FM

50¢

VOL. 3-3

MARCH 1969

iFM

PUBLISHER
Michael J. Van Den Branden

EDITOR
Ken W. Sessions, Jr.

EDITORIAL STAFF
Technical Editor:
Donald L. Milbury
Valinda, California

Associate Editors:
CANADA
Paul Hudson
Ontario

EASTERN U.S.
Gordon Pugh
Manhasset, New York

CENTRAL U.S.
Don Chase
Wichita, Kansas

NORTHERN U.S.
Mike Van Den Branden
Grosse Pointe, Michigan

WESTERN U.S.
Art Brothers
Reno, Nevada

CARTOONS:
Bill Ridenour
Coraopolis, Pennsylvania

CIRCULATION MANAGER:
Glenn Pohl
Detroit, Michigan

ADMINISTRATIVE OFFICE:
2005 Hollywood Street
Grosse Pointe, Michigan 48236

ADVERTISING OFFICE:
4861 Ramona Place
Ontario, California 91762
(714) 599-2010

EDITORIAL OFFICE:
One Radio Ranch
San Dimas (8), California 91773
(714) 599-2010

MARCH 1969

Volume 3 Number 3

REGULAR FEATURES

Subscription Price — $5.00 per year
$9.00. two years

It's our anniversary ...and we've got plans

by KEN SESSIONS

Mike Van Den Branden and I announce — with what we consider to be justifiable aplomb — a whole string of new happenings with FM. There have been so many new developments that it is difficult to know just where to start in the telling.

BROTHERS NAMED TO STAFF POST

It is our pleasure to welcome Art Brothers to the FM editorial staff. To many of you, Art needs no introduction. A top-name writer of long standing, he has served as Wayne Green's right-hand man. He was associate editor of CQ Magazine. He was editor of the late Western Radio Amateur, a once-popular journal covering the eleven western states. Today Art (still W7NVY) has his own business and is kept extremely active supplying radiotelephones to an ever-increasing number of customers in Nevada. But he assures us he'll take time out to share with us from time to time his wealth of knowledge in the amateur and two-way communications field. FM readers can look forward to news from Art about new products in communications, new developments in the VHF marine radio field, and articles about unusual and valuable circuits. And look for changes, too, for Art is an idea man. He'll be serving as FM's Regional Editor for the western United States, and will actively participate in FM staff functions.

Art Brothers

TYPE CHANGE

The more observant of you will notice a "hybrid" appearance to this issue because of our use of two type styles in the text. Up until this issue, all copy was prepared on an IBM "Executive" electric typewriter. Preparation of magazine copy by this method is referred to in the publication trade as "cold typography." "Hot typography," setting the text with molten lead from a Linotype composer, provides much more attractive copy but the process is a great deal more expensive — nearly four times the cost of most forms of cold typography.

The major amateur journals are prepared by the hot process, although cold is still not uncommon in the industry. Communications Magazine, for example, uses cold typography, though the quality of composing machine used is considerably higher than that of a conventional IBM electric typewriter. Nonetheless, it is hot typography that really separates the pros from the dilettantes. And it is with button-busting pride that FM makes its debut into this area. We know you'll notice the difference with respect to ease of reading and beauty of appearance. The combination of both hot and cold styles in this issue will give you the chance to make your own critical comparisons.

ANNIVERSARY

This issue marks the second anniversary of FM. It began as little more than a letter in February 1967. Mike Van Den Branden saw the increasing ham interest in VHF FM, and felt that someone should do something to publicize the many valuable ideas being developed in isolated FM groups. He began by typing a few noteworthy bits of information onto a spirit master and running off a couple dozen copies, which he promptly mailed to local FM'ers. This first issue, now a rare and valuable collector's item, had no name, no masthead — not even a formal editor. It was simply a bulletin prepared in the interest of amateur radio FM enthusiasts. Recipients of this first issue (which was an edition consisting of nothing more than five sheets stapled together at the top) were invited to participate by donating a dollar for cost of mailing and by submitting material of general interest to other local FM operators. A few conscientious FM'ers in the Detroit area thought the bulletin idea was a good one and offered their help periodically to contribute in planning and preparation. Marvin Hoekstra (WA8ARA) and Harold Kulikamp (WA8VIN) were among the first to offer their time and assistance, and they shared the editorial laurels with Mike for the first few issues.


Michael Van Den Branden

So the March issue looked better than the first. It had an unofficial name — FM Bulletin. And on the bottom of the first typewritten sheet, a statement read "Volume 1, number 2." But there was still no masthead and the bulletin had a thrown-together appearance. It was dittoed like the February issue, but there was one significant and important difference: the material was more extensive in scope. And a few more people sent in "donations."

By April, there were 11 "official FM Bulletin Stations" in 8 states. Mike had a product that was needed and he knew it. With each out-of-state subscriber (which he contacted by letter or phone call), he would dub that subscriber a "... Bulletin Station." And the subscribing station was mailed extra copies and urged to spread the word to other FM'ers. In April, the number of typewritten pages was increased to seven.

A masthead was painstakingly prepared in several "spirit-compatible" colors. The Ditto process was still used, of course, but the reproduction quality and content was considerably improved over previous editions. And interest by this time was sufficient to convince Mike of a potential nationwide interest. He pushed for increased circulation by mailing sample copies to every out-of-state FM enthusiast whose address he could get.

By the time the May issue was mailed, Mike had a list of interested hams in 13 states — for a paltry grand total of 50 subscribers. But reports from his "Bulletin Stations" were very promising. So, to the consternation of some of his closer associates, he gambled. The June issue would NOT be dittoed. He would type the copy on his own manual typewriter and have it printed by the photolithographic (offset) process!

June really looked good — like a real magazine! There were three 11 x 17-inch sheets folded to make an 8½ x 11-inch book. And the effort put into the cover photo and bulletin title made a world of difference in appearance. Mike reportedly spent a great many hours just staring at that masterpiece.

The circulation doubled. July and August came and went, each with an improved body of material. And amateurs in the dozen or so states religiously propagated news of the FM Bulletin.

I joined FM Bulletin in September as a result of Mike's tireless quest for territory. QST published a letter I had written which in essence scolded them for their lack of definitive information on FM. Mike, after reading the letter, sent me a copy of his August Bulletin, on which was scrawled a simple message consisting of little more

PAGE 7 IS MISSING FROM SOURCE

PAGE 8 IS MISSING FROM SOURCE

than "help." In response to his request — and to further the cause of FM in general — I prepared an article to FM Bulletin format, but on an IBM electric typewriter. The type looked good in print.

There followed a number of correspondence exchanges and phone communications between Mike and me, and I volunteered to act as editor. After a few months, each with an upsurge in circulation, Mike and I made an agreement to become a team. That was on FM Bulletin's first anniversary. The readers then numbered 403.


Ken Sessions, Jr.

It is now one year later, and the readers number in excess of ten thousand. Obviously, the growth this past year has been just short of exponential.

So it is that FM is celebrating. This explains the dramatic improvements in presentation, the scope of extended coverage.

As part of our celebration, FM proudly introduces a new editorial philosophy with respect to author remuneration. In the past, authors have received publicity, our thanks, and preferential treatment with respect to mailing. But now we offer something a little more substantial: cash!

AUTHOR PAYMENT

Contributors of technical articles accepted for publication in FM will be awarded an honorarium in accordance with a scale now being established. The rates will depend on depeth of editing required, time required in preparation, scope of technical content, relative importance of material, and a few other related factors.

It is unlikely that anyone will ever become rich writing for FM, but the pay rate will be better (per capita) than any other magazine in the technical field. (Per capita rate is defined as amount of money per reader.)

Not all accepted manuscripts will be rewarded by cash compensation. FM will continue to accept nontechnical news, reports, and editorial data from subscribers, and these types of material will not be considered as "pay" items. Also, members of the editorial staff will not be paid for their contributions. Naturally, a great deal of subjectivity will be involved in the grading of received manuscripts. It will be my responsibility to decide between the various submittals.

Payment will be fast, though. An author whose material is accepted as a recompensable article will be awarded his check as soon as his article is set into type. (This much delay is necessary because payment will depend to a large extent on the length of the article as it appears in the pages of the magazine.)

Manuscripts should be submitted to the Editorial Office in San Dimas, California, as this is the office from which payment will be made and acceptance determined.

CODE DREDGINGS

The code issue proved to be emotion-invoking, and readers were split into two camps. This was considered ample cause to abandon efforts to abolish the code as a requisite to amateur radio operation in the VHF range.

LICENSING

The subject of repeater licensing is one of general agreement, and FM's recommended modification to the FCC Rules is being rewritten to incorporate some of the changes suggested at the SAROC meeting in Las Vegas last month. A full report will be published later. In the meantime, all of you who feel strongly about any of the items suggested in the last issue or who have additional suggestions should make it a point to voice your opinions in a letter to the editor (Editorial Office).

ADDRESS CHANGES

If you're having trouble with FM deliveries, take a good look at the address label on the back of your copy of FM. If there are any anomalies, or if you have questions regarding administrative policies, write to Mike Van Den Branden at the Administrative Office.

ARTICLE INDEX

An index of articles — dating all the way back to issue number one — is in preparation. When complete, it will be published as an insert in FM.

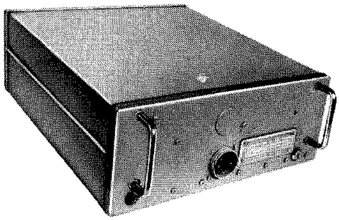
QUESTIONNAIRES

The questionnaires that were published in the October issue are continuing to dribble in. When the results have been fully tabulated, a profile will be prepared showing the makeup of the typical reader. From the 1400-plus questionnaires already received, for example, we have learned that nearly 72% of our subscribers are associated with the two-way radio industry. Comments tend to indicate interests lie primarily in this area; and, as a consequence, readers will begin to see more material in FM's pages in the coming months reflecting this interest.

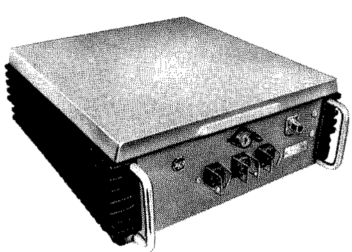
FM REPEATER HANDBOOK

On December 27th, I mailed the completed manuscript of the new FM Repeater Handbook to the publisher (Editors and Engineers, Limited, New Augusta, Indiana). E&E editor Bob Welborn states that the book will be released around March or April of 1969, and two editions (hardbound and softbound) will be available. This is believed to be the first complete "how to" book ever published on repeaters and remote control techniques. The original printing on manuscripts of such a specialized nature are usually quite small, so if you intend to get one it would be wise to reserve your copy now. Write Bob Welborn, Editors & Engineers, Box 68003, New Augusta, Indiana 46268.

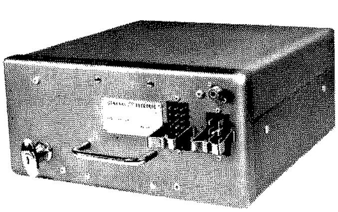
For the newcomer
— BY POPULAR DEMAND:



How to Know What to Buy



by KEN SESSIONS



When you look over the used-equipment catalogs, you will note a marked inconsistency in pricing structure. A late-model DuMont base station, for example, might sell for a fraction of the price of an equivalent Motorola unit. Or a 10-year-old GE unit may be listed at many times the price of a near-new ITT.

GE and Motorola command consistently higher prices than other makes. *But the higher price does not necessarily mean the GE and Motorola units are superior.* GE and Motorola are the two biggest names in two-way radio. But RCA, DuMont, Kaar, Aerotron, and Bendix are common, too. Why, then, are GE and Motorola so sought after?

The amateur buys with the thought of selling, for one thing. And he knows that any amateur with *any* experience in FM has experience with Motorola — or GE. So when he buys, he tries to buy something other FM'ers have used or serviced.

Another contributing factor is documentation. Handbooks, schematics, troubleshooting procedures may or may not be available from the manufacturer, but every FM'er knows he can get access to most Motorola and GE manuals simply by visiting the nearest commercial two-way service center.

But perhaps the principal reason most amateurs select GE or Motorola is "general familiarity." When an inexperienced amateur runs into some trouble trying to service a GE or Motorola unit, he can feel pretty sure of getting experienced help from other local FM amateurs who've worked on similar units with similar problems in the past. Interchangeability of components might be another consideration in favor of the big two. For a number of years, GE and Motorola (and one or two other manufacturers) have employed the "module" concept in the manufacture of their two-way equipment. For a given model "year," for example, the manufacturer will produce singular transmitter and receiver designs. The transmitter, receiver, and power supply are constructed on individual removable chassis.

Thus, for a given radio model, a transmitter "strip" from a mobile unit may be interchanged with a transmitter from a base station; or a base station receiver "strip" can be used in the equivalent model mobile unit.

The lower price of RCA, DuMont, and the others, however, can make a strong case against the two big names. The ultimate decision, of course, must rest with you, the buyer. If you feel confident that you'll be able to handle your own service problems and that you won't be trying to make a quick sale on your equipment, it might pay to weigh a purchase purely in terms of performance versus dollars. The secondary names in the two-way industry have also manufactured gear of sound design and quality workmanship. (They've *had* to; look at the competition they've been bucking.)

Identifying Motorola Equipment by Model Number

The model numbers of some manufacturers can provide a great deal of information about the equipment itself. Motorola, for example, has for at least the past decade employed a model numbering system that gives the type of equipment (mobile or base), method of mounting (trunk or dash), rf power, frequency range, vintages of receiver and transmitter, and type of power supply. A familiarity with these numbering systems will help immensely in evaluating a given piece of equipment.

Motorola model numbers assigned after initiation of the descriptive system include six basic characters in this sequence: letter, digit, digit, letter, letter, letter. The first character tells whether the unit is for portable, mobile, or base station use and gives the following general data:

H — Handie-Talkie®
P — Hand-held (portable) unit, larger than Handie-Talkie
L — Tabletop base station
D — Dash mounting mobile unit
T — Trunk mounting mobile unit
U — Universal (dash or trunk) mounting mobile unit
J — Tall cabinet, weatherproof enclosure
B — Tall cabinet, indoor use
W — Western Electric (mobile telephone)

The second character (digit) describes the power capability of the unit:

1 — 1 watt or less
2 — 2 - 5 watts (up to 20W input)
3 — 10 - 15 watts (up to 50W input)
4 — 18 - 30 watts (up to 80W input)
5 — 30 - 60 watts (up to 180W input)
6 — 70 - 100 watts
7 — 150 watts output
8 — 250 watts output
9 — 300 watts output

The third character (digit) identifies the frequency of operation:

1 — Low band (50 MHz)
2 — Mid band (70 MHz)
3 — High band (150 MHz)
4 — UHF (450 MHz)

The next two letters of the sequence identify the model of the transmitter and the receiver, respectively. The last character (letter) identifies the power supply type:

B — Base station (115 VAC)
T — Transistor (mobile, 12V)
V — Vibrator (mobile)
D — Dynamotor (mobile)
N — Nickel-cadmium battery pack

Identifying GE Equipment by Model Number

The GE numbering system isn't quite as descriptive as the Motorola procedure. The Progress Line system was an improvement over that of the Pre-Prog, but the almost numberless variations make it impossible to accurately identify a unit by its model number alone. In the interest of completeness, however, the table describes all pre-Progress Line units and shows the differences between models.

Freq.	Number	RF Power Out.	DC Input Voltage	type of mount	type of power supply
			MOBILE		
152-174 MHz	LPH6/12	3W	6/12	single-unit	vibrator
	LPH24	3W	19-30	single-unit	dc-ac conv & ac pwr spply
	LPH32	3W	26-40	single-unit	dc-ac conv & ac pwr spply
	LPH64	3W	60-84	single-unit	dc-ac conv & ac pwr spply
	MC203	10W	6	single-unit	vibrator
	MC203-LP	LPI(1 W)	6	single-unit	vibrator
	MC204	50W	6	single-unit	dynamotor & vibrator
	MC205	35W	6	single-unit	dynamotor & vibrator
	MC206	25-30W	6	single-unit	dynamotor & vibrator
	MC208	20-25W	6/12	single-unit	vibrator
	MC213	10W	12	single-unit	vibrator
	MC213-LP	LPI(1W)	12	single-unit	vibrator
	MC214	50W	12	single-unit	dynamotor & vibrator
	MC215	35W	12	single-unit	dynamotor & vibrator
	MC216	25-30W	12	single-unit	dynamotor & vibrator
450-470 MHz	MC306	20W	6	single-unit	vibrator
	MC316	20W	12	single-unit	vibrator

BASE STATIONS

Freq.	Number	RF Power Out.	DC Input Voltage	type of control	type of mounting
152-174 MHz	SC221	50W	-	local	floor
	SC222	50W	-	remote	floor
	SC223	250W	-	local	floor (double enclosure)
	SC224	250W	-	remote	floor (double enclosure)
	SC225	-----	-	local	desk.(auxiliary receiver)
	SC226	50W	-	remote	pole
	SC227	50W	-	local	desk
	SC228	50W	-	remote	desk
	SC229	50W	-	local	pole
	SC230	50W	-	repeater	pole
	SC231	10W	-	local	ac mobile
	SC231-LP	LPI(3W)	-	local	ac mobile
	SC233	250W	-	local	floor
	SC234	250W	-	remote	floor
	SC241	25W	-	local	ac mobile
405-425 MHz or 450-470 MHz	SC321	20 or 30W	-	local	floor
	SC322	20 or 30W	-	remote	floor
	SC325	--------	-	local	desk (auxiliary receiver)
	SC326	20 or 30W	-	remote	pole
	SC327	20 or 30W	-	local	desk
	SC328	20 or 30W	-	remote	desk
	SC330	20 or 30W	-	repeater	pole
	SC337	20 or 30W	-	local	Desk-Mate
	SC338	20 or 30W	-	remote	Desk-Mate

Summary

It is difficult to establish rules of thumb regarding the pricing structure of used two-way radio equipment, but there are a few applicable generalizations it might pay to remember: Used-equipment prices tend to be reasonably stable. Motorola and GE units, particularly the later models, seem to stay somewhat in demand, and are thus usually easy to sell. Two-piece units (separate transmitter and reeciver) are usually a bad buy at any price; the transmitters often do not incorporate limiter circuits to stabilize the audio output, and the receivers are typically far too broad for effective application where adjacent frequencies are likely to be active. One-piece units (of modular construction) are particularly desirable because they provide the means for "system" tailoring to individual requirements and allow a considerable degree of freedom for component/module interchange. For mobiles, vibrator or transistor power supplies offer a significant advantage (in terms of efficiency and power consumption) over dynamotors.

