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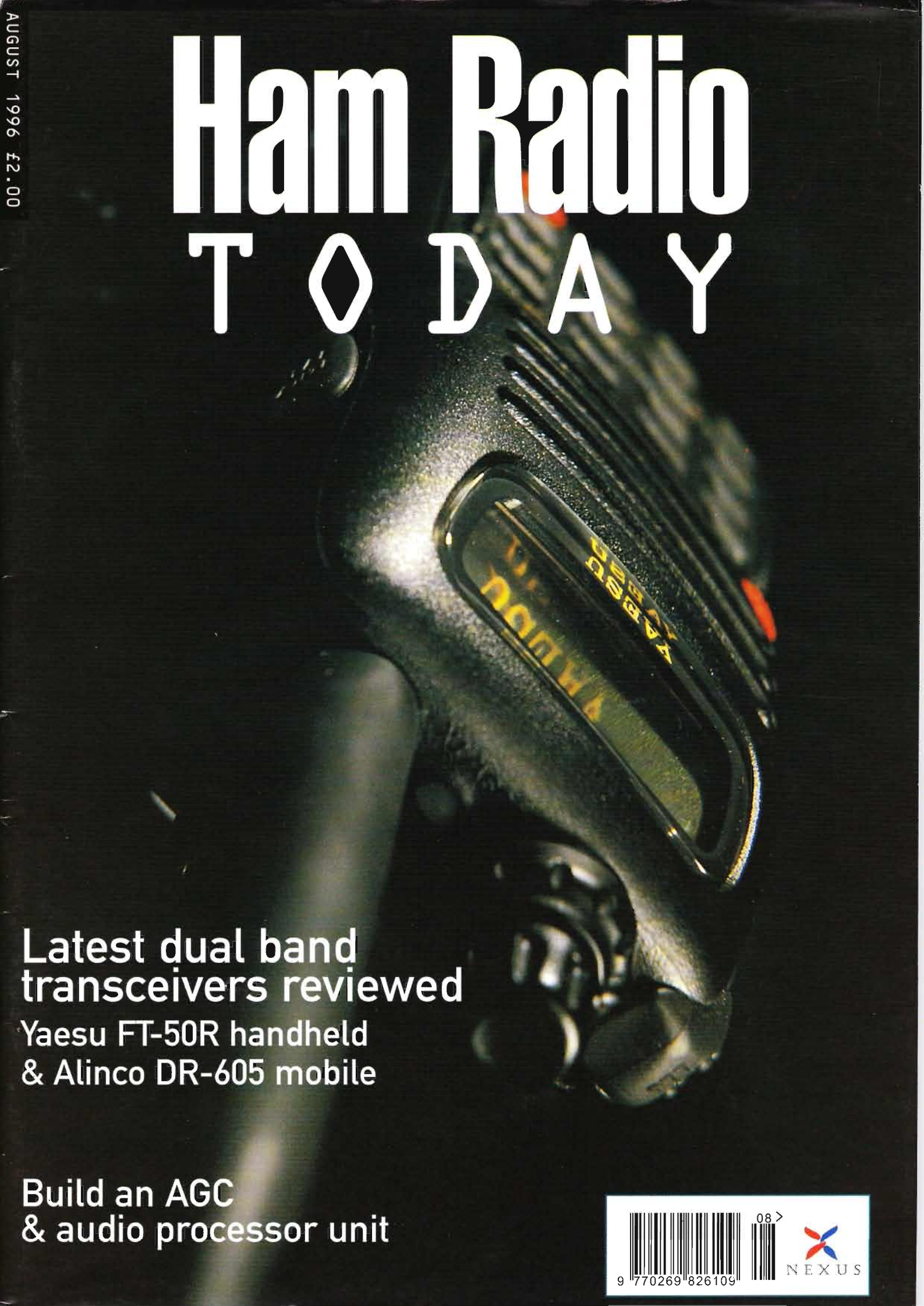

Latest dual band transceivers reviewed

Yaesu FT-50R handheld
& Alinco DR-605 mobile

Build an AGC & audio processor unit

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Alinco DR-605 VHF/UHF mobile reviewed

Realistic PRO-63 handheld receiver reviewed

Yaesu FT-50R dual band portable reviewed

CQ

from G8IYA Editorial

Are you having problems in buying new equipment?

Amateur radio is a 'specialist' interest. As such, much of the equipment we use is naturally also quite specialised. Equipment manufacturers such as Icom, Kenwood, Yaesu and the like have a substantial world market for their offerings, as such they can offset the often very significant design-associated costs across many, many sets sold around the world.

There are, of course, many other companies also manufacturing amateur radio equipment, some to a specialised section of our already specialised market. This includes 'add-on' items, like packet radio TNCs, high-power HF linear amplifiers, accessories such as external DSP filters, and so on. These usually don't sell in as high numbers as the 'core' equipment, i.e. transceivers, as such the manufacturers need to target their market rather more carefully to ensure their 'overhead' costs are met. Some manufacturers operate in quite a small way, possibly employing just one or two staff, maybe even sub-contracting the assembly work to keep overhead costs to the bare minimum.

This is where the thorny subject of EMC regulations rears its head. The regulations have been around for over four years, and most European electronics manufacturers knew about this, and made plans well in time to ensure their products complied to the regulations. It was nothing whatsoever new to them. However, many non-European manufacturers were either totally ignorant of this, or (probably more likely) they turned a 'blind eye' to it, thinking it would never become mandatory. The 'ostrich' syndrome. It did come, of course, and for reasons best known to themselves, it caught these manufacturers unaware, in that their products suddenly could no longer be placed onto the European market.

"No Problem" some of them said, "We sell enough to the other countries, particularly the US and Japan, we won't bother selling to Europe any more". A few others thought "Oh, my gosh" or words to that effect, and took steps to get at least their most profitable, i.e. high-value and/or high-selling products, suitably certified.

Don't believe all the 'horror stories' you hear, of costing the manufacturer £4000 a time for certification. I know it cost less than £50 for one UK distributor to have one of his amateur radio products tested for the required EMC parameters. More complex equipment does of course usually need more tests, but the 'upshot' these 'horror stories' have had is that we suddenly can't buy some equipment that we could have before. How about US or Japanese made HF linear amplifiers? There's a substantial market for these in the US, but a lesser market in the more 'compact' EU countries. How about packet TNCs? How many of these do you see on the dealer's shelves sporting a 'CE' mark? Once their stock of these has been sold, i.e. the stock they had before the 'deadline' of 1st January this year, what's going to happen? Higher prices?

I've already heard a few instances where UK amateurs have been told by their dealer that they can't offer such-and-such any more as it "isn't CE certified", typically when the amateur has the cash in their hand, wanting to buy it!

A twist to the tail

You'll probably have read in Ham Radio Today that the UK Amateur Kit Manufacturer's Association have been successful in achieving recognition that kits don't always require EMC testing and subsequent certification by the person placing it onto the market. This keeps costs down. But there's another twist to this tale. If the kits don't need to meet any standard whatsoever, how do you know how good the gear is? Will it cause TVI because of a high level of transmit harmonics? In kit receivers, how do you know the performance is any good? These are usually marketing-led parameters, but how does the average amateur know that his home-brew linear isn't going to cause EMC problems?

This is where responsible kit manufacturers, possibly coupled with journals such as ours, come in. At Ham Radio Today we already take pride in our technical equipment reviews, with measured performance figures rather than just a list of specifications which the suppliers want us to believe. So why not extend this to kit reviews? We've a winter project lined up, of a high-power 6m linear amplifier. You'll be safely assured that full measurements have been carried out on this, including transmit harmonic levels. Also, although not many readers know it, every receiver and accessory project by Raymond Haigh which we've published in the magazine has been sent to us, as a working unit, for the opportunity of testing in 'real terms' prior to publication. Which is possibly why you see very few 'construction updates' in subsequent issues of Ham Radio Today.

Typesetting and editing errors do sometimes occur of course, no-one's infallible. To take an example, an RX crystal table in a recent ex-PMR conversion was incorrect, even though it had been checked by the Tech Ed, and re-checked by two other amateurs independent of the magazine. But at least we do take steps to keep errors down to a minimum!

More kit reviews

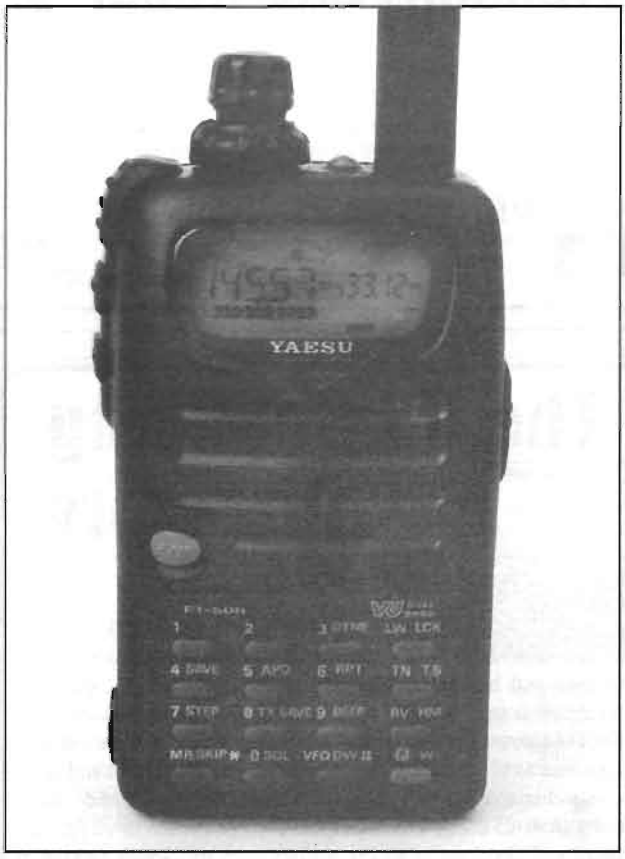
You'll undoubtedly be seeing plenty more projects in future issues, and we've a number of amateur radio kit reviews lined up, for receivers, transceivers, and accessories. Where appropriate, you'll also be seeing measured technical results from these kit reviews!

Maybe it's because of the large number of such products I saw at the recent Yeovil QRP Convention (thanks for the superb reception you gave me there lads!) that's 'spurred me on' to this. But one way or another, it does look like kits are going to be more and more popular in our hobby.

Yaesu FT-50R 2m/70cm Handheld

Chris Lorek G4HCL tests a tough little set

The Yaesu FT-50R



Yaesu call their FT-50R *"One tough little dual bander"*. It is, and their description sums it up very nicely. This 2m/70cm handheld *is* tough, and it *is* little, at 57mm x 99mm x 30mm it's exactly the same size at their FT-10R 2m and 70cm FT-40R single-band handhelds. Take a look at the November 95 issue of Ham Radio Today for a review of the FT-10R.

But the FT-50R covers both 2m *and* 70cm, *either* band at *any* time. It also receives the incredibly wide range of 76-200MHz, 300-500MHz, and 590-1000MHz on FM, AM, and Wide FM. Classic FM on your 70cm handheld? Yes, if you want! If you *really* want to go to town it can even store voice messages for you when you're called with an optional digital voice recording system! What else can Yaesu fit into this little unit? A lot more!

Power

With the supplied 6V 650mAh nicad pack, which clips onto the rear panel of the set, the transmitter gives around 3W out on 2m and 2.5W on 70cm, with no less than three switchable low power levels down to 100mW. Snapping on an optional 9.6V battery, or plugging in an external DC supply, increases the maximum power up to around 4.5W on 2m and 3.5W on 70cm. It has a high 0.5W receive audio output, and 100 memory channels, which you can if you wish assign a four-digit alphanumeric name to rather than the frequency. Two independent VFOs are fitted for tuning around, these can each store any frequency (i.e. both the same band if you wish, or different bands) and each memory channel is fully tuneable, i.e. you can tune away from it to check for activity either side. Five pairs of sub-band limits can be programmed for 'search' type scanning, and the memory channels can of course be scanned for activity, together with various 'dual watch' facilities (scanning two frequencies or channels) for keeping an ear open for activity.

Several different battery savers are fitted to help get that bit more out of your nicad. As well as the manually selectable transmit power levels there's a selectable 'transmit battery saver' which can automatically lower your transmit power on strong receive signals. There's also the usual receive battery saver to cycle the set on/off when monitoring a quiet channel, and an auto-power off facility in case you forget to switch the set off when you're not using it.

Tones

Together with a 1750Hz tone button for European repeater access, there's a CTCSS encoder fitted as standard. For selective calling there's DCS (digital coded squelch, as used in commercial PMR systems) encode and decode fitted. This can also be used with an 'auto-range transpond system' to let you know that you're within range of a similarly equipped station.

Versions

Two versions of the FT-50R are available, both look virtually identical apart from two small additional logos on the keypad. The 'standard' set comes with the FTT-11 keypad version, the optional FTT-12 keypad (which you can also fit later if you wish) adds CTCSS decode plus selective calling (e.g. CTCSS 'bell' paging and DTMF code squelch), as well as the Digital Voice Recording system.

Each set comes with a 6V

nicad, a plug-in 14 hour nicad charger, belt clip, a 56 page user instruction book, full circuit diagram, and a foldout A5 sized 'quick code sheet' giving a quick reference to the set's operation. A variety of optional extras, like different battery packs, rapid charger, speaker/mics etc. are available.

Performance

To keep the number of top-panel controls down in size, Yaesu use a dual-concentric knob arrangement with a 'menu' system. The outer knob is quite simply the volume control, very easy. The inner knob is a rotary click-step type combined with a momentary push-in action, which accesses a 'menu' system using the set's alphanumeric LCD. A combination of pushes and twists of this knob access all manner of different settings, like squelch level, repeater shift, reception mode, channel names and so on. Combined with the keypad buttons, this makes the FT-50R one powerful set to control!

I found the transceiver fitted in my hand nicely, the smooth rounded corners being quite different from many other handhelds I'd used. Just below the PTT bar was the 1750Hz tone button, below this the LCD backlight button, all sensibly arranged so I could easily use the set single-handed. Defeating the squelch (or just changing the level) needed a number of button-pushes unfortunately - I'd have preferred a one-push 'monitor' button as well (although this is fitted instead of the 1750Hz tone facility in non-European versions).

Out in all weathers

The FT-50R uses waterproof inner gaskets together with a rugged outer case. Yaesu claim it even achieves a MIL-STD 810 rating so you really can 'throw it in with your gear'. That's what I did, and it joined me in all weathers at events such as the Drayton Manor rally (hot and sunny but with plenty of water on the log flume!) and the Yeovil Club QRP Convention, RSGB open day, and of course around my home both inside and out.

I also found there was a surprisingly high level of undistorted audio from the set's small internal speaker - most handhelds just go into awful distortion at high volume levels.

I usually used the set in memory scan mode when out and about. Here, I found another handy facility of the set for use at night was that, when halting on a channel on finding a signal, the LCD backlight could be set to automatically light for a few seconds so I could see what channel the set had halted on. Yaesu have certainly come a long way in user-friendliness from their FT-23 handheld which didn't even have *any* LCD backlight!

No cross-band duplex

So how about limitations? Well, the set could only operate on *one* band at any instant of time. It can't simultaneously receive on, say, 2m *and* 70cm, nor receive on a different band whilst transmitting to give cross-band full-duplex operation, although it could give cross-band simplex operation, i.e. transmit on

The transceiver fitted in my hand nicely, the smooth rounded corners being quite different from many other handhelds

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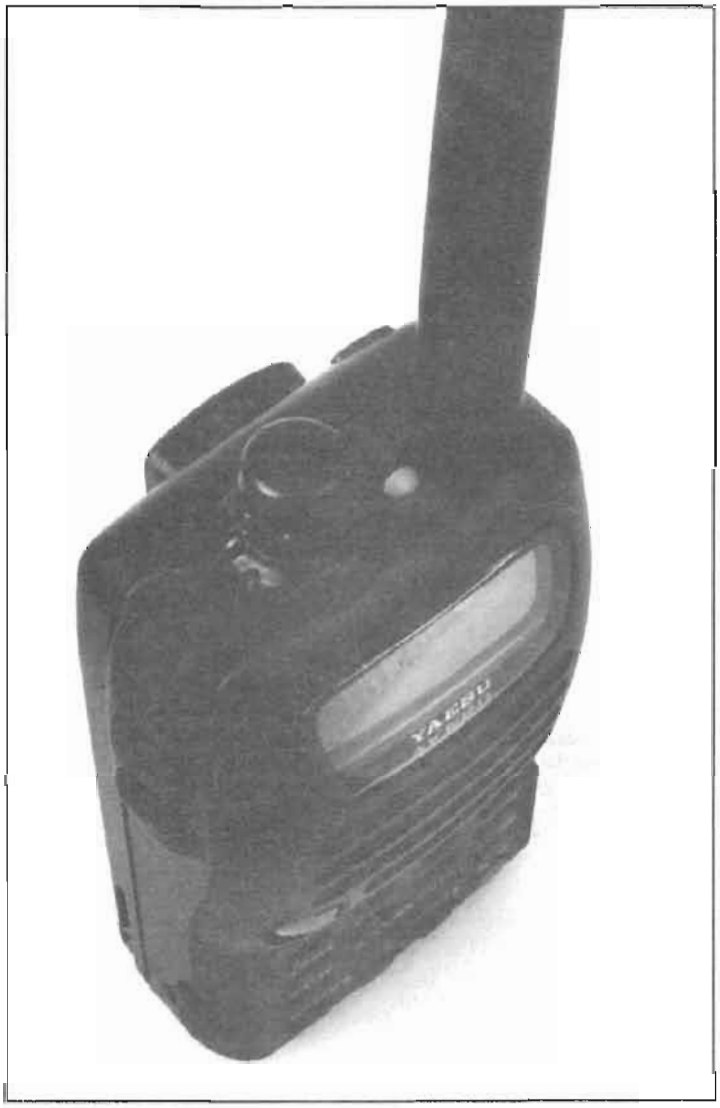


The supplied 6V 650mAh nicad pack, clips onto the rear panel of the set

70cm and then switch back to 2m for receive. Yaesu do state it will operate in (quote) "duplex mode" but this refers to split VFO operation for in-band and cross-band receive/transmit. What else? Very little in fact! The set-top aerial connector uses an SMA coax socket rather than a BNC type, so you'll need to use an adaptor, as I did, if you want to connect an external aerial.

