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Practical Wireless

SEPTEMBER 1981

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H.F.

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Practical Wireless

SEPTEMBER 1981 VOL. 57 NO. 9 ISSUE 894

contents

We regret that, due to pressure on editorial space, Part 5 of *PW* "Stour" and Uncle Ed's Column have had to be held over

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DAIWA POWER METERS

Until recently, the in-line measurement of RF power and SWR involved calculation or the use of two instruments. Now, DAIWA have introduced a range of power meters which provide an elegant solution to the whole problem of RF measurements. Utilising two toriodal current transformers to detect true forward and reflected power, and feeding the outputs to a twin movement meter with crossed pointers, it is now possible to measure forward power (LH scale), reflected power (RH scale) and SWR (where the pointers cross) at a single glance. The DAIWA CN series power meters represent the ultimate power meter for the professional and amateur alike, and are indispensable in the fully equipped station. Three models are currently available covering frequencies right up to 2.5GHz so there's one for you whatever your interests.

CN620A	1.8-150 MHz up to 1KW	**£52.81** inc VAT
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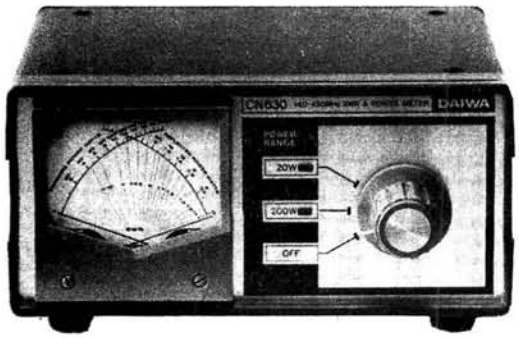
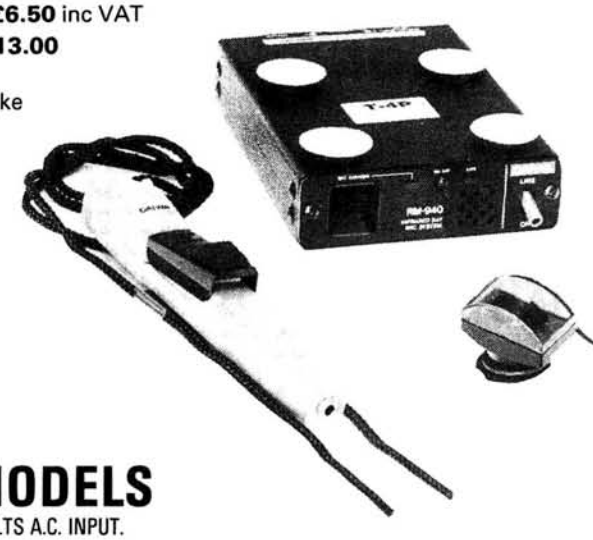


CARRIAGE ON METERS **£1.25**
CARRIAGE ON MIKE SYSTEM **£1.50**

DAIWA CORDLESS INFRA RED MIKE

The Daiwa infrared mike system, comprising of a control box, sensor and infrared mike enables you to dispense with the hand mike and cable when operating in your car or shack. By using an infrared beam audio is transmitted from the mike to the sensor and then to the control box which activates the transmitter. To transmit, press the locking switch on the mike and talk. To receive, release the switch and your rig immediately returns to receive. When you have finished your contact return the mike to its slot in the control box and the mike nicad battery is maintained at full charge. For those of you who like fresh air and drive with all windows open there is a matching wind shield available at an additional 75p. So there we are, the latest technology to bring safety to your mobile operation, the Daiwa infrared mike.

RM 940 **£45.00** inc VAT
S9 spare sensor **£6.50** inc VAT
M9 spare mike **£13.00** inc VAT
Windshield for mike **75p** each.



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the PP1305 4 amp 13.8 volts d.c. ***£18.40*** *inc. VAT.*
the PP137 7 amp 13.8 volts d.c. ***£32.00*** *inc. VAT.*
the PP1310 10 amp 13.8 volts d.c. ***£49.50*** *inc. VAT.*
Carriage £2.00

JRC Japan Radio Co., Ltd.
Since 1915

NRD 515

The NRD 515 is a PLL-synthesised communications receiver of the highest class featuring advanced radio technology combined with the latest digital techniques.
The new NRD 515 is full of performance advantages including general coverage, all modes of operation, PLL digital VFO for digital tuning, 24-channel frequency memory (option), direct mixing, pass-band tuning, etc. JRC's 65 years of radio communications experience will give you "the world at your fingertips".
The NRD 515 is but a single item from the JRC product range which extends all the way to full marine radio installations for supertankers.

NRD 515 SYNTHESISED HG RECEIVER	**£948.75** inc VAT
NHD 515 MULTI CHANNEL MEMORY UNIT	**£161.00** inc VAT
NVA 515 LOUDSPEAKER	**£27.60** inc VAT
CFL 260 600Hz CW FILTER	**£34.50** inc VAT

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TRIO *pacesetter in amateur radio*

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The only 2 metre FM mobile **£276**

TS770E 2m/70cm DUAL BANDER
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"A new direction" **£371.91**

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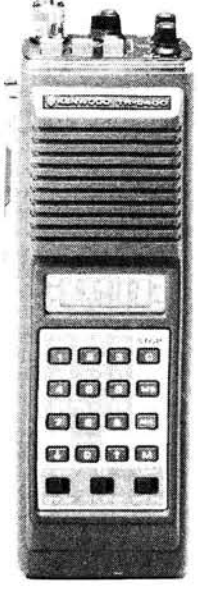

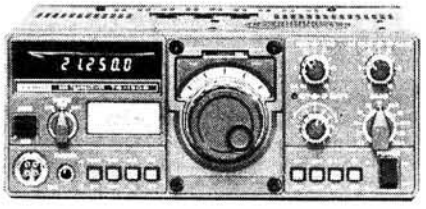

TS 130 S/V *"a big little rig"* **£547/£450**

R-820 AMATEUR RECEIVER **£690**

TS 830S 160-10M TRANSCEIVER
"top notch" **£726.57**

R1000 GENERAL COVERAGE RECEIVER
"hear there and everywhere" **£305.90**

TS180S 160-10M TRANSCEIVER **£679.65**
PS30 POWER SUPPLY UNIT **£85.00**

NOTE PRICES AS OF JULY 1981
ALL PRICES INCLUDE VAT. CARRIAGE ADDED TO ALL ITEMS £4.50.

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LE

ICOM

the amateur's professional friends

Several new products from Icom will be introduced onto the market shortly and when we recently saw the prototypes in Japan we realized just how popular they are going to be. Just to wet your appetites here are a couple of examples:–

IC-290E

£359

IC-290E TWO METRE MULTIMODE MOBILE

The IC-290E incorporates all the features you could want in a multimode mobile to make it easy to use when driving. A standard 6000kHz repeater offset shift is built into its computer's memory but if necessary this can be altered from the front panel for unusual shifts that may be required (such as say 1.6MHz for some transvertors). There are five programmable memories and these can be used in either simplex or duplex mode. Any one of these memories can also be designated as a PRIORITY CHANNEL which can be checked once every five seconds if you wish for that private message you may be expecting. Scanning can be controlled either from the front panel or from the HM10 microphone. There are options to scan the whole band, any selected part of it, or just the memory channels. You do NOT lose the repeater shift when scanning or using either of the VFOs in simplex. Unlike many of its competitors you do have TWO VFOs which can also prove a very useful feature. Further improvements include a brighter frequency readout, a LED bar-type S-Meter and power output meter and the ideal tuning rates of 25kHz per step on FM and 100Hz per step on SSB. Both these rates can be changed to 1kHz steps by use of the TS button on the front panel. For repeater operation both + and – shifts are available and it is possible to listen on the repeater input channel merely by pressing a button. Internal controls allow you to vary scan speed, scan delay time etc. Semi break-in CW and CW sidetone are also available.

Put all these features into an attractive case, add the world wide renowned ICOM quality and performance, and you must see that this is the choice for you. And just as an extra remember that you get a full two year's warranty if you purchase your transceiver direct from THANET or one of our agents listed in this advertisement.

IC-25E

£259

ICOM HAVE GOT IT RIGHT AGAIN!

Again ICOM seem to have got everything right with its new 25W FM mobile. It is one of the smallest around and yet is packed with features which make it really handy to use while still maintaining the very high quality expected in ICOM transceivers.

Like its bigger multimode brother, the IC-25 has TWO VFOs, FIVE MEMORIES (which can be used in either simplex or duplex mode), a PRIORITY CHANNEL (which can be any one of the frequencies stored in the memories), full DUPLEX and REVERSE DUPLEX operation, and a crystal controlled tone burst. Again the display is brighter and there is a LED Bar-type S-Meter and relative power outputer meter. The choice of the frequency steps is 25kHz and 5kHz. Like the IC-290 multi-scanning functions are available either from the front panel or remotely using the HM-10 scanning microphones.

Again we feel that this beautifully designed and constructed piece of equipment is bound to "sell like hot cakes" – and again remember that if you buy one directly from Thanet you will get a full two year's warranty and any work will be carried out in our excellently equipped workshop. One of our engineers has been out to ICOM in Japan for a two week course to learn the "tricks of the trade".

What about other new products? – well you may well ask but we won't be giving too much away just yet. But how about a 70cm version of the IC-2E and a fully automatic antenna tuner to start off with?

Buy direct from us and get two years warranty on all equipment

WE STOCK CUSHCRAFT ANTENNAS

			INC. VAT
H.F.			
A3	20/15/10	3ele Beam 8dB gain	£147.00
ATV5	80-10	Trapped Vertical	£74.40
ATV3	20/15/10	Trapped Vertical	£34.00
VHF (144MHz)			
A3219		19ele Long 'Boomer' Yagi 16.2dB gain	£62.00
214B		14ele Jnr 'Boomer' Yagi 15.2dB gain	£49.50
ARX2		Ringo Ranger 6dB gain vertical	£24.75
A144-4		4ele Yagi 9.0dB gain	£16.25
A144-7		7ele Yagi 10.0dB gain	£20.31
A144-11		11ele Yagi 11.3dB gain	£25.72
DX120		20ele Array 13.2dB gain	£47.20
ARX2B		Ringo Ranger II	£28.75
ARB2K		Conversion Kit for Ringo to Mk II version	£12.75

WE ALSO STOCK:–

J-BEAM ● MICROWAVE MODULES ● YAESU ● WESTERN RSGB BOOKS ● BEARCAT ● JIL ● TAL ANTENNAS ● VIDEO GENIE

Thanet Electronics

IC-251E

IC-2E

£169

£495

IC-451

£599

The Largest Selling Amateur Transceiver in the World

CHECK THE FEATURES:

FULLY SYNTHESIZED – Covering 144-145 99s in 400 5kHz steps.

POWER OUTPUT – 1.5W with fine 9V rechargeable battery pack as supplied – but lower or higher output available with the optional 6V or 12V packs.

BNC ANTENNA OUTPUT SOCKET – 50 ohms for connecting to another antenna or use the Rubber Duck supplied.

SEND/BATTERY INDICATOR – Lights during transmit, but when battery power falls below 6V it doesn't light indicating the need for a recharge.

FREQUENCY SELECTION – by thumbwheel switches, indicating the frequency.
+**5kHz SWITCH** – adds 5kHz to the indicated frequency.

DUPLEX SIMPLEX SWITCH – gives simplex or plus 600kHz or minus 600kHz Transmit.

HI-LOW SWITCH – reduces power output from 1.5W to 150mW reducing battery drain.

EXTERNAL MICROPHONE JACK – If you do not wish to use the built-in electret condenser mic an optional microphone/speaker with PTT control can be used. Useful for pocket operation.

EXTERNAL SPEAKER JACK – for speaker or earphone. This little beauty is supplied ready to go complete with nicad battery pack, charger, rubber duck.

A full range of accessories in stock

IC ML1	
10 Watt Mobile Booster for IC2E	**£49.00**
BPS 11 Volt Battery Pack	**£30.50**
BP4 Empty Battery Case For, 6 × AA Cells	**£5.80**
BP3 Standard Battery Pack	**£17.70**
BP2 6 Volt Pack	**£22.00**
BC30 Base Charger For Above	**£37.00**
BC25 Mains Charger As Supplied	**£4.25**
DC1 12 Volt Adapter Pack	**£8.40**
HM9 Speaker/Microphone	**£12.00**
CP1 Mobile Charging Lead	**£3.20**
IC1/2/3 Cases	**£3.60 each**

Icom produce a perfect trio in the VHF base station range ranging from 50 Metres thru 2 Metres to 70cms. Unfortunately you are not able to benefit from the 5M product in this country, but you CAN own the 215E for your 2 Metre station and the 415E for 70cms.

Both are really well designed and engineered multi-mode transceivers capable of being operated from either the mains or a 12 volt supply. Both contain such exciting features soan facilities, automatic selection of the correct repeater shift for the band concerned, full normal and reverse repeater operation, tuning rate selection according to the mode in use, VOX on SSB, continuous power adjustment capability on FM and 3 memory channels. Of course they are both fitted with a crystal controlled tone burst and have twin VFO's as have most of ICOMs fully synthesized transceivers. These two transceivers have now become really popular throughout the World – so why not pop a note on our ansafone for more details?

Thanet for ICOM

143 RECULVER ROAD, BELTINGE, HERNE BAY, KENT. TEL: (02273) 63859

NOW with TWO YEARS WARRANTY

PROFESSIONAL EQUIPMENT FOR THE AMATEUR

ICOM

IC720A
£849

The main problem that the amateur of today has to deal with is deciding just which rig out of the many excellent products available he is going to choose. Technology is advancing at such a rapid rate and getting so sophisticated that many cannot hope to keep up!

Perhaps one way of dealing with the problem is to look at just what each model offers in its basic form without having to lay out even more hard earned cash on "extras'. The IC720A scores very highly when looked at in this light. How many of its competitors have two VFOs as standard or a memory which can be recalled, even when on a different band to the one in use, and result in instant returning AND BANDCHANGING of the transceiver? How many include a really excellent general coverage receiver covering all the way from 100kHz to 30MHz (with provision to transmit there also if you have the correct licence)? How many need no tuning or loading whatsoever and take great care of your PA, should you have a rotten antenna, by cutting the power back to the safe level? How many have an automatic RU which conceals itself when the main tuning dial moved? How many will run full power out for long periods without getting hot enough to boil an egg? How many have band data output to automatically change bands on a solid state linear AND an automatic antenna tuner unit when you are able to add these to your station?

Well you will have to do quite a bit of hunting through the pages of this magazine to find anything to approach the IC-720-A. It may be just a little more expensive than some of the others – but when you remember just how good it is, and of course the excellent reputation for keeping their secondhand value you will see why your choice will have to be an IC-720A!

IC-2KL
£799 + psu

To complement the excellent IC720A HF Transceiver, ICOM have produced the IC2KL linear amplifier. It is of a similar size and matches the IC720A perfectly. It produces 500W output on SSB, CW, AM and RTTY, needing 80-100W of drive.

As with the IC720A it will operate from 1,6MHz to 30MHz continuously at full output power, but you still need an antenna that matches. It will follow the IC720A, automatically changing bands WITH NO TUNING – the operating is done from the prime mover. This automatic facility can be overidden for use on rigs other than the IC720A, but can be added to the IC701 and the IC720. The IC2KL employs a heat pipe cooling system for the heatsink of the power transistors.

This is a new technology used to transfer the heat, has a high conductance, several hundred times that of copper and a very quick response. The use of this system enables a very compact design for which ICOM is the leader.

This advanced design includes protection circuits against Mismatching, Overheating, Overcurrent, Overdriving, Over Output Power and the PA units unbalancing. Its spurious emissions are more than 60dB below peak power output and third order distortion more than 30dB below each tone of a two tone test could a valve linear ever be as good as this?

The IC2KL has a matching power supply the IC2KLPS delivering 40vDC at 25A continuous for 10 minutes maximum.

IC2KLPS (Power Pack) £199.00

AGENTS (PHONE FIRST – evenings and weekends only)

Scotland	Jack GM8GEC (031-665-2420)	Wales	Tony GW3FKO (0874 2772)
North West	Gordon G3LEQ (Knutsford (0565) 4040)	Midlands	Tony G8AVH (021-329-2305)
	Ansafone Service available		

Thanet for ICOM

TWO YEARS WARRANTY ON ALL EQUIPMENT

IC-730

£574

ICOM'S answer to your HF mobile problems – the JC730. This new 80m-10m 8 band transceiver offers 100W output on SSB, AM and CW.

Outstanding receiver performance is achieved by an up-conversion system using a high IF at 39MHz offering excellent image and IF interference rejection, high sensitivity and above all wide dynamic range. Built in Pass Band Shift allows you to continuously adjust the centre frequency of the IF pass band virtually eliminating close channel interference. Dual VFO's with 10Hz, 100Hz, and 1KHz steps allows effortless tuning and whats more a memory is provided for one channel per band. Further convenience circuits are provided such as Noise Blanker, Vox, CW Monitor, APC and SWR Detector to name a few. Provided the IC730 is kept connected to its supply its CPU will remember your instructions even when turned off! Built in fan keeps the finals cool and remember there is no tuning to be done. A built-in Speech Processor boosts talk power on transmit and a switchable RF Pre-Amp is a boon on todays crowded bands. Full metering, WWV reception and connections for transverter and linear control almost completes the IC730's impressive facilities. Use this rig as a high class mobile or with a suitable 13v psu as your main base station. Give us a ring and ask for a full spec. to be sent to you.

IC-202S

£169

The IC-202S is a very well designed 2m SSB portable. It offers 3W pep output on USB, LSB and CW. Large battery capacity (HP11 type) or Nicads if you wish. A special VXO circuit to provide smooth tuning and crystal stability needed for SSB operation on 2m; Each of the four 200kHz band positions allows operation anywhere in 2m (Supplied with 144-144.2 and 144.2-144.4). Top of the band Oscar xtals available for "crosspond working".

It has a DC socket and SO239 sockets for mobile or base station working barefoot or as a prime mover. Mobile mounting brackets, Nicad packs chargers, cases all available options. You must agree, a very versatile well proved rig. The 70cm twin of the 202S having very similar feature covering the frequency range of 432-435.2MHz. Their versatility is well worth an enquiry.

IC-24G

£169

The famous IC240 has been approved given a face lift, and renamed the IC24G. Many thousands of 240s are in use, and its popularity is due in part to simplicity of operation, high receiver sensitivity and superb audio on TX and RX. The new IC24G has these and other features. Full 80 channels (at 25kHz spacing) are available and read out is by channel number – selected by easy to operate press button thumbwheel switches. This readout can clearly be seen in the brightest of sunlight. Duplex and reverse duplex is provided along with a crystal controlled tone call Hi-10W and low-1W RF output is available along with a 12½kHz unshift should the new channel spacing be necessary. The old IC240 proved to be the most reliable ng we have ever sold – the IC24G, because it is so similar, looks like following the same pattern.

Remember, for mobile use a rig MUST be easy to operate to be safe. Send for technical details.

Thanet Electronics

143 RECULVER ROAD,
BELTINGE, HERNE BAY, KENT
TEL: 02273 63859

ICOM

FAMOUS LOUDSPEAKERS

Post £2

MAKE	model	size	watts	ohms	price
Seas	Tweeter	4in	50	8	£7.50
Goodmans	Tweeter	3½in	25	8	£4.00
Audax	Tweeter	3½in	60	8	£10.50
Seas	Mid-Range	4in	50	8	£7.50
Seas	Mid-Range	5in	80	8	£12.00
Seas	Mid-Range	4½in	100	8	£12.50
Goodmans	Full-Range	5½in	15	8	£6.50
Goodmans	Full-Range	8in	30	8	£12.50
Seas	Woofer	8in	30	8	£14.00
Rigonda	Full-Range	10in	15	8	£5.50
Goodmans	Audiom	12PG	60	8	£20.00
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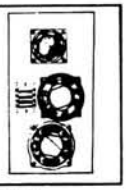

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53	.0022/400v	10	63	.33/100v	15
54	.0033/400v	10	64	.47/250v	22
55	.0047/400v	10	65	.68/100v	15
56	.01/630v	10	66	1.0/100v	15
57	.022/250v	10		**All at 12p**	
58	.033/250v	10	67	1.5/100	22
59	.047/100v	10	68	2.2/100	22
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33 1	13x6	43	2.2/63v	11x5	3p
34 2.2	13x6	44	4.7/63v	11x6	5p
35 3.3	13x6	45	10/63v	12x8	7p
36 4.7	13x6	46	22/35v	13x8	5p
37 6.8	13x7	47	47/35v	12x10	5p
		48	100/25v	13x10	3p
All at 10p		49	220/35v	17x10	9p
38 10	19x7	50	470/6v3	20x10	11p
39 22	19x9				
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79	1.0	20	35	9p★	86	22	20	35	36p★
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BC109C	12p	BFY50	19p	2N1711	19p
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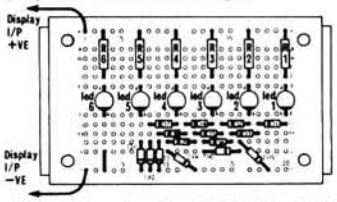

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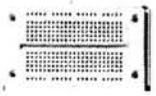

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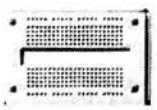

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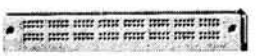

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	2X029	220	0.22	
	2X030	240	0.20	
80va 90 × 30mm 1 Kg regulation 12%	3X010	6 + 6	6.64	£5.47 + £1.43 P&P + 1.04 V.A.T.
	3X011	9 + 9	4.44	
	3X012	12 + 12	3.33	
	3X013	15 + 15	2.66	
	3X014	18 + 18	2.22	
	3X015	22 + 22	1.81	
	3X016	25 + 25	1.60	
	3X017	30 + 30	1.33	
	3X028	110	0.72	
	3X029	220	0.36	
	3X030	240	0.33	
120va 90 × 40mm 1.2 Kg regulation 11%	4X010	6 + 6	10.00	£6.38 + £1.43 P&P + £1.17 V.A.T.
	4X011	9 + 9	6.66	
	4X012	12 + 12	5.00	
	4X013	15 + 15	4.00	
	4X014	18 + 18	3.33	
	4X015	22 + 22	2.72	
	4X016	25 + 25	2.40	
	4X017	30 + 30	2.00	
	4X018	35 + 35	1.71	
	4X028	110	1.09	
	4X029	220	0.54	
	4X030	240	0.50	

TYPE	SERIES NO	SECONDARY Volts	R.M.S Current	PRICE
160va 110 × 40mm 1.8 Kg regulation 8%	5X011	9 + 9	8.89	£8.44 + £1.43 P&P + £1.48 V.A.T.
	5X012	12 + 12	6.66	
	5X013	15 + 15	5.33	
	5X014	18 + 18	4.44	
	5X015	22 + 22	3.63	
	5X016	25 + 25	3.20	
	5X017	30 + 30	2.66	
	5X018	35 + 35	2.28	
	5X026	40 + 40	2.00	
	5X028	110	1.45	
	5X029	220	0.72	
	5X030	240	0.66	
225va 110 × 45mm 2.2 Kg regulation 7%	6X012	12 + 12	9.38	£10.06 + £1.73 P&P + £1.77 V.A.T.
	6X013	15 + 15	7.50	
	6X014	18 + 18	6.25	
	6X015	22 + 22	5.11	
	6X016	25 + 25	4.50	
	6X017	30 + 30	3.75	
	6X018	35 + 35	3.21	
	6X026	40 + 40	2.81	
	6X025	45 + 45	2.50	
	6X028	110	2.04	
	6X029	220	1.02	
	6X030	240	0.93	
300va 110 × 50mm 2.6 Kg regulation 6%	7X014	18 + 18	8.33	£11.66 + £1.73 P&P + £2.01 V.A.T.
	7X015	22 + 22	6.82	
	7X016	25 + 25	6.00	
	7X017	30 + 30	5.00	
	7X018	35 + 35	4.28	
	7X026	40 + 40	3.75	
	7X025	45 + 45	3.33	
	7X033	50 + 50	3.00	
	7X028	110	2.72	
	7X029	220	1.36	
	7X030	240	1.25	

TYPE	SERIES NO	SECONDARY Volts	R.M.S Current	PRICE
500va 140 × 60mm 4 Kg regulation 4%	8X017	30 + 30	8.33	£15.53 + £2.05 P&P + £2.64 V.A.T.
	8X018	35 + 35	7.14	
	8X026	40 + 40	6.25	
	8X025	45 + 45	5.55	
	8X033	50 + 50	5.00	
	8X042	55 + 55	4.54	
	8X028	110	4.54	
	8X029	220	2.27	
	8X030	240	2.08	
625va 140 × 75mm 5.0 Kg regulation 4%	9X017	30 + 30	10.41	£21.54 + £2.20 P&P + £3.56 V.A.T.
	9X018	35 + 35	8.92	
	9X026	40 + 40	7.81	
	9X025	45 + 45	6.94	
	9X033	50 + 50	6.25	
	9X042	55 + 55	5.68	
	9X028	110	5.68	
	9X029	220	2.84	
	9X030	240	2.60	

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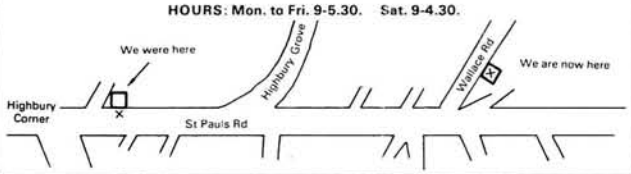

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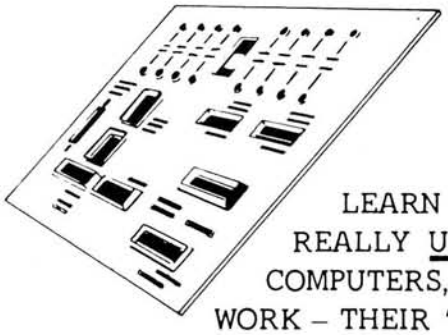

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70FM05TR In case you missed October's review of this single channel FM transceiver for 70 cms here are a few details. The receiver sensitivity is typically 0.4μV and uses dual gate MOSFETS and a high quality crystal filter. *The audio output drives an 8Ω speaker.* The transmitter gives 500mW of RF and has a modulator on the pcb. Both boards use readily available crystals and measure a very compact 6" by less than 1¼".
Kit RX £38.50 TX £17.80 — Assembled RX £47.25 TX £25.95

70MC06TR When one channel is not enough then by adding this two pcb set you will have 6 channels on tx/rx. This includes a toneburst for repeaters and a scanner to ease monitoring.
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AR8	0.75	ECL80	0.70	EY88	0.65	PL81	1.25	JBL1	1.25	5U4G	0.75	6F17	1.15
ARP3	0.70	ECL82	0.75	EZ80	0.70	PL82	0.85	UBL21	1.75	5V4G	0.75	6F23	0.75
ATP4	0.60	ECL83	1.40	EZ81	0.70	PL83	0.70	UCC84	0.85	5Y3GT	0.80	6F24	1.75
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DH76	0.75	EF80	0.65	KT88	9.20*	PY33	3.20	UF85	0.95	6AG5	0.60	6J5	2.30
DL92	0.60	EF83	1.75	MH4	8.95	PY80	0.70	UL41	1.50	6AH6	1.15	6J5GT	0.90
DY86/87	0.65	EF85	0.60	ML6	13.80*	PY81/800	0.80	UL84	0.95	6AK5	0.65	6J6	0.65
DY802	0.65	EF86	0.75	N78	2.50	PY82	0.65	UM80	0.90	6AK8	0.60	6J6W	0.90
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E88CC/01	3.10	EF95	0.65	PABC80	0.80	PY500	1.70	UY85	0.85	6AM5	4.20	6J9	1.20
E92CC	1.20	EF96	0.80	PC85	0.75	PY809	6.45	VR105/30	1.25	6AM6	1.50	6J9E6C	2.95
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E180F	6.30	EF184	0.80	PC88	0.95			X66	0.95	6AQ4	3.40	6K7G	0.50
E182CC	4.95	EF804	4.95					X61M	1.70	6AQ5	1.00	6K8G	0.65
EA76	2.25	EFB12	0.75					XR1-6400A	82.90	6AQ5W	1.80	6L6M	2.80
EABC80	0.60	EFL200	1.85					Z759	9.00	6AS6	1.15	6L6G	2.50
EB91	0.60	EH90	0.85					Z749	0.75	6AT6	0.90	6L6GC	2.10
EBC33	1.15	EL32	1.10					ZR00U	3.45	6AU6	0.60	6L6GT	1.25
EBC90	0.90	EL34	1.80					Z801U	3.75	6AV6	0.85	6L7G	0.65
EBF80	0.60	EL37	4.40					Z803U	3.95	6AX4GT	1.30	6L18	0.70
EBF83	0.60	EL38	4.60					Z900T	2.45	6AX5GT	1.30	6LQ6	2.95
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EC52	0.65	EL81	0.95					1L4	0.50	6BA6	0.55	6SA7	1.00
EC91	3.40	EL82	0.70					1R5	0.60	6BE6	0.60	6SK7	0.95
EC92	0.85	EL84	0.80					1S4	0.45	6BG6G	1.60	6SL7GT	0.85
ECC81	0.65	EL86	0.95					1S5	0.45	6BJ6	1.30	6SN7GT	0.80
ECC82	0.60	EL90	1.00					1T4	0.45	6BQ7A	0.85	6SR7	1.10
ECC83	0.65	EL91	4.20					1U4	0.80	6BR7	4.40	6SQ7	0.95
ECC84	0.60	EL95	0.80					1X2B	1.40	6BW6	5.20	6V6G	1.50
ECC85	0.60	EL504	1.70					2D21	0.90	6BW7	0.90	6V6GT	0.95
ECC86	1.40	EL509	2.70					2K25	11.90	6C4	0.50	6X4	0.75
ECC88	0.80	EL802	1.70					2X2	1.15	6C6	0.55	6X4WA	2.10
ECC189	0.95	EL821	8.20					3A4	0.70	6CH6	8.20	6X5GT	0.65
ECC804	0.90	EL822	9.90					3D6	0.50	6CL6	1.70	6Y6G	0.90
ECF80	0.85	EM31	1.60					3D22	23.00	6CY5	1.15	6Z4	0.70
ECF82	0.65	EM80	0.85					3E29	10.00	6D6	0.70	7B7	1.15
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ECH35	1.70	EM87	1.15							6F6GB	1.10	9D6	2.90
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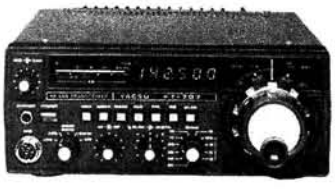

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★ FT101ZAM £515 ★ FT101ZDFM £599

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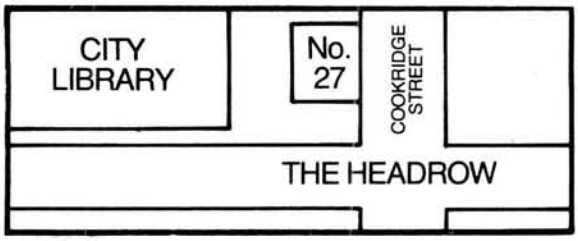

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VHF For All

At last, the BBC has decided to re-arrange its v.h.f. services to give a better coverage for mobile and portable set users and to end the sharing of transmitters by incompatible services.

The BBC now recognises that the future of broadcasting in the UK lies with v.h.f. and not medium and long wave. So far, however, v.h.f. has not taken off with the listening public in the UK for a variety of reasons. Reception is not always satisfactory on portable and car radios, and there are significant gaps in the existing v.h.f. coverage.

However, the most serious defect in the v.h.f. system is the enforced sharing of programmes. This is something the BBC is compelled to do to try to squeeze a quart into a pint pot as there are more BBC services than available channels in the present allocation. The recent BBC Radio Network Working Party has recommended that all services shall be available on v.h.f. by the end of the eighties.

These proposals come up against a big problem in the UK—the use of the 100MHz to 108MHz part of the v.h.f. broadcast band by services such as the police and fire services. The Managing Director of BBC Radio, Mr Aubrey Singer, has stated that the BBC will now go all out to get these services removed and the top of Band II used for its internationally agreed purpose—domestic broadcasting.

The problems with poor reception by portable sets and car radios can be traced back to the 50's when the BBC, in its wisdom, envisaged only hi-fi receivers with properly installed antennas on the roof. Horizontal polarisation was chosen on its technical merits with little thought given to future developments in radio technology. Unfortunately, portables and car radios use vertical antennas and this does not give the best results with the present transmitters. The BBC has now woken up to the problems and has decided to take advantage of the need to replace or update its present ageing transmitters by adding an equal power, vertically polarised signal to give every user the optimum signal into his antenna. The holes in the v.h.f. coverage are also to be filled in by relay stations to give a good signal to all but 0·3 per cent of the population.

To put these proposals into action, the United Kingdom must negotiate with other countries at the forthcoming International VHF Planning Conference in 1982, and will not be able to achieve the optimum plan unless it can co-ordinate its timetable with that of its West European neighbours. At present, part of the v.h.f. broadcasting band in the UK is still being used for mobile communication, notably for the fire and police services. They will need to be moved to quite different frequencies where they can operate just as effectively. According to the Crawford and Annan Reports, the move should have happened by now. However, the change could be as late as 1990 for part of the band and 1995 for the remainder. The BBC believes that the date should be brought forward to about 1986 to coincide with the date when other countries are expected to implement the new plan resulting from the '82, '84 conference. After all, these other services will be moving to a different part of the spectrum anyway—the big question is, how soon? The timing could make a critical difference to the benefit which the United Kingdom can derive from the outcome of the conference.

We can only hope that the BBC does manage to persuade the Home Office to clear the top of Band II so that it can be used for its rightful purpose and allow each programme to have its own separate transmitter.

services

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.

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 to both home and overseas addresses at £11.80 per annum, from **"Practical Wireless" Subscription Department, Room 2613, 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 95p each, including post and packing to addresses at home and overseas.

Binders are available (Price £4.30 to UK addresses and overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

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NEWS NEWS NEWS

RAE Courses

Courses to prepare students for the Radio Amateurs Examination (City and Guilds 765) will be available at the following locations:—

Birkenhead—*North Wirral College of Technology, Borough Road, Birkenhead, Wirral,* commencing during the week beginning 14 September. Enrolment 7, 8 and 9 September. Details from the Senior Lecturer, D. E. Owen G4GGB, Department of Electrical Engineering at the college, tel: 051-653 5555 Ext. 230.

Newcastle upon Tyne—*Gosforth Adult Association, Gosforth Secondary School, Gosforth, Newcastle upon Tyne,* on Tuesdays between 19.00 and 21.00hrs. Commencing in September, the Lecturer will be D. R. Loveday G3FPE and details are available from the Principal at the school or tel: (0632) 668439.

Bracknell—*Bracknell College, Department of Engineering & Science, Church Road, Bracknell, Berks.,* commencing 28 September. Enrolment 10, 11 and 14 September. Course Tutor will be G8KIL, further details from the college, tel: (0344) 20411.

Manchester—*Pendlebury High School, Cromwell Road, Swinton,* on Thursdays at 19.50hrs, commencing 1 October. Enrolment during week beginning 14 September. Details from Course Instructor, P. Whatmough G4HYE, tel: 061-794 3706.

Hemel Hempstead—*Dacorum College, Marlowes, Hemel Hempstead, Hertfordshire HP1 1HD,* commencing Wednesday 23 September between 18.30 and 21.00hrs. Enrolment 7 September. Further details from the Course Organiser, C. B. Burke G3VOZ, tel: (0442) 833300.

