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TRIO

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TS430S	160m-10m Transceiver	752.00	(—)
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TR9130	2M Multimode	442.52	(—)
TW4000A	2M/70cm mobile	469.00	(—)
TM201A	2M 25W mobile	269.00	(—)
TR3500	70cm Handheld	256.45	(—)
TR2500	2M FM Synthesised Handheld	237.82	(—)
ST2	Base Stand	53.13	(1.50)
SC4	Soft Case	14.03	(0.50)
SMC25	Speaker Mike	16.56	(1.00)
PB25	Spare Battery Pack	25.53	(1.00)
MS1	Mobile Stand	32.89	(1.00)
R600	Gen. Cov. Receiver	263.12	(—)
R2000	Synthesiser 200KHz-30MHz Receiver	421.36	(—)
HC10	Digital Station World Time Clock	69.46	(1.50)
HS5	Deluxe Headphones	23.65	(1.00)
HS4	Economy Headphones	11.27	(1.00)
SP40	Mobile External Speaker	14.49	(1.00)

POWER SUPPLIES

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6 amp	49.00 (2.50)	12 amp	86.40 (3.00)
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24 amp	105.00 (4.00)	40 amp	225.00 (4.00)

ICOM PRODUCTS

		£	c&p
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PS30	Systems p.s.u. 25A	229.00	(—)
SM6	Base microphone for 751/745	34.50	(1.00)
IC290H	2m 25w M/Mode	469.00	(—)
IC271E	2m 25w M/Mode Base Stn.	629.00	(—)
IC271H	100W version of above	P.O.A.	(—)
IC25H	2m 45w FM	359.00	(—)
IC27E	25W FM mobile	299.00	(—)
IC45E	70c 10w FM	329.00	(—)
ICBU1	B/U Supply for 25/45/290	24.50	(1.00)
ICR70	General Coverage Receiver	549.00	(—)
ICR71	General Coverage Receiver	649.00	(—)
IC02E	2m H/Held	229.00	(—)
IC2E	2m H/Held	169.00	(—)
ML1	2m 10w Linear	69.00	(2.00)
IC4E	70cm H/Held	219.00	(—)
BC30	Base Charger	56.35	(—)
HM9	Speaker mic	16.50	(0.75)
IC3	Carry Base	5.00	(0.75)
ICBP3	Std Battery Pack	25.00	(0.75)
BP5	High Power Battery Pack	48.00	(0.75)
CP1	Car Charging Lead	4.95	(0.75)
DC1	12v Adaptor	12.50	(0.75)

LINEAR AMPS

TOKYO HY POWER			
HL 32V	2m 30W (1-5W drive)	53.50	(1.50)
HL 82V	2m inc preamp (2-12W in 35-85 + out)	144.50	(2.00)
HL 160V	2m inc preamp (1-10W in 160W + out)	242.40	(2.00)
HL 45U	70cm inc preamp (2-15W in 10-45W out)	119.75	(2.00)
MICROWAVE MODULES			
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MML144/50-S	inc preamp, switchable	92.00	(2.00)
ML144/100-S	inc preamp (10w i/p)	149.95	(2.50)
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MML432/30L	inc preamp (1/3w i/p)	129.95	(2.00)
MML432/50	inc preamp (10w i/p)	129.95	(2.00)
MML432/100	linear (10w i/p)	245.00	(2.50)

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FS200	1.8-150MHz 20/200 Pep	55.95	(1.00)
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FS5E	3.5-150MHz 20/200/1000W HF	41.00	(1.00)
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SP300	1.8-500MHz PWR/SWR	115.00	(1.00)
SP350	1.8-500MHz PWR/SWR	69.95	(1.00)
SP400	130-500MHz PWR/SWR	82.00	(1.00)
SP600	1.8-500MHz PWR/SWR	106.00	(1.00)
TOYO			
T430	144/432 120 W	39.49	(1.00)
T435	144/432 200 W	43.50	(1.00)
YAESU			
YS200	1.8 60MHz	52.90	(1.00)
YS2000	1.8 60MHz	69.79	(1.00)

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TLNA 432s	70cm Switched preamp	74.90	(1.20)
RPCB 144ub	Front end FT221/225	71.00	(1.20)
RPCB 251ub	Front end IC251/211	76.90	(1.20)
BBA 500u	20-500MHz Preamp	29.00	(1.20)
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SBLA 144e	2m Mast head preamp	79.90	(2.50)
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ASP/A	r.f. speech clipper for Yaesu	82.80	(1.00)
ASP	As above with 8 pin conn	89.70	(1.00)
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D70	Morse Tutor	56.35	(1.00)
MK	Keyboard morse sender	137.40	(1.00)
RFA	RF switched pre-amp	33.90	(1.00)
AD270-MPU	Active dipole with mains p.s.u.	51.75	(2.00)
AD370-MPU	Active dipole with mains p.s.u.	69.00	(2.00)
MPU	Mains power unit	6.90	(1.00)
DC144/28	2m converter	39.67	(1.00)
PTS1	Tone squelch unit	46.00	(1.00)
ANF	Automatic notch filter	67.85	(1.00)
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HK702	Up down keyer marble base	27.00	(1.00)
HK704	Up down keyer	19.25	(1.00)
HK705	Up down keyer	13.57	(1.00)
HK706	Up down keyer	15.90	(1.00)
HK708	Up down keyer	13.00	(1.00)
HK808	Up down keyer	39.95	(1.00)
MK704	Twin paddle keyer		(1.00)
MK705	Twin paddle keyer marble base	24.65	(1.00)
KENPRO			
KP 100	Squeeze CMOS 230/13.8v	77.05	(2.00)
KP 200	Memory 4096 Multi Channel	165.62	(2.50)

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AR40	5 core Medium Duty	98.90	(2.00)
KR400	Med/H Duty	99.94	(2.50)
KR500	6 core Elevation	126.50	(2.50)
KR400RC	6 core Medium Duty	118.45	(2.50)
CD45	8 core Heavy Duty	149.50	(2.50)
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SWITCHES

Sigma	2 way SO239	11.50	(0.75)
Sigma	2 way 'n' Skts	15.50	(0.75)
Welz	2 way SO239	20.75	(0.75)
Welz	2 way 'n' Skts	37.00	(0.75)
Drae	3 way SO239	15.40	(0.75)

MISCELLANEOUS

DRAE	Wavemeter	27.50	(1.00)
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T100	100W Dummy load	28.00	(1.00)
T200	200W Dummy load	41.40	(1.50)
CT300	300W Dummy load	54.00	(2.00)
GT4	Digital World Time Clock	49.95	(2.00)
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FOR THE Radio ENTHUSIAST ...

JUNE 1984 VOL. 60 NO. 6 ISSUE 927

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LOWE SHOPS

Whenever you enter a LOWE ELECTRONIC'S shop, be it Glasgow, Darlington, Cambridge, London or here at Matlock, then you can be certain that along with a courteous welcome you will receive straightforward advice. Advice given not with the intention of "making" a sale but the sort which is given freely by one radio amateur to another. Of course, if you decide to purchase then you have the knowledge that LOWE ELECTRONICS are the company that set the standard for amateur radio after-sales service. The shops are open Tuesday to Saturday and close for lunch 12.30 till 1.30pm.

In Glasgow the LOWE ELECTRONICS' shop (telephone 041 945 2626) is managed by Sim GM3SAN. Its address is 4/5 Queen Margaret's Road, off Queen Margaret's Drive. That's the right turn off Great Western Road at the Botanical Gardens' traffic lights. Street parking is available outside the shop and afterwards the Botanical Gardens are well worth a visit . . .

In the North East the LOWE ELECTRONICS' shop is found in the delightful market town of Darlington (telephone 0325 486121) and is managed by Don G3GEA. The shop's address is 56 North Road, Darlington. That is on the A167 Durham Road out of town. A huge free car park across the road, a large supermarket and bistro restaurant combine to make a visit to Darlington a pleasure for the whole family.

Cambridge, not only a University town but now the location of a LOWE ELECTRONICS' shop managed by Tony G4NBS. The address is 162 High Street, Chesterton, Cambridge (telephone 0223 311230). From the A45 just to the north of Cambridge turn off into the town on the A1039, past the science park and turn left at the first roundabout. After passing a children's playground on your left turn left again into High Street. Easy and free street parking is available outside the shop.

The Capital City also has a LOWE ELECTRONICS' shop managed by Andy, G4DHQ. Easy to find, the address is 278 Pentonville Road, London N1 9NR (telephone 01-837 6702) and the shop is located on the lower sales floor of Hepworths. That's only a 3 minutes walk from Kings Cross railway station. So, when you're in the Capital City, visit LOWE ELECTRONICS.

Finally, here in Matlock David G4KFN is in charge. Located in an area of scenic beauty a visit to the shop can combine amateur radio with an outing for the whole family. May I suggest a meal in one of the town's inexpensive restaurants or a picnic on the hill tops followed by a spell of portable operation.

We cannot seem to keep the TR9130 in an "in stock" situation. No sooner has a shipment arrived than we are "out of stock". I must say that even I am surprised by its popularity. Based on the renowned TR9000, the TR9130 has additional features that make it the most popular multimode on today's market. We are still getting requests for second-hand TR9000's and even they are a rarity on our second-hand shelf. Having a clear green readout, reverse repeater, the ability to tune whilst transmitting, 25 watts output, 6 memories and of course memory scan: TRIO's two metre multimode, the TR9130.


TR9130

TR9130 **£442.52 inc. VAT.** carriage £6.00

There are two schools of thought regarding two metre mobile FM equipment. One group are of the opinion that the simpler the rig the better and refer to the TRIO TR7500 as the ultimate mobile transceiver ever made. There are others who require their mobile rig to have memory channels and all associated facilities in order to gain operational flexibility. TRIO cater for both.

The TM201A and the TM401A are simple rigs, designed to fit into the smallest of today's cars and provide the simple functions that make mobile operation a pleasure. Repeater shift and lockable reverse repeater are included as well as superb receive performance. 25 watts from the 2 metre TM201A and 12.5 watts from its 70 centimetre cousin, the TM401A, ensures a strong transmitted signal. A separate 77 mm (3 inch) speakers in a solid enclosure gives high quality receive audio even whilst mobile.


TM201A

TM201A ..... **£269.00 inc VAT.** carriage £6.00
TM401A ..... **£299.00 inc VAT.** carriage £6.00

A remote controller with a green backlit LCD frequency readout is also available as an optional accessory. The FC10 simply plugs into the side of the transceiver and comes complete with mounting bracket and velcro pads to ease fixing without drilling holes in the car's dashboard.


TW4000A

FC10 .... **£41.20 inc VAT.** carriage £6.00

For a mobile transceiver having more operating features the TR7930 is the model to choose. The TR7930 is TRIO's logical progression from the very popular and reliable TR7800. The design of the TR7930 takes into account the minor and justifiable criticisms levelled against the TR7800. You will now find the frequency readout is a green backlit liquid crystal display that can be read in the brightest of sunlight. The memory allocation has been increased to a total of 21 channels and the rig can be instructed to hold on the received signal for either a timed period or until the signal disappears. Programmable band scan is also available between user defined limits. To make mobile operation safer the transceiver is pre-programmed so that if you select for example, 145.450 then the rig will adopt the simplex mode, if you select 145.650 then, automatically, you will get repeater mode. Of course TRIO have made it easy to over-ride this feature as you would naturally expect. I can say no more about the TR7930, a comprehensive rig for the mobile enthusiast.

TR7930 ..... **£312.00 inc VAT.** carriage £6.00

To improve mobile operation there is the TRIO MC55 boom microphone. Not jut an electret condenser microphone but having a transmission timer, up/down frequency shift switch, adjustable microphone gain and fitted with either a 6 or 8 pin microphone plug. To monitor the swr/output power of your mobile installation TRIO have produced the SWR100A/B. (model A: 1.8 to 150 MHz and model B: 140 to 450 MHz) Compact and easily fixed to your dashboard, be the first to know something is wrong with your mobile station.

MC55 ..... **£38.64 inc VAT.** carriage £2.00
SW100A/B ..... **£37.26 inc VAT.** carriage £2.50

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For the real VHF/UHF enthusiast there is only one FM mobile rig that in one compact unit has both 2 metres and 70 centimetres. The TRIO TW4000A. Not a cheap piece of equipment, the TW4000A has to be seen to be appreciated. Having many features to assist mobile operation the TW4000A also speaks. Unless you have actually operated the rig with the optional VS1 voice synthesizer fitted, then you cannot really make a considered judgement. It is easy to say that such a feature is a gimmick but I, on my journeys up and down the country, have found that having the frequency, memory number etc announced in clear distinct voice is much better than stealing a glance at the display. A recent review in AMATEUR RADIO magazine (December 1983) tells more.

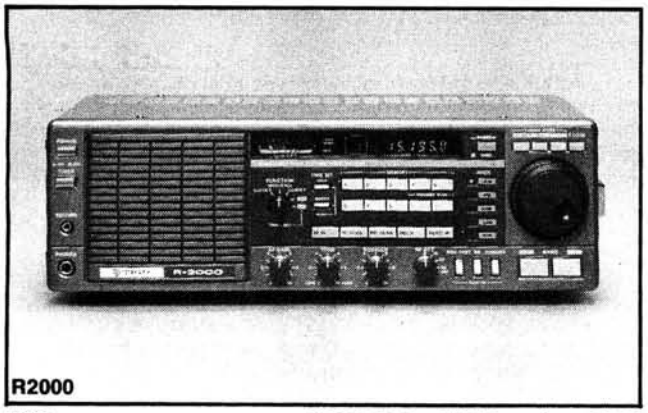
TW4000A ..... **£469.00 inc VAT.** carriage £6.00
VS1 ..... **£24.50 inc VAT.** carriage £0.75
(in fact the VS1 is not a voice synthesizer, it is the digitally recorded voice of a Japanese girl programmed into a dedicated chip, her Japanese diction can be had as an alternative by moving an internal switch on the VS1 board from position EN to JA.)

Don't let us forget the two handhelds from TRIO, the 2 metre TR2500 and the 70 centimetre TR3500. Both very popular pieces of equipment. Reliable and functional. Each having ten memories, memory scan, programmable scan, repeater and reverse repeater shift and a comprehensive range of accessories compatible to both models.


TR2500

TR2500 ..... **£237.82 inc VAT.** carriage £6.00
TR3500 ..... **£256.45 inc VAT.** carriage £6.00

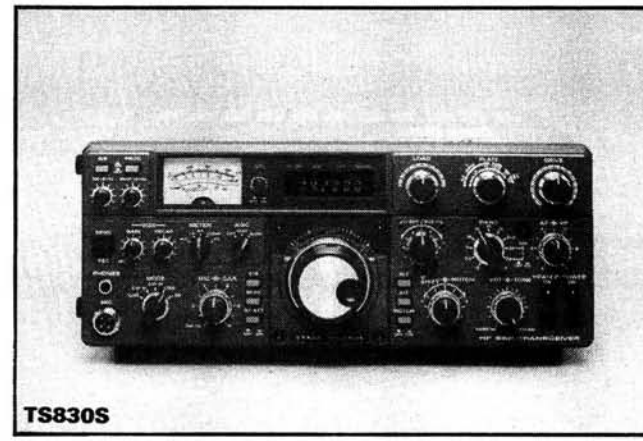
Two general coverage receivers are available from TRIO, the R600 and the R2000. The R600 is the basic model and covers continuously frequencies from 150 KHz to 30 MHz having AM, CW and SSB modes. The R2000 is more sophisticated having the same coverage but FM in addition to the usual modes found on a high quality general coverage receiver. Ten memories, memory scan, programmable band scan between user defined limits all add to the enjoyment to be had from a TRIO R2000. To create the perfect receiver an optional VHF converter covering again continuously 118 to 174 MHz and fitting inside the receiver is available. The nice thing about the VHF converter is that the frequency readout of the R2000 is also corrected so that if you are tuned to 145.600 then that is what the readout displays.


R2000

R600 ..... **£263.00 inc VAT.** carriage £6.00
R2000 ..... **£421.20 inc VAT.** carriage £6.00
VC10 ..... **£113.00 inc VAT.** carriage £6.00

It appears my enthusiasm for the TS530SP has made me forget to keep you informed of the TRIO TS830S HF transceiver. The problem is the number of superb products in the TRIO range. To mention them all each month is impossible.

The TS830S valve transceiver (pair of 6146B valves) is by now a rig which really requires no description. There must be within your sphere of amateur radio operation someone who uses a TRIO TS830S and that person is the equipment's best advertisement. The transceiver covers the full amateur bands and has for its owner, features that will ensure excellent world wide contacts. The variable band width and IF shift system designed by TRIO and now unsuccessfully copied by others, presents the TS830S owner with the ultimate in flexibility. The operator can vary the IF passband width whilst its centre frequency remains unchanged. Much easier than having to constantly retune whilst narrowing the bandwidth. Additionally, whilst keeping the bandwidth at its optimum setting, the pass band of the filter can be moved using the IF shift control. The result, offending adjacent signals are removed and better reception assured. Add to an already comprehensive transceiver a notch filter, audio tone control and RF speech processor and you have the perfect amateur band rig. Take a listen on the bands, find an amateur using a TRIO TS830S and imagine owning one.


TS830S

TS530SP ..... **£638.00 inc VAT.** carriage £6.00
TS830S ..... **£731.40 inc VAT.** carriage £6.00
TS130S ..... **£555.45 inc VAT.** carriage £6.00
TS430S ..... **£752.10 inc VAT.** carriage £6.00
TS930S ..... **£1150.00 inc VAT.** carriage £6.00

So that a full amateur radio station can be set up, TRIO have a comprehensive range of microphones, headphones, separate VFO's, aerial tuning units, for the TS430S and TS930S, the ATU's can be automatic, etc.
The items are too numerous to list, full details and prices can be obtained from any LOWE ELECTRONICS shop.

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(Delivery of stock items normally by return of post)

What price

HF Equipment

IC-751	All band AM.FM.SSB.CW – Gen Cov Rx. 32 Memories	1049.00
PS35	Internal switched mode power supply	149.00
SM6	Desk microphone	34.50
HM12	Hand microphone with up/down scanning	16.50
EX310	Voice synthesizer module	39.00
RC10	Frequency controller unit	29.95
CR64	High stability xtal unit	49.95
FL32	9MHz CW RTTY filter – 500Hz	39.00
FL63	9MHz CW RTTY narrow filter – 250Hz	39.00
FL33	9MHz AM filter – 6KHz	32.50
FL70	9MHz SSB wide filter – 2.8KHz	35.50
FL52a	455KHz CW RTTY filter – 500Hz	79.00
FL53a	455KHz CW RTTY narrow filter – 250Hz	79.00
IC-745	All band SSB.CW.AM(Rx only), Gen Cov Rx. 16 mems.	839.00
PS35	Internal switched mode power supply	149.00
SM6	Desk microphone	34.50
HM12	Hand microphone with up/down scanning	16.50
EX310	Voice synthesizer unit	39.00
EX242	FM unit Tx & Rx	32.50
EX241	Marker unit	15.95
EX243	Curtis keyer unit	39.00
FL45	9MHz CW filter – 500Hz	45.00
FL44a	455KHz SSB narrow filter – 2.4KHz	79.00
FL52a	455KHz CW/RTTY filter – 500Hz	79.00
FL53a	455KHz CW/RTTY narrow filter – 250Hz	79.00
FL54	9MHz CW/RTTY narrow filter – 270Hz	39.00
IC-740	No longer available. Accs still in stock.	
PS740	Internal switched mode power supply	149.00
SM5	Desk microphone	34.50
EX241	Marker unit	15.95
EX242	FM unit	32.50
EX243	Curtis keyer	39.00
FL44	455KHz SSB filter – 2.4KHz	79.00
FL45	9MHz filter – 500Hz	45.00
FL52	455KHz CW/RTTY filter – 500Hz	79.00
FL53	455KHz CW/RTTY narrow filter – 250Hz	79.00
FL54	9MHz CW/RTTY narrow filter – 270Hz	39.00
IC-730	10–80 Mtrs compact transceiver	659.00
PS15	External power supply – 20amps	119.00
PS20	External power supply with speaker – 20 amps	176.00
SM5	Desk microphone	34.50
HM7	Hand microphone with pre amp	14.95
EX202	LDA unit for use with AT100/500	13.50
EX203	CW audio filter	14.50
EX205	Transvertor unit	14.00
EX195	Marker unit	17.00
FL44	455KHz SSB filter – 2.4KHz	79.00
FL45	9MHz CW filter – 500Hz	45.00
FM04	FM unit Tx & Rx	49.00
IC-720A	No longer available. Accs still available.	
PS15	External power supply – 20 amps	119.00
PS20	External power supply with speaker 20 amp	176.00
CF1	Cooling fan for PS20	24.00
SM5	Desk microphone	34.50
FL32	CW narrow filter	39.00
FL34	AM xtal filter	34.00
BC10	Memory back up unit	5.95
FM03	FM unit Tx & Rx	89.00
IC-R70	General Coverage Receiver 0.1–30MHz	549.00
EX257	FM unit	32.50
FL63	CW narrow filter	39.00
FL44a	455KHz SSB filter	79.00
CK70	DC cable kit	5.75
7072	Interface unit to transceive with IC720A	97.50
IC-R71	All mode Gen Cov Rx. k pad entry. 32 memories	649.00
RC11	Remote control unit for above	T.B.A.
IC-2KL	1KW PEP Linear, auto band switching, complete with –	
2KLPS	Power supply to run 2KL linear	1303.33
IC-AT100	100Watt Automatic antenna tuner	269.00
IC-AT500	500Watt Automatic antenna tuner	369.00
IC-PS30	Systems power supply, 25 amps continuous	229.00
IC-AH1	Mobile antenna, 3.5MHz–30MHz	199.00
VHF Equipment		
IC-271E	Multimode base station, 25w, 32 memories	629.00
IC-271H/E	High power version of above, 100w	789.00
PS25	Internal switched mode power supply	89.00
EX310	Speech synthesizer unit	39.00
AG20	Internal receive pre-amp	49.00
SM6	Desk microphone	34.50
IC-290D	25W Multimode mobile, 5 memories, scanning mic	469.00
IC-27E	25W FM mobile, 9 memories, multi function display	299.00
U216	Voice synthesizer unit	T.B.A.
IC-25H	45W FM mobile, high power version of old IC25E	359.00
BU1	Memory back up unit for mobiles	24.50
	DC leads (flat pin or square 6 pin)	4.50
	DC Plugs (flat 4 pin)	.30
	DC Sockets (flat 4 pin)	.30
IC-2E	Synthesized hand portable, 1.5 watts	169.00
IC-02E	Synthesized hand held, keypad entry, LCD display	229.00
ML1	10 watt booster unit for 2E	69.00
BP3	Standard battery pack	25.00
BP2	Low volts high capacity (long life)	38.00
VP4	Empty battery pack, takes 6 x AA size cells	7.95
BP5	High volts high capacity (high power)	48.00
BP7	High volts high capacity (for use with O2E ONLY	59.00
BP8	Low volts high capacity	49.00
DC1	12v regulator pack (2E ONLY)	12.50
CP1	12v charger lead for cigar lighter	4.95
FA2	Helical antenna	7.50
LC1	Leatherette case (BP5)	5.00
LC2	Leatherette case (BP4)	5.00
LC3	Leatherette case (BP3)	5.00
LC11	Case for O2E (BP3)	5.00
T/L1	Heavy duty leather case (all batt packs)	21.27
BC25E	240v wall charger for 2E	6.69
BC25U	110v wall charger for 2E (USA)	6.69
BC16E	240v wall charger for O2E (BP8/BP7)	9.95
BC30	Desk top drop in charger (fast and slow) old packs	56.35
BC35E	Desk charger all packs new & old (fast/slow)	56.35
HM9	Speaker microphone	16.50
IC-202S	SSB Portable, + CW, 3 watt output	199.00
BC15E	AC Charger 240v	41.80
BC20	DC Charger 13.8v	41.80
	DC lead	1.75
	Telescopic antenna	1.50
LC25	Leatherette carrying case	8.25
FA1	Helical screw in antenna	7.50
UHF Equipment		
IC-471E	Multimode base station, 25watts, 32 memories	699.00
IC-471H	High power version of above, 75watts,	879.00
PS25	Internal switched mode power supply	89.00
EX310	Voice synthesizer unit	39.00
SM6	Desk microphone	34.50
IC-490E	Multimode mobile, 10 watts, 5 memories	495.00
IC-45E	FM mobile, 10 watts, 5 memories	329.00
BU1	Memory back up unit for mobiles	24.50
	Spare DC leads (flat 4 pin or square 6 pin)	4.50
	DC plugs & sockets (flat 4 pin)	.30
AG1	Mast head pre-amp for 471/451/490	49.00
IC-4E	Synthesized hand portable, 1.5 watts	219.00
IC-04E	Synthesized hand held, k pad entry, LCD	T.B.A.
FA3	Flexi 1/4 wave antenna	7.50
	Accessories same as IC2E/O2E	
IC-402	SSB portable + CW, 3 watts output	257.00
BC15E	AC charger 240v	41.80
BC20	DC charger 13.8v	41.80
	DC lead	1.75
LC25	Carrying case	8.25
1.2 GHz Equipment		
IC-120	FM mobile, 1 watt output, 40MHz coverage mems	439.00
BT23E	Bit Zero 23e. 1296MHz linear, lw in – 7/8w out	179.00
50 MHz Equipment		
IC-551	Multimode base station, supplied SSB/CW only	379.00
EX106	FM unit	112.00
EX107	VOX unit	49.00
EX108	Pass band tune unit	97.50
IC-505	Multimode portable, 3/10watt, supplied SSB only	382.00
EX282	FM unit	28.50
BP10	Nicad pack	59.00
BC15	Charger unit	6.50
LC10	Carrying case	22.50
Mobile Mounting Brackets		
MMB5	Mount for 251E, 451E, 720A, 730	12.50
MMB6	Mount for 240,	12.50
MMB7	Mount for 245E	12.50
MMB8	Mount for 255E, 260E	12.50
MMB9	Mount for 290E, 490E	12.50
MMB10	Mount for 25E, 45E, 120	12.50
MMB11	Mount for 22U, 24G	12.50
MMB12	Mount for R70, 740, 271E, 471E	12.50
MMB16	Mount for 2E, 4E, O2E, O4E	6.95
MMB18	Mount for 751	T.B.A.
SS1	Shoulder strap for handhelds	7.50

IC-745 £839.

The Wo

ICOM's IC-745 is the all-in-one transceiver featuring an HF all band SSB, CW, RTTY, AM (receive only) ham transceiver, plus a general coverage receiver. Options for FM transceive and an internal power supply make the IC-745 the complete transceiver in an all-in-one package.

The receiver section features a 100KHz to 30MHz general coverage receiver, this allows access to all HF bands plus all the frequencies in between. The IC-745 has an adjustable AGC circuit and DFM (Direct Feed Mixer) giving a wide dynamic range of 103dB with an intercept point at +18dBm. Exceptionally clean reception is achieved with a low noise PLL circuit and a 70MHz first IF.

The IC-745's features include IF shift, 16 programmable memories with lithium battery back-up, passband tuning, a noise blanker both wide and narrow, threshold level control, notch filter, receive audio tone control and an all mode squelch. Also available is a front end switchable receiver preamp providing 12dB gain. RIT has a ±1KHz range.

The transmitter section of the IC-745 features two powerful 2SC2904 transistors running a conservative 100 watts at 100% duty cycle rated output. Also included are a speech compressor and VOX circuits. The 600 ohm microphone system is adaptable to the modern mic of your choice. Monitor circuitry allows the operator to hear sidetone in CW and SSB.

We could go on all day about the 745, but if you need the full story get in touch with us and we will send you a detailed leaflet.

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perfection?

Microphones

HM3	4 Pin hand microphone (IC240)	12.50
HM5	4 Pin hand microphone noise cancelling	20.00
HM7	8 Pin hand microphone (IC-24G, 730, 720A)	14.95
HM9	Speaker microphone for hand helds	16.50
HM10	8 Pin microphone with up/down scanning	29.00
HM11E	8 Pin microphone with up/down scanning + tone call	22.50
HM12	Up/down scanning mic for new sets (271/471/751/745)	16.50
SM2	4 Pin base microphone	34.50
SM5	8 Pin base microphone	34.50
SM6	Base microphone for new sets (271/471/751/745)	34.50

Ext Speaker/Headphones/Headsets

SP3	Matching speaker for ICOM sets	45.00
SP4	Mobile speaker with magnetic mount	19.55
HP1	Good quality headphones	28.50
HS10	Headset and boom mic for ICOM hand helds	18.40
HS10SB	PTT switch box for HS10	18.40
HS10SA	VOX unit for HS10	20.70

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TONO CW/RTTY/ASCII Terminals

9000E	Communications computer. RTTY, CW, ASCII, TX/RX	669.00
550	CW/RTTY decoder, inc CW practice, and CW transmit	299.00
5000E	Comunications terminal & k board, inc AMTOR, VDU.	799.00
9100E	As 9000E with amtor	699.00
CRT1200G	High quality video monitor with green display	136.00

TONO Linears

MR250W	144–146MHz, 10–15W drive, 180–200W out, RX pre-amp	325.00
MR150W	144–146MHz, 10–15W drive, 120–140W out, RX pre-amp	169.00
MR100W	144–146MHz, 10–15W drive, 80–90W out, RX pre-amp	99.00
2M50W	144–146MHz, 1–3W drive, 30–45W out, no pre-amp	59.00

NEW "G" Series

2M40G	144–146MHz, 1–3W drive, 20–35W out, RX pre-amp	79.00
2M90G	144–146MHz, 10–15W drive, 70–90W out, RX pre-amp	115.00
2M130G	144–146MHz, 10–15W drive, 110–130W out, RX pre-amp	160.00
4M60G	430MHZ, 3–15W drive, 40–60W out, RX pre-amp	159.00

TONO Pre-amps

RX144	2 metre mast head pre-amp & control box	65.00
RX430	70 cm mast head pre-amp & control box	70.00

TELEREADER Equipment

CWR685E	CW/RTTY/ASCII terminal & k board, with VDU, TX/RX	730.99
CWR675E	RX only version of 685E, with inbuilt printer/VDU	599.00
CWR670E	CW/RTTY/ASCII RX only, use with TV or VDU 12 pin plug for 670/675/685	349.00 6.00
CWR610	CW/RTTY decoder, slow morse practice	159.00
CWR610E	As 610 with adjs baud rate from front panel (45–600) 13 pin plug for 610/610E	175.00 4.75
CM40PS	40 character dot matrix printer, 11.5cm paper roll	199.00

ZENITH Monitors

123E	12 inch with green display, good quality	109.25
122E	12 inch with amber display, good quality	125.00

TAL, ASP Series System 6 antennas

ASP2016	138–512MHz 1/4 wave whip with threaded adaptor	2.56
ASP3976	66–138MHz 1/4 wave whip with threaded adaptor	5.21
ASP3936	130–174MHz 1/2 wave whip with barrel/spring, 3dB	18.63

Mounts for above

K57	Fits 1/2 wave, 3/8 inch hole, snap-in type	3.10
K440	Fits 1/4 wave, 3/8 inch hole, snap-in type	1.55
K145	Fits 1/2 wave, 3/4 inch hole, snap-in with claw mount	5.43
K65	Fits 1/4 wave, 3/4 inch hole, deep claw with 17ft cable	9.31
K47	Fits 1/2 wave, 3/4 inch hole, wing mount	7.17
KR47	Fits 1/2 wave, 3/4 inch hole, narrow wing mount	12.42
K220	Fits 1/2 wave, magnetic mount with 17ft cable	12.10
K220A	Fits 1/4 wave, magnetic mount with 17ft cable	12.10
M161	Fits 1/2 wave, boot lip mount, needs K57	3.88
M161	Fits 1/4 wave, boot lip mount, needs K440	3.88
KR193	Fits 1/2 wave, swivel ball mount	4.03
K67	Ground plane kit for all whips	16.30

3000 Series System 6 antennas

TAP3006	60–110MHz, 1/4 wave whip with threaded hinge	7.76
TAP3016	110–512MHz, 1/4 wave whip with threaded hinge	7.76
TAP3026	144–174MHz, VHF 1/2 wave, 3dB gain, threaded hinge	10.86
TAP3676	144–174MHz, VHF 1/2 wave, 3dB gain, with spring	12.42
TAP3456	420–440MHz, UHF 3dB gain, with threaded adaptor	14.74
TAP3466	450–470MHz, UHF 3dB gain, with threaded adaptor	14.74
TAP3696	420–440MHz, UHF 5dB gain, with shock spring	18.63
TAP3666	450–470MHz, UHF 5dB gain, with shock spring	18.63

Mounts for above

K68	Snap in adaptor for 3/8 inch hole	2.32
K145	Snap in adaptor with claw fits 3/4 inch hole	5.43
K72	Wing mount with 17ft of cable, fits 3/4 inch hole	11.64
K66	Claw mount with 17ft of cable, fits 3/4 inch hole	7.76
K65	1/2 inch deep claw mount with 17ft cable, 3/4" hole	9.31
K220	Magnetic mount with 17ft of cable	12.10
ASPR332E	Gutter clip with 10ft of cable	11.79
M161	Boot lip mount needs K68	3.88
KR223	Durallex noiseless spring	10.86
K67	Ground plane kit	16.30

Base station antennas

ASP655	130–174MHz economy base, 1/2 wave with g-plane	27.94
TAP4009	156–174MHz Colinear, 3dB gain	50.45
ASPD682	160–166MHz Colinear, 4.5dB gain	194.00
ASPE682UK	164–172MHz Colinear, 4.5dB gain	194.00
ASPD700	450–460MHz Colinear, 7dB gain	163.00
ASP2006	156.174MHz Unity gain	47.44

Low profile/Heavy-duty antennas

ASP2001	66–88MHz dome shape, –12db	55.89
ASP2000	105–108MHz TX – 138–141MHz RX dome shape, –4.5dB	73.74
ASP2002	162–174MHz dome shape, –3.5dB	55.89
ASP2021	162–173MHz fin shape, –1dB	55.89
ASP4005	450–470MHz dome shape, –0.5dB	31.05

Marine antennas 156–162MHz

ASM37E	1/2 wave unity gain, deck mount, with 20ft cable	26.90
ASM38E	Colinear 3dB gain, deck mount, with 20ft cable	39.32
ASM77E	1/2 wave unity gain, mast mount, with 3ft cable	19.67
ASM88E	As above with 60ft of cable	27.83
ASM98E	Dipole, with deck/bulkhead mount & 20ft of cable	24.21
TAM1001	1/2 wave unity gain, lightweight whip style	24.84
TAM1003	Emergency antenna, (CH16) c/w special bracket	23.28

Mounts/Accessories for above:

ASM42	Heavy duty rachet mount all angles	25.88
ASM91	Vertical deck mount, fold over	10.35
K509	Stand off bracket (13cm) for 1001, 1005, 1006, 88E	5.74
TAM108	Antenna extension rod (1.5m)	31.05
ASM93	Antenna support bracket	5.16
CS100	Good quality extension speaker	11.37

Antenna matching units

AMU100	1.5–99MHz 200 watts pep	99.00
AMU400	1.5–60MHz 400 watts pep	116.43

Prices include VAT at 15%.
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As well as ICOM equipment, we also stock the following :- TONO & TELEREADER, CUE DEE, DATONG, MICROWAVE MODULES, MUTEK, LAR, WELTZ, YAESU, JAYBEAM, TAL, G-WHIP, DRAE, B.N.O.S., BEARCAT, TRIO and many accessories. Items listed are subject to availability

IC-471E
£699.

ICOM
d System

The IC-471E is the most advanced 430 MHz transceiver available today, it covers the spectrum from 430-440MHz with FM, SSB, or CW using the most advanced 10Hz PLL system. The IC-471E is suitable for simplex, repeater operation, moonbounce or satellite work, and has features found on no other transceiver.

Some standard features include 32 tunable memories, a high visibility fluorescent display, RIT readout, scanning, 12V DC or AC operation with optional power supply.

The UHF receiver section of the IC-471E features FET front end and mixer, a 70.4515 MHz first IF, low noise PLL locked to 10Hz and an AGC circuit. Sensitivity is less than 0.3uV for 12dB Sinad without the optional GaAs FET preamp which adds another 15dB.

The transmitter section provides 25 watts of power in FM, SSB and CW, this can be varied in all modes from 1 to 25 watts. The design of the IC-471E is based on an entirely new CPU chip that is easy to operate and offers the maximum number of functions available. A lithium battery memory backup is featured maintaining the sets memory for up to 7 years. An internal computer interface option is available as well as the IC-PS25 internal switching AC power supply.

The 471E has a speech synthesizer that announces the displayed frequency, ideal for blind operators, this is an optional extra along with the SM6 desk microphone and 22 channel memory extension with scan facilities.

As you can see from this brief description the IC-471E, (and its 2 meter brother the IC-271E) are very versatile sets indeed. More detailed literature can easily be obtained from Thanet Electronics Limited.

Agent: Gordon G3LEQ, or telephone Knutsford (0565) 4040.
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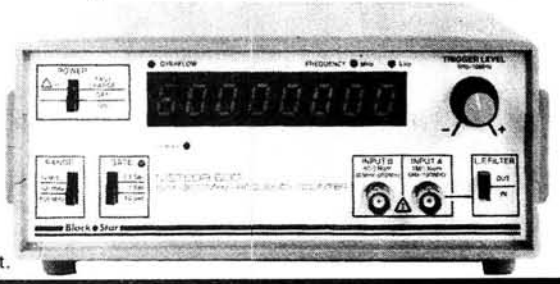

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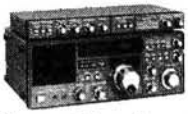

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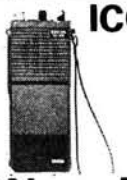

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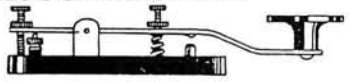

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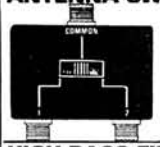

Co-axial switch for one transceiver to two antennae or one antenna to two transceivers. Dims: 86 × 55 × 32mm (Body).
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As above but 3-way.
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Designed to reduce harmonics on the VHS and TV band.
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Insertion loss: −0.2dB @ 27MHz
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O/No. VP 107
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Fixing centres: 38mm.
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Miniature electronic buzzers. Solid state. Ivory plastic. 150 leads. Frequency: 500 Hz approx.
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Output: 82dB (A) @ 1m typ.
Fixing centres: 26mm.
3V 25mA: O/No. VP 82. 6V 25mA: VP 83
9V 25mA: O/No. VP 84. 12V 25mA: VP 86
80p each

SUB-BOX

A neat swivelling disc provides close tolerance substitution resistors of 36 preferred values from 5ohms to 1Kohm. Simply fix clips into circuit and swivel until optimum result is achieved.
O/No. VP 112 **£4.75**

MINIATURE VICE

Miniature plastic and metal vice with strong suction base for portability. Single action to secure or release suction. Plastic jaws with rubber pads 20mm wide, open out to 40mm. Dims: 85 × 65 × 60mm approx.
FANTASTIC VALUE
O/No. VP 95 **ONLY £1.60**

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Slim under pillow unit. 8ohms 2" speaker. 1.5m lead with 3.5mm mono jack plug. Black. Dims: 65 (dia.) ×17mm.
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Steel tapes in sturdy ABs plastic case. Silk wrist strap. These yellow coated convex tapes have inch and metric graduations. Automatic push-button return.
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Tests all types of battery including standard, NICAD, Alkaline etc. Takes all standard sizes including 6V lantern batteries and watch/hearing aid cells. Also tests fuses and lamps by means of internal 9V (PP3) battery. Can also be used to recharge NICAD batteries by means of external 3-12Vd.c. power supply (not included).
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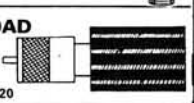
O/No. VP 101 **£7.00**

FM MONITOR

FM monitor for 2 metre band. All metal. Attached earphone. PL259/SO239 connectors. 144MHz. 10W maximum. Dims: (Body) 55 × 30 × 23mm.
O/No. VP 120 **£4.20**

DUMMY LOAD



50 ohms. 30W.
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O/No. VP 87

VALUE PACKS

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VP2	300	CarbonR esistors ¼-½ Watt Pre-Formed	£1.00
VP3	200		£1.00
VP4	150	¼ Watt Resistors 100 ohm-1M Mixed	£1.00
VP5	200	Assorted Capacitors All Types	£1.00
VP6	200	Ceramic Caps Miniature – Mixed	£1.00
VP7	100	Mixed Ceramics Disc. 1pf – 56pf	£1.00
VP8	100	Mixed Ceramic Disc. 68pf – .015pf	£1.00
VP9	100	Assorted Polyester/Polystyrene Caps	£1.00
VP10	60	C280 Type Caps Metal Foil Mixed	£1.00
VP11	100	Electrolytics – All Sorts	£1.00
VP12	60	Bead Type Polystyrene Min Caps	£1.00
VP13	50	Silver Mica Caps Ass. 5.6pf – 150pf	£1.00
VP14	50	Silver Mica Caps Ass. 180pf – 4700pf	£1.00
VP15	50	High Voltage Disc. Ceramic 750v – 8Kv Mixed	£1.00
VP16	50	Wirewound Res. 9W (avg) Ass. 1 ohm – 12K	£1.00
VP17	50	Metres PVC Covered Single Strand Wire Mixed Colours	£1.00
VP18	30	Metres PVC Covered Multi Strand Wire Mixed Colours	£1.00
VP19	40	Metres PVC Single/Multi Strand Hook-Up Wire Mixed	£1.00
VP20	6	Rocker Switches 5 Amp 240v	£1.00
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VP25	10	Sld er Pots. 40 mm 47K 5 × Log. 5 × Lin	£1.00
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VP35	50	1 Amp IN4000 Series Sil. Diodes Uncoded All Good	£1.00
VP36	8	Bridge Rects. 4 × 1 Amp 4 × 2 Amp Mixed Vlts. Coded	£1.00
VP37	8	Black Instrument Type Knobs With Pointer 1" Std	£1.00
VP42	10	Black Heatsinks To Fit TO-3. TO-220 Ready Drilled	£1.00
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TRANSISTOR CLEARANCE

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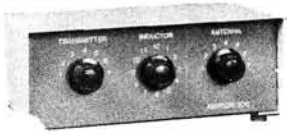

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Looking back a year or so we're extremely surprised that the 290 has not had to face up to any competition. TRYING to see the other manufacturers attitude to it isn't easy, could they better it? or did Yaesu **GET IT RIGHT FIRST TIME.** We know they did, why else has it become the world's Biggest and fastest selling rig of all time? CAN IT BE IMPROVED? functionally we can add a few refinements, you might like to add the MUTEK board if you feel you need it, we'd be happy to do anything like that for you but it still adds up to Yaesu's team doing the big bit **GETTING IT RIGHT FIRST TIME** and leaving the opposition **STRANDED. AND YOU'LL GET IT RIGHT FIRST TIME.** The **FT290R** fitted with **MUTEK BOARD** and complete with **NI-CAD CHARGER** and carrying case **£299** V.A.T. and carriage paid. CALL AMCOMM 01-422 9585. FAST DELIVERY.