One additional point, in case you plan to buy one of the "off brand" makes. Be sure the tubes it uses are standard enough to be generally available. The 6939, for example, a fairly common miniature tube for some RCA and Comco units, can't be found in the usual "used" or "reconditioned" tube markets — and the replacement cost is a fat $16. The cost of only a few at that price might pay for a complete and fully tubed rig of another make.

EDITOR'S REPORT

FCC looks at remote control

BAD NEWS FOR REPEATERS We MUST get together and do it fast or we're really going to be in hot water. The new rules that we want to see incorporated into law must be formulated and submitted before it's too late. The FCC has already started the ball rolling on drastic repeater-licensing changes, and it is about to pass along a new set of tough constraints for operation.

ARRL STUDIES REPEATERS

And the ARRL is getting involved, too. This could be good news, but I'm afraid it turns out not so good. The ARRL wanted to get a committee made up of repeater advisors, and so contacted as many repeater people as they could. When they made their selections, however, it became obvious that knowledge was not one of their criteria. I don't want to get involved with discussions as to qualifications, but I will say the ARRL picked people who either don't care one iota about repeater operation (except as a personal, private communications mode), people who aren't involved with FM repeaters at all (operators of AM repeaters), or people who operate very small carrier-operated repeaters. I know of no individual on the ARRL's advisory committee that owns, maintains, or operates an open repeater in a metropolitan area.

The ARRL had 25 names from which to choose their committee. The names included these individuals: Ken Sessions, K6MVH, licensee of the Radio Ranch open repeater in Los Angeles, California (W6FNO).

Gordon Pugh, W2GHR, of Manhasset, New York, licensee and technical impetus behind the renowned chain of repeaters along the eastern seaboard (W1JTB, et al).

Gil Boelke, W2EUP, technical mind behind the Buffalo repeater, and prime mover of the Buffalo petition (which he drafted). Also, Gil is designer of many advanced repeater control systems which are used by other repeaters throughout the country.

Don Chase, WØDKU, licensee and builder of the popular Wichita repeater, Wichita, Kansas. Don is noted for his close alliance with local government for providing public-service communications.

Pat Devlin, WA5BPS, trustee of the Tulsa repeater, an extremely popular open-type system with multiple capability. The Tulsa repeater, WA5LVT, has an enviable reputation for providing emergency communications for the local Red Cross. Pat Devlin is noted for his pioneering efforts with Touchtone as a repeater control and repeater-compatible technique.

Robert Kelty, WB6DJT, long-time chairman of the California Amateur Relay Council (a State organization of repeater owners), and a key figure in virtually all Northern California mobile-relay activity.

Nathan Bale, WØPXZ, trustee, designer, and builder of the Grand Mesa and Grand Junction repeater combine in Colorado.

Larry Oakley, W7DNX, trustee of the Reno repeater in Reno, Nevada.

Gary Hendrickson, W3DTN, secretary and treasurer of the Maryland Repeater Association; Gary is noted for his keen interest in repeater rulemaking (he took part actively at Paramus, New Jersey, repeater conference, as well as recent SAROC repeater conference in Las Vegas). Hendrickson has designed a number of repeater control-tone signaling systems, which have been published in FM and the new FM Repeater Handbook.

Well, there were a great many more names on the ARRL's list of "possibles" — but not one of these metropolitan-repeater trustees and designer/builders made it.

At the repeater conference at Las Vegas, the names of the ARRL's committee-members were read to see if any were known by those present. Of the nine ARRL appointees, only three were recognized: Art Gentry (W6MEP), H. H. Lang (VE3ADO), and Jon O'Brien (W6GDO).

Art Gentry operates an AM repeater in Los Angeles. H. H. Lang has a small repeater that until recently was VOX-operated (and it may still be); Jon O'Brien is a remote operator in Northern California whose anti-repeater feelings are generally well known. (His first communication with FM Magazine was a stinging letter that warned against publicizing his "private" repeater frequencies.)

FCC TIGHTENS UP

So things aren't looking too good now for those of us who use repeaters as open relays. And to top it off, Gordon Pugh has just sent some scuttlebutt that indicates some negative activity stirring in Washington.

Here's what he says:

The East Coast is up in arms about some proposed FCC actions with regard to repeaters, such as:

Maximum input power of 100 watts.

All repeaters tone-coded.

Repeaters frequencies limited to above 52.25 on six, 146 -.147 on two, 223 - 225, and nothing below 448 in the 450 spectrum.

Narrowband only.

No crossband operation, including links and talkback channels.

Definite repeater frequency assignments, in and out.

Licenses only to clubs.

Logging relaxation, 3-minute identification.

Control allowable from mobile unit on limited basis.

The groups here are preparing to go all out to challenge the proposal if it is dropped as-is. Some of the last few items listed have real merit, but we must oppose the sections that seek to destroy existing setups and prohibit future experimentation.

FM REPEATER ORGANIZATION

It's pretty late to do anything mountain-moving, but we have a start already. The time has come for us to stop dilly-dallying and get going on the repeater organization we've been talking about for years. To this end, a rough organization was mapped out at the recent Las Vegas conference, and ALL REPEATER OWNERS AND TRUSTEES are urged to participate fully. Get in this group and let your voice be heard; because if you don't, someone else's voice *will* be heard. And it may not be the voice you want to be represented by.

Paul Hudson is handling the league of repeater associations. His address is Box 452, Don Mills, Ontario, Canada. For the annual fee of one dollar, you can take part in this extremely important function. The only important requirement is that you must be a repeater user. Nonrepeater users can become associate members for 50 cents per year, but voting and major decisions must rest with those who are involved with repeaters. (The money, by the way, will pay for postage and incidentals.)

Members of the newly formed league will be informed of activities, rulings, decisions, proposals, etc., by direct mail. Most of the current members agree that many things should be discussed without the publicity of FM Magazine. The direct-mail approach makes this possible.

The table below shows the names and affiliations of those who have already enlisted in the league of repeater associations. Most of these individuals can be found in the photo, but it's anybody's guess as to who's who.

The hottest item on the agenda right now is the examination of and comment on the skeleton draft of the repeater petition as it appeared in the January issue of FM Magazine. Many letters have already come in with valuable comments on this. Some of these letters will be published in the letters section of FM, but all cannot be, of course, because of the tremendous volume of mail dealing with this one area.

Updates of the draft will be published in these pages within the next few months, so keep watching. And if there is something you'd like to see in the rules, you will have no one to blame but yourself if you don't get those comments in to the FM Editorial Office.

Paul Hudson is working closely with the other members of the FM staff, and will keep us posted on all pertinent activity on the part of the new organization.

ROUNDTABLE

The letters below represent some of the response to the January "Rules Plea" article in FM.

From: Wilbur Golson
5465 Washington Ave.
Baton Rouge, La. 70806

I want to tell you how much I like the current issue (1-69) and to add my approval to your proposed rule change requests to the FCC . . . The directory of active repeaters indicates a wide-spread interest in the hobby.

Here in Louisiana we find interest high in all major cities with repeaters in the plans stage in Baton Rouge and Alexandria. The FCC New Orleans office has been flooded with requests for information and I am enclosing a copy of the information sheet

AMERICAN LEAGUE OF REPEATER ASSOCIATIONS

CALL	NAME	ADDRESS	GROUP NAME — RPTR CALL
K2AOQ	Mel Stoller	373 Park Ave., Rochester, N.Y. 14607	Rochester Area Rptr Group (President)
W3AEH	Al Lipkin	8822 Fairfield St., Phila., Pa. 19152	WA3BKO rptr
W3DTN	Gary Hendrickson	823 Dale Rd., Glen Burnie, Md. 21061	Md FM Assoc. Inc. WA3DZD rptr (Sec'y)
WA5BPS	Pat Devlin	4817 E. 35th Court, Tulsa, Okla. 74135	Tulsa Rptr Org., WA5LVT rptr (Trustee)
WA6CUZ	Warren Reid	P.O. Box 741, Visalia, Calif. 93277	WA6CUZ, WB6OPG/WB6OPH, (W6ARE rptr)
	Bob Dobbins	3440 Ben Lomond Dr., Sacramento, Cal. 95821	K6KFF/K6ILF - Calif. Amateur Relay Council
WB6EYH	Carl C. Moore	Box 55, Los Alamitos, Calif.	KØJPK - San Gabriel Valley Rptr Orgn.
W6EFE	Al Freeman	5934 Los Arcos Way, Buena Park, Calif.	WB6CZW (Co-owner)
K6MVH	Ken Sessions	4861 Ramona Pl., Ontario, Calif.	W6FNO (control licensee; co-owner)
WB6NOJ	Steve Grimm	10610 Ruoff Ave., Whittier, Calif. 90604	WB6SLR - So. Calif. Rptr Association
W6AXM	Gardner L. Harris	828 S. Hudson, Los Angeles, Calif. 90005	WB6SLR remote
WA6OSB	Ken Decker	4015 Casita Way, San Diego, Calif. 92115	San Diego VHF Club
WA6ZVP	Roger Wiechman	2455 Barjud Ave., Pomona, Calif. 91766	WB6WYM
W7AKE	Don Brickley	4318 Cory, Las Vegas, Nevada, 89107	W7DDB
W7FJM	Frank Beising	6201 McAllister, Las Vegas, Nevada 89107	W7DDB
W7ELQ	Ray Schaefer	P.O. Box 1647, Sierra Vista, Arizona 85635	Cochise Amtr. Radio FM Assoc. W7MES rptr
W7FJN	Mel North	4609 Amherst, Las Vegas, Nevada	Las Vegas Rptr Assoc., K7TDQ remote
K7GHS	Howard Nutter	4206 N. 47 Dr., Phoenix, Arizona 85031	Ariz. Rptr Assc. K7VOR/WA7CEM
W7KZU	Dave Putnam	2210 Canal St., Medford, Oregon 97501	
W7MES	Clarence Sherbundy	P.O. Box 1647, Sierra Vista, Arizona 85635	Cochise Amtr. Radio FM Assoc. W7MES rptr
K7RIE	Wiliam Everett	CMR Box 5277, George AFB, Calif. 92392	WB6SLR repeater
W7TDQ	Tom Burford	6328 Shawnee Ave., Las Vegas, Nev. 89107	Las Vegas Rptr Assoc. Inc., K7TDQ remote
W9ATK	J. W. McLelland	104 W. Clovernook Ln., Milwaukee, Wis. 53217	W9WK rtpr
WA9ERC	Bill Knopp	724 LaPorte, Wilmette, Ill. 60091	Chicago FB Club - WA9ORC
VE3CWA	Paul Hudson	P.O. Box 452, Don Mills, Ontario, Canada	Toronto FM Comctns. Assoc., VE3RPT rptr

they are sending in reply. Keep up the good work.

FCC NOTES ON AMATEUR REPEATERS

The amateur licensee must maintain direct control by either being present at the repeater or at a wire or radio remote control point authorized in accordance with Section 97.43(b).

For remote control by radio, the frequency must be 220 Mc/s or above. Apply for a modified station license on form 610 describing the method of operation. The transmitter can not be unattended. Must be able to turn it on and off.

Automatic activation of the repeater by incoming signals OK provided the licensee maintains the ability to turn off the repeater transmitter when necessary. To do this of course, he must be able to monitor.

Transmissions of the repeater must be clearly identified. Identification and logging of the repeater must comply with Sections 97.87 and 97.103. Automatic identification by taped voice or code tape permissible and should be at least once every three minutes while the repeater is being used.

Logging can be by tape recorder. Time and date may be entered on tape by mobile station transmitting, or on seperate piece of log sheet. Log of responsible amateur in control should be maintained of his signature and his time of duty.

A good way for the licensee to exercise control is as a club project and have various remote control points at the homes of the members.

A three-minute time is suggested as a fail-safe device.

If transmitter is at a TV tower and the amateur licensee is on duty, then remote control authority is not necessary. Could apply for a second station license in the case.

National repeater freqquencies are reported to be 146.94 transmitting and 146.34 receiving.

Mobile station must put in his log that he talked through the repeater.

The whole subject of Amateur repeaters is under study by the Commission and the above notes may be modified by the Commission at any time.

FEDERAL COMMUNICATIONS
COMMISSION
NEW ORLEANS, LA.

From: Carl Robbins, W8JDH
Box 263, Glenwood Rd.
Wheeling, W. Va. 26003

I think that your attempt to get some definite regulations and practices regarding repeater operation from the FCC is great and most certainly overdue.

In looking over your proposals in the January issue of FM, it appears as though you have given considerable throught to the subject.

However, if FM Magazine is truly interested in representing the use of FM communications by radio amateurs as you seem to indicate, I might suggest that you are overlooking something very important in your proposals and your interest in FM.

You are suggesting that repeater operation be permitted on the bands above 51 MHz. What about 10-meter FM?

We here in Wheeling operate about 40 FM units mobile and base on 29.480 and 29.6 MHz and have done so for about four years. There are also several other groups in West Virginia on 10 meters FM. In Texas one group alone has over 200 mobile units operating on 29.6 FM. There are numerous groups around the country such as in Mississippi, New Jersey, and California. All together, I would suspect more than 300 units are on 10 meters FM.

We are presently constructing a repeater for use in conjunction with our 10-meter setup. If you are truly representing the interests of FM users on the amateur frequencies, I think that you should propose repeater operation should be permitted anywhere the present rules permit wideband FM or 40F3 emission. This, of course, includes from 29.450 to 29.650 MHz under part 97.193(3) in the 10-meter band.

ED. NOTE:

Your point is well taken, and the petition will be modified accordingly.

From: Bill Vandermay
W7DET/WA7ANG
3211 S.E. Franklin
Portland, Oregon 97202

I firmly believe in simplification of regulations and have lived with commercial broadcast rules for many years and, noting the great maze of fine print, I have become convinced that it should all be simpler and shorter and more to the point. I would hope that any repeater rules could be quick and short but of course in FCC language this could become very long. I would like to think that the FCC itself would prefer a minimum of regulations for their own benefit to regulate which they are hard-pressed to do these days. Also, by imposing too many regulations, it will inhibit and discourage the development of repeaters and encourage wholesale violation of the rules.

Specifically, the ponts I would question in the proposal include the following items. Logging of the repeater operations at the transmitter site is generally impossible and should not be necessary — other than a master entry of power and frequency in the usual manner and any other pertinent permanent information. The monitoring of a repeater at all times by an authorized amateur with the capability of suspending operation — this is practically impossible and impractical and unworkable. This would result in a rather large group of stations all trying to coordinate and figure out who has the duty and would be extremely difficult to administer and in case of a problem the FCC would have a monstrous task to figure out who was who and when. Further, it would require that each of these stations be equipped with a system to inactivate the repeater. This would demand great amounts of communications and control equipment — bearing in mind, of course, that control must be at 220 MHz and above. I see great confusion and difficulties in working out such control systems and there would not be one system in a dozen that would ever comply.

If the rules are simple enough that stations can comply there might be an effort made, but when they are unduly complex the result could very well be gross non-compliance and a trend in the other direction. I can see no reason why amateur repeater rules should be any more stringent than commercial operations, and for that matter certain citizens band operations that require no logging, licensed operators, etc. Common sense basic rules requiring certain responsibilities of monitoring and control and a built in ID system — boiled down to the simplest common language should be the project to sell to the FCC.

ED. NOTE:

The logging, as proposed in the petition, should pose no problem to anyone. FM proposes that logging take the form of a notice stating the particulars ONLY when the repeater is placed in service and when a maintenance call is necessary.

Monitoring may be burdensome, but it is not necessarily unworkable. We MUST show the FCC that we are willing to be responsible for our repeaters. Shutdown control CAN be accomplished from frequencies below 220 MHz, according to the FCC. Any form of PL or single tone can be applied, or the repeater can shut down automatically and be reactivated from two or six meters.

We at FM think the FCC will bend for us if we do some bending ourselves.

Las Vegas

Ken Sessions (K6MVH), editor of FM Magazine, purchased a Motorola T44 and a B44 base station at SAROC. On Sunday, shortly after 11:30 a.m., while the exhibitors were packing up to go home, some amateur radio operator suddenly turned thief, and, with the help of a friend, carted Ken's newly purchased units right out of the hotel. Las Vegas FM'ers are advised to be on the lookout for unfamiliar signals on 450 MHz.

CONFIDENTIALLY ... THEY DIDN'T TREAT US VERY WELL AT SAROC ...

Those of us who attended the SAROC thing in Las Vegas had a good time in spite of the shuffling we got from Leonard Norman and the other big shots responsible for the affair.

The FM activities were originally set up for Sunday, and were slated to go on all day. At the last second, Norman informed the FM'ers that they would be required to convene on Saturday. As a result, many of those who came Saturday evening with the hope of participating in the FM conference were disappointed. Also, the FM conference room was to be at the disposal of the FM'ers all day Saturday. During the conference, however, Norman interrupted the proceedings to announce that the room must be vacated by 10:30 a.m. — leaving but an hour and a half for the conference.

The affair went that way right on down the line, first with one thing and then with another. It was interesting to note, however, that FM'ers made up a disproportionately large amount of the total SAROC attendance. Everywhere, .34-to-.94 Handie-Talkies could be seen — at restaurant tables, in bars, and at casinos.

FM exhibitors were there in force, too. Mann, Varitronics, Stellar Industries, Sentry Manufacturing Company, and ICE were typical examples. Spectronics was represented also, by its manager, Art Householder, although not as an exhibitor.

Ken Sessions, speaking as an FM reporter, asked Tom Burford why SAROC had been giving the FM'ers the "under-the-carpet" treatment. Tom, a local resident and avid FM amateur, said he had been perplexed with some of the shenanigans but he was at a loss to explain any of them. Tom Burford (W7TDQ), as one of the principals behind the FM portion of the convention, was one of the first to notice the musical chairs Norman was playing with FM's schedule.

