KENWOOD'S DESIGNER PORTABLE
First European Review

STARTING ON SATELLITES
Arthur G2UK tells us how

70cm CONVERSION PROJECT
Burndep UHF Portable

PACKET PRIMER
Packet Mysteries Unfolded

NOVICE • PACKET • REVIEWS • PROJECTS • SATELLITES
The TOKYO HX240 HF Transverter when coupled to an all-mode 2m rig will give you 50 watts on 80 to 10m. RAYCOM have put together this unique unit with the new YAESU FT290R II inc. DC and COAX leads!!!
REGULAR COLUMNS

VHF/UHF MESSAGE .................................................. 36
6m to 23cm latest from the best names in VHF and UHF.

PACKET RADIO ROUNDP ........................................... 22
DX Clusters and the latest upgrades.

HF HAPPENINGS ..................................................... 34
Around the world on 10m with Steve Telenius-Lowe G4JVG.

FROM MY NOTEBOOK ................................................. 42
Geoff Arnold G3GSR with practical hints on mobile voltages.

SATELLITE RENDEZVOUS .......................................... 12
The latest Amsat-UK news from G3RWL.

ORP CORNER .......................................................... 41
The G-QRP club show us how work the world on low power.

NOVICE NOTES ....................................................... 45
Standing Waves, Fact or Fiction?

READERS ADS .......................................................... 51
Bargains galore from rigs to components.

FEATURES

AMSAT-UK COLLOQUIUM REPORT ......................... 20
USSR, DL, G, JA and USA get together.

BURNDEPT CONVERSION TO 70cm ................................ 28
Ex-Police radios on your local repeaters, at low cost.

A PACKET PRIMER .................................................. 38
Phil Anderson WOXI packets from across the pond.

METREWAVE .......................................................... 47
Jack Hum G5UM tells us about 70cm repeaters.

NEWS AND VIEWS

EDITORIAL ............................................................. 5
The stirring, shaking G8IYA editorial that gets you talking.

LETTERS ............................................................... 6
The youth of today tell us what they’re doing.

RADIO TODAY ......................................................... 8
The latest news from the DTI, RSGB and the amateur trade.

CLUB NEWS AND RALLIES ........................................ 49
Where to meet the locals and not so locals.

COMING NEXT MONTH ............................................. 46
What we have in store for you.

ADVERTISERS’ INDEX ................................................. 52
smention HRT when replying to advertisements

KANTRONICS

DATA ENGINE (56,000 bps) £327.95
KPC2 HF/VHF with Wexfa £165.00
KPC4 HF/VHF/dual port £242.00
KAM all mode with Wexfa £285.00
"Smart Watch" Real Time Clock £29.95

PACKCOMM

STATE MACHINE DCD £108.00
HANDSET (6500B) £19.99
MICROSKT-HSK MODEM £189.00
PC-320 dual port 750 card £189.00
TINY-2 with PMS version 3.0 £129.00
TNC-320 dual port HF/VHF £179.00
9600 baud modem £95.00
Real Time Clock 856 ex. mt £29.95

AEA

AMT 3 AMTOR/RTTY £179.95
PK32x+MAIL BOX £299.95

LATEST UPDATE RELEASE DATES

PK-48 & PK 232MEX latest July 1990
PacComm V1.6.6C (PMS 3.0)
Kantronics Version 3.0

If it’s in stock (and it usually is!) we will despatch it same day.

NOTE: Prices do not include carriage

Siskin Electronics Ltd
2 South Street,
Hythe, Southampton,
SO4 6EB.
Tel: 0703-207587,207155
Fax: 0703-847554

ILLEGAL CB RADIO APPARATUS

Licensed radio amateurs are reminded that in accordance with the provisions of the Wireless Telegraphy (Citizens' Band and Amateur Apparatus) (Various Provisions) Order 1988 it is an OFFENCE to possess non-approved CB set(s) (ie NOT marked CB27/81 or PR27) unless under an authority issued by the Secretary of State.

If you are a licensed radio amateur and already possess a non-approved CB set which you intend to convert or which has already been converted to amateur frequency bands but in respect of which you do not hold an authority issued by the Secretary of State, you must apply to the RADIOCOMMUNICATIONS AGENCY for an authority by 31 December 1990 if you have not already done so.

RRTY TRANSCIEVE

The best software available with every feature you could want. Needs TIF1 interface or terminal unit. BBC-B/Master and CBM64 tape £20, disc £22; SPECTRUM tape £35, +3 disc £37 inc. adapter board. Also VIC20 RTTY/CW transceive program £20.

RX-4 RTTY CW SSTV AMTOR RECEIVE

4-mode performance, superb features and ease of use make this still a best-seller. Needs TIF1 interface. BBC-B/Master, CBM64 tape £25, disc £27; VIC20 tape £25. SPECTRUM tape £40, +3 disc £42 inc. adapter board (needs TIF1 also). Software-only version (input to EAR socket) tape £25, +3 disc £27.

TIF1 INTERFACE Designed for TX-3 and RX-4 software and only available with them. Kit £25 (assembled PCB + cables, connectors) or ready-made, boxed with all connections £40.

GX-2 FAX SSTV TRANSCIEVE

Grayscale FAX and mono and colour SSTV on the BBC computer. Fantastic system. Reviews March 90 Amateur Radio and August 90 Ham Radio Today. Complete system of EPROM, interface, instructions, leads, only £99 or £119 with direct FAX printing option.

RX-8 8-MODE RECEIVE

Every possible feature and performance to receive FAX, HF & VHF PACKET, COLOUR SSTV, RTTY, CW, AMTOR, UoSAT and ASCII on any BBC computer. Reviews Oct 89 Ham Radio Today and March 90 Amateur Radio. Complete system of EPROM, interface, instructions, leads and demo cassette £259.

APT-1 WEATHER SATELLITE MODULE

Enables all weather satellite signals to be displayed on any FAX system, £59. Version for our RX-8 system just plugs in and only £39 if ordered with RX-8.

BBC LOCATOR with UK, Europe, World maps £10. MORSE TUTOR £6. LOGBOOK £8, LOCATOR £7, RAE MATHS £9 for BBC, SPECTRUM, CBM64, VIC20, Electron. BBC, CBM64 programs available on disc at £2 extra.

Lots of information available about everything, please ask.

Prices include VAT and p&p by return

technical software (HRT)

Fron, Upper Llandrwlng, Caernarfon LL54 7RF
Tel: 0286 881886

Please mention HRT when replying to advertisements
How did you become interested in amateur radio? Amateur pioneers may well have been excited by the thrill of experimentation in new technology as it was then, keen to discover new techniques. Mature amateurs who came into the hobby much later will probably have become introduced by overhearing amateurs on the short wave bands, particularly 160m ('Top Band') AM. The days of Sunday morning Top Band AM nets and other AM contacts on the HF bands introduced many new amateurs into the hobby. During my younger days in Lancashire, the East Lancs Amateur Radio Club net on 1930kHz AM each Sunday was fondly awaited by a certain SWL, a low cost 'all-wave' receiver coupled to a long wire running down the garden offering good reception of these 'alternative' stations to the usual broadcasters.

New Blood into Amateur Radio

Recent Years
Time passed by, and the most significant influx during recent years has been through the CB explosion of the 1980s, where keener individuals made the effort to pass the RAE and possibly the Morse test. What a pity certain factions did not appreciate this new influx, some even tried to ignore these potential new amateurs! The growth in CB has now steadied out, and less newcomers are apparent. Fewer members of the public are happening to tune into amateur contacts on HF and thus becoming interested that way. Two-way radio communication is nothing new in today's age of international communication by simply picking up a telephone.

Instead, new toys such as computers are taking over, youngsters are writing programs to do wonderful new things, they're dialling up 'Bulletin Board Systems' and downloading files, sending text messages to each other, and catching up on the latest information on the 'special interest' boards. A 'space' board for example could give information on the Space Shuttle, the Russian MIR Space Station and the latest communications satellites, together with Kepler information so they can use their computer to calculate where these craft are at any given time. These enthusiasts pass messages of common interest between themselves, often conscious of running up their parent's phone bill too much. Few may be interested in stringing up wires across their parent's garden, and building things using components that look like they may have come from someone's ancient junk box, then struggle to get some form of a contact.

Suddenly, certain factions are worried that amateur radio isn't now growing as fast as it should!

Education
Why not give them the perfectly correct idea that amateur radio can be exciting. As well as finding out what the MIR cosmonauts and Shuttle astronauts are up to by logging into their local packet radio bulletin board, they won't have packet QSO with the MIR or Shuttle space station - and get a QSL card to prove it! Posted from space as well, I bet...

I met my husband through amateur radio, the very day we were both helping younger people become interested in the hobby through our work with a Scouts 'Jamboree On The Air' station. We were both teenagers.

This month, we received a letter from a group of similarly minded teenagers in Thanet, we're pleased to have placed this as our 'Letter of the month'. But what about the other letters, many of which we couldn't publish. Well last month we had amateurs moaning, the same this month. What will happen next month? Is this an example of what amateurs do, if so then count me out. Let's have some constructive, dynamic actions instead!

If we can be constructive, maybe in the future we'll no longer be regarded by our neighbours as eccentrics living in a house with strange looking aerials, but instead as someone at the forefront of communication, someone to be respected, someone who knows what they're talking about!

ASP — Pioneers in Radio Publishing

We're doing our bit, in the pages of HRT you'll see we're trying to practice what we preach. As well as 'traditional' branches of amateur radio, we're showing you what Ham Radio is about, Today. In our sister publication 'Scanners International', we're showing that radio can be different, it can be exciting, and it isn't just for eccentrics. And these days, the public are more likely to overhear amateurs on 70cm FM than HF AM or CW.

Argus Specialist Publications, who publish more radio magazines than any other UK publishing house (true, just count them all!), have been publishing radio articles (although it was "wireless" at that time) since the beginning of this century. As such, we've been pioneers in radio publishing, in 'Model Engineer' we showed your grandfather how to make his one valve set to listen to 2LO with. As such, we've been at the game longer than the likes of any other UK publisher!

We're not resting on our laurels. We're trying that bit harder. We're continuing our pioneering tradition! So why not help us, write in with your views!
Dear Editor,

We have a Electronics and Radio Club for youth here in Thanet, which has been going for a number of years with Dr. Ken Smith who works in the university, as our leader. So here is a report about the new session and what the boys want to get done.

The average age of members is 13 years, and a lot of people say youth is not interested in radio and electronics, but that is certainly not so with our band of young people. Some of us went with Ken on a week's youth hostel cycle tour round the New Forest and Isle of Wight (yes, we do that too). We visited the 'Wireless Museum' at Arreton Manor, and were most impressed with the interesting things there. Our leader is so keen on collecting and giving talks on old wirelesse, we can see why now!

The main project this term will be everyone building RDF receivers, for club outings to 'find the hidden transmitter'. Also, as quite a lot of old members passed the RAE (and GCE/ GCSE) from the clubwork over the years, some of us will study that course this year. Others are interested in the new RSGB 'novice licence'.

We have a mag, or newsletter called the 'TECnician'. We don't think many 13 year olds will be reading your mag, but what is important is older people such as teachers, dads, uncles etc. who might read it, could mention our club to any young person who could be interested. But they must be keen, and help to run the club, as it is very 'democratic' (we have a members committee who run things).

Thank you, Yours sincerely,
Ross Collins of Ramsgate, Kent.

Dear Editor,

I have just read your constructional article, the 'Sub Tone Controller'. Maybe tone controlled squelch is a good idea for PMR operators, I can't see it being much use to amateurs, in fact it could well escalate the "I was here first" arguments we hear from time to time.

Consider the following scenario; A net of stations, all using tone squelch, are standing by on let's say 144.725MHz. I and another station arrive on the frequency for a QSO, but being good boys, we ask if the frequency is in use before we start chatting. The net stations don't hear us, because our tone-less signals don't open their receivers. Therefore, we carry on with our QSO. The net only become aware of our QSO when one of their own tones opens their squelch. This is also the point when we get interference to our QSO. "We were on this frequency first" say the net stations. "Rubbish" say I, "I asked at xx hrs and received no response, it's our frequency!". Well who's right?

To my mind, any kind of selective access system is all wrong for amateur applications, and will lead to yet more exclusive 'cliques' using amateur radio as a kind of telephone, where 'outsiders' are not welcome. A.J. Howlett, Dukinfield

Editorial comment:
It's great to see an active interest in amateur radio fostered amongst youth people, I remember when I was 13 there was so little information available to a budding young engineer keen on learning about radio. I hope many of our readers will take note of your letter, and that offers of useful help and assistance will be forthcoming. RDF, or radio 'fox-hunting' as it is commonly called, is very popular in many countries, being almost a form of 'radio orienteering', and I'm sure with it's sporting aspects and the new novice licence conditions which allow unattended RDF transmitters it could be the beginning of something very popular over here as well! As a small measure on our part, you'll be receiving our £10 cheque for the 'letter of the month', maybe it could be useful towards component parts for your RDF receivers. Good luck for the future, and enjoy the hobby!
Getting back to CTCSS, we need to ensure that some form of selective calling through devices such as repeaters is available if needed to amateur groups involved in, say, emergency communications. This allows them to be alerted to a call—out without the need to be constantly listening intently to all the activity on the frequency, day or night. Again the HRT pocket 2m pager receiver project (the unit costing typically £1) in the June 87 issue is an example of this.

So having defined a need, and being the only magazine to make it cost effective for those without bottomless pockets, maybe we'd better look at how it's used which I feel could really be the point of Mr. Howlett's letter.

Similar arguments can and do occur in many cases by amateurs in a net tuning their squelches up high and using high power to overcome signals from other users, it's not just CTCSS that can be used. What is needed though is consideration, and the need to check a frequency before simply transmitting on it. This simply means using common sense by defeating the CTCSS circuit and taking a listen. Many of us have come across the "No you can use this channel, this is the such and such frequency and we're going to use it tomorrow" syndrome. No— one owns frequencies, although some users may like to think they do. Using CTCSS, they can listen out for other users of their existing 'clique', or to put it another way their special interest group, without the need to constantly try and defend 'their' frequency.

But amateurs do need to be considerate and listen out before transmitting, this being common sense. Special interest groups are human nature, and we can't change that, but we can endeavour to reduce their hostility to outsiders by the use of CTCSS in this application. What do other readers think?

Dear Editor,
I am writing to point out an error in the October 1990 issue of HRT. It is in the article 'An Accurate Bidirectional Watt Meter' by A. Greenfield G4TPB. On page 26 it is stated that:

\[
\text{SWR} = \frac{\text{Forward Power} + \text{Reflected Power}}{\text{Forward Power} - \text{Reflected Power}}
\]

This is incorrect. 'SWR' or as most commonly written 'VSWR' is given by:

\[
\frac{\text{Reflect Power}}{\text{Forward Power}} = \frac{1 + \text{VSWR}}{1 - \text{VSWR}}
\]

for power meter use.

Editorial Comment:
You're quite right, and HRT now has a new technical editor!

Dear Editor,
The saga began in January this year when I took my 2m transceiver to my local amateur radio dealer for repair, the symptom being low output. After three months of repeated requests about the repair, I was told it had been to another of their branches. Five and a half months later, again after repeated request about the radio, I finally gave them the ultimatum "Return the radio dead or alive within 7 days". It duly arrived, with a 'request' for £87.19 which I paid. When I asked for a detailed account, they said they didn't have one and didn't know what had been done to it. After another week they still had no information, I therefore phoned their other branch myself asking for details of the work carried out. I was told there was no point telling me as I would not understand anyway. End of story as far as I'm concerned, and the end of my dealings with that firm!

J. Roughhead GM1ZUY

Editorial Comment:
Amateur radio firms are in business to make a profit of course, and after inquiring amongst other firms to yours, the above labour rate really doesn't seem to be unreasonably different to the 'norm'. As with any repair, readers must note that labour costs do have to be paid for, it's the dealer's livelihood even though it's our hobby! Very simple, if you can't repair it yourself, and you choose instead to pay someone the 'going rate' to repair it instead, don't argue when the bill comes! Even then, it was a long wait.
Maplin 1991 Catalogue

The new Maplin catalogue for 1991 is now available at W.H. Smith, Maplin shops or by mail order, priced at £2.45 (+50p if ordered direct, UK price). There are over 600 pages, prices and quantities are highlighted in colour.

Of significance to the amateur world is that following the recent marketing agreement between Waters and Stanton Electronics and Maplin, several amateur radio products such as receivers and transceivers, packet radio TNCs and the like, in addition to the Heathkit range of amateur equipment, are also available. Maplin also tell us there are many other famous brand products featured such as Black and Decker and Minicraft tools, and Big Cat eminence loudspeakers. Other new product lines include Kodak films and Olympus cameras, Pro-sound car radio/cassette/speakers, satellite receivers, and 'watch as you build' cassette based learning courses. Meanwhile extended product ranges include batteries, books, cable, protection devices and tools and projects.

Other highlights of the catalogue include the Casio digital diary and personal organiser, Breeze air ioniser, Nicam TV tuner and the multi-satellite receiver system. Maplin are also giving away an all-weather heavy duty torch with purchases of over £5 plus the coupon from the catalogue.

Digital Clamp Meter

Maplin have also recently introduced a new digital clamp meter which measures AC currents and DC resistance in the conventional way with leads. The meter measures AC currents up to 400A without having to break the circuit under test. The sheathed current carrying conductor is held within the jaws of the clamp, with instructions, test leads and probes, temperature probe and one PP3 battery. The meter also measures AC, DC and resistance in the conventional way with leads, and the circuit under test. The sheathed current carrying conductor is held within the jaws of the clamp, with instructions, test leads and probes, temperature probe and one PP3 battery.

QSL with a difference!

This nicely carved hardwood QSL was presented to Cyril, G3YY, by his friend Dusko, YU2ZR, on a recent holiday to Yugoslavia. It was hand carved by Dusko, and features the coat of arms of Opatija together with his QSL card. The plaque is about 270mm high, 200mm wide and 20mm thick. A very nice gift that I'm sure will be remembered by Cyril for years to come, a true mark of east-west friendship through amateur radio.

Yaesu FT-990

Just in time for the Leicester exhibition this year, Yaesu announce the forthcoming launch of their new FT-990 HF DX transceiver. With a general coverage receiver and a 200W transmitter, it provides multiple receiver bandwidths and operation modes together with the facility of adding a Digital Voice Storage option, this automatically recording and replaying received and transmitted speech at the touch of a button. Yaesu's Representative Seiji Yokoi is planning to fly over with the transceiver especially for display at the exhibition. Needless to say, HRT have already been offered the very first UK review opportunity which is currently planned for next month's issue.
Techical Excellence Award

At this year’s Dayton Hamvention, packet pioneer Bob McGwier N4HY was presented with the Dayton Amateur Radio Association's Technical Excellence Award, the second year on the run a Dayton award has been presented to a packet radio developer.

The Dayton Amateur Radio Association tell us that Bob is a member of the original team that pioneered the Microsat series of Oscar satellites in late 1987. His specific contributions involve writing command, telemetry and control flight software for all of the Microsats, designing the Digital Orbiting Voice Encoder (DOVE) and managing software and computer hardware design for the Microsats. N4HY is the author of the well-known satellite tracking software known as Qwiktrak. For seven years, this software has been the single largest source of revenue for Amsat. Bob has co-authored several American magazine articles, and has written several papers that appeared in the proceedings of the ARRL Computer Networking Conferences. In his free time, Bob and Tom Clark W3JWI have championed the cause of digital signal processing (DSP) in amateur radio applications. It was the HRT’s privilege to meet and chat with Bob during his recent visit to the UK.

Powerbreaker

Safety RCD

Powerbreaker tell us that a safety ‘Residual Current Device’ is a device that provides added protection against the risk of electrocution. Unlike a fuse or circuit breaker, which is designed to protect the electrical appliance, an RCD protects the user by automatically cutting the power before you get a serious shock. Powerbreaker units are available not only as adaptors but also as protected 13 Amp plugs and single or twin wall sockets. The adaptors simply plug in, requiring no additional wiring, so they can be moved around easily between appliances and are available from high street stores priced around £20.

New surface mount re-work station from Ungar

Ungar, the soldering and de-soldering specialists have announced the Ungar SMR 1000 surface mount re-work station, now being launched in the UK. This self contained, E.S.D. safe unit features a hot air heater system with closed loop temperature control. The top and bottom heaters warm both sides of the board (useful for warming multi layer boards), components are automatically removed as soon as the solder flows. The components are thus removed and replaced quickly, without damage to the board or the components. Ungar tell us the controls are simple and warm up is rapid, the unit taking approximately 3 minutes from switch on to the ready state.

Enquiries about the SMR 1000, also other products such as hand tools, solder masks and soldering aids, should be made to Ungar, Eldon Industries UK Ltd., Unit 1, Clifton Road, Shefford, Beds SG17 5AB. Tel. 0462 814914

Stolen Property

An Icom IC- R1 scanner receiver, serial number 89001213, was stolen from Characteristics, 44 Hilderthorpe Rd., Bridlington, Yorkshire YO15 3BG at the end of August. If you are offered this radio you can contact Norman Bedford, G4N1P, at above address or Tel. 0262 670568, or of course your local police.

Tandy 1990-91 Catalogue

The Tandy 1990–91 catalogue is now available free of charge from your local Tandy store and authorised dealers. The 140 page catalogue features a complete section by section showcase through the product range, and gives details of all Tandy stores and dealers. Tandy stores have a range of audio, video and specialised electronic products and accessories as well as their “Realistic” range of scanner receivers.

The DTI Announce

Industry minister Douglas Hogg recently welcomed the introduction of a new computer misuse act as further support for computer security. The computer misuse act 1990 creates three new criminal offences:

1. Unauthorised access to computer material.
2. Unauthorised access with intent to commit or facilitate the commission of a serious crime, and
3. Unauthorised modification of computer material.