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COMPETITORS PLEASE CALL AFTER 6 PM OR ANYTIME SUNDAY OR MONDAY.

THE FM MOBILES

There are many on the market these days and it must be difficult for the buyer to make a decision. . . . DON'T LET IT WORRY YOU for we have exactly the same problem. . . . We've searched the specs, tested the performance and analysed the reliability and our findings are simple . . . THEY ARE ALL GOOD . . . some have this and some have that, some are black, some are grey but they all have one thing in common . . . VALUE FOR MONEY. If you like it and it suits you then it's the one for you. . . . It leaves only one problem . . . THE PRICE. We're always helping where it hurts – Try us on 01-422 9585 Now. We'll ease the pain.

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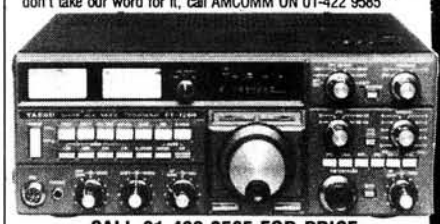

CALL 01-422 9585 FOR PRICE

THE HANDHELDS

As we said last month "It's been a great year for the handhelds, especially the Yaesu FT208R, they are all extremely versatile BUT THE 208 HAS THE EDGE. Did you see the reviews? They certainly told you a lot . . . WHAT THEY DID'NT TELL YOU WAS HOW TO OPERATE YOUR HF RIG FROM THE 208, from the garden, from the car, even the bath if your are willing to chance it. Whichever handheld you're interested in – Marine P.M.R. or Amateur: call us and we'll tell you, we'll even send you the information. Call 01-422 9585.

YAESU FT980 GENERAL COVERAGE TRANSCEIVER

Yaesu said the FT1 was an adventure in electronics and we agreed. The FT980 is something quite different . . . IT'S AN ACCOMPLISHMENT IN ELECTRONICS providing the operator with a brilliantly designed transceiver with a wealth of features. Every feature has been carefully designed in to ensure the operator has MAXIMUM BENEFIT without gimmicks while allowing INCREDIBLE EASE OF OPERATION. We'd need more than this page to do justice to the FT980 so we suggest you call in and try it for yourself or call 01-422 9585 for a beautifully illustrated leaflet with a full description. . . . Yes it is expensive . . . the best usually is unless a way can be found to ease the pain . . . AMCOMM ARE EXPERTS AT THAT . . . TRY US.

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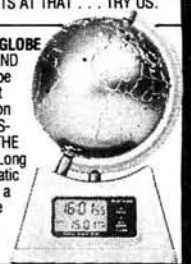

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Bits and Pieces

THIS MONTH we bring you, free, the first issue of a new magazine *Computing in Radio*. The "Special Features" on computing for radio enthusiasts which we've included in our last two December issues have proved very popular with readers, and we felt the time was right to expand our coverage of the topic.

The second issue of *Computing in Radio* is planned to appear with the October 1984 *PW* when, hopefully, you will have got over the summer holiday season and be turning your thoughts to projects for the long winter evenings.

* * * * * *

There has been comment in some sections of the national and local press recently regarding the ethics and legality of the involvement of radio amateurs who are members of the RAYNET organisation in an exercise based on the aftermath of a supposed nuclear explosion in East Anglia.

I do not propose to devote space in *Practical Wireless* to the question of political involvement — political bias is, like beauty, in the eye of the beholder. What does worry me though, is that tape recordings of traffic passed between amateur stations in East Anglia during the exercise apparently show that at no time was any indication given that it was in fact an exercise. Anything more likely to generate panic among listeners to the amateur bands is difficult to imagine.

* * * * * * *

My comment in April *PW* about the confusion between Teletex and Teletext brought a telephone call from Andy Emmerson G8PTH who works for a very well-known telecommunications organisation.

He tells me that Teletex is an international system, given that name by its German inventors some twelve years ago, which will supplant Telex in the developed countries of the world. Teletex is faster than Telex, with upper and lower case character capability and up to 96 characters per line. It can, however, be interlinked with conventional Telex systems, which are likely to be retained in developing countries for reasons of cost.

Andy also pointed out that in the USA, there is yet another system called Teletext which provides data communication over a cable network. Confusing, isn't it?

Geoff Arnold

QUERIES

While we will always try to assist readers in difficulties with a *Practical Wireless* project, we cannot offer advice on modifications to our designs, nor on commercial radio, TV or electronic equipment. Please address your letters to the **Editor, "Practical Wireless", Westover House, West Quay Road, Poole, Dorset BH15 1JG,** giving a clear description of the problem and enclosing a stamped self-addressed envelope. Only one project per letter please.

Components for our projects are usually available from advertisers. For more difficult items, a source will be suggested in the "Buying Guide" box included in each constructional article.

PROJECT COST

The approximate cost quoted in each constructional article includes the box or case used for the prototype. For some projects the type of case may be critical; if so this will be mentioned in the Buying Guide.

INSURANCE

Turn to the following page for details of the PW Radio Users Insurance Scheme, exclusive to our readers.

CONSTRUCTION RATING

Each constructional project will in future be given a rating, to guide readers as to its complexity:

Beginner

A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently. Generally this category will be used for simple projects, but sometimes for more complicated ones of wide appeal. In this case, construction and wiring will be dealt with in some detail.

Intermediate

A project likely to appeal to a wide range of constructors, and requiring only basic test equipment to complete any tests and adjustments. A fair degree of experience in building electronic or radio projects is assumed.

Advanced

A project likely to appeal to an experienced constructor, and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Constructional information will generally be limited to the more critical aspects of the project. Definitely not recommended for a beginner to tackle on his own.

SUBSCRIPTIONS

Subscriptions are available at £13 per annum to UK addresses and £14 overseas, from **"Practical Wireless" Subscription Department, Room 2816, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

BACK NUMBERS AND BINDERS

Limited stocks of some recent issues of *PW* are available at £1 each, including post and packing to addresses at home and overseas.

Binders are available (Price £5.50 to UK addresses, £5.75 overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

Send your orders to **Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.** All prices include VAT where appropriate.

Please make cheques, postal orders, etc., payable to IPC Magazines Limited.

Repeater Management Group—Open Meeting

On Saturday 10.3.84 the RMG held an open meeting for repeater users in the South West of England. The venue for the meeting, which attracted approximately 50 people, was the Mariner at Poole and the first job for RMG Vice Chairman Chris Young G4CCC was to thank Geoff Arnold G3GSR, the Editor of *PW*, for provision of what was agreed by all to be a very plush meeting place.

Two other members of the RMG Committee were present on the day, Geoff Dover G4AFJ and Mick Senior G4EFO, both having travelled considerable distances to be in attendance. Each covered a specific section of the agenda which encompassed 144MHz, 430MHz and 1·3GHz. What followed was a comprehensive evaluation of the UK system, from the early preparatory work now under way on 29MHz units up to advanced proposals for 10GHz input facilities on certain 430MHz repeaters.

Discussions were held about existing repeater coverage and performance together with a statement from the RMG about requirements for filling in any remaining gaps in the network.

Reference was made to a proposal now under consideration to provide an experimental "on frequency" repeater to cover Scarborough in Yorkshire. If technically feasible the aim would be to extend the coverage of GB3HG into what is presently a difficult area from its main site location. Several such r.f. "black holes" have been identified nationally so any viable techniques to cover these areas without involving further use of the already tightly packed available repeater frequencies will be very welcome. The RMG do not at this time wish to consider the "X" channel proposals, involving the creation of additional 12½kHz offsets to existing channels (but maintaining 25kHz system specifications). The whole area of band planning may well be due for review following the April IARU Conference in Sicily.

Relating to repeater coverage Kris Partridge G8AUU (co-editor/producer of the *International f.m. Guide*) requested the RMG to ascertain details of "height above average terrain". This information would allow a far more realistic assessment of potential coverage by the user; any plateau effects created by terrain close-in to the repeater will introduce nulls/field strength fluctuations within the nominal coverage area, even with highly elevated units using low radiation angle antennas.

It is hoped to establish a common specification for future 430MHz "data" repeaters. Such units built to this specification would automatically respond to the appropriate input code used and not be dedicated, for example, to 50 baud RTTY. At the time of this meeting the UK's first 24cm (1·3GHz) ATV repeater at Leicester was reported to be working well, and relaying video over a 40km range. Some work remained to be done to the sound channel performance. Apparently the Brighton 1·3GHz f.m. repeater/beacon GB3WX continues to provide signals along the South Coast with a surprising penetration into built-up areas being noted by users. Similarity to the 934MHz CB tests conducted by *PW* was noted, this mechanism being due to extremely rapid phase reversals/multiple reflections within such areas. Without doubt 1·3GHz is going to be the next growth area for amateur operation.

During the final section open forum many pertinent comments were received from the floor, many of whom were in fact repeater constructors. The Chairman was quick to point out that 144 and 432MHz repeaters were only licensed to run a maximum of 25W e.r.p. (14dBW)—this in response to the information provided to a Dorset repeater builder by his RSGB Zonal rep/Council member who had previously stated that full legal power levels were permissible! The present levels have existed now for several years.

UOSAT 2—An Obituary?

At the time of writing (28.3.84) UOSAT-2 was believed to be in its correct orbital position having experienced a "flawless" launch onboard a Delta 174 vehicle. Separation occurred at 19.11 GMT over Turkey whilst in range of the Surrey University Command Station.

During its first three 98·5 minute orbits the spacecraft was interrogated by the ground station and all systems declared nominal. Telemetry was passed via the 145·825MHz beacon which was activated for the duration of each pass culminating in an instruction for it to remain active during the following 10hrs, whilst it was out of range of Surrey.

The Command Station, not unnaturally after such a successful but hectic period, relaxed at this point and stood by for reports from around the world. Alarm bells started up when several enquiries as to the whereabouts of the spacecraft arrived. At orbit No. 8, the next in-range pass, the Control Station attempted to reactivate the dormant 145MHz beacon, unfortunately with no response. UOSAT-2 is still in this comatose state and it is fervently hoped that the vehicle remains intact.

Initial analysis after the first loss of contact did suggest the possibility of a computer clock rate error leading to premature beacon shut-down. A 21 day auto-fail safe designed to deactivate the satellite beacons, if for instance they become unstable, causing de-sensitisation of the on-board command up-link receivers, has also not worked.

Several reports of low level garbled telemetry were received by UOS during this 21 day period, but no conclusive evidence of survival is yet to hand. The Control Team are currently co-operating with the UK National Observatory at Jodrell Bank, together with NASA ground stations. A status report received on 31 March indicated that the spacecraft had been tracked using a 26m dish antenna, using a crossed-dipole feed at 145MHz. Nothing was heard during a two-day period—the receive capability was such that UOSAT-1 data was peaking at 75dB above noise.

BAEC

The British Amateur Electronics Club may be a new name to some readers, but was originally formed in 1966 at Penarth in South Glamorgan, and has members worldwide.

The club provides contact between members and covers all aspects of electronics, with a special responsibility to those who are just starting.

A quarterly newsletter is sent free to members and includes items from across the broad spectrum of hobbyist electronics. The current newsletter contains 43 A4 sizes pages, and is well illustrated with drawings and diagrams covering several constructional and theoretical articles.

Club members are able to purchase components at a discount from co-operating suppliers, and can also avail themselves of a comprehensive reference library of electronics literature.

UK membership of BAEC is £5.50 per year (£7.00 overseas). For further details, contact: *Hon. Sec., Mr J. G. Margetts, 113 South Road, Horndean, Hants. PO8 0ER.*

Living Antennas

It is difficult enough to erect an antenna at home let alone in the jungle, so an Indian television engineer conceived the idea of using such things as living cypress and banana trees and date palms as antennas at low GHz frequencies. He found that gains of a few dB can be obtained from large living leaves at frequencies of up to at least 4GHz with reasonable matching to the antenna input of a standard television receiver (monochrome or colour). However, if the plant material starts to dry out or dies, the efficiency of the antenna falls very sharply.

The vegetation in the jungle could be employed to receive colour television signals at distances of 25km from a 1kW transmitter with satisfactory signal-to-noise ratios. Live banana trees of some 4 metres in height were fitted with coaxial cable leading into their stems. The sharpened end of the inner wire of the coaxial cable could be used to penetrate through the stem wall into the moist part of the inner wall. Various tapping points could quickly be tried until the optimum signal was obtained.

It was found that leaves pointing towards the transmitter produced the best signals. Leaves pointing in other directions were very unsatisfactory, but several leaves could be used to form an antenna array to obtain a better signal than was available from any one leaf. Studies of the phenomenon have indicated that the dielectric constant of water and of other materials in the plants play a vital role in determining its efficiency as an antenna.

One can only wonder how such an antenna would behave in high winds or in a monsoon! *BD*

Arrow Move

Arrow Electronics have recently moved from their Brentwood base to larger premises at *5, The Street, Hatfield Peverel, near Chelmsford, Essex.*

The move has been occasioned by the need for larger showrooms to display their ever-increasing range of Amateur Radio Equipment, Marine Radios and associated products, and Test Equipment. Arrow will also be expanding their PMR service for which they now will have a purpose-built fitting bay. A welcome feature for customers loading heavy equipment is the large private car park immediately behind the new premises.

Arrow have gone from strength to strength during the last six years and are now one of the largest retailers and wholesalers in their field.

Rallies and Events

The Royal Naval Amateur Radio Society Mobile Rally 1984, will take place on Sunday 17 June at HMS Mercury, near Petersfield, Hampshire, between 10am and 5.30pm. Talk-in will be provided on 144MHz and 430MHz and there will be refreshments available all day, arena events for the whole family, plus many other attractions.

Further details from: *A. G. Walker G4DIU, 103 Torrington Road, North End, Portsmouth PO2 0TN. Tel: (0705) 667889.*

The Barry College of Further Education Radio Society will be holding the Annual Welsh Amateur Radio Rally on Sunday 3 June 1984 at the Barry Leisure Centre, Greenwood Street, Barry, South Glamorgan.

There will be trade stands, bring and buy stalls, plus all the usual rally attractions. Talk-in will be available on S22, car parking is free and the rally will be open between 11am and 5pm.

Further details from: *Reg Rowles GW4FOM, tel: (0222) 565656 (evenings).*

The British Amateur Television Club will be holding their annual get together at The Post House at Crick, Northamptonshire; the new venue has been selected to accommodate the ever-increasing number of visitors to this event.

Doors open at 10.30am on Sunday 13 May 1984, and there will be trade stands, lectures, ATV demonstrations using the club's outside broadcast truck and a satellite TV demonstration. Admission is free and non-members are welcome.

Further details from: *Trevor Brown G8CJS, 25 Gainsbro Drive, Adel, Leeds LS16 7PF. Tel: (0532) 670115.*

Special Event Station

Bournemouth and District RAIBC will be running a station using the callsign GB2WEC, for the Wedgwood Electrical Collection, located in the Old Power Station, Bargates, Christchurch, Dorset.

The Wedgwood Electrical Collection, housed in the Old Power Station, is devoted to the supply of electricity and many fine exhibits trace its history.

GB2WEC will be operating on 3·5MHz (80m)/s.s.b. and 144MHz (2m)/f.m. on the 5, 12, 19 and 26 May between 10am and 5pm. A special QSL card is available via the RSGB or direct from: *G6DUN, QTHR, in return for an s.a.e.*

One Hundred Years Ago

In a letter to Ludwig Löffler, dated 10 February 1884, Werner Siemens described for the first time a method of constructing an induction-free cable. "It consists of individual conductors covered by a sheath which forms the common return conductor." This concept was patented in German Reichspatent No 28978 of 27 March 1884, and solves the problem of "induction-free cables of lightweight design."

This type of cable, with the outer conductor concentrically surrounding the inner conductor, is nowadays called a coaxial cable. With its invention, Werner Siemens was far ahead of his time for it was not until the Olympic Games in 1936 that such a cable was used—between Berlin and Leipzig. With the aid of carrier signals it was possible to transmit 200 long-distance calls and one television programme. A carrier allows several discrete information frequencies, i.e. modulations, to be transmitted over one path. Thus, multiple use of a line is possible (e.g. for telephone calls).

A coaxial cable in one of today's systems has to transmit up to 10 800 calls and one television programme simultaneously in one direction, i.e. in practice, almost 100 000 calls and 18 television programmes can be carried on a cable with 18 coaxial lines.

Siemens Ltd., Siemens House, Windmill Road, Sunbury-on-Thames, Middlesex TW16 7HS.

New BARTG Magazine

The British Amateur Radio Teleprinter Group (BARTG) announces the launch of their new quarterly magazine called *Datacom.* This replaces the BARTG Newsletter, and will be sent free of charge to all members.

Datacom is dedicated to all forms of data communication by conventional teleprinter and by computer, including RTTY, AMTOR, Packet Radio, FAX and so on. The first issue, dated Spring 1984, has 116 pages, and is the largest publication ever produced by BARTG. It contains no less than 21 technical articles of interest to teleprinter and computer enthusiasts, plus a number of special interest columns on emergency communications, FAX, clubs, etc. The centrefold section covers information on the many services offered by BARTG to members.

For full membership details, please contact: *Mr John Beedie G6MOK, 161 Tudor Road, Hayes, Middlesex UB3 2QG. Tel: 01-561 0010.*

D-Day Special Event Stations

To commemorate the 40th anniversary of the D-Day Landings many clubs will be participating at various rallies and displays. We have been notified of two clubs running special event stations.

First, throughout the month of June, the Marconi Radio and Electronics Club will be operating three stations, two in the UK and one in France. An *h.f.* station, using the callsign GB2MAR, will operate from Fort Widley on the 7 and 14MHz bands using s.s.b. mode, and will cover the UK plus North and Western Europe. GB1MAR will be located at Southsea Common, beaming to Europe on 144MHz and 430MHz. The station sited in France will be at either the Normandy Beachead or the Bayeaux Museum, under the control of G6APD and G4RTT. For further details contact: *Mr V. G. Scambell G3FWE, 50 Park Avenue, Widley Purbrook, Nr Portsmouth, Hants.*

During the D-Day anniversary week, 2 to 9 June, Southampton Private Amateur Radio Club (SPARK) will be operating from the premises of the Royal British Legion at Netley, Southampton.

The exercise, which will be called "Operation Overlord", will commence operation at 10am on 2 June until 10pm on 3 June. On the D-Day anniversary, 6 June, the session will start at 9.30am until 10pm. Another all-day session will be held on 9 June between 10am and 10pm. On the 4, 5, 7 and 8 June there will be short operating sessions between 7 and 10pm.

The callsign will be GB4BLC and the station operators will be Bill G4REB, Chris G4UDB, Les G4VNK and Brian G4VYW. Commemorative QSL cards will be sent to all stations contacted. Further details from: *L. Smith G4VNK, 57 Newton Road, Woolston, Southampton, Hants SO2 4MJ.*

Stateside Snips

A no-code class amateur licence proposal was defeated by the FCC on 14 December 1983. Several reasons were cited, including the continued fostering of skilled telegraphy operators for times of emergency and potential military service. A "computer hobbyist radio service" may eventually be considered, using a non-amateur frequency allocation.

A group of US amateurs are currently experimenting with "packet meteor scatter" using the same terminal node controller (t.n.c.) hardware used in packet radio. Although slow, such systems would permit data exchange at approximately 100 bytes per hour — roughly equivalent to 16 words per hour.

It is reported that r.f.i. is increasing dramatically in the US — electromagnetic radiation on our planet is rising at about 50 per cent per annum. The only people likely to benefit from r.f.i. are those employed in the e.m.c. industry, which is currently growing at the rate of 30 per cent per year in the US.

New Catalogue

The 1984 edition of the *Hobby Herald* containing over 1000 new products is now available.

The greatly increased range now includes connectors for most applications including micros, telephone connectors, etching kits, new enclosures and many other items.

To obtain a copy send 50p to: *BICC-Vero Electronics Ltd., Retail Department, Industrial Estate, Chandler's Ford, Hants SO5 3ZR. Tel: (042 15) 62829.*

Scopex Oscilloscopes

Full after-sales support services for all Scopex oscilloscopes have now been established by Scopex Electronics Limited. Users of all instruments from current production models right back to the very first instrument to be produced can now benefit from the availability of an extensive range of spares. Even front panels and individual components can be supplied.

Also under these new facilities, any model of Scopex oscilloscopes can now be factory serviced or repaired. Instruments returned for service or repair will be fully tested to ensure compliance to original specification and all repairs will be guaranteed for six months.

The establishment of spares and repairs facilities is an essential part of the planned long term future of Scopex oscilloscopes now that the new manufacturing company has been formed. In addition, present plans include the continued manufacture of the entire Scopex range as well as continued engineering development aimed at meeting future market requirements.

All enquiries for after-sales service should be made to: *Scopex Electronics Limited, 63–65 High Street, Skipton, North Yorkshire BD23 1EF.*

The RAC Amateur Radio Group Scheme

Membership of this scheme is open to all amateur radio enthusiasts, and provides membership of the Royal Automobile Club at a discount of £2 below the normal RAC membership subscription rate. Since 1 June 1983 the annual subscription for members of the group scheme has been £16.50.

The group scheme's subscription renewal date is 17 May (World Telecommunication Day) each year, and all members renew on the same date. Anyone joining the scheme will pay at the pro-rata rate of £1.37 per month until the next group renewal date. In addition, the RAC once-only joining fee of £3 is also payable, regardless of the period remaining in the membership year. Radio amateurs who are already members of the RAC and who wish to transfer to the group scheme will not pay the joining fee.

Desirable options are the RAC Recovery Service and the "At Home" Service, the annual subscriptions for which are £13.50 and £5.50 respectively, annually from date of taking up the option.

No additional subscriptions are payable for a member's spouse.

The scheme is administered by the Royal Automobile Club's Scottish Western Counties Office, 200 Finnieston Street, Glasgow G3 8NZ. The co-ordinator of the scheme is *Mr. A. W. Hutchinson, 88 Broomfield Road, Chelmsford, Essex CM1 1SS,* from whom application forms may be obtained.

Insurance

Readers who are interested in applying to the *PW Radio Users Insurance Scheme* are advised to use the coupon published on page 18 of last month's issue.

Uncle Ed

POWER INPUT & OUTPUT

Continuing my brief series of articles on topics that gave trouble to some candidates in the May 1983 RAE, it's the turn of transmitter power measurements.

Input Power

The input power of a transmitter amplifier stage is easily calculated from two straightforward measurements with a multimeter (or built-in meters, if your transmitter has them).

When we talk about input power, we **don't** mean the driving power required from the previous stage—input power is the d.c. power drawn from the supply line by the amplifier transistor or valve as collector current or anode current (anode and screen current for a tetrode or pentode valve). The points to connect the ammeter A and voltmeter V are shown in Fig. 1(a) and (b) for a transistor and a valve stage respectively. If there is a voltage dropping/decoupling network like the one made up by resistor R and capacitor C in Fig. 1(c), the voltage must be measured at the bottom end of R, since this becomes the supply point for the amplifier.

The ammeter A could be placed anywhere in the line from the +V rail through the inductor L and the transistor or valve, but if you put it between the inductor and the transistor or valve then it will be "hot" with r.f. energy. Far better to have it at the supply line which is decoupled to make it "dead" from an r.f. point of view.

Having measured the current I and voltage V, all you have to do is to multiply them together to get the input power P in watts ($I \times V = P$).

Output Power

The output power of a transmitter amplifier stage is not a d.c. power. It is an a.c. power rating, but at radio frequency rather than at a power-line frequency such as 50Hz. To measure the power output, you **must** have a load connected to the output terminals. That load can be a further amplifier stage, an antenna, or a dummy load (sometimes called an artificial antenna). It must have a suitable impedance—what is "suitable?"—well, whatever the transmitter amplifier has been designed to drive. If it's the final stage, driving an antenna, the design load impedance will probably be 50Ω in a modern transmitter.

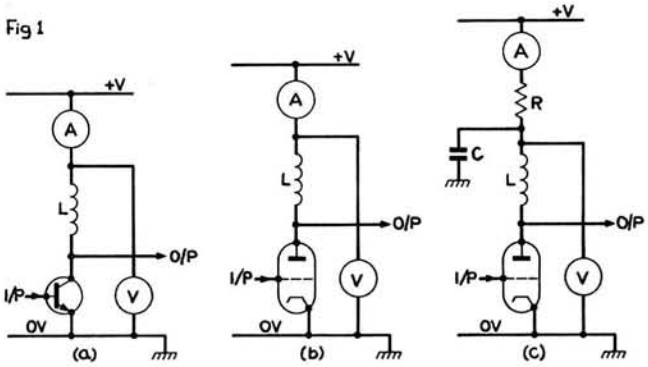
You can measure output power by means of an r.f. voltmeter and an r.f. ammeter, as shown in Fig. 2. The r.f. ammeter is usually a thermocouple instrument, in which the r.f. current is converted into heat, and the heat is converted to a d.c. voltage in a thermo-junction. Thermocouples for use much above the medium frequency band are rather delicate and easily burned out, so other methods are more popular outside the laboratory.

When the load impedance is known, we can use another version of the power formula to calculate the power from just one voltage measurement (Fig. 3). The formula is $P = V^2 \div Z$ where Z is the load impedance. To produce an answer in **average power,** the voltage reading must be an r.m.s. one. Most r.f. voltmeters are peak-reading, but are calibrated in r.m.s. (The r.m.s. value is 0·707 × peak for a sinewave signal—plain carrier or key-down c.w., for example.)

If you have a calibrated oscilloscope with a bandwidth that covers the frequency of interest, you can connect it in place of the voltmeter in Fig. 3 and use it to measure the peak voltage of the amplifier output. This time, you have to do the conversion to r.m.s. yourself, by multiplying the reading by 0·707, having remembered first to divide by 2 if you've read the peak-to-peak voltage, rather than the peak (Fig. 4.).

If it's an s.s.b. transmitter stage you're checking, instead of a c.w. stage, the test is normally done using a two-tone signal as modulation. This produces a waveform with an outline like two overlapping sinewaves when looked at on an oscilloscope (Fig. 5). Why use a two-tone signal? First, because a constant single-tone signal with the same peak level would probably exceed the safe power rating of the amplifier. That two-tone signal, on the other hand, reaches its peak at intervals, falling to zero in between, looking a bit more like the varying speech signals that the amplifier will normally be carrying, but having a constant peak level that helps the measurement process. The average power at the

Fig 1



WRM033

Fig 2

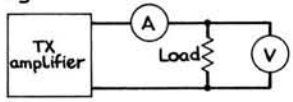


Fig 3

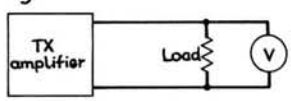
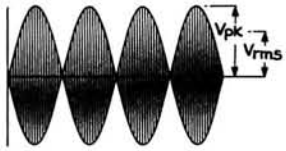


Fig 4

Fig 5



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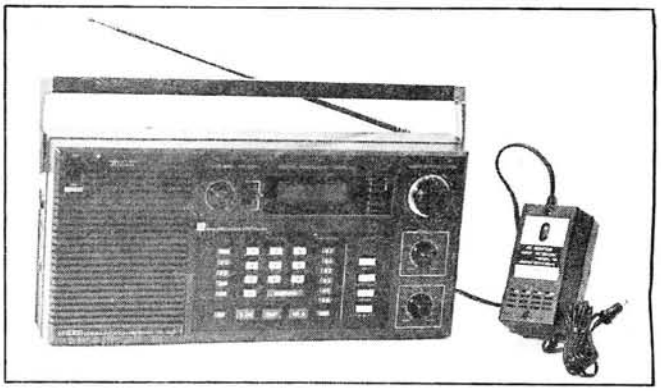
PW REVIEW

UNIDEN CR-2021
Communications Receiver



The Uniden CR-2021 is a fully synthesised receiver covering the long, medium and short-wave bands, plus the v.h.f. f.m. broadcast band (Band II).

Band and mode selection is by three push-buttons, and frequency entry via the keyboard. You can also step up or down in frequency, in steps of 1kHz or 3kHz on the 150–29 999kHz band, and of 50kHz or 100kHz on the 76–108MHz band, one step at a time or continuously at approximately 3 steps per second, or about 30 steps a second when the FAST button is depressed. To resolve s.s.b. and c.w. stations, a separate FINE TUNE control provides a nominal ±2·5kHz adjustment range on the selected frequency.

Scanning of the v.h.f. f.m. band, or of any selected segment of the band 150–29 999kHz, can be arranged either to be continuous, or to stop on receipt of a sufficiently strong signal when AUTO is selected. In either case, the receiver scans upwards in frequency, restarting from the lower limit when the top of the band is reached.

Six memories are provided, each able to retain one frequency in the 150–29 999kHz band and one in the 76–108MHz band. The F1 and F2 scanning limit buttons can be used to retain two additional frequencies in the band below 30MHz.

Completing the range of features incorporated into the Uniden CR-2021 is a "sleep timer", giving a delayed switch-off which can be preset in 10-minute steps up to 90 minutes.

Controls not mentioned so far are an antenna trimmer, which peaks the front-end tuning on the 150–29 999kHz band; a DX/NOR/LOC switch which can give around 10dB or 24dB reduction in r.f. gain—useful in the crowded broadcast bands, and a TONE control. A signal-strength indicator using five l.e.d.s can also check the state of the main or memory back-up batteries.

A pair of terminals on the back panel form the external antenna connection point. Sockets on one end of the case are for extension loudspeaker (6mm jack), headphones (3·5mm jack) and external 12V d.c. supply.

Internal construction is of a very high standard, with all connections off the p.c.b. made by plugs and sockets, and all component references printed on the board, though the Owner's Manual provided with the set does not include any circuit diagrams or details. The descriptions of the control functions and of how to use them are very clear, with lots of examples to help you get used to operating the receiver.

A 6-page section of the Owner's Manual is devoted to a listening guide, which explains such topics as short-wave propagation, erecting an antenna, characteristics and limits of broadcast and amateur bands, the SINPO reporting code, major short-wave broadcast stations and international time-zones. All good stuff, except that the amateur-band information is very out of date—it doesn't even include the 21MHz (15 metre) band, let alone the new WARC bands, and the broadcast station frequency list is very sketchy and somewhat out-of-date. Obviously a major revision *of this* section is needed.

Results

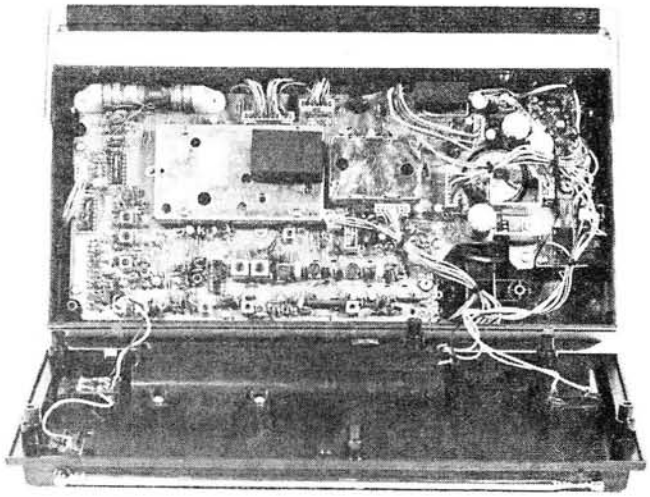
The test figures obtained in the *PW* lab are shown in the measurements table. The few that do not quite correspond with the figures in the specification table all come well inside the limits quoted in the full manufacturer's specification.

When used on the air, the receiver performed very well, with stable tuning good enough for serious c.w. and s.s.b. use. The effect of the NAR/WIDE filter switch, though it doesn't look very dramatic in the test results, gives a useful narrowing of bandwidth when operating in the s.s.b. mode, and to some extent on c.w., too.

Battery life is quoted as 8 hours, and this is probably about right, though it obviously depends on how loudly the radio is played. The computer back-up batteries should last approximately a year.

The l.c.d. frequency read-out also carries several other indicators. These include, sleep-timer length, frequency step, memory number, scan limits and auto-stop, plus the words TRY AGAIN which flash at you if you try to select an out-of-band frequency!

Criticisms? Only one (apart from the listening guide), and that would be very easily remedied. The four rotary controls have black plastics knobs with a tiny arrow-head embossed



★ test measurements

Sensitivity:

Freq. (MHz)	Input e.m.f.(μV) for 10dB (S+N)/N a.m.	s.s.b.
0·15	7·0	4·6
0·6	1·1	0·5
1·4	1·1	0·34
3·1	1·0	0·23
7·1	0·9	0·31
15·1	1·1	0·4
28·1	0·8	0·5
92·0	1·6μV e.m.f. for 6dB (S+N)/N	

R.F. Attenuator: 13dB or 24dB at 7·1MHz

Selectivity, l.f./m.f./h.f.:

Filter	−6dB	−50dB
Narrow	5·4kHz	9·2kHz
Wide	7·2kHz	13·5kHz

Spurious response rejection ratio: > 60dB

Image rejection ratio: > 70dB at 7·1MHz
25dB at 106MHz

I.F. rejection ratio: 71dB (1st i.f.), 61dB (2nd/3rd i.f.) at 7·1MHz
63dB at 78MHz

Audio output: 1·1W in 4Ω for 10% distortion

Current drain (ext. 12V supply): 140mA no signal
250mA full output

Test equipment used:
2017 and 2019 synthesised signal generators, TF2337A automatic distortion/SINAD meter, TF893A a.f. power meter, TF2650 f.e.t. multimeter, all by Marconi Instruments

★ specification

Frequency coverage: 150–29 999kHz a.m./s.s.b./c.w. (A3E/J3E/A1A) in 1kHz or 3kHz steps
76–108MHz f.m. (F3E) in 50kHz or 100kHz steps

Frequency stability: Within ±1kHz after one hour warm-up

Frequency readout: 5-digit l.c.d.

Circuit: a.m./s.s.b./c.w.—Triple superhet
1st i.f. 65·15–65·05MHz
2nd i.f. 10·7MHz
3rd i.f. 455kHz
f.m.—Single superhet
i.f. 10·7MHz

Sensitivity (nominal):

Mode	Input for 10dB(S+N)/N l.f.	m.f./h.f.
a.m.	5μV	1μV
s.s.b./c.w.	5μV	0·5μV
f.m.	2μV for 6dB(S+N)/N	

R.F. Attenuator: 10dB or 24dB at 7·1MHz

Selectivity (nominal), l.f./m.f./h.f.:

Filter	−6dB	−50dB
Narrow	5kHz	10kHz
Wide	6kHz	12kHz

Spurious response rejection ratio: 60dB

Image rejection ratio: 70dB at 7·1MHz
26dB at 106MHz

I.F. rejection ratio: 80dB (1st i.f.), 60dB (2nd/3rd i.f.) at 7·1MHz
70dB at 78MHz

Audio output: 1·2W in 4Ωfor 10% distortion

Antenna: Ferrite rod 360–2199kHz
Telescopic rod or external (75Ω) all frequency range

Power requirements: Six "C" Size dry batteries or external 11–16V d.c.
(a.c. mains adaptor provided as standard)
200mA with no signal

Computer back-up: Two "AA" Size dry batteries
Dimensions: 155 x 320 x 65mm
Weight: 2·1kg (with batteries)

into the cap. Those arrow-heads are very difficult to see, and would be much clearer if they were filled with white paint.

Price

The Uniden CR-2021 is priced at £199.95, including VAT, but will be available for a limited period at a special price of £160.00. Our thanks go to **Uniace Telecommunications,** a subsidiary of **Cravenminster Ltd., Unit 8, Industrial Estate, Llandudno Junction, Gwynedd,** for the loan of the review sample.

Geoff Arnold

Automatic Repeater Access Tone

by Nick Foot G4WHO

Both the 144 and 430MHz band f.m. repeaters in the UK require a 1750Hz tone burst, typically of 0·5 seconds duration, in order to access them from their quiescent state. Once activated all subsequent logic functions are usually initiated by the presence of the input carrier only. Not only are additional tone bursts superfluous, occasionally masking the first syllables of relayed audio, they can unwittingly trigger other co-channel repeaters if the station using the repeater is at a high point or during *lift* conditions.

The design presented here should satisfactorily eliminate both problems.

There are two methods commonly used for access tone generation and both have their disadvantages.

Tone Button

A tone button is provided on many early rigs which when pressed will provide the required tone whilst held down. For base station or portable use this is OK but the disadvantage is that you must remember to use it and if operating mobile finding the button can be yet another safety hazard, especially in the dark.

Automatic Toneburst

The older type of automatic toneburst circuit introduces a short tone at the start of each transmission when enabled. As previously stated, this is annoying to other repeater users when operating in short overs and often results in requests to repeat the obliterated beginnings of the previous over.

In order to overcome these problems and to make the rig easier to operate, the author developed the following design for use in conjunction with his Icom IC240.

Examination of the transceiver circuit diagram indicated that the following voltages were available: REPEATER CONTROL +10V on Repeater, 0V Simplex. SQUELCH (from busy line) +10V when receiving a signal, 0V when squelch closed. TRANSMIT +12V, 0V on receive. POWER +10V, continuous. By using this information it is possible to determine whether tone is necessary, i.e. when switched to a repeater channel and if the repeater is active or not.

Circuit Operation

The circuit diagram of the automatic access tone generator is shown in Fig. 1 and is based around a common 4011 c.m.o.s. chip. A 1750Hz oscillator is formed from i.c. sections IC1a/b and is adjusted to correct frequency by variable resistor R3. The oscillator only runs when pins 2 and 6 are at the supply voltage, i.e. when the repeater shift is selected and the output of IC1c is high. This later section of IC1 is wired as an inverter which produces a high on pin 6, enabling the tone oscillator, when the squelch rail is low (no incoming signal).

The network consisting of D1, C1 and R4 ensures that when the transceiver goes to transmit and the squelch line drops to 0V, the inhibit of the tone is held for longer than the duration of the tone enable signal and prevents the tone burst running.

If both IC1a and IC1b are enabled a continuous tone is present at pin 12 of IC1d. However, this is prevented from reaching the output by pin 13 of IC1d being held low by resistor R5. As the rig goes over to transmit a positive going signal occurs at the input to C3, causing it to charge via R5. Until C3 is charged pin 13 of IC1d is held high and a tone burst occurs. The resistor network R6–8 on the output reduces the tone to a suitable level for connection into the microphone circuit of the rig.

Since its installation into the author's mobile rig some two years ago the circuit has worked without problems and continues to provide tones only when needed. ●

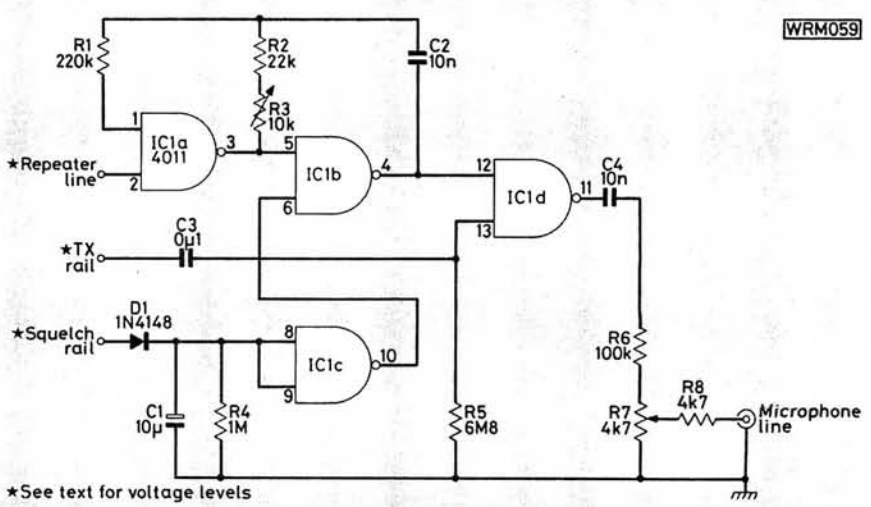


Fig. 1: Circuit diagram of the automatic repeater access tone. The author's prototype was built on Veroboard and fitted within an Icom IC240. The circuit should work with other transceivers fitted with a BUSY l.e.d. indicator or SCAN STOP facility derived from the f.m. demodulator i.c. The d.c. supply to IC1 is connected to Pin 7 (0V) and Pin 14 (+V)

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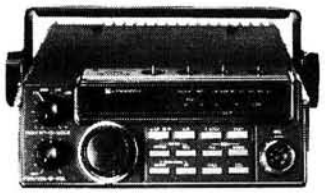

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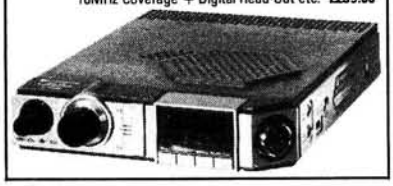

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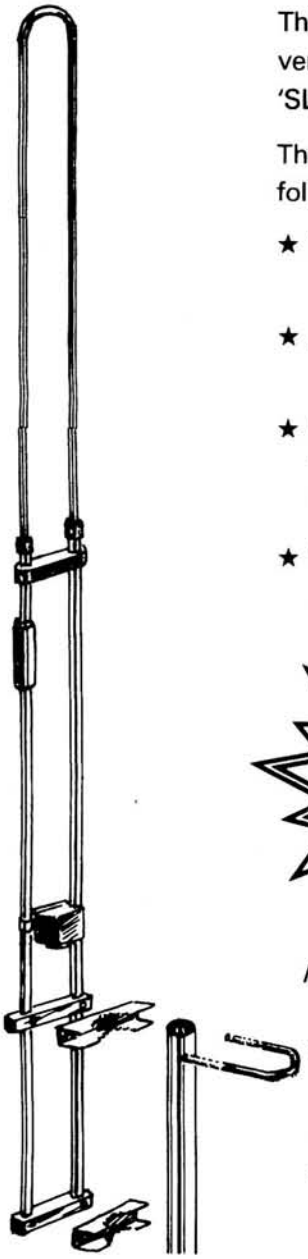

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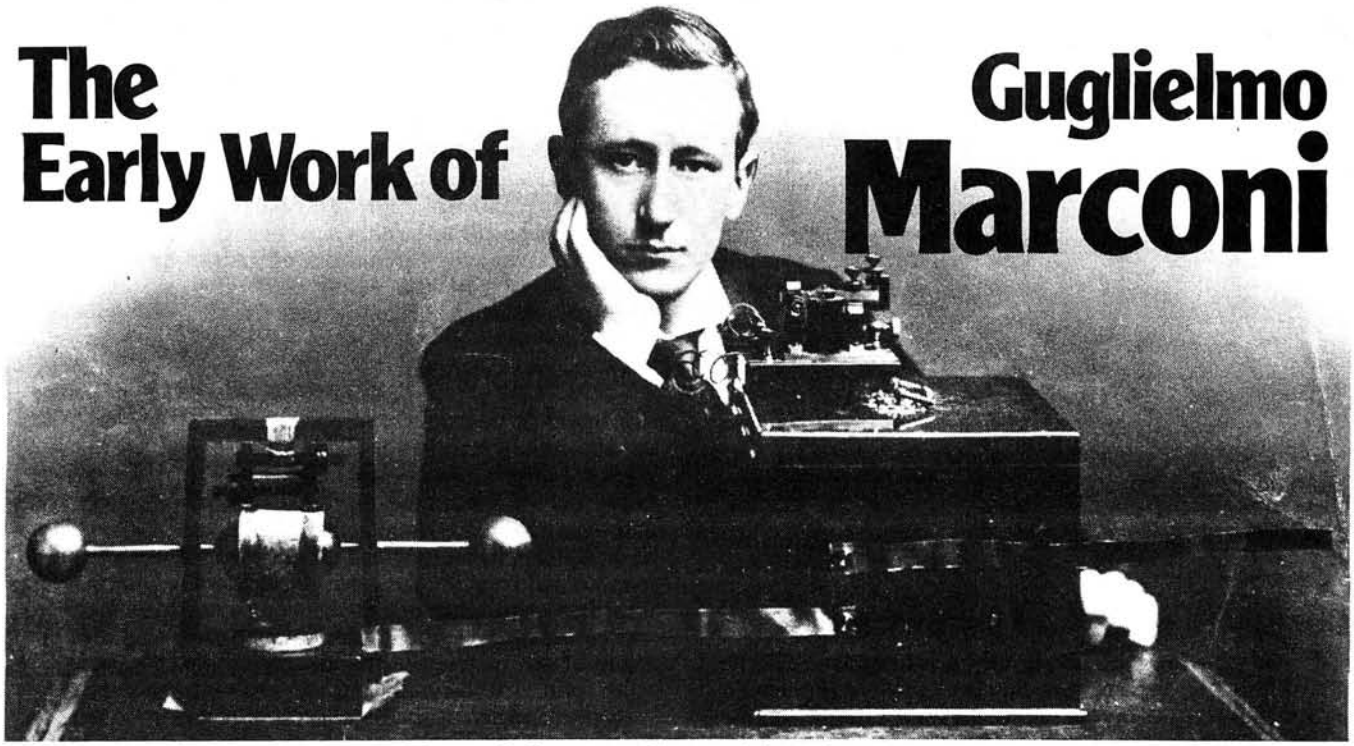

Part 2 by F. C. Judd G2BCX

Before Marconi's achievement in sending wireless signals across the Atlantic Ocean he was trying to squash rumours of doubt about the accuracy of wireless communication ranges he had so far covered. His objective was of course to put "wireless" in competition with the long distance undersea cable telegraph systems operating at the time. The existing British Post Office monopoly and similar restrictions imposed in other countries had made it virtually impossible to provide a paying inland wireless telegraph service. His proposal to attempt sending wireless signals across the Atlantic was however considered somewhat foolhardy because, apart from the cost already incurred in this venture, an objection had been raised about the power needed to cover a distance of nearly 3200km and which might seriously interfere with existing ships' wireless communications. But Marconi had already proved that with his "syntonic" tuning there was little possibility of this.