Durham—*New College, Durham,* commencing in September. Details are available from G3ZJY, QTHR, tel: (0385) 66773.

Bradford—*School of Technology and Design, Electrical & Electronic Engineering Division, Bradford College, Great Horton Road, Bradford, West Yorkshire BD7 1AY,* commencing September. Classes are normally held on Mondays, with Tuesdays available if enrolment numbers permit two classes to be run. Further details from the Course Tutor, P. Nurse G8ZXF, tel: (0274) 34844.

Nottingham—*Hucknall Further Education Centre, Portland Road, Hucknall, Nottingham,* on Mondays between 19.00 and 21.00hrs. Enrolment 14 September between 18.00 and 20.00hrs and the Course Tutor will be Alan Lake G4DVW.

Arnold and Carlton CFE, Digby Avenue, Mapperley, Nottingham, on Wednesdays between 19.00 and 21.00hrs. Enrolment 14, 15 and 16 September between 14.00 and 20.00hrs and the Course Tutor will be Alan Lake G4DVW.

Sutton Centre, High Pavement, Sutton-in-Ashfield, Nottingham, on Tuesdays. Enrolment 15 September between 19.00 and 21.00hrs and the Course Tutor will be Jack Tomlinson G3KTX.

West Bridgford CFE, Greythorn Drive, West Bridgford, Nottingham, on Mondays. Enrolment 14 and 15 September from 14.00 to 16.00 and from 18.00 to 20.00hrs and the Course Tutor will be Geoff Dover G4AFJ.

Belfast—*College of Technology, College Square East, Belfast BT1 6DJ,* on Tuesdays between 17.30 and 20.30hrs and on Thursdays between 18.00 and 20.00hrs, commencing 15 September. Enrolment early September and the Course Lecturer will be J. E. Wilson GI2BX.

Weybridge—*Brooklands Technical College, Heath Road, Weybridge KT13 8TT,* on Wednesdays between 18.45 and 20.15hrs. Enrolment 7, 8 and 9 September, between 18.00 and 20.00hrs. Details from Mike Tooley G8CKT at the Department of Technology at the college, tel: (0932) 53300 Ext. 215/246.

North London—*Hendon College of Further Education, Silkstream Road, Burnt Oak, Edgware, Middlesex HA8 0DA.* Starting in September, the Course Organiser will be C. Holford. Details from the Department of Science and Technology at the college.

Leamington Spa—*Mid-Warwickshire College of Further Education, Warwick New Road, Leamington Spa CV32 5JE,* on Thursdays commencing 17 September. Enrolment 3 and 4 September from 09.00 to 12.00 and 14.00 to 16.00 and 18.00 to 20.00hrs. Further details from C. A. Smith, Department of Engineering at the College, tel: (0926) 311711.

Mobile Repeater?

Following 18 months of negotiations the Dorset 2m repeater on R1, GB3SC, finally went mobile and relocated to a new site in Central Bournemouth at the beginning of June.

After frantic preparation activity prior to the move, the repeater group members were surprised and relieved to obtain full talk-through within 75 minutes after closedown at the original location.

Although GB3SC is only 70m a.s.l. (the lowest sited 2m repeater operational in the UK) the choice of the new site has been fully justified in terms of servicing its allocated area without the often encountered excursions into already well served locations.

Group secretary, John Fell G8MCP, QTHR, welcomes reports from users or s.w.l.s and the group would be prepared to assist other groups of would-be repeater constructors.

Technical Books for the Amateur

The British Amateur Teleprinter Group has recently published a fully revised and re-illustrated 4th edition of their popular book titled "RTTY—The Easy Way."

Designed to take the reader, with no experience of r.t.t.y., from basic principles through to becoming a proficient operator, the book includes sections on suitable equipment, operating techniques and complete constructional data for building a suitable terminal unit.

Costing only £1.00 plus 15p postage, the book is obtainable from: *BARTG, 100 Normandy Avenue, Beverley, North Humberside HU17 8PF.*

The "Amateur Television Handbook" is a CQ-TV publication, produced by the British Amateur Television Club and written by John L. Wood G3YQC and Trevor Brown G8CJS.

The book is intended to deal in greater depth with the more complex and generally less-well publicised techniques used in the modern amateur TV station.

The handbook costs £2.00 plus 35p postage and is available from: *BATC Publications, 14 Lilac Avenue, Leicester LE5 1FN.*

EXEceptional Response

Activity on the 3cm amateur microwave band should increase dramatically if the sales of *PW* parabolic dishes are anything to go by. Members of *PW's* technical staff are seen here with a consignment of dishes awaiting collection by the Post Office from the Poole offices. From the back are G8ZPW, G8MCP, G4LFM and G8VFH. Almost 500 dishes have been sold and orders are still rolling in. For details of the dish offer see page 73.

Amateur Radio Supplies

Auto Marine Development Company originally set up to serve the radio market for cars, boats etc. has expanded substantially into the Amateur Radio field.

So much so that the company have recently opened a new showroom and are officially appointed Yaesu agents for the Greater Manchester Area. They also hold agencies for Microwave Modules, Jaybeam, TAL, Sota, Shure, Bantex, Mosley, LAR, Western and are area dealers for the complete Cushcraft range of antennas.

A catalogue is available from: *Auto Marine Development Company, 60 Orlando Street, Bolton BL2 1DU. Tel: (0204) 21059.*

Rallies and Events

Swindon and District Amateur Radio Club will be holding their Radio & Electronics 81 on Sunday 23 August at Park School, Marlowe Avenue, Swindon.

There will be talk-in on S22 and SU8, plus all the regular attractions. Further details from: *Ken Saunders G8SFM, QTHR.*

Torbay Amateur Radio Society G3NJA-G8IUI, has organised their Rally at the ITT Social Centre, Paignton, Devon on Sunday 30 August 1981.

Included among the usual rally attractions will be trade shows, refreshments and bar facilities. Further details from: *The Secretary, G4DZH, QTHR.*

News from Icom

Several owners of the Icom IC-720A have complained that a very strong signal from a Spanish station, operating on half their i.f. frequency, has been breaking through on their sets when they try to operate on 21MHz. Thanet Electronics Ltd. now have in stock plug-in filters that will cure the problem.

Thanet has also announced that they will soon have in stock a 70cm version of the IC-2E and that will soon be followed by marine and p.m.r. versions. It certainly looks as though Icom got it right when they designed the IC-2E because it has just been officially announced that this rig has now sold worldwide more than any other in the history of amateur radio.

Thanet Electronics Ltd., 143 Reculver Road, Beltinge, Herne Bay, Kent. Tel: (022 73) 63859.

Chalk Pits Museum

Once again the Chalk Pits Museum held another successful "Radio Communications Day" on Sunday 7 June. Among the many exhibitors were both static and active displays.

Margaret Brownlow spent most of her day operating GB2CPM despite the generally poor h.f. conditions, whilst the Sussex Repeater Group worked 40 stations during the 6 hours the museum was open.

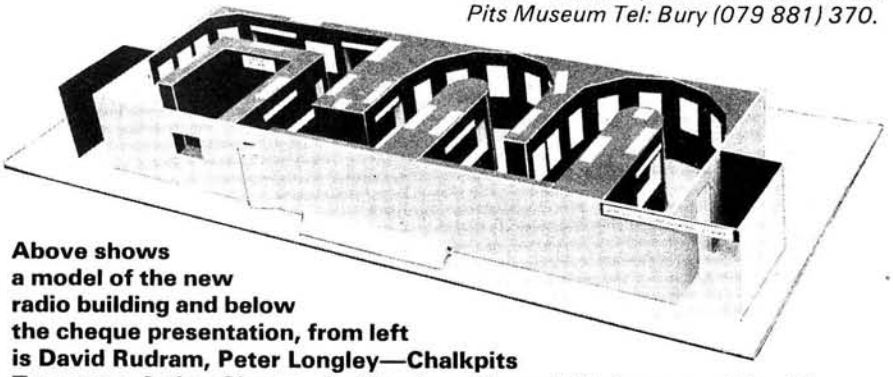
One exhibit that created a great deal of interest was the amateur television display by the Worthing and District Radio Club. They had two mobile units operating on 70cm exchanging pictures with G8XEU stationed outside the old radio building. Many visitors were fascinated to see themselves on the screen. Roy Bray and Ray Davis spent all their time wandering around filming with a colour Akai camera and a National Panasonic Video.

The real highlight of the day was the handing over of a £3654.00 cheque from the Horsham District Council for the new radio building. Appropriately a model of the new building was placed by the entrance of the very old and leaking "temporary" hut. Work will be starting on the new building at the end of the year ready for the Radio Communications Days next year.

At the end of the day the exhibitors and members of the *PW* team were privileged to see a film by Bill Glue called "Radio Times". With this two part film Bill has won the Movie Maker 10 Best Films Award. It was a very professionally made film and well worth a visit if your club gets the chance to show the film.

It takes you through from the very beginnings of radio to the second world war, complete with authentic sounding recordings to go with it, just going to prove how hard Bill worked to produce this documentary.

Another Radio Communications Day is planned for 27 September. For further details please contact: *Chalk Pits Museum Tel: Bury (079 881) 370.*



Above shows a model of the new radio building and below the cheque presentation, from left is David Rudram, Peter Longley—Chalkpits Treasurer, Arthur Sheppard—Horsham Council Chairman and Ron Ham

INTRODUCING SSTV PART 2

M.J.AXSON BA G8WHG

Part 1 of this series considered the basic principles of SSTV with a brief outline of the currently available techniques. In this part we continue with an examination of scan conversion.

Fast to Slow-Scan Conversion

Before investigating the contents of the 'black boxes' used to convert fast-scan video signals to slow-scan standards, and vice versa, we should consider the parameters of fast-scan, with particular reference to the British 625 line system with 25 frames per second.

Actually only about 572 lines containing video information are transmitted, the time period during which the others would be sent being used for the transmission of the frame sync pulses and various control data, including a two line period for Teletext. In order to eliminate flicker, each frame is sent in two parts or fields, the first consisting of the odd numbered lines and the second the even numbered lines. These are then interlaced to produce the complete frame as shown in Fig. 8. Thus the field frequency is 50 Hz, the same as the mains frequency, and each field contains approx 285 lines of video information.

Comparing this with the SSTV standard of 120 lines per frame (although, for reasons which will emerge later, 128 lines is becoming the accepted norm), using every other line of the field will give approx 143 lines per frame. The slight loss of picture area can be compensated for by suitable masking of the camera viewfinder.

Various methods of scan conversion will be considered, but one factor common to all of them is that digital techniques are used. Conventional radio and TV systems employ analogue means to represent the signals. A typical analogue signal of a single line of video information is shown in Fig. 9 and it will no doubt be very familar. This works well in a real-time situation, but this is not the case in scan conversion. A fast-scan camera will output the video data for one line in $1 \div 625 \times 25$ secs = 64 microsecs. This has to be stored so that it can be transmitted over a period of $7{\cdot}2 \div 120$ secs = 60 millisecs, a ratio of 937·5:1. The converse occurs in the receive situation, the slow-scan video data for one line being received over a period of 60 millisecs, stored, and then output to the fast-scan receiver in 64 microsecs.

Fig. 8: Interlace of scanning lines

Theoretically, the input data could be stored on tape, which is then re-run faster, or slower, by a factor of 937·5:1, but this is not a very practical solution! There is no satisfactory way in which a continuously varying voltage can be stored at one speed and then be output at another speed differing by a factor of nearly 1000.

It will be seen from Fig. 9 that the analogue video signal varies between limits of 0V and 15V, and that a continually varying output is obtained. The line could however be divided up into a series of discrete locations, each being called a picture element, or pixel for short. Fig. 10 illustrates the principle for a line divided into 20 pixels. The average voltage in the analogue signal corresponding to each pixel is now read and rounded down to a whole number; e.g. 0·9V = 0V, 8·2V = 8V and so on.

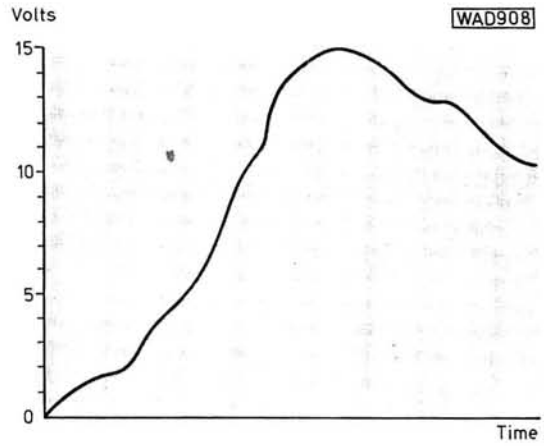


Fig. 9: An analogue signal of one line of video

Applying this principle to Fig. 9 gives the result shown in Fig. 11. The video information contained in the line can now be represented by a series of numbers, which in this case are:

0, 1, 1, 2, 3, 4, 5, 8, 10, 12, 14, 15, 14, 14, 13, 12, 12, 11, 11, 10.

Note that 0 represents black and 15 white so that we can reproduce a total of 16 tones of grey from black to white.

SSTV picture received by PW contributor Sam Faulkner

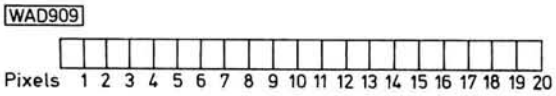


Fig. 10: Dividing the line into 20 pixels

The information to be recorded has now been reduced from a continuously varying signal to one made up of 16 distinct values, which is better but still not quite right, for it is not very easy to devise electronic circuits which will recognise as many as 16 different values and reproduce them rapidly and accurately.

What is easy to recognise is just two values, ON and OFF, or in digital language, 1 and 0. Thus instead of representing the different grey levels in decimal form, they are transformed to binary form; Table 2 shows the binary equivalents for decimal 0 to 15. Now the video information is contained in a series of 4-bit binary words, which can be handled very easily by digital electronic circuitry.

The line of video information in Fig. 11 will now be made up of 20 4-bit words: 0000, 0001, 0001, 0010, 0011, 0100, 0101, 1000, 1010, 1100, 1110, 1111, 1110, 1110, 1101, 1100, 1100, 1011, 1011, 1010.

Therefore the first task of the 'black box' fast to slow-scan converter is to transform the analogue output from the fast-scan camera into digital form, so one of the first circuits in the 'black box' will be a parallel analogue to digital (A–D) converter. Fig. 12 shows a circuit for a 2-bit A–D converter which could handle 4 different grey levels.

The incoming video signal is applied to a bank of comparators where it is compared with a reference voltage. If the video level is below 4 volts, all comparator outputs will be low. If more than 4 volts but less than 8 volts, A will go high with B and C remaining low. If more than 8 volts but less than 12 volts, A and B will be high and C low, whilst above 12 volts all outputs will be high.

These outputs are then applied to the encoder to produce a 2-bit binary word. If the video signal is below 4 volts or between 8 and 12 volts the least significant bit generated by the logic circuit will be 0. Between 4 and 8 volts and above 12 volts it will be 1. The most significant bit will be 1 when the voltage is above 8 volts. Table 3 summarizes the output of the 2-bit A–D converter.

In order to handle the 16 grey levels, the principle is simply extended by using a bank of 15 comparators and extending the logic circuitry of the encoder to produce the binary equivalents for 0 to 15 volts as shown in Table 2. It

Table 2

Decimal	Binary
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

Table 3

Voltage	MSB	LSB
0 to 3·9	0	0
4 to 7·9	0	1
8 to 11·9	1	0
12 plus	1	1

is of course not necessary to build up a circuit from discrete components since complete A–D converters are available in standard d.i.l. packages, but it is worth while understanding the principles on which they operate.

The simplest form of fast to slow-scan converter is a line converter which, as the name implies, takes one line of video output from the camera, converts it to slow-scan standards for transmission and then returns to repeat the process until the whole 128 line frame has been completed. Fig. 13 shows the block diagram for such a converter.

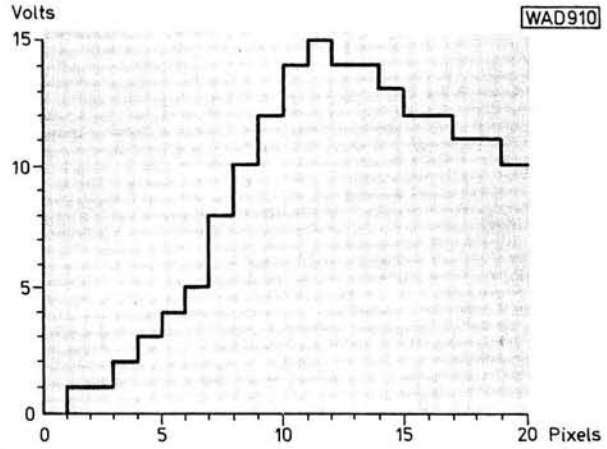


Fig. 11: Digital representation of signal

Video from the fast-scan source is applied to the video stage where the video level is controlled between the required black and white levels. The signal is also fed to the sync separator and the fast-scan sync pulses are used to trigger the fast-speed clock which allows the digitised video information for one line to move from the A–D converter into the shift-register memory.

continued on page 39▶▶▶

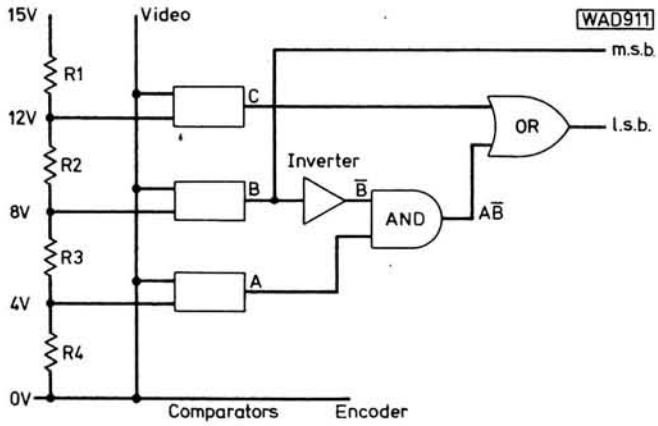


Fig. 12: 2-Bit A-D Converter

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Everybody knows the story of Luigi Galvani and the frogs' legs. They don't? Well, it all began back in the 18th century when Mrs Galvani was preparing a tasty dish of frogs' hind legs for her husband's lunch. He was fond of them. Mrs G noticed that whenever she touched a skinned frog's leg with a metal implement, the leg jumped. So did Mrs Galvani!

She told her husband about it. But he still ate the frogs' legs. All except one—which he selflessly spared in the interests of science. Into its thigh muscles he implanted two metal electrodes, and to them he applied a weak current from a primitive wet battery. Straightaway the frog's leg jumped, Galvani didn't—his wife had told him what to expect.

Some months later, Galvani sat idly cranking the handle of an electrical machine, generating a stream of sparks. He often did this because it frightened his mother-in-law. Suddenly, he noticed that a frog's leg lying nearby was jumping like crazy, although there was no direct electrical connection to it. I should explain here that since his wife's discovery, Galvani always kept a few frogs' legs lying around the house in case of developments. They also came in useful as snacks, if the cat didn't get them first.

Now Galvani was too dumb to notice it—and I bet you didn't twig it either—but he had just discovered radio. Yep, one full century before Heinrich Hertz, who got all the credit anyway, Galvani had lighted on the main principle of wireless transmission. How so? Like this; the sparks from the electrical generator emitted electromagnetic waves, these were collected by the electrodes in the thigh muscle, and the nerve fibres and muscle salts combined to act as a detector of the waves. And Galvani missed it! He was lucky Mussolini wasn't around yet.

At this point we say *addio* to Luigi Galvani and skip a century and a half. Which brings us to around 1918 and to Dr Lefeuvre, a professor at the University of Rennes, France. France? Okay, so he was a *frog*—that's got that out of the way.

Dr Lefeuvre decided to hook-up a radio utilising Galvani's discoveries. From the output terminals of a crystal set he led two wires to a newly killed frog mounted spread-eagled on a vertical panel. Alright, the frog had just been *croaked*—no more puns **please.** Lefeuvre connected the wires to a nerve of the frog's thigh muscle. Then he tied one end of a thread around its kneecap and the other end to a pivoted lever mounted below the frog. Are you all following Daddy? There's only one thing more; the lever was able to inscribe on a smoked paper sleeve surrounding a revolving drum. Something like a seismograph except it didn't need an earthquake to operate it, a bolt of lightning would do.

All set to make a test run, Dr Lefeuvre tuned-in his brainchild to FL. No indelicacy is intended by the use of these letters, they're the callsign of France's most powerful transmitter, the Eiffel Tower. In France, Eiffel is pronounced "eff-ell", FL—get it? Move down the class!

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Radio FL didn't have particularly interesting programmes. All it did was broadcast time signals in Morse. But that was fine by Dr Lefeuvre. The time signal impulses acted on the thigh muscle nerve, the muscle contracted and expanded, and the leg kicked accordingly. I haven't finished yet. The thread from the kicking leg then

continued on page 57 ▶▶▶

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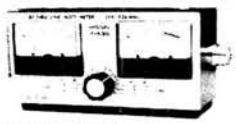

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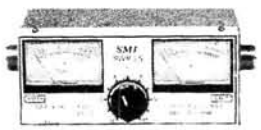

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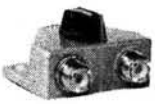

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Hitachi HA11225 & Toko KB4441 FM Receiver Devices

The Hitachi HA11225 and the Toko KB4441 are direct pin-for-pin equivalents which are convenient to consider together in this article, even though they originate from two different manufacturers. These devices are high-performance f.m. limiter-demodulators rather similar to the CA3089 and CA3189 types, both in their connections and in their performance.

The main sections of these chips comprise a high gain 10·7MHz intermediate frequency amplifier which feeds a quadrature detector requiring a single- or double-tuned circuit. The output from the quadrature detector is taken to an audio pre-amplifier stage. The i.c.s. incorporate circuitry specifically designed for providing automatic gain control (a.g.c.), automatic frequency control (a.f.c.), muting when tuning between stations (so that the inter-station hiss noise does not reach the output), tuning meter circuitry and signal strength meter circuitry.

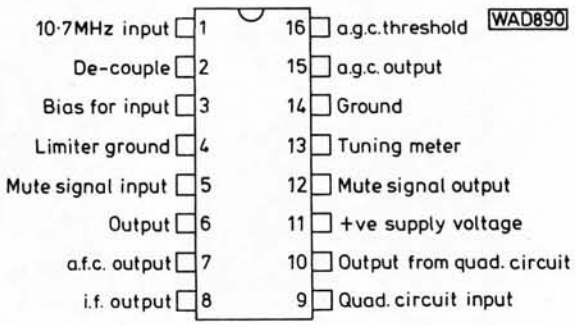


Fig. 1: Connections of the HA11225 and KB4441 devices

Circuit

The connections for the HA11225 and KB4441 devices are shown in Fig. 1 and a typical circuit in Fig. 2. The input to the circuit is obtained from a f.m. front-end unit (which it is much more convenient to purchase than to make, unless one has had experience of 100MHz circuit construction). The output from the front-end unit is the 10·7MHz intermediate frequency signal which is passed through 10·7MHz ceramic filters to provide selectivity before it is passed to pin 1 of the Fig. 2 circuit. The bias voltage from pin 3 passes through the 330Ω resistor to bias pin 1 at the correct point.

The amplified and limited 10·7MHz signal from pin 8 is passed through the 22μH choke shown to the quadrature tuned circuit which is damped by the 3·9kΩ resistor; the value of the latter has been chosen to provide about the optimum compromise between signal-to-noise ratio and distortion.

The audio output is taken from pin 6. The output impedance at this pin is about 5kΩ, but is increased to nearly 10kΩ by the 4·7kΩ output resistor. Thus a 4·7nF capacitor to ground is required in the output circuit to provide the normal 50μs de-emphasis time-constant ($10\,000 \times 4{\cdot}7 \times 10^{-9} = 50 \times 10^{-6}$ approximately). The 100nF output capacitor is employed to prevent any steady voltage from pin 6 being fed to the succeeding audio amplifier circuit.

It is important to note that the de-emphasis circuit comprising of the 4·7kΩ resistor and 4·7nF capacitor should be connected as shown only for monaural use. If a stereo signal is required, these components should be omitted and the 100nF capacitor connected directly to pin 6. The other side of the capacitor will be connected to the input of the stereo decoder circuit which, incidentally, will contain two 50μs de-emphasis circuits, one for each channel.

Muting

The output from pin 12 is a voltage, part of which is fed back to pin 5 so as to mute the circuit when one is tuning between stations. The signal level at which muting commences can be varied by means of the 10kΩ potentiometer. When the signal fed to pin 1 is at a level above this muting threshold, no muting will occur, but signals appreciably smaller than the threshold will not produce significant audio output.

An a.g.c. signal may be taken from pin 15 if required, but if a.g.c. is not to be used the extra connection to pin 15 may be omitted. Similarly, an a.f.c. signal may be taken from pin 7 if required (although various types of front-end require different types of a.f.c. signal).

The tuning meter will provide a zero reading when a signal is correctly tuned provided that the quadrature circuit is also correctly tuned. The use of this meter is optional. The signal strength meter in the pin 13 circuit can provide an indication of a very wide level of inputs, since it has a logarithmic response; the inclusion of this meter is also optional. The variable resistor in the pin 13 circuit sets the signal level at which an a.g.c. voltage is first applied to the tuner circuit from the a.g.c. output shown.

Performance

The absolute maximum power supply voltage rating of the HA11225 is 14V. As any voltage above this can cause

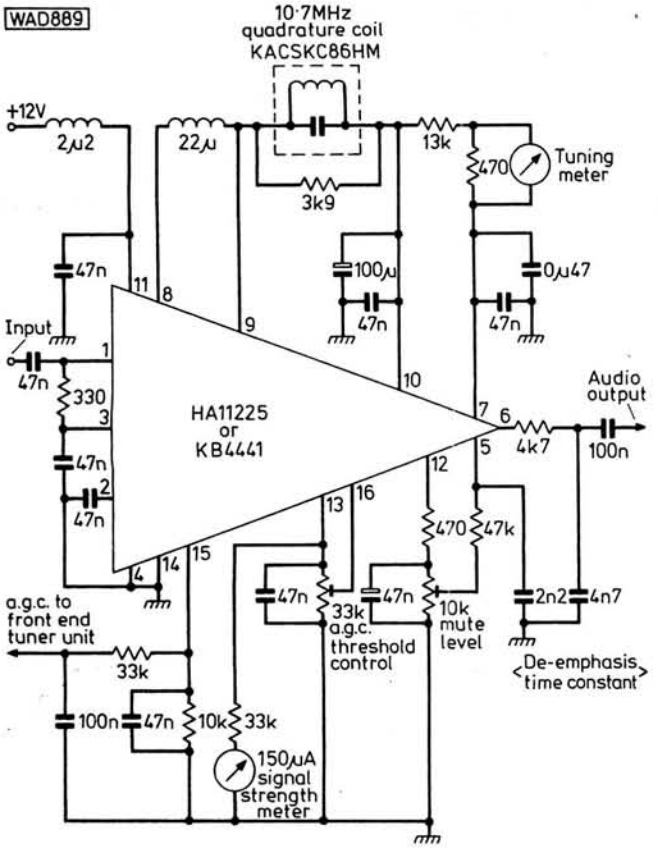


Fig. 2: A simple circuit for the use of these devices using a single-tuned KACSKC86HM quadrature coil

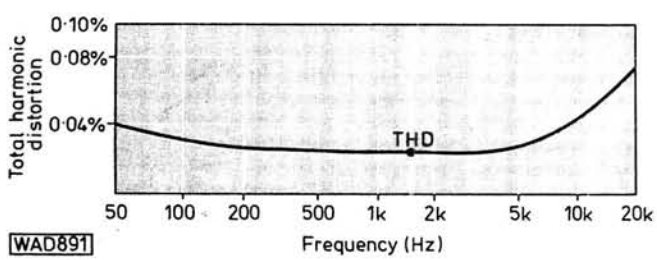
permanent damage, it is wise to regard the upper limit as being about 12V to allow a small margin of safety. The maximum permissible power dissipation in the chip is 590mW at an ambient temperature of 60°C. The quiescent current required from the power supply is between 16mA and 33mA, with 25mA being typical.

When the circuit is correctly limiting with relatively large input signals, audio output voltages of between 265mV and 510mV r.m.s. are obtainable when the input signal has its maximum deviation of ±75kHz (i.e. the loudest signal). A typical signal-to-noise ratio of 84dB is quoted for these devices with a minimum value of 78dB with good input signals.

When a strong input signal at 1kHz, amplitude modulated to the 30 per cent level, is applied at the input, the output is not more than −45dB (typically −54dB) relative to that with a similar frequency modulated signal. This figure provides a measure of amplitude modulation rejection which gets rid of much unwanted noise (such as vehicle ignition noise) in the f.m. band.

When the circuit is muted, the audio signal level at the output can be reduced by as much as 85dB, that is, to a level at which it is virtually inaudible.

Fig. 3: Variation of total harmonic distortion level with audio output frequency using a double-tuned quadrature coil



Distortion

The circuit shown in Fig. 2 employs a single quadrature tuned circuit for simplicity and provides an output with a total harmonic distortion level of the order of 0·5 per cent. A lower distortion level can be obtained by using a double-tuned circuit instead of the single-tuned quadrature coil and distortion levels of not more than 0·1 per cent (typically 0·03 per cent) are then possible.

Readers intending to use the double-tuned circuit are advised to use pre-aligned quadrature coils obtainable from the device supplier named below at a small surcharge, since the alignment of the two cores needs some experience.

The variation of the total harmonic distortion with audio frequency in the case of a typical device (HA11225 or KB4441) is shown in Fig. 3 for input signal deviations of ±75kHz.

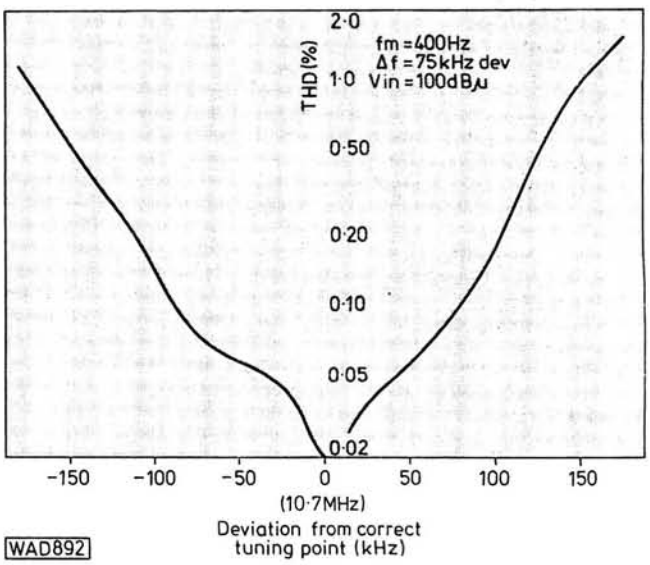


Fig. 4: Increase in total harmonic distortion as the tuning is adjusted on either side of the correct tuning point

The importance of accurate tuning is shown by the measured values in the graph of Fig. 4. As the tuning error increases, the distortion level increases rapidly. Both Fig. 3 and Fig. 4 data apply only in the case of a double-tuned quadrature circuit, not in the simpler circuit of Fig. 2.

Availability

The HA11225 and/or the KB4441 devices are available from Ambit International, 200 North Service Road, Brentwood, Essex, CM14 4SG, together with suitable chokes and coils for both single- and double-tuned quadrature demodulator circuits.

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USER REPORTS ON SETS AND SUNDRIES

LOWE FX-1 Wavemeter

The UK Amateur Licence requires each licensee to have a method of ensuring "that his transmissions do not contain unwanted frequencies (i.e. harmonics and spurious frequencies)." The simplest and cheapest way of complying with this is by having an absorption wavemeter, and the licence says that such a wavemeter must have adequate scale length and accuracy, and that the frequency coverage must extend up to the second, and preferably the third, harmonic of the radiated frequency.

The Lowe FX-1 is an absorption wavemeter covering the frequency range 0·7–250MHz in seven bands: 0·7–1·6MHz, 1·5–3·5MHz, 3–7MHz, 7–18MHz, 18–48MHz, 42–110MHz and 85–250MHz, by means of plug-in coils. Each coil is protected by a heat-shrunk plastics sleeve, and the whole set can be stowed in a compartment in the back of the instrument, as shown in the photograph, so solving the usual problem of keeping the coils safe but to hand.

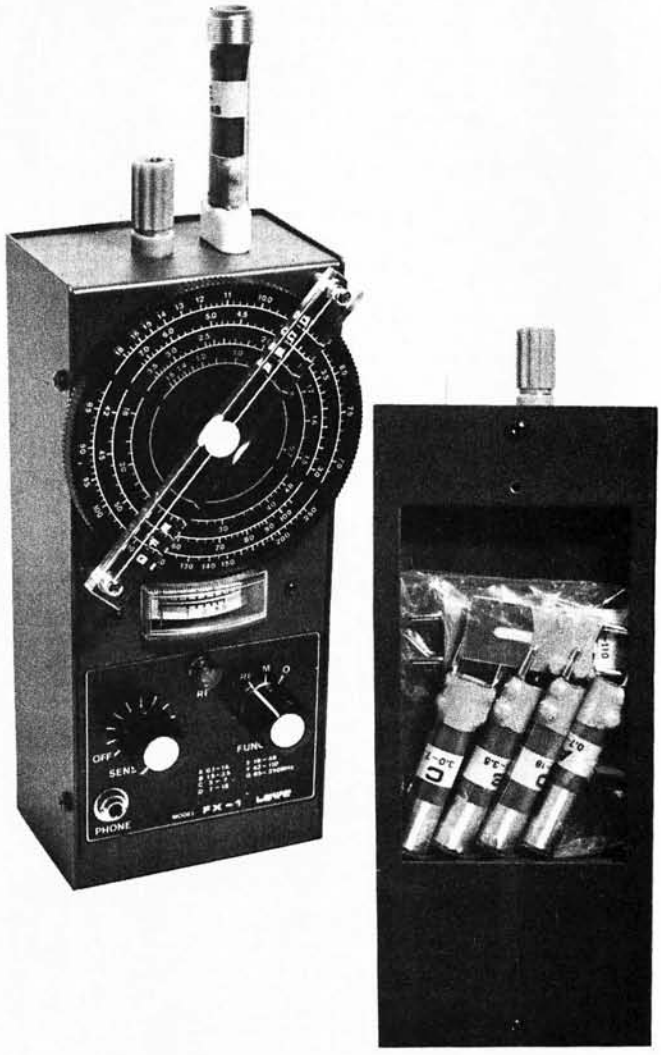
The tuning dial is 80mm in diameter, and overlaps the sides of the case, allowing easy single-handed operation. The scales vary between 18 and 33mm in radius according to band and provide adequate reading accuracy. The coils and scales are colour-coded and also letter-coded, to help in picking out the right scale for the coil in use (and *vice versa*).

The function switch has three positions: 1. "RF", in which indication of resonance is by means of a light-emitting diode driven by a single-transistor amplifier. An internal 9 volt battery (PP3 size) provides the power, the quiescent current consumption being just under 1mA. 2. "M", with resonance shown by means of a small edge-meter. 3. "O", at present unused, but intended to provide g.d.o. facilities with the addition of a small supplementary p.c.b. currently under development.