Signals

I found the set performed well using its small set-top aerial, although I had to be careful with it clipped onto my belt as the lower, thicker section of the aerial was rigid, thus putting some strain on the small connector. I didn't manage to break it though! Both at home and operating mobile, the receiver I found was very sensitive, although sometimes a little prone to overload from strong mixing signals when used with my outdoor 2m/70cm colinear. I also found on 70cm that the set's squelch tended to raise on two adjacent repeater channels from a semi-local 12.5kHz spaced signal in the middle of these (from the 70cm band's primary user in the UK). However I just locked these out of scan mode, frequency planning by that user usually means there isn't an adjacently spaced local repeater to worry them!

The set is also capable of being used for 1200 baud packet radio, although the speaker/mic connector uses a single 4-contact 3.5mm jack socket for this. I found I couldn't plug a normal mono or stereo 3.5mm plug in for an external speaker as the set just went into permanent transmit with this. A CT-30 mic adapter is however available from Yaesu to allow you to use different connections.

Lab tests

The measured results show a reasonable technical performance level for a set of this size. It isn't up to the performance of, say, a mobile rig or possibly much larger portable sets (all with more room for filters etc.) so in this case at least you'll need to offset portability and operational flexibility with performance. The strong-signal handling in terms of 25kHz adjacent channel, and blocking performance (i.e. from adjacent bands) coupled with a very sensitive 2m receiver was however quite impressive.

On transmit, the power output was just under 3W on 2m and just over 2W on 70cm using a fully charged nicad, very good for a 6V supply!

Conclusions

At the risk of echoing myself, the description of "One tough little dual bander" really does sum up the set very well. It gives quite reasonable performance for its size with no major shortcomings, it gives you plenty of operating modes as well as a very wide receive range, about the only thing it doesn't give you is simultaneous two-band operation - you'll need a slightly larger set, like Yaesu's FT-51R, for that!

My thanks go to Yaesu UK for the loan of the review set.

Side view of the set

LABORATORY RESULTS:

All measurements taken on 145.0/435.0MHz, using fully-charged 6.0V nicad as supplied, high power TX, otherwise stated.

RECEIVER

Sensitivity;

Input level required to give 12dB SINAD;

144MHz;	0.11µV pd
145MHz;	0.11µV pd
146MHz;	0.12µV pd
430MHz;	0.17µV pd
435MHz;	0.16µV pd
440MHz;	0.16µV pd

Image Rejection;

Increase in level of signal at 1st and 2nd IF image frequencies, and half 1st IF, over level of on-channel signal, to give identical 12dB SINAD signal;

	145MHz	*435MHz*
Half 1st IF	85.9dB	62.6dB
1st Image	76.0dB	51.0dB
2nd Image	59.8dB	59.3dB

Blocking;

Increase over 12dB SINAD level of interfering signal modulated with 400Hz at 1.5kHz deviation to cause 6dB degradation in 12dB SINAD on-channel signal;

	145MHz	*435MHz*
+100kHz;	81.9dB	84.1dB
+1MHz;	94.1dB	92.4dB
+10MHz;	96.7dB	98.6dB

S meter Linearity;

	145MHz		*435MHz*	
	Sig Level	Rel. Level	Sig. Level	Rel. level
1	0.20µV pd	0dB ref	0.34µV pd	0dB ref
2	0.28µV pd	+3.2dB	0.51µV pd	+3.6dB
3	0.48µV pd	+7.7dB	0.68µV pd	+6.2dB
4	0.76µV pd	+11.7dB	1.03µV pd	+9.8dB
5	1.13µV pd	+15.2dB	1.47µV pd	+12.9dB
6	1.66µV pd	+18.6dB	2.27µV pd	+16.6dB
8	2.49µV pd	+22.0dB	3.45µV pd	+20.3dB
10	3.69µV pd	+25.5dB	5.03µV pd	+23.6dB

Squelch Sensitivity;

	145MHz	*435MHz*
Threshold;	0.09µV pd (7dB SINAD)	0.14µV pd (9dB SINAD)
Maximum;	0.19µV pd (20dB SINAD)	0.29µV pd (21dB SINAD)

Current Consumption

Squelch closed, saver off;	49mA
Receive, mid volume;	91mA
Receive, max volume;	145mA

Adjacent Channel Selectivity;

Measured as increase in level of interfering signal, modulated with 400Hz at 1.5kHz deviation, above 12dB SINAD ref. level to cause 6dB degradation in 12dB on-channel signal;

	145MHz	*435MHz*
+12.5kHz;	29.7dB	20.9dB
-12.5kHz;	25.9dB	37.2dB
+25kHz;	71.1dB	60.9dB
-25kHz;	71.5dB	61.1dB

Intermodulation Rejection;

Increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product;

	145MHz	*435MHz*
25/50kHz spacing;	64.0dB	60.9dB
50/100kHz spacing;	66.7dB	60.7dB

TRANSMITTER

TX Power and Current Consumption;

Freq.	*Power*	*6V nicad*	*9.6V supply*
144MHz	High	2.88W/945mA	4.67W/1.05A
	Low 1	2.52W/790mA	2.59W/805mA
	Low 2	850mW/635mA	865mW/665mA
	Low 3	70mW/290mA	75mW/310mA
145MHz	High	2.95W/950mA	4.69W/1.10A
	Low 1	2.55W/800mA	2.64W/815mA
	Low 2	850mW/635mA	870mW/670mA
	Low 3	70mW/295mA	80mW/325mA
146MHz	High	2.98W/965mA	4.71W/1.15A
	Low 1	2.57W/815mA	2.70W/820mA
	Low 2	850mW640mA	870mW/675A
	Low 3	70mW/295mA	80mW/330mA
430MHz	High	1.94W/1.06A	3.39W/1.07A
	Low 1	1.62W/985mA	1.67W/990mA
	Low 2	560mW/550mA	570mW/550mA
	Low 3	30mW/220mA	35mW/210mA
435MHz	High	2.11W/1.12A	3.24W/1.05A
	Low 1	1.71W/995mA	1.84W/970mA
	Low 2	580mW/555mA	600mW/540mA
	Low 3	40mW/225mA	50mW/215mA
440MHz	High	2.23W/1.15A	3.14W/1.03A
	Low 1	1.78W/1.06A	1.79W/960mA
	Low 2	610mW/565mA	620mW/555mA
	Low 3	40mW/225mA	40mW/220mA

Harmonics;

	145MHz	*435MHz*
2nd Harmonic;	-78dBc	-75dBc
3rd Harmonic;	-83dBc	-78dBc
4th Harmonic;	-85dBc	-86dBc
5th Harmonic;	<-90dBc	-
6th Harmonic;	<-90dBc	-
7th Harmonic;	<-90dB	-

Peak Deviation;

145MHz	*435MHz*
5.18kHz	5.12kHz

Toneburst Deviation;

145MHz	*435MHz*
4.03kHz	4.23kHz

Frequency Accuracy;

145MHz	*435MHz*
-85Hz	+133Hz

Alinco DR-605 Dual Band Mobile

HRT's Consultant Tech Ed tests the latest high power 2m/70cm mobile rig

The Alinco DR-605 dual band mobile transceiver

The most popular purchase nowadays by amateurs looking for a mobile rig is a dual-band FM transceiver covering 2m and 70cm. It's little surprise because the UK, and indeed the rest of Europe, is usually well-served with 2m and 70cm repeaters offering easy mobile QSOs. A high power mobile also gives you the opportunity for plenty of simplex contacts, either with fixed stations or mobile-to-mobile, to get away from the sometimes congested repeaters, particularly during 'rush-hour' times.

The latest offering from Alinco is their compact DR-605, this giving you a 50W maximum output on 2m, 35W on 70cm, with a switchable low power of around 5W on each band. For Europe-wide travellers, including the 'Eastern bloc', as well as a 1750Hz toneburst for repeater access the set can also provide a 2100Hz and 1450Hz toneburst if needed. A CTCSS encoder is fitted, and an optional plug-in board adds CTCSS decoding and sub-tone scanning facilities. A switchable time-out timer prevents you accidentally 'timing out' or indeed driving around unaware that your mic PTT is constantly enabled.

Flexibility

The set has 100 memory channels available, 50 on each band plus a 'call' channel, each of which store frequency (including cross-band frequencies if required), any repeater offset, tone encoder, and scan-skip status. If you prefer channel numbers rather than a frequency readout in memory mode, you can have that as well. The set can also function as a crossband repeater, i.e. re-transmitting received signals on one band to the other, by removing an internal resistor.

The set covers the standard 144-146MHz and 430-440MHz ranges on transceive. With a sequence of front-panel button-pushing operations, the receive coverage can be extended to 136-174MHz and 400-480MHz plus 800-1000MHz, although I'm told by the manufacturers this voids any warranty, so beware!

Controls

Two rotary volume controls are fitted, the left one controlling VHF and the right one controlling UHF. If you're wondering about the squelch level adjustment, so was I until I read the manual. To adjust this, the two volume knobs are used again, but this time as push-button up/down controls. After selecting the 'controlled' band, by pushing either of these knobs, a press of the small 'Func' button then transforms the two knobs into an up/down squelch level adjustment on that band. This has nine incremental levels plus an 'off' level of zero, the level being indicated by a small digit on the front panel LCD. Well, it's different!

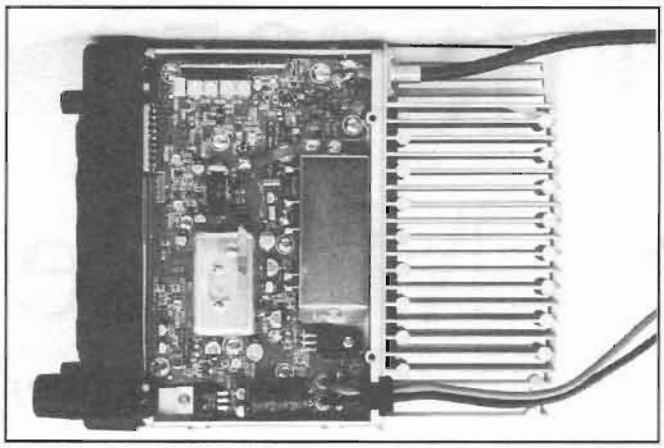
The remainder of the set's functions are also controlled by a combination of knob and button pushes. The LCD is backlit with a warm orange glow, although none of the controls are illuminated.

Round the back

The set uses a substantial heatsink to keep the transmitter power amplifier cool. Some transceivers use a smaller heatsink coupled with a fan, which allows a more compact mobile installation but with the possible annoyance of constant fan noise - especially when operating at home - no problems here with this rig.

As well as an external speaker connector, a separate jack is fitted for 9600 baud packet use. When set for this mode (from the front panel) the microphone audio and PTT controls are disabled. A flying

The set uses a substantial heatsink to keep the transmitter power amplifier cool.



coax lead terminated in an SO-239 socket is used for connection of an external dual-band aerial.

The set measures 140mm (W) x 40mm (H) x 176mm (D) and weighs 1.1kg. It comes with a 50 page user manual, a full circuit digram, mobile mounting bracket and mobile fist mic with up/down buttons, plus a fused DC power lead.

On the road

My first use of the set, after familiarising myself with its operation and having programmed up the memory channels, was on a long motorway journey. I'm pleased to say that my first impressions of the set were quite agreeable. Good, clear receive and enough of it even with just the small set-top speaker. The microphone-mounted up/down controls were easy to use, and I often just left the set in 'memory scan' mode, using the mic-mounted buttons together with the two volume/band change button on the front panel, for control.

I did wish the squelch was easier to adjust though. In 'memory scan' mode, distant repeaters kept 'chattering' the squelch which annoyed me somewhat - and it was a pain to constantly adjust. After around an hour on the road I found a problem - I couldn't shift off 70cm. Eventually when I stopped, I found this was due to a faulty 'UHF' push-button action, which in some knob positions 'locked' the push-button in the 'down' position, thus holding it on that band. I eventually learned how to overcome this fault, although I'm sure it must have been a 'one-off'.

I made plenty more journeys with the set, both over several hundreds of miles and just around town. All in all, the set performed well (apart from the sticking button!), with a sensitive receiver and good reports on my transmitted audio. Even an amateur who I'd met several times in the past and who I heard operating mobile on the air for the first time (he didn't know my callsign, I didn't know his until I heard him), instantly recognised my voice when I called him with just my callsign and a brief "I know you, do you know who I am?".

On driving past my local fire-brigade transmitter site, with its constant-carrier 146MHz transmissions, the set didn't even 'blink' when tuned to my semi-local 2m repeater. Many other sets I've tested here just 'curl up' through overload until I travel away from the transmitter site.

At home

As I found when mobile, the set continued to perform quite well, although I did find some weak breakthrough on receive on the 70cm repeater section from my local packet DX Cluster link operating on 432.675MHz. I found here that I couldn't seem to 'squelch out' weak signals such as this if I wanted, maybe the digitally controlled squelch system didn't go 'high enough'? I also found the S-meter, although displaying 12 apparent 'segments' in total, was actually a four segment indication, each displaying 3 bars.

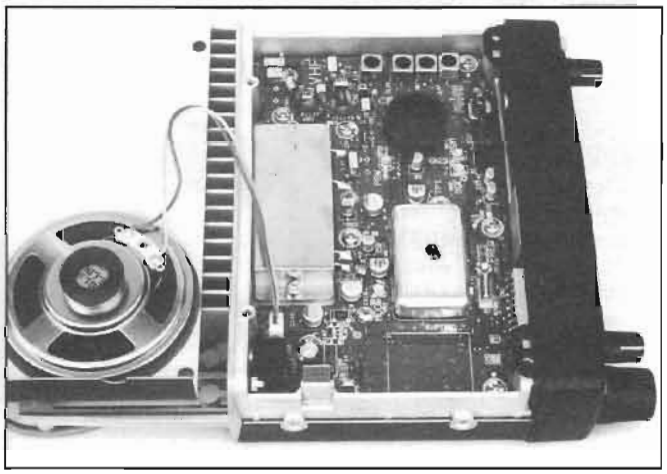
Even during long 'waffle' type contacts, I found the set kept reasonably cool providing the rear heatsink was kept unobstructed, showing the large heatsink to be performing its function well. The LCD backlight dimmed a little when I went onto transmit, I suspected this to be due to the DC lead which, in my opinion at least, was a little thin for the intended 50W power output of the set.

The set had several 'second functions', such as bleep on/off and toneburst frequency setting, I usually needed to refer to the manual to use these. But the set also had the occaisional oddity. For example I couldn't program a memory channel on one band whilst the set was scanning on the other band - the manual didn't mention this and it was some time before I discovered this!

Overall, the set worked well on air, but I must confess that my 'inner conscience' told me it had been designed with an element of economy in mind. This was from the general 'feel' of using the set, compared to the many other Alinco sets, and those from other manufacturers, which I'd reviewed in the past. I couldn't moan about the good RF performance though!

Lab tests

My measured results did indeed show the strong-signal handling, particularly on 2m, to be very good, echoing the results I found on air. The 2m intermodulation rejection was particularly impressive, it looks like Alinco aren't cutting many corners on the 'inside's' here! The receive sensitivity was quite reasonable, and on transmit there was plenty of output power available, with adequately suppressed harmonics. A quick test following my observation of the power lead showed that, on high power transmit, this dropped 1.02V on 2m (i.e. 11W power). The four-level S meter had a limited dynamic range, i.e. little difference between no indication and all segments displayed.



Inside the set, top view

Conclusions

The DR-605 worked quite well on-air RF-wise, it performed nicely both on the move and at home in terms of transmit and receive performance. Throughout the review however, I often had the impression that the overall 'feel' was a little 'plasticky', i.e. built with economy in mind. But then, I'm told it should only cost around £495, which compares favourably with other more expensive sets.

My thanks go to Waters and Stanton Electronics for

LABORATORY RESULTS:

All measurements taken on 145.0/435.0MHz, using 13.8V DC to supplied DC cable length, high power TX, otherwise stated.