The Transatlantic Tests

Marconi was almost ready for his Atlantic tests when the antennas at both Poldhu in Cornwall and at Cape Cod in the USA, to be used for the tests, were virtually destroyed by gale force winds. The Marconi Company board of directors also became very concerned. A large amount of money had been spent on this venture and now there was nothing to show for it. This was September 1901, the disaster with the antennas having occurred on the 17th. By the 24th a temporary antenna as illustrated in Fig. 2.1 had been set up at Poldhu and was ready for operation by the 26th. Although plans were available for the construction of a new permanent antenna at Poldhu, Marconi decided not to wait and not to use the Cape Cod station. The antenna there had been wrecked anyway. Instead he decided to use the Poldhu station with the temporary antenna for transmitting and the next best site he could find across the Atlantic at St. John's, Newfoundland for reception.

On November 27 he set sail with G. S. Kemp and another assistant named Paget, with receiving equipment, kites, balloons and antenna wire etc., and reached St. John's on December 6. A survey of the area showed the most likely location for the receiving station as Signal Hill (a name in keeping with the project) and which was about 180m above the St. John's harbour. By December 9 all the receiving equipment was set up, earthing systems were laid and a balloon was made ready to hoist a long wire antenna. The final task was to send a cable to Poldhu arranging for the letter "S" in Morse code (three dots) to be transmitted continuously from 3pm to 7pm GMT, the transmissions to start on December 11. Incidentally there was a reason why the letter "S" was chosen as the test signal. Firstly it could be sent automatically and would be easier to distinguish should heavy static prevail, which was in fact the case. Also, keyed signals of longer duration, e.g. dashes, would have put a greater load on the transmitter which was being run to its absolute limit.

The transmissions from Poldhu began as scheduled, the transmitter being run at a power of between 10 and 12 kilowatts on a wavelength of approximately 366 metres (820kHz), or at least so it was thought. At Signal Hill they were using a balloon supported antenna but George Kemp was having trouble with this because of very strong winds. The receiver in use employed the "syntonic" tuning operating with a self-restoring coherer detector, a device which functioned almost as a semi-conductor.

However, nothing was heard that could be identified as the letter "S" and Marconi thought the reason might be due to movement of the antenna in the high wind, this, in turn, causing detuning at the receiver. By the 12th the gale was still in full force so a kite was sent up with twin 155m antennas but this was soon carried away completely. Another kite was launched, this time with a single 152m wire and Marconi continued to listen patiently as the allotted time for the transmission of that day was coming to an end. Then, shortly after midday Newfoundland time, Marconi asked Kemp to listen in order to confirm that he too could hear the three dots that were now being received. Kemp confirmed that they were indeed readable despite the crashing noise of static. In a notebook Marconi simply wrote—Sigs. at 12.30, 1.10 and 2.20. His aim had been achieved and history had been made.

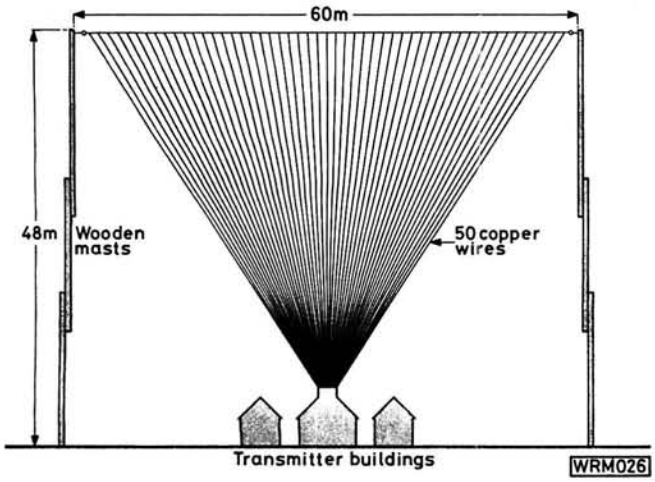

Fig. 2.1: The temporary antenna system set up by Marconi and G.S. Kemp at Poldhu and which was used for transmitting the first wireless signals across the Atlantic Ocean to St. John's, Newfoundland

The weather became worse, however, but in spite of the gale still blowing three more kite antennas were released but they would not stay up, although for a brief period the signals were heard again. On the 14th (Saturday) the weather had still not let up and kite flying became impossible so in sheer desperation George Kemp with help from local people rigged a long wire antenna from Signal Hill to an iceberg that had floated into St. John's harbour—but to no avail. Tests just could not be continued under such appalling weather conditions. It was to be a case of waiting until the weather abated so that a kite or balloon supported antenna could be maintained in a stable condition.

The fact that both Marconi and Kemp had heard and identified the signals was not in itself real proof, except to themselves, that they had been heard at all. They had been too weak to activate the Morse ink recorder which would have provided more concrete proof. Marconi was therefore doubtful whether to make the news public. He did, however, inform the London office on December 14 of success and on the 16th allowed the news to be released to the press.

Problems but More Success

Then another problem arose. The Anglo-American Telegraph Company informed Marconi that they had a monopoly on communication throughout Newfoundland and threatened him with legal action if he continued his tests. Although this was work of a scientific nature and Marconi was not transmitting messages, he decided to find another location. Canada or the USA were equally suitable and there were no restrictions in these countries either.

Then his feat in receiving wireless signals transmitted across the Atlantic was queried. Did it really happen? This was to some extent understandable as there was only Marconi's and Kemp's own confirmation that the signals had been received from Poldhu. Doubt was also expressed as to whether his wireless waves could have followed the curvature of the earth[3].

Marconi realised that more concrete evidence was needed to satisfy those who did not believe that long distance transmission was possible. On February 22 he sailed for Canada in a ship called the Philadelphia, an American Line vessel whose owners had permitted him to install a large antenna on the ship. At this time the Poldhu station had been improved and could send messages of some length. Marconi's idea was of course another attempt to provide absolute proof that the transmission of wireless signals across the Atlantic was possible and accordingly he arranged for a Morse ink recorder to be connected to the ship's receiving equipment. Complete messages were received and recorded when the Philadelphia was 2500km from Poldhu and the letter "S" signals were heard at a distance of 3400km. His proof was now ink recorded messages signed by the ship's master, Captain Miles. Also during this voyage Marconi discovered what he called the "night effect", in that after dark it was found that transmission ranges became much greater.

The Transatlantic Service

Marconi's next journey was to Ottawa to select a site suitable for a station for Transatlantic service, the final choice being a place called Table Head at Glace Bay, Nova Scotia. Meantime more experiments, developments and tests had taken place and Marconi's real task now was to establish reliable long range wireless communication for commercial use. The Glace Bay station was his one hope of providing proof that such a service was possible.

The antenna at Glace Bay, as shown in Fig. 2.2, consisted of 400 wires suspended from triatics stretched between four 61m towers constructed of wood with the wires brought together at the lead-in position to the transmitter building. This inverted square cone somewhat resembles an upturned discone antenna but it could be used either as a whole or in sections.

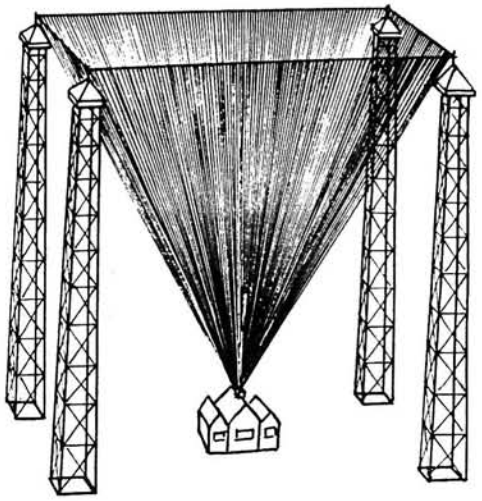

Fig. 2.2: The original Glace Bay (Nova Scotia) antenna for transatlantic service erected 1902

The first transmissions were made on 19 November 1902 but nothing was heard at Poldhu. On the 25th weak signals were received and then only after a number of modifications had been made to circuits and the antenna. However, by December 5 the first really readable signals from East to West across the Atlantic were received and recorded as well but enthusiasm was damped somewhat when on the following night and under the same conditions as far as equipment was concerned, nothing was heard at all. At the time there was no explanation for this and the reason only became known some time later when the existence and behaviour of the ionospheric layers had been discovered.

Marconi was of course unable to explain these seemingly peculiar results to the press and again his own prestige and that of the Marconi Company was at stake. Although propagation conditions were variable they did not always prevent transmissions being made and received in either direction. On December 14 and for a period of 2

hours very good signals were received. Marconi therefore decided to take a chance on declaring that the Transatlantic service would be opened with a special message to be sent the following night, on December 15. He was fortunate in two ways. Conditions remained good and the Times correspondent, a Dr. Parkin, was to be present when his own message to the newspaper in London was the one to be sent. It was received "solid" as we might say today. Conditions on the following night also proved to be suitable for transmission and messages were sent to the then King, Edward VII and to a General Brusati in Rome.

So the transatlantic service began, limited at first and its validity still doubted by some, but progress was made during the coming years despite many setbacks and technical problems. During that period Dr. J. A. Fleming had produced the diode valve which he demonstrated to Marconi on the 16 November 1904. Fleming was a consultant to the Marconi Company and continued to be until he died on 18 April 1945 at the age of 95.

Directional Antennas

One final notable development must be recalled and this concerns what Marconi called "directional antennas". The term directional can of course apply to an antenna that radiates equally in all directions around it and is said to be "omni-directional". By 1905 an entirely new antenna had been erected at Glace Bay with a view to increasing the communication range still further. This particular antenna is shown in Fig. 2.3 and was probably omni-directional. It consisted of an "umbrella" of wires, 200 in all, supported by the original four masts at the centre (as in Fig. 2.2) from which wires ran out laterally to two concentric rings of masts each 55m high, with eight in the inner circle (not shown in the illustration) and 16 for the outer circle. Provision was made to increase the diameter of the "umbrella" sections, if needed, by using another outer circle of 48 masts each 15m high. The diameter of the antenna without the extension was 677m but with the extension would be 885m. The results with this enormous antenna were more than satisfying with reception during daylight hours up to 2880km. But Marconi, never completely satisfied, carried on with tests and improvements until in June 1905 two-way communication was established during the daytime between Glace Bay and Poldhu, this time using a much longer wavelength.

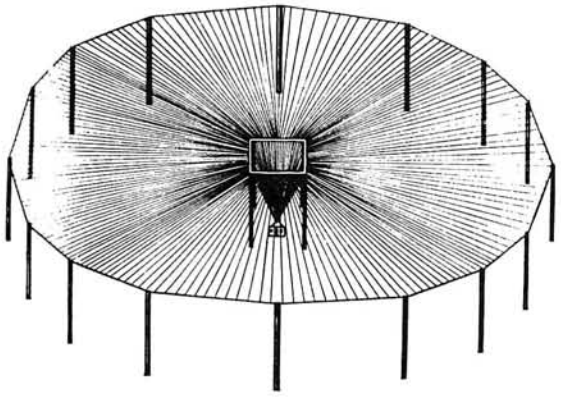

Fig. 2.3: A completely modified antenna at Glace Bay erected 1905 (see text for details)

Marconi made an interesting discovery whilst carrying out experiments at Poldhu. He found that a long wire laid along the ground gave much stronger reception when its free end was pointing in a direction away from the transmitter. Much the same applied to inverted "L" antennas and he eventually registered a patent on what was known as the "bent antenna", as shown in Fig. 2.4, for directional transmission and reception. As a result instructions were sent to Glace Bay to take away three-quarters of the "umbrella" section leaving only one section facing away from England. Reception of the Glace Bay signals at Poldhu increased quite considerably. Was this the first unidirectional antenna?

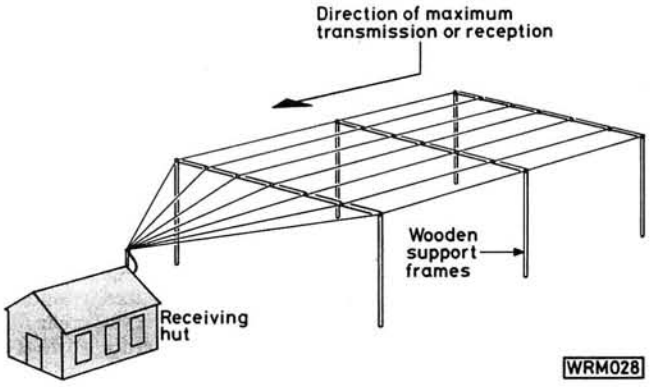

Fig. 2.4: Marconi's patent "bent antenna" for directional transmission and reception

In Conclusion

G. Marconi has been described as an enigma of a man who shunned social contact with anyone he did not really know and yet he was always pleased with news that wireless had been the means of saving life. He had constantly maintained that one of his primary objectives with wireless was to ensure safety at sea but thinking perhaps of the uses it was put to during World War I and the destructive part it may have been responsible for, he was known to have said "Have I done the world good, or have I added a menace".

The Marchese Marconi GCVO died following a heart attack on 20 July 1937. If the registration of his first patent in wireless in 1896 marks the beginning of the era of wireless then its centenary is yet to be celebrated.

The author would like to thank the present Marconi Company of Chelmsford for information, photographs and illustrations used in this article and for permission to quote from the book *A History of the Marconi Company* by W.J. Baker.[3] This and the book given as Ref. 1 are recommended and deal more with the technical aspects of developments that stemmed from the work of Marconi. The book[2] is an informative and impartial biography of Marconi whilst the remaining book[4] *Pioneers of Wireless* contains much detail about famous scientists and their discoveries in magnetism, electricity and wireless including the work of Marconi. Whilst some of the books may be out of print they should be available from the larger public libraries and are well worth reading.

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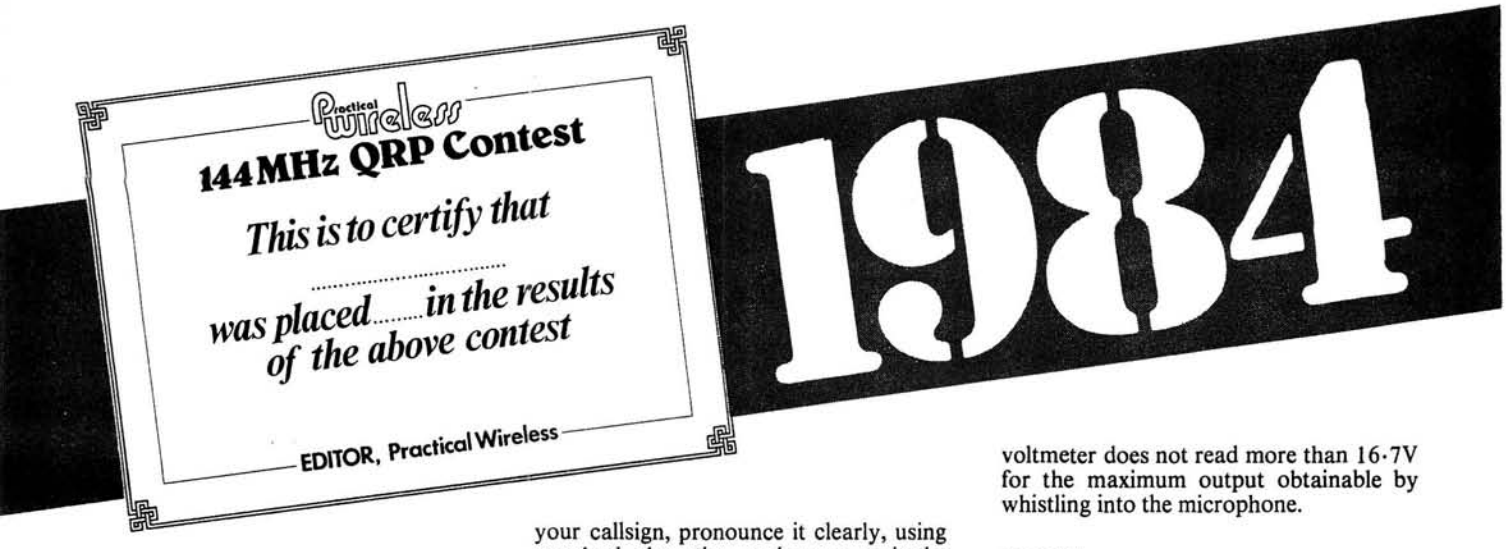

Following the successful and popular QRP contest last year (see *Practical Wireless,* Nov 1983), this year's event has only a few minor changes in the rules. The 3 watt p.e.p. output limit is retained to enable the use of popular 144MHz transceivers without modification. The scoring system is also unchanged, as its simplicity was welcomed by entrants.

As in the 1983 contest, a trophy will be presented to the overall winner, and certificates will be awarded to the runner-up and leading stations in a number of categories. The results table, and a review of the contest with photographs, will be published in a future issue of *PW*. The first 20 stations will be published with full information, followed by just the callsign and number of points for each of the others. A copy of the full results table is available on receipt of a large s.a.e. sent in with an entry.

Newcomers to contest operating are advised to refer to the VHF Contest Special published in *Practical Wireless,* May 1983 for an introduction to operating techniques and the requirements for the station. A few of the important points are summarised here.

Take particular care over the correct logging of the information received and sent. Many entrants lost a substantial number of points last year through errors, mainly in the callsigns of stations worked. A common mistake was the omission or addition of a /P suffix. When sending your callsign, pronounce it clearly, using standard phonetics, and **never** omit the suffix if there is one. A few seconds saved is hardly worth it at the expense of points lost during adjudication!

Copy the log up neatly for submission as an entry, using A4 paper (the right way up, please, not sideways!); the sample here shows how the sheet should be ruled. During the contest, use a check-log to carefully avoid duplicate contacts.

When choosing a frequency on which to transmit, check that it is not already occupied, and always observe the 144MHz band plan. In addition avoid the calling frequencies of 144·300 and 145·500MHz, and during the morning avoid 144·250 and 145·525MHz used for the GB2RS news broadcasts.

When operating from a portable site, obtain permission to use the site from the landowner, and observe the Country Code. Before the contest, try to make sure that you have not chosen a site which another group is planning to use.

If you are using a transmitter or transceiver which is normally rated at more than 3 watts p.e.p. output power, you must reduce the power and measure it by satisfactory methods. The power is best reduced by applying a (variable) negative voltage to the transmitter a.l.c. line, which is normally accessible via an accessory socket on the rear of the equipment. To measure the power output, the circuit of Fig. 1 is suitable. With this connected to the 50Ω output of the transmitter, adjust the a.l.c. voltage so that the voltmeter does not read more than 16·7V for the maximum output obtainable by whistling into the microphone.

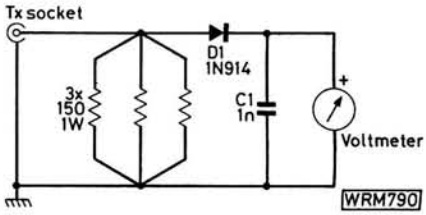

Fig. 1: Suitable circuit for low power measurement in a 50Ω system. The resistors should not be wirewound. All leads (except those to voltmeter) should be as short as possible (10mm maximum). The meter will read ($\sqrt{100P}$–0·6) volts for a power of P watts (16·7V at 3 watts)

Remember that from a good site even a QRP signal can cause others considerable problems if the signal is not clean. Avoid splatter caused by overdriving the transmitter or excessive speech compression, which will only degrade your intelligibility anyway. On the other hand, received signals may appear to be poor quality due to a shortfall in the ability of the receiver to handle several strong signals, and be aware of the problems of this type that may be caused by the use of high-gain pre-amps.

Finally, do please read the *rules* carefully, have fun, and GOOD LUCK!

Neill Taylor G4HLX

WRM776

PRACTICAL WIRELESS 144MHz QRP CONTEST

Date	Callsign	QTH locator	Sheet N° of

Time GMT	Callsign	Report & Serial N°		QTH locator	Points
		Sent	Received		

RULES

1. General
The contest is open to all licensed radio amateurs (but see Rule 2), fixed stations or portable, using s.s.b., c.w. or f.m. in the 144MHz (2m) amateur band. Entries may be from individuals or from groups, clubs, etc. The duration will be from 0900 to 1700GMT on 17 June 1984.

2. Contacts
Contacts will consist of the exchange of the following minimum information:
(i) callsigns of both stations
(ii) signal report, standard RS(T) system
(iii) serial number; a 3-digit number incremented by one for each contact, starting at 001 for the first
(iv) QTH locator
Information must be sent to, and received from, each station individually, and contact may not be established with more than one station at a time.

Entrants outside the British Isles may claim points for contacts with stations within the British Isles only.

If a non-competing station is worked and is unable to send his QTH locator, his location may be logged instead. However, for a QTH square to count as a multiplier (see Rule 4), the full 5-figure locator must have been received in at least one contact with a station in the square.

Contacts via repeaters or satellites are not permitted.

3. Power
The output power of the transmitter final stage shall not exceed 3 watts p.e.p. If the equipment in use is usually capable of higher power, the power shall be reduced and measured by satisfactory methods.

4. Scoring
Each contact will score one point. The total number of points gained in the eight-hour period will then be multiplied by the number of different QTH squares in which contacts were made (a "square" here is the area defined by the first two letters of a QTH locator).

Example: 52 stations worked in AK, ZK, ZL, ZM and YL squares; final score = 5 × 52 = 260.

Only one contact with a given station will count as a scoring contact, even if it has changed its location, e.g. gone /M or /P. If a duplicate contact is inadvertently made, it must be clearly marked as such in the log.

5. Logs
The log submitted as an entry must be clearly written on **one side only** of A4 size paper ruled into columns showing:
(ii) time GMT
(ii) callsign of station worked
(iii) report and serial number sent
(iv) report and serial number received
(v) QTH locator received (or location)
Underline or highlight the first (or any **one**) contact in each of the QTH squares worked.
At the top of each sheet, write:
(a) callsign of your station
(b) your QTH locator as sent
(c) sheet number and total number of sheets (e.g. "sheet No. 3 of 5")

6. Entries
Accompaning each entry must be a separate sheet of A4 size paper bearing the following information:
(a) name of entrant (or of club, etc. in a group entry)
(b) callsign used during the contest (including any suffix)
(c) name and address for correspondence
(d) location of station during contest
(e) QTH locator **as sent**
(f) whether single- or multi-operator (where single-operator means an individual who received no assistance from any person in operating the station, which is either his permanent home station or a portable station established solely by him/her); if multi-operator, include a list of operators' names and callsigns
(g) total number of contacts and QTH squares worked
(h) list of QTH squares worked
(i) a full description of the equipment used including TX p.e.p. output power
(j) if the transmitter is capable of more than 3W p.e.p. output, a description of the methods used (i) to reduce and (ii) to measure the output power
(k) antenna used and approximate station height a.s.l. Failure to supply the previous information may lead to disqualification. The following declaration must then be written and **signed by the entrant** (by one responsible person in the case of a group entry): "I confirm that the station was operated within the rules and spirit of the event, and that the above information is correct."

This declaration concludes the entry, which should be sent, with the log sheets, to: Practical Wireless Contest, c/o Dr. N.P. Taylor G4HLX, 87 Hunters Field, Stanford in the Vale, Faringdon, Oxon SN7 8ND.

A large s.a.e. should be enclosed if a full set of contest results is required.

Entries must be postmarked no later than 2 July 1984.

Any other general comments about the station, the contest and conditions during are welcome, but should be written on a separate sheet of paper. Photographs of the station are also invited (but please note that these cannot be returned); if these are not available by the time the entry is submitted they may be forwarded later, to arrive by 3 August 1984.

7. Adjudication
Points will be deducted for errors in information sent or received as shown by the logs. Unmarked duplicate contacts will carry a heavy points penalty. A breach of these rules may lead to disqualification. In the case of any dispute, the decision of the adjudicators will be final.

PW QRP CONTEST
17 June 1984
0900–1700GMT

Letters

A Look into the Past

Sir: I am particularly interested in vintage radio equipment, and my collection numbers about 125 pieces dating back to the 1920s.

After reading the article "Amateur Radio before 1914", in the September 1983 issue, I have decided to have a go at building a replica station of the period. In fact, I have already managed to collect a number of items to start the project off.

Being 39 years of age the pre-1920s are long before my time, so I wonder if any *PW* readers could furnish me with photographs of typical stations of the time, illustrating the equipment used. I would gladly reimburse any costs incurred.

Thanks for a most enjoyable magazine.

Robin Inggs,
207 Blair Atholl Road, Westville,
Natal 3630, South Africa.

Valve Doubler

Sir: Glancing through a very old copy of Practical Wireless, dated 6 October 1934, I came across a rather intriguing advertisement. Under the headline "Double your valve output without cost", the copy goes on "An amazing new radio development now makes possible a 2-valve set with loud speaker performance, wide range, high selectivity and undistorted output, hitherto only obtained at the high cost of a 3–4 valve set. It doubles the power of any valve without increasing the current consumption. Can be used in conjunction with mains or battery operated valves with amazing results, to make 2-valve receiver equalling 3–4 valves."

Can any "Old-timer" remember this truly "magical" component from half a century ago, or hazard a guess as to what it actually was or how it worked—bearing in mind it had only two terminals, similar to a wire-ended condenser.

My own suggestion is that it was a paper condenser, wired in series with the aerial lead to improve the selectivity of the set, or across the loudspeaker to "improve" the tone . . . but as for "doubling the output"?

Any other ideas, please?

Douglas Byrne G3KPO,
34 Pellhurst Road, Ryde, IOW.

Is Your FM Bandw

by N. D. N. Belham G2BKO

The short answer to the question posed is "No, provided you reduce your deviation". As the number of Class B licences increases by several thousands every year there is every reason for treating the question seriously.

The author's "Black Box" has a specified receiver bandwidth of ±6kHz at 6dB down and ±12kHz at 60dB down. This is compared, in Fig. 1, with the response of an LFD2 ceramic i.f. filter designed for use in high quality communications receivers. It would appear that if only an f.m. signal could be confined within the filter passband there would be room for three times as many stations in the v.h.f. band!

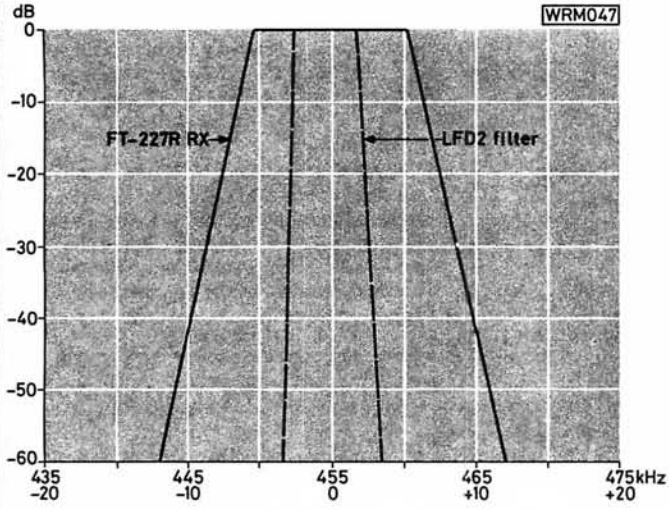

Fig. 1: Passband response comparisons

Most people would consider that possibility very unlikely on the grounds of sideband cutting. The spectrum of an f.m. signal consists of a carrier frequency line with an infinite series of sideband lines. These are spaced on either side of the carrier line at intervals which are integral multiples of the modulation frequency and are usually illustrated as shown in Fig. 2. Perhaps a better illustration is that shown in Fig. 3 since the odd order lower sidebands are reversed in phase compared with the carrier and therefore have "negative" amplitudes.

It is a simple matter to demonstrate that the amplitudes of the sidebands depend on the deviation and, inversely, on the modulation frequency, i.e. on deviation ÷ modulation frequency, or what is called the modulation index. An experimental arrangement is shown in Fig. 4. The output from a 455kHz tuneable frequency modulated oscillator is fed into a single crystal filter and the output displayed on an oscilloscope. Results of one such experiment, as the oscillator was tuned across the band, are shown in Fig. 5, for various deviations and modulation frequencies. During the experiment the output of the oscillator was constant in amplitude. It is clear that the amplitudes, even of the first pair, become very small as the deviation is reduced or the modulation frequency increased. For equal positive *and* negative deviations the amplitudes of each pair would be equal.

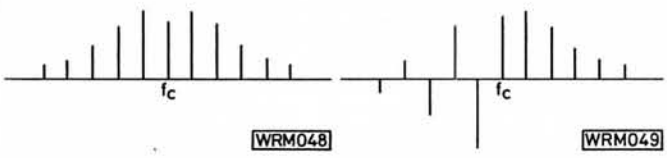

Fig. 2 **Fig. 3**

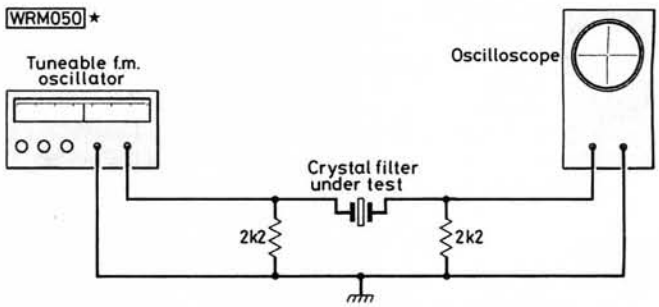

Fig. 4: Test arrangement used to demonstrate sideband amplitude variations

A simple test shows, however, that an acceptable f.m. signal can be sent through ceramic filters of the LFD2 type. By means of a coaxial connection the final 455kHz i.f. signal was brought out from an FT-227R transceiver before the limiter and discriminator. This i.f. signal was then passed through an LFD2 filter to an external limiter and discriminator. As expected, most of the signals in the 144MHz band were badly distorted when treated in this way, but those using low deviation were not. Although well down in audio level they were perfectly clear—a lot clearer than many signals received with the normal bandwidth i.f. filter of the FT-227R.

Fortunately a deviation display was available and this showed that the use of the LFD2 filter required that the deviation of the signal should be no greater than ±1kHz for clarity. This discovery set off a whole series of further experiments and calculations to discover the significance of f.m. sidebands.

Further Experiments

Two ceramic 455kHz filters were available with catalogue specifications as follows: SLFD6 6dB bandwidth 6kHz; insertion loss 7dB; in/out impedance 1·5kΩ; stop band attenuation 70dB. LFD2 6dB bandwidth 3kHz; insertion loss 8dB; in/out impedance 2kΩ; stop band attenuation 75dB, "suitable for the best communications applications".

The response curves of the two filters actually used are shown in Fig. 6 and show the measured bandwidths at

...idth Necessary?

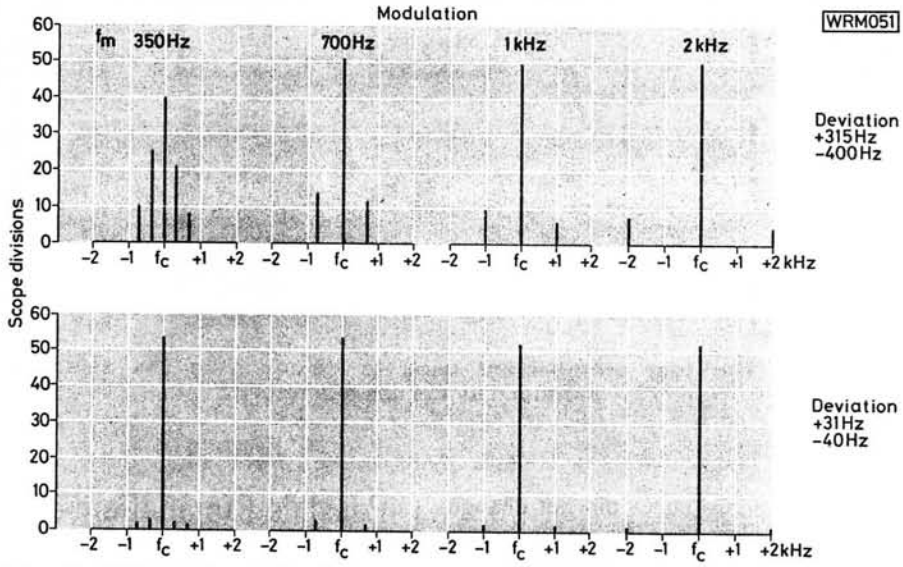

Fig. 5: Sideband amplitudes are shown to reduce with a reduction in deviation or an increase of modulation frequency

10dB down to be 8·5kHz and 5kHz respectively. The 455kHz oscillator already mentioned was used as a signal source but with a 15dB attenuator so that the discriminator to be used did not operate when the oscillator was tuned to frequencies outside the passband of either filter.

Good communication quality speech proved possible with either filter in circuit. The surprise came when the carrier frequency was moved within the passbands of the filters. In the case of the wider filter the carrier could be moved from 452 to 458·5kHz without noticeable change in quality, and from 454 to 457kHz in the case of the narrow filter. It does seem therefore, for deviations below ±1kHz, more than the expected sidebands become insignificant. The displacement of the ranges towards the high frequency side may imply that the lower sidebands are more important than the upper ones.

The modulation of the 455kHz oscillator was then changed from speech to single tones and the audio frequency response curve of the system plotted. This was done first without any filter in circuit, then with the wider filter and finally with the narrow one. Results are given in

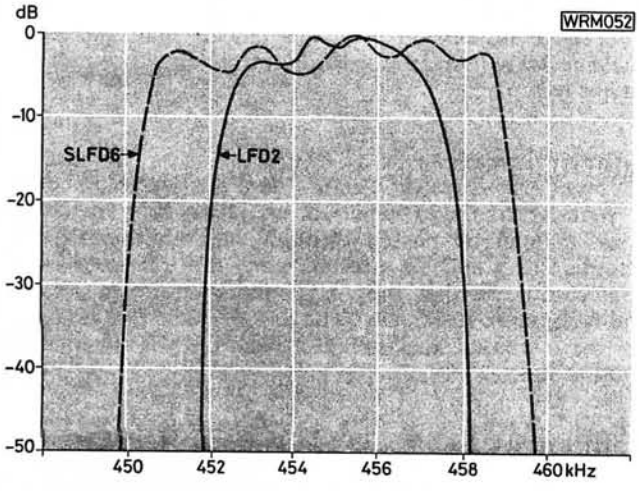

Fig. 6: Comparison of passband characteristic response curves

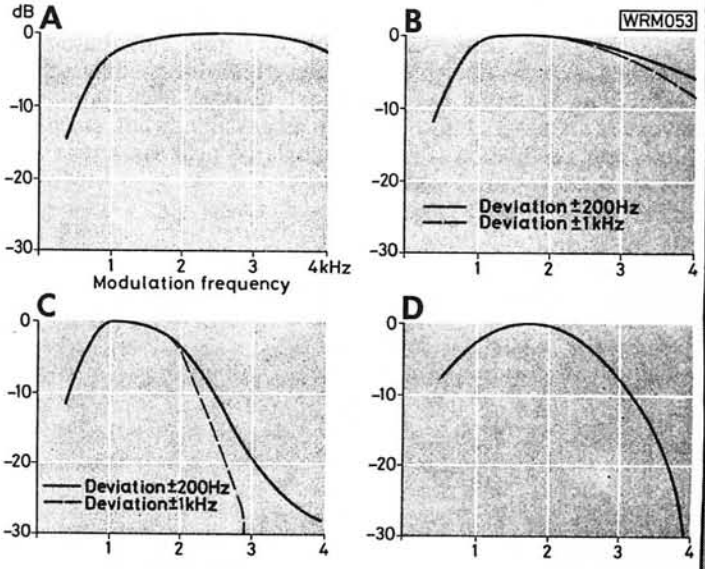

Fig. 7: Audio response curves, A: without filter, carrier 455kHz, deviation ±200Hz and ±1kHz—no change except in amplitude. B: SLFD6 filter under the same conditions. C: LFD2 response. D: The LFD2 again but with deviation adjusted to keep modulation index at 0·3

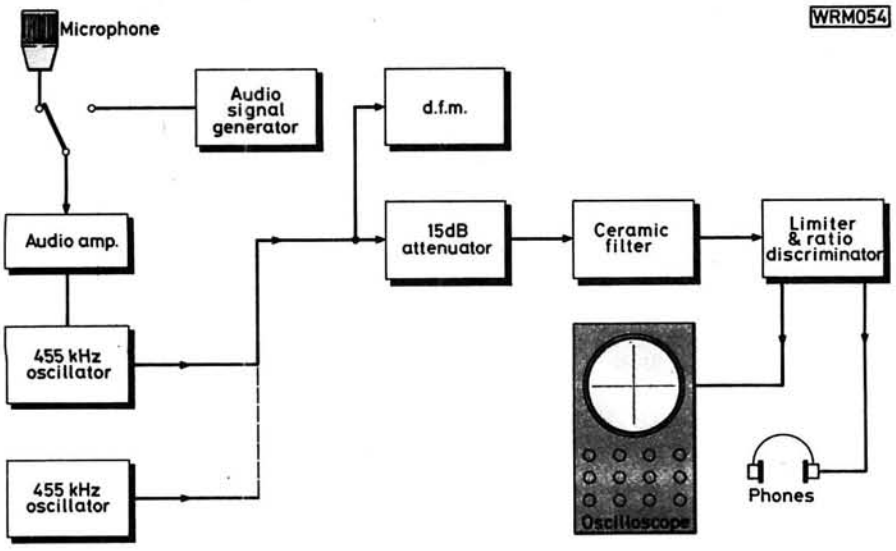

Fig. 8: The test arrangement used to demonstrate the selectivity produced by the use of a filter

Fig. 7. With no filter the response curve did not change with change in deviation but when the filter was in circuit the characteristic improved with decrease in deviation.

Since it had already been established that significance of sidebands depended upon the modulation index (see Fig. 5) it is possible to keep that quantity constant while increasing the deviation with modulation frequency. The modulating circuit was altered to keep the modulation index at 0·3 for all modulation frequencies up to 4kHz. The improved characteristic is also shown in Fig. 7. This approaches the ideal for DX working.

A second 455kHz oscillator, very similar to the first, allowed a demonstration of the selectivity produced by the use of a filter. The steep high frequency side of the SLFD6 passband was used. The modulated oscillator carrier frequency was set at 458·5kHz while the carrier frequency of the second unmodulated oscillator was set at 460kHz. With no filter there was chaos and the modulation vanished. When the filter was inserted the modulated signal was restored to its original clarity. The system layout is shown in Fig. 8. Thus it is possible, when steep filters are used, to work with signals of near equal amplitude that are only 1·5kHz apart!

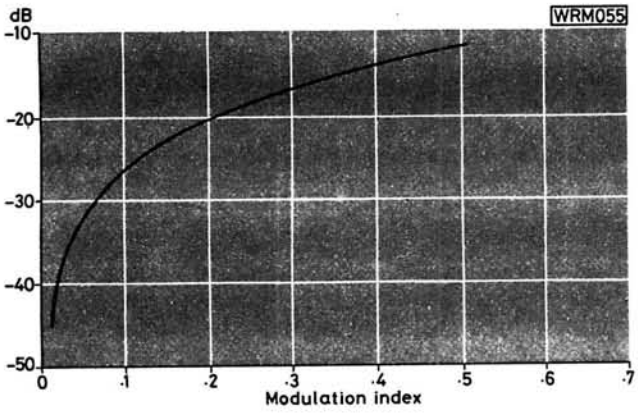

Fig. 9: Graph relating the amplitude of the first pair of sidebands to modulation index

Possible Explanations

The experimental results can be repeated by anyone willing to spend the necessary time and money but the explanation of the results will be open to controversy. The first possibility is that the sidebands as a whole become insignificant if the modulation index is low enough. This will be rejected out of hand by many for, if the sidebands are insignificant, where is the modulation? C. Grey[1] has quoted the results of experiments which showed that sidebands, having an amplitude less than a tenth of that of the carrier, are insignificant for amateur purposes, i.e. 20dB down. Many will be inclined to agree that this could apply to all but the first pair of sidebands. Grey's criterion would be met for the first pair if the modulation index is reduced to 0·2. Does it apply to the first pair? See Fig. 9.

