	48	14	17
JH3LCU	"	2,736	29	17	21
JR1XFS	"	2,380	40	12	16
JA4DZ	"	2,064	30	12	12
JH3BJN	"	1,440	25	13	17
JA4EE	"	1,104	21	11	13
JA1EL	"	1,058	17	10	13
JR3PYW	"	513	12	8	10
JA1BSU	"	468	13	9	9
JA7KM	"	464	13	8	8
JA1RDP	"	42	5	3	4
JR1YYO	"	6	1	1	1
JA2BAY	7	78,805	309	31	60
JA2BET	"	57,828	263	30	49
JA0JHA	"	8,869	81	20	29
JA2IYZ	3.8	3,104	67	7	9
JF1XID	"	1,890	45	8	7

Khmer Republic

XU1DX	A	2,607,750	2,711	133	342

Lebanon

OD5BA	A	416,796	775	48	140

Ma'aysia

9M2CX	A	523,600	1,201	92	188
9M2CJ	"	109,641	498	61	100
9M2DQ	"	104,286	244	70	112

Ogasawara

JD1AJG	A	4,131	115	13	14

Syria

OE2NWL/YK	A	565,757	1,054	50	149

Thailand

HS2AIG	A	482,471	1,249	81	172

Turkey

TA2SC	14	42,029	284	11	42

Yemen

4W1ED	21	364,764	1,205	28	85
4W1GM	14	705,602	1,566	34	123

USSR

Armenia

UK6GAD	A	21,672	148	15	41
UG6JJ	14	57,090	325	15	51

Asiatic Russia

UA9OO	A	163,734	353	52	122
UA9TS	"	3,230	35	13	25
RA9ODC	28	3,740	85	14	20
UA9CFC	"	2,006	38	13	21
RA9CAS	"	1,334	30	12	17
UA9FCW	"	374	12	7	10
UA9UF	14	69,842	363	28	66
UA9UAR	"	24,635	196	21	44
UA9IF	"	22,720	190	20	44
UA9USA	"	10,864	108	23	33
UA9MT	"	3,738	37	13	29
UA9WS	7	19,834	149	11	36
UA9AAP	3.8	14,554	139	8	30
UA0FGM	A	771,858	1,331	103	171
UA0CAH	"	12,282	82	28	41
UA0JAA	"	8,352	205	15	21
UA0JBD	28	5,780	135	14	20
RA0SAI	"	2,774	134	8	11
UA0UBG	"	2,091	124	9	8
RA0SCQ	"	1,152	146	4	4
UA0UBD	"	247	23	7	6
UA0MI	14	41,565	277	28	57
UA0AJ	"	14,892	281	17	36

Azerbaijan

RD6DFV	28	2,660	39	10	18

Georgia

UF6HK	A	442	10	7	10

Kazakh

UL7BAB	A	259,950	828	43	107
UL7DAF	"	234,432	744	53	123
UL7BF	"	73,152	255	41	86
UL7TA	28	27,342	276	21	41
UL7JAW	14	79,695	332	29	76
UL7YR	"	44,806	229	23	63
UL7YP	"	38,688	171	27	69
UL7WI	"	1,536	25	9	15

Tadzik

UJ8JGJ	14	200,836	678	30	88
UJ8JJJ	3.8	2,814	57	6	15

Turkoman

UH8BO	A	171,867	391	50	127

Uzbek

UI8LAK	28	8,820	126	15	27

EUROPE

Aland Island

OH0NI	A	71,248	318	32	114

Austria

OE6RP	A	34,086	187	29	86

Azores

CT2BN	A	1,076,556	1,868	73	195
CT2AE	21	10,140	260	6	7

Belgium

ON4XG	A	48,384	216	35	93
ON5KY	14	317,178	1073	29	105
K6WR/ON4	"	102,604	408	29	84
ON5MG	"	95,033	486	27	86

Bulgaria

LZ1QR	A	50,528	283	36	98
LZ1BY	"	24,648	157	26	78
LZ1CQ	"	7,875	105	13	50
LZ2RF	28	5,952	45	17	31
LZ1CW	21	33,840	259	21	69
LZ2PD	14	31,152	404	18	41
LZ1WE	3.8	13,754	269	10	36

Czechoslovakia

OK1AGQ	A	286,520	669	64	196
OK2PEQ	A	139,656	621	44	140
OK1ADM	"	109,032	222	67	167
OK2KR	"	96,030	465	35	130
OK2BIH	"	86,565	467	32	113
OK3EA	"	78,528	239	50	142
OK1AGN	"	67,697	269	35	98
OK1WT	"	63,756	237	37	124
OK1KZ	"	53,382	424	20	103
OK1BLC	"	34,986	221	24	95
OK1DA	"	33,383	172	36	97
OK1MAD	"	24,208	249	19	70
OK3CFS	"	17,302	177	17	65
OK2BEF	"	15,106	165	16	67
OK1FAR	"	12,810	132	19	51
OK1TW	"	8,970	89	17	52
OK1MSP	"	6,656	54	20	44
OK1KOK	"	1,568	51	6	22
OK1HBT	"	1,330	62	5	14
OK2SAR	"	782	30	8	15
OK3WM	28	7,900	96	15	35
OK2BBI	"	2,849	47	11	26
OK2KRT	21	31,031	202	22	55
OK1MGW	"	21,097	146	20	53
OK1CFH	"	5,184	54	15	21
OK3KFO	"	171	11	3	6
OK1MPP	14	129,080	459	33	107
OK1ATE	"	77,256	387	30	86
OK1AHV	"	24,480	152	23	67
OK1AJN	"	23,579	250	13	60
OK2BBJ	"	15,008	164	12	52
OK1FCA	"	13,800	176	12	48
OK2PBG	"	4,270	102	6	29
OK3TOA	"	2,992	73	8	26
OK2SMO	"	1,566	40	6	23
OK3IAG	"	1,560	44	5	19
OK1AFZ	"	936	29	6	18
OK1MP	7	12,180	153	11	49
OK2OX	"	1,539	53	5	22
OK2BIQ	3.5	25,172	397	11	47
OK2SLS	"	12,890	268	12	46
OK2PEL	"	3,894	121	4	29
OK3CGY	"	2,581	87	5	24
OK1DDS/p	"	2,322	89	3	24
OK1EP	"	1,406	76	3	16
OK2SSS	"	800	39	4	16

Denmark

OZ5KF	A	1,236,000	1716	99	276
OZ6RT	"	1,006,343	1534	86	303
OZ1HX	"	165,820	631	47	143
OZ6HR	"	51,212	389	20	98
OZ3KE	"	32,197	197	26	92
OZ5QU	"	23,928	178	21	75
OZ4HW	"	14,940	132	20	70
OZ2NU	"	13,861	167	16	67
OZ7BG	"	11,988	74	28	53
OZ1ZE/a	"	1,650	26	12	21
OZ2RR	"	1,426	40	6	25
OZ9ZS	"	280	8	6	8
OZ3PO	28	272	12	5	11
OZ3SK	14	111,630	464	30	92
OZ2PG	"	77,934	407	27	66
OZ6PI	"	76,475	537	22	73
OZ5EV	7	18,073	322	9	44

OZ1XO	"	10,692	63	6	22
OZ8KU	"	425	27	4	13
	England				
G3FXB	**A**	**1,055,868**	**1282**	**94**	**324**
G3SEM	"	287,876	666	59	182
G4BVH	"	150,332	441	49	147
G3ZQW	"	139,810	483	47	158
G3YBH	"	69,788	272	37	109
G4CLA	"	67,056	406	32	100
G3SXW	"	47,034	165	38	96
G3TXF	"	27,552	126	38	85
G8VF	"	18,542	180	15	58
G2AJB	"	15,548	148	20	72
G3MWZ	"	9,800	107	18	52
G3MSB	"	7,626	101	15	47
G2BOZ	**28**	**28,674**	**210**	**19**	**62**
G3XYP	**14**	**390,456**	**1215**	**35**	**118**
G4BUE	**7**	**54,614**	**483**	**18**	**76**
G3JVJ	"	10,370	135	11	50
	Finland				
OH2BM	**A**	**678,535**	**1055**	**86**	**279**
OH7OK	"	80,133	388	41	122
OH1KA	"	48,555	309	26	91
OH7OQ	"	36,240	186	38	113
OH5RZ	"	24,752	206	25	66
OH7NW	"	19,000	124	27	73
OH2ZY	"	11,607	90	22	51
OH7TO	"	4,950	110	12	23
OH6NB	"	3,381	51	16	33
OH1PG	"	3,220	45	15	31
OH3PE	"	3,124	31	17	27
OH7SC	"	1,260	24	10	18
OH5TZ	"	1,023	33	9	22
OH2BFS	"	736	14	10	13
OH5MJ	"	680	16	11	16
OH1IJ	**28**	**1,664**	**37**	**8**	**18**
OH3XT	"	1,078	29	7	15
OH2BMG	"	126	12	3	6
OH2BCP	**21**	**80,736**	**389**	**27**	**89**
OH2BC	**14**	**306,464**	**814**	**34**	**123**
OH2BCV	"	200,021	822	34	105
OH2LU	"	117,920	648	30	80
OH7RM	"	34,020	213	24	46
OH6MM	"	18,648	231	16	47
OH1TD	"	17,526	182	18	51
OH1HB	"	9,072	146	11	37
OH7NJ	"	7,544	130	11	35
OH2EQ	"	4,185	53	9	36
OH2BCD	"	2,210	45	9	25
OH9TD	"	399	17	5	16
OH5PC	"	42	4	3	4
OH2QV	**7**	**95,584**	**472**	**28**	**88**
OH1PS	"	20,559	209	16	51
OH2SH/4	"	5,977	106	12	31
OH1XX	**3.5**	**43,435**	**550**	**15**	**57**
OH6ZH	"	640	13	4	10
OH2BO	**1.8**	**992**	**51**	**4**	**12**
	France				
F8RU	**A**	**117,624**	**236**	**65**	**167**
F9MD	"	111,858	257	59	147
F9KP	"	28,469	159	19	68
F8TV	"	27,744	147	28	74
F2SI	**21**	**392,931**	**1058**	**30**	**117**
F8TQ	"	10,672	142	16	30
FØBHC	14	4,033	140	9	28
	Germany (DDR)				
DM2CUO	**A**	**189,152**	**672**	**41**	**143**
DM2BTO	"	57,252	295	35	121
DM2YLO	"	45,312	313	28	100
DM3OML	"	41,789	188	39	92
DH2AJH	"	40,020	200	37	101
DM25L	"	35,991	146	43	86
DM2COJ	"	24,500	176	18	82
DM3CF	"	8,540	100	15	46
DM2SM	"	7,809	104	11	46
DM2AUF	"	6,612	40	21	36
DM2CMF	"	5,610	77	10	41
DM2DRN	"	3,000	50	11	29
DM2BLI	"	2,585	40	15	32
DM2BPB	"	1,875	77	4	21
DM2FGN	**14**	**9,861**	**112**	**12**	**45**
DM2BOO	7	229	19	2	10
DM5YVL	**3.5**	**1,368**	**58**	**3**	**21**
DM4WPF	"	1,235	66	2	17
	Germany (FRG)				
DK4OO	**A**	**1,203,384**	**1425**	**83**	**281**
DK8FZ	"	**1,118,740**	**1373**	**98**	**329**
DK3GI	"	**991,744**	**1276**	**92**	**324**
DJ4PT	"	853,174	1008	93	316
DL8PC	"	648,057	939	98	295
DK6NJ	"	**427,284**	**678**	**75**	**257**
DJ4ZR	"	**345,261**	**576**	**67**	**220**
DJ0BA	"	337,610	588	67	198
DK5EZ	"	293,319	540	71	228
DJ3HJ	"	270,072	526	72	207
DJ2TI	"	192,280	417	65	188
DK6PW	"	120,167	479	43	144
DK5NH	"	119,253	402	39	88
DK5JA	"	108,780	317	52	158
DK8MA	"	101,340	297	49	131
DJ7JC	"	90,093	261	51	126
DL3PN	"	84,320	273	54	116
DL1YA	"	72,056	248	41	122
DL2JO	"	59,340	245	43	129
DK8KD	"	42,600	234	34	108
DJ2UU	"	40,425	170	43	104
DJ4LK	"	34,750	139	39	86
DL3RA	"	30,750	152	34	89
DL7LV	"	28,980	210	27	88
DJ0CR	"	25,899	121	34	55
DK4IO	"	20,856	127	29	50
DJ4EX	"	16,605	112	21	66
DL1HH	"	14,651	88	28	63
DK7NX	"	11,160	83	28	65
DL3RK	"	9,718	84	22	64
DK5KJ	"	8,636	75	24	44
DL1ZC	"	7,630	85	22	48
DJ4BE	"	4,636	58	15	46
DL1JP	**28**	**20,898**	**109**	**19**	**62**
DL9VS	"	8,664	75	16	41
DL6EN	**27**	**146,256**	**433**	**31**	**101**
DJ1ZUA	"	44,602	230	19	56
DK7PI	"	22,649	152	18	53
DJØXT	"	16,353	112	20	49
DL1RB	"	10,431	94	17	44
DJ8OL	"	5,593	50	15	32
DK1AQ	"	2,035	22	15	22
DJ7VY	**14**	**120,260**	**479**	**34**	**106**
DJ6TK	"	115,642	443	30	101
DK5VO	"	47,775	306	22	69
DL2HQ	"	41,472	163	30	98
DL1AMA	"	24,030	156	20	69
DL3AH	"	16,951	147	17	50
DK8KC	"	6,040	32	19	46
DJ6SI	"	1,120	32	9	17
DJ3BZ	"	513	19	5	14
DK3FB	**7**	**57,592**	**479**	**20**	**72**
DL6WE	"	30,780	311	18	63
DJ4PI	"	25,964	216	18	66
DL9XN	"	7,162	152	7	35
DK5BI	"	5,868	169	6	30
DK3HL	"	288	8	4	8
DK6PY	"	180	8	5	7
DF2FS	**3.5**	**9,126**	**234**	**4**	**35**
	Greece				
SV1GA	**A**	**1,202,202**	**1504**	**92**	**270**
SVØWGG	"	679,540	1740	69	191
SVØWZ	"	19,656	189	20	43
SVØWPP	"	24,991	309	16	51
SVØWJJ	**14**	**48,506**	**479**	**21**	**58**
	Hungary				
HA4XX	**A**	**231,093**	**796**	**60**	**183**
HA9KOV	"	145,220	485	55	157
HAØKLU	"	136,808	518	47	149
HAØDI/9	"	133,168	435	53	150
HA4KYB	"	107,238	446	44	139
HA1ZD	"	14,895	145	23	62
HA7SQ	"	4,586	103	13	49
HA7LF	**14**	**162,000**	**860**	**29**	**97**
HA4XT	**3.5**	**20,757**	**403**	**7**	**44**
	Iceland				
TF3IRA	**A**	**768**	**35**	**6**	**10**
	Ireland				
EI2BB	**A**	**111,339**	**518**	**31**	**108**
EI2CL	"	7,599	132	11	40
EI2CA	**14**	**114,855**	**841**	**21**	**72**
EIØREI	**3.8**	**68,112**	**638**	**16**	**70**
	Italy				
I6FLD	**A**	**1,317,498**	**1708**	**104**	**295**
I1BAF	A	958,056	1089	97	285
I4ZSQ	"	953,458	1175	99	319

[*continued on page 66*]

Disqualifications

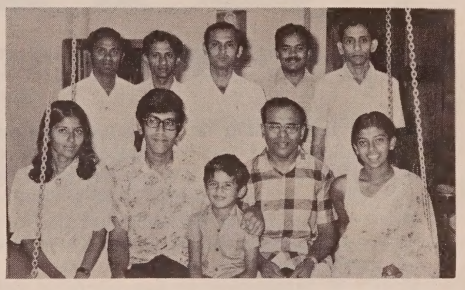
Duplicates: JA9MYO, K8LEE, KA-6DE, KH6BZF, KP4AST, PY7NS, YU4VFC, YV2AA.

Logging Errors: VP2GMB† (80 meter score only).

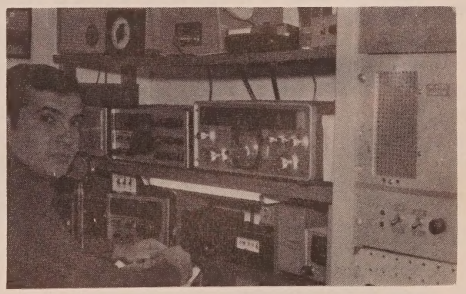
Unverifiable Multipliers: YV5CVE.



CT7EQ made 2,000,000 Multi-Single—with their eyes closed. Congrats to SWL Luis, CT1EQ, CT1LN.



Multi-Multi VU2CBE (sitting) XYL 4S7AB, 4S7AB, Jr. Op VU2GDG, 4S7PB, YL 4S7PB (standing) VU2DX, VU2WY, VU2GDG, VU2MKZ, VU2LE.



Evidently 28 MHz Single Band from the Mid-West didn't give WA8ZAN much to smile about.



Multi-Single VP7BC gang who'd like you to know they need multipliers too (kneeling) K4SHB, WA-4SVO, WB4NXR, WB4TAF (standing) W4BRB, W4EPO, WB4GWL, WB4PQB.

JUP on FM

BY NORM STERNBERG,* W2JUP

In my last column the subject of two meter f.m. radioteletype was introduced and I outlined a basic repeater scheme as in use here on Long Island. But sometimes all is not roses. There are problems, perhaps unique to the f.m.er, that are not usually found when operating RTTY on the h.f. bands.

Deviation

For a RTTY repeater in a high-density metropolitan area, it is advisable to use a receiver with the narrowest i.f. passband available. By maintaining the receiver acceptance at four to five kiloHertz, problems of adjacent channel interference from 15 kHz spacing can be minimized and the resultant lower noise bandwidth will help in the handling of weaker signals. But there is a tradeoff. The deviation or modulation index of stations transmitting to the repeater must be held down to values which may seem too low to the average voice repeater operator. Deviation on mark tone (2125) should be held down to about 2 kHz, and if the transmitter pre-emphasis is nominal, the space tone (2975) will produce about 2.6 kHz. deviation, and with TTY keying rates of 45.5 or 50 baud, peak bandwidth requirements will be satisfied. Practical experience has shown that when stations transmit to the repeater with deviation in excess of 3 kHz., the tight receiver passband tended to clamp down on the space tones with the result that the demodulator thought it was getting "make-break" keying, and the results were negative. Although the modulation index will be lower than that found in routine voice operation any reasonable TTY demodulator should be able to handle the noise figure with no problem.

Base stations when setting up should make provision for a gain-setting control external to their transmitter, on the output side of their tone generator so that the same transmitter can be used for regular voice operation if desired. Input coupling networks and isolation similar to that used in connecting touchtone pads may be employed.

*2 Regal Lane, Levittown, N.Y. 11756

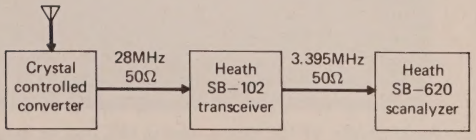


Fig. 1—A simple method of measuring modulation index.

Transmitter Audio Passband

There has been some difficulty with some of the so-called "rice-box" radios where the input audio system tends to roll off the highs and the resultant balance of the mark space tone relationship suffers on the air. The best check would be to sweep the audio section with a generator and adjust the values of the RC circuits that determine the pre-emphasis to obtain the proper rising response. At the same time, internal automatic deviation control and/or clipping devices should be normalized for minimum clipping action on the tones. Similar attention should be paid to the receiver output audio circuits and the de-emphasis networks to assure the best response out to 3000 Hertz.

Duty Cycle

One of the characteristics of the RTTY f.m. repeater is the need for prolonged transmission capability. Therefore the base station equipment should also be capable of making sustained transmissions. It is not unusual for stations to transmit for ten to fifteen minutes, especially when the user hand types his traffic slowly. Some of the "rice-box" radios just will not hack this kind of duty cycle without developing a fever or the plague of some kind. The best way to go, for this application is by acquiring one of the commercial mobile or base station radios such as the Motorola or GE equipments. Practice has shown that the commercial radios will stand up to the long duty cycle requirements rather well. When higher power is required, these rigs are the way to go. One other approach is to operate the "rice-box" radios in the low power positions that many of them have, and invest money in higher gain antennas such as the seven or eleven element Yagi arrays. You know the antenna will not have a duty cycle problem!

Terminal Unit Demodulators

Many RTTY operators have gone into f.m. RTTY with the same demodulator gear that

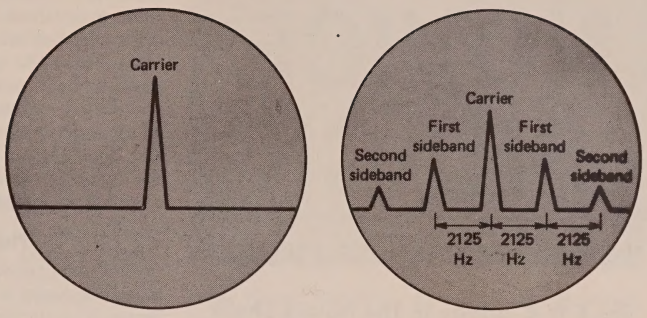


Fig. 2—(A) An unmodulated carrier display. (B) The same carrier modulated in either frequency or phase with a mark tone.

they use on the low bands, and while there is nothing wrong with this approach, it seems to be an unnecessary utilization of complex equipment for the accomplishment of a rather simple task. The simple and effective phase lock loop circuits are most appropriate for f.m. TTY service and can be made to provide autoprint and autostart functions. Stations having dual-loop and dual printer service can use the simpler demodulators for f.m. RTTY service, reserving the more specialized gear for the more rigorous requirements. Examination of the cumulative indices of the popular amateur radio publications will present a wide variety of terminal equipment, almost all of which can be applied to a.f.s.k. service.

Measurement Hints

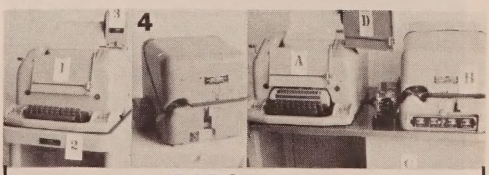
For the serious f.m. operator and RTTY technician, the topic of measurement of modulation index will be of major significance. One of the best techniques can be employed with relatively little equipment and low cost. Figure 1 shows the setup at W2JUP. A good crystal controlled converter feeds a typical s.s.b. transceiver, which in turn has its first i.f. feeding a simple type of spectrum analyzer. The Heathkit SB-620 Scanalyzer is, in my opinion, one of the most valuable tools in my bag of tricks, and although simple in nature, can be used quite nicely for measurement of modulation index and deviation, based on the Bessel function method. In our case, we are fortunate that the carrier-sideband relationship in angle modulation systems follows the Bessel functions precisely[1]. This provides an exceptionally fine method of using a frequency domain presentation for display and analysis of f.m. operation. Figure 2(A) shows a sketch of the display as it appears for the unmodulated carrier. Figure 2(B) is the same carrier modulated in either frequency or phase with a mark tone, at an index of 0.94 radians. Remember the formula:

$$\text{Modulation index} = \frac{\text{deviation in Hertz}}{\text{modulating frequency}}$$

Thus, for 2000 Hertz deviation, with mark tone modulation of 2125 Hertz, a modulation index of 0.94 is required. In the Bessel system, the carrier is represented by the J_0 curve, the first sideband pair is the J_1 function and the second sideband pair is represented by the J_2 curve, and so on ad infinitum. As the modulation index increases, the carrier will decrease to zero and begin to increase again back to maximum, while the sideband pairs will also go through rising and falling cycles. This provides some very useful markers. For example, at a modulation index of approximately 2.4 radians, the carrier will go through the zero null, and at a modulation index of approximately 1.42 radians, the carrier and the first sideband pair will be of equal amplitude (equal height on display). If, for example, you wanted to establish a deviation of 3000 Hertz with a mark tone of 2125 Hertz, you could adjust the audio level until the carrier pip and the first pair of sidebands were at the same height.

