

# RADIO

# TODAY

**NOW WE ARE FIVE!**

**Birthday surprise –  
exclusive first review inside**

**FREE!  
32 PAGE  
SATELLITE TV  
SUPPLEMENT**

**HAPPY  
BIRTHDAY  
HAM  
RADIO  
TODAY  
FIVE TODAY**

**Peter the First Syndrome**

**Understanding frequency synthesis**

**FT711 & FT73 reviewed – /M or /P for 70cms?**

**Build our 20 Amp PSU**

# For Tomorrow's Radio Technology TODAY

## BASE STATIONS

**Good News for FT767 owners. Kenwood users take note!**

FT767GX MK2/RWC

**NEW**



ICOM IC735

### IMPROVED YAESU FT767 RWC/MK2 HF-UHF BASE STATION

We are pleased to announce that we have now improved the synthesizer (see reviews) leading to better dynamic range by up to 20dB which now puts this transceiver in a class of its own! This modification is only available from RWC and is fitted FREE to all New units sold by us, or we will modify any existing unit for £59.50 inc. return carriage.

FT767 MK2/RWC COMPLETE TOP CLASS BASE STATION (EX. VHF-UHF)	£1449.00
FT767 MK2/RWC COMPLETE TOP CLASS BASE STATION (EX. VHF-UHF) WITH 2M FITTED	£1610.00
FT757 MK2 NEW IMPROVED HF TRANSCEIVER	£895.00
<b>FT726R MULTIMODE BASE STATION WITH 2MTRS. (SPECIAL PRICE)</b>	<b>£799.00</b>
ICOM IC735 SUPER MINI HF ALL BAND TRANSCEIVER	£892.50
ICOM IC275E 2MTR 25W BASE STATION, C/W AC PSU	£949.00
<b>NEW ICOM IC575 6M 10W BASE STATION, 26-56 MHZ RECEIVER TX10 AND 6M</b>	<b>£949.00</b>

Many more Makes and Models in stock. Please enquire.



## HANDHELDS

**NEW**

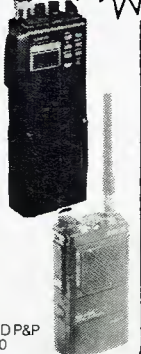
* = Extended RX coverage available, call for details.	
YAESU FT727R 2.5W (5W) DUAL BANDER C/W CHRGR	£395.00
*YAESU FT23R/FNB10 2.5W (5W) 2MTRS C/W CHRGR	£249.00
*YAESU FT73R/FNB10 2.5W (5W) 70CM CHRGR	£259.00
ICOM IC02E QUALITY 2.5W (5W) BP3 C/W CHRGR	£225.00
*ICOM MICRO 2E MINI 2.5W 2MTR C/W CHRGR	£195.00
CTE1600 (VY SIM. IC2E) 2.5W 2MTR C/W CHRGR	£165.00
KENPRO KT400EE 2.5W 70CM C/W CHRGR	£199.00
*KENPRO KT200EE 2.5W (5W) 2MTR LCD C/W CHRGR	£199.00
KENWOOD/TRIO TH21E 2W 2MTRS. (WHILE STOCKS LAST)	£139.00

<b>PORTABLES</b>	
FT690R/MK2 2.5W MULTIMODE. JOIN IN THE FUN!	£399.00
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FT290R/MK2 2.5W MULTIMODE. IMPROVED RECEIVER	£395.00
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<b>MOBILES</b>	
*YAESU FT211E 45W 2MTR NEW SUPER MOBILE FREE SUN 5/8 MOBILE ANTENNA C/W SO239 G/MOUNT	£299.00
*ICOM IC28E 25W SUPER MINI MOBILE FREE SUN 5/8 SO239 GUTTERMOUND ASSY+EXT LOUDSPEAKER	£359.00

NEW LICENCEES CALL FOR SPECIAL DEALS

INSURED P&P  
£10



## SCANNERS

YAESU FRG9600/RWC



### FRG 9600

We supply the Yaesu FRG 9600 modified receiver to Government departments and professional users. We offer more options and facilities than any other company. We transform the basic unit by improving sensitivity and adding extra bands. No other scanner has this many options and modes available. Call now for much more information. Overseas dealer required for our kit.

Modified Yaesu receivers, NOBODY can tune 'em like WE can!	
YAESU FRG9600 RWC/MK1 60-905MHZ IMPROVED RECEIVER	£465.00
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YAESU FRG9600 RWC/MK3 100KHZ-950MHZ MULTIMODE	£595.00
<b>NEW YAESU FRG9600 RWC/MK5 100KHZ-950MHZ ACTIVE F/END</b>	<b>£625.00 NEW</b>
YAESU FRG9600 MK3/AH7000/G5RV/P4AC AC PSU COMPLETE 100KHZ-950MHZ ALL BAND ALL MODE RECEIVING STATION	£699.00
ICOM ICR7000 25-2GHZ ALL MODE SUPER RECEIVER	£857.00
ICOM ICR7000/AH7000 ABOVE WITH MATCHING DISCONE	£945.00
UNIDEN-BEARCAT UBC100XL SUPER H-HELD C/W NCDS PSU	£219.00
UNIDEN-BEARCAT UBC175XL SUPER DESK-TOP C/W PSU	£199.00
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REGENCY MX7000. SAME COVERAGE, SAME MAKE AS AOR2002	£399.00
FDK AIR BAND HANDHELD THUMBWHEEL MINI C/W NCDS PSU	£139.00
FDK AS ABOVE COVERAGE 140-173.00MHZ FM BANDS	£139.00
MANY MORE MAKES AND MODELS IN STOCK. PLEASE CALL FOR DETAILS.	
INSURED P&P £10 ON SCANNERS.	

<b>SHORT WAVE RECEIVERS</b>	
YAESU FRG8800 SHORT WAVE ALL MODE 100KHZ-30MHZ	£572.50
<b>YAESU FRG8800/FRV8800 AS ABOVE WITH VHF CONVERTER</b>	<b>£659.00</b>
ICOM ICR71 100KHZ-30MHZ A TOP CLASS RECEIVER	£738.00

## NEW PRODUCTS

**NEW**

### INTERNATIONAL MODEL 877R AIR-BAND RECEIVERS

This new tuneable receiver covers 52-174 Mhz as well as CB in three bands and is a cost-effective alternative to handheld scanners. The receiver is fitted with a Helical antenna and has good performance for a radio with this coverage. It is ideal for monitoring Air Band, the two-metre and PMR/Marine bands as well as Band 2 FM Broadcast. A squelch control is also provided. Two versions are currently available:

Model 877R, for use with Dry cells.	£39.50
Model 877R, c/w nicads and charger.	£49.50

DEALERS CALL FOR TRADE PRICES P&P £2.50



**INTRODUCTORY OFFER**

## RAYCOM PRODUCTS

**NEW**

### NEW ICOM TYPE COMPATIBLE NICAD PACKS, EMPTY CELL CASES AND DESK TOP CHARGER

A new range of professional Heavy Duty long life nicad packs, imported from the USA, available exclusively at RWC.

<b>10AF 10V 800 MAH LONG LIFE, ICOM EQUIV BP5/8</b>	£55.00
<b>12AF 12V 600 MAH LONG LIFE, ICOM EQUIVALENT BP7</b>	£52.50

(Both above units for use in ICOM BC30/60 OR RAYCOM NC580)  
**MT1 EMPTY Cell case** for self assembly of up to 10x Nicads for a post effective replacement for packs such as BP3 etc, there is ample room for a DC jack, c/w instructions £8.50. **AA NICADS** tagged 1.2V 500mA Nicad cells for above £1.60. **NC580** Desk-Top charger for all Icom type Nicads above 400mA, two charging positions 50mA & 80mA 14hr charge £39.50 Trade and Dealer enquiries welcome. Call for more details.

P&P £2.50 per order

**Business radio users call now!**



## ANTENNAS & ACCESSORIES

ICOM AH7000 SUPER DISCONE 25-1300MHZ INC POST	£79.00
NEW RAYCOM AIR BAND DISCONE 118-170 MHZ 8 ELEMENTS	£12.50
RAYCOM DISCONE 60-600 MHZ 8 ELEMENTS SO239 SOCKET	£27.50
SUN MOBILE 5/8 SO239 C/W SO239 MOULDED LEAD/G/MOUNT	£22.50
G5RV 1/2 SIZE HF MULTIBAND HF ANTENNA (INC POST)	£15.00
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G5KW/W3DZ2 7.1MHZ TRAP DIPOLE ASSY. SO239/COAX FED	£23.50
G5KW/W3DZ2 7.1MHZ MULTIBAND AS ABOVE. BALANCED FED	£22.50
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Hundreds of other types of base and mobile antennas in stock JAYBEAM, TONNA, MET, SUN, HOXIN, POPULAR MODELS IN STOCK.

NEW RWC are now appointed dealers for the West Midlands for Butternut, Cushcraft and MFJ products. Please ask for details of the range currently available.

## MOD KITS

### RWC MOD KITS, ANNOUNCEMENT

We apologize to customers waiting for various mod kits, supplies of crystals and components are inconsistent and demand for kits varies, so there is occasionally a delay before we can send your kit of parts, please be patient, Rome was NOT built in a DAY! Kits still available: SANYO LC7137 SYNTHESIZER CB-10MTRS, LCL/DNT CB-10MTRS, FT75GX MK1 FAST TUNING MOD, STORNO COM713 PMR-2MTR KIT, PYE A200 E-BAND 50MHZ KIT. call for technical details, prices and delivery.

## WANTED DEAD OR ALIVE

Your used equipment. We also offer a very comprehensive range of guaranteed used equipment, e.g. Amateur band transceivers, SW receivers, scanning receivers, PMR and accessories. As far as we are aware we are the only company in the UK to offer a bi-weekly computerized used equipment list and special offers list.

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Most other products advertised in this magazine are available at RWC.

**★ WE WILL MATCH OR IMPROVE ANY GENUINE ADVERTISED PRICE ★**

STOP PRESS... RWC will be moving shortly to new and larger premises. Please keep in touch for further details.



# HAM RADIO TODAY CONTENTS

VOLUME 6 NO 1 JANUARY 1988

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**Published by:**  
Argus Specialist  
Publications Ltd  
**Distributed by**  
SM Distribution Ltd  
**Printed by:**  
Adlard & Son Ltd, The Garden  
City Press, Letchworth, Herts  
SG6 1JS  
**Design by**  
ASP Design Studio  
**Editorial and Advertising  
address:**  
Ham Radio Today  
ASP Ltd  
1 Golden Square  
London W1R 3AB  
Tel: 01 437 0626  
*(please mark your letter for the  
appropriate department)*

**Subscriptions and back issues:**  
Ham Radio Today Subscription  
Dept, Infonet Ltd, 5 River Park  
Estate, Berkhamsted, Herts  
HP4 1HL  
Tel: (04427) 76661/4  
**Subscription rates:**  
UK £15.60, Europe £20.10,  
Middle East £20.30, USA \$30,  
Far East £22.00, Rest of world  
£20.60. Airmail rates on request

**ARGUS PRESS GROUP** Member of the  
Audit Bureau of Circulation **ABC**

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## TODAY

### REGULAR COLUMNS

<b>LETTERS</b> .....	14
Replies to RAYNET criticism	
<b>LISTENING ON</b> .....	16
The HRT guide to winter listening	
<b>RADIO TODAY</b> .....	20
Radio news and a look back at Leicester	
<b>MORSE FORUM</b> .....	41
A look at the world of pump handles and bugs	
<b>RADIO TOMORROW</b> .....	44
How best to fill the gap between now and Christmas	

### CONSTRUCTION

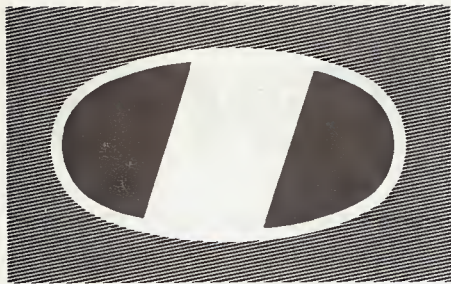
<b>TOP BAND BOX</b> .....	46
Part of of the HRT transceiver project	
<b>DELTA LOOPS</b> .....	49
A simple aerial for better DX	
<b>QRO HOMEBREW PSU</b> .....	55
A high current DC supply for base station rigs	

### REVIEWS

<b>YAESU 70cms DOUBLE ACT</b> .....	28
Mobile or portable for 70cms?	
<b>JST-125 REVIEW</b> .....	36
First UK review of this HF newcomer	

### FEATURES

<b>BEGINNER'S GUIDE TO FREQUENCY SYNTHESIS</b> .....	22
A painless introduction to modern techniques	
<b>PETER THE FIRST SYNDROME</b> .....	25
Another rare location is put on the map	
<b>THE GREAT WELSH ROPE TRICK</b> .....	53
The final episode in this major drama!	
<b>NEW LOWER UK SUBSCRIPTION RATES</b> .....	13
<b>FREE READERS' ADS</b> .....	59
<b>OVERSEAS SUBSCRIPTION RATES</b> .....	61
<b>CLASSIFIED ADS</b> .....	63
<b>ADS INDEX</b> .....	66



# ICOM

# Communications

## VHF/UHF FM Handportables

If you want a handheld with exceptional features quality built to last and a wide variety of interchangeable accessories, take a look at the ICOM range of FM transceivers, all ICOM handportables come with a nicad battery pack, AC wall charger, flexible antenna and wrist strap.

### Micro 2E/4E

These new micro-sized 2 metre and 70 centimetre handportables give the performance and reliability you've come to expect from ICOM. Measuring only 148 x 50 x 30 the Micro fits in your pocket as easily as a cassette tape. The Micro 2E/4E features an up/down tuning system for quick frequency adjustments, 10 programmable memories, a top panel LCD readout, up to 2.5 watts of output (optional).

### IC-2E 2 metre Thumbwheel Handportable

This popular handheld from ICOM is still available. For those amateurs who require a straightforward and effective FM transceiver the IC-2E takes some beating. Frequency selection is by means of thumbwheel switches (with 5Khz up switch) simplex or duplex facility. Power output is 1.5 watts or low 150 milliwatts (2.5 watts possible with BP5A battery pack).

### IC-02E/04E 2 metre and 70cm Keypad Handportable

These direct entry CPU controlled handhelds utilise a 16 button keypad allowing easy access to frequencies, memories and scan functions. Ten memories store frequency and offset, these handhelds have an LCD readout and power output is 2.5 watts or low 0.5 watt. 5 watts is possible with the IC-BP7 battery pack or external 13.8v DC.

### IC-12E 23cm Handportable

Similar in design and style to the 02E/04E this 1296Mhz handheld utilises ICOM's experience in GHZ technology, gained by the excellent IC-1271E base station. Power output is 1 watt from the standard BP3 nicad pack, external 13.8v DC powering is available to the top panel jack. With the growing number of repeaters on 23cm. The IC-12E makes it an ideal band for rag chew contacts.

ALSO AVAILABLE FOR ICOM HANDPORTABLES ARE A LARGE RANGE OF OPTIONAL EXTRAS INCLUDING A VARIETY OF RECHARGEABLE NICAD POWER PACKS, DRY CELL BATTERY PACKS, DESK CHARGERS, HEADSET AND BOOM MIC, LEATHERETTE CASES AND MOBILE MOUNTING BRACKETS.

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## Datapost



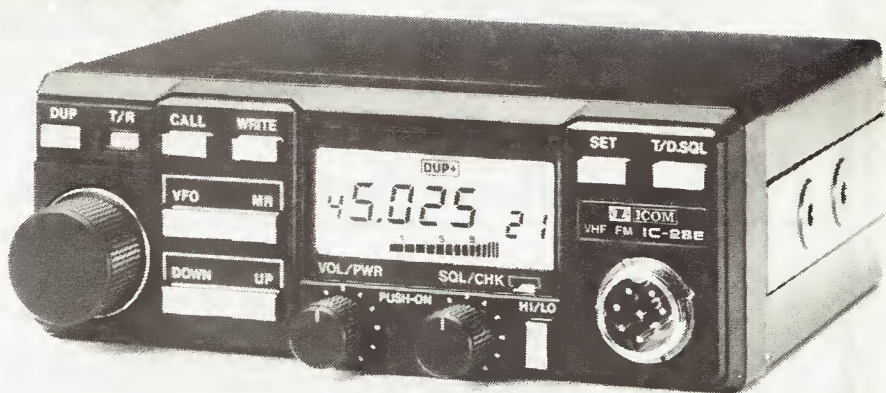
## IC-28E, 2m FM Mini-mobile.

This 2 metre band transceiver is just 140mm (W) x 50mm (H) x 133mm (D) and will fit nearly anywhere in your vehicle or shack. Power output is 25 watts or 5 watts low power and is supplied complete with an internal loudspeaker.

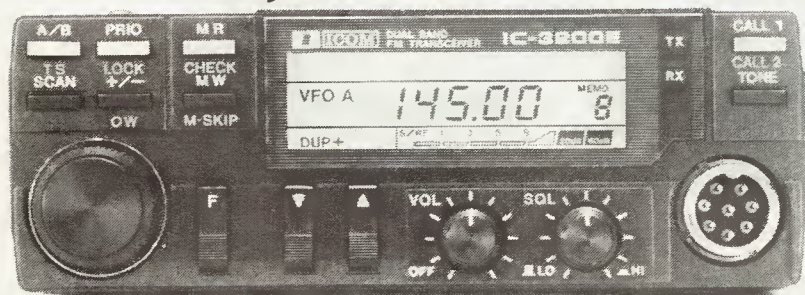
The large front panel LCD readout is designed for wide angle viewing with an automatic dimmer circuit to control the back lighting of the display for day or night operation.

The front layout is very simple, all the controls are easy to select making mobile operation safe. The IC-28E contains 21 memory channels with duplex and memory skip functions. All memories and frequencies can be scanned by using the HM-15 microphone provided. Also available is the IC-28H with the same features but with a 45 watt output power.

Options include IC-PS45 13.8v 8A power supply, SP8 and SP10 external speakers, HS15 flexible mobile microphone and PTT switchbox.



## IC-3200E, Dual-band transceiver.



If you are a newly licensed or just undecided about which band to first operate, then the ICOM IC-3200E is just the answer. This is a dual-band (144-146/430-440MHz) F.M. transceiver ideally suited for the mobile operator. The IC-3200E has a built in duplexer and can operate on one antenna for both VHF and UHF, and with 25 watts of

output power on both bands (the low power can be adjusted from 1 to 10 watts) you can never be far from a contact whether simplex or 2m/70cm repeater.

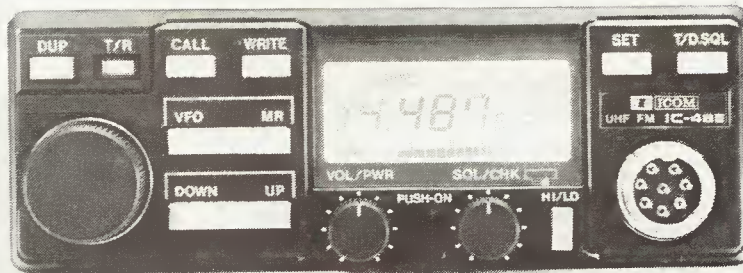
The IC-3200E employs a function key for low priority operations to simplify the front panel and a new LCD display which is easy to read in bright sunlight, 10 memory channels will show operating frequencies simplex or duplex, and four scanning systems memory, band, program and priority scan.

## IC-48E, 70cm. FM Mini-mobile.

This 70cm. band transceiver is so small that it will fit almost anywhere in your vehicle or shack. Power output is 25 watts or 5 watts low, the IC-48E is supplied complete with an internal loud-speaker. The large front panel LCD readout is designed for wide-angle viewing with an automatic dimmer circuit to control the back lighting of the display for day or night operating. The front panel of the IC-48E is straightforward to make mobile operation safe and easy. The IC-48E contains 21 memory channels with duplex and memory skip functions. All memories and frequencies can be scanned by using the HM15 hand mic provided.

IC-48E options include the PS45 13.8V. 8 amp power supply, SP8 and SP10 external loudspeakers, HS15/SB mobile flexible microphone and PTT switchbox.

Why not try 70 cms as a serious alternative to the 2 metre band, you might be amazed at what can be achieved. For more information contact us or your local ICOM dealer.



Telephone us free-of-charge on:

**HELPLINE 0800-521145.**

— Mon-Fri 09.00-13.00 and 1400-17.30 —

This is strictly a helpline for obtaining information about or ordering ICOM equipment. We regret this service cannot be used by dealers or for repair enquiries and parts orders. Thank you.

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# South Midlands C

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## INTRODUCING THE FT736R FROM YAESU



THE VERY LATEST IN VHF/UHF BASE STATIONS FROM YAESU. 2m & 70cms AS STANDARD (25W O/P) 6m & 23cms OPTIONAL (10W O/P). 100 MEMORIES & FULL DUPLEX AS STANDARD.  
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FT270RH*	2m FM Mobile 45w output	£249.00 E/D
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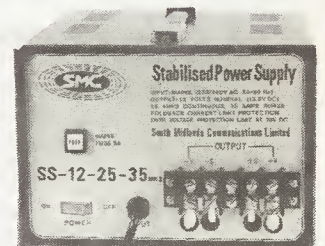
\*All these items have a 3 month warranty. All other items have a 12 month warranty. N = New; E/D = Ex Demo.  
Please add £2.65 postage & packing for non radio items.

#### NEW NEW NEW



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LOW COST  
TRANSCEIVER  
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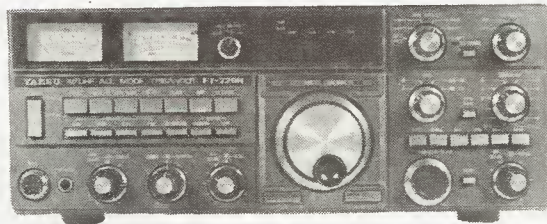
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### £699 inc. VAT



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### COMPARE THE COMPETITION

The FT726R 2m base station, at only £699, is £240 cheaper than its nearest rival. Add 70cms at £199, you now have 2m & 70cms capability for less than the oppositions 2m bases.

**WITH 12 MONTH WARRANTY AND FREE FINANCE AVAILABLE**

### BEST VALUE ON 2m, 70cms & 23cms

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**FT2311R**  
**£499.00 inc.**

- ★ 45(35)\*(10)\$/5(4)\*(1 or 5)\$ WRF OUTPUT
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- ★ Large green easy to read LCD
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- ★ Priority channel monitoring
- ★ CCC/w Hand mic and mobile mounting bracket

THE **FT211RH**  
THE **FT711RH**  
and the **NEW FT2311R**

**FT211RH**  
and **FT711RH**  
**£349.00 inc.**



\*FT711RH \$FT2311R

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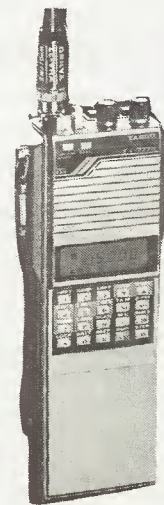


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- ★ Diecast solid chassis
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- ★ One touch operation

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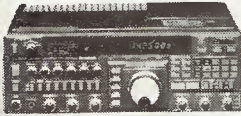
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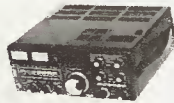
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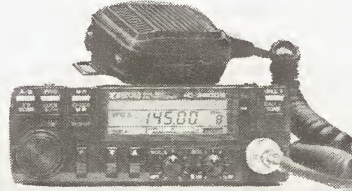
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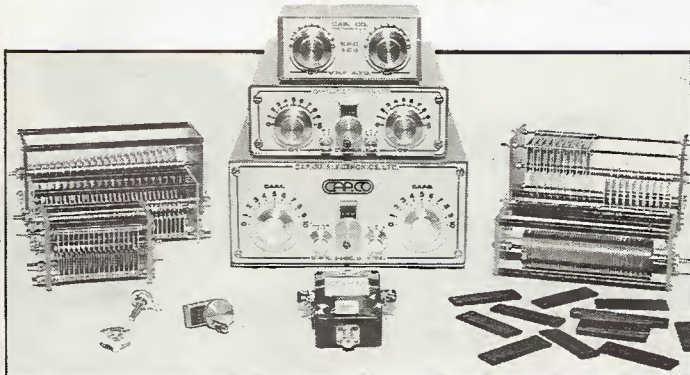
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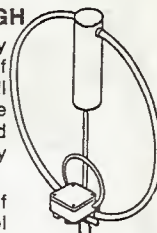
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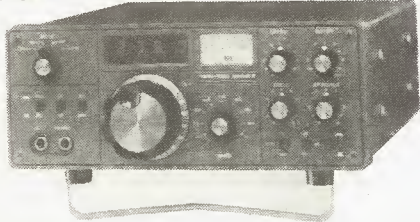
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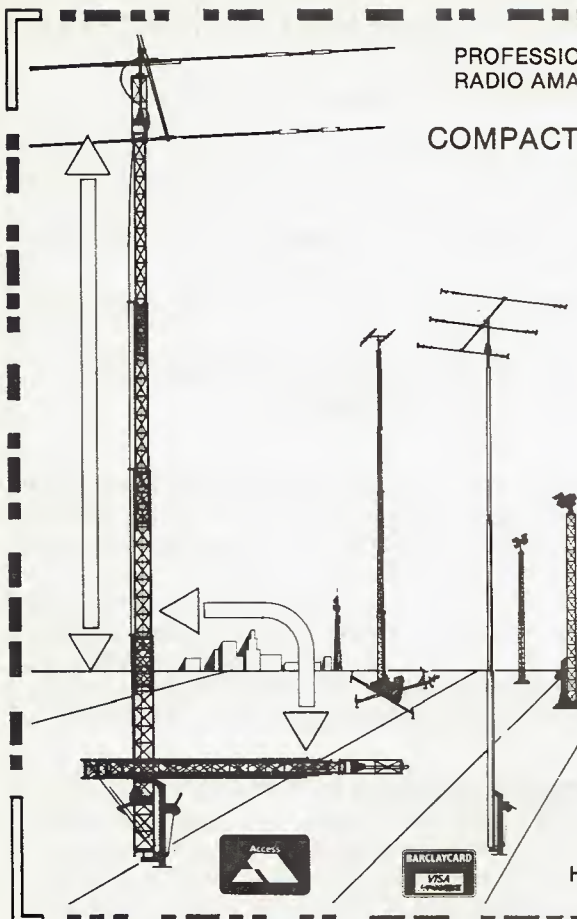
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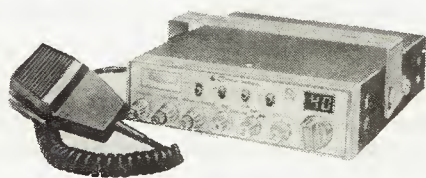
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# LETTERS

## An Open Reply from RAYNET

Dear HRT, I was interested to read the 'Open Letter to RAYNET' from G1LXP in your November column, but have to admit to being surprised by both the tone content of his remarks.

Around seven per cent of all licensed amateurs in the UK are members of RAYNET, the Radio Amateurs' Emergency Network, and in 1986 its members gave over 66,000 man hours in voluntary service to the community by providing communication services for St John, Red Cross, the Police and the County Emergency Planning Service. During this time, their efforts have resulted on many occasions in the saving of life. They have given of their own time and expertise (and money!) during emergencies such as the winter snows in Scotland, where many communities were cut off, and during disasters such as the Zeebrugge Ferry tragedy.

I would ask all radio amateurs to help volunteers by bearing in mind just a few simple do's and don'ts. Please try to stay clear of the frequencies identified in the band plan as being used by RAYNET, particularly at weekends. You might not hear any local activity, but your signal might well mask the power portable operator in the next county who desperately needs to contact other members of his team.

RAYNET members of course do not have an exclusive right to the designated frequencies to the exclusion of everyone else, but I believe that they do deserve the courtesy of being left the frequency clear for the needs of their volunteer service and

training. This give and take normally happens in a spirit of cooperation with most reasonable amateurs, but it is all too easy to get annoyed when someone takes over 'your' frequency. Bear in mind too that some of the equipment being used is provided out of public funds and can only be crystallised on the recognised RAYNET frequencies. Above all, don't criticise from the outside. Make contact with your local group, and go along and meet them. You will find that they are quite reasonable human beings after all!

And finally, just a brief comment on the part of the letter which refers to 'self-opinionated neo-fascists' (who 'play tin-pot soldiers and futile war games.' Hmmm. I do wonder about Mr Follet's motivation!

**Geoff Griffiths G3STG**  
**RSGB RAYNET Committee**

*We don't think that anyone would doubt that sterling work is often done by RAYNET and its members on behalf of a variety of organisations. Having said that however, it is important that everyone associated with RAYNET should bear in mind that they are, in effect, ambassadors for the organisation as a whole and should act accordingly.*

*As you rightly say in your letter, RAYNET members do not have exclusive rights to any frequency - they are able to operate only because of the courtesy shown to them by other operators. The tragedy is that when incidents such as those mentioned by James Follet occur, they undermine both the good name of RAYNET and the goodwill which ensures its continuing existence.*

## Raynet — a reply

Dear HRT, It is unfortunate that your correspondent James Follett has had two very bad experiences of the Raynet organisation.

When realising that Raynet exists to help the local council to set up communications under emergency conditions, such as major floods, factory explosions and the similar, there are few amateurs who would not spring into action if help was requested, Raynet or not. In order to coordinate such an activity, it is necessary to form teams of those who are prepared to learn the techniques and procedures required to handle the radio traffic throughout. This requires

team leaders, and unfortunately, as in all walks of life, there are those who take these responsibilities over seriously. When they do so, they seem to take an authority which is not called for. It is perhaps challenging to realise that the only authority that a member of Raynet has is that of a radio operator — and no more.

The frequencies which are allocated to Raynet should not be seen to be closed to all but Raynet. On the contrary, it is important that no interest group, regardless of enthusiasm, should consider any frequency to be their own preserve. However, if there is an emergency or an organised exercise, a specific frequency needs to

be used, so that others may congregate there. No one in his right mind would broadcast over beacons or satellite downlinks — at least not knowingly! Certainly in South-West Herts, we (and I am no more than an ordinary prole) attend to the normal courtesies before opening up on any frequency.

There are problems engendered by some members of Raynet which have caused discomfort to those who are not part of the team. To judge all by their activities is akin to condemning all football supporters by the actions of a few hooligans.

**Keith Hamlyn, G4WQB**

## Editorial hypocrisy?

Dear HRT, In your November Editorial you criticised amateur radio equipment manufacturers for their high priced equipment accusing them of slowly strangling the hobby by presenting unacceptable financial barriers to prospective newcomers. Surely this is half truth and a hypocritical stance for a magazine that now devotes a large proportion of its content to reviewing the very equipment you're blaming for the demise of the hobby!

I'm sure that many newcomers to the hobby look towards magazines such as HRT for direction and to develop their knowledge and skills in such a diverse and fascinating subject such as radio. It's hardly then surprising that many are misled into believing that in amateur radio proficiency and fulfilment are qualities that are directly proportioned to the capital outlay on commercially manufactured equipment.

By contrast how refreshing it is to note that in various club publications, such as SPRAT, inventiveness and ingenuity are still very much alive as indeed they were in the earlier issues of HRT (remember the Omega, DSB2, Minisynth, etc, etc).

What a pity that HRT can't blow its content back towards the constructional and experimental aspect of the hobby which after all was the original purpose of the amateur licence.

**Ron Taylor, G4GXO (ex G8GJJ, DA2TM)**

*When that editorial was written, we wondered how long it would be before somebody made exactly these points. Well, we look at all the gear we can, and we're always very keen to review*



cheap gear, when we can find it! We still do publish as many good constructional articles as we can (if you saw the amount of work that goes in to editing them, you'd be surprised!). We're always interested in looking at prospective projects, so if you or your club have anything you think we might be interested in, don't be shy, get in touch with us - and remember that unlike club publications, we can pay you for your trouble.

### CW and class B

Dear HRT, I feel compelled to attempt an answer to Mr M Allen's (G4XMH) question of 'what is happening in British amateur radio?' printed in the recent October issue of HRT.

Firstly to answer his point concerning 50MHz; I was under the impression that it was opened to class B licensees due to initial lack of activity and interest by class A operators. I would suggest that any DX contacts made by Class B operators on the 50MHz band would in fact give a taste of the real DX menu available on the HF bands and subsequently encourage the class B operator practising CW to take the test, not give him an easy option as M Allen suggests.

