40p

The SHORT WAVE Magazine

VOL. XXXVII MAY 1979 NUMBER 3

ICOM

THE 'REMOTABLE' 2m RIG

IC-280

£245
inc VAT

25kHz SPACING OVER THE WHOLE BAND: 3 MEMORIES: LED READOUT: BUT MOST IMPORTANT—ICOM QUALITY

Icom's new 2 meter mobile has a detachable micro-processor controlled head, easy to read LED's and a new style meter set in a brushed aluminium front panel.

The 280E comes as one radio which can be mounted in the normal manner but as an option the entire front one third of the radio detached and can be mounted in that small location in the car (such as the glove pocket) where other sets are just too large to fit, while the main body tucks neatly out of sight several feet away—such as under the passenger's seat. No longer do you have to mount a radio in a position where it is poised all ready to smash your right kneecap should you have an accident !

With the microprocessor head the IC-280E can store three frequencies of your choice, which are selected by a four position front panel switch. These frequencies are retained in the 280E's memory for as long as power is applied to the radio. Even when power is turned off at the front panel switch the programmed memories are maintained ; and the 600 kHz repeater shift is always retained.

It goes without saying that the usual high quality engineering for which Icom are renowned is found in the 280E. There are no nasty shortcuts to try to keep the price down to the detriment of performance.

It includes the latest innovations in large signal handling FET front ends for excellent intermodulation performance and good sensitivity at the same time. The IF filters are crystal monolithics in the first IF and ceramic in the second, providing narrow band capacity for today and tomorrow's crowded operating condition. Modular PA construction with broad band tuning provides full rated power across the full 2 metre band.

FROM **THANET ELECTRONICS** OF COURSE

THANET ELECTRONICS

PRICE LIST . MAY 1979

All prices include VAT—Where there is a delivery charge it is shown in brackets

ICom Transceivers

IC–M25. 25w. Marine	£350·00	
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IC–240. 10w. mobile	£189·00	
IC–280E	£245·00	
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RM3	£99·00	
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IC–202S	£199·00	
IC–402	£288·00	

Accessories

IC–30L 10w. Linear 70cm.	£59·00	
IC–3PE PSU	£59·00	
Crystals—pair	£5·00	(10p)
Set of Nicads for 215	£22·00	(£1·00)
IC–SM2 Desk mic.	£26·00	
Mains charger for nicads	£12·00	(50p)
Heavy duty case	£7·50	(50p)
ICHP1 Headphones	£24·00	
HM3 Hand mic	£12·00	
Remote cable 280	£17·00	
FA1 Flex Antenna	£6·00	
240 Channelizer	£36·00	

Antennas

J Beam

C5/2M	£34·88	(£2·00)
5Y/2M	£8·66	(£1·25)
8Y/2M	£11·25	(£1·25)
8XY/2M	£22·50	(£1·75)
10XY/2M	£29·81	(£2·00)
PMH/2C	£5·85	(£1·00)
Q4/2M	£18·68	(£1·50)
Q6/2M	£24·75	(£2·00)
PMH2/2M	£7·71	(£1·00)
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MBM48/70cm.	£24·53	(£2·00)
12XY/70cm.	£33·53	(£2·00)
TAS 5/8	£12·50	(£1·50)

A.S.P.

ASP 201	£2·90	(£1·00)
ASP 629	£10·00	(£1·50)
ASP 667	£19·00	(£1·00)
ASP 2009	£9·00	(£1·50)
ASP 677	£15·00	(£1·50)
Magnetic bases	£8·50	(£1·00)

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DAIWA FM Marine	£59·00	(66p)
CUNA 2M	£59·00	(66p)
SN-10 Marine or amateur with nicads	£54·00	(66p)

Yaesu Musen

FRG7	£210·00	
FRG7D	£270·00	
FT101E	£579·00	
FT227R	£239·60	

Yaesu Musen (*continued*)

CPU–2500R	£328·30	
FT901DM	£960·00	
FT7	£299·00	
FT202R	£99·00	
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FDK

Multi 700E	£229·00	
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MMC144/2–4, 4–6, 28–30	£20·25	
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MMC28/144 (Ten on your rig!)	£20·25	
MMC432/144 or 28 converter	£27·00	
MMC1296/144 or 28 converter	£31·50	
MMD050/500	£69·00	
MML144/100 100w. Linear 2M	£139·50	
MML432/100 100w. Linear 70cm.	£247·50	
MMA28 10M preamp	£14·63	

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BK 100 semi automatic bug key	£19·90	(25p)
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KR400 1/4 Ton heavy duty	£96·00	(£1·00)
RZ100 Alignment bearing	£11·25	(25p)

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AR240	£195·00	

Scanning Monitor Receivers

SM–10 with nicads	£54·00	(66p)
External DC adaptor	£9·00	(15p)
Crystals	£1·90	(10p)

(*Please state amateur or marine*)

Microphones

TW32 Desk mic.	£25·00	(50p)
DH18 Hand mic.	£4·99	(25p)
CH229 Hand Mic.	£15·00	(25p)
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Buy it with Access

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Plus ex-stock delivery of the fabulous new FT-101Z and FT-101ZD, the latest HF band transceivers from Yaesu Musen.

Never before has the radio amateur been offered such sophisticated equipment at such realistic prices—just study the condensed specification below and you'll find features and versatility only available on much more expensive rigs—call, phone or write (please see facing page) for full details.

FT-101ZD SERIES HIGH PERFORMANCE TRANSCEIVER

FULL COVERAGE
Full band coverage is provided on the FT-101ZD: 160 through 10 metres, plus WWV/JJY reception on 5 MHz. Teamed with the FTV901R transverter, operation can be extended to 50, 144, and 430 MHz from your desk top.

CLEAN OUTPUT SIGNAL
With today's crowded bands, we all have the responsibility to keep our transmitted signal free of spurious radiation. YAESU engineers have included RF negative feedback, for a clean output signal.

STATE OF THE ART NOISE BLANKER
The all-new noise blanker is extraordinarily helpful in reducing the level of impulse noise. The blanking level may be adjusted from the front panel.

RF SPEECH PROCESSOR
A high-performance RF speech processor is built into every FT-101ZD, providing an increase in your average talk power of approximately 6 dB. The processor level can be adjusted from the front panel, for optimum signal enhancement.

WORLD-WIDE POWER CAPABILITY
The FT-101ZD has provision for operation from a variety of AC voltages, from 100 to 234 volts. When you're travelling, you'll never need a heavy, bulky transformer for operation with your FT-101ZD. A DC-DC converter is an available option, for mobile operation. The FT-101ZD is small enough to qualify as carry-on baggage on most airlines, and is equipped with a strong, side mounted handle for ease of carrying.

VARIABLE IF BANDWIDTH
Using two 8-pole crystal filters with superior shape factors, the FT-101ZD variable bandwidth system is a valuable tool on today's crowded bands. With the turn of a dial, high-pitched SSB "buckshot," or unwanted CW signals, can be eliminated from the IF passband.
Compare for yourself: other systems, such as "IF shift," use a single filter in the IF; though you can move away from one interfering signal, you may move into more QRM. The YAESU design actually varies the bandwidth, *eliminating* the QRM.
Other manufacturers would have you spend hundreds of pounds on different filters for 2·1 kHz, 1·8 kHz, 1·5 kHz, 800 Hz, 500 Hz, etc. With the FT-101ZD, you have continuously variable bandwidth—from 2·4 kHz down to 300 Hz.

DIGITAL PLUS ANALOG READOUT
The FT-101ZD features digital plus analog frequency readout. The display features big, bright LED digits, for maximum readability. For extra savings, the economy model FT-101Z gives you the same precision analog display, at a significantly reduced cost. You can add the digital display later, if you wish.

INTERFACE WITH 901 SERIES COMPONENTS
Your FT-101ZD may be used with all of the exciting FT-901DM series accessories. The FV-901DM synthesised, scanning VFO provides storage and recall of up to 40 frequencies, in addition to its 3-speed scanner and auto scan function. SAE for full information on available accessories.

HOW TO REACH US (EASY PRIVATE PARKING ON OUR 70ft. FORECOURT)

FROM SOUTH AND EAST. We are located approximately two miles from Junction 5 of the M6 from which follow signposts to Birmingham. Within ½ mile turn right at Clock Garage and proceed towards city. After one mile look for traffic lights at Fox & Goose and immediately over the lights take minor left fork into Alum Rock Road. We are located one mile from this point.

FROM NORTH. Leave M6 at Junction 6 (Spaghetti) and follow left fork down to traffic island beneath motorway complex. Take third turning off to Lichfield. One mile further on follow A 4040 to the right and within 100 yds. veer again to the right, approximately one mile further on brings you to the Fox & Goose. Turn right and see preceding directions.

FROM THE WEST AND SOUTH/WEST. Follow M5 then M6 to Spaghetti Junction (see above). Alternatively, leave M5 at junction 4 or 3 and proceed to inner ring road. Turn South on ring road and leave on A47 (East). We are located three miles from this point.

Hours: 9.30-5.30 Continuous including Saturdays—Early closing Wednesday, 1 p.m.

Access or attractive H.P. terms readily available for on-the-spot transactions. Full demonstration facilities. Free Securicor delivery.

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G3MCN

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All bands 160-10m Amateur Band plus Broadcast Bands. All modes AM-CW-USB-LSB-RTTY. Digital readout; fully variable I.F. Bandwidth plus bandpass tuning; Rejection Notch; Automatic or Manula choice of selectivity £773.00.

The Mk. 2 Multituner was designed by us to many requests who found our Mk. 1 the finest they had ever used but required a wider frequency range. This covers 550 kHz to 30 MHz. The circuitry gives 50 switchable, tunable positions to match any antenna over 5 metres in length to practically all communication receivers. Our "Multituners" are designed and manufactured by ourselves and have been exported to over 50 Countries. Many operators use them for QRP Transmitting also. See the February edition 1977 of the "Short Wave Magazine" or send SAE for details.
£25·00 inc. VAT and postage

YAESU FRG-7 RECEIVER. Mains and battery operated receiver 0·5 to 30 MHz. Solid state. Advance circuitry offers excellent performance for the DX listener at a moderate price. Price £210·00

Yaesu FRG7000 Receiver	£367·00
Yaesu SP101B Speaker	£19·68

TRIO

R820 Receiver	£773·00
TS820 Transceiver	£695·00
Digital readout for TS820	£120·00
VFO820	£121·00
DS1A 12v. DC Inverter	£42·00
SP820 Speaker	£38·00
SM220 Monitorscope	£231·00
TL922 Linear Amplifier	£780·00
TS520S Transceiver	£530·00
VFO520S	£101·00
SP520 Speaker	£17·50
DG5 Digital readout for TS520S	£117·00
TS120V 80–10m. Mobile Transceiver	£399·00
PS–20 AC power supply for TS120V	£51·00
MB100 Mobile mounting bracket	£16·50
TS700S 2m. All mode digital transceiver	£537·00
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TR7010 2m. SSB/CW Mobile 10 watt	£189·00
TR7400A 2m. 30 watt Mobile Transceiver	£336·00
TR7500 2m. FM Transceiver	£235·00
PS6 Power supply	£58·00
TR2300 2m. Portable Transceiver	£195·00
PB15 Battery Pack	£15·00
PS1200 Power supply	£19·55
TR8300 70cm. FM Mobile Transceiver	£245·00
TR3200 70cm. Portable Transceiver	£186·00
R300 General coverage Receiver	£185·00
HS5 Headphones	£23·00
HS4 Headphones	£10·50
MC50 Desk Microphones	£27·00
MC30S Hand microphone 50K	£13·00

Crystals and accessories in stock

ANTENNA SPECIALISTS

ASPR332 ⅝" Gutter Whip	£8·50
ASP201 ¼ waveWhip	£3·26
ASP677 2m. Whip	£16·75
ASP2009 Standard Whip antenna	£10·20
K220 Magnetic Mount	£8·50
K220A Magnetic Mount	£8·50

DRAKE

SSR–1 Solid State Receiver	£175·00
TV3300 Low Pass Filter	£18·00
TR7 Transceiver and AC PSU	£999·00
MS7 Speaker	£24·75
MN7 ATU/RF Wattmeter	£123·75
R4C Receiver	£495·00
DL–1000 Dummy Load	£29·50

HY-GAIN

12AVQ 3 Band Vertical	£42·18
14AVT/WB 4 Band Vertical	£59·06
18AVT/WB B Band Vertical	£85·50
BN86 Balun	£15·19

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MMC70 4m. Converter	£20·25
MMC144/28 LO 2m. Converter	£22·50
MMC32/28 70cm. Converter	£27·00
MMC1296/28 23cm. Converter	£31·50
MMC1296/144 23cm. Converter	£31·50
MMV1296 23cm. Tripler	£33·75
MMD050 50 MHz Counter	£66·96
MMD500P Prescaler	£27·00
MMD500P 500 MHz Counter	£85·32
MMT432/28 70cm. Transverter	£133·88
MMT432/144 70cm. Transverter	£169·88
MMT144/28 2m. Transverter	£88·87

F.D.K.

TM56B 2m. Monitor Receiver	£105·00
Palm 2 Hand Held Transceiver	£139·00
700E 2m. 25 watt Transceiver	£229·00

G-WHIP

Tribander Helical 10–15–20m.	£21·15
LF Coils for Tribander	£6·17
LF Telescopic Whip Section	£2·75
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Multimobile 78, 10–15–20m.	£21·08
MM Coils	£5·91
MM Telescopic whip section	£2·25
Flexiwhip basic 10 metre section	£14·65
Basemount standard	£3·82
Ball type Basemount	£5·35
Coils for Flexiwhip	£6·20
Base thread adaptor USA/G Whip	68p
Extendarod 40"	£9·56

NEW ANTENNA MODELS

H.S. HF5 Vertical 10–80m.	£40·50
HF R. Ground Plane Kit	£22·50
GDX 2 Discone Antenna 50-460 MHz	£36·00

N.E.C.

CQ—R700 General coverage Receiver	£220.00

ROTATORS

AR30	£46·13
AR40	£53·54
CD44	£106·87
AR22	£48·38
KR400	£96·00
DR7500	£105·00

CABLE

UR43	18p metre
UR67	65p
300 ohm Ribbon	10p metre
75 ohm low loss	18p

JAYBEAM

5Y/2M 5 element yagi	£8·67
8y/2M 8 Element yagi	£11·25
10Y/2M 10 element	£24·58
PBM/14/2m. 14 element Parabeam	£35·00
5XY/2m. 5 element crossed yagi	£18·00
8XY/2m. 8 element crossed yagi	£22·50
10XY/2m. 10 element crossed yagi	£29·81
Q4/2m. 4 element Quad	£18·67
Q6/2m. element Quad	£24·75
D5/2m. 5 over 5 slot fed yagi	£15·52
D8/2m. 8 over 8 slot fed yagi	£20·70
UGP/2m. ground plane	£7·79
MBM48/70cms. Multibeam	£24·52
MBM88/70cms. Multibeam	£32·62
TAS ⅝" 2m. Whip mobile	£14·06
C5/m. Colinear	£34·87
C8/70cm. Colinear	£44·43
D15/1296 23cm. Antenna	£26·32

SRX–30

Solid state Receiver 550 kHz–30 MHz £175·00

TEK

SD Multi Band Trapped Dipole 80–40–20–15–10 metres. 50 ohm feed. 23 metres in length. This is complete, not a kit. High quality Traps and wire. 2kW PEP rating
PRICE (inc. VAT) £50·00

BANTEX

Bantex Magnetic Base Mount	£10.40
⅝" glass fibre Whip	£8.44
⅝" stainless steel Whip	£9.40
UHF stainless steel Whip	£8.63
Standard base mount	£2.70

ACCESSORIES

2 way Antenna switch 50 ohm 200W. PEP	£4·95
3 way Antenna switch SWL type	£4·50
3 way Antenna switch 2KW PEP 0–500 MHz	£8·50
3 way Antenna switch 150 watts 0–30 MHz	£5·50
4 way Antenna switch 50 ohm 200 watts PEP	£10·00
6 way Antenna switch 1 KW PEP 0–30 MHz	£16·55
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HP3A High Pass Filters	£3·00
FS301 Through Line Wattmeter 3–5 to 30 MHz	£37·50
FBB–9A Balun 50 ohm 1–1 1–5 to 40 MHz	£12·00
DL 120 120 Watt Dummy Load 50 ohm 0–500 MHz	£20·00
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Gutter Clamp for most whips	£3·50
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Cable Reducers	16p

ALL OUR ACCESSORY PRICES INCLUDE VAT AND POSTAGE

RECEIVERS AND TRANSCEIVERS
(Inc. VAT and Postage)

SR9 Tunable 144–146 MHz FM Receiver	£59·00
AMR217B Scanner Receiver. AC or DC operation	£113·50
SB–144 MHz SSB Portable Transceiver	£157·00
R512 Aircraft Band Scanning Receiver	£135·00
AR240. 800 Channel Hand Held 2m. FM Transceiver	£195·00
HC 1400 2m Transceiver	£255·00

SECONDHAND EQUIPMENT

Due to delay in publishing secondhand lists please send SAE for our up to date lists. We have a very quick turn over in secondhand equipment, especially in receivers. If you require a specific model please let us know and we will inform you as soon as we have one available. Our secondhand equipment carries a three month guarantee. We would be pleased to sell your equipment on a commission basis, which saves you time and money advertising.

ACCESS and BARCLAYCARD facilities.
Instant HP service

Part exchanges always welcome. Spot cash paid for good clean equipment. If you have equipment surplus to your requirement we would be pleased to sell this on commission for you.

Shop Hours: 9.30 to 5.30 Monday to Friday 5 p.m. Saturday.

No parking problems. Turn at the Greyhound Motel on the A580 (East Lancs.) Road. S.A.E. with all enquiries. 25p will bring you latest information and prices, credited to your first purchase over £5. Postage carriage extra.

ALL OUR PRICES INCLUDE VAT
Prices on all imported equipment subject to price increase.

S.T.E. Prices include VAT and postage

Arac 170 10m. and 70 cm. Receiver	£127·00
AA1 Audio Module for AR10 ...	£4·10
AD4 FM Discriminator ...	£5·00
AL8 Linear Amplifier	£27·00
AG10 Tone Generator... ...	£4·50
ATAL 2m. AM-FM Tx ...	£127·00

The finest value for money on the market.

AR20. 12 channel FM receiver 144-146 MHz. Input impedance 50–75 ohm. AM-FM modes. Sensitivity 0·2uV AF output 3 watts. 12v. DC operation. Price £50.00

FDK MULTI-700E

ARAC 102 receiver, 28–30 MHz. 144–146 MHz. AM–SSB–FM–CW Price £100·00

AT23. 12 Channel PM Transmitter. 3 watts. 144–146 MHz. Frequency deviation 3–10 kHz adjustable. 12v. DC operated AF input sensitivity 2mV adjustable to 50 mV. Price £50·00

★ **ALDA 103** ★

★ **The latest Solid State Transceiver** ★ **80-40-20 metres**

Quality engineering gives you all these convenient features : BROAD BAND POWER AMPLIFIER ★ SSB 250 watts PEP Nomina ★ CW 250 watts DC Maximum ★ BUILT-IN CW MONITOR ★ 6 POLE CRYSTAL FILTER ★ SEMI BREAK-IN CW ★ R.I.T. DUAL SPEED VERNIER DIAL ★ MODULAR PLUG IN CIRCUIT BOARDS ★ BUILT-IN SPEAKER ★ 13·5 V DC input at 15 AMPS ★

Send S.A.E. for full specifications.

★  ★

We are now importing these direct from the USA and can offer them at £360 inc. VAT

455 kHz FM Discriminator Amplifier. Limiting threshold 100uV. Amplitude modulation rejection 40dB. Audio output voltage at 1 kHz 200-300mV frequency deviation + or — 3 kHz. Price £5.00

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Rx Band Pass Filter. 9 I.C's. 1 watt output* 8 switched positions of filters* High pass 2·5 kHz–2·00 kHz–1·5 kHz–200 Hz–110 Hz–80 Hz* Ideal for increased selectivity with FRG7, SXR30, ETC ... **Price £29·75**

Printed Circuit Module. Including rotary switch ... ... **Price £17·25**

RX Peak and Notch Filter. Goes between RX and speaker* All I.C's* By-pass switch* Notch width control for optimum width of notch ... ... **Price £29·75**

Printed Circuit Module. Including all pots and switch ... ... **Price £17·25**

Pre-Selector. Coverage 1·6 MHz to 31 MHz* Three switched bands* Type 1 with antenna changeover relay for Transceiver op **Price £29·75**

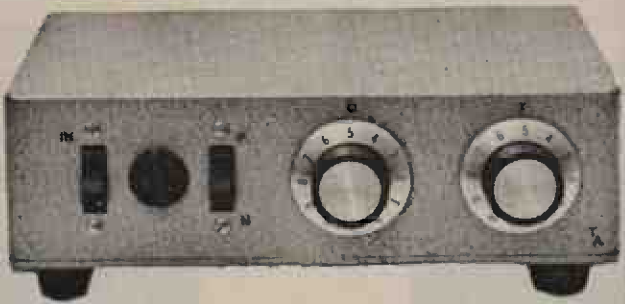
Type 2 for SWL without relay **Price £26·65**

Crystal Calibrator. Seven ranges down to 1 kHz. Selected from front panel. Complete with antenna. ... ... **Price £21·85**

VHF Tunable Pre-amp ... **Price £22·50**

Some Models in New Type Cabinets

These prices include VAT and postage.



Solid State Stabilised Power Supplies

Model 122 0-15v 2.5Amp	£13·53
Model 122S 12.6v 2 5Amp	£18·00
Models 125 12v 5Amp	£24·00
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Model 1210S Twin meter 0-20v 10Amp	£80·00

Further range of models up to 20 amp available shortly.

STEPHENS-JAMES LTD.

47 WARRINGTON ROAD, LEIGH, LANCS. WN7 3EA

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WATERS & STANTON ELECTRONICS

SHORT WAVE LISTENERS . . . OUR RECEIVERS ARE BETTER – WHY?

In choosing a receiver you'll want to be sure that you're making the right choice. There's quite a few to choose from but do not fall into the trap of thinking that a receiver produced by any of the large domestic hi-fi manufacturers and purporting to be a "true short wave or communications receiver" is necessarily a sound investment ! We've been in the communications business long enough to know the good ones from the rest. Listed below are the ones we can recommend as best buys.
All are produced by acknowledged leaders in the communications field and all will give you hours of satisfactory and enjoyable listening, whether it be amateur or broadcast stations you wish to monitor.
But, to make sure you really are getting the best value for money, it's no good purchasing a sealed box. All the receivers listed below have travelled many thousands of miles and are produced on a production line where final alignment time is limited. That's why we test each receiver carefully before selling it. Our tests involve the use of several thousand pounds worth of instrumentation and it's because of this that we can guarantee you that a receiver purchased from us is quite likely to be better than a similar model purchased elsewhere.
Don't therefore take risks with your hard earned cash. Our advice is free and so are our pre-delivery checks—we can deliver anywhere in the U.K. and can quote competitive H.P. terms and accept telephoned orders against Access or Barclaycard—so if it's a receiver you want, come to Waters & Stanton Electronics, one of the largest amateur radio outlets in the U.K.!