RECEIVER

Squelch Sensitivity;

	145MHz	435MHz
Threshold;	0.07µV pd (3dB SINAD)	0.06µV pd (2dB SINAD)
Maximum;	0.16µV pd (16dB SINAD)	0.18µV pd (21dB SINAD)

Sensitivity;

Input level required to give 12dB SINAD;

144MHz;	0.13µV pd
145MHz;	0.14µV pd
146MHz;	0.14µV pd
430MHz;	0.16µV pd
435MHz;	0.16µV pd
440MHz;	0.17µV pd

Blocking;

Increase over 12dB SINAD level of interfering signal modulated with 400Hz at 1.5kHz deviation to cause 6dB degradation in 12dB SINAD on-channel signal;

	145MHz	435MHz
+100kHz;	81.3dB	79.2dB
+1MHz;	94.7dB	94.5dB
+10MHz;	95.8dB	96.6dB

Adjacent Channel Selectivity;

Measured as increase in level of interfering signal, modulated with 400Hz at 1.5kHz deviation, above 12dB SINAD ref. level to cause 6dB degradation in 12dB on-channel signal;

	145MHz	435MHz
+12.5kHz;	46.4dB	34.1dB
-12.5kHz;	34.9dB	33.2dB
+25kHz;	68.4dB	66.1dB
-25kHz;	69.0dB	66.0dB

Intermodulation Rejection;

Increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product;

	145MHz	435MHz
25/50kHz spacing;	78.4dB	70.3dB
50/100kHz spacing;	78.2dB	68.6dB

Image Rejection;

Increase in level of signal at 1st and 2nd IF image frequencies, and half 1st IF, over level of on-channel signal, to give identical 12dB SINAD signal;

	145MHz	435MHz
Half 1st IF	97.8dB	79.9dB
1st Image	80.3dB	80.6dB
2nd Image	90.0dB	86.1dB

Maximum Audio Output;

Measured at 1kHz on the onset of clipping, 8 ohm load;

145MHz	*435MHz*
2.15W RMS	2.14W RMS

S-Meter Linearity

	145MHz		435MHz	
	Sig Level	Rel. Level	Sig. Level	Rel. level
3	0.57µV pd	0dB ref	0.26µV pd	0dB ref
6	0.91µV pd	+4.1dB	0.47µV pd	+5.1dB
9	1.58µV pd	+8.9dB	0.80µV pd	+9.6dB
12	3.31µV pd	+15.3dB	1.99µV pd	+17.6dB

TRANSMITTER

Frequency Accuracy;

145MHz	*435MHz*
-293Hz	-1.073kHz

Toneburst Deviation;

145MHz	*435MHz*
3.00kHz	3.03kHz

Harmonics;

	145MHz	435MHz
2nd Harmonic;	-75dBc	-74dBc
3rd Harmonic;	-81dBc	-77dBc
4th Harmonic;	-87dBc	-84dBc
5th Harmonic;	-89dBc	-
6th Harmonic;	<-90dBc	-
7th Harmonic;	<-90dBc	-

TX Power and Current Consumption;

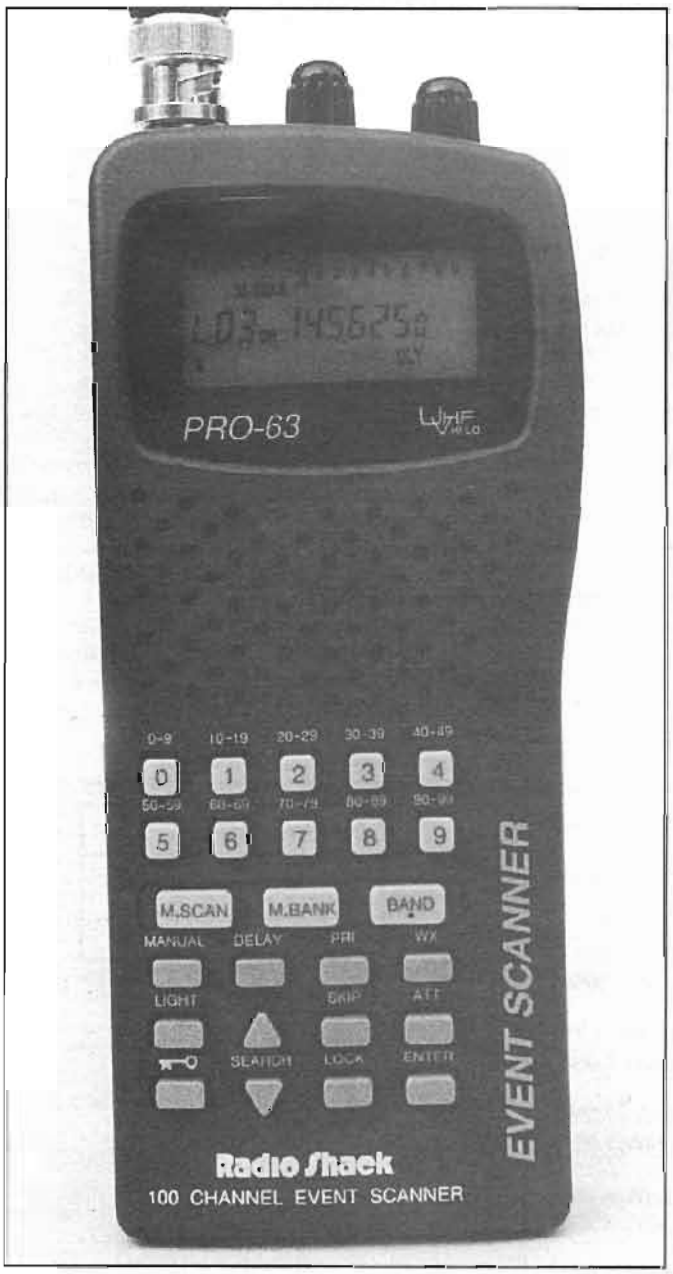
Freq.	*Power*	*10.8V supply*	*13.8V supply*	*15.6V supply*
144MHz	High	43.9W/9.80A	50.5W/10.6A	50.5W/10.6A
	Low	5.30W/3.75A	5.40W/3.90A	5.40W/3.90A
145MHz	High	43.1W/10.1A	50.3W/10.8A	50.4W/10.8A
	Low	5.30W/3.65A	5.40W/4.00A	5.40W/3.95A
146MHz	High	41.3W/10.2A	50.0W/10.8A	50.3W/11.1A
	Low	5.25W/3.80A	5.35W/3.90A	5.35W/4.00A
430MHz	High	21.7W/6.15A	33.1W/7.10A	33.4W/7.05A
	Low	3.65W/2.90A	3.68W/2.95A	3.72W/3.05A
435MHz	High	21.4W/6.00A	33.1W/7.10A	33.4W/6.90A
	Low	3.59W/2.85A	3.62W/2.95A	3.62W/2.95A
440MHz	High	20.9W/5.90A	33.9W/7.10A	34.2W/6.90A
	Low	3.54W/2.85A	3.59W/3.00A	3.57W/2.95A

Peak Deviation;

145MHz	*435MHz*
4.93kHz	5.30kHz

Realistic Pro-63 Handheld Scanner

Chris Lorek goes portable with an "event scanner" and gets in on the action!



The Realistic PRO-63

The PRO-63 is described by Realistic as a "Portable Event Scanner". This could be quite true because it's light, certainly portable, and it covers plenty of the 'action bands' used by many outdoor event organisers. The frequency coverage is 68-88MHz (VHF low band), 108-137MHz (VHF Airband), 137-174MHz (VHF high band) and 380-512MHz (UHF), all being FM only on receive apart from the airband range where AM is automatically switched in.

So, you can be at the air show, or other event, and be listening (where allowed, depending on your country's regulations) to activity both on the ground, and in the air, as well as on the way there and back!

Portability

The set measures 149mm (H) x 64mm (W) x 45mm (D) which although a little 'chunky' should fit most pockets, and weighs a light 250g plus the weight of the batteries. A belt clip is provided as a carrying aid, and a top-panel 3.5mm earphone socket lets you keep in touch with activity without disturbing (or attracting unwanted attention of) others around you.

As well as 100 memory channels, arranged into ten banks of ten channels each, the set also has ten pre-programmed 'search ranges' which you can scan across to find new signals, either at home or when out and about

A rubberised keypad controls most of the set's functions, and an LCD, which can be backlighted at the touch of a keypad button, lets you see what the scanner's doing at night. A handy 'key lock' button, when pressed for three seconds, locks all the keypad buttons except the backlight button, to save any problems when carrying the set in your pocket.

Scanning

The set scans at a maximum of 25 channels per second, and searches across a given frequency range at a maximum of 50 steps per second, these steps being 5kHz on VHF (25kHz on airband), and 12.5kHz on UHF.

You can scan across either all of the memory channels, missing those you've set to 'skip', or when in scan mode select any number of the ten channel banks in or out of the scan mode, to suit your listening interests at any given time or location. A switchable RF attenuator is also fitted, to either help prevent overload or for when you just want to receive local signals.

Easily portable

Power

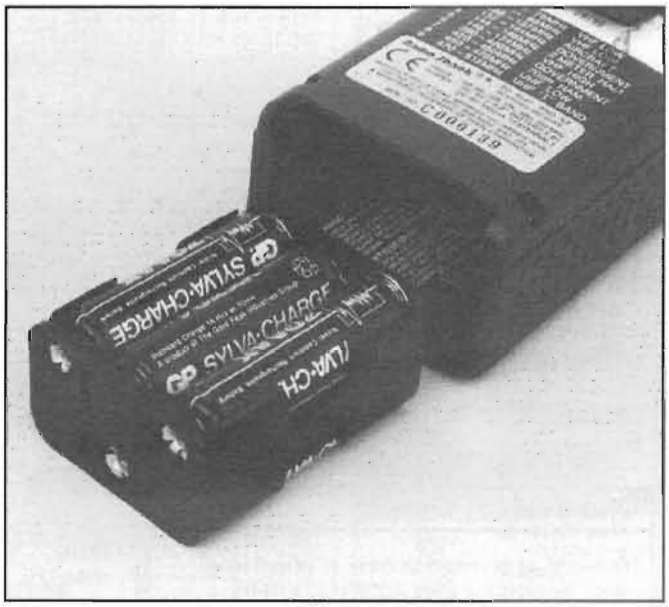
You'll need six AA sized cells, either dry cells or nicad, to power the set, these should give you several hour's worth of listening before a replacement/recharge is needed. Side-mounted sockets are fitted for an external DC power supply, and nicad charger. These need 9V regulated at 300mA, the outer sleeve of the connector being positive so be careful you don't short it out when using it in the car.

In use

I often find Realistic scanners intuitively easy to use, the PRO-63 was no exception. But I also found it had one or two little 'extras' to make it even better for use in its intended use - i.e. at events. First off, unless you know all the frequencies used at any given event, you'll need to search around, then start to program the frequencies you find (or at least, the ones of interest!) into vacant memory channels. Here's where the PRO-63 makes life easy for you.

Let's say you're at a RAYNET event, maybe a walking or bicycle marathon involving various emergency services such as the police and St. John Ambulance, and you want to see which 2m channels are being used. You simply press 'band' followed by the '3' button (for 144-148MHz, which includes the 2m band) and the set starts searching away. (Note that these search bands are fixed, and can't be changed by the user). If you don't know which band to choose, just keep pressing the 'band' button, each press selects a different band which is then shown on the set's LCD. The set then automatically starts searching, and once it finds a signal, as well as letting you listen to it, the set displays the next available memory channel number. If you want to store it, just press the 'enter' button. If you've already got that frequency stored in another channel, "dupl" (duplicate) flashes on the LCD for three seconds together with the original channel number, to let you know in case you didn't want to store it again in a different channel.

You can, of course, also manually enter frequencies into any channel numbers, just by using the up/down keys to select a memory channel and then keying in the frequency. To save you accidentally over-writing a stored frequency, the scanner automatically 'locks' all memory channels containing entered frequencies. To overwrite a memory, you need to press the 'lock' button which toggles the lock on and off on the selected memory channel.



The set uses six internally fitted AA cells

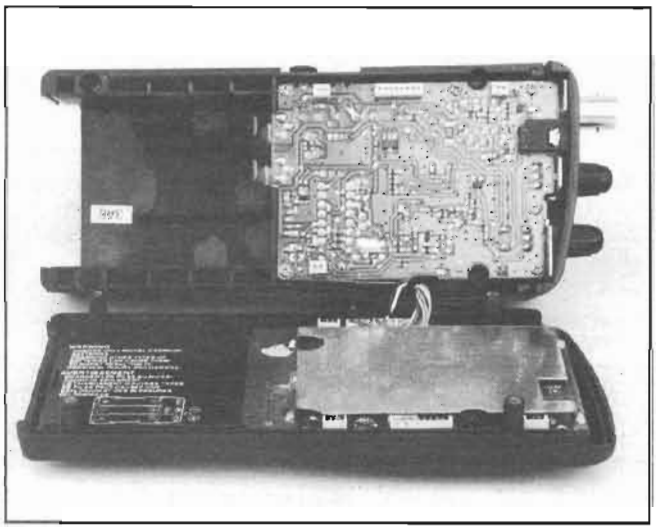
Reception

I used the set over several weeks, portable in a variety of locations with it's set-top whip, mobile with my glass-mounted scanner aerial, and at home with both a Garex 'Nomad' window-mounted aerial and my rooftop VHF/UHF aerial.

In all, the set was reasonably sensitive, just a little short of a dedicated 2m or 70cm amateur handheld. I found rejection of unwanted strong signals to be quite reasonable, living as I do in a 'congested' RF area. I found the fixed 5kHz steps on VHF to be a little annoying, and together with the rather limited 'close-in' channel selectivity I found I couldn't really use it too well on 12.5kHz spaced signals. Although Tandy correctly state 50 steps per second, these are 5kHz steps on VHF, i.e. the result is ten 25kHz channels per second - so 'memory channel scan' was rather faster! An exception here of course is airband, which goes in 25kHz steps, and the 'band search', coupled with the quick channel store, was extremely useful here. Likewise on UHF, although I did find I often received multiple signals here, of roughly equal strength but separated by 21.4MHz - undoubtedly image reception!

The RF attenuator I found quite useful. Besides helping against the occasional 'blocking' problem when using an outdoor aerial from home, I also found it handy to switch in when portable at a given location, so that the scanner would just listen to the local action and not halt on distant signals in 'search mode'.

I found the audio output usually quite sufficient for outdoor use, although I did need to plug in a mono earphone in noisy locations



Inside the set showing main PCB

(an air show isn't the quietest of places!). With a fully-charged set of 700mAh nicads fitted, I found the set gave me at least six hours worth of scanning-based operation and listening, often over 8 hours during 'quiet' times, showing the circuity isn't 'current hungry' at all.

Lab tests

These showed the set to be reasonably sensitive, with quite adequate adjacent channel rejection of 25kHz spaced signals, and good blocking and intermodulation rejection for such a scanner. The only problems I found were rather poor 12.5kHz adjacent channel rejection (as used for most commercial services in the UK and much of Europe) although for VHF airband you occasionally do need a wider bandwidth for offset channel reception. The UHF image rejection, of only a couple of dB however, was pathetic, the VHF image rejection was a little better but still quite poor. But then, you get what you pay for in such a portable 'do-everything' scanner which must of course often be a compromise in a number of aspects.

Conclusions

The PRO-63 could be a good economic choice for a scanner to take out and about with you. It offers easy operation to keep you in touch with the action, and is rugged enough to take the odd 'knock' without shattering into thousands of pieces. Note that it doesn't cover the UHF airband (e.g. for military airshows), and it doesn't offer the ultimate in performance in some respects, although dedicated scanner enthusiasts would likely have to pay a lot more than the price of the PRO-63 for this.

My thanks go to Link Electronics in Peterborough for the loan of the review set.

LABORATORY RESULTS:

All measurements taken at 145MHz, NFM, unless stated.

Sensitivity;

Input signal level in µV pd required to give 12dB SINAD;

Freq.	Level
68MHz	0.15
78MHz	0.14
88MHz	0.15
108MHz	0.17 (AM)
120MHz	0.17 (AM)
136MHz	0.17 (AM)
137MHz	0.20
145MHz	0.22
165MHz	0.26
174MHz	0.27
380MHz	0.26
400MHz	0.25
435MHz	0.27
450MHz	0.23
500MHz	0.28
512MHz	0.24

Squelch Sensitivity;

Level of signal required to raise receiver squelch

Threshold;	0.21µV pd (11dB SINAD)
Maximum;	0.80µV pd (26dB SINAD)

Adjacent Channel Selectivity;

Measured as increase in level of interfering signal, modulated with 400Hz at 1.5kHz deviation, above 12dB SINAD ref. level to cause 6dB degradation in 12dB on-channel signal;

+12.5kHz;	10.3dB
-12.5kHz;	8.4dB
+25kHz:	65.0dB
-25kHz;	64.7dB

Blocking;

Measured as increase over 12dB SINAD level of interfering signal modulated with 400Hz at 1.5kHz deviation to cause 6dB degradation in 12dB SINAD on-channel signal;

+100kHz;	74.9dB
+1MHz;	85.1dB
+10MHz;	87.6dB

Intermodulation Rejection;

Measured as increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product;

25/50kHz spacing;	58.2dB
50/100kHz spacing;	57.8dB
100/200kHz spacing;	59.5dB

Maximum Audio Output;

Measured at speaker/earphone socket, 1kHz audio at the onset of clipping (10% distortion), 8 ohm resistive load;

189mW RMS

Image Rejection;

Difference in level between unwanted and wanted signal levels (1st IF 10.7MHz, 2nd IF 455kHz), each giving 12dB SINAD on-channel 145MHz FM signals;

1st Image;	145MHz; 27.2dB	435MHz; 2.3dB
2nd Image;	145MHz; 68.2dB	435MHz; 60.6dB

Search ranges;

Band	*Range (MHz)*
0	68-78
1	78-88
2	108-137
3	137-144
4	144-148
5	148-174
6	380-420
7	420-450
8	450-470
9	470-512

Attenuator Level;

145MHz;	20.1dB
435MHz;	20.5dB

Current Consumption;

Scanning, no signal;	68mA
Receive, mid vol;	89mA
Receive. max vol;	121mA

SCANNERS

Bill Robertson shows how image limitations can cause 'double reception'

David McCulloch from Newcastle Upon Tyne wrote to me to say that, whilst scanning around the air band using his Realistic PRO-62, his scanner stopped on 133.500MHz. David was unable to find any apparent interference, so he switched to FM. He was amazed to find FM broadcast music, saying it sounded operatic or classical, thinking it could be a 'mirror' frequency to something like Classic FM. He was unable to understand the dialogue broadcast after the music had finished, but asks if any other Ham Radio Today readers have heard the same signal.