Modulation of a.m. signals can be checked by plugging a pair of headphones or an earpiece into the front-panel 3·5mm jack. The meter is disconnected when a jack plug is inserted. Relative field-strength measurements can be made by connecting a suitable antenna (short length of wire) to a terminal provided on the top of the case, alongside the coil socket.

The FX-1 is housed in a substantial sheet steel case, and measures 195 × 80 × 70mm overall, excluding a coil. Weight is approximately 0·8kg with the full set of coils carried in the stowage compartment.

For amateur use, the lowest frequency band of 0·7–1·6MHz will not be of much use, and it is a pity that the top frequency limit could not have been pushed up instead,



to include at least the second harmonic of the 2m band. The coil for the 85–250MHz range cannot be reduced in inductance, for it is already the "p.c.b. equivalent" of a hair-pin, so any increase in frequency would have to be achieved by reducing the value of the tuning capacitor, which would reduce the span of each range and mess up the calibration into the bargain. So there seems to be no scope for easy modification. Nevertheless, this is a handy unit, whose usefulness will be increased still further when the version with the g.d.o. becomes available. Existing owners of FX-1s will be able to fit this feature to their wavemeters if they wish (price to be announced).

The FX-1 is available, price £28.00 plus £1.00 post and packing (both including VAT), from **Lowe Electronics Ltd., Chesterfield Road, Matlock, Derbyshire DE4 5LE, telephone Matlock (0629) 2817,** to whom we offer our thanks for the loan of the review unit.

WORLD BEATER!

TR-7

Some interesting facts on the

DRAKE TR-7

transceiver

- ★ No other amateur transceiver has such a rugged broad banded, no tune up solid state p.a. capable of giving so high an output power over so long a period.
- ★ Only one other transceiver has receiver specifications that can equal the TR-7 and that one costs a great deal more money.
- ★ Built in general coverage receive and the capability to transceive on any future amateur bands between 1.8 and 30 MHz.
- ★ Built in 150 MHz frequency counter.
- ★ Optional Noise Blanker that can deal with the Russian Woodpecker.

R. L. DRAKE PRICE LIST

Model	Description	Inc. VAT	Carr.
TR-7/DR-7	Transceiver/Gen. Cov. Receiver Digital	1035.00	5.00
PS-7	Power Supply 120/240v for TR-7	207.00	5.00
PS-75	Sideband Duty P.S.U. for TR-7 120/240v	138.00	5.00
RV-7	Remote V.F.O. for TR-7	132.25	2.00
MS-7	Matching Speaker for TR-7 and R-7	29.90	2.00
R-7/DR-7	Digital Receiver 0-30 MHz	989.00	5.00
SL-300	CW Filter for TR-7 and R-7 (300 Hz)	39.10	0.50
SL-500	CW Filter for TR-7 and R-7 (500 Hz)	39.10	0.50
SL-1800	SSB/RTTY Filter for TR-7/R-7 (1800 Hz)	39.10	0.50
SL-4000	AM Filter for R-7 Receiver (4000 Hz)	39.10	0.50
SL-6000	AM Filter for TR-7 and R-7 (6000 Hz)	39.10	0.50
AUX-7	Range. Prog. board and 1 Receive module	32.20	1.00
RRM-7	Range receive modules for Aux-7 (500 KHz)	5.75	0.50
RTM-7	Range tcve. modules for Aux-7 (500 KHz)	5.75	0.50
NB-7	Noise Blanker for TR-7	66.24	1.00
NB-7A	Noise Blanker for R-7 Receiver	66.24	1.00
FA-7	Fan for TR-7 and PS-7	20.70	2.00
MMK-7	Mobile mounting kit for TR-7	34.50	2.00
MN-7	ATU/RF Wattmeter. 160-10 m (250w)	124.20	5.00
MN-2700	ATU/RF Wattmeter 160-10m (2kw)	207.00	5.00
WH-7	RF Wattmeter/VSWR Bridge (HF)	59.80	2.00

Model	Description	Inc. VAT	Carr.
SP-75	Speech Processor	79.35	2.00
CW-75	Electronic Keyer	59.80	2.00
P-75	Phone patch	59.80	2.00
7804	Service Manual for TR-7	18.50	2.00
7805	Service Manual for R-7	18.50	2.00
7037	TR-7 Service Kit	37.95	1.00
L-7E	Linear Amp. 2kw. 10m-160m with tubes (2)	897.00	10.00
3-500Z	Tube for L-7E and L-75E	69.00	2.00
L-75E	Linear Amp. 1kw 10-160m with tube (1)	598.00	5.00
TV-42LP	Low Pass Filter 100w	10.35	1.00
TV-3300LP	Low Pass Filter 2kw	18.40	1.50
7073	Hand Microphone for TR-7	18.40	1.00
7077	Desk Microphone for TR-7	29.90	2.00
DL-300	Dummy Load 330w	20.70	1.00
DL-1000	Dummy Load 1000w	37.95	2.00
CS-7	Remote control ant. switch 5 way (7 line)	115.00	5.00
B-1000	Balun for MN-7 and MN-2700 4:1	20.70	1.00
Manuals	Spare Operating Manuals	6.00	1.00
Interface	R-7/TR-7 connecting cable	20.70	1.00
AK-75	Multiband Antenna	23.00	2.00
AA-75	Antenna Insulator Kit	2.30	0.50
HS-75	Headset	9.95	1.00

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HOTLINES

A REVIEW OF RECENT DEVELOPMENTS
In general, the author does not have any more information on products than appears in the article

Regulators for Cars

Did you know that the innocent 12V in your motor car can develop 100V spikes on its supply line? An i.c. regulator could be the answer, but at what cost? And, remember, those temperatures: from Wigan winters to Harpenden heatwaves.

Now for the good news: meet the L2600 series. These devices suppress spikes, and supply a well regulated voltage. In quantity, they could sell for as little as one lonely US dollar each. To date; 5V, 8·5V and 10V versions have been in evidence, and at least one major car manufacturer is reported to be using the 5V devices.

By restricting the current to 500mA, the manufacturers have kept the price down. This current is sufficient for the dashboard illumination and electronics. By simply spending another $1·45 (approx.) on an additional *npn* device, this current capability can be increased to 20 amps.

Fabricating the L2600 devices was no simple task. Input voltages up to +30V need to be accommodated, as do −18V reverse inputs. Handling of positive spikes up to +120V, and negative ones 'down' to −90V was also necessary. The temperature range extends from −50 to +150°C, which should cover all likely environments, including Harpenden! Built-in protection guards against such things as excessive temperature dissipation. Should this rise above 150°C, then current in the output transistor base is guided to ground. A pair of internal semiconductors constantly monitor the temperature, and divert base current if the limit is exceeded.

Solid State Camera

It had to come: the electronic cine camera. Sony caused quite a stir by showing just such a unit, but both industry and trade are puzzled. Sony's president is already quoted as saying that the company will not go into production until industry standards are settled and agreed. But although it may be some time before solid state cameras are on the market, it is interesting that current technology has the ability to produce a working unit.

Heart of the camera is a charge-coupled-device (c.c.d.) sensor that has 490 × 470, or 279 300 picture elements. Note that this bit of light-sensitive, electronic wizardry is contained on a chip 10·1 × 12·1mm. Draw it on a piece of paper; then imagine it split up into 279 300 tiny picture elements.

A microcassette is used for recording. It measures some 13 × 35 ×56mm, and has a special high-coercivity, metal tape that is 14µm thick. Recording/filming time is 20 minutes. Inside, the two rotating recording heads are scaled down miniatures of their bigger brothers used in the company's Betamax video recorders. Two different rotating heads are used for playback in order to ensure optimum signal-to-noise ratio. Once the 'film' has been 'exposed', the camera (it measures 60 × 171 × 191mm) is plugged into a small table top unit, and this may be connected directly to any standard television receiver.

Chips for Scrooge

I never cease to be amazed at just how mean the makers of integrated circuits are when it comes to using up precious area on a silicon chip. But now, they're getting really Scrooge-like.

Take the AMCC 1259. It's a complete microcomputer on a chip measuring only 170 × 199mil. This is a c.m.o.s. device and is fabricated using ion implantation, a technique where ions of the desired impurity are 'fired' at the silicon host chip(s) in a vacuum chamber. The velocity of the impure ion 'bullets' can be precisely controlled. Also, by varying the angle of the silicon to these 'bullets', one can control just how deeply the ions are allowed to penetrate. By these means, very precise doping impurity levels can be achieved.

An advantage of all this is that the AMCC 1259 needs only a single 1·5V battery, and draws a truly miserly 3µA: like an electronic vampire that's slimming! The basics of the i.c. are programmable logic arrays (p.l.a.), and it is intended for timing and control work, although electronic games and toys look a natural market.

The chip accepts five push-button inputs, and has 48 outputs that can drive liquid crystal display segments. There is also an oscillator and divider chain from which all internal timing signals are derived: the user merely adds an external 32kHz crystal. It even has an alarm circuit that requires only a single transistor amplifier and speaker (or whatever) to give audible warning outputs. Eight-bit address register, and r.a.m., are all packed in (somehow). Some 256 program steps are addressable, and up to 64 r.a.m. locations can be uniquely addressed.

All in an area 170 × 199mil, and taking only 1·5V at 3µA. Mean man, like really mean.

High-temperature Regulator

Then there's yet another voltage regulator. This one comes under the heading of, "High-temperature Hybrid". A 15V device, it can operate up to +275°C. Its sister component, one "Model 4160", is a 12-bit a. to d. converter that can operate up to +200°C without missing codes. The manufacturers guarantee it. Wonder what a 'hotted up' version would do?

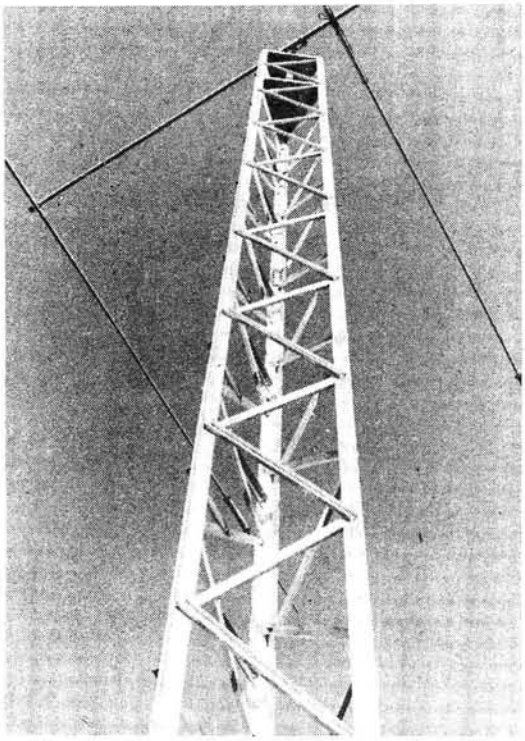
Light-pipe

And finally, a light-pipe imaging device. Most devices have had low resolution so far; typically less that 100 dots/inch. The new light-pipe can improve this figure to 240 dots/inch. The pipe can connect to a flat surface and could be used in such things as copiers. Because the illuminated ends would be so very close to the recording medium, no additional optics, such as lenses etc. would be required. Could be a useful device for 'Spot the Ball' competitions.

Ginsberg

Western

ALUMAST



The **ALUMAST** is a 15in (375mm) wide triangular cross section lattice sectional aluminium mast based on a 10ft (3·05m) section length. It is supplied "knocked-down" in a tubular carton for ease of transport, but can easily be assembled needing no special tools or skills. The system includes top plate with bearing sleeve, rotor plate and a choice of a fixed base frame (FB-1) or one with hinge joints (HB-1) to enable the mast to be pivoted at ground level. Guy brackets are available for use at heights above 30ft.

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- **Easy assembly using bolts and "Nyloc" locking nuts for security.**
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375/PSS/3	30ft mast (3 sections)	£184.00
375/PSS/1	Additional 10ft section	£62.68
HB-1	Hinged base unit	£31.05
FB-1	Fixed base unit	£21.85
RMP-1	Rotor mounting plate	£12.08
TP-1	Top plate with sleeve	£13.23
GB-1	Guy brackets (set of 3)	£11.50

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- ★ Features: long life battery operation, compact size, built-in loudspeaker plus personal earpiece.

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Datong active antennas are ideal for modern broadband communications receivers – especially where space is limited.

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- ★ Broadband coverage (below 200 kHz to over 30 MHz).
- ★ needs no tuning, matching or other adjustments.
- ★ two versions AD270 for indoor mounting or AD370 (illustrated) for outdoor use.
- ★ very compact, only 3 metres overall length.
- ★ professional performance standards.

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Model AD370 (for outdoor use) **£56.35**
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audible FIELD-STRENGTH METER

Ted NIELD GW3ARP

This rather novel device was designed to overcome the obvious difficulty of watching the readings of a distant meter whilst, at the same time, trying to make circuit adjustments to the transmitter, antenna etc., often from a position where it is physically impossible to see the meter. Whatever reliance may be placed upon checks made on the transmitter itself, using dummy loads or power measurements, there is something much more satisfying in using the actual radiated r.f. field and making one's adjustments according to observed results. In the case of v.h.f. antenna adjustments this is particularly so.

Whilst the measurement of field strength in absolute terms is a difficult matter requiring expensive specialised equipment, the measurement of relative field strength is comparatively simple, and this is all that is required.

To achieve our present purpose what is needed is to convert field strength into terms of audio frequency—the stronger the r.f. field the higher the note, a form of analogue to digital conversion.

Fig. 3 shows in block diagram form the stages involved. Stages A and B each employ a CA3140 operational amplifier, the use of this *p*-m.o.s. input type in preference to the older 741 type confers two main advantages: higher gain and the ability to use a single-ended power supply.

A conventional take-off point following the detector stage is provided as an extra feature for use with an external 0-5V d.c. meter, enabling the device to be used in the ordinary way if desired.

Detector Stage

The output of a simple voltage doubler type detector is fed to the non-inverting input at pin 3. A variable degree of d.c. negative feedback from pin 6 is fed via R2 to the inverting input at pin 2 providing control over the gain. The voltage at pin 6 is basically zero in the absence of a signal, and a d.c. voltmeter (0-5V) plugged into SK1 will show a rising output as the r.f. input from L1 tuned circuit increases with increase of field strength. Resistor R2 will vary the sensitivity or gain of the circuit. So far we have a conventional field strength meter with a high degree of sensitivity. A one watt 2m transmitter at 50 metres will give full scale deflection using a 50cm ($\lambda/4$) pick-up antenna.

Analogue to Digital Converter

This consists basically of another CA3140 in a square-wave oscillator arrangement. The potentiometer R1 and diode D3 form a limiting circuit, limiting the negative excursion at the non-inverting input of the operational amplifier (pin 3). When no r.f. signal is present, the output voltage of IC1 is zero, and the full negative swing takes place, but as the voltage at the anode of D3 rises the negative swing is progressively limited, causing the operating frequency of the oscillator to rise.

CONSTRUCTION RATING Beginner

BUYING GUIDE

Constructors of this project should have no difficulty in obtaining all the relevant components. Note L1 consists of $3\frac{1}{2}$ turns closewound on the core, tapped one turn from the bottom.

APPROXIMATE COST £12

★ components

Resistors

¼W 5% Carbon

47Ω	1	R3
15kΩ	2	R8, 9
100kΩ	2	R5, 6
1·5MΩ	1	R4

Miniature horizontal pre-set

10kΩ	1	R1
220kΩ	1	R7

Wirewound linear potentiometer

10kΩ	1	R2

Linear potentiometer with d.p.s.t. switch

100kΩ	1	R10

Capacitors

Sub-miniature ceramic

2·2pF	1	C1
680pF	1	C2
4·7nF	1	C3

Polypropylene

22nF	1	C7
0·1µF	2	C5, 6

Electrolytic 10V

10µF	1	C4

Semiconductors

Diodes

OA91	2	D1, 2
1N4148	2	D3, 4

Transistors

2N2926	1	Tr1

Integrated Circuits

CA3140	2	IC1, 2

Miscellaneous

DIN speaker socket (1); 8-pin d.i.l. holders (2); 5cm diameter speaker 50–100Ω (1); knobs (2); SO239 chassis mounting socket (1); 18 s.w.g. enamelled copper wire; 7mm diameter inductor core.

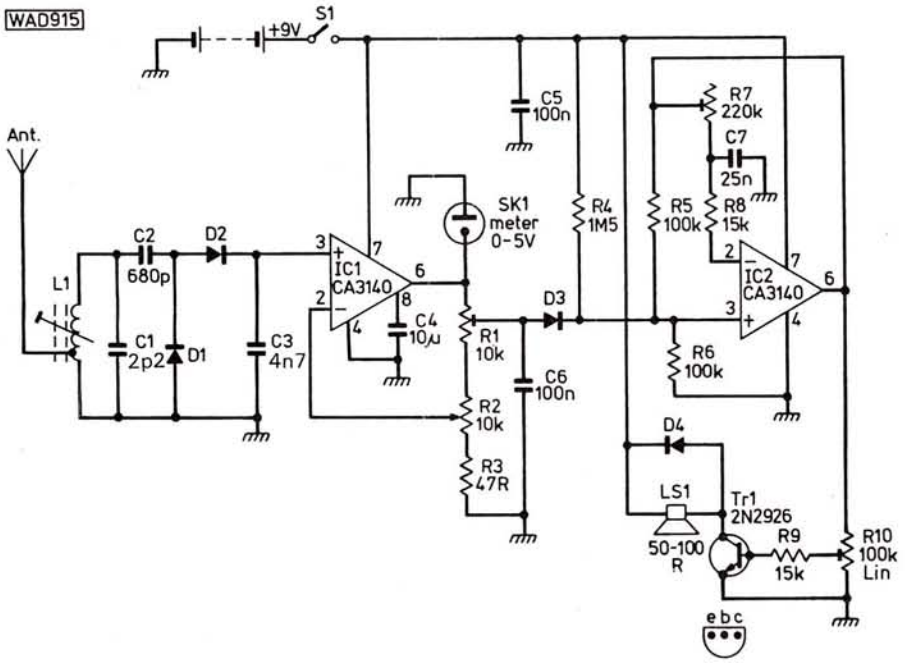
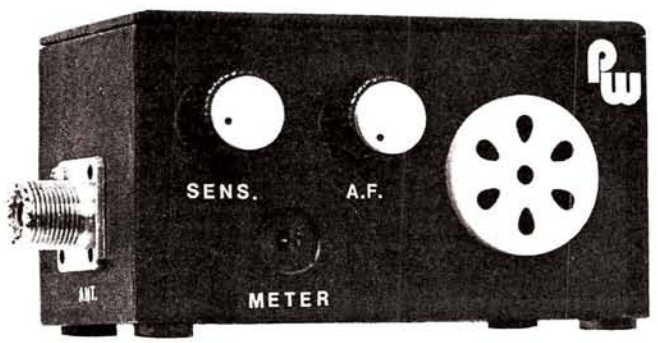


Fig. 1: Full circuit diagram for the audible field strength meter



Output Stage

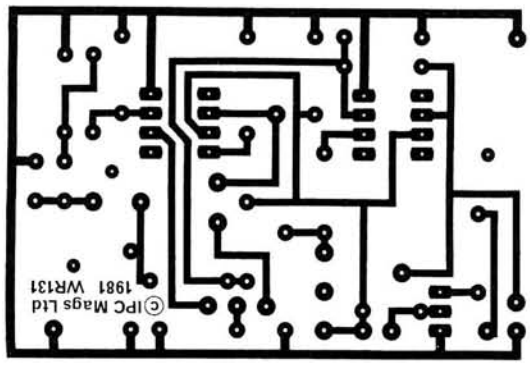
The output stage works in Class B, taking an increasing current as the volume is increased by R10. Most of the current is consumed in this stage, the i.c.s taking only about 3mA the pair. Therefore in the interests of battery life, it pays to keep the volume as low as is practicable. The actual transistor is not critical as long as it is an *npn* device of the 2N2926 type.

Some explanation should be given for the 10µF capacitor C4 between pin 8 of IC1 and earth. Earthing this pin causes the output voltage to fall to zero; consequently, this capacitor increases the rise time, this delay smooths out rapid variations of pitch which would

otherwise occur and render the result far less musical to the ear!

The prototype was built into a homemade hardboard box approximately 125 × 65 × 65mm and was provided with an SO239 socket, but a $\frac{1}{4}$ wavelength of coathanger wire suitably fixed into the "live" is all that will normally be required.

The circuit was constructed on a small p.c.b. measuring approximately 113 × 50mm. Eight pin d.i.l. holders were used for the two i.c.s, with the bottom of the former for L1 stuck through a hole drilled in the board in which it was fixed with Araldite. The extremities of the coil were soldered to the appropriate strips of the p.c.b.



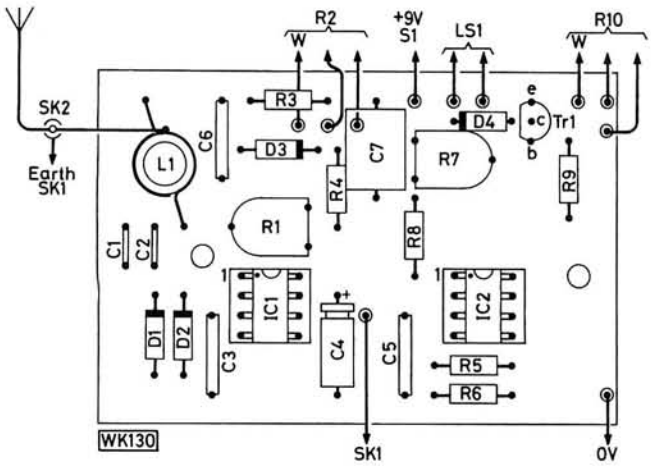


Fig. 2: Track pattern and component layout of the meter

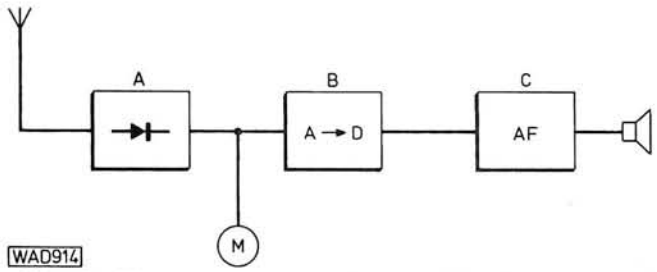
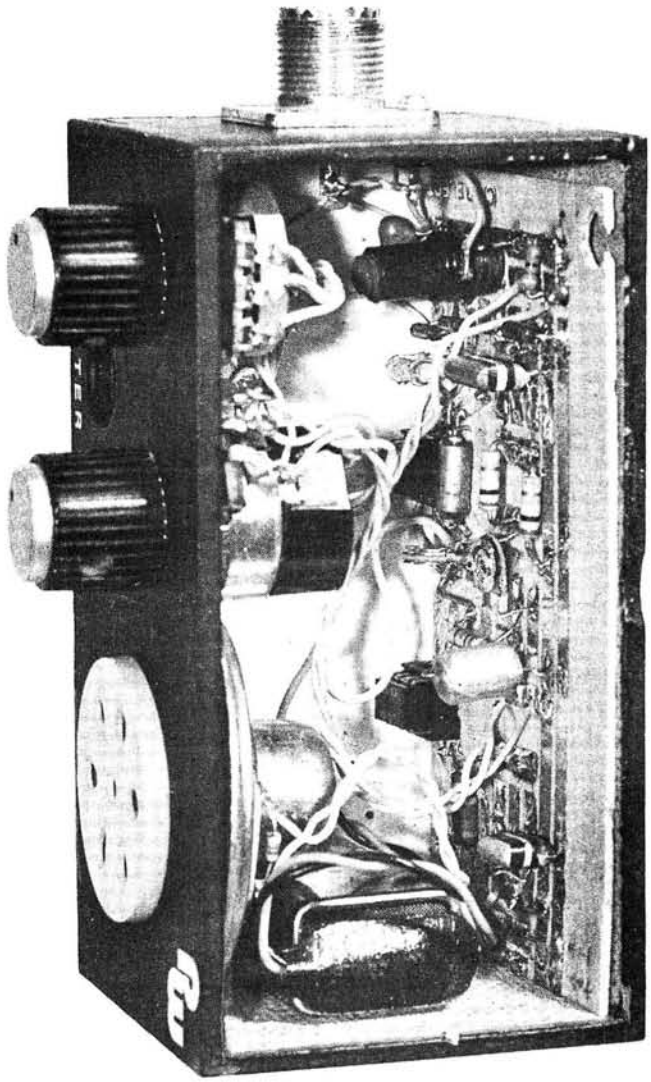


Fig. 3: Block diagram of the audible field strength meter



Setting Up Procedure

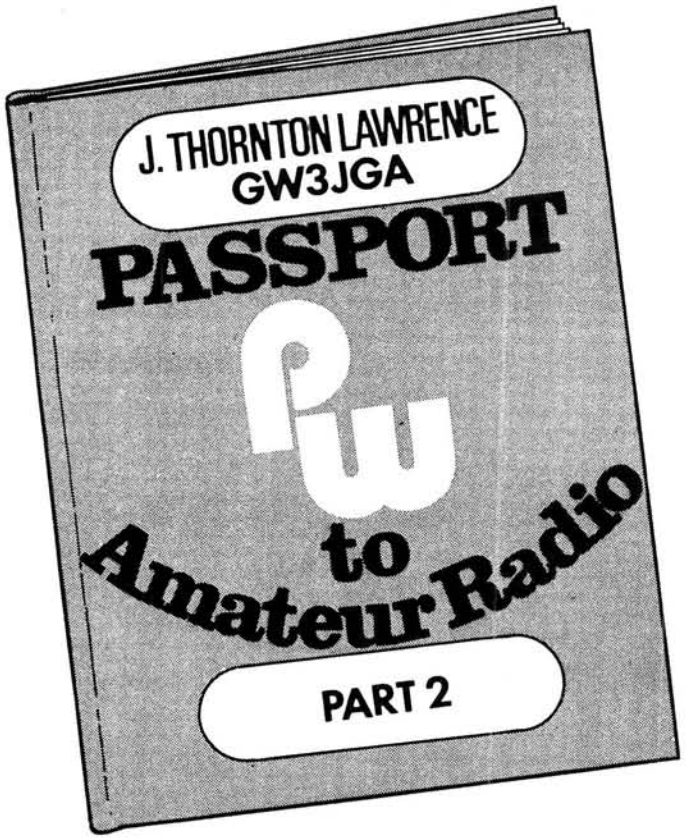
First connect a 1MΩ resistor from pin 3 of IC1 to the positive supply line. Move the slider of R1 towards the pin 6 end until the pitch of the note ceases to rise, then back off slightly.

Next adjust R7 until this note, which is the highest note of the range, is at a suitable pitch (about 2·5kHz), then remove the 1MΩ resistor and the lowest note will now be heard at about 100Hz.

Place the device in a suitable r.f. field and tune the core of L1 for the highest note (in conjunction with the sensitivity control). It will be found that the tuning is fairly broad and that some variation to the parallel tuning capacitor C1 may be called for. Also, tuning in a strong field with the sensitivity turned down is much easier than trying to tune in a weak field with the sensitivity turned up. Note that R2 sets the d.c. output voltage of IC1 for a given r.f. field.

In use the device will consume between 3 and 50mA according to the setting of the audio gain. For convenience S1 is ganged to R10.

In practice, the unit is placed in a suitable part of the r.f. field and the sensitivity set to produce a note in mid-range. The desired adjustments are made to the transmitting equipment, using the pitch of the note to indicate optimum adjustment, the highest pitch denoting the greatest output. It may be necessary to reset the sensitivity control at some stage, as the adjustments proceed. In many cases a dummy load may be used to prevent unnecessary radiation, otherwise one would naturally select a portion of the band not in use. ●



Last month we looked at the idea of becoming a Radio Amateur, now we take a closer look at the licence and studying for the RAE.

Before you can set up an "Amateur Wireless Station" you must first obtain an Amateur Licence, which is issued by the Radio Regulatory Department of the Home Office. There are two types of Licence, Class A and Class B. In order to qualify for the principal type Amateur Licence A, you will need to satisfy certain requirements, as follows:

(1) be over fourteen years of age
(2) be a British subject
(3) have passed the Radio Amateur Examination
(4) have passed the Post Office Morse Code Test
(5) have paid the Licence fee (currently £8.00)

The Amateur Licence A allows operation on all the Amateur Bands.

The requirements for the Amateur Licence B are the same as for the A Licence with the exception of (4), the Morse Test, which is not required.

However possession of the B Licence only allows operation on the 144-146MHz (2 metre) band and higher frequency amateur bands.

Full details of the Amateur Licence, Radio Amateur Examination and Morse Test are given in an excellent 38 page publication *How to become a Radio Amateur*. This is essential reading and is available, free of charge, from:

Home Office,
Radio Regulatory Department,
Radio Regulatory Division,
Licensing Branch (Amateur),
Waterloo Bridge House,
Waterloo Road,
London SE1 8UA.

The RAE is conducted by the City and Guilds of London Institute and candidates must sit the examination at a recognised examination centre (normally the local Technical College or Evening Institute). The exam is held twice yearly in May and December. Special arrangements can be made for disabled or blind candidates.

The form of the RAE was changed in 1978-79, from the old traditional script answer type to the new multiple choice "Objective Testing" type. This is known as the "756, Radio Amateurs' Examination 1979-1981" (the format of this examination will continue substantially unchanged in 1982).

In the past, many would-be radio amateurs failed or did not attempt the RAE simply because they were unable to set down, in words, the answers to the questions. However, the multiple choice question overcomes this problem and the result has been a significant increase in the numbers sitting and passing the new form of the RAE.

Objective Testing

An Objective Test is defined as a series of questions each of which has only one predetermined correct answer, so that subjective judgement in marking is eliminated. The RAE is carried out using a four-option multiple choice type of objective question. In this type, a question is asked or implied, followed by four possible answers or *options*, only one of which is correct. The candidate is required to select the correct answer.

The questions are normally chosen to test the candidate's "factual recall", "comprehension" and "application". In general, the "factual recall" question tests the candidate's ability to remember the facts which he has been taught, and a "comprehension" question tests his understanding of what he has been taught. An "application" question, while requiring him both to know and understand what he has been taught, asks him to go further and apply his knowledge and understanding to a given problem.

An example of a "factual recall" question is given below: Class A3J–J3E amplitude modulation uses:

a. only the upper sideband with a bandwidth of about 4kHz
b. either one of the sidebands with the carrier suppressed
c. morse telegraphy using either sideband
d. one telephony sideband with reduced carrier

In a pre-test conducted to see how candidates would answer the question, the results were as follows:

a. 6 per cent
b. 64 per cent (correct answer)
c. 8 per cent
d. 19 per cent

no answer attempted 3 per cent.

The number of candidates choosing a particular answer is shown as a percentage of the total number of candidates. The next example is of a "comprehension" question:

In a series-resonant circuit, to halve the resonant frequency the *LC* product must be:

a. halved
b. doubled
c. quadrupled
d. tripled

In a pre-test conducted with this question, the results came out rather differently.

a. 17 per cent
b. 55 per cent
c. 23 per cent (correct answer)
d. nil

no answer attempted 5 per cent.

As you can see, the majority chose answer b which was unfortunately incorrect!

Since $f = \frac{1}{2\pi\sqrt{L \times C}}$, halving the frequency would mean doubling L × C and doubling the square root of the *LC* product would require quadrupling the *LC* product itself

(answer c). Finally, an example of an "application" question dealing with Ohm's law.

Fig. 6 shows the relationship between V and I in a d.c. circuit. The resistance of the circuit is:

a. 8Ω
b. 2Ω
c. 0·5Ω
d. 0·2Ω

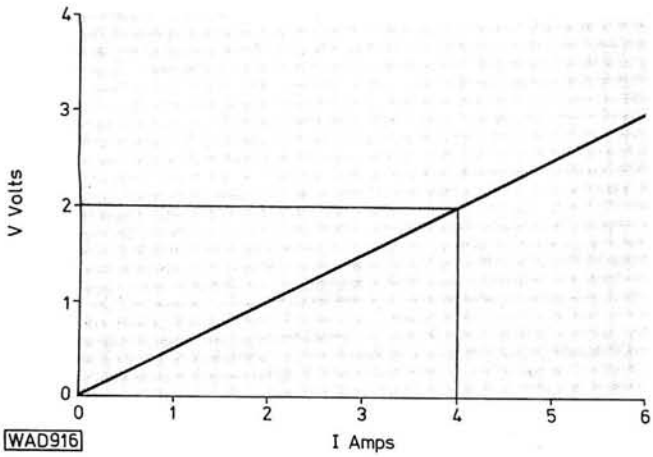


Fig. 6

The results of the pre-test conducted with this fairly easy question are as might be expected.

a. 8 per cent
b. 6 per cent
c. 83 per cent (correct answer)
d. 2 per cent
no answer attempted 1 per cent.

Advantages and Disadvantages

From the examiner's point of view, there are several advantages in Objective Testing. Because it is possible to have a greater number of questions, the paper can include questions on all areas of the syllabus, whereas traditionally only a limited number of topics can be covered. Also no "choice" questions are included, so all candidates answer the same questions.

The preparation of the question paper can be more systematic in covering the syllabus, and pre-tests can be held to estimate the degree of difficulty of each question before it is included in an examination paper. Marking is completely objective and eliminates the possible variations due to points awarded by different markers or by the same marker on different occasions.

From the candidate's point of view, there is less emphasis on his ability to express himself in his own words, his performance depends primarily on his technical knowledge and understanding. He is not hampered by time as adequate time is available. All things being equal his paper will be marked more accurately and impartially, and the results should be available to him sooner.

There are a number of common objections to Objective Testing, the most common being the view that someone with no knowledge can, by guessing the answers, obtain adequate marks. However, the City and Guilds of London Institute state that experience has shown that a rational elimination of one or more of the incorrect options is also likely and that applying a correction factor for guessing does not have a significant effect on the rank order of candidates. The policy of the City and Guilds is, therefore, not to apply a correction factor for guessing.

Another objection is that candidates should be tested on their ability to express themselves in writing. In the case of the RAE this ability is not one of the essential factors, whereas knowledge and understanding are. Objective Testing is, therefore, considered suitable for this examination.

From The Candidate's Viewpoint

The candidate will answer his multiple choice examination paper on special answer sheets using a pencil. He should attempt all questions and should find little difficulty in completing the answers in the time allotted. If he has difficulty in expressing himself but knows and understands the items in the syllabus, then this type of examination will be to his advantage. If he does not know the subject then it is highly unlikely that guessing will help him to gain marks. If he knows all the items in the syllabus reasonably well the overall result is likely to be better than knowing some items very well and some not at all, as all parts of the syllabus will be tested. There are no "choice" questions or "likely" subjects.

Examination Pattern

The RAE consists of two separate papers, a 1 hour paper containing 35 multiple choice questions on Licensing Conditions and Transmitter Interference and a second paper of 1¾ hours containing 60 multiple choice questions on Operating Practices, Procedure and Theory. Details are given below.

765–1–01 Licensing Conditions and Transmitter Interference

1 hour

Syllabus	Number of Questions
Licensing Conditions	23
Transmitter Interference	12
	35

There will be a break of 15 minutes between the two papers.

765–1–02 Operating Practices, Procedures and Theory

1¾ hours

Syllabus	Number of Questions
Operating Practices	5
Electrical Theory	11
Semiconductors	7
Radio Receivers	9
Transmitters	8
Propagation and Antennas	14
Measurement	6
	60

It has been customary when preparing for the old style script examination, to go through past years' examination papers and practise answering the questions.