LOWE SRX 30

The SRX30 is designed as a budget priced receiver that outperforms many receivers costing 3 times as much. Featuring the Barlow Wadley loop, it will enable you to explore the exciting world of short wave radio—amateurs, broadcast, aircraft, shipping, etc. This is a completely self-contained package, having all the features necessary for complete and reliable coverage of the frequency range 0·5 MHz to 30 MHz.

£175 inc. VAT & delivery

YAESU FRG7

The FRG7 is one of the best known receivers. Many thousands have been sold and for value for money it's hard to beat. Based on the Barlow Wadley loop, this sensitive receiver is able to cope with todays crowded air waves. SSB/CW/AM—all are copied perfectly—the receiver has thirty 1 MHz bands with excellent bandspread, operates from 230 volts or 12 volts and built-in speaker—frequency coverage is 0·5 MHz to 30 MHz.

£210 inc. VAT & delivery

> Dear Sirs,
> *Concerning the FRG7 Yaesu receiver which I purchased from your shop in Hockley—it is super, absolutely fantastic ; for instance all I have is twelve feet of 50 ohm coaxial cable thrown over my roof and I can pick up all the hams in every American state, Russia and the rest of the world hams "literally at my fingertips." I am more than pleased: also I might add I have had about 12 SW receivers and for value for money the FRG7 has no equal.*
> S. R. A. LUNN, Southend-on-Sea.

YAESU FRG 7000

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PETER WATERS G3OJV

SHORT WAVE MAGAZINE

(GB3SWM)
ISSN: 0037-4261

Vol. XXXVII | MAY, 1979 | No. 427

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Editor: **PAUL ESSERY, G3KFE/G3SWM**
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Published at 34 High Street, Welwyn, Herts., AL6 9EQ, on the last Friday of the month, dated the month following. Telephone: 04-3871 5206 & 5207

Annual Subscription: *Home: £5·50, 12 issues, post paid*
Overseas: £5·50 ($10·00 U.S.), post free surface mail

Editorial Address: **Short Wave Magazine, 34 High Street, Welwyn, Herts. AL6 9EQ, England.**

Prices shown in advertising in this issue do not necessarily constitute a contract and may be subject to change.

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ADVERTISERS' INDEX

FOR THE RADIO AMATEUR AND AMATEUR RADIO

The SHORT WAVE Magazine

EDITORIAL

Planning Permission

There was recently a proposal by the Metropolitan County of Greater Manchester in a Private Bill, to bar boat-owners from keeping their boats on their own property, in their own gardens. This follows similar bills by Cheshire CC, County of Merseyside, West Midlands CC, and West Yorkshire CC, all of which had the offending clause dropped after strenuous action by the RYA (the national boating organisation). What it boils down to is that, since every County Council will shortly have to promote a private, consolidating Bill, the RYA will have the possibility of some 35 times more protests, despite the Lords deletion of the offending clause.

So, what has this to do with Amateur Radio ? Just that any one of those Private Bills may contain a clause which might in some way further restrict our right to the enjoyment of our transmitting licences. It is an interesting point that up to now, you have been able to keep a boat in your front or back garden without any planning permission, while at the same time you have been required to obtain planning permission for your aerial and mast if it is a "permanent" structure. It seems to us that a guyed aerial mast with a beam on top is *not* a permanent structure; therefore if the RYA can persuade the Lords to delete a clause requiring permission to keep a boat, then by the same token we should be able to put up aerials without let or hindrance, as part of the use of a home.

G3KFE.

COMMUNICATION and DX NEWS

E. P. Essery, G3KFE

ALL sorts of interesting things seem to have been happening of late; we only wish a few more of the organisers would feed in some sort of early-warning to the hoped-for customers. The experts at DX-peditions do, of course, but a distressingly large number seem to contrive to let everyone know after it's all over, and then to have a moan about co-operation from the amateur radio magazines. It must be realised that once the material has gone off to the printer there is just no way in which we can stop the works without completely upsetting the applecart. Thus, *DXNS* or *WCDXB* which come out weekly, often are the only indicators of the short-notice merchants. On the other hand, it must also be said that often the effort is not a DX-pedition at all, but a work activity undertaken at short notice, and a rig packed in the luggage.

Here and There

We hear that in addition to YI1BGD, there is now another YI station, who signs YI4SC—QSL *via* YI1BGD, Box 5864, Baghdad.

If you are sitting around hopefully awaiting the appearance of a big 1S1DX signal from Spratly, you may well be in for a disappointment. We hear rumours that they will be going to Amboyna Cay instead: apparently they tried for Spratly but were turned back by a Vietnamese gunboat. But one thing we haven't heard is their signal, nor yet the signals of the pile-up calling them! Admittedly, the aerial system here is in a mess after the winter, and it has not been possible to get on the air at suitable times; but one would have expected to hear some sort of ruckus going on.

Another one to be noted among those *not* audible is A6XB, who is believed to have had his gear confiscated. On the other hand, PA0GWK/A6 is about, being worked in U.K. around 1730-ish zulu time.

To return to the matter of Spratly, there is another rumour going the rounds which says that VK2BJL and the gang aren't going to be at Spratly until April 28—though to be fair that seems to be just another spot of discouragement put about by a non-DX type.

For those of us who usually run full power, the tale of G4BUE might be of interest; he has made it over to W1HR with just *15 milliwatts*, and with the five watts managed a score of 395000 points in the WPX effort, from some 700 QSOs. Some going with such a low power level, admittedly with a beam, even though the latter is only at 35 feet.

We have a letter from DL9GJ with details of a world activity by radio amateurs who are associated in one way or another with Air Traffic Control operations. They have a net, usually on 14277 KHz, but sometimes they are about on 21373 or 28540 KHz. If you would like to know more, the U.K. representative is E. Bradshaw, 6 Longlands Park, Ayr, KA7 4RJ, or you can work DL9GJ (who is also ON8AA, PA0GJA and F0AAJ) when he is on the /M gear, between 0630-0700, 1100 and 1200, and 1615 to 1645 (all GMT). The preferred band is Twenty, but it is not unusual to find him on 21 or 28 MHz if the propagation is right for him at the noon or afternoon sessions.

Top Band

Various bits and pieces of interest on this band, of which the first is that EA6, EA8, EA9, and the common-or-garden EAs all have Top Band permission, and that they have appeared on the band wearing their ED prefixes.

G3PKS (Wells) seems to have spread his range of operations a little, as he operated /A from St. Mary Cray and managed a QSO with Yorkshire to fill in one of the remaining "wanted" ones. There was also some chatting with the locals around the Wells QTH.

Just to remind us that there is another continent, G2HKU (Sheppey), mentions his SSB QSOs with K1PBW, YU3EF, DFØDX, PA0PN, ED5HM, SP3ADZ, indicating also how many new countries have come on to the band in the last year or so. Turning to CW we find W1BB, K2GNC, DL9RY, and DK6AS/LX.

Next comes the W1BB *Spring Bulletin*, and on the covering letter we notice that Stew is hoping to meet G6CJ of aerial fame; the latter is doing his talk several times over there during his trip, and is attending the FOC meeting in New England.

Turning to the Bulletin, one notes how, despite the conditions being down, doubtless due to the high sunspot count, there has emerged a new type of operation on the band, by the "super-station" types—W1BB is thinking of a long ragchew on SSB between G3SZA, K1PBW, and ZL2BT. Such stations as these, plus ZS6DW, N1AAR, W8LRL, W6SE and so on, are rolling back all the barriers to good and solid contacts. W7TB, lying 1500 feet down in the bottom of an Arizonan canyon managed to snag EI8H and DJ8WL, for example—the sort of QSOs where W1BB is sitting and just not hearing the DX end! On the receiving side (which in the urban places is the limiting factor) we notice that G3LIQ is running a receiving loop with 5-foot sides, all-same the ARRL *Handbook*, with which he has heard VK and W1BB, among others. PAØHIP makes a good point when he writes to W1BB that DHJ and OSN are not necessarily good indicators of conditions, in that both are liable to spend much time at low power, of the order of a few hundred milliwatts. One of the super aerials is that owned by WAØZHH, who has four 130-foot towers arranged on a half-wave square, with a fifth one smack in the middle so that he has choice of 8 ways to radiate. He now reckons, with some experience of the system, that the towers should be half-wave high!

For W1BB, the year has been marked by a couple of jokes against himself: first one is the matter of transceive operation with the Drake "twins", when one just looks at the knobs, sees them apparently on the right frequency but doesn't note the beast is on transceive—the result of course being the rather startling sound of W1BB transmitting in the DX-window! The other one was the case when some local louts managed to bar the shack door while Stew was working some DX. The bar was a piece of two-by-four, secured with several loops of No. 12 house-wiring cable. No other way out, so Stew had to give K1PBW a shout, ask Ernie to alert the local Law to come and get him out!

Eighty

While, like Top Band, Eighty in general terms has been rather down in terms of real DX, there is still quite a bit happening. Lots of rag-chewing on SSB, the odd AM station in the CW end (shoot that man, sergeant!) and of course the QRP experts, who are mostly on CW, around the middle of the day. Even in the cold of March, G2NJ (Peterborough) found G2CAS/P near Wetherby, and G5NX/P in the Lake District. Conditions through the month weren't all that good anyway, with a high noise level, but the "regulars" of course were able to notice and make use of the quiet times. The biggest QRP signal heard after dark was GI3LFH who was a 589 to Nick, when he tGI was using five watts.

Another, and slightly different approach to the game is that practiced by G5NX and G2NJ—the former driving and using VHF, while G2NJ sat in the back with the Uniden, bashing out CW non-stop to a queue of signals.

G3PKS dismisses the band as being not of any great interest, although he does indicate the odd opening into OH/LA/YU during the mid-afternoons, even though he did not feel moved to do anything about them.

Just one contact is mentioned by G2HKU, Ted having connected with W2FC on CW.

Forty

This is a band you either love or hate; and if you like it, you are likely to have shifted elsewhere to get a few hours in while the sunspots are doing their thing higher up in frequency! Seriously, though, if you can work DX on this band during the normal evening hours, you will be able to sit back and congratulate yourself on knowing how to drive a receiver on the one hand, and how to copy through QRM on the other! On the plus side, there is the thought that you aren't so likely to have TVI on 7 MHz. G3PKS mentions it as being another spot for European QSOs on CW or SSB, but he does mention his contact with K1BX, who held G5AHV at one time, and one with VE7CM in BERU.

Looking at the letter from G2HKU we note he has given it a whirl with CW to K1RH, K2GGN, K4PQL all going into the log.

As for the writer, there has been quite enough hassle in other directions to keep him quiet, but on occasion the bandswitch dial was twisted down to that area, the CW filter switched in, and a careful search nearly always showed some DX at least; but we didn't bother to press the key, due to the thought of all the QRM which seemed to be waiting to pounce on any QSO to DX.

Oddments

A separate letter from G4BUE (Upper Beeding) shows some interesting points apart from the ones already mentioned, which were at second-hand, though correct. Chris mentions his Argonaut has been modified so that he can take it right down to ten milliwatts input. At this low level, East Coast Ws were being worked on Ten, about which more anon. What is so interesting about this is that the measured power output at this level of input (10 milliamps at one volt) showed an output, as measured on a 'scope, of a very low efficiency indeed, with some 576 *microwatts* emerging from the aerial socket! Of course, there will be some difference between doing such a measurement in the lab. and doing the same on the aerial: for instance, the microwatts must go down the feeder to the aerial, which therefore gets less RF. To work Ws with this sort of power must be something of a first. What has also emerged is the way in which the Argonaut PA stage likes to have about the right voltage and current for best efficiency at any given input; for a one-watt input, the best output is obtained by using 4.25 volts at some 235 mA, as an example.

Still with G4BUE, let him now put on his QRP Club hat, and discuss the winter QRP contest put on by the AGCW-DL gang. The first six places went to: G4BUE, OK1DKW, G8PG, GM3OXX/A, DJ6FO, and G3DNF—all but DJ6FO being G-QRP club members! Other members in the list included G3NEO at 14th, G4GIE at 20th, G4EJN 26th, G4AYS 28th, these all being from a total entry of 46 in Class A. What a fine showing from U.K. in a contest—and a pleasant change; congratulations to all.

G3PPR (Sherborne) says the school club have now got their Quad up in the air, and it is doing well despite being rather hemmed-in by buildings, not to mention it staying in one piece during the Force 9 gales. It is of interest to note that the tuning of the stub on the Quad is quite important, a change of three inches at the stub in the position of the shorting bar being enough to make a six-fold difference.

To make a complete change of tack, there have been various tales of BY stations on the air; BY1AA, saying his name was Pyng at a Peking address turned out to be a phoney, and we suspect that the BY1AR reported to the SWL column may have been somewhat similar; on the other hand, what does one make of the report that HB9APN, Lambert, is at the Swiss embassy in Peking, and was putting a signal out in the phone bands, as HB9APN/A/BY, or HB9APN/BY according to other reports? The signal is being heard in the W6 country, and the reports of its validity come from HB7MQ, who is understood to have at one time been DX editor of the Swiss national society magazine. One wonders . . .

Ten Metres

Has most definitely been doing its thing. G3PKS says that he "leaned heavily" to cause a report to come from G3OTK from up the road. It seems Richard has been on Two metres for a long time until rumours reached him of the goings-on on 28 MHz. Thus, he built a transverter to bring his Icom-IC202 on to Ten with some 0.4 watt p.e.p. of SSB to a 2N3553, with which he managed to reach western U.S.A. on the key and the Eastern Seaboard on SSB, but it was tough going. A linear was therefore next on the list, and this uses a power FET, (the Siliconix VMP-1) to give some ten watts p.e.p. to the dipole. It is even more of interest to G3PKS that when he is operating a few KHz away, G3OTK doesn't have any problems but just goes serenely working the DX. On SSB there were A4XGY, WA1SQB/HC8, 7X2BK, HI8IH, and FG0DYM/FS7, while the CW dealt with ZF1SV, LU6FAD, OH3XX/OH0, ZE3JO, HK0BKX, HI8IH, not to mention G3PKS several times!

G3PKS himself reckons the band was quite unpredictable, varying from moribund to world-wide. BERU gave with VE3KZ, VE2AEJ/3, VE3DDU, VE3IXE, VE3FAC, and VE3BGA; others in date order included EA3AVV, W4BIZ, ZB2CJ, UA4PNT, LZ1QY/MM in the Gulf of Guinea, WD4JBR, GM3MHG, UB5MKG, and RA4AKC. The latter was followed by UB5MMR, and a CQ DX call on an apparently empty band, which set up quite a wolf-pack among which one could hear a JH2 and a UL7; but Rod chose WA6CLK, who commented that to hear a G was a bit of a surprise as it was at least 2 hours before Gs were normally to be found. A lucky dip just before his letter was written managed a reply from ZD8TM first call through all the wolf-pack.

It seems to have been pretty well all CW for G2KHU, who mentions KØFX (Colorado), AFØQ in Minnesota, W7IR for Arizona, KØUK in Colorado, K7NO, N4AR, K4VAA, VE6APN, and N6BT.

It is a combined 21/28 MHz report from G4BUE, with his five watts to an Argonaut in the CQ WWWPX SSB 'Test', with which some 700 QSOs were made: all W call areas, all JA, UL7s, UA9, UAØ, WL7AAG, ZL1AJU, AX6CT, VK4NPX, HL9KE, 9L1CA, EL2AV, UI8LAG, TF3YH, FG0DYM/FS, VO2CW, W1BIH/PJ2, WA7UWE/C6A, CT3BX, YV5CVE, CK7WG, KP4Q, HI8MOG, HI3XEA, UJ8JCR, KL7IRT, HI8XDJ, AL7J, KL7HR, PY2EE, ZX2XB, AP2KS, 8P6BT, OX3FG, VP1KG, and YY4YC.

G3PPR reckons the band was very good when they got there but they usually looked at 21 MHz to see how the Pestilence of Poltava was getting on, and stayed there; however, when they did finally arrive on Ten they were spoken to by all W call areas, while FG7TD and KL7RA were Gotaways, the latter under a huge pile-up and protesting that there were "plenty of Alaskan stations about" and failing completely to get rid of the callers.

G4EAN (Nottingham) stuck to working all the Ws, with such as W7AO, WD9INX, N2ABS, N4BKX, not to mention K1BK/M1.

We almost forgot to mention G2BJY (Walsall), who, along with everyone else, dislikes the current U.S. callsign allocation business as being very confusing to the rest of the world. Geoff managed HA7KTK and HA7NC to to complete the clutch for the Danube Bend award, and also keyed with LU7HI, PY2JN, SV1IS, UA9s, UI8IZ, KF4O, WA7VZI, 9H1R, and 4X4FW.

'CDXN' deadlines for the next three months—

June/July issue—June 7th
August issue—July 5th
September issue—August 2nd
October issue—Sept. 6th
Please be sure to note these dates.

Fifteen Metres

Still with G2BJY, Geoff notes "lots of U.S.A. stations with weird prefixes," plus a lot of JAs and their variants, VO2CW in Labrador, 4Z4TZ, ZL1AXN, while the Commonwealth contest came up with all VE call areas but VE8, VO1KO, ZL3GQ and 9H1CH.

Just a couple from G4EAN, who seems to have spent too much time clearing up the shack—WB3DEJ and K1BDP.

G3PPR notes N1AAR, running a Sterba curtain array, and solid QSOs with W1-6, the contact with W6OCU being Rod's first Californian, VE1-3, several JAs, AJ4L and AB5A about which last two G3PPR enquires "can someone explain the excitement produced by these gentlemen?" On a totally different tack G3PPR was showing 3.5 MHz to some fifth-form chaps who rapidly got bored and asked "please can we speak to Japan"—quick flip of the switches to 21 MHz and Quad, and JA4SHD in Hiroshima obliged!

G2HKU wanted to make sure his HW-8 batteries weren't too flat, so he keyed with SM5CBC before hurrying off to other places.

G3PKS had a few short spells in BERU, to a total of about 1½ hours, from which VE3BC, VE3CXL, VE3ETV, ZL2LA, VE3BFF, VK2GT, VE1AIH, VE3BQL, VE1EP, VE1BP, VE2KZ, VE3IAE, VE3DAO, and VU2GO were picked; outside the contest, came VE3DMC, PY3FMC, P29EJ, EA5CV, and some small fry. Jack felt conditions were not at their best on several days.

Now 14 MHz, where most people leave the bandswitch most of the time. Whenever G3KFE switched on, which it must be admitted wasn't very often, there seemed to be something doing, if only you could hear it all under the TV timebases and other noises.

For G3PKS time was severely restricted by a holiday, a spell of flu of the "three weeks and wish I were dead" variety, and most of all temperatures like—6 degrees in the shack! However, there was about an hour in BERU, which gave with VE3MXE, VE2FYR, VE3KZ, VE5RG, VE3DAP, VE2CBM, VK2BAT, ZL1AXM, ZL3KR, and 9H1CH. Out of the contest an addition was VK4ALB in Brisbane who was hitting the S-Meter needle to S7 on the morning of April 4.

G2HKU seems to have had a bit of a ball on 14 MHz; on SSB we note W6CNR, W6TT, ZL1VN, ZL1QQ, ZL1AAE, ZL3FV, ZL3RS, and ZL3SE, while CW took care of VE3GCS, VK3BZ, UK6ACQ, WB4BNH, UJ8JAS, K5JZN/Ø, VE3KZ, VE5RG, VK3MR, WB7QYI (Oregon), LU9EBS, and ZB2EO.

Just one contact was the form for G4EAN who came up to grab VP2MBU on SSB.

Finally

That is about it for this time, with quite a lot of mail known to be still in the pipeline, and the mails becoming ever worse—*DXNS* was posted by RSGB from Watford at 1000 on April 4, first class, and arrived here the day after West Coast DX Bulletin of the same date; four days for first class mail as an average is worse than we have ever known, and it does seem to be spreading from London, as the main blockage, to be all over the place. The English Disease again.

However, no good crying about it, we must keep on; deadline dates are in the 'box' in the piece, and the address "CDXN", SHORT WAVE MAGAZINE, 34 High Street, WELWYN, Herts. AL6 9EQ.

A FIELD-EFFECT TRANSISTOR TRANSMITTER FOR TWENTY METRES

PETER LUMB, G3IRM

UNTIL recently field effect transistors have been low power devices. A few attempts have been made to produce unipolar transistors for higher power uses but these have only been in the one watt class. However, several firms are now making high power field effect transistors and one, in particular, has published designs for RF use. As usual, though, these designs are for VHF.

This article describes the writer's attempt to make an all-FET transmitter running about twenty watts input for CW on twenty metres; there is, of course, no reason why the design should not be varied to suit other bands.

Circuit Description

In order to simplify the design and ensure good stability together with clean drive, a crystal oscillator was used but variable frequency excitation can be substituted if desired. As the circuit was intended solely to give power field effect transistors a try, it was kept as simple as possible and a higher power variable frequency version is now under construction. The oscillator transistor is a *Siliconix* J310 which is obtainable quite cheaply and works well in the circuit. A tuned buffer (or doubler) stage follows and another J310 can be used provided a small heat sink is added; a better transistor is a 2N4861 and this is to be preferred. Both stages are keyed by breaking the source leads. It will be seen from the diagram that the oscillator is fed from a 12-volt stabilised line and the buffer from the full PA voltage supply. If a second J310 is used as a buffer it should be connected to 12 volts omitting the 68-ohm decoupling resistor; though this will, naturally, result in reduced drive to the driver transistor.

The driver and PA transistors are VMOS devices by *Siliconix*. Field effect transistors manufactured by the planar technique are horizontal devices and the current carrying capacity is limited; VMOS transistors, on the other hand, use diffused channels and vertical current flow to obtain higher power capabilities. Transistors are now available with breakdown voltages of 400 and others have current carrying capacities of over 10 amps. There is quite a range available but they can be divided into two types—those incorporating a protective Zener diode at the gate and those without. For RF applications unprotected devices are more useful but care must be taken to ground the gate lead when connections are made or desoldered. *Siliconix* made one VMOS FET specially for RF applications—the VMP4—but this is expensive and need only be used at higher frequencies. For the DX bands most other types are suitable.

Power Mosfets are somewhat similar to valves in that they are voltage operated, but differ from valves as they operate in reverse. A valve draws maximum current at zero bias and requires a negative bias supply to reduce the anode current; the mosfet, on the other hand, draws no current at zero bias and requires a positive bias (or drive) to produce drain current. The bias can be obtained from the same power supply as the drain. Thus devices are self-protecting if drive is removed.

The transfer characteristic of a typical VMOS device is shown in Fig. 1 and it will be seen that at gate-to-source voltages above about 3 volts, the characteristic is very straight implying excellent linear amplification At a gate voltage of 8 volts drain currents over 1·5 amps can be expected.

Each of the two main groups (protected and unprotected) can be obtained with drain-source voltages of 35, 60 and 90 but for experimental CW purposes it is necessary to select a transistor with a maximum drain-source rating of twice the supply voltage. Most VMOS transistors have a maximum drain current capability of 2 amps, but some are higher. The two devices used in this circuit have 60 volt breakdown ratings. The driver transistor is a VN66AK in a TO39 case and it must be provided with a heat sink; the PA transistor is a VN66AJ which needs a TO3 heat sink.