Secondly, Mr M Allen appears to question the use of CW by class B licensees on any band. I feel this point is a case of 'sour grapes,' as with his 1984 callsign he missed the opportunity of being able to practice and use CW 'live on the air' as a class B licensee.

Mr M Allen surely fails to see the advantages of practising and using CW 'live on the air,' such advantages as confidence building and expenses of practices and procedures surrounding a good CW QSO with fellow class B operators and the many friendly and helpful class As. Would Mr Allen suggest learning to drive a car by playing on slot machines and computer race games?

Mr M Allen then goes on to suggest that the standard of some examiners carrying out the RSGB

morse tests leaves much to be desired, I find this a slur on those tested and subsequently licensed under the present RSGB system. No matter how we learn CW, Mr Allen we all have to reach the same standards in order to pass the test.

To conclude, it is people like M Allen who are encouraging an 'us the them' attitude and quite frankly ruining the hobby. I suggest Mr Allen could 'cross the pond' on his ego alone, never mind the DX bands.  
John Livesley, G1ARI

### 11 metre magic?

Dear HRT, My first ever radio contact was by CB (as many other hams I'm sure!). After a few months I realised the 'wallyism' and decided to buy a shortwave receiver. As I tuned around the bands I came across 11 metres SSB. After listening for some time I realised that this was nothing like legal CB FM.

On the band I heard nets, very decent QSOs and remarkable DX, so off I went to the shops. After asking about, I found these radios were illegal. I wrote to the RSGB to see if it was able to obtain a licence for this band and I was told this was impossible.

So I still have to listen to this very good band — far better than some of the ham bands! Please could someone tell me why these radios are illegal and have a listen to 11 metre USB — you will find it interesting!  
Neil Flaulker, G??? (exam in December)

All property is theft, especially frequency allocations — you're always depriving someone else. But the bandspace has to be allocated to someone to prevent chaos, though they may not make that much use of it. Illegal CB on 11 metres exists by treading on other people's toes, whatever its other merits.

### 5A in '49

Dear HRT, Stan Crabtree's article 'Operating in 5A Land' in the October issue evoked memories of an era slightly earlier than that described.

In 1949 I was serving in the Army at Barce in Cyrenaica and was operating with a colleague (Len Early) under the call sign MD1A. There were few amateurs in Libya at that time, I recall MD1B and MD1C in Benghazi or El Adem and MT2E in Tripoli.

The main event that comes to mind during that time was the receipt of a letter from the licensing authority (then based in Egypt) stating that the country prefix had been changed and we were henceforth to operate under the call sign MO1A. So we printed new QSL cards and carried on only to receive another letter a month or so later stating that it had all been a mistake and we should revert to our original call MD1A.

So, scattered around the world amongst the older ham fraternity are a number of QSL cards bearing the call MO1A, a call sign which owed its existence only to an administrative blunder!  
Victor Brown, Cirencester

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# Listening On...

to hear, as transmitters in the USSR — now relay those within the country itself. Lots of news about how the 'bandits' are being defeated, and the advantages of socialism for the populace.

## Australia

Radio Australia, based in Melbourne, is one of the favourite stations of most SWLs. A friendly live presentation style with lots of music and one of the best news services in the world, with much emphasis on happenings in the Pacific area. Radio Australia also broadcasts 'Talkback,' a programme of interest to SWLs and DXers on Sundays at 0710, 0910 and 1710 GMT, which always ends with an up-to-date propagation forecast. On every other day propagation reports are broadcast at 0825, 1625 and 2025.

*Winter schedules are upon us on the broadcast bands — so it's time to settle down and get DXing. There's plenty there if you know where to look!*

One of the reasons for taking up short wave broadcast listening, as opposed to listening to amateurs, is to find out a lot more about distant countries. With this in mind, the SWL is often disappointed, as he or she is bombarded with propaganda broadcasts and not learning a lot about the big wide world except which countries have the most money to spend on high power transmitters.

Most of these propaganda broadcasters emanate from Europe, and eastern Europe in particular, so in this *Listening On* we take a look at those broadcasters outside Europe which have programmes in English and which can be heard with some degree of reliability here in Britain. Most DXers will also get more of a thrill listening to stations from the other side of the world, rather than one from across the backyard in Europe, but it is a happy coincidence that many of these have far more interesting programmes as well.

At the time of writing (mid-October) broadcast stations are about to change to their winter frequencies, so the frequency listings will be accurate, in most cases, for several months. As always, it is not a fully exhaustive list. There are some countries, such as Uganda, that have a defunct overseas broadcasting service, but which can nevertheless still be heard in English on short wave fairly regularly, since they utilise the tropical bands for their home

services, and there are other countries (eg Malaysia) that have external services which are only rarely heard in Europe.

## Afghanistan

Whatever you may think of the Soviet occupation of this country, it has certainly made the programmes of Radio Afghanistan, Kabul easier



## Bangladesh

Radio Bangladesh has a small overseas service, mainly intended for Bengalis abroad, especially in Britain. Most programmes are therefore in Bengali, but with some news broadcasts in English, and a lot of music.

## Brazil

Radio Nacional do Brasil (it calls itself that even in English) features a lot of Latin American samba and rumba music, rarely heard elsewhere (except on the tropical bands) as well as the usual fare of news, economic talks and so on.



## Canada

Another favourite with most SWLs, Radio Canada International has programmes covering every possible facet of life in Canada. News, politics, sport (lots about Canadian ice hockey), features about the Arctic and the Eskimos, cookery, a programme called 'DX Digest,' which includes loggings made in North America are just some of the topics covered. An unnecessarily complicated transmission schedule, with different transmissions at weekends, sometimes makes it hard to keep track of, though.

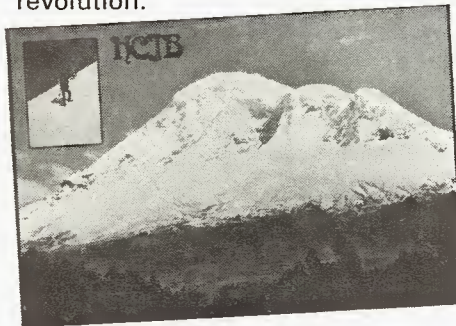
## China

Radio Beijing has toned down the political content of their broadcasts considerably since the days when all broadcasts started with quotations from Mao's Little Red Book. Now programmes concentrate more on China's growing development and contacts with the rest of the world, Chinese history and culture, and lots of Chinese music.

## Cuba

Radio Havana Cuba broadcasts mainly for the USA, but has an

evening programme for Europe too. Like Radio Afghanistan, some broadcasts are relayed by transmitters in the USSR. A lot of recent history programmes, comparing life now with that prior to the revolution.



## Ecuador

Radio Station HCJB in Quito (aka 'The Voice of the Andes') is basically a religious broadcaster, but does also have news programmes, and broadcasts features about life in the remote villages of Ecuador, illustrated with plenty of Andean pipe music.

## Egypt

Radio Cairo is perhaps not the most lively of international broadcasters, though the occasional feature on ancient Egypt can be interesting for budding amateur Egyptologists. A good objective news service.

## India

All India Radio broadcasts mainly Indian film score music — incredibly popular in India itself and with ex-patriates alike. Their news service is good, up to date and covers events in all of South Asia — especially Sri Lanka — as well as India itself.

## Iran

The Voice of the Islamic Republic of Iran devotes most of its daily hour-long programme in English to predictable matters: vitriolic attacks on Iraq and Saddam Hussein in particular, and the USA doesn't escape unscathed either. You can also hear extracts from the Koran and their translation in English.

## Israel

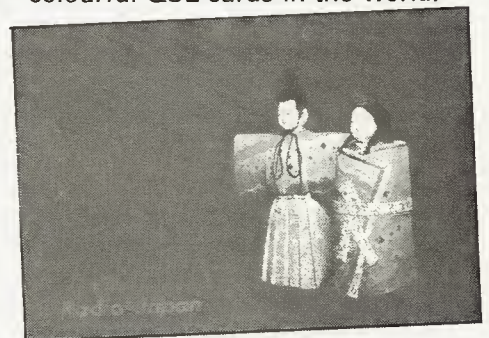
Kol-Yisrael, or The Voice of Israel, devotes a lot of air time to news of the Middle East situation, as may be expected, with plenty of interviews with politicians. Their



programmes are not as 'dry' as this may suggest though, their style of presentation is lively and feature programmes following the news can be on almost any subject. Some are even lightly humorous.

## Japan

Radio Japan, the Overseas Broadcasting Service of NHK, is notoriously difficult to hear in Europe, except when relayed by their station in Gabon, West Africa. Japan's tremendous industrial development features largely in their programmes, but the more traditional Japanese culture is not forgotten either. Radio Japan also has some of the best and most colourful QSL cards in the world.



## North Korea

Radio Pyongyang today sounds rather like Radio Peking at the height of the cultural revolution. Most of its output is dedicated to the glorification of The Great Leader, Comrade Kim Il Sung, but there are occasional interesting features on, for example, the Korean traditional fishing industry.

## South Korea

Radio Korea, in Seoul, will be a good station to listen to for 'from the horse's mouth' reports from the Olympic Games later this year. Until then, programmes are mainly about industry, technology and high finance.

## Kuwait

Radio Kuwait is slightly

different from most of the others listed here inasmuch as their English programmes are really short wave relays of a transmission intended mainly for foreigners working in Kuwait. There is therefore a surprisingly large amount of western pop music, but with a good news service reporting in considerable detail what has been happening in Kuwait.

### Nigeria

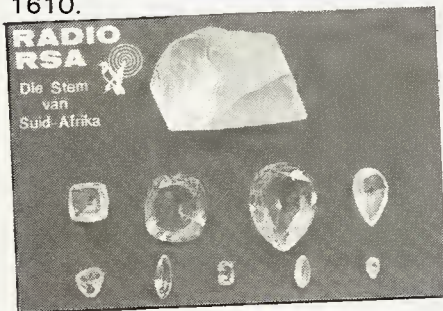
The Voice of Nigeria is sometimes difficult to hear for weeks or months at a time due to transmitter problems, but when it is working properly, reception is often excellent. Apart from news, commentaries and reviews of Nigerian newspapers, much of the Voice of Nigeria's output is given over to 'highlife' and 'ju-ju' music, rarely heard other than on short wave. Well worth a listen.

### Pakistan

Like Radio Bangladesh, Radio Pakistan broadcasts mainly to expatriates living in Britain. Thus much of their output is of Pakistani music and in Urdu, but with news bulletins, comment and an unusual dictation-speed news service (presumably intended for newspaper editors) in English.

### Seychelles

Often quite difficult to hear, as they use quite low power transmitters and do not beam specifically at Europe, FEBA Radio (standing for Far East Broadcasting Association) is basically a religious broadcaster. Most programmes are pre-recorded in the USA or Britain, and most of their output is in Asian and African languages; but they do have their own production studios both in the UK and in the Seychelles, and there is an English news bulletin at 1600-1610.



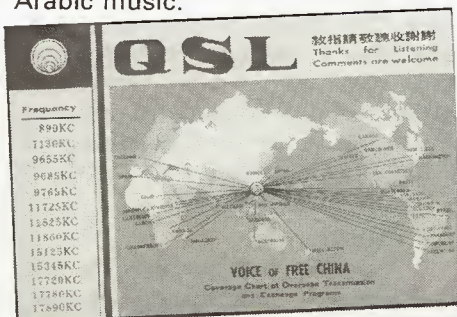
### South Africa

Radio RSA (standing for Republic of South Africa) broad-

casts for several hours a day in English, and reception is generally excellent. Their 'Africa Today' programme covers politics, entertainment, sport, the arts etc and often deals with, for example, the apartheid question with considerable frankness. Their letterbox programme, 'PO Box 4559' sounds as if it is entirely unscripted and is presented in a very light-hearted, even humorous nature.

### Syria

Radio Damascus is very well received thanks to some new 500kW transmitters commissioned a few years ago. Good news of the Middle East area, and plenty of Arabic music.



### Taiwan

The Voice of Free China broadcasts not only from Taipei but also from the transmitters of WYFR in Florida and thus can now be quite well received, whereas in the past it was a most difficult station to hear. Lots of popular Chinese commercial music, quite unlike that heard on Radio Beijing, and news and comment on how The Taiwanese government sees the China question.

### Turkey

Broadcasting from Ankara, the Voice of Turkey has an informal, friendly style of presentation. They feature a lot of pop and disco sounds as well as popular Turkish music (quite different from Arabic music). Their news and commentaries focus mainly on relations with Greece over the Aegean, and the Cyprus question.

### United Arab Emirates

United Arab Emirates Radio from Dubai is the Radio 3 of the short wave broadcasters. Apart from the news and the weekly mail-bag programme, their programmes are almost exclusively high-brow, consisting of discourses from learned professors of theology on

comparative religion, interpretations of the Holy Koran, ancient Arabic literature and so on. Having said this, their production is extremely professional, and for anyone with a serious interest in the Arab world this station is a must. For the average SWL — 15 minutes is about the largest recommended single dose!

### USA

A number of different stations broadcasting from the USA can be heard on short wave, from the interminable ball game commentaries of the American Forces Radio & TV Service (AFRTS), to the interminable Bible-thumping of WINB or WYFR. The *Voice of America* is the official mouthpiece of the USA, and thus reflects official US Government thinking in their news and commentaries. In their music programmes, they feature a lot of good American jazz music. There is a separate service called *VOA-Europe* which caters for a younger audience, with Madonna replacing Duke Ellington. *WCSN*, The World Service of the Christian Science Monitor is still less than a year old, and has built up a good reputation for their impartial, unbiased international news coverage, with their 'moral majority' viewpoint only rarely being overtly obvious. One of the other new shortwave stations from the USA is *WHRI*, World Harvest Radio International. This is basically another religious station,



but prefers the soft-sell approach, with good gospel, R&B, and light music, with short devotional talks sandwiched between. Finally, *WRNO* (the Rock of New Orleans) broadcasts rock music with relays of ABC network news, and a programme called The World of Radio presented by veteran American DXer Glenn Hauser. *WRNO* claims to be the USA's only privately-owned, non-religious, commercial shortwave radio station.

## Vietnam

The Voice of Vietnam devotes much of its programming to the situation in Kampuchea, as well as reporting on the development of their own country since re-unification. About ten minutes of Vietnamese music often rounds up their daily English programme.

The following is a chronological

listing of the above stations programmes in English. Several stations also have programmes beamed to other parts of the world, but in most cases these are merely repeats of the same programme, or are not at all well received in Europe. Although frequencies of some stations may be subject to change, the times of the pro-

grammes should remain the same until the change to local summer time. Usually when stations make frequency changes for propagation reasons or to avoid persistent interference, they keep at least one frequency unchanged, so it should not prove too difficult to hear any of these stations, even on fairly simple receivers.

### The 'Listening On' guide to English Language DX broadcasts

Time (GMT)	Station	Frequency (kHz)
0300-0400	Voice of America	6040 7200
0400-0430	Voice of America	5995 6040 7170 7200 9670 9770
0430-0500	Voice of America	1197 3980 5995 6040 7170 7200 9670 9770
0500-0600	Voice of America	5995 6040 7170 7200 9670
0500-0600	Voice of America	7255 15120
0600-0630	Voice of America	5995 6040 6060 7170 7200 7325 9635 9670
0630-0700	Voice of America	3980 5995 6040 6060 7170 7200 7235 9635 9670
0630-0700	Radio RSA	15125 17790 17825
0700-0800	Radio Japan	17775 21695 (via Moyabi, Gabon relay)
0700-1300	VOA-Europe	1197 (Monday-Saturday)
0715-1100	Radio Pakistan	15605 17660 (service in Urdu, with English news at 0800, 1005 and 1105)
0700-0800	Voice of Nigeria	15120
0700-0830	HCJB, Quito, Ecuador	6130 9845 9860 11835
0700-1030	Radio Australia (long path)	9655
0800-0900	Radio Korea	7550 13670
0830-1000	Voice of Nigeria	15120
0900-1030	Radio Afghanistan	17655
1030-1100	United Arab Emirates Radio, Dubai	15435 17865 21605
1100-1200	Radio RSA	21590
1230-1300	Radio Bangladesh	12030 15525
1300-1600	Radio RSA	15125 17825 21590
1300-1700	VOA-Europe	1197
1330-1400	United Arab Emirates Radio, Dubai	15435 17865 21605
1430-1530	Radio Austria (short path)	7205
1500-1600	Radio Japan	21700* (via Moyabi, Gabon relay)
1500-1700	WHRI, South Bend, Indiana	21700*
1500-1630	FEBA Radio, Seychelles	15325 (includes news at 1600-1610)
1530-2000	Radio Australia (short path)	6035 7205
1545-1600	Radio Canada International	9555 11915 11935 15315 15325 17820
1600-1630	Radio Pakistani	9465 11615 11625 15605
1600-1800	WCSN, Boston, Mass.	15270
1600-2100	WRNO, New Orleans, La.	15420
1630-1700	United Arab Emirates Radio, Dubai	11730 15300 17865
1700-1730	Voice of America	1197 3980 6040 9760 11760
1700-1800	Radio Havana Cuba	15295
1715-1800	Radio Pakistan	7100 11570
1730-2200	Voice of America	6040 9760 11760
1800-1830	Voice of Vietnam	15010
1800-1850	Radio Nacional do Brasil	15265
1800-1900	Radio Korea	15575
1800-2100	Radio Kuwait	11665 (News at 1830-1845)
1815-1915	Radio Bangladesh	6240 7505
1900-1930	Voice of Vietnam	15010
1900-1930	Radio Afghanistan	7175 9635 9665
1900-2000	Radio Beijing, China	9850 11500
1900-2000	HCJB, Quito, Ecuador	15270 17790
1930-2030	Voice of the Islamic Republic of Iran	3779 9022
2000-2030	Voice of Israel	7465 9010 9435 9815 11610 11655
2000-2030	Radio Canada International	5995 7235 11945 15325 17875 (Monday-Friday)
2000-2040	Radio Australia (short path)	6035 7205 9620
2000-2050	Radio Pyongyang	6576 9345 9940 9977
2000-2200	WCSN, Boston, Mass.	11695
2005-2105	Radio Damascus	11625 12085
2015-2145	Radio Cairo	9670
2030-2100	Voice of Vietnam	15010
2030-2130	Radio Korea	6480 7550 15575
2040-2130	Radio Australia (short path)	9620
2100-2130	Radio Canada International	5995 7130 11945 15325
2100-2200	Radio RSA	9580 11900
2100-2200	Radio Beijing, China	9850 11500
2130-2200	HCJB, Quito, Ecuador	15270 17790
2200-2250	Voice of Turkey	7135 9505 9560
2200-2300	Radio Havana Cuba	9590
2200-2300	Voice of Free China (Taiwan)	9455 9955 11900 15370 (some relayed via WYFR, Florida)
2200-2300	Radio Canada International	9760 11945 (relay of CBC home service news programmes 'World at 6' & 'As It Happens')
2230-2300	Voice of Israel	7465 9010 9435 9815 11610 11655
2300-2400	Radio Japan	11800 (via Moyabi, Gabon relay)

\*The station audible depends on propagation conditions.

# RADIO TODAY

## Leicester Show 1987

Held at what is now its traditional site, the Granby Halls, this year's show gave everyone here at HRT an opportunity to meet with some of our readers, discuss interests and get to know people generally. The show was perhaps a little quieter than last year's, but nevertheless packed with stands catering for virtually every aspect of amateur radio from mains plug to antenna — and a lot in between!



In addition to the main hall the Leicester Repeater Group, BARTG, Wigston ARC, RAFARS and and the talk-in station could all be found in a special 'Club Room' featuring photo displays and information covering the various activities.

Meanwhile back in the main hall the eagle eyed were able to sneak a glance of things to come in the shape of new radios which had just been, or were about to be, introduced to the UK. The fact that three out of the five new sets carried the Yaesu label would tend to suggest that Leicester is being seen by some as the penultimate amateur radio exhibition in this country and the ideal venue for new product launches.



## JST-125

First among these was the JST-125 HF transceiver, seen earlier this year at the Friedrichshafen show in southern Germany and recently arrived in this country. We won't go into further details here as this particular rig is featured elsewhere in the magazine, the HRT heavy mob having wrested a unit from the grasp of the importers!

## FT-736

The first of the Yaesu rigs is the FT736, a modular base station designed to work on 50, 144, 430 and 1296MHz offers multimode capability, memories, two VFOs, VOX and a built-in keyer. Cosmetically identical to the FT767 (its HF bands brother) the new FT736 will give 25W output on all bands except 23cms where only 10W will be available. The set will initially be on sale for around £1,500 with just the 2m and 70cm modules fitted — not cheap perhaps but also offering a built-in duplex facility for the price.



## FT-747

There has been much concern voiced both in HRT and elsewhere that the prices of modern amateur radio gear these days is serving to make the hobby too expensive for the newcomer, leading to a contraction of the hobby. It was interesting to see therefore, that the new FT-747 appears to be Yaesu's reaction to this problem. Essentially this is a 'bare-bones' synthesised HF 100W transceiver incorporating a general coverage receiver, twin VFOs, SSB/CW operation, noise blanker and attenuator all for a selling price in Japan of £400. This would suggest that the eventual UK retail price would be in the region of £600 — which puts it very much in the economy band of equipment prices.

Seiji Yokoi, Yaesu's PR representative who was visiting the show said that there were no plans at present to produce more 'economy' gear but judging by past experience when one of the big three produces a new model, the others will surely follow. At the very least it would be nice to see equipment prices getting back into three figures rather than four for base station gear.



## FT-712

The last offering from the Yaesu stable is hardly out of the door at the moment, in fact, the unit shown here was only on display for a few hours before being whisked off to Japan by Masanobu Hasegawa, Yaesu's engineering manager. By itself the idea of a 70cm 25W FM mobile transceiver may not set the world alight, but the really novel design feature of this rig is its ability to digitise and store a message recorded by the operator via the microphone. This may then be 'played back' to other stations using selective calling techniques incorporated in the AQS system.

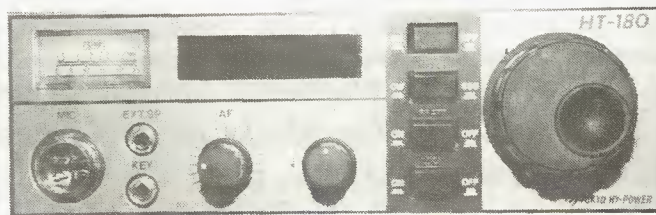


Licensing limitations in the UK may cause a few problems with this sort of unattended operation but it will be interesting to see how the set fares when launched. No prices yet on this box of tricks, even the one in the photograph is a pre-production model, but we couldn't resist whetting your appetite!

## Tokyo HF Monobanders

Although the Tokyo HT-180 80m version is shown in the photo, there are other models available for the 40, 20, 15 and 10m bands. Each set is a 20W PEP SSB/CW single band transceiver principally designed for mobile use. All versions are tunable over a 500kHz range, except for the 10m version which covers 28 through to 29MHz.

The design is based on a 9MHz single conversion super-het receiver in a small 180(W) × 60(H) × 250(D)mm box, using four green seven segment displays for frequency readout. Tuning is by an optical rotary encoder giving a 5kHz per knob revolution in slow mode and 50kHz per rev for fast tuning. Frequency resolution is set at 100Hz steps but there is an RIT facility for receiver fine tuning. With mobile use in mind, there is also a dial lock which doubles as a simple memory function — retaining the last used frequency even when power is disconnected from the rig. A CW side-tone is provided as standard and an optional noise blanker and CW filter can both be added if required. The HT-100 series of mon-banders currently retail at £299 inc VAT.



## Oldham Amateur Radio Rally

Oldham ARC will be holding its third annual rally at the Queen Elizabeth Hall Civic Centre on 24th of January. Doors open at 11am (10.30 for disabled visitors) and the admission will be 50p. Hot and cold snacks will be available,

including licensed (*Class A or B! - Ed*) bars, and a new idea in the shape of a rig minding service to ensure a miserable day for rig thieves. Ample car parking will be available and morse tests can be booked (via the RSGB) for this venue. Further details can be obtained from Cath G4ZEP on 061 624 7354.

## USA gives Region 12 Examiners the chop

There have always been plenty of jokes about 'how much did your ham licence cost you?' but the FCC in the United States has recently decided that, due to what it calls 'widespread irregularities' occurring in the

volunteer examiner system in Puerto Rico, the FCC will no longer accept the services of any currently accredited volunteer examiner in that area.

Although the results of exams already processed will be unaffected, the volunteer examiners may be reinstated following a review of past exam records.

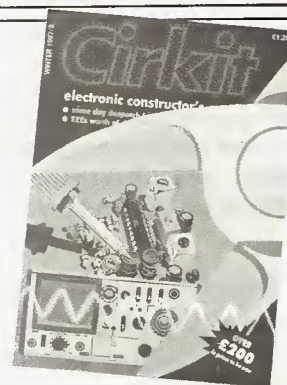
## Stamp Collection Wanted

In fact your stamps to be precise. John Allsop G4YDM is collecting stamps be they new or old, with or without envelopes so as to help buy an amateur transceiver for a disabled ham. So if you're one of those people

who hang on to old law suits, final demands and poison pen letters, why not put them to good use by sending them on to John — in a stamped addressed envelope of course! Send them to: Mr J Allsop, 30 Manor Park, Concord Village, District 11, Washington, Tyne & Wear NE13 2BT.

## New Look CAT From Cirkit

The Winter 1987/88 Cirkit catalogue has just been released, featuring not only a completely re-styled design and discount vouchers but also a competition with a 600MHz frequency counter as first prize. Costing £1.20 the catalogue is divided up into clearly marked sections which feature a wide variety of test gear, components, kits and accessories of interest to the radio amateur. Copies of the



catalogue can be obtained from Cirkit, Park Lane, Broxbourne, Herts EN10 7NQ.

## KwikKalk from Knorway

Methodia Design of Norway have just released KwikKalk, the latest software in their Technical Series.

This very comprehensive program is designed to take the hard work out of radio calculations. You just enter the circuit values you already have and it instantly provides the component value that you need. The current value of all components is held in the program so that you don't have to keep entering them every time when performing a series of related calculations.

The program is menu-driven, very easy to use and contains useful explanations and hints for its operation.

There are versions for Spectrum, CBM64 and BBC-B/Master computers at £12 on tape or £14 on CBM or BBC disc or Spectrum microdrive cartridge. BBC disc users should state if they want 40 or 80 tracks. Available from Technical Software, Fron, Upper Llandwrog Caernarfon, LL54 7RF. Tel: (0286) 881886.

# Beginners Guide To FREQUENCY SYNTHESIS

Virtually all modern Amateur rigs use frequency synthesis to determine their operating frequency. This is more or less taken for granted these days, but a few years ago it was

VFO, but in discrete, equal steps, the step size being equal to the reference frequency.

To illustrate this, consider what happens if we wish to generate a

25kHz, reducing the value of the error voltage.

When the VCO frequency reaches 145.475MHz, the divided down VCO signal arrives at exactly 25kHz and the error voltage is thus zero; hence the VCO stops moving down in frequency and remains on 145.475. We can see that by reducing the number fed to the programmable divider by one, we have moved the VCO frequency lower by one 25kHz step, and we can thus tune the band in 25kHz increments simply by altering the number we program in.

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*Frequency synthesisers are one of the most important building blocks in modern radio gear. Richard Davis, G3TDL, gives us an insight into the basic types.*

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something very new to Amateur technology. What exactly is frequency synthesis, and what advantages and disadvantages does it have compared to other techniques? This article aims to reveal all!

## What is Frequency Synthesis?

Fig.1 shows a block diagram of a simple frequency synthesiser. The function of the circuit is to phase lock a voltage controlled oscillator (VCO), which produces the output signal, to a crystal reference, so that the output signal has the same order of stability as a crystal oscillator. To achieve this, the VCO output is divided down in frequency and compared to a reference signal obtained by dividing down the crystal frequency.

If the frequencies of these two signals are not the same, an error voltage is produced which is applied to the VCO control line in order to alter the VCO frequency to the correct value. By altering the ratio by which the VCO signal is divided, the output frequency can be set to various different values, and thus the output signal can be tuned across a band of frequencies. However, it does not tune continuously like a

signal on S20 (145.500MHz). Since this is an FM channel, we will probably want a step size of 25kHz (ie. one channel), and we thus want a 25kHz reference. A convenient way to produce this is to use a 12.8MHz crystal and divide it by 512, which is  $2^8$ . The reason we use a high frequency crystal and divide is that it is easier to make crystals in the 1-20MHz region than at very low frequencies.

Now we want our VCO on 145.500MHz, so we need to divide this down to 25kHz in our programmable divider; the required division ratio is 5820. Thus we enter 5820 on the control line of the programmable divider, and out pops a signal at 145.500, the accuracy of which is determined purely by that of the crystal.

## How to QSY

What happens if we now reduce the programmable divider's division ratio by 1, ie. to 5819? If we divide 145.500 by 5819 we get 25.0043kHz. As this is no longer exactly 25kHz, the phase detector will produce a small error voltage, the polarity of which will be such as to move the VCO lower in frequency. As the VCO moves LF, the divided down VCO signal moves closer to exactly

## Practical Problems

Of course, in practice, it's not as simple as that! To start off with, the output from the phase detector, which is just another form of mixer, will not be purely a DC error voltage but will also contain a waveform whose frequency corresponds to the frequency difference between the divided down VCO signal and the reference. If nothing is done about this, the VCO will sweep rapidly backwards and forwards across the band following the instantaneous value of this control signal, which will itself follow the VCO frequency. What we need to do is to remove this AC component whilst leaving the DC component alone, and we can do this by inserting a low-pass filter in the control loop.

However, the behaviour of this filter has a critical effect on the performance of the synthesiser. If the cut off frequency of the filter is made too low, the control voltage will only be able to change slowly, and thus when the channel is changed it will take the VCO a long time to move to the new frequency; in fact it may not get there at all! On the other hand,

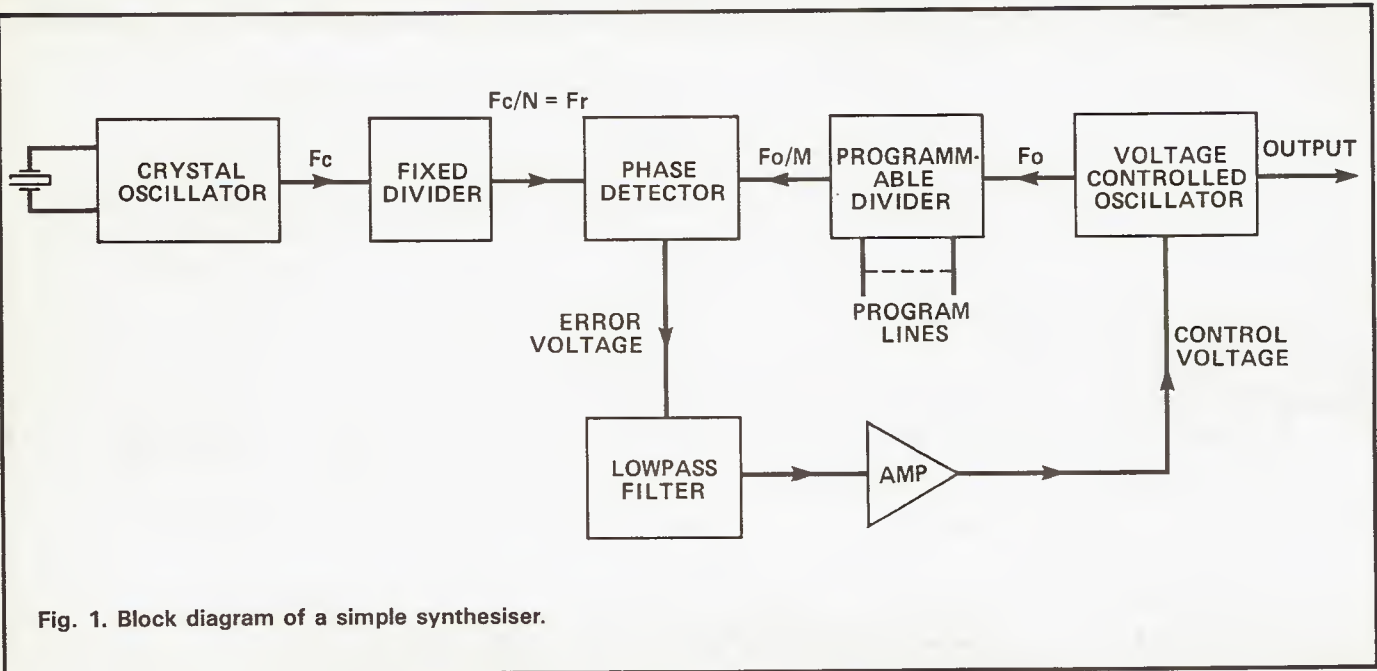


Fig. 1. Block diagram of a simple synthesiser.

if the cut off frequency is set too high, the VCO may overshoot the correct frequency, and then oscillate to and fro about it, only settling to the correct value after a long time.

