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YAESU FT-60E NEW £189 B

The FT 60E is a new dual band FM handheld transceiver from Yaesu. It provides versatile 2 way comms with unmatched monitoring.

**Wide band Reception 108- 520MHz & 700-999.990MHz (Cellular blocked)*
**New Emergency Automatic ID System*
**Huge LCD*
**High 5W Power Output*
**Ni-MH Long-Life Battery FNB-83 (7.2V, 1400mAh)*
**Overnight Charger*
**Programmable Keys for user convenience*
**Split CTCSS/DCS and DCS Encode-Only Capability.*

ICOM IC-756 PRO III NEW £2099 C

The IC-756PRO III marked its debut at the Leicester Amateur Radio Show at Donington. This is Icom's latest HF transceiver and incorporates many of the features from its predecessors and from the new technology used in the IC-7800.

IC-756 PRO II ***Last Few*** **£1899 C**

ICOM IC-7400 SPECIAL OFFER £1299 C

HF/VHF 100W transceiver. Features large LCD with spectrum scope, auto ATU and same DSP system as IC-756PRO II.
Comes with ***FREE*** **SP-21 Speaker & SM-20 Desk mic worth £219.**

ICOM IC-706 IIG DSP £769 C

HF/VHF/UHF mobile DSP transceiver. Its relative small size not only makes it a great mobile rig but also for fixed station use as well. HF general coverage Rx and VHF & UHF.

ICOM IC-703 SPECIAL OFFER £539 C

HF/50MHz Transceiver 0.1-10W Portable, Mobile, Base Station. (9-15.87V DC) Designed especially for the Foundation Licence/QRP. Built-in features auto ATU, DSP memory keyer. (5W when using 9.6V batts)

FREE! **Icom 703 Logbook - while stocks last**

ICOM IC-718 £449 C

HF 100W transceiver. Covers all HF bands plus wideband receive. C/w auto notch, dual VFO, SWR meter etc. Options include extnl ATU DSP & filters.

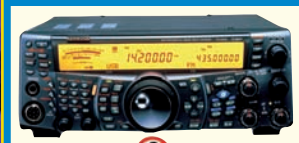
BUDGET BARGAIN

ICOM IC-910X with 23cm £1249 C

Icom's all mode VHF/UHF transceiver with 23cm. Large clear LCD with lots of facilities. 100W on VHF and 75W on UHF, 10W on 23cm.

IC-910H version £1099

KENWOOD TS-2000 £1399 C



Top-of-the-range 100W Kenwood transceiver. HF/VHF/UHF or up to 23cm with the optional module. Built-in auto ATU, DSP and its unique TNC.

TS-2000X + 23CMS £1799

KENWOOD TS-870S DSP £1399 C

HF DSP 100W base station. Excellent all round rig great for DX working with its ability to winkle out weak stations using its true IF DSP. No filters to buy.

KENWOOD TS-570DGE £849 C

HF100W base station with built-in auto ATU. Very popular rig, excellent performance on SSB and CW. Two fitted antenna sockets - very handy.

RELIABLE & EASY

YAESU FT-1000 MKV £2349 C

200W HF transceiver, EDSP, Collins filter, auto ATU, 220V AC PSU - Acknowledged as one of the finest DX rigs on the market. Superb tailored audio and the ability to select Class A bias for dramatic signal purity.

YAESU FT-1000 FIELD £1749 C

100W HF transceiver, EDSP, Collins filter, auto ATU, 220V AC / 13.8V DC - Building on the success of the FT-1000MkV, the Field has become a respected leader in its class.

YAESU FT-897D NEW £899 C

100W HF rig plus 2m and 70cms (50W/20W) 13.8V external supply / internal optional FP-30V AC power supply / self powered portable using optional Ni-MH pack at 20W output. Compatible with FC-30 auto ATU and ATAS 120/100 antennas. The "must have" radio for 2003.

Now with TXCO fitted.

YAESU FT-857D NEW £649 C

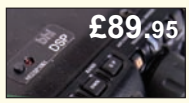
HF/50/144/430MHz Mobile Transceiver HF/6m 100W, 2m 50W, 70cm 20W. (13.8V DC) Developed on the FT-897 and FT-817 transceivers. Built-in features 32 colour display, spectrum scope, AM airband receive, built-in memory keyer, detachable front panel, DSP unit fitted.

YAESU FT-847 £1199 C

Covering 1.8 to 440MHz, this all-in-one transceiver offers unbeatable value. 100W on HF plus 6m, and 50W on 2m and 70cm. You get genuine RF clipping on SSB for up to 6dB gain and there are 4 seperate antenna sockets.

YAESU FT-817ND £499 C

bhi DSP Module now available!



160m 70cms. Up to 5W output all modes. ***Now with Ni-MH battery, charger & DC lead.*** **£589 with DSP ready fitted.**

NEW DSP Module
bhi have produced a lovely 4-stage DSP module that can be fitted inside the FT-817. The module costs £89 (plus a fitting charge of £25 for retro-fitting to existing models). This includes installing a mini switch and LED on top cover.

NEW FT 817 Clip on metal front support stand.
In stock now £14.95 +£1 P&P

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MFJ *In Tune with MFJ...*

MFJ-993

*Auto ATU with digital data dis[play*1.8-30MHz *Long wire, coax & balanced line *300W SSB, 150W CW *Cross needle metering *Size 255 x 70 x 235mm *Weight 1.8kg

The auto ATU that has a digital data display and can even handle wires!

£249.95 C

MFJ-991

Similar to the MFJ-993 but handles 150W SSB/100W CW and matches 6-3200 Ohms. Does not have digital VSWR meter LCD readout aural VSWR, antenna switch or 4:1 balun.

Auto ATU

£209.95 B

MFJ-941E

A great budget ATU. All the great MFJ features that make it ideal for base station use. *1.8-30MHz *300W *Cross needle meter *VSWR & PWR 30/300W *Terminals for wires and bal. lines *Internal 4:1 balun *Ext. Dummy load socket *SO-239 sockets *Size 260 x 180 x 70mm

Manual ATU

£129.95 B

MFJ-974H

A true balanced line ATU that is ready made for open wire feeder. Extremely accurate balancing provides optimum performance. It can also be used for long wires and coax. Great for all-band doublets. *1.8-54MHz (MFJ-974H) *300W *Balanced, wire or coax *SO-239 sockets *Size 195 x 155 x 220mm *Weight 2.05kg

£179.95 C

MFJ-904H

Just the job for portable use. It's so small! *3.5-30MHz (80 - 10m) *150W wire, coax, balanced *Internal 4:1 balun *SO-239 sockets *Size 180w x 60h x 80d (mm) *Weight 650g

Manual ATU

Mobile and portable use

£129.95 B

MFJ-962D

Ideal for use with linears. Gandles balanced, coax and wire. *1.8-30MHz *1.5kW Roller Coaster *VSWR meter *6-way antenna/load switch *Built-in 4:1 balun 2 coax positions *Size: 270x375x115mm

Manual ATU

£279.95 C

YAESU FT-7800 NEW — £239 C

Yaesu's Powerful low cost answer!

* 2m/70cms Dual Band Mobile
* High power 50W 2m /40W 70cms
* Wide receive inc. civil & military airband
* CTCSS & DCS with direct keypad mic.
* Detachable front panel
* 1000 memories plus five one-touch

YAESU FT-8900R NEW — £339 C

Want the best of all worlds then the FT 8900R is just the ticket! A rig with four of the most popular mobile bands 10m/6m/2m & 70cm. Detachable head. Airband Receive.

YAESU FT-2800M — £159 C

The FT 2800M 2m FM 65W High Power mobile trans ceiver. Rugged construc tion, excellent receiver per formance and direct keypad entry.

ICOM IC-2200H NEW — £199 B

The IC-2200H is the latest version of this popular high power 2m mobile rig. It has 207 memories inc 1 call channel & 6 scan edge memory channels.

*144 - 146MHz FM *65/25/10/5W RF o/p *CTCSS & DTCS *Green/amber display *Audio: 2.4W o/p *Tx 15A (65W) *Rx 1A (max audio) *Standby 0.8A *Power 13.8V DC *Size: 140x40x146mm

KENWOOD TMD-700E — £449 C

Certainly the best dual band mobile transceiver with APRS. Does not need extra high cost boards to function. The only extra if required is a compatible GPS receiver.

OTHER MODELS...

ICOM			
IC-2725E	Dual Band FM Transceiver	£269	C
IC-2100H	2m 55W FM Mobile	£189	C
YAESU			
FT-8800E	2m/70cm Mobile	£289	C
KENWOOD			
TM-G707E	2m/70cm Mobile	£289	C
TM-V7E	2m/70cm Mobile	£359	C

YAESU VX-110 — £119 B

Combining the ruggedness of the VX 150 with the simplicity of 8 Key operation, the VX 110 is a fully featured 2m handheld ideal for the most demanding of applications. It has a die cast case, large speaker and illuminated keypad.

ICOM IC-E90 — £269 B

The new E 90 offers triple band coverage of 6m, 2m and 70cms. Up to 5W output and rx coverage from 495kHz 999MHz makes this a very attractive rig.

ICOM IC-T3H — £129 B

The IC T3H 2m handheld features tough quality but with slim looks. Its striking green polycarbonate case has been ergonomically designed. The rig is capable of providing a powerful 5.5W output with either Ni Cad or Ni MH battery packs. Supplied with charger and rechargeable battery.

KENWOOD TH-D7E — £319 B

DATA COMMUNICATOR

One of the most successful handhelds over the past few years. It has a built in TNC for Packet use. You can also use it for APRS operation in conjunction with an external GPS unit. Plus NMEA, 200 memos, and up to 5W output.

KENWOOD TH-F7E — £239 B

WITH EXTRA WIDE RX COVERAGE

• 144 146MHz Tx/Rx: FM
• 430 440MHz Tx/Rx: FM

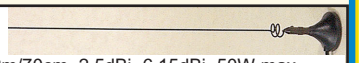
Up to 6W out with Li ion battery and "scanner" style coverage from 100kHz to 1300MHz including SSB on receive! This is a great radio to have at all times when you are on your travels.

OTHER MODELS...

ICOM			
IC-E208	Dual Band FM Mobile	£219	B
YAESU			
VX-7R	6m/2m/70cm Handheld	£299	B
VX-2E	Dual Band FM Handheld	£169	B
KENWOOD			
TH-G71E	2m/70cm Handheld	£179	B

MOBILE ANTENNAS

WATSON ANTENNAS (PL 259 base type)



Comes with coax & BNC

WSM-270. 2m/70cm, 2.5dBi, 6.15dBi, 50W max, micro magnetic 29mm base, length 0.46m. **£19.95** A

W-2LE	2m quarter wave 2.1dBi 0.45m	£9.95	A
W-285	2m 3.4dB 0.48m (fold over base)	£14.95	B
W-77LS	2m/70cm 0/2.5dB 0.42m	£14.95	B
W-770HB	2m/70cm 3/5.5dB 1.1m	£24.95	B
W-7900	2m/70cm 5.6/7.6dB	£32.95	B
W-627	6m/2m/70cm 2.15/4.8/7.2dB 1.6m	£34.95	B
WGM-270	2m/70cm On glass 3.7m coax 50W	£29.95	B

MOBILE BASES

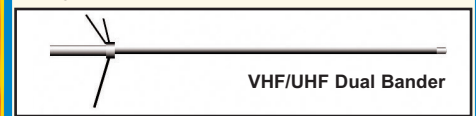
WATSON

WM-14B. Large diameter 14cm magnetic mount SO 239, c/w 5m RG 58 & PL 259

W-3HM	Adjustable hatch mount	£14.95	A
WM-08B	8cm mag mount, 5m cable PL 259	£9.95	A
WM-14B	14cm hvy duty mag mount+cable	£12.95	A
WSM-88V	BNC mag mount plus 3m cable	£14.95	A
W-3CK	5m 5D FB cable assembly+pigtail	£18.95	A
W-ECH	5m standard cable kit assembly	£12.95	A

BASE STATION ANTENNAS

DIAMOND



VHF/UHF Dual Bander

X-50	2m/70cm colinear 6/8dB 2.5m	£54.95	C
X-50N	2m/70cm colinear 6.5/9dB 3.1m	£59.95	C
V-2000	6m/2m/70cm 2.15/6.2/8.4dB 2.5m	£89.95	C

CHECK OUR WEBSITE FOR FULL DIAMOND RANGE

WATSON

W-300. Very popular dualband base antenna. Supplied with u bolts for mast fixing.

W-30	2m/70cm colinear 3/6dB 1.15m long	£39.95	C
W-50	2m/70cm colinear 4.5/7.2dB 1.8m long	£49.95	C
W-300	2m/70cm colinear 6.5/9dB 3.1m long	£64.95	C
W-2000	6m/2m/70cm 2.15/6.2/8.4dBi 2.5m	£69.95	C

WATSON W-25XM PSU NEW — £99.95 B

A compact sized switch mode power supply that will run your base HF station with ease.

*Output Voltage 10 18V DC *Output Current 22A / 25A peak *Over current protected *Rubber Feet *Supply 230V / 115V AC 50/60Hz *Switchable dual voltage input *Size 220 x 180 x 73mm *Weight 1.8kg

WATSON W-25SM PSU — £79.95 B

Very popular budget switch mode power supply. *Output voltage 13.8V DC *Output current of 22A (25A peak) *Front panel output terminals *Over current & voltage protection *Quiet operation

WATSON W-25AM PSU — £89.95 C

DC power supply for the shack & esp. for use with 100W transceivers. Separate voltage and current meters. *Output voltage 0 15V DC *Output current of 25A (30A peak). *3 sets of output terminals *10A cigar socket. *Over current protection

CHECK OUR WEBSITE WWW.WSPLC.COM FOR MORE DETAILS OF THESE PRODUCTS

WATERS & STANTON

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PRICE MATCH

MFJ-269 ANTENNA ANALYSER

Nothing Else Matches It!

1.8 - 170MHz
410 - 470MHz

* VSWR * Impedance
* Resonance * Reactance
* Coax loss * Distance to coax fault and more!

Operates from AA cells (not supplied) it is totally portable. Connect direct to antenna or to coax. Fault-find in seconds, adjust resonance, create your own design and see the results on the LCD screen. It even tells you how far away any coax short or open circuit is!! Solve your antenna problems in minutes rather than hours.

£349.95 C

NRD-545G DSP RECEIVER

NRD-545G
£1395 C

Japanese Engineered

No more plug-in filters to purchase - the NRD-545 offers 10Hz bandwidth steps from 10Hz to 9.999kHz. And with a digital display down to 10Hz, you can be sure your tuning is spot on. DSP offers state of the art filtering. It's built to last and is a typical master-piece of Japanese design. So - are you ready for a new HF listening experience.

* 100kHz - 29.99MHz
* LSB USB CW RTTY AM FM
* 1000 Memories
* Bandwidths 10Hz - 9.9kHz
* Multi-function display
* Variable AGC
* Tuning steps 1Hz to 100kHz
* Variable tuning speeds
* Auto multi-notch control
* Dual noise blankers
* Adjustable scanning
* Peak/hold S-meter
* IF shift tuning
* Coax and wire terminals
* Clock / timer - terminal
* 32 programmable features
* RS-232 Interface
* Tx Mute socket (For tx/rx)
* Dual IF (70MHz - 455kHz)
* Built-in PSU or 12V Ext.

HORIZONTAL BEAMS & DIPOLES

CUSHCRAFT

Premier HF beam used around the world by serious DX'ers.

X-7	20/15/10m 7 el. Yagi 2kW	**£669.95**	D

Not got the space for a full sized HF beam antenna, then the mini beam MA 5B should be considered.

MA-5B	10 12 15 17 20m 4 el. Yagi 2kW	**£369.95**	C
A4-S	10 15 & 20m 4 el. Yagi 2kW	**£569.95**	D
A3-WS	12 & 17m 3 el. Yagi 2kW	**£379.95**	D
D-3	10 15 20m dipole element 2kW	**£249.95**	C

Don't want a wire antenna but can't fit a Yagi, then consider a rotatable dipole.

D-3W	12 17 30m dipole element 2kW	**£249.95**	C
D-4	10 40m dipole element 2kW	**£349.95**	C
D-40	40m dipole element 2kW	**£319.95**	C
TEN-3	10m 3 el. Yagi 2kW	**£229.95**	C
ASL-2010	13.5 32MHz 8 el. log periodic	**£749.95**	C

RADIO WORKS

A choice of quality wire antennas available to fit almost any circum stances.

CW-160	160 10m 76.8m long	**£129.95**	C
CWS-160	160 10m 40.5m long	**£119.95**	C
CW-80	80 10m 40.5m long	**£89.95**	C
CWS-80	80 10m 20.1m long	**£109.95**	C
CW-40	40 10m 20.1m long	**£84.95**	C
CW-20	20 10m 10.36m long	**£89.95**	C
CW-620	20 6m 9.7m (32ft) long	**£89.95**	C
G5RV PLUS	80 10m with balun 31m (102ft) long	**£59.95**	B

YUPITERU MVT-3300 SCANNER £129 B

The MVT-3300EU covers most of the useful bands in the VHF and UHF spectrum. It has 200 memories as standard with a range of band and security channels as well. It has functions normally associated with more expensive sets such as pre-setting the receiving mode and frequency step, Duplex reception with "One Touch" function, Auto-Write and Search-Pass memory functions. There is also a Decipherment function to receive certain scrambled communications.

WATSON FC-130 Freq. Counter £59.95 B

SPECIAL PRICE

The FC 130 is an ideal frequency counter for the shack, mobile or portable use. Supplied complete with Ni Cads, charger and telescopic whip.

WATSON BASE ANTENNAS

Unbeatable Value!

Model	Freq	L(m)	dB	Price
W 30	2/70	1.15	3/6	39.95 B
W 50	2/70	1.8	4.5/7.2	£49.95 C
W 300	2/70	3.1	6.5/9	£64.95 C
W 2000	6/2/70	2.5	2/6/8.4	£69.95 C

These antennas are solidly made of fibreglass, die-cast alloy and stainless steel. Guaranteed lowest prices in the UK.

Totally weatherproof
Pre-tuned & Unbeatable

MFJ-971 QRP Portable ATU £99.95 C

*1.8 - 30MHz *300W/30W/6W selectable *Cross needle meter *12V DC Ext. *SO-239 sockets *Tunes wire, coax, balanced line *Terminals & earth post *Size 160 x 150 x 60mm *Weight 870g

The MFJ-971 is the ideal QRP ATU to have on hand. It incorporates a cross needle SWR meter and displays forward or reflected power and SWR simultaneously.

HUSTLER ZERO SPACE DX ANTENNAS

No Space Needed!

"Ground Level Wonder"

Run full legal power - 80m to 10m
No masts or guys.
Low VSWR 50 Ohm feed.

These HF verticals will take **1kW of power**, work at **ground level**, and are **self-supporting.** A single earth rod will get you going. Add buried radials for even better results. These are **rugged, well-built** antennas that American hams have been using for years. Now they are available in the UK from our three stores.

4BTV
40-20-15-10m. 6.52m high. **£169.95 C**

5BTV
80-40-20-15-10m. 7.64m high. **£199.95 C**

6BTV
80-40-30-20-15-10m. 7.3m. **£229.95 C**

NOTE: 80m coverage limited to 100kHz on 5BTV & 6BTV

YAESU VR-120D £139 B

The VR-120D handheld scanning receiver covers from 100kHz to 1300MHz. AM/FM/WFM modes (inc. preprogrammed broadcast freqs). The VR-120D's small size and tough polycarbonate case allows you to take it anywhere -hiking, skiing or while walking around town. Power is provided by 2 x AA batteries (not supplied). Ni-Cad batteries and charger are available as options.

RIGBLASTER-PLUS

The Adventure Begins!

~~Was £139.95!~~
£119.95
Order as RB/PL/C

New Low Price!! Explore all the new digital modes. All leads provided for computer and radio. Just connect between PC and transceiver. Plugs into 8-pin and RJ-45 radios. Internal jumpers to match your radio. Software on supplied disc for CW, RTTY, PSK-31, SSTV, Packet, AMTOR, DVkeyer, WSJT, Mic EQ, Rig CTL, EchoLink etc. Requires 12V DC

NOMIC Similar to above but no 8-pin front panel socket and no CW keyer function. Self-powered. **£59.95**
Code: RB/NO/CU for 8-pin rigs and for RJ-45 rigs

HEIL QUALITY MICROPHONES


HCL-5/4


GM-4/5


HST-817


PROSET +

Desk Microphones

HCL-5/4	Classic retro look HC 5/4 desk mic	**£199.95**	B

Hand Microphones

GM-4/5	Goldline HC 4/HC 5 hand mic	**£109.95**	B

Headsets & Boom microphones

HST-YM	Traveler single side headset for FT 817	**£79.95**	B
HST-706	Traveler single side headset for IC 706	**£79.95**	B

Headphones & Boom Microphones

PRO-SET-PLUS	Large H/phones with HC 4 & HC 5	**£155.95**	B
PSQP-HC4/HC5	Large H/phones with Quiet Phone	**£189.95**	B
PSQP-IC	Large H/phones with Quiet Phone	**£199.95**	B

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WR-5001 NEARFIELD RECEIVER £79.95 B

30 - 900MHz FM Auto Find Receiver

Auto tunes the spectrum in a second and locks onto the strongest signal. Locks onto local transmissions, emergency services, security, broad cast etc. Also great bug detector! Built in speaker and supplied with antenna, charger and batteries.

MBR-747 LW - VHF World Radio

Last Batch of this famous radio

£79.95

LW, MW, 2.3MHz 22MHz & 87.5MHz 175MHz. AM/FM. Runs from batteries or AC mains. Slide rule dial, LW/MW DF antenna, telescopic whip, large built in speaker, fine tuning dial and headphone socket etc. Ideal for domestic or long distance short wave reception plus VHF monitoring. A lot of radio for the money whilst stocks last.

CHECK OUR 2004 PRODUCT GUIDE FOR MORE DETAILS OF THESE PRODUCTS

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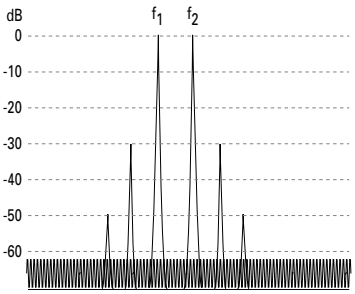
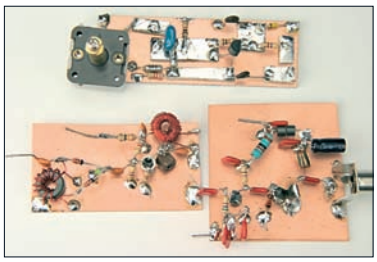
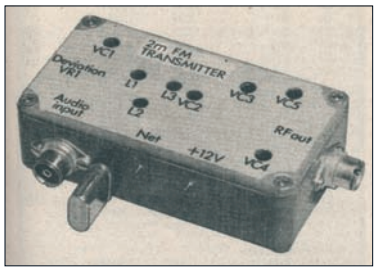
Cover subject

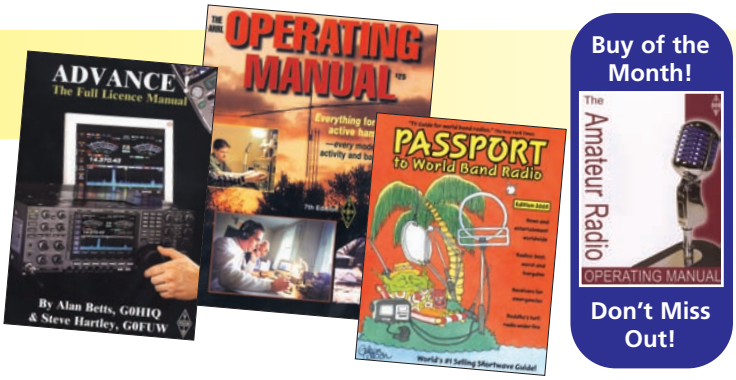
Cover Subject
Our front cover suggests that if you buy a TomTom GPS unit, you don't need a map or compass! Read the review to find out why!
Design: Steve Hunt
Photograph: Tex Swann G1TEX/M3NGS

February features









Page 70. The biggest and best selection of radio related books anywhere!

February **regulars**

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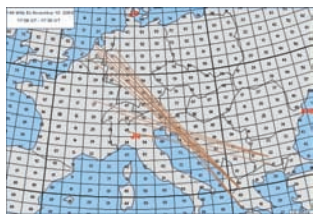

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Unique concept, brilliant execution. Kenwood's compact TS-480HX/480SAT is tailor-made for DX'ing. But its smartly designed standalone LCD control panel — featuring backlit keys to enhance operating ease — is equally at home on your desk, with the main unit up to 4 metres away. And wherever it is, this HF transceiver delivers an astonishing punch: 200W. Performance is equally impressive. For example, a quad-mixer provides RX dynamic range in the TS-950 class, while AF DSP processing offers many powerful features, including noise reduction, a speech processor, and AF filters. And of course you can enjoy all of the convenience of PC-based control. The TS-480HX/480SAT lets you enjoy the best of both worlds.

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ANOTHER PACKED ISSUE

rob mannion's keylines

Welcome to 'Keylines'! Each month Rob introduces topics of interest and comments on current news.

Many readers appear to know of, and have already taken part in the Ofcom Consultation process which is under way for the planning of future spectrum management. However, if you're not aware of the consultation processes adopted by this new agency, please turn to Topical Talk, on page 77. It's vital we make an input!

Tune In Column

Although I personally feel that the h.f. broadcast bands column Tune In has a place in *PW*, this recently re-introduced column will be published for the last time in this month. Obviously, I'm very disappointed in having to announce that we'll no longer be carrying this important column.

Let's face it - many Radio Amateurs started off listening to the h.f. broadcast bands. I still do, and enjoy listening in my shack as I work on the bench.

The decision to remove the Tune In column was taken by my publishers with the view to further concentrating *PW*'s coverage entirely on direct Amateur Radio matters. Fortunately, **Jack Weber** our new columnist who approached writing the column with enthusiasm, is just as keen on writing for us on other subjects and has taken the decision in his stride. Thank you Jack.

In bringing the news of the loss of what I consider to be a traditional part of *PW*, I can at least promise you an increase in editorial coverage of other subjects you especially enjoy. Fortunately, we've recently had a very noticeable upsurge in the number of practical constructional articles (both for equipment and antenna-related subjects) arriving here. Please keep them coming (you can request an *Author's Guide* at anytime) and we'll ensure that *PW*'s pages reflect what you want to see in the magazine.

Radio Basics

Radio Basics has been held over this month. There's no problem though, it's only delayed because we've received some excellent feed back from readers for the special feature on obtaining junk. So many of you have been keen to add your comments, notify us of the local junk shop, etc., that more space is required for the article.

Please keep the information flowing in. It's obvious that readers are as committed as I am that radio enthusiasts keen on the practical side of the hobby can get the vital components and hardware needed.

Mayo Rally 2004

During a short holiday in Ireland in November, after an eventful ferry crossing, I drove from Rosslare, via Waterford, to the **Mayo Radio Experimenter's Network** (MREN) rally, held in Knock, County Mayo on Sunday 21st of November.

The increasingly successful rally drew visitors from all over Ireland and beyond. We even had the company of **RSGB President Jeff Smith MI0AEX** and his charming wife **Jane** from Bangor, County Down in Northern Ireland.

Fig. 1: Paul Norris EI3ENB accepts the 2004 EI/GI trophy from Rob EI5IW/G3XFD at the SEARG meeting in Waterford. (Photo courtesy Mark Wall EI7IS).

A highlight for me was the special dinner on the Saturday evening where I was the guest of MREN for a splendid meal. Thank you everyone, it was very enjoyable indeed!

I also enjoyed meeting and chatting with readers, and I'm looking forward to the 2005 event!

Incidentally, **if you paid for a subscription at the MREN rally** and haven't received the January 2005 *PW* copy by the time you read this, please contact me. This is because I've mislaid some paperwork (it was that busy!). I'll sort out the problem as soon as I hear from you.

South Eastern Amateur Radio Group

Finally, I must mention my eventful trip to visit the **South Eastern Amateur Radio Group** in Waterford (SEARG) on Thursday 18th November.

It's risky arranging a club visit with ferry delays likely in the November weather. But despite gale force winds, strong tides and heavy swell delaying Irish Ferries MV *Isle of Inishmore*, I arrived safely at 9.35, rather than the planned 7pm.

Thanks to the patiently waiting members, the meeting was a superb get-together and the food excellent. It was a shame I wasn't up to staying on in the bar after midnight, but I'd been travelling since 5am on Thursday!

During the meeting, after I presented the *PW* 144MHz QRP Contest EI/GI Trophy Clock to **Paul Norris EI3ENB** (congratulations again Paul!), **Fig. 1**, it was my turn and I was presented with a pair of Waterford Crystal Candlesticks by **Mark Wall EI7IS**, on behalf of the group. They were a delightful gift!

I never cease to be amazed at the welcoming hand of friendship extended as a reflection of the bond we share through *PW*. Amateur Radio is a great hobby with wonderful people isn't it? Cheerio for now.

Rob G3XFD

practical wireless services

Just some of the services *Practical Wireless* offers to readers...

Subscriptions

Subscriptions are available at £32 per annum to UK addresses, £40 Europe Airmail and £49 RoW Airmail. Joint subscriptions to both *Practical Wireless* and *Short Wave Magazine* are available at £61 (UK) £75 Europe Airmail and £92 RoW Airmail.

Components For *PW* Projects

In general all components used in constructing *PW* projects are available from a variety of component suppliers. Where special, or difficult to obtain, components are specified, a supplier will be quoted in the article.

Photocopies & Back Issues

We have a selection of back issues, covering the past three years of *PW*. If you are looking for an article or review that you missed first time around, we can help. If we don't have the whole issue we can always supply a photocopy of the article. See page 72 for details.

Placing An Order

Orders for back numbers, binders and items from our Book Store should be sent to: **PW Publishing Ltd., Post Sales Department, Arrowsmith Court, Station Approach, Broadstone Dorset BH18 8PW**, with details of your credit card or a cheque or postal order payable to PW Publishing Ltd. Cheques with overseas orders must be drawn on a London Clearing Bank and in Sterling. Credit card orders (Access, Mastercard, Eurocard, AMEX or Visa) are also welcome by telephone to Broadstone **0870 224 7830**. An answering machine will accept your order out of office hours and during busy periods in the office. You can also FAX an order, giving full details to Broadstone **0870 224 7850**. The E-mail address is **clive@pwpublishing.ltd.uk**

Technical Help

We regret that due to Editorial time scales, replies to technical queries cannot be given over the telephone. Any technical queries by E-mail are very unlikely to receive immediate attention either. So, if you require help with problems relating to topics covered by *PW*, then please write to the Editorial Offices, we will do our best to help and reply by mail.

amateur radio waves

Make your own 'waves' by writing into *PW* with your comments, ideas, opinions and general 'feedback'.

The Star Letter will receive a voucher worth £20 to spend on items from our Book or other services offered by *Practical Wireless*.

Blueprint Bonanza

● **Dear Sir**

May I start by saying the article in the December 2004 issue 'Blueprint Bonanza' was excellent, but I do think you were a little harsh on the Talisman 2. I am not a great fan of old radios, but my Talisman 2 is still working so it cannot be that bad!

I think that the resistors are blocks of Ebonite, which are then filed down to get to the required resistance. And although I am not sure that they are Ebonite, I can safely say that I find it a lot easier to read off the colour bands on modern resistors than file away until you hit the required resistance! I suppose the avid home-brewers of the 1930s started with the thickest blocks of resistive material, just in case they filed away too much. The fixed capacitors look as though each one was hand-made and are still quite close to specified values.

The variable coupling for the regeneration is the nicest implementation I've ever seen and would still take some beating today. Many thanks for a great magazine.

Richard Ackroyd
Bicester
Oxfordshire

Editor's reply: I'm very pleased you enjoyed the article Richard and other readers have also expressed their own pleasure on reading the feature. Having re-read the article, I came to the point where I clearly stated I wasn't criticising the Talisman Two even from a 2004 viewpoint. However, if I had a remarkable, working 'old timer' myself, perhaps I would leap to its defence when someone offered anything other than glowing praise!

The second article on blueprints has been held over until later in the year (please see Keylines editorial). Incidentally, Tex G1TEX tells me that the resistors were probably a carbon material made to be filed to create specific resistance, rather than Ebonite, which was used as an insulator.

High Impedance Headphones

● **Dear Sir**

Following up on the subject of high impedance headphones, a subject often discussed in *PW*, I recently purchased from Mouser a couple of Kobitone earphones with 1kΩ impedance, making 2kΩ of course if they are wired in series. Although not as sensitive as the old style earphones, they are adequate for crystal set work and other, simple style valve circuits, etc.

I've not found a supplier for the headphones in the UK, although Mouser - **http://www.mouser.com** - are Texas based they have a good world-wide shipping service and their catalogue (on-line, but also sent via mail) is as thick as a telephone directory! They have no minimum order value, but shipping is $12 so it's worth building a reasonable sized order to make the shipping worthwhile.

One word of caution though, if the order value is over £18 then UK customs charges come into play and the Royal Mail service adds a fiver for collecting the customs fee! The current $/£ situation at $1.94 to the £ as I write makes buying direct from the USA worthwhile at the moment, bearing in mind those additional charges.

Mike GM0OXS
Fenwick
Ayrshire
Scotland

Editor's comments: Thanks for the information Mike. Does anyone know of other manufacturers who produces high impedance headphones? I'm sure that somewhere in Taiwan (for example) there's someone capable of producing just what we need. Please contact me at the Editorial offices if you know of other sources - perhaps we'll even be able to avoid the clutches of HM Customs & Excise and their Post Office extra-tax-collectors if we find a source within the newly-extended European Union!

One Off PCBs

● **Dear Sir**

Being an avid constructor often designing 'one off' printed circuit boards, *PW* is the first institution I thought of to inform about supply difficulties of printed circuit board (p.c.b.) material. I use several suppliers, but it's now getting very difficult to obtain transfers to produce neat p.c.b.s.

Electrovalue have ceased to stock all types of rub-on transfers, but it wasn't because they wanted to stop. Instead it's simply because the transfers are no longer manufactured. Maplin stopped stocking them several years ago. This just leaves RS components who are now only stocking certain types of etch resist transfers - at a premium price. Additionally, all types of track tape have been withdrawn from stock.

I can't comment on other suppliers because I don't wish to open further accounts. However, I would love to do all my design by using a Computer Aided Design (CAD) system as it would certainly be much simpler. But this is a high price to pay for one-off projects.

Can you please make a note in the earliest issue of *PW* of the difficulties of supply, as I feel like minded readers need to know what is happening in the p.c.b. world.

Geoff Sims G4GNQ
Glossop
Derbyshire

Editor's comment: Can anyone point Geoff towards a new source of p.c.b. transfers? If readers can help, we would be pleased to publish the suggestions because such manufacturers need us as much as we need them. So, let's be hearing from you!

English Heritage & Radio

● **Dear Sir**

I'm writing with reference to **Stan Brown G4LU's** letter (Star Letter, December 2004 *PW*) regarding English

Gordon G4VFV's 'Scope Series

Dear Sir
I had a welcome arrival yesterday, the January issue of *PW*. I must comment on Gordon King G4VFV's oscilloscope series, I know it's only the first part, but the article made easy and informative reading. I have no doubt that the following articles will be up to the same standard. (I'm always getting my X and Y axis mixed up!).

I wonder if you had given any thought to publishing the whole series in one booklet in the future? I get the feeling it could be a quite useful addition to the workshop bookshelf. Or is there any possibility that *PW* could have a website where this sort of thing could be made available? I'm no businessman and quite possibly it's not feasible, but I throw it to you as a brain storming exercise!

On another point, the January 2005 issue of *PW* carried a letter from **Mark Tuttle G0TMT**, which extols the virtues and recommends the Atlas Component Analyser. I thoroughly endorse his comments. Can I also point out that available from the same sources, and manufactured by the same company, is an 'L,C & R Passive Component Analyser', which apart from dealing with resistance and capacitance, will measure inductance from 1µ up to 10H.

I've no need to mention that building a bridge to measure the above is no great problem, it's the calibration where one meets problems, especially with inductance. This little unit solves all the problems in one shot.

All the best and don't run out of puff! Speaking of puff, I'm reminded of steam...has the Editor got that cowcatcher fitted to his car yet?
Dave Williams G4BII
Bicester
Oxfordshire

Editor's comments: Gordon G4VFV and Tex G1TEX/M3NGS (who prepares the drawings and graphics) have both worked very hard to produce the series Dave, and we're all delighted that readers are already enjoying the articles. Eventually I hope we will produce the series in a small booklet, perhaps with another appropriate subject. I'll keep readers informed on the progress of the idea. The Peak Components analysers have attracted the attention of many readers and we've received a number of favourable comments. As I write this piece, my own set of analysers have just arrived in the newly operational G3XFD workshop and I think they're superb. A review - written by the Rev. George Dobbs G3RJV - featuring these extremely useful units is to appear in the March issue of *PW*. Finally, the answer's no - Toyota don't make cowcatchers for the Yaris Verso, even for eccentrics who imagine they are driving trains!