An alternative explanation is suggested by the fact that the range over which a carrier may be tuned when a filter is in use is displaced towards the high frequency end of the passband, thus favouring the lower sidebands. Does a low modulation index allow f.m. single sideband working? The upper sidebands shown in Fig. 3 are little different from an a.m. signal modulated by a tone and its harmonics, the phase reversal found in the lower f.m. sidebands is perhaps unique to f.m.

Conclusion

Whatever is the explanation, the fact is that low deviation f.m. can be passed through communications type ceramic filters and, as a result, many more stations could be accommodated in the v.h.f. band than are at present, and with improved clarity. The loss of audio can be made up by increased discriminator sensitivity—but that is another story.

References

1. A simple method of measuring frequency deviation. C. Grey VE2AQX, *VHF Communications Magazine* Vol. 3. February 1971. ●

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1366	RA-4	Rubber Antenna	.
1367	RA-3	Telescoping Antenna	.
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1313	MC-60A	Desk Top Mircophone, built-in pre-amp	50.00
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1372	BO-9A	System Base	.
1373	SP-120	External Speaker	.
1374	PS-30	DC Power Supply	114.00
1370	BC-1	AC Adaptor for memory back-up	6.43
1371	MC-46	Touch-tune microphone	41.50
1313	MC-60A	Deluxe Desk Top Mic. + pre-amp.	52.00
1369	SP-40	Compact Mobile Speaker	.
1341	TR-9500	70cm All Mode Transceiver	429.00
1372	BO-9/9A	System Base	48.50
1373	SP-120	External Speaker	34.00
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1370	BC-1	AC Adaptor for memory back-up	8.00
1313	MC-60A	De luxe Desk Top Mic. + pre-amp.	50.00
1369	SP-40	Compact Mobile Speaker	15.75
1316	TL-922	2KW HF Linear Amplifier	799.00
1376	SM-200	1.8-150MHz Station Monitor	250.00
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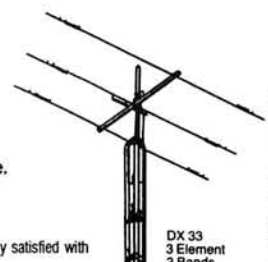

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1086	DX 32/33	Conversion Kit	63.25
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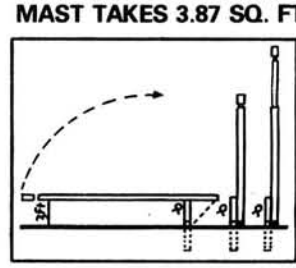

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New Books

25 SIMPLE SHORTWAVE BROADCAST BAND AERIALS
by E. M. Noll. Published by Bernard Babani (publishing) Ltd.
63 pages, 111 × 177mm. Price £1.95
ISBN 0 85934 107 0

The 25 antenna projects in this book range from dipoles to umbrella verticals and beams to end-fire verticals. Each is simple and relatively inexpensive to build and performs well. The antenna is described and usually drawn to illustrate the construction.

As well as antennas the first section of the book gives information on the shortwave bands, directivity and time zones. Dimensions are also given for spacing and phasing lengths of various antennas.

30 SOLDERLESS BREADBOARD PROJECTS—BOOK 2
by R. A. Penfold. Published by Bernard Babani (publishing) Ltd.
142 pages, 110 × 178mm. Price £2.25
ISBN 0 85934 088 0

Intended for the beginner in the world of hobby electronics, this book provides 30 easy-to-build projects. Each has a circuit description, circuit diagram, component layout diagram and a components list. Perhaps most important of all wherever possible the components used are common to various projects and relatively inexpensive.

A wide variety of projects are described from alarms to timers, counters and even a "computer voice". Any beginners should have many hours of enjoyment working their way through a book of this type.

BASIC AND FORTRAN IN PARALLEL
by S. J. Wainright & A. Grant. Published by Bernard Babani (publishing) Ltd.
79 pages, 111 × 178mm. Price £1.95
ISBN 0 85934 112 7

This book was written so that the student can learn FORTRAN, BASIC or both languages at the same time.

A FORTRAN interpreter for the Sinclair Spectrum has been included at the end of the book. This interpreter, after modifications, should also run on the ZX81.

Kindly Note

70cm Repeater Datacard—May 1984

The relative positions of GB3SM and GB3ST were unfortunately transposed on the Datacard map, all other information being correct. Thanks for pointing this out go to Mr. G. A. Booth G8DZJ, who constructed both units and is a Committee member of the UKFM Group Western. GB3OH is located near Linlithgow between the Forth and Kincardine bridges. Also, the DTI advise that GB3AH will be allocated RB11.

Swap Spot

Have Pye 22in colour TV with plenty of spares, used daily. Would exchange for AR88 or Hallicrafters SX28 or similar receiver. Tel: West Drayton 441031. *U757*

Have Harvard 40 channel CB, 2 antennas, p.s.u. 007 speech processor, also Acorn Atom micro computer, tapes, leads, manual etc. Would exchange for 144MHz multimode or 432MHz mobile transceiver. Pete. Tel: Deeside 821277. *U776*

Have SX200 scanner plus new matching antenna. Would exchange for astronomical telescope or watchmakers' lathe. Tel: 0569 30713 (nr. Aberdeen). *U779*

Have Realistic DX-200, Philips 640 pocket memo recorder with mains adaptor, Philips quartz f.m./a.m. clock radio, Motion Electronics TV tuner. Would exchange any three for either a FRG-7 or Lowe SRX-30. All my items are first class. L. J. Taylor, 1 Cadley Close, Blandford Forum DT11 7RY. *U788*

Have 1938 Leica 3A, F2 Summitar lens, E.R.C. excellent condition. Also 1939 Robot 2, F2.8 Tessar lens, E.R.C. Exchange either or both for Eddystone receiver in excellent condition with manual. W.E. Stedman, 133b Lynton Road, Bermondsey, London SE1 5QX. *U808*

Have Burndept 741 handheld on 432MHz band complete with NiCads. Would exchange for FRG-7700, FRG-7, scanner or w.h.y. Tel: Stourbridge 79212. *U819*

Have Realistic PRO22 scanning receiver 30–512MHz, 6 channel, 6 crystals fitted, 2 antennas (cost £100). Would exchange for receiver by Eddystone, AR88, Codar, Heathkit or 28MHz f.m. rig, antenna, p.s.u. or Lafayette receiver, KT-340, DX-302, DX-200 or similar. D.I.C. Haigh, 3 Brora Close, Lakes Estate, Bletchley. *U820*

Have Pentax MX 35mm camera + 50mm f1.7 and 135mm f3.5 lens. Also Braun 370 BVC flash. Would exchange for 430MHz multimode. Tel: 01-340 7573 after 7 p.m. *U875*

Have darkroom equipment including enlarger plus pair of Goodmans hi-fi speakers, all good condition. Would exchange for any working v.h.f. handheld to same value. G6ZVW. Tel: Southery 8409 after 8 p.m. *U877*

Have Yaesu FT101Z (FM) and FC902 antenna tuner, both have under ten hours transmitting use since new. Would exchange for BBC Micro model B with disc drive. Tel: Watford 676319. *U890*

Have Realistic DX302 communications receiver, digital readout etc. in absolutely mint condition. Would exchange for disc drives for Pet computer or w.h.y. G40AK, QTHR. Tel: Storrington 5151 any time. *U896*

Have Baker research microscope, mechanical stage, binocular eyepiece, camera, very comprehensive outfit worth £350. Also Bronica C camera and accessories. Would exchange for CB base station complete, RTTY/CW reader terminal, v.h.f. scanner. Cash adjustment if necessary. Tel: Trowbridge 61482. *U907*

Have FRG-7 receiver as new. Would exchange for 144MHz multimode plus "X" Yagi in good condition please. G1DQE. Tel: Stevenage 350310. *U912*

Have a No. 31 set (no hand/head set), a Thunder-pole II (new/boxed) CB antenna and a Honda 50cc scooter K reg., with two engines plus spares (for spares or repair). Can deliver. Would exchange for a 35–50MHz oscilloscope (any size) plus 50MHz f.m.–a.m. signal generator. Tel: 051-548 2513 (Liverpool). *U915*

Have ZX81 computer, 16K RAM, p.s.u., leads, manual, plus Sinclair learning lab. Would exchange for general coverage receiver, in fact anything in communications will be considered. Tony. Tel: 01-857 7504. Can collect. *U916*

Have TEAC X3R stereo reel-to-reel tape recorder auto reverse (cost £400). Brand new, used half hour. Would exchange for ICOM IC251E or Sommerkamp TS 788 DX transceiver or w.h.y. R.M. Dotchin, 2 The Crescent, Shortstown, Bedford MK42 0UJ. *U929*

Have Microwave Modules MM144/28 LO 144MHz converter (new) and HW202 144MHz transceiver with manual (needs p.a. transistor). Would exchange for Morse tutor or 35mm s.l.r. camera or w.h.y. Tel: Plymouth 788798. *U956*

Have u.h.f. signal generator 370/630MHz, old and heavy but in good order. Would exchange for manual for u.h.f. Star Radiotelephone 3 channel. Anything interesting considered. Tel: 0782 612868 (Newcastle). *U960*

Have ZX Spectrum 48K, ZX printer and Sharp cassette recorder, packed in original boxes with leads. Would exchange for Trio R-600 general coverage receiver. Tel: 051-426 3375 (Merseyside). *U966*

Have complete set-up of match fishing tackle including a carbon rod worth over £300. Also have gents 10-gear racing cycle—good condition but needs a little work doing. Would exchange for h.f. or v./u.h.f. equipment, w.h.y. Clive. Tel: 0279 28857 evenings (Harlow, Essex). *U995*

Have Tektronix 'scope model 545B with plug-in unit CA and mobile stand. Would exchange for TV receiver Ceefax/Oracle adaptor. T. Burgess, 26 Merton Road, Bedford MK40 3AF. *U997*

Have Realistic PRO-2002 scanner. Would exchange for mobile/handheld 430MHz set-up, w.h.y. Also have 12in motor chainsaw "Frontier", very good condition and typewriter in leather case. Local swap if possible—disabled G1. Tel: Bursledon 4333. *U999*

Have Mamiyaflex system, C220, C3, 65mm, 80mm, 105mm, 180mm plus extras. Would exchange for 430MHz multimode and accessories. Dave Ross G1DBR. Tel: Winsford, Cheshire 56702 after 5pm weekdays. *V012*

Have Eddystone 730/4 communications receiver 150kHz–30MHz. Would exchange (with cash adjustment) for Sony ICF7600 receiver. Tel: 0246 410545 evenings (Sheffield). *V013*

Have Video Genie (Level II) with £150 worth of software and a brand new Practika MTL3 with flash and all accessories. Also have 144MHz gutter-mount antenna—all perfect. Would exchange for IC-2E or IC-4E, w.h.y. G6HKD. Tel: Weymouth 787747. *V020*

Have MM2001 converter as new, unused since purchase. Would exchange for CWR610E Tasco converter (straight swap) or part exchange R100 or R200 as new. Tel: Bacup 874928 after 7pm. *V021*

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A FEW SIMPLE RULES: Your ad. should follow the format of those appearing above; it must be typed or written in block letters; it must be not more than 40 words long including name and address/telephone number. Swaps only—no items for sale—and one of the items MUST be radio related. Adverts for ILLEGAL CB equipment will not be accepted.

Auto-Notch Filter

by R. A. Penfold

Of the various audio "add-ons" available for communications receivers, a notch filter is probably the type which is capable of providing the most dramatic improvement in performance. A strong heterodyne will usually render the wanted signal practically unintelligible, but an audio notch filter can attenuate the interfering tone to the point where it is insignificant, or even completely inaudible!

A novel feature of this particular audio notch filter is its ability to lock on to a heterodyne automatically, and severely attenuate it. This may seem like nothing more than a clever gimmick, but in practice it is a very useful feature. A snag with manually-tuned notch filters is that of maintaining the filter at just the right frequency. The problem is caused by drift in the receiver and transmitter rather than by any fault in the filter, and often necessitates frequent trimming of the filter's tuning control. The main advantage of the automatic tuning is not that the filter will lock itself onto the heterodyne, but the fact that it will then automatically track it and maintain a high level of attenuation.

The filter has an operating range of about 150Hz to a little over 4kHz in both the automatic and manual modes. The degree of attenuation is not quite as good as the best of manually tuned filters (which can exceed 80dB of suppression), but at typically 30 to 40dB in the automatic mode the level of performance is perfectly adequate in this respect, and the filter has proved to be very useful in practice when DXing on the low frequency bands. In the manual mode about 60dB of attenuation is obtained at the centre of the notch.

Switched Capacitor

The unit is based on a type of filter which will probably be unfamiliar to many readers, namely a switched-capacitor filter. Filters of this kind use an arrangement of the type shown in Fig. 1, and this is analogous to a single stage *CR* lowpass filter. The electronic switch and the small capacitor (Ca) replace the resistor of a normal *CR* filter.

A clock signal is used to operate the electronic switch, and Ca is therefore repeatedly charged by the input signal, and then discharged into Cb. If the output voltage is higher than the input voltage the charge transfer is in the opposite direction. This tends to keep the charge on Cb at much the same level as the input voltage, but just how accurately the output signal matches the input one is dependent on the clock frequency and the input frequency.

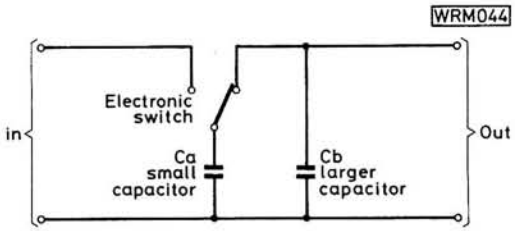
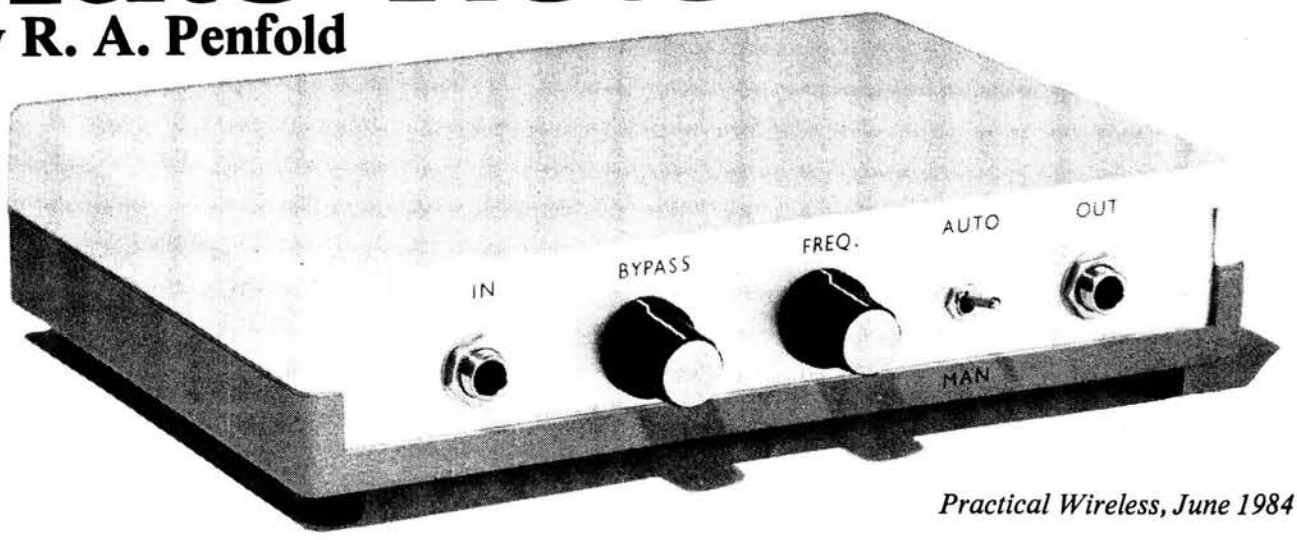


Fig. 1: The basic arrangement of a switched capacitor filter

A high clock-rate enables Ca to transfer a substantial amount of electrical energy between the input and the output of the circuit, despite the low value of this component. This enables the circuit to maintain the output at virtually the same voltage as the input, but only if the input frequency is substantially less than the clock frequency. With an input signal at something approaching the clock frequency, regardless of the actual clock frequency, there are too few charge transfers during each input cycle to give an efficient signal transfer, and high attenuation is produced. In other words, the circuit is giving the required high frequency roll-off.

What is happening here is that the effective resistance of Ca and the electronic switch is reduced as the clock frequency is raised and a greater rate of charge transfer can be achieved. This raises the filter's cut-off frequency in proportion to the increase in clock frequency, and it is this constant filter frequency/clock frequency relationship that is of crucial importance in this application. With the MF10CN monolithic filter used in this design the filter frequency is one hundredth of the clock frequency. This makes an automatic tracking filter quite easy to implement since it is merely necessary to lock the clock frequency at one hundred times the input frequency. This is achieved using a phase-locked loop (p.l.l.) and a divider circuit.



★ components

Resistors

¼W 5% Carbon film

470Ω	1	R9
2·2kΩ	1	R1
4·7kΩ	2	R5,6
6·8kΩ	1	R14
15kΩ	4	R7,8,12,13
33kΩ	3	R2,3,4
39kΩ	1	R15
100kΩ	2	R10,11
10MΩ	1	R16

Potentiometer, carbon track

47kΩ (lin)	1	R17

Integrated circuits

CA3140E	1	IC3
MF10CN	1	IC1
741C	1	IC2
4017BE	2	IC5,6
4046BE	1	IC4

Capacitors

Miniature ceramic plate

47pF	1	C10

Disc ceramic

0·1µF	1	C12

Mylar

1nF	1	C2
2·2nF	1	C5

Polyester

10nF	1	C4
0·1µF	1	C8
0·33µF	1	C11

Electrolytic, double-ended

100µF 10V	1	C3

Electrolytic, single-ended

1µF 63V	2	C1,9
100µF 10V	2	C6,7

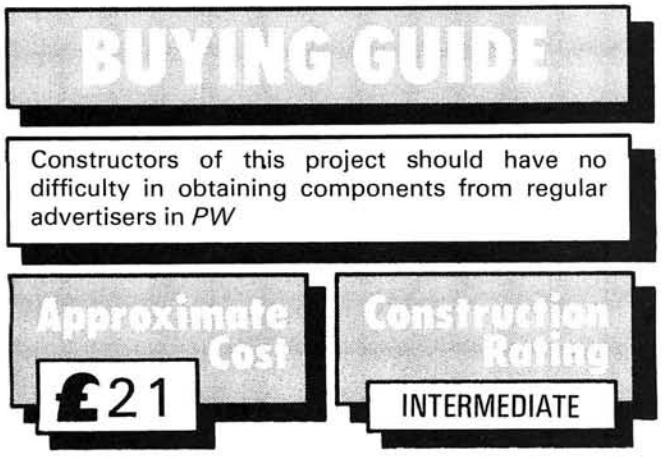
Miscellaneous

Sub-miniature s.p.s.t. toggle switch (S1); 4-way 3-pole rotary switch with end stop (S2); ¼in jack sockets (2); PP3 or PP6 battery; PP3 style battery connector; printed circuit board; control knobs (2); 205 × 140 × 40mm Verocase (Vero Part No. 202–21034J); 8-pin d.i.l. i.c. sockets (2); 16-pin d.i.l. i.c. sockets (3); 20-pin d.i.l. i.c. socket; twin jack-lead; M3 fixings, Veropins, etc.

Block Diagram

The arrangement used in the Auto-Notch Filter is shown in Fig. 2.

The MF10CN has a lot of circuitry in addition to the basic filter, and this enables a state-variable filter to be produced. Amongst other things, this gives the required notch filtering. A simple lowpass filter is used at the input to eliminate any high frequency signals which might otherwise react with the clock signal to produce heterodynes. A filter is used at the output to reduce the breakthrough of the clock signal at the output. This is not a major problem since the clock output level is only about



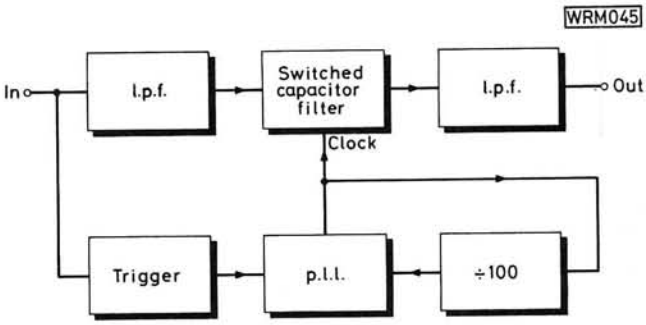


Fig. 2: The Auto-Notch Filter block diagram

10 millivolts r.m.s. anyway, but it is advisable to attenuate the clock signal, especially the harmonics, which might otherwise be radiated by the headphone lead and picked up by the receiver!

The phase-locked loop has one input fed with the input signal and the other fed with the output of its voltage-controlled oscillator (v.c.o.) via a divide-by-100 circuit. As the phase-locked loop requires logic level input signals, a trigger circuit has to be used to process the input signal to produce suitable drive levels. The phase-locked loop maintains the signal from the v.c.o. at the same frequency as the input signal, but due to the divider circuit the v.c.o. operates at one hundred times the input frequency. By using the v.c.o. to provide the clock signal for the filter the automatic tuning action is produced.

The Circuit

The full circuit diagram of the unit is shown in Fig. 3. R1 and C2 form the input lowpass filter. IC1 is the filter i.c., and this has an operational-amplifier input stage. R2 and R3 are a negative feedback network which set the voltage gain of the input stage at unity. This stage is followed by a form of mixer and two switched-capacitor filter stages. An internal feedback circuit plus external feedback by way of R4 set up the circuit to give the required notch filtering at pin 3. The value of R4 controls the Q factor of the filter, and the specified value gives only a low Q value. A higher Q would be beneficial in that it would give a narrower notch and remove less of the wanted signal. However, a low Q gives perfectly acceptable results, and a higher Q would tend to make any slight error in the filter frequency more significant, probably resulting in reduced performance. It should perhaps be pointed out that IC1 contains a second filter, but in this circuit it is unused, and the only connections made to the second filter are those that are needed in order to obtain proper operation from the section of the device that is used.

The notch output at pin 3 of IC1 feeds into the input of a 12dB per octave active filter built around IC2. This has a cut-off frequency of approximately 3·5kHz, and when used with an inexpensive receiver this filtering can help to reduce adjacent channel interference. The output is suitable for medium- or high-impedance headphones, and good results are even obtained using most low-impedance (8 ohm) types.

The m.o.s.f.e.t. op-amp IC3 is used in a simple trigger circuit, and IC4 is a c.m.o.s. 4046BE phase-locked loop. This is a slightly unusual device, and as can be seen from the block diagram of Fig. 4, it has two phase comparators. In most applications phase comparator 1 is used, and the device then works in the conventional manner with the v.c.o. going to the centre of the capture range when there

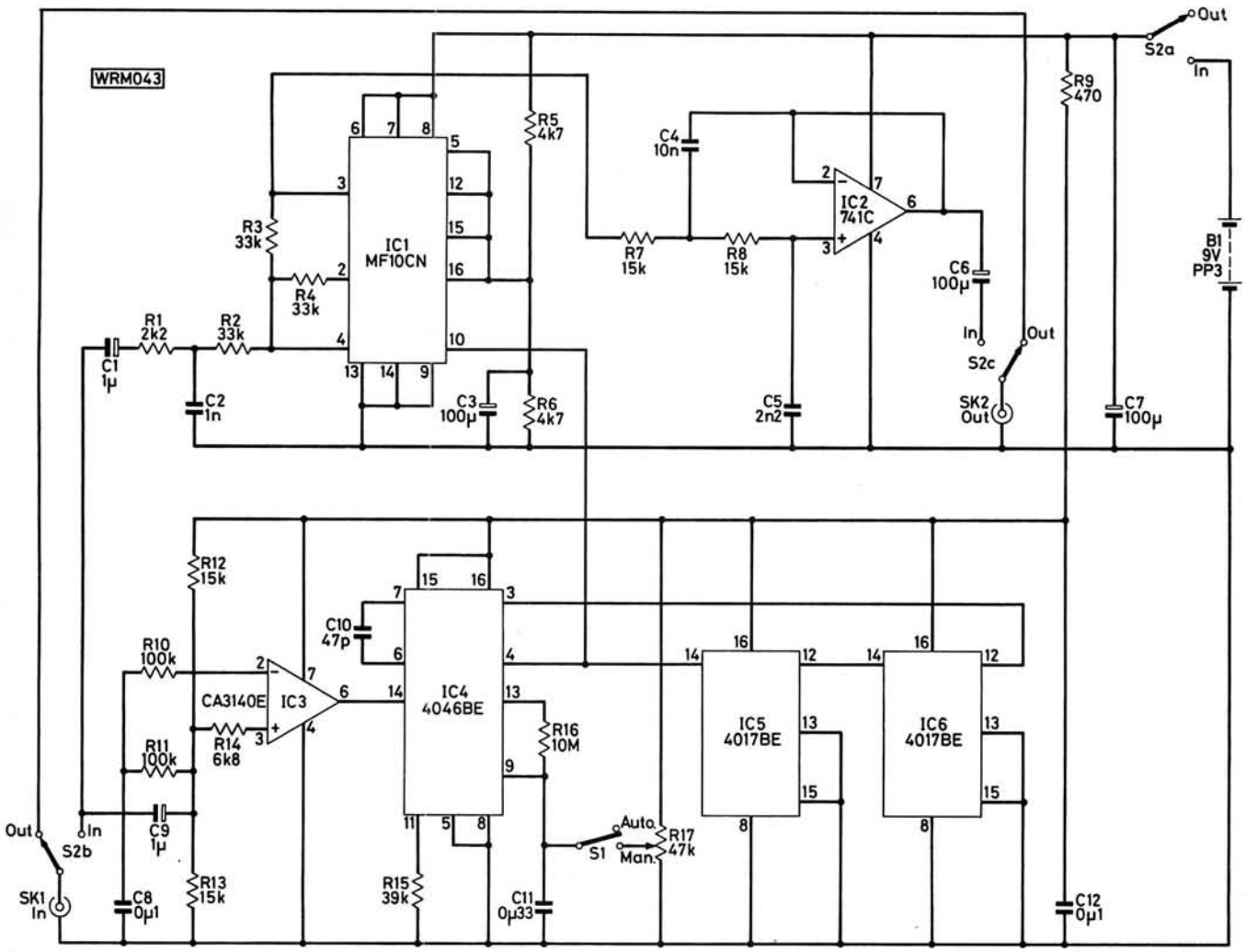
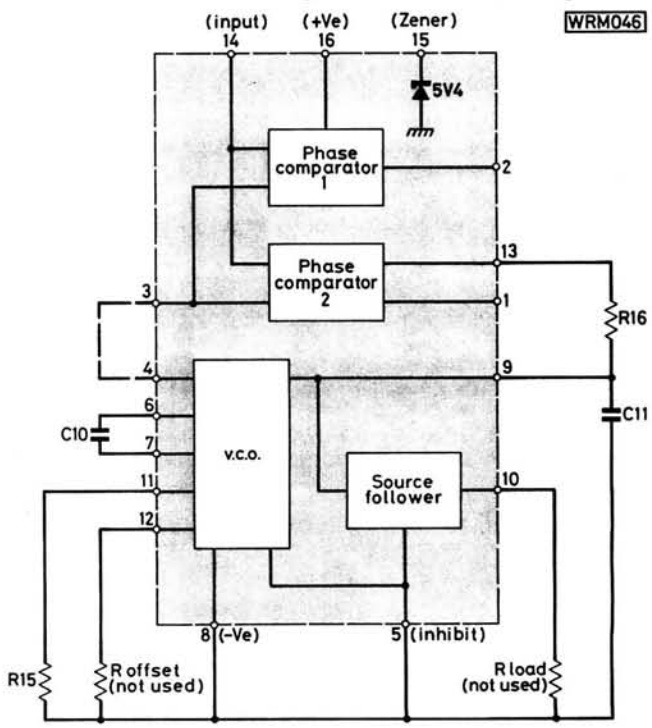


Fig. 3 ▲

Fig. 4: 4046BE block diagram ▼

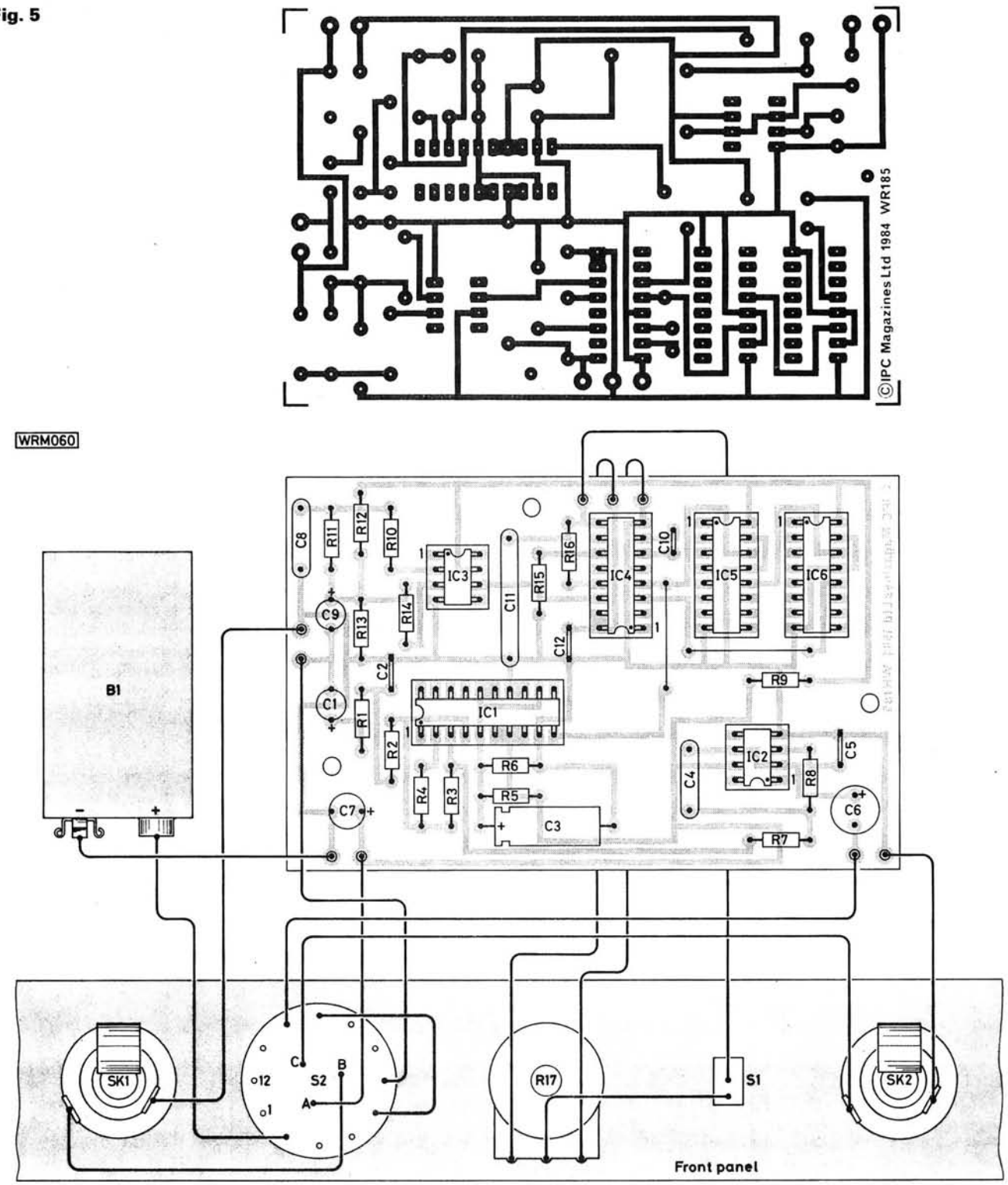


is no input signal. This comparator is not usable in the present application as, like most phase-locked loops, the circuit has only a narrow lock-in range using this comparator. In fact a range of only about 300 to 400Hz would be covered. With phase comparator 2 the v.c.o. goes to its minimum frequency if there is no input signal, but of more importance, a very wide frequency range can be covered. It is therefore phase comparator 2 that is utilised in this circuit.

The frequency-determining components of the v.c.o. are C10 and R15, while R16 and C11 form the lowpass filter feeding the control input of the v.c.o. and a long time constant of 3·3 seconds is used here. The interfering heterodyne will often be severely contaminated by the wanted signal, and a long time-constant seems to be helpful in maintaining lock under these adverse conditions. Of course, if the heterodyne is too weak in comparison to the wanted signal it will be impossible for the automatic tuning to operate properly, but manual tuning can then be used, although the heterodyne may well be at such a low level that no filtering is really needed.

With S1 set for manual tuning, the control voltage for the v.c.o. is provided by R17. This potentiometer can vary the clock frequency right down to zero, and in theory the lower limit of the frequency range is well into the sub-audio zone. However, in practice there will be a noticeable breakthrough of the clock signal at frequencies of less than

Fig. 5



about 10kHz, which will limit the minimum usable notch frequency to about 100Hz except where the clock breakthrough is less troublesome than a strong heterodyne.

The phase-locked loop circuit IC4 has a built-in 5·4 volt Zener diode, and R9 is the load resistor for this. All the logic circuitry is powered from this stabilised supply.

The two chips IC5 and IC6 are 4017BE one-of-10 decoders and decade counters. In this circuit they are used as straightforward divide-by-10 circuits, and are connected in series to give the required divide-by-100 action.

Switch S2 enables the circuit to be bypassed when the filtering is not required, and it also provides on/off switching. Power is provided by a PP3 or PP6 9 volt battery, with a total current consumption about 8mA.

Construction

A Verocase measuring about 205 by 140 by 40mm is used as the case for the prototype, but the unit could be fitted into a somewhat smaller case without difficulty. The suggested front-panel layout can be seen by referring to the photograph in the heading.

Details of the printed circuit board and wiring are provided in Fig. 5. Construction of the board is perfectly straighforward, but note that all the integrated circuits are m.o.s. types, and that the appropriate handling precautions must therefore be taken. Sockets should be used for all six devices; they should be left in their anti-static packaging until they are to be fitted onto the board; they should be handled as little as possible; they should not be fitted onto the board until it is complete in all other respects. Make sure that all the integrated circuits are fitted onto the board the right way round, and do not overlook the two link wires near ICs 4, 5 and 6.

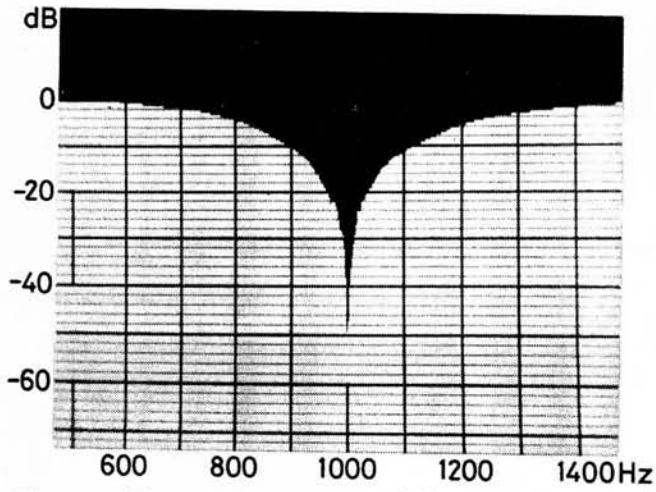
The small amount of point-to-point wiring should not present any difficulties. A standard 3-pole 4-way rotary switch having an adjustable end stop is used for S2, the stop being set for 2-way operation.

In Use

In use the filter connects between the headphone (or loudspeaker) output of the receiver and the headphones. A twin jack lead is used to connect the receiver to the filter, and, as the signal is at a fairly high amplitude and low impedance it is not essential to use a screened cable. The output of the filter will drive practically any type of headphones. With low- and medium-impedance types results will probably be best with the earpieces wired in series, but with high-impedance types parallel connection is preferable, and most headphones of this type are supplied wired like this. The filter is unable to drive a loudspeaker properly, but the output can fully drive any normal audio power amplifier.

With S2 set in the anticlockwise position the audio input signal is fed straight through to the output, and the filter is switched off. Switching S2 to the clockwise position turns on the filter, and closing S1 permits any tone within the frequency range of the filter to be nulled using R17. When initially testing the unit a heterodyne can be produced by tuning to an a.m. broadcast station and switching on the b.f.o. Switching S1 to the "auto" mode should give little reduction in the attenuation of the tone, and if the pitch of the tone is varied slightly by adjusting the tuning or the b.f.o. frequency control, the filter should track the heterodyne. However, the circuit necessarily has a slow response time, and it can take a second or so for the filter to initially lock onto a heterodyne, or to follow any large and sudden change in pitch. This is unimportant in normal use since any drift in the frequency of a heterodyne will be very slow indeed, and readily tracked by the filter. If the lowpass filtering is required but the notch filtering is not, switch S1 to the manual mode and set R17 fully anticlockwise.

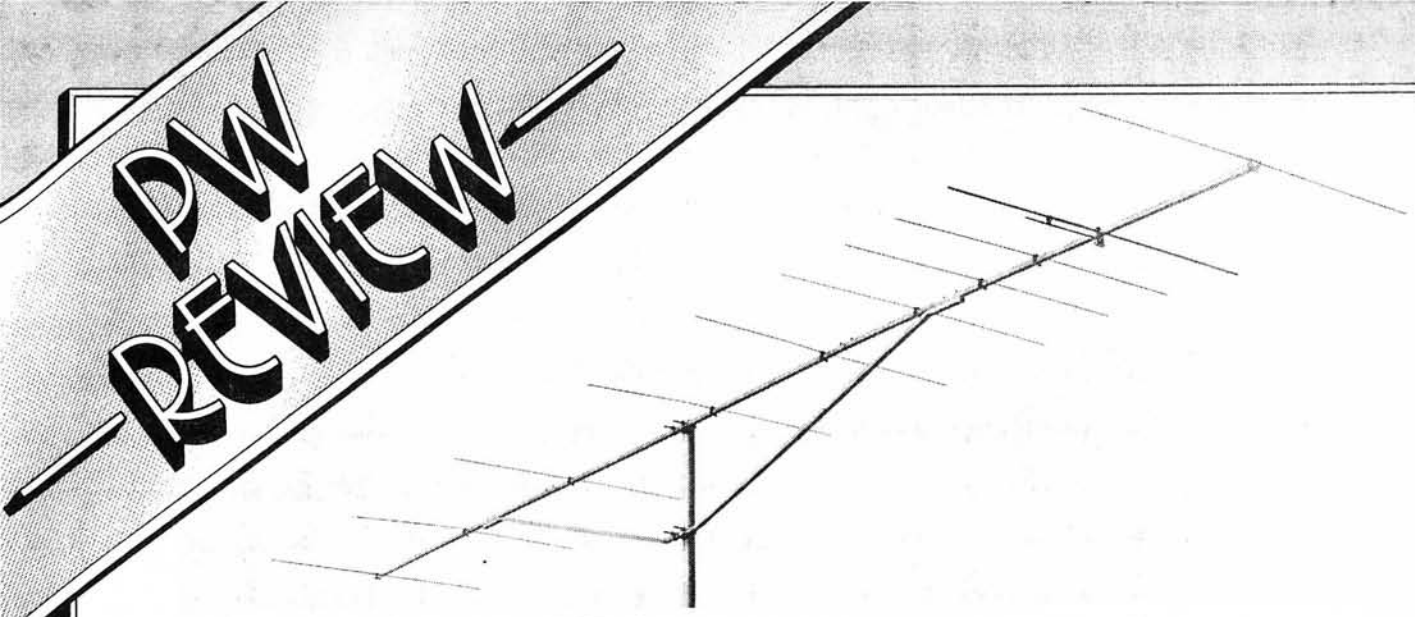
The unit is reasonably efficient at eliminating an interfering c.w. signal despite its intermittent nature, but it will consequently be necessary to use manual tuning if the filter is used during c.w. reception! ●



Measured frequency response of the prototype tuned to 1kHz on "Manual"

Benny

PW REVIEW



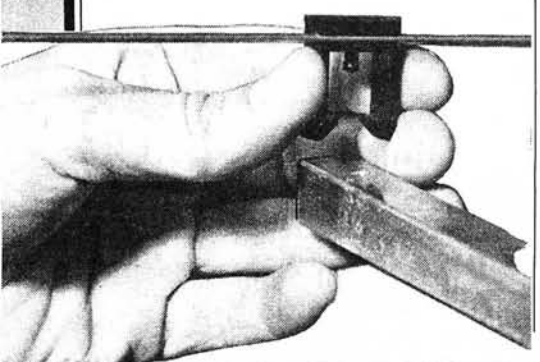
ANT PRODUCTS TIGER LY10 144MHz Yagi Antenna

During 1983 Ant Products introduced their Tiger range of lightweight 144MHz Yagi antennas. The highest performance model, the LY10, forms the subject of this review.

The LY10 is a straight 10-element Yagi with a boom length of 4·72m, featuring equal-length directors of non-constant pitch. In line with other antenna designs from this company, emphasis has been given to keeping the weight of the assembly to a minimum. This results in an all-up weight of 1·5kg—not much more than the bracing struts of some traditional designs!

Examination of the contents of the plastics bag that the LY10 arrives in reveals eight 2mm diameter stainless steel directors, 890mm in length, each fitted with a plastics centre insulator. This latter feature is identical to those fitted to the Ant Silver 70 432MHz antenna and once again confers the advantage of reduction in both galvanic and electrolytic corrosion often encountered with metallic element clamping. The single reflector element is also of this format. Strangely enough the 6mm driven element passes through the boom and is secured by a zinc plated self-tapping screw.

To allow for transportation the 15mm square tubular boom comes in three sections which are secured together on assembly by pairs of 2BA setscrews and a circular tube locating spigot. Supporting the boom is a "D" type brace, also supplied in two parts. Boom and brace connect to the vertical mast by way of separate "U" bolt clamps, which will accommodate masts of up to 50mm in diameter.



Assembly of the "knocked down" antenna is a very straightforward affair and took this reviewer approximately 30 minutes, following the blow-by-blow instruction sheet. The antenna was then mounted onto a luffed-over Western Electronics Ultimast and elevated to approximately two metres above ground ready for matching/alignment. Driven element adjustments consist of positioning the gamma matching section capacitor clip for lowest indicated v.s.w.r. A reference dimension for this setting is quoted in the instructions and proved to be very close to the optimum. The manufacturers quote the v.s.w.r. as better than 1·2:1 across the band, when aligned at 145MHz. In practice however the review sample remained within 1·4:1 over the required range, which is still a perfectly acceptable figure. The driven element input termination is formed by an SO239 socket mounted into an aluminium block, clamped to the boom section. It is a pity that this could not have been an N type device with integral weatherproofing; the SO239 requires the fitting of a rubber shroud (supplied) filled with silicone grease (not supplied), together with a coat of water repellant to seal the central pin at the point of connection to the gamma match.