Next year, I am happy to report, the national FM convention will be held in Chicago. The exact date will be announced later, but look for it to be scheduled concurrently with the IEEE's Vehicular Technology Group conference in December. Responsible Chicago amateurs interested in helping to set up the convention particulars are invited to write

ADMINISTRATIVE OFFICE
2005 Hollywood Street
Grosse Pointe, Michigan
48236
Phone (313) 886-4115

UP NORTH AND AROUND

Buffalo, New York

WB2TLJ is moving a little further up onto the same hill it now occupies. The new location will be the township of Boston. A long-term agreement with the owner of the property (a ham and new member of BARRA) should insure continued operation of the repeater. Hydro (Canadian term for electricity) is being installed and Gil Boelke (W2EUP), the repeater technical director, plans to house the equipment in an old refrigerator with temperature control.

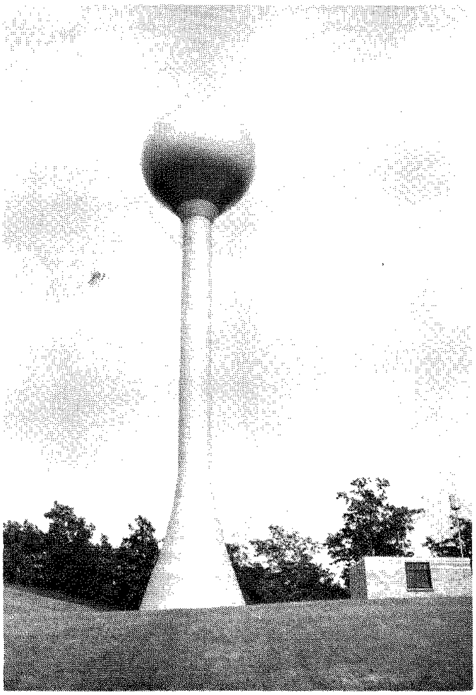
The 52.525 transmitter is continually operating as WB2TLJ. VE3ADO is working on a message secretary system for the repeater. This device will allow the Buffalo fellows to leave a message recorded for others to hear at a later time. The Cherry Creek repeater, now licensed for repeater operation using the call W2EUP, is temporarily off the air for minor repairs but has been moved from the outskirts of metro- and storage batteries (no hydro). The repeater is entirely solid state with spares for each piece of equipment in the system.

Toronto, Ontario

The Toronto repeater (VE3RPT) has been moved from the outskirts of Metropolitan Toronto to the city itself. Although the mean elevation is much lower, the coverage inside the city has been generally improved. At the previous site of VE3RPT, a new repeater has been installed. The location is near Oshawa, Ontario. VE3OSH, the Oshawa repeater, operates from 146.400 to 147.12. Marconi equipment is used with 3 dB antennas on a 65-foot tower.

Teletype activity in the Toronto area has been increasing with some activity on the repeaters. A recent release of facsimile machines should add to the confusion.

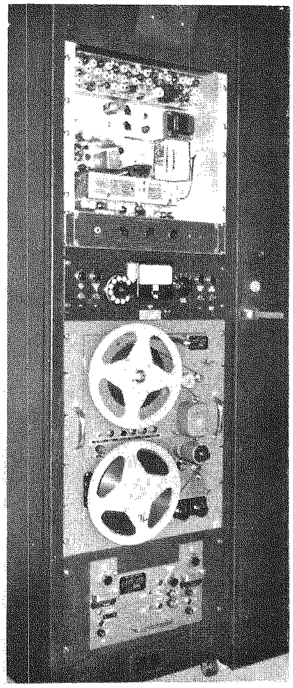
VE3MOT, operating from 146.580 to 147.180, has been modified for wideband operation as well as narrowband. The location of MOT has been moved to a good downtown commercial site atop a large apartment building. Excellent coverage of the metro area has been realized.



Repeater and antenna site of Detroit's new repeater, WA8BDD. This newly licensed facility is reportedly Michigan's first officially sanctioned repeater. See story, next page.

MICHIGAN'S FIRST:

GREAT LAKES REPEATER A REALITY



by JAMES L. STEVENSON, K8PZL*
Trustee and Technical Director
Great Lakes Repeater Association

The first licensed repeater in the State of Michigan is at last a reality. A repeater for the Detroit metropolitan area has been the dream of a few two-meter "FM"ers for some time. The license was received during the last week in December, after a wait of three months. The application, patterned after an application for commercial broadcast station license, and broadcast station "proof-of-performance," was approved without challenge.

While waiting for the license, the repeater was put into operation under local control. During this time, the repeater was tested and adjusted for optimum performance. During the preceding months, through the combined efforts of K8AIZ, WA8OXK, K8IYZ, WA8UTB, K8BMF, myself, and others, equipment was scrounged, bought, designed, built, and put into operation. Much of this gear was donated by generous individuals. Receiver decks were donated by the Michigan RTTY Assn. and tape equipment for logging purposes was consigned to us by the Michigan State MARS director.

The permanent site of the repeater is a water tower (see picture) on the grounds of Columbiere College at Clarkston, Michigan about 25 airline miles from the center of Detroit. This site was chosen for its high natural elevation, 1268 feet above sealevel. This puts the repeater about 600 feet above the ground level of Detroit proper. The cabinets containing the repeater and control equipment are installed in the base of the tower, with the receiving antennas for repeater and control frequencies mounted on the top of the tank. The transmitting antenna is located just below the tank, on the southeast side of the stem, facing Detroit.

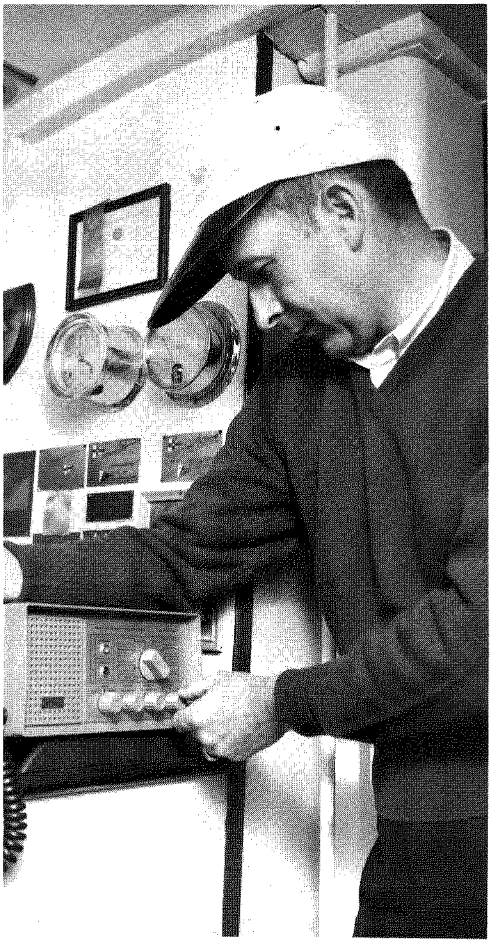
At present there are five control points scattered around the Metropolitan area.

The remote control installation at K8PZL is fully automatic. The rack contains a monitor receiver, control transmitter, WWV receiver, master panel, and tape equipment for logging. The remote control equipment contains a fail-safe device to automatically put the repeater off the air in the event of failure of any of the monitoring and logging equipment.

**Jim Stevenson is a Staff Engineer at WWJ-TV in Detroit. He was formerly Chief Engineer with WCRM and WSMA radio stations, before assuming his present position.*

marine VHF

A general revamping of the rules governing Marine Radio appears likely



TEN CHANNEL VHF/FM radiotelephones from Raytheon is designed around new requirements recommended by FCC. The RAY-42 VHF/FM operates at maximum allowable power of 25 watts with power stepdown for close range operation. It also complies with new narrow bandwidth provisions. Introduced at the National Boat Show in New York (January 25-February 2, 1969), the new Raytheon two-way radio requires no ground plate and can operate from miniature antenna.

by ARTHUR W. BROTHERS

In March of 1967, the FCC released a notice of proposed rulemaking relating to marine VHF FM channels. For many years, there have been some 24 channels available for marine VHF FM use. Equipment standards were 50 kHz channel spacing. Use was parceled out to such functions as ship-to-ship, coast guard, and harbor, with five channels set aside for mobile telephone.

On 25 July 1968 the FCC issued its report and order relating to new regulations for VHF FM; there are now 48 nongovernment channels using 25 kHz spacing and 5 kHz deviation. This is 5 kHz less than the 30 kHz spacing utilized by land and other FM assignments within the U.S. However, international agreements call for other countries to use 25 kHz spacing, so the only way the U.S. could keep its marine assignments in line with those of other countries was to adopt the same standards.

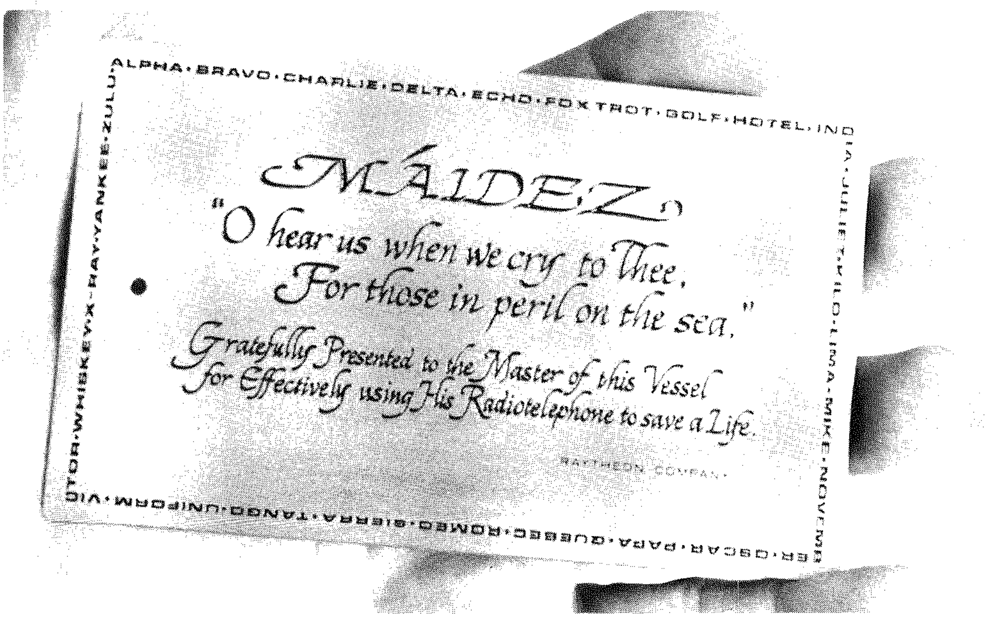
The marine channels start at 156.275 MHz, and extend in 25 kHz increments to 157.425 (with the exception of nonassigned guard bands on either side of 156.8 MHz, the new marine emergency channel). There are various channels for duplex use: 161.60 (port operations); and from 161.8 to 162 MHz in 25 kHz steps are the coast station transmit frequencies for telephone use (9 channels).

For the most part, after March of this year, all marine stations should have their deviation reduced to 5 kHz which can be an easy thing if audio characteristics aren't to be considered top criteria — just knock down the gain control. Receivers are another thing, however, and in general it is expected that within five years all current equipment will be phased out of service with new hardware. This should provide a boon to the amateur equipment market, as most of the existing VHF FM equipment should be easily convertible to the amateur two-meter frequencies. Power supplies will be required, but this is the easy part.

The FCC will promote the use of VHF over LF and HF. When you consider that there are over 1,000 boats a month being licensed, it stands to reason that a good percentage of them will have radios. As of today, you can do several things for marine radio.

If you buy a new VHF set, you will be ready for the years to come. If you buy an LF radio, you're going to have to junk it within five years, as the FCC is going to switch all LF and HF from AM to SSB. And, the congestion on LF in many parts of the country is something to behold. So — if VHF can be provided over the operating range of a boat, then the boats will switch to VHF for their short-range communications needs.

Towards this, plans are now being formulated to provide additional VHF FM coverage from all types of shore stations all over the country. Government and private business are all gearing up to satisfy this expected new demand. For the serviceman who wants to keep up, a subscription to FCC Rules and Regulations, Parts 81 and 83 would appear to be in order now.



M'AIDEZ AWARD created by Raytheon, honors mariners who have used their radiotelephones to save a life at sea. Featuring the international telephony call "M'Aidez", or "help me", the 3" by 5" engraved bronze plaques are offered as a public service to emphasize the boating safety role played by radiotelephones.

- Field effect transistor front end
- Operation on either 115 VAC or 12 VDC
  Operation is fully regulated on AC or DC with voltage reversal protection
- Military type fiberglass printed circuit boards
- 12 channel operation with plug-in crystals (1 MHZ max. spread)
- Built-in 3" X 5" speaker
- Only 20 MA current drain on 12 VDC (Squelched)
- Small size — for easy mobile mounting
- Built-in power supply allows quick change from AC to DC operation by simply plugging in proper power cable

ICE

INTERNATIONAL COMMUNICATIONS AND ELECTRONICS, INC.

8507 SPEEDWAY A/C (512) 341-1311

SAN ANTONIO, TEXAS 78230

CIRCLE NO. 83 ON READER SERVICE CARD

DETACHED CONTACTS

Introducing a not-too-new but truly better approach to schematic preparation

by Gordon Pugh*

FM repeater systems are well into their second generation in many parts of the country. As these systems grow more complex and refined, more sophisticated control and supervisory systems must, by necessity, evolve.

A group of repeater operators in the northeastern part of the country are now hooking up a point-to-point link that will ultimately be capable of connecting any terminal in the system with any other terminal without involving any other repeater (except as a UHF relay point). The switching and control requirements for this task are formidable, but not beyond the understanding of any of us who have put together a working repeater.

What does become unmanageable when developing a control system is the *schematic*.

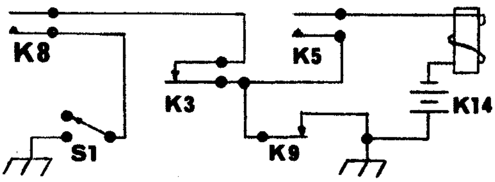
Haven't you ever looked at the schematic of a circuit containing ten or more interconnected relays only to become lost in the tangle of lines? As the number of functions or relays increases, the confusion grows at a geometrically proportional rate.

*GORDON M. PUGH
89 TRUMBULL ROAD
MANHASSET, NEW YORK 11030

Whether using relays or solid-state devices, consider the complexity of a schematic with forty or fifty devices. There is very little that can be done with the actual wiring of the equipment; however, it can be represented in a much simpler form: the detached-contact schematic.

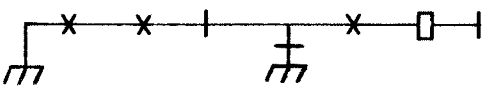
Consider for a moment only one relay in a complex circuit. There are certain conditions that cause the relay to operate. These conditions are usually the states of other relays or switches in the equipment. In a conventional schematic, the operating path through these relays may wander back and forth over the entire drawing. Detaching the contacts from their relays on the schematic eliminates most of this frequently aggravating problem.

Working with detached-contact drawings requires a small amount of "new thinking" and self-discipline — like working with Boolean algebra — *but it is simpler.* And it's easy to get used to. Think about it! When you design a circuit, you actually think it out in a detached manner. When it gets down on paper the old conventions force the contacts back to the relays. THIS IS NONSENSE! Leave the contacts where they were in the thinking phase, marking down the number or designation of the relay the contact is associated with. Using conventional contacts, this could result in something like this:



This resembles a path through a complex schematic that has been cut away from the rest of the drawing and then labeled to show the relays and contacts.

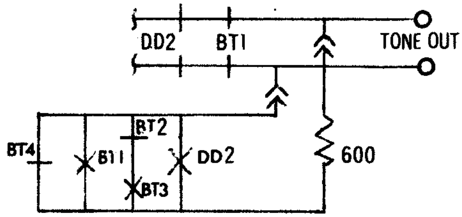
To complete the transformation to detached contacts, simply change the symbols to make it easier and quicker to draw (and to read). The "make" contact becomes , representing a connection not normally completed. The "break contact becomes , representing a normally closed contact. The transfer contact, normally drawn , becomes or , showing the two paths. The same symbol is used for a make-before-break transfer . The contact is then designated as an 'MB' (make-break) rather than a 'BM' (break-make) contact. This circuit is identical to the one shown above, but using the detached-contact notation.



When designing a circuit using this notation it is quite easy to rearrange and eliminate duplicated or unnecessary contacts by inspection. Contacts in different operate paths are easily associated to form transfer contacts. Another advantage of the detached-contact drawing is that options may be shown or added later without redrawing the entire schematic.

An example of the option is taken from *The Roadrunner,* in this issue. The optional circuit would be difficult to add to a conventional schematic. It is easy using detached contacts.