Oscilloscope Information Sheet

Dear Sir
I haven't received the oscilloscope information sheet as mentioned in August 2004 issue. I requested this, with s.a.e., at the same as I ordered a copy of Fred Judd G2BCX's articles and these have been received. If you are still preparing this material, please accept my apologies for badgering you.
Ron Blacker
Sleaford
Lincolnshire

Editor's apologies: You've been VERY patient Ron! Apologies to you and other readers who are still waiting. We hope to get the information out to you as soon as possible. In the meantime does anyone know how we can get a 36-hour day to help?

Heritage's lack of interest in the preservation of various radio sites. As he was apparently a senior BT Manager, why did he not do something himself? In fact, BT has, through its 'Connected Earth' project supported ten museums in the history of communications.

Most transmitting site buildings seem to have little to offer by way of 'Architecture' and are situated in the middle of a large field (15-40 thousand £ per acre). The masts, while of interest to a few (me included), must be both expensive to maintain and insure. They are hardly the domain of 'amateurs' and probably beyond the physical capabilities of more than just a few of the retired professionals.

The probable reason for the masts' hasty demise as soon as they become redundant is simply the economics and the damage an unplanned falling mast could do. I hate to be so negative, but even the Americans lay their old Saturn 5's down! Perhaps the preservation of a section of mast may be possible. The site would become a usable area and part of the remaining buildings used as a museum. The rest could then be developed.

The former GWR railway works at Swindon spring to mind as an example of an industrial site rescued with its buildings sympathetically refurbished. Yes, they've been converted into a shopping centre, retaining some of the plant inside, but a large building is given over to a museum of the GWR.

If we all rely on 'them' to do anything then we mustn't moan too much when they fail in our wishes. The old saying of "if you want anything done then do it yourself" comes to mind.

All museums are crying out for volunteers, far too many people fall into the; "I'm bored...entertain me" category. I manage one or two days a week with the old exchanges and 'phone boxes at the Avoncroft Museum ***See note**, so I can honestly say I am not bored, in fact, I don't know how I ever found time to go to work.
Gus Malcolm G8DEC
Bromsgrove
Worcestershire

***Note: See the article Crystal Sets - A Good Place to Start, written by Gus G8DEC and published in the August 2004 issue of *PW*. It features the Avoncroft Museum and his work at the site. Editor.**

Antenna Tuners For VHF/UHF?

Dear Sir
I have been following the articles on bits from the past, for no other reason than pure nostalgia! But there's something that seems to have been ignored, down the years, on the v.h.f. and u.h.f. side. I refer to the fact that I cannot recall any articles on Antenna Tuners for 144 and 430MHz.

Twenty or 30 years ago, one of the radio magazines came up with a tuner for 144MHz (I can't recall which magazine) and I built it. It

has proved most useful when used with a beam covering 144-146MHz. Perhaps you might persuade one of your authors to consider some data for 144 and 430MHz antenna tuners?
Richard Walker G4PRI
Uxbridge
Middlesex

Editor's comments: Tex Swan G1TEX/M3NGS has collected and shown several ideas in *PW* in the past Richard. He's had quite a bit of experience along the lines you've suggested and we hope to look at the subject again soon.

Simple Valve Circuits

● **Dear Sir**
Recent articles in *PW* about simple valve circuits remind me of one I came across whilst training as an Air Radar Mechanic at RAF Yatesbury, in 1947/48. This was contained in a wooden box, approximately 6 x 6in and the tuning coil and frame antenna consisted of about 12 turns of 26s.w.g. double cotton covered copper wire wound round the outside of the box, which covered the medium wave.

The reaction winding had fewer turns and was wound about a quarter of an inch away from the tuned winding. Tuning was by a 500pF variable capacitor, while the reaction used a 300pF variable capacitor which were mounted on the wooden front panel. The circuit required one DL35 output valve with a 1.4V direct heater, taking 0.1A current.

Power was supplied by one D-type cell and a 9V grid bias battery for the high tension. The box was constructed so that the latter battery was a neat fit inside the box. Reception could be improved by connecting about 6 feet of wire to the tuned winding. Unfortunately, the circuit has become lost over the years. I wonder if anyone remembers it and still has a copy of the circuit?
John Haliburton
GM4AQO
Burntisland
Fife

Editor: It's over to you readers!

Information From Ofcom

● **Dear Sir**
I read the Editor's comments (Stop Press, page 14 January 2005 issue) concerning the lack of information from Ofcom, regarding the band extension in the UK on 7MHz.

I had notice of the procedures via E-mail. As I joined the BT-Yahoo group to receive Ofcom updated details as and when they E-mail me.

I suggest everybody joins this group as information is at first hand, I do not think Ofcom had made any mistakes. I'm not siding with them, but I did receive the information, whereas it seems that a lot of official representatives had to dig deep into the website to look for the notice. I've had no troubles at all regarding this. I join every essential mailing list, so I don't miss all the important issues to hand.

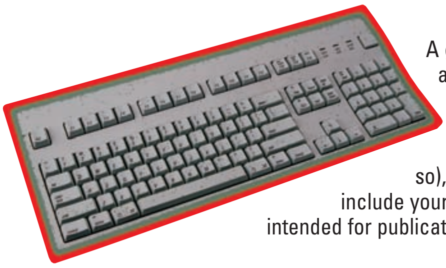
I'm an M3, but have been an s.w.l. for 53 years and have built my own radios, etc., and find even now great interest in all aspects of Amateur Radio. Antennas are my favourites and the working out of their formulas, the EH antenna intrigues me, due to its small size, but I still say home grown is best. Happy Christmas to all the staff and a great new year!

PS: Does anyone know how I can get a digital display for the Kenwood TS-520SE?
Jim Strawbridge
M3WNZ
Kingsbridge
Devon

Editor's Note: Please see Topical Talk on page 77 for further news regarding Ofcom.

● Keep your letters coming to fill *PW*'s postbag

Letters Received Via E-mail



A great deal of correspondence intended for 'letters' now arrives via E-mail, and although there's no problem in general, many correspondents are forgetting to provide their postal address. I have to remind readers that although we will not publish a full postal address (unless we are asked to do so), we require it if the letter is to be considered. So, please include your full postal address and callsign with your E-Mail. All letters intended for publication must be clearly marked 'For Publication'. **Editor**

amateur radio rallies

Radio rallies are held throughout the UK. They're hard work to organise so visit one soon and support your clubs and organisations.

2005

February 6
South Essex Amateur Radio Society's Canvey Island Radio Rally
Contact: **Brian G7IIO**
Tel: **(01268) 756331**
Website: **www.southessexars.btinternet.co.uk**

February 13
Harwell & Computing Rally
Contact: **Ann**
Tel: **(01235) 816379**
Website: **www.hamradio.harwell.com**
The rally takes place from 1030 till 1530 at the Didcot Leisure Centre, Didcot, Oxfordshire (come off A34 at Milton Interchange midway between Oxford and Newbury). Talk-in on S22, Bring & Buy, junk stalls, trade stands, craft stalls, special interest groups, home-made refreshments, bar, full disabled visitors and good free parking. Admission £1.50 (children under 12 free).

March 13
The Wythall Radio Club's 20th Annual Radio & Computer Rally
Contact: **Chris G0EYO**
Tel: **(07710) 412819**
E-mail: **g0eyo@blueyonder.co.uk**
The 20th Annual Radio & Computer Rally is to be held at the Woodrush Sports Centre, Shawhurst Lane, Hollywood, near Wythall, Birmingham. Book early as this is a popular rally.

March 20
The Cambridge & District Amateur Radio Club's Rally
Contact: **John Bonner G0GKP**
Tel: **(01954) 200072**
E-mail: **j.bonner@ntlworld.com**
The rally is to be held at Britten Arena, Wood Green Animal Shelter, King's Bush Farm, London Road, Godmanchester. Doors open at 1000 and entrance fee is just £2 (concessions for OAP/disabled, children free). There will be free parking for up to 2000 cars, along with a bar and restaurant on site. There will also be a Bring & Buy and a Talk-in on S22.

April 3
The Northern Mobile Rally (Harrogate Rally)
Contact: **Gerald Brady G0UFI**
Tel: **(07734) 478080**
Website: **www.harrogaterally.co.uk**
To be held at the Harrogate Ladies College, Clarence Drive, Harrogate, North Yorkshire. There will be all the usual facilities plus a Bring & Buy, catering and transport for any disabled visitors, etc.

April 10
The Yeovil ARC's 21st QRP Convention
E-mail: **george@mudford.fsnet.co.uk**
The Yeovil ARC have booked the Digby Hall, Sherbourne for their 21st QRP Convention, the popular get together of QRPers from the South and West of England. Doors open at 1000 and car parking is free in the town centre car parks, which adjoin the hall. Follow the black and white Town Centre signs, off the A30 Yeovil to Salisbury Road. There will be two talks in the morning and another after visitors have enjoyed the excellent food available and browsed the many trade stands. Also, the Construction Challenge will be adjudicated and certificates will be presented to winners of the QRP Convention CW Funrun, which takes place prior to the Convention on the evenings 14-18th March, 1900-2100. (Rules available from G3ICO).

May 2
The 21st Dartmoor Radio Rally
Contact: **Ron G7LLG**
Tel: **(01822) 852586**
To be held at Tavistock College, Tavistock, Devon. This is the same location as last year, with plenty of space for traders to display their wares and for visitors to see them and talk to old friends. There is access for disabled visitors, but due to extensive building work, there will be no dedicated disabled parking. However, there is adequate car parking around the college site. There will be trade stands, a Bring & Buy and refreshments, etc. Doors open 1030 (1015 for disabled visitors), Talk-in on S22. Come and visit beautiful Dartmoor, ideal for picnics, so why not bring the family along?

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

amateur radio news

A comprehensive look at what's new in our hobby this month.

NEW PRODUCT

Comet High Power Current Baluns

Nevada are pleased to announce the release of three new 1:1 ratio 50Ω current baluns from Japanese manufacturer Comet.

The baluns from Comet distributor, Nevada, stop radiation from the outer of the coaxial cables feeding matched antenna systems, such as dipoles and beams and are suitable for frequencies from 1.3-500MHz. They are constructed with an SO-239 socket on each end, for easy connection to a 50Ω coaxial cable. The baluns are available in three power ratings: TF-400 (400W), TF-1800 (1.8kW) and TF-4000 (4kW) and prices start from £59.

Nevada
Unit 1, Fitzherbert Spur,
Farlington,
Portsmouth PO6 1TT
Tel: (02392) 313095
FAX: (02392) 313091
Website: www.nevada.co.uk

CLUB NEWS

January Foundation Course

The Lothians Radio Society in Scotland have news of a foundation licence course to be run in January.

The **Lothians Radio Society** will by holding a Foundation Licence Course commencing the 29 January. The course will be held over two weekends and anyone interested in attending should contact the Lothians Radio Society Secretary **Toby Sigouin MM0TSS** on **(07739) 742367** or **tobysigouin@onetel.com** for further details.

Lothians Radio Society recently held a Foundation Course attended by three participants. Congratulations to **John McCaig**, **Kelly Tait** and **Wim Ton** on successfully completing the course and written exam. Two candidates scored full marks in the exam whilst the other dropped only one point. Course tutors **Peter Dick GM4DTH** and **Norman Stewart GM1CNH** also deserve many thanks for their great efforts in assisting the students to achieve this excellent result.

AMATEUR RADIO COURSES

Essex Foundation Courses

Keen to get your M3 licence? Below is a list of clubs running courses in Essex to start you off in the right direction!

Chelmsford Amateur Radio Society run Foundation, Intermediate and Advanced courses. Contact: **Clive Ward M0SIX** on **(01245) 224577**, Mobile: **(07860) 418835**, E-mail: **training2005@g0mwt.org.uk** or visit **www.g0mwt.org.uk** for more information

Colchester Radio Amateurs run Foundation and Intermediate courses. Contact: **Frank Howe G3FIJ** on **(01206) 851189**, E-mail: **james@mcginty.net** or visit their website at **www.g3co.ccom.co.uk**

Havering & District Amateur Radio Club are also running Intermediate courses. Contact: **Oliver Tillet G3TPJ** on **(01708) 746677**, E-mail: **g4hrc@haveringradioclub.co.uk** or **www.haveringradioclub.co.uk**

Harlow & District Amateur Radio Society run Foundation and Intermediate courses. Contact: **Len Brackstone G7UFF** on **(01279) 864973**, Mobile: **(07931) 207184**, E-mail: **g6ut@qsl.net** or visit **www.qsl.net/g6ut**

Loughton & Epping Forest run Foundation courses. Contact: **Marc Litchman G0TOC** on **0208-502 1645**, Mobile: **(07743) 456058**, E-mail: **info@lefars.org.uk** or **www.lefars.org.uk**

NEW TEAM MEMBER

Icom's New Addition!

Icom welcome Annabel Clarke to Icom's marketing department.

Icom (UK) has made a new addition to their marketing department. **Annabel Clarke** joins the department as Marketing Assistant. Annabel's role will be to support Marketing Manager **Ian Lockyer**, in promoting the company's wide portfolio of communications technology products.

Annabel has spent the past two years working in the Customer Services department at commercial refrigeration company, Blighline Ltd. In this position she was responsible for client liaison, database management and general administration. She is also a recent Business and Marketing graduate from Christchurch College, Canterbury.

Icom (UK) Ltd.,
Sea Street,
Herne Bay,
Kent
CT6 8LD
Tel: (01227) 741741
FAX: (01227) 741742
Website: www.icomuk.co.uk

CONGRATULATIONS

Happy 30th Birthday!

The Essex Repeater Group will celebrate its 30th birthday on 10 January 2005. So, Happy Birthday from PW!

The **Essex Repeater Group** (ERG) maintains repeaters and beacons in Essex:- GB3DA (2m), GB3ER (70cm), GB3DB (6m), GB3ZP (23cm) and GB3CMS (10GHz) and are located on Danbury and Rettendon hills. The ERG has over 50 members.

On 10 January 2005, they will celebrate their 30th anniversary of the Group's founding, when it grew out of Chelmsford Radio Society in 1975, and with whom it continues to maintain a close relationship. The picture shows the new 2004/5 committee, which was elected on 21 October at a very popular AGM, which included free refreshments and a raffle.

Backrow (standing left to right): **Jim Batchelor M1GUS**, **Keith Wainwright G1NHW**, **Trevor Downey M0TDA**, **Alan Radley G0TTM**, **Simon Wilton G7HCD**, **Anthony Martin M1FDE**, **Bob Cheverall M0DTA**. Front Row (seated left to right): Treasurer **Clive Ward G1EUC**, Chairman **Mike Wheaton G4ZPE**, Secretary **Murray Niman G6JYB** (the smart one in the suit and tie!).

The Essex Repeater Group will welcome members and visitors to its stand at its next major event - Canvey Rally on Sunday 6 February. More details about the Group can be found on their website, visit **www.essexrepeatergroup.org.uk/**

NEW UNIT

Palstar's High Performance Pre-Amplifier

Nevada are pleased to introduce their new Palstar WM550 pre-amplifier manufactured in the USA.

The WM550 pre-amplifier from **Nevada** is aimed at the medium wave or 160m LF DXer. It has a vernier driven pre-selector and variable selectivity control to pull out the weakest of medium wave DX broadcast stations or 160m DX stations and is suitable for use with a wide range of antennas from long wires to beverages.

A built-in broadband pre-amplifier enables the unit to be used up to 30MHz as a general pre-amp. The full specifications are as follows:

* High performance pre-selector for medium wave & 160m
* Pre-selector range: 510kHz to 2.5MHz
* Covers a.m. broadcast and 160m reception
* Broadband Pre-amp to 30MHz, for short wave reception
* Vastly improves reception for medium wave DXing
* Suitable for all types of antenna
* Special input socket for beverage antennas
* Variable selectivity control (down to 4kHz bandwidth for broadcast)

Continued on page14

* Switchable 'low noise' pre-amp to 30MHz
* Switcheable 15dB attenuator
* Bypass switch
* Vernier tuning for 'super smooth' action
* Designed for the R30 receiver, but may be used with any RX (with 12V supply)
* Size 8.25in (w) x 4.24in (h) x 9in (d)

Priced at £225 plus £8 P&P contact Nevada below for more information.

Nevada
Unit 1, Fitzherbert Spur,
Farlington,
Portsmouth PO6 1TT
Tel: (02392) 313095
FAX: (02392) 313091
Website: www.nevada.co.uk

READING SERVICE

Reading Rattle

The 'Reading Rattle' is now available to more listeners.

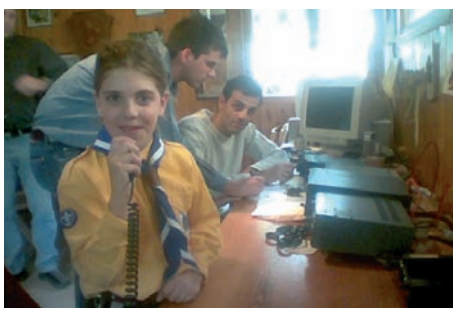
Richard Neale-Gardner M1EYA, the tapes manager of the RAIBC, has kindly offered to duplicate cassettes for the reading service called the 'Reading Rattle'. If anyone who is eligible because they have a visual handicap and who wishes to receive *PW*, *SWM*, *RadCom* read onto C-90 cassettes, please send a good quality type 1 cassette to Richard at QTHR in an RNIB wallet, with your return address.

GREEK RADIO

JOTA in Athens

On-activities at JOTA with members of the Greek Radio Club.

The *PW* Newsdesk has recently heard from **Panos Dadis SV1GRN** (a very keen *PW* supporter) who has sent some pictures that were taken from JOTA in Athens. As you can see, the Scouts were enjoying on-air activities with members of the Greek Radio Club.



AMATEUR SATELLITES

Ralphie and Sparkie launched!

Ralphie and Sparkie, a pair of satellites from the University of New Mexico are presently scheduled to launch as part of the Boeing Delta 4 Heavy Lift Launch demonstration for the USAF from Cape Canaveral.

Satellite launch 'Ralphie and Sparkie' was scheduled for 1931 on 10 December 2004. The two satellites will be ejected while the Delta 4 coasts in a parking orbit approximately 100x135 nautical miles high with a 28° inclination. The satellites will conduct a technical investigation to demonstrate packet radio for inter-satellite links using a frequency of 437.5MHz. Due to the low orbit it is anticipated that re-entry will occur within one to two weeks.

The AMSAT-UK Group publishes a bi-monthly newsletter packed with the latest Amateur Satellite news. For more information contact **Jim Heck G3WGM** on **(01258) 453959**, E-mail: **g3wgm@amsat.org** or visit **www.uk.amsat.org**

RUSSIAN RELIEF

Recycle your old 'phones

Do you have any old mobile 'phones or laser ink jet printer cartridges cluttering up your cupboards? If so, now's your chance to put it to good use.

Howard Ketley G4BAS has contacted the Newsdesk with a plea for old mobile 'phones and chargers, PDAs and expired SIM cards to be donated to the Russian Relief charity to help less fortunate children. Howard is the UK co-ordinator for the Russian Relief Charity, which is connected to the Club of Friendship between UK and Russian Radio Amateurs.

Once donated the 'phones can often be used by ambulance crews and doctors in remote areas or for emergency use by people in danger. Used laser and ink jet printer cartridges can also be recycled to help children in orphanages and hospitals.

If you would like to donate items to Russian Relief please send them direct to:
Russian Relief,
E Palusinksi,
105 Bridget Street,
Rugby CV21 2BX

TUNING IN

Help Fund for Blind

The winners of this year's Transmission 2004 fund raising weekend in aid of the British Wireless for the Blind Fund (BWBF) have been announced.

Prizes were awarded for groups and individuals who raised the most money for the charity or made the most contacts. The **Poldhu Amateur Radio Club** in Cornwall was awarded the trophy in the most money raised by a club category, netting an impressive £1304.

Meanwhile, the prize for making the greatest number of contacts went to the Cray Valley Society in Kent. Spending 43 hours on-air they made a staggering 3000 contacts in more than 100 different countries.

The individual who raised the most funds for the BWBF was **Daren Loxle**y, from Sheffield, and the individual making the most QSOs was **Bob Palmer**, from Kempston, Bedfordshire. Prizes were presented by chief executive of the BWBF, **Margaret Grainger** and the Radio Society of Great Britain's (RSGB) president **Jeff Smith MI0AEX** at this year's RSGB HF & IOTA Convention 200 at Gatwick Hotel in West Sussex.

Through a network of over 300 voluntary agents, the BWBF issues specially adapted audio equipment on free permanent loan to blind and partially sighted people in need across the UK. They are repaired or replaced by the Fund when necessary. Sets are also available to buy through the Fund's commercial wing. To find out more, or to support their work, visit **www.blind.org** or call **(01634) 832501**.

CLUB WEBSITE

Out Of Service

The Trowbridge & District Amateur Radio Club's website is currently out of service, pending a switch to a new webmaster and ISP.

As the website of the Trowbridge & DARC is currently out of service, anyone wishing to know more details about the club, activities and training courses, should contact **Ian Carter G0GRI** on **(01225) 864698** evenings and weekend or by E-mail: **tdarc@btinternet.com** or in writing to QTHR.

AIR TATTOO 2005

MiG-nificent Start for Air Tattoo 2005

Legendary Soviet aircraft from the Cold War era are set to be among the star attractions at the Royal International Air Tattoo at RAF Fairford in Gloucestershire on 16 and 17 July 2005.

The Romanian Air Force has agreed to send four MiG-21 'LanceR' aircraft to the world's largest military airshow and organisers are quietly confident of other Eastern and Central European participation. The MiG-21 is one of the most famous Soviet Cold War fighter aircraft and the four from the Romanian Air Force will be in the UK next summer to conduct a joint exercise with 617 Squadron, the Dambusters, at RAF Lossiemouth.

The Tattoo was the first airshow to feature aircraft from former Eastern Bloc countries following the fall of the Berlin Wall in 1989. The historic appearance of a Russian TU-95 'Bear' at the Tattoo in 1993 paved the way for a number of rarely-seen Eastern European aircraft appearing in the West.

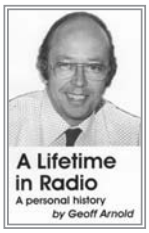
The Romanian MiG-21 is among a number of special aircraft the Tattoo hopes to showcase next year. Others include the ever-popular F-117A stealth fighter and the B-2 stealth bomber from the US Air Force plus the latest fast jets Europe has to offer. They also hope approval will be given for a number of Unmanned Aerial Vehicles (UAVs) to make an appearance.

Tattoo Director **Tim Prince** said he is constantly bombarded by enthusiasts calling for aircraft from Central and Eastern Europe to appear at the Tattoo and he was pleased to be in a position to announce the Romanians' participation. "For many years these aircraft had been firmly hidden behind the Iron Curtain and it has only been during the past decade or so that we have been privileged to view them. The Tattoo has enjoyed close relations with the Romanian Air Force for a number of years and in 2001 we helped develop their airshow at Mihail Kogalniceanu airfield into a truly international event. We are delighted that they are able to come here and display".

A Lifetime in Radio - A Personal History

By Geoff Arnold G3GSR

Book Review



Rob Mannion G3XFD has thoroughly enjoyed reading an interesting personal history of Geoff Arnold G3GSR. Geoff was the Editor of PW until 1989 when Rob took over, but there's much more to Geoff than journalism!

I'm very pleased to count **Geoff Arnold G3GSR**, *PW*'s former Editor and his wife **Barbara** as good friends, and since I took over his Editor's chair in 1989 we've kept in contact. So, I was delighted when a copy of his newly-published personal history arrived on my desk. It makes fascinating reading!

Occasionally I discover something about a friend that's remarkable, and in the case of Geoff G3GSR on reading the book I've just found out that he was born on 25 April, Marconi's birthday! If that wasn't a portent of young Geoff's future...what other inducement into radio could there be?

The 98-page A5-sized book is packed with a personal history which also records a lost era - the time of the dedicated seagoing Merchant Navy Radio Officer. And, writing from the perspective of someone who spent most of his youth in and around the internationally famous seaport of Southampton, Geoff's own story aroused many of my own memories. In my opinion the book is worth reading just for the marine adventures, but in addition there are sections on Geoff's time with *PW* and his own magazine *Radio Bygones*. Geoff also records the seemingly lightning-like speedy jump in technology as the production of *PW* sped onwards from the early pioneering Amstrad PCW computer (which I loathed!) to the truly superb Apple Macintosh machines we rely on today.

It's not often that anyone can pay a worthwhile tribute to the efforts of a former magazine Editor as our work can be difficult to quantify. However, in a way, by recording his own input to the world of radio, Amateur Radio and publishing, Geoff has done it himself. And in my opinion he's done it in an interesting and readable fashion as I found it totally absorbing. It comes highly recommended as there's something of interest for everyone within its 98 pages; from Geoff's work on battered old colliers to ocean liners, and onwards to Amateur Radio and Publishing. I hope you enjoy your copy as much as I did mine.

The book costs £4.95 inc. P&P (UK) and is available from: Wimborne Publishing, 408 Wimborne Road East Ferndown, Dorset BH22 9ND, Tel: (01202) 873872, FAX: (01202) 874562.

OOPS

Errors and Updates

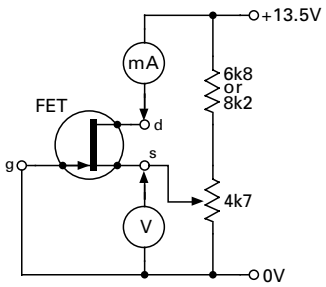
The gremlins have crept in again in the Doing By Design article by Tony Nailer G4CFY pages 31-33 January 2005 PW. The drawing shown here replaces the one last month.

On page 31, column 1, towards the bottom the "…change in gate-to-source voltage …" should of course be: I_d/V_{gs}. And the table in the middle of the page, the column headings should from left to right read **Sil J304**, **Ph BF256a**, **Mot BF256a**, **Sil MPF102**, **Ti/Sil 2N3819**. The parameters were taken from bulk testing units from various manufacturers. In particular these tests drew attention to the Phillips & Motorola BF256a, where the I_{dss} and V_{pgs} ranges tested do not even overlap and are therefore sufficiently different to warrant being given different part numbers.

My apologies to Tony Nailer and readers for these errors.

Editor.

WST2577

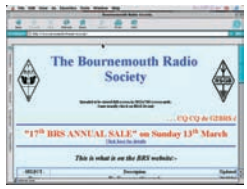


amateur radio clubs

Keep up-to-date with your local club's activities and meet new friends by joining in!

DORSET
South Dorset Radio Society
Contact: Carol Hodges 2E1RBH
Tel: (01305) 820400
Members meet every second Tuesday of the Month at Chickerell Church Hall, Chickerell, Weymouth, Dorset. Meetings commence at 1900 for a 1930 start. A guest speaker is usually invited to talk on a subject of interest to the Club Members. Membership is open to all who are interested in all facets of Amateur Radio, the numerous activities are not just limited to those who hold transmitting licenses. Club members range from youngsters to Senior Citizens. All visitors are made most welcome and on Club Nights will receive a cup of tea or coffee and cake for just 50p! The Society also has a Training Shack, with facilities for all kinds of radio oriented work and, of course, study and exam facilities are also available on request. The Training Shack is also open for all enthusiasts on Wednesday and Sunday Nights and is a must for up and coming radio amateurs or for those who just want to know what the hobby is all about.

DORSET
Bournemouth Radio Society
Contact: David Wright G4BKE
Tel: (01202) 697338
E-mail: g4bke@thersgb.net
Website: brswebsite.freeserve.co.uk
The Bournemouth Radio Society meet on the 1st and 3rd Fridays of each month at 1930 at the Kinson Community Centre, Millhams Road, Kinson, Bournemouth. Planned events for 2005 include: Jan 21: Guest Alan G4UWS of Poole Radio Society with a talk on Kites and Aerials, 4 Feb: John G0API - Local Repeater Keeper - with a talk on repeaters.



ESSEX
Havering & District Amateur Radio Club
Contact: Oliver G3TPJ
Tel: (01708) 746677
Members meet on Wednesday at 2000 the Fairkytes Art Centre, 53 Billet Lane, Hornchurch, Essex, opposite the Queens Theatre. There are plenty of car parking spaces available in the area. Just a few of the up and coming events include **Jan 19:** Data On The Air - PSK & RTTY, **26th:** G4ZST - RAYNET Talk.

ESSEX
Clacton Radio Club
Contact: Geoff G4AQZ
Tel: (01255) 429117
The Clacton Radio Club would like to tell everyone that they have a new secretary - this being Geoff G4AQZ. Members meet on the 1st Wednesday of the month at the Clacton-on-Sea Sailing Club, Holland Haven, Holland-on-Sea.

HAMPSHIRE
Horndean & District Amateur Radio Club
Contact: Stuart G0FYX
Tel: 02392 472846
Meetings commence at 1930 at the Lovedean Village Hall, 160 Lovedean Lane, Lovedean, Hants on the 1st and 4th Tuesday of each month. Lots of events are planned for 2005. The club also runs club nets. Contact Stuart as above for more information on times and frequencies.

Keep those details coming in!

The TomTom GO Vehicle and hand-held Satellite Navigation Unit

Do you enjoy operating mobile on your travels and enjoy gadgets? If so, Roger Hall G4TNT has found just the thing to help you find your way and help locate the all important 144MHz repeaters!

This is one hand-held gadget that's always going to tell you where to go. It can even help you locate those 144MHz repeaters!

TomTom, already well-known for their satellite navigation software for the Pocket PC and Palm platforms, have recently introduced a self-contained model. And when *PW* got the chance to road test it, I got the job!

I've been using a Philips Carin in-car satellite navigation system for the last six years or so and often I would have been lost without it, literally. Now, however, it's starting to show its age so I jumped at the chance to try out a modern, up-to-date model.

I'd already thought about buying TomTom's satellite navigation software for the Palm Pilot or one of the many Pocket PCs, but I haven't because I would have had to buy a PDA as well. Now I'm tempted by the TomTom GO because it's a self-contained, dedicated unit with everything you need in one box.

When the unit arrived I found that it's supplied in an unusual cube of a box that folds open in the middle to reveal the head unit, a mounting bracket, an SD memory card, a carry case, an installation guide, the manual, an installation CD, a USB cable, a d.c. cigar lighter adapter. It was also supplied with an a.c. adapter and several international pin adapters.

Installation

My existing Carin unit was hard-wired into my car with so many connections that I took the easy way out and paid a garage to install the Philips unit for me. So I was intrigued to how see how I'd get on with installing the TomTom GO myself. As it turned out, it couldn't have been much easier!

First I had to assemble the mounting bracket - a hinged arm with a lever operated suction cup at one end and a cradle for the head unit at the other. After a bit of fiddling, it was ready and I stuck it to the inside of my windscreen.

Incidentally, a word of caution here; some cars have a heat reflective shield in the windscreen glass that stops the satellite signals from reaching the TomTom GO. The only way round this is to buy the optional external antenna. Luckily, my vehicle uses plain glass so it wasn't a problem.

After I'd plugged one end of the d.c. adapter into the cigar lighter and the other into the bracket, I clicked the head unit into the cradle and a little green light came on to show it was receiving power.

Then I inserted the supplied 128Mb SD card into the slot on the front panel of the unit and turned it on by pressing and holding the power switch for two seconds. The screen came to life and I was presented with a series of one-off questions that allowed me to customise the unit by tapping the touch screen. When I'd finished, I was shown a slide show of the TomTom GO's main features.

That's it - there's nothing else needed for the installation. Because the SD card comes pre-programmed with the operating system and a street level map of Britain there's no

Fig. 1: The TomTom GO has very few external controls, most of the operations are controlled by using your fingers n the touch screen (see text).

need to do anything other than plug it in, insert the card, turn it on and tell it your preferences.

On The Road

The next step was to take the TomTom GO out on the road to see how well it worked and I have to say that I was impressed. It acquired the satellite signals very quickly and the 3.5 inch screen showed my position extremely accurately.

Driving around I was surprised at how much software has improved in the last few years. As well as the flat, two dimensional overhead view that I'm used to, the TomTom GO also offers a very intuitive 3D view that shows the road ahead as it would appear through my windscreen.

Different colours are used to good effect to indicate the road you're on, the route you should take at the next junction (assuming you've entered a destination) and different classes of road. It's all very easy to see and to understand.

Touch Screen

As I've already briefly mentioned, the TomTom GO has a touch screen and it's this you use to enter all data and to access the menus. There are no external buttons other than an On/Off switch and a head unit release catch. You enter destinations, add addresses to the database, change your preferences and so on by tapping the appropriate icon on the screen.

So, having found that the TomTom GO showed me where I was, I thought I'd see how it coped with finding a route for me. I tapped on the **Navigate to...** icon and entered an address that I knew.

Within moments, I was presented with a map showing me an overview of the suggested route. I tapped the **Done** button and the screen immediately switched to show the road ahead of me along with a white arrow to indicate the direction in which I should move. In the distance was a green arrow that showed that I should turn left at the next junction.

The screen not only shows the road ahead, it also has a wealth of information in a blue bar across the bottom. For example, there's a small graphic in the bottom left-hand corner that shows the action to be taken at the next junction. Next to that are digits that count down the distance to the junction and to the right of that is the name of the road you'll turn into, the current time, journey information (distance and journey time remaining and estimated time of arrival), a signal strength meter and your current speed.

Fig. 2: The TomTom GO installed behind the windscreen of G4TNT's pick-up truck. (He's got no excuse losing his way to the Leicester Show now!).

Don't worry, if all that information sounds as though there's too much to take in while you're driving TomTom have thoughtfully added a voice prompt. This gives you turn-by-turn directions so that you can navigate without taking your eyes off the road. And yes, there are several voices and languages to choose from!

Long Way Round?

One of the problems I've found with satellite navigation systems is that they often take you the long way round, probably because the manufacturers don't have the local knowledge we all gain by living in an area for a while. However, although I found the TomTom GO to be better than my old system it wasn't perfect. Where it did shine was in its ability to quickly recalculate a new route once I'd deviated from the suggested one.

My old Carin unit tells me several times to make a U-turn and then, when it eventually realises that I'm not going to, it deigns to show me an alternative route. On the other hand, the TomTom GO adjusts almost immediately.

Miss a turning, take the wrong exit on a roundabout or deviate from the suggested route in any way and it will almost instantly display a new one. This is probably down to its processing power; it has a 200MHz ARM920T processor running a version of *Linux* and 32MB of RAM on board.

I used the TomTom GO for various journeys and was very happy with its performance. I even used it for a trip to Belgium but wasn't able to test its street level mapping over there because I didn't have the European maps - they are an extra cost option, as are the maps for America.

However, the installation disk does come with main road maps for Europe. Unfortunately, the supplied 128MB SD isn't big enough to hold the European maps as well as the British one so I had to copy its contents onto a 256MB card and then there was plenty of space to install the European maps as well.

Away From Car

One major plus with the TomTom GO is that it is supplied with an internal 2200mAh Li-ion battery so that it can be used away from the car. This makes it extremely useful if you have to park some way away from your destination and finish the journey on foot. The internal battery also means that this unit would be ideal for cyclists.

Despite the internal battery the unit isn't really a substitute for a dedicated hand-held GPS unit because the battery will only power the unit for approximately four or five hours, depending on usage.

Also, although it comes with a carrying case, its shape and size make it a little difficult to carry in a pocket. It measures 115 x 92 x 58mm and has an unusually curved back. The best way to describe it is to say that it looks like a miniature iMac computer.

pros

Overall, I would say this is one of the best satellite navigation systems I've tried. It's relatively inexpensive, it's small but still has a reasonably sized screen, the audio is superb and the navigation software is especially efficient.

cons

Just a few small niggles; the screen is too reflective and it can be a bit difficult to see in certain lights.

There's a tiny bug that makes setting up A to B routes awkward. For example, you might be sitting at home in Birmingham, idly wondering how to drive from London to Penzance. You enter London as the start of your journey and Penzance as the end but the software keeps trying to get you to start from Birmingham. It doesn't like it when you plan a journey that starts from somewhere other than your current location. There are various ways to work around this but it would be nice if you didn't have to.

Also, the Assisted Satellite Navigation (ASN) system could be improved. The TomTom GO incorporates two sensors to compensate for loss of signal. They detect your speed and direction of travel and are designed to keep track of your position in tunnels and other places where the signal can't get through. It's a good idea but it's not as accurate as the stabilised electronic gyroscopes used in other systems. That said, I've only ever seen gyroscopes in models costing much more than the TomTom GO.

price

The TomTom GO costs £439.

thanks

My thanks go to **Martin Lynch & Sons Limited, Outline House, 73 Guildford Street, Chertsey, Surrey KT16 9AS, Tel: 0845 2300 599**, for the loan of the review sample.

Points Of Interest

One of the most interesting features of this unit is its ability to display Points Of Interest (POI). As supplied, the TomTom GO has databases of Airports, Amusement Parks, Beaches, Car Dealers and so on (far too many to list here).