Mr. Hogg said, “Computer misuse is a growing threat, and users must take the protection of their computers seriously, adopting the appropriate level of physical and technical security. I welcome this valuable Act which provides new avenues for prosecution where misuse has occurred”.

With this tightening up of landline computer ‘hacking’, maybe we could persuade these dedicated computer experts to become involved in the wonderful world of digital communication by radio!
NEW MULTIBAND
IC-970E Base Station

Designed for the serious operator on the 144, 430 and 1200MHz bands, Icom's new IC-970E has up-to-date technology for DX, digital and satellite communications.

The IC-970E is supplied as an all mode dual-bander for 144 and 430MHz bands. Optional units expand its capabilities to 1200MHz or wideband receiving from 50-905MHz.

Communications via satellites has never been easier. The IC-970E automatically tracks uplink and downlink frequencies as the tuning control is rotated also, ten specific memory channels for satellite frequencies.

The dual-band watch allows you to receive both MAIN and SUB band audio simultaneously, multiple scanning systems on the MAIN and SUB bands plus 99 memories, an easy to read central display and Icom's DDS sytem make this one of the most comprehensive multi-band transceivers available.

For more detailed information on the IC-970E Base Station or any other Icom radio equipment contact your local authorised dealer or call Icom (UK) Ltd.

Icom (UK) Ltd.
Dept HRT, Sea Street, Herne Bay, Kent CT6 8LD. Tel: 0227 363859. 24 Hour.

AS FROM THE 1st SEPTEMBER OUR showRoom OPENING TIMES WILL BE:
MONDAY—FRIDAY 0900—1300 AND 1400—1750.
These new models from ICOM add a new dimension to the mobile scene. Enjoy the freedom of the open road and experience the advantages of simultaneous dual-band operation.

They are capable of receiving on both MAIN and SUB bands at the same time. While operating on one band, you can monitor a second band for activity. It is very easy to switch between the MAIN and SUB bands allowing you to reply immediately to calls received on either bands.

Full duplex operation lets you transmit on one band while receiving on the other for telephone style contacts. Each band can be independently regulated using separate volume and squelch controls.

Both models incorporate 20 memory channels and a call channel for each band, these memory channels store all the information needed for repeater operation.

For 23cms operation the IC-2500 features an AFC function which automatically tunes the receive frequency to the transmit station frequency. The AFC function eliminates the need to retune if a station’s transmit frequency is off centre.

IC-2400
144/430MHz
2m 45W
70c 35W

IC-2500
430/1200MHz
70c 35W
23c 10W
Please mention HRT when replying to advertisements.

**Satellite Rendezvous**

**Oscar**

I was recently told that Oscar-10 could no longer be commanded due to its damaged memory. However it is using the Mode B transponder at all times and thus provides a very useful service. The apogee lies close to the Equator, like it was at launch, and the attitude is 'back to front', i.e. Earth pointing at perigee.

The accompanying list (table 1) from James G3RUH shows the relevant operational parameters. James tells us it's important to realise that the current attitude in orbit plane coordinates, and SEL/SAZ are the Sun's position, also in orbit plane coordinates. Eclipses occur when SEL is around 0 degrees, i.e. the Sun lies in the orbit plane. SA is Sun angle, the angle the Sun makes with the solar panels. Illumination (%) = 100 times SIN(SA).

### New Microsat Command Stations

Amsat-NA have just announced the appointment of two Microsat command stations. At the request of Microsat software developer Bob McGwier N4HY, WB9ANQ and WDOE have received assignments for AO-16 satellite maintenance, operation, and characterisation. This event marks the beginning of the transfer of the Microsats from engineering development to routine operational control. The move corresponds to the transfers of control of WO-18 to Weber State University and AO-19 to AMSAT-LU which have already been announced.

### TNC Telemetry

Some stations using their TNCs KISS mode for decoding telemetry have had problems getting back to command level. The way to get a TNC out of KISS mode is to send it the following hexadecimal characters: CO FF CO. On a PC you can send this method is part of the KISS spec. Thanks to Dave G4WRW for this information.

**The latest Amsat-UK information, courtesy of Richard G3RWL**

attitude (and hence Sun angle) is extrapolated from the last known attitude, which was in January 1987, nearly 4 years ago. However the true attitude isn’t far off. If the Sun angle exceeds 45 degrees, then the solar panel illumination is too low, the battery voltage falls, and the beacon starts to warble. Hence the approximate time when AO-10 is expected to be healthy again commences later this month, from around November 17 until February 09 next year. Listen to the beacon to make sure.

Note that ALON/ALAT are the spacecraft's attitude in orbit plane coordinates, and SEL/SAZ are the Sun's position, also in orbit plane coordinates. Eclipses occur when SEL is around 0 degrees, i.e. the Sun lies in the orbit plane. SA is Sun angle, the angle the Sun makes with the solar panels. Illumination (%) = 100 times SIN(SA).

### Oscar 13 Mode S Users

From Toshe JR4BRS comes the latest Mode S user list, with inclusions of ON, G, etc. added by Freddy ON6UG. If you are active on mode S then drop Freddy a message on the Fuji Oscar – 20 BBS.

<table>
<thead>
<tr>
<th>DATE</th>
<th>Attitude</th>
<th>Sun Angle</th>
<th>Sun's Position</th>
<th>Eclipses</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td>ALON</td>
<td>ALAT</td>
<td>SEL</td>
<td>SAZ</td>
</tr>
<tr>
<td>1990 Oct 27 (Sat)</td>
<td>10</td>
<td>-3</td>
<td>-61</td>
<td>24</td>
</tr>
<tr>
<td>1990 Nov 3 (Sat)</td>
<td>9</td>
<td>-2</td>
<td>-54</td>
<td>29</td>
</tr>
<tr>
<td>1990 Nov 10 (Sat)</td>
<td>9</td>
<td>-2</td>
<td>-48</td>
<td>34</td>
</tr>
<tr>
<td>1990 Nov 17 (Sat)</td>
<td>8</td>
<td>1</td>
<td>-41</td>
<td>39</td>
</tr>
<tr>
<td>1990 Nov 24 (Sat)</td>
<td>7</td>
<td>-1</td>
<td>-34</td>
<td>43</td>
</tr>
<tr>
<td>1990 Dec 1 (Sat)</td>
<td>6</td>
<td>-1</td>
<td>-27</td>
<td>46</td>
</tr>
<tr>
<td>1990 Dec 8 (Sat)</td>
<td>5</td>
<td>0</td>
<td>-21</td>
<td>48</td>
</tr>
<tr>
<td>1990 Dec 15 (Sat)</td>
<td>4</td>
<td>0</td>
<td>-14</td>
<td>50</td>
</tr>
<tr>
<td>1990 Dec 22 (Sat)</td>
<td>3</td>
<td>0</td>
<td>-7</td>
<td>50</td>
</tr>
<tr>
<td>1990 Dec 29 (Sat)</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>48</td>
</tr>
<tr>
<td>1991 Jan 5 (Sat)</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>46</td>
</tr>
<tr>
<td>1991 Jan 12 (Sat)</td>
<td>1</td>
<td>1</td>
<td>13</td>
<td>42</td>
</tr>
<tr>
<td>1991 Jan 19 (Sat)</td>
<td>0</td>
<td>2</td>
<td>20</td>
<td>-38</td>
</tr>
<tr>
<td>1991 Jan 26 (Sat)</td>
<td>359</td>
<td>2</td>
<td>27</td>
<td>-34</td>
</tr>
<tr>
<td>1991 Feb 2 (Sat)</td>
<td>358</td>
<td>3</td>
<td>34</td>
<td>-28</td>
</tr>
<tr>
<td>1991 Feb 9 (Sat)</td>
<td>357</td>
<td>3</td>
<td>41</td>
<td>-23</td>
</tr>
<tr>
<td>1991 Feb 16 (Sat)</td>
<td>357</td>
<td>4</td>
<td>48</td>
<td>-17</td>
</tr>
<tr>
<td>1991 Feb 23 (Sat)</td>
<td>356</td>
<td>4</td>
<td>54</td>
<td>-12</td>
</tr>
<tr>
<td>1991 Mar 2 (Sat)</td>
<td>355</td>
<td>4</td>
<td>61</td>
<td>-6</td>
</tr>
<tr>
<td>1991 Mar 9 (Sat)</td>
<td>354</td>
<td>5</td>
<td>67</td>
<td>-6</td>
</tr>
<tr>
<td>1991 Mar 16 (Sat)</td>
<td>353</td>
<td>5</td>
<td>72</td>
<td>-6</td>
</tr>
<tr>
<td>1991 Mar 23 (Sat)</td>
<td>352</td>
<td>6</td>
<td>76</td>
<td>11</td>
</tr>
<tr>
<td>1991 Mar 30 (Sat)</td>
<td>351</td>
<td>6</td>
<td>77</td>
<td>16</td>
</tr>
</tbody>
</table>

please mention HRT when replying to advertisements

HAM RADIO TODAY DECEMBER 1990
Shuttle Packet Hints

A number of publications reported earlier this year that the SSID for the SAREX packet robot would be -1, i.e., WA4SIR-1. Tom Clark W3WI reports that both the HK 21 robot TNC and the operational software for the ‘grid’ laptop computer have the calls defaulted to WA4SIR, i.e., an SSID of 0, and this call should be used unless, for some unanticipated reason, the defaults are over-ridden. Tom continues, the best advice is for you to monitor the downlink signals from STS – 35 and use whatever call you see on the downlink. The robot TNC code uses only one SSID at a time. Because the WA4SIR SAREX robot will be bombarded with signals from tens or hundreds of ground-based users when STS – 35 is flying over populated areas, it is not possible for the robot TNC and radio to use normal half-duplex packet procedures, the CD (carrier detect) signal will simply never drop! The robot will instead be running in a modified full-duplex mode. When the robot copies a modulated packet frame (or when it is time to send a beacon), the data to be sent is put into a buffer and a timer (called the FUDtimer) is started. The robot firmware then queues all other outgoing transmissions in the buffer until FUDtimer expires 3 seconds later, and all downlink frames in the queue are sent in one long transmission. You may discover that the response time while running in this mode is sluggish when compared to normal packet operation.

Since the SAREX handheld radio cannot receive when it is transmitting, users should ensure that they remain silent and only listen when the shuttle is transmitting. In other words, don’t run full duplex on the ground! Leave your TNC in half-duplex mode (FULLDUP OFF) with CD active just like you do for normal VHF packet operations.

As of this time, the launch of STS – 35 has been delayed somewhat with modified dates given, but to paraphrase Yogi Berra “… it ain’t orbiting ‘til it’s orbiting’.

Short Bursts

NASA has finally stopped confusing Fuji Oscar – 20 with the Debut satellite in their Kepler lists. JARL advise that the current Fuji Oscar – 20 eclipse season is over until May 1991. The latest keplers are reproduced here, again in the two line format which may be read in by popular computer tracking programs. An SAE to the editorial address gets you a listing of a conversion program written in Basic if you need one. That’s it for this month. For further information about Amsat – UK contact Amsat – UK, c/o Ron Broadbent G3AAJ, 94 Herongate Rd, London, E12 5EQ. A large SAE gets you membership info, and SWLS are welcome.

<table>
<thead>
<tr>
<th>OSCAR 10</th>
<th>1</th>
<th>14129U</th>
<th>83 88 B</th>
<th>90238.61357863</th>
<th>-</th>
<th>0000014 00000</th>
<th>-0 00000 0 0 5476</th>
<th>2 14129U</th>
<th>26.0406 187.8479 5952609 170.7338 209.0516 2.05880945 26187</th>
</tr>
</thead>
<tbody>
<tr>
<td>UoSat 2</td>
<td>1</td>
<td>14781U</td>
<td>84 21 B</td>
<td>90248.58465124</td>
<td>000001795 00000</td>
<td>0 33854 – 3 0 7765</td>
<td>1 14781U 97.9445 298.4935 0010783 285.7121 38.2846 14.2870</td>
<td>32222</td>
<td></td>
</tr>
<tr>
<td>PACSAT</td>
<td>2</td>
<td>20437U</td>
<td>90 5 G</td>
<td>90244.2371614</td>
<td>000002625 00000</td>
<td>0 26393 – 3 0 2039</td>
<td>2 20437H 98.6920 323.5953 0011018 285.7121 74.2846 14.2870</td>
<td>25287</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 – Keplers

- For the Pacsat, it will be necessary for the user to have a specially written program for the computer which will be used in their Pacsat station. This program must follow all the rules specified in the Pacsat file transfer protocol. The basic reason for using this new protocol is to allow for more efficient file transfers. Although users may initially find this a burdensome requirement, it was Amsat’s goal to release this file transfer protocol far in advance of BBS operations on the Pacsats, so that software developers can start to work immediately on terminal programs for the various computers found today in Pacsat stations. Also, there will be ‘shareware’ programs which will provide examples for software developers, they will keep you informed here on the latest developments of course. The protocol is a 50 page long document by the way.

HAM RADIO TODAY DECEMBER 1990
Kenwood TH27E Review

When I first saw a photo of the TH-27 series in a foreign amateur magazine, I knew this was the first step towards the 'portable design of the future'. I was honoured and overjoyed when HRT were offered the only review sample in Europe.

Styling

As you may see, the transceiver isn't just the usual 'rectangular box', instead it's made using an angled body together with a curved and gently moulded PTT section, the PTT button itself being a flexible 'S' shaped moulding. As a result, the set fits into your hand like the proverbial glove. The nicad battery fits into an internal section of the set, a small bar on the rear being used to extract the battery 'cartridge' in a similar manner to a revolver clip. Even the set-top helical aerial is a moulded 'designer' style, a fashion-conscious set! The rubberised controls and buttons allow it to survive the odd shower or two as well, and for water enthusiasts the transceiver can even be fitted into a purpose made waterproof bag.

Features

The set measures a compact 49 (W) x 121 (H) x 38 (D) mm, weighing in at a light 360g. In fact, when I took the fitted 7.2V 700mA nicad out, there hardly seemed to be any weight left. The transceiver covers the usual 144-146MHz in selectable tuning steps, and besides the keypad letting you enter frequencies in directly, the top panel rotary click-step tuning knob allows you to step through the channels one by one.

With the supplied nicad, the set gives around 2.5W output power. A set-top mounted socket also lets you plug in an external 13.8V DC supply which, as well as charging the nicad, boosts the maximum transmitter output to over 5W - useful for when you're either mobile or operating from home. The set-top aerial unplugs to reveal a normal BNC aerial connector, again allowing you to connect...
an external aerial when you're in a position to do so.

To conserve your battery life, or indeed so as not to cause too much spectrum congestion when operating locally, the transmit output power can be switched to no less than four levels, High, Medium, Low and 'Economy Low', these being around 5W (with a 13.8V supply), 1.5W, 0.5W and 20mW respectively.

Using the set's internal nicad, the 'Economy Low' power level of 20mW is specified as providing around 15 hours of continuous operation, as opposed to 2 hours on high power. This could indeed be very useful for local communication around a given site such as a radio rally, or indeed when using the set to command a remote transceiver on the same site as allowed under the latest UK licence conditions (more of this next month).

Controls

Rather than an On/Off switch being combined with the volume control, this set uses a separate push-button on the front of the case, you press this for about half a second to switch the set on or off. Below this is the 'lamp' button, this illuminates the LCD panel so you can see what frequency you're on when out on a dark winter's evening. Concentric rotary volume and squelch controls allow you then keep to your preferred settings, and the rotary channel knob next to these gives you an easy method of selecting the operating channel.

The two larger circular buttons on the top row of the facia array act as the 'Toneburst' and 'Call Channel' selectors, the second quickly selecting your pre-programmed 'Call' channel for quick access. Other buttons, both circular and rectangular, control the many other features of the set which if I described them all here would fill about five pages of the magazine! Suffice to say the set gives you all the normal features such as repeater shifts and memory channels (40 of them) combined with scanning facilities of either your selected channels or any pre-programmed section of the 2m band. Scan 'halt' modes may be switched between a timed halt on each active channel, a halt followed by a short time delay after the squelch closes on each active channel, and a 'stop' mode where the set stays locked onto the first active channel it finds.

Selective Calling

Some 2m and 70cm operators may wonder what is going on when on listening to their local repeater a call is sometimes preceded by a small number of 'touch tone' digits. This is because the operators are using a system of DTMF (Dual Tone Medium Frequency) selective signalling, to 'open up' the other party's receiver. Regular readers will know how this works from the HRT article in the Feb 1989 issue, where we showed how you could use a DTMF controller to automatically wake your receiver up. The TH-27E has a DTMF encoder and decoder built in, to allow the use of this system with other similarly equipped stations. When this is enabled on the set, the receiver squelch opens up only when a pre-programmed 3-digit DTMF sequence has been received, this sequence may even be stored in all the memory channels as well as the VFO.

One step further from this is the TH-27E's 'Pager' facility. Here the set uses digital codes to open the squelch, using a 3-digit calling/group sequence followed by an additional 3-digit 'private' code. When received, the private code and the group or calling code of the calling station are shown on the set's LCD panel and held there, so you can even see who's called you if you weren't around at the time.

Options

The set comes with a belt clip and carrying strap, together with a plug—in 14 hour charger for the supplied nicad. A 5l page user instruction manual is also included, this gives comprehensive operating details on all the set's many functions together with block and circuit diagrams of the set's innards.

An internally fitted CTCSS (Continuous Tone Controlled Squelch System) is available as an option for the set, for use in operating through some UK repeaters as well as for quiet monitoring of club channels and the like. A 'monitor' button above the PTT lets you defeat the CTCSS to listen out on the channel before transmitting.

A number of speaker microphones are also available, including the SMC-33 model which gives you remote control of a selection of the set's functions, i.e. selection of the first three memory channels and any three other functions such as up/down channel control, tone, reverse repeater, call channel access and the like. A VOX (Voice Operated Transmit) headset is also available, so you can wander round the rally or whatever chatting away to your QSO partner whilst carrying boxes full of radio goodies (or indeed keeping hold of the kids).

Further options include a rapid nicad charger, a soft carrying case, an empty battery case for AA size batteries, and various external DC cables.

Insides

Referring to the block diagram shows that the usual arrangement of a double conversion superhet is used on receive, the TH-27E using a high 1st IF of 45.05MHz to provide a good degree of image rejection. On transmit, again the usual final frequency VCO (Voltage Controlled Oscillator) is used together with a block PA module. A single chip synthesiser is used, fed by the VCO through a buffer only with no external dual-modulus prescaler being used.

A metal rear cabinet die casting is used to provide rigidity as well as a heatsink for the power amplifier, another die—cast metal inner section acting as a further heatsink and providing screening between the RF circuits. The plastic front
please mention HRT when replying to advertisements

Base Station Use

At home, operating the set from a 13.8V DC power supply and plugged into an external aerial, showed the set was nicely sensitive with a corresponding 'punch' on transmit with it's slightly higher power in this mode. I did however find during long transmission on and off that the rear panel became quite warm, sometimes hot, and I often switched down to 'Medium' power to keep the set cool. Sharing my station with no less than three 2m packet nodes gives me a good idea of the strong signal handling capabilities of the set under test. The TH-27E was certainly no worse than other portables I have tried, although I found it did suffer from desensitisation to a worse degree than a purpose made base station, although this would of course be expected.

Flexibility

Walking Around

Whilst out and about, I was pleased to find there was plenty of undistorted receive audio available from the small front panel speaker, and I could happily walk along without needing to hold the set up to ear level in normal use. On transmit, reports on my audio were normally quite good, although I did receive the odd report of compression when I used the set through my semi-local 2m repeater. At first, I often received reports of an intermittent transmission, this I later found was due to use of the set with my right hand, my index finger not quite keeping the PTT held down all the time due to the set's curved moulding. Switching over to my left hand, with my thumb operating the PTT in all cases, restored normal operation, maybe my hands are too small for the rig!

sensibly placed on the bottom right hand 'corner' of the keypad array for easy use. Likewise the 'Tone' button for repeater access was well placed, but I sometimes found that due to the large number of operation modes I often pressed the wrong button by mistake. Yet with the large number of memory channels available I found by using these together with just the top panel tuning knob allowed me to get where I wanted, thus providing the best of both worlds.

Laboratory Tests

The measured receive sensitivity was quite good, the strong signal handling in terms of blocking and the like was again good for a handheld although as expected understandably not up to that of a mobile or base rig. The adjacent channel rejection was a little on the asymmetric side probably due to the high IF used, this was noticeably so at 12.5kHz offsets but the set still gave good performance at 25kHz channel spacing offsets. The S-meter bar graph gave a useful dynamic range, far better than some FM only equipments, although I found the upper segment at each level nearly always tended to flash rather than stay constantly displayed.

On transmit, the higher order harmonics were extremely well suppressed, these being below the -90dBc mark, and the frequency accuracy was very good. The transmit power with a 7.2V supply was around the 1.75W mark, although substituting a freshly charged nicad bought this up to over 2W in all cases. I found that with the set operating from an external 13.8V DC supply, the 'High' level of output power tended to 'slump' as the PA warmed up, although this was only found in early several cases. I found that with the set operating from various frequencies! the 'Medium' level of output power tended to be set above the 25kHz absolute maximum level for 25kHz spacing, although this could easily have been a 'one-off' example.

Conclusions

Kenwood's latest portable represents a new step not only in a deviation away from 'traditional' styling, but also providing a large number of features, many of which can be user-programmed as 'start-up' conditions to virtually personalise the set to the user's individual needs. The DTMF selective calling can be quite a useful feature for operators who need to listen out for specific calls from similarly DTMF-equipped stations, and I can see this to be potentially very popular in future times if frequency congestion gets the better of us – emergency net users and the like could then have little excuse for demanding 'sole use' of various frequencies!

I did find that, due to the large number of features offered, it was
184 PAGES PACKED WITH COMPONENTS, KITS, TEST EQUIPMENT AND BOOKS...