What we want ideally is that the control voltage should change rapidly at first, slowing down as it approaches the correct value. A great many erudite articles, involving fiendish mathematics, have been written on the subject of loop filter design, and I don't propose to go into detail here! Whatever else happens, the loop bandwidth must be less than the reference frequency, since the phase detector will always produce an output at this frequency. Thus the maximum allowable loop bandwidth becomes less as the step size is reduced.

### Oscillator sideband noise

Another problem is that of oscillator sideband noise. Since our oscillator frequency is voltage controlled, any small noise voltage getting into the system will frequency modulate the VCO signal, producing noise sidebands which can extend a considerable distance on either side of the carrier. It will be obvious that, as the VCO tuning range is increased, the amount of noise modulation will also increase since the sensitivity of the VCO in terms of frequency change per volt will be increased.

Sideband noise can cause two problems. On transmit, it causes noise to be radiated for many kilo-

hertz on either side of the signal, causing interference to other local stations working on adjacent channels. On receive, it causes an effect known as 'reciprocal mixing', whereby a strong signal on a channel near to the one on which you are receiving can degrade your receive signal to noise ratio. What happens can be explained as follows:—

Suppose that you are listening to a weak signal on 145.250MHz, and the local high-power merchant G4QRO is operating on 145.275. Your receiver is probably sufficiently selective for you not to hear his transmission as such, but your receiver local oscillator is producing noise sidebands which extend for, say 50kHz on either side of its nominal frequency.

To receive 145.250, your oscillator will be set to  $145.250 - 10.7 = 134.550$ . However, it will be producing sideband noise at 134.575MHz, and when this mixes with G4QRO's transmission we get  $145.275 - 134.575 = 10.7$ MHz. In other words, a strong unwanted signal mixing with the noise sidebands of your oscillator has produced an output at IF. You won't actually hear G4QRO, of course — what you will hear is an increase in the noise level whenever he transmits! However, this increased noise may well blot out the weak signal you are trying to receive.

If you read transceiver reviews in HRT and elsewhere, you will see reference to oscillator sideband noise and its effect on ultimate receiver

selectivity. Normal free running oscillators are much better in this respect than VCOs. It has been found that the use of junction field effect transistors in VCOs minimises the problem, since the noise they produce is mostly at very low frequencies.

In practice, the control loop will cancel out any noise within its bandwidth, and if the bandwidth is fairly wide, the noise sidebands near the carrier will be cancelled, leaving only the noise further out which is of lower level. However, as pointed out above, the loop bandwidth will need to be fairly narrow for other reasons, and in any case must be less than the reference frequency.

This means, of course, that noise on the adjacent channel, which was the case we were considering above, will not be cancelled. Since the reference frequency is equal to the step size, it follows that the sideband noise will become worse as the step size is reduced.

### HF Problems and Prescalers

There is one further practical problem which can influence the cost effectiveness of using a frequency synthesiser for any given application. As can be seen from Fig.1, the VCO output signal is divided down to a much lower frequency for comparison with the crystal-derived reference. At low frequencies this creates no problems, but the cost of suitable program-

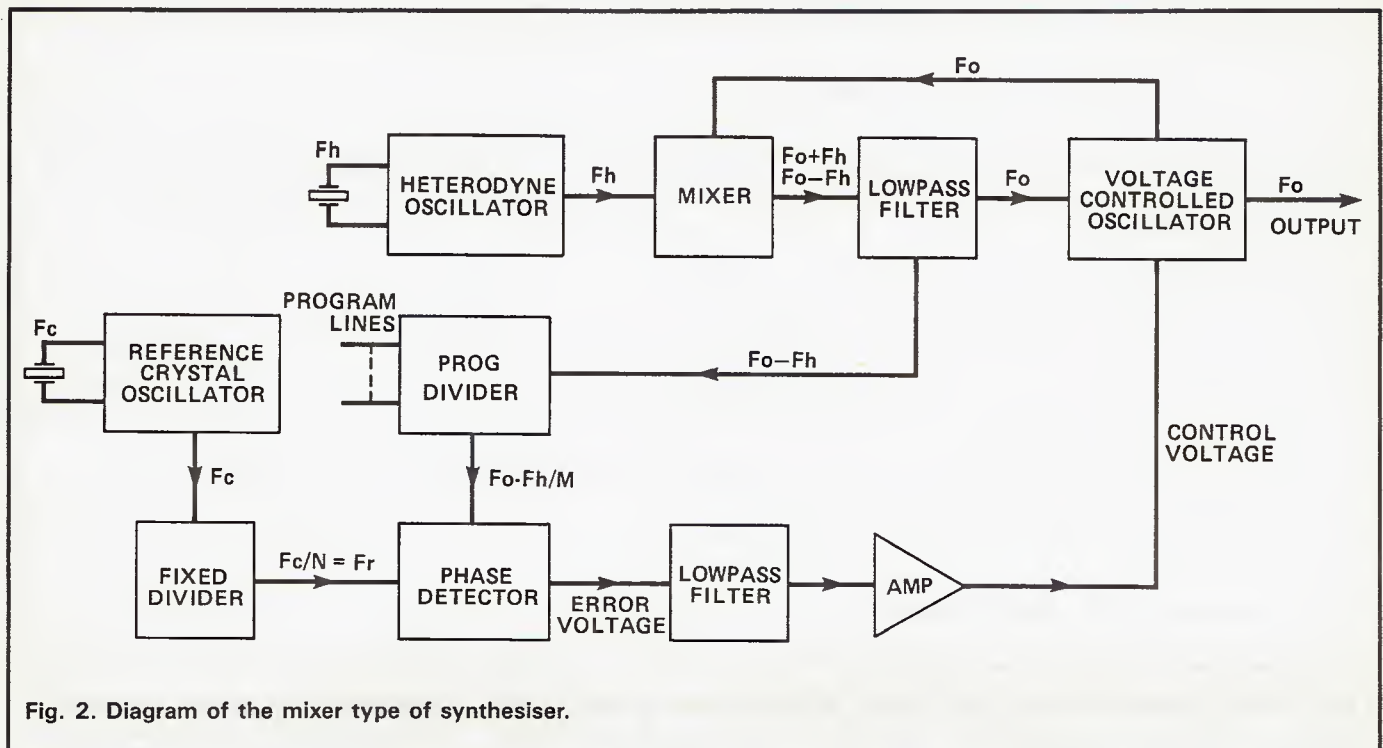


Fig. 2. Diagram of the mixer type of synthesiser.

mable divider ICs rises very rapidly with frequency, and by the time we reach 144MHz the situation is that suitable devices, whilst they are still available, are prohibitively expensive for use in amateur equipment.

There are various ways of getting round this problem. To start off with, it turns out that fixed dividers which will work at VHF are much cheaper than programmable dividers, and thus we can use a fixed divider to divide the VCO output signal down to a frequency where it can be handled by a cheap programmable divider. The fixed divider here is known as a *prescaler*. There is however a side effect to doing this which may or may not be important.

To illustrate this, consider again our 144MHz synthesiser, and assume that we are using a prescaler to divide our VCO signal down to 36MHz, ie. by 4, so that we can use a cheap CB-type programmable divider. Again we want 25kHz channel spacing, so we are using a 25kHz reference. Our required division ratio for an output frequency of 145.500MHz is, as before, 5820, but the signal has already been divided by 4 by the time it reaches the output of the prescaler, so our programmable divider must be set to  $5820/4=1455$ .

Now assume that, as before, we want to QSY one channel LF, so we reduce the division ratio by 1. Our

VCO frequency will now be  $.025 \times 1454 \times 4 = 145.400\text{MHz}$ . Thus instead of moving one channel lower, we have moved four channels lower! In fact, whenever we use a prescaler the step size is multiplied by the prescaler's division ratio.

To get back to 25kHz steps we need to reduce the reference frequency to  $25/4=6.25\text{kHz}$ . In the case we are considering this presents no problems (except that the sideband noise will be made somewhat worse), but if we are using very small steps, as for instance on SSB, it could be difficult.

### Mixed Synthesis

There is a simple way we can get round the problem of the cost of high frequency programmable dividers without prescaling. In order to use a cheap, low frequency device we need to reduce the output frequency of our VCO to one which the divider can handle. Instead of dividing it down using a prescaler, we can mix the VCO signal with one from a high frequency crystal oscillator to produce a low frequency output; the block diagram for this system is shown in Fig. 2.

Consider again our example of a synthesiser used to generate 145.500MHz; we can use a crystal at 115MHz to mix the VCO frequency down to 30.5MHz where a

cheap programmable divider can be used. With this type of synthesiser the step size remains the same as the reference frequency, so we can again use a reference of 25kHz. The only real disadvantage of this system is that the frequency stability is marginally worse, since it is now dependent on two crystals rather than one. However, this is only really a problem for commercial users.

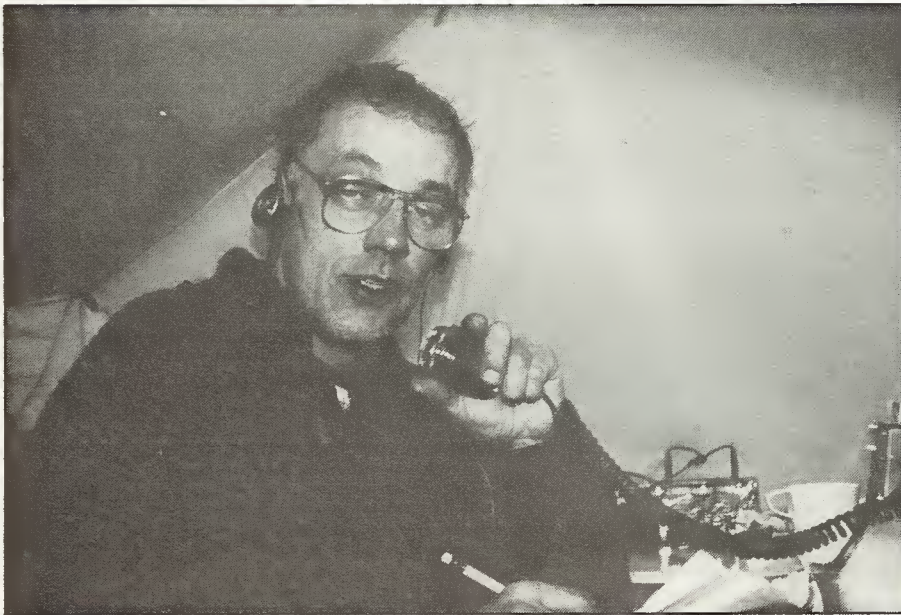
A useful property of this system for amateur use is that, by changing the frequency of the heterodyning crystal, we can move the frequency of the VCO without having to alter the setting of the programmable divider. This is very useful, for example, for introducing repeater shift; we simply arrange to switch in a crystal 600kHz higher in frequency when we go to receive, using the normal crystal for transmit.

The only other way of performing repeater shift is to alter the setting of the programmable divider between receive and transmit, which is fairly easy in a microprocessor controlled rig, but difficult in the simpler rigs such as the IC2E. In fact, this is the type of synthesiser which, until very recently, was used in nearly all amateur VHF transceivers.

*Next month we will look at the problems associated with mixed synthesis and introduce alternative synthesis systems.*



# Peter the First syndrome



Kare, LA2GV, after several sleepless nights on the air — and without any hot water to shave with (photo courtesy LA1EE)

A mysterious epidemic hit the world in late January. Its strangest feature was that it affected only amateur radio operators with a commitment to DXing. The period of sickness and time off work varied from one to

ance of an entirely new disease — Peter First Islanditis — triggered by the presence of two amateurs on a remote spot in the Antarctic.

The evolution of the sickness can be traced back several years to

Clearly no-one would go to all the trouble of mounting an expedition unless they could be 100% certain it would count for DXCC.

The DX world greeted the League's announcement with mixed feelings. Everyone wanted a new country to chase but they were terrified that there would just be a brief operation to put it on the list, working perhaps only a few hundred people, and then nothing for many years. Their fears were heightened by everything that appeared in the amateur press about the remoteness and climatic horrors of the place.

## The Island Itself

The Peter First is an ice-covered wilderness of some 80 square miles, discovered in 1821 by the Russian explorer Bellinghausen and named (very astutely in view of the expedition's finances) after the Tsar. Its highest point, Lars Christensen Peak, is 1220 meters above sea level. The only exposed rock is where the cliffs are too steep for ice or snow to cling.

Approach to the island is difficult. Even in mid-summer it is surrounded by up to 100 miles of pack ice. Visitors this century have been few and far between: just a handful of tourists from the Antarctic cruise ship Lindblad Explorer, and occasional passing scientists. Norway claimed the island earlier this century but until this year had done little in the way of exploration or surveying to justify its potential ownership.

The first mention of a possible radio operation came in the early '80s from the Belgian solo navigator, Willy de Roos, VK9XR, who was then in the vicinity of Adelaide Island off the Antarctic Peninsula. He made a couple of attempts to get close in his yacht 'Williwaw' but was foiled by pack ice on one occasion and by the failure of navigation equipment on another.

## *Martin Atherton, G3ZAY, reports how a Russian Tsar briefly assumed overwhelming importance in many ham's lives.*

ten days and was inversely related to the size of the sufferers' antennas and linear amplifiers!

Symptoms included sleepless nights tuning across 40 or 80 meters, loss of concentration on anything except a receiver dial, obsessive retuning of antennas and rigs, and frequent verbal outbursts of a single phrase "Where the \*\*\*\* is he listening?"

Communiqués from the LA DX Group and the Northern California DX Foundation have confirmed that the outbreak was the first appear-

a decision by the American Radio Relay League that DXCC country status would be given to Peter The First Island as soon as an operation took place from there. The ruling was based on the fact that Peter First is more than the required distance from the Antarctic mainland. The ruling was made in advance of an operation taking place; despite the League's usual practice being to defer consideration until after a place has been activated, an exception was made because of the great difficulty and expense of getting there.



Helicopter delivery to the camp on Peter The First Island (photo courtesy LA2GV)

The next possibility was in late December 1986 when Bob Winter, KD7P, announced that he would be on board a research vessel scheduled to sail past the island en-route to the US base at McMurdo Sound. The DX world prepared itself for what was expected to be less than a twenty-four hour operation, but, perhaps fortunately, the visit was cancelled when the ship was turned back by ice about 70 miles from the island. The pile-ups and panic as people scrambled to avoid sliding down (or even off) the DXCC Honour Roll would have been terrible to hear.

While the KD7P excitement was building, the LA DX Group in Oslo was quietly making its own plans for a much grander expedition. An ice-strengthened vessel equipped with helicopters was available for charter in New Zealand, having taken a private expedition to the Antarctic mainland, and the Norwegian Polar Institute had engaged it for a mapping expedition to Peter First. Two spare places were available for radio amateurs providing they could raise the necessary total costs of around \$50,000.

The Northern California DX Foundation agreed to find the majority of this sum and donations were solicited from DX clubs and national societies around the world. In mid-December a decision was taken to go and a major effort was under way to get the two operators, LA1EE (3Y1EE) and LA2GV (3Y2GV), and their equipment to New Zealand in time for a mid-January departure.

The operation was followed with intense interest in the UK and regular skeds with the boat were monitored as it neared the island in order to get an idea of the best times for propagation. The pundits reckoned that four of the main bands would provide good openings: 80 metres from 0600 to 0700, 40 metres from 0000 to 0800, 20 metres from 0800 to 1000 and 1600 to 2300, and 15 metres from 1500 to 1700. They were actually too pessimistic as the expedition proved to be audible on 20 metres almost around the clock, and would come through in bursts on 15 metres from 1130 to 2330.

### The First From First

The first day of activity was every bit as hectic as expected.

Europe's first opening was on 20m CW and the 3Y's transmit frequency was clogged with the usual lids calling co-channel and the policemen sending "UP", "QSY UP", "5 UP" etc. The listening frequencies were a little hard to determine because the size of the pile-up made it very hard to adopt the usual technique of looking for the stations being worked. They were buried under the QRM.

The two metre DX discussion channel (144.525MHz) was very busy throughout the country as people divided the task of pinning down the listening pattern. It was quickly noticed that a disproportionate number of Norwegian stations were being worked and within 30 minutes a spot frequency of 14.065 had been discovered; several Gs who copied this information on 2m then got through straight away. There was no intention by the 3Y ops to favour Norway, indeed a condition of the North California DX Foundation grant had been that no country, club, or interest group should receive special treatment; 14.065 was simply the expedition's talkback frequency for admin purposes, but the secret got out.

The story that eventually emerged for both CW & SSB was that the operators had two main techniques. They would either adopt the traditional approach of listening between two specified frequencies (e.g. 14200-14210), or would program a number of spot frequencies into their receivers (14210, 14220, 230, 240, etc.) and hop at random from one to another. With the latter technique they would usually continue on one frequency for 3 or 4 QSOs until the pile-up became too big and would then move to another.

The difficulty in the early days was that in order to make the pile-ups manageable they would announce the details very infrequently, usually when a 'policeman' was jamming the channel telling someone else to keep quiet. A technique which they developed for working Europe was to announce a spot listening frequency in a foreign language; Spanish, German and French seemed quite effective at keeping the pile-up to a manageable size.

The spot frequency technique has triggered a debate in the DX world on whether it represents an improvement over traditional split frequency working. It certainly gives an advantage to the owners of digital synthesised rigs as they can locate the active channel more quickly than the op. with a separate VFO who has to tune manually all the way up the band. Three or four rubber stamp QSOs only take 60 seconds and the operator has to find the right spot after the first or second QSO if he's to have a chance of getting through; that's no more than 30 seconds to check 10 different frequencies!

### Sheer Stamina

The stamina of the 3Y operators had to be admired as they kept notching up the QSOs day after day from their 'igloo' tent on a glacier at Cape Eva (the north-west tip of the island). The physical and electrical 'ground' was just the glacier ice and this inevitably caused problems with any antennas which had to be fed against earth. It also made life unpleasant for the operators as their tent began to sink into a puddle of water! Despite these hazards they made nearly 20,000 QSOs.

The logistic side of the operation contributed enormously to its

success. Two separate stations with beams and linears were established on the glacier even though everything had to be flown in by helicopter.

One of the most significant effects of the DXpedition was the stimulus it gave to DXing. Calls which had seldom been heard for years were back in the pile-ups. Strategy and tactics were again being discussed the length and breadth of the HF bands.

Off the air the amateur spirit was also rekindled as phone lines buzzed with people telling their friends that the 3Y was coming through again. Everyone has their story to tell but perhaps the greatest melodrama was staged by one of the UK's DXCC Honour Roll members. Jury service tied him up for most of the DXpedition period and with only 48 hours to go he left a message on the DX



Einar, LA1EE, makes a local QSO (with a penguin? — Ed) (photo courtesy LA2GV)

Voicebank asking people to phone him at any time of the day or night if they heard the 3Y working Europe. His voice gave clear signs of relief and triumph when he reported a QSO on the last day of the operation.

The families should not be forgotten in this story. They had to tolerate complete disruption to household routine as everything was focussed on getting a QSO in the log. Frances, the wife of G3UJE, penned the following poem to give vent to her feelings.

I wish that I were gifted with the  
patience of a saint,  
To show encouragement, compas-  
sion, good humour and restraint.  
To deliver endless sandwiches, cakes  
and cups of tea,  
In order that HE can stay tuned to  
3Y1EE.

He creeps in bed at half past two  
and out again at four.  
What used to be my husband's now  
a shadow through the door.  
Impatient and frustrated, very tired  
and getting hoarse,  
He'd be pleased with any contact,  
SSB or even morse.

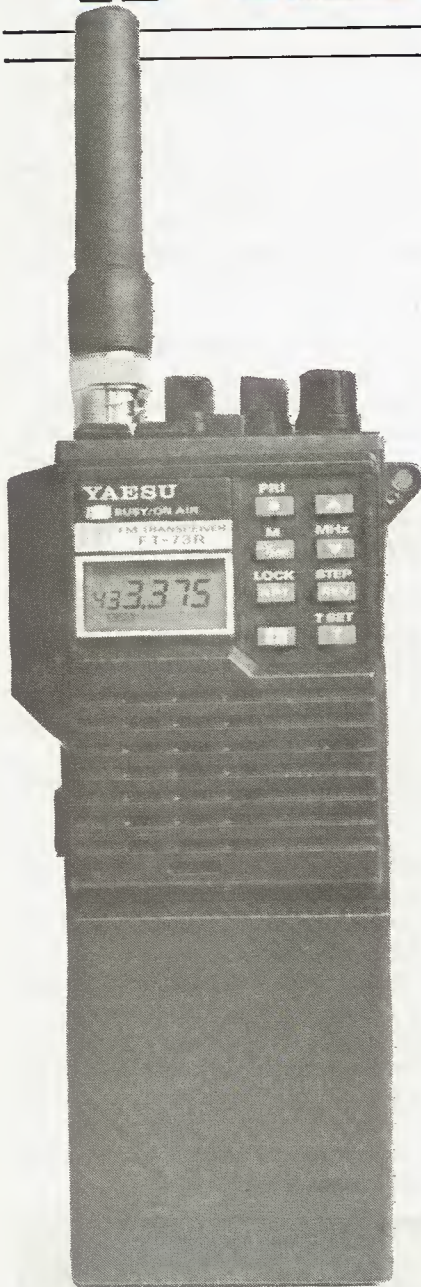
Then joy and jubilation, OM's air  
waves have got through.  
He's had his QSO confirmed — on  
80 metres too!  
So if any other XYLs want OMs with  
a smile,  
Make sure you help them get  
through to that wretched Peter  
Isle!

What more can be said? See you  
in the next pile-up.



The beautiful (but cold!) disposition of the tent (photo courtesy LA2VG)

# YAESU 70cms



At the 1986 Leicester show, Yaesu first showed the FT23R portable and this was shortly followed by the FT-211RH, a high power 2m mobile that was virtually identical in its operation. The matching 70cm counterparts reviewed here have followed hot on the trail and at first glance look virtually identical, in fact the only way you can tell them apart is by the front label. Do they follow on with the same performance as their 2m versions? *HRT* gave them a good going-over with the analysers and signal

generators, as well as joining in the fun on the local 70cm repeaters.

## The FT-73R

The FT-73R portable is tiny, and that *means* tiny, the set itself being around the same size as the 600mAh battery. The combination

Jack sockets are provided for connection of an external speaker/mic with PTT facility allowing bodyworn or mobile use, with other functions being operated by the set-mounted controls.

The set is supplied with the helical aerial, a wrist strap and a

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*Can't make up your mind whether to go /M or /P on 70cms? We take a look at the latest Yaesu rigs to help you decide.*

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measures 150mm(H) × 62mm(W) × 42mm(D) including the knobs, but excluding the PTT bar extrusion and weighs in at 430g. The battery pack supplied was the 7.2V FNB-10 which gives 2W on transmit, other packs are available such as the 200mAh 7.2V FNB-9 giving 1.5W, and the 600mAh 12V FNB-11 giving 5W; dry cell cases also available giving 1W and 1.5W outputs.

## Top Panel

A top-panel mounted BNC connector mates with the supplied rubber helical whip, this also allowing connection of an external aerial when required. A side-mounted PTT panel is used for transmit keying, immediately above which is a smaller panel giving a 1750Hz tone for repeater access. Small top-panel mounted rotary controls are used for on/off/volume and squelch, a slightly larger knob for controlling the frequency or memory channel and adjacent to this is a high/low transmit power selection button.

manual giving user operating instructions but no circuit or adjustment information. A small fold-out operator's reference card is also provided for portable use. Other options include a range of Ni-Cad chargers, cases for the different battery sizes, a DTMF keypad encoder, sub-tone unit, a mobile hanger bracket and a technical service supplement.

## The FT-711H

The FT-711RH mobile offers 35W transmitter power from a standard 13.8V supply, the set drawing around 8.5A in high power transmit mode. For mobile use, it has the novel facility of a reversible tilting fascia panel to allow the set to be mounted either below the dash, or above the windscreen for professional drivers. The fascia has the usual rotary on/off/volume and squelch controls, together with the keypad array and the LCD — all of which are backlit for night-time



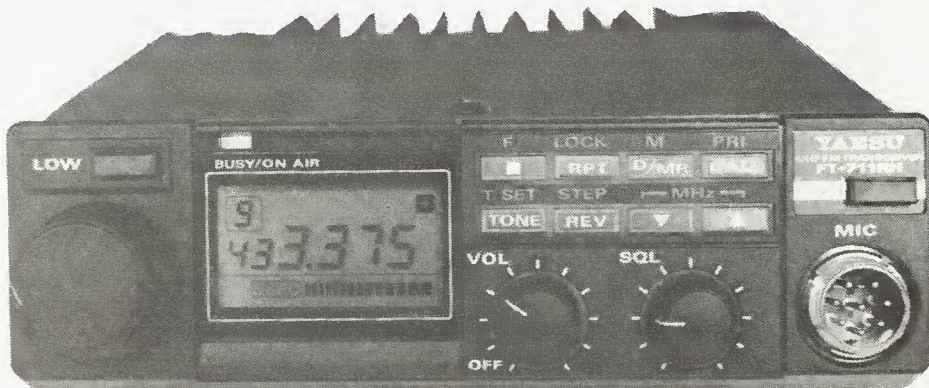
Top panel detail of the FT-73.

# DOUBLE ACT

operation. Further buttons control high/low transmitter power and 1750Hz tone for repeater access, a large rotary knob to the left of the fascia giving frequency and channel control.

The manual gives wiring details for bringing the receive squelch state output to the microphone socket if required, allowing the set to be interfaced with a terminal unit for RTTY or Packet Radio use (there are several 70cm RTTY/Data FM repeaters in the UK). However, this modification disables the mic-mounted 1750Hz toneburst button so the set-mounted 'T Call' button must be used instead. The rear panel sports the large finned heat-sink for the transmitter power amplifier, together with a N-type aerial socket, DC flying leads with bullet connectors and a 3.5mm jack socket for an external speaker, this disabling the internal speaker when in use.

The set measures 160m(W) × 50mm(H) × 175mm(D) and weighs just under 1.5kg, and comes supplied with a fist mic with Up/Down and 1750Hz toneburst buttons, mobile mounting bracket and fixing hardware, DC lead and



Front panel of the FT-211, showing the large well-lit LCD.

spare fuses, rubber feet for base station use, a 3.5mm jack plug for connection of an extension speaker, an operating manual complete with block and circuit diagrams, and an operators quick reference chart. Optional extras include a sub-tone unit, an external speaker, a mobile boom microphone, and a headset with built-in microphone.

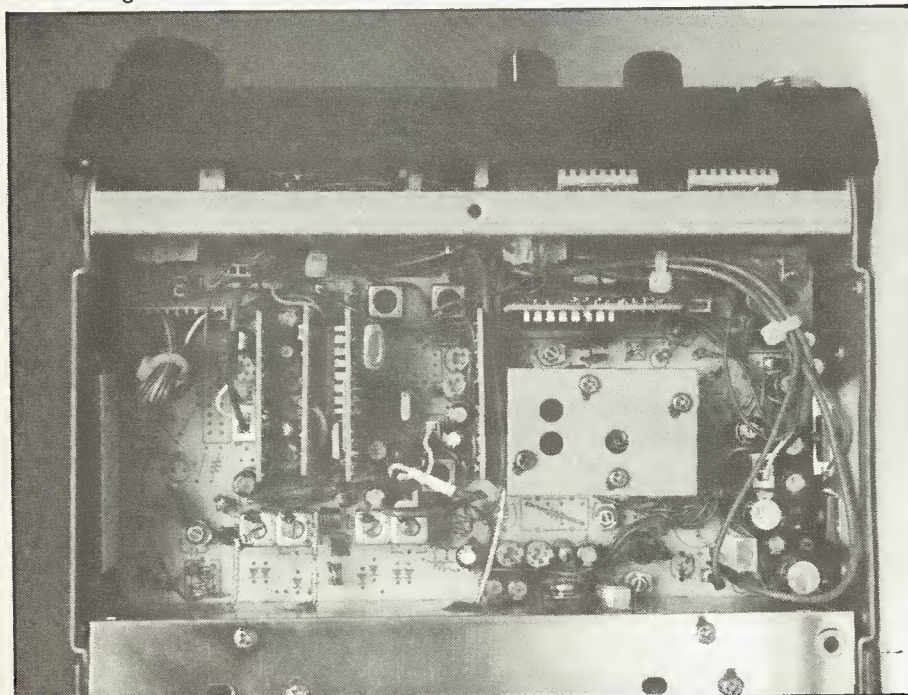
## Operating Features

Both sets cover 430MHz to 440MHz in selectable 25kHz or 12.5kHz steps, controlled by the main rotary knob or by Up/Down

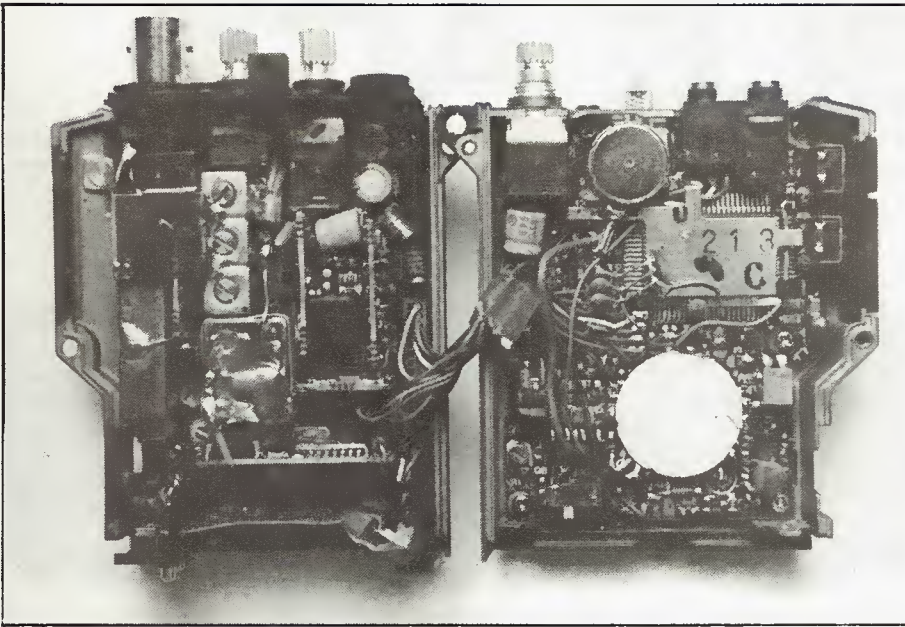
buttons on the fascia, these buttons being duplicated on the FT-711RH fist mic. 1MHz steps may be selected by first pressing the 'Function' button followed by the Up/Down buttons. A standard  $\pm 1.6$ MHz repeater shift is selectable, and full reverse repeater operation is possible by a single button push. Ten memories are available, each storing frequency and offset, together with sub-tone frequency and encode/decode mode if fitted. Memories 1 to 6 may store any TX/RX split by first programming the receive frequency, then the transmit frequency whilst pressing the TX PTT. One-touch access to memory channel 0 is available by a single button push.

Scanning of the entire band is initiated by pressing the Up or Down buttons for over half a second, the scan halting on a busy channel and then continuing two seconds after the squelch closes. Likewise, scanning of memory channels is possible, again initiated by a long press of the Up or Down button. However, in scan mode memories may be skipped as required by suitable pre-programming, yet still allowing their manual selection.

Priority channel monitoring is another facility, where a pre-set frequency is briefly checked for activity every few seconds whilst monitoring another channel, the set locking onto the priority channel when occupied. A keypad lock facility is available by a two-button push to prevent accidental frequency shifts, but still allowing



Inside top view showing the low component density.



Internal view of the portable rig's circuitry.

control via the rotary knobs or the FT711RH fist mic Up/Down buttons. Further protection is provided by a small slider switch disabling the mic-mounted Up/Down buttons if required.

The 'T Set' button is used where the optional sub-audible tone encoder/decoder has been fitted, allowing the operator to select from a standard range of 37 sub-tones for quiet monitoring of a busy channel. For the uninitiated, this transmits a low deviation, low frequency tone superimposed with the operator's transmission. Suitable receivers may be programmed to open their squelch only when receiving transmissions with the correct sub-tone frequency. There are already several groups of UK amateurs using this system, together with current and planned use on some UK repeaters.

