

THE UK'S BEST SELLING MAGAZINE FOR AMATEUR RADIO ENTHUSIASTS

OCTOBER 1995 £1.90

# practical Wireless

2 handy reviews

THE ICOM IC-W31E & THE ICOM IC-Z1E



Featuring  
**DESIGN  
DILEMMAS**  
**ELECTRONICS  
WORKBENCH  
REVIEW**

*It's a Classic*  
**THE AR-88D**

*Build*

**THE PW DAVENTRY  
7MHz Receiver**

*plus*

**ANTENNA WORKSHOP  
& ALL THE REGULAR FAVOURITES**

ISSN 0141-0857

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**NEW  
DUAL BAND**

# Dual Band Mobile FT-8500

Never before has Yaesu technology changed an industry so dramatically.

"With the Smart Controller Mic, all the radio functions are in your hand."

"And, look, the digital voltage display monitors my car battery voltage!"



"Spectra-Analyzer lets me check out channel activity in UHF, VHF and keep track of my favourite repeaters, too."

"Yaesu did it again!"

## Specifications

- Frequency Coverage:
  - 2m RX: 110-174 MHz TX: 144-146 MHz
  - 70 cm RX: 420-500 MHz TX: 430-440 MHz
- Spectra-Analyzer™ w/adjustable signal width, spacing & span markers
- 6-Character Alpha-Numeric Display
- 110 Memories (in 5 memory banks)
- Omni-Glow™ Display
- Digital voltage display
- Selectable 1200/9600 baud
- 3-Level Auto-Mute w/Mute Timer
- V+V, U+U, V+U Dual Receive
- 3 Power Output Levels
  - 2 m 50/10/5 Watt
  - 70 cm 35/10/5 Watt
- Built-in Auto Power Off (APO) and Time-out Timer (TOT)
- MIL-STD 810/C Rating
- 9 Memory DTMF Autodialer
- Handy Cloning Feature
- 3 Scanning Modes w/ Clear Scan
- Adjustable LCD Contrast/Brightness Control
- Accessories: Consult your local Yaesu dealer.

Rear-panel data jack for packet with 6-pin connections for Data Input, PTT, 9600 bps and 1200 bps Receive Data, Squelch Status, Ground.

ACTUAL SIZE  
140x40x160mm (5.6"x1.6"x6.4")

### Omni-Glow™ LCD Dual-Band Display



VHF&VHF, UHF&UHF, VHF&UHF  
Select three dual band configurations. Menu loop contains 13 headings and 53 transceiver settings. Shown with custom 6-character alpha-numeric code.



Spectra-Analyzer™ displays station activity above and below the current operating channel. In Memory Recall, display signal strength of programmed channels.



Built-in digital voltage display monitors automobile battery voltage. Menu-Selectable Packet Baud Rate. Choose 1200 or 9600 bps.

Rotary Dial Selector Knob  
Select memories and other settings according to the current mode functions.



The FT-8500 and Smart Controller™ Microphone demonstrates Yaesu's world leadership position in 2-way radio communication again! With just four simple flicks of the Smart Controller™ Microphone "joystick"-type lever, you command over 50 separate functions from the palm of your hand! The FT-8500 defines "high-tech" in mobile radio engineering.

The Smart Controller™ Microphone

isn't the only engineering advancement. Watch the unique Spectra-Analyzer™ exhibit station activity above and below your current operating channel, and the digital voltage readout monitor your car battery voltage big and bold in the Omni-Glow™ display. In V+V, U+U or V+U view frequencies and custom alpha-numeric messages at the same time. Other features include handy cloning, selectable 1200/9600 baud, and a rear-panel data jack for packet! All of

this and more in the deluxe, compact FT-8500.

The extraordinary FT-8500 Dual Band Mobile is at your Yaesu dealer now. Find out how this dramatic change will affect mobile technology for you from this day forward.

**YAESU**  
Performance without compromise.™

YAESU UK LTD, Unit 2, Maple Grove Business Centre, Lawrence Rd., Hounslow, Middlesex, TW4 6DR

Specifications subject to change without notice. Specifications guaranteed only within amateur bands. Some accessories and/or options are standard in certain areas. Check with your local Yaesu dealer for specific details.

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# SMC, ARE & REG WARD

*37 years and still Number 1*

**THIS MONTHS SPECIAL**

**Yaesu FT-900 ONLY £1069**

save  
**£330**  
FT-900



save  
**£400**  
FT-900AT

**Yaesu FT-900AT ONLY £1199**

**Latest models from  
Yaesu & Kenwood**

**TS-870** **NEW**  
Kenwood HF base station



**NEW** **FT-1000 MP**  
Yaesu mid-priced HF  
base station

**HF  
TRANSCIVERS**

**KENWOOD**

- TS-950SDX list £3995 our price £3495
- TS-850S list £1809 our price £1579
- TS-850SAT list £1959 our price £1699
- TS-450S list £1499 our price £1299
- TS-450SAT list £1649 our price £1439
- TS-50S list £1059 our price £929



**YAESU**

- FT-1000 list £3999 our price £3399
- FT-990 list £2399 our price £2039
- FT-990/DC list £2099 our price £1779
- FT-900 list £1399 our price £1189
- FT-900AT list £1599 our price £1359
- FT-840 list £959 our price £819

**ICOM**

- IC-775DSP list £3699 our price £3239
- IC-736 list £1969 our price £1719
- IC-738 list £1649 our price £1439
- IC-729 list £1325 our price £1175
- IC-706 list £1195 our price £PHONE
- IC-707 list £889 our price £775



**VHF  
TRANSCIVERS**

**ICOM**

- IC-820H list £1795 our price £1569
- IC-275H list £1495 our price £1395
- IC-281H list £449 our price £399
- IC-2000H list £369 our price £329
- IC-2340H list £689 our price £599

**KENWOOD**

- TS-790E list £1959 our price £1699
- TM-255E list £949 our price £829
- TM-455E list £1059 our price £925
- TM-733E list £739 our price £645
- TM-251E list £419 our price £359
- TM-702E list £579 our price £519

**YAESU**

- FT-736R list £1999 our price £1699
- FT-8500 list £749 our price £659
- FT-5200 list £729 our price £619
- FT-5100 list £679 our price £579
- FT-2500M list £399 our price £339
- FT-2200 list £419 our price £355



**VHF/UHF  
HANDI'S &  
PORTABLES**

**YAESU**

- FT-11R list £324 our price £275
- FT-41R list £369 our price £315
- FT-51R list £529 our price £449
- FT-416G list £369 our price £249
- FT-290R2 list £599 our price £509
- FT-690R2 list £649 our price £549
- FT-790R2 list £749 our price £625

**ICOM**

- IC-Z1E list £529 our price £459
- IC-2GXE list £255 our price £225
- IC-2GXET list £279 our price £229
- IC-T22E list £259 our price £229
- IC-T42E list £269 our price £269
- IC-W31E list £469 our price £419

**KENWOOD**

- TH-79E list £479 our price £419
- TH-22E list £254 our price £219
- TH-42E list £289 our price £249
- TH-28E list £319 our price £279
- TH-48E list £369 our price £319

**STANDARD**

- C188 sale offer price £169

*On some items supplies are limited  
at our offer prices*

**NEW**  
**FT-10R 2m**  
**FT-40R 70cm**



Two new "Ultra Compact"  
handies from Yaesu –  
offering a choice of four  
keypads and many new  
features.

**PHONE FOR THE LATEST INFORMATION**  
**BRAND NEW YAESU UHF COMERCIAL**  
**TRANSCIVERS SUITABLE FOR**  
**CONVERSION FOR PACKET**

**Single channel ONLY £79**



**SMC-545LIN/B**

**2 channel ONLY £89**



**SMC-1045L2(B)**

*Matching base station power supply £29.  
All sets supplied W/O mics. Mics are normally  
priced at £29. However, these are available for  
£10 if purchased with the transceiver. All sets  
supplied with conversion details XTAL specs.*

**All discounts are based on recommended retail prices.**

**CARR A = £2.50    CARR B = £5 (Handi's)    CARR C = £9.50 (Mobiles)    CARR D = £13.50 (Base Stations)    CARR E = £16.50**

Tokyo Hy-Power. One can only describe their products as "Japanese design and build quality at its very best"

**LINEARS**

		£	Carr
HL1008/10	10M Linear, 10W in 100W out PEP Suitable for 21/24/28MHz	210	C
HL1008/20	20M Linear, 10W in 100W out PEP	210	C
HL1008/80	80M Linear, 10W in 100W out PEP	210	C
HL66V	6M Linear, 10W in 50-60W out Rx Preamp	169	C
HL166V	6M Linear, 3/10W in Auto select 80/160W out Rx Preamp	299	C
HL37VXS	2M Linear, 0.5-5W in 20-35W out variable gain preamp	109	B
HL62VXS	2M Linear, 5/10/25W in 50W out preamp	235	C
HL36U	70cm Linear, 6/10W in 25/30W GaAs FET Preamp	155	B
HL63U	70cms Linear, 10/25W in 50W out GaAs FET Preamp	259	C
HL180V	2M Linear, 3/10/25W up auto select 170W out Rx Preamp	389	C
HL130U	70cms Linear, 3/10/25W up auto select 120W out Rx Preamp	485	C

**TRANSVERTORS**

HX240	2M to HF 80, 40, 20, 15, 10M 2.5/10W Drive 30-40W o/p	299	B
HX640	6M to HF Specs as above	299	B



**USED EQUIPMENT\***

**HF TRANSCEIVERS/AMPLIFIERS**

PX AT50S	Auto ATU Matching TSS0	£225.00
PX IC728	HF 100W Gen Cov RX	£899.00
PX IC735	HF 100W Gen Cov RX with PSU	£675.00
PX FT1000	HF Transceiver with additional Sub RX	£2,595.00
PX FT757GX11	HF TX/RX Gen Cov RX	£675.00
PX TS130S	HF 100 Watts with Ext VFO	£395.00
PX FTONE	HF Transceiver Gen Cov RX	£750.00
PX FT980	HF 100W gen RX/TX ham s/h	£925.00
PX HT180	HF 10W 80mtr mobile SSB/CW s/h	£289.00
BX FT747GX	HF Transceiver	£449.00
BX FT901DE	HF Transceiver	£449.00
LX FT101B	HF Transceiver	£275.00
LX FT101E	HF Transceiver 6 Band	£325.00
LX FL7000	HF linear, boxed	£1,650.00
LX FT890AT	HF Transceiver, boxed	£1,250.00
LX FT757GX	HF Transceiver	£575.00
LX IC-726	HF + 6m Transceiver	£665.00
LX FT747	HF Transceiver	£475.00
LX TS820S	HF transceiver, no WARC bands	£400.01
LX TS140S	HF Transceiver	£595.00
LX FT767GX	HF Transceiver	£1,450.00
LX TS850SAT	HF TX/RX with internal ATU	£1,350.00
LX FT757GX	HF Transceiver Gen Cov Rx	£575.00
AX IC720A	HF Transceiver	£400.00
AX FT902DM	HF Transceiver Valve PA	£450.00
AX LA-120	HF 100W amp	£125.00
AX FT102	HF Transceiver PA - 3 x 6416B's	£475.00
AX FT747GX	HF 12 w Transceiver	£499.00
AX TS430S	HF Transceiver	£650.00
AX TS830S	HF Transceiver	£575.00
AX IC725	HF transceiver, boxed	£624.99
AX IC726	HF & 6m transceiver, boxed	£699.00
AX TS430S	HF TX/RX FM, CW filter	£650.00
AX FT890AT	HF Transceiver with ATU	£1,199.00
RX FT102	HF Transceiver	£450.00
RX FT707	HF Transceiver	£260.00
RX FT101Z	HF Transceiver	£325.00
RX TS530	HF Transceiver	£395.00
RX FT1000	HF Transceiver 200 Watt Dual RX	£1,950.00
RX FT757GX	HF Transceiver with 6 mtrs fitted	£975.00
RX TS450SAT	HF Transceiver with Auto ATU	£1,025.00
RX TS530SP	HF Transceiver	£360.00
RX TS870	6mtrs Gen Coverage RX	£595.00
RX 30L-1	HF lin amp	£425.00
RX IC735	HF TX/RX	£695.00
RX FT101Z	HF transceiver	£425.00
RX FT277	HF transceiver	£250.00
RX SB104	Transceiver	£225.00
RX JST100	HF TX/RX	£595.00

**HF Antennas**

R5	10/12/15/17/20 vertical	£279.00
R7	10 thru to 40m vertical	£369.00
AV-3	14-21-28MHz vertical 4.3m long	£85.00
AV-5	3-5-7-14-21-28MHz vertical 7.4m long	£149.00
AP8A	8 Band Vertical	£199.00
APR18A	Radial Kit	£49.00
40-2CD	2-ele 40m Yagi	£439.00
A3S	14-21-28MHz Yagi	£349.00
A3WS	12/17m 3-ele Yagi	£275.00
A103	30m Extension A3WS	£115.00
204CD	4 ele 20m Yagi	£439.00
154CD	4 ele 15m Yagi	£249.00
D4	Dipole 10/15/20/40m	£229.00
D3W	Dipole 12/17/30m	£169.00
A4S	3-4 ele Yagi 10/15/20m	£425.00

**VHF Antennas**

AR-270	2/70 Dual Band Vertical 1.13m long	£60.00
AR-270b	2/70 Dual Band Vertical 2.3m long	£89.00
AR2	2m Vertical 1.2m long	£35.00
AR6	6m Vertical 3.1m long	£48.00
A148-10S	2m 10-ele Yagi 13.2 dBd	£59.00
A144-20T	2m 10-ele Cross Yagi 12.2 dBd	£99.00
13B2	13-ele 2m Yagi	£99.95
17B2	17-ele 2m Yagi	£169.00
A50-3S	3-ele 6m Yagi	£75.95
424B	24-ele 70cms Yagi	£115.00

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As from 12th September 1995, our Northern showrooms are being amalgamated. To create the largest retail branch outside of SMC's HQ. The transfer of staff and stocks to Leeds means "Greater stock availability and more expertise on hand within SMC Northern".  
Special offers for personal callers during September & October. Come in and meet Roger Balnes G3YBO and his team at SMC Northern.  
A date for your diary - 21st September SMC Northern open evening 7pm onwards. A further 5% off all listed prices (except special offers) on the evening.  
A lecture on equipment reviews by Chris Lorek G4HCL, consultant technical editor of H.R.T.  
Many bargains on offer plus FREE refreshments.

**Taiwan Serene**

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TSM-1005	2m 7/8 1.89m	£29.50
TSM-1316	2m/70 0.44m	£18.00
TSM-1339	2m/70 0.89m	£22.50
TSM-1312	2m/70 0.89m	£23.00
TSM-1309	2m/70 0.93m	£25.00
TSA-5004	Mirror/R rack mount	£16.00
<b>BASE ANTENNAS</b>		
TSB-3301	2m/70 G/Fibre 3.18m	£68.00
TSB-3302	2m/70 G/Fibre 1.79m	£59.50
TSB-3303	2m/70 G/Fibre 1.15m	£42.50
TSB-3603	2m/70/23 G/Fibre 3.07m	£85.00
TSA-600/C	Duplexer 2/70 'N'-N/PL leads	£25.00
TSA-601/E	Triplexer 2/70/23 'N'/PL,N,N	£43.00
TSA-6601	2/70 mini PWR/SWR meter	£29.00

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		£	Carr
SMC 12040	13.8V 4/6A max PSU	£10.00	B
FS 711H	Hansen SWR meter 2-30MHz 20/200W	£35.00	B
FS 711V	Hansen SWR meter 50-150MHz 20/200W	£35.00	B
FS 711U	Hansen SWR meter 430-440MHz 5/20W	£35.00	B
<i>All FS 711 have remote display head</i>			
FS20 DL	Hansen SWR meter 3-150MHz 1/10W	£35.00	B
FS 20D	Hansen SWR meter 3-150MHz 5/20W	£35.00	B
<i>FS 20D &amp; DL have built in dummy leads</i>			
FS 710V	Hansen PEP SWR 50-150MHz 15/150W	£75.00	B
HT 180	Tokyo 80m SSB/CW OR & transceiver 10W PEP	£279.00	C
HT 106	Tokyo 6m SSB/CW transceiver 10W PEP	£319.00	C
HP 100S	Tokyo matching PSU for HT transceivers	£99.95	C
432/17X	Met 34 ele crossed 70cm Yagi	£59.00	C
70/3	Met 3 ele 4m Yagi	£35.00	C
144-4	Met 2m 4 way power splitter	£29.00	B
UGP/2m	2m grand plane antenna	£15.00	B
9523	Channel master offset support bearing	£14.50	B
SQ 144	2m Swiss Quad antenna	£39.00	B
88F	2m 8/8 wave high gain mobile	£15.00	B
GP 23	2m 3 x % colinear base antenna	£39.00	C

**VHF/UHF TRANSCEIVERS**

PX FT2500	Dual Band Mobile Detachable Head	£599.00
PX TM251	2m 50watt Mobile	£329.00
PX FT815	70cms Hand Held	£239.00
PX FT51R	Dual Band Hand Held	£375.00
PX FT290R	2m Multimode Portable	£249.00
PX FT736R	2m / 70cm All Mode Base Station TX/RX	£1,195.00
PX FT415	70cms Handheld	£169.00
PX FT530	2m / 70cms H/Hand	£375.00
PX IC25ET	2mtr Handheld	£195.00
PX C500	2/70cm h/held transceiver	£245.00
PX DJ580E	2/70cm Hand/Held	£249.00
PX DJF1E	2m h/held transceiver, boxed	£235.00
PX FT203R	2m handheld transceiver, charger & antenna	£120.00
PX FT530	2/70 Handheld	£359.00
PX TH205E	2m Hand Held	£139.00
PX IC900E	2mtr / 70cms / Head Display complete	£475.00
BX FT203R	2m Hand Held	£119.00
BX TS700	2m All Mode base TX/RX	£289.00
LX DJ580	VHF/UHF Handheld +Mic,DC,Mount	£380.00
LX DJ580E	2m/70cms Hand Held	£350.00
LX FT2500M	2mtr Mobile	£295.00
LX TH21E	VHF Hand/Held	£100.00
LX FT727R	H/held transceiver dualband	£260.85
LX FT2200	2mtr FM Transceiver	£275.00
LX IC25ET	2mtr Handheld	£176.00

\*Used equipment index: PX = Southampton BX = Birmingham AX = London RX = Axminster LX = Leeds

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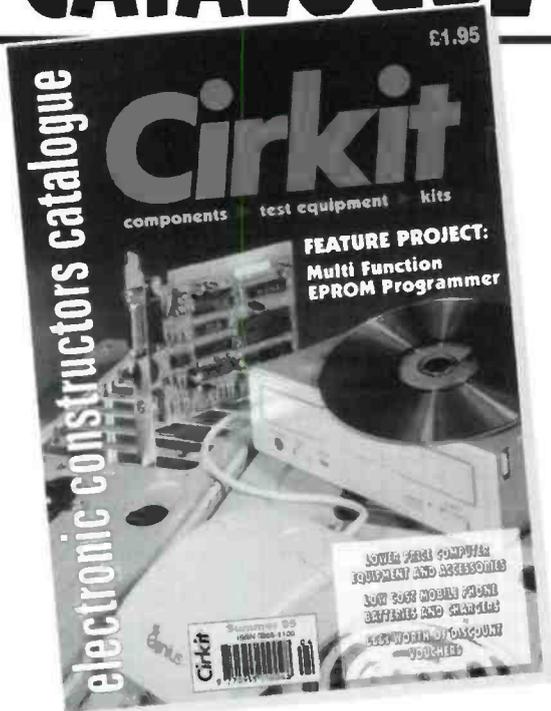
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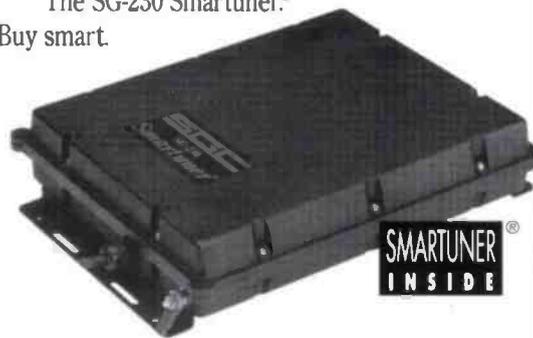
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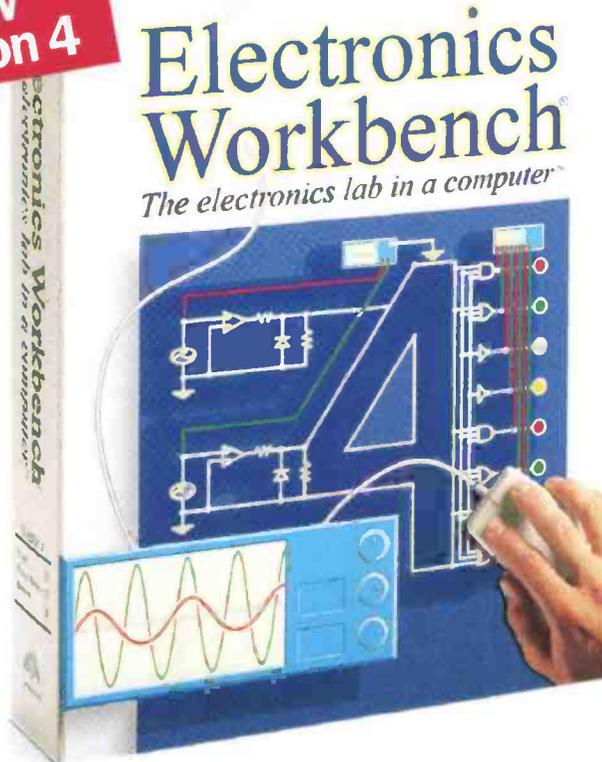
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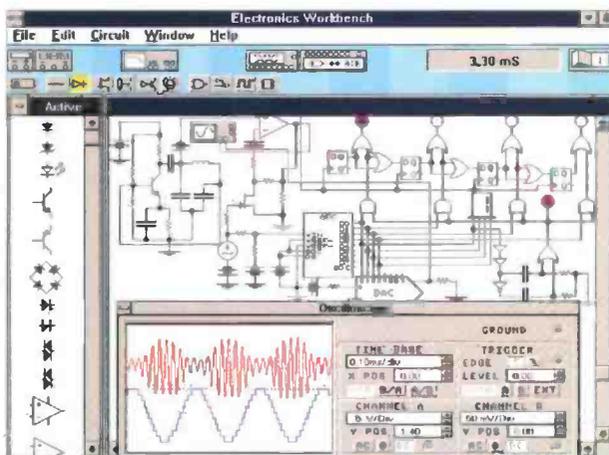
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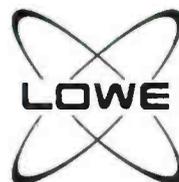
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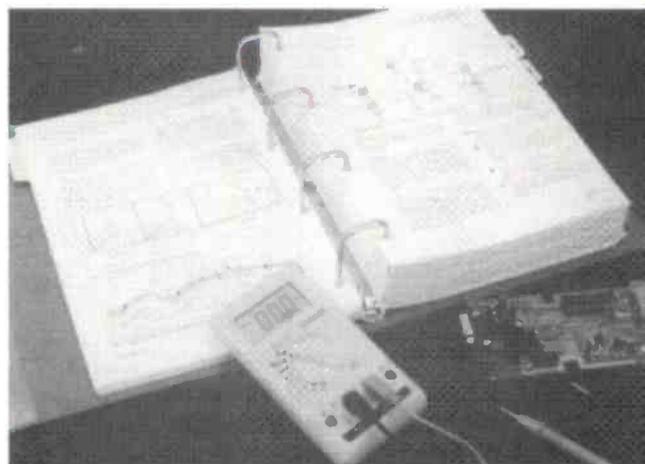
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# EDITOR'S Keylines

**A**s I'm writing this 'Keylines' in August, the rally season is at its height. The annual trip to the RSGB National Mobile Rally has come and gone, and last weekend (the 13th of August) I attended what must be one of the best regional rallies...the Flight Refuelling Club's Hamfest at Wimborne.

I hear many moans regarding rallies nowadays, especially regarding the ever-increasing amount of computer surplus on sale. Readers write and tell me that they think 'radio rallies' are turning into 'computer rallies'!

I'm pleased to report that neither the Woburn event or the Wimborne Hamfest can be thought of as 'computer rallies'. And in fact, I feel that the Wimborne rally has a marvellous selection of amateur radio gear, collector's items, and an excellent cross section of everything to interest the radio enthusiast.

But this year, Woburn and Wimborne had something else in common. They both attracted vendors (in one case selling direct out of the back of the proverbial van) illicit 'pirate' decoder hardware to enable satellite TV viewers to decode encrypted broadcasts.

I sympathise with rally organisers regarding traders selling 'pirate' software. Very often, you don't know they're going to do it until they've arrived...and it's only when the traders start selling, that the rally organisers realise they have a problem.

However, the situation regarding 'pirated' software is so bad now that action is being taken by the Performing Rights Society. It was announced on the BBC Radio 4 7am news bulletin on Friday 18th August that in conjunction

with Trading Standards Officers, the Performing Rights Society (who oversee this aspect of copyright) are to take concerted action throughout the UK.

I fervently hope that our hobby does not attract unwelcome publicity when 'pirate' software vendors are caught in action at rallies. And bearing in mind that some of the dealers openly promote the ability to receive so called 'Adult' channels...the possibility of attracting bad publicity is high. So, rally organisers everywhere (it is a nation-wide problem)...please be aware of the dangers and help us to get rid of these unwelcome 'hangers on'.

## Illegal CB Transceivers

Readers may remember my efforts to convince the Department of Trade & Industry's Radiocommunications Agency to continue to allow radio amateurs to obtain (otherwise illegal) multi-mode 27MHz CB radio transceivers for conversion. The efforts came to nothing, but there are still hundreds of the illegal transceivers for sale.

All through the rally season this year I've seen at least a dozen or so multi-modes for sale at each

rally I've attended. Some even appear on the 'Bring & Buy' stalls!

So, I think it's about time the DTI and RA admit that they don't have the staff to enforce the removal of multimode CB transceivers from circulation. They clearly don't have the staff, and I think their priorities are elsewhere.

In the meantime, there are many very reasonably priced transceivers 'going to waste'. They could (if only the DTI and RA would relent) be converted to the amateur bands, thus removing a problem for the authorities and helping radio amateurs at the same time. Hopefully, someone will take note and see sense in my suggestion!



Rob Mannion G3XFD

# COMPETITION CORNER



## SPOT THE DIFFERENCE

Our worthy cartoonist John Worthington GW3COI took his family out for a picnic in search of inspiration for this month's 'Receiving Special' issue. However, family Worthington don't seem to appreciate his efforts, and he's on the 'receiving end' in more ways than one! Never mind John, it still makes an interesting 'Spot The Difference' cartoon!

There are 12 differences to mark on the bottom version of the cartoon this month, good luck.

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## STAR LETTER

### Hobby Memories

Dear Sir

One of the fascinating things about this hobby of ours, is the fund of memories (good, bad and indifferent!) that one accumulates as the years go by.

Looking at the 'innards' of one of the state-of-the-art rigs recently, I could not help comparing it with the highly illegal 18 sets that my friends and I acquired in the late 1940s. Five of us had these rigs and would chat happily about our school homework, or the girl next door!

Mine was in the garden shed and my father was just as fascinated with it as I was. My mother used to worry about the possibility of the police descending upon us and arresting us all as Russian spies!

Seeking to become a bit more legal, a friend and myself each built a contraption which was described in an issue of the late and sadly missed *Radio Constructor*. This consisted of four fluorescent tubes mounted in front of a polished aluminium reflector.

A bit of an old Spitfire wing, I remember! Power was applied to the tubes and the light output was modulated by a 6L6 valve amplifier, this being driven by a carbon microphone.

This 'signal' was received by a battery of light sensitive cells which fed a small amplifier. We both lived in houses facing one another and about 50 feet apart. Upon the arrival of a suitably dark night, we would dangle these creations out of our bedroom windows and, if one yelled loudly enough into the carbon microphone, a faint signal could be heard coming from the speaker at the other end!

It would have been cheaper and much less trouble just to have called to each other through open windows. Not as much fun though!

One day, when I had just arrived home from school, a little man called at the house and told my father that he was the local Wireless Interference Officer. He told us that we had to cease, desist and otherwise stop using our contraptions, as they were illegal devices and were unlicensed.

I was none too pleased and pointed out, with all the arrogance of a 15 year old, that they were not radio sets and that we were not breaking any regulations. He replied that there was no direct connection between the two devices and that meant that they were 'wireless'! My parents accepted his peculiar logic and assured that the equipment would be destroyed.

The little man left, muttering darkly! Thank Heavens he did not know about the 18 sets! I don't think they were ever used again and I reverted to listening to amateurs on the family radiogram.

Incidentally GW4CZ and GW5VX were the first two QSL cards I ever received. Both in the Port Talbot area, if I remember correctly.

How nice it would have been to contact them when I finally got on the air in '51 as ZB2A. Sadly, it never happened.

I wonder if any readers remember the Modulated Light Transmitter referred to above? Thanks to you all for a super magazine.

**Tony Tuite GWONSR**  
Gwynedd

**Editor's reply:** Thanks for sharing your memories Tony. Fascinating! My first rig was an 18 set (quite legal on 7MHz I might add!). Have you any more memories like this readers?

## Antennas & Small Garden

Dear Sir

Having been QRT for a number of years, I have been toying with the idea of becoming active again, using the equipment of my late brother (G4LEO). I've been wondering what I could do in the way of an antenna in my garden, only about 45 feet long, and where I understand planning permission is required even for a small 4ft x 6ft shed!

Imagine my surprise when a CB antenna suddenly appeared near the end of my neighbour's garden - and the objections which were immediately raised! Anybody got any ideas for an invisible antenna?

**Cyril Finch G3AHO**  
Bedfordshire

## Key Project

Dear Sir

Greetings to 'Tex' and all at *PW*. I'm writing to say just a few lines to say about the 'Key Project' from the June 1995 *PW*. As G4BXD said, it was very simple to build and very cost effective.

I etched a p.c.b., as for me there were too many links using the Veroboard layout. I've had some favourable reports (wish I could say the same about my sending!). But, overall for the cost of £1.30, I am very pleased.

It would be nice if you could print this letter as it would make a change from seeing those of my ex tutor GONEE Mike being printed! But I would like to say thank you to Mike as I am now enjoying c.w. on 3.5MHz, and to all stations worked.

Look forward to the next issue. Thank you all.

**John 2E0AJN**  
Newcastle Upon Tyne

**Editor's reply:** Many readers successfully built Ben Nock G4BXD's 'Key Project' from the circuit diagram and others built it after making their own p.c.b. rather than the Veroboard. However, I'm sorry to say that there are errors on the Veroboard layout (updates to be published). But despite this, the *PW* team are delighted the project was so popular.

## Digital Disadvantage

Dear Sir

In Ian Poole's description of the Direct Digital Synthesiser (August *PW*), the major disadvantage of the DDS wasn't mentioned. This is that for small step sizes, the amount of memory needed in the ROM is enormous!

You can cut it down by

only using the values 0 to 90° and cycling through the memory four times for each output cycle. But it still needs a lot of memory for small steps.

This means that the ROM size is deliberately reduced (truncated) in practical designs and the D-A converter is cut down to a size allowing reasonable accuracy and linearity, e.g. 8bits at 500MHz output. These truncations

lead to the big problem of spurious output frequencies.

It's usually reckoned that spurs produced just by the truncation of the size of the word in the DAC will be about 6n (dB) down, where n is the number of bit in the DAC. Also, at high frequencies, a 10bit DAC may be less accurate than an 8bit DAC, depending on settling time.

So, the DDS is by no means a simple answer that

cures all ills - in some ways, it's more like Pandora's box. I guess the p.l.l. will be with us for some time to come.

**Peter Chadwick G3RZP**  
Wiltshire

**Editor:** Sounds like there's an interesting article waiting to be written Peter, and we look forward to seeing it published in *PW*!

## Joining A QSO

### Dear Sir

I wish to reply to the letter from Andrew Howlett G1HBE in 'Receiving You' (PW July).