[*Continued on page 64*]

[1]A brief but excellent discussion of sinusoidal phase and frequency modulation and expression thereof by Bessel functions will be found in "Data Transmission" by Bennett & Davey, McGraw Hill, 1965, pp 36-37.



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NOVICE SHACK

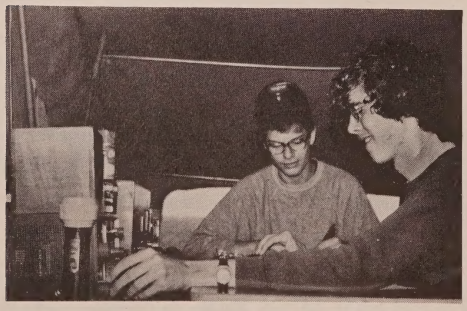
BY HERBERT S. BRIER,* W9EGQ

The S.W.R. Bridge in The Novice Shack

Very shortly after a person starts learning about transmitting antennas, he hears about transmission line matching and standing wave ratio (s.w.r.—often pronounced "swear!"). Fundamental theory and measurement show that a ½-wave antenna hung in space 25 to 150 feet or so above the earth "looks like" a very high resistance at its ends and like a 40 to 100 ohm resistance at its center. At any other position along its length, it looks like an intermediate value of resistance in series with a capacitance or an inductance. If the antenna is longer or shorter than a ½-wave long, its center also looks like a resistance in series with a capacitance or inductance. Longer, full-wave, 3/2-wave, etc. antennas, repeat these capacitive, inductive, and resistive patterns each ½ wave throughout their lengths.

Any uniformly spaced, two-conductor transmission line has a "characteristic impedance" determined by its construction. Readily available RG-coaxial cables, which consist of an outer sheath surrounding and insulated from an inner conductor, have characteristic impedances of 50 and 75 ohms. When such a line is connected to an antenna with a feedpoint resistance that equals the line impedance, line and load are "matched," 1:1; and whether the line is long or short, the maximum percentage of the power fed into the transmission line reaches the antenna. If the match between the transmission line and the antenna is not perfect, however, it would take a large book to explore all the weird effects that occur in the transmission line. Fortunately, you do not have to read the book to detect and compensate for most mismatches between the line and the antenna.

*385 Johnson Street, Gary, IN 46402



Dave, WN9MAM, and Jay, WN9MDS, made 112 contacts in the 1974 Field Day. Both will participate as Generals in the 1975 Field Day, June 28-29 as members of the Fort Wayne, IN, team operating W9LT/9.

The S.W.R. Meter

The most convenient means of measuring the match between a transmission line and an antenna is a standing wave ratio (s.w.r.) meter. It compares the voltage (current) in a bridge circuit when the transmission line is feeding a matched load with the voltage generated in the bridge when the actual load is switched into the circuit. No reflected voltage indicates a 1:1 match, and equal forward and reflected voltages indicate that the transmission line terminals are open or shorted.

Many amateurs are convinced that the reflected power in a mismatched transmission line is lost forever. The truth is that the mismatch does increase losses compared to the losses in a perfectly matched line. But the increase is insignificant for a 2:1 mismatch; and a 4:1 to 5:1 s.w.r. only doubles losses. As an example, 100 feet of RG-8 cable, perfectly matched, has a one-db loss at 30 MHz and a two-db loss with a 4.5:1 mismatch. Losses decrease proportionately for shorter lines and lower frequencies.

Possibly the most useful application of an s.w.r. meter is to find the resonant frequency of a new antenna. Cut it a little long, and insert the meter between the transmitter and the feedline. Feed power in the line at the antenna design frequency; then, trim the antenna length a few inches at a time until the indicated s.w.r. is minimum at that frequency. Whatever that minimum turns out to be, nothing that you can do at the input end of the transmission line will improve the match between the line and antenna.

If your transmitter does not have a wide-range output loading control, however, cutting the transmission line to an integral multiple of a ½-wavelength may make transmitter loading more uniform on frequencies where line s.w.r. is greater than 1:1. For standard RG- cable, an electrical ½-wavelength in feet is: $\text{Length}_{ft} = 325/\text{Frequency}_{MHz}$, or 45.3 feet (45 feet, 4 inches) at 7.125 MHz.

Hobby For The Handicapped

Extending our remarks about amateur radio being an ideal hobby for the handicapped person in the October, 1974, NOVICE SHACK, there are over 260 blind amateurs in Canada, largely through the efforts of the Radio Society of

Ontario. Incidentally, Canada does not have either a Novice or Technician class license. The correct address of the Hadley School For The Blind, mentioned in October as offering a correspondence course in amateur radio for blind students, is 700 Elm St., Winnetka, IL 60093, not Evanston, as we were told by a graduate of the course.

FCC Docket 20282

If you are planning on filing comments with the FCC on the "restructuring" Docket 20282, remember that the deadline is June 16, 1975, and the address to mail your comments to is Federal Communications Commission, Washington, D.C. 20554. Send an original and 14 copies. Do not be bashful. Whatever the class of your license, the FCC will welcome your thoughts on the subject. After all, your amateur radio life for years to come will be determined by the final disposition of the docket.

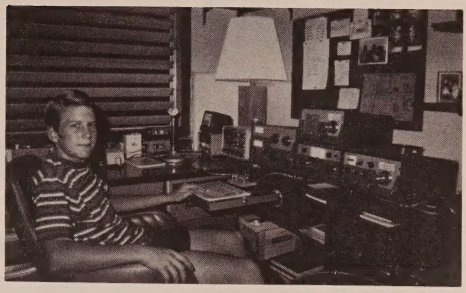
Our impression is that the average amateur likes more things than he dislikes in the docket. For example, there is general approval of the proposal to make the Novice license renewable and allow holding a Novice license and Technician license simultaneously. Also, there is general approval of the requirement that conditional licensees must pass the test before an official examiner before their licenses can be renewed—except by the conditional class licensees, of course.

As expected, the proposed new code-free, V.H.F. Communicator phone license still raises the most controversy. Most of the comments against it sound a lot like the objections raised against the Novice license 25 years ago—making the license too easy to get will cheapen the license, etc. However, requiring that every licensee will have to pass an examination on amateur regulations and operating practices before two amateurs and the outstanding record of self discipline displayed by Novices make these fears seem groundless.

As Harry Dannals, W2TUK, president of the American Radio Relay League, Inc., pointed out in a recent speech and discussion before the Lake County (Ind) Amateur Radio Club, if we just license the Communicators and then ignore them, we will be doing only half the job. The other half of the job will be to help them to become good amateurs.

News And Views

Laurie Procto, WN9QJL, 101 County Farm Rd., Wheaton, Ill., runs a Heathkit HW-101 transceiver to an all-band dipole 70 feet high, but she didn't say what or who she worked. Laurie's ham idol is Darleen, HC2YL, of Ecuador. "One day I will be like her and take a world trip to visit hams and their families like she did. Maybe even write a book, too."



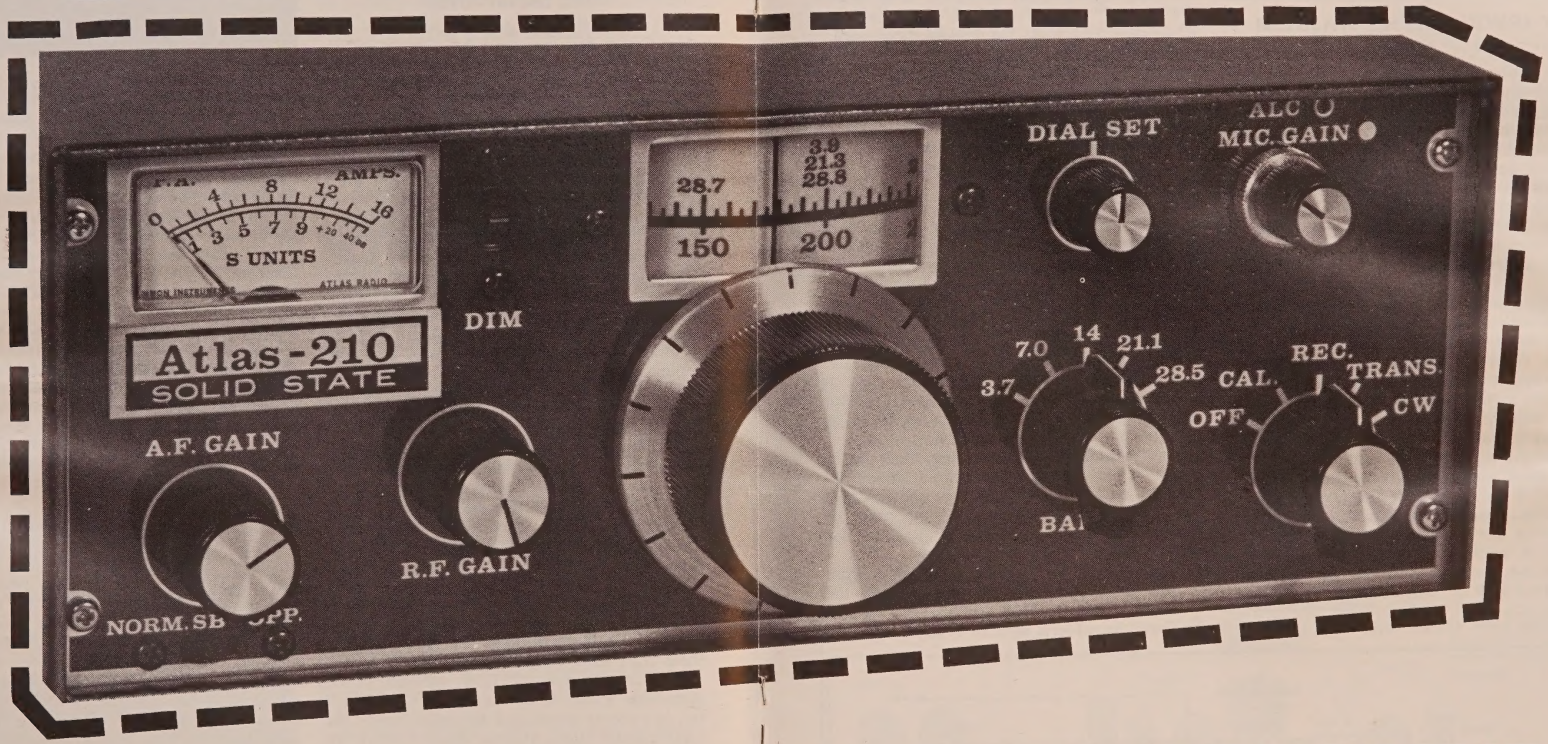
Gary Payne, WH6INX, 55 Akilolo St., Honolulu, Hawaii 96821, has the good fortune to be the son of KH6IJE, who went from Novice to Advanced in six months. Father and son share the equipment shown in this picture, except the 1000-watt amplifier. They also share a Hy-Gain TH-6DXXX, tri-band beam and a vertical antenna for the lower frequencies. Gary is a member of the Punahhou School Radio Club (KH6CSN). And if you would like to work a Hawaiian Novice, listen for WH6INX on the 21-MHz Novice band every Saturday at 10:00 A.M., HST, which translates to 3:00 P.M. EST, 1:00 P.M. PST. We are sending Gary a 1-year subscription to CQ for sending this winning entry in the Monthly Novice Shack Photo Contest. If you would like to enter, send good photograph of yourself at the controls of your station and some details about your radio career to: CQ Novice Shack Photo Contest, 385 Johnson St., Gary, IN 46402. Even if you do not win, suitable photos will be published as space permits.

...**Mickey Smith, WN8TEE,** Box 1718, Williamson, West Virginia 25661, likes the NOVICE SHACK to tell the fun things in ham radio. He had to wait four months for his Drake TR-4C transceiver to come after he got his ticket. But he has not wasted any time since. Using a half-wave dipole usually around 7140 kHz, he has worked 39 states and four countries in less than two months. Mickey likes amateur radio especially because of all the great people he meets... **Peter Katenski WN2VYR,** 14 Buckingham Dr., Dix Hlls, N.Y. 11746, works 15 and 40 meters with a Heathkit HW-16 and an inverted-V dipole. His states worked total is 21, with Bermuda thrown in by waiting until the VP9 signed off from his previous contact. That technique is a good one. It didn't work though, for a Puerto Rican Pete waited almost an hour for. So many other stations kept calling the KP4 before he had signed off from his contact that he left the air in disgust. That happens, too. At any rate, Pete suggests that Novices do not call a DX station while he is trying to copy someone else.

Preston Shute, WN4JTP, 232 Pinewood Dr.,

[*Continued on page 64*]

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MATH'S NOTES

BY IRWIN MATH,* WA2NDM

In the course of our experimentation we have progressively had the need to measure higher and higher frequencies reliability. Our first effort was the old standby, the LM frequency meter but this soon gave way to a true digital frequency counter we were fortunate enough to obtain from a used test equipment source. The only problem we encountered in its use was its specified upper frequency limit of 32 MHz. Ours actually worked up to 45 MHz, however unfortunately just missed the 6 meter band.

At this point it was obvious that to do any serious work in the v.h.f. region, we would have to build some sort of pre-scaler for the counter. The results, which enabled the range of our counter to extend beyond the 220 MHz band (306 MHz to be exact), will be presented as our topic this month but one caution—if you plan to build this pre-scaler, be prepared to follow the instructions carefully. It is not the easiest thing to get going but after you have "tweaked it up" it is quite stable and reliable and should operate satisfactorily with almost any used or new counter available today.

Fig. 1 is a schematic of the pre-scaler. The circuitry uses the popular, often used Fairchild 95H90 in a DIP 16 lead package.

*5 Melville Lane, Great Neck, N.Y. 11023.

In the design of this pre-scaler we initially built at least 6 different variations of the 95H90 circuitry and finally developed this one, a variation of the others, as the most stable, easy to get going unit with the highest degree of sensitivity possible without resorting to an input amplifier or tricky sensitivity controls.

The 95H90 is an emitter coupled MSI device designed to divide an input signal by a factor of 10 or 11 all the way up to 320 MHz. In our application we have hooked it up to divide by 10 for ease in reading the counter being used.

An input signal is fed through a full wave diode limiter (to prevent damage to the 95H90) to the input of the divider. A selected value resistor, R_A, used to bias the 95H90 to its point of maximum sensitivity in a procedure discussed later. To isolate r.f. from this bias source, LC filtering is used with a ferrite bead taking care of very high frequencies and a 4.7 μh choke taking care of lower frequencies. The B+ line is also bypassed for very high and somewhat lower frequencies with a .1 μf and .001 μf capacitor. Output from the divider chip is coupled by means of a .01 μf capacitor to a single stage of amplification which is adequate to drive most counters or subsequent dividers if division by more than 10 is desired.

This amplifier provides 2-3 volts, peak-to-peak, of output signal. The amplifier stage is also biased by means of a selected resistor from collector to base, and must be set up as per the final alignment procedure.

Figures 2 and 3 are construction diagrams of the pre-scaler. Note that all wiring is done right on a 16 pin IC socket so that the shortest possible leads commensurate with v.h.f. practices can be achieved. The step by step procedure for building the pre-scaler is as follows:

1. Cut off pins 15, 13, 11, 10, 7, and 6 from the IC socket cutting them flush with the socket body.
2. Carefully solder a piece of braid or stripped,

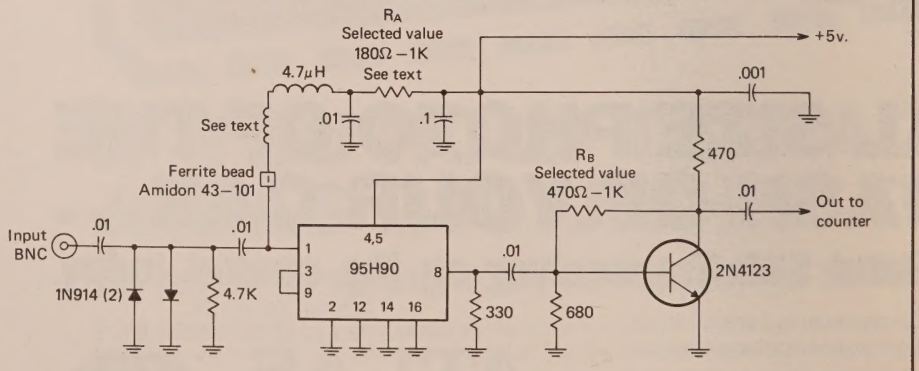


Fig. 1—The schematic of the 300 MHz prescaler. See text for details.

twisted, tinned and flattened #14 copper wire between pins 16, 14 and 12 of the socket. Be sure the braid does not touch any other pins.

3. Connect a piece of #24-26 wire (or a IN914 diode lead) between pin 2 and the braid between pins 16 and 14.
4. Connect a wire between pins 3 and 9 of the IC socket putting a piece of insulating tubing or insulation from another piece of hookup wire over the lead.
5. Connect one lead of a .001 μf disc ceramic capacitor to pins 4 and 5 using the capacitor lead as a jumper.
6. Connect the other lead of the capacitor to the braid on pin 12.
7. Connect a 330 ohm 5% ¼ watt resistor between pin 8 and the braid on pin 12.
8. Connect a .1 μf capacitor between pins 4, 5 and pin 12. Be sure the capacitor stands on end(perpendicular to the socket).
9. Connect a .01 μf capacitor to pin 1. Be sure the capacitor lays directly next to the socket as shown in fig. 3. Use the shortest lead possible.
10. Connect two IN914 diodes and a 4.7K ¼ watt 5% resistor in parallel as shown. Cut the diode leads short and leave the resistor leads long.
11. Connect the diode-resistor network to the .01 μf capacitor installed in step 9 and connect another .01 μf as shown, flattening it into the space available.
12. Connect the remaining resistor lead to pin 16.
13. Wind one lead of a 4.7 μh choke into a small coil of 3-4 turns around a 1/16-⅛ inch diameter nail, then remove the nail and slip a ferrite bead over the end of the short coil and connect to pin 1. Position the choke as shown.
14. Connect a .01 μf capacitor to the free end of the 4.7 μh choke and braid at pin 12. Position the capacitor as shown—flat against the socket.
15. Connect a .01 μf capacitor to pin 8 and position the capacitor as shown.
16. Connect a 680 ohm ¼ watt 5% resistor between the free end of this capacitor and the braid near pin 12. You can cut the top off pin 9 to simplify this connection.
17. Now connect a 2N4123 transistor across the 680 ohm resistor as shown.
18. Finally, connect a 470 ohm resistor to the collector lead of the transistor and let the remaining lead hang free.

This completes the wiring—now to the alignment.

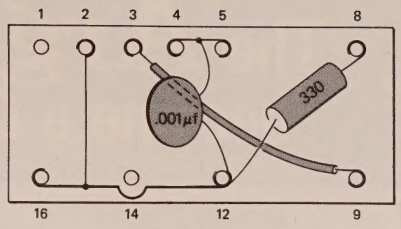


Fig. 2—Construction steps 1-7, bottom view.

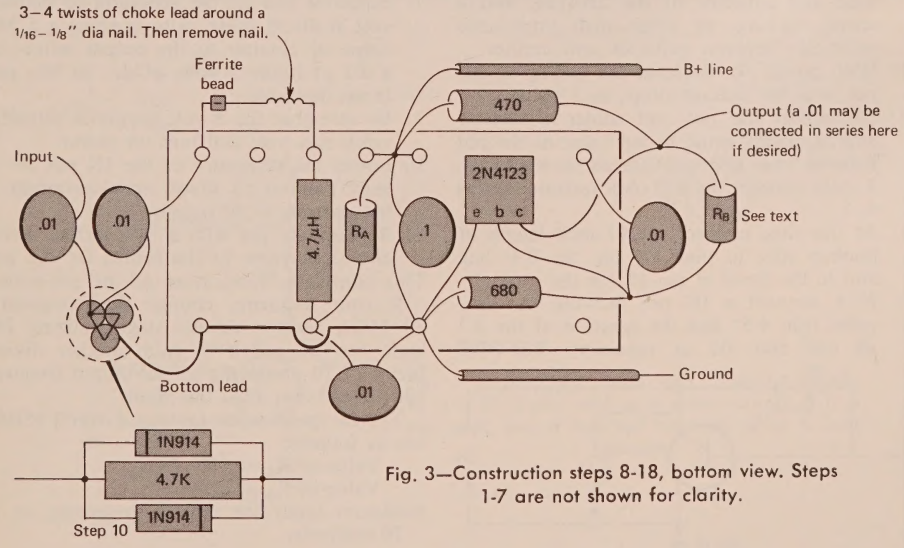
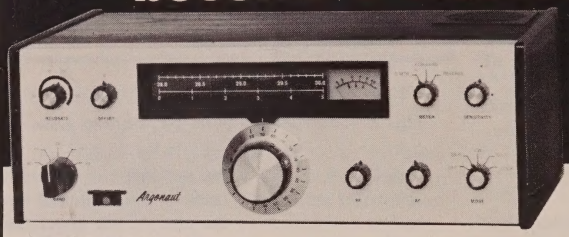
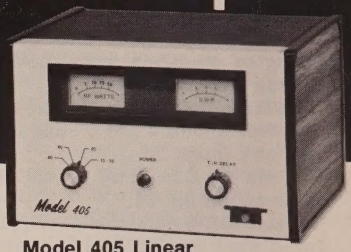


Fig. 3—Construction steps 8-18, bottom view. Steps 1-7 are not shown for clarity.

The Argonaut has become a *Classic* in QRPp



Argonaut



Model 405 Linear

The sustained demand and the enthusiastic comments from happy Argonaut owners are music to our ears. We designed this portable pair to be fun, and your response tells us that it's just what you've been looking for. The Argonaut and it's companion, the 405 Linear, are here to stay—thanks to you.

