DECEMBER 1968

Radio Communication

incorporating RSGB BULLETIN

JOURNAL OF THE RADIO SOCIETY OF GREAT BRITAIN

The New RSGB Headquarters

see page 815

choose

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HIGH POWER TRANSCEIVER
500 watts PEP, 10-80 metres; SSB, AM, CW. Built-in 100KHz crystal calibrator.

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SSB TRANSCEIVER
180 watt PEP, 10-160 metres, complete AC psu, VOX, P.T.T.

KW VESPA Mark II
TRANSMITTER FOR ALL H.F. BANDS
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KW 1000
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1200 watts PEP with built-in psu and SWR indicator.

KW 201
AMATEUR BANDS COMMUNICATIONS RECEIVER
SSB CW, and AM; 10-160 metres.

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JANUARY
4 DECEMBER

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6 JANUARY

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DECEMBER 1968
VOLUME 44 No. 12

GAREX ELECTRONICS

MOBILE SOLID STATE POWER UNITS AND RF CONVERTERS READY BUILT OR IN KIT FORM

QQV03-10.2 metre TRANSMITTER KIT
6BH6-6BH6-QQV03-10-QQV30-10. 6 or 12 volt heaters. Inc. Valves AE relay 6 or 12 volt. Less Crystal 8 MHz. Modulator. P.S.U. & Chassis. Delivery 14 days. **£4 17 6**

2 metre converter AFZ 12 1st RF amp. AFZ 122nd RF amp: AFZ 12 osc-multiplier GEX 66 mixer: or equivalent transistors of equal performance. Built on printed circuit. Will operate from 8 to 14 volt neg. or pos. earth. Space inside case (5" × 2" × 6") to take battery for portable use. IF adjustable from 12 to 29 MHz. Crystal supplied is in this band, but cannot be specified at this price. Low noise figure. Guaranteed for 3 months. Postage 3/6. Delivery 14 days. **£8 17 6**

Garex ABP70. Transistorised 70cm converter. GM0290a grounded base RF amp. GM0290a mixer. Two trough line circuits at 432 Mc/s. Cathodean VHF crystal. 4½ db. noise figure. Built on copper clad fibre glass laminate and housed in 4½ in. × 3½ in. × 2 in. diecast box. IF 28-30 MHz ex stock; others to order over 20 MHz. 12 volt DC operation.
Postage 3/6 **£14 17 0**

NEW POPULAR
12 volt DC input. 300v DC 150ma output, or 175v at 100ma. Built on aluminium chassis 6 in. × 4 in. × 2½ in. with Toroidal transformer (2½ in. × 2 in. × 1⅞ in.) mounted on top of chassis.
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HEAVY DUTY
12v DC in. 390v DC 200ma out.: or 160v at 145ma. Built on chassis 8 in. × 5 in. × 2½ in. with Toroidal transformer (2⅞ in. h. × 2½ in. w. × 2½ in.) and large heat sink mounted on top of chassis. Postage 6/6 **£8 18 6**

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12v DC in. 400v DC 200ma out plus 250v at 150ma; or 200v only. Available on relay version. Built on aluminium chassis 8 in. × 5 in. × 2½ in. with Toroidal transformer (3½ in. h × 2½ in. w. × 2½ in.) and heat sink mounted on top of chassis.
Postage 6/6 **£11 15 0**

All above available with inputs and outputs relay controlled at 37/6 extra. All units are fully fused. Transformers are completely potted. Negative or positive earth without change, complete and working with 3 months Guarantee. Delivery 21 days. Outputs are measured with mobile vehicles. With static vehicle they will be a little lower.

KITS
2 metre transmitter kit (4m version available shortly). 6BH6—6BH6—QQV03-10—QQV03-20a. 6 or 12 volt heaters. Includes AE relay, 6 or 12 volt; and kit of spare valves. Full circuit and point to point wiring instructions. Items not included: Chassis Crystal (8 MHz), Modulator or P.S.U. Delivery 14 days. **£14 5 0**
Or less spare set of valves: £11 5 0.
Based on ready built units less chassis. All components, Toroidal transformer, relays and circuit supplied.

POPULAR Postage 4/6 **£3 15 0**
HEAVY DUTY Postage 6/6 **£4 12 0**

DE LUXE DUAL Postage 6/6 **£6 18 6**

MOBILE SOLID STATE MODULATED KITS

De Luxe 12 volt input. 15 watts output. Pre-tested wired and dipped printed circuit boards. OC700a and OA81 limiter. NKT 224 emitter follower. NKT223a amplifier. NKT224 emitter follower. NKT404/OC35 driver. Push Pull NKT404/OC35 output. Complete with transformer (includes P.A. winding) to match QQV03-20a. Inc. tailored mike, press to talk 300-3500 Hz. Average *wiring* time 30 minutes. Less chassis. Postage 6/6 **£7 17 6**

Standard Model 12 volts input. 15 watts output. OC71 amp. OC72 amp. on pre-tested wired and dipped, printed circuit board. NKT404/404/OC35 driver. P.P. NKT404/OC35 output. Including transformer to suit QQV03-20a. Inc. tailored mike 300-3500 Hz. Less chassis. Postage 6/6 **£4 15 0**

QQV03-10 modulator and audio amplifier dual purpose kit, relay switched. OC 200 mod. compressor, NKT223 emitter follower, NKT223a Tx mod. amp and Rx audio amp. NKT 223a emitter follower. NKT404 Tx and Rx driver. P.P. NKT 404 Mod. and Audio output. Complete with transformers. Pre-tested wired and dipped printed circuit board. Inc. tailored mike, press to talk. 300-3500 Hz. Less chassis
Postage 4/6 **£4 18 6**

Built with selected radiotelephone components. All kits include instructions & circuits. Negative or positive earth. Delivery ex stock unless otherwise stated. QQV06-40a/5894. **£2 0 0**

Valves
QQV03-10 **6/6**
QQV03-20a/C1134 **38/6**
TD03-5/DET 23. 2000 MHz Disc Seal triode **12/6**
E88CC **5/0**, 6AM4 **8/6**, 12AX7 **3/6.**

Transistors DT1602

Modulation Transformers
6V6/EL84p pto QQV03-20a Postage 4/6 **17 6**
6AQ5pp to QQV03-10 Postage 3/6 **12 6**
Single EL84 to QQV03-10 Postage 3/6 **10 0**

Transformers
Toroidal transformers for transistor power supplies. With secondary taps up to 390V 200ma 12V. DC input. New 2½h × 2½ × 2⅞ circuits provided **£2 7 6**

Aerial relay up to 200 mc/s 25 watts 6v or 12v coil **5 0**

Edge reading British 100 microamp calibrated in DB's scale slides out. Depth 3 in. overall width 2½ in. height 1½ in. **£1 7 6**

Postage packing insurance 2/6 except on valves large type 1/- & small type 6d each. Orders over £2 post free unless otherwise stated.

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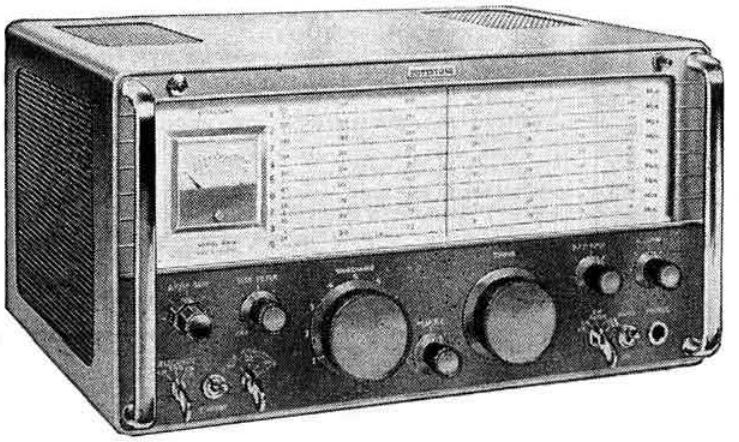
Eddystone

BRITISH MADE

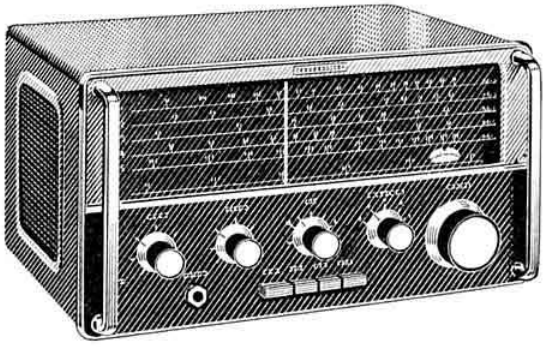
Amateur communications receivers

EA12



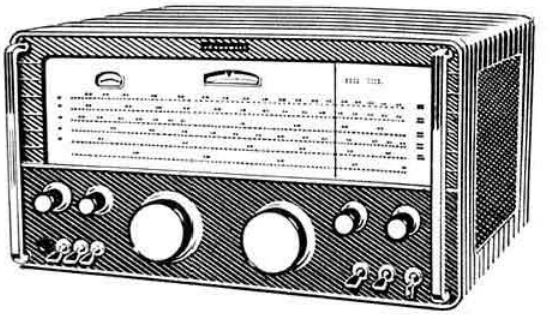
An amateur bands double-conversion superheterodyne receiver, for a.m, c.w, and s.s.b reception. For all amateur channels between 1.8 MHz and 30 MHz in nine 600 kHz bands with 28 MHz to 30 MHz in four bands.

Primary features. Crystal-controlled 1st oscillator, 2nd oscillator with continuously variable selectivity to 50 Hz, muting switched or by external relay, twin noise limiters, for a.m/c.w, and s.s.b, short-term drift better than 20 Hz and less than 100 Hz in any one hour, 'S' meter calibrated in nine levels of 6 dB and dB levels beyond 'S9', two a.g.c time constants, deep slot filter, independent r.f, i.f, and audio gain controls with outputs for f.s.k and panoramic adaptor.



EC10 communications receiver

The fully transistorized EC10 communications receiver, supreme in its class, covers both medium-wave broadcasting and all shortwave service to 30 MHz. Incorporating the famous Eddystone tuning drive, with logging scale and auxiliary vernier, shortwave reception is particularly simple. Battery-operated or from optional a.c mains unit.



940 H.F communications receiver

An outstanding 13-valve receiver with two r.f and two i.f stages, silicon diode noise limiter circuit and high quality push-pull output. Built to a professional specification, facilities include provision for c.w, a.m, and s.s.b reception over the range of 480 kHz to 30 MHz in five bands. Suitable for 110/125 V and 200/250 V. 40-60 Hz a.c mains.

Comprehensive information from your Eddystone distributor or: Eddystone Radio Limited, Eddystone Works, Alvechurch Road, Birmingham 31. Telephone: 021-475 2231. Telex: 33708

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LTD/ED551

RADIO SHACK

LONDON'S AMATEUR RADIO STOCKISTS

Hy-Gain have already increased their prices. You are still able to buy at the existing prices shown below during December, New prices effective January 1st. For instance the 18–AVQ 5 Band Vertical will then cost £35 10 0.

		£	s.	d.
18–AVQ	Vertical 10–80 metres	29	15	0
14–AVQ	Vertical 10–40 metres	18	0	0
12–AVQ	Vertical –1020 metres	16	0	0
LC–80Q	80 M Loading coil for 14–AVQ ...	4	15	0
14–RMQ	Roof mounting kit for 14–AVQ ...	5	15	0
12–RMQ	Roof mounting kit for 12–AVQ ...	5	0	0
18–HT	Hy-Tower 10–30 metre vertical ...	100	0	0
TH6DXX	Beam, triband, 6 element	85	10	0
TH3MK3	Beam, triband, 3 element	63	10	0
TH3JR	Beam, triband, 3 element, junior model	38	10	0
TH2MK3	Beam, triband, 2 element	38	10	0
DB–24A	Beam, Two band 20 and 40, 4 element	106	0	0
402BA	Beam, 40 metre, 2 element	65	0	0
204BA	Beam, 20 metre, 4 element	65	0	0
203BA	Beam, 20 metre, 3 elememt	46	10	0
153BA	Beam, 15 metre, 3 element	27	0	0
103BA	Beam, 10 metre, 3 element	23	0	0
BN–86	Balun for any Beam or Quad	8	0	0
Swan Transceivers and Accessories:				
350C	Transceiver	216	0	0
500C	Transceiver	263	0	0
TV–2	Transverter	150	0	0
230–XC	Power supply, A.C.	65	0	0
	Full range of accessories stocked also			
Omega	TE 7–01 Antennia noise bridge ...	13	0	0
EACO	CO–AX 4 4-way coaxial switch ...	3	15	0
Copal	101, 24 hour digital clocks	12	10	0
Copal	601, 24 hour digital clocks with day and date	18	15	0
CDR Rotators:				
AR–10	Suitable for 10 M and VHF beams ...	16	7	6
AR–22	Suitable for TH3JR and TA33JR... ...	22	9	0
TR–44	Suitable for larger antennas	38	0	0
Ham–M	Built for the biggest	65	10	0

New Equipment:

We have the biggest stocks of Drake and can supply anything in factory sealed cartons if you wish, otherwise we check before shipping. Swan transceivers and accessories straight off the shelf as is also the case with KW equipment.

If you are a millionaire buy your Collins from us and get rapid delivery of the latest models.

Down to earth with feet and prices we offer you amongst our Trade-ins.:

ACR–5. 3–6 mc/s. receiver	2	10	0
CR–100 receiver	15	0	0
AR–88D receiver and speaker	45	0	0
CR–150. Jap. verotone receiver	12	0	0
Collins 75S3 receiver. As new	225	0	0
Collins 30L–1 linear. As new	200	0	0
Racal RA–17 receiver. Perfect	235	0	0
Drake 2–C receiver. As new	99	0	0
Green LA–600 linear	50	0	0
Sommerkamp FL-100	75	0	0
Airmec radiation monitor 1021 B and Beta probe 1021			
Sanders VSWR Amp. Mk. 3 (list £110). As new, with manual	65	0	0
Telequipment Serviscope	25	0	0
Cossor scope 1049	15	0	0
Airmec 723 scope	45	0	0
Airmec phasemeter 206. As new condition and leads	75	0	0
Evershold recording voltmeter Murday system, D.C. 200v.	15	0	0
Crompton Parkinson wattmeter. D.C., A.C. 25–100 cycles 10A	15	0	0
Heathkit RF–IU sig. gen.	10	0	0
Ferris field strength meter, 32A 16–20 mc/s. ...	20	0	0
Marconi TF 801A/1. 10–310 mc/s.	30	0	0
Marconi UHF sig. gen. TF 762B. 300–600 mc/s. ...	35	0	0
Marconi Q meter TF 329G	35	0	0
Marconi video oscillator TF 410C	50	0	0
Marconi impedance bridge TF 373D	30	0	0
1 only—Hallicrafters HA–1 keyer. Brand new with guarantee. (List price £42 15 0) our price to clear	35	0	0
Trio JR 500SE. Brand new with guarantee. Our price to clear	60	0	0

Buy a Copal digital clock whilst they are at this excellent price

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TELEPHONE LEEDS 622131

EDDYSTONE EA12 Amateur bands double conversion Rx in nine 600 kHz bands 1·8 to 30 MHz. AM CW SSB. **£192.** Carriage £1.

EDDYSTONE EC 10. All transistor communications Rx. General coverage medium waves to 30 MHz battery operated with optional mains. **£59/10/0.** Carriage 10/-.

EDDYSTONE 940 C. 480 Kc/s to 30 Mcs in five overlapping ranges for CW AM & SSB. **£143/0/0,** carriage £1.

EDDYSTONE. General Coverage Communications Receiver Model 840 C. 480 kHz to 30 MHz. In excellent condition. Complete with matching plinth speaker **£45,** carriage £1.

TRIO 9R59DE. General coverage receiver 550 kHz to 30 MHz. Bandspread turning over Amateur bands. Employs two mechanical filters, product detector and large easy to read "S" meter. Large sae for leaflet. **£39/15/-,** carriage 10/-.

TRIO JR 500SE COMMUNICATIONS RECEIVER. All Amateur Bands from 3·5 MHz to 29·7 MHz. Direct reading down to 1 kHz. Dial speed ratio of 28-1. Incorporates solid state VFO with output for external Tx control. **£69/10/-.** Carriage 10/-. Large sae for leaflet.

TRIO HS-4 communications headphones. Large, soft padded earphones. Low impedance. Very smart. **£5/19/6,** P.P. 5/-.

HEATHKIT famous SB300 SSB Receiver. 80 through 10 metres, Amateur bands only. Extra CW & AM filters. Provision for transceive. In as new condition **£95,** carriage paid.

CODAR mini clipper all band RX kit miniature one valve, can be built in one evening. **£2/4/6.** P.P. 2/6.

CODAR AT5 TRANSMITTER. 160-80 metre fixed or mobile. Outstanding value. **£16/19/6.** P.P. 5/-.

CODAR mains power supply for above incorporating send receive switching **£8/10/-.** P.P. 7/6.

NATIONAL HRO. Jnr. Nine plug in coils, complete with original power supply. Roughish but going like a bomb, some of the coils need attention. **£12.** Where is and as is.

TVI BANISHED. High passfilters sharp cut off below 40 MHz. Neat metal case clips on to back of offending TV set. Short fly lead and coax plug and socket. Just insert in the TV line. A boon. **25/-** each. P.P. 2/6.

LEARNING MORSE? Code Oscillators. All-transistor. Speaker and jack for earphone. Key terminals and pitch control. Very smart appearance. **69/-,** P.P. 5/-.

G8KW TRAP DIPOLES. For all amateur bands, 80 to 10 metres. Complete with coaxial cable and ribbed glass pyrex insulators, ready to install. **£10/12/6,** P.P. 6/-.

DURAL MASTS. 28ft. × 2in. Dural masts. In two sections of 14ft. each complete with sturdy jointing sleeve, base plate and two guy clamps. price **£12/15/-,** carriage paid.

CERAMIC COIL FORMERS. 2¾in. diameter × 4½in., long grooved for winding. **21/-,** each. P.P. 1/6.

ANTENNA INSULATORS. ribbed heavy duty, 7in. long, **10/-** each, 3½in. long, **5/3** each, P.P. 1/6.
Beehive, egg and dipole centre insulators also available, P.P. 1/6.

SHACK TABLE ANGLE LAMPS. metal shade, adjustable angle, heavy case for stability, in black or white enamel, **£3,** P.P. 2/6.

AMPHENOL 83 series American type coax plugs and sockets **6/6** each Sleeve adaptors 2/-. P.P. 1/6.

HEATHKIT. The whole range of kits or assembled.

CORNELL DUBILIER AR22 Antenna rotator. Including remote control. Will handle any Amateur antenna, stand up to any weather. . . years and years of trouble free service. **£22/9/0.** Carriage 10/.

SHURE MICROPHONES
444T. Desk model PTT transistorised level control built in. **£15.**
444. Desk model PTT **£12/15/-.**
401A. Hand held PTT **£6/15/-.**
202. Hand held PTT **£6.**
201. Hand held PTT **£5/12/-.** P.P. 5/.

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Telephone Matlock 2817 (2430 evenings)

MERRY CHRISTMAS

The dust of the RSGB Exhibition has settled and things are pretty well back to normal I would have dearly loved to have had a natter with you, but things were pretty hectic and one can't very well chat about this and that when a dozen poor chaps are crowding round eager to thrust their pennies into my hot, grasping palm. I don't mind telling you that on Saturday night Mike, Allan and myself were absolutely beat—we were to the point of sleeping just where we fell! A great success, though. Normally, on the cost of the stand, expenses etc., I would expect to be out of pocket between £50 0s. 0d. and £100 0s. 0d. and write it off against advertising, but this year I more than broke even, so I am indeed chuffed. The highlight of the show was when Bill Lowe lifted an AR88 off the Stand and put it on the floor. There was a loud tearing noise as the seat of my pants split in twain. Rent assunder! The sight of a middleaged, nattily dressed Bill Lowe tottering down Victoria Street with his shirt tail stuck out the back must have given Londoners some cause for wonder. "I expect 'e's one o' them 'ams, Ethel, they're all a bit balmy."

Anyway, to get to the business of flogging, I have large stocks of new, glossy, expensive gear, but this time of year most people are a bit short of the folding stuff, so I'll concentrate more on the smaller goodies.

NEW:

Inoue range, Star SR-200, SR-700 and ST-700, Sommerkamp FR-500, FL-500, FL-2000, FT-150, FT-500 and by the time you read this, I may even have the FT-250 in stock. The What?? What on earth's the FT-250? Well, it's a transceiver kit at a very attractive price. Send me a s.a.e. and I'll give you the inside dope.

SECONDHAND:

Loads of stuff ranging from an old TCS12 up to an HRO500 with plenty of choice in between—give me a yell if you want s/h gear in top shape.

SPECIAL:

Anyone want the ultimate VFO? I have one or two things made by some outfit called Collins. They tune 2-4 mc/s. Phase locked a.f.c., direct readout to 50 cycles, yes, 50 cycles. Drift? There ain't any. 18 miniature tubes just for a VFO. I shudder to think what these cost. £45.0.0.

SUNDRY—ALL NEW

S.W.R. Bridges—Hansen 50 or 75 ohm. £3.10.0.

G.D.O.'s—Tech TE18, 360 kc/s-220 mc/s 240 V mains £11.10.0.

Headsets—The low-impedance padded jobs which were sold out at the Show. £2.2.6.

Converters—21 mc/s or 28 mc/s. These are a very hot converter—twin triode cascode r.f., 12AT7 low noise mixer/osc. and 6AU6 I.F. out. The output frequency is 5-5.5 mc/s (21 mc/s) and 5-7 mc/s (28 mc/s). They require 6.3 V a.c. and 150-200 V d.c. £7.10.0.

Keys—A plain, small, ordinary morse key with ball bearing pivots. 18.6.

Key with buzzer, ideal for getting that magic 12 w.p.m. 15.0.

C.W. Monitors—A nice job with a quiet high speed relay and spare contacts. £7.15.0.

Cable—75 and 300 ohm twin. 6d. per yard.

Tavasu mobile whips—Complete £12.10.0

Or just bits of it if you wish.

100 kc/s crystals—These are very accurate series resonant jobs to fit the HC6/U holder. £2.0.0.

Standard Aluminium Coax plugs—1/4 each, sockets 1/- each, line connectors 1/6d each.

PL259 plugs 5/- each, SO239 sockets 5/- each. PL259 reducers 1/3d each. Toggle switches SPDT 2/6d; DPST 2/9d; DPDT 3/-. Slide switches DPDT miniature or sub miniature 2/-. Valve holders B9A 8d, skirted 1/-, B7G skirted, 6d. Tubular trimmers ½-5pF or 3-15pF 1/- each, 10/- a doz. Feedthroughs screw type 1000pF 500 V 1/- each, 10/- doz. HC6/U xtal solders, 1/- each. Panel lampholders, bracket type green, enclosed type green or red, 2/- each. These are very small and take standard Lilliput bulbs. Lilliput bulbs, 6.3V 1/-. Rectifiers, silicon 500 mA 1000 piv, SE-05 4/6d each. Knobs, AR88 type, large 1/6d each, small 1/3d each. Filters, KVG XF9B 9 mc/s, £16.0.0. Kokusai 2.4; 600 cycle and 5 kc/s.

CAPACITORS:

Electrolytics:

100mfd/350V 5/6d; 100/100/350V 6/8d; 100/450V 7/2d; 100/100/450V 13/2d; 40/40/500V 7/3d; 100/500V 7/9d.

These are all prong types and complete with mounting clips. The following are all tiny little things for transistor work, less than ½" long wire ended. 100/12V 8d each, 7/- a doz; 10/16V 6d each 5/- a doz; 33/16V 8d each, 7/- a doz; 100/16V 1/- each, 10/- a doz:

Discs:

.01 500V 6d each 5/- a doz; .001 500V 4d each, 3/6d a doz. Small 50V types .002, .005, .01 3d each 2/6d a doz. .02 and .05 4d each 3/6d a doz. I should perhaps mention that I import these capacitors direct from Japan—I can get very much cheaper ones and flog 'em like hot cakes at very low prices, but I'm a firm believer in the fact that by and large you get exactly what you pay for, so I order the expensive ones knowing they are the best. You may possibly get them a bit cheaper than the above prices if you shop around carefully, but watch it, old buddy, watch it.

"GOD REST YE MERRY GENTLEMEN"

RADIO SOCIETY OF GREAT BRITAIN

FOUNDED 1913, INCORPORATED 1926

MEMBER SOCIETY INTERNATIONAL
AMATEUR RADIO UNION

PATRON: H.R.H. THE PRINCE PHILIP, DUKE OF EDINBURGH, KG

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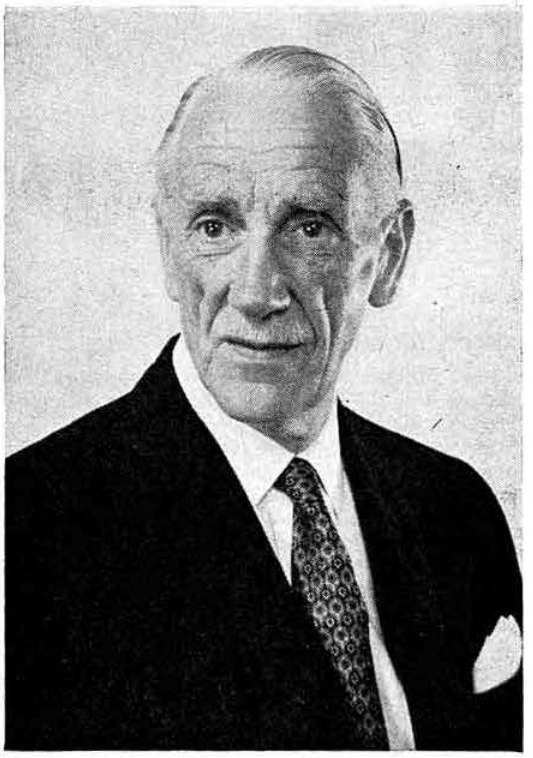
Region 8.—South Eastern.	D. N. T. Williams, G3MDO, Seletar, New House Lane, Thanington, Canterbury, Kent.
Region 9.—South Western.	J. Thorne G3PQE, Jessamine House Chapel Allerton, Axbridge, Somerset.
Region 10.—South Wales.	C. H. Parsons, GW8NP, 90 Maesycoed Road, Heath, Cardiff, Glam.
Region 11.—North Wales.	M. Williams, GW3LCQ, " Dwyros," 12 Penrhos Avenue West Llandudno Junction, Caerns.
Region 12.—North-East Scotland.	J. MacIntosh, FCCS, MIERE, FAIA, GM3IAA, Broom Park, Cradlehall, Inverness.
Region 13.—South-East Scotland.	G. P. Millar, GM3UM, 8 Plewlands Gardens, Edinburgh 10.
Region 14.—West Scotland.	N. G. Cox, GM3MUY, 191 Maxwell Avenue, Westerton, Bearsden, Glasgow.
Region 15.—Northern Ireland.	J. Thompson, GI3ILV " Albany," Newry Road, Armagh N. Ireland.
Region 16.—East Anglia.	W. J. Green, G3FBA, Meadway, Links Avenue, Brundall, Norwich, Norfolk, NOR 86Z
Region 17.—Southern.	C. Sharpe, G2HIF, 20 Harcourt Road, Wantage Berks.

CERTIFICATES MANAGER	C. R. Emary, G5GH, c/o RSGB HQ.
FILM LIBRARY CURATOR	R. A. Cathles, G3NDF, 4 Dawnay Road, Great Bookham, Leatherhead, Surrey.
INTRUDER WATCH ORGANIZER	C. J. Thomas, GW3PSM, 59 Maendy Way, West Pontenwydd, Cwmbran, Monmouthshire.
PUBLIC RELATIONS OFFICER	Mrs Sylvia Margolis, 95 Collinwood Gardens, Clayhall, Ilford, Essex.
QSL BUREAU MANAGER	A. O. Milne, G2MI, 29 Kechill Gardens, Bromley, Kent.
RECORDED LECTURE LIBRARY CURATOR	A. O. Milne, G2MI, 29 Kechill Gardens, Bromley, Kent.
SLOW MORSE PRACTICE TRANSMISSIONS ORGANIZER	M. A. C. MacBrayne, G3KGU, 25 Purlieu Way, Theydon Bois, Essex.
V.H.F. MANAGER	G. M. C. Stone, G3FZL, 11 Liphook Crescent, Forest Hill, London, SE23

A Christmas Message from our President



John Graham, G3TR

My year as President of the Society is now rapidly drawing to a close and it has been a memorable year for both the RSGB and myself.

The Society has moved into the new Headquarters building which we purchased last year. The permanent staff are now able to work in much better conditions than before and to provide a more efficient service to members.

We have published the long awaited Fourth Edition of the Handbook and this is a volume which should be on the bookshelf of every member.

The Class " B " Transmitting licence facilities have been extended to include the 2 metre band and an extension to the 4 metre band has been negotiated and is now available.

For myself it has been a year I shall never forget, always busy and at times even hectic. When I was installed in January, 1968, I said that I felt that close personal contact between the President and the membership was most important and hoped that I would be invited to visit clubs and to meet their members. The response to this has been overwhelming and I have visited more than forty clubs and met a very large number of their members.

The hospitality and kindness shown to me throughout my travels will never be forgotten and I am most grateful to all concerned.

In conclusion may I wish you all a very happy Christmas and a prosperous New Year.

QTC

The President, Council and Staff
of the Radio Society of Great Britain
wish all members a
Happy Christmas and Prosperous New Year

Licence Amendments

The Postmaster General has announced licensing changes which affect amateur sound and amateur television licences.

The changes announced are: The Four metre amateur band limits have been amended to read 70·025 MHz to 70·7 MHz. These changes affect the holders of amateur sound licences A, C and D together with sound mobile licences issued supplemental to the sound licence A. In addition sound mobile licences C and D.

The other licensing changes affect the 70cm amateur band. The frequency allocation has been amended to read 425 MHz to 429 MHz and 432 MHz to 450 MHz. This change affects holders of sound licences A, B, C and D and all amateur sound mobile licences.

The frequency limits for holders of amateur television licences has been amended to read 425 MHz to 429 MHz and 432 MHz to 445 MHz.

All of these licensing changes were effective from 1 November, 1968. Licences issued on or before 1 November, 1968, are amended in accordance with the preceding information, while licences issued after November, 1968 will automatically contain these amendments.

Post Office Bill Introduced

This Bill will change the status of the Post Office from that of a Government department to that of a nationalised corporation. The powers of the Postmaster General to licence radio stations, to control frequency usage and co-ordinate the use of radio apparatus for transmitting and receiving will be transferred to the new Minister of Posts and Telecommunications who will also be responsible for the oversight of the new Post Office. Vesting day for the new corporation is scheduled for the autumn of 1970. The new Ministry will be located in Waterloo Bridge Road and will presumably recruit staff from the existing Post Office headquarters.

The Bill is a very large document, having 224 pages and 138 clauses, and repeals or amends some 500 Acts of Parliament. Copies may be purchased from branches of H.M. Stationery Office.

Affiliated Societies and Clubs

The list of Affiliated Societies which appears in the RSGB Amateur Radio Call Book has been brought up to date and reprinted in leaflet form. Copies are available to Club secretaries and Members and requests should be sent to RSGB Headquarters.

The President honoured by the Federation Aeronautique International

John Graham, G3TR, who was until recently in charge of Air Traffic Control at Gatwick Airport, London, has been awarded an FAI Tissandier Diploma for outstanding service to private and general aviation in the field of Air Traffic Control.

John received his diploma at the 61st Convention of the FAI held at the Lecture Theatre of the Royal Aero Club in London.

Film Library Terms and Conditions

The Film Library is available to RSGB Members, Affiliated Societies and Groups, and for certain special purposes.

When booking RSGB films, hirers are asked (1) to state the date for which the films are required together with alternative dates where possible, (2) to state the name and address of the responsible officer to whom the films are to be sent, with telephone number (if any), and (3) to state the name of the Society or Group to which the films are to be screened. When bookings are accepted, an Invoice will be rendered and hirers are asked to remit the charges promptly in order to clinch the bookings.

It is a condition of the use of the Film Library that hirers are responsible for the safe handling of the films, and that liability is accepted for loss or damage to films (other than fair wear and tear) between the time of delivery of the films to them and the return of the films to the Library. RSGB 16mm sound-films may only be used on reputable and properly serviced 16mm sound projectors by experienced operators. It is also a condition of hire that films will be despatched promptly on the day following screening, any undue delay attracting liability for extra days hire by way of penalty. (This condition is intended as a safeguard to re-imburse the Library for any fees which may have to be returned to subsequent hirers arising from such failure to despatch promptly.) Should the Library be unable to deliver against a booking as a result of accident, or delay on the part of a previous hirer, liability will be limited to the return of the hire fees paid. The Film Library will make every effort to see that films are delivered in good time and in good condition ready for immediate use. Return labels are provided.

Booking correspondence should be sent direct to the Curator, G3NDF, and remittances made out to the *Company*, RSGB Film Library, Kine Production Services Limited, 4 Dawnay Rd., Gt. Bookham, Leatherhead, Surrey. Telephone number and telegraphic address is Bookham 3291.

See page 807

The Baden-Powell House, Jamboree on the Air station operating on the h.f. bands (see below)

Jamboree on the Air

AS in past years Baden-Powell House was on the air with GB3BPH and a special stand in the foyer containing four stations—80m using a KW2000A, 40m using a SB101, 20, 15 and 10m with a KW2000 + KW600 linear, and a 2m station with a 4 over 4 yagi.

The all Scout operator team included: Paul Wright, G3SEM; Bill Hayes, G3CJQ; Jeff Bottom, G3SDG; Alf Watts, G3FXC; Arnold Bryan, G2CAJ; Peter Kerry, G8AUZ; John Waters, G8CDO; Don Sheppard, G8CDR; Val Sedgeley, G8CDS.

John Waters, G8CDO, aged 15, Patrol Leader in the 1st Edgware, was our youngest operator and together with G8CDR and G8CDS operated for the first time.

The 80m station started at 2300 BST on the Friday until 2100 BST on the Sunday and for most of the time had a queue of stations waiting. The other stations operated from early morning till late at night. The H.F. Station was disappointing as conditions seemed poor, resulting in difficulty in hearing and working DX stations.

The stations made 424 contacts of which 126 were Scout stations—40 overseas in 18 countries, 86 British, with 23 using GB calls.

Many interesting contacts were made with other Scouts and as a result closer contacts will be made between other Scout Radio Groups.

New Headquarters Contributions to Fund

We acknowledge with thanks the following donations:

Bristol RSGB Group	£5
Chiltern ARC	£4 17s.
Cornish ARC	£10
Crawley ARC	£20 18s. 7d.
Crystal Palace DARC	£5
Verulam ARC	£1 1s.
Wolverton District ARC	£7

The total response to the " Harrow Challenge " now amounts to £200 3s. 11d., and we commend especially the following clubs which have made further contributions and established new " highs " as follows:

Chiltern ARC	£14 8s.
Crawley ARC	£27 9s. 1d.
	(8s. 5d. per member)
Crystal Palace DARC	£16
Verualm ARC	£6 7s.

Three Presidents meet at the EI-GI Convention, Ballymascanlon, earlier this year. Left to right are Leo Purcell, EI6D (IRTS), Bob Denniston, W0DX (ARRL) and John Graham, G3TR (RSGB)

Silent Key

We record with sorrow the passing of:
R. S. Collins, BRS1150, of Cockermouth, Cumberland.

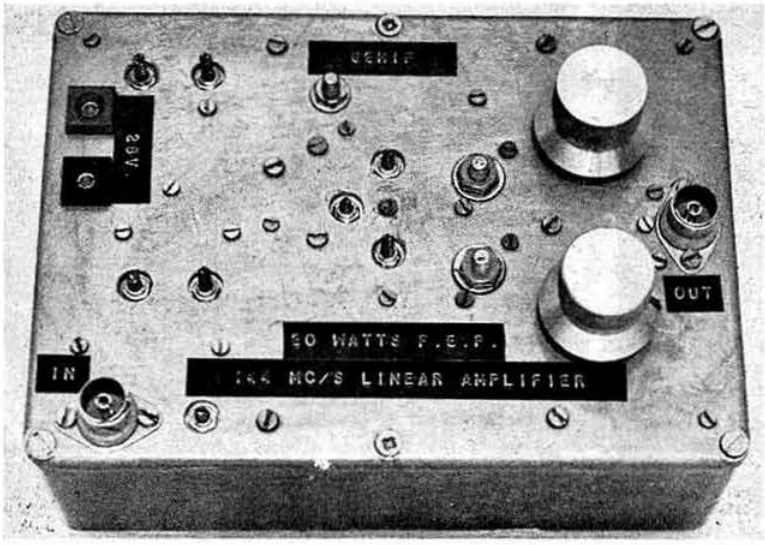
The RSGB News Bulletin Service

Every Sunday morning the RSGB News Bulletin, (GB2RS), is broadcast. The News Bulletin can be received on either v.h.f. or h.f., which gives almost complete coverage of the British Isles. It keeps radio amateurs informed about the latest happenings in the world of Amateur Radio and gives notice of future events.

This is the schedule for the RSGB News Bulletin:

Time (BST)	Frequency (MHz)	Location of Station
09.30	3·6	S.E. England
	145·1	S.E. England (beaming N.)
10.00	3·6	Severn Area
	145·1	S.E. England (beaming W.)
	145·8	Aberdeen (beaming W.)
10.15	145·8	Belfast
	145·8	Belfast (beaming S.)
10.30	3·6	N. Midlands
	145·8	Aberdeen (beaming S.W.)
	145·3	Birmingham Area (beaming N.W.)
11.00	3·6	N.W. England
	145·3	Birmingham Area (beaming S.W.)
11.30	3·6	S.W. Scotland
	145·5	Leeds (beaming N.)
12.00	3·6	N.E. Scotland
	145·5	Leeds (beaming E.)

Exhibitions—Beacons—Conventions—Contests—Local Events Rallies — Scientific Projects— Meetings— Licensing— Clubs Propagation Reports—Lectures—Field Days—Expeditions.



A Design for a V.H.F. Solid State Linear Amplifier

By CLIFF SHARPE, G2HIF*

Factors essential to the stability and "fail-safe" features of a 144 MHz Linear Amplifier are discussed. The criteria for interstage coupling networks are established, and a simple theoretical approach to the design is suggested. The parameters of a complete amplifier are determined in a worked example.

EARLY work on two experimental, 20 watt p.e.p. p.a. stages, each based on a couple of 2N3632 v.h.f. power transistors connected in parallel, established a number of factors vital to the successful development of a complete amplifier. The most important of these was proof that the theoretical approach, which for practical purposes had been reduced to the simplest possible terms, was valid. Since most circuit analysis has to rely upon making justifiable assumptions or approximations, it is a considerable help to the designer to know that he is building on a sound foundation.

Of almost equal importance during the determination of the final circuit was the need to include in the design particular features which were essential to the stability and reliability of the amplifier. The choice of interstage coupling networks, for example, was made not only upon the desirability of combining easy alignment with efficient energy transfer, but also upon other characteristics which could provide protection to the semiconductors in the event of any misadjustment or malfunction during alignment.

Initially, the lack of experience with v.h.f. power devices had condemned an excessively high proportion of the available transistors to a quick, and often violent end, so that it took many hours of trouble free operation before confidence was built up in the ultimate design. The final circuit, therefore, tends to err upon the side of "fail-safe" rather than upon achieving the maximum possible efficiency in all modes of operation.

An account of this initial development work which culminated in design criteria for the output stage, together with the evolution of the L-Pi Tank Network has been described already in an earlier article [1], and will not be repeated here. It is sufficient to state that the subsequent development of the complete amplifier not only strengthened the arguments in favour of all the salient features of the p.a. design, but also proved them to be equally important in the earlier stages of the amplifier.

The criteria and design method established by the high power output stage, required some reinforcement before they could be applied to the earlier stages of the amplifier in complete confidence. The higher impedances encountered in these stages created its own problems, particularly in respect of a tendency for the basic calculations to yield too large value reactances for practical application. Moreover, as the general design technique could be used in the deter-

* 20 Harcourt Road, Wantage, Berks.

mination of a variety of interstage coupling networks, consideration had to be given to each in order that the most suitable configuration could be adopted.

A number of circuits which appeared at first sight to possess special advantages were analysed by Malcolm Bibby, G3NJY, and subsequently tried out in experimental amplifiers with varying degrees of success. Before the assessment was complete, two unfortunate incidents occurred whilst using relatively conventional coupling networks, and compelled a re-appraisal of the mechanisms by which destructive failure of semiconductors can occur in this type of circuit.

Mechanism of Semiconductor Failure

An examination of damaged devices revealed three main categories of catastrophic failure; "punch-through" between collector and emitter; short circuit breakdown of either the base/emitter or the base/collector junction; and open circuited emitter connections. **(Readers are warned from breaking open many types of V.H.F. power transistors because damage to the berillium oxide seal could result in exposure to the highly toxic berillia particles.)**

In all those cases exhibiting open circuit emitters, the fine wire joining the semiconductor to the external terminals had fused. This was proved to be either a consequence of a failure in the device itself, or else due to excess current in an undamaged base/emitter junction.