With regard to the specific point Andrew makes with regard to requesting to join a QSO which is already taking place, and his hint at the end of his letter that G7s need to improve their manners. Firstly, let me say I think that 'Break please' is sufficient, while including a callsign initially means disrupting the conversation of those already in the QSO for too long.

While some might consider it bad manners not to say 'please', others might consider it bad manners to interrupt the conversation which is already underway for longer than absolutely necessary. Since both views are valid to some degree, how does a newcomer know what to say?

The best way is to listen, but then you might hear a 'G3' request to enter a conversation with just 'Break'. Also, since both views have merit and different radio amateurs may view this topic differently, can non-radio amateur parents reasonably be expected to know and teach their children this point?

I am, however, quite happy to accept that on the wider aspects of manners and etiquette on air that newcomers most commonly fall foul. It is inevitable since they are at the beginning of a learning curve. I'm sure that most, if not all newcomers, share my desire to follow all the rules, be they written or not, and that the inadequacies are due to lack of knowledge. Perhaps Andrew Howlett would like to assist newcomers by writing an article explaining points about operating etiquette and manners on air?

Finally, I'm sure we are all aware of the valuable nature of frequency allocations. If it was not for the easy access to the bands which today's amateurs enjoy, the number of UK licensees would certainly be massively less. Would the bands then be more likely sold off to the highest commercial bidder?

To all newcomers, I wish you the best. Listen and learn from the veterans, then make the most of amateur radio.

**Paul Hardcastle G7SLP**  
Saudi Arabia

## Antenna Special

### Dear Sir

The August edition of PW dropped through the mailbox yesterday and on the front cover was the large caption 'Antenna Special'. As I have been trying to find drawings/dimensions to enable me to build a triband h.f. Yagi (with or without traps) for a very long time, I thought the article would be the answer, but no such luck as the main content was related to dipoles which are difficult to rotate!

If you have space to publish this letter, it would be greatly appreciated if any reader can assist me with dimensions for a tribander with a mid range of 14MHz. As will be noted from my licence, the Yagi will only be used for DX work on 7 and 14MHz, so, if anyone can assist, he or she will have a friend for life!

A word of warning to anyone erecting a mast in the near future. Recently I decided to erect a 40ft mast to replace the multiple full wave dipoles, so a large hole was dug, 1.5 tons concrete poured along with the relevant steel work positioned and allowed to cure for two weeks.

Then came the time for the erection and as there was no room for a 'gin' pole. The ARRL *Antenna Handbook* was consulted and it was decided to use the method described in pages 22-26 as the mast was 5in round steel. The instructions are quite simple, ie. walk the mast up to 8 to 10 turns of rope wound around the mast above the centre point.

The 'gang' assembled for the big pull (it should be noted that all the team were over 14 stones, with the exception of the XYL!) and we started to pull/lift using this method. The results could have been very serious as the rope turns started to slide down the mast as the mast angle changed from the horizontal to the vertical.

After calling a halt at about 45°, it was decided to use the guy wires that had previously been attached to the top of the mast. It was with great ease that the mast then continued upwards until vertical.

Much has been said and written after safety over the years, so my recommendation is ask advice before starting a project like this, rather than assuming that what's written is safe!

**Nigel R. Tucker Z21KIR/G7URW**  
Zimbabwe

**Editor's reply:** Although I'm sending some material directly to Nigel (I've recommended a cubical quad array) if readers have any favourite designs or ideas using a Yagi, the Editorial team would be interested as it could make a very practical article.

## Antennas & Budget Rigs

### Dear Sir

On reading the letters in the September issue, I was especially interested by two, one about antennas and another about budget rigs. I know it's different for v.h.f. op's. As a novice to get set-up, I bought a second-hand Howes TX/RX as the one I was building sort of went wrong.

My garden is 22 yards long and not being very technical or rich, I bought a roll of copper wire from an engineers shop and two ten foot wooden poles and rigged up the classic 'back leg of the dog' or 'a double S bend antenna' depending on which way I pulled the guy ropes.

So what, my latest page in my log states I have worked Ds, Fs, LAs, LY, YL in the past couple of weeks. The LY in palanger turned out to be Dave G0BZF said 'VY good signals considering my three watts 'he' 'he'. Did he think I was cheating? But three watts is all I have.

So, for me, budget and antennas are no problem! But where would I get with a proper antenna? If your antenna expert needs a test bed, he can always try my garden.

**T. J. Stevens**  
Cambridge

## Resin & Hardener Remover

### Dear Sir

I write in reference to PW July 1995, page 31 'The Weekend Special' bottom of the first column on page 31.

My extensive research suggests that tubes of resin/hardener remover are no longer available. A manufacturer recommends:

"Before epoxy has set, remove with nail polish remover (active ingredient: acetone). Should also work with cyanoacrylic 'superglue' adhesives".

"After hardening, polymer bonds (epoxy only) can be broken by Nitromors

paint stripper" (active ingredient: methylene chloride).

Given time, skin will shrug off even stubborn adhesives, **but washing with a solution of glycerine sometimes helps.**

None of the above seem suitable for eye contamination. If in doubt, attend the nearest Accident & Emergency Dept. If you can find one that's still open after Virginia Bottomley has finished with them!

**Dr. Godfrey Manning**  
Middlesex

**Editor's reply:** Godfrey's advice is very sound, and (from personal experience) I can warn readers to be very careful when handling synthetic hardeners and resins, they can damage the skin significantly. One reader wrote and suggested using the disposable gloves (the same type as dispensed at diesel pumps in garages) when handling the chemicals. But, check before use that the resin/hardener will not 'melt' the plastic gloves on to your fingers!

Send in your news, photographs and product information to Donna Vincent G7TZB at the editorial offices in Broadstone.

# NEWS '95

## Intelligent Kenwood Arrives

The Stafford Show, held over the weekend August 19 - 20th, saw the launch of Kenwood's new high performance TS-870S h.f. transceiver. The new transceiver includes many state-of-the-art facilities, including digital signal processing (DSP) and a feature which Kenwood call an "Intelligent Enhanced Communications System".

Kenwood also report that the new transceiver incorporates high speed PC control, a built-in automatic antenna tuner, and for the c.w. enthusiast the TS-870S comes complete with a K1 'LogiKey' with a variety of operator selectable operations.

General receive coverage on the TS-870S extends from 100kHz to 30MHz, with transmit only on the amateur bands. The transceiver is equipped with a quadruple-conversion receiver with h.f. DSP for post-i.f. signal processing. Kenwood claim that the receiver is capable of picking out a target signal which is 'buried' under the noise.

Production of the TS-870 started in August, with deliveries expected in the UK during September. Price of the new transceiver is expected to be in the region of **£2399.95**. More details can be obtained direct from **Trio-Kenwood (UK) Ltd., Kenwood House, Dwight Road, Watford, Herts WD1 8EB. Tel: (01923) 816444** or any Kenwood approved dealer. *Practical Wireless* will be reviewing the TS-870S in the near future.



## Slim Line Hand-Held

With the introduction this year of no less than four new Alinco radios you would have thought there was nothing left to come from the Japanese manufacturers but there is! This time the newest Alinco addition takes the form of the DJ-191.



The DJ-191 is a v.h.f. f.m. hand-held transceiver and is described by the manufacturers as being "slim-line, simple to operate with its enormous display and effortless to use, large DTMF keypad". The frequency coverage is 144 - 145.995MHz with a maximum of 5W output.

Features include 40 memory channels, a call memory channel, cloning capability, DTMF squelch and nine auto dialer memories. The DJ-191 also features auto power off with Morse alert before it turns off.

More information on the DJ-191 is available from **Waters & Stanton Electronics, 22 Main Road, Hockley, Essex SS5 4QS. Tel: (01702) 206835**. They are expecting their first shipments mid-September and the expected retail price is **£249** inc. VAT.



Veda Morris pictured centre with Sue Reardon G0NLX WAB president and Adrian Keeble G4HPU WAB Appeal Co-ordinator, together with the commemorative plaque.

## Amateur Lifeboat

Following the raising of £12500 by the Worked All Britain (WAB) Group and a cheque being presented to the Royal National Lifeboat Institution (as reported in 'News '95' in *PW* August) a new D Class Lifeboat was officially launched and named at the RNLI's Open Day on Friday July 28.

The D Class Lifeboat D-483 was named *C. John Morris* DFM G3ABG after the founder of the WAB. The naming ceremony was carried out by Veda Morris, G3ABG's widow at the RNLI Headquarters in Poole, Dorset.

The D-483 is an inshore inflatable lifeboat of the type originally designed and built in 1963. It measures 4.72m overall in length by 1.93m wide.

This D Class lifeboat needs at least 18in of water to operate and is capable of maintaining a top speed of 20 knots from its 31hp engine. This latest addition to the RNLI fleet will be housed at the headquarters in Poole, as it is relief boat and will be despatched to inshore waters around the UK and Ireland as and when it is required.



The D-483 the latest addition to the RNLI's relief fleet.

## Economy Wide Band Dipole

South Midlands Communications have recently designed and are currently manufacturing the TFDSE wide band h.f. dipole, which is based on the TFD range of terminated folded h.f. dipole antennas. It is an economy version of the TFDDB.

The TFDSE is constructed from lightweight, but heavy duty pvc covered copper wire and has a centre

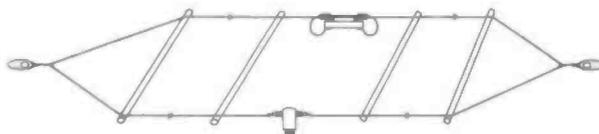
balun, which SMC, say has been carefully designed tested to give minimum losses, excellent balance ratio and prolonged performance. Computer aided design and testing has enabled SMC to provide full efficiency figures, polar plots and technical back-up which is all backed by their ISO9001 design and manufacture quality system.

The frequency range covered by the TFDSE antenna is 2.5 - 30MHz with a p.e.p. rating of 125W. The

antenna measures 30m overall and weighs in at 3kg. Optional coaxial cable assemblies of 10, 20 and 30m are also available.

South Midlands Communications are currently selling the TFDSE wide

band dipole antenna for **£99.95** including VAT. Further information is available from **S.M. House, School Close, Chandlers Ford Industrial Estate, Eastleigh, Hampshire SO53 4BY. Tel: (01703) 255111**.



## Hand Tuned Antenna

**Dick Pascoe G0BPS** has recently informed the 'Newsdesk' of a new hand-made, individually tuned antenna, which **Kanga Products** have added to their range of products. The 789 Low Cost antenna has been designed with the Novice in mind and is specifically aimed at them with a price tag of just £24.95.

The 789 antenna uses a Franklin collinear which the manufacturer's say ensures high efficiency with a low s.w.r. and requires no matching. The

frequency range of the 789 is 430 - 435MHz with a s.w.r. of under 1:1.5 within the band.

A BNC connector is used to give good connections and Kanga Products say that once installed the 789 antenna should give the operator good service for many years.

The 789 Low Cost antenna is available direct from **Kanga Products, Seaview House, Crete Road East, Folkestone CT18 7EG for £24.95 plus £4.50 P&P.**

## Communications Stamp

The Royal Mail have honoured the achievements of Guglielmo Marconi on two stamps in their latest 'special' set, which was issued on September 5. The stamps are part of a set on communications, which also feature Rowland Hill 'inventor' of the the postage stamp.

Marconi's portrait is featured on the 41 and 60p stamps. The 41p stamp shows Marconi with some of his early wireless equipment and the 60p stamp depicts the importance of his work for marine safety and navigation. Rowland Hill is featured on the 19 and 25p stamps.

To get a set of these special stamps you should contact your nearest Royal Mail Post Office.



## New From Yaesu

Following hot on the heels of the FT-8500 dual-band f.m. mobile transceiver which features the FS-10 Smart Controller microphone for the first time (all the radio functions are housed on the microphone), comes the FT-1000MP h.f. all-mode transceiver and the FT10R/40R hand-held transceivers. These new offerings from Yaesu were on display for the first time at Stafford Amateur Radio & Computer Show, held over the weekend of August 19 - 20th.

The FT-1000MP features enhanced digital signal processing, dual-band receive with separate S-meters, a built-in Collins mechanical 455/2.7kHz s.s.b. filter and an optional Collins 455kHz/500Hz c.w. mechanical filter. There is also an independent 2nd and 3rd i.f. filter selection together with wide receiver dynamic range.

Also featured on the FT-1000MP is a transverter jack for v.h.f./u.h.f. operation, selectable antenna jacks and a 'Quick Memory Bank'. There's also a built-in high speed automatic a.t.u. and electronic contest memory

keyer.

The FT-10R/40R hand-held transceivers are said to be the first amateur hand-helds to carry the MIL-STD810 rating. The FT-10R is for 144MHz operation with the FT-40R covering the 430MHz band.

Described by Yaesu as being ultra compact with their unique clamshell design and rear mounted batteries the FT-10R/40R offer the buyer a choice of four keypads. Other features include alpha-numeric display, digital coded squelch, direct f.m. designed to improve packet performance and voice quality, dual-watch, high

speed scanning and four output power levels.

**Yaesu UK Ltd., Unit 2, Maple Grove Business Centre, Lawrence Road, Hounslow, Middlesex TW4 6DR. Tel: 0181-814 200** or any approved dealer can supply you with more information on the FT-1000MP, FT-10R and FT-40R together with prices and expected delivery dates.

*Practical Wireless* will be reviewing the FT-10R and the FT-8500 in the November issue - watch this space! Our review of the FT-1000MP will appear in the very near future too.

## Tennamast Trophy & Frank Hall GM8BZX

The Tennamast Trophy, sponsored by the Ayrshire-based company, has been renamed in honour of the late Frank Hall GM8BZX (RSGB President in 1990) who died in April this year. The Tennamast Trophy is awarded to the leading Scottish station in the annual PW 144MHz QRP Contest.

Frank Hall was renowned for his work on behalf of Amateur Radio in the UK, and particularly in Scotland. So, **Norrie Brown GM4VHZ** of **Tennamast**, searching for an appropriate memorial to Frank's work for the hobby, discussed ideas with Rob Mannion G3XFD, Editor of

*PW*. They agreed to rename the award as "**The Tennamast Trophy In Memoriam To Frank Hall GM8BZX**" and to approach Frank's widow on the matter. Beth Hall replied that she was delighted to agree to the renaming.

Presentation of the newly renamed trophy took place at the Port Seton Community Centre near Edinburgh on Friday August 18 when **Beth Hall** presented it to **Colin Smith GM0CLN**. Colin accepted the trophy on behalf of the Cockenzie & Port Seton Amateur Radio Club. The club's contest station GM0CLN/P, located in the

Lammermuir Hills southeast of Edinburgh was operated by Colin himself, **Ron GM4IKU, Margaret GM0ALX, Bob GM4UYZ, Alex GM6VIU** and **John GM7OLQ**.

The event took place on the same evening as the C&PS's successful 'Radio Junk Sale'. And the grand total of £473 raised during the evening, has been donated to the Scottish Branch of the British Heart Foundation.



**Beth Hall, widow of Frank Hall presenting the newly renamed "Tennamast Trophy In Memoriam To Frank Hall GM8BZX" to Colin Smith GM0CLN, while Sponsor Norrie Brown GM4VHZ of Tennamast looks on.** (The full results and details of the 1995 PW QRP Contest will appear as usual in the November issue of the magazine).

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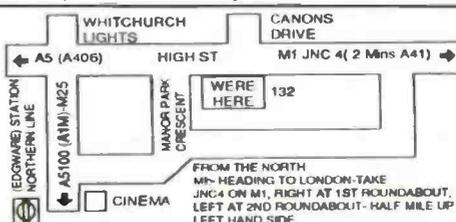
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The **Southend and District Radio Society** was founded in 1920 and was known as The Wireless Society of Southend on Sea. The Society was formed by a group of keen enthusiasts who were determined to delve further into the fascinating and mysterious science of communication by wireless.

## Historic Year

It was in that historic year of 1920 that two daily programmes were sent out over the air from the Marconi works at Chelmsford. The first being on February 23.

However, wireless communication had been going on for some time before that and had been carried out on long and medium waves. Short waves were, at the time, thought to be unreliable for distant communication, so these bands were given to the amateurs to experiment with.

## Licence Granted

In 1923, the Society was re-named and became the Southend and District Radio and Scientific Society. During this year, the Post Master General granted the society its transmitting licence under the call 5QK.

It was also during this year that the RSGB was founded, formerly known as the London Wireless Club since 1913.

The year 1924 saw the first radio exhibition in Southend, organised by the Society to promote radio to the general public and to raise funds for charity. The Society continued to flourish throughout the 1920s with meetings, outings, visits to other clubs and lots more.

## Committee Meeting

In 1926, at a committee meeting, the purchase of an 'Anode Converter' was discussed. But at a cost of £15-10s-0d, (although a 15% discount was offered), the committee were not in the position to purchase the instrument, (in those days, average wages were about 30 shillings a week!).

Also discussed at the meeting was the Victoria Hospital, which was in need of an efficient wireless receiving system and an appeal was launched through the press to raise a minimum of £50 to carry out the work.

As a result, The Southend and District Radio Society took on the task of equipping the entire hospital with the aid of funds collected by them in

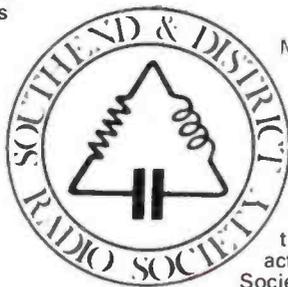
# CLUB Spotlight

Send your information to the  
'Club Spotlight' newshound  
Zoë Shortland at the PW Offices.

1926. Once completed, a silver plaque was put on the receiving set at Victoria Hospital.

## Charitable Activities

Moving on through the years 1927-1932, the Society remained very active and in 1932, another hospital was equipped with wireless. This time, the charitable activities of the Society included the



## Name Change

In 1937, the name of the Society was changed to The Southend & District Radio Society (SADRS) and has remained unchanged to the present day.

In 1949 **Mr F. H. Garon** was appointed Vice President and in 1950 **Mr E. H. Bridges** was appointed as Chairman of the Society. Also in 1950 a Hamfest was held in Southend and was attended by 66 members of the SADRS.

The year 1951 saw the first edition of the Amateur Radio Call Book, price 3/6d and it had 6000 entries, a far cry from the present book! In this year, the

## Southend's Success

'Spotlighted' this month is the Southend & District Radio Society, the story traces the 75 year history of the club.

provision and upkeep of wireless equipment for the wards of Southend General Hospital, consisting of 135 pairs of headphones, 40 pillow phones, 20 loudspeakers and miles of wiring and other ancillary equipment.

All the installation was provided and serviced by the Society. The handing over ceremony took place on September 6 1932 at 8pm, and a plaque was erected by the hospital as a memorial to the Society.

## Maintain Interest

In 1939, the Society's activities continued until the outbreak of war. During the war, meetings carried on in one or another homes, to maintain interest.

**Mr J. Fitch** was in the chair and he recalled that the Society had been in existence for 25 years. (Further detailed research proved that the society had in fact been in existence for 26 years). His Worship the Mayor was made Patron of the Society in 1946 and in the same year, the Society's call was re-issued with the prefix G added, so the call became G5QK.

Hon Sec received a letter from the RSGB reminding him that it was not permissible to operate a transmitter from a moving vehicle!

## Society Badge

In February of 1951, a block of the Society's badge consisting of a capacitor, resistor and an inductor in series in a triangular formation, with the letters SDRS individually placed in the corners was presented to the Society by the President, **Mr Burrows**. It was designed by **Mr Knipe**.

Lots more happened between the years 1951 and 1955, which was the Society's 35th anniversary. From 1955 onwards the Society continued successfully with various activities.

## 50th Anniversary

In 1970, the Society celebrated their 50th anniversary with a dinner held at the Gallo Doro Restaurant in Hadleigh, 15

members were present. The Society continued with meetings, talks, field days, lectures, etc.

In 1981, Citizen Band radio was made legal and the public were able to communicate over limited distances on f.m.

## Membership Increase

The insight into radio communication, although limited, gave those who were interested, a path to amateur radio having sat and passed the RAE.

This turned out to be a good thing for amateur radio, and certainly for the Society. For between 1981 and 1984, membership increased dramatically and in November 1984, membership was in excess of 100, and for a time, entry as a new member was restricted!

At the time, meetings were held every Friday at a room in the Rayleigh Civic Suite, a very nice venue, but because of fire regulations, which only allowed 60 persons, the Society had to find other accommodation.

## Alternative Venue

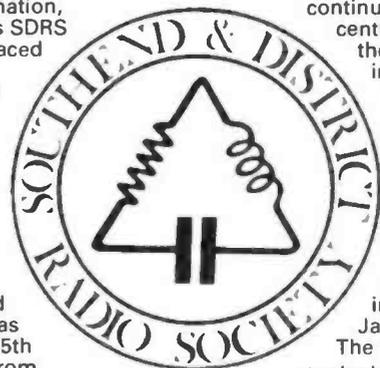
After looking for alternative venues, the Rocheway Center at Rochford was chosen. It was not as nicely appointed as the previous venue, but it did have its advantages.

Firstly, an annual rally could be held, with use of the whole building, there was a playing field, an out building for a shack, plenty of scope for putting up antennas and a car parking area. Lastly, there was a licensed bar and tea bar, which would be popular with members.

The first rally was held at Rocheway in 1985, and was very successful. This was the start of the annual rallies at Rocheway.

However, with the continued use of the centre and when the fees increased considerably, the committee looked for an alternative venue. As a result, it was agreed to make a move in early January.

The first meeting took place on January 5 1995 at **The Venture Scout Centre, 191 Eastern Avenue, Southend on Sea**. Meetings now take place every Thursday evening at 8pm. Later this year is a very special occasion for the Southend & District Radio Society as it's their 75th anniversary!



# RADIO Diary

**September 17:** Peterborough Radio & Electronics Society East of England Rally is to be held at the Peterborough Showground, easy access from A1, A605, A47. There will be trade stands, radio car boot and other local attractions. Full catering and bar. Acres of free parking. Doors open at 10.30am, 10am for disabled visitors. Admission is £1. Talk-in on S22 via G3DQW. General enquiries to **Ted GOREM** on (01733) 66471, QTHR.

**September 17:** The Central Lancaster Radio Rally is to be held at the Central Lancaster High School, Craig Road, Lancaster (five minutes from Jcn 34 M6). Doors open at 10.30am and the entrance fee is £1. There will be the usual traders, special interest groups, a Bring & Buy and refreshments. **Susan Griffin** on (01524) 64239/(01384) 896199.

**September 23:** A Radio Amateur Table Top Sale is to be held at St Mary's Hall, Reddish, Stockport. More details from **John G4ILA** on 0161-477 6702.

**September 24:** North Wakefield Radio Club Rally is to be held at the Outwood Grange School, Porovens Lane, Outwood, Wakefield, junction 41 M1. Further details from 0113-253 9087.

**September 24:** The Droitwich Amateur Radio Club are holding their Three Counties Radio Rally at The Three Counties Showground, Malvern. For further details you can contact **Eddie G4POZ** on (01905) 773181.

**October 1:** Blackwood & DARS rally is to be held at the Community College, Oakdale, near Blackwood, Gwent. Doors open at 10.30am. There will be traders, a Bring & Buy and a raffle. Talk-in on S22. Further details from **Norman GWOMAW** on (01495) 227550.

**\*October 1:** The Great Lumley Amateur Radio & Electronics Society will take place in the Community Centre, Gt. Lumley, Chester-le-Street. Doors open at 10.30am for disabled visitors and 11am for others. There will be trade stands, a Bring & Buy and much more. **Barry G1JDP** on 0191-3885936.

**October 8:** Computercations '95 Computer &

Radio Rally, Hillhead Camp Site, Dartmouth Road, Brixham, South Devon. Overnight camping, car boot sale (weather permitting), trade stands, professional flight simulator demonstration, Bring & Buy, refreshments, unlimited free parking. Talk-in on S22-G7FDC. Special event station GB2CPU. Morse test on the day: **John May** on (01803) 522995. Details for rally from **W. Trezise G6ZRM** on (01803) 522216.

**October 15:** The North Monaghan Hobby Radio & Computer Exhibition will be held at Cupids Nightclub and Restaurant, Smithborough, County Monaghan. Proceedings start at 11.30am and continue until 5.30pm. All the usual retailers will be in attendance along with a large display of computer equipment and a Bring & Buy. Refreshments will be available all day in the adjoining restaurant along with full facilities for QSLing via the brewery! Admission is £2 and half price for all under fourteen. Talk-in will be on S22 from 10.30am. Facilities will be provided for disabled access. **Stephen Hand G17UIM** (08) (013657) 51479 evenings or **Ken O'Reilly G17UIP** on (08) (013657) 38955 daytime.

**\*October 20/21:** Leicester ARS is being held at the Granby Halls, Leicester. Doors open at 10am each day (9.30am for

disabled visitors). All the usual facilities. **Frank G4PDZ** on (01533) 871086.

**\*November 4-5:** The Eighth North Wales Radio & Electronics Show is being held at the Aberconwy Conference & The Bew Theatre, Llandudno. The show opens at 10am, both days. **B. Mee GW7EXH** on (01745)591704.

**November 19:** The Bishop Auckland Radio Amateurs' Club will be holding its annual radio rally at the Newton Aycliffe Leisure Centre. Doors open at 10.30am for disabled visitors and 11am for everyone else. Further info. from **Mike Shield**. (01388) 766264.

**\*November 26:** The Bridgend & District Amateur Radio Club will be holding its 9th Amateur Radio & Computer Rally at the Bridgend Recreation Centre in Bridgend. The rally will have all the usual amateur radio and computer dealers, a Bring & Buy, RSGB Morse test on demand (two passport size photos must be produced). Doors open at 11am, 10.30 for disabled visitors. Admission is £1. Further details from **Maurice GW0JZN** (01656) 864579 or **Don GW3RVG** (01656) 860434.

**December 3:** The SDX Cluster Support Group will be holding a Radio, Electronics & Computer Rally in the Maryhill Community Centre, which is located just

along from junction 17 of the M8 motorway and is located on major public transport routes. Doors open at 10.30am for disabled visitors and 11am to 4.15pm for everyone else. Entrance fee is £2 for disabled, UB40 holders and £2.50 for all other visitors (children under 14 accompanied by a parent free of charge). There will be many traders, club stands, lectures and demonstrations. Further information can be obtained from **John Dundas GMOOPS**, Rally Organiser, on 0141-638 7670.

**\*December 3:** The Verulam Amateur Radio Club are holding their rally at the Watford Leisure Centre, which is located less than five minutes drive from the Junction of the M1 and M25 motorways. Trading will be from 10am to 4pm. (01923) 222284.

**December 3:** The Thames Valley Electronics Rally is being held at Kempton Park, Race Course, Sunbury-on-Thames, Middlesex. Doors open 10.30am to 4.30pm (10am free entry to the Bring & Buy stand). Major manufacturers and retailers, accessory supplies, antenna supplies, Bring & Buy stall, computers and component retailers and specialist groups. Admission for adults £1.50, OAPs £1 and children under 14yrs free. (01494) 450504.

If you're travelling a long distance to a rally, it could be worth phoning the contact number to check all is well, before setting off.

The Editorial staff of PW cannot be held responsible for information on Rallies, as this is supplied by the organisers and is published in good faith as a service to readers.

If you have any queries about a particular event, please contact the organisers direct.

Editor



## SUBS CLUB

### 'Receive' A Super Superhet Book

To accompany our special 'Receiving' themed issue this month, I've chosen an excellent recently published book by one of our authors. **Ian Poole G3YWX** who writes our 'Equipment Specifications' column, has written *The Superhet Radio Handbook*.

Published by Bernard Babani, Ian Poole's book provides an excellent 'inside guide' to the superhet receiver, suitable for both the beginner and experienced radio enthusiast. Ian's book is a worthy successor to the classic valve era (long out of print) *Radio Circuits A Step-by-step Survey of superhet receivers* written by W. E. Miller, Editor of *Wireless & Electrical Trader* and published by Iliffe & Sons Ltd.

The newly published book covers a great deal of ground in its 100 plus pages. Ian starts it off with a look at the history of the superhet (fascinating in itself) and then Chapter 2, with a heading entitled Basic Principles, covers mixing, the superhet radio, tuning, basic superhet design, automatic gain control, other configurations, digital signal processing, advantages of the superhet (and that's just Chapter 2!). The other chapter headings include Sensitivity & Overload, Selectivity, Local Oscillator, Demodulation, Operation (all also sub-divided into many comprehensive sections).

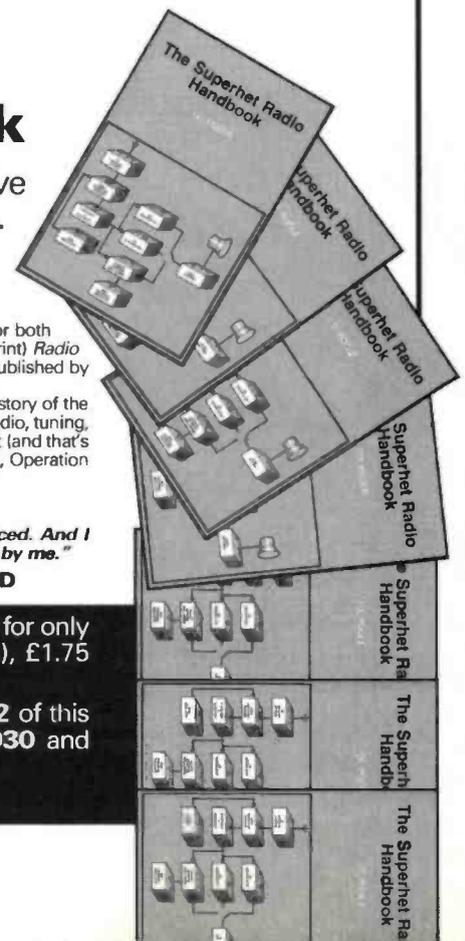
*"Altogether this little book provides a superb guide for any radio enthusiast, whether beginner or advanced. And I especially recommend it to anyone embarking on an RAE course. This book comes as highly recommended by me."*

**Rob Mannion G3XFD**

By becoming a Subscriber, you can get your copy of *The Superhet Radio Handbook* for only **£4.95** including P&P UK and overseas (normal price £4.95 plus £1 P&P (UK), £1.75 (overseas) and get PW delivered right to your door

To take advantage of this offer just fill in the details on the order form on page 62 of this issue. Alternatively call **Michael** on our **Credit Card Hotline** on (01202) 659930 and quote **SCPW10** to place your order.

Offer open until 13 October 1995 (UK), 27 October 1995 (overseas).



# NOVICE Natter

## Multi-Band Bargain

I'm always on the look out for a bargain and I've come across details of a multi-band transceiver kit. The price was what really attracted me, £99 for the basic kit and then £14 for each extra band. This means you could get on the air quite cheaply if you are prepared to put the time and effort in. The kit is called the Taunton and is available from Walford Electronics.

The Taunton can be built as either a receiver or a transceiver and there is room inside for an extra plug-in band card. Optional extras are things like an automatic gain control (a.g.c.) controlled intermediate frequency (i.f.) amplifier, S-meter and receiver incremental tuning (r.i.t.).

The catalogue from Walford Electronics goes into the workings of the circuit, so if you are interested I suggest you contact them direct at **Walford Electronics, Upton Bridge Farm, Long Sutton, Langport, Somerset TA10 9NJ. Tel: (01458) 241224.**

## For Radio Beginners of all Ages.

**Elaine Richards G4LFM, PO Box 1863, Ringwood, Hants BH24 3XD.**

*This month Elaine Richards G4LFM has news of a bargain transceiver kit, other radio societies and looks at the a.t.u. in 'First Steps'.*

The Taunton could be a good club project too, as well as being suitable for the newcomer. If you are members of a Novice class or a radio club, you should have others around you to help if you get stuck at any stage of the construction.

Projects like the Taunton usually come with excellent documentation and detailed instructions. As long as you can solder well (and it's worth practising a bit beforehand) you should be able to construct a kit of this type.

As I mentioned before, it's

worth getting help from more experienced hobbyists when you get to the difficult bits. Home construction can be very satisfying to those that enjoy that aspect of the hobby.