Because multiple choice questions for the RAE are extracted from a "bank" of pre-tested questions and because these are on returnable answer sheets, "previous years' questions" as such, are not available for practise. However, a selection of typical sample questions for practise purposes are available from the City and Guilds of London Institute, and details are given as follows.

Syllabus and Question Paper

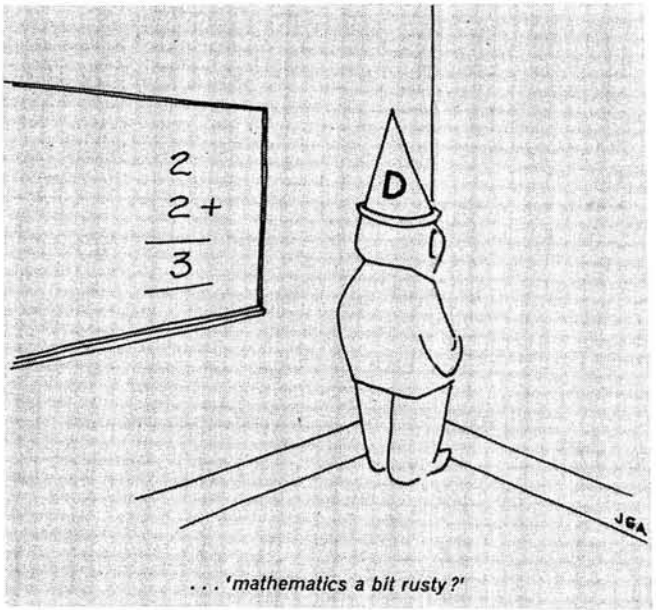
The syllabus upon which the examination is set is contained in a pamphlet *No. 765, Radio Amateurs' Examination*. A copy of the syllabus, plus a set of 40 sample ques-

tions from the paper (price 80p) can be obtained by post only from:
The City and Guilds of London Institute,
Sales Section,
76 Portland Place,
London W1N 4AA.
The syllabus is also reproduced in Appendix C of the Home Office publication *How to become a Radio Amateur.*

One of the important factors when embarking on a new hobby or area of interest, is to find sources of help and information. This is particularly true in amateur radio, where both technical and practical knowledge is needed.

It is very useful to attend meetings of your local radio club or society, as you will then have the opportunity to see amateur radio equipment being used and will be able to obtain guidance and help when you are purchasing or building things for yourself.

Membership of the RSGB is also very useful, as then you can take advantage of the QSL Card Bureau, the Slow Morse Transmissions, a discount on RSGB publications, and obtain information about radio clubs and societies which are affiliated to the RSGB. The annual subscription includes the supply, by post, of the Society's monthly journal *Radio Communication (RadCom).*



. . . 'mathematics a bit rusty?'

Studying for the RAE

The method of studying for the RAE depends on your personal circumstances. The various ways are:
Evening classes
Correspondence course
Home study, with or without some tuition

If you live near a technical college or school which runs evening classes, then this is probably the best way for you to study. Details of these courses appear in various radio magazines and in the local press. The cost of tuition and examination fees varies from place to place but these will be known when registering, usually in September.

It is often advantageous to contact your local evening institute ahead of time, stating your interest in the RAE as, without prior knowledge of the need, the institute may not have considered putting on such a course. Courses can only be run providing there is a sufficient number of candidates and liaison with the local radio club is often a way of overcoming this problem.

Correspondence courses or home study for the RAE require continuous and regular work sessions. Home study requires a lot more personal discipline to get through the more difficult items, as you will find it a great temptation to leave them until the end, when it is usually too late! It is always useful and particularly so in the case of home study, if you can enlist the help of a local radio amateur or suitably qualified friend, who will talk-through any problems you may have.

As far as textbooks are concerned, these can be divided into two categories, the "essential" and the "desirable but not essential". Those concerned directly with becoming a radio amateur are essential reading. They are:
(1) *The Radio Amateur's Examination Manual (8th Edition)* by G.L. Benbow G3HA. RSGB £2.73.
(2) *A Guide to Amateur Radio (18th Edition)* by Pat Hawker G3VA. RSGB £3.07.

The books in the second category are much more comprehensive and naturally cost more; they are:
Radio Communication Handbook Volume 1 & 2 (5th Edition) RSGB £10.20 and £9.06 respectively.

All items can be obtained from:
RSGB Publications (Sales),
35 Doughty Street,
London WC1 2AE.

Here we are then, you have registered at your local evening institute for the RAE course, the books are ordered and you are ready and waiting to get down to the "nitty gritty".

Arithmetic

Let's start with arithmetic (I always think that the word arithmetic is less daunting than mathematics). There are going to be some calculation questions in the RAE and if you can do these correctly, you can gain "full marks" on each question in a matter of seconds. Even fairly straightforward electrical calculations can present very real difficulties if you have not seen the sharp end of a blackboard pointer since you left school, so the purpose of this section is to remind you of the basics involved.

If you have read through the instruction book of a pocket calculator you will know that there are four "basic arithmetical functions", namely, addition, subtraction, multiplication and division.

Addition and Subtraction

So far as the problems that you will meet in the RAE are concerned, addition and subtraction will take care of themselves, for example, $3 + 7 = 10$ and $4 - 2 = 2$.

Multiplication and division may be written down in several different ways, so here are a few alternatives.

Multiplication

$a \times b$ can also be written as $a.b$ or simply ab.

Division

$a \div b$ can also be written as $\frac{a}{b}$ Thus $1 \div 2$ is the same as $\frac{1}{2}$ (one upon two or one over two).

Now for the not-so-basic arithmetic functions, reciprocals, squares and square roots.

. . . still having trouble with square roots?

Reciprocals

The reciprocal of "a" is $\frac{1}{a}$ or from division $1 \div a$ or one upon a, and to put it numerically, the reciprocal of 4 is $\frac{1}{4}$ and 100 is $\frac{1}{100}$.

This function, together with the squares and square roots, occurs often in resonance and frequency calculations.

Squares

If a number is multiplied by itself the answer is known as the square of the number. For example $a \times a$ is written as a^2 or a squared. Thus a^2 is the square of a. And, to put it numerically, 9 is the square of 3, since $3 \times 3 = 9$.

Square Roots

The square root of a number is a figure which, when multiplied by itself, is equal to the original number. For example the square root of 9 is 3 because when 3 is multiplied by itself, it equals 9, written $\sqrt{9} = 3$. Similarly, $\sqrt{25} = 5$ (because $5 \times 5 = 25$) and $\sqrt{4}$ or root $4 = 2$ (because $2 \times 2 = 4$) and so on.

Incidentally, not all square roots are whole numbers. For instance, $\sqrt{2}$ has been calculated to at least 50 decimal places, but is most often used as 1·41 or 1·414. Finally, $\sqrt{2} \times \sqrt{2} = 2$ and $\sqrt{5} \times \sqrt{5} = 5$ and $\sqrt{25} \times \sqrt{25} = 25$.

Problems in the actual RAE which involve square roots are likely to work out exactly to some simple figure, as the question will be arranged to test your knowledge and application of the formulae rather than your ability to do extensive mental calculations.

NEXT MONTH: ELECTRICAL UNITS AND OHM'S LAW

INTRODUCING SSTV—2

▶▶▶*continued from page 21*

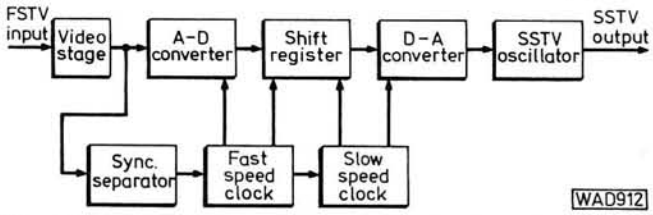


Fig. 13: Block diagram of a digital fast to slow-scan line converter

For simplicity, in our example we divided the line into 20 pixels, but in practice many more are used. Optimum overall definition occurs when the vertical and horizontal resolving powers are equal, so for a 128 line square SSTV picture the line is divided up into 128 pixels. Since each pixel is represented by a 4-bit word, the shift register must have a capacity of 512 bits. The shift register memory will be loaded with the digitised video information for the one line in approx 65 microsecs. The fast-speed clock then triggers the slow-speed clock which allows the information to move out of the shift register at the slow-scan speed of 60 ms per line. This has completed the conversion and the digitised information could be transmitted directly. This will probably be the mode adopted in the future when most amateurs have scan conversion equipment, but at the present time a D–A converter is used to convert the signal back to analogue form for transmission (Fig. 14).

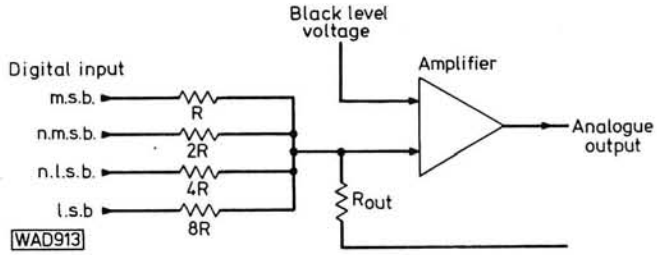


Fig. 14: 4-Bit D-A converter

The D–A conversion is effected by controlling the gain of an amplifier by a series of binary weighted resistors, which are brought into circuit when the corresponding bit is 1. A d.c. voltage equal to the video black level voltage is applied to the input of the amplifier. When all the bits are at 0, the amplifier acts as a unity gain voltage amplifier, thus the output will be the video black level voltage. As any bit becomes 1, the appropriate resistor will be brought into circuit, which will increase the gain of the amplifier, thus the output will be proportional to the binary code presented to the converter. This output is then used to frequency modulate the SSTV oscillator between 1·6 kHz and 2·3 kHz, the black and white frequencies.

When the transmission of the line data has been completed a sync pulse at 1·2 kHz is inserted and the conversion process is repeated for the next line. In 7·2 secs all 120 lines comprising the frame will have been transmitted, but as mentioned before, it is becoming common practice to transmit a further 8 lines of grey scale at the bottom of the picture, so making the frame up to 128 lines (2^7). The grey scale makes for easier alignment of the receiver, and also allows the interesting possibility of transmitting the sending stations' call sign on every frame.

Part 3 of this series will examine the 'black box' used at the receiving station to convert slow-scan back to fast-scan standards suitable for display on a conventional TV receiver.

'EXE' MICROWAVE TRANSCEIVER

Part 4

Dick GANDERTON G8VFH , John M.FELL G8MCP & Owen COCKRAM G8OWZ

By now you should have a working 10GHz wide-band f.m. transceiver all ready and waiting for your first microwave QSO. Obviously it is useless setting up the equipment and calling CQ-CQ-CQ and expecting a reply. The chance of another amateur being on the same frequency as you and actually beaming his signals your way is extremely remote. In fact, most microwave QSOs are arranged in advance and this is where it is useful in the early stages to have a friend building a *PW* Exe as well.

With your friend you can start with short hops of a few hundred metres to get the equipment sorted out and get some sort of feel for microwave operation. There is no real substitute for practical experience.

IF Alignment

As was explained in the first part of this series, the i.f. of both transceivers must be the same. This can be achieved by simply calibrating the i.f. Tune control using known broadcast stations and extrapolating upwards. This is not too bad for short hops where you can literally talk to your partner, but for longer distances where you cannot have frequent meetings and have to rely on some form of radio talkback a more precise means of i.f. tuning is needed.

A simple alignment aid can be constructed at little cost using the design shown in Fig. 11. A simple crystal controlled oscillator is used with a tuned collector load arranged so as to allow the required harmonic to be fed to the small antenna. The prototype used a readily obtainable cheap TV crystal with a fundamental frequency of 4·43MHz. In this case, the 23rd harmonic is selected to give an output at 102MHz. Other crystals could be used to give different frequencies. Obviously, though, it is essential for both you and your partner to use the same frequency. Again, you can calibrate the i.f. Tune control.

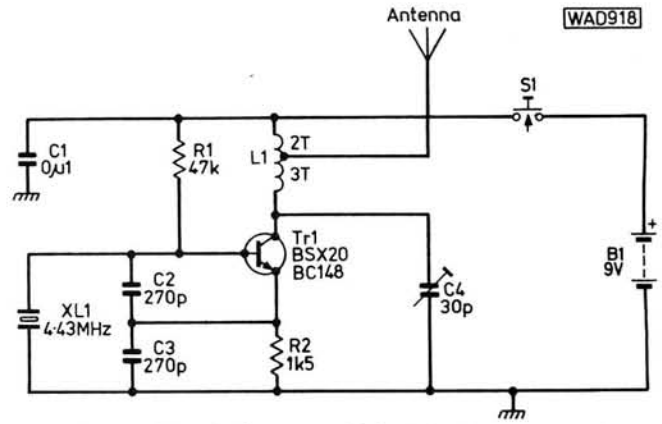


Fig. 11: Circuit diagram of the i.f. alignment aid

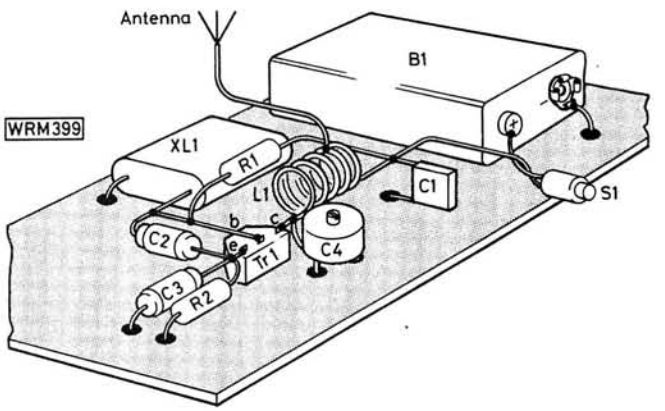


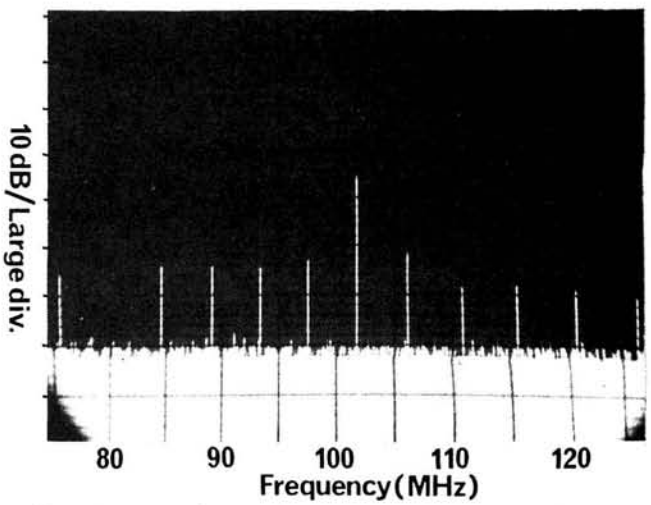
Fig. 12: Component layout details of the oscillator

Construction

The calibrator is built on a piece of p.c.b. using the copper as a ground plane. The components are built up as shown in Fig. 12, ensuring that leads are kept as short as possible and that all the joints made to the ground plane are well made. The PP3 battery is also soldered to the ground plane to ensure that the metal case of the battery does not affect the stability of the oscillator.

The complete calibrator can be housed in a suitable case. The on-off switch is mounted in the case lid and the antenna brought out via a small grommet.

In use, the calibrator is switched on and held close to the input of the 100MHz i.f. module. The i.f. Tune control is then adjusted for reception of the carrier put out from the calibrator. It is advisable to check for other harmonics to satisfy oneself that the correct harmonic has been selected. The photograph shows the various harmonics generated by the calibrator displayed on a Marconi Instruments spectrum analyser.



Spectrum analyser photograph showing relative harmonic output and amplitudes

Operating with the Exe

Having aligned your 100MHz i.f. to coincide with your partner's *PW* Exe you are now ready to attempt your first QSO over a short range.

Set up the two Exe units on their tripods and point the antennas towards each other. Decide which of the two stations will run with a.f.c. in and then slowly adjust the micrometer tuning control on one station only until you receive the signal from the other station. This is easily recognisable as a sharp ping in the speaker. One station must have its 1kHz tone switched on to provide some modulation. Now, carefully adjust the tuning controls for optimum reception of the 1kHz tone and then try switching in the a.f.c. and note the result.

If the signal disappears, then try switching the a.f.c. to the other sense. If the modulator is set correctly then the a.f.c. should hold the Gunn oscillator frequency at its set value. A useful addition is a voltmeter to monitor the Gunn diode voltage. With such a voltmeter, which need not be super-accurate, it is easy to keep track of the operation of the a.f.c. as well as making it simple to set the Gunn diode voltage correctly at the start.

You should now be in a position to attempt to pass speech over the link. The tone should be switched off and the microphone plugged in. You should be able to transmit speech simultaneously in both directions if you have set the i.f. correctly and have tuned one station l.o. high and the other l.o. low.

Beacons

There are several 10GHz beacons dotted around the UK and these are very useful when testing the functioning of a microwave station. Using a known beacon it is possible to calibrate the micrometer readings in terms of frequency. For example, if you listen to a beacon with a known frequency of 10·100GHz you can make a note of the setting of the micrometer and then use this for future reference.

Beacon hunting can be frustrating at times, especially if you try it on your own. If you can receive the beacon early on then it is not so bad, but you can spend fruitless hours searching up and down the band for a particular beacon not knowing if it is working or if conditions are such that it is impossible to hear the beacon.

Longer Paths

When you are confident that your equipment is working correctly and that you know how to operate it over short distances you are ready to try longer line-of-sight paths. The popular way of achieving longer paths is to use two suitable hilltops which are unobstructed by other hills and which allow you a clear take-off without trees or buildings getting in the way. You should be equipped with an Ordnance Survey map(s) covering both sites, and plot the path on the map. This will allow you to work out the compass bearing from your station to the other site and thus you can accurately align your dish, using a small compass. You must be prepared to spend some time and effort in getting the dish properly lined up both horizontally and vertically. A small circular spirit level is useful for the vertical alignment and could be attached permanently to the lid of the diecast box.

The tripod should be anchored by guy-ropes and pegs to prevent it being blown over or accidentally moved.

Some form of reliable talk-back is required and this can be either 2m or 70cm to suit you and your partner. There is an agreed talk-back frequency used by microwave enthusiasts, particularly during cumulative activity periods and obviously it is important to adhere to this if you intend to work contests later on. The frequency agreed for the talk-back calling channel is 144·330MHz u.s.b. Talk-back equipment should be positioned so that you can use it without have to keep walking away from the microwave station.

The RSGB organises the Cumulative Activity Periods and members can obtain details by subscribing to the monthly *Microwave Newsletter*. This useful publication gives information on current developments and amateur activity on all the allocated microwave frequencies. The RSGB also organises Microwave Roundtables where members can discuss developments and cross-fertilise ideas on all aspects of microwave working. Further details are available from RSGB headquarters.

The Cumulative Activity Periods provide a means of getting as many operators out working as possible. However, some operators take it extremely seriously and it is probably advisable not to operate during these 'contests' unless you can set-up properly. These 'super-enthusiasts' do not take kindly to having a complete beginner tuning up and down the band when they are trying to get their gear tuned in for a really long distance QSO. Get a fair amount of operating under your belt with your partner before venturing out and seeking unknown operators.

Readers who intend to operate the *PW* Exe should be in possession of the appropriate licence issued by the Home Office to those who have passed the City and Guilds Radio Amateurs' Examination. Details may be obtained from: The Home Office, Radio Regulatory Department, Amateur Licensing Section, Waterloo Bridge House, Waterloo Road, London SE1 8UA.

★ components

Resistors

¼W 10%

1·5kΩ	1	R2
47kΩ	1	R1

Capacitors

Ceramic

270pF	2	C2,3
0·1μF	1	C1

Min. Trimmer

30pF	1	C4

Semiconductors

Transistors

BSX20	1	Tr1

Inductors

5T, 6mm dia. 18 s.w.g. L1 (see text)

Miscellaneous

Crystal 4·43MHz (see text); Copper-clad board 90 x 70mm; Case to fit board, plastic or metal.

Buying Guide

Microwave Heads

Pascal Electronics, Hawke House, Green Street, Sunbury on Thames, Middlesex, TW16 6RA.
Plessey Optoelectronics and Microwave Ltd. Wood Burcote Way, Towcester, Northamptonshire, NN12 7JN.
Electronic Workshops, 5 Burston Road, London SW15.
Chordgate Ltd. (Dept C), 75 Faringdon Road, Swindon, Wilts.

Waveguide and Flanges

Earth Stations, 22 Howie Street, London SW11 4AR.
JMG Electronics, 50 East Street, Horsham, Sussex.
Electroforms and Components Ltd., 90 High Street, Whetstone, Leicester LE8 3LQ.
N. Foot, 29 Wheelers Lane, Bear Cross, Bournemouth BH11 9QQ.

Microwave Semiconductors

Pascall Electronics.
J. Birkett Radio Component Suppliers, 25 The Strait, Lincoln LN2 1JF.

Antennas

PW Editorial Offices, Westover House, West Quay Road, Poole BH15 1JG, or Hatfield House, Stamford Street, London SE1 9LS.
M & B Radio, Leeds, 86 Bishopgate Street, Leeds LS1 4BB.
MuTek Ltd., Bradworthy, Holsworthy, N. Devon, EX22 7TU.
Plessey Optoelectronics and Microwave Ltd.

General Mechanical Items

K.R. Whiston Ltd., New Mills, Stockport SK12 4PT.
Also consult Yellow Pages directory.

Reference Material

The Microwave Column—RSGB Radio Communication journal.
Ham Radio Magazine.
VHF Communications magazine.
RSGB v.h.f.–u.h.f. Manual, Third Edition.
Microwave Newsletter, RSGB

Operational UK 10GHz Beacons

		QRA	NGR	BEACON KEEPER
GB3IOW	10·1GHz	ZK34a	SZ494772	G8IDZ
GB3ALD	10·12GHz	YT30a	CI865798	G3JHM
GB3LEX	10·4GHz	ZM24d	SK485108	G8CAC
GB3XGH	10·4GHz	YN57d	SJ567721	G3PFR

WARNING

Microwave energy can cause damage to the tissues of the eye. Whilst there is no risk during normal working of the *PW* Exe *under no circumstances* should you look down the waveguide or into the microwave head cavity during operation.

Miscellany

At the start of this series we mentioned alternative microwave heads. One of these was the Wessex Alarms unit and this is readily available on the surplus market at around £8.00 for just the microwave unit.

Although it is possible to use this unit with the *PW* Exe, and some readers have already done this, its disadvantages make it less attractive than the AEI or Plessey units.

However, it can be used to make a useful bench frequency standard to allow you to work the *PW* Exe without having to find a beacon or disturbing your friend to provide the necessary signal.

By using your *PW* Exe calibrated for reception of a 10·1GHz beacon it is possible to retune the Gunn oscillator to give 10·1GHz with a known fixed voltage on the Gunn diode. The screw behind the Gunn diode post is the tuning screw and this is carefully adjusted inwards until you hear the 'ping' in the Exe speaker. You will, of course, need the 1kHz tone. Remember to keep the Schottky mixer diode shorted out as this is not used for this application.

Mention was made of the usefulness of a voltmeter to measure the Gunn diode voltage. The same meter can also be used to check the Schottky mixer diode current and a suitable circuit is given in Fig. 13. The meter and associated switching can be mounted on the rear of the diecast box to the left of the a.f.c. switch.

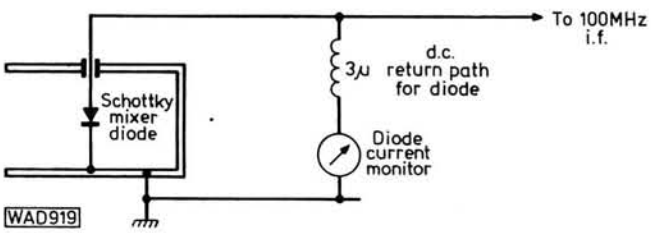


Fig. 14: Schottky mixer diode current monitor circuit

The Future

The response to this project has been remarkable and already several readers have built systems based on this design. We would like to hear from readers who have built and used the *PW* Exe. In particular, we are interested in hearing of the path lengths worked, conditions etc.

Practical Wireless will continue to cover microwaves with other projects and ideas.

Acknowledgments

We would like to thank a number of local amateurs for their help and encouragement during the development phase of this project. In particular G8MXW, G8OWZ, G8MCQ and G3VPF. ●

Next month in PW

Free Inside

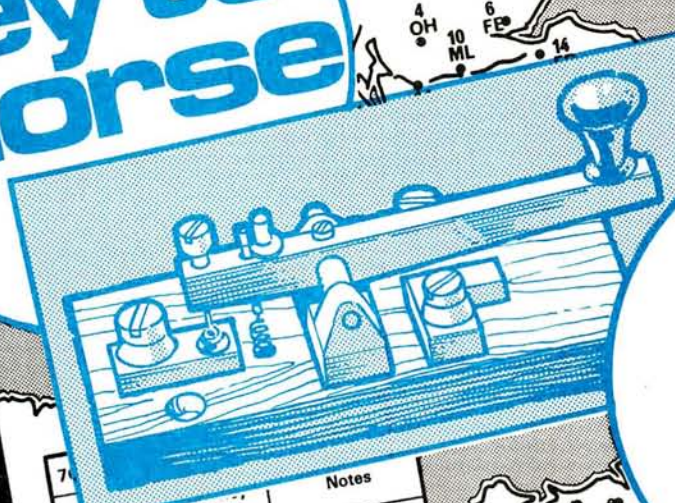
Practical Wireless OCT 1981

70cm Repeaters

DATACARD

Channel	Repeater Input (MHz)	Repeater Output (MHz)
RB0	434·600	433·000
RB2	434·650	433·050
RB4	434·700	433·100
RB6	434·750	433·150
RB10	434·850	433·250
RR11	434·875	433·275
	434·900	433·300
	434·925	433·325
	434·950	433·350
	434·975	433·375

the key to morse



There is a lot more to c.w. than just sending a stream of dots and dashes and it is not really so difficult to learn. We hope to dispell some of the fears that haunt many potential Class A licensees

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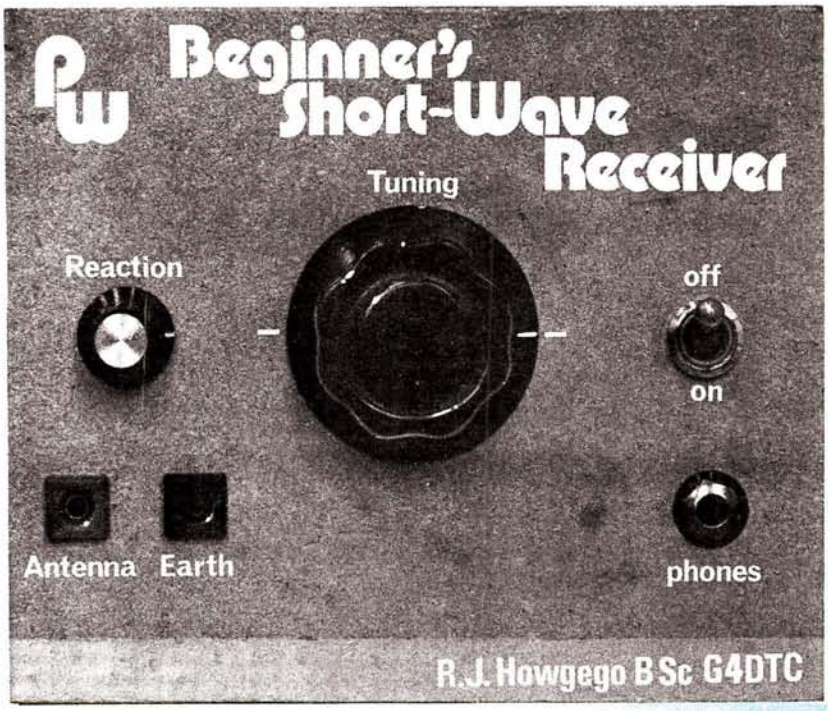
The callsigns of all amateur repeaters in the UK prefix GB3 followed by two unique letters. Repeaters are identified on the map only by their numbers together with the allocated channel numbers

PW Beginner's Short-Wave Receiver



This circuit was developed in response to the demands of a number of young s.w.l.s, most of them absolute beginners, for a simple but effective short-wave receiver.

It was felt that the following criteria should be satisfied:
1) The price should be kept to a minimum. If every part is bought new the total outlay will be about £12 but this may be halved if suitable variable capacitors are already to hand.
2) Since the s.w.l.s concerned were potential radio amateurs it was essential that the design gave good results on the amateur bands. This receiver brought in DX at loudspeaker strength and on 80 metres the results were comparable with the standard amateur transceiver. In fact, in comparison with the author's £200 FRG7 it was found that, with careful adjustment, most signals audible on the FRG7 could be resolved on the simple receiver.
3) The receiver should work first time and require no alignment.
4) There should be no metalwork, costly boxes or glamorous dials.

The present design uses a wooden base and hardboard front panel but it was found necessary to line these with kitchen foil to prevent hand-capacity effects and a slight 50 Hz hum noticeable on c.w. and s.s.b. signals.

To minimise the cost the ancient and educational art of coil winding was revived and details of two coils covering 3·5–30 MHz have been included. The circuit will function quite happily at all frequencies between 150 kHz and 100 MHz although at very high frequencies adjustment becomes somewhat critical. A low impedance output is provided as it was thought more likely that low, rather than high, impedance headphones or speaker might already be available. Hi-Fi stereo headphones gave excellent results and it was found that the three-way stereo jack plug connected well with the two-way socket provided. Adequate loudspeaker volume for "personal" listening was provided by all but the weakest stations.

Circuit Description

The field effect transistor (f.e.t.) Tr1 operates as a regenerative detector in a way that will be well-known to more mature readers familiar with the equivalent valve circuit. C2 tunes the receiver to any frequency within a band determined by the number of turns on coil L2. Some of the amplified signal appearing at Tr1 drain is fed back to L2 by L1, the amount of feedback being controlled by C1. C1 is adjusted so that the feedback is almost sufficient to cause the circuit to oscillate.

At this point the gain of Tr1 is considerable, the circuit becomes highly selective and most effective for the reception of a.m. signals. For c.w./s.s.b. signals feedback is increased just beyond the point of oscillation, resulting in extreme sensitivity. The detected signal is isolated by the r.f. choke and passed to Tr2 which is a simple audio amplifier.

Almost any *n*-channel f.e.t. will operate as Tr1 but the 2N3819 was found to produce the best audio output of those tried and is probably the most readily available. Similarly almost any small *npn* transistor will work as Tr2.

Component values are not critical but should be within 20 per cent of those suggested. Any small output transformer will do for T1 such as Eagle LT700 or those found in "Hong Kong" pocket radios, most of which have three connections on one side and two on the other. The centre wire of the three should be cut off and the remaining two used as the primary connections; the opposite pair are the secondary (loudspeaker) connections. Similarly C2 may be any small variable capacitor such as those found in pocket radios, or the larger type used for valve receivers; in all cases only one tuning gang should be used, the other(s) ignored. A slow motion drive for C2 is desirable for tuning above 10 MHz and essential if the receiver is intended primarily for s.s.b. C1 could be a Jackson Type C804 and C2 a Jackson Type O if new components are being bought.

Construction

The front panel, a piece of 170 × 100mm hardboard, is drilled to take the panel controls and sockets as shown in Fig. 2. This is nailed or screwed onto a piece of 12·5mm thick wooden board measuring about 170 × 150mm which forms the base. Holes will also need to be drilled to take the particular arrangement of bolts for fixing C2 to the panel. A single sheet of kitchen foil is cut to size (270 × 170mm), glued with Copydex or Unibond to the inside surface of the base and panel and rubbed out flat. The front panel components are then mounted, taking care that both variable capacitors make electrical contact with the foil.

Most of the components are soldered to a piece of Veroboard 95 × 64mm having a 0·15in. matrix and this should be assembled next. The copper tracks must be cut as shown in Fig. 2 with a Vero cutting tool or a hand-held 5mm drill.

The components are inserted as shown in Fig. 2, soldering them as close as possible to the board and taking care not to bridge the copper tracks with solder. Two tags, bent at 90°, are soldered to the lower part of the board for fixing the board to the wooden base. Four lengths of bare wire, each about 100mm long, should be soldered to the copper side of the board for later connection to the variable capacitors and antenna and earth sockets. Five Veropins are inserted as shown and form the soldering points for the coils.

The Veroboard layout must now be checked thoroughly and the completed board screwed onto the base so that the tags hold it vertically behind the front panel. At the same time the four bare leads may be cut to size and soldered to

★ components

Resistors

¼W 10%

2·2kΩ	1	R2
4·7kΩ	1	R3
330kΩ	1	R4
1·8MΩ	1	R1

Capacitors

Ceramic plate

100pF	1	C3
10nF	1	C4
47nF	1	C5

Electrolytic, axial lead

47µF 10V	1	C6
220µF 10V	1	To be fitted between A2 and K2 on Veroboard if needed + to A2

Variable, see text

100pF	1	C1
300pF	1	C2

Semiconductors

Transistors

BC108	1	Tr2
2N3819	1	Tr1

Miscellaneous

2·5mH choke (Repanco CH1); Transistor output transformer (see text); 4mm sockets (2); 0·15in. Veroboard 95 × 64mm; ¼in. moulded jack socket; Toggle switch; Knobs (2); 9V battery and connector; 26 s.w.g. enamelled copper wire; Cooking foil; Wood, screws etc.

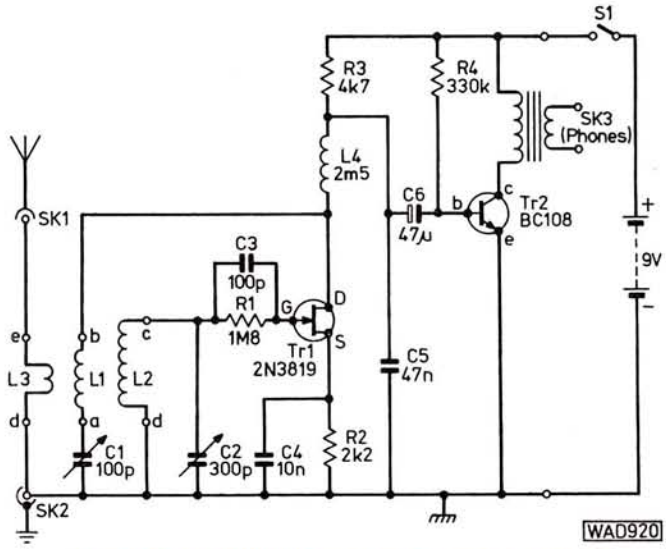


Fig. 1: The circuit diagram of the s.w. receiver

Coil Winding Details

	Number of turns		
	L1	L2	L3
3·5 to 11 MHz	9	36	6
9 to 30 MHz	4	10	3

All coils close-wound with 26 s.w.g. enamelled wire on 16 mm diameter plastic former.