Each category can be switched on or off so that you see only the POIs you've chosen. This could be useful if, for instance, you need to find the nearest petrol station. Simply activate the Petrol Station POI list and they will be graphically displayed on the map.

You can then either tap on the **Find Nearest POI** button to show the nearest one or use the Point Of Interest icon in the menu to have the full list displayed, sorted by distance from your current position.

As well as its own collection of POIs, the TomTom GO can import lists from other sources. There are thousands of lists available, everything from Asda stores to Dr Who film locations, McDonalds to Pizza Huts. If you need to find it, someone, somewhere has almost certainly listed it, probably because it's so easy to compile a POI list by using a 3-column spreadsheet to record the longitude, latitude and name of the POI. This is then exported as a .csv file, run through some very simple free software to convert it into the right format and imported into the TomTom GO.

Currently, the most popular list is the one that shows traffic accident blackspots. Fortunately, they are easy to recognise because local authorities have marked them with speed ('safety') cameras. So, if you download the list of all the speed camera sites, you'll know where you should drive with extra care. The TomTom GO helpfully alerts you to the presence of a camera by sounding a tone as you approach it. You might think the authorities would disapprove of this practice as it could be seen as a way of detecting speed cameras but it seems not!

The government has specifically excluded GPS based systems from its forthcoming ban on radar detectors which is incorporated in the Road Safety Bill currently going through parliament.

Finding 144MHz Repeaters

I've already found one list that could be of interest to Radio Amateurs. It shows all the 144MHz repeaters and once I'd loaded in into the TomTom GO, I had the electronic equivalent of the popular *PW* repeater Datacard. To me, the many possibilities for the Amateur Radio mobile operating enthusiast are obvious.

The ability to compile your own personal lists of POIs makes the TomTom GO a very versatile tool. For example, a salesman or a service engineer could list all his customers and then, when they're planning visits, they would see them all graphically displayed on their map.

Useful websites

www.pocketgps.co.uk - lots of interesting information and POI lists.
www.trigpointinguk.com/info/trigpoints.php - find out all about Triangulation Pillars
www.dnote.nl/pda/poi/PoiEdit/ - POI manager
www.pdamods.com/products.asp?cat=71 - lots of accessories to buy
www.expansys-usa.com/forum.asp?code=TOMTOMGO - an interesting TomTom GO forum

For versatility, ease of use and value for money, it's hard to fault the TomTom GO and I'm sure it will have its uses in Amateur Radio. I could see myself using it to find the nearest repeater, to compile a POI list of contacts or even to have it show me on a map all the shops that sell *PW*!

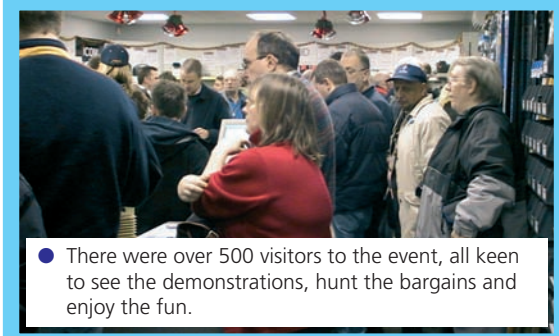
PW

Stop Press News!

ML&S Open Day

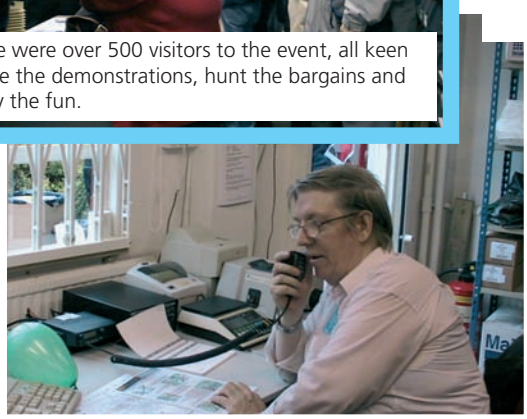
- Martin Lynch & Son contacted the *PW* Newsdesk to report that their open day on December 4 2004 was a rip-roaring success. But enough words - we'll let Martin's photographs tell the story!

- The free Hog Roast, coffee and soup was kindly sponsored by Yaesu, Kenwood and Icom. The large number of visitors meant it had all been 'hogged' by 1330!



- There were over 500 visitors to the event, all keen to see the demonstrations, hunt the bargains and enjoy the fun.

- During the day bhi were running demonstrations of their DSP products. And although the doors officially shut at 1600, the ML&S team didn't finally leave for home until 1830. They're preparing for next year's event now!



- The Boot Fair, talk-in and demonstrations were arranged by the Whitton Amateur Radio Club. The club also laid on a small army of members to marshal the car parking.

- Martin had a total of 23 staff helping out and none actually got anywhere near the food themselves. So, Next year generous Mr Lynch is planning a bigger Hog Roast!

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- Optional keyer

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- Experimental insect repellent feature!

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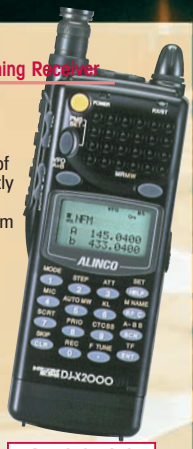

- Covers 100kHz - 2,149.99MHz
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EME-18	***£9.95*** earphone
EBP-58N	***£24.00*** Li-Ion battery pack
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- 1200 memory channels
- Channel scope spectrum analyser - allows monitoring of 40 channels
- Advanced scanning features:
  Programmed scan (up to 10 groups)
  Programmed memory scan
  - Any memory scan
  - Mode scan
  - VFO search
  - Dual VFO search
  - Band encursion scan
  - Priority scan
  - Any channel ship scan
- Battery save facility
- Facilities for cloning another set
- Built-in 24 hour clock
- Switchable attenuator

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DJ-596 E Dual Bander

- 100 memory channels, any mix of VHF/UHF
- Alphanumeric channel labels
- Direct freq input from keypad
- Large backlit display
- CTCSS, DCS encode + decode
- DTMF tones and autodial memories
- Tone bursts
- Three scan modes
- Theft Alarm feature
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- 12VDC direct input (5W output)
- High-power NiMH battery (4.5w output VHF/4w UHF)
- Busy Channel Lock Out
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- External Terminal Control
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Ultra Modern Scanning Receiver

with 8.33kHz for airband

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- 700 memory channels
- Steps: 5/6.5/8.33/10/12.5/ 15/20/25/ 30/50/100kHz
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- Bug detector
- Stereo FM (with headphones)
- Attenuator
- SMA Antenna
- Battery saver cct
- Size: 56w x 102h x 23d mm
- Weight: 14.5g (without batteries)
- Supplied c/w: 3 AA dry cell battery case, carrying strap

Optional extras

- Ni-Mh battery pack
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- New dual band handy transceiver
- 5W/1W/0.5W output power
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- Includes wide FM mode
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- Alphanumeric Display, up to 6 characters
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The PW Two Tone Oscillator

Tony Nailer G4CFY describes a two tone oscillator for transmitter linearity testing. Although a simple instrument it's an essential addition to your collection of test equipment.

You might ask; "What's the purpose of the Two Tone Oscillator"? In answering, this handy little unit is used in conjunction with an oscilloscope to test amplitude modulation (a.m.), double sideband (d.s.b.) and single sideband (s.s.b.) rigs for linearity and correct power output limits.

Home-brewers of h.f. transmitters using these modes need to have an oscilloscope with a -3dB bandwidth of at least 20MHz. Though ideally 40MHz would allow precise measurement of envelope amplitude.

When undertaking realignment or initial alignment of a transmitter it's not practical to use the human voice when testing for linearity of the signal processing and amplification stages. This is because the modulating signal needs to be constant frequency, low in harmonics and a constant controllable amplitude. This is the work of the two tone tester.

Wien Bridge Oscillator

The circuit of a dual supply Wien Bridge Oscillator is shown in **Fig. 1**. The mathematics of the derivation is too complex to be included here but can be found in most good electronic books.

The frequency of operation is determined by R3 and C1, R4 and C2. If R3 = R4 and C3 = C4 then Vo / V+ will be 3. This is a positive feedback signal of 1/3 and if not counteracted by a similar signal to the negative input would allow an oscillation to build up until severe distortion occurs.

To control the oscillation negative feedback of just slightly less than one third is applied by R2 and R1.

In this condition, oscillation will build up slowly until very slight distortion occurs. If the negative feedback is increased slightly more the oscillation will collapse. To get the negative feedback just right, the input resistor R1 is split into a large fixed part and a small adjustable part.

If R2 is chosen to be 8.2kΩ then R1 could be 3.9kΩ in series with a 470Ω trimpot. This choice allows a gain range of 2.9 to 3.1 with perfect components and should cope with resistors and capacitors of 5% tolerance. You could use 10% tolerance capacitors but might need to swap them around to get within adjustment range.

Practical Oscillator

The oscillators U1a and U1d are two parts of a quad op-amp, see **Fig. 2**. The feedback network from output to positive input is a series combination of resistor and capacitor, R16 and C8 for U1a and R8 + R9 and C6 for U1d.

The input network comprises the parallel network of resistor and capacitor C9 and R17 for U1a, and R6 + R7 and C5 for U1d, both networks were connected to a mid rail point created by U1c and decoupled to a.c. via C2, 10µF which is 8Ω at 2kHz.

The negative feedback components R11 and R10 + RV1 for U1d and R18, R19 + RV2 for UIa are the values chosen earlier. An electrolytic capacitor is added in each path to allow the negative inputs to float at the d.c. level of the positive inputs.

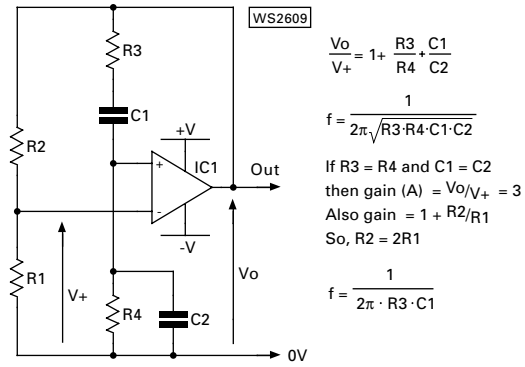
Choice of frequencies for use with oscilloscope measurement requires the two tones to be near the top of the Amateur rig audio range of 2.1kHz and fairly close together so the low frequency (l.f.) envelope is clearly locked by the timebase of the scope. Initially I'll try for around 2 and 1.8kHz.

The formula is $f = 1/(2\pi RC)$ and I choose 22nF for the initial value of C and 2000Hz for f. Transposing the formula to make R the subject gives;- $R = 1/(2\pi fC)$

$R = 1/(2\pi 2000 \times 22 \times 10^{-9})\ \Omega.$

$R = 1/(88\pi \times 10^{-6})\ \Omega\ R = 1{,}000{,}000/88\pi = 3617\Omega.$

Values of 3.9kΩ and 22nF were put into the formula $F = 1/2pRC$ and which gave a frequency of 1.855kHz. I then bread-boarded a circuit using a quad Op Amp with a mid-rail supply, and with 3.9kΩ



$$\frac{Vo}{V+} = 1 + \frac{R3}{R4} + \frac{C1}{C2}$$

$$f = \frac{1}{2\pi\sqrt{R3 \cdot R4 \cdot C1 \cdot C2}}$$

If R3 = R4 and C1 = C2
then gain (A) $= {}^{Vo}/_{V+} = 3$
Also gain $= 1 + {}^{R2}/_{R1}$
So, R2 = 2R1

$$f = \frac{1}{2\pi \cdot R3 \cdot C1}$$

Fig. 1: The circuit of a dual supply Wien Bridge Oscillator (see text).

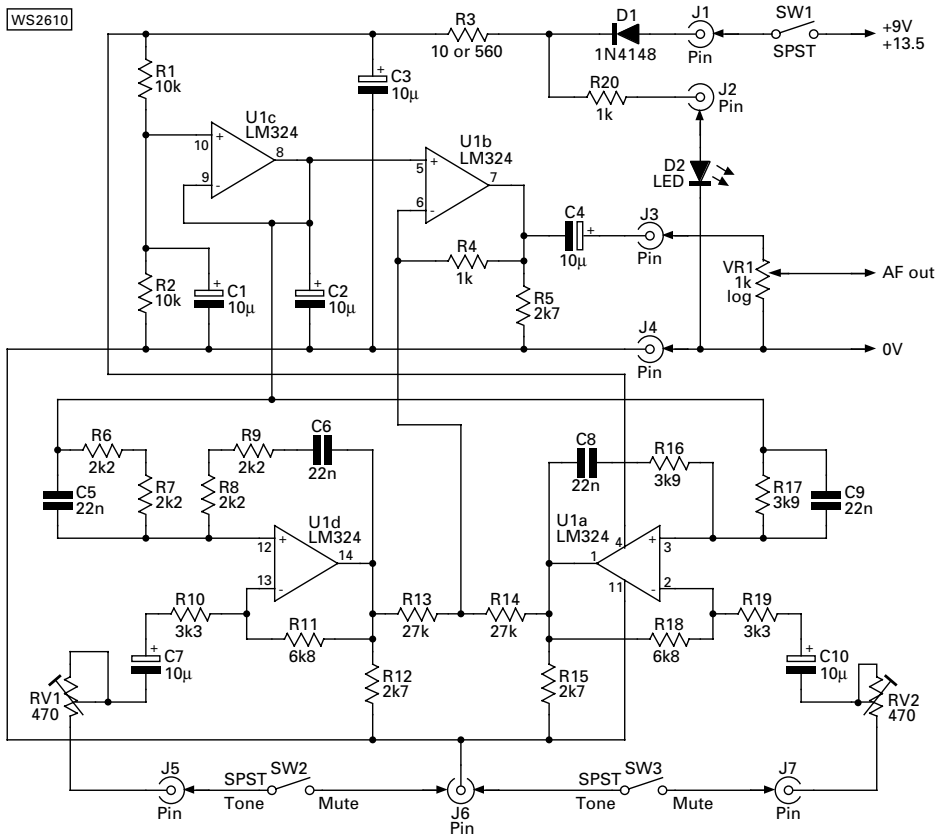


Fig. 2: The oscillators U1a and U1d are two parts of a quad op-amp (see text). Switching of the individual tones was achieved by breaking the connection to the input networks using toggle switches.

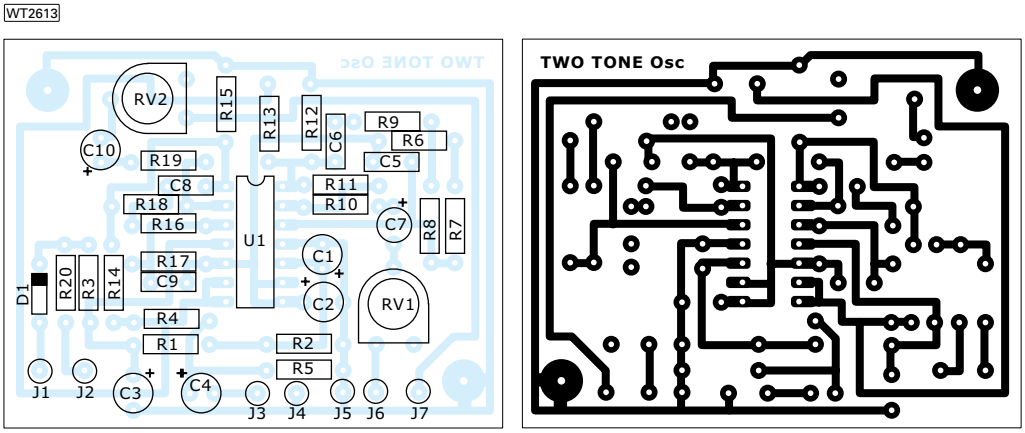


Fig. 3: Track, parts lay outs and component positioning guide of the two tone oscillator (see text).

for R3 and R4 the frequency was 1.887kHz.

Second Oscillator

A second oscillator was created from the third amplifier in the package. I could have tried using two 1.8kΩ resistors in series to achieve 2.010kHz but decided instead to go for something around 1.6kHz by using two 2.2kHz in series each for R3 and R4. The frequency was 1.666kHz, close enough for what's required.

By careful adjustment of RV1 and RV2 the clipping can be minimised. Go too far one way and the waveform collapses and too far the other way and the clipping increases. At the correct setting (done by observation of the waveform on an oscilloscope) the distortion due to clipping can be limited to around 1%, that is -40dB second harmonic distortion.

The last amplifier in the package U1b was then utilised as a dual input mixer and output buffer. As the waveforms were around 4.5V peak-to-peak (p.t.p.) I used the input and feedback resistors to form an attenuator so that with a single tone it was 220mV p.t.p. and with dual tones 440mV p.t.p. An output control potentiometer was included so the output could be reduced to the 50 to 100mV level of a dynamic microphone.

Crossover distortion was visible on the waveforms because of the low quiescent current in the outputs of the LM324 Op Amp. I added 2.7kΩ resistors to clear this problem. Finally the supply rail circuitry was configured to include a supply resistor for 9V or 13.5V and an in-line safety diode.

Switching of the individual tones was achieved by breaking the connection to the input networks using toggle switches. This allows the unit to be used with one tone or the other or with both tones. Distortion of the individual tones is less than 1% and the amplitudes appear identical.

The quad op-amp quad Op Amp and l.e.d. have a total drain of about 25mA. Two values of supply resistor R3 have been allowed, 560Ω for use with a 13.5V bench supply and 10Ω for use with an internal 9V PP3

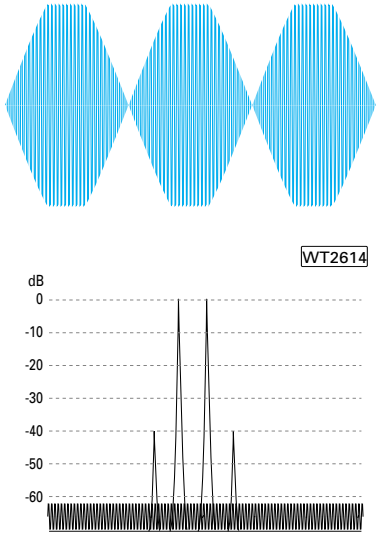


Fig. 4: An ideal envelope (see text).

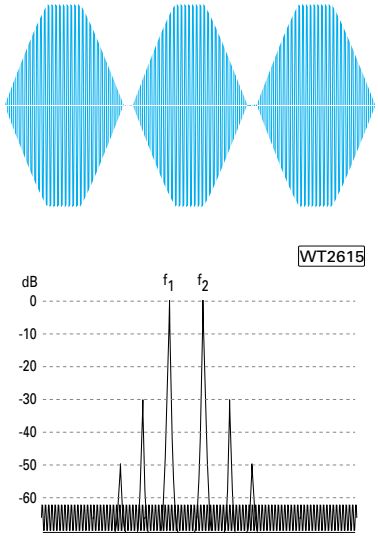


Fig. 5: In this display there is some intermodulation distortion which might be created in the transmit mixer stages and further enhanced by the class AB amplifier stage (see text).

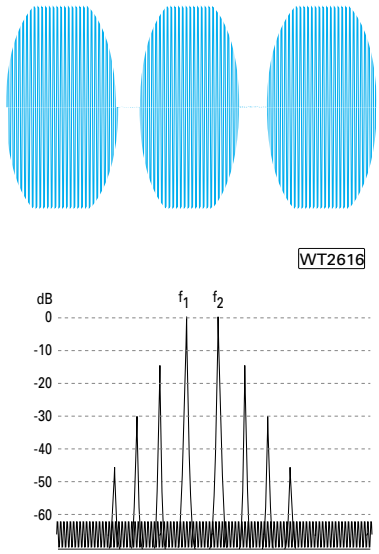


Fig. 6: This diagram shows further flattening in the zones between the envelope half cycles and is indicative of a poor or overdriven transmit mixer or amplifier stages with insufficient quiescent current (see text).

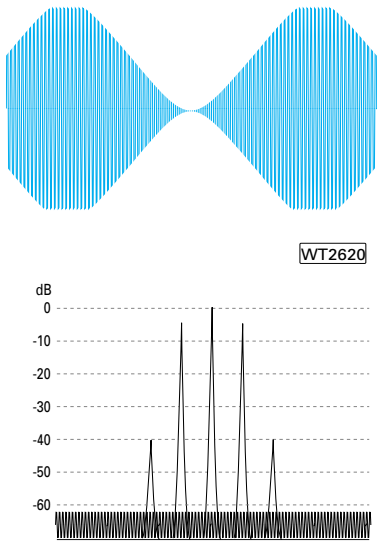


Fig. 10: In this display a perfectly 100% modulated a.m. signal is represented. The outsides of the envelopes are perfect sinewaves with no added flattening at the pinch off point (see text).

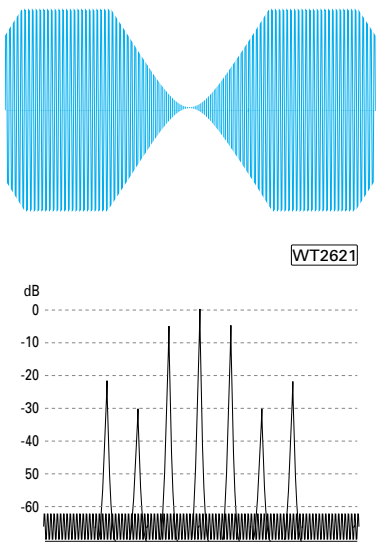


Fig. 11: Showing an otherwise correctly set up amplifier which is being driven into clipping. This has probably occurred by having the unmodulated carrier level set too high or the modulating signal too great (see text).

Intermodulation chart (harmonics)

	2nd	3rd	4th	5th
0	d.c.	d.c.	d.c.	d.c.
1	f2-f1		f2-f1	
2			2f2-2f1	
3				
4				3f1-2f2
5		2f1-f2		2f1-f2
6	f1	f1	f1	f1
7	f2	f2	f2	f2
8		2f2-f1		2f2-f1
9				3f2-2f1
10				
11			3f1-f2	
12	2f1		2f1	
13	f1+f2		f1+f2	
14	2f2		2f2	
15			3f2-f1	
16				
17				4f1-f2
18		3f1		3f1
19		2f1+f2		2f1+f2
20		2f2+f1		2f2+f1
21		3f2		3f2
22				4f2-f1
23				
24			4f1	
25			3f1+f2	
26			2f1+2f2	
27			3f2+f1	
28			4f2	
29				
30				5f1
31				4f1+f2
32				3f1+2f2
33				3f2+2f1
34				4f2+f1
35				5f2

WT2622

Fig. 12: For those interested in further study of i.m.d.s Tony G4CFY has included four charts showing two signals, f1 and f2, and how the products build up(see text).

battery. The latter being the preferred option to avoid r.f. feedback from the circuit or transmitter under test. The circuit, and parts layout together with the p.c.b. track layout are shown in **Figs 3**.

Using With Oscilloscope

The unit is designed to work in conjunction with an oscilloscope to display the radio frequency (r.f.) envelope of a transmitter using a.m., or d.s.b. or s.s.b. to check linearity. By observing the waveform it will be clearly visible if there is excessive intermodulation or overdriving in the mixing and amplifying circuits.

The transmitter is connected into a dummy load Wattmeter, which has a 'sniffer' low level output. Alternatively an in-line sniffer unit can be made with a small metal box with coaxial cable sockets at each end, and a BNC connector on a side face. A line of 16 or 18s.w.g. wire connects the centre pins of the connectors at each end. Then from the line a 4.7kΩ resistor to the BNC centre pin and a 56Ω resistor from centre pin to ground.

Typical Waveforms

Typical waveforms for an s.s.b. transmitter driven by two tones, or of a d.s.b. transmitter driven with a single tone are depicted in **Figs 4** to **7**. The ideal envelope is shown in Fig. 4, where the individual envelopes touch and appear to cross smoothly from one half cycle to the next.

The spectrum analyser display corresponding to Fig. 4 shows two signals representing the two tones at the 0dB level. In reality the envelope of the two tones has a peak power four times (6dB) higher than the average power. The additional

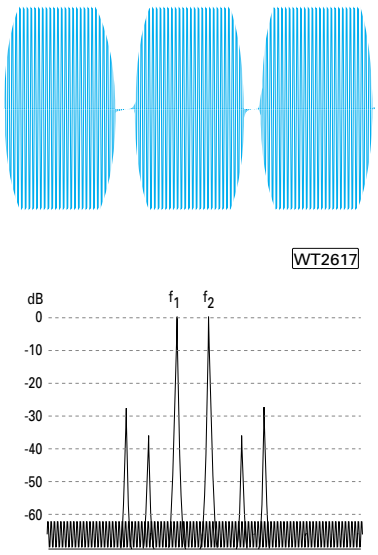


Fig. 7: This envelope display represents an otherwise correctly adjusted transmit amplifier which is either being overdriven or which has its automatic level control (a.l.c.) set too high (see text).

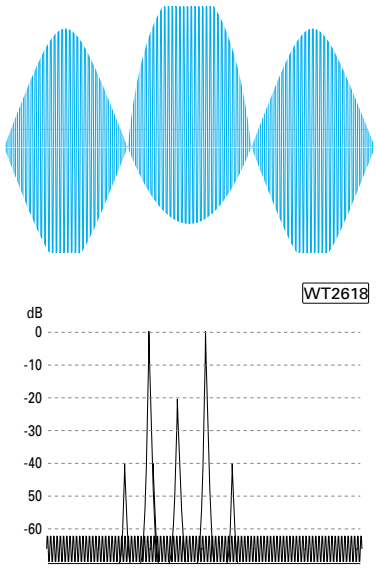


Fig. 8: The diagram shows a d.s.b. transmitter fed with a single tone. The envelopes are offset about 10% above and below the centre line and correspond to a carrier level of -20dB (see text).

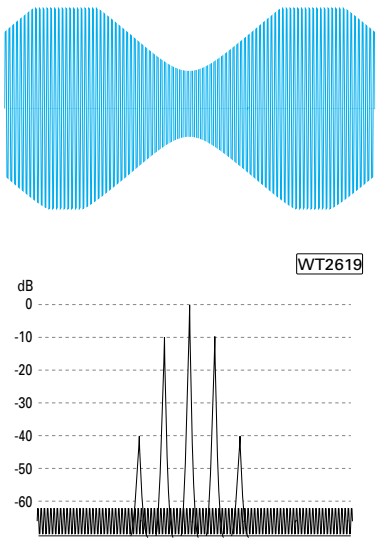


Fig. 9: Amplitude modulation at a level of 50% using a single tone is shown here, where the peak to peak amplitude is twice the trough to trough amplitude. In the spectrum display the sidebands are 12dB down from the carrier level (see text).

sidebands each side are third order intermodulation products (i.m.d.), the one on the left being 2f1 - f2, and the one on the right 2f2 - f1. These products are therefore 46dB below the peak power level of the two tones.

Second order i.m.d.s are any signal made up from two times one signal, or one signal plus or minus the other one. These are then 2f1, 2f2, f1 + f2, f2 - f1. Third order i.m.d.s are any signal made up from three times one signal or two times one signal plus or minus the other one. These are then 2f1 - f2, 2f2 - f1, 3f1, 2f1 + f2, 2f2 + f1, 3f2.

In **Fig. 5** there is some intermodulation distortion which might be created in the transmit mixer stages and further enhanced by the class AB amplifier stages. The effect is that the individual envelopes do not now quite touch, nor cross over as in the ideal case.

The spectrum display shows this effect is caused by the additional third order sidebands now at the -36dB relative to the peak level. Each side are fifth orders products with that on the left being 3f1 - 2f2, and that on the right 3f2 -2f1. They are at a level 56dB below peak level. This would be considered an acceptable signal.

Moving on now to **Fig. 6**, shows further flattening in the zones between the envelope half cycles and is indicative of a poor or overdriven transmit mixer or amplifier stages with insufficient quiescent current. The third and fifth order products are now unacceptably high and the additional products are seventh order made up from 4f1 - 3f2, and 4f2 - 3f1. In this situation try adjusting the quiescent currents in the amplifier stages.

The next envelope display in **Fig. 7**, is for an otherwise correctly adjusted transmit amplifier which is either being overdriven or which has its automatic level control (a.l.c.) set too high. If ALC is fitted try turning it down so the peaks are just below the point of flat topping. In a transmitter with no ALC the audio drive should be turned down.

The diagram, **Fig. 8**, shows a d.s.b. transmitter fed with a single tone. The envelopes are offset about 10% above and below the centre line and correspond to a carrier level of -20dB. Clearly by adjusting the carrier balance, the envelope will move further away or closer to the centre line.

Amplitude modulation at a level of 50% using a single tone is shown in **Fig. 19** where the p.t.p. amplitude is twice the trough-to-trough amplitude. In the spectrum display the sidebands are 12dB down from the carrier level. Again I show two further sidebands representing third order products at an acceptable level.

In the next display, **Fig. 10**, is shown a perfectly 100% modulated a.m. signal. The outsides of the envelopes are perfect sinewaves with no added flatting at the pinch off point. This would have exactly twice the peak-to-peak voltage of the unmodulated carrier and the spectrum display shows the sidebands 6dB down from the carrier.

Finally, **Fig. 11** shows an otherwise correctly set up amplifier which is being driven into clipping. This has probably occurred by having the unmodulated carrier level set too high or the modulating signal too great. The troughs of the envelope would also be pinching off but tend to get filled in with higher order intermod products.

Further Study

For those interested in further study of i.m.d.s I've included, in **Fig. 12,** four states showing two signals, f1 and f2, and how the products build up. The charts show the second order products and the next chart the third order products. The fourth order chart shows the second order and fourth order products, and the fifth order chart shows fifths together with the thirds.

If you had a circuit with poor bias and being overdriven with signals at 6 and 7 the spectrum could obtain the products from all the charts. They'd be filling all the slots from 0 to 35 with the exception of 3, 10, 16, 23, and 29. It's notable that it's the odd order products which makes a signal spread and splatter over adjacent channel users. Hopefully you'll be able to avoid that problem on any project you build! **PW**

Kits & Bits

Two Tone Oscillator Parts availability: The p.c.b. is available for £3.75, P&P 50p. The p.c.b. and bits £9, P&P £1. The ready-assembled costs £19, with P&P at £1. Box and hardware, p.c.b. and bits £23, P&P £2. Ready built and tested unit £50.50, P&P £2. Available from **Spectrum Communications, 12 Weatherbury Way, Dorchester, Dorset DT1 2EF**. Order by post with cheque or Postal Order (no credit cards) made payable to **A.J. & J.R. Nailer**.

John Sketch GW3DDY looks into "A Bit of Two Metre History". His article reflects on Marconi's pioneering work on this v.h.f. band and suggests some experiments for the keen constructor to try for themselves.

Cautionary Note: Any transmitter connected to a suitable antenna can radiate a signal capable of creating interference to other users. My advice to anyone considering repeating the interesting experiments described in this article, is to ensure that wherever possible they are carried out in a location that is heavily screened. Even very lower power signals from a simple transistor transmitter could travel some distance. Just be aware of the possibilities, but don't let them stop you from experimenting. Marconi's own records indicate that he achieved ranges of several miles. However in those days there were no other users on the band for the Senatore to worry about! **Editor.**

Looking At Two Metre History

The large number of 144MHz transceivers which are nowadays available for base or mobile use is a remarkable achievement. But just how did this come about, and apart from Heinrich Hertz's original test transmissions (which were actually on microwaves), just when did tests on what we now know as v.h.f. begin? To find some answers I started to research and came up with some fascinating information.

Looking back in history, **Senatore Marconi**, even in 1916 was very concerned with the congestion on wavelengths commonly used for wireless communication. He conducted experiments with the shorter wavelengths of two and three metres and found that these waves could be successfully used to communicate over useful distances. Following his experiments he then offered his results to wireless enthusiasts.

Reflectors & Waves

Anyone who cares to make up a simple 144MHz valve transmitter and crystal receiver will at once be able to experiment with reflectors and to study waves in their most tangible form. In 1916 Senatore Marconi said; "valve transmitters could be constructed to work well below one metre, but a wavelength of 2m is a good one to start with, as the ordinary Marconi V24 valve can be used for the transmitting valve".

In the Marconi design described here, a simple 'tonic train' (modulated continuous wave or m.c.w.) oscillator, **Fig. 1**, is shown and V24 is the valve with its grid marked G and anode marked A. The valve is mounted on an Ebonite block and a 9in* rod (229mm) is fixed to a substantial base, which has four terminals.

Note:** For the sake of simplicity in this article only Imperial measurements, in decimal form, will be provided when quoted by the author. Metric measurement will remain as quoted by the author.* ***Editor.

Four pieces of insulated bell wire are soldered to the valve terminals and all four wires are carefully wound around the ebonite rod. These make four good chokes, which are soldered to the terminals.

A very small adjustable condenser then has to be made. This is made from a piece of glass tube, as shown in **Fig. 2**, 0.25in diameter and 2.75in long. Two strips of one inch copper foil are wrapped around it being soldered by a piece of binding wire and the edges of the copper foil are soldered to make them into tubes. A thin rod of wood having a plunger made out of a piece of copper foil 2.25in wide is then fitted to the inside of the tube, this can then be pulled in and out to alter the capacity of the condenser.

The condenser is then mounted on the top of the valve holder and the two binding wires soldered to points G and A. Two stiff copper wires, each 500mm in length, are fitted to points G and A to form the antenna. No earth is required.

Three batteries, one 6V, one of 4V and the other 240V are used, the latter may be made up from flash-lamp batteries. Alternatively, an inverter working from 12V can be used to provide the necessary h.t. If you're fortunate enough to have one of the rotary transformers

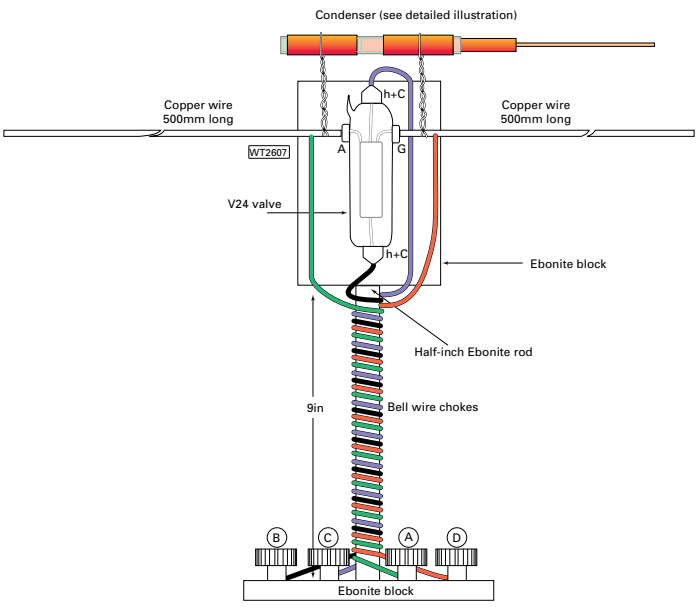
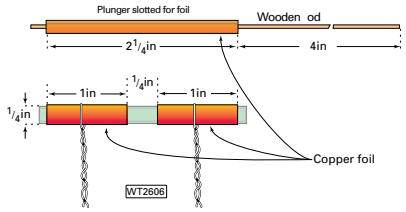
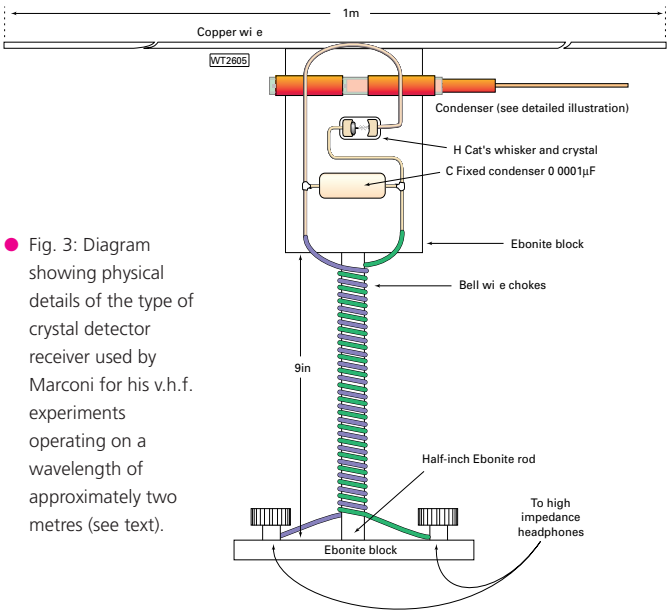


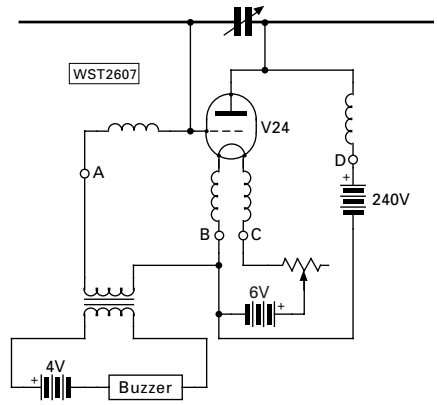
Fig. 1: Reproduction of one of the circuits used by Marconi for experimental transmissions on wavelengths of around two metres in 1916. Not to scale (see text)



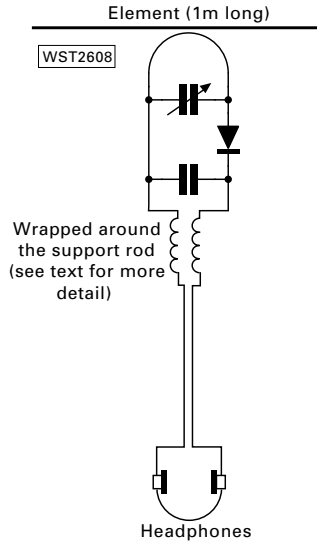
● Fig. 2: Detailed diagram of the 'condenser with plunger' unit used with the transmitter for the early v.h.f. experiments (see text).