Argonaut, Model 505	**$319.00**
Linear, 100 Watt, Model 405	**159.00**
Power Supply for 505 only, Model 210	**27.50**
Power Supply for 505 and 405, Model 251	**99.00**

TEN-TEC
INCORPORATED
SEVIERVILLE, TENNESSEE 37862

1. Connect the free end of the 470 ohm resistor to a source of 5 volts (+) and connect the lead of the supply to pin 12 as shown in figure 4.
2. Connect a 1K pot (set to IK) between the base and collector of the 2N4123, and a scope, v.t.v.m., or other high impedance voltmeter between collector and emitter.
3. With power on, decrease the setting of the pot until the voltage drops to 3 volts.
4. Disconnect the pot and solder a resistor approximately equal to the value of the pot between base and collector as shown in fig. 3. Also connect the 470 ohm resistor to pins 4, 5.
5. At this time connect a 6-12 inch length of hookup wire to pins 4-5 for the B+ line and to the braid at pin 12 for the ground.
6. Now connect a IK pot between the B+ point (pin 4-5) and the junction of the 4.7 μh coil and .01 μf capacitor. BEFORE CONNECTING THE I.C. RECHECK ALL WIRING—A NEW 95H90 IS QUITE EXPENSIVE AS I AM SURE YOU KNOW!
7. Correctly plug a 95H90 into the socket!
8. Connect a signal generator to the input capacitor and set the generator to deliver 1 volt at 40-50 MHz. Also connect a 5 MHz scope or counter to the output point—add a .01 μf if the 3 volts of d.c. at this point is not desirable.
9. Be sure that the 5 volt supply is actually 5 volts $\pm$¼ volt and turn on power.
10. Lower the resistance of the 1K pot for the least amount of input signal required for the correct ÷ 10 output.
11. Replace the pot with a 5% carbon resistor closest in value to the setting on the pot.

This completes fabrication of the pre-scale.

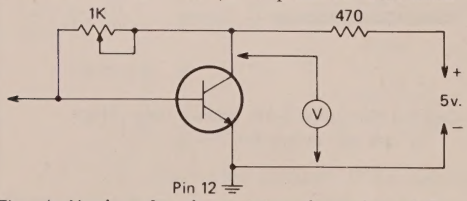


Fig. 4—Hookup for determining the value of R_B.

If your frequency counter does respond to 30 MHz, another decade stage utilizing 7400 logic can be added to gain another division factor of 10 producing a final output frequency 100 times lower than the input.

Typical specification (averaged over 3 95H90's are as follows:

Value of R_A = 680 ohms
Value of R_B = 620 ohms
minimum input for reliable triggering = 65-70 millivolts

[*Continued on page 64*]

QRPp

LOW-LOW POWER OPERATING

Driver-Final Design Notes

A considerable number of options are open to the QRPp transmitter designer in respect to circuits for the driver-final section of the transmitter. One basic principle that ought to be followed is: be very conservative in estimates of the power output available from each stage. If a particular circuit is to deliver five watts output from the final, the predriver and driver stages ought to be able to deliver considerably more excitation to the final than would seem necessary, given the gain figure of the final transistor. If this rule is followed, one is assured of at least achieving the desired output level; one can expect to exceed it if the rig is properly designed. Translated into practical terms, this means that at times an extra stage is advisable, even though it would appear on paper not to be necessary.

In designing an all-band transmitter, one inevitably faces a trade-off between peak efficiency on a given band, and acceptable efficiency on all bands. The ideal situation is one in which every stage is tuned by means of a separate network for each band, for in that case peak efficiency can be achieved on each band. But usually the bandswitching requirements make that approach impractical. It is this designer's experience that a transmitter designed for a single band can be peaked in practice to achieve very high orders of efficiency and gain. One such rig for 20 meters managed about 8 watts output with a mere 200 milliwatts drive! Don't expect this in an all-band design.

*213 Forest Ave., Vermillion, SD 57069.

Device Selection

The availability of high gain, for f_t small signal devices is such that no problem should be encountered in finding excellent devices for predriver stages that will operate at the one watt level. The MPS6514 has proven itself in many designs here and is a favorite. Really top-quality 2N706's *(not the "cheapie" types floating around for 25¢ or so!)* do an excellent job at low power levels if you can find them —surplus p.c. boards are a good source.

In selecting a device for the driver or multiplier-driver stage, emphasis should be placed upon gain and power handling capability, for one is seeking power gain and output and as a result, the driver stage should be capable of considerable "pushing." This is especially true of a frequency multiplier-driver stage because it is run deep class C to achieve rich harmonic output, and that costs considerable amounts of power dissipation. A wide range of excellent devices are available. I prefer 5 watt types myself. In this class fit such devices as 2N2102, 2N3866, 2N5188 (if you can find them), 2N3642, and the 2N2224. Especially attractive

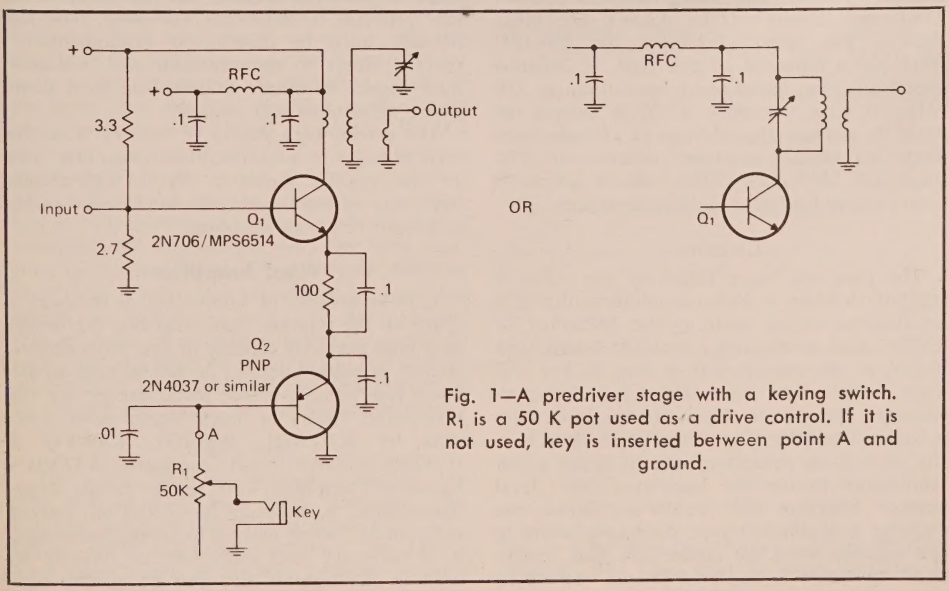


Fig. 1—A predriver stage with a keying switch. R_1 is a 50 K pot used as a drive control. If it is not used, key is inserted between point A and ground.

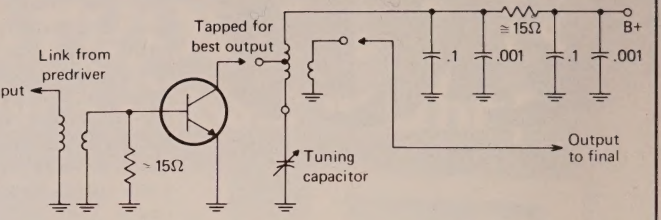


Fig. 2—A driver-multiplier stage. This should be mounted on the bandswitch to minimize lead length. See text.

are balanced emitter types, such as the 2N5913 and 2N5589 because they do not require "kid-glove" handling, are immune to mismatch dispatch, and exhibit excellent gain and stability.

The final ought to utilize a balanced emitter, mismatch protected type device, which is designed for operation from 12.5-13.6 v.d.c. power sources, typical for QRP_p operation. Experience has shown that a device rated far in excess of the desired power output level works quite well even when run far below its maximum rated level, and often allows greater gain than a device with a lower rating. Some applicable devices follows. Especially attractive are the 2N5589 and 2N5590 types (13.6 v.d.c., 3w and 10w respectively) which have exceeded the rated output and gain in every application I've used them in. Perfect as a driver-final combination. Next, the 2N5944, 2N5945, and 2N5946 (respectively 12.5 v.d.c., 2w., 4w., and 12w.) seem a good choice for the predriver-driver-final chain. Probably can operate with 13.6 v.d.c. without damage, although I haven't done it! The 2N5645 (12.5v, 4w), 2N6080, 2N6081 (12.5v, 4w, 15w) 2N6082 (12.5v, 25w) and 2N6097 (25w, 12.5v) are other choices. For linear amplifiers, the 2N6135, while not a balanced emitter type, is designed specifically for broad-band operation to 250 MHz, 18 v.d.c., 5w class. K7QWR showed the 2N5070, a linear type device, in a single transistor broadband amplifier capable of 25w p.e.p. (at 28 v.d.c.).[1] This classic article is must reading for linear-inclined designers.

Circuits

The predriver stage following the v.f.o. is typically a class A buffer-amplifier utilizing a small-signal device such as the MPS6514 or 2N706, and employing a parallel tuned tank circuit in the collector. It is wise to key this stage, rather than later stages for numerous reasons. The circuit shown in fig. 1 includes a keying transistor that will provide clean keying as well as permitting one to insert a potentiometer in the key lead as a drive level control. Alternate tank circuits are shown, one utilizing a double-link type discussed before in this column. With the double-link tank, multiband operation is rendered simpler by virtue of the fact that two or three primaries (L_2) can be wound on a single T-60-8 core, and the proper one switched for a given band. Efficiency will be somewhat lowered because the same links must serve on 80-15 meters, but since outputs are usually higher on the lower bands, a generally adequate level can be had on all bands with this arrangement.

The driver stage requires a bit more care in design. In an all-band rig where a frequency-multiplication scheme is used, the best approach is to run the predriver on the v.f.o. fundamental, and multiply (double) to the operating frequency in a Class C driver. The last column (April) showed such a driver-multiplier stage (fig. 6). In a rig developed at K8EEG/ϕ, that stage used the double-link tank approach in conjunction with a 365 pf variable to produce outputs 80-15 meters with two primaries, one for 80-40, the other for 20-15 meters. Otherwise, the typical tapped tank will do the job (see Fig. 2) but bandswitching is complicated because of the need for long leads from the collector to the bandswitch. If the stage is mounted directly on the bandswitch, that problem is somewhat alleviated. The tap position must be determined experimentally: tapping closer to the capacitor end will produce higher harmonic outputs—up to a point where all outputs will drop off.

The driver stage should be isolated from the final in order to avoid feedback instability. The 15 ohm resistor shown in Fig. 2, with double bypassing as both ends, will do the job usually in conjunction with shielding.

Final Amplifier

It is impossible to summarize in so short a space all the relevant data regarding the design of a final amplifier capable of five watts output. As yet, published designs do not include an all-band type at this power level, except for the broadband linears at much higher power outputs by K7QWR[1], W6FIG[2], K4WYQ & W6GFS[3], OZ1AM[4], and Chambers[5]. W5TVW's broadband amplifier, very similar to the Argonaut design, is shown in fig. 3 and has proven trustworthy. When using a broadband amplifier, it is necessary that some sort of filtering be used in the output: this can be simple half-

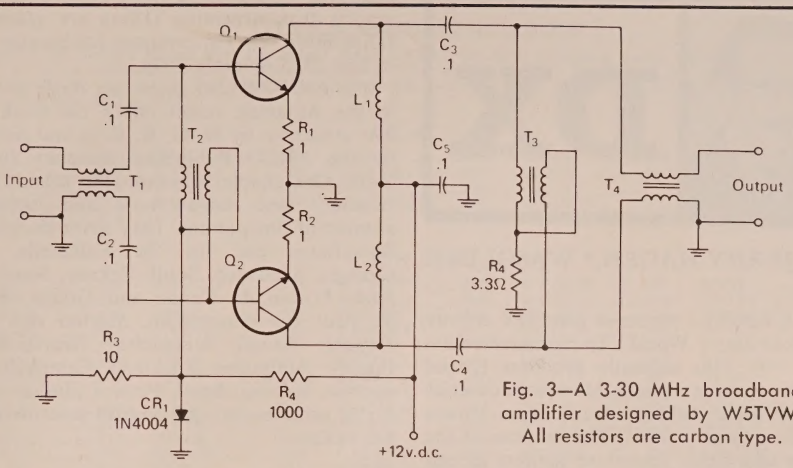


Fig. 3—A 3-30 MHz broadband amplifier designed by W5TVW. All resistors are carbon type.

C_{1-5}—All capacitors are 0.1 μf disc ceramic.

$L_{1,2}$—20t #22 Ind. Gen. CF102Q1 (Amidon T-50-2).

$Q_{1,2}$—2N3924, 2N2102, 2N3053, 2N3866, 2N-4427, or other v.h.f. types. 0.5 watt drive for 5-7 watts output.

$T_{1,2}$—18t #28 bifilar twisted pair (two strands twisted together), Indiana Gen. CF102Q1 core (Amidon T-50-2, equiv.)

$T_{3,4}$—14t #22 bifilar twisted pair, Ind. Gen. CF108Q1 (Amidon T-68-2).

wave low pass filters, as shown in fig. 4, or more sophisticated types as discussed by WAØJYK[6]. The above references will provide an excellent survey of the principles of broadband design and application. Although intended for high power applications, the principles apply as well to our level.

Narrow-band final amplifiers are by no means obsolete. Perhaps a bit more effort is required because of the added circuitry in the form of input and output networks, but this results in the ability to peak the transmitter for each specific frequency of operation, while at the same time, the final amplifier is developing power only at the desired frequency. W7ZOI described the techniques of discrete amplifiers in an earlier paper[7] using an absolete device: with a balanced emitter types, his "caveats" can be disregarded. A paper by this writer is scheduled for appearance soon that also deals with the subject in detail[8]. Motorola Applications Note AN-267 is a valuable aid in amplifier design, as it provides computer solutions for several types of matching networks useful in solid state amplifier design. Finally, WA7KRE's introduction to the amplifier design subject is very useful and should be familiar to designers.[9]

QRPp Net

The QRPp Net has been a moderate success, with as many as a dozen check-ins, with the best QSO to date WB2TEN-K7BD (NY-ORE). QRN has been a problem, but QSO's have been made all around between various stations. Summer promises an end to this enterprise though! Beginning June 7, 1975, we'll shift the QRPp Net to 14065 kHz at 1600Z. Until then, checkin on 3540 kHz, Tuesdays, 2200 EDT (0200Z). Don't forget that Field Day is right around the corner! Time to get ready. And let's have a last minute effort on the designs for the all-band QRPp transmitter.

73, Ade, K8EEG

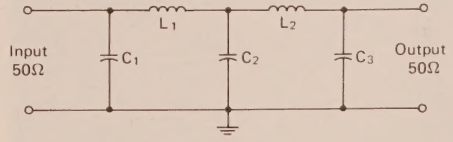
References

[1]R. Hejhall, "Broadband Solid State Power Amplifiers for SSB Service," *QST*, March '72, p. 36.

[2]J. Manon, "An HF-Band Solid State Amplifier," *QST*, Sept. '73, p. 18.

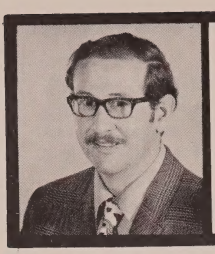
[3]Johnson & Artigo, "Fundamentals of Solid-State Power-Amplifier Design," Part I, *QST*, Sept. '72, p. 29; Part II, *QST*, Nov. '72, p. 16;

[*Continued on page 63*]



Band	C_1/C_3	C_2	L_1/L_2
80	830pf	1500pf	3.0μH
40	430pf	780pf	1.5μH
20	220pf	370pf	0.75μH
15/10	100pf	180pf	0.4μH

Fig. 4—A low pass filter for use with the W5TVW amplifier. The filter must be used to eliminate harmonics.



DX

BY JERRY HAGEN,* WA6GLD

MAY is usually a month of good DX activity and propagation. World Telecommunication Day on May 17th normally produces special prefix activity from various Member Countries of International Telecommunication Union which was created in 1865. The purpose of the ITU is to coordinate important matters as call sign assignments and frequency allocations.

Antarctic DX

The *West Coast DX Bulletin* notes that DX-ers seeking QSO's with the DXCC Countries of South Orkney, South Shetland should be alert for LU Stations with a Z suffix and CE9 Stations. Activity in the Winter and Spring was heard from the following:

LUIZA—South Orkney Island (64°S and 44°W) has been active around 14.300 MHz at 0000 hours GMT.

CE9AT—South Shetland Islands has been active on 14.210 MHz about 0100 GMT.

LU4ZS—Antarctica (Palmer Peninsula) has been active around 14.300 MHz about 0100 GMT.

LU1ZR—Antarctica (Dunley Island, 63° 28″ S and 57° 17″ W. Also active on 14.300 MHz at 0100 GMT.

There has been no activity from the South Sandwich Islands since 1964, however there are reports that Argentine DXers are planning a DXpedition (via Government Ice-Breaker Boat) in late 1975 or early 1976.

The *WCDXB* also notes that those interested in the Antarctic might check the book titled *The Antarctic* by H. G. R. King and published by the ARCO Publishing company in New York. One chapter discusses the islands of the Antarctic and sub-antarctic and includes a number of illustrations. They cover the climate/flora/fauna etc. for the Falklands, South Georgia, Sandwich, South Orkney, South Shetland, Tristan da Cunha and Gough, Bouvet, St. Paul and Amsterdam, Marion and Prince Edward, Crozet, Kerguelen, Heard, Snares, Bounty, Antipodes, Auckland, Campbell, Macquarrie, Balleny, Scott, Peter I plus an appendix of other useful and wishful information for the DXer.

SEANET Convention

The 1974 SEANET Convention was held in Manila and over 100 were in attendance including hams from VK, W, 9M2, 9V1, HS, XV5, F, JA, YB and the DU hosts. Past SEANET Conventions were held in Penang—1971, Bangkok—1972, Singapore—1973, and the 1975 Convention will be held in Kuala Lumpur on November 7-9th. The Malaysian Ama-

*P.O. Box 1271, Covina, CA 91722.



Richard, OE1ZGA (VE7DL) helping with the installation of a Triband beam on the American Embassy in Vienna. The beam is now being used by OE1ZGA (K3NZV). *(Photo via W9CJW)*

The WPX Program

Mixed

475 ..... WB5DDI
476 ..... G4AMJ
477 ..... W7NJ

2 × SSB

839 ..... EL2BA

C.W.

1381 ..... IØMDP
1382 ..... W2MEI
1383 ..... XL2IR

WPNX

79 ..... WN2SJG
80 ..... WN1TAI

VPX

85 ..... WN4HHJ
86 ..... G-13667

Endorsements

Mixed: F9RM-1250, W9DWQ-1200, YU2DX-1000, I4ZSQ-850, K3SXQ-700, W6ANB-600, I8QO-550

2×S.S.B.: HP1JC, IØZV-950, W8GKM-850, WB2NYM, OK1MP-800, WA2EAH-750, WA6TAX, VE7WJ-700, WA5VDH-650, W2IOZ-600, WA1JMP-450, WB4TPU, IT9AZS-400

C.W.: W8KPL-1050, W9WCE-950, W9DWQ-900, VO1KE, K4RDU-600, ISØFIC-550, SM6BZE-500, WØMH&K, G3DPX/W6-400, ZL2IR-350

160 Meters: WA6JVD, WA2EAH, W4HHN

80 Meters: YU1AG

20 Meters: VO1KE, DJ7CX

15 Meters: DJ7CX

10 Meters: W8GKM

Europe: G3TLV, IØMDP

North America: VO1KE, W8IEC, I4ZSQ

South America: WA6JVD

Complete rules for WPX may be found on page 67 of the February, 1972 issue of *CQ*. Application forms and reprints of the rules may be obtained by sending a business size, self-addressed envelope to WPX Manager, P.O. Box 1271, Covina, CA 91722—USA.

CQ DX AWARD HONOR ROLL

The *CQ* DX Award Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more countries for the mode indicated. The ARRL DXCC Country List, LESS DELETED COUNTRIES, is used as the country standard. The total number of current countries on the DXCC list as of this listing is 321.

C.W.

W6PT 320	W4IC 309	ON4QX 304	W4BQY1 299	K1SHN 289
K6EC 316	W4YWX 309	WØAUB 304	DL3RK 298	WA6EPQ 288
W6ID 316	W6ISQ 305	K6LEB 302	W6NJU 294	WA8DXA 287
W8KPL 314	W9DWQ 305	VK3AHQ 301	WA6MWG 293	DJ7CX 281
W8LY 310				

2 × SSB

TI2HP 320	SM6CKS 314	W6YMV 309	WA2HSX 301	YV1LA 289
W2TP 320	VE3MR 314	K4RTA 308	WB6DXU 300	OE1FF 288
W2RGV 319	W6EL 314	W9KRU 308	K6AQV 299	WAØKDI 288
DL9OH 318	W6KTE 314	VE3GMT 307	K8DYZ 299	DJ7CX 287
G3FKM 318	W9DWQ 314	K3GKU 307	HP1JC 298	DL6KG 287
IØAMU 318	W9JT 314	K6EC 307	W0YDB 298	K1KNQ 287
WA2RAU 318	F9RM 313	F9MS 306	KØHJE 297	SP5BSV 287
W3NKM 318	WA2EOQ 313	SM6CWK 306	W6FW 297	DL1MD 286
W9ILW 318	W2QK 313	WA3IKK 306	DK2BI 296	OE3WWB 286
K2FL 317	W6RKP 313	W9QLD 306	YV1KZ 296	K8GQG 286
W4EEE 316	K6WR 313	XE1AE 306	G3RWQ 295	W3CRE 284
W4NJF 316	K4MQG 312	OE2EGL 305	W9OHH 295	DK1FW 282
SM5SB 315	F2MO 311	OZ9SK 305	YS1O 295	OK1MP 282
W3AZD 315	IØZV 311	K9WEH 305	K1SHN 294	VA7WJ 282
W4IC 315	I8YRK 310	ZL1AGO 305	W8ZOK 293	WB6PNB 282
W4SSU 315	W6NJU 310	VE2WY 304	WAØCPX 293	W6TCQ 282
W6EUF 315	ZL3NS 310	W2CNQ 304	WØSFU 291	K8PYD 282
W6REH 315	ZS6LW 310	G3DO 303	G3KYF 290	WA2VEG 280
I8AA 314	KH6BB 309	WA6AHF 303	WB2RLK 290	W6HUR 279
I8KDB 314	W3DJZ 309	W6KZS 303	W6FET 290	I1WT 275
IT9JT 314	WA6MWG 309	VE3MJ 302	XE2YP 289	VE7HP 275

teur Radio Transmitters Society will sponsor the 1975 event and hopes to have 9M2SEA as the Convention Station call.

The South Asia Net meets every day at 1200 GMT and is a very active net. Stations throughout Asia, the Middle East, East Africa, the Pacific and Indian Oceans are regular check-ins. The Net Control is normally 4S7PB and present active stations are XU1DX, VS5MC, XW8GV, XV5AA, 8Q6AC, YBØCJ, as well as a number of 9MZ's, 9VI's, DU's and HS's.

Here And There In The World Of DX

Northern California DX Club Member K6WR is now living in the Netherlands where he has received the call PA9WRR. Brad says he has also been assigned the call ON8WR and may activate that call this year. He hopes to get a beam up shortly to improve his signal into W6 Land! In the Winter PA9WRR was active on 80 meters where several W6's were worked.

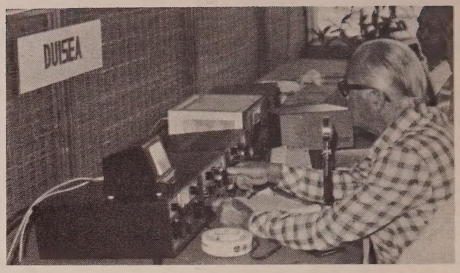
Our French *CQ* Checkpoint, Claude-F9MS has returned from Reunion Island where he operated for 3 months as FRØBCS. He made over 5000 QSO's including 1000 in the *CQ* WW CW Contract. Claude states that the shipment of a 204BA Beam was worthwhile as he has received many comments on his FB signal. Upon arriving on Reunion the biggest problem was to find a suitable support for the Beam. Two sections of heavy water pipe plus some guy wire provided the necessary mast which is shown in the photo. This was the *first* FRØ prefix operation and Claude has answered over



This nice home was the QTH of FRØBCS on Reunion Island in the latter part of 1974. OM Claude (F9MS) is on the right with his son and XYL on the left of the photo. Note the neatly installed 4 el Yagi!