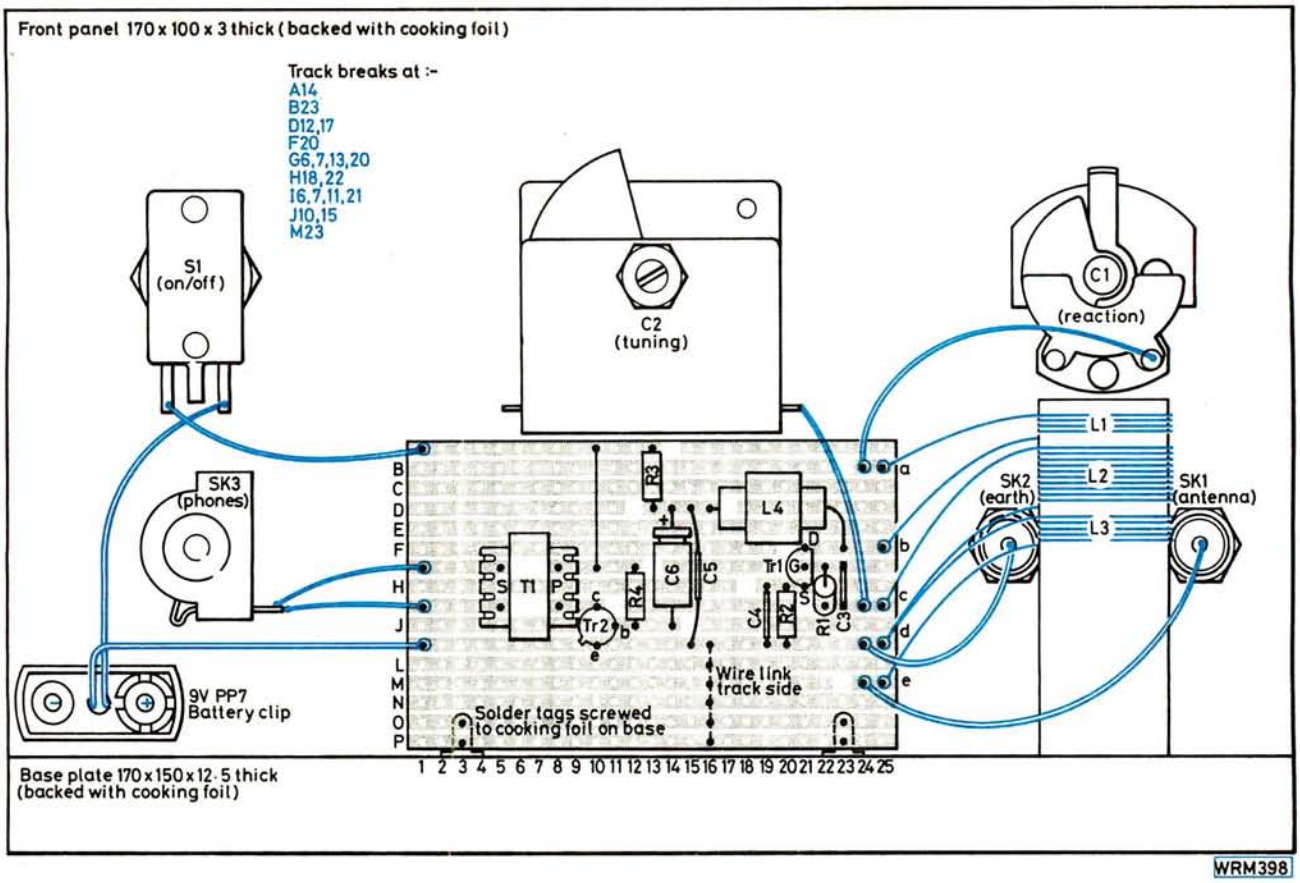


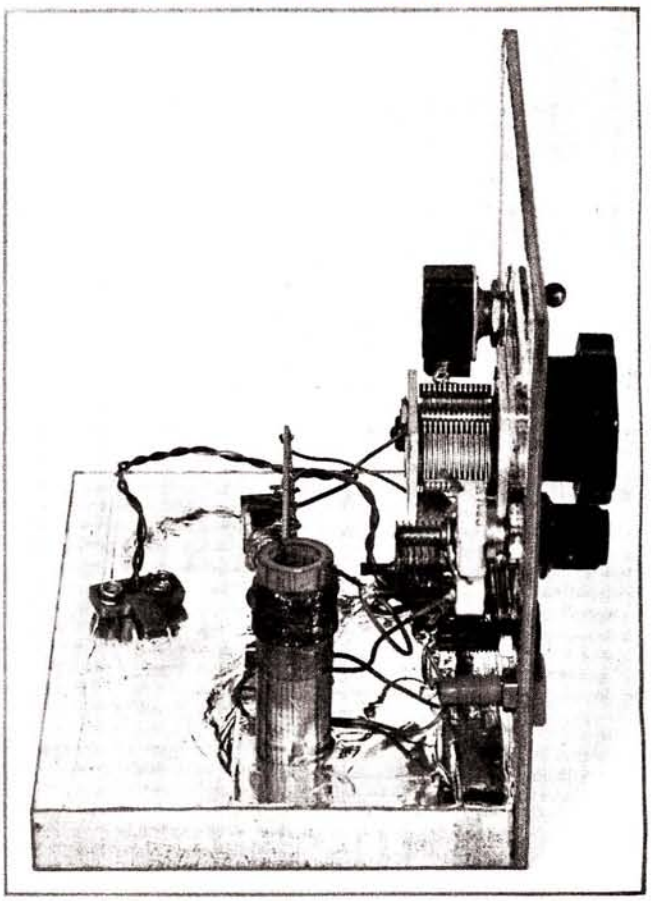
Fig. 2: Interwiring and Veroboard layout. This drawing is to scale to allow the front panel layout to be copied

the variable capacitors' fixed vanes and antenna and earth sockets. The switch, output socket and battery connector leads may now be wired to the Veroboard. The wiring is checked, battery and headphones connected and the power switched on. If a loud hum emanates from the headphones when a finger is placed on C3 the circuit is probably functioning correctly.

All that remains is for the coils to be wound and it is recommended that the coil covering 11–3·5MHz be tried first. A 76mm length of plastic or paxolin tube having a diameter of about 16mm will be required for each former and the author found some small plastic phials used for holding Christmas glitter to be ideal. The plastic stopper provided could be screwed onto the receiver base and the coils then pushed onto the stopper before soldering the coil connections to the Veropins. Holes can be drilled through the tube to anchor the ends of the windings and each winding may be painted with French polish to keep it in shape. Although the number of turns is not critical it is essential that, when looking from one end of the coil L1 and L2 are wound in the same direction, as indicated in Fig. 2. The enamel is scraped off the ends of the wires which are soldered directly to the Veropins and the wiring is then complete.

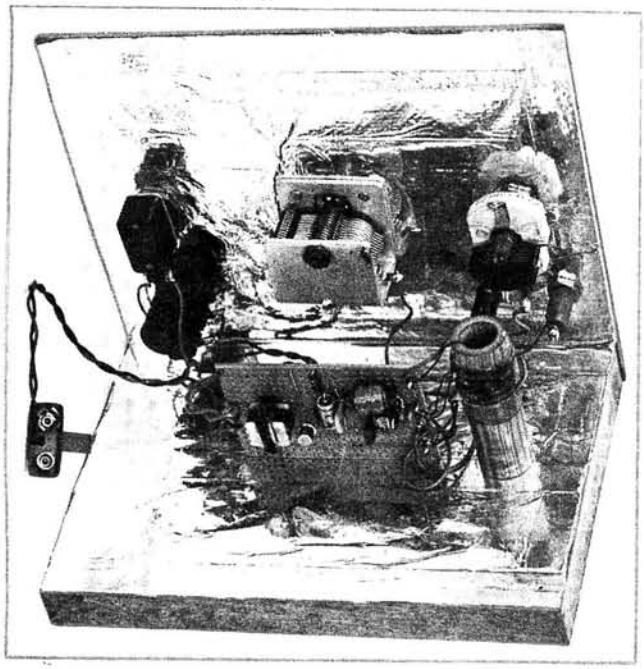
Operation and Calibration

Although many stations will be received on only a short piece of wire the longest possible antenna is recommended. An earth connection will normally produce a slight improvement but is not essential. Adjust C1 so that the vanes are fully unmeshed and rotate C2 until a station is found. If nothing is heard close C1 slightly and repeat the procedure. Once a station is found, further rotation of C1 will considerably increase the volume of the signal up to a



point at which the circuit begins to oscillate. This is evident when a whistle accompanies each station tuned in. The circuit should be held just below this point of oscillation when tuning a.m. stations or just beyond it for c.w./s.s.b. signals. With a little practice this technique is quite easily mastered.

A paper dial is glued to the front panel around the tuning control which is then ready for calibration. An r.f. signal generator makes calibration easy and accurate and younger readers might be advised to seek out such instruments in their school physics laboratories.



CONSTRUCTION RATING Beginner

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However, an alternative technique is to advance C1 beyond the point of oscillation, at which point the receiver will radiate a signal at the frequency set by C2. This radiated signal may then be found on an already calibrated receiver and the frequency marked on the dial. Failing this, if the coil winding details have been followed precisely and hence the tuning range approximately known it is possible, by tuning slowly across the band, to recognise the various amateur and broadcast bands and gradually piece together the calibration in this way.

Once the constructor is familiar with coil winding techniques other smaller or larger coils may be tried, eventually providing access to a large part of the radio spectrum. ●

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RADIO **SPECIAL PRODUCT REPORT**

GRUNDIG

Satellit 1400

GENERAL COVERAGE RECEIVER

The name of Grundig has long been synonymous with quality in the field of radio, TV and hi-fi, and the Satellit 1400 certainly maintains that reputation. It is a portable receiver for mains/battery operation, about the size and shape of an attache case, complete with a carrying handle on top. There are nine wavebands:

FM87·5–108MHz
LW145–320kHz
MW520–1620kHz
SW1 1·6–3·5MHz
SW2 3·5–7·7MHz
SW3 7·7–12·5MHz
SW4 12·5–18·2MHz
SW5 18·2–23·5MHz
SW6 23·5–28MHz

covering all the long, medium and short wave broadcast bands, plus all the h.f. amateur bands except for 10m. On the review model, the actual limit was 28·075MHz, so you could get some c.w., but it's a pity the whole 10m band couldn't have been squeezed in. The broadcast and amateur bands are all marked on the tuning scale.

Features

On the v.h.f. f.m. band, varicap diode tuning is used, the line-up being: dual-gate MOSFET r.f. amplifier, followed by bipolar mixer, i.f. amplifier with two tuned transformers (10·7MHz), double ceramic filter, i.c. demodulator/a.f.c./inter-station muting. A switching-type converter i.c. generates the 30V tuning supply from the nominal 9V d.c. supply used for the rest of the receiver.

On long and medium waves and SW1, a single superhet with an i.f. of 460kHz is adopted. Ganged capacitor tuning is used, and the line-up is: MOSFET r.f. amplifier, i.c. local oscillator/mixer, ceramic filter, two a.g.c.-controlled i.f. amplifiers with four tuned transformers. For a.m. a conventional diode detector is used, but on s.s.b. a product detector is switched in instead. The b.f.o./c.i.o. is *LC* controlled, with a small padding inductor for the front-panel clarifier control. The 460kHz i.f. stages can be switched to a manual gain control as an alternative to the a.g.c. mentioned above.

On SW2–SW6, the receiver becomes a double superhet with a first i.f. of 2MHz. The r.f. stage is another dual-gate MOSFET, with separate amplified a.g.c. derived from the tuning meter amplifier. An i.c. local oscillator/mixer of the same type as used to generate the 460kHz i.f. signal, feeds into a chain of four tuned circuits and thence to the SW1 single superhet circuit, which is fixed-tuned at 2MHz.

As well as the 175mm-long tuning scale, a 5-digit frequency read-out using a 12·5mm high liquid crystal display is provided. Like all digital circuitry, the frequency counter is liable to generate r.f. interference, and a switch has been provided to turn it off when not required. Since it consumes quite a lot of power (30mA approximately), this is advisable when operationg from the internal batteries. The main dial has a 0–100 logging scale, which seems somewhat pointless when a digital read-out is fitted.

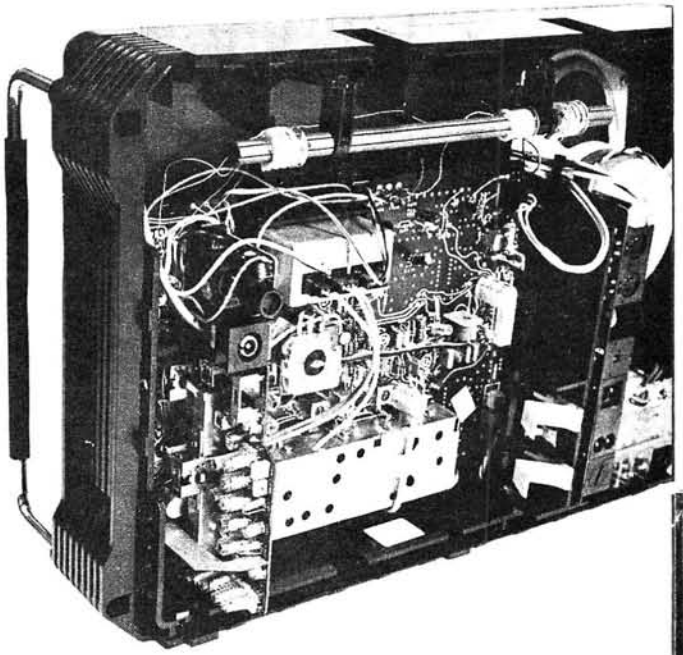
The audio amplifier chain comprises three transistors, followed by the bass and treble tone controls, tone-compensated volume control, and an i.c. power amplifier giving 2W output on battery operation, or 4W on a.c. mains where the i.c. supply voltage is increased. As well as the normal internal loudspeaker, an additional tweeter can be switched in when receiving good-quality f.m. broadcasts. Sockets are also provided for a 4Ω external loudspeaker (2-pin DIN), and headphones ($\frac{1}{4}$in jack) of 4–2000Ω impedance. Connecting either mutes the internal loudspeaker(s).

Inputs and outputs for connecting a tape recorder or gramophone pick-up, and an output to drive an external audio amplifier, are provided before the tone controls. Both use 5-pin DIN sockets.

The power supply arrangements are very versatile, offering the following options:

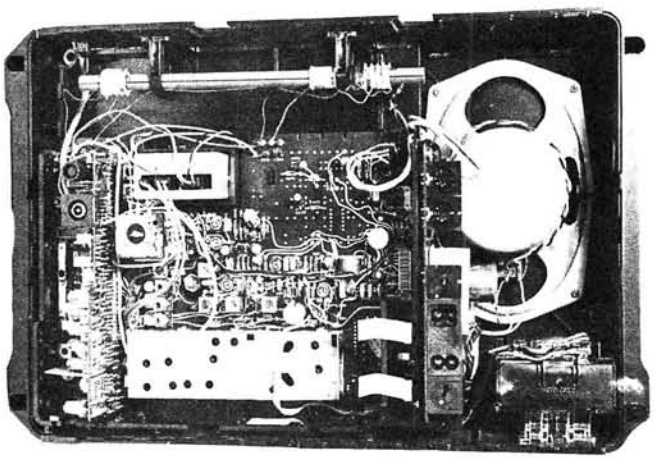
1. Mains operation from 110/127V or 220/240V 50/60Hz supplies, maximum consumption 16VA.
2. External battery operation from 10/16V d.c. supplies (e.g., a 12V car battery).
3. Internal dry batteries (6 off HP2 or equivalent) giving a quoted life of around 86–112 hours, depending on the frequency band in use. (Counter switched off.)
4. Internal rechargeable battery, giving a quoted life of some 32–43 hours (counter switched off), and capable of being charged from the internal power pack when a.c. mains are available, taking approximately 15 hours from a fully discharged state.

When operating on internal batteries, the lamps illuminating the tuning scale, digital frequency read-out and



tuning/battery state meter are normally switched off to conserve power, but can be brought on by pressing a spring-loaded switch.

For long and medium waves, the antenna is an internal ferrite rod, and there is no way of using an external antenna in its place, which is a drawback so far as the m.w. DXer is concerned. For the short waves and v.h.f. band, a telescopic antenna extending to a maximum of 1·44m is provided, but this can be switched off to use an external antenna. A rear-panel trimmer control allows the external antenna tuning to be peaked. Some 20-30dB of attenuation can be inserted into the antenna circuit on short waves by means of the LOCAL/DX switch.



Results

Due to circumstances beyond our control, it was not possible to make any measurements of sensitivity, selectivity, etc., during the trial period, but extensive listening tests were made on all bands.

On v.h.f. f.m., sensitivity and selectivity were very good, and audio quality excellent, fully justifying the use of the tweeter on this band. The a.f.c. circuit is rather imprecise in its action, but the tuning stability without it is quite satisfactory. The tuning scale is marked with channel numbers as well as frequency.

The long and medium waves perform well, with adequate selectivity to separate stations at 9kHz intervals cleanly and with reasonable quality. A few "birdies" were noted on the long waves during darkness hours, probably due to image interference from strong medium wave broadcast stations.

On the short wave broadcast bands, selectivity is just about optimum for a.m. reception, giving good results on speech and music. For s.s.b. and c.w. on the amateur bands, selectivity does leave something to be desired, inevitably because the i.f. bandwidth is fixed. However, the Satellit 1400 does perform very creditably on these modes, and the sensibly limited range of the clarifier control helps a lot. The main tuning control is a two-speed arrangement, using concentric knobs of approximately 37mm and 43mm diameter. The "fast" control takes eight turns to traverse the tuning scale, and the "slow" one is geared down by about 5·6:1 on that. The tuning rate on the "slow" control varies between about 50kHz and 170kHz per revolution on the various h.f.

amateur bands. There is very slight backlash on the tuning control, normally a thing which annoys me intensely, but this backlash I can only describe as smooth, and not a real problem.

I noticed no spurious signals on the h.f. bands, apart from a strong buzz at 24MHz from the digital frequency counter circuitry. The Operating Instructions booklet warns of possible interference from this source at multiples of 4MHz, but this was the only one which I found.

Accessories supplied with the receiver are a power lead for a.c. mains operation and an envelope of data. Apart from an interesting-looking booklet on DXing and lists of stations, all unfortunately in German only, there is quite a good multi-language Operating Instructions booklet and a complete circuit diagram with d.c. test voltages marked.

The Satellit 1400 measures 267 × 412 × 120mm, and weighs 5·5kg without batteries fitted, and must be worthy of consideration by anyone looking for a receiver for world-wide listening on the broadcast bands. Its performance on the amateur bands is less good, but still acceptable. It is available through Grundig authorised dealers in the UK (see your local *Yellow Pages* under "Television and Radio Shops"), at around £180·00 including VAT.

We are grateful to **Grundig International Ltd., Newlands Park, London SE26 5NQ, telephone 01-659 2468,** for the loan of the review receiver.

G. C. Arnold

MODS

IMPORTANT—The ideas presented here are suggestions only, and as they are untried by this magazine, we cannot accept responsibility for any resultant damage, however caused. Before alterations are attempted, care should be taken to ensure that any guarantee is not invalidated, and it should also be borne in mind that modifications usually have an adverse effect on resale prices. In cases where specialist skills or equipment are needed, most dealers will undertake the work for a reasonable fee.

Roger Hall G8TNT(Sam)

No. 9

Icom IC-2E

In response to the Icom IC-2E semi-reverse repeater mod that I described in Mods No. 7 (June 1981), Andrew G8MLM has written in with an improvement on Thanet's original suggestion that the ±600kHz switch should be modified to give the normal −600kHz shift in one position and semi-reverse in the other, +600kHz position. Andrew pointed out that although the mod works, the ±600kHz switch is awkward to manipulate. He has suggested substituting a standard Icom volume control for the existing squelch control. This has no effect on the action of the squelch as both controls have the same value, 10kΩ, but, as the volume control has a built in switch that is normally used to activate the tone burst, we now have a spare switch that Andrew suggests can be used instead of the ±600kHz one. Carrying out the mod this way means that you can listen on the input by just pressing the squelch control instead of fiddling around with the ±600kHz switch. Thanks for passing on a nice idea Andrew.

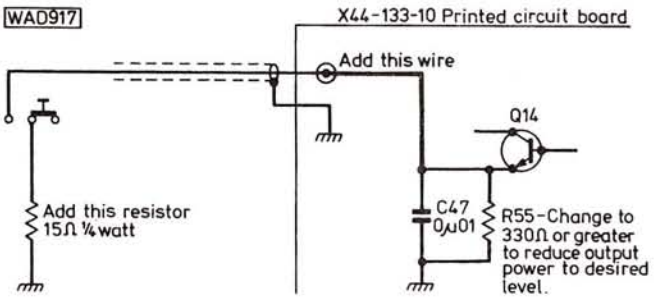
Trio TR-2400

Neil GW6APS wrote to me with a request for a switchable high/low power mod for the Trio TR-2400. Fortunately I subscribe to the Users International Radio Club, an organisation that publishes two newsletters every month, one for Icom users and one for Trio/Kenwood users. These newsletters are always packed with mods and the Trio/Kenwood newsletter for January 1980 contained the one that Neil has asked for. Robert Pohorence N8RT is the publisher and the editor of the newsletters and he has given me permission to reprint his articles and so for Neil, courtesy of the UIRC, here is a mod that was originally supplied by Harrison Clark KA2R. As this mod was first published in America you may find that there are some minor differences between the circuit of your European set and the one described here.

This mod makes use of the fact that if the 10Ω emitter resistor of Q14 is increased in value, then the output power is decreased proportionately. Harrison's suggestion for the switching is to disable the sub-tone switch and then to use it as a high/low power switch but it is also possible to fit an additional s.p.s.t. sub-miniature switch instead.

Remove the covers from the set and then locate the sub-tone switch and cut the wire that is connected to the centre. Tape it up and tuck it out of the way somewhere because it won't be used again. Now install a 15Ω $\frac{1}{4}$ watt resistor from this point on the switch to chassis. Next locate Q14 on the X44-1330-10 board and remove its 10Ω emitter resistor, R55. Replace it with a 33Ω $\frac{1}{4}$ watt one. Finally, connect a wire from the emitter of Q14 to the point on the board marked "SUB".

Before turning the set on, you should connect one side of an ohmmeter to the chassis and the other side to the emitter of Q14. If, when the sub-tone switch is turned on and off, the meter indicates approximately 10Ω and 33Ω you can then disconnect the meter, re-assemble the set and turn it on.



If you decide that you would like an even lower output, simply increase the value of the Q14 emitter resistor, but keep in mind that the value of the emitter resistor and the sub-tone switch resistor when connected in parallel must equal 10Ω if you want to maintain full output power when the switch is open.

When this mod was originally published in the newsletter it was read by Jon K. Lobe N3BDS, and he wrote a letter that was then published in the March 1981 Trio/Kenwood newsletter. He pointed out that his TR-2400 is slightly different because his R55 is 4·7Ω and not 10Ω as stated in the Trio circuit diagram. He overcame this problem by using a 5·6Ω resistor on the sub-tone switch instead of a 15Ω one. He also noticed that the emitter by-pass capacitor (C47) is different in his set, but as there is no need to change it for this mod, it would appear to be irrelevant.

In his letter Neil also asked if I have details of an external power supply that could be used to run the TR-2400. If you can Neil, try and obtain a November 1980 copy of *PW* because it was in that issue that the first Mods page appeared and one of the first mods that appeared in that issue was for the circuit that you have asked for. If you can't find a copy, the address of our back numbers department is at the front of this magazine and they will be able to let you have one. I should point out that Trio/Kenwood have said, via the pages of the UIRC newsletter, that they do not recommend this mod as it is possible for the set to be seriously damaged in the event of the regulator device becoming short circuited.

Wanted

Brian G4ETN would like any mods for the AR-240. He has heard that it is possible to fit an automatic tone burst, an external microphone and an external power supply and he would like to hear about them, or any other mods that you may know of for this set.

If you can help with any mods, or if you have any mods or requests that you would like published, please write to: R. S. Hall, Practical Wireless, King's Reach Tower (Hatfield House), Stamford Street, London SE1 9LS .

73's
Sam G8TNT

the YL COLUMN

Elaine HOWARD G4LFM

Back again for another month. Firstly, thanks for the letters I've received since I wrote the last YL column, at least I know that I'm not the only one who reads it! I heard from Gloria G8ZYL, Carolyn G4LIL and Mary G8ZUN—all December RAE passes with new callsigns.

Gloria had both a word of praise and a moan for her local amateurs. Firstly the praise—not long after she was first licensed she was taken ill and needed to keep in contact with her husband G8STO who is "on the road" all day long. What better than to use the rig and the local repeater, that was until the batteries in her portable rig faded. She then managed to reach the shack and connect the rig to the power supply. Some of the local amateurs who had heard her on earlier began to get worried when the silence fell, and between them all they managed to keep Gloria in touch with her husband so he knew how she was getting on throughout the day. As Gloria said in her letter, it's good to have the radio if you cannot keep in touch by phone.

Now for the moan—as always, there seem to be a few who want to spoil a good thing for others. Gloria said that some people seem determined to upset the local YL's and other amateurs. "Insulted, run down and generally been harassed" were her words, which they find hardly fair. She finished her letter on a fighting note, "I enjoy my hobby and no-one is going to put me off the air."

Carolyn and Mary wrote to me just to let me know they have read the column and tell me their callsigns. Both ladies claim to be non-technical but with the RAE behind them they have evey reason to be pleased with themselves. Mary said that her fiancé was studying Morse for his Class A licence, but her French degree was taking precedence over her Morse learning.

For the first few weeks after I had my callsign I suffered from lack of sleep like most new amateurs. There always seemed to be people willing to talk to you—whatever the time of day or night. One thing I think I will remember for a long time is my first CQ call on 2m. For the first week or so all I did was reply to other people calling CQ.

I eventually plucked up the courage to call CQ; as soon as I had finished I hoped that no-one would reply because I was sure that I wouldn't have the nerve to carry on a QSO. Then after a few calls when I did get a reply things were very much easier. I'm sure a lot of amateurs soon forget what it was like to be newly licensed, but it does take a great deal of nerve. It was a good thing that I did practice on 2m before I ventured on the h.f. bands because there is a huge difference between operating methods.

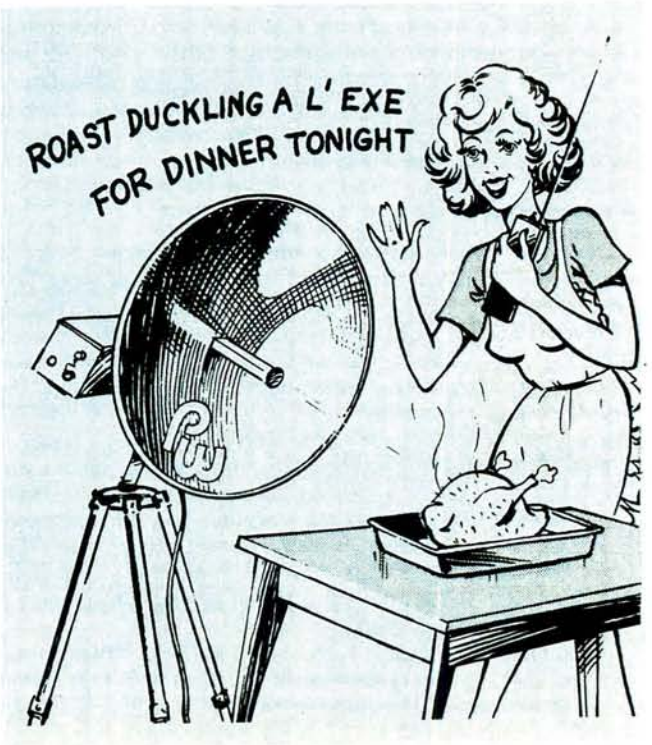
I was on the air for seven hours all told one Sunday, it really was as interesting as I had been told it would. I managed to contact two Japanese stations, numerous Russians and many stations in Europe on different bands. It's now a case of waiting until I get the next chance to use the h.f. bands.

The first Italian station I ever worked turned out to be an Englishman who lived half of his time in Italy and the rest in Weymouth (not far from here). Strange what a small world it is. One very interesting contact I did have on 10m was with a YL from Finland called Inga. I was delighted to hear another YL's voice on the air so I waited until she finished her previous QSO and then I called her. She told me that she was quite active on the h.f. bands and enjoyed the hobby a great deal.

Even on 2m I have had some excitement: there I was happily scanning the band when the scanning stopped on S20, a station was calling for help. In the dark and dusty corners of my memory stirred the recollection of how to handle an emergency. It was a long time ago—but there are some things you never quite forget. The problem seemed to be that a car was on fire on one of the local dual-carriageways; being a base station with a land line it was obvious I could do something. All the others who could hear what was happening got things right too, so between us all the Fire Brigade was called and the excitement was over.

Oh, yes, before we go any further, I know you can't use the *PW* Exe for cooking, but what's the first thing you think of when the word "microwaves" is used? Mind you, think how useful the project could be if it had a dual function, communications and cooking!

I'm now set up with a lovely little base station (well, I think so), my IC2E serves as a base station, mobile station and a portable rig. With the aid of a power supply, regulator battery pack and a Slim Jim it has done very



continued on page 57▶▶▶

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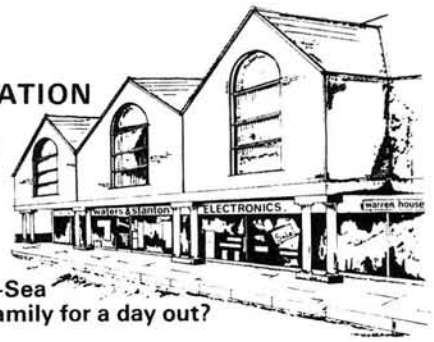

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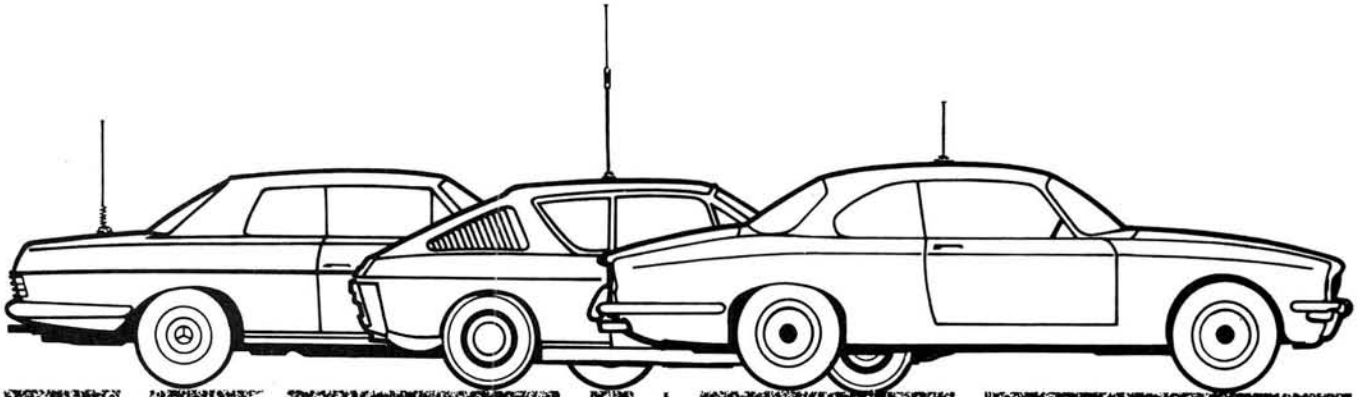


V.H.F. mobile antennas

D.O.White G3ZPA

Whether you are a licensed radio amateur, short wave listener or just interested in the v.h.f. bands in general, if you wish to participate from your motor vehicle this article on mobile antennas will be of interest.

Polarisation

The majority of v.h.f. and u.h.f. radio signals emanating from public authority and radio amateur antennas utilise vertical polarisation. In other words the electrical part of the radiated field is emitted vertically whilst the magnetic component is radiated horizontally, perpendicular to the electric field.

The principal reasons for selecting vertical rather than horizontal polarisation are as follows:

1. It makes for simple unobtrusive antennas with an associated ease of mounting to the vehicle.
2. Simple single element antennas will give an omni-directional, all round, coverage yielding equal strength signals independent of the direction that the vehicle is pointing.
3. Vertical polarisation has been widely accepted as the standard for mobile working throughout the country.

Types of Vertical Mobile Antennas

The main types of vertical mobile antennas fitted to vehicles today can be summarised as follows:—

Quarter wave	($\lambda/4$)
Half wave	($\lambda/2$)
Five eighths wave	($5/8\lambda$)
Seven eighths wave	($7/8\lambda$)

Ground-plane

You may have encountered the term 'ground-plane' antenna and in the mobile context any of these antennas will become ground-plane types when mounted over the large metallic plane of the vehicle roof.

Quarter Wave Antenna

This is the simplest, cheapest and most common of all the mobile antennas in use, particularly favoured by the various public authorities.

The $\lambda/4$ antenna will radiate an omni-directional signal, of even strength, when placed in the centre of the roof of a motor vehicle. If mounted on the gutter or the wing of a car the radiation pattern will become distorted with the maximum radiation usually towards the main body of metal of the vehicle.

The impedance of a $\lambda/4$ ground-plane whip antenna can be shown to be approximately 40 ohms. When mounted on a roof rack or gutter the impedance becomes difficult to determine because of the uneven ground system.

Coaxial feeder cables suitable for connecting this form of antenna to its associated transmitter or receiver usually have a characteristic impedance of 50 or 75 ohms. In this case 50 ohm cable would be the best for matching purposes.

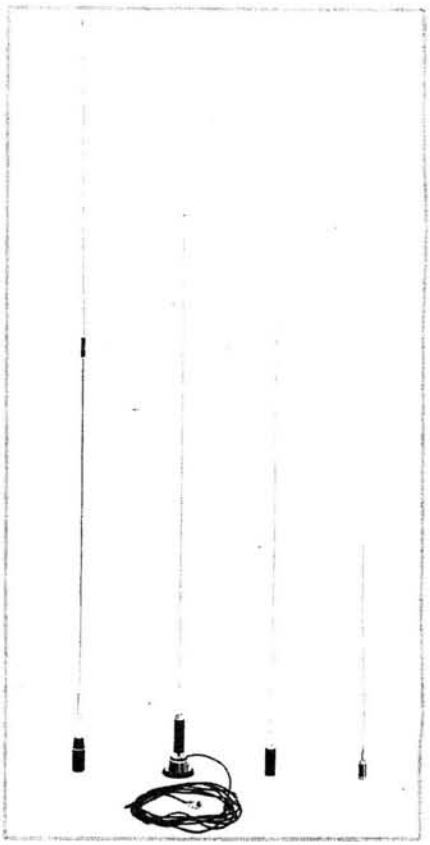
On a voltage standing wave ratio (v.s.w.r.) meter the indicated mismatch should be approximately 1·5:1, which is slight.

The following example demonstrates the method used to obtain the physical length of the $\lambda/4$ antenna at the required operating frequency using the practical formula:—

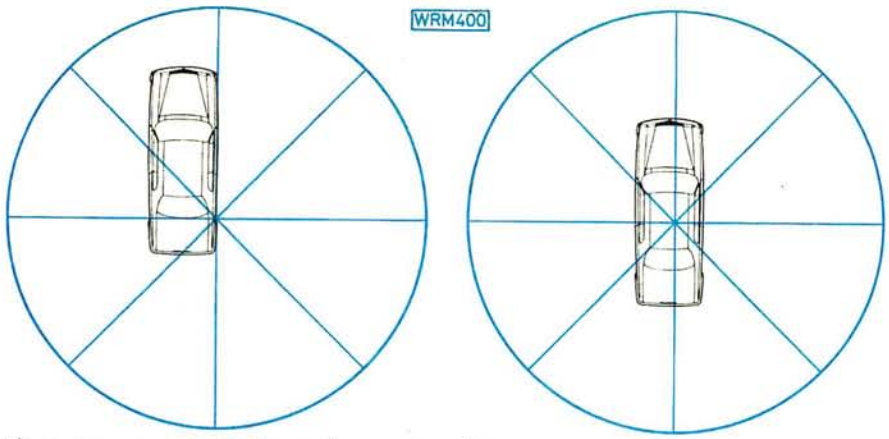
70358÷frequency (MHz)=length (mm)

At a frequency of 145·000MHz this will result in an element length of 485mm at resonance.