● Fig. 3: Diagram showing physical details of the type of crystal detector receiver used by Marconi for his v.h.f. experiments operating on a wavelength of approximately two metres (see text).



● Fig. 4: Circuit of the 2m transmitter. It produces a tone modulated a.m. signal that Marconi called a 'tonic train oscillator'.



● Fig. 5: Circuit of 2m v.h.f. detector. Note 'coupling' between the receiving antenna and the circuit (see text).

(dynamotors) in the junk box they'll also work well in this application.

A microphone transformer which has a secondary impedance of about 3000Ω will be required and a small buzzer and dry cell are connected as shown.

When connected up, this transmitter will oscillate and send out a tonic train wave of about 14.4MHz. If a microphone is put in place of the buzzer, speech may be transmitted.

The crystal receiver will require a similar holder shown in **Fig. 3**, but the antenna will be in one piece 1m long and fixed on top of the ebonite block. A condenser as shown in Fig. 2 is mounted on the ebonite block and the two plates are soldered to a loop of wire about 1in in radius, which is brought within about 1/4in from the antenna and so forms the coupling to it. A crystal is fixed at H in Fig. 3.

A small fixed condenser of about 0.0001µF (100pF) is mounted at C in Fig. 3. Two insulated bell wires are wound around the ebonite rod to form isolating chokes and connections to the terminals, which are attached to the headphones. With these short waves, all metal fittings must be very small or the self capacity would be high.

Historical Condenser

Technical circuits are shown in **Fig. 4** and **Fig. 5**. Incidentally, the term condenser has been retained, as used by Senatore Marconi, instead of capacitor and please be aware that none of the drawings are to scale.

In 1916 the technology I've described was the state of the two metre wavelength knowledge and activity. Today any Amateur wishing to use this design could replace the valve and crystal with a transistor and diode to operate on a low voltage. This could produce an interesting experiment to study absorption, reflection, polarisation and refraction of short waves. It's both interesting, enjoyable and worthwhile to try it out for yourself. *pw*

Further reading on early Amateur Radio v.h.f. developments

Anyone who is interested in the history of Amateur Radio should invest in a copy of the book The *World At Their Fingertips*, originally written by the late **John Clarricoats G6CL** (Gen. Sec RSGB from 1932-1963, *RadCom* [and its predecessor titles] Editor 1932-63. Originally in hardback this book is now available in a softback form and comes as highly recommended. Particularly interesting for v.h.f. enthusiasts are the chapters dealing with pioneering work on v.h.f. This should be - if for nothing else - on any Amateur Radio bookshelf to remind us all just how much hard work was carried out on our behalf when anything above 30MHz (sorry - 30Mc/s!) was considered as being 'off the dial and away from reality' by many radio users. Please contact the RSGB direct to check for availability of this title. However, second-hand copies can often be picked up at rallies and shows...if you're quick enough! **Editor**.

The Oscilloscope

Part 2 - Basic Applications

In the second part of his series, Gordon King G4VFV introduces the basic applications of the 'scope on your workbench. You're about to discover it's hidden talents!

In the previous instalment, dealing with the basic principles of the 'scope, we saw that the stream of electrons yielded by the gun system arrive at the fluorescent screen at high velocity. Also, that the electrons are formed into a focused beam by the voltages (positive with respect to the cathode) applied to the anodes, and then further accelerated, after having passed the deflection plates, by a positive potential applied to a helical conductive coating inside the flare of the tube.

Since the beam is composed of negatively charged electrons, it's attracted towards a positive-going deflection plate and repelled by a negatively going one (remember that like repel and unlike attract), which, of course, is the underlying principle of the electrostatic beam deflection system.

I also mentioned last month that in some tubes a thin layer of aluminium is deposited over the screen. This is then held at a high positive potential to counteract the adverse effects of secondary electrons, which if retained by the screen could impair the brightness of the display.

We saw that the aluminium backing also improves the brightness by reflecting phosphor illumination forward. There are numerous other technical details of the oscilloscope c.r.t., but I think we have considered enough to keep us going for the time being!

Basic Points

Before venturing into real practical applications of the 'scope there are still a number of basic points that we need to become acquainted with. First, let's suppose that a spot of suitable brightness is focused in the centre of the c.r.t. screen and then a sinewave signal is applied to the Y input.

Assuming that the oscilloscope's Y input sensitivity (this will be dealt with later) suits the amplitude of the sinewave, the spot will be deflected vertically from screen centre in one direction and then the other on the positive and negative swings of the waveform, resulting in a vertical trace.

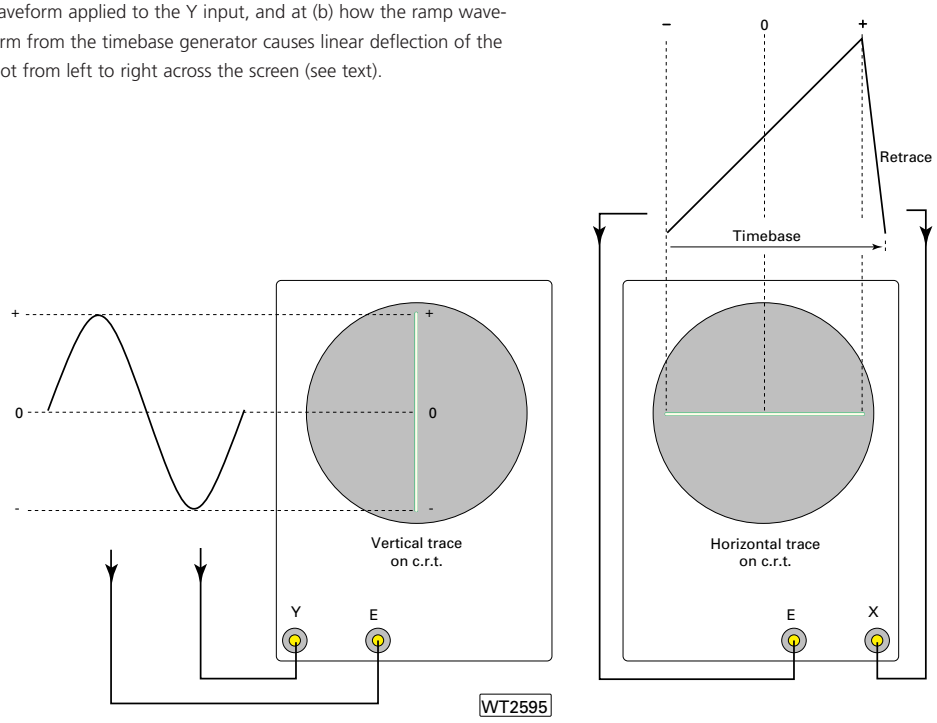
The repetition rate of the deflection, of course, will be the same as the frequency of the sinewave. The display will become flicker-free at frequencies greater than about 10Hz, while the overall length of the vertical line will correspond to the peak-to-peak amplitude of the sinewave, as shown in **Fig. 1(a).** At very low frequencies, and hence relatively low deflection rates, the actual movement of the scanning spot will be discernible as it slowly moves across the 'scope screen.

Although such a basic display would provide a measure of the peak-to-peak amplitude of a sinewave, from which the peak and the root mean square values could then be calculated (such measurements will be shown later), it would not be of much more use. However, when the scanning spot is deflected linearly across the screen at the same time as it's being deflected vertically, a completely new world of application opens up! This is where the instrument's 'second heart', its timebase, comes in.

Timebase Circuit

All practical 'scopes embody a timebase circuit, which is a basically a sawtooth (or ramp) generator. The circuit is called a timebase because it provides a time scale along the X-axis.

As the ramp signal rises linearly in amplitude, so it takes the scanning spot with it from the left to the right-hand side of the screen. At the end of this forward stroke the waveform drops rapidly to its base level (giving the waveform its sawtooth characteristic), which results in the spot swiftly returning to the left-hand side of the



● Fig. 1: Showing at (a) how a vertical trace results from a signal waveform applied to the Y input, and at (b) how the ramp waveform from the timebase generator causes linear deflection of the spot from left to right across the screen (see text).

Did You Know?

Since the beam is composed of negatively charged electrons, it's attracted towards a positive-going deflection plate and repelled by a negatively going one.

screen (called the return trace or 'flyback') ready to start another scan. The idea is shown in **Fig.1(b)**.

There are many applications of the 'scope that require the electron beam to be deflected horizontally across the screen while the waveform under examination is causing the beam to be deflected vertically. For example, **Fig. 2** reveals how a sinewave signal is traced out on the screen. Here the sinewave signal applied to the Y input for display is shown at the bottom of the diagram, above this the timebase waveform with its rising ramp voltage as applied to the X input, and at the top of the diagram the display as it would be traced on the instrument's screen.

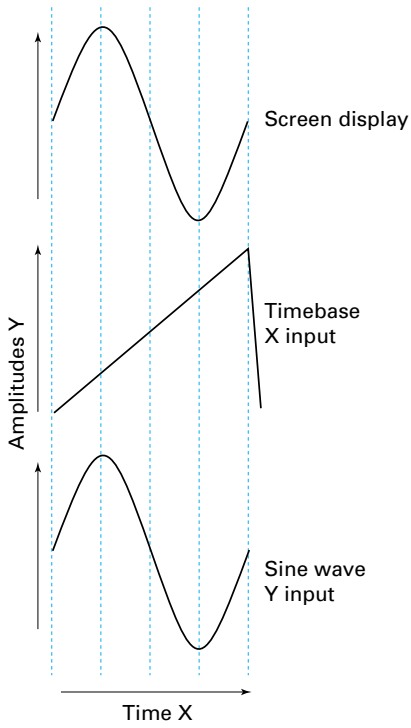
The vertical dotted lines make it easier to follow how the sinewave is progressively traced on the screen as the ramp signal from the timebase rises and deflects the scanning spot from the left across the screen. **Note:** Although the retrace is shown on the display diagram, this is usually blanked out by the oscilloscope's circuitry. An interesting aspect here is that the time taken by the ramp voltage to rise from its base level to maximum corresponds to the time taken by one complete cycle of sinewave. If this weren't the case, the screen would not display just one complete cycle of the sinewave input.

Time & Frequency

Now, we've arrived at an interesting but important point of application - namely time and frequency. When we're dealing with screen displays we should always remember that frequency is being related to time. Actually, of course, they are one of the same thing!

Let's just consider one cycle of a sinewave for the moment. If this has the frequency of the 50Hz mains supply, then from the start to the finish of the waveform the time taken will be 1/50th of a second (0.02 second). Referring back to Fig. 2 again, it's clear, then, that if the frequency of the sinewave at the Y input is 50Hz, the timebase ramp voltage will need to rise from its base level to its maximum value in 0.02 second in order for a full cycle of signal to be traced on the screen.

With the timebase running at, say, half that rate mentioned, so that a full sweep takes 0.04 seconds, there would be two full traces per cycle of signal. The screen will then display two full signal cycles instead of one. Conversely, at twice the timebase rate, only half a cycle would be traced. This, then, brings us neatly to the way in which the 'scope timebase is calibrated.



● Fig. 2: This diagram reveals how a sinewave Y input is scanned across the screen by the timebase ramp waveform at the X input to appear on the screen as a replica of the of the Y input signal. Note: The retrace shown on the screen display is generally blanked out (see text).

Did You Know?

All practical 'scopes embody a timebase circuit, which is a basically a sawtooth (or ramp) generator.

Timebase Calibration

With an analogue test meter the pointer deflection is calibrated against a scale (volts, amperes, etc.); with a 'scope the spot deflection is calibrated against a graticule at the front of the c.r.t. Such a graticule is shown in **Fig. 3**. On the

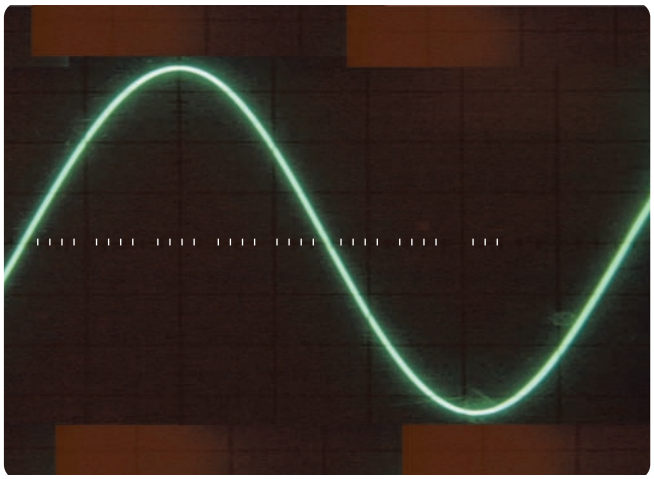


Fig. 3: With the timebase set to 10 microseconds/div. And the Y attenuator to 1V/div., this sinewave would have a frequency of 10kHz and a peak amplitude of 3V.

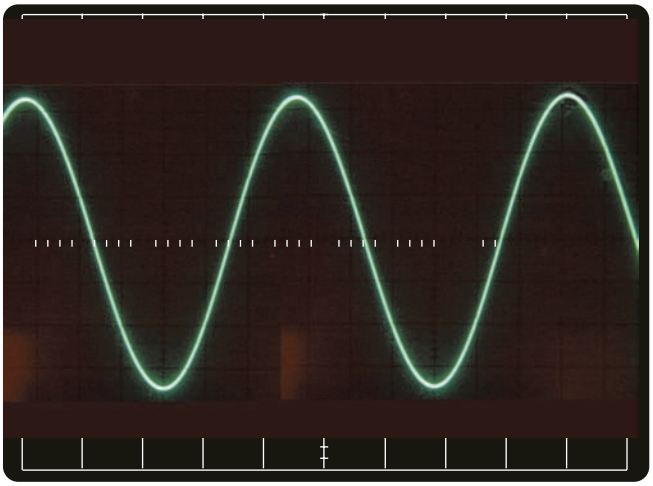


Fig. 4: This oscillogram has an amplitude of about 0.88V r.m.s. and a frequency around 227Hz, as explained in the text.

graticule shown there are ten equal divisions horizontally and eight vertically, providing 80 equal-sized squares in all.

In practice all 'scopes are equipped with a control calibrated in terms of time per division (time/div.). It's the job of this control simply to set the timebase ramp generator to deflect the spot across one horizontal division of the graticule in the time indicated.

Say, for example, we wish to examine a 1,000Hz (1kHz) sinewave over the whole width of the graticule. Well, the speed taken by a 1kHz signal is equal to 1/1,000 second, which works out to 1 millisecond (mS). You just enter 1,000 in your calculator and then press the 1/x (the reciprocal key) to get the answer!

But don't forget that there are ten horizontal divisions on the graticule, so we need to set the timebase control to 0.1 ms/div, the ten adding up to the required 1m total time. By setting the timebase control to 1 ms/div. we would have a complete 1kHz sine wave appearing in each of the ten horizontal divisions.

Most 'scopes, even those of early specifications (such as might well be on sale at radio rallies), have quite a wide range timebase control. Incidentally, the 'scope running in my 'den' while I'm actually writing this instalment, ranges from 0.5 microseconds to 0.2 seconds per division, with the final position on the switch marked 'external'. This switch position allows the internal timebase to be disconnected so that an external X input signal can be connected in its place. (There are many applications where an external X input would be required - more on this later).

The Graticule

Let's return once again to the graticule in **Fig. 3**. The sinewave displayed on this almost fills the entire deflection area. We shall see later that the Y input attenuator control is also calibrated, but in this case in terms of volts/div.

But for now, let's say that the control is set to 1 volt/div. and the timebase control to 10 microseconds/div. So, if that's the case - what would be the frequency and the amplitude of the sinewave?

Okay, then, to find the answer let's take frequency first. We see that the full waveform occupies all 10 of the horizontal divisions of the graticule, and since each division is equal to 10 microseconds, the total time taken by the waveform is 100 microseconds, or $1x10^{-4}$ second.

To find the frequency we merely find the reciprocal of the time in seconds (e.g., $1/(1x10^{-4})$, which works out to 10,000. The frequency of the sinewave is thus 10,000Hz (10kHz). So it's really simple isn't it!

Looking At Amplitude

Now let's now take a look at the amplitude. When this is measured between the positive and negative peaks it's known as the peak-to-peak amplitude, which in the example occupies six of the vertical divisions of the graticule.

Since each division corresponds to 1V, the peak-to-peak value must be 6V and the peak value is 3V. Using a basic a.c. voltmeter to measure the same waveform, assuming that the voltmeter is accurately responsive up to 10kHz, a reading of 3V would not be obtained. It would be something less than this. Why would this be? Well, to answer, the basic a.c. voltmeter provides its reading in the root mean square (r.m.s.) value of the waveform, while the 'scope displays the peak values.

Did You Know?

When amplitude is measured between the positive and negative peaks it's known as the peak-to-peak amplitude.

However, the r.m.s. value can easily be found simply by multiplying the peak value by 0.707. This means that the r.m.s. value of the example 3V peak waveform would be in the order of 2.1V, which is the value that would be indicated on an a.c. voltmeter.

I shall be having more to say about the parameters of voltage later, but to round off this month's instalment I thought it would be a good idea to look at a real sinewave display. The oscillogram, **Fig. 4**, was taken sometime ago from the screen of the 'scope that has long become part of my shack's furniture!

Timebase & Sensitivity

The oscilloscope's timebase was set to 1ms/div. and the X sensitivity to 0.5V/div. These settings mean that the display has a frequency around 227Hz and a peak amplitude close to 1.25V corresponding to 0.88V r.m.s.

Although we've seen that a 'scope is able to measure frequency and amplitude, the readout accuracy is obviously below that achievable with modern digital frequency and voltage measuring instruments. Despite this, you should be able to achieve an accuracy around 5%, even from some of the early instruments - so it's well worth keeping an eye open for that rally bargain 'scope! **PW**

High Voltages!

When fiddling inside an Oscilloscope beware of high voltages, make sure:

- ***The 'scope is switched off***
- ***Any high voltage capacitors are discharged (including the feed from the high voltage supply)***
- ***The mains supply is disconnected***

You have been warned!

Technical FOR THE TE

Tony Nailer G4CFY introduces his new column, aimed at bridging the gap between basic understanding and his other - extremely popular series - Doing it by Design. Tony says that when it gets technical, there's no need to panic!

Editor's Comment: In welcoming Tony Nailer G4CFY's new column, which has been especially written for *PW* readers, I'm indebted to my friend for his valuable input to the magazine. One regular column is quite a commitment, whereas two are a real undertaking! (Thanks Tony). The *PW* staff hope readers enjoy this series as much as we have done by preparing the drawings and text for your pleasure.

Rob G3XFD.

There seems to be a need to bridge the gap between the simple articles, aimed at the beginner, which have no calculations and Doing it By Design, which assumes a knowledge of basic algebra. Very few people ever have need to apply algebra after leaving school and most students realise this in advance. This is one of the main reasons why interest in mathematics is generally low in our schools.

For those who like the idea of home-brewing in the first step is to start is by copying complete projects presented in books or magazines. The second step is to start making up projects by pinching nice looking stages from a variety of designs and making a new project from the jig-saw puzzle pieces.

The third step is to become sufficiently familiar with stage circuits so that you can draw them from memory and even put in popular values. The final step is to learn how to calculate the values so that not only do the individual stages now work well, but that proper consideration is given to the interstage coupling.

Don't Panic!

Before any calculations are possible, it's necessary to revise the principals of basic algebra. However, the primary principal of Technical for the Terrified is **DON'T PANIC !**

I'm sure all readers are familiar with **+**, **-**, *****, and **/**. And to complete the team of symbols there is also **( )**, Square root and Powers.

Let's start with the brackets. These are used to indicate which bits have to be dealt with separately so that no confusion occurs. If there is the calculation 5 - 6 x 0.5 there would be different results dependent upon the order of the calculation. For example 5 - 6 gives -1, then multiply this by 0.5 gives -0.5. Whereas it could be done as 6 x 0.5 = 3, and then taking the results from 5 and the answer is 2.

By using the brackets the confusion is cleared. For example 5 - (6 x 0.5) instructs that the 6 x 0.5 is done **before subtracting** the result from the 5.

Square Roots

If we say the square root of the number A is another number B, then by that we mean if B is multiplied by itself, the result is the number A. The square root of 4 is 2. The square root of 81 is 9, because 9 x 9 is 81. Most calculators have a square root button which will determine the roots of difficult numbers.

Powers are the opposites of roots. 9 x 9 can be written as 9^2 or 9^2. The ^2 is the power, or 'indice'. Similarly 8 x 8 x 8 can be written as 8^3 (8^3). 10^3 (10^3) is 1000. This is really neat but it isn't rocket science!

Not So Dreaded Algebra!

I'm now aiming to prove that algebra isn't to be so dreaded! In fact, algebra is the use of letters in relationships which allow the manipulation of quantities according to a certain plan.

A classic example is speed. If we use the notations S for speed, D for distance, and T for time, then S = D/T. If the car travelled 45 miles in 1.5 hours then its speed was 45/1.5 = 30 miles/hour.

Transposition Of Formula

With transposition of formula the basic rule is: "Change the side, change the sign", where the = sign is the 'fence'.

If C = D + E, then C - E = D. What happened was: The +E on the right swapped sides and became a -E. Note that although the C and D do not have a symbol in front of them they are positive values.

To prove this let C = 5, D = 2, & E = 3. Putting the values in the two formula proves the rule. 5 = 2 + 3 or we can write 5 - 3 = 2.

The Subject

In algebra the symbol on its own on one side of the equals sign is known as the subject. As often happens some of the symbols including the subject are known, but not one of the others. Then apply the 'change the side and change the sign' rule to make the unknown into the subject;

F = G + H. Great but F = 8 and G = 5. So the formula is transposed to make H the subject.

Get rid of the G, swap it to the other side and then F - G = H, or H = F - G. H = 8 - 5 = 3. (Spooky eh?).

A similar arrangement occurs between multiply and divide so that multiply on one side becomes divide on the other and vice - versa. N = A/B. N x B = A. The B

RRIFIED!

divided on the right hand side becomes multiply on the left. I know it is unbelievable, so numbers will be put in to prove it. N = 5, A =10, and B = 2. So, 5 = 10/2. 5 x 2 = 10.

Ohm's Law revisited. V = I x R. Using transposition V/I = R, likewise V/R = I.

Manipulating Roots & Powers

Let's now look at manipulating roots and powers. Power can be calculated by $P = V^2/R$, or by $P=I^2R$

If the voltage V is 70V and resistance R is 50Ω,

then $P = 70^2/50 = 70 \times 70 /50$. P = 4900 / 50 = 98W. That wasn't too bad, was it ?

Now we'll consider the a.c. voltage swing in a low pass filter rated at 25W at 50Ω

$P = V^2/R$. So $P \times R = V^2$. To find V, both sides of the equation are square rooted.

Then, Square Root (P x R) = V. V = SqRt (25 x 50) = SqRt (1250). On my calculator it gives 35.35V.

Powers Of Ten

Time to look at power of ten now. The little chart below should help!

Value	Power	Name	Symbol
Million Million	10^{12}	Tera	T
Thousand Million	10^{9}	Giga	G
Million	10^{6}	Mega	M
Thousand	10^{3}	Kilo	k
One	10^{0}	Unity	
Thousandth	10^{-3}	milli	m
Millionth	10^{-6}	micro	u
Thousand Millionth	10^{-9}	nano	n
Million Millionth	10^{-12}	pico	p

This is quite enough for someone returning to maths who hasn't done it for years and maybe never was really happy with it previously. But it will at least set you along the right road.

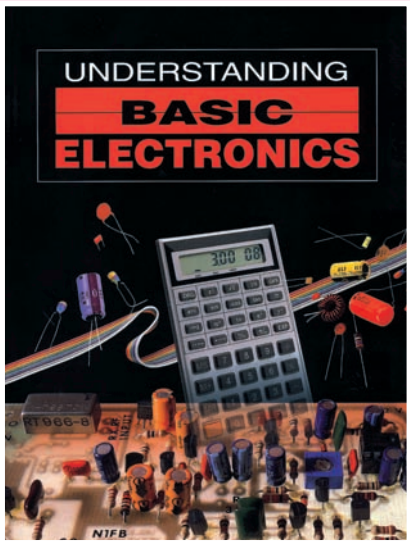
To be able to manipulate the pF, µH, and MHz terms in the standard resonant frequency equation I will consider the rules which apply to indices and powers of 10 in the next issue. So, as you'll now realise - there's no need to be technically terrified is there?

Recommended Further Reading

Understanding Basic Electronics

Published by the American Radio Relay League.

Determined to help 'technically terrified' readers to overcome their fears, Rob Mannion G3XFD suggests some extra reading. Rob says that with the help of Tony G4CFY's new series, the book he's to recommend will help the keen radio enthusiast get the most from the fascinating technology lying around in our workshops.



Literally ever since the American Radio Relay League's book *Understanding Basic Electronics* first arrived in Europe I've been encouraging readers to get their own copy. And, as I clearly stated in my very first review of this remarkable publication - it fills a real need. This is because in my opinion the book is absolutely superb. In fact, I feel it couldn't be bettered nowadays. American it may be, and yes there are some grammatical expressions and word terms more familiar in the USA, but generally speaking I really couldn't begin to suggest a better book than this superb effort.

For many years I used the once popular (but no longer available) Common Core series *Basic Electricity*, *Basic Electronics* and *Basic Television* for initial teaching. In fact there are many people around nowadays (with far greater knowledge than I've ever gained) who I started off on radio using the old Common Core books. Once started they quickly went on to higher level textbooks and eventually ended up at university.

You can imagine how proud I've been over the years whenever I come across an old school radio club member who I launched towards their career in electronics/electrical engineering with the help of the plain, simple and no-nonsense Common Core textbooks. Very often I found they've excelled with an Honours Degree. Surely that says something for the early help the textbook provided? The Common Core series helped teach me the basics in the Royal Navy in the late 1950s, and nowadays I'm delighted to say that the ARRL *Understanding Basic Electronics* can do the same for readers in 2005.

With 30 chapter the book is itself a complete training course and is, in fact, used as such in some American schools. The topics include Learning to work with numbers (ideal if you wish to back up G4CFY's articles), and this chapter sets the scene up until chapter 6 as the book prepares you with the basic maths needed. The chapters onwards from seven deal with voltage, electricity and magnetism, conductors, insulators and resistors. From chapter to chapter circuits are dealt with in a delightfully simple, no frills, manner. In fact, along with providing a complete electronics course in one manual you are then left with an excellent reference source. I keep my copies (I have one at home and one at the office) for cross checking technical points. It's that good!

The main advantage of the ARRL book is that the technicalities are provided in easily digested and understood bite-sized chunks. This excellent technique is helped further by the drawing and diagram presentation; it's simple and effective. In the same way the Common Core books all the artwork is effective. I enjoyed the cartoons in the original *Basic Electricity* books, and I'm pleased that the ARRL publication also uses them just as wisely.

In short this book - as I've said many times in the past - is superb. It should be in the reference library of all radio enthusiasts. Even if you don't need to learn yourself (there are not many about who can claim that!) you'll have handy explanations ready to encourage a friend, or a young family member who is showing the first spark of interest in the hobby. Go on, treat yourself - at £15.50 a copy it's a technical bargain! (Available from the PW Bookstore).

more next month...

HF Bands Low-pass Filters

Stefan Niewiadomski shows you how to severely reduce the out-of-band signals that reach the antenna from the output socket of your rig. His idea is one filter for each of the h.f. bands.

In the November 2003 issue of *Practical Wireless* **Gordon King G4VFV** rightly points out the importance of transmitting a signal that's significantly free harmonics, so avoiding interference to TV receivers. You also won't unintentionally transmit in a harmonically related band. An example of this is where you are transmitting at (let's say) 7.03MHz the third harmonic is at 21.09MHz, and is audible in the 15m band.

Of course the designers of commercial transmitters and transceivers understand the issues. They therefore equip their products with good quality low-pass filters at the transmitter output and unless faulty are generally not the origin of such interference. The same cannot always be said about all home-built equipment, especially if simple output stages are being used employing low cost output devices such as power m.o.s.f.e.t.s. I've seen output waveforms that are so distorted that they probably contain about the same amount of r.f. energy in the harmonics as in the fundamental frequency. It is with these transmitters, having up to about 10W output, which this unit is intended for use.

Let's say that you've just knocked up a transmitter and are eager to try a QSO with it, but you can't spare the time to build a decent low-pass filter. Or you've just found a crystal for another band, then this unit is your saviour. You can simply plug it in between the transmitter and the antenna.

I make no apologies for showing some of the theory in the design of these filters (which isn't difficult). This will allow constructors to adapt them to other cut-off frequencies and/or impedances if needed.

Basic Design

The filters in this unit were designed using the basic design of a 'Normal' filter. A normal filter is one that's been designed for a 1Ω load/feed resistance and operating at a frequency of 1radian/sec (rad/sec)*. Many commercially available prototype designs are created so that, by scaling the component values to 50Ω and your desired cut-off frequencies, you may create the filter that you need. (* The frequency of 1rad/sec is equal to (1/2π)Hz, or about 0.1592Hz).

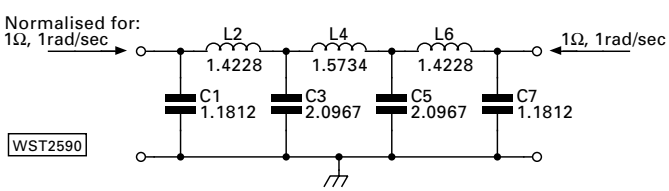
I chose a 7-element Chebyshev filter with 0.1dB passband ripple, **Fig. 1** because it gives better than 56dB of attenuation at twice its cut-off frequency. The precise identifier for this filter is C07-15, where 07 indicates the order of the filter and 15 indicates the reflection coefficient of the filter, which is another way of expressing the passband ripple. This filter uses one more inductor and capacitor than the 5-element version often used, but the extra 20dB or so of attenuation at the second harmonic frequency gives worthwhile peace of mind.

Practical Components

After the calculations, the capacitor values shown in **Fig. 2** don't look very practical and so a compromise has to be made as to what exact values are to be used when actually building the filter. The compromise used here is to approximate each of them to the nearest parallel combination of two capacitors, as shown in **Fig. 3**, and in fact this leads to an overall value, which is very close to the exact value.

Remember that capacitors in parallel simply add their values together So, for example the 'real' C1 consists of 1500pF in parallel with 220pF, which gives 1720pF, that's within 1% of the calculated value of 1709pF. Of course the tolerance of the capacitors makes these values deviate from the calculated value, but getting the nominal values very close to the exact value is a good strategy.

The inductors need to be wound on toroid cores and so only a whole number of turns can be wound on each core. Therefore the inductor values shown in Fig. 3 are the



● Fig. 1: These are the values and layout for a 7-element Chebyshev filter designs for 1Ω and 1radian/second. Values for inductances are in Henries and capacitors are in Farads.

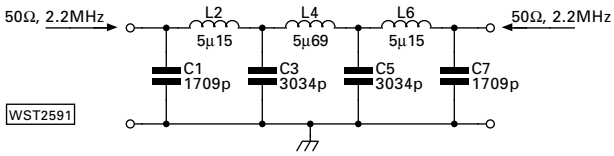
inductance value that is obtained from the whole number of turns giving the closest inductance value.

So what is the effect on the filter's response of approximating these component values? I used *SwCAD III* , Linear Technology's circuit simulator, waveform viewer and schematic capture to simulate the effect of these component approximations, and results on the passband response are shown in **Fig. 4**. Although this package is intended for the simulation of Linear Technology's range of switching regulators it is a general purpose tool and is eminently suitable for verifying lots of analogue circuits before building them. This is available from: **www.linear.com/software**

At first sight the ripples in the passband characteristic of a Chebyshev filter look severe. But the vertical scaling is 0.02dB per division and so the version of the filter with the practical component values is only slightly worse than the 0.1dB ripple of the filter with ideal values. Clearly this is not a significant increase in the passband ripple, and shows that practical versions of such filters are easy to construct.

The complete response of the 1.8MHz low-pass filter up to 6.1MHz is shown in **Fig. 5**. It can be seen that at 4MHz (just above the second harmonic of the highest frequency in the band) the attenuation is about 50dB, and about 78dB at 6MHz. I chose 2.2MHz as the nominal cut-off frequency for this filter so that the tolerance of the real-life capacitors used to build it can't take the cut-off frequency too close to the 2MHz edge of the band.

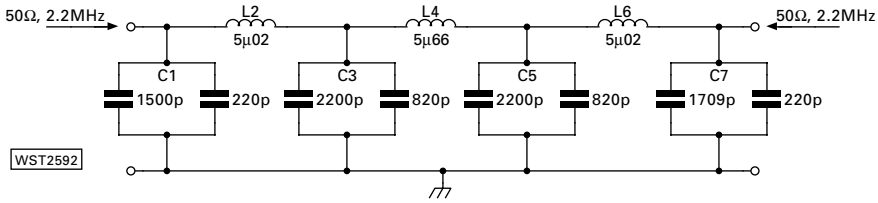
Note: With Chebyshev filters the -3dB point, generally accepted as the cut-off point of filters, has no significance. For a Chebyshev design filter, the cut-off frequency is defined as that point where the attenuation first exceeds the passband ripple value.



To calculate values of C	To calculate values of L
$C = C_n \frac{1}{2\pi f R}$	$L = L_n \frac{R}{2\pi f}$
Where C_n is one of the capacitors shown in Fig. 1	Where L_n is one of he inductors shown in Fig. 1

C is the final capacitor value,
L is the final inductor value,
C_n is the 1Ω, 1rad/sec capacitor value,
L_n is the 1Ω, 1rad/sec inductor value,
R is the final impedance value,
f is the final frequency.

● Fig. 2: Scaling the values from Fig. 1: gives practical values for a design of 2.2MHz with 50Ω characteristic impedance. The formulae are shown to scale the capacitors and inductors for other bands. (See text for more detail.)



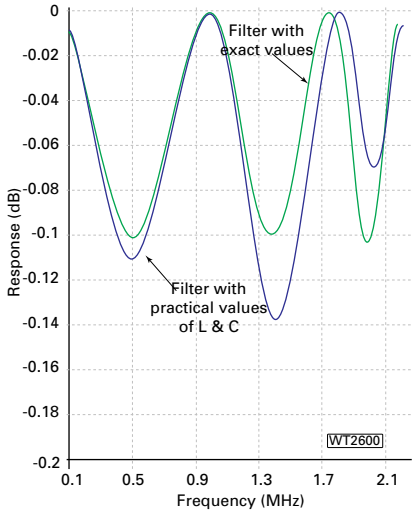
● Fig. 3: Creating values close to the calculated ones using two standard value capacitors. (See the tables for details of the inductors.)

Circuit Description

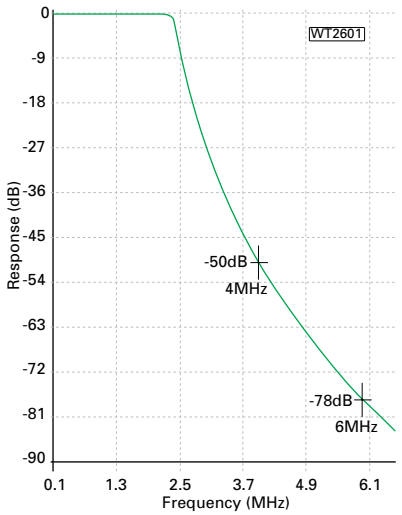
Filters have been designed for all nine h.f bands and **Fig. 6** shows the skeletal schematic of the filter unit. It has been designed to accommodate the six pre-WARC h.f. Amateur bands plus the newer 10, 18 and 24MHz bands. Alternatively the 7MHz filter can be used for both 7 and 10MHz, the 14MHz filter for the 18MHz band and the 21MHz filter for 24MHz band, with some reduction in stopband attenuation (see later).

The filters are shown in blocks of three, so any number of filters can be incorporated into the unit, up to the limit of the switches used. The filters are completely symmetrical, as there is no difference between their inputs and outputs. The switches, S1 and S2, are separate rotary switches, switching the input and output sides of the filters respectively.