Impedances and Matching

The input impedance of a VMOS transistor is many millions of ohms in parallel with a capacity of about 33pF. In numerical terms it varies from 200 ohms at 2 MHz, to 60 ohms at 60 MHz—which is considerably higher than can be expected with bipolar transistors. To couple the driver to the preceding buffer stage a simple link coupling is used with an anti-parasitic bead at the gate lead. VMOS devices can be operated with negative, zero, or positive bias and Class-C is obtained by simply returning the gate to earth. For experimental purposes provision has been made to add a little positive bias fed into the cold end of the link coil; with the high gate resistance of a VMOS transistor low resistance bias sources are unnecessary and a simple divider from a stabilised voltage is all that is needed. This stabilised voltage through another divider is used to bias the PA stage as required. The output circuit for the driver is matched to about 50-80 ohms and the trimmer capacitor can be used to adjust the tuning. (Remember, voltage is needed for drive, not power). The load on the driver is the 100 ohm resistor in parallel with the PA input which was estimated to be somewhere between 100 and 200 ohms: hence the matching circuit used. Should it be desired to change to other bands all the necessary calcula-

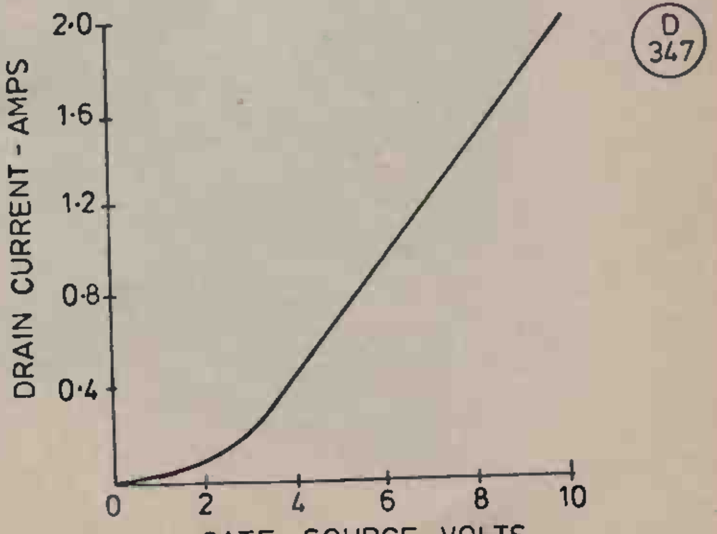


Fig.1 VMOS TRANSFER CHARACTERISTIC

tions can be found in Application Note AN267 entitled "Matching Network Designs with Computer Solutions," published by *Motorola Semiconductor Products Inc.* An alternative source can be found in either "Solid State Design for the Radio Amateur" or "Electronics Data Book," both published by the *American Radio Relay League*. The same calculations can be used to match the output transistor to 50 ohms and a similar network can be used.

Adjustments

To line up the transmitter it is only necessary to use a 50-ohm load with a suitable monitoring RF probe or output meter. With supplies to the driver and PA disconnected, key the oscillator and buffer stages and listen for the output on a receiver. Set the two bias resistors at zero volts and temporarily disconnect at point 'X' and connect the dummy load and probe to the output of the driver; add a 1 amp. meter in the drain lead to the driver and tune C15 for maximum output. Remove the load and probe and reconnect point 'X'. Transfer the load and probe to the PA and connect a 2 amp. meter in the PA supply lead; tune C22 for maximum output and re-trim C15. (This procedure is not really necessary, but it at least proves all is well and shows what is happening). It is now possible to increase the bias slightly on the driver, watching the drain current

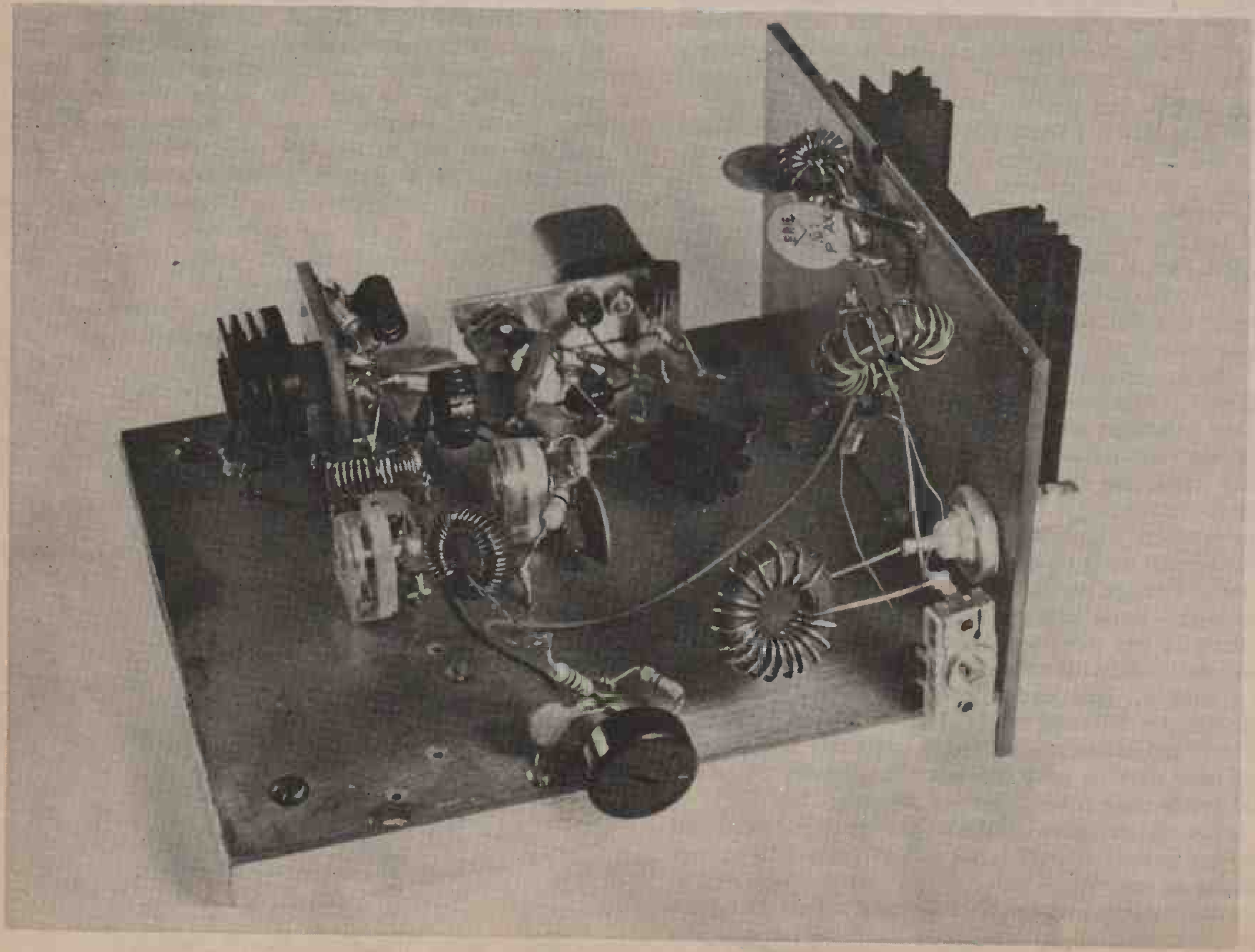
Table of Values

Fig. 2

C1, C7	= 0·1 μF	R1	= 82K
C2, C4	= 220 pF	R2, R9	= 100R
C3	= 82 pF	R3	= 150R
C5	= 39 pF	R4	= 33K
C6, C15	= 60 pF max.	R5, R6	= 68R
C8, C12, C17, C19	= 2·2 μF	R7, R8	= 470R
		R10	= 270R
C9, C11, C13, C14, C16, C18, C20	= 0·01 μF	RV1, RV2	= 470R
		TR1	= J310 Siliconix
		TR2	= 2N4861 Texas
C10	= 22 pF	TR3	= VN66AK Siliconix
C21	= 68 pF		
C22	= 140 pF max.	TR4	= VN66AJ Siliconix
ZD1	= 12 volt Zener		
ZD2	= 9·1 volt Zener	FB	= Ferrite bead

L1 = 1 mH choke
L2 = 15 turns on T50-2 with 3 turn link
L3 = 6 hole ferrite bead, single wire passed through each hole
L4 = 40 turns on T50-2
L5 = 35 turns on T50-2
L6 = 15 turns on FT37-61
L7 = 17 turns on T68-2
L8 = 19 turns on T68-2

Note: C10 and C11 connect direct from L3 to ground.
C18 and C19 connect direct from L6 to ground.



The G3IRM FET transmitter

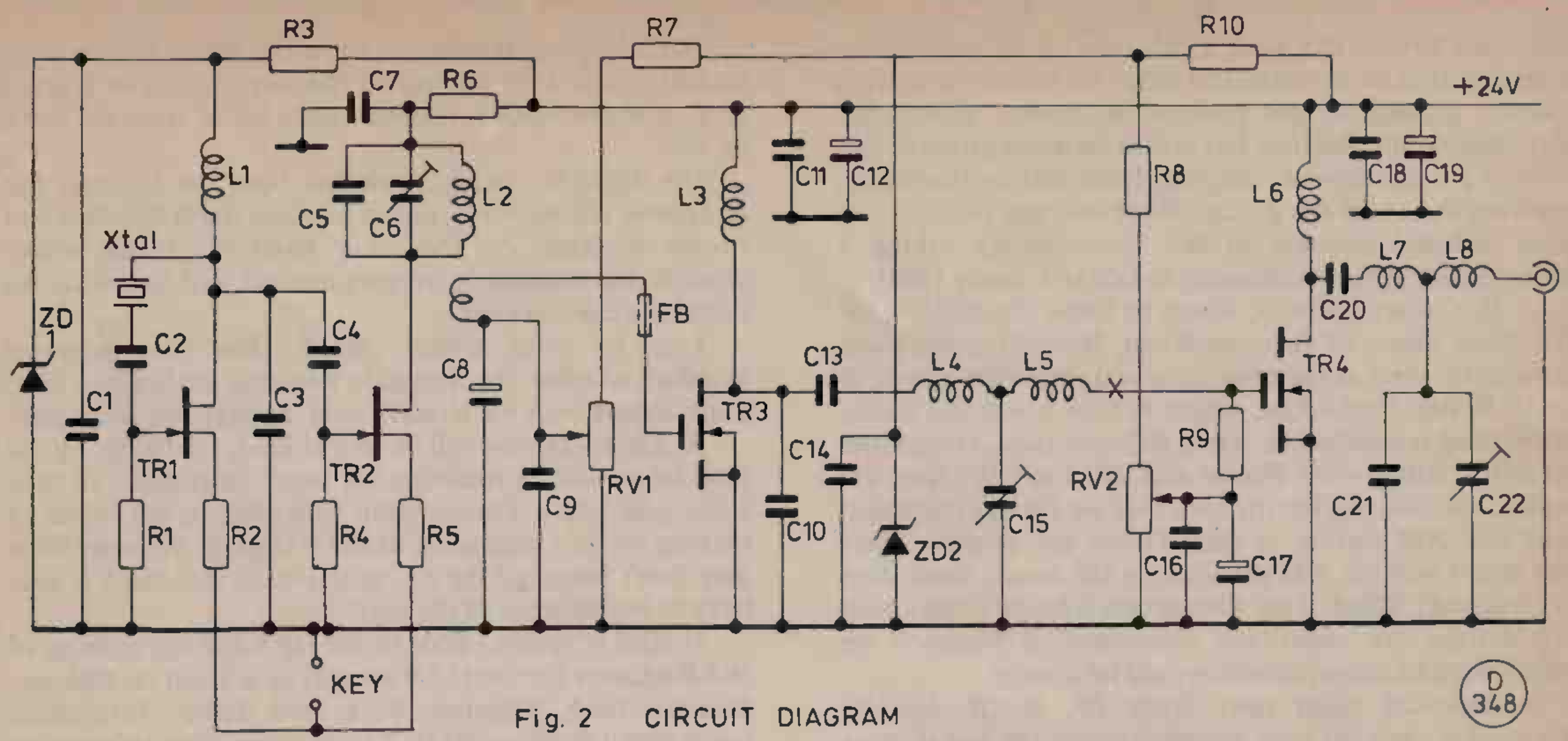


Fig. 2 CIRCUIT DIAGRAM

and noting the effect on the output. Repeat with the PA bias supply and retune the capacitors if necessary for maximum output. By setting the bias to a suitable-value Class-AB linear, amplification of SSB (or CW) signals can be obtained. Adaptation to SSB has not been tried but should present no serious problems.

Final Notes

A few notes on the advantages of VMOS transistors may be mentioned. VMOS transistors do not suffer from thermal runaway or secondary breakdown, and there is no minority carrier storage time. Any SWR can be handled from open to short circuits at any phase. Try this with a bipolar transistor if you dare! Any class of operation is possible—A, AB, C or switching Class-D. If more power is needed VMOS transistors can be connected in parallel without current hogging and ballasting resistors are not needed; capacitances are, of course, increased.

The photograph shows the method of construction used which will be found suitable for temporary bread-boards at HF. (It must be mentioned that the writer's constructional projects normally are of a higher standard than one might guess from the prototypes!). The board consists of a piece of plywood covered with printed circuit board, copper side upwards; all earth connections are soldered down to the copper and insulated points are made by drilling a small hole through the board and into the plywood. If the hole is countersunk to remove the copper, 'Veropins' can be pushed in to form insulated points.

• • • SWL • • •

SHORT WAVE LISTENER FEATURE

By Justin Cooper

THE main topic this time round must be the U.S.A. prefix allocations. To be fair, the Americans themselves are quite happy with the system now in use, though it looks to the rest of the world as though prefixes are being granted at random. Let us try and clarify the picture. All the possible U.S.A. calls have an initial letter W, K, N or A. Previously a second letter, and maybe even the number, would indicate a station from part of the American 'empire' without any doubt. What has happened is that instead of regarding such places as the U.S. Virgin Islands as requiring distinctive callsigns, the American authorities have lumped them all in with the mainland with the calls being dished out along lines defined by the licence level, whether General, Novice, Technician, Advanced, Extra or whatever. At least, that's what *seems* to be the situation!

All this naturally brings up the whole question of the continuance in its present form of the HPX Ladder. At the moment, the feeling is that we should go on with it, and sticking to the existing Rules exactly; so if you are the proud possessor of, say, a KH6 in your log, claim it as such regardless of whether it is in what used to be known as KH6 or is a plain Californian Kilowatt. If we give it a whirl, we can see how it goes, and make a firm decision as to whether to scrap HPX, alter the Rules, or go at it as we have always done.

The Mail

A. Oakley (*Blackburn*) is a bit hot under the collar because after he had done 3-4 weeks at the local RAE class, County Hall came into the act and stopped them all on the basis that they would not allow anyone on to a course under the age of fifteen, regardless of the fact that

that same person can hold a call (and so by implication accepting that he can take the exam for which he needs a course!) granted by the national authority. About the only consolation Andrew has is that he is not alone in this—there are regulations, differing from county-to-county, covering the 14-16 age group. Were this not enough, one finds different colleges in the same county taking a different line without bothering to talk to County Hall!

I. D. Calvert (*Shipley*) wants to know the address for *DX News Sheet:* 62 Belmore Road, Norwich is the place to write to—and at the same time you can order a copy of Geoff Watts' *Prefix List*, which is well worth the effort, and indeed is invaluable. On a different tack, Ian queries the HPX Rules—200 Phone and 200 for CW; they are separate tables. As for the idea that we should require at least one AM station in each Phone list up-date, there just aren't enough AM stations on the bands these days to go round! Mind, if an AM station is heard (Amplitude Modulation, we mean, not /Aeronautical Mobile!) we would want to know, as such would be a rarity.

A technical point next, from *Dr. W. B. Jamison* (*Larne, Co. Antrim*) who wonders about the use of coax feeders to a dipole. Theoretically it is a bit naughty; either you come down from the dipole in low-impedance balanced feeder and fit a balun where the feeder goes into the (unbalanced) connection to the receiver or, better, fit the balun at the feedpoint of the dipole and come down in coax. Practically, there doesn't seem to be a lot in it for a receiving amateur. Years ago, old J.C. used to have a job which took him out on to an antenna test range quite frequently, and he recalls doing some measurements on UHF aerial designs: there was no distortion of gain or polar diagram that could be pinned down at all—any variations were within the variations one would expect from high-grade lab. test gear.

H. A. Londesborough (*Swanland*) is over the 1000 mark both on Phone and CW; and it is of interest in that we wonder a bit about his HV2VO heard on 21 MHz on March 24, the more so since none of the usual grapevine outlets mention anything of that nature.

G. F. Green (*Middlesbrough*) sends in his first list, and we note he has dredged up a remarkably large number of AM stations and then comments that there is a dearth of them about! The fewer the better, we say, at least on the HF bands, as any OT will tell you what a band-full of AM carriers was like!

Thanks to the high sunspot count *J. Fitzgerald* (*Gt. Missenden*) has been enjoying the DX on Ten and bewailing the like of activity on the 3·5 MHz Phone segment where he usually lurks. John will be taking over the equivalent spot to this in the ISWL publication—best of luck from us all, and we hope he gets lots of support.

Another one with a double-entry letter is *D. W. Waddell* (*Herne Bay*) who now is near the 1000 in CW, and at the top of the 1979 Table to boot. The lad's been working on it, obviously!

We do occasionally slip up—and it's nice to find someone who blames it on his own dilatoriness when the mistake was in fact at this end! In the Jan./Feb/ issue, we took him in at 902—but since we acknowledged receipt of his letter in the final paragraph, we should have shown him 938. Probably the result of a strayed paper-clip, but annoying none the less, for *D. Taylor* (*Harborne*).

B. F. Hughes (*Worcester*) has a thumping 76 new ons to add to the 1694 already in the bag, thanks to a good session at the ARRL contest and a bit of time off work as well.

On the other hand, work has been the bugbear for *P. Leather* (*Camberley*), not to mention the RAE class and Morse practice; on the other hand the bitter winter weather has assisted by staying around well into what we hopefully call "Spring".

Like so many others, *D. G. Sim* (*Southampton*) wonders whether the Stateside licensing authorities have gone beserk—we've already said enough on that one!

K. Steele (*Derby*) will be in YU-land, probably, by the time he should be receiving his issue; he reckons to take some gear and a Tavasu whip with him, in the hopes of making contact with some of the YU gang. We only hope they don't impound the rig on arrival so that the YU lads have to bail him out of the jug!

D. Hill (*Crawley*) adds to his HPX-ing the chasing of WAB squares for the HAB award; he is short on Orkney, Western Isles, Alderney, Sark, and Scilly. Interesting point about Scilly—G3UUZ is on there when he's not on the Bishop Rock lighthouse being televised (and giving out a unique WAB square from the Rock, at that!), G5BIU is still licensed from an address in Hugh Town, and G3RPC is up on Telegraph—see if you can see his quad from the sea, near the station end of the Decca aerials. We might add that old G3KFE and G3UUZ have both noted that, not far from the G3UUZ residence, up on the Garrison, there is a point where no less than four WAB squares adjoin, and it seems not impossible to get power to that same spot. We also note that David has a CW offering in the ladder—he comments that SWL participation in a contest shows up how much he needs to make up before he actually gets to punching the key for himself.

S. B. Harris sends in an up-date of some 96 prefixes to a previous list which we don't have trace of in the file; Stuart says he has made a change of gear, in anticipation of passing RAE and Morse, to an FT-101EE. At the moment this is "sniffing the air" from an ATU and end-fed wire, but a 14AVQ is going up soon, plus a dipole for Eighty.

D. Brooks and his XYL, *Judith* (*Loughborough*) both took the Morse at Trusthorpe the day before writing, and both passed, so we should hear their callsigns next time. A good effort by both, and showing just how easy it all is once one sets the mind seriously to it. On a different tack, they now have a set of G3HSC Morse records and an ex-R.A.F. key to dispose of, gratis, to someone seriously studying for a G4 ticket. Contact them direct at 28 Avon Vale South, Loughborough.

Nice to hear again from *S. Foster* (*Metheringham*),

ANNUAL HPX LADDER

Starting Date, January 1, 1979

SWL	PREFIXES	SWL	PREFIXES
D. W. Waddell (Herne Bay)	499	C. Stevens (Spondon)	253
S. B. Harris (Coventry)	369	R. Miller (Chelmsford)	209
G. F. Green (M'brough)	271		

200 Prefixes must have been heard, since January 1, 1979, for an entry to be made. See also HPX Rules.

who seems to have spent quite a bit of time at the receiver, to collect up some 52 new prefixes, and his all-time countries score to 310, by way of Desecheo, Mayotte (FH80M) and, earlier, 4U1UN and STØRK. Listening is mainly late evening, with the occasional 0600-0700 session.

B. Shepherd (*Staines*) has modified his FRG-7 to the Toko filter, and reckons the effort well worth while, as the scoring rate immediately showed. Thus, by adding the rarer ones heard before the FRG-7 came on the scene (some dating back to the fifties) an ATPW score now adorns the Table. On a different tack, Briant recalls that prior to the attack on the U.S. Embassy in Iran in mid-February, he heard a station calling itself "Cactus Pete" trying to contact "Lucky Debonair" as to the proposal to "land a communications satellite in the grounds of the embassy in Tehran." This was around 14345 KHz and in the afternoon. Clearly one might deduce that these two odd names were involved in the attack, since this was before the event, and equally clearly they seem to think radio amateurs in general are dim enough not to perceive the import of such traffic. They might not have rumbled it then, but they certainly do now, and we strongly suggest that if anyone hears such traffic they note (or, preferably record) the details and pass them immediately to the local police who will know how to deal with it. One can understand someone turning a blind eye to piracy, but turning a blind eye to terrorism and murder is not feasible.

Yet another one to be upset by the comic prefix scheme now being used in U.S.A. is *M. Shaw* (*Huddersfield*). One would guess that, having read thus far, Malcolm is in no doubt about J. C.'s view of that!

E. W. Robinson (*Bury St. Edmunds*) sends in his 47th entry to the Table, and indicates some degree of annoyance that he heard 601FG operating from Somalia; one of these "list" jobs, and 601FG was just calling stations and giving their reports, without once actually mentioning his own callsign; so—no claim! We agree, and most DX operators and SWLs dislike "list" efforts, but one has to admit that it does make life a little easier for the chap at the sharp-end. But we see no reason why he should reciprocate by breaking the conditions of his licence!

The letters from *D. C. Casson* (*Reading*) could almost justify a column to themselves. We think, to start, that we have sorted out the tangle at this end with the HPX. Among the prefixes, Derek mentions his pleasure at hearing VS6EZ—as he was describing his place near the China Fleet Club it brought back memories of R.N. service in 1946-7. We seem to recall that the China Fleet Club has also been Hq address for the Hong Kong amateur radio club since then; and we ended up wondering whether Derek is a member of the R.N. ARS—he ought to be!

R. Miller (*Chelmsford*) returns to the fray with an entry for the Annual. We were rather amused at his description of sitting at 199: almost netting a BY call which disappeared under heavy QRM, then tuning across to find who the offender was and find JA3CQI working a French station—both ends audible and the 200 up in an unexpected way!

Thinking on about BY2AR who disappeared before definite identification mentioned in the last paragraph, raises an interesting question in that the QRM was also from the same area as a real BY would have been: and with the amateur radio noises being made by those in authority in China that might just have been a genuine BY and hence the first such for many years.