As previously noted the impedance when mounted on a good metallic ground-plane will be 40 ohms. By way



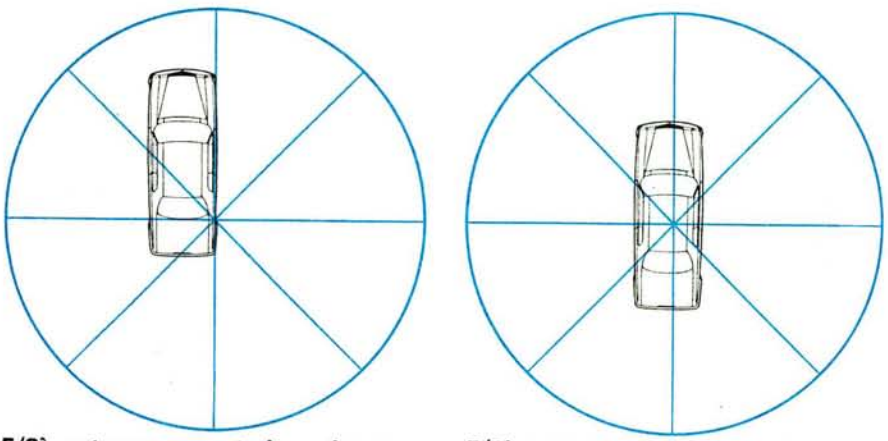
A selection of widely used mobile antennas



λ/4 antenna mounted on the rear wing

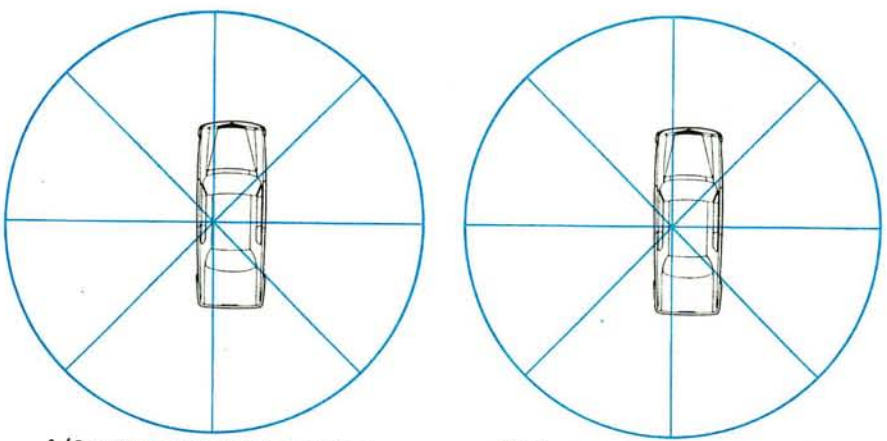
λ/4 antenna mounted centrally on the roof

◀ **Radiation pattern plots of popular mobile antennas**



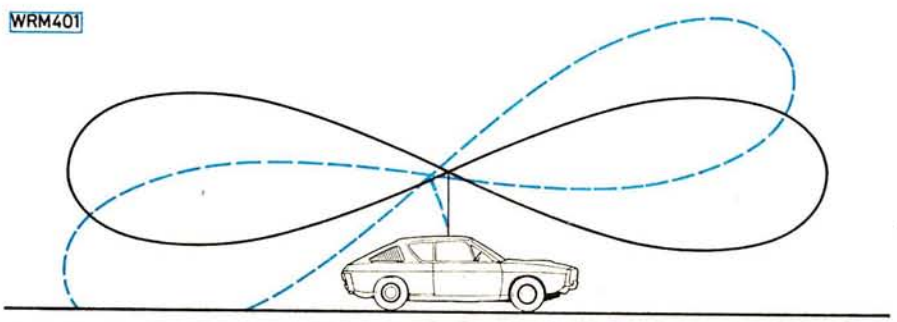
5/8λ antenna mounted on the rear wing

5/8λ antenna mounted centrally on the roof



λ/4 antenna gutter mounted

5/8λ antenna gutter mounted



◀ **Fig. 1: 5/8λ antenna radiation pattern—solid line vehicle stationary—dotted line vehicle on the move**

of experiment, if the length of the λ/4 element is extended the indicated v.s.w.r. can be made to fall towards 1:1, a very good match. Unfortunately, the antenna will no longer be resonant at the required operating frequency but at some lower frequency determined by its new overall length. The base impedance will however be nearer to 50 ohms but possessing a small amount of inductive reactance.

Antenna Matching

A classic system used for matching the impedance at resonance uses the transmission line transformer technique shown in Fig. 3. With the frequency used in our example calculation, 318mm of 50 ohm coaxial cable connected between the λ/4 antenna and a 75 ohm feeder will allow an ideal match.

Five Eighths Wave Antenna

There is a relationship between the gain of an antenna and its directivity; any achievement of gain in a particular direction is always accompanied by a loss in another.

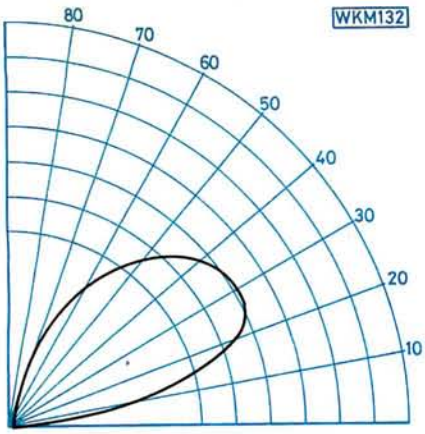
When a claim is made of gain in a vertical antenna, what is actually meant is that less radiation occurs in a skyward direction and more radiation is transmitted in a horizontal direction.

The angle made between the centre maximum of the radiated wave and ground is known as the radiation angle; the lower the angle the further the signal will go before it becomes too weak to be heard.

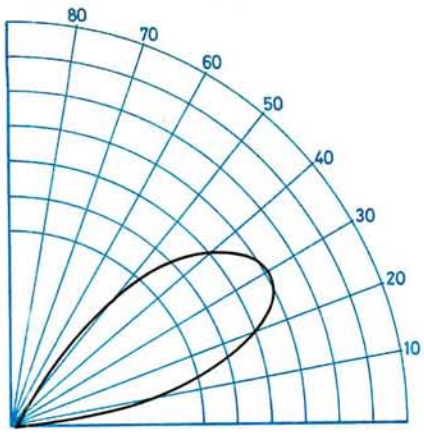
The 5/8λ antenna was derived for this very purpose; by increasing the length of the antenna the high current portion is elevated much further up the element resulting in a lower radiation angle towards the horizon.

From the radiation angle plots it can be seen that the λ/4 antenna radiates at approximately 44° whilst the 5/8λ radiates at only 30°. The resultant concentration of energy, nearer to the ground, produces an apparent gain of 3dB over the λ/4 antenna system.

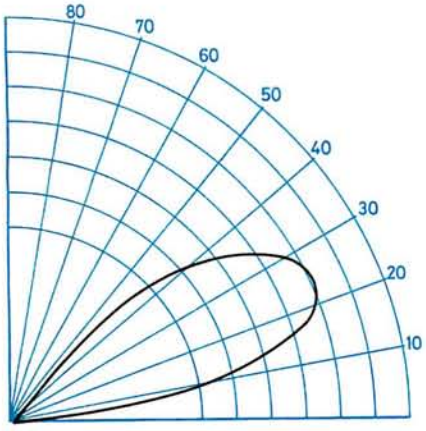
In general the greater the length of a vertical antenna, compared to a λ/4,



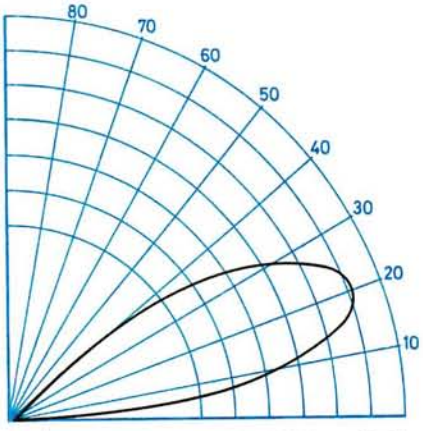
λ/4 antenna, gain 0dB radiation angle 44°



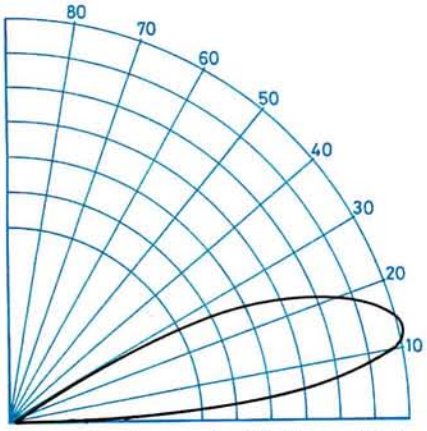
λ/2 antenna, gain 2dB radiation angle 35°



5/8λ antenna, gain 3dB radiation angle 30°



7/8λ antenna, gain 4dB radiation angle 25°



PW Slim Jim, gain 5·5dB radiation angle 15°

◀ **Fig. 2: Radiation angle plots—gain figures are referenced to the test λ/4 antenna mounted on the vehicle**

the lower the angle of radiation will become. This applies equally for reception, allowing the 5/8λ to receive low angle signals better than high angle ones.

One other important factor influences reception and this is termed the capture area of the antenna. A λ/4 vertical antenna at 70MHz will perform far better than a vertical λ/4 at 430MHz because, due to its greater length it is able to intercept more of the wanted signal. It is not possible to connect a coaxial feeder directly to a 5/8λ antenna due to the high impedance mismatch. What is required is a means of tricking the r.f. energy into thinking that it is feeding into a 3/4λ antenna, as this is the nearest length likely to allow a match.

To achieve this matching condition it is necessary to insert an additional λ/8 into the base of the 5/8λ element. By winding the additional material into a coil form the overall physical length is kept at approximately 5/8λ but the all important electrical length becomes 3/4λ with a corresponding reduced base impedance of 68 ohms and a close match to 75 ohm feeder. A typical v.s.w.r. reading for 75 ohm systems would be 1·2:1 and with a 50 ohm feeder 1·4:1.

At our example frequency of 145·000MHz the 5/8λ antenna would have a length of 1245mm from its tip to the top of the λ/8 coil section. As supplied most commercial antennas of this type are produced overlength to allow the user to trim for lowest indicated v.s.w.r. A disadvantage of the 5/8λ and other extended vertical antennas is that they will bend over towards the rear of the vehicle when travelling at speed. This effect distorts the normal radiation pattern, as illustrated in Fig. 3, and reduces the effectiveness of the antenna. At slow speeds the antenna can swing about its base mount giving rise to rapid signal fluctuations known as 'flutter', again caused by the continual change of radiation angle.

Flutter effects can also be observed when the vehicle is passing through built-up, wooded or hilly areas. In this case the flutter is created by multi-path propagation of the signal resulting from reflection from the various obstructions within the direct signal path. The minute time delays caused by the variations in path length produce signal phase changes at the receiver input with a corresponding change in signal strength.

Apart from the audible variations in signal strength a good illustration of flutter effect can be obtained by observing the "S" meter. Results are more pronounced with f.m. systems when operated under low level signal conditions due to the so called threshold effect, where a small increase in signal strength will produce a substantial increase in signal to noise ratio.

Antenna Comparisons

Four different types of antenna, suitable for mobile operation, have been evaluated by the author and the following conclusions are the result of these lengthy tests. All gain figures quoted are referenced to the value from the λ/4 antenna.

1. The λ/4 antenna was found to be the most consistent for mobile use, being the least prone to flutter fade, although its overall gain was low.

2. The 5/8λ gave an increase in gain but, due to the bending effect whilst on the move, inconsistent results must be expected. The radiation pattern was found to be somewhat distorted when mounted in any position other than the centre of the roof but in all positions produced superior performance to the λ/4. This is probably due to the fact that

THE CRAZIEST EVER RADIO SET

▶▶▶ continued from page 23

jerked the lever up and down and this drew zigzags on the smoked paper in time with the impulses from FL. (Don't keep saying that!) The world's first Frog's Leg Radio was a success! And Dr Lefeuvre's gold half-hunter was a minute and a quarter slow.

That, in brief, is the true story of the craziest radio of all time. Why didn't it catch on? Because it suffered from a serious defect: rigor mortis. After only a few hours' use the frog would no longer operate, and the bother of frequently plugging-in a replacement amphibian killed the FLR dead—like the frog. So the thermionic valve triumphed, and men came to boast of their "six-valve superhet" instead of their "six-frog superhet". Maybe Galvani wasn't so dumb after all.

There's a postscript to this amazing history. Some years ago, the writer had a yen to build a working replica of Dr Lefeuvre's hook-up. Not having a frog, he downgraded the project to a static model fitted with an ersatz croaker moulded in green Plasticine. Since his infant daughter had only orange Plasticine, and the frog she moulded was a dead ringer for a hippopotamus, the scheme was abandoned altogether.

Yet it lurks in the background. Frogs are out, I can't catch one. But the cabbage patch is teeming with fauna ranging from wireworms to next-door's tomcat. Somewhere in there must be a suitable substitute.

Is mankind ready for the world's first Blackbeetle Radio? ●

THE YL COLUMN

▶▶▶continued from page 52

well. The antenna is propped up in the window sill as it is impossible to have an outside antenna at the moment. That is far more convenient than when I was using the NiCads and the helical whip antenna that comes with the rig. To use our local repeater I had to find a position in the room that I could access it and then stay there! If I so much as moved, then my transmission would drop out of the repeater, which was not very easy as the only place I seemed to be able to stand was very precarious to say the least. It tended to be rather doubtful balancing positions on chairs and the end of the bed, which risked life and limb. Things have become far less dangerous now and it makes talking to people so much easier, but doesn't provide others with quite so many laughs at my expense.

I find it very useful to have a rig that just fits into a handbag (or pocket); it can then travel everywhere with me. Seeing that I do quite a lot of travelling I get lots of chances to operate in many different locations. Mind you, when you are out and using the rig portable you collect plenty of funny looks and whispered comments. People in the street don't quite know what to make of the sight of you strolling down the main road deep in conversation with a small plastic box!

That's all the space used up for this month, I would still like to hear from any other YL's: let me know if you have something you want to say. So, 33's until I write next time.

---

the high current part of the antenna is located well above the metallic bodywork. The λ/4 performed extremely badly when placed anywhere on the vehicle other than the centre of the roof.

3. The λ/2 antenna gave 1dB less gain than the 5/8λ but otherwise appeared to behave exactly as the former.
4. The 7/8λ antenna gave a gain of approximately 4dB compared to the λ/4 and was the best of the four antennas tested in terms of relative gain. Unfortunately the 7/8λ also suffered from the effects of bending and its 1740mm length did result in several collisions with overhead obstructions!

A cure may be effected by using nylon monofilament fishing line, but subsequent removal operations take longer.

***PW* Slim Jim mobile antenna ▼**

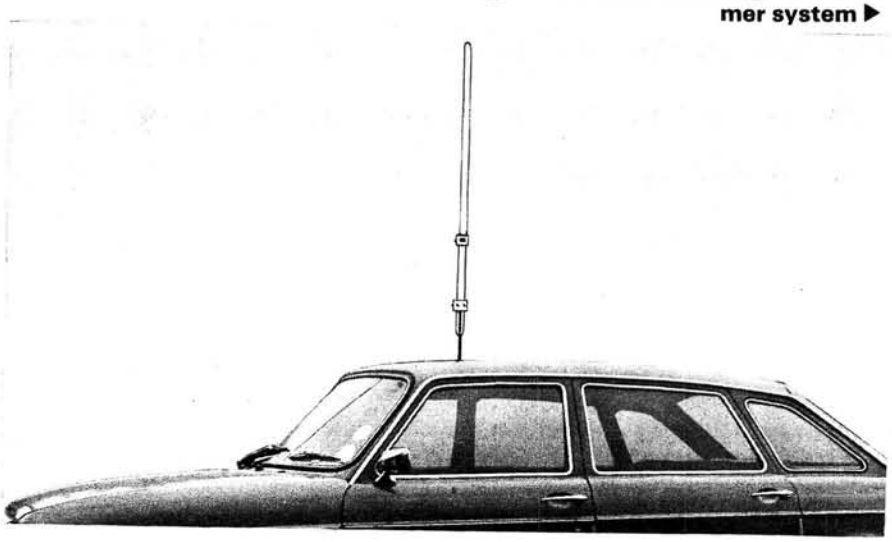
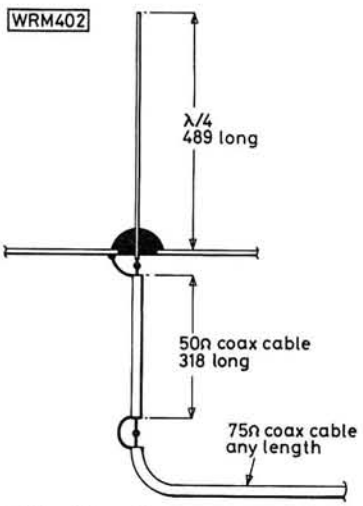


Fig. 3: Coaxial matching transformer system ▶



Mobile Slim Jim

One further antenna was tested out to see how it would perform under mobile conditions and consisted of an 'ordinary' Slim Jim, constructed from aluminium tube. This reasonably rigid device was mounted on a short length of wooden broom stick and supported from the roof rack. The results obtained were quite astonishing and a gain figure of 5·5dB was recorded, with no signs of flutter fade. If a suitable means could be devised to overcome low-flying obstacles this format would be a winner. ●

AMATEUR RADIO EXCHANGE

A SPECIAL ANNOUNCEMENT THIS MONTH FOR OUR FRIENDS AND CUSTOMERS IN THE NORTH WEST.

Our first branch outside London is about to open in St. Helens under the management of that well-known technical wizard Mike, G8EWU. As you would expect, he will be stocking a good, representative range of rigs by YAESU, ICOM and TRIO/KENWOOD plus a wide selection of accessories.
*We promise you will be made as welcome at 136 Gladstone Street, St. Helens **(near the Rugby ground)** as you always have been at Ealing. The only thing missing will be Brenda's coffee!*

FT-707
The ultimate in HF mobile transceivers from Yaesu. All the new bands, and all the latest technology.
PHONE FOR PRICE INCLUDING FREE MIC.

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The tried and tested Yaesu HF base station, now with audio peak filter and reject notch filter as standard and choice of AM or FM.
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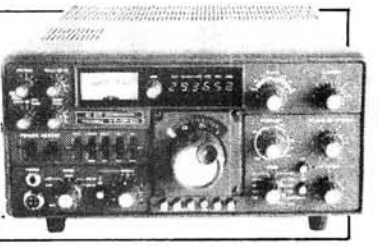

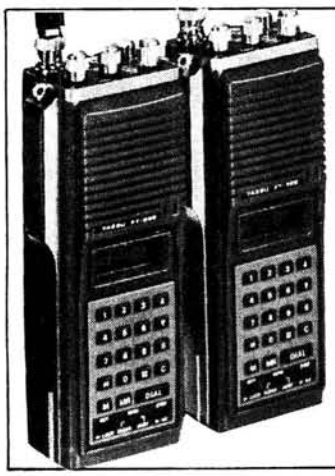

FT-208/FT-708
Yaesu's marvellous new hand-held for either 2m or 70cm operation. Its LCD display (with night lamp feature) is coupled to a 4-bit microprocessor giving 10 memories, up/down scanning in 25 or 50kc steps (manual or auto) plus memory scan and scanning between two desired frequencies, priority channel with search-back, keyboard entry allowing split frequency for non-standard repeaters . . . and lots more.
PHONE FOR PRICES

TRIO/KENWOOD – LATEST MODEL IMPROVEMENTS
Three best-sellers in the range up-rated with new model designations. The TS-520 and TS-820 become the TS-530S and TS-830S respectively, both with all the new bands, IF shift etc . . . and the TR-7800 becomes the TR-7850, now giving 40W out.

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YAESU's LATEST . . .
the new all-mode 2m portable FT-290R
So many features *10 memories *Memory scan *2 VFOs *Band scan *Clarifier *FM/LSB/USB/CW *LCD readout *Real S-meter *Priority channel *2.5W out
PHONE FOR PRICE

FRG-7700
Yaesu's latest receiver with FM right across the band now offers all these optional extras *Memory facility *FRT-7700 Aerial Tuning Unit at only **£34.75** *Four VHF converters running from 50MHz up to 170MHz.

BASIC RECEIVER £299 inc. VAT and **FREE HELISCAN AERIAL**

Converter specifications * Phone for Prices

FRV-7700A	118-130MHz	130-140MHz	140-150MHz
FRV-7700B	118-140MHz	140-150MHz	50-60MHz
FRV-7700C	140-150MHz	150-160MHz	160-170MHz
FRV-7700D	118-130MHz	140-150MHz	70-80MHz

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PRODUCTION LINES

ALAN MARTIN G8ZPW

Enclosures

Eldon Electric Ltd. stock an enormous range of enclosures from floor-standing cabinets to miniature die-cast aluminium boxes and are prepared to supply their products to the general public on a one-off basis.

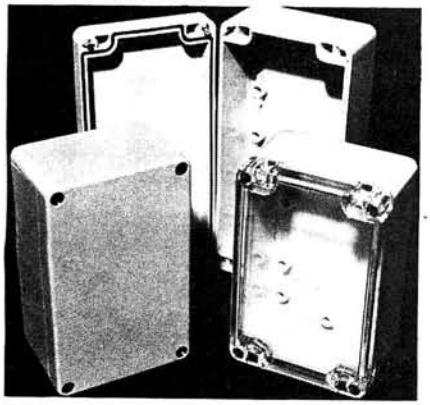
Our photograph shows three examples of their "Compact" series of enclosures supplied in three different materials.

There is a choice of 76 separate sized cases which range from 50 x 45 x 30mm to 600 x 310 x 110mm and are manufactured in die-cast aluminium, polycarbonate and ABS. All the enclosures have recessed sealing gaskets in the cover which affords protection to IP65.

In the aluminium range the covers are secured by captive stainless steel screws. Covers for both the polycarbonate and ABS enclosures are retained by "quick release" stainless steel fasteners and can also be supplied with optional transparent covers for a small extra charge. Mounting plates and external mounting brackets are available for any of the enclosures.

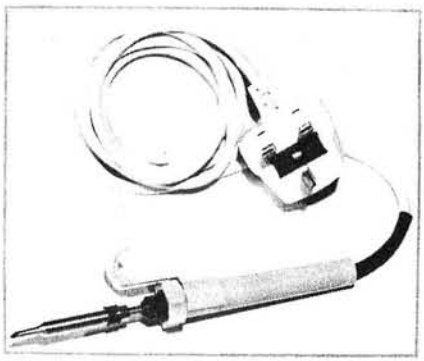
As an example of prices across the three ranges, the CM160 (die-cast aluminium) measures 125 x 80 x 54mm and costs £6.00, the CK621 (polycarbonate) measures 160 x 80 x 55mm and costs £4.40 and the CK622 (ABS) measures 160 x 80 x 55mm and costs £3.50. Prices quoted include carriage but 15% VAT must be added.

A catalogue covering the "Compact" series (OB80) is available along with information and prices on the whole of their product range from: *Eldon Electric Ltd., Lovett Road, Staines TW18 3AH. Tel: (0784) 61851.*



New Soldering Irons

Antex (Electronics) Ltd., of Plymouth, Devon, has introduced a new "Ready to go" range of soldering irons for industrial and domestic use. The CS and XS miniature irons are fitted with a fused, moulded 3-pin mains plug and 0·75mm² cable. The anti-roll handle and the new first finger guide/protector are made from extra tough engineering plastic.



With a power consumption of 17W, the CS model produces a maximum tip temperature of 420°C. The larger 25W model produces up to 400°C with much greater thermal capacity for use as a general purpose soldering iron.

On sale at a recommended selling price of £5.30 plus VAT, the CS and XS soldering irons are available from electrical suppliers, hardware and chain stores.

Antex (Electronics) Ltd., Mayflower House, Plymouth, Devon. Tel: (0752) 67377/67378.

Low-cost d.f.c. Kit

Timestep Electronics Ltd. can supply a low-cost digital frequency counter kit called the DFC-4.

The DFC-4 will provide direct frequency readout to at least 150MHz, and the in-built ROM circuitry provides automatic offset for both 10·7MHz (f.m.) and 470kHz (a.m.) operation; both these offsets can be reprogrammed if required. Although primarily designed for l.w., m.w. and f.m. operation, it can also function as a direct frequency counter.

Connection to most receivers is simple and readout is via a flicker-free fluorescent display which also indicates a.m., f.m., kHz and MHz. With sensitivity of 1mV a.m. and 10mV f.m., the counter is powered from its own fully isolated mains power supply unit.

Timestep offer the DFC-4 in two kit forms, the complete kit costs £12·50 and a cost-saving kit, which omits the commonly available resistors and capacitors, costs £10·50, both prices include VAT, but £1·50 p&p must be added.

Both kits for the DFC-4 or further details (please send s.a.e. for details) are available from: *Timestep Electronics Ltd., 48 Egremont Street, Glemsford, Sudbury, Suffolk. Tel: (0787) 280154.*

The Shape of Things to Come

Fidelity Radio Ltd. has just issued a photograph of their starter unit for the 27MHz f.m. Citizens Band radio service, which the Government plans to introduce in the autumn.

The basic unit, the CB-1000 FM, is expected to retail at around £60, with a more sophisticated version selling at approximately £80.

Fidelity Radio Ltd., Victoria Road, London NW10.

PRODUCTION LINES

PCB Designing Aid

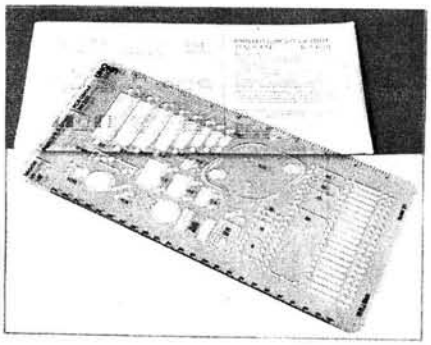
UNO Sales, the Croydon based manufacturer and distributor of drawing office products, have introduced a range of templates specifically designed to meet the requirements of designers and illustrators.

Part of the range consists of a series devoted to the electronics and electrical industry. One in particular, the DT609 p.c.b. layout template, should be very useful to the constructor who wishes to design his own p.c.b.s.

The DT609 template cutouts are twice full size and include pad spacings patterns for capacitors, resistors, transistors, i.c.s and edge connectors.

Technical templates are available from good drawing office suppliers and cost approximately £6.45.

UNO Sales, A. West & Partners Ltd., 684 Mitcham Road, Croydon CR9 3AB. Tel: 01-684 6171.



Latest from Trio

The very latest from Trio is the TR-7730, a really compact 2m f.m. mobile transceiver which measures only 147·5 x 51·5 x 198mm.

Possessing plenty of convenient operating features, such as five memories, memory scan, automatic band scan, Up/Down manual scan and the r.f. output power can be switched from 25W to 2W.

The TR-7730 should be available in the UK by the time this issue of *Practical Wireless* is published (early August), but for confirmation of availability and further details contact: *Lowe Electronics Ltd., Bentley Bridge, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 2817.*

Signal Generator

Sinclair Electronics Ltd. has recently introduced the LSG-16, a wideband mains operated signal generator with a frequency range of 100kHz to 100MHz (300MHz on harmonics) over six positions. It can be modulated internally at 1kHz or between 50Hz and 20kHz from an external source. Crystal oscillator facility is also provided for 1MHz to 15MHz.

The LSG-16 is housed in an attractive professional case and competitively priced at £55.00 plus VAT.

Further details can be obtained from:

Sinclair Electronics Ltd., London Road, St Ives, Huntingdon, Cambs. Tel: (0480) 64646.

The photograph shows left the IC-25E and right the IC290-E

Two New Rigs from Icom

Icom has recently announced the introduction of two new rigs. First, the IC-25E, a very compact 2m f.m. mobile transceiver that features 25W output, five memories, 1kHz or 25kHz v.f.o. steps, programmable priority channel, automatic repeater selection with alternative frequency splits available, full reverse repeater at the touch of a button and two scanning modes (all the band or just the memories) which can be instigated from the front of the rig or from the microphone. There are also several controls under the top plate that can be used to adjust the length of time the scanner spends on each channel and the speed at which it scans. The large digital display is extremely bright and should remain visible even in bright daylight, as should the l.e.d. combined r.f. out/S-meter.

The IC-290E has been introduced as a replacement for the IC-260E which will now be withdrawn. It has basically the same specification as the IC-25E and as it is a multimode operates on c.w., f.m. and s.s.b. and also has an RIT button. Facilities for listening on repeater inputs is another feature.

Further details of price and availability for both the rigs are obtainable from: *Thanet Electronics Ltd., 143 Reculver Road, Beltinge, Herne Bay, Kent. Tel: (022 73) 63859.*

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BRAND NEW FROM FLUKE . . . NOW AVAILABLE THE 8024A HAND HELD DMM

This model incorporates all the features of the 8020A but in addition has:

A peak hold switch which can be used in AC or DC for volts and current functions.

Audible continuity testing and level detection for sensing logic levels.

A temperature (°C) range for use with a thermocouple.

£155

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80I-600 Clamp-on AC Current Probe	**£61.00**
80J-10 Current Probe	**£22.00**

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Consider the following features:
6 resistance ranges from 200 ohm-20 ohms.
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Meets tough military specs. – drop proof.
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All this plus a 2-year full guarantee.

£89

Carriage and Insurance £3

Soft carrying case £8 extra

Even more sophisticated the Fluke 8020A.
Identical in most respects to the 8022A but in addition incorporates a conductance range from 2mS-200nS.

Price £125

Carriage and Insurance £3.00

A handsome soft carrying case is included (this model only)

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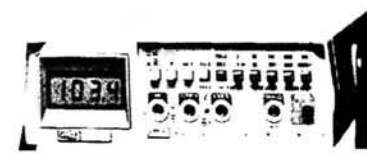
FLUKE



8010A AND 8012A BENCH MODEL D.M.M.s

The 8010A is a general purpose, bench/portable digital multimeter with more functions and features than ever offered for such a low price. Its companion, the 8012A, has identical characteristics except that it has two additional low resistance ranges, 2Ω and 20Ω to replace the 8010A's 10 ampere current range.
The 8010A and 8012A feature:
10 voltage ranges from 200mv-1000v dc, 200mv-75v ac.
3 conductance ranges from 2mS-200nS.
6 resistance ranges from 200Ω-20mΩ – the 8012A has two additional resistance ranges 2Ω and 20Ω.
10 current ranges from 200μA-2A AC/DC – the 8010A has two additional current ranges 10A AC and 10A DC.

80 10A **£167** 80 12A **£218**

Carriage and Insurance £3.

The 8010A is also available with two rechargeable Nicad size C batteries installed in option –01 a+ **£193.00.**

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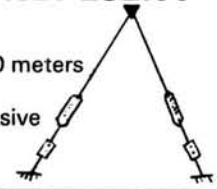

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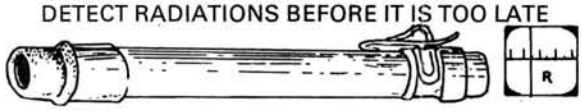

BOSCH 2.5kW 40uF Capacitor £8.00

- Mini Transformers 12 volt 250mA **£1.00** p&p inc.
- Transformers 12-0-12, 24-0-24 500mA **£3.25** VAT p&p inc.
- Auto Wound 240 to 110v, 6.3A **£9.00**
- Transformer 15-0-15 volt, 5A **£6.50**

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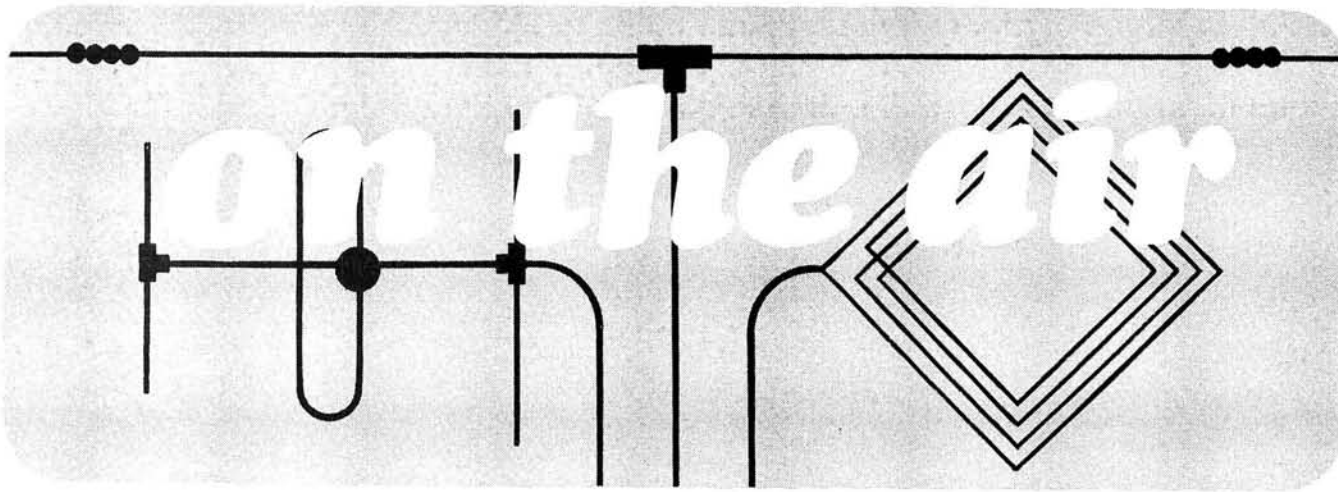


Amateur Bands

by Eric Dowdeswell G4AR

Reports to: Eric Dowdeswell G4AR
Silver Firs, Leatherhead Road,
Ashtead, Surrey KT21 2TW.
Logs by bands in alphabetical order.

With the release next year of one of the three amateur bands allocated at the WARC in 1979, many amateurs will be lashing up temporary antennas in order to see what the new 10MHz band can offer. There will probably be a spate of transverters for use with existing rigs and, hopefully, *PW* will come up with a design. Whether it will be worthwhile including facilities for the other two new allocations, 18 and 24MHz, is very much a matter of speculation, since their release date is indefinite at the moment and could be of the order of years.

For the listener with a general coverage receiver the problems of using the new bands are few, mainly tuning the a.t.u. to the appropriate frequency, once the band limits have been ascertained. If dipole antennas are being used then another cut for 10MHz can be soldered in parallel with an existing one.

For anyone with an amateur-bands-only receiver then an external converter would seem the only answer, preferably crystal controlled and feeding into the set which is then used as a tunable i.f. stage. While 3·5 to 4MHz is a favourite spread for this particular application, the risk of breakthrough of powerful signals in this segment is very real and perhaps the 28MHz band would be better for the tunable i.f. stage. Anyway, signals on this band are going to fall off in the next few years as we slide down the slippery slope of the present solar cycle!