A liquid crystal display panel is used to indicate the operating functions of the sets, this showing the operating frequency, memory channel if selected, + or - TX offset (displaying - and + if an odd split has been programmed), tone squelch encode and decode mode, keypad locked, and a bargraph indication of relative receive signal strength and transmitter power output. If you accidentally try to transmit out of band, for instance with a positive repeater shift at the top of the frequency range, the transmitter is disabled and 'Err' is shown on the LCD. The two sets have identical

displays, apart from the mobile display being larger. Both also have a fascia mounted dual colour LED which glows green when the channel is busy and red on transmit.

A further facility, possibly only of interest to users of several identical sets, is that of memory 'cloning'. By connecting the speaker/mic leads on a pair of FT-73Rs, or the microphone connectors on a pair of FT-711RHs and operating an internal switch, it is possible to download the memory information from one radio to the other. Maybe one day we'll be able

to auto-load from off-air signals, the AQS facility on some Yaesu sets already allowing off-air auto QSY on demand.

### On The Air

As with their 2m counterparts (reviewed in *HRT Feb 87* and *Aug 87* issues) I found the sets extremely easy to use due to Yaesu's sensible choice of operation modes. Many mobile and portable sets nowadays are fairly complex to operate and I have often witnessed radio users almost walking into someone or something when tapping numbers into a keypad-entry portable.

I feel the designers are to be commended on this point, as after familiarising myself with the controls I could easily operate the sets in memory mode simply by touch alone. The microphone mounted 1750Hz tone button was also a great asset in this respect, being the most sensible position for it in my opinion and saving the operator having to fumble around under the dash whilst driving. This preferred tone button position was first mentioned in my FT2700RH review in *HRT Jul 85* as the only other thing I would have liked, it appears that someone out there may have been listening!

### FT-711RH Mobile

The set was placed in the enclosed glove compartment of my

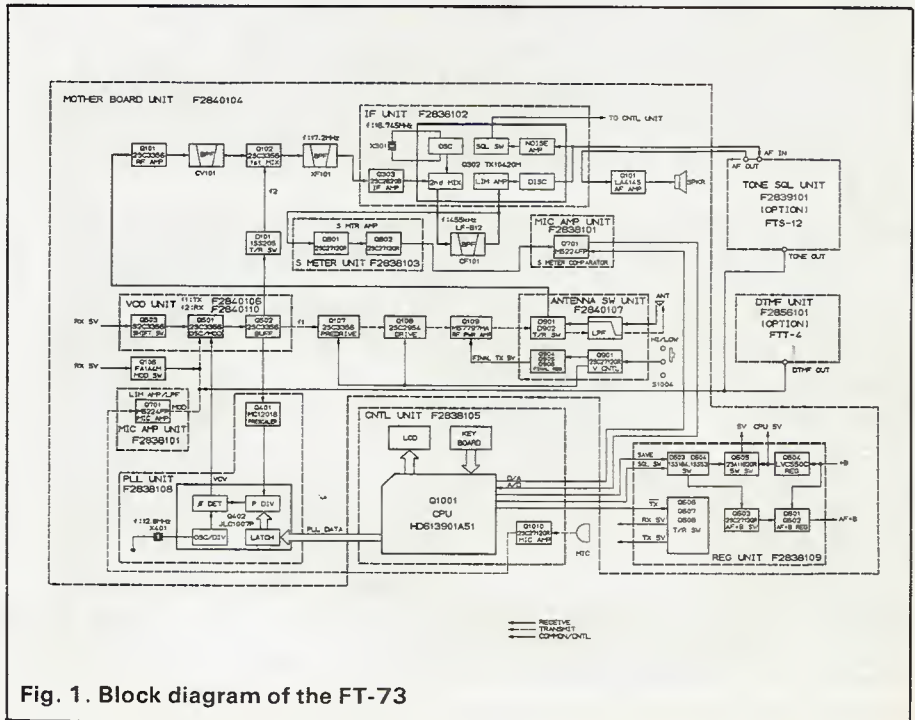
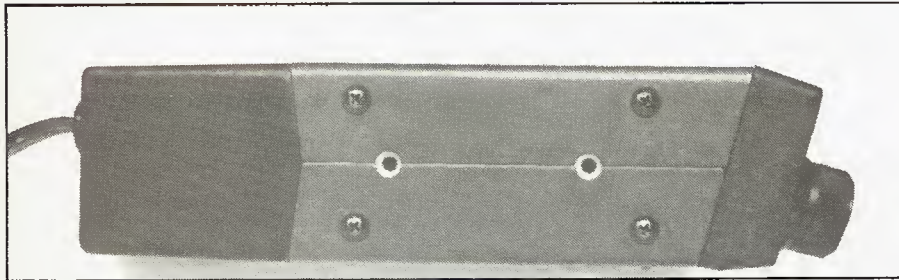
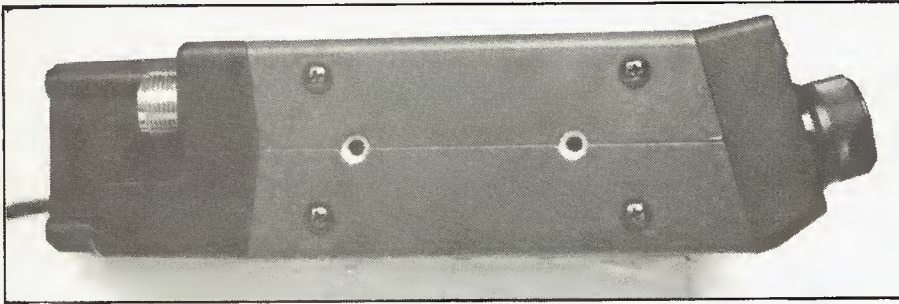


Fig. 1. Block diagram of the FT-73



The special tilt-up/tilt down design of the FT-211, although you have to dismantle the case to alter the tilt

car to see how the high power set would stand up to use in such a 'worst case' position. After several hundred miles of driving (I normally travel over 300 miles each week), I found no problems in its operation, the set becoming warm but never hot to the touch. Normal use with the set placed beneath the dashboard should hence prove reliable even on the hottest of days, when many sets start to 'power slump' on transmit. The mobile mounting bracket is of the 'bolt the set in and leave it' type, so if you prefer to remove your set each day for security purposes I would recommend obtaining some large knurled nuts to allow this to be done without a screwdriver. Alternatively, the set should securely fit into a standard car radio aperture, I personally tend to rely on my proven car anti-theft system.

Using the set both in bright sunlight and at night confirmed that the display was easily read and the backlit controls made operation at night easy. Most of my channel and frequency changes were made using the mic mounted Up/Down buttons as I did find the main tuning knob occasionally a little erratic — switching channel before I felt the indent, similar to the effect noted on the FT-211RH. This meant that one cannot always rely on 'counting the clicks' when QSYing whilst driving along, so be warned!

Audio reports on transmit were good as long as I held the mic around 10cm from my mouth and spoke into it rather than across it,

the mic itself being fairly directional and hence picking up little background noise. On receive, I found the audio a little on the muffled side, mainly due to the downward facing speaker. When used as a base station with the four rubber feet (supplied), the speaker would only be a few millimetres above the table top, hence providing a muffled response. When used with an external speaker, excellent readability was produced. I found the receiver sensitivity nicely matched the high transmit power, in driving around it was surprising to hear the number of distant 70cm signals opening the receiver squelch.

Operating in the vicinity of other radio users, such as when driving past transmitter sites showed few problems in blocking effects, which is very good.

### FT-73R

Using the portable was a delight, the set fitted comfortably into my hand, and the small size certainly didn't cause a bulge in my jacket inside pocket. Frequency control of the set by use of the rotary knob was very handy, and one-handed operation of this and the keypad was easily possible. The two blanked off screw holes on the rear of the case can be used to attach the optional metal belt clip if preferred to the standard wrist strap.

One thing I must mention though is the total omission of any form of backlighting for the display, making night-time operation of the set extremely difficult. Oh dear . . . I'd be diving in there with a wire-ended bulb coupled to the tone button myself, but then Yaesu don't provide any circuit information with the set do they . . . Tut, tut.

Having had my little moan, I'll go on to say that I was literally amazed with the sensitivity of the receiver, it is certainly the most sensitive 70cm portable I have yet come across. Even a 35km distant repeater in Cambridge was fully quieting on the helical whip inside my bungalow. A comparative test with my usual

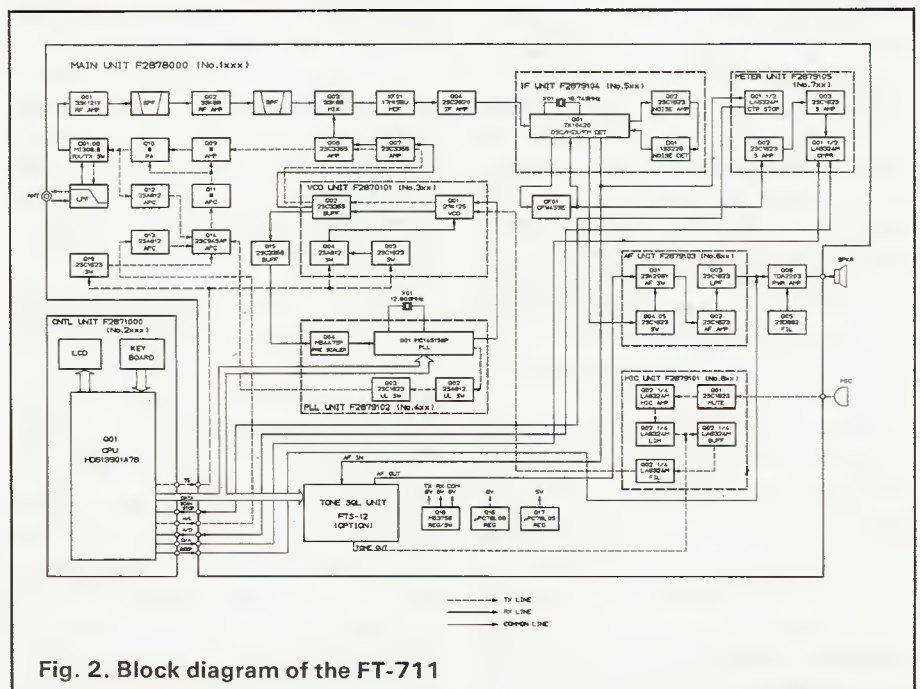
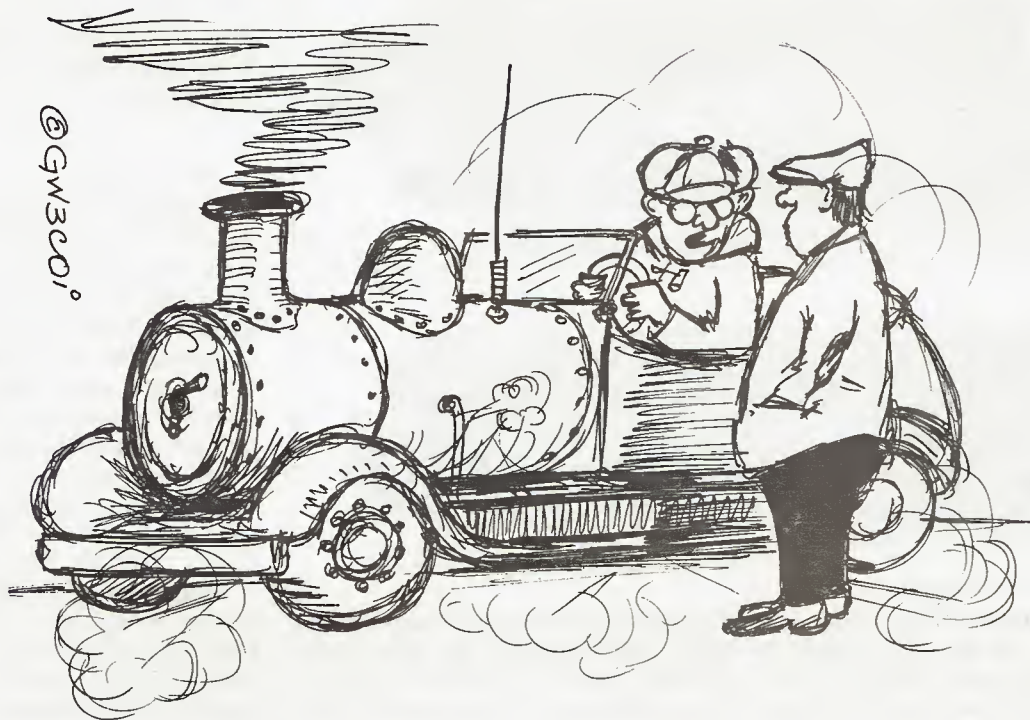


Fig. 2. Block diagram of the FT-711



"IT'S AN ANSWER TO THE IGNITION NOISE PROBLEM...."

70cm portable, which I normally have to move around to get such a good signal, confirmed this. On transmit I found the battery life excellent, several hours of monitoring as well as a continuous hour or so of QSO was certainly possible before recharging and during the review period the nicad pack never went flat!

When operating the set within 100m of an active 70cm repeater, listening for distant signals showed a slight increase in noise when operating close to the stronger signal, but this really was a severe test. I found by tuning 12.5kHz off frequency, distant signals disappeared quite nicely, showing good selectivity was in hand for getting rid of those 12.5kHz spaced signals from the widely publicised primary band users that we're not supposed to listen to.

Reports received on my transmitted modulation were very pleasing, on receive I found the audio certainly wasn't the usual 'tinny' quality one expects from such tiny speakers, but instead was very full and readable; however, I found the available volume was only just sufficient for use in noisy surroundings. Placing the set in an

inside pocket in such conditions could mean the odd lost call if an earphone was not used.

### Innards

Both sets employ a main motherboard with fitted daughter boards housing the RF and analogue circuits, with the digital control circuitry fitted to a separate front-panel board in each case. Chip components are liberally used to give good reliability coupled with compact size, the FT-73R is especially full inside but I can't help thinking that the FT-711RH could have been made smaller, albeit at the expense of a more cluttered front panel.

The FT-73R uses a two-piece zinc and aluminium die-cast alloy case, with rubber-sealed controls and a polycarbonate battery case, giving a good degree of protection against accidental drops and the ravages of the weather. The FT-711RH uses a pressed metal case and lids, together with a large die-cast rear panel and heatsink to which the high-power TX PA module is directly bolted. The transmitter amplifier is completely screened, and thick earth straps to

this screen are in evidence on the receiver front end and VCO to provide the good earthing that is so essential at UHF.

From the accompanying block diagrams, it can be seen that only a broadly similar arrangement is used, even though the two sets are almost identical in their operation. Small tunable helical front-end bandpass stages are used in each receiver, three in the FT-73R and four in the FT-711RH, followed by a mixer and monolithic dual crystal filtering at the first IF of 17.2MHz. On transmit a directly modulated final frequency VCO is used and this is amplified and fed to a block PA module in each case. Different synthesisers are used between the equipment, but each is driven by a variant of a battery-backed HD613901A CPU. No mention is made of this backup battery in the manual, even in the sections entitled '*In case of problems*', maybe they somehow don't go flat!

### Laboratory Tests

The measured receive sensitivity on both sets confirmed the good results obtained in practice, the FT-73R particularly so. Likewise



with the intermodulation rejection, especially taking the sensitivity into account and the adjacent channel rejection at  $\pm 12.5\text{kHz}$  was also very good.

The close-in blocking rejection on the FT-73R was a bit poor, this probably being caused by synthesiser noise reciprocal mixing from the on-air effect already noted, this improved greatly further out where both sets were excellent. The maximum available audio output from the FT-73R (measured using the 7.2V nicad supplied) was a little disappointing, but I believe a higher output might drive the small internal speaker into distortion and I would recommend a headset or earphone for use in high ambient noise surroundings.

On transmit, the FT-711RH gave an ample amount of RF power output, which would certainly be used to good effect in fringe areas or

for long distance simplex work on 70cm with its higher path loss over 2m. The FT-73R gave just under 2W measured with a 7.2V supply and a potent 7.5W at 12V, as would be gained when using the larger battery pack. The resultant efficiency in both cases was very good, again confirming the long battery life of the FT-73R and cool operation of the FT-711RH. The harmonics were very well suppressed, but I noted spurious on the FT-711RH at  $-69\text{dBc}$  separated by around  $\pm 38\text{MHz}$  from the carrier frequency. These fall just below the TV band yet just above the UHF two-way frequencies hence they shouldn't cause too many problems in use, and are reasonably well suppressed in any case. The transmit deviation of the FT-73R was a bit over the top, but this shouldn't cause too many problems with 25kHz channel spacing.

## Conclusions

Both sets are certainly good performers and coupled with the extremely easy-to-use operating system they would appeal to the user who would like a no-frills mobile or portable for everyday use. The high power mobile is especially useful for fringe area use, aided by the good receiver sensitivity in both cases. I was delighted with the FT-73R concept especially for local use, and the simple operation of the FT-711RH was very handy when mobile, but bear in mind the number of memory channels provided. Being less than the number of repeater channels currently in use this could possibly be limiting if you never want to miss a signal. Mind you, if they had more memories they'd be more complicated...

*My thanks go to South Midlands Communications for the loan of the review equipment.*

### Laboratory Results — FT-73R & FT-711RH Receiver

Sensitivity: Input level to give 12dB SINAD		
Freq.	FT-73R	FT-711RH
430MHz	0.139 $\mu\text{V}$ pd	0.141 $\mu\text{V}$
435MHz	0.128 $\mu\text{V}$ pd	0.139 $\mu\text{V}$
440MHz	0.142 $\mu\text{V}$ pd	0.157 $\mu\text{V}$

Squelch Sensitivity		
Level	FT-73R	FT-711R
Threshold	0.087 $\mu\text{V}$ pd 3.5dB SINAD	0.051 $\mu\text{V}$ pd 1.5dB SINAD
Maximum	0.211 >20dB SINAD	0.239 >20dB SINAD

Adjacent Channel Selectivity: Measured as increase in level of interfering signal, modulated with 400Hz at 30% system deviation, above 12dB SINAD ref. level to cause 6dB degradation in 12dB SINAD on-channel signal		
Spacing	FT-73R	FT-711R
+12.5kHz	52.0dB	48.5dB
-12.5kHz	39.0dB	35.5dB
+25kHz	63.0dB	73.0dB
-25kHz	62.5dB	72.0dB

Blocking: Increase over 12dB SINAD level of interfering signal modulated with 400Hz at 1.5kHz deviation to cause 6dB degradation in 12dB SINAD on-channel signal		
Spacing	FT-73R	FT-711R
+100kHz	76.0dB	87.0dB
-100kHz	78.0dB	86.5dB
+1MHz	93.0dB	98.0dB
-1MHz	93.0dB	95.5dB
+10MHz	99.0dB	110.0dB
-10MHz	100.0dB	112.0dB

Intermodulation Rejection: Increase in level over 12dB SINAD of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product		
Spacing	FT-73R	FT-711R
25/50kHz	66.5dB	70.5dB
50/100kHz	67.5dB	70.0dB

Maximum Audio Output: Measured at 1kHz on the onset of clipping		
Load	F7-73R	FT-711RH
3ohm load	195mW RMS	2.20W RMS
8ohm load	190mW RMS	1.25W RMS
15ohm load	150mW RMS	820mW RMS

	FT-73R	FT-711RH
Peak Deviation	6.06kHz	4.65kHz
Toneburst Deviation	4.10kHz	4.25kHz
Frequency Accuracy	-500Hz	-800Hz

Harmonics/Spurii		
Harmonic	FT-73R	FT-711RH
2nd Harmonic	-73dBc	-87dBc
3rd Harmonic	-94dBc	>-100dBc
4th Harmonic	>-100dBc	>-100dBc
Spurii	-92dBc at $\pm 12.8\text{MHz}$	-69dBc at $\pm 38\text{MHz}$

Image rejection: Increase in level of signal at -34.MHz to give identical 12dB SINAD signal		
	FT-73R	FT-711R
	0.117mV pd 59.2dB	0.198mV pd 63.2dB

S-Meter Linearity			
Lit segments	FT-73R		FT-711RH
2	0.34 $\mu\text{V}$ pd	0dB ref	0.42 $\mu\text{V}$ pd
4	0.52 $\mu\text{V}$	+3.7dB	0.61 $\mu\text{V}$
6	0.75 $\mu\text{V}$	+6.9dB	0.93 $\mu\text{V}$
8	1.07 $\mu\text{V}$	+10.0dB	1.34 $\mu\text{V}$
10	1.41 $\mu\text{V}$	+12.4dB	1.69 $\mu\text{V}$
12	1.96 $\mu\text{V}$	+15.2dB	2.05 $\mu\text{V}$
14	5.12 $\mu\text{V}$	+23.6dB	2.95 $\mu\text{V}$

### Transmitter

TX Power and Current Consumption — FT-711RH				
Freq.	Power	10.8V Supply	13.8V Supply	15.6V Supply
430MHz	High	26.2W/5.86A	44.9W/7.58A	44.9W/7.62A
	Low	5.9W/2.98A	5.9W/3.06W	5.9W/3.08A
435MHz	High	25.1W/5.43A	44.9W/7.12A	44.9W/7.09A
	Low	5.7W/2.78A	5.7W/2.88A	5.7W/2.90W
440MHz	High	23.5W/4.99A	42.4W/6.75A	43.3W/6.04A
	Low	5.6W/2.58A	5.6W/2.66A	5.6A/2.68A

TX Power and Current Consumption — FT-73R			
Freq.	Power	7.2V Supply	12.0V Supply
430MHz	High	1.94W/800mA	7.81W/1.68A
	Low	0.22W/376mA	0.75W/530mA
435MHz	High	1.76W/762mA	7.5W/1.64A
	Low	0.13W/335mA	0.61W/495mA
440MHz	High	1.72W/748mA	8.26W/1.63A
	Low	0.09W/313mA	0.35W/428mA

# LOWE SHOPS.

## In Glasgow,

the shop manager is Sim, GM3SAN,  
the address, 4/5 Queen Margaret Road,  
off Queen Margaret Drive, Glasgow,  
telephone 041-945 2626.

## In the North East,

the shop manager is Hank, G3ASM,  
the address, 56 North Road, Darlington,  
telephone 0325 486121.

## In Cambridge,

the shop manager is Tony, G4NBS,  
the address is, 162 High Street, Chesterton, Cambridge  
telephone 0223 311230.

## In Cardiff,

the shop manager is Carl, GWOCAB,  
the address, c/o South Wales Carpets, Clifton Street, Cardiff,  
telephone 0222 464154.

## In London,

the shop manager is Paul, G4PTI  
the address, 223/225 Field End Road, Eastcote, Middlesex,  
telephone 01-429 3256.

## In Bournemouth,

the shop manager is Colin, G3XAS,  
the address, 27 Gillam Road, Northbourne, Bournemouth,  
telephone 0202 577760.

**Lowe Electronic Shops** are open from 9.00am to 5.30pm,  
Tuesday to Friday and from 9.00am on Saturday. Shop lunch  
hours vary and are timed to suit local needs. For exact details  
please telephone the shop manager.

# packet radio from Kantronics.

**KPCS**...This KANTRONICS designed AX25 version 2 TNC features a built-in VHF and HF modem, full duplex operation and multiple connect facilities. The serial RS 232 port, combined with the enhanced generic command structure allows operation with any computer.

**KPCS** ..... £165.00 inc vat, carriage £8.00

**KPC4**...A KPC4 is your gateway into packet flexibility. Having two packet ports, digipeating on each port and gateway between ports, the KPC4 lets you bridge two frequencies on one band or operate cross band. The KPC4 also includes the PERSONAL PACKET MAILBOX feature.

**KPC4** ..... £510.00 inc vat, carriage £8.00

**KAM**...Combine VHF packet, HF packet, CW, RTTY, ASCII and AMTOR in one unit.

**KAM** ..... £289.00 inc vat, carriage £8.00



# 1300HC frequency counter.

Small enough to fit into a shirt pocket, the 1300HC frequency counter brings easy and accurate frequency measurement well within everyone's reach.

The 1300HC uses a full 8 digit display, and measures to 1300 MHz, thus being ideal for amateur as well as all mobile radio bands including cellular.

The unit contains its own rechargeable NiCad battery pack which is charged from an external supply. The frequency counter can also be powered from any 9 to 12V dc supply, which charges the batteries as well.

The 1300HC has excellent sensitivity, and when used with the optional telescope whip, easily measures transmitter frequencies of mobile or handheld transmitters, even low powered "bug" devices. When used in conjunction with a simple "dip oscillator", the 1300HC makes checking tuned circuit or aerial resonance an easy task.

The high performance of the 1300HC frequency counter makes it an indispensable tool for every amateur, engineer or technician. Its small size makes it suitable for either shack or "on the move" use.

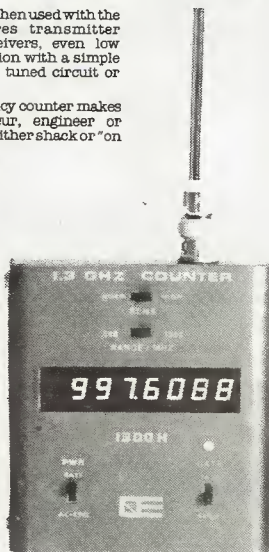
## SPECIFICATION

Range ..... 1-1300 MHz  
Resolution ..... 100Hz at 2.5 sec. gate  
1 kHz at 250 ms. gate  
Display ..... 8 digit 0.3" LED  
MHz decimal point  
Leading zero blanking  
Gate times ..... Fast. 250 ms  
Slow. 2.5 s  
Sensitivity  
(typical) 1-10 Mhz...10 - 150 mV rms  
10-1000 Mhz...3 - 50 mV rms  
1 - 1.3 GHz...10 - 150 mV rms  
Accuracy  
(typical) .... +/- 1ppm, +/- 1 count 1SD  
Aging ..... 0.1 ppm/month (typical)  
Gate indication Red LED during sampling  
Input connector ..... BNC  
Input power ..... 0 - 12 Vdc at 150 mA  
Power connector Concentric. Centre pos.  
Case .... Brushed anodised aluminium  
Size ..... 3.9H x 3.5W x 1D (inches)  
Weight ..... 255 g  
Power supply ..... Internal NiCad pack  
(supplied) or external dc source (option)  
9

**1300HC** Handheld frequency counter  
..... £135.00 inc vat, carriage £2.00

## OPTIONS

**PS12** AC mains power supply  
..... £5.50 inc vat, carriage £2.00  
**BNC6** Telescopic whip



..... £7.46 inc vat, carriage £0.50  
**CG12** Padded carrying case  
..... £9.90 inc vat, carriage £1.00

# HOKUSHIN aerials.

## BASE STATION AERIALS

**HSVKS**...80 to 10 metres vertical, includes radials £218.00 inc. vat, carriage £8.00

**HF5R**...Radial kit for use with HF5 when mounted on chimney or gable end. .... £54.81 inc vat, carriage £8.00

**GFV5**...Two metre base station colinear, 6.5 dB gain, 3.1 metres high ..... £54.92 inc vat, carriage £8.00

**GFV23**...as above but 3 section colinear, 7.8 dB gain, 4.45 metres high ..... £51.97 inc vat, carriage £8.00

**GFV7**...Seventy centimetre triple 5/8 base station colinear, 6.8 dB gain ..... £45.59 inc vat, carriage £8.00

**GFV720**...Dual band (144/430 MHz) base station aerial. £45.66 inc vat, carriage £8.00

## MOBILE AERIALS

**2E**...Two metres 5/8 whip, 3.4 dB gain, foldover base £14.55 inc vat, carriage £2.00.

**2NE**...Two metres 7/8 whip, 4.5 dB gain, foldover base £24.23 inc vat, carriage £2.00.

**OSCAR430**...Seventy centimetre triple 5/8 whip, 6.3 dB gain ..... £27.72 inc vat, carriage £2.00.

**OSCAR720**...Dual band (144/430 MHz) whip ... £24.59 inc vat, carriage £2.00.

**HS770**...144/430 MHz diplexer for use with OSCAR720. £18.02 inc vat, carriage £1.50.

**GSS**...Gutter mount (requires RG4M cable assembly). £6.26 inc vat, carriage £1.25.

**RG4M**...Cable assembly for GSS base, complete with SO239 and PL259 plug ..... £6.26 inc vat, carriage £1.00.

**12B**...Car wing mount with SO239 top and bottom. £5.73 inc vat, carriage £1.00.

**HSTMB**...Car boot mount including cable and PL259. £15.42 inc vat, carriage £1.50.

**MA200S**...High quality mag mount with cable and strong protective cover to prevent paintwork damage. £22.90 inc vat, carriage £2.00.

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Chesterfield Road, Matlock, Derbyshire DE4 5LE

Telephone 0629 580800 (4 lines)



# 45 watts on 2 metres, the TM221E. 35 watts on 70 centimetres, the TM421E.



The new **KENWOOD** and **TM421E** two metre and seventy centimetre **FM** mobile transceivers have been specifically designed to condense maximum performance and operating convenience into a compact package. Output power is 45 watts on two metres (**TM221E**) and 35 watts on 70 centimetres (**TM421E**). Receiver sensitivity matches the output power of the set and measures an amazing 0.14µV for 12dB SINAD (across 144-146). The figures are those given by Chris Lorek in his recent **TM221E** review published in the July edition of **HAM RADIO TODAY**.

**Much discussion** has taken place recently regarding 12.5 and 25 kHz spaced frequency channels on the two metre band. With the new mobiles channel spacing is not a problem. **KENWOOD** with their usual attention to detail have made the frequency step user selectable. The steps available are 5, 10, 12.5, 15, 20 and 25 kHz. Once programmed either microphone up/down button or the transceivers front panel knob can be used to step the transceiver across the band. Of course should it be necessary the selected step can easily be changed.

**A new orange backlit liquid crystal display** gives the transceiver an amazingly clear frequency readout that can be read in the brightest of sunlight.

**The transceiver has all essential operating aids.** There are 14 memory channels, each of which holds frequency, whether simplex or repeater operation is required and whether or not the tone burst is on or off. Scanning can either be memory with the ability to lock out unwanted channels or band with the scan limits set by the operator. The usual priority channel facility is also included to make sure that

no call is missed. As well as showing the operating frequency the display also indicates which of the facilities are being used.

**Occasionally** a piece of equipment comes along which catches the imagination: the **RC10** remote controller/handset for the **TM221E** and **TM421E** does just that. Designed to operate with either transceivers or link both together, the **RC10** looks more like a cellular radio car phone than a piece of amateur radio equipment.

**In fact** the **RC10** not only looks like a car phone, but as a speaker and microphone are built-in, operates as would a telephone handset. Easily mounted in any car, dashboard or transmission tunnel, the **RC10** controls all transceiver front panel functions with the exception of on/off and high/low power selection. The functions controlled by the **RC10** are volume, squelch on/off, frequency readout, keypad frequency entry, memory selection and frequency or memory scanning. Full duplex operation is possible when both transceivers are fitted.

**From a security point of view** it may even possible to mount the transceivers out of sight and only have the controller on view. Since most thieves now know that a cellular phone is not a saleable item, owning an **RC10** may be a wise investment!

**Although** I have not seen the **RC10**, I am of the opinion that it will do much more than I have already described. I suspect that it will be possible for the **RC10**, when used in conjunction with both 2 metre and 70 centimetre transceivers, to operate as a personal repeater. Parked at the top of a multi-storey car park and left unattended, I would not be surprised if you could not talk-in to the installation from another small handheld on 70 centimetres (say a **TH41E**) and have your transmission re-broadcast at a higher power from the good location on 2 metres. Any reply would be re-transmitted to you on 70 centimetres. Useful and ideal for staying in contact when wandering around town. Helpful also for **RAYNET** use.

**Of course I may be wrong!**

**TM221E** ..... £317.30 inc VAT Carriage £8.00  
**TM421E** ..... £352.84 inc VAT Carriage £8.00

# FREE

Send only £1 to cover postage and packing and we will send you, by return, a **FREE** copy of the new full colour **KENWOOD** catalogue which lists the features and specification of every model and accessory currently available. We will also include, **FREE OF CHARGE**, a copy of our general catalogue which, along with items to enhance your operating contains much useful information. Finally, we will add the latest edition of our price list.

## the **TS711E** and **TS811E** PERFECT BASE STATIONS!



The **KENWOOD TS711E** two metre base station is perfection epitomised; receiver sensitivity and the ability to reject unwanted adjacent signals is outstanding. For the serious operator, any other transceiver is unacceptable.