HPX LADDER

(All-Time Post War)

SWL	PREFIXES
PHONE ONLY	
K. Kyezor (Brandon)	2043
B. Hughes (Worcester)	1770
S. Foster (Lincoln)	1744
R. Shilvock (Kingswinford)	1650
J. Fitzgerald (Gt. Missenden)	1610
R. Carter (Blackburn)	1510
E. W. Robinson (Bury St. Edmunds)	1465
M. J. Quentin (Wotton-u-Edge)	1416
M. C. P. Bennett (Datchet)	1385
H. A. Londesborough (Swanland)	1381
J. H. Sparkes (Trowbridge)	1164
H. M. Graham (Harefield)	1105
M. Rodgers (Harwood)	1046
D. Taylor (Harborne)	942
P. L. Shakespeare (Foulness)	927
M. Law (Chesterfield)	918
K. A. Burch (Plymouth)	911
B. T. Mackness (Dagenham)	881
D. Brooks (Loughborough)	837
K. Linge (Willingham)	835
M. Shaw (Huddersfield)	804
R. Towlson (Nottingham)	764
J. A. Nicol (South Croxley)	761
D. J. Byers (London N7)	758
M. Ribton (Oxted)	731
D. Hill (Crawley)	707
K. Kniveton (Kingswinford)	706
A. Twelves (Rhos-on-Sea)	698
L. Stockwell (Grays)	670
P. Leather (Camberley)	669
D. A. Robinson (Felixstowe)	646
G. Brazil (Dublin)	635
R. Jacobs (Margate)	617
D. G. Sim (Southampton)	599
D. Casson (Reading)	561
T. Anderson (Stroud)	549
B. Shepherd (Staines)	531
R. C. Mackay (New Romney)	516
Mrs. J. Brooks (Loughborough)	500
CW ONLY	
H. A. Londesborough (Swanland)	1140
D. W. Waddell (Herne Bay)	963
J. H. Rosling (Bakewell)	750
H. Scott (Wetherby)	674
P. L. Shakespeare (Foulness)	671
K. Kniveton (Kingswinford)	310
D. L. Hill (Crawley)	298

Minimum score for an entry: 500 for Phone, 200 for CW to be heard. Listings include only recent claims, and are in accordance with HPX Rules. A 'nil' return is permissible to hold a place.

Another hang-up on the Ladder is noted by the top scorer *K. Kyezor* who is now installed at *Brandon* in Suffolk, where he finds the signals are adequate from most easterly directions out to the Far East, but a lack of much activity from South America reaching his aerial—which we find a bit surprising in view of the flat countryside which we would have thought would give a clean take-off in pretty well any direction.

J. Timms is now residing on the eighth floor of a block of flats not far from the *Barking* club Hq; this has a fine take-off from north-east round to west, and the move is the result of the lad getting himself "hitched". Congratulations to John and his XYL from us all.

Perhaps the first correspondent to this column to mention it—*M. Law* (*Chesterfield*)—not only managed to hear YI1BGD but also got a caid back. On a different tack Mike questions "V2XO" which we reckon to be a phoney or a mis-hearing.

T. Anderson (*Stroud*) is still suffering from QRM from TV sets around the place. Some are worse than others, and the relative orientation of aerials and feeders is important. Some consideration to the earth for the SWL rig is worth while too, in that it is not impossible for the QRM to be coupled to the earth leg of the house mains. Now, if any of the earth to the SWL rig is common lead, then that common section will have resistance, and hence voltage drop across it when any current flows; hence if for "currents" we say "TV timebase harmonics", we can see that the earth connection to the communications receiver is going to carry the QRM sginal up to the input terminals.

The problem is alleviated by using a suitable aerial which doesn't need an earth for its operation, while the safety earth to the receiver can then be treated to make sure none of the QRM can get to the input terminals. This can be a choke-type device, but it is imperative that the resistance of the choke be very low to DC, lest the additional R be enough (added to what is already present) to inhibit the blowing of a fuse should an earth fault appear on the receiver. If one talks of 13 amp fuses, a reasonable fault current to ensure reliable blowing would be 26 amperes, which implies a *total earth resistance* (fault, plus resistance of wire, plus actual earth resistance, plus resistance of fuse, plus resistance of any choke used) of 9 ohms; and that leaves no room for manoeuvre at all. A typical station RF earth may be 30 or more ohms if it is a six-foot stake on its own with a 14/·0076 wire lead to the ATU in a ground-floor shack, which is no use at all for safety. If one is going to dispense with the house mains earth to the receiver you've got to spend a lot of time getting wire down into the ground to bring it to a low enough level. And it should be checked to see that it is capable of fuse-blowing reliably before one places faith in it. On the other hand the performance of the aerial may be much improved.

J. Stott (*Penistone*) is at the starting-gate with a "Direx" receiver by G3RJV which we ran some time ago. Past experience was with a kit, from which the component board and various bits were identifiable, but in this case there is a bag of bits to be identified. Well, we might start with the resistor colour coding. Look at the resistor so that the colour bands are nearest the left hand end: there will be seen three, four or five coloured bands, of which the first two give the first two significant figures, the third band the 'multiplier', the fourth the tolerance, and the fifth will give an indication of the other characteristics (or be missing). The fourth will also on occasion be absent, in which case the tolerance on the resistance is ± 20 per cent. Now the colours are representing numbers as follows: black = 0, brown = 1, red = 2, orange = 3, yellow = 4, green = 5, blue = 6, violet = 7, grey = 8, white = 9. The fourth band may show as silver or gold, respectively 10 and 5 per cent; closer tolerances of 2 per cent and 1 per cent are shown by giving the fourth band the standard colour of red or brown respectively. Thus a 47K resistor will be yellow, violet, orange, and if it is of 10 per cent tolerance it will be endowed with a fourth band of silver colour. From the example, the function of the third band is a multiplier—the orange band says there are three zeros after the first two significant figures. A code using the same colour-to-number significance is also on occasion to be seen on capacitors, using four, five or six coloured dots. If no tolerance is shown on an item in the circuit/component list, the widest may be assumed to be suitable—although since the semiconductor came on the scene with its built-in self-destruct habit, (plus the availability of more stable non-wirewound types), it is often the case that one can find closer tolerances costing no more.

As to where the "beehive" capacitors go, this can be deduced from a look at the circuit diagram and a bit of inductive reasoning, the more so if you accept that you are going to mount your IC's direct to the board; clearly all your bits go on the non-copper side if you are using the strip board, and as far as possible all on one side if one uses the non-copper stuff. This leaves a variable capacitor mounted to the box, and a scrap of board with most of, if not all, the rest of the bits mounted on it, saving the switches, S1 and S2 and the volume control RV1. One may go a bit further and have S1 as part of the RV1, but whichever way you do it these will be front-panel mounted items. Your bit of board can be mounted to the box with nuts and bolts (with suitable spacers of course, which can usually be found lying around the garage floor!), or if you are crude like J.C. the board is just held in place with a bit of *Blu-tack*! (The current invention in the shack is stuck to its case in the latter way, and the 'spacers' no more than matchsticks, at least until we get it "perking" as we want).

No wonder we mentioned earlier we couldn't find the first list from S. B. Harris—it was attached to the back of the letter from *R. Barker* (*Worksop*) by a misplaced paper-clip! Ron B. is ever more convinced of the improvement he has made in his RFG-7 by the modification he wrote up in July 1978 in these pages, and he would like a CW filter now—but there is a matter of RAE and Morse to be tackled meantime!

Does anyone know of a paperback or leaflet on crystal sets, wonders *J. Waters*, who lives at 33 Quarn Drive, Kedleston Road, Allestree, *Derby* DE3 2NR, and is an OAP wishing to do some experimentation with them. Contact him direct if you can help.

M. Ribton (*Oxted*) is attacking the QSL-ing game with a vengeance, having some 2500 cards to use up, but of course he has noted the snag that arises with the DX station quoting a QSL Manager who wants SAE/IRC—either you spend out on IRCs and an addressed envelope, or you find a dealer in foreign stamps with a list of what stamps are needed for the return trip from each country, so you can stamp the SAE correctly. Either way it is an expensive game, and only justifiable where a country is heard or worked which is really rare, in the sense of having no resident amateur population. In practice the return *via* the Bureau is about 65 per cent, although slow; the Editor recently got one for a QSO in 1968 from the Bureau, doubtless some DX station belatedly catching up on the chores.

L. Stockwell (*Grays*) is like to many others in hoping all is back under control again—we tell more directly by listening to the cuss-words coming through the wall!!

Work is an annoyance to an SWL says *K. Linge* (*Willington*) in the covering letter to his HPX list, and we couldn't agree more. However, we must admit that there are times when it is more interesting to read all your letters instead of fighting through a pile-up!

Finally, three letters which contained just an HPX list—these were from *M. Rodgers* (*Harwood*); a first one from *C. Stevens* (*Spondon*), and *J. H. Sparkes* of *Trowbridge*.

Deadline

Thanks to you all for so many interesting letters to mull over, and we look forward to hearing from you again by May 25, addressed as ever to "SWL", SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ. And, to be sure of reaching us in time, we recommend you get it into the post *early*. For mail going through London, it seems the service is slower now than it was 120 years ago! *Bcnu*.

ANTENNAS—THE WEAK LINK, PART VIII

TEST INSTRUMENTS

A. P. ASHTON, G3XAP

IN the earlier parts of this series we discussed the resonant antenna with its matched feeder, and looked at the method of efficiently transferring power from the transmitter to the feeder, and from the feeder to the antenna. We used terms such as 'resonant frequency', 'feed impedance' and 'standing wave ratio' and what affected these parameters. It is obvious that in order to achieve a matched system, we must be able to measure these parameters and to interpret the results. Indiscriminate use of test instruments can give rise to misleading results, and to emphasise this fact and demonstrate the possible outcome, it is proposed to commence this discussion with two examples taken from early G3XAP notebooks:—

1. An 80 metre dipole was erected at a height of 35ft. with a feeder of 75-ohm coaxial cable. The antenna was 'pruned' a few feet at a time until the SWR bridge (situated at the transmitter end of the feeder) gave a minimum reading of 1·04 : 1 at 3550 kHz.

2. A quarter wave vertical antenna was erected, and adjusted in length until a SWR of 1·10 : 1 was obtained at the desired frequency of 14050 kHz. The feeder was 50 ohm-coaxial cable.

Neither antenna appeared to function well in spite of the virtual absence of any reflected power, so the resonant frequencies were determined with a GDO. The 80 metre dipole was found to resonate around 3900 kHz whilst the vertical was resonant at about 14450 kHz. Unfortunately it was not possible to measure the apparent SWRs at the resonant frequencies of the two antennas, as this would have meant radiating 'out of band' signals in both cases. The two antennas were adjusted in length with the use of the GDO to resonate them on the desired frequencies of 3550 and 14050 kHz respectively, and the SWRs were checked at these frequencies. The measured SWRs were 1·75 : 1 for the dipole and 1·90 : 1 for the vertical—suggesting feed impedances of 43 ohms (75/1·75) and 26 ohms (50/1·90) respectively. These devices were used with these levels of SWR, and the improvement in performance was immediate on both bands.

At a much later date the two antennas were checked with a noise bridge and the results obtained were 39 ohms at a resonant frequency of 3580 kHz for the dipole, whilst the vertical gave 23 ohms at 14030 kHz. These figures not only confirm the resonant frequencies, but also show the inherent error in either the SWR bridge or the noise bridge. However, agreement in feed impedance results of around 10 per cent for the two methods of measurement is quite acceptable for amateur purposes.

The fallacy in the original method of trimming the antennas until the SWR bridge gave a very low reverse reading (*i.e.* low SWR) is quite simply that these devices are only reliable when used in conjunction with a resonant antenna. The presence of reactance can distort SWR readings badly, as was seen in the examples above.

Hopefully the reader will now understand why readings obtained with test instruments will only be meaningful if all the conditions governing the use of the device have been met. (An antenna at or near resonance in the case of the SWR bridge). During the discussion on each instrument its limitations will be indicated, together with any precautions that need to be taken in order to obtain useful results. The devices are not listed in any order of priority or importance.

The Field Strength Meter

This simple device, shown in Fig. 1, measures relative levels of RF radiation. The radiation picked up on its associated 'pick-up' antenna is rectified, the magnitude of the rectified current being indicated by the meter. The author uses this device in its simplest form—that is, with a simple untuned input (tunable devices are available which enable the pick-up antenna to be tuned to the frequency of the radiation which is being measured). The advantage of this is that by tuning the device to harmonics of the transmitter, a rough idea of the level of harmonic radiation can be obtained (or the level of any *spurii* for that matter). It should be recognised, however, that the response of the meter is frequency conscious—*i.e.* a reading of exactly half scale on 3·5 MHz, for example, does not indicate the same power radiated as an identical scale reading on, say, 14 MHz.

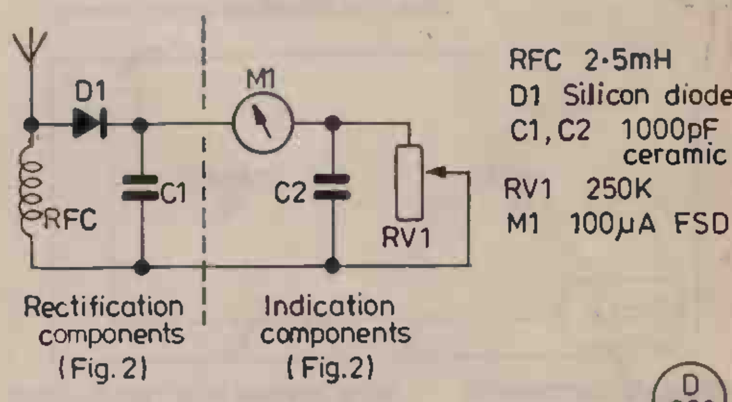


Fig. 1 The Field Strength Meter

The field strength meter is a useful device if used correctly, but there are pitfalls. Firstly, the pick-up antenna should be located at least one wavelength from the antenna being investigated, and ideally should be similarly remote from both the feeder and the transmitter. Many amateurs have a field strength meter and whip antenna located in the shack, and they tune the transmitter plus antenna matching unit for maximum field strength indication. This practice can give rise to meaningless results—for example we could be simply tuning the matching unit in such a way that its coil is acting as an antenna; the radiation from it is probably close enough to the field strength meter to completely override any radiation reaching it from the true transmitting antenna!

Similarly, if a horizontal antenna is being adjusted to give maximum radiated power, and the field strength is being picked up on a vertical pick-up antenna, it is possible that radiation from the feeder (if it is suspended vertically from the antenna) can override horizontally polarised radiation from the antenna itself. A further source of trouble concerns the fact that if the end of an antenna is trimmed in the process of adjustment, the point of maximum current (*i.e.* maximum radiation) is moved toward the feed point (current antinodes are a quarter-wave from the end of the antenna). If the field strength meter's pick-up antenna is poorly located, this point of 'maximum radiation' could be moving closer to it, giving the possibly erroneous impression that more power is being radiated from the transmitting antenna!

The field strength meter is, therefore, not ideally suited to the purpose of monitoring radiated field strength if the antenna's length is being adjusted but, for a given antenna, it is a very useful device when adjusting such items as antenna matching units, etc. The most important point to bear in mind when monitoring radiation from an antenna is the placement of the pick-up antenna in relation to the transmitting antenna, the feeder, the transmitter, and in some cases radials used with verticals.

Obviously, on bands such as 160, 80 and 40 metres, it is rarely possible to mount the pick-up antenna a wavelength away from the antenna, so location must be closer and a compromise exists. At G3XAP the pick-up antenna (untuned) is located at the furthest corner of the garden from the shack (and hence feeders), and a buried cable carries the rectified DC into the shack where the meter and potentiometers are located, *see* Fig. 2.

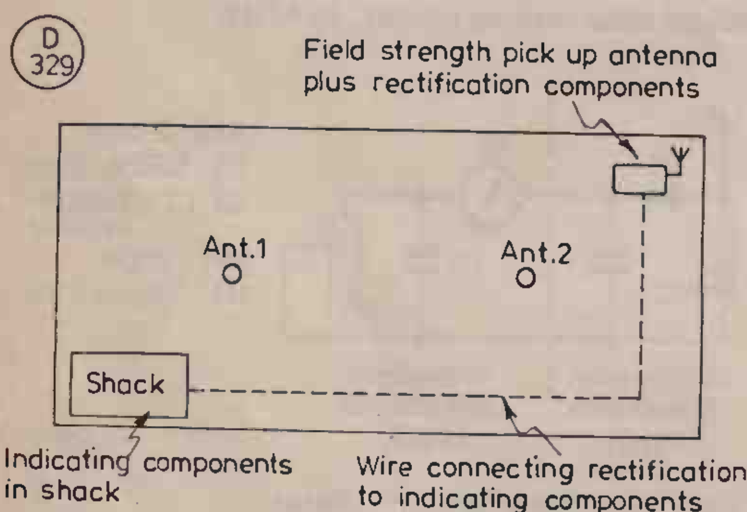


Fig. 2 Location of F S. Meter components at G3XAP

The meter used is a 6in. by 2in. device with a 50μA movement which gives adequate indication—even with 9 watts input on 1·8 MHz. Less sensitive meters can be used with simple DC amplifiers—Fig. 3. It should be noted that if it is intended to mount a remote pick-up antenna and connect it to a field strength meter in the shack with coaxial cable, then unless the pick-up antenna is resonant and matched to the coaxial cable, standing waves will be present and the outside surface of the cable will act as a pick-up antenna itself! In order to ensure that the pick-up antenna at G3XAP has the correct polarisation, the device used is "three-dimensional", with two horizontal rods at 90° to each other and a vertical rod—all three rods being connected together at the point of entry into the box holding the rectification components (Fig. 4).

The device is used almost soley as a check that the transmitting antenna in use is radiating as it should, and for the adjustment of antenna matching units, and has proven invaluable as an ever-present monitor to show that all is as it should be.

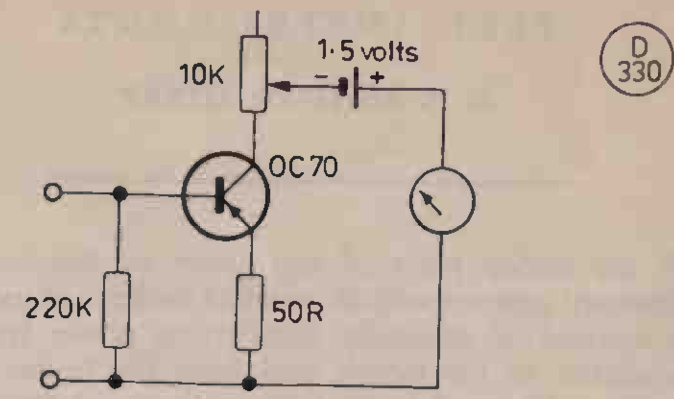


Fig.3 Simple amplifier for increasing sensitivity of Field Strength Meter

The Grid Dip Oscillator

It is not proposed to provide a circuit diagram for this device as numerous examples have appeared in just about every magazine concerned with Amateur Radio—including of course, *Short Wave Magazine*. The author has found the fully portable transistorised devices to be invaluable for antenna work—the mains lead associated with the older valve models being rather impractical.

Basically the instrument relies on the fact that if a source of RF energy is coupled to a tuned circuit, the circuit will draw energy from the source when the source is tuned to the circuit's resonant frequency. An antenna can be considered as an electrical circuit—it displays inductance and capacitance and, therefore, has a resonant frequency. Hence if we couple a GDO to it, it will draw energy from the GDO when the latter is tuned to the antenna's resonant frequency—this being indicated by a "dip" on the GDO's meter. (The device as originally designed had this meter in the grid of the valve: hence the name *Grid* Dip Oscillator). There have been statements made in amateur radio circles to the effect that a GDO does not work with some antennas, *e.g.* the cubical quad. However, the author has checked the resonant frequencies of numerous antenna types with a GDO, and has not encountered any problems, and therefore feels that the absence of a "dip" probably results from the instrument has not being suitably coupled to the antenna in question.

Coupling the GDO to the antenna is a very important point: too loose coupling results in a very shallow dip that can be easily missed, whilst too tight coupling causes erratic dips—with critical tuning of the device—and can result in "pulling" the GDO's frequency. The

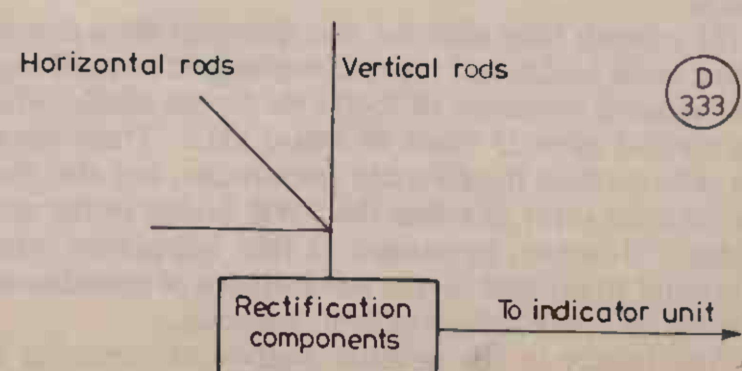


Fig. 4 The "3-Dimensional" pick up antenna used at G3XAP

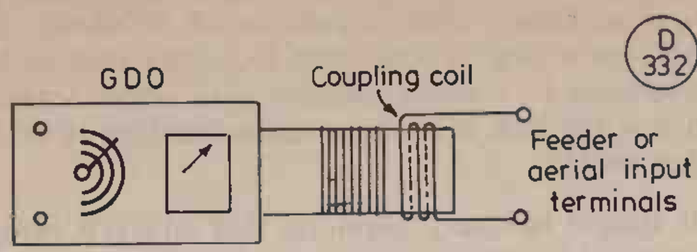


Fig. 5 Coupling GDO to the antenna or feeder

frequency reading on the GDO itself should not be relied on for accurate results—the RF from the GDO should be monitored on a receiver, and the frequency determined from the receiver's calibration. It should be noted that few GDOs have "backlash free" tuning mechanisms and a measurement should be repeated three, or preferably four or five times, and the average result determined (it is unlikely that repeat measurements will give identical results). An example of readings obtained at G3XAP on a 7 MHz vertical antenna is: 7022, 7028, 7009, 7027 and 7019 kHz. The 7009 kHz result was regarded as being anomalous, the average of the other four readings being taken as the resonant frequency, that is 7024 kHz.

The most accurate results are obtained by coupling to the antenna at the feed point, but although this technique is simple with base-fed verticals, it can be very difficult in the case of, say, a dipole erected 50ft. from the ground. It is possible to couple the GDO to the input end of the feeder and obtain a dip in this manner, but there are dangers in this approach, as the feeder itself can show resonances at or near the frequency of interest, and such dips can mask the antenna's resonance. The practice used at G3XAP is to install the feeder on its own and note the frequencies at which dips occur—these can then be recognised as being caused by the feeder when the test is repeated with the antenna in position. Readers will doubtless query how it is possible to have a feeder mounted without an antenna to "hang it on". In the case of dipoles the author uses polythene rope as a 'synthetic' antenna, attaches the feeder to it and pulls the 'antenna' plus feeder into position. It has often been found (especially on the higher frequencies) that the feeder will dip very close to the frequency that the antenna is designed for—in such cases the feeder's length should be altered, because in addition to masking the antenna's dip, such 'line resonances' can cause severe problems with coupling the transmitter to the feeder.

The actual coupling of the GDO to the antenna or feeder is easily achieved by using a coupling coil, this consisting of one or two turns of wire, the ends of which are temporarily connected to the feeder/antenna. The coil's diameter should be such that the GDO coil will just fit inside it (Fig. 5). It should be noted that with measurements made at the antenna itself, the presence of this inductance across the input terminals of the attenna will 'detune' the antenna to a lower frequency, and a single turn coil with very short leads should be used. At the lower frequencies, the error caused will obviously be much smaller, but even here very large coupling coils can give rise to significant errors, so multi-turn coils must be avoided. Such errors do not occur if the antenna is dipped 'through the feeder'.