Some of the delegates at the SEANET Convention in Manila are shown in this photo, including DU1JMG, HS1WR, XV5DA, 9M2CX, HS4AFD and XV5AA.



At the 1974 SEANET Convention VK3JF is shown operating the special DU1SEA net control station. *(Photo via 9M2CJ)*

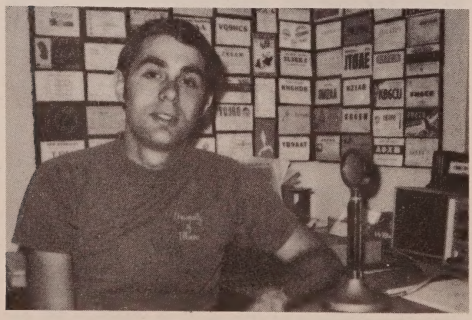
1700 QSL's and still has 2000 to complete!

Howard, W6BYB is operating from Prince Edward Island as W6GYB/VE1 and enjoying 160 meters. Several Europeans and South Americans have been worked on the Top Band.

Ken, K2FJ spent February in the Caribbean signing VP2EEC and K2FJ/VP2D. During the first half of the ARRL CW Test Ken signed VP2E and put out an excellent signal to the West Coast! QSL's for VP2E for the 1975 ARRL Test go to K2FJ. This special Call was previously used by other operators, for which Ken does *not* have logs.

Mike, W9CJW reports that Tom, OE1ZGA is active from Vienna using a TA-33 Beam on top of the US Embassy! Mike, W9CJW spent the past year in Vienna where he signed OE1-ZHW and lived close to OE1JHA who lives near the world famous "Riesenrod" (Merry-Go-Round). Mike visited F3EG, SM5FC and several stations in Yugoslavia including YU2-RHG and YU2RJW. Since returning to Illinois Mike has been able to return the hospitality by hosting OE1EWB who was visiting the U.S.

Sig, WA9INK has been touring Europe and operating from quite a few locations including DA1SI, FØZR, ZB2DA and C31IL. He has been surprised at the number of W/K's that state that he was a new country for them.



Jim Simon, K4KQB, recently returned from a stint in the Pacific which included operation during the CQ World-wide DX Contests. He has also qualified for WAZ.

160 Meter News

The *W1BB 160 meter DX Bulletin* reports that the 1974/75 160 Meter season was quite good. Many DXpeditions put rare countries on 160 meters and DXCC scores climbed with KV4FZ getting close to DXCC. Stu reports that VE1MX copied VK6HD via long path for 40 minutes on December 19. Activity from PY1-RO, HC1XG, ZE7JX, ST2AY, 4X4NJ, 4X4-UH, KZ5AA, VK6HD, 9L1JT, EP2BQ, JY9-FOC, OA8V, HC1CW, VP8NP, 5Z4KL and HH2WF was heard during the season. According to the *160 meter DX Bulletin*, 55–1.8 MHz WAC Certificates have been issued by the ARRL.

QSL Information

C31IL—via WA9INK
CE9AT—via CE2AA
CT2AK—via W3HNK
DA1SI—via WA9INK
DU6BG—via WA7RFH
EA8CR—via K9KXA
EL7F—via DK5BH
EP2SN—via W3KT
FØZR—via WA9INK
FY7AA—via R. Gemehl, F2QQ 52 Rue de Saussure 75017 Paris, France
FYØRHI—via F2QQ
HD1QRC—via WA8TDY
HDØQRC—via WA8TDY
HR6SWA—via W8CNL
LU1ZA—via LU2AFH
PJ8AS—via W0IPU
PJ8KI—via W8KI
VE8OO—via Box 72 Fort Smith NWT X0E-0P0 Canada
VKØDM—via WA4NRE
VP1FF—via W0ELT
VP2DM—via WA1ABV
K2FJ/VP2D—via K2FJ
VP2E (75 Apr1)—via K2FJ
VP2EEC—via K2FJ
XQ9BI—via CE2AA
2B2DA—via WA9INK
6Y5NY—via WB6PYI
9G1AK—via W1YRC
9V1SH—via W7PHO

QSL's for the following stations are handled by W2GHK

C6ANY/VP7NY	KV4FZ	VK9XI
CN8HD	LA1H	VK9XK
CR5SP	OY7ML	VK9XX
CX2CO	P29JK	VK9XW
C21DC	/VK9JK	VP9GR
C21DR	PA9AFZ	VS6DR
FM7WQ	PJ7VL	XE1IIJ
HKØAI	PJ8GQN	XD8NC
HM1AJ	PJ9GQN	ZS6IW
HP1IE	PJ8HS	4C5AA
HS2AGP	PJ9JR	4C9AA
I1MOL	PY2PA	4U1ITU (NA only)
I1RB	PY2PE	6V5RS
I1RBJ	VE8CV	8P6CW
JW1EE	VE8RCS	9Y4VT
	VK3BM	

A more detailed list with log dates, etc. is available by sending a self addressed stamped envelope (4 X 9½") to Box 7388, Newark, NJ 07107. Ask for bulletin #174.

73, Jerry, WA6GLD

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10 DAY MONEY BACK GUARANTEE



Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

*May	3-4	Bermuda C.W. Contest
*May	3-5	Connecticut QSO Party
*May	10-11	Georgia QSO Party
May	10-11	USSR "M-CQ" DX Contest
*May	11	WAB LF Phone Contest
*May	10	World Telecomm. Phone
*May	17	World Telecomm. C.W.
May	17-18	Armed Forces Day
May	17-18	YL ISSBers QSO Party
May	17-19	Michigan QSO Party
May	24-25	New York State QSO Party
May	25	Memorial Day Zip Code
June	1	WAB LF C.W. Contest
June	6-9	CHC/FHC/HTH Party
June	7-8	RSGB National Field Day
June	14-15	ARRL VHF QSO Party
June	21-22	All Asian Phone Contest
June	28-29	ARRL Field Day
July	12-13	Ten Ten Net QSO Party
July	12-13	ARRL "Open" CD C.W.
July	19-20	ARRL "Open" CD Phone
July	19-20	Space Net VHF Contest
July	20	WAB VHF Contest
July	26-27	Itchycoo VHF Contest
July	26-28	County Hunters C.W. Contest
Aug.	9-10	European DX C.W. Contest
Aug.	23-24	All Asian C.W. Contest
Sept.	13-14	European DX Phone Contest
Sept.	13-15	Washington State QSO Party
Sept.	27-29	Delta QSO Party
Oct.	19-20	Manitoba QSO Party

*Covered in last month's Calendar

USSR "CQ-M" C.W. Contest

Starts: 2100 GMT Saturday, May 10
Ends: 2100 GMT Sunday, May 11

This is a world wide contest so do not confine your activity to working USSR stations only. All bands 3.5 thru 28 MHz c.w. only.

Catagories: Single operator, both single and all band. Multi-operator, single transmitter. And s.w.l.'s.

Exchange: RST plus a progressive 3 figure QSO number. The USSR boys will send RST plus the number of their region. (oblast)

Points: Contacts between stations on same continent 1 point, different continent 3 points. No credit if in same country.

S.w.l.'s get one point for reporting one exchange, 3 points if both serial numbers.

Multiplier: Is determined by the countries and regions worked on the "R-150-S" country list. Essentially same as the DXCC list plus some additional oblasts. (Believe following count separately: 02, 13, 14, 56, 84 thru 98, 105, 128, 138, 139, 153, 159)

Final Score: Total QSO points from all bands times the country/oblast multiplier. Counted *once* only, not once on each band.

Awards: In the forms of certificates and badges to the top scorers in each country and each catagory, first 3 places in each continent, and the top 6 places among all groups. Country winners must show a minimum of 6 hours operation and continental 12 hours to be eligible.

Contest contacts may be credited for the many USSR awards in lieu of QSL cards. (R-150-S, R-100-O, W-100-U, R-15-R, R-10-R, R-6-K, "Jubilee.")

All entries must be postmarked no later than July 1st and go to: Krenkel Central Radio Club, P.O. Box 88, Moscow, USSR.

Michigan QSO Party

Starts: 1800 GMT Saturday, May 17
Ends: 0200 GMT Monday, May 19

This years Party will be sponsored by the Oak Park ARC. Phone and c.w. are separate contests. A station may be worked on each band and mode, portable and mobiles for each county change, and in-state contacts are permitted.

Exchange: RS(T), QSO no. and QTH. County for Mich.; state or country for others.

Scoring: 1 point per QSO, 5 points if its a WN8 or special events station.

Final Score: Mich. stations, QSO × (states + countries) Max. mult. 75 (?). Others, QSO points × Mich. counties. (max. 83) V.h.f. same above except multiplier per v.h.f. band is added together for total multiplier.

Frequencies: c.w.-1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125. Phone-1815, 3905, 7280, 14280, 21380, 28580. v.h.f.-50.125, 145.025.

Awards: Top scorers, both c.w. and phone, in each state, country and Mich. county. (min. of 15 QSOs). There are also trophies and plaques for the top scorers in Michigan and out-of-state, for c.w., phone, Novice, v.h.f. and Club entry.

For scoring purposes KH6 and KL7 count as states, and VE as a country.

Mailing deadline for logs is June 20th to: Dennis Motschenbacher, WB8FUO, 24101 Meadowlark, Oak Park, Mich. 48237.

YL ISSBers QSO Party

Starts: 0001 GMT Saturday, May 17
Ends: 2400 GMT Sunday, May 18

*14 Sherwood Road, Stamford, Conn. 06905

The YL ISSBers decided to eliminate the contest element this year and just have one big QSO Party. Details will be found in the system's newsletter, or you can write to: Lyle Coleman, W7EOI, 412-19th Street S.W., Great Falls, Mont. 59404.

Armed Forces Day

Starts: 1300 GMT Saturday, May 17
Ends: 0245 GMT Sunday, May 18

This is the 26th anniversary of this activity in which military stations will make cross-band contacts with amateurs on c.w., s.s.b., and RTTY.

There will be four military stations, AIR, Air Force; WAR, Army; NAM and NPG, Navy. They will operate on military frequencies just outside the amateur bands, both lower and higher edges, 3.5 thru 21 MHz. (There will also be some limited u.h.f. operation.) The military will listen in the amateur bands on frequencies they will specify.

A special commemorative QSL card is available to those making two-way contacts. In further recognition of operating ability a special certificate will be issued for accurately copying a message from the Secretary of Defense.

This will be transmitted by all four stations on c.w. at 25 w.p.m. at exactly 0310 GMT on the 18th. On RTTY the test will be at 60 w.p.m. at exactly 0345 GMT. There will be a 10 min. tune-up period prior to both tests. They will be on the same frequencies used during the QSO period, except the 21 MHz band , which is not used.

Transcriptions should be submitted "as received" and no attempt to correct possible transmission errors should be made. Include all information as to time, frequency, station copied or worked and etc. on your copy or log.

All entries, QSL or Test, go to: Armed Forces Day Tests, Chief, Navy-Marine Corps. MARS, 4401 Massachusetts Ave., N.W., Washington, D.C. 20390

New York State QSO Party

Two Periods (GMT)
1700 Sat. May 24 to 0500 Sun. May 25
1200 to 2359 Sunday May 25

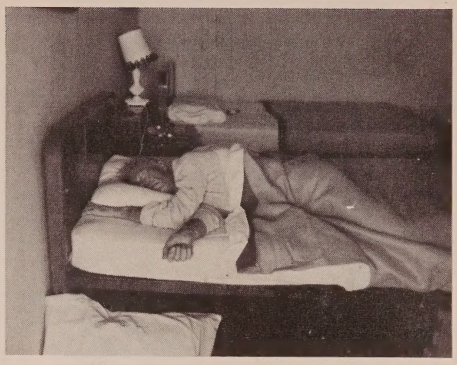
The Radio Club of Rensselaer Polytechnic Institute, W2SZ again sponsors this one.

The same station may be worked on each band and mode, and N.Y. stations may work other N.Y. stations for QSO and multiplier credit.

Exchange: RS(T) and QSO no. starting with 001 and QTH. County for N.Y., ARRL section or country for others.

Scoring: One point per QSO times the multiplier. ARRL section plus countries for N.Y., and N.Y. counties for others. (max. of 62)

Indicate each new multiplier as worked.



Here you see Charlie O'Brien W9NFC, (ex-W2EQS) doing his stuff at 6Y5BF during the CQ WW C.W. Contest last November. The boys tell me that Charlie-O expires when the sun comes up and spends the next 10 hours in bed. With the lengthening shadows and urged by the pangs of hunger he is up and around and ready for another all night bout with QRN on 160.

Check sheet from stations making over 100 contacts.

Frequencies: C.W.—1810, 3560, 7060, 14060, 21060, 28060. Phone—3975, 7275, 14285, 21375, 28575. Novice—3725, 7125, 21125, 28125.

Appropriate certificates to winners.

Mailing deadline June 30th to: John C. Yodis, WA2EAH, 43 Beacon Avenue, Albany, N.Y. 12203. Include large s.a.s.e for results.

Memorial Day Zip-Code Contest

Starts: 0001 GMT Sunday, May 25
Ends: 2359 GMT Sunday, May 25

This is the third of a series of Zip-Code contests organized by the South Eastern Virginia Wireless Assoc. There are 3 each year, Labor Day, Christmas and Memorial Day.

The same station may be worked once per band and mode. Phone and c.w. are separate and should be scored separately.

Exchange: RS(T), Zip-Code as it appears on station license, and state, province or country. DX stations use 00050.

Scoring: Based on the last two digits in the Zip-Code worked. (ie: 23518 is worth 18 points) Multiplier of one for each state worked, plus 1 for the first DX contact. (max. multiplier of 51) KH6 and KL7 are states but may be counted for the first DX contact.

Final Score: Total of all Zip points times the state plus DX multiplier.

Frequencies: C.W.—40 to 60 kHz up from each band edge. Phone—3900, 7225, 14275, 21350, 28550. Novice—3710, 7110, 21110, 28110.

Awards: Certificates to highest score in each

1974 All Asian Phone Results

All Band

K6UA	**80,275**
W6DGH	15,370
WB6KBK	11,408
K3MNT/7	9,423
WA7PMI	903
WB6URY	448
W6SC	266

21 MHz

W6PAA/6	**2,160**
WA6HAE	525

14 MHz

WA6LHN	**23,760**
W6JZU	**23,715**
W6LPM	**16,960**
W6ONV	16,263
W6NUT	13,962
VE7AUA/6	8,316
K6SDK	4,160
W6EEG	1,071
WA6WOX	954
W4WSF	629
W6KYA	434
W6RQZ	240
LU1BAR/3	120
WA6WUI	90
W6GBY	88
K7IWD	70
WA5VDH	63
W4BAA	50
WB2VYA	25
WB2WOW	16
WA7TUS	1

7 MHz

W6MAR	**6,808**
W6MAV	6,486
W1ARR/6	595

3.5 MHz

K6ERT	**28**

Multi-Op.

WA6AHF	**52,516**
W6OKK	27,132

Continental Leaders

Africa	CR7IZ	70,519
Asia	UA9BE	149,687
Europe	YU1BCD	61,712
N. Amer.	K6UA	80,275
Oceania	JA5IEV/JD1	96,324

call area and overall winners, both phone and c.w. Also overall DX winner on each continent and for the Top Novice.

Mailing deadline June 30th to: South Eastern Virginia Wireless Assoc., P.O. Box 14411, Norfolk, Virginia 23513.

IARS/CHC/FHC/HTH QSO Party

Starts: 2300 GMT Friday, June 6
Ends: 0600 GMT Monday, June 9

A s.a.s.e. to K6BX will get you detailed information. Rules in brief:

Exchange: QSO no., report, name, CHC/FHC no., state, county or similar division. Non-members omit no. and send HTH instead.

Scoring: *For CHC*—1 point per QSO with other CHCers, 2 points if its a HTHer, 1 additional point if its a YL, B/P, FHC, Novice, CHC-200, Merit or Club station, or if its on vhf/uhf. Double above points if QSO is out of own country. *For HTH*—Contacts with other HTHers 1 point, with CHCers 3 points. Rest same as above. S.w.l. use same scoring system as for HTHers.

Multiplier: Each continent, country, ITU zone and U.S. state. (Counted only *once*)

Final Score: Total QSO points from all bands times the sum of the multiplier. Multi-opr. stations divide score by number of operators. The same station may be worked on each band and mode for QSO points but not multiplier.

Frequencies: C.W.—3575, 3710, 7070, 7160, 14075, 21075, 21090, 21140, 28090. Phone—3770, 3790, 3943, 3960, 7090, 7210, 7275, 14320, 14340, 21360, 21440, 28620, 28690. And 50.1-50.5, 145-147. For US and DX as allowed.

Awards: The party supports hundreds of certificates and trophies in all catagories and divisions. A s.a.s.e. will get you a list. Include extra postage for ITU, IARU, IARC, IARS country, prefix and zone lists.

Send all requests and your logs to: International Amateur Radio Society, K6BX, P.O. Box 385, Bonita, Calif. 92002.

RSGB National Field Day

Starts: 1700 GMT Saturday, June 7
Ends: 1700 GMT Sunday, June 8

While stations outside Great Britain are not eligible to enter this activity on a competitive basis you can contact the British portables and submit your check log.

A certificate will be awarded to the overseas station in each continent whose log shows that he contributed the most contacts to the competitors.

Send your logs to: RSGB HF Contests Committee, c/o A. Davis, 41 Gainsborough Road, Crawley, Sussex RH10-5LD, England.

All Asian DX Contest

Phone: June 21-22 C.W.: August 23-24
Starts: 1000 GMT Saturday
End: 1600 GMT Sunday

This is the 16th year the JARL has sponsored this contest, with the Phone section now a permanent fixture. The exchange is between Asians and the rest of the world on all bands.

Classifications: Single operator, single and all band. Multi-operator, single transmitter, all band only. (No multi transmitter)

Exchange: For OM stations, RS(T) plus age of operator. For YL's, RS(T) plus 00.

Scoring: One point per QSO. Asians use non-Asian countries worked for their multiplier. (ARRL DXCC list) Non-Asians use prefixes of Asian countries. (*CQ* WPX list) Note: Ogasawara JD1 (Bonin & Volcano) are in Asia. Minamitori Shima JD1 (Marcus) is in Oceania.

Final Score: The total QSO points from each band × the sum of the multiplier on each band.

Awards: To the highest scorers, both phone and c.w. as follows: Single operator, all band and each single band, in each country and USA call areas, up to the fifth rank where returns justify. The continental all band leaders will receive a medal in addition to the certificate, as will the multi-operator continental leaders.

Logs: Keep all times in GMT, fill in country or prefix column only first time it is worked, and use a separate sheet for each band. A summary sheet is a must, showing the scoring and other information, and a signed declaration that all rules and regulations have been observed.

Things to remember: Disqualification regulations are strictly enforced so check your log carefully for duplicate contacts. On 3.8 MHz

[*Continued on page 63*]



THE awards PROGRAM

BY ED HOPPER,* W2GT

USA-CA HONOR ROLL

2000	1000	500
K7LQI 214	W1LQQ 345	W1LQQ 1032
1500	WA2GLU 346	G2AYG 1033
WB0FRM 256		W6RFX 1034
		F9IL 1035

THE May "Story of The Month", as told by Avis, is:

Avis E. Miracle, W8WUT

(All Counties #115, 1-10-74)

"My OM is Willie, W8WUU. and we have two Jr. Operators. The youngest one is also a ham, WA8SLE. Other hams in the family are my brother, W8VIB and his lovely YW, W8-YBL. My brother was the first one to get his ticket, then Willie got interested and started studying and working on the code. Pretty soon my interest was sparked and I started studying and we got our calls together, as usual Ladies before Gentlemen- Hi.

"I have always enjoyed working for Awards along with my fair share of ragchewing. It didn't take me long to get my RCC, and I had already figured how many counties I had, before any County Hunting program was created, but it seemed like all of my California contacts were in Los Angeles County. I was having a nice QSO with Marv, W4WLM on 40 meters one day and we were talking about awards and counties and things, and he told me about the 40 meter County Hunter Net. I checked into that Net at once, it was March 3, 1964.

"Some may think that it sure took me a long time to work them *all*, well for a long time I was never going to work them *all*, but I just kept plugging along working new ones now and then. In 1973 I decided I wanted to get them *all*, if possible, and is sure was exciting. I have many people to thank for their wonderful help, all the grand mobilers, the patient NCs (bless them), people who relayed, and so on. . . . Herb, W5RDV gave me the very last County (Haskell, Okla.) and Chuck, KØKXR gave me the next to last one. I think the 'next to last One' is just about as important as the 'last One' and oftimes they are not given any recognition.

*P.O. Box 73, Rochelle Park, NJ 07662.



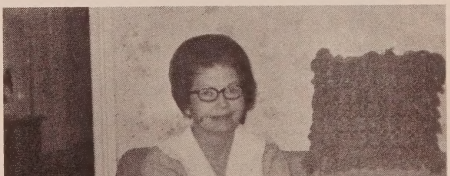
HI8LC Award.

"When starting County Hunting, I did not know that Counties in Louisiana are called 'Parishes', so when I received my first QSL marked Lafourche Parish, I assumed that this person lived in a home called Lafourche Parish, Hi.

"I thoroughly enjoy giving out Counties and help others get some needed Counties, so we usually take a nice long trek out west every summer and try to get into some of the *rare* ones. Helped 15 to get the last County in a particular state on our trip in 1973.

"Have many hobbies, but County Hunting sure tops them all. Have made so many friends and how nice it was to meet so many of them, in person at KC in '74.

"I used low power for a long time, a home-brew 50 watt rig and worked a lot of good things with it, but finally got tired of that old phrase, "I can hear you calling but just can't copy, Sorry!", so went to higher power and found it a little easier on the nerves. At present using a Swan-500CX which we also use in the mobile, also have an SB-220 ready for use when extra power is needed, so may I again say thanks to ALL and you will and do still hear me in there at home and Mobiling." *(May I say, Yes, I do still believe in Miracles, Ed.)*



Avis Miracle, W8WUT.



Josef Cech, OK2-4857, 1st oversea s.w.l. to obtain USA-CA, all other s.w.l.s were to U.S. and Canadians.

Awards Issued

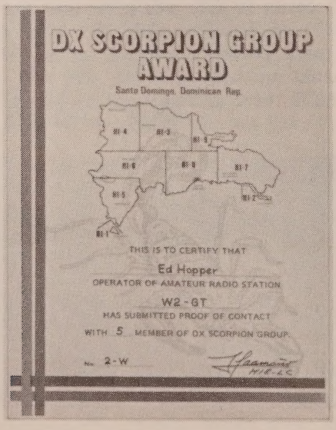
Although telephone calls from Herman, WA4WQG and Bill, W6CLM, as I write this column, indicate they have them *all*, applications have not yet arrived.

Frank McJannet, K7LQI, was issued USA-CA-2000-Mixed.

Will Weisert, WBØFRM (not to be confused with "Stokley," WAØFRM), gained USA-CA-1500 endorsed All 2×SSB, All Mobiles.