If that means you, why not send off for the catalogue. With the darker nights approaching this could keep you busy all winter long!

## Other Regions

Living on the south coast (well inland a bit), details of what goes on in the other regions of the UK can sometimes be a bit hazy. A fellow Royal Naval Amateur Radio Society (RNARS) member, **Colin Topping**, recently set me straight. In fact, he's explained something I didn't have a clue about.

In *PW* August in 'First Steps' about RAYNET I mentioned the St. John Ambulance with regards to the whole of the UK. Did you know that in Scotland they have the St. Andrews Ambulance? Well I didn't, that's why I didn't mention them when I was talking about the First Aid Groups.

Thanks for putting the record straight Colin, I didn't mean to miss out Scottish causes or their users. I hope to be able to bring you more information on RAYNET and their activities in the near future.

## Different Societies

If you have read more than a couple of 'Novice Natters' you will have read about the Radio Society of Great Britain (RSGB), and my suggesting that you consider joining your local radio club (again, with me suggesting you join). But there are other groups that you may want to get involved with on a national level.

The other groups bring together people who have perhaps been in the same job, have the same interests or share a language. So, let's go through a few of these specialist groups.

**AMSAT-UK.** This group has been around for about 15 years or so and they specialise in amateur satellite matters. If you join you get a regular newsletter filled with all kinds of amateur satellite matters. I'm sure they have regular Nets too.

The **BARTG (British Amateur Radio Teledata Group)** is a group for those interested in any kind of data mode, they produce a newsletter and have some books on the subject. They also stock bits and pieces needed for their projects and sell bits of kit for data work.

The **BATC (British Amateur Television Club)** this groups represents

those interested in amateur television. This is another busy group with both newsletters and books available to members.

Perhaps you worked for a railway company? If so the **British Rail ARS** may be of interest to you.

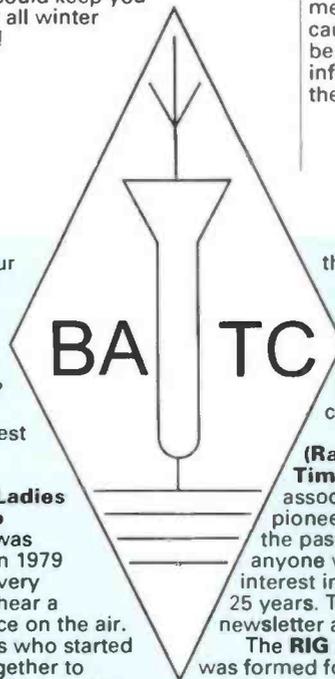
The **BYLARA (British Young Ladies Amateur Radio Association)** was formed back in 1979 when it was very unusual to hear a female voice on the air.

The ladies who started it got together to further YL operation.

The **Civil Service ARS** actually have regular meetings (this is unusual in a national group) in London. I think they also have an amateur station for members use.

The **G-ORP Club**, this group is probably one of the most well-known clubs. The club specialises in low power operation. It's founder, the Rev George Dobbs G3RJV, is a very well-known person in the world of amateur radio.

The **International Police Association Radio Club** is open to those serving or pensioned from the police service. They hold regular Nets on



the air.

The **Prudential Amateur Radio Society** is open to all current, retired and pensioned employees of the Prudential Group of companies.

Then there is **RAOTA (Radio Amateurs Old Timers Association)**. This association is keeping alive the pioneer spirit of amateur radio in the past. Membership is open to anyone who has had an active interest in amateur radio for at least 25 years. This group publishes a newsletter and holds regular Nets.

The **RIG (Remote Imaging Group)** was formed for those interested in receiving weather satellites.

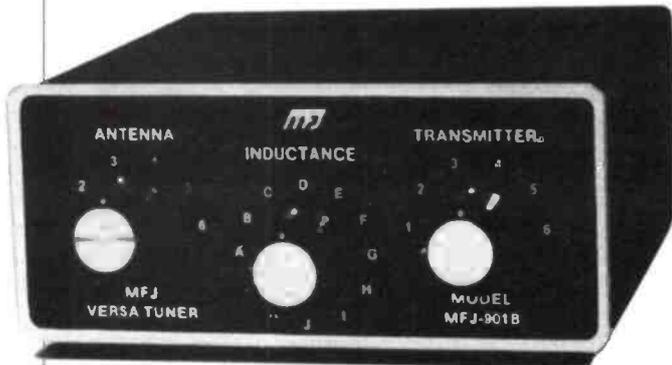
The **RAF Amateur Radio Society** is the national society for those who have or have had connections with the RAF in various ways, both civilian or military ways.

The **Royal Navy ARS** is open to those who have had connections with the Royal Navy, Merchant Navy or even foreign navies.

The **Royal Signals ARS** is the



## First Steps



## Antenna Tuning Units

Now you all know why the antenna tuning unit (a.t.u.) is used, but do you know how to use one? If not, let me try and give you a few tips.

Let's start with a quick refresher on why you need an a.t.u. It's important to note that there are many eminent engineers out there who will advise you that anything that interrupts the path between the transmitter and antenna is a bad thing.

In many cases they are right as any additional devices are bound to introduce unwanted losses. However, this approach is only really feasible when you're dealing with professional standard antenna systems where the antenna characteristics are both predictable and repeatable.

In the world of the amateur, home-built, antennas the a.t.u. serves a vital role in equalising the differences between the theoretical antenna and the practical result. It's most important role is to match the (usually) 50Ω output impedance of the transmitter to the often variable impedance of the antenna.

Once the 50Ω match has been achieved you can be assured of maximum power transfer and the best radiated signal. But, there is another important advantage from the a.t.u. that's not normally covered as part of the Novice course - harmonic suppression.

The scourge of many amateurs operating within our densely populated shores is TV and radio interference. Whilst poor design in domestic appliances are often to blame, anything that can be done to reduce the harmonic content of your transmission is bound to help.

Because the a.t.u. achieves its impedance matching using a tuned circuit, the side benefit is a filtering effect that reduces the

harmonics from any transmitter. Whilst the reduction is not particularly great, it's still worth having.

### How To Use It

So, now you understand why you should have the a.t.u., let's look at how to use it. Most a.t.u.s have three controls, two tuning capacitors and a switched inductor.

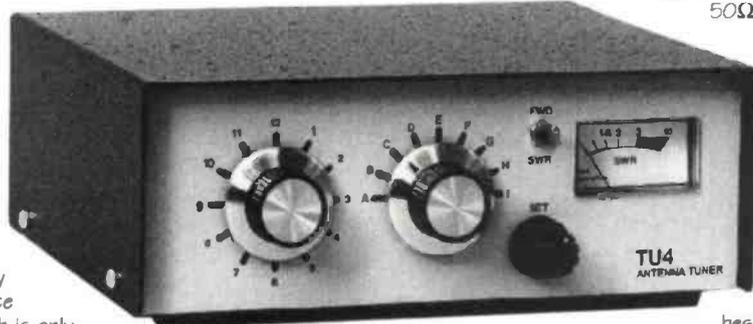
The markings will vary from unit to unit, but often the switched inductor will be marked in bands. So, to use the a.t.u., you set the inductor to the appropriate band, connect an s.w.r. meter between the transmitter and a.t.u., and adjust the controls for minimum s.w.r. Sounds easy, and it is, but there are a few important points to note.

The first is to start by disconnecting your antenna and connecting a suitable dummy load. This enables you to find the approximate settings without polluting the airwaves! Once this is done you can connect your antenna and complete the fine tuning, taking care to make sure you're operating on a clear frequency.

If you've never used an a.t.u. in anger, you must be sure to be very careful and move the controls quite slowly. The optimum setting can easily be missed, especially if your antenna is a long way adrift from the required 50Ω.

It's also important to note that the a.t.u. settings will probably need to be changed as you move around a band and every time you change bands. Once you've found the best setting for a

particular band, it's well worth jotting it down so you can return to those settings on your return to that band. Be patient, and remember - practice makes perfect.



national group for those of the Royal Corps of Signals including the TA and other military personnel.

The **St. Dunstan's ARS** is a wonderful society catering for those blinded during their time in the services. I've been to several St. Dunstan's meetings and you couldn't belong to a better group of people. I look back on those meetings with very happy memories.

The **WACRAL (World Association of Christian**

**Radio Amateurs and Listeners)** welcome all Christian radio amateurs and listeners regardless of denomination.

Finally, how about the **British Esperanto Association**. I haven't heard about them for a while, but I think they still operate. (Walter G3ESP, QTHR, can help. **Editor**.)

This list is a fairly large sample of the many organisations you could join. There's a lot to be said for meeting and or talking with

like-minded people. Now, all the societies I mentioned have addresses to write to if you are interested in more information. If I include them here I shall be in big trouble over space!

If you would like a list of the most current addresses, then either look in the RSGB Call Book (the latest edition) or send an s.a.e. to the **PW Editorial Offices** and they'll post the list out to you.

*Have you just passed your RAE? If so you may have a list of questions on how to put everything into practice or maybe there are certain areas of the hobby that you're not sure about. And if that's the case why not drop me a line with your queries and I'll cover them in 'First Steps'.*

*That's all the 'Natterings' for this issue so until next month cheerio.*

*Elaine G4LFM*

# Helpful Hand-Held

Richard Newton G0RSN reports on his experiences with a new v.h.f./u.h.f. rig from Icom which proved itself in his car and demonstrated how it fights off interference from computers and 'wide area paging' transmissions.



I was very excited when I got a call, well actually a post card, from Rob G3XFD at PW. He'd had mislaid my 'phone number, and the card asked whether I would review the new dual-band 144/433MHz hand-held from Icom, the Icom IC-W31E. Put it this way, he didn't have to send me a post card twice!

The IC-W31E was an exciting prospect. I enjoy looking at the new innovations and new ways manufacturers incorporate established features.

However, I must say that looking at some modern hand-held radios I have cringed when I have seen what I would term as the latest gimmick. How elated I was when I opened up the box and found the IC-W31E to be, in modern terms, a straightforward, down-to-earth radio.

## First Impression

The Icom IC-W31E creates a very good first impression. The transceiver has a good solid feel to it.

The unit is professionally finished in charcoal grey metals and plastic, it looks very smart indeed. It's not big enough to be cumbersome, nor too small to be difficult to use.

The size and design of the unit make it easy to handle and use for both left and right-handed operators. It has well labelled buttons and controls. The buttons are large and easily operated.

The controls are in general well laid out. The press to talk (p.t.t.), Volume select and Light buttons are all on a side panel.

The inner part of the dual rotary switches on the top of the radio control tuning the v.f.o. and memories and also take you through the various menus that can be displayed. When the Volume button is depressed, these controls then become the volume controls for their respective bands.

The outer part of these dual rotary switches are the Squelch controls. I accept that this is

personal preference, but I found that I would have rather had the volume controlled as a primary function and the squelch as a secondary function. (I find that I adjust the volume far more regularly than the squelch).

## Easy To Read

The display is easy to read and uncluttered. The main read-outs such as frequency and memory numbers are bold and I found that even the smaller function indicators were not a problem.

The IC-W31E has all the controls you would expect to find on a modern hand-held. I will not list them all as there a specific aspects I would like to give a mention.

However, I will say that the various functions are controlled from the front panel keypad the buttons are translucent and when the backlight is activated these illuminate splendidly.

My father-in-law, Terry G7VJJ, has just passed his RAE. He asked me give him some ideas on hand-held transceivers.

Terry's greatest concerns were that, would he be able to read the display? Would he be able to use the controls without a magnifying glass and to be able to operate the radio without having to go on a six week course?

I'm sure that Terry's concerns are shared by many amateurs. The IC-W31E is not the only hand-held on the market that satisfies Terry's criteria. However, I would certainly say that it was near to the top of the list.

## Back To Basics

The Icom IC-W31E seems to be a back to basics transceiver. It does include advanced features such as CTCSS encode (decode is an optional extra) and DTMF paging, however these I believe are now considered to be basics by many operators.

There are no gimmicky frills I'm glad to say. Instead, Icom have included some rather useful little features and all the normal features that you would expect.

One particular feature that caught my eye was the battery voltage check. This will display exactly how much voltage there is in the battery, and this actually operates under load, so that you really do see just how well (or not!) your battery is.

Icom have included a function called 'repeater memory'. This is where the radio will automatically remember the last frequency you transmitted on using a shift of any kind.

On depressing the relevant button the unit will recall the information along with any other information, such as tone squelch settings. This applies for both bands.

So, 'repeater memory' provides you instant access to three frequencies. These include: the standard memory, the v.f.o. and the last used repeater, all at the touch of a single button.

The memory channels can be given names. These can be up to six characters in length and will only appear in 'Name' mode. (In this mode the operating frequency is replaced with a channel number).

## Paging Facility

On many hand-held transceivers these days you will see a Paging facility using DTMF tones. This is also true of the IC-W31E.

Along with a small number of other hand-held radios the Icom IC-W31E has the advanced feature of Message Paging. This takes the Paging facility one step onwards.

You can page someone, and as long as they own a transceiver with a similar facility, you can leave them a message. Using the Icom IC-W31E these messages

# The Icom IC-W31E D

can be up to six characters long.

However, memories are put aside for incoming and outgoing messages. Therefore you get a string of messages stored. For example, 'Terry...ringme...tonight...Rich...GORSN'. You just toggle through the memories to read the full message.

I've owned a hand-held rig with message paging for sometime, but hardly ever used it in anger. Personally, I have always regarded it as a bit of fun and little else.

However, I can see some possible uses for message paging. One example could be on a RAYNET operation or perhaps a group of friends who live nearby to one another who do not have Packet! The list, I am sure, is endless...almost.

Other features include single band working. There's also sub-band working, where you can have either two u.h.f. frequencies in each v.f.o. or two v.h.f. in each v.f.o. Other features include v.f.o. and memory scanning, variable settings for v.f.o. frequency steps, output power and repeater off-set.

So enough of what it looks like, feels like and is supposed to do. So, how did it actually work?

### First Contact

My first contact using the Icom IC-W31E was under very difficult circumstances. The family and I were going across Bournemouth to visit Steve G1YNY and his wife Diane.

We were late, but no fear I thought, I'll call Steve on the radio. Unfortunately my mobile set was in the shack and not the car. That's when the Icom IC-W31E came to the rescue.

There was no time to put an antenna on the car. So off I went Icom in hand. And as we got to one of the most notoriously bad spots for GB3SC (the Bournemouth repeater), I put a call out for Steve.

To my utter surprise I got in to the repeater, 1.5W into a helical antenna in the car. I was impressed! Steve gave the transmitted audio a very favourable report, likewise the received audio was very good indeed.

On the subject of repeater working comes my only disappointment. The 1750Hz tone burst is sent by depressing the p.t.t. switch and the repeater memory button.

The repeater memory control is on the front panel just about as far away from the p.t.t. as Icom could have made it. This made accessing a repeater a cumbersome, two-handed affair, that I gave up on after a very short while, reverting to my now infamous 1750Hz whistle! This can be achieved one-handed and not withstanding cold sores, hangovers and chapped lips, will work every time!

### At The Computer

When I eventually sat down at the

## Manufacturer's Specifications

### General

Frequency coverage	144-146 and 433-440MHz
Mode	f.m. (F3E)
Frequency stability	5ppm (0 to +50°C)
Tuning steps	5, 10, 12.5, 15, 20, 25, 30 or 50kHz
Antenna impedance	50Ω unbalanced
External power	4.5 to 16V d.c. negative ground

### Current drain

Transmit v.h.f. high power/low power	1.3A/500mA
Transmit u.h.f. high power/low power	1.5A/600mA
Receiving v.h.f. only, rated audio/power save	160mA/15mA average
Receiving u.h.f. only, rated audio/power save	170mA/19mA average
Receiving both bands rated audio/power save	210mA/28mA average
Usable temperature range	-10 to +60°C
Dimensions with BP-171 battery pack	57x125x31mm
Weight	340 g/12.0 oz

### Transmitter

Output power @ 13.5V	5 W/ 500mW/15mW
Modulation system	Variable reactance
Maximum frequency deviation	5kHz
Microphone impedance	2kΩ

### Receiver

Receive type	Double conversion superheterodyne
1st Intermediate frequency	43.1MHz (v.h.f.) 35.8MHz (u.h.f.)
2nd Intermediate frequency	455kHz (both bands)
Sensitivity (12dB SINAD)	<0.18μV

### Selectivity

Spurious and image rejection ratio	< 0.32μV for v.h.f. and u.h.f.
Audio output power @ 13.5V	>15kHz/-6dB
Audio output impedance	<30kHz/-60dB
	>50dB (more than 40dB at IF/2)
	>180mW
	(at 10% distortion with an 8Ω load)
	8Ω

computer, recording some notes and ideas for this review, I had the Icom IC-W31E next to me. This is when I've noticed that other radios I've reviewed have suffered somewhat with the usual awful interference from the computer and monitor.

However, the Icom IC-W31E did not suffer from interference at all. It didn't even react when I took the squelch off and placed it next to the monitor. Very impressive!

Well, the next contact was nearly as strange as the first. I had sat down at the computer to start the review and turned on the Icom IC-W31E to check something. This was when I heard someone calling through the Bournemouth repeater (GB3SZ) on 433.375MHz. The unexpected call seemed highly unusual for the time in the morning I was listening.

However, as you may have gathered I enjoyed using the little radio and due to that fact, the battery was almost depleted. Despite this and the fact that the path to GB3SZ from my home is not great at the best of times, I returned the call.

I could not let the station who was calling, suffer any longer. He was getting no replies. So, to cut a long story short, I had a very interesting contact with David G8EMA. David, his son Simon 2E1BDJ and the rest of the family were camping near to Corfe Castle.

So, what was strange about the contact? To be able to hold the repeater I spend the whole contact standing on my office chair!

### Real Test

The real test for my location is to put a hand-held on my WX-1 antenna and see if it copes. I live very close to a large site for pagers (much to my ever lasting joy!). The Icom IC-W31E coped very well indeed, suffering hardly at all from the terrible signals these things put out.

I found the Icom IC-W31E a well made and easy to use radio. It's supplied with a good quality highly flexible helical antenna, wrist strap, a battery pack, belt clip and wall charger.

The instruction manual is well laid out and illustrated. I was up on air within a very short time and had soon come to grips with the more advanced features. There are a couple examples of 'Japanese English' but none that cause any problems.

The Icom IC-W31E rejects interference well but retains a good receive sensitivity on both bands and I like it. It's not cluttered with controls or unnecessary features, just a good, solid, amateur radio hand-held.

I'm certain that it will bring years of enjoyment to those who decide to be the proud owners of one. The IC-W31E is available from any Icom approved dealer for £469. My thanks go to Icom (UK) Ltd., Sea Street, Herne Bay, Kent CT6 8LD. Tel: (01227) 741741, FAX: (01227) 741742 for the loan of the review model.

PW

# Dual-Band Hand-Held

# Designer Software

Mike Rowe G8JVE, has reviewed an electronics simulation package for PW.

Can he design his next project on Electronic Workbench Version 4?

**W**hen Rob Mannion G3XFD, 'phoned me up and said "I've a little job for you, I want you to review some computer software", my immediate reaction was "Oh 'eck, is he out of his mind (off 'is trolleybus)? I'm no computer whizz-kid". (That's why we asked you Mike. *Editor*)

So, the very well presented Electronics Workbench package arrived. It had two splendid manuals, both very well written and easily understood, and two disks. Thumbing through the manuals to get a feel of the program before installing it - immediately gave me feeling that this was going to be a nice assignment after all.

The actual installation process was very straightforward, and following the on screen prompts it took about ten minutes. You select either ANSI (zigzag resistors, etc.) or DIN (box resistors) and type in the serial number. Later you type in a word from the text, as a security measure.

The main working screen of Electronics Workbench is divided into three main areas, the 'Work area', the 'Parts bin' and the 'Instrument shelf'. At the top right hand corner of the screen is an 'on/off' switch.

The Instrument shelf consists of seven instruments, a multimeter, an oscilloscope, a function generator, and a bode plotter (this is explained later, but it doesn't exist in real life!). There's a logic analyser, a binary word generator and logic converter.

Each of the instruments on the test bench can only be used once. However, in the parts bin there are voltmeters and ammeters which can be used in your circuit as many times as you wish.

## Multimeter Functions

The multimeter has six functions, measuring voltage and current (both a.c. & d.c.), resistance and decibels. Voltages may be measured in the range of 0.001 $\mu$  V to 999kV (all to three decimal places).

Current ranges are from 0.001 $\mu$ A to 999kA again to three decimal places. Ohmmeter ranges will measure circuit resistances from 0.001 $\Omega$  to 999M $\Omega$

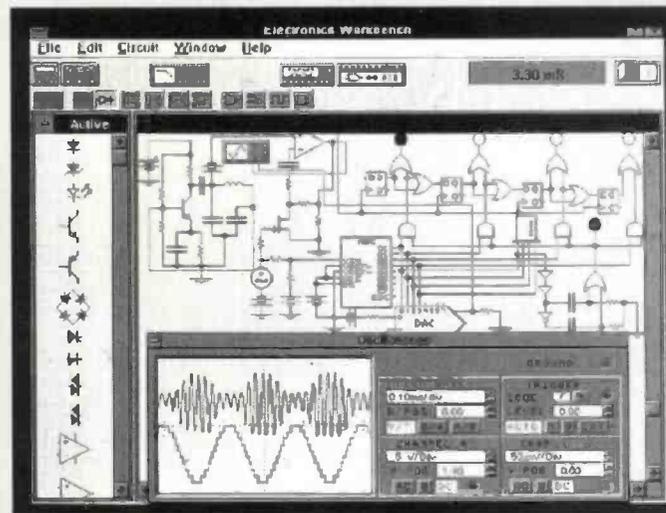
There's a truly superb simulated 'oscilloscope' in Electronics Workbench, dual-beam with independent trace positioning, timebase speed 0.01ns to

0.5s/div, input range 0.01mV to 5kV/div (a.c./d.c. coupling selectable). It has features such as automatic, A, B or external triggering with leading or trailing edge triggering.

The simulation even has variable trigger level! Oh for such an instrument in real life! The 'scope has two zoom levels within the program. The second level of which fills the screen and gives a magnificent display.

## Function Generator

The function generator is used to generate signals for the circuit under test. It has variable waveform signals between 0.001Hz to 999GHz with output levels of



1 $\mu$  V to 999kV. These ranges are all easily set using the mouse and the 'selection box' on the 'instrument panel'.

## Bode Plotter

The Bode plotter (think of it as a cross between a spectrum analyser and oscilloscope) is not a 'real' instrument, it only exists within a computer simulation. It is however an extremely useful piece of equipment, invaluable in testing simulations of a.c. circuits, and really comes into its own on filters.

Within the program the Bode generator will diagnose a circuit giving the response curve from 0.001Hz to 10GHz. It can draw the response (either logarithmic or linear) curve in either amplitude or phase over the frequency band selected.

## Logical Side

Let's now have a look at the logical side of the simulator and start with the Word Generator. In digital terms 16x8bit words may be generated and can be triggered internally or externally triggered on either the rising or falling edge.

The words are easily written using a mouse and can be stepped, cycled or applied in a single burst of sixteen words. The speed of the cycling or burst may be varied in Hz, kHz or MHz depending upon the setting applied.

A Logic Analyser will display up to eight channels with all the normal controls on the 'front panel'. This is a very useful function gives the

hexadecimal value of the currently displayed word.

An inbuilt Logic Converter is a very useful tool for people like myself who are not 'too hot' on logic, it enables you to specify the output that you require given a set of up to eight input conditions. In practice it simplifies the Boolean algebra and will draw for you the gate sequence required.

At this point, I would also

recommend that everyone who uses Electronics Workbench runs the tutorial files. By carrying out the simple but informative tests, you can familiarise yourself with the program. All of which may be analysed. (It's interesting to monitor the waveforms and voltages around the circuit before getting a printout of the screen).

## Spares Bin

In the spares bin the operator has a good supply of components. There's a wide choice of passive components such as resistors, capacitors and inductors in both fixed and variable forms.

Resistors are available from 0.001 $\Omega$  to 999M $\Omega$ , and inductors from  $\mu$ H to Henrys, capacitors from pF to Farads. All values are editable.

There's a selection of power sources for your circuit, including a 'Battery' where you nominate your terminal voltage ( $\mu\text{V}$  to  $\text{kV}$ ). A similar range is available from an a.c. source. Both sources can be constant current sources.

Analogue active components are well catered for, there are diodes, opamps, i.c.s, transistors and f.e.t.s (junction and m.o.s. types) of both polarities. Unfortunately, at the moment there is no dual gate f.e.t.s such as the 3SK88 in the system.

For the digital designer, there's a choice of logic gates. There's also a selection of inverters, flip-flops, monostables, DACs, ADCs, etc. There's also a comprehensive range of the 74xxx series of ICs (TTL or HCMOS).

It's a pity that the 4000 range of i.c.s was limited to only the 4066 quad analogue switch. But it's possible to cross reference types (7400 = 4011) and use the HC version instead. There are however, no Schmitt trigger i.c.s in the library, although they can be simulated with other components.

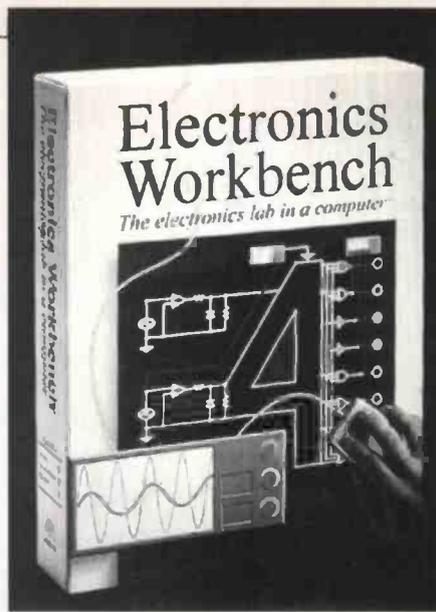
The program provides a range of control devices. These range from a simple on/off switch (keyboard controlled) through a time delayed switch, simple relays to a more comprehensive voltage or current operated switches.

### Building A Circuit

So let's get going on 'building' a circuit. And to start (the use of a mouse is mandatory with Electronics Workbench) you simply drag the component you want from the 'Parts bin' and place it on the workbench.

When you're satisfied with the component's position, you can edit its value. Then you simply drag a wire from the end of one components to the end of the one that you wish to connect to. Electronics Workbench will automatically route the wire for you.

To make a connection to an existing wire, simply route to that wire until a small circle appears and let go of the mouse button, a connection is automatically made and a small black dot



appears. The auto routing of the 'wire' can take a somewhat roundabout way, but don't worry all will be well.

Test instruments are connected in a similar fashion, you just drag a wire from the instrument to the point of test. The colour of the wiring may be changed to avoid confusion, and this colour is related to the traces on the oscilloscope and logic analyser.

I think it's a shame there's no crystal in the parts bin. Although one can be simulated, the mathematics involved are horrendous. Another failing appears to be the inability to simulate mutually coupled items like an i.f. transformer or an interstage r.f. transformer.

### My Trials

Now to my trials. In trying out some simple circuits, I found that if you do something really stupid, Electronics Workbench checks and warns you if something is amiss. For example, if you put too much voltage on a bulb - it 'blows'!

However, if all is well, there is a timer window to the left of the on/off switch which shows the state of the circuit in real time.

Using the facilities of Electronic workbench I designed a simple receiver. The project was a direct conversion data

receiver with mark and space filters to improve selectivity. I was able to plot the response of both the r.f. input low pass filter and the mark and space audio filters.

When designing with inductors, it has to be remembered that the components are ideal inductors, with no resistance (this must be added). The result of omitting these resistances will give you some breathtaking but unobtainable results!

To provide a test on the logic front, I 'built' a keying circuit based upon several designs I have seen. On completion I found it was very easy to simulate the keying action and demonstrate the output.

You can also design your own 'Black Box' (rather like an i.c. where you don't really want to know what's inside) and store this for later use as a sub-circuit. Examples of this may be found in the sample circuits on the disk.

Despite its minor shortcomings, I found Electronics Workbench version 4 to be a very useful tool to have around in my workshop. I must admit, that when the time comes to 'Uninstall' the program and return it, I will miss it when doing designs for *PW*.

From an educational point of view, I have demonstrated some of its capabilities to a young Novice friend of mine. And I'm sure that he found it much easier to understand the operation of a circuit when watching it happen in real time on the screen.

I did have occasion to telephone the UK help line and found them very helpful. Any questions they could not answer, they contacted Canada and telephoned me back with the reply. **PW**

Electronics Workbench version-4 costs £199 + P&P + VAT, and is available from Robinson Marshall (Europe) PLC, Nadella Building, Progress Close, Leofric Business Park, Coventry CV3 2TF. Tel: (01203) 233216 FAX: (01203) 233210. E-mail: rme@cityscape.co.uk

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# It's A Classic...



## The RCA AR88D General Purpose Communications Receiver

**W**here to begin? That, as a famous

bard once wrote, is the question! What can be said about the AR88D that truly conveys its standing in the field of communication receivers? This set, known to almost everyone who knows what a valve is, has been around since the early 1940s.

Used by the military and then by commercial users, amateurs and short wave enthusiasts the world over, the RCA AR88D receiver and the AR88LF version are a joy to operate. They both have large smooth tuning controls, variable selectivity, large, easy to operate knobs and a wonderful tone in audio output.

The AR88D set covers 535kHz to 32MHz in six bands and produces 2.5W of audio into 2.5 or 600Ω. It has a sensitivity down to 0.5μV (for 0.5W o/p) and a five position variable selectivity employing a crystal filter for the sharpest response.

The set operates on 100 to 260V a.c., external batteries or via an external vibrator power supply, the MI-8319. The set employs 14 valves in two r.f. stages, a mixer, three i.f. stages, local oscillator (l.o.) and b.f.o., noise limiter and audio output, rectifier and stabiliser.

The AR88D is large and this fact cannot be overlooked. At 19in wide by 11in high by 19in deep, and weighing in at 100lbs, this is a real piece of communication hardware, but you certainly get your money's worth.

### Antenna Input

The antenna input of the AR88D is designed to match a 200Ω transmission line on all but the lowest frequency band. A three terminal connector on the rear wall allows either balanced or end-fed wire to be used.

If an end-fed antenna is used, then a link from the ground to the centre terminal is required. A front panel mounted antenna trimmer is provided to peak the r.f. input tuned circuit.

Two stages of tuned r.f. amplification feed the mixer along with the output of the l.o., this running at 455kHz higher than the r.f. frequency. The l.o. is fed from the regulator valve h.t., which provides a stabilised supply under varying line variations.

The i.f. amplifiers contain 12 tuned circuits in the signal path along with a crystal, used to obtain the sharpest selectivity for c.w. reception. The third i.f. amplifier stage is not connected to the a.g.c. line to permit the b.f.o. injection to be coupled in and give a better s.s.b. reception.

Automatic gain control is obtained from a 6H6 valve, a variable delay gain dependent upon the r.f. gain control is provided for. The b.f.o. output voltage is just lower than the a.g.c. diode bias voltage so that it does not

desense the receiver on s.s.b./c.w.

A variable noise limiter allows high, pulse type ignition noise to be greatly reduced. The noise

limiter is switchable along with manual or a.g.c. controlled gain.

The audio output has provision for high impedance (20kΩ) headphones, 2.5Ω speaker and 600Ω line or speaker. The headphone jack on the front panel is special in that, if the jack is inserted to the first position then the 'phones are in parallel with the 2.5Ω winding and both speaker and phones work.

With the jack pushed fully home into position, the 'phones are connected to the phones winding and the 2.5Ω is cut off from the rear speaker terminals. If there is no speaker connected to the 2.5 or 600Ω tap then the phones should always be used in the second position. This is because a load resistor is shunted across the 2.5 tap to provide the correct loading.

Space on the front panel was provided so as to add a tuning meter at a later date. It's usual to find this added by now although the correct meter has not always been installed. The meter is wired in the cathode circuit of the first i.f. amplifier and should be a 5mA type with zero on the right.