**Similar in specification and appearance** to the **TS711E** but operating on seventy centimetres is the **KENWOOD TS811E**. When used along side the **TS711E**, the **TS811E** completes the ideal equipment line-up and provides the best possible access to the satellites for the **VHF/UHF** enthusiast.

The **TS711E (TS811E)** covers the two metre (seventy centimetre) band from 144 to 146 MHz (430 to 440 MHz). Operating modes are USB, LSB, CW and FM. When switched to the "auto" position the transceiver correctly selects mode according to frequency, a great advantage for the blind operator. Simple up/down frequency shift is provided on the front panels and also on the microphones.

**Power output** on all modes is 25 watts. For **QRP** operation the output can be reduced using a front panel control.

The **TS711E (TS811E)** has **IF shift**, an essential feature when the band is crowded during a contest. To help work DX, speech processing is also available.

The transceiver has two separate **VFO's** and forty memory channels. Each memory stores frequency, operating mode, whether simplex or repeater shift and if the 1750 Hz tone burst is on or off. The **VFO** can be either free running as for **SSB** or **CW** operation or electrically switched to a "click" stop for **FM** where it changes frequency in 12.5 or 5 kHz steps. Frequencies stored in memory can be readily transferred to either **VFO A** or **B**. Depending on how **VFO** was set when the information was put into memory i.e. click stop or free running **VFO**, the rig is set the same when memory information is transferred. It is therefore possible to have **SSB** frequencies transferred with a free running **VFO** and **FM** channels with click stop. A great aid to operating! The second **VFO** can also be quickly put on the same frequency as the one currently being used, ideal when checking the position of a strong adjacent signal whilst remaining on your operating frequency.

**Frequency scan** on **VFO** can either be between or outside user set limits. On memory the transceiver can either scan the entire memory content or be instructed to look at those frequencies of a particular mode. The **TS711E (TS811E)** has a timed hold on an occupied channel.

**Both priority channel** and immediate recall of your local net frequency are possible with the **TS711E (TS811E)**.

**For those with failing sight** or a blind operator the **TS711E (TS811E)** is a dream come true; not only is the operating mode identified by the appropriate **CW** letter sent in tone (**F** for **FM**, **U** for **USB** etc.) but when fitted with the **VSI** optional board, a digitally encoded girl's voice will announce both frequency and, where applicable, whether the rig is switched to repeater shift.

**DCS** (digital code squelch) is also fitted to the **TS711E (TS811E)**.

**TS711E** ..... £940.00 inc VAT Carriage £8.00  
**TS811E** ..... £1094.00 inc VAT Carriage £8.00  
**VSI** ..... £32.62 inc VAT Carriage £8.00

# JST-125

## HF RIG REVIEW



Attracting a lot of attention at the Leicester Show this year was the JST-125 from the Japan Radio Co, displayed in full 'lids-off' condition as well as complete and operational. Selling for £1,395, could this be a worthy contender against the 'Big Three'? The HRT exhibition

itself measures 300mm(W) × 130mm(H) × 273mm(D) excluding projections, and weighs around 10kg. The review model came supplied with the 18MHz and 24MHz amateur bands inhibited on transmit but an internal link can alter this.

horizon radar, as well as ignition interference. Switchable 10dB and 20dB receiver attenuators are fitted for monster aerial users and an RF gain control is complemented by selectable (slow, fast, or off) AGC.

With specialised digital modes of operation becoming more popular each day, it is not surprising to find a designated RTTY position (allowing true FSK as well as AFSK), but the addition of a FAX position could certainly be welcomed by the increasing number of remote image enthusiasts. The transceiver is claimed to withstand high duty-cycle transmit at full power, with continuous transmission capability at 50W output. A front panel mounted power output control gives continuously variable transmit power from 10W to 100W, and an internal RF speech processor with front-panel variable compression level is fitted for SSB DX chasing, together with VOX with front panel variable sensitivity and delay for the ragchewers or for simple AFSK TX/RX switching. Rear panel sockets are provided for a multiplicity of accessory functions such as external linear keying and positive/negative ALC, RTTY mark/space keying, patch in, sidetone out, as well as phono sockets for IF output, audio line level output,

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*Ready for that once in a lifetime splurge on an HF rig?  
Chris Lorek, G4HCL, investigates the new JST-125.  
Could this be the answer to your prayers?*

---

team performed a rapid transfer of the demo unit, immediately subjecting the set to over 40 hours of on-air testing as well as to the evils of G4HCL's spectrum analyser and signal generators.

### Offerings

The set is an extremely smart and professional looking piece of equipment, with hardly a hint of chrome plating to be seen. It offers transmit operation on all HF amateur bands with a 100W output, together with a general coverage receiver from 100kHz to 30MHz. The transceiver operates from a 13.8V supply, requiring a current capability of about 20A for 100W output, a matching power supply being available if required. The set

### Modus Operandi

Modes of operation are CW, LSB, USB, RTTY, AM (Receive only), and FAX (facsimile). A 2.3kHz wide mechanical filter is fitted for all modes apart from AM, where a 6kHz ceramic filter is fitted — two optional narrower filters may be installed for CW use with independently selectable 0.7kHz and 0.32kHz bandwidths. A Passband Tuning control allows the operator to narrow the filter width on either the HF or LF side as desired and this facility operates on all modes apart from AM. Further interference rejection capability is given by a tunable IF notch filter and a switchable noise blanker with variable threshold level, claimed to get rid of 'Woodpecker' type over-the-

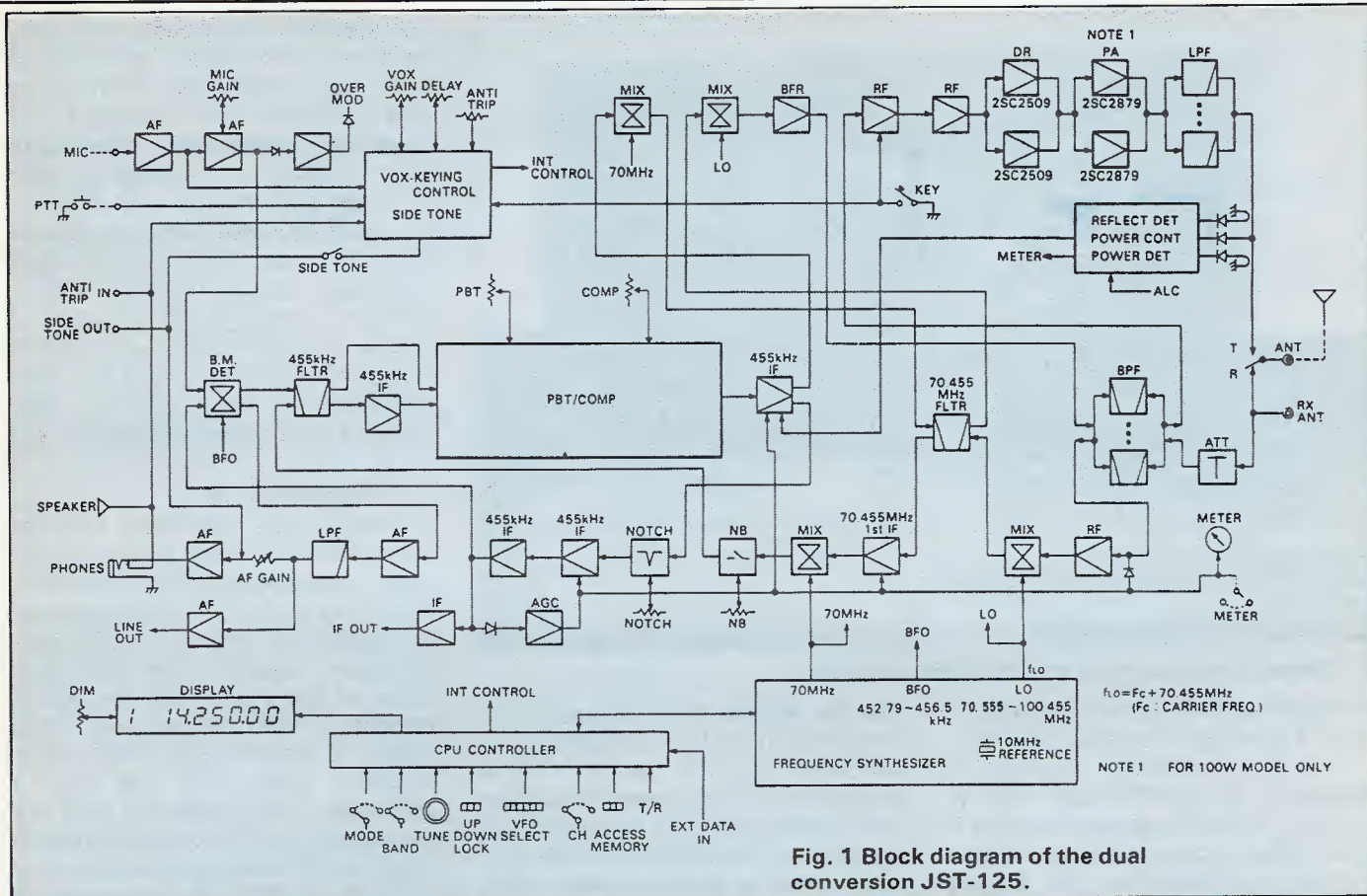


Fig. 1 Block diagram of the dual conversion JST-125.

external speaker and accessory receiver aerial output, together with the usual CW key jack and SO239 main aerial socket.

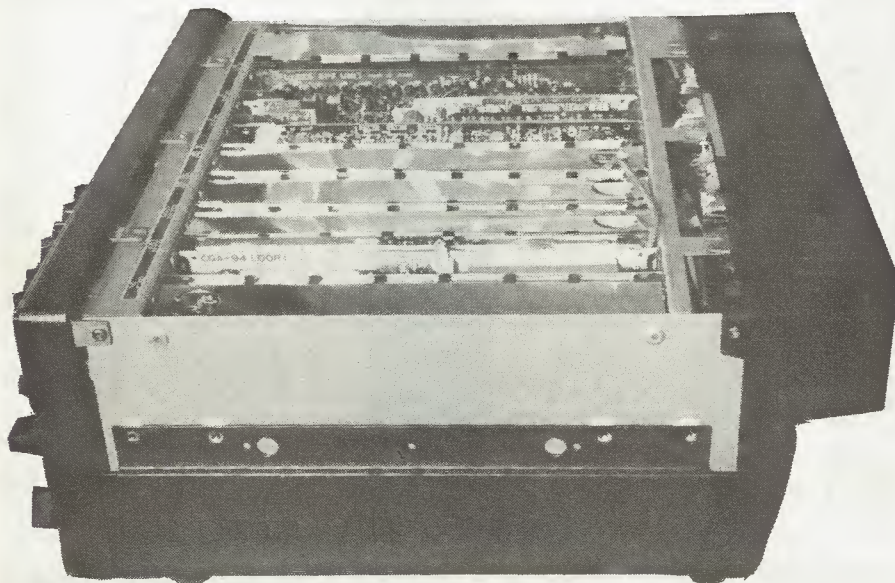
### VFOs and Memories

The large main tuning knob controls both the operating frequency and RIT (Receiver Incremental Tuning) in 10Hz steps, with 10KHz per rotation. Front panel mounted Up/Down buttons allow

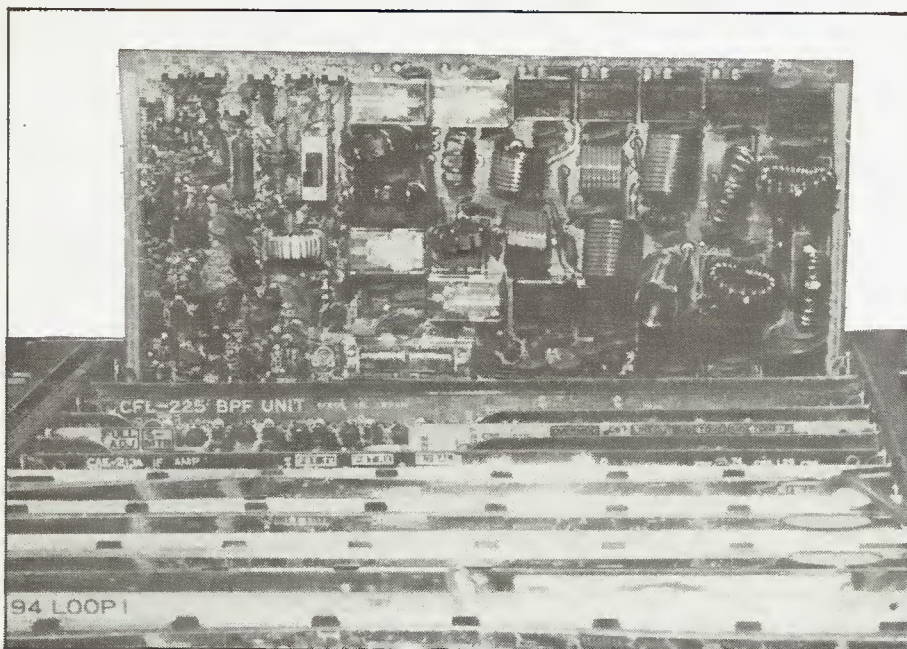
rapid QSY from a selected frequency to aid general coverage reception and these buttons are duplicated on an optional microphone. Two digital VFOs are fitted, each storing frequency and mode with independent or split frequency operation possible and a 'lock' button prevents accidental frequency shifts. A blue-green fluorescent display shows the frequency (or RIT offset) whilst above

this is a string of LEDs indicating the operation mode, transmit mode, memory recall, and TX audio level overmodulation. An adjacent analogue meter shows the received signal level, together with switchable DC supply voltage, PA current, relative power output, compression, and reflected power on transmit. All displays together with the meter backlighting may be dimmed to save your eyes during all-night contest sessions or for the night-owl ragchewers.

Six memory banks designated A-F are fitted, each storing 12 channels; any bank may be selected by a cycling action with a further rotary knob selecting the individual memory channel. Every channel may store frequency and mode data and once selected, the operator may QSY from the memory simply by using the main tuning knob or Up/Down buttons. A scan function cycles through the memory groups, giving a short reception time on the selected memory channel of each group, and a priority check facility gives a short reception period on channel 1 every few seconds when operating in VFO mode. Both Priority and Scan modes may be combined if required, to give for



Modular construction is used throughout.



Modules pull out using the extractor tool provided.

example a check of Channel 1A with each alternate frequency change.

A comprehensive manual is supplied and although this is written in Japanese type English it gives clear operating instructions, connection details, full circuit diagrams and adjustment points plus a troubleshooting guide including how to change the internal lithium battery when it goes flat. The set also comes supplied with plugs for microphone and CW key, two phono plugs for extension speaker/line output, a 12 pin accessory connector, DC power cable and spare fuse and a pair of PCB board extractors.

### User-Definable Features

The manual also gives details on 'customising' the operating modes of the transceiver by initialisation programming to suit the particular user's requirements. For instance, the RIT range may be changed from  $\pm 20\text{kHz}$  max to  $\pm 200\text{Hz}$  max, frequency display offset for LSB/USB, RIT frequency memory, TX frequency variable/unvariable, total TX inhibition, 'Aux' fixed memory frequencies and so on. Some of the above could also prove useful in certain non-amateur applications which the transceiver may encounter.

### Accessories

As well as the PSU and CW filters, a range of add-on units are available. Two types of aerial tuner

may be added, the first being the manually-controlled NFG-97 unit that sits alongside the set. This is claimed to correct mismatches of up to 3:1 VSWR, and has a single meter measuring 200W/20W/2.5W forward and reflected power, with calibrated VSWR up to 10:1.

A more interesting unit is the weatherproof, remote mounting NFG-220 automatic ATU, designed to be fitted at the aerial feedpoint. JRC claim this is the best position for an ATU, a view with which I wholeheartedly agree. It is claimed to match 5-1,000 ohms resistance and 200pF max capacitance, with a typical tuning time of 2-4 seconds,

10 seconds maximum. The unit receives command information from the transceiver and may be user-defined in 'through' or 'matched' operation dependant upon whether the frequency is in an amateur band or not.

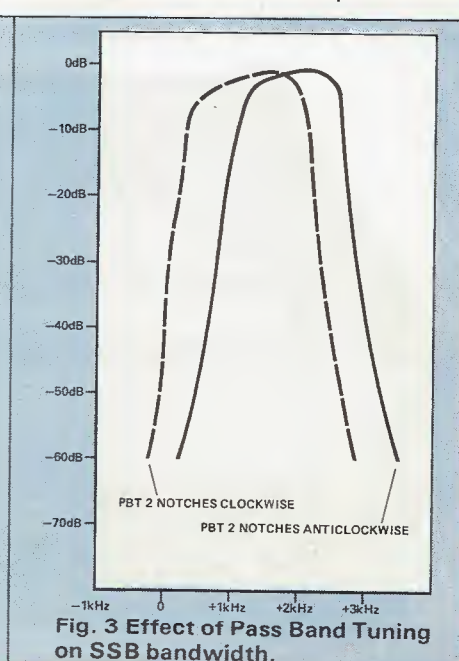
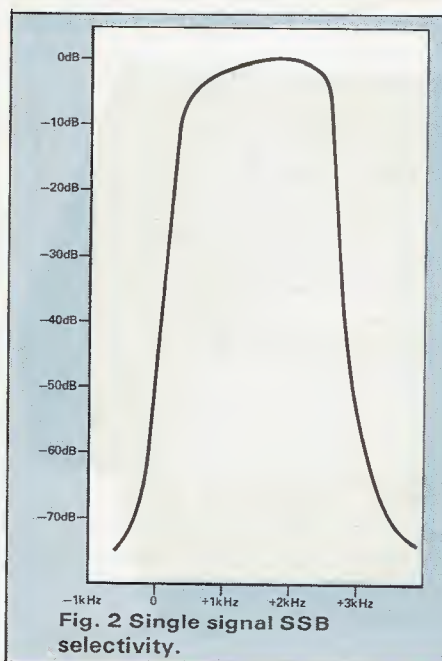
Another potentially very useful device is the NMC-325 RS232C interface unit, allowing remote control of the rig by a personal computer. Further add-ons such as a matching speaker, hand and desk microphones, and even a JRC morse key are also available.

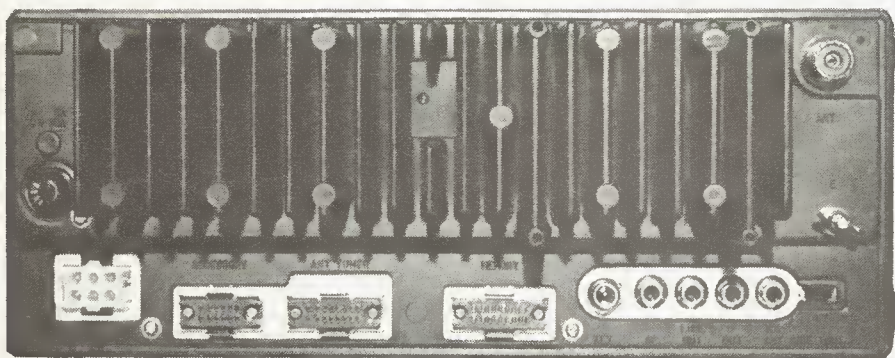
### Impressions

In the past JRC have had the reputation of being in the 'upper class' range of amateur equipment, bordering on the semi-professional. In examining the JST-125 user-definable features, I'm sure that some of these (such as the 200Hz maximum RIT range) are more suited to professional rather than amateur use. The set has a definitive 'aura' about it and the extensive use of plug-in modules for quick repair make one think that it is perhaps a little *too* good for us amateurs! One thing you won't find though are extras such as a built-in iambic keyer, FM mode, simple VHF/UHF transverter capability, speech synthesisers and so on, which reinforces this view.

### Circuitry

The block diagram shows that a double conversion superhetero-





The rear panel consists of the substantial heatsink and interfacing socketry.

dyne receiver is used, a little surprising as many HF receivers nowadays tend to use triple conversion. This shows that careful design must have been used to ensure adequate gain and selectivity distribution in the receiver, with the benefit of having one less mixer stage to overload and hence degrade reception. Signals entering the receiver pass through the switchable T-attenuator, and into the bank of nine bandpass filters covering 0.1-0.5MHz (low-pass filter), 0.5-1.6MHz, 1.6-3.0MHz, 3.0-4.0MHz, 4.0-6.0MHz, 6.0-9.0MHz, 9.0-13.0MHz, 13.0-20.0MHz, and 20.0-30.0MHz. The filtered signal is then passed to a dual 2SK125 RF amp, followed by another pair of 2SK125s acting as the first mixer. The synthesiser-generated 70.555MHz-100.4MHz signal is mixed with the incoming RF to provide the first IF of 70.455kHz, a multi-pole filter providing roofing selectivity. A 2KS192 FET acts as the second mixer to produce the 455kHz second IF, where noise blanking, passband and notch tuning, and demodulation takes place. A multi-pole mechanical filter is used for SSB/CW, a small CFU455H ceramic filter being used on AM.

On transmit, a 455kHz SSB signal is generated in a balanced modulator and this is then filtered, amplified and mixed to 70.455kHz. Here it is filtered again by the 70.455kHz roofing filter, mixed with the synthesiser local oscillator to generate the final RF frequency, and fed through the bandpass filter stack common to the receiver. Amplification to a low level is performed by a pair of 2SC2509s, the final 100W amplifier using a pair of 2SC2879 transistors in push-pull.

The dual loop synthesiser employing MC145145 divider/phase comparators is driven

together with the remainder of the set's control functions by an 8085 CPU, the operating program being stored in a 2764 EPROM with a lithium battery backed 8464 thrown in for good measure.

### On The Air

The set was coupled to my HF trap dipole system, a check of 40m and 80m during the first evening showed fairly quiet bands, had I accidentally left the 10dB attenuator switched in? No, there were signals there but they were not accompanied by the usual burly hash of interference that one often finds. The S-meter was reading fairly low however which I quickly confirmed with a signal generator, so maybe there was a slight psychological element involved here! Tuning around on SSB was a pleasure, I only needed to switch the attenuator in to give my ears a slight rest, rather than being due to any overload problems. Even the strong local 80m station I could hear with the aerial completely disconnected caused me no problems.

The set was given a good testing on the broadcast bands, I found reception of AM signals was a little muffled and I feel the filter band-

width could have done with being a bit wider, but then this could have been at the expense of greater adjacent channel interference. Using the IF notch did cause the occasional problem, for some reason despite the interfering signal being effectively notched out, the wanted SSB or AM signal was sometimes made distorted unless I backed off the RF gain somewhat, this being dependant upon the position of the notch control. I soon learned to live with this, and try as I might I could find no other problems on receive. I appreciated the passband tuning control, this was very effective in cutting out adjacent QRM although sometimes at the expense of loss of fidelity in the wanted signal. Even so, I believe this type of control is certainly more useful than a simple IF shift, which retains the filter width but moves the passband either side of the wanted signal.

Using the Up/Down buttons was very handy in effecting a fast QSY from one end of the band to another, or when tuning away from the amateur bands. The band switch only controls the MHz portion of the selected frequency, so for example if you are on 14.05MHz and select the 1.8MHz band, you are placed on 1.05MHz which is a bit annoying. Eventually I programmed the amateur bands into one of the memory groups, selecting the amateur memory bank which placed me in the correct frequency section as well as the correct mode which, coupled with the ability to instantly QSY, I found most useful.

On transmit, I gained excellent reports on my SSB speech quality using my normal microphone and the 'OVR' peak level modulation LED was very useful in setting up the required mic gain. The front panel analogue meter needle is by its nature little use as a peak reading indication. Using the RTTY mode was rather limited in my case as the transceiver filter centre is unfortunately set up on the American 2125/2295Hz tones rather than the 1275/1445Hz standard as used by the rest of the world — a common problem with many Japanese transceivers. Unless you have a switchable terminal unit, you'll have to use AFSK on LSB instead. Using full power on RTTY QSO's did not cause

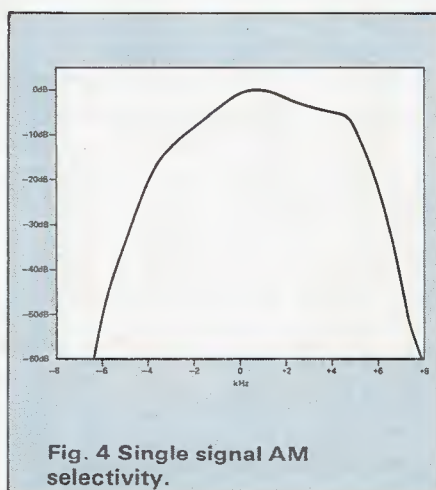


Fig. 4 Single signal AM selectivity.

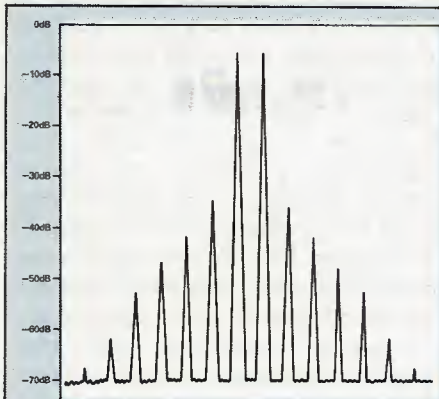


Fig. 5 SSB Tx IMD — 50% power.

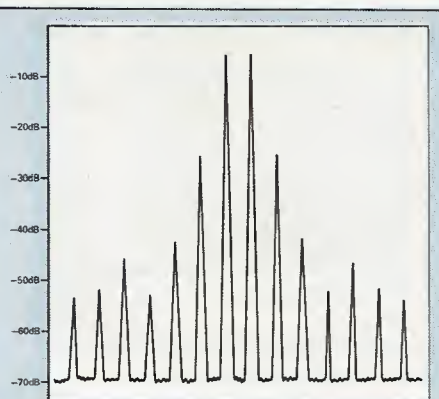


Fig. 6 SSB Tx IMD — full power.

any discernable problems, the large rear heatsink coping admirably.

### Laboratory Tests

Technical boffins read on, mere mortals however may skip this section and be assured that the tests showed no major nasties.

My low-noise cavity-tuned signal generators were being stretched a bit when measuring the blocking immunity of the receiver, which was certainly very good — confirming the on-air results. The SSB selectivity was quite reasonable, limited only at the -70dB level downwards by synthesiser reciprocal mixing. Another synthesiser problem encountered were slight receive spurious

responses, separated by  $\pm 100\text{kHz}$  from the wanted signal, measured at -87dB down caused by second loop reference frequency feed-through. Being a perfectionist, I'm being fairly critical though, and one must bear in mind that I experienced no discernable problems here in rigorous on-air testing.

Inserting and varying the notch filter whilst receiving a steady carrier showed the wanted signal occasionally increased in S-meter level, confirming the on-air effect noted. Further investigation showed this was probably due to the operation on the notch affecting the following AGC detection circuitry.

On transmit, the spectral purity

was fairly reasonable, harmonics and spurious mixing products being well suppressed when considering all the internally generated signals that are floating around. I did find spurious at  $\pm 0.5\text{MHz}$  and  $\pm 1.0\text{MHz}$  on 160m, 80m, and 40m, and at  $\pm 5.0\text{MHz}$  on the higher bands, caused by leakage and mixing of the divided synthesiser reference crystal frequency. From the two-tone IMD tests, I found no degradation was caused by overdriving the transmitter (the 'OVR' LED glowing brightly) even when I added 20dB of RF compression, showing the ALC circuitry was doing its stuff.

### Conclusions

The transceiver performs very well, it does suffer from the usual synthesiser-related problems but not to the extent of some of the competition. The set I feel would not appeal to the gadget freaks or VHF/UHF transverter users, you get a HF set with good receiver strong signal handling and a versatile, rugged transmitter for your money. I feel a few competition and DX-pedition stations may soon be diving into their coffers!

*My thanks go to ARE Communications Ltd for the loan of the review transceiver.*

### Laboratory Test Results JST-125

Receiver Sensitivity for 12dB SINAD (in $\mu\text{V}$ pd)		
Freq (MHz)	CW/SSB	AM (30% Mod)
0.500	1.77	6.60
1.0	0.99	4.50
1.8	0.45	2.10
3.5	0.32	1.40
7.0	0.28	1.20
10.05	0.32	1.30
14.0	0.35	1.50
18.0	0.32	1.30
21.0	0.35	1.40
24.5	0.35	1.50
28.5	0.32	1.30
29.5	0.37	1.60

Internally generated spurious: 447kHz, 455kHz, 2.0MHz, 5.0MHz, 9.155MHz, 10.0MHz, 30MHz. All other signals <1 $\mu\text{V}$  pd equivalent strength.

3rd Order Intermodulation Rejection	
Measured as ratio difference in level required for 12dB SINAD, modified set	
Spacing	Level
50kHz/100kHz	92dB
100kHz/200kHz	92dB

Image and IF Rejection Measured as ratio between on channel 12dB SINAD signal and ( $2 \times 70.455\text{MHz}$ ) and 70.455MHz interfering signal giving 12dB SINAD.