BATTERIES
Ni-cad, Dry Cell, Ni-cad Chargers, Eliminators, Holders, Connections

BOOKS
General, Textbook and Basics, Radio and TV, Data/Reference, Projects/DIY,
Measurement/Servicing, Linear Electronics, Audio, Digital Electronics, Computers

CABLE AND WIRE
Equipment Wire, Mains Cable, RF Cable, Audio Cables, Ribbon Cable,
Enamelled Copper Wire, Accessories

CAPACITORS
Electrolytic, Ceramic, Foil, Variable, Trimmers

COMPONENT PACKS

COMPUTERS
Amstrad 464/6128 Peripherals, Software, Computer Leads, Cable
Adapters/Testers, Data Switches, PC Cards, Microcomputing Kits/
Modules, Accessories

CONNECTORS
Audio, Servo, DC, RF, RF Adapters, IEC Mains, 13A Mains, Low Current,
Terminal Blocks, PCB Ribbon, IDC Edge, 0.1" Pitch Edge, IC Sockets,
Waterproof Sockets

COUNTERS AND TIMERS
LCD Modules Stopwatch

CRYSTALS
Crystals, Ceramic Resonators

FILTERS
Ceramic, Pilot Tone/and Birdie,
LC Video Block, Helical, Crystal,
Ceramic, RF Interference

HARDWARE
Equipment Cases, Aluminium Boxes,
Plastic Boxes, Mounting Accessories,
Knobs, Breadboards, Fuses,
Fuseholders, Heatsinks, DC Fans

INDUCTORS
Toko Coils, Fixed Inductors, Axial RF
Chokes, Surface Mount Inductors,
Moulded VHF Coils, Ferrite Materials,
Dust Iron Toroids

KITS AND MODULES
FM Tuner Sets, FM IF Amplifiers, Digital
Frequency Meters, TV and Video
Systems, Aerial Amplifiers, AM Systems,
HF Amplifiers, Signal Processors,
6m Systems, VHF Systems, Satellite
Systems, UHF Systems, Audio
Amplifiers, Audio Accessories, Cassette
Systems, Home and Hobby, Radio
Control Systems, RF Test Equipment,

SPEAKERS/SOUNDERS
Piezo Buzzers, Headphones,
Loudspeakers, Microphones

SWITCHES
Key, DIL, Push Button, Contact,
Code, Rotary

TEST EQUIPMENT
Oscilloscopes, Frequency Meters, Signal
Generators, AF and RF Generators,
Analogue Multimeters, Digital
Multimeters, Multimeter Accessories,
RF Power Measurement, Digital
Thermometers, Logic Probe and Pulses,
DC Power Supplies, LCR Meters,
Oscilloscope Probes, Test Leads,
Calculators

TOOLS
Soldering Irons, Soldering accessories,
Drills and accessories, Screwdrivers,
General Tools, Static Protection,
Service Aids

TRANSFORMERS
PCB Mounting, Chassis Mounting

AVAILABLE FROM LARGER NEWSAGENTS OR DIRECT FROM CIRKIT

LOW COST MULTIMETERS
MANY NEW PRODUCTS

Cirkit Distribution Ltd
Park Lane, Broxbourne, Herts EN10 7NQ
(0992) 444111

THE NEW WINTER 90/91 CATALOGUE OUT NOW FREE!
25W SOLDERING IRON WORTH £5.98
WHEN YOU SUBSCRIBE TO THIS AND THE NEXT TWO ISSUES - FOR ONLY £5.00.
SIMPLY FILL IN THE COUPON AND KEEP UP TO DATE!

NAME: _______________________
ADDRESS: ___________________
POST CODE: __________________
ACCESS OR VISA ______________
EXPIRY DATE: ________________
SIGNATURE: __________________
DATE: _______________________

Please supply:
☒ Winter '90/91 Catalogue @ £1.60
☒ Winter '90/91 Catalogue and subscription to the
next two issues @ £5.00

I enclose Cheque/Postal Order for
Please debit my Access/Visa card for

Please mention HRT when replying to advertisements
sometimes difficult to fully comprehend every mode of operation of the set, although by storing the various operations and DTMF sequences into the memory channels allowed a degree of easier use. The TH – 27E could thus be a very appealing set for the techno – freaks such as myself, but I'd advise just staying with the memory channels on the set if microprocessor operations get you baffled.

I'm now just visualising what the next 'style' of Kenwood portable will look like!

The TH – 27E is currently priced at £249, and our thanks go to Lowe Electronics Ltd. for the loan of the review transceiver.

LABORATORY RESULTS

RECEIVER

Sensitivity: Input level required to give 12dB SINAD:
144MHz: 0.150µV pd
145MHz: 0.145µV pd
146MHz: 0.150µV pd

Image Rejection: Increase in level of signal at first IF image frequency over level of on-channel signal to give identical 12dB SINAD signals:
83dB

Maximum Audio Output: Measured at 1kHz on the onset of clipping.
3ohm load: 155mW RMS
8 ohm load: 113mW RMS
15ohm load: 89mW RMS

Squelch Sensitivity:
Threshold: <0.06µV pd (≤2dB SINAD)
Maximum: 0.13µV pd (9dB SINAD)

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:
+ 100kHz: 85.5dB
+ 1MHz: 92.0dB
+ 10MHz: 95.5dB

Intermodulation Rejection: Increase over 12dB sinad level of two interfering signals giving identical 12dB sinad on-channel 3rd order intermodulation product:
25/50kHz spacing: 61.0dB
50/100kHz spacing: 63.5dB

TRANSMITTER

TX Power and Current Consumption:

<table>
<thead>
<tr>
<th>Freq MHz</th>
<th>Power</th>
<th>7.2V Supply</th>
<th>13.8V Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>144</td>
<td>High</td>
<td>1.66W/920mA</td>
<td>5.09W/1.47A</td>
</tr>
<tr>
<td></td>
<td>Mid</td>
<td>1.58W/915mA</td>
<td>2.11W/940mA</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>0.43W/550mA</td>
<td>18mW/102mA</td>
</tr>
<tr>
<td></td>
<td>E. Low</td>
<td>17mW/97mA</td>
<td>18mW/102mA</td>
</tr>
</tbody>
</table>

| 145      | High  | 1.70W/925mA | 5.16W/1.47A  |
|          | Mid   | 1.60W/915mA | 2.07W/945mA  |
|          | Low   | 0.43W/555mA | 0.36W/550mA  |
|          | E. Low| 17mW/98mA   | 19mW/102mA   |

| 146      | High  | 1.75W/925mA | 5.19W/1.48A  |
|          | Mid   | 1.62W/920mA | 2.01W/945mA  |
|          | Low   | 0.42W/555mA | 0.36W/550mA  |
|          | E. Low| 18mW/99mA   | 19mW/102mA   |

S-Meter Linearity:

<table>
<thead>
<tr>
<th>Indication</th>
<th>Sig. Level</th>
<th>Rel. Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.40µV pd</td>
<td>0dB ref.</td>
</tr>
<tr>
<td>2</td>
<td>0.66µV pd</td>
<td>+4.1dB</td>
</tr>
<tr>
<td>3</td>
<td>1.07µV pd</td>
<td>+8.4dB</td>
</tr>
<tr>
<td>5</td>
<td>2.27µV pd</td>
<td>+15.0dB</td>
</tr>
<tr>
<td>7</td>
<td>6.80µV pd</td>
<td>+24.5dB</td>
</tr>
</tbody>
</table>

Current Consumption:

Standby, economiser operating: 12mA average
Receive, Mid Volume: 76mA
Receive, Max Volume: 114mA

Squelch Sensitivity: Measured as increase in level of interfering signal, modulated with 400Hz at 1.5kHz deviation, above 12dB SINAD ref. level to cause 6dB degradation in 12dB on-channel signal:
+12.5kHz: 21dB
−12.5kHz: 36dB
+25kHz: 64.5dB
−25kHz: 76.0dB

Adjacent Channel Selectivity: Measured as increase in level of interfering signal, modulated with 400Hz at 1.5kHz deviation, above 12dB SINAD ref. level to cause 6dB degradation in 12dB on-channel signal:
+100kHz: 21dB
+1MHz: 36dB
+10MHz: 76.0dB

Harmonics:
2nd Harmonic: -68dBc
3rd Harmonic: -79dBc
4th Harmonic: < -95dBc
5th Harmonic: < -90dBc
6th Harmonic: < -90dBc
7th Harmonic: < -90dBc

Peak Deviation:
5.82kHz

Toneburst Deviation:
3.78kHz

Frequency Accuracy
-150Hz
TREAT YOURSELF ... TREAT A FRIEND!

Subscribe to HAM RADIO TODAY and receive a FREE Copy of ‘Surplus 2-Way Radio Conversion Handbook’, from Argus Books — worth £10.95!

That's right, if you take out a year's subscription to HAM RADIO TODAY for either yourself or as a gift for a friend, not only will we make sure it's delivered to you each month at no extra charge*, but you or the recipient of your gift subscription will also receive a copy of this superb book with the compliments of HAM RADIO TODAY.

As 2-way radio equipment, as used by the police etc., is replaced, these sets become available on the surplus market for very economic prices and they can often outperform purpose-designed amateur radio equipment!

This book explains how to modify this equipment to amateur radio frequencies and describes the equipment suitable for conversion. Together with relevant photographs and sources of supply, plus alignment and modification details, this book is the reference and handbook that amateur radio operators have been waiting for.

Just fill in the coupon below and send it to the address given, with a cheque, money order or credit card instructions to cover the cost of the subscription. We'll do the rest.

Subscription Rates:

<table>
<thead>
<tr>
<th>Region</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>£19.20</td>
</tr>
<tr>
<td>Europe</td>
<td>£24.00</td>
</tr>
<tr>
<td>Middle East</td>
<td>£24.35</td>
</tr>
<tr>
<td>Far East</td>
<td>£26.70</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>£25.75</td>
</tr>
</tbody>
</table>

Airmail Rates on Request

* Overseas Subscriptions include postage.

ORDER FORM

Please tick
☐ I would like to subscribe to HAM RADIO TODAY and receive a free gift.
☐ I would like to send a HAM RADIO TODAY gift subscription and free gift.

My Name: ___________________________ Recipient's Name: ___________________________

Address: ___________________________ Address: ___________________________

Postcode: ___________________________ Postcode: ___________________________

☐ New Subscriber ☐ Renewal ☐ New Subscriber ☐ Renewal

Please commence the subscription(s) with the issue.

I enclose my cheque/money order for £____ payable to A.S.P. or debit my Access/Visa Account.

Valid from ______ to ______

Signature: ___________________________ Date: ___________________________

Return this order form and remittance to: The Subscription Manager (HRT/10), Argus Specialist Publications, Argus House, Boundary Way, Hemel Hempstead, Herts, HP2 7ST.

TERMS AND CONDITIONS

This offer closes on Friday 7th December 1990 and is also open to current HAM RADIO TODAY subscribers who wish to renew or extend their current subscription but must do so using the order form provided.

Please allow 28 days for delivery of your gift. To guarantee receipt of gift subscriptions before Christmas, orders MUST be received by the closing date.
The Amsat-UK Colloquium took place over the 'long weekend' of 26th – 29th July, a central focus for forward thinking amateurs of the world to come and give information to others through lectures, or listen to what others are up to, and in all lead to better communication amongst amateur nations of the world. Over 200 delegates from 29 countries attended, with significant names in the worldwide satellite field very much in evidence.

The lectures included topics such as Microsat Packet Operations by Dr. Bob McGwier N4HY, Fuji-Oscar 20 operations who's satellites they try their target practice out on. During the lectures, other announcements of possibly more use to the amateur fraternity were of course also announced:

**Fuji Oscar**

The Japanese Amateur Radio League (JA)RL represented by Fujio JS1UKR, said they have initiated a satellite 'Fuji' award for Mode JA operations, up till now only three amateurs have achieved this award. UK operators pointed out that we could do with some more mode JA time over mounted inside the Ariane rocket's separation collar on the September 1992 flight carrying the Telecom 2B payload. The final orbit is expected to be equatorial with an apogee of 36,000km and a perigee of 20,000km, with a period of 17 hours 30 mins. Visibility figures for the UK for this type of orbit are 'interesting' to say the least, the longest pass is around 31 hours with gaps of 48 hours between passes occurring from time to time.

A solid fuel rocket motor will be used to raise the perigee after launch into a Geostationary Transfer Orbit. The spin-stabilised satellite will carry three deployable solar panels, and will be earth-pointing using nitrogen gas for its attitude control, its lifetime is expected to be in the order of five years. The six-sided body will measure 900mm in diameter with a height of 880mm, the whole bird weighing around 140kg before the kick motor fires.

The communications payload will be located here, Fujio said he would attempt to make arrangements for this, and hopefully also for the FO-20 operating schedules to be published in future. Watch this space! Also whilst the delegates took photos of Fujio presenting his paper, Fujio introduced much humour by taking a couple of photographs of us from his end — saying that he liked to be different!

**New Satellite — Arsenen**

F6BVP gave a comprehensive presentation about the long awaited French satellite. ARSENE (Arianne Radioamateur Satellite pour l'ENseignement de l'Espace) will be
Delegates from all nations attended the colloquium. have a 70cm uplink together with downlinks on 145MHz and 2445MHz, however the two modes B and S won't operate simultaneously. Mode B operation will use FSK packet with three uplink channels and one downlink, and mode S will employ a linear transponder.

Other New Satellites
Also at the Colloquium, Amsat-Israel announced that they are to follow the example of universities abroad and launch a satellite project. Plans are currently in hand for a small store-and-forward spacecraft, perhaps also carrying scientific experiments. A launch by Ariane is being explored.

Phase 3D
During the convention, design requirements for the Phase-3D satellite were also discussed. The plan is to improve communication links by greater than 10dB over AO-13 by using greater power and greater antenna gain together with measures to guard against uplink stations using excessive power. The preliminary specification of the satellite describes a 3m diameter 'bird' weighing 400kg, carrying a 250W PEP transmitter. There is also a possibility that it may carry 10GHz experiments, these being favoured by Amsat-DL, as well as the more usual communications transponders and beacons.

UoSAT-F
The AMSAT-UK Chairman (and HRT contributor) Dr. Arthur Gee G2UK announced a proposal for a UoSAT-F spacecraft to be launched on an Ariane flight in April 1991. If the proposal is realised, Amsat-UK will donate £25,000 to the project which is hoped to carry a Mode A transponder. This will have a 2m uplink and a 10m downlink, to show prospective newcomers to satellite operation that complex gear certainly isn't necessary.

Tours and Meetings
During spare periods in between convention activities, staff from the University of Surrey gave colloquium delegates the chance to see around the UoSAT Mission Control station together with a tour of the extensive satellite research laboratories in the University. This was quite an eye-opener, showing how advanced amateur communication can be. At the same time, various informal 'workshops' were held, where delegates shared their skills and experience with others during 'mini-lectures' on specialist subjects.

On the Saturday evening, the Amsat-UK AGM was held and members re-elected the current committee, apparently it was deemed the committee had done such a good job in the past! This was followed by the annual Amsat-UK buffet dinner where we all had a chance to chat informally with other satellite personalities throughout the world. Following this, a marathon junk sale took place with Ron Broadbent G3AAJ as 'master of ceremonies' ably assisted by HRT contributor Richard G3RWL. The star prize in the raffle was the Toshiba T1200 portable computer used at the radio command station of the recent North Pole expedition, a very valuable as well as unique prize.

As the evening progressed, hilarity became the order of the day with surplus gear sometimes being virtually given away, and at one memorable point in the proceedings Ron actually donned a protective helmet, supposedly to guard against junk being thrown back at him! By midnight we had all just about finished, yours truly going back to his University Residence accommodation laden with goodies.

As well as the lectures and meetings, the opportunity of minds working together was put to good use. To this end, during the 'Colloquium Week' Harold Price NK6K and Jeff Ward GO/KB6A spent much time in loading and testing the 210 kbytes of forward communications software on UO-14. By the Saturday after five reloads and many tests, several software 'bugs' had been ironed out and the 'alpha tests' were declared complete. This cleared the way for release of the file transfer and broadcast protocols together with other information, and this should be available to satellite enthusiasts by the time this comes into print.

Well done chaps, thanks for a great convention and all the work, and here's to next year's get-together!

The extensive array of UoSAT tracking aerials.
DX PacketCluster — you may have heard of this used on the packet network but what does it actually provide? Well if you attended this year’s HF convention in Daventry, then you will have seen a first hand demonstration of the powers of packet, courtesy of Ian G4LJF who gave a presentation on the subject of the DX PacketCluster. As promised in last month’s Roundup, here’s a brief description of what it’s all about.

As its name suggests, the system is designed to be used in a ‘cluster’ of stations, all linked together via the packet network to carry the latest DX information as provided by other users of the cluster. At the time of writing there are several PacketCluster stations in operation around the UK, and undoubtedly this number is sure to grow. Another PacketCluster will shortly spring up in Chandler’s Ford for example, linked to the multiple TheNet nodes already in operation. The cluster acts as a ‘share’ of DX information, any station connected to a ‘host’ PacketCluster can enter a piece of information, such as the DX station callsign, frequency, and other information such as the operator’s listening frequencies and QSL information.

The host PacketCluster station then automatically relays this to all the other connected users, as well as to other PacketCluster nodes spread around the UK, each node storing the information into memory. To take a typical example, on the GB7YDX PacketCluster more than 100 different stations have logged in from around the North Midlands and Northern England, and several PacketClusters in the UK have also been successfully linked together. Work is currently progressing to improve links between these nodes.

In typical usage, you can connect into your local PacketCluster node and request a display of what’s been going on. The user command SH/DX for example will list the last 5 DX ‘spots’. A mailbox facility also exists for either DX or personal messages and a DIR command lists the message directory, as usual messages to ALL or indeed ‘private’ messages to other stations may be entered. As well as this, a propagation routine is present which when supplied with appropriate data can calculate the minimum and maximum usable frequencies at any given time from the users’ QTH to any other chosen location in the world. Beam heading information and sunrise/sunset times can even be provided.

DX enthusiasts will immediately recognise this as a powerful tool, the ability to pass on information about a ‘rare one’ on 20m say, to all other stations in the Cluster by simply tapping a line or so into their terminal can be a very, very useful DX aid. So much so, that in the USA a single operator using this during an ARRL contest is classed as a special case — that of ‘assisted operation’ i.e. similar to having a second ‘DX spotting’ station operator at his or her side! In fact, for contest use PacketCluster can be linked in with a simple communication terminal program to a contest logging and duplicate checking program such as CT. By typing one keystroke (ALT-F4) in CT the Cluster DX spot is automatically placed into the CT log’s callsign field, the computer even changes your transceiver’s frequency through the remote port to the frequency of the DX spot. Needed multiplier prefix stations and like can easily be searched for, automatically. Is it any wonder it’s classed as ‘assisted operation’!

G4HCL looks at the DX PacketCluster and Kantronics’ latest upgrade

The software author of DX PacketCluster is Dick Newell AK1A, a 39 year old consulting software engineer for the Digital Equipment Corporation. So now you know who to blame for the DX piles-ups once the word gets around about a ‘rare one’ over the PacketCluster! It’s a commercial program, and if you’re interested you can get details on the purchase of it from Pavilion Software, Box 803, Hudson, Massachusetts 01749, USA.

Kantronics Upgrade

The latest software for Kantronics TNCs, version 3.0, has just become available, one of the very first samples being delivered courtesy of Siskin Electronics (thanks, Phill) and placed into the editorial KAM TNC to test for our readers. A significant new feature offered is that of reverse forwarding from the user’s PBBS into a network BBS, by arrangement with your local friendly BBS sysop of course. For those not familiar with this system, you simply enter outgoing mail into your TNC’s memory, then at periodic intervals your local network BBS ‘polls’ your TNC to see if there is any outgoing mail. If so, it uploads this, also downloading any stored mail from the network addressed to your station call-sign.

A ‘software DCD’ may be selected, where your radio can be run in unsquelched mode or indeed for the TNC to be fed with ‘raw’ audio straight from the discriminator for better performance on packet. Host mode is added which allows special programs to be run to speed up operation, and the PBBS may now be accessed by issuing a connect request to the PBBS Call sign itself just as you would do on air but without the TNC actually transmitting. For the KAM, NAVTEX mode is also supported to allow processing of the various navigational bulletin messages, together with the 7 character selective AMTOR 625 mode and an ‘Auto-start’ mode of up to 7 characters for RTTY and ASCII use.

9600 Baud

Another new product from Kantronics is the 9600 baud plug-in...
place at 2.00pm on November 10th, and it will be held at the Churchill room, London House, Mecklenburgh Square, London WC1. London House is close to the junction of Grays Inn Road and Guildford Street, a few minutes walk from the Kings Cross/St. Pancras BR and underground stations. You can get further details from Ian Brothwell G4AEN, 1, Dale Close, Breaston, Derby DE7 3AZ.

Maxpak the Midland AX25 Packet Group, continue to go from strength to strength, their latest quarterly 'Digicom' magazine having a total of 40 pages and being very professionally produced. An interesting article by Hayden GBAMD in the issue I have sitting here is entitled a 'Network Strategy Paper', which certainly gets sysops thinking about the future growth potential of packet and ways in which to ease the congestion that occurs under station overcrowding.

The IMABIC KEYER features full Iambic Keying, dot dash memories, low consumption, negative and positive keying, keying up to 50V @ 500mA, on board speed control, all on a compact PCB. All this for £16.95.

The ONER Transceiver is made up of five separate kits, each on a one square inch PCB, they are...

Please note, some kits are supplied semi-complete, none are supplied with boxes to house the unit. If in doubt ask.

ONER TRANSMITTER, up to 2 watts output, crystal controlled, or use the...ONER VFO, a small vfo for the transmitter or the...ONER RECEIVER, a simple direct conversion receiver, NB it needs a VFO to drive it...ONER QSK, the changeover PCB for switching from receive to transmit, and finally the...