Since these latter failures can almost always be avoided by the use of a rapid overload current cut-out in association with the supply rail, only those breakdowns directly attributable to junction failure were considered as being relevant in this context.

Damage to the device itself, as in the remaining cases, occurs when the junction has been subjected, often only momentarily, to an excess reverse voltage. Catastrophic failure happens almost instantaneously, and may be several orders faster than any current cut-out can sense the overload.

When a small quantity of new 2N3632 transistors were tested, all exhibited a collector/emitter breakdown considerably in excess of 65 volts; base/emitter resistance of 47 ohms. All the device failures examined were known to have occurred whilst the supply rail was stabilized at 26 volts, therefore it was not immediately obvious how the critical overvoltage had been exceeded in this application. The only conclusion to be drawn was that the usually accepted theory was not valid in this instance, and that peak to peak voltage swings greater than twice the supply rail had been generated.

Three mechanisms were eventually established as being primarily responsible; the sudden cessation of a heavy current flowing through a lightly damped, inductive load; the modulation of the supply rail (as seen by the collector) whether by an externally applied signal or as a consequence of a parasitic oscillation; and by parametric amplification of the r.f. signal resulting from variations in the transistor collector/base capacitance.

This latter condition, however, cannot be regarded as being a fault condition, and discussion of its behaviour is outside the scope of this article. It has been taken into account in the design of this amplifier, and readers who are interested in pursuing the subject are referred to papers by Muller and Figel [3], and by Hilbers [4], in which stability problems arising from parametric action are given a complex mathematical treatment to prove that the peak collector voltage can rise in normal operation to almost *three times* that of the supply rail.

All the foregoing collector excursions, even if insufficient to cause collector/emitter breakdown, can, in some quite conventional coupling networks, be communicated to the junctions of the succeeding stage, often with dire consequences. Equally disastrous, and for similar reasons, is the hazard of a suddenly short circuited supply rail; a factor often neglected under the mistaken impression that the more rapidly any overload trip operates, the better will be the protection afforded to the transistors.

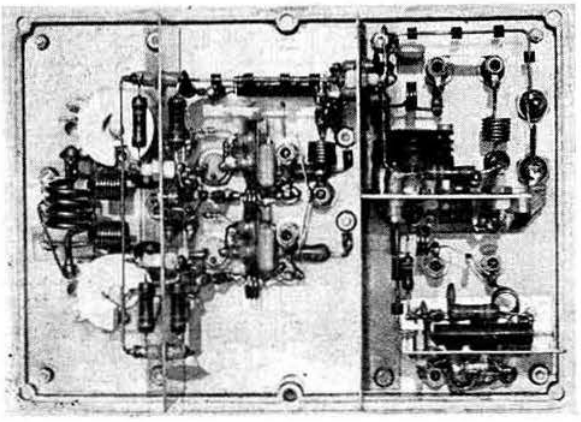
Typical of such undesirable interstage couplings are unnecessarily large value capacitors wired directly between a collector and base of the next stage. All types of low-pass filters, including pi networks, are also examples of circuit configurations which may, in the event of a malfunction, put a transistor at risk.

Design Criteria

Once a general approach to a design method has been accepted, the designer's job crystallizes into finding a solution to two main problems; that of optimizing the working conditions of each transistor in order to ensure maximum linearity, and that of determining a suitable interstage coupling network.

The design criteria which govern chokes and decoupling time constants are no less mandatory in the earlier stages of the amplifier than they are in the output stage, and the designer is well advised to adhere to those relevant factors discussed in the original article on p.a. tank circuit design [1]. Furthermore, every possible precaution to safeguard against interstage feedback must be taken since this can adversely affect the linearity of the amplifier before causing actual instability.

The ideal interstage network must possess several desirable characteristics which are not necessarily a feature of those networks found in common usage. In addition to being efficient and easy to align, such a coupling circuit must match the output impedance of one stage to the input impedance of the next without sacrificing those features which afford protection to the transistors in the event of overload, misalignment or mal-function. The network



The complete linear amplifier mounted on the lid of a diacast box.

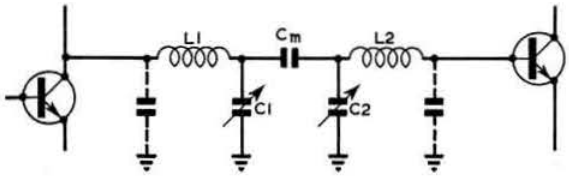


Fig. 1

must have sufficient bandwidth to work over the desired frequency range without the need to re-align, and still be capable of heavily attenuating, even under off tune conditions, the transfer of unwanted frequencies, transients and step functions from collector to succeeding base.

The circuit into which any transistor is connected should provide good current limiting to both d.c. and a.c. and there should be no tendencies towards ringing or self-oscillation as a consequence of shock excitation or unintentional positive feedback.

Parametric amplification at signal frequency will increase the efficiency of any amplifier stage operating in Class C, but where linearity and stability are of primary importance to the design, it is often preferrable to minimize these effects by a choice of coupling network parameters. The determination of any such network, therefore, must be sufficiently flexible to accommodate some choice of component value without compromising its essential characteristics.

Several advantages acrue from a network in which all the variable capacitors necessary to the routine alignment of the amplifier have a direct connection to the earth-plane or chassis. Mechanically, this reduces the mounting problems to one of providing a single hole fixing, whilst electrically the earth-plane reduces unwanted coupling to a minimum.

In a complete amplifier design incorporating four or five stages, the initial alignment and subsequent tuning-up procedure must be kept simple. At least two variable capacitors per stage is normal practice, therefore any network in which the capacitor settings are interdependent cannot be tolerated. The preferred procedure for a complex circuit is one of sequential tuning; the correct setting of each capacitor being determined by observation of the magnitude of the signal currents flowing in the load.

Interstage Coupling Network

The interstage coupling network which was finally chosen for all the stages of the amplifier is illustrated in Fig. 1. It is the only circuit which meets the requirements of efficient energy transfer and is entirely compatible with the design criteria stated above. The top capacity coupling capacitor, C_m, is determined during the initial alignment, but once set it requires no further adjustment; all subsequent tuning being carried out by independent alignment of the capacitors C_1 and C_2.

The theoretical approach used in calculating each tuned circuit is similar to that employed in the determination of the L-Pi tank network; Fig. 2. The optimum load for each transistor is calculated at the peak power rating of the stage in order to accommodate the signals developed during the maximum output on c.w., f.m. or at the peaks of amplitude modulation.

Minor variations in the approach, however, become necessary when the parallel combination (R_p), of the transistor output and load impedances result in values of inductive and capacitive reactance which cannot be realized in practice. In these circumstances, some advantage may be gained by postulating both a convenient value of Q (usually between 10 and 20) and a practical value of L_1 (say between 0·15 and 0·3 μH on 144 MHz).

These values may then be substituted in the formula

$$wL = QR_s$$

$w = 2\pi f$

L = inductance of L1

in order to derive R_s; the series resistive component of the resultant output circuit necessary to satisfy the parameters postulated.

The optimum shunt load, R_o, can be readily obtained from the familiar formula

$$R_o = \frac{(V_{cc} - V_{sat})^2}{2P}$$

where

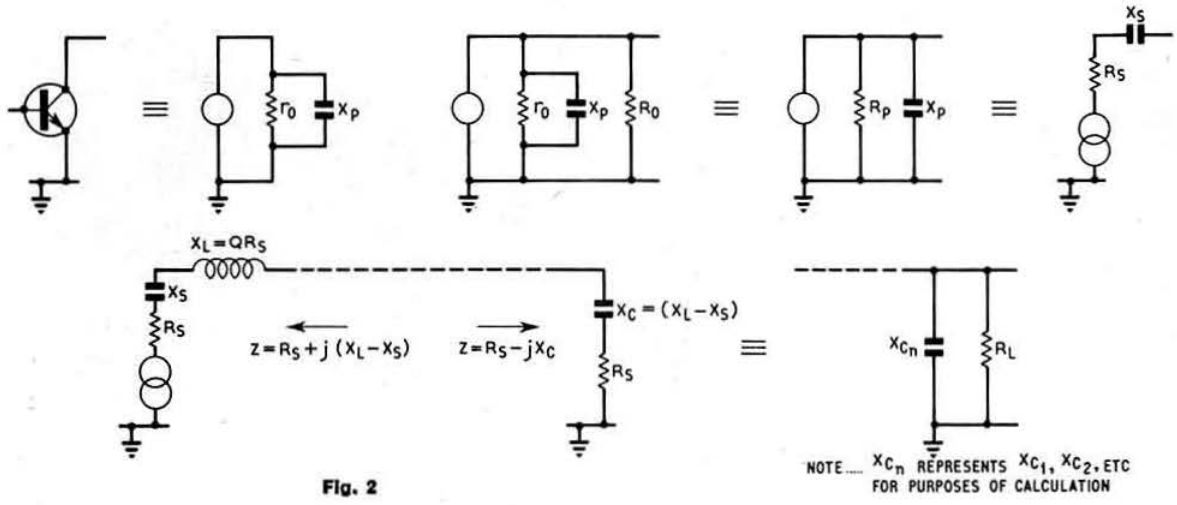


Fig. 2

V_{cc} = supply voltage
V_{sat} = saturation voltage
P = power output
and the shunt resistance, R_p, calculated by taking the optimum shunt load, R_o, and the transistor output resistance, r_o, in parallel.

$$R_p = \frac{R_o r_o}{R_o + r_o}$$

Thus by a simple substitution in the parallel to series conversion formula, a value of shunt reactance, X_p, to satisfy the equation

$$R_s = \frac{R_p X_p}{R_p^2 + X_p^2} X_p$$

may be found.

Unless an impossibly high value of inductance, L_1, has been chosen in the first instance, the value of capacitive reactance, X_p, will be smaller than that provided by the output capacity of the transistor alone, and an additional shunt capacitor may therefore be connected in parallel to make up the required value.

Certain practical advantages acrue from padding out this capacity quite apart from those of being able to postulate both the inductance L_1 and Q. Appearing in shunt with the output capacity of the transistor, this padding capacitor not only reduces the detuning effects which occur with signal amplitude, but also it minimizes parametric amplification due to the variations of transistor internal capacity.

The determination of the shunt reactance, X_p, enables the series reactance, X_s, to be calculated from

$$X_s = \frac{R_p X_p}{R_p^2 + X_p^2} R_p$$

so that the precise value of C_n may be derived by making a series to parallel conversion on the conjugate match for the impedance, $R_s + j(X_L - X_s)$.

However, since R_s is usually small for power levels greater than 250 mW, the value of C_n resulting from the conversion differs only marginally from the conjugate capacity. The difference is lost in the tuning adjustments in the practical network, and hence a trimmer equal to the conjugate value is adequate and renders the series-parallel conversion unnecessary.

The base input section of the network follows the normal derivation of an L section, and takes for the purposes of calculation the base series impedance as being the generator, and Q as being that value postulated in the determination of the first part of the network. The very low input impedances of power devices will result in equally low values of inductive and capacitive reactances, but in practice, these were found to be quite realizable on 144 MHz provided the connections are kept short. Inductance values less than 0·05 μH are apt to become swamped by the need to connect other components, therefore, if such values are required, a small increase in Q must be tolerated in both halves of the network.

The optimum transfer characteristics of the network occur when the two sections are critically coupled. At critical coupling

$$k\,(Q_1\,Q_2)^{\frac{1}{2}} = 1$$

where k is the coefficient of coupling and Q_1, Q_2 are the Qs of the sections. The value of k is approximately equal to

$$k \simeq C_m(C_1C_2)^{-\frac{1}{2}}$$

where C_1, C_2 are the tuning capacitors of the sections and C_m is the top coupling capacitor.

A value for C_m can thus be determined, and in practice works out to between 0·5 pF and 3·0 pF in the cases under discussion. Such a small value of capacitor offers excellent isolation between stages to lower frequency spurious signals, and at the same time allows the desired bandpass transfer characteristic at signal frequency. In addition, the amplitude of any transient step function voltages at a collector is most effectively reduced through the capacitive potentiometer, C_m and C_2, and also by the filtering action of the L section inductance, L_2, and the input capacitance of the subsequent stage.

The initial alignment of the interstage coupling network should always be carried out at sub-critical coupling. Each section should be resonated to the centre of the pass-band and the value of C_m then increased until no further rise in output is noted. If the network sections are over-critically coupled in order to obtain the familiar double humped pass-band characteristic, and thereby to give almost constant drive over the full bandwidth of 2m, the initial determination of the tuning should also be carried out at sub-critical coupling, but at a frequency h.f. of band centre. As the coupling is increased beyond the critical value, the second peak will appear l.f. of band centre. The correct setting of C_m will be that at which the humps are symmetrical about the centre of the band.

Once determined, the capacitor C_m will require no further adjustment. All subsequent circuit alignment, such as may be required by routine tuning at infrequent intervals, may be carried out merely by trimming C_1 and C_2 for maximum output into the amplifier load.

The Importance of Efficient Decoupling

Most essential to the overall stability of the amplifier is the need to ensure the efficient decoupling of all emitters and the supply rails to each stage. At 144 MHz, large value capacitors are too inductive to be satisfactory, whilst smaller values which are adequate at signal frequencies, often do not prevent spurious oscillations from developing at the lower frequencies where a choke and circuit capacitors become resonant. High and low value capacitors in shunt sometimes behave as a parallel tuned circuit resonant at or near signal frequency and therefore offer no solution.

The cheap "Ceramicon" filter which comprises two 1000 pF capacitors and a ferrite bead inductance connected as a Pi section, and designed to be soldered directly to the earth plane has excellent high frequency characteristics. The inductance can be neglected at low frequencies, and therefore does not impair the efficiency of any large value capacitor connected in shunt at the remote side. Such a combination of filter network and large value capacitor extends the frequency range over which the decoupling is effective, and liberal use of this technique throughout the amplifier contributes greatly to the overall stability under adverse conditions.

At frequencies above 100 MHz "Neosid" F14 ferrite beads are essentially resistive, and can be used as non-resonant chokes where the conventional inductances present the possibility of a resonance, and hence instability, on a spurious frequency. The base input circuit of v.h.f. power devices is particularly vulnerable in this respect, and this amplifier design takes full advantage of the ferrite bead's resistive properties on 144 MHz to provide a safe method of

decoupling a point where neither conventional resistive nor inductive impedances are desirable.

The Requirements of Linear Operation

The special requirements of linear amplification at radio frequencies impose further conditions upon the amplifier design. At very small signal levels, such as will be found at the input of the first transistor, only Class A operation is possible if true linearity is to be maintained. Fortunately the maximum power levels required to drive the next stage are within the capabilities of most medium sized transistors having an adequate gain-bandwidth product. The design procedure for the first stage is therefore conventional, and conforms to receiver practices except for the higher current ratings imposed by the power level.

The choice of semiconductor is not critical, and may be any device having a f_t greater than 500 MHz and a collector dissipation greater than half a watt. Expediency rather than design factors dictated the choice in the first instance to be a 2N3137, but the low power " overlay " device, 2N3866, is to be preferred, and has been incorporated in the final circuit.

At power levels larger than a few hundreds of milliwatts the limitations on the collector dissipation forbids operation in Class A unless excessively large devices are to be used uneconomically. A working point at, or very near, cut-off is essential in order to raise the efficiency, therefore a compromise is clearly necessary if the stage is to accommodate the wide dynamic range demanded by linear amplification.

These conflicting requirements for Class A and Class B operation at different power levels can be resolved only by allowing the working point to move with the signal envelope; that is, as the r.f. signal increases in amplitude, so the working point is permitted to move from the Class A condition towards and into Class B.

The initial d.c. conditions, which are determined by the circuit parameters, are such that each of the higher power stages are forward biased just sufficiently to allow linear amplification of small signals. As the device is driven into the higher peak currents by the signal input, so an increasing voltage developed across the decoupled emitter resistance back-biases the transistor towards the cut-off region. Ultimately, at maximum input, the working point moves into Class C thus permitting the stage to function at greater efficiencies. This bias voltage is augmented also by the base currents flowing through the resistor which provides the base return circuit to earth.

The time constant associated with the decoupling capacitor and emitter resistance is fairly critical. The capacitor must be chosen to have negligible reactance at signal frequency, yet form a time constant in association with the resistance which is short enough to follow closely the highest frequencies present in the modulation envelope.

Since the working point moves into Class C as the input level increases, care should always be taken to ensure that the maximum reverse base-emitter voltage of the device is never exceeded. Although normally a robust junction, the reverse rating is seldom more than 4·0 V in v.h.f. devices irrespective of their power rating. This junction in the 2N3632 transistor is no exception, and in this amplifier design these devices have been protected by fast diodes, normally inoperative, connected across the base-emitter junctions.

The protection offered by these diodes, however, does not extend beyond preventing any excess reverse voltages from developing across the base-emitter junction. Under conditions of heavy drive, the temperature of the junctions in a transistor can be expected to rise appreciably, and unless adequate precautions are taken, the initial Class A biasing conditions which are restored as the drive is removed need not be favourable to thermal stability at the higher temperature. It is good design, therefore, to safeguard any amplifier stage operating in Class A from thermal runaway by the provision of an adequate resistance in the emitter circuit.

In this amplifier, all stages are so protected, and additional d.c. stabilization is provided by developing the forward bias from a voltage which itself is dependent upon the mean collector current. This feedback operates so as to decrease the forward bias at the base-emitter junction as the collector current increases, and its action may be taken as being complimentary to that provided by the emitter resistance. Excellent d.c. stabilization, and complete protection against thermal runaway, is thus obtained.

The Circuit

The circuit diagram of the complete amplifier is given in Fig. 3. The transistor, TR1, a 2N3866 device operates as a straightforward Class A amplifier. The input to the stage is a parallel tuned circuit having a Q equal to 8; the input impedance of the stage and the co-axial line being matched by the appropriate taps on the coil. An input power of 20 mW is sufficient to drive the amplifier to its full output capabilities of more than 25W on c.w. Linearity is maintained to about 20W.

The first stage provides a power gain of not less than 10 to 12dB, and is designed to deliver 200 mW into the next stage through an interstage coupling network which operates at a Q of 12.

The transistor, TR2, a 2N3553, is the first of the stages in which the working point moves into Class B. The quiescent current of 15 mA increases with drive to approximately 90 mA, and the temperature rise is kept well below the maximum ratings by the small heat sink in which the device is mounted. Both the series input and parallel output impedances of TR2 have been taken from the manufacturer's data sheets as being 12 ohms resistive, $+j$ 1·2 ohms reactive, and 160 ohms resistive, $-j$ 84 ohms reactive respectively at 144 MHz.

The interstage network to TR3 operates at a Q of 12 and a peak power level of 1·5 watts. Stage gain is 8 to 10dB.

The power driver stage, TR3, a 2N3632 transistor, is able to deliver a maximum power of 6 watts to the output stages, TR4 and TR5; the quiescent collector current of 15 mA rising to over 200 mA at this output level. The stage gain is approximately 7dB. The series input impedance at the 6W rating and 144 MHz has been taken to be 9·0 ohms resistive, $+j$ 0·5 ohms reactive. The shunt output impedances from the data sheets are 75 ohms resistive, $-j$ 50 ohms reactive.

The diode, D1, is provided to give protection to the 2N3632 transistor by preventing any excess drive from developing more than the rated maximum reverse base-emitter voltage. Similar diode protection, D2, D3 and D4, D5, is fitted to the input circuits of the output transistors, TR4 and TR5.

A simple modification of the coupling networks used in the earlier stages allows the output transistors, TR4 and TR5, to be driven in parallel without departing from the design criteria or method in any way. The actual power level delivered to each transistor depends upon two factors; the

precise values of the top coupling capacitors, C_{12} and C_{13}, and/or the input impedances of the two similar halves of the network into which these capacitors couple.

Practical considerations make it desirable to share the drive power by minor adjustments of C_{12} and C_{13}, although the latter parameter can be trimmed by adding an extra capacitor in shunt with the transistor base input capacity.

Each section of this coupling network operates with a Q of 15. The series input impedance of each of the output transistors is 6·5 ohms resistive, $+j$ 1·0 ohms reactive. The quiescent collector currents of each output transistor, as with the power driver stage, is set by the circuit constants to be 15 mA. At full drive (c.w.) the mean current of each transistor rises to over 500 mA when the combined output should be at least 20W. If the supply rail is increased to compensate for the voltage drop across the resistances in series with the transistors, the absolute maximum power output on c.w. can approach 26W although at this level linearity cannot be maintained. The stage gain in the linear mode is approximately 6 to 8dB.

In this final design, the collectors of TR4 and TR5 are matched into the Pi tank circuit through independent L sections in order to provide better isolation between the paralleled transistors. The performance of this variation of the L-Pi tank differs only marginally from the conventional network, and the independent L sections result in a more stable configuration which contributes to the "fail-safe" characteristics of the amplifier.

As with the lower power stages, the shunt output impedance of each of the final transistors is a function of the frequency and the power level at which the stage operates. In this case, the figures relative to a 10W rating are 62 ohms resistive and $-j$ 46 ohms reactive.

Minor variations in these parameters can be expected not only between different models of the amplifier, but also between the transistors themselves, especially as no attempt has been made to swamp the parametric capacities. However, the L-Pi tank circuit retains the tuning flexibility of the conventional Pi tank, and no difficulties will be experienced in taking up these variations whilst matching the output stage into a 50 ohm load.

The p.a. stages may be tuned either for maximum power output on c.w. or for optimum linearity. In this latter case, the best performance may be expected if the alignment is carried out whilst delivering about 8W to the load on c.w. Under these conditions, the input signal may be modulated to 100 per cent before the output gives any indication of reaching saturation on the positive peaks of the modulation envelope.

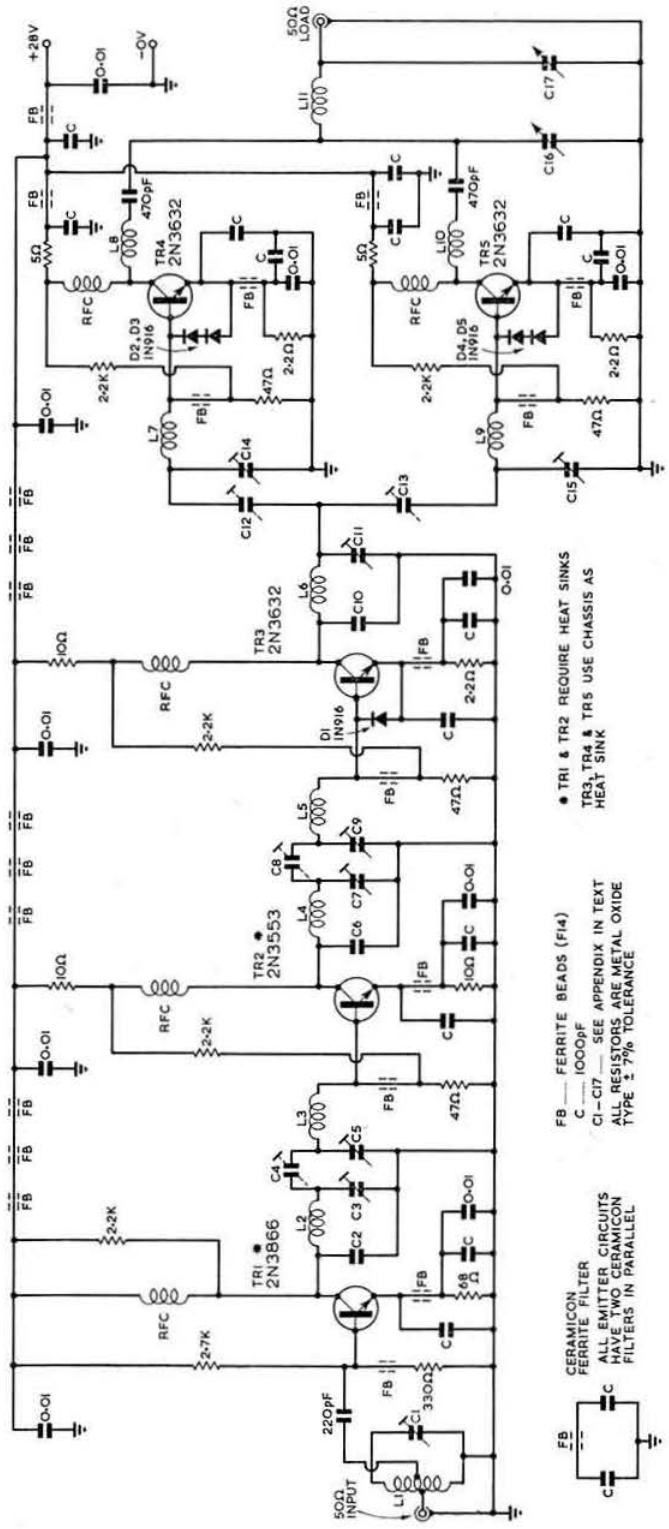
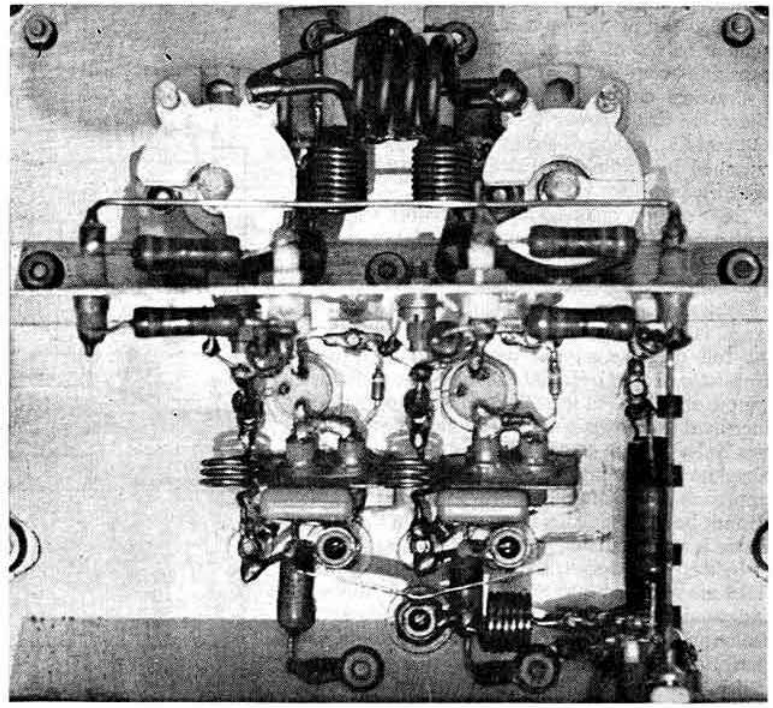


Fig. 3. Circuit of the complete 144 MHz Linear Amplifier.



For guidance of constructors, this photograph illustrates the layout of the output stage as used by the author. The 2N3632 transistors are mounted just beneath the screen.

Acknowledgement

The author wishes to express his gratitude to many of his fellow Amateurs for helpful discussions and experimental data. In particular, he wishes to thank Malcolm Bibby, G3NJY, for his detailed analysis of many experimental networks, and Colin Desborough, G3NNG, for confirming so many conclusions and values by independent effort.

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Appendix

Determination of Circuit Constants

V_{cc} = Supply voltage
V_{sat} = Transistor Saturation Voltage
V_p = Peak Signal Voltage at Collector
I_c = Mean Collector Current
$I_{c\ peak}$ = Peak Collector Current
$w = 2\pi f$ (144 MHz = $9{\cdot}1\ 10^8$)
X_{cs} = Series Capacitive Reactance
X_{cp} = Shunt Capacitive Reactance
X_L = Inductive Reactance
r_o = Transistor Output Resistance
R_o = Optimum Shunt Load Resistance
R_p = Resistive Component of Resultant Shunt Output Circuit
R_s = Resistive Component of Resultant Series Output Circuit.
X_p = Reactive Component of Resultant Shunt Output Circuit.
X_s = Reactive Component of Resultant Series Output Circuit
X_{L_1}, X_{C_1}, etc. Reactance of L_1, C_1 etc., in circuit diagram, Fig. 3.

Input Stage

Select a convenient value of L_1 to resonate in a parallel tuned circuit with a practical value of C_1. Say 6 turns, $\frac{1}{4}$ in. dia., of 20 s.w.g., spaced to give $L_1 = 0{\cdot}165\ \mu H$

$X_{L_1} = wL_1 = 9{\cdot}1\ 10^8\ 0{\cdot}165\ 10^{-6} = 150$ ohms

To resonate, $X_{C_1} = X_{L_1}$.

Therefore, $C_1 = \dfrac{10^{12}}{9{\cdot}1\ 10^8\ 150} = 7{\cdot}3$ pF

The Dynamic Resistance R_d of the tuned circuit L_1 C_1 is given by

$R_d = \dfrac{Q}{wC_1}$, thus if $Q = 8$, $R_d = 8 \times 150 = 1{\cdot}2$ K ohms

From data sheet, the Input Impedance of the 2N3866 (at 144 MHz and I_c = 45 mA) is 24 ohms resistive and $-j$ 148 ohms reactive.

The reactive component of the input impedance appears in shunt with the resistive component and it may be neglected

since it will tune out. To a first approximation, the tap on L_1 is given by

$$\frac{N_t}{N_T} = \sqrt{\frac{R_t}{R_d}}$$

where N_t = number of turns to tap
N_T = number of turns on coil
R_t = tap impedance
R_d = dynamic resistance

Thus for 24 ohm tap,

$$N_t = N_T\sqrt{\frac{R_t}{R_d}} = 6\sqrt{\frac{24}{1200}} = 0{\cdot}85 \text{ turns}$$

Similarly for the 50 ohm tap $N_t = 1{\cdot}2$ turns

Let Peak Collector Voltage swing, V_p, of TR1 = 20 and Power Output, P, = 200 mW.

$$\text{Optimum Load Resistance, } R_o = \frac{V_p^2}{2P} = \frac{20^2}{2 \times 200\ 10^{-3}} = 1{\cdot}0 \text{ K ohms}$$

From data sheet, the Resistive component, r_o, of the 2N3866 Output Impedance (f = 144 MHz, P = 250 mW) is 450 ohms and the Reactive component, X_p, is $-j210$ ohms.

The Transistor Output Resistance, r_o, appears in shunt with the Load Resistance, R_o. The Resultant Output Resistance, R_p, is therefore,

$$R_p = \frac{r_o\ R_o}{r_o + R_o} = \frac{450 \times 1000}{450 + 1000} = 312 \text{ ohms.}$$

So Peak Collector Current of Tr_1 is given by

$$I_{c\ peak} = \frac{V_p}{R_p} = \frac{20\quad 10^3}{312} = 64 \text{ mA}$$

In Class A, the Mean Collector Current, I_c, must be at least half the Peak Collector Current,
Thus $I_c = \frac{1}{2}\ I_{c\ peak} = 32$ mA. Say 35 to 40 mA to allow tolerance margin.

If 3·0V are allowed for d.c. stabilization, and 0·7V for the base-emitter voltage,

$$\text{The Emitter Resistance} = \frac{V_{base} - 0{\cdot}7}{I_c} = \frac{3{\cdot}0\ -\ 0{\cdot}7}{35{\cdot}0 \times 10^{-3}} = 68 \text{ ohms}$$

Suitable resistors to provide V_{base} = 3·0V from the 28V Supply Rail are 2·7 K ohms and 330 ohms.

Coupling Network, TR1 to TR2

Let Q = 12 and L_2 = 0·22 μH. (X_{L_2} = 200 ohms. Say six turns $\frac{1}{4}$in. dia. No. 20 s.w.g., close spaced)

$$\text{From } wL = Q\ R_s, \text{ so } R_s = \frac{200}{12} = 16{\cdot}7 \text{ ohms.}$$

By substitution in the parallel to series circuit formula,

$$R_s = \frac{X_p\ R_p}{X_p^2 + R_p^2}\ X_p$$

$$\text{or } X_p = \sqrt{\frac{R_s R_p^2}{R_p - R_s}} = \sqrt{\frac{16{\cdot}7\quad 312^2}{312 - 16{\cdot}7}} = 75 \text{ ohms}$$

$$\text{Thus the capacity at the collector of TR1} = \frac{10^{12}}{9{\cdot}1\ 10^8\ 75} = 14{\cdot}7 \text{ pF}$$

Reactive component of TR1 Output Impedance = $-j210$ ohms or 5·2 pF.

So extra capacitor, C_2, required to make up 14·7 pF
C_2 = (14·7 − 5·2) pF = 9·5 pF. Say C_2 = 10 pF.

By reference to the parallel/series formula $R_s = y\ X_p$

$$\text{where } y = \frac{X_p\ R_p}{X_p^2 + R_p^2}, \text{ so } y = \frac{R_s}{X_p}$$

$$\text{Similarly, } X_s = yR_p = \frac{R_s\ R_p}{X_p}$$

$$\text{Thus by substitution, } X_s = \frac{16{\cdot}7}{75}\frac{312}{} = 69 \text{ ohms}$$

To complete the network section, the impedance

$$Z = R_s + j(X_L - X_s)$$

requires to be terminated in the conjugate match, $R_s - j\ X_c$ where $X_c = (X_{L_2} - X_s)$

This gives an approximate value for X_{c_3} = (200 − 69) = 131 ohms.

$$\text{Thus } C_3 = \frac{10^{12}}{9{\cdot}1\ 10^8\ 131} = 8{\cdot}4 \text{ pF}$$

(By making a series to parallel conversion on the impedance, $R_s - j\ X_c$

$$X_{c_3} = \frac{R_s^2 + X_c^2}{X_c} = \frac{16{\cdot}7^2 + 131^2}{131} = 133 \text{ ohms}$$

or C_3 = 8·2 pF
which justifies the above approximation.)

From data sheet, the Series Input Impedance of the 2N3553, TR2, is equal to 12 + j 1·2 ohms. So for Q = 12, from $wL = Q\ R_s$

$$X_{L_3} = 12 \times 12 = 144 \text{ ohms}$$

of which + j 1·2 ohms is the reactive component of TR2 Input Impedance. So

$$L_3 = \frac{(144 - 1{\cdot}2)\ 10^6}{9{\cdot}1\ 10^8} = 0{\cdot}156\ \mu\text{H}$$

To complete the network section, the impedance

$$Z = R_s + j(X_L + X_s)$$

requires to be terminated in the conjugate match, $R_s - j\ X_c$ where $X_c = (X_{L_3} + X_s)$

This gives an approximate value for X_{C_5} = (142·8 + 1·2) = 144 ohms.

$$\text{Thus } C_5 = \frac{10^{12}}{9{\cdot}1\ 10^8\ 144} = 7{\cdot}6 \text{ pF}$$

By eliminating k from the formula (see text):

$$k = (Q_1\ Q_2)^{\frac{1}{2}} = 1$$

$$\text{and } C_m\ (C_1\ C_2)^{-\frac{1}{2}} = k,$$

$$C_m = \sqrt{\frac{C_1\ C_2}{Q_1\ Q_2}}$$

Thus by substitution of the appropriate values

$$C_4 = \sqrt{\frac{8{\cdot}4\ 7{\cdot}6}{12\ 12}} = 0{\cdot}67 \text{ pF}$$

Coupling Network, TR2 to TR3

Similar reasoning give the following values for the network coupling TR2 to TR3.

C_6 = 12 pF	C_8 = 0·69 pF	L_4 = 0·22 μH
C_7 = 6·7 pF	C_9 = 10·2 pF	L_5 = 0·11 μH

TR2 operates in Class B (see text). No signal I_c is set to be approximately 15 mA by circuit constants. Max V_c peak is taken as being 25V, and Q = 12.

Coupling Network, TR3 to TR4 and TR5

From data sheet, the Resistive component, r_o, of the 2N3632 Output Impedance (f = 144 MHz, I_c = 200 mA) is 75 ohms and the Reactive component, X_p, is − j 50 ohms.

Let Peak Collector Voltage swing, V_p, of TR3 = 25 and Power Output, P = 6W.

$$\text{Optimum Load Resistance, } R_o = \frac{V_p^2}{2 \times P} = \frac{25^2}{2 \times 6{\cdot}0} = 52 \text{ ohms}$$

The Transistor Output Resistance, r_o, appears in shunt with the Load Resistance, R_o. The Resultant Output Resistance, R_p, is therefore,

$$R_p = \frac{r_o \ R_o}{r_o + R_o} = \frac{75 \times 52}{75 + 52} = 31 \text{ ohms}$$

Let $Q = 15$ and $L_s = 0{\cdot}22\ \mu H$ ($X_{L_s} = 200$ ohms)

From $wL = Q\ R_s$

$$R_s = \frac{200}{15} = 13{\cdot}34 \text{ ohms}$$

By substitution in the parallel to series circuit formula,

$$X_p = \sqrt{\frac{R_s\ R_p^2}{R_p - R_s}} = \sqrt{\frac{13{\cdot}34 \times 31^2}{31 - 13{\cdot}34}} = 27 \text{ ohms}$$

Thus capacity at collector of TR3 = 41 pF

The Reactive component of TR3 Output Impedance $= -j\,50$ ohms or 22 pF.

So extra capacitor, C_{10}, required to make up to 41 pF

$$C_{10} = (41 - 22) = 19 \text{ pF. Say} = 18 \text{ pF.}$$

$$\text{From } X_s = \frac{R_s\ R_p}{X_p} = \frac{13{\cdot}34 \times 31}{27} = 15{\cdot}2 \text{ ohms}$$

To complete the network section, the impedance

$$Z = R_s + j(X_L - X_s)$$

requires to be terminated in the conjugate match, $R_s - j\,X_c$ where $X_c = (X_{L_s} - X_s)$

This gives an aproximate value for $X_{c_{11}} = (200 - 15{\cdot}2) = 184{\cdot}8$ ohms

Thus $C_{11} = 5{\cdot}95$ pF.

The Series Input Impedance to each of the Output Stage Transistors, TR4 and TR5 is $6{\cdot}5 + j\,1{\cdot}0$ ohms. $Q = 15$. Therefore by similar reasoning to that which gives the input section to the base of TR2

X_{L_7} and $X_{L_9} = 97$ ohms

or L_7 and $L_9 = 0{\cdot}105\ \mu H$ each

and

C_{14} and $C_{15} = 11{\cdot}3$ pF each.

If the couplings to TR4 and TR5 are equal, the values of C_{12} and C_{13} will also be equal. The approximate value of each capacitor is therefore

$$C_{12} = C_{13} = 0{\cdot}55 \text{ pF.}$$

The Determination of the L-Pi Tank Circuit

From data sheet, the Resistive component, r_o, of each 2N3632 Transistor is 62 ohms and the Reactive component, X_p, is $-j\,46$ ohms

Let Peak Collector Voltage swing, $V_p = 26$ and Power Output per transistor, $P = 13\frac{1}{2}$ watts

$$\text{Thus Optimum Load Resistance, } R_o = \frac{26^2}{2\ 13{\cdot}5} = 25 \text{ ohms.}$$

R_o is shunted by r_o, therefore $R_p = \dfrac{25 \times 62}{25 + 62} = 17{\cdot}8$ ohms

The parallel to series circuit conversion gives

$$R_s = \frac{R_p\ X_p}{R_p^2 + X_p^2} X_p, = \frac{17{\cdot}8 \quad 46}{17{\cdot}8^2 + 46^2} 46 = 15{\cdot}5 \text{ ohms}$$

and

$$X_s = \frac{R_p\ X_p}{R_p^2 + X_p^2} R_p = \frac{17{\cdot}8 \quad 46}{17{\cdot}8^2 + 46^2} 17{\cdot}8 = 6{\cdot}04 \text{ ohms}$$

Thus from $wL = Q\ R_s$, by putting $Q = 20$,

X_{L_8} and $X_{L_{10}} = 20 \times 15{\cdot}5 = 310$ ohms

or L_8 and $L_{10} = 0{\cdot}34\ \mu H$ each.

The conjugate termination is $17{\cdot}8 - j\,(310 - 6{\cdot}04)$ ohms. This impedance, converted into the parallel configuration, gives 5·18 K ohms in shunt with 3·65 pF.

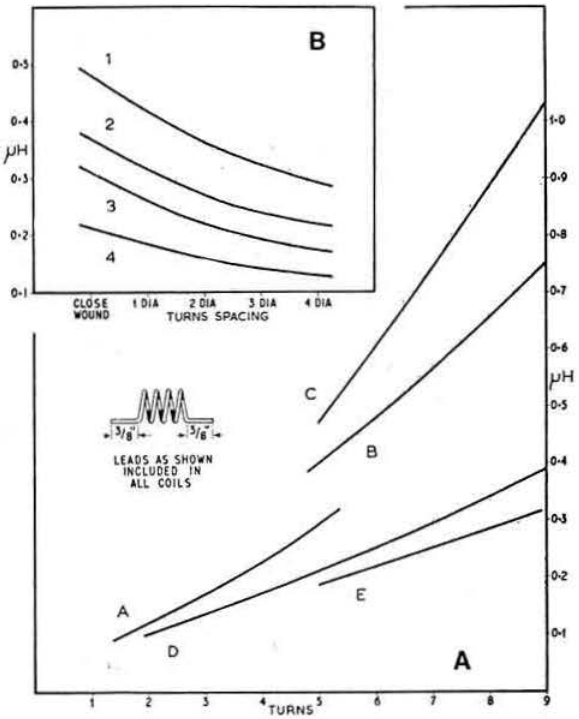

CHART A—Shows relationship of inductance against turns.