It will be found helpful to place the GDO on a suitable, steady object whilst measurements are being made: slight movements of the device whilst tuning it can give rise to sudden, erratic movements of the meter needle, causing confusion. The GDO should first be tuned with its coil right inside the coupling coil (as shown in Fig. 5) in order to find the approximate frequency of the dip. The GDO coil should then be withdrawn slightly and the dip again found—this process being repeated until the dip from full scale deflection on the meter is about 10 to 15 per cent, thus ensuring that the GDO is not being 'pulled' by the antenna.

SWR Bridge

This device is probably the best-known piece of antenna test equipment, but is also one of the most misused. It relies on the fact that if a feeder is not correctly matched to the antenna, not all of the power put into the feeder is radiated by the antenna—some of it is reflected back down the feeder towards the transmitter. The percentage of power which is thus reflected increases as the degree of mismatch increases.

Most SWR bridges consist of a 'sampling line' which is placed parallell to the feeder enabling a current to be induced into it from the feeder itself. Diodes are used to rectify this current and, since current can only flow through a diode in one direction, by suitable orientation of the diode's anode and cathode, we can rectify either the forward current induced from the feeder, or the reverse current. As with the GDO, there are so many circuits available for SWR bridges that it is not proposed to include one here; however, there is another type of bridge available, namely the Resistance SWR bridge, the circuit of which is shown in Fig. 6, and it will be noted that in this instrument the whole of the power in the feeder passes through the resistor R_x. Clearly, excessive power will result in an increase in temperature

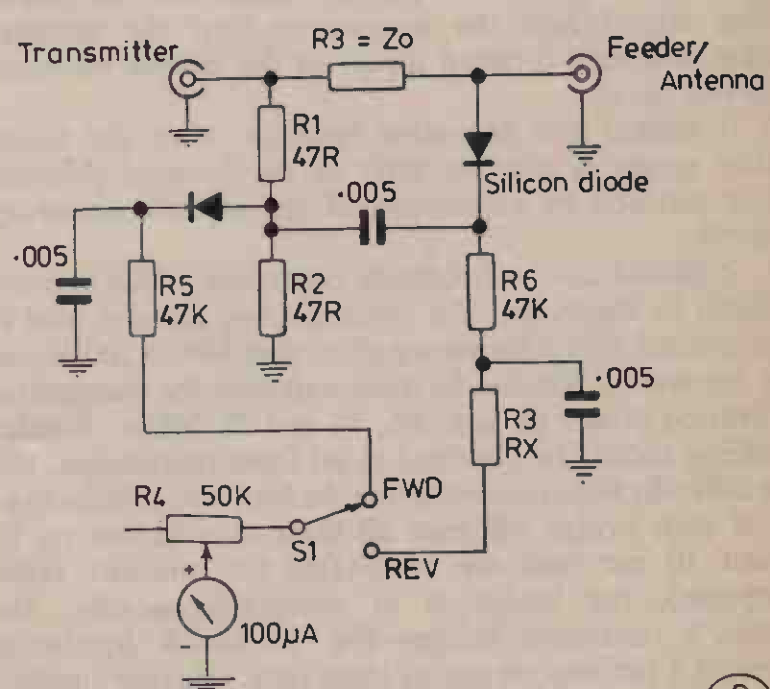


Fig. 6 The Resistance SWR Bridge

Fig. 6 Rx is a small 'correction' resistor; bridge meter should give same forward and reverse readings if power is applied with no feeder/antenna connected to output socket.

(In the G3XAP bridge, Rx =470 ohms)

of this component, followed by a consequent change in its resistance. However, the author has found that by using very low power, a very sensitive meter and a large wattage resistor, R_x, the results obtained from this device appear to be more accurate than from the more common 'coupled line' type of bridge.

The method of usage of either type of bridge is to insert it in the feeder, switch on the transmitter and adjust the sensitivity of the instrument to enable forward and reverse currents to be read from the meter. The calculation of SWR from these readings is from the formula:

$$\frac{I_F + I_R}{I_F - I_R},$$

where I_F is the meter reading in the forward position, and I_R is the reflected current reading.

By adjusting the sensitivity of the instrument and/or the transmitter's power output to give full-scale deflection with the instrument in the 'forward' position, the scale can be directly calibrated in SWR—this value being read off the scale with the instrument switched to the 'reverse' position. Most commercially built instruments have scales calibrated in this manner, although a great many of them are highly inaccurate (both commercial and home-brew!) when it comes to reading true SWR values greater than 1 : 1. Even simple devices will show the absence of reflected power when a feeder is perfectly matched, but few devices are accurate in any other condition, and over-emphasis of results should be avoided. It is common practice to quote SWRs to two decimal places (the author is guilty of this) but it is debatable whether even the first decimal place is accurate!

Checking the accuracy of a bridge is simple as it should comply with the following conditions:—

(*a*) It should give the same readings if the input and output are reversed—*i.e.* put the feeder into the transmitter socket and the transmitter into the antenna socket and read forward power in the reverse position, and *vice versa*.

(*b*) It should give the same readings when the transmitter power is altered: FSD in the forward position being restored by adjustment of the meter's sensitivity control.

(*c*) It should not be frequency conscious. This is more difficult to check, but if a non-inductive dummy load is constructed with a resistance of around 100 to 200 ohms, the apparent SWR can be measured with the transmitter delivering power at, say, 3·5, 14 and 28 MHz. Similar readings should be obtained at all three frequencies, but the difficulty lies in ensuring that the load is non-inductive!

If your bridge will pass all three tests (errors up to about 10 per cent are acceptable for amateur radio purposes), the bridge is of acceptable quality; the author's resistance bridge—Fig. 6—has a maximum error of 4 per cent on any of these tests. Having checked the accuracy of the device the next step is to consider how it should be used. The two examples quoted earlier show the most common *mistake* made with SWR bridges, as they are inherently inaccurate in a non-resistive feed situation (*i.e.* non-resonant antenna); from our study of antennas so far, we should not expect a 3·5 MHz dipole at 35ft. to have a feed impedance of 75 ohms, and we should not expect a quarter-wave vertical to have a feed impedance of 50 ohms. (The author was wrong in both cases to assume that an SWR approaching 1 : 1 was attainable with either antenna—such was the lack of antenna understanding at G3XAP at that time!).

It should be clear, therefore, that an SWR bridge is not a suitable instrument for establishing resonance in most cases—its true purpose is to give an idea of the degree of mismatch present when we connect a feeder to an antenna which is at or near to resonance, and also as an aid in adjusting antenna matching units. Provided that the antenna is resonant, the author will accept an SWR of up to about 2·5 : 1, but will not accept an indicated SWR of 2·5 : 1 with a reactive system. (Indeed, in working VK6MD on 1·8 MHz CW with 9 watts DC input, the antenna was resonant, but the SWR on the feeder was well over 2 : 1!).

Having resonated our antenna and checked the SWR on the feeder, we can now calculate the feed impedance from the formula:—

Antenna Feed Impedance = SWR × Feeder Characteristic Impedance.

or

$$\text{Antenna Feed Impedance} = \frac{\text{Feeder Characteristic Impedance}}{\text{SWR}}$$

Hence we have two possible answers and although it is sometimes possible to deduce which one is correct, this is not always the case. It is useful, however, to know which is correct, because we may be deciding upon using some form of impedance matching device such as an 'L' network. There are various forms of impedance measuring equipment available, but the author has found the 'Antennascope' to be the most versatile.

The Antennascope

The circuit for the antennascope is shown in Fig. 7, and this instrument relies on the fact that when the potentiometer is adjusted to give the same resistance as the feed impedance of the antenna under test, the bridge is in a balanced state and the meter will read zero. How-

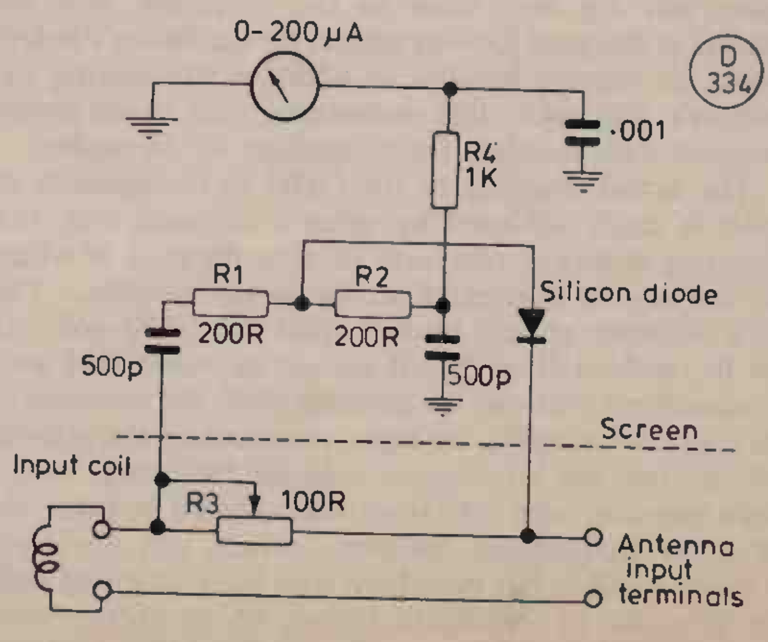


Fig. 7 The Antennascope

ever, a complete null will only occur when the source of excitation is at the resonant frequency of the antenna, *i.e.* there is a purely resistive load. A GDO is normally used as the source of excitation, and the method of usage is as follows:

(*a*) Connect the test clips to the antenna's input terminals.

(*b*) Insert the GDO coil into the input coil.

(*c*) Tune the GDO for a dip.

(*d*) Adjust the antennascope's potentiometer for a null on the antennascope meter.

(*e*) If the null is not quite at zero, repeat (*c*) and (*d*) until the best null is obtained.

We have now measured both the resonant frequency of the antenna and its feed impedance. In cases where the feed point of the antenna cannot be reached, a length of feeder that is an exact multiple of a half-wave can be connected to the antenna's feed point and the antennascope's test clips connected to the other end of the feeder. (For a balanced antenna, 300 ohm twin feeder is best suited for this purpose). The potentiometer R_3 must be a high quality carbon device, and is the 'weak link' in the instrument—just about every potentiometer displays both inductance and capacitance, and this tends to limit the upper frequency at which the bridge is useful. (The one finally used by the author is actually a 150 ohm device of unknown origin). The method of testing the instrument is to clip carbon resistors of known value between the test clips and check the antennascope readings with the GDO tuned to, say, 3·5 and 30 MHz. If a non-inductive resistor is used, the meter should give a complete null at the same setting of the potentiometer at both frequencies—serious differences (above 10 per cent) indicating a frequency-conscious potentiometer.

Other Measurements

With a good quality example of each of the four test instruments discussed above, we are in a position to carry out just about any measurement that may be necessary in order to resonate our antenna and match it to its feeder—the obvious exception being the measurement of actual values of reactance. With a matched system it is possible to switch from the dummy load to the antenna, or from one antenna to another with absolutely no re-adjustment of the transmitter at all. If this can be done, the indications are that all is as it should be, but it gives added confidence when it is possible to use two different instruments and get virtually identical results. The last antenna to be adjusted at G3XAP was an inverted-L for 80 metres, and the following results were obtained:—

(*a*) Resonant frequency with GDO: 3·520 MHz.

(*b*) SWR at 3·520 MHz: 1·5 : 1 (50 ohm bridge and feeder).

(*c*) Feed Impedance calculated from SWR: 33 ohms.

(*d*) Feed Impedance with Noise Bridge: 30 ohms.

(*e*) Resonant frequency with Noise Bridge: 3·530 MHz.

(*f*) Feed Impedance with Antennascope: 34 ohms.

The antenna consisted of 40ft. of vertical tubing with an approximately 30ft. top section and had four resonant quarter-wave radials. The first QSO was with a W8 station, a 589 report being received with 150 watts DC input.

In spite of the above results, there are other measurements which it is useful to be able to carry out, and these include the detection of standing waves on twin feeders, the accurate measurement of quarter and half-wavelengths of feeders for impedance matching applications and the detection and measurement of feeder losses.

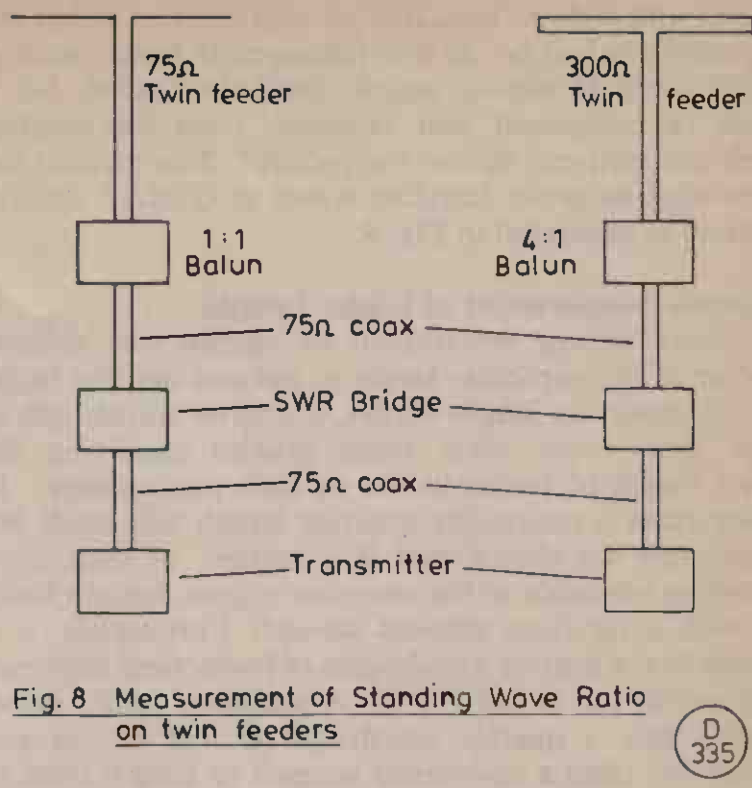


Fig. 8 Measurement of Standing Wave Ratio on twin feeders

Standing Waves on Balanced Feeders

If the antenna is resonant, and the feeder is either 75 or 300 ohm, the measurement of SWR is simply achieved by inserting either a 1 : 1 or a 4 : 1 balun in the feeder, hence enabling us to connect a 75 ohm coaxial feeder in which we insert out 75 ohm SWR bridge, *see* Fig. 8. (Details of suitable baluns were given in *Part VII* of this series). However, it should be realised that such measurements are less accurate than in the simple case of the antenna fed directly with coaxial cable because (*a*) twin feeders always carry currents induced onto them by radiation from the antenna itself—these currents can pass through the balun and seriously effect the operation of the SWR bridge, and (*b*) no balun is perfect—*i.e.* the ratio of forward to reverse current can be altered by the action of these devices, but this is likely to be troublesome only with relatively high standing wave ratios. However, the absence of reflected current as seen by the bridge can indicate a good match, whereas the numerical value of SWRs above 1 : 1 can be prone to large errors.

With open-wire lines, the situation is somewhat more complex as a balun of some other ratio will be necessary to match into either 50 or 75 ohm coaxial cable. However, as explained in the article on feeders, the presence of standing waves on open-wire feeders causes very small losses even with very high levels of SWR. Standing waves can be detected by running a small neon tube along one of the feeder conductors while the feeder/antenna is receiving power from the transmitter: if the distance of the neon from the feeder is kept constant, the presence of standing waves will cause the brightness of the neon to vary as it is moved along the feeder-points of maximum brightness occurring every half wavelength along the line.

A more elegant method is to use a Field Strength

Meter with a short, insulated pick-up antenna which can accurately be laid on the wire (comparison meter readings being taken at various points along the feeder), but it must be recognised that radiation from the antenna itself can seriously distort the picture! This method has been used to detect standing waves at G3XAP and the method is illustrated in Fig. 9.

Accurate Measurement of Feeder Lengths

Many writers are content to assume the Velocity Factor of the particular feeder in use and use this factor to determine the length of, say, a quarter wavelength of that feeder—one often reads articles specifying the exact length of feeder to use in such applications. In many cases a reasonably accurate length will result but experience has shown that if a number of such compromises are made in the complete system, we can finish up with a far from efficient set-up! Fortunately, it is simple to cut quarter wavelengths of feeder (and multiples thereof) by use of our GDO. A section of feeder rather longer than a quarter wavelength should be cut and suspended from a convenient support to keep it clear of influencing metallic objects. The two conductors at the lower end of the feeder should be temporarily connected together through a one-turn coil and the GDO coupled to this coil. The GDO can now be tuned for a dip as described earlier, and the feeder length adjusted until the dip occurs at the desired frequency—the feeder is now a quarter wave long *at the frequency of the dip.* Other lengths can now be determined by measurement of the physical length of the quarter wave section.

Measurement of Feeder Losses

The loss in a feeder at a particular frequency can be determined by use of the SWR bridge. Let us assume that we wish to use a certain length of coaxial feeder to feed an antenna for 28 MHz, for example. If we short-out the two conductors at one end of the feeder and connect a transmitter to the other end, the SWR on the feeder should be infinite because the feed impedance of the 'antenna' (dead short) at its end is zero (Fig. 10). If we measure the SWR on the feeder in this condition, the reflected power should be identical to the forward power, assuming that the feeder has no losses. Obviously if the feeder has losses, not all of the power supplied to it will return to the transmitter, and from the SWR measured

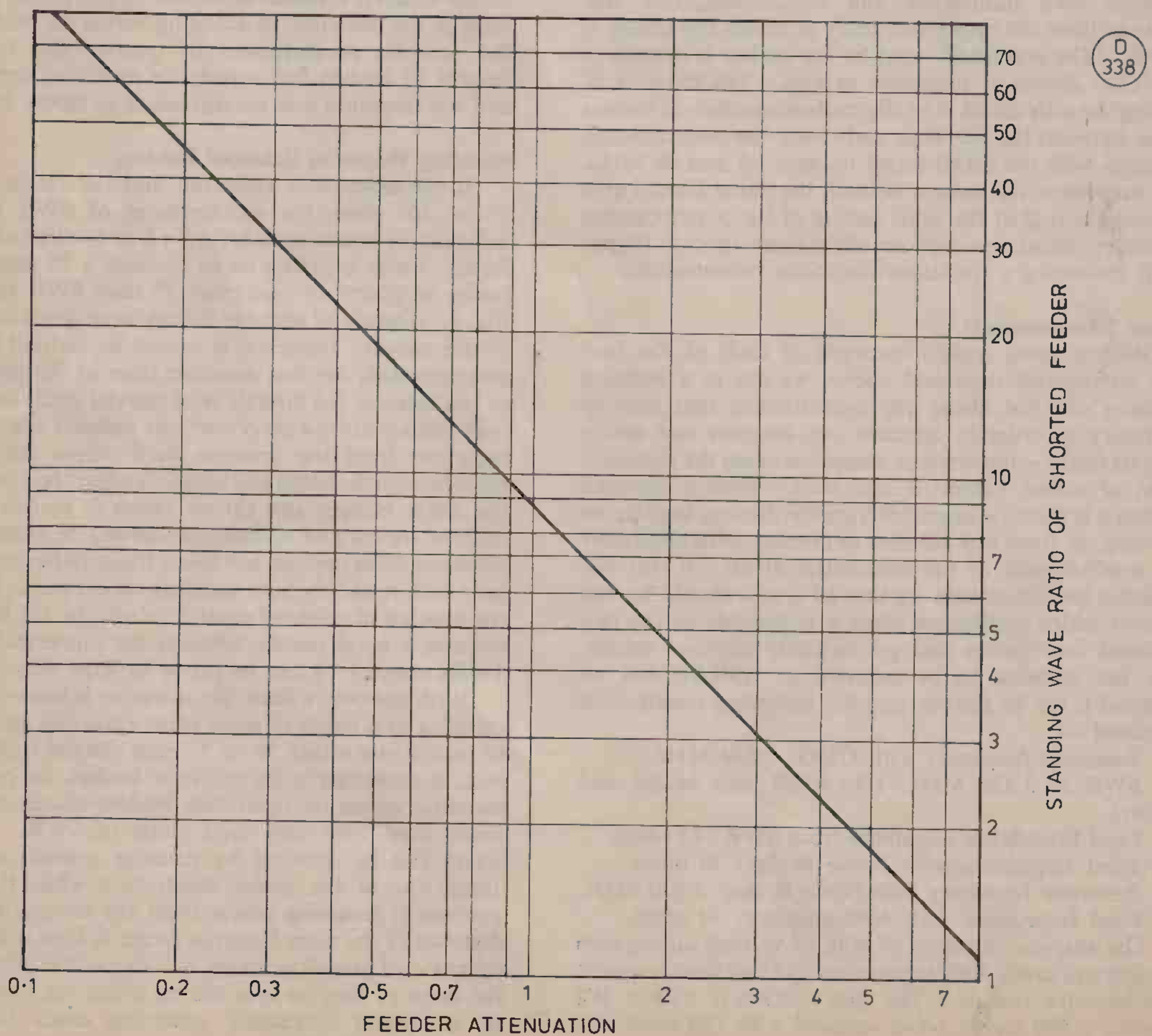


Fig.11 GRAPH FOR COMPUTING FEEDER ATTENUATION AFTER MEASUREMENT OF SWR ON SHORTED FEEDER

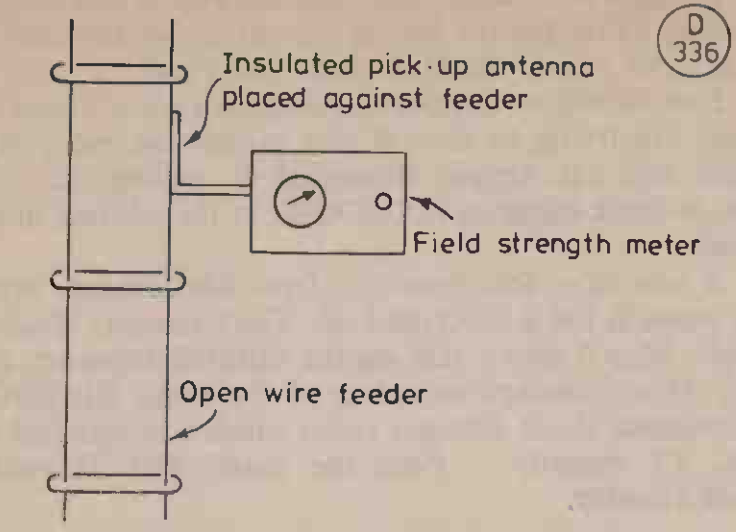


Fig. 9 Detection of Standing Waves on Open wire feeders

in the test we can determine the feeder loss by reference to Fig. 11. *Needless to say, the transmitter should be run at very low power for this test or the PA stage could be damaged.*

It should be realised from the comments made earlier on SWR bridges that the average bridge may give erroneous results, and so again the author must advise the use of a resistance-type bridge rather than the more common 'coupled line' type if accurate results are required. (Regular users of 28 MHz and the VHF bands may have an unpleasant shock if they subject their feeders to this test!). Note that the attenuation figure determined by this test only applies when the SWR is 1 : 1; the presence of standing waves will increase the losses—the higher the SWR, the higher the total losses.