I used separate switches so that the input and output sides of the filters could be kept physically separated from each other, hence eliminating any chance of signal leakage around the filters. The alternative is to use a switch with two wafers a couple of inches away from each other on a long shaft. Buying such a switch new is fairly expensive so, I avoided it in my prototype.



● Fig. 4: Showing the differences of in-band ripple of both calculated and 'real world' capacitors values. Note the value of the response scaling.



● Fig. 5: Looking at the overall response of the 1.8MHz band filter shows just how effective a low-pass unit it is. (See text for more detail.)

Nine Filters

The scaled component values for each of the nine filters are shown in **Tables 1**, **2** and **3** (page 39). For each filter the impedance match is 50Ω in all cases. I've also shown the band covered; the upper band edge and the upper band edge+10%, which is the filter cut-off frequency. I've also shown the exact scaled capacitor values in pF and inductor values in µH, along with practical capacitor values using two capacitors where needed. Finally I've shown practical inductor values, showing the toroid core used, the number of turns needed and the inductance.

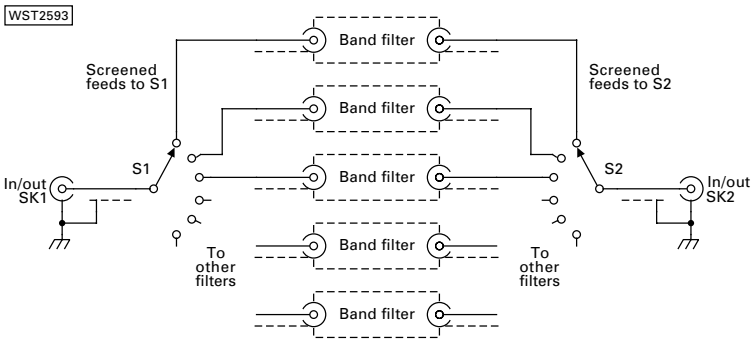


Fig. 6: Switching between various filters uses individual switches for the filters minimizes interaction between input and output due to proximity.

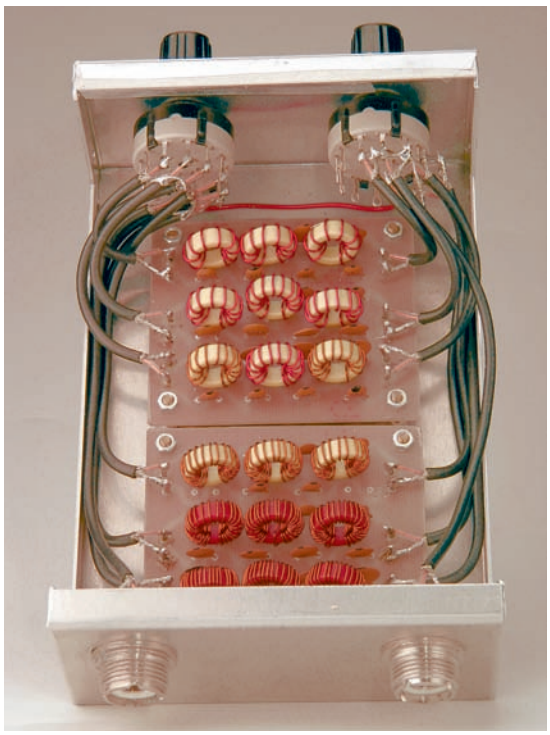
If the expense of building separate filters for the newer bands can't be justified, then the filters for 14, 21 and 28MHz can be used. Simulations indicate the following performance of these filters at the relevant frequencies:

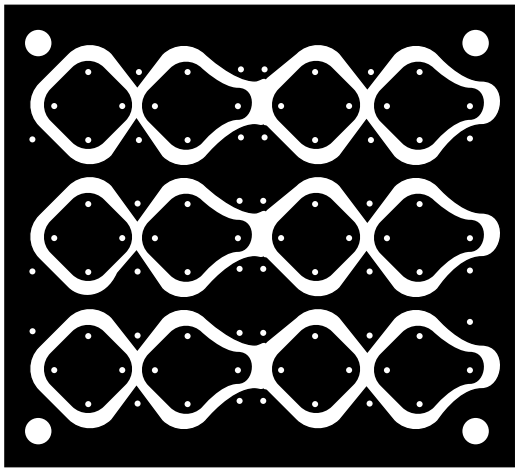
14MHz:	-0.15dB at 11.165MHz: -29.3dB at 22.33MHz:
21MHz	-0.023dB at 18.168MHz: -38.9dB at 36.376MHz:
28MHz	-0.16dB at 24.99MHz: -36.3dB at 49.98MHz:

You can see that the passband response of these filters is flat enough to give very low attenuation in the 10, 18 and 24MHz bands. The stopband performance is greater than 36dB at twice those band edge frequencies, except for the 14MHz filter.

Single-Sided PCB

I built the filters, three at a time on single-sided p.c.b.s, the track pattern and component placement of which are shown in **Fig. 7**. With three filters per board only two boards may be used for the pre-WARC bands and you can add another board if you need filters for the other bands.





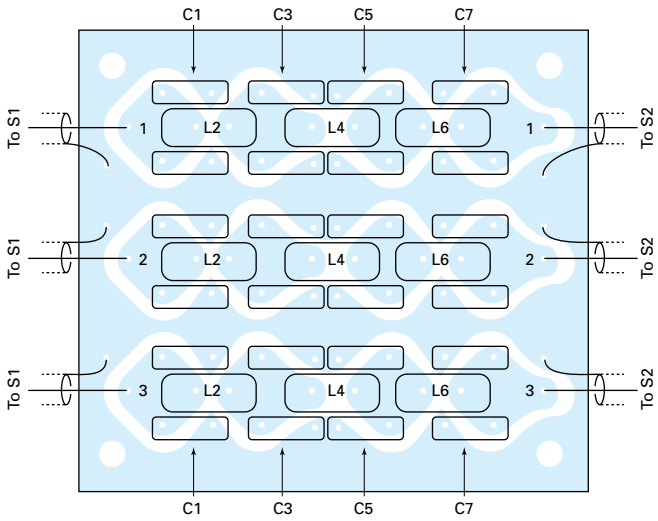


Fig. 7: The individual p.c.b.s can accommodate up to three filters on each board. (See text for more detail.)

Alternatively the filters can be built 'ugly style' on unetched p.c.b. material. Each capacitor position on the p.c.b. allows for the placement of two real capacitors. On the cases where values indicate only one real capacitor, simply leave the other position unoccupied.

All the toroids were wound using 0.46mm enamelled copper wire. The through power that the filters can handle depends on the size of the toroids, the gauge of the wire used and the working voltage of the capacitors.

The T50 toroids used in the prototype are typically used in designs up to 10W, and the 100V working voltage of the capacitors is suitable for the same power level. You can adapt the filters to higher power by using larger toroids and higher voltage capacitors, though these are becoming more difficult to obtain.

Almost any metal housing or case, big enough to house the number of boards can be used. I used a 152x102x50mm two-piece metal case (**NB13** from **Sycom**), which allows for two p.c.b.s to be mounted side-by-side. To accommodate more boards a bigger case would be needed, or the boards could be mounted above each other.

The p.c.b.s are bolted to the chassis by 12mm long screws and nuts and all the unit's wiring completed using miniature coaxial cable cable. The layout of

Fig. 8: The inside of Stefan's prototype.

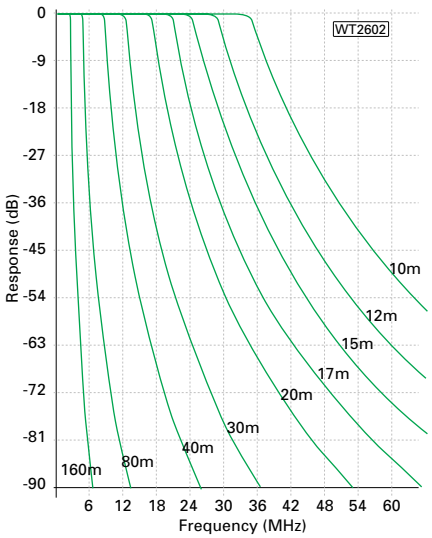


Fig. 9: Looking at all nine h.f. band filter response curves, shows how you signal should have much reduced out-of-band signals.

Shopping List

Capacitor and inductor values for the h.f. bands are shown in the various tables.

The 1.8 and 3.5MHz filters each use 3-off T50-2 (Red) toroids, all other filters each use 3-off T50-6 (Yellow) toroids, for which you'll need some 0.46mm (26swg) enameled copper wire to complete.

All capacitors are ceramic type. In my prototype, I used metallised ceramic plate capacitor range from Maplin.

Two suitable multi-way single pole rotary switch, with suitable knobs, two suitable coaxial sockets, miniature coaxial cable, terminal pins, a suitable case: 152x102x50mm two-piece aluminium case, earth tags, screws and nuts.

the inside of the case is shown in **Fig 8**.

My prototype, shown in the heading photograph, has lettering for the front panel created using *PowerPoint*, printed out and stuck onto the panel after the holes for the controls had been drilled. This was then covered with sticky-backed clear plastic, the holes cut and the controls carefully mounted on the panel.

Using the Unit

The unit is very simple to use. Simply connect it in the signal path between the transmitter output and the antenna, before the antenna matching unit, which itself is essential to match the 50Ω transmitter/filter impedance to the complex, frequency-dependent impedance of the antenna. The only adjustment of the filter unit is to switch S1 and S2 to the band in use.

So, there you have it. A great filter to limit 'sproggies' from your station as you can see in the response graphs of the nine h.f. band filters shown in **Fig. 9**.

PW

Table 1 (1-8 to 7MHz bands)

Impedance 50Ω			HF Band		2.0MHz	HF Band		3.8MHz	HF Band		7.2MHz
1Ω and 1Rad/Sec			1.8MHz (160m)	Band edge +10%	2.2MHz	3.5MHz (80m)	Band edge +10%	4.18MHz	7MHz (40m)	Band edge +10%	7.92MHz
	'Normal' values C (F)	L (H)	Scaled values C (pF)	L (µH)	Practical value	Scaled values C (pF)	L (µH)	Practical value	Scaled values C (pF)	L (µH)	Practical value
C1	1.1812		1709		1720pF (1500 + 220pF)	900		902pF (820 + 82pF)	475		470pF
L2		1.4228		5.15	32 turns on T50-2 (Red) (5.02µH)		2.71	24 turns T50-2 (Red) (2.82µH)		1.43	19 turns on T50-6 (Yellow) (1.44µH)
C3	2.0967		3034		3020pF (2200 + 820pF)	1597		1582pF (1500 +82pF)	843		842pF (820 + 22pF)
L4		1.5734		5.69	34 turns on T50-2 (Red) (5.66µH)		3.00	25 turns on T50-2 (Red) (3.06µH)		1.58	20 turns on T50-6 (Yellow) (1.60µH)
C5	2.0967		3034		3020pF (2200 + 820pF)	1597		1582pF (1500 +82pF)	843		842pF (820 + 22pF)
L6		1.4228		5.15	32 turns on T50-2 (Red) (5.02µH)		2.71	24 turns T50-2 (Red) (2.82µH)		1.43	19 turns on T50-6 (Yellow) (1.44µH)
C7	1.1812		1709		1720pF (1500 + 220pF)	900		902pF (820 + 82pF)	475		470pF

Table 2 (10 to 18MHz bands)

Impedance 50Ω			HF Band		10.15MHz	HF Band		14.35MHz	HF Band		18.168MHz
1Ω and 1Rad/Sec			10.05MHz (30m)	Band edge +10%	11.165MHz	14MHz (20m)	Band edge +10%	15.785MHz	18.068MHz (17m)	Band edge +10%	19.985MHz
	'Normal' values C (F)	L (H)	Scaled values C (pF)	L (µH)	Practical value	Scaled values C (pF)	L (µH)	Practical value	Scaled values C (pF)	L (µH)	Practical value
C1	1.1812		337		330pF	238		238pF (220pF + 18pF)	188		189pF (150 + 39pF)
L2		1.4228		1.01	16 turns on T50-6 (Yellow) (1.01µH)		0.72	13 turns on T50-6 (Yellow) (0.676µH)		0.57	12 turns on T50-6 (Yellow) (0.576µH)
C3	2.0967		598		590pF (470 + 120pF)	423		423pF (390 + 33pF)	334		330pF
L4		1.5734		1.12	17 turns on T50-6 (Yellow) (1.16µH)		0.79	14 turns on T50-6 (Yellow) (0.784µH)		0.63	13 turns on T50-6 (Yellow) (0.676µH)
C5	2.0967		598		590pF (470 + 120pF)	423		423pF (390 + 33pF)	334		330pF
L6		1.4228		1.01	16 turns on T50-6 (Yellow) (1.01µH)		0.72	13 turns on T50-6 (Yellow) (0.676µH)		0.57	12 turns on T50-6 (Yellow) (0.576µH)
C7	1.1812		337		330pF	238		238pF (220 + 18pF)	188		189pF (150 + 39pF)

Table 3 (21 to 28MHz bands)

Impedance 50Ω			HF Band		21.45MHz	HF Band		24.99MHz	HF Band		29.7MHz
1Ω and 1Rad/Sec			21MHz (15m)	Band edge +10%	23.595MHz	24.89MHz (12m)	Band edge +10%	27.489MHz	28.0MHz (10m)	Band edge +10%	32.67MHz
	'Normal' values C (F)	L (H)	Scaled values C (pF)	L (µH)	Practical value	Scaled values C (pF)	L (µH)	Practical value	Scaled values C (pF)	L (µH)	Practical value
C1	1.1812		159		153pF (120 + 33pF)	137		138pF (120 + 18pF)	115		115pF (100 + 15pF)
L2		1.4228		0.480	11 turns on T50-6 (Yellow) (0.484µH)		0.412	10 turns on T50-6 (Yellow) (0.400µH)		0.347	9 turns on T50-6 (Yellow) (0.324µH)
C3	2.0967		283		282pF (270 + 12pF)	243		242pF (220 + 22pF)	204		202pF (180 + 22pF)
L4		1.5734		0.531	12 turns on T50-6 (Yellow) (0.576µH)		0.455	11 turns on T50-6 (Yellow) (0.484µH)		0.383	10 turns on T50-6 (Yellow) (0.400µH)
C5	2.0967		283		282pF (270 + 12pF)	243		242pF (220 + 22pF)	204		202pF (180 + 22pF)
L6		1.4228		0.480	11 turns on T50-6 (Yellow) (0.484µH)		0.412	10 turns on T50-6 (Yellow) (0.400µH)		0.347	9 turns on T50-6 (Yellow) (0.324µH)
C7	1.1812		159		153pF (120 + 33pF)	137		138pF (120 + 18pF)	115		115pF (100 + 15pF)

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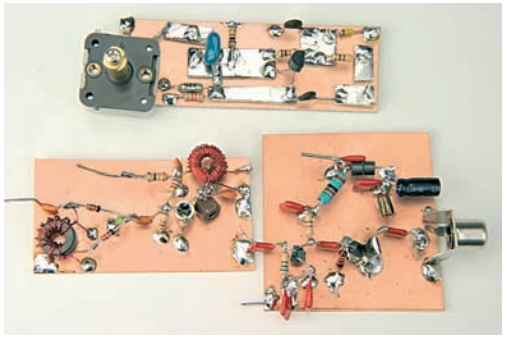


● This month's project uses a frequency doubler - the 3.5MHz signals are then used to provide the required 7MHz output.

This month the Rev. George Dobbs says he's describing a "40 metre transmitter that starts off on 80 metres". It seems an ideal weekend project, so get those soldering irons switched on!

Welcome to Carrying On The Practical Way (COTPW). Looking back, it was in this column for October 2002 I introduced *PW* readers to the RA3AAE sub-harmonic mixer circuit. This mixer circuit first appeared in an article by **Vladimir Polyakov RA3AAE**, in the December issue of 1976 of the Russian magazine *Radio*.

Vladimir's circuit is a simple idea using a pair of anti-parallel (back-to-back) diodes. The diodes not only act as a product detector (mixer) for the input and oscillator signals, but also as a frequency doubler for the local oscillator signal, so the local oscillator runs at half the desired reception frequency.

The frequency doubler method of product detection has several advantages. The oscillator operates at half the desired signal frequency, so the receiver input circuit does not tend to 'pull' the oscillator.

It's also easier to generate a stable signal at lower frequencies. Thus we can make a 7MHz receiver using a 3.5MHz local oscillator!

Good Results

I've had good results using the RA3AAE mixer with a local oscillator operating on 3.5 for a receiver working on 7MHz and have long mused on a transceiver based on this principle. However, this approach would have advantages and some disadvantages.

The main advantages would be the inherent simplicity and effectiveness of the RA3AAE mixer, together with the relative ease of producing a stable signal at half the receiver frequency. Another, great advantage is that a free running variable frequency oscillator (v.f.o.) can be avoided by using a commonly available ceramic resonator in a variable crystal oscillator (VXO) circuit to cover the whole of the 7MHz band.

My original *PW* article showed that the easily available, and cheap, 3.58MHz ceramic resonators could be pulled using a variable capacitor to produce a signal that could be doubled to cover 7 to 7.2MHz.

Main Disadvantage

The main disadvantage comes with the transmitter circuitry as the VXO signal source is in the 3.5MHz range for a transmitter in the 7MHz range. (The frequency doubling occurs in the receiver mixer).

However, for the transmitter a separate frequency doubling circuit will be required. So, to achieve this I began some 'circuit doodling' on my workbench to attempt to produce a 7MHz transmitter driven by a 3.58MHz ceramic resonator VXO. What follows is the result of that doodling.

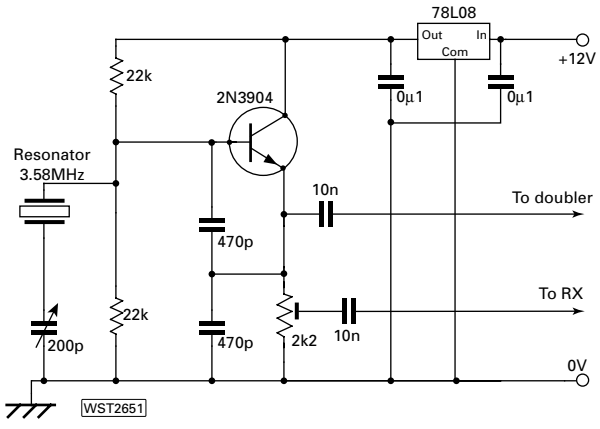
The circuit, **Fig. 1**, shows the 3.5MHz (80m) VXO using the 3.58MHz ceramic resonator. It's a version of the Colpitts Oscillator with two 470pF capacitors providing the feedback path.

Most common bipolar transistors with a fair amount of gain at higher frequencies would do the job in this application. (I used a 2N3904 transistor).

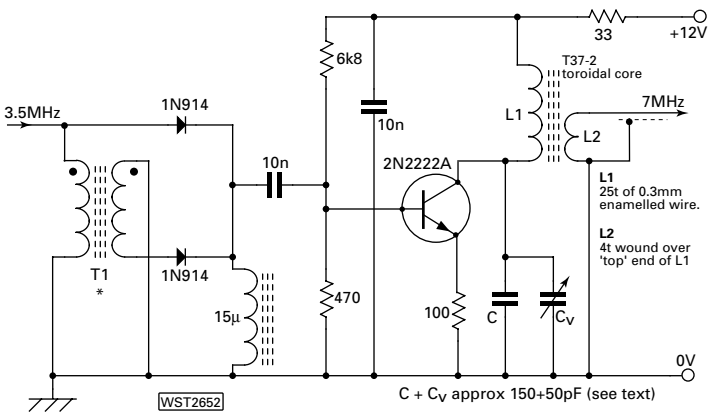
The output is taken from the emitter resistor. I used a small pre-set resistor and a relatively high value coupling capacitor (10nF) to allow for adjusting the oscillator injection to the receiver mixer. Another capacitor picks off the signal directly at the emitter for driving the frequency doubler for the transmitter. **Note:** The frequency doubler circuit requires a fair amount of signal injection.

Frequency Doubler

The diagram, **Fig. 2**, shows the frequency doubler circuit. It shows the well known two diode



● Fig. 1: The circuit of the 3.5MHz (80m) VXO using the 3.58MHz ceramic resonator (see text).



● Fig. 2: The frequency doubler circuit. It shows the well known two diode frequency doubler and functions like a full-wave power supply rectifier (see text).

frequency doubler and functions like a full-wave power supply rectifier.

In the full-wave rectifier application the 50Hz a.c. signal is converted to 100Hz through the diode action. (The positive and negative swings of the input waveform are changed into successive positive only swings).

Unfortunately, there's one 'downside' of the diode doubler - and that's the loss of signal; probably up to 8dB, although this can be recovered by adding a following amplifier. An 'upside' of the circuit is that the input frequency can be attenuated as much as 40dB. This can be then increased by tuning the amplifier to the doubled frequency.

The two diodes in the doubler arrangement are fed with a bifiliar wound transformer and have a small choke as their output choke. Incidentally, I'm always cautious in offering a bifilar winding in a project and even more cautious if I include a trifiliar winding!

Sadly, constructors often appear to get the windings wrong. In reality, it's a very simple task. So, here I'm offering a blow-by-blow (perhaps winding by winding?) account of making the transformer in Fig. 2.

Let's Begin!

To start the process, begin with two 400mm lengths of 30s.w.g. 0.3mm (28/30s.w.g. would work) enamelled copper wire. Lay them side by side and tie a knot, as near to one end as possible, to join them.

Next, secure the joined end firmly in a vice or the jaws of a 'third hand jig', (the type equipped with several larger crocodile clips, a heavy base and magnifying lens). The next stage is to lightly twist the wires together, in barley sugar stick style.

Some constructors use a hand drill bit, although personally I prefer a pencil by pulling the wire taut. I then form a loop at the non-secured end, and insert the pencil into the loop.

Next, I rotate the pencil to form twists in the wire (the idea is to add about three or four twists per 10mm. As the twists are added, it can be helpful to pull the twists down the wire to obtain an even rate of twisting.

The transformer itself is wound treating the twisted wires as if they are actually one wire. Add ten turns; each time the wires pass through the core counts as one turn. Trim the wires to allow about 100mm at each end of the winding.

The next stage is to scrape the enamel off the four ends of the separate wires (close to the core) and tin the bared copper with a hot iron and solder. Now we are going to do the bit that some people get wrong – working out which wire goes where!

Diagram Dot

You'll notice that in Fig. 2, two dots on the upper ends of the windings of T1, signifying the same end of both (or all) windings. I'll call this end of the windings the 'start' (and the non-dotted one, the finish). On the left hand (first) winding, the finish connects to the 0V rail. And for the right hand (second) winding, the 'start' connects to the same point. So, that makes it easy – the finish of the first winding, connects to the start of the second, both being connected to 0V.

Slightly untwist the wires, at both ends of the windings so that they're only twisted together where they wrap around the toroid. With a multimeter, identify **both** ends of one winding and mentally mark them as start and finish. The second winding also has its start and finish points at the same 'ends' of the toriodal winding. Now take the finish of the first winding and, connect it together with the start of the second. This common point connects to 0V. It's easier than you thought!

Tuned Amplifier

The frequency doubler is followed by a tuned amplifier. Again any similar *npn* silicon transistor would serve the purpose. The collector load of this amplifier is a tuned circuit at7MHz.

The tuned circuit includes a trimmer capacitor to tune the doubled frequency. With the value of L2 as given, the centre of the 7MHz band will require a capacitance of about 200pF.

The values of C_V and C should be adjusted to suit. A link winding, L2, feeds the 7MHz signal to the next stage.

Tuning C_V and L1 is not difficult although a spectrum analyser is useful. But I fully understand that few readers will probably have one on their test bench!

Practically speaking, just tuning C_V for maximum output will do the job. You could also use a diode r.f. probe of the sort I have described several times in this column and connect it to low voltage range on an analogue multi-meter. Then, feed the VXO signal into the frequency doubler and adjust C_V for the maximum output.

Power Amplifier

The diagram, **Fig. 3**, shows a circuit for a possible simple power amplifier (p.a.) to complete a 7MHz c.w. transmitter. I owe the circuit to **Dr. Mike King G3MY*(see note)** and it is about a simple a design as possible to produce a few watts of output at 7MHz.

The amplifier does however, push the little VN10KM device to the edge of its limits. It draws over 400mA on key-down and it gets hot. In the original G3MY version a home-made copper heat sink was added to the tab of the VN10KM and I soldered a small piece of sheet copper to the tab.

Unfortunately on key-down the solder melted and the heat sink fell off, but the device still lived! A good method is to cut two pieces of copper and bolt them either side of the device tab. So, I leave the reader to experiment with a suitable heat sink.

Sadly, Mike King G3MY became a Silent Key in late 2003. **Editor.*

Around 3W Output

My little prototype power amplifier delivered about 3W of r.f. output to a W3NQN design low pass filter shown in **Fig. 4**. All the windings used 0.3mm enamelled copper wire. It keys cleanly and puts out a worthwhile signal that can be tuned over the whole 7MHz band. Perhaps it will even form the basis of a transceiver using the RA3AAE receiver mixer.

I'll probably use a better power amplifier but you can be sure I will keep readers informed of how the ideas develop.

So there you are... an easy to build variable frequency transmitter for the 7MHz band!

PW

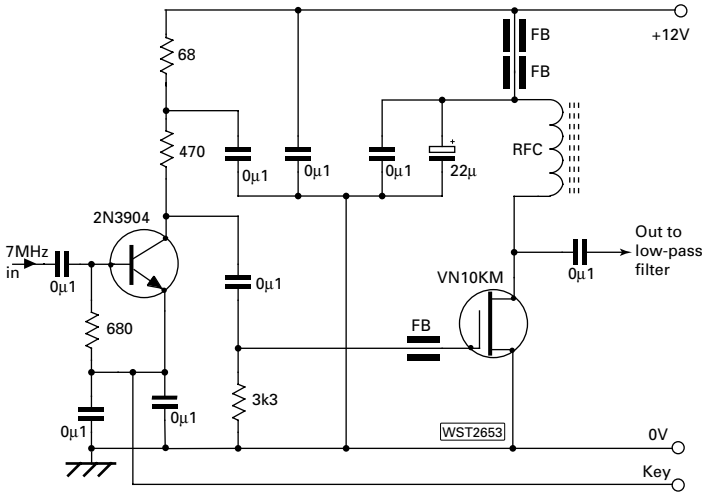


Fig. 3: A circuit for a possible simple power amplifier (p.a.) to complete a 7MHz c.w. transmitter, from an idea by the late Mike King G3MY (see text).

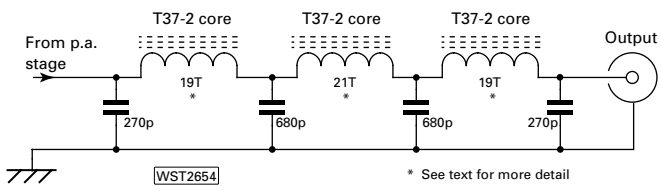


Fig. 4: George G3RJV used his prototype power amplifier, which delivers about 3W of r.f. output, to a W3NQN design low pass filter shown (see text).

Continuing the republishing of *PW* v.h.f. and u.h.f. classic projects, Rob Mannion G3XFD introduces a practical 144MHz f.m. transmitter. It could be used as a low power unit or to drive a linear amplifier.

Introduction: This article and project first appeared in the December 1975 issue of *PW*. The author was **Dr. W. H. Bond FRCS* G3XGP**, and was part of that author's excellent series of projects published under the title Miniature 2m Equipment. This article appeared as part 3: FM Transmitter.
***Fellow Royal College of Surgeons**.

I built several versions of this transmitter and also adapted the circuit (using a different multiplier chain) to produce an f.m. transmitter for 70MHz. The design worked very well on 144MHz and I was also happy with my own version for 70MHz. Hopefully you will also enjoy the constructional challenge while taking into account any implied (but unintentional) inferences on the technical skills of Amateurs who were not G3 plus three letter callsign holders! I mention this, as in my broadcasting days the vast majority of G8 plus three letters operators were involved in the forefront of the designing and building of the now long established (and reliable) u.h.f. TV and v.h.f. radio network. In fact they were often the designers of the BBC and IBA broadcasting versions of the 'black boxes'. **Editor**.

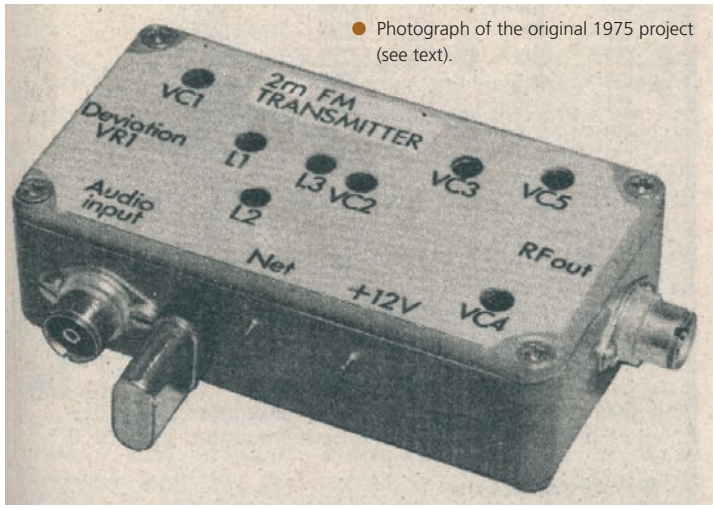
A Practical 144MHz FM Transmitter

The 1975 Article

In the past the most popular band for local contacts and the means whereby one began to learn about Amateur Radio, was 'Top Band'. With the increasing proportion of G8+3 callsigns, 'two metres' has largely replaced the lower frequency.

Readily available and easily modified commercial equipment has resulted in a new group of 'black box' operators, sufficiently knowledgeable to modify their equipment, erect an antenna and operate a microphone. They don't experience however, the pleasure of making something from scratch, or with the help of other local Amateurs, getting the bugs out of their equipment, . This transmitter is recommended for bringing back some of the adventure of Top Band and to give the beginner the same delight that I had when I made my first contact.

The transmitter to be described takes advantage of two facts. Firstly, 144MHz transmissions are remarkably penetrating, bearing in mind that on 1.8MHz 10W was essential to get across town in comfort. On the other hand at 144MHz, 500mW will do the same job with greater efficiency.



Photograph of the original 1975 project (see text).

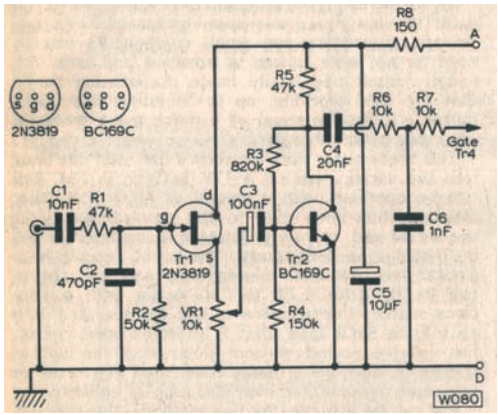
The second fact is that amplitude modulation (a.m.) is expensive, consumes unnecessary power and penetrates the front-end of the average TV like a hot iron through solder! So, instead of a.m. this transmitter employs frequency modulation (f.m.) to which TV sets and hi-fi equipment is relatively insensitive.

The transmitter has the additional advantage that v.h.f. antennas can be physically small or simple construction and can even be used inside the shack. Furthermore the antennas can give considerable gain. For the six-over-six slot fed antenna I use, it multiplies the 1W produced by this transmitter by over ten times.

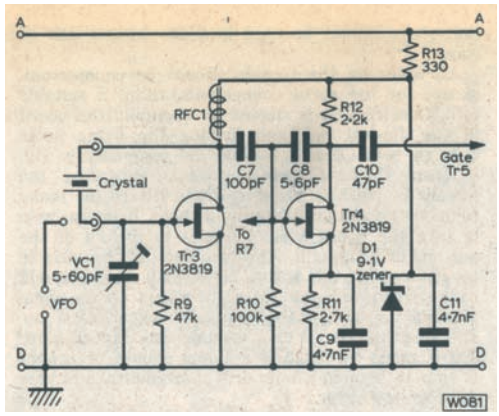
A 1W transmitter on v.h.f. gives me all the contacts I previously made on Top Band. The DX is also there, for when tropospheric openings appear the Continent is wide open to the skilled operator.

Many Advantages

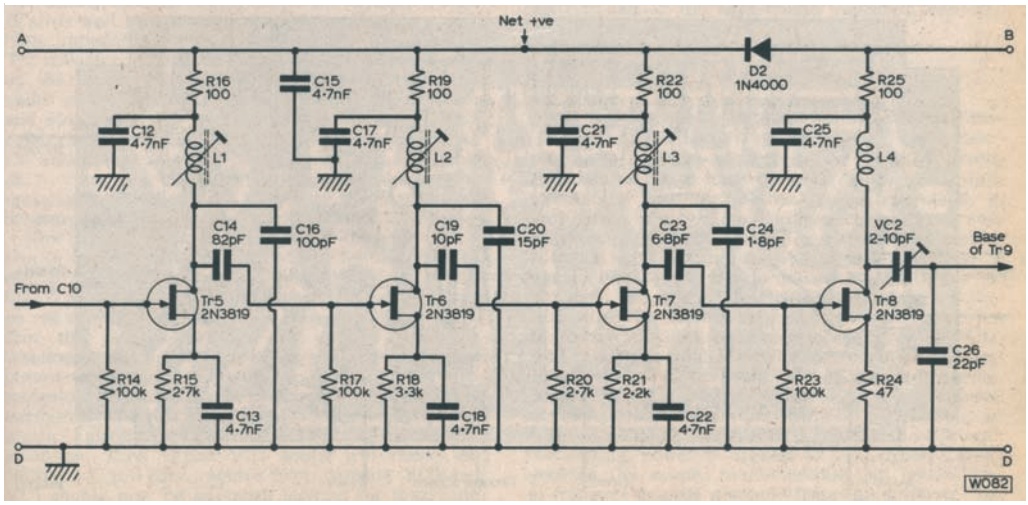
From the constructor's point of view, v.h.f. has many advantages. At low powers, transistors and small components can be used as no large power is involved and coils are equally small and easily made.



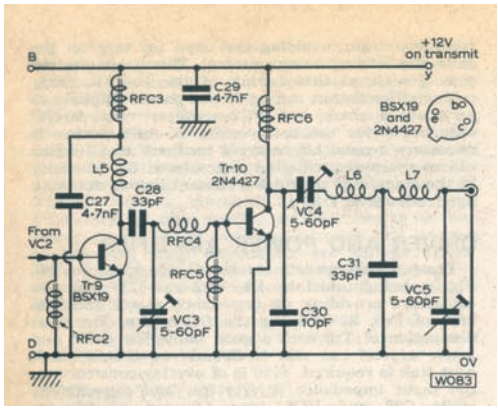
● Fig. 1: Circuit of the modulator section with transistor pin-outs (see text).



● Fig. 2: Crystal oscillator/v.f.o. amplifier and phase modulator circuit. The diode D1 and C11 are for voltage stabilisation (see text).



● Fig. 3 (above): Circuit diagram of multiplier chain and output to power amplifier stage (see text).



● Fig. 4 (right): Circuit of the driver, power amplifier and output sections. Please note than an efficient heat sink is required for Tr10 as up to 2.5W needs to be dissipated (see text).

Experience shows that for local working, as I previously mentioned, up to 50km, this transmitter is fully the equal of a much more powerful 1.8MHz version using 10W.

The transmitter I'm to describe puts between 500mW and 1W into the antenna, runs off a 12V battery, uses narrow band f.m. (n.b.f.m.) and can be operated with a crystal or v.f.o. Particular attention has been paid to the spectral purity of the signal and, correctly adjusted, harmonics should be better than 45dB down.

The audio input accepts both crystal and dynamic microphones and the output can be fed into a 50 to 75Ω antenna with a very close match. Furthermore, it can be operated, for a brief period, into an infinite s.w.r. load that's short or open circuit, without destroying the output transistor. Additionally, being phase modulated converted to frequency modulation, over-deviation is unlikely.

Achieving FM

In practice, f.m. can be achieved by using two methods, the simplest being the use of a varicap diode across the crystal or v.f.o. This method calls for little additional circuitry, but has the disadvantage of the possibility of over-deviation, that's more than the ±2.5kHz used in the UK.

Because the capacity variation with voltage is not linear, the deviation can be asymmetrical resulting in more power in one set of sidebands. The second method is achieved by the generation of a stable carrier frequency which is then phase modulated and converted into f.m. by trimming of the a.f. response.

Phase modulation causes an increase in deviation not only with amplitude but also with rising audio frequencies (a.f.) so that the audio amplifier has to have a falling characteristic. The advantages are that over-deviation is almost impossible, deviation is symmetrical and resolution on a receiver using simple slope detection is a little bit easier than with pure f.m. For these reasons I chose to adopt phase modulation for the project.