Curve	Inside Diam:	Wire Size	Turns Spacing
A	0·5 in.	16 s.w.g.	1 wire diam.
B	0·5 in.	16 s.w.g.	close wound
C	0·5 in.	20 s.w.g.	close wound
D	0·25 in.	20 s.w.g.	close wound
E	0·25 in.	20 s.w.g.	1 wire diam.

CHART B—Shows the effect of varying the spacing between turns

Curve	Inside Diam.	Turns	Wire Turns
1	0·5 in.	5	20 s.w.g.
2	0·5 in.	5	16 s.w.g.
3	0·5 in.	4	16 s.w.g.
4	0·5 in.	3	16 s.w.g.

To combine the outputs of TR4 and TR5, the L sections may be connected in parallel and matched into a 50 ohm load through a conventional Pi section. Thus from

$$X_1 = \frac{R}{Q}\left(1 + \sqrt{\frac{R_L}{R}}\right)$$

$$X_2 = X_1 \sqrt{\frac{R_L}{R}}$$

$$X_L = X_1 + X_2$$

where $R = \frac{1}{2}(5{\cdot}18 \text{ K ohms})$

and $Q = 20$

$X_1 = 148$ ohms or 6·75 pF

$X_2 = 20{\cdot}6$ ohms or 53 pF

$X_L = 168$ ohms or $0{\cdot}175\ \mu H$

So the complete L-Pi Network

$L_8 = 0{\cdot}34\ \mu H$ $\quad C_{16} = 3{\cdot}65 + 3{\cdot}65 + 6{\cdot}75 = 14{\cdot}05$ pF

$L_{10} = 0{\cdot}34\ \mu H$

$L_{11} = 0{\cdot}175\ \mu H$ $\quad C_{17} = 53$ pF

Radio News of 1968

New RSGB Film

The Society's new film, *Radio News of 1968*, is now complete and will be shown for the first time at the Annual General Meeting on 6 December. It is a 16mm sound-film, the length is 1,050 ft., and it runs for 29 minutes. As its title suggests, it is a news-magazine type of film, and includes reports on some of the interesting happenings of the amateur radio year. There are items on Radio Astronomy—BRS 15744, Weather-map picture-recording from the Essa satellites—GM3BST, visits to three NFD stations and to the shack of 1968 President, G3TR, the City of London Festival station—GB2LO, a look at what's new at the Amateur Radio Exhibition, and a brief visit to G3LTF to hear the Moonbounce story of April 1968. The latter item is a quickie/trailer for the " Moonbounce " film planned to be released in March 1969. The Society acknowledges gratefully the donation, by International General Electric Co. of NY, of a copy of their filmed material of GM3BST, included in the News.

Radio News of 1968 has its own signature tune, composed and played by G3ILT. G3TDB assisted with the lighting of the Exhibition item. G3NDF, producer/editor, acknowledges their help and also the help and co-operation of all those who took part in the making of this, the first of the new RSGB Newsreels.

Radio News of 1968 will be available from the Film Library from 7 December onwards. The Library reference number is RSGB/11, and the hire charge 25s. for the first day and half-rate for additional days, outward postage included. Although the hire is more than anticipated, it should enable the production costs to be paid off out of the film's earnings, for as Members will know, the Film Library has to be operated on a self-supporting basis. Financing of the film and the prints for release through the Film Library has been a joint project between the RSGB and the Curator's Company who operate the Library for the Society.

The clips from *Radio News of 1968* show; a. G3WSC—the Crawley end of the 2m link to the Exhibition station, b. G3LTF —the 1296 MHz feed to Peter's dish, c. GB2LO-G6CL in QSO with W1AW—the first formal QSO between RSGB and ARRL d. BRS15744—136 MHz converter, e. RAEN—the caravan at the Exhibition, f. GM3BST—the picture-recorder for receiving weather-maps from Essa satellites.

REGULAR FEATURE

TECHNICAL TOPICS

By PAT HAWKER, G3VA

DYED-IN-THE-WOOL phone men must forgive us for coming back again this month with what may appear at first sight to be an opener aimed exclusively at the key-bashers—though perhaps no excuses are needed since did not Ken Warner (who did so much to build up ARRL) always insist that " c.w. is inescapably the basic form of amateur communication "? In practice, a good deal of the information which follows is not without interest even to those to whom the voice is all—since s.s.b. after all is nothing but a lot of little c.w.-like signals popping up and down over (hopefully) 3 kHz of bandwidth. And s.s.b. gets a fair showing later.

Linear Detection

Certainly, the interest in narrow-band c.w. operation (*TT*, July, September, October) should be a revelation to those who may have been thinking that A1 is on its way out. Several letters have not only given useful ideas on improving receivers for this application but also recount the experiences of those who have really sharpened up response curves.

For example, the importance of the linearity and inter-modulation performance of detectors for c.w. is stressed by B. Priestley, G3JGO and his remarks recall a classic article of 20 years ago. He has been looking into the question of distortion produced by detectors and has clearly been surprised to discover the important role of intermodulation on c.w. He notes that an analysis in *S.S.B. Principles and Circuits* of a diode detector, with 0·5 volt b.f.o. injection and two 5 volt s.s.b. tones, indicates that intermodulation between the tones would be 22dB stronger than the desired output! The comment is made however that due to the large peak to average ratio of the speech waveform, the average istortion produced in this manner will be much lower than peak distortion. Thus while the analysis indicates that a high level of b.f.o. voltage is desirable, it need not be impossibly high for acceptable s.s.b. results (as in the conventional product detector).

But when it comes to c.w. reception, many text books suggest that harmonic distortion resulting from low level b.f.o. injection does not matter, and can usefully provide an a.g.c. action. G3JGO, however, stresses that when an interfering signal is also present at the detector, intermodulation between it and the desired signal could give serious trouble. Taking the figures given above, and assuming b.f.o. injection (0·5 V) at 466 kHz, desired signal (5 V) at 465 kHz and an interfering signal at 464 kHz (also 5 V), then the unwanted intermodulation beat would be at 1 kHz, the same as the desired signal, but 22 dB stronger!

This illustration leads G3JGO to the conclusion that a very good, low-distortion product detector is even more desirable for c.w. than for s.s.b., and, if fitted, would make audio filters seem far more effective. The combination of a good product detector and a.f. filter should cost less than a good crystal filter, he points out.

Now, it is interesting to note that almost exactly the same conclusions (though making no specific reference to i.p.) were arrived at over 20 years ago in the classic article by O. G. Villard, W6QYT in the very first account of what became known as product detectors (" Selectivity in s.s.s.c. reception " *QST*, April 1948 when s.s.b. was still called s.s.s.c.). In that article Professor Villard described a balanced " frequency converter " detector and noted that " in a combination of this sort, audio selectivity becomes the complete equivalent of i.f. selectivity except for the audio image."

Within a very few years of this pioneering article, the product detector was all the rage, but almost exclusively in its unbalanced form. Later (*QST*, May 1961) J. R. White, W2WBI revived the W6QYT balanced detector of two mixers, for what he termed a t.r.f. receiver, but which could also be regarded as a simple form of synchrodyne, using an audio filter shaped for s.s.b. This receiver made no attempt to solve the problem of the unwanted audio image, on c.w. The " detector " was two 6SB7Y.

An alternative form of balanced product detector is now available in the form of the 7360 beam deflection device. This technique (but not in fully balanced form) is used in the G3PDM receiver in the new *RSGB Radio Communication Handbook* (Fig. 1) where, for c.w., it precedes a three-section phase-shift oscillator form of a.f. filter with a bandwidth stated to be about 200 Hz at 6 dB down.

With a linear detector incorporated at the end of an i.f. strip having sufficient selectivity to provide "single signal " audio selectivity, a well balanced product detector should offer the opportunity to take full advantage of a narrow-band a.f. filter, without the difficulties caused by non-linear elements in the form of blocking and intermodulation products.

What we are really saying here, as so often before, is that all stages of a receiver up to the final selectivity shaping circuits should be as linear as possible. This argument is often used to advocate single-conversion with crystal filter immediately after the first mixer; but can with care be

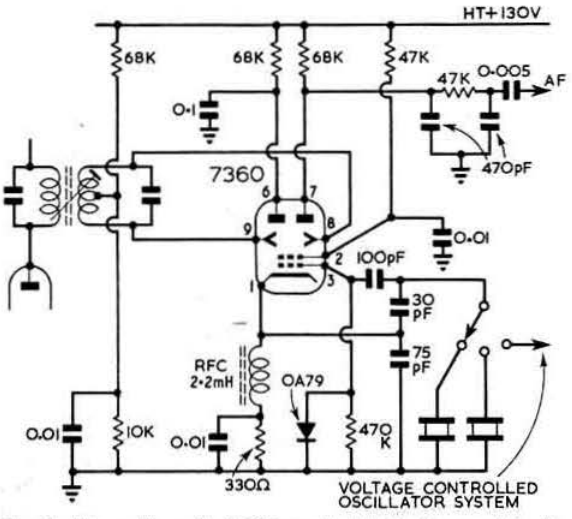

Fig. 1. The self-excited 7360 product detector used in the G3PDM receiver (*RSGB Radio Communication Handbook*). The OA79 diode prevents the control grid from going positive. Note, in this form it is not a fully balanced system, in that output is taken from one anode only.

extended even to triple-conversion and a.f. filter; it may be more difficult to take care of non-linearities right up to the post-detector stages, but with such valves as the 7360, attention paid to gain distribution, and the advantages of balanced and double-balanced stages there is no reason why it cannot be done. Furthermore, low final i.f. *LC* circuits are less prone to " ringing " than either crystal or mechanical filters, as W0DX, president of ARRL, pointed out to me at the recent Exhibition.

Narrow-band Hints from ZS6BT

On the same general subject of narrow-band reception, but from a different viewpoint, a long letter from Ted Cook, ZS6BT (one-time G6OU etc.) goes into the practical aspects of the matter in the light of long experience. He uses a home-built triple-conversion receiver with peaking Q multiplier and audio filtering to give him a nose bandwidth of 50 Hz, and station-to-station separation from roughly 100 Hz at equal station strengths, to 1 kHz for the nearest local, and a typical 250 Hz for S3 wanted to S8 unwanted signal. But to make good use of this degree of selectivity ZS6BT suggests there are several " jokers."

(*a*) Owing to the need to search, there must be some bandwidth outside the nose peaks, and some spread of the " skirts " is essential; but the total bandwidth to " total audio disappearance point " for the loudest signals should not be more than about ± 1 kHz from peak.

(*b*) If stations are to be separated by 100 Hz intervals, the tuning dial must have a re-set accuracy (without backlash) of 50 Hz or less, with vernier dial capable of being read to within 50/60 Hz (he uses a magnifying glass arrangement).

(*c*) The operator must fully understand the principles of his receiver adjustments (see below).

He stresses the essential difference between A3 and A1 in that A3 has an inherent " focal point " for tuning, with any mistuning distorting the signal. A1 has no focal point unless one is created by the selectivity: even with a fixed frequency b.f.o. the full spectrum of audio can be obtained by mistuning any earlier oscillator.

If the b.f.o. is variable, considerable mistuning can be compensated for by shifting the b.f.o. frequency. This was the fundamental reason why the single-crystal filter was so often criticized as having excessive insertion loss. The reluctance to use such filters has always been an excellent example of (*c*). (This is a point we have tried to make in *A Guide to Amateur Radio* and elsewhere.)

A sinusoidal signal applied to a product detector can produce any audio frequency by shifting the b.f.o.—and here, ZS6BT believes, lies the whole case for the use of audio filters to create a focal tuning point.

He comments that few AR88 operators appreciate that the tone control can help selectivity. The leakage-reactance of the output transformer is tuned to give a sharp high frequency roll off above about 3 kHz; if this is re-inforced with the aid of the tone control, the high-side curve is minimal in the crystal position, provided that the b.f.o. is set for an output note of 3 kHz. ZS6BT, in fact, favours the adoption of a c.w. note of 3 kHz since this readily gives complete suppression of the audio image 6 kHz away; furthermore it is the upper limit for speech, so that only the low cut-off point need be moved for c.w./phone switching. The lower skirt can be modified by switching in a lower value coupling capacitor and/or an a.f. filter. In his own case, '6BT introduces 3 kHz positive feed-back to really peak up the response.

Using such techniques " results are fantastic " he comments. A single tone can be picked out of multi-tone teleprinter signalling; stations can be received in the 250 Hz " gap " between typically " netted " stations; an entirely new view of band occupancy is realised even on 7000-7015 kHz! Chirpy signals no longer sound chirpy—they just lose part of their dots and dashes.

The problem of detector intermodulation and blocking would, in his case, seem to have been eased by incorporating separate gain controls for (1) r.f., (2) i.f. and (3) low i.f.-only, for skirt-limiting and allowing only " tips " of signals to reach the product detector. Operating under such conditions, says '6BT, is to re-discover some of the joys of the 1926-28 era when stations worked the world on 10 watts using 0-v-1 receivers; though he admits that distant stations, with conventional receiver approaches, still tend to suffer from the QRM that in most cases no longer troubles him. (Perhaps one should point out that as long ago as August 1936, Reg Hammans, G2IG was describing in the " Bull " crystal-gate receivers in which a deviation of 50 Hz from resonance would reduce output by 20 dB.)

'6BT makes several specific suggestions for improving selectivity on well known receivers including 75A4, G2DAF, HRO etc.: (1) ensure high-cut at 3 kHz with capacitor for resonating transformer leakage inductance right across primary and not (e.g. as in 75A4) across only part; (2) bypass grid of the output stage permanently to chassis to give cut-off slope around 10 dB/octave with 50 per cent response point between 3000-3500 Hz; (3) insert 200-470 pF capacitor in grid coupling to output stage, with switch to short-circuit it for speech. FL8 or other a.f. filters can be used to improve low cut-off.

While the selectivity at G3VA is not yet to the ZS6BT standard, our own experience bears out the soundness of many of these suggestions—particularly the value of creating a sharp focal tuning point a few tens of Hz wide; the need for extremely low tuning rate (we use 2½ kHz per complete

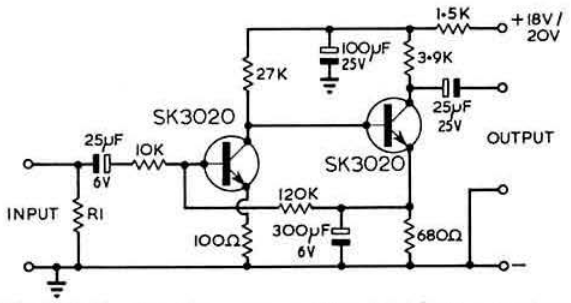

Fig. 2. RCA microphone pre-amplifier. R1 220 ohms for low impedance microphones, 270,000 ohms for high impedance types.

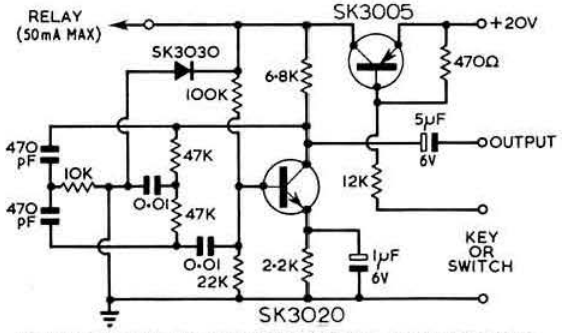

Fig. 3. The tone oscillator for the RCA control system.

rotation on 14 MHz); and the value of having a number of gain controls. And while it is usual to adopt a beat note less than 3000 Hz, there is no doubt that by moving this upwards audio " image " suppression becomes much easier (and anything less than complete suppression leads to one inadvertently copying on the wrong side) though percentage difference between audio notes is lowered: once a clean note has been achieved in the post-detector stages there are always T5-er type techniques (*TT*, September 1967) to broaden the note in the headphones.

And finally, it is well worth underlining ZS6BT's comment that to achieve maximum benefit an *operator* should be fully aware of what he is doing *technically*. Amateur radio is about the only communications service which still tries to avoid the arms-length separation between *designers*, *engineers* and *operators*—and long may it so remain.

Audio Control System for S.S.B.

Several transistor circuits of interest to amateurs are included in the recent *RCA Solid-State Hobby Circuits Manual* and the three elements of a useful-looking audio control system are reprinted by W2YM in the July, 1968 issue of *RCA Ham Tips*, complete with full constructional details and layout templates etc. The system comprises a microphone pre-amplifier, a single-tone a.f. oscillator, and an audio mixer, compressor and line-driver. Clearly, the system in part, or *in toto*, would have many applications in the handling of audio for hi-fi, recording etc, but is presented primarily for its value to the s.s.b. operator. Several techniques, including the use of a MOSFET as compressor control device, have not previously been covered in *TT* so that the circuits should be of general interest.

The low-distortion microphone pre-amplifier (Fig. 2) is intended to boost the output of a dynamic microphone (impedances from 250 ohms to 30,000 ohms by changing the input resistor) to an 0·5 to 1·0 volt level. An advantage of transistors for this application is their low susceptibility to r.f. pick-up, resulting from the low impedances involved. The biasing arrangement for the input transistor is a little unusual, being obtained from the emitter current of the output transistor, and providing d.c. feedback for stabilization of the device operating point.

The audio oscillator (Fig. 3), W2YM states, was designed originally for Morse code practice but is well suited to provide a near sine wave tone for tuning and keying s.s.b. transmitters, being based on the twin-T circuits, and is capable of keying a relay; the diode is part of a protective circuit to protect the output transistor from the high inductive voltages that appear at the relay terminals when the relay-coil circuit is interrupted.

The combined audio mixer, compressor and line-driver unit (Fig. 4) can be used to combine the outputs from the pre-amplifier and the tone oscillator with provision, in the example shown, for a further two input sources. The compressor can be adjusted so that any input signal between about 50 mV and 1·0 volt will provide an output of about 1·0 volt. The line-driver is designed for operation at 1 volt r.m.s. into a line of 250 ohms.

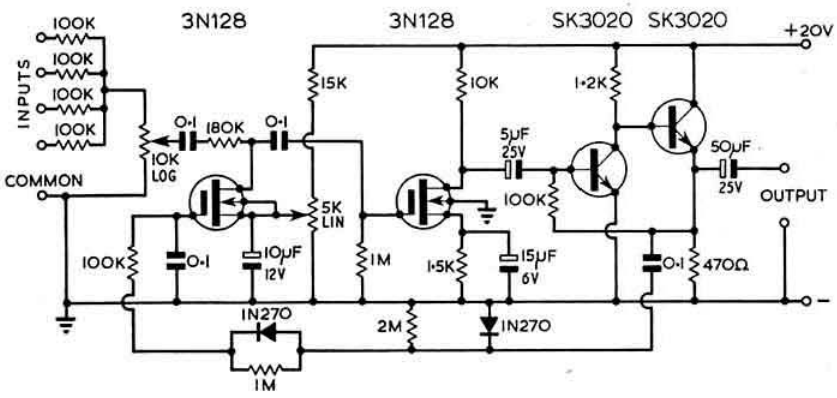

Fig. 4. The combined audio-mixer, compressor and line-driver amplifier suitable for use with the units of Figs. 2 and 3. "SK" units are RCA devices.

The resistive mixer is straightforward but the use of an MOSFET as a voltage variable resistor/attenuator is interesting, and the technique could probably be readily adapted for such other applications as audio-derived a.g.c., or for remote gain control of a.f. amplifiers by means of a d.c. control voltage. A second MOSFET is used as a high-impedance amplifier, with a two-stage bipolar line driver amplifier.

Initial bias for the MOSFET attenuator is set by the 5K linear-taper potentiometer; when the device is biased off it has high resistance and there is little attenuation of the input circuit. As bias is reduced, current flows and the drain-to-source resistance drops, forming a variable shunt across the a.f. path, thus increasing attenuation. To provide a suitable control voltage, a little of the driver output signal is rectified and fed back to the MOSFET.

The *RCA Ham Tips* article shows how these three units can conveniently be assembled into a single neat control unit. There is, of course, no reason why some of the circuit techniques should not be adapted for custom-built control systems both for a.m. and s.s.b.

What's happening in the Coax?

The number of novel ideas that turn up is a constant reminder that, whatever may be said sometimes, a lot of useful development is still going on. Occasionally, an idea sent in to *TT* tends to lose itself for a time among the paper work, but here is one from F8ZF, which came in some while ago and which has now reached the top of the pile.

F8ZF reported using an ingenious little item of gear which shows what is happening inside a co-ax feeder without any direct electrical connection being made to the feeder. This consists (Fig. 5) essentially of a toroidal ferrite core wound with 50 or so turns of fine wire, with a detector diode and bypass capacitor, all of which can easily be mounted on a piece of Bakelite drilled to let the coax through. The meter should then give a reading in proportion to the current flowing in the coax, and thus is not unlike the old type of r.f. meters used in aerial leads. But it will do rather more —since it can easily be pushed along the cable to see if the line is flat. This device could easily become one of those indispensable gimmicks—so long as it is not used for telephone tapping!

Voice Peaks on S.S.B.

A short item by J. D. Bicknell, ZL2CE (*Break-in*, August 1968) offers assistance in the problem of setting the audio gain control of an s.s.b. rig. Too much gain, he points out, and the transmission splatters; too little, and the DX comes back to someone else.

ZL2CE describes a simple voice peak indicator (Fig. 6) of the type often used in tape recorders; he readily admits that this will not really take the place of an oscilloscope, but does at least give a fair indication of how far the audio gain can be advanced.

A little r.f. is sampled from the output tank, fed through an adjustable r.f. voltage divider, rectified and used to bias an EM84 or similar magic eye indicator. One of the miniature transistor radio ganged capacitors can be used for C1 (250pF variable) which forms the adjustable divider.

Adjustment, ZL2CE writes, is simple. Fully mesh C1, load the transmitter with a test tone, and unmesh C1 until the EM84 closes. Remove tone and adjust a.f. gain until the eye just closes on peaks. All components connected

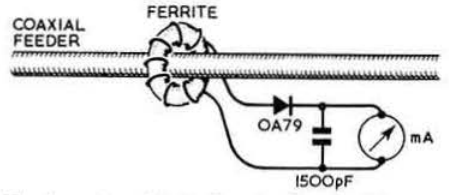

Fig. 5. The ingenious F8ZF r.f. meter for checking on current and/or standing waves inside a coaxial feeder.

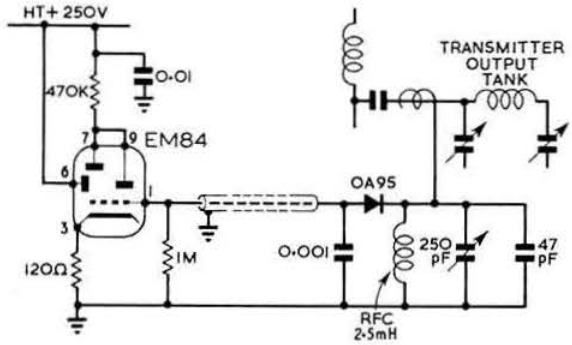

Fig. 6. The ZL2CE s.s.b. voice peak indicator.

with r.f. can be mounted near the final tank (this will put the diode inside the screening to avoid the old problem of harmonic generation with all forms of diode indicators), and the EM84 can be located where it can easily be viewed.

Feedback

It is regretted that two errors slipped through recently. *TT* (October) Fig. 4 caption, coil diameter should have been $\frac{5}{16}$ inches not 6 in. inner diameter! November, Fig. 1, top end of tuned circuit should be shown joined to " drain " of the IGFET (i.e. top lead of 47pF capacitor connected to top end of 18pF capacitor). Sorry!

My description of the zener diode bridge circuit (November, Fig. 6) was also rather misleading, as G30SU points out. This improves stabilization over a wider range of *input voltages* not output *currents*; ideally it is for constant load applications.

Capacitively Loaded Dipoles

Have you ever wanted a dipole element that could be used on 14, 21 and 28 MHz—or anywhere between—and possibly slung immediately below a 7 MHz dipole without any interaction? Or another covering both 70 and 144 MHz? Or in quarter-wave form as a grounded monopole or ground-plane in which ground losses are dramatically reduced? Or a " dipole " with a 3·2 dB gain over a dipole, though requiring more space?

The answer is hardly likely to be " no." Yet it seems quite possible that these and other benefits have been there for the asking for a number of years, certainly ever since Dud Charman, G6CJ wrote an article " Loaded Wire Dipoles " (*RSGB Bulletin*, July 1961). Surprisingly, we have never seen much evidence of any rush to take advantage of this interesting concept, which is not to be found in the handbooks.

G6CJ showed how capacitively loaded or " stretched " dipoles up to 100 ft. long for 14 MHz could be formed quite

Continued on page 814

The ZD7WR Beacon Station

By R. A. Whiting, G3UYO*

A preliminary report covering May to December 1967.

ST HELENA is a speck of volcanic rock in the vastness of the South Atlantic Ocean, carrying a population of four thousand people and measuring some ten miles by six miles. The nearest land is Ascension island over seven hundred miles to the North, and its geographical isolation is accentuated by rather tenuous links with the outside world. There is no airfield and the island is served by ships of the Clan and Union Castle lines operating on the UK Southern Africa route. A ship calls on the average about once every six weeks; some bring mail and passengers and stop for only two hours, while others are cargo ships bringing supplies of food, fuel and miscellaneous cargo. It takes up to three months to obtain an answer to a letter. For amateurs it has one major asset—a rare call-sign!

I had occasion to spend about one year on the island from April 1967 and during this period operated a beacon transmitter, call-sign ZD7WR, on 29 MHz for the study of trans-equatorial propagation. Other associated projects were also considered, but because of the late or non-arrival of equipment these did not come to fruition. Amongst these projects was the operation of an additional beacon on 50 or 70 MHz and the regular plotting of the m.u.f., using a v.h.f. receiver and available signals. The v.h.f. receiver arrived about a month before I departed. The beacon was sited at Longwood, near what is known locally as Napoleon's deathplace, Longwood House, which is 1,700 ft. above sea level near the centre of the island on a windswept ridge flanked by deep valleys running towards the precipitous coast. This area is normally in the cloud which caps the island throughout a large part of the year. To the North, rising another 500 ft., is the cone shaped mass of Flagstaff Hill and south lie the central ridges of the island, the highest point being Mount Actaeon, 2,685 ft. above sea level. It is an ideal radio location, free from man-made radio noise and with a clear view out over the South Atlantic to the North, with the exception of the narrow angle subtended by Flagstaff Hill about two miles away!

The beacon transmitter was a rebuilt DX40U arranged for both A1 and F1. The latter type of emission was principally used and was preferred by the majority of the listeners. The power output of the transmitter was maintained at 50 watts. To achieve an omni directional radiation pattern and to obtain a degree of low angle radiation the aerial was a vertical radiator $\frac{5}{8}$ of a wavelength long and fed against a ground plane of four radial wires $\frac{1}{4}$ wavelength long. The whole structure mounted $\frac{1}{2}$ wavelength above ground. Precautions were taken in redesigning the transmitter to minimize radiation from the driver stages to prevent interference with the short wave listeners in the Longwood area. Harmonic radiation was not a problem as the nearest operational TV set was some 2000 miles away! ZD7DI provided contact with G2BVN and passed information on beacon operation when required. The beacon ran continuously with only minor outages during the operational period; once the final plate tank coil support melted and caught fire, which produced the only major outage of some eight hours in duration. Other outages of considerably lesser duration were produced mainly by keyer malfunction—which plagued me—and occasional mains shutdowns. The log bears such remarks as,

"B . . . . . keyer again !!, contacts adjusted and rig restarted."

On my departure from the island I loaned the equipment to ZD7GO to help him get on the air, as for various reasons it was not possible to provide for its continued operation as a beacon.

Reports

The reports received can be classified into two main groups:

(*a*) QSL cards mainly carrying a brief report of one interception of the beacon transmission.

(*b*) Detailed day by day observations of the beacon signal over monthly periods and in some cases for several months.

Listener reports classified under (*a*) to date have proved to be disappointing both as regards quantity and quality. At the date of writing I have received 72 listener cards from 20 countries tabulated as follows:

Germany—20 UK—11 Netherlands—7
Africa—4 Canada—4
Belgium—3 USA—3 Yugoslavia—3
Czechoslovakia—2 Norway—2 Rumania—2 Spain—2 USSR—2
Austria—1 Brunei—1 France—1 Greece—1 Italy—1
Japan—1 Switzerland—1

The highest number of reports and from the widest area were for the months of May, August, September and October 1967. About a quarter of the reports gave insufficient data to be of real value, in general the ones from transmitting amateurs being the best. Considering the rareness of the call-sign and the publicity given to the beacon I expected a bigger response, and ordered 500 QSL cards for the first printing. Incidentally all reports have been QSLd and there are plenty of cards left over for the reports yet to come in!

The reports classified under (*b*) form the main basis of the data presented in this report. They were detailed, accurate and logically presented and represented a good deal of effort on the part of the amateurs concerned. To date detailed reports received cover the period from May to November 1967. These along with some of the reports classified under (*a*) have been analysed to extract the data they contain and to present it in a form suitable for comparison and illustration. These reports were from amateurs in Europe (including the UK) and thus the results presented are for this path from St Helena. The majority of the reports were received from members of DARC (IGI), the German Society's ionospheric observation group.

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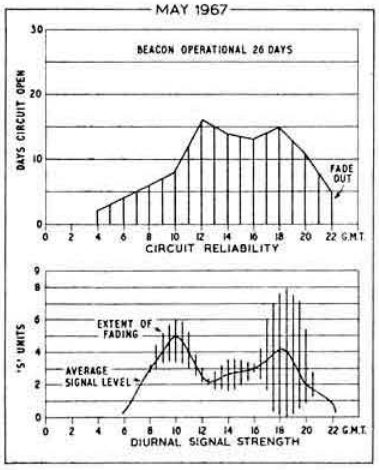
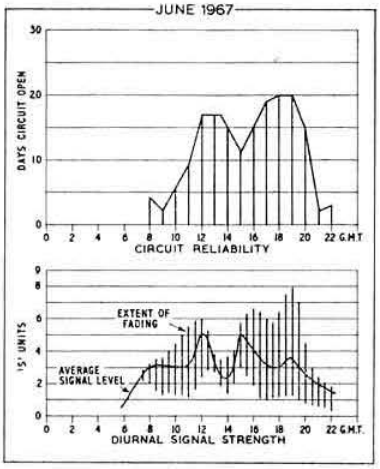
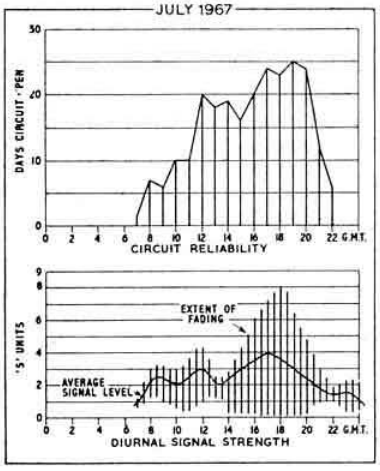
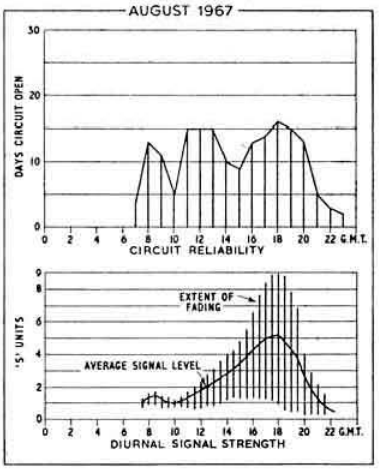
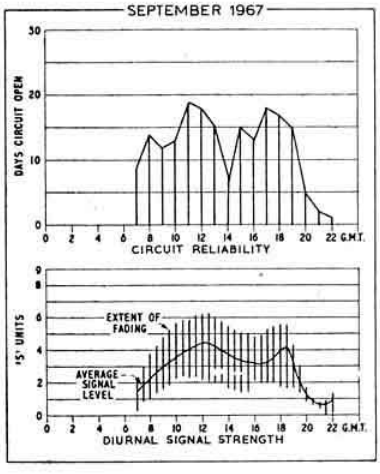


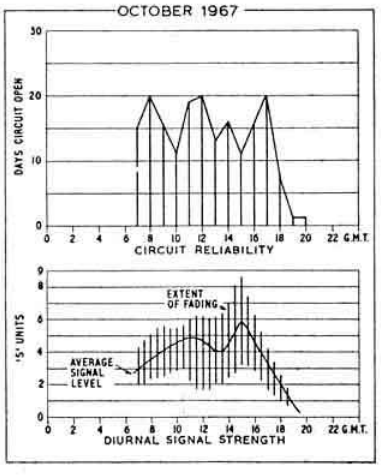


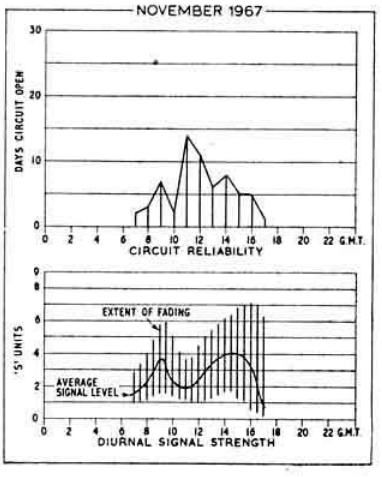
Reports received from European stations on reception of the ZD7WR 29 MHz beacon have been analysed and used to plot the accompanying charts for the period May to November 1967.











The data from these reports can be generally summarized as follows:

1. The reliability of the circuit expressed as the number of days the path was open each month on an hourly basis.
2. The diurnal variation in signal strength, including an indication of the extent and duration of the fading encountered. An average presented on the same monthly basis as 1.

The attached graphs present this data under these two main headings and should be examined in conjunction with these notes.

Summary of Results

The results presented, particularly those for July and August illustrate one important characteristic of the trans-equatorial circuit, the rise in m.u.f. after ground sunset time over the path. From May through to July the circuit gradually opened less often during the day and more often around sunset with a corresponding and time coincident increase in average signal strengths and an increase in the depth of fading. Of interest is the dip in signal strength, fading range and circuit reliability around 14.00 hours during this period. By August both daytime and evening openings had decreased accompanied by a marked decrease in daytime signal levels reported. Signals now peaked up around 19.00 hours coincident with an increase in path openings reported.

The results for September through to November show a qualitative and gradual reversion in circuit conditions to those experienced at the beginning of the observational period. It is possible that the results for the period from May to October represent a typical cycle in propagation conditions over this path. The few results received so far for November to December tend to bear this out. From this it might tentatively be suggested that January should be another good month for evening openings. The remarkable consistency in the general shape of the diurnal signal strength curve for the majority of the months should also be noted. Flutter fading was reported on very few occasions and appeared during both daytime and evening hours. Unlike the trans-equatorial circuits from Central Africa to Cyprus flutter fading was not apparently a major phenomenon on the St Helena-Europe path. One other point worth noting is that, from the presented data, the circuit shows no marked seasonal improvement associated with the equinoctial periods as did the paths from Africa into Cyprus. If anything it would appear that the St Helena to Europe path is best around the Solstice periods.

What this means to an amateur desirous of hearing and perhaps working a ZD7 is well illustrated by the graphs presented. For example, in June it would appear that the best times are around 10.00 and 18.00. Also for the period under review July was the best month for working a ZD7 in the evenings, around 19.00, if TVI is no problem. Perhaps this data should be passed on to the ZD7s to ensure their co-operation.

One interesting report on the beacon's signals is worthy of separate mention. This came from G3RFH (K. J. Randall) who was on board a ship bound from Freemantle, via the Cape of Good Hope, to the UK. The report covers the period from 6 September to 22 September 1967. G3RFH first heard signals from the beacon when the ship was in the South Indian Ocean about 5000 radio miles from St Helena, this was during the period 11.00-14.00, at an average signal strength of S4. The next time the beacon was heard was by ground, or seawave, propagation when the ship was about 45 miles from St Helena with signals increasing from S5 to S8 as the ship sailed to within one mile of the island. When the ship was very close to the island it passed through the radio shadow created by the high cliffs and the general topography of the island in relation to the beacon location, in this area signals faded badly. The beacon was again received at a signal level averaging S5 at around 20.00 when the ship was about 1500 radio miles North of the island. It is possible that these reports of reception represent three distinct modes of propagation.

Conclusion

For obvious reasons I have made no attempt to draw other than general operational conclusions from the data presented and no direct comparison can be made with other TEP circuits since parallel data is not available. It has been prepared to inform the RSGB Scientific Studies Committee and in the hope that it may prove interesting in view of the DARC (IGI) proposal for a world wide system of amateur radio beacons. The amateurs who supplied reports (too many to name individually) made these notes possible and the operation of ZD7WR worthwhile.

Technical Topics—*Continued from page 811*

simply from overlapping sections of 80-ohm flat twin line.

My excuse for referring back to this neglected 1961 item is a recent article "Impedance properties of capacitively loaded dipoles" by T. S. M. Maclean of the University of Birmingham (*Proc IEE*, October 1968) complete with some pretty ferocious-looking mathematical analyses. This reports experimental work at v.h.f. and u.h.f. using a ground plane monopole made of short brass rod elements of about 0·5 cm diameter fitting together by plugging them into perspex tubes which have a controlled gap between the rods. This technique was used to form a triply-loaded monopole providing a v.s.w.r. better than 2·5 in the 75-ohm feeder over a frequency range greater than 2·5:1. The article provides graphs comparing input resistance and reactance of unloaded, dual-loaded and triply-loaded monopoles.

The *Proc IEE* paper makes no reference to the G6CJ-type dipoles which stemmed from the work of E. C. Cork of EMI on the tilted wire TV aerial that never gained much popularity (despite its useful characteristics). Nevertheless, the principles seem to be the same. This new paper puts main emphasis on the broadband feature: the characteristic impedance increases progressively from the centre; thus the outgoing current waveform decreases, so that ideally at the end of the aerial there is virtually no current to be reflected, so that variation of input impedance with frequency is much reduced.

Probably, the *Proc IEE* paper is likely to appeal primarily to professional aerial people—but this seems an opportune time for suggesting that all of us could do worse than to re-read 6CJ's 1961 article, and perhaps be stirred into taking the capacitively loaded dipole much more seriously.

New RSGB Headquarters

35 Doughty Street, London, WC1

"Open Weekend"

14-15 December, 1968

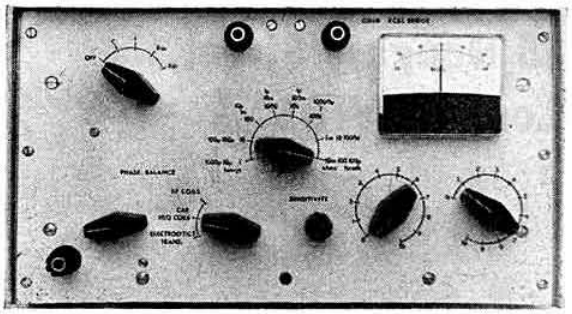
The new Headquarters of the Radio Society of Great Britain will be open to members and friends over the weekend of 14–15 December, 1968. Throughout the weekend there will be talk-in stations operational on 2m, 4m and we hope 160m (aerial space permitting). There will also be a station operating on either 80m or 40m (depending on conditions) to give contact to those not able to visit the new Headquarters. The call-sign to be used on all bands will be GB2HQ. Members of Council and Staff, Honorary Officers and members of the Society's Committees will be at the new headquarters over the weekend to receive visitors and answer queries. The latest RSGB publications will be on show and available for sale. There will also be displays showing the work of the Society. Light refreshments will be provided.

The new Headquarters is located a short distance North of the junction of Doughty Street and Guilford Street, the latter running West from the junction with Grays Inn Road where the intersection is controlled by traffic lights. Parking in the area is controlled by meters during the week but it is a free parking area at weekends. There is a National Car Park off Millman Street. The nearest Underground stations are Chancery Lane on the Central Line and Russell Square on the Piccadilly Line. The former is about ten minutes walk from the new Headquarters (Northward up Grays Inn Road) and the latter a slightly lesser distance. Bus services 17, 18, 45 and 168A run through Grays Inn Road and may be used either from the Northern end of Grays Inn Road, when coming from Kings Cross British Rail station, or from Chancery Lane Underground station.

Why not come to see the Headquarters that you have helped finance ?