In use and elevated to 10m a.g.l. the LY10 has performed favourably over a period of several months, many of which supplied their fair share of winter gales. After one particular stormy night with broadside gusts **well** in excess of force 10 the antenna was noticed to have developed a squint of some 15 degrees. The moral here is *always* leave your antenna pointing into the wind or if possible lower it during severe weather; there are finite limits to the structural capabilities of 1mm wall thickness aluminium booms. This problem aside the electrical performance remained stable and a visit to the workshop vice returned the antenna and its polar diagram to the normal shape.

Measurements taken during the review period differ from the quoted figures. The front-to-back ratio is stated to be 24dB and in practice consistently measured 14dB. Beamwidth is quoted at 30° E plane and was found to be nearer 38°. The forward gain figure was also found to be slightly lower than the 14dBd specified but was still respectable and allowed the reviewer to copy signals from the GB3ANG beacon at well over 700km.

In conclusion, the Tiger LY10 provides a reasonable performance from a *very* lightweight assembly, allowing it to be installed on even the smallest TV type rotators, *providing* warnings about wind loading are noted. Its ease of assembly should not go unnoticed by those who enjoy hilltop portable operations.

Thanks for the loan of the review sample Tiger LY10 Yagi, which is currently available at £32.95 + £5 Securicor, go to **Ant Products, All Saints Industrial Estate, Baghill Lane, Pontefract, West Yorkshire. Tel: (0977) 700949.**

John M. Fell

WARC

Conference or Confrontation?

by Peter Laughton

One could be forgiven for assuming that WARC are the call-letters of a small medium-wave music station somewhere in the United States. In reality, the letters stand for World Administrative Radio Conference. One such conference was recently held in Geneva which could have long-term implications for short-wave broadcast listeners. Peter Laughton was there for Practical Wireless.

Back in 1979, considerable coverage was given to the high-frequency World Administrative Radio Conference of that year. PTT administrations from all over the world convened in Geneva to re-allocate the short-wave spectrum to its various users. Several delegates went in with a certain amount of optimism. Many point-to-point users have been gradually switching to satellites, instead of unpredictable short-wave, for transferring telephone calls and telex data. Other users, such as international broadcasting stations, hoped that these point-to-point users would give up their claim to certain portions of the radio dial, allowing everyone else to spread out a little. But they didn't. Military users, in particular, pointed to the dangers of putting all the eggs into the vulnerable satellite basket, especially in these days when the concept of a "killer" satellite is a reality. Administrations left the 1979 WARC with about 30 per cent more space for international broadcasts, effective in 1989. They also passed a resolution to meet in 1984 and 1986 to discuss better ways of distributing the space available to broadcasters.

No-one argues that the present situation on the short-wave broadcasting bands is anything but chaos. Each country's PTT selects its own frequencies and sends notification to the International Telecommunications Union body dealing with this matter—the so-called International Frequency Registration Board. The IFRB publish all the registrations on a regular basis, noting where interference is bound to occur. In recent years, though, the "white" IFRB publication has gained the reputation as the book of "white" lies. Many countries register nearly every frequency in the broadcasting bands for themselves, even though monitoring later reveals they never use all that they ask for. When interference arises, telexes fly between the countries concerned. Each usually asks the other to move, either because they were there first, or the other country has so many other transmitters on the air that they "must" be able to give up one frequency.

With this situation prevailing, some 60 delegates turned up on January 10 this year to begin five weeks of negotiations. Many short-wave broadcasting stations sent representatives either to advise or actively take part in the PTT discussions. But this wasn't a case of everyone sitting around one large table analysing matters point by point. Five committees ran simultaneously, not to mention a number of "private" meetings between various PTT delegations to plan some strategy. There was plenty of reading to be done. Some 127 technical proposals were submitted to delegates before the conference began, and new ones appeared from participants almost by the hour. Each was translated into several conference languages. It is therefore impossible to cover all the discussions in detail, but perhaps this necessarily over-simplified summary will at least give you an idea of the scale of the problems to be solved. Two committees quickly became the main focus of interest to any outside observer.

Committee 4—Technical Parameters

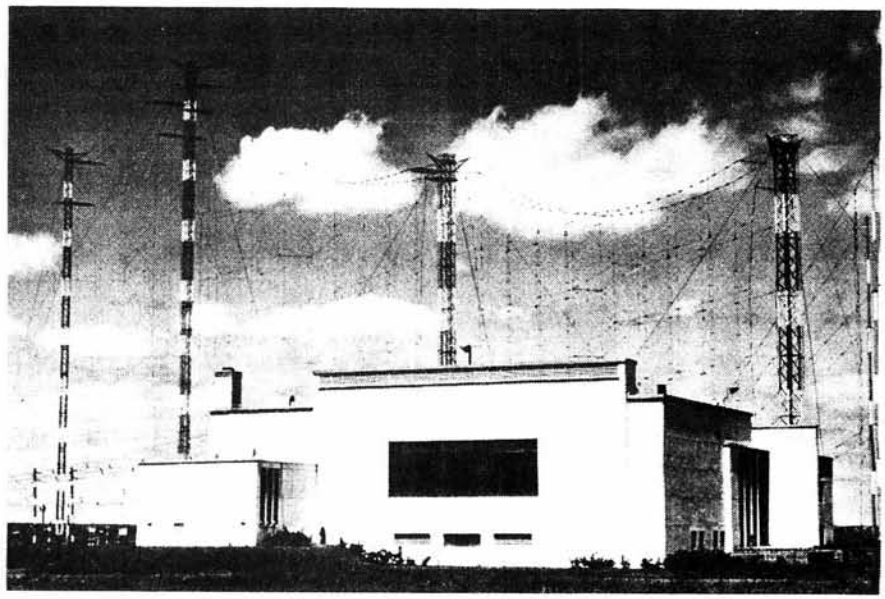
Before you can discuss what can be done to give each country fairer access to the short-wave bands, technical terms have to be defined. How sensitive is the "average" short-wave radio? Many of the terms in use today are based on standards set two decades ago. Technology has improved in many parts of the world, and there is no longer the need to use such high-power transmitters. This particular point proved to be a major stumbling block for a while, with western PTTs arguing that figures of 200 microvolts for 30 per cent modulation, submitted by the Soviet Union, assumed receivers were far less sensitive than in practice, and 50 microvolts is considered to be sufficient by some countries. In the end, a figure of 100 microvolts was approved.

Decisions also had to be made as to what levels of interference would be tolerated. Those who use dozens of transmitters simultaneously were willing to allow a much greater level of background interference than countries who can only afford to put one transmitter on the air and aim it towards, e.g. "Asia". This is still a bone of contention which may come up again in the second conference in 1986.

Committee 5—Planning Methods

This was the crucial committee which really determined if the conference would succeed. It slowly began to highlight the political background to all the technical discussions. Countries differ in their reports as to how successful it all was. On the face of it, the way to solve the current chaos looks remarkably simple.

Postal and telecommunications authorities in each country will no longer be allowed to select their own frequencies. Instead, they will have to submit a list of all the programmes their country's radio station(s) wish to broadcast, at what time, and where to. All these details are collated in Geneva and fed into a large computer at the IFRB. The computer has been programmed with an advanced propagation



Sackville transmitter — site of Radio Canada International. Will medium-sized stations such as RCI gain from any new computer planning?

program, so it knows what is technically possible. It sorts all the requests, trying to make sure that no-one is trying to broadcast to the same part of the world on the same frequency at the same time. The results are published, and PTTs are requested to stick to what the computer has decided.

Even in discussion process, serious differences of opinion emerged:

1. Some countries like Norway and Denmark broadcast programmes to ships at sea. Do these get equal priority to listeners on the mainland?
2. Short-wave transmitters around the world are in various states of repair. Countries such as the Dominican Republic or Denmark use old transmitters which cannot suddenly start "hopping about" the band because a computer in Geneva says they have to. Should countries with modern transmitters at their disposal, such as Britain, West Germany or Kuwait, be required to be more flexible than the others?
3. India, and a number of other countries in the developing world, use short-wave for domestic broadcasting. A medium-wave or v.h.f. system covering their vast terrain would be economically impossible. Should their "spots on the dial" get more protection from interference than international broadcasts?

It was clear that each country was trying to make the maximum gain on these issues, which made finding a fair solution even more difficult. No delegation wants to go home saying they have given anything away. The whole planning process is further complicated by an important fact which everyone pretended didn't exist: jamming.

Harmful Interference

At present, a large proportion of the short-wave broadcast bands is rendered useless by the effects of jamming, i.e. the use of noise to "drown out" a broadcast from another country. Recent western estimates quote an example that around 80 per cent of the 17MHz broadcast band is disturbed in Western Europe by jamming at 1900 hours UTC. By far the greatest amount of deliberate interference comes from the Soviet Union and members of the Warsaw Pact. However, the problem is now spreading to other areas of active conflict, such as the Iraq–Iran war. Britain, Canada and Holland all took a stand on this issue. A proposal by the Dutch delegation to WARC, attempting to show that this problem is not simply an East–West conflict, met with mixed reaction. A survey was conducted by The Netherlands in conjunction with a

Radio Mozambique, Maputo. Developing countries asked for a fairer share of the short-wave spectrum at WARC 84

group of developing countries. The conclusions indicated that broadcasts from developing countries such as India or Nigeria are rendered inaudible because of the "spill-over" from jamming stations near to the frequency.

However, it would appear that the developing countries hold a lot of faith in the future planning with the computer. At most, the IFRB computer would allocate four frequencies for a West-European station to broadcast to the Soviet Union, instead of the 17 or more currently used by some countries to try to combat the jamming. That means that, in theory, with less frequencies carrying programmes to Eastern Europe, the jamming should be reduced, resulting in more spectrum space for other users. Problem solved. Ironically, both West and East European PTTs from countries that use a lot of transmitters (e.g. USA & USSR) are agreed that they should have the right to veto anything that comes out of the Geneva computer.

Although the word "jamming" was a word reserved for the corridors at WARC '84, the very much watered down Dutch proposal has been adopted. It requires the IFRB to publish information received from monitoring stations around the world as to the extent of "harmful" interference, deliberate or otherwise. This will be available to the delegates at the second round of WARC in August–September 1986. No-one is obliged to take any action.

Single Sideband by 2006?

The system used by short-wave broadcasters at present, so-called double-sideband or a.m., is extremely inefficient when you consider how much energy is used to convey information to the listener. Amateur radio enthusiasts have already adopted the far more effective modulation method known as single-sideband (s.s.b.) for voice communication. It not only uses less power, it takes up half the space on the dial of a similar a.m. transmitter. The problem is that a more sophisticated and highly stable short-wave receiver is required to successfully pick up an s.s.b. broadcast. Such receivers can be bought, at a price, in Europe, the Far East, Pacific and North America. But they are beyond the dreams of listeners in Africa and Asia, two of the major targets for short-wave broadcasters. Here begins the "Catch 22" situation. Receiver manufacturers won't invest time and money developing s.s.b. receivers until broadcasters start using it. Radio stations can't switch over to s.s.b. until a fair percentage of the audience has the correct receiver.

To start the ball rolling, some countries hope to start a trend if an s.s.b. transition period of 20 years is approved in 1986. Radio Norway International, Deutsche Welle and the BBC have already conducted tests with a form of "compatible" single sideband, which can be picked up on a conventional a.m. radio. Only industrialised countries are expected to venture into the "compatible" s.s.b. market. This is because it costs a lot to convert existing transmitters, there is little reduction in power costs, and opinion is divided as to whether it provides any improvement in reception compared to existing a.m. signals. But in the long term, when "proper" s.s.b. comes in, short-wave transmitters will become cheaper to build and to run, and stations can then operate much closer together on the dial without mutual interference.

Conclusions

It is only when you stop to think about the concept of international broadcasting that you realise how complex a conference such as WARC turns out to be. Politics and diplomacy become vital, even though the conference is intended to be purely technical. Most delegates emerged from WARC '84 looking very tired. They refrained from commenting on its success, or otherwise, until they had a chance to take it all in. Those five weeks cost about two million dollars to organise. The ITU is now asking for software specialists to work on programming the IFRB computer ready for 1986. About three dozen people are working on it at present, but in most cases, the harder they work, the more their country stands to lose. Delegates know that most of the agreements made earlier this year can be completely overturned in 1986. So the final solution is still a long way off! ●

144MHz Miniature Multi-mode

The hand-held transceiver market will soon have a completely new contender to deal with, entitled the LS-202E, it is a compact 144MHz rig that incorporates not only f.m. but also the s.s.b. modes as well.

By utilising hybrid i.c.s and a miniature s.s.b. crystal filter, the overall size of the rig measures only 165 x 62 x 40mm and weighs only 500g including batteries.

Frequency selection, for both f.m. and s.s.b., is in 5kHz steps, via thumbwheel switches and a pushbutton for 0 or 5kHz, and covering a range of 144·000 to 145·995MHz. In addition, the VXO (variable crystal oscillator) allows the operating frequency to be fully tuned over ±5kHz; an RIT control with centre-click stop is provided on the top panel.

Dependent on the particular battery power pack being used, r.f. power output, on Hi, varies between 1·5W for 7·2V to 3·5W for 10·8V, with Lo at 0·5W for the nominal 9V.

On the top control panel, other features include on/off and volume; squelch; noise blanker; mode switch (f.m., u.s.b. and l.s.b); external microphone and speaker; RIT and VXO, S-meter/battery meter; and thumbwheel switches. The meter and thumbwheel switches may be illuminated simultaneously, by an l.e.d. lamp, switched from the side panel.

Also on the side panel is the battery charger socket, p.t.t. switch, ±600kHz repeater shift switch and 1750Hz repeater tone burst switch.

Supplied as standard is the helical rubber antenna, belt clip, hand strap and operating manual. A wide range of optional accessories are available, and include: re-chargeable battery packs; a.c. charger; mobile charger; speaker microphone; headset with built-in VOX facility; λ/4 telescopic rod antenna; soft case; mobile console with front speaker and mobile mounts; and a 25W linear amplifier unit.

The Belcom LS-202E 144MHz f.m./s.s.b. transceiver should be available by the time this issue of *Practical Wireless* is published, and will cost £225.00. Further details from: *Lowe Electronics, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 2817, 2430, 4057 and 4995.*

PEP Conversion Module

Single sideband (s.s.b.) is one of the most widely used modes of transmission on the amateur bands. It is also likely that most operators can observe the "peak" received input power on their S-meter, but on transmit the only way they are able to obtain an approximate reading of peak output power is to "whistle" into the microphone. This method produces a fairly fundamental frequency that results in most of the power being concentrated in one side band, allowing the meter to read this level, providing a poor approximate indication.

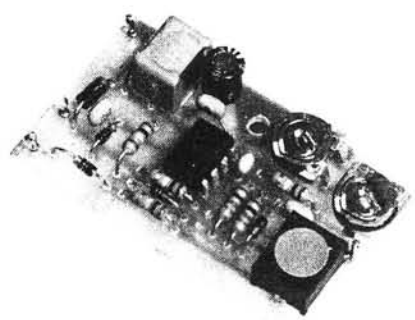
The regularly used s.w.r. meter or in-line watt meter will provide acceptable readings on continuous carrier modes (f.m., c.w. and f.s.k.) but are not suitable, and may even be misleading, on s.s.b. The natural tendency is to increase the microphone gain and speak too close to the microphone to obtain maximum deflection on the power meter, resulting in distortion and splatter.

To counteract these and a variety of other problems by producing an accurate s.s.b. "peak" reading on the power meter, Amateur Accessories Ltd. can supply their Peak Power Module that can be fitted to any power/s.w.r. meter enabling the meter to read transmitted p.e.p. and mean power.

Briefly, the circuit consists of an "on board" variable resistance in two parts—"coarse" and "fine"—which replaces the moving coil meter. The voltage generated across this resistance provides the input voltage to the first amplifier, which in turn charges a capacitor via a diode. The second amplifier is a voltage follower which drives the meter.

The circuit is arranged with 100% feedback from output to input and has a gain of unity. On installation the input resistance is adjusted so that the meter reads the same as it did prior to modification in continuous carrier mode.

As the output voltage equals the input voltage, it follows that the input resistance now equals the resistance of the moving coil, and the original manufacturer's calibration remains correct on all ranges.



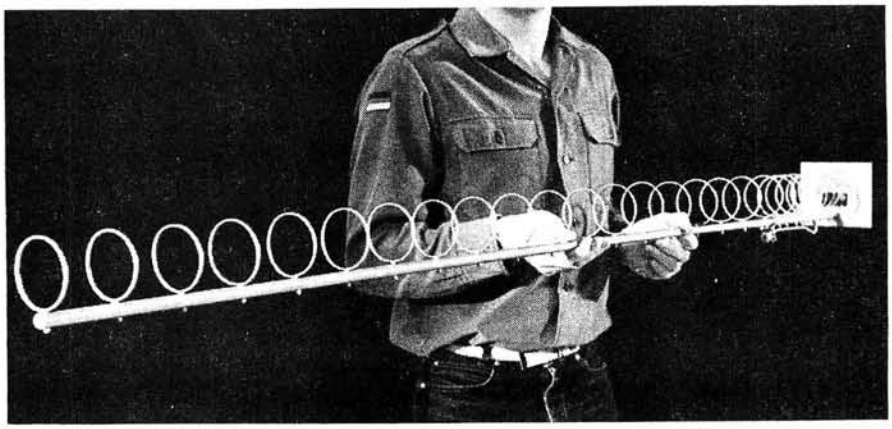
The input voltage to the amplifier is derived from a non-reactive source and is accurate to steady state or transient inputs. Errors due to back e.m.f. of the moving coil are eliminated.

The module is constructed on a p.c.b. measuring 55 x 30mm, employs one i.c. and some 20 other components, and consumes around 1mA at any voltage between 3 and 15V d.c. The module is unaffected by voltage change during operation.

Along with mechanical parts for mounting on the meter and top earthed screen with mounting pillars, the module is supplied assembled, tested and adjusted for zero. Full instructions show how simple it is to fit and calibrate the unit, and also describes how to fit a d.p.d.t. switch (not supplied) which enables the peak reading function and its power source to be switched off and the meter returned to normal operation.

Priced at £12.60, which includes p&p, the Peak Power Module is obtainable only from: *Amateur Accessories Ltd., Church Street, Glan Conwy, Colwyn Bay, Clwyd LL28 5LS.*

Microwave Antennas from SMC



I have recently obtained details of a new range of loop quad antennas available from South Midlands Communications, designed and produced by JVL Electronics.

Devotees of the microwave page in *Radio Communication* will already be familiar with the extensive range of antenna designs produced over the last few years by Mike Walters, G3JVL. Until now it has been up to the reader to construct these items on an individual basis, often with variable results. With the formation of JVL Electronics, several versions of the quad loop Yagi antenna are now available in kit form requiring minimal constructional effort to obtain the full rated performance device.

Two versions are available for 1·3GHz: the 1296-26QL has a two metre long boom (8·7λ), a gain of 18·5dBi and a 3dB beamwidth of 17° in both planes. The bandwidth should accommodate operations on the OSCAR 10 mode L uplink and 1·3GHz ATV. The 1296-46QL has a four metre boom (17λ) and a gain of 22dBi, with correspondingly reduced beamwidth.

In addition to 1·3GHz SMC will have loop quad antennas for 144 and 432MHz, 2·32GHz and possibly a 20λ version for 3·46GHz. If your antenna maxim is "big is beautiful" how about trying the 144-26QL? This "compact" little device also features an 8·7λ boom—a *mere* 18m in length together with a gain of 18·5dBi! It should be noted that from the performance plots supplied, all gain figures quoted are expected *minimums*.

Temperature Controlled Soldering Iron

New to the range of soldering tools offered by Tele-Production Tools Ltd. is a temperature controlled pencil iron entitled the Thermomatic.

This new iron, which is rated at 24V/50W, has a "closed loop" electronic control system, enclosed in the handle, and is fully adjustable from 200° to 400°C.

Suitable for use with any 24V power supply, the Thermomatic has no moving parts and creates no magnetic or electrical interference whatsoever.

Safety features include burn resistant silicon rubber lead, self-extinguishing polycarbonate handle and low operational voltage.

The Thermomatic is priced at £19.26, which includes VAT and carriage, also available is a range of 14 iron-clad long-life bits, which include screwdriver, chisel and conical-shaped tips, priced at £1.60 each.

Further details from: *Tele-Production Tools Ltd., Stiron House, Electric Avenue, Westcliff-on-Sea, Essex SS0 9NW. Tel: (0702) 352719.*

Copperfoil Tape

A product that could effect substantial savings in the construction of printed circuit boards is a novel tape produced by Copperfoil Enterprises.

Copperfoil tape is produced from 99.999 per cent fine copper and is supplied backed with a high temperature resistant adhesive which bonds to virtually all insulating surfaces, including plastic and paper. It is ideal for soldered connections.

Tested and approved at 24V d.c. with a current carrying capacity of five amps, it conforms to BS Safety Regulations, but is not recommended for a.c. mains voltage.

In low voltage applications it is suitable for repairing and producing p.c.b.s., burglar alarm systems, proximity switches, moisture detection, bus bars, and opens up a field of possibilities in constructing antenna systems for the radio amateur.

Copperfoil tape is available in 4, 4·75, 6 and 8mm widths in 33m rolls, and costs £2.95, £3.35, £3.95 and £4.25, respectively. Prices quoted include VAT and orders for up to five rolls will be supplied post free.

For further information, contact: *Copperfoil Enterprises, 141 Lyndhurst Drive, Hornchurch, Essex RM11 1JP. Tel: (040 24) 56697.*

10GHz SSB/CW

Most people interested in 10GHz microwave experimentation will have started their operations using wideband f.m. systems, probably based on ex-commercial cavities. In order to fully exploit the potential propagation modes available and to permit working over non-optical paths the only solution is to go narrowband, using s.s.b. or c.w. techniques. The realisable increase in performance by reducing the bandwidth from 300kHz to 300Hz together with elimination of the f.m. threshold effect amounts to some 40dB, making feasible fixed station and long distance contacts.

However the construction of suitable systems, requiring a fair amount of mechanical engineering, has proved to be a block to many would-be constructors. With this in mind JVL Electronics are introducing a ready built and aligned 10GHz image recovery mixer, based on the classic G3JVL design. This device is essentially the basis of a microwave transverter and can be interfaced to a 144MHz multimode transceiver to provide full transceive capability on 10GHz.

Also to be made available are Alford Slot omni-directional antennas together with interdigital microwave filters and a 5·7GHz version of the mixer system.

For further details, prices etc. send an s.a.e. to: *JVL Electronics, 26 Fernhurst Close, Hayling Island, Hampshire, PO11 0DT. Tel: (07016) 4482.*

Simple Top-Band Receiver

by Chris Plummer G8APB

From previous articles* you will gather that there are a small number of sado-masochistic maniacs spread around the country, otherwise known as "Top-Band d.f.ers" (direction finding experts). The previous articles covered the construction and use of a d.f. set for Top-Band and, as can be imagined, a set that has a specialised antenna and headphone output is of limited use in a moving vehicle to monitor signals at random intervals. So the author developed the 1·8MHz monitor receiver using an external car whip, and including an amplifier with loudspeaker output. This receiver can of course be used for any Top-Band listening, and is reasonably sensitive and stable. It can also be adapted for use on the 3MHz band by setting the v.f.o. on the low side of the input signal, i.e. tuning 3·045–3·345MHz and using less inductance on the tuned input circuits.

PW, March/April, 1984

The Circuit

Basically the heart of the circuit is identical to the previous design except that the unwanted sense-amplifier circuit is removed, and an i.c. audio-amplifier has been added. In the author's prototype the a.g.c. system is still disabled but details are given in Fig. 1 to allow for a.g.c.

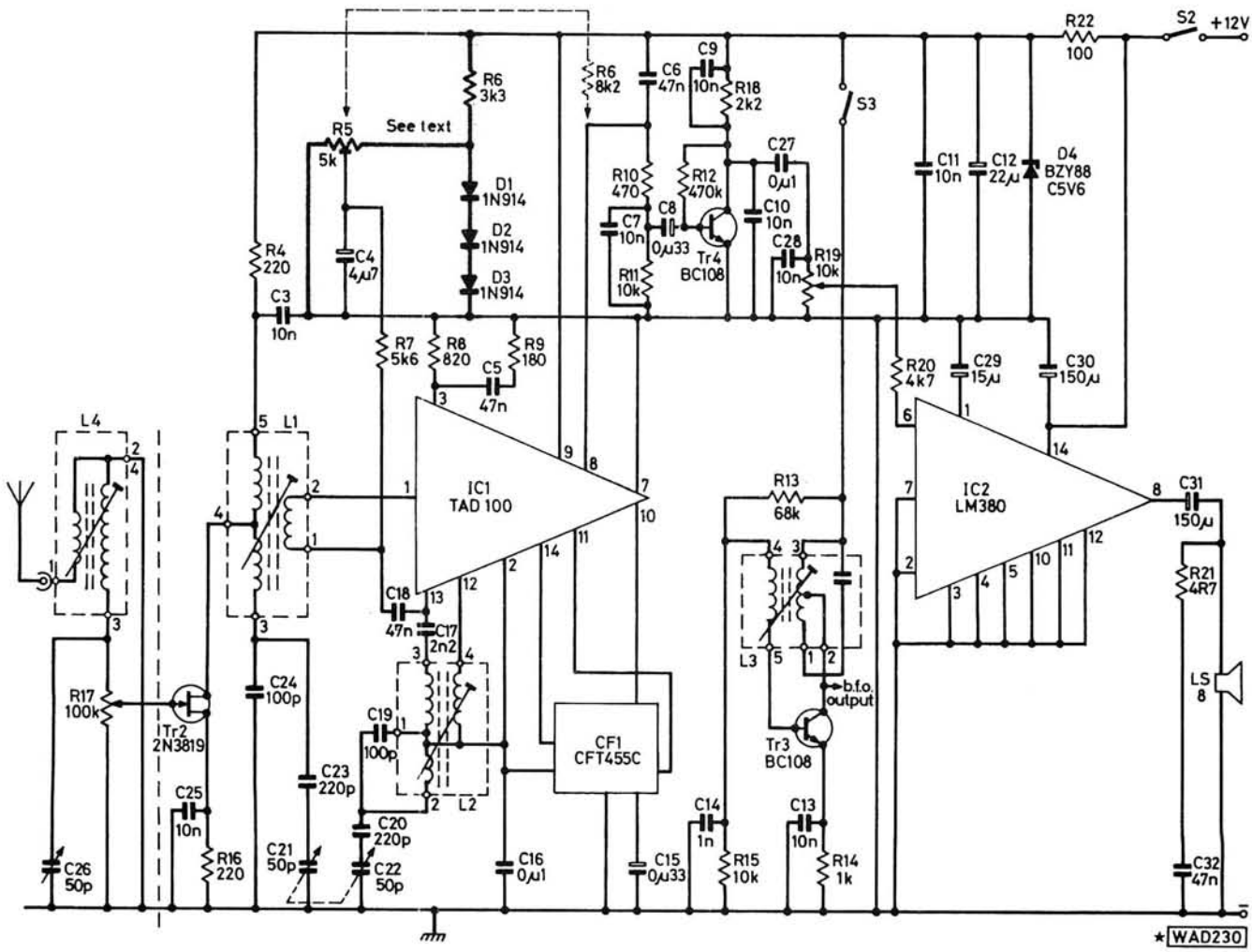


Fig. 1: The circuit diagram of the simple Top-Band receiver with the a.g.c. disabled. To enable the a.g.c. the components under the tint are omitted and the connection shown dotted made instead. C4 is changed to 10µF and R7 to 8·2kΩ. The p.c.b. will accommodate the changes

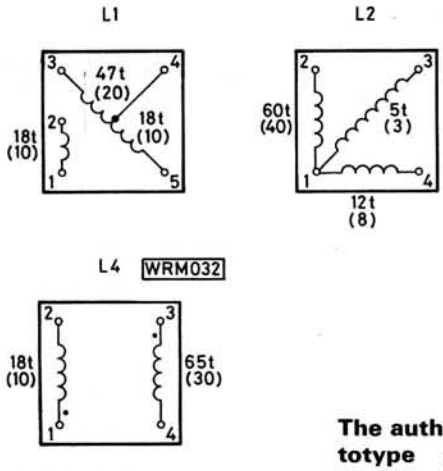
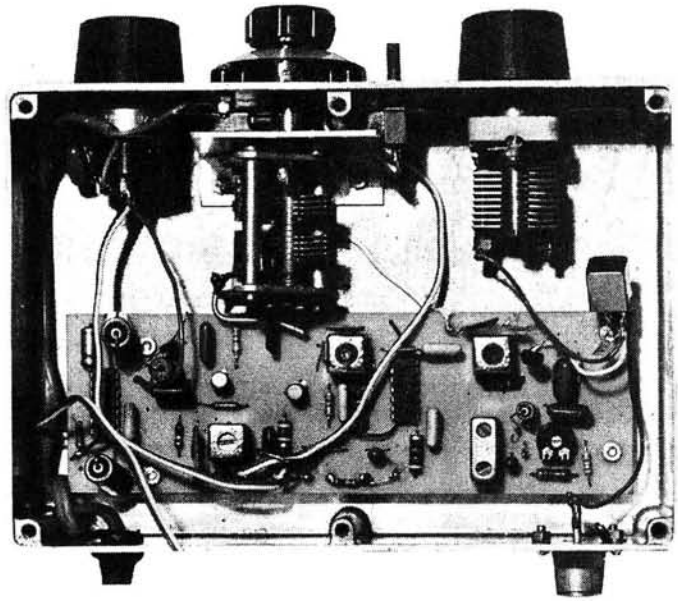
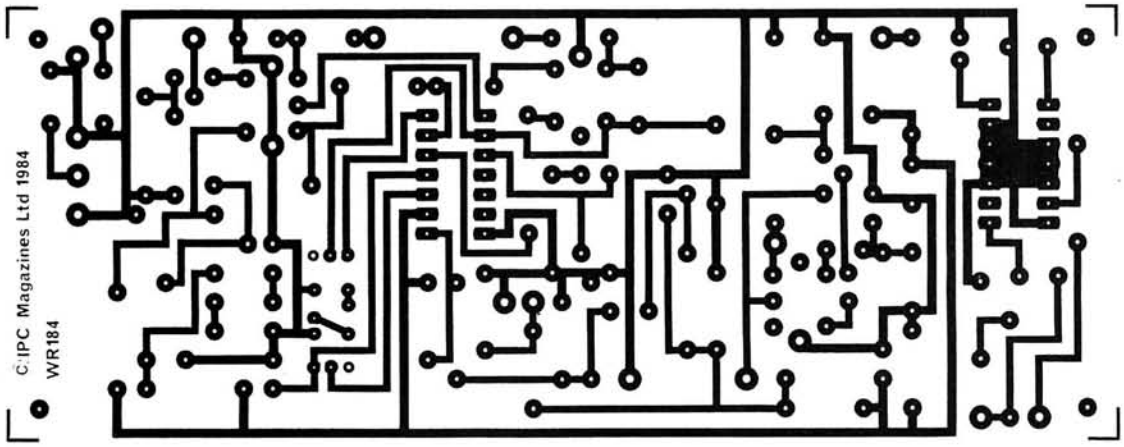


Fig. 2: Coil winding details



The author's prototype receiver. The speaker is housed in the lid of the box



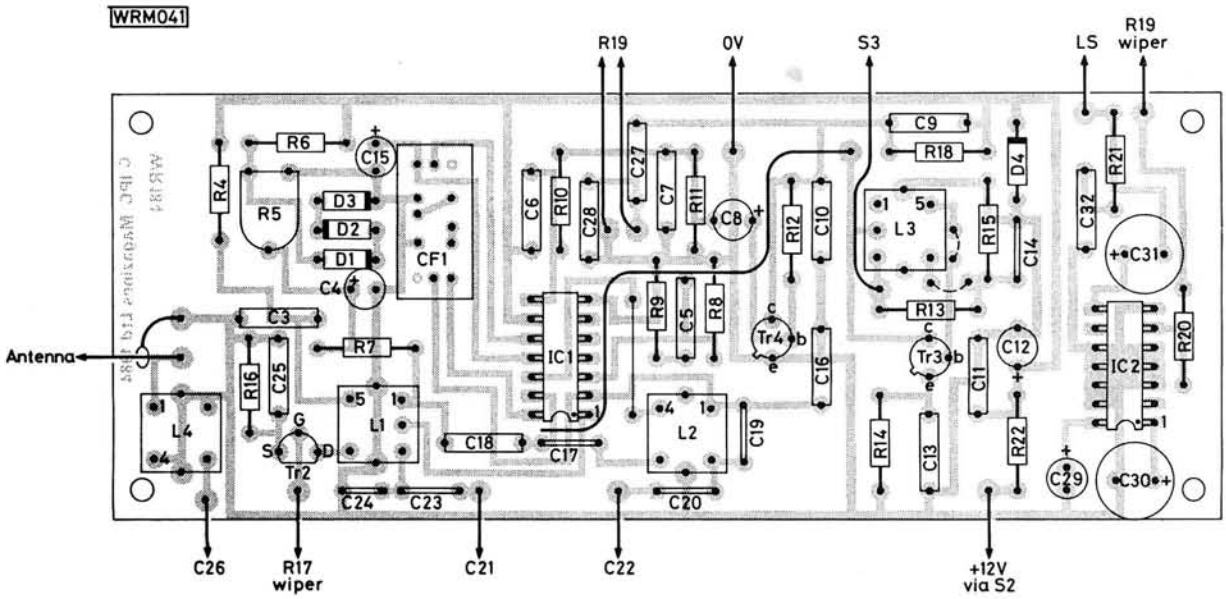


Fig. 3: Full-size p.c.b. track pattern and component layout for the receiver

★ components

Resistors

Carbon film ¼W 5%

4·7Ω	1	R21
100Ω	1	R22
180Ω	1	R9
220Ω	2	R4,16
470Ω	1	R10
820Ω	1	R8
1kΩ	1	R14
2·2kΩ	1	R18
3·3kΩ	1	R6
4·7kΩ	1	R20
5·6kΩ	1	R7
10kΩ	2	R11,15
68kΩ	1	R13
470kΩ	1	R12

Potentiometers

Min. horizontal presets

5kΩ	1	R5

Carbon track

10kΩ (log) (with switch)	1	R19
100kΩ (1in.)	1	R17

Capacitors

Polyester

10nF	8	C3,7,9,10,11,13,25,28
47nF	4	C5,6,18,32
0·1µF	2	C16,27

Ceramic plate

100pF	2	C19,24
220pF	2	C20,23
1nF	1	C14
2·2nF	1	C17

Min. Electrolytic p.c.b. mounting

0·33µF	25V	2	C8,15
4·7µF	25V	1	C4
15µF	16V	1	C29
22µF	16V	1	C12
150µF	16V	2	C30,31

Air-spaced variable

50pF	1	C26 (Jackson C804)
50pF + 50pF	1	C21,22 (Jackson C808)

Semiconductors

Diodes

1N914	3	D1,2,3
BZY88C5V6	1	D4

Transistors

BC108	2	Tr3,4
2N3819	1	Tr2

Integrated Circuits

LM380N	1	IC2
TAD100	1	IC1

Miscellaneous

Speaker 8Ω; min. switch s.p.s.t. (S3); diecast box 172 x 120 x 55mm; crystal filter Toko CFT455C; Toko YRCS12374ACS (L3); Toko 10K coil formers (3); knobs (3); slow motion dial; printed circuit board.

BUYING GUIDE

Most of the components used are readily obtainable from advertisers in *PW*. The TAD100 can be obtained from Watford Electronics. The p.c.b. is available from the usual suppliers or from the author QTHR. Toko coils and formers can be obtained from Ambit International. A suitable "vernier slow-motion drive" is available from Maplin Electronics as RX39N vernier dial small.

Approximate Cost £40

Construction Rating Intermediate

action as per the manufacturer's intentions. The author's prototype still uses the TAD100 i.c.; however the TAD110 is pin compatible and may be easier to obtain.

The system now runs from a nominal 12V supply so that the audio i.c., an LM380, can give a reasonable output, the supply to the rest of the set being about 6V either by using a 78L05 regulator or a resistor and Zener diode system so that the TAD100/110 behaves as in the companion d.f. set. Alignment is as previously described but without the sense-amplifier; the audio stages need no alignment. If a.g.c. is added then the marked components in the layout should be changed accordingly. All components can be mounted on the p.c.b. as shown except the tuning controls and gain control. Coil winding details and detail layouts are given in Figs. 2 and 3. ●

Uncle Ed

▶▶▶*continued from page 21*

peak of the modulation envelope is called the **peak envelope power (p.e.p.).** You can calculate the p.e.p. by taking 0·707 of the peak voltage read from the oscilloscope screen, squaring it and dividing by the load impedance, in just the same way as I described for average power.

The second reason for using the two-tone test signal is that, as the drive level is increased, it is easy to see the peaks of the waveform begin to flatten, a sign that the amplifier is being overdriven and is generating intermodulation distortion products. The waveform envelope should be a clean sinewave at lower drive levels of course. If not, you have distortion somewhere that must be cured.

A speech signal driving the amplifier to the same peak height on the oscilloscope display as the two-tone test signal will give the same p.e.p. as that two-tone signal. If you watch your s.s.b. output on an oscilloscope during normal operation, having checked the maximum peak height you can get without peak-flattening on the two-tone signal, you can safely turn up the microphone gain to give the same height on loudest speech, knowing that you're not overdriving the transmitter and splattering all over the band.

PUBLICITY

Getting The Message Across

by David W. Green G4OTV

Historically, the workings and purposes of amateur radio have been known in great detail by its enthusiastic practitioners but have been a closed book and completely unknown to everyone else. In the past this has, perhaps, not really mattered, but I would suggest the situation has changed.

With the advent of CB and the erroneous view of Joe Public (and indeed much of the media) that CB is synonymous with amateur radio, it is vital that we educate the public and make clear the differences between the two types of communication.

In the last few years, the rate of issue of new amateur licences has been greater than could ever have been dreamed of a decade ago and yet many local clubs are failing to recruit this new blood into their ranks. This happens because in many cases the club's activities and perhaps even its existence are not made public. Probably the majority of clubs do not have anyone appointed to specifically look after publicity and public relations matters.

Ironically in this the hobby of communications, we must learn how to communicate! There is nothing to be gained by remaining insular and hiding our lights under a bushel!

There is nothing unduly difficult in ensuring that amateur radio and the activities of clubs and organisations associated with it receive the publicity which they deserve. It requires only an appreciation of those activities which would be of general interest and the passing of information to the media in an attractive format.

Probably the most effective way of communicating with the press is by means of issuing a press release. This simply means writing the story as the writer would wish it to appear in print. Often the publication will reproduce the press release verbatim. To increase the chances of good publicity it is a good idea to add a footnote offering a photograph to accompany the story if possible. (This should normally be a black and white glossy print with good contrast—unless of course you can persuade the editor to run a colour feature!) It is important also that the press release should contain details of someone who can be contacted during office hours to provide additional information.

If a press release is intended for the local press as distinct from the specialist amateur radio press, it should be written in a completely non-technical style. The criteria should be, "Will my grandmother/next door neighbour/the paper's editor be able to understand it?"

Reproduced with this article is a simple press release prepared by the West Kent ARS following a contest. The story was sent to the three local newspapers; one ignored it (you can't win them all!), the second printed it exactly as written and the third contacted the club for a photograph and ran a well-written item which also covered the intention to put an amateur in space aboard the space shuttle Columbia. The editor has also shown interest in a large amateur radio feature in his paper. The club will ensure that he is gently reminded!

It is even possible to send out a story before it has actually happened by placing an embargo on the press release; that is, it can be marked "Not for publication before . . .". It is necessary of course to be very sure that the event will actually take place but it is a valuable technique for getting your story printed immediately following the event.

There is no need to stop at the local papers in a search for publicity. Local radio now plays an important part in the community and has obvious ties with amateur radio that can be exploited to the full. Television too has regional stations that might be persuaded to send a crew to cover the strange goings on at a field day site.

So have a go and, for affiliated clubs, do not forget to send a copy of any resulting publicity to the RSGB.

If it's a membership drive you need, then why not try an open evening or an open talk on the "Introduction to Amateur Radio" theme? You will need to ensure, of course, that your "target" population know about the meeting through the media, notices are exhibited in libraries and local electronics shops, and that personal invitations are handed out by existing club members. An obvious source of newcomers to the hobby are the CB operators who have become interested in radio and who want to go beyond a restrictive short range communication system. Another possible source of new members could be the ever-increasing band of home computer owners who, perhaps, would like to use their micros for something more challenging than playing games.

It is worth remembering that publicity and membership growth should be on-going objectives.

See you on the telly!!

PRESS RELEASE

Amateur Radio Contest

A hardy band of enthusiasts from the West Kent Amateur Radio Society took part last weekend in a national amateur radio contest. Operating non-stop for twenty four hours from a site near Cranbrook, the Society made a total of 230 contacts with other amateur stations in 10 different countries. The contest used Morse code on the two-metre v.h.f. amateur band.

Whilst it will be some time before the results of the contest are published, the Society hopes to see its callsign, G3WKS, appearing reasonably prominently in the results list.

WKARS enter a number of contests each year and organise a full programme of lectures, demonstrations and social events. Society membership is open to everyone interested in radio whether a licensed amateur or not.

ENDS

Editorial Note:

A photograph of the contest site is available from Dave Green of .....)

(Office 'phone no. .....

The secretary of the Society is .....

(Phone .....).

on the air

AMATEUR BANDS by Eric Dowdeswell G4AR

Reports to: Eric Dowdeswell G4AR, 57 The Kingsway, Ewell Village, Epsom, Surrey, KT17 1NA.
Logs by bands in alphabetical order.

As an enthusiastic user of the Morse code since an early age I always feel that the s.w.l./licensed amateur is using a receiver/transceiver to half its potential if only s.s.b. is used to the exclusion of c.w. In modern parlance it is only 50 per cent cost effective.

As many s.w.l.s go on to take their RAE for their AR transmitting licence a working knowledge of the code and procedures will enable them to go straight to the "A" ticket saving money in the process, a not undesirable objective these days. This is not to decry the "B" licence because even if one is addicted to the v.h.f./u.h.f. bands there are times when a knowledge of c.w. working can be an advantage.

Again, a multimode v.h.f. or u.h.f. transceiver used only on f.m. when it has c.w. facilities is to miss out on an exciting aspect of AR. There have been many articles on learning the code so it is not the place here to repeat that advice but a few pointers to success may help. Like most learning processes the code is best learned at an early age. Many young s.w.l.s up to their ears in "O" and "A" level studies still find time to swot up for the code test and are successful, often to their own amazement!

Don't worry about the sending side of Morse, forget it until you are copying at about 10 w.p.m. when you will have acquired the proper rhythm and spacing of the characters as a natural process. If you start to try to send too soon then you will only make the same mistakes as you are making when copying the code. Once you have committed the Morse characters to memory never miss the opportunity to send words and letters to yourself by humming or even whistling. Car registration numbers, advertisements, shop names or anything your eyes alight on, even if it gets the odd look from a passer-by! This is one of the fastest ways of speeding up one's code speed and does not need a second person to help.