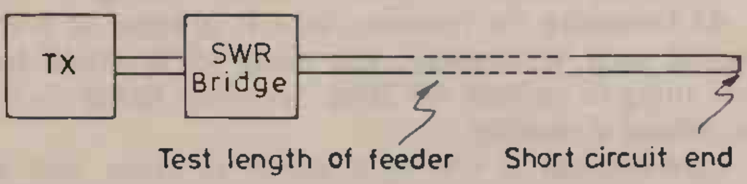


Fig. 10 System for measuring Attenuation of coaxial feeders

Summary

Only when an operator has made measurements with reliable instruments can he be assured that his system is operating efficiently. The peace of mind that results from operating such a matched system has to be experienced to be appreciated. In the very first section of *Part I* of this series we said that we would not operate a receiver which we had just constructed without testing and aligning it, and the same should be true of our antenna. The instruments described above enable us to tune and align our antenna system, and the improvement in performance that can result from such an exercise can be very great indeed. We are now in a position to be able to build and tune our own antenna system, and the next article will therefore deal with planning, construction, erection and tuning.

to be continued

CLUBS ROUNDUP

By *"Club Secretary"*

Every month the pile gets fatter! Let's start at **Acton, Brentford & Chiswick**; a General Discussion, on Tuesday May 15, at Chiswick Trades & Social Club, 66 High Road, Chiswick, London W4.

Addiscombe are a mainly contest group; they are at the Spread Eagle, Portland Road, South Norwood, on Tuesdays starting around 2115.

AMSAT-UK is the British arm of the worldwide organisation which defines and creates OSCAR—details from the Hon. Sec., *see* Panel.

A.R.M.S. is the one for the /M enthusiasts, in whatever part of the world they may be—details from the Hon. Sec. at the address in the Panel.

Next we head for **Ashford**, in Kent, where the Hq. address is Top of Hart Hill, near Charing, where the group foregather every Tuesday evening.

For **Barking** the venue is Westbury Recreation Centre, Westbury School, Ripple Road, Barking; we understand that they are there regularly on Thursdays, but that there is also a Morse class on Tuesdays at the same place.

B.A.R.T.G.: here the basic qualification is to have a teleprinter in the shack and tied to the receiver, or the station if you have a transmitting ticket.

Yet another of the nationals now; this time its **B.A.T.C.**, who are the amateur television chaps, be they fast-scan or slow-scan types, B/W or colour. Details are available from the Hon. Sec.—*see* Panel.

Bishops Stortford seem to be on the upswing now, with attendances on the third Monday in each month rising and a programme fairly well settled for the year. The venue is the British Legion Club at the top of Windhill.

Bournemouth may be found on the first and third Fridays in each month at the Dolphin Hotel, Holdenhurst Road, Bournemouth.

For all the details of the **British Rail** group, we must refer you to the Hon. Sec.—*see* Panel.

At **Bury** we find them at the Mosses Community Centre, Cecil Street, Bury on the second Tuesday every month.

Another group where things seem to be on the upswing is at **Cheltenham**; the Old Bakery, Chester Walk, at the rear of the Public Library, Thursday May 3, and Friday May 18.

Chester have just had their AGM at which G3EWZ, who served them well as chairman for year, was elected President. They have a wide-ranging programme in the pot for the Tuesday evening sessions at Chester YMCA. However, remember that they *miss the first Tuesday* in each month.

Cheshunt can be found at Cheshunt Church Room, Church Lane, Wormley, every Wednesday.

It is the first Tuesday and the third Thursday in each month for **Chichester**, and their Hq. is at Room 34A, Lancastrian Wing, Chichester High School for Boys, in Basin Road.

On we go to **Chiltern,** where there will be a meeting on the last Wednesday of May at the John Hawkins furniture factory, Victoria Street, High Wycombe; this is off West Wycombe Road which is a part of the A40. There are noises in the current newsletter about a club shack which may indicate a change is in view, or it may be in addition to the regular formal sessions.

The Liberal Club, 20 Gladstone Road, is home to the **Chippingham** lads; they are booked in for every Tuesday evening.

Down away in the West Country, we find Camborne and then Pool, where the SWEB Clubroom is home to the **Cornish** group—and we never cease to be amazed at the sort of attendances recorded there.

Now **Crawley,** where you have to find Trinity Church Hall, Ifield, on the second and fourth Wednesday. If you intend to look them up, we suggest you contact the Hon. Sec. first, as we believe one of the meetings is held in members' homes.

Cray Valley are booked to meet in Christchurch Centre, High Street, Eltham on the first and third Thursdays of each month; normally a talk or whatever on the first date, and a natter on the other one.

Crystal Palace have a "main" meeting at Emmanuel Church Hall, Barry Road, London SE22 on the third Saturday evening each month. In addition, there is a gathering at the home of one or other of the members on the first Tuesday evening each month.

Although the programme is nominally the first and third Fridays at the Scout Hut in Broomhill Road, Dartford, check with the Hon. Sec. of **Dartford Heath D/F** first, lest you arrive and find they are off on a hunt.

119 Green Lane is the address of the **Derby** club Hq., and they are there, on the top floor, every Wednesday evening, and usually with something interesting to do.

May 10 and 24 it is at **Edgware;** on the former date G3GC and G3SJE explain contest operating techniques, and the other meeting is for the constructors contest. As for the venue, Watling Community Centre it is, at 145 Orange Hill Road, Burnt Oak.

Exeter provide us with a doubt as to the venue, which we think to be the Community Centre, St. David's Hill on the second Monday. We could also do with an up-date as to who is now doing the chores of Hon. Sec. Our contact is in the Panel.

Next we come to the **G-QRP Club,** and clearly the reverend gentleman who started this one is a real whiz-kid, with a membership of upwards of 400 and the QRP game of low-power operating turned almost into a cult. Mostly we think the attraction is in the 'doing it the hard way' line, also the club newsletter, which always seems to have something of interest to build—sometimes a little gadget, sometimes a full-blown transmitter or transceiver. All the details from the Hon. Sec., *see* Panel.

Every time we type out the address of the **Hereford** group we get a shudder down the spine—Civil Defence Hq., Gaol Street. Find this very successful gang on the first and third Friday evenings.

Should you be in the EI part of Ireland, you can get to know most of what goes on by getting into contact with **IRTS Region 1;** we understand they are based on 91 Lower Baggot Street, but we recommend getting in touch with the Hon. Sec. first if you are not near to Dublin. His address will be found in the Panel.

Loughor is Swansea way, and the Hq. is at Loughor Boating Club; for the rest of the details on this one we must refer you to the Hon. Sec.—*see* Panel.

Last month we mentioned **Lough** as a place where the locals are trying to form a new group—we mention it again, and ask anyone interested to contact the chap who is spark-plugging it, G8OOW, at the address in the Panel.

A new Hon. Sec. reports in from **Maidenhead,** where the venue is the Red Cross Hall, The Crescent, Maidenhead. May 3 sees a talk on the GB3HR repeater, and May 15 a videotape recording of the Brian Rix/RSGB programme about amateur radio which was radiated by BBC TV recently. Note the dates: first Thursday, third Tuesday.

Deadlines for "Clubs" for the next three months—
(June/July issue—May 25th)
August issue—June 29th
September issue—July 27th
October issue—August 31st
Please be sure to note these dates!

Melton Mowbray meet at the St. John Ambulance Hall, Asfordby Hill, Melton Mowbray on the third Friday in each month with a full programme of events mapped out.

The scribe at **Milton Keynes** is organised—he has some blank sheets pre-printed with the vital data, and with a space for the current activity. Thus, we see that on May 14 they will be at Lovat Hall, Newport Pagnell for a talk on Radio and TV Interference.

The British Sub-Aqua Club, Mountain, Queensbury provide the venue for **Northern Heights,** where the Halifax gang foregather every Tuesday evening.

At **Ormskirk** the members take it in turns to host a meeting each Wednesday; this being so, it would be a good thing to contact the Hon. Sec.—*see* Panel—before you attend a meeting.

Peterborough is one of a group of clubs who are co-operating to improve the programme for all (clubs in March, Peterborough, Spalding and Stamford; we hope this effort will increase the amateur radio population of East Anglia quite a bit. Back to Peterborough; they have the third Friday at the Scout Hut, Occupation Road, Peterborough.

If you know of anyone who is handicapped or blind, and would be interested in SWL or license, you would be doing them a favour by getting them into **R.A.I.B.C.;** and while we are at it we could add that we would like to see every reader in U.K. becoming at least a supporter by way of a sub! Details from the Hon. Sec.—*see* Panel.

Reigate next; they live at the Constitutional Centre, Warwick Road, Redhill on the third Tuesday each month.

If you served in the Royal Navy or its reserves, or the merchant navy, or a foreign navy, you are eligible for one or another grade of membership of the **Royal Navy** club. Contact the Hon. Sec. for details, and if you are near London don't forget there is a regular group based on *HMS Belfast* opposite the Tower.

Saltash have their base, we believe, on Burraton

Toc H, but we feel it would be best for you to contact the Hon. Sec.—*see* Panel—to find out the current state of play.

No such doubt about **Silverthorn**: they are to be found every Friday at Friday Hill House, Simmons Lane, Chingford, London E4.

Back to the Midlands now and **Solihull**. They foregather on the third Tuesday in the month at Manor House, High Street, Solihull.

Just up the road, as it were, is **South Birmingham**, where the venue is Hampstead House, Fairfax Road, West Heath. The 'official' meeting is on the first Wednesday in the month, but in addition they are on the air from the club every Thursday evening, and on every Friday there is an open evening. There are also club nets on Top Band, Two metres and 70 cms. On Two metres there are also slow Morse transmissions made for an hour on Sunday mornings and Thursday evenings.

Southdown usually send us in a pre-printed form with all the gen on it; the fact that it doesn't seem to have arrived this time probably means it's sitting in some London sorting office. However, we can tell you that they are based on Chaseley Home, South Cliff, Eastbourne, on the first Monday of each month.

Our letter from **Southgate** tells us that the place to look for is the Scout Hut, Wilson Street, Winchmore Hill—and if you can find Winchmore Hill Green, you aren't a hundred miles away! They are booked for the second Thursday of each month.

Our next port of call is **Stevenage**. The base here is the Senior Staff canteen, British Aerospace Dynamics Gunnels Wood Road, Stevenage. The club bookings

Names and Addresses of Club Secretaries reporting in this issue:

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YEOVIL: D. L. McLean, G3NOF, 9 Cedar Grove, Yeovil.
YORK: K. R. Cass, G8WVO, 4 Heworth Village, York.

are for the first and third Thursdays.

If we read the **Worcester** group newsletter aright, there will be no meeting in May—which leads us to think it would be a good idea to confirm that with the Hon. Sec. in case they have fixed up some alternative.

Neachells Cottage, Stockwell End, Tettenhall, is the Hq. of the **Wolverhampton** gang, and it is here they will be found on Monday evenings.

At the West Kirby end of the Wirral peninsula there lives a club called Wirral (West Kirby); they are at the Sports Concourse, West Kirby, on the second and fourth Wednesdays.

Yeovil have an unusual sort of address, namely **Hut** 101, Houndstone Camp, Yeovil, every Thursday. For more details, contact the Hon. Sec.—*see* Panel.

A humorous touch appears in the letter from **York,** where it is mentioned that there is to be a Junk Sale and a home-brew night, the two events to be kept separate 'for obvious reasons'! The gang are at the United Services Club, 61 Micklegate, York, every Friday evening except for the third one in each month.

Now for **Surrey** where the routine is to get together on the first and third Wednesdays, at *T.S. Terra Nova*, 34 The Waldrons, South Croydon.

A puzzle for us with the **Sutton & Cheam** data—they forget to mention which meeting goes where! However, if past form is anything to go by, Friday, May 18 will see the talk on RTTY at Sutton College of Liberal Arts, while May 30 sees a talk on the FT901 and the ICOM 701, given by the proud owners, G3MES and G8DF, which we guess to be at Rays Social Club. However, check with the Hon. Sec. first about the venues.

Another **Swansea** group now; this one is at Sketty Park Sports & Social Club, Aneurin Way, Sketty Park, Swansea, on alternate Tuesdays.

Zooming back to the London area, we come to **Thames Valley,** at Giggs Hill Green Library, Thames Ditton, and note in addition that there is a booking for the first Tuesday in each month.

It seems odd not to see the signature of G4DUS at the bottom of the letter from **Verulam;** and more so in that we have to refer you to the Hon. Sec. for the details about May 24's talk on Microphones by Adrian Bilton. The difficulty arises from the fact that they hope to be in their new Hq., Gardenfields Centre, St. Catherine Street, St. Albans by then—but hope and certainty aren't always the same thing! As for informals, from May to September these are at Salisbury Hall, London Colney.

The group we used to know as WAMRAC has changed its name to **WACRAL,** indicating that the Methodist-only approach has changed and become inter-denominational. Details from the Hon. Sec.—*see* Panel.

Finale

We've got to the bottom again; deadline dates are in the 'box' in the body of the piece; the address, as ever, is "Club Secretary," SHORT WAVE MAGAZINE, 34 High Street, WELWYN, HERTS. AL6 9EQ.

OTHER MAN'S STATION—GJ8ORH

OUR subject this time is Geoff Brown, GJ8ORH, "Lemnos," Longueville Road, St. Saviour, Jersey, Channel Isles. First licensed on February 10 1978, Geoff has his shack in his workshop, which is also the focus of his own business as a colour television engineer, causing him to be in there and monitoring for up to 18 hours daily. Some 78 countries are confirmed by way of *Oscar* 7 and 8, aerials being a 14-ele. Parabeam for 144 MHz, 12XY for Seventycems, and suitable aiming gear.

On the equipment side there is, at top left in the picture, a 4CX250B Linear at 500 watts input, which can be built in two hours, and next to it its PSU, which takes a little longer(!); power meter, 20-amp 12 volts DC PSU and a video converter complete the top row, while below there are, again from the left, a TS-700, JR-500S, Liner-430, and a Sony TV for video reception. Geoff is interested in meteor-scatter, and a regular contributor to our *VHF Bands* column; anyone wanting a sked with him can reach him at the QTH given here, or by phoning him—0534 (Jersey) 26788.

So, there it is; a new chum with a very definite idea of what he is up to, and where he is going—long may he enjoy it all.

HOW TO PUT UP AN AERIAL MAST

PHILIP MAYNARD

AT this time of year the various forces of nature gather together and inspire us to put up aerial masts. The lower frequency bands become more attractive, the frost has seen off the garden plants, the gardener has done a first pruning of his or her fine thorny roses, and generally the ritual war dance of mast erection is relatively easy.

This is where the temptation arises to lay in a dozen or two bottles of beer and to ask three or four well-built friends to come round at the weekend and help with the mast. Resist this temptation, at least until you have read what follows here and done a bit of thinking. Let me explain.

The usual basic form of guyed mast is a thin stalk kept straight by four sets of guys, each set consisting of three guy lines radiating from one ground anchor or peg. Now we all know that the great strength of the amateur is that he can cut corners where the pro dare not: accordingly it seems natural to reduce the number of guys, to use only three anchor points instead of four, and to try to put the thing up with the aid of several amateur helpers each with a handful of guy ropes. This way you need a mast stout enough not to be bent up or strained during erection, far heavier than would be needed in actual use. It's chance or good luck whether all goes well; for masts much over thirty feet it is pure murder.

Instead of this, keep to the basic multi-guy mast and consider how it is put up in the formal way—using a gin pole.

Imagine you already have the mast assembly, Fig. 1a. Lay it down flat with the base of the mast at its final site and the mast lying close by one of the guy anchors, Fig. 1b. Two complete sets of guys, (K, L) are laid out at the sides of the recumbent mast, attached to the mast and to their guy anchors. Note the length between the mast base and a guy anchor and put up the gin pole of approximately that length, first having fixed one set of guys from the mast to the end of the gin pole.

One need only pull on a rope from the top of that pole (the lower end of the pole preferably being fixed to the bottom of the mast, of course) and the whole assembly of mast and guys will rise from the ground and come up to the vertical. Stop before it gets completely vertical and make sure that its fourth set of guys (N) are of about the right length and firmly fixed to mast and ground anchor. Then pull the gin pole right down to the ground, the mast coming up vertical, and transfer guys from the end of the gin pole to their anchor. A leisurely stroll around to adjust the guy lengths and the job is done. Take away the gin pole (note that it is really only two clothes props lashed together, or the like) and return it to its normal duties.

If it should happen that the mast isn't just a vertical radiator and you find after it's up that you've forgotten to hitch a pulley and halliards to the top end, no matter. Replace the gin pole, if already removed, and in a dignified manner let the mast down again in the same way. When the guy lengths are correct you can raise and lower the mast with no trouble at all.

If on the other hand the mast carries, or is a vertical radiator, note that although it is quite easy to lash good, varnished bamboo canes together to attain a 33-foot upright wire—easy to load with a large, low-loss inductor at ground level (repeat, at ground level)—you still have to dig in a load of earth wires or perhaps cover the landscape with wire netting if you are to avoid relatively low aerial efficiency.

To put up the mast is only the first step, and many a sufferer has run out of steam after a terrific struggle. Consider therefore the advantages of the easy way, detailed above.

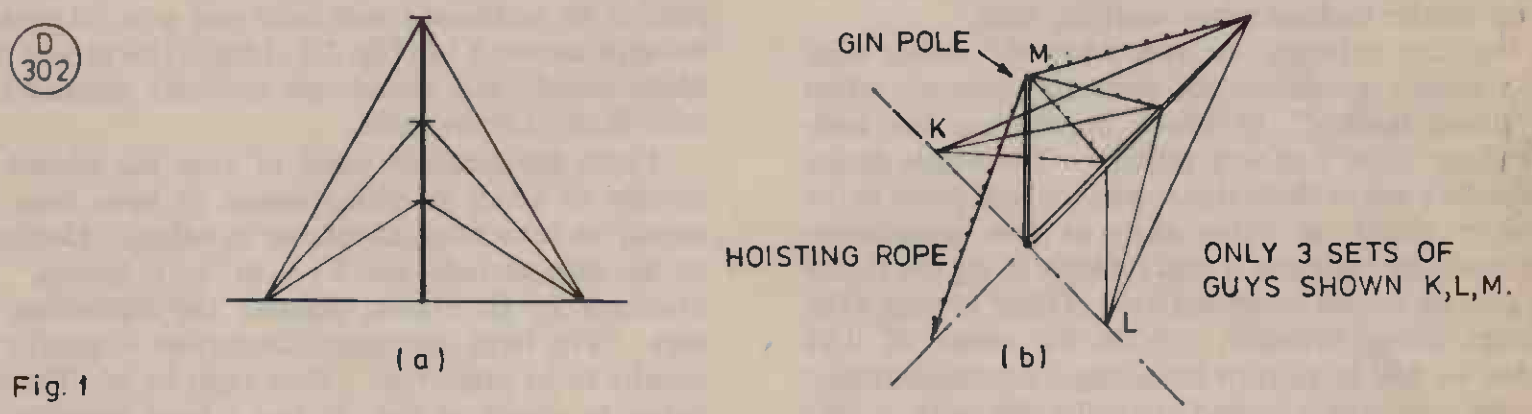

Fig. 1

TOROIDS IN HF APPLICATION
Part II

N. H. SEDGWICK, G8WV

IT is accepted practice to make the characteristic impedance of transmission lines in radio frequency service equal to the impedance of the source from which the power is being drawn, and equal to the impedance of the load to which the power is being conveyed. Fig. 1 is a simple graph illustrating that in any circuit optimum power transfer takes place when the load resistance (R_l) is equal to the source resistance (R_g). In the transmission of RF power from source to load, the radio technician is concerned to observe the "standing wave ratio", since mismatch into the load will cause power to be reflected back to the source, increasing the power dissipation at the source and causing "hot spots" along the transmission line arising from the standing wave, which could exceed the voltage or current rating of the cable. A reflectometer in the line enables the reflected power to be directly measured, and the use of such an instrument is recommended, since not only does it provide the means for initial setting-up of the matching into the load, but it monitors it thereafter, displays the forward power during tuning, immediately indicates an aerial fault, and will show up carrier leakage when working SSB.

In the days between the wars when RF cables were not too readily available, the amateur fraternity often used "tuned feeders", in which application the well-known Zepp aerial was very popular. The whole device used standing waves throughout, and the feed point at the transmitter could be either high or low impedance. Losses could be high and it was difficult to rig the feeder inside a room, and to insert any kind of filter to stop VHF harmonics being radiated. With the onset of TVI problems we had to turn to travelling-wave transmission lines, and amateurs adopted coaxial cable with a preference for the 75-ohm variety, since this matched the load impedance imposed by the popular dipole. The unbalanced line had the advantage that it simplified the Low Pass Filter for prevention of TVI, but as balanced aerials were becoming popular the need for an unbalance-to-balance conversion arose.

The so-called 'balun' made of just wire (Fig. 2a) allowed a 300 ohms balanced load to be fed by an unbalanced 75-ohm cable by virtue of its fixed impedance transformation of 4 : 1, provided the length of the balun was set at least to one quarter-wavelength at the lowest frequency used. The folded dipole provided the 300 ohms load and "four-to-one" became so much a part of unbalance-to-balance conversion that plenty of amateurs still regard the integration of the two functions as one of Nature's unalterable fixtures.

To make the wire balun more compact it was found that the wires could be coiled, and then a remarkable reduction in size came along with the R.H. Minns ferrite-loaded balun, which is contained in a box measuring $9\frac{3}{4}$ x $3\frac{1}{2}$ x $1\frac{5}{8}$ inches, and handles 500 watts, from 1 to 30 MHz. This has the same configuration as the standard wire balun but the two arms are each sleeved with several short ferrite tubes (Fig. 2b), which so raise the inductance of the wires that the arms are only six inches or so long. R. H. Minns has extended the method to produce a 600 ohms line balun, which he does by putting an additional wire onto one arm, so making the transformation 9 : 1 (Fig. 2c). Ideally this gives a 67 : 600 ohms match, but would not seriously mismatch if fed with 52 or 75 ohms cable.