Low Fundamental Frequency

Phase modulation calls for low fundamental frequency if adequate deviation is to be obtained at 144-146MHz. So, I chose 8 to 8.1MHz as the fundamental, requiring a x18 multiplier chain to reach the operating frequency.

Conventional transmitters employ bi-polar transistors operating in class C in the multiplier chains, but they have considerable disadvantages. The input impedance is very low and they are driven by current rather than voltage. This absorbs power from the preceding circuit so that careful matching into the preceding stage is required if the *Q* of the stage is to be maintained and the amplification of unwanted harmonics avoided.

Though not as efficient, field effect transistors (f.e.t.s) overcome the difficulties. They operate well in class C for harmonic generation at very low currents and because of the high input impedance, are voltage driven. Therefore the *Q* is maintained, unwanted harmonics suppressed, but still provide selective amplification to the desired frequency.

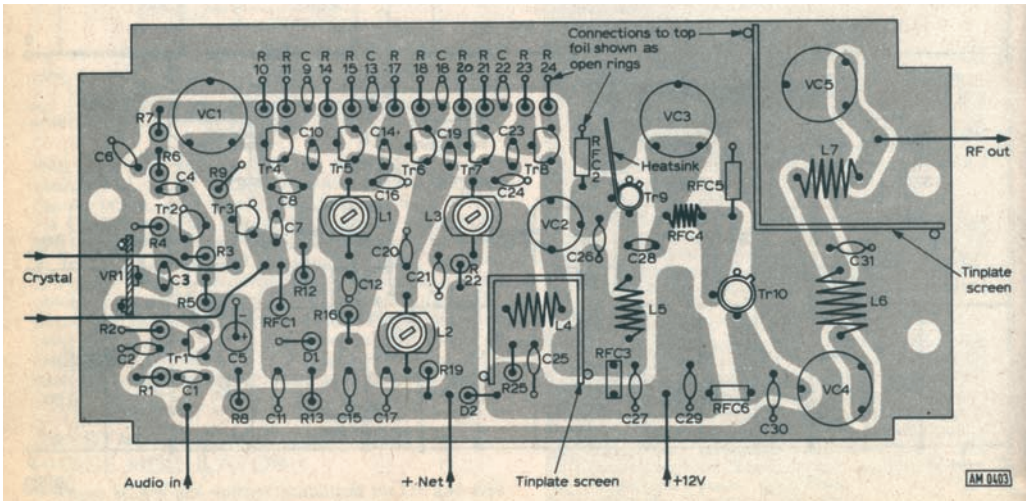
The output from the multiplier is another f.e.t. This runs at 10 to 20mA feeding a conventional driver and power amplifier.

Modulator Circuit

A high impedance microphone input is provided by Tr1 and C1, **Fig. 1**, though not essential, isolates the microphone while R1 and C2 constitute an r.f. filter and the gate of Tr1 is earthed by R2. (This resistor is not critical and any value over 50kΩ will suffice).

The transistor, Tr1, is an impedance changer giving current amplification only, with a voltage loss of 30% or more. The variable resistor, VR1, in the source lead of Tr1 varies the audio output and thus the deviation, source following into the base of Tr2 via C3.

● Fig. 5: Copper track side of the p.c.b. The actual size is 105 x 51mm (see text).



● Fig. 6: Component side of the p.c.b.

The transistor, Tr2, supplies voltage gain and by connecting the top of the bias chain to the collector, a measure of feedback is provided, limiting the gain to about 100 times. The resistor R8 and capacitor C5 decouple the modulator on the power supply side and R7 and C6 keep r.f. from the output of the modulator.

Resistor R6 and capacitor C4 add the final tailoring to the circuit to provide the required falling characteristic to the audio response. The current consumption of the modulator is about 500µA.

Other Stages

Let's now look at the crystal oscillator, v.f.o. amplifier and a.f. modulator stages. These sections are voltage stabilised by D1 and R13, **Fig. 2**. The crystal oscillator is the Pierce configuration, the crystal being connected between gate and drain so that the removal leaves the gate free for v.f.o. input when Tr3 acts as an amplifier. The variable capacitor VC1 is used to pull a crystal to a specific frequency and makes little difference to the v.f.o. The choke, RFC1, blocks the signal from Tr3, passing it via C7 to the gate of Tr4, the phase modulator, whose load is R12.

The output goes through C10 to the multiplier chain and feedback through C8 induces phase modulation, the audio signal being applied to the gate of Tr3, 1V peak-to-peak being required by the phase modulator.

Multiplier Chain

Transistors Tr5, Tr6 and Tr7, **Fig. 3**, are tripler, tripler and doubler respectively, with identical circuitry save for the necessary changes in coil and capacitor values required to resonate on the harmonic frequencies. All run quiescent currents of about 500µA, increasing to 1.5mA when r.f. is applied, thus running in Class AB.

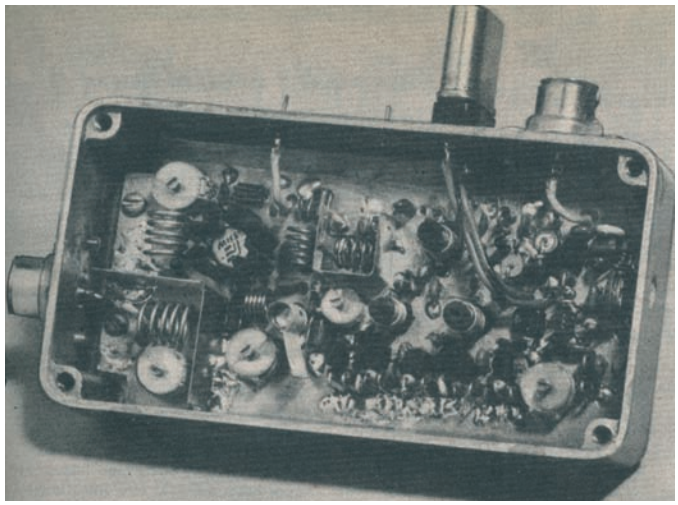
Because of the high input impedance of the f.e.t.s the output may be taken from the drain, avoiding the need for taps on the coils, the loading being minimal. This keeps the circuit *Q* high so that tuning of the coils is fairly critical. The output tuning of the power amplifier is particularly sharp and VC2 required very careful adjustment for the best results. **Note:** A small screen is necessary around L4, to avoid feedback to L3, which causes spurious oscillation and reduces the efficiency of the stage. R24 provides a current limiter and voltage feedback to Tr8.

The transistor Tr10 is of overlay construction, the input impedance is very low and capacitive, while C28 and VC3, tune L5 and provide an impedance match into the base. The choke RFC4 compensates for the input capacity and RFC5 is the d.c. return.

As Tr10 dissipates up to 2.5W, an efficient heat sink is required. Here RFC6 blocks r.f. so that the collector load becomes the output circuit consisting of VC4, C30, L6, C31, L7 and VC5. The screen around L7 and VC5 considerably reduces the harmonic content of the output and should not be omitted.

Double Sided Board

The circuit is constructed on double sided copper-clad board, **Fig. 5**, and it's recommended that the components and the instructions be followed precisely. Every earth point is taken to the top side of the board, all leads are made as short as possible, and the longer lead of coils and resistors being made earthy.



● Fig. 7: The completed project (1975 original) with lid removed (see text).

Class C

The driver and power amplifier stages operate in class C, the input to Tr9, **Fig. 4**, being tuned by L4, VC2 and C26, the two capacitors providing an impedance match into the base of Tr9, RFC2 being the d.c. return.

Note: The total dissipation of Tr9 with a good multiplier chain and active crystal can rise to 300mW so that a small heat sink is required.

The coils should be wound on the appropriate sized drill and then forced on the former after being correctly spaced, finally being held in place with a very light coat of epoxy resin adhesive. Coil slugs should be held in place with a dab of wax.

All holes on the topside should be countersunk, except for the earth connections, using a suitable drill. Construction is started by clamping the board in the die-cast box and drilling the fixing holes through both.

Components List

Resistors

All resistors 1/3W 5%

R1	47kΩ	R14	100kΩ
R2	50kΩ	R15	2.7kΩ
R3	820kΩ	R16	100Ω
R4	150kΩ	R17	100kΩ
R5	47kΩ	R18	3.3kΩ
R6	10kΩ	R19	100Ω
R7	10kΩ	R20	2.7kΩ
R8	150kΩ	R21	2.2kΩ
R9	47kΩ	R22	100Ω
R10	100kΩ	R23	100kΩ
R11	2.7kΩ	R24	47Ω
R12	2.2kΩ	R25	100Ω
R13	330Ω	VR1	10Ω vert. preset

Capacitors

C1	10nF	C17	4.7nF
C2	470pF	C18	4.7nF
C3	100nF	C19	10pF
C4	200nF	C20	15pF
C5	10µF (16V)	C21	4.7nF
C6	1nF	C22	4.7nF
C7	100pF	C23	6.8pF
C8	5.6pF	C24	1.8pF
C9	4.7nF	C25	4.7nF
C10	47pF	C26	22pF
C11	4.7nF	C27	4.7nF
C12	4.7nF	C28	33pF
C13	4.7nF	C29	4.7nF
C14	82pF	C30	10pF
C15	4.7nF	C31	33pF
C16	100pF		

Apart from C5, all capacitors are high-K ceramic, Erie ceramicons or Mullard types

VC1, 3, 4 and 5 5-60pF, plastic insulated Mullard.

VC2 2-10pF, plastic insulated Mullard.

Semiconductors

Tr1	2N3819	Tr10	2N4427
Tr2	BC169C		
Tr3, Tr4, Tr5, Tr6, Tr7, Tr8 2N3819		D1	9.1V Zener
Tr9	BSX19 or 20	D2	1N4000

Inductors

L1	9.1 turns stretched to 10mm
L2	6.5 turns stretched to 6mm
L3	4.5 turns stretched to 5mm

These coils wound on a No. 15 drill, mounted on 4mm formers, using 24s.w.g. enamelled copper wire

L4 and L5	5 turns stretched to 8mm wound on a No. 13 drill using 22s.w.g. enamelled copper wire
L6 and L7	5 turns stretched to 10mm, wound on a 6mm drill, using 20s.w.g. tinned copper wire
RFC1	33µH or higher
RFC2, 3, 5 and 6	2.5 turns 22.s.w.g. enamelled wire or FX1115 ferrite bead
RFC4	5 turns closewound on a No. 13 drill using 22s.w.g. enamelled wire (if a 2N4427 is used for Tr10, fewer turns may be required).

Miscellaneous

Tr9 heat sink, 10 x 22mm, one end rolled on a 5mm drill. Tr10 heat sink, 12.7 x 14.3mm star shaped type. Screens made from tin-plate 38 x 13mm bent into three sides of a square and 45 x 13mm bent approximately at the centre. Die-cast box 114 x 64 x 30mm Eddystone or similar, 1.5mm double sided copper clad fibreglass board 104 x 49mm. Two coaxial cable sockets. Three 4mm stand off bushes HC6U crystal socket. Two small feed-through capacitors, and a suitable 8-8.11MHz crystal.

Next, you should then assemble the components, **Fig. 6**, from the long axis outwards. You then solder the screens in place at an early stage before too many components accumulate around them.

It's also wise to turn the board over, clamp it to the lid of the box and drill through the centre point of the variable capacitors and coils with a No. 60 drill. These should be enlarged to 6mm to allow access to the components for final tuning purposes when boxed up.

Note: The heat sink for Tr10 is commercial, but that for Tr9 is made up by bending a 12mm square of copper or tinplate around a 5mm drill shaft and then forcing it on the transistor.

Setting Up

Before starting the setting-up process, you should as usual, check the board very carefully for solder bridges. A scrub with an old toothbrush is also worthwhile before applying power.

It's a wise move now to get the transmitter working, before fixing it into the case, so temporary connections should be made to input, output and crystal connections. A suitable meter can also be connected in the supply line, including a 470Ω resistor to limit current flow, should a short exist. Having taken these precautions, the output is fed to a 50 or 75Ω screened dummy load through a suitable power meter.

Next, without a crystal, apply 12V and check that no more than 15mA flows, to the audio stage, oscillator, phase modulator, zener and quiescent multiplier stage. More current indicates a faulty device or just possibly that Tr8 is oscillating. This is best revealed by an r.f. 'sniffer', near L4, and cured by adjusting VC2.

If all is well, turn to the modulator and using a very high impedance meter, check that the voltage on Tr2 collector is half the supply voltage as measured on the supply side of R19. If higher, increase the value of R4 until the correct reading is reached and vice versa.

For perfection, those with an audio generator and oscilloscope can change the value of C6 until there is a 3dB drop in voltage output at 3kHz compared with 1kHz. This represents the optimum 'roll off' for good frequency modulation, the measurement being made on the gate of Tr4.

Next, plug in a crystal and check that there is a rise in current consumption, which for the sake of the output transistor, should be optimised by adjusting VC4 and VC5. The multiplier chain should now be set-up using an absorption wave meter to ensure that the circuits are on the correct harmonic frequency.

Alternatively, you can tune the slugs for maximum output with a sniffer, or for maximum current consumption, as this still puts the circuits on the correct harmonic. The variable capacitor VC2 should be adjusted with a sharpened plastic knitting needle, for maximum current consumption. Then adjust VC3, which will reflect on VC2, which will then require readjustment. Then VC4 and VC5 should be adjusted, looking for maximum r.f. output and minimum total current consumption.

Note: It's well worth while repeating all of the adjustments, as they all reflect on one another. The final result should be between 0.75 and 1W into the dummy load for a total current consumption of about 300mA.

On The Air

If an s.w.r. meter is available the unit may then be connected to an antenna using a crystal on a clear frequency. The final adjustments of VC4 and VC5 are then made to achieve optimum output for minimum s.w.r. (No change in output should be seen when the transmitter is modulated).

For those constructors with a good absorption wavemeter, a loop can be used to pick-up from the output coil. The instrument should show that all harmonics and spurii are better than 45dB down on the fundamental and further improvement on this figure can be made using such a wavemeter by readjustment of the variable capacitors.

Once a satisfactory performance has been obtained the unit may be fixed in the die-cast box and all adjustments repeated until the same figures are obtained.

Final Notes

Finally, please note that VR1 controls the audio amplification and thus the deviation and without very sophisticated equipment this is best set by on-the-air testing. Any crystal between 8 and 8.11MHz may be used, although if full coverage of the 144MHz band is envisaged, a compromise must be reached between output and band coverage.

Because the *Q* of the multiplier chain is high, very careful adjustment of the coils is required. The variable capacitor VC2 must be maximised to the centre of the band, but fall off of power is inevitable at the band edges if full coverage is to be achieved.

The transmitter, frankly, is happiest when covering 1MHz of the band, rather than the whole 2MHz of it. However, this proves to be no real disadvantage for all local operating and fits in with the band plan for 2m.

The crystal socket may be used as the input for a v.f.o. as it's high impedance and 2V RMS is more than sufficient. For netting on receive, power is applied to the earlier stages blocking the supply to power amplifier stage of the unit. PW

Antenna Workshop

Steve VK5AIM tells how he salvaged an antenna rotator. It had been left when all the equipment from the Silent Key's shack was taken down to the local second hand shop and sold by relatives who knew nothing about Amateur Radio.

Many, if not all, simple rotators run at 30V a.c. for safety reasons. The motor is usually up to about one tenth horsepower (about 30-80W) and uses split windings. There's usually a high value unpolarised capacitor to enable the motor's direction of rotation to be changed, from say clock-wise (CW) to anti (or counter)-clockwise (CCW). This is done by feeding either winding via the capacitor to make it rotate in the desired direction.

Some form of remote indicator is required to indicate the direction in which the antenna's pointing. This can be done with a voltmeter rescaled to show 'South', 'West', 'North', 'East', 'South', at the 0, 25, 50, 75 and 100% full-scale points. A supply of 15V a.c. is rectified, filtered and regulated down to 12V d.c. for this stage. In the rotator, there is a potentiometer driven by the final drive system to travel through 360° either directly or through a 36:27 gearing system. The wiper of the this pot, along with both ends, are brought back to the controller.

Voltage Divider

The variable resistor is used as a voltage divider so that South reads at minimum resistance, North is at half resistance and maximum resistance displays South again. If the 12V is connected across the ends of this potentiometer, often just called a 'pot', and the wiper connected to a voltmeter, then at the intermediate positions of the rotator, the voltmeter will read a proportional voltages, e.g., South = 0V, North =6V, and through to South again at 12V.

Before you decide to make your controller, you must check that the rotator is working and the connections are in good condition. If it's a well known brand , then you're probably halfway there. Beg or borrow a copy of the circuit you will see a similarity between the maker's circuit and the circuits of this article. If you cannot obtain a circuit, you'll have to check out the terminals with an continuity tester. The motor windings will be very low resistance, between about 8-18Ω each winding on the total of three terminals.

The position potentiometer will be in the range of 500 to 1kΩ total resistance, with an intermediate value depending which end you measure from. Record these values in the instruction book on the rotator, or your own circuit if you make your own controller. They will be a great help in the future, if anything goes wrong.

Depending on the make of the rotator the phase shift capacitor may be in the control box or up in the rotator itself. It's interesting to note that, if the capacitor for the motor is in the control box, it lasts longer than the one in the motor where it's subject to the extremes of temperature with the weather. If you are lucky enough to obtain a circuit, it will be shown.

Non-Polarised Capacitor

Many rotators just use a large value non-polarised capacitor, varying in value from 90 to 150µF at about 50V a.c. to drive the motor. And if it's in the rotator the job's easy. If not, you'll have to find out or guess its value. At this point it may be wise to seek assistance from someone who has some electrical knowledge, or give up and look for another rotator!

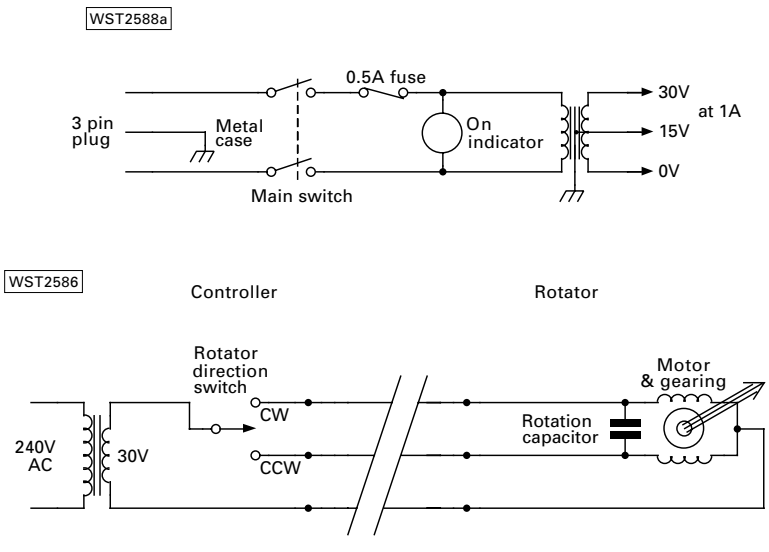
To check that the rotator is working, all that is necessary is to apply up to 30V a.c. to the motor windings, though many rotators will run on as low as 15V a.c.. Three 6.3V a.c. heater windings in series and phased to give 18V a.c. will do the job. My preferred option is a 15-0-15V a.c transformer providing around 1-2A maximum (**Fig. 1**).

After identifying the motor 'common', connect one side of the a.c. to this terminal, and momentarily apply the low voltage a.c. supply to one of the other motor terminals. You should have already checked them for continuity and resistance to identify them. The motor should run and rotate in one direction. Transferring the a.c. to the previously unused terminal should make it run in the other direction.

Some rotators have two limit switches built in (if you have been able to obtain a circuit, it would show this). They're incorporated to prevent the unit from going more than 360°. After all who wants to tie their coaxial cables in a knot?

Simple low power units only have a mechanical stop and stall the motor. Continued application of the a.c. will burn out the windings, so be careful. If

● Fig. 1: This is both running and testing a.c. supply. The transformer should be able to provide between one and two amperes.



● Fig. 2: I've found that this is the circuit layout of many smaller (and so cheaper) rotator units.

the rotator won't go with the a.c. on one winding, try the other terminal.

If the rotator then turns, after the rotator has travelled about 45°, reconnect the a.c. to the previous terminal. If it then goes the other way, you probably had it at the stop, or had reached the limit and operated one of the limit switches. You should now be able to trip these limit switches in both clockwise and counter clockwise rotation and be able to run it the full 360° and back again.

Position Resistor

When you have the rotation set up it's a good time to check out the position potentiometer. If you have previously identified the pot terminals, you can connect your Ohmmeter, (multimeter) across one end and the wiper of this pot. You should have established its value on your previous checks. With your Ohmmeter connected and reading some value, lower than the total value, apply the 18V a.c. briefly to the motor windings again.

The resistance value displayed should either increase or decrease, depending on the direction of rotation, and the wiring of the pot. If you can get the total resistance and minimum resistances as you go from clockwise to counter-clockwise, things are looking good. Change over the Ohmmeter lead from one end of the pot to the other end and repeat the procedure. Maximum and minimum resistance should be obtained with no sudden jumps or open circuits. If all these tests work then it's worth making up a control box for the rotator.

Some times the motor common wire is internally connected to one end of the position potentiometer to save conductors in the connecting cable. I suggest that you record the resistances of the motor and potentiometer in the instruction book of the rotator, or your own circuit. They will be of great help in the future if anything goes wrong.

Now some ideas to assist you in making up a controller. Most rotator motors require only about an ampere or so and then only intermittently. After all who runs the rotator for more than a minute or two, even if it is to get the antenna from south all the way around through north and nearly back to south again? I've found that readily available transformers with 15-0-15V windings are often suitable (Fig. 1).

Three Position Switch

The 30V a.c. is used to run the motor via a three position switch (**Fig. 2**). I use a spring loaded centre-off toggle switch for this, the larger the toggle lever the better. It is mounted so that the lever goes sideways. It must be 'Off' in the middle, otherwise you could run the motor continually and burn it out.

To run the position indicator, a single diode rectifies the 12 to 15V a.c. from the transformer tap and is filtered with a 1000µF 25/30V electrolytic capacitor. This is further regulated with a three terminal regulator integrated circuit, such as a LM317 or other regulator, arranged to give a regulated 12-15V d.c. The voltage itself isn't critical, as long as it is regulated (**Fig. 3**).

Don't forget the 0.1µF bypass capacitors close to the regulator chip. A heat sink is usually not required as not much current is drawn by the

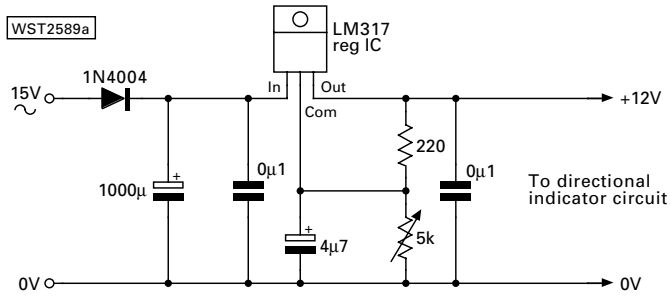


Fig. 3: A simple 12V regulated power supply. You could also use a fixed voltage regulator such as the 78L12, as the current needs of the direction indicating electronics is minimal.

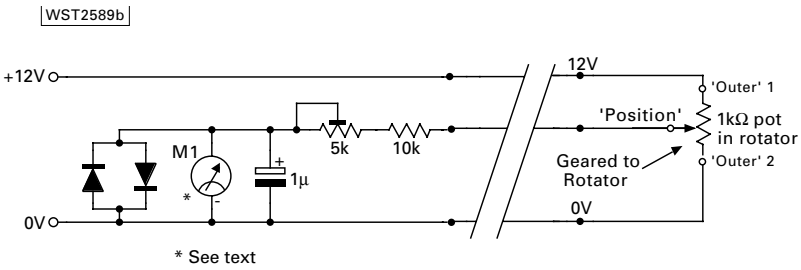


Fig. 4: When there's a direction indicating potentiometer inside the rotator, this circuit will show the actual direction reasonably well.

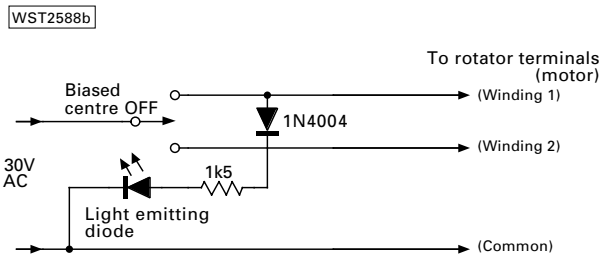


Fig. 5: When driving the rotator type shown in Fig. 2, the l.e.d. will glow for rotation in any direction.

indicator and a medium resistance feedback potentiometer.

The indicating meter can be whatever you have. A meter with a full scale deflection (f.s.d.) or maximum reading of 1mA is a good choice, though 500µA, or even 100µA will do. But the meter should have a reasonably large display, to enable the position of the antenna to be read at arms length and at a glance. Choose a suitable series multiplier resistor and trim pot to make your meter read f.s.d. for the supply voltage.

A meter with an f.s.d. of 1mA needs 1kΩ per volt of the supply, so a nominal 12kΩ is needed, but a 10kΩ resistor and a 5kΩ trim pot would probably be better. Allowing a degree of adjustment(**Fig. 4**).

The power supply and regulator can be made up on resistor strip, a small p.c.b. or Veroboard. The meter resistor and trim pot can be mounted on the back of the meter on the terminals, along with a couple of back-to-back diodes to protect the meter movement. You may like to put a 1µF low voltage electrolytic cap across the meter to dampen it down a little.

Some form of indicator across the motor circuit is necessary to tell you the motor has voltage on it. A diode, a series resistor and a light emitting diode (l.e.d.) connected from the motor common to either

CONTINUED ON PAGE 51

CONTINUED FROM PAGE 49

side of the switched motor circuit will do this (**Fig. 5**). A 1N4004, 1.5kΩ resistor and an l.e.d. (colour of your choice) is suggested. It works in both directions, as the a.c. passes through the shift capacitor.

An on/off toggle or rocker switch and a neon indicator are used to control the 240V mains supply. And don't forget the fuse (a 1A fuse should be adequate if you're unable to find a 500mA one). Finally anchor the mains cable to stop it moving around.

With all my rotator controllers I've fitted a multi-pin socket on the control box and a corresponding plug to the end of the rotator cable. Something with respectable pins to avoid voltage drop. I've found that an eight-pin Octal valve base and plug is good. A six or eight-pin Jones plug and socket would also be very suitable. A good source of rotator cable is 'Trailer cable' used to wire up the lights etc of trailers. It comes in five and seven conductor types, all colour coded. The conductors are of a good size to prevent voltage drop in the motor circuit.

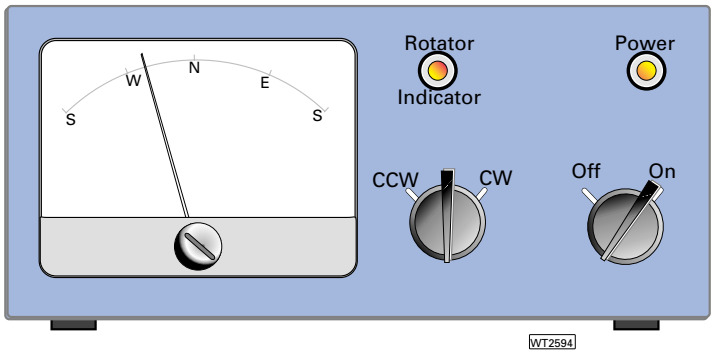


Fig. 6: A simple layout for the controller box and the direction indicating meter. Note that I've shown a rotary switch controlling the direction of turning rather than the 'more meaty' centre-off toggle switch that I prefer.

Colour Code

Another help in identifying the controller to rotator cables is to use the standard resistor colour code, eg 1 = brown, 2 = red, 3 = orange and so on. The plug/socket along with the colour code makes is so easy to disconnect for checking, and minimises any error in connecting it up again. After all you don't want to put 30V across the feedback pot up in the rotator, as that would probably burn it out!

The choice of box for the controller is entirely up to you. Make it yourself or buy a commercial one, but make sure it's large enough to hold all the components. Consider the depth of the meter that you use, and how easy the box material is to drill, cut and work.

With the controller unit wired up in the box, it's time to check it out. Before plugging it in for the first time, the mains side of the unit should be checked with an ohmmeter for continuity via the on/off switch. You should see 20 to 30Ω across the active and neutral pins of the three pin plug, when you turn the mains switch "on" and open circuit with it "off".

Next shift one of the leads of the Ohmmeter from the neutral pin to the earth pin and check for insulation to earth and active. Switch the Ohmmeter right up to the MΩ range. It should read 20MΩ or more. The same from neutral to earth. Repeat with the power switch in the "on" position. Anything below 10MΩ indicates a dangerous fault in the mains wiring. Correct it immediately before going any further. If in doubt get someone more competent to check it for you.

Some may comment on the use of the MΩ range of the multi-meter being used with only low voltage to check the 240V a.c. insulation! Most home brewers do not have a 500V 'Megger', and this at least checks the insulation on the 240V wiring. If there is an error, it will show up.

With the 240V mains proves to be okay you can check the 30V a.c. at the motor switch. Set the multi-meter to 50V a.c., connect one test lead to the common of the motor terminals then check and see if the 30V a.c. appears at the terminals as the switch is moved each side for CW And CCW operation. The l.e.d. connected to the motor circuit should light, but only on one position, as you do not have the rotator and it's capacitor connected. If all is well you can now check the 12V d.c. circuit.

Check Voltage

With the multimeter set up to 30V d.c. range, check the voltage at the 1000µF, capacitor. It should be 25V or more. Check the voltage the other side of the regulator i.c. Set it to 12V if possible with your circuit. If it is fixed, it should be the set voltage. All being well, obtain (from your junk box) a potentiometer of a value approximately the same as in the rotator, eg 500Ω to 1kΩ. Solder 300 mm lengths of wire to the terminals and identify them in some way. The same colours as the rotator control cable will make it easy.

Switch off the power and connect the wires up the three wires to the correct terminals, +12V, wiper to the meter +, 0V return. Switch on and observe the voltmeter. It should read some where between 0V and full scale, provided you have selected the correct value of multiplier resistor and trimpot. If okay, rotate the temporary potentiometer. The meter should go from 0 to full scale.

Should it go over scale at one extreme of the test, adjust the trimpot multiplier for full-scale deflection (f.s.d.). Now as you rotate the test pot, the meter should go from zero to f.s.d., corresponding to south, west, north, east and south for your rotator and it's motor drive pot.

Now comes the big test. Connect up the rotator, either with some temporary wires a couple of metres long, or the multi-core cable you will use for the job. You can use your plug and socket as suggested. Plug it in, switch it on and look for smoke! All being ok try the rotator control switch.

On operating the rotator switch, the indicator l.e.d should light, The voltmeter should read somewhere on the scale and move up and down. Check that the rotator goes clockwise for 'CW' on the switch, and counter-clockwise for the 'CCW' position of the switch. It should stop at each extreme, either with the limit switches or just stall.

You can now decide how to label your voltmeter according to the way your rotator goes. Caution! It's easy to get your east and west transposed, and your antenna 180° out of alignment. Working 'long-path' isn't always the easiest route!

Dry-Transfer Letters

I find that the rub-on dry transfer letters are ideal. They can be used for the power switch, labels of 'CCW' and 'CW' for the switch. Depending on the design of your meter, you may be able remove the front cover and then the scale to apply the letters representing the directions. You may have to remove the meter from it's case to get at the scale. Be careful, watch the pointer needle and the meter movement.

Again if, with any of these modifications, you're not confident of you abilities, get someone to help you. I've shown a layout in the illustration of **Fig. 6**. You can even give it a name; but you can't call it an 'Antenna Aimer', that's mine! Thanks to my good wife **Sue** for her suggestion.

You now have a usable rotator and controller, one you can understand and even repair if necessary. Keep your eyes and ears open for just such an bargain rotator opportunity. It does happen and you'll have the opportunity to say "look I made it myself"!

PW

valve & vintage

Ben Nock G4BXD uses his soapbox to support his interest in vintage equipment first, and then shares information on new items in the G4BXD museum.

Here we are again, another year passed and seemingly not a lot wiser I have to say. I hope you all had a great Xmas and New Year celebration. However, lead times for this column mean I have not yet had mine as I write this, but I'm certainly looking forward to it. For now though, a very happy New Year to you all!

It has been a good last quarter of 2004 as far as the G4BXD vintage collection is concerned. The museum collection here has grown - three Chinese sets, another three or four American made units, including another type of mine detector, one from Australia, and even one from Switzerland have arrived. These, together with a couple of Russian items have increased the collection here quite a bit, much to the consternation of my floor boards!

Vintage Discussion

Recently there has been some correspondence in *PW,* about whether or not there's any interest or point in discussing vintage equipment and if they have any bearing on the modern hobby. Obviously, I'm slightly biased in my opinions as I've been playing with radios since 1969. Even back then it was equipment such as the 19 Set, the R1155 and the radio chassis out of an old radiogram, which formed the mainstay in my first radio shack.

I have to say though, that if I had to confine myself to talking about modern sets I would soon be bored! Maybe newcomers to the hobby see these sets as the norm? Nowadays it seems that many people have little experience of even older Amateur Radio equipment, let alone ex-military sets. But in my opinion there seems to be a distinct lack of character or 'flavour' (call it what you will), with the modern plastic boxes with glowing liquid crystal displays (l.c.d.s).

I would be hard pushed to be able to tell you one modern set from another, be it the CI-9786GXDSP or the TF-849PDXDSP (model references made up!) as they all look alike to me. They all pump out 100W, all have Digital Signal Processing (whatever that is), 1000 memories, 10 v.f.o.s, etc. I know I exaggerate, or do I?

Fig. 1: The AVT-111 Aircraft Transmitter. Ben says "It has nice simple clean lines" (see text).

My point is that despite modern sets doing what they are intended to do, i.e. put out and receive a decent signal, they lack any real charm.

My interest in older equipment, and in particular ex-military sets, is maintained and enhanced by their warmth and charm. Another important factor is their quirkiness and sometimes the additional need to figure them out when all the dial markings are in Russian or Chinese! Anyway, enough from my soapbox and back to the equipment.

Aircraft Transmitter

First up this time I've got a cute little Radio Corporation of America (RCA) made transmitter, which was fitted to light aircraft including military spotter aeroplanes. This little four valved transmitter, the AVT-111, is a crystal controlled, two band set offering radiotelephone communication with an all up weight of 1.9kg (4.2lbs), that's two old bags of sugar to us old timers!

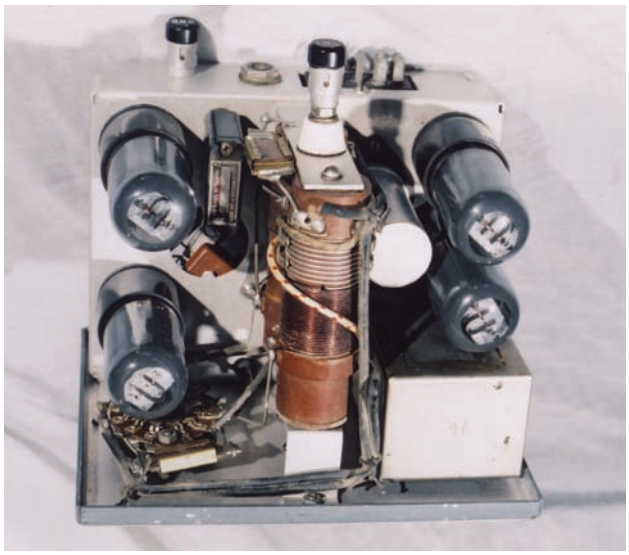
The AVT-111 uses four 6V6 valves as crystal oscillator, power amplifier (p.a.) and doubler stage employing a push-pull modulator fed from a carbon microphone. The transmitter was designed to be powered from a vibrator-inverter running from the aircraft's d.c. supply. Incidentally, the transmitter could be wired for 6 or 12V heater operation.

There was another version of this transmitter, the AVT-110, which operated from dry batteries. This set used five 1Q5-GT types with the same line-up in the first version except that two valves in the p.a. stage operated in parallel. (Batteries providing 1.5, 7.5 and 135V were required for this option).

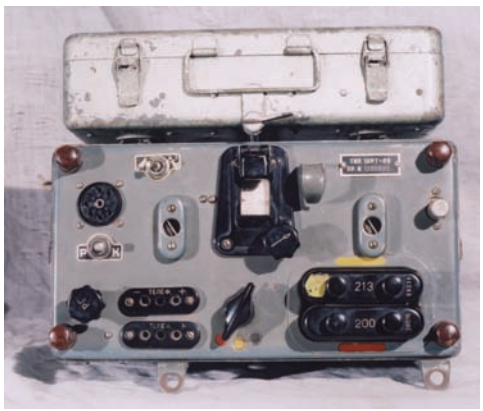
The transmitter is fitted a crystal for 3.105MHz, this apparently

Fig. 3: The A-510 transit case, after being unwrapped (see text).

Fig. 4: The contents of the A-510 case, showing the radio, antennas, Morse key, microphone, bags and handbook.