Look for GB2HQ on

1·920 MHz
3·780 MHz
7·080 MHz
70·2/70·26 MHz
144·7 MHz



G3LUB R, C & L Bridge

By D. R. Bowman, G3LUB *

OVER many years the author has tackled numerous Amateur Radio construction projects, including G2DAF receivers and transmitters. The main difficulties were always traced to coil construction, particularly when large numbers were involved, but this was finally overcome by the extensive use of the commercial sets of coils. About two years ago owing to increasing difficulty in obtaining supplies the author was driven once again to consider home construction. It became obvious that if the mistakes made previously were to be avoided it was imperative to be able to measure accurately and quickly the inductance of home constructed coils. First thoughts suggested the use of a grid dip oscillator to measure the resonant frequency of the unknown inductances when shunted by known values of capacitance. The construction of a grid dip oscillator kit had been completed a few months previously and, although this unit turned out to be first rate when used for dipping resonant circuits, the system was rather long winded and somewhat inaccurate when used to measure inductance. It became plain that the only solution was to construct a reactance bridge.

After considerable time had been spent studying the various bridge circuits, and it became obvious that a little extra circuit detail would allow values of capacitance and resistance as well as inductance to be measured.

The Aim of the Design

To measure:

1 R.F. coils with inductance values down to 1 μH and lower if possible.
2 Capacitance down to 1 pico-farad.
3 Capacitance values of electrolytic types.
4 Resistance, particularly values of less than 1 ohm used mainly in meter shunt construction. Most resistance measuring multimeters are inaccurate over this range.
5 Any other components, the measurement facilities of which could be incorporated into the unit without too much increase in circuit complexity.

* 32 Lynton Road, Chesham, Bucks.

A circuit of a Wheatstone Bridge which will be familiar to most amateurs is shown in Fig. 1. The resistance values of B, C and the linear potentiometer A are known. The unknown value of resistance is denoted X. The meter current limiting resistor S should be set to maximum and with the supply connected the variable resistance A should be adjusted until the meter indication approaches zero. The sensitivity resistance S is then progressively reduced in value while resistance A is readjusted to maintain zero meter deflection. With the bridge at balance there is no meter current and therefore points H and G are at the same potential:

but the voltage drop across $B = BI_1$
and the voltage drop across $A = AI_2$
therefore $BI_1 = AI_2$ (1)
also $CI_1 = XI_2$ (2)

dividing (1) by (2) $\frac{B}{C} = \frac{A}{X}$

therefore the unknown resistance $X = A.\frac{C}{B.}$

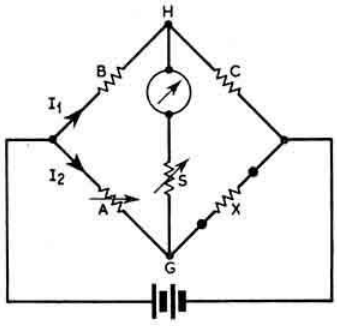
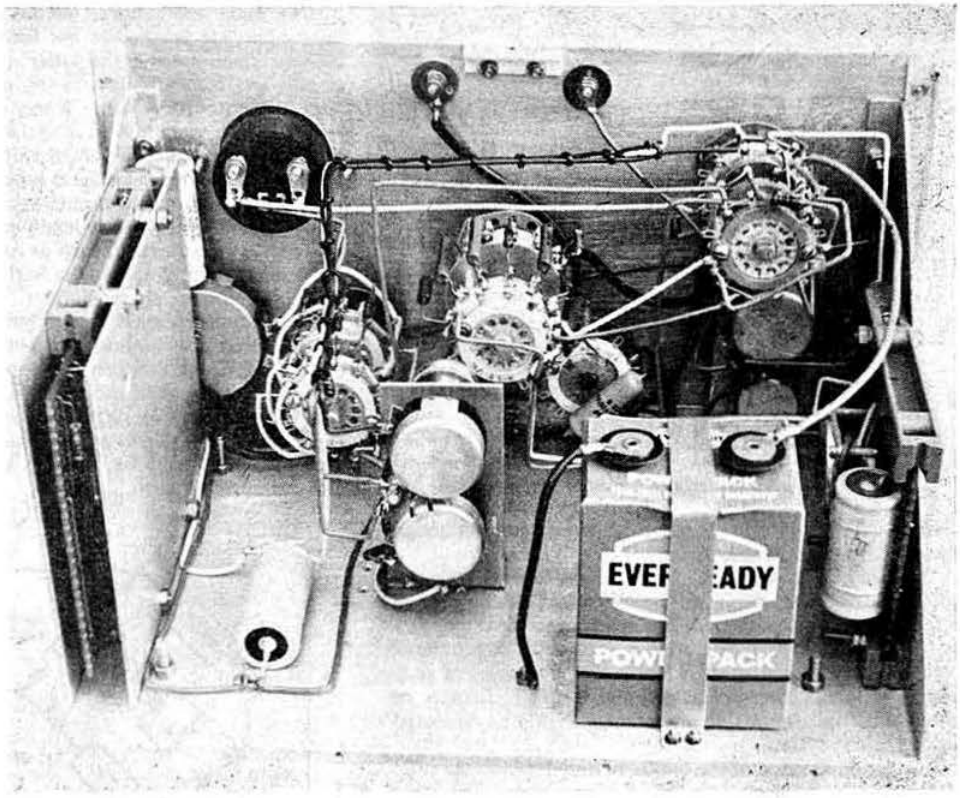


Fig. 1. Wheatstone Bridge.



Component layout used by the Author.

Now if resistances C and B are chosen to be equal then X = A and the value of X can be taken from the calibrated linear potentiometer A. Assuming the values of B and C are known precisely then the overall measuring accuracy of the bridge will be determined by the resolution of the calibrated potentiometer A and the sensitivity of the detector. In practice it is found that greater resolution can be obtained if A is made up with a switched decade resistance in series with a fine balance potentiometer. The sensitivity of the detector can only be increased by using either a more sensitive meter movement or increasing the supply voltage. This simple bridge has a rather limited measuring range say 1000 ohms–1 ohm, but this can easily be remedied by substituting a switched range of resistances in place of B while C remains constant at say 100 ohms.

$$X = A.\frac{C}{B}$$

$$\text{if } \frac{C}{B} = 10 \text{ then } X = 10 \times A$$

$$\frac{C}{B} = 100 \text{ then } X = 100 \times A$$

$$\text{or } \frac{C}{B} = 0{\cdot}1 \text{ then } X = 0{\cdot}1 \times A$$

The finalised circuit used to measure resistance using a d.c. supply is shown in Fig. 2.

The accuracy of measurement, as has already been mentioned in the text, can be increased within the limits of the resolution of the fine balance potentiometer, by using a more sensitive detector. Although a solid state d.c. amplifier using a balanced differential circuit is practical, an a.c. detection system will be shown to increase the versatility of the bridge. To use such an amplifier it is necessary to replace the bridge energizing d.c. by an oscillator-generated supply with an output isolated from earth. The use of an a.c. amplifier removes the drift problems encountered with high gain d.c. amplifiers and with careful design an amount of 50 Hz rejection can also be incorporated into the design. The

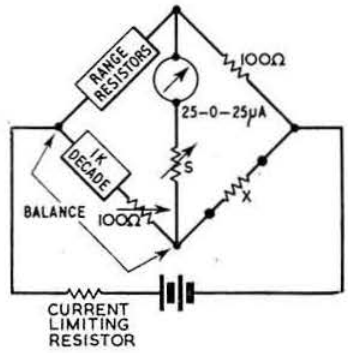


Fig. 2. D.c. resistance circuit.

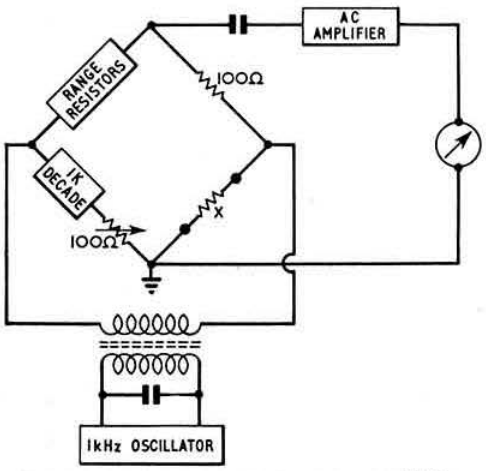


Fig. 3. Circuit additions to improve sensitivity.

oscillator frequency was chosen to be about 1 kHz although the exact figure is unimportant.

The circuit shown in Fig. 3 has a considerably increased gain compared with the simple d.c. Wheatstone Bridge. Even so it was decided to include both circuits in the final unit as a few components requiring to be measured have a large reactance in addition to their resistance. Examples of such components are wire wound resistances and resistances of chokes and transformer windings which should be measured using the d.c. system.

Further description of the oscillator and detector amplifier circuit will follow later as the design requirements are mainly determined by the bridge circuits used for inductance and capacitance measurements.

Among the many bridge circuits capable of measuring inductance, the author decided to use a combination of the Hays and Maxwell designs. It will be seen from Figs. 4 and 5 that the Hays and Maxwell circuits are almost identical, the only difference being that the former uses a series phase balance circuit, while the latter a parallel phase balance circuit. As the capacitor, in the author's case a 0·1 μF paper type, has to be either a very close tolerance unit or a selected value component it is to the constructor's advantage that only one such component should be required. It will be seen that the Hays bridge is most relevant to rather high loss inductance measurements such as transformers, etc., whilst the Maxwell circuit lends itself to low loss high Q inductance measurement, such as r.f. coils.

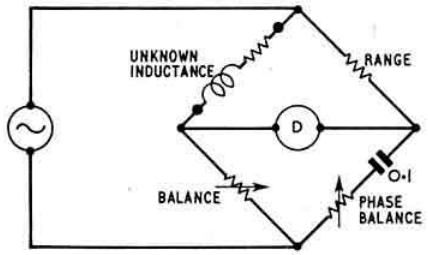


Fig. 4. Hays Bridge.

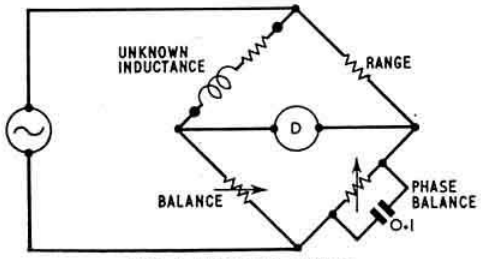


Fig. 5. Maxwell Bridge.

The only point of note in the final inductance circuit Fig. 6 is the oscillator feed transformer. This transformer has a secondary which should be well balanced about earth so as not to unbalance the bridge to which it is connected. The author had some difficulty designing this transformer and any prospective constructor should follow the physical details with great care. To reduce the transformer's secondary capacitance misbalance a thin aluminium foil screen was introduced between the primary and secondary windings and connected to earth.

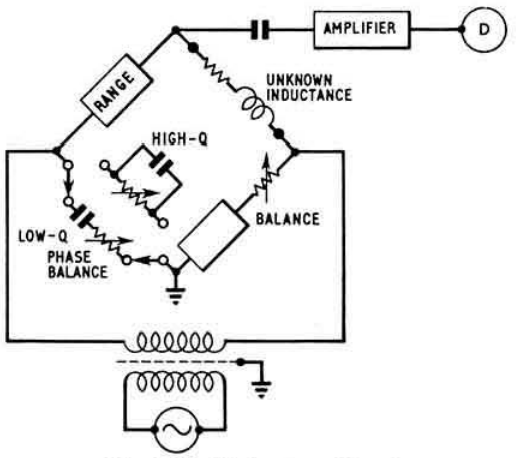


Fig. 6. Final Inductance Circuit.

So far this description has covered basic bridge circuits capable of measuring resistance and inductance. We are now only left with the measure of capacitance. The circuit finally chosen is remarkably like the previous Hays and Maxwell combination. The circuit shown in Fig. 7 is best suited for measuring high Q capacitors such as ceramic and mica types, while Fig. 8 should accommodate electrolytics. It is found that if the same balance and range resistor chains are used to measure R C and L then the balance potentiometer calibration is correct for each and the unknown component value is simply the balance calibration reading multiplied by the range resistor. Although the phase balance potentiometer could be calibrated in effective Q figures, the author decided this was an unnecessary complication.

In the author's bridge the two phase balance controls are ganged together using a home constructed string drive. This required access to a lathe, and as most amateurs have not got this facility, it is suggested that no attempt is made to gang this control and instead two controls are mounted on

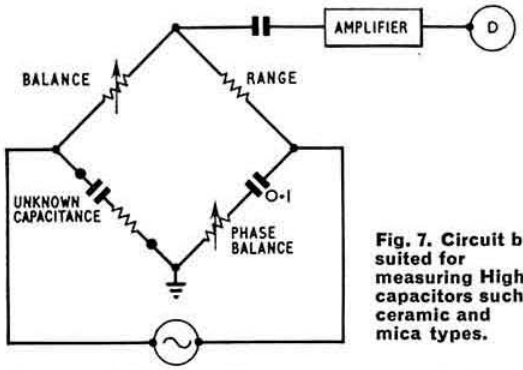


Fig. 7. Circuit best suited for measuring High Q capacitors such as ceramic and mica types.

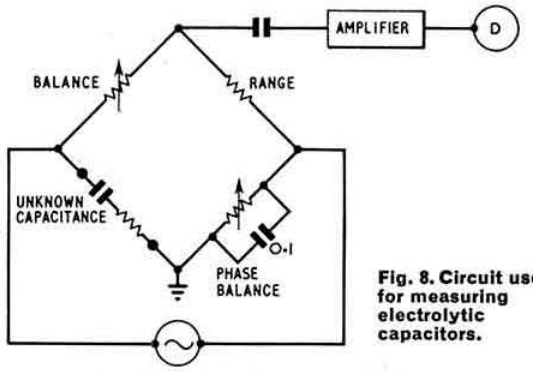
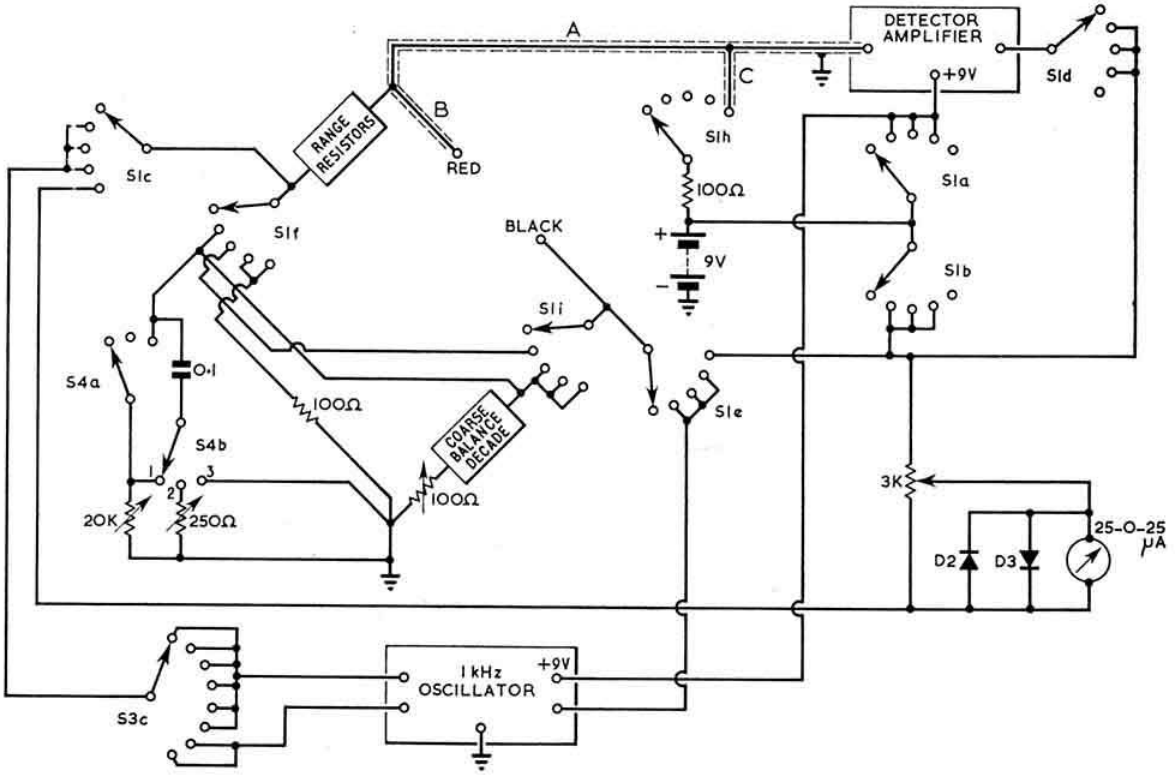


Fig. 8. Circuit used for measuring electrolytic capacitors.

the front panel. The use of two separate controls is no disadvantage as the phase balance can always be controlled by one or the other. The front panel detector gain control is also ganged, but once again two separate potentiometers can be used. One controls the a.c. amplifier gain while the other the meter sensitivity when the d.c. bridge is being used.

Any reader contemplating the construction of this piece of test equipment would be well advised to use new components throughout. It is well worth remembering that all future construction projects are likely to lean heavily on the accuracy of the R C and L bridge, as once built the reader will wonder how he did without such a unit for so long. The cost is unlikely to exceed £15 which is very much less than the £100 or so that would be required to purchase a similar commercially produced bridge. The active sections of the bridge were constructed on Vero plug-in boards, the oscillator and amplifier each being situated at opposite ends of an aluminium chassis, the shape of which is best seen from the photographs. There is no need to use plug-in boards, although the author found them useful during the circuit



Switching layout:

S1 Function switch
- **1 Off**
- **2 Capacitance**
- **3 Inductance**
- **4 Resistance a.c.**
- **5 Resistance d.c.**

S3 The Range Switch

S4 Phase balance
- **1 R.F. Coils**
- **2 Capacitance and High Q Inductance**
- **3 Electrolytic Capacitance and Transformers.**

development as they facilitated easy circuit modification. The general layout of the components seems not to be critical with the exception of leads A, B and C which should be wired with miniature screened lead and kept as short as the layout will allow.

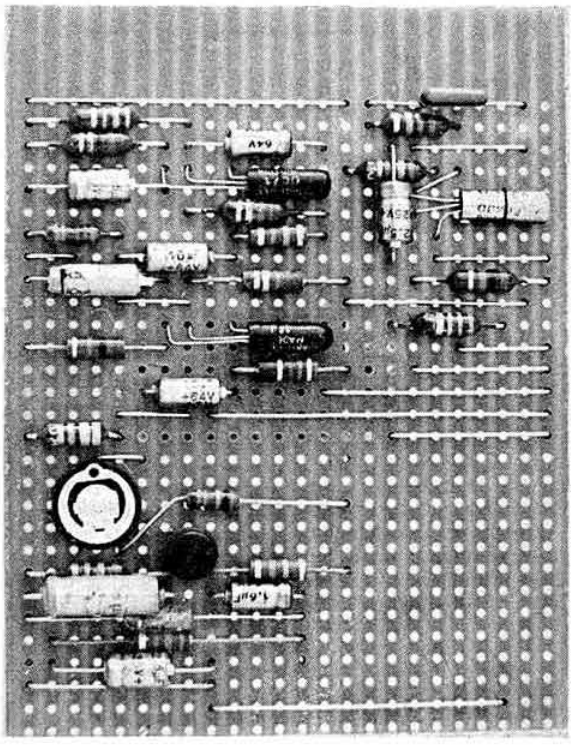
On range switch position 1 a resistance of about 0·1 ohms is in circuit and as this is the most important inductance range it was considered worth the extra expense of connecting extra wafers in parallel to reduce the switch contact resistance. The input and output wafers are separated by a small aluminium screen and to further reduce stray effects two of the front three wafers are shorting types, earthing all unused range change resistors to earth.

The wafer switches used throughout the unit were of the "Maka" switch type obtainable from Home Radio (Mitcham) Ltd. The shorting wafers will be found advertised by Electroniques in their catalogue. All bridge resistors, with the exception of those used in the amplifier and oscillator, must be of the highest stability type that the constructor can afford. Metal oxide high stability 1 watt resistors were used by the author and are obtainable from Home Radio.

A nominal 100 ohms linear wirewound potentiometer is specified for the fine balance control, although a 105 ohms potentiometer would allow some scale overlap and should be better. The writer was lucky in that a number of 100 ohms ± 20 per cent controls were available and from these one was selected. The calibration can either be copied from the photographs or for greater accuracy individually marked with the help of a general purpose ohm multimeter.

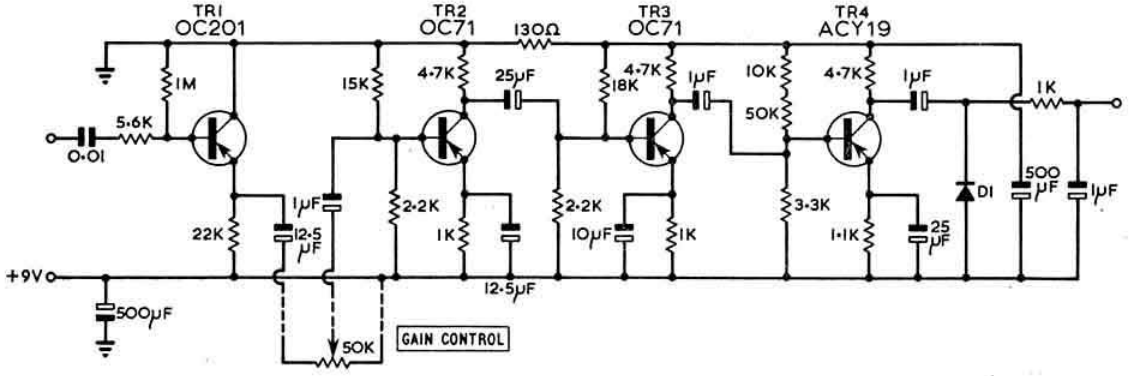
A thousand ohm decade is constructed using a 10 position switch and is used as the coarse balance control. As the standard range of metal oxide resistors does not include 200, 300 or 600 ohm values, these are made up using either series or parallel combinations.

The amplifier consists of a high impedance emitter follower first stage required to retain the detector's sensitivity when the bridge output impedance is high. The following stages make up an RC coupled a.c. amplifier driving a diode detector and meter drive circuit. The author was lucky enough to have a centre zero 25 μA–0–25 μA meter, but on reflection considers a non-centre zero meter more useful. When using the oscillator produced a.c. supply the metre deflection is always in the same sense and it is only when using the d.c. supplied Wheatstone bridge that the centre zero meter would be an advantage. The amplifier gain is such that a 0·1 mV signal inserted into the measuring terminals should produce full scale deflections on the meter.

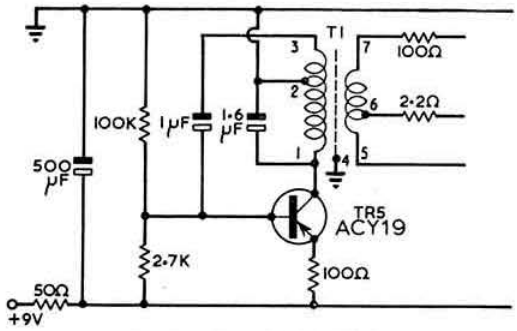


Amplifier and Detector Circuit Board.

The amplifier is constructed on a Vero board 5 in. × 3¾ in. in size. Although no instability was experienced, great care was taken to connect all unused copper strips in the region of the emitter follower and first voltage amplifier to earth. The general board layout was chosen to keep the input away from the output. Two removable aluminium screens were also positioned above and below the amplifier board to



The Amplifier and Detector Circuit employed.



Circuit of oscillator stage.

provide extra screening. The screens may not be necessary but even so they are likely to reduce stray signal pick-up.

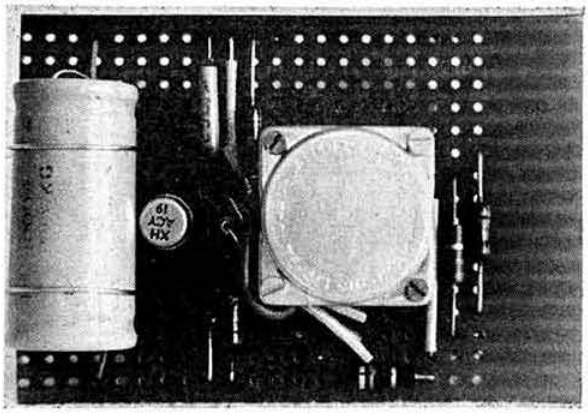
Almost any high gain p-n-p transistor type can be used in the construction of the amplifier with the exception of the first stage emitter follower for which a silicon device is best suited, having a rather lower inherent noise figure. The coupling and bypass capacitors are also not critical and any value of capacitance of the same order as those shown could be substituted.

Even if the circuit is copied exactly the bias conditions of each stage should be checked and compared with the figures given in the accompanying tables. If any one emitter current differs appreciably from the expected value then the bias resistors should be altered to correct the situation.

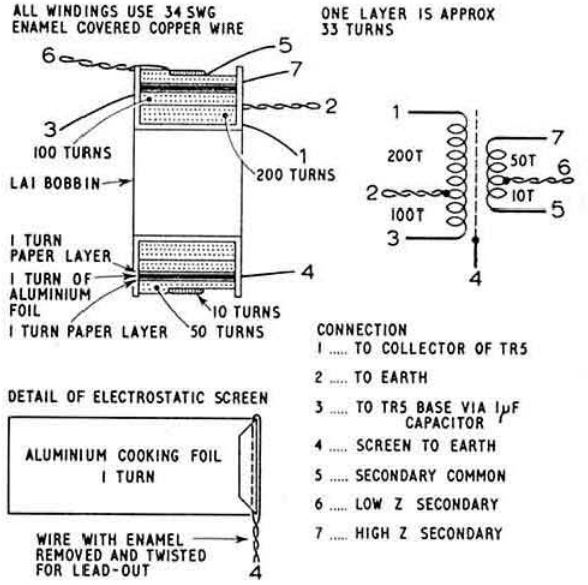
It might well be that one of the new RCA linear integrated circuits could be used for this amplifier, but to date the author has not had the chance to try one.

The oscillator is also built on a Vero board, somewhat smaller, $3\frac{3}{4}$ in. × $2\frac{1}{2}$ in. in size. The circuit is a standard Hartley oscillator with the output being taken from a secondary winding on top of the main tapped coil. The output is a pure 1 kHz signal and has a good sine wave shape when examined with an oscilloscope. An ACY19 germanium p-n-p transistor is used, although again almost any other medium gain device should work equally well. An amount of negative feedback is introduced into the oscillator circuit by leaving the emitter circuit unbypassed. This helps the oscillator to maintain a good sine wave output even into the wide range of load impedance caused by the variations in bridge input impedance due to range changes.

The transformer construction does require special care and even though the core used was rather small it was the only type of ferrite pot core that is freely available to all prospective constructors. Home Radio can supply the Mullard Pot core type LA1 which was used. If the bobbin, clamped between an 0BA nut and bolt, is mounted in the chuck of a small hand drill, it will be found quite easy to wind the hundreds of turns of 24 s.w.g. enamel covered wire required on the core. The hand drill should itself be held in a bench vice, or clamped to the kitchen table, and the handle rotated with one hand while the wire is guided on to the bobbin using the other hand. By attaching the end of the wire to the 0BA bolt the wire can be fed on to the bobbin through one of the slots and with care an even winding may be produced. The author found that one layer of 34 s.w.g. wire constituted about 33 turns and therefore 6 layers i.e. 200 turns of wire were wound on to the bobbin. The end was then extracted through one of the slots and formed into a

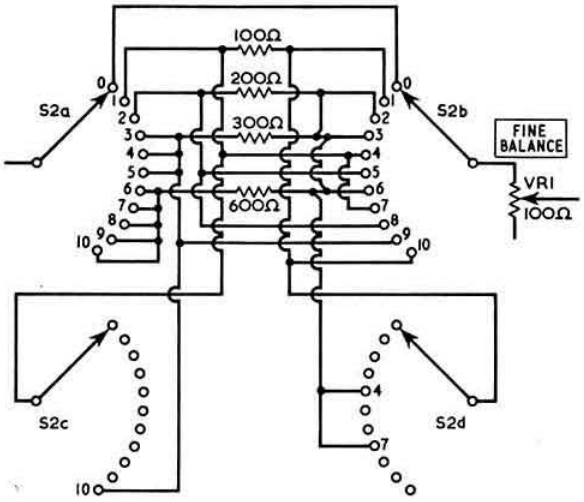


The Oscillator Circuit Board showing component layout.

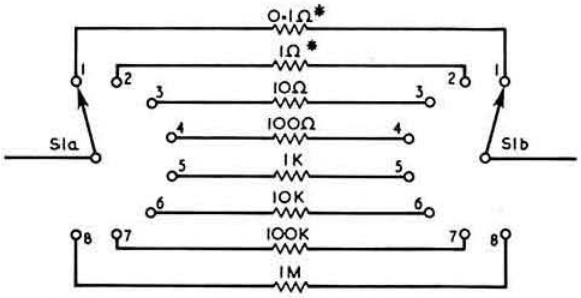


Constructional details of oscillator transformer T1.

2 in. loop and without cutting the wire returned to the bobbin. The winding was continued with a further 100 turns i.e. 3 layers wound on top of the previous winding. This completes the primary winding. One layer of thin paper was placed over the wire on the bobbin and fixed using Evostick. A thin strip of aluminium cooking foil was next wound on to the bobbin, with a connection made to it using a short piece of 34 s.w.g. wire with the enamel covering removed from the end gently wrapped round the foil, as shown in the diagram. The foil strip acts as an electrostatic screen and should be connected to earth via the short piece of attached wire. One more layer of thin paper was wound on top of the foil and followed by 50 turns of wire with once again a 2 in. loop being made before winding on a final 10 turns. The construction of the transformer was completed by winding a further layer of paper on top of the final winding and the bobbin assembled inside the LA1 pot core.



The Potentiometric chain 0–1000 ohm balance control.



Resistors employed in S1a and S1b.

Great care was exercised in the final assembly to avoid damaging the enamel covering on the wires particularly where they emerge from the ferrite core. The end plates were screwed up tightly and connected to earth when the transformer was wired into circuit. One word of warning is appropriate at this point in the description. During the development of the bridge a most annoying intermittent fault developed when the instrument was shaken. It was difficult to find the electrical balance and finally the fault was traced to loose transformer end plates which were not firmly bonded to earth.

To reduce the number of front panel controls the two phase balance potentiometers were ganged together using home-made cord drives. The two gain controls were similarly ganged. This expedient is not absolutely necessary but any prospective constructor who wishes can obtain drives that should be suitable from Jackson Bros. (London) Ltd., Kingsway, Waddon, Croydon, Surrey, Reference No. 4597.

The Final Test Technique

On completing the construction of the bridge a preliminary test should be made by measuring the resistances of an assortment of carbon resistors over the range of 10 ohms to 50 k ohms. With the check resistor connected to the test terminals and the bridge detector gain control at minimum, the " on " switch should be operated. The appropriate range, with the exception of numbers one and two should be selected and the gain advanced, while the coarse balance control is rotated, searching for a null in the indicated meter reading. The bridge should be carefully balanced while further increasing the detector gain. The final balance point is found using the fine balance control. It should be noted that for resistance measurements the phase controls are inoperative. If any unusual results are noted the circuit fault must be diagnosed and rectified before proceeding. The next step is to check the capacitance measuring capability. Select a number of capacitors with values between say 5 pF and 100 μF and connect them one by one to the measuring terminals noting that with electrolytic construction the positive lead should be connected to the red terminal. As with resistance measurement, the aim is to balance the bridge for a meter deflection null, while progressively increasing the detector's gain, but with the added complication of having also to balance the phase control. Low loss capacitors of silver mica and ceramic construction should be measured using position 2 of the coarse phase balance control in conjunction with the 250 ohm fine balance potentiometer. Electrolytic and other low Q capacitors require the use of the third position of switch S4 and the 20K ohms potentiometer.

Up to this point it may have been noticed that no measurements using range one and two have been made as the 0·1 ohm and 1 ohm range resistors have not yet been wired into circuit. The construction of the 1 ohm resistor should proceed as follows. A high value large carbon resistor say 1 or 2 watt 100 k ohm resistor should be used as a former rather in the same way as v.h.f. radio frequency chokes are made. A seven inch length of 30 s.w.g. resistance wire should be bent double to give a twin wire with a length of 3·5 inches. The double wire should be wound on to the resistor former with the uncut end first and then finally the two free ends tacked with solder to alternate ends of the resistor. This technique is usually termed non-inductive winding. Some form of adhesive such as shellac or varnish should be applied to the resistor, but leaving the tacked resistance wire ends free for final adjustment in circuit. The 1 ohm resistor should now be mounted in a temporary fashion on the range switch position 2. The extra 10 ohm metal oxide resistor included in the components list should now be connected across the measuring terminals and the 1 ohm resistor adjusted so that the bridge reads 10 ohms by carefully trimming equally the two resistance wire ends. The 1 ohm resistor should be finally soldered into circuit after having been varnished to fix the wire permanently to its resistor former.

We come now to the construction of the 0·1 ohms resistor,

which in practice should have a value nearer 0·09 ohms, the missing 0·01 ohms being made up by the switch contacts and internal wiring. If the prospective constructor has access to an accurate 1 ohm resistor then a similar procedure to that used to adjust range 2 should be followed. If such a resistor is not available the following technique should be substituted. Once again a length of resistance wire, this time 2·5 in. of 24 s.w.g. is tacked with solder into range switch-on position 1. No former is required and the wire should be mounted in such a fashion that when the adjustments are completed the wire can be formed into a hairpin so as to reduce the stray inductance. Next, using range 2, a spare piece of 30 s.w.g. resistance wire 7 in. long should be connected to the measuring terminals and adjusted in length until it measures exactly 1 ohm.

On switching the bridge to range 1, the short ·1 ohm, 2·5 in. long resistance, tacked into place previously, should be adjusted in length until the bridge indicates exactly 1 ohm.

This completes the construction of the bridge and all that is left is to confirm that inductance can be measured. When R.F. air cored coils are being measured, position 1 of the coarse phase balance switch in conjunction with the 20 k ohm fine balance potentiometer is used. Switch position 2 being used for high Q inductors such as ferrite Vinkors etc. and position 3 for power transformers and smoothing chokes. In common with most inductance bridges, great care must be taken to balance for the null concurrent with maximum detector gain. This may require considerable backwards and forwards adjustment of the balance controls in conjunction with the phase balance settings; always aiming for a null with maximum detector gain.

On completion of this unit it is likely that a large number of unmarked junk box components will be checked. It is most important to remember that until very recently the vast majority of capacitors had a tolerance of ± 10 per cent or worse and if these are old they cannot necessarily be expected still to be even within this limit. Resistors were also not often better than ± 5 per cent and again usually much worse. If unselected 1 per cent metal oxide resistors are used where specified and care is taken to calibrate the fine balance potentiometer accurately ± 3 per cent final measuring accuracy can be expected. Even ± 1 per cent measurement is likely as the metal oxide resistors are usually much more accurate than the stated ± 1 per cent.

All measurements unless stated otherwise were made using a Sanwa 360YTR Multimeter.

Transistor No.	Potential Measured Across	Transistor Emitter Current
TR1	22 k Emitter Resistor 2·8V	1·2 mA
TR2	1 k Emitter Resistor 0·95V	·95 mA
TR3	1 k Emitter Resistor 0·9V	·9 mA
TR4	1·1 K Emitter Resistor 0·75V	·7 mA
		Total
TR5	50 ohms Oscillator Decoupling Resistor 0·38V	7·6 mA
TR5	100 ohms Emitter Resistor 0·75V	7·5 mA

Amplifier gain check

Set the front panel gain control to maximum and the oscillator board either disconnected or removed. A 0·03 V r.m.s. signal from an audio frequency generator adjusted to 1 kHz and fed into the measuring terminals should produce full scale deflection on the meter.

The 1 kHz oscillator

0·5 V r.m.s. across terminals 7–5 when terminated in 100 ohms resistor.

0·05 V r.m.s. across terminals 6–5 when terminated in 1·5 ohms resistor.

Special components

All resistors used, with the exception of those listed below are carbon ¼ watt types, Home Radio Type HYSTAB being suitable.

Circuit	Value
Coarse balance decade	
100 ohms	100 ohms 1W metal oxide resistor
200 ohms	2 × 100 ohms in series
300 ohms	2 × 150 ohms in series
600 ohms	2 × 1·2 k ohms in parallel
The Range Resistance Box	
Position 1	0·1 ohm see text.
Position 2	1 ohm see text
Position 3	10 ohms
Position 4	100 ohms
Position 5	1 k ohms
Position 6	10 k ohms
Position 7	100 k ohms
Position 8	1 M ohm
Bridge arm when measuring resistance	
100 ohms	100 ohms
Spare for final alignment	10 ohms

All above obtainable from Home Radio Ltd.

Fine Balance Potentiometer
100 ohms linear wirewound potentiometer
Large type (3 watt) for increased resolution.

Circuit	Value
Gain control	50 k ohms log carbon pot. ¼ watt.
Gain control	3 k ohms wire wound pot. 1 watt.
Phase Balance	20 k ohms wire wound pot. 1 watt.
	250 ohms wire wound Pot. 1 watt.
T1 Oscillator	Ferrox Cube Pot Core LA1
Transformer Core	Mullard. Obtainable from Home Radio.

34 s.w.g. enamelled copper wire used for the windings of T1 2oz 4/7
24 s.w.g. double cotton covered eurena and constantin resistance wire required for 0·1 ohm range resistor 1·0 oz 5/6
30 s.w.g. d.c.c. As above.
For 1 ohm range resistor 1 oz. 6/3
All wire noted above is obtainable from: Post Radio Supplies, 33 Bourne Gardens, London, E4.

Transistor and Diode Table

	Type used	Possible alternative
TR1	OC201	OC200 OC202
TR2	OC71	OC75
TR3	OC71	OC75
TR4	ACY19	OC75
TR5	ACY19	OC72
D1, D2, D3	Any germanium point contact Diode such as CV448, OA85, OA81 etc.	

THE MONTH ON THE AIR

By JOHN ALLAWAY, G3FKM*

READERS will be grateful to G2DC for investigating the complaints concerning non-arrival of QSL's from the YASME Foundation QSL Bureau. The facts established are briefly as follows: Every card received will be answered if it checks with the logs. QSL's received with IRC's and s.a.e. are dealt with as soon as they are opened. QSL's with IRC's but no addressed envelope are subject to some delay as addressing envelopes causes considerable extra work and is the main reason for delays for direct replies. QSL's received by bureau service amount to many thousands and a reply may not be expected for at least 12 months. All are checked against logs and a complete record is kept of incoming and outgoing cards. It would appear that one of the main causes of the non receipt of a card by a G station whose QSL was sent via the bureau is that the card does not reach YASME. Of 17 complaints checked by G2DC, only one card sent via the bureau had been received, it was also found that nine cards sent out by YASME via the bureau had not reached their destinations. These investigations have obviously taken up a great deal of time, but have been most useful in showing that YASME have been carrying on Iris and Lloyd Colvin's tradition of friendly service to DX'ers throughout the world.

Another aspect of non-arrival of QSL cards has been mentioned by AP5HQ. He points out that in some countries communications bearing attractive stamps never seem to get delivered. This is supported by W4BPD who says that during his stay in Bhutan he never received any correspondence which had been sent to him bearing commemorative stamps. The moral seems to be to use only definitive stamps (preferably of low value) on cards sent direct to the less developed countries.

Howard Cunningham, G8FG (ex ZB1A/9H1A) has now taken over the post of certificates manager for the Ex-G Radio Club, and all UK applicants for the Ex-G Club Certificate should send their cards to him at 8 The Laurels, Fleet, Aldershot, Hants.

Apologies for the errors in last month's MOTA which were due to the non-arrival of proofs at G3FKM's. The 9I4 prefix was incorrectly referred to as 9L4 and MP4TCF's QSL manager is G3WET, *not* G3HSR.

Top Band News

The first issue of the 1968/69 season *160m DX Bulletin* from W1BB gives the unhappy news that Stew's wife has been taken ill. Your scribe is certain that all readers would wish to join him in wishing her a speedy recovery. In the meantime W1BB may not be as active on the band as he otherwise would have been, but he will still try to keep in touch with activities, and asks for all results of Transatlantic tests, and other DX items to be sent to him as before at 36 Pleasant Street, Winthrop, Mass., USA, 02152. One of the more important items mentioned in the *DX Bulletin* is the change brought about by the increased frequency allocation available to USA and Canadian stations. This means that the area between 1825 and 1830 kHz, formerly much used by non-American stations,, will now be subject to considerable interference at the US/Canada end. A Loran station which previously occupied 1850 kHz has now moved, and it is suggested that European and other DX stations may find 1850 to 1860, (or even 1875 kHz) more suitable. It is suggested that the situation is watched carefully to discover which is now the best area for DX stations to use.