Charlie Gagnon, Jr., W1LQQ, qualified for USA-CA-1000 and USA-CA-500, endorsed All SSB.

Howard Siegel, WA2GLU acquired USA-CA-1000-Mixed and brought his endorsement for USA-CA-500 to read All 14, All SSB, All Mobiles.



DX Scorpion Group Award.

Joe Openshaw, G2AYG applied for and received USA-CA-500. This is #16 to England which, of course, includes All Counties to Frank Coursey, G4JZ.

Bob Faulkner, W6RFX was also issued USA-CA-500-Mixed.

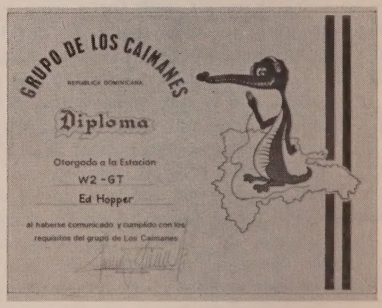
Edmond Dubois, F9IL, DUF Awards Manager for *REF*, was happy to receive USA-CA-500. This is #4 to France.

Awards

Scorpion Group Award: Issued for valid QSOs (Also available to s.w.l.s) after January 1, 1971. HI stations must contact all 7 members of the Scorpion Group on at least any 2 bands, any mode (14 QSOs) *or* 5 members on c.w. any band (5 QSOs). North and South American stations contact 5 members on any mode, any band, *or* 4 members on c.w. on any band. European stations must contact 4 members any mode. All others (Asia, Africa & Oceania stations) contact 2 members, any band, any mode. Send log data and your QSL confirmations of each QSO and 10 IRCs to: DX Scorpion Group, P.O. Box 1722, Santo Domingo, Dominican Republic. Valid stations are: HI8CAB, CRO, EJH, FED, HAM, LC, LPN, and VHF. **HI8LC Award:** Contact *HI8LC* on 5 bands, any mode on or after 1 January 1963. Send your 5 QSLs and U.S. $1.00 or 10 IRCs for postage to: HI8LC, P.O. Box 88, Santo Domingo, Dominican Republic. S.w.ls also eligible.

Cayman Award (HI Land): Available for QSOs from January 1, 1974 to December 31, 1975. HI station need QSOs with 15 members any band, any mode. Others need QSOs with 5 members, any band, any mode. Send GCR list and your QSLs and 15 IRCs to: Diploma Grupo de los Caimanes, P.O. Box 491, Santo Domingo, Rep. Dominicana. S.w.ls of HI need 7 members, DX s.w.ls need 2 members. Members are: HI3AJL, AGG, AMF, DRL, HAP, LRG, MGS, MGG, NGB, NDB, NFL, PPR, PJR, RER, ROP, XEG, CCA; HI6JHL, HI7-BAG, BAF; HI8CRO, EJH, GAR, HM, LAR,

[*Continued on page 63*]



Cayman Award, (HI Land)



Propagation

BY GEORGE JACOBS,* W3ASK

THE following is an overall picture of h.f. amateur band openings expected this month. For specific times of DX openings, refer to the *DX Propagation Charts* which appeared in last month's column. This month's column contains *Short-Skip Propagation Charts* valid for May and June, as well as Charts centered on Alaska and Hawaii. The *Short-Skip Charts* contain propagation forecasts for openings varying in distance between 50 and 2300 miles. For day-to-day propagation conditions expected during May, see the "Last Minute Forecast," which appears at the beginning of this column.

10 Meters: Except for an occasional daytime opening to South America and the South Pacific, not many DX openings are forecast during May. The afternoon hours are the best time to check for DX openings. Frequent short-skip openings between distances of approximately 750 and 1400 miles, however, should be possible.

15 Meters: A decrease in DX openings on this band is normal for May and the summer months. Some fairly good openings should still be possible towards South America, Africa and the South Pacific during the afternoon hours. Numerous short-skip openings, between approximately 600 and 2300 miles, should be possible on most days.

20 Meters: This should be the best band for DX propagation during May. Opening shortly after sunrise, good DX conditions are expected to one area of the world or another, throughout most of the day and well into the evening hours. Conditions should peak for an hour or two after sunrise and again during the late afternoon and early evening hours, with openings possible to almost all areas of the world. Very frequent short-skip openings are also expected throughout most of the day, ranging between 350 and 2300 miles. Quite often, especially during the late afternoon, optimum conditions may exist for both short and long skip, with stations a few hundred miles away QRMing DX stations.

40 Meters: Shorter hours of daylight and seasonally higher levels of static will mean fewer DX openings on this band during May. Some fairly good ones, however, should still be possible. Check from about an hour before sundown, through the hours of darkness, and until shortly after sunrise for openings to many areas of the world. Good daytime short-skip openings can be expected over distances between 150 and 750 miles, with nighttime openings extending up to the one-hop limit of 2300 miles.

80 Meters: Fewer DX openings are also expected on this band during the month. It's worth checking, however, during the hours of darkness and the sunrise period for some fairly good openings that may still be possible to several areas of the world. Excellent short-skip openings should be possible throughout the daylight hours over distances ranging between 50 and 250 miles. During the hours of darkness, the short-skip range should increase up to approximately 2300 miles.

160 Meters: Propagation conditions on this band have passed their seasonal peak, and should decline until the early fall. Openings up to a distance of 1000 miles, or so, should be possible this month during the hours of darkness. An occasional opening well beyond this range may also be possible from time-to-time. Expect high levels of static for long periods of time.

*11307 Clara Street, Silver Spring, MD 20902.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For May, 1975

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date *May*				
Above Normal: 16-17	A	A	B	C
High Normal: 1, 3-4, 15, 21-22, 26-27, 31	B	B	C	D
Low Normal: 2, 10, 13-14, 19-20, 23-25, 29-30	B	C	D	E
Below Normal: 5-6, 8, 11-12, 18, 28	C	D	E	E
Disturbed: 7, 9	D-E	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, an opening shown in the Charts with a *propagation index* of (3) will be good (B) on May 1, 3-4, fair (C) on May 2, and poor (D) on May 5-6, 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, or check WWV at 14 minutes past each hour.

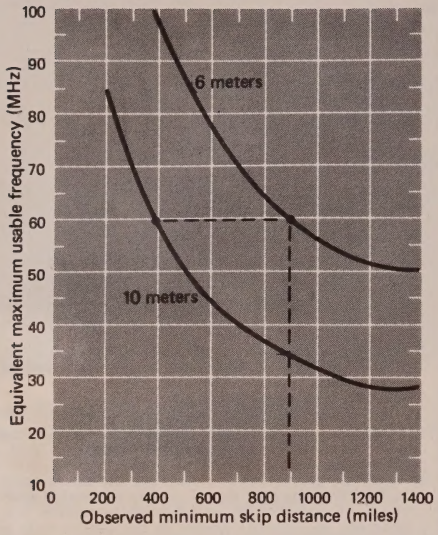


Fig. 1—Chart describing correlation between sporadic-E openings on the 10 meter amateur band and possible 6-meter openings at the same time. The example shows a minimum skip distance of 400 miles observed on 10 meters; from the chart 6 meters should be open with skip greater than 900 miles.

V.H.F. Ionospheric Openings

Sporadic-E ionization should increase considerably this month, and some fairly good *6 meter* openings should be possible between approximately 1000 and 1400 miles. These openings are most likely to occur between 10 A.M. and 2 P.M. and between 6 and 10 P.M., local daylight time, although they can also occur at other times. During periods of intense and widespread sporadic-E ionization, two-hop openings considerably beyond 1400 miles may occasionally occur on *6 meters,* and openings between approximately 1200 and 1400 miles may be possible on 2 meters!

Here's a useful tip for predicting *6 meter* short-skip openings from observations made on *10 meters.* The geometry of propagation is such that as the skip distance *decreases* on *10 meters,* the highest frequency that will be reflected by sporadic-E ionization is *increasing.* By observing the *minimum* skip heard on *10 meters,* and using the relationship shown in fig. 1, it should be possible to tell whether or not *6 meters* is open, and over what distance.

For example, if the minimum skip heard on *10 meters* in a south westerly direction is observed to be 400 miles (it's the distance to the *nearest* skip station that counts, not others), from fig. 1 the intersection between 400 miles and the *10 meter* curve corresponds to an muf of 60 MHz. This means that there is a very good chance that *6 meters* should also open in the same general direction. The minimum skip distance that can be expected on *6 meters* can be found from fig. 1 by locating the intersection between 60 MHz and the *6 meter* curve. The resulting distance is found to be 900 miles. A useful rule of thumb to remember is that when skip stations are heard less than *500 miles* away on *10 meters,* the chances are very good that *6 meters* will also open in the same general direction.

The *Eta Aquarids* meteor shower should intersect the earth's atmosphere between May 4 and 6. This is a major meteor shower and it should reach maximum intensity during the afternoon of May 5, with a predicted hourly meteor count in excess of 20. Chances are excellent for meteor-burst openings during the period of the shower.

While there is generally little auroral activity during May, some displays could occur during periods of radio storminess. Check the "Last Minute Forecast" at the beginning of this column for those days that are likely to be "Below Normal" or "Disturbed" during May.

Sunspot Cycle

A smoothed sunspot number of 21 is forecast for this month, as the present sunspot cycle continues to decline slowly towards a minimum. We will have more up-to-date sunspot information to report in next monht's column. 73, George, W3ASK

CQ Short-Skip Propagation Chart
May & June, 1975
Local Daylight Savings Time At Path Mid-Point

Band (Meters)	*Distance Between Stations (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	08-09 (0-1) 09-13 (0-2) 13-17 (0-1) 17-21 (0-2) 21-23 (0-1)	08-09 (1) 09-13 (2) 13-17 (1-2) 17-21 (2) 21-23 (1) 23-07 (0-1)	08-09 (1-0) 09-21 (2-0) 21-23 (1-0) 23-07 (1-0)
15	*Nil*	07-09 (0-1) 09-13 (0-2) 13-17 (0-1) 17-21 (0-2) 21-00 (0-1)	07-09 (1-2) 09-13 (2-3) 13-17 (1-2) 17-19 (2-3) 19-21 (2) 21-00 (1) 00-07 (0-1)	07-09 (2-0) 09-16 (3-1) 16-19 (3-2) 19-21 (2-1) 21-22 (1) 22-07 (1-0)
20	09-20 (0-1)	07-09 (0-2) 09-12 (1-3) 12-17 (1-4) 17-19 (1-3) 19-20 (1-2) 20-23 (0-2) 23-07 (0-1)	07-08 (2) 08-09 (2-3) 09-12 (3-4) 12-17 (4) 17-19 (3-4) 19-20 (2-4) 20-22 (2-3) 22-23 (2) 23-07 (1)	07-08 (2) 08-09 (3-2) 09-15 (4-3) 15-20 (4) 20-22 (3) 22-23 (2) 23-07 (1)

40	08-10 (1-2) 10-19 (2-4) 19-21 (1-3) 21-23 (0-2) 23-08 (0-1)	08-10 (2-4) 10-15 (4-2) 15-17 (4-3) 17-19 (4) 19-21 (3-4) 21-23 (2-3) 23-08 (1-2)	08-09 (4-3) 09-10 (4-2) 10-15 (2-1) 15-17 (3-1) 17-19 (4-2) 19-21 (4) 21-23 (3-4) 23-02 (2-4) 02-04 (2-3) 04-08 (2)	08-09 (3-1) 09-10 (2-1) 10-17 (1-0) 17-19 (2-1) 19-21 (4-3) 21-02 (4) 02-04 (3) 04-06 (2) 06-08 (2-1)
80	08-10 (4) 10-18 (4-3) 18-22 (4) 22-00 (3-4) 00-06 (2-3) 06-08 (3-4)	08-10 (4-1) 10-16 (3-0) 16-18 (3-1) 18-20 (4-2) 20-00 (4) 00-06 (3-4) 06-08 (4-3)	08-09 (1) 09-10 (1-0) 10-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-3) 22-02 (4) 02-06 (4-3) 06-08 (3-2)	08-09 (1-0) 09-18 (0) 18-20 (1-0) 20-22 (3-2) 22-02 (4-3) 02-06 (3-2) 06-08 (2-1)
160	06-09 (4-1) 09-10 (2-0) 10-19 (1-0) 19-21 (3-1) 21-23 (4-2) 23-06 (4-3)	06-09 (1) 09-19 (0) 19-21 (1-0) 21-23 (2-1) 23-01 (3-2) 01-04 (3) 04-06 (3-2)	08-09 (1-0) 09-21 (0) 21-23 (1) 23-01 (2-1) 01-04 (3-2) 04-07 (2) 07-08 (1)	08-21 (0) 21-01 (1) 01-04 (2) 04-06 (2-1) 06-07 (1) 07-08 (1-0)

ALASKA

Openings Given In GMT

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	*Nil*	*Nil*	00-02 (1) 02-04 (2) 04-05 (1) 12-14 (1)	*Nil*
Central USA	*Nil*	23-02 (1)	01-03 (1) 03-05 (2) 05-06 (1) 13-15 (1)	08-12 (1)
Western USA	*Nil*	00-02 (1) 02-04 (2) 04-05 (1)	00-02 (1) 02-04 (2) 04-06 (3) 06-07 (2) 07-08 (1) 14-15 (1) 15-18 (2) 18-20 (1)	08-09 (1) 09-14 (2) 14-15 (1) 11-13 (1)*

HAWAII

Openings Given In Hawaiian Standard Time

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	*Nil*	12-14 (1) 14-16 (2) 16-18 (1)	06-08 (1) 10-14 (1) 14-16 (2) 16-18 (3) 18-19 (2) 19-22 (1)	19-20 (1) 20-23 (2) 23-02 (1) 21-23 (1)*
Central USA	*Nil*	12-15 (1) 15-18 (2) 18-20 (1)	04-06 (1) 06-09 (2) 09-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-00 (1)	19-20 (1) 20-21 (2) 21-01 (3) 01-02 (2) 02-04 (1) 20-21 (1)* 21-00 (2)* 00-03 (1)*

See explanation in "How To Use Short-Skip Charts" in box at beginning of this column.

* Indicates best time for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a forecast rating of (2), or higher.

Note: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.

How To Use The Short-Skip Charts

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters), as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts, the predicted times of openings are found under the appropriate Meter band column (10 through 80 Meters) for a particular geographical region of the continental USA, as shown in the left hand column of the Charts. An * indicates 80 Meter openings. Openings on 160 Meters are likely to occur during those times when 80 Meter openings are shown with a *propagation index* of (2), or higher.

2. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. 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) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this 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.

3. Times 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. On the Short-Skip Chart appropriate *daylight* time is used at the *path midpoint*. For example, on a circuit between Maine and Florida, the time shown would be EDT; on a circuit between N.Y. and Texas, the time at the midpoint would be CDT, etc. Times shown in the Hawaii Chart are in HST. To convert to daylight time in other USA time zones, *add* 3 hours in the PDT zone; 4 hours in MST zone; 5 hours in CDT zone; and 6 hours in EDT zone. *Add* 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 15 or 3 P.M. in Los Angeles; 18 or 6 P.M. in Washington D.C; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to daylight in other areas of the USA, *subtract* 7 hours in the PDT zone, 6 hours in MDT zone, 5 hours in CDT zone and 4 hours in EDT zone. For example, at 20 GMT it is 16 or 4 P.M. in N.Y.C.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts c.w. or 300 watts p.e.p. on sideband; The Alaska and Hawaii Charts are based upon a transmitter power of 250 watts cw or 1 kw p.e.p. on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 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 10db loss, it will lower by one level.

5. 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.

Western	13-17 (1)	09-14 (1) 14-18 (2) 18-20 (1)	04-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-16 (3) 16-19 (4) **19-20 (3)** 20-21 (2) 21-00 (1)	18-19 (1) 19-20 (2) 20-22 (3) 22-02 (4) 02-04 (3) 04-05 (2) **05-07 (1)** 19-20 (1)* 20-22 (2)* 22-02 (3)* 02-04 (2)* 04-05 (1)*

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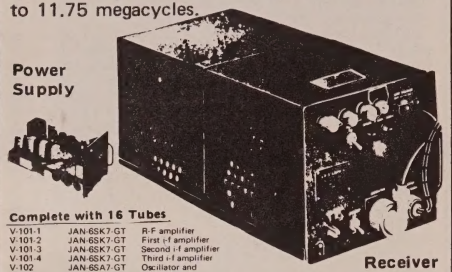
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V-105-3 and V-105-3		
V-106	JAN-6SJ7-GT	Voltage control
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SURPLUS sidelights

BY GORDON ELIOT WHITE*

THE AN/ARC-44 transceiver has been around for quite a while, but has not been widely known, probably because large quantities have not been released by the Army, and many that have come on the market have been snatched up by foreign governments. One parts dealer I am familiar with is re-manufacturing ARC-44 tuning units now, for overseas sale.

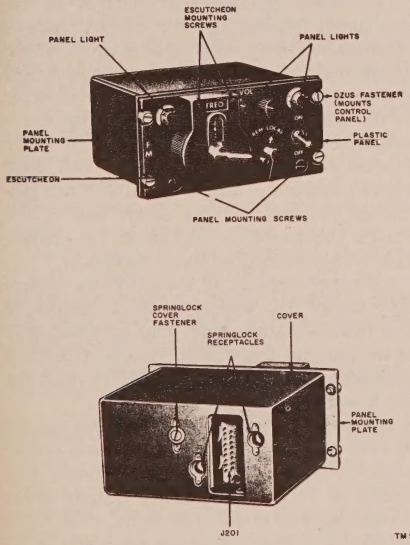
As time marches on, however, this 24-52 MHz frequency modulation set is becoming more available from the usual dealer and government sources such as advertise in *CQ*.

This month's column will describe the unit with basic particulars on it. The photos show the AN/ARC-44 transceiver and control head as it was used typically in an Army L-19 "Birddog" observation plane.

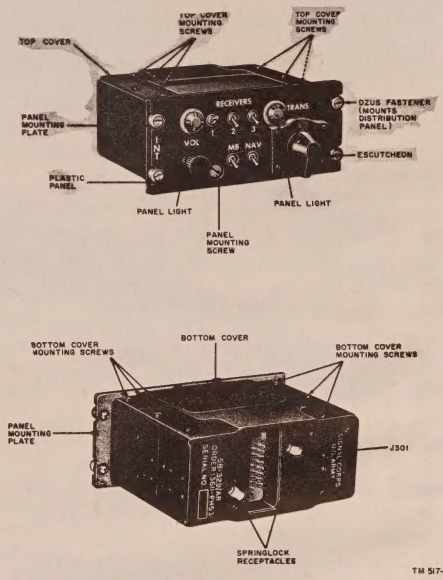
The design grew out of the Korean War, with its demonstrated need for better air-to-ground liaison equipment to coordinate close air support. The result was a 29-tube transceiver, using the then-modern miniature and subminiature tube types such as 5763, 5902,

*1502 Stonewall Rd., Alexandria, Va. 22302

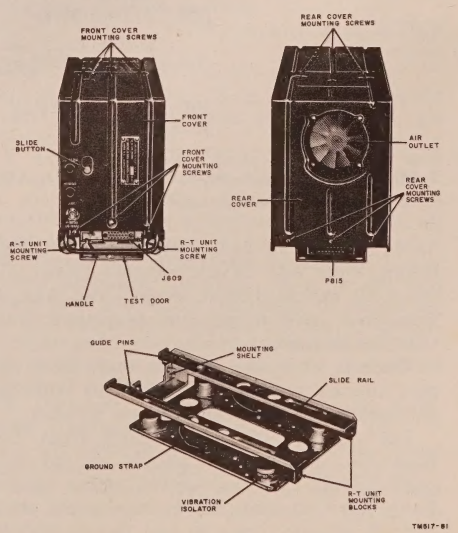
(A) shows front and rear views of the SB-327/ARC-44 control panel. (B) The SB-329/AR radio signal distribution panel, front and rear views. (C) Front and rear views of the RT-294(*)/ARC-44 transceiver and the MT-1268/AR mounting bracket.



A



(B)



(C)

Pin Connections RT-294A/ARC-44

Test Jack J-9

V—1st osc test	*U*—1st limiter grid, rec.; carrier-on on trans.
R—power ampl grid	*H*—n/c
T—1st IPA grid	*W*—400 Hz to fan motor
B—sidestep osc.	*E*—+ 150 Volts d.c.
F—+ 27.5 volts d.c.	*J*—homing test switch
X—d.c. ground	*S*—second osc
K—n/c	*L*—discrim. load
C—d.c. ground	*M*—½ discrim. load
D—+ 300 volts d.c.	*N*—audio input
A—n/c	*P*—audio output

Transceiver Jack P-15

L—+ 150 volts d.c.	*K*—n/c
C—receiver audio output	*D*—n/c
T—+ 300 volts d.c.	*Z*—n/c
B—audio input from SB-329/AR control	*M*—homing relay
E—n/c	*JJ*—whole MHz tuning
H—audio ground	*KK*—whole MHz tuning
A—d.c. ground	*LL*—whole MHz tuning
F—+ 27.5 volts d.c.	*MM*—whole MHz tuning
Y—n/c	*NN*—whole MHz tuning
S—+ 27.5 volts d.c.	*CC*—1/10th MHz tuning
W—+27.5 volts d.c.	*DD*—1/10th MHz tuning
U—n/c	*EE*—1/10th MHz tuning
R—n/c	*FF*—1/10th MHz tuning
P—n/c	*HH*—1/10th MHz tuning
X—27 volts 400 Hz	*AA*—transmit/rec relay
V—27 volts 400 Hz	*BB*—retransmit relay
N—n/c	*J*—f.m. squelch

Table I—Pin connections for the RT-294A/ARC-44 transceiver.

5840, etc. The limited lifting ability of single engine Piper and Cessna spotting planes like the L-19 indicated light weight—the ARC-44 transceiver itself weighs just 14 pounds, quite light for its time.

The sets were later used in other close-support aircraft, on into the Viet Nam War, and are used by many foreign military services.

The ARC-44 is now available from Fair Radio Co., at about $20, plus $4 for the audio control head. I do not see the tuning head in Fair's latest catalog, but in buying the set, I strongly suggest trying to find the digital control unit, SB-327/ARC-44 as construction of a control would be a fairly lengthy job.

Other dealers around the country seem to have at least modest quantities of the units as well.

The set consists of the transceiver, with its mounting base, a dynamotor, DY-107/AR, the SB-327/ARC-44 tuning head, an SB-329/AR distribution panel, an SA-474/AR switch assembly, an AT-454/AR antenna, and, optionally, an AN/ARA-31 homing antenna and control system.

The main unit, RT-294/ARC-44, contains the receive and transmit circuitry, as would seem obvious. The SR-329 contains audio amplifiers, headset and micro phone controls. It uses five tubes, and draws B+ and filament power from the power unit.

The DY-107 is rated at 4.75 amps at 28 volts and puts out 140 ma at 150 volts d.c., 125 ma at 300 volts, and 27 volts a.c. at 400 Hz.

The AT-454 is a fiberglass whip about eight feet long, with copper conductors embedded in it. A matching network mates it to the transceiver's 52 ohm output.

For navigating, the ARC-44 uses two 51 inch dipoles, switched in tthe ARA-31 unit. This is probably not much use to amateurs.