Frequency	Image Rejection	IF Rejection
500kHz	210mV pd (101dB)	26.3mV pd (83dB)
1.0MHz	165mV pd (104dB)	62.3mV pd (96dB)
1.8MHz	415mV pd (119dB)	37.5mV pd (98dB)
3.5MHz	277mV pd (119dB)	53.0mV pd (104dB)
7.0MHz	614mV pd (126dB)	66.0mV pd (107dB)
10.95MHz	69.7mV pd (107dB)	62.3mV pd (106dB)
14.0MHz	91.8mV pd (108dB)	25.7mV pd (97dB)
18.0MHz	82.0mV pd (108dB)	22.4mV pd (97dB)
21.0MHz	66.7mV pd (106dB)	15.7mV pd (93dB)
24.5MHz	59.4mV pd (105dB)	13.3mV pd (92dB)
28.5MHz	56.1mV pd (105dB)	12.6mV pd (92dB)
29.5MHz	53.6mV pd (103dB)	12.2mV pd (90dB)

S-Meter S9 Level sensitivity:		
Frequency	Level	
500 kHz	812 $\mu\text{V}$ pd	
1.0 MHz	451	
1.8	158	
3.5	130	
7.0	126	
10.05	162	
14.0	155	
18.0	166	
21.0	184	
24.5	190	
28.5	197	
29.5	182	

S-Meter Linearity, 14.25 MHz			
Reading	Signal $\mu\text{V}$ pd	ref. S9	Rel. increase
S1	1.08	-43.2dB	—
S2	1.13	-42.9dB	0.3dB
S3	1.24	-42.0dB	0.9dB
S4	2.18	-37.1dB	4.9dB
S5	4.60	-30.8dB	6.3dB
S6	10.1	-23.8dB	7.0dB
S7	21.6	-17.2dB	6.6dB
S8	51.7	-9.6dB	7.6dB
S9	157	0.0dB	9.6dB
S9+10dB	178	+10.8dB	10.8dB
S9+15dB	>15mV pd	>+19.2dB	>8.4dB

Selectivity		
Mode	Measurement point	Bandwidth
SSB/CW	-3dB	1.71kHz
	-6dB	2.09kHz
	-60dB	4.79kHz
AM	-3dB	3.22kHz
	-6dB	6.02kHz
	-60dB	15.79kHz

Blocking: Measured as degradation of on-channel 12 dB SINAD signal to 6 dB SINAD by unmodulated interfering signal	
Spacing	Level
$\pm 50\text{kHz}$	99dB
$\pm 100\text{kHz}$	112dB
$\pm 200\text{kHz}$	>120dB
IF Notch Rejection	>30dB

### Transmitter Tests

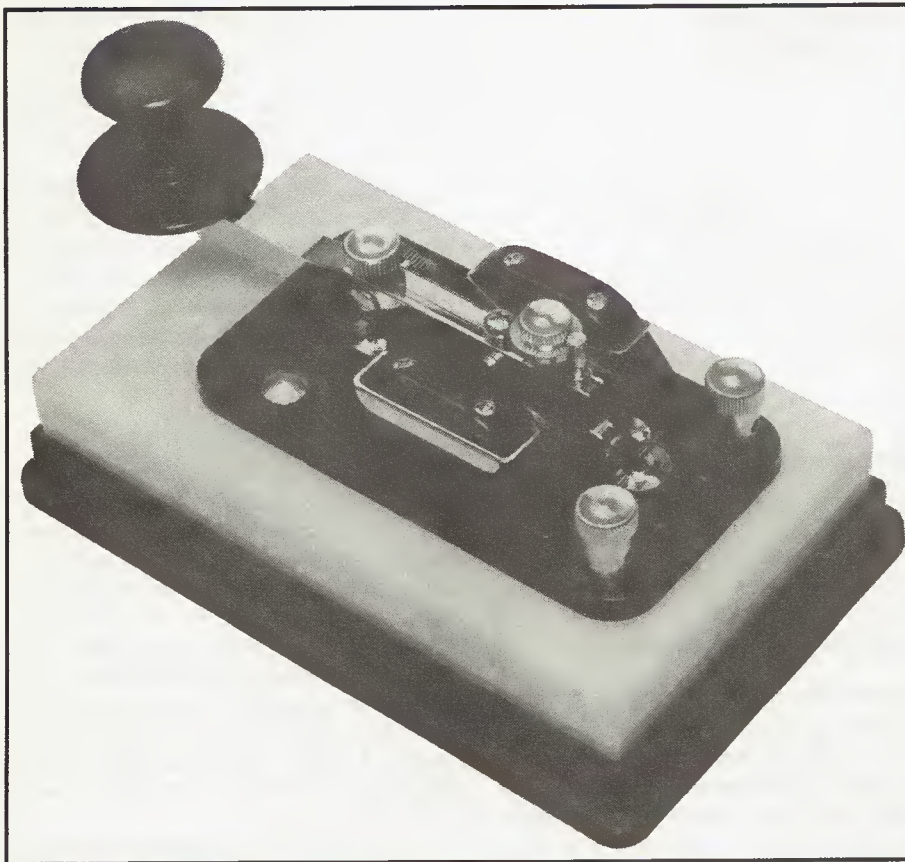
TX Measured Maximum Power (SSB pep)	
Frequency (MHz)	Power
1.8MHz	102W
3.5MHz	104W
7.0MHz	105W
10.05MHz	105W
14.0MHz	104W
21.0MHz	105W
28.5MHz	101W
29.5MHz	101W

TX Harmonics and Spurii					
Freq (MHz)	Harmonics				Spurii
	2nd	3rd	4th	5th	
1.8MHz	-62dBc	-52dBc	-70dBc	-58dBc	-54dBc
3.5MHz	-58dBc	-dBc	<-70dBc	-60dBc	-54dBc
7.0MHz	-61dBc	-62dBc	-68dBc	-69dBc	-55dBc
10.0MHz	-68dBc	-65dBc	<-70dBc	-69dBc	-57dBc
14.0MHz	-43dBc	-63dBc	-70dBc	<-70dBc	-58dBc
21.0MHz	-60dBc	-67dBc	<-70dBc	<-70dBc	-59dBc
28.0MHz	-67dBc	-69dBc	<-70dBc	-69dBc	-57dBc
29.0MHz	-68dBc	-69dBc	<-70dBc	<-70dBc	-57dBc

Two Tone SSB Intermodulation Measured as dB below pep level						
	Order					
	3rd	5th	7th	9th	11th	13th
50% Power	+ -36dB	-42dB	-48dB	-53dB	-62dB	-68dB
Full Power	+ -35dB	-42dB	-47dB	-53dB	-62dB	-68dB
	+ -26dB	-42dB	-53dB	-47dB	-52dB	-54dB
	- -26dB	-43dB	-53dB	-46dB	-52dB	-54dB



# MORSE FORUM



*Ian Poole brings us all the latest news from the world of the on-off carrier and explains how to make your bugs more comfortable with a piece of foam rubber!*

It is obvious from the response to Morse Forum that there are a lot of people who are interested in morse and all matters relating to it. Despite the initial drudgery of learning the code it brings great rewards later on if you can stay with it, and I can vouch for this personally. I can still remember having a couple of 'false starts' in learning the code. Then finally having gained the incentive to start properly I was able to get up to speed fairly quickly until all that was left was to take the morse test itself. With this hurdle passed and the ticket obtained, I found that I could only run some old AM CM equipment as I was still at school and this was all I could afford. This meant that the only way to work DX was to use CW, and as a result, I became

fairly proficient at using it.

Although I envied those who could afford to run sideband equipment, I now look back on the time I spent on CW as a good training and I wouldn't swap it. Now, about eighteen years later (doesn't time fly!), I am able to afford to run sideband equipment, but I still find a lot of enjoyment in CW.

So for those people who have just obtained their Class A licences, it is well worth giving CW a go and resisting the temptation to forget it. There are many people who enjoy using CW because it adds another dimension to their hobby, so why not join them?

Before I go any further with this month's column I must say thank you to everyone who wrote in. I was

very much encouraged by the response as well as the interest which there obviously is in CW. To everyone else who has something to say, please write in, I will be only too pleased to hear from you.

## Using Bug Keys

The mechanical semi automatic keyers, or bug keys as they are often called are still widely used, although possibly not as much as they used to be. These keys work well and I often remember the one I used for many years. However, they do require treating with a little care.

The main problem occurs as a result of contact bounce on the dot contact. This has two effects. The first is obviously that key clicks will be generated and they will have to be suppressed if they are not to spread up and down the band. The second effect is that the contacts become worn and pitted. This results in the key clicks becoming worse and difficulty in adjusting the dot ratio.

All of this can be avoided by taking certain precautions. The first is to avoid keying a circuit carrying a large amount of current. This is easily done in transistor transmitters by simply placing an extra transistor in the supply line of the stage to be keyed, as shown in Fig.1.

The other precaution is quite well known amongst bug key operators and it is easy to implement. It simply involves placing a small piece of foam rubber in the U spring of the dot generator as shown in Fig.2. If both of these ideas are implemented the key should give better service for a longer period of time.

## Morsum Magnificat

It may seem surprising that with the amount of interest there is at the moment in morse, there is a large gap in the market and comparatively little is written about it. Fortunately this gap is now beginning to be filled with regular columns like Morse Forum and a specialist CW magazine.

For those who are interested the magazine is called Morsum Magnificat and is devoted completely to

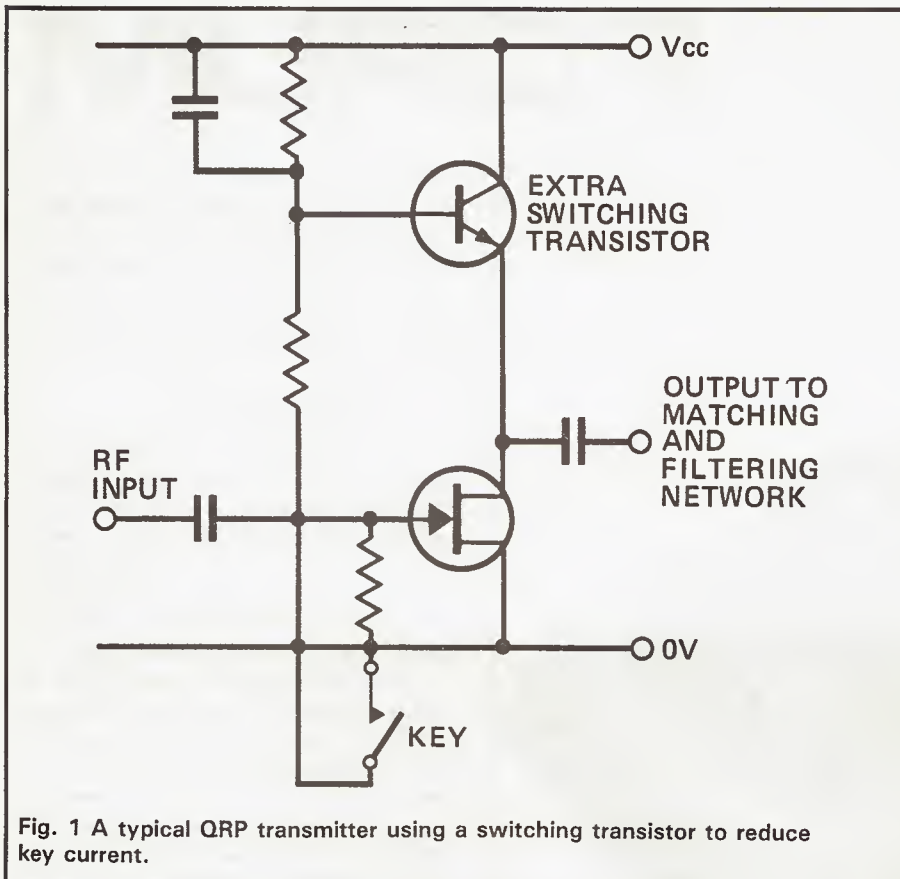


Fig. 1 A typical QRP transmitter using a switching transistor to reduce key current.

morse and its related topics. It was first started in Dutch and continued like this for about three years. Then, in August 1986, it was brought out in English and its circulation grew so that it is now worldwide. To make it even more international it has editors in Holland in the shape of PA0BFN and PA3ALM, and Tony Smith, G4FAI, in the UK.

The magazine contains a wide variety of topics about morse. There are reminiscences of old telegrapher's and ships 'sparks' together with articles from amateurs old and new. On top of this there are up-to-date views with comments and ideas for the future. The magazine is published quarterly and costs £6 a year. Any further information about it can be obtained from Tony Smith, 1 Tash Place, London, N11 1PA.

### New Books

Until recently there have been very few books available which are devoted to the morse code and various aspects of it. Fortunately this is all changing now and a number of books have come out recently. One of these is published by the ARRL, then there is 'Morse Code for Radio Amateurs' published by the RSGB, and I believe they will be publishing

another book shortly as well.

The most recent book to come out was published in August by SPA publishing. It is called 'The Secret of Learning Morse Code' and it is written by Mark Francis G0GBY. As it is new to the field, I felt that a short review would be in order.

As the name suggests this book deals with actually *learning* the Morse Code. It makes easy reading and contains a lot of useful information and advice about learning the code right from scratch, up to taking the all-important test. One of the strong points about the book is that it is written from recent personal experience and the author cites many of the problems he encountered and the ways in which he overcame them.

The book contains chapters entitled: How it all Started; Making up Your Mind; Learning the Basics; Receiving the Code; Sending Morse; Improving your Speed; The Test Itself; and Other Information.

There are also some appendices: The Code; International Q Code and Abbreviations; Sample QSO; Additional Sending Practice; Sample Tests; Definition of 12 words per minute and Useful Addresses.

So all in all, for anyone considering taking the CW test it could be a good investment. It may also convince you that CW is worth using after the test (I hope so anyway). Finally the cost: £4.95 plus 90p p&p, and it is available from Waters and Stanton at Hockley.

### Reporting Systems

One of the advantages of the abbreviations which are widely used on CW, and on phone to a lesser degree, is that they enable information to be transmitted more quickly and more concisely. Having said this the faithful old RST code does not report everything that needs to be said. For example, how often is it useful to send information about the level of QRM, QRN or QSB. This obviously takes extra time as it is not part of the code.

To overcome this sort of problem Jesse Luxton G4GOF has devised a system he calls the RSTINF code. In this, the RST part is the same as the code which is in everyday use on the bands. Then the 'INF' section reports Interference (QRM), Noise (QRN) and Fading (QSB).

The degree of each of these would be indicated by a figure between 1 and 5. 1 would indicate very slight; 2 slight; 3 moderate; 4 severe; 5 extreme. So a signal report of 589231 would indicate a perfectly readable strong signal with a pure DC note. It would additionally tell that there was slight interference,

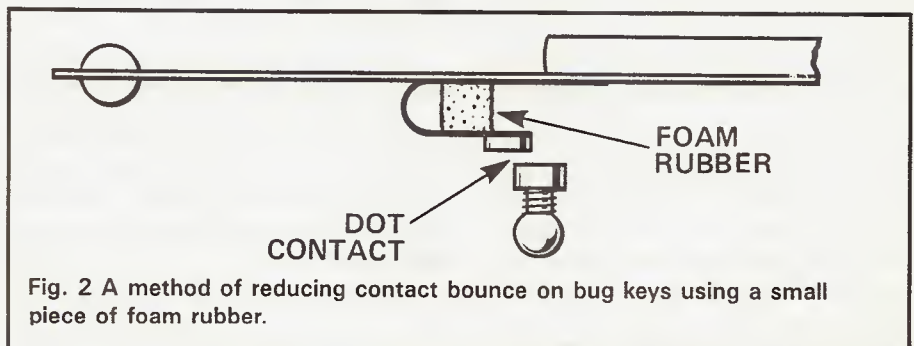


Fig. 2 A method of reducing contact bounce on bug keys using a small piece of foam rubber.

moderate noise and very slight fading — a quick and concise way of giving a report.

### News and Happenings

Straight Key evenings and operating periods are becoming increasingly popular these days. There was the Edgware and District Amateur Radio Society evening in May and now the RSGB have announced one as well. Unfortunately news of this came through too late to be included in the previous Morse Forum so the actual event will be history by the time this appears. For the record though, it took place on Saturday, 10th October, and lasted from 0800 to 2100 GMT, using frequencies between 3515 and 3555kHz. For next year it might be nice to extend it to 2 metres because there is quite a lot of activity there as well.

November 7th and 8th sees the RSGB annual 144MHz CW contest. Lasting from 1400 GMT on the Saturday to 1400 GMT on the Sunday, it gives a good opportunity for a CW contest on 2 metres.

On the following weekend, November 14th and 15th, is the EUCW Fraternising QSO Party. For those who don't know about the EUCW it is an organisation of European clubs interested in CW operation.

For example, two UK members are the G-QRP Club and CW Tops. The rules for the QSO Party are a little involved, but here goes! Dates and frequencies: November 14th 1500-1700 GMT use frequencies between 7010-7030 and 14020-14050kHz. Then between 1800 and 2000 GMT used 7010-7030 and 3520-3550kHz. On November 15th 0700-0900 GMT use 7010-7030 and 3520-3550kHz then 1000-1200 GMT use 7010-7030 and 14020-14050kHz.

There are four classes of operation: a) licenced members of EUCW member organisations using more than 10W input or 5W output; b) licenced members of EUCW organisations using less power than above; c) other licenced amateurs using any power; d) SWL's.

QSO exchanges should be RST/QTH/Name/Club/Membership Number for classes A and B or RST/QTH/Name/NM (ie. non-member) for class C. SWL's must log the exchanges of both stations. Contacts with one's own country count for one point, and contacts outside count for three. SWL's claim three points for each complete QSO. Multipliers — one for each EUCW organisation worked per day and band. Logs showing date, time (GMT), band, callsign, information sent and received and points claimed for each contact together with a signal summary sheet of name, callsign, score and rig details including power used should be sent to: DJ2XP Guenther Niebauer, Illingerstr. 74, D6682 Ottweiler, Federal Republic of Germany.

### Sign-Off

That's it for now. Please remember to write in with your news, views or anything that is associated with CW. Contributors are always acknowledged — unless you *want* to be anonymous of course!

# It's easy to complain about advertisements. But which ones?

Every week millions of advertisements appear in print, on posters or in the cinema. Most of them comply with the rules contained in the British Code of Advertising Practice.

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# RADIO Tomorrow

- 1 Dec** Loughborough ARC: Night on the air.  
Wakefield DRS: Night on the air.  
Fylde ARS: Construction competition.  
Chester DRS: Committee meeting.  
Sutton & Cheam RS: Committee meeting.  
Chichester DARC: Club meeting.
- 2 Dec** Fareham DARC: Talk 'Bobbins, baluns and beads' by G3CCB.  
S Bristol ARC: Test equipment rally.  
Chesham DARS: Natter night.  
Banbury ARS: Talk 'Satellite Communications' plus Questions & Answer forum on the RSGB by Neill Taylor G4HLX.
- 3 Dec** Mid Sussex ARS: Night on the air.  
Bredhurst RTS: Talk 'Simple sideband' by G3ROO.  
Salop ARS: Talk 'Drug abuse.'  
Salop ARS: Talk 'Drug abuse' by Community Police Officers.  
E Kent RS: Annual cheese & wine party.  
Yeovil ARC: Talk 'VHF propagation & choosing a site' by G3GC.  
Horsham ARC: AGM.
- 4 Dec** Mansfield ARS: Christmas party.  
Loughton DARS: Night on the air — 6m.  
Harrow RS: Activity night.
- 5 Dec** **RSGB AGM.**
- 6 Dec** 144MHz fixed & AFS contest.  
**Verulam ARC Christmas Rally, St Albans City Hall. From 11am to 5.30pm. Admission £1, plenty of parking, trade stands, bring & buy, refreshments and bar. Talk in on 2m and 70cm. Details from G4JKS on (0727) 59318.**
- 7 Dec** Stourbridge DARS: Night on the air.  
Welwyn/Hatfield ARC: AGM.  
Todmorden DARS: George Dobbs Annual Christmas Lecture.  
Sutton & Cheam RS: Natter night.  
Sheffield ARC: Morse forum.
- 8 Dec** Keighley ARS: Informal meeting.  
Midland ARS: Christmas Party.  
Dorking DRS: Informal meeting.  
Dartford Heath DFC: Pre hunt meeting, Horse & Groom.  
Loughborough ARC: Film show.  
Biggin Hill ARC: Video 'Amateur Radio in Space' and Christmas party.  
Bury RS: AGM.  
Delyn RC: Informal meeting.  
Wakefield DRS: Satellite TV demo.  
Verulam ARC: Activity evening.
- 9 Dec** Chiltern ARC: Christmas party.  
Trowbridge DARC: Natter night.  
Bath DARC: Christmas party.  
SE Kent YMCA ARC: Talk 'How to work meteor scatter' by Ken Willis G8VR.  
S Bristol ARC: Discussion — club project.  
Chesham DARS: Talk 'Technical topics.'  
Farnborough DRS: Christmas social evening.
- 10 Dec** Mid Sussex ARS: Club Christmas Dinner.  
Bredhurst RTS: Talk 'Building GB3KN' by Ted Kent G3YCN.  
Edgware DRS: Annual junk sale.  
Salop ARS: Natter night.  
Yeovil ARC: Talk 'Broadcast studio techniques' by G3FQO.  
Southgate ARC: AGM.
- 11 Dec** Wimbledon DARS: Social evening.  
Itchen Valley RC: Christmas party.  
Dunstable Downs RC: Christmas TV show via GB3TV.
- 13 Dec** Dartford Heath DFC: Club hunt, 2.30pm, Dartford Heath.  
**Leeds DARS Christmas Rally, Pudsey Civic Centre. Details from G4WYD on (0274) 658039.**
- 14 Dec** Sheffield ARC: Pea and Pie supper.  
Felixstowe DARS: Christmas drinks, Grosvenor Hotel, Felixstowe.  
Atherstone ARC: Talk 'Central electricity generating board' by R Hammond.
- 15 Dec** Dartford Heath DFC: EGM.  
Mansfield ARS: Talk 'The oscilloscope' by Mike G8GNN.  
Loughborough ARC: Construction night.  
Fylde ARS: Hot Pot supper at club.  
Rugby ATS: Annual Christmas Dinner.  
Chester DRS: Construction contest.  
Wakefield DRS: Talk 'What am I doing in Amateur Radio — Part 2.'  
Chichester DARC: Annual Christmas social.  
Verulam ARC: AGM.  
Halifax DARS: Christmas social, quiz and pie supper.
- 16 Dec** Hastings ERC: Christmas social.  
SE Kent YMCA ARC: Christmas social.  
Fareham DARC: Talk 'Taking the morse test' by G3TZL.  
Chesham DARS: General meeting.  
S Bristol ARC: Christmas Party.  
Banbury ARS: Talk 'Packet radio' by Roger G4OCO.
- 17 Dec** North Wakefield RC: Christmas dinner.  
Bredhurst RTS: Construction & natter night.  
Salop ARS: Christmas social.  
E Kent RS: Natter night.  
Yeovil ARC: Natter night.
- 18 Dec** Sutton & Cheam RS: Christmas get together.  
Loughton DARS: Christmas dinner.  
Dunstable Downs RC: Members' Christmas party.  
Harrow RS: Activity night.
- 20 Dec** Wakefield DRS: Start of club cumulative contest (ends on 2 Jan).
- 21 Dec** Stourbridge DARS: Main meeting.  
Todmorden DARS: Natter night.  
Yeovil ARC: Christmas party & junk sale.
- 22 Dec** Rugby ATS: Mincepie evening.  
Loughborough ARC: Christmas drink in The Black Swan.  
Wakefield DRS: Christmas social.  
Delyn RC: Informal meeting.  
Chester DRS: Christmas meeting.

- 23 Dec Trowbridge DARC: Christmas Party.  
Chesham DARS: Drinks & sandwiches at The Queen's Head.  
S Bristol ARC: VHF Activity evening.
- 28 Dec Sheffield ARC: Christmas present swapshop!
- 29 Dec Chester DRS: Drink & waffle.

## 1988 HAPPY NEW YEAR!

- 1 Jan Sutton & Cheam RS: Natter night.
- 4 Jan Todmorden DARS: Construction competition.
- 5 Jan Fylde ARS: AGM.  
Delyn RC: Informal meeting.  
Rugby ATS: New Year natter night.  
Chester DRS: AGM.  
Wakefield DRS: Night on the air.
- 6 Jan S Bristol ARC: Cine film evening.
- 7 Jan Bredhurst RTS: Talk 'Phase Lock Loops' by Steve G8NVH.  
Yeovil ARC: Talk 'Contest Operating' by G3GC.  
Salop ARS: Equipment bring & buy.  
Horsham ARC: Talk 'Planning applications' by G3UDU.
- 8 Jan Itchen Valley ARC: Talk 'A low cost panoramic receiver' by Andrew G4XZL.
- 11 Jan Atherstone ARC: Club night.
- 12 Jan Rugby ATS: Constructors' corner.  
Keighley ARS: Natter night  
Wakefield DRS: Debate.
- 13 Jan S Bristol ARC: Bring & Buy.  
Wirral DARC: AGM.  
Willenhall DARS: CW night.
- 14 Jan Edgware DRS: AGM.  
Yeovil ARC: Talk 'Producing Aerial Gain' by G3MYM.  
Bredhurst RTS: Construction & natter night.

- Salop ARS: Special event station GB2SSJ on air (Salop Silver Jubilee).
- 15 Jan Sutton & Cheam RS: Talk 'Air Speed Capacitors' by Malcolm Kirk G4XMK.
- 18 Jan Todmorden DARS: Natter night.  
Bredhurst RTS: Slide competition with Parkwood Photo Society.
- 19 Jan Delyn RC: Informal meeting.  
Wakefield DRS: Mastermind.  
Halifax DARS: Talk 'RAYNET' by David Holdsworth G6COG.
- 20 Jan S Bristol ARC: Hf Activity Evening.
- 21 Jan Yeovil ARC: Talk 'Moonbounce' by G3MYM.  
Bredhurst RTS: Talk 'SWR — the facts' by G3MCK.  
Salop ARS: Video Night.
- 23 Jan Wakefield DRS: Annual dinner.
- 25 Jan Atherstone ARC: Informal at The Bull, Witherley.
- 26 Jan Keighley ARS: AGM.  
Wirral DARC: Surplus equipment sale.  
Wakefield DRS: Talk 'Stateside' by G1FOC.  
Itchen Valley ARC: Talk 'Wireless from the beginning' by Peter G3CBU.
- 27 Jan S Bristol ARC: Club Project — construction evening.
- 28 Jan Yeovil ARC: Natter night.  
Bredhurst RTS: Construction & natter night.  
Salop ARS: HF night on the air.
- 29 Jan Bredhurst RTS: Christmas dinner & dance.
- 31 Jan Belle Vue/Norbreck Radio Rally. Norbreck Castle Hotel Exhibition Centre, Queen's Promenade, North Shore, Blackpool. Show opens at 11am. Admission £1, Senior citizens 50p, under 14's free. Trade stands, bring & buy, ample free parking, bars & restaurants, RSGB Morse Tests (book in advance with RSGB).  
Talk in on S22 and SU8. Further details from Peter G6CGF on 051 630 5790.

# CONTACTS CONTACTS

Aberdeen ARS	Don	04676251
Abergavenny & NH ARC	GW4XQH	0873 4655
Aberporth ARC	GWODPR	023987 274
Aire Valley RS	G6NFT	0532 44597
Alyn & Deeside ARS	GW4EKK	0244 660066
Amateur Radio & CC	Trevor	04895 81032
AMRAC	Phil, G6DLJ	0703 987754
Armath & Dungannon DARC	J Murphy	0861 522153
Atherstone ARC	Roy	0203 393518
Axe Vale ARC	Bob	02974 5282
Ayr ARG	GM3TH1	0292 42313
Banbury ARS	Bryan, G1IIO	Banbury 51774
Barking RES	R Woodberry	01 594 4009
Barry College RS	John	065679 710
Basingstoke ARC	Jim, G1WKK	QTHR
Bath DARC	G4UMN	0373 63939
Biggin Hill ARC	G3UMI	01 462 2689
Borehamwood & Elstree ARS	Tony	01 207 3809
Braintree ARS	Pub Sec	0376 28714
Bredhurst RTS	Kelvin, GOAMZ	0634 376991
Bridgend DARC	Dave	0656 723508
Brighton DARS	Peter	0273 607737
Binstead ARS	Douglas	0983 67665
Bristol ARC	G4YOC	0272 4116
Bristol (Shirehampton) ARC	Ron Ford	0272 770504
Burnham Beeches RC	G6EIL	0628 25720
BT (Reading) ARC	G4MUT	0734 693766

Bury RS	Allan	0204 706191
Cambridge DARC	D Wilcox	0954 50597
Chesham DARS	Liz GOETU	09278 3911
Cheshunt DARC	G4VMR	092084 250
Chester DRS	Dave G8ZRE	0244 336639
Chichester DARC	C Bryan	0243 789587
Clacton ARS	Reg	0255 430466
Chiltern ARC	Ron G3NCL	0494 712020
Clifton ARS	R Hinton	01 301 1864
Conwy Valley ARC	GWKGI	0745 823674
Coulsdon ATS	Alan	01 684 0610
Coventry ARS	Bill G3UOL	0203 414684
Crawley ARC	Jack	0293 28612
Darenth Valley RC	Sec	0322 63368
Dartford Heath DFC	Pete	0322 844467
Delyn RC	Sec	0244 819618
Denby Dale DARC	G3SDY	0484 602905
Derwentside ARC	Dave G3KMG	0207 504198
Donegal ARC	EI3BOB	074 57155
Dorking DRS	John	0306 77236
Droitwich DARC	G4HFP	0299 33818
Dudley ARC	John	0384 278300
Dunfermline RS	GMODYD	0383 413440
Dunstable Downs RC	Phil Morris	0582 607623
Ealing DARS	Anton Berg	01 997 1416
Eastbourne EARC	G1BRC	0323 29913
East Kent ARS	Stuart	0227 68913
East Lancashire ARC	Stuart	0254 887385
Edgware DRS	G4IUZ	0707 65707
Exeter ARS	R Tipper	0392 68065
Fareham DARC	Alan G3CCB	0329 288139
Farnborough DRS	Mr Taylor	0252 837581
Felixstowe DARS	G4YQC	0473 642595

Please note that the deadline for the March segment of *Radio Tomorrow* (covering activities from 1st February to 1st April 1988) is 14th December.

# SSB TRANSCEIVER

## Part 2

Although not included on the PCB, there are a couple of additional circuit facilities which have been used with this transceiver, and circuits are shown here for them.

frequency is considered to be the centre of the transmitted frequency it is a simple matter to mentally subtract 1.5 from the dial reading on USB or add 1.5 on LSB.

correct way look at a commercially constructed PCB. Ideally resistors should be mounted half a millimetre above the board, but the insulation on them is adequate for most working voltages for them to be laid flat on the surface. Capacitors again should be just off the surface but diodes can be mounted flat on the board. Transistors should be pushed home to between three and five millimetres from the board as should integrated circuits.

### *Soldering irons at the ready? Well, let's begin construction, after a guided tour to some optional extras from the Kanga Gang.*

They are an S-meter and a reflectometer, which uses the same meter movement as the S-meter.

The S-meter is driven from the source of the final IF amplifier, and uses a very simple circuit which depends on the fact that the source current of this stage will vary as the AGC voltage applied to the second gate varies. A simple bridge circuit enables this variation to be registered on the meter.

The reflectometer circuit cuts into operation automatically on the changeover to transmit. Both circuits are shown together in Fig. 1.

The frequency display unit be used here can be obtained from Timestep Electronics and wired up for direct frequency readout. However the offset of the dial can be set to only 455kHz, although on LSB the offset should be 453.5 and USB 456.5, so there is a slight frequency readout error, but if the displayed

### Assembly

May we take the advantage of this article to reinforce what we have said before about faults on units constructed from articles? Over the last few months we have seen many examples of home brew equipment, and these range from excellent to worse than bad! Examples in the latter category are caused by the constructor not paying attention to detail, mounting components poorly and using incorrect tools. To cover these points in order we start with detail; the worst seen here was a board where some components were soldered at only one end, the other not having seen the iron let alone some solder. Another typical problem in this category is getting diodes, electrolytic capacitors (especially tantalum types) and transistors and ICs in the board the wrong way round.

Mounting components properly is important, and to find out the

The use of poor or inappropriate tools shows up in the large majority of cases we see. Cutters which are too large are given away by long wires poking out of the solder bead. Ideally the wire should be cut one millimetre above the board prior to soldering, but this is rather fiddly. To save having to fight through a forest of wire ends, we insert one component at the time, solder it, then trim it using flush cutters.

Large puddles of solder indicate too thick a solder and ridged solder beads indicate too small an iron. A little more care taken in constructing the boards will reduce the errors considerably and proportionally increase the chance of the board working first time to switch on!

### Setting up — Receiver

On applying power, aerial signals should be audible from the loudspeaker as the set is tuned over the band. Select a suitable signal in the middle of the band and peak T1 and T2. Now peak T8 and T9 for maximum output. By this time the selected signal should be fairly strong and on tuning T10 it will be noticed that the signal will decrease in amplitude as the core comes to resonance; this is because the AGC voltage increases as this core is resonated and this in turn reduces the gain of the receiver. This core should be tuned for minimum loudspeaker signal.

Now the CIO frequencies have to be set up. To do this find a carrier and it will be noticed that as the signal is tuned to zero beat it will either disappear before you get

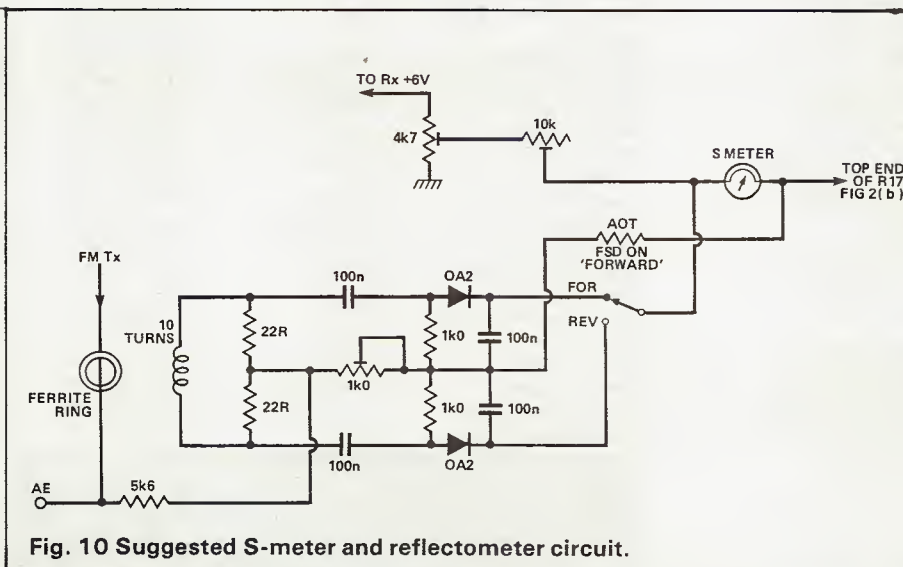


Fig. 10 Suggested S-meter and reflectometer circuit.

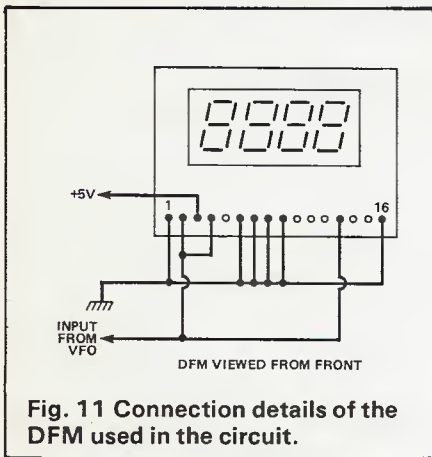


Fig. 11 Connection details of the DFM used in the circuit.

there or the signal will go through zero, rise the other side somewhat and then go. The trimmer of each resonator must be adjusted so that the signal disappears just as the signal arrives at zero beat. Having set one, switch to the other sideband on the mode switch and adjust the other. That completes setting up of the receiver.