ONER LOW PASS FILTER, this LPF can be used on any single band hombrew transmitter. State band required when ordering. These kits are available for...

TRANSMITTER @ £5.50,
V.F.O. @ £7.95,
RECEIVER @ £9.95,
Q.S.K. @ £9.95,
LOW PASS FILTER (state band) @ £3.95

The KANGA DIRECTIONAL POWER METER is a superb piece of equipment, if you want accuracy in your power measurements and cannot afford the Bird version try ours. With full information and with capabilities of handling up to 200 watts or more. N.B. not supplied with box to house the final unit

The sensor head alone costs just £17.95 With suitable meters the unit costs £32.95

Please add £1 to cover Post & Packing
Send a A5 SAE for free full catalogue

F1717 and FT77 TOP BAND CONVERSION Due to popular demand we have revived this kit to put top band (160 metres) into the FT77 and the FT77. This conversion replaces the 12 metre band and can be carried out by anyone with some constructive experience. The conversion will take about five hours and involves working on the ‘innards’ of the set. FULL instructions are included.

The full conversion kit costs just £29.95
The SUDDEN RECEIVER is a small Direct Conversion receiver for use on the bands from 20m to 60m. It is simple to build and can be built by a child under instruction. State band required.

£1795
Building a POWER SUPPLY? We have the control and safety unit for you, facilities for between 8 and 19 volts set at your choice and the facilities to set the trip current too, all for £14.95.

The IMABIC KEYER features full Iambic Keying, dot dash memories, low consumption, negative and positive keying, keying up to 50V @ 500mA, on board speed control, all on a compact PCB. All this for £16.95

The ONER Transceiver is made up of five separate kits, each on a one square inch PCB, they are...

Please note, some kits are supplied semi-complete, none are supplied with boxes to house the unit. If in doubt ask.

ONER TRANSMITTER, up to 2 watts output, crystal controlled, or use the...ONER VFO, a small vfo for the transmitter or the...ONER RECEIVER, a simple direct conversion receiver, NB it needs a VFO to drive it...ONER QSK, the changeover PCB for switching from receive to transmit, and finally the...

ONER LOW PASS FILTER, this LPF can be used on any single band hombrew transmitter. State band required when ordering. These kits are available for...

TRANSMITTER @ £5.50,
V.F.O. @ £7.95,
RECEIVER @ £9.95,
Q.S.K. @ £9.95,
LOW PASS FILTER (state band) @ £3.95

The KANGA DIRECTIONAL POWER METER is a superb piece of equipment, if you want accuracy in your power measurements and cannot afford the Bird version try ours. With full information and with capabilities of handling up to 200 watts or more. N.B. not supplied with box to house the final unit

The sensor head alone costs just £17.95 With suitable meters the unit costs £32.95

Please add £1 to cover Post & Packing
Send a A5 SAE for free full catalogue

New Salisbury Node

At a meeting held in Fordingbridge on the 21st September, amateurs from no less than three repeater and packet groups got together with a view to getting a packet node on the air from the Salisbury area. It was proposed to pursue an initial system on 4m using a horizontally polarised two or three element yagi, with the future objective of a 23cm system. The site rental and electricity costs will shared between the groups, and you can get further details on the packet side of things from Dave G4WPT @ GB7HNM.

Tiny-2 State DCD

If you'd like to be able to run your Tiny-2 with the receiver squelch open, to catch those stations with very short TXDelay settings which you otherwise miss due to the squelch opening time of your receiver, the latest Pac-Comm 'State DCD' board could be of interest to you. I recently added one to the Tiny-2 used on my 70cm node line of a line of several Tiny-2s), the results being remarkable. Previously, stations connecting to the node sometimes had to extend their TXDelay slightly as, guess what, the 70cm node receiver squelch took a couple of hundred milliseconds to open. Coupled with a possible transmit power-up delay at the remote end sometimes meant zero results, now however no more problems!

Costing £19.95, the fitment is simply a plug-in job. You first remove the existing plug-in TCM3105 IC on the TNC PCB, plug in the DCD board, then plug in the TCM3105 IC into the socket on the DCD board. In practice, I found I had to bend the two legs of a PCB link over to be able to fit the PCB fully home, however once this was done the overall unit worked very well indeed. My thanks go to Siskin Electronics who are the UK Pac-Comm distributors, for the speedy provision of this board.

If you fancy making your own state DCD board up as a kit, a larger version, i.e. 'non-chip is available from the Tucson Amateur Packet Radio Corporation (TAPR) in the USA, costing your credit card the equivalent of £20. You can reach them at PO Box 12925, Tucson, AZ 85732 USA, Tel. (010) 1 602 749 9479.

CTRL-Z End of Message

That's it for this month, please do keep your messages coming, I'm always glad to give your packet group's activities a mention or indeed let other readers know what packet activities you get up to in your area of the world. I can be reached either at the editorial address and phone/fax numbers, or via, packet via the GB7XJZ BBS.

Until next month, 73 de Chris G4HCL @ GB7XJZ.
At this year's BARTG Data convention, the Tereleader TNC - 24 caused rather a stir. With facilities for HF and VHF terrestrial packet, a built-in PSK modem for satellite use with normal and Fuji Oscar 20 modes together with auto doppler-shift tuning, RTTY, AMTOR, CW TX/RX with training mode and built-in keyer, message stores for 'rubber stamp' QSOs and an automatically incrementing serial number for contests if needed, Weather Fax printer and computer output, it looks most interesting.

It was even described on the exhibition stand as 'Microwaves frozen food in under a minute' and can also double up as a data equipment for other 'household names' in amateur circles. This time the importers have chosen to retain the original name rather than just 'badge engineer' it as is often the case. In true HRT tradition we managed to get our hands on the only model in the UK prior to bulk shipments, to publish just in time for when the units appear on sale!

Compact

Measuring 222 (W) x 33 (H) x 135 (D)mm it's 'footprint' is around half the size of an A4 sheet, in other words fairly small! It operates as usual from an external 13.8V DC supply, drawing a maximum of 330mA, an internal lithium battery is used for memory retention of the TNC's start-up parameters as well as the various internally programmed message memories. Front panel LEDs show various functions such as Power On, TX status, CW and PSK modes and the various STA, CON and DCD indicators familiar to packet users. A further bar-graph array of LEDs above these acts as a tuning indicator for various modes such as HF packet, CW and RTTY.

Rear Panel Array

On the rear of the unit are several connectors in addition to the usual computer RS-232 and DC input sockets. A multi-pin 'radio' connector handles the receive and transmit audio together with the transmit keying line, this also provides outputs for the transceiver up/down frequency control when used in PSK mode with AFC selected under software control, for use with low earth orbiting satellites for example. Next to this are a pair of 3.5mm and 2.5mm jack sockets for Speaker and Mic/PTT respectively, with ready-made leads provided to interface with handportables for packet operation. An external modem connector is also fitted to allow you to simply plug in an external packet modem such as a 9600 baud affair if required, and CW key 'In' and 'Out' jacks are fitted for Morse use.

Packet

The latest AX.25 packet protocol is used, with the common TAPR command set to be used, an important point with there...

---

**Exclusive — G4HCL tests the all-mode terminal that even talks to satellites**

emacs

Exclusive

The name 'Tereleader' may not be as familiar as some others, but the manufacturing firm of Tasco certainly makes

Teasmid! At just under £300, we at HRT thought we'd take a closer look for our readers.

Exclusive

The name 'Tereleader' may not be as familiar as some others, but the manufacturing firm of Tasco certainly makes
being so many of them! A ‘KISS’ mode is also available for computer-driven terminal applications if required. For terrestrial VHF and UHF use, the normal AFSK tones are used at 1200 baud, and for HF 300 baud packet use the normal Bell 103 tone pair is employed, the front for HF 300 baud packet use the normal terminal applications also being so many of them! A ‘KISS’ mode is an alternative packet modem, with encoded PSK is handled with a special satellite ‘orbiting’ PSK modem operates at the usual 1200 baud, usually an expensive external option. This accessory unit for this being needed, is fitted inside the TNC, rather than an internal PSK (Phase Shift Keying) modem here.

The external modem connector on the rear panel lets you plug in an alternative packet modem, with connections for TX and RX TTL level data, PTT, modem selection DC, and an X32 clock output for modem synchronisation, the external modem being software-selectable from the terminal program used. Following a manufacturing agreement, James Miller G3RUH tells me that Tereleader are also producing a purpose built G3RUH 9600 baud modem to plug into the TNC – 24.

Mailbox

A personal mailbox is fitted, with a message storage capacity of up to 14000 characters. A sub-set of the usual WORL/WA7ML/JAS – 1 BBS commands are used, and by arrangement with your local network BBS operator these also allow for the unattended reception of auto – forwarded messages from your local BBS to your personal mailbox. Hence by leaving the TNC and radio switched on, the system has the capability of automatically accepting and storing messages addressed to your callsign, these having been forwarded through the international BBS packet network.

The third party message storage capability can be toggled on or off to comply with UK license requirements where needed for an individual station, yet still allowing for ‘communal use’ in countries or other circumstances where this is allowed. Likewise, an internal CW ID allows for automatic periodic identification of your station to comply with UK license requirements.

A real – time clock is fitted to the TNC, the internal battery keeping this running even with the TNC switched off, thus received and stored messages and the like can be time and date stamped as required without you needing to reset the internal clock each time you switch the TNC on.

Morse

The unit will send and receive Morse using a computer screen and keyboard or manual means, with automatic speed sensing of received CW and software selection of the transmit speed between 4 and 50 WPM. Side tone is provided by an internal incrementing counter may be used for contests, to automatically add the QSO number to each contact, this for example may be set to follow your pre-programmed ‘599’ signal report that everyone seems to give! Just to complete the line – up, a random code generator is also provided, complete with on – screen display of sent characters to give you or your class a bit of Morse training whenever required. A modulated audio output is available for ‘FM Morse’ use, for on – air practice in the channelized sections of 2m or 70cm for example.

RTTY/Amtor

The usual five unit Baudot RTTY code may be used with speeds of 45.5, 50, and 75 baud, together with 100 baud AMTOR using all the usual FEC, ARQ and ‘Listen’ modes. The American standard tone pair are used for the modem, to make the TNC compatible with transceivers that only provide filtering for these tones. An ‘RXReverse’ command lets you quickly swap tone frequencies without needing to switch sidebands and retune your transceiver. As well as this, straight 7 – bit ASCII transmission and reception can be handled at speeds of 75 and 110 baud.

Fax

Remote imaging enthusiasts may like to know that the TNC will accept fax signals with selectable drum speeds of 60, 90, 120 and 240 RPM, thus handling most transmission standards. Two shades are used, i.e. black and white, corresponding to received audio of 1900Hz +/- 400Hz, with auto start and stop on reception. The unit may be connected to an optional printer for reception, and Tereleader also provide an MS – DOS disc with a fax program C source code stored so that computer whiz – kids can tailor the software to their individual needs for on – screen display.

The TNC is provided with a pair of handbooks, one detailing the hardware and connections, the other detailing the many commands used by the TNC. Connectors for the radio port, CW key, handportable microphone and speaker leads, and a DC power lead are supplied in the box, together with the computer disc with the fax source code stored.

In Use

With all these modes of operation, it was really a case of where to start! The first thing I needed to do of course was to get my computer talking to the TNC, so in went a shareware ‘dumb terminal’ emulation program which I then set to the default settings of 8 bit data, 1 stop bit, and no parity. Connecting the RS – 232 leads up and switching the TNC on then nicely brought up the usual sign – on message similar to that shown in Fig.1.
else, to see what the unit would do as I off-air 'connect' without doing anything else, to see what the unit would do as I had not told it yet what my callsign was! I've lost count of the number of 'NOCALL' callsigns I've seen around on packet, their owners wondering why they were having no luck, simply because they had not read the instruction book. Full marks to the Teralleader, as a message automatically came back from the TNC telling me to set my callsign — very good!

Following my entry of this, without any further modifications I plugged in a 2m rig, switched to FM and tried my first 'on air' connect to my local packet node. The 'CONNECTED' response came back almost instantly, and I was 'in', without any further changes to the numerous pre-loaded default settings. Idiot proof? — Yes!

After accessing the local network BBS and downloading streams of messages, I disconnected and tried the personal mailbox. After entering my selected callsign for this and switching the mailbox 'on', I tried a self-connect again through the local node. The mailbox greets the connected user with the response shown in Fig. 2, a short menu of commands being offered. Although the TNC lists commands such as 'File' and 'Write', I found it would also accept the more usual 'L' and 'S' commands for 'List' and 'Send' as used on network BBSs. Front panel LED's show the state of the personal mailbox, and whether any messages to you are stored, waiting to be read.

Entering a message either off air was fairly straightforward with the mailbox requesting the usual 'Subject:' and 'Message:' texts, terminating the message again with the usual CTRL-Z or 'EXIT' even giving the user a 'Thanks for your message' text to confirm it has been stored. If a user connects and has mail waiting for him to list and read, the personal mailbox gives a 'You have mail waiting' message, subsequently disconnecting from the personal mailbox with a 'B' command even causes the TNC to send a chequey 'Thank you CU AGN 73 & 88' message prior to the mailbox issuing a 'disconnect' command, very user-friendly!

**CW**

The rear panel 3.5mm key jack may be used for either a 'straight' key or a paddle key, the paddle key mode being enabled under software control by entering 'CW ON' when in CW mode. As well as variable sending speed, the 'weight' of automatic sending i.e. the dot/dash ratio, both from the paddle or from the keyboard, could be varied again under software control in true automatic keyer tradition.

I found the CW memories very handy indeed, by pre-loading these with 'CQ etc.', another with my station details, and so on, I found I could give my brain a slight rest occasionally. As luck would have it, one weekend during the review period a HF contest was in full swing, thus loading one of the memories with my call, region and signal report followed by a 'E'Symbol, the TNC nicely placed an incrementing CW serial number in place of the 'E' each time that memory button was used! Combined with automatic logging of QSOs from my computer terminal program, with the screen displaying and the computer storing my transmitted and received text for each contact, the chances of 'human error' were much diminished!

In practice I found the TNC to correctly detect even very badly sent Morse, rather than being limited to 'perfect Morse'. As an experiment I used a pair of pliers shorting out the key contacts off-air, to send a section of 'terrible' Morse at a constantly varying speed. The TNC decoded every symbol correctly which really surprised me! On air, I did however find that I needed to be careful with my receiver tuning and the setting of the receiver volume control, hence controlling the 'threshold' of audio input to the TNC. Not surprisingly under heavy QRM conditions I found the trained human ear was rather better at decoding!

**RTTY**

A test of other modes also proved worthwhile. Selecting RTTY as the operation mode, followed by the usual entered 'k' command to place the unit in converse mode, brought forth plenty of RTTY activity filling my screen. I found the receiver tuning was again fairly critical as would be expected, the LED bar graph together with the 'DCD' LED being useful here to make sure I was spot-on. By entering 'Command' mode again on the unit I could halt the decoding of received text, this I found quite useful to prevent the screen filling up with random characters due to received noise in the absence of signals. As with CW, I found RTTY and AMTOR needed a reasonably 'clean' signal for the unit to decode. However the FSK crystal filter in my usual transceiver, this being centred on the high 'American' tone pair rather than the normally used 1275/1445Hz tones, was in this case very useful.

**Inside the Box**

The TNC board itself is housed in a light grey metal enclosure, this keeping down the level of RF radiation from the unit. A single PCB contains all the circuitry, this may be removed complete with all its connectors and switches, by undoing four screws. Discrete, i.e. loaded,
The "SRW Kilowatt"

An easy 400 watts O/P, Mains Powered HF Linear
Covers all 9 Bands — 1.8 to 30 MHz
Only 14" wide, 10" deep and 5" high. Fits on desk!
Built-in mains PSU
Total weight under 7 Kg
Drive with any 50 to 300 watt O/P HF rig
Quick and simple to tune. Dip Cl, Load C2!
Now in full production at last!

Would you like to run the full 'Legal Limit' and:

- Keep that daily sked with VK, even when the band seems dead?
- Work all the DX, even without a beam, tower and rotator? (The 6 dB power gain of a linear is much more cost effective.)
- Beat the pile ups, get that DX station first call?
- Be 2 or 5 points stronger, the strongest signal on the band?
- Conduct 'tests' and QSOs on frequencies being operated by illegal intruders?
- A great service to amateur radio!
- Be heard via LLR Scatter? No more QRM caused by skip zone Go getting into QSO on the same frequency.
- Present a 50ohm load to your rig, and maint is the full 400 watts O/P power up to band edges, with no ATU?

Then help yourself...
ORDER AN "SRW KILOWATT" FOR ONLY £561 + VAT

S. R. W. Communications Ltd.,
Astrid House, The Green, Swinton,
Malton, North Yorkshire Y017 0SY
Tel: Malton (0653) 697513
Please write or phone Steve Webb, G3TPW, for more details and leaflets.

Zonaltime will tell you, along with another 174 locations worldwide. It's quick and easy to use. Built by craftsmen on a beautiful oak finished plinth. Zonaltime has two clocks one local time and one world time. Each clock is set in a diamond turned and polished solid brass bezel. Zonaltime is suitable for any room, office or home. Zonaltime is easy to read/plinth size measures approx 15½ x 12½". Made in UK, with a full 12 month guarantee. Ideal for own use, gift or presentation.

Price £95.00 (S.S.P £145.00) inc postage packing and vat PROMIT DELIVERIES EX STOCK
Please make cheques postal orders payable to:
G. R. M. Ltd Wibec House 19-21 Copse Road Fleetwood
Lancashire FY7 6RP.
Dept RH Tel: 03917 73177 Fax: 03917 73037.

components are used on the topside with just a smattering of surface mount ICs on the underside. An AM7911 'World Modem' IC under microprocessor control using 280 software commands handles all the tone encoding and decoding functions.

The operating firmware is stored in a plug-in EPROM hence this can be changed when the time comes for an upgrade to provide new operating modes or whatever. The lithium memory backup battery is even housed in a plug-in enclosure, again making this easy to replace in years to come if the need arises, the battery type and replacement being described in the manual.

Four stick-on feet are fitted to the bottom of the unit, however the internal acoustic transducer is secured to the bottom panel by a couple of screws, these project though the panel and could I feel be a nuisance if one or more of the panel feet became unstuck due to the ravages of time, however I understand this arrangement may be modified in the future.

Conclusions

The Tereleader TNC—24 seems a very powerful tool for today's digital age, with its built-in PSK modem and plug-in RUH 9600 baud modem soon to come it looks like offering a very comprehensive package for the amateur who likes a 'taste' of operating several digital modes. For satellite use, the cost of the unit at a shade under £300 compares very favourably when considering the cost of a 'normal' TNC plus an add-on PSK modem. But it will take you quite a while to read through the manual! I'm now off to try Fuji-Oscar 20, with the TNC automatically controlling my receiver frequency,......

Our thanks go to South Midlands Communications Ltd, for the loan of the review equipment.

<table>
<thead>
<tr>
<th>Personal Mailbox Commands</th>
<th>Fig. 3.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write = Type W &lt;callsign&gt;&lt;cr&gt; to begin message entering.</td>
<td></td>
</tr>
<tr>
<td>Subject = Header (max 32 characters) are entered after the prompt: &quot;Subject: &quot; ending the header with a carriage return &lt;cr&gt; Message: = Message are entered after the prompt: &quot;Message:&quot;. Ending each line with &lt;cr&gt; You terminate with either a &lt;cr&gt;/EX&lt;cr&gt; or &lt;cr&gt;&lt;ctl-Z&gt;&lt;cr&gt; to the indicate end of your message.</td>
<td></td>
</tr>
<tr>
<td>Byel = Type B&lt;cr&gt; to DISCONNECT.</td>
<td></td>
</tr>
<tr>
<td>File = Type F&lt;cr&gt; to show the latest 10 messages.</td>
<td></td>
</tr>
<tr>
<td>Mline = Type M&lt;cr&gt; to show latest 10 messages (to or from you). Subsequent F or M command will show next 10 active messages.</td>
<td></td>
</tr>
<tr>
<td>Read = Type R n&lt;cr&gt; to show the number n message.</td>
<td></td>
</tr>
<tr>
<td>Kill = Type K n&lt;cr&gt; to delete the number n message (only to or from you).</td>
<td></td>
</tr>
<tr>
<td>Help? = Type H&lt;cr&gt; to display this.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical Message Listing</th>
<th>Fig. 4.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Msg#</td>
<td>Size</td>
</tr>
<tr>
<td>1</td>
<td>213</td>
</tr>
<tr>
<td>13958 Bytes free</td>
<td></td>
</tr>
</tbody>
</table>

Next message Number 2
The Burndec portable range of equipment has now been around for about 15 years in one form or another. Operating on UHF, they have been the workhorse of many a PMR system and now they are finding a new life on the amateur bands.

Preliminaries
The UHF transceiver range covers model numbers BE439 to BE470, there are some slight differences to these model types but they basically all operate in the same manner. It must be borne in mind that normally some degree of test equipment will be required to re-tune the set onto a different frequency range.

Tony Skaife G4XIV guides us through the innards of the set.

Circuit Operation
Assuming you now have appropriate crystals fitted, I shall explain the circuit arrangement at block level, treating transmit and receive sections separately.

The PTT (push to transmit) switch when pressed serves two functions. As well as acting as an aerial change over switch, it removes the supply voltage (9V) from the receiver and places both 9V batteries in series to generate 18V to power the transmitter units. Therefore, a point to remember is that in transmit mode, both batteries are in use and thus both must be in good order.

Diode D3 is across one of the batteries, so beware of D3 going short circuit. The position of D3 on the circuit board can vary depending on which model is in use, but it can easily be found and tested. D3 incidentally is fitted to provide isolation between the batteries on receive. So far I have mentioned only battery power for use, but a mains power supply unit can be useful for bench testing or battery charging, several designs have of course been published for these. Note that if you use this in place of batteries, you will need either a double output type, or a pair of power supplies, for the transmitter tests.