The navigation (homing) system was, I would say, rather quaint. A ground transmitter sends out a steady carrier modulated with 400 Hz audio. The aircraft receives that signal via the ARA-31 dipoles mounted on each side of the fuselage, and the switching unit of the ARA-31 keys the signal from each antenna with a "U" in morse (..- ..- ..-) for the right side and "D" (-.. -.. -..) for the left.

By turning toward the side giving the stronger signal (assuming the f.m. characteristic of the stronger signal "capturing" the receiver detection circuits) the pilot would seek a point where the signals balanced, resulting in a combined steady tone when he was headed either directly toward the station or directly away from it.

It would seem likely that reflections or other propagation disturbances from the aircraft itself might give ambiguous information with the system, but it was the best the Army had at the time, given the problems of setting up navigation points in potentially hostile territory.

Among other options in the ARC-44 system was re-transmit, by which a signal could be received from a distant point and automatically re-sent on another frequency, greatly extending the communication range available beyond the reliable line-of-sight distance.

The transceiver provides 280 channels, spaced at 100 kHz intervals. Sensitivity is rated at one microvolt or better for a signal to noise plus noise ratio of 10 db. Transmitted output in the dash A model was rated at 8 watts, or 6 watts in the —( ) set. f.m. frequency deviation is 20 kHz.

The receiver is a double conversion superhet, using a variable first intermediate frequency of 6.55-7.45 MHz, and a fixed second i.f. of 2.9875 MHz. Bandwith is rated at 75 kHz at 6 db down. Audio output is 50 mw into 150 ohms.

Table I indicates the transceiver plug pin connections.

A door at the lower front of the transceiver package gives access to test jacks for servicing the unit.

The book on the AN/ARC-44 is *TM-11-517*. It should be available from Sam Consalvo, 7218 Roanne Dr., Oxon Hill, Md. 20021, or Quaker Electronics, Hunlock Creek, Pa., 18621. ■

Awards [*from page 56*]

LPN, NBB, NCE, NEG, NVJ, PDV, RSB, XLF, XJI; HI9BFO.

NOTE—These three Awards are on very nice parchment paper and in colors. If anyone would like a beautiful, heavy parchment, in color, map of the Dominican Republic showing the cities, outlines of the 9 call areas, size 13 inches by 15 inches—send 15 IRCs to HI8LC, P.O. Box 88, Santo Domingo, Dominican Republic and you will receive it by return air mail.

Notes

In the USA-CA Honor Roll in January 1975 *CQ*, sorry that an error put K2AMN in Japan as KA2AMN—hope he enjoyed his trip. If anything should seem strange about my February and March columns it is because mail got a bit mixed up, perhaps by Uncle Sam and/or *CQ* mail room and columns got swapped.

If anyone has any questions regarding Independent Cities, Alaska Counties/Judicial Divisions, may I refer you to my column in *CQ* October 1974.

Oh yes, in late October 1974 via WA2AMU and VP9BY I received a copy of the New Bermuda Award (even more beautiful than the previous one) but before I could use it I was told to *wait*, the rules were being changed again, but so far—no new rules have arrived.

Hope you all check, CONTEST CALENDAR, by Frank Anzalone, W1WY, each and every month for data on County Hunter Contests and the many State QSO Parties—great way to catch needed Counties.

Also remember to write and tell me, How was your month?, 73, Ed., W2GT.

Contest Calendar [*from page 54*]

the JA's will be found between 3793 and 3802. Non-Asians use prefixes for their multiplier, not countries. Club stations are considered multi-operator. Each operator of a multi station will give his age in the exchange. KA contacts do not count.

Logs must be *received* no later than Sept. 30th for phone entries and Nov. 30th for the c.w. Logs go to: J.A.R.L. Contest Committee, P.O. Box 377, Tokyo Central, Japan. Include a IRC and s.a.e. for copy of results.

Asian Country List: A4X, A51, A6X, A7X, A9X, AC3, AP, BV, BY, CR9, EP, HL/HM, HS, HZ/7Z, JA/JE/JF/JG/JH/JR, JD1, JT, JY, OD5, S21, TA, UA/UK/UV/UW9-0, UD6/UK6C-D-K, UF6/UK6F-O-Q-V, UG6/UK6G, UH8/UK8H, UI8/UK8A-G-I-L-O-T-Z, UJ8/UK8J-R, UL7/UK7, UM8/UK8M-N, VS6 VS9M/8Q6, VU, VU (Andaman), VU (Laccadive), XU, XV/3W8, XW8, XZ, YA, YI, YK, ZC4/5B4, IS9 (Spratly) 4W, 4X/4Z, 7O (S. Yemen) 7O/VS9K (Kamaran), 8Z4, 9K2, 9M2, 9N1, 9V1.

Editor's Notes

The Massachusetts Amateur Radio Week usually in May will not be held this year. In its place, however, there will be a Massachusetts Bicentennial Activity. Since Massachusetts is "Where It All Began" its quite fitting that it be celebrated in that state.

A special award is being issued for contacting Mass. amateurs during the United States Bicentennial years, January 1, 1975 to December 31, 1976.

You must meet certain requirements for this Award, the scoring system being based on the number of contacts with Mass. amateurs. Extra points may be gained by working stations in certain historical cities and towns and on certain holidays.

This is something more appropriate in Ed. Hopper's department. Check W2GT's Awards Column next month. In the meantime build up your total of Mass. contacts.

73, for now, Frank, W1WY

QRP [*from page 47*]

Part III, *QST*, April, '73, p. 28. The series focuses on vhf amplifiers but principles are relevant to hf.

[4]A. Mathiesen, "100 Watts PEP Output with Power Transistors," *QST*, Jan. '75, p. 34. Uses a pair of 2N5942's. Details on impedance transformers using miniature coax instead of twisted pair windings.

[5]S. Chambers, "High-Power Solid-State Linear Power Amplifier," *hr*, Aug. '74, p. 6. 320 watt linear but valuable for techniques of paralleling several transistors through the use of power-splitting and power combining transformers.

[6]K. Shubert, "Lowpass Filters for Solid-State Linears," *hr*, March, '74, p. 38.

[7]W. Hayward, "Increased Power for the Solid-State Transmitter," *QST*, May, '72, p. 19.

[8]See my "Design Notes on a Moderate Power Solid State Transmitter for 1.8MHz," *CQ*, Nov., '72, p. 18; also, "Design Technique for Solid State Amplifiers" scheduled for *QST* this month or next.

[9]P. Franson, "How To Use RF Power Transistors," *hr*, Jan., '70, p. 8. ■

Math's Notes [*from page 44*]

typical output signal level = 2 volts p-p
current at 5V = 110 milliamperes
(NOTE: The 95H90 will get warm during normal operation).

When hooking this pre-scaler into your existing frequency counter (as we did) or mounting it in a small minibox, be sure you connect the input and output grounds directly to the ground braid. Also, it is a good idea to coil (around a pencil) the B+ wire to prevent r.f. from riding on it. If the pre-scaler does not work properly for you be certain that no wires are shorting, that the B+ value is between 4.75 - 5.25 volts, and that your counter can handle the fast rise time output of the circuit. If not, a 100 ohm resistor and 10 pF capacitor can be connected across the output as a roll off filter and will solve that problem.

While not pretty by esthetic standards, the unit works quite well and of three units, one reached 306 MHz, one 323 MHz, and the 3rd 290 MHz. The unit will also trigger from your 1 watt 2 meter transceiver by putting an 18" length of #20 wire into the input BNC connector as an antenna.

73, See you next month, WA2NDM.

A complete parts list follows:

4 .01 μf 16V disc ceramics Sprague HY-420 or equiv.
1 .1 μf 12V disc ceramics .375" diam. max.
1 .001 μf disc ceramics as small as possible.
1 4.7K 5% ¼ watt carbon resistor
1 330 ohm ¼ watt carbon resistor
1 680 ohm ¼ watt carbon resistor
1 470 ohm ¼ watt carbon resistor
2 selected values
1 2N4123 transistor
1 95H90 DIP I.C. (Fairchild)
2 1N914 diodes
1 4.7 μh r.f. choke Nytronics WEE-4.7, Miller 70F476A1
1 Ferrite bead—Amidon 43-101 or equiv.
1 BNC Connector, VG 1094/V
1 I.C. Socket, Augat 316-AG5D-R or Amphenol 021-25011-162

Novice [*from page 39*]

Holiday, Fla. 33589, reports that he had a great time in the 1975 Novice Roundup Contest. No wonder! He worked four new states and broke the 13-w.p.m. barrier. His next stop is the FCC office to take his General class test. Preston suggests a special award for all contestants in the NR who worked 40 meters only —after they get out of the hospital... Speaking of FCC offices, a friend who prefers not to be identified by call letters recommends taking a pair of ear plugs along when you visit the new FCC examination room in Chicago. The room has music piped into it. So the code machine is turned way up in volume: so it can be heard over the music and the hub-bub in the room—which is smaller than the old room. After you stagger back after passing the code test, find a chair in the back of the room, put your ear plugs in, and start on the written exam.

Remember our monthly story. The NOVICE SHACK is your column: so send your "News And Views," photos, and suggestions of things that you would like to see discussed to the address on the first page of the column, and we will try to do the rest.

73, Herb, W9EGQ

JUP on F.M. [*from page 37*]

$$\frac{3000}{2125} = 1.41 \text{ radians.}$$

Eyeball accuracy will be more than adequate for all but the greatest nitpickers.

The same general techniques can be used for the setup of touchtone pads, PL encoders, and by careful calibration of the horizontal baseline (frequency), voice modulation can be read to within about half a kiloHertz deviation, and the display will be a peak display with no worries of meter ballistic considerations. It can be an excellent tool for showing why some guys sound so poorly via the repeaters, because the technique really displays vividly just how far out in the frequency spectrum the voice sidebands do extend, and why some of these voice peaks seem to turn into square waves as they pass through "the Machine"! Next time a discussion of some of the characteristics of f.m. transmitters and receivers, and a beginner's glossary of terms in use. Tune in and learn some new ones to snow the other guys on the repeaters. ■

The HRO Receiver [*from page 21*]

form during the last years of World War II.

The DPF concept entailed two receivers. The *DPF-201* was a double conversion receiver covering 550 kHz to 31.5 MHz (fig. 4). Very sturdy and rugged, the receiver provided full bandspread on an easily-read slide-rule dial for all h.f. amateur bands. A 6AK5 was used in the r.f. stage for the ultimate in sensitivity. Weight of the DPF-201 was an impressive 80 pounds, most of it being in the impressive, rugged chassis and the sliding coil catacomb.

The second receiver, the *DPF-501,* was a deluxe job, weighing in at 107 pounds! With direct dial calibration for the ham bands and general coverage to 41.5 MHz, the 501 was to be the ultimate in receiver design (fig. 5).

But, wisely, Jim Millen recognized that the receivers were obsolete before they were even in production. Weight and a rugged chassis were no longer required for stability. Special mechanical filters obsoleted the concept of the original Lamb crystal filter. The product

detector was now at hand for s.s.b. reception. And, most important, the cost of building such a hand-crafted receiver had sky-rocketed, and it seemed impractical, or rash, to continue with the project. Regretfully, it was shelved.

L'envoi

Jim Millen has been in the "wireless" business for 50 years. The Millen Company continues, although all of the pre-war competitors of years ago have long since disappeared. *No large communications company that made amateur communication receivers pre-war is in the business today!* James Millen ran his first advertisement in 1922 in *Radio News*. Today—over fifty years later—if you look in the advertising pages of *CQ*, you will see an advertisement for his present company! *CQ*, and the author of this article, salute a great radio amateur and pioneer, Jim Millen, and his famous HRO receiver, the first *modern* communication receiver! ■

Announcements [*from page 8*]

They will operate on 40 meters, phone and cw; 20 meters, phone and cw; and 2 meter FM. The Novice Bands will be kept active on 40. Shows and exhibits will be all day in Van Cortland Park in The Bronx.

● **Trenton, Tennessee** — The Annual Humboldt ARC Hamfest is Sunday, May 18th at Shady Acres City Park, Trenton, TN. For information, contact: Hugh Wardlaw, WB4SLI, 2678 Cole Dr., Humboldt TN 38343. ● **Knoxville, Tennessee** — The Radio Amateur Club of Knoxville is pleased to announce that it's annual Greater Knoxville Hamfest will be held on May 24th and 25th 1975. Activities will be located in the Jacobs Building at Chilhowee Park, Knoxville. More information for SASE from WA4 BTK, 1316 Kirby Road., Knoxville, TN 37919. ● **Rochester, New York** — The FCC will conduct amateur radio examinations at the Western New York Hamfest, in Rochester, NY, on Saturday, May 31st for General and higher class licenses. Examinations requiring a code test (13 or 20 wpm) will begin at 10 am. Those not requiring a code test (advanced class) will begin at 1 pm. Applications should be submitted with the $4.00 filing fee no later than May 23rd to the FCC, Room 1005 Customhouse, Second and Chestnut Sts., Philadelphia, PA 19106. ● **Burlington, Kentucky** — The Kentucky HAM-O-RAMA will take place Sunday, June 1, at the Boone County Fairgrounds, Burlington, Kentucky. Located 10 miles south of Cincinnati, Ohio near I-75. Advance tickets, $1.50, for information, contact: WA8OGS, 6381 Mullen Road, Cincinnati, OH 45239. ● **Oglesby, Illinois** — The Starved Rock Radio Club's annual Hamfest is June 1st at the Bureau County Fairgrounds in Princeton. A long SASE is required for information an/or advance registration. Write, G.E. Keith W9MKS/W9QLZ, RFD no. 1, Box 171, Oglesby, IL 61348. (815) 667-4614. ● **Winfield, PA** — The Twelvth Annual Penn-Central Hamfest will be held by the Williamsport and Milton clubs on Sunday, June 1st, 1975 at the Union Township Volunteer Fire Co. grounds on route 15 in Winfield, PA. For more information, write, West Branch Amateur Radio Association, c/o Allan Owen, WA3OWT, 2901 Highland, Ave., Montoursville, PA 17754.

CQ Reviews Atlas [*from page 27*]

should give out eventually, a simple repair or replacement effort is all that is needed.

Instruction Manual

The instruction manual starts off well enough with some general circuit description, hints for mobile installation and then the basic schematics, but PC board layouts and complete parts numbering for replacement purposes are lacking.

Accessory Items

Desk mounted consoles which include a built-in a.c. power supply and two types of mobile mounts are available (one a completely plug-in affair and the other a support bracket with manual plug-in of external cables).

The MT-1 mobile whip matching transformer is also available. Other accessories still to be produced are an accessory v.f.o., a semi-break in keyer/monitor unit and possibly a c.w. filter.

Summary

The 210 or 215 is not a transceiver loaded with frills but its basic performance is very good to outstanding. It is definitely s.s.b oriented for the mobile amateur but there is no reason why it could not be adapted to become the heart of a home station also for both s.s.b. and c.w. For portable operation with a nic-cad battery pack it opens up possibilities for portable operation about which one can only speculate. The frills that are missing can be added if one is a bit handy with circuit work.

For instance, one could easily enough put in digital frequency readout via a preprogrammed counter since only one frequency conversion is involved. Plenty of room exists if the dial drum is removed. The disadvantage is that a TTL counter will draw much more current than the receiver alone and this may restrict the versatility of the transceiver for portable use. A c.w. monitor and VOX are easy to install or can be used as external accessories. The restricted coverage on some bands can be shifted to cover desired portions of a band by retuning the internal v.f.o. Full coverage of any band can be achieved by an external v.f.o. since only the range of the internal v.f.o. (350 kHz on most bands) restricts individual band coverage. The broad-band receiver/transmitter circuits fully cover each band.

The Atlas Models 210 and 215 are available from dealers throughout the USA, and are manufactured domestically by Atlas Radio Inc., 490 Via Del Norte, Oceanside, CA 92054. Either model costs $599. Power supply console for 117 volt operation is $129. —*W2EEY*

Phone Results

[from page 35]

I3PRK	"	739,968	1040	98	319	
I4GKM	"	648,333	1103	76	211	
IC8DAG	"	246,340	679	62	164	
I8MYN	"	210,632	615	57	169	
I3GRX	"	158,760	379	58	158	
I4CSP	"	63,623	208	42	107	
I2DMK	"	53,340	259	33	94	
I1WIJ	"	11,619	89	24	50	
I4BMJ	**28**	**48,792**	**234**	**23**	**84**	
I4PGD	"	27,090	194	20	66	
I3BYT	"	15,189	125	18	48	
I2ARC	"	7,155	85	13	32	
I1EFC	"	6,164	74	13	33	
I1MDQ	"	3,224	46	11	20	
I2TTL	**21**	**111,724**	**382**	**29**	**95**	
I4DVT	"	69,024	275	26	70	
I3FGX	"	62,100	300	21	71	
I3AWK	"	47,151	240	24	69	
I5BPD	**14**	**551,040**	**1436**	**36**	**156**	
I4GAD	**"**	**391,960**	**1271**	**36**	**128**	
I1VDF	"	223,299	1731	32	97	
I0SJX	"	89,824	448	26	86	
I3GNX	"	85,166	530	23	74	
I1COB	"	77,126	481	21	77	
I3BBZ	**7**	**48,300**	**460**	**18**	**66**	
I5ZCN	"	3,552	101	6	26	
I3MAU	**3.5**	**46,588**	**530**	**12**	**64**	
Luxemburg						
LX1MK	**A**	**13,122**	**125**	**22**	**59**	
LX1GG	"	9,880	124	16	49	
Netherlands						
PI1ARS	**A**	**144,072**	**425**	**46**	**138**	
PA0UV	"	2,478	47	13	29	
PA0ADC	21	4,410	66	12	30	
PA0VB	14	315	23	4	11	
PA0HIP	**1.8**	**5,200**	**249**	**4**	**16**	
Market Reef						
OJ0MA	**A**	**206,610**	**931**	**38**	**156**	
Norway						
LA6HL	**A**	**102,024**	**313**	**45**	**111**	
LA5JS	"	35,853	256	25	86	
LA4TG	"	33,235	268	18	67	
LA5QK	"	27,816	212	26	88	
LA1BR	"	12,699	103	20	63	
LA1HI	"	2,346				
LA1LO	"	323	13	8	11	
LA2DR	**21**	**23,826**	**311**	**14**	**43**	
LA3XI	**14**	**294,060**	**847**	**36**	**120**	
		(Opr. LA5KG)				
LA3UQ	"	30,186	222	21	57	
LA7FD	"	13,396	101	17	51	
LA2CQ	"	3,010	40	10	33	
LA4PQ	"	714	18	8	9	
LA9T	"	660	15	5	12	
LA5HE	7	2,184	38	9	30	
LA1RN	"	140	12	4	6	
Poland						
SQ5BB	**A**	**89,433**	**381**	**39**	**132**	
SQ3GEM	"	34,028	290	19	75	
SQ8AWP	"	33,060	227	25	89	
SQ1PBW	"	12,508	199	10	49	
Q1KIZ	"	11,016	203	11	43	
SP2GNB	"	9,180	142	13	47	
SP9DFH	"	7,015	92	15	46	
SP1KHI	"	5,891	138	7	36	
SP9CTW	"	4,400	70	13	47	
SQ6AYP/7	"	2,028	35	11	28	
SP9ZAS	"	1,144	42	8	18	
SQ3DOI	**28**	**12,308**	**90**	**19**	**49**	
SP6FSH	**21**	**24,794**	**165**	**20**	**57**	
SQ8ARK	"	2,997	42	13	24	
SP9EHW	"	264	22	3	9	
SQ4AS	**14**	**69,832**	**674**	**19**	**67**	
SQ4CLX	**"**	**56,583**	**401**	**22**	**72**	
SQ2BBD	"	36,828	252	24	69	
SQ6DNS	"	28,980	297	14	56	
SQ8AOV	"	19,596	169	18	51	
SQ5XM	"	15,750	135	21	54	
SQ1EOI	"	15,600	171	9	51	
SQ7ETG	"	11,312	135	14	42	
SQ7ASZ	"	9,016	99	15	41	
SQ6DMJ	"	7,200	128	10	35	
SP5ARP	"	7,040	66	16	39	
SP9AVZ	"	3,744	102	7	25	
SP9YP	"	1,525	51	7	18	
SQ9ABU	**7**	**8,448**	**167**	**8**	**36**	
SP9DH	"	2,523	83	5	24	
SP5CJL	**3.8**	**17,649**	**298**	**9**	**44**	
SP5KGT	"	16,146	326	6	40	
		(Opr. SP5ELA)				
SP8KGI	"	12,452	232	7	37	
SQ6TQ	"	10,277	248	6	37	
SQ6AFO	"	4,340	171	4	24	
SP6DYD	"	3,339	104	4	29	
SP1EIC	"	1,248	54	4	20	
SP9HRP	"	675	48	2	13	
Portugal						
CT7BY	**A**	**36,738**	**245**	**29**	**88**	
CT1DW	"	32,046	149	27	71	
CT1AV	**28**	**23,944**	**154**	**20**	**62**	
CT7SH	**14**	**140,705**	**652**	**22**	**85**	
CT1QN	7	968	40	5	17	
Roumania						
YO6KAF	**A**	**156,832**	**503**	**56**	**160**	
YO7VJ	"	43,240	299	23	92	
YO5AFJ	"	36,498	360	37	114	
YO3AC	"	12,376	92	27	182	
YO3JW/P	**28**	**10,880**	**79**	**16**	**52**	
YO2AFB	**21**	**20,224**	**149**	**18**	**46**	
YO8AHL	"	13,333	110	18	49	
YO5BQ	**14**	**31,339**	**289**	**17**	**60**	
YO7NA	14	17,136	161	20	48	
YO8RL	"	1,825	53	6	19	
YO2ASJ	"	275	25	4	9	
Scotland						
GM3BCL	**A**	**82,016**	**285**	**44**	**121**	
GM3SSB	"	16,642	130	27	79	
GM3BCV	21	10,440	150	11	29	
GM3YOR	"	2,528	27	12	20	
GM5AIW	**14**	**36,714**	**281**	**21**	**66**	
GM5AXY	"	7,920	117	10	38	
GM4ASY	**1.8**	**2,244**	**130**	**3**	**14**	
Sicily						
IT9RKA	**A**	**604,691**	**1,1197**	**67**	**210**	
IT9ZGY	**3.8**	**66,360**	**699**	**19**	**65**	
Spain						
EA2IA	**A**	**838,950**	**1,366**	**80**	**249**	
EA3OJ	"	40,500	251	20	80	
EA3NA	**21**	**78,280**	**463**	**23**	**80**	
EA2JD	"	33,280	267	17	47	
EA4LH	**7**	**164,952**	**678**	**25**	**91**	
Sweden						
SM5CEU	**A**	**540,640**	**982**	**74**	**236**	
SM3BIZ	"	203,232	534	54	178	
SM6FYZ	"	117,480	284	63	157	
SM5EEP	"	112,700	518	38	123	
SM7ID	"	65,523	373	32	107	
SM7CMV	"	60,192	290	42	110	
SM7DMN	"	51,544	253	40	96	
SM2DMU	"	24,477	105	37	86	
SM7KU	"	20,140	151	22	84	
SM7EVM	"	11,130	112	21	49	
SM7TV	"	10,560	114	20	44	
SM5BAX	"	9,842	95	23	51	
SM5RE	"	7,239	86	19	38	
SMØBDS	"	6,174	64	21	42	
SM6CDG	"	6,060	101	22	38	
SM7BGF	"	1,856	48	9	23	
SM5BHW	28	3,876	89	8	26	
SMØOS	"	966	29	7	14	
SM6EOC	**21**	**100,739**	**504**	**26**	**105**	
SM5EP	"	23,184	201	20	49	
SM7ABL	"	10,890	71	19	47	
SM5ACQ	"	8,957	110	13	40	
SM4DQE	"	4,410	67	12	30	
SK3AH	**14**	**388,385**	**1,166**	**36**	**119**	
		(Opr. SM3PZ)				
SM7ACB	"	89,667	344	32	91	
SM6BGG	"	75,152	341	28	60	
SL7DM	"	34,314	234	23	63	
		(Opr. SM7CUY)				
SM3DSP	"	32,184	284	22	50	
SMØTW	"	10,206	138	13	41	
SM4FUG	"	682	25	5	17	
SM6CKU	**7**	**110,922**	**518**	**32**	**101**	
SM5GZ	**3.8**	**35,926**	**453**	**13**	**58**	
Switzer'and						
HB9UD	**A**	**7,00**	**57**	**21**	**35**	
HB9DX	**21**	**10,191**	**60**	**20**	**59**	
Wales						
GW3SLA	**A**	**53,063**	**308**	**36**	**111**	
GW3GHC	**28**	**14,248**	**212**	**13**	**39**	
GW4CYD	28	595	35	5	12	
GW4DHS	**21**	**26,122**	**204**	**17**	**57**	
GW4BLE	**3.8**	**31,746**	**402**	**11**	**55**	
GW3XNS	**1.8**	**14**	**18**	**1**	**6**	
Yugoslavia						
YU2OB	**A**	**234,260**	**510**	**70**	**190**	
YU1UM	"	163,924	503	60	154	
YU3EJ	**28**	**36,360**	**187**	**23**	**78**	
YU2RKC	"	13,356	91	15	38	
YU2ROZ	**21**	**92,876**	**357**	**27**	**80**	
YU3TKT	14	1,365	47	7	21	
YU3DBC	**7**	**87,890**	**644**	**28**	**84**	
YU1EXY	**"**	**80,352**	**533**	**23**	**85**	
YU3NBO/X	"	11,400	302	7	31	
YU3TPM	"	10,070	149	9	44	
YU3TXT	**3.5**	**24,168**	**423**	**10**	**47**	
YU3TCQ	"	5,985	166	5	30	