The most likely explanation here is that of 'image' reception. All scanners use what's called the superheterodyne principle, where a local oscillator generates an internal signal, which is fed to a mixer in the scanner receiver. This 'mixer' combines the signal with that from the aerial via the 'front end', to produce an IF - Intermediate Frequency - which is subsequently demodulated to audio. The 'front end' is usually electronically tuned using varicap diodes, to 'track' the tuned frequency range (and usually more than one IF is used). But there are technical limits to the performance of the front end, and receivers can receive an unwanted 'image' frequency, for example the sum of a negative rather than positive frequency mix.

In David's case, his receiver was tuned to 133.500MHz, and his scanner's first IF is probably 21.6MHz, with negative side injection used for the local oscillator. Thus, the local oscillator would be operating at 133.500MHz minus 21.6MHz, which is 111.900MHz. The 'image' frequency would then be 111.900MHz minus 21.6MHz, which is 90.300MHz. Just around the frequency range BBC Radio 4 uses!

POCSAG for the Atari

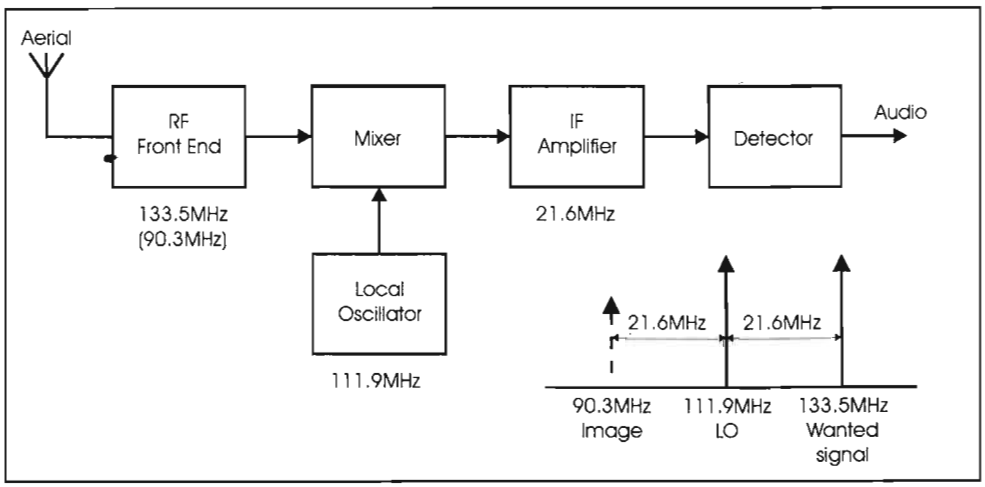
Following my mention of this in an earlier column, Jason Petty writes in to say that he's now managed to write a 1200/512 baud POCSAG paging signal decoder, *Pager-RX*, which will work on any Amiga computer. It's based on the *PD* decoder by Pete Baston, and uses the same interface except that the input is on pin 6 (DSR) and not pin 5 (CTS). The main features are decoding of alphanumeric and numeric messages, error checking to ensure only clean messages are displayed, four program modes for display and logging, a tuning indicator, and compatibility with some, usually older, JVFAX and Hamcomm decoders available for the PC. Full instructions, schematic etc. are on the disk, and the shareware program has logging to disk disabled and a time-out of six minutes.

Jason tells me you can get a shareware copy of the Pager-RX program (and/or Jason's Amiga Morse decoder, *AM-RX*) from B&J Telecommunications, although he doesn't give contact details for these. Jason's kindly allowed me to 'pass it on', but unfortunately I don't have an Atari computer (neither does the Editorial office), otherwise I've have been glad to arrange to have copies available for the benefit of readers.

Spaceships on your scanner

Massimo from Italy says that, a few days ago, he tried to listen to the Mir spacecraft on 143.625MHz FM. Using his satellite tracking program loaded with the latest Keplerian elements (available each month to readers from the Ham Radio Today voicebank, Tel/Fax. 01703 263429 - Ed) he heard the Russian cosmonauts taking with their base on two overhead 'passes' the very same day. The communications he heard were extremely good on his ground plane vertical aerial, the only problem he had was with the Russian language!

The Mir spacecraft is a low-Earth orbiting craft, and circles the Earth every 80-90 mins or so. You can of course take 'pot luck' and just tune your scanner to that frequency - you'll undoubtedly hear it eventually. Alternatively, if you have a suitable satellite tracking program, such as one of the many offered from the HRT Software Service, you'll know exactly, to the second in fact, when it will be in range of your listening post each day.



Scanner image limitations can lead to 'ghost' signals

The signals are extremely strong - indeed I've regularly 'tuned in' with just the set-top helical on my handheld scanner when used outdoors. It certainly impresses my friends at my local pub's beer garden - "Listen up lads, in exactly 10 seconds time you'll hear some cosmonauts on my scanner from the Mir spacecraft" and magically, they appear!

Remote Imaging

In the past I've received a number of letters from readers who are interested in receiving Weather Satellite pictures using their scanner. One such query asks about the Remote Imaging Group, and how to get in contact with this group. The answer here is simple, just send an SAE to their Membership Secretary, Ray Godden, Wayfield Cottage, The Clump, Chorleywood, Herts, WD3 4BG, for information. The RIG produce an excellent quarterly journal, sent to all members.

JVFAX V7.1 now out

Many readers, including myself, use the superb JVFAX software for off-air fax and weather sat reception. Version 7.1. is now available - I've arranged for interested readers to be able to obtain this through this month's HRT Software Service offer.

More numbers

An interesting message I read, from Andy in Eire, was on a further 'numbers' station, this reportedly (supposedly?) run by the Israeli intelligence agency, MOSSAD. It's a female voice on USB (Upper Sideband), in English with a three letter phonetic callsign plus either '1' or '2'. '1' means that no message follows, '2' means there's a message. The standard NATO phonetic alphabet is used. The callsign, e.g. "Kilo Papa Alpha Two" is given for three minutes, then "Message, Message" followed by about 100 random 5 letter groups given phonetically. "End of message" then follows, the message is repeated as required, finally ending with "End of message, end of transmission". The schedule is 24hour per day, on the hour, quarter hour, half hour and three quarter hour.

Numbers station frequency list

Freq.	Callsign	Freq.	Callsign
2270	JSR	6745	CIO, VLB
2515	CIO, VLB	6840	JSR,EZI
2628	FTJ	6912	OEM (occasional)
2743	ULX	7323	KPA
2957	SYN	7372	GBZ (occasional)
3150	PCD, ART	7446	KPA
3270	KPA	7540	JSR
3417	ART	7605	SYN, CIO, VLB
3640	VLB	7613	GPO (occasional)
3840	YHF	7760	ULX
4168	SYN	7866	SYN
4270	PCD	7918	YHF
4360	CIO	8025	CIO
4463	FTJ	8127	CIO, MIW
4465	FTJ	8465	SYN, CIO
4560	YHF	8641	MIW
4665	VLB	9130	EZI
4780	KPA, ULX	9270	???
4880	ULX	9402	YHF (occasional)
5091	JSR	10125	CIO, KPA
5170	GBZ (occasional), CIO	10352	VLB
		10526	VLB
5230	MIW, SYN, VLB, CIO	10648	YHF
		10820	VLB, SYN
5339	OEM (occasional)	10970	MIW
5437	ART	11565	EZI
5530	CIO	12747	SYN
5531	BAY (occasional)	12950	MIW
5560	YHF	13533	EZI
5629	SYN, CIO	14750	CIO, MIW
5715	ZWL (occasional)	13921	CIO
5820	YHF	14866	VLB
5911	OEM (occasional)	15980	EZI
6270	ULX	17410	EZI
6370	MIW	18178	VLB
6500	PCD	19715	EZI
6685	SYN	20740	SYN

ACARS

Kevin Chown says he's tried without success to find any public domain or shareware software for ACARS (Aircraft Communications Addressing and Reporting System) decoding. He says commercial products are available, such as the Lowe Airmaster and a new product from AEA, but other options are rather expensive stand-alone units such as the 'Universal' decoders. Kevin uses the *Airmaster* with success on his Sony ICF2001, adding that it works well with an MVT7100 and MVT7200, but connected to a Realistic or Netset scanner the results for him were appalling. One other enthusiast however finds the AEA ACARS unit operates very well with his Realistic Pro-2026. A problem often mentioned is the repetition of data, however there are now a few commercial software offerings about. One of these is the *ACARS 900* just released by AEA, for their DSP-232 and PK-900 data units (you can get further info on AEA products in the UK from Siskin, Tel. 01703 424300, Lynch, Tel. 0181 566 1120, and SMC, Tel. 01703 255111). But does anyone know of any shareware ACARS software? Please let me know, I'm sure many airband enthusiasts would be very pleased to hear of a source!

New scanner interface

Optoelectronics have announced the release of their new *Optolinx* PC-Radio universal interface. They say the Optolinx can adapt a wide variety of radios, scanners, decoders, frequency counters and recorders, GPS receivers and other devices for connection to an RS-232C personal computer serial port. The unit incorporates special provisions for connecting the AR2700 and AR8000 to a PC for full featured computer control scanning, and can let you control multiple radios at the same time. If you interface the AOR AR3000A receiver with the DC440 decoder and the Optolinx this allows decoding of DCS, CTCSS, and DTMF. The Optolinx can also interface with an NMEA 0183 compatible GPS or LORAN receiver, and to the 'Scout' frequency recorder for the downloading of Scout frequencies in memory. The Optolinx will also computer control the Icom R7000, R7100, and R9000. You can get further details on the unit from your dealer, or in the UK, distributors Waters and Stanton, Haydon Communications, and Nevada Communications.

Bill Robertson is pleased to hear from readers and will answer queries through this column - address your letters to; Bill Robertson, c/o HRT Editor, Nexus, Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, or by fax or email to the Ham Radio Today direct Editorial contact points.

Please remember that reception of some services may not be permitted without appropriate authority. The RA's information sheet on 'Scanners' has full information for the UK.

AGC and Audio Processor Unit

Raymond Haigh says this add-on unit for simple receivers will keep receiver output constant over wide variations in signal input as well as providing audio filtering

Direct conversion and regenerative receivers can give a good standard of performance at modest cost. However, most designs of this kind lack automatic gain control circuitry, and signal fading and sudden changes in output as the receiver is tuned across the bands can be irritating; even deafening when listening on headphones.

This problem is not confined to simple receivers. Many superhets, when switched to process suppressed carrier single-side-band transmissions (most amateur stations transmit in this mode on the HF bands), lack AGC because their radio frequency based systems are swamped by the BFO (beat frequency oscillator), or because the circuitry is not sufficiently effective in the absence of a carrier wave.

The AGC circuit described here derives its control voltage by rectifying the audio signal rather than the modulated carrier wave. With the input level to the unit correctly set, output is held constant over wide variations in signal input. Alternative versions of the circuit can be constructed. One with a single compression stage, another with two stages in cascade to give a more powerful AGC action.

Special signal compressing ICs are available, but this well-tested and inexpensive design uses standard op-amps and other readily available components to achieve the desired result.

AGC and Audio Processor Unit

The Circuit

The theoretical circuit of the unit is shown in Fig.1, where field effect transistors (FETS), TR2 and TR3, are used as voltage-variable resistors to control the gain of operational amplifiers, IC1 and IC2.

Audio signals are applied to the base of TR1 via DC blocking capacitors, C1 and C3, and preset potentiometer, R2, which adjusts the input voltage. Common emitter stage, TR1, is used as a preamplifier to boost signal levels and ensure the correct

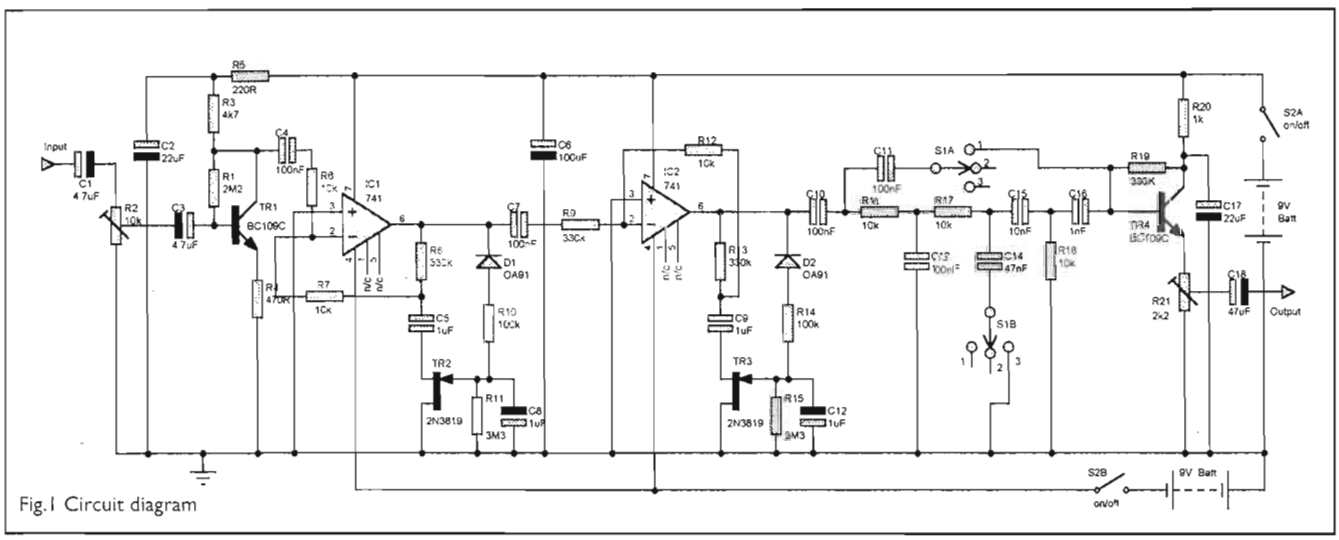


Fig.1 Circuit diagram

operation of the compressor circuitry. Emitter resistor, R4, is unbypassed, and the resulting negative feedback improves linearity and reduces the gain of the stage to around 10. Bias resistor, R1, fixes the operating point of the device, and the output is developed across collector load resistor, R3. R5 and C2 decouple the transistor from the supply. Modifications to increase the gain of the stage are discussed later.

Output from the preamplifier is connected, via DC blocking capacitor, C4, and R6, to the inverting input of op-amp, IC1. The AC gain of this stage is set by the relative values of R6, feedback resistor, R7, and the potential divider across the output of the IC formed by R8 and the drain to source resistance of TR2. The relationship is expressed as;

$$\text{AC gain} = \frac{R7}{R6} \times \frac{R8+RFET}{RFET}$$

As the gate of the FET is made more negative, the resistance between its drain and source increases from a couple of hundred ohms to around a million ohms. Diode D1 rectifies the signal output and the resulting negative control voltage is applied to the gate of TR2 via R10. By this means, increasing signal levels are made to increase the resistance of the FET, thereby reducing the gain of the op-amp and keeping its output constant. Gate resistor, R11, and smoothing capacitor, C8, determine the response time of the system. FET characteristics vary widely, even between individual samples of the same type, but this does not have any significant effect on the operation of the circuit. Most FETs do not display a pronounced change in drain to source resistance until the negative voltage on the gate has reached 1 - 1.5V, after which the resistance rise is considerable. This limits the ability of the circuit to effect control over low-level signals and, for best performance, signal input to the compression stage has to be kept as high as possible. The need to avoid clipping and distortion on very strong signals imposes limits on what can be achieved, and the most effective solution when a very constant output is required is to cascade two of the compression stages.