Transmit
With one of the channels selected, its transmit crystal (approx. 48MHz) is tuned by the associated 15pF trimmer, the output being fed to the TX Osc/Mult unit. Audio from the built-in microphone is amplified in the modulator unit and then fed to the varicap diode in the TX Osc/Mult unit, hence FM is generated and the crystal frequency is given a 9 times

However, this article should also help understanding of the circuitry and allow minor servicing or adjustments to be carried out if required. Additional alignment comments have been added by G4HCL.
Multiplication here. The resulting UHF signal generated is about 8–10mW.

Further amplification takes place in the TX 1st PA stage, this single stage unit producing 50mW. The TX 2nd PA, also a single stage unit, boosts the output to approximately 350mW. The output to the built-in aerial is via C1 (5p6) so it is vital that this capacitor is not damaged or poorly soldered.

After the appropriate crystals have been fitted and the set tuned you’ll need to set the deviation on the transmitter. Each crystal will have its own performance characteristics, because of this if a crystal is changed the resultant deviation is likely to differ from the one originally fitted. The deviation is reset by adjusting the potentiometer on the modulator unit, as shown in the accompanying diagram, to suit the new crystal. This can be performed by comparison to other signals such as a repeater, or of course by using a suitable deviation meter if you have access to one.

Where more than one channel is used the solution is a little more difficult. On the circuit side of the board are 3 resistors R17, R18 and R19, these are soldered across each trimmer for the transmit channels. Remove the resistors and check each channel for it’s level of deviation, using an adjacent receiver for example and noting which one has the lowest level of audio. The channel with the least deviation should have its resistor replaced by one with the value of 100k. The other channels with their higher deviation levels should then be adjusted to the correct deviation level by using lower resistance values, typically between 12k and 82k. It can be a little daunting at first, but with patience one can set the deviation levels to match, the overall setting is again adjusted with the deviation control on the modulator unit.

On the TX Osc/Mult unit can be seen a resistor having a 'Select On Test' (SOT) resistance value. By increasing this SOT resistor value, a reduction in battery current drain can take place although the output power is likely to reduce. By reducing the value of this resistor it may increase both power out and battery current. So the final value of this depends on the right balance of power out to power used. It is not much use to increase output power by 10% and your find battery life reduced by over 30%. A typical SOT value would be 180R, the usual range being from 120R to 390R. Selecting the right value should give 350mW out for 120mA or less.

Receive

Releasing the PTT removes the power (18V) from the transmit circuitry and allows 9V to power the RX units. Hence only a single 9V supply is required for receive only test purposes, thus just a single battery or power supply may be used.

Starting again with the crystal, it is tuned by the adjacent trimmer C3, C4, or C5. The first local oscillator multiplies this by a factor of nine and feeds it to a mixer in the RF Amp. Received UHF from the aerial passes through C1 and is amplified in the RF amplifier, then fed to the first mixer to beat with the LO output. The output here at 10.7MHz is filtered through the crystal filter and is amplified by the first IF amplifier. Further IF gain takes place in the 2nd IF Amp with its final stage being a mixer, into this is fed the 2nd LO which is a crystal controlled.
Noisy, crowded frequencies are about as productive as motorways in rush hour. Now, you can jump the queues and head for the wide, open spaces with the FT650 from Yaesu.

The FT650 packs substantial communications power in a streamlined, compact case. A flip out handle makes it the perfect portable, especially for those remote locations. The three frequency operation lets you win the battle of the bands on 6m, 10m, & 12m. The transceiver covers from 24 to 56MHz continuous on receive with a full 100W output.

An optional power supply and desk mic are available for base station operation.

The Best of The Best — the FT1000

Designed with no spared effort or expense for optimum performance and operability, the FT-1000 is the fruit of over 25,000 man-hours of intensive research and development by Yaesu’s top design engineers. Instead of merely offering incremental improvements on existing designs or adding bells and whistles to an old model, the FT-1000 project involves a wholly new approach to the application of the latest digital and RF technologies to today’s most demanding needs on the hf bands. Extensive surface-mount component technology allowed six microprocessors and five Direct Digital Synthesizers to be harmoniously integrated with a simple operator interface into a highly reliable full-featured transceiver optimized for serious hf applications.
The IF-100PC & IF-100CC64 are two new computer interfaces that work with the Yaesu G-5400B and G-5600B azimuth/elevation rotators. This is possibly the most comprehensive, yet easy to use satellite antenna control interface. Supplied with comprehensive software for either PC's or CBM 64/128 computers. The satellite tracking programme is valid for all present and future satellites up to the next century. Rotator control is automatic once the satellite to be tracked is chosen. Satellite data can be updated at anytime, very easily.

IF-100PC Interface, lead & software for IBMPC............ £139.00
IF-100CC64 Interface, lead & software for CBM64/128... £145.00

**HF LINEARS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Power</th>
<th>Input</th>
<th>Output</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HL/KGX</td>
<td>160-10m 2A,4CX250B</td>
<td>1KW PEP RF INPUT</td>
<td>70-120W DRIVE</td>
<td>£945.00</td>
</tr>
<tr>
<td>HL2K</td>
<td>160-10m 2 x 3-5007</td>
<td>2KW PEP RF INPUT</td>
<td>60-120W DRIVE</td>
<td>£1425.00</td>
</tr>
</tbody>
</table>

**VHF LINEARS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Power</th>
<th>Input</th>
<th>Output</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HL66V</td>
<td>6m</td>
<td>10W In 50-60W out RX Preamp</td>
<td>£129.00</td>
<td></td>
</tr>
<tr>
<td>HL166V</td>
<td>6m</td>
<td>3/10W In 80-160W out RX Preamp</td>
<td>£249.00</td>
<td></td>
</tr>
<tr>
<td>HL37V</td>
<td>2m</td>
<td>3W In 32W out RX Preamp</td>
<td>£399.00</td>
<td></td>
</tr>
<tr>
<td>HL62V</td>
<td>2m</td>
<td>10W In 60W out RX Preamp</td>
<td>£315.00</td>
<td></td>
</tr>
<tr>
<td>HL110V</td>
<td>2m</td>
<td>2/10W In 100W out RX Preamp</td>
<td>£315.00</td>
<td></td>
</tr>
<tr>
<td>HL180V</td>
<td>2m</td>
<td>2-5W In 120W out RX Preamp</td>
<td>£215.00</td>
<td></td>
</tr>
<tr>
<td>HL180V</td>
<td>70cm</td>
<td>6/10W In 25/30W out RX Preamp</td>
<td>£135.00</td>
<td></td>
</tr>
<tr>
<td>HL130U</td>
<td>70cm</td>
<td>3-25W In 120W out RX Preamp</td>
<td>£215.00</td>
<td></td>
</tr>
</tbody>
</table>

**NOW BACK IN STOCK THE POPULAR**

<table>
<thead>
<tr>
<th>Model</th>
<th>Power</th>
<th>Band Coverage</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT106</td>
<td>6m</td>
<td>80, 40, 20, 15 &amp; 10m</td>
<td>£299 inc VAT</td>
</tr>
</tbody>
</table>

**FREE FINANCE ON SELECTED ITEMS**

On many regularly priced items SMC offers Free Finance on invoice balances over £120. 20% down and the balance over 6 months or 50% down and the balance over a year. You pay no more than the cash price.

Details of eligible items available on request

*Subject to status.

**CARRIAGE CHARGES**

Carriage charges are charged on all items, Small items, Plugs, Sockets etc by post £1.75. Antennas, Cables and larger items by YPS from £5.95. Transceivers etc, next day delivery from £8.38. Overnight delivery can be specified at extra cost for other items. Same day despatch whenever possible.

**PRICES & AVAILABILITY SUBJECT TO CHANGE WITHOUT PRIOR NOTICE**

**HAM RADIO TODAY DECEMBER 1990**

please mention HRT when replying to advertisements
block diagram of receiver units

RX Alignment

Turning the set with its printed circuit uppermost, C6 can easily be identified as it is in the centre of the board. It is the value of C6 that determines the squelch setting and once set it should not need altering again. The value of C6 can range from 56pF to 270pF, and any values significantly outside that range should make one suspect the IF units. Remove C6 to open the squelch while aligning the receiver.

After you have inserted your receive crystal and initially tuned onto frequency using a strong local signal, you will need to adjust the coil and trimmer capacitor on the RX 1st LO unit, followed by the three

head unit which houses the speaker/microphone.

There is still one unit remaining which I have deliberately left until last, this is called the 'Standby and Mute' unit. One purpose of this unit is to provide 5V and 8V supplies to sections of the receiver circuitry. Another function of this unit is to provide a battery save function. Part of the unit is an oscillator which switches the receiver on and off until a signal is present, and while it's there the receiver stays on. When no signal is present the receiver reverts to its On/Off state thus using less battery power than if it were to be on permanently. On some sets, this oscillator can be heard faintly in the speaker as a ticking sound. The presence or absence of this sound is not important but I think one should know that it could be there.
tr trimmer capacitors on the RF Amp and Mixer unit for best reception using a 70cm signal source of a variable level. The methods of achieving this have been well documented in previous HRT PMR conversion projects, and thus will not be dwelled on here. You'll find by adjusting the bottom left, bottom right, then the top right trimmers on the RF Amp should eventually provide you with a working set, providing no faults exist.

Fault Finding
Before I continue, let me stress the importance of cleanliness as many a 'poor receive' problem has been cured by giving the board a good scrub with a stiff stencil brush and solvent. It's amazing how the board can pick up small pieces of debris after years of use, also I'd recommend placing the chassis on a piece of paper kitchen roll while working on the set to guard against further problems.

As I've briefly explained the circuitry, I'll continue with some useful monitor points and show what to expect. Earlier on, C1 was mentioned and this is found on the component side of the board between a socket in the top frame (aerial) and the central pin of the PTT switch. On the adjacent pin to C6 is the inner of a miniature coax, which being quite stiff can break, thus giving no receive. This may not be apparent as the coax rigidity will hold it close to the pin, so a careful check here could prove useful.

If either of the rotary controls become intermittent, a proprietary switch cleaner may be applied along their shafts, but this cleaner should contain a lubricant or the contacts will soon wear again. If in doubt, a brief spray test on a non-porous surface will determine if yours is the correct type, as an oily residue will be left.

On the inner of the miniature coax running between the local oscillator and the RF amp is a DC voltage of 4.5V, if this value is nearly 8V then there is a good chance the local oscillator has developed an internal short circuit. This may be proved by unsoldering one end of coax inner and measuring the voltage again. Two points further along on the RF Amp are where the 8V and 5V supplies can be found. The two supplies are routed to the RF Amp by small link wires which can break without this being apparent, a careful check with a test meter will soon identify any fault here.

A little further along the board is a length of track that joins the 2nd Local Oscillator and the 2nd IF Amp/Mixer, this carries the 10.8MHz signal. Therefore, a check with a frequency counter will prove if the Local Oscillator unit is working. If an RF voltmeter is available then one should be able to measure something in the order of 125mV RMS here.

Spares
It is a good idea to keep a look out for 'scrap' sets which may be acquired very cheaply, as these may be used for spare parts if needed. Another outer case, even if cracked and marked, can have holes made in it and used as a 'test case'. With holes in the appropriate places, internal adjustments can be made while the set is in the case with batteries fitted. It is worth mentioning that although the case is plastic there can be a subsequent slight shift in the frequency when a set has been tuned with no case present.

On the subject of spares from scrap sets, the battery terminals from these can be mounted on pieces of wood or the like to hold batteries for charging. If the head unit containing the speaker/microphone and aerial becomes suspect, then a spare head can be swapped with the original to prove the fault.

That's It
The Burndept portable isn't a high power all singing and dancing transceiver, but under the right circumstances it's ideal for working through a local repeater or for locating a lost chum at a rally. (Ed's note — why not give one to your youngster when they've passed their Novice test!).
HF HAPPENINGS

After the frenetic activity on the HF bands during the spring, with activity from such rare countries as Spratly Islands, Conway Reef (off Fiji), South Sudan, another Vietnamese operation and culminating in two superb operations from Yemen in the summer, I feel that things have been pretty poor during the last month or so. True, conditions usually do take a dive in July and August, the familiar summer doldrums, when you can tune across 10 metres and hear no signals at all (even now, at a sunspot maximum), while 15 and 20 metres have plenty of strong Europeans but not a lot else. If you are a DXer, and are primarily interested in working new countries rather than having a ragchew with someone in Germany or Italy (or, these days, the Soviet Union), this is the time to be out in the garden doing some antenna farming.

Steve Telenius-Lowe G4JVG shows 10m DX is within easy reach

This call was lucky, for not only is it a short snappy call, just the thing you want in a contest, but also K7SS is a well recognised contest callsign all over the world. Dave goes on to say that John KA7MCX and John's wife made them feel very welcome and they both had a great time, if a rather exhausting one, over there.

Radiosport Stations

In last month's 'HF Happenings' I wrote about a unique amateur radio operating occasion which took place in Seattle USA, in July, the World Radiosport Team Contest, Dave Lawley, G4BUO, one of the two British competitors in Seattle, says that the teams were allocated their stations and the callsigns to be used at the last minute and in random fashion - so the British team used the station of KA7MCX but used the callsign K7SS.

Japan, and far more Europeans (generally a more difficult path) were worked than JAs.

Treshnish Expedition

In August, Andrew GOHSD was one of a group of intrepid operators who activated the rare Treshnish Islands (EU108 for the Islands on the Air awards) as GS6UW/P. Unfortunately the operation did not quite go as planned, as Andrew's ancient MG broke down several times on the M1 and the ferry from Oban was missed. When he eventually met up with the remainder of the group (who'd had no such transport problems), the boatman who had been persuaded to take them out to the Treshnish Islands had been contacted and had agreed to take them out 24 hours later than originally planned. Andrew says "The boat, Puffin II, was a diesel ferry about 45 foot long and took tourists to visit Fingal's Cave on Staffa and then on to the Treshnish Islands. Martin G3ZAY had arranged for him to stop there and drop us off and then collect us on Wednesday. While loading, the First Mate was heard to say something about a kitchen sink, but we eventually got loaded up!"

"We arrived on Lunga, the largest of the islands, after having had a great time on Staffa. We set up the tents first due to impending rain, and got on the air by 1645 GMT. I manned the TS120S running barefoot on a 15m dipole at 20 feet, I still worked KH6 Hawaii though, and Martin got on 20m with the FT101ZD and KW1000 to our trusty Butternut vertical. We were on the air solidly until about mid-night, then we closed down for the night. We had been on 15–80m and had worked around 700 – 800 stations in that time. The call GS6UW caused quite a stir, I was asked repeatedly if we were a new country. Perhaps not, but we probably were the first people to air the GS6 prefix."

"Lunga is about 2km in length and 500 feet at its highest point. From the top we could see Skye to the north, Staffa and Mull to the east and Coll and Tiree to the west. Our camp far below us was almost at sea level, a heavy 1.5kw generator being the reason for this. The camp was 50 yards from the sea, but to get the rigs, food, whisky glasses etc. ashore we had to scramble over very slippery seaweed, not ideal with valve equipment. Impending storms caused an early return by the boatman, so the GS6UW operation
exception. After several weeks of poor September, and this expeditions recently as during the spring. It has been fairly poor the last few weeks, and this single day operation and the demand by September, it was only planned as a short GX4CRC/P

awards (EU-11) and although the Cornish from the Treshnish Islands.

However, conditions usually improve in September, and this expeditions typically those to the Caribbean. It is also an excellent opportunity to look for those rare States such as New Mexico or Montana which are not often heard except during ARRL contests. At the last sunspot maximum, I worked all USA States except Hawaii in the first 12 hours of operating in this contest. Let me know how you get on!

It looks very likely that I may be active from Papua New Guinea early in 1991, at the time of writing nothing is very definite but if all goes well expect to hear me from P29 (callsign unknown at present) in January or February.

Let me know how you get on in the ARRL contest, and any other input to this column would also be most welcome. Please send it to: Steve Telenius-Lowe, G4JVG, 'Penworth', Tokers Green Lane, Tokers Green, Reading, RG4 9EB. See you next month.
forming over the UK, he found that on average there had been fewer tropo openings on 2m than in those years. The moral here of course is that it takes more than a hot day to produce its share of VHF DX, and when the nights stay hot don't expect much in the way of exotic calls on the band. The folklore among the real old time VHF operators in the USA decreed that if you gave the mast a shake or in two at sundown, when a few drops of moisture fell off you should head for the shack because a temperature inversion with good ducting was a possibility. If everything stayed dry, however you could make for the sack in the certain knowledge that there would be no tropo that night.

Ken Ellis G5KW details propagation in his roundup this month.

From Ken Willis G8VR:
I asked my very good friend Ken Willis G8VR from Broadstairs, who for some years wrote the VHF column for Radcom, to give his opinion. Ken is mainly to be heard on 6m, although these days he regularly also monitors other VHF/UHF bands. Before 'emigrating' to 6m he worked 50 countries and more than 250 grid squares on 2m, making use of all the available modes i.e. tropo, aurora, Es, meteor scatter, plus a single EME contact with the USA to reach these totals. Ken looked up his logs for the early 1980s – an interesting period because in 1979/81 we had reached much the same point in the current cycle, number 22. He said that he certainly got the impression that there was much greater daily activity on the 2m band at that time, with the low end of the band well populated with SSB and CW signals. Groups of weak-signal operators, several of whom one never seems to hear on the band today, gathered regularly to discuss conditions and participated in the VHF net on 144.350MHz, a very popular meeting place for UK and European 2m operators. I wonder how many of today's operators are aware of its existence?

Ken also commented on the fact that although we have had two very good summers with stable high pressure areas
propagation from Britain on 50MHz on every day of the month, although very little on the 8th, 20th, 29th and 30th. The increase in the number of European stations permitted to operate on 50MHz tends to give a distorted impression and must be set off against the incidence of transatlantic openings which this year have been in the main of short duration and very localised in extent. Compared with 1983–87 (the sunspot minimum period) when there were 100 permits only for most of the period against an estimated 3000 this year in Britain, this year’s results on transatlantic circuits can only be described as disappointing.

Similarly on 28MHz where beacons such as DL0IGI have provided a consistent signal source over several solar cycles, it is evident that Sporadic-E is independent from the solar cycle except in as much as it is a form of propagation which is disrupted by magnetic storms and prominent solar flares, and these tend to maximise at or just after the peak of the solar cycle. This is a very important consideration especially for those countries with short term permits if the mistakes of 1949 (when the 50MHz band was given up without much more than a murmur of protest after the 1947 maximum) are not to be repeated.

Other longer distance circuits from Africa and South America opened on several days mainly to the south and west which could be reached by F layer propagation (by TEP or otherwise) and to the rest of the British Isles with a final hope of Sporadic-E. From the midlands it was apparent that these occurred when stations in the south of France were also being received very strongly.

50MHz Report From Ted Collins G4UPS

Sovereign Military Order of Malta; The first major opening into UK for IA0KM, operated by IOAMU, took place on September 1st. I worked him at 1609 but gathered he had started operations shortly before this. The locator was JN61FU and QSL information is via IOAMU. Later during the opening, Alfredo informed me that he had worked 49 G stations and 51 European stations. This surprise operation was a way of saying ‘Thank you’ to Geoff GJ4ICD who had paid for the four July operators to be enrolled into the UK Six metre group.

VO1MUN Beacon; This beacon which is being heard extensively all over Europe and W land is located in Newfoundland, the measured frequency is 50.0375MHz. Power is low to a vertical aerial, 50m AGL. Reports are invited, sent to the Memorial University Amateur Radio Club, P.O. Box 51, St John’s, Newfoundland A1C 5H3.

OHOBNP; Ed OHOBNP, who when at home is OHOBNP, has just spent a few days on Aland Island, returning home on September 3rd. QSL via his home QTH.

4U1ITU; QSL via IK2CFR, Mr. Maren Pavia, Via Mozart 28, 1 – 20052 Monza Italy.

Back Home; Arnold Mynet ZB6BMS is now back home and we should be hearing him soon on the band as G3BBW. Arnold was a very active member of the 1957 IGY group and VHF manager of SARL.

Turkey; Nick G3KOS and Nev G3RFS who recently gave many Europeans their first CU contact on six have received a permit for 6m operation from Turkey, this commencing mid-November.

Trans-Equatorial Propagation (TEP); TEP normally takes place during the periods around the Spring and Autumn equinox i.e. 21st March and 21st September. Although we had a reasonable opening during the Spring season, here in the northern hemisphere the only activity reported was by F1JKK with 7O7JA on 14th of September, but there have been regular daily openings from Italy to South Africa.

DXCC on 6m; On 20th Sept Geoff GJ4ICD worked Swaziland, 3DAOBK, during a brief opening between 15.00–18.00 GMT, this was his 97th country on 6m. Geoff has now 91 countries confirmed, of the balance at least two do not QSL.

Next Month

To summarise, it has been a very disappointing period recently for VHF DX. It is hoped to include 70cm news in future months, so please send me your reports for inclusion in this column, to Ken Ellis G5KW, 18 Joyles Road, Folkestone, Kent. CT19 6NX. Until next month 73 and good DX on the bands.
One of the world's packet pioneers tells us what packet can do.

Five years ago another CW fan told me about Packet Radio. After he described it, I said what many have probably said, “Sounds a bit crazy, probably won’t ever get off the ground. It’ll just stay with the fringe crowd.” Guess who was wrong? Today packet breaks squelch more often than voice on FM.

In fact, packet has evolved as a useful mode for more than just packet experimenters! In recent years, DXers evolved what is called the DX Packet Cluster; this system consists of packet stations linked together to share current DX information and conditions. Connect to your packet cluster and you can find out about activity on 15 meters for example; you can see what others locally have heard or worked, a real-time DX bulletin board!