● Fig. 2: Inside the AVT-111 transmitter. The oscillator and p.a. are on left, with the modulator section on the right.



● Fig. 5: The Russian 10RT receiver showing the twin headphone sockets (lower left), crystal channel selectors lower right (see text).

● Fig. 6: The 10RT's crystal selection housed in a sturdy case mounted on top of the receiver (see text).

whips, spares, microphone, headset, key, etc., is 18.6kg (41lbs).

Russian Tank Transceiver

Something from the Russian 'radio front' now. It arrived thanks to a very good French collector friend of mine who kindly facilitated the exchange of a couple of sets during a delightful dinner in a Dutch town near Arnhem last September. After the meeting I departed with not only the following Russian set, but also an interesting item of Swiss equipment which I'll mention in the future.

The 10RT (10PT in Russian script) set was possibly first designed in 1942 and was used in the T-34 and KV heavy tank and other combat vehicles used by the Soviet forces. It seems (from what can be gleaned from the worldwide web) that the first time this set was encountered by American forces was during the Korean War. The 10RT followed on from the wartime 9RS set, was a common airfield tower frequency in those days. The p.a. stage could also be switched to act as a doubler providing 6.210MHz as a second frequency. The antenna matching on the transmitter has facility for using either a fixed short wire on the aircraft itself, or a trailing long wire, presumably for greater range.

Australian A-510

Although I already had a very nice example of the Australian A-510 transmitter - receiver the chance to obtain a complete cased set with all the bits inside could not be missed. Delivery from the 'land of Oz' was straightforward enough; the only slight snag being that the seller had simply taped up the case.

After delivery though, the removal of this tape took off half the original paint work, as can be seen in the photo of the case. The three vertical stripes are where the paint parted company with the wood.

The A-510 is a super little set, using a separate receiver and transmitter connected together with a rather thick cable. The battery (for the valve heaters) is housed in the base of the receiver case while the high-tension (h.t.) battery is in the base of the transmitter case. Heater supply is 1.5V and h.t. supply is 90V, but this battery has a 7.5V bias supply incorporated.

Designed as a 'manpack', the A-510 has a quoted power of 150mW on phone and 500mW when operating on c.w. (Morse code) telegraphy. The antenna in the manpack role is a 2.4m (8-ft) whip which even has a small tuner unit mounted at the base. Long wire and dipole antennas could also be used when stationary, increasing the range from between 3 and 6km (2 to 4 miles) to 190km plus (120 miles plus).

The receiver is a five valves design, tunes from 2 to 10MHz in two bands, while the transmitter, using four valves, has four crystal controlled positions available. The weight of the receiver and transmitter, with batteries, is about 7.7kg (17lbs). Total weight of the complete transit case with all the accessories, antennas, but it's always difficult in getting really accurate data on equipment of this type.

The 10RT consists of a transmitter unit, a receiver, a dual dynamotor unit and associated cabling. Power plug connections have been improved in this later version because in addition to the pins, a screw down centre connector has been incorporated to keep them from falling out as the tank went over rough terrain. This is similar in concept to the power plug screws found on most 1950 vintage American radios such as the AN/GRR5, GRC-9, AN/VRC10s, etc.

The tuning range of the equipment is from 3.75 to 6MHz and the receiver has the facility to be either v.f.o. or crystal controlled. Two crystal channels can also be fitted to the front of the receiver using small plug-in modules. A carry case fixed to the top holds 15 crystal modules; with the two fitted to the set this provides 17 fixed channels in total.

The receiver unit has the extra role of supplying the transmitter with its fundamental frequency. And although further details need to be found out but it seems there is a transceiver configuration being employed. The receiver side uses eight valves and in addition to the receiving function the unit generates the transmitted signal at low level.

The transmitter unit simply amplifies the signal from the receiver and applies the modulation for radiotelephone use; three valves are used, buffer, p.a. and modulator. The power unit employs two dynamotors supplying 250 and 400V h.t. for receiver and transmitters respectively.

The 10RT-12 runs off 12V and the 10RT-26, well I think you can guess that's 26V. Of course, having now acquired the receiver I now need to locate a transmitter and power supply unit to finish off the station. This collecting lark is never ending!

PW

And Finally

Well once again that's all the space I have for now. I'm looking forward to the start of the rally season and meeting old friends.

As always, you can write to me at; **62 Cobden Street, Kidderminster, Worcestershire DY11 6RP** or via my E-mail at **military1944@aol.com** my web pages are still at **www.qsl.net/g4bxd**

Cheerio until next time.

VHF DXER

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YOUR REPORTS & INFORMATION BY THE LAST SATURDAY OF EACH MONTH PLEASE.

THIS MONTH DAVID BUTLER G4ASR HAS REPORTS OF FIVE CONTINUOUS DAYS OF AURORAL AND SPORADIC-E OPENINGS ON THE 50, 70 AND 144MHZ BANDS

The lack of auroral backscatter openings during October was rather disappointing, as the autumn period normally produces a surplus of geomagnetic storms. On the other hand, the lack of Sporadic-E (Sp-E) propagation on the 50MHz band during October was completely understandable, as this is well past the end of the summer Sp-E season.

This was all about to change with November. Right at the beginning of the month a large sunspot formed on the surface of the Sun unleashing a series of X-class and M-class solar flares. Coincident with this flare activity the Sun was also expelling ionised material via a number of Earth facing coronal holes. The upshot of all this solar activity was to produce some excellent auroral openings on the 50, 70 and 144MHz bands. It also created Sporadic-E openings on the 50 and 70MHz bands and one very rare opening on the 144MHz band.

Magnetic storms come and go but this was an amazing succession of storms that had a direct effect on v.h.f. propagation for five days during 7-11 November. Normally, I like to keep reports of different propagation events completely separate, but as the openings were clearly defined (although intermingled with each other) I'm going to provide a report in the chronological order in which they occurred.

SUNDAY 7 NOVEMBER

The first of a series of auroral backscatter openings commenced around 1654UTC on Sunday 7 November continuing through to 0145UTC the following day. It was a fairly small-scale event on the 50MHz band with Scottish stations making c.w. and s.s.b. contacts into England and Wales and also with stations in Scandinavia. The opening reached the 70MHz band but activity was low and the only report came from **Bo Christensen OZ1DJJ (JO65)** who heard the station of G4IGO (IO80) peaking 52A just before midnight.

Activity was much higher on the 144MHz band and from 2045UTC stations over much of the UK were heard making some reasonably long distance c.w. contacts. For example **Dave Edwards G7RAU** (Isle of Wight IO90) reported the c.w. stations of LA4YGA (Norway) at 1022km, SM4IVE (Sweden) at 1420km, SM5CUI at 1575km, LY2BJ (Lithuania) at 1783km, ES1RF (Estonia) at 1920km and the Finnish station of OH6QU (KP03) at 1934km.

MONDAY 8 NOVEMBER

Another auroral opening was reported on Monday 8 November starting at 2045UTC on the 50MHz band and later in the evening at 2145UTC on the 144MHz band. This was a brief event with auroral signals being reported until 2200UTC when the event faded out on both bands. It was a 'Scottish aurora', so termed because the majority of contacts were made by stations in Scotland over short distances into the UK and the nearer reaches of mainland Europe.

The opening was made slightly more interesting by an Auroral-E (Au-E) event, which occurred simultaneously on the 50MHz band between 2130-2215UTC. Unlike auroral signals which are very rough sounding, those via Au-E are very pure and with no obvious distortion. Stations in southern England reported hearing s.s.b. signals from the Icelandic stations of TF3EE and TF8GX operating on 50.150MHz and the Faroe Island beacon OY6SMC (50.035MHz).

TUESDAY 9 NOVEMBER

Propagation on the v.h.f. bands was quite interesting on Tuesday 9 November with the events kicking off at 1200UTC with an auroral event on the 50MHz band and later at 1345UTC when it reached the 144MHz band. UK operators reported making c.w. and s.s.b. contacts on the Six Metre band with stations in Denmark (OZ), Norway (LA), Sweden (SM), Czech Republic (OK), Germany (DL) and other countries nearer to home.

As usual, there was some very good DX to be found on c.w. at the bottom of the Two Metre band. Among the stations worked from central England were EW6FS (Belarus), HA0HO and HA8V (Hungary), OH1NOR (Finland), SP6GWB (Poland) and YL3AG (Latvia). At my QTH (Herefordshire IO81) I concentrated activity on the 70MHz band. Using a home-made transverter, 100W amplifier and a 6-element NBS Yagi I first detected auroral signals at 1450UTC when I heard the beacon stations GB3MCB (IO70) peaking 53A and GB3ANG (IO86) at 54A.

Beam-headings were different for the two stations, as I had to beam at 40° to hear the Cornish beacon and at 10° to hear the Angus beacon. From 1400UTC I then made c.w. contacts with the stations of EI3IO (IO63), G3JYP (IO84), G3NAQ (IO91), GD0TEP (IO74), GM4BYF (IO85) and heard the stations of G3UKV (IO82) and G4FUF (JO01). I heard no Danish (OZ) stations during the event, but did hear a report that G3JYP (Cumbria) had worked the c.w. station of OZ2LD at 1710UTC.

Around 1735UTC all auroral activity suddenly disappeared on the v.h.f. bands to be replaced by a 50MHz Sp-E opening, which lasted for over an hour. Running a Kenwood TS-690S transceiver and a 6-element DJ9BV Yagi I made s.s.b. QSOs with the stations of I8MPO (Italy), IS0GQX (Sardinia) and IT9TJH (Sicily). Other stations working into the UK around this time included CT1FMX (Portugal), I0JX, I5MXX, I8LPR, IH9GPI (Pantelleria Island) and IW9CER (Sicily).

The southerly Sp-E event faded out at 1900UTC to be replaced at 1950UTC by an Auroral-E opening on the 50MHz band and literally a few minutes later by an auroral opening on the 50, 70 and 144MHz bands. It was stations located in Scotland and northern England that were able to participate in the 50MHz Au-E event. Among the DX worked were the stations of LA5TFA (JP99), LA6PV (JO59) and OH9HFX (KP14).

Activity on the 50MHz band during the auroral phase was fairly subdued with only Scottish stations making anything in the way of DX contacts. It was a similar state of affairs on the 70MHz band with only a handful of operators making inter-UK contacts, although at 2000UTC I did manage to briefly hear the station of OZ3ZW (JO54) peaking 41A on 70.100MHz. Stations operational on the 144MHz band reported working into Germany and a few c.w. operators even managed to work the Italian station I2FAK (JN45) before the aurora faded out at 2100UTC.

WEDNESDAY 10 NOVEMBER

Events on Wednesday 10 November were quite spectacular with widespread auroral

activity being reported before 0500UTC continuing through to 1000UTC. It re-appeared again at 1130UTC staying in for nearly five hours before fading out around 1600UTC.

At this time a large Sporadic-E opening commenced on the 50MHz band, which was to last for three hours before disappearing at 1900UTC. Between 1700-1830UTC the maximum usable frequency (m.u.f.) rose to encompass the 70MHz band with DX contacts being made into Slovenia (S5) and for a 20-minute period between 1710-1730UTC the m.u.f. rose as high as the 144MHz band.

The early morning aurora, which commenced before 0500UTC, was understandably too early for many operators. I was active on the 50MHz band from 0800UTC (a far more sensible time!) and made c.w. contacts with the stations of DL7HG (JO62), EI3IO (IO63), GM4DZX (IO89), GM4ILS (IO87), ON5FU (JO11) and SM7AED (JO65) with beam-headings ranging between 10 to 65°. No stations could be heard on the 70MHz band although I did copy the beacons GB3MCB 53A at 45° and GB3ANG 57A at 30°.

Those UK operators that were active early in the morning on the 144MHz band reported that the best propagation path was to locator squares JO43/JO53 in northern Germany. The aurora faded out around 1000UTC, but fortunately another phase started up from 1130UTC. Although activity was quite poor on the 50 and 70MHz bands there was some good DX to be found on the 144MHz band, especially in the period 1400-1530UTC.

Running a Kenwood TS-790E transceiver, 400W and an 18-element DL6WU Yagi, I made many short distance c.w. contacts with stations located in England, Belgium, France, Germany and Holland. My longest distance contacts were made with the stations of OK1DFC (Czech Republic) at 1243km, HA5OV (Hungary) at 1660km and HA8V (KN06) at 1790km. Other DX reported on the 144MHz band during the afternoon included the stations of OK2SBG, OM5UM, OZ2TF, OZ5AGJ and SP6GWB.

The aurora waxed up and down in strength until finally fading out at 1600UTC. At the same time (1559UTC to be exact!) the Bulgarian station LZ1ZP spotted the GB3BAA beacon (50.016MHz) with 599 signals. It wasn't via aurora, but an unusual form of E-layer propagation. Some say it was Auroral-E, which had formed over central Europe, but others weren't so sure about that!

However, **Geoff Grayer G3NAQ** didn't think that the observations rule out Au-E. He mentions that the very high levels of ionisation spread itself throughout the E-layer, as there are very high circulating currents during an aurora. It is well known that the conditions for E-layer propagation are best in the Mediterranean region and the time also matches when it is most likely to occur.

So, although it was E-layer propagation it was Auroral-E because the origin of the high ionisation was not the Sun being overhead but the preceding auroral input. The accepted wisdom is that Au-E occurs either before or after an aurora. As usual, E-layer propagation is very localised especially on the 144MHz band and stations were fortunate to catch it.

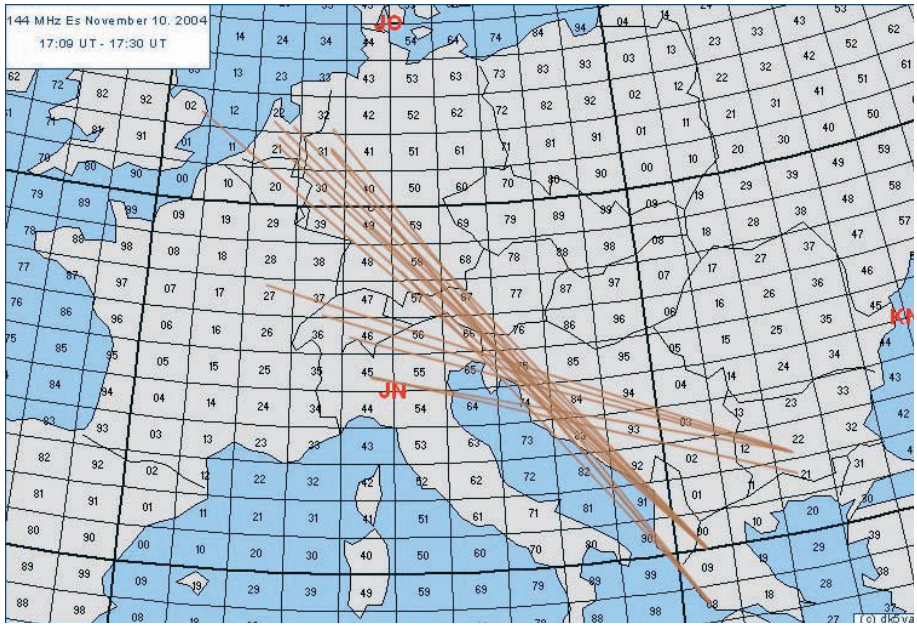

Fig. 1: The Sporadic-E opening on the 144MHz band - 10 November 2004.

Propagation on the 50MHz band was amazing considering that it occurred during November. For example the station of **Neil Carr G0JHC** (Lancashire IO83) reported making contacts with stations located in Albania (ZA), Austria (OE), Bosnia-Hercegovina (T9), Bulgaria (LZ), Cyprus (5B), France (F), Germany (DL), Greece (SV), Israel (4X), Italy (I), Romania (YO), Sicily (IT9), Slovenia (S5) and Switzerland (HB9).

The first 50MHz signal I heard at my QTH was the beacon station OD5SIX (Lebanon) at 3575km, which I heard peaking 559 at 1635UTC. So this was not the usual single-hop E-layer propagation but a two-hop (maybe even a three-hop) path. That is very rare in November. From 1638UTC I then made s.s.b. contacts with the stations of 4Z5AO (KM72) at 3704km, 5B4FL (KM64) at 3450km, SV8UM (KM17) at 2590km and others in Bosnia, Croatia, Italy and Slovenia.

Between 1700-1830UTC the m.u.f. rose sufficiently to allow E-layer contacts to be made on the 70MHz band. As the band was open in a south-easterly path the only DX countries that could be worked in that direction were Croatia (9A) and Slovenia (S5) as all the other don't have permission to use the 70MHz band. I haven't received any reports of UK stations working into Croatia but a number did manage to make contact with Slovenia.

Ivan Dobnik S51DI (JN76) reports that at his QTH the band was open to the UK between 1700-1830UTC. He mentions that he made many more contacts on f.m. (including G4ASR at 59 both ways!) than on s.s.b. That's probably because of the large amount of surplus private mobile radio (p.m.r.) equipment that is available in the UK for use on this band.

Amazingly the m.u.f. continued to rise during the opening on 10 November and for a 20-minute period between 1710-1730UTC it even reached the 144MHz band. Operators in Belgium, Holland and Germany reported making s.s.b. contacts with the Greek stations of SV2DCD (KM00) and SV3GKE (KM08) as shown in the diagram, **Fig. 1**.

Leo SV2DCD running 300W into a pair of 11-element F9FT Yagis made 35 s.s.b. contacts and although he was briefly heard in eastern England it was insufficient time to make a two-way contact. At 1710UTC **Dave Dibley G4RGK** (Buckinghamshire IO91) heard a Bulgarian station on 144.295MHz, but signals were weak and he couldn't resolve the callsign.

THURSDAY 11 NOVEMBER

The m.u.f. was also very high on the following morning of Thursday 11 November. The 50MHz band was wide open between 0900-1300UTC with contacts being made into Bosnia, Croatia, France, Italy, Romania, Slovakia, Slovenia and Switzerland. Around 0930UTC I made s.s.b. contacts with the stations of YO7VS (KN14) at 2145km and YO9HP (KN35) at 2260km.

The m.u.f. continued to rise and at 0955UTC both G4FUF and myself reported hearing the Slovenian beacon S55ZMB (70.029MHz) with 539 signals. At 1000 and 1200UTC the m.u.f. rose even higher to 100MHz with Italian f.m. broadcast stations being received in southern England. By 1215UTC it was all over bringing to an end five days of very unusual v.h.f. propagation.

That's it for now. See you again next month.

73, David G4ASR

HF HIGHLIGHTS

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AS USUAL, INFORMATION, REPORTS AND PHOTOGRAPHS TO ME PLEASE BY THE 15TH OF EACH MONTH.

Well, we are into the coldest time of year and hopefully you are all now able to spend more time in your shack working that elusive DX. This period is certainly not the best time to be outside working on antennas! And, thinking about the cold, if you are fortunate to have worked stations in Antarctica, I wonder if you have ever thought about their location and difficulties in working from that part of the world?

Many of the callsigns you hear are 'aired' by non Amateur operators who transmit in what little spare time they have. Imagine what it would be like erecting an antenna when the temperatures are well below freezing and you have very strong winds dropping the temperatures even more with wind chill. Those are the sort of conditions found around the South Pole and I thought, as we are in the middle of winter, it would be interesting to learn some more about these operators and the stations they work in.

DX ANTARCTICA

The **McMurdo Station** is the USA's main station in Antarctica and positioned on the barren volcanic hills on the southern tip of Ross Island (AN-011), which is about 3864km (2415 miles) south of Christchurch, New Zealand and 1360km (850 miles) north of the South Pole. The original station was constructed between 1955-1956 and has had many additions and modernisations over the years. Today it's the primary logistics facility for airborne re-supply of inland stations and for various field science projects as well as being the waste management centre for much of the **United States Antarctic Program**.

The mean annual temperature is -18°C (0°F) and temperatures may reach 8°C (46°F) in summer and -50°C (-58°F) in winter and with an average wind speed of 12 knots, which can exceed 100 knots during severe weather, it is not the most hospitable of areas! Approximately 90% of American participants reside or pass through McMurdo Station at sometime and the winter population ranges from 150 to 200 personnel to a summer population that can rise as high as 1100.

The station is normally isolated from late February until early October, except for a brief period in August when several closely spaced flights known as WINFLY (winter flights) deliver personnel, supplies and early scientific teams. Amateur operator **Christopher Post N3SIG** has recently accepted employment there as a Fire Fighter/Emergency Medical Technician and is expecting to be staying until 5 March this year.

However, the Amateur shack's antennas have been destroyed and the main h.f. equipment has also suffered damage. He plans to take with him a replacement h.f. rig, which may well be his Icom IC-706 and when time allows he will construct a dipole antenna to operate using the call **KC4/N3SIG**. Activity will be mainly on 14.243MHz, which is the 'unofficial' Antarctica Amateur frequency and possibly some operation on 7MHz.

Chris has created an Antarctic Amateur Radio mailing list under Yahoo Groups and he will post his operating schedules there together with other Antarctic topics. He invites everyone to join and to subscribe you only need to send an E-mail to: **AntarcticHamRadio-subscribe@yahoogroups.com** If you are lucky enough to work Chris, you can obtain his QSL card direct only from **PO Box 1232, Bethlehem, PA 18016, USA**. You can also read more about McMurdo at **www.nsf.gov/od/opp/support/mcmurdo.htm**

MARIO ZUCCHELLI STATION

The Mario Zucchelli Station, which was previously known as Baia Terra Nova at Terra Nova Bay, Victoria Land (AN-16) is only 45 feet above sea level and was opened in 1985/6. Among the 80 people now present at the Base is **Dr. Mario Pillon**, a researcher from the Italian ENEA Antarctic department who holds the callsign **I0QHM**. He has been showing up on 14.180MHz at 1845UTC signing **I0QHM/IA0PS**.

Recently Mario has also been signing **I0QHM/KC4** and is expected to remain in Antarctica until around mid-February. He could also operate from Dome C and probably from other remote camps in the future so long as time and equipment permit. The Mario Zucchelli Station (MZS) is referenced as ITA-01 for the World-Wide Antarctic Programme (WAP) awards. Further information on this Italian base and others can be found at **www.pnra.it/**

MATRI BASE

Amateur operator **Bhagwati Prasad Semwal VU3BPZ** is now located at **Maitri Base** for a second term and has promised to be active from India's Antarctic Base IND-03. The Maitri Station is located on the East Antarctic mainland south of Capetown and 90 nautical miles from the usual Antarctic coastline. It was built in 1989 after the first base **Dakshin Gangotri** became buried in ice. It is built on adjustable telescopic legs and is reinforced with iron bars to withstand high wind speeds of up to 320km an hour and the walls are thermally insulated for protection against the very low temperatures.

The energy for the station is supplied by generators located within the station, which is kept warm by circulating hot water from the boilers. Bhagwati was due to reach Maitri Base just before Christmas so should be active about now. He is expected to check into the Indian AIRNET on 14.150MHz, which runs everyday (probably) around 1400UTC after which he will try working DX stations on his own. Try **www.newzeal.com/theme/bases/Indian/Maitri.htm** for further details of the base and several 'special covers', which may be of interest to those of you who collect stamps.

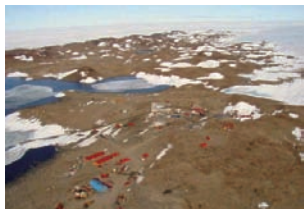
If you would like more details on the WAP awards programme, check out **www.ddxc.net/wap/** which contains details of all bases, callsigns and award information and includes many interesting photographs.

YOUR REPORTS

On to your reports now and first off this

CARL GW0VSW HAS NEWS OF OPERATION AND WORKING CONDITIONS FROM ANTARCTICA PLUS MORE HF NEWS

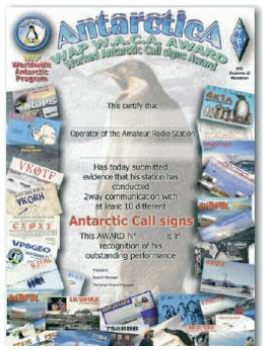
● The McMurdo Station is the main US station in Antarctica.

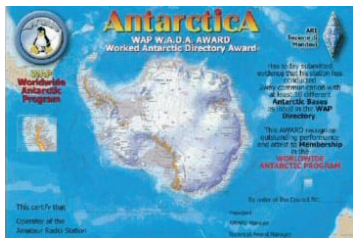


● Indian Maitri Base.

● N3SIG QSL card.

● This postcard, which was specially stamped, issued in April 2002 was posted from the Maitri Base and delivered by helicopter.





● Antarctica Awards.

month is **Robin Trebilcock GW3ZCF** in Bishopston near Swansea who worked s.s.b. stations FP/VE7SV (St. Pierre & Miquelon) on NA-032 at 2342 followed by K5ZD (USA) in Uxbridge, Massachusetts at 2359UTC using an Icom IC-775 and horizontal loop on 3.5MHz.

On the Isle of Sheppey in Kent **Ted Trowel G2HKU** used his Ten-Tec Omni V and Butternut HF-6 vertical to have c.w. QSOs with 4U1ITU (ITU Geneva) on 1.8MHz at 2100 followed by TK5EF (Corsica) EU-014 a little earlier around 2000UTC.

THE 14MHz BAND

A new Hustler 4-band vertical was the chosen antenna this month for **Martyn Medcalf M3VAM** in Chelmsford, Essex, who used his Icom IC-746 and s.s.b. on 14MHz to work T92D (Bosnia-Herzegovina) 0515, HA8CZ (Hungary) at 1237, OH1MU (Finland) 1308, 7S3A at 1312 (Sweden), EY8MM (Tajikistan) 1601 and OY4JN (Faroe Islands) EU-018 1858UTC. Martyn cannot leave this vertical up because of planning restrictions, but has been very pleased with the performance so far!

In Newtonabbey, Northern Ireland **Peter Lowrie MI5JYK** used his MFJ-9420, MFJ-901 tuner and 5W out to a quarter-wave vertical, logging SO2R (Poland), RU1A (European Russia), EA8KK (Canary Island) AF-004, EW6AF (Belarus), OH8NC (Finland), LA9VDA (Norway), 9A7D (Croatia), HB0/HB9OAN (Liechtenstein), TF3W (Iceland) EU-021, OH0Z (Aland Island) EU-002, Z31GX (Macedonia), UA9AYA (Asiatic Russia) and D44TD (Cape Verde) AF-005 between 0945 and 1550UTC. Not bad going for QRP!

THE 18 & 21MHz BANDS

On 18MHz and mobile once again was **Mark Taylor G0LGJ** in Dereham who uses a Yaesu FT-100 and Outbacker antenna which continues to work well. Contacts this month on 18MHz using s.s.b. included UA9ORN (Asiatic Russia) 0123, VE7SV (Canada) 1819 in Surrey, British Columbia and VQ9LA (Chagos) AF-006 at 1746UTC.

Chris Colclough G1VDP in Nuneaton uses a Yaesu FT-897 and Cushcraft MA5B beam for his DXing and had a 'reasonable month' on 21MHz. Stations worked on the band include YI9KT (Iraq) 0906, IF9ZWA (Italy) on

● Dome C in Antarctica.

Marettimo Island EU-054 at 1037, 5Z4DZ (Kenya) 1042 and PY7XC/7 (Brazil) on Itamaraca Island SA-046 and FR/PA3GIO/P (Reunion Island) AF-016 at 1556UTC.

THE 24 & 28MHz BANDS

Onto 24MHz now and the log of **Jim Pedley GM7TUD** in Dumfries who was pleased to find this band open on several occasions during the day. Using a Kenwood TS-450S and TGM MQ4 beam Jim worked JT1BG (Mongolia) 0929, VK8DP (Australia) in Ringwood, Victoria at 0943, VP5/CT1ILT (Turks and Caicos Islands) NA-002 at 1225, ST2M (Sudan) 1234, EL2PM (Liberia) 1425 and XE2K (Mexico) at 1610UTC.

On 28MHz, **Owen Williams G0PHY** in Biggleswade, Bedfordshire, tells me he uses a Yaesu FT-747 and dipole antenna for his DXing. This month's 100W contacts using s.s.b. included A61AJ (United Arab Emirates) at 1020 followed later by EM1HO (Antarctica) AN-016 at 1510UTC.

Also on this band was **Rob Hastings M3AHH** who also lives in Chelmsford and enjoyed time working some DX. His equipment includes a Kenwood TS-50, MFJ-945E tuner and inverted Carolina Windom. His first contacts were using f.m. and included RN3FV (European Russia) in Moscow 1351, UA3PB (Ukraine) and SV2CWV (Greece) around 1420UTC. This was followed by s.s.b. contacts with CT3MD (Madeira Island) AF-014 1519, CU3GD (Azores) EU-003 at 1604 and PU1KGG (Brazil) in Rio De Janeiro at 1641UTC.

I was pleased to meet **Charlie Morrison GI4FUE** from Carrickfergus, Northern Ireland at the Leicester Rally last year and he promised to send in a log. Well he finally got round to it and he has managed to find some great openings on 28MHz this month. Best DX includes VR2XMT (Hong Kong) AS-006 at 1040, YI9QWO (Iraq) 1108, C91Z (Mozambique) 1121, VU2SMN (India) in Kolhapur at 1202, 9J2KC (Zambia) 1204, VK9XD (Christmas Island) OC-002 at 1210, C56ACA (Gambia) 1212, V26B (Antigua) NA-100 1238, V55V (Namibia) 1423 and finally ZD8I (Ascension Island) AF-003. It looks like Charlie's station of an Icom IC-756PRO with Cushcraft A3 beam was working overtime here!

SIGNING OFF

Well that wraps it up for another month and it is good to see most bands opening at some time during the day. There was a lot to fit in from our reporters and I do hope I've not missed anyone out? As usual, my thanks go to all our reporters for their logs and to **Tedd Mirgliotta KB8NW**, Editor of the *OPDX Bulletin* for all the DX information. Until next time I hope we get some good band conditions and you have an interesting and fruitful DX filled month. Happy New year to you all.

73, Carl GW0VSW

DATA BURST

TEX SWANN G1TEX/M3NGS
C/O PRACTICAL WIRELESS
TEL: 0870 224 7810
E-MAIL: tex@pwpublishing.ltd.uk

In my column in November last, I mentioned that I'd be looking at *McCad EDS Lite,* as well as a variety of other topics of interest to Radio Amateurs. Well I then thought I'd widen the remit I'd given myself, and look into circuit diagram and printed circuit board (p.c.b.) layout drawing programs, in general terms.

Initially, circuit diagrams and p.c.b. layout designing may seem to be somewhat different, but that's not really the case. In simple terms, both forms treat the diagrams as interlinked symbols, or predefined shapes with external 'attachment' points. And I'll start with a little general information about circuit diagram drawing or 'schematic capture' as is is sometimes called.

As mentioned, a circuit diagram is really a set of two or more symbols joined by connections that link together fixed points on the symbols. A symbol may be as simple as a box with only one attachment point, or it may be a complex integrated circuit with literally hundreds of attachment points.

I've shown a simple part circuit, in **Fig. 1** to illustrate the points outlined above. The symbols are those items that consist of black lines and shapes (I've put a blue box around each one to make it clearer). The black line connections that appear at the edge of each blue box, are the symbol's own attachment points.

So, the chassis and input points (circles) have only one attachment point each. Other components symbols, such as capacitors and resistors have two linked points. These represent the two 'ends' of the component itself. Though note that variable capacitors and resistors may have three linkable point.

The transistor shown in Fig. 1, has three points of attachment, for the emitter, base and collector connections. Another semi-conductor, such as dual-gate m.o.s.f.e.t. will most likely have four linkable point for drain, source, gate 1 and gate 2. Integrated circuits (i.c.s) will have as many links as the number of pins, from four to four hundred (perhaps more for computer chips).

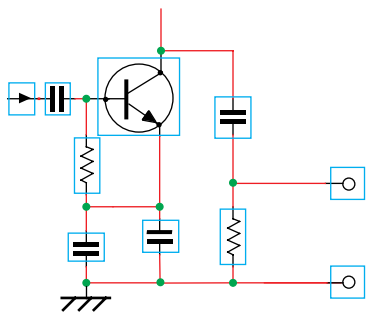
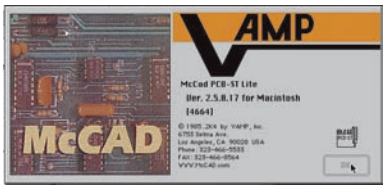


Fig 1: A circuit, illustrating the various elements of a schematics capture program's world. (see text for more detail).

Most circuit diagram software comes with many pre-defined symbols and almost all allow you to create your own to meet every eventuality. The various symbols are placed on a virtual page, then each attachment point is linked to the corresponding point on other



TEX SWANN G1TEX/M3NGS TAKES HIS TURN TO 'BURST' YOU WITH DATA! AS PROMISED, HE'S GOT SOME INTERSTING ITEMS THIS TIME

Table 1

Capilano Computing - Home of *DesignWorks* Schematic Capture for *Windows, Linux* and Macintosh. *OSX*
www.capilano.com/freedemo.shtml
www.capilano.com/html/index_other.shtml

For a copy of the *EAGLE* Layout Editor from Cadsoft:
www.cadsoftusa.com

MOZAIX schematic capture software for PCB design
www.intercept.com/html_files/ download/software/mozaix_release.htm

MATRICS Group Distributes Catena's *SPE Schematic Capture Tool*
www.matricsgroup.com/spe.asp

PCB design tools *DESIGN WORKS PCB* schematic capture and simulation software. OSMOND PPC FREE *MAC PCB CAD/CAM* software. ...
www.olimex.com/pcb/dtools.html

AnaSoft Home Page, *Mixed-Mode Analog Simulation* with Schematic ...
www.anasoft.co.uk

Rimu *Schematic Electrical and Electronic Schematic Capture* Software. ...
www.hutson.co.nz/rimu.htm

symbols. These linking lines are shown in red. Where a link is made to an already existent link a pseudo-symbol is created (green dots), these are totally under the control of the program, and will disappear when one of the links to this point is broken.

If you need to move a component symbol for any reason, then the interconnecting links remain attached and become like 'rubber-bands' stretching to remain linked. Some programs realign these links automatically after the symbol is placed, with others, you have to clean up afterwards yourself.

In many cases, when a circuit drawing package calls this diagram creation 'schematic capture', the list of components and the links are used to create a draft printed circuit layout. Some software will attempt to create a complete layout, others merely place the major components and leave you to complete the various track runs. That's a function of the software itself and I have no intention of trying to cover this in any greater detail.

On using my favourite Internet search-engine Google, I got around two-thirds of a million (yes - 650,000) pages in response to typing "schematic capture free" into the search line. And in **Table 1** you'll find a few of the first answers that were in that huge list. They're in no particular order, and I make no real recommendations about their suitability for your needs, that is beyond me! Treat them as just a start point for your own needs. We use *McCad EDS* by **Vamp Inc.** here at *PW* and that's available as a 'lite' version for both PCs and Macintosh computers.

Several of the programs I found had 'free to use' version, limited sometimes by pins, sometimes by facilities. *EDS Lite* is limited by both number of links and single page only. But it has all of the many features that you may like to try out. The download is big, at around 17Mb so, a broadband connection is preferred. Have fun trying them out, I know I shall have plenty to try out for some time to come!

HAM RADIO DELUXE

I've had some detail about a rig controlling programs from **Graham M0GAB**, who has taken time out to try *Ham Radio Deluxe.* Sponsored by Martin Lynch and Sons, this complete and complex software can make light work of controlling the rig, noting details for its logbook and even decoding PSK31 transmission.

Graham wrote: " I've had a lot of pleasure using the *Ham Radio Deluxe* recently and must say that I have managed to get the program working on the PC, but you need to be very patient as there is a considerable amount of setting up to do. Once you have the program as you want it to, it is great to see exactly what you are doing. And with the waterfall cascade and the spectrum graph you can easily go to other stations that are nearby on the band very quickly.

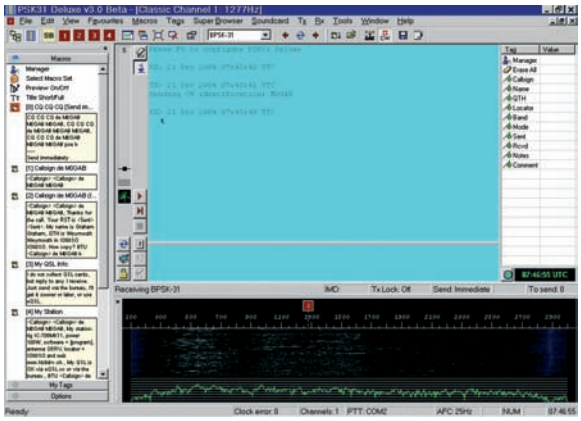
"The only problem I have found is that if you are using this program it certainly helps if you are on the Internet as from time-to-time it does try to connect and download upgrades for the Keplerian elements for satellite tracking as well as other information that the program requires to run properly. I don't use the internet so am limited to what I could actually do, but this didn't stop me from enjoying looking at and using, the software. I think that once you *Ham Radio Deluxe* you will be pleasantly surprised at just how well it does work.