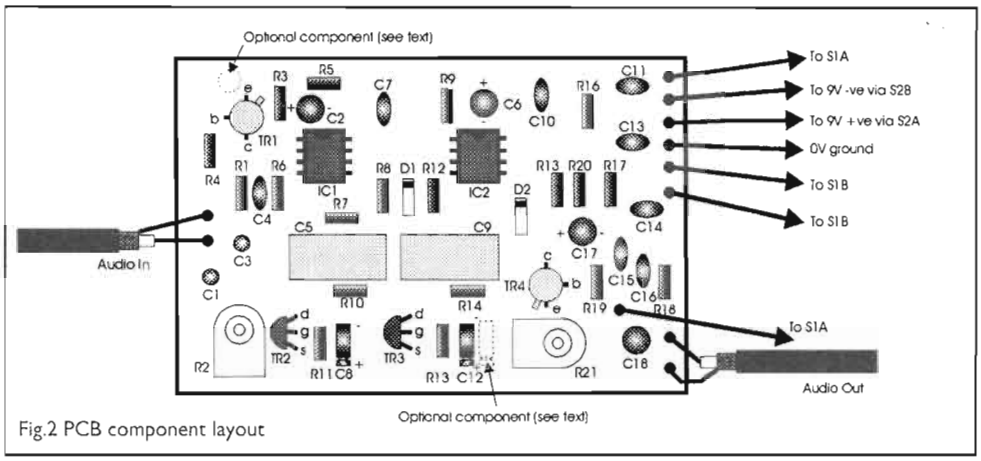


Fig.2 PCB component layout

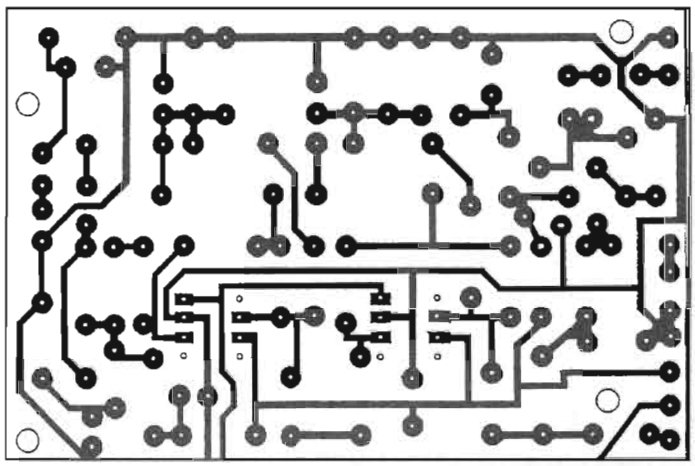


Fig.3 PCB, track side, full size

Accordingly, DC blocking capacitor, C7, couples the compressed output of IC1, via R9, to IC2. Gain controlling resistor, R9, is increased in value to compensate for the raised signal levels, but, apart from this, the stage is identical in all respects to the previous one.

The inclusion of C5 and C9 in series with the FETs makes the lower leg of the feedback potential divider an open circuit to DC. A high degree of DC negative feedback is, therefore, constantly applied to the op-amps via R7 or R12, irrespective of changing signal levels, and this ensures the DC stability of the devices. Because of this, the offset null facility (pins 1 and 5) is not required, and there is no need to connect a resistor between pin 3 and ground in order to control thermal drift. Capacitors C5 and C9 have a negligible effect at audio frequencies, and the voltage-divider action of R8 and TR2 (or R13 and TR3) is able to increase feedback as signal level increases.

Resistors R6 and R9 set the ultimate, small-signal gain levels of the ICs, and their values have been chosen to ensure constant output over the widest possible variation in signal input. The circuit gives a high degree of amplification to weak transmissions, and background noise (picked up by the aerial, from the receiver, and from the unit itself), becomes audible when signal levels are very low. To minimize this, the output from IC2 is connected, via DC blocking capacitor, C10, to a passive filter network designed to broadly peak the audio output over the band of frequencies to which the human ear is most sensitive; i.e., 300 to 3000 Hz. This considerably improves the perceived signal-to-noise ratio when the receiving system is straining hard to make a weak signal audible. R16 and C13 act as a low-pass filter, and a second low-pass filter, comprising R17 and C14, can be switched in when conditions are particularly noisy. C15, R18 and C16 form a high-pass filter, and the whole arrangement can be bypassed to give a flatter frequency response by switching C11 into circuit.

Passive networks of this type work best when feeding into a relatively high impedance, and the buffer amplifier, TR4, ensures this. Arranged in the common collector mode, the stage has a high input impedance and a low output impedance. R20 and C17 decouple the stage from the supply rail, R19 biases the device, and the output is developed across potentiometer, R21. C18 acts as a DC blocking capacitor.

Components

All of the components are commonplace and widely available from a number of sources. The 1µF blocking capacitors, C5 and C9, *must* be of the non-polarized type; electrolytics are *not* suitable. Small and relatively inexpensive metallised film capacitors were used in the prototype unit.

Lower cost, plastic packaged, BC549 transistors

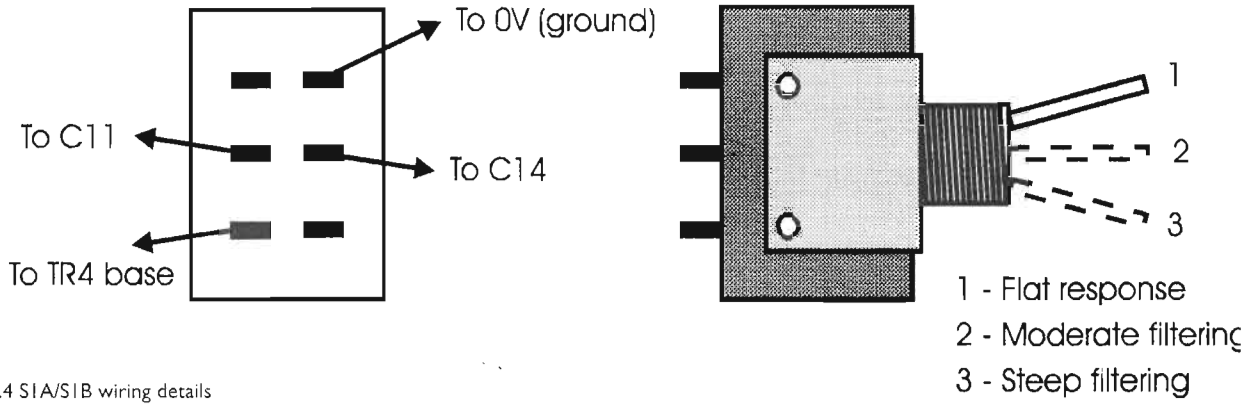


Fig.4 S1A/S1B wiring details

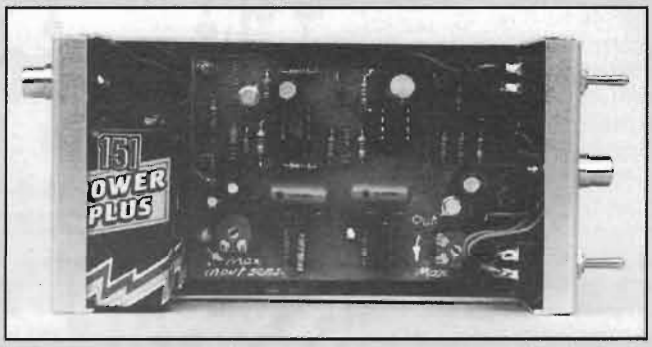
could be substituted for the BC109s, and most N channel FETs should function as voltage variable resistors in this circuit. Similarly, most germanium and silicon signal diodes will be suitable in the D1 and D2 positions.

Substituting an NE5534AN op-amp in the IC1 position improves the signal handling and audio frequency response of the unit. However, noise level increases very slightly under no-signal conditions with this IC, probably because of its higher gain and wider small signal bandwidth (it is specified as a low-noise device for high-quality audio equipment). System noise drops to an inaudible level when a modest signal is fed into the unit and, on balance, this higher performance op-amp is to be preferred in the IC1 position.

Construction

All of the components, with the exception of the switches and phono sockets, are mounted on a small PCB. The component side of the board is illustrated in Fig.2, and the copper track side (shown full size) in Fig.3. Provision is made on the board for a bypass capacitor to R4 in order to increase the gain of TR1 should this be required. Likewise, there is provision for an extra capacitor to lengthen the time-constant of the AGC system. These measures are discussed later. The board will accommodate large or small

Inside the unit showing the PCB layout



format preset potentiometers.

Vero pins inserted at the lead-out points will simplify the task of off-board wiring, and the use of IC sockets makes the substitution checking of the op-amps an easy matter. A double-pole, double-throw toggle switch, with a centre 'off' position was used for S1A and B. The wiring details are given in Fig.4.

Housing the Unit

The PCB, batteries, switches and phono sockets can be mounted in a small metal or plastic box. The *photograph* shows the arrangement adopted for the prototype. Use insulated rather than metal spacers when mounting the PCB in an enclosure. The layout of the board is fairly dense, and a tubular metal stand-off could short the tracks.

Checking and Testing

Check the orientation of semiconductors, ICs and electrolytic capacitors. Note that the positive leads of C8 and C12 are connected to ground. (The control voltages on the gates of TR2 and TR3 are negative going).

Check the printed circuit board for bridged tracks and poor soldered joints and, if everything is in order, set R2 and R21 to zero and connect 9V batteries. Current in the positive rail should be of the order of 7.5 mA and on the negative rail approximately 5 mA.

Connect the output of the unit across your receiver's AF gain or volume control, and transfer the original connections to the volume control to the input socket of the unit. Advance R2 and R21. Signals should be audible in the speaker of the receiver. Operate S1: tonal quality will be more or less unchanged with C11 switched into circuit. With S1 in the central, 'off' position, audio response and noise from all sources will be cut. With C14 switched into circuit the response to upper audio frequencies will be severely limited and noise further reduced. Signal output falls as bandwidth is progressively cut, but the voltage available across R21 is such that this can easily be made good by turning up the receiver's volume or AF gain control.

Set R2 to give the highest possible input to the unit; i.e., just short of clipping or distortion on very strong signals, then set R21 so that the receiver volume control functions normally. It is likely that R21 will have to be rotated to a very low setting. Adjustment of R2 will have been optimised when background noise wells up between passages of speech or when tuning between stations.

Performance of the Circuit

When properly adjusted, the unit will maintain a constant output over wide variations in signal input and there is no noticeable deterioration of audio quality. In common with all audio-derived AGC systems, however, noise rises in the absence of speech or music (the RF carrier activates the AGC network in conventional systems and holds the gain down even in the absence of modulation), and the unit detracts from the enjoyment of any music with long, quiet passages. This is not, of course, the purpose for which it is intended, and it certainly enables simple receivers to be constantly operated in their most sensitive condition without discomfort to the listener.

The in-built audio filters

Components.

Resistors; all 1/4 Watt, 5% tolerance or better.

R1 2M2
R2 10k pre-set.
R3 4k7
R4 470
R5 220
R6 10k
R7 10k
R8 330k
R9 330k
R10 100k
R11 3M3
R12 10k
R13 330k
R14 100k
R15 3M3
R16 10k
R17 10k
R18 10k
R19 330k
R20 1k
R21 2k2 pre-set.

Capacitors; *all 16V working or greater.*

C1 4.7µF electrolytic, radial lead.
C2 22µF electrolytic, radial lead.
C3 4.7µF electrolytic, radial lead.
C4 100nF (0.1µF) ceramic.
C5 1µF metallised polyester film.
C6 100µF electrolytic, radial lead.
C7 100nF ceramic.
C8 1µF electrolytic, axial lead.
C9 1µF metallised polyester film.
C10 100nF ceramic.
C11 100nF ceramic.
C12 1µF electrolytic, axial lead.
C13 100nF ceramic.
C14 47nF (.047µF) ceramic.
C15 10nF (.01µF) ceramic.
C16 1nF (1000pF) ceramic.
C17 22µF electrolytic, radial lead.
C18 47µF electrolytic, radial lead.

Semiconductors and ICs;

TR1 BC109C
TR2 2N3819
TR3 2N3819
TR4 BC109C
D1 OA91
D2 OA91
IC1 741 op-amp (or NE5534AN: see text)
IC2 741 op-amp

Switches;

S1 Double pole, double throw, centre 'off' toggle switch.
S2 Double pole, double throw toggle switch.

Sundry Items;

PCB materials, hook-up wire, phono plugs and sockets, IC holders, Vero pins, battery connectors and PP3 batteries, insulated stand-offs, nuts and bolts, small metal or plastic case.

Please see Ham Radio Today display and classified ads for PCB services and component suppliers

restrict the response of the system and help to clarify weak speech transmissions buried in the noise. They also greatly mask the noise generated within the receiver and the compression circuit.

Expressing input sensitivities in terms of millivolts is not very helpful with equipment of this kind. It is, perhaps, more useful to say that a regenerative detector or an active product detector (a dual-gate MOSFET or an NE602 IC) will normally require a single transistor stage of audio amplification before it will adequately load the AGC unit. Superhets should present a stronger signal, and it is likely that R2 will have to be turned well down with these receivers.

Modifications to the Design

The circuit gives a reasonable level of performance with a single stage of compression. Constructors wishing to try this before assembling the complete unit should delete IC2 and all of the components associated with it (i.e., R9, 12, 13, 14 and 15; C9, 10, and 12; D2 and TR3), and connect C7 to the junction of R16 and C11 with a wire link. The performance of a unit with only one compression stage can be improved by increasing the supply voltages to 12 - 0 - 12V, as this permits the injection of higher signal levels before distortion becomes audible.

The sensitivity of the preamplifier stage, TR1, can be increased by connecting a 22µF electrolytic capacitor across emitter resistor, R4, in order to prevent gain-reducing negative feedback. Provision is made for this capacitor on the PCB. Increasing the collector load to 10k will also increase the gain of the stage. These measures can be tried in cases where the available signal input is not quite sufficient to adequately drive the compression circuits.

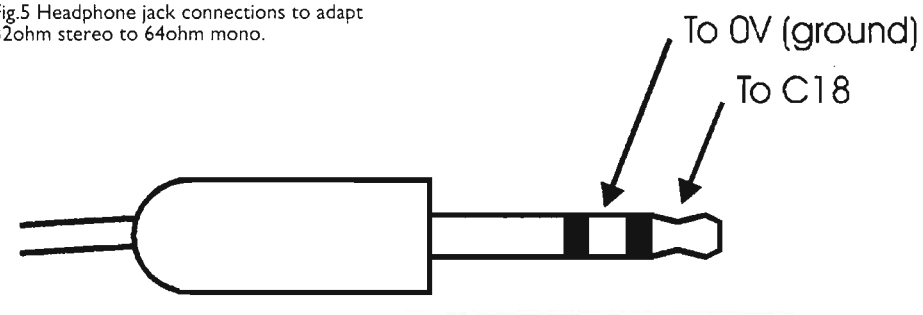
As already mentioned, the noise level rises between bursts of speech. Constructors who find this irritating can lengthen the time-constant of the control voltage smoothing network simply by wiring a larger value electrolytic capacitor across R15. A 10µF or even 22µF component should prove suitable, and provision is made for this extra capacitor on the PCB. It is recommended, however, that the setting up procedure be carried out with only 1µF in circuit, as the significant rise in noise level between bursts of speech is a good indication that the input signal level has been correctly set. Any delay in the rise in noise level will make the phenomenon more difficult to spot.

Output from the unit will drive a pair of 32ohm earphones of the type used with portable stereo players. Both earpieces should be connected in series in order to make best use of the power available, and the correct wiring of the phone jack is given in Fig.5.

If you have any queries regarding this project please address them to the author c/o the HRT address (ensure you write the author's name followed by the HRT address so that your letter can be re-directed).

Any reported updates to this project will be available for at least the next 12 months on the HRT voicebank/fax-back information line, Tel. 01703 263429

Fig.5 Headphone jack connections to adapt 32ohm stereo to 64ohm mono.



Letters

Letter of the month

Dear HRT,

With reference to the letter from G1HBE (June '96 HRT). I am one of those black box operators despised by the technophobes, I haven't a single receiver or transmitter in the shack built by me. The only thing I know about synthesizers is that they make nice tunes, particularly in the hands of experts like Vangelis. I admit, without any shame, to having scraped through my RAE. For all this I enjoyed 22 years of the hobby although I'm now left with a guilty conscience that I might well have bored many to tears with my non-technical QSOs!

By the same token, what of the lowly short wave listener, I suppose he contributes nothing whatsoever to the hobby. But hang on, what is a hobby all about? I don't participate in ham radio for you, I do it for me. You come a very close second in my list of priorities because, of course, without you I might as well pack my bags and go because there'd be no-one to talk to!

I have administered a 70cm voice repeater for some 15 years or so. I am the Editor of my club newsletter, I've served on various radio committees and done contests and special event stations to death. Without blowing my own trumpet I consider that I have contributed, and still do, to this hobby in no small way. Am I still not worthy to be called a radio amateur just because I can't talk technical and don't build my own equipment? A friend of mine is a compulsive builder, his shack is slowly sinking under the weight of home-brew gear but he hardly ever uses it and doesn't go on the air. What has he contributed to the hobby? The enjoyment he gets is immense but is that nullified by him never communicating with people?

The truth is that this hobby has so many facets that we can all find our niche and milk it for our own benefit. What we put back into it is our own business and no one else's; a hobby is first and foremost for one's own enjoyment. I wouldn't go out and buy HRT for someone else (sorry, HRT!), I buy it to read myself. That someone else might benefit when I've read it by passing it on, that's another matter. Within the realms of decency and the law, how we exploit any hobby is a matter for each individual; we should not decry another person's enjoyment, no matter how wacky or seemingly non-contributory they might be.

Bob Mersh, G8JNZ

Incentive licensing?

Dear HRT,

I find it difficult to understand why anyone would still want to embrace the concept of 'incentive licensing'. After reading Mr Barber's letter in the June issue, he obviously thinks otherwise. For some inexplicable reason, even though he started his 'involvement' in Ham Radio in the USA, he appears strangely ignorant of the fact that the incentive licensing concept that presumedly he and others would like to see implemented in the UK, was responsible for the virtual decimation of amateur radio and, I might add, most of the companies that manufactured amateur radio, in America!