### Mechanical Construction

The AR88D is usable either as a table-top set with its accompanying case or as a 19in

*Even though the RCA AR88D receiver has been around since the early 1940s, Ben Knock G4BXD says the set is a joy to operate, despite being large and heavy.*

### Technical Summary

	AR88D	AR88LF
Band 1	535 to 1600kHz	73 to 205kHz
Band 2	1570 to 4550kHz	195 to 550kHz
Band 3	4450 to 12150kHz	1480 to 4400kHz
Band 4	11900 to 16600kHz	4250 to 12150kHz
Band 5	16100 to 22700kHz	11900 to 19500kHz
Band 6	22000 to 32000kHz	19000 to 30500kHz
Intermediate Freq:	455kHz	735kHz

### Valve line-up

r.f. amp & i.f. amp	5	6SG7
1st mixer	1	6SA7
l. osc.	1	6J5
2nd mixer	1	6H6
noise limiter	1	6H6
a.f. amp	1	6SJ7
power amp version)	1	6K6GT (6V6 l.f.)
b.f.o.	1	6J5
rectifier	1	5Y3GT
Voltage regulator	1	VR150

rack mounted receiver, the front panel having standard mounting holes provided. The receiver was designed to be very rugged so as to stand up to the severe conditions imposed by military life.

All the components are secured by nuts and bolts rather than rivets to permit easy replacement. The tuning capacitor is rigidly mounted to the tuning unit yet flexible to the main chassis, this prevents any chassis distortion from having any appreciable effect on the oscillator stability.

### Audio Quality

Using the AR88 is a joy in itself. The slow and easy tuning and the audio quality make this one of the best receivers I have ever played with to tune around the short wave bands.

The manual recommends a random wire of around 25 to 50 feet. But even with a short whip antenna on the back of the set, signals can be heard from around the world.

Using the main 130ft end-fed wire available in my shack the set did not overload at all. It coped extremely well on all frequencies.

The mechanical rigidity of the set is most welcome. There is none of that warbling whilst listening to s.s.b. stations that is caused by the oscillator drifting if you breathe on the front plate.

The large black knobs are easy to grip, again no fiddling with tiny little plastic things! The variable selectivity, wide open for a rich a.m. output, very narrow for c.w. reception, is most impressive. And the large central vernier with its logging scale allows speedy re-tuning to any previously noted

frequency.

There are drawbacks to the AR88D of course. It's large, heavy, and it is valved. I recently heard one amateur stating that valves are 'no good' as they start deteriorating right from day one.

This is true, but then it's true of all components, they all start ageing from the second they are first used. You simply have to ask yourself 'how many modern plastic-cased, c.p.u.-controlled wonders, will still be around and working in 50 years time?'

The AR88D, and its LF brother, are a superb example of receiver design, both in

the electronics, circuitry and the ergonomic appearance of the front panel layout. It's clear, easy to understand, easy to operate and the set produces superb results in use. Having seen the prime condition of many examples of this set it is quite conceivable that it will still be around in another 50 years time.

There were in fact the three versions. The AR88, the AR88D and the AR88LF. In RAF service they became the R1556, the R1556A and the R1556B respectively.

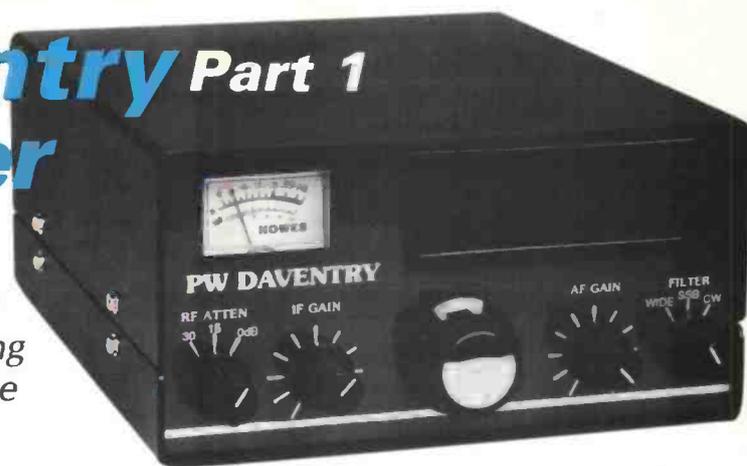
PW



.. ARE YOU THE CHAP WHO ADVERTISED THE AR88 IN THE PRACTICAL WIRELESS BARGAIN BASEMENT?..

# The PW Daventry Part 1 7MHz Receiver

A good receiver is a must for use on 7MHz. So, PW commissioned well known designer Dave Howes G4KQH to design an interesting superhet to take the 'fear out of forty', and he came up with the 'Daventry'.



**T**he 7MHz band is a band that needs a decent receiver for operation in Europe. With far too many radios you simply get lots of noise and apparently very little in the way of clear signals, especially at night.

The Daventry receiver project sets out to provide a good level of performance that will transform the 7MHz band. It turns into a happy DX hunting ground for any reader who finds their current receiver provides little more than 'mush' on this band.

The 7MHz or '40 metres' is a great band with lots of DX, but only those with superior receivers know this! So, if the band seems nothing but grossly overcrowded and noisy on your present receiver, then it's time to get the soldering iron out and build the PW Daventry!

## Extensive Filtering

The PW Daventry is a single up-conversion superhet, l.s.b. and c.w. receiver. The receiver employs extensive radio frequency (r.f.) filtering.

The design incorporates a good quality double balanced mixer and crystal intermediate frequency (i.f.) filter. It also uses a low noise discreet MOSFET i.f. amplifier strip.

An active audio frequency (a.f.) filter is fitted and there's provision for additional a.f. filtering within the automatic gain control (a.g.c.) loop. The prototype also has the benefit of digital frequency read-out using a commercial kit design (Howes DFD4).

My design objective was to try and keep all spurious responses over 90dB down as far as practical, without incurring too much expense. This is a considerably higher standard of technical performance than

offered by many general coverage receivers on the amateur market.

## Circuit Outline

So, let's now look at the circuit outline starting from the r.f. input. The signals from the antenna socket are taken to the r.f. attenuator switch where 15 or 30dB resistive attenuators can be switched into line.

The attenuators can be used to increase the basic dynamic range of signals handled (approx. 90dB spurious free range) up to 120dB. This should cope with almost anything, no matter how big your antenna! The signals then pass on to the main printed circuit board (p.c.b.).

The 7MHz band signals are separated from the rest of the r.f. spectrum by a band-pass filter. This filter's bandwidth is only just greater than the width of the 7MHz band.

So, the level of r.f. filtering used in this design is much higher than that encountered in most modern general coverage receivers (which have relatively wide open front ends). This is one of the circuit techniques that helps this receiver outperform many general coverage sets.

The r.f. filter also provides an impedance transformation. This helps match the 50Ω antenna input to the higher input impedance of the SL6440 double balanced mixer integrated circuit (IC1).

## Balanced Mixer

Mixing on the Daventry is carried out by the SL6440 double balanced mixer. It provides much better strong signal handling than most types of mixer i.c. and also needs less local oscillator (l.o.) drive than diode type double balanced mixers.

The SL6440 is a good choice for this

**The PW Daventry 7MHz receiver prototype, designed and built by Dave Howes G4KQH. (The digital frequency display unit is an optional extra).**

application where I was looking for good performance. I was also trying to keep things reasonably simple to build, and not too costly either!

The 7MHz input signal is mixed with the v.f.o. signal of 17.7MHz to give the i.f. of nominally 10.7MHz. It's at this frequency that most of the 'close in' selectivity is obtained by use of a crystal filter.

Quite a wide range of i.f. filters are available for the 10.7MHz i.f. frequency. So, you do not have to use the same device as the prototype receiver.

The filter I used in the prototype is an s.s.b. filter with a nominal bandwidth of 2.4kHz at the -6dB points. A c.w. bandwidth filter could be installed as an alternative, if you are only interested in this mode. However, in the prototype receiver I have envisaged using an accessory audio filter kit (Howes CSL4) to give a narrow c.w. bandwidth.

## Intermediate Frequency Amplifiers

After the i.f. crystal filter, the signal is passed on to the i.f. amplifiers. These stages have been designed to be much less susceptible to pick-up of stray signals that is usually the case.

Many superhet receivers are almost impossible to test and fault find with the p.c.b. exposed on the workbench. This is due to direct pick-up of signals by their i.f. stages.

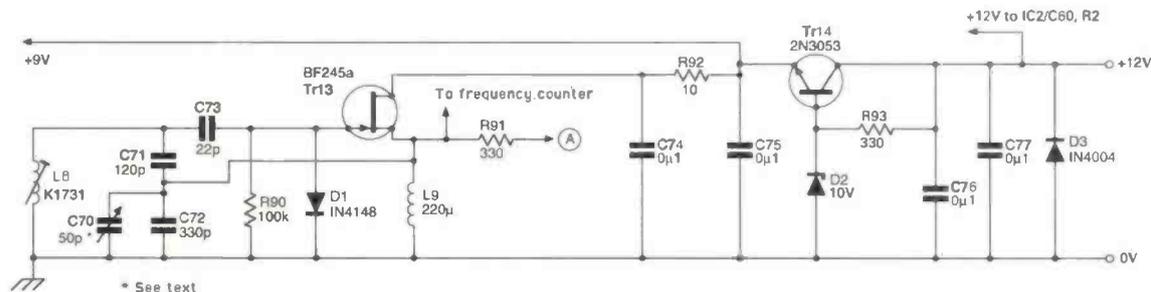


Fig. 2: The v.f.o. and voltage regulator stages (see text).

**Fig. 1: The PW Daventry r.f. and i.f. stages (see text). Fig. 1a (inset) shows the r.f. input attenuation circuit which G4KQH explains in the text. In switch position 3, the feed is 'straight through', in position 2 it's -15dB, and in position 1 attenuation is -30dB.**

The pick-up is not a problem for professional engineers who have r.f. screened rooms. But it can cause a lot of problems for the amateur constructor who does not wish to fully line the walls, floor and ceiling of their home with sheet metal!

The avoidance of any tuned i.f. stages helps with this low level of i.f. pick-up. It also helps by avoiding the associated alignment of any i.f. coils.

The penalty is that more stages are needed for a given amount of i.f. gain, but the cost of the extra transistors is largely offset by the saving in tuned circuits. I think the advantages of this approach certainly helps to make alignment and testing much easier for the home constructor.

The gain of four of the i.f. stages is controlled automatically by a.g.c. The a.g.c. voltage can also be varied manually by the front panel mounted IF Gain control.

### Product Detector

The i.f. signal is converted to audio by the product detector stage (Tr7). This mixes the incoming signal with one from the 10.7MHz crystal controlled beat frequency oscillator (b.f.o.), Tr6.

Lower sideband reception is needed for 7MHz. But, as the mixing process in this receiver inverts the signal frequencies, the b.f.o. needs to be set for upper sideband (u.s.b.).

A small series inductor (L6) is used to lower the resonant frequency of a standard 10.7MHz crystal (XL2), to avoid the expense of a custom made item. This inductor can be replaced by a wire link if you need the other sideband for any reason.

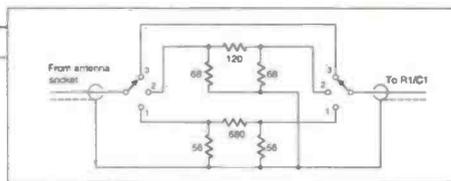
The resultant audio signal from the product detector is then filtered by an active audio frequency (a.f.) filter stage. This may strike an amateur as being slightly unusual as signal selectivity has already been provided by a crystal filter at the front-end of the i.f. system.

### Professional Grade

However, in professional grade communications receivers, it's common practice to have an i.f. crystal filter at both ends of the i.f. system. This is not seen in amateur equipment due to the cost implications.

But in the interests of performance, I have taken a small step in the professional direction. I've done this by providing filtering immediately after the product detector (rather than just before as in professional designs).

My approach enables much cheaper a.f. filtering to be used, rather than expensive i.f. crystal filters. But it does give some of the benefits that a second i.f. filter bestows (removal of wide-band i.f. noise and extra



### PW Daventry Prototype Performance Table

Supply Voltage: 10 to 15V d.c.c. (tests at 13.5V d.c.c.).  
Sensitivity: -107dBm (wide filter) for 12dB S+N/N:  
Noise Floor (MDS): -119dBm (Wide), -120dBm (s.s.b.),  
-126dBm (c.w.).

Intermediate frequency Rejection: 107dB.  
Spurious responses 1 to 30MHz, outside  $\pm 100$ kHz: Better than -90dB.  
Blocking level: (for -3dB desensing at 50kHz spacing): -10dBm.

Dynamic range: (MDS to Blocking) 109dB.  
Dynamic Range (spurious free): 90dB.

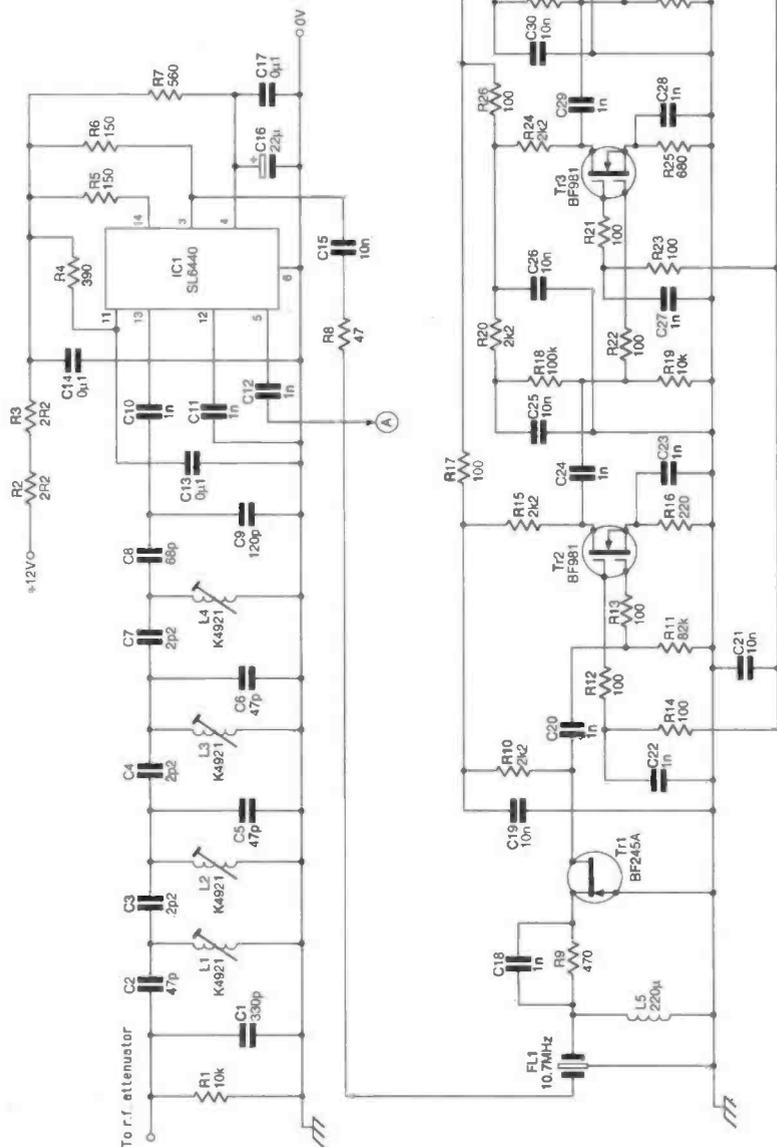
Automatic gain control range: approx. 110dB

Third Order I/P Intercept: +12dBm.

Audio frequency distortion, (S9 signal, 100mW Output): < than 1%.

Ultimate S/N Ratio: Greater than 50dB.

Switch on drift: (10 sec to 10 mins): less than 400Hz



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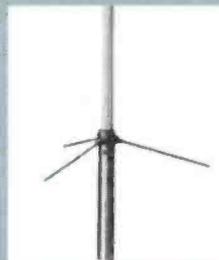


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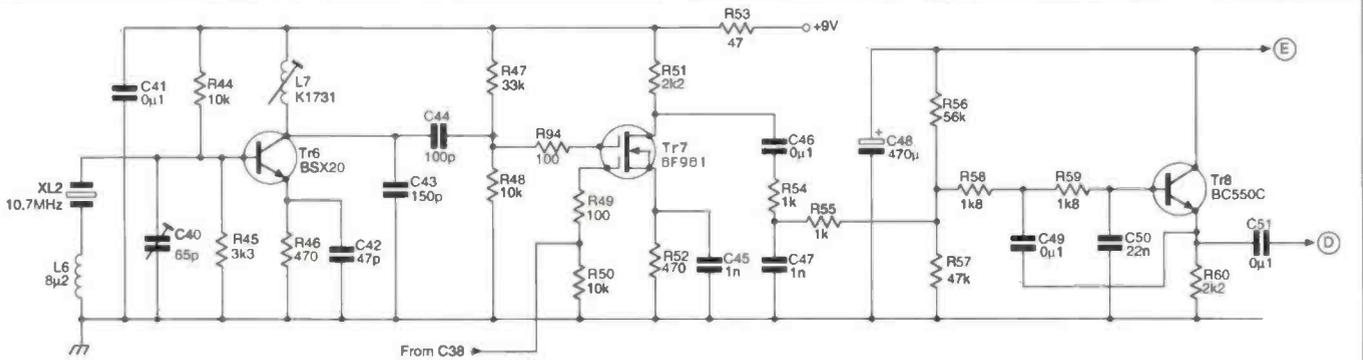


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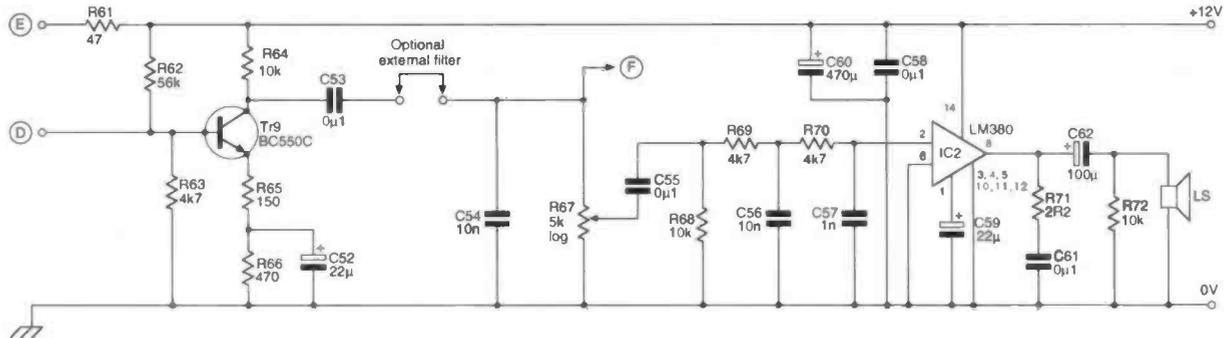
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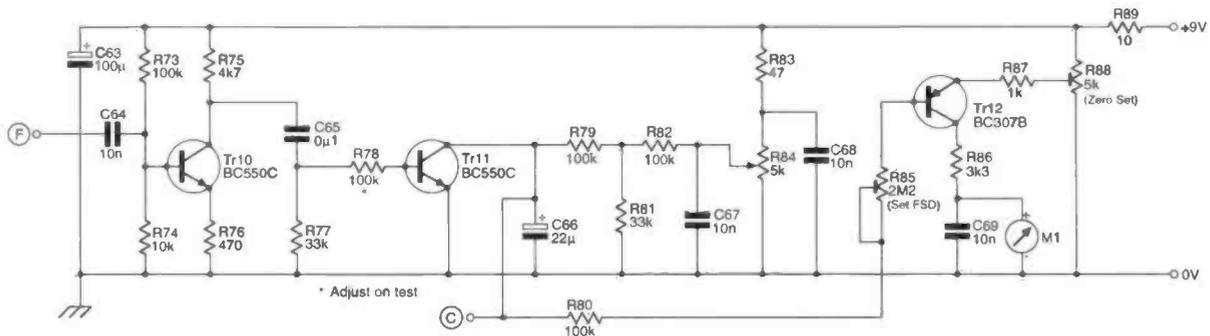
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**Fig. 3: The product detector b.f.o. and audio frequency low pass filter stages (see text).**



**Fig. 4: The Daventry audio stages.**



**Fig. 5: The a.g.c. and S-meter driver circuitry (see text).**

skirt selectivity). Let's face it, 7MHz operators need the best performance that can be reasonably justified in a receiver!

### Extra Filtering

After the 'on board' a.f. filtering, the signal is amplified further and fed to a terminal for connection of an optional outboard a.f. filter unit. It's here that you can connect a c.w. filter or any other additional selectivity that you fancy to enhance the performance a little more.

The outboard filter should have a nominal gain of around unity, with some adjustment to match the signal levels between bandwidth settings. For understandable reasons, I've used a Howes CSL4 dual bandwidth filter kit in the prototype receiver. On this unit an additional 4.7kΩ resistor is fitted to the s.s.b. output to match the audio level to the Wide (no a.f. filter) switch setting.

The c.w. filter audio level is adjusted by the preset resistor on the filter p.c.b. After the additional filtering, the signal is fed on to both the volume control and the a.g.c. amplifier.

The output of the volume control is fed to the LM380 a.f. output i.c. This provides plenty of drive for an 8Ω loudspeaker or headphones.

### Automatic Gain Control

The automatic gain control circuit used in the PW Daventry is quite simple. I set myself a strict design limit of just three transistors for a.g.c. and S-meter drive!

It's all too easy, in the search for the perfect a.g.c. response and S-meter tracking to complicate matters. You can end up with more devices devoted to these functions than the rest of the receiver circuits put together!

The use of audio derived a.g.c. enables the audio filtering to be within the a.g.c. loop. This is an important advantage over i.f. derived a.g.c. for this application.

The a.g.c. range is over 100dB and the S-meter indication seems to work quite nicely too, with the meter capable of reading S9 for the standard input signal level of 50μV. This is more than can be said for many commercial designs!

The S-meter I used is a 400μA type. But the use of adjustable preset resistors to adjust

the zero setting and meter drive currents enables meters with slightly different current ratings to be used, if you wish.

In Part 2 of the Daventry project I'll be describing the constructional and the assembly stages. In the meantime, perhaps it's time you got that antenna ready...to join in the action on 7MHz!

**CONTINUED NEXT MONTH**

## BUILDING THE DAVENTRY RECEIVER

All the necessary p.c.b.s for the Daventry will be available from the PW PCB Service.

**Dave Howes G4KQH, of C. M. Howes Communications, Eydon, Daventry, Northamptonshire NN11 3PT. Tel: (01327)**

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# DESIGN Dilemmas

Regular PW author Ian Poole G3YWX, takes time off from his usual 'Specifications' column to describe some of the practical design considerations (and some of the dilemmas!) behind modern communications receivers.

**T**he idea of the superhet radio is well known, and most radio amateurs and listeners have a very good idea of the basic principles.

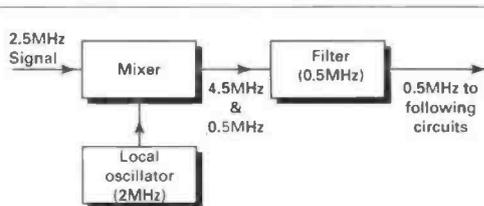
However, to make a set which gives a good performance is not always as easy as it might seem. There are a lot of variables to consider if the best performance is to be achieved.

It is not always the most sensitive receiver which can give the best reception. In many cases the strong signal handling and other aspects are just as, if not more important.

## Basic Idea

The basic idea behind the superhet radio is that it's possible to change the frequency of a signal by mixing it with another. It's found that if two signals are passed into a non-linear circuit called a mixer, the level of the first signal appearing at the output will be dependent upon the level of the other.

Analysing the circuit, the two signals can be seen to be multiplied together. In a normal linear circuit the output signal is



**Fig. 1:** Block diagram showing the basic idea behind a superhet receiver with mixing arrangements illustrated.

only proportional to the level of the input signal and the gain or loss of the circuit.

When two signals are mixed or multiplied together in this way new signals appear at the output. Apart from the two input signals, new ones appear at frequencies equal to the sum of the two original ones, and at the difference between them.

For example, two signals at 1

and 0.75MHz will create new signals at  $1 - 0.75$ , i.e. 0.25MHz and also at  $1.0 + 0.75$ , i.e. 1.75MHz. In the superhet radio this principle is used to change the frequency of the required incoming signal to a fixed intermediate frequency.

In the diagram, Fig. 1, you'll see that a signal on 2.5MHz is mixed with a local oscillator (l.o.) signal at 2MHz generated in the radio. The resultant signals generated are at 0.5 and 4.5MHz.

A typical intermediate frequency filter might be at a frequency around 0.5MHz. This would mean that the signal at 0.5MHz would pass through the filter and be amplified.

## Different Frequencies

All seems fine, until you discover that signals on two different frequencies can mix with the l.o. to give an output at 0.5MHz. I've already mentioned that a signal at 2.5MHz mixed with the local oscillator gives a signal at 0.5MHz.

However, a signal at 1.5MHz also does the same! This is a problem because it means that two signals at totally different frequencies can be heard together. Fortunately, the difficulty can be overcome by having some tuning before the mixer as shown in Fig. 2a.

The tuned circuit at the input in Fig. 2a does not have to be as selective as any tuning in the intermediate frequency amplifier which needs to separate signals adjacent channels from one another. It only needs to accept the wanted signal entering the mixer and reject the unwanted one

called the image. The general idea is shown in Fig. 2b. In fact if this tuning is made

too critical it can sometimes be difficult to keep it on exactly the right frequency.

## Different Stages

Any receiver will be made up of a number of different stages. Each has its own function, and should be designed to give the optimum performance.

However, receiver designers must look at the set as a whole to see how all the different aspects of the design inter-relate. Only when this has been done can a satisfactory design be implemented. But it's first necessary to look at the individual sections to see their own requirements.

## Prime Considerations

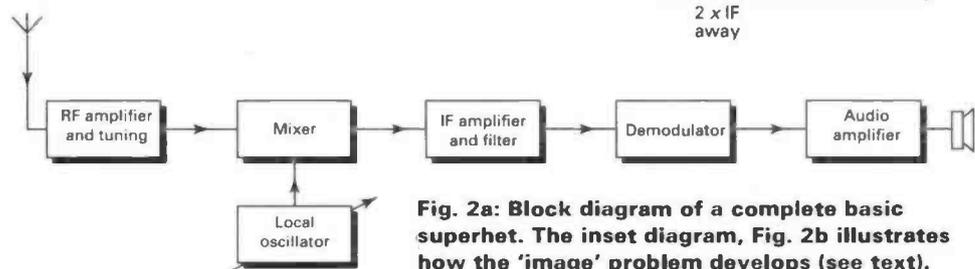
While sensitivity is not the only important factor of the performance of a radio, it's still one of the prime considerations. A 'deaf' receiver can be very annoying!

The degree of amplification at the various stages in a set determines many of its other parameters. It's also found that an h.f. receiver does not need to be as sensitive as one used for v.h.f. or u.h.f. reception.

The reason for the lower sensitivity is that on frequencies below about 30MHz, the amount of noise picked up by the antenna will usually be much greater than that generated by the set itself. As a result, an h.f. receiver does not need to have a noise figure better than about 10 or 15dB.

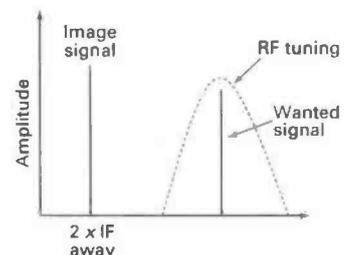
On the other hand, v.h.f. receivers might be around 3dB or better, with preamplifiers on their own often quoted as having figures of 1dB and less.

To obtain the best noise figure it's necessary to have as much gain at the early stages in the receiver as possible. However, this can lead to its own problems.

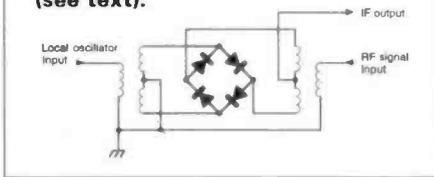


**Fig. 2a:** Block diagram of a complete basic superhet. The inset diagram, Fig. 2b illustrates how the 'image' problem develops (see text).

**Fig. 2b.**



**Fig. 3: Diode ring mixer circuit (see text).**



Too much gain can result in overloading of the later stages. When this happens spurious signals and noise can be generated and sometimes this can result in a reduction in real sensitivity when the receiver is used under real conditions.

In some h.f. receivers where sensitivity

levels of i.o. drive. This is to ensure that they can withstand high signal levels before they overload. And in some receivers the levels may be as high as 100mW.

Active mixers can be used to good effect. They also have the advantage over the diode ring mixers that they usually give some gain.

A number of high performance i.c.s exist. One of these is the i.c. 1496, with a typical circuit shown in Fig. 4. This has been around for many years but still gives a good account of itself. In fact this particular i.c. is used in my Ten-Tec Argosy which I find gives very good performance.

### Intermediate Frequency

Choice of the intermediate frequency (i.f.) depends upon a number of factors. It's a careful balance between some opposing requirements. For example, a low frequency i.f. will make it easier to obtain good filters.

But, on the other hand a high frequency will increase the

difference between the wanted signal and the image signals. This will improve the image rejection, a factor which is very important with today's crowded band conditions.

Unfortunately it is not easy to come to a compromise over the factors mentioned. Accordingly many sets have two or more i.f. stages.

The first i.f. stage will be at a high frequency to give the good image rejection. The first i.f. signal will then be converted

down in frequency where it's filtered.

Sometimes in h.f. sets, the first conversion may even 'up-convert' the signal to a

higher frequency. Around 40MHz is a popular area.

A 'first conversion' of 40MHz means that the image response will be 80MHz away from the wanted signal. This enables very high degrees of image rejection to be achieved without the need for excessive filtering.

Despite the high 'first conversion' it's still advisable to retain some filtering to reduce the occurrence of intermodulation products in the front end.

### Filter Performance

Filter performance has improved drastically over the past few years. Modern filters are much smaller than they used to be and it's possible to have them made for higher frequencies.

Whereas 20 years ago the last i.f. had to

be at 455kHz or possibly 1.6MHz, now many h.f. receivers use an i.f. of 9MHz. Modern v.h.f./u.h.f. receivers have i.f.s of 10.7MHz without the need for a further conversion if high

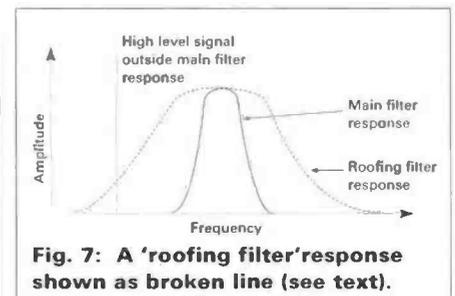
grade filtering is required.

### Discrete Crystals

Nowadays crystal filters are often made from discrete crystals in configurations like the half lattice filter shown in Fig. 5. Alternatively, monolithic crystal filters are becoming more widespread.

Monolithic filters use the same material and basic principles as normal crystals, but contain a filter on a single crystal element. This is done by placing two sets of electrodes at opposite sides of the crystal as shown in Fig. 6.

The monolithic filters generally give improved performance over filters made from discrete elements. However, they require specialised equipment for their manufacture, and are made by relatively few companies. Despite this they can be



**Fig. 7: A 'roofing filter' response shown as broken line (see text).**

manufactured for operation at quite high frequencies, making higher frequency i.f.s a practical reality.

### Ideal Location

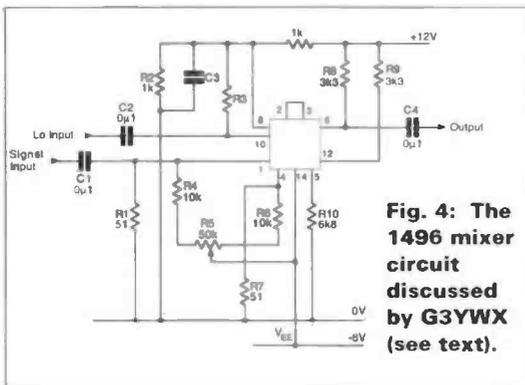
The ideal location for a filter would be immediately after the first mixer. In this way only signals on the required channel would be amplified though the receiver.