In addition, HF enthusiasts have added packet to their arsenal to forward international messages error-free. With packet it is possible to pass long messages from say the UK to Kansas, USA without error! You see, packet is by nature error free, it just takes the automatically controlled stations longer to send the message when conditions are poor. And packet is used on VHF to support message forwarding and bulletin boards across the nation. Hundreds of bulletins are available on all sorts of subjects, right on your local bulletin board system.

Tremendous Activity

Yes, packet breaks squelch more often than voice on FM! On a recent trip to Minnesota from Kansas City, about a seven hour drive, I alternately listened to the most common VHF repeater frequencies and our central packet frequency, 145.01 MHz. You know we’ve got loads of VHF repeaters over here, but I didn’t hear much voice when compared to the amount of packet! “Probably won’t ever get off the ground.” Oh Well! I suspect the same is true on both sides of the Atlantic. Still at many rallies, I meet fellow amateurs who haven’t been caught by the packet bug, or they just don’t know about packet. Perhaps they prefer DX? Maybe computers don’t interest them. But usually, I find they just haven’t had the time to take a look, and maybe you’re in that group. Come along, take a quick look at packet. You might just find another fun mode. As a CW operator, I did!

So what is this packet stuff anyway?

A typical dictionary identifies a packet as ‘a small package, a little parcel.’ In nautical terms it is a vessel conveying dispatches, mails, passengers, goods, and having fixed sailing days. When wrapping, to package would be to make up into, wrap or put up in. While all these definitions are close, none really describes the packet we are seeking. That would be just too easy. It would be like describing RTTY as if it were amateur radio. Yes, RTTY is a part of amateur radio, but just one of many modes. In the same way, packets are a part of packet radio, but just one of the many parts of packet. Now you think I’ve gone off my rocker? Here’s the point. Like
amateur radio in general, packet has grown to have many areas of interest, both technically and operationally. Hence, a simple dictionary definition simply doesn’t do the mode justice.

Packet is interesting simply because it has so many applications and areas for exploration. If you like to send bulletins, packet is ideal. If you like writing programs and integrating your computer with amateur radio, packet is it. If you like to experiment with VHF or UHF radios in sending data, packet fits the bill. If you’re interested in networking, packet wins that too. If you want to communicate error-free, leaving a message for later automatic delivery by the amateur radio packet network.

That’s packet too
But let’s skip all that, let’s get down to the basics. What’s in a packet station? Why do we call this mode packet radio? How do two stations communicate? OK, one step at a time.

What’s in a Packet Station?
A basic packet station consists of a computer, your VHF radio station and the packet controller, as shown in Figure 1. Yes, if you are like 67% of amateur households, adding packet means you only have one piece of equipment to add, the packet controller.

In the early days of packet, the controller was mysteriously called a terminal node controller or TNC. This term, a sort of double-speak, comes from packet radio’s origins, a computer networking. Let’s not bother further with that!

How do two stations communicate?
Once you type a line of text on your computer, it’s packaged and sent by your packet controller. Then, when another station hears the packet, it’s controller looks for its own callsign within that packet. If it finds it, it takes the packet and passes it on to its own attached computer.

But that would mean that all packet stations can hear all packets? Yes, if the signal is strong enough, of course. But, ‘TO’ and ‘FROM’ call signs are embedded within each packet. Your station will print only those intended for you. Other types of packets can, of course, be monitored.

What about computer needs?
Well, of course, questions lead to more questions. What kind of program does your computer need? How is the computer wired to the packet controller? For that matter, what does the inside of a packet controller look like anyway? And while we are at it, how many packet stations can we get on one frequency?

Rumours have it that more than two can operate ‘simultaneously’ on the same frequency! If you believe that, then I can sell you my gas-fired perpetual motion machine that Uncle Harry invented to grind corn. Again, let’s hammer at these one at a time.

What program does my computer need?
That’s kind of like asking ‘What kind of car do you need?’, it depends upon what you plan to do. If you just want to chat with another amateur, then all you’ll need is a simple terminal program. If you need a freely available public-domain terminal program will do. If you haven’t used one of these, it’s a program that allows your computer to talk to a modem by sending and receiving data via your computer’s RS-232 serial port.

If you are a bulletin handler, then you’ll want a program that allows editing, saving, and transmitting or receiving. If you want to run a packet bulletin board system, then you’ll need one of the popular amateur radio written BBS programs.

In basic terms, your computer needs a program that allows you to type at the keyboard or view the screen information that is to be sent or is received via your computer’s serial port.

How is the computer wired to the controller?
All packet controllers are attached to a computer at the computer serial port. While some computers, such as the C-64 require a ‘TTL’ interface, the vast majority have serial ports that meet the RS-232 standard. This standard dictates required voltage levels for signals and also assigns the various required signals to specific pins in the standard DB-25 connector. Get the detail out of a packet communicator manual.

What does a Packet Communicator look like inside?
Figure 2 shows a typical arrangement. A packet communicator is made up of a microprocessor, memory, a

Fig. 2. Block Diagram of a packet communicator.
How many packet stations can use one frequency?

Boy, we're getting ahead of ourselves already! That's a question about packet networking. Let's stop a minute and summarise where we are. First a packet station consists of your aerial, radio, a packet controller (TNC), and computer. Once you are 'connected' to another station, lines you type on your computer are assembled into packets by your controller and sent via your transceiver to your partner at the other station. His station copies packets for him because his packet controller sees his callsign embedded within the packet received. And finally, each controller is able to do all this because it is a smart controller, it contains a microprocessor and memory and runs a packet program stored in its EPROM (a special read only memory chip).

Now we can kind of answer the question, how many packet stations can use one frequency?

As long as we don't try to stuff too many packets on one frequency during an interval of time, we can easily have several groups of stations carrying on conversations at the same time on the same frequency. But how is this possible you say? It is not done with mirrors as some might expect. Instead, basically, each station listens to all other stations. Then, when it has a packet to send, it waits until the channel is clear and then simply sends the packet. In other words, the channel is time-shared. A combination of carrier detect circuitry and controller times in each unit allow this to happen. For more detail, dig into the manual of a packet controller.

That's all well and good, but what about the radio side of things. How do we interface the controller to an amateur FM transceiver? What kind of signals are sent? What does packet sound like?

What about the radio interfacing?

This part is actually very straightforward, good job! It just takes two steps; replace your microphone connection with the transmit cable from the TNC, and attach the receive audio lead to the external speaker output of your radio. The TNC provides signals for push-to-talk (PTT) and the data transmit signal. Received packets are then converted to audio tone while the 'zeros' are then converted to another one audio tone. This results in a signal designated as Audio Frequency Shift Keying or AFSK for short. If you slowed a packet down with a two-tone police siren: blu-blow-blu-blublow- if you can visualise that. If you can't, try saying audio tape, you'd hear a sound like a two-tone police siren: blu-blow-blu-blow.

What kind of signals are sent?

Like RTTY, packets start out as a string of 'ones' and 'zeros', i.e. the text is converted into a digital signal. The 'ones' are then converted to one audio tone while the 'zeros' are then converted to another. Like RTTY, packets start out as a string of 'ones' and 'zeros', i.e. the text is converted into a digital signal. The 'ones' are then converted to one audio tone while the 'zeros' are then converted to another.

That's it for now

Well, we made it. We made it through from computer, through the packet controller, and via the FM transceiver to the antenna and back again in reverse order. That's the path a packet takes. In a nutshell that's packet, a typical station consisting of computer, TNC, and radio. Next time we'll dig into details about the makeup of individual packets, digipeating with packet radio, working a packet bulletin board, and so on, in other words expanding your horizons for worldwide error free communication. If you can't wait now, just dig into past issues of Ham Radio Today. You'll find packet articles everywhere!
In last month's QRP corner I gave a brief introduction into how to operate using QRP, i.e. low power. I could fill endless pages of hints and tips on how to get your worldwide DXCC, but for the beginner then the more 'local' 80m or even 160m band is the place to start.

**Achieving Low Power**

Most modern rigs have a front panel control for reducing the transmitter power, but for those of you who have rigs without this adjustable drive level there is an alternative method that may be employed. It is difficult to be specific because of the multitude of rigs available today, but suffice to say that if a variable negative voltage is fed to the transmitter ALC line, this often being available via the rear panel accessories socket, then variable output power will be available by varying this negative voltage. If you don't have such an input, then a study of the set's circuit diagram will help. However if you are not certain of your rig, or unsure of carrying out any mods then don't do it.

**Joining the Club**

What is gained by joining this G-QRP club then? Well, apart from the friendly atmosphere generated by meeting fellow QRPers, there is the constant challenge of doing what a lot of amateurs consider impossible, by working fellow club members using very low power levels. Another benefit of the club is the quarterly journal, 'SPRAT'. This small magazine is not only of interest to those interested in low power operation, as it has items of interest for all. The journal has a very strict rule, at least two thirds of the magazine is circuit diagrams and circuit ideas.

If you are interested in joining, then write to D. Jackson, G4HYY, Castle Lodge West, Halifax Road, Todmorden, West Yorkshire for details.

**External Attenuator**

Even with external ALC, getting below the 2W level is sometimes difficult. If you're in this position, or if you don't feel like performing internal modifications to your rig, the circuit arrangement described here is a simple method of attenuating your transmitted signal. A power of 2W into the unit can be attenuated in steps of 1, 2, 3, 5, 10, and 20dB. As each step is switchable, the exact amount of attenuation required can be selected.

If 2W carbon composite or film resistors of 5% tolerance are used then reasonable accuracy will be obtained. After all, if the resistor value is the maximum of 5% in error and the calculated power is 200mW, the actual power out will be between 190 and 210mW. Make sure you don't use wirewound resistors, as these are often significantly inductive at radio frequencies.

The more astute of you will immediately recognise that there is no facility for switching the path of the signal, so the received signal will also be attenuated by the same amount unless of course we switch the received signal to bypass the attenuator. In this case, remember that many transceivers have external receive inputs either on the rear panel or accessible inside.

**QRU**

That's it for this month, ideas to me please, either through the HRT editorial address or on packet to the GB7SEK mailbox. I hope to see many of you at the rallies, so do come and chat. BCNU es 73 de G0BPS.
In last month's article, I talked about the simplest forms of voltage regulator circuits used to provide stable low-voltage DC supplies. The circuits shown there were all arranged to provide a stabilised positive supply rail, but could just as well provide a stabilised negative rail by reversing the polarity of the input voltage, and reversing the Zener diode, for example as Fig. 1. In the same way, the circuit using a transistor as a regulator element can be adapted to provide a stabilised negative rail by reversing the polarity of the input voltage and using a PNP transistor instead of an NPN device, as shown in Fig. 2.

We are lucky in these days when almost all contemporary circuits use solid-state devices requiring only low-voltage supplies to power them. In earlier days the occasional need to provide a stabilised negative supply rail (for a transmitter bias line, for example) could involve some quite complicated circuitry, because unfortunately no-one ever invented what might be called a PNP valve, i.e. one which passed current when its anode was negative with respect to its cathode!

Supply Rails

Maybe this idea of positive and negative supply rails could do with some further explanation, because the topic of supply polarity and the labelling of supply rails is something that often baffles the beginner. It really boils down to that old problem of an unstated convention, i.e. things that are assumed as understood, and not actually quoted. All very well for the 'old hand' or professional, but most confusing for the poor beginner.

The particular convention we're talking about here is one that says that one of the supply rails in any equipment is considered to be a 'common' rail, meaning that the line on the circuit diagram which represents that rail goes through from the input to the output without a resistor or any other component such as a transistor in series with it. In equipment with a metal chassis or frame, the common rail is often connected to that metalwork too.

Earth Connections

Thinking back to earlier days once more, in mains powered equipment such as radio receivers the 'common' rail and chassis would usually be connected to earth, because reception on medium and long waves using the old fashioned outside wire aerial is better when an earth is connected too. The exception of course was in receivers where the supply was taken directly from the electricity mains, without the safety benefits conferred by a mains isolating transformer. Such an arrangement, called live-chassis working, was common in the so-called AC/DC radio receivers, where the requirement to work on DC as well as AC mains meant that you couldn’t use a mains transformer. It’s also been used more recently in TV receivers.

In a portable battery-powered item such as a transistorised receiver or tape-player, there’s no real need for an earth connection, nor any convenient way of providing it. Apart from anything else, you'd keep tripping over the wire! So, although it would be nice to have a simple convention which says that the common rail is one that is earthed, it’s just not possible. The common rail may be earthen, but then again it may not. For example, none of my circuits last month had an earth connection. In those circuits, the negative rail was the common rail in every case, i.e. it was common to the supply, the stabiliser and the Load. All the work that was done to the supply, in
reducing it or stabilising it, was done in the positive rail.

**Zero Volt Rail**

A very useful convention which I first encountered some thirty or forty years ago, though I’m not sure where or when it originated, is to call the common rail ‘zero volts’ or ‘nought volts’, identified on circuit diagrams as ‘OV’. It’s specially helpful where you have several supply rails, either of different voltages or of different polarities, or perhaps a mixture of the two as are required for some families of logic and linear integrated circuits.

If we look at the simplest sort of DC supply, a 9V dry battery for example, we shall find that it has terminals marked ‘+’ and ‘−’. The beginner sometimes thinks that the ‘+’ terminal supplies +9V and the ‘−’ terminal supplies −9V. Not so; what the markings mean is that the difference between the terminals is 9V. If you connect the ‘−’ battery terminal to the OV or common rail of a piece of equipment then the ‘+’ terminal will be at +9V, but if you connect the ‘+’ battery terminal to the OV rail you will get −9V on the ‘−’ terminal.

**Reference Point**

How can you tell that this is so? By making measurements with a simple multimeter or DC voltmeter. Any test meter needs to be connected to two points in a circuit, not just one. Usually, you connect one of the leads from the meter to the OV or common rail of the circuit, which provides the reference point against which the measurements are made. If you are using a traditional analogue (i.e. pointer and scale) meter to compare voltages in a piece of equipment with those quoted in a circuit diagram or table of readings, you will connect the negative (black) lead of the test meter to the OV rail when measuring positive voltages, but the positive (red) lead goes to the OV rail when measuring negative voltages. Otherwise the pointer will go off the bottom of the scale. If, on the other hand, you use a digital test meter, the display will generally indicate a ‘reverse’ connection of the test-prods by putting a minus sign in front of the voltage value.

**Loading Effects**

Very occasionally, you may come across a voltage measurement which has to be made with both test meter leads connected to ‘live’ points in the circuit, rather than one to a live point and one to the OV rail. This is generally done where there is a need to reduce the loading effect of the meter on the operation of the circuit. The current drawn by a test meter can totally upset the operation of a high-impedance circuit when the test-prods are applied, so that the reading indicated on the meter bears no relation to the normal state of the circuit.

Trying to measure the voltage between the emitter and base of a transistor is a typical example. This is a topic I plan to return to in a later ‘Notebook’.

By now, you may well be thinking along the lines of ‘If something like a portable transistor radio or tape player has its own built—in power source (the battery), and has no connections to the outside world, does it matter which power supply rail we call ‘common’, or indeed whether a voltage stabiliser is in the positive or negative supply rail?’ The answer is almost certainly ‘No’, providing the equipment remains in glorious isolation, never being connected to any other item, or to an external power supply, especially one that is shared with the other equipment. Otherwise, you could be in real trouble!

**Shared Power**

The most dangerous situation comes with two pieces of equipment, one feeding a signal to another, and both powered from the same DC supply. This is often the case in an amateur shack, where a nominal 12V stabilised supply is used to power several items of equipment which are quite likely to be interconnected. The same thing can happen in a mobile installation in a car, with a transceiver and its associated linear amplifier both powered from the car electrical supply. There’s a real danger of fire in that situation, because of the enormous energy that can be drawn from a car’s lead—acid accumulator by an accidental short circuit. The electrical systems in modern cars are reasonably well protected with fuses in most circuits, but it’s not so many years ago that cars were being made in which the only fuse fitted was the one feeding the flasher for the turn indicators!

A look at Fig. 3 will soon show the possible risk of short circuiting all or part of the power supply arrangements for a ‘home—brew’ mobile installation. Picture the scene. Our home—brewer, let’s call him H/B, has a 1 watt handie—talkie 2m rig which he plans to use in his car with a nice little 25W linear amplifier he bought from a fellow member up at the club. The linear is designed for a nominal 12V supply, probably specified as 13.8V (this allows for the fact that each 2V cell in a lead—acid accumulator will usually give more like 2.2 to 2.3V when fully charged). No problem there. The handie—talkie though normally runs off 8V NiCads, but H/B decides it would be less hassle to drop the car’s 12V supply down to 8V in some way. For simplicity, I’ve shown a simple series resistor, but this wouldn’t be at all satisfactory in practice, because of the difference in the current drawn from the supply when the handie—talkie is on receive and that required on transmit, producing a different voltage drop across the resistor. Anyone who read last month’s ‘Notebook’ will know what H/B ought to have done!

When H/B wires up the system in his car, he fits a coaxial lead between the output socket of the handie—talkie and

---

**Fig. 3.**

![Diagram](attachment:image.png)

---

**HAM RADIO TODAY DECEMBER 1990**

please mention HRT when replying to advertisements
the input socket of the linear. He then connects up the supplies to the linear and the handie-talkie, but foolishly inserts the dropper in the negative lead to the rig.

Connecting Up

Connecting two items of equipment together may well involve the use of screened leads, as in our example. The plugs and sockets used for screened leads are usually designed so that the screening braid is connected to the body of the connector, and more often than not, that body is bolted to the chassis. Can you see what's going to happen to the equipment in the circuit of Fig. 3. The link between the body of the coaxial connector and the common rail in each item is shown by the dotted line.

When H/B switches the handie-talkie on, if he's lucky a fuse may blow. It's quite possible, though, that there will be a deafening silence from the rig, maybe even a wisp of smoke! Even before he switched the linear amplifier on, his series dropping resistance had been shorted out via. the outer braid connection of the link between the rig and the linear, putting something in excess of 12V onto the handie-talkie. If he'd put the voltage dropper in the positive lead, all the 'common' rails, of the supply, the handie-talkie and the linear amplifier, would have been safely at the same potential.

That, of course, is what is done by equipment manufacturers who produce DC to DC converters to reduce a 12V bench or mobile supply to the necessary level for their handie-talkies. Also in the so-called 'docking boosters', i.e. desk-top units incorporating a linear amplifier and its power supply, along with a supply at the correct voltage for the handie-talkie, which slots into a recess on top of the unit.

It is quite practical to produce equipment whose signal or control inputs and outputs are totally isolated from the power supply rails, but the more complicated design and engineering required will undoubtedly increase the price. It is therefore a method to be avoided unless absolutely necessary. Equipment such as receivers or audio amplifiers intended for DC mains operation used to be designed in this way, sometimes with a metal case which was earthed for safety, but with internal wiring, even a metal chassis, connected to the negative side of the DC mains and totally isolated from the case. Woe betide the service man who touched both at the same time, or dropped a screw or other metallic object which bridged the two!

Car Polarities

As another example, in the days when car electrical systems were either positive earth or negative earth according to the whim of the designer, car radio receivers were sometimes made with a movable shorting screw or wire which could be set to link either the positive or negative supply rail of the set to its case. It meant that a single design of receiver could be used in either situation, rather than having to produce two different versions, but now that cars are made universally with negative-earth systems, car radios come with the negative rail firmly strapped to the case.

Do It Properly

Providing you understand the risks involved, and the precautions you should take, it is quite possible to do unconventional things with power supplies for the sake of convenience, and get away with it. However, there is always the risk that someone else may have to use or do work on your unconventional arrangements and connections at some time in the future. That person may not realise what has been done until it is too late, i.e. you could be the cause of damage, injury, even death. If you feel you must connect something up in an unusual way, at least put a clear and permanent warning label on the equipment. Better still, do it the proper way.

See you next month.
Over the years many amateurs, and others, seem to have got a fixation on achieving the lowest SWR possible. Whilst to many it may seem that an SWR of unity is the best, this may not be totally true. What most people require from an aerial system is for the maximum amount of generated signal is radiated, i.e. that the aerial system acts with the maximum amount of efficiency. Now it must be accepted that in any mechanical device 100% efficiency can only be a dream, but can we get close?

Standing Waves

When an aerial is energised from an RF source, as happens when it is coupled to a transmitter, standing waves appear on the aerial. One way to visualise this is to take a length of cord, about 8m long and tie one end to a solid point. Pull it fairly tight and then wave it gently. We have all done this as children and the wave movement can be clearly seen as in Fig 1. This oscillation is an exact replica of an electrical oscillation in an aerial. As the cord is moved, the strongest pull will be felt when the cord is at the extremity of the swing. At this point the cord is coming to rest and reversing its direction, and at this instant of reversal it has no energy or motion. All the energy is in the form of a force at the ends of the cord.

This analogy shows exactly how the current in an aerial flows, whilst the force being applied represents the electrical force or voltage at the ends. The energy could equally be fed to the cord from the centre or any other place in the line (try it) and so it can be seen that a resonant aerial can be fed at any point. If fed at the end it is said to be voltage fed, and if fed at the centre it is said to be current fed as shown in Fig 2. The ratio of the voltage at any point to the current at the same point is called the impedance, and this will obviously change from being a high ratio at one end to a low ratio at the centre.

Radiation Resistance

It is not possible in this short article to give a complete account of how the energy leaves the aerial, but it should be noted that a fundamental requirement for an efficient system is the presence of standing wave system on the aerial itself. As energy moves about on the aerial, alternating between voltage and current forms, each interchange of current and voltage causes a quantity of energy to be lost, in the form of electrical and magnetic forces. These are 'pushed forward' by the next oscillation and thus travel out into space.

The electromagnetic waves leaving the aerial represent a flow of power, the same as a current flowing in a circuit. Many of us know the formula to calculate power, i.e. 

\[ P = I \times I \times R \]

Where P is the power, I is the current flowing and R is the resistance. But in an aerial it is rather more difficult to calculate, as it is not a closed circuit. So we introduce a fictional resistance which we call radiation resistance to help define the radiating properties of aerials. The power radiated in Watts is equal to the radiation resistance times the square of the current flowing. It can be determined at any part of the aerial but it is more usual to refer to the point of maximum current.