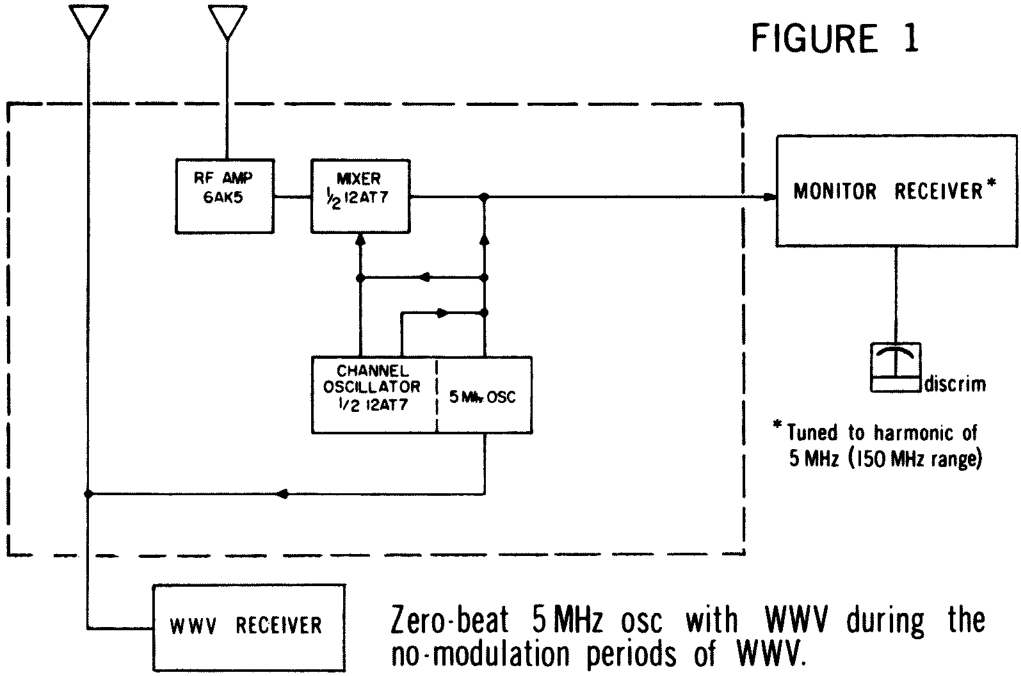
The audio output in *The Roadrunner* is processed by seven relays to produce two short tone bursts in several combinations:



The optional circuit provides a load similar to the tone oscillator when looking into the output terminals during all periods when the tone is absent. Since it is optional, it must be separate from the main circuit but still use the same relays. This option was designed using a truth table after inspection of the relay operation. For this option, one additional contact pair was added to each of five relays. The contact arrangement provides three relay combinations for breaking the termination. Showing this option in detached form is simple; adding it to a conventional drawing is not.

If your project requires more than one page of schematics, the rewards of detached-contact drawings are even greater. Each relay may be picked apart and scattered throughout the overall schematic, placing the contacts close to the circuit they control.

Now that you have been introduced to the concept of detached contact schematics, try converting one of your favorite circuits into this new notation. You may discover an extra relay or two that are not really necessary. Don't be dismayed — this is one of the typical fallout advantages of detached-contact notation.



The POOR MAN'S FREQUENCY METER

by DONALD L. MILBURY

Yes Virginia.

There IS a way to accurately measure frequency without the use of expensive test equipment. With a handful of parts and a few items found commonly around the radio shop, you can build the poor man's frequency meter, which is capable of tolerances that should amaze those of you who think two grand is what it takes to make the "trek to accuracy."

This is *not* a substitute for a good frequency meter for commercial use, but if you have a limited number of frequencies that you want to be "dead on," this may be the answer. It will provide a handy "extra" unit for your two-way shop, perhaps freeing the Gertsch for use elsewhere.

A nice feature of the poor man's frequency meter is the fact that it puts to use that old noise spectrum demodulator (communications receiver, that is) which has undoubtedly been sitting around in a dark corner of your basement under piles of old magazines and discarded dynamotors. It also uses that old wideband FM receiver you've been hesitating to throw away.

The idea is not new; it has been used for many years for the Motorola station monitor and various other common applications. Basically, it is composed of four major units:

- Receiver converter with calibration oscillator constructed on a high-band front-end deck from a Sensicon A receiver chassis.
- Monitor receiver (any 150 MHz wideband receiver); a low i-f of 455 kHz is best.

- WWV receiver (here is where the old communications reecIver comes in).
- Accessory items (hang a modulation meter on it).

The block diagram of Fig. 1 shows how the individual items of equipment are interconnected to form the frequency meter. Note that although a narrowband receiver can be used, a more dependable "off frequency" indication is obtainable with a wideband i-f receiver. Periodic calibration (before use) to WWV is recommended for high-accuracy measurements; however, the unit will maintain its operating frequency to within 1 kHz (an error of 0.0006%) for an ambient temperature within the range of −20°C to +60°C.

PRINCIPLE OF OPERATION . . . .

The frequency converter operates on the heterodyne principle. A station frequency is monitored by heterodyning its carrier with the output frequency of the crystal oscillator and then feeding the resultant frequency of these two signals into the calibrated monitor receiver. If the beat frequency between the crystal oscillator signal and the monitored carrier is exactly equal to the frequency to which the receiver is aligned, the discriminator meter will indicate zero. If the beat frequency is lower or higher in frequency than the one to which the receiver is aligned, a direct indication of carrier frequency error in the monitored transmitter will be given on the meter.

The monitor receiver is aligned to a predetermined frequency. The specific frequency used will depend upon the spurious harmonics emitted by the channel crystals which will be required to monitor the specific carrier channels in consideration, plus the operating frequency to be measured.

The beat frequency fed to the control receiver may be either the sum or difference frequency of the channel crystal frequency and the monitored carrier frequency. Channel crystals for operation in the range from approximately 1.6 to 12.5 MHz may be used.

Calibration Oscillator

The calibrating oscillator consists basically of an rf amplifier stage, a mixer, and an oscillator. The calibrating crystal, shunted by a trimmer capacitor for any minor adjustment of oscillator frequency, is used for calibrating the monitor receiver.

Although the crystal is temperature controlled, a *greater degree of accuracy is obtainable without the use of the heater.* The trimmer capacitor provides *exact* calibration of the crystal frequency at any temperature by zero-beating the oscillator against the WWV signal.

The crystal heater should be used *only* when a quick check is necessary; such as, where it is desired to quickly bring the crystal to a temperature that would eventually be reached due to the heat dissipation of the equipment.

The control receiver may operate in the 145-160 MHz range; therefore, when using a 5 MHz calibration crystal, the 29th, 30th, 31st, or 32nd harmonic of the 5 MHz crystal frequency is used to calibrate the receiver to 145, 150, 155, or 160 MHz.

The selector switch operates in conjunction with the calibrating oscillator. This switch may be used to select any one of several crystals as the frequency controlling element of the oscillator. These crystals include the 5 MHz calibration crystal and the five channel crystals.

One half of a 12AT7 tube is used as the oscillator while the other half of the tube functions as the mixer. The carrier frequency to be monitored is picked up by the VHF antenna, amplified by the 6AK5 amplifier, and then mixed with the selected channel crystal frequency. The output of the mixer is fed to the calibrated monitor receiver where it is determined if the transmitted carrier is on frequency.

Assume that it is desired to monitor the output of the transmitter which is operating on 152.45 MHz and that the control receiver has been calibrated at 150 MHz. The necessary channel crystal frequency will be

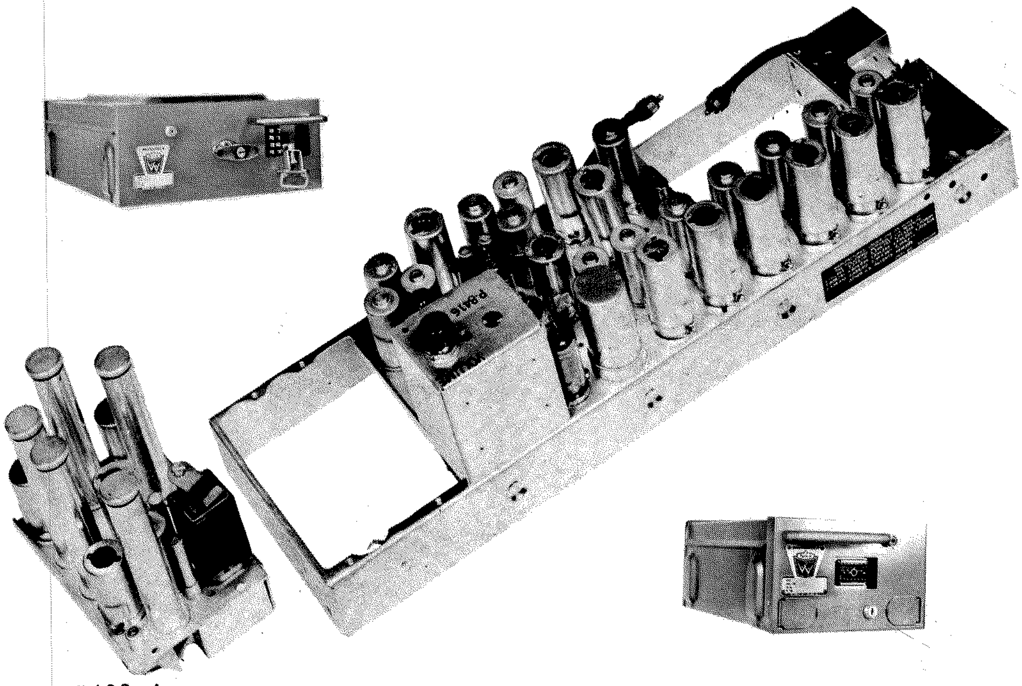


FIGURE 2

the difference between 152.45 MHz and 150 MHz, or 2.45 MHz. If the transmitter is on frequency, the 152.45 MHz signal will mix with the 2.45 MHz channel crystal frequency to produce an input signal of 150 MHz at the control receiver. In this case, no indication will be given by the discriminator meter. If the monitored transmitter carrier is above or below its designated frequency, the input signal to the monitor receiver will be above or below 150 MHz, causing the discriminator to produce an output voltage. This voltage is fed to the meter which is calibrated in kilohertz to give a direct reading of carrier frequency error.

When monitoring transmitters which operate in the 440-470 MHz band, the monitor must be placed so that the monitor antenna is within a few feet of the transmitter. For this application, the frequency of the stage preceding the final tripler is monitored. This is done by selecting a difference frequency crystal for the monitor which, when beat against the frequency of the transmitter stage preceding the tripler, produces the frequency at which the control receiver is tuned.

Assume that it is desired to monitor the output of a transmitter which is operating on 453.750 and that the monitor receiver is calibrated at 160 MHz. The channel crystal frequency is determined as follows:

453.750 ÷ 3 (tripler)
= 151.250 MHz (frequency actually monitored)

160.00 − 151.250 =
8.75 MHz (channel frequency crystal)

CONTINUED

If the transmitter is on frequency the frequency of the stage preceding the final tripler will mix with the 8.75 MHz channel crystal frequency to produce an input signal of 160 MHz at the monitor receiver. In this case, no indication will be given by the discriminator meter. If the monitored transmitter carrier is above or below its designated frequency, the input signal to the monitor reeciver will be above or below 160 MHz, causing the discriminator to produce an output voltage. This voltage is fed to the discriminator meter which can be calibrated to give a direct reading of carrier frequency error.

Any error in carrier frequency indicated on the discriminator meter is an error in the frequency of the stage preceding the tripler; therefore, the error in the transmitter signal from the final amplifier will be three times as great. When using this method of monitoring, check the output (440-470) of the transmitter with a reliable wavemeter to ascertain that proper frequency multiplication is made.

Channel Crystal Accuracy

Since the fundamental frequency of the channel crystals is used, any error in crystal frequency is not multiplied. Therefore, the error in monitoring a frequency by this method is very small. Crystals are held to within 0.002% of the specified frequency over the ambient temperature range of −30°C to +60°C. Therefore, with the previous example, the maximum frequency error of the 2.45 MHz crystal would be 2.45 x 0.0020%. At the frequency being monitored the percentage error would be 49/-152.45 MHz x 100, or 0.000032%. This amount of error is not discernible on the meter.

The "improvement factor" of possible percentage accuracy at the channel crystal frequency over the percentage accuracy at the carrier frequency is approximately the same ratio as the monitored carrier frequency over the channel crystal frequency. Hence, 0.0020/0.000032 equals 62.5 and 152.45/2.45 equals 62.2. This is another way of stating that the channel crystal is more than 62 times as good percentage-wise at the monitored frequency than at its fundamental frequency.

The improvement factor may be checked on any channel by the above method. It will always remain reasonably high; therefore, the possible error of the channel crystal frequency is negligible.

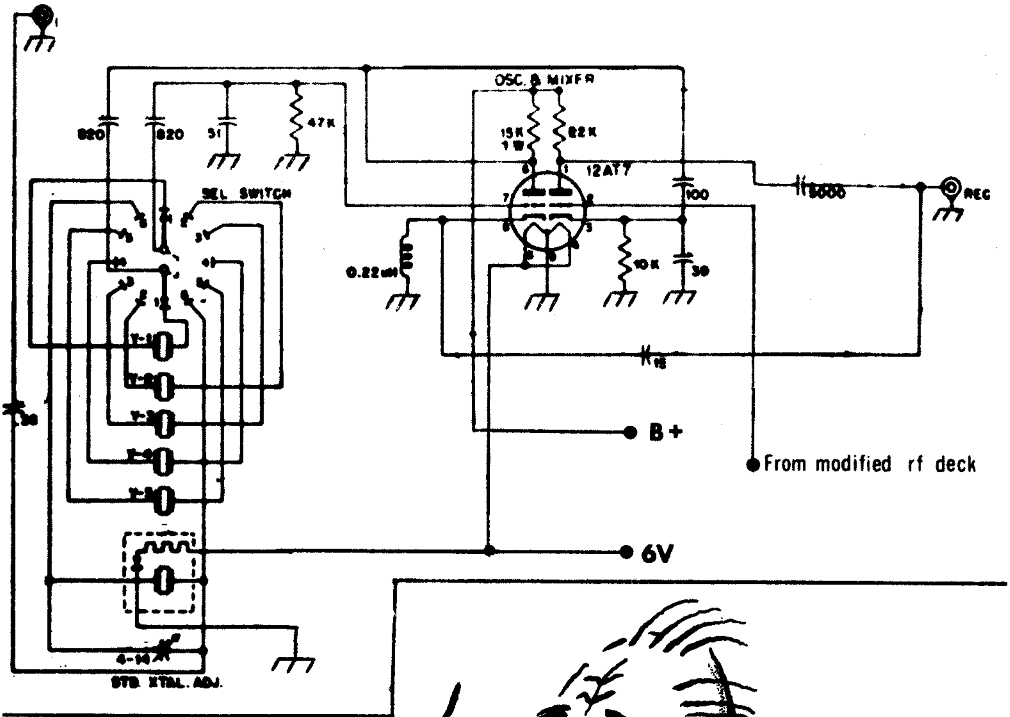
CONSTRUCTION....

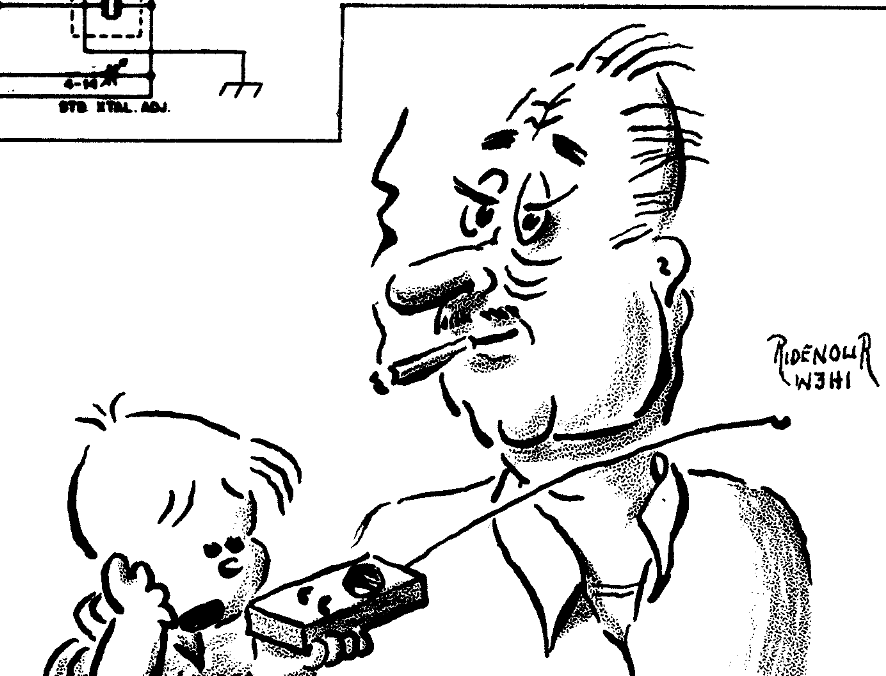
The front end deck of a Sensicon A receiver provides an ideal converter for the poor man's frequency meter. Figure 2 shows this assembly as a separate unit as well as in its original form installed in a Motorola Sensicon A receiver. The part numbers referred to in the modification procedures described here are those part numbers called out in the Motorola manual for the Sensicon A 150 MHz receiver. The procedure is quite simple, too. Here is all you do:

1. Replace R102 (2.2 meg) with 3.3 meg and ground low side.
2. Remove C104.
3. Replace R103 (33K) with 470K.
4. Replace L101 with a 100K resistor.
5. Remove R112 (3.9K), complete B-plus circuit.
6. Replace X102 with 9-pin socket (with shield).
7. Remove wire from pin 1 and connect to pin 2.
8. Connect 1 meg resistor from pin 2 to ground.
9. Wire 12AT7 socket for 6V filaments. (Connect 6V to pins 4 and 5, and ground pin 9.)

This completes the modification of the rf amplifier. To construct the oscillator/mixer, remove the balance of the circuitry on the deck with the exception of the crystal socket. Then build the circuit shown in Fig. 3 around the new X102. Be sure to use silver mica capacitors in the crystal circuits. The crystals themselves are Motorola SFMT-2 (R11, 5 MHz), and they may be obtained from Sentry or International.

FIGURE 3



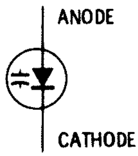


"Bobby says if I want to stay on the net I'll have to install a preamp, secode and a Permakay filter."

Practical circuit applications using that strange diode: the varactor

by **Bill Mengel**

The varactor is a simple two-terminal device extending dependable operation in the VHF, UHF, as well as microwave frequencies by utilizing the voltage-variable capacitance of a pn junction. The varactor provides a way of tuning circuits, multiplying and dividing frequencies, controlling frequencies, and performing other functions. A varactor, which is a special-purpose junction diode, has been designed to make its junction capacitance useful; it is because of this property of a varactor that capacitance, which is an unavoidable nuisance in conventional diodes, is purposely cultivated into the varactor. The basic configuration for the varactor is shown in the illustration below.



The operating portion of a varactor is in the region where a conventional diode would be considered to be cut off — principally in the region between forward conduction and reverse breakdown. In most cases, the varactor is reverse-biased since in this state it draws a minimum of current, making it essentially voltage-operated. The behavior of the pn junction of the varactor at different applied bias potentials is as follows:

ZERO BIAS — At zero bias, the contact potential is determined by the semiconductor. There is no change in capacitance and no current flowing at this time.