From the amateur point of view the advent of RF toroids in aerial matching seems to have been treated merely as something adaptable to baluns. Designs seem to be offered only for 1 : 1 or 4 : 1 baluns. In his brochure R. H. Minns, defining the expression 'balun' says: "The term *matching transformer* is generic and is usually to be preferred." How right he is! The original balun as shown in Fig. 2a has a fixed impedance ratio

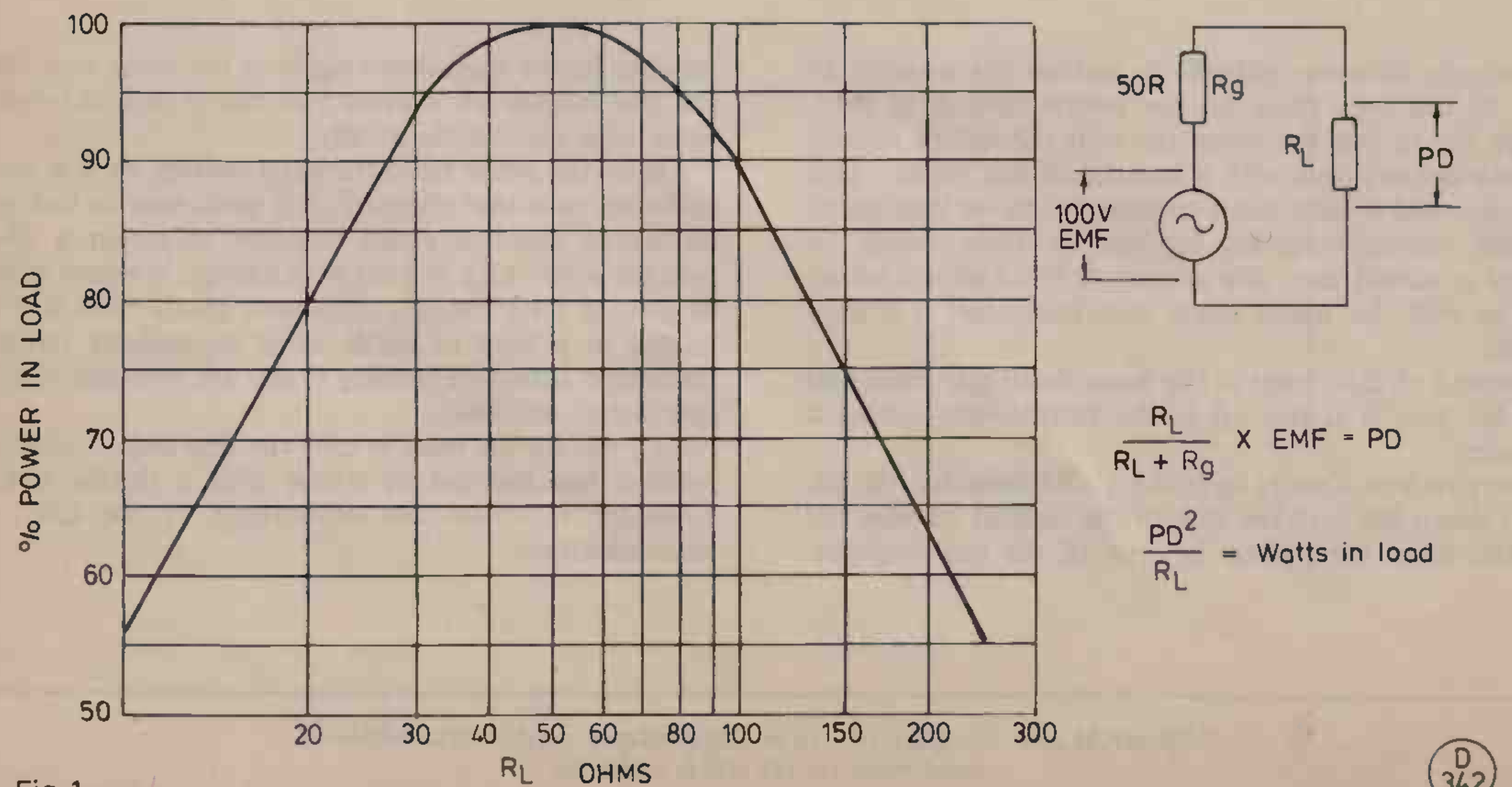

Fig. 1

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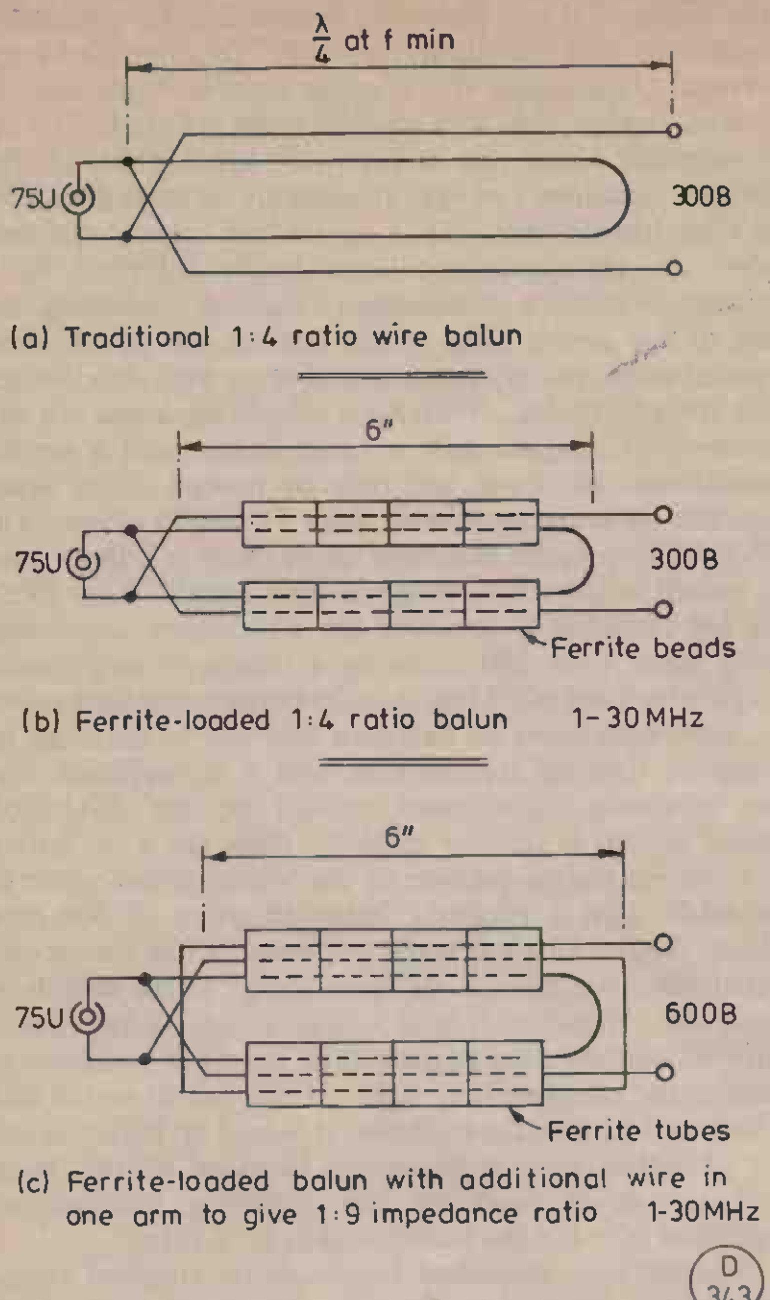

Fig. 2

which cannot be varied, but the toroidal transformer can be tapped or given primary and secondary windings within a wide range of practical limits. The so-called 1 : 1 balun using a toroid cannot be duplicated in the traditional balun configuration, and the perpetuation of the term to describe transformers simply creates an impression that toroids can only be used for balance-to-unbalance conversion.

Windings. The "Radio Communication Handbook", 4th Edition, in its specification for a toroidal balun specifies use of 0·110 x 0·060in. enamelled copper wire, which is not the sort of thing every amateur will keep in a kitchen drawer together with a reel of insulating tape and a card of fuse wire! *TMP Electronic Supplies* send a small coil of 16 s.w.g. enamelled copper wire with their balun kit. At G8WV, flat-twin electrical cable with 1·5mm. solid conductor is stripped of its outer coating and the red and black insulated wires used for the windings. When available winding length and number of turns require smaller wire, 23 s.w.g. PVC insulated wire from multi-core telephone cable is used.

Bifilar Winding. A 'bifilar winding' is two wires wound on simultaneously, side by side; it is generally intended that they should be so spaced that the required number of turns fills the whole winding length of the toroid. The finish of one wire is then joined to the start of the other, putting the two windings in series, and one has in effect a centre-tapped winding which goes twice round the toroid, having a number of turns equal to twice the number of bifilar turns. Fig. 3 shows a bifilar winding early in the process and Fig. 4 shows one completed. As it stands this becomes the inevitable '75 ohms unbalanced to 300 ohms balanced' toroid transformer, shown in schematic form in Fig. 5. The object of the bifilar winding is to keep the coupling between the two halves of the centre-tapped winding very tight, rather like interleaving of windings in audio transformers; this keeps the leakage reactances on each side of the circuit low, which is very necessary if the transformer is going to have a good wide-band performance and realise the advantages offered by toroids. It is best to *push* the two wires through the toroid as shown in Fig. 3, keeping the turn held in position on the core whilst the remaining slack wire is pulled through. The wire should be cut to a little more than is actually needed for the winding before starting, and this can be accurately measured by winding on a piece of string and cutting it to length (pushing the tips of the wires through the toroid first when putting on a turn always results in the slack wire becoming bent and possibly kinked). The use of insulated wire with different colours for each of the bifilar wires helps to identify them when tapping a completed winding or putting the two wires in series. Before starting the winding, a clove-hitch with long free ends is tied on the core, and the loose ends are used to secure start and finish of the winding. For large cores twine is used, and thread for smaller ones; in both cases it is waxed by dipping in melted beeswax, as this helps to hold it in position when tying off.

Balance-to-Unbalance Transformers (*Baluns*). It is usual practice to denote winding application by the letters 'U' and 'B' following a numeral which is the matching impedance in ohms. Thus a 300 ohms balanced to 75 ohms unbalanced transformer is succinctly described as '300B-75U'. The same transformer could equally be '200B-50U', but in common practice there is a dearth of RF devices requiring a 200B match!

Balun functions likely to be required are:—

1. Feeding a 50 ohms multi-band trap aerial with 50 ohms coaxial cable, *viz* 50U-50B.
2. Feeding a 75 ohms dipole aerial with a 75 ohms coaxial cable, *viz* 75U-75B.

Fig. 3.

Fig. 4.

3 Feeding a 300 ohms folded dipole with a 75 ohms coaxial cable, *viz* 75U-300B.

4. Joining a 600 ohms open-wire external transmission line to an internal 75 ohms coaxial cable, or feeding a 600 ohms wide-band cage dipole or rhombic with a 75 ohms coaxial cable, *viz* 75U-600B.

The so-called 1 : 1 balun toroidal transformer will meet the first two requirements; this is shown in Fig. 6, and is in fact a trifilar winding. Requirement *3* is met either by the open-wire or coiled 4 : 1 balun, or the R.H. Minns ferrite loaded balun, or the toroidal balun shown in Fig. 5 using a bifilar winding. Requirement *4* is rather unlikely in amateur service, but is best catered for by the Minns ferrite loaded balun with 9 : 1 impedance transformation (Fig. 2c) if it does arise.

The point that seems to be missed in amateur thinking is that the toroidal HF transformer offers much improved flexibility in respect of transmitter output, LP filter, transmission line, reflectometer, and aerials. When an amateur equips his station he decides on the characteristic impedance of his coaxial cable feeding the aerial, or it can be decided for him by his choice of aerial. For example, the popular Mosley TA-33Jr. three-band Yagi trap beam calls for 50 ohms matching, and whilst it is undoubtedly a 'balanced' aerial the suppliers suggest it should be fed directly with an unbalanced 50 ohms cable. Use of a toroidal balance-to-unbalance transformer sorts out that side of the problem, but one is still left with the requirement for a 50 ohms cable which will impose itself on the reflectometer, LP filter, and transmitter output circuit, so making these devices unsuitable for using with an alternative dipole aerial—which calls for them all to be 75 ohms impedance.

Exploiting the Flexibility of HF Transformers. At the aerial farm, toroidal HF transformers can be used in the actual aerial feed points to transform the load impedances of the various aerials to one standard impedance throughout the system, so ensuring that the equipment in the shack will serve all the aerials without worrying about impedances. If one insists on combining the unbalance-to-balance and impedance matching functions into one toroidal transformer the possible combinations become limited, but the iron dust toroidal cores are cheap and the transformer losses can be kept very low indeed, so that the two functions can very reasonably be served each by its own transformer. Thus we should have at the feed point an unbalance-to-balance balun followed by a balance-to-balance transformer, together matching the line to the aerial. The writer favours use of 75 ohms coaxial cable, mainly because it goes so well with dipoles and folded dipoles. With such aerials we know we can achieve our purpose with a single balun, and a second transformer in circuit will only be needed if the aerial matches an impedance other than 75 or 300 ohms. The TA33JR trap aerial matching to 50 ohms is a likely one, as indeed is the whole range of trap aerials. Less likely are log-periodics in amateur use which look like something more than 100 ohms as a rule, and single-band Yagis which are often less than 20 ohms at the feed point.

Such aerials are all balanced and can be matched by a second toroidal transformer, and it is suggested that the balancing transformer should be the 75U-300B design as this is simpler to make than the 1 : 1 balun, and enables the connection to the second transformer to be made with a properly balanced piece of 300-ohm ribbon feeder, which is quite important since the second transformer will need to be up in the air in the middle of the aerial. However, it is as well to avoid big impedance ratio transformations as these raise practical problems in keeping the coupling very tight. If one has to match into a Yagi at 15 ohms for example, it would be better to use a 1 : 1 balun for the balancing function as this gives 5 : 1 step-down ratio for the matching transformer, instead of 20 : 1 if the balun used is 1 : 4 ratio.

Incidentally, published literature on toroidal transformers for external service gives emphasis on coating the finished article with some sticky compound to protect it from the weather and, as a by-product of the process,

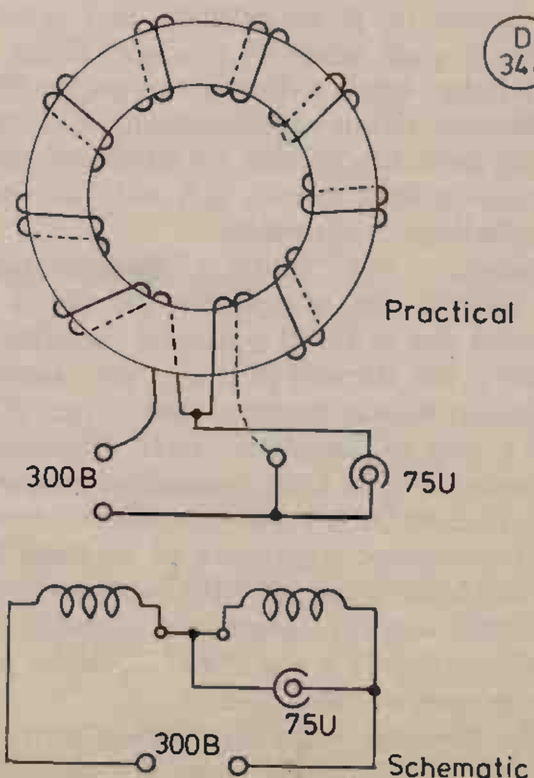

Fig. 5 Bifilar-wound toroidal balun 75U-300B

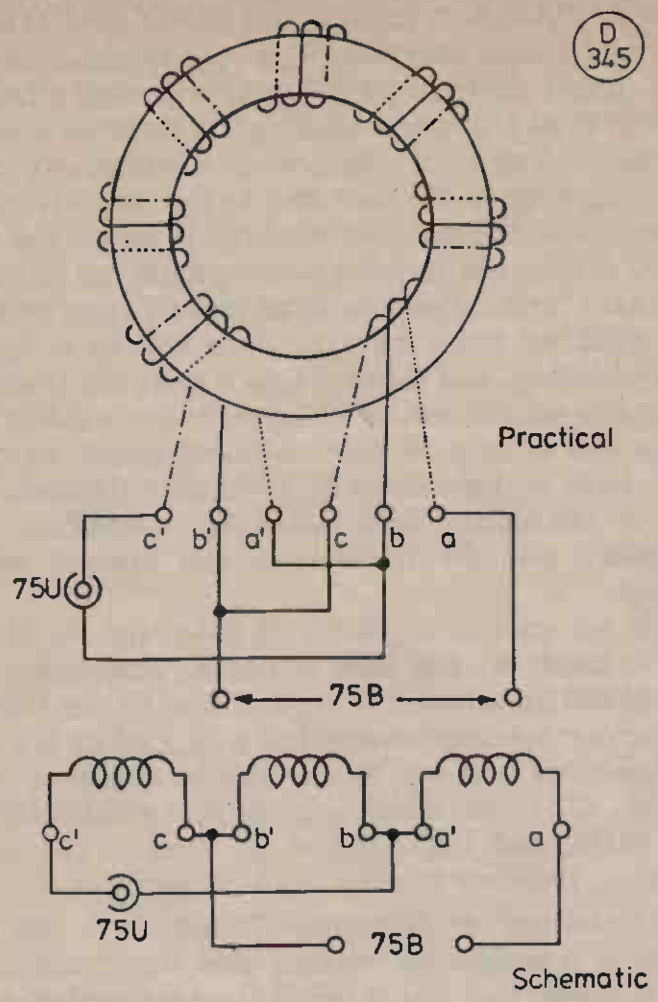

Fig.6 Trifilar-wound toroidal balun 75U-75B

make the core irrecoverable if one wishes to salvage it for a change in plan. There are lots of cheap moulded plastic boxes of suitable size on the market these days, and an edging of *Cementone* joint sealing compound around the lid before it is screwed on tightly will seal and protect the transformer inside against all the weather we are likely to get!

Transformer Design. At this stage it would be as well to run through actual design procedures for a number of types. We need to know the application specification telling us:—

(*a*) Peak power to be handled.

(*b*) Maximum and minimum frequencies to be served, f_{max} and f_{min}.

(*c*) Input and output style, balance and unbalance.

(*d*) Input and output impedance, Z_{in} and Z_{out}.

About (*a*), the size of the core used is determined by this, but the information available about core ratings is indeterminate: *TMP* give a rule-of-thumb suggestion for iron powder cores that halving the size quarters the power handling capacity. (Since the core sizes are stated in outside diameters one assumes the expression "halving the size" means "halving the diameter"!). T200 cores are offered for the amateur aerial matching needs and are mentioned as capable of 1kW in the absence of stand ing waves. The safe answer is to see if the core gets hot and go bigger if it does, which means that it needs bench checking on full power before putting it in its box and sealing it up. Watch peak power on SSB as core saturation on peaks is quite possible, and will lead to envelope distortion and all the splatter that goes with it.

Regarding (*b*), minimum frequency determines the number of turns which should be seen by a given circuit impedance. The inductive reactance X_L of the winding is right across the circuit impedance Z_o; both quantities are stated in ohms, and X_L at f_{min} should be at least $3Z_o$. If $X_L = Z_o$ the transformer response will be 3 dB down (which is half the power gone!), and if $X_L = 2Z_o$ the response will still be 1 dB down approximately. X_L will increase with the number of turns but these should be no more than strictly necessary, for more turns mean more copper loss and more self-capacity, which will affect the high frequency end of the range. However, provided the core material is right, it is normal expectation for a single transformer to cover a frequency spectrum of more than eight octaves, so if we design for $X_L = 3Z_o$ at f_{min} it will surely meet any amateur requirement without fussing about dialectric constants of wire insulation or the wire size or cross-sectional shape to reduce the winding self-capacity.

The input and output style specified in (*c*) (U or B) is no trouble provided they are both the same style. It is just a question of whether one regards one end (U) or the middle (B) of the winding as the "cold" point which can be earthed. If there is a U-to-B requirement, one is into 'balun' techniques and unless the impedance ratio is 1 : 1 or 4 : 1 the writer's advice is to tackle the U-to-B and Z_{in} to Z_{out} as two separate problems to be solved with two separate transformers. That is not to say it is impossible to use a single transformer to do both functions, but it can be very difficult in practice and the amateur is liable to end up with a degree of unbalance at the high frequency end and a bigger insertion loss than he would get using separate transformers.

The input and output impedances given in (*d*) set the impedance ratio $\frac{Z_{out}}{Z_{in}}$ and hence the turns ratio

$$\frac{n_2}{n_1} = \sqrt{\frac{Z_{out}}{Z_{in}}}$$

Worked Examples. Let us proceed to work out some actual transformers, using some of the formulae given in *Part I* as well as this part, and make a start with the following specifications:—

1. Peak power = 400 watts.
2. F_{min} = 3·5 MHz, F_{max} = 30 MHz.
3. Style = B to B.

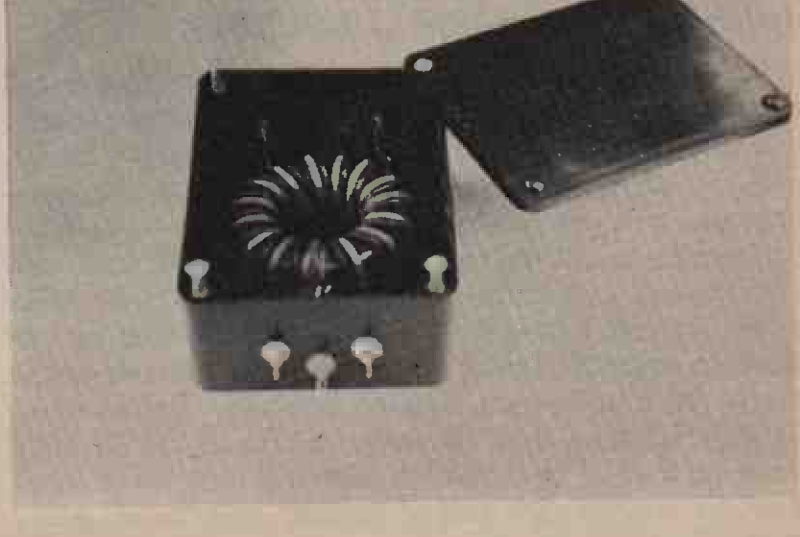

Fig. 7.

4. Z_{in} = 50 ohms, Z_{out} = 300 ohms.

From the specification we determine:—

Impedance ratio $\frac{Z_{out}}{Z_{in}} = \frac{300}{50} = 6$, so turns ratio = $\sqrt{6} = 2{\cdot}45$.

We make $X_L = 3Z_{out} = 3 \times 300 = 900$ ohms at f_{min}, which is 3·5 MHz; and $X_L = 2\pi fL$, so $\frac{900}{6{\cdot}28 \times 3{\cdot}5}$ = L = *41 microHenries*

Peak power is 400 watts and we should leave some in hand in our core rating for we are sure to run into an SWR of anything up to 2 : 1 with such a big frequency range. So we choose the 1 kW rated T-200-2 iron dust core, which is listed as requiring 100 turns to make 120 microHenries. We need 41 microHenries, so the number of turns is:—

$$n_2 = \sqrt{\frac{41}{120}} \times 100 = 58{\cdot}45 \text{ turns.}$$

We round this figure up to an exact even number as it is a balanced winding, which gives us 60 turns.

The number of turns for the 50 ohms circuit, n_1, is:—

$$\frac{n_2}{2{\cdot}45} = \frac{60}{2{\cdot}45} = 24{\cdot}48 \text{ turns.}$$

Once again we need an even whole number, so we reduce that to 24 and then check to see how our impedance match has reacted to the practical changes:—

$$\sqrt{\frac{n_1}{n_2}} = \sqrt{\frac{24}{60}} = 0{\cdot}16 = \frac{Z_{in}}{Z_{out}}$$

Thus 0·16 x 300 = Z_{in} = 48 ohms, giving us a mismatch of 4% from specification, which will have negligible effect on the power transfer, and is entirely acceptable.

To keep the transformer nicely balanced we put on 30 bifilar turns, joining the two windings in series to give the 60 total turns. Now we need 24 turns for the 50 ohms connection, we we count off 12 turns from each side of the centre tap (which is the junction of the two windings) and place our taps at those points.

It is rather doubtful that an amateur will need a transformer covering such a big frequency range because it is of necessity part of the aerial, and aerials which present a constant resistive load over an 8 : 1 frequency range are well out of amateur scope! A more probable requirement would be to design a transformer to match a feeder into a three-band aerial serving 14-21-28 MHz bands. In such a case f_{min} becomes 14 MHz and we can afford to make X_L rather larger than $3Z_o$ because of the greatly reduced frequency range involved. Let us make the Z_{out} winding total 40 turns, giving an X_L of 1688 ohms, or $5{\cdot}6Z_{out}$; the 50-ohm taps will then be 16 turns apart, or 8 turns each side of centre. This should make an excellent transformer.