With such a converter, coverage of all three new bands would be wise from the outset, involving only a few extra components. Naturally, anyone buying a communications receiver today should ensure that it does cover the 10, 18 and 24MHz bands, and while this would seem very obvious there is one new set being advertised for several hundred pounds that does not do so! The same reasoning applies to transceivers, of course, where the vast majority are amateur-bands-only. We might even be getting some good bargains before long in transceivers and receivers that do not meet our future requirements in much the same way as the 22-channel 27MHz CB sets became dirt cheap once 40 channels were allocated, forming a good foundation for a 28MHz set-up.

Come to think of it, the present illegal CB a.m. rigs in this country may also come on to the surplus market before long, once the legalised f.m. service gets under way; another opportunity for *PW* to get some designs organised for converting such rigs to our 28MHz band?, followed by a linear, of course. Nothing new in this idea, but little has appeared in print on the subject, since such basic sets are illegal, as they stand, in the UK. The Government might be delighted if a few tens of thousands of such rigs were converted for the 10m band!

My piece on receiver i.f. filters seems to have been well received, so next month I propose to chat on the pros and cons of single and multiple frequency conversion in receivers.

Club Time

A veritable explosion of reports from secretaries, so many of the club names mentioned may be new to the column. Owing to space restrictions (note the smaller type face recently), famous club names may be missing, but be assured they are as active as ever.

Consensus of opinion is that the recent "radio only" policy of *PW* is more likely to mean readers of the type acceptable to the average club.

Southdown ARS. Feature is the Dreaded Draw where, every month, the committee draws members' names from the hat for the honour of writing a short article for the club newsletter. What a clever idea! The SARS, with other local clubs, was very active organising stations and social events at the recent IARU Region 1 conference at Brighton. Try R. E. Holtham G4EKS, 2 Benbow Avenue, Eastbourne, E. Sx, for up-to-date info on club actitivities, or ring Eastbourne 32777. Meetings first Monday at 7.30 at Chaseley Home for Disabled Ex-Servicemen, Southcliff, Eastbourne, with Arthur Milne G2MI of QSL bureau fame discoursing on amateur radio of the past at the August meeting.

Edgware & District RS. Second and fourth Thursdays, 8pm, Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware, Middx, only event in August being s.s.b. f.d. briefing on the 27th. General news on club, details of slow morse from G3ASR, plus club net info from Howard Drury G4HMD, 39 Wemborough Road, Stanmore, or 01-952 6462.

Sutton Coldfield RS. Meets at S.C. Public Library, Sainsbury Centre, second and fourth Mondays, 7.30. Talks, discussions, etc, for the welcome visitor on radio and allied subjects. Contact sec Derek Turner G8TUR, 10 Jervis Crescent, S.C., W. Mids or (021) 353 2061.

Cheltenham ARA. Following the sad loss of Edgar Janes G2FWA, news is that member Bill G2AGX has also passed away. Meetings at the Old Bakery, Chester Walk, Clarence Street, on first Thursday and third Friday. EME tests are discussed by G4ERP and G8PZD on Aug 6, and the 21st is natter-night, always a jolly occasion, ideal for the visitor popping in for the first time. Do contact Grant Cratchley G4ILI, 47 Golden Miller Road, Cheltenham, or 43891. Club is organising coach trip to the ARRA exhibition at Donington Park on Oct 30, so get your name down now!

Dartford Heath DF Club. No regular pm meetings but frequent d.f. hunts, which Margaret Burchmore G8LXK, 49

School Lane, Horton Kirby, Dartford, Kent, will gladly tell you about on request.

University College of N. Wales ARS (GW3UCB). Aug 2 has the club engaging in the 2m QRP contest from Cyrn-y-Brain with a 2m meteor scatter trial on the 11–12th from the same QTH and a 4m trophy contest on the 16th. All go, isn't it! Club recruitment is in full swing, and Simon Brown GW4ELI, School of Eng. Science, Dean Street, Bangor, Gwynedd, would be particularly glad to hear from any s.w.l. or licensed amateur considering a degree course, especially in electronic engineering.

Wirral ARS. First and third Weds, 7.45pm, Sports Centre, Grange Road West, Birkenhead, with G4KVP running a quiz on Aug 5 and a live demo of slow-scan TV by G4CZR on the 19th. Latest issue of newsletter has G3TKN holding forth, very practically, on DX working on 80m. More from G. O'Keeffe-Wilson G8VPF, 20 South Drive, Upton, or 677 1531.

Wigan College of Technology RS. Club in process of formation with call G4KOG, with college offering RAE course in Sept, projected code classes and practical evenings, with a "wealth of test equipment and expert advice", so what more could one ask? Senior lecturer J. Hesford G8WLS at the college, Parsons Walk, Wigan, or 494911, can help on any aspect.

Southgate RC. Second Thursday at the Scout Hut, Wilson Street, Winchmore Hill, London N21, just two mins from W'more Hill BR station. Interesting newsletter *Bandspread* has details of RAE classes and code sessions for its 130 or more members, and following a recent club vote it's "no smoking" at lectures. Write to PRO Stuart Lindell G4IEH, 73 Old Park Ridings, Winchmore Hill, London N21, or 01-360 4936.

Stevenage & District ARS. First and third Thurs, 8.15, Senior Staff Canteen, British Aerospace, Plant B, Gunnelswood Road, Stevenage. Aug 6 is natternight and club station on the air with a beginner's night on the 20th. Make a note of Sept 3 when Mike Waterman chats on video recorders. Contact S. Clarke G8LXY, 126 Putteridge Road, Luton, Beds, or try the f.m. net on 145·25MHz Mondays at 2000 local.

Mid-Sussex ARS. At the QTH of G3ZMS, Marle Place, Leylands Road, Burgess Hill, W. Sx, at 7.45. although during August meetings will be informal. Recent highlight was presentation of two trophies in club constructional contest. Club was another of those concerned with the GB1IARU venture at Brighton. Details from G3ZMS, as above.

Wireless Preservation Society. Bit off the usual track but advance notice of annual get-together on Sunday, Sept 20, at the National Wireless Museum, Arreton Manor, near Newport, IOW, from 2.30pm. Talk-ins GB3WM on S22 and (SYLEDIS permitting) GB3IW on RB4. More from Doug Byrne G3KPO, Arlington House, 34 Pellhurst Road, Ryde, IOW, or it might be easier to ring Ryde 62513.

School of Engineering Radio Club (G3IHH). At the REME Arborfield Garrison, near Reading, Berks, every Thursday, 1930 hours. Excellent newsletter tells of activities such as film nights, visit to the Racal plant, socials, satellite communication, and many practical projects. Very wisely, the club is considering buying CB f.m. equipment in due course for contacting the many students at the School who will be similarly equipped but perhaps unaware of the club's activities. Write to John Northcott, at Shardcroft, 328 Nine Mile Ride, Wokingham, Berks, Eversley 732218, who will tell how to reach the club.

East Antrim ARC. The Carntall Hall at 8pm on Sept 8 for the AGM will be a good opportunity for visitors to find out all about this club, where new members are especially welcome. Sec is Jim Welsh GI4JXM, 20 Bryantang Brae, Doagh, Ballyclare, Co Antrim, BT39 0RJ.

Chichester & District ARC. It's room 34A, Lancastrian Wing, Chichester High School, Basin Road, Chichester, first and third Thurs at 7.30pm, although August is a closed month. However, Sept 1 sees Peter Brooks enlarging on electronic games machines. More from S. Talbot G8FCX, 31 Pier Road, Littlehampton, W. Sx, or Littlehampton 5082.

City of Belfast YMCA RC. "Increasing number of members reading *PW* with recent orientation towards radio, and amateur radio in particular", says hon sec Paul McTaggart GI6BJO. Club holds famous old call GI6YM with own shack in Belfast YMCA, meetings at 7pm, Tuesdays. The tri-bander antenna is 100ft over street level! Try Paul at YMCA Radio Club, 12 Wellington Place, Belfast BT1 6GE.

Harwell ARS (G3PIA). Third Tuesday of the month, 7.30pm, in the Social Club, AERE, Harwell, with visitors assured of a warm welcome. RAE classes look like adding nearly a dozen new licences before very long, with local CBers expressing a lot of interest in the club's activities. So says Ann Stevens G8NVI, 78 Whitehorns Way, Drayton, Abingdon, Oxon, who will be pleased to answer your queries. Drayton 430 will also do.

Torbay ARS. Fridays, 7pm, Bath Lane, rear of 94 Belgrave Road, Torquay, with a general meeting on last Sat of month at same QTH. Big event to come is the Torbay Rally at ITT Social Centre, Old Brixham Road, Paignton, on Aug 30, with trade stands, prize draws and refreshments, hard and soft. Talk-in on S23 with G8NJA and through GB3TR. Have a word with L. G. Mays G2CWR, Atlantis, Clennon Avenue, Paignton, for more details.

Mexborough & District ARS. Fridays, 7pm, at Harrop Hall, Dolcliffe Road, Mexborough, with meeting details from Ian Abel G3ZHI, 9 Grove Terrace, Maltby, Rotherham, or R'ham 814911.

Gloucester ARS. Thursdays, 7.30pm, Chequers Bridge Centre, Painswick Road, Gloucester, with other outdoor activities like d.f. hunts, picnics, etc, during the summer (?) months. Pat Perkins, 40 Carlton Road, Gloucester, will fill you in.

Fareham RC. From Sept to Dec meetings every Wednesday, at 7.30pm, Portchester Community Centre, Room 12, with forthcoming events dealing with TVI matters, club 80m receiver project and computers. Three members are already working on the *PW* Exe transceiver project but why blame me if *PW* ran out of dishes at Ally Pally! I wasn't even there! Brian Davey G4ITG, 31 Somervell Drive, Fareham, Hants, or F'ham 234904 will help with the details.

Bury RS. Second Tuesday of the month with other Tuesdays for morse tuition, construction projects and operation of club station G3BRS or you can just have a "noggin and natter". Just go along, that's all. Aug 11 is a d.f. foxhunt event, with notice of a talk on meteor scatter techniques by G8JHL on Sept 8th. More from Peter Butterworth, 6 Wilton Avenue, Prestwich, Manchester M25 8HB, or on (061) 798 0970. Congrats, Peter, on your excellent calligraphy, it's a pleasure to look at as well as to read!

North Bristol ARC. Meetings at SHE7, Braemar Crescent, Northville, Bristol, every Friday at 7.30pm for lectures, RAE classes, code instruction and club projects. I'm sure club sec W. E. Bidmead, 4 Pine Grove, Northville, Bristol BS7 0SL, will be pleased to tell you what "SHE7" is. Afraid I don't know!

Andover RAC. Second Wednesdays and fourth Tuesdays at the Wolverdene, Love Lane, 8pm, says club treasurer Bill Wynn G4EUQ, 263 Oak Close, Middle Wallop, near Stockbridge, Hants.

Loughborough Falcon ARC. Every Friday, 8pm, at Brush Sports and Social Club, Fennel Street, L'boro, Leics, although during this time of the year d.f. hunt station G3RAL is kept pretty busy, with signal reports welcomed. Try around 1850kHz a.m./c.w. Routine matters mean RAE classes, morse tuition and constructional work. Write, only, to Jim Smith G4DZL, 91 Anson Road, Shepshed, Leics, or try the 2m f.m. net on S17–145·425MHz Tuesdays from "eight till late"!

Cray Valley RS. Advance notice of popular s.w.l. contest on Sept 12 1800GMT to Sept 13 1800GMT, with up to 18 hours logging time, but there is a multi-op section, plus phone and c.w. sections. Details from CVRS chairman Owen Cross G4DFI, 28 Garden Avenue, Bexleyheath, Kent DA7 4LF. Member G3VLX recently activated 9H3AM on the h.f. bands with over 1500 QSOs. Meetings Christchurch Centre Hall, Eltham High Street, Eltham, London SE9, at 8pm, on first and third Thursdays, and don't miss G8UVD describing his "Dopplescan" d.f. system for the 2m band on Aug 6th.

Now the DX

ISWL sec **Ed Baker** (Cramlington, Northumberland) has acquired a Hallicrafters SX62A which pleases him mightily getting CT2AK, N6YK/VP2A on 80m, CO2MQ and M1IPA on 40, plus 9Y4NP and FO8DX on 20m. The antenna is 20m long. From **C. Griffiths** in Northam, Devon, come reports of 9G1SJ, C31VE, 5N2EME, ZB2BL and OY9K on 14MHz, DU7RLC on 21 and 6W8AR on 28MHz with his CR150 and two long wires.

YL **Anne Edmondson** still awaits her BRS number from the RSGB but already belongs to the RNARS (1743). Her DX200

and short wire brought in YC6NH (QSL Box 1, Medan, Indonesia), VP2MDG (QSL W6FDG) and N2APR/4X4 of PO Box 5707, Jerusalem 91056, with M1C, HI3BEA, SVØBL, U4DP (QSL UK4ABZ), VP2AK (QSL Box 1156, Antigua), 8Q7AZ on the 20m band. Ah, yes, QTH is Edinburgh.

First report from **Graeme Caselton** BRS44984 of Orpington, Kent, where a BC348 is in use with a 50ft inverted-V. This set is an "R" model and covers 10m where HH2BW, 9M2CW and TU2JQ were captured, with PJ2MN, VP8AGY (QSL G4DEP) on 15m plus EA8TE, W9RBD/VP9 and FM7AV on 20m, with nothing special on 80 or 160m. I suspect this last-mentioned state of affairs ought to be looked into as 80m, in particular, is very active with DX.

Another first timer for the column is **Stephen Pearson** of Arundel, W. Sx, also using a BC348 on 20m where he found VP8HZ, VP2VJ, DU1EH, 9H1ET and EA8LD, after only a few months in the hobby. In Truro, Cornwall, **Bill Rendell** has not been too active on the bands of late but does mention the whopping signal from VP8QI who has now moved from Faraday Base on Argentine Is. to Rothera Base on the SE side of Adelaide Is. with QSLs to G4CHD.

Just along the corridor from my office resides **Frank Ogden** G4JST of *Electronics Weekly* (and ex-*PW*!) and over a lunchtime noggin he tells me he has just completed an all-band s.s.b. rig, and was delighted to work a DF7 on 10m when using only 50mW input while testing the rig. The DF sent Frank an excellent tape recording of the QSO as a memento. QTH is Ardingly, West Sussex.

Just to prove me wrong about no c.w. reports for the column, **Jim Dunnett,** of Prestatyn, Clwyd, reels off 4U6ITU on 3·5MHz, C31DB, N6YK/VP2A on 7MHz, EA8TY, FM7AV, HS5AID, ZB2EO, ZS4T and 9X5AB on 14 with dozens on 21MHz like CP8DK, CX7AQ, D4CBC, HH2VP, HKØBKX, JTØWA, SV1IW/5 in the Dodecanese, TU4BD, ZC4AR, ZL2FH, and 9X5AB again. 28MHz wasn't quite so exciting, with N6YK/VP2A again, ZD8TC and 4U6ITU. Interesting DX on s.s.b. included C5AAP and ZS2KG on 21, but the best, possibly, is yet to come! Jim also copies RTTY stuff so, at long last, Dennis Sheppard, of Earl Shilton, Leics, gets a companion in this mode. A 7B machine uses an all-i.c. design terminal unit to record local or off-air traffic on to a tape cassette. DX on RTTY runs to EA8RU, K4VDM, LX2LH, Y53UA on 14MHz with 21 coming up with FP8DF, K4ZS, and Y53UA again among others. Receivers are an AR88 and SRX30 and two short wires.

Dave Coggins, of Knutsford, Cheshire, hasn't found conditions too good generally with his FRG7700M receiver, but he did get two QSL cards from VR6TC on Pitcairn for reports of one, and one and a half years ago, just to cheer him up! With a two-element quad on 10m and inverted-L on other bands plus a.t.u. Dave logged something on all bands with EL2AU, S79WHW, TU2JD, ZE1AR, 3D6BE on 10m, KH6AFM, TY9ER, ZK1AR, 9X5PP on 15, AH8A on American Samoa, VK9NS and VR6TC on 20m while on 40m it was KG4WM for a rare one, TG9AL, VK2WC and 6W8AR. CW was copied from several UA-land stations on 160m.

John Kaczmarek BRS46526 of London SW10, has got going finding that an a.t.u. did wonders for his FRG7700M from the 100ft wire. Best find was VP2MDG on Montserrat on 21MHz band. Present plans call for a go at the RAE in 1982, probably sticking to a "B" ticket for a while. Well OM, it is well worth while having a go at the code, too, if you possibly can, and anyway, it's cheaper in the long run to get the full ticket right away!

Something strange going on! Several readers report getting a QSL card from GB4RS special event station which infers that their report was the only one received. "Unique" is the word used on the card, but someone seems to have got it wrong somewhere!

As usual, reports by around the 15th of the month please, with a few more logs covering c.w. operation very welcome.

One last note. The East Herts College at Turnford will be offering an RAE course over three terms from September this year aiming at the May, 1982, exam. Times probably between 7 and 9pm Mondays, but up-to-date details from Jim Sleight G3OJI, 18 Coltsfoot Road, Ware, Herts, or (0920) 4316 of the Chesham and District Radio Club, which meets at the Church Rooms, Church Lane, Wormley, not far from the College, at 8pm on Wednesdays.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

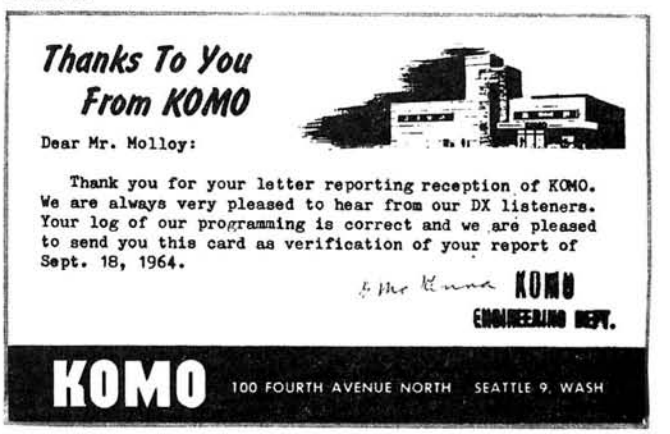
As the nights start to grow longer it is worth having another look at DX from North America. In the June issue we saw that it is possible to hear North America during that month although reception is limited to the maritime provinces of Canada and the eastern states of the USA. There must be a path of darkness between transmitter and receiver. Signals peak up for a short period at sunrise in the UK which corresponds in mid-June to sunset on the eastern seaboard of North America and, if the path is open, we get half an hour or so of very good reception. What is the situation then a couple of months later?

North America East Coast

Signals will now fade in when sunset occurs at the North American end of the path, provided of course that propagation is favourable. Reception will then settle down for a couple of hours until the arrival of sunrise in the UK when signals will peak up again before fading out. This is the pattern for the rest of the year. Signals peak up as they fade in and peak up again as they fade out. During winter, these peaks occur at times of heavy QRM so they pass largely un-noticed, though occasionally CJYQ in St John's, Newfoundland, is logged in the early evening as it peaks in.

North America West Coast

As the period of darkness increases, how far west will nighttime extend when sunrise occurs in the UK? By the last week in August dawn in the UK corresponds roughly to sunset along the west coast of North America. Signals from that area will then get a double boost, just like those from the east coast in June. This occasion marks the start of a six week season during which the west coast can be heard well in the UK while Europe can be logged by DXers in north west USA and British Columbia in Canada.



KOMO in Seattle

My first logging of the west coast was at 0530 UTC on September 18th 1964 when I listened for half an hour to KOMO on 1000kHz, which is located in Seattle in the state of Washington. Others followed including KING on 1090kHz which is also in Seattle, KFBK on 1530kHz in Sacramento, California, and two stations in Portland, Oregon, KEX on 1190kHz and KYMN (now KYXI) on 1520kHz. This was at a time of low sunspot activity which favours medium wave propagation. What about the present?

Last year, DXers in Seattle and Victoria BC pulled in a number of European medium wave stations between September 27th and October 3rd. DXers in the UK seemed to have missed this opening but two stations have been picked up recently in the UK—KEX on 1190 and CJVB in Vancouver on 1470kHz.

So if you can make the effort to get out of bed half an hour before sunrise during September you may be lucky enough to hear some real North American DX. Some frequencies to try are 1000, 1090, 1220, 1410, 1470 and 1530kHz, and the time zone is Pacific Standard Time (or daylight saving) which is 8 hours back. A communications receiver and m.w. loop antenna is essential for this sort of DXing and don't forget to have your tape recorder at the ready.

KFBK in Sacramento

KYMN in Portland, Oregon

TVI

These letters stand for Television Interference and the interference (QRM) referred to is QRM picked up by television receivers. TVI means interference with the reception of TV programmes. There is another type of TV QRM which is radio interference produced by TV receivers. In the United States this sort of QRM is called i.t.v. (interference from TV) but as this term might cause some confusion in the UK I'll just call it TV buzz. What is TV buzz, how does it occur, who does it affect and what can be done about it?

A TV set operating on the 625 line system generates a strong signal at 15·625kHz in order to produce the lines on the screen. This signal also produces a buzz at intervals of 15·625kHz across the long, medium and tropical bands. In severe cases these harmonics can be heard on the international s.w. bands as well but usually it is only the lower frequencies that are affected. TV buzz is radiated in three ways: direct from the TV set which is the main cause of QRM, from the TV antenna and its feeder, from the TV set into the house mains wiring which then acts as an antenna.

A letter from reader **Norman King** started me off on this subject. Norman lives on the top floor of a four-storey block of flats in Scotsburgh in the RSA and he is troubled with TV buzz which he thinks is coming from the 220 volt mains wiring.

What can be done about it. The first thing is to find where it is coming from. An ordinary portable receiver with internal antenna will help track it down. Tune across the medium waves to a point on the scale where the buzz is audible. Then use the receiver as a detector and try to find a spot where the buzz is weak. You might also try it with your own TV switched off, for if you live in flats the buzz may be coming from a neighbour's TV.

In general, if you use a battery operated receiver near a window as far away from the TV set as you can get and you have a whip antenna mounted on the window ledge with a screened lead to the receiver, you stand a good chance of reducing TV buzz. I've found I can null out buzz at my QTH using a m.w. loop which can be used for m.w. DXing provided you don't move it, or as a passable antenna for the tropical or short-wave bands.

Radiation from Mains Wiring

If you are sure this is happening then fit a mains suppression filter in the mains lead between the TV set and the mains socket. A typical suppressor is the RS Components 238-435 which is rated at 2 amps and attenuates in the range 150kHz to 30MHz. This means that it can be used with equipment that consumes no more than 480 watts on 240 volt mains and that radio frequencies within the long, medium and short wave broadcast bands will not pass through it. Has anyone been successful in dealing with TV buzz? It is quite a serious problem for some DXers.

Readers' Letters

Reader **David Appleyard,** who lives at the university town of Uppsala in Sweden, has built a medium wave loop and his first catches with it "during this period of extremely short nights up here" are Damman in Saudi Arabia on 1440kHz which knocked out Luxemburg at 1950 and Metro Radio in Newcastle on 1153kHz at 0100. David has been on a month long visit to New Zealand where "I enjoyed the most sensational listening I have ever known". Using up to 1500m of antenna (Bev e) at Tiwai Point, South Island, he picked up La Voz de Cuba 600kHz, TWR Bonaire 800kHz and a number of stations in eastern USA including the 5kW WSIX in Nashville on 980kHz. Wouldn't it be wonderful to have a 1500m longwire!

"The longwaves are quite interesting" writes **Edward Baker** of Cramlington in Northumberland who has received QSL cards from Baku 218kHz, Algeria 251kHz, Yerevan in Armenia on 254kHz, Poland 227kHz and Czechoslovakia on 272kHz. A Realistic DX100L is in use by **Colin Watson** (Cumbernauld) who pulled in Manx Radio 1368kHz and Dublin on 1278kHz during the daytime. **Harold Brodribb** of St Leonards-on-Sea is another local radio enthusiast. He used his AR88LF, which covers the top end only of the medium waves above 1484kHz, to pull in the 250 watt Kings Lynn on 1602kHz. The antenna is a longwire and reception was during the day. Harold reckons that the good reception he experiences to the north and the south west is due to the sea path in those directions.

"I had my letter answered over Radio Finland's Airmail (Mondays at 2030 on 254kHz, 558kHz and 963kHz) and Radio Sweden's Mailbag (Sundays on 1179kHz at 1830, 2100 and 2315)" writes **Simon Hamer** of New Radnor. He reports the medium wave reception on his Grundig Melody Boy is improved by connecting a 20 metre antenna and earth to it. Harold Brodribb has had a different experience. He followed Simon's advice (July issue) and connected a longwire via a loop to a portable and got "dreadful second channel whistles even when using the socket provided by the maker". It probably depends a lot on the particular receiver but it is a dodgy practice to connect a longwire to a portable designed to work off its internal antenna.

Short Wave Broadcast Bands

by Charles Molloy G8BUS

Reports: as for medium wave DX, but please keep separate.

Antennas for DXing is a subject that is endless. My preference is for the end fed (longwire) used with an antenna tuning unit (a.t.u.) but many DXers prefer the half wave dipole and its variant the inverted V. These two are directional antennas, maximum pick up being broadside-on to the wire and both give a boost to signals in the band for which they are cut. On other bands these antennas are non-directional and they give no gain. There is also the inverted L which is really a longwire with downlead and both have similar properties. Is there any other antenna we can try.

The Windom is a cross between the inverted L and the half wave dipole (see Fig. 1) and it has some of the properties of each. It is a non-directional antenna, which may be handy at a QTH where a choice of direction is not available. The windom is an all-band antenna and can be used with an a.t.u. but it does, so it is claimed, produce optimum results on the waveband for which it is cut and on half and one quarter that wavelength.

The horizontal part (L) equals half a wavelength minus 5 per cent at the lowest frequency to be used and the downlead is attached to a point 0·36L from either end, the end nearer the house being more convenient. An antenna cut for the 49m band (6MHz) could be 23·75 metres in length with the downlead 8·55 metres from the end. It will perform well on the 49m, 25m (12MHz) and probably on the 13m (21MHz) bands. If this is too long then one for the 31m band (9MHz) could be 15·4 metres with the downlead at 5·55 metres from the house and this antenna should work reasonably well on the 31m and 16m (18MHz) bands. There is plenty of scope for the experimenter here.

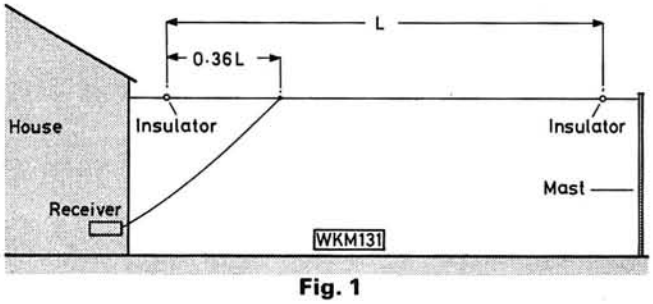


Fig. 1

Reception Reports

"I would be grateful if you would sometime in your column give a model example of a short-wave report as I wish to start collecting QSL cards" writes **Stephan Rogalson** from Birmingham.

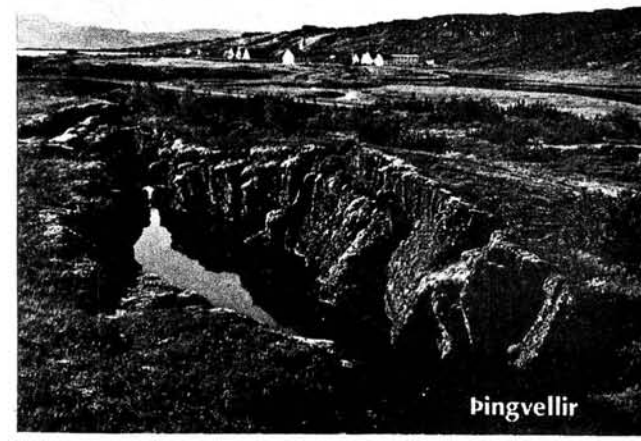
The model medium wave reception report in the February 1981 issue will do when writing to stations in the Tropical Bands or to short-wave stations that are not broadcasting to your area. Times have changed though, when writing to international broadcasters who are beaming to your part of the world. These are no longer experimental transmissions. The stations know they are being received well in the target area so what they want is feedback from the audience about the programmes.

This point was made forcibly by the Two Bobs during a Swiss Short-Wave Merry-go-round programme recently. What they said in essence was that "you wouldn't send a reception report to your local TV or radio station so why send one to us?" They went on to say that Swiss Radio International has a network of reception monitors who provide all the reception information that is required by their engineering section. SRI will however issue a QSL card to listeners who write in, but what they are asking for is comment on the programme. "If you don't like our programmes write and say so and get them changed."

I read somewhere recently that the BBC Monitoring Station at Caversham have a continuous check on Radio Canada International's transmissions to Europe. If this is so then it is hardly surprising if RCI are not over enthusiastic about reception reports from listeners in the UK. On the other hand this station's Sunday Weekend Magazine programme is built round listeners' letters which has led to some interesting mini-talks on a variety of subject. You can also experience the thrill of hearing your name broadcast all over the world.

Many stations run a letterbox type of programme. This is what stations want, so if you supply material for their programmes or comment on them, you can reasonably expect a QSL or listener card in return.

When writing to a DX station such as Radio New Zealand, which does not beam to Europe, then the traditional type of report is in order. You are asking for a verification of reception so you have to supply "evidence" that you really pick them up.



QSL card from Iceland (12·175MHz) received by Martin Whittington

Return postage in the form of an international reply coupon is appropriate in this case as you are not one of the station's audience and they are really doing you a favour in answering at all.

The European DX Council produces the EDXC Reporting Guide which "explains how to write a constructive reception report in English and other languages". It is aimed at the DXer and a DX vocabulary is included. Further details of this and other EDXC publications are obtainable by sending an SAE to EDXC, PO Box 4, St Ives, Huntingdon, PE17 4FE.

International Listeners Guide

I have recently taken out a subscription to this 16 page A5 size guide to programmes on the international short-wave bands. The ILG, which comes out four times a year in March, May, September and November, is a directory of external broadcasts in English to Europe and overseas. It gives the times, frequencies, target areas and relay stations in use throughout the day and there is also some information about programme structure, world news and commentaries and important English language DX programmes.

A specimen copy of the English version of the ILG (there is also a German version) is available for one IRC from Bernd Friedwald, Merianstr 2, D-3588 Homberg, FRG-West Germany. The annual subscription is DM7 or 10 IRC. This publication is of particular interest to the s.w. programme listener as it indicates what is on the air throughout the 24 hours.

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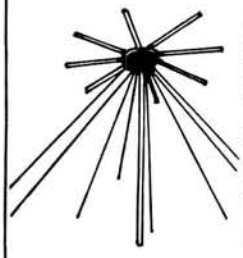

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Time Signal Stations

The reference to these stations in the July issue prompted reader **Alan Procter** of Bristol to reply. Alan uses a Drake R7 receiver with 30 metre longwire and he reports that CHU in Canada can also be heard on 3·33MHz in the 90m band when Radio Rwanda on 3·30MHz is off the air. ZSC in Cape Town is recognisable regularly on the three higher frequencies which are 22·245MHz, 17·018MHz and 12·724MHz, mainly because of their distinctive brief transmissions. JJY in Japan comes through occasionally on 10MHz and 15MHz.

DX Heard

An R1000 receiver and 30 metre longwire with antenna tuning unit (a.t.u.) are in use by **Jim Edwards** who prefers this receiver to the FRG7 on account of the narrower filters (better selectivity). He mentions hearing Paramaribo on 4·85MHz at 0415 and Apinte on 5·005MHz at 0615, both stations being in Surinam on the north east coast of South America. Jim wonders if any reader has heard of a Hartley Tuner which covers the l.w., m.w. and s.w. bands, the valve types being VP4B, TDD4, TH4B, TV4A. Replies direct to Jim please at 7 Clifton Road, Bryn, Nr Wigan, Lancs, WW4 OA2.

QSL card from Denmark received by reader Ken Wilkins. This station broadcasts in Danish only.

More DX comes from **Mathew Phillips** who has come back to DXing after a long break. With his re-aligned HR0, longwire and a.t.u. he pulled in Uruguay on 15·27MHz at 0020, Radio Gobo Brasil on 15·265 MHz at 0015, Radio el Mundo Argentina on 15·290MHz at 0040 and Radio New Zealand on two channels, 15·485MHz at 0810 and 11·945MHz at 0830, plus an unidentified on 10·005MHz at 1745 with either Arabic or Indian music. Mathew is looking for the 1·7 to 4MHz coil pack for his HR0. Anyone who can help can contact him at 4 Nether Court, Halstead, Essex, CO9 2HE.

Readers' Letters

The confusion, in my mind at least, between the Voice of Hope and the Voice of Peace has been cleared up by **Gavin Robertson** of Edinburgh. The Voice of Hope is the short wave service of a station which also operates a m.w. and TV station in Israeli occupied Lebanon. The station will verify reports as Gavin received a QSL card recently from Hotel Arazim, Metulla, Israel, and there is also an American address which is PO Box 7466, Van Nuys, California 91409, USA. This station has been heard on 6·215MHz. The Voice of Peace broadcasts from a coaster off Tel Aviv on 1530kHz medium wave and their address is PO Box 4399, Tel Aviv, Israel.

Gavin edits a section of "Communication" which is the monthly journal of the British DX Club. A sample copy can be obtained for return postage from the club secretary at 55 Boundary Rd., Worthing, West Sussex, BN11 4LL.

VHF Bands

by Ron Ham BRS15744

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

Although I spent most of June 7th at the Chalk Pits Museum and missed all the fun, I heard from one of my readers that there were so many stations on 2m, due to a tropospheric opening, that he had great difficulty in working the extra DX caused, in the late afternoon, by an extensive Sporadic-E and as it turned out, this was only one of several DXy days during the first three weeks of June.

Solar

Both **Cmdr Henry Hatfield**, Sevenoaks, and I recorded a solar noise storm, at 136 and 143 MHz respectively, between May 18 and 22 and individual bursts of noise on May 27 and June 12 and 16. Despite the poor weather conditions **Ted Waring**, Bristol, did get a few glimpses of the sun and counted 60 sunspots on May 16, 35 on the 19th, 8 on June 3, 14 on the 9th and 28 on the 13th.

The 10m Band

Conditions were generally poor for h.f. and for long periods on many of the 34 days between May 18 and June 20, 10m was completely dead, not even a beacon signal broke the silence, a point confirmed by a near neighbour of mine, **Ron Munn** G2ALO. During the 34 days, I heard signals, at varying strengths, from the International Beacon Project stations in Australia VK5WI on 3 days, Bahrain A9XC on 16 days, Bermuda VP9BA on 2 days, Cyprus 5B4CY on 20 days, Germany DL0IGI on 16 days and DK0TE on 3 days, Mauritius 3B8MS and Norway LA5TEN on 5 days, South Africa ZS6PW on 8 days and Venezuela YV5AYV on 3 days. Ted Waring's beacon log, covering the period May 15 to June 14, is similar to mine and we both found that 5B4CY was the most consistent beacon signal on the band. Despite the poor conditions I did hear signals from amateur stations in Australia on May 30 and June 1 and 13 and from Japan on May 29 and June 5.