FORWARD BIAS — When forward-biased, high forward current flows as the external voltage applied is in series with the contact potential. The contact potential decreases thus increasing the capacitance.

REVERSE BIAS — When reverse-biased, the external voltage applied is in parallel with the contact potential. The contact potential increases, extremely low reverse current flows, and the capacity decreases.

The property of being able to vary the capacitance by changing the applied voltage enables the varactor to do the work of a conventional variable capacitor many times its size. The capacitance of a varactor varies inversely as the reverse voltage, and directly as the forward voltage. It may also be noted that the capacitance of a varactor also varies nonlinearly. Varactors also have a Q approaching that of air trimmer capacitors, so they could be used in such locations as rf front ends and high-efficiency multipliers as well as other normally sensitive circuits.

The varactor diode by itself is unique in frequency multiplying and dividing. First, the rf signal itself is the only power required to operate the varactor. Secondly, the varactor, by distorting the input signal develops an output rich in harmonics. Thirdly, a varactor can provide a means of high power output at frequencies normally beyond the limits of present power transistors. In frequency multiplication, it is only a matter of placing a tuned circuit (tuned to the input frequency) on one side of the varactor and placing another tuned circuit on the other side tuned at the desired harmonic. As shown in Fig. 1, the input circuit is tuned to frequency f. The output of this circuit is then fed to the varactor where it is distorted. This distorted output is then fed into an output circuit tuned to frequency f(n)out.

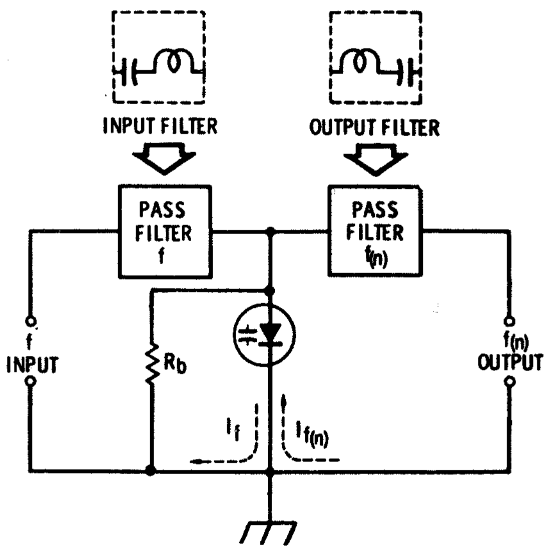


FIG. 1 FREQUENCY MULTIPLICATION

In typical frequency doublers, efficiencies as high as 90% — as compared to the 50% efficiency of conventional tubes and transistors — can be realized. This can be attributed to the fact that a varactor dissipates very little power and has low loss. A properly designed varactor multiplier does not generate noise. However, parametric oscillations can occur from highly overdriven varactors or from unwanted

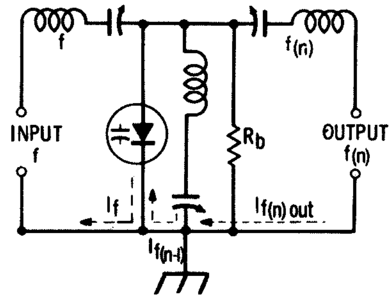


FIG. 2 POSTDOUBLER MULTIPLICATION

idler resonances. A bias resistor Rb (shown in the above diagram) will usually have a value of from 68K to 270K. The higher values of resistance make the circuit more efficient while the lower values of resistance make the circuit operate more linearly.

Since average capacitance varies with input power applied, some detuning will occur if the input power to a multiplier using a varactor is changed appreciably. All frequency multipliers beyond a doubler require an idler circuit for maximum efficiency. An idler circuit is used to reinforce the output frequency of a multiplier. This is done in the following manner. The current developed by the idler circuit is added to the fundamental current to form the harmonic current. The tuned frequency of an idler is generally set to one harmonic below the output frequency, as illustrated in Fig. 2.

A basic example will now illustrate the principles of operation of a typical varactor circuit. Our problem is that we want to take a present signal of, say, 150 MHz and develop an output of 450 MHz.

Referencing Fig. 3, capacitors C_2 are used to match the input and ouput of the tripler to the input and output impedances. With an input frequency of 150 MHz, the input filter is tuned to a frequency of 150 MHz. A type 1N4387 varactor is chosen. This varactor is capable of 60% efficiency at 450 MHz (offering a power output of

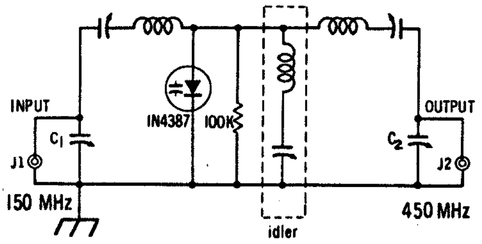


FIG. 3 VARACTOR TRIPLER CIRCUIT

18 watts with an input of 30 watts). The idler circuit is tuned to one harmonic below the output frequency. In this case the idler should be tuned to resonate at 300 MHz. The bias resistor is chosen as 100K so the circuit will operate linearly. The output circuit is then tuned to resonate at the desired output frequency (450 MHz). After alignment, it is a good idea to repeat the tuning procedure because there is almost always some interaction between stages.

Another use for the varactor is in the development of an FM signal. By rectifying a modulated signal and applying that fluctuating voltage to the terminals of a varactor, we could use the changing capacitance of the varactor to cause frequency deviation of an oscillator*. Hence, the development of frequency modulation via the varactor. Also, by properly proportioning the fluctuating audio voltage going into the varactor with respect to the oscillator, either narrowband or wideband FM may be obtained, as shown in Fig. 4.

In the circuit of Fig. 4, a rectified audio voltage is introduced at the potentiometer which can be adjusted to allow the required frequency deviation whether it be wideband or narrowband. The charging and discharging of capacitor C_1 through resistor R_1 applies a fluctuating voltage on the anode of the varactor. This fluctuating voltage will cause the capacitance capabilities of the varactor to vary, thereby pulling the oscillator off its center frequency.

As mentioned earlier, the property of being able to vary the capacitance of a varactor by varying the input voltage enables it to do the work of a conventional variable capacitor. One great advantage as opposed to conventional tuning is miniaturization. A typical varactor for this type of service in most cases is about the size of a small signal diode (1N34, for example) and this is many times smaller than even

**See "AM to FM Conversion," this issue.*

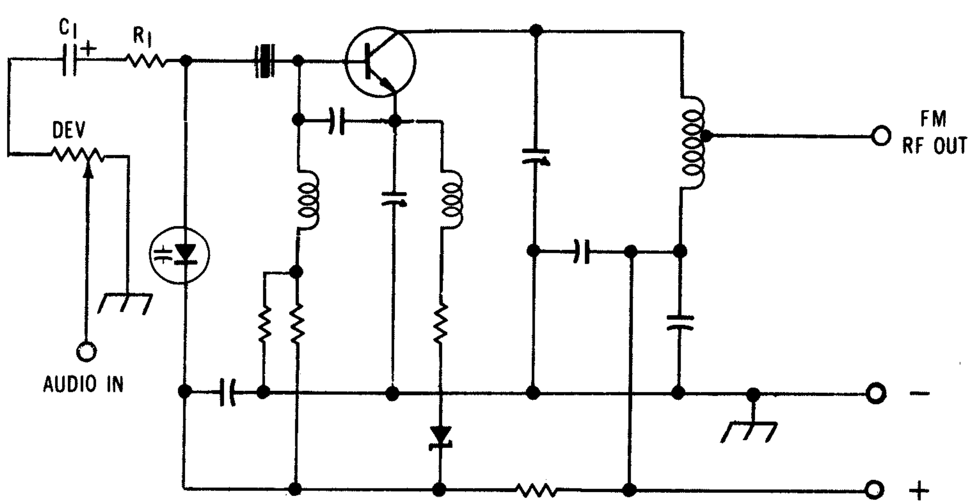


FIG. 4 FREQUENCY MODULATION USING THE VARACTOR

the smallest variable tuning capacitor. In cases where larger values of varactors are needed than is available, parallel operation is feasible. However, it must be kept in mind that both the minimum and the maximum capacitance capabilities are increased with parallel operation. Multistage tuning that at one time required a large ganged variable capacitor can now be controlled by a single small variable potentiometer by varying the dc control voltage to the varactor. The illustrations of Fig. 5 show a typical circuit using a varactor for tuning along with a circuit utilizing varactors for multistage tuning.

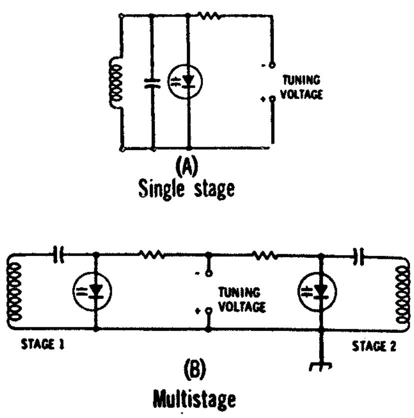


FIG. 5 VARACTOR TUNING

In the case of an FM receiver, a varactor can be utilized to regulate the amount of drift of the local oscillator by compensating for that drift and, in a sense, locking it on frequency. This type of circuit is commonly known as automatic frequency control or simply AFC.

What occurs in a typical AFC circuit (Fig. 6) is this: A correction voltage developed in the discriminator circuit is directed to a varactor through a filtering network. Any error in tuning will result in a voltage change at the discriminator and it is this change that is used to alter the capacitance of the varactor to compensate for that error. This changing capacitance is then used to complement the final tuning of the oscillator to lock it on frequency.

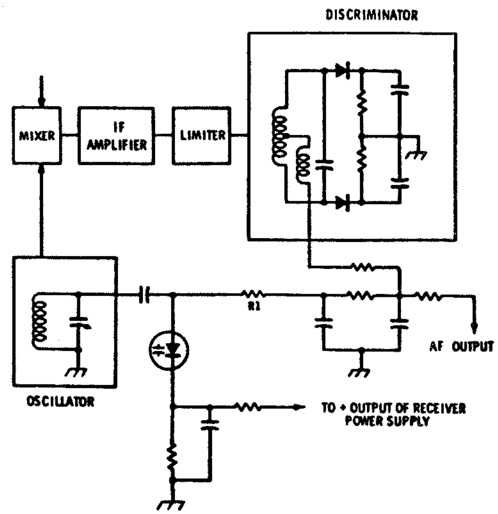


FIG. 6 VARACTOR AFC CIRCUIT

The possibilities of a varactor in communciations applications are almost limitless. Scan-tuning, a technique that once required many complicated circuits, is now simplified by a varactor: With scan-tuning, band sweeping is accomplished by applying a fluctuating voltage from a sawtooth oscillator. The sweeping rate is then predetermined by the frequency of that sawtooth oscillator.

This article just briefly illustrates how the varactor, a comparative newcomer to the field of semiconductors, opens the door to simplifying and improving many different types of electronic circuits.

Quickie CTS DECODER

by Louis J. "Buz" LaBonte*

Two common tubes, a few junkbox parts, and a Motorola VIBRASPONDER reed are all you need to build this commercial-quality PL decoder.

Remote operation of repeaters is one phase of amateur radio that has been increasing tremendously in the past few years. Repeaters have been springing up in areas where, not too long ago, there was no activity at all — even of a direct nature. Inevitably, with the rise of repeaters comes the rise of interference — interference from areas often not even considered likely to be potential sources of trouble.

On my own remote base station (referred to locally as the "Voice of Auburn"), I experienced some very elusive interference on the control link that caused spurious keying of not only the UHF repeater output but the low-band base station as well. Inadvertent keying of a high-powered base station at a strategic location can cause a bit of dissention, as many — including me — can attest. The Voice of Auburn, during this interference phase of its career, drew its share of criticism from local 51 MHz stations attempting to communicate on the output channel.

Although the source of the interference was traced to something as innocent as a military altimeter, the fact that emissions from the remote transmitter hampered communications was sufficient to create on-channel friction. The answer to the interference problem, of course, was installation of CTS (continuous-tone squelched) decoding and encoding networks, referred to on the west coast as PL, for private line. The big trouble here, however, was the fact that CTS equipment is hard to come by, difficult to build, and quite expensive when purchased new.

But it was a matter of either (1) designing relatively easy-to-build CTS circuitry, (2) spending beaucoup dollars for new stuff, or (3) staying off the air until the potential sources of interference were gone

*932 Dornajo Way No. 4
Sacramento, California 95825

for good. The Scotsman's blood in me kept me from going the "buy new" route. And I wasn't about to stay off the air; for one thing, there will always be interference sources, and with the passage of time the sources are likely to increase rather than diminish. So I was left with the prospect of original design and construction.

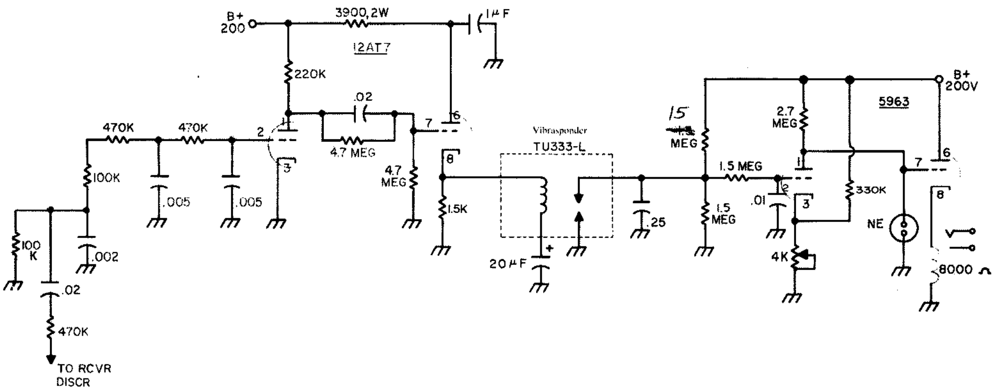
The result of it all, I am happy to report, was positive. A simple decoder was developed using readily available (and cheap!) parts. This equipment was placed into operation at the repeater site, and the control point was outfitted with a matching encoder (much easier to scorunge than the decoder). After two years of operation, the system still works with all the security it was designed for.

The decoder unit is shown in the schematic. Its sensitivity is such that 1 to 3 kHz of CTS deviation on any 15 KHz system will provide reliable and trouble-free operation with any signal capable of providing some degree of quieting into the repeater. The CTS frequency for which this decoder is designed can be anywhere between 80 and 200 Hz, as determined by the Vibrasponder reed (TU-333-L). The Vibrasponder may be obtained from radio service shops, or other two-way service organizations. They are hard to come by. Motorola will not sell reeds without special authorization from their zone headquarters, I obtained them stating they were "for control of amateur repeaters . . . and not for commercial or public safety use."

Audio to drive the decoder is obtained from the discriminator of the receiver into which it is to be connected. The 12AT7 amplifiies the signal to drive the reed. The output circuit (5963) drives a conventional 8 - 10K plate relay that may be used to key the transmitter directly or it may be connected in series with the repeater's carrier-operated relay for faster dropout. If there are additional functions to be triggered by the CTS decoder, it is a good idea to use the sensitive plate relay to drive a second relay constructed for heavy-duty applications.

The socket, a Motorola 9K832860, can be obtained from Motorola C & E. No changes are necessary to change frequency other than replacing the reed Vibrasponder.

Frequencies around 100 Hz or lower are preferred as they do not pass through the receiver audio section easily. Usually a filter is not required to eliminate the tone if it is below 100 Hz and encoder level is set properly.



the roadrunner

"Beep-Beep" oscillator indicates relative frequency of repeater input signals

by GORDON PUGH*

Considerable interest has been demonstrated recently in devices that will indicate when a transmitter is "netted" to the input frequency of a community repeater. The very useful gadget described in this article goes one step further: it also indicates *how well* the signal was received at the repeater.

It has been suggested that a variable-frequency tone could automatically be transmitted by a repeater, indicating incoming carrier frequency as detected by the receiver discriminator for the benefit of anyone listening on the repeater output. The trouble with this system is that the listener must have a reference tone available for comparison, or an audiofrequency counter. Or he must be endowed with perfect pitch. Transmission of a *pair of tones,* however, allows even those of us who are tone-deaf to determine whether the radio signal is on frequency. If the two beeps are transmitted *after* the incoming signal ends, the originating station can check his own frequency without assistance.

In application, the two-beep indication yields a strangely familiar sound suggesting the characteristic trademark of the animated Roadrunner cartoon creature.

The circuit for generating the "beep beep" uses a double-contact meter relay and a handful of other relays to produce three tone-beep combinations: low-high, high-low, and two of the same pitch. These combinations indicate that the discriminator is low, high, or within an "on frequency" range, based upon the settings of the meter relay. In addition, the circuit transmits the beeps only if the incoming carrier has held the carrier-operated relay energized continuously during the entire transmission. *Beep-width* modulation of the two tones to indicate signal strength will be described in a future article.

Indications

When the "Roadrunner" is installed in a repeater, the repeater carrier will remain on briefly after the incoming signal ends. (Many repeaters provide this feature now, but it is usually controlled by a timer in the transmitter circuit. If a long delay exists prior to installation, it may be desirable to disable the delay when using this circuit.) During the dropout delay two very short tones are heard sequentially on the repeater output, provided the incoming signal did not drop below the carrier-operated relay release threshold during the transmission. The tones will be of the same or two different pitches indicating the reading of the discriminator.

(CONT)

89 Trumbull Road
Manhasset, New York

Theory of Operation

As shown in Fig. 1, an external electronic timer is included to cut off the output keying circuit to the transmitter after five minutes of continuous input signal. The timer can be located in the transmitter plate circuit or elsewhere. It was designed into the keying control unit because the output is coupled to more than one transmitter in the existing application. For this reason the keying output circuit includes an additional diode-isolated output.