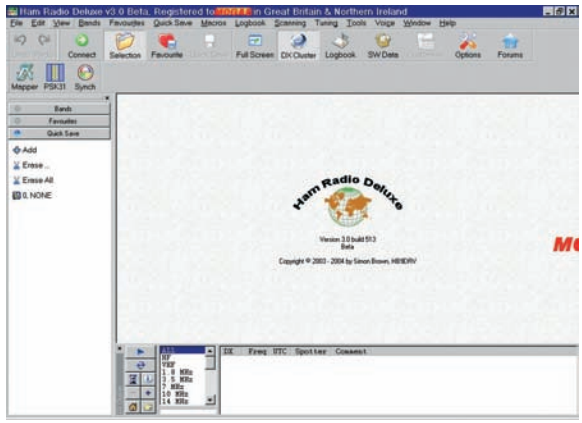
"However, the program I found that there's quite a bit of initial input with details such as callsign, latitude and longitude and various other details. But it is worth taking the time to put in as much as you can, if only to save you a lot of typing whilst in contact with another station. There are a number of different data modes you can decode and use with the program and each mode is cleanly and nicely presented.

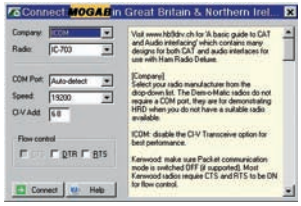
"Registration of the sponsored software is now free, many thanks I guess to Martin Lynch. I imagine that it will have a great impact on Amateur Radio and will help in the continuation of our hobby. As this is quite a short note, I've only touched on a few things the program can do. I can't really say that I have found any major problems with the program and basically it is a case of getting the program and testing it out yourselves. The help file within the program is very useful and detailed and you can print out different parts of the file very easily.

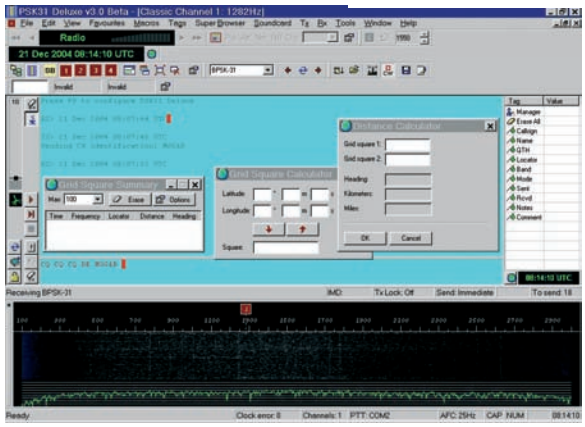
"There is a great deal more for you to discover such as being ability to synchronise your radio with the different data modes and also changing settings to suit your needs. As I said earlier it is a program well worth exploring. 73 de M0GAB". Many thanks for that mini-review Graham, as I don't have a radio that appears in the list of controllable rigs, I had been a slight loss as how I could present that piece of software. For more details and to download your own copy of the software, which has recently reached version 3, point your web-browser at: **http://hrd.ham-radio.ch/**

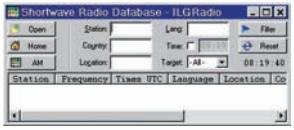
Well that's all the space and time I have for this session. See you next time.











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Let's start the amateur television news in 2005 by zooming in for a close-up of the 10GHz (3cm) band. These are the frequencies where coaxial cable gives way to waveguide, the Yagi antenna morphs into a horn or dish and a new device enters the ATV dictionary - the Gunn Diode. Radio tends to be described as microwave when the frequency exceeds 1GHz (1000MHz) so 10GHz is the fifth such band available to the Radio Amateur.

GRAHAM G8EMX POINTS HIS CAMERA AT THE 10GHz BAND THIS TIME. THIS IS WHERE WE ENTER THE AREA OF WAVEGUIDES, HORNS & DISHES!

The 3cm band has gained popularity within the Amateur community due to the availability of microwave motion detectors and satellite systems, which have provided Gunn oscillators and Low Noise Blocks (LNB) onto the surplus market. The science of 10GHz radio is a study in physics and mathematics, so what follows is much simplified. Not so that you, dear reader, can understand it, but so that I can write about it! Paradoxically, it is perhaps because it is so theoretically complex, that the practicalities are sometimes considered as relatively simple. We shall see...(hopefully!).

HIGH FREQUENCY

To begin, how can such a high frequency be generated? At 10GHz we are not dealing with inductors, capacitors, conventional resonant circuits and feedback within unity-gain amplifiers. Instead, we're dealing with the structure, formulation and properties of a piece of silicon. The humble semiconductor diode can be manufactured to exhibit remarkable behaviour and we are all familiar with the basic forward and reverse conduction curves. These demonstrate characteristics of straightforward 'positive' resistance, i.e. the higher the applied voltage, the greater the current flow.

However, the performance graph for the Gunn Diode would show a region of 'negative' resistance - decreasing current for increasing voltage - and it's within this region that a Gunn diode will resonate at around 10GHz when placed within an accurately dimensioned cavity. The full theory of operation is extremely complex, but my explanation gives the basic idea.

The actual amplitude and frequency of oscillation depends on the applied voltage, so clearly frequency modulation is fairly straightforward. For ATV, our video and sound modulate the power supply to the Gunn diode. This produces both frequency and amplitude modulation, but the a.m. will be ignored by the receiver.

Our Gunn diode has generated a few milliwatts of microwave power, which has to be passed to an antenna. Coaxial cable, the universal transmission line at lower frequencies, becomes useless at 10GHz. Cable losses are significant and the losses at 10GHz

would be quite unacceptable, but there is another factor to be considered.

At 3cm, the 'mechanism' by which the r.f. energy travels is fundamentally different. At 10GHz, the energy is 'launched' into a 'waveguide' - a hollow metal tube, normally of rectangular cross-section, along which the wave will travel by a variety of transmission modes, for example TE01 - Transverse Electric 01. Once again, very complex to study, but waveguide is very efficient at carrying 10GHz signals, can be made as curved lengths, and enables microwave attenuators to be formed.

At microwave frequencies, wave energy bounces when it hits a solid surface and GHz signals will bounce off solid buildings, and are reflected off the curves of a dish. So, if a final waveguide is positioned at the focal point of a reflecting dish, the microwave energy will be very accurately concentrated into a precise beam. This means that a modulated Gunn diode oscillator when coupled to lengths of waveguide and a suitable dish will form a 3cm ATV transmitter.

HELPED TO BOOST

Naturally, the satellite television industry has helped to boost 10GHz ATV. The Low Noise Block (LNB) pointing at every domestic dish is basically a frequency down-converter with a local oscillator around 9GHz. An incoming 10GHz ATV signal will emerge at around 1.3GHz, into your 24cm ATV receiver! Next time you look at a satellite dish, note where the LNB actually is, probably below the apparent centre of the dish. You'll see that it's by changing the geometry of the dish surface, the focal point can be shifted and the LNB moved away from the path of the incoming signal. Just one of the many variants of microwave design.

For Amateur ATV contacts, 10GHz has been a pioneering band. The myth that microwaves were only capable of line-of-sight communication was proved false as distance records for point-to-point contacts rapidly increased. Then, microwave ATV between portable stations from the north-east coast of England to Holland demonstrated the phenomenon of 'ducting', where a low-loss atmospheric path could exist just a few metres above sea-level.

To provide more regular contacts, the 2005 *RSGB Yearbook* lists ten ATV repeaters on 10GHz. A slotted waveguide can be used as an antenna to produce the required horizontally polarised signal, Gunn diodes are available producing higher powers than a few mW and careful antenna design can result in useful effective radiated powers. Next time, I will take a more detailed look at 10GHz practicalities - for example, just how is frequency and power measured?

BEGINNING OF THE END?

When I was writing this at the end of November, with sales of the video cassette recorder (VCR) being outstripped by the DVD recorder and receivers incorporating a hard disc, the media reported the beginning of the end for the VCR. Certainly my new Freeview receiver contains a Hard Disk (HD); recordings are indistinguishable from broadcast and the HD menu shows all programmes that are stored.

But let us not allow this latest domestic wonder to overshadow the outstanding contribution that the VCR made to television viewing and, maybe not an exaggeration, to how we now live and organise our very lives! Recording the vision signal was an electronic and mechanical achievement in the professional field to produce reliable, precision mechanics and electronics operable by completely unskilled consumers within their homes was an engineering feat in itself.

The VCR then brought an end to the domestic tie with published schedules, decisions over clashing programmes, gosh - viewers could even leave the house and still see a programme later! Let's all raise a glass to the not-so-humble video cassette recorder **and** the engineers who designed them!

Graham G8EMX

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THIS MONTH JACK LOOKS AT THE USE OF SSB BY PROFESSIONAL HF BROADCASTERS

As a general rule, short wave broadcasters use a.m. (amplitude modulation) while utility and amateur stations favour s.s.b. (single-sideband) for sending voice. Of course, like any generalisation, it's never entirely right, so this month I thought I'd look at some of those broadcasters who do use s.s.b.

Normal a.m. transmission sends a carrier frequency plus two sidebands - upper and lower - which contain the programme audio. For the broadcaster this is expensive because the carrier uses up about 40% of the transmitter power and the two sidebands merely duplicate each other. However, just about any radio in the world can receive it, the audio quality can be quite good and it doesn't require very precise tuning. All of which makes a.m. well suited to simple receivers and ideal for listeners who want to hear the programme with minimum fuss.

The s.s.b. transmission discards the carrier and one of the sidebands, which saves a great deal on the broadcaster's electricity bill and uses less bandwidth. But the listener needs to have a special s.s.b. receiver, which is more complex, more expensive and requires careful tuning. It's not surprising then that s.s.b. hasn't really taken off for general broadcasting.

However, s.s.b. is ideal for broadcasting to ships and military bases, or to any other specific audience that can be relied on to have suitable receivers. That's why one of the main s.s.b. broadcasters is AFRTS - the American Forces Radio and Television Service. They have a ring of transmitter sites around the world that broadcast AFN (Armed Forces Network) programmes as well as relays of NRP (National Public Radio). Individual sites may be active for months on end, then suddenly disappear for a while. Frequencies are also liable to change at any time, but you can get reasonably accurate details of current transmissions from their website at **http://myafn.dodmedia.osd.mil/radio/shortwave/**

At the time of writing, the stations listed as being on air (not all of these may actually be active) are Diego Garcia in the Indian Ocean on 4.319 and 12.579MHz; Guam on 5.765 and 13.362MHz; Keflavik, Iceland on 7.590 and 13.855MHz; Key West, Florida on 5.4465 and 12.1335MHz; Pearl Harbour, Hawaii on 6.350 and 10.320MHz and Roosevelt Roads, Puerto Rico on 7.507MHz. All stations transmit 24 hours a day in u.s.b.

If two frequencies are shown, they usually use the higher one by day and the lower one at night. Many of them can be heard in the UK, but obviously the Pacific stations are much more difficult. One of the most reliable signals here recently has been Key West on 5.4465MHz at night.

Another station with s.s.b. transmissions apparently aimed at military bases is Radyus FM in Belarus. You can find them at various times around the clock on 2.338, 3.346, 4.246 and 5.256MHz carrying either Radyus FM programmes or those of Radio Mayak from Moscow. They're usually in u.s.b. and often suffer from noticeable distortion.

Rikisutvarpid, the state broadcaster in Iceland, uses s.s.b.

SPECIAL RECEIVER

I mentioned earlier that s.s.b. reception requires a special receiver. For true s.s.b. this is correct because the receiver has to generate and add in the missing carrier to make the signal intelligible. However, there is also a.m.-compatible s.s.b. - known as mode A3A - in which a single sideband is transmitted along with a low-level carrier at -6dB. This is enough for ordinary a.m. receivers to demodulate the signal, but it also works (usually better) with a proper s.s.b. receiver. Although not as efficient as true s.s.b., it does still represent a significant power saving for the broadcaster and doesn't require any new investment by the listener.

An international conference in 1989 decreed that all h.f. broadcasting should move to a.m.-compatible s.s.b. by 2015. Very few broadcasters have made the switch so far, presumably because they're eyeing DRM as a way of reducing power consumption even further and so haven't invested in s.s.b. equipment.

However, two stations that adopted A3A early on are Radio Bahrain and Rikisutvarpid, the state broadcaster in Iceland. Bahrain is on 9.745MHz broadcasting 24 hours a day in Arabic using compatible l.s.b. It's difficult to pick up in the UK, but try at around 2300 or 2400UTC. Iceland on the other hand is easy to hear. They're on air to Europe in Icelandic at 1215-1300UTC on 13.865MHz and at 1755-1825 on 12115 (the transmission times are often slightly erratic). They use compatible u.s.b.

Among other broadcasters adopting A3A is WBCQ in Kennebunk, Maine, USA. They're on air in English throughout our evening and night on 9.330MHz and from 2300UTC (some days from 0000) on 5.105MHz in compatible l.s.b. Also, religious broadcaster HCJB in Ecuador is using compatible u.s.b. on 21.455MHz. This is via a bi-directional antenna, which means that it's sometimes audible with an echo when both the long and short-path signals reach the UK. English is on this frequency at 1100-1330UTC. Another station that appears to have adopted A3A recently is Radio Asgabat in Turkmenistan which is audible in late afternoon and evening using l.s.b. on 4.930MHz.

The list of s.s.b. broadcasters is steadily growing, but the long-term future of compatible s.s.b. remains far from clear. The requirement to convert all h.f. analogue broadcasting to A3A by 2015 still stands. It could safely be ignored if everyone has migrated to DRM by then.

However, even if DRM succeeds (which is also far from clear), it's unlikely that many millions of listeners in the world's poorer countries will be able to obtain, let alone afford, new DRM radios by then. Either they will be abandoned or we can expect a rush to s.s.b. in a few years time.

That's it for this month. Until next time, good listening!

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NES1042 Switch Box	£19.95

Watson Supplies

W30-AM

0-15VDC
30/35A Peak
£119.95

W25-XM NEW

13.8VDC
25A Switchmode
£99.95

W-25AM 25A Supply	£89.95
W-10AM 10A Supply	£59.95
W-5A 5A Supply	£29.95
W-3A 3A Supply	£22.95
W-25SM 25A Supply	£79.95
W-10SM 10A Supply	£49.95

Diamond Supplies

GZV4000
5-15 VDC
40A Peak
£154.95

GZV-6000 60A Supply .NEW.	£299.95
GZV-4000 40A Supply	£154.95
GSV-3000 30A Supply	£144.95
GZV-2500 25A Supply	£114.95

Frequency Counters

Will tune AR-8200, AR8000 & IC-R10
Super Searcher
£99.95

FC130	£79.95
Hunter	£59.95

Call for further details

* 10Hz-3GHz
* Imp - 50 Ohms
* LCD readout
* 10-Digit display

Super Hunter
£149.95

Daiwa Accessories

Cross-needle meters

CN101L HF/VHF	£59.95
CN103N VHF/UHF	£65.95
CN801H HF/VHF	£109.95
CN801V VHF/UHF	£119.95

Coax Switches 2/4 Way.

CS-201 2-Way	£24.95
CX401 4-Way	£49.95
CS401N 4-Way NType	£Call

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AV-200
HF / VHF PWR SWR meter

AV-200 HF/VHF	£49.95
AV-400 VHF/UHF	£49.95
AV-600 HF/VHF/UHF	£69.95
SX-1000 HF/VHF/UHF	£99.95
AV-20 HF/VHF	£39.95
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CT6 HQ Straight Key	£139.95
CT9 Iambic Paddle	£69.95
CT11 Single Paddle	£90.95
CT12 Classic Paddle	£97.95
CT12DX DX Paddle	£111.95
CT91Single Paddle	£Phone

Watson Antennas

Watson W2000
Bands 6m/2m/70cm
Gain 2.15/6.2/8.4dB
Power 200W (50W 6m)
Type 1/2, 2x5/8, 4x5/8
Length 2.5m
£69.95

W-30 2/70 Base	£39.95
W-50 2/70 Base	£49.95
W-300 2/70 Base	£64.95
W-2000 6/2/70 Base	£69.95
WBV-70 4m 1/2 Wave Base	£39.95

Bencher Antennas

Butternut HF-6V
Bands: 80/40/30/20/15/10
Height (Adj): 26 ft (7.9 m)
Weight: 12 lbs (5.4 kg)
Impedance: Nom 50 ohms
VSWR: 1.5:1 or less
£299.95

Butternut HF-2V 40/80m	£229.95
Butternut HF-6V 80-10m	£299.95
Butternut HF-9V 80-6m	£349.95
Butternut HF-5B 20-10m	£319.95
30-MRK 30m ad for HF2V	£89.95
A-17-12 17&12 ad for HF6V	£49.95
A-6 6m ad for HF6V-X	£14.95
TBR-160S 160m HF2/6/9V	£114.95

Hustler Antennas

Hustler 5-BTV
5 Bands - 80-10m
Height 7.64m - Weight 7.7kg
SWR 1.15:1 - Power 1kW
£179.95

Hustler 4-BTV 4 Band Vert	£149.95
Hustler 6-BTV 6 Band Vert	£209.95

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RIGblaster Pro	£209.95
RIGblaster Plus	£119.95
RIGblaster M8	£89.95
RIGblaster M4	£89.95
RIGblaster RJ	£89.95
Nomic 8P	£59.95
Nomic 4P	£59.95
Nomic RJ	£59.95

Tonna Antennas

Tonna - 20655
23cms (1296 Mhz) 55 element 21.5 dbi gain "N" 4.64m long.

Tonna 20505 6m 5el	£89.95
Tonna 20809 2m 9el	£54.95
Tonna 20811 2m 11el	£79.95
Tonna 20817 2m 17el	£99.95
Tonna 20909 70cm 9el	£45.95
Tonna 20919 70cm 19el	£59.95
Tonna 20921 70cm 21el	£74.95
Tonna 20635 23cm 35el	£64.95
Tonna 20655 23cm 55el	£89.95
Tonna 20745 13cm 25el	£69.95

Diamond Antennas

HF10FX 10m Mobile	£39.95
HF15FX 15m Mobile	£39.95
HF20FX 20m Mobile	£39.95
HF40FX 40m Mobile	£39.95
HF80FX 80m Mobile	£42.95
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CP6 Base 6m-80m	£239.95
X50 Base 2/70	£54.95
X200 Base 2/70	£84.95
X300 Base 2/70	£99.95
X510 Base 2/70	£124.95
X700 Base 2/70	£249.95

Cushcraft Antennas

X-7 - 20/15/10 7el Yagi	£669.95
A3S - 20/15/10 3el Yagi	£499.95
A4S - 20/15/10 Yagi	£569.95
A3WS - 12/17 3el Yagi	£379.95
ASL-2010 13-32MHz Log	£749.95
MA5B - Mini Beam	£369.95
D3 - 20/15/10 Dipole	£249.95
D3W - 30/17/12 Dipole	£249.95
D4 - 40m Rotary Dipole	£349.95

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M-150GSA 1/4 2m Mobile	£11.95
M-285 5/8 2m Mobile	£13.95
NR-770H 2&70 Mobile	£23.95
SG-7900 2&70 Mobile	£31.95
CR-627 6&2&70 Mobile	£33.95
X-200 2&70 Base	£58.95
X-300 2&70 Base	£63.95
X-510 2&70 Base	£98.95
V-2000 6&2&70 Base	£68.95

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CWS-80 80-10m (66ft)	£109.95
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Radioworld G5RV Fullsize	£29.95
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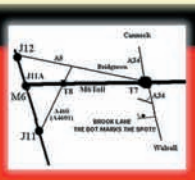

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LDG Electronics

AT-1000

1KW Auto ATU - 1.8-54MHz - 1-8 secs Tune - Approx SWR Rating of 10:1

£499.95

LDG Z-100

100w Auto ATU - 1.8-54MHz - 0.5 - 6 secs

£129.95 ***BEST SELLER****

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100w Auto ATU - Covers 1.8-54MHz
1-5 secs Tune - Cross needle meters

£199.95

LDG AT-100Pro *New*

100w Auto ATU - 1.8-54MHz
1-5 seconds Tune - 2 Pos Ant switch

£169.95 ***New****

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1:1 or 4:1 Balun - Covers 1.8 - 30Mhz
Power rating 200w

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LDG AT-897

100w Auto ATU for FT-897 - 1.8-54MHz

£199.95

Accessories:

K-OTT Kenwood Interface	£49.95
Y-OTT Yaesu Interface	£54.95
Icom-IC1 Icom Interface	£29.95
Alinco-IC1 Alinco Interface	£29.95
AC-1 Cable	£19.95

W4RT Electronics

One-Plug-Power

One-Plug Power is the internal FT-817 battery solution you have been waiting for until now.

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£54.95
NEW! 2300 mAh Large Capacity FT-817 Internal Battary Solution Still use Internal 817 Charger

OPP-897
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One Plug Power for the FT-897 4500 mAh; Fully Compatible with the FT-897 and Yaesu Charger.

NEW!

One-Plug Power is the internal FT-817 battery solution you have been waiting for until now. One-Plug Power comprises a 1800 mAh NiMH battery pack, both over-termperature and over-current protection, connection to the FT-817 Molex connector, and a modified Yaesu battery cover door featuring a power jack that allows connection of a battery charger such as the Maha MH-C777 or MH-C888.

One-Big Punch

One BIG Punch (OBP) is a custom add-on accessory for the Yaesu MH-31 microphone commonly used with many Yaesu amateur radios

OBP
£49.95
Speech Compressor for the Yaesu MH-31 mic and FT817, FT857, FT897. Improve the TALK POWER.

Hand Mike
£57.95
W4RT Electronics Microphone with One BIG Punch Speech Compressor included.

The One BIG Punch is an AF-based speech compressor specifically configured to provide remarkable increase in talk power while maintaining good audio quality. The OBP is NOT a clipper, but a compressor providing great voice compression, high-level limiting, and noise gating. The unit can be mounted inside the MH-31, requires no additional electrical power, and can be turned on or off by using the MH-31's TONE switch.

One-Board-Filter

The One-Board Filter (OBF) affords you the opportunity to have both the Collins CW and SSB mechanical filters available in your FT-817 together!

OBF
£229.95
Replace two filters in the space of one. OBF includes the two optional filters and fitting.

Collins Mechanical Filters
for the Yaesu FT-817, 857 & 897.

500 Hz CW - £94.95 ***2.3kHz SSB - £94.95***

This is the option that many, many FT-817 owners have requested. The OBF utilizes Collins Mechanical Filters that are the same as used in the optional Yaesu filters for the FT-817. The bandwidth of the 7-pole CW filter is 500 Hz and the 10-pole SSB filter is 2.3 kHz. The One-Board Filter is NOT available for installation by FT-817 owners. This is not a "do-it-yourself" option. The One-Board Filter must be installed by RADIOWORLD, or a competent engineer. If in doubt please call for details.

One-Touch-Tune

At the touch of a button, you have the carrier needed for tuning. One-Touch Tune (OTT) is totally transparent to the FT-817 and to any external equipment that you have attached to the rig.

OTT-817
£54.95
It requires no external power and works with both manual and automatic tuners.

W4RT OTT-FT817	£54.95
W4RT OTT-FT100/857/897	£54.95
W4RT OTT-FT847	£54.95
W4RT FT817 One Fast Charger	£Call
W4RT Antenna Boss	£139.95

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Simply snaps into position. Adjust for desired height. Complete with non slip feet and allen wrench.

Professional-Grade FT-817 Stand

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ATX Walk--about PL-259

£47.95

The ATX Walkabout covers all bands (including WARC bands) from 80-6m, 5W guaranteed, 25W max. When fully telescoped it is about 65 inches long. This makes it ideal for the FT-817 or any other portable HF radio.

ATX Walkabout BNC	£47.95
ATX Walkabout PL259	£47.95
ATX Walkabout Universal	£54.95

The Miracle Whip

RX - 0.6 to 460 Mhz
TX - 40,30,20,17,15,12, 10, 6, 2m & 70cm

Power Limits 25W PEP 10W Cont.

£127.95

In Stock*

* The Miracle Whip will transmit on almost any frequency you are licensed to use including WARC, MARS/CAP, Alaska Emergency, Citizens Band, Marine, and most commercial HF SSB and VHF/UHF channels

** The Miracle Whip is optimized for for best receive rather than lowest swr on 80 and 160, as no short antenna will present good transmitting opportunities at these frequencies

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Small 17' 6"	£55.95
Medium 26' 0"	£65.95
Large 33' 0"	£75.95
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Solarcon MAGZ-17 TRI-MAG

£39.95

An extremely strong magnet base which actually consists of 3 x 5" chrome magnets that are interconnected with metal strips to form one very large mount. Suitable for very large mobile antennae such as ¼ wave tank whips.

Siro MAG125 3/8	£17.95
Siro MAG125 PL	£17.95
Siro MAG 145 3/8	£22.95
Siro MAG 145 PL	£22.95
Solarcon Magz-17	£39.95

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LA-STNM Bal Super Tuner	£345.00
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SGC-235 HF-500w	£749.95
SGC-237 HF+6m	£299.95
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SGC-237 PCB	£299.95
SGC-239 HF	£185.95
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YAESU

G-2800SDX Rotator	£999.95
G-450C Rotator	£379.00
G-550C Rotator	£309.00
G-650C Rotator	£499.00
G-1000DXC Rotator	£599.00
G-5500C Rotator	£569.00

Feeders & Wire

Military Spec High grade
50 Ohm coaxial Cable
£69.95 A 100m Drum

RG58U	£0.50 per Metre
RG8 Super	£0.70 per Metre
RG213	£0.90 per Metre
W103 Westflex	£1.20 per Metre
RG-8 75 Metre Drum Special	£39.95
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Flexweave-PVC-50 50m	£39.95
Enamelled Copper Wire 50m	£12.95
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3 core	£0.45 per Metre
7 core	£0.79 per Metre
8 core	£1.09 per Metre

DC Connecting Cable

5A DC Cable	£0.50 per Metre
10A DC Cable	£0.75 per Metre
20A DC Cable	£1.00 per Metre
25A DC Cable	£1.10 per Metre

Second Hand List

Second Hand Antennas

Cushcraft X9 10/15/20 9ele	£450.00
Cushcraft MA5B 10-20m	£250.00
Cushcraft R-6000 Vertical	£200.00
Cushcraft A3S 10/15/20 3ele	£299.00
Butternut HF6V Vertical	£175.00

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Kenwood YK88SN	£40.00
Yaesu XF114SN	£60.00
Yaesu XF112C	£40.00
Icom FL-53	£100.00
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Alinco DJ-G5EY Dual Band Handheld £199.00
Alinco DJ-V5 Handheld £99.00
Alinco DJ-X2000 Scanner 0.1kHz-2.1GHz £299.00
Alinco DJ-X10 Wide Band Receiver £200.00
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Alinco DR-605 2m/70cms £175.00
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Alinco DX-70 HF & 6m Transceiver £389.00
Alinco DX-70TH HF & 6m Transceiver (100W Output) £475.00
Alinco DX-77 HF Base £399.00
Ameritron QSK-5 Amplifier Switch / Pre Heat £200.00
AOR 5000 Top Receiver £899.00
AOR 5500 Display As new display model £450.00
AOR AR-3030 HF Receiver, Including PSU £350.00
AOR AR5000+A AR5000+A £1,599.00
AOR AR-7030 Top Receiver £550.00
Bearcat UBC-278XLT RX Scanner £99.00
Bearcat UBC-780XLT RX Trunktrack £220.00
Bearcat UBC-9000 RX Scanner £179.00
BHI BHI Noise Eliminating Module £89.00
Bnos 20AMP PSU 20A PSU £89.00
Bnos LP50-3-50 6M Amp Solid State £89.00
Bnos LPM144/10/100 2m 100w Amp £119.00
Comet CD-270D SWR Power Meter £49.00
Commtel Comm-225 Receiver £150.00
Daiwa CN-103L 2/70cms Cross needle Meter £40.00
Daiwa CN-801H 1.8-200 MHz SWR+PWR Meter £80.00
Daiwa CS-201 2 way Switch £10.00
Daiwa PS120 10A PSU £40.00
Daiwa PS-30 XM II 30A PSU £99.00
Datong FL2 Multimode Filter £69.00
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Kenwood MB-201 MB-201 £20.00
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Kenwood TM-V7E 2m/70cms £250.00
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SGC MAC-200 £170.00
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Target HF3 HF3 RX £99.00
Tentec Paragon HF Baselnc. Speaker £700.00
TenTec RX-350 HF Receiver £999.00
Timewave DSP9+ External DSP Unit £99.00
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Trio TR-9130 2m multimode £220.00
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Yaesu FP-700 Power Supply £100.00
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Yaesu FP-757GX 757 PSU £99.00
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Yaesu FRG-100 HF Receiver £299.00
Yaesu FRG-8800 RX £199.00 or inc Converter £299.00
Yaesu FRG-9600 RX VHF/UHF £189.00
Yaesu FRT-7700 FRT-7700 £70.00
Yaesu FRV-7700 Converter for FRG-7700 £60.00
Yaesu FT-100 HF/6m/2m/70cms Mobile Transceiver £499.00
Yaesu FT-107 HF Trx £375.00
Yaesu FT-1000MP AC HF Base £1,199.00
Yaesu FT-1000MP Field HF DSP Base £1,599.00
Yaesu FT-200 FT200 £175.00
Yaesu FT-2600M Mobile VHF / FM Transceiver £120.00
Yaesu FT-290R Mk II 2m multimode £250.00
Yaesu FT-290RmkII 2m Multimode Mobile Transceiver £225.00
Yaesu FT-41R Handheld Transceiver £120.00
Yaesu FT-470R Dual Band Handheld £129.00
Yaesu FT-480 2m £150.00
Yaesu FT-690Rmk2 6m Multimode Mobile Transceiver £275.00
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Yaesu FT-8100R 2m / 70cms Mobile Transceiver £220.00
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YAESU FT290 MK1 VHF TRANSCEIVER £95
YAESU FT690/MK1 6MTR TRANSCEIVER £125
YEASU FT100D HF/6/2/70 TCVR £495
YEASU FT815ND HF/6/2/70 QRP TCVR £375
KENWOOD TS850SAT HF TCVR £525
KENWOOD TS850S HF TCVR £495
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KENWOOD 9130 VHF MULTIMODE £195
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DRAKE R8E HF RECEIVER £425
LOWE HF 125 HF RECEIVER £135
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AOR 7030+ HF RECEIVER £575
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AOR AR8000 HANDHELD RECEIVER £245
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JPS NTR-1 DSP NOISE REDUCER £85
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TIMEWAVE DSP9+ DSP UNIT £85
GLOBAL AT2000 SWL ATU £59
HEIL HMM-K HAND MIC FOR KENWOOD £45
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Kenwood TR7730 2m FM 25w T ansceiver £89
Trio Tr9500 70cms Mobile/Base Transceiver c/w PSU & B09 ..... £ 99
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Yaesu FT290II 2m All Mode Transceiver with 25w Amp & Case etc. £249
Yaesu FT726R 2M/70CM All Mode 0W Base Transceiver £499
Yaesu FT726R 2M/70CM All Mode Base Transceiver £399
Yaesu FT726R 2M/6M All Mode 0W Base Transceiver £395
Yaesu FT736R VHF/UHF All Mode T ansceiver £699
Yaesu VX2E Twinband Compact Handie with Wide Receive £139 95
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AOR AR8200 MkIII Wideband Scanning Receiver £299
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Icom R2 Wideband AM/FM/WFM Handheld Scanner £95
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Datong FL-3 multimode filter £99
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Kenwood TM255E 2m 45watt multimode mint £349
Kenwood TR751E 2m 25watt multimode mobile £299
Kenwood TH79E true dualband hand held £199

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Yaesu FT817 portable HF,6,2,70cm charger etc £399
Yaesu FT857 HF to 70cms Demo model £599
Kenwood TS140S 0-35mhz all mode £399
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Icom IC746 HF,6m,2m,Auto ATU 100W £899
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Yaesu RG100 0-30mhz PSU and Keypad £399
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MFJ MFJ 9406X 6m SSB QRP Transceiver 0W 12V £129
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Yaesu FT 8 00R 2m,70cm FM 50W,35W Full Duplex + Remote Head £249

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Icom C-M11 VHF FM Marine 6W Transceiver £149
Palstar KH-6 6m FM H/Held with CTCSS £75
Yaesu VX-150 2m FM Mil. Spec. 5W + CTCSS & DTMF keypad £89

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Icom C-R8500 00kHz-2GHz All Mode Receiver 000ch. 12V + PSU 899
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Kenwood TS-870 h.f. transceiver with i.f., d.s.p., ATV, etc., v.g.c. with mic., manual and power leads, £750. Any trial welcome. Tel: (07930) 387120 or E-mail: toby_walsh@hotmail.com

M3 callsign instruction manual for Icom IC-706MkII, free to anyone who wants it and could post if you like. Steve on (01449) 711763.

Mirage linear amp f.m./s.s.b., 100W Gas f.e.t. pre-amp attenuator, £100. MFJ v.h.f. antenna tuner and s.w.r. meter, model 921, £45. Tonna 9-ele crossed beam, £30, £170 the lot. John, Norfolk. Tel: (01842) 878703.

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WANTED

1155 RX and 1154 TX required, good price paid, any condition, can collect or carriage paid. Peter G8CKM on (01939) 290118, E-mail: peterparker2@lineone.net

Any info, especially circuit for PCR comms receiver, I have no serial no., but I believe it is model 1 covering SML waves to 18MHz, all expenses will be reimbursed. E-mail: crgro@tiscali.com or Tel: (01299) 400472.

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B.B. Feb '05

Practical Wireless BO

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The Amateur Radio Operating Manual costs **£19.95 plus £1.75 P&P UK**, **£2.75 P&P overseas**. To order call **0870 224 7830** or post your order using the order form on **page 73** to: **Book Store, PW Publishing Ltd., Arrowsmith Court, Station Approach, Broadstone, Dorset BH18 8PW**. Remember to include your payment (in Sterling, cash not accepted), name, address and telephone number with your order.

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topical talk

A letter from a reader regarding the flow of information from Ofcom, prompts Rob Mannion G3XFD to alert readers to a consultation process. It's underway now, has exceedingly important implications for Amateur Radio and requires our carefully considered feedback.

The letter from **Jim Strawbridge M3WNZ** (Letters, page 12 this issue) demonstrates that he's overcome the difficulties experienced by myself, and many others, in obtaining information from Ofcom. I'm pleased that the system is working for Jim and I can confirm from my point of view it seems to be working effectively too. I'm now being bombarded with relevant E-mails from Ofcom, although some of the announcements (informative as they are) have only a tenuous connection with radio communications.

Jim's letter prompted me to remind readers of a number of concerns that 'informed sources' within Ofcom have raised regarding the Spectrum Review consultation process which was launched in November 2004, and closes on February 15 2005. The 'informed sources' have made it very clear to me that those Radio Amateurs who have responded with comments to be considered - have misunderstood some of the questions. And, as the Spectrum Review has immensely important implications for Amateurs Radio in the UK, I've been asked to publicise the interpretation problems so that as many of us active in the hobby can provide input to the consultation.

Unworkable Remit

Recently, in my work on behalf of *PW* readers I've made it abundantly clear that I regard Ofcom's remit to be unworkable. Despite that Ofcom, and the staff within this large organisation, are seemingly working very hard indeed to overcome the impossible odds.

Despite my reservations, in their efforts to involve everyone in the consultations, Ofcom are also trying hard to obtain the feedback required from Radio Amateurs. Unfortunately, the *Spectrum Framework Review* document is - on the whole- difficult to understand and digest. Indeed, this is actually one of the concerns raised by the 'informed sources' as they realise the interpretation of the document is causing problems. Unfortunately it seems to have been prepared in a such a way as to confuse the reader. I was confused myself, and it's obvious others are too!

Although the Ofcom sources aren't able to help us answer the document's questions themselves they stress that the wrong answer could send entirely the wrong message. So it's vital that everyone responding to it should do so with extreme care, thinking their answers through before submitting them to Ofcom.

My advice is that readers with access to the internet should go to the **www.ofcom.org.uk/consultations** web site and follow the leads there. A PDF file can be downloaded, and you can then respond following careful consideration. My 'informed sources' stress just how important our reactions and feed back are. We should also be prepared for a further consultation process specifically aimed at Amateur Radio to be launched early in 2005 (I'm writing Topical Talk in mid December 2004).

Finally, for those readers without access to the Internet, the *Spectrum Framework Review* consultation document in paper form is available directly from Ofcom, via the **Ofcom Contact Centre, Riverside House, 2A Southwark Bridge Road, London SE1 9HA. Tel: 0845 456 3000** or **0207-981 3040**. But please remember that the consultation process finishes on **February 15**.

The consultation process specifically aimed at Amateur Radio will soon follow, but I again stress that you should make sure your input on the *Spectrum Framework Review* reaches Ofcom before February 15. This is because the future of our hobby depends very much on the response officialdom receives from us. Finally, with apologies for the unusually draconian comment I must close with the phrase; **You have been warned!**

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