In an electrical half wave dipole, this resistance is normally about 75 ohms at the centre feed point, but this does not take into account any internal resistance of the material used to construct the aerial itself. You may note a slight problem here, as most modern transmitters are set for an impedance of 50 ohms. But more on this later.

Impedance Matching

When a transmission line is terminated with a resistance equal to its characteristic impedance, power is absorbed by the resistance as fast as it can be supplied. There are no standing waves along the feeder, but the current is uniform along its length. The loss along the length is also at a minimum and the impedance at the transmitter end is the same as at the aerial end irrespective of its length.

If the load is not of the correct impedance then we can say that the line is mis-matched. This means that power sent down the feeder does not all go to the load, some of it is reflected back from the point of mismatch down the feeder. This causes waves to build up on the line in the same way that they build up in the aerial (remember the cord). The standing wave ratio is the ratio of the maximum and minimum values of the standing wave system on the aerial itself.

**The secrets of SWR revealed by Dick Pascoe G0BPS**
waves existing along the line.

In operation, the amount of power reflected from the point of mismatch (normally the feed point at the aerial) will travel back down the feeder. This feeder may or may not match the impedance of the transmitter, although it should match the line impedance if the correct feeder has been used. Subject to a further mismatch at the rig, the reflected power will be reflected back along the line towards the load (the aerial). This will continue until all the power is absorbed in the load, providing that the mismatch at the aerial equals the mismatch at the rig and there are no feeder losses. Confusing isn’t it!

It should be remembered by all those who swear by their aerial tuner units that the SWR of a line is dependent on the amount of match or mismatch of the aerial against the feeder, and nothing done at the transmitter end can alter this standing wave ratio. All that is done is to fool the transmitter that it is looking at a better match.

The Perfect Setup

Let’s for example consider a perfectly tuned electrical half wave dipole aerial, fed from a commercial rig with, say, a nominal length of UR67 feeder as in Fig 3. The aerial, ignoring mechanical losses, has an impedance at the centre feed point of 75 ohms, the feeder is nominally 50 ohms and the rig would also be nominally 50 ohms. Using the formula

\[ \text{SWR} = \frac{Z_t}{Z_s} = \frac{Z_s}{Z_t} \]

where \( Z_s \) is the line impedance and \( Z_t \) is the aerial impedance, with the larger of the two values above the lesser to determine the SWR ratio. We can now see that \( 75/50 = 1.5 \). Thus the SWR in an almost perfect situation is not 1:1 but 1.5:1.

You can now see that our supposed ‘perfect’ SWR is almost an impossibility. If we look at the added impedance of some of the connectors used today and we include the impedance of the material used in typical aerial construction, we’re very lucky to get a typical SWR of less than 2:1.

One thing we users of ‘black boxes’ must remember is that in the ‘old days’ of valve output stages, these could withstand quite a high SWR on the aerial. But now with circuit protection fitted to look after those expensive output transistors and modules, a low SWR is a necessity.

Don’t forget, the more reflected power the modern rig sees the more it cuts back on delivered.

For those who cannot get a low SWR, a chart of the losses in power in relation to varying SWR’s is shown here to provide a degree of information as to exactly what you’re losing! So it can be seen that even with an SWR of 1.5, of your 100W total of 98W is, in theory, reaching the aerial and being radiated. But those who operate with a higher SWR of, say 2.5, are losing over 10% of their power and creating more standing waves in their feeder which could also be the cause of EMC problems. But that’s another story.
At almost the northernmost tip of Scotland there is a 70cm repeater, GB3NU (North Uist) on RB10. And at almost the westerly tip of Wales there is one at Pembroke, GB3SP on RB4. In mid-Wales itself, deep among the green hills, GB3CW (Central Wales) at Newtown is another, providing a remarkable order of coverage on RB6. All these 'boxes' are sited in fairly remote and, except at tourist-time, low population areas. Others which come to mind in similar districts are GB3AN peeping away on Anglesey on RB4, north Norfolk GB3AH on RB11 and at Barnstaple in North Devon GB3ND is to be found on RB14.

**Use the 70cm repeater chain to maximise your mobile coverage suggests JACK HUM, G5UM**

The enquiring mind will ask itself how much 'trade' the repeaters in the more remote parts of the UK actually enjoy? The outsider may well wonder whether or not they repay the considerable organisational and design effort entailed but the 'insider' may equally well reply that '... we wouldn't have done it if we didn't expect our repeater to be used once its services had become available'. Metrewave persons in remote areas who wonder if it is all worth the effort (if ever they do) are surprised indeed when they have the opportunity to sample activity on the 70cm repeaters in more populous areas. They find it lower than they had anticipated. It is a fact of amateur radio life that many a repeater, commissioned with great enthusiasm, enjoys a first fine carelessness of great activity during its first few weeks on the air but little in the subsequent months and years. A few minutes before this article was due to go through the typewriter, a local operator had described to your G5UM his experiences when operating mobile in the London area. Anxious to escape the congestion on the 145MHz repeaters he decided to transfer his RF to the 433MHz ones. He was startled and disappointed at the response, there was virtually none.

**The right investment**

The immediately obvious explanation for this situation is simply that far fewer mobile operators invest in 70cm transceivers than in 2 metre ones. Many of them are heard to say that they are put off by the cost, no excuse at all when the modest price of a 70cm handheld is taken into consideration, such as £25 each from SMC, and handhelds work wonders when provided with an adequately gainy aerial atop the vehicle. Other operators tell you they don't propose to invest in 'Seventy Cems' '... because there is nobody to talk to', which invites the rejoinder that if you don't put out a call you can't expect an answer.

The sceptical may also be asked if in fact they have ever tried 433MHz for themselves, or are they allowing themselves to be influenced by operators who allege that they have tried it and found it wanting? This is a widespread state of mind fostered by one simple fact; that those who have tried out 70cm all too frequently did so with quite inadequate aerials, often useless adaptations of some of the low gain types which provide results-of-a-sort on 145MHz. The old adage that you should get as much metal aloft as you possibly can applies even to low power sites; a low gear pull up a nearby hill adding a couple more 70cm repeaters for every hundred or so feet of height gained. Not typical, of course: if lifts occurred all the time, and they do in hot-weather countries, life would become positively exhausting. It is as well to bear in mind, then, that they are artificial boosts, not to be taken as the norm.

What, then, *is* the norm where 'Seventy' is concerned? It can be very simply described; it is the facility to sustain conversation over quite considerable distances when mobile, provided with adequate aerials, often useless adaptions of some of the low gain types which provide results-of-a-sort on 145MHz. The old adage that you should get as much metal aloft as you possibly can applies even to lower frequency metrewave bands.

The corollary; when installing that 433MHz FM rig get yourself the best possible, highest gain aerial which your supplier has on offer. Thuswise you will be giving the band the best chance to return positive results. Note the above term; FM rig. It is a fact of electronic life that single-mode transceivers come much less expensively than multimode ones. If your 70cm rig (either mobile or base) incorporates CW and SSB facilities, you will find that these seldom get themselves used and in any case require a horizontal aerial. All the run-of-the-mill activity on 'Seventy' is in the FM segment. And it is vertically polarised.

The amateur's best investment, then, will be to acquire an FM-only transceiver. Plenty of handhelds are to be had new. Plenty of used transceivers are to be found on suppliers' secondhand shelves to permit an inexpensive entre into mobile coverage on the band. When selecting a rig obtain if possible one with the reverse repeater facility on it to permit 'checking on the input' to decide if a simple contact is possible. If it is, go simplex and leave the 'box' to the next comer.

**Artificial boost**

During the long hot summer of 1990, the anomalous propagation induced on the metrewaves caused some startling phenomena. Notable among them was the temporary availability of numerous repeaters on any one channel. From home sites using adequate aerials it was possible, particularly under dawn-lift conditions, to detect as many as half a dozen repeaters on any one of the RB channels, bleeping their Morse idents. A toneburst offered to the local one could well bring up several others in the same slot. Many mobiles reported the same kind of results even from hemmed-in sites; a low gear pull up a nearby hill adding a couple more 70cm repeaters for every hundred or so feet of height gained. Not typical, of course: if lifts occurred all the time, and they do in hot-weather countries, life would become positively exhausting. It is as well to bear in mind, then, that these are artificial boosts, not to be taken as the norm.

What, then, is the norm where 'Seventy' is concerned? It can be very simply described; it is the facility to sustain conversation over quite considerable distances when mobile, provided the next available repeater on the route is selected. This may call for a modicum of pre-journey planning. Look up the repeater list in the RSGB Callbook and jot down the locations and channel numbers of the 'boxes', which will be met on the journey. Record this information on a postcard; it travels better than flimsy paper that flaps in every draught turned on to it through the vehicle window or the air-conditioning blower. The card may be affixed to any easy to reach protuberance on the car facia, to be visible at all times with no handling. Operators who use rigid press buttons that provide instant channel changing, may wish to add to the card a note of which button to press to bring up the next nearest repeater.
may well conclude that he or she will never run out of repeaters on 433MHz. This is indeed true. More repeaters on prime-sites exist on 70cm than on 'Two'. Because they use aerials which are electrically larger than those which can be conveniently erected for a 2 metre repeater, their service areas compare favourably with 2 metre ones and indeed are often exceeded. For an available height of repeater mast, the designer can accommodate many more quarter wavelengths of metal on 'Seventy' than he can on 'Two'.

To date, congestion has invaded 70cm infrequently; and it is sociologically a 'clean band'. This is yet one more good reason for getting going there. Another is to take the weight off 'Two, though most operators will tell you that the weight on 'Two' is nothing like as heavy as it is sometimes suggested, and that costly proposals to go for 12½ KHz channel spacing are, at this stage at any rate, misguided.

Any difficulty in finding a disengaged repeater channel on 'Two' is obviated when the operator turns his or her attention to 'Seventy'; although a conversation may be in progress it is characteristic of 'Seventy Centimetalists' that they always welcome others on to their local talk-box, and often take breaks between overs to give some of those 'others' a chance to join in.

'Maximise your coverage by using 70cm' suggests our title line. You'll not find this difficult; there are 150 repeaters on the band compared with 75 on 'Two' and the service and coverage they give is often superb.

Maximise your mobile range on 70cm with the help of this repeater list.

<table>
<thead>
<tr>
<th>Channel number</th>
<th>Frequency in (MHz)</th>
<th>Frequency out (MHz)</th>
<th>Channels available</th>
</tr>
</thead>
<tbody>
<tr>
<td>RB0</td>
<td>434.600</td>
<td>433.000</td>
<td>17</td>
</tr>
<tr>
<td>RB1</td>
<td>434.625</td>
<td>433.025</td>
<td>4</td>
</tr>
<tr>
<td>RB2</td>
<td>434.650</td>
<td>433.050</td>
<td>15</td>
</tr>
<tr>
<td>RB3</td>
<td>434.675</td>
<td>433.075</td>
<td>5</td>
</tr>
<tr>
<td>RB4</td>
<td>434.700</td>
<td>433.100</td>
<td>12</td>
</tr>
<tr>
<td>RB5</td>
<td>434.725</td>
<td>433.125</td>
<td>5</td>
</tr>
<tr>
<td>RB6</td>
<td>434.750</td>
<td>433.150</td>
<td>12</td>
</tr>
<tr>
<td>RB7</td>
<td>434.775</td>
<td>433.175</td>
<td>3</td>
</tr>
<tr>
<td>RB8</td>
<td>434.800</td>
<td>433.200</td>
<td>4</td>
</tr>
<tr>
<td>RB9</td>
<td>434.825</td>
<td>433.225</td>
<td>2</td>
</tr>
<tr>
<td>RB10</td>
<td>434.850</td>
<td>433.250</td>
<td>14</td>
</tr>
<tr>
<td>RB11</td>
<td>434.875</td>
<td>433.275</td>
<td>13</td>
</tr>
<tr>
<td>RB12</td>
<td>434.900</td>
<td>433.300</td>
<td>5</td>
</tr>
<tr>
<td>RB13</td>
<td>434.925</td>
<td>433.325</td>
<td>10</td>
</tr>
<tr>
<td>RB14</td>
<td>434.950</td>
<td>433.350</td>
<td>16</td>
</tr>
<tr>
<td>RB15</td>
<td>434.975</td>
<td>433.375</td>
<td>13</td>
</tr>
</tbody>
</table>

Note 1: The separation or receive frequency from transmit frequency is 1.6MHz. The separation between channels is 25KHz.
Note 2: The SU simplex channels (SU = 'Simplex-UF') are available in the frequency area between repeater-inputs and repeater-outputs.
**The latest get-togethers**

**Bromley and District Amateur Radio Society** meets on the third Tuesday of each month, 7.30pm for 8.00pm, at the Victory Social Club, Kechill Gardens, Hayes, Kent. Their forthcoming events include:
- Nov. 20th Junk Sale
- Dec. 18th Christmas Party

**South Bristol Amateur Radio Club** meets every Wednesday at the Whitchurch Folkhouse Association, Bridge Farm House, East Dundry Road, Bristol, Avon. BS14 0LN. Events include:
- Nov. 7th 20 metre activity evening
- Nov. 14th Simple computer programming
- Nov. 21st Free ice-cream evening
- Nov. 28th 20 metre DX, RX evening
- Dec. 5th Judging for Terry Dunsford Trophy
- Dec. 12th HF contest evening

Events and dates often change, so for more information Tel. Whitchurch 832222 on a Wednesday evening.

**Dragon Amateur Radio Club, North Wales, GW4TTA**. Their contact man is Tony Rees, Tel. 0248 600963. They meet at the Four Crosses, Pentraeth Rd, Menai Bridge. 7.30pm, on 1st and 3rd Mondays.
- Nov. 5th Sale of surplus equipment
- Nov. 19th Talk by Dr David Last GW3MZY
- Dec. 3rd Club talk
- Dec. 17th Christmas party (ticket only)

**Dunstable Downs Radio Club**, meet in Room 3, Chews House, 77 High St South, Dunstable, Beds. Their events are:
- Nov. 2nd Junk sale
- Nov. 16th Components and their characteristics
- Nov. 30th ERG race, (constructors contest)
Further details from Mike Spacey G1NWZ.

**Fakenham Amateur Radio Society** hold meetings on the first and third Tuesday every month at the Thurstford Crawfish at 7.30pm for 8.00pm, all are welcome. All other Tuesdays there is a net on first and third Wednesdays each month at the Bradshaw Tavern, Nr. Queensbury, Bedfordshire, at 8.15pm. Events include:
- Nov. 21st Radio alarm systems by Geoff Milner G8NNK
- Dec. 5th Alignment evening with Alan Robinson G3TQA.
For details contact Stan Catton GOIYR on 0274 673116

**Hastings Electronics and Radio Club**, meets every third Wednesday, 7.45pm at West Hill Community Centre, Croft Road, Hastings. Also every Friday at 8.30pm in the club room at Ashdown Farm Community Downey Close, Hastings. During November they have a demo of vintage military wartime radio planned. For further details Tel. Stan Simpson G4ITM on Hastings 430579.

**Halifax & District Amateur Radio Society** meet at The Running Man, Pellan Lane, Halifax at 7.30pm every 3rd Tuesday.
- Nov. 20th Tony G4UZN discusses the WARC Bands
- Dec. 18th Christmas social with free pie and peas.
Details from David Moss on Halifax 202306

**Keighley Amateur Radio Society** meet at the Ingrow Cricket Club. Their programme for the next couple of months is:
- Nov. 8th Night on the air, GOKRS
- Nov. 15th Films
- Nov. 22nd Natter night
- Nov. 29th 'The Sun' by L.M. Dougherty
- Dec. 6th Natter night
- Dec. 13th Natter night
- Dec. 20th Christmas buffet

Further details available from Kathy, on Bradford 496222

**Mansfield Amateur Radio Society** meets on the 1st Thurs of each month at the Polish Catholic Club, off Windmill Lane, Wood house Road, Mansfield.

**Midland Amateur Radio Society** meet on Tuesdays at 7.30pm. at Unit 16, 60 Regent Place, off Caroline Street, Birmingham, B1 3NJ. Dates for October and November are:
- Nov. 20th Rally Debrief (possible)
- Dec. 4th Christmas party.
Details from David Jarrett, G4DCJ, on 048522 633.

**Midlands AX-25 Packet Radio Users Group** (better known as Maxpak) meet on the first Monday of the month at 8.00pm at the Community Centre, Perton, nr Wolverhampton. Details from Greg Lewin, GONEN, The Hawthorns, Wheaton Aston, Stafford ST19 9NG.
Tel. 0785 840186

**Norfolk Amateur Radio Club** meet every Wednesday at 7.30pm for 8.00pm at The Norfolk Dumpling, The Livestock Market, Harford, Norwich. Dates to look forward to are:
- Nov. 7th 'Real Radio' evening
- Nov. 14th Surplus equipment auction/Bring and Buy, 7.00pm.
- Nov. 21st An introduction to power supplies, Mike Lemin G4UUB
- Nov. 28th Informal & Committee meeting.
Further details from the Club Secretary, Steve Sewell, G4VCE, Medway, The Rosary, Mulbarton, Norwich. NR14 8AL Tel. 0508 78258.

**Northern Heights Amateur Radio and Electronics Society** meet on the first and third Wednesdays each month at the Bradshaw Tavern, Nr. Queensbury, Bedfordshire, at 8.15pm. Events include:
- Nov. 21st Construction contest and alignment evening,
- Dec. 5th Alignment evening with Alan Robinson G3TQA.
For details contact Stan Catton G0IYR on 0274 673116

**Reading and District Amateur Radio Club** meet at The Woodley Pavilion, Woodford Park, Hadden Drive, Woodley, Reading, Berks. Meetings start at 8.00pm. Club events are:
- Nov. 8th Club talk
- Nov. 22nd Construction contest and alignment evening,
- Dec. 13th AGM with cheese and wine
- Dec. 27th Christmas informal drinks party
Further details can be obtained from the club secretary Mike Anthony, G4THN, Tel. 0734 774042

**Stourbridge & District Amateur Radio Society** meet on the first and third Monday of each month at the Robin Wood's Community Centre, Scotts Road, Stourbridge. Programme of events;
- Nov. 5th On air and natter night
- Nov. 19th Winter Surplus sale
- Dec. 3rd On air and natter night
- Dec. 17th Club talk.
Their secretary is Dennis Body G0HTJ.

**Stoke On Trent Amateur Radio Society** have a new venue and have changed the day on which they meet. They now meet at the Sacred Heart R.C. Church Hall, Jasper Street, Hanley, Stoke-on-Trent, Staffs, every Thursday evening now at 7.30pm. For further details contact D. Wire, G0XMD,31, Abbots Way, Westlands Newcastle-under-Lyme, Staffs ST5 2EK. Tel. 0782 639476
Stratford upon Avon & District Radio Society meet at the Baptist Church, Payton Street, Stratford upon Avon, at 7.30pm. Club dates include:
Nov. 12th The Radio Investigation Service, by Bruce Davies.
Nov. 26th Antenna's and Baluns, by Dave Yates G3PGQ.
Dec. 10th Chaired discussion.
Dec. 24th No meeting.
Details from A. Beasley G0CXJ. Tel. 060 882 495.

Wigan and District Amateur Radio Club meet on the first and third Thursdays each month in the 'Old Pear Tree Inn', Frog Lane in the centre of Wigan. The club welcomes new members interested in all aspects of amateur radio from age 10 to 70. For further details Tel. Mrs M. E. Norton on Wigan (0942) 47416

Welwyn – Hatfield Amateur Radio Club meet at two venues. Events at the Lemsford Village Hall, Brocket Road, Welwyn Garden City include;
Nov. 5th Construction contest.
Dec. 3rd AGM.
Events at Knightsfield Scout HQ, Knightsfield W.G.C.;
Nov. 19th QO challenge.
Dec. 17th Christmas social event.
Details from Roger Curtis Tel. 0707 324958

York Radio Club, G4YRC meets every Wednesday at the Civil Service Club, Poppleton Rd, York. Hon Sec George Tweedy G0LOP (York) 656179

Wimbledon and District Amateur Radio Society meet on the second and last Friday of each month at 7.30pm, in St Andrews Church Hall, Herbert Road, London. SW19
Nov. 9th Meet the committee
Nov. 30th Design of Direct Conversion Receivers by Steve, G8CYE
Dec. 14th Christmas social
Further details from Nick on 081 330 2703

Wirral Amateur Radio Society, G3NWR, Ivy Farm, Arrowe Park Road, Birkenhead, L49 5LW
Further details from Alec Seed G3FOO on 051 644 6094.

Yeovil Amateur Radio Society meets every Thursday 7.30pm at the Recreation centre, Chilton Grove, Yeovil. Dates for your diary are;
Nov. 1st Discussion night.
Nov. 8th A simple ATU by G3MYM.
Nov. 15th HF propagation this winter by G3MYM.
Nov. 22nd Ideas for club events in 1991 with G3MYM.
Nov. 29th Natter night.
Dec. 6th Low pass filters by G3MYM.
Further details from the Chairman, Adrian G4JBH. Tel. 0935 28341.

York Amateur Radio Society G3HWW, meets every Friday at the York City football ground, Bootham Cres. York. Hon Sec George Tweedy G0LOP (York) 656179

Yeovil Amateur Radio Society G3HWW, meets every Friday at the York City football ground, Bootham Cres. York. Hon Sec George Tweedy G0LOP (York)

National and International
The Irish Radio Transmitters Society send out regular newsletters giving details of local activities. The contact man for this is Dave Moore EI4BZ, 12 Castle Ave, Carrigtwohill, Co Cork. Tel. (Eire) 021 883555
To include your club in this feature, make sure you send your events details to the editorial office address, then we'll make sure our readers know exactly what you're up to each month. You might even get some new members!