When an incoming signal is received, the carrier-operated relay closes, placing a ground on the KEYING IN terminal. This starts the electronic timer and operates relay DD1. Closure of the DD1 relay energizes the DD2 relay through normally closed contacts in the electronic timer and normally open contacts of the DD1 relay. The DD2 relay closes the output keying circuit to ground, keying the transmitter. Relay DD2 also closes the operating path to the DD3 relay.

Operation of the DD3 relay closes ground through contacts of the DD3 and the previously operated DD1 relay to the external meter relay common contact. The delay in supplying ground to the meter relay prevents false operation of the FL or FH relays by extraneous signals holding the meter relay at either the H or L contacts falsely. If the incoming signal is on frequency, relays FL and FH remain unoperated. If, however, either the high or low contacts of the meter relay are operated during the transmission, the FH or FL relays will operate and hold through their own contact and the DD3 normally open contact to ground.

Operation of the DD2 relay closes ground to and operates the BT2 relay. The BT2 relay closes ground to and operates the BT3 relay. The BT3 relay closes ground to and operates the BT4 relay. At this point the circuit is ready to send the beeps upon release of the carrier for periods in excess of the release time of relay BT.

An intermittent closure of the keying input circuit will lock out the beeps as follows: Operation of relays DD1, DD2 and DD3 will take place even with an intermittent input signal due to the slow release of the DD2 and DD3 relays. On the first release of the DD1 after operation of the DD2 and DD3 relays, the BT relay

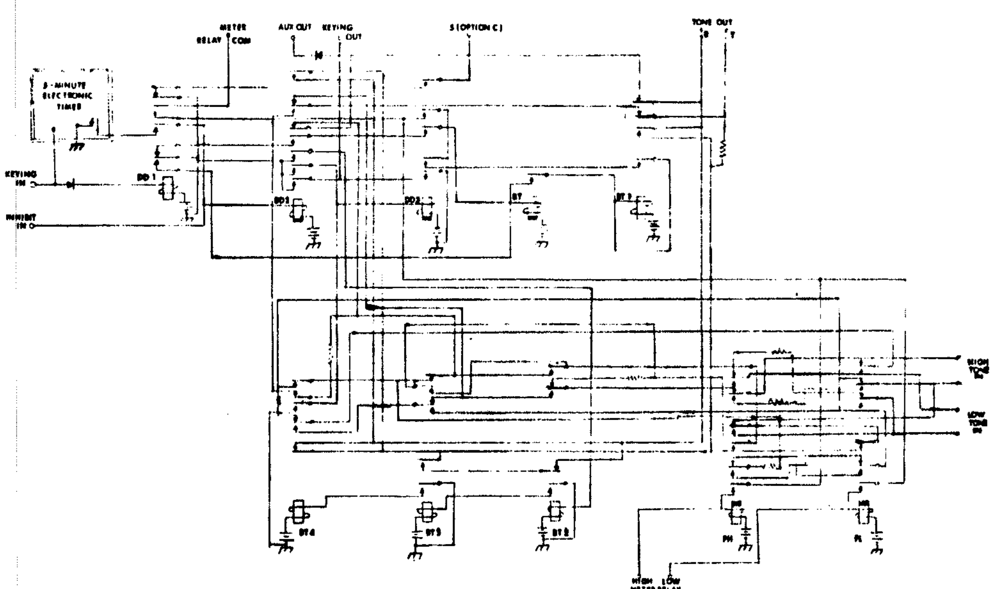


FIG. 1 ROADRUNNER DISCRIMINATOR-INDICATION CONTROL CIRCUIT.

operates through the normally closed contact of the DD1 and the normally open contacts of the DD3 relay. Operation of the DD1 *following* closure of the BT relay closes an operate path to the BT1 relay winding through the operated contacts of the slow-release BT relay and the operated contacts of the DD1 relay. The BT1 relay locks its own contacts through operated contacts of the DD3 relay. Operation of the BT1 relay breaks the tone circuit, preventing transmission of the beeps.

A received signal that has held the DD1 throughout the transmission will cause the following sequence when it ends: Release of the keying input ground releases the timer and the DD1 relay. Release of the DD1 relay operates the BT relay, breaks the operate path to the DD2 relay, and breaks the ground to the common meter relay contact. Removal of ground to the meter relay prevents false operation of the FH and FL relays by the discriminator action when no signal is present. The DD2 relay releases after 100 to 500 milliseconds (depending upon the relay selected), breaking the operate path to the BT and BT2 relays but not to relay DD3, which is held operated by the BT4 relay. Release of the DD2 cuts the first tone through to the transmitter from the high tone supply unless the FH relay is operated, in which case the low tone supply is cut through.

The BT2 releases following the DD2, interrupting the first tone and releasing the operate path to the BT3 relay. The BT3 relay releases, closing the path for the second tone through the BT4-operated contacts to the high tone supply unless the FL relay is operated, in which case the low tone supply is cut through. Release of the BT3 relay interrupts the operate path to the BT4 relay. Release of the BT4 relay interrupts the second tone and the operate path to the DD3 relay. Release of the DD3 relay after 100 to 500 milliseconds releases the output keying circuit, the holding path to the FL and FH relays and the operate path to the BT1 relay.

The release sequence is identical when the BT1 is operated, except that the tones are cut off by the BT1 relay. If the BT1 relay is held operated at the end of an incoming transmission, it releases upon release of the DD3 relay.

Release of the DD3 relay restores the circuit to the initial state, ready for the next transmission.

Options

If the repeater is subject to "hits" on the input receiver, the DD2 relay should be selected for both slow operate and slow release. To further delay the keying of the transmitter, use a slow-operate and slow-release type relay for DD3 and eliminate the make contact of the DD2 relay in the keying output circuit.

A single AFSK type oscillator may be used instead of the two tone supplies. This arrangement is shown in the detached-contact drawing of Fig. 2. The oscillator for the circuit shown would be mark-high (shift lead grounded). Option C is used together with the audio switching relays when the AFSK oscillator will not key rapidly enough to transmit the desired beeps accurately.

FH and FL relays are slow to operate. If the meter relay is highly damped, FH and FL relays should be made slower. Relays may be made to operate slowly by using a thermistor in *series* with the winding as shown in Fig. 1. The thermistor starts at a high resistance and drops to a low value when current passes through it (in the order of up to 100:1 ratio). Selection of the right thermistor can delay operation of a relay by several seconds.

Slow-release relays may also be made (but not to the same degree) with simple passive devices. The easiest way to slow the release of a relay is to connect a diode backwards across the winding. When the field starts to collapse in the relay, the

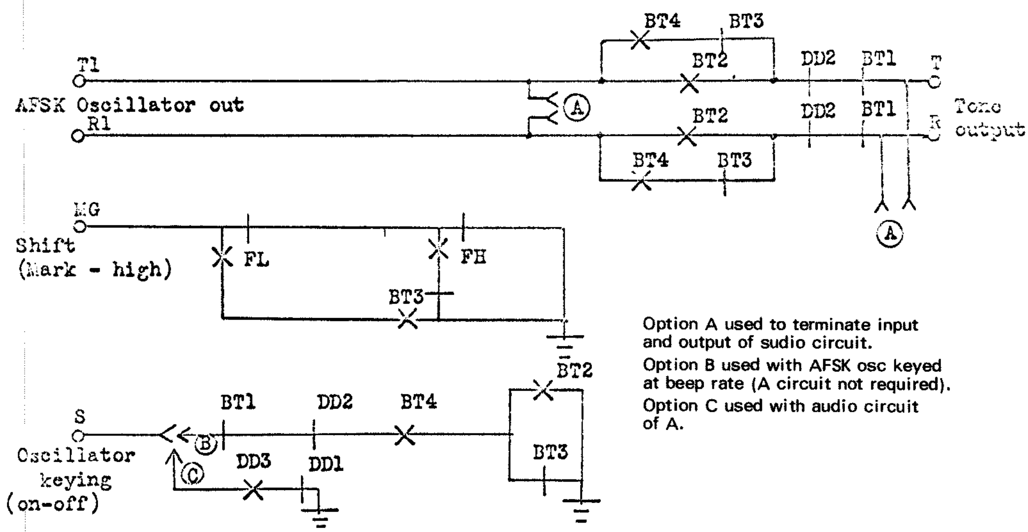


FIG. 2 TONE KEYING CIRCUIT USING SINGLE AFSK OSCILLATOR.

diode acts as a short on the winding, retarding the decay of the field. Another method is to short a second winding on the relay. These methods do not give a long time delay. To obtain delays over 250-500 millisceonds, an active solid-state circuit or multiple relays should be used.

The beeps produced by this circuit will depend upon the type of relay used for BT2, BT3, and BT4. It is suggested that ordinary fast-acting relays be used here. If the beeps are too short, use a diode across the winding of relays BT2 and BT4. To increase the interval between beeps, place a diode across the BT3 winding.

The beep tone circuit was designed to operate with a balanced audio impedance of 600 ohms in and out. Terminating resistors are shown in Fig. 1 to maintain proper load on the tone supplies. All resistors should be the same value as the tone supply output impedance.

When this circuit is used with an automatic tone identifier, the beeps should be inhibited during the identification period or the identification sequence should be delayed until after the beeps. To inhibit the beeps, a ground keyed by the ID unit may be supplied to the DD2 winding as shown in the schematic. Figure 3 shows an additional circuit to inhibit the identification sequence during the beep signal.

The following table shows the parts required to construct the Roadrunner, and identifies all relay contact arrangements.

NOTES:

Relay types

F — Fast acting

SR — Slow release

SO — Slow operate

Meter relay — 10-0-10 or 20-0-20 microamp with high and low nonlocking adjustable contacts.

Contacts

M — Normally open contact (A)

B — Normally closed contact (B)

BM — Transfer contact (C). In this equipment the contacts may be either break-before-make or make-before-break or combinations of both.

Thermistors

Select to provide desired delay in operation of the relay based upon the operate current, resistance, and supply voltage of the relay and circuit.

CONTACTS

Relay	Type	With Termination A	Without Termination A	Option B	Option C With Terminations	Option C Without Terminations
BT	SR	1M	1M	1M	1M	1M
BT1	F	2M, 2B	1M, 2B	1M, 2M	1M, 2B	3M, 2B
BT2	F	2M, 1B, 1BM	2M, 1BM	2M	3M, 2B	3M
BT3	F	3M, 1B, 1BM	2M, 1B, 1BM	1M, 1B, 1BM	3M, 2B, 1BM	1M, 2B, 1BM
BT4	F	2M, 2B, 1BM	2M, 1B, 1BM	2M, 1B	3M, 2B	3M
DD1	F	2M, 1BM	2M, 1BM	2M, 1BM	2M, 1B, 1BM	2M, 1B, 1BM
DD2	SR	4M, 2B, 1BM	4M, 1B, 1BM	4M, 1B	4M, 4B	4M, 2B
DD3	SR	4M	4M	4M	5M	5M
FH	SO	2M, 4BM	2M, 4BM	1M, 1BM	1M, 1BM	1M, 1BM
FL	SO	2M, 4BM	2M, 4BM	1M, 1BM	1M, 1BM	1M, 1BM

NOTES: Relay types
- F – Fast acting
- SR – Slow release
- SO – Slow operate
- Meter relay – 10-0-10 or 20-0-20 microamp with high and low non-locking adjustable contacts.

Contacts
- M – Normally open contact (A)
- B – Normally closed contact (B)
- BM – Transfer contact (C). In this equipment the contacts may be either break-before-make or make-before-break or combinations of both.

Thermistors

Select to provide desired delay in operation of the relay based upon the operate current, resistance, and supply coltage of the relay and circuit.

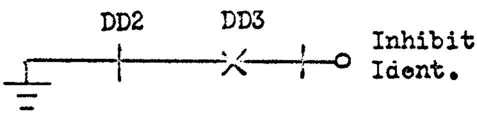


FIG. 3 INHIBIT IDENTIFICATION CIRCUIT

AM to FM . . . in 10 minutes!

by GAR HARRIS*

Are you one of the small percentage of FM Magazine readers — perhaps even a subscriber — who has never transmitted on FM simply because you had no FM equipment or no way of frequency-modulating your existing gear? Now there can be no excuse, for here are descriptions of two simple modification circuits, one of which will almost instantaneously put your vfo-operated transmitter on FM. The other is a bit more complex, but will do an equally good job on your crystal-controlled job.

Both modulators should be driven with a high output, high impedance crystal or ceramic microphone. No audio amplification other than that provided by the circuits themselves will be necessary.

The vfo varactor modulator, as simple as it is, seems to be a little-known but most effective method of producing frequency modulation; it utilizes the minute voltage generated by the piezoelectric action of the microphone element to cause the varactor to shift the vfo frequency at an audio rate, thus producing true FM (as opposed to phase modulation, which is found in most commercial gear). Although the actual shift is only a few hundred hertz, by the time the vfo frequency is multiplied 18 times (assuming an 8 MHz oscillator frequency) the total deviation will be more than enough to suffice for good communication.

The vfo varactor modulator shown in Fig. 1 may be assembled on a standard three-terminal phenolic tiestrip and tucked into a corner of most any vfo chassis. If all parts are purchased new, the total cost will be less than two dollars.

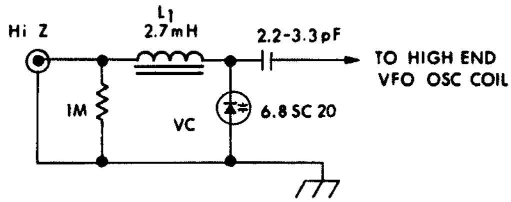


FIG. 1 VARACTOR FREQUENCY-MODULATOR FOR VFO-EQUIPPED AM RIGS.

Now, if you don't happen to have a vfo, it becomes a little more difficult to achieve a reasonable level of deviation since it is considerably more difficult to shift a crystal oscillator than it is a vfo. But it *can* be done without too much work or expense.

The schematic of Fig. 2 is straightforward and should require little explanation. A couple of ideas which might prove useful, however, are as follows:

1. Use the basic crystal frequency which will provide the highest multiplication factor; for example, use a 3, 4, or 6 MHz crystal rather than an 8 MHz fundamental frequency if your oscillator will accept it.

2. A 5-25 pF trimmer across the crystal will assist greatly in centering your transmitter on channel. Remember too, that not every crystal will work in every oscillator and be on frequency. It may be necessary to order a crystal specifically for your rig!

3. Resistor R6 may be varied to suit each individual varactor diode, although the value shown should give satisfactory operation.

* 828 S. Hudson Ave Los Angeles, CA

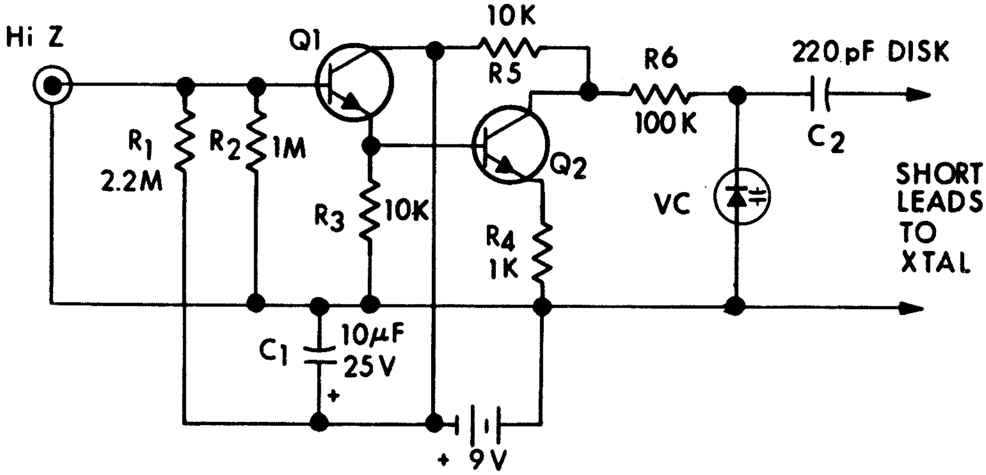


FIG. 2 VARACTOR FREQUENCY-MODULATOR CIRCUIT FOR CRYSTAL-CONTROLLED AM RIGS.

Whichever method you decide to use, much pleasure will be derived through the new associations encountered on FM. Remember though, that the only true way to fly is with a full FM system utilizing an FM receiver as well as a transmitter. Perhaps in the near future if there is a demand for same an article will appear covering an instant FM adapter for existing AM receivers.

FM COMPLETE INDEX FROM PAST ISSUES

ANTENNAS

COATHANGER GROUNDPLANE
Ken Sessions K6MVH, Jun 68
Abstract:
How to produce a professional-looking antenna from a coathanger and a standard chassis-type UHF connector. Cutting charts for 150 MHz and 450 MHz also included.

FRECQUENCY–INDEPENDENT BEAM
Ken Sessions K6MVH, mar 68
Abstract:
The theory behind the log periodic antenna. Sketches and data provided by the engineering staff of Prodelin, Inc.

LOWERING THE FREQUENCY OF OMNI GAIN ANTENNAS
Van Fields W2OQI, Jun 68
Abstract:
How to put off-frecquency antennas (like antennas that have been used in commercial service) to use in the amateur band without cutting into the antenna itself.

TWO–METER COLLINEAR
Bob Lans VE3BXA, feb 68
Abstract:
Condensation of an article which appeared earlier in Toronto FM Association Bulletin. Includes diagram that shows layout of antenna and electrical configuration.

CONSTRUCTION EQUIPMENT

AC SUPPLY FOR THE H23 HANDIE TALKIE
Richard Thomas W8VJC, nov 68
Abstract:
How to build a regulated ac supply to fit into a standard Motorola Handie-Talkie battery case.

AC THE GE EP2 POWER SUPPLY
Gary Hendrickson W3DTN, Sep 67
Abstract:
Complete step-by-step how-to on changing this mobile to a base

CAR RADIO CONVERTER
WA8ALL, Jun 67
Abstract:
Schematic and parts list for transistorized converter is crystal-controlled on six meters.

INTEGRATED CIRCUIT REPEATER IDENTIFIER
Tom Woore WB6BFM, Jan 69
Abstract:
Complete plans, schematics, pc layout and theory for building a cw repeater identification unit.