The oft-repeated best advice is to treat the code characters as sounds and never as individual dots and dashes. Each letter and number or punctuation mark has its unique sound which must be recognised as such immediately. Very soon whole words are recognised as a sound and not mentally broken down into dots and dashes. The expert teacher of the Morse code will not send everything at a very slow speed to start with, but don't panic! In between the characters there will be a much longer pause giving you time to recognise the letter or number and to write it down. Then the pauses between the characters are slowly reduced until suddenly one is copying the code correctly at say 5 w.p.m. and after that it is just a matter of starting the process again but at a higher speed.

Always try to copy code that is just a bit too fast for you to copy 100 per cent. You will drop letters here and there but when you do FORGET IT! Get on with the next character and slowly the errors will disappear. You will go on to recognise words as such and copy them down with a delay which, with an expert op, can often be several words, making the whole process smooth and effortless. In fact it just becomes another language which one is unlikely ever to forget.

If one does any form of constructional work with receivers or transmitters then a dip oscillator is a very necessary bit of equipment for determining the resonant frequency of a tuned circuit or even an antenna. Briefly, the dip oscillator is calibrated in frequency and the grid current (in the case of a valve dip oscillator) is monitored on a meter. This current will dip when the oscillator is loosely coupled to the external circuit of unknown frequency which then absorbs energy from the oscillator when they are both on the same frequency.

However I have found that dip oscillators using solid state devices are seldom as smooth in operation as a valved design, tending to go out of oscillation completely with even moderate loading by the external circuit. I have just resurrected an old g.d.o. circuit using an ECC82 (12AU7) double triode valve which is still to be found in junk boxes or in *PW* ads. Normally this valve needs a fairly high voltage supply on the anodes, say 100V or more, with the heaters in parallel or series for 6·3V or 12·6V operation. I was able to get it to work using a car battery in the shack for both the heaters in series and for the h.t. supply! Since most shacks today have a 12V d.c. supply for driving receivers or transceivers this old circuit may prove of interest, Fig. 1, being simple to construct and a delight to use.

The g.d.o. dial may be calibrated using a s.w. receiver located within 600mm or so. When using the g.d.o. keep the coupling to the tuned circuit being measured as loose as possible to give the faintest of dips on the meter. For accurate frequency measurements check the g.d.o. frequency on an adjacent receiver rather than relying upon the g.d.o. dial reading because of the variable load that the external circuit imposes on the g.d.o.

General

Many questions are asked by 16-year-old **Adrian Bunting** of Chaddesden, Derby, concerning amateur radio and

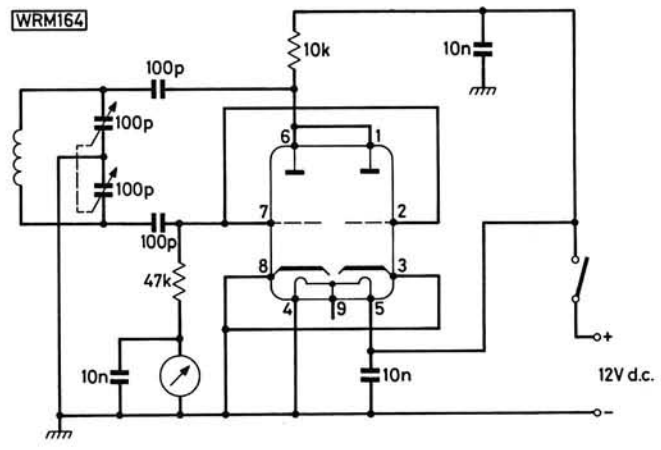


Fig. 1: Circuit of grid dip oscillator using a 12V d.c. supply for both valve heater and h.t. Other valve types which may be used, with similar pin connections, are the ECC81 and ECC83. Four or five plug-in coils may be used to cover 1·8 to 30MHz although the circuit will work into the v.h.f. range. Fixed capacitors should be silver mica or similar. The meter can be a 50 or 100μA f.s.d. type

how to get started. He has been DXing on the broadcast bands for about three years but now wants to know about QSL cards, where to buy them, how to send them. As he has already applied for membership of the RSGB I told him to hold his horses until he gets his Receiving Station (RS) number which he can then have printed on his personal QSL cards, on top of which he will be told all about QSLing by an RSGB leaflet and he'll find plenty of firms supplying cards in the society's journal *Radio Communication* more popularly known as *Radcom*.

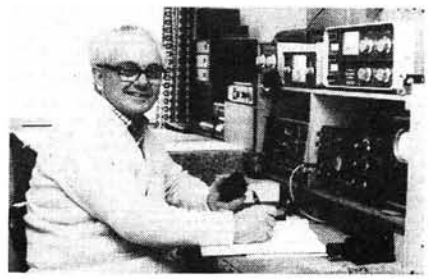
But the best advice of all is to get along to the Derby radio club and meet some real amateurs who will be only too pleased to get Adrian started on the right path. This, of course, applies to any newcomer to AR. More can be learned in a few evenings at a club, especially if there is an active club station, than by reading or correspondence. Above all, advice on suitable receivers and antennas could save a lot of money being spent, in ignorance, on unsuitable equipment.

Adrian started when he was only 10 years old by constructing a crystal set but now has an R206. Hope to get some logs for the DX feature before long, OM.

DX News

Patchy, probably sums up the state of the h.f. bands recently, covered from 28MHz to 1·8MHz by **Denis Norton** of London W6 on his FRDX500 aided and abetted by a long wire, plus a ground plane on 28MHz and a 5/8th vertical for the 144MHz side of the receiver. On the audio side a Datong FL2 filter helps to sort out the QRM. 28MHz looked good with J28DX of POB 1076 Djibouti, LU4FY, YC2AFP, ZP5CF and 9J2LG. A4XJQ on 21MHz turned out to be G4MSX, plus EL2BA, HZ1HZ POB 1999 Jeddah, JY9CL, VE5LG, YC4FW, ZS1EZ who showed off by reducing his power down from 225W to 1W, 6W1DY and 9J2BO. Denis was very happy to get a card from CE3ACA, heard on 14MHz, in just 10 days. Then there were KE5MB/C6A, KR4C/PJ7, K2KW/KV4, TR8GM (QSL F6ESH), TU73 in Abidjan with another non-amateur call (QSL AK3F), VP8MT,

This attractive card, based on the orange, white and blue horizontal stripes of the South African flag, will be used to confirm contacts with ZS5RSA on Republic Day, May 31



Now you know what he looks like! Well-known, just a voice to many amateurs and s.w.l.s around the country Jim Grieve G4ARZ of Edenbridge, Kent, conducts the pre-news net on 3·650MHz or thereabouts most Sunday mornings before Arthur Milne G2MI reads the GB2RS RSGB news on amateur affairs at 9am for the benefit of listeners in the South East. Main equipment at G4ARZ is an FT-101ZD and trapped dipole

XT2BR and 5N2AHQ with cards to WB4UDS. Drop to 3·5MHz for VP2KCA who is also K0GU, 5B4LP and 7X2LS. Solitary station of note on 1·8MHz was T77V in San Marino.

Rob Proctor G4PZW of Sudbury, Norfolk, points out the lack of any reports of the f.m. activity around the 29·6MHz region having worked the likes of RA6LXB, 4X6FK, UA6AHT, 4Z4OM, DL4GBM/EA8, 5B4JY, G4EMM/MM near Ascension Island, WD4JSL, 5B4JE and ZS5BK, with gotaways in VK6, YB3 and HI8, all with his converted Icom ICB-1050 with around 15W and a half-wave vertical 10m high, also ex-CB. He has also heard many US stations via repeater outputs on 29·620, 29·640, 29·660 and 29·680MHz. I have frequently monitored this band at peak times and have never heard a single station! With the 28MHz band on its way out perhaps it is a bit of a hit-or-miss situation.

D. Burton down in Brighton bemoans the lack of Gs on 28MHz believing that because of the decline in sunspot activity they have all "run off into a corner, gibbering!" However I suspect the short skip on that band has more to do with it. To show what they are missing he logged lots of N. Americans, CX2CH, CP8HD, EA8BI, 5B4JE, A4XYH, 6Y5IC, PY6WO, JH6QPD, HK6DUS, and VP8AIB said to be YL Janet at Goose Green. All this on a Sony 2001 receiver with an external long wire antenna.

Retired **D. Goodwin** of North Walsham, Norfolk, runs an FRG-7700 and FRT-7700 matching a.t.u. fed from a trapped dipole covering 3·5MHz to 28MHz. Just occurred to me, why the a.t.u.? The low-impedance feeder from the antenna ought to match straight into the receiver on all bands. On 21MHz he heard XU1SS in Cambodia for a rather rare one, OE8FL/YK on the Golan Heights, C9CS in Mozambique, VU2RAT, PZ1AP and A71BJ. Only one reported on 14MHz was YB3AF.

The 40m wire delta-loop antenna of **David Price** (Wellington, Somerset) came a cropper in the high winds and is now a horizontal loop round the garden fence! He reckons it's even better now! David comments on the number of stations that seem to tune up on a DX station to add to the general confusion. All too common I'm afraid and a pity that rigs do not incorporate dummy loads for tuning purposes. What a good idea! David's FRG-7 and loop captured FM8AYE, 9J2JI, TL8ER (QSL F6GWK), 6W1KP, all on 21MHz, while 14MHz provided ZL2BNJ and JH2CJW. A different story on 3·5MHz, thanks to the loop, with 9Q5JE, 5V7RE, VK2AVA, VK3AKK, OX3PT, JY9CL, 5N1ARY and 3X4EX. A late list for 14MHz features TU1BSF, 5N6BLM, 3D6AL, VP8KF (QSL G3VPW, card received in three weeks), 5T5RY (QSL F6FNU), TA0F in Turkey, and XT2BR who said QSL POB 116, Ouagadougou, Upper Volta, W. Africa. David, if the loop is made 43m it will be optimum on the 7MHz band,

Thursday May 31 is Republic Day in South Africa and ZS5RSA will be on to celebrate the occasion, using all h.f. bands from 3·5 to 28MHz c.w. and s.s.b. A special QSL card, reproduced herewith, will be available to confirm contacts and s.w.l. reports, from POB 1058, Durban 4000. Thanks to **Bruce Dunn ZS5XT** of the Durban Branch of the SARL for this information.

Pat Cullen of Saltburn-by-Sea, Cleveland, decided to put up 40m of wire in his attic by winding the wire on to a broom handle and then transferring it to a length of twine about 7·5m long, the maximum possible. I have no idea what the resonant frequency of this antenna is but it is obviously working extremely well indeed judging by results on Pat's Panasonic DR48. Pat mentions D44BS on the air although D44BC reckons he is the only amateur on the Cape Verde Islands. A lack of coummunications! So on to 3·5MHz and FY7AN, TG9VT and VP2KB, then 14MHz with C53FG, FR7DB, TR8GM, TU73, OE8HLF/YK, YV0AA on Aves Island, 3X4EX, 4K1F in the USSR South Shetlands Islands, G8GRN/5X in Uganda, 8R1Y, 9M2GL and 9X5MH. 21MHz accounted for A22ME in Botswana, C53BI, CO7RM, CY9SAB on Sable Is off the VE coast, FR7DB, HH5CB, S83H, ZD8RC, Z21AL, 3X4EX, 4S7PVR, 5H3BH, 5R8AL, 6W1CK, 7Q7LW and 9J2BR. Whew! Who needs a tribander at 30m? I do!

"Simply superb" is how **Graham Cunningham** described band conditions in Paisley, Renfrewshire, Scotland, with his FR-100B rig with separate dipoles for 14, 21 and 28MHz bands plus a vertical for 14MHz also. However, time has been spent listening on 144MHz and studying for the RAE due to be taken next December so the h.f. bands log is a bit brief, like 6W1AR and A4XYS on 28MHz,

9J2BO, ZS2RJ, D44BC, OD5AT and HV3SJ on 21MHz. On 14MHz it was just TU73 and 3X4EX of note. Many queries regarding the validity of that TU73 but seemingly that is the call issued and it smacks of a previous oddball, TYA11, but it seems that if one asks for an odd call in some of these places one can get it. Sour grapes, really! Incidentally, TYA11 is now 9U5JB by all accounts, s.s.b. only, while KA7KSY activates the 9U5JB call on c.w. with all cards going to ON5NT.

If you are lucky enough to hear an XX9 call, that is Macau, previously CR9, where CR9AN and WW are active as well as CR0AK.

The DX302 and a.t.u. plus 20m-long wire antenna have been put to good use on bands from 3·5 to 28MHz by **Marcus Walden** of Harrogate who did surprisingly well on 28MHz, a band which often seems to be devoid of DX for days on end. He logged CN2AQ, C31SD, VO1IT and 4X4BO on 3·5MHz or thereabouts, then to 7MHz for just 4X4KT of note so guess the BC QRM got to him on what could otherwise be a fine DX spot. On to 14MHz and AP2MQ, EL2AT, VP8KF, 9V1VP with 21MHz producing CO7RM (POB 44, Lavilla), VP2KCA and 9Y4LL with QSLs to K2QIE. The secret duct to the DX on 28MHz that Marcus seems to have brought in A4XRS, A71BK (QSL POB 1556, Doha, Qatar), CP8HD, DF3NZ/ST2, FY7CG, J28DX, OD5AS, OX/BM, TL8YD (QSL F6FYD), VU2GI, ZP5RG, ZS6CBY, 5N8AFE and 9J2LG.

Following the previous comments on 28MHz I have just been checking the band and although I can copy several of the beacon stations such as 5B4CY, ZS1CTB, Z21ANB, ZS6PW, and TR8DX on 28·264MHz but not on my list, there is not one amateur signal to be heard over the entire band!

From Fulham, London SW6, **I. Richardson** says he is a newcomer to the h.f. bands with his Kenwood R-1000 and 18m-long wire plus a 5/8th wave vertical for 21MHz. He has booked for the May exam so we wish him luck. His log shows 9Q2DZ and CT3BM on 3·5MHz, YB2BA and D44BC on 7MHz and then ZF2RJ, 5V7JJ and ZS5YD, all on s.s.b.

Club Time

The numbers of newsletters and magazines that arrive from clubs continues to grow which must surely reflect a very healthy tendency in the AR movement. For the newcomer to AR there is no better place than the local club in which to find out what AR is all about, and also to find what may probably be his or her first s.w. receiver at a very reasonable price. The traditional junk sales are very popular but the name often belies the quality of the equipment that is offered for sale or auction, frequently at ridiculously low prices.

308 ARC The unusual title of this Surbiton, Surrey, club is not derived from the wavelength of the local pop station but from the room number in the Coach House, behind St Mark's Church, where the founder members of the club studied for their RAE! They meet there every Tuesday in the Church Hall and more info on activities can be had from Dave Davis G8YQD, 13 Maple Road, Surbiton or on his 'fone 01-399 5487.

Acton, Brentford & Chiswick ARC G3IIU What should be an interesting lecture and discussion takes place on Tuesday May 15 at 7.30 when the subject will be the s.w.r. meter. Venue, as always, is the Chiswick Town Hall, High Road, Chiswick, London W4. New members and visitors especially welcome says sec W.G. Dyer G3GEH, 188 Gunnersbury Avenue, London W3.

Ainsdale ARC Normally at the Scout HQ, Marine Drive, near to the pier, says sec David Norris G4TUP, available on Southport 35947. Tuesdays with May 8 carrying a lecture while the 15th and 29th will be d.f. hunts starting at 7.30pm. NFD on June 2/3 is uppermost in the minds of the members at the moment with those new to c.w. being weaned on to the club's SB101 rig.

Axe Vale ARC G8CA First Friday at 7.30 at the Cavalier Hotel, West Street, Axminster, Devon, begin just west of the parish church on the main A35. This may be in time to tell you of the talk on antennas by G3GC on May 4, otherwise the lecture on June 1 is on the "Entertaining Electron" but main forthcoming attraction is the visit to the IBA, Stockland Hill, on July 6 so make a note. A call to R.W. Jones G3YMK on Upottery 468 will get you lots more info on the club and its doings.

Aylesbury Vale RS G4VRS Sec Cathy Clark awaits her G1GQJ call, booked already, being a link with brother-in-law G8GQJ, with the OM being G1ECE so it's a matter of keeping it in the family! Cathy is on (0844) 51461 or 9 Conigre, Chinnor, Oxford. Meetings at Haydon Hill Community Hall, Dickens Way, Aylesbury, on "alternate Tuesdays" which means May 15 for G6ASA talking on "Alternative Energy" and May 29 when G2NRW (think that should be G3NRW) is dealing with AMTOR.

Bangor & District RS May 4 has GI6ATZ discoursing on satellites at the usual venue of the Sands Hotel at 7.45. Club's rally will be on Sunday June 10 but venue as yet not determined but more from sec Stewart Mackay GI4OCK, 11 Delmont Park, Bangor, Co Down, otherwise B'gor 54049. However please note that there are no meetings for July or August but the AGM is on Friday, September 7.

Bath & District ARC G4TMH "Alternate Wednesdays" which according to my diary makes it the 16th and 30th of May, at the Englishcombe Inn, E'combe Lane, Bath, at 7.45, when it may be a demonstration, lecture or just a night on-the-air, although I'm assured that all facets of AR are covered. PRO is Colin Ashley G4UMN, 57 Stonebridge Drive, Frome, Somerset or try Frome 63939.

Biggin Hill ARC G4RQT G6TBH St Mark's Church Hall, Church Road, Biggin Hill, at 8.30 third Tuesdays, with an operating evening on the club's rigs on May 15, with a reminder of the junk sale on June 19. Sec Ian Mitchell G4NSD, Greenway Cottage, Tatsfield, Westerham, Kent or buzz (09598) 376.

Bridgend & District RC Gathers on the second Wednesday of the month at the NCB HQ, Tondu. That's all I know except that the sec is T.C. Morgan GW4SML, 4 Rhiw Tremaen, Brackla, Bridgend, Mid Glam, or try the chairman Clive on (065693) 226198.

Bury RS Tuesday May 8 has G8XUR continuing with his confessions of a TV repair man! This at the Mosses Community Centre, Cecil Street, Bury, where meetings are held every Tuesday at 8pm. Main meeting on second Tuesday otherwise informal. Sec is Brian Tyldsley G4TBT, 4 Colne Road, Burnley, also on B'ley 24254.

Cambridge & District ARC G2XV Every Friday during term time at the Visual Aids Room, on the ground floor of the Coleridge Community College, Radegund Road, off Coleridge Road, at 7.30. May 4 has a talk by G4FFO on v.h.f. work, with 11th and 25th devoted to code classes, informal chat and operating club station G2XV while the 18th is construction time. NOTE the College is closed on June 1 so a junk sale will be held at the Comberton Village Hall, but more on that and any club matter from David Wilcock G3FKS, 6 Lyles Road, Cottenham, Cambridge (0954) 50597.

Carmarthen ARS the West Wales Hospital Social Club, the Quay, Carmarthen, on the second and fourth Fridays, being a general meeting on the second Friday and an activity evening on the fourth. This from Milly Meredith (RAE in May) XYL of GW1ABP, residing at 50 Caecoed, Llandybie, Ammanford, Dyfed.

Cheltenham ARA G5BK The Stanton Room, Charlton Kings Library, C'ham first and third Fridays. May 4 will have G4CHD talking on antenna matching problems, with a natter night on the 18th. Your contact is Mrs G. Harmsworth G6COH, 42 Leckhampton Road, C'ham, Glos or try C'ham 25162.

Cheshunt & District ARC G4ECT G6CRC Every Wednesday at 8, the Church Room, Church Lane, Wormley, with a natter night on May 9 and 23, highlight on the 16th is G3NRW on AMTOR/RTTY and packet radio, while a 144MHz portable operation is planned on Baas Hill Common, Broxbourne, for the 30th. R. Frisby G4OAA, 2 Westfield Road, Hoddesdon, Herts can tell you more about the club's activities.

College of Technology, Belfast ARS GI2BX Last Wednesday of the month, the Millfield Complex in lecture theatre room B10 at 7. Unusually, open to the public and of course, any visiting amateurs. Sec Jim Barr GI1CET can be reached on Belfast 227244 ext 243 any workday except Thursdays.

Coulsdon ATS G4FUR CATS PRO G6VYT lives at 54 The Glade, Old Coulsdon, Surrey, and sends a copy of well-produced club mag *CATS Whispers*, "for a little light relief" which it certainly provides. Second Monday at St. Swithun's Church Hall, Grovelands Road, Purley, with May 14 being an open evening with all welcome to come and see the many aspects of AR with working dis-

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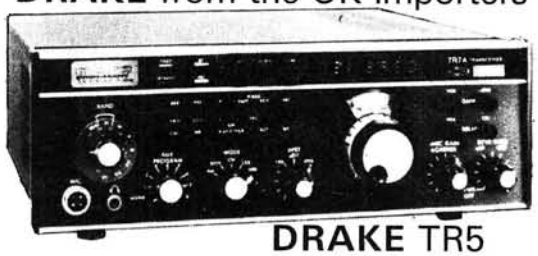

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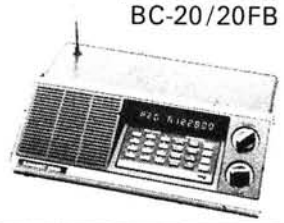

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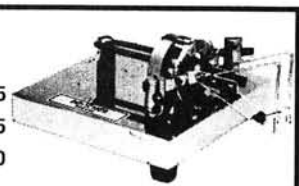

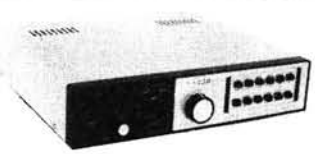

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EBC81	1.50	EL41	3.50	PCF808	1.25	6AC7	2.00	6LF6	4.50	6080	4.75				
EBC91	0.75	EL82	0.58	PCH200	1.50	6AF4A	2.50	6LQ6	4.95	6146B	7.50				
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AC187K	0.28	BC184LA	0.09
AC188	0.25	BC212	0.09
AD142	0.79	BC212L	0.09
AD149	0.70	BC213	0.09
AD161	0.39	BC213L	0.09
AD162	0.39	BC237	0.10
AF124	0.34	BC238	0.09
AF125	0.35	BC307	0.09
AF126	0.32	BC327	0.10
AF127	0.40	BC461	0.35
AF139	0.40	BC478	0.20
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BC107	0.11	BD131	0.32
BC108	0.10	BD132	0.35
BC109B	0.12	BD133	0.40
BC139	0.20	BD135	0.30
BC140	0.31	BD136	0.30
BC141	0.25	BD137	0.32
BC142	0.21	BD138	0.30
BC143	0.24	BD139	0.32
BC147	0.09	BD140	0.30
BC148	0.09	BD508	0.40
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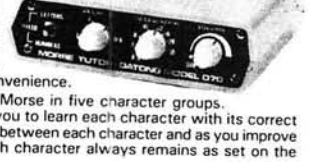

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Derby & District RS G3ERD G2DJ G8DBY Another note for the diary, the annual Derby Mobile Radio Rally on Sunday August 12 at the usual venue of Lower Bemrose School, St Albans Road, Derby and all the expected attractions, including free admission and parking. Details from G3SZJ or G4EYM on (0332) 556875.

Derwentside ARC (Consett) G4PFQ Every Monday at 7.30, RAFA HQ, Sherburn Terrace, Consett, with lectures, RAYNET activity, Morse code classes and many other activities and new members most welcome. Details from June Wallis G1AAJ, 10 Middlewood Road, Lancaster, Durham (0207) 520477.

Dudley ARC G4DAR Second and fourth Tuesdays it is, in the Central Library, Dudley, at 7.45. Further info from Cheryl Wilding G4SQP, 92 Ravenhill Drive, Codsall, Wolverhampton, W.Mids, also Codsall 5636.

Dunstable Downs RC Main event for May is a chat by G3VZV on Oscar 10 on the 25th although the club meets every Friday at 8pm, the Chews House, High Street South, Dunstable, and responsible for GB3LT, the GB3DUN 1·3GHz repeater and GB3TV the 1·3GHz TV repeater. Everyone most welcome says sec P.G. Seaford G8XTW, 12 Jupiter Drive, Leighton Buzzard, Beds or (0525) 384419.

East Kent RS G3LTY G6EKR Notice of the mobile rally on Sunday August 19 with more details from Stuart Alexander G6LZG, 66 Downs Road, Canterbury, Kent, who can also answer queries on the club which meets first and third Thursdays at the Cabin, Kings Road, Herne Bay, Kent.

Edgware & District RS G3ASR May 10 has a rep from Neosid Ltd talking on ferrite materials, with the constructors' contest on the 24th plus briefing for NFD. That makes it the second and fourth Thursdays at 8pm at 145 Orange Hill Road, Burnt Oak, Edgware, Middx. Don't forget the club net on 1875kHz at 10pm Mondays. Publicity Officer is now Michael Harlock G4TOC, 91 Flamborough Road, Ruislip Manor, Middx otherwise Ruislip 72855.

Exeter ARS G4ARE Second Monday at the Community Centre, St Davids Hill, Exeter, with informal meetings on the remaining Mondays at the Scout Hut, Emmanuel Hall, Okehampton Road, Exeter where there are code practice facilities and the club station G4ARE. Main meeting in May features a surplus equipment sale, which is May 14. Roger Tipper G4KXR, the PRO, is at 11 Chancel Court, Chancel Lane, Pinhoe, Exeter, likewise Exeter 68065.

Fareham & District ARC G3VEF G8KGI New members and visitors are very welcome at the Portchester Community Centre, Westlands Grove, P'chester, any Wednesday evening at 7.30. VHF/UHF contest operation is a feature in addition to the usual club activities. A special events station will be in operation at the P'chester Community Arts and Crafts Exhibition on Wednesday May 16, with BASIC computing the subject of May 23 ostensibly given by a "Mr Sinclair!" However Brian Davey G4ITG, 31 Somervell Drive, Fareham, Hants can fill in the details or buzz him on F'ham 234904.

Fingal RC EI2FRC Every Monday at 8 in the Scout Hall, Ballygall Road East, Dublin, with radio theory classes to lead off the activities. The station is also active on Mondays 8.15 to 9.30pm via the 144MHz repeater EI1DK on R0. The sec David Tobin EI7BFB, 52 Clune Road, Finglas East, Dublin 11, will be glad to hear from potential members or visitors.

Fylde ARS Considering that the club subscription also includes membership of the Kite Club members seem to have a good deal going up there. It's the Club on Blackpool Airport first and third Tuesdays at 7.45 with an equipment sale scheduled for May 15. June 5 will see the final arrangements being made for the Top Band d.f. hunt to be held on Sunday June 17. Classes include code practice on the third Tuesdays. More from PRO F.F. Whitehead G4CSA, 91 Blackpool Road, Ansdell, Lytham St Annes, Lancs otherwise Lytham 737680.

Goole Radio & Electronics Society Tuesdays at 7.30, the Goole Junior Chamber, Boothferry Road, Goole. On May 8 G8VHL talks on computer logic, the 15th has the G3XAY Memorial Trophy d.f. event starting at the club, an instructional evening on the 22nd, and a video tape evening on the 29th. Sec Richard Sugden G8IOH can be contacted at 8 Kings Road, Swinefleet, Goole, N. Humberside.

Great Yarmouth ARC G3YRC The STC Sports & Social Club, Beevor Road, South Denes, Gt Y'mouth, fortnightly on a Thursday which looks like May 10 and 24. Programme details from John Noy G8VPE, 14 Poplar Drive, Filby, Gt Y'mouth, Norfolk, the PRO.

Halifax & District ARS G2UG The third Tuesday of the month at 7.30 at the Running Man, Pellon Lane, H'fax, and note that the demo by Lowe Electronics will now be given on May 22 instead of the 15. In addition ragchew evenings are held the first Tuesday of the month at 7.30. Visitors and friends are most welcome at any time, according to PRO Max Townsend G4SDX, 26 Roundhill, Holmfield, Halifax, who is also (0422) 248542.

Hornsea ARC Every Wednesday, 7.30, The Mill, Atwick Road, Hornsea, Yorks, with more details from club sec Norman Bedford G4NJP, 39 Hamilton Road, Bridlington, Yorks or 'fone (0262) 73635.

Horsham ARC First Thursday at 8pm, the Guide HQ, Denne Road, Horsham, Sussex. Too late to tell you of the May 3 programme so on to June 7 and a home-brew evening or it could be on interference matters. Contact Peter Head G4LKW, 120 New Street, H'sham, for final arrangements, otherwise H'sham 64580.

Ipswich RC G4IRC A day out for the family is promised at the East Suffolk Wireless Revival on Sunday May 27 at the Civil Service Sportsground, Bucklesham, Ipswich, starting at 10am. Free draw, many trade displays, ample refreshments of all kinds, steam engine rides and a multitude of other attractions. Talk-in on GB4SWR on 144MHz R3 and S22 and on 430MHz GB3IH. More on that and on club activities from Jack Toothill G4IFF, 76 Fircroft Road, Ipswich (Ipswich 44047). Back to normal and club meetings on the second and last Wednesdays at 8 at the Club Room of the Rose & Crown, 77 Norwich Road, Ipswich, with a d.f. hunt on May 9 finishing at the club, and a bring-and-buy sale at the Barrack Corner Church Hall on May 30.

Lincoln SWC G5FZ G6COL Make a note of the Hamfest at the Lincolnshire Showground on Sunday September 23, otherwise Wednesdays at the City Engineers Club, Central Depot, Waterside South, Lincoln, with May 9 having a slide/tape show of the W1PFA/FP8BH DXpedition to the St Pierre et Miquelon Islands, c.w. and RAE classes on the 16th and 30th plus the AGM on the 23rd. Pam G4STO can be contacted at the club QTH, being the sec, as can G8VGF if you want more info on the Hamfest.

Maesteg ARC Newly-formed club meets first and third Tuesdays at the 7777 Club, Llangwynyd, Maesteg, Mid-Glam, and needless to say new members will be welcomed with open arms, says sec M.R. Carey GW6ZIH, 47 Heol Ty-Gwyn, Maesteg, Mid-Glam, or M'steg 734668.

Medway ARTS G5MW G8MWA Friday evenings around 7.30 at St Lukes Church Hall, King William Road, Gillingham, Kent, with May 11 devoted to a talk by John Nelson G4FRX on the work of the RSGB, not forgetting the junk sale on June 8. It's Andy Wallis G4TQS, 13 Stoneacre Close, Parkwood, Rainham, Gillingham, Kent or (0634) 363960.

Norfolk ARC G4ARN Don't forget that the HQ is now at the Valley Drive Community Centre, Plumstead Road, Norwich, every Wednesday at 7.45 and a permanent station should now be active from there. Peter Forster G3VWQ, 12 Thor Road, Thorpe-St-Andrew, Norwich is your contact or buzz N'wich 37709.

North Devon RC Bit complicated I'm afraid . . . Pilton Community College, Chaddiford Lane, Barnstaple, on fourth Wednesday in even months and at the Bideford Community College, Abbotsham Road, Bideford, on the fourth Wednesday of odd months, at 7.30pm. So says sec George Hughes G4CG, Crinnis, Highwall, Barnstaple, N. Devon who will be glad to fill you in. Or (0271) 43683.

Oldham ARC Visitors and potential members are particularly welcome, hopefully to increase the membership of this fairly new club, meeting every Monday at 8.30pm at the Devonshire Arms, Elliot Street, Lees, near Oldham, Lancs. Further info from Fiona Butterworth G4SPX, POB 29, Oldham, Lancs, alternatively 061-652 8862.

Radio Club of Thanet G2IC Second and fourth Tuesdays at 8pm, the Grosvenor Club, Grosvenor Place, Margate, Kent, with a talk on p.c.b.s on May 8 by G3DNR, a d.f. foxhunt on the 13th (Sunday), and a visit to HM Coastguard at Dover on the 22nd. Try sec Ian Gane G4NEF, 17 Penshurst Road, Ramsgate, Kent for more details, or ring Thanet 594152.

Rolls Royce ARC G3RR As one might expect, meets in the RR Sports and Social Club, Barnoldswick, Colne, Lancs, every Monday at 7.30 starting with Morse code classes, and every Sunday at 3.30pm for general constructional work and a natter. Visitors always welcome according to L. Logan G4ILG, 19 Fenton Avenue, Barnoldswick, Colne, Lancs or (0282) 812288.

Salop ARS G3SRT The Albert Hotel, Smithfield Road, Shrewsbury, on Thursdays at 8. May 17 and 31 are natter nights with a d.f. foxhunt (the second of four projected) on the 24th. Contact Diane Parslow G6UDB, 1 Willington Close, Little Harlescott Lane, Shrewsbury, Salop or try S'bury 62737.

Severn Valley RS First and third Tuesdays at 8pm, the King's Head Hotel, Whitburn Street, Bridgnorth, Salop, with sec Julian Sutcliffe G6TMP only too willing to fill in the details of club events, on (0952) 883752.

South Bristol ARC G4WAW Wednesdays, the Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol, but no time given so imagine 7.30 wouldn't be far out. The club sub includes membership of the Folk House and its facilities throughout the week. On May 9 there is a "QSL card and awards rally" run by Les Wooldridge, with a briefing for a forthcoming d.f. foxhunt, on the 16th. May 23 is a 144MHz s.s.b. night; on the air with ATV the subject for the 30th. Len Baker G4RZY is hon sec, at 62 Court Farm Road, Whitchurch, Bristol or try (0272) 834282.

South East Kent (YMCA) ARC G3YMD G8YMD Big event on Sunday May 13 is a Spring Cleaning Rally at the Dover YMCA Centre, Leybourne Road, Dover, starting at 10.30am with talk-in on GB3KS and G8YMD on 144MHz-S22, virtually a big bring-and-buy sale. More details of this and other club goings-on from Alan Moore G3VSU, 42 Nursery Lane, Whitfield, Dover, Kent, also on (0304) 822738.

Southend & District RS Fridays at the Council Offices, Rayleigh, at 7.30. Special event station GB4LMF will be operational for the Rayleigh Lions Club May Fair on Monday May 7. Liaison Officer is Brian Wood G4RDS, 27 Fernlea Road, Benfleet, Essex or via (03745) 50494.

South Lakeland ARS A relatively new group with a membership mainly from the Furness area of South Cumbria, principally from Barrow-in-Furness, Dalton and Ulverston. Meetings first and third Thursdays in Barrow but I'm sure Dave Warburton G6LKB, 36 Bigland Drive, Ulverston can tell you precisely where and at what time. He can also be found on Ulverston 54982 or (0229) 23366 ext 4892 during working hours.

South Manchester RC G3FVA G3UHF G8SMR Fridays, 8 pm, the Sale Moor Community Centre, Norris Road, Sale, with informal natter nights on Mondays. May 11 has G3CSG chatting on his wartime experiences with the Japanese equivalent of the Morse code, the AGM is on the 18th and the winners of a home-brew contest will talk about their efforts on the 25th. Club sec for more info is David Holland G3WFT, 32 Woodville Drive, Sale, 061-973 1837. Must tell you now of the interesting talk by G4MYB on modifying the club's FT-221, on June 1.

Stratford-upon-Avon & District RC G3PGU The Control Tower, Bearley Radio Station, about three miles north of Stratford, second and fourth Mondays at 7.30. On May 14 G3PGQ holds forth on antennas with construction the main theme on May 28. PRO is Clive Ousbey G6DCL, Ormond Lodge, Newbold-on-Stour, Stratford-upon-Avon, Warks, or try G6CWK on S'ford 68863.

Sutton & Cheam RS A talk on amateur satellites by AMSAT UK sec Ron Broadbent G3AAJ is down for Friday May 18, at the Down Lawn Tennis Club, Holland Avenue, Cheam, Surrey. A familiarisation session for NFD equipment will be held at the same spot on Friday June 1. Other meetings are held at the Sutton College of Liberal Arts in Sutton. Acting secretary is Jack Korndorffer G2DMR, 19 Park Road, Banstead, Surrey or ring 073 73 58729.

Swale ARC Remember the new HQ is now at the Ivy Leaf Club, Dover Street, Sittingbourne, Kent, every Monday at 7.30pm. Details of all club activities from B. Hancock G4NPM, Leahurst, Augustine Road, Minster, Sheppey, Kent or on Minster 873147.

Mid-Ulster ARC GI3VFW Don't forget the club's rally on Sunday May 20 at Parkanaur House and Park. This is a training school for handicapped youngsters and all proceeds from the rally go to them. Last year's proceeds topped £750! Otherwise the club meets at 3pm on second Sundays at the QTH of GI4BAC in Banbridge, says sec D.F. Campbell GI4NKD, 109 Drumgor Park, Craigavon, N.I. or ring (0762) 42620.

Watford RC The venue is the Tudor Arms, Bushey Mill Lane, N. Watford, Herts, first and third Wednesdays at 8pm. Gordon Clarke G8XXV of 28 Little Potters, Bushey Heath, Herts, is sec and will be glad to tell you of club events, on 01-950 3611 if you like.

Wimbledon & District ARS This year marks the 21st anniversary of the formation of the society, marked by the issue of the call GB0WIM which will be used from the 1st to the 22nd of May by club members from the QTH of G4OWM and on June 8 from the club's HQ at St John Ambulance HQ, 124 Kingston Road, Wimbledon, London SW19. Otherwise meetings on the second and last Fridays of the month, at 8pm. The call will also be activated for the club's summer camp at Chessington, Surrey, at the end of July. In the meantime May 11th is a film night with a constructional contest on the 25th. Hon sec is Geoff Mellitt G4MVS, 26 Paget Avenue, Sutton, Surrey or 01-644 8249.

Worcester & District ARC Advance notice of the club's annual mobile rally at Droitwich High School, Ombersley Road, D'wich, starting at 11am, with many attractions for all the family, on Sunday, July 1. Contact is B. Jones G8ASO, on Worcester 351565. Meeting on June 4 at the Oddfellows Club, New Street, W'ter, will see G3WHO dealing with RTTY and AMTOR, at 8pm. More details from A.C. Lindsay G4NRD, 11 Durcott Road, Evesham, Worcs or telephone Evesham 41508.

MEDIUM WAVE BROADCAST BAND DX

by Charles Molloy G8BUS

Reports to: Charles Molloy G8BUS, 132 Segars Lane, Southport PR8 3JG.

The most difficult thing about DXing on the medium waves is getting started. This is very apparent from correspondence from budding DXers who have great difficulty in picking up North America for the first time. Once this hurdle is passed then they are away! Typical is the experience of reader **Keith Lilley** of Coventry who has a 30m random wire antenna fixed 10m above the ground, which he uses with a semi vintage l.w./m.w./f.m. receiver of the 1950s. This set has a socket for an external antenna so it should be suitable for use with the 30m random wire. Keith tried the band at 0300 one night last winter and was disappointed so he asks "I would be very grateful if you could supply me with any information which would help me receive some transatlantic DX".

Radio County Sound, Guildford, is on 1476kHz, sent in by Ted Jones

Transatlantic DX

The path across the Atlantic is not always open for the propagation of signals on the medium waves. It isn't just because of fadeouts like we find on the short waves. You can encounter a period of several days on end when there is nothing at all to be heard from North America, no matter how good the receiver and antenna. The experienced DXer will know what to look for and which channels to check. All the tyro can do is to try again a few days, or even a week later.

The nature of the DX signal on the medium waves is worth examining. Fading is normal and takes the form of a cycle lasting several minutes. The signal rises slowly to a peak and then sinks, perhaps to inaudibility below the noise level. It is caused by signals arriving at the receiver by slightly different paths and going in and out of phase with each other. Sometimes they add, sometimes they cancel. A sensitive set will pick up DX for a greater part of the fading cycle than a less sensitive one! If you are looking for CJYO on 930kHz then stay tuned to the frequency for at least five minutes. The signal may, if conditions are poor and the receiver is not very sensitive, only be audible for half a minute out of every five. On a good night though with a sensitive set the fadeout may only be half a minute.

Interference (QRM) from European broadcasters is a major problem, especially in winter, so DXers have turned to the old frame antenna of the early days of wireless. The modern equivalent is the medium wave loop antenna. Constructional details of a loop can be found in my article in *Out of Thin Air,* which is available from the *PW* Post Sales Department. A good outdoor antenna will pick up weaker signals than a loop but it will pick up more QRM as well. A loop is used to deal with interference.

Transatlantic DXing in Summer

We are fortunate in the UK as we are at the western extremity of Europe so we can pick up transatlantic DX in summer. Even on the longest day it is possible to DX for a couple of hours but it does mean getting out of bed in the middle of the night. Why bother when we can pick up DX around 2300 in winter? Transatlantic DX is more conspicuous in summer as there is a lot less European QRM. The DX path opens up about two hours before sunrise in mid-June, which is around 0100 UTC at my QTH. Any QRM from Central, Eastern and Southern Europe and from the Middle East, i.e. from time zones two hours ahead of us, will be fading out because of local sunrise. QRM from Western Europe will be at a minimum as it is too early yet to hear those stations that sign on in the morning.

What can we expect to hear? Those stations nearest to us will fade in first, as sunset sweeps across North America. Start by listening for Newfoundland. On 600kHz there is CBNA in St Anthony, on 610 CKYQ in Grand Bank, 620 CKCM in Grand Falls, 640 CBN in St John's, 750 CBGY in Bonavista and of course there is CJYQ in St. John's, on 930kHz. Remember the slow fading cycle. Try each channel in turn and investigate weak signals. They may peak up.

On a good night you can hear a few high power stations from the USA. Listen from 0200 onwards for WMRE in Boston on 1510, WCAU in Philadelphia on 1210, WHN on 1050 and WQXR on 1560 both in New York City. Try too for CKLM in Montreal on 1570 which broadcasts in Quebec French.

The time taken for sunset to travel across the North American coast is compressed in summer. Broadcasts from the United States appear sooner after CJYQ than in winter owing to the different position of the terminator, which is the dividing line between day and night on the earth's surface. In winter, sunset in New York is the best part of two hours later than it is in Newfoundland. At this time of year it is a little over one hour later.

We are now starting the run up to the sunspot minimum which means good reception on the lower frequencies. We can look forward to a couple of years of really good DXing on the medium waves. If you have still to pick up North America on the medium waves, well now is the time to try.

The Luxembourg Effect

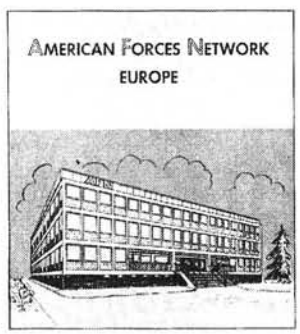
"I am writing to you about an experience on the medium wave broadcast band" reports **Hugh Tyson** (G3IXO) of Winscombe in Somerset who goes on to say that he hears Langenberg on 1593kHz and Bonn on 972kHz with the BBC World Service as a background. this occurs late at night. At first Hugh thought it was a receiver spurio but he found the same phenomena when using every m.w. receiver he could get his hands on.