Unfortunately, there are a number of reasons why it's not normally possible to place the main filtering at the 'ideal' location.

The main reason is that the frequency of the first i.f. is usually quite high. Even with the advances in technology, high frequency filters are more expensive and may not be able to meet all the requirements placed on them.

A sharp filter will also have a significant loss. Placing it very early in the line-up will reduce the degrade the receiver's noise performance.

If the main filtering is placed much later in the receiver, this can cause it's own problems. It opens the early stages to the much greater possibility of large signals outside the final bandwidth causing overload in some of the stages, even with a



**Fig. 4: The 1496 mixer circuit discussed by G3YWX (see text).**

is not the prime consideration there may be very little r.f. gain. Sometimes the signal is fed virtually directly into the first mixer. By adopting this approach the mixer stands less chance of being overloaded.

For v.h.f. and u.h.f. receivers where sensitivity is of prime importance, very low noise amplifiers are employed. In view of the circuit limitations these are not switched between different bands. Instead they are normally only designed for one band.

### Mixer Crucial

The mixer is a crucial part of the receiver line up. Many receivers these days have two and sometimes three

conversions and as a result they have an equivalent number of mixers.

Having a high quality mixer is a key factor in reducing unwanted mixer products as low as possible. It also keeps other problems like cross modulation under control.

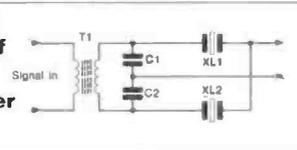
There are many different types of mixer which can be used. Many professional receivers use diode ring types. These are similar to that shown in Fig. 3.

Diode ring mixers give a very good performance over a wide band of frequencies, but they do not give any gain. Instead they have a loss of a few decibels called their 'conversion loss'.

Typically the conversion loss might be about 7dB. They can also be rather expensive, sometimes costing several tens of pounds.

Often, the mixers operate with very high

**Fig. 5: An example of a half lattice filter circuit.**



good a.g.c. system.

To overcome the problem, a filter called a 'roofing filter' is normally used. This is placed early on in the receiver line-up, often virtually straight after the first mixer.

A 'roofing filter' does not have the same specification as the main filter but it is able to give sufficient selectivity to reduce signals which are definitely off channel as shown in Fig. 7. Having a less stringent requirement than the main filter, it does not need as many stages and its loss will be significantly less.

### Automatic Gain Control

Unfortunately, the automatic gain control (a.g.c.) system does not often receive the full attention it deserves. A properly operational a.g.c. will improve the overall performance of the receiver when strong signals are about. It's not there just to keep the audio level at a constant level when the signals are changing.

In many receivers the a.g.c. only acts on a number of the stages fairly late on in the line-up. This means that early stages can be

needed. This would to adjust the gain of the later stages and ensure that the level of the signal being received did not overload any of the later stages in the traditional way. I've outlined a possible system in the diagram, Fig. 8. A more complicated a.g.c. system of this nature would have a few additional problems which I'll briefly mention.

Most of us use the 'S' meters on our sets, even though they are notoriously inaccurate. And in the case of the multi-loop a.g.c. system a little ingenuity would be needed to obtain a meaningful reading.

If, for example, the signal strength indication was generated from the second loop, the action of the first loop in reducing the front-end gain would affect it. Conversely the first loop takes account of signals outside the final filter bandwidth so this could not be used.

oscillator drifts then it's particularly annoying and results in having to retune the set to keep the wanted station on tune.

Before the 1960s, a free running variable frequency oscillator was generally used. However, as single sideband (single sideband, suppressed carrier, usually referred to as s.s.b.) operation grew in popularity the need for stability became very important.

Receivers with crystal controlled first conversions, having a v.f.o. for a second conversion, as shown in Fig. 9, became popular. This meant that the inherently stable crystal oscillator was used for the high frequency switched oscillator used for the first conversion. The variable frequency oscillator would remain unswitched and could be optimised for stability.

Nowadays, frequency synthesisers are generally used. They offer excellent

stability because they use a crystal oscillator as a reference to generate all the other frequencies.

Frequency synthesisers also have the advantage of being easy to programme digitally. This fits in well with today's microprocessor controlled circuitry, and offers a vast number of advantages in terms of flexibility of operation.

The main disadvantage of phase locked loop (p.l.l.)

synthesisers is that they can generate large amounts of phase noise. This is noise which spreads out either side of the signal, as shown in Fig. 10.

Phase noise can mix with 'off channel' signals to generate noise within the receiver pass-band, thereby reducing the sensitivity. To overcome this the synthesiser must be very carefully designed, not always accepting the cheapest approach. In fact the new direct digital synthesisers have a lot to offer in this area and they are being introduced in many of today's sets.

### Final Design

The final design of any receiver will be a carefully balanced compromise between a number of different requirements. However, care taken in the initial design will ensure that the best performance is obtained.

Best performance however, is not necessarily the best sensitivity (for example). It can be the optimum sensitivity under all conditions. This is a much harder requirement to meet!

PW

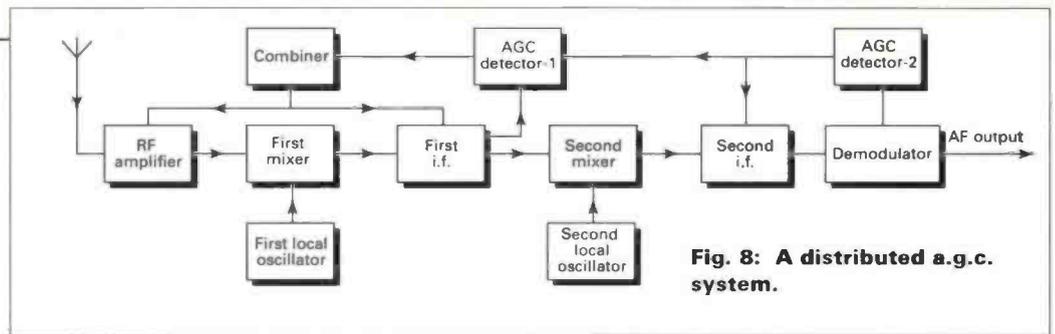


Fig. 8: A distributed a.g.c. system.

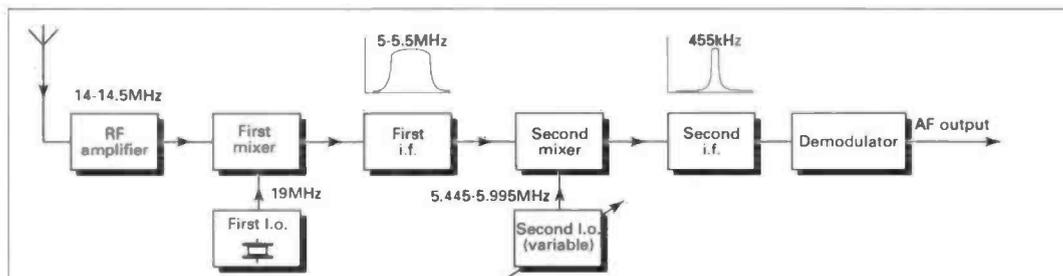


Fig. 9: Superhet receiver with crystal-controlled first conversion. The wider response of the first i.f. (illustrated by inset response curve above the stage) is necessary because of the second mixer/oscillator combination's need to 'tune' over the required passband (see text).

overloaded, especially if the signal falls outside the filter bandwidth.

With the enormous range in level of signals which are picked up by any receiver, even the early stages of the set can be overloaded. This means that some means of reducing the gain must be employed.

Often, manual r.f. gain controls are used. However, most people including myself tend to leave these controls at maximum unless the received signal is very strong.

Accordingly, the gain control should be reduced when the other signals on the band are strong, so that the set does not become overloaded. And in fact it may not be the wanted signal which causes the problem, but one which is outside the main filter bandwidth.

Instead of using a manual control, it would be much better to use an automatic gain control. If it could detect the levels of the signals at an early stage in the receiver, then the information could be used to control the gain of the early stages and prevent them becoming overloaded.

If automatic control was accomplished in the way described, a further 'loop' would be

The solution lies in using a combination of the two loops. The reading of the second loop would need to be taken, but it should be modified by the voltage on the first so that any reduction in gain it causes can be taken into account.

### Oscillator Performance

The local oscillator or oscillators' performance will govern many aspects of the receiver's operation. The main requirement is that it should be stable. If the

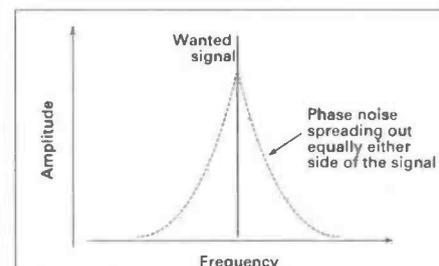


Fig. 10: Phase noise spreading out either side of the main signal of a receiver using a synthesiser (see text).

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With the current FT1000 in its fifth year, Yaesu Musen have decided to continue with the model number - FT-1000, but up date its best HF Transceiver to date, from the ground up.

- ◆ EDSP - Enhanced Digital Signal Processing. A new multifaceted filtering technology unmatched in the Amateur Radio Industry.
- ◆ Dual In-Band Receive with separate S Meters.
- ◆ Collins 455kHz 2.7kHz SSB mechanical filter - as standard! Collins CW filters as optional extras.
- ◆ Selected Cascaded Crystal & mechanical Filtering, Independent 2nd & 3rd IF filter selection.
- ◆ New High Resolution DDS Tuning (0.025Hz tuning steps!)
- ◆ Wide Receiver Dynamic Range, with separate Optimised FET RF Preamplifiers for High & Low Bands "Shuttle Jog" Enhanced Tuning System, CAT System capability with built in RS-232C Level converter.
- ◆ Transverter jack for VHF/UHF operation (Display indicates actual VHF or UHF Frequencies).
- ◆ Selectable antenna jacks. Separate RX only jack also included.
- ◆ Custom Feature Configuration via new Menu system.
- ◆ Quick Memory Bank system to recall important memory channels.
- ◆ Built in high speed Auto Antenna Tuner.
- ◆ Built in Contest memory keyer.

Yaesu's exciting new Enhanced Digital Signal Processing system provides four random noise reduction settings, selectable bandpass filtering with adjustable low and high cut responses, and transmitted audio enhancement with four voice response equalisation technique.

In addition, an automatic seeking EDSP notch filter will identify and eliminate interfering heterodynes and carriers should they appear in the passband. It's interesting to note the introduction of Collins mechanical filters in the new FT-1000MP. It's debut was actually at the Stafford Show in August and customers who visited the Yaesu stand commented how the Audio quality was in a different class, no doubt due to the DSP and more importantly the employment of Collins filtering. The price is in fact lower, (its true!), than the current out going FT-1000.

Retailing at only £2849 including a built in PSU and £2599 for the version without, that's a saving of over £1100 on the original. We will gladly take trade in's as deposit, (even the current FT-1000), and can offer the balance on our very advantageous finance terms. Martin Lynch is offering the FT-1000MP with FIVE YEAR WARRANTY as standard, once again proving customer peace of mind is our satisfaction!

### ICOM IC-775DSP NEW MODEL

Although the IC-775DSP has been around in production form for several months, with the introduction of the new TS870 and FT1000MP, Icom's new flagship really is the "Grand Daddy" of the trio. In size, it dwarfs both the Kenwood and Yaesu. In features it isn't lagging behind, either. DSP noise reduction is available on the IC-

775DSP along with 200 Watts of power output, (the other two only produce 100W), Auto notch for those annoying interfering carriers, two receivers with Independent tuning dials and a REAL "S" Meter - (I don't like flashing bar graphs!). It is our best selling flagship HF since the FT1000 was introduced back in 1990. We've supplied many to the U.K.'s top DX'ers and once you see and feel the overwhelming quality of construction, use the wealth of features the IC-775DSP has to offer, you too will find it difficult to pass this one by.

The new IC-775DSP still lists at £3699.00. At the price, it comes with FIVE YEARS WARRANTY, (Only from Martin Lynch), Includes an internal PSU, auto ATU and is ready to go. Finance packages are available, for a lot less than you think. What have you got to part exchange?



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Deposits from only £399.95.



### The "Next Generation"

The first of a new breed, this HF all mode transceiver is equipped with not one but two 24-Bit digital signal processors at the "IF" stage - an innovation that leads to such benefits as high efficiency digital filtering, powerful noise-and interference-reduction, equalisers and DSP detection.

### KENWOOD TS-870S NEW MODEL

Forget Naomi Campbell, (well try anyway), Yaesu Icom and Kenwood have just released their latest H.F. rigs and they will be displayed at this years LEICESTER SHOW. Stocks of that rather exclusive, (or should that read "elusive"?), Icom IC-706 will also be ready to purchase with the MARTIN LYNCH FIVE YEAR WARRANTY for those of you wishing to buy or order at the show. Its going to be a real winning Leicester this year - come along and pay a visit!

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### THE YAESU FT-900AT

Lynch Price  
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### THE KENWOOD TH-79E

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### THE ALINCO DX-70

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### THE ALINCO DJ-C5

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### THE YAESU FT-990



With all the new wave of DSP transceivers, don't forget YAESU had Digital bandwidth control on the FT-990 three years ago! 100 watts out, Auto ATU built-in, plus the option of AC (internal PSU), or DC, the FT990 is still our best selling HF Transceiver. No other has plug in boards for easy maintenance either!!  
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REMEMBER  
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# External Noise Vs Receiver Sensitivity

Mike van der Westhuizen ZS6UP looks at the external noise effect on the sensitivity figures of modern receivers. He also looks at the part played by the operator's own hearing abilities.

All listeners to the h.f. bands know that external noise can sometimes cause even strong signals to become unreadable. For this reason, many textbooks on h.f. receivers contain a sentence to the effect that, the sensitivity of h.f. receivers need not be very good.

In spite of what the textbooks say, the signal to noise ratio sensitivity of modern receivers is becoming better and better. You only need to look at advertisements and reviews. Many amateurs must have asked themselves the question: When really is the sensitivity good enough and at what value is there no point in improving it anymore?

I found a few articles on this subject but none really gave me the answer, until I read the article by Gerald Stancey G3MCK (±1).

where  
 $N_y$  = noisiness of the receiver  
 $N_i$  = noise at input of receiver (external noise)  
 $N_r$  = noise added by receiver  
 If the lowest possible external noise is only the thermal noise at room temperature in a certain bandwidth, we can take this as standard ( $N_s$ ). Then  $N_i = N_s$ . At this condition, the noisiness,  $N_y = NF_a$  (the well-known noise factor) or noise figure  $NFi$  if expressed in dB. The relationship between the two is:  $NFi = 10\log(NF_a)$ .  
 Thus we can see that

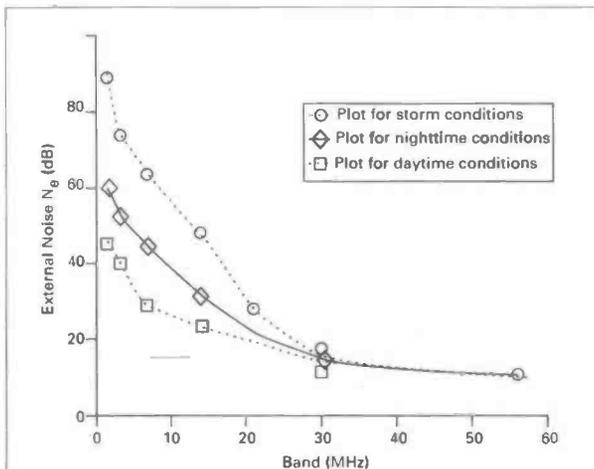


Fig. 1: This graph plots the external noise above a standard level for over the various bands.

$$NF_a = 1 + \frac{N_r}{N_s}$$

Now, say the noise input  $N_i$  is a factor  $N_e$  more than the standard  $N_s$ , then  
 $N_i = N_e N_s$  or  $N_i = N_e + N_s$  (when expressed in dB)  
 Then

$$N_y = 1 + \frac{NF_a - 1}{N_e}$$

We now have the noisiness,  $N_y$ , in terms of the Noise Factor,  $NF_a$ , and the external noise,  $N_e$ , above the noise standard,  $N_s$ .

### An Example

Let's have an example. Say a receiver has a  $NFi = 16\text{dB}$ , then  $NF_a = 40$ . If on 21MHz the external noise is 20dB above the standard, eg.  $N_e = 100$ , then

$$N_y = 1 + \frac{39}{100} = 1.39$$

So, if the minimum discernible signal (m.d.s.) is where  $S_o = N_o$  then  $S_i = N_y N_i = 1.39 N_i$  or,  $S_i$  must be 1.43dB higher than  $N_i$ . If  $S_o/N_o$  must be 10dB then  $S_i$  must be 14.3dB above  $N_i$ . Or if  $S_i/N_i = 10\text{dB}$ , then  $S_o$  is only 8.57dB above  $N_o$ .

### Calculations & Results

From the above theory we can now draw up a few tables and graphs to put the whole thing into perspective. In Table 1 the external h.f. spectrum noise data is

summarised. This data can be found in virtually every radio handbook.

The data in Table 1 is taken from the *Radio Communications Handbook*. In column 1 of the table are the different frequency bands. Column 2 is the different times of day conditions. Column 3 is the external noise  $N_i$  reaching the antenna in dBm (referred to one milliwatt).

Column 4 is the same data expressed in microvolts to give you a better feeling for the values. In modern transceivers S9 on the S-meter can represent anything between 20 to 50µV an the antenna.

Column 5 in the table is the external noise  $N_e$  (in dB) above the standard (-141dBm in this article, which is the thermal noise at room temperature in a 2100Hz bandwidth).

A rough plot of  $N_e$  against frequency is shown in Fig. 1. You can see the noise levels on the 1.8, 3.5 and 7MHz bands in stormy conditions really are quite high - as you all well know.

Now we come to Table 2 where column one contains different values of  $N_e$ . Column two has four different values of receiver sensitivity noise figure (NFi) in every  $N_e$  group. Column three has the same values in V.

Columns 4 and 5 are calculated values of  $S_i/N_i$  for m.d.s. ( $S_o = N_o$ ), using the relevant values of  $N_e$  and NFi (converted to  $NF_a$ ). In columns 1, 2 and 6 are the value of  $S_o/N_o$  (in dB) to give an input value of  $S_i/N_i = 10\text{dB}$  for the different  $N_e$  and NFi values.

If the above sounds complicated, it will be clearer after looking at Fig. 2, a plot of the figures in Table 2. The plot is column one against column six for the different values in column two. Putting the explanation in full: Fig. 2 is a plot of the external noise  $N_e$  against  $S_o/N_o$  (if  $S_i/N_i = 10$ ) for different values of receiver sensitivity NFi.

### Another Example

As an example: Say on 7MHz during daytime the figure for  $N_e = 30$  (from Fig. 1) and you have a receiver with a poor  $NFi = 34\text{dB}$  (1µV). You can see from Fig. 2 that you will get  $S_o/N_o = 4.4\text{dB}$  for an input of  $S_i/N_i = 10\text{dB}$ . It is from Fig. 2 that we will try to answer the question posed at the start of the article.

This article addresses the point directly and is actually a very good one. My article is an extension and expansion of Gerald's thoughts and an attempt to arrive at some sort of answer.

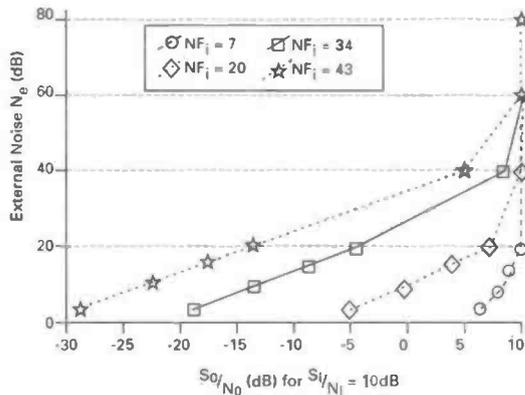
### No Theory

I'm not going through all the theory of noise, sensitivity, noise figure, noise factor, etc. This is given in all textbooks and well condensed in Gerald's article. I shall only give a few of his final formula here.

If the 'noisiness'  $N_y$ , of a receiver is defined as: the signal to noise ratio at the input ( $S_i/N_i$ ) divided by the signal to noise ratio at the output ( $S_o/N_o$ ) of a receiver, it can be shown that

$$N_y = 1 + \frac{N_r}{N_i}$$

**Fig. 2:** This graph shows the external noise above a standard against  $S_o/N_o$  (when  $S_i/N_i=10$ ) for differing values of receiver sensitivity (NFi).



**Table 1:** Showing external noise for various frequency bands. The right hand column ( $N_e$ ) is shown as dB above above the standard ( $N_s$ ) { $N_e=N_i-N_s$  or  $N_i(-141$ dB)}.

Band MHz	Condition	Noise		Noise above standard
		dBm	$\mu$ V	
1.8	Storm	-51	830	90
	Night Day	-81 20		60 45
3.5	Storm	-66	112	75
	Night Day	-88 8.9		53 40
7	Storm	-76	35	65
	Night Day	-96 3.5		45 30
14	Storm	-96	3.5	45
	Night Day	-108 0.89		33 25
21	Storm	-111	0.63	30
	Night Day	-116 0.35		25 20
28	Storm	-126	0.11	15
	Night Day	-126 0.11		15 15
56	Storm	-131	0.063	10
	Night Day	-131 0.063		10 10

**Some Conclusions**

To arrive at some conclusion we must move from radio science to human physiology, which differ from individual to individual. In physiology textbooks one reads that the smallest difference in sound (at say 1000Hz) that the human ear can detect is 1dB ( $\pm 3$ ).

The figures quoted seemed very low in value so, in the interests of science, I did a few rough experiments with two of my children. Using an amplified audio signal generator, and an a.c. digital voltmeter I let them hear pure tones through headphones. Sure enough, all the values were between 1 and 2dB except at very low sound levels where it rose to 3 or 4dB.

Returning to Fig. 2, if the perfect receiver gives  $S_o/N_o = 10$ dB for  $S_i/N_i = 10$ dB and, if one can detect a 1dB difference, then you should be able to detect a difference at  $S_o/N_o = 9$ dB and lower.

So, if we draw a vertical line at  $S_o/N_o = 9$ dB in Figure 2, then at all conditions left of this line we will be able to detect a deterioration in readability. Let's take a few examples.

(a) During daytime on 3.5MHz, the  $N_e =$

40dB (from Fig. 1). Entering  $N_e = 40$  in Fig. 2 we see that it cuts the vertical line where  $S_o/N_o = 9$ dB at  $N_{Fi} = 34$ dB (1 $\mu$ V). So, any better sensitivity won't help you at 3.5MHz.

(b) At 28MHz it can be seen from Fig. 1 that  $N_e$  is about 15dB. Entering  $N_e = 15$ dB in Fig. 2, we see that it cuts the  $S_o/N_o = 9$ dB line at a point between  $N_{Fi} = 20$  and  $N_{Fi} = 7$ . But I estimate the value, to be probably at  $N_{Fi} = 9$ dB. So, on 28MHz it is worthwhile to have a receiver or pre-amp with this lower noise figure.

(c) Let's take everybody's favourite band (well it's mine anyway) 14MHz. During day time  $N_e = 25$ dB, giving an  $N_{Fi}$  of approximately 18dB. During night time  $N_e = 33$ , which gives an  $N_{Fi}$  of approximately 24dB. During stormy conditions,  $N_e = 45$  giving a  $N_{Fi}$  of approximately 39dB. All of the above interpolated at the  $S_o/N_o = 9$ dB line.

(d) If you build small receivers at home, then design it for the  $N_{Fi}$  values in Table 3 for good readability, taken from daytime  $N_e$  values.

There is another question that can be asked. If you don't really need  $S_o/N_o = 10$  or 9dB to read a signal, what is the lowest value of  $S_o/N_o$  that is still readable. There are experienced c.w. operators can read a signal below the noise level. On s.s.b. mode if someone at the other end of the link is reading numbers slowly it can also be read just below the noise level ( $\pm 4$ ).

Say, for arguments sake, the lowest that can be read is  $S_o/N_o = 0$ dB, that is the m.d.s. level. Now we can determine the approximate least sensitivity which is needed on the different bands if  $S_i/N_i = 10$ dB. From Fig. 1, again get the daytime  $N_e$  values for the different bands, enter this at the left hand side of Fig.

2 and read the approximate values of  $N_{Fi}$  at the  $S_o/N_o = 0$ dB vertical line. We get the following:

- 1.8MHz:  $N_{Fi} = 60$ dB
- 3.5MHz:  $N_{Fi} = 50$ dB
- 7MHz:  $N_{Fi} = 38$ dB
- 14MHz:  $N_{Fi} = 34$ dB
- 21MHz:  $N_{Fi} = 28$ dB
- 28MHz:  $N_{Fi} = 23$ dB
- 56MHz:  $N_{Fi} = 21$ dB

The above values of  $N_{Fi}$  are for  $S_o/N_o = 0$ dB if  $S_i/N_i = 10$ dB

We can now determine  $N_{Fi}$  for many  $S_o/N_o$  values, or we can take a certain  $N_{Fi}$  value from Table 2 and determine what  $S_i/N_i$  must be for  $S_o/N_o = 0$  on every band. An interesting  $S_o/N_o$  case is where  $S_i/N_i = 1$ dB ( $S_i/N_i =$  ratio 1.26). At this point  $S_o/N_o$  is 1dB less than  $S_i/N_i$ . If we follow the arguments through we see that in this case the  $N_{Fi}$  values are the same as that given in Table 3. So, it seems as if the  $N_{Fi}$  values in Table 3 is the lowest that we must aim for on the different bands.

I must emphasise that my conclusions will differ from person to person. The human ear/brain is a remarkable instrument with surprising filtering properties. So much so, that it's nearly impossible to describe in exact terms.

PW

External Noise above standard $N_e = N_i - N_s$	Receiver sensitivity		$S_i/N_i$ for m.d.s.		$S_o$ for $S_i/N_i = 10$ dB
	$N_{Fi}$	$\mu$ V	Ratio ( $N_s/N_i$ )	dB	
80dB	7	0.046	1	0	10
	20	0.2	1	0	10
	34	1.0	1	0	10
	43	3.0	1.0002	0.0009	9.9991
60dB	7	0.046	1	0	10
	20	0.20	1.0001	0.0004	9.9996
	34	1.0	1.0025	0.0018	9.9892
	43	3.0	1.0200	0.0860	9.9140
40dB	7	0.046	1.0004	0.0017	9.9983
	20	0.20	1.0099	0.0428	9.9572
	34	1.0	1.2511	0.9729	9.0271
	43	3.0	2.9952	4.7643	5.2357
20dB	7	0.046	1.0400	0.1703	9.8297
	20	0.20	1.9900	2.9885	7.0115
	34	1.0	26.11	14.168	-4.168
	43	3.0	200.5	23.021	-13.021
15dB	7	0.046	1.1266	0.5177	9.4823
	20	0.20	4.1329	6.1625	3.8375
	34	1.0	80.46	19.056	-9.056
	43	3.0	632.4	28.010	-18.010
10dB	7	0.046	1.4000	1.4612	8.5388
	20	0.20	10.90	10.374	0.374
	34	1.0	252.1	24.016	-14.016
	43	3.0	1996	33.002	-23.002
5dB	7	0.046	2.2658	3.5522	6.4478
	20	0.20	32.33	15.096	-5.096
	34	1.0	795.6	29.007	-19.007
	43	3.0	6315	38.004	-28.004

**Table 2:** External noise and signal to noise ratios for differing receiver sensitivities.

**Table 3: Suggested minimum receiver noise figures for the various frequency bands (see the text for more details).**

Band (MHz)	$N_e$ (dB)	$N_{Fi}$ (dB)
1.8	45	40
3.5	40	34
7	30	22
14	25	18
21	20	13
28	15	9
56	10	6

**References**

- ‡1. Stacey Gerald G3MCK, 'Noise in h.f. receivers', *Practical Wireless*, August 1984.
- ‡2. Radio Society of Great Britain, *Radio Communication Handbook*, Volumes 1 & 2.
- ‡3. Katz J., *Handbook of Clinical Audiology*, 1985
- ‡4. Ainsworth W., 'Recognising speech in noise'. *Electronics Today International*, April 1989.

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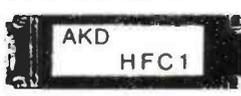
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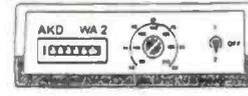
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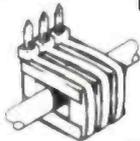
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# A Really Remote Radio

**U**nbiased objectivity, that's what being a reviewer is all about. Well it is most of the time!

But I personally believe that if you are going to give the reader of any review something to get their teeth into you must have an opinion about the product that you're writing about. If not, then why bother writing anything?

Personally I find that I either love or hate a piece of equipment. Sometimes though the odd piece of kit, be it a radio, computer, or car seems to defy the norm. Although I most often find this happens with music.

I can hear a tune, and really like it, then grow to loath it as I get over exposed to it. Conversely something I would initially switch of the radio to avoid, mysteriously 'grows on me' and it ends up being one of my all time favourites - life's strange isn't it?

## The IC-Z1E

You're probably wondering where all this preamble is leading. Well when G3XFD asked me to review the IC-Z1E I was very pleased to get my hands on one.

I have to say that the only piece of Icom equipment that I've ever used is an air band hand-held transceiver. That was while I was under going micro-light pilot training.

During my flying training my only contact with the radio was via the in-helmet intercom. So I was looking forward to putting this radio - from the manufacturer with a not inconsiderable reputation - through its paces.

I can only say that my initial impressions of the IC-Z1E were extreme disappointment. I didn't like the case, I didn't like the buttons, and the removable display seemed like a crazy idea.

The battery latch mechanism didn't feel right, I really didn't like what I saw (and held). But before you read on, you must realise that this is a million miles away from the un-biased objectivity that I opened with.

Indeed, here in the opening paragraphs I've provided very emotive, critical views which were formed in seconds. And on reflection I was disappointed with myself just as much as with this transceiver, for jumping to the rash conclusions!

After some considerable time with the rig, my impressions changed. It's worth bearing in mind that although mostly our first impressions are correct, you can get caught out! In the case of the IC-Z1E I most certainly did (well about most things) I still don't see much point in having a display on the speaker/microphone.

## Many Kinds

I've come to a conclusion after three decades of experience using electronic devices of many kinds. My experience, plus a decade of being involved in specifying or writing guides for the use of such devices both simple and very complicated, that there is **no substitute** for making equipment simple to operate.

The main criteria - in my opinion - is that you should be able to use the apparatus, without consultation to a handbook. The controls should have responses that agree with what you might expect, especially if you've used something similar before. This is what I mean when I refer to controls being intuitive.

You may have to spend a little time working out the logic behind the way that controls achieve the desired effect. But once you have familiarised yourself, with a good design it then all falls into place and off you go.

## Ultimate Test

The ultimate test, in my opinion, is can you use the transceiver without reading the manual? The IC-Z1E passed this test with flying colours.

It might interest you to know that I'm writing this part of the review after a week of using the IC-Z1E and so far I've only referred to the user guide once. This was to establish to charge time for the battery (some things you must not find by experimentation).

By now you are probably wondering what this hand-held is a capable of. So, without further ado I'll outline its capabilities.



## The Icom IC-Z1E

*Kevin Nice G7TZC,  
Assistant Editor of Short  
Wave Magazine, tries  
out a really different  
hand-held transceiver  
which has a detachable  
front control panel  
microphone to provide  
remote operating  
capabilities.*

## Dual-Band

The IC-Z1E is a v.h.f./u.h.f. dual-band hand-held transceiver. It features a removable display panel which can be connected via an umbilical cord to form an enhanced function speaker/microphone.

The radio has three switchable power levels. These, as you would expect with a modern hand-held, are dependent upon which battery pack is being used (there are, as seems to be standard these days, four options), or indeed whether the rig is connected to an external p.s.u.

Referring to the specification panel revealed only figures for a 13.5V d.c. external source. However, the standard battery supplied is the BP-171 which is a 4.8V 700mAh unit.

I carried out a quick check with a 'rough and ready' power meter and dummy load. This indicated that high power with a battery voltage of some 4.5V yielded about 1.5W in high power on v.h.f.