### Setting up — Transmitter

Before we start it is assumed that the Cirkit PA module has already been set up as instructed in the kit.

Two things must be done prior to tuning the main PCB; firstly RV3 must be rotated fully anticlockwise to unbalance the balanced modulator and secondly 12 volts applied to the filter control pin to switch to the AM filter. This will supply a signal to set up the transmitter bandpass circuits.

With a reflectometer and dummy load connected to the aerial socket apply power and press the PTT. If all is well a signal will be evident on the reflectometer. Tune the dial to mid band and peak T11, T4, T5, T6, and T7 for maximum output.

Tune to 1970kHz and adjust T4 and T6 for maximum signal, then tune to 1850 and tune T5 and T7 for maximum. If the dial is now tuned across the band the output level should be fairly constant. Do not worry if this level is only a watt or two as the degree of unbalance of the balanced modulator varies from device to device and is dependant on the value of R61.

Using another receiver very loosely coupled to the transmitter, listen to the 160 metre signal and adjust RV3 for minimum carrier,

this should be at about half track setting. If a microphone is now plugged in and spoken into, the output should talk to full output of the PA, 15 to 20 watts. The value of R66 is now increased so that it is only just possible to reach full output when speaking into the microphone with a normal voice and the microphone gain up full.

The set can either be left as an SSB only rig, or if CW is required a keyed 454.5kHz oscillator must be built. This frequency is 1kHz HF of the USB CIO signal which is used to receive and transmit a LSB signal on 160 metres. This signal is fed into the transmit IF strip at the diode gate formed by D4. The small length of track on the top side of the board between pin 4 IC6 and the top end of R47 must be cut. This will have two effects, the supply is removed from TR6 effectively isolating the signal from the sideband generator from reaching the transmitter stages and will also turn off gate D4. The signal from the keyed CW oscillator is fed onto the cathode of D4 and passes through the transmitter stages in the normal way. The drive level is adjusted on first setting up using the preset on the keyed oscillator PCB. Fig. 15 shows the wiring necessary for CW operation and it will be noted that the supply to the oscillator is keyed by the TX+6V supply and that this is selected by the mode switch in the CW mode. This will disable the oscillator in the sideband modes. The emitter is also keyed by the PTT line. The CW key is plugged into the microphone socket on the front panel or a jack socket could be included on the backdrop.

The reason for this double keying is to ensure that the oscillator is running prior to the amplifier stages coming to life so reducing 'click' on the make of the key. The click on the break of the key relies on the Q of the resonator prolonging the signal after removal of supply and so shaping the break.

### Errors

Unfortunately, a number of errors crept into the circuit diagrams published with the first part; most of these are fairly obvious.

On all circuit diagrams, the little boxes marked 'FB' indicate the position of ferrite beads.

On Fig. 2, the output pin of IC1 should be labelled pin 3; the two connections labelled 'RX +6V SUPPLY,' etc., and 'CONTROL RF AMP ON/OFF' are in fact to the same point and they have a pair of decoupling capacitors added, C111, 112. The wiring round RLA6 is obviously wrong, the earth symbol should have been drawn attached to the RH side of the coil box, at the junction with C24. Also, below Q2, the lower junction of C18 and R9 should go to earth, not to the junction of R7, R10 and C19. And the right-hand output to the frequency meter unit should be labelled 'GND', ie ground.

Fig. 3 gained a few duplicate capacitors: the one directly below R25 should be C43, not a second C42, and that below T9 should be C46 not C45. The tops of R24 and R31 should go to the +8V line, not to the +6V (Rx) line. R28 is 330R not 300R and R40 is 10R.

IC6 on Fig. 4 has an additional capacitor, C113 (10n) between pin 5 and earth. On the same diagram, C67 is connected between earth and pin 8 of IC7 (though this will not make any practical difference, it's the way the PCB is designed) and the capacitor labelled C89 above IC7 should be C69.

Like all the other NPN transistors in the project, Q12, 13, 14 should be BC183 or similar, not BC182 as wrongly stated on Fig. 5. Also R51 should be 470K not 470K and the connection to the pole of SW1c should be labelled +8V.

Finally, on Fig. 9 the switch to the middle left is SW2, the main on-off switch, and the socket is SK4. The top pin of this should be connected to +12V from the supply and the bottom to 0V. C10, below Q22, is in fact C110.

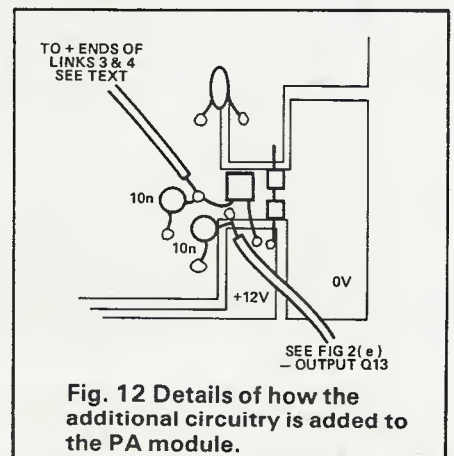


Fig. 12 Details of how the additional circuitry is added to the PA module.

## Components List

### Coil Winding Data

T4, 5, 6, 7	Primary: 60 turns centre taped; secondary 10 turns; both in enamelled copper wire, 40 SWG, on Toko 10K coil former.
L1	30 turns 36 SWG wire, close wound, on 1/2in dia former with slug.
L4, 5	25 turns 26 SWG wire on T68.2 former

### RESISTORS (all 0.25W 5%)

R1, 16, 76	47R
R2, 4, 14	68R
R3	12R
R5, 22, 29, 62	68k
R6	15k
R7	47k
R8, 37, 50, 53, 58, 60, 72	1k0
R9, 18-20, 25-27, 32-34, 65	100R (11 off)
R10, 56, 61, 69, 73, 74, 77	10k
R11	220R
R12, 48, 51, 59	470K
R13	1k8
R15	470R
R17, 49, 52	56k
R21, 28, 35, 66	330R
R23, 30, 57	1k5
R24, 31, 44	6k8
R36	220k
R38, 70, 71	18k
R39, 41	120k
R40	10R (but see text)
R42	1M0
R43, 67, 68, 75, 78, 79	2k2
R45, 46, 47, 63, 64	100k
R54, 55	22k
RV1, 2	10k panel-mounting pots, logarithmic
RV3	47k miniature horizontal preset pot
RV4	470k miniature horizontal preset pot

### CAPACITORS (all ceramic disc unless specified)

C1, 3, 12	270p polystyrene
C2	10p
C4-7, 9, 10, 18, 19, 29-31, 36, 37, 52, 58, 59, 85, 87, 89-94, 105, 106, 108, 113	10n (23 off)
C11	100p
C13, 14, 72, 74, 76, 78	560p polystyrene
C15, 16, 20, 23, 24, 32, 38-40, 42-50, 53, 55-57, 60, 61, 63, 66, 68, 73, 77,	

84, 86, 109-112	100n (31 off)
C17, 21, 22, 26, 34	22p
C25, 27, 33, 35, 75, 79	220p polystyrene
C41, 51, 54, 62, 64, 65, 67, 80, 81, 83, 99	1n0 (11 off)
C69, 71	100u 15V electrolytic
C70, 82, 88	2u2 tantalum electrolytic, 25 volts
C95-98	1n5
C100, 101	470n
C102, 103, 107	1u0 25 volt tantalum electrolytic
CV1	5-50p variable capacitor
CV2, 3	9-50p trimmer capacitor, 5mm size

### SEMICONDUCTORS

IC1, 7	SL610 or SL1610
IC2	SBL1
IC3, 4	78L05
IC5	78L08
IC7	ULN2283
IC8	SL640 or SL1640
IC9	4069B
Q1	2N3819
Q2-5, 9-15, 17-22	BC183 or similar (17 off)
Q6-8, 16	3N204 or 3SK85, or similar
D1-3	OA2 or similar germanium diode
D4-7	1N4148
D8	1N4001
ZD1	3V3 zener diode

### MISCELLANEOUS

T1, 2	KANK 3333 (Toko)
T3	RMC41996 filter matching transformer (Cirkit)
T4-7	See coil winding data
T8-11	YHCS11100AC2 (Bonex)
L1, 4, 5	see coil winding data
L2	1 mH RF choke
L3	ferrite bead on lead
FL1	MF31C SSB filter (IQD Ltd)
FL2	CFW455H AM filter (IQD Ltd)
XTAL1	455B ceramic filter (Bonex)
XTAL2	455H ceramic filter (Bonex)
RLA1	2 pole 2 way relay, 6V coil (MS Components)
RLA2-6	1 pole 2 way relay, 6V coil (MS Components)
SW1	4 pole 3 way rotary switch
SW2	on-off switch
SK1	Phones jack
SK2	CW jack
SK3	Microphone/PTT socket
SK4	Power supply connector
SK5	Antenna connector

PCB, ferrite beads, Cirkit PA module (see text), heatsink, connectors, wire, case, loudspeaker.



# DELTA LOOP AERIALS

With the cost of HF beam aerials now reaching levels which only a few years ago would have purchased a complete station, many amateurs are contemplating the use of wire

In all probability, the reason for this misunderstanding is that most text books show the aerial fed either at the apex or at the mid point of the horizontal side. In this configuration

ground. The author uses a delta loop on 21 MHz, with the apex at a height of 21 feet. The performance of this has been compared both with that of a multiband trap dipole and of a full size G5RV at a height of 30 ft. In nearly twelve months operation there has only been one instance where the received signal from the delta loop was weaker than that from the larger aerial and normally the difference is in the order of two S points or more. Investigation of the 'rogue' report showed that the station worked was in an optimum direction for the larger aerial yet directly in the plane of the loop.

*An often misunderstood and maligned antenna is the delta loop, but with a bit of tender love and care, it can turn in good DX for minimal outlay, Brian Kendal, G3GDU, explains.*

aerials for the DX bands. The first choice is often a multiband device, such as a trap dipole or a G5RV, but although capable of operation on a wide range of frequencies, with few exceptions (the G5RV is outstanding on 20 metres), the performance on the DX bands is often disappointing and the operator is tempted to take the hammer to the piggy bank.

Nevertheless, there are many types of wire aerials which are capable of good DX performance, even when suspended at only modest heights. Of these, the most effective are those which radiate vertical polarisation. This is of particular importance, for it is often not realised that it is at least as important to radiate at a low angle as it is to achieve gain in the horizontal plane. One type of aerial capable of meeting these parameters is the delta loop.

## The Delta Loop

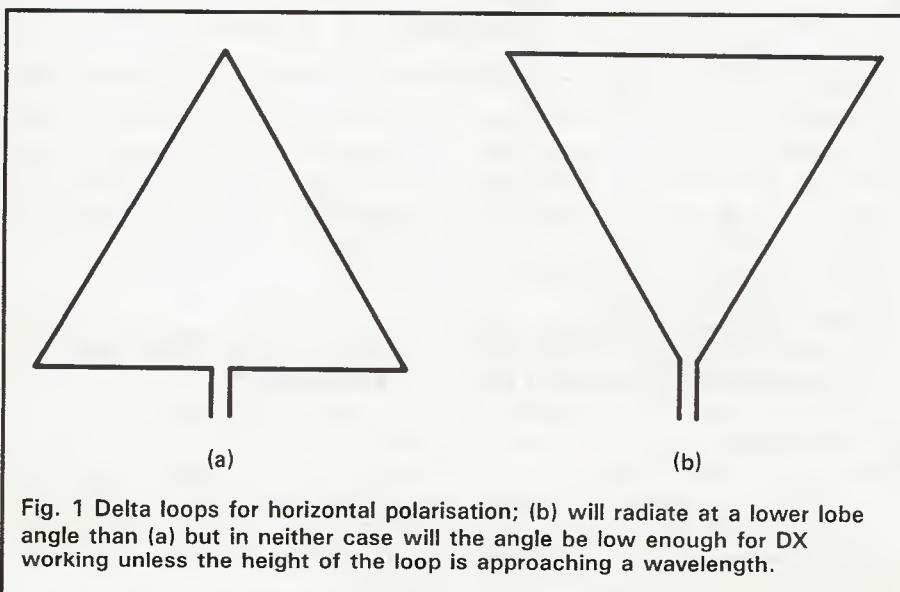
The delta loop is probably one of the simplest yet least understood of wire aerials, and it is often compared unfavourably with the quad loop. Nevertheless, when configured correctly, it can provide DX capability from almost any location. Furthermore, in common with many other types of loop aerial, it is very tolerant to location and can perform effectively even in confined spaces.

the aerial is operating in the horizontally polarised mode in which it is comparable with, though offering slightly less gain than the conventional quad loop. It is consequently subject to the same constraints as all other horizontally polarised aerials, requiring considerable height to achieve a low radiation angle.

However, if the position of the feed point is changed, the radiation becomes vertically polarised and the aerial becomes an efficient low angle radiator, even when the base of the delta is only a few feet above the

## Design Factors

In its simplest form, the delta loop comprises about a wavelength of wire mounted vertically in a triangular configuration with either the apex or base uppermost. By varying the position of the feedpoint, the loop will radiate either vertically or horizontally polarised signals. No matter which polarisation is selected, the loop will exhibit a feed



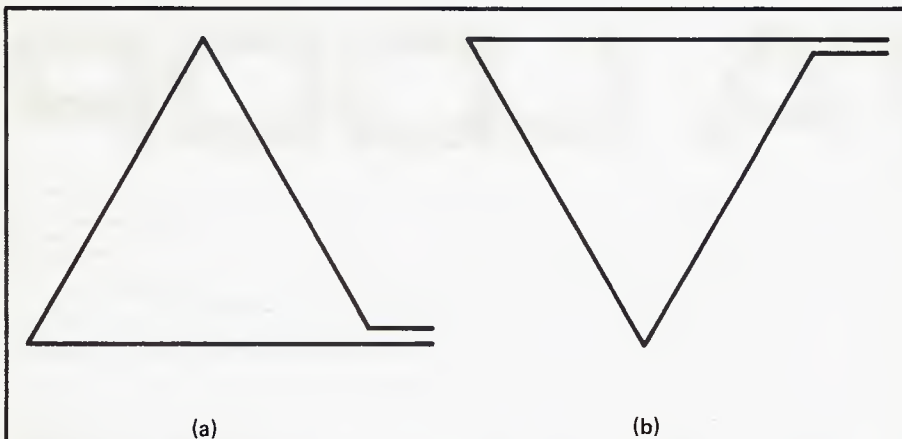


Fig. 2 Vertically polarised delta loops; (b) will radiate a lower lobe angle than (a) but either is quite capable of excellent performance even when the top of the loop is less than a wavelength in height.



impedance of about 100 ohms and will therefore offer a reasonable match to 75 ohm feeder. If 50 ohm feeder is to be used, an electrical quarter wavelength of 75 ohm feeder will provide a satisfactory impedance transformation.

The maximum efficiency will occur when the aerial takes the form of an equilateral triangle when the gain at right angles to the plane of the wire will be about 1.5 dB over a dipole at the same height.

If there is insufficient height available to make the sides of equal length, the loop may be flattened with some loss in gain. Alternatively

the aerial may be 'top loaded' with a claimed increase in gain, but the author has, as yet, no practical experience of this configuration, although it is high on his list of future projects.

### Horizontally Polarised Delta Loop

If the loop is fed either at the apex or at the centre of the horizontal side, the radiation will be horizontally polarised with the aerial acting in a somewhat similar manner to a stacked inverted Vee and a dipole.

In such circumstances, in common with all other horizontally polarised aerials, the height above ground will have a considerable effect on the angle of radiation. Unless the centre of the loop exceeds a half wavelength in height, very little low angle signal can be expected and the DX performance will be disappointing to say the least.

Unless sufficient height is available, it is always preferable to use the delta loop in the vertically polarised configuration.

### Vertically Polarised Delta Loop

It is when the delta loop is used in the vertically polarised mode of operation that it really comes into its own, for in this configuration it operates in a similar manner to and with the same low angle characteristics of a pair of phased quarter wave vertical aerials without the associated problems of ground plane radials. Furthermore, in common with many other types of loop aerial, it is very tolerant to location, being little affected by nearby objects. I have heard of loops being mounted between houses and hidden in the foliage of trees, whilst my own is suspended a few inches from a metal mast with one guy wire passing through the loop and another only a few inches distant and the lower side passes through the branches of a tree, all without apparent detriment to the performance.

The loop may be mounted apex upwards or inverted, the latter

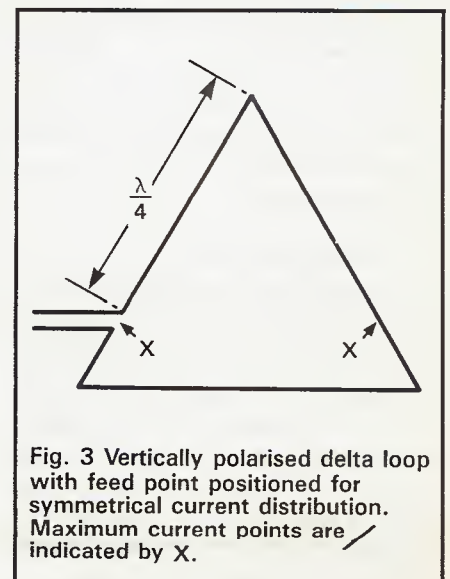


Fig. 3 Vertically polarised delta loop with feed point positioned for symmetrical current distribution. Maximum current points are indicated by X.

```

10 REM DELTA LOOP CALCULATIONS
20 CLS
30 PRINT"H.F. DELTA LOOP CALCULATIONS"
40 PRINT
50 INPUT "FREQUENCY OF OPERATION (MHZ) ",F
60 IF F>75 THEN GOTO 350
70 PRINT
80 PRINT "OPTIMUM SHAPE IS EQUILATERAL TRIANGLE"
90 PRINT
100 L=(INT(10*(1007/F))/10)
110 PRINT "LENGTH OF LOOP = ";L;" FT"
120 PRINT
130 PRINT "LENGTH OF DIAGONAL SIDE = ";(INT(10*(1007/F))/10)/3;" FT"
140 H=SQR(((1007/F)^2)/12)
150 PRINT
160 PRINT "HEIGHT OF LOOP = ";(INT(10*H))/10 ; " FT"
170 PRINT
180 PRINT
190 INPUT "IS ADEQUATE HEIGHT AVAILABLE (Y/N) ",ZS
200 PRINT
210 IF ZS="Y" OR ZS="y" THEN GOTO 290
220 INPUT "AVAILABLE HEIGHT ",H
230 PRINT
240 A=(L*L+(4*H*H))/(4*L)
250 PRINT "LENGTH OF DIAGONAL SIDE NOW ";(INT(10*A))/10;" FT"
260 PRINT
270 PRINT "LENGTH OF HORIZONTAL SIDE NOW ";(INT(10*(L-(2*A))))/10;" FT"
280 PRINT
290 INPUT "FURTHER CALCULATION (Y/N)",AS
300 PRINT""
310 IF AS="N" THEN GOTO 340
320 IF AS="Y" THEN GOTO 10
330 GOTO 290
340 STOP
350 PRINT
360 PRINT "FREQUENCY TOO HIGH FOR PROGRAM"
370 PRINT
380 GOTO 50

```

Fig. 4 Simple computer program for calculating the dimensions of delta loops. Provision is also made for calculating alternative dimensions should insufficient height for an equilateral configuration be available.

signal will be balanced out and virtually all of the transmitted signal will be vertically polarised.

For all delta loops the generally accepted formula for calculating the length of wire required is:

$$\text{length (feet)} = \frac{1007}{\text{frequency (MHz)}}$$

Although the aerial is very tolerant, some pruning may be necessary; however this has not proved necessary in any of the half dozen or so that the author has used over the years.

Once resonated, it will be found that the loop has sufficient bandwidth to exhibit a low VSWR across the whole of the band.

The loop is also surprisingly tolerant to the type of wire used in its construction whether it be insulated or not, stranded or single, thick or thin. The only criteria seems to be that it is sufficiently strong so as not to break under its own weight or in the wind.

### Top Loaded Delta Loop

An interesting variation of the delta loop was described by W1DTV

providing the lower radiation angle, but the former being more convenient for installation as it needs but a single suspension point such as a tree, mast or chimney.

In practical terms, the minimum height is only limited by the necessity of avoiding garrotting innocent passers-by with the lower side. Even at these heights the angle of radiation is sufficiently low to provide considerable DX potential.

The most simple method of configuring the delta loop in order to radiate vertical polarisation is to feed at one end of the horizontal section. If fed directly with coaxial cable, the inner core should be connected to the diagonal and the screen to the horizontal side.

In this configuration the current maxima (and consequently the points of maximum radiation) will be at the feed point and approximately the mid point of the opposite side.

A better position for the feed point, however, is along one of the diagonal sides at a quarter wavelength from the apex. This will give a more symmetrical current distribution and, furthermore, the horizontal component of the radiated



"HAVING FUN HERE WITH AN INDOOR WHIP..."

H.F. DELTA LOOP CALCULATIONS

FREQUENCY OF OPERATION (MHZ) ?7.05  
 OPTIMUM SHAPE IS EQUILATERAL TRIANGLE  
 LENGTH OF LOOP = 142.8 FT  
 LENGTH OF DIAGONAL SIDE = 47.6 FT  
 HEIGHT OF LOOP = 41.2 FT

IS ADEQUATE HEIGHT AVAILABLE (Y/N) ?N  
 AVAILABLE HEIGHT ?35  
 LENGTH OF DIAGONAL SIDE NOW 44.2 FT  
 LENGTH OF HORIZONTAL SIDE NOW 54.2 FT  
 FURTHER CALCULATION (Y/N) ?N

Fig. 5 Sample print-out to confirm that the program of Fig. 4 has been entered and is compatible with the computer.

wavelength, it will be realised that the top loaded delta loop is potentially a formidable DX aerial even though the support height need only be a little over a quarter of a wavelength and the material cost but that of a few yards of wire.

Conclusion

My experience with a conventional vertically polarised delta loop has convinced me that, even in its present form, it is an effective DX aerial. Nevertheless, there is still room for experimentation, which at a cost of only time and a few yards of wire, could provide an interesting, inexpensive and worthwhile project.

in 1978. Although I have not, as yet, not tried this configuration, I feel that it is well worth investigation.

In the conventional vertically polarised delta loop, the sections of the aerial which carry high current (and consequently maximum radiation) are mostly horizontal and near to the ground. Also, in any half wave element, the 1/8th of a wavelength at either end contributes very little to the overall radiation. The loop can be thought of as comprising two half-wave elements so reducing the horizontal section to 1/4 wavelength (ie. 1/8 wavelength from each element) will effectively move the parts of each element contributing most to the radiation into the vertical plane.

This elongates the loop vertically, but by the same consideration, the 1/8 wavelength of the loop on either side adjacent to the apex also contributes very little. No harm will result if these are brought together and folded at right angles to the plane of the loop, thus restoring the loop to its original height. The folded part of the loop could then be replaced by a single wire stub which could be varied in length to tune the loop.

In practice W1DTV found that the stub had to be considerably longer than the section of the loop which it replaced, but that if necessary for space reasons, its length could be reduced by inductive loading with some loss of bandwidth.

From a combination of practical measurements and mathematical analysis, W1DTV concluded that the effect of loading and raising the high current part of the aerial gave a gain of 2.3dB over a conventional delta loop.

If this figure is added to the 1.5dB gain of a conventional delta

loop over a dipole, and considering that the resulting 3.8dB gain is at an angle for which a horizontally polarised beam would need to be raised to a height in excess of a

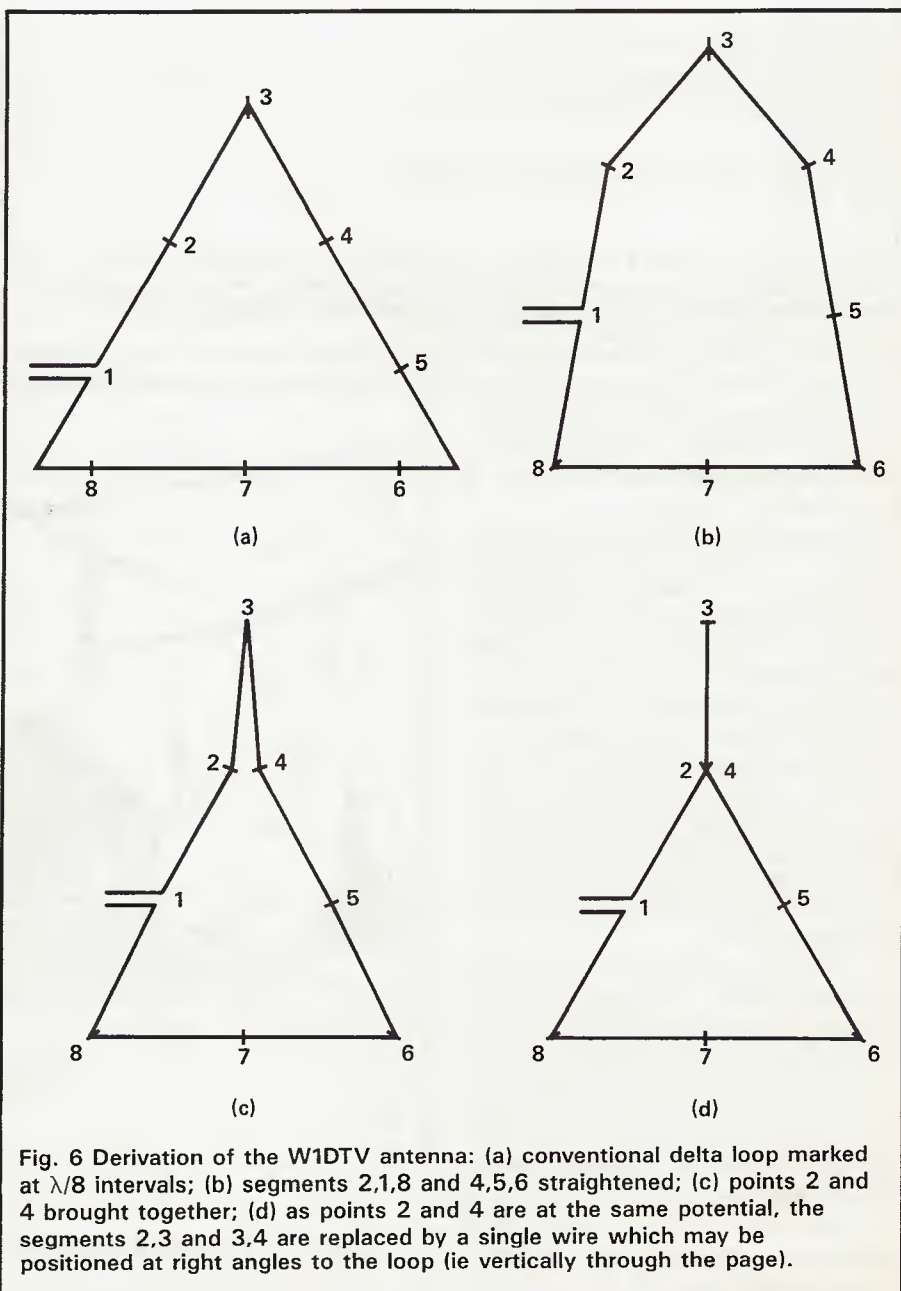


Fig. 6 Derivation of the W1DTV antenna: (a) conventional delta loop marked at  $\lambda/8$  intervals; (b) segments 2,1,8 and 4,5,6 straightened; (c) points 2 and 4 brought together; (d) as points 2 and 4 are at the same potential, the segments 2,3 and 3,4 are replaced by a single wire which may be positioned at right angles to the loop (ie vertically through the page).

# The Great Welsh Rope Trick

*The second and final part in the story of one ham against the world — and with the sort of help he's got, the world doesn't stand a chance!*

## The story so far . . .

Two years have gone by since the first hint of animosity between our hero and the dreaded Mr Wythinton. In that time nearly everyone from the Court of Human Rights down to the local Boy Scouts have been involved in the dispute, an aerial goes up and the planning officer comes down. But Mr Wythinton has not reckoned with the combined might of our hero and his wife Blodwen, who is described (out of earshot) as the poor mans Pershing.

Yet another aerial takes to the sky as Wythinton goes off the deep end, but then comes to a stuttering halt as he realises that there's nothing holding it up! Can his mind be going? Well, with a bit of luck . . .

As if the wild flute music was affecting him similarly the observer swayed towards the garden his eyes still fixed on the ascending wires.

"Yes?" The hissing sibilant just under his nose made him jump. Blodwen materialised before him on the other side of the fence, projecting all the benign malignancy of a laughing shark.

"I — er — how —?" inquired the mesmerised man keenly.

"Balloon" uttered Blodwen succinctly, turning to go.

"Balloon?" repeated Wythinton in ascending scale.

"Balloon," affirmed Blodwen over her shoulder, wiggling her thumbs akimbo and enjoying life tremendously.

"H-how . . .?" asked the other, displaying no little expertise at slackmouthed interrogation.

Turning to face him again and without looking upwards the woman pointed above her head. "See those?"

Wythinton craned his neck and surveyed the grey, lowering mist.

"See . . .?"

"Clouds!"

"Clouds?"

"Clouds. There's got to be a balloon above 'em, hasn't there, eh?"

"Above . . .?"

"I reckon an antenna's tied to a helium balloon with fishing line in between. It's gone up above that cloud," theorised Blodwen, showing surprising

patience. "You couldn't see it — the cord I mean. It's light grey nylon line."

"The — the flute?"

Blodwen shrugged. "My husband's practising so's he can teach the kid, look you?"

Mr Wythinton did look. Long and hard. The stupefied look vanished from his face to be replaced by its usual day-to-day expression; the hateful scowl a pocket calculator wears on its LCD when working out VAT. "That'll be against some law. Low flying aircraft at risk. I'm making a complaint," and he departed exultingly.

Blodwen watched the nagging gnome scamper off. She had her "Hubble bubble, toil and trouble!" look on that morning. The slit-eyed one a hawk wears as it's figuring where exactly to drop in on the pigeon.

Our phone rang scarcely fifteen minutes later and I answered. "No, not a balloon. Actually it's a jumbo jet I hired for the day. . ."

". . . I'm serious," cut in the pleasant young planning officer.

"So am I. Look, I'll level with you. It's a police chopper I've been lent. Costs about a hundred pound an hour up there, but you've got to take the rough with the sour in ham radio I always say. . ." A click told me we had failed to communicate.

A half hour later the sound of tyres screeching followed shortly by frenzied dogs on the front door bell told me our Bastille was being stormed. Outside I found a line of cars disgorging a boarding party with enough admin clout to negotiate an arms deal, plus a yeastily swelling mob of partisan neighbours attracted by the plus transport. Actually loitering with marked intent on my drawbridge stood: Inspector Sunneshyne of the Pembrokeshire Police; the Chief Planning Officer; Town Manager Dafyd Hughes; the



pleasant young planning officer, still reasonably pleasant; a bewildered looking gent who turned out to be from British Telecom via the DTI; a RAF Squadron Leader in full uniform by god. And Wythinton.

"Enter, gentlemen," I cried cheerily. "You too, Mr Wythinton. Let the social classes mix, say! Four legs fair enough, two legs good, eh?" They all trooped past me wearing grim frowns, but fetched up abruptly in front of Blodwen standing at the kitchen door. The Thinking Woman's Doberman used her steel-ballbearing-chewie voice:

"What is all this about I wonder? Hm?" Her hms could leave a nasty bruise, I tell you . . .

"We 'ave reason to believe you 'ave — er — some sort of flying machine, a balloon, above this 'ere 'ouse," commenced Inspector Sunneshyne, predictably taking out a little notebook but wisely holding it closed in his hand.

"Flying machine?" we chorussed, trying to look like The Nerd had looked earlier on. Dead thick.

The RAF-type shoved his oar in. "You must see — ah — dangerous, what, eh?"

The Telecom Manager huffed and puffed. "Vary your licence if you've no satisfactory explanation. In breach . . ."

God was indubitably delivering a Final Public Warning and the joke was plainly over so we proceeded smoothly to the denoument. ". . . come with me, gents," I interrupted. We all crowded through the back door and stood on the patio, gazing upwards.