A letter to the BBC brought Hugh the reply that the effect was due to ionospheric crossmodulation. During the hours of darkness the high power World Service broadcast from Orfordness on 648kHz strikes the same part of the ionosphere as the two transmissions coming from West Germany on their way to Somerset. The modulation from 648 is superimposed on the 972 and 1593 carriers by a non-linear process in the ionosphere.

"Frankly I was staggered by the explanation—my next door neighbour is a BBC engineer and radio amateur and even he had never heard of this effect" concludes our reader.

Those of us who are a bit longer in the tooth will remember the Luxembourg Effect of the 1930s. It created quite a stir at the time as well as speculation how the (unwanted) English programme from Luxembourg on the long waves, could appear as a background to other stations.

Ionospheric crossmodulation is more prevalent today than one would think—there is so much co-channel QRM on the medium waves that a little more from above passes un-noticed. At my QTH in winter, as I wait for the Belgian station on 927kHz to sign off so that I can check for CJYQ, I often hear the BBC WS; a sort of ionospheric cuckoo that only vanishes when its Belgian host closes down for the night.



AFN Europe sent in by Ted Jones

Experimenters' Corner

"I'm 17 years old and left England when I was 14" writes **Yemisi Ayodele** of Lagos in Nigeria who goes on to say that his favourite stations were Radio Luxembourg and Capital Radio. Our reader got hold of an a.m./f.m. cassette radio which was in poor condition, with the f.m. and the cassette not working, no dial and no telescopic antenna. "I started experimenting, I opened up the radio and connected a piece of wire to the ferrite rod coil and another to the telescopic antenna connection." These wires were joined together at the far end and connected to one end of a ferrite rod antenna belonging to an electronics project kit. The other end of this antenna was led off to a 1·5m whip antenna mounted on the roof. "With this I can now receive Radio Luxembourg, Capital Radio, Radio London, TWR, Radio Mediterranean. I'm now going to buy a new receiver and to quote you, it will be a product of modern technology." Full marks for being such a good experimenter, Yemisi. It is surprising how few people are prepared to have a go, these days.

"I am an engineer and spend many hours working in my workshop with my Binatone Play Boy as company" writes **Oliver Rogers** of Bodmin. In order to improve reception Oliver constructed the Portable Receiver Booster mentioned in *50 FET Projects,* by Babani Books. Instead of a coupling loop to feed signal to the receiver, a ready made coil from a scrap ferrite rod was used instead. A 7 metre long antenna was joined to the booster together with an earth. Stations heard include a number of UK local and Irish stations plus Manx Radio on 1368kHz, which came booming in. "I couldn't identify many of the stations as I was supposed to be working!"

SHORT WAVE BROADCAST BANDS

by Charles Molloy G8BUS

Reports: as for Medium Wave DX, but please keep separate.

Last month we had a look at the trapped dipole. By adding parallel tuned circuits called traps to a simple dipole it is possible to convert it from a single band to a multiband antenna. On its own, a dipole covers only one band, the length of the dipole determining which band is to be given a boost. The trapped dipole provides an elegant space saving solution but there is another way. It is possible to erect a number of dipoles cut to different bands and to combine them into a single

multiband antenna with a single feeder to the receiver.

The Multiband Dipole

A multiband dipole designed for use on the 6MHz (49m), 9MHz (31m) and 15MHz (19m) broadcast bands is shown in Fig. 1. It is based on the method of construction employed by reader **Bill Pentland** of Dairsie in Scotland. The three dipoles fan out from a single central insulator, where they are connected together, Fig. 2 shows how this is done. The three wires going to the left hand side of the central insulator are joined (preferably soldered) together and also to one of the wires from the downlead. The other downlead wire goes to the right hand part of each dipole.

The downlead can be either 75-ohm twin feeder or coaxial cable. The central insulator shown is a specially made "T" type designed for use with a dipole but almost any other insulator such as a circular or oval shaped one will do instead. Table 1 gives the length of each half of a dipole for every one of the standard broadcast bands. The overall length of the dipole will be double this figure.

At the receiver end, the feeder goes straight to the A and A1 terminals, or A and E if the set does not have a dipole input. It is possible to use this antenna on other frequencies as well, by joining the two wires of the feeder together at the receiver end and connecting them to an antenna tuning unit (a.t.u.). The output of the a.t.u. goes to the A terminal on the receiver and the E terminal now goes to earth. This changeover can be done by switching.

Thanks are due to reader Bill Pentland who says "these types of antenna do require a fair bit of space in which to be erected. By using an a.t.u. it is possible to get effective reception on lower bands and also on the amateur bands as well."

QSLs

"I wonder how I can get more replies and a QSL from stations" asks **Glen Hocking** of Redruth while **M. P. McKay** of Blackpool praises the *International Listening Guide* which has helped him pick up a number of broadcasts in English, which have led to a QSL.

There is no doubt that major broadcasters are uncertain at the moment how to deal with listeners' reception reports. On a recent visit to the BBC bookshop in Bush House, I picked up a leaflet called *QSLs and the BBC*. It started off by saying "Many thousands of reception reports arrive every year and each report is acknowledged by a postcard — most listeners are satisfied with this present card, the extra staff needed to issue many thousands of full QSLs would be considerable and also the BBC can be heard throughout the world at some time of the day, even with simple receiving equipment." The leaflet finished with an apparent contradiction saying that "the BBC's External Services are always glad to receive reception reports from listeners throughout the world —".

My sympathy is with the broadcasters. Do they spend a significant proportion of their budget sending QSLs to listeners whose main interest seems to be in the strength of the station's carrier, or does the money go on programming? HCJB, the Voice of Andes in Ecuador, has an interesting approach. It produces a new QSL card every two months and will verify readily provided certain criteria are met. The report has to give the date, time, exact frequency etc, plus details of several minutes of the programme heard. Perhaps this is the direction along which the QSL hunter will have to move in the future. It is programme comment rather than SINPO that some broadcasters want.

Fortunately many of the less conspicuous broadcasters still QSL in the traditional way. Some of them ask for reception reports over the air. Radio Cairo for example, asks for reports, answers them in the mailbag programme and sends out a QSL card and programme schedule. The EDXC *QSL Survey* mentioned in the March issue is an invaluable guide for the newcomer to the hobby. Not only does it indicate where success is possible but perhaps more importantly, those areas where disappointment is certain.

European DX Council

Two items which caught the eye in the current EDXC publications list are the Reporting Guide and the Receiver Files. For the benefit of new readers, the EDXC is an association of short wave listeners and DX organisations in Europe. Its Secretary General is Michael Murray and its headquarters are in the UK, the address being PO Box 4, St Ives, Huntingdon, Cambs. PE17 4FE.

The Reporting Guide contains reception report information and samples in English, French, German and other important DX languages. A DX vocabulary is also included together with essential details of what should be included in reports. An ideal companion for the QSL Survey! The Reporting Guide price is £1.00 in the UK and £1.50 or 6 IRCs worldwide, while the QSL Survey is 50 pence (in stamps) in the UK or 3 IRCs abroad.

Each Receiver File consists of manufacturer's brochure, circuit diagram, details of possible modifications to the set together with a summary of user comments compiled from answers to questionnaires distributed throughout the world. Currently available are files on the SPR4, DX160, R-1000, FRG-7, FRG-7000 and FRG-7700. Each receiver file costs 50 pence for the UK and 3 IRCs worldwide.

International Reply Coupons

Michael Murray tells me that the EDXC is receiving IRCs for payment for its publications from a few readers in the UK. Perhaps it might be useful to examine the role of the IRC and what its place is in the world of DXing.

You can purchase an IRC at main post offices in the UK and abroad. This coupon costs 30p and can be exchanged in most parts of the world for stamps of sufficient value to cover a reply by surface mail. It is the normal way of including return postage when writing to someone abroad for it would be a waste of time sending a s.a.e. as British stamps are not valid outside this country. If you want to cover a reply by airmail then two or even three IRCs are required.

Table 1

Band (MHz)	Band (m)	Length (m)
6	49	11·72
7	41	9·93
9	31	7·40
11	25	6·03
15	19	4·67
17	16	4·02
21	13	3·31
26	11	2·77

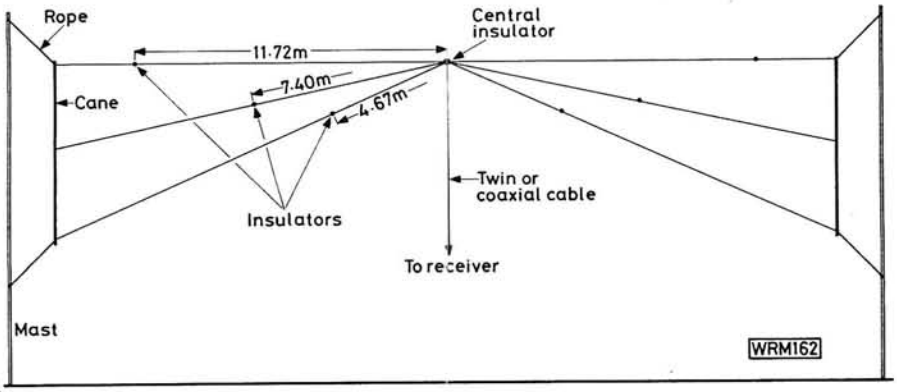


Fig. 1

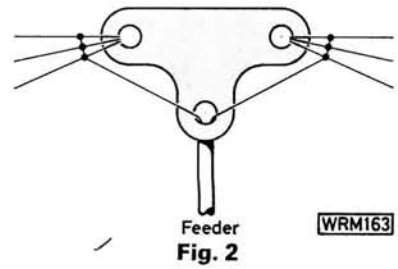
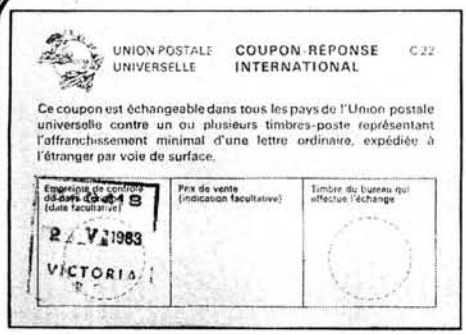
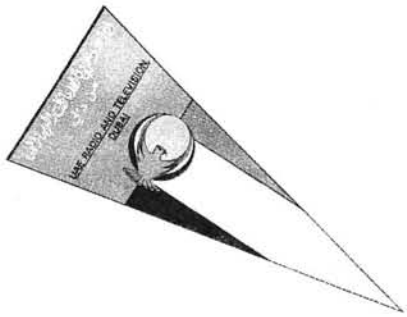


Fig. 2



International Reply Coupon issued in Australia



Pennant from Dubai sent in by Andrew Hill

The IRC has become a sort of international currency among DXers. An extra one or two IRCs may on occasion be asked for the cost of printing as well as postage. Even club subscriptions can be paid in IRCs for members abroad.

Personally I have never been in favour of sending large numbers of IRCs to anyone. Apart from the bulk it is uneconomic. The IRC is exchangeable, again at the Post Office, for 20½ pence worth of stamps, so clearly it is rather wasteful to use them within the UK when ordinary stamps will do just as well.

DX Heard

Try for Radio Brasil Central on 4·985MHz near sunrise says **John Dennis Court** of Birmingham who has been picking up this 10kW broadcaster at good strength recently. Reader **S. R. Smith** of Crewe mentions hearing Radio RSA on 25·79MHz in the 11 metre band at 1100. Not much on these frequencies at the moment. In reply to **Ken Easom** in the RSA. Sorry but I cannot deal with your queries. Point-to-point DXing is illegal in the UK. Radio Dubai has attracted **Andrew Hill** who says the best signal is at 1600 on 15·32, 15·30, and 11·955MHz. This station does QSL, the address being External Service UAE, Radio Dubai, PO Box 1695, Dubai, United Arab Emirates.

VHF BANDS *by Ron Ham BRS15744*

Reports to: Ron Ham BRS15744, Faraday, Greyfriars, Storrington, West Sussex RH20 4HE.

During the year a variety of natural changes occur within the earth's atmosphere and attenuate or enhance the normal range of radio signals from several kilometres at the microwave end of the spectrum, to hundreds of kilometres at metre wavelengths. With this in mind, the search for long-distance signals becomes exciting, so be prepared and remember, whatever radio frequency is your special interest it can be disturbed at any time and often produce DX without warning.

Solar

Although the sun is relatively quiet at the time of writing, 16 years of solar radio observations has taught me to expect anything. The sudden appearance of a sunspot and its subsequent activity, can cause an ionospheric disturbance or an aurora to manifest and give a new set of conditions for the h.f. and v.h.f. DXer respectively to make the most of. When the sun is active its radio emissions are very strong between 130 and 150MHz. So, readers with horizontal beams and suitable 144MHz band equipment can check for solar noise by directing their antenna toward the rising or setting sun, tuning to a spot around 144MHz free of terrestrial signals, switching their receiver to a.m. and listening to the background noise. If it sounds like the sea rolling in and out then the cause is most likely solar and should stop when the beam is turned away from the sun. **Ted Waring,** Bristol, counted 25 sunspots on February 25, possibly why the 28MHz band was open on the 26th, 21 on March 1, 7 on the 3rd and 16 on the 13th and says, "Sunspot groups crossing the central meridian on February 23 to 25 were presumably those of January 28/29 coming around again. Both **Cmdr Henry Hatfield,** Sevenoaks and I recorded radio noise from the sun at 136 and 143MHz respectively on several days between February 17 and March 16. During my midday observations I recorded tiny bursts of noise, typical of quiet solar periods, on February 19, 21, 22 and 25 and March 2, 9, 12 and 16 and a noise storm on February 24, which ties in nicely with all those sunspots Ted observed around that time. While Henry was using his spectrohelioscope on February 19, he saw 2 sunspot groups containing about 11 spots, but at that time no flares were seen.

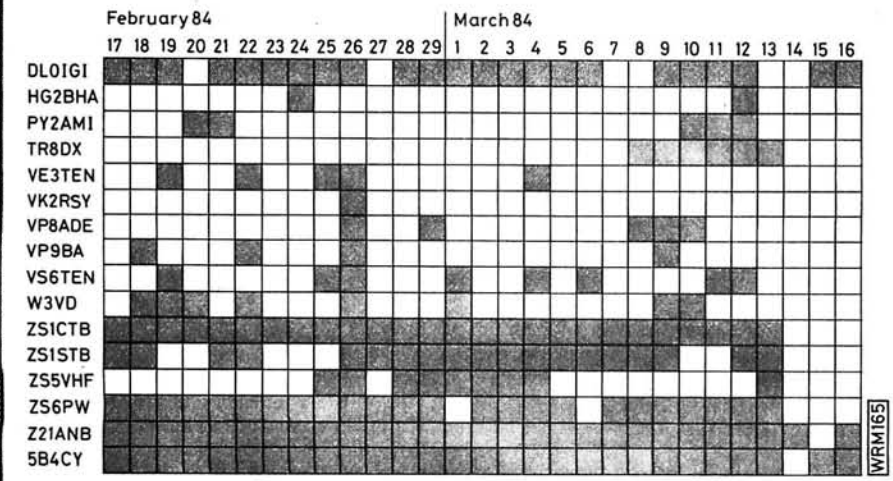


Fig. 1: Distribution of beacon signals

Aurora

An auroral warning beacon, organised by **Rolf Niefind** DK2ZF, is operational on 10·144MHz under the callsign DK0WCY, Fig. 2 and its signals, at my QTH, vary between 539 and 589. Rolf is v.h.f. editor of *CQ-DL* and is extremely interested in auroral and Sporadic-E propagation and would welcome reports on these subjects. It is explained on the reverse side of the beacon's QSL card that when auroral propagation on v.h.f. is observed in northern Germany, DK0WCY will send a corresponding message which should help amateurs in more southerly parts of Europe to participate in a programme to study auroral propagation. Aurora is a fascinating subject and both the British Astronomical Association and the Radio Society of Great Britain have auroral co-ordinators and specific groups of people, who study each particular event.

The 50MHz (6m) Band

"There is no doubt that the fine work carried out by the original 40 has demonstrated that there is a great deal of scope for experimental work on 50MHz",

Fig. 2

Fig. 3▲

Fig. 4▶

Fig. 5

Fig. 6

writes G4JCC, Editor of *Six News*, having learnt that the number of permit holders to use this band is to be increased by 60 to 100. **Ken Ellis** G5KW, Meopham, Kent, leads both the 50MHz crossband ladder and permit holders table in *Six News* having worked stations in 6 continents, 39 countries and 48 states of the USA in the former and 2 continents, 9 6/6 countries and 4 crossband countries in the latter. He is closely followed by G4BPY and G4JCC in the ladder and GI3ZSC and GW3LDH among the permit holders. Our congratulations to the leading and the other stations in the lists for their fine efforts.

Readers with equipment for the 70MHz (4m) band should find the RSGB's contest for that band, on June 3, an interesting event especially if a bout of Sporadic-E stirs things up during the day.

28MHz Beacons

"Nice to see that you mention LA5TEN in *PW*. I have been asked to increase the power. I am building a new transmitter", writes **Pal Justnaes** LA5PN, so we must keep a listen out for our old friend the 5W Norwegian beacon LA5TEN, when it increases power to 20W. The modulation will be c.w. and 45·45 baud RTTY and two frequencies will be used, 28·2375MHz for 25 minutes from 10 minutes past each half hour and 28·200MHz for 5 minutes from 5 minutes past each half hour. The beacon's QTH is at Ski near Oslo and the antenna to be used is a 5/8 ground plane. One of the special features is an automatic QSL card, Fig. 3, giving time, date and frequency. The information underlined in Fig. 3 is of course variable.

During the good conditions on February 26, **Dave Coggins,** Knutsford, heard the South African beacons ZS6PW and Z21ANB with watery sounding signals up till as late as 1900. "Both beacons suffered fairly fast QSB and on Z21ANB I noted a very slight echo" says Dave and adds that the Adelaide Island beacon VP8ADE 28·285MHz was audible at the same time. At 0952 on the 26th, **Christiaan van den Berg** NL-9165/R18, The Hague, logged the Hong Kong beacon VS6TEN 28·290MHz, at R3 and S3, but after some outbursts of heavy noise across the whole band, the strength of the beacon's signals increased to 57 at 1009 and for a short while after 1011 it was 59 plus 30dB. A most interesting observation Chris, the noise could have been from a solar event which influenced the ionosphere and consequently the 28MHz band. Chris, a member of VERON, uses a Yaesu 7700 receiver and Windom antenna and like **Greg Lovelock** G3III, Shipston-on-Stour, **Ted Owen,** Maldon, Norman Hyde and Ted Waring, heard the new beacon from Gabon TR8DX on 28·265MHz. Greg also heard the beacons EA6AU on March 9 and LU1UG on February 25 and 26 and March 9. **John Coulter** logged KA1YE on February 20.

"PY2AMI was probably receivable on more occasions than the 4 days logged, but the frequency is often obscured by another station sending a series of 8 dashes or 7 dots, according to the receiver tuning", writes **Norman Hyde.** Ted Owen reports hearing the 8 dashes every day between February 18, when it started, and March 9, excluding the 28th. "I wonder if the curious '8 dashes' station is a real beacon. He just gives 8 dashes in approximately two seconds, with mark and space like many others, but no callsign" writes Ted, who was also pleased with the sudden reappearance of our old friend EA6AU on the 9th.

My thanks to Chris van den Berg, Dave Coggins, John Coulter, Henry Hatfield, Norman Hyde, **Bill Kelly,** Greg Lovelock, Ted Owen and Ted Waring for their beacon logs which enabled me to produce the monthly beacons heard chart, Fig. 1, for everyone to see.

28MHz Satellites

Chris van den Berg also heard Radiosputnik 5 sending new year wishes during the last days of December and writes, "Wsem soeastxya uspehow w nowom godu", translates as "Wishing everybody happiness and successes in the new year". He adds that sometimes the keying of the robot is not fully correct. Bill Kelly heard several European and Russian stations calling and working through RS7 at 0950 and 2315 on February 23. John Coulter reports hearing data store readouts giving callsigns worked and he often hears G2AMT, G3DDG, I5PIW and UK1AAA working through the RS satellites and logged a JH8 on March 8. Bill Kelly heard the orbital data through RS6 on the 23rd.

Tropospheric

The atmospheric pressure, measured at my QTH, was 30·0in (1015mb) at midnight on February 19 and between midnight on the 20th and 2000 on the 22nd it was down to 29·7 (1005). This was followed by a period above 30·0, peaking at 30·4 (1029) for some 30 hours on the 24th, from 0800 on the 23rd to midday on March 1. At 1400 on the 3rd the pressure gently rose to 30·5 (1032) by 1000 on the 6th, where it remained until 0200 on the 10th and then slowly decreased to 30·1 (1019) by 0600 on the 12th. The barograph trace hovered around this level until the 15th when another decline began.

On February 27 and 28, Bill Kelly heard signals from the Tyne and Wear area working through his local 144MHz band repeater GB3NI on R5, but the very high pressure between March 5 and 11 did not produce the v.h.f. opening we were all waiting for. Let's hope conditions are a lot better for the RSGB's 144 and 430MHz contests on May 19 and 20 and June 10 respectively and VHF NFD on July 7 and 8. All three events have s.w.l. sections and even if you do not enter as a competitor, the Society's VHF Contest Committee are pleased to receive lists of stations heard during the events to assist with their log checking. Who knows, it may be your check log that confirms those few vital points which can mean the difference between first and second place for a participant.

Band II

On February 16 **Damien Read,** Newport, received signals from the ILR station BRMB and possibly BBC Radio Stoke. He tells me that he is pleased with his Dual CT1430 tuner and says that it is very good for both DX and good-quality music in stereo. Damien has now received QSL cards confirming his reports from BBC Radio Solent, Fig. 4, Independent Local Radio LBC, Fig. 5 and a sticker from the French network Frequence Nord, Fig. 6.

Toward the end of 1983, **Andrew Guy,** Newport, had logged Dutch, French and German stations via tropo and Italian and Yugoslavian stations via Sporadic-E using a Crown 6300 Music Centre and ribbon dipole antenna. At 1750 on February 13 he heard France Inter, Frequence Nord and ILR Capital and LBC on the 15th.

On the 24th, I used the f.m. radio section of my Plustron TVR5D at Telegraph Hill on the South Downs near the Sussex Hampshire border and heard many of the "twerbles" of interference from continental stations trying to break through between 88 and 95MHz and a few French

stations around 100MHz. Between 1000 and 1200 on the 25th, **Neil Pound,** Hull, using a Grundig Satellit 1400 and a 6-element loft-mounted Yagi, positively identified 23 local broadcast stations ranging from London to Scotland and Chiltern to Tyne-Tees. That was not counting his own locals such as Humberside, Leeds, Lincoln, Sheffield and York.

"In spite of a first-class anticyclone in the last 10 days or so, no extensive DX, but some interesting directional variations, coincident with the placings of the isobars, are worth reporting", writes **Harold Brodribb,** St Leonards-on-Sea. Harold follows the pressure and isobar movements on the weather maps in his daily newspaper and compares them with the 16 French stations he heard at noon on March 5, 12 at 0930 on the 6th, 13 at 1445 on the 7th, 9 and 3 Dutch at 1000 on the 8th, 10 at 0915 on the 9th and 9 at 0945 on the 10th. He also heard Radio Cymru on the 6th, 7th, 8th and 9th.

RTTY

Although **Ted Double** G8CDW, Enfield, was busy for 16 years with work for the British Amateur Radio Teleprinter Group and active on the v.h.f. bands, he kept his s.w.l. hat on and to date has 115 countries confirmed in the RTTY mode on the h.f. bands. During the month prior to March 14, **Peter Lincoln** copied mainly European and North American stations in the late afternoons on 21MHz and says that he logged VU2VIM quite often on both the 14 and 21MHz bands. "VU2VIM and 6W1CK are now regulars" writes **Norman Jennings,** Rye, who between February 14 and March 14 received RTTY signals from 48 countries, of which 29 were Europeans, and among his DX callsigns were EL, KP4, VE7, XT2 and a QSO between a VK3 and ZL between 1000 and 1100 on March 8.

I found a general increase in activity between February 17 and March 16 when I copied 21 callsign prefixes, CT, DF, DL, EA, F, HA, I, IS, LA, LZ, OE, OH, OK, SM, UK, UT, VK, YO, YU, YV and Y25 on the 14MHz band around 14·090MHz; another 17: CT, EA, EA8, EL, I, IT9, JR, K1, N8, OE, OH, UT, Ws 2, 3, 4 and 0 and 4X4 on the 21MHz band around 21·090MHz, and Ws 1, 3, 4, 5, 8 and 9 on 10m around 28·090MHz. Among my best was a QSO between IK2 and JR6 at 1026 on February 19, a ZL3 despite the "woodpecker" at 0917 on the 22nd, and a QSO between a VK2 and an Italian at 0832 on the 24th. At 1640 on the 29th, Norman copied a strong signal from a W5 calling CQ on the 28MHz band, but alas there were no replies.

TELEVISION *by Ron Ham BRS15744*

Reports: as for VHF Bands, but please keep separate.

Although there is no major atmospheric disturbance to write about this time, a few limited-life tropospheric openings and brief outbursts of Sporadic-E did occur during the latter half of February and towards the middle of March.

Tropospheric

Looking back towards the "fantastic conditions" on December 4, **Walter Haller,** Bicester, using a Panasonic video recorder taped, in colour, the whole Belgian BRT news and *BRT Journal* programmes on Ch. 43 from Egem. He then photographed their clock, Fig. 1, sport and title captions, Figs. 2 and 3 and weather report, Fig. 4, for my readers to see. I am always pleased with ident pictures because they are a great help to the newcomers to DXTV. Walter is now using a 4-element Yagi from Tandy for Band I, and a Tandy Archer Super Colour X-Tend wideband antenna for u.h.f. to feed his receivers.

February was a very rewarding month for **Tony Palfreyman,** Sheffield, because on the 13th he received his first u.h.f. pictures from SR2 Sweden, Figs. 5, 6 and 7. While the band was open on the previous day he received strong pictures from Nederland 1 and 2 on Chs. 39 and 45, saw a sports programme called *Veronica Sports* and a Dutch Teletext transmission, *Proeftt Teletekst*. Later in the evening he received a test card from DR Danmark on v.h.f. Ch. 10, and strong colour pictures from Anglia TV on Ch. 59. Tony logged continental stations in the u.h.f. band on the 13th and 14th, and saw the captions PTT NED 1 and 2 from Holland and ARD, NDR and ZDF from Germany.

I received a test card from Holland on Ch. E4 at 0805 on March 6 and like **Harold Brodribb** saw, on several occasions, some faint flickering shadows in Band III when an opening was trying to break. The u.h.f. bands suffered short periods of very directional co-channel interference while the pressure was high between the 6th and 10th, but not enough to identify any long-distance pictures.

Band I

"The Sporadic-E season of 1983 extended up to mid-December," writes **Major Rana Roy,** from India, and among the pictures he received on Ch. 2 was a test pattern, Fig. 8, possibly from Bangladesh on November 3 and 4. He also received a programme from Dubai, Fig. 9, on December 12. Rana also saw a cartoon film in English, followed by prayer at 2030 for 5 minutes, then the signal faded and an African station came up. At 2100, a weak Russian station appeared with a male newscaster and the familiar BPEMR news caption. "January and February has had spurts of Sporadic-E but signals were weak," says Rana, and adds: "However, on February 15 strong signals from a south-east Asian station came up at 1800 with an electronic test card and faded away at 2030." Rana also received multiple images from a south-east Asian station on Ch. 3, via "F2," at 1930 on November 4, and when the signal cleared at 1950, he saw adverts and at 2000 a feature film in a south-east Asian language." During the film, the multiple images kept appearing and clearing," said Rana.

During one of the brief bursts of Sporadic-E, at 1344 on March 15, I managed to identify a test card from Poland somewhat different to the long and strong signals we get during the main Sporadic-E season, when there is often time to take a close look and study the details in each test card and caption.

SSTV

"I strongly recommend to any of your readers who would like to get into SSTV to consider building Brian Smith G3WCY's excellent project," writes **Allan Sancto** DD5FM. He built the unit described in the February and March 1983 issues of the RSGB's journal, *Radio Communication*. He says, "I can now report 100 per cent success with the gadget," and he sent photographs of the pictures he received from EA2JO, Fig. 10, GJ4TAF Fig. 11, and LA4R Fig. 12, to prove it. Allan uses the unit in conjunction with a Sony ICF-2001 receiver fed by a long wire antenna and home-brew a.t.u. Allan's best DX, received on February 20, was KP4YD Fig. 13, and he comments: "It is absolutely fascinating watching the picture forming before your eyes." At 1320 on February 13, **Richard Thurlow** G3WW, March, received a 32-seconds monochrome picture of a Tiger, Fig. 14, from I3XQW, who transmitted the picture via a Volker Wrasse SSTV/FAX converter on 14·230MHz. Richard recorded the SSTV pulses on an audio tape recorder and re-played the cassette into several memories of his own Volker Wrasse SC-1 converter and the image of the Tiger was reproduced on his GP-250X Seikosha printer. During a 2-way 8-seconds SSTV QSO with I6GKI on the 14MHz band at 1545 on February 26, Richard stored at least 6 of the pictures he received in a similar way ready for later print-out. "A recent new station on the SSTV scene is 5N8HEM, operated either by himself, 5N8AFE or 5N8SHE using the 16-seconds frame, monochrome, of a SC422A converter. They use approximately 14·230MHz around 1745 to 1800GMT," writes Richard. He also had a shaky 2-way SSTV QSO with ZL2AUJ, on the 14MHz band at 0821 on the 27th.

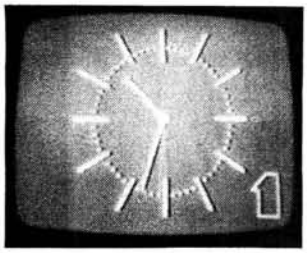


Fig. 1

Fig. 2

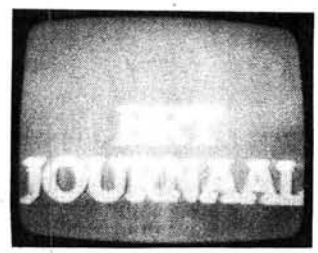


Fig. 3

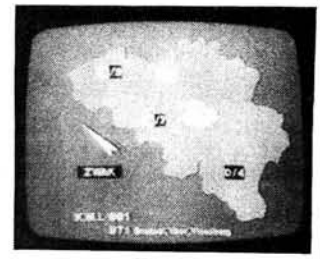


Fig. 4

Fig. 5

Fig. 6

Fig. 7

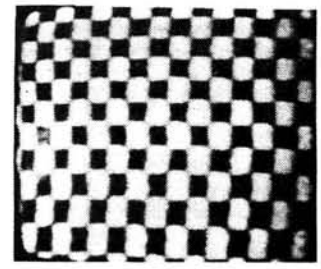


Fig. 8

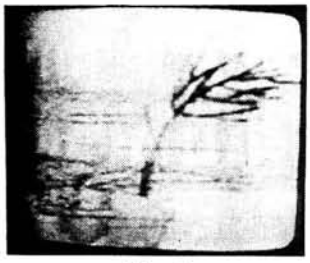


Fig. 9

Fig. 10

Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 15

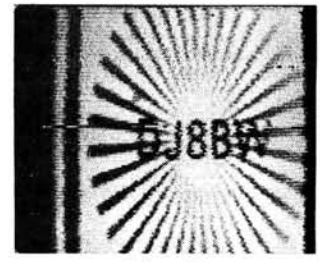


Fig. 16

Fig. 17

Fig. 18

"The most active station on SSTV seems to have been SP3LPM," Fig. 15, writes **Peter Lincoln** on March 14, who, in the previous month received SSTV pictures, mainly from Europe, Figs. 16, 17 and 18, and a few from the USA on both the 14 and 21MHz bands.

Station Reports

Owen Jones, Stoke-on-Trent, has a Vega 402DE receiver and although he is getting good u.h.f. pictures on its own antenna, he is experimenting with a variety of home-brew arrays ready for the DX on v.h.f. via both Sporadic-E in Band I and tropo in Band III.

My thanks to **Andy Emmerson** G8PTH, Northampton, for the information that the coloured test card scribed KRS which I referred to in our March issue, is in fact a line-up signal source from a London TV studio used before the actual programme starts.

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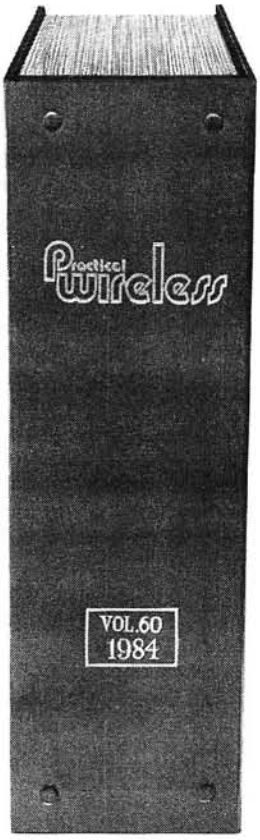

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5	As for Programs-4	Spectrum (16/48K)	£3.75	PW Radio Programs-5	

Ere! Bin down the Docks lately?

Engineers from Marconi Communications Systems Ltd. are nearing the first stages of completion on two different projects that will not only bring the space age to London's dockland, but revolutionise the skyline.

On the Isle of Dogs, Marconi is supplying Mercury Communications Ltd. with two complete satellite earth stations that will be used to provide international links for leased-line and other switched services. A 13-metre dish will provide service to North America via the Intelsat V satellite and an 8-metre station will provide services to Europe.

At Woolwich, Marconi is supplying British Telecom International—BTI—with three 13-metre antennas which will also be providing services via Intelsat V and through the ECS satellite.

The new BTI London 1 Satellite Earth Station at Woolwich

At this site the system is designed so that, by the substitution of a few components, either terminal may assume the role of one of the others. The first antenna is now in position as is the container housing the ground communication equipment and work has already started on the second antenna.

In addition to the two sites in London Marconi has also received an order for the supply of a complete earth station from Mercury Communications for the first terminal to be built at a site near Kidlington in Oxfordshire.

Marconi, on completion of these projects, will have been involved in the installation of over 22 separate earth stations in the UK. At Goonhilly and Madley, Marconi Engineers are at present working on seven new systems, as well as the updating of the existing terminals.

Balloon Relay Communications

The US Navy is intending to develop a communications system using free-floating balloons which will be allowed to drift at an altitude of some 24 to 30km above the earth. The balloons will carry equipment able to receive and relay back to earth a wide range of frequencies in the l.f., v.l.f., v.h.f. and u.h.f. bands, over long distances.

As the balloons will drift in the atmosphere and are not satellites, it will not be necessary to place them at the enormous distance required by geosynchronous satellites above the equator. Hence the relayed signals will be much more powerful for a given transmitter and antenna system.

The balloons are expected to be launched from sites on the land, from ships and even from submarines and fixed-wing aircraft. The exact launching technique has not been finalised, but two main techniques are being considered, namely:

(i) A rocket assisted launch with inflation of the balloons at an altitude above the tropopause.

(ii) Inflation prior to launch with the force due to the air displaced by the balloon carrying it to the desired altitude. This method would doubtless be much slower than method (i), but cheaper.

In order to keep the noise figures as low as possible, the US Navy plans to employ cryogenically cooled equipment in its relay system.

Balloons of this type intended for military applications will be "EMP hardened"; that is, they will be made as capable as possible of resisting the Electro-Magnetic Pulses (EMP) which are formed when a nuclear explosion occurs outside the atmosphere of the earth.

BD

QTI Talking Newspaper Association

QTI Talking Newspaper for blind and partially sighted radio amateurs has been granted full charity status by the Charity Commission (No. 326454).

QTI (Questions of Technical Interest) takes the form of two C90 cassettes, onto which is recorded three hours of readings from the technical pages of *Practical Wireless, Wireless World, Shortwave Magazine, Radio and Electronics World, Ham Radio Today, Amateur Radio, Hobby Electronics* and *Sprat*—the journal of the G-QRP Club.

As with most charities, finance is a constant problem, so, any donations or offers of financial support will be gratefully received by QTI's Chairman: *John Feeley G4MRB, 79 Narrow Lane, North Anston, Sheffield S31 7BJ;* alternatively, contact: *Dawn, tel: (0909) 566301, between 10.00am and 4.00pm, Monday to Thursday.*

I.T. for Ships at Sea

Ships' crews and passengers can, as from 9 January, plug into the world of information technology.

Ships which use British Telecom International's maritime satellite system, known as Inmarsat, can access a wide range of computers and databases round the world through BTI's international packet switching service, IPSS.

The new service will provide packet-switched links to the UK's public data network, Packet SwitchStream (PSS), and also to more than 50 similar data networks in over 30 countries.

It will enable shipboard users to call up data on a wide range of marine related subjects, including meteorology, geoastrophysics, oceanography, naval records, marine pollution and its control, ports and harbours, seaways and ocean mining.

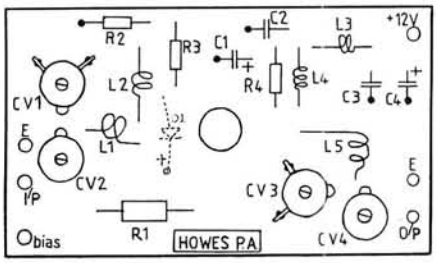
For computer users, packet switching has several important features: 1/ It makes national and international data communications simpler to set up, quicker to connect and more reliable in operation. 2/ It provides a flexible and reliable way of linking different computers and terminals. 3/ It enables terminals working at different speeds to communicate with each other. 4/ It automatically reroutes packets along different paths to avoid congestion or route failure.

Shipboard customers will be able to use synchronous character terminals generating data at 300 bit/s. They will connect to IPSS by dialling the London IPSS exchange. Ships in the Atlantic Ocean would use BTI's earth station at Goonhilly Downs, Cornwall.

C. M. HOWES Communications
Dept. PW

EASY TO BUILD KITS BY MAIL ORDER

Enjoy the satisfaction of building your own equipment with one of our kits.
We make construction a pleasure, the right parts, the right performance, and very good instructions.
Our kits are designed to be easy to build, even for those with no previous experience of this absorbing side of the hobby.
All kits come complete with all board-mounted components, a drilled, tinned PCB that has the component locations screen printed on it for straightforward assembly, and full instructions, parts list and circuit diagram.
The parts list details the colour code/marking information for each individual component. Choose a worthwhile project from our expanding range:-



PA Series Linear Amplifiers
These amplifiers have been designed to help you put out a stronger 2 meter signal. Double-sided board is used with screen printed parts location (see illustration above), PTFE output trimmers in the PA2/30. The easy way to build your own linear, complete with pre-formed inductors.

PA2/15 Up to 15W output, with 1½W drive (10dB gain) **kit £18.90, assembled PCB £22.80.**

PA2/30 Up to 30W output. This design gives approx 8dB gain and therefore has a good margin against overdriving with an FT290 or IC202. We feel that a signal that you can be proud of is more important than the slightly higher gain of some designs with their "wide" signals. **Kit £22.90, assembled PCB £26.90.**

CO1 TX/RX Switching Unit for use with the above, or any HF or 2M linear up to 100W. Coax relays are the best for TX/RX switching of linears or preamps, but they cost a fair bit. The CO1 uses high reliability, low cost conventional relays to give a reasonable performance at a sensible price. RF or PTT operated the CO1 also has provision for connecting a preamp if required. **Kit £8.90, assembled PCB £11.90.**

139 HIGHVIEW, VIGO, MEOPHAM KENT, DA13 0UT. FAIRSEAT (0732) 823129

AP3 Automatic Speech Processor. Kit £14.80, assembled PCB £19.80. *This is the* excellent processor described by Dave, G4KQH in the September '83 edition of "Ham Radio Today". We have sold hundreds and hundreds of these and many customers have come back to buy a second, third or even fourth unit *for use with their other rigs.* The AP3 uses a combination of compression, clipping, and response tailoring to give you a really "punchy" signal that enables you to make contacts that may not be possible without it. The unit will run from your rigs 12V supply or a 9V battery, it turns itself off automatically when not in use, so saving batteries. Clipping level is selectable in 6dB steps, no other operational controls to fiddle with, operation is fully automatic, speak as loudly or quietly as you like, the AP3 will adjust itself. Suitable for high and low impedance mics.

DcRx DIRECT CONVERSION COMMUNICATIONS RECEIVER. Kit £13.95, built £18.90. DcRx is a low cost, easy to build amateur band receiver, designed so that a newcomer to the hoobby can build a shortwave receiver with the minimum of trouble. The DcRx is also proving to be very popular with experienced QRP operators. Two versions of the DcRx are available at the moment, one covering 10 or 14 MHz, and one covering 3.5MHz (80M). The kit comes complete with ready-wound coils and requires very little alignment. You will be amazed how well a simple receiver can work, don't be put off by the low price, this set performs well and is capable of world-wide reception. The DcRx runs from a nominal 12V supply and will drive a loudspeaker or headphones. Modes: SSB and CW. PCB size 77 by 77 by 25mm approx.

XM1 CRYSTAL CONTROLLED FREQUENCY MARKER. Kit £15.60, assembled £19.60. A really useful piece of test equipment, besides helping you meet Amateur licence frequency measurement requirements. Our kit has a built in voltage stabiliser to maintain accuracy over a wide voltage range (8 to 24V DC). The XM1 provides marker outputs at 1MHz, 100kHz, 25kHz and 10kHz, these are usable up to 70cm, unlike some CMOS designs. The XM1 has a pulsed ident facility for distinguishing markers from off-air signals on crowded bands. This facility is very useful, and much preferable to tone modulated markers, whose bandwidth becomes larger as a frequency increases. If you are going to invest in a piece of test equipment, it pays to go for a good quality design, the XM1 provides this.

ST2 CW SIDE-TONE UNIT or PRACTICE OSCILLATOR. Kit £6.20, built £8.90. The ST2 provides a nice sounding sinewave note, either from your key or from the output of your TX by RF sensing. This design should not be confused with cheap and nasty squarewave circuits so common in horrible sounding practice units. We think side-tone, or a practice oscillator should sound like a good off-air signal received on a quality set. Output is up to approx. 1W at 800Hz, a volume control is included.

If you would like more information on any item simply drop us a line, enclosing an SAE. We have an A4 information sheet for each of our products.

Please add 60p P&P to your total order value.

We aim to keep everything in stock and delivery within 7 days, but sometimes the demand for one item or another takes us by surprise! If there is a delay we will let you know.