Another correspondent (G1HBE), goes on to ask if "10,000 of us be such a bad thing in itself?". Well, as Andrew rightly infers, from a 'quality' point of view probably a good thing. However, if this was taken to factual reality, amateur radio would either have been consigned to the bin of history years ago or if not, be facing assured extinction. No, the numbers game is now a far more important criteria than the ability to wax lyrical for hours on end about the pro's and con's of digital signal processing or multi-path propagation.

In reply to G7KNA (same issue), yes I too welcome the abolition of the Morse test. It has been of total irrelevance for decades. It has also been an unfortunate and insurmountable barrier for many people wishing to enter amateur radio - some of whom, may well have enriched our hobby beyond measure, but didn't. They probably went the computer route instead!

If Morse wasn't mandatory, more people would use it as a fun mode, which it is. Funnily enough, Morse code is easy to tame. However, most people start to learn it the wrong way. Instead of sitting down and starting off at 12 wpm which if followed, would have the majority of people copying at this speed fairly quickly, they go the masochistic route and begin the uphill struggle from 5 wpm, crazy.

This is one of the main reasons why Morse code is reviled within the amateur radio community. And it is forced upon us much like a vaccination whether we want it or not. Yes, if the dreaded code were voluntary, I'm sure there would be an upsurge in its popularity - and a corresponding increase in amateur radio membership. That way, all of us would benefit. Now, and in the future.

Ray J. Howes, G4OWY

£10 for letter of the month

Do you have something constructive to say on the state of Amateur Radio today? Perhaps you'd like to put your viewpoint to the readers, get some discussion going, or give an answer to one of the issues raised? We'll pay £10 for the best letter we publish each month (normally paid during the month following publication). So write in with *your* views, to: *Letters Column*, Ham Radio Today, Nexus, Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, or fax your letter direct to the Editor's desk on 01703 263429 (fax letters for publication *only*, for general readers queries please see the 'Readers queries' section in the *'Who's Who and What's What in HRT'* section at the rear of this issue), or Email to hrt@netlink.co.uk. Please keep your letters short, we reserve the right to shorten them if needed for publication. Letters must be original and not have been sent to any other magazines, and must include names and addresses plus callsign if held. Reader's views published here may not necessarily be those of the magazine

"TONE" BURST

by G6MEN

Don't blame the lecturers!

Dear HRT,

Dennis Barber G0UFS (May '96 HRT), complains that his tutor admitted to training his classes to pass the exams, *not* necessarily to learn the subject. As an ex-Chief Engineer in the electronics industry, a teacher in a Sixth-Form College and an RAE tutor, I hope I can see things from both sides of the fence. We would all like to see students emerging from any course, knowing all there was to know about the subject. Life is not perfect, however, and teachers are being squeezed by current financial pressures to deliver courses in shorter and shorter times. It's what is called 'efficiency', for some strange reason. Is it any wonder that, in order to maintain their school's place in the infamous 'league table', teachers are having to pare their courses with one thing in mind - to get their students through the exam?

This applies to the RAE too. The college where I work (and teach the RAE on Saturday mornings) insisted two years ago that I could not run the RAE unless I had about 20 people enrolled. This was to ensure 'adequate' numbers after the usual drop-outs. The course did not run. This year I managed to persuade the management to waive this restriction in order to get the course off the ground. They did, and I am currently running the RAE with three students! I fear the course will not be renewed.

Please don't blame the teachers; they are pawns in a mindless game of political chess. Was it Confucius who said "Live to learn, and in the fullness of time you will learn to live"? I'm afraid the passing of an exam is only a ticket to begin learning a subject in earnest!

George Brown, BSc, Ph.D, C.Eng, FIEE
G1VCY / GX7PRU

Renewal problems

Dear HRT,

SSL have done it to me again!, every year since they took over the Subscription Service, they've messed up each and every year's payments from my bank. The first year I sent them a cheque which they had *demanded* in February, I sent it to them on the 21st April, I still didn't get my documents until mid June.

The next year, having given them a Direct Debiting Mandate, they lost it, so again I had to sent them a cheque. Last year, I switched to a Standing Order, and due to SSL's banking switching, I had to change the direction, twice, before my bank was finally able to send the standing order out.

Yesterday, the 1st May '96, I received another red letter from SSL. Again they say they haven't received my standing order payment. So I checked with my bank, and yes, you've guessed it, the bank *had* sent it out to SSL. I phoned them, they came out with the usual excuse about needing payment 10 to 14 days prior to the expiry date. Why? It only takes three working days for the standing order to be transferred from my bank to theirs.

Their main problem appears to be with the link between the SSL workers and their bank. Either there is no phone link, or their bank is failing to notify them when monies have been paid in, or, as is more likely, there's someone at SSL who is slow at dealing with incoming notification of licence payments.

The other major problem, is that the RA and politicians do not seem to listen to, or appreciate the complaints from licensed amateurs, who, like me, suffer at the incompetency in SSL. Why don't they give it back to the PO, I *never* had *any* problems with them, and I had a direct debiting mandate which they accessed just seven days before my renewal date. Most importantly of all, I always received my new documents on, or not more than two days after, the due date. Come back Post Office Counters *all is forgiven!*

J. Davies-Bolton, G4XPP

Disheartened

I have been very disheartened recently. I have become interested in Packet Radio with the aid of a good amateur friend. A message was sent to my friend in praise of a picture he had sent out, it happened to be from a station who lives in an area where I used to live. My friend asked if I would like to reply on his behalf. I answered the gentleman's letter in a friendly manner, but the message my friend received back on my behalf was anything but friendly. I was accused of being a pirate operator and told that I would be investigated.

If this is the attitude of some amateurs towards newcomers, I can understand why people are losing interest in the hobby. I have not let this put me off and hope to be on packet soon, but to some people this attitude might rather dissuade them!

A.R. Orchiston, G7SYQ

more letters next month

From my notebook

Geoff Arnold G3GSR discusses holes and electrons

Around two hundred years ago, experimenters and scientists could demonstrate the effects of electrical current flow - chemical effects, heating, and eventually magnetic effects, but they didn't know what that current was made up of.

In earlier experiments in static electricity, it had been decided that there were two sorts of electricity. A glass rod rubbed with a piece of dry silk acquired a charge which they called positive electricity, but a an ebonite rod rubbed with fur acquired a charge which they called negative electricity.

When the Italian scientist Alessandro Volta discovered the first battery (Fig. 1), which he made up of a copper plate and a zinc plate separated by a piece of cloth soaked in brine

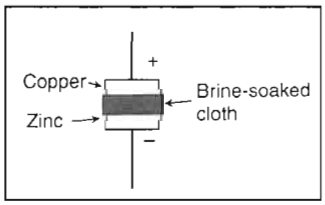


Fig 1

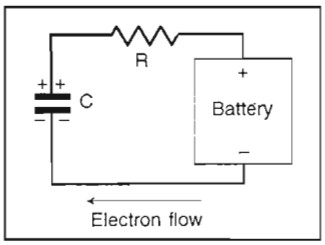


Fig 2

(a salt solution), the same names were used for the two plates. The copper one was called the positive and the zinc one the negative. In trying to understand and explain their experiments, scientists often found it necessary to specify the direction of current flow. But as already mentioned, they didn't know what current was, so they decided to adopt a convention that current flowed out of the positive terminal of the cell or battery, around the external circuit and back in at the negative terminal.

When the electron was discovered by Thomson, exactly a hundred years ago this year, it was realised that electric current in metallic conductors was made up of these negatively-charged electrons. These flow away from the negative terminal of the battery and around the circuit to the positive terminal, thus obeying the principle already established with static electricity, that like charges repel and opposite charges attract.

There were now two ways of specifying the direction of current flow - conventional current, which went from positive to negative, and electron flow, which went from negative to positive. In many ways it would have been a good idea to simply acknowledge that they'd got conventional current wrong, and forget about it, but it had become so well established by then that it just didn't happen. One of the most obvious legacies of the earlier convention still around today is the circuit symbol for the diode, which has an arrowhead pointing in the direction of conventional current flow.

I personally find it much easier to think about the action of any electrical circuit in terms of electron flow. I can picture all those electrons rushing around the circuit as they are drawn towards the positive terminal of the battery. If there's a capacitor in the circuit, I can imagine the pulse of current which flows as electrons are drawn away from one plate of the capacitor, leaving it with a net positive charge, and piled up on the opposite plate to give it a negative charge (Fig. 2). Gradually, that increasingly 'negative' plate will become less and less attractive to the electrons, and the rate of current flow will fall away to nothing. This is the so-called exponential decay of current associated with a charging capacitor.

Because it's so easy to visualise what's happening to all those electrons, I've always been very much a devotee of the 'electron flow' school - apart from anything else, it's the way I was taught at radio college, and old habits die hard. If you become involved in valve technology, you will be taught that a thermionic valve functions basically by means of a stream of electrons given off by a heated cathode, and attracted towards the anode because of the positive voltage applied to it.

That said, you will find plenty of descriptions in magazines and textbooks which are based on 'conventional current', so you need to learn to live with both ideas, even if it does mean accepting that current flow through a valve is through a vacuum from anode to cathode, by some unexplained means!

Inside the Battery

Where the electron flow idea seems to fall down so far as beginners are concerned is inside the battery. Textbooks tell us that, according to something called Kirchhof's law, the current leaving any point must be equal to the current arriving at that point. So, the electrons arriving at the positive terminal of the battery from the external circuit must be flowing from the positive terminal towards the negative

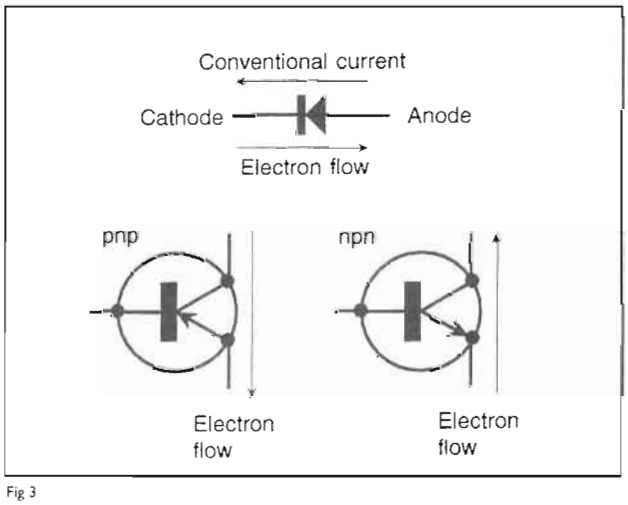


Fig 3

one inside the battery - how can this be, and what is providing the driving force?

The answer is that a chemical action inside the battery drives the current through it, and instead of being a simple flow of electrons, the current through the battery consists of a flow of positively and negatively charged ions. In a primary cell (the sort that we commonly call a dry battery, as used in most torches and many portable radios), the chemicals involved gradually get 'used up' as the positive and negative ions combine and the terminal voltage drops. At this point the battery is said to be discharged (in polite terminology, at least), and you have to throw it away and fit a replacement.

In a secondary cell (a NiCad, for example), although the chemicals change as the ions combine with use, they can be separated again and the chemicals 'rejuvenated' by a process known as recharging - you push power into the battery from an external source. This process can be repeated over and over again, so you don't have to replace the battery every time it runs down.

If you want to understand more about the chemical action involving charged ions in electrolytes - liquids, jellies and pastes - in batteries, etc., a school science textbook or something like Volume 1 of the Admiralty Handbook of Wireless Telegraphy is a good place to look.

Semiconductors

As I mentioned earlier, the arrow-head in a diode symbol points in the direction of conventional current flow. The same applies also to any junction transistor (Fig. 3), where the collector of a PNP type has a negative voltage on it, but the collector of an NPN type has a positive voltage on it.

In explanations of current flow through semiconductors, you will encounter not only electrons, which have a negative charge, but also

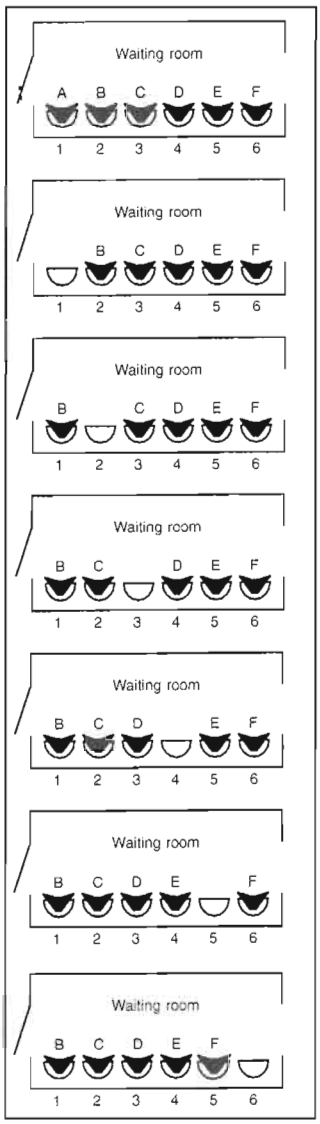


Fig 4

something called 'holes', which have a positive charge. To explain, if you take an atom which is electrically neutral - in other words its internal negative and positive charges are exactly balanced - then stripping away one of its electrons will leave it short of negative charge, and anything which is short of negative charge has a positive charge. In fact, as the name implies, a hole is a place where something has gone missing, and in this case that thing is an electron.

What causes holes? In a pure semiconductor, which is electrically neutral, electrons can be liberated from individual atoms by the application of heat or light. This electron leaves behind it a hole, which has a positive charge, and which will attract any free electron which may have been liberated from another nearby atom. This random movement of electrons, leapfrogging from hole to hole, appears as 'leakage current' in diodes and transistors, and depending on the semiconductor material involved, it can be significant even at room temperatures.

The name leakage implies that it's an unwanted current, and indeed that is the case. It can cause all sorts of problems in a transistor circuit where the emitter/collector current flow is supposed to be zero until the appropriate forward bias is applied to the base, for example. And it's something that gets worse with increasing temperature.

Moving Holes

All this is fair enough for a current of electrons, but if a hole is merely a place where an electron has gone missing, how can we have a current made up of holes?

As always, I like to develop a picture 'in my mind's eye' as the saying goes, and in this case that picture is of an old-fashioned waiting room at the dentist or doctor. It is a long, narrow room with half a dozen chairs along one wall, ranged between the door in from the street and the entrance to the surgery itself. It's the start of a busy morning, and the chairs are all full (Fig. 4).

Suddenly the door to the surgery opens and there's a call "First patient please". Patient 'A' gets up from chair '1' and goes in, leaving an empty chair, whereupon patient 'B', not wishing to be queue-jumped, gets up from chair '2' and moves along to chair '1'. Next, patient 'C' shuffles along to occupy chair '2', and so on down the row, until chair '6' is left vacant for the next arrival off the street.

As you will see from the succession of drawings in Fig. 4, the empty chair, or 'hole', has moved from '1' to '6'. The process will repeat itself each time a patient is called into the surgery, with any empty chairs near the entrance refilled as new patients arrive. If you think of the empty chairs as 'holes' and the patients as 'electrons', this steady movement is just what happens in a piece of semiconductor material when a voltage is applied across it.

Silicon, the material most commonly used in diodes and transistors, has what are known as tetravalent atoms. This means that each atom has four (tetra = 4) electrons in its outer shell. In a lump of silicon, these outer electrons link up with those of adjacent atoms, bonding the whole together to produce a crystal lattice structure. However, being in the outer shell of the atom, they are less tightly held by the positive nucleus, and it is these outer electrons which escape under the influence of heat or light to form the leakage current.

Semiconductor material used in transistors and diodes is usually 'doped' by the addition of very small quantities of an impurity which is either 'pentavalent' (having five electrons in the outer shell of each atom) or 'trivalent' (having only three electrons in the outer shell). Arsenic or antimony are used as the pentavalent impurities, and indium or gallium as trivalent ones. At each point where the atoms of the impurity fit into the overall crystal structure, there will be a surplus electron or a surplus hole, since the number of electrons on adjacent atoms no longer match. Material doped so as to have a surplus of electrons is called n-type ('n' for negative), and that with a surplus of holes is called p-type ('p' for positive). Incidentally, material which has not been doped is said to be intrinsically pure, and is called i-type. This is the material in the middle layer of a 'pin' diode.

There will still be some thermally-generated hole and electron pairs in the doped material, but far fewer than those due to the impurity, which are termed the 'majority carriers' of current through the semiconductor.

QRP corner

Dick Pascoe G0BPS gives some tips on modifying the Heathkit HW9 rig

The news about the new 73kHz amateur LF allocation now available is very good news. It is a long time since we had a new band. I remember when the new 6 metre band was allocated to us, I recall sitting in the shack with a converted CB for 6m, waiting for midnight so that I could have a chat with a few friends with similar equipment. When we got the 18MHz band I also sat there waiting. I well remember the pile-up as I worked many new countries that day.

The new LF band will be great fun, and of course even the simplest of QRP equipment will be successful after dark on the band.

For those not on the Internet the following may be of less interest, but will show that we lag a little behind on this side of the 'pond'. The ARRL (the national radio society of the USA) has been on the Internet for some years now. They have several items of interest available to hams. The ones that are of main interest to us may be obtained by sending a message to 'info@arrl.org' the files to ask for are; QRP-INFO.TXT, QRPCLUBS.TXT, QRPRIGS.TXT and QRP.TXT. These may be obtained by sending an email to the above with no subject and the following as the text line only; send <filename.ext> This will get you the file to browse.

The QRP-INFO file gives a list of various information on QRP as a broad subject. The clubs list gives a longish list of clubs throughout the world. The rigs text as its name implies gives a brief resume of some of the QRP rigs available today.