OSCILLATOR CIRCUITS FOR ALIGNING RECEIVERS
Mike Van Den Branden WA8UTB, Jun 67
Abstract:
Three crystal oscillator circuits using inexpensive transistors. Outputs: 8 MHz, 455 kHz, and 48.98 MHz

QUICKIE T–POWER WITH WHINE FILTER
C. L. Goltin, July, 68
Abstract:
An old filament transformer makes and ideal T-supply. A surplus 400 Hz transformer is even better. Article tells how to do it.

REMOTE CRYSTAL OSCILLATOR
Sam Craig W2ACM, July 68
Abstract:
A four channel oscillator using two transistors is described. Schematics, plans, chassis layout, circuir board "maps" are included.

R O L L – Y O U R – O W N 2 M HANDIE–TALKIE
Dan Haiger W8BCI, Dec 67, Jan 68, Feb 68
Abstract:
Complete "how to" on construction of transmitter, receiver, and power 2W amplifier.

SOLID–STATE COR
Jerry Schneider, Jun 68
Abstract:
Schematic and details on how to build a two-transistor carrier-operated relay. If you build it, add a IK resistor between bias pot and ground or you'll burn up the pot or some wire.

2 & 6 METER PREAMP
Anonymous, July 67
Abstract:
Two-transistor preamp circuit with 30–40 dB gain on six and two meters.

VHF–UHF "QUICKIE" PREAMPS
Ken Sessions K6MVH, Dec 68
Abstract:
How and where to use receiver preamplifiers. Includes two circuits, one for 150 MHz and one Milbury-designed unit for UHF. The UHF unit is a converted "final" cage from a UHF mobile unit.

CONVERSION

FM ON 10?
Joel Eschmann K9MLD, Jan 69
Abstract:
How to convert the GE4ET6 and 4E6 low-band units to ten meters. Includes photo and detailed schematics.

FOUR–FREQ CONVERSION FOR THE 450 PRE–PROG
James J. Lev K6DGX, July 68
Abstract:
The expert tells how it's done, with step-by-step instructions, complete schematics.

6–FREQ DECK FOR 80D and 140D TRANSMITTERS
Charles Copp W2ZSD, Aug 68
Abstract:
Photos, plans, layout for multi freq. oscillator deck using circuit shown in FM Schematic Digest.

FM ACTIVITY

ACTIVITY BOOMS IN NATIONS CAPITOL
Bob England W3JCN, July 67
Abstract:
As the name implies, a description of two-meter FM activity in Washington, D.C.

ARIZONA REPEATER ASSN
Peter Marshall K7AWI, Dec 67
Abstract:
How the Scottsdale group managed to snag a repeater site under unusual conditions.

CALIFORNIA SPEAKS UP
Ken Decker WA6OSP, Aug 67
Abstract:
General report of San Diego FM action.

CINCY TOO!!
Carl Morgan K8NHE, Aug 67
Abstract:
Activity on 6 and 2 meters around Cincy. Author includes opinion on 10-codes.

COMMUNITY FM CLINIC
Scott Kostenbauder W3WLF, Oct 68
Abstract:
A report on the formation of a "clinic" for tuning up, aligning, and frequency-checking radio units on a production line basis.

THE DAY FM TOOK OVER
Scott Kostendauder N3WLF, Oct 68
Abstract:
How FM got its start as the reliable communications medium in an area that was previously all AM.

FACTS AND FIGURES ON ROCHESTER
Mel Stoller K2AOQ, Nov 67
Abstract:
FM operation in and around Rochester

FORTY–NINE FM'ERS LOGGED
Marion Stoner W8VWY, Jun 67
Abstract:
A list of wide-band FM stations worked on "Oldtimers Day" at Dearborn. Frequency: 146.94 Mode: WBFM

FM IN NEVADA
Tom Burford W7TDQ, Dec 67
Abstract:
Rundown on current FM activity in the city of casinos

FREQUENCY COORDINATION IN CALIF
Jack Bankson WA6JXG, Dec 67
Abstract:
How the 450 MHz channels are allocated in the land of interference and secrecy

FT. WORTH REPEATER
Leslie Norman WA5HWW, Nov 67
Abstract:
A rundown on the continuing growth of FM's popularity in Texas and a report of a new repeater in Fort Worth.

GENESEE COUNTY FM
Gloria Sturn K8WKE, Nov 67
Abstract:
Pattern on activities in and around Flint, Michigan.

LA GETS REPEATER AND PROBLEMS
Ken Sessions, K6MVH, Nov 67
Abstract:
The humorous episode of how the LA repeater managed to rid itself of nonham interference.

SAN DIEGO
Ken Decker WA6OSB, Jan 68
Abstract:
Operational data on local activity

SOUTHEASTERN WASHINGTON
H. R. Hughes, Jr. K7VNV, Feb 68
Abstract:
A closeup glimpse at the FM activity around the lower portions of Washington State.

TOLEDO'S TEAR
Willard Shears W8HYE, Nov 67
Abstract:
Dissertation on Toledo emergency net activity.

MISCELLANEOUS

CHECKING CRYSTAL OVER
James Lev K6DGX, May 68
Abstract:
How to tell when an oven is bad.

CHESS BY HAM RADIO
Kayla Bloom W1EMV (Editor, 73), Jun 68
Abstract:
How to use the descriptive notation of chess for playing the game by radio

CONTROLLED CHARGING OF NI–CADS
Neil McKie WA6KLA, Sept 68
Abstract:
Plans and schematic for simple but ubiquitous charger. The capacitor in the circuit was incorrectly labeled electrolytic by editor. If you build it, make sure capacitor is nonpolarized.

DETROIT'S POLICE RADIO
Paul Van Wie W8IDJ, Aug 67
Abstract:
A rundown on local police communications, complete with photos.

INTERGONE
Willard Shears W8HYE, Sept 67
Abstract:
One solution to the TVI problem

THE TECHNICAL ABBREVIATION MYSTERY
Ken Sessions K6MVH, Sept 68
Abstract:
An explanation of the whys and whats in technical abbreviation; includes a completely uncalled-for slam against the ARRL.

10–4 TO YOU, TOO
Marion Stoner W8VWY, July 67
Abstract:
Controversial negative opinion on the 10-code system so popular with two-way industry and amateur FM'ers.

TWO–WIRE REMOTE WITH ZENER STABLIZED SQUELCH
Phil Ferrell, Sept 68
Abstract:
How to build a simple system for remoting the control of a transceiver to another part of the house. Also, how to use a Zener to eliminate squelch "drift".

HOW TO GET THE MOST FROM YOUR MOBILE
Bill Harris K9FOV, Jun 68
Abstract:
"Must" reading for FM newcomer who intends to go mobile. Installation hints, do's and don'ts. Written in Harris' inimitable "a touch of humor" style.

THE NEW CAR INSTALLATION
Staff, Mar 68
Abstract:
Suggested mounting ideas and installation hints for new car.

HAM REPEATER SITES – HOW THE U.S. GOV'T CAN HELP
Fred Daniel, Mar 68
Abstract:
How to get a lease on hilltop property by doing business with the U.S. Forest Service.

NI–CADS–HOW NOT TO RUIN THEM
Ken Sessions K6MVH, May 68
Abstract:
All about care and feeding of Ni–Cads with Schematics for chargers.

TRANSMITTER HUNTING
Pat Devlin K5BPS, Oct 68
Abstract:
Photos and story of transmitter hunting, an Am sport practiced on amateur FM in the Tulsa area.

THE FT. WORTH AIR FORCE
Leslie Norman WA5HWW, Nov 67
Abstract:
Photos and story of a group of flying FM'ers.

A CHEAPEE
Dave Freitag K8ZKZ, Aug 67
Abstract:
How to use a signal generator and diode to copy the 150 MHz public service band on a 146.94 MHz receiver without degrading the .94 operation.

TWO–FREQ & SIMULT MONITORING WITH GE 4ER6
Bill Harris K9FOV, Nov 68
Abstract:
How to modify oscillator of GE 4 ER6 for multifrequency operation; how to use more than one oscillator at once for multichannel monitoring with single receiver.

COMPLETE NARROWBANDING OF THE 450 MHz GE PRE–PROG
Jim Lev K6DGX, Nov 68
Abstract:
Article describes complete procedure for narrowbanding transmitter and receiver of the UHF GE Pre–Prog. Includes schematics and instructions for receiver oscillator modification to Prog-Line standards.

PUTTING THE NINIC POCKET RECEIVER ON CHANNEL
Donald Milbury W6YAN, May 68
Abstract:
Complete photos and schematics of the Ninic receiver with instructions for tuneup and alignment.

GE/MOTOROLA UNITS FOR UHF (450 MHZ) AMATEUR USE
Ken Sessions K6MVH, Nov 67
Abstract:
Good and bad points on popular mobile units. How to correct some of the bad. Includes DGX circuit for modifying Pre–Prog receiver oscillator.

CONVERTING THE 450MHz PROG LINE TELEPHONE MOBILE
C. L. Coltin K6VBT, Jan 69
Abstract:
Suggestions for putting the exmobilephone unit onto the UHF ham band.

IMPROVING THE GONSET G–151 FM COMMUNICATOR
Bill Harris K9FOV, Sept 68
Abstract;
The lowdown on a rare bird; includes lots of special tips for modifying audio and squelch circuits.

NEW LEASE ON LIFE FOR GE 450 PRE–PROG RECEIVERS
Jim Lev K6DGX, Aug 68

Abstract:
An expert on GE UHF gear gives some tips on improving reliability and service life of GE Pre–Progs.

CONVERTING THE 41V
Don Milbury W6YAN, July 68
Abstract:
Procedural steps on how to put a Motorola 41V on channel. Schematic included.

CONVERTING THE HANDIE–TALKIE
Bob Lyon WA6DTG, Jun 68
Abstract:
Procedural steps for getting the Motorola "Walkie" on amateur band (2M). Includes photos and schematic.

DUPLEX YOUR 450 MHz MOBILE
Jim Mann WB6JAJ, Mar 68
Abstract:
How to add a separate receiver supply to a UHF GE or Motorola mobile for duplex "phone-type" operation. Includes schematic and photos.

FM'ERS AID BOY SCOUTS
Flint, Mich. Jun 67
Abstract:
How a handful of 2m FM'ers helped the BSA in a clothing drive.

WICHITA REPEATER & CIVIL DEFENSE
Bob Novdstrom KOIFJ, Nov 68
Abstract:
How the Wichita Repeater group set up a Civil Defense net; how principals got local civic officials to participate and lend support. Article describes a few of the actual emergency situations in which the repeater was used as the communications medium.

SPOOK PATROL
Jim Grubs W8GRT, Dec 67
Abstract:
A report on Halloween services performed by the local FM'ers.

FM RADIO & PUBLIC SERVICE
Jack Bankson WA6JXG, May 68
Abstract:
How the local AREC net on 146.82 FM (San Gabriel Valley, CA) participates in civic functions.

PUBLIC SERVICE–LUCAS COUNTY
Mark Schnabel WA8SAE, Mar 68
Abstract:
Report of AREC group in action.

TOUCHTONE AS A STANDARDIZED CONTROL APPROACH
Bill Strack WA8ZTJ, Jun 68
Abstract:
Problems and advantages of using Touchtone for repeater control; includes technical data on Touchtone response characteristics.

REMOTES/REPEATERS . . . AND MOBILE CONTROL
Ken Sessions K6MVH, Nov 67
Abstract:
Arguments for the legality of mobile repeater control. A UHF/VHF mobile monitoring setup is described.

RF POWER TRANSFER BY REMOTE CONTROLKen Sessions K6MVH, Nov 67
Ken Sessions K6MVH, Nov 67
Abstract:
How to change power level on a remote transmitter by initiating a command to charge a fullwave power supply to a bridge. Also describes method for controlling a kilowatt Class C add-on amplifier. Includes circuits and pictorials.

PORTABLE DUAL-TONE DIGITAL ENCODER

Gary Hendrickson W3DTN, July 68
Abstract:
Article describes portable (handheld) and mobile encoders. Editorial error billed unit as dual-tone, but schematics are for single-tone units. Perfect for repeater function selection.

DIAL-ON FREQ STANDARD
C. L. Coltin K6VBT, Aug 68
Abstract:
Uniquely connected system lets you zero your mobiles and base stations to the repeater discriminator by remote control.

SIMPLIFIED TOUCHTONE DECODER FOR AMATEUR REPEATER USE
Pat Devlin WA5BPS and Dick Pembroke K5LDR
Sept 68
Abstract:
All-encompassing article on touchtone requirements with detailed construction data for professional-looking decoder. Schematic, plans, and photos of circuit board included.

TIMING DEVICES FOR REMOTE CONTROL
Ken Sessions K6MVH, Dec 68
Abstract:
Describes the basic types of timers with operational sketches of each variety. Tells how timers are employed in control system. Solid-state timer circuit included

MITCHELL ON TOUCHTONE
Gene Mitchell K3DSM, Dec 68
Abstract:
How to use logic elements (and gates) with Touchtone decoding circuits. Includes schematic and logic diagram.

TOUCHTONE DIAL FREQUENCIES
Bob England W3JCN, Aug 67
Abstract:
Chart shows frequency for each Touchtone digit.

QUICKIE TONE GENERATOR
Ken Sessions K6MVH, Jan 69
Abstract:
Plans for a single-transistor tone encoder suitable for use with single-tone systems.

TELEPHONE COMMAND OF REPEATER OPERATIONS
Ken Sessions K6MVH, Jan 69
Abstract:
How to use the repeater site's landline for backup control. Complete description with two schematics.

STABLE TONE UNITS FOR REMOTE RADIO CONTROL
C. L. Coltin K6VBT, Jan 68
Abstract:
Plans and article on single-tone encoder and decoder. Diodes were inadvertently reversed on decoder schematic.

DIALS AND SWITCHES AND THINGS LIKE THAT
Don Milbury W6YAN, Jan 68
Abstract:
How to use steppers in amateur control applications

TOUCHTONE: HOW TO USE IT FOR FM CONTROL
Gene Mitchell K3DSM, May 68
Abstract:
Schematics and suggestions for using Touchtone in repeater control applications. Incorrect schematics were shown in corrected form in June issue.

REPEATERS

THE FCC SPEAKS OUT ON REPEATERS
FCC staff, July 68
Abstract:
Acceptable practices, sanctions, etc. for repeater owners. A MUST.

NAVY MARS FM REPEATER
Jack McLeland W9ATK, June 67
Abstract:
A progress report on the MARS machine in Wisconsin and a description of the system.

TORONTO'S REPEATER TOWERS
Anonymous, Aug 67
Abstract:
Vital statistics on various repeaters, including VE3RPT, the Toronto machine.

REPEATER LOGGING STILL REQUIRED
Staff, Aug 68
Abstract:
Clarification of the logging issue.

THE SECOND INPUT CHANNEL
Gordon Pugh W2GHR, Aug 68
Abstract:
Using alternate inputs to a repeater; establishing a priority selection system.

LET'S PUT UP A REPEATER
P.L. Cohen WB4DZH, July 68
Abstract:

The formation of a repeater group and how the boys worked to get a repeater on the air.

REPEATER LICENSING - HOW TO BEAT THE HASSLE

Gary Hendrickson W3DTN, July 68
Abstract:
Helpful hints on licensing a repeater.

BUFFALO REPEATER
Gil Boelke W2EUP, Feb 68
Abstract:
A brief description of perhaps the most up-to-date repeater in the country by the expert who made it that way.

LOS ANGELES AREA REPEATER
Ken Sessions K6MVH, Nov 67
Abstract:
Complete technical and operational details on the LA repeater.

LAS VEGAS REPEATER ASSN
Tom Burford K7TDQ, Jan 68
Abstract:
Formation data and plans of the group.

W1JTB STORY
Gordon Pugh W2GHR, Dec 67, Jan 68
Abstract:
Photos, coverage plans, and operational data on the Killington machine.

BALTIMORE REPEATER
Bruce Carpenter W3YVV, Sept 67
Abstract:
Photos and operational description of WA3DZD, The Baltimore machine.

REPORTS

SOUND REASON FOR UNITING
Tom Burford K7TDQ, Feb 68
Abstract:
A few convincing words in favor of a national FM Association.

WHY-3-MIN. I.D.?
Harry Hughes K7VNV, Nov 67
Abstract:
The author gives his views on 3-minute ID rule and subjectively interprets logging requirements.

RIGS NEED ANTENNAS
Bob England W3JCN, Sept 67
Abstract:
Soapbox editorial on pushing repeaters off 146.94 MHz.

COMMON CARRIER, AMATEUR STYLE
Ken Sessions K6MVH, Jan 68
Abstract:
How some of the hilltop commandos in Southern California share the wealth.

ARE PHONE PATCHES LEGAL?
Ken Sessions K6MVH, Jan 68
Abstract:
A report on FCC's current (at the time) views.

FM TO BACK REPEATER RULES PLEA
Ken Sessions K6MVH, Jan 69
Abstract:
Suggested FCC Rules to govern future repeater operation.

MOTOROLA IC APPLICATION NOTE ABSTRACTS
Staff, Jan 69
Abstract:
Complete abstracts of Motorola's file of application notes.

THE CODE: A STEP BACKWARD?
Ken Sessions K6MVH, Editorial, Nov 68
Abstract:
Some rash editorializing and wishful thinking about an emotion-evoking subject that should never have been opened.

LANDMARK DECISION GIVES GREEN LIGHT
TO PHONE PATCHES
Ken Sessions K6MVH, Oct 68
Abstract:
Late news on FCC decisions based on aftermath of Carterfone hearings.

REALLOCATION
Don Milbury W6YAN, Oct 68
Abstract:
Report on an FCC plan destined to bring long-sought relief to crowded land-mobile services.

FCC ABOLISHMENT-AN ANSWER TO THE SPECTRUM SQUEEZE
Don Milbury W6YAN Sept 68
Abstract:
A report on an FCC meeting in which a prominent official recommended replacing FCC with a new authority.

SARAH-THE AMATEUR'S OSCAR
Staff, Aug 68
Abstract:
Announcement of annual amateur award by Sentry Mfg. Co. with listing of categories.

THE FM'ERS AND THE LAW
Ken Sessions K6MVH Editorial, July 68
Abstract:
Clearing up a few of the no-no's.