VP8KF is reported to be interested in putting out a 160m signal from the Falkland Is. in the near future. He will be prepared to arrange skeds via G3SJJ (J. C. Burbanks, 28 Leacroft Road, Bobbers Mill, Nottingham). VP8JR, also in Port Stanley, is said to be on 1850 kHz at 02.00 looking for UK stations.

A reminder that details of the forthcoming Sunday morning DX tests was given on page 668 of October *Radio Communication*. Please remember that these are *tests* and *not contests*!

The 1969 CQ Magazine 160m DX Contest is scheduled to take place on the weekend of 25/26 January. Details will be given in January *MOTA*.

Roger Crofts, G3UPK, will be on the air again from Gibraltar as ZB2AY for a four week spell commencing 14 December and will be active on 160m. QSL's should be sent via K3RLY (see *QTH Corner*).

News from Overseas

In a letter to G2MI, 5U7AL has given details of present activity in the French area of Africa. In **Niger**, besides himself, are Yves 5U7AC, Dave 5U7AK, Bill 5U7AN, and Jacques, 5U7AH, and his wife 5U7XYL who are presently not on the air. The only licensed amateurs in the **Central African Republic** are Dave TL8DL, Gilbert TL8GL, and 5U7AL who holds the call TL8AL. Fred also holds the only active licence in **Dahomey** (TY6ATE), although several licences are still valid, including those of Iris and Lloyd Colvin, and two Nigerians who are at present out of the country. The **Niger** PTT have no record of 5U2AB or 5U2WS, QSL's for c.w. contacts with these two pirates are being received in considerable numbers. At present there are no amateur operations authorized in **Upper Volta**, and although QSL's are being received for XT2A, according to PTT this station is illegal. TT8AN operated from **Tchad** recently, using an existing call with permission and the

*10 Knightlow Road, Birmingham 17. Closing date for the January issue is 4 December, for the February issue 15 January and for the March issue, 11 February.

owner of the call present. Fred is expecting a TN8 licence to be issued to him within the next month.

ZS5ZS has a weekly schedule with ZS1ANT (the South African Antarctic Expedition) at 4 p.m. South African time each Sunday. Anyone wishing to have a contact with ZS1ANT is invited to contact ZS5ZS, Ron Tester, 1 Wilson Drive, Pinelands, Pinetown, Nr. Durban, Natal, Rep. of South Africa.

ZD5V (who is ex-G3UUK) is particularly looking for contacts with the UK. He is most frequently to be found around 28,600 kHz in the afternoon. At the time of writing he was using a KW2000A transceiver and a ZL-special antenna at 45 ft., but he is expecting to receive a linear soon. QSL's should be sent *via* 4A2YP.

A much delayed letter from KR6TAB mentions that the possible " KD6AA " operation referred to in August *MOTA* is strictly a rumour. If any operation were to take place from the Daito Is. it would be under a KR6 or KR8 prefix since it has been confirmed by the chairman of the Armed Forces Amateur Radio Board that these islands are under the jurisdiction of the Ryukyu Is. Referring to the change of prefix by stations in the Bonin and Volcano Islands, it is not known what prefix local inhabitants may use, since the KA1 prefix is only used by US service stations. KR6TAB has now taken over the post of QSL manager for the Okinawa Amateur Radio Club (with effect from 1 July 1968).

Mike Dransfield, 5N2AAF, takes your scribe to task (in October *NARS News*) over allegations of UK inactivity. He points out that he contacted 369 UK stations during the RSGB 28 MHz contest—nearly three per cent of our amateur population. During the WAE contest over 100 G's were worked compared with 150 DL's. Mike suggests that some of the evening inactivity is due to interference *from* TV—erstwhile operators are viewing instead of being on the band! Apparently a large number of QSL cards (particularly from the USSR) are being sent for Cameroun stations, via the NARS QSL bureau. This is not the correct routing for these cards, which should be sent direct, or via QSL managers. Unfortunately there is no TJ Amateur Radio Society or QSL bureau yet.

Dick Buckby, ZD8RB, has returned home to the UK after his 2½ year stay on Ascension Is. He still has a good supply of QSL cards left and will be pleased to deal with requests sent to his G3VGW address (see *QTH Corner*). There is still quite a lot of activity down there with ZD8's JL and JW active from the British community. ZD8DG is at present on leave in the UK but returns in December. Dick used a KW Vespa, Racal receiver, and ground planes whilst on the island and had many enjoyable contacts, including a few on 160m.

Nick Henwood, G3RWF, is now in Kenya, and will be on the air just as soon as the school where he works is connected to the electricity supply, which should be very soon! His new callsign is 5Z4LS.

Readers who had the pleasure of a personal QSO with John, OA4KY, during one of his visits to the UK will be interested to know that he is now F0DU.

John Steel, G3VJI, is now in Guyana and looking for UK stations daily between 12.00 and 14.00 on 28 MHz. He has 50 watts of a.m. to a dipole which should be at 25 ft. by now. Anyone interested in fixing a sked is invited to write to the address in *QTH Corner*. John believes that he is the first holder of a reciprocal licence in Guyana.

Colin McRae (ex G3WRN), has written from Singapore to clarify the situation with regard to VS9MB QSL cards. He makes occasional two weekly trips to VS9MB and the logs for these visits are despatched *immediately* to W2CTN on his return to Singapore. He commenced these operations in February 1968 and has been meticulous in seeing that all QSO's have a QSL, either direct or via W2CTN. If anyone is lacking a card from an operator called Colin for a contact *since February 1968* he suggests that they write to W2CTN, or direct to: Colin McRae, 40 Jalan Chempaka Puteh, Singapore 16.

QRP

Reports of really low power DX contacts seem to be few and far between, and G6XN is to be congratulated on his achievement of maintaining daily schedules (whilst on holiday in Mull) with VK3IP and VK2NN between 20 and 25 October on 14 MHz s.s.b. and only missing contact on one day. He was running 1 watt output into an inverted vee which was sloping steeply in the direction of Australia via the long path (over Central America). His signal reached S7 in VK at best, and in addition VK5BB was raised on 21 MHz, this time on the direct (short) path. Other QSO's from GM6XN/P were with two W's and a number of Europeans. Similar good results had been obtained whilst operating portable in the Lake District two weeks previously, but when using the quad antenna at his home QTH contacts were only possible on three out of six days.

The Cardiff University Trans-Africa Expedition

This expedition, which consists of five graduates of Cardiff University, will depart in January 1969 in a Bedford seven ton lorry en route for North Africa, the Nile Valley, Ethiopia, Kenya, Uganda, Malawi, Zambia, Tanzania, Mozambique, Rhodesia, and South Africa. They will attempt to maintain contact with the U.C. Cardiff Radio Station (GW3UWC) on 10, 15 and 20 metres, and may also try some V.H.F. working. Actual equipment to be used will depend on the state of their finances at departure time, but it is intended to take some kind of a beam antenna as well as dipoles and vee beams. Each member of the party is contributing £250 towards the cost of the trip, and they have already received generous additional support from certain food and oil firms. They are hoping to receive similar support from manufacturers of radio gear. The whole trip is expected to last between four and six months.

Contests

Results of the **1968 CQ 160 Metre Contest** are now to hand. Conditions seem to have been far better than might have been expected at this stage in the sunspot cycle, with quite good propagation on the transatlantic path. Stations in 33 countries were known to be active, G3KMI has the most QSO's 256—only three short of the highest ever made by K8RRH in 1967), and G3SED had the highest number of countries worked (18). Top world score was made by W1BB/1 with 35,530 points, UK scores were as follows:

GI3OQR	**17,280 points**	G3PVA	3790 points
G3KMI	**17,040 points**	G3VPS	3790 points
G3SED	13,692 points	**GD3TNS**	**3322 points**
G3IGW	9010 points	G3HZL	3300 points
GM3KMR	**8736 points**	G3SXW	2930 points
GM3OXX	6408 points	G3ADH	2760 points
G2DC	4550 points	GD3HQR	2358 points
G3SVW/A	4521 points	G3JVJ	1881 points
GW3UCB	**4059 points**	G3VRY	679 points

Congratulations to the certificate winners (in heavy type). Details of the 1969 event will appear in next month's *MOTA*.

The **" Town of Porto Amelia " Contest** will be held between 00.00 7 December and 24.00 9 December. It will cover all bands 3·5 to 28 MHz, and all modes. Cross mode QSO's s.s.b./a.m., s.s.b./c.w., and a.m./c.w. will also be allowed, but cross band QSO's are not. The object of the contest is to work as many CR7 stations as possible, and each CR7 may be worked on each band/mode during each 24 hour section of the contest. Reports plus serial number of contact (starting with 001) must be exchanged. QSO's with CR7's count 3 points, and with CR7's BM, EF, FM, GW, HF, HQ, IC, and IZ (who are all in Porto Amelia) count 6 points. Logs should be sent to: Camara Municipal de Porto Amelia, Caixa Postal 29, Porto Amelia, Mozambique.

There will be no TOPS 80 Metre contest this year. Results of the last event will be published soon, but unfortunately pressure on checking the 150–200 logs received has meant that there has been no time to organize a contest this year. The organizers point out that more enthusiastic support from UK stations would be appreciated during the next year's event—usually most of the entrants are from E. Europe, and the British entry is well under 10 per cent.

Results of the 1967 **OK DX Contest** show that UK entries were as follows: Multi-band **G3TIF** (32,890 points), G3NSY (22,632 points), **GM5AHS** (6532 points). Single band (14 MHz) **G3PJW** (30,705 points), G3OXI (9016 points), (3·5 MHz) **GW3WVG** (572 points).

The W9WNV Story—Finale

Following the mention of ARRL's agreement with Don Miller, W9WNV, in September *MOTA*, a letter has been received from Don requesting that his side of the settlement should be published. This information was to be published in November " *CQ* " and thanks are extended to that magazine for permission to quote from their article. Unfortunately space precludes the reproduction of the statement in its entirety but relevant extracts are as follow:

" When any case is decided out of court, as this one was and as the term ' settlement ' implies, both sides make concessions. As you know, this was not simply a ' withdrawal of suit,' as the *QST* article would have us believe. In every settlement the plaintiff withdraws his suit in exchange for what he regards as fair concession or reimbursement by the defendant (ARRL in this case). The League's concesssions were as follows: *a* The Awards Committee were to accredit Geyser Reef, Blenheim Reef, and Nelson's Is. *b* I was paid, through attorneys (the standard method of payment), the sum of $2,500. *c* In addition to that sum, I was reimbursed most of my legal (deposition, hotel, etc.,) expenses in the case.

" It was what I considered a fair settlement of the case, and so I signed the settlement agreement, knowing full well that they would seek to publicize the PY0XA operation to make it seem as though the League had won some kind of ' victory.' I presume that Huntoon and the Directors were satisfied with the settlement, or they wouldn't have signed the agreement. As of this date, seven of the eleven DXpedition operations discredited by the Awards Committee have been reinstated or accredited full standing. Four of these (FR7ZP, VQ9AA/D, VQ9AA/A, and 1M4A) were reinstated when the Committee learned that its charges of unethical QSL card distribution were unfounded. For this, they never apologized. Four remain discredited by Huntoon and his committee—Navassa—where the League (but not the Coast Guard) claims we trespassed, Heard Is., where they claimed my licence was invalid (although they have seen my VK licence authorizing operation from Heard), Laccadive Is., where they state the licence was valid only for the mainland and not for the islands, and have unsupported statements that we did not land, and St. Peter and Paul's Rocks, discussed below. Certain points have never been mentioned by ARRL (i) Over 60 valid operations were conducted and never challenged. (ii) Proven illegal operations by other DXpeditions were still accredited by the Awards Committee. (iii) No case has been cited where any licence to me was ever revoked, suspended, or cancelled. No single action has ever been taken against me by any government or agency of any country, and no example given of where amateur radio has been jeopardized at all. (iv) My disqualifications from past ARRL DX contests were wholly unsupported, a check of my logs during the deposition showed them to be as, or more, accurate than the others checked.

" Regarding the PY0XA operation, I feel that all amateurs are entitled to an explanation. It took place from a ship, not from the rocks. We were unable to reach the Rocks before the 30 day, non-renewable licence expired. The only previous operation from those rocks had been accepted by ARRL, despite verification by the LABRE that the licence was for /MM operation only. In the same sense our licence should have been valid for /MM use. Never, during the PY0XA operation did I state we were at St. Peter and Paul's Rocks. I informed ARRL, quite some time ago, that many of the photos submitted were not actually of the Rocks, but of some other location. The caption in *QST* failed to mention this. Those are the facts of that operation and of the outcome of my suit against the League and Huntoon. Regardless of what you or your readers may hear or believe, I must state, unqualifyingly, that I am completely satisfied with the outcome, and believe that the settlement, including both the reinstatement of my operations and the financial outcome, were perfectly fair and appropriate. The important result should be that some manner of dignity should now be restored at Newington and that future membership and international dealings will be carried out in a dignified manner by the HQ staff under strict supervision of our Directors, whom we elect to represent us."

DXpeditions

FR7ZL/T was scheduled to reappear from **Tromelin Is.** about the middle of November and is expected to be there for a six month stay. It is reported that his QSL's are now being accepted for DXCC credit.

W5RBO confirms that the recent reports of imminent **Chatham Is.** activity are premature. No plans of any kind have been made by the group of ZL's who were mentioned in the rumours, although these would very much like to make the trip if the financial side of the problem can be overcome. Estimated cost of the exercise for three operators is around £200, and nothing is likely to happen before 1 January as they would wish their contacts to be valid for the new 5BDXCC.

According to PY2PE there is a possibility that s.s.b. equipment belonging to PY2PA and HB9TL will be in use by FB8ZZ **(Amsterdam Is.)** and FB8XX **(Kerguelen Is.)** during the coming winter.

QSL cards from W4UDF/AP2 have been received and apparently indicate /MM operation. It is reported that

AP2AD contacted the licensing authorities in Karachi during the time this station was on the air, and was told that they had no knowledge of such a call.

The projected trip by Flavio, PY1CK, to the Abrolhos archipelago (some 50 miles off the coast of Brazil, approximately 18 S. 39 W.) had to be postponed on account of bad weather. He hopes to make another attempt during December and will use the call PY0CK.

VP8KH will be in the South Shetland Is. for a four month stay, starting early in December. He hopes to have the use of an SBE 33 and the Base equipment. QSL's for all areas will be dealt with by G3NMH.

Awards

The **West Mercia Counties Award** is being sponsored by the Hereford Amateur Radio Society for working stations in the counties of Hereford, Worcester, and Shropshire. The Class 1 award is for confirmed contact with four stations in at least two of the counties, and the Class 2 for six stations with at least one from each of the three counties. The charge is 5s. or 8 IRC's, but the certificate is free to sightless or handicapped applicants. It is also available to listeners on a " heard " basis. Applications, consisting of a list certified by two licensed amateurs that the QSL's have been seen, should be sent to: G3RJB, Brian R. Edwards, 5 Powys Walk, Hereford.

The **MARC** certificate is obtained by proving contact with at least 15 members of the Montreal ARC since 1 January, 1967. VE/W applicants need 30 QSO's, 15 members on each of two bands. Applicants should send certified list plus seven IRC's to MARC, Awards Chairman, 535 Landsdowne Avenue, Montreal 6, Quebec, Canada.

The **WLANAC Award** is available to European stations who have worked five stations in Vasterbotten Lan (Sweden). At least one must have been in Umea, one in Skelleftea, and one must be an SK or SL station. Stations outside Europe need only three QSOs, including one in Umea and one in Skelleftea. This certificate is available to listeners. The usual certified list plus eight IRC's should be sent to Roy Graan, SM2RI, O. Kyrkogatan 14-B, 902-45 Umea, Sweden.

DX Briefs

As from 1 January next stations in the **Netherlands Antilles** will use the following prefixes, according to their location: PJ1 (Special stations), PJ2 (Curacao), PJ3 (Aruba), PJ4 (Bonaire), PJ5 (St. Eustacius), PJ6 (Saba), PJ7 (Sint Maarten), PJ8 (Visitors on islands in Zone 8—PJ's 5, 6, and 7), PJ9 (Visitors to islands in Zone 9—PJ's 2, 3, and 4), and PJ0 (Special stations). PJ2MI's new callsign will be PJ7JC.

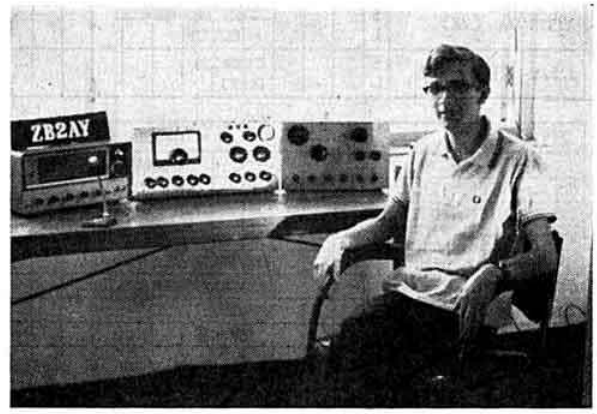
EA0AH has now returned to Spain and may be reached at the address in *QTH Corner*. Other activity from **Spanish Guinea** has been reported in the form of HB9ET/EA0 (who has been worked near the low end of the 14 MHz c.w. band), and 9X5MF/EA0 who appears to favour the s.s.b. mode on the same band.

G3HSR will be departing for Singapore in December and hopes to be on the air with a 9V1 call before long. All QSL card chores for MP4MBC and MP4TCE have been completed to date, but Jim is no longer in a position to continue as their QSL manager.

HH9DL seems to be very active on 21 MHz c.w. in the late afternoons. No other Haitian stations have been heard for a considerable time.

Les Newport, 3A2CP operating from his home in Monaco.
Photo by J. A. Steele ,G3KZI

Joaquim, CE3ZN (centre) seen during a visit to G3NMH (left) last August. Readers may remember that he operated /0 from Juan Fernandez Is. some time ago. On the right of the trio is G4JZ.



Roger Crofts, G3UPK, will be active again from Gibraltar on 160m during December, using the callsign ZB2AY.

OR4ES is said to be located at Jabal al Uwaynat in the Libyan desert. He has a daily schedule with DL0MB on 21,150 kHz at 12.00, and asks for QSL's via the ON4 bureau. Operations should continue for another four months or so.

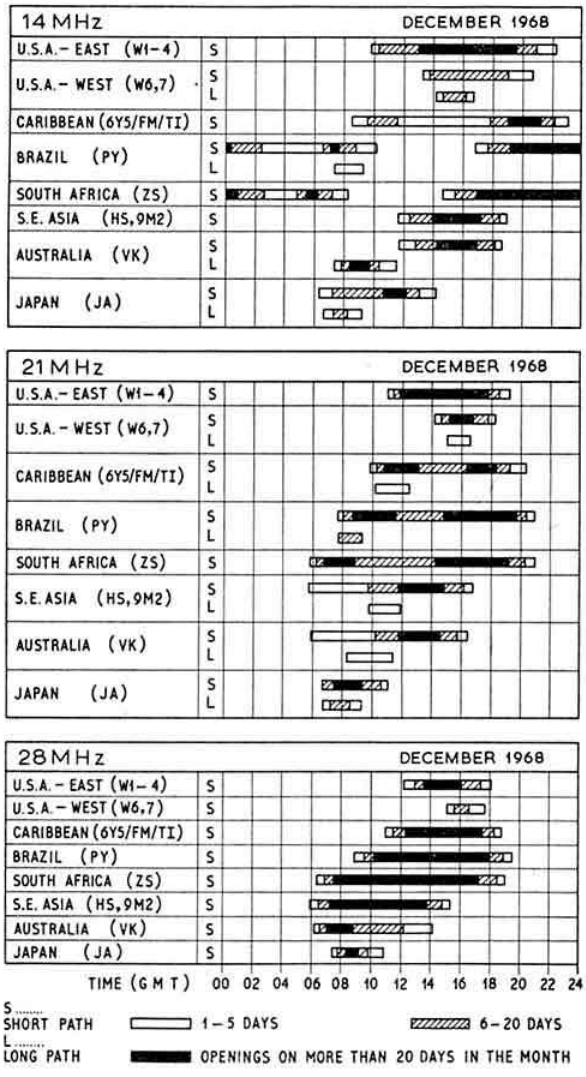
A summary of active VP8 stations and their locations is as follows: **South Georgia:** VP8HO. **S. Orkney Is.:** VP8JH. **Falkland Is.:** (Port Stanley) VP8's FL, HS, JM, JR, KD, KE, KF, KL, (Saunders Is.) VP8's HZ, IA, JB, JC, KI. **Antarctica:** VP8's DJ, JP, JX, (Argentine Is.) VP8's JN, JS, JT, JU, (Stonington Is.) VP8's JG, JJ, JW. The QSL situation is as follows—VP8DJ *via* VP8HZ, VP8's FL, JG, JH, and JI *via* E. R. Chilvers, 1 Grove Road, Lydney, Glos., VP8HS *via* W2CTN, VP8's HZ, IA, JB, JC, KI, *via* VP8HZ (UK stations *only via* G3NMH plus s.a.e.). VP8JN *via* VE2AGH, VP8JT *via* VE1ASJ, VP8JX *via* GD3HQR. VP8JZ *via* G3LEO. VP8KD *via* K2JXY (UK *via* G3LDA). VP8KE *via* W4NJF and VP8KF *via* G3TWV. Much credit is due to *DX News Sheet* for this comprehensive list.

Those who still wish to work VK9RJ (Nauru) will be relieved to learn that he hopes to put up a tri-band quad during November, and will then be on 14, 21, and 28 MHz.

Reciprocal licensing agreements have now been concluded between the US and Nicaragua, and between the US and Eire. In future citizens of the countries concerned will be allowed to operate in each other's country.

Although originally an RAF station, ZB2A is now used by operators from all three services in Gibraltar. A favourite frequency seems to be around 14,280 kHz.

As *MOTA* went to press PY0OK and PY0OM appeared on the bands, giving their location as Santa Barbara Is., Abrolhos group (see DXpedition section), and asking for QSL cards via PY2SO, (Mrs Sonia Rotenburg, R.Sta.Cruz 325, Sao Paulo 8, S.P., Brazil).



PROPAGATION PREDICTIONS

The highest level of sunspot activity has already been passed. The decrease of sunspot activity is usually much slower than the rise. For this reason the propagation predictions for this month will be much like those of December 1967.

On undisturbed days **28 MHz** will be open to all directions, but to the Western USA only on favourable days, i.e. those with above average F2 m.u.f's. Possibilities for working Western North America will be better in Southern Europe than places further north.

On **21 MHz** all continents should be workable with certainty. The mid-winter conditions will also enable contacts to be made with various zones via the long path, especially with South America and East Asia. Contacts via the long path are most favourable when the signal path approximately coincides with the twilight zone.

Because of the long winter nights and consequently low F2 m.u.f's. at night **14 MHz** will cease to be a DX band during the night, especially in the latter half, as it was during the summer months. No noticeable improvements in this respect will occur before the end of February or the beginning of March. As on 21 MHz various DX zones should be workable via the long path as shown in the diagram in detail.

7 MHz will take over from 14 MHz as the main DX band at night, especially in the latter half. Basically DX will be possible on this band whenever the greater part of the signal path lies in darkness. During daytime 7 MHz will be ideal for local and European contacts without interruption by the dead zone. The seasonally depressed atmospheric noise level favours DX traffic on 7 MHz and **3·5 MHz** especially the latter. On disturbed occasions local traffic on 3·5 MHz at night may be interrupted by the dead zone, especially in the period before sunrise.

The provisional sunspot number for October 1968 from the Swiss Federal Observatory was 108·7. The period of greatest solar activity occurred during the last twelve days of the month. The predicted smoothed sunspot numbers for February, March and April 1969 are 98, 97 and 95 respectively.

Band Reports

The month preceding the writing of this paragraph appears to have provided all degrees of openings for DX ranging from excellent to all bands nearly useless. Fortunately the Society's 28 MHz and the CQ WW DX (Phone) contests were just before conditions on the HF bands deteriorated. Complaints have also come in from the LF band enthusiasts that things are not up to their usual standards, although things could apparently have been worse judging by the stations worked on 3·5 and 7 MHz!

Many thanks to the following for reporting the stations listed below: G2HKU, GW3AX, G3HCT, G3HDA, G3NKQ, G3OLY, G3PQF, G3TXZ, G3URX, G3VPS, G3WTJ, G3XBY, G3XKV, G8JM, G8VG, SM2BYD, BRS29862, A5154, A5637, A5662, A5812, A5980 and A6081. Stations in italics are c.w., the rest s.s.b. unless otherwise stated.

3·5 MHz—AP2MR (20.35), EP2GI (21.05), ET3USA (22.00), W1FZJ/KP4 (00.47). Formerly W1BU), W0VXO/KV4 (04.32), MP4BGX (23.50), PY1CAD (21.55), TI2AP (04.45), 4X4WN (20.30), 5N2AAX (23.50), 5T5AD (01.50), 9H1BL (ex-G3MOJ, 21.10), 9I4BC (21.45), 9M2DQ (23.05).

7 MHz—AP2MR (21.40), CO8RA (04.05), DU1FH (20.07), HR2HH (03.22), JA's 1EKX, 2BAY, 6BJT (20.30), KR6KN (20.00), W0VXO/KV4 (02.10), OA4OS (06.05), OX3JV (20.35), PJ0MM (01.29), *PZ1DE* (07.08. P.O. Box 1810, Paramaribo, Surinam), *VE7VC* (07.35), VK3BM/3ZL (20.30), VU2DKZ (20.30), W6/W7 (07.00–07.30), YA1KO (21.05) ZD8Z (21.23), ZS1JA (22.00), 4A1WS (04.05), 4S7AB (20.30), 9M2's DQ, MX (22.00), 9Y4ER (23.30).

14 MHz—*AP5HQ* (15.45), DU1OR (18.12), *FB8YY* (17.50), FO8's BS, CB (07.12), FK8BG (06.00), *HH9DL* (18.00), *HS3AB* (20.15), KW6AA (06.58), *KX6BQ* (20.32. S9), *KH6ER* (12.15), *KX6FN* (05.38), *MP4BEU* (17.40. Box 138, Bahrein), *TJ1QQ* (21.45), VK9RJ (07.00), *VP9GD* (17.05 PO Box 275, Hamilton, Bermuda), VR1L (07.10), VR2CC (07.20), VR4EL (07.23, 10.07 a.m.), *VS6FX* (18.30), ZD9BE (07.10), *7P8AR* (18.10). *7X2SX* (19.46).

21 MHz—*EA6BD* (12.20), *FB8WW* (16.45), *FY7YI* (15.30), *HH9DL* (16.45–23.30), JX3DH (17.37), *KL7GGU* (17.30), *KS6CX* (09.10), OD5's CS, FH (14.45 a.m.), *SM5WI/OY* (16.47), *ST2SA* (17.40), *VS6AA* (15.10), *YN1AA* (16.40), *ZL1AIM* (09.28), 6O1GB (19.05), 9G1FL (09.05. a.m.).

28 MHz—A2CAH (08.01), AP2MR (10.33), *CT3AS* (15.27), DU1FH (07.41), *ET3USA* (07.30), FG7TI/FS7 (16.00), HM1BB (07.43), HS3DR (07.27), HZ1AB (11.33), KA2NY (08.18), KR6NR (07.45), MP4BHA (09.21), *OD5LX* (14.45), TI4FHC (16.40. a.m.), TJ1AQ (12.01), TU2CF (13.48), VK2FU etc. (13.42), VK6XX (08.02), VK9DJ (12.10), VP2AW (15.06), VP5CB (16.14 QSL *via* K3NAU), VP8KF (15.24), VP8JG (17.50), VQ8CC (11.10), VQ9DH (09.15), VS6DR (10.05), VS9MB (10.30), VU2LO (07.58), XW8BP (13.30), YA1HD (12.22), ZD3D (12.09), ZD9BE (10.09), ZF1EP (19.18), 4S7PB (09.25), 5R8's AX, CJ (12.00), 7Q7RM (11.16), 9I4BC (16.21), 9L1KZ (09.18), 9N1MM (10.45), 9V1NY (08.40).

Very many thanks are expressed to all correspondents, and particularly to the following for permission to use information from their publications: The *Florida DX Report* (W4BRB), *CQ DX* (A.R.I.), the *HKARTS Newsletter* (5N2AAF), *Long Skip* (VE3HJ), *QUAX* (SM4DXL), the *DX'er* (K6CQF), *DX News Sheet* (Geoff Watts), the *Ex-G Radio Club Bulletin* (W3HQO), and the *DX'ers Magazine* (W4BPD).

Your scribe would like to wish all readers everywhere a very Happy Christmas and an equally happy and peaceful New Year.

QTH CORNER

EA0AH	Jose M. Manzono, Avenida Aragon 292, Madrid 22, Spain.
EL2BC	PO Box 251, Monrovia, Liberia.
HB9ET/EA0	via HB9ET, 25 Chemin Bonvent, 1218 Gosaconnex, Ge., Switzerland.
9X5MF/EA0	via HB9MQ, Felix Suter, Hauptstr. 13, 5742 Koelliken, Ag., Switzerland.
FL8DG	Guy Danancher, Hospital Peltier, Djibouti, T.F.A.I.
FR7ZR/G	(4/11 to 21/11) Jean Pierre Viode, B.P. 130, St. Pierre, Reunion Is.
FY7YQ	via WA4GQM, Paul Gallagher, 392 Byron Drive, Memphis, Tenn., USA.
HL9TF	via W4CYC, Reginald Cain Jr., P.O. Box 729, Phoenix City, Ala., USA, 36867.
KC4USX	via K3UZM, Francis Smith, 6926 Lynford St., Philadelphia, Pa., USA.
OX5AY	via VE3DLC, R. J. Kreger, 30 Zenith Drive, Scarborough, Ont., Canada.
PX1BW	via W2GHK, Box 7388, Newark, NJ, USA, 07107.
TA3X	via WA7GQA, Kay Hargis, 2615W. 5750 S., Roy, Utah, USA.
TL8GL	QSL Mgr. VE2DCY, 8900 Lacordaire, St. Leonard de Port Maurice, Que., Canada.
VK2BKM/VK2	via W2CTN, 159 Ketcham Av., Amityville, NY, USA, 11701.
VP7NA	(Oct. 26/27) K9GZK, Jack Kohl, PO Box 312, Ripon, Wis., USA.
VP8KH	(S. Shetlands) via G3NMH, 24 Hook St., Hook, Nr. Swindon, Wilts.
VQ8CI	Jada Soobarah, 47 Labourdonnais Av., Quatre Bornes, Mauritius.
VS6DR	Philip Wight Jr., PO Box 16321, Hong Kong.
WC4GSC	via W4DQD, Larry Price, Box 2067-Georgia Southern Branch, Statesboro, Ga., USA.
XE1PLJ/4A4	4A1J, Jose Levy, M. Herrera 254, Box 200, Colima, Mexico.
XW8CR	via W2CTN (see VK2BKM/VK2).
ZB2AY	via K3RLY, Bud Kellam, 35 Allview Drive, Elliott City, Md., USA.
ZD8DG	Dave Adkins, c/o BBC, Ascension Is.
ZD8JL	Dr John Lynn, c/o Cable and Wireless, Ascension Is.
ZD8RB	now R. I. Buckby, 62 Wheatley Av., Corby, Northants.
ZF1EP	via W4PJG, PO Box 1647, Fort Myers Fla., USA, 33902.
VE3EUP/5H3	via Canadian DX Ass'n, PO Box 717, Stn "Q" Toronto 7, Ont., Canada.
5Z4LS	Nick Henwood, Chinga Secondary School, PO Box 448, Nyeri, Kenya.
G3VJI/8R1	John Steel, Cable & Wireless (W.I.) Ltd., PO Box 239, George town, Guyana.

RSGB QSL Bureau, G2MI, Bromley, Kent.

1968 COUNTRIES TABLE

	160m	80m	40m	20m	15m	10m	Total
G3OLY	—	5	18	139	105	95	362
G8JM	—	—	8	200	116	81	405
G3TXZ	5	30	9	25	68	92	229
G3XBY	4	30	40	75	90	54	293
G3IAR	4	38	40	124	101	28	357
9J2BC	—	—	17	108	54	64	241
G8VG	5	16	27	46	58	58	210
G3VJG	—	2	10	18	22	59	111
G3PQF	10	26	38	65	12	64	215
G3TBK	3	6	26	39	31	23	128
SM2BYD	—	16	16	58	25	11	126
G3ING	12	16	22	21	20	14	105
G3VPS	13	27	18	73	13	13	157
G3XDV	15	10	17	38	1	18	99
A5662	13	39	60	155	144	144	542
BRS30094	10	33	29	157	150	111	490
BRS25429	3	57	80	176	141	114	568
A5390	4	22	35	161	163	92	477
BRS27806	4	27	17	168	136	78	473
A5154	3	29	30	153	127	84	426
A4886	14	56	50	187	103	89	489
A5489	—	10	6	110	95	51	272
A5950	7	23	20	66	73	68	257
A5135	5	24	37	115	81	56	318
BRS28198	2	32	46	66	32	92	270
A5852	5	15	11	110	114	1	256
A3942	14	33	38	58	60	50	213
A5943	10	42	30	83	65	33	233
A5126	2	31	31	81	53	44	242
A6015	6	16	30	65	53	43	213
A5466	5	21	23	106	38	28	216
A6081	—	16	12	57	62	—	147
A5459	8	25	34	84	37	22	210
A5610	10	71	17	35	25	31	191
A5457	3	24	3	19	18	6	73
A5805	—	—	42	—	—	—	42

(This month's table is in order of 15 plus 10m totals).

REGULAR FEATURE

FOUR METRES AND DOWN

By JACK HUM, G5UM*

Sixty-Eight

ANOTHER Christmas imminent, another opportunity for expressions of a goodwill which, in most areas of human activity outside amateur radio, barely outlasts the season, more's the pity. Let us be thankful that *inside* amateur radio the goodwill is year-long, and nowhere more so than in the particular spectrum with which this feature deals. For it is in the v.h.f. and u.h.f. regions that the "self training of the licensee in communication by wireless telegraphy," as our licence puts it, develops in all its diversity because knowledge is willingly shared by the people who work within it.

It would be a sad day if this spirit fled out of the window with the appearance on the operating desks of amateur radio of little black boxes whose owners, ignorant of what went on inside them, had no answer to the layman's observation "But can't you do it just as easily with the telephone?"

That this gloomsome prospect is nowhere in sight on the metre-wave scene has been emphasized time and again during the year now closing. The scene's top two events—Convention in April and Field Day in September—attracted record numbers of participants. Difficult bands have been opened up as new challengers attempted them. On 4m and down "communication by wireless telegraphy" (a semantic curiosity includes speech within the definition) has been established over distances once thought impossible, even to the moon and back.

With so much to do in the metre-wave spectrum, and so many developing techniques to master, it is not surprising that the insatiable thirst for knowledge which exists among the aficionados of v.h.f. and u.h.f. is accompanied by the slightly bothering thought that "it's difficult to keep up." In one particular area, that of single sideband transmission, the prospects of pushing a penetrative phone signal to distances once workable only on c.w. have been smothered by the daunting technical difficulties of building adequate gear for the job.

It was with these considerations in mind that the Society decided to put on at the I.E.E. last month a lecture-meeting intended to give guidance to those wishing not just "to have a go" but to do the job properly. The occasion was an important one, and deserves the extended amount of space we now give to it below.

S.S.B. at "The Institution"

The date was Friday, 15 November, and the place the Institution of Electrical Engineers' building on London's Thames Embankment, venue of many historic RSGB gatherings in the past. The speakers were Geoff Stone, G3FZL, who is the Society's V.H.F. Manager, Robin Greenwood, G3LBA, Tony Griffiths, G3MED, and Richard Pett, G3SHK.

"If amateurs embark on a better means of communication they must do the job properly so that it doesn't get a bad name," said Geoff Stone, in opening the proceedings. There was some evidence that s.s.b. at v.h.f. *had* been getting a bad name; hence the formation of the new V.H.F. S.S.B. Sub-Committee of the Technical Committee. Hence also the present meeting, its purpose to make people competent to judge s.s.b. designs for themselves.

What specification should amateurs aim for? After declaring that they should aim to do better even than the professionals and thereby keep their house in order, G3FZL considered the case of typical v.h.f. and u.h.f. transmitters to show how the spurious level would need to be kept down to microwatt proportions, better than minus 90dB within the band and minus 60 outside. Amateur transmitters are required to cause "no undue interference": a spurious level of even minus 60dB *was* undue, and could in unfavourable circumstances cause interference.

Stating that "we are anxious to get the maximum number of s.s.b. operators on to 2m with minimum trouble to their neighbours," G3FZL said the transverter approach was now so widespread that the lecturers proposed to concentrate on it alone, though the ultimate technical solution is to build a specially designed v.h.f./s.s.b. transmitter. To set the scene for the subsequent speakers he described the performance of a home-made transceiver/transverter combination which gave four spurii at minus 30/35dB, seven at minus 60/68dB and some more at minus 90dB: a near neighbour could hear at least 14 signals from it. It was necessary to find out the origin of the spurii and as a first step he had investigated the performance of 2 h.f. equipments, one a well-known amateur band transceiver and the other a professional transmitter of a similar power rating. The former had one spurious at a minus 35dB level with the remainder better than minus 60dB, while the latter had a number of spurii, harmonics of the nominal frequency, at around minus 25dB.

The next speaker, G3LBA, took up the point of proximity effect by postulating the case of two stations beaming at each other with 10dB gain arrays and 100 watt transmitters (whether c.w., a.m. or s.s.b. didn't matter). Given line of sight conditions it could be calculated that at 2 miles there would be 36 millivolts (yes, *milli*volts!) at the receiver, at 8 miles 9 mV, and at 32 miles 2¼ mV. This gave an idea of the possible strength of spurious emissions.

He then described in much detail how effectively tne situation could be improved by the use of appropriate filters within and without the s.s.b. transmitter.

The third speaker, G3MED, described mixer circuitry, and especially the QQV03/10 approach ("the most popular"). Of the methods available, he suggested tuning the

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push-pull grids to 14 MHz, the sideband injection loosely coupled to the centre of the coil, and 131 MHz from a crystal controlled chain centre-tapped on to the same coil. This provided good inbuilt selectivity and reduction of spurii and being balanced reduced the level of the oscillator chain signal. He emphasized the dangers of starting with a crystal of too low a frequency: harmonics would come out of each stage on the way up. A simple transistor overtone oscillator above 30 MHz was the most satisfactory way of minimizing the risk of unwanted harmonics although even certain frequencies above 30 MHz must be avoided.

As for receivers, obvious requirements were for *stability* (how ridiculous to have to say to a station "Sorry, I missed the first few words."); a *bandwidth* half that required for a.m.; a level of *b.f.o. injection* much increased over that provided by many older receivers; and *audio a.g.c.*, invaluable when excursions of s.s.b. speech might vary between 3 and 120dB.

As for so-called shock excitation, he scouted the idea that s.s.b. is guilty: it is simply that a big local signal drives the latter stages of the receiver into grid current. Answer: reduce converter gain. In his own experience a distant station close in frequency to a powerful local s.s.b. one was much easier to work than if the local had been on a.m.

The fourth speaker, G3SHK, dealt with the oscillator chain that would provide the v.h.f signal into the mixer systems already covered by G3MED. To develop the latter's recommendation to start with as high a frequency crystal as possible, he displayed a chart which compared harmonics from a 28 MHz sideband source with the harmonics to be expected from a c.c. chain, using a variety of crystal frequencies. The resultant unwanted products ran into scores, many of them capable of putting spurii in or near the band.

After explaining the pitfalls of injecting from a 28 MHz source G3SHK recommended trying subtractive mixing instead of the more usual additive, even though this might play havoc with the tuning arrangements of certain commercial rigs! Subtracting from a crystal chain frequency well above 146 MHz helped keep c.c. harmonics farther apart.

From the ensuing discussion space allows the recording of only one comment, but a significant one: G2NH, in the thick of the London sideband belt, reported that during the 11 November S.S.B. Contest on 2m he detected virtually no spurii at all—a tribute to the high design standards at present in use by many stations.

G3FZL wound up by saying " Don't be frightened about trying s.s.b. on 2m. If you do the mixer sums correctly and filter the h.f. s.s.b. feed you should have an excellent signal."

Finally, G3DAH in proposing the vote of thanks congratulated the four speakers on presenting a valuable two-hour practical and mathematical session. He put in a plea for more contacts to be made between s.s.b. and a.m. stations—a thought which most readers of this page will heartily endorse.

The FM Mode

So much, then for sideband. Another mode finding increasing favour (it is in general easier to set up than s.s.b., and offers virtual freedom from audio breakthrough in nearby TV receivers) is frequency modulation.

To those who have not yet tried it by one or other of the methods which are described in the literature there will be a special appeal in the G8ACC device described in detail in the last two issues of *Radio Communication* (it deservedly won the " Horace Freeman Trophy " at the show). Varactor multipliers have come in for some hard words by reason of misuse or maladjustment, but " amateurs familiar with r.f. power transistor techniques "—to quote the warning at the head of the G8ACC article—should be able to sidestep the pitfalls if the constructional and setting-up details are meticulously observed.