Unfortunately, I didn't have access to a meter that has reliable performance at 430MHz. Despite this it's reasonable to assume a similar level on this band.

The output level indicated by the tests was confirmed by my ability to access the local 144MHz repeater GB3SC, on the standard 'rubber duck' antenna. This would also indicate the good performance of the antenna, as with my own 144MHz transceiver - using 1W - I have to use a telescopic quarter wave rod antenna to gain access from my test location in the lounge.

I particularly liked the standard antenna, it has just the right balance of flexibility and robustness. Other manufacturers please note!

## Very Good Radio

To be totally objective I think the IC-Z1E is a very good radio, it has no problem in getting the job done. Apart from the emotive stuff I've already dwelled on for too long, the only major criticism I have is that the volume and squelch controls should be swapped.

I think they have to be swapped because to operate the volume for either section of the radio you must first depress a button (which is too small) above the p.t.t. switch (which is recessed!). And this is located on the left-hand side of the set.

Once pressed, the display area below the frequency display indicates the current levels for either or both v.h.f. and u.h.f. sections depending what you've got selected.

To change the setting you either rotate the 'dial' knob - located on the top of the set - for the left or right section. Alternatively you can use the up or dn (up or down) controls on the top edge of display panel - buttons to change the

level of the section which is highlighted as the **Main band** - i.e. the band for which transmit is enabled.

There are 17 discrete volume levels available on the IC-Z1E. The squelch on the other hand is operated simply by rotating the squelch knob for the appropriate section.

To further complicate or simplify - I'm not sure which - is the use of the volume control. The way in which the volume selection button operates is programmable. It has three different modes these are changed using the 'set mode' functions.

All of this idiosyncratic operation of course, revolves around the fact that the display - the home of the volume controls and not the squelch - is removable. Therefore, I guess the theory is, that you need to use the volume control much more often than you need to set the squelch threshold.

For the record, the three volume modes that can be selected are as follows. A: depression of the volume button causes the volume display to be activated for five seconds. It will remain for longer with dial activity, but it times

out after five seconds of user inactivity. The selection can be toggled off sooner by a second depression of the **Vol** button. B: The button must be held continuously whilst the volume is set. C: The volume setting display remains until toggled of by a second depression of the **Vol** button. Although this sounds very complicated, it isn't really. I have to say that all the functions are very straightforward to operate.

There's really very little you can't do with the IC-Z1E. However, I do seem to keep returning to things which 'niggle'. But the overall petty nature of the 'niggles' does show what a good performer this transceiver is.

## Monitor Channels

Like its peers, the IC-Z1E has the ability to monitor two channels at once. So it's possible to set the transceiver to v.h.f. and u.h.f., or v.h.f. and v.h.f., u.h.f. and u.h.f. or either v.h.f. or u.h.f. only.

It's also possible to operate full duplex same band or cross-band. Unfortunately though, I wasn't able to test this function

The front panel with microphone detaches, and is then remounted on a special carrier. The transceiver can then be operated from the remote-control unit which is connected to the transceiver via a flexible (telephone type) umbilical cord.



fully as I couldn't find anyone else with this capability.

Repeater operation is well catered for, with selectable offsets offered. The ability to work reverse repeater at the touch of a button is not available, although it's possible to listen on the transmit frequency by depressing the **Moni** (monitor) button. This is actually much more sensible - lets face it who actually wants to transmit on the output of a repeater?

The CTCSS facility is an option with the IC-Z1E both for transmit and receive...but DTMF is standard. Odd for the European model!

A very useful feature fitted on the transceiver is the **Repeater Memory** function. This enables you to return to the last used offset (as apposed to duplex) channel used, simply by depressing the **RPT-M** button (this is the same button which requires pressing to activate the tone burst during transmit).

## Functions Memory

As with any microprocessor controlled radio, there are comprehensive memory functions available on the IC-Z1E. These include six digit alpha tagging.

Those of you who have read any of my previous reviews will know that I like a rig with lots of memories. So, I was not disappointed with the Icom's offering of 46 per band.

Scanning is also catered for, with four options. These are: **Full Scan** which uses the currently selected step size to traverse the band to the edges looping back from one to the other, depending whether the scan direction is up or down.

Next there's **Programmed Scan**. This is much the same as previous but scan edges are programmable.

Another feature is **Memory Scan**. In this, all the programmed memories are scanned in sequence of memory number, either incremental or decremental.

Finally, there's **Memory Skip Scan**. This feature is similar to plain Memory Scan, but memories can be tagged as skip channels, which avoids busy channels that are not of immediate interest.

An internal 24-hour real time clock function is also provided. This allows such niceties as time display, auto power on and auto power off - phew!

## Comprehensive Manual

The IC-Z1E comes complete with a comprehensive 58-page instruction manual. It's subdivided into 19 sections. This A5 landscape guide, like its contemporaries, lacks a proper cover which in my experience, leads quickly, to the loss of outer pages.

The guide is very well written and easy to follow, if you need it that is! (See my earlier comments). Also included is a

## Manufacturer's Specifications

### General

Frequency Range:	144 to 146MHz and 430 to 440MHz
Modulation type:	F3
Frequency stability:	±5p.p.m. (0° to +50°C)
Tuning steps:	5, 10, 12.5, 15, 20, 25, 30 or 50kHz
Antenna impedance:	50Ω (nominal)
External d.c. power:	4.5 - 16V (negative earth)
Current consumption at 13.5V	1.3A (High) 500mA (low)
Operating temperature range:	-10° to +60°C
Dimensions including (BP-171):	57x125x36mm
Weight (including BP-171 and antenna)	380g

### Receiver

Receiver type	Double conversion superhet
Intermediate frequencies:	1st 43.1MHz (v.h.f.) 35.8MHz (u.h.f.) 2nd 455kHz
Sensitivity* (12dB SINAD):	<0.16µV
Squelch sensitivity	<0.16µV (at threshold)
Selectivity:	>15kHz at -6dB <30kHz at -60dB
Spurious and image rejection ratio*	>60dB >45dB at i.f.2
Audio output* (at 13.5V)	>180mW (at 10% distortion into 8Ω load)
Audio output impedance:	8Ω

### Transmitter

Output power (at 13.5V)	
High	5W
Low	500mW
Extra low	15mW
Modulation method:	Reactance
Maximum deviation*:	±5kHz
Microphone impedance:	2kΩ

\*Specifications guaranteed at a transceiver temperature of +25°C

convenient A7 folded 'quick' operating guide which is cross referenced to the instruction manual. Also included with the review model was a small errata sheet correcting three errors in the manual.

## Brilliant Idea

One brilliant idea, is the function provided in the IC-Z1E of the capability to automatically switch to extra low power when the set detects the imminent exhaustion of the battery. This clearly can avoid that total disappearance into thin air mid-QSO.

While on the subject of batteries, I cannot understand the logic of equipment manufacturers who provide chargers that take most of a day to provide full capacity. I really wish they would take a leaf out of the cellphone companies and provide rapid charge facilities as standard!

As always, the space available for reviews precludes the detailed explanation of all of the capabilities of the IC-Z1E. But if you're tempted to find out more, then I'm sure that any of the Icom dealers will be happy to let you put one through it's paces.

At the £529 price tag the IC-Z1E is not a cheap transceiver. But if you need to have a removable display/speaker/microphone, you don't have much choice.

Would I buy one? I've already got a hand-held I'm happy with thanks. I'm not biased though, because I would love an Icom IC-R7100 receiver.

For the loan of the review radio, my thanks go to Icom (UK) Ltd. Sea Street, Herne Bay, Kent CT6 8LD. Tel: (01227) 741741, FAX: (01227) 741742.



# W valve & vintage

*This month Charles Miller, the second of our new team of valve & vintage 'shopkeepers', takes his turn to 'man' the PW 'wireless shop', looking after the historical department.*

**A**s an inveterate vintage radio 'nut' I was delighted when the Editor asked me to become one of his rotating writers for the 'Valve and Vintage' column (so long as I can be at 78 r.p.m. of course).

Since the valve is virtually synonymous with vintage radio, it seemed a good idea to commence by delving into its history. What I found surprised me because it's not just an everyday story of scientific folk.

On the contrary, some of the goings-on could provide the basis of a TV series, embracing as they do questionable ethics, curious coincidences, shadowy go-betweens, dodgy businesses, industrial espionage and big courtroom dramas. Stay tuned!

## First Recorded

The first recorded use of a thermionic diode as a radio detector was in October of 1904 by the British scientist Dr. Ambrose Fleming. What the record books don't usually reveal is that the diode used wasn't actually Fleming's invention.

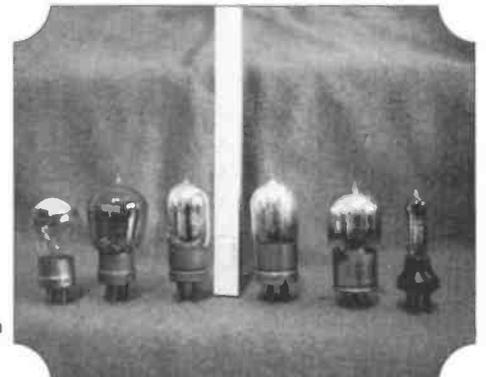
It was in fact something called a voltage indicator lamp. This dated back 25 years to 1879, when Thomas Alva Edison was making the first practical electric light bulbs.

There were two significant things about these lamps, as it turned out. First that the carbon-thread filament was supported on two long legs within the envelope and secondly that Edison always powered them with direct current (d.c.).

The lamps had a fairly short life of about 40 hours and as they aged, they tended to go black inside. After a while Edison noticed that in most of them the blackening extended all round the envelope except for a single thin but distinct clear stripe.

The stripe was invariably down the glass opposite the filament support leg that had connected to the positive side of the supply. Edison figured that the negative leg must somehow be emitting carbon which was being drawn from the filament.

Carbon was being sent out in straight lines. And for some reason the positive leg was acting as a shield to produce a sort of shadow in reverse on the glass.



**A selection of five very early B E valve types and (extreme right) a WECO dull emitter valve.**

## Filament Emission

To check his theory about the filament emission, Edison made up a special lamp. This was equipped with a small metal plate mounted vertically between the filament legs and connected to a separate lead-out wire.

With the lamp alight he connected a galvanometer between the plate and each leg of the filament in turn. The galvanometer registered a small current when taken to the positive leg but not when taken to the negative lead.

Edison also found that the galvanometer readings increased with the brightness of the filament. He might not have known the reason for all this, but the 'Wizard', as he was known, wasn't a man to waste anything if he could help it!

It struck him that one of these special lamps in conjunction with a

calibrated galvanometer could be used to indicate when the filament was running at the correct brightness level. This in turn would show when the mains voltage was correct.

It's not clear what the advantage of the voltage indicator was supposed to be over a conventional voltmeter, but it's fortunate for radio that the indicator lamps took Edison's fancy! He applied for a patent on the idea and

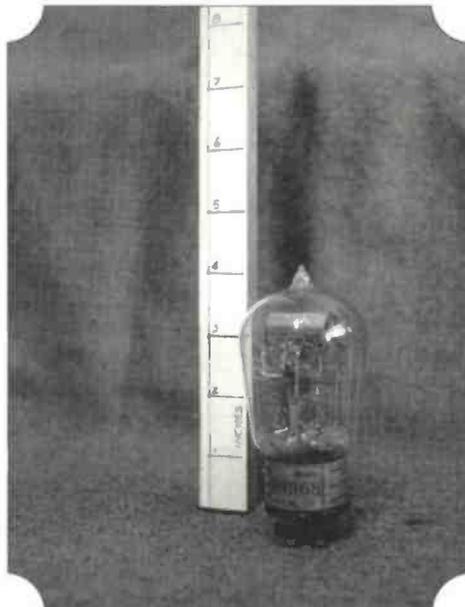
soon they came into general use in the electric lighting plants which he was then installing in and around New York.

## English Subsidiary

In 1882 Edison established an English subsidiary called the Edison Electric Lighting Company of London. This venture took on as its chief electrician a young man called John Ambrose (later Sir Ambrose) Fleming.

Fleming soon discovered for himself the blackening effect in carbon lamps and made his own experiments with Edison indicator lamps.

In one of the lamps he found that if he connected a battery with its positive to the metal plate and its negative to either filament leg, a



**An early German triode 2V 1.1A filament (Siemens & Halske).**



**Mullard valve boxes.**

small current would flow through the lamp. But if the battery was reversed no current flowed.

Although he didn't realise it at the time, this uni-directional effect meant that Fleming had accidentally discovered the principle of the valve rectifier. In another experiment on the same lines he found that exactly the same results were obtained if a.c. instead of d.c. was used to light the filament.

Fleming wrote reports and presented various papers to learned societies on these experiments. But as they didn't appear to have any practical use and eventually his interest fizzled out.

In the meantime, the indicator lamps had been put on show at an International Electrical Exhibition in Philadelphia towards the end of 1884. One of the visitors was an engineer with the British Post Office called William Preece.

Preece too, was taken by the indicator lamps and managed to talk Edison into giving him a few examples to bring back to England. Preece carried out various experiments with them and gave talks to learned societies, so what with his and Fleming's efforts the lamps were fairly well known in London's scientific circles by 1885.

### Technical Adviser

In 1899 Fleming changed his job and became technical adviser to Marconi's Wireless Telegraph Co., Ltd. (MWT). This was then getting ready for an attempt to send radio signals across the Atlantic.

Fleming worked for a while on the transmitters, then turned his attention to the receivers. His particular job was to find a better detector to replace the inefficient and unreliable magnetic or chemical detectors then in use.

By this time he was in his late 50s and suffering from deafness that was becoming progressively worse. Since keen hearing was

needed for the faint, scratchy sounds produced in headphones by existing receivers, it's understandable that he should explore the possibility of replacing them by some kind of visual indicator.

Fortunately, there was no problem about a sensitive display

unit. This already existed in the form of the d'Arsonval mirror galvanometer. If you imagine a very sensitive moving-coil microammeter with its pointer replaced by a small mirror you have its principle.

A narrow beam of light is focussed on the mirror so that when it moves the light is reflected onto a translucent scale. The result is that the slightest movement of the mirror shows up as quite a big deflection on the scale.

The mirror galvanometer idea is fine. But the snag for the Fleming's point of view was that the galvanometer would respond only to d.c. and the spark transmitters sent out high frequency a.c. Somehow this would have to be turned back into d.c. at the receiver.

### Seated One Day

Seated one day in his workshop, weary and ill at ease, Fleming suddenly remembered his experiments with the Edison indicator lamps nearly 20 years earlier. If the lamp would pass current only when a positive d.c. voltage was applied to the plate what would happen if a.c. were applied?

On form, the lamp should block the negative swings and allow only the positive through. This would result in a positive voltage appearing at the filament.

Luckily, like so many of us (ask my wife!) Fleming was a hoarder and had kept those old Edison lamps in a store cupboard in the laboratory. He and his assistant excavated them and connected one up to a mirror galvanometer and a tuned circuit.

They cobbled together a makeshift spark transmitter from an old induction coil and another similar tuned circuit, then switched it on and held their breath. The galvanometer registered and in one bound the Edison voltage indicator

lamp was transformed into the Fleming thermionic diode.

The tricky question now arose of who owned the rights on this makeshift detector. It after all, might still technically have been the property of the Edison Electric Lighting Company. Fleming got round this by having new, purpose built diodes made for him.

Cleverly, Fleming ordered the diode from the Edison & Swan United Electric Company - a bit cheeky in the circumstances? - to be made to his own specification. They were to have a 4V filament, with the central plate replaced by a cylindrical anode made of platinum.

It would be interesting to know how much Edison charged Fleming. Presumably platinum was a great deal cheaper than it is now! They also received a new name.

Working on the analogy of a mechanical valve letting liquid through in one direction only, Fleming christened his diodes "oscillation valves". The name has persisted to this day.

Incidentally, when they carried out Fleming's order, Edison gained the honour of being the world's first valve manufacturer.

### Provisional Patents

A few more weeks and experiments later, Fleming applied for a provisional patent on his oscillation valves which was granted in full the following September. He was also granted a patent in America, which was just as well in view of what happened later.

Personally speaking, I think Fleming was lucky to get away with the American patent since he was on Edison's home ground and the Wizard was well-known for defending jealously his own rights.

It was fortunate for Fleming that Edison never seemed to take much interest in radio. And anyway Edison was presently occupied in making a fortune (10 cents a foot on every film produced) from the movie industry. This probably saved Fleming from expensive litigation. He wasn't to be so fortunate in the future, however.

### Filaments And Anodes

Even before his British patent had been granted Fleming had redesigned his valves to use 12V filaments and aluminium anodes. This type was used at Marconi's wireless station at Poldhu, Cornwall.



**The well known Mullard PM3A valve.**



**Mullard PM4 with characteristic curve circa 1929.**

Fleming also discovered that if he applied a certain amount of voltage (we'd call it bias) to the anode of the valve with a separate battery he could get it to work more efficiently. More improvements followed as a result of experience gained in service.

It also turned out that the valves would work with a lot less filament power than had been thought. So their voltage was reduced back to 4V.

Substituting tungsten for carbon threads improved the valve's efficiency and also made them last much longer. Fleming duly took out patents on these developments as well.

With the valves established in service with MWT, it wasn't long before examples were being shipped across the Atlantic to be used by its subsidiary, the Marconi Wireless Telegraph Company of America.

At this point the plot, as they say, thickens with the entry of Dr. Lee de Forest on the scene. Next time I'll look at the early career of the man who is credited with giving the World the triode valve.

PW

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73 from Dave G4KQH, Technical Manager.

# VHF REPORT

*This month David Butler G4ASR looks at Sp-E propagation on the 144MHz band and theories about the recent transatlantic openings on the 50MHz band.*

Last time I took a look at the many Sp-E openings that occurred on the 144MHz band during June. For those keeping records they occurred on June 2, 5, 6, 9, 12 and 25. (There was also one on May 20).

John Nixon G7SMA (I093) has sent me a report concerning the opening on June 12. I've included it because I want to show you that you don't need lot's of power and big antennas to work the DX.

At 1145UTC on June 12 while monitoring the f.m. calling frequency 145.500MHz, John heard a Spanish station calling CQ. Unfortunately he disappeared very quickly, but John continued to listen this time on and around 144.300MHz (the s.s.b. calling frequency).

At 1210UTC John was pleased to hear EA7AG (IM86) who came back to his first call. This was John's first ever DX contact on the 144MHz band.

The distance was 1835km which was even further than he had worked on the 50MHz band. Six minutes later, at 1216UTC, he heard EA9IB (IM85) calling CQ. John managed to work him, first call, at 59 both ways over a path length of 2012km. His second DX QSO on the 144MHz band and it was to Africa!

What makes the DX even more remarkable was that John used only 25W and a 5-element Yagi in the loft space. On the same day he also worked 12 countries on the 50MHz band with 10W and a simple half-wave vertical antenna.

Well, after that news I hope that's encouraged more of you to try this amazing propagation mode. Of course if you run high power and have large antennas then you will get more consistent results but you shouldn't forget that being in the right place at the right time is worth many dB!

## Conditions On 144MHz

Many operators were hoping that Sp-E conditions on the 144MHz band would be as good during July as they were the previous month. However, it was not to be with only three events being recorded in the UK. These occurred on July 1, 2 and 15, the former coinciding with the RSGB

v.h.f. national field day contest.

The opening on July 1 actually consisted of a five separate events. The first started around 0915UTC lasting approximately 35 minutes.

Stations situated in HA, OE, OK, OM, S5 (Slovenia) and 9A (Croatia) were worked by operators throughout the British Isles. Alan ChIn G170TB (I074) was astonished to hear several DX stations on 144.300MHz coming through loud and clear.

At 0930 Alan worked YU1WP (JN94) and during the next 30 minutes he also heard 9A1CCY, 9A3RU and 9A3VD. His station consists of an FT-290 Mk1, a Tokyo HL37V amplifier running 30W and a 7-element Yagi.

Alan reports that he is a bit incredulous about these contacts and wonders whether I had received similar reports.

Well Alan, it really did happen. And if you listen to the 144MHz band again next June and July you'll probably make some more DX contacts. Good luck!

Philip Lancaster G0ISW (I084) runs 25W output from an FT-736 into a Create Log Periodic Yagi. He also reports catching the early morning event from 0925UTC. Philip managed to make s.s.b. contacts with OE8XXK/8, S53RY, YU1WP and 9A3VD. He also heard S57TTI, 9A1CCY and 9A2PT.

## Second Event

The second event of the day was quite brief lasting from 1010-1020UTC. Stations in S5, YU, 9A were being worked from central and southern England.

A similar event occurred between 1040-1055UTC. Graham Taylor G7UJC (I083) reports working YU7BW (JN95), 9A1CCY and 9A1KDE, both in JN96. Interestingly Graham was running 25W into a 5/8 over 5/8 vertical antenna to make these contacts.

During the event stations located on the eastern side of England were able to make contacts with stations in Italy. The station of Silvio IW1AZJ (JN35) reports working GM4IPK, GW3EJR, GW3ZTH, GW6EOL, EI3GE, EI4DQ, EI5FK and EI9EJ.

Ken Osborne G4IGO (I080)

worked many stations during the morning events. His best contacts were with UT3WWY/P (KN19), UT5DE (KN18) and YO5CBX (KN27).

Another opening, the fourth of the day, started around 1200UTC and lasted for about 30 minutes. By this time the propagation path had moved further south and contacts were being made into eastern and southern Spain.

Finally, between 1720-1920UTC the last event of the day occurred. This enabled operators participating in v.h.f. field day to really bump up their scores. Many 144MHz portable stations were heard contacting DX throughout I, IS, IT9, TK, EA and EA6.

The band was also in good shape the next day July 2 with a good Sp-E opening to Spain and northern Africa. Typically, it commenced about 30 minutes after the field day contest had finished!

Steve Potter G1JHZ (I082) reports working EA9IB at 1459UTC and EA5GRB (IM98) a few minutes later. He runs a Trio TR-9130, 25W and a 7-element ZL-Special antenna.

What was probably the last and arguably the best Sp-E opening of the season took place on July 15. It started around 1630UTC, and lasted well over three hours allowing UK operators to make contacts into I, IS, IT9, LZ, SV7, SV8, UT, YO and 9H.

Among the DX callsigns noted on the 144MHz band were SV7AI and SV7VU (KN20), SV1QJ/8 (KM27), US7CO (KN59), UT1E (KN68), UT3JE (KN65) and UT4JX (KN64). What a way to end the season!

## Mouth Watering

If all the DX on the 144MHz band sounds mouth-watering you should have heard what was happening on the 50MHz band! After a faltering start in early May the band really came alive and for over two months on an almost daily basis much DX could be worked.

What set this year's Sp-E openings apart from others were the many transatlantic openings to North America. Based on results from previous years, about four or five such openings are expected during the months of June and July.

This year however, the total was eighteen! For those that missed them they occurred on June 7, 12, 13, 16, 18, 19, 20, 21, 22, 27, July 2, 3, 4, 5, 6, 7, 8 and 10.

What I found remarkable was that most of the openings reappeared day-after-day. I've shown all the 50MHz transatlantic openings and the 144MHz Sp-E openings in Fig. 1. It also shows some of the recent auroral openings observed at my QTH.

So what caused the tremendous conditions on the 50MHz band and why was this year particularly good? Looking back for a possible answer, in previous issues I wrote that transatlantic openings have frequently occurred after a day of intense European Sp-E, especially if there had been openings on the 144MHz band.

## The Chart

Interestingly the chart, Fig. 1, shows that only two 50MHz transatlantic openings occurred on days when the m.u.f. reached the 144MHz band. Jim Smith G0OFE also makes the observation that there was a distinct lack of intense Sp-E within Europe prior to many of these openings.

Jim also noticed that on many occasions the m.u.f. was relatively low and didn't reach up to the 144MHz band. He suggests that the transatlantic propagation was created by a different kind of mechanism, more like E-layer propagation, rather than 'conventional' Sp-E.

Roger Horne G4HBA agrees with the comments made by G0OFE. He also thinks that the E-layer becomes ionised, not in patchy clouds but rather in a large stable sheet.

Roger notes that the transatlantic openings seem to coincide with a sudden drop in the geomagnetic A and K indices. He suggests that this type of propagation also appears on easterly paths but tends to be masked by active Sp-E within Europe at the same time.

Both G4HBA and G4IGO have been aware for some years of the E-layer propagation on the middle-eastern path to 4X, 5B and 9K. They both think that some of the old theories do not stand up to the

Aurora										
Month	Dates									
January	2	6	16	17	29	30				
February	3	7	11	12	13	14	26	27	28	
March		1	4	5	9	10	11	12	13	26 28
April		1	7	8	9	23	24			
May		2	3	4	5	6	16	23	31	
June		1	30							
144MHz Sp-E										
May	20									
June	2	5	6	9	12	25				
July	1	2	15							
50MHz Transatlantic										
June	7	12	13	16	18	19	20	21	22	27
July	2	3	4	5	6	7	8	10		

Fig. 1: 27-Day Solar Rotation Calendar by G4ASR (see text).

evidence now available and that text books will have to be re-written.

## Radical Suggestion

Martyn Vincent G3UKV makes an even more radical suggestion. He doesn't think double-hop Sp-E is the mechanism at all. Martyn reckons it might actually be via the F1-layer.

However, Emil Pocock W3EP says that F-layer propagation, especially F1, is definitely out of the question. Although he cannot give a definitive answer, Emil thinks that it is very unlikely to be anything other than E-layer propagation.

Emil suggests that some of the activity may be attributed to a large increase in European stations using more sophisticated monitoring and reporting systems. He does agree however, that there appears to have been far more openings this year than at similar low points of the solar cycle. Emil also says that there are indications that Sp-E is more frequent at solar minimum but it's certainly not an established fact.

Chris Deacon G4IFX reports that like everyone else he has been amazed by the amount of long distance propagation on the 50MHz band. He doesn't agree with the theories put forward by G00FE, G4IGO and others regarding E-layer propagation.

In his view we are actually seeing what Sp-E should be like near sun spot minimum. There was Sp-E virtually every day in June and July and more Sp-E inevitably means more multi-hop paths.

This year has been particularly good, not just to the west. There have been long double-hop openings to the eastern Mediterranean (4X, 5B) and even further to 4K6D.

Stations located in CT3, EH8 and 5T5 have also been regularly heard throughout the summer. Almost invariably 'normal' Sp-E type contacts have been made at the same time as these long distance contacts.

It doesn't seem at all strange to G4IFX that multi-hop propagation to the west doesn't necessarily occur when there is intense Sp-E to the east or south. He reminds us that Sp-E is just that...it is 'sporadic' and there's no great correlation between Sp-E events in widely separated areas.

In any case, the requirements for the two sorts of propagation are rather different. Chris suggests that for Sp-E at 144MHz or for short-skip at 50MHz high intensity ionisation is required but not necessarily a large cloud.

On the other hand long distance multi-hop propagation requires widespread ionisation with several clouds approximately 2000km apart. These clouds don't need to be particularly intense provided they will support 50MHz reflections at low angles.

So, you can have either intense Sp-E or widespread Sp-E but you don't need both for the multi-hop transatlantic path. Although of course there will be occasions when both do occur at the same time.

Chris says that in his experience he's noticed that long-distance signals have more or less the same characteristics as single-hop Sp-E. Their occurrence is sporadic and signals can be strong but often with rapid fading.

Frequently propagation is highly localised and moves rapidly. This is very different from F-layer propagation. Of course signal strengths may at times be very stable for long periods but that can also be true of single-hop Sp-E as well.

Both types of this E-layer mode peak in June/July and are best near sun spot minimum. (Expected to be 1996/7). A recent article by Geoff Grayer G3NAQ in the RSGB's *Radio Communications* journal, showed that the probability of long distance 50MHz E-layer propagation can be directly related to the probability of Sp-E occurring at the intermediate reflection points.

Chris suggests that there is significant evidence that his observations are at least consistent with multiple Sp-E reflections. Finally, he makes the point that if a simple extension of a well established model can explain observations then there is no reason to invent another more complicated one. In his view the Sp-E theory works very well for long distance 50MHz propagation away from sun spot maximum.

I must say at this point that I totally agree with the views of G4IFX. But what do you think? I'll be very happy to open up a debate on this very interesting subject. Please send me your theories or ideas to the address given below.

## Moonbounce Contest

Billy Lunt KR1R, the ARRL Contest Manager, has confirmed the dates for this year's ARRL e.m.e. 'moonbounce' competition. It will be held during the weekends of October 7-8 and November 4-5.

Unfortunately, both weekends clash with major European v.h.f. and u.h.f. contests. The November weekend is a particularly bad choice as the Marconi Memorial 24-hour and RSGB six-hour c.w. events are running at the same time.

However, the ARRL contest is usually one of the best opportunities to work some of the larger e.m.e. stations around the world. If you can get about 100W c.w. into a single long Yagi then you stand a chance of making your first e.m.e. contact.

Satellite operators with elevation facilities will be even better placed to make a contact via the moon. One group that you may possibly hear is VE3ONT, the Toronto v.h.f. Society.

Once again, the VE3ONT group have received permission to use the 46m diameter radio telescope dish antenna belonging to the Institute for Space and Terrestrial Science.

Situated in locator FN05XW, the Toronto Society intend to be active

on the 50, 144 and 1296MHz bands during the first leg of the contest in October.

Moonbounce operation on the 50MHz band is very difficult but it may be worth listening for VE3ONT as the 46m dish will have a useful amount of gain at this frequency. The VE3ONT GROUP will be active on 50.100MHz between 2306UTC on October 7 to 1013 on October 8.

Link budget calculations indicate that 50MHz stations with an antenna gain of 10dBd and 1kW should be able to work VE3ONT. Smaller stations however are urged to try if signals can be heard. The operators at VE3ONT will be listening between 50.100-50.105MHz for replies.

## Circular Polarisation

On the 144MHz band the VE3ONT dish will be configured to transmit and receive right-hand circular polarisation (r.h.c.p.). If you're using circular polarisation be very careful which mode you select.

Get the polarisation wrong and you won't hear anything at all! It's probably safer therefore to use linear polarisation. Either vertical or horizontal polarisation can be used, it doesn't matter which.

The Canadian group will be active between 0000-0907UTC on October 7, transmitting on 144.100MHz and listening for replies up to 10kHz higher. Operation on the 1.3GHz band will be conducted simultaneously with activity on the 50MHz band. They'll transmit on 1296.050MHz, again listening up to 10kHz higher for replies.

If you send me an s.a.e I'll provide you with a list of azimuth and elevation bearings for use during the e.m.e. contest. But don't forget to give me your full six figure locator! (I can also accept requests via packet radio).

## Deadline Time

It's deadline time again. If you have any material for the column please send details (to reach me by the end of the month) to: Yew Tree Cottage, Lower Maescoed, Herefordshire HR2 0HP. Alternatively via packet radio @GB7MAD or the DX Cluster system. Or you can telephone me on (01873) 860679.

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# Antenn

Gerald Stancey G3MCK explains why transmission lines that seem to be 'short' or 'open' circuit actually have an impedance which is fixed.

**W**e all know that feeders from transceivers to antenna come in various guises. For instance we may use coaxial cable, balanced twin or open wire feeder. And we casually refer to them by names such as 50Ω coaxial or 600Ω line.

However, if we take a length of any feeder and measure it with an Ohm-meter the only readings we get are infinity or zero Ohms (or a few milliohms). You never get readings such as 50, 75, 300Ω with which we are familiar with. So what are these 'Ohms' that don't register on an Ohm-meter?

Like many puzzles, the 'mystery Ohm' version is not hard to solve once you look at it correctly. Radio enthusiasts are so used to relating the term Ohms to a definite object, like a 47Ω resistor, that we forget that the term Ohm is the ratio of the voltage across a circuit to the current flowing through the circuit. This definition is the key to understanding the enigma.

Termination	Power	
	Absorbed	Reflected
$R = \infty$	None	All
$R = Z_0$	All	None
$R = 0$	None	All

**Table 1.** This table shows whether power is reflected or absorbed by a load in three specialised cases.

impeded by the inductive action of the first inductor. As soon as a voltage appears across the first capacitor, current will start to flow through the second inductor pair into the second capacitor.