USSR

Byelo Russia						
UC2OC	**A**	**81,162**	**356**	**40**	**127**	
UC2BF	"	41,230	200	35	98	
UC2BA	"	2,847	53	10	29	
UC2OAA	**21**	**8,775**	**70**	**20**	**45**	
UC2AAX	**3.6**	**6,600**	**195**	**5**	**28**	
Estonia						
UR2TAX	28	1,075	43	8	17	
UR2DE	21	1,876	47	9	19	
UR2FQ	**14**	**274,820**	**961**	**34**	**106**	
UR2QD	"	67,204	436	26	80	
UR2JI	"	12,996	182	15	42	
UR2DW	"	888	29	6	18	
UR2MG	**7**	**18,090**	**284**	**12**	**42**	
UR2MO	"	15,444	248	11	43	
UR2HB	"	684	38	3	15	
UR2PL	**3.6**	**9,282**	**213**	**7**	**35**	
UR2FU	**"**	**8,244**	**223**	**6**	**30**	
UR2TAU	"	7,080	160	6	34	
Latvia						
UQ2GCN	**3.6**	**21,070**	**401**	**8**	**41**	
UQ2NU	"	3,500	118	5	25	
Lithuania						
UP2OX	**A**	**214,334**	**622**	**60**	**178**	
UP2SA	"	148,213	662	35	134	
UP2BAR	"	140,430	640	41	145	
UP2PT	"	48,433	321	24	95	
UP2PD	"	1,276	32	8	21	
UP2BAS	**21**	**7,700**	**105**	**13**	**37**	
UP2ER	**3.6**	**21,700**	**396**	**8**	**42**	
UP2PBW	"	4,454	127	5	29	
UP2PCH	"	4,175	109	5	24	
UP2PBM	"	135	16	2	9	
Kaliningrad						
UA2EC	**A**	**115,364**	**480**	**47**	**144**	
Moldavia						
UO5AP	**A**	**41,440**	**260**	**27**	**85**	
RO5OBO	28	2,541	39	12	31	
Russia						
UA4NAA	**A**	**163,940**	**523**	**45**	**95**	
UV3DN	**A**	**147,740**	**630**	**43**	**135**	
UA3ERD	"	103,530	422	46	124	
UW1BM	"	81,100	441	38	107	
UA3ST	"	58,630	326	34	96	
UA3XP	"	54,210	284	34	104	
UW3DH	"	45,175	179	38	101	
UK3DBG	"	43,900	297	29	71	
UA3TN	"	40,172	221	30	91	
UV3CS	"	22,323	165	13	41	
UV3FD	"	20,710	128	28	67	
UA4DK	"	18,216	84	32	60	
UA3FT	"	17,360	155	21	59	
UW3WZ	"	6,936	101	12	39	
UA3AAU	"	2,730	65	10	32	
UA4RT	"	1,537	36	10	19	
UA3IE	"	323	19	4	13	
UA6JWW	**28**	**35,113**	**239**	**20**	**53**	
UA6HBU	"	7,399	69	17	32	
UA6LAP	"	5,400	48	18	27	
UA4CBO	"	3,740	37	16	28	
UA3QBG	"	3,382	39	13	25	
UA6HYL	"	1,530	19	11	15	
UA6XAL	"	1,449	21	10	13	
RA3YAA	"	350	12	6	8	
RA3AHD	"	330	11	7	8	
UW6CV	**21**	**27,170**	**340**	**14**	**41**	
UW3RR	"	19,136	225	14	50	
UA6BV	"	18,848	208	18	44	
UA6RB	"	135	5	3	3	
UA4AN	**14**	**101,520**	**478**	**29**	**91**	
UW3CX	"	30,789	204	25	74	
UA3GM	"	21,840	224	18	52	
UA6RD	"	11,868	258	8	35	
UW6LC	"	7,004	58	18	30	
UA3BJ	"	6,480	79	14	40	
UW3IN	"	1,284	17	11	15	
UA6LWI	"	1,280	36	6	26	
UA3QAQ	**3.6**	**8,342**	**194**	**8**	**35**	
UA1ACQ	"	1,430	61	4	18	
UW6FB	"	861	82	5	16	
UK3TAR	"	465	22	5	10	
UW6AJ	"	288	15	6	10	
Ukraine						
UB5PS	A	3,640	57	10	30	
UB5VAZ	**28**	**13,824**	**97**	**18**	**46**	
RB5IOV	"	7,581	77	18	39	
UB5GBY	"	6,480	71	17	31	
RB5VAC	"	4,485	54	15	24	
RB5ABX	"	990	23	8	14	
UB5XY	**14**	**18,486**	**248**	**12**	**45**	
UY5ZM	"	8,134	120	12	37	
UB5IDL	7	9,600	163	9	39	
UB5CAY	**3.6**	**6,615**	**162**	**7**	**28**	
UT5OF	**"**	**6,422**	**155**	**6**	**32**	
UB5YBC	"	735	47	2	13	

OCEANIA

Australia						
VK2ADA	**7**	**2,016**	**96**	**4**	**3**	
VK3ARY	**A**	**74,302**	**266**	**31**	**66**	
VK3SM	"	61,204	211	36	71	
VK4DO	**14**	**17,864**	**112**	**21**	**37**	
VK5MF	**A**	**118,932**	**414**	**42**	**64**	
VK6CT	**A**	**378,540**	**749**	**75**	**105**	
VK6RU	"	22,635	174	20	25	
Brunei						
VS5MC	**A**	**1,447, 776**	**1,884**	**95**	**196**	
Fiji						
3D2DD	**A**	**364,672**	**1,055**	**50**	**78**	
French Polynesia						
FO8DF	**A**	**190,198**	**597**	**49**	**73**	
FO8CX	"	63,717	338	32	35	
FO8EE	**14**	**56,776**	**415**	**19**	**28**	
Gilbert Is.						
VR1AA	**A**	**144,820**	**418**	**59**	**71**	
Guam						
KG6JAR	**14**	**176,448**	**700**	**30**	**66**	
Hawaii						
KH6RS	**A**	**3,337,005**	**3,732**	**109**	**196**	
			(Opr. W6DQX)			
KH6IGJ	**A**	**1,886,820**	**2,264**	**102**	**193**	
KH6IJ	**"**	**1,617,736**	**2,380**	**84**	**143**	
KH6IJA	"	19,825	112	28	37	
KH6HQG	28	3,030	38	12	18	
KH6IGC	**21**	**241,166**	**1,096**	**23**	**51**	
KH6ICR	"	200,817	1,289	20	33	
KH6GQW	**14**	**374,608**	**1,251**	**32**	**72**	
Indonesia						
YBØABB	**A**	**139,017**	**324**	**64**	**85**	
Mariana Is.						
KG6SX	**A**	**1,421,251**	**2,209**	**72**	**149**	
New Zealand						
ZL1BKX	**A**	**1,029,100**	**1,442**	**81**	**170**	
ZL1AMM	"	205,697	428	59	114	
ZL3GG	"	151,080	445	53	67	
ZL1TB	"	22,528	100	34	54	
ZL2AH	**21**	**22,728**	**324**	**11**	**13**	
ZL1AAS	**14**	**245,952**	**689**	**31**	**91**	
ZL2ACP	"	128,915	390	31	84	
ZL4BO	**7**	**55,056**	**270**	**24**	**50**	
Wake Island						
WB4KSE/KW6	**14**	**120,540**	**544**	**28**	**54**	

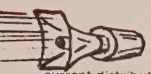
USA QRM *[from page 31]*

PVRC and couldn't stop . . . *K3GJD*. I believe that the results of this contest will demonstrate the injustice of permitting DXpedition contest station scores to count towards club award . . . *W3KT*. This was the first time I've ever used a beam on 7mHz phone—what a difference! . . .*WA6EPQ*. More operator courtesy this year than ever before . . . *W6EYY*. Use a quota system so endurance working JA's not such a factor . . . *K6QW*. My quad blew down the day *after* the contest . . . *K6QPH*. Neighborhood in uproar over stereo interference. *WB6NHF*. Only heard one European station . . . *W6HXW*. The biggest thrill was a rum and coke when it was over . . . *W6ANB*. Operator courtesy better than usual . . . *K6PO*.

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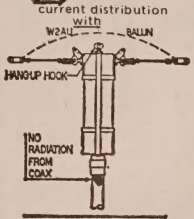
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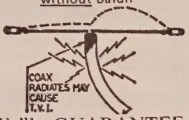
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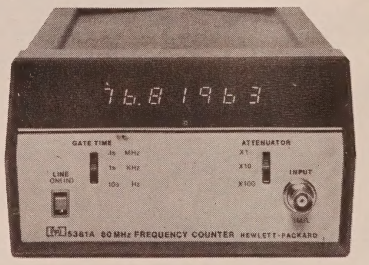
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SOUTH AMERICA

Argentina

LU8AJG	A	1,645,056	1,831	91	215
LU8FEU	28	488,488	1,584	25	79
LU2DEK	"	201,628	890	23	53
LU2DNC	"	3,888	54	9	15
LU4MBI	14	46,079	226	27	32
LU1ADI	7	360	14	7	8

Bolivia

CP3BY/1	14	12,642	118	19	24

Brazil

PY7AZQ	A	786,464	1,192	58	166
PY4KL	"	498,304	752	63	166
PY7ARM	"	298,500	669	38	112
PY1FI	"	186,543	439	53	94
PY6SB	"	142,780	410	40	81
PY6AM	"	85,085	251	44	75
PY2GNR	"	75,702	295	38	73
PY1JB	"	26,623	122	33	46
PY4AKL	"	21,560	73	39	59
PY1BQI	"	4,484	28	16	22
PY3CKL	"	2,640	59	8	8
PY1BDU	"	1,620	20	13	17
PY3BXW	28	361,936	1273	25	63
PY1CHP	21	52,668	798	19	47
PT1MBN	"	14,960	122	13	31
PY7ARM	14	298,500	669	38	112
PY1BAR	"	69,165	276	29	58
PY7BRU	"	1,416	21	8	16
PY3AFO	"	646	20	16	18
PY7AOR	"	561	11	8	9
PY1CPL	"	45	5	2	1
PY2ELZ	7	29,920	191	15	40
PY3APH	"	15,984	112	19	35
PY7YH	"	7,098	62	13	29
PY3CGP	"	4,080	44	13	27
PY3CEM	"	1,408	27	11	11
PY2FXH	3.8	4,403	52	15	22
PY2FUS	"	3,420	34	14	24
PY2FZK	"	357	11	8	9
PY2FPZ	"	225	9	6	9

Chile

CE5GO	A	77,062	273	47	59
CE6EZ	28	424,212	1501	25	81

Ecuador

HC2YL	A	2,316,953	2,515	93	224
HC1CW	"	84,110	239	53	77
HC1BI	14	56,724	235	26	61

French Guiana

FYØBHI					
	A	5,956,416	4,771	106	326

Opr. F5QQ)

Guyana

8R1G	A	1,160,866	1332	87	206

Netherlands Antilles

PJ2RR	A	1,017,975	1,282	75	202

Peru

OA4PQ	A	10,640	97	20	18
OA4AIW	14	314,375	866	31	94

Trinidad

9Y4VU	A	2,522,532	2,331	96	276

Uruguay

CX7BQ	28	63,900	362	20	40
CX7B	14	967,050	2,193	36	114
CX3BH	3.8	1,008	25	10	11

Venezuela

4M6AW					
	A	6,428,946	4,741	112	394
YV1AQE	28	399,504	1,605	23	61
YV5AK	"	1,008	28	6	6
YV4TI	14	579,020	1,518	28	102
YV1YC/5	"	184,896	651	20	76
YV5EED	"	56,610	263	20	54

Multi Operator

Single Transmitter

UNITED STATES

W2HPF		878,217	745	104	314
WA2BLV		665,575	631	99	296
W2HHB		275,096	377	77	197
W3WJD		2,440,167	1569	127	420
WA3EPT		393,225	464	85	236
K3BW		199,350	327	67	158
K3IVO		136,827	256	61	146
W4FDA		1,217,920	1022	105	335
WB4BGY		484,050	509	92	258
W4OZF		437,884	568	87	234
W4MII		422,862	571	82	216
WB4RUA/4		370,260	524	89	217
W4DJD		207,024	344	64	124
WB4HQE		85,536	207	52	110
WB4TEL		62,514	178	49	102
W4JVN/4		11,310	69	29	49
W5NOP		523,016	551	101	275
WA5RTG		352,070	437	90	233
W5QKR		343,584	469	85	203
WA5OCN		124,530	250	58	152
K5LZJ		10,293	52	27	46
W6ONV		1,277,586	1283	112	242
K6CQF		1,030,428	1106	107	241
W6YRA		883,353	1125	91	186
W6KG		390,166	669	85	118
WB6KBK		386,904	519	94	188
W6BZE		225,888	404	74	134
W6BIP		149,124	336	59	113
W6BVN		108,580	241	59	119
W7VRO		294,273	456	79	164
W7FR		215,798	416	64	123
W8CNL		227,484	333	75	192
W9LT		1,119,180	938	117	343
WB9NKH		319,507	438	81	202
KØKU		429,900	511	83	217
WØEEE		247,050	355	95	165
WBØFHH		110,320	233	60	137
KØPVI		89,424	203	62	122
KØLIR		32,431	117	38	75

Anguilla

VP2E		2,420,910	3079	86	247

Bahamas

VP7BC		3,711,390	4412	105	281

Canada

VE3HUM		738,261	926	94	239

Costa Rica

TI2BEV		968,220	2088	73	147

Dominican Republic

HI8XAW		800,037	2026	57	132

Grenada

VP2GMB		5,077,140	5070	102	342

Guantanamo

KG4DS		473,193	1505	47	100

Montserrat

VP2MSU		5,512,584	5339	112	350

Puerto Rico

KP4AXM		913,920	1963	68	142

Turks & Caicos

VP5WW		3,246,010	3913	98	272

AFRICA

Liberia

EL2JC		2,820,840	2874	100	230

ASIA

Japan

JA2ZAP		25,662	109	40	54

Israel

4Z4HF		2,148,072	2281	79	249
4Z4NV		118,828	342	36	86

Lebanon

OD5HC		4,606,547	3375	109	364

U.S.S.R.

Asiatic

UK9ABA		4,033,024	2810	129	383
UK9FER		431,800	769	45	155
UKØAAB		385,743	932	71	142
UK9HAF		163,387	783	38	81
UKØAAC		94,620	746	33	62

Georgia

UK6FAA		95,550	375	24	67

Kazakh

UK7PAL		291,233	678	52	127

EUROPE

Belgium

ON5GQ		476,084	739	79	264
ON5JE		288,120	809	50	146

Bulgaria

LZ2KAD		123,140	467	43	145
LZ2KLC		66,120	271	39	113

Czechoslovakia

OK2KOS		1,002,996	1309	103	341
OK3KAG		270,336	702	64	200
OK3KMY		214,880	494	69	203
OK1KCI		154,428	525	49	155
OK3KGI		125,120	500	40	144
OK3KAP		21,409	174	27	52

England

G3WYX		2,288,551	2261	114	377
G3UBR		1,215,500	1576	91	284
G3RCV		871,168	1349	69	259
G3KMI		299,761	844	55	174
G3EEO		44,608	436	28	54

Finland

OH4TM		125,100	414	53	140

France

F6KCK		451,820	1144	55	150

Germany (DDR)

DM25K		1,009,360	1903	85	256
DM25F		115,650	598	24	126
DM250		29,340	314	17	73
DM25H		28,866	228	19	83
DM25E		27,132	323	19	65
DM25DDR		22,272	248	19	68

Germany (FRG)

DLØWU		2,207,161	2048	114	379
DK2BI		1,925,131	1851	114	413
DLØJK		976,282	1705	86	248
DL8DC		658,345	803	85	288
DLØKL		655,200	969	76	239
DLØDX		605,052	1055	70	224
DJ5FW		483,616	843	73	199
DLØIB		447,430	1070	76	126
DLØRCA		336,840	759	65	215
DJ9YI		306,636	563	61	215

Hungary

HG5A		1,045,662	1720	91	275
HA9KOB		509,652	1256	75	222
HA5KKB		275,264	672	63	209
HAØKLE		253,043	673	69	190
HA5KKC/2		226,149	743	57	174
HA5KHH		178,992	716	45	153
HA5KAS		137,837	497	45	158
HA7KLF		119,680	556	42	134
HA7KLC		116,760	365	56	154
HA3KNA		101,360	393	47	134
HA5KAI		95,030	442	42	128
HA7KLG		92,736	405	38	123
HA9KPU		61,290	397	37	100
HA5KFN		50,250	289	30	95

Ireland

E10GRC		160,366	541	47	134

Italy

I1MOL		1,452,864	1913	90	278
I1DSG		1,052,946	1650	69	237
I4BNR		523,035	921	70	225
I2AT		495,216	951	75	229
I3AWW		275,094	559	66	195

I.T.U. Geneva

4U1ITU		679,245	1361	70	275

Luxembourg

LXØRL		511,462	1439	59	179

Netherlands

PAØHBO		771,387	1282	83	306
PI1PT		29,088	224	21	80

Northern Ireland

GI3FFF		236,995	1082	36	119

Norway

LA1K		206,736	816	44	133
LA1H		107,632	509	31	81

Poland

SP5PWK		670,080	936	94	255
SP6PZB		538,749	1163	66	213
SQ9KRT		183,340	764	48	170
SP3KGJ		172,806	809	33	133
SP9KDD		53,086	355	27	100
SP9PDF		41,496	363	16	88
SP9PDJ		32,264	244	28	81
SQ9ZAF		19,656	251	14	64
SP9PWT		15,925	231	14	51

Portugal

CT7EQ		2,100,384	2096	98	318

Romania

YO3KAA		388,388	800	85	223
YO3KBC		179,683	714	58	135

Scotland

GM3ZRC		63,618	461	29	109
GM3PXK		17,860	178	18	72

Sweden

SK2DR		859,563	1526	79	227
SM5AOE		617,900	1018	89	281
SMØMC		296,208	642	65	177
SK1AQ		44,811	225	36	81
SM7BDA		44,251	239	35	102

Wales

GW3UCB		3,534	190	4	15

Yugoslavia

YU1BCD		2,398,348	2057	116	408
YU2CDS		2,321,313	2542	109	324
YU3DJK		1,805,200	1902	105	363
YU1INO		145,912	691	48	136
YU4EDV		27,472	202	26	75
YU2CBM		22,680	345	15	45

U.S.S.R.

Byelo Russia

UK2WAF		249,100	884	53	159
UK2LAH		52,900	383	22	93

Estonia

UK2RAA		429,084	1017	62	199

Latvia

UK2GDZ		171,647	579	55	162

Lithuania

UK2PAF		416,702	965	65	221
UK2BAS		192,723	614	53	174
UK2PAT		9,405	117	14	43

European SSR

UK6APA		2,921,625	2699	114	363
UK6LAZ		1,181,606	1407	99	295
UK3SAB		828,709	1348	82	236
UK3WAC		172,718	678	43	139
UK4HBB		156,262	620	40	118
UK4NAA		125,860	402	46	109
UK3MAA		96,612	582	45	121
UK3MAX		93,526	593	25	76
UK4LAC		56,970	366	22	68
UK3AAY		19,135	151	24	65
UK3GAA		9,882	125	12	42
UK3TAA		5,831	69	17	32
UK3YAA		5,412	104	11	32
UA3DAO		5,400	64	19	41
UK3QAV		2,046	62	8	25
UK6PAA		508	20	5	14

Ukraine

UK5JBO		661,476	1082	72	205
UK5EAQ		268,044	735	47	187
UK5VAA		182,452	578	53	153
UK5ICD		142,486	486	49	142
UK5EAB		17,600	169	20	60
UK5ICS		4,658	115	5	29
UK5EDQ		2,784	65	8	24
UK5QAA		2,250	53	9	21
UK5QBE		612	20	6	12

SOUTH AMERICA

Brazil

PY2CAB		6,959,562	4495	130	397
PY1EMM		2,269,841	2549	81	220

Netherlands Antilles

PJ3A		262,209	579	48	113

Uruguay

CV4C		4,959,474	3917	123	315

Multi-Op., Multi-Xmtr

NORTH AMERICA

TI1K		6,833,020	5673	120	415
W2PV		3,859,185	2397	140	487
W3GPE		3,091,770	1880	130	464
W4BVV		2,889,254	1945	127	420
WA8ZDF		2,889,048	1851	135	449
WB5DTX		2,559,972	1757	140	417
W1ZM		2,491,061	1783	122	407
W7RM		2,345,576	1994	126	323
W3FRY		1,985,404	1282	128	420
W3GM		1,568,619	1072	121	412
W6DGH*		1,365,210	1278	119	266
K4CG		1,212,200	1003	110	330
WA3ATX		734,135	695	103	312
W2LSX/2		638,290	727	76	248
W4USN		558,360	602	94	266
VE3EDC		477,500	917	73	177
W8GIO		398,454	508	96	222
K3UZY		396,116	459	83	218
W8NGO		380,975	462	85	226
WA3ATP		378,235	496	74	225
W3BYX		371,478	466	81	222
W3TV		347,807	489	75	194
W3DHM		315,180	377	90	219
WO6PDC		199,104	707	43	93

ASIA

4Z4EU		3,968,844	3312	96	332
VU2CBE		3,205,488	3090	128	339
UK9AAN		2,810,832	2200	127	369
JA3YKC		522,795	708	100	173
JA2YEF		513,697	729	93	166
JA7YRR		426,760	746	87	148
JA6YTU		410,958	562	91	146
JA6YAP		61,992	217	43	65

EUROPE

DLØPG		4,280,214	3412	130	512
OH1AA		1,812,723	2202	112	377
HB9H		1,616,220	2403	93	345
OH2AW		1,159,158	1635	99	330
GB3MCG		1,136,832	1668	82	300
DLØII		252,945	881	51	180
SQ6PAZ		79,524	458	32	109

OCEANIA

KS6EZ		2,764,910	3467	97	186
5W1AV		2,254,520	3016	104	176
ZL1AA/C		639,210	1273	75	120

SOUTH AMERICA

PJ9JR		19,469,094	10,043	142	519
LU2AFH		939,681	1371	83	160

*Commitee Member. Ineligible for Award.