Rallies

Where to get the bargains

November 11th
Birmingham Autumn Rally
Stockland Green Leisure Centre Slade Road, Erdington, 2 miles from spagetti junction.
Details from Peter G6DRN. Tel: 021 4431189.

November 18th
West Manchester RC Winter Rally
Bolton Sports and Exhibition Centre, Bolton.
Details from Dave G1L00, Tel: 0204 24104 evenings.

November 25th
Sunny Dale Leisure Centre, Shildon, Bishop Auckland, Co Durham.
Details from Ernie, G4TYF, Tel: 0388 607500.

Starting on Satellites. Due to space limitations beyond the Editor’s control, this series will commence in the next issue of HRT.

please mention HRT when replying to advertisements

HAM RADIO TODAY DECEMBER 1990
FOR SALE

Yaesu FRG 7700 receiver plus manual and listening guide. Excellent condition, guaranteed. Little use. £270.00. Amtor ATU (for receivers) £15.00. Sumner 0902 737054.

Mutek TV7FV144A2 2m transverter £230. Yaesu FT890R 70cm 10Watt all mode £300. Microwave modules 70cm amplifier MML432-50 £80. Tonna 1Bele 70cm £20. Tonna Bele £20. Tonna Bele crossed £10. Ring 0393 834141.

Pye Europa, 2m, 4m, 70cm. Commercial Quality and standard components! Fully synthesised, frequency readout. Either buy, or send in your old crystallised rig for modification! Demonstration given. Complete £155. Tel. 081 953 7984. 24h.

Kenwood R1000 communication receiver 150 kc/s 30 Mc/s, excellent condition, ready for 12V DC and 240V AC £200 or with VHF converter £225-0300V. Crowborough 0892 664960 afternoon or evenings not QTHR. SONY AN1 active antenna also Sony AIR7 air, PS8, FM, AM scanner with power pack etc. Both mint. Require comms receiver or anything interesting. Please phone Bournemouth (0202) 422273 after 6.30pm.

JAYBEAM 10 element 2 metre band Yagi aerial, never been used £15. Telephone Mick York after 7pm 0536-60189.


For sale Ex PMR equipment, Pye PF2S vhf low high and UHF bodywork and handheld £35, VC Burndeps 473 UHF £40, VGC Pye PF5000s 4 watt UHF £50. ITT Starphone £15. Motorola voice paging system £100. Telephone Sean 0347 21208.


Realistic PRO-32 handheld scanner, 200 channel memory, 68-88MHz, 108-136MHz, 138-174MHz, 380-512MHz £110. economic adaptation onto similar 2060, 50-500MHz range used, boxed as new £20. Tel. 081 991 2608 evenings after 7pm. Exchange my Matsui MR-4099 150KHz to 29.999 receiver A.A. S.B. L.S.B. narrow filter F.M. stereo, for scanner hand held must have air band. Phone Barry 0416 739734 between 09.00 & 10.30. Has Arlasdried P.M. and D.S.M. ATU for right deal. Phone Halifax (0422) 368021.

TS530S for sale original packing and manual and various u.g.c. £525. Call Roger GOFCH Swindon 0793 695262 after 6pm.

Frequency counter Solartron EM1616, good cond, working no ins. book £45. Oscilloscope dual trace telemetry modelled D54 (Kolster brandes) working but needs attention. no book £30. Sale Ex-WV RX, etc. GIP/VIP Street 0458/47019. Icom IC-256 handle with spkr mic £220. Trio TR3200 70cm portable with packet freqs £90. Atari frequency counter with special port, terminal program manual 32K memory card, £220. Phone Julian on Colchester (0206) 210878.

Yaesu 7000 RX, 0 - 30MHz, £130. or swap for 2m handheld i.e IC 2E etc. or scanner, must cover airband and 512MHz, anything considered or swap for 2m handheld i.e. IC2E Yaesu 7000 RX, 0- 30MHz, £130, 12V DC and 240V AC £200 or 953 7984. 24h.

Particle counter Solartron 1A01, 100V - 240V AC £10. Multi 368021. Best hard drive P.C. setup offered. £10.00; SANYO RX portable receiver, £80. 13.8V 5A PSU, £40. Digital multimeter £50, small AVO meter £220. Trio TR3200 70cm portable £80. Memory card, £220. Phone Julian 0554 2913 6pm - 8pm.

TS530S, 2050, 50-500MHz range, unused, £25.00. Light, plus many more features, slow/fast tuning, wide/narrow, dial tuning. Super Sensitivity, "S meter, 10W linear amplifier, £50. Tel. (Solihull, W. Midlands) 021 742 7272.

Trio TR3200 70cm handheld £110. £220. Trio TR3200 70cm portable £80. Memory card, £220. Contact Julian 0554 2913 6pm - 8pm.

FOR SALE

Yaesu FT202R handheld, battery charger, xtal. £150. 10m - 15MHz receiver, £80. 13.8V 5A PSU, £40. Dual band equaliser, £30. BN0S 2m 100W output PA, £60. 2m 2 ele beam, £30. The lot for £350. Tel. 0748 850430 after 1800 Hrs. (Richmond, Yorks.)

Sony PRO800 HF/VHF scanner, 150KHz - 108MHz plus 115MHz - 212MHz with converter, AM/FM/SSB. Will swap for Yaesu FT202R scanner or sell for £195. Tel. 0827 250038, (Tamworth, Staffs).

Loops. Have two loops made from domestic copper pipe. Circular. Inner pipe is 1.2m dia 22mm, the other is 1.4m dia 22mm. Will let them go for a lot cheaper than they cost to make. (Malvern, Worcs.) Tel. 0684 560068 evenings.

Saisho world receiver, 1-300Mhz, £554 2913. Handy. WHY. Tel. Chris Taylor G1MFH on (Watford) 0923 671024 after 6pm.

Spectrum 40K with drill interface and books £60. A disk drive for this will also work with Acorn BBC Computers, £60. Texas T199/4A computer, fully boxed £60. Tel. Bob on (Stevenage) 0438 720910.

Microwave Modules 1296MHz transverter, 2m IF, want to swap for 6m, will accept 70cm handy. WHY. Tel. Chris Taylor G1MFH on (Watford) 0923 671024 after 6pm.

Sony PRO800 HF/VHF scanner, 150KHz - 108MHz plus 115MHz - 212MHz with converter, AM/FM/SSB. Will swap for Yaesu FT202R scanner or sell for £195. Tel. 0827 250038, (Tamworth, Staffs).

Loops. Have two loops made from domestic copper pipe. Circular. Inner pipe is 1.2m dia 22mm, the other is 1.4m dia 22mm. Will let them go for a lot cheaper than they cost to make. (Malvern, Worcs.) Tel. 0684 560068 evenings.

Saisho world receiver, 1-300Mhz, £554 2913. Handy. WHY. Tel. Chris Taylor G1MFH on (Watford) 0923 671024 after 6pm.

Spectrum 40K with drill interface and books £60. A disk drive for this will also work with Acorn BBC Computers, £60. Texas T199/4A computer, fully boxed £60. Tel. Bob on (Stevenage) 0438 720910.

Microwave Modules 1296MHz transverter, 2m IF, want to swap for 6m, will accept 70cm handy. WHY. Tel. Chris Taylor G1MFH on (Watford) 0923 671024 after 6pm.
051.2 RGB or green screen monitor any reasonable price accepted. Two 32K sideways rams for above £150. Tel. (Bedford) 0243 750050.

Racal AR17 MKII very good condition AR117E overhauled 5 years ago, choice of two £175 and £150. Tel. (Southall, Hanse) 081 571 5759.

Kenwood TS 830S nine band HF transceiver 160-10m. Also Kenwood AT230, VFO240, and MC50 mic, all items in pristine condition with original boxes and manuals. Tel Brian on (London) 071 515 5517.


Yaesu FT726R 2m multimode £500, 6m module £199, HF module 180, satellite board £150, all in mint condition £950 complete. FDK 750E 2m multimode with 70cms expander £850. Contact K. Greenough, G8BEQ, 2 Bexley Close, Glossop, Derbyshire SK13 9BG. Tel. 0457 854688.

Please use last month's coupon for your free ad.

WANTED
WANTED Cheap air band receiver and general coverage receiver by pensioner returning to hobby. Roger 0689 20281.

Yaesu FT101ZD transceiver, must be in mint condition and good working order. Or Icom IC7400 HF transceiver with matching mains power supply, must also be in mint condition. Tel. 0689 890227. 10X or any crystals for 7MHz CW band. Have Hm Mound BK100 and ex-RAF Type D Morse keys for sale, SWB? Tel. John 0326 290711.

Good Short Wave receiver, will exchange for 216 receiver with power pack and a microphone and headphones. Clive Powis, Tel. 021 769 8447.

Ham Radio Today February 1987, June and August 1985 copies, Ham Radio Today February 1987, 221870. Printed No 1. £35.00, 6m module £199, HF module £180, satellite board £150, all in mint condition £950 complete. FDK 750E 2m multimode with 70cms expander £850. Contact K. Greenough, G8BEQ, 2 Bexley Close, Glossop, Derbyshire SK13 9BG. Tel. 0457 854688.

Please use last month's coupon for your free ad.
RETAIL NETWORK

WEST YORKSHIRE

AMATEUR RADIO SHOP
4 CROSS CHURCH STREET
HUDSDERSFIELD HD1 3PT
Telephone 0484 420774

G4MH
G0HRT
G3WAH

Good range of
YAESU & KENWOOD
plus quality second-
hand equipment

JAYCEE ELECTRONICS LTD
20 Woodside Way Glenerothes
Fife KY7 5DF
Tel: 0592 756952 (Day or Night)
Open: Tues-Fri 9-5; Sat 9-4; Sunday by appointment
Good range Kenwood & Icom etc, plus
ICOM Quality Secondhand Equipment

0442 66551

CLASSIFIED

TARP COMMUNICATIONS
27 PINFOLD INDUSTRIAL ESTATE
PINFOLD LANE, RUCKEYE, CW15 6DZ
NORTH WALES 0244 549563
LARGE STOCK OF SECONDHAND EQUIPMENT (CHANGING DAILY)
OPEN THROUGH THE WEEK 10-6PM EXCEPT TUESDAYS AND SUNDAYS
EXTENSIVE REPAIR/CalIBRATION SERVICE

GOOD RANGE OF
YAESU & KENWOOD
PLUS QUALITY SECOND-
HAND EQUIPMENT

NORTH WALES

COMMUNICATIONS
UNIT 27, PINFOLD INDUSTRIAL ESTATE
PINFOLD LANE, BUCKLEY, CLWYD
NORTH WALES 0244 549563
LARGE STOCK OF SECONDHAND EQUIPMENT (CHANGING DAILY)
OPEN THROUGH THE WEEK 10-6PM EXCEPT TUESDAYS AND SUNDAYS

COURSES

RADIO AMATEUR LICENCE
Start training now for the following courses. Send for our brochure — without obligation
or Telephone us on 0626 779398

HEATHKIT U.K. Spares and
Service Centre. Cedar Electronics,
12 Isbourne Way, Broadway Road,
Winchcombe, Cheltenham GL54 5NS. Tel: 0242 820402.

MICROPROCESSOR

ADVERTISE
IN HAM RADIO
TODAY

FOR SALE

MISCELLANEOUS

Name

Radio & Telecommunications Correspondence School,
12, Moor View Drive, Teignmouth, Devon TQ14 9UN

Rates: Lineage 55p per word + VAT, minimum £11.00. Semi-display £10.00
+ VAT per single column centimetre. No reimbursers for cancellations. All advertisements must be pre-paid.

CLASSIFIED COUPON

Name

Address

Signature

Date

Please mention HRT when replying to advertisements
BIRMINGHAM
RAYCOM COMMUNICATION SYSTEMS
International House, 963 Wolverhampton Road, Oldbury, West Midlands B69 4RT. Tel: 021 644 6767
Opening hours 9-5.30pm Late nights Thurs. Fri. Send just £1.00 refundable against purchase for latest catalogue our exclusive products & used list.

BIRMINGHAM
HEWARD'S HOME STORES LTD.
(Stat. 1963)
822/4 Kingstanding Rd., Birmingham B44 9RT.
Tel: 021-354 2083
G4RJM with over 40 years in The Radio Trade Ham Equipment urgently wanted!
Open: Mon-Sat 9-6

BIRMINGHAM
B&C ELECTRONICS
51 SIR HILTONS RD
WEST HEATH, BIRMINGHAM B31 3NH
New and Used
Amateur Radio and Computer Sales
Elastomers main dealer and commission
sale items always required
BRUM'S PREMIER JUNK SHOP
Tel: (021) 4752426

CAMBRIDESHIRE
LOWE ELECTRONICS
CAMBRIDGE
Sole U.K. Distributor for KENWOOD
162 High Street, Chesterton
Cambridge CB4 1NL
Tel: 0223 311230

LANCASHIRE
AMATEUR ELECTRONICS/HOLDINGS G3LLL.
YAESU, JAYBEAM, DRAKE, DATING, BLACK STAR COUNTERS, ETC FI 10X EXPERTS.
G4JIC, G6KDS, 1287KM Original type approved valves & our own Double Balanced Mixer and new base WARC Mods for original FTI01 MK4
S.A.E. Lea Fylde Yaseu range, 15m, 10m, 7m, 2m Transceivers, Free parking, Call and consult G3LLL
without obligation. Holidays/ Phone. check we are open before calling
45 JOHNSTON STREET, BLACKBURN BB1 1LF
G2LLL

SURREY
GUILDFORD COMMUNICATIONS
Open: Mon-Sat 9.00am to 5.30pm, Sun 10am to 1pm
Secondhand wanted

ANDOVER
LOWE ELECTRONICS
Sole U.K. Distributor for KENWOOD
223/225 Field End Road
Eastcote, Middlesex HA5 1IQZ
Tel: 081 429 3256

HAMPSTEAD
LOWE ELECTRONICS
Sole U.K. Distributor for KENWOOD
223/225 Field End Road
Eastcote, Middlesex HA5 1HQ
Tel: 081 429 3256

HAMPSHIRE
LOWE ELECTRONICS
Sole U.K. Distributor for KENWOOD
223/225 Field End Road
Eastcote, Middlesex HA5 1IQZ
Tel: 081 429 3256

HARTLEPOOL
BORDER COMMUNICATIONS LTD
Communications Centre
Unit 10A to 1c
Odham Industrial Estate
Chester-le-Street
Co. Durham DH1 1XH
TEL: 091 4150969

HARTLEPOOL
VANNER'S Scanner and C.B. Centre
Sales, Service and Repairs of Scanners, C.B.s, Phones, Answer Machines, Radios etc.
Agents for Garex, Revco, Bearcat, Uniden, Panasonic
Part Exchange. All items welcome.
34 Gloucester Avenue, Northampton
Telephone 0604 766704

HARTLEPOOL
COMMUNICATION HOUSE
Open: Mon-Fri 9-5.30pm.

HARTLEPOOL
LOWE ELECTRONICS
Sole U.K. Distributor for KENWOOD
223/225 Field End Road
Eastcote, Middlesex HA5 1IQZ
Tel: 081 429 3256

HARTLEPOOL
BORDER COMMUNICATIONS LTD
Communications Centre
Unit 10A to 1c
Odham Industrial Estate
Chester-le-Street
Co. Durham DH1 1XH
TEL: 091 4150969

HARTLEPOOL
VANNER'S Scanner and C.B. Centre
Sales, Service and Repairs of Scanners, C.B.s, Phones, Answer Machines, Radios etc.
Agents for Garex, Revco, Bearcat, Uniden, Panasonic
Part Exchange. All items welcome.
34 Gloucester Avenue, Northampton
Telephone 0604 766704

HARTLEPOOL
COMMUNICATION HOUSE
Open: Mon-Fri 9-5.30pm.

HARTLEPOOL
LOWE ELECTRONICS
Sole U.K. Distributor for KENWOOD
223/225 Field End Road
Eastcote, Middlesex HA5 1IQZ
Tel: 081 429 3256

HARTLEPOOL
BORDER COMMUNICATIONS LTD
Communications Centre
Unit 10A to 1c
Odham Industrial Estate
Chester-le-Street
Co. Durham DH1 1XH
TEL: 091 4150969

HARTLEPOOL
VANNER'S Scanner and C.B. Centre
Sales, Service and Repairs of Scanners, C.B.s, Phones, Answer Machines, Radios etc.
Agents for Garex, Revco, Bearcat, Uniden, Panasonic
Part Exchange. All items welcome.
34 Gloucester Avenue, Northampton
Telephone 0604 766704

HARTLEPOOL
COMMUNICATION HOUSE
Open: Mon-Fri 9-5.30pm.
There is a branch near you
COMPACT TRANSCEIVERS FROM KENWOOD

TH-77E 2M and 70cm FM HANDHELD TRANSCEIVER. THE SMALLEST DUAL BANDER IN THE WORLD — AND LIGHT TOO!
It is incredible how many features Kenwood have included in their latest range of handhelds whilst improving ease of use, size and weight. The TH-77E is an excellent example.

Size: 58mm wide, 30mm deep, 141mm high (excl. aerial).
Weight: Less than 1lb!
RF Output: From 500mW to a powerful 5W. The battery pack supplied gives 2W output on VHF and 1.5W on UHF.
Receive: The TH-77E can receive both VHF and UHF at the same time or dual frequencies on UHF. Dual display of large, easy-to-read LCD display make operation simple and efficient.

Squelch: Independent squelch circuit for each band.
Other functions: * Repeaters Offset and Reverse switches * 40 Multi-function Memory Channels with Lithium battery back-up * And more.
Options: * Remote Control Speaker Microphone with controls the most useful functions required by the mobile operator * Headset with VOX/PTT * Filtered cigar lighter cord * Battery Packs * Wall Chargers * Soft Case * And others.

VFO's: There are two. For added convenience they can be sent immediately. Better still, seeing is believing, so why not drop in on one of our shops or approved dealers and get a feel for what we are talking about!

A full colour specification sheet is available upon request and both models are in the showrooms of our shops and approved dealers. When you see the transceiver as a handheld, you will find it small. When you see its profile in your car without the battery pack, we think you will be pleasantly surprised at the very small amount of space required to house a fully functional FM VHF/UHF transceiver.

TH-77E . . . £389

TH27E (VHF)/TH-47E (UHF) ULTRA-COMPACT FM TRANSCEIVER. SIZE AND STYLING UNBEATABLE FOR COMFORT!
The high impact moulded case is designed with a five degree incline. This simple idea coupled with compact dimensions makes these models the most comfortable handhelds on the amateur market today.

Size: 50mm wide, 38mm deep, 125mm high (excl. aerial).
Weight: Less than 13oz (360g).
RF Output: From and Economy Low Power of 20mW to high power of 5W.
Battery Power: The new 7.2VDC/700mAH NiCad battery gives extended operating time.
Scanning: Both models offer a fully flexible scanning system, including carrier or time operated resume and busy channel scan stop.

Squelch: The built-in Dual Tone Squelch System (DTSS) provides selective reception using DTMF tones.
Other features: * 40 Multi-function Split Frequency Memory channels * Auto Battery Saver * Repeater Offset and Reverse Offset * Programmable VFO * And more.
Options: * Remote control speaker microphone which operates a whole range of transceiver functions * Sub-audible tone unit * Battery Packs * Wall Charger * Soft Case * And many others.

The detailed information sheet does these little handhelds more justice, so write, phone or FAX for one and it will be sent immediately. Better still, seeing is believing, so why not drop in on one of our shops or approved dealers and get a feel for what we are talking about!

TH-27E . . . £249
TH-47E . . . £269

TH-26E (VHF)/TH-46E (UHF) COMPACT FM HANDHELD TRANSCEIVER. SIZE AND DESIGN IDEAL FOR PORTABLE/MOBILE!
A compact handheld transceiver with controls and readout on the top of the unit. Remove the battery pack and use an external power source when mobile and no other transceiver will match this one for small size and all the state-of-the-art features expected in a modern FM transceiver.

Size: 58mm wide, 30mm deep, 136mm high (excl. aerial).
Weight: Less than 11b!
RF Output: Economy Low Power of 20mW up to a high power of 5W using the optional PB-8 power pack. Power pack supplied gives 2.5W.
Scanning: 20 Multi-function Memory Channels with Lithium battery back-up.
Other features: * Repeaters Offset and Reverse switches * Lamp Lock Key for continual illumination of the LCD display when mobile * And others.
Options: * Remote Control Speaker Microphone controls the most useful functions required by the mobile operator * Headset with VOX/PTT * Filtered cigar lighter cord * Battery Packs * Wall Chargers * Soft Case * And many more.

A full colour specification sheet is available upon request and both models are in the showrooms of our shops and approved dealers. When you see the transceiver as a handheld, you will find it small. When you see its profile in your car without the battery pack, we think you will be pleasantly surprised at the very small amount of space required to house a fully functional FM VHF/UHF transceiver.

TH-26E . . . £269
TH-46E . . . £269

Head Office: Chesterfield Road, Matlock, Derbyshire DE4 5LE
Tel: 0629 580800 (4 lines) Fax: 0629 580020

Shops in GLASGOW Telephone 041-945 2626, DARLINGTON Telephone 0325 486121, CAMBRIDGE Telephone 0223 311230, S. WALES (BARRY) Telephone 0446 721304, LONDON Telephone 081-429 3256, BOURNEMOUTH Telephone 0202 577760

All branches are closed all day Monday.
The FT-1000 is a new top of the range all mode h.f. transceiver that is the result of more than 25,000 hours of intensive research by Yaesu's top design engineers. They have adopted a completely new approach to the application of digital and RF technology. The extensive use of surface mounted components has allowed six microprocessors and five Direct Digital Synthesisers to be integrated with a simple to use operator interface to give a highly reliable full featured transceiver that has been optimised for serious h.f. applications.

Please write or call SMC or your local authorised Yaesu dealer for the full specifications of this dynamic new transceiver and discover how you can open up the bands.