The current flowing into the second capacitor will also be impeded by action of the second inductor pair. This composite action will carry on down the line with each set of inductors and capacitors.

If you have a line which is infinitely long you will arrive at a situation where the capacitors at the start of the line are fully charged and yet a constant current is still flowing through their associated inductors.

Termination	Power	
	Absorbed	Reflected
$R = \infty$	None	All
$R > Z_0$	Some	Some
$R = Z_0$	All	None
$R < Z_0$	Some	Some
$R = 0$	None	All

**Table 2.** This table shows whether power is reflected or absorbed by a load depending on the value of the terminating resistor.

measured in Ohms.

Let's look at the infinitely long line a little more closely as shown in the drawing of Fig. 2. If you consider a section of the line some way from the generator, you can see that the voltage across the section is the same at the input and the output. Note also the same current flows into the section as flows out of it.

Because there is no voltage or current loss in the line, you can replace the rest of line to the right of the considered section by a resistor. This

resistor you haven't changed the way the line looks when viewed from the generator. What we have done is we have provided a load that is said to be matched to the line. The value of resistor that can replace a section of line without changing what the generator 'sees' is called the characteristic impedance, and is usually labelled  $Z_0$ .

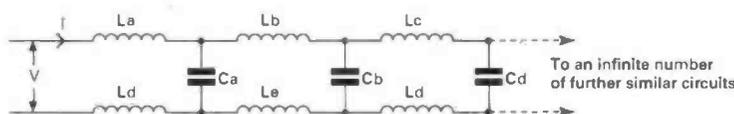
## Impedance Difference

Now I've explained what's meant by line impedance and by a matched line, let's see what happens when a line is terminated with a load which differs from the line's impedance. First of all consider the simplest case of line with a load that differs from its characteristic impedance. Such a case is called a mismatched load.

The simplest mismatched load is when the line is not terminated at all. In other words the load is an open circuit. In the case of an open circuit, it is easy to see that none of the energy fed into the line can be dissipated in a load as there is no load to absorb it.

The energy fed down the line can't just hang about in limbo. It's being fed into the line and has to go somewhere. So, as it cannot go any further it has to return from whence it came. In other words it is reflected back down the line.

When the line is terminated in a short circuit there is again no power consumed, as short



**Fig. 1:** The theoretical circuit of a section from an infinite length of r.f. feeder. Each inductor is equivalent to the inductance of a short length of conductor. Each capacitor is the capacitance between the same length of both conductors. The effective, or characteristic, impedance ( $Z_0$ ) can be calculated from the applied  $V$  and the current ( $i$ ) flowing.

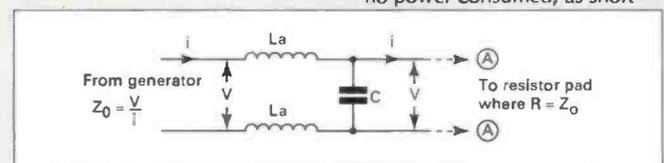
## Balanced Line

For simplicity let us consider a balanced line. Diagrammatically this can be represented as a series of capacitors and inductors as shown in Fig. 1. If a voltage is applied across the line, current will start to flow through the first inductors into the first capacitor.

However, the flow of current into this first capacitor will be

The reason for this constant current still flowing through the inductors is that the capacitors further down the line are still being charged up. As the line is considered to be of infinite length, there are always going to be capacitors that are being charged up.

The ratio of the voltage across the charged capacitors and the current flowing through their inductors is the impedance of the line. So, it's not surprising to learn that impedance is



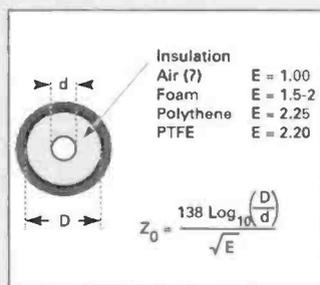
**Fig. 2:** If a resistor of the same resistance as  $Z_0$  is attached to the points A-A then all the energy from the generator will be absorbed in it.

resistor would have a resistance equal to the ratio of the voltage across the section to the current flowing out of the section.

By replacing the line by a

circuits do not consume energy. So, once again the power is redirected whence it came, towards the generator. I've summarised the normal case of

# a Workshop



**Fig. 3: These are the two measurements needed to 'guess' the characteristic impedance of a section of coaxial line. See Fig. 4 for more details.**

correctly matched line, and the two special case of mismatched lines in Table 1.

Now consider the situation where the line terminates in a load which is greater than the line's impedance but is not an open circuit. Examining Table 1 suggests that some of the power will be absorbed in the load and some will be reflected back down the line.

Similar reasoning can be applied to the case where the load impedance is greater than zero but is less than the line characteristic impedance. When the line is loaded with a real impedance, you can expect the results to be as shown in Table 2. Note I've included the two special cases of infinite and zero Ohms load for comparison.

The figures shown in Table 2 are very simplified, but show basically what happens. For each case of characteristic impedance and load, the reflected and absorbed portions can be proved by complex mathematics. However, I've obtained the same result by simply looking at the situation and applying a bit of common-sense.

For simplicity this explanation has only considered purely resistive loads. If the load contains a reactive element it can also be shown that reflection occurs irrespective of the value of the reactive element of the load.

## Funny Ohms

Now I've explained the meaning of these 'funny' Ohms that are associated with feeders. This lead us to the concept of a matched and an un-matched

lines. I've explained that to get maximum power from the generator (transmitter) to the load (antenna) the load should have the same resistance as the characteristic impedance as the feeder line.

I've not said what happens to the power reflected from the load, because this introduces us to the concept of voltage standing wave ratio (v.s.w.r.) or

**Fig. 4: A graph to help you 'guesstimate' the impedance of a coaxial line. Measure the inner diameter (estimate if it's a stranded conductor), and the inside diameter of the screening conductor. To use the graph, lay a ruler vertically on the diameter of the screen conductor. Where the ruler crosses the lines of the inner conductor size, read off (on the left hand scale) the approximate characteristic impedance of the cable.**

more usually just called standing wave ratio (s.w.r.). This is a more complex subject and I'll look at this aspect of feeders in another article.

## Real Cables

For interest let's look at real cables and as coaxial cable is probably the most widely used I will only consider this type. The cross section of a coaxial cable is shown in Fig. 3. The centre conductor, which is either stranded or solid, is surrounded by a cylindrical outer conductor which is

usually made of copper braid.

The whole cable is protected by a black plastic sheath to keep out the weather. The spacing between the inner conductor and the shield is maintained by filling the space with solid plastic material, and the most usual is made from polythene. Sometimes to reduce losses plastic foam or a spiral of plastic may be used.

The impedance of coaxial cable is given by the formula shown in the illustration Fig. 3. The factor E is the dielectric constant of the insulation material between the centre and the screen.

For polythene the dielectric coefficient figure is about 2.25, and this is the figure I'll base my calculations on.

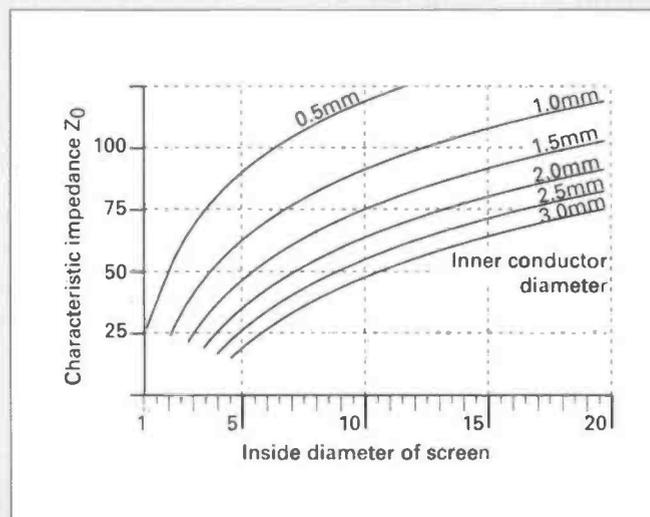
these lengths is the velocity factor of the line.

For solid coaxial cables the velocity factor is about 0.66. Usually this factor is only of interest when designing matching or phasing stubs.

Cable manufacturers supply more information on both the parameters I've mentioned. Their data sheets should be consulted if there appears to be a problem.

The impedance of an unknown piece of coaxial cable can be estimated by measuring the inside diameter of the braid or screen and the diameter of the inner conductor. This is best done using a vernier gauge.

If you like to do some work then you'd can apply the formula (in Fig. 3) to the two



In addition to the impedance of the cable two other characteristics need considering, namely power handling and velocity factor. However, in the UK with a limit of 400W, anyone using reasonably well matched coaxial cable, power handling limitations are unlikely to find a problem.

Due to the dielectric in a cable the speed at which the radio wave passes down the line is reduced. The effect of this is to make the electrical length of a cable longer than its physical length. The ratio of

dimensions. If the plastic between the braid and the centre conductor is solid assume E=2.25. If it is foam or semi-air spaced "guesstimate" a value for E to be between 1.5 and 2.0.

You could however use the small graph shown in Fig. 4. To use the graph all you need is a small 150mm steel rule with millimetre marks. Your answer should be close enough to 50, 75, or 90Ω to enable you to decide which is correct.

PW

## HF FAR &amp; WIDE

Leighton Smart GWOLBI invites you to join him and his reporters as they explore the world of h.f. operations 'far and wide'.

The month of July has seen some patchy conditions on the h.f. bands. Reports vary a great deal, but our reporters, no less than 13 this month, have been digging out some juicy DX.

They've been busy by listening at the right times and on the right bands. There seems to be a lesson here for many of us - that despite relatively poor propagation conditions, certain bands are very productive at certain times!

I hope you can listen in on our listening watch frequencies, and report back to the pages of this column. Already, reports are coming in of our reporters being heard by other reporters. What I'd like to see now is a PW listening station in a far flung location; would any of our readers outside the UK like to volunteer?

### Your Reports

So, it's on to your reports and I'm starting off with 1.8 and 3.5MHz this month. **Eric Masters GOKRT** in Surrey, using his 5watt QRP Plus rig and a 26m end fed wire antenna has been busy.

Eric took advantage of the recent RSGB 1.8MHz contest to hook up with DA0HQ Germany, at 0106UTC, GM3POI Orkney, at 2246, and GM4DGT/P central Scotland at 2216, all on c.w. His 3.5MHz reports list contacts with 2E0AIR in Cambridge, at 0720, and G0PEM/QRP at 1405UTC.

### The 7MHz Band

The 7MHz band seems to be attracting lots of attention recently, and yet again '40' proved itself to be an excellent DX band. **Ted Trowell G2HKU** in Kent, using a Ten Tec Omni V transceiver at just 70W into G5RV and HF6 vertical antennas reports c.w. contacts, all at around 0500UTC with W1CW (USA), EA6/G0BQV Balearic Islands, OH0/DL1RNW Aaland Island, 8P6DY Barbados, ZL3APV New Zealand, and N2NU in the USA who was using a staggering 1.5kW into a 3-element beam mounted at 43m!

**Charlie Blake RS96034** in Milton Keynes, who uses a NRD 525 Receiver, and an 11m sloping wire

antenna, says he found conditions noisy around his usual listening frequency of 7.061MHz. But he logged CO3RX Cuba, calling CQ Europe (no replies) at 0420UTC, ZL4B0 New Zealand, working G3DAM at 0510, VK7AZ Hobart Australia, working G0AWF at 0530, PP2BV Brazil, working G0KFN at 0532 on 7.078MHz, and LA3HQ Norway, working G4KHM at 0503UTC.

New reporter **John Share G30KA** in Wirral, logged 3V8BB Tunisia, on this band with 100W around midnight. He agreed to QSY to 3.5MHz to give John a new country there too!

### The 10MHz Band

Up a bit now to the 10MHz band where **Carl Mason GW0VSW**, in Skewen, West Glamorgan has been working. Carl, using an Icom 737A 10W rig and a G5RV antenna reports working YO7UN Romania, at 1602UTC, HB9CRO Nr Bern, Switzerland at 1316, and SP7GV in Lodz, Poland at 1445UTC.

On this band Eric GOKRT lists contacts with DJ8KE Germany, at 0808, OH5LHY Finland, at 2012, and his best QRP DX so far, to NG30 USA at 2323UTC.

### The 14MHz Band

As usual, the 14MHz band seems to see most of our reporters activity. **Don Mclean G3NOF** in Yeovil says in his monthly propagation report that the best time for this band has been from 1700 onwards to Africa and Asia, with the Americas coming in later evening.

Don has worked A92MM Bahrain at 2001UTC, C53HG Gambia, at 1846, KF6FC/KL7 Alaska, at 1734, R1FJZ Franz Josef Land, at 1536, and TI2CC Costa Rica, at 2310UTC using his Kenwood TS-950 transceiver and a TET HB33SP 3-element beam with s.s.b.

**Gordon Foote G7NCR** in Bristol uses a Howes DcRx 14MHz receiver and a loft mounted receive antenna sent a massive 15-page log. He logged VE9MO Canada, working G4SQA at 1924UTC, DA0WCY Germany working G4PZQ at around 1830, VU2AVG India, working F5LKH

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at 1640, YU7YZ Serbia, working G3YCC at 1900, S21YE Bangladesh, working G40JH at 1640, and YU5NR Serbia, working fellow reporter Steve GWOSGL at 1054UTC.

Speaking of Steve Locke GWOSGL, his log this month indicates contacts with DU97RG Philippines, at 1700, HS0/G0HFF Thailand at 1814 (QSL via G0HFF), KG4ZE Guantanamo Bay, at 1837 (QSL via K4SXT), and JT1BG Ulan Bator, Mongolia, at 1708UTC, as well as DK2FY/M (German bicycle mobile!), at 1307, and 5A1A Libya, at 0931 (QSL via LZ2UA), all with 100W s.s.b. and a 7-element beam antenna at 14m.

Another new reporter, **Dave Griffiths GW0JUJ** in Pontypridd reports contacts with his new TH3 beam antenna and a 100W TS-440 rig into JA3AA Japan, at 2037, S92YL Leslie, Sao Tome & Principe Islands, at 1033, 9K20Z Kuwait City at 22.30, and VH3AHY Canada at 1921UTC

Another reporter, s.w.l. **David Henry** in Aberdeen sent a very long list. A small selection include Y10EB Iraqi special call, at 1758, (QSL via Box 55072, Baghdad), 7W5J Algerian special call at 2258, 9G1BJ Ghana at 1928, (QSL via G3XTA) and 4U/V01TED in the Golan Heights, Syria. David uses a Trio R1000 RX and a 20m long wire antenna for this band.

And now to new reporter **David Ian Wright GW0VML** in Wrexham, who, using 100W and a 20m inverted V dipole reports contacts with N18L USA at 1158UTC, R1FJZ Franz Josef Land, at 0748, P39P Cyprus, at 1618, CU3FQ Azores Islands, at 0904, and RA3WJZ Russia, at 1503UTC.

### The 18 & 21MHz Bands

I'll start the 18 and 21MHz band section with **John Heys G3BDQ's** report. John, based in Hastings, says conditions were very poor. He logged

an s.s.b. contact at 300W with XX9GD Macao, at 1358, plus 80W c.w. to Y19CG Iraq at 1402, and FR5DD Reunion Island with a long wire at 1357UTC, while 21MHz gave him an s.s.b. contact with 9J2SZ Zambia at 1342, (QSL via SP8DIP).

Don G3NOF reports from a long list, contacts with A22BW Botswana, at 1633, BV2KI Taiwan, at 1801, J3/N3SIY Grenada, at 2150, (QSL via KF0UI), 5N0GC Nigeria at 1916UTC, VP2MR Montserrat Island at 2130, and FY5FY French Guiana at 1900UTC (QSL via F6EZV).

### The 28MHz Band

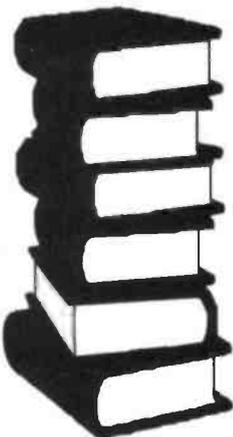
A brief look at the 28MHz band this time. New reporter s.w.l. **Dennis Sheppard** in Earl Shilton using a KW2000 on receive and a 10m dipole at 5m reports various Europeans on the band.

However, Dennis also heard W1SEB USA, and PU2YZP Brazil during the afternoon. These contacts would appear to indicate the presence of 'double hop' sporadic 'E' propagation on 28MHz. John G3BDQ agrees with this scenario - any other observations?

That's it for this time, my grateful thanks go to our growing band of reporters for the vast amounts of information you send me! As usual, reports, information, (and photos please!) to me please by the 15th of each month at the address below: **Leighton Smart GWOLBI, 33 Nant Gwyn, Trelewis, Mid Glamorgan Wales CF46 6DB. Tel: (01443) 411459** (Please mark your envelope 'HF Far & Wide').

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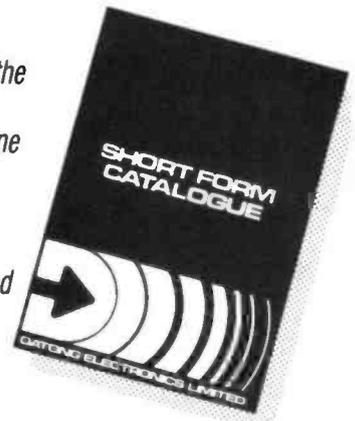
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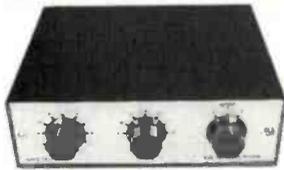
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EF37A	3.50	PCF86	2.50	5U4G	5.75	6H56	4.95	872A	20.00
EF39	2.75	PCF801	2.50	5V4G	4.00	6J5	3.00	931A	25.00
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EF80	1.50	PCL84	2.00	6A96	4.00	6J86C	20.00	5814A	5.00
FR85	1.50	PCL85	2.50	6AK5	1.50	6J86C GE	17.50	5842	12.80
EF86	7.50	PCL86	2.50	6AL5	1.00	6K6GT	3.00	6080	7.50
EF91	2.00	PCL805	2.50	6AM6	2.00	6K7	4.00	6146B GE	15.00
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EL36	4.00	PL504	2.50	6AT6	2.00	6L06/6JEEC	20.00	7581A	15.00
ELL80	25.00	PL508	5.50	6AU5GT	5.00	607	4.00	7586	15.00
EL41	3.50	PL509	6.00	6A36	2.50	6RH/8/6KN8	12.00	7587	23.00
EL81	3.00	PL519	6.00	6AW8A	4.00	6SA7	3.00	7866	15.00
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# BROADCAST ROUND-UP

*Peter Shore brings you the latest programme schedules from around the world together with news of a new short wave transmitter guide.*

Taiwan has been in the news recently as the People's Republic of China fired missiles, apparently as part of military tests, near the island's coast. Tension has been high and the United States has been brought in to the arena as China protested against the visit of the Taiwanese president to the US.

So, it might be worth keeping an ear to the Voice of Free China which broadcasts from Taipei. English can be heard at: 0200-0300 on 15.345, 11.825, 11.74, 9.68, 7.13 and 5.95; 0300-0400 on 15.435, 11.825, 11.74, 9.68 and 5.95; 0700-0800 on 5.95; 1200-1300 on 9.61 and 7.13 and 2200-2300 on 21.72 and 17.75MHz. The European transmission is at 2200UTC.

Also from Taiwan comes the Voice of Asia. It beams to the mainland and includes an English language programme at 1100 for an hour on 7.445MHz.

Meanwhile the mainland Chinese transmit several services towards Taiwan. One is the Voice of Pujiang, believed to be based in Shanghai. It's on the air between 1000 and 1400 on 7.115, 4.95 and 3.28MHz in Mandarin Chinese.

The European service of China Radio International has English at: 2000-2200 on 9.92 and 6.95; 2200-2230 on 3.985 via Switzerland and 2200-2300 on 7.170MHz via Russia

Staying in Asia for the time being with North Korea's Radio Pyongyang which transmits English at: 0000-0050 on 15.13, 13.76 and 11.335; 0400-0450 on 17.765, 15.23 and 15.18; 0600-0650 on 15.23 and 15.18; 0700-0750 on 17.765 and 15.34; 0800-0850 on 15.23 and 15.18; 1100-1150 on 11.335, 9.977 and 6.576; 1300-1350 on 15.43, 15.23, 11.74, 9.64 and 9.345; 1500-1550 on 13.785, 9.977, 9.64 and 9.325; 1700-1750 on 13.785, 9.977, 9.64 and 9.325; 2000-2050 on 9.977, 9.64, 9.345 and 6.576 and 2300-2350 on 13.65 and 11.70MHz.

As a by-product of reaching Canadian troops in Bosnia, Radio Canada International (RCI) has increased its availability to listeners in Europe. If you have access to satellite equipment then try tuning to Eutelsat II F6 at 13° East, as that's the new Hot Bird One satellite - and

the transponder at 11.265GHz. You'll find the RCI audio at 7.20MHz.

Radio Vilnius is now using a new frequency for its weekend English language broadcasts. You should tune to 7.36MHz at 2300 on Saturday and Sunday.

If you would like to listen to the music that beats across Central and West Africa, tune in to Africa No 1 from Gabon. This commercial station is partly owned by a French media group, and in addition to carrying its own programmes, the station hires out its 500kW short wave transmitters to other broadcasters.

All programmes are in French, and it opens at 0500 on 9.58, changing to 17.63 at 0800, 15.475 at 1600 and back to 9.58MHz at 1900 on which it remains until closedown at 2300UTC.

The Ecuadorian religious station, HCJB, has stopped its single sideband transmissions, and is reducing its English language service. The s.s.b. frequencies of 15.54 and 21.455MHz were taken off the air on September 1 although they had been well received in many parts of the world.

Budget cutbacks are to blame. In addition, the 49 metre band frequency of 6.08MHz, used for English from 1330 to 2100UTC, has been dropped.

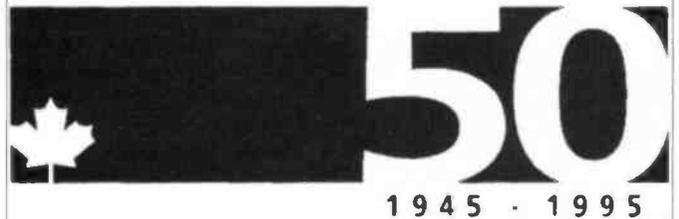
The Voice of the Islamic Republic of Iran has English at: 0030-0130 on 9.022, 7.26, 7.158 and 6.175; 1130-1230 on 17.75, 15.26, 11.93, 11.875, 11.79 and 11.745; 1530-1630 on 17.75, 15.26, 11.875; 1930-2030 on 9.022 and 7.26 and 2130-2230 on 6.175MHz.

The Voice of Armenia in Yerevan might be audible in the UK and Europe. Try tuning to English programmes on Sundays at 0830-0900 on 15.27 and 15.17 or Monday to Friday at 1745-1800 on 11.96, 9.675, 7.48 or 4.81, or daily at 2030-2100 on 11.92MHz.

## Restricted Licence

World Radio Network (WRN) has gained a Restricted Service Licence for 28 days from 29 August 1995. This means that listeners in the London area will be able to tune to the rich mix of international radio

**RCI**  **RADIO CANADA INTERNATIONAL**



**Radio Canada International has increased its availability to listeners in Europe.**

stations that WRN carries.

There will also be explanations about international broadcasting, as well as competitions to tempt listeners. Try tuning in on 107.8MHz to hear WRN.

## Netherlands On-Line

Radio Netherlands has improved its on-line Internet service, improving the design of the station's computerised information pages and speeding up the computer it's based on. There is also a new address:

<http://www/rnw.nl>

If you have access to the Internet, you can skip the schedule details for Radio Netherlands's English service to Europe which is at: 1030-1225 on 9.65 and 6.045 (both via DW sites) and 2030-2225 on 1.386MHz (via Russia). You can also try Astra 1C and the transponder at 10.936GHz, audio subcarriers at 7.74 and 7.92MHz.

## Transmitter Guide

Belgian DXer Ludo Maes has sent me a copy of *TDP SW-95*, a new guide to the world's short wave transmitters. The *TDP SW-95* is a review of which country owns which transmitter, with details of manufacturer, year of installation, and whether it is still in service.

There are 60 pages of data, with tables at the rear of the book including a league table of total transmitter power by country (for example the UK has 17181.5kW whilst Cambodia has 5kW) and a

breakdown of the number of transmitters each major manufacturer has sold. In the country-by-country listing exact geographic co-ordinates are given for transmitter location including a large number of sites in the former Soviet Union.



**Peter Shore says it could be worth keeping an ear out for the Voice of Free China which broadcasts from Taipei.**

The *TDP SW-95* costs £5 including airmail delivery, and can be ordered from Ludo Maes, PO Box 1, 2310 Rijkevorsel, Belgium.

That's all for this month, join me again next month in the same spot in your monthly *PW* for more news from the bands, and news of a new budget priced digital receiver from Grundig. Until then, good listening!

**END**

# BITS & BYTES - COMPUTING IN RADIO

Mike Richards G4WNC brings you all the latest news and views from the computing in radio world.

**M**uch interest has been shown following the various digital signal processing (d.s.p.) features in this column - and there's more to come! The latest news comes from Mike Kerry G4BMK of Grosvenor Software.

Mike's sent me a note to say that he's developed software routines for the Texas DSK so that it can be used with his BMK-Multy for Amtor, Pactor, RTTY and c.w. Mike also reports a few problems with the assembler supplied with the DSK.

The package has poor validation and can produce unpredictable results. By way of a solution Mike has written his own cross assembler that runs on a PC. He is releasing the assembler as shareware and has kindly supplied a copy so it will be included on all future DSP starter disks.

Much of the E-mail I've received has been asking for details of good d.s.p. sites on the Internet. The key sites to watch are: <ftp://tapr.org> /[tapr/SIG/hfsig/upload](ftp://tapr.org) This is the site used by Johan Forrer for uploading new programs. The <ftp://ucsd.edu/hamradio/dsp> site contains mainly older material but is still very interesting.

## Low Cost Connection

Good news at last for all who've been put off the Internet due to the potentially high 'phone bills. Most of the main connection suppliers are busy opening-up what are known as v-PoPs or virtual Points of Presence.

Before the v-PoP, most users made their connection to the Internet by making a 'phone call to their nearest conventional PoP. These PoPs were located around the country to give as many people as possible local access to the Internet.

The disadvantage of course was that Murphy's law makes sure none of the PoPs were within your own local call area! The other disadvantage for the connection supplier was that he had to maintain a number of remote sites located all around the country.

The v-PoPs represent a very neat technical solution to the problems

using the facilities available from modern telecommunications switching techniques. Because all these networks use centralised interconnected processors it's now possible to easily redirect traffic under central control.

In the case of v-PoPs, local phone numbers are allocated so that most of the population can access them with just a local call charge. When these numbers are dialled the switching network recognises that this is a special number and automatically re-routes the call to one of the network supplier's modem sites at no extra charge to the customer. Another advantage of the system is that you should rarely suffer from busy tone as the system will automatically re-route you to the next free PoP.

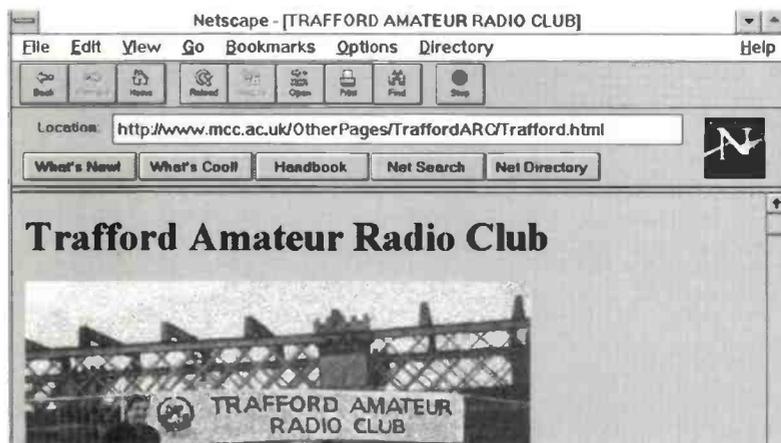
The other development that goes hand-in-hand with this is British Telecom's (BT) revised pricing structure. Not only have the rates been reduced over recent months, but they've just changed to per second charging. This is particularly attractive for the Internet user, but you need to note that there is a 5p minimum charge for any call.

If you restrict your main Internet access times to the weekend you can also take advantage of BT's Weekend rate which gives you local calls at just 1p per minute. You can reduce your costs by a further 5% if you take advantage of BT's Friends and Family offer.

You can take this even further if you normally pay more than about £40 or so per quarter on call charges by taking-up BT's PremierLine. This could add an extra 15% savings making the total 20% so reducing the local call charge to just 0.8p per minute at weekends!

## Internet Applications

I thought you might find it useful if I ran through what I have found to be the best applications that are



Trafford Amateur Radio club Internet page.

available from the Internet. With the vast majority of people using Windows based PCs for Internet access I've concentrated on those applications for this.

Probably the first application that new users seek out is some form of E-mail program. The two main contenders in this area are Eudora (ver 1.44) and WinPmail (ver 2.0). Both programs are equally competent and well tested but in my view WinPmail has the edge with a better range of facilities.

WinPmail is particularly powerful for attaching files to messages and automatically filtering messages to a folder. This is particularly handy if you subscribe to a specialist listserv where you can set-up the mail filter so that all messages from the listserv are automatically filed away in an appropriate folder without out clogging-up the new mail area.

Next on the list of goodies is a news reader and this is an area that's been very poorly served until relatively recently. What you really need is what's known as an off-line news reader. This lets you bulk download messages so you can browse at your leisure without having to stay logged-on to the Internet.

As far as I'm aware, the only shareware off-line reader is Forte' FreeAgent (ver 1.0). This is a really excellent program with a top class interface and range of facilities.

If you want to impress your family and friends you really do need

a World Wide Web browser. This provides an easy to use graphical interface to the Internet.

In my opinion by far the best available World Wide Web browser is Netscape Navigator which is currently at version 1.2 (beta2). For many of us, one of the great benefits of Internet access is the ability to find and retrieve a wide range of top quality software.

One of the main tools for doing this is a good File Transfer Protocol or FTP client. There are several of these available, but one of the best is WS-FTP (ver 95.04.27).

This provides all the important features including clear indication of transfer time, progress and data rate. Searching out the required information can be something of a black art but good Gopher and Archie clients make a good starting point.

The two I use are WSGopher (ver 1.2) and WSArchie (ver Alpha 0.8 ). Both are well tried and have a good interface with all the necessary features.

The home/UK sites for all the programs are listed in Table 1.

## FAX With Slow PCs

One of the most common problems with JVFAX comes from trying to run it on a slow, 286 based PC. Most of the difficulties stem from trying to use the simple comparator interface with a slow 286 processor. In many cases the end result is either

garbage or a system crash as the processor just can't keep up with the demand. Thanks to some tips from readers there are a few things that can be done to minimise the problems.

The most important single change is to adjust the maximum interrupt frequency shown in the main configuration screen. Whilst the default setting is usually 7500Hz, this can be reduced to 3500Hz or less with a markedly lower demand on processor time. But even 386 processors are not trouble free.

The next important change is to limit the number of bits set against the comparator. Here the default setting is 8 but some experimentation should reveal a lower value that will give improved overall performance.

can be lowered to a minimum of two levels which effectively dithers the incoming FAX to just black or white.

### Serial Communications

One of the many problems facing PC users is getting the serial port to work reliably. This problem is particularly troublesome for amateurs as they often depend on the serial port for data signals or maybe to control the transceiver.

Whatever the usage, you can bet the port will be asked to run at 9600baud or faster. As serial port operation is such a widespread problem, I thought I'd attempt to shed some light on the subject with a few tips.

Let's start with getting your serial

your computer's manual you will have noted that the serial ports are numbered from COM 1 through to a maximum of COM 4. However, most computers operate with just two serial ports and the standard settings for these are:

	IRQ	Base Addr
COM 1	4	03F8
COM 2	3	02F8.