Our deep thanks to the following stations who sent in check logs, and to those whose logs we solicited for checking purposes:

CT1MZ, DM2ARA, DM2CBB, DM-2CJF, DM2CLG, DM2DEO, DM2-DGO, DM2FEN, DM2FLN, DM2-YLJ, DM3VUH, DM25I, DM-EA-7651/F, G4BRO, G6NK, I1WKW, LA2IE, LA5XQ, LA6U, LA8KQ, LZ1KDP, OH1IG, OH2BMV, OH-30F, OH8OR, OK1ATO, OK1TA, OK2BCJ, OK2BKI, OK2SKU, OK-IAJJ, OK1FAF, OZ6QE, OZ7JZ, PAØGBY, PAØKSB, PAØTV, SM5-FNB, SM5GA, SM6ZU, SM7BBV, SM7DMT, SP5PTR, SP6AHQ, SP-6DB, SQ1AGE, SQ5AMX, SQ5CKM, SQ7CDM, YO3JU, YO6VZ, YO8-KAN, YO6-5836, YU1DGH, YU1-GMN, YU3WS/X, VP2SG, DL8PG, PY1KZ, OZ6DA, LA6PA, ZL2BFR, ON6DU, OH2BH, LU1FM, WIQBC, WA4FEC, W2RSO, K6RT, K4KUC, W8KIT, W5EHY, WA9KGO, WØMGI, W2BMK, W3RF, W4BAI, K8RWL, K6LOP, W9MVG, W9BPG, WØSGV, KIGQV, W2GUK, OK1-IAJJ, OK1FAF, OZ6QE, OZ7JZ, 15835, DM-EA-7651/F, WØUYL.

STATION OPERATORS

Multi-Operator, Single-Transmitter

CT7EQ & CT1LN, **CV4C:** CX4CR, CX8BBH, CX1BBL, CX-1AAC, CX9BT, CX2CL. **DJ5FW** & DJ4GO, DK4OV, DL3LU, DL8RL. **DJ9YI** & DL9DY. **DK2BI** & DK5WL, DK5WM. **DL8DC** & DL8AN, DL8CH, DL8CM, DL8FR, DL8HA. **DLØDX:** No list. **DLØIB:** DF1SR, DF2SR, DJ3SR, DJØRQ, DJØYI, DK2FY, W2FAO. **DLØJK:** DJ3AS, DK1DU, DK3ZE, DK3ZF, DK7FL, DK8ZL, DK9FO, DF1FR, DF2FK. **DLØKL:** DJ4PX, DJ9OV, DK6NN, DK7NM, DL8NE. **DLØRCA:** DC2-KB, DJ1GX, DL2QB, OH8TP. **DLØWU:** DJ4AX, DJ8SW, DK-4TP. **DM25DDR:** DM2CJJ, DM2DQD, DM2EQH. **DM25E:** DM2COE, DM4PEE, DM4UEE. **DM25F:** DM2ABF, DM2-AMF, DM3NKF, DM3YBF. **DM25H:** DM2DTH, DM6TAH. **DM25K:** DM2AYK, DM2CEK, DM2DUK. **DM250:** Club. **EIØGRC:** EI4CF & Club. **EL2JC** & EL2FT. **F6KCK:** F6BUG, F6BKT, F5XM, F5YW. **G3EEO:** G3VKH, G3YTX, G3ZOW, G4AKE, G4ASB, G4CMZ, G8GBU, G8IYZ, G8JDK. **G3KMI:** G3WIF, G3YOZ, G3ZBU, G3ZYW, G4AMH, G4AMI, G4APA, G4BJI, G4CBQ, G4CEN, G4CIG. **G3RCV:** G3VLT, G3VLX, G3XMD, G3ZAY, G4DCV, G4DFI, G8GGP. **G3UBR:** G3ZZI, G4BCH, G4BTY, G4CVN, G4CQO, GW3ZQN. **G3WYX:** G3-HTA, G3RUV, G3RUX, G3TJW. **G8JC:** G3RMF, G3TQD, G3TQZ, G4BXS, G4CXM, G3VDX, G3WFZ, G8ASO, G8IXS. **GI3FFF:** GI3BWM, GI3YDO, GI3ZSC. **GM3ZRC** & GM3LRG, GM3LYI, GM3HZN, GM3XNJ, GM4DGE. **GM3PXK:** GM3-XVR, GM3KMG. **GW3UCB:** G3XZK, G3ZLL, G4AJW, G4BRK, G4BRT, G4BZD, G8DMJ, G8EPA, G8GSS. **HA3KNA:** HA3-NA, HA3NU. **HA5KAI:** Club. **HA5KAS:** HA5CE, H5-304. **HA5KFN:** Club. **HA5KHH:** Club. **HA5KKB:** HA5LX & Club. **HA5KKC/2:** Club. **HA7KLC:** Club. **HA7KLF:** H-7013, H-7014, H-7045. **HA7KLG:** HA7MC, H-7031, H-7033. **HA9-KOB:** HA9RB, HA9RU, Peter. **HA9KPU** Club. **HAØKLE:** HAØLM, HAØLZ, HAØMJ, HAØ-543. **HG5A:** HA5DB, HA5FM, HA5HO, HA5MK, HA6NN. **HI8XAW** & HI8XFD. **I1DSG** & I1ANF, I1GJC, I1PCT, I1VVZ, I1UW. **I1MOL** & I1MOL. **I2AT** & I2BJS, I2DBS, I2LPA, I2TIG, I2TUJ. **I3AWW** & I3XFV. **I4BNR** & I4IJY. **KG4DS** & KG4LH. **KP4AXM:** K1OTI, W8KYR, WB4ZWK, 3 SWLs. **LA1K:** LA4CQ, LA5KO, LA7DS, LA9UO.**LAIH:** LA6GES, LA4KQ, LA4PQ, LA4NL. **LZ2KAD:** Club. **LZ2KLC:** Club. **ØD5HC** & OH2MM, OH2SB. **OH4TM** & OH4OO. **OK1KCI:** OK1DK, OK1AMI, OK1AVD, OK1EJ, OK1ZL. **OK2KOS:** OK2HZ, OK2RZ, OK2SFS, OK2SIR. **OK3KAG:** OK3CIR, OK3YBD, OK3ZFM. **OK3KAP:** OK3CGI, OK3TFN. **OK3KGI:** OK3CFA, OK3TAV, OK3-7555. **OK3-KMY:** OK3CM, OK3LU. **ON5GQ** & ON5TR. **ON5JE** & ON-5CY, ON5UQ. **PAØHBO** & PA-1555. **PI1PT:** Club. **PJ3A:** PJ3IDP, PJ3AT, PJ3AJG, PJ3MV, PJ3DO, PJ3AD. **PY1-EMM:** PY1TC, PY1ZBJ, SM7FJY, F3TA, PY2GRO. **PY2CAB** & PY2s, DYI, ELV, EGM, BU. **SK1AQ:** SM1CJV & SM1CXE. **SK2DR:** SM2CEW, SM2CLY, SM2EKM. **SM5AOE** & SM5-CZZ, SM6AGR, SM6BJI. **SM7DBA** & SM7ERU. **SMØMC:** No List. **SP3KGJ:** Club. **SP5PWK:** SP5DZI, SP5DZJ. **SP6-PWT:** Club. **SP9KDD:** Club. **SP9PDF:** Club. **SQ6PZB:** SP6-FAF, SP6FIH. **SQ9ZAF:** SP9EWO, SP9EYX. **SQ9KRT:** SP9-ZW, SP9FKQ, SP9HMF. **SP9PDJ:** SP9BLF, SP9FR, SP9KZ. **TI2BEV:** K4IA, K4VW.**UA3DAO** & UA3DBC, UW3IO. **UK2-BAS:** UP2PAJ, UK2PAO. **UK2GDZ:** Club. **UK2LAH:** Club. **UK2PAF:** UP2PAQ, UP2PAX, UP2-038-225, UP2-038-362, UP2-038-609. **UP2PAT:** Club. **UK2RAA:** UR2RCN, UR2REZ, UR2RJ, UR2RL. **UK2WAF:** UC2XT, UC2XW, UC2-006-12, UC2-006-60. **UK3AAY:** Club. **UK3GAA:** Club. **UK3MAA:** Club. **UK3MAX:** Club. **UK3QAV:** UA3QBJ, UA3-121-1216, UA3-121-715. **UK3SAB:** UA3SAL, UA3SAQ, UA3SAX. **UK3-TAA:** Club. **UK3WAC:** Club. **UK3YAA:** Club. **UK4HBB:** UA4-HBW, UA4HCV, UA4HCW. **UK4LAC:** Club. **UK4NAA:** Club. **UK5EAB:** Club. **UK5EAQ:** Club. **UK5EDQ:** UB5-060-900, UB5-060-901, UB5-060-913. **UK5ICD:** UB5-073-433, UB 5-073-820, UB5-073-1416. **UK5ICS:** UB5-073-577. **UB** 5-073-1562, UB5-073-1559. **UK5JBO:** UB5JCC, UB5TM, UT5LH. **UK5QAA:** **UY5CZ**, UB5-064-608. UB5-064-775. **UK5QBE:** Club. **UK5VAA:** UB5VAC, UB5-066-32. **UK6APA:** UA3XM, UA6APW, UA6-101089. **UK6LAZ:** Club. **UK6PAA:** UA6PAW, UA6-096227, UA6-096228. **UK6FAA:** A. Merkulov, A. Tejmurazov, A. Shargorodsky **UK7PAL:** A. Levrenkov, Y. Loparev, G. Filatov **UK9ABA:** UA9ACN, UA9BB, UA9BE, UW9AF, UW9BC, UA9ABA **UK9FER:** UA914005, UA9FAJ, UV9FN, UA9FAL, UA9140280, UA9FBA **UK9HAF:** V. Komzyuk, J. Dedyurin, A. Netaev **UKØAAB:** UAØABY, UAØ103418, UAØ103344, UAØ103106, UAØ10340 **UKØAAC:** UAØACG, UAØACN, UAØAAK **VE3EDC** & VE3EDG. **VE3-HUM:** VE3KZ, VE1AL/3, VE3BVD, VE3CHZ. **VP2E:** W4-GSM, W3HNK. **VP2GMB:** W5MYA, W5TMN. **VP2MSU:** WB4JEZ, WA5JMK, WB5IZN. **VP5WW:** WB4EYX, W4ORT, W4SME, WA4SGF, WA4DRU. **VP7BC** & W4EPO, K4SHB, WB4TAF, WB4PQB, WA4SVO, WB4GWL. **W2HHB** & W2-RHE. **W2HPF** & WA2BCK, WA2MBP, WB2LCC, WB2FNS, WA3RGW. **WA2BLV** & W2HEU, W2HMH. **W3WJD** & WA3-LRO. **K3BW** & K3JLK. **K3IVO** & Larry, Furg, Bill. **WA3-EPT** & WB2MZE, WB2UZU. **W4DJD** & WA4GWN. **W4FDA:** WA4UFW, WB4IAE, WB4UYD. **W4JVN/4** & WB4UUE. **W4MII** & WB2QHB, K5WTA, WN6HFQ. **W4OZF** & K4DGZ. **WB4BGY** & K6ETM. **WB4HQE** & EI4AG. **WB4RUA/4** & W4UHP, WA4AKU, WA4FOU, WB4ABY, WB4BCL, WB4-CTL, WB4TVU, WB4UFW, WB4VAF, WB4ZBS, WB4ZHJ. **WB4TEL** & WB4WIW. **W5NOP** & W5UDK, W5WQI, K5FVA. **W5QKR** & W5LQN, WA5YMW, WB5GZR, WB5IDF. **K5LZJ** & K5PFE. **WA5OCN** & WA5ZWC. **WA5RTG** & W5DRW, WA5SDT, R. Rogers. **W6BIP** & WA6DJI. **W6BVN** & WB6-ZGL. **W6BZE** & W6AXX. **W6KG** & W6DOD. **W6ONV** & WA-9UCE. **W6YRA:** K3ZLA, WA6ABP, WA6DPQ. WA6MSP, WB6GJO, WB6JAN, WB6NKO, WB6PXP, WB6ZPU, WA7-DAC. **K6CQF** & VE3DXV. **WB6KBK** & WA6PGB. **W7FR:** W7PHO, WA7TLK, WA7UQG. **W7VRO** & W7DQM, W7EKM, WA7ZWG. **W8CNL** & K8YYE, WA8MOA, WA8MKU, WB8-LUI, WB8RAZ. **W9LT** & K9TZH, K9UWA, WB9LHI. **WB9-NKH** & WA9PBK. **WØEEE:** WB4OEM, WB9FSL, WBØGOP, WBØIXI. **KØKU** & **WBØEYS**, WBØFGU, WBØJFJ, WBØLQC. **KØLIR** & WBØIKR. **KØPVI** & WBØLEX. **WBØFHH** & KØFLY, KØHWE, KØLFF, WBØBPH, WBØIUO, WBØJKI, WBØJGS, WØPFR. **YO3KAA:** YO9APJ, YO3FU, YO3AC. **YO3KBC:** YO3YZ, YO3QK, YO3JE. **YU1BCD:** YU1NZV. YU1PCF, YU1ODO, YU1OBC, YU3EY. YU1-RS458. **YU3DJK:** YU3BO, YU3CM, YU3EP, YU3EZ, YU3TFB, YU3ZV. **YU4EDV:** Club. **YU2CDS.** YU2RNE, YU2RNC, YU2RMN, KOS. **YU1INO:** Club. **YU2CBM:** YU2RTW, GURAN. **4U1ITU:** HB9AXK, HB9AXY, HB9A7D. **4Z4HF** & 4X4IL, 4Z4IX. **4Z4NV** & 4Z4NPC, WN3WFR.

Multi-Operator, Multi-Transmitter

DLØII: DJ2YE, DJ4TJ, DK8EY, DL6RY. **DLØPG:** DJ1FC, DJ1FG, DJ9IE, DJ9TQ, DK1FW, DK1HV, DK2DX, DK2QL, DK5KY, DL8OH. **HB9H:** HB9AEB, HB9AGC, HB9AIB, HB9AJM, HB9ALM, HB9ALO, HB9ALX, HB9BAH, HB9-BAL, HB9LG, HB9ZE. **JA2YEF:** JA2SAP, JA2SWH, JA2TCA, JA2VHO, JH2BFT, JH2IRH, JH2NTZ, JAØTJT. **JA3YKC:** JA2VUP, JA3ODC, JA3REU, JA3RZN, JA3TRO, JH3FZB, JH3GLP, JH3HBF, JH3LIJ, JH3NYM, JR3WLK, JH3BNH, JH3PLE, JR3PKG, JR3WBE. **JA7YRR:** JA7CEC, JA7CFB, JA7CLN, JA7CLX, JA7CXV. **JA6YTU:** JA6AD, JA6AAB, JA6BSM, JA6CTN, JA6ERR, JA6JVJ, JA6MDD, JA6MVU, JA6PFZ, JA6QET, JA6QW, JA6RLM, JA6RCB, JA6STS, JA4RIT/6. **KS6EZ** & KS6DH, KS6FD, WA6TJV. LU2AFH & LU8AGF, LU5ACA, LU3BAT. **OH1AA:** OH1LX, OH1NH, OH1NK, OH1SS, OH1SW, OH1SY, OH1VJ, OH3NB. **OH2-AW:** OH2BAD, OH2BBM, OH2BGA, OH2BIA, OH2BPN, OH2BR, OH2BS, OH2EO, OH2KA, OH5XL. **PJ9JR:** K3EST, W3ZKH, WA3IAQ, W3AZD, W4WSF, W3IN, W6UM. **SQ6-PAZ:** SP6DVP, SP6FJG, SP6HEK. **TI1K:** TI2CAP, TI2CF, TI2J, TI2SW, TI2WD, K6JGS. **UK9AAN:** UR2AR, UR2CW, UA9AN, UA9AEN, UW9BY, UV9AB, **UA9AAZ**, UA9CBO. **VU2CBE:** VU2BG, VU2DX, VU2FET, VU2GDG, VU2HY, VU2KBN, VU2KMK, VU2LE, VVU2MKZ, VU2RKN, VU2-RVB, VU2SF, VU2TKR, VVU2WY, 4S7AB, 4S7PB.

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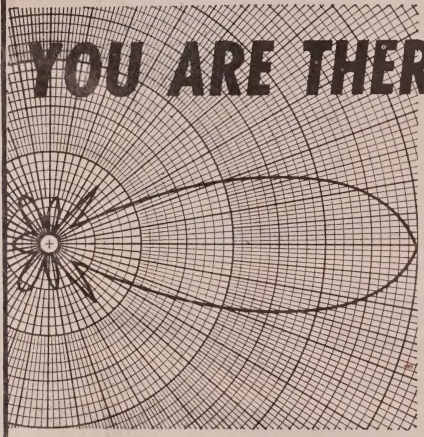
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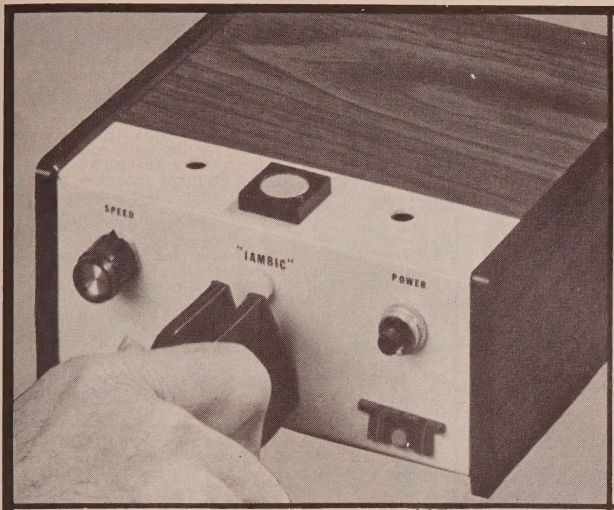
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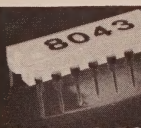
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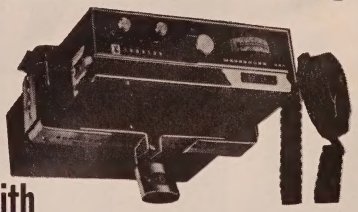
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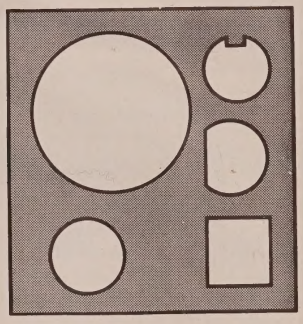


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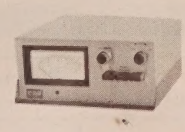
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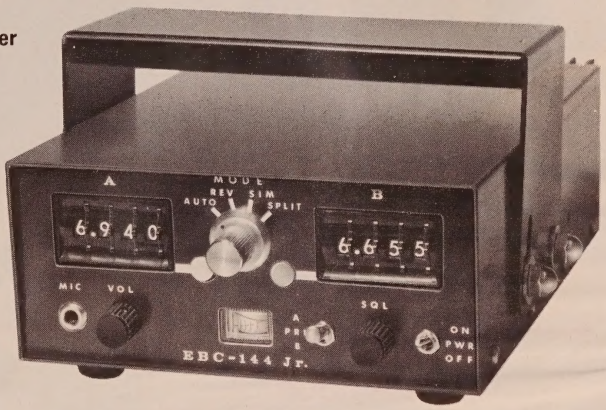
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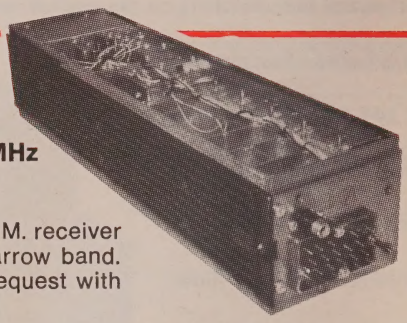
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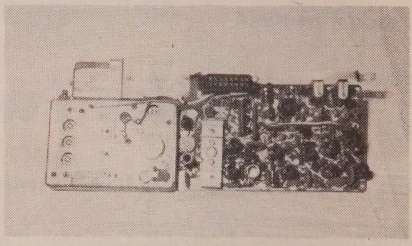
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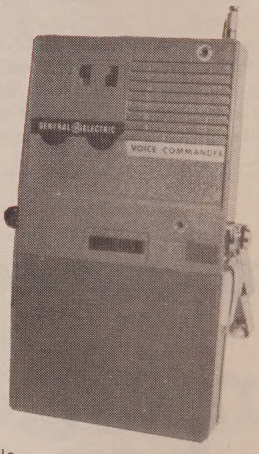


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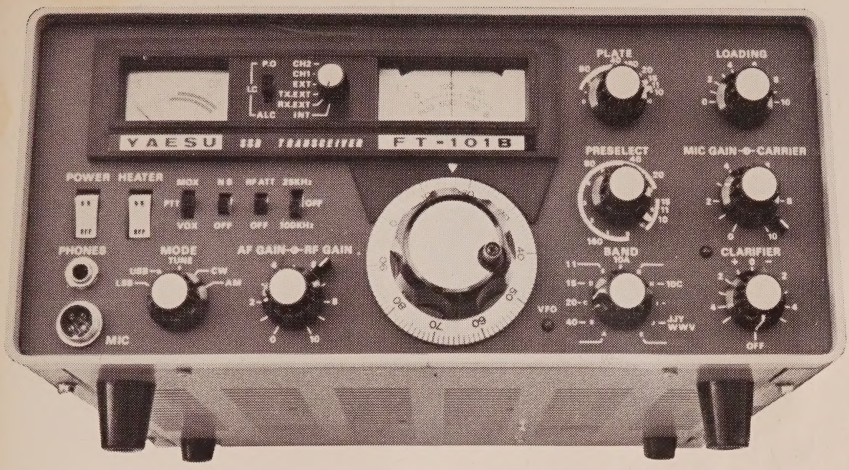
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