There are many groups surfacing on the net these days, quite a few related to the low power side of the hobby. If you know of any please let me know. I am already with qrp-l and gqrp-l the main QRP interest groups. To subscribe to the US one, send a message to 'listserv@lehigh.edu' with 'subscribe qrp-l <yourname>', for the UK list try 'majordomo@blacksheep.org and 'subscribe gqrp-l <yourname>

Having acquired an HW9 I was even more interested than normal in finding out about any modifications for this rig. I have been aware of the profusion of alterations and improvements that can be made to the HW7 and 8, but the model number 9 was another ball game.

Having thoroughly berated Mike Bryce WB8VGE last year at Dayton for some rather unthinking comments he had made, I was offered in recompense a pile of his books *'The HW-8 Handbook'*. This handy little volume covers all of the HW series of rigs which includes a few for the HW9. I left all but one of the books in the USA but the one I brought home offers lots of interesting ideas.

Firstly these ideas were collated by Mike and are not all of his own, he even states in his introduction "not all of these mods have been tried by the Editors .... etc"

On 15m and 10m these rigs sometimes show evidence of instability. Apparently Heath knew about this and changed Q402, try a 2N5770 or a 2N4401 to obviate the problem. Changes in C434 may also be required. The best way would be to change this to 68pF with a small trimmer in parallel and tune for best performance.

Another problem with the HW9 was key thumps, mine did this and this modification improves most. Add a 1k resistor in series with the wiper of R3 (Volume Control) and the collector of Q303, and set the MUTE delay (R445) for a slight delay in restoring receiver output. This will not eliminate the key thumps but it helps a lot. Maximum audio out can be increased also by reducing R373 to about 220 ohms, but this has not been tried.

One of the most important problems found with this rig, when I'm out in my caravan, was the ease of connecting the power line the wrong way round. Lots of blown transistors ensue if this is done and they are not only expensive but very difficult to replace.

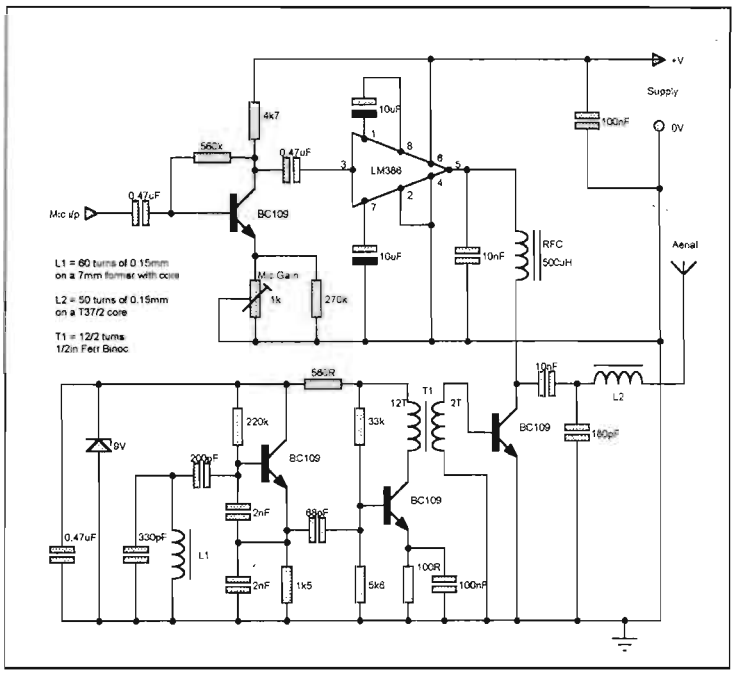
This answer relies on a power diode, forward biased in series with the power lead. Yes, there will be a slight voltage drop of up to 0.7V, but think of the advantages! (Tech Ed's note - a diode across the DC supply connections inside the rig with an in-line fuse used in the power lead is another way, this overcomes the voltage drop but results in a blown fuse if you get things wrong).

One thing about the HW9 that I find infuriating is that I don't know if it is on or off, except by looking at the power control. One easy method of changing this is to employ a few miniature bulbs, these are often found at rallies and are easy to fit.

Lift the top cover off your rig, there will be seen that there is a gap between the front panel and the inside chassis, just enough room to slide a small bulb inside. If the bulb is dabbed with a small amount of superglue it can be stuck just beside the meter. The power leads can be picked up from the power switch. Again there will be a trade-off for holiday users and a small switch may have to be included. The consumption of the bulbs should only be about 100mA or so. If they are too bright add a current limiting resistor in the supply lead to the bulbs.

My HW9 had a narrow filter added. The standard rig uses a four-pole crystal filter for the IF, this has a -6dB bandwidth in excess of 2kHz. This is fine for listening, or for SSB but not for good CW use. The fitted narrow filter which by filtering the audio is great except when a loud signal appears that activates the rigs AGC. Then the desired signal may not be heard! By adding a narrow IF filter we can overcome this problem, but what to fit?

Luckily the HW9 uses an 8.8307MHz IF which corresponds to some Kenwood rigs, and narrow filters are available for these. You could



The 'Poppet' low power rig circuit, designed by G4RGN, which provides a few milliwatts out on 160m

fit a 250Hz filter, and even at this range it should not ring. A 500Hz filter would be better for those not used to narrow CW filters, Mine used the Kenwood YK-88S 500Hz CW filter. You should retain the original filter for general tuning. The insertion loss of this filter will require some extra work though. For those interested I can make available photocopies of the original information.

SPRAT, the magazine of the G-QRP club has had many articles printed on mods for the HW9, including a digital readout by George Scholtes LX1BK. This uses an NE602 and an FC177, again copies are available.

The VFO on all the Heath range were renowned for their drift. The best thing to do was throw away the Heath one and replace it with a known one such as one of the well known kit types available today.

That's enough about the Heath rigs for the time being, except to say, if you have never operated one you should. They bring back to the hobby the mystique missing from the black boxes sold today. The joy of getting a contact using one is great. It is never easy, especially keeping track of the frequency (I use my counter in sniffer mode linked to the feeder). Unfortunately the price of these rigs has climbed through the roof lately, far beyond their true value. I even saw one, an HW8 advertised for sale at $225 which equates to £150. About three times what they should be worth.

Doug Gibson G4RGN is always popping up with different ideas for low power rigs, he runs a small AM net in his home town of Ashford, Kent, with the little rig he calls the 'Poppet'. It provides a few milliwatts out on 160m and should prove a lot of fun for any enthusiast. This circuit first appeared in Sprat.

That's all for this month, I'm off to Dayton next week so more info on that when I return. News and views to me via the editor, Packet @ GB7RMS E-mail to Dick@kanga.demon.co.uk or direct via snail mail to Seaview House, Crete Road East Folkestone CT18 7EG.

VHF/UHF message

Geoff Brown GJ4ICD visits a new VHF Convention in France

Rumoured as the largest VHF event in France, Allan GJ4ZUK, and myself set off to see just what was brewing in France. We set off from Jersey on Friday April 11th and heading via the ferry to St Malo in Brittany. We arrived in St Malo at 2200 French time and made tracks south towards Rennes, and eventually we found accommodation for 150 Francs, I was amazed at the hotel prices, under £18 for a twin room!

Next morning we had an early start at around 5.00am and headed for Le Mans, Laval, and finally Tours. The convention was located about 30 miles further on. Eventually we arrived at the venue which was a small village called Chatillion sur Cher in the middle of nowhere.

There were several bring and buy stalls outside the main village hall, and after a short wait in the queue we were inside the main hall. The entrance fee was 30 FF which is the equivalent of four pounds, so next time you moan about paying at British venues just remember this (however, we *did* get a free half bottle of wine with our program!).

Looking around the hall, both Allan and I were amazed to see Mainline Electronics from the UK, there were many other smaller dealers selling some very rare commodities like beautiful tin plate boxes for VHF/UHF projects. There were vast quantities of microwave equipment, including dishes for 10 and 47GHz with feeds, and 1 to 5 watt PA devices for the microwave bands, but we didn't see any TWT's.

Giga-Tech from Germany also displayed some remarkable products, ranging from trimmer capacitors to full kits for the microwave bands. The stand was so busy that it was difficult to seek advice!

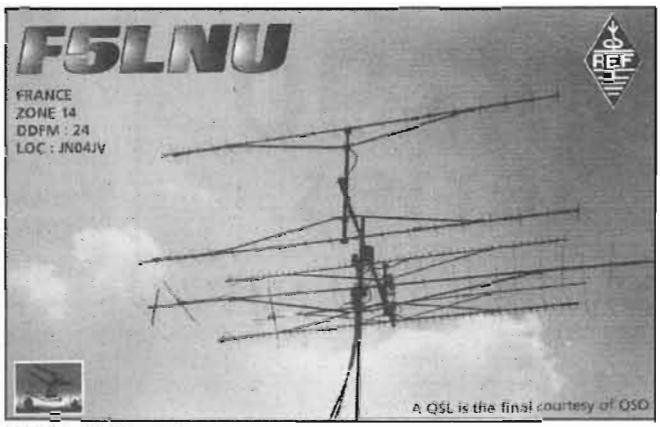
Many large tubes caught my eyes, mainly the Thomson variety, but there were several 4CX3000's and large triodes, which prompted the question "where do you get the filament transformers from?"

Considering that France has only 15,000 amateurs, they all seem to work for broadcast companies, hence the large amount of commercial tubes!

As we walked around the halls, several familiar lapel badges emerged. Our first eyeball QSO was with Graham G8MBI, who now lives in the south of France and has a rather large station on 144MHz EME with a 4CX1000. Graham is also active on 432 and 1296MHz. It was certainly a help in chatting to Graham as French is not my strong point, so Graham helped us with several questions we had.

There were several lecture forums by dedicated amateurs, which included 'An ultra low cost SSB/CW transceiver' by F6IWF, 'Simulation d'aerials' by G8MBI, 'An 8 watt linear amplifier for 10GHz' by DL2AM/F6DPH, Beacon information on VHF/UHF/SHF by F6HTJ/F1MOZ, and lots more. "But be prepared" I was told, as they are all in French!

Both Allan and I then decided that we should go and try to find the hotel that we had reserved, so off we went through the French countryside. Eventually we found the hotel, which reminded me of 'Allo Allo'. We then decided that we should stay for lunch, but this turned out to be rather a mistake. Allan decided to go for the Chicken Supreme and I decided that the fish dish looked interesting. We were joined by 14 operators of the famous HB9WW HF/VHF group and chatted over lunch.



F5LNU's VHF aerial system

After lunch we returned to the convention named by the way CJ96. We were puzzled over the name, and only found out what it stood for on our return back to Jersey. It stood for 'Seigy', the radio club organisers F6KCS, the 'CJ' bit was 'Seigy' i.e. 'CJ' and the 96 was of course the year.

By this time more visitors had arrived, together with probably the most famous 'voice' in France and a very old friend of mine, Joseph F6CTT also known as TM1E. I

had met Joseph many times before and even operated at his old QTH south of Rennes. It had been 15 years since I had seen Joseph, so we had lots to catch up on. Meanwhile Allan had vanished, he eventually surfaced looking like a walking corpse. Allan had been very ill, which we put down to the Chicken Supreme he'd eaten.

Later in the afternoon we returned back to our hotel, Allan was feeling even worse and decided that he should not go to the evening meal event which was some kilometres away. So a taxi was called and I returned back to the convention, hoping for a lift to the evening event. Joseph F6CTT, and another good friend for many years, Jean Pierre F1ANH, assisted me with this. Jean Pierre filled me in on the 'missing years'. Jean had built an eight metre dish and feeds, and was active on 432MHz, 1296MHz and 2.3GHz off the moon, Jean by the way speaks beautiful English.

So time for another meal, and this time Graham F/G8MBI very kindly offered me a space at his table for the evening. The wine flowed and then various home-brews arrived. These home-brews were mixtures of Calvados and Brandies, but I called them all 'Rocket Fuels'. In fact I'm sure I saw Graham's eyes light up at one point!

A good evening was had by all, and more familiar calls on VHF were introduced. Like Henri F5ZA, F5LNU who is a UKSMG member and very active on the 50MHz band and one of the leaders on 'Six' in France, Phillipe F1DPU, Phillipe F6ETI, Jean Noel F6APE, Pascal F6EAS, Christian F1BYM from Bordeaux, Jean Pierre F5BUU also from Bordeaux and many, many more.

So it was time to get back to the hotel, and rather than take a taxi a lift was offered by the good old hospitality of more friends. I didn't know these lads though, but I felt sure that the driver was related to Allain Prost, or practising for the Le Mans 24 hour race!

Well, I *did* get back to the hotel, only to find that it was all closed up. But I had the key, or so I thought. I had the key to get through the side gate, but not to get into the hotel! Allan appeared again, looking very ill again, believe me it was a very sleepless night!

Next day Allan was feeling a little better so we ventured back to the convention to met more friends. Mainline's stand was as busy as ever and everybody seemed to be enquiring about the 2.3GHz DB6NT transverter at £140, great for 1 watt out on the band. Still more tubes were arriving, 3CX10,000 at 500 FF or £60! Good for a driver I suppose?

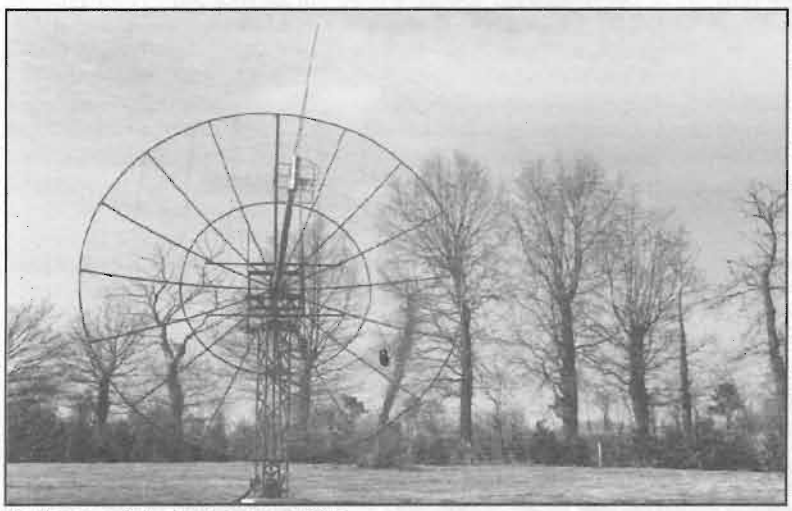
Eventually we left at around 1100 on the Sunday. It was a beautiful day so Allan suggested that we have a slow run back to St Malo via the Loire Valley. Unfortunately our map was a little out of date, and so were the signposts!

After visits to Angers and Rennes, we finally arrived at St Malo. The night was spent there and we both had an early night. After all, we had left Jersey on Friday night and had maybe a total of 15 hours sleep throughout the three days. It was nice to get back home and our sincere thanks to all our friends in France, especially Graham F/G8MBI and Georges F8OP for his help in supplying the information. See you there next year? Well I have to say 'no', the trip is too long for a weekend from Jersey as we have a three hour ferry crossing, and it is nearly a several hundred mile round trip from Jersey. But there again, I may fly next time!

Conclusion!

For the dedicated VHF/UHF/SHF operator, this venue is worth the visit. There were many components and equipment that I have never seen in the UK, especially power devices for the microwave bands, 5 watts out on 10GHz! The venue seems to be located in central France, and with the easy access from the French motorway system this also makes it easy for HB9 and DL amateurs of which there were many. However, if you do decide to go next year then my suggestion is you incorporate it into a short break holiday, so the costs can be dissipated due to the infamous 'Peage' costs on motorways. Finally, I'm pleased to say Allan has recovered from the trip, but, sadly he left Jersey after his 2 year secondment for the BBC as a technician.

Allan has given the 'GJ' prefix on both HF and VHF/UHF/SHF and will surely be remembered for his enthusiasm in Jersey. Viva la France and the rocket fuel!



The 8 metre dish of Jean Pierre F1ANH

DX news challenge

In order to create a little bit of fun, Internet Six News has created the 50MHz Summer DX Challenge!

A special prize/award will be given to the two stations who make the longest 'ES' QSO during June/July. This prize is substantial and both participants will each receive it. Full details can be found at *http://user.itl.net/~equinox/ch.html*

Beacon news

Information was received from Nick SV1EN that the SV9SIX beacon will soon be off the air for an undefined period. This is because the installation site is closing down, and Nick is looking for a new home for the beacon. Also note that the aerial for SV1SIX is (and always was) a vertical dipole and not turnstile as listed in many beacon lists.

Steve VK3OT states that he closed down the 28 and 50MHz beacons due to lack of interest by other parties, running costs and time.

Other snippets

Chris G3WOS has resigned as Secretary of the UKSMG. He will continue office until later in the year, or when another Secretary is found. If you are interested in the job *(no pay!)* contact G3HBR.

News and views to Geoff Brown, Tv Shop, Belmont Rd, St Helier, Jersey. C.I. or fax/phone anytime 01534 877067, or via GJ4HXJ@GB7GUR and GJ4ICD@WD5B, and finally email is available at equinox@itl.net.