The 1 : 1 Balun. A requirement to feed a 3·5 MHz dipole with a 75 ohms coaxial cable is very possible. In this case we should use the 1 : 1 balun arrangement which Fig. 6 shows to have a trifilar winding (*i.e.* three wires wound on simultaneously), of which two windings are in series looking both to the load and to the line. Thus our X_L concerns once again two windings in series, but since we have three wires to wind on we should not be too lavish with the turns. This time let us make a guess on the basis of what we know by experience will be a reasonably easy winding, and then see how it suits our specification. Suppose we put on an 18 turns trifilar winding? Then Z_{out} will offer a 36 turns winding which we calculate will have an inductance of 15·55 microHenries, and an X_L of 342 ohms, which makes $X_L = 4{\cdot}56Z_{out}$. This is excellent and the transformer can proceed with that design.

If we want to use the 1 : 1 balun for 14, 21 and 28 MHz bands we can look at our X_L calculation for the 300B-50B transformer above and note X_L was 1688 ohms. Since our new requirement has a Z_{out} which is a quarter of the other one, our X_L can also be quartered and that equals 422 ohms, which is given by 4·8 microHenries at 14 MHz, and requires just 20 turns. The complete winding therefore consists of 10 trifilar turns.

An Unbalance to Unbalance Transformer. At G8WV there is a top-loaded vertical steel mast used as a 3·5 MHz aerial, and this is fed at the base against an earth of buried radial wires. The feed impedance is 37·5 ohms, and a 75U-37·5U transformer fixed right at the insulated base of the mast provides the match to a 75-ohm coaxial cable. The transformer is arranged inside a die-cast aluminium box mounted on a strip of steel cemented into the mast base; all screws passing through the box have been sealed in with *Araldite* and it has worked happily for five years ever since the original installation—without being opened.

The transformer is 2 : 1 impedance ratio and so is 1·414 : 1 turns ratio. It is, in fact, an auto transformer with the 37·5 ohms tap at the 0·707 point along the winding from the earthed end. The calculation for a 75 ohms winding at 3·5 MHz already been done in the 1 : 1 balun above, and it came to 36 turns. A turns ratio of 34 : 24 works out to 1·416 : 1 and is as close as one can get in complete turns to the ideal. 34 turns gives an inductance of 13·87 microHenries, and X_L of 305 ohms at 3·5 MHz—so that X_L will be $4Z_{out}$.

It is still desirable to interleave the turns to give very close coupling between them although the transformer is for unbalanced service. This can be done by putting on a 12 turns trifilar winding and then joining all three windings in series. Make one free end the earth connection and remove two turns from the opposite end, so reducing the total winding to 34 turns; the 37·5 ohms tap is then the second join of the windings from the earthed end.

Readers should now have got the idea of how to design their own transformers for any sort of service—within the limitation imposed by self-capacity that terminating impedances should be low and in any case, not exceeding 600 ohms. Testing of these transformers at their working power level and applications other than aerial matching remain to be dealt with.

to be continued

VHF BANDS

NORMAN FITCH, G3FPK

More World Records

HISTORY was made on March 20, 1979 when George Vernardakis, SV1AB, and Costas Fimerellis, SV1DH, in the Athens region both positively identified the ZE2JV *seventy centimetre* beacon in Salisbury, Rhodesia, at 1816 GMT. That such reception over a path in excess of 6250 kms. is possible is truly astonishing. It is reminiscent of the pioneering days of short wave radio communication when the "experts" pronounced that the high frequencies would be useless for long distance circuits. Fortunately, radio amateurs proved otherwise.

It was logical that these dedicated amateurs in Greece and Rhodesia should attempt the impossible, following their many successful contacts over this path on 2m. It is a fitting tribute to their patience that they have now proved that it *is* possible to propagate UHF signals over such a long path without resorting to *e.r.p's* of the "Pave Paws" type.

Shortly afterwards, the world record distance for a 2m. QSO was convincingly shattered when contacts between Italy and Namibia took place. These were on March 30 and 31, the participants being Fausto Minardi, I4EAT, from Florenze, and ZS3B in Windhoek. The distance would be about 7450 kms. depending upon the exact latitude and longitude of the African station.

Naturally, there has been much speculation amongst propagation experts concerning just what mode can sustain such long distance communication at VHF and now UHF. An important clue is the *auroral* sound of the signals. SV1AB and SV1DH reported this phenomenon on 70 cms. and noticed a *Doppler* shift. Another clue is that at ZE2JV, the aerial array, consisting of two 8-ele. *Quagis* side-by-side, was elevated at 20°. At the time the *MUF* was high and the "A" indices above 30. In the 2m. QSO's the *solar flux* readings were 190 and 212, and the "A" figures 12 and 17 on March 30 and 31 respectively.

From this, it is suggested that this is another form of *auroral* type propagation requiring high *solar flux* and disturbed magnetic conditions. As the peak of sunspot cycle no. 21 is predicted for the end of this year, it would seem that the next autumnal and vernal equinoxes would offer prime times for further propagation studies.

In a letter dated March 13 which arrived on the 27th, Martin Harrison, G3USF, from Keele University, sent an account of the various TEP goings-on from which it appears that ZS6DN on 2m. was received in western Greece by SV8JE on Feb. 16. Paul Galea, 9H1BT, in Malta has also been testing with ZS3B on 2m. without results and TU2GK in the Ivory Coast has skeds with Greece. Pierre Pasteur, HB9QQ, no doubt spurred on by I4EAT's success, is QRV for TEP tests on 144·150 MHz daily 1800-1805 GMT.

On March 10, ZS6DN's 2m. signal was received in Athens at 24 dB. over the noise, suggesting that a 10 watt station could have made a contact! It seems that high *e.r.p.* is not essential for TEP contacts though it undoubtedly helps.

G3USF writes that these continuing tests are to establish diurnal/seasonal patterns and to permit comparison with solar-geophysical data; to see if the TEP zone can be extended even further north and south; to compare the time delay on 28 MHz and 144 MHz by means of simultaneous pulsed transmissions, and to check the angle of arrival and polarisation of signals.

Your scribe feels that, with some of the ambitious aerial arrays now in use, coupled with really low noise receiving systems, it is by no means impossible that the ZE and ZS beacons could be received in parts of the British Isles, such as the Channel Islands and south-east England. This view is shared by the RSGB's VHF Committee which has proposed that 144·130 MHz be monitored daily around 1800 GMT just in case ZS6DN is heard. The note would be an *auroral*-sounding one but perhaps not quite so rough as we are accustomed to with temperate zone *Ar*. As mentioned earlier, the equinoxes would afford the most like opportunities for such reception.

Awards News

The first of our new QTHCC—QTH Squares Century Club—awards have been issued. G3FPK's claim for Number 1 for the basic 100 confirmations, plus the "125" sticker, was processed by Paul Essery, G3KFE. No. 2 has been issued to Bryn Llewellyn, G4DEZ, from Didcot in Oxfordshire (ZL34a). His collection included a nicely assorted quantity of tropo., *auroral*, *E's* and MS cards. Bryn's present gear comprises *Trio* separates, *Microwave Modules* transverter and *Nag* 144XL linear, with a pair of bayed 16-ele. *Tonna* aerials.

No. 3 award went to John Hunter, G3IMV, from Bletchley, Bucks. (ZL07h). John is a fine CW operator so it was not surprising that 73 per cent of the QSO's were for A1 mode, including 11 MS ones. The station at G3IMV ends up with a home-built, single 4CX250B amplifier, the earlier 10-ele. *Parabeam* having been replaced recently by a 16-ele. *Tonna*. For full details of the QTHCC award, send a stamped and addressed envelope to the Awards Dept. (QTHCC) at the QTH at the end of this feature.

It is nearly a year since the last 70 cm. VHFCC certificate was issued so it is a pleasure to record that No. 25 was sent to Tony Oakley, G8IWA, from Beverley, North Humberside, on April 1. Tony is now G4HYD and readers may not have realised that he was the Captain Tony Oakley whose company first salvaged and then had to scuttle the infamous oil tanker *Christos Bitas*—hope that's the right spelling—earlier this year. The first equipment used was a home-brew, solid-state, low-level job from a *VHF Communications* design, followed by a couple of *QQV02-6* amplifier stages. About a year ago, a *Microwave Modules* transverter was obtained. This, with its stabilised power supply, is mounted on top of a 60ft. *Versatower* in a watertight box. Tony reports that the improvement in performance, " . . . is quite amazing . . . and well worth the effort." The drive source is a *Trio* TS-700 and the aerial an 88-ele. *Multibeam.*

Three more 2m. VHFCC certificates have been won this month. No. 310 went to Jim Rabbitts, G8LFB, from Luton, Beds. Up to September, 1978, vertically polarised FM from a *Pye* Cambridge was the mode which brought in 39 counties and 5 countries confirmed. After that, Jim, " . . . succumbed to SSB . . . " and now uses a *Belcom* Liner-2 into a 16-ele. *Tonna* which combination has pushed the countries total to 9.

C. Shearer, G8LVG, currently operating from Chelmsford, Essex, received No. 311. When first licensed in August 1976, operation was as GM8LVG from Lossiemouth (YR24a) using a *Yaesu* FT-101E/ *Europa B* set up with a 10-ele. *Yagi.* The move to Chelmsford was due to employment requirements and the station now comprises a *Yaesu* FT-221R and 16-ele. *Tonna.* In his first week of operating from Essex, G8LVG worked ten times as many stations as did GM8LVG in *two years.* A linear amplifier is under construction and CW lessons are progressing with a view to HF band operation soon.

Award No. 312 goes to one of our youngest readers, Bob Mackean, G4HAO, from Liverpool, who applied before his 17th birthday. Licensed as G8LYH in August 1976 at 14 years of age, Bob's first venture onto 2m. was with a *Liner-2* and *halo* aerial. A few weeks later a *Telford* TC-10 and *ARAC* 102 were bought using an indoor 8-ele. *Yagi.* A year later a *Liner-2* was purchased and the aerial put up outside in Jan. 1978. In April, 1978, he passed the CW test first go. The present set-up comprises an *Icom* IC-202 and amplifier and Bob hopes to get going on the HF bands soon.

Satellite News

Ron Broadbent, G3AAJ, remains the Secretary of AMSAT-UK and editor of the quarterly journal, *Oscar News* following the organisation's A.G.M., which was attended by 22 members. Pat Gowen, G3IOR, was elected the President and Dr. Arthur Gee, G2UK, the Chairman. The AMSAT-UK orbital prediction calendar is now available for £2·15, post free, and includes predictions up to March 1980. The format is very good as data for *Oscars 7* and *8* and the two Russian *Sputniks*, *RS-1* and *RS-2* are given side-by-side for each day.

Nothing seems to have been heard of either Russian satellite for some weeks now so it would seem these have not proved very successful. It seems a feeble excuse for them to infer that the high-power merchants have caused all the problems. They knew all about this from AMSAT so it seems surprising that, with all their alleged expertise, they were not able to produce something better.

QTH LOCATOR SQUARES TABLE

Station	23 cm.	70 cm.	2 m.	Total
G3POI	—	—	265	265
I4EAT	—	25	217	242
G3SEK	—	—	179	179
G3IMV	—	—	175	175
G3CHN	—	—	167	167
G3FPK	—	—	154	154
G4DEZ	—	—	150	150
G4CMV	—	30	140	170
9H1BT	—	—	138	138
GM4CXP	—	25	133	158
9H1CD	—	13	127	140
G8HVY	—	17	119	190
G4BWG	—	29	118	147
G3XCS	—	21	111	132
G8BKR	1	30	108	139
G8GML	11	63	106	180
GM4COK	—	9	106	115
G8LEF	22	61	101	184
G3OHC	4	33	101	138
G8HHI	—	30	101	131
GJ8ORH	—	30	99	129
G4AWU	—	—	94	94
G8KSS	—	—	93	93
G4BAH	—	32	92	124
G2AXI	2	52	91	145
G3BW	3	25	91	119
G4FBK	—	5	90	95
G4FCD	—	22	89	111
G3JXN	26	66	88	180
G8ATK	—	38	88	126
G6UW	—	—	85	85
G3KPU	—	20	84	104
GM8NCM	—	12	84	96
G4HYD	—	40	83	123
9H1C	—	—	83	83
GJ8KNV	—	26	82	108
G4ERG	—	—	82	82
G3COJ	23	66	80	169
G8LHT	3	34	80	117
G8KGF	—	5	80	85
G8JHX	—	—	80	80
G8JJR	—	—	79	79
G8KPL	—	7	74	81
G8LGL	—	1	74	75
G8JAG	—	7	73	80
G8KSP	—	2	72	74
G4GET	—	—	70	70
G4DKX	5	30	68	103
GD2HDZ	11	34	67	112
G4ERX	1	29	67	97
GJ8AAZ	1	24	67	92
G3FIJ	—	27	65	92
G3SPJ	5	21	63	89
G8GII	—	22	63	85
G8KLN	—	1	62	63
G4CIK	—	—	62	62
G4AEZ	3	28	61	92
GI8EWM	—	18	61	79
G4GCQ	—	—	61	61
G8KUC	—	7	60	67
GD3YEO	—	8	59	67
G8JEF	—	—	58	58
GW4FJK	—	—	57	57
G4GEE	—	27	56	83
G8ITS	—	16	56	72
OZ9IY	—	—	53	53
G8IFT	7	18	49	74
G8MFJ	—	9	48	57
G4GSA	—	1	48	49
G4GXT	—	—	43	43
G4EYL	—	—	41	41
G8JGK	—	—	41	41
G8EOP	8	36	38	82
G8PRG	—	—	15	15

Starting Date January 1, 1975. No satellite or repeater QSO's. "Band of the Month" 2m.

Greg Roberts, ZS1BI, who works at an observatory in Cape Province, has made some visual sightings of *RS-1* and *RS-2* and calculates the following data for orbit 1864 for each object on March 31 as:—for *RS-1*, 0042·24s at 120·1°W. and for *RS-2*, 0129·06s at 131·8°W. The respective periods are 120·38930189 and 120·41453121 mins. The times are UT (GMT).

Oscar 8's orbit has been slowed down by ion flux density caused by the recent high levels of solar flux. It is proposed to give corrections on the first Sundayof-the-month net. *O-7*, *RS-1* and *RS-2*, being in higher orbits, seem less affected.

In spite of earlier fears that *O-7* was about "done for," it is still giving excellent service in Mode "A" and lately, quite satisfactory service in Mode "B" even though the telemetry is garbage. Both AMSAT birds are now being effectively commanded from the University of Surrey's control station.

Progress on the British amateur satellite being built at the UOS is good. The main framework has been built and the side panels fitted. All the solar cells have been selected and the best ones chosen. A name for this project has yet to be chosen and ideas should be sent to G3YJO at the UOS in Guildford. The launch date for the first *Phase 3* AMSAT transponder is now given as March 5 1980. It could spend up to the first 50 days in an *O-7* type, circular orbit so that the precise moment of firing the kick motor which will put it into the desired highly elliptical orbit can be calculated.

AMSAT-UK HQ now has two large polar projection "maps," correctly known as Admiralty Plotting Charts. One is 48 x 48ins., the other being 28 x 20ins., both at £1·25 post free. You will have to draw in the continents yourself though. For full information on AMSAT-UK, send an *s.a.e.* to The Secretary, 92 Herongate Road, London E12 5EQ. One late item is that in future, the "Newsletter" from AMSAT in the U.S.A. will be sent to ordinary members direct *via* surface mail which can take anything up to ten weeks.

THREE BAND ANNUAL VHF TABLE
January to December 1979

Station	FOUR METRES Counties	FOUR METRES Countries	TWO METRES Counties	TWO METRES Countries	70 CENTIMETRES Counties	70 CENTIMETRES Countries	TOTAL Points
G4DEZ	—	—	56	17	—	—	73
G3FPK	—	—	60	11	—	—	71
G2AXI	13	1	35	6	13	2	70
G4ERG	—	—	55	15	—	—	70
G3FIJ	13	1	35	8	11	1	69
G8LHT	—	—	35	4	17	2	58
GM4CXP	3	2	33	12	1	1	52
G4GXT	—	—	38	7	—	—	45
GI8EWM	2	1	33	6	—	—	42
G4HAO	—	—	36	6	—	—	42
GD2HDZ	2	2	9	2	20	2	37
G4FKI	3	1	6	1	2	1	14

Repeater Notes

GB3FC, the Fylde Coast UHF relay on RB2, was scheduled to become fully operative on April 12. On April 1, the Llandulas UHF repeater on RB4 suffered severe storm damage so will be QRT for some time. Anyone interested in helping should contact G3LEQ. According to a news item on GB2RS the same day, the Brighton VHF relay, GB3SR on R3 was taken out of service on March 21 but no date for its recommissioning was known. The deliberate interference to GB3LO continues. In common with many other radio amateurs, your scribe is amazed that the Home Office allows this abuse to go on. If any other licensee broadcast the obscenities and rubbish that emanates from this station, he would be closed down very quickly.

Beacon News

The Wrotham beacon Tx has now been fully tested by its keeper, G3COJ, and has been perking away satisfactorily on its new frequency, 144·925 MHz, at his home. It will be re-commissioned as soon as final Home Office approval is received. The Angus beacon, GB3ANG, on 144·975 MHz was taken out of service at noon on April 6 for a re-build and will be off until further notice. GB3SUT has been re-built by Roger Taylor, G4BEL, and "soak tested" at his home. At the time of editing, it is ready to be sent to G3BA for re-installation.

Six Metres

S.w.l. Jean-Louis Delport from Brussels reports reception of four South African 50 MHz beacons on March 6 and 9. On the 6th, from 1422 to 1559 GMT, ZS6's VHF (50·04); PW (50·0265 FSK); XJ (50·0214 FSK) and LN (50·050). 'VHF and 'LN are on A1 and all were 599. On the 9th, ZS6PW was received from 1355 for 95 mins. subject to slow QSB from S2-S9, likewise ZS6LN for 33 mins. from 1357. ZS6VHF was copied at S2 between 1434 and 1500. Jean-Louis uses a ground plane aerial and 10 dB. pre-amp. into a superhet Rx with a digital frequency counter.

G3USF heard ZS6LN and ZS6PW at 1410 on March 3 and reports G3COJ (Bucks.) having worked 'LN at 1435. Martin heard these two signals at the same time on the 6th and between 1610 and 1627, 'LN, 'PW and 'XJ. G3FXB also heard the beacons at 1410 and worked several ZS's around 1620 to 1635, including '6XJ and '6AUB. On March 12, ZS6PW was heard in New Jersey by WB2MAI at 1515. During early March the ZS beacons were heard in DL, EA, F, HB, PA, SV and 9H1. Of course, the British QSO's referred to were cross-band, with the G's on 10m. A new world record distance on 6m. was established recently by LU8AHW in Argentina and HL9TG in South Korea. East coast VK stations have been working into KL7 and Jimmy Bruzon, ZB2BL, has been having trouble with QRM from Japan when trying to work into Brazil!

Two Metres

The long spell of mediocre tropo. conditions continues with no big lifts to cause any excitement. On March 25, the Barking Club's contest created a lot of activity in flat conditions. There was some confusion concerning counties as it seems the organisers intended one's *postal* address should be given rather than the actual county. *E.g.*, Romford, *Essex* although that town is now in Greater London. John Lemay, G8KAX, operating -/P, notched up 2184 pts. Peter Skolar (Highgate) managed 81 QSO's and 1377 pts. in a very interrupted session and George Zitterstein, G8ITS, from his Barbican balcony made 59 QSO's worth 1275 pts. Bryn Llewellyn, G4DEZ (Oxon.), lost a couple of hours when one of his *Tonna* aerials worked loose on its stub mast but nevertheless managed 89 contacts and 1177 pts.

On the *auroral* scene, Derrick Dance, GM4CXP (YP37c), caught the one on March 29 and kicked off with OY5NS (WW77f) at 1555 GMT, the QTF being 10°. Others worked included SMØBYC (IT70b) described as "a half QSO," LA3WU (CU47d), PA3AES and PAØSGL both in CM square, the QTF's being between 50 and 60 degrees. Fade-out was after 1900 and between 1710 and 1720, GM3YOR (YQ65f) and G6WR (YO33g) were worked on 4m. The OY QSO was a new country and square and GM4CXP was all the more pleased as he was just using an *IC-202* at the time.

Your scribe was alerted to the March 29 affair at 1700 but only heard and worked G's and GM's. By 1815, *Ar* signals had gone. On April 3/4 there occurred an extensive, two-phase event, the first of which was missed by G3FPK. Jon Dougherty, G4FUT (ZO14h) did well, however, his best DX being UC2ABN (NN18e) at 2315, a QRB of 1866 kms. During the first session, from 1700—1815, four LA's, two G's and one GM were worked at QTF's 50°. The first QSO in phase 2 was at 2244 with LA3JA, followed by OZ10F (EQ78b), SM4FXR (HT57g). From Jon's list, the best DX contacts are; DM2DQG (FM79h) at 2342, SM6CEN (FR40b) at 2345, SM6DHD (GR26g) at 2359 and SM6EHY (GR13g) at 0116, at which time he went to bed with the event still in progress but no new calls being heard. One rather interesting observation is that the received *Ar* signals were some 5 kHz *higher* than the transmitted signals.

Jon caught a brief *Ar* on April 5 from 1741-1755 when it faded out. In this DK5LA, GM4BYF and GM3YOR were worked at QTF 50° and in this one the received signals were 2 kHz *lower* than the transmitted ones.

Your scribe had been working up to midnight on April 3 and switched on by chance to discover the *Ar* in full spate. At 2327, OZ10F was heard calling UA3LBO (QO21h) but nothing was heard from the Russian. The best DX heard was UQ2IV in KQ square, called at 0003. Things seemed to be fading at 0040 with G4CJG only S2, so G3FPK was closed down.

Random Jottings

The long delays with the post through London, coupled with our publishing hiccups, have resulted in no reports of the 1296 and 432 MHz contests on April 7/8. With very little spare time these days, your scribe has not been able to be so active "on the wireless" to gather reports that way, either.

G4FUT, whose UC2 QSO brings his *Ar* score to 21 countries, infers that we are dropping our VHFCC award. This is *not* the case since it is well appreciated that collecting 100 confirmations is a great challenge for many poorer-sited stations.

G4HYD (ex-G8IWA) is putting the finishing touches to his high-level 23 cm. transverter destined for masthead mounting. Tony also mentioned that VHF repeater GB3HS on R2 serving Hull and district, became fully QRV at midday on March 4, " . . . about 20 feet from my office desk."

Deadlines

Please send all your news, claims and comments for the June/July issue by June 7th, and for August by July 5th. As usual, everything to:—"VHF Bands," SHORT WAVE MAGAZINE, 34 High Street, WELWYN, Herts., AL6 9EQ. *73 de G3FPK.*

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Printed by The Courier Printing Co. Ltd., Tunbridge Wells for the Proprietors and Publishers, The Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts., AL6 9EQ. The *Short Wave Magazine* is obtainable abroad through the following: Continental Publishers & Distributors, Ltd., William Dawson & Son Ltd.; AUSTRALIA AND NEW ZEALAND — Gordon & Gotch, Ltd.; AMERICA—International News Company, 131 Varick Street, NEW YORK. Registered for transmission to Canada by Magazine Post. *May 1979*