73, Dave, G4KQH Technical Manager

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1000pf 100V disc ceramics	10p	125uF 350V electrolytics	50p
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0.01uf 100V disc ceramics	10p	60uF 450V electrolytics	50p
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C804 var. caps. 10,25,50pf	£4.65	Mixed capacitor Bags	75p
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April 84 Lists 30p containing many bargains.
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DOUBLE SECTION TELESCOPIC FOLDOVER

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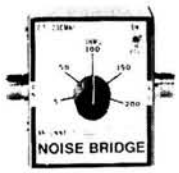

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Price **£36-95** *inc VAT* *P&P* **£2**

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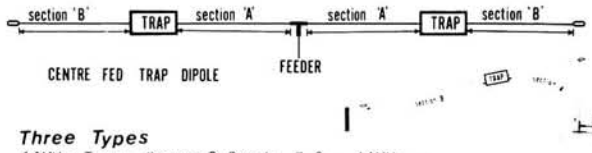

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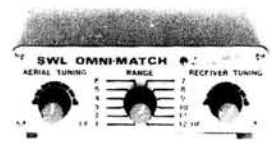

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Please send for our Catalogue and/or Antenna Catalogue

60p EACH or £1·00 FOR BOTH PLUS PRICE LIST

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Crystals for 2 meters
HC25 **£2.15** for one crystal, **£1.96** when 2 or more purchased. HC6 **£2.15** for one crystal, **£2.05** when 2 or more purchased.

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HC6/U 4 & 8MHz 30 PF	44 Mhz Series Res	RO to R7, S11, S20 to S23
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HC25/U 18 Mhz 25 & 20PF	14/15 Mhz 20 & 30PF	RO to R7, S8, to S23 & S32
HC25	Scanner XTLS (Not SR9)	RO to R7, S8, to S23 &S32

Full list available on request, please send SAE.
4 metre Crystals for 70.26 in HC6/U at £2.40 each.
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For Pye PF1 PF2 & PF70 series. Wood & Douglas and FDK Multi U11. Sub (433.2) SU20, RB0, RB2, RB4, RB6, RB10, RB11, RB13, RB14, RB15. Also for Multi U11 only. SU12, SU16, SU18.
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Frequency Standards £2.75 each.
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Toneburst, I.F. & MPU Crystals in HC18 £2.25 each.
7.168MHz (For 1750 HZ Tone), 10.245 (For 10.7 I.F.). 3.2768, 5.0688, 14.3180, 15.0000.

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FUNDAMENTALS FREQUENCY RANGE	PRICE	OVERTONES FREQUENCY RANGE	PRICE
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TERMS: Cash with order post inc. U.K. & Ireland. Cheques & P.O.'s to QSL Ltd. A stamped addressed envelope with ALL enquiries please.

QSL QuartSLab MARKETING LTD

ALL PRICES ARE EX VAT PLEASE ADD 15%

P.O. Box 19
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Telephone: 01-318 4419 24 Hr Ansafone: Erith (03224) 30830
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Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfil orders within 28 days, unless a longer delivery period is stated. Where goods are returned undamaged within seven days, the purchaser's money must be refunded. Please retain proof of postage/despatch, as this may be needed.

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If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, PRACTICAL WIRELESS will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:

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Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required.

We guarantee to meet clais from readers made in accordance with the above procedure a soon as possible after the Advertiser has been declared bankrupt or insolvent.

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The prepaid rate for classified advertisements is 36 pence per word (minimum 12 words), box number 60p extra. Semi-display setting £12.00 per single column centimetre (minimum 2·5 cms). All cheques, postal orders etc., to be made payable to Practical Wireless and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance should be sent to the Classified Advertisement Dept., Practical Wireless, Room 2612, IPC Magazines Limited, King's Reach Tower, Stamford St, London, SE1 9LS. (Telephone 01-261 5785).

NOTICE TO READERS

Whilst prices of goods shown in advertisements are correct at the time of closing for press, readers are advised to check with the advertiser both prices and availability of goods before ordering from non-current issues of the magazine.

For Sale

AMATEUR EQUIPMENT BOUGHT sold exchanged. Telephone 040-24-55733; or send SAE for current list. G3RCQ, 65 Cecil Avenue, Hornchurch, Essex.

Receivers and Components

4 Meter East European FM.
Broadcast Band Converter (MOSFET)
66-73 Mhz/93-100Mhz IF.
Example Price £27.95 incl.
SAE for details
GERWIN INSTRUMENTS,
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Colchester, Essex, CO4 3TY.

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BOURNEMOUTH/BOSCOMBE. Electronic components specialists for 33 years. Forresters (National Radio Supplies) late Holdenhurst Road. Now at 36, Ashley Road, Boscombe. Tel. 302204. Closed Weds.

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PROGRAMMABLE OSCILLATORS (PXO) for baud rates, MPU, and freq markers *£12.50*.
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KILL THAT INTERFERENCE
ANTI-TVI ANTI-QRN
Data sheets, Large 23p SAE.
Aerial Guide **75p.**
Callers for Appointment Tel. 03986-215,
G2DYM, Uplowman, Tiverton, Devon.

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Next to the set fitting
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AMPLIFIED SET TOP AERIALS for UHF TV, trebles the gain. **PRICE £11.70.**
All Boosters we make work off a PP3/006p/6F22 type battery or 9v to 18v DC. **P&P 30p PER ORDER.**
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48K SPECTRUM SOFTWARE. Q.R.A. Distance Bearing Log, Contest Score, Graphic Maps £4.95. Callsign Log with Search and List £4.95. Morse Tutor with dummy B.T. test £4.95 any two £7.95 all three £12.00. ALAN PARROTT, 72 Godstone Road, Kenley, Surrey CR2 5AA.

RADIO MORSE READING PROG. For ZX81 unexpanded memory. Prints translated Morse Code on screen with spaced scroll action – easy to read. Variable speed. £7. Spectrum version £8. PINEHURST DATA STUDIOS, 69 Pinehurst Park, W. Moors, Wimborne, Dorset, BH22 0BP.

BBC MORSE TUTOR £3.50p. Morse RX/TX £4.00. Valves, circuit diagrams, Computer Software. S.A.E. list. Mr C. J. DUFFY, 105 Cranbrook Street, Oldham, Lancs OL4 1QH.

SPECTRUM SOFTWARE (48K) Dxers greyline predictor, gives great circle bearing and distance for any point on Earth's surface. Shows graphically night/day conditions on either short or long path. Invaluable for twilight dxing. Cassette and instructions £8.50. QUALTECH, 2 Brickenhole Lane, Walkeringham, Doncaster, South Yorks DN10 4HX.

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EARLY WIRELESS. Always required: Crystal sets, Piptop valves, 1920s period wirelesses, bought, sold, exchanged. Stand 31/2, 288 Westbourne Grove, Portobello Market, London, W11 (Saturdays). Tel. 01-363 7494 (evenings).

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COLOUR MANUALS ALSO AVAILABLE
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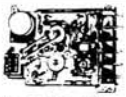

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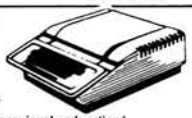

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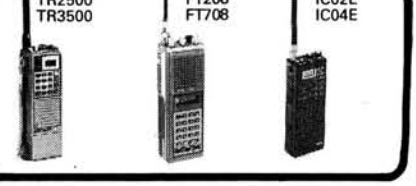

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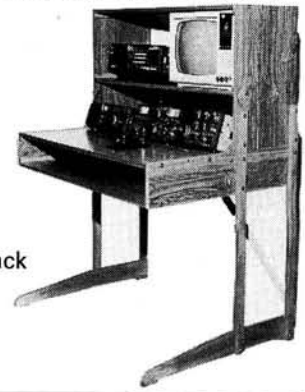

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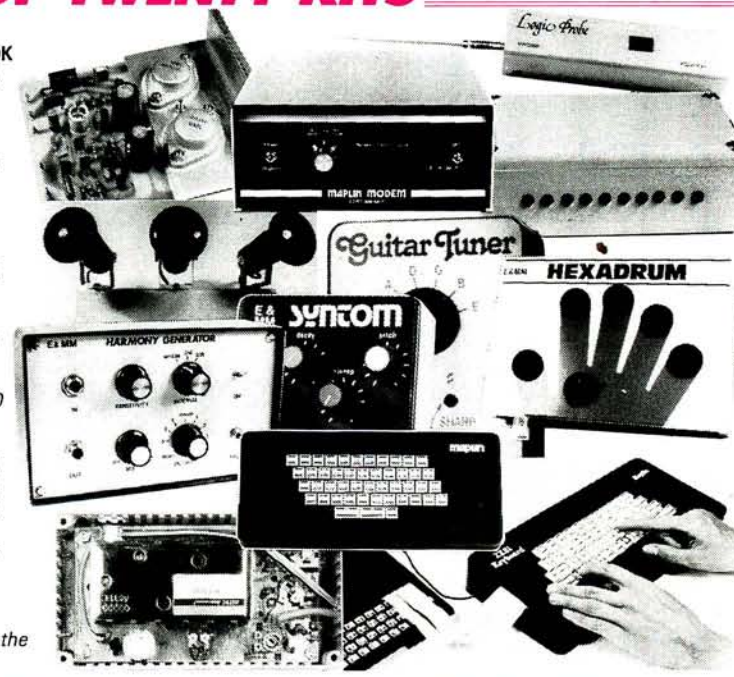
6.	(19)	Spectrum Keyboard	LK29G	£28.50	9 XA09K
		Also required: LK30H £6.50; Case: XG35Q £4.95 — Total £39.95.			
		Also available complete ready-built: XG36P £44.95.			
7.	(9)	Syntom Drum Synthesiser	LW86T	£11.95	Best of E&MM
8.	(8)	VIC20/64 RS232 Interface	LK11M	£9.45	7 XA07H
9.	(7)	8W Amp Module	LW36P	£4.45	Catalogue
10.	(10)	Harmony Generator	LW91Y	£17.95	Best of E&MM
11.	(15)	Logic Probe	LK13P	£9.95	8 XA08J
12.	(6)	Keyboard for ZX81	LW72P	£23.95	3 XA03D
		Case also available: XG17T £4.95. Complete ready-built: XG22Y £32.50			
13.	(14)	Ultrasonic Intruder Detctor	LW83E	£10.95	4 XA04E
14.	(11)	Spectrum RS232 Interface	LK21X	£17.95	8 XA08J
15.	(17)	Hexadrum	LW85G	£19.95	Best of E&MM
16.	(–)	Noise Gate	LK43W	£9.95	Best of E&MM
17.	(–)	Guitar Tuner	LW90X	£10.75	Best of E&MM
18.	(–)	Freq. Meter Adaptor	LK20W	£8.99	9 XA09K
19.	(16)	Car Battery Monitor	LK42V	£6.25	Best of E&MM
20.	(20)	ZX81 Speech Synthesiser	LK01B	£16.95	6 XA06G

Over 80 other kits also available. All kits supplied with instructions.

The desriptions above are necessarily short. Please ensure you know exactly what the kit is and what it comprises before ordering, by checking the appropriate Project Book mentioned in the list above.



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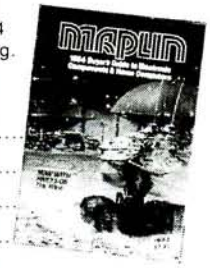
PW684



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'84 SUMMER

software in radio

contents

comment

Not another Computing Magazine?

Welcome to the first issue of *Computing in Radio*—a new regular magazine which will keep you informed of the latest developments in the use of computers for the radio hobbyist.

Over the last couple of years *Practical Wireless* has been exploring the best means of covering the boom in home computers while not turning the magazine into another computing book or alienating those readers who had no interest in computing. Our two pull-out supplements (December 1982 and 1983) created a lot of interest and gained us experience in presenting computer programs in an intelligible form.

Now we feel that the time is right to launch a different type of magazine—one that deals not with the computer but with its uses, in particular its uses in the shack. *Computing in Radio* will bring you not only the latest information on programs and hardware available commercially but will show you how to use your computer to try out those interesting modes of communication that up to now have required dedicated chunks of machinery or expensive hardware. Although we have equipped our office with the five computers which are most popular with radio amateurs—ZX81, Spectrum, BBC-B, Dragon 32 and VIC20—we will not be restricting our coverage to just these machines. If it is of interest to radio hobbyists and uses a computer then we will consider it. In general, however, the five computers mentioned above will receive the lion's share of our attention.

G8VFH

news

ACE Returns

The Jupiter ACE has reappeared on the computing scene. Although at present there are no plans to resume production of the FORTH based computer **Boldfield Ltd Computing, Sussex House, Hobson Street, Cambridge. Tel: 0487 840740,** have obtained the rights to retail the existing stocks.

Obtainable only by mail order from Boldfield, the selling price of the Jupiter ACE has been dramatically cut and now costs £44 plus VAT and £3.45 postage for the ACE with a 16K RAMpack. The bare machine is only £26 plus VAT and postage and this includes power supply, 182 page manual, demo cassette, leads and a 12 month guarantee.

Boldfield told us that they intend to assist ACE owners by developing new software and acting as selling agents for any company that wishes to produce interfaces, etc.

This development in the fortunes of the Jupiter ACE is interesting and it will open up a means of learning FORTH, a language that has much to offer the radio amateur.

Aztec Software Club

Bradfield School in Sheffield is in a rural setting and as the majority of pupils stay to lunch many clubs and societies meet in the lunch break.

One of the most popular of these was the "Radio Club" which later changed its name to "Electronics Club" to reflect the changing technology. With the advent of the school's first computer, a BBC won in a competition, the need for computer software became apparent.

So Aztec Software Club was formed to make the schools programs available to other schools at reasonably low cost and helping to contribute to the school's funds. As Sheffield Education Authority gave a lot of support all Aztec Software is available free of charge to all Sheffield schools.

One program produced by Aztec is "Morse Code" which produces the appropriate Morse code for any letter. Text can be typed in via the keyboard and as the computer stores the sequence the Morse is sent through the speaker at a steady rate.

For details write to **Aztec Software, 25 St. Mark Road, Deepcar, Sheffield S30 5TF.**

RAMTOP Moves

The quarterly newsletter for radio amateurs with computing interests has moved. Not only has it moved but for an extra £3 on their subscriptions readers can now receive an "in-between" monthly news sheet to keep them updated.

The Editor of RAMTOP, the Rev. Richard Butcher, G4NWH was, until recently Chaplain to Wellingborough School. However his Bishop saw fit to move him on to fresh pastures in Northampton so RAMTOP has a new address.

A subscription will cost you £4.50 (plus £3 if you want the news sheet) and the address to send your money to is **RAMTOP, Great Billing Rectory, Northampton NN3 4ED.** Subscriptions run from the March issue so you will get back issues from then.

BBC gets Multi-FORTH

Multi-FORTH 83 for the BBC Micro. This multi-tasking FORTH 83 is so new that it represents the "state-of-the-art" as far as FORTH on the BBC Micro is concerned. This version has been specially written for the BBC and is not rehashed FORTH-79 Code.

David Husband built up a world-wide reputation with his ZX81 FORTH ROM and the success of this product has enabled him to move to much larger premises and to concentrate on producing similar products for other computers.

The Spectrum FORTH I/O Cartridge was well publicised but it was decided to bring forward his plans for a multi-tasking BBC ROM in the light of the release of the latest FORTH-83 Standard by the FORTH Standards Team.

Hence Multi-FORTH 83, which represents the latest FORTH-83 standard, but specially written for the BBC Micro, and with multi-tasking as well.

The cost of Multi-FORTH 83 for the BBC Micro is £40 excluding VAT, with post and packing for the UK £2, Europe £5 and outside Europe £10. It is available from **Skywave Software, 73 Curzon Road, Boscombe, Bournemouth BH1 4PW. Tel: 0202 302385.**

reviews

G4BMK RTTY for Dragon-32

"Welcome to the fascinating world of RTTY." This is how the instructions supplied with the G4BMK Dragon 32 RTTY program begin. The description of RTTY and where it can be heard is good and will at least help the raw beginner who has just bought the program to find something to listen to.

The advantage of the Dragon 32 over say the ZX81 or Spectrum is that for RTTY it is possible to feed the audio from the receiver straight into the cassette port so doing away with the need for a terminal unit. To be fair the results obtained with a t.u. should be much better especially on the amateur h.f. bands but during my tests I had no problems in resolving h.f. signals using an Icom IC-R70 receiver and a long piece of wire as an antenna. My problems arose when, to try the program out on transmit, I went to 144·6MHz. Using a Standard C58 and an identical set-up to that used with my ZX81 I found that the QRM from the Dragon was completely swamping everything—something that has not afflicted my ZX81.

The ability to accept audio from the receiver does give someone with a Dragon 32 the means to sample RTTY with the minimal outlay and fuss.

The program is available on either cassette or cartridge and you have your callsign pre-programmed when you order. The advantage of the cartridge, which plugs into the port on the right hand side of the computer, is that it loads much faster without having to rewind or fiddle about. However, it does cost nearly twice as much as the cassette.

Versions of the program are also available for CBM 64, VIC 20, Acorn Atom and TRS-80 colour computers and a c.w. program for the Dragon 32/64 is available either separately or combined with the RTTY program.

The program is very pleasant to use with the split screen, and type ahead facilities making for easy operation. Initial loading and setting up is simple and the instructions indicate how to make the selections asked for. The bottom line of the screen carries a set of indicators to let you know what mode you are in, whether you are inverted or normal, have a filter inserted or are receiving with the "auto-synch" on. Further along the line is the baud rate indicator followed by a novel tuning indicator. This takes the form of an "L" for a space (low) or an upside down "L" for a mark (high). This can be used to tune the receiver until the vertical bar is steady with the horizontal bar alternating between high and low. I found that this worked and tied in with other types of tuning indication.

The memory part of the program was quite impressive. You can prepare up to ten pages of text each capable of holding 480 characters and transmitted by typing ! followed by the appropriate page number (0–9). It is possible to "nest" one page within another and this "nesting" can be performed any number of times so that you can build up your transmissions with the appropriate pages as required. The pages of information can be saved onto cassette for further use.

For transmitting RTTY you will need at least a two-tone audio oscillator controlled by the computer and the instructions clearly show how this is achieved. As an added bonus the program sets the computer's cassette motor relay to closed during TRANSMIT so that it can be used to switch the TX p.t.t. switch automatically.

I liked the program and the Dragon 32 is a pleasant computer to use as well as being reasonably priced. All I have to do now is somehow get to the root of the QRM problem and cure it. When I do I will report on it in *Computing in Radio*.

For details and prices of the G4BMK RTTY Programs and other useful programs for the radio amateur contact **Grosvenor Software, 22 Grosvenor Road, Seaford, E. Sussex, BN25 2BS. Tel: 0323 893378.** *G8VFH*

Feature

FORTH for the Radio Amateur

by David Husband G8HJT

The radio amateur must nowadays be very well aware of the potential of the microcomputer system for amateur radio uses, but he will be frustrated in his efforts by the problems in relating programming in BASIC to the needs of amateur radio which invariably require Machine Code.

Machine Code programming is a subject that nobody can enter into lightly and it also suffers from the problems of machine dependence. Other than that, it is the ultimate and most powerful means of programming a computer. However it is also a form of torture, and the user cannot test his code very easily as it does not present a very interactive environment.

A language that has been growing in popularity recently is FORTH and FORTH has a lot to offer the hobbyist as it is only one step up from Machine Code and yet is very user friendly, interactive and very fast.

Some readers will be aware of my multi-tasking versions of FORTH for the ZX81, Spectrum and BBC Micro, and this series of articles will be covering these machines and in particular developing amateur radio applications including RTTY, Morse and Packet Radio. We will take the reader through hardware and software aspects, and in particular we will deal with interfacing to the outside world.

SOFTNET

In this article I want to tell you about a system of Packet Radio using FORTH currently being developed by AMSAT/SM at the Department of Engineering, Linkoping University, Sweden. It is known as "SOFTNET" and is designed specifically for amateur radio use. Further articles will develop practical hardware and software to implement SOFTNET.

Radio amateurs have long used their equipment to transmit digitally encoded data. Through the use of modems low bit-rate RTTY and ASCII data have been put on to narrowband channels normally used for speech communication.

With the evolution of large digital data networks came the notion of packet transmission. This technique turned out to be practical when messages were forwarded in a multi-hop fashion using several intermediate repeaters. The integrity of each packet could easily be kept using simple error checking and acknowledge procedures. It furthermore turned out that a highly flexible time multiplexing technique could be implemented based on packetised data. Packet switching has thus become the leading technique also for local networks where a number of users share the same transmission medium.

As the next step towards more sophisticated data transmission it is therefore natural that radio amateurs consider packet transmission as a viable way to go. However, radio-based packet switching is still largely in its infancy and many issues have to be resolved. The network design should acknowledge this fact as well as be tailored to the purpose of providing a testbed for network experiments.

SOFTNET is a network for digital communication using a single wideband channel in the 430MHz u.h.f. band utilising bit rates up to 100Kbit/s. and each node is capable of acting as a repeater for messages. Global communication is thus possible through distributed multi-hop routing. The main feature is, however, that each network node is completely programmable from every other node in the network. This unconventional approach to the protocol issue offers novel solutions to higher level communication problems.

The following are requirements of SOFTNET:

The network should be completely decentralised to eliminate the need for, and dependence on, jointly operated complex stations.

It should be robust against failures of individual nodes, and should quickly accept new entering nodes.

It should be open-ended so that new functions may be added when needed.

It should allow and encourage users to conduct their own network experiments.

Throughput should be reasonably high and the cost per node low.

The main concept behind SOFTNET is that all packets are considered to be programs of a common network language (FORTH). These programs are interpreted in the nodes as soon as they arrive. SOFTNET-nodes accept programming by any number of users simultaneously without unwanted interaction. This approach makes it possible for a user to define his own high level services such as Datagrams, Virtual Calls, File Transfers, Mailboxes etc. In addition the concept allows changes at lower levels during operations thus permitting redefinition of link-level access-protocols.

Packet Switching

The network consists of a number of identical nodes, i.e. there is **no** hierarchical structure. A node consists of a u.h.f. radio transceiver with an output of approximately 5 watts and a multi-tasking controlling computer.

These nodes communicate through what is called Packet Switching, a method of communication whereby the flow of data is divided in small "packets" of about 100 bytes each. These "packets" are then communicated through the network one by one at a rate of 100Kbit/s. and the transmission system is synchronous. The modulation used is duo-binary f.s.k. with a modulation index of approximately 1.

To reduce the bandwidth, duo-binary coding and pulse shaping of the baseband signal is used before it is fed to an f.m. modulator. This method reduces the bandwidth by a factor of two with only a minor increase in circuit complexity.

A "packet" will be able to reach any node attached to the network through a multi-hop technique whereby any intermediate node can act as a repeater. As all nodes reduce their output power respectively to the lowest usable limit, neighbouring nodes may exchange "packets" simultaneously thus resulting in a highly dynamic system. Alternate paths and simultaneous traffic may occur.

Optimal Paths

A common task for all nodes is the process of finding optimal paths. Usually this means delivering packets to their target nodes in the shortest possible time. Considerable theoretical effort has been put into designing these algorithms for effectiveness and security.

In packet networks using a single radio channel, some means must be found to share this channel effectively. Since there is no other means than the radio channel for the nodes to communicate, this sharing has to be done in a distributed manner. Each node has to decide whether to transmit a packet or not, on its own. The algorithm by which this decision is made can, however, be the same for all nodes.

Algorithms

A large number of algorithms for packet multiple access have been proposed in the last decade. These algorithms differ in the amount of information about the channel available to the nodes. Some algorithms use very little information, like the simple ALOHA algorithm. Here, the only information a node has access to is whether his packet has collided or not. Other schemes make use of carrier sense information, like the CSMA algorithm, recognising the fact that it is of no use to transmit on a channel, when a transmission is already in progress. Even more advanced algorithms can be used which may utilise traffic load estimates and other higher level information.

In the SOFTNET environment with its distributed nodes, the basic access algorithm is an algorithm of the CSMA variety. Each node uses its channel signal level reading to decide if a transmission is in progress. Due to the presence of "hidden terminals" this algorithm will not perform as well as in the classical case with a fully connected network. To ensure collision detection, no node which is able to detect a transmission is allowed to transmit until an acknowledge packet has been issued. This algorithm is used together with an "alternating bit" or "stop-and-wait" procedure, which in this case is a natural procedure for packet transmissions. The acknowledge packets have a double role, they are used both for collision and transmission error detection. As SOFTNET is programmable, it

will provide the amateur radio community with a uniquely flexible tool to perform research in this area.

In SOFTNET FORTH is used throughout. Suffice it to say that the choice of FORTH as the network language turned out to be very rewarding. Although the basic kernel had to be extensively extended (with multi-tasking, etc.) the properties of the language turned out to be well matched for this particular application. All incoming packets are given to the node computer for interpretation. A user may execute programs of his own design in any of the nodes he can reach. He would, for example, be able to instruct a node to pass his packets along a predefined path or simply to forward his packets to the owner of that particular node. These can later be triggered either through additional packets or through the node's real-time clock.

As an owner of a SOFTNET node, the user will primarily see an ordinary FORTH computer. The user will not immediately be aware of the fact that the node in fact is a multi-user system, in which several remote users are being served.

In the user's dictionary the ordinary FORTH-79 (or 83) standard instruction set plus a set of "magic words" will be available. This instruction set allows the user to define his own high level services, such as file transfers, datagrams, and virtual calls, etc.

The next part of this series will deal with the practical aspects of interfacing to the ZX81, Spectrum and BBC Micro.
Watch this space!!
73s G8HJT

Software

Morse Code Reader

Pinehurst Data, 69 Pinehurst Park, West Moors, Wimborne, Dorset BH22 0BP
ZX81 1K
Black and White **Cassette**

This program, using the unexpanded ZX81, translates Morse code from a radio, or other source, printing it on the screen with automatic scrolling. Speed is manually adjustable.

The audio output from the receiver is fed into the EAR socket on the ZX81 and the instruction leaflet with the program gives full details on how to set up the receiver and connect it to the computer.

We have not had enough time to test the program off-air but we understand that several local amateurs have tried the program with marked success. We hope to be able to report on its performance in a future issue.

Morse Tutor

Softricks—R. Forbes GM6RLE, 1a Dundee Street, Letham, Angus DD8 2PQ. Tel: 030781 432
Spectrum 48K
Colour **Cassette**

The program takes a long time to load and is done in two parts—you must remember to wait until the end of the second part and not break-in to the program too soon. This program could actually make learning Morse fun—especially if you have a warped sense of humour.

First you set the tone of the Morse you like from the keyboard. You also decide the speed at which characters are to be sent.

The menu gives 8 options:

1. The alphabet is shown with its equivalent in Morse e.g. A · —
2. The numbers are shown in a similar manner.
3. The punctuation marks . (full stop) , (comma) and ? (question mark) are shown with their Morse equivalents.
4. Random letters. These are sent in the traditional 5 character groups.
5. Random words. The computer has a store of "real" words in its memory which it sends to help with plain language practice.
6. Morse typewriter. In this option if you press the A key the computer sends the Morse equivalent and so on.
7. Message Repeat. The computer asks you to input some text, it is often better if the student gets someone else to do that, then the computer sends the text. It will repeat the passage of text until the student stops the computer.
8. Hang the Cat. This is where the warped humorists come into their own. The computer sends a 5 letter word and like Hangman you have to guess the word. Each wrong guess adds another part of the purple cat until, if you don't know the word, the cat's neck is stretched! It's worth getting a word wrong deliberately just to watch the graphics!

Transistor Amplifier Design

Gilsoft, 30 Hawthorn Road, Barry, South Glamorgan CF6 8LE. Tel: 0446 732765
BBC Model B
Colour **Cassette**

This interesting program contains five design programs each of which presents a full on-screen graphical circuit diagram followed by prompts for you to input values and data. The program calculates the values of various circuit components followed by a breakdown of the expected circuit performance.

The five circuits are:

1. Common emitter amplifier.
2. Common base amplifier.
3. Common collector amplifier.
4. Two-stage common emitter amplifier.
5. Two-stage common emitter amplifier with negative signal feedback applied.

Several other programs on the tape assist the designer to use the main programs. These are a general introductory program concerning the amplifier circuits used, a resistor conversion program giving colour codes, and a similar program for capacitors of the C280 polyester type.

RAE Calculation Practice Questions

Richard Wilmott GW3RRI, Fron, Caernarfon LL54 7RF. Tel: 0286 881886
Spectrum, ZX81+16K, VIC20, Commodore 64
Black and White **Cassette**

The notes with the program should be read carefully before starting any calculations. Generally the questions are presented to 2 significant figures and answers corrected to 3—this should be remembered as it will save time (and "wrong" answers) later.

Fifteen different topics are covered, lettered A to O. Amongst these topics are ones such as Ohm's Law, Power, Parallel Components, Sinewaves, Transformers, Sidebands and Electromagnetic Waves.

It is wise to have a calculator to hand when attempting to answer the questions. The necessary formulae and other information is given on a "cribsheet" on the reverse of the instruction sheet to help any student who gets stuck.

After each question you can opt to have the same formula but different numbers, a similar formula or go back to the menu.

QTH Locator

Richard Wilmott GW3RRI, Fron, Caernarfon LL54 7RF. Tel: 0286 881886
Spectrum, ZX81+16K, VIC20, Commodore 64
Black and White **Cassette**

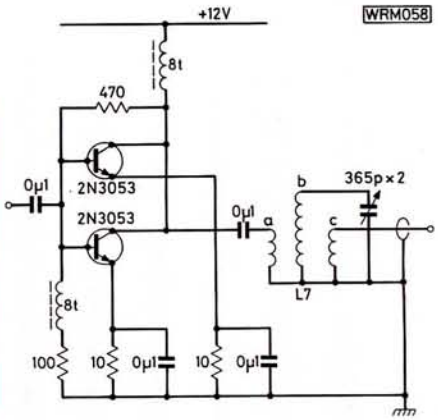
Your own base QTH position needed for all calculations is entered before the menu is displayed, either as latitude and longitude or as a locator. The notes on the instruction sheet should be read carefully as each computer has different ways of inputting latitude and longitude.

The options available on the menu are:

1. *LAT/LONG.* You input the latitude and longitude of the other station and the computer calculates the distance in kilometres and beam heading in degrees true.
2. *QTH general.* You input the QTH locator of the other station and the computer calculates the latitude and longitude, distance in kilometres and beam heading.
3. *QTH contest.* You input the QTH locator of the other station and the computer calculates the latitude and longitude, distance and points score. At the end of this calculation the computer will give you a total score of the number of contacts and final points score.
4. *New base QTH.* You input a new base QTH locator or new position in latitude and longitude.

Tuned Output Stage Design

by S. Baynes



This program, written in Sinclair BASIC for the 16K Spectrum, will help you to design a tuned link-coupled output stage such as that used in the *PW* Dart QRP transceiver. A simplified circuit diagram of the output stage is shown in Fig. 1 to give you an idea of the type of circuit dealt with.

As there is no machine code it should be straightforward to translate the program into other dialects of BASIC. It should run on a 16K ZX81 with very little change—try omitting lines 1Ø, 4ØØ1 and 4Ø65 and changing lines 171, 44Ø and 41Ø5 to PAUSE 4ØØØ and, of course, you cannot use lower case characters.

This program is typical of the design programs that can be written for even the simplest computer so long as you can break the circuit down into blocks and can apply the correct formulae to these blocks. With a program such as this one you can very quickly try different component values to see the effect on the performance—why not try writing additional subroutines to alter the number of turns for instance or alter the value of the tuning capacitor?

```
    1 REM By S.Baynes G6OUN
    5 GO SUB 4000
    6 CLS
   10 POKE 23658,8
   20 PRINT "ENTER AMIDON CORE TY
PE FROM THE FOLLOWING LIST"
   35 PRINT AT 5,4;"T30-2    A.   T
50-2    B.              T68-2    C.  TT
50-2    D.              T94-2    E.  TT
106-2   F.              T130-2   G.  T
184-2   H.              T200-2   I.
                                     T
25-6    J.              T37-6    K.  T
50-6    L.              T68-6    M.  TT
80-6    N.              T94-6    O.  TT
106-6   P.              T184-6   Q.  T
200-6   R."
   50 INPUT A$
   60 IF A$="A" THEN LET K=4.3
   62 IF A$="B" THEN LET K=5
   64 IF A$="C" THEN LET K=5.7
   66 IF A$="D" THEN LET K=5.5
   68 IF A$="E" THEN LET K=8.4
   70 IF A$="F" THEN LET K=13.5
   72 IF A$="G" THEN LET K=11
   74 IF A$="H" THEN LET K=24
   76 IF A$="I" THEN LET K=12
   78 IF A$="J" THEN LET K=2.7
   80 IF A$="K" THEN LET K=3
   82 IF A$="L" THEN LET K=4
   84 IF A$="M" THEN LET K=4.7
   86 IF A$="N" THEN LET K=4.5
   88 IF A$="O" THEN LET K=7
   90 IF A$="P" THEN LET K=11.6
   92 IF A$="Q" THEN LET K=19.5
   94 IF A$="R" THEN LET K=10.5
  100 CLS : PRINT "ENTER NUMBER O
F TURNS OF WIRE"
  110 PRINT
  120 PRINT AT 8,1;"DO NOT WORRY
ABOUT SIZE OF WIRE BUT REMEMBER
TO COVER AS MUCH    OF THE COIL A
S POSSIBLE"
  130 INPUT T
  140 CLS
  150 LET L=K*(T*T)/1000
  160 PRINT AT 8,2;"INDUCTANCE OF
 COIL= "
  165 PRINT AT 10,2;L;" microhenr
ys"
  170 PRINT AT 19,4;"PRESS ANY KE
Y TO CONTINUE"
  171 PAUSE 0
  172 CLS
  173 PRINT AT 8,8;"ENTER FREQUEN
CY"
  174 PRINT AT 9,8;"In MHz"
  176 INPUT F
  179 CLS
  180 LET YY=4*(PI↑2)*((F*1e6)↑2)
*(L*1e-6)
  190 LET Y=1/YY
  200 PRINT AT 6,3;"CAPACITANCE A
T RESONANCE ="
  210 PRINT AT 8,6;FN r(Y*1e12);"
 picofarads"
  220 PRINT AT 17,1;"PRESS 1 TO C
ARRY ON"
  230 PRINT AT 19,1;"PRESS 3 IF V
ALUE OF CAPACITANCE IS NOT TO YO
UR CHOICE"
  240 LET Y$=INKEY$
  250 IF Y$="1" THEN GO TO 300
  260 IF Y$="3" THEN GO TO 6
  270 GO TO 240
  300 CLS
  310 PRINT AT 6,3;"ENTER Q OF LO
ADED CIRCUIT"
  320 PRINT AT 9,1;"(normal value
 of Q =10          this is a com
promise between     circuit effic
iency and harmonic suppression)"
  330 INPUT Q
  335 CLS
  340 LET Z=Q*2*PI*(F*1e6)*(L*1e-
6)
  350 PRINT AT 6,3;"ENTER OUTPUT
LOAD RESISTANCE"
  360 PRINT AT 8,0;" normal value
s are 50 or 75 ohms"
  370 INPUT O
  375 CLS
  380 LET S=SQR (O/Z)
  390 LET A=FN r(S*T)
  400 PRINT AT 6,2;"NUMBER OF TUR
NS OF OUTPUT COIL"
  410 PRINT AT 8,3;" = ";A;
  430 PRINT AT 19,3;"PRESS ANY KE
Y TO CONTINUE"
  440 PAUSE 0
  500 CLS
  510 PRINT AT 6,3;"ENTER VOLTAGE
 ON COLLECTOR       OF PA-TRANSIS
TOR(S)"
  520 INPUT U
  530 CLS
  540 PRINT AT 6,3,"ENTER OUTPUT
POWER IN WATTS"
  550 INPUT P
  560 CLS
  570 LET I=U↑2/(2*P)
  580 PRINT AT 6,3;"LOAD TO TRANS
ISTOR"
  590 PRINT AT 8,3;" = ";I;" Ohms
"
  600 PAUSE 100
  605 CLS
  610 LET C=SQR (I/O)
  620 LET B=FN r(C*A)
  650 PRINT AT 6,0;"NUMBER OF TUR
NS OF INPUT COIL"
  660 PRINT AT 8,3;" = ";B;
  670 PAUSE 150
  700 CLS
  710 PRINT AT 4,0;"INPUT COIL =
";B;" TURNS"
  720 PRINT AT 6,0;"TUNED COIL =
";T;" TURNS AT ";F;" MHz"
  730 PRINT AT 9,0;"WITH A CAPACI
TOR OF ";FN r(Y*1e12);" pF."
  740 PRINT AT 11,0;"OUTPUT COIL
= ";A;" TURNS"
  745 PRINT AT 19,0;"PRESS 1 TO S
TART AGAIN"
  750 PRINT AT 21,0;"PRESS 8 TO E
XIT PROGRAM"
  760 LET Y$=INKEY$
  770 IF Y$="1" THEN GO TO 6
  780 IF Y$="8" THEN GO TO 800
  790 GO TO 760
  800 CLS
  801 PRINT AT 10,6;"ARE YOU SURE
?"
  810 PRINT AT 11,7;"Y OR N"
  820 LET Z$=INKEY$
  830 IF Z$="Y" THEN GO TO 900
```

```
 840 IF Z$="N" THEN GO TO 742
 850 GO TO 820
 900 NEW
1000 SAVE "TOO" LINE 1
4000 CLS
4001 POKE 23609,255
4005 PRINT AT 10,10;"COMPUTER-AI
DED "
4010 PRINT AT 11,10;"LINK-COUPLE
D"
4020 PRINT AT 12,10;"OUTPUT DESI
GN"
4025 PRINT AT 13,10;"USING TOROI
DAL COILS"
4030 PRINT AT 15,7;"©1984 IPC Ma
gazines Ltd."
4040 PAUSE 150:
4050 PRINT AT 19,5;"INSTRUCTIONS
 FOR USE "
4060 PRINT AT 20,9;"FOLLOWS SHOR
TLY": PAUSE 100
```

```
4065 BORDER 0: INK 7: PAPER 0: C
LS
4069 CLS
4070 PRINT AT 5,0;"THIS PROGRAM
WILL AID YOU IN THEDESIGN OF TUN
ED LINK-COUPLED     OUTPUT STAGES
"
4079 PRINT
4080 PRINT "YOU WILL BE ASKED TO
 ENTER      VARIOUS QUANTITIES S
UCH AS-     TURNS OF MAIN COIL-0
 OF COIL etc"
4085 PRINT
4090 PRINT "ALSO WITH EACH INPUT
 WILL BE A  DESCRIPTION TO HELP
YOU DECIDE  THE VALUE WANTED"
4100 PRINT AT 20,3;"PRESS ANY KE
Y TO START"
4105 PAUSE 0
4106 DEF FN r(x)=INT (x+0.5)
4110 RETURN
```

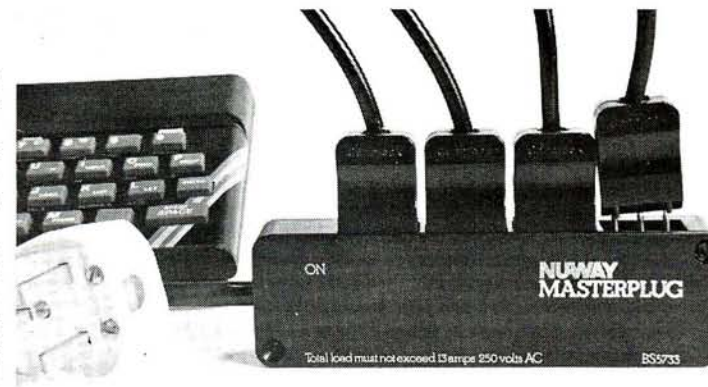
products

Four-to-one Mains Socket

If your computer set-up is anything like ours then you need the Masterplug 4-into-1 mains connector to tidy-up the mains leads that seem to proliferate as more peripherals are acquired.

The Masterplug is a compact and versatile unit that measures 150 × 45mm and accepts the special plugs which measure a mere 25 × 30mm each. The unit is supplied with the four plugs together with 1·5m of mains cable and a 13 amp mains plug.

The total current must not exceed 13 amps and any single plug is limited to a maximum current of 6 amps so there should be no problems with overloading it. The system complies with BS5733 and the Electrical Equipment Safety regulations 11975 (amended 1976). Priced at £8.99 (inc. postage) the Masterplug is available from **H & K Supplies, 322 Guildford Road, Bisley, Surrey, GU21 9AD.**



books

INTERFACING TO MICROPROCESSORS & MICROCOMPUTERS

By Owen Bishop
Published by Butterworth & Co.
147 pages, 137 × 215mm.
Price £4.95
ISBN: 0-408-01129-7

This book covers a series of practical interfaces for microcomputers in general. Constructional details together with programming ideas should enable constructors to build and use these interfaces to perform a wide range of tasks.

MICROCOMPUTERS IN AMATEUR RADIO

by Joe Kasser G3ZCZ
Published by Tab Books Inc. Available from W. Foulsham, Yeovil Rd, Slough SL1 4JH (or technical book shops)
308 pages, 128 × 208mm. Price £8.95 plus £0.90 p & p

In the fifteen chapters of this book it shows how computers and amateur radio fit together. Even the reader with very little knowledge of computers is catered for, from buying to programming.

The book includes eight program listings in the appendices covering such wide subjects as Morse code. OSCAR orbit calculator, RTTY and contest logging. Details of programming techniques, flow charts, debugging, assembly language techniques and printing numbers are just some of the topics covered in this book. It even covers how to interface each part of the system and how to interface the computer to your existing station equipment.

PROGRAMMING THE BBC MICRO

Edited by Peter Williams
Published by Newnes Technical Books
176 pages, 216 × 138mm. Price £6.50
ISBN 0 408 01302 8

This book concentrates on programming and using the machine, assuming little or no knowledge on the reader's part. Early chapters introduce some practical programming points, and later chapters cover BBC BASIC as applied to graphics, words, numbers and sound.

Machine code, HEX, ASSEMBLY LANGUAGE, interfacing, file handling and hardware are also discussed.

FORTH FOR MICROS

by Steve Oakey
Published by Newnes Technical Books
160 pages, 216 × 138mm. Price £5.95
ISBN 0 408 01355 4

FORTH is a relatively new language that is rapidly catching on with micro users—it is easy to use and *much* faster than BASIC. This book teaches the reader to program in FORTH and demonstrates the use and power of this extensible language.

EASY ADD-ON PROJECTS FOR SPECTRUM, ZX81 & ACE

By Owen Bishop
Published by Bernard Babini (publishing) Ltd.
183 pages, 110 × 179mm.
Price £2.75
ISBN: 0-85934-099-6

This book describes how to build a number of electronic projects which can be used with your Spectrum, ZX81 or Jupiter Ace.

Projects described include a pulse detector, picture digitiser, bleeper, lamp flasher, model controller, light pen and a weather station.

All the projects are straightforward to build and simple programs are included to get you started.

COMPUTER PROGRAMMING—MADE SIMPLE

by J. Maynard MBCS
Published by Made Simple Books
350 pages, 128 × 215mm. Price £2.50
ISBN: 0 490 00872 4

This offers a comprehensive introduction to modern techniques of programming without assuming previous knowledge of mathematics or electronics. It will therefore be of interest to a wide variety of readers, ranging from students at schools and further education establishments to aspiring programmers and general readers seeking a basic knowledge of the subject.