Also don't forget the VHF/UHF dedicated pages on the Internet at:
http://user.itl.net/~equinox

DATA connection

Our resident data-over-radio SysOp looks at BPQ nodes, new links, and HF data modes

With the growing use of PCs running automated packet radio systems (I use one here myself with the superb WinPack program by Roger G4IDE), many users are naturally tempted to also employ a BPQ node running as a 'front end' to the packet 'user' program on their PC. This has the advantages of being able to automatically update itself on the best routes to, say, a given DX cluster or BBS which can't be accessed directly, but which must be accessed via the node system. This includes automatically deciding which band to use if you've a multi-frequency packet system connected up at your station. Network links sometimes go down, or operating parameters change, and a BPQ node can 'cope' with this by automatically trying the 'next best', and if needed 'next best but one' route at each node in turn including yours, if the primary route fails for some reason.

However, you should ask yourself the question, "Do I *need* to run a node?" BPQ doesn't have to act as a 'full-blown node', you have to set it to do so! In any given area, node links are usually very carefully planned, often by a local packet group, and 'unplanned' nodes can often cause a lot of havoc! This isn't just the aspect of beacons and CWIDs, but the fact that your node can 'broadcast' its existence to all other nodes, including network nodes, which then could try to route network traffic through *your* node! The simple answer to this is, in your BPQCFG.TXT configuration file, to set QUALITY=0 on each of your ports. This way, your station won't send any node 'broadcasts', and you won't appear in other node tables to upset their routings!

Bombay BBS

Shashi, VU2NA sent me a message to say he's now running a packet BBS from Bombay, the first one in the city for the last one and a half years (it operates under his own callsign). Shashi was interested in my comments in this column on packet operation by blind amateurs and in seeking help for others, as one of his users, Harish VU2SOC, is also blind but is certainly active on packet. You can contact Harish with a message to VU2SOC @ VU2NA.BOM.IND.AS and I'm sure Des G8SBU, who's also visually impaired, will soon also be active on the mode through Harish's help.

UK National Packet Journal

An email from John GM0OPS tells me he found it nice to see Ham Radio Today on the Web *(http://www.netlink.co.uk/users/hrt)*, saying that it's a pity some others don't see the same way! John has recently sent out 100 copies of the UK National Packet Journal, but is now looking for a 'home' on it on the Web. The Journal deals with what's going on with packet in the UK, i.e. developments, group projects around the UK etc. You may soon find it's available via a one-touch link from the Ham Radio Today site - watch this space folks! John kindly thanked me for my report on the SDX Cluster Support Group rally, and asks if I'll be able to visit this year's event in December. I may very well be able to, it all depends upon job constraints as I occasionally must disappear abroad at short notice. For example, this week I'm off to the Middle East for a couple of weeks, the travel arrangements having been confirmed just yesterday! Now, how do I get a quick reciprocal licence for the 7O and A61 prefixes?

7Mbits/sec data on 23cm?

For those who are interested in high speed data, GB3HV at High Wycombe (IO91OO) has been running 7MBit/s data with its 23cm ATV pictures for the last 18 months. The coverage area is about 1000 square miles, for those with big 23cm beams and hilltop sites! A message from John G8MNY @ GB7HSA who is the Home Counties ATV Club Secretary says that a 'data through' mode was planed for this repeater to permit hard disk dumps/ethernet links though the 5MHz wide ATV system, but that no data groups have been interested. If you're in range of this repeater and would be interested in a link, why not drop John a message?

PacTOR vs CLOVER

Although I haven't used CLOVER myself on the air up to now, I recently saw an impressive demonstration of a commercial CLOVER data unit on HF, which also had PacTOR operation incorporated in auto-answer/changeover mode. The CLOVER throughput was extremely fast, although PacTOR is more commonly used amongst amateurs. On

this topic, a message from Peter VK2YX @ VK2YX.NSW.AUS.OC asks about any worldwide CLOVER network in existence. I don't know of one, maybe you do? CLOVER data unit prices are now more affordable, after having a very high initial cost, so maybe we'll be seeing such a system in the future? Please do drop me a message if you're running a BBS or network link on this mode, or indeed if you've done a comparison between the two modes, I'll be pleased to publicise it.

Alphanumeric Paging on 2m and 70cm

Last month you'll have read about the use of APRS (Automatic Packet Reporting System) for event communication. Here's another event/emergency possibility. We've all seen the small VHF and UHF alphanumeric pagers available in the high street, so how about using them on the amateur bands? A quick crystal change, e.g. from 139MHz to 144MHz, and 'Bob's your uncle'. What about the base station transmit side though? Well last month, HRT's *Scanners* columnist Bill Robertson beat me to it, with news that the latest Kantronics KPC9610 TNC firmware, as well as offering 1200 baud and 9600 baud packet operation, now also has POCSAG paging facilities built in. Kantronics can even supply suitable POCSAG pager receivers ready-converted to 2m and 70cm. So, from your PC or terminal you can enter a message to be transmitted to any individual pager, or indeed a group of pager users on an event or emergency operation, from exactly the same gear as you use for packet radio! I wonder if we'll soon be hearing the familiar 'Brrrrrrp brrp' paging noises on RAYNET repeater systems? I'm looking forward to be able to review this new feature on the KPC9610 in a forthcoming issue of Ham Radio Today.

SUNPAC News

The SUNPAC (Southern Users Packet Network) group tell me the 4m node at GB7IW, at Chillerton Down on the Isle of Wight and hence giving coverage to a significant proportion of users around the south coast of England, will now be operating on 70.3375MHz rather than it's earlier frequency of 70.3125MHz. This uses an ex-PMR MX294 rig, with a diode matrix board as per the HRT article in the March 94 issue, and has been working faultlessly since its installation several years ago at this remote site. For Novices in the South, the 70cm 1200 baud user port at the GB7XJZ BBS will soon be upgraded to 9600 baud, although existing 1200 baud users who don't wish to upgrade can either access GB7XJZ via the GB7IW or NEND nodes on 432.675MHz.

The SUNPAC Secretary, John G8OQN, reminds users that membership renewals are due this summer. You'll be able to meet SUNPAC members at their stand at the Fight Refuelling ARS Hamfest on 11th August. If you're visiting then why not say 'hello' and maybe pick up some node maps, or BBS and DX Cluster guides. SUNPAC is a non-profit making organisation, dedicated to the improvement and development of the packet network in Hampshire, Dorset and South Wiltshire. You can get further information on the group from John G8OQN @ GB7XJZ.#48.GBR.EU

Novice nodes

Possibly the reason you don't see many Novices taking advantage of 'automatic' packet programs such as WinPack, running 24hr/day with timed BBS scripts etc., is that Novices aren't allowed to operate unattended packet on the most popular band, 70cm, also they don't have 2m operation allowed. However, what about 6m? SUNPAC tell me they're looking at the possibility of making a 1200baud user access port available on 6m in the Portsmouth area if there is sufficient demand. Again, contact G8OQN @ GB7XJZ if you are a Novice and would make use of such a facility.

9600 baud G/GU/F link

I'm told that, after two years of hard work, a 70cm 9600 baud network link from England to France via Guernsey has just been completed by CIPAC, the Channel Islands Packet Group. The longest leg of the link is 121 miles from Guernsey to Princetown in Dartmoor, SW England, with equipment thus having to be very carefully chosen. The RF gear is ex-PMR equipment (ex-London taxi transceivers!), and TNCs are a Symex and a BSX, both with G3RUH modems built in. GAsFET preamps and LDF-450 heliax coax are used to achieve absolute best performance, and tests have shown that a very reliable link has been the end result. Each of the back-to-back nodes cost just £395, although the cost if everything were bought as new would have been £961 each, added to these are backup battery facilities (which were donated) to maintain 24hr operation in the event or power interruption. Users please take note - maybe if you use the links you could consider a small donation, even if just for the electricity bill? Future plans are for an increase in link speed to 38.4kb but time, money, and a clear channel are needed first! The nodes are currently awaiting their licence, the group are hoping for the callsign of GB7CI. You can get further information from Mike GU8IRF @ GB7GSY.#47.GBR.EU (Mike is the SysOp of GU8IRF-7)

Node map

Talking of nodes, a bulletin from Andy G7TFJ @ GB7WRG says that he's attempting to put together a UK node map, including node/BBS links, and asks if anyone from the UK can help him with information. Andy says he'll then make the completed map available on packet. You know where to send your node info to.

CTRL-Z, end of message

That's it for this month. As always, please *do* let me know what you're up to in the ham radio data comms field, or indeed what your local group are doing. If you'd like a specific topic covered in this column, or a question you'd like to ask, just get in touch and I'll try and help. You can contact me either direct via packet, or via post, fax or email c/o the Ham Radio Today Editor. Until next month, 73 from Chris G4HCL @ GB7XJZ.#48.GBR.EU

New firmware for the KPC9612 now adds POCSAG paging facilities

Satellite rendezvous

Richard Limebear G3RWL with this month's collation of AMSAT-UK news

US astronaut Shannon Lucid has been heard operating as ROMIR from MIR. She was using 145.550 MHz simplex, although apparently (at the time of writing) it will be some time before she's familiar in running all the equipment. Also they have been trying to discover why the packet hasn't been working. At the moment it seems likely that she will experiment over Europe with 145.800 simplex or 145.800/145.200 down/up as was originally fixed at last year's AMSAT-UK Colloquium. If you want a QSL card for a contact with Mir send a SASE business size envelope along with your QSL card to: Thomas Kieselbach, DL2MDE, Joerg Hahn, DL3LUM, DLR Amateurfunkstation Oberpfaffenhofen, P.O. Box 1116, 82230 West Germany. This address is for all of Europe (i.e. not rest of the world).

Micro/Digital Satellites

WO-18 has been in MBL for a while; diagnosis and treatment are under way.

AO-27 is now on 7 days a week, but only during daylight hours. It turns on a few minutes after it comes into the sun and remains on for a fixed length of time (currently set for about 20 minutes). It is not necessary to move the transmit frequency away from 145.850 MHz; but adjustments for Doppler shift on the 436.800 MHz downlink can make reception easier.

After the recent software re-load of UO-22, the directory became damaged; some users noticed that their directories did not show new files correctly. It is necessary to clean your *.PFH files removing the damaged entries using the PFH.EXE utility with the -CS option.

Oscar 10

It's currently available in mode-B when in view but *please do not* attempt to use it if you hear the beacon or the transponder signals FMing.

Keplers on UO-22

It was noted recently by a number of people that the supply of Keplerian elements for amateur spacecraft has not been reliable. To try and improve the availability of up to date elements, UoS will now upload the most recent Keps for all amateur spacecraft to UO-22 each Monday. This is carried out automatically by the UoSAT groundstation. The Keps are downloaded direct from the NASA Goddard Space Flight Centre, in the standard NASA Two Line Element format, and will be placed on the satellite with an additional header / footer for packet BBS forwarding. This service is brought to you by UoSAT and AMSAT-UK.

JAS-2

JAS-2 will be launched with primary payload ADEOS some time in mid August.

SUNSAT

Reliable sources indicate that the launch date of the SUNSAT micro-satellite has been set for 6th March 1997. SUNSAT is an amateur satellite sponsored by the University of Stellenbosch, in South Africa. SUNSAT's mission will be closely tied in with education. Three school projects have been accepted for inclusion on the satellite's payload so far, and although final preparations are being made to the spacecraft, time still remains for the inclusion of four additional school projects.

One of the more unusual projects riding on SUNSAT is an experiment that will monitor the internal sounds of the spacecraft during the early part of its mission. Through this experiment, it should be possible to hear things such as the gravity gradient boom extending and locking into place, 'creaking' sounds caused by thermal changes to the spacecraft structure, and sounds from the reaction-wheel assemblies. Sounds from the spacecraft will be available in real-time on the 2m FM downlink transmitter.

Listeners may recall that SUNSAT is a piggy-back payload (along with the Danish Oersted microsatellite) to be launched on a USAF Delta II from Vandenberg. The orbit will be polar, 400 by 840 km with equatorial crossing initially at approximately 3.00pm, drifting an hour earlier every seventy days.

The amateur radio communications payload comprises a packet radio service, a 2m band 'parrot' speech transponder, and a Mode LS transponder.

GB1IMD

The GB1IMD call was active on Satellite again this year for International Marconi day on April 20th. John G7HIA and Robert G8ATE planned to use all of the analogue birds throughout most of the 24 hour period of the event. GB1IMD was part of the official activity for International Marconi Day and a contact with GB1IMD qualifies towards the Award Certificate (this also counts for the SWL Certificate). For more information, contact John G7HIA.

InstantTrack Patch

InstantTrack Patch #4 is now out and will be included in future AMSAT-UK sales of this program. The patch update is available separately from AMSAT-UK for the usual small donation, disk and SAE etc. The patch solves the incompatibility that InstantTrack 1.00 or 1.00b exhibits with certain newer video adapters. If you have the problem, you will see rubbish at the bottom of the map screens where the text is supposed to be. If you don't see that rubbish, this patch won't do you any good. The patch is also available from FTP.AMSAT.ORG, in the directory */amsat/software/PC/Instant Track*. This patch is independent of Patch #2, which allows InstantTrack to accept 2-line format Keplerian element files using either of two checksum formats. Patch #1 and Patch #3 were bugged and should not be used.

WISP

There are two upgraded WISP programs: MSPE version 0.99j and PROCMAIL 0.95.These files include capability for Satgate use of the new filetype 18; they are for use with Windows 3.1. These versions may contain other minor changes as well so recheck the setup on each of them to be sure you have the options set as you want them. They too are on the amsat.org ftp site and should have appeared on KO-23 recently. They are also available from Amsat-UK for a small donation. WISP users are reminded they can still register the program with Amsat-UK in exchange for a fixed donation to P3D; details from the office.

Launches

Intelsat have cancelled two contracts with Great Wall Industries for the launches of Intelsat 8 and 8A satellites on Long March launch vehicles. Contracts are expected to be signed with Lockheed for Atlas launch vehicles.

The Intelsat 709 spacecraft, which was originally under consideration for launch on the Ariane 502 launch vehicle is now planned for launch on an Ariane 4. Allowing for the difference in insurance, Intelsat will pay about $30 Million more for the Ariane 4 launch. According to "Space News", Panamsat is likely to sign a contract to launch it's PAS 5 satellite on Ariane 502. It's not surprising for Intelsat to take this move, given the Long March failure. The risk of placing another satellite on an unproven launch vehicle isn't worth the benefits of lower launch costs, given the recent loss.

Arianespace has always had a provision in it's launch contracts which permits a customer who has recently lost a satellite (whether or not it's due to an Ariane launch problem) to get priority in the Arianespace manifest. Panamsat has had a history of willingness to accept Ariane test flights in the past, PAS 1 was launched on the first Ariane 4 launch vehicle -the flight which launched OSCAR-13!

If this is the case, then maybe Phase 3-D will launch on Ariane 502, with Panamsat 5 and the European Atmospheric Reentry Demonstrator (ARD). PAS-5 is a Hughes HS-601 satellite and somewhat lighter than Intelsat 709, so it should be possible to launch all three satellites together given Ariane 5's predicted performance. ARD would be the top satellite on the stack. Phase 3-D could either be the bottom or middle satellite.

After launch, but before orbital velocity is achieved the ARD will separate, and will travel on a ballistic trajectory, splashing down on parachutes south of Hawaii. The launch vehicle will then fire the upper stage to place Phase 3-D and PAS 5 into a geosynchronous transfer orbit, with a fairly typical Ariane separation sequence. Apparently the ARD launch is expected by the end of this year, subject to a nominal first flight for the Ariane 5.

AMSAT-NA Symposium

The 1996 AMSAT-NA Annual Meeting and Space Symposium will be held on November 8-10th, 1996 at the Holiday Inn, City Centre in Tucson, AZ. This is the first call for papers to authors who wish to submit papers for this event. As always, the scope of the papers should be on topics of interest to the amateur satellite service. Final versions of all papers should be received by August 15, 1996. Submissions and enquiries should be made to Dave Burnett, WD8KRV: By Internet: *wd8krv@amsat.org*. By Mail: G. D. Burnett, 4809 E. Pima #223, Tucson, AZ 85712

AMSAT-UK colloquium this month

The 11th AMSAT-UK Colloquium will be held at Surrey University, Guildford, Surrey, U.K., from Thursday 25th to Sunday 28th July 1996. The Thursday will be devoted to international/IARU matters and other subjects will be structured across the following three days. There will also be the usual social events including: Command Station visits, the Annual Dinner and Auction, Amsat-UK AGM, and other light-hearted fun.

Ron G3AAJ has a few more of the Electronic Warfare books; get in touch if you want one (I've already bought mine superb value - Tech Ed!).

For further information about Amsat-UK contact: AMSAT-UK, c/o Ron Broadbent MBE, G3AAJ, 94 Herongate Rd, London, E12 5EQ. A large SAE gets you membership info, and SWL's are welcome. All new joiners get the USAT-P tracking program on 5-1/4in disk.

Latest Keplers

AMSAT-UK Keplers are put out on packet fortnightly, sent to *KEPLER @ GBR*. The latest satellite Keplers as supplied by AMSAT-UK are also available by automatic fax retrieval from the 24hr Ham Radio Today fax-back line, 01703 263429 *(use with a personal DTMF, i.e. 'touch-tone', phone/fax keypad - follow the voice menu)*, request fax document 92 from the satellite menu for this month's. You can also get a copy in the post by sending an SAE together with the original corner flash from this column to the Ham Radio Today Editor, marking your envelope 'Keplers' and stating whether you want *all amateur* satellites (one A4 page) or *all* satellites (10-15 A4 pages - you'll need an A5 or A4 sized SAE with postage for 100g for this).