DOT DROPS BOMB ON VE's
Paul Hudson VE3CWA, July 68
Abstract:
A rundown on Canada's new restrictions.

CIVIL STRIFE: LONG ISLAND vs POUGHKEEPSIE
Ken Sessions K6MVH Editorial, Jun 68
Abstract:
A report of a conflict between two FM groups with suggestions for solution.

PARAMUS EXPO REPORT
Staff, Jun 68
Abstract:
Report on Paramus FM Conference, with data on League's participation.

ABOUT THOSE PROPOSALS
Pat Devlin WA5BPS, Aug 67
Abstract:
A discussion on repeater proposals with author's recommendations.

AM-FM: THE CONFLICT
Editorial, Ken Sessions K6MVH, Mar 68
Abstract:
The frequency debate between L.A. AM Races group and the local FM Channel.

REVIEWS

MOTOROLA LOW-PROFILE MOBILE ANTENNA
Staff, Feb 68
Abstract:
Writeup and two sketches.

PRE–PROG SCHEMATIC COLLECTION
Don Milbury W6YAN, Jun 68
Abstract:
GE's Schematic Books.

FM COMPARES 450 MHz MOBILE GAIN ANTENNAS
Don Milbury and Staff, July 68
Abstract:
A look at Larsen Antenna Specialists and, Com Prod Models.

ENVOY 764 MOBILE ANTENNA (6 and 2M)
Ken Sessions K6MVH, Aug 68
Abstract:
Photos and description of Hy Gain's Mobile gain antennas.

FDFM–2 FM TRANSCEIVER
Staff, Jan 69

TAB'S VHF HAM RADIO HANDBOOK
Ken Sessions K6MVH, Sept 68
Abstract:
A few harsh words about a handbook whose FM directory section was obsolete before the book was published.

TECHNICAL INFORMATION

ANTENNA MATCH
Michael Whittlesey WA8RUC, July 68
Abstract:
Theoretical data for the homebrew antenna fan.

DEVIATION SETTING BY CLEVER ESTIMATING
Bill Harris K9FOV, Oct 68
Abstract:
A few pointers on adjusting deviation when there are no expensive test instruments around the shop.

THE CASE FOR NARROWBAND
Robert Kelty W6DJT, Aug 68
Abstract:
Some comparisons of narrow with wide, with author's recommendation for narrowband based on certain claimed advantages.

DEFEATING DESENSITIZATION IN REPEATERS
Van R. Fields W2OQI, July 68
Abstract:
Article describes an unique and effective way of phasing out desensitization by feeding controlled transmitter signal into the receiver to cause cancellation.

INSIDE STORY OF $7 GEM
Gene Kralik, Sentry Mfg. Co., July 68
Abstract:
The birth of a crystal is described, from raw quartz through final inspection. Photos show each operation at Sentry's Chickasha plant.

ESTIMATING REPEATER COVERAGE
Ken Sessions K6MVH, Dec 68
Abstract:
Tells what to expect from your repeater installation by using standardized range-gaging techniques. Range chart included.

HYBRID LOOPS-"MAGIC RINGS" FOR REPEATERS
Gil Boelke W2EVP, July 68
Abstract:
Complete theory of loops plus plans for diplexing cavity arrangement that allows transmitting and receiving on a single antenna, simultaneously.

TWO METERS-A CROSS COUNTRY FM NETWORK?
Don Milbury W6YAN, Dec 67
Abstract:
Describes a means for using broadcast FM Stations for communicating on a compatible (but still illegal) basis.

THE TRANSISTORIZED POWER SUPPLY
Ken Sessions K6MVH, March 68
Abstract:
The advantages of transistors over vibrators in mobile supplies.

THE FINE ART OF RECEIVER ALIGNMENT
Don Milbury W6YAN, March 68
Abstract:
Article describes a surefire way to align GE receivers and tells how to tell when a receiver needs alighment in high and low i-f's and discriminator.

TELEPHONES

HYBRID COUPLING IN REMOTE TELEPHONES
Ken Sessions K6MVH, Dec 68
Abstracts:
Article describes basic requirements of automatic telephone patches (autopatches) and compares various commercial patches in an autopatch system. Includes complete autopatch circuit and describes how and why commercial patch must be modified.

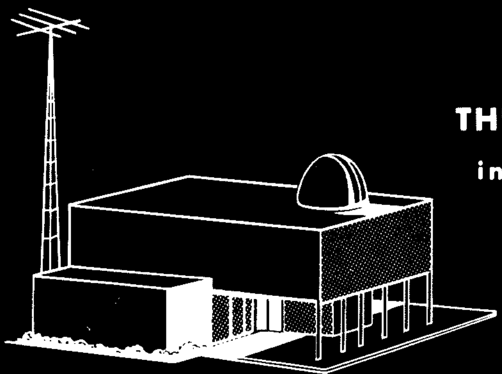
UHF AMATEUR MOBILE TELEPHONE
Ken Sessions K6MVH, July 68
Abstract:
Article and plans for ham mobilephone (autopatch); includes tone encoder and decoder schematics; dial hookup.

TELEPHONE OPERATION BY REMOTE CONTROL
Ken Sessions K6MVH, Dec 67
Abstract:
Complete description of autopatch; what it does, how it works. Circuit included for autopatch and "ring" oscillator.

HUMOR

STARTED IN CHOCAGA!
Bill Harris K9FOV, Jan 69
Abstract:
Delicious satire on how the 41V got invented.

CHRONICLES OF SEVEN-SIX
Ken Sessions K6MVH, Sept 67 through Sept 68
Abstract:
Humorous satire on Los Angeles FM operation; presented in series form. Channel of action is 146.76 MHz.



THE DAYTON AMATEUR RADIO ASSN.

invites you to attend the

DAYTON HAMVENTION

at Convention-Designed --- Saturday, April 26, 1969

Wampler
ARENA CENTER

1001 SHILOH SPRINGS ROAD
DAYTON 15, OHIO

12 Minutes From Downtown Dayton

Exhibits . . .

Among the many radio equipment manufacturers and parts distributors who will have their latest products on display during the Hamvention will be:

Aerotron (Gonset-Ameco), North Raleigh, N.C.
Collins Radio, Cedar Rapids, Iowa
Coston Electronics, Cincinnati, Ohio
Cowan Publishing Co., Port Washington, L.I., N.Y.
Design Industries, Texas
E. F. Johnson, Waseca, Minnesota
Evansville Amateur Radio, Evansville, Ind.
Fallert's Engraving, Hamilton, Ohio

FM Magazine

Galaxy Electronics, Council Bluffs, Iowa
Ham Radio Magazine, Greenville, N. H.
Hammarlund Manufacturing Co., Mars Hill, N. C.
Heath Company, Benton Harbor, Mich.
Hy Gain Electronics Corporation, Lincoln, Nebraska
Kirk Electronics, Dayton, Ohio
Mosley Electronics, Inc., Bridgeton, Missouri
Organs & Electronics, Lockport, Illinois
R. L. Drake Company, Miamisburg, Ohio
Raytrack Company, Columbus, Ohio
Spaulding Products Company, Frankfort, Indiana
Squires Sanders, Morris Plains, N. J.
Srepco Electronics, Dayton, Ohio
Stellar Industries, Inc., West Ithaca, N. Y.
Sylvania Electric Co., New York, N. Y.
Waters Manufacturing, Inc., Wayland, Mass.
73 Magazine, Peterborough, N. H.

Hidden Transmitter Hunt

A hidden transmitter hunt will be held at the Arena Center with the transmitter operating on about 430 mcs. A folded dipole 13-1/4" long connected in series with a germanium or silicon diode and a capacitor can serve as a receiver. Prizes will be awarded to the winners. Plan to participate. Write Dayton Hamvention for Rcvr/Ant diagram.

Call-in Frequencies . . .

W8RXM/8, at the Arena Center site will monitor the following frequencies for directions and information:

3.995 Mcs.	50.4 Mcs.	28.6 Mcs.
52.525 Mcs. FM		145.2 Mcs.

Flea Market

Giant Flea Market open all day Saturday for sellers and traders. Vendors must furnish their own tables. A Flea Market permit is required for sellers.

Bus Transportation . . .

Free bus from Sheraton-Dayton Hotel, Holiday Aire Motel, Howard Johnson's Lodge, Imperial House Motel North and Dayton Motor Hotel to Wampler's Friday from 1800 to 2200 and Saturday from 0730 until after the Banquet. Special bus service for Ladies DXpedition. Bus service between local airports, listed Motels or Hamvention provided courtesy John Meyer Volkswagon. Contact Dayton Hamvention in advance.

Parking . . .

Plenty of **free** parking is assured at the Arena Center. Self-contained trailers and camper units are permitted to park overnight in the arena parking area.

Dayton Hamvention
P.O. Box 44
Dayton, Ohio 45401

PAGE 57 IS MISSING FROM SOURCE

PAGE 58 IS MISSING FROM SOURCE

FM

CLASSIFIED ADVERTISING

Non-commercial advertising is accepted Free of charge from individuals, provided that the copy pertains to equipment relative to FM two-way service. However, insertion is contingent upon space availability. Classified Advertising of a commercial nature is accepted at $.10 per word, including the address. Payment must accompany the Ad copy and Agency commissions do not apply. A Reader Service Card number may be used in your Ad, for an additional five dollars.

FM is not responsible for the reliability of the statements made herein.

FOR SALE

RCA CARFONE 150, 12 volts mobile complete and tune for 146-940 MHz for $40. RCA Carfone 150, 110 volts, 2 channels tuned but choice burned for $50. Marconi 2 channel, 12 volt mobile tuned with spare cable for easier service for $50 with extra control head. Wiring diagram for all included. Will ship to USA if you pay transportation. P.B. Couture, 1380 Rue Duplessis, Sherbrooke Quebec. Phone (819) 562-6020

GE VOICE COMMANDER I, on 146.940 MHz, with charger and leather case. Voice Commander II with pre-amp, xtals on 94 simplex and 34 rpt., dry pack, and weather proof case, $125 ea. Ed Rasmussen, 275 Eyre St., Merritt Island, Fla Phone (305) 452-6348 8 to 9 p.m.

MOTOROLA 41V, mobile, 146.94 rev, 146.34/94 trans. $65 Larry Blouin, Warner Hill Road, Derry, N.H.

MOTOROLA 80D, on 146.34/46/94 transmit tuned cavity rec. on 146.940 MHz. Complete $125. Andrew Boucher, 131 Park Drive, Boston, MA 02215

MOTOROLA 41V BASE station on 52.525 MHz 2 freq. rec & trans. $75. Bob Coburn, R.F.D.-2 Tinkham Lane, Londonderry, NH. 03053

MOTOROLA T44AAV, T44A6A, L44 Base, 50 Br Base, 5V w/ac conv. parts, 30D Base 50 watt. t-33, 12VDC, H23 w/xsistor Rcur. Rtty Loop Supply in 19" rack. Homebrew wque t.v., RCA Remote, Alum 5' Rack, ESL Nuvistor Conv. 2 mtr-30-35 MHz. I.F., P.C. Lab Kit, Back issues of QST-CQ to '58. Popular Electronics also. Write or phone Ted Bleiman k9MDM 5025 N. Hamlin Ave., Chicago, Ill 60625 (312) 478-8986

RCA PERSONALFONE, Hi-band FM Pocket receivers, 17 transistors, 7 diodes. 12 volt, Squelch, volume control and built in speaker. $40 new and $30 used. Used receivers checked out and tuned up on your freq. for 146-170 MHz International crystal add $15. --1 watt miniature FM transmitter in metal case, 1½x2½x6, 4 MHz crystal, 9 tube, $12. ——¾ watt miniature FM transmitter, 1½x2½x5, 7 tube, 4 MHz crystal, $8. specify wide or narrow band. P.T.T. mic for above $1.50. Lapel SPKR for receiver $1. Schematics $ .25. Clubs ordering 5 or more receivers will receive free set of spare parts/mobules. James W. Holloway, 2027 Harton Rd., San Diego, CA 9213

BACK ISSUES OF FM are available for a limited time. Specify which issues you want. Aut. '67 and Jan., July, Aug., Sep., Oct., and Nov., '68 are $ .40 each. Dec. '68, Jan., and Feb. Oct., and Nov., '68 are $ .40 each. Dec. '68, Jan. and Feb. '69 are $ .60 each. Allow at least 4 weeks for mail delivery. Mail to FM , Back issues, 2005 Hollywood, Grosse Pointe, Michigan 48236

MOTOROLA L43G, Hi-band, AC utility, narrow banded, with mike, in operating condition, $140. FOB...Cletus G. Reinsel. Box 25, Bigler, PA 16825

PERMAKAY FILTERS, Motorola Permakay Filters No. TFN 6013AW wide band for Motrac 450MHz receivers, $4.00 each. Art Housholder, 1774 Farwell, Des Plaines, Illinois 60018. Ph. 827-3433.

MOTOROLA 450 T44A-6 excellent condition $40. ea. T44AAV $20. – $50. ea. J44AAB with PL $125. RCA CMU-15A less mic and spkr, some have 2-freq. receivers $15 ea. GE ¼ KW base Tx final $55. Hi-band T43GGV $125. ea. FMTRU-80D $50. ea. Motorola Station Monitor $275. Lo-band D41GGV with PL $40. – $70. ea. T41GGV with PL $75 – $100 ea. U41GGT with PL $150. ea. L51GJB 60w PL base $250. GE MT-16N 60w T-Power like new $175. All equipment complete with accessories. Lo-band equipment in the 40-50 MHz range. Also have Tx, Rx, and P.S. strips, xtals, single tone equipment, reeds and parts. Sorry we do not ship. Illinois Communications Co., Inc. 10347 S. Oxford Avenue, Chicago Ridge, Illinois, 60415, (312) 445-0364, 423-0364.

WANTED

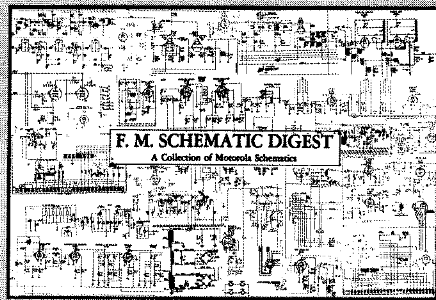
GE 30w TPL Late version, LO-band, with crystals on 52.525 and 52.640 MHz for a Hi-band TPL with crystals etc. Ed Rasmussen, 275 Eyre St., Merritt Island, Fla (305) 452-6348-8 to 9 p.m.

CALIFORNIANS: Why was "demonstrator" truned off? How can t be reactivated? Richard M. Jacobs, WAQAIY, 4941 Tracy Ave. Kansas City, Mo 64110 (816) 444-1968

COLLINS FRR-33 Remote switching control. Brevard Repeater Assn., P.O. Box 82, Palm Bay, Fla 32901

RECEIVER -450-470 MHz, for 110 vac, Home vsc. Warren Goldberg. 269 B Elmwood Ave. Maplewood, N.J. 07040

250 WATT BASE, L4366V Base, Motvac, HT-200, P-33, 140 By Base, Pocket Receiver, Battery charger for Ht 200, Deviation meter. I have to trade the following (All in mint condition.) (21) T43GGV's (some T power)-dual channel, (2) 41V's, 60 watt Comco Base, (2) 30 watt Comco, (2) GE 60 watt Bases, (2) 30D Bases, (4) FHtRu-IV, Lampkin 105B, B&W 5100 and 55B Adapter, C.B. Base, Leece Neville 100A,-12 volt alternator. Pick your combination and lets trade, or send me your best price-all my gear is 150 MHz and I want same. Carl Spatari. (K7KAE) 805 E 10th, Ellensburg, Wash.



LINK MODEL 2750, Schematic for remote mount, high band mobile, Circa Middle '50's. Present Link organization has no information. W. Van Aller, P.O. Box 351, Barneveld, NY 13304

MOTOROLA AC SUPPLY, for the L44AAB, B44, J44, or similiar units, to operate Transmitter and receiver strips of my T44A6A. If your AC Motorola supply is compatible please state price and condition, etc. Robert A. Young, Jr., 319 Wyatt Rd., Harrisburg, PA 17104

INSTRUCTION MANUAL and spare D.C.U.'s for a Beckman Berkley Model 7370 Frequency Counter. Also want B.B. 7572 converter module for 7570 series, frequency conversion equipment. Need manuals for this also. J.T. Greene III, Hwy 15 South, St. George, S.C. 29477

GONSET G-151-A, FM Communicator, in good repairable condition. W. J. Davis, 4434 Josie Ave., Lakewood, CA 90713

MOTOROLA SENSICON G or Uni-channel D reciever for lo-band. Will swap or sell a Collins KWM-2 mobile supply MP-2 $75. Los Angles, Calif.

MISCELLANEOUS

MARCH 29th, the Wexaukee Radio Club is holding their 9th Annual Swapshop in Cadillac, Michigan at the National Guard Armory, 9 A.M. to 4 p.m. No charge for table space and everyone is welcome. Lunches will be available at the armory.

MICH. APRL CONV., May 9-10 at the Grand Rapids Civic Auditorium and Pantlind Hotel in Grand Rapids, Michigan. FM meeting 11 a.m. Saturday, May 10. See ad in this issue. Check in on 52.525 or 146.940 MHz.

DAYTON HAMVENTION, April 26, 1969: Sponsored by the Dayton Amateur Radio Association for the 18th year. Technical sessions, exhibits and hidden transmitter hunt. An interesting ladies' program for XYLs. For information watch ads or circle number 76 on the Reader Service Card or write to: Dayton Hamvention, FM Activities, Box 44, Dayton, Ohio 45401.

FREE

PLUS

36

. . . just by taking advantage of this Sentry offer you can get a free Sentry crystal and 36 issues of FM for just $14.00. You will receive by return mail a coupon entitling you to any Sentry crystal valued from $5 to $7, for use in any two-way radio equipment. It comes with Sentry's full guarantee of frequency, stability, temperature, and performance. And you specify the holder type and operating frequency. Use the subscription card in the front of this book.

FM 2005 HOLLYWOOD GROSSE POINTE, MI. 48236