The G8ACC design is for 70cm where at the present time the amount of f.m. to be heard is about equal to the amount of sideband—very little. It should help to promote more, especially during field days, where its superb portability and modest thirst could quite transform many outdoor transmitting events. There are advantages with the f.m. mode which make it particularly suitable for use with semiconductor devices. The main problem with f.m. lies in the receiving side. Few amateurs have f.m. discriminators, so if not by chance G8ACC has designed a simple f.m. detector which can be built in an hour or so. This unit will be the subject of an article in *Radio Communication* shortly.

On 2m frequency modulation is now in extensive use, if not to the same extent as s.s.b. If its protagonists were minded to pass on through " Four Metres and Down " some technical details of what they use, and the receiving set-up is just as important to know about as the transmitting, they might encourage others to join them.

Tone A Again

News of the Auroral opening at the end of October was noised around on the bands very quickly, following the pattern set by previous manifestations, i.e., that one or two

One end of the 13cm link established during the recent tests on the 2300 MHz band between G3BNL/M in the Cotswolds with G3EEZ/P who was 52 miles away near Wolverhampton. Les Sharrock, G3BNL, by starboard tail light. The 70cm aerials used for the essential talk-link may be seen just below the 13cm dish. Subsequently signals were lifted over an 80 mile path. The tests are planned to continue when " portable" weather returns next year.

BEACON STATIONS

Call-sign	Location	Nominal Frequency	Emission	Aerial Direction
GB3ANG	Craigowl Hill, Dundee	145·950 MHz	A1	S
GB3CTC	Redruth, Cornwall	144·13 MHz	A1	NE
GB3GW	Swansea	144·250 MHz	A1	E.N.E.
GB3GM	Thurso	144·995 MHz	A1	N/S
GB3GM	Thurso	70·305 MHz	A1	N/S
GB3GM	Thurso	29·005 MHz	A1	Omni
GB3GEC	W. London	434·000 MHz	F1	N/W
GB3SX	Crowborough,Sussex*	28·185 MHz	A1	E/Omni
GB3VHF	Wrotham, Kent	144·500 MHz	F1	North-West

* Not operational

GB3VHF

The Society's v.h.f. beacon transmitter frequency at Wrotham, Kent, measured by the BBC Frequency Checking Station (nominal frequency 144·50 MHz):

Date	Time	Error
24 October	08.46 GMT	420 Hz high
29 October	14.13 GMT	1070 Hz high
5 November	15.20 GMT	1021 Hz high
12 November	18.30 GMT	1170 Hz high

operators, observing Dellinger fade outs on the h.f. bands, decided to try a " CQ A " on " Four " or " Two." Others heard them and did the same, and before long logs were being filled up with choice DX.

Thus on 4m on 29 October there was no more than scattered c.w. activity, when a minor Aurora seemed to be developing. Two days later a dozen or more were on. Next day, 1 November, the numbers had doubled again.

Apart from going out after the DX two of the band's keenest operators, G3TCT and G3WBQ, both in Surrey, did some systematic observations which the RSGB Scientific Studies Committee ought to be finding useful. (They have sent a detailed report.) They comment particularly on the peculiar things which were happening to the GB3GM signal from Thurso, normally audible by meteor scatter in the south of England but completely absent on a number of occasions when a high meteor count should have brought it up out of the noise, "possibly indicating Auroral absorption between Thurso and the S.E. of England," suggests Trevor Brook, G3WBQ.

Much farther north, at York, G3UUT, too, remarks on the fleeting character of the GB3GM signal on " Four," when the Aurora was at its maximum. He asks if anyone heard on the night of 1–2 November a very strong Auroral carrier on 70·3 MHz which, not being keyed, could not have been GB3GM. It drifted somewhat, but regrettably failed to identify itself. On 2m some attenuation of the nearer beacons seemed evident during the Aurora, but SM4MPI and DL0PR were very strong, as they had been on previous openings of this kind.

Several operators comment on the value of BBC1 at Meldrum as a pointer to Auroral possibilities. Its sound channel is on 58·25 MHz horizontally polarized. Could not the GB3ANG beacon, which is in roughly the same area, be arranged to radiate northwards? asks G3UUT, adding " . . . a waste of a potentially good beacon well positioned for Aurora."

At Storrington BRS15744 as well as hearing much DX on 2m and 4m noted that the Aurora was causing big lifts on the chart trace which is the output of his 136 MHz radio telescope. They began on 30 October, subsided on 31 October and were emphatic on 1 November. But these were midday readings: by most accounts, 31 October *did* produce some DX later in the day. For example, GW3FSP in South Wales worked GI, G, PA, GW and GM in quick succession that evening, on a beam heading of almost 045 degrees. By the next day the beam heading required had swung round to 015 degrees—the " moving Aurora " effect many have reported at various times.

The same phenomenon was observed by GM3GUI, who describes the Auroral opening as " unique as far as I was concerned because of the easterly bearing of signals and because of the sudden shift of bearing from time to time." A comprehensive log—mainly reception—which Alex kept over the Aurora period is with the Scientific Studies Committee.

Tailpiece to the Auroral opening: GM3KSU remarks with humorous ruefulness that on going up to Edinburgh Observatory where he has his " Stroke A " station he noticed that the 4m chart recorder output showed that GB3GM had been thundering in. Then he remembered that the previous night BBC1 had had cause to apologize for interference on Rosemarkie TV up in the far north. "So I sat, wondering what the cause of the QRM might be! Ah well, I'll know next time " he says.

Now for DX of a different kind. . . .

" TA " and " TE " from Gib on " Six "

The Gib-twins ZB2BC and ZB2BO continue to show what can be done on " Six." Following their success with trans-equatorial contacts reported here last time, a transatlantic one has now been achieved: ZB2BO has just worked KV4FU. " We are hoping for further openings possibly to W " he says. Already John has worked ZS3E and ZS3B on the 50 MHz band; so has ZB2BC plus 3 ZE stations besides. And all we in the UK can do, it seems, is to stand on the sidelines and applaud; if only we had "Six."! The 6m amateur band is the most interesting and fascinating (propagation wise) v.h.f. band. However, it was taken away from us decades ago and its return seems most unlikely. The worry is channel 2 t.v.i., but in the same way that many have coped with the channel 5 problem on 4m, could we not do the same with channel 2 on " Six "? In the meantime if by any chance anybody in the UK is hearing amateur signals on " Six," " Four metres and Down " would like to know.

Plans and Modes

Few if any dissident voices have been heard objecting to the new 4m band plan shown in the diagram on this page in October.

Trevor Brook, G3WBQ, of Effingham in Surrey especially likes the recommendation: " No cross channel working when on 70·26 " and goes on to suggest that s.s.b. should never be used on this national calling channel to avoid annoyance to the increasing number of stations using squelch systems in their receivers on " Four." He welcomes the choice of single sideband frequency as 70·65 MHz. " In years to come it may expand to become a sub-band several tens of kHz wide without intruding on established operation on the band," he observes. But *in re* the reading of weak signals among the strong ones, subject of recent comment here, he hopes someone will come up with an article in *Radio Communication* describing transmitter and receiver

Four Metres and Down Certificates

70 MHz Transmitting Section

1 G3EHY
2 G3PJK
3 G2AIH
4 G3OHH
5 G3KEU/P
6 G3NUE
7 G3IUD
8 G6NB
9 G8PD/A
10 G5FK
11 G3NDF
12 G3IMV
13 GI3HXV/P
14 G3SKR
15 G3OUF
16 G3BNL
17 G3PMJ
18 G3PHG
19 GC3OBM
20 G3TLA/P
21 GI3HXV
22 G5UM
23 G3OJE
24 G3SEK
25 G3RWM/P
26 G3FDW
27 G3PPG
28 G3FIJ
29 G3GGL
30 G3RDO
31 G3NJF/P
32 G3RWN/P
33 G3NUE/P
34 G3AZI
35 G3FWD
36 GI3HCG
37 G3LAS
38 G3HRH
39 GM2UU
40 GI3PGG
41 G3VPK
42 G3RLE
43 G3UFS
44 ZB2VHF
45 G3OUL
46 G3UUT
47 G5NU
48 G3OZJ
49 GI3HCG/P
50 GI3PGG/P
51 G3UBX
52 G3VSA
53 G3NKL
54 G3JHQ/P
55 G3JHM/A

70 MHz Senior Transmitting Section

1 G3SKR
2 G3RWM/P
3 G3FDW

70 MHz Receiving Section

1 BRS15744

144 MHz Transmitting Section

1 G3HBW
2 G3BLP
3 G3MTI
4 G5YV
5 G3BNL
6 G3MCS
7 G3LAR
8 G3CO
9 G3BA
10 GW3MFY
11 G3DFL
12 G3NAQ
13 G3NNG
14 G3OJY
15 G3KPT
16 G3JYP
17 G3KMT
18 G3OHD
19 G3BBR/A
20 G3HRH
21 GM3EGW
22 GI3OFT
23 G3OBD/P
24 G2HIF
25 G3JDN
26 G8VZ
27 G2AXI
28 G3JYT
29 G5UM
30 G3EJO
31 G3PBV
32 G3FDG
33 G3OSA
34 G3JLA
35 GC2FZC
36 G3BOC
37 G3MTI/M
38 G3OJY (new QTH)
39 G3JWQ
40 G3NOH
41 G3PSL
42 G3LBA
43 G3FUR
44 G2BJY
45 G3MRA
46 G3AGN
47 G3MDH/P
48 G3GMY
49 G3GGK
50 G3MDH
51 G3NLR
52 GM3LDU
53 G3CKQ
54 G5HZ
55 G3NNK
56 G6GN
57 G5ZT
58 G2PL
59 G3FZL
60 G3SAR
61 G3NUE
62 PA0EZ
63 G3AHB
64 G3PTM
65 G3LAS
66 G3RMJ
67 G2CDX
68 G3ORL
69 G2DHV/P
70 G3FIJ
71 G3CXM
72 G3HRH/P
73 G3BDS
74 G3FNM
75 G3IMV
76 G2BQ
77 G3KHA
78 G3OHC
79 G3SHZ
80 G3PKT
81 G3UFA
82 G3RST
83 G5NU
84 G2BHN
85 G3OZP
86 GW3KYT
87 G3ICO
88 G3ETH
89 G2WS
90 G3NJF/P
91 GW3CBY
92 G3TLA/P
93 G3JFO
94 G3TDR
95 G5UM/P
96 GM2UU
97 G3UUT
98 G3BNC
99 G3SZX
100 G3UKV
101 GC3OBM
102 G3FVC
103 G3BJD
104 G3PWJ
105 G2ATM
106 G3ISX
107 G3USF
108 G3OUL
109 G3UIK
110 G3GZJ
111 G3EJA
112 G3JHM/A
113 G8AAZ

144 MHz Senior Transmitting Section

1 G3CCH
2 G3FAN
3 G5MA
4 G3BLP
5 G3CO
6 G3BA
7 G6NB
8 G3EDD
9 G3HRH
10 G8GP
11 G3LAS
12 G3IMV
13 G3PTM
14 G5NU
15 G6GN
16 G3KHA
17 G3AOS

144 MHz Receiving Section

1 BRS22550
2 BRS22322
3 BRS15822
4 BRS15744
5 NL687
6 BRS20108
7 A3470
8 A4048
9 BRS21667
10 A4871
11 BRS23140
12 BRS7323
13 A3942/P
14 A3942

144 MHz Senior Receiving Section

1 BRS15744

432 MHz Transmitting Section

1 G3NNG
2 G3KPT
3 G3LHA
4 G3BNL
5 G3MCS
6 G8AAZ
7 G8ABP
8 G3AHS
9 G5UM
10 G8ACQ
11 GW8ACG
12 GW8ACG/P
13 G8AHQ
14 G8AEJ
15 G8AGG
16 G8AGU/P
17 G3PTM
18 G8AAY/A
19 G8AGO/A
20 G3HRH
21 G8AJU
22 G8ARM
23 G8ADP/P
24 G8AUE
25 G6GN
26 G8AQA
27 G8AWO
28 G8AXP
29 G8AHE/P
30 G8AOD
31 G8AWW
32 G8AKT
33 G8ANS
34 G8ARD
35 G8AIE
36 G3PKT
37 G8ATK
38 G8ACP
39 G8AQZ
40 G8ARC
41 G8AVL
42 G8ART
43 G5NU

432 MHz Receiving Section

1 BRS15744

432 MHz Senior Transmitting Section

1 G3MCS

1296 MHz Transmitting Section

1 G3MCS

designs that will allow interference-free operation less than 75 kHz away from strong signals, as will be necessary if several local stations attempt to use the c.w. zone simultaneously!

Both G3WBQ and G3BLP, John Haydon of Woldingham, write in to support the G3EDD advocacy of split channel working on v.h.f. As John puts it: " I don't want a dozen or more stations replying on my own frequency, including maybe the strongest not being the one I wish to work! " He goes on to voice the reminder that in split working the whole band needs to be tuned . . . " only the segments you are beaming at need to be given priority, though this is difficult with a typical s.s.b. receiver having four 500 kHz bands."

Comment on similar lines comes from G3OEJ of Stockport with the observation: " Surely it is preferable to be able to read at least one of a number of stations on a *clear* off-channel frequency as opposed to an unreadable conglomeration of signals on the calling frequency." The low power and weak DX signals get a better chance, too, he thinks, and " patronizing pickaback contacts can be dispensed with."

Where single sideband operation is concerned the situation is of course that co-channel is a *sine qua non*. One of its advocates, G3MNQ, a pioneer of s.s.b. on v.h.f. (and more recently author of a forward looking article on a vest pocket exciter, (*Radio Communication* for last June) finds he cannot go along with the G8VN criticisms of the mode printed here last time. He feels that as the QRM-level on " Two " increases with the appearance of more a.m. stations, the value of single sideband is enhanced: it doesn't produce any heterodynes. And he will not agree that there is anything " brute force " about it: " . . . in fact. everything has to be done without force, i.e., linear amplification starting with a modulated signal in the milliwatt region. by contrast with the a.m. situation, where modulation applied at the high power end of a transmitter is in roughly the same quantity as the r.f. coming out! "

Orpington's Bruce Hackney, G6YP, springs to the defence of s.s.b. and challenges the often-expressed opinion that it is a " brute force " method. Offering the reminder that a watt is still a watt and produces the same signal power into a receiver whether it is s.s.b., a.m., or c.w., he recalls a 2m QSO with an a.m. operator who offered some s.s.b. " with the same peak envelope power as the a.m.," with the predictable result that both sounded the same. As for superb audio quality on v.h.f., " Yellow Peter " remarks that little more than about 2 kHz is required for communication, so

" throw away the hi-fi audio into the transmitters and clean up the output of these transmitters . . . a given effort if applied to cleaning up a.m. on 144 would yield a greater return than the same effort devoted to putting s.s.b. on the band."

These will be regarded as challenging remarks by those who still believe in " BBC quality " and feel that v.h.f. is wide enough to accommodate it, even if the h.f. bands aren't. Any comments from their neck of the woods?

Certificate Holders

A slightly increased space allowance this month gives us the opportunity to include once again the table of holders of " Four Metres and Down " certificates for its half-yearly showing.

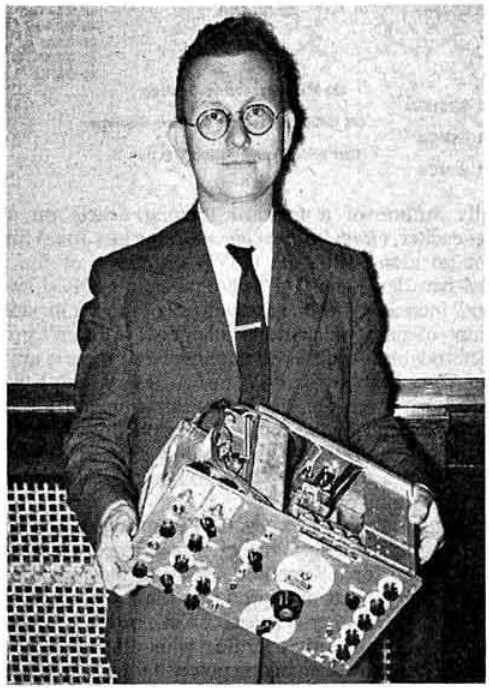
As always, the key to success on the certificate front is not just working them but getting the verifications in afterwards. Assuming that G8AAZ, the first Class B licensee to secure the 2m certificate, came on to " Two " as soon as it was released, it has taken him about six months to contact the needful five countries and 30 counties and get their QSL's in—not at all a bad rate of batting in a year devoid of any sensational openings (though with plenty of contests to help the numbers to accumulate). Other G8-men need not lose patience if their own QSL-in rate is a bit slower.

Of course, 2m being what it is everybody would expect most " Four Metres and Down " awards to be earned on this band. But as a measure of performance and technical progress it would be good to see more claims coming along for " Twenty-three." It is about time some additional call-signs appeared in the 1296 MHz category to relieve Bill Hawthorne's solitary state as the only certificate holder here. The cards with which he won it were illustrated on this page last January.

V.H.F. Personalities: No. 4

Arnold Mynett, G3HBW

" He must be a perfectionist." This is the reaction which most people feel after looking at, listening to or reading the work of Arnold Mynett, G3HBW. His home built equipment submitted for entry in the Constructors' Competition at the annual V.H.F./U.H.F. Convention has a style and finish to it enough to demoralize those less gifted with hand and brain, though it *could* set them an example. And to hear him on the air is a lesson in communications procedure; even allowing for the fact that he is blessed with a call-sign which has a specially rhythmic swing to it, his manner of sending telegraphy prompts the remark: " I could listen to that for hours."



Arnold Mynett, G3HBW, with the 2m transceiver using three phase locked oscillators, which secured for him the constructors' trophy at the 1968 V.H.F./U.H.F. Convention.

As for his writings, he has been responsible for much work that opens up new avenues of investigation to the experimentally minded amateur. When FETs were new he wrote three authoritative articles for this journal on equipment which the ordinary man could make: he must have spent dozens of man hours building, testing and authoring it. Frequency synthesis, new to most of us now, was his subject earlier this year at the Convention. Through his advocacy, many know more about it than they would otherwise have done.

Proffering praise for G3HBW constructions brings from Arnold a characteristically modest reply: " But you didn't see those that fell by the wayside," or some such remark about the high reject rate that preceded completion of the final job. And as for that " perfectionist " description he doesn't like it at all: he feels that the perfectionist never actually manages to finish anything!

Arnold Mynett's unassuming exterior paradoxically makes him an ideal choice for positions of authority: the quietly spoken opinion expressed at the right moment has often clinched a decision by the Society's V.H.F. Committee, of which he has been a member for very many years. When the 120 members of the Harrow Radio Club wanted a technically orientated chairman to lead a constructional project they turned to G3HBW. As a result many scores of v.h.f. transmitters and converters (plus a few 160m rigs to show he is not prejudiced!) were built to standard designs.

By persuading members to help themselves in this way HBW was instrumental in promoting much more local v.h.f. activity than would otherwise have developed. He emphasizes that several of the equipments which were designed " were the excellent products of G3PFR . . . you can tell they're not mine because they all worked first time! "

With all the above preoccupations, not to mention a job with GEC which involves him in advanced systems of telephony, G3HBW doesn't get on the air as much as he once did. But not many portable contests come round without his voice being heard behind the microphone at G3EFX/P, the Harrow Club call-sign, located probably in a county of low v.h.f. activity such as Dorset or Oxfordshire, which will give special pleasure to others to work. That is G3HBW all over, ready to place his services and skills at the disposal of others.

Progress on " 13 "

Development of the 13cm band continues to follow the pattern set earlier by 23cm, and before that by 70cm. What appeared at one time to be difficult becomes accepted—and it is noteworthy how many of those who helped open up the lower u.h.fs in earlier years are now applying the benefits of their experience to the 2340 MHz band.

One of these is G3FP, Bernard Arnold of Thornton Heath in Surrey, whose quiet plugging away at the problems of 70cm and then " 23 " put him much in demand for " getting started " lectures at meetings of the London U.H.F. Group and other societies where the realization existed that it is on the " ultra highs " that the true future of amateur radio lies. Now G3FP has equipment capable of putting a regular nightly signal on 13cm over the 40 mile path out to G3MCS of High Wycombe—and the accent is on "regular." Nearly always he is S9 at the High Wycombe end, and comparable with the 23cm signal. Some of the success comes from a good converter there, some from the efficacy of the G3FP set-up of varactor final feeding a trapezoidal aerial (see *November* 1966 *RSGB Bulletin*) focused by a 3 ft. expanded aluminium dish.

Normal procedure is that G3MCS and G3FP link up first on 70cm before Bernard transfers to 13cm to continue the contact in the duplex mode. Soon it will be full two way: the G3MCS transmitter is nearly ready for commissioning, QQV03–20A on 384 MHz, 2C39 on 1152 and DET22 on 2304 MHz delivering 1·5 watts, of which, says Bill, half is likely to be lost on the way up the Uniradio 67 to the 2 ft. solid dish.

One of Bill's neighbours, G8AGM, has a transistor converter on 13cm displaying a fantastic order of stability—and the oscillator is on about 2000 MHz. It employs a hybrid-ring arrangement to isolate oscillator from front-end.

Which Locator?

Earlier this year members were invited to send for a questionnaire on which to express their opinions on location-fixing systems for use on v.h.f. A good job of work has been done by G3TUX in processing the replies received.

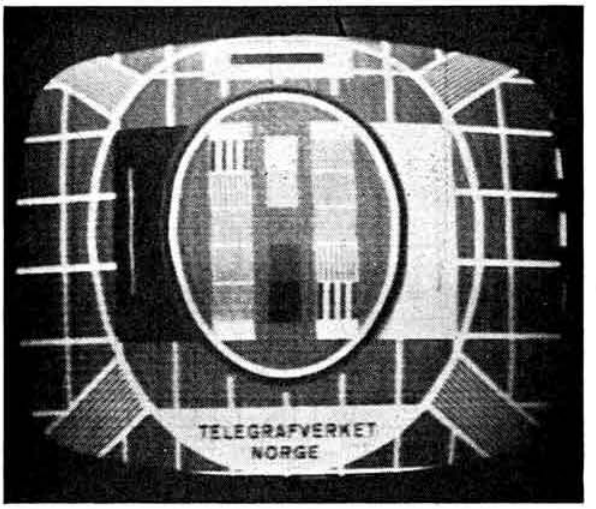
In total 59 members returned the questionnaire, which to the writer personally seems to be a small proportion of those who regularly engage in v.h.f. and u.h.f. contests and are in the habit of exchanging location information.

A preponderance of those replying said they frequently took part in contests and favoured a grid locator system—and Georef was favoured by 73 per cent.

In his report G3TUX offers *inter alia* the following conclusions: Generally speaking, the majority were in favour of Georef, some quite strongly so. On the other hand, some of those preferring QRA were equally violently opposed to Georef. Objections against Georef seemed mainly to be that it gave unnecessary accuracy, and that it could not really be expected to replace the QRA system now firmly established in Europe.

In favour of Georef, people commented on its accuracy, simplicity, the fact that it is a standard locator system with world-wide application, and that maps are readily available.

Finally, one person suggested that Georef might be given a trial run during a 4m contest. This would obviate any confusion with European stations who cannot use " Four," although not necessarily all that easy to organize.



" Have given up short-wave listening and thoughts of the RAE . . . now concentrating on DX television reception " says BRS27148, Denis Boniface of Ripon. The illustration shows the sort of picture his equipment will resolve, a Norwegian test card identified on 48·25 MHz, in spite of the fact that tropo openings have not been frequent this year (that wet summer). Before long Denis hopes to be sending reports to G6 " Stroke T " stations.

Cumulative for " Four "?

Support for the G5NU suggestion of a 4m cumulative activity contest comes from G3UUT of York. Have it on Sunday mornings, he suggests, clear of any existing 4m contests.

Remarking that he " is a bit fed up with these brute force letters," he thinks that nevertheless it would be intriguing to run a low power field day on 2m, with a maximum of 5 watts in and a multiplier for lower powers still. "This would really show up deficiencies of operating, aerial and site."

It certainly would. Passed to the V.H.F. Contests Committee for mulling over.

Listen out especially for . . .

. . . GB2HQ on 70·26/70·2 and 144·7 MHz from the new RSGB Headquarters during the " Open Weekend " on the 14–15 December (further details of the " Open Weekend " appear on page 815 in this issue).

. . . the University of Southampton Club station, G3KMI, on 70·26, 70·415 and 70·17 MHz, operating lunchtimes and most evenings, with concentration on Thursday evenings. A 4-element beam at 45 ft. promises good signals into the JXK converter and out from the modified Pye baser at 24 watts.

. . . G8AYN, a member of the G3KMI team, operates from his lodgings on 144·156 MHz on Monday and Tuesday evenings. Sometimes a colleague's callsign, G8CCG, may be heard from the same rig and address, 99, Bellemoor Road, Shirley, Southampton.

. . . G8CEF, Desmond Walsh, " Sedan," Stock Lane, Ingatestone, Essex, who is collecting equipment together to make his debut on " Two." As a native of EI he hopes to operate from Waterford, Kilkenny and Tipperary come the holiday months of '69.

. . . F1AHZ, G. J. Paul, of St Gatien des Boise, pt L'Eveque,

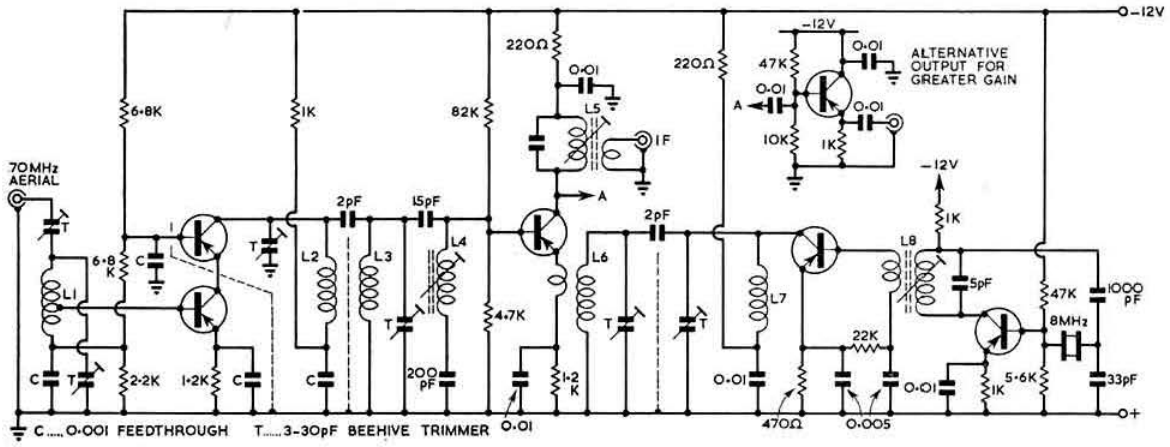


Fig. 1. The 4m converter developed by G3MNQ for long period meteor scatter reception. All transistors are AFZ12. Component values are marked. Inductor values are as follows:

L1, 5 turns on 0·3 in. former, tapped 1 turn. L2, L3, 4 turns on 0·3 in. former, L2 screened from L3. L4, slug tuned to chosen i.f., with 200 pF in series. L5, to suit chosen i.f., slug tuned. L6, 5 turns 0·3 in. former with one turn of 22 s.w.g. over the cold end. L7, 5 turns 0·3 in. former, screened from L6. L8, 25 turns 36 s.w.g. on 0·3 in. former with 4½ turns of 28 s.w.g. over the cold end, slug tuned. All wire 28 s.w.g. unless otherwise stated.

Calvados 14 (who incidentally is also A5711). He beams on the UK every Monday and Tuesday from 20.05 to 21.05 GMT and operates on 145·139 and 145·239 MHz (no, the DX is not always at the bottom of the band!) He has 6 watts into the 9-element well sited at almost 60 ft.

... G8APX/M on 2m near Newcastle on Tyne, 21–28 Dec. and Bristol 29 Dec.–2 Jan. For skeds write W. H. Jarvis, Royal Masonic Senior School, Bushey, Herts (WD2 2LN)

... GM3KSU who seeks 4m schedules with any stations well to the north of Edinburgh. Write him 35 Howard Place, Edinburgh 3.

Tech Corner

From G2CUZ (Norman Horrocks of Southport):

I was very pleased to read the comment on 4m TVI and the fact that most of it occurs only from phone transmissions. The advantage of using c.w. is so obvious as to need no further emphasis.

Almost every case in which local members have received TVI reports the trouble has been sound breakthrough, with usually no trace on the picture at all: any interference to video has usually been due to a birdie in the transmitter.

Getting rid of sound TVI is a very variable job, taking into account the many poor designs of television receiver there are about, using open printed circuitry.

I would like to suggest that a monthly section be run in " Four Metres and Down " on cases of TVI experienced on v.h.f., and their cures to provide information to the faint-hearted who stay off the air until television close-down. We in the Ainsdale Radio Club are about to embark on a similar project here, and would be pleased to add our results as they come to hand, for the problem must be tackled in a firm manner if we are to find the bands populated in the early evenings.

From G3MNQ (Eric Goodwin, Peatling Parva, Rugby):

A 70 MHz converter which has been in use for the last two years for recording meteor-trail bursts from overseas broadcasting stations has been the subject of inquiry by visitors to G3MNQ, and some particulars are therefore given below:

The converter uses the AFZ12 throughout, a transistor which although some years old is capable of giving high performance up to 100 MHz. Two are connected in cascode configuration to give good r.f. amplification at a low noise figure. No need for a neutralizing coil between the collector of the first and the emitter of the second has been apparent, though it is advisable to screen the two transistors from one another. (Screen shown dotted in Fig. 1).

The output of the second half of the cascode pair is bandpass coupled to the mixer by means of two 4-turn coils which must be screened from one another and top coupling applied through a 2 pF capacitor. This mechanical elaborateness is well worth while to reduce front end bandwidth and the possibilities of cross-modulation.

Good noise performance can be spoilt by i.f. breakthrough, and an i.f. rejection circuit is provided in the shape of L4 with a 200 pF series capacitor. This circuit also provides a low impedance at the mixer base for efficient mixing. The inductor L4 can be identical with the i.f. output coil L5. Its tuning is reasonably flat.

The crystal chain, too, incorporates bandpass coupling from the second transistor to ensure reduction of unwanted crystal harmonics. The crystal oscillator will be recognized as a transistor version of the Robert Dollar. If an FT243 type crystal is used somewhere in the 8 MHz region third harmonics will appear at L8.

If instead of the standard low-impedance i.f.-output coil an emitter follower is used greater gain will be achieved. The method of adding the emitter follower at " A " is shown.

Here and There

" I hope the 4m bandplan as shown on page 673 (October) really works. It appears to me to be a very sensible compromise and I sincerely hope it will be adhered to "—G3UUT.

* * *

" We all (well, a few of us) know the meaning of QLF, QHL and QLH. You may hear QTS after a telegraphy CQ. This means: Listening on Two Six. (No, not three seven: that is strictly for Raynet) "—G3PMJ.

Christmas gifts for the radio amateur

These are but a small selection of publications held in stock. For prices of these, other books and shack accessories see the rear inside cover.

RSGB Publications, 35 Doughty Street, London, WC1

SOCIETY AFFAIRS AND NEWS SUPPLEMENT

A brief report of the RSGB Council Meeting held on Monday 14 October, 1968 at the Kingsley Hotel, London, WC1.

Present: The President (Mr J. C. Graham in the Chair); Messrs B. Armstrong, N. Caws, J. Etherington, R. J. Hughes, A. Hunter, E. G. Ingram, H. E. McNally, L. E. Newnham, J. Petty, R. F. Stevens, G. M. C. Stone, G. Twist, J. W. Swinnerton, E. W. Yeomanson (Members of Council), C. P. Pope (Secretary), A. E. Dowdeswell (General Manager) and T. R. Preece (Assistant Editor).

Apologies for absence were received from Messrs A. D. Patterson and D. M. Thomas.

Membership and Affiliation

Council resolved to elect:
(i) 259 Corporate and 56 Associate Members,
(ii) To grant Corporate Membership to 13 Associate Members.
No applications for Affiliation were received.

New Headquarters

It was reported that the alterations and renovations had been completed, the building had been handed over by the builders and apart from minor items everything was in order.

Publications

It was reported that a further 2,000 copies of the *Radio Communication Handbook* would be available shortly and these would be immediately despatched to fulfil outstanding orders. The delivery of a further supply of postal cases was promised during the next few days.

Presidential Installation 1969

The Installation of the President for 1969 would follow the pattern of previous years but the possibility of a new venue would be investigated.

Regional Representative Conference

Council decided that the triennial conference would be held during October 1969. Suggestions for several venues would be sent to all Regional Representatives who would be asked to state their preference.

Annual Report of the Society's Activities

The draft Annual Report was presented to Council and after some ammendments was passed for publication.

Region 14 ORM

After discussion Council approved this meeting. The venue would be in the Glasgow area.

Reader's Small Advertisements

After discussion Council agreed to allow Affiliated Societies the same facilities as were available to Members.

Nominations for Council

The General Manager reported the following nominations had been received for the vacancies on the 1969 Council. *Ordinary Members of Council*—Messrs J. Etherington, G. R. Jessop, A. D. Patterson, G. M. C. Stone and R. G. B. Vaughan. *Council Members elected by zones*—Zone B, Dr. E. J. Allaway, R. W. Fisher and F. C. Ward. Zone C, Messrs F. J. Barns and R. J. Hughes.

13cm Tests 1967

After discussion Council decided to award the *Arthur Watts Trophy* jointly to the G.E.C. Group, G5FK and the G3EEZ Group.

Minutes

Council accepted the Minutes of the following Committee Meetings:

RAEN Committee, (17.8.68); VHF Contests Committee, (12.9.68); Finance and Staff Committee, (12.9.68); Exhibition Committee, (13.9.68); Membership and Representation Committee, (16.9.68); Mobile Committee, (17.9.68); H.F. Contests Committee, (19.9.68); Scientific Studies Committee, (23.9.68); Technial Committee, (24.9.68); Finance and Staff Committee, (8.10.68);

The Council was in session for five hours.

Here photographed on the roof of 28 Little Russell Street, shortly before our move are Roy Stevens, G2BVN (RSGB Council Member), Richard L. Baldwin, W1IKE (ARRL Assistant General Manager), Eric Dowdeswell, G4AR (RSGB General Manager) and Noel Eaton, VE3CJ (ARRL Canadian Director).

V.H.F. National Field Day

Two errors occurred in the list of award winners as published on page 762 of the November issue of *Radio Communication*. The leading Scottish entry should have read: GM3WML and not the Pennine V.H.F. Expedition Group as published. The overall runners-up were the Worcester V.H.F. Group (combined with) *Loughborough* V.H.F. Group.

RSGB QSL Bureau Sub-Managers

This is a list of the RSGB QSL Bureau Sub-Managers showing the call-sign groups for which they are responsible:

G2:	J. W. Russell, G2ZR, 45 Shakespeare Avenue, Bath.
G3, 4 and 5 two-letter calls and GC:	E. G. Allen, G3DRN, 65a Melbury Gardens, London, SW20.
G6 and G8:	A. J. Mathews, G6QM, 62 Ashlands Road, Hesters Way Estate, Cheltenham.
G3AAA-BZZ:	C. C. Olley G3AIZ, 157 Wanstead Park Road, Ilford, Essex.
G3CAA-DZZ:	C. A. Bradbury, BRS1066, 13 Salisbury Avenue, Cheltenham.
G3EAA-HZZ:	W. J. Green, G3FBA, "Meadway," Links Avenue, Brundall, Norfolk, NOR 86Z.
G3IAA-KZZ BRS and A numbers:	G. L. V. Butler, G2BUL, 995 London Road, Thornton Heath, Surrey.
G3LAA-NZZ:	C. R. Emary, G5GH, Westbury End, Finmere, Buckingham.
G3OAA-PZZ:	J. H. Brazzill, G3WP, 43 Forest Drive, Chelmsford, Essex.
G3RAA-RZZ:	K. Walden, G3OLN, 250 Gloucester Road, Cheltenham, Gloucestershire.
G3SAA-TZZ:	E. G. Allen, G3DRN, 65a Melbury Gardens, London, SW20.
G3UAA-VZZ:	P. R. Cox, G3RYV, 20 Allenby Road, Maidenhead, Berks.
G3WAA-G3XZZ:	R. W. Martin, G3RWM, 76 St Paul's Crescent, Coleshill, Warks.
G8AAA series, all prefixes:	E. G. Allen, G3DRN, 65a Melbury Gardens, London, SW20.
GD:	T. R. Moore, GD3ENK, "Glyn Moar," St. John's, Isle of Man.
GI:	R. R. Parsons, GI3HXV, 45 Erinvale Avenue, Finaghy, Belfast.
GM:	D. Macadie, GM6MD, 154 Kingsacre Road, Glasgow, S4.
GW:	J. L. Reid, GW3ANU, 28 Waterston Road, Gabalfa, Cardiff.

The address of the QSL Bureau Manager (Mr A. O. Milne, G2MI) is 29 Kechill Gardens, Bromley, Kent.

Cards must be sent to G2MI but envelopes may be sent to the appropriate Sub-Manager or to G2MI. Printed, gummed labels are obtainable from G2MI by sending an s.a.e.

Obituary

P. J. Brisbar, G3JHZ

It is with sorrow that we report the death, on 28 September, 1968, of Peter Brisbar, G3JHZ, in Ibiza, Spain.
Peter, who held calls in nine countries, was very well known on twenty metres. We extend our deepest sympathies to his mother, his widow in Spain and his father, G3FGM.

G. C. B.

CONTEST NEWS

Listeners 144 MHz Contest 1968

Held on 3–4 August, this contest attracted seven entries including three from newcomers to the Listeners V.H.F.–U.H.F. Championship. Top scorer was Terence Cooper, BRS28005 operating portable from the South Downs. He logged 101 stations including three GWs and six Fs. His best DX, however, was G3WIN/P in Cumberland. The runner-up was C. J. Baker of Brookmans Park, with a log of 115 stations including the same three GWs and one ON4. Valve converters predominated with a TW, two VQ4EVs, a nuvistor type and an E88CC. BRS26234 used an f.e.t. unit while BRS28005 gave no details of his front-end stages. BRS26234 mentions he heard snatches of GM5PI, but not enough to log. A5662 offers a word of praise for the good manners of v.h.f. contest operators. Subject to the approval of Council the winner and runner-up will be awarded Certificates of Merit.

RSGB No.	Name	Posn.	Score	Cnty. Code	Best DX km	Aerial	Aerial Height (ft)
BRS 28005/P	T. M. Cooper	1	324	SX	420	8 el.	12
A5032	C. J. Baker	2	242	HF	335	4 el.	42
BRS 26234/P	E. MacDuff	3	220	SX	460	8 el.	15
BRS 15822	R. W. Thomas	4	131	LD	370	8 el.	35
A5662	M. G. Toms	5	71	EX	225	Halo	20
BRS 18456	E. H. Doublebra	6	68	MX	140	6 el.	40
A6020	N. J. Sears	7	24	BS	180	8 el.	30

Third 432 MHz (Open) Contest 1968

" Where have all the 70cm operators gone," was the main comment from the nineteen entrants, in the Third 432 MHz (Open) Contest held on the 5–6 October 1968. Although the weather was kind, conditions were average to poor but with occasional lifts of short duration. Good dx tended to be a matter of luck; lack of activity made the contest hard work.

Only one entrant used a semiconductor in the transmitter output stage but conversely only one entrant used a valve in the receiver first r.f. stage. Parabeams and BF180 transistors were obviously very popular.

Subject to the council's approval, Certificates of Merit will be awarded to G8AKE, G8AAC and G3NNG winners of sections A, B and C respectively and G8BBB will receive a Certificate of Merit as runner-up in Section A.

A check log was received from G2WS who complained of lack of activity and that few entrants paid any attention to stations in the South West.