"If you look carefully," intoned Blodwen, sounding like a guide in the Chamber of Horrors, "you'll see a very thin line, fishing line actually, as I told Mr Wythinton when he inquired. It goes from the top of our flagpole to the top of our poplar tree down there, by the fence. Tom put it up with a bow and arrow, see? All we had to do was tie two lengths of bellwire in the middle of it, soldered to sixty feet of co-ax. So we made, as I'm sure all you technically educated gents are aware," and here she cast the Inquisition a singeing glance causing a collective step backwards, "an inverted Vee suitable for use on eighty metres. I raised it all up with the flagpole lanyard, my husband being occupied elsewhere at the time."

Turning to The Nerd she went on, "The sight of it going up, I'm sorry to say, induced another fit in Mr Wythinton . . ."

"Fit?" frothed The Nerd, looking as if he was having a fit.

". . . or attack . . ."

"Attack?" snarled the unfortunate man, looking as if he was having one of those too and clearly suffering from a bad case of the repeats for the second time that day.

"A spasm, paroxysm?" Blodwen switched into Venus Flytrap mode, looking unexpectedly appealing and helpless, which is how she nailed me. "I don't know. I'm not a psychiatrist. But I think poor Mr Wythinton is ill and I hope his behaviour today will convince you all that I'm right, eh?"

Moving towards The Nerd who was sighing and slobbering a little, Blodwen bestowed a look on him fairly dripping with saintly pity, slipped a hand under



his arm and turned him towards the back door. "You need medical help, Mr Wythinton. I'm sure all these powerful people," and she swept the rapt throng with jet, lustrous eyes shining like coals in Hell, "will come up with suitable advice you can take to help you get rid of the nasties, look you."

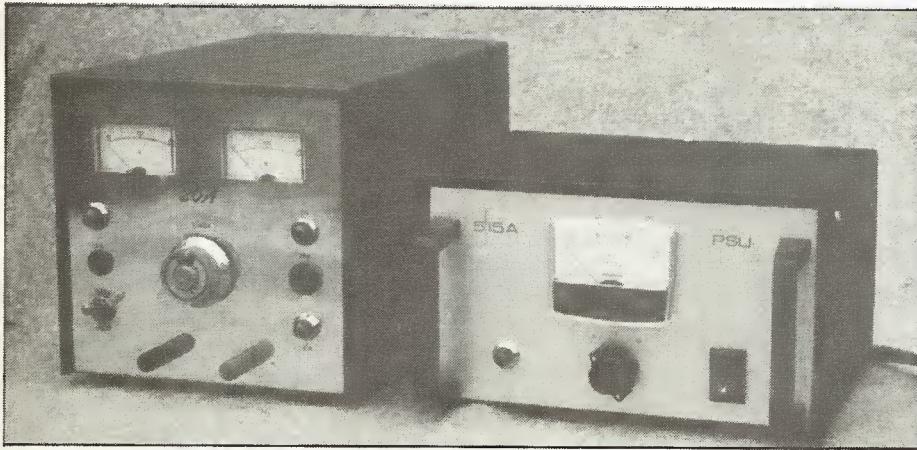
"Nasties?" croaked The Nerd as he was thrust out of the front door a second later, a broken man. It was his last repetition of the day.

Since our performance of the Great Welsh Rope Trick as Blodwen calls it, there have been no further assaults on the front door during prime time and we have not received a single official complaint. Our neighbour has, very agreeably, not addressed a single word to us. He probably continues to make complaints; once a nerd always one, says Blodwen's mother; nerds plough the furrow to the bitter end. But we can only guess his malice still lives from a certain wilderness of manner displayed before darting inside his office after we have erected something he thinks to be particularly provactive.

Thus, when we were putting up the monoband ratatable Yagi on the chimney last week, he came to the door of his factory, viewed the erection, and foamed visibly. In a little while he started to tear his hair and shot. Alas, The Nerd was so far away from us sitting on the roof that what he had to communicate could not be heard.

"D'ye think it's the Yagi shape that set him off, darling; like our Trix barking at that cardboard cow?" asked Blodwen gently, looking in Mr Wythinton's direction, wiggling both thumbs at him and shaking her head sadly from side to side. Whereupon he began to jump up and down.

# QRO HOMEBREW PSU



For whatever rig we run on whatever band, most of us will at sometime require a 13.5 volt supply. With commercial units costing from £80 to £200, it is well worth considering building your own.

while to limit the switch-on current drawn by the main reservoir capacitors C4 and C5. The time delay produced by R2 and C1 prevents RLA1 from operating until C1 has charged; the voltage fed to the transformer is reduced by R1

## *Need heavy current at a light price? G. G. Peters has the answer.*

Detailed here is a 13.5 volt 20 amp supply using readily available tried and tested components, which are also reasonably priced. Whilst cost is a major design consideration, reliability and safety must come first with the possibility of several thousand pounds worth of gear being attached to the supply — not to mention the operator also! To this end, several protective features have been included, such as over-current and over-voltage circuits.

### **The Circuit**

For the detail of the circuit, refer to Fig. 1. The 240 volts main supply is fused and switched, then passed through a mains filter; the one used on the prototype was from RS (or Electromail) stock number 238-536, but any filter rated at least 3 amps can be employed. With the amount of interference to be found on domestic mains supplies, a filter is now essential.

A soft start circuit is incorporated which reduces the transformer input voltage for a short

until relay RLA1's contacts close.

The 20 volts required to drive the relay circuit is derived from the 220 volt connection on the transformer primary; if this is not present, then 18 volts from the secondary can be used, and this is shown in Fig. 2 where other details of alternative transformers are shown (for a centre-taped transformer, like that used in Fig. 1, the anode of D1 and the negative connection of C1 would be connected across just one half of the secondary).

### **Transformer Choice**

The transformer used on the prototype was 18-0-18 volts with 10 amps per arm. Several different types can be used, and Fig. 2 shows the transformer (and delay) circuit for two 18V transformers; a single 18V 20A transformer could be used if one can be obtained. There are two important points when using two transformers: firstly, they must be identical, if they are not one secondary will tend to 'drive' the

other (this problem will be particularly noticeable on low loads, but if you have two dissimilar transformers already, you could try using separate rectifiers for them, and joining the + and - outputs of the two rectifiers at the smoothing capacitors); secondly, you must be very careful to join the secondaries together in the same phase.

C4 and 5 are the main smoothing capacitors and they must be computer grade with 10 amp ripple ratings. R3 is present to discharge the capacitors after switch-off, especially if the fuse FS2 should blow.

### **Controlling current and voltage**

IC1 is the control IC, and provides not only the voltage regulation but also the current limiting. The output voltage is sensed via IC1 pin 4, and this is used to determine the output of IC1 pin 10. Because the voltage on pin 4 is adjusted by RV2, this can be used to set the output voltage to exactly 13.5 volts.

There are three options here: RV2 could be a potentiometer buried in the internals of the PSU, so that it is adjusted once on setting up; it can be mounted on the front panel so that the output voltage can be adjusted from 5 volts to 14.5 volts (above which the crow-bar fires); and the voltage input to RV1 can be taken not from the PSU terminals but from the terminals of the rig (or whatever) to be supplied, using a third wire specially for this. This later option would cancel out any voltage drop in the positive supply lead to the rig (but note that it cannot compensate for any drop in the negative lead). It is possible to use either of the first two options with this final option, but it should be noted that under high current conditions, the voltage registered by the PSU's meter will be higher than that actually supplied to the rig.

IC1 can produce an output of only 150mA, so Q1, a single

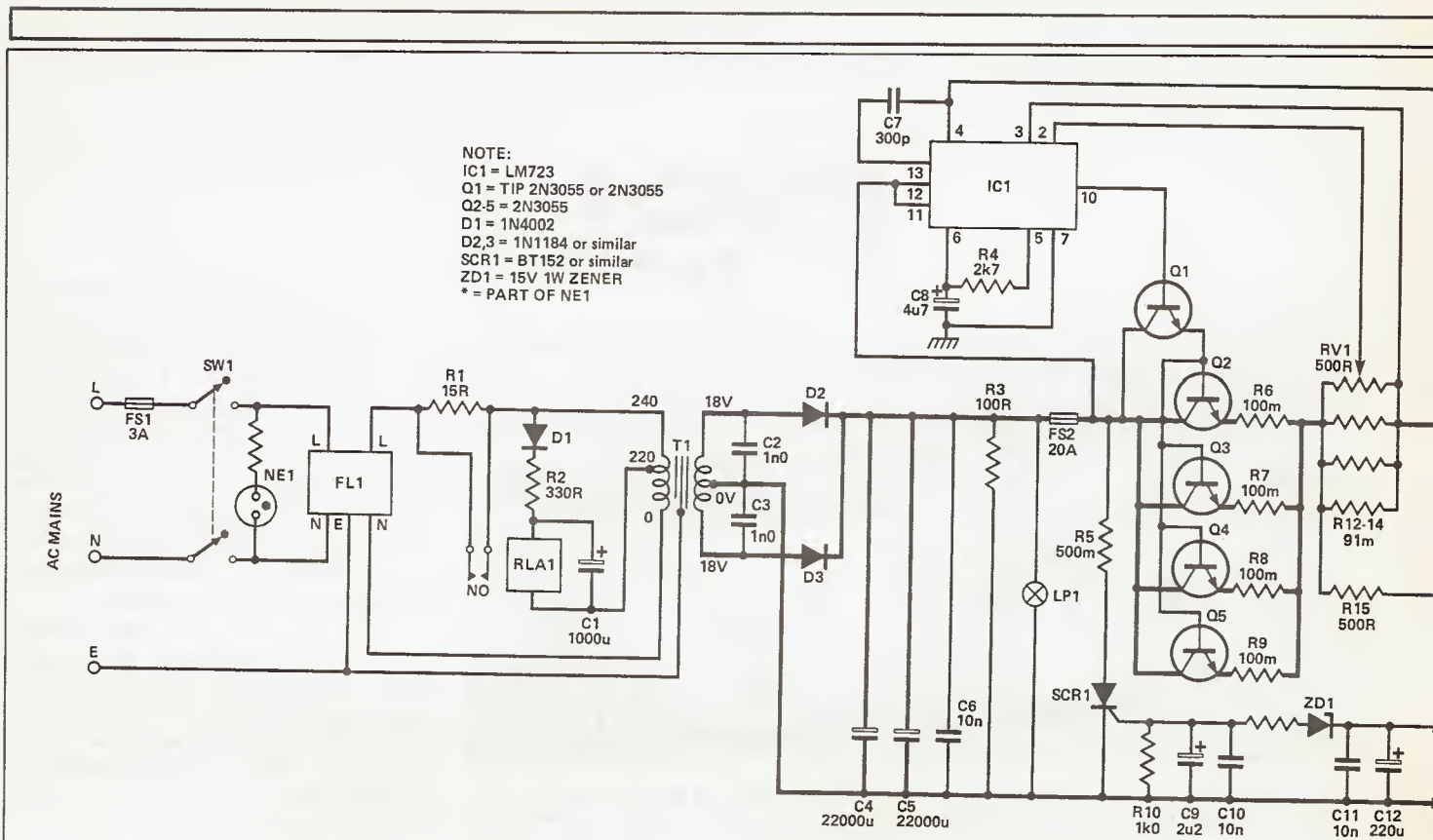


Fig. 1 The circuit diagram of the PSU.

between pins 2 and 3 of IC1. R12 to 14 together have an effective resistance of 30 milliohms, so at full scale the trip will occur at about 18 amps, but RV1 makes it possible to *increase* this trip current.

**Over-voltage protection**

The over-voltage protection becomes most important when really expensive gear is being supplied, as already noted. If any of the output transistors, Q2 to 5, were to sustain an emitter to collector short, then the output voltage could rise to as much as 20 volts, which would damage most items that could be connected to the PSU. To protect the supplied item, there is a crowbar circuit, which is aptly named because what it does is to literally take a crowbar to the output! In electronic terms, the crowbar circuit fires SCR1 so that a very large current flows and blows fuse FS2. The protection level voltage is set by ZD1, a 15 volt zener diode; when the threshold voltage of the zener is exceeded, a current will flow into the trigger input of SCR1, limited by R11, which will

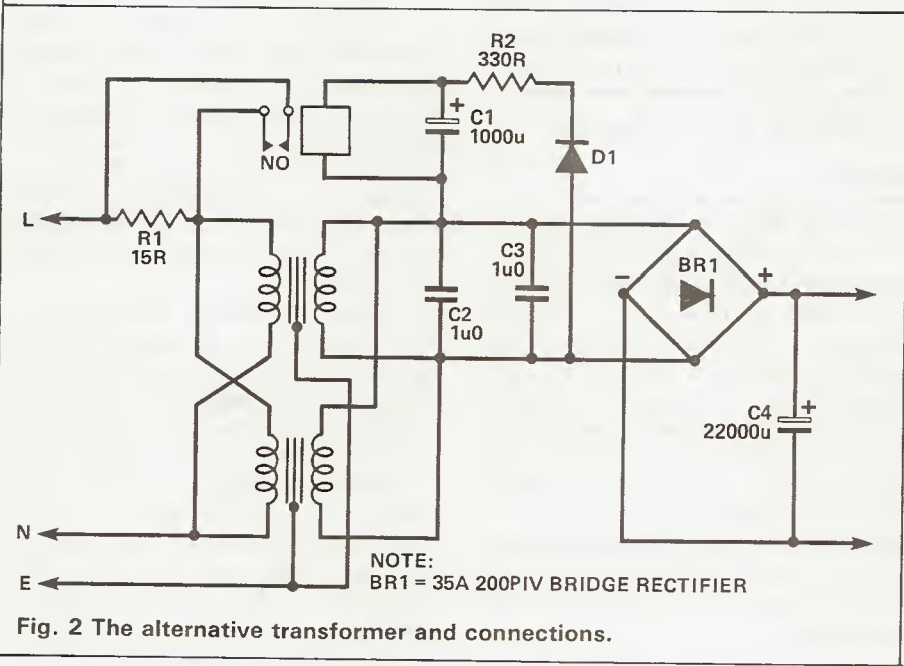


Fig. 2 The alternative transformer and connections.

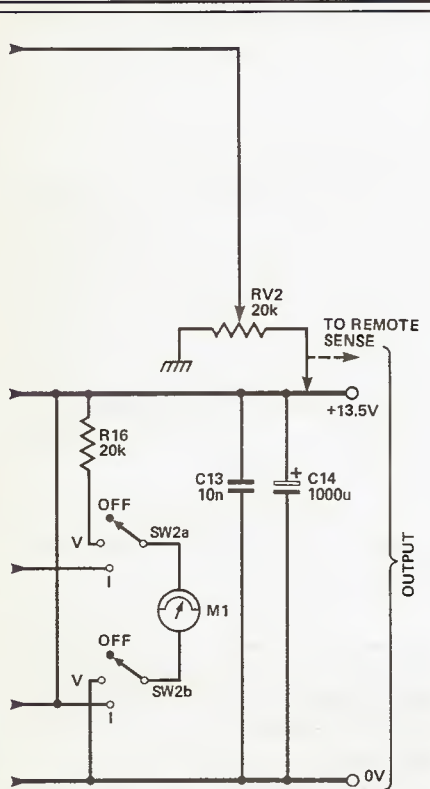
2N3055, is used to source enough current to drive the four output transistors, Q2-5. As Q1 will carry just the base current for Q2-5, heat dissipation will not be too high and so just a small heat sink is required (and the plastic power version of the TIP3055 can be used which is less trouble to heat-sink).

The output transistors, Q2-5, are four TO3 2N3055s, which will easily provide the required 20amps,

but they need large and efficient heat sinks with thermal coefficients of 2 degrees C per watt or lower. To ensure that the current is shared equally by the transistors, each emitter has a 100m (milliohm!) resistor in series with its output.

R12 to 14 provide the current sense for IC1 and RV1 allows the adjustment of the trip current. When the trip happens there should be approximately 0.55 volts





cause the SCR to fire and conduct. C9, 10, 11 and 12 are present to prevent accidental firing of the SCR due to RF and/or pulses finding their way back into the PSU from the supplied circuit.

Resistor R5 is approximately 500m (milliohms again) and this is present to prevent the SCR from being destroyed by the amount of current that the capacitors C4, 5 can deliver — which could be of the order of a 100 amps or more, for a brief period. Because R5 has to withstand high currents, it has been wound from four strands of nichrome wire (as used in electric fire elements) on the prototype, as shown in Fig. 3. Because this type of wire cannot be soldered with electrician's solder, it is bolted through the PCB as shown in the figure.

Metering is provided by M1, which can be switched to display either voltage or current output. A 1mA FSD standard meter is used which on the prototype had a scale running from 0 to 20 and an internal resistance of 100ohms. For correct reading, the value of R16 plus the

internal resistance of the meter should be equal to 20k, and as the meter's resistance was so much smaller than this, 20k was used for R16. For the current ranges to read correctly, R15 plus the meter's internal resistance should equal 600ohms, so on the prototype 500ohms was used. (These values give FSDs of 20V and 20A respectively.)

### Construction

The exact components used in the construction of this project are by no means critical; however, the ratings for them given in the components listing must not be reduced, and there will be no harm in exceeding them, within reason.

The construction and layout are in most respects quite straightforward, the vast majority of components being wired directly. It was judged unnecessary to make a special PCB, and the few components that do require this sort of mounting were put on to a piece of Veroboard; the layout for this is shown in Fig. 4.

For normal operation, high currents are kept away from the Veroboard; however, the SCR and associated circuitry for the crow-bar over voltage protection are mounted on the Veroboard, and the high-current lines here are doubled up with the gap between them flooded with solder.

The heat sink for the output transistors, Q2-5, needs to be quite large as already mentioned; on the prototype one heatsink was used for all four which was finned and ap-

proximately 180 by 180 mm; this seemed to provide adequate cooling even after prolonged use. The rectifier diodes, D2, 3, also require a separate much smaller heatsink, and the same heatsink could also be used for the driver transistor Q1 (but take care over insulating the components electrically from each other).

All the wires in the high current path should be made with wire of at least 50/0.25mm or equivalent and be capable of carrying the full 20amps or more. It is important to keep the runs between the transformer secondaries, the rectifier diodes D2, 3 and the smoothing capacitors C2, 3 as short as possible, because these will be carrying the very high charging currents (possible peak currents of 100A).

### Setting Up

After you have finished assembly, carefully check all the wiring and the connections, paying particular attention to polarities of the diodes and capacitors in the secondary circuits — any mistake here could be costly and dangerous. It will be worth checking that the rectifiers, etc. work first before using the regulator section and this can be done by removing the fuse, FS2. The voltage across either C2 or 3 should be approximately 24 volts, and this should die away over 20 seconds or so when the supply is switched off, being discharged by R3. The circuit can then be tested with the fuse re-inserted — but use a dummy load, not your latest HF

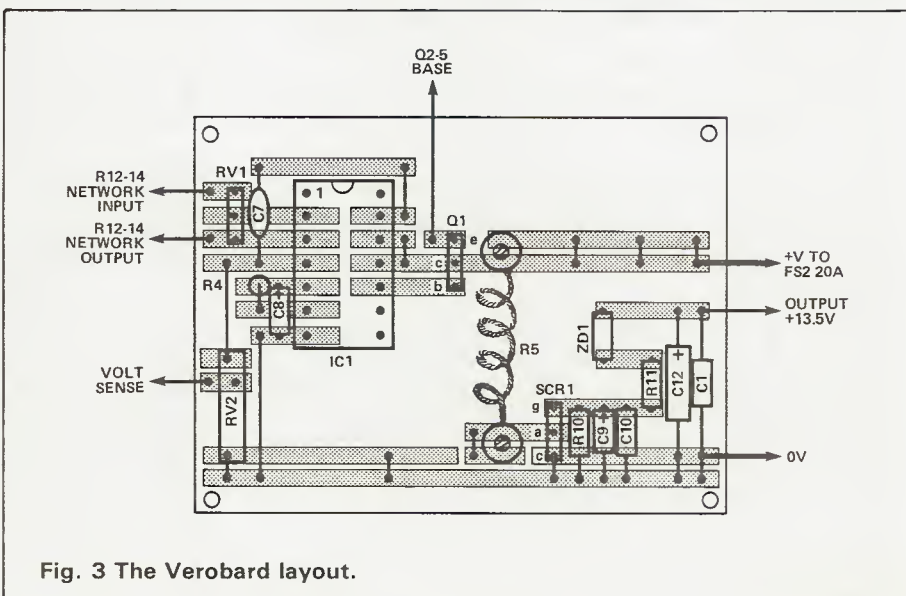


Fig. 3 The Veroboard layout.

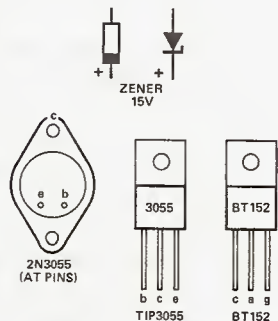
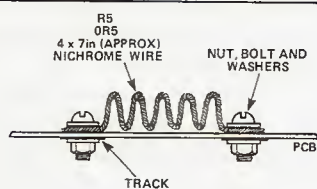


Fig. 4 The pin connections for the active components used.

super-rig! RV2 should adjust the output voltage from about 5 volts to 15 volts; be careful testing to above 15 volts, which the PSU might be

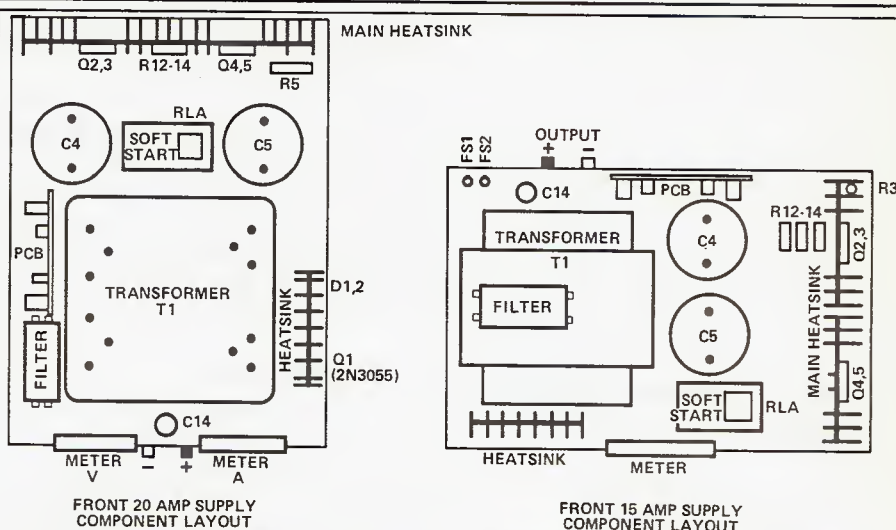


Fig. 5 Two suggested layouts for the PSU. Whatever layout is used, the PCB should be kept away from the output transistor heat sinks.

capable of delivering, because this is likely to trip the crowbar. If RV2 is a preset, set the output voltage to 13.5 volts.

Adjusting RV1 has to be done when 20amps is being drawn from the supply, and at this point RV1 should be set to give 0.55 volts between pins 2 and 3 of IC1. Increasing the voltage here should lead the circuit to trip.

Many parts of the circuit have 240 volt mains present, so care is needed to avoid accidental shock. We'd like to hang on to our readers, please!

The prototype has been delivering power to the author's FT757 for the last 18 months and has proved equal to the task. A second version, for just 15amps, has been supplying his two metre rig and 10watt linear for some months too (other than the change to the transformer, the only circuit mod is to increase the effective value of resistors R12-14 to 40 milliohms together, to give a current limit of 15 amps).

Look out for part two of this project, how to reinforce the shack floor!

### Components List

#### RESISTORS (1/2 W 5% unless noted)

- R1 15R 10W wire wound
- R2 330R
- R3 100R 10W wire wound
- R4 2k7
- R5 500 milliohms (see text)
- R6-9 100 milliohms 10 watt wire-wound
- R10 1k0
- R11 15R
- R12-14 91 milliohms 10 watts wire-wound
- R15 500R
- R16 20k
- RV1 500R (or 470R) preset pot
- RV2 20k (or 22k) pot, preset or panel mounting as required

#### CAPACITORS

- C1 1000u 50V electrolytic, radial leads
- C2,3 1n0 200V disc capacitors
- C4,5 22,000u 50V electrolytics, 10A ripple current
- C6 10n 100V disc
- C7 500p silver mica
- C8 4u7 50V electrolytic, radial leads
- C9 2u2 50V electrolytic, radial leads
- C10,11,13 10n 100V disc

- C12 220u 50V electrolytic, radial leads
- C14 1000u 50V electrolytic, radial leads

#### SEMI-CONDUCTORS

- IC1 LM723
- Q1 TIP3055 or 2N3055
- Q2-5 2N3055
- D1 1N4002
- D2,3 1N1184 35A 100PIV rectifier diodes
- BR1 35A 200PIV bridge, if used
- SCR1 BT152 or similar 10A 400V SCR, TO220
- ZD1 15V 1 watt zener diode

#### MISCELLANEOUS

- NE1 240 volt mains neon
- FL1 mains filter, 3A minimum current
- FS1 3A mains fuse and holder
- FS2 20A fuse and holder
- SW1 double pole mains switch
- SW2 2 pole 3 way switch
- RLA1 12V 800 ohm coil relay, 240V at 5A normally open contact
- LP1 24V 3W lamp with holder, etc.
- T1 18-0-18V 10A mains transformer, with tap at 220V on primary if possible.
- Veroboard, case, wire, etc.

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**KENWOOD** MA4000 dual band (70cm, 2M) mobile Antenna with built in Duplexer, new, ½ price at £25. Ham International TW232DX base station microphone with speech

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 we are open before calling  
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FEBRUARY ISSUE  
 23rd NOVEMBER 1987  
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 21st DECEMBER 1987  
 APRIL ISSUE  
 26th JANUARY 1988

**01-437 0626**

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Pama House, 433 Wilmslow Road, Manchester M20 9AF.



OPEN EVERY DAY, SUNDAY BY APPOINTMENT

NATIONWIDE DELIVERY  
CB DEALERS contact us today

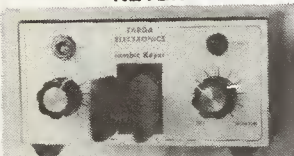
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RIGHT  
WAVELENGTH  
WITH H.R.T.

CLASSIFIED COUPON

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PLEASE DEBIT MY ACCESS/BARCLAYCARD NO. EXPIRY DATE -

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WANTED

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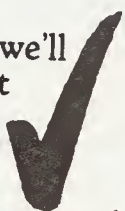
Allweld Engineering .....	12
ARE Communications .....	OBC
Arrow Electronics .....	8
CAP Co. ....	10
Cirkit Distribution .....	IBC
Datung Electronics .....	9
Elliot Electronics .....	12
ERA C .....	9
Icom UK Ltd. ....	4, 5
Garex Electronics .....	11
KWTenTec .....	11
Low Electronics .....	34, 35
RAS Nottingham .....	11
Satellite TV .....	10
Spectrum Communications .....	12
South Midland Communications .....	6, 7
Subscriptions .....	13, 61
Technical Software .....	11
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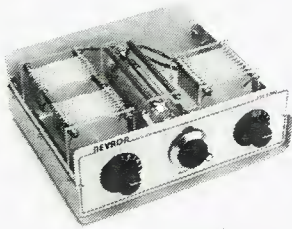
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1KW All Band ATU  
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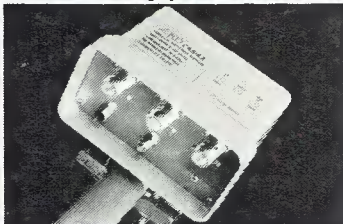
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**£165** + £5 p+p

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(For masthead mounting)

Freq: DC - 1.2 Ghz

Power: 150 Watts

Insertion Loss: 0.19 dB at 900 Mhz

Connectors: Green Par 'N' Type

**£59.95**

ALLOWS SELECTION OF 2 ANTENNAS FROM 1 COAX FEEDER

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(For masthead mounting)

Now you can switch between two  
HF Antennas on one coax feeder.

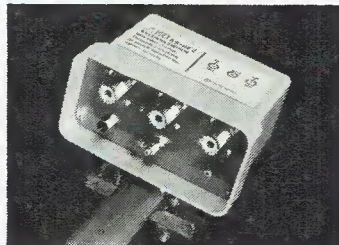
Freq: DC - 185 Mhz

RF Power: 400W P.E.P.

Insertion Loss: 0.15 dB at 144 Mhz

Connectors: SO239

**£39.95**



**50 Mhz LINEAR AMPLIFIER**

WITH HARMONIC FILTER

**SPECIFICATIONS**

Supply: 13 V DC

Input Power: 2.5 Watts

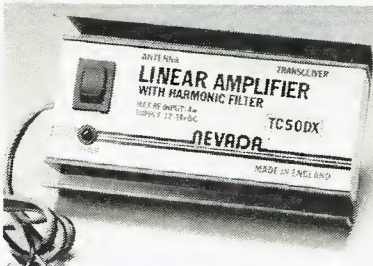
Output Power: 15 Watts

Freq: 50-52 Mhz

Power Gain: Approx 8dB

**£29.95**

+ £1 p+p



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WITH HARMONIC FILTER

**SPECIFICATIONS**

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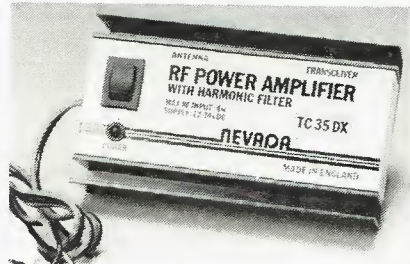
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### FREQUENCY COUNTER!

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1987/88

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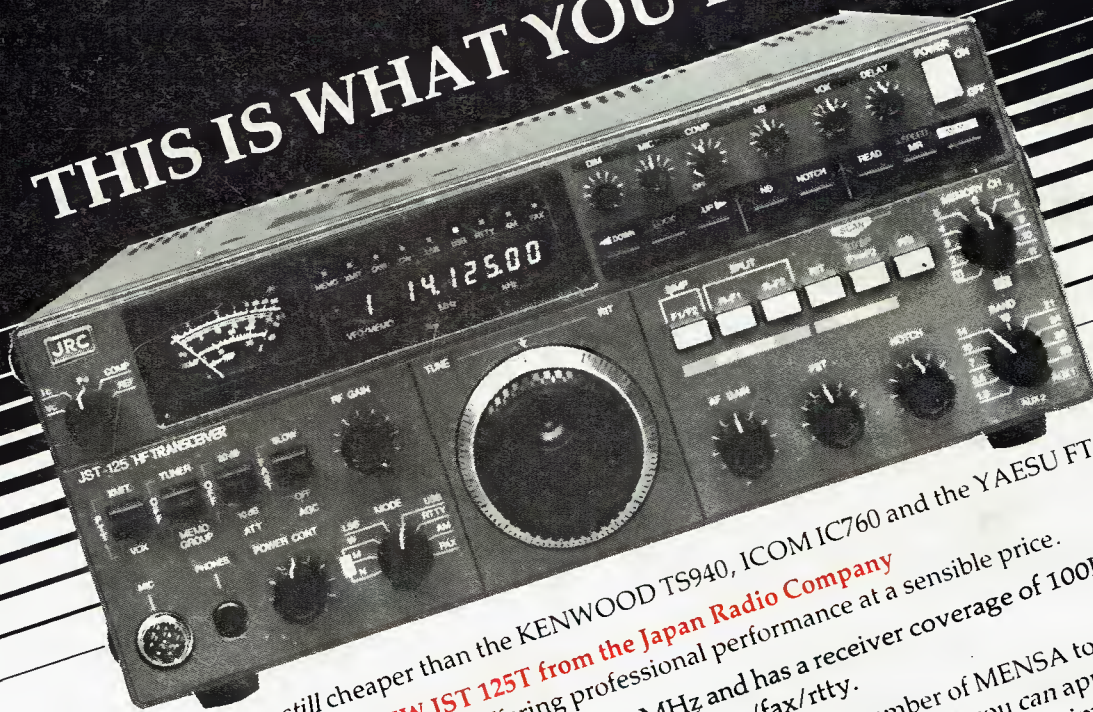
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IF MONEY WAS NO OBJECT  
YOU KNOW WHAT YOU'D DRIVE  
YOU KNOW WHAT YOU'D WEAR  
YOU KNOW WHERE YOU'D LIVE

THIS IS WHAT YOU'D USE



(Even though it is still cheaper than the KENWOOD TS940, ICOM IC760 and the YAESU FTONE)  
**The NEW JST 125T from the Japan Radio Company**  
A beautifully built machine, offering professional performance at a sensible price.  
100w output, am/usb/lsb/cw/fax/rtty.

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**The NEW JST-125T from JRC.** Prices start from as little as £1,395.00 including VAT.  
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