RTTY

Earlier this year, **Jim Usher** RS46955, Bournemouth, began listening on the amateur bands and now has a Yaesu FRG7700 receiver fed by two long-wire antennas and a MM2000 RTTY unit feeding its signals to a Binatone 12 inch TV receiver. Jim has enrolled on an RAE course and hopes to take the exam in December. Good luck to you Jim and congratulations to G8PWX, Newcastle-on-Tyne, who, between 2000 and 2100 on June 21 almost certainly put up a first, when he made a RTTY contact with LA3EQ on 70cm and to G8RBY, Melton Mowbray, who established another possible first soon after, by working the Norwegian station on 2m RTTY. Between May 18 and June 20 I logged 60 RTTY stations on 20m spread over 12 countries, CN, DJ, EA, F, HA, I, LA, OE, OH, OZ, SM and UK and at 1400 on May 20, I copied both sides of a QSO between OE8LKK and OH2HN and at 1308 on June 12 I logged DL3WL calling CQ DX giving me my first RTTY signal on 10m.

Sporadic-E

During an extensive Sporadic-E disturbance on 2m around 1730 on June 7, **Phil Hodson**, G8RBY, Melton Mowbray, heard

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a station in Poland and worked another in Russia, **John Cooper**, G8NGO, Cowfold, worked 4 SPs and 1 UB. **J.R. Matthews**, G3WZT in nearby Partridge Green, worked 2 UCs, 2 UBs and a SP and another Sussex station, **Harold Goble**, G4FDQ, Lancing, worked 70 year old **Edward Kawczynski**, SP8CK, who has been on the air since 1929 and was as pleased as Harold was to make the contact because it was his first 'G' QSO on 145 MHz. For most of June 9, all bands from 28 to 100 MHz were disturbed by Sporadic-E and although the 10m band was quiet, I received 599 signals from DL0IGI and DK0TE and 559 signals from LA5TEN. During the afternoon, **Barry Ainsworth**, G4GPW, Lancing, heard 599 plus signals from ZB2VHF on the 6m band. **Walter Carmichael**, a member of the British DX Club from Haywards Heath, Sussex, using a Technics ST8044L tuner and a 3-element beam, heard strong signals in Band II from broadcast stations in Yugoslavia and like myself heard orchestral music on 101 MHz frequently interrupted by the announcement—"This is a test transmission from the Belgian Radio Television, in co-operation with mobile services in the United Kingdom. The frequency is 101 MHz"—any ideas? **Ken Smith**, BRS20001 also heard the Yugoslavian stations among the many continentals in Band-II and at midday both **Harold Brodribb** and I counted 31 east-European broadcast stations between 66 and 73 MHz and at 1845 most of them were still there and exceptionally strong. "This was the most remarkable v.h.f. opening I have ever heard" said Harold who like many other readers sent me a detailed report. Similar, but some less intense disturbances occurred on May 21 and 26 and June 2, 8, 10, 11 and 12 when, at the peak of each event I counted 18, 13, 33, 27, 34, 54 and 12 east-European stations respectively, between 66 and 73 MHz. **Edward Baker**, Cramlington, Northumberland, also logs these broadcast stations with a Hallicrafters communications receiver and **R.C. Taylor**, Glasgow, using an Armstrong 624 and a temporary indoor antenna for Band II, heard Italian stations at 1650 on June 2nd, Spanish stations between 1807 and 1936 on the 8th and Yugoslavian between 1805 and 1835 on the 11th. It is important for readers to keep in mind that the propagation of radio signals in Band II (88-108 MHz) can be influenced by both Sporadic-E and tropospheric openings and it is not unusual to have both together during the mid-summer months.

Tropospheric

The atmospheric pressure remained steady at 30·0 inches (1015mb) from midday on June 2nd to noon on the 7th and, true to form, as it fell, a v.h.f. opening occurred and G4DFQ with his Multi 800D and a Ringo Ranger Colinear antenna worked into Dorset, London and France on 2m f.m. from his home in Lancing. During the morning of the 7th, **John Williams**, Cheltenham, was listening to Radio 3 f.m. and became aware of other music breaking through, so he tuned his Fidelity RAD 26, with its telescopic antenna, higher in frequency and heard flamingo style music from a Spanish station and later in the day G8NGO worked stations in DL, F, G, GJ, HB9, ON and PA on 2m s.s.b. The pressure began to rise again at midday on June 12 and after reaching a peak of 30·4 inches (1029mb) at 0800 on the 13th the v.h.f.s opened and as the pressure fell, **Mike Rowe**, G8JVE, Chichester, worked many French stations on the Mediterranean coast and stations in EA, HB9 at 20 over S9, ON and PA0 on 2m s.s.b. **Gloria Hills**, G8ZYL, Gillingham, worked several ONs around 2300 and earlier at 2045, **Alan Baker**, G4GNX, Newhaven, worked EA1XH with 59 signals, like Gloria on 2m s.s.b. As usual **Simon Hamer**, Presteigne, sent an interesting log for Band II covering the openings on May 24 and 29 and June 4, 7, 12 and 15 when he received signals from stations in Belgium, France, Germany, Italy, Spain, BBC radios London, Medway and Solent and ILR stations Capitol, LBC and Thames Valley. During this DX hunt Simon heard adverts, discussions, pop-music, country and western music, news, jazz, the French national anthem at close-down and a talk about flower pruning. For the past 4 years, **Derek Cooper**, G8CUP and G8KAH, both in York, have kept a regular sked on 144·365 MHz at 1700 on Fridays and Saturdays with PE0RTM and PE1AGN. "We don't always make it, but it's worth trying" said Derek. It sure is Derek because this is one way of learning a great deal about a particular signal path.

Where are you all?

On June 14, I met husband and wife team Roy and Gloria Hills, G8STO and G8ZYL, at the Chalk Pits Museum and as we sat in the sun and talked about radio Gloria said "from one YL to all the others, where are you? and what about a sked". She often works **Elaine Howard**, G4LFM, our Technical Sub-Editor, and although Gloria is a keen contest worker and DX hunter on 2m she is looking forward to getting her G4 call so that she can chase the DX on the h.f. bands. Both Roy and Gloria are members of the Medway Amateur Receiving and Transmitting Society and are often heard working through the Kent repeater, GB3KN R4. Roy has a great interest in v.h.f. RTTY and uses a Creed 75 printer and BARTG ST5 terminal unit for receiving and a home brew electronic key board for transmitting. At contest time on 2m Roy and Gloria join forces with G4LZV, G4JJX, G8VJU, G8XLH and G8ZTE and as a group they enter the events with the club call-sign G8MWA.

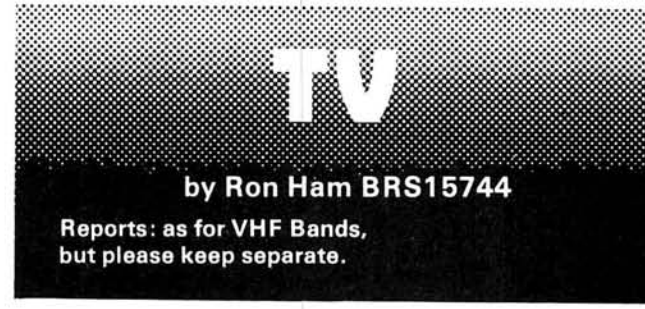
Hard Boiled?

At 2220 on August 26, 1976, a QSO lasting more than 4 minutes took place on 2m s.s.b. between G8EGG in Surrey and G8CUP in York. Later both stations exchanged QSL cards appropriately marked.

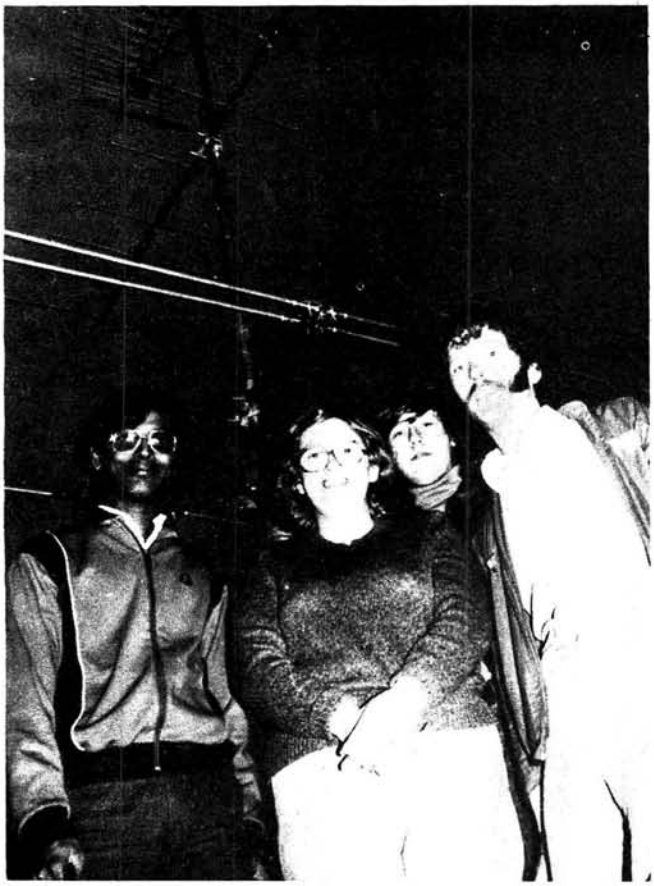
News Items

During Sporadic-E events on June 2nd to 8th inclusive, Phil Hodson, G8RBY, heard a Polish voice on 144·596MHz and wonders if this is a harmonic from a broadcast station around 72·25MHz. Any ideas? Can anyone help **Derek Cooper**, G8CUP, QTHR, with a genuine ex-RAF manual, or photocopy, for a R1224 which he is renovating.

Many amateurs from all over the country attended the first meeting of the UK Horizontal FM Group on May 16 when a sound and progressive constitution was formed. The gathering elected **Paul Hancock**, G8UAV, Chairman, **Arthur Dorsett** G8YLH, Secretary, **Rod Walker**, G8WJF, Treasurer and **Mitch Tribe**, G8PMT, Contest Officer. The group is organising contests, rallies, a field day for the disabled and are applying for affiliation to the RSGB. Further information is available from G8YLH, The Coach House, Dogmersfield Park, Dogmersfield, Hants. The membership fee is £1 per annum and the group net is on Monday, Wednesday and Friday evenings at 1930 BST on 144·670MHz and listener reports, to the secretary, are welcome.



It is obvious from my postbag that the number of TV DXers is growing, especially now that several well known Japanese manufacturers are incorporating 625 line Band I and III tuners in their domestic sets. In fact the Sanyo 9300 pn VCR has 8 buttons all capable of tuning through Bands I, III and V. Although it is not always possible to receive the sound on the v.h.f. bands owing to the differing international systems, the DX picture alone can give much pleasure, particularly during an atmospheric disturbance.



Members of the London TV DX Group. T. Ampi (left) with Wendy Evans, George Grzebieniak and Norman Reynolds

Sporadic-E

"Absolutely fabulous conditions on Bands I and II resulting in some really excellent video from many countries" writes **Sam Faulkner** and that just about sums it up for most of my readers. Although the larger Sporadic-E disturbances occurred on May 21 and 26 and June 2, 7, 8, 9, 10, 11 and 19, there were several short lived events which also produced some good DX on the other days. Detailed information about these events came from **David Appleyard,** Uppsala, Sweden, **T. Ampi,** London, **Edward Baker,** Cramlington, Northumberland, Harold Brodribb, St Leonards-on-Sea, Sussex, **Mike Evans,** London, Sam Faulkner, Burton-on-Trent, **Keith Hamer,** Derby, Michael Hahn, Rainham, Essex, Simon Hamer, Presteigne, Wales, **Ian Rennison,** Horsham, Sussex, **Andrew Rogers,** Bristol, **Philip Sado,** London, **Garry Smith,** Derby, **John Thompson,** Gillingham, Kent, **B. Walsh,** Romford and **Nicholas Wythe,** Folkestone, Kent. Between them they received programmes and test cards from stations in Albania RTS, Austria ORF, Belgium BRT and RTBF, Bulgaria BT, Czechoslovakia CST-O1 and TN, Finland YLE-HLKI, East and West Germany DDR-F and ZDF respectively, Holland NED-2, Hungary MTV and MTU-1 Budapest (Fig. 2), Iceland RUU, Italy RAI, Norway NRK, Gulen, Melhus, Gamlemsveten and Hemnes, Poland (Fig. 3) TP and TVP, Portugal RTP, Spain RTVE and Control Central RTVE, Sweden TV1, USSR TSS (Fig. 4) and Yugoslavia JRT (Fig. 5) and RTU. My readers reported seeing adverts for Coca Cola, Fiat cars, Gillette and Kelloggs cornflakes and among the identifiable programmes were American police films with sub-titles, Bullfights, Circus, cycle racing, children's specials, cartoons (Figs. 6, 7), dancing, football, a variety of films. T. Ampi watched one from Yugoslavia about Samuel Morse and the Telegraph, news including the landing of the Salyut space-craft, Mr Brezhnev giving out medals, the shots fired at the Queen and the launch of Ariane, motor-cycle racing, Travel (Fig. 8), tennis, and many bits of technical films impossible to identify because very often programmes and test cards, from different stations, are fighting for predominance on the screen. A typical example of this was seen between 1300 and 1340 on June 11, when rock crushing pictures, often in colour, were received from Iceland and Norway with my beam toward them but when the beam was turned toward Poland, the pictures from Iceland were still strong enough to overpower the Polish signal during periods of deep QSB. Test cards from Poland and Spain were received during the afternoon and early evening of June 19 by **Brian Renforth,** Chippenham, Wilts. Brian is 15 years old and a keen TV DXer and I look forward to more reports from him in the future.

Tropospheric

At 1530 on June 11, T. Ampi received test cards from Belgium BRT UTU-2 on Channels 25 and 62 and again on the 12th with the addition of RTBF1 on Ch 52. At 2245 on the 12th I saw a clock showing 2345 followed by a test card, BRT UTU-1 on Ch E10. This clock appeared again at 1845, on the 13th, showing 1945 on Ch E10, followed by the news. Toward the end of this mild tropospheric opening, I received strong test cards from RTBF1 on Ch E8 and BRT UTU-1 on Ch E10 at midday on the 15th.

SSTV

Norman Reynolds, G8YXL, London, has installed Slow Scan television equipment and would like to arrange skeds with other SSTV enthusiasts on 2m. So far, using his Trio communications receiver and a Robot 400 SSTV converter, Norman has received pictures from France, Germany, Spain, Switzerland and the USA. Despite the poor conditions on 10m, Sam Faulkner managed to log signals from DL, EA, I7, LU, OH, ON, W1, WO and ZS6 between May 14 and June 10, using mainly the 28·680MHz calling channel. Signals from EA8RX showing pictures of himself, equipment and various circuits were excellent during the evening of May 17 Sam told me and at 1716 the EA worked WD0FNL. Later Sam saw a portrait of ZS6BFU while he was in QSO with a W and said that European SSTV stations were received during the Sporadic-E disturbances on May 31 and June 7 and 8. He also received SSTV pictures from JA1DEQ and JA1PGH which he stored on audio cassette tape (Figs. 9, 10).

Equipment

Among my new contributors, Mike Evans is using a 5in National Panasonic 5060 fed with a 6-element antenna for Band I, a 3-element for Band III and a 91-element for u.h.f., all driven by a Stolle 2010 rotator. Andrew Rogers has a Teleng up-converter and a 3-element wide-band antenna and John Thompson uses a JVC 3040 and *Practical Wireless* wide-band preamp fed with an 'H' aerial for Band I, a 9-element for Band

SSTV equipment installed by Norman Reynolds G8YXL

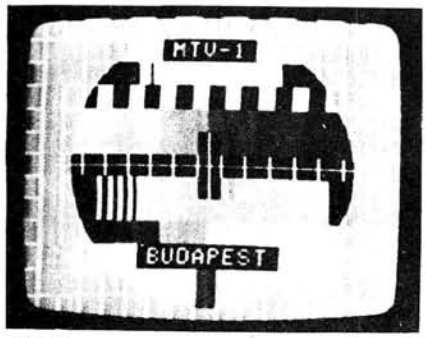


Fig. 2 *(N. Wythe)*

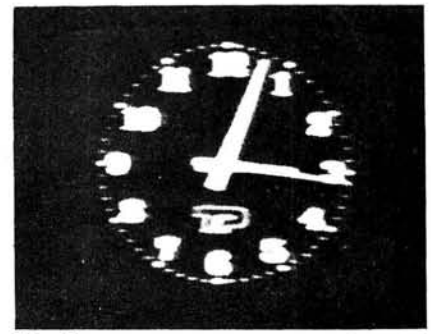


Fig. 3 *(N. Wythe)*

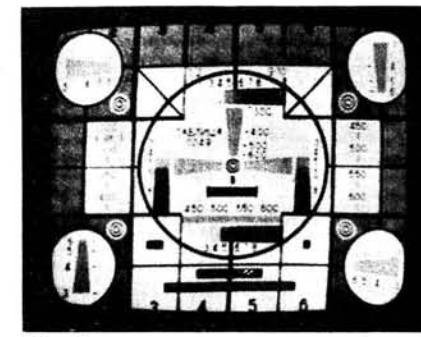


Fig. 4 *(N. Wythe)*

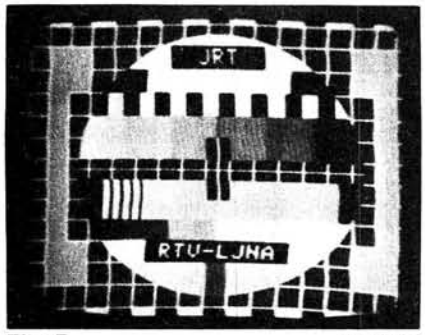


Fig. 5 *(N. Wythe)*

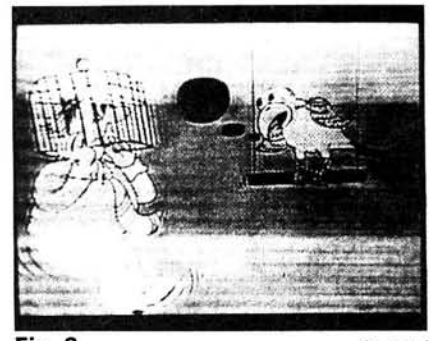


Fig. 6 *(R. Ham)*

Fig. 7 *(R. Ham)*

Fig. 8 *(R. Ham)*

Fig. 9 *(S. Faulkner)*

Fig. 10 *(S. Faulkner)*

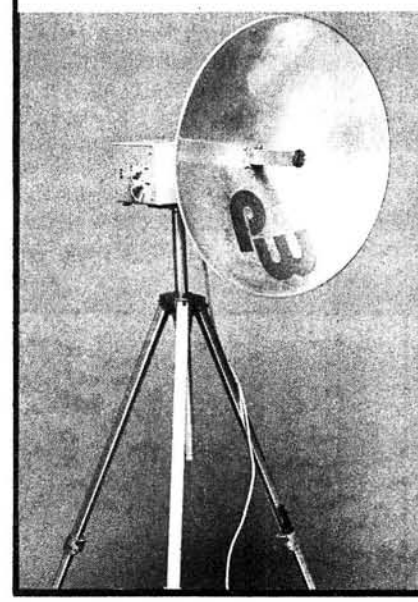
III and should by now be using a JVC CX610GB colour set. Edward Baker tunes the Band I TV sound channels on a Hallicrafters SX62A communications receiver and for vision he uses a Baird TV receiver fed with a Band I dipole. B. Walsh began TV DXing last September and now uses a varicap tuner via a 'G8' selectivity module into a Rank TV161 receiver fed with crossed dipoles in the loft and **Brian Renforth** feeds one of Hugh Cocks's converters into a Baird 8807 receiver fed by an 'X' antenna for Band I, a 6-element Yagi for Band III and a 43-element Fuba for u.h.f.

"Pauze"

My thanks to **J.F. Coulter,** Winchester, Harold Brodribb and B. Walsh for telling me that the caption "PAUZE" I referred to in my July column is most likely to come from a Dutch station meaning pause or break.

Finally I apologise for putting the wrong caption on Fig. 4 in my July column; this should have been Rumania and not Italy as I said.

PW EXE PARABOLIC DISH OFFER



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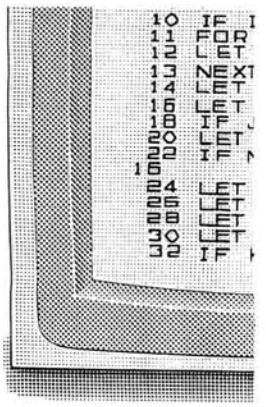

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Now the Sinclair lead is increased: for just £69.95, the new Sinclair ZX81 offers even more advanced computer facilities at an even lower price. And the ZX81 kit means an even bigger saving. At £49.95 it costs almost 40% less than the ZX80 kit!

Lower price: higher capability
With the ZX81, it's just as simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, or to select a program off a cassette through the keyboard.

Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

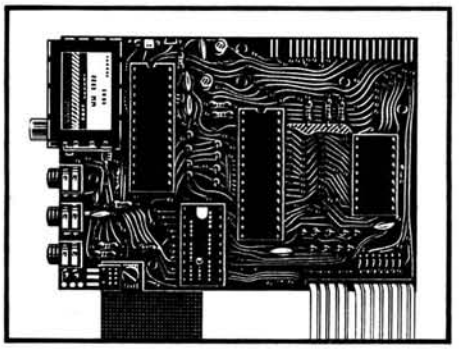
The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

Built: £69.95 complete

Kit or built – it's up to you!

The picture shows dramatically how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

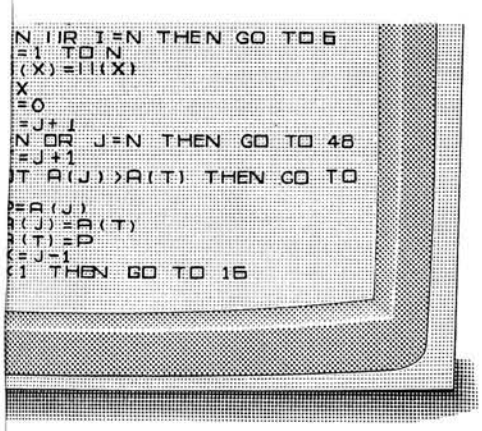
Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



Proven micro-processor, new 8K BASIC ROM, RAM – and unique new master chip.

New Sinclair teach-yourself BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs. You need no prior knowledge – children from 12 upwards soon become familiar with computer operation.



If you own a Sinclair ZX80...

The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 – including the ability to drive the Sinclair ZX Printer.

Coming soon- the ZX Printer.

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alphanumerics across 32 columns, *and* highly sophisticated graphics. Special features include COPY, which prints out exactly what is on the whole TV screen without the need for further instructions. The ZX Printer will be available in Summer 1981, at around £50 – watch this space!

16K-BYTE RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

New, improved specification

- Z80A micro-processor – new faster version of the famous Z80 chip, widely *recognised* as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer (not available yet – but coming soon!)
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

How to order your ZX81

BY PHONE – Access or Barclaycard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access or Barclaycard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

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	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack(s).	18	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

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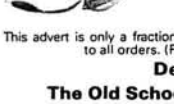

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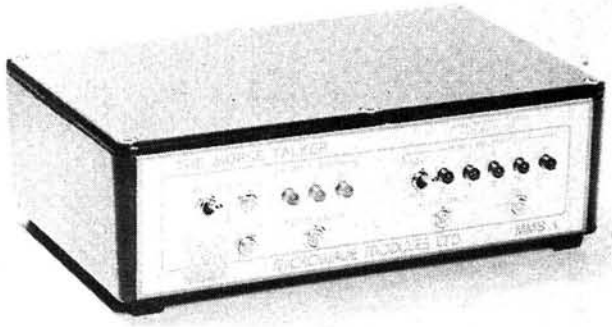

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This unique product is a self-contained and SPEAKING MORSE TUTOR and, unlike a random morse generator, the MMS1 incorporates a microprocessor speech synthesis system which provides talk back of the morse after transmission, giving the pupil the opportunity of checking his proficiency. This unit represents a truly cost-effective means of obtaining a full class A amateur licence, without having to rely on a third party for instruction.

The unit requires only a DC power supply, 9 to 13.8 volts, to enable operation and this should be connected to the power socket located on the rear panel via the supplied plug.

To give this product appeal not only to the beginner but also to the proficient operator we have incorporated six 'learning levels'. In this way it is a simple matter to become more and more proficient, even after passing the Morse Test.

The six ranges are:-	LETTERS ONLY	: A-F, A-M, A-U, A-Z.
	NUMBERS ONLY	: 0-9
	LETTERS & NUMBERS	: 0-Z

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} BEFORE TALKBACK

In addition a useful facility is provided in that continuous morse can be sent. (No talkback facility in this mode).

Morse can be sent in the range 2-20 words per minute (w.p.m.) in 2 w.p.m. increments. Speed selection is made by depressing the front panel mounted switch marked 'SPEED SELECT'. However, at speeds of 12 w.p.m. or less, characters are sent at 12 w.p.m. but the spacing is adjusted for the selected speed. In this way morse rhythm will be instilled, since this is the essence of good morse rather than the 'dots and dashes' approach. The incorporation of a crystal-controlled reference ensures totally accurate character and space, lengths and intervals thereby producing a perfect rhythm.

The MMS1 contains an internal loudspeaker which may be supplemented by either headphones or an external loudspeaker, by connection to the socket marked 'EXTERNAL SPEAKER' located on the rear panel. The available audio output level at this socket is 250mW. In addition a tape recorder socket is also located on the rear panel, so that recordings may be made at any time, without disabling the internal loudspeaker.

It is also possible to use the internal sidetone oscillator for sending practice and this may be achieved by connecting a suitable morse key to the socket marked 'KEY'. (N.B. – This facility does not provide talkback).

The MMS1 utilises 2 microprocessors, 2 memory I.C.'s and various other integrated circuits and semiconductors. All circuitry is constructed on high quality glass-fibre printed circuit board, and the unit is housed in a highly durable black diecast enclosure.

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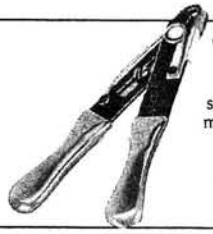

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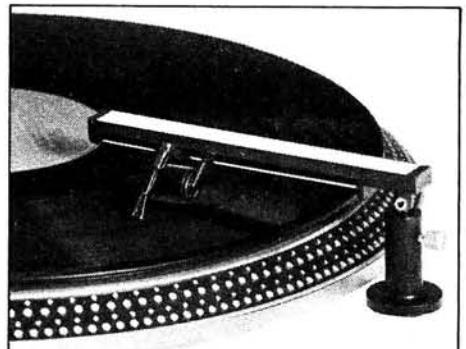

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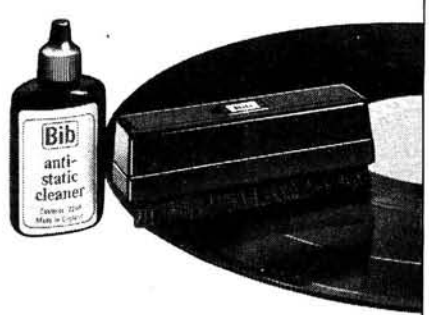

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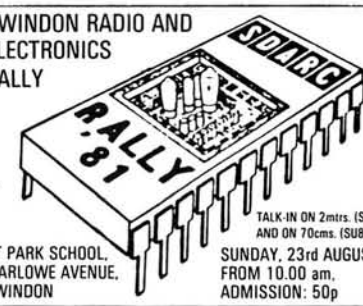

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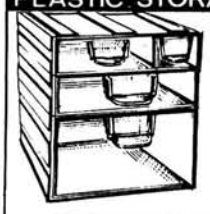

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112	.5	1	**2.90**	1.00
79	1	2	**3.93**	1.00
3	2	4	**6.35**	1.20
20	3	6	**7.39**	1.44
21	4	8	**8.79**	1.60
51	5	10	**10.86**	1.60
117	6	12	**12.29**	1.72
88	8	16	**16.45**	1.96
89	10	20	**18.98**	1.84
90	12	24	**21.09**	O.A.
91	15	30	**24.18**	O.A.
92	20	40	**32.40**	O.A.

50 VOLT RANGE (Split Sec) Pri 120/240V
Sec 50V Voltages available 5, 7, 8, 10, 13, 15, 17, 20, 33, 40 or 20V-0-20V or 25V-0-25V

Ref.	Amps 50V	Amps 25V	Price	P&P
102	.5	1	**3.75**	1.20
103	1	2	**4.57**	1.20
104	2	4	**7.88**	1.44
105	3	6	**9.42**	1.60
106	4	8	**12.82**	1.72
107	6	12	**16.37**	1.84
118	8	16	**22.29**	2.20
119	10	20	**27.48**	O.A.
109	12	24	**32.88**	O.A.

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Ref	VA	Price	P & F
*07	20	**4·84**	1.20
149	60	**7·37**	1.20
150	100	**8·38**	1.44
151	200	**12·28**	1.72
152	250	**14·61**	2.04
154	500	**22·52**	2.20
155	750	**32·03**	O.A.
156	1000	**40·92**	O.A.
157	1500	**56·52**	O.A.
158	2000	**67·99**	O.A.
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150	**11·00**	1.44	4W
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500	**20·13**	2.04	67W
1000	**30.67**	2.20	84W
2000	**54.97**	O.A.	95W

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Pri 120/240V. Voltages available 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 or 24V-0-24V or 30V-0-30V.

Ref	Amps 60V	Amps 30V	Price	P&P
124	.5	1	**4.27**	1.20
126	1	2	**6.50**	1.20
127	2	4	**8.36**	1.60
125	3	6	**12.10**	1.72
123	4	8	**13.77**	1.96
40	5	10	**17.42**	1.84
120	6	12	**19.87**	2.04
121	8	16	**27.92**	O.A.
122	10	20	**32.51**	O.A.
189	12	24	**37.47**	O.A.

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Pri 220-240 volts

Ref	Amps 12V	Amps 24V	Price	P&P
111	0·5	0·25	**2·42**	0.95
213	1·0	0·5	**2·90**	1.00
71	2	1	**3·86**	1.00
18	4	2	**4·46**	1.20
85	0·5	2·5	**6·16**	1.20
70	6	3	**6·99**	1.20
108	8	4	**8·16**	1.44
72	10	5	**8·93**	1.60
116	12	6	**9·89**	1.60
17	16	8	**11·79**	1.72
115	20	10	**15.87**	1.84
187	30	15	**19.72**	2.04
226	60	30	**40.41**	O.A.

SCREENED MINIATURES

Ref	mA	Volts	£	P&P
238	200	3-0-3	**2·83**	0.50
212	1A, 1A	0-6, 0-6	**3·14**	1.00
13	100	9-0-9	**2·35**	0.50
235	330, 330	0-9, 0-9	**2·19**	0.60
207	500, 500	0-8·9, 0-8·9	**3·05**	0.95
208	1A, 1A	0-8·9, 0-8·9	**3·88**	1.20
236	200, 200	0-15, 0-15	**2·19**	0.60
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203	500, 500	0-15-27	**4.39**	1.20
204	1A, 1A	0-15-27	**6.84**	1.20
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93	1500	**25.61**	O.A.
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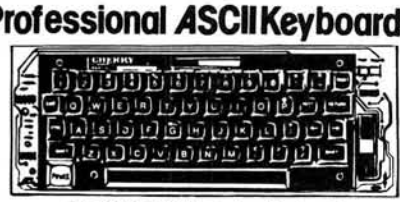

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EABC80	0.56
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ECC81	0.55
ECC82	0.55
ECC83	0.60
ECC85	0.60
ECC88	0.65
ECC807	1.30
ECF80	0.65
ECF82	0.60
ECH81	0.58
ECL82	0.58
ECL83	1.13
ECL86	0.74
EF37A	3.60
EF80	0.48
EF86	0.70
EF89	0.75
EF91	1.22
EF93	0.65
EF94	0.55
EF95	0.78
EF183	0.56
EF184	0.56
EL34	1.54
EL84	0.60
EM84	0.70
EZ80	0.56
EZ81	0.56
GZ32	0.85
GZ33	3.25
GZ34	2.00
KT61	3.50
KT66	4.95
KT77	5.00
KT88	6.00
N78	8.90
OA2	0.60
PCF80	0.70
PCF802	0.72
PCF808	1.48
PCL82	0.74
PCL84	0.76
PCL86	0.76
PCL805	0.80
PFL200	1.13
PL504	1.20
PL508	1.48
PL509	2.30
PL802	2.50
PY88	0.74
PY500A	1.35
PY801	0.65
QQV02/6	10.50
QQV03-20A	12.25
QQV06-40A	13.95
QV03-12	3.50
TY2-125A	45.00
U19	11.95
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UCL82	0.76
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Z759	9.00
2D21	0.95
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4CX250B	26.60
5U4G	0.85
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6GK6	2.50
6J6	0.65
6JS6C	2.55
6KD6	3.95
6L6GC	1.75
6LD20	0.60
6SN7GT	0.69
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7S7	2.00
12AT7	0.55
12AU7	0.55
12AX7	0.55
12BA6	0.80
12BE6	1.05
12BH7	0.95
12HG7	3.25
30FL2	0.95
85A2	1.20
90C1	1.69
807	1.09
811A	9.00
813	11.30
833A	47.85
866A	3.00
2050A	3.90
5763	3.20
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7025	1.50
7360	7.50
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AC127	0.22
AC128	0.28
AC141K	0.34
AC176	0.22
AC176K	0.31
AC187	0.26
AC187K	0.28
AC188	0.22
AD149	0.70
AD161	0.39
AD161/2	1.04
AD162	0.39
AF127	0.32
AF139	0.42
AF239	0.42
BC107	0.10
BC107B	0.10
BC108	0.10
BC108C	0.10
BC109B	0.10
BC140	0.31
BC141	0.25
BC142	0.21
BC143	0.24
BC147	0.09
BC148	0.09
BC149	0.09
BC157	0.10
BC158	0.09
BC159	0.09
BC160	0.28
BC170B	0.10
BC171	0.08
BC172	0.09
BC173B	0.10
BC182	0.09
BC183	0.09
BC184LA	0.09
BC212	0.09
BC212L	0.09
BC213	0.09
BC213L	0.09
BC214	0.09
BC214L	0.09
BC237	0.09
BC238	0.08
BC307	0.09
BC327	0.10
BC337	0.10
BC461	0.30
BC478	0.20
BC547	0.10
BC548	0.10
BC549A	0.08
BC557	0.07
BC558	0.07
BD131	0.32
BD132	0.35
BD133	0.40
BD135	0.30
BD136	0.30
BD137	0.28
BD138	0.30
BD139	0.32
BD140	0.30
BD144	1.20
BF115	0.35
BF167	0.24
BF179	0.34
BF180	0.29
BF183	0.29
BF194	0.11
BF195	0.11
BF196	0.11
BF197	0.11
BF198	0.10
BF199	0.14
BF200	0.30
BF257	0.28
BF258	0.25
BF259	0.26
BF336	0.34
BFX29	0.30
BFX84	0.26
BFX85	0.28
BFX86	0.30
BFX88	0.25
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BU105	1.22
BU108	1.69
BU205	1.30
BU208	1.39
BU208A	1.52
MJE340	0.40
OC71	0.22
R2008B	1.70
R2010B	1.70
R2540	2.48
TIP29	0.40
TIP29C	0.42
TIP30C	0.43
TIP31C	0.42
TIP32C	0.42
TIP41C	0.45
TIP42C	0.47
TIP47	0.65
TIP2955	0.84
TIP3055	0.60
TIS91	0.20
2N3054	0.59
2N3055	0.59
2N3702	0.12
2N3703	0.12
2N3704	0.12
2N3705	0.12
2N3706	0.12
2N3708	0.12
2N5294	0.38
2N5296	0.48
2N5298	0.38

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