Section A, Single Operator Fixed Station

Call-sign	Posn.	Score	QSO'	Best DX Km	DX Aerial	Power (watts)	P.A.	Rx.
G8AKE	1	15510	76	340	4 × 14 el.	150	4CX250B	BF180
G8BBB	2	6390	50	325	Pb.	150	4CX250B	BF180
G8AWO	3	5074	55	275	2 × Pb.	100	4X150A	BF180
G8AUE	4	4144	43	224	2 × Pb.	50	QQVO3-20A	BF180
G3XEB	5	4010	53	248	Pb.	28	QQVO3-20A	BF180
G8ARM	6	2806	45	230	2 × Pb.	18	DET 24	BF180
G3COJ	7	1281	31	310	14 el.	150	4CX250B	TIXM101
G3NEO	8	1007	25	227	Pb.	20	QQVO3-20	AF239
G3WFM	9	468	32	95	8/8 el.	25	QQVO3-20A	GM290A
G8ART	10	364	23	—	24 el.	50	QQVO3-20A	BF180
G8AGV	11	28	4	110	Pb.	15	TT15	PC88
Section B, Club/A, and Multi-Operator Fixed Stations								
G8AAC/A	1	2704	38	310	8/8 el.	20	QQVO3-20A	AF239
G8AKT	2	2601	35	293	24 el.	24	QQE03-20	AF239
Section C, Portable Stations								
G3NNG/P	1	17484	75	460	2 × 8/8 el.	12	DET24	TIS88
G8AWS/P	2	15660	82	453	Pb.	35*	IN4387	TIXM01
G8AYB/P	3	8126	64	310	14 el.	25	QQVO3-20A	BF180
G3KKP/P	4	5733	40	295	2 × Pb.	20	QQVO3-20A	AF139
G8APQ/P	5	2380	30	310	Pb.	18	QQVO3-25	GM0290
G3GHN/P	6	646	26	160	Pb.	24	QQVO3-20	GM0290

* — Power to tripler
Pb — Parabeam

Second 1296 MHz (Open) Contest 1968

The level of activity in this contest, held on 13 October, was very similar to that in the May event, with 31 callsigns appearing in 15 logs compared with 35 and 13 earlier in the year.

G2RD of Caterham was the leader in Section A, his best contact being with G3GWL at Bletchley. Runner-up G8AUE of Belper exchanged RS 58 signals with GW3BNL/P at a distance of 165 km for his best contact in a log which only contained 2 single point QSOs.

First and last in Section B, G3OXD/A repeated their win in the May contest. It is to be hoped that support for this section will improve.

G3BNL and G3TXR climbed to a site 2400 ft up in the Black Mountains to take first place in the portable section. The runner-up, G3NNG, reported the signal from GW3BNL/P as " phenomenal." The signal in question emanated from a BAY66, all other contestants using 2C39s (12) or DET24s (2) in their transmitter final stages.

No conclusions can be drawn as to the desirability of separate or combined contests on 70 and 23 cm. The main objection to a combined contest is the unwillingness of 70 cm operators to break off to carry out tests on 23. G3NZS for G3OXD points out that conditions tend to peak during the evening and early morning and that a 24 hour contest is thus preferred. It may be that a return to the system of a 23 cm contest immediately following a 70 cm contest may be preferable or alternatively a 24 hour combined contest including two periods during which scoring contacts may not be made on 70 cm. The V.H.F. Contest Committee will be pleased to consider any suggestions on this subject.

It had been intended that the contest would be scored on a points-per-kilometre basis, as mentioned in the results of the May event. However, due to an oversight on the part of the Committee, the rules published were those originally prepared. Contestants may be assured that the points-per-kilometre system will be used in future 23 cm contests.

AJG

Section A, Single Operator Fixed Station

Callsign	Posn.	Score	QSOs	County Code	Power (Watts)	Aerial
G2RD	1	116	11	SY	30	3 ft. P.
G8AUE	2	72	7	DY	24	5 ft. P.
G8AEJ	3	30	7	LD	50	3 ft. P.
G5UM	4	6	2	LR	40	Dish
G8AOD	4	6	4	SX	9	8 + 8
G2WS	6	5	2	ST	25	11'11 Slot Fed
G8ARM	7	4	3	LD	18	Parabeam
G8AUF	8	1	1	DY	9·5	4 ft. P.
Section B, Club/A, and Multi-Operator Fixed Stations						
G3OXD/A	1	60	6	WR	20	4 ft Dish
Section C, Portable Stations						
GW3BNL/P	1	250	10	BR	12	3 ft. P.
G3NNG/P	2	176	11	BE	12	3 ft. Dish
G3MAR/P	3	171	10	WR	30	TR
G8ACE/P	4	60	5	LR	40	Dish
G3OBD/P	5	28	5	WE	25	4 ft P
G8ADC/P	6	13	3	BD	12	4 ft. × 2 ft. P.

Glossary P.—Parabola
TR—Trough Reflector

RADIO AMATEUR EMERGENCY NETWORK

By S. W. LAW, G3PAZ*

AT the approach of the year's end we may well pause and look back upon the hills and valleys of the past twelve months. For some the rearward glance discloses a steady rise, for others there are the well-remembered peaks of activity or endeavour (all successfully surmounted despite either forebodings or a rocky path). True, for some, there may be discerned the areas of aridity where the path was lost. We have already given praise in these columns to those who have had the opportunity to prove themselves and they themselves would be the first to point out that the laws of chance played a great part in determining the location and time of the events in which they took part. What, then, of those who perhaps lost heart? They are not alone, for in other spheres the wind of change has proved too chill. As is well known, certain official outlooks have changed for reasons best not discussed here—but nothing remains still except our wish to employ our skills to speed the relief of suffering.

The Winds—And The Flame

We once quoted Shakespeare on the subject of Adversity. May we now cull from another byegone saga a thought on the subject? It has been written (and we paraphrase freely) "The wind will extinguish the feeble flame, but only serves to fan the fire to greater heights." Specifically, may we extend the hand of encouragement to those Groups who have been so dismayed by the turn of events as to think the effort not worth the candle? Try "lighting a fire" and you may well discover the flame roar into a new and healthy blaze of activity. Look around a little and you will find certain bodies of people who, far from meekly accepting the scrapheap, have voluntarily formed themselves into a powerful and widespread body whom we are proud to acknowledge and with whom (should certain eventualities come to pass) we would only be too pleased to co-operate. There we leave the thought, refraining with some difficulty from the paradox of doors that shut—and open!

Odd!

Those who scan the small news items may have noted, with chagrin, that certain local councils have been reported as having raised the question of the possibility of ascertaining the location and availability of Radio Amateurs in their localities with a view to obtaining their assistance in times of civil emergency. This, mark you, in some areas where RAEN has been in being for years past! Comment would seem pointless.

RAEN Committee

The last meeting of the RAEN Committee for 1968 took place at the new RSGB Headquarters, on 9 November at 11 a.m. A practically full attendance of members rapidly adjusted to the new and improved accommodation to greet Mr E. G. Gregory of the British Red Cross Society for discussions on various aspects of liaison. Some knotty points were raised, but settled before an early lunch-break to the satisfaction of all. Next the Committee discussed the problem of the allocation of the RAEN Trophy for the period June 1967 to 1968. The general opinion was expressed that, as the Committee were unaware of any outstanding growth or activity during the period, the Trophy should not be awarded on this occasion. Nevertheless, it was put on record that the Committee wish to express their thanks for the good work known to have been done by a number of Groups around the country, coupled at this time with all good wishes for the approaching festive season. Membership is rising all the time, and this in spite of the surprising number of ex-members who have still at this late date failed to re-register! Since a number of these members are known to be still active, it would seem to devolve upon the relevant Controllers to ensure that groups consisted only of registered members and that any group equipment held by ex-members be returned to the group allocation. In order that the question of the Trophy award may be more satisfactorily settled in the future, a letter is to be sent to all known (and registered) Controllers asking that the Committee be kept informed of activities. A suggestion was put forward that a certificate award be made to Groups who have actually taken part in relief operations. This may well be adopted as a part of the future award policy. It was noted, with satisfaction, that activity is being stimulated in the Sussex area by Police requests for the provision of emergency communications and that groups are in the process of formation. Nominations were read, discussed and ratified for the appointment of Group Controllers including G3MFB (Surrey), G3WQF (Mid-Anglia) and GW3JBH (Monmouth). A great deal of items were dealt with, in consequence of which the Chairman's gavel did not finally fall until nearly 6 p.m.

Credit Due

It has only just come to our notice that another flood relief operation was carried out by an Essex Group in the Billericay area in September. The interesting thing as far as Essex is concerned is the operation of the net on 70·375 MHz. We understand that the band has now proved its worth for this type of emergency in the area.

Any Offers?

To date, despite the *Torrey Canyon* affair not far away and the flood troubles in the area, we have no news of any prospective RAEN Group in Devon. Perhaps the cautious Devonians are anxious to ensure that a really good set-up is in being before they present the RAEN Committee with their programme for approval? We hope that something will come along in the New Year, as the Committee would very much like to hear that this area was operative. Remember, only five signatures from registered members are required proposing a sixth as controller for a group to become officially recognized. There was a rumour that G3WPJ was trying to do something about his area, so this might trigger something off! Let us see if Somerset will create some competition from the other side. The registrations will show!

Ghosts?

Who were the phantom group in the South who objected to *their* emergency channel being used for certain other (quite legitimate) modes of transmission? And they're not even registered—Tut, tut!

Coda

Before we run out of space, may we say thanks to our correspondents and wish all members the best for the Festive Season. One last thought, where applicable—get yourself an up-to-date Registration Card for Christmas!

* 11 Chisholm Road, Croydon, Surrey, CRO 6UQ.

Honorary Registrations Secretary: **Mr R. A. Ledgerton, G2ABC 1 Latchingdon Gardens, Woodford Bridge, Essex.**

Honorary Secretary, RAEN Committee: **Mr E. R. L. Bassett, BRS16075, 57 Upper St. Helens Road, Hedge End, Southampton, SO3 4LG.**

YOUR OPINION

Loop Aerials

From B. Rose, BSc., G3ULR, Hartlepool, Co Durham

I have constructed a loop aerial similar to the one described by Spenny, G6NA, in "Radio Communication," September, 1968. I am using coaxial cable having two separately insulated braids, of about 0·4 in. o.d., intended for use in wired television relay. The results seem to indicate definite directivity in the plane of the loop.

I wish to point out some errors in the interpretation of the equations as given by G6NA, as these caused some trouble to me. I am using the notation in my Fig. 1, taken from page 5–25 *Radio*

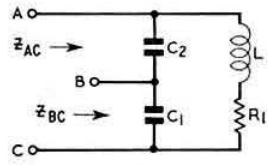


Fig. 1

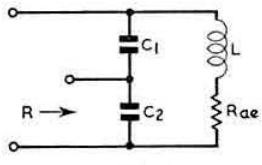


Fig. 2

Engineering Handbook, Ed. K. Henney (McGraw-Hill). Notice that C_1 is here the C_2 of the G6NA article.

$$\frac{C_1}{C_2} = \left[\sqrt{\frac{Z_{AC}}{Z_{BC}}} - 1\right] \qquad \text{Table 1}$$

... if $R_1 << L\omega$ (Henney)

Now Z_{AC}, Z_{BC} are purely resistive at resonance, *but* Z_{AC} is actually the dynamic resistance of the tuned circuit of the loop, and is not equal to R_1 as stated by G6NA (see line 7, page 577 column 2, "Radio Communication" September, 1968). Rather,

$$Z_{AC} = \frac{1}{R_1}\left(\frac{L}{C}\right) \qquad \text{Table 2}$$

—see for instance loc. cit 5–21 equation 4.

Needless to say there is a large discrepancy, G6NA style, between the calculated and the experimental parameters! The final values used at G3ULR were got by cut and try, and were very like the ones given by G6NA, in Fig. 4 of his article. These values do not result using his figures on p. 578 column 2, inserted back into the expressions he gives. Using G6NA's 121 milliohms and 19 μH, the original equations give 10,000 pF for C_2 which is not the same as in Fig. 4. (C_2 is here as in my Fig. 2, to agree with G6NA's notation.)

Translating the other expressions from "Henney's handbook" into the notation used by G6NA, in my Fig. 2, we get:

$$C_1 = \frac{1}{4\pi^2 f^2 L\left[1 - \sqrt{\frac{R\,R_{ae}C}{L}}\right]} \qquad \text{Table 3}$$

$$C_2 = \frac{1}{4\pi^2 f^2 L}\sqrt{\frac{L}{R\,R_{ae}C}} \qquad \text{Table 4}$$

Note that C_2 and C_1 in 3, 4 are exactly the same as in the Fig. 2 of G6NA's article. As $C = \frac{C_1C_2}{C_1+C_1}$ and $10 < \frac{C_2}{C_1} < 10^3$, a first approximation for C_1, C_2 can be obtained from 3 and 4 by putting $C = C_1$ on the right hand side, as he suggests. The expression for the ratio C_2/C_1 is also wrong as originally given. The right equation is:

$$\frac{C_2}{C_1} = \left[\sqrt{\frac{L}{R\,R_{ae}\,C}} - 1\right] \doteq \left[\sqrt{\frac{L}{R\,R_{ae}\,C_1}} - 1\right]$$

If any doubt is left, readers are referred to Henney where the problem is fully worked out, or to their own experiments; the equations given *do* work!

I thank G3ULR for pointing out this error in my article on Loop Aerials. G3ULR is of course quite right in his interpretation. Unfortunately the correct expressions used by G3ULR give a greater discrepancy between the value found to be best in practice and the calculated one, although this tendency (which has nothing to do with the accuracy of his equations) will be narrowed and reversed as the diameter of the loop is progressively increased.—G6NA.

Single Sideband

From : L. J. Smith, VK6LJ, ex G3HJF, Morley, Western Australia.

The recent decision by the Australian GPO that many internal l.f. radio services, including the famous Flying Doctor system, shall change to s.s.b. operation after 1970 has given me, and no doubt many other amateurs, great satisfaction. I am quite sure that Communication Authorities all over the world have been noting the remarkable uprising of s.s.b. operation on the amateur bands as a first class example of practice proving theory wrong. Less than ten years ago it was still stated that s.s.b. operation with manual frequency control on the l.f. bands was nearly impossible. Everyone, it seemed, who knew about these things was sure that, amongst other formidable difficulties, the reinserted carrier had to be within 10 c/s or less of the suppressed carrier for the speech to be intelligible. Amateurs have proved that, and many other theoretical difficulties, completely unfounded and in doing so have rendered the art of radio communication a very real service. Mind you, not all amateurs realized the possibilities of s.s.b. at first. It is therefore with unashamed smugness that I recall that I was, if not the first, then certainly among the happy band of pioneers of s.s.b. on the amateur bands who endured much chaffing, mostly good-natured but occasionally a little bad tempered, from our fellow operators, back in the early 'fifties. What vindication for the real pioneers in the UK of whom G2NH and G3FHL spring to mind.

For myself, sir, the wheel is beginning to turn full circle. Having worked the world on s.s.b. with a minute commercial transceiver I find greater satisfaction now in operating in a manner which hitherto I have been shamefully incompetent—C.W.!

How do you start on U.H.F.?

From: S/Ldr. I. B. Bullock, Stamford, Lincs.

I have been an Associate Member of the RSGB for some years now during which period the RSGB has fought successfully for the inclusion of the 2m band within the G8 licence conditions.

However very little seems to have been done during this period of battle, or since, to give advice on starting-up on the v.h.f. and u.h.f. bands. Your excellent publications are fine for the l.f. and h.f. bands but where does one get the answers to such questions as

How much power is needed?
S.s.b. or normal a.m.?
Transceiver or Transmitter and Receiver?
Size of aerial (i.e. number of elements, etc.)?
V.f.o. or crystal?

And other basic points. Odd comments here and there in the *Bulletin/Communication* seem to me to show a need for an article giving guidance on these lines. Such an article should give those about to embark on G8 licences some grounding before they go off to discuss finer points with their neighbouring, may I say it, hams.

Buy British Again!

From: M. Hearsey G8ATK, Camberley, Surrey.

In this day and age we are asked to Buy British, what a misfortune! Some months ago I had to order six chassis from H. L. Smith & Co. Ltd., Edgware Road. This order was speedily despatched. Later I again re-ordered six chassis from the same company. I duly sent off an order, the next day a telephone call was received at my QTH to say that I had forgotten to put my cheque inside, the chassis were made and on receipt of my cheque would be despatched. On my arrival home a letter and cheque were written and left to be posted the next morning, however before the letter could be posted, six chassis arrived by post, without the supplier having his money.

If all British firms would conduct their business in this way there would be many less frustrated amateurs.

To H. L. Smith & Co. Ltd. I say "thank you' my orders will in future always go to you."

RSGB SLOW MORSE PRACTICE TRANSMISSIONS

These Slow Morse Practice transmissions are sponsored by the RSGB. Alterations and additions to this list should be sent to the Honorary Organizer, M. MacBrayne, G3KGU, 25 Purlieu Way, Theydon Bois, Essex.

Clock Time	Call-sign	MHz	Town
Sundays			
09.30	†G3KZZ / G3TNF	1·920	South Shields, Co. Durham / Gateshead
09.30	G3HZL	1·940	Isleworth, Middlesex
09.45	G3USK	1·975	Mablethorpe, Lincs.
10.00	G2FXA	437·000 to North	Stockton-on-Tees
10.00	G3TTK	1·860	Coalville, Leics.
10.00	GM3PIP	3·590	Mintlaw, Aberdeen
10.15	G3CGD	1·875	Cheltenham
10.30	G3SJE	28·100	Harrow, Middlx.
10.30	G2FXA	437·000 to South	Stockton-on-Tees
10.30	G3NPB	1·875	St. Ives, Cornwall
11.00	G2FXA	1·900	Stockton-on-Tees
11.00	GW3UMB	1·880	Colwyn Bay
11.30	G3KKU	1·940	Liverpool
12.00	G3HVI	1·890	Stoke-on-Trent
12.00	G3GNS	1·910	Weston-super-Mare
12.30	G3FWW	1·880	Burnham-on-Sea, Soms.
14.00	G3XGJ	1·830	Huddersfield, Yorks.
17.30	G3TNF	1·920	Gateshead
Mondays			
17.30	G3TNF	1·920	Gateshead
18.00	G3SWR	1·980	Birmingham
18.30	G3NCZ	1·920	Blackburn, Lancs.
18.30	G3RXH	1·910	Skipton, Yorks.
19.00	G3WGU	1·880	Bispham, Lancs.
19.00	†GC4LI / GC2FMV	3·600	Jersey, C.I.
20.00	G3USK	1·975	Mablethorpe, Lincs.
20.00	G3KAN	1·990	Northampton
20.00	G3IBJ	1·910	Southampton, Hants.
20.00	GI3JEX	1·860	Belfast
20.00	†G3WDW / G3VTY	1·915	Leeds, Yorks.
20.15	G3SAZ	1·845	Ashford, Middlesex
20.30	G3XSE	1·915	Harlow, Essex
† Alternately			
Tuesdays			
17·30	G3TNF	1·920	Gateshead
19.00	†G3UFO / G3XAM	1·980	Wirral, Cheshire
19.30	G3SWP	1·850	Doncaster, Yorks.
19.30	G3WGU	433·500 to South-East	Bispham, Lancs.
20.00	G3UPA	1·850	Meriden, Warks.
20.00	†G3FAU / G3KSS / G3OVT	1·980	Stevenage, Herts.
20.00	G3FWW	1·880	Burnham-on-Sea, Soms.
20.00	G3TPV	1·910	Hythe, Hants.
20.00	GM3UWX	3·590	Bishopton, Renfrewshire
20.30	G3UNV	1·845	Ashford, Middlx.
20.30	G2ABC	1·915	Woodford, Essex
21.00	G4RS	1·865	Blandford, Dorset
21.30	G2ABC	144·750	Woodford, Essex
22.00	G3HZM	1·925	Manchester
Wednesdays			
17.30	G3TNF	1·920	Gateshead
18.30	G2FXA	1·900	Stockton-on-Tees
19.00	G3HT	1·930	Tiptree, Essex
19.30	G3WGU	433·500 to South-East	Bispham, Lancs.
19.30	G3UJD	1·825	Farnborough, Hants.
20.00	G8QU	1·970	London, N22
20.00	GM3PIP	3·590	Mintlaw, Aberdeen
20.30	G3HZL	1·845	Isleworth, Middlx.
20.30	G3KGU	1·915	Theydon Bois, Essex
21.00	G3HVI	1·890	Stoke-on-Trent
21.00	G3LQI	1·990	Lancing, Sussex
† Alternately			
Thursdays			
17.30	G3TNF	1·920	Gateshead
18.00	G3SWR	1·980	Birmingham
18.30	GW3VBP	3·590	Barry, Glam.
18.30	GW3UMB	1·880	Colwyn Bay
18.30	G3NC	1·968	Swindon, Wilts.
19.00	G3WGU	1·880	Bispham, Lancs.
19.30	G3GNS	1·910	Weston-super-Mare
20.00	GI3JEX	1·860	Belfast
20.30	G3SJE	1·875	Harrow, Middlx.
20.30	†G3ROE / G3RSF / G3TIQ	1·915	Harlow, Essex
21.00	G4RS	1·865	Blandford, Dorset
Fridays			
17.30	G3TNF	1·920	Gateshead
18.30	G3NCZ	1·920	Blackburn, Lancs.
19.00	G3NPB	1·875	St Ives, Cornwall
19.30	G3PQF	1·825	Farnborough, Hants.
20.00	†G3WGW	1·915	Pudsey, Yorks.
	G3WIX		Bradford, Yorks.
20.00	G3EEL	1·980	Peterborough
20.15	G3SAZ	1·845	Ashford, Middlesex
Saturdays			
09·30	G3UNV	1·940	Ashford, Middlesex
10.00	G3PLE	1·820	Stourbridge, Worcs.
13·00	G2FXA	1·900	Stockton-on-Tees
14.00	†GC4LI / GC2FMV	3·600	Jersey, C.I.
17.30	G3TNF	1·920	Gateshead
17.30	G3EFS	1·913	Bromley, Kent
20.00	G3KPO	1·980	Peterborough
20.00	G3WPR	1·915	Ilford, Essex
21.00	G3TTK	1·823	Coalville, Leics.
† Alternately			

Members might like to be reminded that the Royal Naval Amateur Radio Society using their call-sign G3BZU, transmits c.w. as a proficiency test at 19.00 GMT on the first Tuesday of each month. Frequencies used are 1·875 MHz for practice only, and 3·520 MHz for speed proficiency tests. Certificates are issued against correct copy submitted to: The Royal Naval Amateur Radio Society, HMS Mercury, Leydene, Hants. A small charge is made to cover costs.

Listeners: These slow Morse practice transmissions are promoted specifically to help you, and unless you play your part it will become increasingly difficult to keep the service going. If you benefit from any of these transmissions you owe it to the operator concerned to let him know you listen. This service is a call upon the operator's leisure time, and he is more likely to sacrifice it to help you, if he knows he has an audience.

CLUB NEWS

Please send all information direct to Regional Representatives, giving full details of future meetings, and any snippets of activities which would be interesting in print. When listing meetings, please be sure to include the date and time, the meeting place, the lecturer's full name and the call-sign to whom prospective members can refer. The last day on which Regional Representatives can accept letters for inclusion is the first of the previous month.

A brief description of the production of " Club News " might be mutually beneficial to secretaries, Regional Representatives and the " Radio Communication " editorial team.

It should work like this. Each Club Secretary compiles a list of coming events in his club. He then submits this to his Regional Representative who prepares all the details from his region in the same form as they are printed in the journal. The list is then checked at headquarters and submitted to the printers.

Unfortunately, this idyllic situation hasn't happened yet! Each month we get the RR's reporting to a standard format, but in addition we have the club secretaries who send their copy straight to Headquarters. This then has to be written into the main report involving a considerable amount of cross-checking.

To help us produce the journal rapidly and accurately, please try to keep to the system. Secretaries, please do *not* send your copy to headquarters. Send it to your RR, and in plenty of time. He may have dozens of clubs to handle. Try to make your information clear and concise. Type it if possible. And if the RR's could keep to our brief, it would make preparation a pleasure. Thank you!

Region 1 News

At the recent ORM in Southport (fully reported in the last issue) the following trophies were presented for the various regional events.

Region 1 Field Day

	Call-sign	Points
Winners—Blackpool & Fylde ARS	G8GG/P	148
Second—Wirral ARS	G3NWR/P	137
Third—Leyland Hundred	G3HKV/P	120
Region 1 VHF Contest		
Winners—Winscale group	G3WIN/P	7493
Second—Wirral ARS	G3NWR/P	4061
Third—Single Operator	G3PUO/P	3058
Band Winners. 4 metres	G3OHH	
2 metres	G3WIN/P	
70 cm	G2CUZ/P	

The Regional Representative's trophy for highest placed Region 1 Station in NFD was won by **Leyland Hundred group.**

The Harold Hilton Rose Bowl for leading Region 1 NFD Station on 160m is shared by **Leyland Hundred and Ainsdale** groups. It has been agreed that each group shall hold the Rose Bowl for six months.

Ainsdale (ARC)—4, 18 December, 1 January, 8 p.m., " Morris Dancers " Scarisbrick.

Allerton (Liverpool) (SRHS)—Thursdays, 8 p.m., 3rd Allerton Scout Group Headquarters, Church Road, Woolton, Liverpool.

Ashton under Lyne (AUL & DARS)—Fridays, 7.30 p.m., 6 Stamford Street, Stalybridge.

Blackburn (ELARC)—5 December, 2 January, 7.30 p.m., YMCA, Limbrick, Blackburn.

Blackpool (B & FARS)—Mondays, 8 p.m., Pontins Holiday Camp, Squires Gate. Morse tuition from 7.30 p.m.

Bury (B & RRS)—10 December is scheduled for the AGM. (On these occasions, the club room is usually a little less well attended. This time it is hoped to see an improvement on past records and in order to try to achieve this aim, the club will be holding a raffle amongst members present. The prize should be well worth coming for, as it has been decided to allot a sum not exceeding £5 towards the raffle), 14 January 1969 (" Nuclear Energy " by J. Shepherd) 8 p.m., George Hotel (private room), Market Street, Bury, Club Secretary *G3VVQ*, 411 Holcombe Road, Greenmount, Bury.

Cheshire (MCARC)—Wednesdays, 7.30 p.m., Technical Activities Centre, Winsford Verdin Grammar School, Winsford, Cheshire, (7.30 p.m. to 8 p.m. Morse Tuition), Secretary *G3SIQ*, 83 Ash Road, Cuddington, Northwich.

Chester (C & DARS)—Tuesdays, 8 p.m., YMCA.

Crewe & District—No Meetings will be held for the time being as no accommodation is available. However, the Area Representative, R. Owen, 10 Circle Avenue, Willaston, Nantwich will welcome visitors at his home.

Eccles (E & DRC)—Tuesdays, 8 p.m., Patricroft Congregational School, Shakespeare Crescent, Patricroft. Every Thursday Club Top Band net 8.30 p.m.

Leyland Hundred (ARG)—The Thursday net will now start at 8 p.m. on 1915 MHz. At the recent AGM G3GGS was elected Contests Manager. Contests entered by the Group include NFD, Region 1 FD, Affiliated Society's Contest, MCC. It is hoped that next year some V.H.F. Contests will be entered by the Group. Building of 2m gear is now in progress so that the Group can have a Monday night net on 2m.

Liverpool (L & DARS)—Tuesdays, 8 p.m. Conservative Association Rooms, Church Road, Wavertree. 3 December (" Servo-Mechanics " by G3PNL), 6 December (Hamfest—Tickets £1 from G3MCN), 10 December (Talk on Audio Films), 17 December (Visit by RSGB Region 1 Representative, G2AMV) 24, 31 December (No Meetings), 26 January, 1969—a Top Band Contest. Rules may be obtained from *G3KOR*. Club Secretary, Philip Storey, 29 Chalfont Road, Liverpool 18.

(NLRC)—6, 20 December, 3 January 8 p.m. Landsbury House, 13 Crosby Road South, Liverpool 22. Secretary, R. Simmons, *G3PNS* 62 Daneville Road, Liverpool, L4 RG.

Macclesfield (M & DRS)—3, 17, 31 December, 14 January, 8 p.m. The George Hotel, Jordangate.

Manchester (M & DARS)—Wednesdays. 7.30 p.m., 203 Droylsden Road, Newton Heath, Manchester. 10. Hon. Secretary, G. Tillson, *G3TJX*, 95 Kelverlow Street, Oldham, Lancs.

(SMRC)—Fridays, 8 p.m., Conservative Association Divisional Office, 449 Palatine Road, Northenden, Manchester 22.

North West V.H.F. Group—reports good news in that a new Headquarters has been obtained at 26 Cannell Street, Manchester 4. Meetings will continue on Tuesdays at 8 p.m. Club Secretary, *G3FNM*, 141 Norris Rd., Sale. Tel. 061-973 1472.

Preston (PARS)—12 December, 9, 23 January, 7.30 p.m. (private room), " Windsor Castle," St. Paul's Square.

St. Helens (SES)—Meetings have been discontinued following poor attendance. It is hoped, however, that interest may revive before long and that Local Members will again have the opportunity to meet each other. Enthusiasts should keep in touch with B. Hardy, 198 Knowsley Road, St. Helens, Lancs.

Southport (SRS)—Wednesdays, 8 p.m., Sundays, 2.30 p.m., The Esplanade. Please note new Secretary, S. Miller, 72 Station Road, Banks, Southport.

(73 S.S.B. Society)—Tuesdays (all commencing with a talk on part of RAE Syllabus), 8 p.m., 73 Avondale Road North, Southport.

Stockport (SRS)—11 December, 8 January, 8 p.m., Royal Oak Hotel, Castle Street, Edgeley; new Members are always welcome. Further details from *G3FYE*.

Warrington-Culcheth (CARC)—Fridays, 7.30 p.m., Chat Moss Hotel, Glazebury. All visitors will be welcome. Secretary, K. Bulgess, 32 Hendon Street, Leigh.

Westmorland—Please note new meeting arrangements. They now take place every Friday at 7.30 p.m., 24 Park Road, Milnthorpe.

Additionally there is an RAE class on Mondays and Thursdays at the same time.

Wirral (WARS)—Former Civil Defence Headquarters, Upton Road, Bidston, Birkenhead. First and third Wednesday of each month at 8 p.m., 4 December (Surplus Gear Sale), 18 December (Film Show). At the Club's AGM in October, the following were elected: Chairman—G2FOS, Hon. Treasurer—G3OKF, Hon. Secretary—G3FOO, Newsletter Editor—G3OKA. The Chairman, who continues in office, thanked the retiring Hon. Treasurer, Archie Keiller, G3KXR, for his many years of devoted service to the Club. He added the Club's gratitude that " devaluation " had not been necessary!

REGION 2

Barnsley (B & DARC)—13 December ("Simple Aerials and Tuning Units " by G. Scattergood), Meetings held seconds and fourth Fridays, 7.30 p.m., King George Hotel, Peel Street, Barnsley.

Bradford (BRS)—3 December (" Emergency Communications " by D. Pratt, G3KEP), 17 December (Quiz Night), 7.30 p.m., Bradford Technical College, Great Horton Road, Bradford. In October an interesting tape/slide evening was given by Keith Wells, on his expedition to the wilds of Scotland; penetrating as far north as Inverness. He met many locals and was accorded a friendly welcome. A visit to the ITA Transmitter at Emley Moor was well worth the journey, a most interesting addition there being the BBC Transmitter putting out colour on " 2." Still with the BBC, we welcomed Geoff Lennard of " Radio Leeds " who put over a very instructive and entertaining talk on " Microphone Techniques." November brought the Annual and always welcome Mullard Film Show and a change from radio, a visit to a " Wool Conditioning House " in Bradford, a look at local industry.

Hull (H & DARS)—7 December (Seeing is believing—Fault finding with a scope), 13 December (" 2m Transverters," by G3OHT), 20 December (Films, Slides and comment by several members), 27 December (No meeting). 7.45 p.m., 592 Hessle Road, Hull.

Northern Heights—11 December (Annual Dinner), 18 December (" Economics of the Shack Layout " by G. Theaby, G8BMI), 7.45 p.m., Sportsman Inn, Ogden, Near Halifax.

Scarborough (SARS)—7.30 p.m., Thursdays, c/o RAF Association Felbeck House, 3 Westover Road, Scarborough.

Spen Valley (SVARS)—5 December (" Aeromodelling as a Hobby " by G. W. Hawksworth, G3JQC), 12 December (Film Show by the Army Information Office), 7.30 p.m., The Grammar School, High Street, Heckmondwike.

South Shields (SS & DARS)—13 December (Talk by G3WOM and G8BQF on their new 2m Transmitters), 8 p.m., Trinity House Community Centre, Laygate, South Shields.

REGION 3

Birmingham (MARS)—17 December (Christmas Party, Equipment Sale, Trophy Presentation), 7.45 p.m., Midland Institute, Margaret St., Birmingham 3. *G3KPT*.

(Solihull)—Meetings will be held on the Third Thursday in each month, Masons Arms, High Street, Solihull. Visitors always welcome. Hon. Sec., *G3VXV*, 173 Damson Lane, Solihull. Tel. 705-3060.

(South)—4 December (Annual Christmas party and Surplus Sale), 8 p.m. St. Stephens Scout Hut, Pershore Road, Stirchley. Birmingham 29).

Bromsgrove (B & DARC)—13 December (Talk and Demonstration on home brew s.s.b. tx) 8 p.m., Co-op Hall.

Coventry (CARS)—6 December (Film Show), 13 December (Night on the Air), 20 December (Christmas Social Evening), 27 December (No Meeting), Scout HQ, 121 St. Nicholas Road, Radford, Coventry.

Dudley (DARC)—3, 17 31 December, 8 p.m., Central Library, St. James Road, Dudley. *G3PWJ*.

East-Worc's (EWARG)—The December meeting will be held as usual at the Old People's Centre, Park Road, Redditch at 8 p.m. and will be a talk by J. R. Tipple about "The Birmingham Post Office Tower," All Amateurs and SWL's most welcome. *G3WJN*.

Hereford (HARS)—6 December 7.30 p.m. (Results of gdo with finished examples demonstrated by Ian Cooper, G3WTK and Bill Wells). *G3HVX*.

Lichfield (LARS)—2, 17 December, 7.30 p.m., Swan Hotel, Lichfield.

Nuneaton (NARS)—12 December 8 p.m., Anchor Inn, Hartshill, Nr. Nuneaton.

Rugby (RADARAEC)—Tuesday and Thursday each week. RAE and Morse practice Wednesday RAEN Group last Tuesday of each month, 10 Drury Lane. *G3IKL*.

Salop (SARS)—5 December (Dx Working, Ben Ford, G2FSR), 12 December (Coffee Evening, Mrs Linney, XYL's and YL's), 7.30 p.m., Old Post Hotel, Milk Street, Shrewsbury. *G3WNI*.

Stourbridge (STARS)—First Tuesday of the month, 7.30 p.m. The Longlands School, Stourbridge.

Stoke (SoTARS)—5 December (G8ASG will give a short talk on his experience of 2 metre converters), 12 December (Homebrew gear competition, judged by G3DML), 19 December (Christmas Party), 7.30 p.m., 2 Racecourse Road, Oakhill, Stoke-on-Trent.

Sutton Coldfield (SCARS)—9 December (" Workshop Practice " by G3KPT), 23 December (Natter and projects evening), HQ SCTFC Clubhouse, Coles Lanes, Sutton Coldfield.

Wolverhampton (WARS)—2 December (Transistors In Transmission by N. Lockley), 9 December (Natternite), 16 December (Discussion on propagation, H.F. and V.H.F.), 8 p.m., Neachells Cottage Stockwell Road, Tettenhall.

Worcester (W & CARC)—Meetings Wednesday and Saturday, 7.45 p.m., 35 Perdiswell Park, Droitwich Road, Worcester. The Date of our 1969 Rally will be 13 July. *G3TQD*.

REGION 4

Chesterfield (C & DARS)—11 December (Annual Dinner and Social Evening), details from *G3VDI*.

Derby (D & DARS)—4 December (Surplus Sale), 8 December (G5YY Trophy Contest), 11 December (Constructors' Contest for Founder Members' Trophy), 15 December (Contest for President's Trophy), 18 December (Annual Christmas Party), 25 December (Club Net at 10.30 a.m.), 7.30 p.m., Club Room No. 4, 119 Green Lane, Derby. The Society has recently been co-operating with the BBC in the making of a Documentary Film on the Pioneers of Radio. *G2CVV*.

Grimsby (GARS)—Thursdays, 8 p.m., North Lincs Photographic Society's Room (back of) 50 Welholme Road, Grismby. *G3RSD*.

Heanor (TSEDRS)—3 December (Bring and Buy Sale), 10 December (Musical Social Evening—Ladies invited), 17 December (Closed) 7.30 p.m., Club Room, South East Derbyshire College of Further Education, Ilkeston Road, Heanor, Derbys. *G3LGK*.

Leicester (LRS)—Mondays, 7.30 p.m., Sundays, 10.30 a.m., The Club Rooms, Gilroes Estate Cottage, Groby Road, Leicester. *G3UQX*.

Lincoln (LSWC)—Tuesdays, 7.30 p.m., No. 2 Guardroom, Sobroan Barracks, Breedon Drive, Lincoln. *G8BSS*.

Mansfield (MARS)—First Friday in each month, 7.45 p.m., New Inn, Westgate, Mansfield. *G8HX*.

Melton Mowbray (MMARS)—13 December (Shack Visit—G3NVK) 7.30 p.m., St. John's Ambulance Hall, Holwell Works, Asfordby Hill. *G3NVK*.

Newark (NSWC)—Mondays, Thursdays, 7.30 p.m., Guildhall, Guildhall Street, Newark. *G3TWV*.

Nottingham (ARCN)—Tuesdays, Thursdays, 7.30 p.m., Room No. 3 Sherwood Community Centre, Woodthorpe House, Mansfield Road, Sherwood, Nottingham. *G3SRX*.

Peterborough (P & DARS)—First Friday in month, Lecture or Demonstration in the Electronics Section at Peterborough Technical College, Eastfield Road, 7.30 p.m. Other Fridays meet at the Club HQ in the Old Windmill, behind The Peacock Inn, London Road, 8 p.m., onwards. *G3KPO*.

Worksop (NNARS)—Tuesdays, Thursdays, 7.30 p.m., Club Room Gateford Road, Worksop, Notts. *G8ON*.

REGION 5

Bedford (B & DARC)—Thursdays, Dolphin Inn, Broadway, Bedford (Morse Classes, 7.30 p.m.).

Bishop's Stortford (BS & DARC)—Meetings on Third Thursday of each month, 16 December (" V.H.F. Working," by Douglas Durrant G3NUI), British Legion Club, Windhill, Bishop's Stortford, Hertfordshire.

Cambridge (C & DARC)—6 December (Transparencies evening), 13 December (Junk Sale for benefit of Club Funds), 20 December (Christmas Fare), 27 December (Club closed), Fridays, 7.30 p.m.. Club Headquarters, Corporation Yard, Victoria Road, Cambridge.

(CUWS)—Tuesdays during Term, 8.15 p.m., Psychology Department Lecture Rooms, Downing Site.

Dunstable (D & DRC)—Alternate Fridays, 7.30 p.m., " Star and Garter ", High Street, South Dunstable, Bedfordshire.

March (M & DRAS)—Tuesdays, 7.30 p.m., Old Police Headquarters High Street, March, Cambs.

Shefford (S & DARC)—5 December (" Making a Communication Receiver " by M. Draycott), 12 December (" Receiver Topics," by G3TDW), 19, 26 December (No Meetings), 2 January 1969 (" Radio for Beginners," by G3VMI) 7.45 p.m., Church Hall, High Street, Shefford, Bedfordshire.

Stevenage (S & DARS)—First and third Tuesdays in each

month, 8 p.m., Hawker-Siddeley Dynamics Ltd., Gunnels Wood Road, Stevenage, Hertfordshire.

REGION 6

Cheltenham (RSGB Group)—First Thursday in each month 8 p.m., Great Western Hotel, Clarence Street, Cheltenham, *G3TVW*.
Chiltern (CARC)—Last Thursday in each month, 8 p.m., British Legion, St. Mary's Street, High Wycombe, Bucks.
Gloucester (GRC)—Second and fourth Thursdays in each month, 7.30 p.m., Lamb Inn, Market Parade, Gloucester.