When you fit your serial card you'll usually find some on-board jumper or switch settings to select the appropriate IRQ and Base address. Once this has been done, you still have to make sure your software package knows the address and interrupt number of your serial port.

The problem is directly related to the chip that handles the serial communications. This chip is known as a Universal Asynchronous Receiver Transmitter or UART.

This device takes 8bit parallel data and converts it into serial format and vice versa. However, the problem I'm covering occurs when receiving serial data.

Whilst data is arriving the UART takes each bit as it arrives and builds it into an 8bit number in a single byte buffer. Once the byte has been assembled the UART sends out an interrupt signal to the computer's main processor to tell it to collect the data byte.

If the processor doesn't perform this task quickly enough the data will be overwritten by the next data byte so causing a loss of data. It's this slow response from the processor that is responsible for the data loss that many people experience.

Now I'm sure you can see that the faster the serial data speed the more chance there is that data will be lost. The solution comes in the form of a more modern UART that has a 16byte buffer built-in.

By using this buffer, the UART can continue to receive up to 16 more data bytes before any risk of data loss. Now to get down to details, the single buffer UARTs in common use are the 8250 and 16450 devices.

The replacement device is a 16550 UART but even here you need to be careful as not all 16550s are the same. The chip to go for is the National Semiconductor variant which has become the standard. The type number of this device is NS16550AFN - It's usually the most expensive, but it could well be worth spending the extra.

If your existing serial card has an 8250 or 16450 device you can change it yourself providing you are used to working on computer standard double sided circuit boards. However, you may well find that your board has a specialist multi-function chip so, the only answer is to change the board for a modern 16550 based unit.

These are widely available for around £50. If you're not sure whether or not you have the right chip most diagnostic programs will report the type of serial port. The most common diagnostic program is Microsoft's MSD which comes bundled with MSDOS.

That's all the computing news I have for you this month, cheerio for now, keep your letters coming to me Mike Richards G4WNC, 'Bits & Bytes', PO Box 1863, Ringwood, Hants BH24 3XD. CompuServe: 100411, 3444; Internet: mike.richards@bbcnc.org.uk

Table 1

Eudora	<a href="ftp://demon.co.uk:/pub/ibmpc/winsoc/apps/eudora">ftp.demon.co.uk:/pub/ibmpc/winsoc/apps/eudora</a>
WinPmail	<a href="micros.hensa.ac.uk/mirrors/simtel/win3/mail/winpm201.zip">micros.hensa.ac.uk/mirrors/simtel/win3/mail/winpm201.zip</a>
Forte FreeAgent	<a href="http://www.forteinc.com/forte">http://www.forteinc.com/forte</a>
Netscape	<a href="netscape.com/pub">netscape.com/pub</a> or <a href="sunsite.doc.ic.ac.uk/computing/information-systems/www/Netscapes/">sunsite.doc.ic.ac.uk/computing/information-systems/www/Netscapes/</a>
WS-FTP	<a href="ftp://demon.co.uk:/pub/ibmpc/winsoc/apps/WSFTP">ftp.demon.co.uk:/pub/ibmpc/winsoc/apps/WSFTP</a>
WS-ARCHIE	<a href="ftp://demon.co.uk:/pub/ibmpc/winsoc/apps/wsarchie">ftp.demon.co.uk:/pub/ibmpc/winsoc/apps/wsarchie</a>

If these changes don't resolve the problems, you may be experiencing a conflict with the extended memory manager. The precise reason for this interaction is not too clear, but on some computers this program interferes with JVFX's timing routines.

port to be recognised by the computer. Plugging-in a serial card is just the start as you also need to let the computer know where to find it.

There are two key items the computer needs to know - the base address and the interrupt number. The base address is the hexadecimal

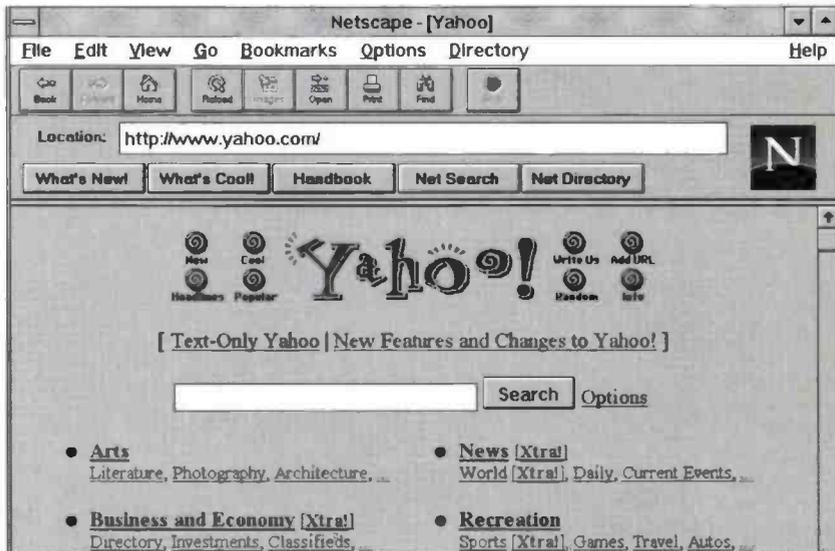
This is usually done via the configuration screen of the program. You need to make sure that no other cards are using the same base address or interrupt as your serial card.

If you do encounter a conflict you will find that both devices either won't work at all or will suffer all manner of seemingly random errors. A common device for conflicts with serial ports is the modern sound-card.

I would strongly recommend you settle the conflict by altering the sound card not the serial port. I say this because most programs that use serial ports expect to find them assigned to one of the standard interrupts and base addresses.

Even if you have your serial port correctly

configured there is still room for problems especially if you are using speeds of 9600baud or greater. This is particularly true if you are also running your software under Windows. At these high communication speeds you may well find you suffer a loss of characters or that your software reports data errors.



#### Yahoo Internet search site.

It can also be useful to make a couple of changes to minimise JVFX's use of the, often limited, hard disk capacity on 286 machines. The first saving comes from disabling the quicksave option from the miscellaneous settings in the configuration screen. The second is to change the number of grey levels. The default setting is 255, but this

address where the computer will go to read and write the data signal. The interrupt on the other hand is a communications line that the serial port uses to let the computer know that it needs attention. The good news is there are standard settings for both these parameters - you just have to choose the right ones!

If you've already taken a look at

# SCENE USA

*This quarter, Ed Taylor WT3U reports on Field Day. This is a popular institution both in Europe and across the Atlantic, but there are differences!*

## It's Field Day Again!

Think back to earlier this year, to the month of May. Consider the state of mind evident in the people who run your local radio club. Were they cool, calm, collected?

Did they discuss matters rationally and make reasoned decisions? Not likely! They were probably in an increasing state of panic, seeking equipment and volunteers. Why? Because it was getting close to Field Day time.

A typical British group would be planning for one or more of these four weekends: National Field Day (c.w.); VHF Field Day; Low Power Field Day (CW) and SSB Field Day.

The v.h.f. event is a multi-mode contest which also includes u.h.f. The other three are single-mode and involve the h.f. bands. Participants are likely to include not just British stations, but also thousands set-up under in a similar way from all over Europe.

Most amateurs who have any connection with a club have been roped in to help during a Field Day. This is because the skills required

are not just those of a good operator.

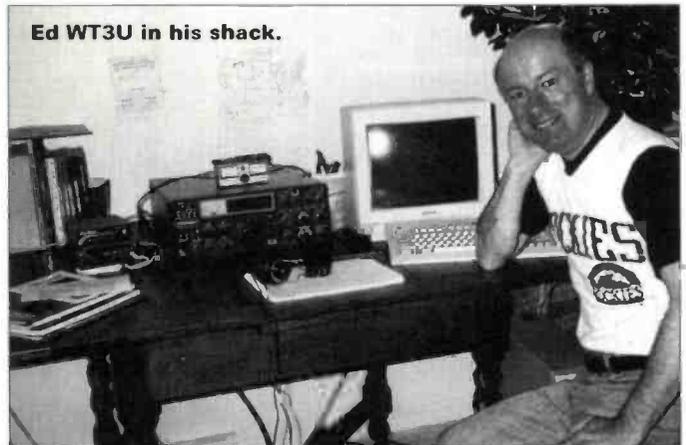
You also need mechanics, cooks, drivers, labourers and general assistants. Anyone who owns a caravan will be very popular over certain weekends!

The idea of Field Day is that you try to set-up a station (perhaps several, according to the rules) in 'emergency conditions'.

Starting with an empty field, a group is required to erect antennas and get the stations going without using mains power or any permanent structures. It's not just a question of getting on the bands and making a few contacts, the events last for 24 hours, so you have to arrange operating shifts, decide tactics for band usage and so on.

The point is this: the weekend is made interesting and worthwhile by requiring entrants to participate in a contest once they have got everything working.

Needless to say, many things can go wrong during a Field Day. The power supply (often a generator) can go wrong. At the Flight Refuelling club, near Bourneouth, Dorset, where I took part for many



Ed WT3U in his shack.

years, we had a spectacular diesel generator failure one year.

A piston decided not to participate in the contest any more, and made an exit out of the side of the crankcase. This did not increase our score, and caused a couple of rude words (maybe more!).

The weather can make life very difficult. Antennas may be blown over, and rain can find its way into any operating position. There is sometimes a danger of lightning, particularly for entrants in Southern Europe.

## Bigger In The USA

As you might expect, everything is bigger here in the USA! It doesn't mean to say that everything is better, although most people would agree that an increase in interest from British clubs would be very good news!

The main difference is that the US has just one Field Day each year, and it incorporates most of the features of all of the British four. Unsurprisingly, the number of participants is huge.

Just to give you a few statistics, more than 2000 groups enter, involving over 36,000 people. About one and a half million QSOs are made, two thirds on s.s.b. and the rest mainly on c.w.

All bands can be used, apart from 10, 18, 24MHz and the higher u.h.f. bands. Contacts are also made by packet and satellite.

So, how does this compare with a British Field Day? It's hard to say, because of the different formats.

However, the concentration of effort into one weekend seems to grab the attention of most clubs. Instead of deciding to enter one or two of the available Field Days (as most British clubs do), Americans

can concentrate on just one, and put all their effort into that.

As the interests of radio amateurs become more diverse, it may be worth considering a single Field Day for Europe. Then a group can ask its members for help on a single weekend a year, without diluting their efforts in all the other activities they would like to take part in throughout the summer.

There have been unsuccessful efforts to coordinate dates in Europe and North America, so that portable stations would have the opportunity to contact each other across the Atlantic. This is an issue which might be worth bringing up again in a few years' time, as the sunspot cycle brings better conditions.

## Entry Categories

A nice feature of the US Field Day is that you can enter in any one of dozens of entry categories. Because the contest is oriented towards emergency operation, several categories call for different types of temporary power supplies.

The categories include generators and battery power. Then you get bonuses for 'natural' power sources, such as solar, wind or alcohol!

Unlike our own Field Days, antennas are not restricted in type or number, and maximum licensed power may be used. Bonuses are available for lower power levels down to 5W. Interestingly, there are categories which allow various numbers of simultaneous transmitters to be used.

A welcome feature is that Novice and Technician licensees are encouraged by the scoring system to enter, which is not a feature of our own events. Of course, the licence categories in the USA are different,



**Fig. 1: A general view of some of the Field Day antennas at NOAUS, showing a 50MHz 6-element quad, a 4-element mono-bander for 14MHz and a 22-element array for 144MHz.**



**Fig. 2: Luca VE2WKR prepares satellite equipment, note that it's all mounted on the back of his car!**

but it would be nice to have more encouragement for newcomers in the UK.

### Local Group

I decided to find out how one of the local groups organised themselves here in Colorado. Several in the Denver area go out to various sites, with differing expectations of what they might achieve.

Some treat the weekend as another contest in their calendar, and try to get the best score in their state or perhaps nationwide. Some go for a weekend out in the countryside, operating whenever they can.

The group I visited were specifically set-up to provide emergency communications in the event of any sort of disaster. Like RAYNET groups in the UK, they practice throughout the year in exercises, during sporting events and so on. They rejoice in the unexciting (but accurate) name of Amateur Radio Emergency Service District 22, or ARES 22.

Under the leadership of **Al Cooley**, and using his callsign, **NOAUS**, ARES 22 operated from Daniels Park. This is a wooded area, located about 20 miles south of Denver.

It would be unusual for a UK station to use a place like this, which was so open and available to the public. Anyone could stop and wander around the campers and tents, which were in a small clearing at the side of the road.

### Site Ideal

Al explained that they found the site ideal. Part of the group's aim is to educate and inform the general public about amateur radio, and particularly its role in emergency communication.

In fact, the rules of the contest give extra bonuses for encouraging access. There's even more points for such things as running an

information booth, and for publicity in newspapers, radio and television.

We are pretty bad in the UK at explaining our hobby to the world at large. Most people think that we have meaningless conversations about trivial topics with the folks down the road.

Of course, we do! But that's only a small part of it. Amateur radio has the potential to teach something about electronics, geography, international relations and many other subjects.

It's ideal for anyone to take up at any age, but particularly for youngsters. Why don't we say so whenever we can?

We could do much more by following the lead of our American friends. We could put up signs directing visitors to Field Days and other radio activities.

We could ensure that someone is always available to explain what's happening. We could make up a leaflet with some basic facts, showing how to get more information.

I feel strongly that Amateur Radio will gradually cease to exist, to everybody's detriment, if the public is indifferent because of ignorance. We somehow need to boost our image, and find ways of informing the world about ourselves.

### On The Air

Apart from the publicity aspect, the participation of ARES 22 in Field Day could be said to meet a combination of two goals: first, to use whatever means reasonably necessary to put their three stations on the air and secondly, to train newcomers in the setting up of an emergency station. Thus it was fairly low key, and was by no stretch of the imagination an attempt to reach a high scoring position.

As you can see from **Fig. 1**, they use a selection of antennas. Because operation was limited to three simultaneous transmitters without amplifiers, the amount of co-



**Fig. 3: Jim WAOCML operates one of the NOAUS stations, c.w. is his preferred mode.**

interference was not great and it was unnecessary to achieve large station separation.

At the start of the 24 hours, operation was mainly on h.f., with s.s.b. and c.w. stations achieving good rates on 7 and 14MHz.

The relatively relaxed nature of the group's efforts was illustrated by the arrival of Luca VE2WKR (**Fig. 2**). He was late because he had been skiing on Saturday, and found the snow conditions good (very unusual in June!)

Nobody was perturbed. Luca proceeded to set up satellite equipment, gaining bonus points for his contacts.

### Different Bands And Modes

As time went by, different bands and modes were used. Use of 1.8 and 3.5MHz (and, to some extent, 7 and even 14MHz) is limited during the summer, because of the high static noise. A continuous S9 level is something we rarely encounter in the UK, but in North America it's common.

For a different reason, v.h.f. and u.h.f. do not feature heavily in less populated regions. There are just a limited number of amateurs to contact, and distances are generally too great.

The nearest large city to Denver is 600km away, which means that you need an opening to build up large numbers of QSDs. However, contacts are allowed via packet relays, so this is a popular way of achieving greater distances.

By the end of Field Day, a respectable number of QSDs had been made (over 1000). The leaders in the entry category had probably made more than 5000, but nobody minded.

Al Cooley said he was very pleased with the way that ARES 22 had performed. He was particularly happy that the Novices had not only learnt a lot, but wanted to do more next year.

No disasters took place, but I

had the feeling that problems were just calmly dealt with as they happened. Maybe I'll report next year on a club which really tries to win. It will be a different atmosphere, but there is much to be said for a laid-back approach!

### Comments And Suggestions

Thank you to those who have written with comments and suggestions. For example **Wyn GW8AWT** has proposed showing questions from the RAE along with those set for various US licence exams, so that we can compare standards.

Perhaps I will go one stage further, and devote a whole column to the US exams, with examples. There seems to be a lot of interest in this topic.

And **John G4POF**, asks when I will be on the h.f. bands to make contacts. In answer, I operate mainly 14MHz c.w., and look for G stations at the weekends.

Conditions have not been good from here to Europe during the summer. But we can hope for improvement this winter.

I will certainly be on the air (along with thousands of others) for the two most popular contests in the world. The CQ WW DX contests.

The contests are organised by the American magazine *CQ*, and are taking place on October 28-29 (s.s.b.) and November 25-26 (c.w.), on 1.8, 3.5, 7, 14, 21 and 28MHz.

**That's all from me for this quarter, so until next time, 73 and keep writing with your news and views to me Ed Taylor WT3U, PO Box 261304, Denver, Colorado 80226, USA. Deadline time for the next edition of 'Scene USA' (January PW) is the middle of October.**

**END**

# FOCAL POINT

*This time Andy Emmerson G8PTH has an update on the future of ATV on 430MHz, together with Internet and repeater news.*

It seems that it's not just in Europe that ATV operation on 430MHz is threatened. From the States, Henry Ruh KB9FO the publisher of *ATV Quarterly magazine* writes: "Also big trouble here. MACC (Midwest Association of Co-ordinating Councils) have passed a resolution to eliminate ATV from 430MHz. WBOCMC told us of this at Dayton. I have copy of their minutes, a pile of 'red tape' from stem to stern. Time to get on my political horse and burn these people!"

As I discussed last time, banning amateur television from 430MHz may actually not be a bad thing. One solution would be to transmit a very narrow band vestigial side band (v.s.b.) a.m. signal, with the advantage that a 1MHz-wide signal would get through the DX better than a wider band one.

But if this debate stimulates ATVers into going digital and adapting/adopting MPEG2 techniques, then we could possibly have ATV anyplace, anytime, anywhere as the slogan goes. It would raise the profile of ATV far above packet and all other modes.

In fact I'd even go so far as to say that if the ATVers can't be bothered, they don't deserve to keep their ATV privileges. I don't expect many other amateurs would share my viewpoint but they must admit that playing around with the same techniques that amateurs in the States were using back in the 1940s is scarcely the cutting edge now, far less true 'self training in the art of radio communication'.

## Internet ATV

Want to view the ATV WWW Home Pages? An ATV group called LISATS based in Florida has one you can view by typing

<http://www.digital.net/HamRadio>  
Tom O'Hara (TOMSMB@aol.com)

writes: "For the Internet Surfers among your ATV group, they might want to check out the ATV home pages on the World Wide Web. I expect that the number of active ATV groups who create and add their own home page will increase and might be interesting to put on the ATV repeaters. The address for the ATN group here in Southern

California is:  
<http://www.realm.net/~jpawluk/KB6MMF.html>

The keeper of the page is John Pawluk KB6MMF and his Internet mail address is: [jpawluk@realm.net](mailto:jpawluk@realm.net) if you wish to communicate.

This home page is also linked to other groups so you only need to call up one or the other: Atlanta ATV: <http://www.mindspring.com/~rwf/aatn.htm> or Houston ATV: <http://www.stevens.com>

Tom continues: "Any additional ATV groups who create and add their own home page, please pass on the address to me so that I can spread the word. I think the Internet is a great way for ATV groups to exchange info rapidly.

Also include the call and Internet address of your groups main contact. I'll keep a list for distribution".

Many thanks for that report Tom.

ATN S. California. KB6MMF  
ATC Columbus OH WA8RMC  
HATS Houston TX N5JXO  
BATC England G1FEF  
Amateur Television Quarterly Magazine KB9FO

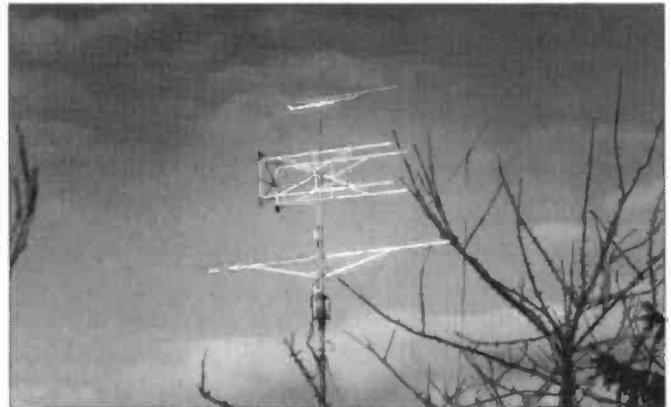
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## On The Air

Pressure from the Civil Aviation Authority (CAA) has caused some restrictions to 1270MHz amateur television activities, mainly because a couple of our repeaters were interfering with aeronautical radar systems which share our band.

The GB3GV repeater (Markfield, near Leicester) is still off the air but GB3UD (near Stoke-on-Trent) is back on 1318.5MHz with the approval of the man at Clee Hill Radar. All other operational units are active except GB3VV in Weymouth which has been closed down by the operator due to lack of support (it was for sale at the BATC's Coventry rally).

The Radio Society of Great Britain (RSGB) is trying to set up an unofficial meeting with the CAA to sort out the present log jam of licence applications affecting GB3VX, GB3AF and GB3AT. Clearly



Here's a shot of the antenna system belonging to Ian Vincent G4MLY, secretary of the Kent Television Group. Top of the pole is a 44-element loop Yagi for 13cm; the receive converter is mounted here as well. Below are four 28-element loop yagis for 1296/1270MHz operation. All these are home-made, also the four-way power splitter. Closest to ground is the 13-element Tonna antenna for 144MHz. The whole system is mounted on a 28ft tall ex-Government mast and well guyed with 16 steel ropes.

our priorities are not those of the CAA! The licence for GB3KT may also appear before long.

Up at 10GHz the RSGB has received a note from the Radiocommunications Authority proposing the withdrawal of some spectrum in this band, in order that it may be re-allocated for 'Radio Local Loop' services. This would enable

uncommon.

An input to one repeater is automatically transmitted on the output of all eight repeaters (unless already occupied with local traffic). Input is on 434MHz at all sites, with output variously on 900 or 1200MHz.

The highest repeater is at 8,500 feet on Mount Podice. This particular site also has on the antenna tower a remote control television camera which can be panned round through 360°.

Already several forest fires have been spotted and notified in this way. Inter-site links are on 900MHz, 1.2GHz, 2.4 or 10GHz. The longest link path is 174 miles.

A user benefit is that all repeaters have a sound input on 146.43MHz, allowing viewers without ATV transmitters to join in round table discussions and comment on transmissions. To simplify maintenance, all transmitter and receiver modules, regardless of manufacturer, are fitted with DB9 sub-D miniature connectors for audio, video, control line and power.

Pin assignments are fully standardised and in this way any module can be changed in seconds. Previously maintenance was a tedious procedure and valuable minutes could be wasted fiddling with wiring. Now, as ATN's technical wizard Mike Collis WA6SVT says, "You can plug and play without delay!"

**That's all for this month so, until next time keep those letters coming to me Andy Emmerson G8PTH at 71 Falcutt Way, Northampton NN2 8PH.**

newcomer telephone companies to provide service to homes without the need to lay wires.

The BATC has briefed the RSGB why this should be resisted; in practice the risk of interference would be quite small, given the directional antennas in use. The primary user of the lower 10GHz band is the Ministry of Defence and the Home Office (mainly police users). The prospect of increased commercial exploitation of the band may not suit these existing users either.

## American Repeater

The Amateur Television Network (ATN) now covers all of the south-western USA. It now directly supports seven repeaters, with another one affiliated. The land surface covered is large and thanks to full interlinking, contacts from Los Angeles, California to Las Vegas, Nevada (about 270 miles) are not

**END**

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**DSP 59 Plus**, new, boxed, instruction book, upgrade Eprom chip inserted plus power supply 12V 100mA, £275. Yaesu interface system FIF 232C for FRG100s, FRG9600s, new, unused, boxed, £50. W. Rigby, Lancs. Tel: (01524) 833506 answerphone.

**FT-736R 144/430MHz** with 70MHz option, as new, condition unmarked, in original box with Yaesu MD-1 microphone, £1150. Tel: W. Midlands 0121-704 2393.

**Heathkit SW7800** complete with manuals, etc., 120V a.c., £75. Metal boxed auto Xfrmr (110/230V) available, £20. Ideal first RX for beginner to s.w.l. All plus carriage or

collect. Tel: Surrey (01428) 713326 or FAX: (01428) 717167.

**Icom 735 h.f. transceiver**, boxed with mic. and manual, excellent condition, £595 o.n.o. Mizuho 28MHz hand-held QRP transceiver, s.s.b./c.w. plus four crystals, £125 o.n.o. Pete, Epsom. Tel: 0181-393 9115.

**Icom IC-28H 45W**, t/squelch, £130. Two of BNDS (LPM 144-3-100) linears with pre-amps, £150 each. Yaesu FT-23R hand-held, t/squelch, new, 12V NiCads, speaker/mic., charger, dry cell case, £130. Tel: Surrey 0181-397 7823.

**Kenwood 78E dual-band hand-held**, one year old, £375. 144MHz 5-element beam plus balun, excellent condition, £25. G3PYP, 33 Mead Park, Atworth, Melksham, Wiltshire SN12 8JS. Tel: (01225) 708816.

**Kenwood TR-751E 144MHz**, £485. TR-851E 430MHz, £495. Icom IC-745 h.f., £825. Elevator G500A, unused, £240. All have original cartons and manuals. Diamond DP-CP5, five band h.f. antenna, £150. Rotator G400, £125. Malcom, Ruislip. Tel: (01895) 676919.

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**Roberts R808** stereo headphones, leather carry case, battery, p.s.u., s.w. 1.711-29.999MHz, f.m. 87.5-108MHz, m.w., l.w., antenna socket, socket external power, ordered in error, new, £68. J. Bonfils, 47 Forest Park, Leixlip, Co. Kildare, Ireland.

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**Yaesu FRG-7700** general coverage receiver, 150kHz to 30MHz. FRT-7700 tuner. Vertical mobile antenna and dipole antenna with coax cable, price complete, £320 o.n.o. Ian, Hants. Tel: (01489) 571629 evenings.

**Yaesu FT-7** mobile h.f. transceiver, 3.5-28MHz, £250 o.n.o. Alinco DJF1E v.h.f. f.m. hand-held TX 144-146, RX 108-174, £170 o.n.o. Tel: Cleveland (01287) 637902.

**Yaesu FT-9900DC**, £1250. Daiwa RS-40XII 40A, £120. TS-790T, £1250. Kenwood MC60A, £55. Cushcraft 17B2, boxed, £100. Kent brass key, £25. 1000SOX rotator, £150. Icom SP-20, £70. All boxed. Tel: West Midlands (01384) 370695.

## Wanted

**Handbook and case for Trio 2300** plus any information. Mike, Bournemouth. Tel: (01202) 433775.

**Help! Has anyone got info on PC control** for JRC NRD535 in particular 25-way 'D' cable pin connections? All costs met. Thanks. Dave Jones, 50 New Dock Street, Llanelli, Dyfed SA15 2MB.

**High gain ferrite rod antennas**, must be half inch in diameter, no more or less, must be six inches long or more. Peter Tankard, Sheffield. Tel: 0114-234 3030 anytime.

**IC type TDS 1047** for repair of car radio, have tried all trade outlets to no avail. So fellow readers, w.h.y.? Any expenses reimbursed. Tel: Essex (01702) 395968.

**Microwave modules**, 144-28MHz transverter. G4KIN, Liverpool. Tel: 0151-531 1305.

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Station**

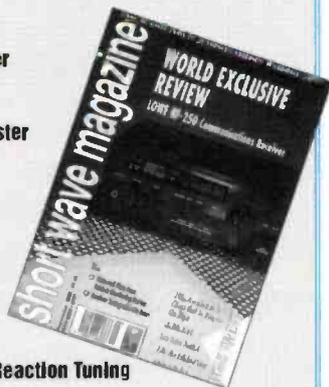
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- ★ Stand up the Real Listener
- ★ How The Wartime 'Y' Stations Operated
- ★ International Short Wave Broadcasting
- ★ Mods. To Saisho R7000
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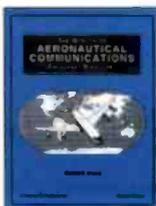
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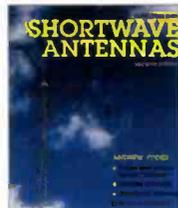
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# ENDNOTES

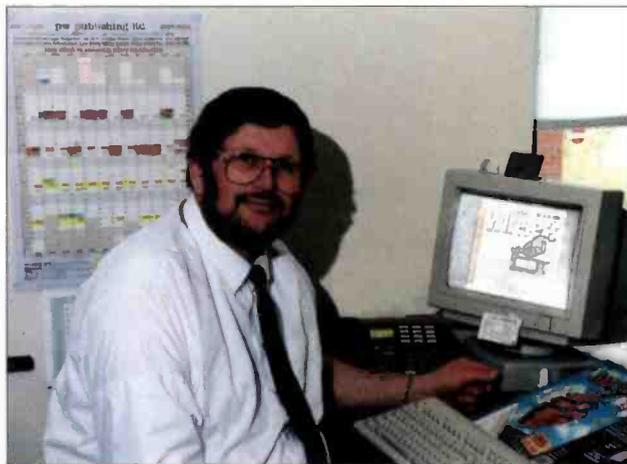
The receiving side of the amateur radio hobby is not often the focus of attention in *PW*, so this month the Editorial team hope we've redressed that situation! In particular, I feel that Ian Poole's article 'Design Dilemmas' will go a long way in helping anyone thinking of designing their own receiver for the first time.

Dave Howes G4KQH has come up trumps with the *PW* Daventry receiver design. Anyone wishing to learn and apply the various techniques behind receiver development, can enjoy themselves and get on (to my favourite band!) 7MHz to good advantage with minimal outlay.

Regular readers of *PW*'s 'Bargain Basement' section will also notice we've now included some more advice and requirements for intending advertisers. The notice is also aimed at helping everyone to get the best service out of a popular reader service. A large amount of amateur radio equipment 'circulates' within the hobby and this helps many a beginner. It also helps you to raise ready cash to re-invest! So, please take care in composing you advert and follow the guidelines to help us to provide the best reader service possible.

Next month, in our November issue we've got our 'DX Special' theme and there's some fascinating tales waiting to be told! So, until then, good reading and good listening!

*Rob G3XFD*



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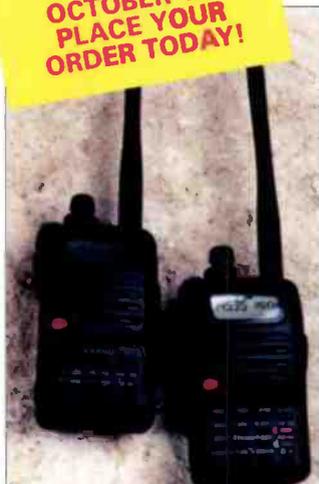
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### Build The 'High Flyer' Antenna

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### Tex's Tour

*PW*'s Tex Swann G1TEX has been on holiday with the FT-10R hand-held transceiver and describes his experiences while reviewing two interesting alternatives from Yaesu.

### Smart Mobile!

Regular *PW* author Leighton Smart GWOLBI goes mobile in the Welsh Valleys with a friend to review the FT-8500 v.h.f./u.h.f. transceiver.



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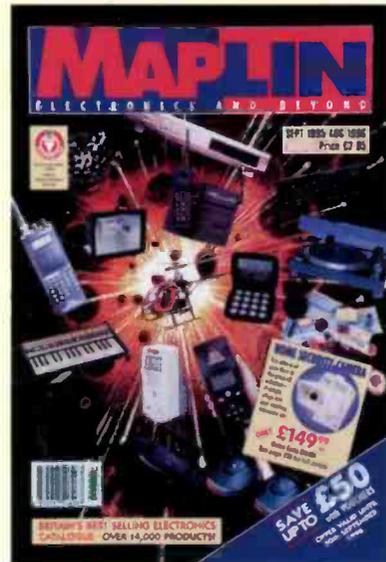
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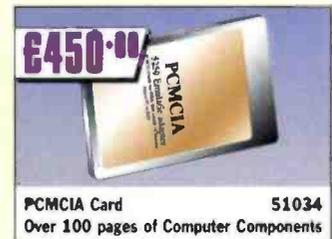
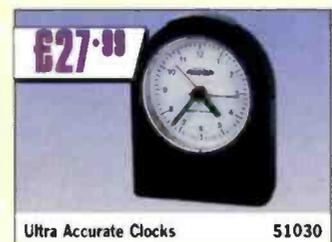
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