REGION 7

Acton, Brentford, Chiswick (ABCRC)—17 December, 7.30 p.m., Chiswick Trades and Social Coub, 66 High Road, Chiswick.
Addiscombe (AARC)—Second Tuesday in each month, 7.30 p.m., 158 Lower Addisco mbe Road (Toc H Hall).
Ashford (Mddx.), (Echelford ARS)—16 December (Christmas Natter), 7.30 p.m., St. Martin's Court, Kingston Crescent, Ashford.
Barking (B & DREC)—Every Tuesday and Thursday, 7.30 p.m., Gascoigne Recreation Centre, Gascoigne School, Morley Road, Barking.
Bexleyheath (NKRS)—12 December (" BBC Sound Production" by Trevor Taylor), 7.30 p.m., Congregational Church Hall, Chapel Road, Bexleyheath, 16 December (EGM), 7.30 p.m., " The Yacht," Long Lane, Bexleyheath.
Chingford Group—Fridays, Tel. 01-524 0308 for details.
(SRC)—First Friday in each month, 8 p.m., Friday Hill House, Simmon's Lane, Chingford, E4.
Civil Service Radio Society—19 December (Christmas Party), 6.30 p.m., Civil Service Sports Centre, Monck Street, SW1.
Croydon (SRCC)—17 December (" DX Operating on the L.F. Bands "), 7.30 p.m., Blue Anchor, South End.
Dorking (DR & DRS)—10 December, " Wheatsheaf ", Dorking.
Ealing (E & DARS)—Tuesdays, 7.30 p.m., Northfields Community Centre, Northcroft Road, W13.
East London—15 December (AGM and junk sale), bring plenty of junk and cash, 2.30 p.m., Wanstead House, The Green, E11.
Edgware and Hendon (EADRS)—9 December, 8 p.m., St. Georges School, 51 Flower Lane, Mill Hill, NW7.
Gravesend (GRS)—Third Wednesday, 8 p.m., RAFTA Club, Overcliff Road.
Guildford (G & DRS)—13 December (Natter Night) 8 p.m., 27 December (no meeting). Guildford Engineering Society, Stoke Park.
Hampton Court (TVARTS)—First Wednesday in month, 7.30 p.m., " Cardinal Wolsey," Hampton Court.
Harrow (RSH)—6 December (Practical), 13 December (Junk Sale), 20 December (Christmas Party), 27 December (no meeting), 3 January (AGM), Roxeth Manor School, Eastcote Lane, Harrow, Middx.
Havering (H & DARC)—4, 18 December, 8 p.m., British Legion House, Western Road, Romford.
Hemel Hempstead (HH & DARS)—6, 20 December, 8 p.m., Rucklers Lane Hall, Kings Langley.
Holloway (GRS)—Mondays (RAE) 7 p.m., Wednesdays (Morse) 7.30 p.m., Fridays (Club) 7.30 p.m., Monten School, Hornsey Road.
Kingston (K & DARS)—Second Wednesday in month, 8 p.m., Penguin Lounge, 37 Brighton Road, Surbiton.
Leyton and Walthamstow—Tuesdays, 7.30 p.m., Leyton Senior Institute, Essex Road, E10.
London U.H.F. Group—First Thursday in each month, 5 December (Wine and Cheese Reunion) 7.30 p.m., Whitehall Hotel, Bloomsbury Square, Holborn, WC1.
Loughton—4, 8 December, Loughton Hall (Near Debden Station).
Maidenhead (M & DARC)—17 December, 7.30 p.m., Victoria Hall, Cox Green, Maidenhead.
New Cross (CARS)—6 December, (" Facsimile," by G3SZR and G8BTC), 20 December (Construction Contest and Cup Presentation), 25 December, (Christmas Net on 160 and 2m), 8 p.m., 225 New Cross Road, SE14.
Paddington (P & DARS)—Thursdays, 7.30 p.m., Beauchamp Lodge, 2 Warwick Crescent, W2.
Purley (P & DRS)—First and Third Fridays in each month, 8 p.m., Railwaymen's Hall, Side Entrance, 58 Whytecliff Road, Purley.
Reigate (RATS)—First Wednesday, 4 December (Annual Construction Contest), 7.45 p.m., " George and Dragon," Cromwell Road, Redhill.
Romford (R & DRS)—Tuesdays, 8.15 p.m., RAFTA House, 18 Carlton Road.
Scouts ARS—19 December (Party Night), 7.30 p.m., Baden Powell House, Queensgate, South Kensington, SW7.

Tony Kosking, A5856, receives the G3NJL trophy from G8BON chairman of the Silverthorn Radio Club. The trophy, presented to the winner of a construction competition, is to perpetuate the memory of the late George Clark, G3NJL. Although not a club member, George Clark showed great generosity to the Silverthorn club. The judges, G8BAM and G3VMS, stand in the background.

Sidcup (CVRS)—5 December (" Moonbounce " by G3LTF), 2 January (" Activating Rare Counties " by G3SVK), 8 p.m., Congregational Church Hall, Court Road, Eltham, 19 December (Natter Night), 16 January (Surplus Night), 8 p.m., All Saints Church Hall, Bercta Road, New Eltham.
Slough (SDR Group)—First Wednesday in each month, 7.30 p.m., United Services Club, Wellington Street.
Southgate Radio Club—12 December, 7.30 p.m., Parkwood Girls School. (Behind Wood Green Town Hall).
St. Albans (Verulam ARC)—18 December, 7.30 p.m., Cavalier Hall, Watford Road, St. Albans.
Stevenage (SDARS)—First and Third Thursdays, details from 83 Spring Road, Letchworth, Herts.
Sutton and Cheam (SCRS)—17 December, 8 p.m., The Harrow Inn, High Street, Cheam.
Welwyn (Mid Herts ARS)—12 December (G3UFA conducts annual junk sale), visitors welcome, 8 p.m. Welwyn Civic Centre, Welwyn, Herts.
Wimbledon (W & DRS)—13 December (AGM), 14 December (Christmas Party), 8 p.m., St. John Hall, 124 Kingston Road, South Wimbledon, SW19.
Wembley (GECARS)—Thursdays, 7 p.m. (this club is open to non GEC employees by invitation). Tel. ARN 1262, Sports Club, St. Augustin Avenue, North Wembley.

REGION 8

Crawley (CARC)—Details from *G3FRV*. Trinity Congregational Church, Ifield, Nr. Crawley, Sussex.
Mid-Sussex (MSARC)—Details from *G3RXJ*, Marle Place Further Education Centre, Leylands Road, Burgess Hill.
South Coast (South Coast V.H.F. Group)—Details from *G3JHM*.
Worthing (W & DARC)—Roes Wilmot Youth Centre, Worthing.

REGION 9

Bristol Group—9 December (AGM), 7.30 p.m., Becket Hall, St. Thomas Street Bristol 1, off Victoria Street. During October there has been two gatherings of the group, the first a Social evening presenting a group of interesting films to a large gathering of friends and members. The second a talk by G. Twist, G3LWH on his problems in constructing his Quad, and illustrating with projected slides. The November meeting covered the construction of a three band V.H.F. Transmitter presented by E. Robinson, G3TWT. *G3PFD*.
Bristol ARC—Every Monday and Thursday from 7.30 p.m., at the University Settlement, 41 Ducie Road, Barton Hill, Bristol 5. *G3WLZ*.
Cornwall (CRAC)—5 December (Special Junk Sale in aid of the RAIBC), 2 January (Ladies Night), South Western Electricity Board Social Centre, Pool, Camborne. *G3NKE*.
S.S.B. Group—Second Thursday in each month. *G3OCB*.
V.H.F. Group—Third Thursday in each month, both 7.30 p.m., Barley Sheaf, Truro. *G3XC*.

Exeter (EARS)—First Tuesday in each month, 7.30 p.m., George and Dragon, Blackboy Hill, Exeter. *G3HMY*.
Plymouth (PRC)—First and Third Tuesday in each month, 7.30 p.m., Virginia House, Bretonside, Plymouth. *G3UQF*.
Saltash (S & DRC)—Burraton Toc H. Hall, Warraton Road, Saltash. *G3UBY*.
South Dorset (SDARS)—First Friday in each month, 7.30 p.m., Labour Rooms, West Walk, Dorchester. *G3BKV*.
Taunton (T & DARC)—6 December, Lecture Theatre, Taunton Technical College. The AGM was held in October, G3NNE was elected Chairman, G3WNV the Treasurer, G3WPJ was Secretary, the Club are hoping to have their own HQ, and the RAEN Group for Somerset is actively being formed. *G3WPJ*.
Torquay (TARS)—Every Tuesday and Friday (Club Nights), 14 December, not the usual last Saturday for December (Christmas Social Gala Night), with a Quiz, Torbay competing against visiting Clubs, Exeter and Plymouth. The October meeting was a very interesting talk by Sir Douglas Hall, on Transistorized Reflex Receivers. G3XXS is congratulated on attaining his goal, The RAE classes have recommenced. *G3VNG*.
Wells (WARS)—Mondays, EMIE Social Club, Chamberlain Street, Wells. *G3MQQ*.
Weston Super Mare (W-S-M ARS)—6 December 7.30 p.m., Westhaven School, Ellesmere Road, Uphill, WSM. Cliff Toomer has been nominated as Weston's AR. *G3GNS*.
Yeovil (YARS)—Wednesdays, 11 December (" Tape Lecture " by G2BCX) 7.30 p.m., Park Lodge, The Park, Yeovil. *G3NOF*.

REGION 10

Blackwood (ARC)—Meets at 7.30 p.m. on Fridays (Club call-sign GW6GW), Headquarters off High Street, Blackwood, Mon.
Barry College of Further Education (ARS)—Meets on Thursdays 7 p.m., College, Colcot Road, Barry.
Cardiff (RSGB) Group—Monday, 9 December at 7.30 p.m. Christmas Social, TA Centre, Park Street, Cardiff.
Coleg Prifathrofaol, Abertawe (University Radio Society)—11 December (Social Evening), 7.30 p.m., Lab. Technicians Common Room, West Wing College House, The Society meets alternate Wednesdays at 7.30 p.m. Details from D. West, GW3TYI, c/o Students Union Coleg Prifathrofaol, Parc Singleton, Abertawe, Sir Morgannwg.
Llanelli Boys Grammar School (ARS)—Meets at the School on Fridays at 3.30 p.m. Interested amateurs are invited.
Pontypool (ARC)—Meetings at 7 p.m. on Tuesdays, Educational Settlement, Rockhill Road, Pontypool, Mon.
Pembroke (ARC)—Details of December meeting from GW3LXI, the Headquarters, Defensible Barracks, Pembroke Dock, Pembs.
Rhondda (ARS)—Pengelli Hotel, Treorchy Details from the Secretary, Cyril Parry, 34 Cae'r Gwerlas, Tonyrefail, Glam.
University College, Cardiff (ARS)—This Society is now well established, and is running RAE and Morse classes. Details from the Secretary, Students Union, Dumfries Place, Cardiff.

REGION 11

Llandudno (CVARC)—14 December (Annual Club Dinner) 7.30 p.m., Colwyn Bay Hotel, 19 December (Christmas Junk Sale) 7.30 p.m., Paradise Hotel, Llandudno. Secretary, 61 The Dales, Abergele, Denbighshire.
Rhyl (R & DARC)—Second Tuesday in each month. Rhyl's Silver Band Room, Windsor Street, Rhyl.

REGION 12

Aberdeen ARS—6 December (Junk Sale), 13 December (" Space Flight Communication " by GM3AEL), 20 December (Annual Dinner Dance at Hazlehead Restaurant), 27 December (Ragchew), 7.30 p.m., 6 Blenheim Lane, Aberdeen. *GM3IAA*.
Moray Firth (MFARS)—Further details from GM3IAA.

REGION 13

Border Area—Members in the Scottish Border Area are asked to contact George Shankie, GM3WIG, 8 Ettrick Terrace, Hawick, who has recently formed a Club to cater for amateurs in this area.
Edinburgh (Lothian RS)—12 December (" Hospital Radio Service" by J. McRitchie) 7.30 p.m., YMCA, 14 St Andrew Street, Edinburgh.

REGION 14

Glasgow University (GWRC)—13 December, 7.30 p.m., Engineering, South Building, University of Glasgow.
Greenock (G & DARC)—6, 20 December, 7.30 p.m., Arts Guild, Campbell Street, Greenock.
Lowlands Royal Signal, Group (LRSG)—17 December, 7.30 p.m., 21 Jardine Street, Glasgow.
Mid-Lanark RSGB Group—20 December (Film Show), 7.30 p.m., YMCA, Brandon Street, Motherwell.

REGION 15

Belfast (YMCARC)—Every Wednesday and Saturday, 8 p.m., City YMCA, (3rd floor), 12 Wellington Place, Belfast, BT1 6GE.
Bangor (B & DARC)—First Friday in each month. Silverstream Unionist Hall, Belfast Road, Bangor, Co. Down. Further details from GI3OLJ.

REGION 16

Ipswich Radio Club—Details from *G3UJR*.
Norwich (NARC)—9 December (Informal Meeting), 16 December (Christmas Party), 23 December (no meeting), 30 December (Technical Quiz), 7.30 p.m., Clubroom, Brickmaker's Arms, Spowston Road, Norwich.
Yarmouth (GYRC)—Fridays, 7.30 p.m., 98 South Market Street, Yarmouth.

REGION 17

Farnborough (F & DRS)—Alternate Tuesdays, 7.30 p.m., Railway Enthusiasts Clubrooms, 310 Farnborough Road, Farnborough, Hants.
Swindon (S & DARC)—Alternate Wednesdays, Penhill Jun.
Royal Naval Amateur Radio Society—At the AGM on 5 October it was decided that associate membership of the RNARS should be extended to members of the merchant navy and foreign navies. First foreign members include GM5AHS and ON5OJ. The highly successful code exhibit on the RNARS stand at the show resulted in the issue of over sixty certificates. On-the-Air code sessions are scheduled for 3 December and 7 January on 3520 kHz at 19.00 GMT. Also acknowledged with thanks are publications from **RAIBC** and **RSARS**.

The President and Council of the

RADIO SOCIETY OF GREAT BRITAIN

extend a cordial invitation to

All Members and Friends

to visit the Society's new Headquarters during the weekend of

14 - 15 DECEMBER, 1968

The Headquarters, at 35 Doughty St., London, WC1, will be open from 10 a.m. to 6 p.m. each day. See page 815.

Region 15

Belfast & District Group——18 December " Quiz "

8 p.m., War Memorial Building, Waring Street, Belfast.

Would all members of the Society in Northern Ireland please notify B. G. Hamilton, GI3VYY, 13 Abbeydale Crescent, Belfast 14, giving full name, call or BRS No. and present address.

Belfast & District RSGB Group

Annual Christmas Dinner Dance,

23 December, 1968

7.30 p.m. Woodbourne House Hotel.

Tickets £1 7s. 6d per person

obtainable from B. G. Hamilton, GI3VYY
Dress Formal.

LOOKING AHEAD

6 December—RSGB Annual General Meeting. Royal Society of Arts, John Adam Street (off Strand), London WC2.
14-15 December—"Open Weekend" at the new RSGB Headquarters, GB2HQ will be operational on 160, 80, 4 and 2 metres. Full details on Page 815 in this issue.
10 January—Presidential Installation, Bonnington Hotel, Southampton Row, London WC1.
7 March—RSGB London Lecture Meeting.
27 April—Bellevue Convention, Manchester.

CONTESTS

7-9 December—Town of Porto Amelia Contest.
11-12 January—Affiliated Societies' Contest.
13 January—First 144 MHz (S.S.B.) Contest.†
26 January—Second 144 MHz (C.W.) Contest.
15-16 February—First 1·8 MHz Contest.
16 February—First 70 MHz (Fixed Station) Contest.
22-23 February—YL-OM Contest (Phone) 18.00 Saturday-18.00 Sunday.
1-2 March—Third 144 MHz (Open) Contest.*
8-9 March—BERU Contest.
8-9 March—YL-OM Contest (C.W.) 18.00 Saturday-18.00 Sunday.
30 March—Low Power 3·5 MHz Contest.
12-13 April—Second 70 MHz (Open) Contest.
3-4 May—Fourth 144 MHz (Portable) Contest.
24-25 May—First 432 MHz (Open) Contest.*
24-25 May—First 1296 MHz Contest.*
7-8 June—National Field Day.
22 June—Second 432 MHz (Portable) Contest.
5-6 July—Summer 1·8 MHz Contest.*
5-6 July—Fifth 144 MHz (Open) Contest.
12-13 July—High Power Field Day.
27 July—Third 70 MHz (Portable) Contest.
4 August—Sixth 144 MHz (S.S.B.) Contest.
10 August—Third 432 MHz (Open) Contest.
17 August—Fourth 70 MHz (C.W.) Contest.
6-7 September—V.H.F. National Field Day.*
14 September—3·5 MHz Field Day.
21 September—Seventh 144 MHz (C.W.) Contest.
5 October—Second 1296 MHz (Open) Contest.
11-12 October—28 MHz Telephony Contest.
25-26 October—7 MHz Contest (C.W.).
3 November—Eighth 144 MHz (S.S.B.) Contest.
8-9 November—7 MHz Contest (Phone).
15-16 November—Second 1·8 MHz Contest.
7 December—Fifth 70 MHz (C.W.) Contest.

† Ammended date.

* To coincide with a Region 1 IARU Contest.

MOBILE RALLIES

20 April—North Midlands Mobile Rally, Drayton Manor Park, Near Tamworth, Staffs.
1 June—ARMS Rally.
29 June—Longleat Mobile Rally, Longleat Park, Nr. Warminster, Wiltshire. Organized by the Bristol RSGB Group, assisted by the Bristol ARC.
6 July—South Shields Mobile Rally.
10 August—RSGB National Mobile Rally, Woburn Abbey.
17 August—Derby and District Mobile Rally.
24 August—Torbay ARS Mobile Rally.

MEMBERS' ADS

Owing to the increasing number of members advertisements submitted for publication we regret that some form of limitation has to be brought into effect. As from the January edition four pages will be scheduled for members ads. Advertisements will be processed in strict rotation and any which do not appear will not be held over and should therefore be re-submitted. Members wishing to guarantee inclusion can do so by sending copy to our classified ads office, c/o Sawell and Sons Ltd., enclosing, of course, the appropriate remittance. (See page 861).

CLOSING DATE FOR JANUARY—4 DECEMBER FORM ON PAGE 861

FOR SALE

Super Sky Rider SX28, gd wkg cnd, manual, offers, prefer collect but can deliver locally. J. A. Ward, G4JJ, 44 Northgate, Barnsley, Yorks.

RSGB Amateur Radio Handbook, 3rd ed., mint cnd, 25s. pp. W. G. Hopkinson, 6 Avondale Mount, Shipley, Yorks.

Cossor 339 scope, 343 wobbulator, £10 pair. CR-100 £5. BC221 £5. 160m Tx £2. RC bridge 30s. Scope unit £2. P.s.u.'s 15s. and £1. 4X150A 10s. Collect. S.a.e. further details. W. E. Thompson, G3MQT, " Y Grisiau," 8 Coventry Rd, St Leonards-on-Sea, Sussex. Hastings 3681.

SB300, SB400, H010 Scope £245 complete. Marconi U.H.F. sig gen TF517F/1 £15. Philips 4 tk stereo tpe rcdr EL3536, cost £100, sell at £48, consider sensible offers on everything. G3NMR, M. Margolis, 95 Collinwood Gdns, Clayhall, Ilford, Essex. Tel. 01-550 0882.

Eddystone 680X mint cnd, no mods, unmarked, would exch for 77OR, Offers. W. Hodkinson, 29 Wellhouse St, Barnoldswick, nr Colne, Lancs.

Eddystone S640, 1·8–31 MHz, £18. B. H. Turner, G3RLE, 241 Whitechapel Rd, Scholes, Cleckheaton, Yorks. Cleckheaton 2769.

Lafayette HA63 rx, 0·5–31 MHz, v.g.c., perfect wkg order, 3 yrs old, £10 o.n.o. AVO Multiminor, v.g.c. but plastic carry-case a bit battered, £5 o.n.o. P. Davidson, 19 Forest Rd, Sutton, Surrey. Tel. 01-641 2784 (after 6 p.m.).

AVO multimeter, 97 ranges, exc order, cost £165, sell at £12 10s. Sangamo Weston reference standard d.c. voltmeter. 0–400 V, 400·000 o.p.v., 6 ins mirror scale, new, terrific bargain at £7 10s. S.a.e. details, carriage extra. A. G. Thorburn, G3WBT, 27 Banklands, Workington, Cumb.

KW160 Mk II £20. Mohican Mk II rx £20. Appearance in and out as new, offers considered. E. W. Taylor, G3FK, 4 Brownsea Ave., Corfe Mullen, Dorset. Broadstone 2631.

Marconi AD108 rx xtal. filter £7. Two B44 Mk 3 tx/rx, one modified 4m, £7 and £5. Geloso 2m v.f.o. £5. R1155A modified 160m £5. Pair Pye PTC122 walkie-phones, manual available, £5 pair. P. Daragh, G3MNV, 44 Jervis Cres, Streetly, Sutton Coldfield, Warks. Tel. 021-353 3012.

Star SR600 £50. Trio 9R59DE £27 10s. (both as new). New AR88D manual 15s. 3 ohm phones (not ex W.D.) 15s. 240/220 V h.d. trnsfrmr 10s. *RSGB* and *SWM journals* 1962 on 1s. each. Wanted AR85162. G. E. Westwood, 114 Pettits Lane, Romford RM1 4EJ, Essex. Tel. Romford 47577.

Cheap equipment needed to start school radio soc, e.g. R1155 rx, please contact, R. C. Wainwright, 65 Wraysbury Rd, Staines, Mddx. Tel. Staines 53765.

Alternator system, 45 A, 12 V, Lucas 11AC, Transistor regulator warning light, control relay, universal mounting bracket, full instructions and circuitry. Bargain £12 carriage extra. R. Toby, G2CDN, 13 Wood Lane, Isleworth, Mddx.

Mosley Commando s.s.b. tx, 180 W p.e.p. 80–10m, Linear 3 TT21 300 W p.e.p. output, both in one cabinet £90. AR88LF rack mounting. Few mods inc prod det £15. DAF rx £20 or exch. g.c. rx e.g. HRO, S640 etc. Johnson, 3 Folly Gdns, Wymondham, Norfolk.

Drake R4A rx with MS4 spkr. (as new) additional xtals. covering 160m and all of 10m. Cost over £200, sell at £140. D. Evans, G3OUF, 80 Argyle Rd, London, W13. Tel. 01-997 7210.

A.f. amp 35 W, 807s, 3–15 ohm output, steel case £5. Mullard mixer 4 channel, high and low imp mic inputs, p.s.u. £5. Two Fane bass 25 W spkrs, 12 in as new, tatty cabinets 45s. each. Prefer insp and collect. J. B. King, G5TA, 9 Hemsby Rd., Chessington, Surrey.

Heathkit Q mult as new, 1·6 MHz i.f. £6 o.n.o. N. H. Hyde, G3PJM, 91 Pelsall Lane, Rushall, Walsall, Staffs. Walsall 21014.

Grundig TK5 tpe rcdr £10. Ilford Sportsman Auto RF 35mm colour camera. Blt-in light meter, coupled rangefinder, ever ready case. Cost £35, sell at £12. J. Margolis, 95 Collinwood Gdns, Clayhall, Ilford, Essex. Tel. 01-550 0882.

CSE 2A10 160m tx with MM2 mic exc cnd £30 o.n.o. G. F. Ward, G3TUQ, 19 Portland Rd, East Grinstead, Sussex. East Grinstead 24594.

Heathkit DX100U brand new. Trio 9R59 rx. Hetrodyne wavemeter Class D for a.c. Heathkit reflectometer. Joystick antenna. Preamp for rx all as new, failed RAE! £70 the lot, buyer arranges carriage. S. Keene, The Vicarage, Colgate, Horsham, Sussex.

Decca stereo pickup FFSS Mk 2 arm and head £3. Japanese junior student microscope, ideal for biology g.c.e. four lens nosepiece, two eyepieces, magnification ×1200 max, boxed £10. Two portable lightweight geiger-counters, offers? R. J. Hey, G3TDZ, 8 Armley Grange Cres, Leeds 12, LS12 3QL. Tel. Pudsey 5478 (day only).

Transformer RCA 2000/2000 400 ma as new £3 10s. UM4 modulation transformer £3. 2 Electro-Voice mics T50/PTT 15s. ea. Calrad mic dual impedance £3. Zenith variac 230 V 8 A £5 10s. Carriage extra. L. H. Lee, 17 Knottsall Lane, Warley, Birmingham. Tel. 021-552 1338.

Panda PR120 £20. Buyer please collect. E. T. Ward, G3JWC, 21 Rangemore St, Burton on Trent, Staffs.

National NCX5 Mk 2 with NCXA p.s.u. in mint cnd £200 o.n.o. J. G. H. Pearce, G3IGP, 73 Deerswood Ave, Hatfield, Herts. Tel. Hatfield 65098.

Mint Codar CR70A £15 or exch for AT5 tx. G3RAD, 1 Approach Rd, Broadstairs, Kent.

W1191A wavemeter, unmodified, complete with correct calibration book but less 1 MHz xtal. £2. KW160 tx £17 10s. Minimitter MR44/11 £30. All prices include carriage. Samson ETM-2 Electronic Keyer wanted. M. Evans, GW3UCJ, 4 Gower Cres, Baglan, Port Talbot, Glam.

Eddystone 680X g.c. rx 0·5–32 MHz var selec, b.f.o., xtal filter, phasing cont, offers around £65. Transistor rx covering v.h.f. aircraft band and/or 2m 108–136 MHz. I. W. Gower, BRS27372, 10 Homethorpe, Orchard Park Estate, Kingston-Upon-Hull, Yorks.

MEMBERS' ADS members' ads MEMBERS' ADS members' ads MEMBERS' ADS

C.W. man's dream, new Collins 455 kHz filter, 500 Hz swap, 3 kHz ditto. Sell £10. Spider type Quad 10-15-20 glass skin bamboo. £5 plus 10s. pp. or collect. H. Bird, G3OUQ, 344 Coventry Rd, Hinckley, Leics. Tel. Hinckley 3390.

Codar AT5 with mains p.s.u. £18. Codar PR30X £5. Eddystone EC10 £38. Shorrock Mk 5 aircraft band incl. l.w., m.w. £20. LM14 frequency meter with p.s.u., £25. A. M. H. Wyse, G3IWE, 36 Wilmslow Cres, Thelwall, Warrington, Lancs. Tel. Warrington 64178.

DX100U £40 o.n.o. H. Powell, G3RAQ, 12 Christchurch Ave, London NW6. Tel. 01-836 1207, ex 1457 (Office hours).

Hallicrafter HT37 tx, c.w., a.m., s.s.b., 80–10m. HT40 tx 50 W, c.w., a.m. Both as new with manuals. R. Ward, G2BSW, "Alauna," Venlake Close, Uplyme, Lyme Regis, Dorset. Axminster 3163 day.

Lafayette HA500. 6 mnths. old. £30. Buyer collects. M. Kaye, 98 Limetree Ave, Goole, Yorks.

AR88D, spkr, manual, exc cnd, will deliver 40 miles. LG300 r.f. unit, v.g.c, spare 813 £18. Buyer collects. W. F. Cooper, G4GN, The Naight House, Minsterworth, Gloucester. Tel. Minsterworth 339.

Star SR550 rx, mint cnd, sell or exch Eddystone EC10. Brown, G3NQX, 21 Princess Street, Leyland, Lancs. Leyland 23331.

Eddystone 680X rx in v.g.c. £60 o.n.o. L. Emmett, G3VKO, Box Tree Cottage, Whiteleaf, Princes Risborough, Bucks.

Tiger 150, 160–10m (68 counties 160m), £45. Lafayette HE80 0·55–30 MHz, 142–148 MHz, £40 or complete station £75. Will deliver 50 miles. J. W. Nixon, G3CLP, 49 Meersbrook Road, Sheffield S8 9HU, Yorks. Tel. Sheffield 50597.

Trio 9R59DE bandspread rx, v.g.c. £27/10/-. Hamgear PM1 self-powered preselector/a.t.u. £5. Codar RQ10X Q mult £5 or £40 complete. Pos delivery London area. Various WW, PW, PE, RC, free to club or beginner. D. J. Turney, 9 Hengist Way, Bromley, Kent. BR2 ONS. Tel. 01-460 6326 (after 7 p.m.).

Heathkit SB10U gd cnd £20. 3 Japanese car radios, need attention £10. Dural masts, 3 ten ft × 1½ in, new £6. Five 6 ft × 1 in, £2 10s. All pp. RF1U wanted. O. Kennedy, G3OCS, 77 Seaview Road, Brightlingsea, Essex.

Operation and maintenance inst book for BC224B and BC348B 30/-. 2 HRO 21 MHz b.s. coilpacks 45s. ea. Woden DT1 unused 30s. All these pp. Tested 807s 3s. ea. M. J. Darkin, G3KTH, 4 Ash Drive, Catshill, Bromsgrove, Worcs. Tel. Bromsgrove 5554.

Versatile TR GDX/20C transistor rx 0·5–30 MHz, b.f.o. with 9v battery. Bargain £5 plus post. Twomobile or similar rx wanted. M. J. Cooke, 76 Falcon Road, West Sprowston, Norwich, Norfolk, NOR 73R.

TW160 Topmobile with mains spkr p.s.u., two years old, gd cnd, cost £73, sell at £48. Also W1191A wavemeter with charts £6. Prefer buyer insp and collect. Going v.h.f. J. L. Green, G3PYF, 68 Magdalene Lane, Wingfield, Trowbridge, Wilts.

Rx type 52 with case and p.s.u. type ZE12 mint cond, £7 10s. P.s.u. for T1154, R1155 mains operated £5 (pair). Tx 1154N £3, 1154H £2 15s., Rx R9APN4 £1 2s. 6d. Carriage extra. A. F. Stagles, G3RBY, 2 Blackthorn Close, St Albans, Herts. Tel. 56-54009.

DX4OU, VF1U, exc, cnd, £25 o.n.o. B2 "spy" tx/rx, fair, £8 o.n.o. N. P. Brown, 8 Villa Grove, Bingley, Yorks. Tel. Bingley 3679. AR88D and PR120V £55 pair o.n.o., fb cnd, going QRT. J. R. Platt, 78 Cunningham Drive, Bury, Lancs. Tel. Whitefield 3981.

Lorenz EO/10175 80/1500 kHz. Minor parts missing, tuning pack complete, huge dial, exc cabinet £3 pp. Straight exch prof blt fb RG1 for RA1 in similar cnd. S. Howson, 28 Middletons Lane, Norwich, Nor 33 M. Norwich 49485 evenings.

Unmodified Eddystone 888A complete with matching Eddystone s-meter, spkr and mounting blocks £65. Also panoramic adaptor model RCX, input 450–475 kHz sweep pos or neg 100kHz, internal p.s.u., handbook £20. Prefer insp collect. R. S. Hodgson, G3TBT, 18 Clayhill, Lyndhurst, Hants. Tel. Lyndhurst 2127.

KT320 rx, gd cnd, semicond p.s.u., recently aligned, exch gd cnd Trio 9R59DE with cash adj. J. W Shelley, Decca Navigation Transmitting Station, Denhall Lane, Neston, Cheshire. Tel. 051–336 1974.

Cabinet, double sided, 7 ft high, 2 ft wide, 30 in deep, for 19 in rack mounting. Doors back and front, as adv in *WW* by Harris of Organford. Purchased in error £25 o.n.o. or exch BC221. Buyer collects. Luxton, 8 Twyford Crescent, W. Acton, London W3. Tel. 01-992 4708.

Heathkit linear model HA14 with Heathkit p.s.u. £50 no offers. N. E. Hall, G3DRF, 8 Radnor Park, Corston, Malmesbury, Wilts.

LG300 tx with companion p.s.u./mod, mic, connectors etc, gd cnd and wkg order £75 o.n.o. complete, delivered anywhere in UK. C. Malcolm, GM3BXW, 26 St Clair Avenue, Giffnock, Glasgow. Tel. 041-638 3924.

Panda Cub £22 10s. G3GFN 20w mod complete with p.a. current meter. Spare power available, 6·3 V, 1·2 A, 250 V, 50 mA, £5. C. A. Collins, 32 Albany Road, Skegness, Lincs.

Eddystone 680 rx £39. Eddystone prof rx 730/1A similar 680X but cost £220 when current, v.g.c. £70 o.n.o. Part exch. welcome. Delivery 100 miles. M. R. G. Snowden, Swainsea Lane, Pickering, Yorks.

BRT400E exc cnd deliver 50 miles £45. Webb, G6XY, 22 Southbank Road, Kenilworth, Warks. Tel. Kenilworth 52679.

TF144G sig gen £16 16s. TF517 £9 10s. 500 W isolating transformer £7 10s. 4X150A 16s. 6d. Pye car radio five wavebands £9 19s. 6d. Beam Echo stereo preamp STEP21 £3 19s. 6d. Philco s.w. converter mobile £2 10s. o.n.o. All plus carriage please. D. Byrne, G3KPO, Jersey House, Eye, Peterborough. Tel. Eye 351.

Exch various complete of *QST* and *SWM* (bound) before 1965 for recent American callbook (DX or US listings). G3KAA, 43 Nappsbury Road, Luton, Beds.

RCA 2000 V 500 mA transformer £4. GXU1 rects as used in KW500 10s. ea. Valveholders for GXU1 4s. ea. 2m s.s.b. transverter, 28–30 MHz i/p, QQV06–40A p.a. £10. S.a.e. for components. T. J. Griffiths, G3NPZ, 7 Somaford Grove, East Barnet, Herts.

Transistorized elec keyer (G3IAS design) 6 in × 4 in × 3½ in, microswitch paddle, uses four internal PP9 batteries, sealed, quiet, double pole, c/o relay £5. Prefer collect, otherwise pp extra. J. D. Speake, G3URX, 10 Mill Close, Tiptree, nr Colchester, Essex. Tel. Tiptree 6533.

888A recently overhauled with matching feet and spkr, Lafayette 59er S meter £70. CTS2 tx £12. Reslo ribbon mic £3. H. G. Peers, G3BEZ, 3 Monks Brook Close, Eastleigh, Hants. Tel. Eastleigh 2467.

Codar AT5, 12MS d.c. p.s.u., 12RC control £20. FIF whip 25s. 160, 80, 20m coils 35s. each. Offers for BCC69 D transceiver, less valves. Thurlow, G3WBN, 19 Gravel Hill, Croydon, Surrey. Tel. 654-2761.

Codar AT5 and a.c. p.s.u. A1 cnd £18. Carriage included. RSGB manual (old type) also available. Sanderson, G3UQZ, 175 Johnson Road, Erdington, Birmingham 23. Tel. 021-373 8806.

SB101 with 400 Hz filter, HP23E power supply, SB600 speaker, v.g.c. Recently checked. Aligned and tested by Heathkit, £205. Delivered free within 70 miles. A. T. Eley, G3GHB, 14 Warmington Road, Hollywood, Birmingham. Tel. Wythall 2036.

Emigrating. Sommerkamp FL200B, unmarked £115. G2DAF rx, Mk II £50. R.t.t.y. setup complete comprising teletype 15P/P, 14TD, DL6EQ TU, filters, p.s.u.'s £35 or separate. Creed 7B £7. CR100 £15. Many other items. Offers. Copson, 51 Ellers Drive Doncaster. Tel. Doncaster 55357.

HRO-MX, rewired, resprayed, realigned, stabilized p.s.u. £22 o.n.o. Green 2m converter 28–30 MHz i.f. £7. 4X150 with base, new, £5. Sinclair Z12 amp. 37s. 6d. Jason Mercury 2 tuner £3. Field strength meter, transistor, £1. M. A. Pawley, G8AWV, 52 Sumatra Road, West Hampstead, London NW6.

12 bound volumes *Wireless World*, red and gold. 1945–1956, W.h.y.? N. I. Briggs, G3WGL, 127 Newshaw Lane, Hadfield, via Hyde, Cheshire SK148AT.

Pye Ranger low band C29 set. CR150/4 xtal filters (2), offers or exch 70cm converter or w.h.y., Circuit diagram PTC 290 wanted. B. Dodds, 1 Croft View, Killingworth, Newcastle-upon-Tyne, NE12 OBT.

MEMBERS' ADS members' ads MEMBERS' ADS members' ads MEMBERS' ADS

Complete Heathkit station DX4OU with v.f.o., RA1 rx, xtal mike, mint cnd, £60. TGF144 sig gen Ok but faulty attenuator £3. Myford ML7 lathe, motorized, fully equipped, lovely condition £45. Buyer collects. J. Pye, G3KFZ, 41 Walbeck Road, Norwich, Nor 90 E. Norwich 53268.

R.f. linear amplifier AM-33/ART. 500 W final two 4E27. All complete with blower £10. J. Farlow, G3BXI, 49 Mount Pleasant Road, Chigwell, Essex. Tel. 01-500 4546.

Lafayette communication rx HE40, slight attention needed £10. Command tx, modified 1·8–2 MHz, all coils and xtal etc. £1. K. Fisher, G3WSN, "Repton", Plot 79, Longmead Avenue, Gt Baddow, Chelmsford, Essex.

R1933A rx a.m./f.m. 66–77 MHz, 21 valves. 2 r.f., 5 i.f. stages, new, unused, complete with pluggery and circuit, £4 10s. D. Spooner, 39 Brambley Crescent, Folkestone, Kent. Tel. Folkestone 76523.

BC221T original book, spares £15. Mosely TA31 £9. Advance sig gen 9–300 MHz £8. Calibration unit CT155 £5, exch any for AR22 or similar rotator. KW E-Z match. H. G. Newland, G5ND, 161 Penrose Avenue, Marton, Blackpool, Lancs.

Valves boxed new. CV1926 (6G6) 1s. 6d. ea CV529 (12AH7GT) 3s. ea, pp paid. L. Cowen, 69 Oakwood Crescent, Winchmore Hill London, N21.

HRO Senior. 5 g.c. coils, 900 kHz to 30 MHz, p.s.u., new cnd, super performance. £15 o.n.o. Buyer collects, any trial. R. Field, G3IPM, 1 Haines Street, Battersea Park Road, London SW8.

Electronic Organ enthusiasts. Brand new Texas transistors, p.n.p., germanium type 2G382, exc output stages, amplifiers, dividers, –30V, 500mA, beta 90, Ft 5 MHz, 9d. each, £3 per 100. Full data, send s.a.e., D. T. Wilson, G8APS, 177 Dower Road, Four Oaks, Sutton Coldfield, Warks. Tel. FOU 3044.

Heathkit Mohican, hardly used, as new, checked by Daystrom this summer. Any reasonable offer or w.h.y., may be able to deliver. D. W. Martin, G3XSF, 32 Clifton Road, Halifax, Yorks. Tel. OHA-2 60438.

Labgear Quad spider kit, new, all wire, hardware, U bolts, nylon, less bamboo, £7. Spider only, used but ok £2 10s. 3 G3HZP baluns 7s. 6d. ea. Four 6HF5 30s. ea. Unused bases 2s. S. J. Taylor, G30FN, Chy-Yn-Gwel, Woodbine Lane, Illogan, Redruth, Cornwall.

Eddystone 888 with matching speaker, S-meter mint cnd, recently revalved, no mods £65. Table top tx 50W a.m./c.w., modulator AB1, internal p.s.u.'s, v.g.c. 80–10m £25. or together £80 with spare valves. R. A. Ridleigh, G3UTX, 39 Lonsdale Avenue, Weston-super-Mare, Somerset.

Zone 7 xtal. Little used, B7G vacuum mounted QCC 24·220 MHz 3rd overtone xtal. giving 145·320 MHz final freq £1 1s. including postage. A. G. Blackmore, G3FKO, 199 The Holloway, Droitwich, Worcs.

70cm transistor converter and preamps. Phone/video tx, 8/8 and parabeam. Also amateur bands rx 10–160m and 12 ft glass fibre sailing dinghy, hull and deck, needs fitting out. G. R. Addis, G3TEB, 13 Keats Close, Woodley, Reading.

Eagle RF40 field strength meter 17s. 6d. R. North, G3WAR, "Pyrmont", Dukes Wood, Crowthorne, Berks.

SB300E plus c.w. filter, prof wired £110. DX100U factory wired and SB10U £60. E. Neal, G8GP, 34 Manor Avenue, Brockley, London, SE4.

B2 tx/rx/p.s.u. complete station 80–40–20m. Original f.b. cnd. Also Japanese quality camera. Exchange both for rx or w.h.y. D. V. Walters, G3MXO, 14 Woodend Road, Erdington, Birmingham 24. Tel. 021-373 0225.

Trio 5R59DE with additional voltage regulator, cathode follower, xtal cal Mint inst manual £25 (listed £39 15s.). R. Brand, G2ANB, 78 Broadwalk, Hockley, Essex. Tel. Hockley 3278.

Minimitter Mercury tx, a.m., f.m., c.w., no t.v.i. 150 W £30. Rose, 84 Cock Lane, High Wycombe, Bucks.

Pair unused 805s for lin amp or mod £1. Magnetic compass type 11 as new in box £5 or would exch for handheld prismatic model. Direction indicator with 360° pot £1. L. M. Airey, G3GEJ, 14 Brandles Road, Letchworth, Herts. Tel, Letchworth 5896.

2 metre power pack. Transmitting bench, cupboard under, 5 ft steel racking. 4 ft steel unit. 4 Thordason transformers. "Viewmaster" 12 in tv. Buyer collects. Mrs Yates, 63 Birley Road, N20. Tel. Hillside 6994.

Simpson U.S.A. multirange test meter v.o.m., a.c./d.c. 5000V, 5K per volt with leads £3 10s. AVO Minor test meter in leatherette case and leads £4 10s. Post extra. R. A. Butterworth, G8BI, 20 Ravenfield Road, Welwyn Garden City, Herts. Tel. W9 23676 (after 6 p.m.).

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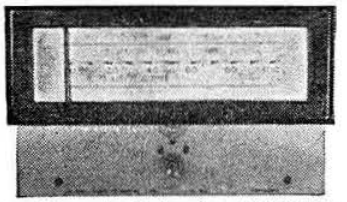

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Abbreviations: *MOTA* Month on the Air; *TT* Technical Topics; *FMD* Four Metres and Down; *HQ* Headquarters News

V.H.F.-U.H.F. Transmitting

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